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The Systematics of Neotropical Orb-weaving Spiders in the Genus *Metepeira* (Araneae: Araneidae)

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THE SYSTEMATICS OF NEOTROPICAL ORB-WEAVING SPIDERS IN THE GENUS *METEPEIRA* (ARANEAE: ARANEIDAE)

WILLIAM H. PIEL[1]

CONTENTS

Abstract. Of the 39 species and three subspecies of the orb-weaver genus *Metepeira* in the Americas, 36 species and two subspecies are known to occur outside of the U.S. and Canada. Yet, despite their conspicuous webs, diurnal foraging, and relatively common presence, the taxonomy of *Metepeira* is poorly understood, probably because the genitalia are small and difficult to distinguish. In fact, many names for species south of the U.S. were, at some time, incorrectly synonymized with the name *Metepeira labyrinthea*. In this paper, 14 new species are named (*Metepeira atascadero*, *M. cajabamba*, *M. calamuchita*, *M. celestun*, *M. inca*, *M. lacandon*, *M. maya*, *M. olmec*, *M. pacifica*, *M. petatlan*, *M. pimungan*, *M. revillagigedo*, *M. roraima*, *M. tarapaca*); 11 new junior

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synonyms are reported (*M. acostai, M. bani, M. dominicana, M. grinnelli, M. latigyna, M. perezi, M. santa, M. salei, M. seditiosa, M. vaurieorum, M. virginensis*); five cases of erroneously synonymized names are reversed; 22 species and two subspecies are redescribed (*M. arizonica, M. triangularis, M. chilapae, M. comanche, M. compsa, M. crassipes, M. datona, M. desenderi, M. galatheae, M. glomerabilis, M. gosoga, M. grandiosa alpina, M. grandiosa grandiosa, M. gressa, M. incrassata, M. jamaicensis, M. karkii, M. minima, M. nigriventris, M. rectangula, M. spinipes, M. uncata, M. ventura, M. vigilax*); and a key to all *Metepeira* species is presented. In addition, several ecological and life history observations are reported for various species.

INTRODUCTION

The absence of a comprehensive revision of Neotropical *Metepeira* has left the taxonomy of this group in shambles. Over the years, a fair number of species have been named, particularly by A. F. Archer, R. V. Chamberlin, and W. Ivie. However, these efforts have been sporadic and, for the most part, scant. For example, the description of *Metepeira dominicana* (Archer, 1965) provides little information other than "form typical of *Metepeira* in all respects," a few measurements, and two unrecognizable figures. Even when species are properly described they have far less taxonomic value when published alone, in the absence of a full comparative revision.

The poor understanding of *Metepeira* taxonomy has persisted despite great ecological and behavioral interest in this genus. Indeed, many species are obligate or facultative social species and offer excellent models for investigating genetic and environmental factors that influence colony formation (e.g., Uetz and Cangialosi, 1986; Uetz et al., 1987). The monumental work carried out over many years by G. W. Uetz has made great strides in our understanding of gregarious social behavior in spiders and in risk-sensitive foraging theory in general (e.g., Uetz, 1996). Still, in the absence of solid taxonomic literature, behavioral ecologists have been forced to apply informal names to their study animals (e.g., *Metepeira* "atascadero" in Uetz [1989] or *Metepeira* "Species A" in Viera [1989]), but this practice can lead to trouble. In one case, the behavior of several different species was initially studied under the false assumption that they all belonged to the same species (e.g., Uetz et al., 1982). Clearly, a strong taxonomic foundation is important for further biological work.

Ultimately, the relatively small, indistinct genitalia and the relatively homogeneous abdominal patterns are to blame for the weakness in our knowledge of *Metepeira* taxonomy. Many of these species are undoubtedly hard to distinguish, and this fact has surely intimidated arachnologists from taking on the painful task of revising the group. In the absence of good distinguishing characteristics, the catalogs of Bonnet (1957) and Roewer (1942) synonymized the names of many Neotropical species with the name *Metepeira labyrinthea*. Levi's (1977) revision of Nearctic species observes that *M. labyrinthea* is actually limited to the eastern United States. One task in this revision consists of reasserting the names of species that were improperly synonymized and clarifying the diagnostic characters that are needed to identify them.

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This paper is part of my Ph.D. thesis for the Department of Organismic and Evolutionary Biology, Harvard University. I am indebted to many people for their help, assistance, and encouragement in this project. I am especially thankful for the dedication and support of my advisors, Herbert W. Levi and Edward O. Wilson. I am grateful that my colleagues in the Department of Invertebrate Zoology provided such a pleasant place to work: Edward Cutler, Ardis Johnston, Laura Leibensperger, Damhnait McHugh, Diana Sherry, Van Wallach, and Dee Woessner, among others.

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MATERIALS AND METHODS

Collections Examined. The taxonomic revision was carried out on specimens borrowed from the following collections. The abbreviations correspond to those listed with each record after every species description. I am grateful to the museums, curators, and staff that graciously loaned the material.

ADC A. Dean, Texas A&M University, College Station, Texas, United States
AMNH American Museum of Natural History, New York, United States; N. Platnick, L. Sorkin
BMNH Natural History Museum, London, England; P. Hillyard
CAS California Academy of Sciences, San Francisco, California, United States; C. Griswold
CV Carlos Valderrama A.; Bogotá, Colombia
FSCA Florida State Collection of Arthropods, Gainesville, Florida, United States; G. B. Edwards
IRSNB Institut Royal des Sciences Naturelles de Belgique, Brussels, Belgium; L. Baert
JAK J. A. Kochalka, Ciudad Universitaria, Paraguay
JEC J. Carico, Lynchburg, Virginia, United States
JMM J. Maes, León, Nicaragua
MACN Museo Argentino de Ciencias Naturales, Buenos Aires, Argentina; E. A. Maury, C. L. Scioscia
MCN Museu de Ciências Naturais, Fundação Zoobotânica do Rio Grande do Sul, Porto Alegre, Rio Grande do Sul, Brazil; E. H. Buckup, M. A. L. Marques
MCZ Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts, United States; H. W. Levi
MECN Museo Ecuatoriano de Ciencias Naturales, Quito, Ecuador; Germania Estévez Jácome
MEG M. E. Galiano, Buenos Aires, Argentina
MLJC Maria Luisa Jiménez, Centro de Investigaciones Biológicas del Noroeste, La Paz, Mexico
MLP Museo de Universidad Nacional, La Plata, Argentina; R. F. Arrozpide, C. Sutton
MNRJ Museu Nacional, Rio de Janeiro, Brazil; A. Timotheo da Costa
MNSD Museo Nacional de Historia Natural, Santo Domingo, República Dominicana; Félix Del Monte
MUSM Museo de Historia Natural, Universidad Nacional Mayor de San Marcos, Lima, Peru; D. Silva
MZSP Museu de Zoologia, Universidade de São Paulo, São Paulo, SP, Brazil; P. Vanzolini, J. L. Leme
MZUF Museo Zoologico de "La Specola" Università di Firenze, Florence, Italy; S. Whitman
NRMS Naturhistoriska Riksmuseet, Stockholm, Sweden; T. Kronestedt
PAN Polska Akademia Nauk, Warsza-

wa, Poland; J. Prószynski, A. Slojewska, W. B. Jedryczkowski

REL	R. E. Leech, Edmonton, Alberta, Canada
SMF	Forschungsinstitut Senckenberg, Frankfurt am Main, Germany; M. Grasshoff
SR	Susan Riechert, Knoxville, Tennessee, United States
USNM	National Museum of Natural History, Smithsonian Institution, Washington, D.C., United States; J. Coddington, S. F. Larcher
ZMB	Zoologisches Museum der Humboldt Universität, Berlin, Germany; M. Moritz
ZMUC	Zoologisk Museum, Copenhagen, Denmark; H. Enghoff, N. Scharff
ZSM	Zoologische Staatssammlung, Munich, Germany

Locality Data Storage and Manipulation. Locality data from each collection vial were entered into a database designed using Claris FileMaker Pro™. Geographic coordinates were added to locality data that lacked them using maps, USBGN gazetteers, and on-line databases (http://164.214.2.59/gns/html/ and http://mapping.usgs.gov/www/gnis/). Occasionally locality information was illegible or unknown or one of several homonymous sites. In such cases a reasonable, educated guess was made and a "[?]" designation was appended to the locality. In some cases the itinerary of a collector was reconstructed from other known records, and the ambiguous locality was assigned a coordinate halfway between the previous and following known collection sites. The locality database worked in concert with the mapping program Atlas Pro™ to generate thematic maps on the fly. These maps helped in the process of delimiting species and discovering cryptic species.

Elevation (in meters) was estimated for each locality that lacked this information. In some cases, elevation was estimated using contour maps, such as DMAAC ONC aeronautical maps; in most cases, elevation was estimated using NOAA data with an on-line database server (http://phylogeny.harvard.edu/~piel/find.html).

The enhanced locality database was used to reveal ecological and life history traits. Seasonality of species was expressed by plotting a circular histogram showing the relative amount of collecting activity per 5-day interval (Figs. 300–337). While locality dates alone cannot control for the seasonal activity of human collectors, these data at least provide an estimate of spider seasonal abundance, if only approximate. Some sympatric species show incongruous seasonal abundance, which is at least some evidence that seasonality of spider collectors does not unduly overshadow the seasonality of the spiders themselves.

Examination and Illustration. Specimens were examined under 80% ethanol in a dish with light and dark sand grains for specimen support. Digital photographs of preserved specimens were taken through a Nikon SMZ-10 photomicroscope using a Panasonic WV-CL320 CCD video camera, chosen for its high sensitivity to light. Video images were captured using a QuickImage™24 digitizer and edited on a Quadra 700 Macintosh™ computer. The computer allows relatively inexpensive pictures to be printed rapidly on a 1,200 dpi Xanté™ Accel-a-Writer 8200 laser printer. Digital pictures were used to help sort out individuals to species, to create publishable pictures of gross dorsal and ventral markings, and to aid in the illustration of genitalia. As an aid in illustration, the digital pictures functioned as a camera lucida because they assured accuracy when drawing the proportions of genital parts and sclerites. Usually a digital picture was laid over carbon paper and an outline of the genitalia was transferred to coquille board underneath. The illustration continued on the coquille board using a Staedtler OmniChrom™ pencil and a drafting pen with India ink and then was scanned at 600 dpi on a LaCie Silverscanner II™. The resulting digital image was edited in Adobe Photoshop™ and reduced in size to 1,200 dpi. The edited figures were finally arranged on plates using Canvas™.

External genital structures were manipulated with pins to reveal hidden parts. The terminal division on the male palp is hinged, so it had to be pried open to see the embolus and embolic apophyses properly. In females, mating plugs had to be removed from epigynal openings using pins. Sometimes the entire epigynum was partly cut from the body so as to see it from a posterior view.

Internal genital structures were studied by clearing them in clove oil and examining them using an Olympus BH-2 compound microscope. Sketches were made directly on the computer in Canvas™ by aiming the camera lucida at the computer monitor. While internal genital structures helped in the process of delimiting species, they did not prove to be as useful as external genital structures in describing species; thus, these working sketches are not figured herein.

Measurements of the spiders were taken using a Leitz stereo dissecting microscope with a calibrated reticule. Sizes of leg articles, eyes, and carapace, were performed on one specimen of each sex, for each species. The respective localities of the candidate specimens were indicated in the descriptions. This study placed little reliance on spider leg measurements because they are not usually very useful in spider taxonomy, and because *Metepeira* species are notorious for their variability in size (Levi, 1977; Piel, 1996).

All eye sizes were reported as a ratio of the posterior median eye diameters to the diameter of every other eye type. For example, in the case of "ratio of eye diameters: posterior medians and anterior medians 2.0, anterior laterals 0.5, posterior laterals 1.0," the reader should interpret the anterior medians to be half the size of the posterior medians, and the anterior laterals to be twice the size of the posterior medians. Eye separations were expressed in terms of their own diameters, or in terms of the anterior lateral eyes when between eyes of different types. Oval eyes were measured as an average of the longest and shortest lengths.

In parallel with the last revision of *Metepeira* (Levi, 1977), leg measurements were made on each article distal to the trochanter for the first leg and on the combined lengths of the patellae and tibiae for all remaining legs. Variation in total body size was provided as an average, minimum, and maximum of the total lengths from a number of mature specimens, usually chosen from a wide geographic spread.

Metepeira F. O. P.-Cambridge

Metepeira F. O. P.-Cambridge, 1903: 457. Type species by original designation *M. spinipes* F. O. P.-Cambridge 1903. The name is feminine.

Diagnostic Abstract. Web combines barrier or scaffolding structure surrounding a classic araneid orb with a retreat suspended in air (Fig. 1). Like a raccoon with its facial colors reversed, the eye region is lighter than any other part of the carapace (Fig. 2). The venter has a wide median white line set on a black background that, with only some exception, extends anteriorly on the sternum (Fig. 3). With one exception, the total lengths of distal leg articles (metatarsus and tarsus) exceed that of the middle articles (patella and tibia). The median apophysis has two distinctive flagella (F in Fig. 5) and, in some species, an easily recognizable keel (K in Fig. 5). The dorsal abdominal markings (the folium) look like an inverted fleur-de-lis, allowing easy recognition of the genus in the field (Fig. 2).

Description and Diagnosis. For field ecologists, the most obvious and distinctive feature of *Metepeira* is the combination of orb and barrier web (Fig. 1). The barrier web forms scaffolding around an almost vertical orb and supports the spider's retreat, which is thus suspended away from any substrate.

In contrast to most araneids, the carapace of *Metepeira* is lightest in the eye region. However, this distinctive feature varies within the genus: in the case of *M. rectangula* (Nicolet, 1849), the lighter region takes up almost half the carapace (Fig. 65); in the case of *Metepeira* F. O. P.-Cambridge, 1903, the lighter region is usually limited to the anterior edges of the carapace (Fig. 2). White, downy hairs often cover the carapace but are especially white and conspicuous on the lighter parts of the carapace outside the eye region. In some species, such as *M. spinipes,* these hairs make the carapace look gray or silvery when the spider is alive, but dark brown when the spider is in ethanol.

The eyes of *Metepeira* are not particularly unusual. Eye separations relative to eye diameters increase with spider size: larger spiders tend to have relatively greater eye separations. In either sex, the posterior median eyes are between 1.1 and 1.7 times the size of the anterior medians, and the separation between posterior median eyes is between 0.4 and 0.7 of that between anterior median eyes. The separation between the anterior median eyes and the anterior lateral eyes is between 1 and 3.7 times the size of anterior median eyes in males and between one and five times the size in females. The diameter of the anterior median eyes exceeds the height of the clypeus.

The shape of the female abdomen ranges from wider than long and rhomboid (*M. datona,* Fig. 12) to roundish (e.g., *M. desenderi,* Fig. 20; *M. rectangula,* Fig. 65), to longer than wide and oval (e.g., *M. inca,* Fig. 169). The dorsal folium has a recognizable white fleur-de-lis pattern, usually on a dark background, its edges shaped by a wavy, zig-zag white outline (Fig. 2). The dorsum of live spiders is often more reddish—a pigment that rapidly dissolves in alcohol.

Somewhat less common among other araneids is the median white line on the venter of the abdomen (Fig. 3), which is present (though shortened) even in the most darkly pigmented species. However, unique among araneid genera is the combination of median white line on the venter and median white line on a black or brown sternum. Some *Metepeira* species lack a complete white line on the sternum, but even those, such as *M. datona,* that usually have an entirely black sternum nonetheless show hints of white markings in some specimens. Characteristics found in the carapace, abdomen, and sternum of *Metepeira* are also found in *Araneus koepckeorum* Levi, but this last species lacks the white line on the venter.

With the exception of *M. datona,* and in some cases, *M. desenderi,* all *Metepeira* species have a combined metatarsus and tarsus that is longer than the combined patella and tibia. This feature is unusual among araneids and is not found in *Kaira* O. P.-Cambridge or other likely relatives to *Metepeira* (Levi, 1977; Piel and Nutt, 1997).

In most species the leg articles are ringed, usually with brownish black on the distal and dorsal surfaces of each article, except for the patellae and tarsi which are usually entirely dark. In mainly tropical and high-altitude species, the coxae are mostly black (e.g., Fig. 75), but in desert/mesquite species they appear yellowish white (e.g., Fig. 28).

Unlike many other araneids—and perhaps because of the small male size—the coxa on leg I of male *Metepeira* lacks the hook and corresponding groove typically found on femur II. In addition, males lack a tooth on the lateral side of the endite, and they lack a basal tooth on the palpal femur. The phylogenetic analysis of Scharff and Coddington (1997) incorrectly codes *Metepeira* as having a tooth on the endite. However, had the authors coded this character as absent, they would have decreased the length of their preferred tree because the nearest relatives hypothesized for *Metepeira* (*Kaira, Zygiella,* and *Singa*) also lack this tooth.

Macrosetae usually concentrate on articles that contact other spiders during mating or grappling. In contrast to most gen-

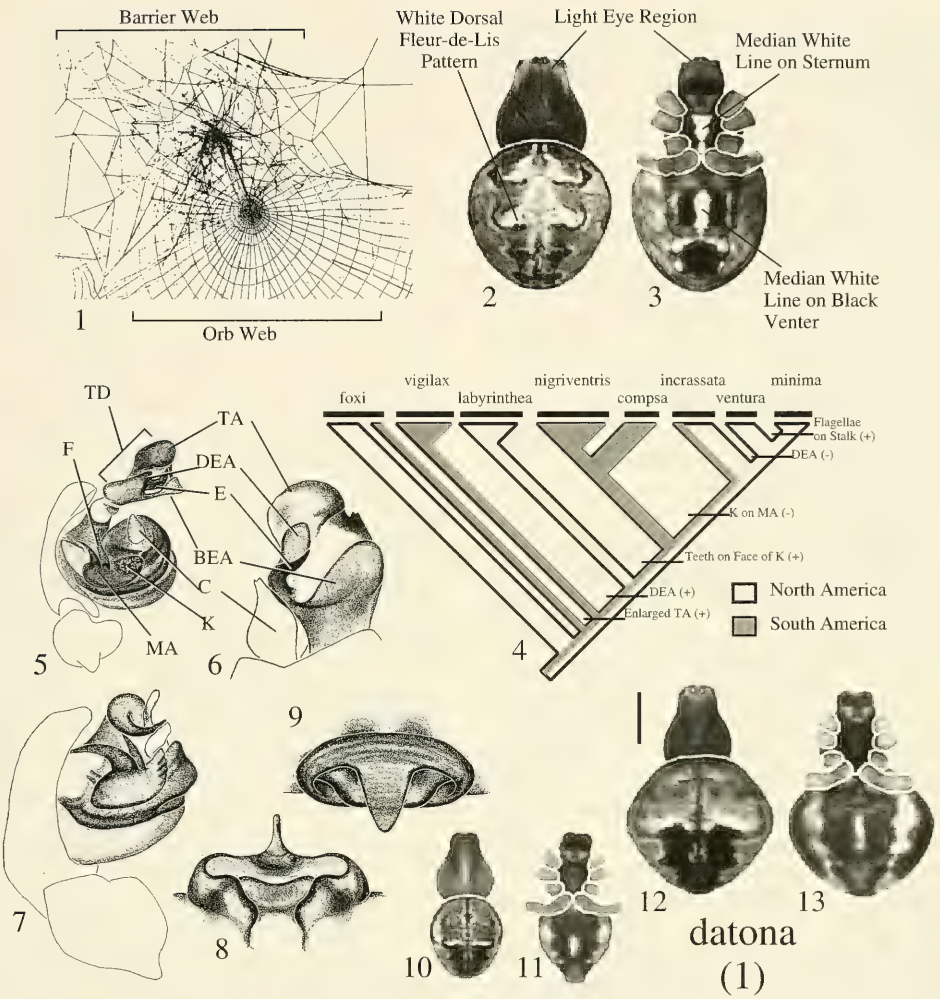


Figure 1. Web of immature *Metepeira grandiosa alpina* from Chihuahua, Mexico.
Figure 2. Dorsum of adult female *Metepeira crassipes.*
Figure 3. Venter of adult female *Metepeira tarapaca* new species.
Figure 4. Hypothetical phylogenetic relationships among *Metepeira* species groups. Shaded branches indicate species groups that live in South America; open branches indicate species groups that live in North America, Central America, and the Caribbean. *Abbreviations:* DEA, distal embolic apophysis; K, keel of median apophysis; TA, terminal apophysis; (+), character state gain; (−), character state loss.
Figures 5, 6. Male palpus. 5, mesal view, *Metepeira compsa.* 6, ventral view of distal embolic division, *Metepeira labyrinthea* (Hentz).
Abbreviations: BEA, basal embolic apophysis; C, conductor; DEA, distal embolic apophysis; E, embolus; F, flagellum on median apophysis; K, keel of median apophysis; MA, median apophysis; TA, terminal apophysis; TD, terminal division.
Figures 7–13. *Metepeira datona* Chamberlin and Ivie (sp. 1; 17°53′N, 76°19′W). 7, male palpus, mesal. 8, epigynum, posterior. 9, epigynum, ventral. 10, male, dorsal. 11, male, ventral. 12, female, dorsal. 13, female, ventral.
Scale bar: dorsum and venter figures 1.0 mm.

era related to *Araneus, Metepeira* has concentrated macrosetae on femur I instead of tibia II (Scharff and Coddington, 1997). Female *Metepeira* have between two and five macrosetae on the anterior side of the femur, and between zero and seven on the anteroventral side. Males typically have more setae than their conspecific females: four to nine on the anterior side and two to nine on the anteroventral side. Variation in the number of macrosetae appears to correlate with body size. In most species, the male palpal tibia and patella each have two strong macrosetae (Levi, 1977, fig. 8).

Compared with other araneid genera, *Metepeira* have rather small and similar genitalia, which on the one hand makes the genus easy to recognize, but on the other hand makes species tough to identify. The small epigynum is fleshy, variable in shape, and weakly sclerotized. Unlike *Araneus, Metepeira*'s scape never has a pocket but always ends with a pointed tip (e.g., Fig. 31). The cleared epigynum—and in many cases the uncleared epigynum—reveals a pair of sclerotized spherical structures where the embolus is inserted, as well as ducts to pass semen to the larger, spherical seminal receptacles. In some species, these spherical structures are wide apart (e.g., Figs. 16, 17), in others they are tubular (e.g., Figs. 39, 40), but in many, they are closer together (e.g., Figs. 93, 94). Frequently the deeper, large seminal receptacles can be seen through uncleared tissue (e.g., Figs. 201, 295).

The male palp is more distinctive. In particular, the median apophysis (MA in Fig. 5), while not always a good character for separating closely related species, is excellent when it comes to identifying the genus. Two flagellae (F in Fig. 5) gracefully curve off the base of the median apophysis, and in some species, a toothed or smooth keel (K in Fig. 5) extends in the opposite direction. This design is also seen in *Kaira, Aculepeira,* and *Amazonepeira,* but none of these have flagellae that appear so integral to the base structure.

The terminal division on the *Metepeira* palp is very similar in almost all species. When this structure is pulled up, a basal embolic apophysis (also known as an embolar lamella) can be seen in the shape of a club or spatula (E in Figs. 5, 6). Sometimes a distal embolic apophysis can be seen if it is not hidden from view by an overhanging terminal apophysis. When the terminal apophysis is large and sclerotized—which is the case in all but the *Metepeira foxi* species group—it has a recognizable toothed notch, like the mouth on a wrench (Fig. 6). Virgin males have a cap on the embolus that remains in the epigynum after mating and presumably serves as a barrier to subsequent mating (Levi, 1977). The shape of the embolus cap varies from tiny (e.g., Fig. 178) to short but wide (e.g., Fig. 199) to large and winged (Fig. 46). Finally, the terminal division lacks a stipes—a sclerite between the radix and the embolus that is frequently found in other genera related to *Araneus* (Scharff and Coddington, 1997).

Natural History. All *Metepeira* species build a unique web that combines an orb with a barrier web (Levi, 1977; Lopez, 1993). As with *Cyrtophora* Simon or *Mecynogea* Simon (Levi, 1997), the retreat of *Metepeira* hangs in the air, away from substrate, and is suspended by a scaffolding structure created by the barrier web (Fig. 1). The spider detects vibrations in the web and gains quick access to the hub using a signal line that runs from the retreat to the center of the orb (Fig. 1). Tan colored egg sacs are strung together, usually above the retreat, and the most recently laid eggs are nearest to the spider. In some species the egg sacs and retreat are decorated with insect parts (e.g., *M. spinipes*); in other species they are carefully wrapped by leaves and woven together (e.g., *M. datona*). Unlike the webs of *Cyrtophora* and *Mecynogea,* the orb web of *Metepeira* is oriented vertically, and the number of radii and sticky spirals are more typical of other araneines.

In some species, such as *M. pimungan* (personal observation) and, to a lesser degree, *M. incrassata* (G. Uetz, personal communication), juveniles and adults without eggs will live on webs lacking a suspended retreat. Instead, the spider sits on a white disk-shaped stabilimentum in the center of the hub. Of 110 *M. pimungan* specimens observed on San Miguel Island, about 40% occupied webs of this type. In two cases the disk stabilimenta were partly separated from the hub by barrier web lines and were further bent over to form a partly covered protective retreat for the spider. This observation makes it possible to imagine that the disk stabilimentum seen in *M. pimungan* results from the fusion of the suspended retreat with the hub.

When food supplies are plentiful, spiders of all kinds show an increased tolerance for one another and an increased tendency to aggregate (e.g., Gillespie, 1987; Rypstra, 1986). The suspended retreats and barrier webs of *Metepeira, Cyrtophora,* and *Mecynogea* may actually further facilitate in the formation of aggregations by easing dependency on substrate availability and by providing a common support system (Burgess and Witt, 1976; Uetz, 1986). In any case, colony formation is known to occur in all three genera (e.g., Rypstra, 1979), but especially in *Metepeira.* Small colonial aggregations of two to 10 individuals occur in *M. datona* (Spiller and Schoener, 1989), *M. minima* (personal observation), *M. glomerabilis* (R. Baptista, personal communication), and *M. atascadero* new species (e.g., Uetz and Hodge, 1990). Medium-size colonies of 10 to 30 individuals occur in *M. pimungan* (personal observation), *M. gressa* (Viera and Costa, 1988), *M. nigriventris* (L. Rayor, personal communication), *M. tarapaca* (V. Roth, locality label), and *M. spinipes* (e.g., Uetz, 1988a). Large colonies, sometimes in the thousands of individuals, commonly occur in *M. incrassata* (e.g., Uetz and Hodge, 1990). Near rivers and in other lush habitats, *M. tarapaca* colonies can reach 200 individuals (M. Roy, personal communication). These cases of social behavior, broadly spread across seven different species groups, may mean that aggregation is a frequently lost and relatively old trait, or it may mean that species are prone to converge and evolve the same behavior independently.

Either way, much research has focused on elucidating the selective forces behind colonial behavior in *Metepeira.* In particular, Uetz (1988a,b, 1996) has provided strong support for the hypothesis that *Metepeira* forage using a risk-sensitive strategy. He suggests that spiders in abundant habitats seek to minimize individual variance in prey capture by aggregating in colonies, whereas spiders in poor habitats seek to maximize variance by living solitarily—perhaps in a risky attempt to find areas of local prey maxima. The diversity of social tendencies among species is therefore commensurate of the diversity of ecological habitats that they inhabit.

Indeed, *Metepeira* species thrive in a wide array of habitats, though often they are quite harsh. These include wet, montane cloud forests in Mexico and Panama (*M. incrassata, M. olmec*); tropical and wet agricultural areas (*M. uncata, M. vigilax, M. glomerabilis, M. roraima*); high-elevation pine forests (*M. lacandon, M. nigriventris, M. grandiosa alpina*); Canadian bogs (*M. grandiosa palustris*); deciduous forests in the eastern U.S. (*M. labyrinthea*); Caribbean coastal shrubbery (*M. datona, M. minima, M. triangularis, M. jamaicensis, M. maya, M. celestun*); Mexican mesquite grasslands (*M. atascadero, M. chilapae*); Patagonian dunes and scrub (*M. galatheae*) and pampas grass (*M. karkii*); dry Californian buckwheat and sage (*M. crassipes, M. ventura, M. foxi, M. grandiosa grandiosa*); and arid and semiarid deserts (*M. arizonica, M. inca, M. ventura, M. crassipes*). Although some species (e.g., *M. galatheae, M. spinipes, M. compsa*) cover vast geographic areas and live in many different habitats, many species are more biogeographically restricted. In fact, several species follow narrow ecological zones that decrease in elevation with distance from the equator (e.g., *M. rectangula, M. vigilax, M. cajabamba,* Fig. 36; *M. arizonica,* Fig. 213).

Close cohabitation with different inter- and intrageneric species is not uncommon. Colonies of *M. incrassata* are known to contact webs of *Nephila clavipes* Linnaeus (Hodge and Uetz, 1996) and *Mecynogea ocosingo* and *Gasteracantha cancriformis* (personal observation). Often *M. crassipes, M. ventura, M. foxi,* and *M. grandiosa grandiosa* are collected together (Levi, 1977), as are *M. minima* and *M. celestun* (personal observation). Species that have been collected from identical localities, though not necessarily at the same time, include: *M. chilapae* and *M. spinipes*; *M. chilapae* and *M. atascadero*; *M. karkii* and *M. galatheae*; *M. calamuchita* new species, *M. gressa,* and *M. galatheae*; *M. rectangula, M. calamuchita,* and *M. galatheae*; *M. compsa* and *M. gressa*; *M. vigilax* and *M. compsa*; *M. glomerabilis* and *M. vigilax*; *M. compsa* and *M. glomerabilis*; *M. compsa* and *M. nigriventris*; *M. compsa* and *M. inca*; *M. datona* and *M. jamaicensis*; and *M. datona* and *M. triangularis.*

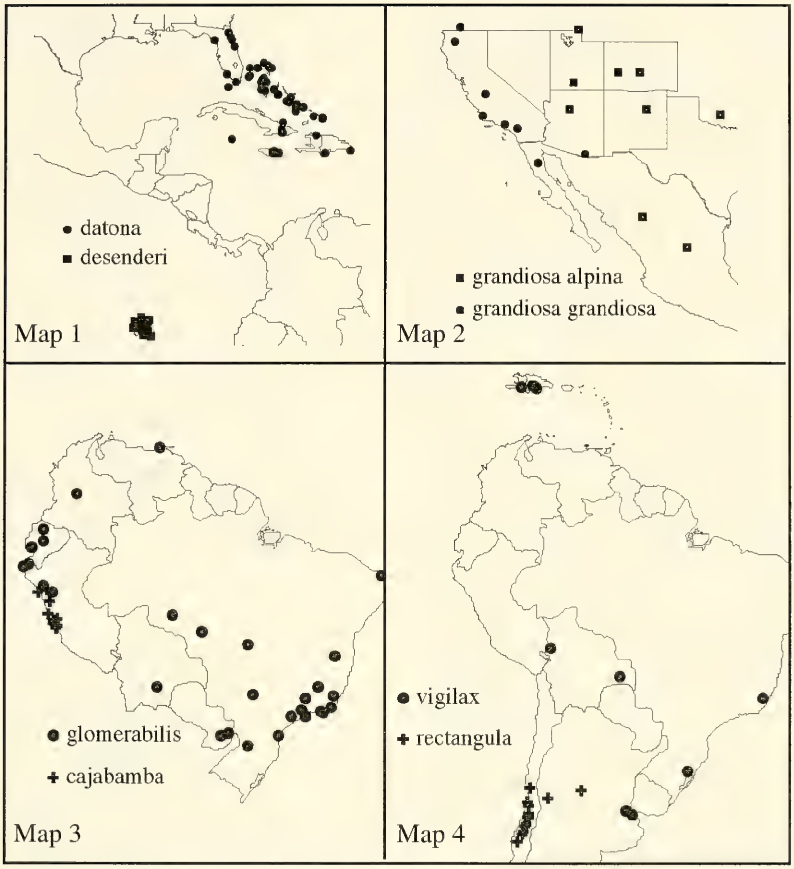
Despite the wide biogeographic ranges of *M. compsa* (Puerto Rico and south to Argentina, Map 8) and *M. datona* (Hispaniola and north to Florida, Map 1), they nonetheless come geographically close to one another but do not overlap. It is hard to imagine that the hurricanes that frequently pass through the Caribbean, as well as the homogeneous island environments, would not gradually cause these two species distributions to overlap. Perhaps these abrupt, disjunct distributions are a rare example of competitive exclusion in *Metepeira,* which in other species is not thought to be an important factor (Wise, 1983).

Sphecid wasps are predators on *Metepeira.* Locality labels indicated that *M. pacifica* has been found in the nests of *Trypargilum nitidum, T. tenoctitlan,* and *T. bensoni.* Jiménez and Tejas (1994) report that *M. crassipes* is the most frequent prey item in the nests of *Trypargilum tridentatum.* Colonial spiders, such as *M. incrassata,* are especially vulnerable to wasps, other spiders, sarcophagid flies (e.g., *Arachnidomyia lindae, A. rayorae*), and hummingbirds (Hieber and Uetz, 1990; Lopez, 1989; Rayor and Uetz, 1990).

Species Groups. Nearctic *Metepeira* were divided into two species groups: the *M. labyrinthea* group and the *M. foxi* group, based on the pattern on the sternum and the shape of the median apophysis (Levi, 1977). Baert (1987) questioned the taxonomic usefulness of the *M. foxi* species group (*M. foxi, M. grandiosa, M. datona*) because he found that *M. desenderi* has both a keel on the median apophysis and a white sternal line (Figs. 15, 21)—a combination that is incompatible by Levi's scheme. Nonetheless, the genitalia of *M. desenderi* closely ally this species with the *M. foxi* group, so I am redefining the *M. foxi* group based on purely genitalic characters. This is likely to be a basal, paraphyletic group (Fig. 4) (Piel and Nutt, 1997).

Seven additional species groups are distal to the *M. foxi.* These remaining species are united by sharing a large terminal apophysis that is sclerotized and usually studded with teeth or denticles. The *M. vigilax* group (*M. vigilax, M. cajabamba, M. glomerabilis, M. rectangula*) are united by large emboli with long scooplike basal embolic apophyses (Fig. 60). Unlike the remaining species, the terminal apophysis in this group—albeit large—does not actually overhang or hide the embolus. In addition to an overhanging terminal apophysis, the remaining taxa are also united by a distal embolic apophysis that either protrudes (Fig. 76), curves off (Fig. 185), or is secondarily lost (Fig. 264). The *M. labyrinthea* group (*M. labyrinthea, M. lacandon, M. spinipes*) share a toothless, smooth keel on the median apophysis (Figs. 67, 69).

The *M. nigriventris* group and the *M. compsa* group together share a median apophysis with teeth on the face of the keel (Figs. 92, 149). The *M. incrassata*



Maps 1, 2. *Metepeira foxi* species group. 1, *M. datona, M. desenderi*. 2, *M. grandiosa grandiosa, M. grandiosa alpina*. Maps 3, 4. *Metepeira vigilax* species group. 3, *M. glomerabilis, M. cajabamba*. 4, *M. vigilax, M. rectangula*.

group, the *M. ventura* group, and the *M. minima* group all lack a keel on the median apophysis (Figs. 164, 222, 293). However, both the *M. compsa* group and the *M. incrassata* group have epigyna with similar oval or round sclerotized rims (Figs. 151, 166), so it is likely that these are paraphyletic and consist of species leading up to a major North American (without a keel) and South American (with a keel) phylogenetic split (Fig. 4).

The South American branch includes the *M. compsa* group (*M. compsa, M. roraima, M. gressa*) and, more distally, the *M. nigriventris* group (*M. nigriventris, M. tarapaca, M. calamuchita, M. galatheae, M. karkii*). This latter group is united by a distinctive and derived scape, which projects out and down, creating a noticeable arch and overhang (Fig. 86).

The remaining species all lack a keel on the median apophysis, and with one exception (*M. inca*), they live exclusively in North America (from the Caribbean and Panama to Nevada). The *M. incrassata* group (*M. gosoga, M. maya, M. inca, M. comanche, M. olmec, M. atascadero, M. arizonica, M. incrassata, M. triangularis, M. pimungan*) are very likely paraphyletic. The epigynum on each species seems autapomorphic and difficult to unite with any others. Some species (*M. gosoga, M. maya, M. inca*) have a pointed or projecting distal embolic apophysis (Fig. 171). Others have a distal embolic apophysis that curves off sharply but does not project forward (Fig. 185). Finally, others have a distal embolic apophysis that curves off gently, almost to the point of hiding the existence of an apophysis (Fig. 206).

The *M. minima* group (*M. jamaicensis, M. minima, M. pacifica, M. petatlan*) and the *M. ventura* group (*M. uncata, M. ventura, M. celestun, M. chilapae, M. revillagigedo* new species, *M. crassipes*) are united by derived characters: both have thin flagellae arising from a thin base on the median apophysis (Fig. 264), and both share the secondary loss of the distal embolic apophysis. The *M. minima* group is clearly monophyletic; its species all have their flagellae further set off from the median apophysis on a separate, narrow stalk (Fig. 286).

Key to Female *Metepeira*

1 Epigynal openings strongly sclerotized, round but tilted so that they appear oval from a ventral view (Figs. 40, 48, 55) 2

– Epigynal openings weakly sclerotized (e.g., Fig. 208), and if round, they are not tilted and do not appear oval from a ventral view (Fig. 131) 4

2(1) Epigynal openings shaped like the entrance to a snail shell (Fig. 55); Hispaniola, Brazil, Argentina (Map 4) .... (7) *vigilax*

– Epigynal openings tubular (Figs. 40, 48) 3

3(2) Epigynal openings strongly tilted (Fig. 40); Peru (Map 3) .... (5) *cajabamba*

– Epigynal openings weakly tilted (Fig. 48); Colombia to Brazil (Map 3) .... (6) *glomerabilis*

4(1) Epigynal openings large and gaping, creating large atria inside (Figs. 61, 62); Chile and Argentina (Map 4) .... (8) *rectangula*

– Epigynal openings not gaping and not creating large atria (e.g., Fig. 69) 5

5(4) Weak posterior lobes on the epigynum create a single, wide epigynal depression (Figs. 9, 17, 24, 31) or epigynum with crescent-shaped sclerotized openings on either side of a thin scape (Levi, 1977, fig. 87). Dark, sclerotized spheres below epigynal openings are greatly separated (Figs. 8, 16) 6

– Stronger posterior lobes on the epigynum create separate, smaller epigynal depressions that are not crescent-shaped, or if crescent-shaped, the scape is thick and puffy (e.g., Figs. 86, 102, 143, 166, 187, 208). Dark, sclerotized spheres below epigynal openings are closer together (e.g., Figs. 101, 142) 11

6(5) Sternum with longitudinal white line (Fig. 21); Galapagos Islands (Map 1) .... (2) *desenderi*

– Sternum entirely black or brown (Figs. 13, 28, 35) 7

7(6) Abdomen wider than long (Fig. 12); Florida to Hispaniola (Map 1) .... (1) *datona*

– Abdomen longer than wide (Figs. 27, 34) 8

8(7) Coxae as black as sternum (Levi, 1977, fig. 98); Canada–U.S. border (Levi, 1977, map 2) .... (Levi, 1977: 212) *grandiosa palustris*

– Coxae yellow or orange and lighter than sternum (Figs. 28, 35) 9

9(8) Epigynum with crescent-shaped sclerotized openings on either side of the scape (Levi, 1977, fig. 87); western U.S. and Canada (Levi, 1977, map 2) .... (Levi, 1977: 210) *foxi*

– Epigynum with wide, transverse depression (Figs. 23, 24, 30, 31) 10

10(9) Scape wide and stubby (Fig. 24); Baja California north to Canada (Map 2) .... (3) *grandiosa grandiosa*

– Scape triangular (Fig. 31); in mountains from north-central Mexico to Canada (Map 2) .... (4) *grandiosa alpina*

11(5) Scape thickness equal to greater than width of epigynal depressions (e.g., Figs. 86, 119, 131, 143, 180, 201, 266) 12

– Scape narrower than epigynal depressions, or epigynal depressions in the shape of longitudinal slits (e.g., Figs. 238, 252, 280) 35

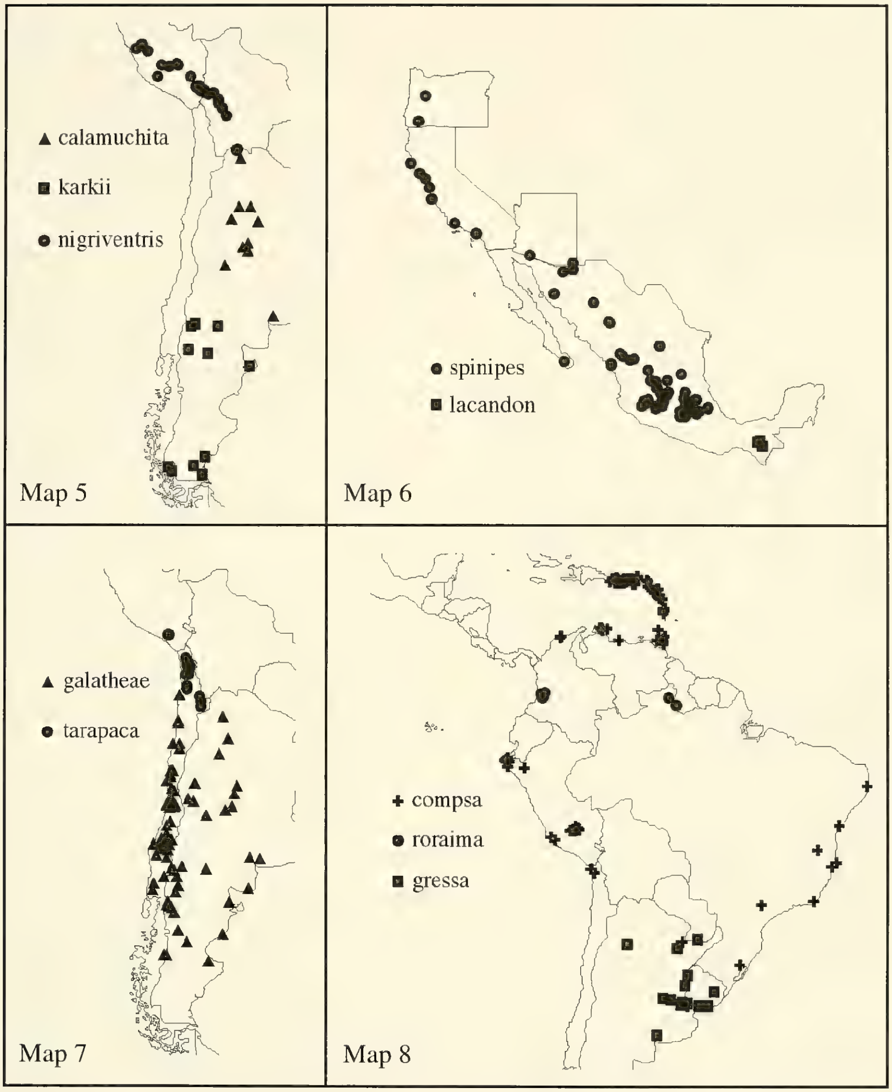
12(11) Base of scape originates anteriorly and projects ventrally before curving posteriorly. This projection creates an overhang and a noticeable gap between the scape and the genital openings (e.g., Figs. 85, 86, 101, 102, 119, 143) 13

– Scape does not create a noticeable gap or overhang (e.g., Figs. 77, 78, 130, 131, 165, 166, 265) 18

13(12) Rim of epigynal depressions slightly sclerotized and oval-shaped (Fig. 143); northern Brazil, French Guiana, and Colombia (Map 8) .... (17) *roraima*

– Epigynal depressions without distinct rim (Fig. 123) or not sclerotized (e.g., Fig. 102) 14

14(13) Sternum black, coxae mostly black (Fig.



Maps 5, 7. *Metepeira nigriventris* species group. *M. calamuchita, M. karkii, M. nigriventris, M. galatheae, M. tarapaca.*
Map 6. *Metepeira labyrinthea* species group. *M. spinipes, M. lacandon.*
Map 8. *Metepeira compsa* species group. *M. compsa, M. roraima, M. gressa.*

91), and carapace without lighter median mark (Fig. 90); high altitudes in Bolivia and Peru near Lake Titicaca (Map 5) .... (11) *nigriventris*

– Sternum with median white line (Fig. 99), or if sternum is black, then either the carapace has a median lighter arrow-shaped mark (Fig. 113) or the coxae are mostly yellow (Figs. 114, 128) 15

15(14) Sternum brown to black with parallel lines on either side of median white line on venter: the parallel lines are thicker anteriorly than posteriorly (Fig. 128). Lower lip on epigynum thick and bulbous (Fig. 123); southern Argentina and southern Chile (Map 5) .... (15) *karkii*

– Sternum with median white line, or if sternum is entirely brown to black, then parallel lines on either side of white line on venter are either absent (Fig. 114) or equally thick anteriorly as posteriorly (Fig. 99). Epigynum without thickened lower lip (Figs. 94, 102, 118, 119, 120) 16

16(15) Dark, sclerotized spheres in epigynal openings small (Figs. 119, 120). Anterior lip of epigynum rounded off, sometimes with openings shifted posteriorly and wrinkled portion of the scape's hood shifted more to the epigynum proper (Fig. 118); Chile and Argentina (Map 7) .... (14) *galatheae*

– Dark, sclerotized spheres in epigynal openings large, and anterior lip of epigynum not rounded off. Openings always located midway down the epigynum (Figs. 94, 102) 17

17(16) General shape of epigynum is triangular with posterior width greater than anterior width. Scooped-out depressions project more posteriorly than laterally (Fig. 102); north-central Argentina (Map 5) .... (13) *calamuchita*

– General shape of epigynum square. Scooped-out depressions project more laterally than posteriorly (Fig. 94); northern Chile and southern Peru (Map 7) .... (12) *tarapaca*

18(12) Epigynal openings almond-shaped, not noticeably sclerotized, and at a 40° to 60° angle from axis of spider (Figs. 69, 78) 19

– Epigynal openings not almond-shaped (e.g., Figs. 180, 187, 201), or if almond-shaped, slightly sclerotized and at an angle from spider's axis of 80° to 100° (Figs. 151, 159, 166) 22

19(18) Almond-shaped openings created by depression where scape arises from epigynum (Fig. 173); California, Arizona, northwestern Mexico (Map 9) .... (21) *gosoga*

– Almond-shaped openings created by membranes inside depressions and not associated with scape (Figs. 69, 78) 20

20(19) Distinct C-shaped depression created where the scape arises from the epigynum (Fig. 78). Black marks inside almond-shaped openings not cross-eyed in appearance (Fig. 78). Black sternum, usually with white spot in center (Fig. 83); mountainous regions of Chiapas, Mexico (Map 6) .... (10) *lacandon*

– Indistinct depression created where the scape arises from the epigynum (Fig. 69). Black marks inside almond-shaped openings cross-eyed in appearance (Fig. 69). Sternum black, with or without a median white line. If with only a portion of a median white line present, usually only at the posterior end of the sternum (Fig. 75). Never with only one white spot in center 21

21(20) Because of interspecific variability and polymorphism, females of the following two species are almost impossible to separate reliably without molecular sequence data. Small ribosomal subunit (12S) mtDNA sequence data has the following diagnostic markers. Base 14261: ACGGT; base 14285: ATTTT; base 14361: ACTAC; base 14394: CTTAT; base 14412: ATTA. (Base numbers refer to homologous sites in the mitochondrion of *Drosophila yakuba*, as reported by Clary and Wolstenholme [1985].) One quarter of scape extends below lower lips of epigynum (Levi, 1977, fig. 14); New England to Florida and west to eastern Texas (Levi, 1977, map 1, but not including points appearing in Mexico) .... (Levi, 1977: 196) *labyrinthea*

– For 12S mtDNA sequence data, the following sequences are diagnostic. Base 14261: ACGAT; base 14285: ATCTT; base 14361: ACCAC; base 14394: CTAAT; base 14412: TTTA. One third of scape extends below lower lips of epigynum (Levi, 1977, fig. 21; Fig. 69); Mexico City north to California (Map 6) .... (9) *spinipes*

22(18) Epigynal openings small, round, and sclerotized (Fig. 131). Openings sometimes hidden by wide scape (Fig. 134); Puerto Rico to Argentina and Chile (Map 8) .... (16) *compsa*

– Epigynal openings not small, round, and sclerotized 23

23(22) Rim of epigynal openings sclerotized and in an oval or teardrop shape (Figs. 151, 159, 166, 187) 24

– Rim of epigynal openings not sclerotized in an oval or teardrop shape (Figs. 180, 194, 201, 208) 27

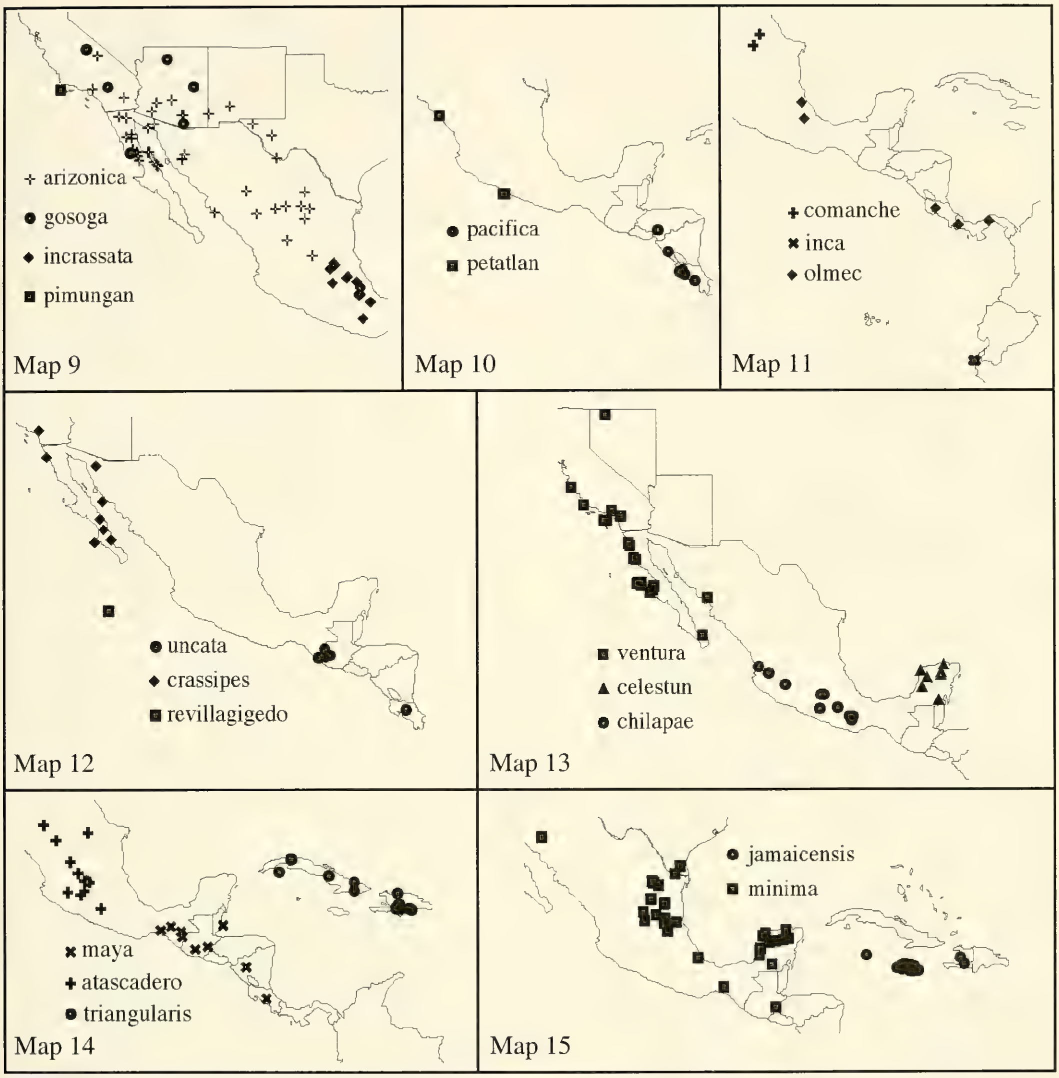
24(23) Epigynal openings oval, small, and partly hidden by scape (Fig. 151); northern Argentina, Uruguay, and southern Brazil (Map 8) .... (18) *gressa*

– Epigynal openings teardrop-shaped (Fig. 187) or large and oval but not hidden by scape (Figs. 159, 166) 25

25(24) Epigynal openings teardrop-shaped (Fig. 187); northeastern Mexico to Texas (Levi, 1977, map 1; Map 11) .... (23) *comanche*

– Epigynal openings oval-shaped (Figs. 159, 166) 26

26(25) Lower lip of epigynum pointed (Fig. 166), abdomen white (Fig. 169); northern tip of Peru (Map 11) .... (20) *inca*



Maps 9, 11, 14. *Metepeira incrassata* species group. 9, *M. arizonica, M. gosoga, M. incrassata, M. pimungan.* 11, *M. comanche, M. inca, M. olmec.* 14, *M. maya, M. atascadero, M. triangularis.*
Maps 10, 15. *Metepeira minima* species group. 10, *M. pacifica, M. petatlan.* 15, *M. minima, M. jamaicensis.*
Maps 12, 13. *Metepeira ventura* species group. 12, *M. uncata, M. crassipes, M. revillagigedo.* 13, *M. ventura, M. celestun, M. chilapae.*

– Lower lip of epigynum thickened but not pointed (Fig. 159), abdomen dark (Fig. 162); southern Mexico and Belize to Costa Rica (Map 14) .... (19) *maya*

27(23) Rim of epigynal openings sclerotized and shaped like a pair of sunglasses (Fig. 201); eastern Cuba and Hispaniola (Map 14) .... (25) *triangularis*

– Rim of epigynal openings not sclerotized or, if sclerotized, not in shape of sunglasses (e.g., Figs. 208, 224) 28

28(27) Posterior epigynal lobes converge behind the scape so that epigynal depressions appear closed off from ventral view (Figs. 180, 208, 216, 224) 29

– Posterior epigynal lobes end before they disappear behind the scape so that epigynal depressions appear open posteriorly from ventral view (Figs. 194, 245, 259, 266) 32

29(28) Scape relatively long and thin, epigynal depressions large and round, large black spheres take up almost all the space in the depressions (Fig. 180); southern Veracruz to Panama (Map 11) .... (22) *olmec*

– Scape relatively short, fat, and fleshy. Epigynal depressions not perfectly round; black spheres do not take up most of the space in the depression (Figs. 208, 216, 224) 30

30(29) Epigynum puffy, scape so thick that depressions on either side of scape appear crescent-shaped (Fig. 208); southwestern U.S. to central Mexico (Map 9) .... (26) *arizonica*

– Epigynum not puffy, scape not so fat that depressions become crescent-shaped (Figs. 216, 224) 31

31(30) Very social. Epigynal depressions large, disk-shaped, with shiny-smooth sclerotized inner surfaces and thin posterior lips (Fig. 224). Sternum mostly black, sometimes with anterior white marks. Venter without U-shaped mark circumscribing median white line posteriorly. Coxae mostly dark brown (Fig. 228); mainly in southern Veracruz (Map 9) .... (28) *incrassata*

– Mostly solitary. Epigynal depressions small, oval, with reduced shiny-smooth sclerotized surfaces and thick posterior lips (Fig. 216). Sternum with median white line or only white mark at posterior end. Venter with U-shaped mark circumscribing median white line posteriorly. Coxae mostly yellow (Fig. 221); central Mexican plateau (Map 14) .... (27) *atascadero*

32(28) Small square-shaped epigynal depressions on either side of scape (Figs. 259, 266) 33

– Large, more rounded epigynal depressions (Fig. 194) or with straight to S-shaped edges mostly covered by scape (Fig. 245) 34

33(32) Dark spheres inside epigynal depressions appear slightly walleyed. Scape relatively narrower at base: about the width of the depressions (Fig. 266); southeast and south-central Mexico (Map 13) .... (34) *chilapae*

– Dark spheres inside epigynal depressions appear slightly cross-eyed. Scape relatively wider at base: about twice the width of the depressions (Fig. 259); northwestern Mexico and California (Map 12) .... (33) *crassipes*

34(32) Large, rounded epigynal depressions with large black spheres inside (Fig. 194). Sternum black with posterior dewdrop-shaped mark. Pair of short parallel lines on either side of ventral median white line (Fig. 198). Carapace with large anterior white region (Fig. 197); San Nicolas Island off southern California (Map 9) .... (24) *pimungan*

– Epigynal depressions with straight to slightly S-shaped edges, mostly hidden by a wide triangular scape (Fig. 245). Sternum with wide median white line. No parallel white lines on either side of ventral median white line (Fig. 249). Carapace with small anterior white region (Fig. 248); Yucatan Peninsula (Map 13) .... (31) *celestun*

35(11) Epigynal depressions wider than long (Figs. 231, 252) 36

– Epigynal depressions longer than wide (e.g., Figs. 238, 273, 280, 288) 37

36(35) Black comma shapes inside epigynal depressions (Fig. 231). Sternum with median white line (Fig. 235). Dorsum lightly pigmented (Fig. 234); northwestern Mexico and coastal California (Map 13) .... (29) *ventura*

– Black S-shaped marks inside epigynal depressions (Fig. 252). Sternum black with dewdrop mark at posterior end (Fig. 256). Dorsum darkly pigmented (Fig. 255); Guatemala and Costa Rica (Map 12) .... (32) *uncata*

37(35) Epigynal depressions indistinct anteriorly. Black comma-shaped marks inside depressions and covered by translucent membranes (Fig. 238); Isla Socorro of the Archipiélago de Revillagigedo (Map 12) .... (30) *revillagigedo*

– Epigynal depressions distinct anteriorly. Black spheres shifted laterally and located outside the depressions (e.g., Figs. 273, 280, 295) 38

38(37) Epigynal depressions slit-shaped and usually narrower than scape (Figs. 280, 281); northwestern Mexico and Yucatan Peninsula (Map 15) .... (36) *minima*

– Epigynal depressions oval and wider than scape (Figs. 273, 288) 39

39(38) Dark spheres larger than epigynal openings (Fig. 273); west coastal Mexico (Map 10) .... (35) *petatlan*

– Dark spheres smaller than epigynal openings (Figs. 288, 295) 40

40(39) V-shaped ridge under the scape. Dark spheres located behind the junction where the ridge meets the lateral edge of the epigynal depressions (Fig. 288); Honduras to Costa Rica (Map 10) .... (37) *pacifica*

– Straight ridge under the scape. Dark

spheres located laterally and outside of the junction where the ridge meets the lateral edge of the epigynal depressions (Fig. 295); Cayman Islands, Jamaica, and Haiti (Map 15) .... (38) *jamaicensis*

KEY TO MALE *METEPEIRA*

1 Terminal apophysis thin, small, fleshy, without teeth or sclerotized parts (Figs. 7, 15, 22, 29) 2

– Terminal apophysis enlarged, meaty, with teeth or sclerotized parts (e.g., Figs. 38, 60, 84, 199) 7

2(1) Terminal apophysis narrow; embolus curled clockwise like the tip on a corkscrew (Figs. 7, 15) 3

– Terminal apophysis wide; embolus tilted up and L-shaped (Figs. 22, 29) 4

3(2) Curled embolus with a ridge on the upper surface and raised on a pedicel; basal embolic apophysis enormous (Fig. 15). Sternum with wide median white line (Fig. 21); Galapagos Islands (Map 1) .... (2) *desenderi*

– Curled embolus smooth on its upper surface and not raised on a pedicel; basal embolic apophysis hardly noticeable (Fig. 7). Sternum entirely black (Fig. 11); Florida to Hispaniola (Map 1) .... (1) *datona*

4(2) L-shaped embolus at an acute (< 90°) angle (Levi, 1977, figs. 91–93); western U.S. and Canada (Levi, 1977, map 2) .... (Levi, 1977: 210) *foxi*

– L-shaped embolus at angle of 90° or greater (Figs. 22, 29) 5

5(4) Median apophysis with rounded projection on dorsal side; jagged posterior edge of keel (Figs. 22, 29) 6

– Median apophysis without projection—flat on dorsal side; rounded posterior edge of keel (Levi, 1977, fig. 105); along the Canadian and U.S. border, north to Nova Scotia and British Columbia, south to Maine and North Dakota (Levi, 1977, map 2) .... (Levi, 1977: 212) *grandiosa palustris*

6(5) Lower, transverse part of L-shaped embolus longer than vertical part (Fig. 29); mountains from north-central Mexico to Canada (Map 2) .... (4) *grandiosa alpina*

– Lower, transverse part of L-shape embolus shorter than or equal to vertical part (Fig. 22); Baja California north to Canada (Map 2) .. (3) *grandiosa grandiosa*

7(1) Terminal apophysis does not entirely overhang the embolus. Embolus long and robust, with a long and thin gap created between the embolus and the basal embolic apophysis (Figs. 38, 46, 53, 60) 8

– Terminal apophysis often overhangs the embolus, covering it from view. Embolus not long and robust, without long, thin gap between embolus and basal embolic apophysis (e.g., Figs. 67, 79, 92, 121, 141, 185) 11

8(7) Longer flagellum as thick as shorter flagellum. Keel short, slim, and feather-shaped. Embolus as wide as base of median apophysis (Fig. 53); Hispaniola, Brazil, Argentina (Map 4) .... (7) *vigilax*

– Longer flagellum thicker than shorter flagellum. Keel absent (Fig. 38) or wide and arrowhead-shaped. Embolus thinner than base of median apophysis (Figs. 38, 46, 60) 9

9(8) Keel absent or greatly reduced (Fig. 38); Peru (Map 3) .... (5) *cajabamba*

– Keel present (Figs. 46, 60) 10

10(9) Large embolus as long as basal embolic apophysis (Fig. 60). Normal embolic cap; Chile and Argentina (Map 4) .... (8) *rectangula*

– Small embolus shorter than basal embolic apophysis, often seen with winged embolic cap (Fig. 46); Colombia to Brazil (Map 3) .... (6) *glomerabilis*

11(7) Median apophysis with keel (e.g., Figs. 92, 141) 12

– Median apophysis without keel (e.g., Figs. 157, 178, 286); all North American or Caribbean species except for *M. inca* 22

12(11) Keel without teeth; smooth (e.g., Figs. 67, 76); North America 13

– Keel with teeth on face; rough (e.g., Figs. 84, 92, 100); South America 15

13(12) Distal embolic apophysis sleek, pointed, and feather-shaped when viewed from underside of terminal division (Fig. 70); Mexico City north to California (Map 6) .... (9) *spinipes*

– Distal embolic apophysis spoon-shaped (Fig. 6) or widened with bump (Fig. 79) 14

14(13) Distal embolic apophysis spoon-shaped (Fig. 6). Sternum reddish brown with median white line. New England to Florida and west to eastern Texas (Levi, 1977, map 1, excluding points in Mexico) .... (Levi, 1977: 196) *labyrinthea*

– Distal embolic apophysis widened with bump (Fig. 79). Sternum black with or without faint white mark in center (Fig. 81); mountainous regions of Chiapas, Mexico (Map 6) .... (10) *lacandon*

15(12) Distal embolic apophysis a simple extension that projects forward, parallel to the embolus. Keel usually rounded

(Fig. 129); Puerto Rico to Argentina and Chile (Map 8) .... (16) *compsa*

– Distal embolic apophysis raised up or projected away from the embolus. Keel usually pointed or jagged (Figs. 84, 92, 100, 121, 141, 149) 16

16(15) Distal embolic apophysis points up and away from the embolus. Keel usually jagged (Figs. 141, 149) 21

– Distal embolic apophysis wide and raised up on boss. Keel usually pointed (Figs. 84, 92, 100) 17

17(16) Dewlap extension under embolus (Fig. 100) curves under, narrowing the gap between the embolus and the basal embolic apophysis by one-half (Fig. 103); north-central Argentina (Map 5) .... (13) *calamuchita*

– No such dewlap (Figs. 84, 92, 110, 121). Gap between embolus and basal embolic apophysis narrow by less than one-half the widest distance (Figs. 87, 95, 117, 124) 18

18(17) Outside edge of distal embolic apophysis gently rounded when viewed from underside of terminal division (Fig. 124); southern Argentina and southern Chile (Map 5) .... (15) *karkii*

– Outside edge of distal embolic apophysis with distinct bump when viewed from underside of terminal division (Figs. 87, 95, 117) 19

19(18) Outside edge of distal embolic apophysis with rounded bump that is sclerotized and has a distinct line rising up from embolus (Fig. 117); Chile and Argentina (Map 7) .... (14) *galatheae*

– Outside edge of distal embolic apophysis with pointed bump, less sclerotized than embolus proper and without a distinct line rising up from the embolus (Figs. 87, 95) 20

20(19) Thick neck joining embolus and basal embolic apophysis. Bump on distal embolic apophysis peeks out from under the terminal apophysis (Figs. 92, 95). Sternum usually with white spot or median white line (Fig. 97); northern Chile and southern Peru (Map 7) .... (12) *tarapaca*

– Thin neck joining embolus and basal embolic apophysis. Bump on distal embolic apophysis does not peek out from under the terminal apophysis (Figs. 84, 87). Sternum always black, general coloration dark (Figs. 88, 89); high altitudes in Bolivia and Peru near Lake Titicaca (Map 5) .... (11) *nigriventris*

21(16) Distal embolic apophysis thinner than embolus near the junction of the two. Embolus tip is curved gently (Fig. 149); northern Argentina, Uruguay, and southern Brazil (Map 8) .... (18) *gressa*

– Distal embolic apophysis the same size as embolus near the junction of the two. Embolus tip is curved abruptly (Fig. 141); northern Brazil, French Guiana, and Colombia (Map 8) .... (17) *roraima*

22(11) Distal embolic apophysis a projecting bump (Figs. 157, 164, 171) 23

– Distal embolic apophysis curved off (Figs. 178, 185, 199, 214), rounded (Figs. 192, 206), or absent (Figs. 264, 278, 293) 25

23(22) Distal embolic apophysis raised up from the embolus and pointed (Fig. 171); California, Arizona, northwestern Mexico (Map 9) .... (21) *gosoga*

– Distal embolic apophysis not raised up, but projecting forward and rounded off (Figs. 157, 164) 24

24(23) Main flagellum on median apophysis thin and initially as thick as base. Embolus and embolic cap shortened (Fig. 164); northern tip of Peru (Map 11) .... (20) *inca*

– Main flagellum on median apophysis thick, but initially thinner than base. Embolus and embolic cap elongated (Fig. 157); southern Mexico and Belize to Costa Rica (Map 14) .... (19) *maya*

25(22) Embolus shaped like the nib on a fountain pen, with bump near tip on opposite side of distal embolic apophysis (Figs. 214, 217); central Mexican plateau (Map 14) .... (27) *atascadero*

– Embolus without such bump near tip (e.g., Fig. 222) 26

26(25) Distal embolic apophysis abruptly ends in sharp curve and flagellae not set off on a narrow stalk (Figs. 178, 185, 199, 222) 27

– Distal embolic apophysis gently curved off (Figs. 229, 236, 243), rounded (Figs. 192, 206), or absent (e.g., Fig. 293) 30

27(26) Flagellae very thin and equal in length. Embolus long and arching, with wide but short embolus cap. Overhanging terminal apophysis covers only a distal portion of the sclerotized part of the embolus (Fig. 199); eastern Cuba and Hispaniola (Map 14) .... (25) *triangularis*

– Flagellae normal in thickness and usually of different lengths. Terminal apophysis centered above the entire sclerotized portion of the embolus (Figs. 178, 185, 222) 28

28(27) Not known to be very social. Height of embolus plus distal embolic apophysis just before the latter curves off sharply is equal to or greater than length of embolus tip distal to this point (Figs.

178, 185). Sternum with median white markings (Figs. 182, 189) 29
– Highly social species. Height of embolus plus distal embolic apophysis just before the latter curves off sharply is less than the length of the embolus tip distal to this point (Fig. 222). Sternum mostly black; sometimes with anterior white marks. Coxae mostly dark brown (Fig. 226); mainly in southern Veracruz, Mexico (Map 9) .... (28) *incrassata*
29(28) Darker, sclerotized portion of the embolus does not extend over the hump of the distal embolic apophysis. Base of embolus narrower than widest part of the first flagellum (Fig. 178); southern Veracruz, Mexico to Panama (Map 11) .... (22) *olmec*
– Darker, sclerotized portion of the embolus extends over the hump of the distal embolic apophysis. Width of embolus base the same or greater than widest part of the first flagellum (Fig. 185); northeastern Mexico to Texas (Levi, 1977, map 1; Map 11) .... (23) *comanche*
30(26) Distal embolic apophysis rounded off to form convex curve (Figs. 192, 206) 31
– Distal embolic apophysis gently falls off to form concave shape (Figs. 229, 236, 243) or absent (e.g., Fig. 293) 32
31(30) Embolus S-shaped (Fig. 192). Sternum black with posterior white mark. Venter without white anchor shape mark (Fig. 196); San Nicolas Island off southern California (Map 9) .... (24) *pimungan*
– Embolus convex on upper surface, straight on lower surface (Fig. 206). Sternum black with median white line. Venter with faint white anchor-shaped mark posterior to median white line (Fig. 210); southwestern U.S. to central Mexico (Map 9) .... (26) *arizonica*
32(30) Flagellae on median apophysis set off on separate, narrow, stalk (e.g., Figs. 278, 286) 38
– Flagellae on median apophysis not set off on a separate, narrow, stalk (e.g., Figs. 229, 264) 33
33(32) Larger flagellum twice as wide as smaller flagellum (Fig. 236); Isla Socorro of the Archipiélago de Revillagigedo (Map 12) .... (30) *revillagigedo*
– Larger flagellum less than twice as thick as smaller flagellum (e.g., Figs. 229, 243) 34
34(33) Flagellae on median apophysis relatively thin (Figs. 250, 264) 35
– Flagellae on median apophysis thicker (Figs. 229, 243, 257) 36
35(34) Embolus with sharp bend near the tip (Fig. 264). Sternum with median white line (Fig. 268); southeast and southcentral Mexico (Map 13) .... (34) *chilapae*
– Embolus with gentle bend further from the tip (Fig. 250). Sternum mostly black with small white mark at posterior end of sternum (Fig. 254); Guatemala and Costa Rica (Map 12) .... (32) *uncata*
36(34) Embolus with sharp bend near the tip (Fig. 229); northwestern Mexico and coastal California (Map 13) .... (29) *ventura*
– Embolus with gentle bend further from the tip (Figs. 243, 257) 37
37(36) Sclerotized portion of embolus about as long as the longer flagellum (Fig. 243); Yucatan Peninsula (Map 13) .... (31) *celestun*
– Sclerotized portion of embolus shorter than the longer flagellum (Fig. 257); northwestern Mexico and California (Map 12) .... (33) *crassipes*
38(32) Embolus thick and tapering to a point (Figs. 271, 278) 39
– Embolus thin and needlelike (Figs. 286, 293) 40
39(38) Longer flagellum greater than half the length of the cymbium (Fig. 271); west coastal Mexico (Map 10) .... (35) *petatlan*
– Longer flagellum less than half the length of the cymbium (Fig. 278); northwestern Mexico and Yucatan Peninsula (Map 15) .... (36) *minima*
40(38) Flagellae set off on long, thin stalk (Fig. 293); Cayman Islands, Jamaica, and Haiti (Map 15) .... (38) *jamaicensis*
– Flagellae set off on short, thicker stalk (Fig. 286); Honduras to Costa Rica (Map 10) .... (37) *pacifica*

Metepeira foxi Group

The *M. foxi* species group (*sensu* Levi, 1977) and *M. desenderi* share very similar genitalia, especially among males. Consequently, I am expanding the *M. foxi* group to include *M. desenderi,* but with the exclusion of the black sternum as a diagnostic character. The *M. foxi* group (*sensu lato*) includes males with an embolus that lacks a distal apophysis. The embolus curls almost 180° clockwise around a reduced or fleshy terminal apophysis (Figs. 7, 15, 22, 29). In other species groups the embolus is straighter and does not curl (e.g., Fig. 60), and the terminal apophysis is large, overhanging the embolus, and often sclerotized with teeth (e.g., Fig. 121). Epigynal features uniting females in the *M. foxi* species group are harder to discern. Generally speaking, the epigynum has a stubby, shorter, often triangular scape and weaker posterior lobes that permit a wider view into the epigynal openings (compare Figs. 9, 17, 24, 31 with Figs. 143, 252).

1. *Metepeira datona* Chamberlin and Ivie
Figures 7–13, 312; Map 1

Metepeira datona Chamberlin and Ivie, 1942: 68, fig. 196, ♀. Female holotype from Daytona Beach, Florida, USA, in the AMNH, examined. Levi, 1977: 208–210, figs. 78–86, ♂, ♀. Brignoli, 1983: 275.

Metepeira inerma Bryant, 1945: 378. Female holotype from Cap Haitien, Haiti in the MCZ, examined. First synonymized by Levi, 1977: 208–210.

Description. Female from Morant Point, Mammee Bay, Jamaica. Carapace light around eyes with short lateral posterior extensions, sometimes with thin longitudinal white line (Fig. 12). Legs ringed. Femur I with row of two macrosetae on anterior side; three light setae on anteroventral side. Anterior half of dorsal folium white, posterior half black, margined by white; two halves separated by transverse white line. Abdomen widest in center (Fig. 12). Venter with a longitudinal white line. Pair of white spots on either side of spiracle (Fig. 13). Sternum usually entirely black, though sometimes with thin anterior and posterior marks, suggestive of median white line (Fig. 13). Ratio of eye diameters: posterior medians and anterior medians 1.0, anterior laterals 1.3, posterior laterals 1.1. Anterior median eyes separated by 1.4 diameters, posterior median eyes by 0.9, anterior median eyes separated from anterior laterals by 1.6 diameters of anterior lateral eyes, lateral eyes separated by 0.3 their diameters. Total length 4.2 mm. Carapace 1.7 mm long, 1.4 wide. First femur 2 mm, patella and tibia 2.4, metatarsus 1.5, tarsus 0.8. Second patella and tibia 1.9 mm, third 1.1, fourth 1.6.

Male from Morant Point, Mammee Bay, Jamaica. Carapace yellowish brown, light around eyes. Median white mark anterior to thoracic furrow (Fig. 10). Legs same color as carapace, lightly ringed. Femur I with row of three macrosetae on anterior side, two on anteroventral side. Center of dorsum with transverse white line; posterior half darker than anterior half; thin median black line; margin of folium white (Fig. 10). Venter, sternum as in female (Fig. 11). Ratio of eye diameters: posterior medians and anterior medians 1.0, anterior laterals 1.3, posterior laterals 1.2. Anterior median eyes separated by 1.8 diameters, posterior median eyes by 1.1, anterior median eyes separated from anterior laterals by 1.5 diameters of anterior lateral eyes, lateral eyes separated by 0.5 their diameters. Total length 3 mm. Carapace 1.4 mm long, 1.1 wide. First femur 2.7 mm, patella and tibia 2.7, metatarsus 1.9, tarsus 0.8. Second patella and tibia 2.1 mm, third 1.0, fourth 1.3.

Diagnosis. The dorsal folium and abdominal shape is distinctive in *M. datona.* Typically, the female's abdomen is widest in the middle, forming a rhomboid in shape (Fig. 12), and both sexes have a transverse white line dividing the dorsal folium, with wide black markings on the posterior half (Figs. 10, 12). A ventral view of the epigynum in *M. datona* reveals a ridge under the scape that almost forms a straight line and which curves up at the ends (Fig. 9) instead of a V-shape (Figs. 17, 24, 31). The openings to the epigynum consist of small slits that flank a wide depression (Fig. 9), compared to larger openings that are relatively closer together (Figs. 17, 24, 31). The smooth embolus on *M. datona* is somewhat more compressed as it curls clockwise like the tip on a corkscrew, in contrast to the slightly ridged embolus supported on a stalk (Fig. 15) or the strongly ridged and tilted embolus (Figs. 22, 29). Like *M. desenderi* (Fig. 15) but unlike *M. grandiosa grandiosa* (Fig. 22) and *M. grandiosa alpina* (Fig. 29), the posteroventral edge of the keel on the median apophysis is rounded, as opposed to pointed (Fig. 7). Finally, *M. datona* has the thinnest and fleshiest terminal apophysis in the genus (Fig. 7).

Variation. Average body length of 15 females examined 3.8 mm, range 2.9 to 4.8 mm. Average body length of seven males examined 2.6 mm, range 1.8 to 3 mm.

Natural History. Mature adults have been collected throughout the year (Fig. 312). According to locality labels, *M. datona* are found near the beach on cactus, palm, low scrub, mangrove, and bamboo. Females are known to wrap their egg sacs in dead leaves.

Distribution. At sea level in Florida, Bahamas, British West Indies, and the Dominican Republic (Levi, 1977, map 2; Map 1).

Records Examined. BAHAMAS *Abaco Cays:* Abaco, 26°29′N, 77°5′W, 2.xii.1964 (W. B. Peck, MCZ); Allons Cay, 26°59′N, 77°40′W, 9.v.1953 (E. B. Hayden, AMNH); Hopetown, Elbow Cay, 26°33′N, 76°57′W, 5.v.1953 (E. Hayden, AMNH); New Plymouth, Green Turtle Cay, 26°50′N, 77°23′W, 7.v.1953 (G. Rabb, AMNH); Whale Cay, 26°43′N, 77°14′W, 12.i.1964 (W. B. Peck, CAS). *Acklin's Id.:* Atwood's Harbor, 22°13′N, 74°18′W, 15.ix.1958 (A. W. Scott Jr., MCZ); Salina Point, 22°13′N, 74°18′W, 15.viii.1958 (R. Robertson & A. W. Scott Jr, MCZ). *Andros:* Fresh Creek, 24°26′N, 77°57′W, 23.iv.1953 (L. Giovannoli, AMNH); Mangrove Cay, 24°15′N, 77°39′W, 26.iv.1953 (E. Hayden, AMNH); Nicolls Town, 25°8′N, 78°0′W, 14.iii.1967 (A. M. Nadler, AMNH). *Berry Islands:* Frazier's Hog Cay, 25°24′N, 77°50′W, 29.iv.1953 (E. Hayden, AMNH); Little Harbor Cay, 25°34′N, 77°43′W, 1.v.1953 (Hayden & Giovannoli, AMNH). *Crooked Island:* North shore of Cripple Hill, 22°49′N, 74°16′W, 15.ix.1958 (A. W. Scott Jr, MCZ); NW end, Gordon (= Gun) Bluff, 22°50′N, 74°20′W, 15.viii.1958 (R. Robinson & A. W. Scott Jr, MCZ). *Crooked Island Group:* Long Cay, 22°37′N, 74°20′W, 7.iii.1953 (Hayden & Giovannoli, AMNH). *East Plana Cay:* 22°37′N, 73°33′W, 4.iii.1953 (E. Hayden, AMNH). *Exumas:* Musha Cay, 23°50′N, 76°15′W, 29.xii.1985 (A. Boutard, MCZ); Warderick Wells Cay, 24°22′N, 76°36′W, 9.i.1953 (L. Giovannoli, AMNH), 11.i.1953 (Hayden & Giovannoli, AMNH). *Grand Bahamas Island:* Dundee Bay, 26°30′N, 79°15′W [?], 25.xii.1965 (L. Pinter, MCZ); near Fre port, pine-palmetto, 26°34′N, 78°27′W [?], 25.vii.1965 (L. Pinter, MCZ). *Long Island:* Clarence Town, 23°6′N, 74°59′W, 10.iii.1953 (L. Giovannoli, AMNH); Deadman's Cay, 23°14′N, 75°14′W, 11.iii.1953 (E. Hayden, AMNH). *New Providence Island:* 7 mi W. of Nassau, 25°5′N, 77°28′W, 4.i.1953 (Hayden & Giovannoli, AMNH). *North Bimini:* 25°44′N, 79°15′W, 25.i.1950 (C. M. Bogert, AMNH), 6.vi.1950 (M. Cazier & F. Rindge, AMNH), 15.v.1951 (W. J. Gertsch & M. Cazier, AMNH), 15.vi.1951 (M. Cazier, P. & C. Vaurie, AMNH), 15.vii.1951 (C. & P. Vaurie, AMNH), 13.xii.1952 (A. M. Nadler, AMNH), 28.xi.1959 (A. M. Nadler, AMNH). *Rum Cay:* near Port Nelson, 23°38′N, 74°50′W, 16.iii.1953 (Hayden & Giovannoli, AMNH). *South Bimini:* 25°42′N, 79°17′W, 12.vi.1950 (M. Cazier & F. Rindge, AMNH), 22.vi.1950 (M. Cazier & F. Rindge, AMNH), 15.v.1951 (W. J. Gertsch & M. Cazier, AMNH), 15.vii.1951 (C. & P. Vaurie, AMNH), 4.viii.1951 (C. & P. Vaurie, AMNH), 4.xii.1952 (A. M. Nadler, AMNH), 25.iii.1953 (A. M. Nadler, AMNH); Gun Cay, 25°35′N, 79°20′W, 15.vi.1951 (AMNH). BRITISH WEST INDIES *Caicos Islands:* Long Cay, 21°28′N, 71°33′W, 10.ii.1953 (E. Hayden, AMNH); South Caicos, from webs in upper beach zone, 21°31′N, 71°30′W, 3.iv.1973 (D. W. Buden, MCZ); West Caicos, 21°39′N, 72°28′W, 4.ii.1953 (Hayden & Giovannoli, AMNH), 5.ii.1953 (Hayden, Rabb, & Giovannoli, AMNH). *Grand Cayman Island:* 19°20′N, 81°10′W, 15.ii.1960 (R. A. Lewin, MCZ). CUBA *Oriente:* Banes, 20°58′N, 75°43′W, 2.viii.1955 (A. F. Archer, AMNH); Ensenada Nispero, Ciudamar, 19°58′N, 75°52′W, 9.xi.1945 (P. Alayo, AMNH); Juraguá, 19°56′N, 75°40′W, 1.x.1955 (P. Alayo, AMNH); Santa Fé [?], 20°22′N, 75°53′W (A. F. Archer, AMNH). DOMINICAN REPUBLIC *Barahona:* Playa Los Patos, 17°58′N, 71°11′W, 31.viii.1976 (J. A. Ottenwalder, MNSD). *La Altagracia:* Punta Cana, Isla Saona, 18°8′N, 68°34′W (Felix E. Del Monte & K. Guerrero, MNSD). HAITI *Dept. du Nord:* Cap-Haïtien, 19°46′N, 72°13′W, 15.iii.1934 (E. Bryant, Utawana Exp., MCZ). JAMAICA *Portland:* between Boston and Blue Hole, 18°6′N, 76°37′W, 29.vii.1955 (A. F. Archer, AMNH). *Saint Andrews:* Hope Gardens, Gordontown, 18°2′N, 76°45′W, 27.vii.1955 (A. F. Archer, AMNH). *Surrey:* Morant Point, Mammee Bay, 17°53′N, 76°19′W, 14.x.1957 (A. M. Chickering, MCZ); Palisadoes, 17°56′N, 76°46′W, 11.xi.1967 (A. M. Chickering, MCZ); Palisadoes Area, 17°56′N, 76°46′W, 1.xi.1957 (A. M. Chickering, MCZ). U.S. VIRGIN ISLANDS *Saint Thomas:* Morant Point, 17°55′N, 76°10′W, 25.vii.1985 (G. B. Edwards, FSCA).

2. *Metepeira desenderi* Baert
Figures 14–21, 307; Map 1

Epeira labyrinthea:—Banks, 1902: 60. Banks, 1924: 97. Misidentification.

Metepeira sp.:—Roth and Craig, 1970: 116.

Metepeira desenderi Baert, 1987: 145, figs. 16–21, ♂, ♀. Male holotype from Isla Pinzon, Galapagos, Ecuador, in the IRSNB. Platnick, 1989: 341.

Note. Holotype not examined because the figures in Baert (1987) are clear and because this is the only *Metepeira* species found on the Galapagos.

Description. Female from east slope of Isla Santa Cruz, Galapagos Islands, Ecua-

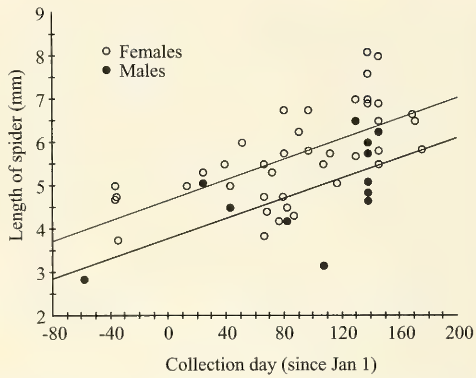


Figure 14. The length of mature *M. desenderi* collected on specific days of the year over a period of 84 years. There is a trend from smaller spiders early in the season to large spiders later in the season.
Scale of abscissa: −80 = October 12 of the previous year; 40 = February 9; 160 = June 9.
Symbols: Females (○), stippled regression line (r^2 = 40%); males (●), solid regression line (r^2 = 42%).

dor. Carapace yellowish brown, white around eyes, lighter median line (Fig. 20). Legs yellowish white, slightly darker annulations on distal ends of articles. Femur I with row of four macrosetae on anterior side; two to four on anteroventral side. Dorsal fleur-de-lis pattern broken into four white patches with anterior pair often larger than in most species. Posterior pair straighter than usual, forming a cross in center of folium (Fig. 20). Venter olive-brown with median white line surrounded by white U-shaped marking (Fig. 21). Pair of white spots on either side of spiracle. Sternum brownish black with wide, white line widening anteriorly (Fig. 21). Ratio of eye diameters: posterior medians and anterior medians 1.0, anterior laterals 1.3, posterior laterals 1.3. Anterior median eyes separated by 1.5 diameters, posterior median eyes by 0.9, anterior median eyes separated from anterior laterals by 2.3 diameters of anterior lateral eyes, lateral eyes separated by 0.2 their diameters. Total length 5.5 mm. Carapace 2.3 mm long, 1.7 wide. First femur 2.7 mm, patella and tibia 3, metatarsus 2.2, tarsus 0.8. Second patella and tibia 2.4 mm, third 1.4, fourth 2.

Male from same locality as female. Carapace yellowish brown with wide white median mark (Fig. 18). Legs ringed like female. Femur I with row of four macrosetae on anterior side; four to seven on anteroventral side. Dorsum and venter as in female, though median white line on sternum sometimes broken (Figs. 18, 19). Ratio of eye diameters: posterior medians and anterior medians 0.9, anterior laterals 1.2, posterior laterals 1.1. Anterior median eyes separated by 2.2 diameters, posterior median eyes by 1.4, anterior median eyes separated from anterior laterals by 2.3 diameters of anterior lateral eyes, lateral eyes separated by 0.5 their diameters. Total length 3.2 mm. Carapace 1.6 mm long, 1.3 wide. First femur 2.6 mm, patella and tibia 2.6, metatarsus 2.3, tarsus 0.8. Second patella and tibia 2.2 mm, third 1.0, fourth 1.6.

Diagnosis. Within the *M. foxi* species group, the female abdomen shape of *M. desenderi* is closest to *M. datona,* though not quite as rhomboid (compare Fig. 20 with Figs. 12, 27, 34). The scape on *M. desenderi* is narrower and less triangular than other *M. foxi* species, and the depression under the scape forms a distinct U-shaped smile that is not seen in the others (compare Fig. 17 with Figs. 9, 24, 31). Like *M. datona* (Fig. 7) but unlike *M. grandiosa grandiosa* (Fig. 22) or *M. grandiosa alpina* (Fig. 29), the posteroventral edge of the keel on the median apophysis is rounded as opposed to pointed (Fig. 15). Similar to *M. datona* (Fig. 7), the embolus of *M. desenderi* is curved like a slightly flattened corkscrew. Unlike *M. datona,* the embolus seems to be supported by a pedicel off a large basal embolic apophysis (Fig. 15). In contrast, a pedicel is not evident in *M. datona,* and the basal embolic apophysis is barely visible (Fig. 7).

Variation. Average body length of 45 females examined 5.8 mm, range 3.8 to 8.5 mm. Average body length of 13 males examined 4.9 mm, range 2.9 to 6.5 mm.

Natural History. Notes on the collection labels of Y. Lubin and R. Silberglied indicate that *M. desenderi* is active at night and that the retreat is composed of *Opuntia* bark and croton leaves. According to Baert (1987), *M. desenderi* is found in large numbers in arid ecological zones on all islands. Although some mature specimens have been collected in November and August, most specimens are found between January and June (Fig. 307), corresponding to the "warm and wet" season in the Galapagos (van der Werff, 1978). The size of mature *M. desenderi* specimens appears to correlate with the collection date: female spiders taken in August are, on average, 80% larger than those taken in November (Fig. 14). This trend may indicate that *M. desenderi* can vary the number of instars before maturity. Alternatively, the intermolt growth may be greater for spiders with their antepenultimate or penultimate instars occurring during the warmer and wetter season.

Distribution. Endemic to the Galapagos Islands (Map 1).

Records Examined. ECUADOR *Galapagos:* Albemarle, Tagus Cove, 0°16′S 91°22′W, 23.i.1899 (AMNH), 8.ii.1899 (AMNH), 21.iii.1899 (AMNH), 23.iii.1899 (AMNH); Archipiélago de Galapagos, 0°0′N, 90°30′W (Williams Exped., 1923, MCZ); Bahia Conway, Indefatigable Island, 0°33′S, 90°32′W, 17.iii.1935 (Exline-Peck, CAS); Barrington Island, 0°49′S, 90°4′W, 1.viii.1929 (H. H. Cleaves, CAS); Campion, nr. Floreana (Santa María), 1°15′S, 90°27′W, 1.vi.1981 (Y. Lubin, MCZ); Charles Island, 1°17′S, 90°26′W, 10.v.1899 (AMNH); Indefatigable Island, 0°38′S, 90°23′W, 27.iv.1899 (AMNH), 18.vi.1929 (Pinchot South Sea Exp, USNM); Isla Abingdon, 0°35′N, 90°44′W, 25.vi.1899 (AMNH); Isla Albemarle, 0°30′S, 91°4′W, 13.i.1899 (AMNH), 20.ii.1899 (AMNH), 20.iii.1899 (AMNH); Isla Bindloe, 0°19′N, 90°29′W, 20.vi.1899 (AMNH); Isla Hood, 1°23′S, 89°39′W, 18.v.1899 (AMNH), 26.v.1899 (AMNH); Isla Pinta, S Coast, 0°35′N, 90°44′W, 25.v.1964 (D. Q. Cavagnaro, CAS); Isla Plaza, 0°35′S, 90°9′W, 7.iii.1970 (R. Silberglied, MCZ), 26.xi.1973 (Y. Lubin, MCZ); Isla Santa Cruz, Academy Bay, 0°44′30″S, 90°17′30″W, 13.iii.1970 (R. Silberglied, MCZ); Isla Santa Cruz, E slope, 0°38′S, 90°23′W, 16.iv.1964 (D. Q. Cavagnaro, CAS); Isla Santa Cruz, Estacion Cientifica Charles Darwin, 0°44′S, 90°18′W, 24.i.1964 (D. Q. Cavagnaro & R. O. Schuster, CAS), 12.ii.1964 (Cavagnero & Schuster, CAS), 3.xi.1973 (Y. Lubin, MCZ), 24.xi.1973 (Y. Lubin, MCZ), 25.xi.1973 (Y. Lubin, MCZ); Isla Santa Fé, S coast, 0°50′S, 90°4′W, 30.i.1983 (Y. Lubin, MCZ); James, 0°16′S, 90°42′W, 22.iv.1899 (AMNH); Narborough Island, 0°25′S, 91°30′W, 28.iii.1899 (AMNH); Sombrero Chino, Rocas Bainbridge, SE of Santiago, 0°21′S, 90°34′W, 31.iii.1970 (R. Silberglied, MCZ); Tower Island, Darwin's Bay [?], 0°17′N, 89°59′W (AMNH); Tower Islands, 0°20′N, 89°58′W, 7.iv.1925 (N.Y. Zoological Society, AMNH); W coast of Albemarle Island, 0°11′N, 91°21′W, 9.iii.1935 (AMNH).

3. *Metepeira grandiosa grandiosa* Chamberlin & Ivie
Figures 22–28, 321; Map 2

Metepeira grandiosa Chamberlin and Ivie, 1941: 17, figs. 24–26, ♀. Female holotype from Ben Lomond, California, USA in the AMNH, examined.

Metepeira palomara Chamberlin and Ivie, 1942: 72, figs. 200–204, ♀, ♂. Female holotype and paratypes from Mt. Palomar, California, in the AMNH, examined. First synonymized by Levi, 1977: 214.

Metepeira grandiosa grandiosa:—Levi, 1977: 214, figs. 112–116, ♀, ♂.

Note. Levi (1977) opted to collapse *M. palustris, M. grandiosa, M. alpina, M. dakota,* and *M. palomara* into three subspecies of *M. grandiosa,* with the caveat that more data may show the three subspecies to be distinct species. D. Buckle (personal communication) claims that his own recent observations suggest that *M. grandiosa alpina* and *M. grandiosa palustris* are separate species. However, since the bulk of *M. grandiosa* specimens are outside of the geographic range of this revision, and in the absence of molecular data, I will follow Levi's (1977) recommendation and leave these as separate subspecies.

Description. Female from Los Angeles, California, USA. Carapace light around eyes with median white line extending to thoracic furrow (Fig. 27). Legs ringed. Femur I with row of three to four macrosetae on anterior; one on anteroventral. Dorsum with usual folium, though lighter and more speckled than in most species (Fig. 27). Venter with a wide longitudinal white line. Pair of white spots on either side of spiracle (Fig. 28). Sternum entirely black (Fig. 28). Ratio of eye diameters: posterior medians and anterior medians 1.0, anterior laterals 1.2, posterior laterals 1. Anterior median eyes separated by 1.9 diameters, posterior median eyes by 1.3, anterior median eyes separated from anterior laterals by 3 diameters of anterior lateral eyes, lateral eyes separated by 0.4 their diameters. Total length 6.5 mm. Carapace 3.2 mm long, 2.3 wide. First femur 3.5 mm, patella and tibia 3.7, metatarsus 3.2, tarsus 1.1. Second patella and tibia 3.2 mm, third 1.9, fourth 2.8.

Male from Parque Nacional Sierra San Pedro Martir, Baja California Norte, Mexico. Carapace as in female. Legs lightly ringed. Macrosetae on femur I variable—usually row of four macrosetae on anterior side, five on anteroventral side. Dorsum as in female (Fig. 25). Venter and sternum as in female (Fig. 26). Ratio of eye diameters: posterior medians and anterior medians 1.1, anterior laterals 1.5, posterior laterals 1.5. Anterior median eyes separated by 1.7 diameters, posterior median eyes by 0.8, anterior median eyes separated from anterior laterals by 2.1 diameters of anterior lateral eyes, lateral eyes separated by 0.3 their diameters. Total length 3.6 mm. Carapace 1.9 mm long, 1.5 wide. First femur 2.9 mm, patella and tibia 2.8, metatarsus 2.5, tarsus 0.9. Second patella and tibia 2.3 mm, third 1.3, fourth 1.9.

Diagnosis. The epigynal scape of *M. grandiosa grandiosa* is shorter and stubbier than in other members of the *M. foxi* species group (compare Fig. 24 with Figs. 9, 17, 31). Unlike *M. datona* and *M. desenderi* (Figs. 7, 15), the corkscrew embolus is tilted up with a heavy ridge (Fig. 22), but unlike *M. grandiosa alpina* (Fig. 29), it is more graceful and not as sharply bent. The posteroventral edge of the keel on the median apophysis in *M. grandiosa grandiosa* is not as pointed (Fig. 22) as in *M. grandiosa alpina* (Fig. 29) but not curved as in *M. datona* and *M. desenderi* (Figs. 7, 15).

Variation. Body length of females varies from 5.4 to 8.5 mm; males from 3.5 to 5.1 mm (Levi, 1977).

Natural History. Mature specimens have been collected from March to September (Fig. 321; Levi, 1977) in yellow pine forests and on *Eriogonum fasciculatum* bushes. Elevations range from sea level to 2,000 m.

Distribution. Coastal mountainous regions from British Columbia to Baja California Norte (Levi, 1977, map 2; Map 2).

Records Examined. MEXICO *Baja California Norte:* Parque Nacional Sierra San Pedro Mártir, 30°45′N, 115°13′W, 1.vii.1977 (C. E. Griswold, CAS). USA *Arizona:* Sycamore Canyon [?] Santa Cruz Co, 31°28′N, 110°42′W, 9.ix.1978 (G. F. Knowlton, MCZ). *California:* Los Angeles, 34°3′N, 118°15′W (Davidson, MCZ); Winchester, Double Butte, 33°42′N, 117°5′W, 20.iv.1974 (W. Icenogle, MCZ).

4. *Metepeira grandiosa alpina* Chamberlin and Ivie

Figures 29–35, 325; Map 2

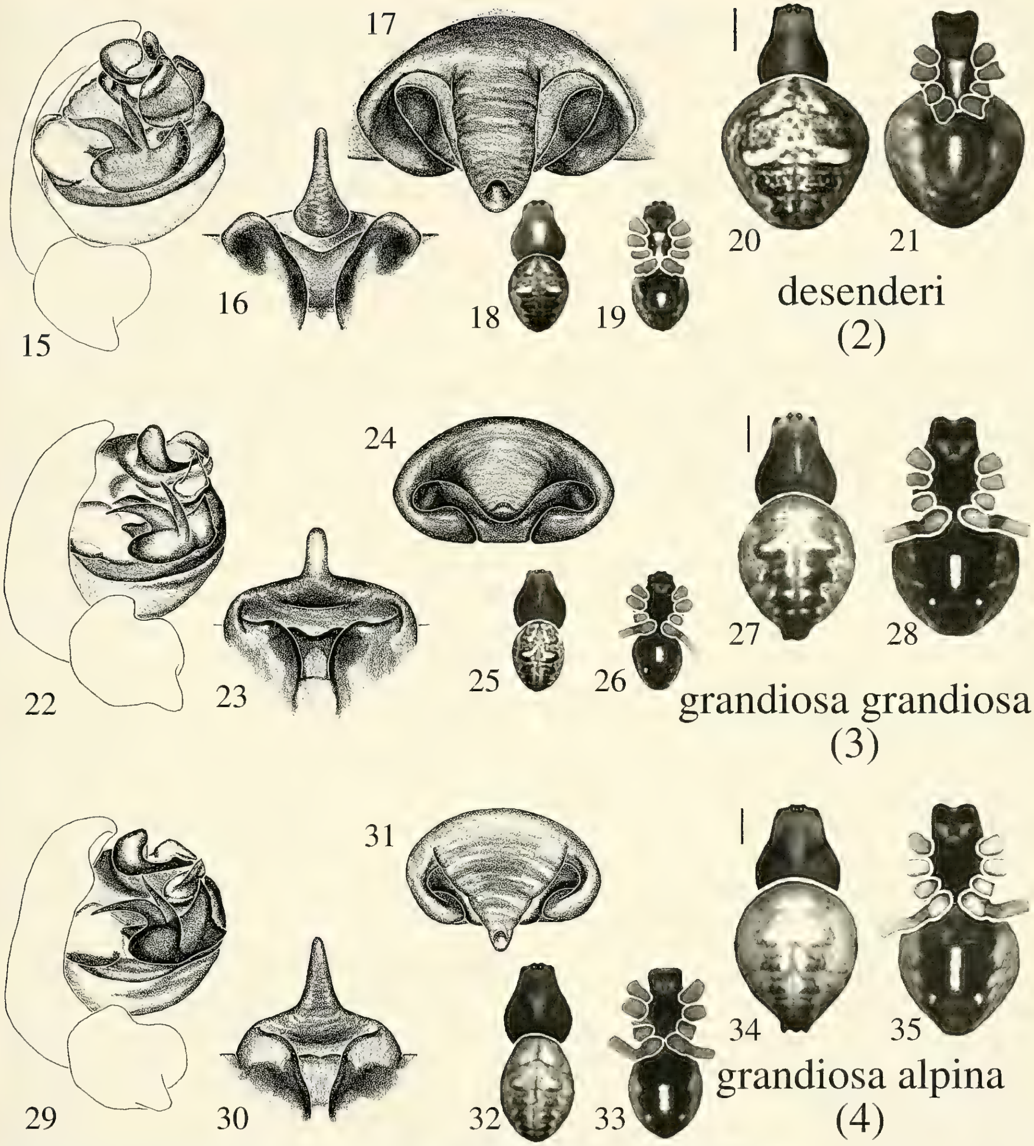
Metepeira dakota Chamberlin and Ivie, 1942: 73, figs. 205–207, ♀, ♂. Male holotype and female paratype from Noonan, North Dakota, USA, in the AMNH, examined. Name synonymized by Levi, 1977: 212–214.

Metepeira alpina Chamberlin and Ivie, 1942: 74. Female holotype and female paratypes from Fish Lake, Utah, USA, in the AMNH, examined.

Metepeira grandiosa alpina:—Levi, 1977: 212–214, figs. 99, 100, 106–111, ♀, ♂. Brignoli, 1983: 276.

Note. As first revisor, Levi (1977) chose to use the name *M. alpina* because its type specimen was collected closer to the center of the subspecies distribution.

Description. Female from Charcas, San Luis Potosí, Mexico. Carapace light around eyes with lateral posterior extensions and median white line extending to thoracic furrow (Fig. 34). Legs lightly ringed. Femur I with row of four macrosetae on anterior side; one on anteroventral side. Dorsum with usual folium, though lighter than in most species (Fig. 34). Venter with a wide longitudinal white line. Pair of white spots on either side of spiracle (Fig. 35). Sternum entirely black (Fig. 35). Ratio of eye diameters: posterior medians and anterior medians 1.0, anterior laterals 1.1, posterior laterals 1.1. Anterior median eyes separated by 1.7 diameters, posterior median eyes by 0.7, anterior median eyes separated from anterior laterals by 2.8 diameters of anterior lateral eyes, lateral eyes separated by 1.1 their diameters. Total length 6.7 mm. Carapace 3 mm long, 2.4 wide. First femur 3.5 mm, patella and tibia 3.8, metatarsus 3.4, tarsus 1.2.



Figures 15–21. *Metepeira desenderi* Baert (sp. 2; 0°38′S, 90°23′W). 15, male palpus, mesal. 16, epigynum, posterior. 17, epigynum, ventral. 18, male, dorsal. 19, male, ventral. 20, female, dorsal. 21, female, ventral.
Figures 22–28. *Metepeira grandiosa grandiosa* Chamberlin and Ivie (sp. 3 [22, 25, 26] 30°45′N, 115°13′W; [23, 24, 27, 28] 34°3′N, 118°15′W). 22, male palpus, mesal. 23, epigynum, posterior. 24, epigynum, ventral. 25, male, dorsal. 26, male, ventral. 27, female, dorsal. 28, female, ventral.
Figures 29–35. *Metepeira grandiosa alpina* Chamberlin and Ivie (sp. 4 [29,32,33] 25°56′N, 105°22′W; [30,31,34,35] 23°8′N, 101°7′W). 29, male palpus, mesal. 30, epigynum, posterior. 31, epigynum, ventral. 32, male, dorsal. 33, male, ventral. 34, female, dorsal. 35, female, ventral.
Scale bars: dorsum and venter figures 1.0 mm.

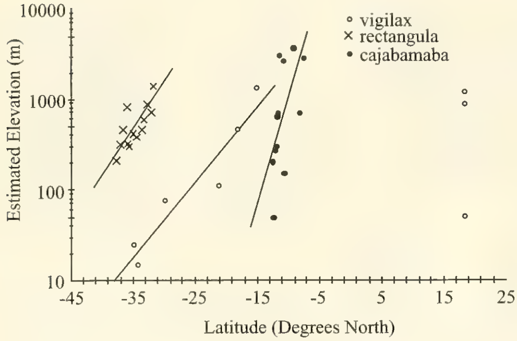


Figure 36. The elevation of collection localities for *M. vigilax, M. rectangula,* and *M. cajabamba* at their corresponding latitudes. Species-specific altitudes appear to decrease with distance from the equator. Elevations estimated from NOAA database of 5- by 5-minute geographic tiles. Regression line of *M. vigilax* does not include data points north of the equator. Symbols: *M. vigilax* (○), *M. rectangula* [✖], *M. cajabamba* [●].

Second patella and tibia 3.3 mm, third 1.9, fourth 2.9.

Male from Santa María del Oro, Durango, Mexico. Carapace yellowish brown, light around eyes. Median white triangular mark anterior to thoracic furrow (Fig. 32). Legs same color as carapace. Macrosetae on femur I variable—usually row of four macrosetae on anterior side, five to six on anteroventral side. Dorsum, venter, and sternum as in female (Figs. 32, 33). Ratio of eye diameters: posterior medians and anterior medians 1.0, anterior laterals 1.4, posterior laterals 1.2. Anterior median eyes separated by 1.5 diameters, posterior median eyes by 0.8, anterior median eyes separated from anterior laterals by 2.3 diameters of anterior lateral eyes, lateral eyes separated by 0.3 their diameters. Total length 5.2 mm. Carapace 2.5 mm long, 2 wide. First femur 4.5 mm, patella and tibia 4.6, metatarsus 4.5, tarsus 1.3. Second patella and tibia 3.6 mm, third 1.8, fourth 2.8.

Diagnosis. The epigynal scape of *M. grandiosa alpina* has the widest base of all members of the *M. foxi* species group, and the lobes surrounding the central depression are somewhat fatter (compare Fig. 31 with Figs. 9, 17, 24,). Unlike *M. datona* and *M. desenderi* (Figs. 7, 15), the corkscrew embolus is tilted up with a heavy ridge (Fig. 29), but unlike *M. grandiosa grandiosa* (Fig. 22), it is thicker and with a sharper L-shape bend instead of a more curved L-shape. The posteroventral edge of the keel on the median apophysis in *M. grandiosa alpina* is pointier (Fig. 29) than in *M. grandiosa grandiosa* (Fig. 22) and not curved as in *M. datona* and *M. desenderi* (Figs. 7, 15).

Variation. Body length of females varies from 4.0 to 6.8 mm; males from 3.1 to 5.3 mm (Levi, 1977).

Natural History. According to Levi (1977), mature specimens have been collected from June to August in meadows of bunchgrass, browsed aspen, oak, juniper, and sagebrush (Fig. 325). Elevations are at around 2,000 m.

Distribution. North American Rockies from southern Alberta and Saskatchewan to Central Mexico (Levi, 1977, map 2; Map 2).

Records Examined. MEXICO *Durango:* Santa María del Oro, 25°56′N, 105°22′W, 28.vii.1947 (W. J. Gertsch, AMNH). *San Luis Potosí:* Charcas, mountain side, 23°8′N, 101°7′W, 7.vii.1934 (MCZ). USA. *Colorado:* Cimarron, 38°27′N, 107°33′W, 21.vii.1959 (H. W. & L. Levi, MCZ); Hayden Creek, Sangre de Cristo Mtns., 38°25′N, 105°35′W [?], 11.vii.1961 (H. W. & L. Levi, MCZ). *Utah:* SE shore of Bear Lake, 41°59′N, 111°20′W, 3.vii.1978 (G. F. Knowlton, MCZ).

Metepeira vigilax Group

Spiders in the *M. vigilax* group (*Metepeira cajabamba, Metepeira glomerabilis, Metepeira vigilax, Metepeira rectangula*) are characterized by large, sclerotized epigynal openings, not unlike a snail's shell (Figs. 40, 48, 55, 62), and long, robust, emboli with large scooplike basal embolic apophyses (Figs. 38, 46, 53, 60).

5. *Metepeira cajabamba* new species
Figures 36, 38–45, 315; Map 3

Holotype. Male from Cajabamba, Cajamarca, Peru, 25.ix.1955, W Weyrauch, in CAS. The specific name is a noun in apposition after the locality.

Description. Female paratype from Cajabamba, Cajamarca, Peru. Carapace dark brown, light around eyes with lateral posterior extensions (Fig. 43). Proximal two-thirds of femora white, remainder dark brown. Remaining articles lightly annulated. Femur I with row of three macrosetae on anterior side; none on anteroventral side. Dorsal folium dark; white fleur-de-lis pattern reduced with thin branches (Fig. 43). Venter of abdomen black with wide white median line. Pair of small white spots on either side of colulus (Fig. 44). Sometimes the posterior end of median line ends in anchor shape (Fig. 45). Sternum black, sometimes with (Fig. 44) or without (Fig. 45) median white line. Ratio of eye diameters: posterior medians and anterior medians 1.1, anterior laterals 1.4, posterior laterals 1.2. Anterior median eyes separated by 1.6 diameters, posterior median eyes by 0.9, anterior median eyes separated from anterior laterals by 3 diameters of anterior lateral eyes, lateral eyes separated by 0.2 their diameters. Total length 6.4 mm. Carapace 3 mm long, 2.3 wide. First femur 3.3 mm, patella and tibia 3.5, metatarsus 2.9, tarsus 0.9. Second patella and tibia 2.9 mm, third 1.7, fourth 2.7.

Male holotype. Carapace dark brown, white around eyes with lateral posterior extensions and median white mark (Fig. 41). Proximal third of femora white, remainder dark brown. Remaining articles lightly annulated. Femur I with row of three macrosetae on anterior side; one on anteroventral side. Dorsal folium dark; white fleur-de-lis pattern indistinct with thin and broken branches (Fig. 41). Venter of abdomen black with median white mark. Pair of small white spots on either side of spiracle and colulus (Fig. 42). Sternum black, often with median white line (Fig. 42). Ratio of eye diameters: posterior medians and anterior medians 1.0, anterior laterals 1.3, posterior laterals 1. Anterior median eyes separated by 1.5 diameters, posterior median eyes by 0.9, anterior median eyes separated from anterior laterals by 2.3 diameters of anterior lateral eyes, lateral eyes separated by 0.3 their diameters. Total length 4 mm. Carapace 1.9 mm long, 1.5 wide. First femur 3 mm, patella and tibia 3, metatarsus 2.7, tarsus 0.9. Second patella and tibia 2.4 mm, third 1.2, fourth 1.8.

Diagnosis. Female *M. cajabamba* and *M. glomerabilis* differ from the other species in the *M. vigilax* group (*M. vigilax* and *M. rectangula*) by the smaller and more tubelike openings to the epigynum (compare Figs. 40, 48 with Figs. 55, 62). Female *M. cajabamba* differs from *M. glomerabilis* by having epigynal openings that are more oval (Fig. 40) than round (Fig. 48) when viewed ventrally, having the epigynal openings farther apart (compare Fig. 40 with Fig. 48), and by having the sclerotized tubelike openings more anteriorly directed (Fig. 40) than parallel to the epigynal groove (Fig. 48). Male *M. cajabamba* and *M. glomerabilis* differ from other species in the *M. vigilax* group by the smaller, thinner, and more graceful emboli (compare Figs. 38, 46 with Figs. 53, 60). *Metepeira cajabamba* differs from *M. glomerabilis* by lacking a keel on the median apophysis, an only slightly fatter embolus, and having a normal embolus cap, in contrast to a winged embolus cap (Fig. 46). A larger portion of the prosoma is dark in *M. cajabamba* (Fig. 43) as compared to *M. glomerabilis* (Fig. 51).

Variation. Average body length of nine females examined 6.2 mm, range 5.4 to 7.5 mm. Average body length of four males examined 4 mm, range 3.7 to 4.9 mm.

Natural History. With the exception of two specimens, mature *M. cajabamba* specimens have been collected in May through October (Fig. 315). Altitudes of collection localities appear to correlate steeply with latitude (Fig. 36). Median elevation, about 500 m, with a range from near sea level to 3,500 m.

Distribution. Ecuador and Peru (Map 3).

Records Examined. PERU *Ancash:* Callejon de Huaylas, 9°10′S, 77°45′W, 15.viii.1988 (V. and B. Roth, CAS). *Cajamarca:* Cajabamba, 12.427, 7°37′S, 78°3′W, 25.ix.1955 (W. Weyrauch, CAS). *La Libertad:*

Cerro Campana, La Cumbre, 8°1′S, 79°5′W, 10.x.1966 (A. F. Archer, AMNH). *Lima:* 20 km E Ancón, 11°47′S, 76°59′W, 1.xi.1953 (W. Weyrauch, CAS); 23 mi N Pativilca, 10°42′S, 77°47′W, 15.i.1955 (E. I. Schlinger and E. S. Ross, CAS); 5 km NW Chilca, 12°29′S, 76°48′W, 12.ix.1954 (E. I. Schlinger and E. S. Ross, CAS); between mouths of Río Chillon and Ancon [?], 11°54′S, 77°7′W, 5.viii.1953 (M. Koepcke and Koepcke, MUSM); Cajacay [?], Río Fortaleza, 10°40′S, 77°52′W, 6.iii.1956 (W. Weyrauch, CAS); Canta, Río Chillón, 11°28′12″S, 76°37′23″W, 12.v.1951 (W. Weyrauch, CAS); Cerro Caracoles, 12°23′S, 76°45′W, 15.ix.1951 (W. Weyrauch, CAS); Lima, 12°3′S, 77°3′W (K. Jelski and Stolzman, PAN); Lomas de Iguanil [?] (Huaral), 11°29′51″S, 77°12′12″W, 14.vi.1986 (D. Silva, MUSM).

6. *Metepeira glomerabilis* (Keyserling) Figures 37, 46–52, 314; Map 3

Epeira glomerabilis Keyserling, 1892: 154, fig. 113, ♀, ♂. Male and female syntypes from Taquara, Rio Grande do Sul and Serra Vermelha, Rio de Janeiro, Brazil, in BMNH, examined. Male here designated lectotype.

Araneus glomerabilis:—Petrunkevitch, 1911: 294. Roewer, 1942: 843.

Aranea santa Chamberlin, 1916: 254, pl. 19, fig. 10, ♀. Female holotype from Santa Ana, 3,000 m, Cuzco, Peru, in MCZ, examined. NEW SYNONYMY.

Metepeira santa:—Chamberlin and Ivie, 1942: 67. Platnick, 1993: 449.

Metepeira glomerabilis:—Chamberlin and Ivie, 1942: 68, fig. 181.

Metazygia glomerabilis:—Levi, 1991: 179. Platnick, 1993: 448. Erroneous transfer.

Description. Female from Puñapí, Tungurahua, Ecuador. Carapace brown; white arrowhead mark between eye region and thoracic furrow (Fig. 51). Legs dusky brown, lighter on ventral surfaces of femora I and II; lighter on dorsal surfaces of patellae, tibiae, and metatarsi I and II. Femur I with row of two to three macrosetae on anterior side; none on anteroventral side. Dorsal folium dark, speckled white, and white fleur-de-lis pattern with thin branches (Fig. 51). Venter black with short, wide, white median line ending in a T-shape; pair of small white spots on either side of spiracle (Fig. 52). Sternum black with median white line widening anteriorly (Fig. 52). Ratio of eye diameters: posterior medians and anterior medians 1.0, anterior laterals 1.3, posterior laterals 1.2. Anterior median eyes separated by 1.3 diameters, posterior median eyes by 0.9, anterior median eyes separated from anterior laterals by 1.7 diameters of anterior lateral eyes, lateral eyes separated by 0.2 their diameters. Total length 5 mm. Carapace 2.4 mm long, 1.7 wide. First femur 2.2 mm, patella and tibia 2.3, metatarsus 1.9, tarsus 0.9. Second patella and tibia 1.9 mm, third 1.2, fourth 1.8.

Male from Puñapí, Tungurahua, Ecuador. Carapace as in female, except for a greater separation between white coloration around eyes and arrowhead mark (Fig. 49). Legs light tan, dark distally on femora. Femur I with row of three macrosetae on anterior side; four on anteroventral side. Dorsal folium and venter as in female (Figs. 49, 50). Sternum black with partly broken median white line widening anteriorly (Fig. 50). Ratio of eye diameters: posterior medians and anterior medians 1.1, anterior laterals 1.3, posterior laterals 1.2. Anterior median eyes separated by 1.8 diameters, posterior median eyes by 1.2, anterior median eyes separated from anterior laterals by 2 diameters of anterior lateral eyes, lateral eyes separated by 0.3 their diameters. Total length 3.5 mm. Carapace 1.7 mm long, 1.4 wide. First femur 2.5 mm, patella and tibia 2.4, metatarsus 2.3, tarsus 0.9. Second patella and tibia 1.9 mm, third 1.0, fourth 1.7.

Diagnosis. Female *M. glomerabilis* and *M. cajabamba* differ from the other species in the *M. vigilax* group (*M. vigilax* and *M. rectangula*) by the smaller and more tubelike openings to the epigynum (compare Figs. 40, 48 with Figs. 55, 62). *Metepeira glomerabilis* differs from *M. cajabamba* by having epigynal openings that are more round (Fig. 48) than oval (Fig. 40) when viewed ventrally, having the epigynal openings closer together (compare Fig. 48 with Fig. 40), and by having the sclerotized tubelike openings more parallel to the epigynal groove (Fig. 48) than anteriorly directed (Fig. 40). Male *M. glomerabilis* and *M. cajabamba* differ from other species in the *M. vigilax* group by the smaller, thinner, and more graceful emboli (compare Figs. 38, 46 with Figs. 53, 60). *Metepeira glomerabilis* differs from *M. cajabamba* by having a keel on the median apophysis, an only slightly slimmer embolus, and a larger, winged embolus cap (compare Fig. 46 with Fig. 38). A larger portion of the prosoma is white in *M. glomerabilis* (Fig. 51), compared to *M. cajabamba* (Fig. 43). In addition, the margins of the folium, particularly in the male, are whiter than in other species in the group (compare Fig. 49 and Keyserling [1892, fig. 113b] with Figs. 41, 56, 63).

Variation. Average body length of 28 females examined 5.1 mm, range 3.8 to 7.3 mm. Average body length of 10 males examined 3.1 mm, range 2.4 to 4.3 mm. The base of the embolus varies from relatively thin (Fig. 46) to somewhat thicker, as in *M. cajabamba* (Fig. 38).

Natural History. At first it would appear that this species is not seasonal—mature specimens have been collected throughout the year (Fig. 315). However on closer inspection, there seems to be a seasonal shift with elevation: mature spiders are found at low altitudes (0–500 m) between March and October, at medium altitudes (500–1,500 m) between August and March, and at high altitudes (1,500–4,000 m) between December and June (Fig. 37). In coastal regions, R. Baptista (personal communication) reports that this species forms small aggregations of two to 10 spiders.

Distribution. Colombia, Ecuador, Peru, Bolivia, Paraguay, and southern Brazil (Map 3). Elevations range from sea level to 4,000 m.

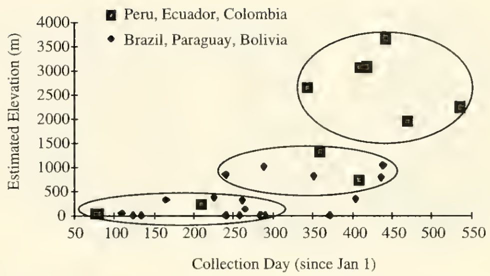


Figure 37. The elevation of collection localities for mature spiders of *M. glomerabilis* on specific days of the year between 1939 and 1990. There appears to be a shift in seasonal maturation times that corresponds better with elevation than with latitude. Elevations estimated from NOAA database of 5- by 5-minute geographic tiles.
Scale of abscissa: 100 = April 9; 300 = October 27; 500 = May 15 of the following year.
Symbols: Peru, Ecuador, Colombia [■]; Brazil, Paraguay, Bolivia [♦].

Records Examined. BOLIVIA *Chuquisaca:* Monteagudo, 19°49′S, 63°59′W, 24.xii.1984 (L. E. Peña, AMNH). BRAZIL *Espírito Santo:* Fazenda Santa Maria [?], Apiaca, 21°4′S, 41°25′W, 22.ix.1985 (R. L. C. Baptista, MZSP). *Mato Grosso:* Chavantina, 14°40′S, 52°21′W, 15.vi.1947 (J. C. Carvalho, MNRJ); Fazenda Cervo, Três Lagoas, 20°48′S, 51°43′W, 18.ix.1964 (Exp. Depto. Zool., MZSP); Utiariti, 13°2′S, 58°17′W, 15.viii.1961 (Lenks, MZSP). *Minas Gerais:* Lavras, 21°14′S, 45°0′W, 20.x.1978 (W. Don Fronk, MCZ); Pedra Azul, 16°1′S, 41°16′W, 15.xii.1970 (F. M. Oliveira, AMNH); Peti Forest Res. [?] Santa Bárbara, on bushes in cerrado, 19°56′S, 43°24′W, 28.viii.1986 (R. L. C. Baptista, MZSP). *Paraná:* Praia do Leste, Paranagua, 25°46′S, 48°31′W, 4.v.1967 (P. Biasi, MZSP). *Rio de Janeiro:* Guaratiba, 22°58′S, 42°48′W, 28.viii.1976 (J. A. P. Dutra, MZSP); Ilha de Santana, Macae, 22°25′S, 41°44′W, 18.x.1986 (R. L. C. Baptista, MZSP); Itaipu, Niteroi, 22°56′S, 43°5′W, 20.iv.1985 (R. L. C. Baptista, MZSP). *Rio Grande do Norte:* Fazenda Canaan [?], Macaíba, 5°51′S, 35°21′W, 15.ix.1951 (M. Alvorenga, MZSP). *Rondônia:* Vila Rondônia, 10°52′S, 61°57′W, 9.ii.1961 (Pereira & Machado, MZSP). *Santa Catarina:* Nova Teutonia, 27°3′S, 52°24′W, 12.v.1949 (SMF). *São Paulo:* Barueri, 23°31′S, 46°53′W, 13.iii.1966 (K. Lenko, MZSP); Campos do Jordão, 22°44′S, 45°35′W, 15.iii.1945 (Wygod, MZSP); Instituto Oceanografico, Ubatuba, 23°26′S, 45°4′W, 15.v.1967 (P. Montouchat, MZSP); km 1 Rod, Rio Santos [?], Ubatuba, 23°26′S, 45°4′W, 12.x.1985 (R. L. C. Baptista, MZSP), 13.x.1985 (R. L. C. Baptista, MZSP); km 3 Rod, Rio Santos [?], Ubatuba, 23°26′S, 45°4′W, 6.i.1985 (R. L. C. Baptista, MZSP). COLOMBIA *Cundinamarca:* Sabana de Bogotá, 4°43′N, 74°10′W, 10.xii.1990 (C. Valderrama, CV). ECUADOR *Guayas:* Guayaquil, 2°10′S, 79°54′W, 18.iii.1942 (H. E. F. & D. E. F, CAS), 22.iii.1942 (Landis, CAS). *Pichincha:* 15 mi N Quito, 0°0′N, 78°30′W, 23.ii.1955 (E. I. Schlinger & E. S. Ross, CAS). *Tungurahua:* Baños, 1°24′S, 78°25′W, 15.iv.1939 (W. C. Macintyre, MCZ); Puñapí, 1°22′S, 78°28′W, 19.vi.1943 (D. L. F. & H. E. F, CAS). PARAGUAY *Alto Paraná:* Taguararaya [?], 25°30′S, 54°50′W (AMNH). *Caazapa:* Villa Pastoreo, 25°53′S, 55°45′W (D. Wees, MCZ). PERU *Cajamarca:* Cajamarca, 7°10′S, 78°31′W, 15.ii.1942 (W. Weyrauch, AMNH). *Lambayeque:* 10 km S Chiclayo, 7°59′S, 77°17′W, 19.iii.1951 (E. S. Ross & Michelbacher, CAS). *Piura:* Cerro Prieto, La Brea, 4°41′S, 81°6′W (CAS); Higueron (Las Lomas) [?], 4°19′S, 80°26′W, 29.vii.1941 (D. L. F. & H. E. F, CAS). VENEZUELA *Sucre:* 1 km S Villa Frontado, Rd. to

Caripe, 10°27′N, 63°37′W, 12.ii.1984 (J. Coddington, USNM).

7. *Metepeira vigilax* (Keyserling) Figures 36, 53–59, 327; Map 4

Epeira vigilax Keyserling, 1893: 211, fig. 156, ♂. Male holotype from Taquara, Rio Grande do Sul, Brazil, in BMNH, examined.

Araneus vigilax:—Petrunkevitch, 1911: 324. Roewer, 1942: 856.

Metepeira dominicana Archer, 1965: 132, figs. 12, 18, ♀. Female holotype from west of Baní, Dominican Republic, in AMNH. Holotype lost. Brignoli, 1983: 275. NEW SYNONYMY.

Metepeira vigilax:—Levi, 1991: 180. Platnick, 1993: 449.

Note. Although the type for *M. dominicana* is lost, the name has been identified by using Archer's (1965) description and illustration.

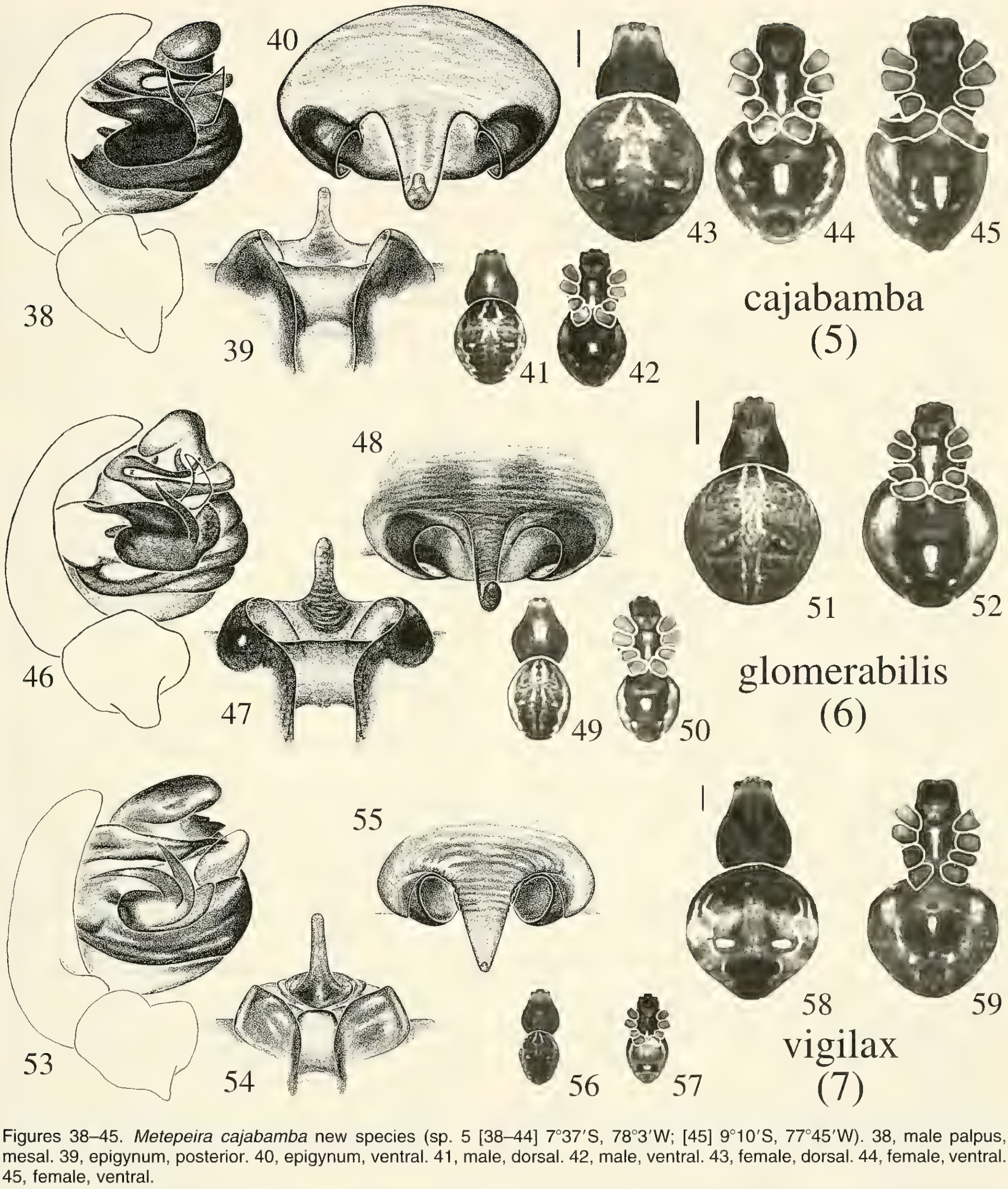
Description. Female from Trujillo, west of Baní, Dominican Republic. Carapace light around eyes with lateral posterior extensions (Fig. 58). Legs dark, light rings on proximal ends of leg articles. Femur I with row of four macrosetae on anterior side; three on anteroventral side. Dorsal folium darker than in most species; fleur-de-lis usually reduced to two white spots (Fig. 58). Venter brownish gray with lighter margins. Wide, short, median white line with pair of white spots on either side of spiracle (Fig. 59). Sternum brownish black with wide, white line widening anteriorly (Fig. 59). Ratio of eye diameters: posterior medians and anterior medians 1.2, anterior laterals 1.2, posterior laterals 1.1. Anterior median eyes separated by 1.8 diameters, posterior median eyes by 1.1, anterior median eyes separated from anterior laterals by 3.5 diameters of anterior lateral eyes, lateral eyes separated by 0.1 their diameters. Total length 9.2 mm. Carapace 3.9 mm long, 3.2 wide. First femur 4.1 mm, patella and tibia 4, metatarsus 3.3, tarsus 1.2. Second patella and tibia 3.4 mm, third 2.3, fourth 3.4.

Male from same locality as female. Black carapace with white around eyes and extending posteriorly; white wedge mark in center (Fig. 56). Legs ringed like female. Femur I with row of three macrosetae on anterior side; three on anteroventral side. Dorsum and venter as in female (Figs. 56, 57). Median white line may be limited to posterior end of sternum (Fig. 57). Ratio of eye diameters: posterior medians and anterior medians 0.9, anterior laterals 1.1, posterior laterals 1. Anterior median eyes separated by 1.6 diameters, posterior median eyes by 1.3, anterior median eyes separated from anterior laterals by 2 diameters of anterior lateral eyes, lateral eyes separated by 0.2 their diameters. Total length 3.9 mm. Carapace 2 mm long, 1.5 wide. First femur 2.6 mm, patella and tibia 2.5, metatarsus 2.4, tarsus 0.9. Second patella and tibia 2.1 mm, third 1.2, fourth 1.7.

Diagnosis. Female *M. vigilax* differ from those of other species in the *M. vigilax* species group by the shape of the epigynal openings: from a ventral view the openings are oval and angled inward posteriorly (Fig. 55); from a posterior view, the edges of the openings are more parallel to the body (Fig. 61) as opposed to more perpendicular to the body (Figs. 39, 61). Male *M. vigilax* differ from other species because the embolus is larger and more robust (compare Fig. 53 with Figs. 38, 46, 60); the two flagella on the median apophysis are of more similar width (compare Fig. 53 with Fig. 38), and the keel on the median apophysis is slim and feather-shaped (Fig. 38), in contrast to arrow-shaped (Figs. 46, 60) or absent (Fig. 38). The dorsal folium differs from other *Metepeira* species by having a wide black median stripe at the posterior end of the abdomen (Fig. 58). In Brazilian and Bolivian specimens this stripe often extends all the way to the black anterior shoulders of the dorsum, forming a wide T-shape mark.

Variation. Specimens from Argentina tend to be more lightly pigmented than those from more northern localities. White markings on the eye region of Brazilian and Bolivian specimens surround only the lateral eyes, in contrast to those on Hispaniolan specimens, which cover the entire eye region.

Natural History. Mature adults have



Figures 38–45. *Metepeira cajabamba* new species (sp. 5 [38–44] 7°37′S, 78°3′W; [45] 9°10′S, 77°45′W). 38, male palpus, mesal. 39, epigynum, posterior. 40, epigynum, ventral. 41, male, dorsal. 42, male, ventral. 43, female, dorsal. 44, female, ventral. 45, female, ventral.

Figures 46–52. *Metepeira glomerabilis* (Keyserling) (sp. 6; 1°22′S, 78°28′W). 46, male palpus, mesal. 47, epigynum, posterior. 48, epigynum, ventral. 49, male, dorsal. 50, male, ventral. 51, female, dorsal. 52, female, ventral.

Figures 53–59. *Metepeira vigilax* (Keyserling) (sp. 7 [53–57] 18°27′N, 72°17′W; [58,59] 18°17′N, 70°22′W). 53, male palpus, mesal. 54, epigynum, posterior. 55, epigynum, ventral. 56, male, dorsal. 57, male, ventral. 58, female, dorsal. 59, female, ventral. *Scale bars:* dorsum and venter figures 1.0 mm.

been collected throughout the year except January, February, and March (Fig. 327). Spiders have been found among electric wires four meters above ground. Locality elevations range from near sea level to 1,400 m and follow an ecological zone that decreases in elevation with distance from the equator (Fig. 36). Over equivalent latitudes, *M. vigilax* lives at less than one-tenth of the elevation of *M. rectangula* (Fig. 36).

Distribution. Hispaniola, Bolivia, Brazil, and coastal Argentina (Map 4). The disjunct distribution between Hispaniolan and South American populations may be due to human-assisted migration.

Records Examined. ARGENTINA *Buenos Aires:* Celsya–Pereyra [?], 34°50′S, 58°6′W (MACN); Zelaya, 34°21′S, 58°52′W (MACN). BOLIVIA *La Paz:* Apolo, 14°43′S, 68°31′W, 10.viii.1989 (L. E. Peña, AMNH). *Santa Cruz:* Estación Robore, above creek, 18°20′S, 59°45′W, 27.ix.1955 (Azambuya, CAS). BRAZIL *Espírito Santo:* Fazenda Santa Maria [?], Apiacá, 21°4′S, 41°25′W, 14.v.1988 (R. L. C. Baptista, MZSP). *Rio Grande do Sul:* São Leopoldo, 29°46′S, 51°9′W, 14.vi.1964 (Celia Valle, MZSP). DOMINICAN REPUBLIC *Azua:* El Puerto, Majagual and Peralta, 18°34′N, 70°47′W, 10.xi.1979 (E. Marcano, MNSD). *Prov. Trujillo Váldez:* W Baní, 18°17′N, 70°22′W, 8.viii.1958 (A. F. Archer & E. de Boyrie Moya, AMNH). HAITI *Departement de L'Ouest:* Kenscoff, 18°27′N, 72°17′W, 15.xii.1929 (J. C. Myers, AMNH), 17.iv.1935 (AMNH).

8. *Metepeira rectangula* (Nicolet)
Figures 36, 60–66, 306; Map 4

Epeira rectangula Nicolet, 1849: 500, female holotype from Valdivia, Chile, in MNHN.

Metepeira labyrinthea:—Petrunkevitch, 1911: 298. Roewer, 1942: 868. Bonnet, 1957: 2821. Erroneous synonymy.

Metepeira rectangulata:—Chamberlin and Ivie, 1942: 71. Unjustified emendation.

Note. The name was identified using drawings of the holotype (H. W. Levi, personal illustrations).

Description. Female from Angol, Malleco, Chile. Carapace reddish brown with long white setae behind lateral eyes. Anterior third of carapace white, median white line reaching thoracic furrow (Fig. 65). Proximal halves of femora white, remainder black with distal white marks on dorsal surfaces. Patellae mostly black, remaining articles white with black marks at base of setae. Femur I with row of three to five macrosetae on anterior side; three to four on anteroventral side. Anterior margin of dorsal abdomen black; dorsal folium yellowish with brown speckles, white fleur-de-lis pattern with wide branches (Fig. 65). Venter black with wide white median line, flanked by pair of thin white lines; pair of white spots on either side of spiracle connected by white line (Fig. 66). Sternum black with posterior white mark (Fig. 66). Ratio of eye diameters: posterior medians and anterior medians 1.0, anterior laterals 1.1, posterior laterals 1.1. Anterior median eyes separated by 1.7 diameters, posterior median eyes by 1.0, anterior median eyes separated from anterior laterals by 3.3 diameters of anterior lateral eyes, lateral eyes separated by 0.1 their diameters. Total length 8.4 mm. Carapace 3.7 mm long, 2.9 wide. First femur 4.2 mm, patella and tibia 4.1, metatarsus 3.7, tarsus 1.2. Second patella and tibia 3.4 mm, third 2.1, fourth 3.1.

Male from Angol, Malleco, Chile. Carapace reddish brown, anterior third white, median white line extending to thoracic furrow (Fig. 63). Proximal halves of femora, white, distal halves black. Patellae black, remaining articles white with black spots at base of setae. Femur I with row of six to eight macrosetae on anterior side; seven to 11 on anteroventral side. Dorsal abdomen white, marbled, and speckled brown (Fig. 63). Venter dark brown with wide white median mark, flanked by pair of thin white lines; pair of white spots on either side of spiracle connected by white line (Fig. 64). Sternum dark brown with partly broken median white line (Fig. 64). Ratio of eye diameters: posterior medians and anterior medians 1.0, anterior laterals 1.2, posterior laterals 1.1. Anterior median eyes separated by 1.7 diameters, posterior median eyes by 1.1, anterior median eyes separated from anterior laterals by 2.9 diameters of anterior lateral eyes, lateral eyes separated by 0.2 their diameters. Total length 6.1 mm. Carapace 3.2 mm long, 2.5 wide. First femur 5.2 mm, patella and tibia 5, metatarsus 4.9, tarsus 1.2. Second patella and tibia 4.1 mm, third 2, fourth 3.1.

Diagnosis. Female *M. rectangula* differ from the other species in the *M. vigilax* group (*M. vigilax, M. glomerabilis, M. cajabamba*) by the shape of the epigynal openings: from a ventral view they are larger, wider, and more gaping than in the other species (compare Fig. 62 with Figs. 40, 48, 55). Males differ from other species in the group by having an embolus that is relatively larger than that of *M. glomerabilis* and *M. cajabamba*, yet smaller than that of *M. vigilax* (compare Fig. 60 with Figs. 38, 46, 53). Among all members of the *M. vigilax* group, the keel on the median apophysis of *M. rectangula* is the largest and most robust, and the dorsal folium has the lightest coloration (Fig. 65).

Variation. Average body length of 11 females examined 8.6 mm, range 5.8 to 10 mm. Average body length of six males examined 6 mm, range 4.1 to 7 mm. Specimens from two localities in western Argentina resemble *M. vigilax*, and may be hybrids.

Natural History. This species appears to follow a narrow ecological zone that decreases in elevation with increasing southern latitude (Fig. 36). Median elevation, about 500 m. Mature specimens have been collected January through April (Fig. 306). Specimens from localities south of the 36th parallel tend to be found in January and February, whereas those north of the 36th parallel tend to be found in March and April.

Distribution. Chilean Andes between 31° and 38° south (Map 4).

Records Examined. ARGENTINA *Córdoba:* Calamuchita, 32°4′S, 64°33′W, 15.iii.1954 (J. M. Viana, MACN). *Mendoza:* Mendoza, 32°53′S, 68°49′W, 30.iii.1965 (H. W. Levi, MCZ). CHILE *Bío-Bío:* 4 km E road to Pinto, 36°42′S, 71°53′W, 4.i.1976 (B. Moreno, AMNH); Road to Pemuco, Cruce del Carmen, 36°56′S, 72°4′W, 10.i.1976 (G. Moreno, AMNH). *Coquimbo:* Illapel: Salamanca: Fundo Tahuinco, 31°44′S, 71°5′W, 30.iv.1946 (R. Doneso, AMNH). *Malleco:* Angol, 37°48′S, 72°43′W (D. S. Bullock, CAS), 10.iii.1945 (E. A. Chapin, USNM). *Maule:* 10 km S Curico, 35°4′S, 71°14′W, 15.iii.1968 (L. E. Peña, MCZ); Cordillera de Parral [?], 36°9′S, 71°50′W, 25.ii.1956 (L. E. Peña, IRSNB); Linares, 35°51′S, 71°36′W (L. E. Peña, IRSNB); Miraflores, Pedag. [?], 35°55′S, 71°39′W (Toro, AMNH). *O'Higgins:* Fundo Millahue, Cunaco, 34°36′S, 71°16′W, 30.iv.1961 (AMNH). *Región Metropolitana:* Melipilla, 33°42′S, 71°13′W (L. E. Peña, IRSNB). *Valparaíso:* Casablanca, 33°19′S, 71°25′W, 15.ii.1955 (Edwin Reed, AMNH).

Metepeira labyrinthea Group

Levi (1977) described the *M. labyrinthea* group very broadly—it included species with a longitudinal white line down the sternum and a short keel on the median apophysis. Here, this species group is much narrowed to include only three North American species: *Metepeira labyrinthea, Metepeira lacandon,* and *Metepeira spinipes.* Males of these three species are unique among *Metepeira* by having a toothless, smooth keel on the median apophysis. In addition, their distal embolic apophysis rises away (anteriorly) from the embolus proper and projects forward (ventrally) until it is almost even with the embolus tip (Figs. 67, 76). In contrast, other *Metepeira* species with distal embolic apophyses have the embolus tip extend far beyond the projection of the apophysis (e.g., Fig. 171). The female epigynum has a characteristic shape. The scape is thick and fleshy and the epigynal openings have membranes that make them look distinctly (Fig. 69) or indistinctly (Fig. 78) almond-shaped. The epigyna of the *M. labyrinthea* species group are easily confused with that of the closely related species, *M. gosoga* (Fig. 173). Although most differences between *M. labyinthea* group and *M. gosoga* are only obvious in the epigynum, it should be noted that the dark marks inside the epigynal openings of the former appear to look cross-eyed, but this cannot be said for the latter. In this work, only the species collected at localities south of the U.S./Mexico boarder are treated.

9. *Metepeira spinipes* F. O. P.-Cambridge
Figures 67–75, 335; Map 6

Metepeira spinipes F. O. P.-Cambridge, 1903: 459, figs. 9, 10, ♂, ♀. Male holotype from Mexico City, Mexico, in BMNH, examined. Roewer, 1942: 868.
Epeira labyrinthea grinnelli Coolidge, 1910: 281, ♀. Holotype from Palo Alto, California, lost.
Araneus spinipes:—Petrunkevitch, 1911: 317.
Aranea labyrinthea grinnelli:—Moles, 1921: 42.
Metepeira douglasi Chamberlin and Ivie, 1941: 18, figs. 21–23, ♀. Female holotype from Santa Ana, California, in AMNH, examined. Chamberlin and Ivie, 1942: 66, figs. 169–170. First synonymized with *M. labyrinthea grinnelli* by Levi, 1977: 198.
Metepeira labyrinthea grinnelli:—Roewer, 1942: 868.
Metepeira labyrinthea:—Bonnet, 1957: 2822. Erroneous synonymy.
Metepeira grinnelli:—Levi, 1977: 198, figs. 21–27, ♂, ♀. NEW SYNONYMY.

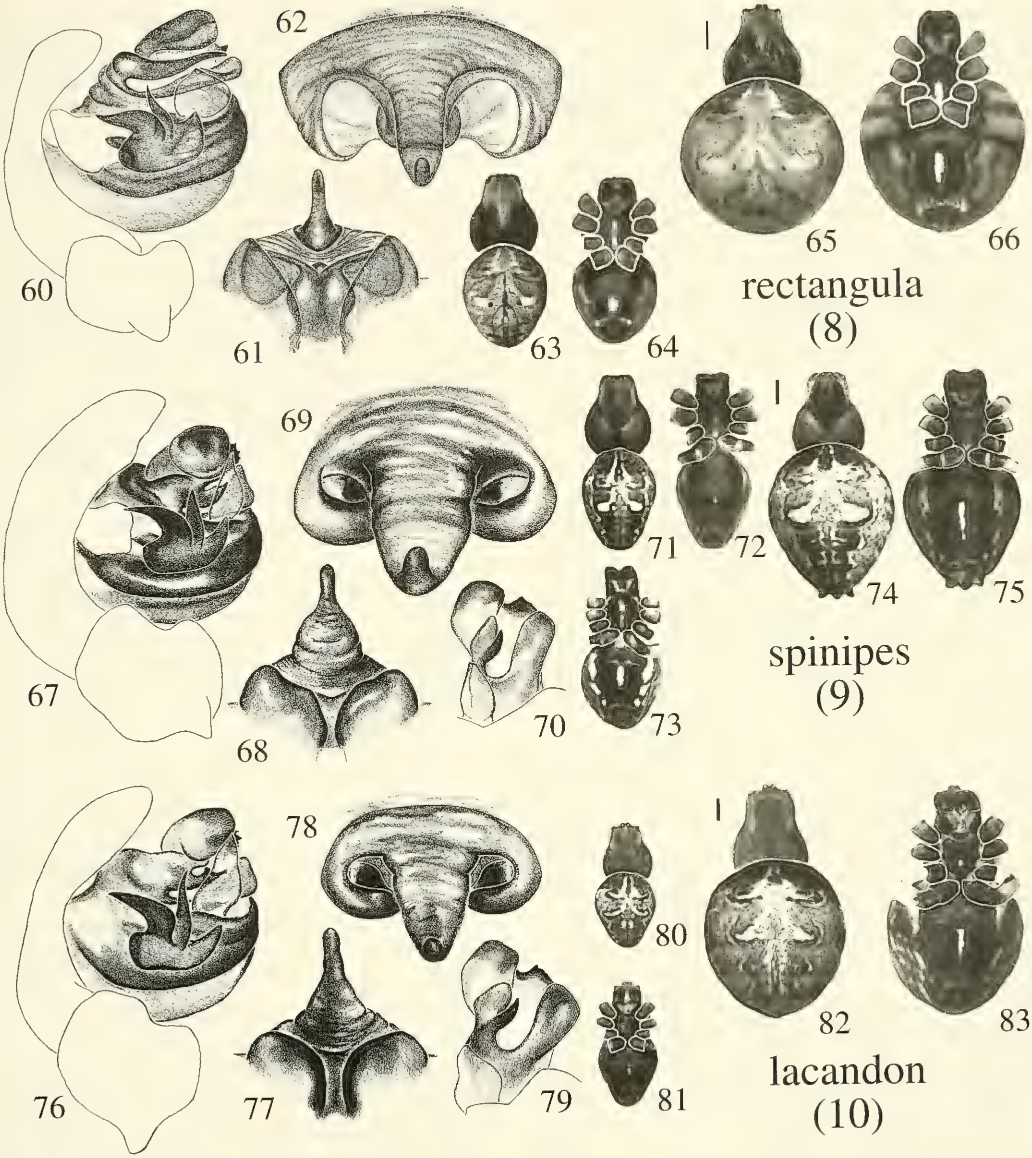
Description. Female from Huitzilac, Morelos, Mexico. Brown carapace with anterior portion darker reddish brown, white behind lateral eyes (Fig. 74). Legs yellowish, femora reddish brown distally, other articles dark brown distally. Femur I with row of four to five macrosetae on anterior side; two to seven on anteroventral side. Anterior shoulders of abdomen black. Dorsal folium with usual *Metepeira* pattern, though largest branches of white fleur-de-lis shape usually widened into large spots (Fig. 74). Venter of abdomen black with wide white median line (Fig. 75). Pair of small white spots on either side of spiracle. Sternum black with posterior white mark that in some cases extends anteriorly to the labium (Figs. 73, 75). Ratio of eye diameters: posterior medians and anterior medians 1.1, anterior laterals 1.0, posterior laterals 0.9. Anterior median eyes separated by 1.9 diameters, posterior median eyes by 1.3, anterior median eyes separated from anterior laterals by 2.9 diameters of anterior lateral eyes, lateral eyes separated by 0.2 their diameters. Total length 9.2 mm. Carapace 3.7 mm long, 2.9 wide. First femur 4.4 mm, patella and tibia 4.7, metatarsus 4.6, tarsus 1.3. Second patella and tibia 4.1 mm, third 2.4, fourth 3.6.

Male from Huitzilac, Morelos, Mexico. Carapace, dorsum, venter, sternum as in female (Figs. 71, 72). Distal portions of leg articles reddish black, elsewhere yellowish. Femur I with row of four to six macrosetae on anterior side; five to nine on anteroventral side. Ratio of eye diameters: posterior medians and anterior medians 1.1, anterior laterals 1.2, posterior laterals 1.1. Anterior median eyes separated by 1.8 diameters, posterior median eyes by 1.1, anterior median eyes separated from anterior laterals by 3.2 diameters of anterior lateral eyes, lateral eyes separated by 0.3 their diameters. Total length 7.5 mm. Carapace 3.8 mm long, 2.8 wide. First femur 6.2 mm, patella and tibia 6.3, metatarsus 7.1, tarsus 1.8. Second patella and tibia 5.3 mm, third 2.5, fourth 4.

Diagnosis. Inside each epigynal depression of *M. spinipes* and *M. lacandon* is a membrane that forms a slanted, oval-shaped opening (Figs. 69, 78). Within each oval-shaped opening is a dark mark, which in *M. spinipes* takes up a small part of that opening, resulting in a cross-eyed appearance (Fig. 69). Also, in *M. spinipes* (Fig. 69), the edges of the epigynal depressions are less distinct than in *M. lacandon* (Fig. 78). The distal embolic apophysis of *M. spinipes* is arrow-shaped (Fig. 79), in contrast to a wider shovel-shape in *M. lacandon* (Fig. 79).

Variation. Average body length of 54 females examined 9.1 mm, range 5.5 to 12.4 mm. Average body length of 55 males examined 6.6 mm, range 3 to 10.8 mm.

Natural History. Mature specimens have been collected between August and early November (Fig. 335). Elevations range from near sea level in California to 2,600 m in central Mexico. Variation in sexual dimorphism appears to correlate with habitat and social structure (Piel, 1996). Webs are found in dry regions among mesquite, *Opuntia, Agave* (maguey), cultivated *Yucca,* and *Cactus.* Spiders live in medium to small social colonies, which vary in size in accordance with local habitat quality (Uetz, 1988a,b). This behavioral and ecological relationship is



Figures 60–66. *Metepeira rectangula* (Nicolet) (sp. 8; 37°48′S, 72°43′W). 60, male palpus, mesal. 61, epigynum, posterior. 62, epigynum, ventral. 63, male, dorsal. 64, male, ventral. 65, female, dorsal. 66, female, ventral.
Figures 67–75. *Metepeira spinipes* F. O. P.-Cambridge (sp. 9 [67–72,74,75] 19°0′29″N, 99°15′50″W; [73] 39°18′N, 123°48′W). 67, male palpus, mesal. 68, epigynum, posterior. 69, epigynum, ventral. 70, male embolic division, ventral. 71, male, dorsal. 72, male, ventral. 73, female, ventral. 74, female, dorsal. 75, female, ventral.
Figures 76–83. *Metepeira lacandon* new species (sp. 10; 16°45′N, 92°38′W). 76, male palpus, mesal. 77, epigynum, posterior. 78, epigynum, ventral. 79, male embolic division, ventral. 80, male, dorsal. 81, male, ventral. 82, female, dorsal. 83, female, ventral.
Scale bars: dorsum and venter figures 1.0 mm.

thought to occur as a result of the spiders pursuing a risk-sensitive foraging strategy (Uetz, 1996).

Distribution. Oregon to central Mexico (Levi, 1977, map 1; Map 6).

Records Examined. MEXICO *Aguascalientes:* Hwy 45, 5.3 mi N Aguascalientes, 21°57′N, 102°17′W, 7.ix.1967 (R. E. Leech, REL). *Baja California Sur:* Sierra Laguna, 17 air mi ENE Todos Santos, 23°34′N, 110°0′W, 15.xii.1979 (C. E. Griswold, CAS). *Chihuahua:* 22.4 mi S Miñaca, 28°24′N, 107°26′W, 23.viii.1950 (R. Smith, AMNH). *Durango:* 10 mi E El Salto, 23°12′N, 105°52′W, 8.viii.1947 (W. J. Gertsch, AMNH); 11 km W Suchil, 23°35′N, 104°5′W, 5.ix.1984 (W. J. Pulawski, CAS); 6 mi NE El Salto, 23°19′N, 105°50′W, 11.viii.1947 (W. J. Gertsch, AMNH); Las Puentes [?], 26°49′N, 106°2′W, 23.vii.1947 (W. J. Gertsch, AMNH); Otinapa, 24°11′N, 105°2′W, 12.viii.1947 (W. J. Gertsch, AMNH); Palos Colorados, 24°2′N, 104°54′W, 5.viii.1947 (W. J. Gertsch, AMNH); Providencia, 26°44′N, 105°56′W, 24.viii.1947 (A. M. Davis, AMNH); SW Durango, 23°59′17″N, 104°45′47″W, 22.x.1994 (W. H. Piel, MCZ). *Guanajuato:* 30 mi SE Leon, 6 mi SE Silao, 20°52′N, 101°21′W, 6.ix.1964 (Jean & Wilton Ivie, AMNH); 6.3 mi NW León, 21°13′N, 101°43′W, 6.ix.1967 (R. E. Leech, REL); between Moroleon & Cuitzeo, 20°5′36″N, 101°9′28″W, 20.x.1994 (W. H. Piel, MCZ); near San Miguel de Allende, 20°55′N, 100°45′W, 16.ix.1976 (C. E. Griswold, CAS); S San Miguel de Allende, 20°46′36″N, 100°47′28″W, 20.x.1994 (W. H. Piel, MCZ); San Miguel de Allende. Road SW town, 20°52′N, 100°56′W, 25.x.1982 (George Uetz, MCZ). *Hidalgo:* 18 mi E Huichapan, off Hwy 45, 20°23′N, 99°22′W, 25.viii.1984 (W. D. Sissom, C. Myers & L. Born, MCZ); 4 mi N Tizayuca, 19°54′N, 98°59′W, 20.xi.1946 (E. S. Ross, CAS); 41 km N Zimapan, 20°54′N, 99°13′W, 10.viii.1991 (W. H. Piel & G. S. Bodner, MCZ); Apulco, 20°19′N, 98°20′W, 6.x.1947 (H. Wagner, AMNH); Ozumbilla, 20°9′N, 101°16′W, 2.x.1957 (R. Dreisbach, MCZ); Pachuca, 20°7′N, 98°44′W, 30.viii.1957 (R. Dreisbach, MCZ); Tenango de Doria, 20°19′N, 98°13′W, 5.x.1947 (H. Wagner, AMNH). *Jalisco:* 12 mi S Mazamitla, 19°47′N, 103°8′W, 5.xii.1948 (H. B. Leech, CAS); Charco Ondo, 30 km W Ojuelos, 21°47′N, 101°53′W, 25.ix.1945 (H. Wagner, AMNH). *México:* Ixtapan de la Sal, 18°50′N, 99°41′W, 24.viii.1946 (H. Wagner, AMNH); Nevado de Toluca, 19°18′N, 99°44′W, 8.iv.1979 (George Uetz, MCZ); San Juan Teotihuacán, 19°41′N, 98°52′W, 4.xi.1939 (C. M. Bogert & H. E. Vokes, AMNH); Tenancingo, 18°58′N, 99°36′W, 6.ix.1946 (H. Wagner, AMNH), 1.x.1946 (H. Wagner, AMNH), 15.x.1946 (H. Wagner, AMNH); Tenango del Valle, 19°7′N, 99°33′W, 25.viii.1946 (H. Wagner, AMNH), 27.viii.1946 (H. Wagner, AMNH); Teotihuacán, 19°41′N, 98°52′W, 31.viii.1959 (A. F. Archer, AMNH); Tepotzotlán, 19°43′N, 99°13′W, 26.x.1982 (George Uetz, MCZ), 21.ii.1983 (George Uetz, MCZ), 5.x.1983 (George Uetz, MCZ); Toluca, 19°18′N, 99°44′W, 10.viii.1978 (George Uetz, MCZ), 1.viii.1986 (George Uetz, MCZ); Toluca, at bottom of mountain near Parque Cierra Morelos, 19°18′N, 99°44′W, 10.viii.1978 (George Uetz, MCZ); Toluca, E of town on Paseo Tollocan [?], 19°18′N, 99°42′W, 23.x.1982 (George Uetz, MCZ). México D. F.: 19°25′N, 99°10′W, 12.x.1940 (H. Wagner, AMNH), 28.xii.1940 (R. H. Crandall, AMNH), 15.ix.1943 (H. & D. Frizzell, AMNH); Contreras, 19°18′N, 99°17′W, 4.xii.1944 (H. Wagner, AMNH), 15.ix.1965 (N. L. H. Krauss, AMNH); Delegacion Tlalpan, Colonia Santa Ursula Xitla, 19°16′0″N, 99°10′25″W, 12.x.1994 (W. H. Piel, MCZ); Desierto de los Leones, 19°22′N, 99°16′W, 15.ix.1941 (H. Wagner, AMNH); El Xitle, 18°61′N, 99°17′W [?], 12.viii.1942 (C. Tellez, AMNH); Hacienda Córdoba, 19°26′N, 99°10′W [?], 29.x.1944 (H. Wagner, AMNH); Ouieros, 18°62′N, 99°17′W [?], 5.vii.1943 (M. Cardenas, AMNH); Mexico City, 19°25′N, 99°10′W, 1.xi.1941 (C. Velo, AMNH), 25.ix.1957 (R. Dreisbach, MCZ); Mixcoac, 19°23′N, 99°11′W (AMNH), 13.x.1940 (A. F. Archer, AMNH); Mixenac, 19°25′N, 99°10′W, 13.x.1940 (H. Wagner, AMNH); Pedregales, 18°60′N, 99°17′W [?], 15.viii.1909 (AMNH); Petregal [?], 18°60′N, 99°17′W, 1.xii.1943 (AMNH); Rancho Córdoba, 19°27′N, 99°10′W, 29.x.1944 (H. Wagner, AMNH); Tlaplan, 19°17′N, 99°10′W, 7.viii.1991 (W. H. Piel & G. S. Bodner, MCZ). *Michoacan:* 25 mi W. La Barca nr. Lago de Chapala, 20°17′N, 102°34′W, 11.ix.1976 (C. E. Griswold & Jackson, CAS); between Patzcuaro & Uruapan, 19°29′19″N, 101°48′20″W, 19.x.1994 (W. H. Piel, MCZ); Hills N of Pátzcuaro, 19°45′N, 101°36′W, 24.viii.1959 (A. F. Archer, AMNH); Hwy 110, 4 mi W. Jiquilpan, 19°59′N, 102°47′W, 2.viii.1967 (R. E. Leech, REL); Hwy 15, 9.5 mi W. Morelia, 19°42′N, 101°16′W, 18.viii.1967 (R. E. Leech, REL); Lake Chapala, NW of Cojumatlan, 20°10′N, 102°53′W, 7.ix.1966 (Jean & Wilton Ivie, AMNH); Monte de Zacapu, 19°47′N, 101°50′W, 24.viii.1959 (A. F. Archer, AMNH). *Morelos:* Cuernavaca, 18°55′N, 99°15′W (AMNH), 15.ix.1941 (H. Wagner, AMNH), 18.xi.1946 (M. G. Bradt, AMNH); Cuernavaca/Tepotzotlan, interchange between I-95 & 115, 18°55′N, 99°13′W, 7.viii.1978 (MCZ); Huitzilac, 19°2′2″N, 99°16′13″W, 13.x.1994 (W. H. Piel, MCZ); North of Cuernavaca, 18°58′11″N, 99°14′37″W, 11.x.1994 (W. H. Piel, MCZ); S of Huitzilac, 19°0′29″N, 99°15′50″W, 16.x.1994 (W. H. Piel, MCZ). *Puebla:* 6 mi E Río Frio, 19°20′N, 98°35′W, 22.viii.1964 (Jean & Wilton Ivie, AMNH); Puebla, 19°3′N, 98°12′W, 21.x.1982 (George Uetz, MCZ). *San Luis Potosí:* 3 km W. Pilares, 21°55′34″N, 100°48′6″W, 21.x.1994 (W. H. Piel, MCZ); Cuidad del Maíz, 22°24′N, 99°36′W, 25.viii.1954 (R. Dreisbach, MCZ). *Sonora:* 46 mi S Agua Prieta on Highway 10, 31°0′N, 109°16′W, 15.viii.1959 (B. A. Branson, AMNH); Hermosillo, 29°4′N, 110°55′W, 20.ix.1952 (B. Malkin & V. E. Thatcher, AMNH); Sierra Manzanal, 30°50′N, 110°10′W, 14.ix.1976 (Roth & Schroepfer, MCZ). *Tlaxcala:* Huamantla, 19°19′N, 97°56′W [?], 15.vii.1981 (C. Gold, CAS). *Veracruz:* 15 mi W. Banderilla, 19°39′N, 97°8′W, 31.x.1973 (S. C. Williams & C. L. Mullinex, CAS); 15 mi West of Jalapa, 19°32′N, 97°9′W, 23.vi.1946 (A. M. & L. I. Davis, AMNH). *Zacatecas:* 13 mi N. Sombrerete, 23°44′32″N, 103°47′10″W, 22.x.1994 (W. H. Piel, MCZ); Canutillo, 24°47′N, 101°31′W, 14.viii.1947 (W. J. Gertsch, AMNH); S. Zacatecas, 22°45′7″N, 102°29′37″W, 22.x.1994 (W. H. Piel, MCZ). USA. *Arizona:* Southwestern Research Station, Chiricahua Mtns., 31°35′N, 109°14′W, 20.viii.1976 (V. Roth, MCZ). *California:* 26 mi W. Santa Rosa on Hwy 116, 38°31′N, 123°4′W, 19.ix.1976 (M. E. Thompson, MCZ); Mendocino, 39°18′N, 123°48′W, 18.viii.1959 (W. J. Gertsch, MCZ); Monterey, 36°36′N, 121°54′W, 1.ix.1949 (A. F. Archer, MCZ); Pacific Grove, 36°37′N, 121°56′W (R. V. Chamberlin, MCZ); Palo Alto, 37°27′N, 122°9′W (Doane, MCZ); Salt marsh on N shore of San Pablo Bay, Vallejo, 38°8′N, 122°27′W (D. Spiller, MCZ).

10. *Metepeira lacandon* new species
Figures 76–83, 332; Map 6

Holotype. Male from San Cristobal, Chiapas, Mexico. The specific name is a noun in apposition after the Indian people who live in Chiapas. Holotype deposited in the AMNH.

Description. Female paratype from San Cristobal, Chiapas, Mexico. Reddish carapace, slightly darker in anterior half, lighter behind lateral eyes (Fig. 82). Leg articles yellowish, gradually turning reddish brown distally. Femur I with row of four or five macrosetae on anterior side; two to four setae on anteroventral side. Anterior shoulders of abdomen black. Branches of white fleur-de-lis shape in dorsal folium thinner than in most species (Fig. 82). Venter of abdomen black with wide white median line that extends about half the distance between epigynal groove and spinnerets (Fig. 83). Pair of very small white spots on either side of spiracle. Sternum black, often with central white spot (Fig. 83). Ratio of eye diameters: posterior medians and anterior medians 1.0, anterior laterals 1.3, posterior laterals 1.2. Anterior median eyes separated by 1.7 diameters, posterior median eyes by 1.0, anterior median eyes separated from anterior laterals by 4.5 diameters of anterior lateral eyes, lateral eyes separated by 0.1 their diameters. Total length 11.5 mm. Carapace 4.6 mm long, 3.6 wide. First femur 5.3 mm, patella and tibia 5.3, metatarsus 4.9, tarsus 1.6. Second patella and tibia 4.4 mm, third 2.7, fourth 4.

Male holotype. Carapace, dorsum, venter, sternum as in female (Figs. 80, 81). Distal halves of femora, tibia reddish brown, elsewhere yellowish. Patellae, metatarsi reddish. Femur I with row of four or five macrosetae on anterior side; six or seven on anteroventral side. Ratio of eye diameters: posterior medians and anterior medians 1.1, anterior laterals 1.5, posterior laterals 1.3. Anterior median eyes separated by 1.7 diameters, posterior median eyes by 0.9, anterior median eyes separated from anterior laterals by 3.3 diameters of anterior lateral eyes, lateral eyes separated by 0.3 their diameters. Total length 6.8 mm. Carapace 3.5 mm long, 2.7 wide. First femur 5.3 mm, patella and tibia 3.9, metatarsus 5.6, tarsus 1.7. Second patella and tibia 4.4 mm, third 2.3, fourth 3.4.

Diagnosis. Inside each epigynal depression of *M. lacandon* and *M. spinipes* is a membrane that forms a slanted, oval-shaped opening (Figs. 69, 78). Within each oval-shaped opening is a dark mark, which in *M. lacandon* takes up only a large part of that opening, resulting in a less cross-eyed appearance (Fig. 78). Also, in *M. lacandon* (Fig. 78), the edges of the epigynal depressions are more distinct than in *M. spinipes* (Fig. 69). The distal embolic apophysis of *M. lacandon* is more shovel-shaped (Fig. 79) than the thinner, arrow-shaped one in *M. spinipes* (Fig. 70).

Variation. Average body length of three females examined 8.5 mm, range 7.5 to 10 mm. Average body length of four males examined 5.8 mm, range 4.2 to 6.8 mm.

Natural History. Mature specimens were collected between July and September (Fig. 332) from oak–pine woodland. Elevations range from 1,700 to 2,300 m.

Distribution. Mountainous regions of Chiapas, Mexico (Map 6).

Records Examined. MEXICO *Chiapas:* 12 km NW Comitán, 16°23′N, 92°15′W, 30.viii.1976 (E. S. Ross, CAS); 4 mi SE San Cristobal, 16°42′N, 92°36′W, 23.viii.1966 (Jean & Wilton Ivie, AMNH); 5 km W San Cristobal de Las Casas on HWY 190, 16°44′N, 92°41′W, 27.vii.1983 (W. Maddison & R. S. Anderson, MCZ); 5 mi W San Cristobal, 16°45′N, 92°41′W, 24.viii.1966 (Jean & Wilton Ivie, AMNH); San Cristobal, 16°45′N, 92°38′W, 13.ix.1947 (H. Wagner, AMNH); San Cristobal de las Casas, 16°45′N, 92°38′W, 22.vii.1947 (C. J. & M. Goodnight, AMNH); Tenejapa, 16°49′N, 92°31′W, 22.vii.1950 (C. J. & M. Goodnight, AMNH).

Metepeira nigriventris Group

There are five species in the *Metepeira nigriventris* group: *Metepeira nigriventris, Metepeira tarapaca, Metepeira calamuchita, Metepeira galatheae,* and *Metepeira karkii.* These closely related species are often hard to distinguish because their genitalia are similar, yet highly variable within a species. This species group is easily recognized by the distinctive shape of the scape and similarities in palp morphology. Typically the base of the scape originates anteriorly and projects ventrally before curving posteriorly. This projection creates an overhang and a noticeable gap between the scape and the genital openings (e.g., Figs. 85, 86, 101, 102). The embolus is thick and has a large, prominent, distal apophysis that hides under the terminal apophysis (Figs. 84, 92, 100, 110, 121).

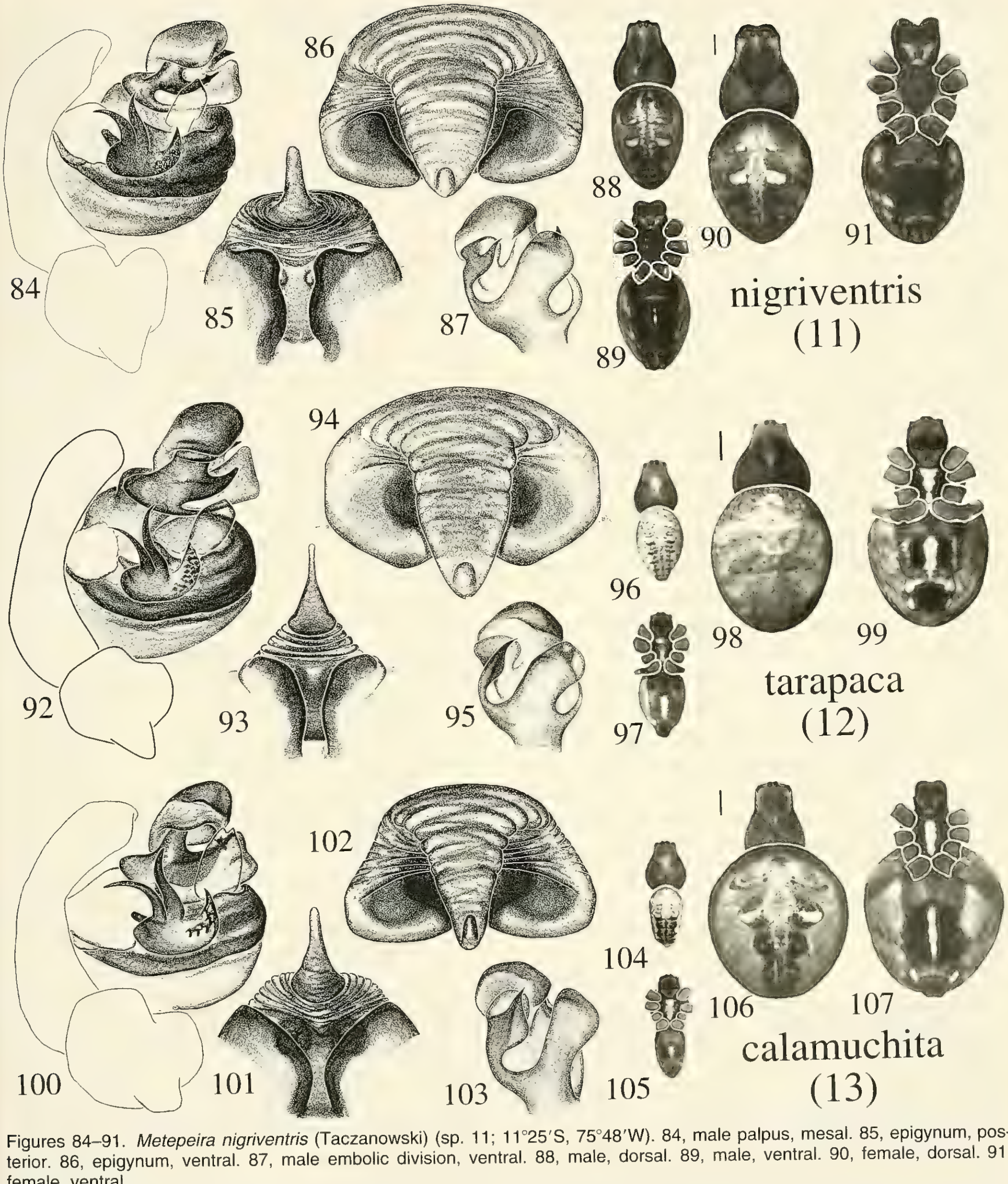
11. *Metepeira nigriventris* (Taczanowski) Figures, 84–91, 310; Map 5

Epeira nigriventris Taczanowski, 1878: 151, fig. 6, ♀. Female lectotype from Lake Junín, Peru, in PAN, type lost. Keyserling, 1893: 217, fig. 161, ♀, ♂.
Araneus nigriventris:—Chamberlin, 1916: 248. Bonnet, 1955: 550.
Metepeira nigriventris:—Chamberlin and Ivie, 1942: 74, figs. 211–214, ♀, ♂. Platnick, 1993: 449.
Note. Although the type is lost, the type locality and Taczanowski's descriptions are sufficient to recognize the species.

Description. Female from 12 km west of Tarma, Junín, Peru. Carapace dark brown, light around eyes with lateral posterior extensions (Fig. 90). Proximal halves of leg articles yellow, distal halves black. Femur I with row of four macrosetae on anterior side; five on anteroventral side. Dorsum darker and white fleur-de-lis pattern smaller than in most species (Fig. 90). Venter mostly black with reduced, short, thin, white median line (Fig. 91). Sternum entirely black. Ratio of eye diameters: posterior medians and anterior medians 1.0, anterior laterals 1.4, posterior laterals 1.4. Anterior median eyes separated by 1.8 diameters, posterior median eyes by 1.2, anterior median eyes separated from anterior laterals by 5 diameters of anterior lateral eyes, lateral eyes separated by 0.4 their diameters. Total length 11 mm. Carapace 5.1 mm long, 4.2 wide. First femur 5.5 mm, patella and tibia 5.8, metatarsus 5.5, tarsus 1.9. Second patella and tibia 5.3 mm, third 3.3, fourth 4.5.

Male from same locality as female. Anterior margin of chelicerae with large, swollen tooth and several denticles. Carapace reddish brown with lighter eye region, lateral posterior extensions, and long, thin median white line (Fig. 88). Femur I with row of about five macrosetae on anterior side; nine on anteroventral side. Coloration of legs, dorsum, venter, and sternum as in female (Figs. 88, 89). Ratio of eye diameters: posterior medians and anterior medians 1.1, anterior laterals 1.3, posterior laterals 1.3. Anterior median eyes separated by 1.8 diameters, posterior median eyes by 1.2, anterior median eyes separated from anterior laterals by 3.7 diameters of anterior lateral eyes, lateral eyes separated by 0.4 their diameters. Total length 9 mm. Carapace 4 mm long, 3.2 wide. First femur 5.8 mm, patella and tibia 6.2, metatarsus 6.5, tarsus 1.7. Second patella and tibia 4.5 mm, third 2.8, fourth 4.

Diagnosis. Metepeira nigriventris is easily distinguished from other species in the *M. nigriventris* group by its dark pigmentation. As its name implies, the sternum is black and the white ventral mark on the abdomen is reduced to a much shorter and thinner line (Figs. 88–91). While the sternum of *M. karkii* is similarly dark, the dorsal and ventral markings on the abdomen are much lighter (compare Figs. 88–91



Figures 84–91. *Metepeira nigriventris* (Taczanowski) (sp. 11; 11°25′S, 75°48′W). 84, male palpus, mesal. 85, epigynum, posterior. 86, epigynum, ventral. 87, male embolic division, ventral. 88, male, dorsal. 89, male, ventral. 90, female, dorsal. 91, female, ventral.

Figures 92–99. *Metepeira tarapaca* new species (sp. 12; 21°39′S, 69°33′W). 92, male palpus, mesal. 93, epigynum, posterior. 94, epigynum, ventral. 95, male embolic division, ventral. 96, male, dorsal. 97, male, ventral. 98, female, dorsal. 99, female, ventral.

Figures 100–107. *Metepeira calamuchita* new species (sp. 13; 32°4′S, 64°33′W). 100, male palpus, mesal. 101, epigynum, posterior. 102, epigynum, ventral. 103, male embolic division, ventral. 104, male, dorsal. 105, male, ventral. 106, female, dorsal. 107, female, ventral.

Scale bars: dorsum and venter figures 1.0 mm.

with Figs. 125–128). The epigynum of *M. nigriventris* has a wider membrane over the openings that is visible on either side of a very wide scape (Fig. 86). In contrast, this feature is hidden behind a thinner scape in its likely sister species, *M. tarapaca* (Fig. 94). The overall shape of the epigynum (Fig. 86) and the pair of small notches in the posterior lobes (Fig. 85) also make this species distinctive. The male palp of *M. nigriventris* has an embolus that is relatively slimmer and more graceful than those of other species in the *M. nigriventris* species group (compare Fig. 84 with Figs. 92, 100, 109–110, 121). The shape of the embolus and its distal apophysis differs from other species (compare Fig. 87 with Figs. 95, 103, 112, 124).

Variation. Average body length of 25 females examined 9.5 mm, range 7.2 to 11.5 mm. Average body length of 16 males examined 7.4 mm, range 5.3 to 9.5 mm.

Natural History. Spiders are commonly found around Lake Titicaca living in medium and large colonies among power lines, Bolivian pines, *Cactus*, *Bacharis*, rock outcroppings, and tall grasses (L. Rayor, personal communication, and various locality labels). Mature specimens have been collected throughout the year except September and October (Fig. 310). Median elevation, 3,900 m.

Distribution. High altitude regions of southern Peru and western Bolivia (Map 5).

Records Examined. ARGENTINA *Jujuy:* Pumahuasi, 22°17′S, 65°41′W, 8.xi.1970 (L. E. Peña, MCZ). BOLIVIA *La Paz:* 45 mi S La Paz, 17°9′S, 67°36′W, 25.ii.1951 (E. S. Ross & Michelbacher, CAS); 70 mi S La Paz, 17°30′S, 67°36′W, 25.ii.1951 (E. S. Ross & Michelbacher, CAS); La Paz, Avenida Sport Club, 16°30′S, 68°9′W, 4.i.1959 (A. M. Nadler, AMNH); La Paz, in garden of house, 16°30′S, 68°9′W, 15.iv.1959 (R. Walsh, AMNH); Lake Titicaca, Copacabana, Yampupata, & Isla del Sol, 16°10′S, 69°5′W, 17.v.1995 (L. Rayor, MCZ); near La Paz, 16°30′S, 68°9′W, 24.v.1958 (R. Walsh, AMNH); S end of Lake Titicaca, 100 km NW La Paz, 16°10′S, 69°5′W, 5.vii.1958 (R. Walsh, AMNH); Tiahuanaco, Puma Puerto Ruins, 16°33′S, 68°42′W, 1.ii.1973 (Ann Moreton, MCZ). *Oruro:* 6 km N Challapata, 18°51′S, 66°47′W, 23.ii.1951 (E. S. Ross & Michelbacher, CAS); Gorge Uhuschlucht, near Oruro, 17°59′S, 67°9′W, 7.ii.1954 (Forster & Schindler, ZSM). *Potosí:* Villazon, 22°6′S, 65°36′W, 30.xii.1984 (L. E. Peña, AMNH). PERU *Apurímac:* Chincheros, 13°30′48″S, 73°42′47″W, 12.xii.1980 (C. Gold, CAS); Puna near Abancay, 13°38′2″S, 72°52′52″W, 15.xii.1947 (W. Weyrauch, CAS). *Ayacucho:* Puquio, 14°42′S, 74°8′W, 15.iv.1950 (F. Blancas, MUSM); San Antonio (Puquio), 14°47′S, 74°7′W, 1.xi.1985 (D. Silva, MUSM). *Cusco:* Cheqquerec, 13°23′S, 72°8′W, 2.ix.1993 (J. Ochoa Camara, MCZ); Cusco, 13°31′6″S, 71°58′41″W, 8.viii.1965 (P. & B. Wygodzinsky, AMNH). *Junín:* 8 mi W Tarma, 11°25′S, 75°48′W, 6.i.1955 (E. I. Schlinger & E. S. Ross, CAS); Cochas Bajo, 11 km W Tarma, 11°25′21″S, 75°46′11″W, 27.iii.1988 (J. Palmer & D. Smith, MCZ); Cochas Bajo, 11 km W Tarma, rock ledge in agricultural valley, 11°25′21″S, 75°46′11″W, 29.iii.1988 (J. Palmer, MCZ); Huancayo, 12°4′S, 75°14′W, 15.vi.1947 (W. Weyrauch, AMNH); Oroya, 11°32′S, 75°54′W, 12.iv.1914 (M. P. Anderson, AMNH). *Lima:* Bosque de Zarate, 11°53′S, 76°27′W, 18.i.1981 (J. Francke, MUSM). *Puno:* 10 mi N Ayaviri, 14°45′S, 70°35′W, 1.iii.1951 (E. S. Ross & Michelbacher, CAS); Camacane, 15°55′S, 69°50′W, 20.xi.1955 (L. E. Peña, IRSNB); Isla Taquili, Lago Titicaca, 15°46′S, 69°41′W, 23.xii.1980 (C. Gold, CAS); Juli (col. Chucuito), 16°13′S, 69°27′W, 7.xi.1952 (F. Blancas, MUSM); near Chucuito, Lago Titicaca, 15°50′S, 69°48′W, 10.iii.1953 (M. Koepcke, MUSM); Puna, Lake Titicaca, 15°50′S, 70°2′W, 15.vi.1947 (W. Weyrauch, AMNH); Puno, 15°50′S, 70°2′W (Soukup, AMNH); Yunguyo, downtown plaza, 16°15′S, 69°5′W, 31.i.1973 (Ann Moreton, MCZ).

12. *Metepeira tarapaca* new species
Figures 92–99, 305; Map 7

Holotype. Male from Quillagua, Antofagasta, Chile, 4.ii.1965, L. E. Peña, in MCZ. The specific name is a noun in apposition after a Chilean province where it is abundant.

Description. Female paratype from Quillagua, Antofagasta, Chile. Light reddish brown carapace, white in center and around eyes with lateral posterior extensions (Fig. 98). Legs yellowish white, ringed brown at distal ends of articles. Femur I with row of four macrosetae on anterior side; three on anteroventral side. Dorsal folium white with black speckles (Fig. 98). Venter of abdomen black with wide, white median line, sometimes flanked by thinner white lines that together form a U-shape posteriorly (Fig. 98). Sternum black with median white line, sometimes broken (Fig. 99). Ratio of eye

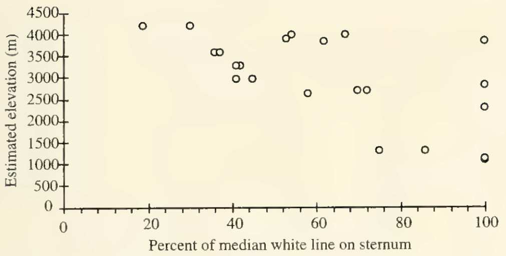


Figure 108. Elevation of collection localities of mature female *M. tarapaca* with differing amounts of white on the sternum. Spiders with a median white line covering 100% of the sternum length are found at a wide altitude range. Spiders with a median white mark covering only a short length of the sternum are only found at high elevations. Elevations estimated from NOAA database of 5- by 5-minute geographic tiles.

diameters: posterior medians and anterior medians 1.0, anterior laterals 1.3, posterior laterals 1.2. Anterior median eyes separated by 1.4 diameters, posterior median eyes by 1.0, anterior median eyes separated from anterior laterals by 3.4 diameters of anterior lateral eyes, lateral eyes separated by 0.1 their diameters. Total length 7.8 mm. Carapace 3.2 mm long, 2.8 wide. First femur 4.3 mm, patella and tibia 4.4, metatarsus 4, tarsus 1.2. Second patella and tibia 3.8 mm, third 2.1, fourth 3.2.

Male holotype. Light reddish brown carapace, lighter around eyes and white mark in center (Fig. 96). Legs yellowish white, gradually growing darker toward distal ends of articles. Femur I with row of four macrosetae on anterior side; five on anteroventral side. Dorsal folium, venter, and sternum as in female (Figs. 96, 97). Ratio of eye diameters: posterior medians and anterior medians 1.0, anterior laterals 1.2, posterior laterals 1.1. Anterior median eyes separated by 1.5 diameters, posterior median eyes by 1.0, anterior median eyes separated from anterior laterals by 2.5 diameters of anterior lateral eyes, lateral eyes separated by 0.1 their diameters. Total length 4.4 mm. Carapace 2 mm long, 1.6 wide. First femur 3.3 mm, patella and tibia 3.5, metatarsus 3.3, tarsus 1. Second patella and tibia 2.8 mm, third 1.4, fourth 2.2.

Diagnosis. Unlike *M. nigriventris* or *M. karkii*, *M. tarapaca* has a white mark on the sternum (Figs. 97, 99). The epigynum is close to that of *M. nigriventris*, except that it is less robust (compare Fig. 93 with Fig. 85), and the membrane just over the openings cannot be seen behind the thinner scape (compare Fig. 86 with Fig. 94). Unlike *M. calamuchita*, the epigynum of *M. tarapaca* does not widen posteriorly (compare Fig. 94 with Fig. 102); unlike *M. karkii*, the posterior epigynal lobes are not swollen (compare Fig. 94 with Fig. 123); unlike *M. galatheae*, the black sclerotized circles behind the epigynal openings are larger and not shifted posteriorly (compare Fig. 94 with Figs. 118–120). The segment of the embolus between the basal and distal embolic apophysis is relatively thicker than in other members of the *M. nigriventris* species group (compare Fig. 92 with Figs. 84, 100, 109, 121). The terminal division of the male palp in *M. tarapaca* shows a distal embolic apophysis that differs in shape from that of other species (compare Fig. 95 with Figs. 87, 103, 117, 124).

Variation. Average body length of 22 females examined 7.4 mm, range 5 to 11.5 mm. Average body length of six males examined 5.9 mm, range 4.4 to 7.3 mm. The dorsum and venter are often darker than the holotype. Many lack the flanking lines and the U-shape on the venter; some at higher elevation have a much reduced white line on the sternum.

Natural History. Mature specimens have been collected throughout the year, especially between January and April (Fig. 305). V. Roth (vial label) notes that these spiders live in a social colony. M. Roy (personal communication) reports that colonies can reach 200 individuals. Median elevation, 2,800 m.

Distribution. Moderately high altitudes in northern Chile and southern Peru (Map 7).

Records Examined. CHILE *Antofagasta:* 7 km S Toconao, 23°11'S, 68°1'W, 25.xii.1988 (V. & B. Roth, CAS); Aguas Blancas [?] (= 24°11'S 69°51'W), Toconao, 23°11'S, 68°1'W, 11.x.1955 (L. E. Peña, IRSN); Antofagasta, 23°39′S, 70°24′W, 15.xi.1975 (L. E. Peña, AMNH); Quillagua, 21°39′S, 69°33′W, 4.ii.1965 (L. E. Peña, MCZ), 21.i.1973 (W. C. Sedgwick, MCZ); Río Loa, 25 km S Quillagua, 21°54′S, 69°33′W, 20.viii.1966 (E. Schlinger & M. Irwin, CAS). *Elloa:* Thermo Puritania, 35 km N San Pedro de Atacama, 22°37′S, 68°13′W, 25.xii.1988 (V. & B. Roth, CAS). *Tarapaca:* Arica Timar, Alociado [?], 18°45′S, 69°42′W, 22.iii.1973 (N. Hichins, AMNH); Ariquilda, 19°38′S, 69°32′W, 29.iv.1969 (L. E. Peña, MCZ); Canchones, 20°27′S, 69°37′W, 29.i.1973 (W. C. Sedgwick, MCZ); Chapiquilta, 19°18′S, 69°25′W, 6.vi.1968 (L. E. Peña, MCZ); Chiapa, 19°32′S, 69°13′W, 24.iv.1969 (L. E. Peña, MCZ); Pica, 20°30′S, 69°21′W, 26.i.1973 (W. C. Sedgwick, MCZ); Poroma, Quebrada de Tarapaca, 19°52′S, 69°11′W, 20.iv.1969 (L. E. Peña, MCZ); Quisama, 19°19′S, 69°28′W, 5.vi.1968 (L. E. Peña, MCZ). PERU *Arequipa:* Arequipa, 16°23′56″S, 71°32′6″W, 15.vii.1955 (A. Meza, MZSP); Chiguata, near Arequipa, 16°24′S, 71°24′W, 15.ii.1948 (W. Weyrauch, MUSM).

13. *Metepeira calamuchita* new species
Figures 100–107, 308; Map 5

Holotype. Male from Calamuchita, Córdoba, Argentina, 15.i.1955, J. M. Viana, in MACN. The specific name is a noun in apposition after the locality.

Description. Female paratype from Calamuchita, Córdoba, Argentina. Carapace reddish brown, light around eyes with lateral posterior extensions (Fig. 106). Leg articles annulated distally. Femur I with row of six or seven macrosetae on anterior side; five on anteroventral side. Anterior portion of dorsal folium lighter than in most species (Fig. 106). Venter black with wide white median line and pair of large white spots on either side of spiracle (Fig. 107). Sternum brownish black with wide, white median line (Fig. 107). Ratio of eye diameters: posterior medians and anterior medians 1.1, anterior laterals 1.4, posterior laterals 1.3. Anterior median eyes separated by 1.6 diameters, posterior median eyes by 0.9, anterior median eyes separated from anterior laterals by 3.2 diameters of anterior lateral eyes, lateral eyes separated by 0.2 their diameters. Total length 8.9 mm. Carapace 3.4 mm long, 2.8 wide. First femur 4.5 mm, patella and tibia 4.7, metatarsus 4.7, tarsus 1.3. Second patella and tibia 4.1 mm, third 2.3, fourth 3.5.

Male holotype. Carapace brown with light, triangular, median mark pointing posteriorly (Fig. 104). Leg articles white, darkening brown distally. Femur I with row of four macrosetae on anterior side; five or six on anteroventral side. Anterior dorsal folium mostly white, posterior mostly black (Fig. 104). Venter as in female (Fig. 105). Broad white median mark on sternum (Fig. 105). Ratio of eye diameters: posterior medians and anterior medians 1.1, anterior laterals 1.4, posterior laterals 1.4. Anterior median eyes separated by 1.4 diameters, posterior median eyes by 0.9, anterior median eyes separated from anterior laterals by 2.2 diameters of anterior lateral eyes, lateral eyes separated by 0.2 their diameters. Total length 4.4 mm. Carapace 2.3 mm long, 1.8 wide. First femur 3.8 mm, patella and tibia 3.7, metatarsus 4, tarsus 1.2. Second patella and tibia 2.9 mm, third 1.5, fourth 2.5.

Diagnosis. Metepeira calamuchita differs from others in the *M. nigriventris* species group by the large, scooped openings, and posteriorly widening epigynum (Fig. 102). The epigyna of *M. tarapaca* and *M. calamuchita* both have deep scooped-out openings, but these are angled posteriorly in the latter (Fig. 102) and laterally in the former (Fig. 94). The male palp of *M. calamuchita* is easily distinguished from that of other species by the widened (Fig. 100) and inwardly curved (Fig. 103) "dewlap" under the embolus.

Variation. Average body length of 13 females examined 7.7 mm, range 5 to 9.8 mm. Average body length of five males examined 5.2 mm, range 4 to 6.4 mm. Two specimens collected near 2,700 m in Iturbe, Jujuy, Argentina, have entirely dark sterna. In contrast, most specimens are found at lower elevations with white median lines on their sterna.

Natural History. Mature specimens have been collected between October and July, although they are probably available throughout the year (Fig. 308). Most elevations range from 150 to 1,700 m, with one population at 2,700 m.

Distribution. Northern Argentina, at

mostly lower altitudes east of the Andes (Map. 5).

Records Examined. ARGENTINA *Buenos Aires:* Las Espaduñas [?], Sierra de la Ventana, 38°9′S, 61°48′W, 15.x.1973 (Maury & Cesari, MACN); Sierra de la Ventana, 38°9′S, 61°48′W, 15.vii.1972 (Amarrilla, MACN). *Córdoba:* C. Paz, 31°24′S, 64°31′W, 15.v.1940 (C. Marti, MACN); Calamuchita, 32°4′S, 64°33′W, 15.xii.1941 (J. M. Viana, MACN), 15.i.1955 (J. M. Viana, MACN); Mina Clareo, 31°43′S, 65°0′W, 15.iv.1973 (Stiebel, MACN). *Jujuy:* Iturbe, 22°59′S, 65°21′W, 22.ii.1983 (L. E. Peña, AMNH). *La Rioja:* Ilias [?], 29°5′S, 66°19′W (P. M. Gomez, MACN). *San Luis:* Chosmes and Desaguadero (Mendoza), 33°24′30″S, 67°0′0″W, 14.iv.1967 (L. E. Peña, MCZ). *Santiago del Estero:* Santiago del Estero, 27°47′S, 64°16′W (AMNH), 3.iv.1965 (H. W. Levi, MCZ); 70 km W Santiago, 27°47′S, 65°25′W, 3.iv.1965 (H. W. Levi, MCZ); *Quebrachos:* Sumampa, Parayacu [?], 29°22′S, 63°28′W, 15.xi.1944 (Maldonado Bruzzone, MLP).

14. *Metepeira galatheae* (Thorell)
Figures 108–120, 304; Map 7

Epeira galatheae Thorell, 1891: 53. Female holotype from "Cobija, Bolivia," now, Cobija, Antofagasta, Chile, in the UZMK, examined.

Araneus galatheae:—Bonnet, 1955: 506.

Metepeira galatheae:—Levi, 1991: 179. Platnick, 1993.

Metepeira cereicola nomen nudum, female in AMNH but no description has been found. Female manuscript type from Salamanca, Coquimbo, Chile, collected by Archer on 30.iv.1961.

Note. Thorell (1891) listed the holotype's locality as "Cobija, Bolivia." While Cobija, Bolivia exists (11°02′S 68°44′W), it is an unlikely locality for the corvette Galathea to visit on its voyage to southern Asia because it would have meant climbing over the Andes. Instead, the port town of Cobija, Chile (22°33′S 70°16′W) is much more likely, especially since this region of Chile was under Bolivian administration throughout the period of Galathea's voyage, 1845–1847 (Paynter et al., 1975).

Description. Female from Chile Chico, Aisén province, Chile. Reddish brown carapace with white setae, light around eyes, lateral posterior extensions, central arrow-shaped mark (Fig. 113). Legs light yellow, articles annulated distally. Femur I with row of four or five macrosetae on anterior side; two to four on anteroventral side. Dorsum with black and white setae. Folium speckled brown with a white fleur-de-lis that reduces posteriorly (Fig. 113). Venter brownish gray with wide median white line and pair of large white spots on either side of spiracle. A pair of very faint white stitching parallel to and on either side of median line (Fig. 114). Sternum reddish brown, sometimes with small posterior and anterior white marks (Fig. 114). Ratio of eye diameters: posterior medians and anterior medians 1.0, anterior laterals 1.2, posterior laterals 1.2. Anterior median eyes separated by 1.7 diameters, posterior median eyes by 1.2, anterior median eyes separated from anterior laterals by 3.6 diameters of anterior lateral eyes, lateral eyes separated by 0.1 their diameters. Total length 7.8 mm. Carapace 3.5 mm long, 2.7 wide. First femur 3.7 mm, patella and tibia 3.9, metatarsus 3.5, tarsus 1.2. Second patella and tibia 3.4 mm, third 2.1, fourth 3.

Male from Chile Chico, Aisén province, Chile. Leg coloration as in female, except femur I mostly reddish brown with row of four macrosetae on anterior side; five on anteroventral side. Carapace, dorsum, venter and sternum as in female (Figs. 111, 112). Ratio of eye diameters: posterior medians and anterior medians 1.0, anterior laterals 1.3, posterior laterals 1.3. Anterior median eyes separated by 1.6 diameters, posterior median eyes by 1.2, anterior median eyes separated from anterior laterals by 3.3 diameters of anterior lateral eyes, lateral eyes separated by 0.4 their diameters. Total length 5.3 mm. Carapace 2.7 mm long, 2.1 wide. First femur 3.9 mm, patella and tibia 3.8, metatarsus 3.6, tarsus 1.1. Second patella and tibia 3.2 mm, third 1.8, fourth 2.6.

Diagnosis. Although the sternum of *M. galatheae* varies from solid brown (Fig. 114) to brown with median white marks, the venter of the abdomen is surprisingly consistent. The venter has a wide brownish gray area and a short median white line flanked by very faint indications of parallel lines (Fig. 114). In contrast, the flanking lines in *M. karkii* thicken anteriorly (Fig. 128) and the venter of *M. nigriventris* is almost completely black (Fig. 91). Despite enormous variation in the hood of the

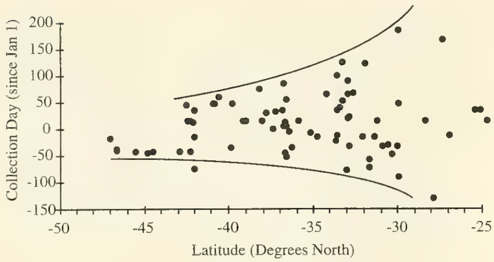


Figure 109. Days on which mature *M. galatheae* were collected between 1937 and 1989 with latitude of the collection locality. Seasonality appears to be more restricted in southern regions than in northern regions.
Scale of abscissa: −150 = August 3; 1 = January 1; 150 = May 30.

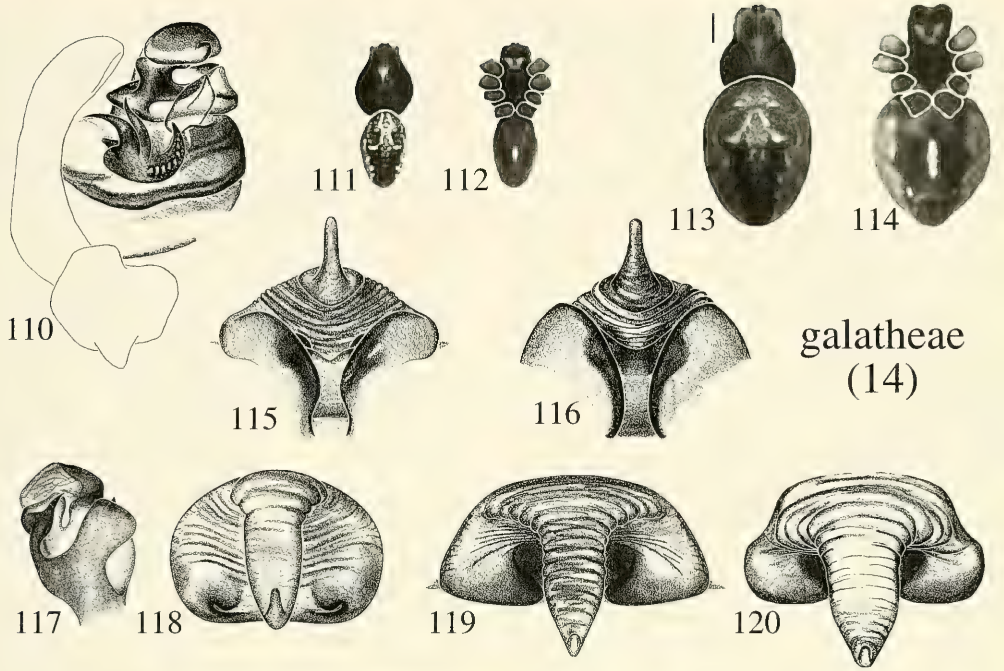
scape with a corresponding variation in the position of the epigynal openings, it is nonetheless possible to distinguish the females of *M. galatheae* from those of other species in the *M. nigriventris* group. Whether ventrally or posteriorly positioned, the epigynal openings and the darkened shadows of the sclerotized receptacles beneath them are relatively smaller than those of *M. calamuchita, M. tarapaca,* and *M. nigriventris* (compare Figs. 118–120 with Figs. 86, 94, 102). Also, *M. galatheae* lacks the swollen posterior lobes present in *M. karkii* (compare Figs. 118–120 with Fig. 123). The shape of the embolus of *M. galatheae* varies significantly (compare Fig. 109 with Fig. 110). However, unlike other species, the embolus of *M. galatheae* has a distinct, round and swollen protrusion (Fig. 117).

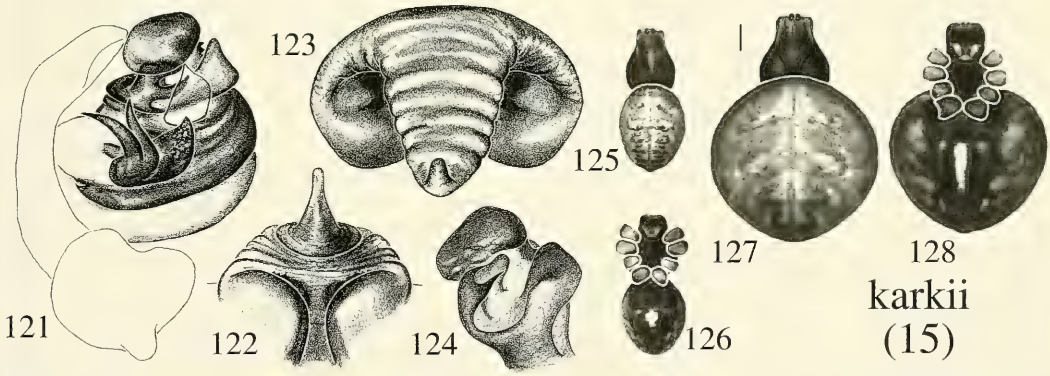
Variation. Average body length of 80 females examined 7.9 mm, range 4.8 to 12.5 mm. Average body length of 16 males examined 5.9 mm, range 3.5 to 8.1 mm. Epigyna vary considerably. Many, similar to the holotype, open ventrally and resemble a posteriorly widened version of *M. tarapaca* (Figs. 119, 120); cleared epigyna show relatively straight ducts connecting the epigynal openings with the seminal receptacles. These have a short distance between the openings and the hood of the scape. Others, usually in southern Chile, have posterior openings and look surprisingly different (Fig. 118); cleared epigyna show S-shaped ducts connecting the openings with the seminal receptacles. These have an extended wrinkled area between the openings and the hood of the scape. However, several females [e.g., CHILE *Bío-Bío:* Chillán, 8.xi.1976 (G. Moreno, AMNH); Las Lajuelas, 11.i.1976 (G. Moreno, AMNH)] have epigyna that appear to be intermediate between the two forms. Furthermore, no somatic features were found to be sufficiently different, and little corresponding variation was found among sympatric males. It is possible that further collecting efforts will discover corresponding males, and future molecular studies may show that speciation has, in fact, occurred. But in the meantime, I am opting to treat both varieties as belonging to the same species.

Natural History. Although mature specimens have been collected throughout the year (Fig. 304), the seasonality of this species appears to depend on its latitude. At the 45th southern parallel, spiders are usually found in late November and December; at the 40th parallel, spiders occur between October and February; and at the 30th parallel, they are collected year round (Fig. 108). Median elevation, 550 m. Spiders are found on Patagonian scrub, dunes, and wire fences.

Distribution. Chile and Argentina (Map 7).

Records Examined. ARGENTINA *Buenos Aires:* Felipe Sola, 38°1′S, 62°50′W, 15.i.1944 (Prosen, MLP); Patagones, 40°48′S, 62°59′W, 15.ii.1937 (J. M. Viana, MACN); Sierra de la Ventana, 38°9′S, 61°48′W, 15.iii.1939 (J. C. Gario, MACN). *Catamarca:* Mutquin, 28°19′S, 66°10′W, 15.i.1963 (O. de Ferrariis, AMNH). *Chubut:* 15 km S Epuyen, 42°22′S, 71°21′W, 15.i.1986 (P. A. Goloboff, N. I. Platnick, & R. T. Schuh, AMNH); 19.5 km E Shaman, 44°27′S, 70°30′W, 19.xi.1966 (E. I. Schlinger & M. E. Irwin, CAS); 3 km N Puerto Lobos, 41°59′S, 65°6′W, 14.xii.1966 (E. I. Schlinger & M. E. Irwin, CAS); 35 km E Esquel, 42°54′S, 70°53′W, 18.xi.1966 (E. I. Schlinger & M. E. Irwin, CAS); El Hoyo [?], 42°4′S, 71°30′W (A. Kovacs, AMNH), 10.i.1962 (Andor Kovacs, AMNH); Epuyen, 42°15′S, 71°23′W, 18.xi.1962 (Andor Kovacs, AMNH); Leleque, 42°28′S, 71°6′W, 12.ii.1965 (Andor Kovacs, AMNH); Los Manantiales,





Figures 110–120. *Metepeira galatheae* (Thorell) (sp. 14 [110–114,116,117,120] 46°33′S, 71°57′W; [115,119] 29°50′S, 70°2′W; [118] 33°30′S, 71°25′W). 110, male palpus, mesal. 111, male, dorsal. 112, male, ventral. 113, female, dorsal. 114, female, ventral. 115, epigynum, posterior. 116, epigynum, posterior. 117, male embolic division, ventral. 118–120, epigynum, ventral.
Figures 121–128. *Metepeira karkii* (Tullgren) (sp. 15; 51°38′S, 69°13′W). 121, male palpus, mesal. 122, epigynum, posterior. 123, epigynum, ventral. 124, male, dorsal. 125, male, ventral. 126, female, dorsal. 127, female, ventral.
Scale bars: dorsum and venter figures 1.0 mm.

N of Comodoro-Rivadavia, 45°28′S, 69°29′W, 19.xi.1985 (L. E. Peña, AMNH); N of Camarones, Cantera, Namuncura, 44°46′S, 65°42′W, 17.xi.1985 (L. E. Peña, AMNH); Río Turbio, 42°13′S, 71°41′W (Andor Kovacs, AMNH), 12.i.1962 (Andor Kovacs, AMNH). *Córdoba:* 12 mi W Sampacho, 33°23′S, 64°43′W, 7.ii.1951 (E. S. Ross & Michelbacher, CAS); Arguello, 31°21′S, 64°15′W, 15.xii.1943 (J. A. De Carlo, MACN); Calamuchita, 32°4′S, 64°33′W, 15.xii.1940 (J. M. Viana, MACN); Sampacho, 33°23′S, 64°43′W, 7.ii.1951 (E. S. Ross & Michelbacher, CAS). *Mendoza:* Between Beazley and San Rafael, 34°10′S, 67°29′W, 4.iii.1983 (L. E. Peña, AMNH); Mendoza, 32°53′S, 68°49′W, 30.iii.1965 (H. W. Levi, MCZ); Uspallata, 32°35′S, 69°20′W, 7.iii.1983 (L. E. Peña, AMNH). *Neuquén:* Catan Lil, Charahuilla, 39°45′S, 70°37'W, 15.ii.1971 (O. de Ferrariis, AMNH); Cuba del Leon [?], 39°9'S, 70°53'W, 15.i.1975 (Maury, MACN); Lago Alumine, 38°55'S, 71°9'W, 15.i.1976 (O. de Ferrariis, AMNH); Zapala, 38°54'S, 70°4'W, 15.i.1958 (J. R. Navas, MACN). *Río Negro:* Cerro Alto [?], 41°8'S, 70°40'W (MACN); Co. Leones, source of Río Limay, 40°33'S, 70°26'W, 28.ii.1959 (J. R. Navas, MACN); El Bolson, 41°58'S, 71°31'W, 1.ii.1961 (A. Kovacs, AMNH), 17.x.1961 (Andor Kovacs, AMNH); El Bolson, 41°58'S, 71°35'W, 2.ii.1965 (Andor Kovacs, AMNH); General Roca, 39°3'S, 67°32'W, 15.ix.1964 (Bachmann, MEG). *Salta:* Maury [?], 24°40'S, 65°45'W, 15.i.1975 (MACN). *San Juan:* 10 km N Matagusanos, 31°10'S, 68°38'W, 13.i.1983 (L. E. Peña, AMNH). *San Luis:* INTA Experimental Station, E of Villa Mercedes, 33°40'S, 65°27'W, 8.xii.1967 (C. R. Ward, CAS). *Santa Cruz:* 2.4 km S Fitz Roy, 47°2'S, 67°15'W, 12.xii.1966 (E. I. Schlinger & M. E. Irwin, CAS). *Tucumán:* San Miguel de Tucumán, IML gardens, 26°49'S, 65°13'W, 19.xii.1979 (L. A. Stange, FSCA). BRAZIL *Mato Grosso:* Campo Grande, 20°27'S, 54°37'W, 7.ii.1952 (M. Alvarenga, MZSP). CHILE *Aconcagua:* W end tunnel, 85 km S Illapel, 32°49'S, 71°7'W, 29.xi.1950 (E. S. Ross & Michelbacher, CAS). *Aisén:* 8 km W Chile Chico, 46°33'S, 71°57'W, 22.xi.1966 (E. I. Schlinger & M. E. Irwin, CAS); Chile Chico, near lake, 46°33'S, 71°43'W, 21.xi.1966 (E. I. Schlinger & M. E. Irwin, CAS). *Antofagasta:* 6 km N Muelle de Piedra, N Taltal, 25°21'S, 70°30'W, 4.ii.1942 (Junius Bird, AMNH); Caleta Hueso Parado, Taltal, 25°22'S, 70°28'W, 1.ii.1941 (Junius Bird, AMNH); Cobija, 22°33'S, 70°16'W (ZMUC); Quebrada Paposo, 25°2'S, 70°27'W, 3.ii.1989 (L. Stange, FSCA). *Araucanía:* Pemehue [?], 38°3'S, 71°43'W (L. E. Peña, IRSNB); Villarrica, 36°16'S, 72°13'W, 25.xi.1963 (G. F. Edmunds, AMNH). *Atacama:* 50–60 km S Copiapo, 27°51'S, 70°20'W, 24.viii.1966 (E. I. Schlinger & M. E. Irwin, CAS); Copiapo, 27°22'S, 70°20'W (Cartis, MNRJ); Río Copiapo, by the sea, 27°19'S, 70°56'W, 13.vi.1968 (L. E. Peña, MCZ). *Bío-Bío:* 4 km E road to Pinto, 36°42'S, 71°53'W, 4.i.1976 (B. Moreno, AMNH); Chillán, 36°36'S, 72°7'W, 2.i.1976 (G. Moreno, AMNH), 21.ii.1978 (G. Moren, MCZ); Chillán, in cemetery, 36°36'S, 72°7'W, 8.xi.1976 (G. Moreno, AMNH); Cuesta de Quilmo, Chillán, 36°38'S, 72°12'W, 13.xi.1976 (G. Moreno, AMNH); El Abanico, 37°20'S, 71°31'W, 30.xii.1950 (E. S. Ross & Michelbacher, CAS); Las Lajuelas, 36°39'S, 72°8'W, 11.i.1976 (G. Moreno, AMNH). Concepción, 36°50'S, 73°3'W (L. E. Peña, IRSNB); Concepción: Salta de Río Laja, 37°13'S, 72°23'W, 30.i.1951 (E. S. Ross & Michelbacher, CAS); Ñuble: 50 km E San Carlos, 36°25'S, 71°6'W, 26.xii.1950 (E. S. Ross & Michelbacher, CAS); Ñuble: Cordillera de Chillán [?], 36°51'S, 71°24'W, 1.ii.1947 (L. E. Peña, IRSNB); Río Andalien, 36°44'S, 73°1'W, 25.iii.1979 (S. Gutierrez, MCZ). *Coquimbo:* 20 mi E La Serena, 29°54'S, 70°56'W, 3.vii.1950 (E. S. Ross & Michelbacher, CAS); 5 mi N Ovalle, 30°31'S, 71°12'W, 1.xii.1950 (E. S. Ross & Michelbacher, CAS); Baños del Toro, 29°50'S, 70°2'W, 15.ii.1947 (L. E. Peña, IRSNB); Cerro Talinay, 30°50'29"S, 71°37'14"W, 29.xi.1961 (A. F. Archer, AMNH); Cuesta las Cardas, Ovalle Rd., 30°17'S, 71°16'W, 13.xi.1961 (R. Wagenknecht, AMNH); Hacienda Illapel, 31°36'S, 71°7'W, 3.xi.1954 (L. E. Peña, IRSNB), 19.x.1966 (E. I. Schlinger, M. E. Irwin, & L. E. Peña, CAS); Illapel: Salamanca: Fundo Quelén, 31°52'S, 70°52'W, 30.iv.1961 (A. F. Archer, AMNH); La Serena, 29°54'28"S, 71°15'15"W, 15.ii.1947 (L. E. Peña, IRSNB); Loma de Peñuelas, 6 km S La Serena, 29°57'S, 71°18'W, 28.xi.1961 (A. F. Archer, AMNH); Quilacán, 16 km E La Serena, 29°54'S, 71°5'W, 2.x.1961 (R. Wagenknecht, AMNH). *Los Lagos:* Purranque, 40°55'S, 73°10'W, 15.ii.1955 (Edwin Reed, AMNH); Río Bueno, 40°19'S, 72°58'W (L. E. Peña, IRSNB); Valdivia: Neltume, 39°48'S, 71°57'W, 23.xi.1988 (V. & B. Roth, CAS). *Malleco:* Angol, 37°48'S, 72°43'W, 29.i.1951 (E. S. Ross & Michelbacher, CAS). *Maule:* Linares, 35°51'S, 71°36'W (L. E. Peña, IRSNB), 15.i.1947 (L. E. Peña, IRSNB); Miraflores, Pedag. [?], 35°55'S, 71°39'W (Toro, AMNH). *O'Higgins:* Chépica, 34°44'S, 71°17'W, 15.xii.1947 (L. E. Peña, IRSNB). *Región Metropolitana:* 34 km W Santiago, 33°30'S, 71°25'W, 19.xii.1950 (E. S. Ross & Michelbacher, CAS); Batuco, nr. Santiago, 33°13'S, 70°47'W (Guil. Mann, AMNH); Lampa, 33°17'S, 70°54'W, 1.v.1979 (L. E. Peña, AMNH). *Santiago:* El Golf [?], 33°30'S, 71°25'W, 9.iv.1961 (A. F. Archer & J. Aros, AMNH); Santiago, 33°30'S, 71°25'W (L. E. Peña, IRSNB), 1.ii.1973 (W. C. Sedgwick, MCZ). *Talca:* 22 mi N Talca, 35°7'S, 71°40'W, 22.xii.1950 (CAS). *Valparaíso:* Concón, in cow farm, 32°55'S, 71°31'W, 4.iii.1962 (H. Morales, AMNH); La Cruz, 32°53'S, 71°16'W, 18.i.1973 (W. C. Sedgwick, MCZ); Llay-Llay, 32°51'S, 70°58'W, 20.i.1973 (W. C. Sedgwick, MCZ); Los Maitenes [?], 32°59'S, 71°15'W, 14.x.1954 (L. E. Peña, IRSNB); Quintay, 33°11'S, 71°42'W, 19.ii.1967 (E. I. Schlinger, CAS); Valparaíso, 33°2'S, 71°38'W (Edwin Reed, AMNH).

15. *Metepeira karkii* (Tullgren) Figures 121–128, 303; Map 5

Araneus karkii Tullgren, 1901: 219, 259. Female holotype from Kark, Chile in the SMNH, examined.
Metepeira labyrinthea:—Roewer, 1942: 868. Bonnet, 1957: 2821. Erroneous synonymy.

Description. Female from Río Gallegos, Santa Cruz Province, Argentina. Carapace reddish brown with white setae, light around eyes with lateral posterior extensions (Fig. 127). Legs light yellow, articles annulated distally. Femur I with row of three to four macrosetae on anterior side; one to four on anteroventral side. Dorsum covered with denser, longer, black and white setae than in most species. Folium mostly white with brown speckles (Fig. 127). Venter brownish gray with wide white median line; pair of large white spots on either side of spiracle. A pair of thin white lines, parallel to and on either side of median line, sometimes connect to a pair of thinner transverse white lines: one just posterior to the epigynal groove, one just anterior to the spinnerets (Fig. 128). Sternum dark reddish brown (Fig. 128). Ratio of eye diameters: posterior medians and anterior medians 1.2, anterior laterals 1.4, posterior laterals 1.5. Anterior median eyes separated by 1.8 diameters, posterior median eyes by 1.0, anterior median eyes separated from anterior laterals by 4.2 diameters of anterior lateral eyes, lateral eyes separated by 0.3 their diameters. Total length 9.5 mm. Carapace 4 mm long, 3.4 wide. First femur 4 mm, patella and tibia 4.4, metatarsus 3.7, tarsus 1.2. Second patella and tibia 3.9 mm, third 2.5, fourth 3.8.

Male from Río Gallegos, Santa Cruz Province, Argentina. Carapace reddish brown with lighter eye region, lateral posterior extensions, and median arrowhead mark (Fig. 125). Legs light yellow, articles distally annulated reddish brown. Femur I with row of three to four macrosetae on anterior side; five to six on anteroventral side. Dorsal folium mostly white with brown speckles (Fig. 125). Venter and sternum as in female (Fig. 126). Ratio of eye diameters: posterior medians and anterior medians 1.0, anterior laterals 1.3, posterior laterals 1.2. Anterior median eyes separated by 1.7 diameters, posterior median eyes by 1.2, anterior median eyes separated from anterior laterals by 2.8 diameters of anterior lateral eyes, lateral eyes separated by 0.4 their diameters. Total length 5.7 mm. Carapace 2.8 mm long, 2 wide. First femur 4.3 mm, patella and tibia 4.3, metatarsus 4.1, tarsus 1.2. Second patella and tibia 3.5 mm, third 1.9, fourth 2.9.

Diagnosis. Females are easily separated from other species in the *M. nigriventris* group by the thick posterior epigynal lobes (compare Fig. 123 with Fig. 119). The distal embolic apophysis does not protrude out from under the terminal apophysis (Fig. 124) as it does in *M. galatheae, M. tarapaca,* and *M. nigriventris* (Figs. 87, 95, 119). The embolus of *M. karkii* differs from *M. calamuchita* by lacking the inwardly curved "dewlap" under the embolus (compare Fig. 121 with Fig. 103).

Variation. Average body length of 13 females examined 6.8 mm, range 5 to 8.2 mm. Average body length of five males examined 4.4 mm, range 2 to 5.3 mm. Dorsal folia vary from white with little contrast and indistinct fleur-de-lis to darker with more contrast and distinct fleur-de-lis.

Natural History. This species appears to be strongly seasonal: mature specimens have been collected between November and March (Fig. 303). Median elevation, 300 m. Spiders are found in pampas (treeless grassland).

Distribution. Lower altitudes in southern Argentina and Chile (Map 5).

Records Examined. ARGENTINA *Chubut:* Puerto Piramides, Peninsula Valdes, 42°34′S, 64°17′W, 12.xi.1988 (V. & B. Roth, CAS). *Neuquén:* Laguna Blanca, 39°3′S, 70°23′W, 15.iii.1959 (J. Nara, MACN); Zapala, 38°54′S, 70°4′W, 15.i.1958 (J. R. Navas, MACN); Zapala, Laguna Blanca, 38°54′S, 70°4′W, 15.i.1959 (J. R. Navas, MACN). *Río Negro:* Cerro Alto [?], 41°8′S, 70°40′W (MACN); Coronel Juan José Gomez, 39°2′S, 67°39′W, 15.xi.1945 (Ibarra Grasso, MLP); Ne-Luan, 41°25′S, 68°45′W (MACN). *Santa Cruz:* Laguna Calafate, Precordilfera [?], 50°55′S, 70°9′W, 22.i.1967 (P. San Martin, MCZ); Río Gallegos, 51°38′S, 69°13′W, 20.i.1967 (P. San Martin, MCZ). BOLIVIA *Santa Cruz:* Patagonia: Estancia Monte, cerca Río Coyby [?], 50°14′S, 68°55′W (B. Brown, AMNH). CHILE *Magallanes:* 4 km W Laguna Amarga, 50°59′S, 72°49′W, 8.xii.1966 (E. I. Schlinger & M. E. Irwin, CAS); Kark, 51°17′30″S, 72°32′30″W, 13.iii.1899 (E. Nordenskiöld, NRMS).

Metepeira compsa Group

The three species in the *M. compsa* group include *Metepeira compsa, Metepeira roraima,* and *Metepeira gressa.* Along with the *Metepeira nigriventris* group, this group has a median apophysis with teeth on the face of the keel. Unlike the *Mete-*

peira nigriventris group, this group has smaller, slimmer distal embolic apophyses that do not arch up over the embolus tip (compare Fig. 149 with Fig. 84). The openings to the epigynum have distinct, sclerotized edges and are clearly visible either as circles (Figs. 131, 134) or eye-shaped ovals (Figs. 143, 151).

16. *Metepeira compsa* (Chamberlin) Figures 129–140, 311; Map 8

Aranea compsa Chamberlin, 1916: 252, fig. 6, ♀. Female holotype from Ollantaitambo, Cusco, Peru, in the MCZ, examined. Bonnet, 1955: 462.

Araneus labyrintheus:—Petrunkevitch, 1926: 27. Erroneous synonymy.

Metepeira virginensis Chamberlin and Ivie, 1942: 70, figs. 188–190, ♀, ♂. Female holotype from St. Thomas, U.S. Virgin Islands, in AMNH, examined. NEW SYNONYMY.

Metepeira latigyna Chamberlin and Ivie, 1942: 70, figs. 191, 192, ♀. Female holotype from Porto Alegre [Bahia], Brazil, in AMNH, examined. NEW SYNONYMY.

Metepeira compsa:—Chamberlin and Ivie, 1942: 71, figs. 193–195, ♀, ♂.

Metepeira labyrinthea:—Bryant, 1942: 346.

Metepeira perezi Archer, 1965: 132, figs. 14, 16, ♂, ♀. Male holotype from subexperiment station, Isabela, Puerto Rico, in AMNH, examined. Brignoli, 1983: 276. NEW SYNONYMY.

Metepeira vaurieorum Archer, 1965: 133, figs. 15, 19, ♂, ♀. Male holotype from Usine de Robert, Martinique, in AMNH, lost. Brignoli, 1983: 276. Lopez, 1993: 10, 11, figs. 1–4, 11, ♂. NEW SYNONYMY.

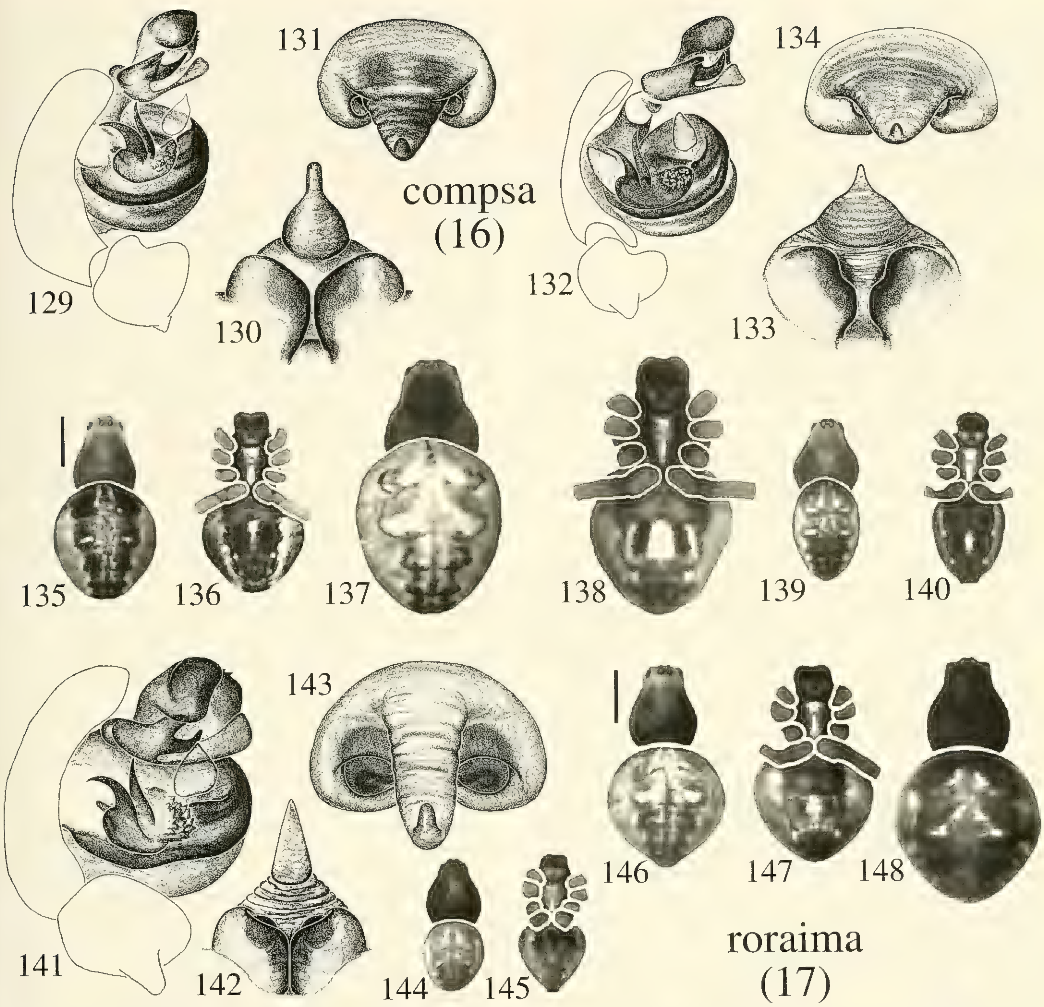
Note. Although the type for *M. vaurieorum* is lost, all examined records from Martinique (including ones from "Usine de Robert") belong to *M. compsa.*

Description. Female from Savonet, Curaçao, Netherlands Antilles. Carapace light around eyes with lateral posterior extensions (Figs. 135, 137). Only tibia IV ringed. Femur I with row of four macrosetae on anterior side; two or three fine setae on anteroventral side. Dorsum of abdomen with usual *Metepeira* folium, though whiter than usual in some specimens (Figs. 135, 137). Venter with wide white median line flanked by two thin (Fig. 136) or wide (Fig. 138) white lines; pair of white spots on either side of spiracle. Sternum has wide median white line widening anteriorly, sometimes broken (Figs. 136, 138). Ratio of eye diameters: posterior medians and anterior medians 1.0, anterior laterals 1.3, posterior laterals 1.2. Anterior median eyes separated by 1.3 diameters, posterior median eyes by 0.7, anterior median eyes separated from anterior laterals by 1.8 diameters of anterior lateral eyes, lateral eyes separated by 0.2 their diameters. Total length 3.9 mm. Carapace 1.8 mm long, 1.4 wide. First femur 1.9 mm, patella and tibia 1.9, metatarsus 1.5, tarsus 0.7. Second patella and tibia 1.7 mm, third 0.9, fourth 1.5.

Male from Savonet, Curaçao, Netherlands Antilles. Carapace light around eyes with lateral posterior extensions. Slightly lighter median triangular mark anterior to thoracic furrow (Fig. 139). Legs lightly ringed. Femur I with row of four macrosetae on anterior side, four on anteroventral side. Dorsum, venter, and sternum as in female (Figs. 139, 140). Ratio of eye diameters: posterior medians and anterior medians 1.0, anterior laterals 1.3, posterior laterals 1.2. Anterior median eyes separated by 1.3 diameters, posterior median eyes by 0.6, anterior median eyes separated from anterior laterals by 1.4 diameters of anterior lateral eyes, lateral eyes separated by 0.3 their diameters. Total length 3.6 mm. Carapace 1.8 mm long, 1.4 wide. First femur 2.7 mm, patella and tibia 2.8, metatarsus 2.4, tarsus 0.9. Second patella and tibia 2.3 mm, third 1.2, fourth 1.8.

Diagnosis. Unlike other species, the openings to the epigynum of *M. compsa* are small and almost perfectly round and sclerotized around the rim (Fig. 131). In Peruvian and Argentinean populations the scape can be extremely wide, often entirely covering a ventral view of the openings (Fig. 134). The distal embolic apophysis on the male palp extends straight from its base and parallel to the embolus tip (Figs. 129, 132), in contrast to those of other species in the *M. compsa* species group that lift away from the embolus tip (Figs. 141, 149).

Variation. Average body length of 22 fe-



Figures 129–140. *Metepeira compsa* (Chamberlin) (sp. 16 [129–131,135,136,139,140] 12°20′N, 69°7′W; [132] 4°30′S, 81°8′W; [133,134] 4°51′S, 80°46′W; [137,138] 17°5′N, 61°42′W). 129, male palpus, mesal. 130, epigynum, posterior. 131, epigynum, ventral. 132, male palpus, mesal. 133, epigynum, posterior. 134, epigynum, ventral. 135, female, dorsal. 136, female, ventral. 137, female, dorsal. 138, female, ventral. 139, male, dorsal. 140, male, ventral.
Figures 141–148. *Metepeira roraima* new species (sp. 17 [141–147] 3°22′N, 60°19′W; [148] 3°21′N, 76°33′W). 141, male palpus, mesal. 142, epigynum, posterior. 143, epigynum, ventral. 144, male, dorsal. 145, male, ventral. 146, female, dorsal. 147, female, ventral. 148, female, dorsal.
Scale bars: dorsum and venter figures 1.0 mm.

males examined 5 mm, range 3.5 to 7.3 mm. Average body length of 18 males examined 3.6 mm, range 2.4 to 4.7 mm. Enormous variation in the shape of the scape can be seen in this species: populations in the Caribbean and northeastern South America have a narrow scape (Fig. 131), whereas populations in Argentina and Peru have a thick scape (Fig. 134). Somewhat less consistently parallel differences can be seen in the shape of the median apophysis: flagella are centered in Caribbean and northeastern South America (Fig. 129) but shifted to the left in Argentina and Peru (Fig. 132). Further subtle differences appear in the shape of the embolus tip and embolus arm (compare Fig. 129 with Fig. 132). These male and female genital differences are not sufficiently consistent to provide solid evidence for speciation; thus, these populations will be treated as one species.

Natural History. Mature specimens have been collected throughout the year (Fig. 311). Altitudes range from just above sea level (for Caribbean and eastern South American localities) to 4,000 m (for Peruvian localities). Spiders have been found in everything from second growth mixed exotics (e.g., mango, citrus, banana) and mangroves to grasses and semidesert chaparral.

Distribution. Puerto Rico to northern Argentina, but absent from the Amazon (Map 8).

Records Examined. ARGENTINA *Buenos Aires:* Punta Lara, 34°49′S, 57°59′W, 15.ii.1941 (F. Moneos, MACN). *Chaco:* Basail, 27°52′S, 59°18′W, 18.iv.1942 (MACN). *Corrientes:* Paso de la Patria, 27°19′S, 58°35′W, 15.i.1966 (M. E. Galiano, MEG). *Entre Ríos:* Paraná, 31°44′S, 60°32′W (Rosenzwaig, MLP); Salto Grande, 31°13′S, 57°56′W, 15.iii.1964 (M. E. Galiano, MEG). *Misiones:* Posadas, 27°23′S, 55°53′W, 15.ix.1963 (M. E. Galiano, MEG). *Neuquén:* Piedra del Aguila, 40°3′S, 70°5′W, 18.vii.1978 (Mision Cientifica Danesa, ZMUC). *Santa Fé:* Tostado, 29°14′S, 61°46′W (A. Giai, MACN). BOLIVIA *La Paz:* Apolo, 14°43′S, 68°31′W, 10.viii.1989 (L. E. Peña, AMNH). BRAZIL *Bahia:* Arquipélago dos Abrolhos, 17°40′S, 38°50′W, 28.xii.1887 (U.S.F.C., Voy. of Albatross, USNM); Parque Ondina, Salvador, 12°59′S, 38°31′W, 25.vii.1962 (A. F. Archer, AMNH); Porto Alegre, 18°5′S, 39°34′W (AMNH). *Minas Gerais:* Pedra Azul, 16°1′S, 41°16′W, 15.xii.1970 (F. M. Oliveira, AMNH). *Pernambuco:* Pernambuco [?], 8°3′S, 34°54′W, 12.iii.1927 (SMF), 8.iii.1955 (SMF). *Rio de Janeiro:* Lagomar [?], Macae, near sea, 22°23′S, 41°47′W, 17.vii.1986 (R. L. C. Baptista, MZSP). *Rio Grande do Sul:* Montenegro, 29°42′S, 51°28′W, 3.xi.1977 (E. H. Buckup, MCN); Rambo [?], 30°4′0″S, 51°11′W (MNRJ); Sao Leopoldo, 29°46′S, 51°9′W, 14.x.1965 (Celia Valle, MZSP). *São Paulo:* Rubião, Jr. [?], Botucatu, 22°52′S, 48°26′W, 25.iv.1988 (R. L. C. Baptista, MZSP); Sao Paulo, Guaruja, 24°0′S, 46°16′W, 24.vii.1983 (R. Sievers, AMNH). BRITISH WEST INDIES *Anegada:* 18°45′N, 64°20′W, 12.xi.1966 (Harry Beatty, AMNH); center, nr. salt pond, 18°45′N, 64°20′W, 4.vi.1966 (Island Project Staff, Univ. of Puerto Rico, AMNH); West end, 18°45′N, 64°22′W, 4.vi.1966 (Island Project Staff, Univ. of Puerto Rico, AMNH); Anegada Settlement: 18°45′N, 64°20′W, 5.vi.1966 (Island Project Staff, Univ. of Puerto Rico, AMNH). *Antigua:* Coolidge Airport, 17°6′N, 61°51′W, 15.xi.1967 (N. L. H. Krauss, AMNH); Devil's Bridge, 17°5′N, 61°42′W, 30.vi.1963 (Rick & E. N. Kjellesvig-Waering, AMNH); Jolly Beach, 17°4′N, 61°53′W, 20.ix.1963 (E. N. Kjellesvig-Waering, AMNH); Lignum Vitae Bay: Jolly Beach [?], 17°4′N, 61°53′W, 19.vi.1968 (E. N. Kjellesvig-Waering, AMNH); Redonda Island, from webs spun between boulders on beach, 16°55′N, 62°19′W, 10.iv.1956 (J. F. G. Clarke, USNM); Reeds Point, nr. Jolly Beach, 17°4′N, 61°53′W, 2.vii.1963 (E. N. Kjellesvig-Waering, AMNH); Saint John's, 17°6′N, 61°51′W, 15.viii.1967 (N. L. H. Krauss, AMNH), 15.xii.1967 (N. L. H. Krauss, AMNH). Dead Man's Chest [?]: 18°22′N, 64°34′W, 26.v.1966 (Island Project Staff, Univ. of Puerto Rico, AMNH). *East Seal Dog:* 18°30′N, 64°25′W, 7.vi.1966 (Island Project Staff, Univ. of Puerto Rico, AMNH). *George Dog Island:* 18°30′N, 64°27′W, 7.vi.1966 (Island Project Staff, Univ. of Puerto Rico, AMNH); 4 mi W Virgin Gorda Isl, high on dry cliffs, 18°30′N, 64°27′W, 25.iii.1979 (K. Johnson, AMNH). *Ginger Island:* 18°24′N, 64°28′W, 25.v.1966 (Island Project Staff, Univ. of Puerto Rico, AMNH). *Great Dog:* 18°29′N, 64°27′W, 7.vi.1966 (Island Project Staff, Univ. of Puerto Rico, AMNH). Green Cay, near Tortola: 18°27′N, 64°42′30″W, 14.viii.1965 (Island Project Staff, Univ. of Puerto Rico, AMNH). Island O. near Anegada Settlement: 18°45′N, 64°20′W, 5.vi.1966 (Island Project Staff, Univ. of Puerto Rico, AMNH). Island R. near Anegada Settlement: 18°45′N, 64°20′W, 4.vi.1966 (Island Project Staff, Univ. of Puerto Rico, AMNH). *Jost Van Dyke:* 18°28′N, 64°45′W, 30.viii.1965 (H. Heatwole, R. Levins & F. MacKenzie, AMNH). Large mangrove patch nr. Settlement Anegado: 18°45′N, 64°20′W [?], 5.vi.1966 (Island Project Staff, Univ. of Puerto Rico, AMNH). *Little Camanoe:* 18°28′N, 64°33′W, 25.v.1966 (Island Project Staff, Univ. of Puerto Rico, AMNH). Little *Jost Van Dyke:* 18°27′N, 64°43′W, 27.vii.1965 (Island Project Staff, Univ. of Puerto Rico, AMNH). *Little Tobago:* 18°26′N, 64°51′W, 4.iv.1966 (Island Project Staff, Univ. of Puerto Rico, AMNH). *Montserrat:* Gage's Soufrière [?], 16°43′N, 62°10′W, 28.vii.1972 (N. L. H. Krauss, AMNH); Plymouth, 16°42′N, 62°13′W, 15.xi.1967 (N. L. H. Krauss, AMNH). *Necker Island:* 18°33′N, 64°21′W, 6.vi.1966 (Island Project Staff, Univ. of Puerto Rico, AMNH). nr. Anegada Settlement: Byer's Bache [?], 18°45′N, 64°20′W, 5.vi.1966 (Island Project Staff, Univ. of Puerto Rico, AMNH). *Peter Island:* 18°22′N, 64°35′W, 6.vii.1965 (Island Project Staff, Univ. of Puerto Rico, AMNH), 12.v.1966 (Percy Chubb, AMNH). *Prickly Pear Island:* 17°10′N, 61°48′W, 6.vi.1966 (Island Project Staff, Univ. of Puerto Rico, AMNH). *Saint Christopher Island:* Basseterre, 17°18′N, 62°43′W, 6.ii.1968 (B. Malkin, AMNH). *Salt Island:* 18°23′N, 64°31′W, 24.v.1966 (Island Project Staff, Univ. of Puerto Rico, AMNH). *Sandy Key:* near Tortola, 18°13′N, 63°7′W, 31.viii.1965 (H. & A. Heatwole, AMNH). *Tobago Island:* 18°27′N, 64°48′W, 2.iv.1966 (Island Project

Staff, Univ. of Puerto Rico, AMNH). *Tortola:* 18°27′N, 64°36′W, 8.vii.1958 (A. F. Archer, C. Helsley, & M. Sanderson, AMNH); Beef Island, 18°27′N, 64°31′W, 21.vii.1965 (H. Heatwole, R. Levins & F. MacKenzie, AMNH); Greater Camanoe Isl, 18°29′N, 64°32′W, 1.vii.1965 (Island Project Staff, Univ. of Puerto Rico, AMNH); Little Thatch Island, 18°23′N, 64°42′W, 16.viii.1965 (Island Project Staff, Univ. of Puerto Rico, AMNH); Long Bay Estate, 18°24′N, 64°41′W, 24.vii.1965 (Island Project Staff, Univ. of Puerto Rico, AMNH); Marina Key [?], 18°27′N, 64°36′W, 4.vii.1965 (H. Heatwole & R. Levins, AMNH); Prospect Reef, S Roadtown, 18°25′N, 64°36′W, 23.iii.1979 (K. Johnson, AMNH), 31.iii.1979 (K. Johnson, AMNH); Road to town, 18°27′N, 64°36′W, 15.vii.1972 (N. L. H. Krauss, AMNH); Sandy Spit [?], 18°27′N, 64°36′W, 14.viii.1965 (Island Project Staff, Univ. of Puerto Rico, AMNH). *Tortola Island:* 18°27′N, 64°36′W, 15.vii.1965 (Island Project Staff, Univ. of Puerto Rico, AMNH). *Virgin Gorda:* 18°30′N, 64°24′W, 15.xi.1966 (Harry Beatty, AMNH); Baths & Devil's Bay, 18°26′N, 64°27′W, 25.vi.1966 (Island Project Staff, Univ. of Puerto Rico, AMNH); Cooper Mine Trail, 18°26′N, 64°26′W, 25.vi.1966 (Island Project Staff, Univ. of Puerto Rico, AMNH); Savana Bay & Pond Bay, 18°28′N, 64°25′W, 27.vi.1966 (Island Project Staff, Univ. of Puerto Rico, AMNH); Trellis Bay (W end of island), nr. harbor, 18°27′N, 64°26′W, 27.iii.1979 (K. Johnson, AMNH); Virgin Gorda Mountain, 18°30′N, 64°24′W, 26.vi.1966 (Island Project Staff, Univ. of Puerto Rico, AMNH). *Virgin Islands Area:* Island Q [?], 18°45′N, 64°20′W, 5.vi.1966 (Island Project Staff, Univ. of Puerto Rico, AMNH). *West Seal Dog Island:* 18°29′N, 64°28′W, 7.vi.1966 (Island Project Staff, Univ. of Puerto Rico, AMNH). CHILE *Tarapaca:* Arica, 18°29′S, 70°20′W, 28.i.1973 (W. C. Sedgwick, MCZ); Azapa Arica, 18°31′S, 70°11′W, 9.xi.1955 (L. E. Peña, IRSNB); Lluta, 18°24′S, 70°19′W, 12.xi.1955 (L. E. Peña, IRSNB); Río Lluta, 18°24′S, 70°19′W, 12.xi.1955 (L. E. Peña, IRSNB); Sobraya, 18°32′S, 70°9′W, 10.xi.1955 (L. E. Peña, IRSNB); Taltape, Camarones Valley, 18°59′S, 69°47′W, 29.i.1973 (MCZ). COLOMBIA *Magdalena:* Cabaña "Villa Culebra," 10 km E Station Marta, 11°12′N, 74°7′W, 15.x.1985 (H.-G. Müller, SMF); Casajera [?], 11°0′N, 74°15′W, 1.ii.1974 (J. A. Kochalka, JAK); Cienaga, 11°1′N, 74°15′W, 30.i.1974 (J. A. Kochalka, JAK); Gaira, 11°11′N, 74°13′W, 15.xii.1975 (W. Eberhard, MCZ). DOMINICAN REPUBLIC *Barahona:* Patos, 10°38′N, 61°52′W, 24.ix.1944 (R. H. Montgomery, AMNH). FRENCH WEST INDIES *Guadeloupe:* Deshaies, 16°18′N, 61°48′W, 28.vi.1960 (C. & P. Vaurie, AMNH); Domaine Duclos [?], 16°16′N, 61°31′W, 25.vi.1960 (C. & P. Vaurie, AMNH), 15.vii.1960 (C. & P. Vaurie, AMNH); Marie-Galante, in citrus, 15°56′N, 61°16′W, 15.iii.1977 (W. H. Whitcomb, FSCA); Pointe-à-Pitre, Îlet à Boissard, 16°14′N, 61°34′W, 26.vi.1960 (C. & P. Vaurie, AMNH); Terre-de-Haut, Les Saintes, 15°58′N, 61°35′W, 2.vii.1960 (C. & P. Vaurie, AMNH). *Martinique:* Ansemitian [?], Trois-Îlets, 14°33′N, 61°2′W, 10.vi.1960 (C. & P. Vaurie, AMNH); Diamant, 14°29′N, 61°2′W, 17.vi.1960 (C. & P. Vaurie, AMNH), 18.vi.1966 (C. & P. Vaurie, AMNH); Fort de France, 14°36′N, 61°5′W, 15.xii.1950 (N. L. H. Krauss, MCZ); Pointe Ferret, La Caravelle, 14°45′N, 60°54′W, 19.vi.1960 (C. & P. Vaurie, AMNH); Sainte-Anne, 14°26′N, 60°53′W, 20.vi.1966 (C. & P. Vaurie, AMNH); Usine de Robert [?], 14°41′N, 60°57′W, 16.vi.1960 (C. & P. Vaurie, AMNH). GRENADA *nr. Saint Georges:* 12°3′N, 61°45′W, 3.vi.1950 (Leo Isaacs, AMNH). NETHERLAND ANTILLES *Bonaire:* Red Pond [?], 12°12′N, 68°15′W, 3.i.1968 (B. Malkin, AMNH). *Curaçao:* 12°11′N, 68°58′W, 13.i.1968 (B. Malkin, AMNH); Fuik (Oostpunt), muddauber nests, 12°4′N, 68°49′W, 20.xii.1962 (H. W. Levi & B. de Jong, MCZ); Groot Sint Joris, plantation, 12°14′N, 69°3′W, 22.xii.1962 (H. W. Levi & B. de Jong, MCZ); Groote Berg, 12°11′N, 69°0′W, 19.xii.1962 (H. W. & L. Levi, MCZ); Hato, 12°11′N, 68°58′W, 28.xii.1967 (B. Malkin, AMNH), 7.i.1968 (B. Malkin, AMNH); Piscadera Baai, 12°8′N, 68°59′W, 18.xii.1962 (H. W. Levi, MCZ), 20.xii.1962 (H. W. Levi, MCZ); Savonet; shady ravine, 12°20′N, 69°7′W, 28.xii.1962 (H. W. Levi, MCZ); SE of airport, 12°10′N, 68°54′W, 20.xii.1962 (H. W. Levi & B. de Jong, MCZ); Siberië, 12°14′N, 69°3′W, 25.xii.1962 (H. W. Levi, MCZ); Sint Jan, 12°15′N, 69°6′W, 25.xii.1962 (H. W. Levi & B. de Jong, MCZ); Willemstad, Jewish Cemetary, 12°7′N, 68°57′W, 24.xii.1962 (H. W. Levi, MCZ). *Sint Eustatius:* Oranjestad, 17°29′N, 62°59′W, 18.i.1968 (B. Malkin, AMNH). *Sint Maarten:* nr. Juliana Airport [?], 18°4′N, 63°4′W, 24.ii.1965 (H. Heatwole & F. MacKenzie, AMNH). PARAGUAY *Alto Paraná:* Taguarazaya [?], 25°30′S, 54°50′W (AMNH). PERU *Ancash:* Huaraz, 9°32′S, 77°32′W, 6.xii.1980 (C. Gold, CAS). *Apurimac:* 35 mi E Abancay, 13°38′S, 72°22′W, 5.iii.1951 (E. S. Ross & Michelbacher, CAS); 40 mi E Abancay, 13°38′S, 72°20′W, 4.iii.1951 (E. S. Ross & Michelbacher, CAS); Abancay, 13°38′2″S, 72°52′53″W, 6.iii.1951 (E. S. Ross & Michelbacher, CAS). *Cajamarca:* Jaen, 5°42′34″S, 78°48′32″W, 17.v.1967 (A. F. Archer, AMNH). *Cusco:* 40 mi W Cusco, 13°32′S, 72°33′W, 5.iii.1951 (E. S. Ross & Michelbacher, CAS); Hacienda Urco, near Calea, 13°22′S, 71°54′W, 19.ix.1939 (Karl P. Schmidt, AMNH); Huacerpay [?], 13°37′S, 72°13′W, 10.ix.1993 (J. Ochoa Camara, MCZ); Ollantaitambo, 13°15′17″S, 72°15′48″W, 15.vii.1911 (Yale Peruvian Expedition, AMNH), 15.xii.1980 (C. Gold, CAS); Pisac, 13°25′21″S, 71°50′48″W, 13.xii.1980 (C. Gold, CAS); Urubamba, 13°18′28″S, 72°6′55″W, 15.i.1965 (Carrasco, MCZ), 18.ii.1965 (H. W. Levi, MCZ), 6.viii.1987 (D. Silva, MUSM). *Huanuco:* Huanuco, 9°55′S, 76°14′W, 6.x.1946 (J. C. Pallister, AMNH). *Ica:* km 367 between Ica and Nazca, sandy semidesert, 14°24′S, 75°23′W, 22.i.1952 (W. Weyrauch, CAS); Nazca, 14°50′S, 74°57′W, 15.iv.1951 (P. Aguilar, CAS). *Piura:* Cerro Prieto, La Brea, 4°41′S, 81°6′W (CAS); Mallares, 4°51′S, 80°46′W, 8.vi.1941 (H. E. F. & D. E. F, CAS), 13.vii.1941 (H. E. F. & D. E. F, CAS); N of Negritos, Pariñas Valley, 4°41′S, 81°18′W, 9.x.1938 (D. L. & H. E. Frizzell, CAS); nr. Negritos, 4°42′S, 81°18′W, 5.iii.1939 (H. E. F, CAS); nr. Sechura, 5°33′S, 80°51′W, 4.xi.1941 (D. L. F, CAS); Negritos, 4°42′S, 81°18′W, 15.xi.1934 (H. E. F, CAS), 15.iii.1941 (H. E. F, CAS); Pariñas, 4°30′S, 81°8′W, 7.v.1939 (D. L. & H. E. Frizzell, CAS), 31.v.1939 (D. L. & H. E. Frizzell, CAS), 15.x.1939 (D. L. & H. E. Frizzell, CAS); Pariñas Valley, 4°30′S, 81°8′W, 6.iii.1939 (D. L. & H. E. Frizzell, CAS), 8.iv.1939 (D. L. & H. E. Frizzell, CAS); Portachuelo, 4°59′S, 79°54′W, 29.iv.1939 (M. H. & H. E. Frizzell, CAS); Quebrada Mogollon, 4°32′S, 81°4′W, 30.iv.1939 (D. L. & H. E. Frizzell, CAS), 11.vi.1939 (D. L. & H. E. Frizzell, CAS); Río Chira Valley, N of Amotape, 4°53′S, 81°1′W, 13.xi.1938 (D. L. & H. E. Frizzell, CAS); S of Sechura, 5°33′S, 80°51′W, 25.x.1941 (D. L. F, CAS); San Lorenzo [?], Zona Alta Este Herrera, 5°4′S, 79°47′W, 12.iv.1969 (P. Aguilar, MCZ); Sullaña, 4°53′S, 80°41′W, 8.x.1939 (D. L. & H. E. Frizzell, CAS), 5.x.1941 (D. L. & H. E. Frizzell, CAS). *Tumbes:* 34 km E, 25 km N Punta Pariñas, 4°18′S, 80°51′W, 1.i.1939 (D. L. & H. E. Frizzell, CAS). SAINT LUCIA *Castries:* 14°1′N, 61°0′W, 28.vii.1963 (E. N. Kjellesvig-Waering, AMNH). TRINIDAD & TOBAGO *Tobago Island:* Buccoo Bay, 11°10′N, 60°48′W, 15.viii.1965 (E. N. Kjellesvig-Waering, AMNH); Guayaguayare Point, 10°8′N, 61°2′W, 14.ix.1963 (E. N. Kjellesvig-Waering, AMNH); Pigeon Point, 11°10′N, 60°50′W, 18.viii.1937 (E. D., MCZ); Salybia Bay, by shore, 10°42′N, 61°2′W, 15.ii.1972 (J. A. L. Cooke, MCZ); Toco, 10°50′N, 60°57′W, 19.iv.1964 (Erik N. Kjellesvig-Waering, AMNH). *Trinidad:* Gasparee, 10°46′N, 61°19′W, 3.xi.1944 (R. Montgomery, AMNH). URUGUAY *Colonia:* Punta Gorda [?], 34°28′S, 57°51′W, 25.ii.1968 (R. Capocasale & L. Bruno, CAS). USA *Puerto Rico:* Algodones Key, 18°12′N, 65°41′W, 15.x.1964 (H. Heatwole, R. Levins & F. MacKenzie, AMNH); Balneario [?] Guajataca, 18°21′N, 66°55′W, 4.vii.1958 (A. F. Archer, AMNH); Baños de Coamo, 17°59′N, 67°3′W, 2.iv.1990 (H. W. & L. Levi, MCZ), 3.iv.1990 (H. W. & L. Levi, MCZ); Barranquitas, 18°11′N, 66°18′W, 28.xii.1977 (J. Coddington, USNM); below Quebradillas along old RR track, 18°28′N, 66°56′W, 30.iii.1989 (H. W. & L. Levi, MCZ); Cabeza de Perro Island, 18°15′N, 65°35′W, 16.i.1965 (H. Heatwole & F. MacKenzie, AMNH); Cayo Don Luis, 17°57′N, 66°58′W, 12.i.1966 (Island Project Staff, Univ. of Puerto Rico, AMNH); Cayo Norte, off Culebra, 18°20′N, 65°15′W, 14.iv.1965 (H. Heatwole & F. MacKenzie, AMNH); Cayo Piñerito, 18°15′N, 65°36′W, 24.ix.1964 (H. Heatwole & F. MacKenzie, AMNH); Channel at Culebra, Isla del Diablo, 18°23′N, 65°40′W, 12.viii.1965 (Island Project Staff, Univ. of Puerto Rico, AMNH); Cuevas de los Alfaros, Barrio Mora, 18°29′N, 67°1′W, 20.vii.1958 (A. F. Archer & Rolle, AMNH); Culebra Island, 18°19′N, 65°17′W, 19.vii.1965 (F. MacKenzie, AMNH); Culebra, near Dewey, 18°18′N, 65°18′W, 10.viii.1965 (Island Project Staff, Univ. of Puerto Rico, AMNH); Culebrita Island, 18°19′N, 65°14′W, 15.iv.1965 (H. Heatwole & F. MacKenzie, AMNH), 11.viii.1965 (Island Project Staff, Univ. of Puerto Rico, AMNH); Desecheo Is, 18°23′N, 67°29′W, 19.ii.1914 (AMNH); Desecheo Island, 18°23′N, 67°29′W, 28.v.1965 (H. Heatwole, R. Levins & F. MacKenzie, AMNH); Faro de Cabo Rojo, 18°5′N, 67°9′W, 13.iii.1961 (F. Rolle, AMNH); Frank Key, Isl. #13 nr. La Parguera area, 17°58′N, 67°3′W, 14.i.1966 (Island Project Staff, Univ. of Puerto Rico, MCZ); Heatwole Island, off Culebrita, 18°19′N, 65°13′W, 14.iv.1965 (H. Heatwole & F. MacKenzie, AMNH); Hormiqueros, 18°9′N, 67°8′W, 16.ii.1962 (Aida Velez, AMNH), 11.iii.1962 (Aida Velez, AMNH), 19.iii.1962 (Aida Velez, AMNH); Isabela, subexperiment station, 18°30′N, 67°1′W, 17.viii.1957 (A. F. Archer, AMNH); Jayuya, coffee plantation, 18°13′N, 66°37′W, 23.iii.1986 (H. W. & L. Levi, MCZ); Juana Díaz, 18°3′N, 66°31′W, 7.xi.1971 (J. E. Carico, JEC); Levin's Rock [?], 18°12′N, 65°41′W, 15.x.1964 (H. Heatwole, R. Levins & F. MacKenzie, AMNH); Loma Tinaja [?], S of Laguna Cartagena, 17°59′N, 67°6′W, 5.vii.1958 (A. F. Archer & M. Sanderson, AMNH); Luquillo, near beach, 18°23′N, 65°44′W, 24.i.1932 (A. S. Mills, AMNH), 24.xii.1985 (V. & B. Roth, CAS), 27.iii.1988 (H. W. & L. Levi, MCZ); Mayagüez, 18°12′N, 67°9′W, 15.vii.1958 (A. F. Archer, MCZ); Mayagüez, 5 km N university campus, 18°12′N, 67°9′W, 5.i.1964 (MCZ); Mayagüez: Las Mesas, 18°11′N, 67°6′W, 20.xi.1960 (F. Rolle, AMNH); Mayagüez, university farm N university campus, 18°12′N, 67°9′W, 7.ii.1964 (MCZ); McKenzie Key, Key #3 [?], 18°12′N, 65°41′W, 29.x.1964 (H. Heatwole, R. Levins & F. MacKenzie, AMNH); Mona Island, Serrallés, 18°5′N, 67°54′W [?], 7.iv.1944 (Beatty, MCZ); Muertos Island, beating bushes, 17°54′N, 66°32′W, 28.v.1959 (Jordan & Martorell, AMNH); Muertos Island, mud nests of Sceliphron caementarium, 17°54′N, 66°32′W, 27.v.1959 (Medina & Martorell, AMNH); N slope Tinaja, nr. Cartagena Lagoon, beating and sweeping, 18°23′N, 67°10′W, 5.vii.1958 (M. W. Sanderson, AMNH); Palominitos, 18°20′N, 65°34′W, 16.vi.1965 (Island Project Staff, Univ. of Puerto Rico, AMNH); Palomino Island, 18°21′N, 65°34′W, 7.xi.1964 (H. Heatwole & F. MacKenzie, AMNH); Parguera, 17°59′N, 67°3′W, 25.iii.1990 (H. W. & L. Levi, MCZ); Patillas, 18°0′N, 66°1′W, 3.iv.1931 (Mills & Leonard, AMNH); Pico Atalaya, Rte. 2, nr. Añasco, 18°18′N, 67°11′W, 3.vii.1958 (M. W. Sanderson, AMNH); Piñeros Island, 18°15′N, 65°35′W, 24.ix.1964 (H. Heatwole & F. MacKenzie, AMNH); Playa de Humacao, 18°10′N, 65°45′W, 23.v.1964 (MCZ); Quebradillas, around hotel, 18°29′N, 66°56′W, 30.iii.1989 (H. W. & L. Levi, MCZ); Ratones Island, 17°56′N, 66°17′W, 19.xi.1964 (H. Heatwole & R. Levins, AMNH); Romero III [?], 17°57′N, 67°0′W, 13.i.1966 (Island Project Staff, Univ. of Puerto Rico, AMNH); Rubianes, Caimito Bajo [?], Cord. Jaicoa, 18°26′N, 67°8′W, 19.vii.1958 (A. F. Archer & Rolle, AMNH); Santurce, 18°27′N, 66°4′W, 28.iii.1931 (A. S. Mills, AMNH); South of Corozo, Cabo Rojo salt flats, edge of salt ponds, 17°56′N, 67°11′W, 23.iii.1990 (H. W. & L. Levi, MCZ); Valle de Lajas, 18°1′N, 67°8′W, 3.vi.1958 (A. F. Archer, AMNH); xeric hills N of Guánica, 18°0′N, 66°55′W, 28.viii.1957 (A. F. Archer, AMNH); Zancudo Island (Isleta Marina), 18°20′N, 65°37′W, 2.xi.1964 (H. Heatwole & F. MacKenzie, AMNH). U.S. VIRGIN ISLANDS *Big Cockroach:* 18°24′N, 65°4′W, 7.vi.1966 (Island Project Staff, Univ. of Puerto Rico, AMNH). *Congo Cay:* 18°22′N, 64°48′W, 12.xi.1966 (Island Project Staff, Univ. of Puerto Rico, AMNH). *Grass Cay:* 18°22′N, 64°50′W, 12.xi.1966 (Univ. of Puerto Rico, AMNH). *Great Saint James Island:* 18°19′N, 64°50′W, 13.xi.1966 (Island Project Staff, Univ. of Puerto Rico, AMNH). *Hans Lollik Island:* 18°24′N, 64°55′W, 6.iv.1966 (Island Project Staff, Univ. of Puerto Rico, AMNH). *Little Cockroaches:* 18°25′N, 65°3′W, 7.vi.1966 (Island Project Staff, Univ. of Puerto Rico, AMNH). *Little Hans Lollick:* 18°25′N, 64°54′W, 5.iv.1966 (Island Project Staff, Univ. of Puerto Rico, AMNH). *Little Saint James Island:* 18°18′N, 64°50′W, 13.xi.1966 (Island Project Staff, Univ. of Puerto Rico, AMNH). *Mingo Cay:* 18°22′N, 64°49′W, 12.xi.1966 (Island Project Staff, Univ. of Puerto Rico, AMNH). *Saint John:* 18°20′N, 64°45′W, 9.iii.1925 (F. E. Lutz, AMNH), 11.vii.1958 (A. F. Archer & M. Sanderson, AMNH), 15.xii.1967 (N. L. H. Krauss, AMNH); Cruz Bay, 18°20′N, 64°48′W, 27.ii.1964 (A. M. Chickering, MCZ); nr. Cinnamon & Hart Bays on W half of island, 18°20′N, 64°46′W, 2.viii.1976 (D. E. & D. N. Rosen, AMNH). *Saint Thomas:* 18°24′N, 64°55′W, 24.ii.1925 (AMNH), 24.vii.1925 (A. Petrunkevitch, CAS), 24.xi.1925 (AMNH); Crown Mountain, 18°21′N, 64°58′W, 30.viii.1957 (A. F. Archer, AMNH), 7.vii.1958 (A. F. Archer, AMNH); Denmark Hill [?], 18°24′N, 66°55′W, 1.ix.1957 (A. F. Archer, AMNH); Flagstok Hill, Stumpy Bay, 18°22′N, 65°0′W, 9.vii.1958 (A. F. Archer, AMNH); Harman's, Charlotte Amalia, 18°21′N, 64°56′W, 2.ix.1957 (A. F. Archer & family, AMNH); Hassell Island, 18°20′N, 64°56′W, 1.ix.1957 (A. F. Archer, AMNH), 15.ii.1964 (A. M. Chickering, MCZ), 10.viii.1966 (M. L. Pressick, AMNH). *St. Croix:* Christiansted, 17°45′N, 64°42′W, 3.vi.1911 (AMNH), 15.i.1955 (A. M. Nadler, AMNH); East End, 17°45′N, 64°40′W, 15.xii.1965 (Island Project Staff, Univ. of Puerto Rico, AMNH); Green Key, 17°46′N, 64°40′W, 17.iv.1964 (H. Heatwole, MCZ); Mount Eagle, dryish forest, 17°46′N, 64°49′W, 15.xii.1965 (Island Project Staff, Univ. of Puerto Rico, AMNH); Protestant Cay, 17°45′N, 64°42′W, 18.iv.1964 (H. Heatwole, MCZ); St. Croix, 17°45′N, 64°54′W, 1.ix.1966 (Chickering, MCZ), 6.ix.1966 (Chickering, MCZ). VENEZUELA *Dependencias Federales:* Patos, 10°38′N, 61°52′W, 23.ix.1944 (R. H. Montgomery, AMNH). *Districto Federal:* Punta Tanaguarena, in coastal bldg. & garden, 10°37′N, 66°48′W, 26.xii.1970 (W. B. Peck, CAS).

17. *Metepeira roraima* new species
Figures 141–148, 316; Map 8

Holotype. Female from Rio Surumu, Roraima, Brazil, x.1966, M. Abrorenga, in MZSP. The specific name is a noun in apposition after the locality.

Description. Female holotype. Brown carapace; lighter around eyes (Fig. 146). Coxae, femora, tibiae, and patellae tan, lighter ventrally. Metatarsi, tarsi white. Femur I with row of three or four macrosetae on anterior side; none on anteroventral side. Dorsal folium with typical *Metepeira* fleur-de-lis pattern (Fig. 146). Venter of abdomen brown with wide white median line, flanked by thinner white lines that together form a T-shape posteriorly (Fig. 147). Pair of small white spots on either side of T-shape mark. Sternum brown with median white line (Fig. 147). Ratio of eye diameters: posterior medians and anterior medians 1.1, anterior laterals 1.5, posterior laterals 1.3. Anterior median eyes separated by 1.2 diameters, posterior median eyes by 0.6, anterior median eyes separated from anterior laterals by 1.9 diameters of anterior lateral eyes, lateral eyes separated by 0.1 their diameters. Total length 4 mm. Carapace 1.8 mm long, 1.4 wide. First femur 1.9 mm, patella and tibia 2.1, metatarsus 1.8, tarsus 0.7. Second patella and tibia 1.7 mm, third 1.0, fourth 1.6.

Male paratype from Rio Surumu, Roraima, Brazil. Carapace brown; lighter around eyes with median white mark (Fig. 144). Legs brown, white at base of femora. Femur I with row of four to five macrosetae on anterior side; four to five on anteroventral side. Dorsal folium, venter, and sternum as in female (Figs. 144, 145). Ratio of eye diameters: posterior medians and anterior medians 1.1, anterior laterals 1.6, posterior laterals 1.4. Anterior median eyes separated by 1.4 diameters, posterior median eyes by 0.6, anterior median eyes separated from anterior laterals by 1.6 diameters of anterior lateral eyes, lateral eyes separated by 0.2 their diameters. Total length 2.9 mm. Carapace 1.3 mm long, 1.1 wide. First femur 1.9 mm, patella and tibia 2, metatarsus 1.6, tarsus 0.6. Second patella and tibia 1.5 mm, third 0.8, fourth 1.3.

Diagnosis. The epigynum of *M. roraima* differs from that of *M. compsa* by having oval openings (Fig. 143) instead of round openings (Figs. 131, 134); it differs from *M. gressa* by being more translucent and by having a narrower scape (compare Fig. 143 with Fig. 151). Unlike *M. gressa*, the embolus tip of *M. roraima* is more bent and the distal apophysis is as wide as the embolus tip (compare Fig. 141 with Fig. 149). Unlike *M. compsa*, the distal embolic apophysis projects away from the embolus tip (Fig. 141) instead of extending straight from the base and parallel to the embolus tip (Figs. 129, 132).

Variation. Average body length of eight females examined 5 mm, range 4 to 7 mm. Average body length of five males examined 3.1 mm, range 2.8 to 4 mm. Colombian specimens are much darker than those from northern Brazil and southern Guyana, suggesting the possibility that these populations represent separate cryptic species. In fact, the carapace on Colombian specimens is often jet black with the white marks on the dorsal folium much reduced (Fig. 148). However, there is little corresponding genitalic difference, especially among males; consequently, these populations are deemed to be conspecific.

Natural History. Mature *M. roraima* specimens from eastern South America have been collected in November and December; specimens from western South America have been collected between March and July (Fig. 316). Median elevation, 1,000 m.

Distribution. Western Colombia, northern Brazil, and southern Guyana (Map 8).

Records Examined. BRAZIL *Roraima:* Rio Surumu, Jerrit Rio Branco [?], 3°22′N, 60°19′W, x.1966 (M. Abrorenga, MZSP). COLOMBIA. Valle del *Cauca:* Atuncela, 3°46′N, 76°42′W, 19.vii.1970 (W. Eberhard, MCZ); Cali, around house, 3°27′N, 76°31′W (W. Eberhard, MCZ); Palmira, 3°32′N, 76°17′W, 1.iii.1964 (Ballo, CAS); Rio Pance, below Buenos Aires, 3°55′N, 76°8′W, 5.iv.1970 (W. Eberhard, MCZ); Rio Pance, near Cali., 3°21′N, 76°33′W, 8.v.1970 (W. Eberhard, MCZ), 8.vi.1970 (W. Eberhard, MCZ), 15.vi.1970 (W. Eberhard, MCZ), 23.vi.1970 (W. Eberhard, MCZ), 25.vi.1973 (W. Eberhard, MCZ). GUYANA *Upper Takutu:* Isherton, on lat. 2, 10 mi E Rupununi River, 2°19′N, 59°22′W, 15.xi.1937 (W. G. Hassler, AMNH).

18. *Metepeira gressa* (Keyserling)
Figures 149–156, 300; Map 8

Epeira gressa Keyserling, 1892: 166, fig. 123, ♀. Five female syntypes from Taquara, Rio Grande do Sul, Brazil, in BMNH, examined. One specimen designated lectotype.

Epeira seditiosa Keyserling, 1893: 212, fig. 157, ♂. Male holotype from Rio Grande do Sul, Brazil, in BMNH, examined. NEW SYNONYMY.

Araneus gressus:—Petrunkevitch, 1911: 314. Roewer, 1942: 844. Bonnet, 1955: 511.

Araneus seditiosus:—Petrunkevitch, 1911: 314. Roewer, 1942: 852. Bonnet (1955: 592) erroneously suggests that Petrunkevitch (1911: 314) synonymized *Araneus scitulus* (Blackwall, 1863) with *Araneus seditiosus.*

Eustala seditiosa:—Mello-Leitão, 1943: 179. Erroneous transfer.

Metazygia gressa:—Mello-Leitão, 1943: 187. Erroneous transfer.

Metepeira gressa:—Levi, 1991: 179. Platnick, 1993: 449.

Metepeira seditiosa:—Levi, 1991: 180. Platnick, 1993: 449.

Note. Examination of voucher specimens of Viera suggest that in the behavioral studies of Viera (1986, 1989) and Viera and Costa (1988), the name "*Metepeira* sp. A" is, in fact, *M. gressa.*

Description. Female from Punta del Espinillo, Montevideo, Uruguay. Chelicerae brown, lighter on distal inside margins. Carapace brown; yellowish white across and just behind posterior eye row; median white line reaching thoracic furrow, sometimes thickened into arrow shape (Fig. 155). Proximal halves of femora, white; remainder black. Patellae black ventrally, white dorsally. Distal halves of tibiae, black; remainder white with black annulation. Femur I with row of four macrosetae on anterior side; none on anteroventral side. Dorsal folium white fleur-delis pattern on black, margined with wavy white lines (Fig. 155). Venter black with short, wide, white median line; pair of small white spots on either side of spiracle

(Fig. 156). Sternum black with median white line, often broken (Fig. 156). Ratio of eye diameters: posterior medians and anterior medians 1.2, anterior laterals 1.3, posterior laterals 1.3. Anterior median eyes separated by 1.8 diameters, posterior median eyes by 1.0, anterior median eyes separated from anterior laterals by 2 diameters of anterior lateral eyes, lateral eyes separated by 0.2 their diameters. Total length 3.3 mm. Carapace 1.8 mm long, 1.4 wide. First femur 1.9 mm, patella and tibia 2, metatarsus 1.6, tarsus 0.7. Second patella and tibia 1.8 mm, third 1.1, fourth 1.6.

Male from Punta del Espinillo, Montevideo, Uruguay. Coloration of chelicerae and carapace as in female except median line brighter, thickened into arrow shape (Fig. 153). Leg coloration as in female. Femur I with row of four macrosetae on anterior side; five to six on anteroventral side. Dorsal folium, venter, and sternum as in female (Figs. 153, 154). Ratio of eye diameters: posterior medians and anterior medians 1.0, anterior laterals 1.5, posterior laterals 1.4. Anterior median eyes separated by 1.3 diameters, posterior median eyes by 0.8, anterior median eyes separated from anterior laterals by 1.9 diameters of anterior lateral eyes, lateral eyes separated by 0.3 their diameters. Total length 3 mm. Carapace 1.8 mm long, 1.3 wide. First femur 2.5 mm, patella and tibia 2.3, metatarsus 1.9, tarsus 0.9. Second patella and tibia 1.8 mm, third 1.1, fourth 1.6.

Diagnosis. The epigynum of *M. gressa* differs from that of *M. compsa* by having oval openings (Fig. 151) instead of round openings (Figs. 131, 134); it differs from *M. roraima* by being less translucent and by having a wider scape (compare Fig. 151 with Fig. 143). Unlike *M. roraima,* the embolus tip in *M. gressa* is not as bent, and the distal apophysis is thinner than the point on the embolus where it is attached (compare Fig. 149 with Fig. 141). Unlike *M. compsa,* the distal embolic apophysis projects away from the embolus tip (Fig. 149) instead of extending straight from the base and parallel to the embolus tip (Figs. 129, 132).

Variation. Average body length of 14 females examined 4.8 mm, range 3.3 to 6.8 mm. Average body length of five males examined 3.4 mm, range 2.8 to 4.3 mm.

Natural History. In Uruguay, *M. gressa* live in small colonies of up to five individuals surrounding the inflorescences of *Eryngium* sp. (Viera and Costa, 1988). The number of sticky spirals (14 below the hub, 22 above the hub) and radii (c. 40) are the same irrespective of age; however the length and width of the web differ between juveniles (c. 6 and 5 cm, respectively) and adults (c. 9 and 7 cm, respectively) (Viera, 1992). Mature specimens are most often collected between September and March at low elevation (Fig. 300).

Distribution. Northern Argentina, Paraguay, and Uruguay (Map 8).

Records Examined. ARGENTINA *Buenos Aires:* Arrecifes, 34°3′S, 60°7′W, 17.i.1939 (Biraben, MLP); Boulogne, 34°30′S, 58°34′W, 15.x.1938 (Prosen, MLP); Colon [?], 33°53′29″S, 61°6′35″W, 20.ix.1944 (Torres, MLP); Moreno, 34°39′S, 58°48′W, 15.ii.1966 (Rossi and Maury, MACN); San Isidro, 34°27′S, 58°30′W, 15.xii.1937 (Peregra, MACN); San Miguel—San Fernando, 34°29′S, 58°39′W, 15.vii.1940 (F. Morrios, MACN); Sierra de la Ventana, 38°9′S, 61°48′W, 15.iii.1939 (S. H. Bavio, MACN), 15.xi.1954 (Fritz, MACN), 31.x.1969 (Carlos Grisolia, MCZ), 15.vii.1972 (Amarrilla, MACN); Tigre, 34°25′S, 58°34′W (J. M. Viana, MACN). *Entre Ríos:* Concepción del Uruguay, 32°29′0″S, 58°13′42″W, 4.i.1941 (Prosen, MLP); Salto Grande, 31°13′S, 57°56′W, 15.iii.1964 (M. E. Galiano, MEG). *Santa Fé:* Florencia Varelo [?], 28°2′S, 59°15′W, 15.xii.1939 (F. Morris, MACN). *Tucumán:* 30 km S Concepción, 27°36′S, 65°35′W, 16.i.1983 (L. E. Peña, AMNH). PARAGUAY *Itapua:* San Luis, 27°6′S, 56°36′W, 15.x.1908 (AMNH). URUGUAY *Canelones: Montevideo:* Detras del Cerro, Camino de las tropas [?], 34°45′S, 56°10′W, 6.ii.1963 (R. Capocasale and L. Bruno, CAS). *Colonia:* Punta Gorda [?], 34°28′S, 57°51′W, 25.ii.1968 (R. Capocasale and L. Bruno, CAS), 26.ii.1968 (R. Capocasale and L. Bruno, CAS). *Maldonado:* Colonia, Cerro de las Animas. Small stones in native forest, 34°46′S, 55°19′W, 30.x.1967 (P. San Martin, MCZ). *Montevideo:* Punta del Espinillo, 34°50′S, 56°26′W, 12.x.1983 (Carmen Viera, MCZ), 15.xii.1983 (Carmen Viera, CV). *Treinta y Tres:* Quebrada de los Cuervos, 33°10′S, 54°27′W, 27.x.1990 (Lopez, Perez, Viera, MCZ).

Metepeira incrassata Group

Species in the *M. incrassata* group all lack a keel on the median apophysis. Males have a distal embolic apophysis that either projects toward the embolus tip (e.g., Fig. 157), forms a sharp corner but does not actually project forward (e.g., Fig. 185), or forms a smoother, rounded, and gradual corner (e.g., Figs. 192, 206). The *M. incrassata* species group includes *Metepeira maya, Metepeira inca, Metepeira gosoga, Metepeira olmec, Metepeira comanche, Metepeira pimungan, Metepeira triangularis, Metepeira arizonica, Metepeira atascadero,* and *Metepeira incrassata.*

19. *Metepeira maya* new species
Figures 157–163, 317; Map 14

Holotype. Male from North Bay, Twin Cays, Stann Creek District, Belize, 14.iii.1986, P. Sierwald, in USNM. The specific name is a noun in apposition after the Indian people of southern Mexico and Central America.

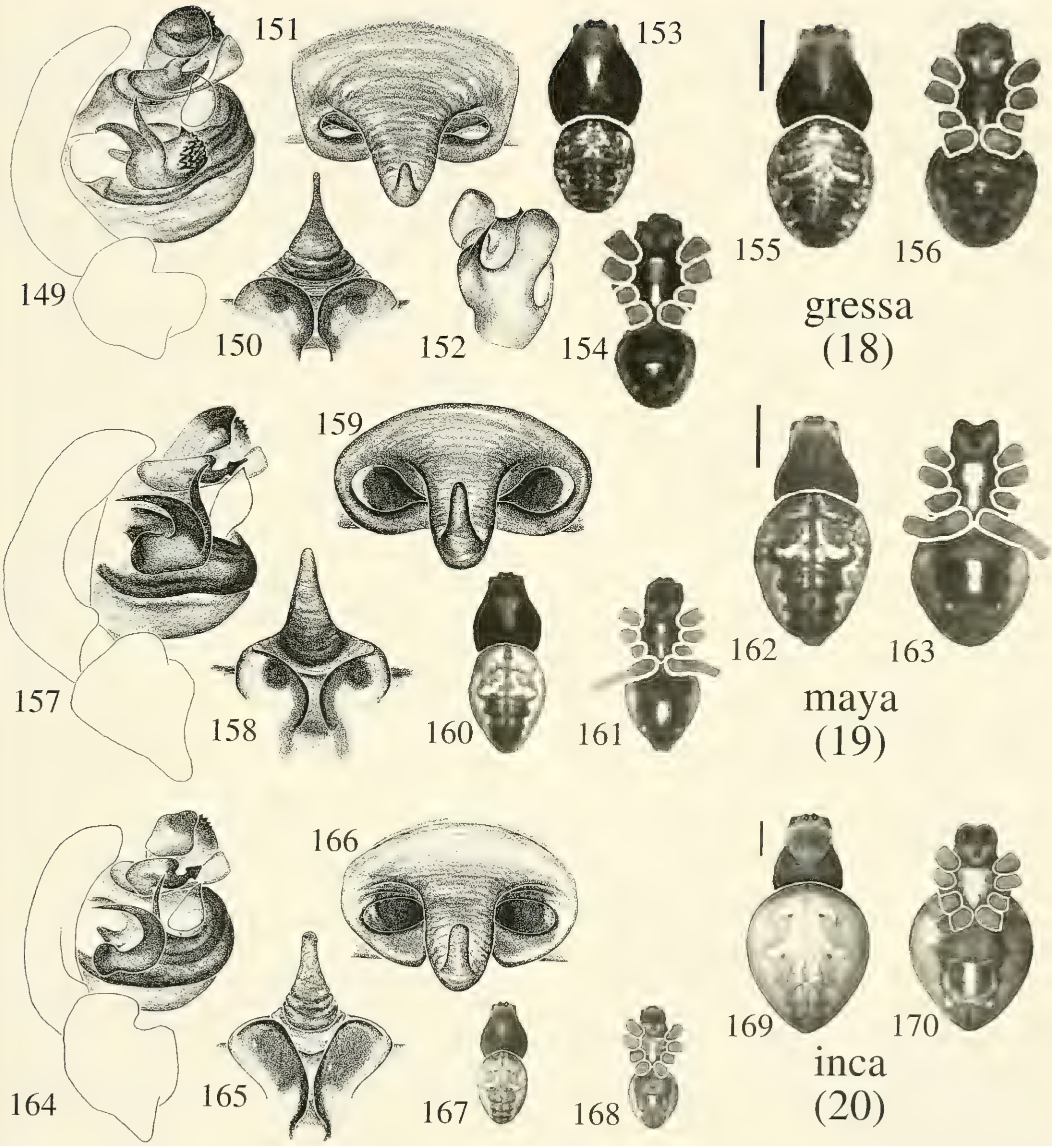
Description. Female paratype from Twin Cays, Stann Creek District, Belize. Carapace brown with large white eye region, white lateral posterior extensions, and short median posterior extension (Fig. 162). Legs white, ringed black on distal ends of articles. Femur I with row of four macrosetae on anterior side; none on anteroventral side. Dorsum of abdomen with usual *Metepeira* folium, though frequently with deep red pigmentation on anterior half (Fig. 162). Venter wide, white median line with pair of large white spots on either side of spiracle (Fig. 163). Sternum with wide median white line widening anteriorly with constriction in center (Fig. 163). Ratio of eye diameters: posterior medians and anterior medians 1.0, anterior laterals 1.3, posterior laterals 1.3. Anterior median eyes separated by 1.2 diameters, posterior median eyes by 0.8, anterior median eyes separated from anterior laterals by 2 diameters of anterior lateral eyes, lateral eyes separated by 0.2 their diameters. Total length 3.9 mm. Carapace 1.8 mm long, 1.4 wide. First femur 2.2 mm, patella and tibia 2.1, metatarsus 1.6, tarsus 0.8. Second patella and tibia 1.8 mm, third 1.0, fourth 1.6.

Male holotype. Carapace dark with light region around eyes and light triangular mark anterior to thoracic furrow (Fig. 160). Legs darker than in female. Femur I with row of four macrosetae on anterior side; four on anteroventral side. Dorsum, venter, sternum as in female except median white line on sternum usually broken (Figs. 160, 161). Ratio of eye diameters: posterior medians and anterior medians 1.0, anterior laterals 1.4, posterior laterals 1.2. Anterior median eyes separated by 1.2 diameters, posterior median eyes by 0.9, anterior median eyes separated from anterior laterals by 1.7 diameters of anterior lateral eyes, lateral eyes separated by 0.3 their diameters. Total length 3 mm. Carapace 1.5 mm long, 1.2 wide. First femur 2.2 mm, patella and tibia 2.3, metatarsus 1.8, tarsus 0.9. Second patella and tibia 1.8 mm, third 1.0, fourth 1.4.

Diagnosis. Unlike others in the *M. incrassata* species group, *M. maya* and *M. inca* both have distal embolic apophyses that project forward, forming rounded bumps (Figs. 157, 164). The male palps of these two species differ by the thickness of the flagellae and base on the median apophysis: thicker in *M. maya* than in *M. inca* (compare Fig. 157 with Fig. 164). The epigynum of *M. maya* resembles those of *M. inca* and *M. comanche* because the oval epigynal openings are formed out of membranous surfaces that are distinctly separate from the base of the scape (Figs. 159, 166, 187). The epigynal openings of *M. maya* (Fig. 159) are much wider than those of *M. comanche* (Fig. 187); and the posterior lobes on *M. maya* are thickened (Fig. 159) but not pointed as in *M. inca* (Fig. 166).

Variation. Average body length of five females examined 5.2 mm, range 3.9 to 6.3 mm. Average body length of four males examined 2.8 mm, range 2.3 to 3.1 mm.

Natural History. Mature specimens have been collected in March through August



Figures 149–156. *Metepeira gressa* (Keyserling) (sp. 18; 34°50′S, 56°26′W). 149, male palpus, mesal. 150, epigynum, posterior. 151, epigynum, ventral. 152, male embolic division, ventral. 153, male, dorsal. 154, male, ventral. 155, female, dorsal. 156, female, ventral.

Figures 157–163. *Metepeira maya* new species (sp. 19; 16°50′N, 88°5′W). 157, male palpus, mesal. 158, epigynum, posterior. 159, epigynum, ventral. 160, male, dorsal. 161, male, ventral. 162, female, dorsal. 163, female, ventral.

Figures 164–170. *Metepeira inca* new species (sp. 20; 4°30′S, 81°8′W). 164, male palpus, mesal. 165, epigynum, posterior. 166, epigynum, ventral. 167, male, dorsal. 168, male, ventral. 169, female, dorsal. 170, female, ventral.

Scale bars: dorsum and venter figures 1.0 mm.

(Fig. 317). Habitats range from mangroves at sea level to pine forests at 1,600 m.

Distribution. Southern Mexico to Costa Rica (Map 14).

Records Examined. BELIZE *Stann Creek:* Twin Cays, Andera Flats, 16°50′N, 88°5′W, 20.iii.1986 (P. Sierwald, USNM); Twin Cays, North part of West Pond, West of Swamp Doc, 16°50′N, 88°5′W, 28.iii.1986 (P. Sierwald, USNM); Twin Cays, Northwest Point, North Bay, 16°50′N, 88°5′W, 14.iii.1986 (P. Sierwald, USNM); Twin Cays, Northwest Point, North Bay, ground not flooded, 16°50′N, 88°5′W, 14.iii.1986 (P. Sierwald, USNM); Twin Cays, red mangrove, 16°50′N, 88°5′W, 17.v.1985 (Feller, USNM); Twin Cays, white mangrove, 16°50′N, 88°5′W, 15.vi.1984 (Feller, USNM), 5.vi.1985 (Erwin, Mathis, Sims, USNM). COSTA RICA *San José:* San José, 9°56′N, 84°5′W (Tristan & Banks, MCZ). GUATEMALA *Chiquimula:* Chiquimula, 14°48′N, 89°33′W, 22.vii.1947 (C. & P. Vaurie, AMNH). *Sacatepequez:* Antigua, 14°34′N, 90°44′W, 16.viii.1947 (C. & P. Vaurie, AMNH). MEXICO *Chiapas:* Comitan de Dominguez, 16°15′N, 92°8′W, 19.vii.1950 (C. J. & M. Goodnight, AMNH); near Río San Gregorio, between Comitan and Ocotal, 15°45′N, 92°0′W, 18.vii.1950 (C. J. & M. Goodnight, AMNH); pine forest, 15 mi NW Arriaga, 16°25′N, 94°1′W, 27.viii.1966 (Jean & Wilton Ivie, AMNH); Tuxtla Gutierrez, 16°45′N, 93°7′W, 10.vi.1964 (Pallister, AMNH). NICARAGUA *Matagalpa:* Matagaslpa, 12°53′N, 85°57′W, 15.vii.1989 (R. Reinbold, JMM).

20. *Metepeira inca* new species
Figures 164–170, 318; Map 11

Holotype. Male from Pariñas Valley, Piura, Peru, 21.v.1939, D. L. & H. E. Frizzell, in CAS. The specific name is a noun in apposition after the Quechuan people who once ruled Peru.

Description. Female paratype from Pariñas Valley, Piura, Peru. Light reddish brown carapace, white around eyes, very faint light mark in center (Fig. 169). Legs white; slightly darker on dorsal surfaces. Femur I with row of four to five macrosetae on anterior side; none on anteroventral side. Dorsal folium white; darker on shoulders and posteriorly (Fig. 169). Venter grayish brown with wide white median mark inside U-shaped pattern; pair of white spots on either side of spiracle (Fig. 170). Sternum white (Fig. 170). Ratio of eye diameters: posterior medians and anterior medians 0.9, anterior laterals 1.0, posterior laterals 1.1. Anterior median eyes separated by 1.6 diameters, posterior median eyes by 1.3, anterior median eyes separated from anterior laterals by 2.5 diameters of anterior lateral eyes, lateral eyes separated by 0.3 their diameters. Total length 6.8 mm. Carapace 2.9 mm long, 2.3 wide. First femur 3 mm, patella and tibia 3.3, metatarsus 2.6, tarsus 1. Second patella and tibia 2.8 mm, third 1.7, fourth 2.5.

Male holotype. Light reddish brown carapace, white around eyes, faint light triangular mark in center (Fig. 167). Legs white, save for light reddish brown on dorsal surfaces of femora and patellae. Femur I with row of three macrosetae on anterior side; two to three on anteroventral side. Dorsal folium white with wavy black lines thickening posteriorly (Fig. 167). Venter and sternum as in female (Fig. 168). Ratio of eye diameters: posterior medians and anterior medians 1.0, anterior laterals 1.3, posterior laterals 1.1. Anterior median eyes separated by 1.3 diameters, posterior median eyes by 0.8, anterior median eyes separated from anterior laterals by 1.9 diameters of anterior lateral eyes, lateral eyes almost touching. Total length 3.7 mm. Carapace 1.9 mm long, 1.4 wide. First femur 2.9 mm, patella and tibia 2.9, metatarsus 2.7, tarsus 1. Second patella and tibia 2.4 mm, third 1.3, fourth 1.9.

Diagnosis. Unlike others in the *M. incrassata* species group, *M. inca* and *M. maya* both have distal embolic apophyses that project forward, forming rounded bumps (Figs. 157, 164). The male palps of these two species are separated by the thinner flagellae and base on the median apophysis of *M. inca* (compare Fig. 164 with Fig. 157). The epigynum of *M. inca* resembles those of *M. maya* and *M. comanche* because the oval epigynal openings are formed out of membranous surfaces that are distinctly separate from the base of the scape (Figs. 159, 166, 187). The epigynal openings of *M. inca* (Fig. 166) are much wider than those of *M. comanche* (Fig. 187); the posterior lobes on *M. inca* are pointed (Fig. 166), not just thickened, as in *M. maya* (Fig. 159).

Variation. Average body length of six females examined 5.7 mm, range 5.2 to 6.8 mm. Average body length of four males examined 3.7 mm, range 2.8 to 4.4 mm. Coloration varies significantly among localities, especially in the males, where some are frequently much darker than others.

Natural History. Mature specimens have been collected in April through October (Fig. 318) at elevations between 300 and 600 m.

Distribution. Most northern tip of Peru (Map 11).

Records Examined. PERU *Piura:* 12 mi N Mancora, 4°0′S, 80°54′W, 11.xii.1938; Pariñas Valley, 4°30′S, 81°8′W, 3.iv.1939, 8.iv.1939, 16.iv.1939, 7.v.1939, 21.v.1939, 25.vi.1939, 3.vii.1939, 6.viii.1939, 15.viii.1939, 15.x.1939; Quebrada de Pariñas, 4°32′S, 81°17′W, 14.iv.1939, 7.v.1939, 21.v.1939; Quebrada Mogollon, 4°32′S, 81°4′W, 30.iv.1939, 11.vi.1939, 18.vi.1939, 21.vi.1939, 11.vii.1939, 16.vii.1939, 24.ix.1939 (all records: D. L. & H. E. Frizzell, CAS).

21. *Metepeira gosoga* Chamberlin and Ivie
Figures 171–177, 322; Map 9

Metepeira gosoga Chamberlin and Ivie, 1935: 21 figs 82–83, ♀. Female holotype from Pilot Knob Valley, Mohave Desert, California, in the AMNH, examined. Roewer, 1942: 868. Bonnet, 1957: 2820. Levi, 1977: 200, figs. 28–36.

Description. Female from Baja California Norte, Mexico. Carapace dirty yellowish brown, lighter anterior half, darker diamond-shaped mark behind eyes (Fig. 176). Legs same color as carapace; dark rings on distal ends of articles. Femur I with row of three to five macrosetae on anterior side; two or three macrosetae on anteroventral side. Folium lighter than in other species, darkening posteriorly (Fig. 176). Venter black surrounded by yellow. Wide white median line with pair of large white spots on either side of spiracle. Sometimes with parallel pair of lateral white lines that join transverse white line posteriorly (Fig. 177). Sternum black with wide, white line widening anteriorly, often broken in center (Fig. 177). Ratio of eye diameters: posterior medians and anterior medians 0.9, anterior laterals 1.3, posterior laterals 1.2. Anterior median eyes separated by 1.2 diameters, posterior median eyes by 0.6, anterior median eyes separated from anterior laterals by 3.4 diameters of anterior lateral eyes, lateral eyes separated by 0.4 their diameters. Total length 8.3 mm. Carapace 4 mm long, 3.3 wide. First femur 4.5 mm, patella and tibia 4.8, metatarsus 4.5, tarsus 1.3. Second patella and tibia 4.3 mm, third 2.5, fourth 3.8.

Male from Baja California Norte, Mexico. Male carapace, dorsum, venter, sternum as in female (Figs. 174, 175). Femur I with row of five macrosetae on anterior side; row of nine macrosetae on anteroventral side. Ratio of eye diameters: posterior medians and anterior medians 0.8, anterior laterals 1.1, posterior laterals 1.3. Anterior median eyes separated by 1 diameter, posterior median eyes by 0.8, anterior median eyes separated from anterior laterals by 2.1 diameters of anterior lateral eyes, lateral eyes separated by 0.2 their diameters. Total length 5.5 mm. Carapace 2.8 mm long, 2.3 wide. First femur 4.5 mm, patella and tibia 4.5, metatarsus 4.5, tarsus 1.4. Second patella and tibia 3.8 mm, third 1.9, fourth 3.

Diagnosis. Within the *M. incrassata* species group, only *M. gosoga, M. inca,* and *M. maya* have projecting distal embolic apophyses (Figs. 157, 164, 171). Of these, only *M. gosoga* has a distinctly pointed one (Fig. 171). The epigynum of *M. gosoga* differs from those of other species in the *M. incrassata* group by the small, oval shape of the openings (Fig. 173).

Variation. Average body length of two females examined 6.8 mm, range 5 to 8.5 mm. Average body length of two males examined 4.9 mm, range 4.1 to 5.7 mm.

Natural History. Mature specimens have been collected in June through August (Fig. 322) between 500 and 2,000 m. Levi (1977) notes that these have been collected on *Opuntia* and desert vegetation.

Distribution. Southwestern U.S. and Baja California Norte, Mexico (Levi, 1977, map 1; Map 9).

Records Examined. MEXICO *Baja Calif. Norte:* 23 mi S Catavina, 29°32′N, 114°57′W, 20.vi.1983 (L. Strange & R. Miller, FSCA). USA *Arizona:* Show Low Lake, 34°12′N, 110°0′W, 15.viii.1966 (MCZ).

22. *Metepeira olmec* new species
Figures 178–184, 324; Map 11

Holotype. Female from Fortín de las Flores, Veracruz, Mexico, 26.vi.1944, L. I. Davis, in AMNH. The specific name is a noun in apposition after the ancient Indian people of southern Veracruz and Tabasco.

Description. Female holotype. Carapace reddish brown with white region around eyes that extends posteriorly along lateral margins (Fig. 183). Legs ringed on distal ends of articles. Femur I with row of four macrosetae on anterior side; none on anteroventral side. Dorsum of abdomen with usual *Metepeira* folium (Fig. 183). Venter of abdomen with wide, long white median line set within surrounding U-shaped markings. Pair of white spots on either side of spiracle (Fig. 184). Sternum has wide median white line widening anteriorly with broken constriction in center (Fig. 184). Ratio of eye diameters: posterior medians and anterior medians 1.0, anterior laterals 1.1, posterior laterals 1.5. Anterior median eyes separated by 1.5 diameters, posterior median eyes by 0.8, anterior median eyes separated from anterior laterals by 2.1 diameters of anterior lateral eyes, lateral eyes separated by 0.2 their diameters. Total length 5.9 mm. Carapace 2.8 mm long, 2 wide. First femur 2.8 mm, patella and tibia 2.8, metatarsus 2.5, tarsus 1. Second patella and tibia 2.5 mm, third 1.5, fourth 2.3.

Male paratype from Fortín de las Flores, Veracruz, Mexico. Carapace dark with light region around eyes and a light mark anterior to thoracic furrow (Fig. 181). Legs darker than in female. Macrosetae on legs variable with spider's size—femur I with row of three or four macrosetae on anterior side; one to three on anteroventral side. Dorsum, venter, sternum as in female, except median white line on venter shortened to spot and median white line on sternum often broken (Figs. 181, 182). Ratio of eye diameters: posterior medians and anterior medians 1.0, anterior laterals 1.3, posterior laterals 1.3. Anterior median eyes separated by 1.3 diameters, posterior median eyes by 0.8, anterior median eyes separated from anterior laterals by 1.3 diameters of anterior lateral eyes, lateral eyes separated by 0.1 their diameters. Total length 2.8 mm. Carapace 1.4 mm long, 1.2 wide. First femur 1.7 mm, patella and tibia 1.6, metatarsus 1.1, tarsus 0.7. Second patella and tibia 1.3 mm, third 0.8, fourth 1.1.

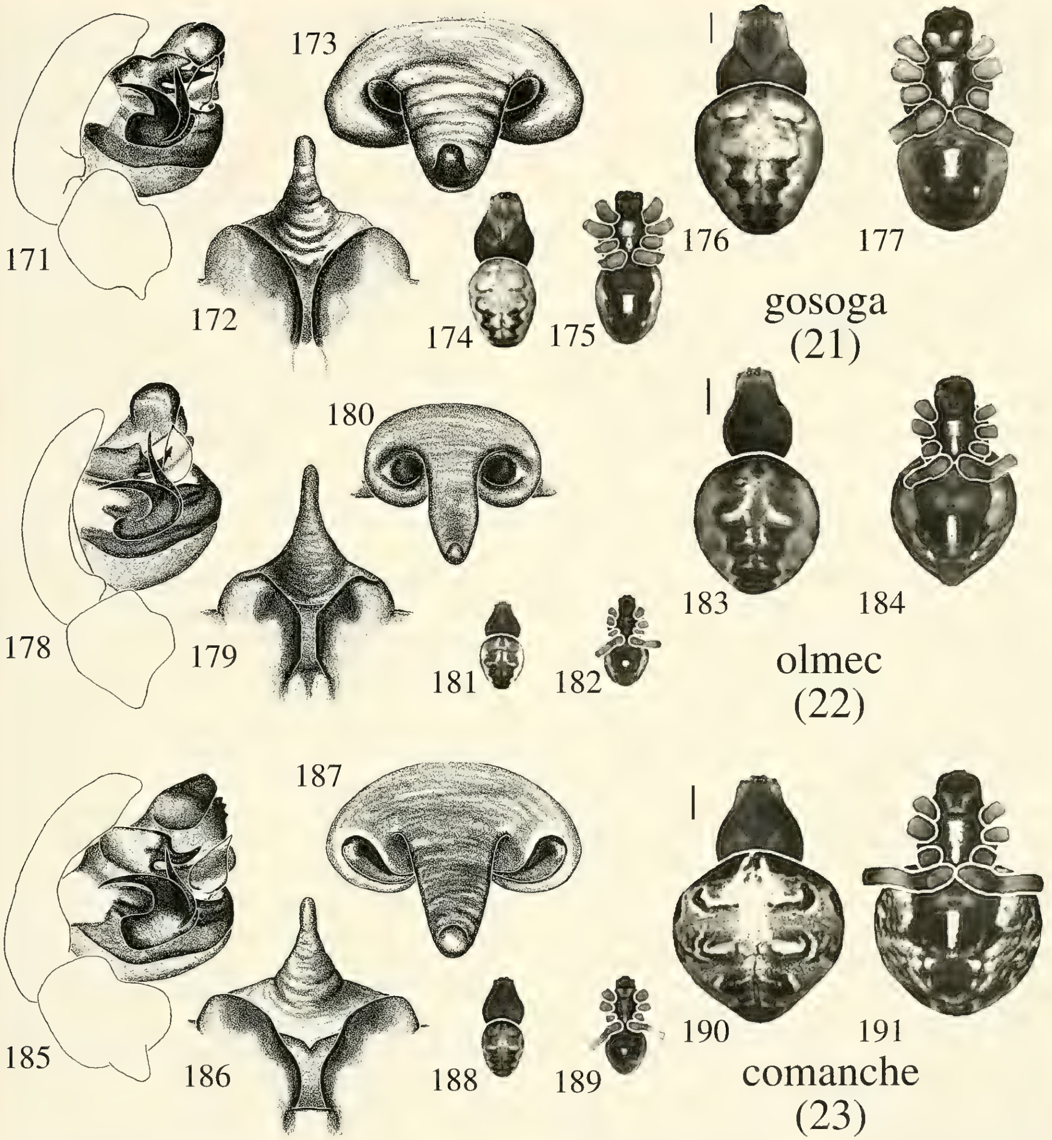
Diagnosis. Female *M. olmec* are diagnosed by their almost perfectly round epigynal depressions with uniform thickness around the posterior edges (Fig. 180). The male embolus is relatively short and has a vestigial distal embolic apophysis that does not project forward, but instead drops off, forming a sharp curve (Fig. 178). Among other species in the *M. incrassata* species group, this embolus shape is also seen in *M. comanche* and *M. triangularis*: unlike *M. comanche* (Fig. 185), the darker, sclerotized portion of the embolus does not extend over the hump of the distal embolic apophysis; unlike *M. triangularis* (Fig. 199), the flagellae are thicker than the base of the median apophysis.

Variation. Average body length of four females examined 6.2 mm, range 5.6 to 6.7 mm. Average body length of three males examined 2.3 mm, range 2.2 to 2.6 mm.

Natural History. Mature specimens have been collected perennially (Fig. 324) at elevations between 500 and 1,400 m.

Distribution. Montane rain forests from Veracruz to Panama (Map 11).

Records Examined. COSTA RICA *San José:* San Antonio de Escanza, 9°59′N, 84°11′W [?], 4.iii.1984 (W. Eberhard, MCZ). MEXICO *Veracruz:* Fortín de las Flores, 18°54′N, 97°0′W, 26.vi.1944 (L. I. Davis, AMNH); Papantla, 20°27′N, 97°19′W, 12.x.1947 (H. Wagner, AMNH). PANAMA *Chiriquí:* Boquete, 8°47′N, 82°26′W, 15.viii.1950 (A. M. Chickering,



Figures 171–177. *Metepeira gosoga* Chamberlin and Ivie (sp. 21; 29°32′N, 114°57′W). 171, male palpus, mesal. 172, epigynum, posterior. 173, epigynum, ventral. 174, male, dorsal. 175, male, ventral. 176, female, dorsal. 177, female, ventral.
Figures 178–184. *Metepeira olmec* new species (sp. 22; 18°54′N, 97°0′W). 178, male palpus, mesal. 179, epigynum, posterior. 180, epigynum, ventral. 181, male, dorsal. 182, male, ventral. 183, female, dorsal. 184, female, ventral.
Figures 185–191. *Metepeira comanche* Levi (sp. 23 [185,188,189] 33°22′N, 99°56′W; [186,187] 25°45′N, 101°55′W; [190, 191] 26°41′N, 101°23′W). 185, male palpus, mesal. 186, epigynum, posterior. 187, epigynum, ventral. 188, male, dorsal. 189, male, ventral. 190, female, dorsal. 191, female, ventral.
Scale bars: dorsum and venter figures 1.0 mm.

MCZ), 7.viii.1954 (A. M. Chickering, MCZ). *Panamá:* Cerro Galera, 8°55′N, 79°38′W, 7.i.1977 (H. W. Levi & Y. Lubin, MCZ).

23. *Metepeira comanche* Levi
Figures 185–191, 331; Map 11

Metepeira comanche Levi, 1977: 204, figs. 61–69, ♂, ♀. Male holotype from 9.7 km west of O'Brien, Haskell Co., Texas, in the MCZ, examined. Brignoli, 1983: 275.

Description. Female from Gloria, Coahuila, Mexico. Carapace dark with light region around eyes, extending posteriorly behind posterior lateral eyes (Fig. 190). Legs ringed. Femur I with row of four macrosetae on anterior side; one or two on anteroventral side. Dorsal folium high in contrast; black comma-shaped markings shadow white fleur-de-lis pattern (Fig. 190). Venter of abdomen with wide white median line posteriorly set within surrounding U-shaped marking. Pair of white spots on either side of spiracle (Fig. 191). Sternum has wide median white line widening anteriorly (Fig. 191). Ratio of eye diameters: posterior medians and anterior medians 0.9, anterior laterals 1.2, posterior laterals 1.1. Anterior median eyes separated by 1.2 diameters, posterior median eyes by 1.0, anterior median eyes separated from anterior laterals by 2.7 diameters of anterior lateral eyes, lateral eyes separated by 0.2 their diameters. Total length 7.8 mm. Carapace 3.3 mm long, 2.5 wide. First femur 3.6 mm, patella and tibia 3.9, metatarsus 3.4, tarsus 1.2. Second patella and tibia 3.3 mm, third 2, fourth 2.9.

Male from 9.7 km west of O'Brien, Haskell Co., Texas. Carapace light around eyes, darker posteriorly (Fig. 188). Legs ringed. Macrosetae on femur I variable; usually row of four macrosetae on anterior side, six on anteroventral side. Dorsum with usual *Metepeira* folium (Fig. 188). Venter with median oval white mark; pair of white spots on either side of spiracle (Fig. 189). Median white line on sternum usually broken (Fig. 189). Ratio of eye diameters: posterior medians and anterior medians 1.0, anterior laterals 1.3, posterior laterals 1.3. Anterior median eyes separated by 1.4 diameters, posterior median eyes by 0.9, anterior median eyes separated from anterior laterals by 1.6 diameters of anterior lateral eyes, lateral eyes separated by 0.2 their diameters. Total length 3.1 mm. Carapace 1.7 mm long, 1.3 wide. First femur 2.4 mm, patella and tibia 2.2, metatarsus 2, tarsus 0.9. Second patella and tibia 1.9 mm, third 1.0, fourth 1.5.

Diagnosis. The epigynum of *M. comanche* resembles those of *M. maya* and *M. inca* because the oval epigynal openings are formed out of membranous surfaces that are distinctly separate from the base of the scape (Figs. 159, 166, 187). The epigynum of *M. comanche* differs from *M. maya* and *M. inca* by having much narrower epigynal openings (compare Fig. 187 with Figs. 159, 166). The male embolus is relatively short and has a vestigial distal embolic apophysis that does not project forward, but instead drops off, forming a sharp curve (Fig. 185). Among other species in the *M. incrassata* species group, this embolus shape is also seen in *M. olmec* and *M. triangularis*: unlike *M. olmec* (Fig. 178), the darker, sclerotized portion of the embolus extends over the hump of the distal embolic apophysis; unlike *M. triangularis* (Fig. 199), the flagellae and base of the median apophysis are wide (Fig. 185).

Natural History. Mature specimens have been collected from May to November (Levi, 1977, Fig. 331).

Distribution. New Mexico, Texas, and northern Mexico (Levi, 1977, map 1; Map 11).

Records Examined. MEXICO *Coahuila:* Gloria, 26°41′N, 101°23′W, 24.viii.1947 (W. J. Gertsch, AMNH); Paila, 25°45′N, 101°55′W, 21.viii.1947 (W. J. Gertsch, AMNH).

24. *Metepeira pimungan* new species
Figures 192–198, 330; Map 9

Holotype. Male from San Miguel Island, Santa Barbara Co., California, USA, 20.vii.1968, M. E. Thompson, in the MCZ. The specific name is a noun in apposition after the Indian people who once lived on the Channel Islands.

Description. Female paratype from San Miguel Island, California USA. Carapace with large white eye region and lateral posterior extensions. White median arrow-shaped mark extends to thoracic furrow (Fig. 197). Legs mostly white with rings on legs III and IV. Femur I with row of four macrosetae on anterior side; one on anteroventral side. Dorsum of abdomen with usual *Metepeira* folium (Fig. 197); venter wide, with long white median line, flanked by shorter parallel thin white lines on either side. Pair of white spots on either side of spiracle. Sternum black with posterior drop-shaped white mark (Fig. 198). Ratio of eye diameters: posterior medians and anterior medians 1.0, anterior laterals 1.4, posterior laterals 1.3. Anterior median eyes separated by 1.6 diameters, posterior median eyes by 1.0, anterior median eyes separated from anterior laterals by 3.4 diameters of anterior lateral eyes, lateral eyes separated by 0.3 their diameters. Total length 6.9 mm. Carapace 3.3 mm long, 2.6 wide. First femur 3.5 mm, patella and tibia 3.5, metatarsus 2.8, tarsus 1.3. Second patella and tibia 3 mm, third 1.9, fourth 2.8.

Male holotype. Carapace, legs, abdomen, venter, sternum as in female, though legs darker and not ringed (Figs. 195, 196). Femur I with row of four to five macrosetae on anterior side; four to five on anteroventral side: both rows concentrated distally on femur. Ratio of eye diameters: posterior medians and anterior medians 1.0, anterior laterals 1.3, posterior laterals 1.3. Anterior median eyes separated by 1.6 diameters, posterior median eyes by 0.8, anterior median eyes separated from anterior laterals by 1.9 diameters of anterior lateral eyes, lateral eyes separated by 0.3 their diameters. Total length 4.5 mm. Carapace 2.3 mm long, 1.8 wide. First femur 3.1 mm, patella and tibia 3, metatarsus 2.8, tarsus 1. Second patella and tibia 2.5 mm, third 1.3, fourth 1.9.

Diagnosis. Like *M. atascadero,* but unlike other species in the *M. incrassata* group, the posterior end of the sternum of *M. pimungan* has a white water drop mark (Figs. 196, 198). Unlike *M. atascadero, M. pimungan* lacks U-shaped white markings on the venter, just anterior to the spiracle (compare Fig. 198 with Fig. 221). In contrast to other species in the *M. incrassata* group, the embolus on male *M. pimungan* specimens is curved to form a gentle S-shape (Fig. 192). The female has a squarish-shaped black mark inside each epigynal depression (Fig. 198) which is not seen in other *M. incrassata* group species.

Variation. Average body length of four females examined 7.7 mm, range 6.9 to 8.5 mm. Average body length of five males examined 5.3 mm, range 4.6 to 6.4 mm.

Natural History. Mature specimens have been collected in August (Fig. 330). Webs are found near the ground, sheltered from the perennial strong winds by *Coryopsis* and lupines.

Distribution. Endemic to San Miguel Island (Map 9).

Records Examined. USA *California:* San Miguel Island, 34°2′28.6″N, 120°21′13.6″W, 11.viii.1995 (W. H. Piel, MCZ); 34°2′6.1″N, 120°21′9.1″W, 12.viii.1995 (W. H. Piel, MCZ); 34°2′N, 120°22′W, 20.viii.1968 (M. E. Thompson, MCZ); 34°3′3.1″N, 120°21′53.3″W, 13.viii.1995 (W. H. Piel, MCZ); behind dunes on beach, 34°2′43.8″N, 120°21′0.8″W, 11.viii.1995 (W. H. Piel, MCZ).

25. *Metepeira triangularis* (Franganillo)
Figures 199–205, 337; Map 14

Mangora triangularis Franganillo, 1930: 21–22. Female holotype from Sierra Maestra, lost. Platnick, 1993: 449.

Metepeira labyrinthea:—Franganillo, 1936: 75. Bryant, 1940: 341. Platnick, 1993: 449.

Metepeira triangularis:—Archer, 1958: 15, fig. 37, ♀.

Metepeira acostai Archer, 1958: 15, fig. 36, ♀. Female holotype from the savannas, Agramont, Camagüey Province, Cuba, in the AMNH, examined. NEW SYNONYMY.

Metepeira bani Archer, 1965: 132, figs. 11, 17 ♀, 13 ♂. Male and female syntypes from Baní, Dominican Republic, in the AMNH, examined. NEW SYNONYMY. Brignoli, 1983: 275.

Note. Franganillo's collection vials are not labeled, making it impossible to find the holotype. Based on the descriptions by Franganillo (1930), Archer (1958), the illustrations of Archer (1958, 1965), and material determined by Archer, I conclude that there is no evidence to support three separate species. For the name *M. triangularis,* I designate a female neotype from Camagüey Province, Cuba. 21°30′N, 78°10′W, x.1954 (J. T. Acosta, AMNH).

Description. Female from La Descubierta, Lago Enriquillo, Isla Cabritos, Dominican Republic. Light reddish brown carapace, white around eyes (Fig. 204). Legs yellowish white, sometimes ringed brown at distal ends of articles. Femur I with row of three, or sometimes four, macrosetae on anterior side; none on anteroventral side. Dorsal folium white with slightly darker markings posteriorly (Fig. 204). In some cases, dark anterior marks on shoulders of dorsum. Venter of abdomen black with wide white median line, sometimes flanked by thinner white lines that together form an anchor shape (Fig. 205). Pair of small white spots on either side of spiracle. Sternum black with median white line, wider anteriorly (Fig. 205). Ratio of eye diameters: posterior medians and anterior medians 1.0, anterior laterals 1.4, posterior laterals 1.4. Anterior median eyes separated by 1.5 diameters, posterior median eyes by 1.1, anterior median eyes separated from anterior laterals by 3.3 diameters of anterior lateral eyes, lateral eyes separated by 0.2 their diameters. Total length 5.9 mm. Carapace 2.7 mm long, 2 wide. First femur 2.6 mm, patella and tibia 2.9, metatarsus 2.5, tarsus 1. Second patella and tibia 2.4 mm, third 1.4, fourth 2.2.

Male from La Descubierta, Lago Enriquillo, Isla Cabritos, Dominican Republic. Carapace as in female, though lighter eye region often extends to cover entire anterior half (Fig. 202). Legs yellowish white. Distal half of femora often dark. Femur I with row of four macrosetae on anterior side; three to five on anteroventral side. Dorsal folium white with slightly darker markings posteriorly (Fig. 202). Venter of abdomen as in female; sternum black with median white line (Fig. 203). Ratio of eye diameters: posterior medians and anterior medians 1.1, anterior laterals 0.7, posterior laterals 1.1. Anterior median eyes separated by 1.6 diameters, posterior median eyes by 0.8, anterior median eyes separated from anterior laterals by 1.0 diameters of anterior lateral eyes, lateral eyes separated by 0.1 their diameters. Total length 4.2 mm. Carapace 2 mm long, 1.5 wide. First femur 2.9 mm, patella and tibia 3, metatarsus 2.8, tarsus 1.1. Second patella and tibia 2.4 mm, third 0.8, fourth 1.3.

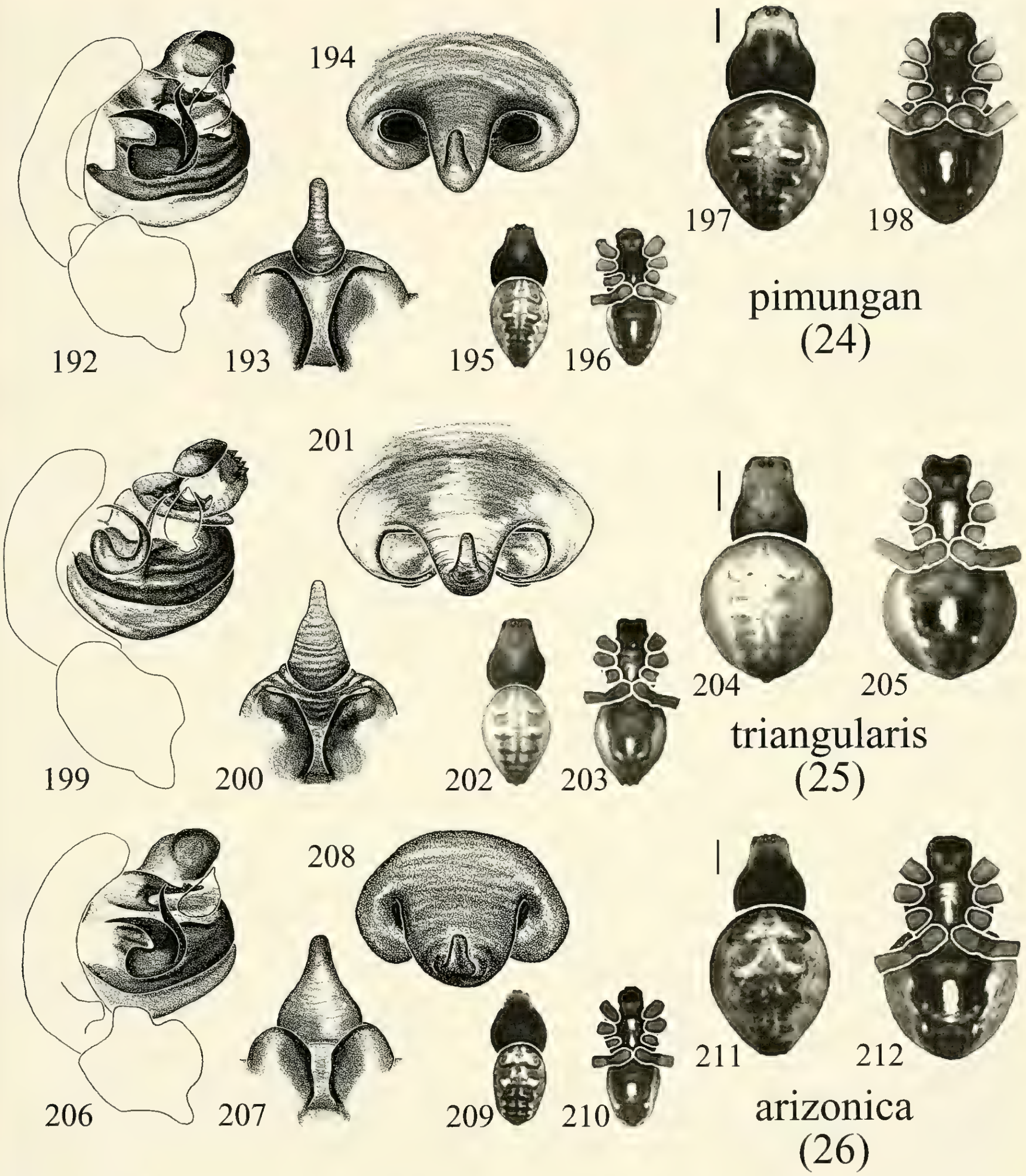
Diagnosis. The epigynum of *M. triangularis* differs from other species by the thin, sclerotized openings in the shape of Ray-Ban sunglasses (Fig. 201). The male embolus has a vestigial distal embolic apophysis that does not project forward, but instead drops off, forming a sharp curve (Fig. 199). Among other species in the *M. incrassata* species group, shorter versions of this embolus shape is also seen in *M. comanche* and *M. olmec*: unlike *M. comanche* (Fig. 185), the darker, sclerotized portion of the embolus does not extend over the hump of the distal embolic apophysis; unlike *M. olmec* (Fig. 178), the flagellae and base of the median apophysis are much thinner (Fig. 199).

Variation. Average body length of seven females examined 5.5 mm, range 4.6 to 6.3 mm. Average body length of five males examined 3.8 mm, range 3.2 to 4.3 mm.

Natural History. Mature specimens have been collected from June to February, although I suspect that like other Caribbean species, *M. triangularis* is actually entirely perennial (Fig. 337).

Distribution. Dominican Republic and Cuba (Map 14).

Records Examined. CUBA *Camagüey Prov.:* 21°30′N, 78°10′W, x.1954 (J. T. Acosta, AMNH). *Matanzas:* Matanzas, Parque Watkins, 23°3′N, 81°35′W, 9.viii.1955 (A. F. Archer, AMNH); Pan de Palenque [?], 23°1′N, 81°43′W, 11.viii.1955 (A. F. Archer, AMNH). *Oriente:* Banes, 20°58′N, 75°43′W, 2.viii.1955 (A. F. Archer, AMNH); Cuabitas, Santiago, 20°4′N, 75°48′W, 15.xii.1955 (P. Alayo, AMNH); Puerto Boniato, 20°7′N, 75°47′W, 4.xi.1945 (P. Alayo, AMNH). *Sierra las Casas:* Isla de Pinos, 21°53′N, 82°48′W, 17.viii.1955 (A. F. Archer, AMNH). DOMINICAN REPUBLIC *Azua:* Hatillo, 18°24′N, 70°32′W, 30.i.1991 (Felix E. Del Monte, CAS). *Banahona:* Sierra Martín García [?], 18°25′N, 70°30′W, 8.viii.1958 (A. F. Archer & E. de Boyrie Moya,



Figures 192–198. *Metepeira pimungan* new species (sp. 24; 34°2′N, 120°22′W). 192, male palpus, mesal. 193, epigynum, posterior. 194, epigynum, ventral. 195, male, dorsal. 196, male, ventral. 197, female, dorsal. 198, female, ventral.
Figures 199–205. *Metepeira triangularis* (Franganillo) (sp. 25; 18°34′N, 71°44′W). 199, male palpus, mesal. 200, epigynum, posterior. 201, epigynum, ventral. 202, male, dorsal. 203, male, ventral. 204, female, dorsal. 205, female, ventral.
Figures 206–212. *Metepeira arizonica* Chamberlin and Ivie (sp. 26; 28°53′N, 113°4′W). 206, male palpus, mesal. 207, epigynum, posterior. 208, epigynum, ventral. 209, male, dorsal. 210, male, ventral. 211, female, dorsal. 212, female, ventral.
Scale bars: dorsum and venter figures 1.0 mm.

AMNH). *La Independencia:* 2 km SE El Limón, Jimani. S side of road, 18°25′N, 71°45′W, 30.i.1991 (Felix E. Del Monte, MNSD); Isla Cabritos: La Descubierta, Lago Enriquillo, 18°34′N, 71°44′W, 18.vi.1981 (E. Marcano, MNSD). *Montecristi:* Carretera Montecristi, El Morro [?], 19°54′N, 71°39′W, 2.xii.1991 (Felix E. Del Monte, MNSD), 21.xii.1991 (Felix E. Del Monte, MNSD). *Peravia:* Las Dunas, Prov. Baní [?], 18°25′N, 71°25′W, 23.i.1992 (Felix E. Del Monte, MNSD). *Prov. Trujillo Valdez:* W of Baní, 18°17′N, 70°22′W, 8.viii.1958 (A. F. Archer, AMNH). *San Juan:* 1 km S Las Matas de Farfán, 18°51′N, 71°31′W, 25.viii.1970 (B. Patterson, MCZ).

26. *Metepeira arizonica* Chamberlin and Ivie
Figures 206–213, 319; Map 9

Metepeira arizonica Chamberlin and Ivie, 1942: 69, figs. 182–187, ♀, ♂. Female holotype from Canyon Lake, Arizona, in the AMNH, examined. Levi, 1977: 200, figs. 12, 13, 39–46, ♀, ♂. Brignoli, 1983: 275.

Description. Female from Isla Partida, Baja Calif. Norte, Mexico. General coloration high in contrast. Carapace dark brown; large white eye region, white lateral posterior extensions, and short median posterior extension (Fig. 211). Distinct black rings on all legs. Femur I with row of four macrosetae on anterior side; four on anteroventral side. Dorsum of abdomen with usual *Metepeira* folium, though generally slightly lighter (Fig. 211); venter wide, with long white median line set within surrounding U-shaped markings. Pair of white spots on either side of spiracle (Fig. 212). Wide median white line widening anteriorly with constriction in center, set on black sternum (Fig. 212). Ratio of eye diameters: posterior medians and anterior medians 1.0, anterior laterals 1.4, posterior laterals 1.2. Anterior median eyes separated by 1.4 diameters, posterior median eyes by 0.9, anterior median eyes separated from anterior laterals by 2.7 diameters of anterior lateral eyes, lateral eyes separated by 0.1 their diameters. Total length 6.2 mm. Carapace 2.8 mm long, 2.2 wide. First femur 3.4 mm, patella and tibia 3.5, metatarsus 3, tarsus 1.2. Second patella and tibia 3 mm, third 1.9, fourth 2.8.

Male from Isla Partida, Baja Calif. Norte, Mexico. Carapace, legs, abdomen, venter, sternum as in female, though legs darker with less distinct rings, and white line on sternum often broken (Figs. 209, 210). Femur I with row of four macrosetae on anterior side; five to eight on anteroventral side. Ratio of eye diameters: posterior medians and anterior medians 1.1, anterior laterals 1.4, posterior laterals 1.2. Anterior median eyes separated by 1.5 diameters, posterior median eyes by 0.7, anterior median eyes separated from anterior laterals by 1.6 diameters of anterior lateral eyes, lateral eyes separated by 0.2 their diameters. Total length 4.4 mm. Carapace 2.3 mm long, 1.8 wide. First femur 3.3 mm, patella and tibia 3.3, metatarsus 3.2, tarsus 1.2. Second patella and tibia 2.8 mm, third 1.5, fourth 2.2.

Diagnosis. Unlike all other species in the *M. incrassata* group, the epigynum of *M. arizonica* is puffy and swollen, causing the openings to reduce (from a ventral view) to crescent-shaped slits (Fig. 187). The embolus differs from others in the *M. incrassata* group because the distal embolic apophysis is reduced to a gentle arching curve (Fig. 206).

Variation. Average body length of nine females examined 5.5 mm, range 4.7 to 6.3 mm. Average body length of 13 males examined 3.9 mm, range 3.1 to 5.1 mm. In some males a small ventral keel is visible extending beyond the flagella of the median apophysis (Levi, 1977, fig. 46).

Natural History. Mature specimens are most commonly collected between April and August (Fig. 319), from dry oak–pine–juniper woodland, alfalfa, cactus, and desert shrub (Levi, 1977). Localities have a large range in altitude, from sea level to 2,300 m; however, spiders from southern regions live at higher elevations than spiders from northern regions (Fig. 213).

Distribution. American southwest to San Luis Potosí (Levi, 1977, map 1; Map 9).

Records Examined. MEXICO *Baja Calif. Norte:* 15

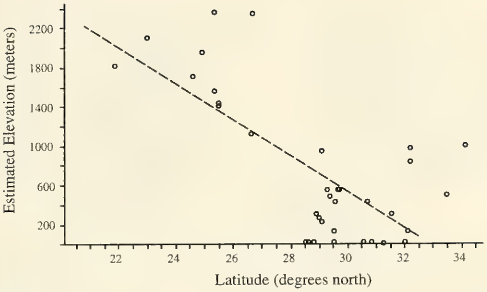


Figure 213. The elevation of collection localities for *M. arizonica* at their corresponding latitudes. Species-specific altitudes appear to decrease with distance from the equator. Elevations estimated from NOAA database of 5- by 5-minute geographic tiles.

mi S Punta Prieta, 28°58′N, 114°17′W, 7.vii.1973 (S. C. Williams & K. B. Blair, CAS); 24 mi S Santa Inés, 29°20′N, 114°20′W, 7.vii.1973 (S. C. Williams & K. B. Blair, CAS); 26 mi S San Felipe, 30°38′N, 114°50′W, 15.iv.1965 (D. Q. Cavagnaro, C. E. & E. S. Ross, V. L. Vesterby, CAS); 6 km NW Racho Santa Inés, 29°43′N, 114°43′W, 28.iii.1981 (Paul E. Blom, WHC); 6 mi S San Felipe, 30°55′N, 114°52′W, 14.iv.1965 (D. Q. Cavagnaro, C. E. & E. S. Ross, V. L. Vesterby, CAS); 9 km NW Racho Santa Inés, 29°46′N, 114°46′W, 3.vii.1981 (David Crowe, WHC); Arroyo de Calamajué at carbonated spring, 29°38′N, 114°25′W, 26.vi.1973 (S. C. Williams & K. B. Blair, CAS); Cañon de Guadalupe, off Laguna Salada, 32°10′N, 115°48′W, 11.i.1958 (V. Roth, AMNH); El Mayor, 32°5′N, 115°13′W, 15.vi.1952 (M. Cazier, W. Gertsch, & R. Schrammel, AMNH); Isla Mejía, 29°34′N, 113°35′W, 30.iv.1921 (J. C. Chamberlin, MCZ); Isla Partida, 28°53′N, 113°4′W, 2.vii.1921 (J. C. Chamberlin, MCZ); Isla San Lorenzo, N end, 28°40′N, 112°52′W, 24.vi.1921 (J. C. Chamberlin, CAS); Isla San Lorenzo, south Tobart, 28°36′N, 112°46′W [?], 9.iv.1921 (J. C. Chamberlin, CAS); Puerto Refugio, N end Angel de la Guarda Isl. Webs in cracks in cliff overhanging beach, 29°34′N, 113°32′W, 18.iv.1962 (Howard W. Campbell, CAS); San Pedro Martir, 30°45′N, 115°13′W, 18.iv.1921 (J. C. Chamberlin, CAS). *Coahuila:* 25 mi SE San Pedro, 25°35′N, 102°50′W, 21.viii.1947 (W. J. Gertsch, AMNH); Cabos, 25°35′N, 101°43′W, 21.viii.1947 (W. J. Gertsch, AMNH); Gloria, 26°41′N, 101°23′W, 24.viii.1947 (W. J. Gertsch, AMNH); Saltillo, 25°25′N, 101°0′W, 23.v.1952 (M. Cazier, W. Gertsch, & R. Schrammel, AMNH). *Durango:* La Loma, 25°27′N, 103°40′W, 20.viii.1947 (W. J. Gertsch, AMNH); Providencia, 26°44′N, 105°56′W, 24.viii.1947 (A. M. Davis, AMNH); San Isidro, 60 mi NW Durango, 25°1′N, 105°6′W, 19.viii.1947 (W. J. Gertsch, AMNH). *San Luis Potosí:* 3 km W. Pilares, 21°55′34″N, 100°48′6″W, 21.x.1994 (W. H. Piel, MCZ). *Sinaloa:* Las Saleras Is. (= Isla Saliaca [?]), 25°11′N, 108°20′W [?], 13.vi.1921 (J. C. Chamberlin, CAS). *Sonora:* 20 mi N Hermosillo, 29°8′N, 110°58′W, 13.ix.1966 (Jean & Wilton Ivie, AMNH); 20 mi SW Sonoyta, 31°38′N, 113°4′W, 13.vi.1952 (W. J. Gertsch, AMNH); 22 mi E Hermosillo on the banks of Río Sonora, 29°4′N, 110°55′W, 17.viii.1959 (B. A. Branson, AMNH); Los Angeles, 29°27′N, 110°46′W, 4.x.1966 (V. Roth, AMNH); Puerto Peñasco at seashore, 31°20′N, 113°33′W, 3.iv.1968 (D. E. Bixler, MCZ). *Zacatecas:* 14 mi S Fresnillo, 23°5′N, 102°45′W, 4.viii.1954 (W. J. Gertsch, AMNH); 4 mi NE Concepción del Oro, 24°41′N, 101°23′W, 4.vii.1984 (J. B. Woolley, AD). USA *Arizona:* Santa Catalina Mtns., mile 7.9 of Catalina Highway from Tuscon to Mt. Lemmon., 32°17′N, 110°48′W, 19.vi.1985 (W. Maddison, MCZ); Tucson, 32°15′N, 110°57′W, 5.vii.1991 (W. H. Piel & G. S. Bodner, MCZ). *California:* Corn Springs, Chuckawalla Mtns., 10 mi SE Desert Center, 33°33′N, 115°24′W, 29.xi.1963 (D. C. Lorn, MCZ); Manzanita chaparral, San Gabriel Canyon, Coldbrook Ranger Station, 34°11′N, 117°53′W, 19.viii.1964 (L. Pinter, MCZ). *Texas:* Big Bend Nat'l Park, Old Ranch House on St. Elena Rd., 29°10′N, 103°30′W, 25.v.1967 (E. Sabath, MCZ).

27. *Metepeira atascadero* new species
Figures 214–221, 336; Map 14

Holotype. Male from San Miguel de Allende, Guanajuato, Mexico, 25.x.1982, George Uetz, in MCZ. The specific name is a noun in apposition after the Rancho Hotel Atascadero in San Miguel de Allende. This name was coined by George Uetz when he and his colleagues stayed in Rancho Hotel Atascadero while studying the behavioral ecology of this species. This name has been in informal use in the literature (e.g., Uetz and Hodge, 1990).

Description. Female paratype from San Miguel de Allende, Guanajuato, Mexico. Reddish brown carapace, white around eyes, faint light marks extend posteriorly behind lateral eyes (Fig. 220). Legs yellowish, ringed brown at distal ends of articles. Femur I with row of four macrosetae on anterior side; three on anteroventral side. Largest branches of fleur-delis pattern on dorsal folium form large paired white spots (Fig. 220). Venter of abdomen black with wide white median line, flanked by white U-shape mark (Fig. 221). Pair of small white spots on either side of spiracle. Sternum black with white posterior mark (Fig. 221). Ratio of eye diameters: posterior medians and anterior medians 1.0, anterior laterals 1.6, posterior laterals 1.3. Anterior median eyes separated by 1.4 diameters, posterior median eyes by 0.9, anterior median eyes separated from anterior laterals by 3.7 diameters of anterior lateral eyes, lateral eyes separated by 0.4 their diameters. Total length 7.5 mm. Carapace 3.1 mm long, 2.5 wide. First femur 4 mm, patella and tibia 4, metatarsus 3.9, tarsus 1.3. Second patella and tibia 3.3 mm, third 1.8, fourth 2.8.

Male holotype. Reddish brown carapace, lighter around eyes, faint light marks extend posteriorly behind lateral eyes and median eyes (Fig. 218). Legs yellowish white, each article gradually turning reddish brown distally. Femur I with row of four or five macrosetae on anterior side; eight or nine on anteroventral side. Largest branches of fleur-de-lis pattern on dorsal folium form large paired white spots (Fig. 218). Venter of abdomen black with wide white median line, flanked by faint white U-shape mark (Fig. 219). Pair of small white spots on either side of spiracle. Sternum black with white posterior mark (Fig. 219). Ratio of eye diameters: posterior medians and anterior medians 1.0, anterior laterals 1.7, posterior laterals 1.4. Anterior median eyes separated by 1.8 diameters, posterior median eyes by 1.0, anterior median eyes separated from anterior laterals by 3.6 diameters of anterior lateral eyes, lateral eyes separated by 0.5 their diameters. Total length 5 mm. Carapace 2.5 mm long, 1.8 wide. First femur 4 mm, patella and tibia 4.2, metatarsus 4.5, tarsus 1.4. Second patella and tibia 3.3 mm, third 1.7, fourth 2.5.

Diagnosis. The male embolus of *M. atascadero* has a protruding bump between the embolus tip and the basal embolic apophysis (Figs. 214, 217) which separates it from all other *Metepeira* species. As with *M. incrasssata* (Fig. 224) and, to a lesser degree, *M. triangularis* (Fig. 201), the epigynal depressions on either side of the scape of *M. atascadero* (Fig. 216) are sclerotized to create a scooped and slick quality. The darker epigynal openings inside the depressions are hidden anteriorly under the scape's hood. *Metepeira atascadero*'s epigynum differs from that of *M. incrassata* by its much smaller depressions (compare Fig. 216 with 224).

Variation. Average body length of 12 females examined 7.9 mm, range 6 to 9.5 mm. Average body length of 12 males examined 5.7 mm, range 3.5 to 6.9 mm.

Natural History. Mature specimens have been collected from the end of August to the end of October (Fig. 336). This species lives solitarily: only 20% of spiders live in aggregations of two or more individuals (Uetz and Hodge, 1990). It is thought that the low level of social behavior in *M. atascadero* occurs because the species pursues a risk-prone foraging strategy (Uetz, 1988a,b). Spiders are found between 1,500 and 2,500 m elevation.

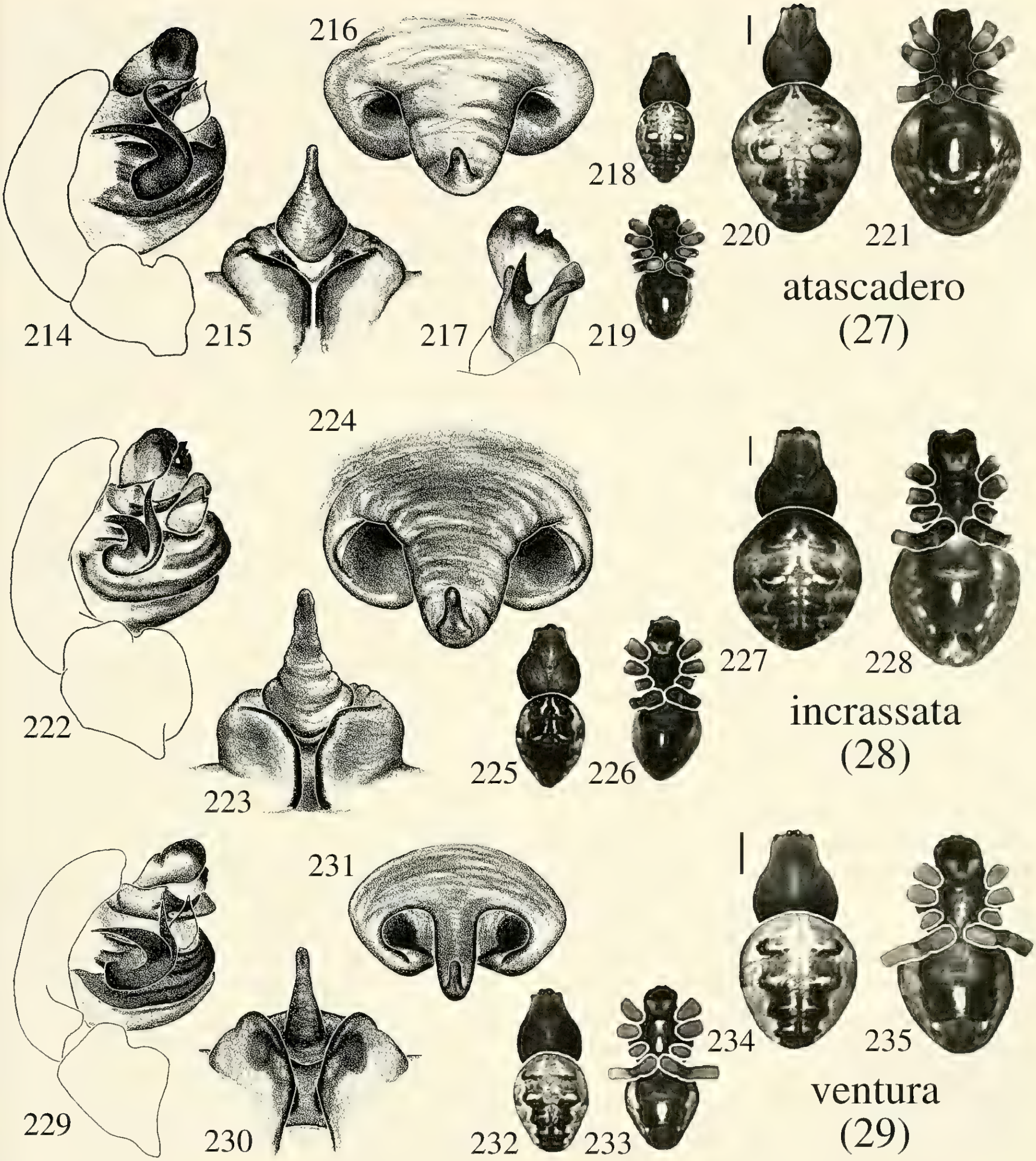
Distribution. Mexican highlands from Durango to Guerrero (Map 14).

Records Examined. MEXICO *Coahuila:* Saltillo, 14 mi E in Larrea Desert, 25°25′N, 100°55′W, 28.vii.1944 (AMNH). *Durango:* El Tascate, 26°12′N, 105°7′W, 27.vii.1947 (W. J. Gertsch, AMNH); Yerbanís, 80 mi NW Durango, 24°45′N, 103°50′W, 19.viii.1947 (W. J. Gertsch, AMNH). *Guanajuato:* 20 mi E. Guanajuato, 21°1′N, 100°57′W, 15.ix.1976 (C. E. Griswold & Jackson, CAS); Guanajuato, 21°1′N, 101°15′W (N. Banks, MCZ); San Miguel de Allende, 20°55′N, 100°45′W, 25.x.1982 (George Uetz, MCZ), 14.x.1983 (MCZ), 14.x.1985 (MCZ), 17.x.1985 (MCZ), 26.x.1985 (MCZ). *Guerrero:* Tecalpulco, 25 km N Iguala, 18°29′N, 99°38′W, 1.i.1948 (AMNH). *Hidalgo:* Ozumbilla, 20°9′N, 101°16′W, 2.x.1957 (R. Dreisbach, MCZ). *Jalisco:* Cyarco Onda, 30 km W Ojuelos, 21°47′N, 101°53′W (H. Wagner, AMNH). *Michoacan:* Hills N of Pátzcuaro, 19°45′N, 101°36′W, 24.viii.1959 (A. F. Archer, AMNH); Hwy 110, 4 mi W Jiquilpan, 19°59′N, 102°47′W, 2.viii.1967 (R. E. Leech, REL). *Zacatecas:* East of Guadalupe, 22°46′N, 102°31′W, 21.viii.1959 (A. F. Archer, AMNH); Guadalupe, 22°45′N, 102°31′W, 16.viii.1947 (W. J. Gertsch, AMNH).

28. *Metepeira incrassata* F. O. P.-Cambridge
Figures 222–228, 323; Map 9

Epeira Salèi Keyserling, 1864: 93, fig., ♂, ♀. Female holotype from Oaxaca, Mexico, in BMNH, examined. Keyserling, 1892: 196, fig. 145, ♀. Roewer, 1942: 851. NEW SYNONYMY.

Metepeira incrassata F. O. P.-Cambridge, 1904: 460, fig. 11, ♀. Female holotype from Jalapa, Mexico, in BMNH. Roewer, 1942: 868. Bonnet, 1957: 2821.



Figures 214–221. *Metepeira atascadero* new species (sp. 27; 20°55′N, 100°45′W). 214, male palpus, mesal. 215, epigynum, posterior. 216, epigynum, ventral. 217, male embolic division, ventral. 218, male, dorsal. 219, male, ventral. 220, female, dorsal. 221, female, ventral.

Figures 222–228. *Metepeira incrassata* F. O. P.-Cambridge (sp. 28 [222,225–228] 19°4′N, 97°2′W; [223,224] 18°54′N, 97°0′W). 222, male palpus, mesal. 223, epigynum, posterior. 224, epigynum, ventral. 225, male, dorsal. 226, male, ventral. 227, female, dorsal. 228, female, ventral.

Figures 229–235. *Metepeira ventura* Chamberlin and Ivie (sp. 29; 28°5′N, 114°8′W). 229, male palpus, mesal. 230, epigynum, posterior. 231, epigynum, ventral. 232, male, dorsal. 233, male, ventral. 234, female, dorsal. 235, female, ventral.

Scale bars: dorsum and venter figures 1.0 mm.

Aranea sallei:—F.O.P.-Cambridge, 1904: 519. Roewer, 1942: 851.
Araneus incrassata:—Petrunkevitch, 1911: 289.
Araneus sallei:—Petrunkevitch, 1911: 314.
Metepeira salei:—Levi, 1991: 180. Platnick, 1993: 449.

Note. Although *M. incrassata* is not the oldest name, it has been cited more than 20 times in the general literature (e.g., Caraco et al. 1995; Hieber and Uetz, 1990; Hodge and Uetz, 1992, 1995, 1996; Jakob et al., 1996; Rayor, 1996; Rayor and Uetz, 1990, 1993; Uetz, 1988a,b, 1989, 1991, 1992, 1996; Uetz and Hieber, 1994, 1997; Uetz and Hodge, 1990; Uetz et al., 1994). In contrast, the senior synonym has not been cited outside of taxonomic catalogues. In compliance with Article 79 of the ICZN (1985), I choose to assert the priority of the more popular junior name.

Description. Female from Rancho Chula-Vista, Veracruz, Mexico. Brown carapace, darker around margins, lighter around eyes and behind lateral eyes (Fig. 227). Legs brown, yellow at base of articles and on articles distal to the femur for legs I and II. Femur I with row of three to four macrosetae on anterior side; one on anteroventral side. Dorsal folium darker than most *Metepeira* species. White fleur-de-lis pattern with thin branches (Fig. 227). Venter dark brown to black with white median mark that is shorter than it is in most other species (Fig. 228). Sternum dark brown to black with one or two small white spots, usually in the center or anteriorly (Fig. 228). Ratio of eye diameters: posterior medians and anterior medians 0.9, anterior laterals 1.3, posterior laterals 1.1. Anterior median eyes separated by 1.5 diameters, posterior median eyes by 1.1, anterior median eyes separated from anterior laterals by 4.1 diameters of anterior lateral eyes, lateral eyes separated by 0.5 their diameters. Total length 7.8 mm. Carapace 3.6 mm long, 2.9 wide. First femur 3.9 mm, patella and tibia 4.1, metatarsus 3.5, tarsus 1.4. Second patella and tibia 3.7 mm, third 2.3, fourth 3.3.

Male from Rancho Chula-Vista, Veracruz, Mexico. Carapace, dorsum, venter, sternum a darker version of female (Figs. 225, 226). Base of femora yellow, remainder dark brown; other articles gradually turning lighter distally. Femur I with row of four to six macrosetae on anterior side; six to nine on anteroventral side. Ratio of eye diameters: posterior medians and anterior medians 1.0, anterior laterals 1.4, posterior laterals 1.2. Anterior median eyes separated by 1.4 diameters, posterior median eyes by 1.0, anterior median eyes separated from anterior laterals by 3.7 diameters of anterior lateral eyes, lateral eyes separated by 0.4 their diameters. Total length 7 mm. Carapace 3.3 mm long, 2.7 wide. First femur 4.9 mm, patella and tibia 5.3, metatarsus 4.8, tarsus 1.7. Second patella and tibia 4.3 mm, third 2.2, fourth 3.4.

Diagnosis. Overall pigmentation of *M. incrassata* is darker than all others in its species group. The thin branches on the dorsal folium (Figs. 225, 227), the almost entirely dark sternum, and the shortened median line on the venter (Figs. 226, 228) are distinctive. As with *M. olmec* (Fig. 178), *M. comanche* (Fig. 185), and *M. triangularis* (Fig. 199), the embolus of *M. incrassata* (Fig. 222) curves off sharply from a distal embolic apophysis that does not project forward. Compared to *M. olmec* (Fig. 178) and *M. comanche* (Fig. 185), *M. incrassata*'s embolus tip beyond the distal apophysis is relatively longer and not as curved (Fig. 222). Male *M. incrassata* are easily separated from *M. triangularis* by the shape of the median apophysis (compare Fig. 222 with Fig. 199). As with *M. atascadero* (Fig. 216) and, to a lesser degree, *M. triangularis* (Fig. 201), the epigynal depressions on either side of the scape of *M. incrassata* (Fig. 224) are sclerotized to create a scooped and slick quality. The darker epigynal openings inside the depressions are hidden anteriorly under the scape's hood. *Metepeira incrassata*'s epigynum differs from those of *M. atascadero* and *M. triangularis* by its much larger and disk-shaped depressions (compare Fig. 224 with Figs. 201, 216).

Variation. Average body length of 31 females examined 7.6 mm, range 6.4 to 9.1

mm. Average body length of 22 males examined 6.2 mm, range 4.3 to 8 mm.

Natural History. Mature specimens have been collected in February through October but are most frequently found in July (Fig. 323). This species lives socially: half of all spiders live in aggregations of 1,000 or more individuals (Uetz and Hodge, 1990). Colonies are frequently found spanning telephone lines, houses, fences, and other man-made structures. It is thought that this high level of social behavior occurs because the species pursues a risk-averse foraging strategy in which the variance in survival attenuates with increasing colony size (Uetz, 1988a,b). Elevations center around 800 m and range from about 500 to 1,500 m.

Distribution. Tropical Mexico from San Luis Potosí to southern Veracruz and Oaxaca (Map 9).

Records Examined. MEXICO *Hidalgo:* 20 mi S of Jacala, 20°50′N, 99°16′W, 18.iv.1946 (L. I. Davis & M. Johnston, AMNH); Chapulhuacan, 21°10′N, 98°54′W, 20.v.1952 (M. Cazier, W. Gertsch, & R. Schrammel, AMNH), 27.vii.1966 (Jean & Wilton Ivie, AMNH), 16.vii.1969 (S. & J. Peck, MCZ). *México:* 1 mi S Palomas, 19°50′N, 99°5′W, 28.vii.1950 (AMNH). *Oaxaca:* Oaxaca, 17°3′N, 96°43′W (Nathan Banks, MCZ). *Puebla:* Huauchinango, 20°11′N, 98°3′W, 7.x.1947 (H. Wagner, AMNH); north of Xicotepec de Juárez, 20°18′N, 97°57′W, 19.iv.1967 (W. B. Peck, MCZ). *San Luis Potosí:* 10km W Xilitla on r120, 21°22′N, 99°4′W, 10.viii.1991 (W. H. Piel & G. S. Bodner, MCZ). *Veracruz:* 1 mi SW Tlapacoyan, 19°57′N, 97°14′W, 16.vii.1973 (A. Newton, MCZ); 2 mi N Fortín de las Flores, 18°56′N, 97°1′W, 5.viii.1966 (Jean & Wilton Ivie, AMNH); 5 mi E Orizaba, 18°51′N, 97°4′W, 25.vii.1956 (W. Gertsch & V. Roth, AMNH); Coatepec, 19°27′N, 96°58′W, 28.vii.1955 (C. & P. Vaurie, AMNH), 19.vii.1991 (W. H. Piel & G. S. Bodner, MCZ); Fortín de las Flores, 18°54′N, 97°0′W, 7.vii.1947 (G. & M. Goodnight, AMNH), 25.iv.1963 (W. J. Gertsch & W. Ivie, AMNH), 10.vii.1976 (A. Newton, MCZ), 21.x.1982 (George Uetz, MCZ), 17.vii.1991 (W. H. Piel & G. S. Bodner, MCZ); Jalapa, 19°32′N, 96°55′W, 14.ii.1948 (H. Wagner, AMNH), 15.iii.1948 (H. Wagner, AMNH), 15.x.1962 (N. L. H. Krauss, AMNH); Los Naranjos, 18°21′N, 96°10′W, 4.iii.1948 (H. Wagner, AMNH); near Monte Blanco, 18°58′N, 97°1′W, 3.viii.1973 (A. Newton, MCZ); Orizaba, 18°51′N, 97°4′W, 6.vii.1963 (D. Bixler, MCZ); Rancho Chula-Vista, N of Córdoba, 19°4′N, 97°2′W, 18.vii.1991 (W. H. Piel & G. S. Bodner, MCZ).

Metepeira ventura Group

Spiders in the *M. ventura* group (*Metepeira ventura, Metepeira revillagigedo, Metepeira celestun, Metepeira uncata, Metepeira crassipes, Metepeira chilapae*) are closely related to those in the *M. minima* group (*M. petatlan, M. minima, M. pacifica, M. jamaicensis*). Females in the *M. ventura* group have epigynal openings that are wider than long and shaped as triangles (Fig. 231), ovals (Fig. 252), or squares (Figs. 259, 266), with their posterior edges open. The posterior edges are observed to be open because the posterior lobes at their distal edge are wider than the distal end of the scape. In many other species, the gap between the lobes is narrower than the scape and therefore hidden from a ventral view, giving the impression that the openings form closed shapes (e.g., Fig. 123). In addition, with the exception of *M. celestun* (Fig. 245), the scape is relatively thin throughout its entire length (Figs. 231, 238, 252, 259, 266). In males, the embolus can be slim and elongated with a gentle curve (e.g., Figs. 236, 243), or as with some species in the *M. minima* group, it can be tapering to a sharp bend right at the tip (e.g., Figs. 229, 264). In general, the larger flagellum is a simple tapering extension off the base (Figs. 229, 243, 250, 257, 264, and to a lesser extent, Fig. 236), as opposed to being a distinctly separate structure that abruptly curves off the base (e.g., Fig. 129). Although the flagellae can be thin, as in the *M. minima* species group, they are not set off on a distinctly narrower stalk (e.g., compare Fig. 264 with Fig. 278).

29. *Metepeira ventura* Chamberlin and Ivie
Figures 229–235, 320; Map 13

Metepeira ensenada Chamberlin and Ivie, 1942: 65, figs. 166–168, ♂. Male holotype from beach near Ensenada, Mexico, in the AMNH, examined. Synonymized by Levi (1977).

Metepeira ventura Chamberlin and Ivie, 1942: 67, figs. 175–179, ♀. Female holotype, 1 male and 3 female paratypes from between Oxnard and Santa Monica, California, USA, in the AMNH, examined.

Levi, 1977: 204, figs. 53–60. Brignoli, 1983: 275.

Note. As first reviser, Levi (1977) preferred to use the name *M. ventura* because a larger number of specimens were available from the type locality.

Description. Female from 10 mi north of Colonia Guerrero, Baja California Norte, Mexico. Carapace brown with white eye region, lateral posterior extensions, and white median line (Fig. 234). Legs yellowish tan with darker rings on fourth pair of legs. Femur I with row of four macrosetae on anterior side; two on anteroventral side. Dorsum of abdomen with usual *Metepeira* folium, lighter in anterior third (Fig. 234). Venter of abdomen with wide white median line posteriorly set within hint of surrounding U-shaped marking. Pair of white spots on either side of spiracle (Fig. 235). Sternum has wide median white line widening anteriorly, sometimes fragmented (Fig. 235). Ratio of eye diameters: posterior medians and anterior medians 1.0, anterior laterals 1.6, posterior laterals 1.4. Anterior median eyes separated by 1.4 diameters, posterior median eyes by 0.7, anterior median eyes separated from anterior laterals by 2.9 diameters of anterior lateral eyes, lateral eyes separated by 0.3 their diameters. Total length 5.5 mm. Carapace 2.8 mm long, 2.2 wide. First femur 3.3 mm, patella and tibia 3.3, metatarsus 3, tarsus 1.2. Second patella and tibia 2.9 mm, third 1.7, fourth 2.5.

Male from 10 mi north of Colonia Guerrero, Baja California Norte, Mexico. Carapace, abdomen, venter as in female (Figs. 232, 233). Ringed legs darker than in female. Femur I with row of four macrosetae on anterior side; six to seven on anteroventral side. Median white line on sternum often broken (Fig. 233). Ratio of eye diameters: posterior medians and anterior medians 0.9, anterior laterals 1.2, posterior laterals 1.1. Anterior median eyes separated by 1.6 diameters, posterior median eyes by 0.8, anterior median eyes separated from anterior laterals by 1.9 diameters of anterior lateral eyes, lateral eyes separated by 0.3 their diameters. Total length 4.3 mm. Carapace 2.2 mm long, 1.7 wide. First femur 3.6 mm, patella and tibia 3.6, metatarsus 3.7, tarsus 1.3. Second patella and tibia 2.8 mm, third 1.5, fourth 2.3.

Diagnosis. Unlike other members of the *M. minima* species group, the larger flagellum on the median apophysis of *M. ventura* is a tapering extension off the base (Fig. 229), as opposed to arising from a distinctly separate stalk (Fig. 286). Like *M. uncata*, the epigynal openings of *M. ventura* (Fig. 231) are somewhat triangular in shape, in contrast to oval (Fig. 288) or slit-shaped (Fig. 280) as in other members of the *M. minima* species group. The relatively shorter scape and the dark circles inside the epigynal openings of *M. ventura* (Fig. 231) contrast with *M. uncata*'s relatively longer scape and the dark sinuous shapes inside the epigynal openings (Fig. 252).

Variation. Average body length of eight females examined 6.7 mm, range 5.6 to 9.7 mm. Average body length of seven males examined 5.1 mm, range 3.9 to 7 mm.

Natural History. Mature specimens are mostly collected April through September (Fig. 320). Altitudes range from near sea level to 1,000 m.

Distribution. California to northwestern Mexico (Levi, 1977, map 1; Map 13).

Records Examined. MEXICO *Baja Calif. Norte:* 10 m E El Rosario, 30°11′N, 115°46′W, 8.vii.1973 (S. C. Williams & K. B. Blair, CAS); 10 mi N Col. Guerrero, 28°5′N, 114°8′W, 1.ix.1957 (V. Roth, AMNH); 2 mi SE Eréndira, 31°19′N, 116°19′W, 12.v.1973 (S. C. Williams & K. B. Blair, CAS); Isla Cedros, Gran Cañon, 28°12′N, 115°15′W, 10.iii.1945 (B. F. Osorio Tafall, AMNH); Isla de Cedros, Cerro de Cedros, 28°12′N, 115°15′W, 1.vii.1983 (V. F. Lee, CAS); Isla de Cedros, Punta Norte [?], 28°22′N, 115°14′W, 3.vii.1983 (V. F. Lee, CAS); Isla de Cedros, trail to Cerro de Cedros, at spring, 28°12′N, 115°15′W, 27.ix.1984 (D. B. Weissman, V. F. Lee, CAS); Islas San Benito, Benitos del Oeste, 28°18′N, 115°35′W, 4.vii.1983 (D. C. Lightfoot & V. F. Lee, CAS); Islas San Benito, Middle Island, 28°19′N, 115°34′W, 9.iv.1981 (Stanley C. Williams, CAS); Islas San Benito, South Island, 28°18′N, 115°35′W, 9.iv.1981 (Stanley C. Williams, CAS); near Consuelo, 6 mi NW El Rosario, 30°11′N, 115°46′W, 18.iv.1965 (D. Q. Cavagnaro, C. E. & E. S. Ross, V. L. Vesterby, CAS); Rancho Las Parritas, 10 mi S San Quintin, 30°20′N, 115°57′W, 27.vi.1977 (C. E. Griswold, CAS); Santo Tomás, 31°33′N, 116°24′W, 8.vii.1953 (W. J. & J. W. Gertsch, AMNH). *Baja Calif. Sur:* Bahia de los Muertos, 23°58′N, 109°50′W, 20.xii.1958 (H. B. Leech, CAS); Desierto del Vizcaino, Laguna Ojo de Liebre, sobre frutilla, 27°43′N, 114°15′W, 11.xi.1981 (A. Cota & M. Jiménez, MLJ); E edge of Sierra Placeres, 27°35′N, 114°30′W, 25.iii.1984 (W. J. Pulawski, CAS). *Sonora:* 6 mi E Navojoa, 27°6′N, 109°23′W, 23.viii.1965 (W. J. Gertsch & R. Hastings, AMNH). USA *California:* 1 mi NW Winchester (Double Butte), 33°43′N, 117°6′W, 7.xii.1976 (W. Icenogle, MCZ); Lompoc, by US 63, 34°38′N, 120°27′W, 17.viii.1966 (L. & P. Pinter, MCZ); Lucia, Monterey Co., 36°1′N, 121°33′W, 15.ix.1964 (L. Pinter, MCZ); Manzanita chaparral, San Gabriel Canyon, Coldbrook Ranger Station, 34°11′N, 117°53′W, 29.v.1965 (L. Pinter, MCZ); Santa Catalina Island Area near Haypress Res, 33°23′N, 118°25′W, 6.ii.1993 (Martin G. Ramirez & Laura B. Fandino, MCZ); Santa Catalina Island, Mt. Torquemada, 33°26′N, 118°33′W, 15.viii.1965 (L. Pinter, MCZ); Winchester, 33°42′N, 117°5′W, 11.v.1970 (W. Icenogle, MCZ); Winchester, Double Butte, 33°42′N, 117°5′W, 19.v.1974 (W. Icenogle, MCZ). *Nevada:* Quin River Crossing, 41°35′N, 118°27′W, 21.vi.1975 (G. F. Knowlton, MCZ).

30. *Metepeira revillagigedo* new species
Figures 236–242, 301; Map 12

Holotype. Female from south of Isla Socorro, Archipiélago de Revillagigedo, State of Colima, Mexico, 15.xii.1988, M. Jiménez, in MCZ. The specific name is a noun in apposition after the locality.

Description. Female holotype. Carapace dark brown with light region in median eye quadrangle and surrounding lateral eyes. Pair of darker, elliptic, walnut leaf shapes on lighter patch near center of carapace (see Fig. 241). Darker rings on distal ends of femora, patellae, tibiae, and proximal dorsal portion of tibia I, II. Femur I with three to four macrosetae on anterior side; none on the anteroventral side. Dorsum of abdomen with white oak leaf folium, margined with dark markings, particularly on trailing edges of lobes (Fig. 241). Coloration has a slightly golden hue. Dark lateral band wraps around sides of abdomen and stretches up over anterior dorsal portion. Venter with two white spots on either side of spiracle. Anterior to spiracle, slight indication of a V-shaped mark with longitudinal extensions reaching halfway up abdomen. Wide, white medial longitudinal line to epigynal groove (Fig. 242). Sternum with wide, white longitudinal mark widening anteriorly (Fig. 242). Ratio of eye diameters: posterior medians and anterior medians 0.8, anterior laterals 1.1, posterior laterals 1. Anterior median eyes separated by 1.3 diameters, posterior median eyes by 1.0, anterior median eyes separated from anterior laterals by 2.5 diameters of anterior lateral eyes, lateral eyes separated by 0.3 their diameters. Total length 7.5 mm. Carapace 3.2 mm long, 2.5 wide. First femur 3.5 mm, patella and tibia 3.8, metatarsus 3.2, tarsus 1.2. Second patella and tibia 3.2 mm, third 1.8, fourth 2.8.

Male paratype from Isla Socorro, Colima. Carapace dirty yellowish brown with lighter posteriorly pointing acute triangle in center (Fig. 239). Legs same color as carapace, except lighter on proximal half of femora. Femur I with row of four macrosetae on anterior side, row of two macrosetae on anteroventral side. Male abdomen lighter and with less contrast than female (Fig. 239). Venter with a much reduced and shorter longitudinal line than female. Sternum as in female, except longitudinal line more often broken (Fig. 240). Ratio of eye diameters: posterior medians and anterior medians 1.0, anterior laterals 1.1, posterior laterals 1.1. Anterior median eyes separated by 1.5 diameters, posterior median eyes by 0.8, anterior median eyes separated from anterior laterals by 1.4 diameters of anterior lateral eyes, lateral eyes separated by 0.3 their diameters. Total length 3.2 mm. Carapace 1.7 mm long, 1.1 wide. First femur 2.5 mm, patella and tibia 2.5, metatarsus 2.3, tarsus 0.9. Second patella and tibia 2 mm, third 1.0, fourth 1.5.

Diagnosis. The epigynum of *M. revillagigedo* looks very different from those of other species in the *M. ventura* group. Instead of having small, sharply delineated depressions on either side of the scape (e.g., Fig. 259), *M. revillagigedo* has larger but more gradual depressions (Fig. 238). Despite the unique appearance of the epigynum, the affinity between *M. revillagigedo* and the *M. ventura* species group can be seen in the black comma-shaped marks inside the epigynal depressions (Fig. 238) similar to those in, for example, *M. ventura* (Fig. 231). The male emboli of *M. revillagigedo* (Fig. 236) and *M. celestun* (Fig. 243) are very similar in shape and relatively longer than in other species in the *M. ventura* group. Males of *M. revillagigedo* differ from males of *M. celestun* by the thickness and shape of the median apophysis (compare Fig. 236 with Fig. 243).

Natural History. Specimens have only twice been collected: once in December and once in April (Fig. 301). This species is known to live in fig trees.

Distribution. This species is found on Isla Socorro in the Pacific Ocean (Map 12), the island being one of several that form the Archipiélago de Revillagigedo. It is well isolated, situated about 465 km south of Baja California Sur and 588 km west of the Jalisco coastline.

Records Examined. MEXICO *Colima:* Archipiélago de Revillagigedo: Isla Socorro, 18°45′N, 110°57′W, 26.iv.1932 (Templeton, Crocker Exped., CAS); Archipiélago de Revillagigedo: Sur de la Isla Socorro, 18°44′N, 110°57′W, 15.xii.1988 (M. Jiménez, MCZ).

31. *Metepeira celestun* new species
Figures 243–249, 326; Map 13

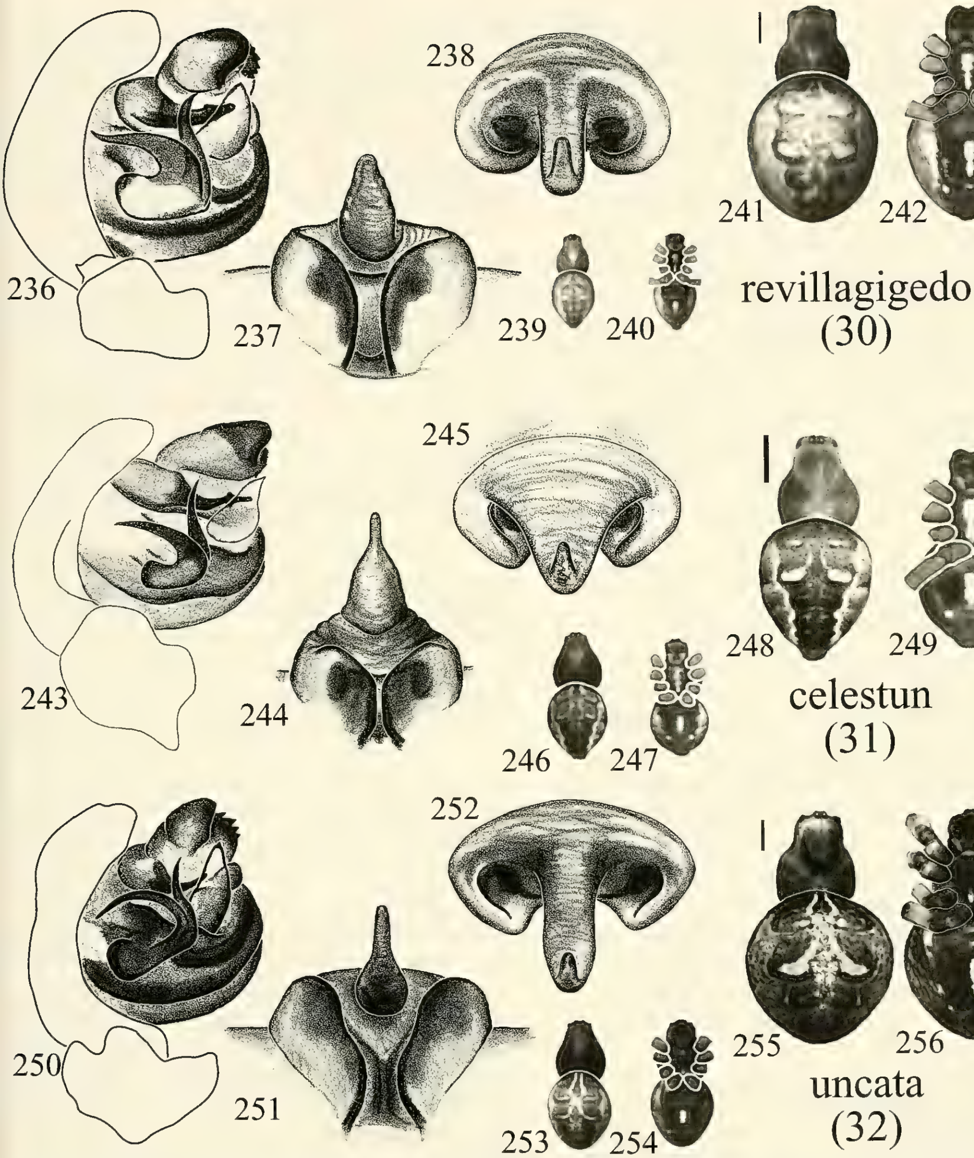
Holotype. Male from Celestun, Yucatan, Mexico, 24.vii.1991, W. H. Piel & G. S. Bodner, in MCZ. The specific name is a noun in apposition after the locality.

Note. Since males of this species were never found with females, one cannot be sure absolutely that they are conspecific. Several facts argue for conspecificity: all specimens were collected in similar habitats and during the same season; dorsal folium of males and females share similar patterns and both have hint of gold coloration; based on parallel correspondence with other species, the male palp is arguably compatible with the female's epigynum.

Description. Female paratype from Edzna, Campeche, Mexico. Carapace yellowish tan with lighter area around eyes (Fig. 248). Legs yellowish tan with darker rings on fourth pair of legs. Femur I with row of four macrosetae on anterior side; sometimes four on anteroventral side. Dorsal folium as in other *Metepeira*, except speckled an unusual reddish gold color (Fig. 248). Venter wide white median line with pair of large white spots on either side of spiracle (Fig. 249). Sternum has wide median white line widening anteriorly with constriction in center (Fig. 249). Ratio of eye diameters: posterior medians and anterior medians 1.0, anterior laterals 1.3, posterior laterals 1.2. Anterior median eyes separated by 1.5 diameters, posterior median eyes by 0.9, anterior median eyes separated from anterior laterals by 2.4 diameters of anterior lateral eyes, lateral eyes separated by 0.2 their diameters. Total length 5.2 mm. Carapace 2.5 mm long, 1.9 wide. First femur 2.6 mm, patella and tibia 2.8, metatarsus 2.2, tarsus 0.9. Second patella and tibia 2.4 mm, third 1.4, fourth 2.

Male holotype. Carapace dark with light region around eyes and a light triangular mark anterior to thoracic furrow (Fig. 246). Coxae and proximal third of femora white, remaining two-thirds black; other articles similarly ringed. Femur I with row of four macrosetae on anterior side; three on anteroventral side. Dorsal folium with slight gold iridescence. Fleur-de-lis pattern leafy and pinnate (Fig. 246). Venter, sternum as in female, except median white line on sternum often broken (Fig. 247). Ratio of eye diameters: posterior medians and anterior medians 1.1, anterior laterals 1.4, posterior laterals 1.3. Anterior median eyes separated by 1.6 diameters, posterior median eyes by 0.9, anterior median eyes separated from anterior laterals by 1.4 diameters of anterior lateral eyes, lateral eyes separated by 0.2 their diameters. Total length 2.8 mm. Carapace 1.4 mm long, 1.1 wide. First femur 1.8 mm, patella and tibia 1.8, metatarsus 1.4, tarsus 0.8. Second patella and tibia 1.5 mm, third 0.8, fourth 1.2.

Diagnosis. The overall coloration of *M. celestun* in alcohol has an unusually golden quality that is rare among preserved *Me-*



Figures 236–242. *Metepeira revillagigedo* new species (sp. 30; 18°44′N, 110°57′W). 236, male palpus, mesal. 237, epigynum, posterior. 238, epigynum, ventral. 239, male, dorsal. 240, male, ventral. 241, female, dorsal. 242, female, ventral.
Figures 243–249. *Metepeira celestun* new species (sp. 31 [243,246,247] 20°56′N, 90°21′W; [244,245,248,249] 19°35′N, 90°15′W). 243, male palpus, mesal. 244, epigynum, posterior. 245, epigynum, ventral. 246, male, dorsal. 247, male, ventral. 248, female, dorsal. 249, female, ventral.
Figures 250–256. *Metepeira uncata* F. O. P.-Cambridge (sp. 32 [250,251,253–256] 14°40′N, 92°9′W; [252] 14°49′N, 91°31′W), 250, male palpus, mesal. 251, epigynum, posterior. 252, epigynum, ventral. 253, male, dorsal. 254, male, ventral. 255, female, dorsal. 256, female, ventral.
Scale bars: dorsum and venter figures 1.0 mm.

tepeira. Unlike all other members of the *M. ventura* species group, the scape of *M. celestun* is very wide at its base, thereby partly concealing the epigynal openings (Fig. 245). However, if the scape is discarded, the exposed openings have black comma-shaped marks similar to those of *M. ventura* (Fig. 231), thereby confirming the species' affinities with other members in the *M. ventura* species group. Unlike other members, the posterior lobes nearly touch each other near their base (Fig. 244). The emboli of *M. celestun* and *M. revillagigedo* are very similar in shape and relatively longer than in other species in the *M. ventura* group (Fig. 243). *Metepeira celestun* differs from *M. revillagigedo* by the thickness and shape of the median apophysis (compare Fig. 243 with Fig. 236).

Variation. Average body length of four females examined 5.6 mm, range 5.2 to 6.4 mm. Average body length of three males examined 2.7 mm, range 2.2 to 2.9 mm. Female scape sometimes wider than it appears in Fig. 245, resembling *Metepeira arizonica.* Legs and carapace color vary from yellowish tan to orange-red.

Natural History. Mature specimens have been collected in July (Fig. 326) in forested clearings, roadside bushes, palms, and swampy areas near the beach.

Distribution. Yucatan peninsula (Map 13).

Records Examined. MEXICO *Campeche:* Edzna, 19°35′N, 90°15′W, 22.vii.1991 (W. H. Piel & G. S. Bodner, MCZ). *Quintana Roo:* Kohunlich ruins, 9 km S Francisco Villa, 18°26′N, 88°48′W, 15.vii.1983 (R. S. Anderson, MCZ). *Yucatan:* 3km S San Felipe, 21°32′N, 88°14′W, 25.vii.1991 (W. H. Piel & G. S. Bodner, MCZ); 4 km N Xocenpich, 12 km N Piste, on road to Dzitas, 20°47′N, 88°34′W, 20.vii.1983 (W. Maddison, MCZ); Balankanche Cave, 2 km E Chichen Itza, 20°40′N, 88°33′W, 19.vii.1983 (W. Maddison, MCZ); beach north of Celestún, 20°56′N, 90°21′W, 24.vii.1991 (W. H. Piel & G. S. Bodner, MCZ); Chichen Itza ruins on HWY 180, seasonal forest, 20°40′N, 88°34′W, 19.vii.1983 (W. Maddison & R. S. Anderson, MCZ); Uxmal, 20°22′N, 89°46′W, 23.vii.1991 (W. H. Piel & G. S. Bodner, MCZ).

32. *Metepeira uncata* F. O. P.-Cambridge
Figures 250–256, 329; Map 12

Metepeira uncata F. O. P.-Cambridge, 1903: 459, fig. 8, ♂. Male holotype from Santa Ana, Guatemala, in BMNH. Roewer, 1942: 868. Bonnet, 1957: 2823.
Araneus uncatus:—Petrunkevitch, 1911: 321.

Description. Female from Ayutla, San Marcos, Guatemala. Carapace dark brown with light region surrounding the eyes and extending posteriorly behind the lateral eyes. Pair of darker feather-shaped patches anterior of thoracic furrow, touching posteriorly to create a U-shape (see Fig. 255). Dark rings on distal half of leg articles, anterior side of patellae, and dark markings on dorsal, proximal end of tibia I and II. Femur I with four macrosetae on anterior side; one on anteroventral side. Dorsum of abdomen with white fleur-de-lis folium; this pattern thinner than in most other species. Fleur-de-lis pattern on a dark background, outlined on either side by thin white stripe (Fig. 255). Dark lateral band follows sides of abdomen and stretches up over anterior dorsal portion. Venter with two white spots on each side of spiracle; wide, white, medial longitudinal line starts anterior to the colulus and ends posterior to the epigynal groove. Thin, faint lines run parallel to wide median one anterior to white spots. White patch separates epigynum and dark depression posterior to pedicel (Fig. 256). Sternum black with white dewdrop-shaped mark at posterior end (Fig. 256). Ratio of eye diameters: posterior medians and anterior medians 1.0, anterior laterals 1.3, posterior laterals 1.2. Anterior median eyes separated by 1.6 diameters, posterior median eyes by 1.1, anterior median eyes separated from anterior laterals by 4 diameters of anterior lateral eyes, lateral eyes separated by 0.4 their diameters. Total length 7.8 mm. Carapace 3.7 mm long, 2.9 wide. First femur 4 mm, patella and tibia 4.3, metatarsus 3.8, tarsus 1.4. Second patella and tibia 3.6 mm, third 2.3, fourth 3.2.

Male from Ayutla, San Marcos, Guatemala. Carapace dirty yellowish brown with lighter mark in center (Fig. 253). Same color as carapace except lighter on proximal half of femora. Femur I with row of nine macrosetae on anterior side; five on anteroventral side. Male abdomen similar to female, but leaves of fleur-de-lis pattern thinner (Fig. 253). Venter with a shorter longitudinal line, as compared with female (Fig. 254). Sternum with posterior white dewdrop as in female, and additional anterior white mark near labium (Fig. 254). Ratio of eye diameters: posterior medians and anterior medians 0.9, anterior laterals 1.3, posterior laterals 1.3. Anterior median eyes separated by 1.5 diameters, posterior median eyes by 1.0, anterior median eyes separated from anterior laterals by 2 diameters of anterior lateral eyes, lateral eyes separated by 0.3 their diameters. Total length 4.5 mm. Carapace 2.3 mm long, 1.8 wide. First femur 3.4 mm, patella and tibia 3.4, metatarsus 3.2, tarsus 1.1. Second patella and tibia 2.7 mm, third 1.4, fourth 2.

Diagnosis. The generally darker pigmentation (Fig. 255) and the small white mark on the sternum (Fig. 256) separate *M. uncata* from all other members of the *M. ventura* species group. Like *M. ventura* (Fig. 231) but unlike other members of the *M. ventura* species group, the openings to the epigynum are more triangular to oval (Fig. 252), rather than square (Figs. 259, 266). Also distinctive are the sinuous black lines that form upside-down U-shapes inside each epigynal opening (Fig. 252), in contrast to the comma-shaped marks in *M. ventura* or *M. chilapae* (Figs. 231, 266). Like *M. chilapae* but unlike other members of the *M. ventura* group, the median apophysis and flagellae of *M. uncata* are slimmer and of uniform thickness (Figs. 250, 264). The palp of *M. uncata* differs from that of *M. chilapae* by the more basal position of the bend in the embolus tip (compare Fig. 250 with Fig. 264).

Variation. Average body length of five females examined 8.2 mm, range 7.5 to 8.8 mm. Average body length of four males examined 5.6 mm, range 4.5 to 6.4 mm.

Natural History. Mature specimens have been collected in August (Fig. 329).

Distribution. Southwestern Guatemala to northern Costa Rica (Map 12) at altitudes ranging from 100 to 3,000 m.

Records Examined. COSTA RICA *Cordillera:* 20 km N Siquires, 10°9′N, 84°17′W, 15.viii.1980 (W. Eberhard, MCZ). GUATEMALA *El Quiche:* Chichicastenango, 14°56′N, 91°7′W, 6.viii.1947 (C. & P. Vaurie, AMNH). *Huehuetenango:* Todos Santos Cuchumatán, 15°31′N, 91°37′W, 16.viii.1979 (C. E. Griswold, CAS). *Quetzaltenango:* El Baul, 1 km S Quetzaltenango, 14°49′N, 91°31′W, 14.viii.1979 (T. C. Meikle & C. E. Griswold, CAS); Quetzaltenango, 14°50′N, 91°31′W, 16.viii.1950 (C. J. & M. Goodnight, AMNH). *San Marcos:* Ayutla, 14°40′N, 92°9′W, 19.viii.1947 (AMNH).

33. *Metepeira crassipes* Chamberlin and Ivie

Figures 257–263, 309; Map 12

Metepeira josepha Chamberlin and Ivie, 1942: 64, fig. 165, ♀. Female holotype from Kings Mtn. near Palo Alto, California in the AMNH. Synonymized by Levi (1977).

Metepeira crassipes Chamberlin and Ivie, 1942: 66, figs. 171–173, ♀, ♂. Male holotype, female, male paratypes from Laguna Beach, California in the AMNH. Levi, 1977: 202, figs. 47–52, ♀, ♂.

Note. As first reviser, Levi (1977) preferred to use name *M. crassipes*.

Description. Female from Isla San Pedro Nolasco, Sonora, Mexico. Carapace with large white eye region and lateral posterior extensions (Fig. 262). Legs ringed at distal ends of articles—though sometimes only lightly. Femur I with four macrosetae on anterior side aligned in straight row; one to four light setae on anteroventral side. Dorsum of abdomen with usual *Metepeira* folium (Fig. 262); venter wide, with long white median line set within U-shaped thinner white lines. Pair of white spots on either side of spiracle (Fig. 263). Sternum black with wide median white line widening anteriorly (Fig. 263). Ratio of eye diameters: posterior medians and anterior medians 1.1, anterior laterals 1.4, posterior laterals 1.3. Anterior median eyes separated by 1.4 diameters, posterior median eyes by 0.8, anterior median eyes separated from anterior laterals by 3 diameters of anterior lateral eyes, lateral eyes separated by 0.1 their diameters. Total length 5.7 mm. Carapace 2.8 mm long, 2.1 wide. First femur 3.2 mm, patella and tibia 3.1, metatarsus 2.8, tarsus 1. Second patella and tibia 2.7 mm, third 1.6, fourth 2.5.

Male from Winchester, California. Carapace as in female except often with median white mark. Femur I with row of four macrosetae on anterior side; about four to eight on anteroventral side. Dorsum, venter as in female (Fig. 260); median white line on sternum more often broken (Fig. 261). Ratio of eye diameters: posterior medians and anterior medians 1.0, anterior laterals 1.6, posterior laterals 1.4. Anterior median eyes separated by 1.2 diameters, posterior median eyes by 0.6, anterior median eyes separated from anterior laterals by 2 diameters of anterior lateral eyes, lateral eyes separated by 0.3 their diameters. Total length 4 mm. Carapace 2.1 mm long, 1.5 wide. First femur 3.2 mm, patella and tibia 3.2, metatarsus 3.2, tarsus 1.1. Second patella and tibia 2.5 mm, third 1.3, fourth 2.

Diagnosis. Unlike other species in the *M. ventura* species group, the openings to the epigynum of *M. crassipes* resemble those of *M. chilapae* because they are shaped like squares with rounded edges (compare Fig. 259 with Fig. 266). However, compared to *M. chilapae*, the epigynal openings of *M. crassipes* are relatively smaller and the scape is relatively longer. The embolus of *M. crassipes* is distinguished by its gentle curvature (Fig. 257), in contrast to much more abrupt curvature seen in other species in the *M. ventura* group (e.g., Fig. 264), with the exception of *M. revillagigedo*. The median apophysis of *M. crassipes* (Fig. 257) is slimmer than that of *M. revillagigedo* (Fig. 236).

Variation. Average body length of four females examined 6 mm, range 5 to 6.5 mm. Average body length of two males examined 4.4 mm, range 4.1 to 4.7 mm. Sometimes the scape is greatly swollen, adding to its relative width. In such cases the scape can cover the epigynal openings, which may mislead the investigator to confuse it for *Metepeira arizonica*.

Natural History. Levi (1977) reports that males in the U.S. have been collected from April to October, primarily in California buckwheat and sage. Mexican records expand this seasonality to include the entire year (Fig. 309).

Distribution. From northern California in the U.S. to Baja California Sur, Mexico (Levi, 1977, map 1; Map 12).

Records Examined. MEXICO *Baja Calif. Norte:* Santo Tomás, 31°33′N, 116°24′W, 8.vii.1953 (W. J. & J. W. Gertsch, AMNH), 12.xi.1976 (S. C. Williams & K. B. Blair, CAS). *Baja Calif. Sur:* 26 mi S Loreto, 25°37′N, 111°17′W, 1.i.1977 (C. E. Griswold & L. Vincent, CAS); Isla Magdalena, Puerto Magdalena, 24°38′N, 112°9′W, 16.iii.1957 (R. Zweifel, AMNH); Isla San Francisco, South Side, 24°50′N, 110°35′W, 19.v.1970 (S. C. Williams & V. F. Lee, CAS); Sierra San Nicolas, 26°32′N, 111°36′W [?] (Eisen & Vaslit, MCZ). *Sonora:* Isla San Pedro Nolasco, 27°58′N, 111°25′W, 17.iv.1921 (G. C. Chamberlin, MCZ); Sierra de Alamos, 30°51′N, 112°2′W [?], 19.i.1968 (V. Roth, AMNH). USA *California:* 1 mi NW Winchester (Double Butte), in web between *Artemisia californica* bushes, 33°43′N, 117°6′W, 4.xii.1976 (W. Icenogle, MCZ).

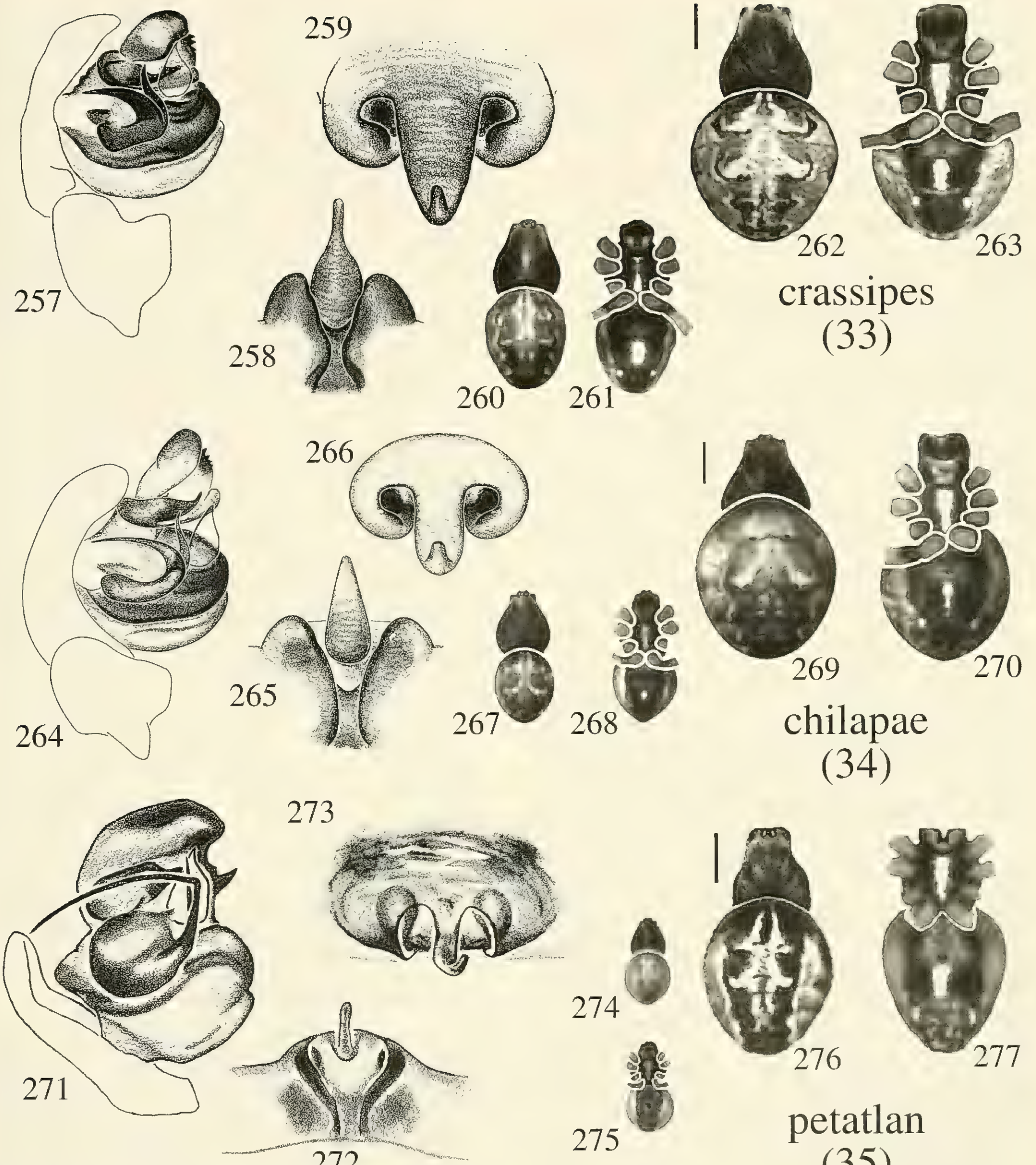
34. *Metepeira chilapae* Chamberlin and Ivie
Figures 264–270, 333; Map 13

Metepeira chilapae Chamberlin and Ivie, 1936: 45, figs. 119–121, ♂. Male holotype from Chilapa, Guerrero, Mexico, in the ZMB. Roewer, 1942: 868.

Metepeira chilapica:—Bonnet, 1957: 2820. Unjustified emendation.

Note. Examination of Chamberlin and Ivie's (1936) and Levi's (personal illustrations) figures of the holotype was sufficient to identify *M. chilapae* accurately.

Description. Female from Cocoyoc, Morelos, Mexico. Brownish black carapace, paler around and just posterior to lateral eyes (Fig. 269). Distal halves of ventral leg articles black, elsewhere yellowish. Femur I with row of four macrosetae on anterior side; zero to three setae on anteroventral side. Dorsal folium a white fleur-de-lis marking set on golden-



Figures 257–263. *Metepeira crassipes* Chamberlin and Ivie (sp. 33 [257–261] 33°43′N, 117°6′W; [262,263] 27°58′N, 111°25′W). 257, male palpus, mesal. 258, epigynum, posterior. 259, epigynum, ventral. 260, male, dorsal. 261, male, ventral. 262, female, dorsal. 263, female, ventral.

Figures 264–270. *Metepeira chilapae* Chamberlin and Ivie (sp. 34 [264] 17°39′N, 99°22′W; [265–270] 17°39′N, 99°22′W). 264, male palpus, mesal. 265, epigynum, posterior. 266, epigynum, ventral. 267, male, dorsal. 268, male, ventral. 269, female, dorsal. 270, female, ventral.

Figures 271–277. *Metepeira petatlan* new species (sp. 35 [271,274,275] 17°14′N, 100°53′W; [272,273,276,277] 17°17′32″N, 101°2′40″W). 271, male palpus, mesal. 272, epigynum, posterior. 273, epigynum, ventral. 274, male, dorsal. 275, male, ventral. 276, female, dorsal. 277, female, ventral.

Scale bars: dorsum and venter figures 1.0 mm.

brown speckled pattern over white. Folium darkens posteriorly (Fig. 269). Anterior shoulders black. Venter black with wide median white line and pair of white spots on either side of spiracle (Fig. 270). Sternum brownish black with wide, white line widening anteriorly (Fig. 270). Ratio of eye diameters: posterior medians and anterior medians 1.0, anterior laterals 1.1, posterior laterals 1.1. Anterior median eyes separated by 1.3 diameters, posterior median eyes by 0.8, anterior median eyes separated from anterior laterals by 2.2 diameters of anterior lateral eyes, lateral eyes separated by 0.2 their diameters. Total length 5.8 mm. Carapace 2.7 mm long, 2.3 wide. First femur 2.9 mm, patella and tibia 3, metatarsus 2.6, tarsus 1. Second patella and tibia 2.4 mm, third 1.6, fourth 2.3.

Male from 6 mi northeast of Tixtla de Guerrero, Guerrero, Mexico. Carapace, dorsum, venter, sternum darker and more contrasty version of female (Figs. 267, 268). Distal halves of ventral leg articles black, elsewhere yellowish. Femur I with row of four macrosetae on anterior side; three on anteroventral side. Ratio of eye diameters: posterior medians and anterior medians 1.0, anterior laterals 1.3, posterior laterals 1.3. Anterior median eyes separated by 1.7 diameters, posterior median eyes by 0.9, anterior median eyes separated from anterior laterals by 1.9 diameters of anterior lateral eyes, lateral eyes separated by 0.3 their diameters. Total length 3.5 mm. Carapace 1.8 mm long, 1.4 wide. First femur 2.3 mm, patella and tibia 2.1, metatarsus 1.8, tarsus 0.8. Second patella and tibia 1.8 mm, third 0.9, fourth 1.4.

Diagnosis. The openings to the epigynum resemble those of *M. crassipes* because they are shaped like squares with rounded edges (compare Fig. 266 with Fig. 259). However, the dark, comma-shaped mark inside each opening resembles that of *M. ventura* (compare Fig. 266 with Fig. 231). As in *M. ventura* (Fig. 229) but unlike all other species in the *M. ventura* species group, the embolus tapers strongly then curves sharply up and inward right at the tip (Fig. 264). The bend in the embolus in other *M. ventura* group species is less pronounced (Figs. 236, 257) or not so near the tip (Figs. 243, 250). Unlike *M. ventura,* the median apophysis in *M. chilapae* is slimmer (Fig. 264) and the separation between the embolus and the basal embolic apophysis is relatively greater.

Variation. Average body length of eight females examined 6.5 mm, range 5.7 to 8.3 mm. Average body length of three males examined 2.9 mm, range 2.3 to 3.5 mm.

Natural History. Mature specimens have been collected in July through October (Fig. 333).

Distribution. Southern Mexican states between Nayarit and Oaxaca; elevations from 1,000 to 2,000 m (Map 13).

Records Examined. MEXICO *Guerrero:* 6 mi NE Tixtla de Guerrero, 17°39′N, 99°22′W, 16.vii.1984 (J. B. Woolley, ADC). *Morelos:* Cocoyoc, 18°52′N, 98°59′W, 28.vii.1956 (W. Gertsch & V. Roth, AMNH); Cuernavaca, 18°55′N, 99°15′W, 15.x.1944 (N. L. H. Krauss, AMNH). *Nayarit:* 30 mi SE Tepic, 21°12′N, 104°33′W, 23.xi.1948 (E. S. Ross, CAS); 5 mi NW Tepic, 21°32′N, 104°57′W, 13.v.1963 (W. J. Gertsch & W. Ivie, AMNH). *Oaxaca:* 6 mi NE Mitla, 16°59′N, 96°21′W, 20.viii.1985 (J. Woolley & G. Zolnerowich, ADC); Huajuapan, 17°48′N, 97°46′W, 1.x.1946 (H. Wagner, AMNH); Oaxaca, 17°3′N, 96°43′W, 17.vii.1955 (C. & P. Vaurie, AMNH), 12.viii.1991 (W. H. Piel & G. S. Bodner, MCZ); San Balt. Chichicapan, 16°45′N, 96°29′W, 4.viii.1991 (W. H. Piel & G. S. Bodner, MCZ).

Metepeira minima Group

Female spiders in the *M. minima* group (*Metepeira petatlan, Metepeira minima, Metepeira pacifica, Metepeira jamaicensis*) have a thin scape with epigynal openings that are shaped from longitudinal slits (Figs. 273, 280, 281) to ovals that are longer than wide (Figs. 288, 295). In males, the flagellae on the median apophysis are set off on a distinctly narrower stalk (Figs. 271, 278, 286, 293).

35. *Metepeira petatlan* new species
Figures 271–277, 334; Map 10

Holotype. Male from 50 km southeast of Petatlán, Guerrero, Mexico, 14.viii.1984, J. B. Woolley, in

MCZ. The specific name is a noun in apposition after the locality.

Description. Female paratype from Papanoa, Guerrero. Light region around posterior eye row; carapace darkens posteriorly, then lightens under overhang of abdomen (Fig. 276). Slight rings on patella and tibia. Femur I with three macrosetae on anterior side, none on anteroventral side. Dorsum of abdomen with typical folium, except that white oak leaf pattern narrower than most species and set on a narrow, remarkably darker brownish dovetail (Fig. 276). Dark lateral band wraps around abdomen and stretches up over anterior dorsal portion. Venter with two spots on either side of spiracle and slight indication of a transverse bar. Wide, white longitudinal mark ends at the epigynal groove (Fig. 277). Sternum with wide, white longitudinal mark widening anteriorly (Fig. 277). Ratio of eye diameters: posterior medians and anterior medians 1.0, anterior laterals 1.3, posterior laterals 1.2. Anterior median eyes separated by 1.1 diameters, posterior median eyes by 0.7, anterior median eyes separated from anterior laterals by 1 diameter of anterior lateral eyes, lateral eyes almost touching. Total length 5 mm. Carapace 2.2 mm long, 1.7 wide. First femur 2.3 mm, patella and tibia 2.5, metatarsus 2, tarsus 0.9. Second patella and tibia 2 mm, third 1.3, fourth 1.9.

Male holotype. Carapace uniform brown with a lighter median streak just anterior to thoracic depression (Fig. 274). Weakly ringed on tibia; distal half of femora dark. Femur I with two macrosetae on anterior side. Abdomen is a lighter version of the female (Fig. 274). Venter with a much reduced and shorter longitudinal line, compared to the female (Fig. 275). Sternum as in female. Ratio of eye diameters: posterior medians and anterior medians 1.0, anterior laterals 1.4, posterior laterals 1.4. Anterior median eyes separated by 1.1 diameters, posterior median eyes by 0.7, anterior median eyes separated from anterior laterals by 1.1 diameters of anterior lateral eyes, lateral eyes separated by 0.2 their diameters. Total length 2 mm. Carapace 1 mm long, 0.7 wide. First femur 1.2 mm, patella and tibia 1.0, metatarsus 0.8, tarsus 0.5. Second patella and tibia 0.9 mm, third 0.5, fourth 0.8.

Diagnosis. The female's dorsum can be distinguished from other species by the unusually dark brown color of the dovetail-shaped mark (Fig. 276). Both this mark and the white oak leaf pattern have narrower margins that are more parallel and not as wedge-shaped as they are in other species (Fig. 276). The epigynum resembles that of *M. minima* by the narrow scape and the parallel slitlike openings on either side. These openings differ from those of *M. minima* because they have conspicuous sclerotized spheres just anterior to the lateral edge of the slits (Fig. 273) but which are much farther away in *M. minima* (Fig. 280). The male is unusually small and its palp is unique and easily distinguished from other species. The longer flagellum on the median apophysis is needlelike over its entire length, not gradually tapering (compare Fig. 271 with Fig. 278). In addition, the long needlelike flagellum has a sharper elbow. At the elbow it projects away from the palp for a short distance and then strongly curves around the palp (Fig. 271).

Natural History. The female paratype was found at eye level on a hot, dry, wooded hillside overlooking the Pacific Ocean at an altitude of about 200 m. Her web differed considerably from the usual *Metepeira* web: instead of an elaborate barrier web, it consisted of a much reduced Y-shaped structure with a curled leaf in the center. The leaf served as a retreat for the spider and protected and hid three egg sacs. The retreat was suspended very near the hub, as opposed to farther away and above it, as found in most other species. Mature specimens have been collected in August through October (Fig. 334).

Distribution. Western Mexico: Guerrero and Sinaloa (Map 10).

Records Examined. MEXICO *Guerrero:* 32 mi SE Petatlán, 17°14′N, 100°53′W, 14.viii.1984 (J. B. Woolley, MCZ); Microondas Tamarindos, S. Papanoa, 17°17′32″N, 101°2′40″W, 18.x.1994 (W. H. Piel, MCZ). *Sinaloa:* 2 mi S Elota, 23°55′N, 106°48′W, 11.ix.1966 (Jean & Wilton Ivie, AMNH).

36. *Metepeira minima* Gertsch
Figures 278–285, 328; Map 15

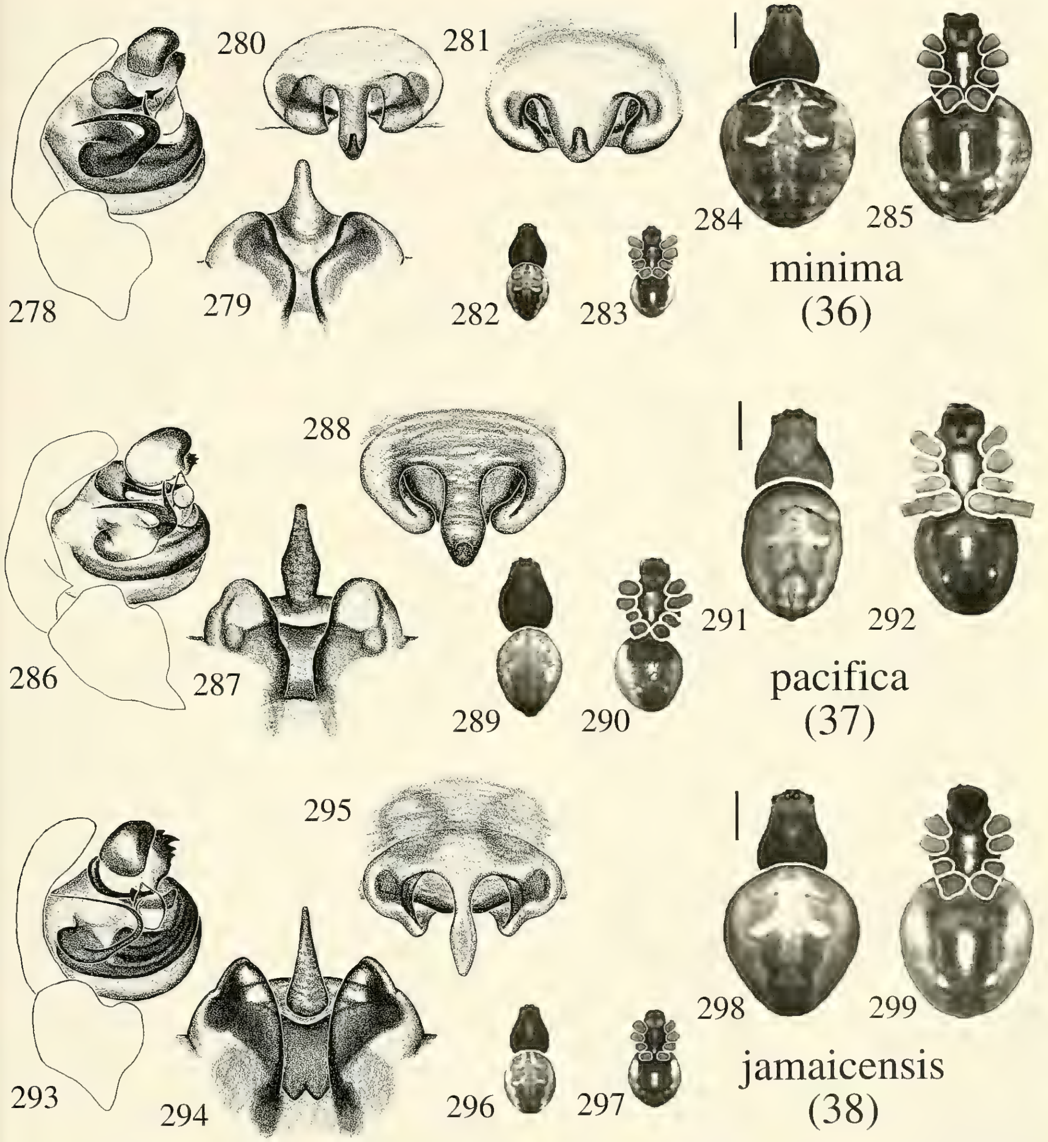
Metepeira minima Gertsch, 1936: 10, fig. 31, ♂. Male holotype from Edinburg, Texas, in the AMNH, examined. Roewer, 1942: 869. Chamberlin and Ivie, 1942: 67, fig. 174, ♀. Levi, 1977: 206, fig. 70–73, 76–77, ♀; 74–75, ♂. Bonnet, 1957: 2822. Brignoli, 1983: 275.

Description. Female from Celestun, Yucatan, Mexico. Carapace dark brown with light region surrounding the eyes, sometimes extending posteriorly behind the lateral eyes. Faint pair of darker feather-shaped patches in center of carapace (Fig. 284). Legs same color as carapace; darker on distal ends of articles. Femur I with row of four macrosetae on anterior side; rarely any on anteroventral side. Dorsum of abdomen with usual *Metepeira* folium (Fig. 284); venter wide, with long white median line surrounded by faint, thin, white U-shaped line (Fig. 285). Pair of large white spots on either side of spiracle. Sternum black with wide, white, uneven median line (Fig. 285). Ratio of eye diameters: posterior medians and anterior medians 1.0, anterior laterals 1.2, posterior laterals 1.1. Anterior median eyes separated by 1.2 diameters, posterior median eyes by 0.9, anterior median eyes separated from anterior laterals by 1.9 diameters of anterior lateral eyes, lateral eyes separated by 0.2 their diameters. Total length 6.5 mm. Carapace 2.7 mm long, 2 wide. First femur 2.8 mm, patella and tibia 2.8, metatarsus 2.5, tarsus 0.9. Second patella and tibia 2.4 mm, third 1.5, fourth 2.

Male from Celestun, Yucatan, Mexico. Carapace dark with light mark anterior to thoracic furrow (Fig. 282). Femur I with row of four macrosetae on anterior side; row of two to five macrosetae on anteroventral side. Distal two-thirds same color as carapace, proximal third white. Folium of abdomen as in female, except posterior half darker than anterior half (Fig. 282). Venter of abdomen and sternum as in female, except median white line of sternum often broken (Fig. 283). Ratio of eye diameters: posterior medians and anterior medians 1.1, anterior laterals 1.4, posterior laterals 1.1. Anterior median eyes separated by 1.2 diameters, posterior median eyes by 0.8, anterior median eyes separated from anterior laterals by 1.5 diameters of anterior lateral eyes, lateral eyes separated by 0.1 their diameters. Total length 3 mm. Carapace 1.5 mm long, 1.2 wide. First femur 2 mm, patella and tibia 1.9, metatarsus 1.8, tarsus 0.8. Second patella and tibia 1.6 mm, third 0.8, fourth 1.3.

Diagnosis. Unlike other members of the *M. minima* species group, the openings to the epigynum of *M. minima* are narrow slits around a scape of variable size (Figs. 280, 281). The openings of *M. petatlan* are only slightly wider than *M. minima,* but the internal darker sclerotized spheres in *M. minima* sit much farther apart (compare Fig. 280 with 273). Unlike *M. pacifica* (Fig. 286) and *M. jamaicensis* (Fig. 293), the bent embolus on *M. minima* tapers strongly and is therefore not like a needle (Fig. 278). Unlike *M. petatlan,* the longer flagellum on *M. minima* tapers (Fig. 278) and is not thin over its entire length (Fig. 271).

Variation. Average body length of 13 females examined 5.4 mm, range 3.7 to 6.5 mm. Average body length of 17 males examined 3.4 mm, range 2.5 to 4.5 mm. The epigyna of females from the Yucatan peninsula differ noticeably from all others, but the males hardly show any distinguishing features. These differences can be seen in the much wider scape and the greater separation between openings in a specimen from the Yucatan (Fig. 281), compared to a specimen from Tamaulipas (Fig. 280) or one from Texas (Levi, 1977: 209, fig. 71). In addition, the posterior view of the epigynum from a Yucatan specimen shows the lobes converging to form a V-shape (Fig. 279), whereas females outside of the



Figures 278–285. *Metepeira minima* Gertsch (sp. 36 [278,279,281–285] 20°56′N, 90°21′W; [280] 22°30′N, 99°4′W). 278, male palpus, mesal. 279, epigynum, posterior. 280,281, epigynum, ventral. 282, male, dorsal. 283, male, ventral. 284, female, dorsal. 285, female, ventral.
Figures 286–292. *Metepeira pacifica* new species (sp. 37; 10°27′N, 85°9′W). 286, male palpus, mesal. 287, epigynum, posterior. 288, epigynum, ventral. 289, male, dorsal. 290, male, ventral. 291, female, dorsal. 292, female, ventral.
Figures 293–299. *Metepeira jamaicensis* Archer (sp. 38; 18°17′N, 76°48′W). 293, male palpus, mesal. 294, epigynum, posterior. 295, epigynum, ventral. 296, male, dorsal. 297, male, ventral. 298, female, dorsal. 299, female, ventral.
Scale bars: dorsum and venter figures 1.0 mm.

Yucatan show largely parallel lobes (Levi, 1977: 209, fig. 71).

Natural History. Adults have been observed on tree trunks and on bushes at and above 150 cm. They can be found in shaded areas, which is unusual for Mexican *Metepeira.* Most mature specimens have been collected in May through September (Fig. 328). Elevations range from sea level to just under 2,000 m.

Distribution. Southern Texas to Honduras (Map 15).

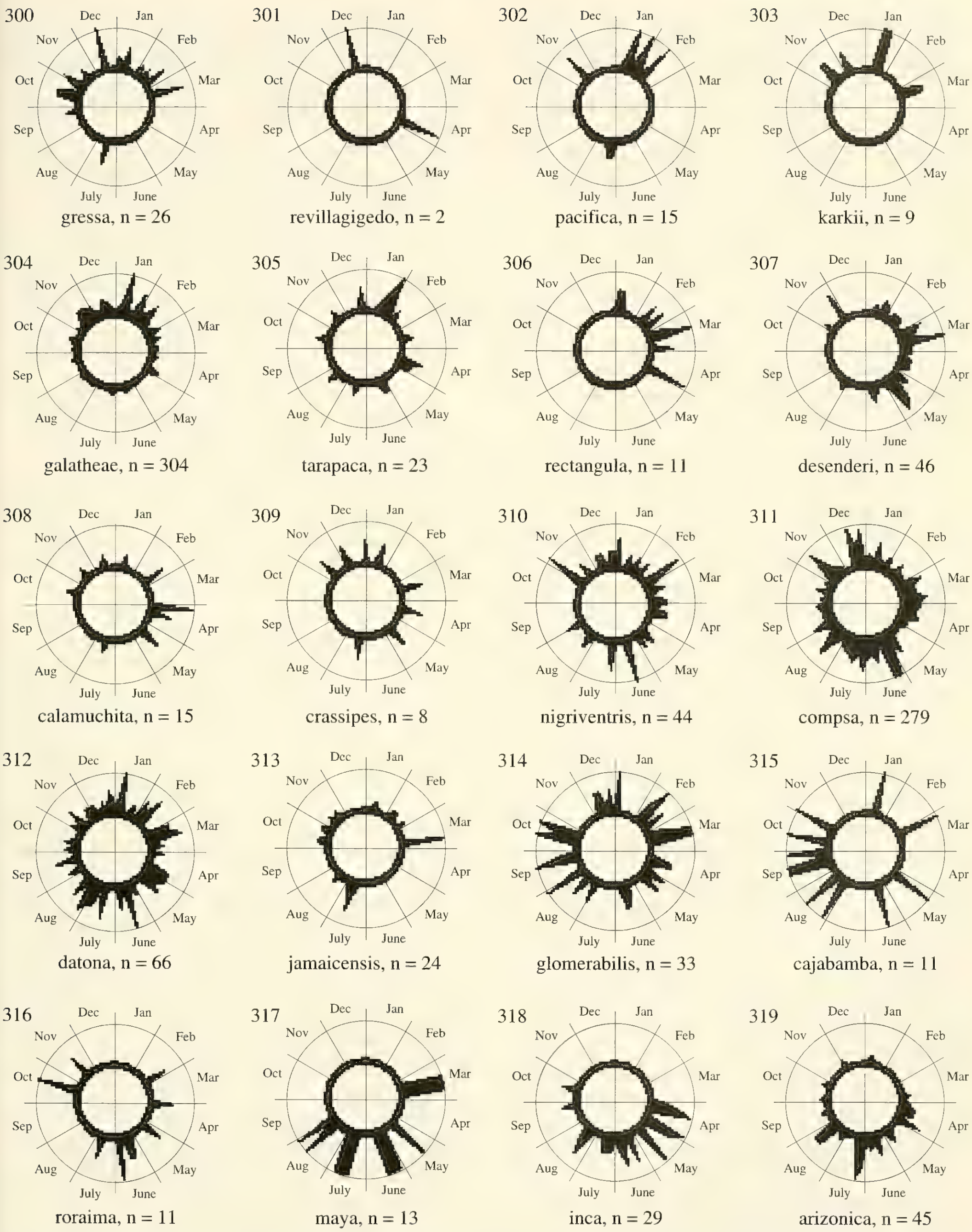
Records Examined. HONDURAS *Copán:* 14°50′N, 89°9′W, 7.iii.1939 (AMNH); Ruinas, 14°50′N, 89°9′W, 7.iii.1939 (AMNH). MEXICO *Campeche:* Becan, 18°33′N, 89°30′W, 31.vii.1991 (W. H. Piel & G. S. Bodner, MCZ); Campeche, 19°51′N, 90°32′W, 14.vii.1948 (C. J. Goodnight, AMNH); Champotón beach, 19°21′N, 90°43′W, 22.vii.1991 (W. H. Piel & G. S. Bodner, MCZ); Seybaplaya, 19°39′N, 90°40′W, 2.viii.1949 (C. J. Goodnight, AMNH). *Chiapas:* 16 mi W Cintalpa on rt 190, 16°36′N, 93°51′W, 15.vi.1982 (F. Coyle, MCZ). *Nuevo Léon:* 20 km E Montemorelos, Camino Q. Rayones, 25°16′N, 99°41′W, 22.vi.1981 (L. Stange, FSCA); Los Cristales, 25°33′N, 100°12′W, 15.viii.1972 (A. F. Archer, AMNH); Villa de Santiago, Hacienda Vista Hermosa, 25°25′N, 100°9′W, 19.vi.1940 (H. Hoogstraal, MCZ); Villa Santiago, Horsetail Falls, 25°25′N, 100°9′W, 19.vi.1940 (H. Hoogstraal, MCZ). *San Luis Potosí:* 20 km W Cd. Valles, 21°58′N, 99°11′W, 18.iii.1972 (J. A. L. Cooke, AMNH); Cd. Valles, 21°59′N, 99°1′W, 6.vii.1940 (P. Rau, MCZ), 19.vii.1956 (W. J. Gertsch & V. Roth, AMNH), 15.vii.1959 (L. Steude, AMNH); Cd. Valles, Hotel Covadonga, 21°59′N, 99°1′W (L. Steude, AMNH); Huichichuyan, 21°25′N, 98°55′W, 19.v.1952 (M. Cazier, W. Gertsch, & R. Schrammel, AMNH); Medina, 24°1′N, 100°24′W, 9.ix.1956 (A. F. Archer, AMNH); N section of San Luis Potosí, 22°13′N, 100°58′W, 8.ix.1956 (A. F. Archer, AMNH); Venado Arroyo, 22°56′N, 101°5′W [?], 27.vii.1934 (MCZ). *Sonora:* 8 mi W Alamos, 29°13′N, 110°10′W, 23.viii.1965 (W. J. Gertsch & R. Hastings, AMNH). *Tamaulipas:* 60 km N Cd Valles, 22°30′N, 99°4′W, 10.viii.1991 (W. H. Piel & G. S. Bodner, MCZ); Cd. Victoria, 23°44′N, 99°8′W, 17.v.1952 (M. Cazier, W. Gertsch, & R. Schrammel, AMNH); Laredo road near Cd. Victoria, 23°44′N, 99°8′W, 20.viii.1947 (C. J. & M. Goodnight, AMNH); r101 26km S Tula, 22°49′N, 99°55′W, 8.ix.1991 (W. H. Piel & G. S. Bodner, MCZ); Sisal, 15 mi S Cd. Victoria, 23°38′N, 99°12′W, 22.vii.1966 (Jean & Wilton Ivie, AMNH). *Veracruz:* 15 mi E Panuco, 22°10′N, 98°3′W, 29.xi.1941 (A. M. & L. I. Davis, AMNH); Plan del Río, 19°6′N, 96°6′W [?], 26.vii.1956 (W. J. Gertsch & V. Roth, AMNH). *Yucatan:* 20 km E Valladolid, 20°41′N, 88°2′W, 26.vii.1991 (W. H. Piel & G. S. Bodner, MCZ); 3 km S San Felipe, 21°32′N, 88°14′W, 25.vii.1991 (W. H. Piel & G. S. Bodner, MCZ); 5 mi E Sisal salt flat, 21°9′N, 90°5′W, 9.i.1984 (V. & B. Roth, CAS); Balankanche Cave, 2 km E Chichen Itza, 20°40′N, 88°33′W, 19.vii.1983 (W. Maddison, MCZ); beach north of Celestún, 20°56′N, 90°21′W, 24.vii.1991 (W. H. Piel & G. S. Bodner, MCZ); Chichén Itza, 20°40′N, 88°34′W (C. J. Goodnight, AMNH), 15.vii.1981 (C. Gold, CAS); Cordilleria Mayapán, 20°28′N, 89°11′W, 6.ix.1952 (J. & D. Pallister, AMNH); Uxmal, 20°22′N, 89°46′W, 7.ix.1970 (A. F. Archer, AMNH), 23.vii.1991 (W. H. Piel & G. S. Bodner, MCZ). USA *Texas:* 29 mi S Sarita, 26°47′N, 97°47′W, 14.xi.1958 (A. Brady, MCZ); 1 mi S Pharr, 26°10′N, 98°11′W, 14.xi.1958 (A. Brady, MCZ); 1 mi S Pharr on U.S. HW 281, 26°10′N, 98°11′W, 14.xi.1958 (A. Brady, MCZ).

37. *Metepeira pacifica* new species
Figures 286–292, 302; Map 10

Holotype. Male from La Pacifica, Guanacaste, Costa Rica, 1.ii.1975–2.iii.1975, R. E. Coville, in MCZ. The specific name is a noun in apposition after the locality.

Description. Female paratype from La Pacifica, Guanacaste, Costa Rica. Carapace tan, lighter around eyes. Legs white. Femur I with row of three macrosetae on anterior side; none on anteroventral side. Dorsum of abdomen white with faint, indistinct folium, darker distally (Fig. 291). Gravid females often slightly marbled. Venter wide, with long white median line surrounded by faint, thin, white U-shaped line on black. Pair of large white spots on each side of spiracle (Fig. 292). Sternum black with wide, white, uneven median line (Fig. 292). Ratio of eye diameters: posterior medians and anterior medians 1.0, anterior laterals 1.2, posterior laterals 1.2. Anterior median eyes separated by 1.2 diameters, posterior median eyes by 0.9, anterior median eyes separated from anterior laterals by 1.8 diameters of anterior lateral eyes, lateral eyes separated by 0.2 their diameters. Total length 4.5 mm. Carapace 2.2 mm long, 1.7 wide. First femur 2.3 mm, patella and tibia 2.4, metatarsus 1.9, tarsus 0.8. Second patella and tibia 2 mm, third 1.2, fourth 1.8.

Male holotype. Carapace, legs, abdomen as in female, though often darker (Figs. 289, 290). Femur I with row of four



Figures 300–319. Circular histograms depicting relative seasonal abundance of collecting events for mature spiders. 300–308. Primarily collected during the northern hemisphere winter and spring seasons. 300, *Metepeira gressa*; 301, *Metepeira revillagigedo*; 302, *Metepeira pacifica*; 303, *Metepeira karkii*; 304, *Metepeira galatheae*; 305, *Metepeira tarapaca*; 306, *Metepeira rectangula*; 307, *Metepeira desenderi*; 308, *Metepeira calamuchita*. 309–314. Generally collected throughout. 309, *Metepeira crassipes*; 310, *Metepeira nigriventris*; 311, *Metepeira compsa*; 312, *Metepeira datona*; 313, *Metepeira jamaicensis*; 314, *Metepeira glomerabilis*. 315–319. Primarily collected during the Northern Hemisphere summer season. 315, *Metepeira cajabamba*; 316, *Metepeira roraima*; 317, *Metepeira maya*; 318, *Metepeira inca*; 319, *Metepeira arizonica*.

macrosetae on anterior side; two to three on anteroventral side. Median white line on sternum often broken (Fig. 290). Ratio of eye diameters: posterior medians and anterior medians 1.0, anterior laterals 1.6, posterior laterals 1.6. Anterior median eyes separated by 1.1 diameters, posterior median eyes by 0.6, anterior median eyes separated from anterior laterals by 1.4 diameters of anterior lateral eyes, lateral eyes separated by 0.3 their diameters. Total length 3.4 mm. Carapace 1.7 mm long, 1.2 wide. First femur 2.2 mm, patella and tibia 2, metatarsus 1.7, tarsus 0.8. Second patella and tibia 1.6 mm, third 0.9, fourth 1.3.

Diagnosis. Unlike other members of the *M. minima* species group, *M. pacifica* and *M. jamaicensis* share very light pigmentation, and the embolus in both species is needle-shaped (Figs. 286, 289, 291, 293, 296, 298). Unlike *M. jamaicensis,* the flagellae on the median apophysis of *M. pacifica* are set off on a short, wide stalk (Fig. 286) rather than a long, thin one (Fig. 293). A ventral view of the epigynum in *M. pacifica* shows a ridge under the scape that is more V-shaped (Fig. 288), compared to a straighter line (Fig. 295).

Variation. Average body length of three females examined 5.3 mm, range 4.5 to 5.8 mm. Average body length of five males examined 3 mm, range 2.8 to 3.4 mm. Most specimens appear whitish, but the loss of pigment is variable, especially among males.

Natural History. Specimens have been collected from the wasp nests of *Trypargilum nitidum, T. tenoctitlan,* and *T. bensoni.* In Costa Rica, mature specimens have been collected in November through February; Honduras and Nicaragua in July (Fig. 302). Altitudes range from 100 to 2,600 m.

Distribution. Costa Rica, Honduras, and Nicaragua (Map 10).

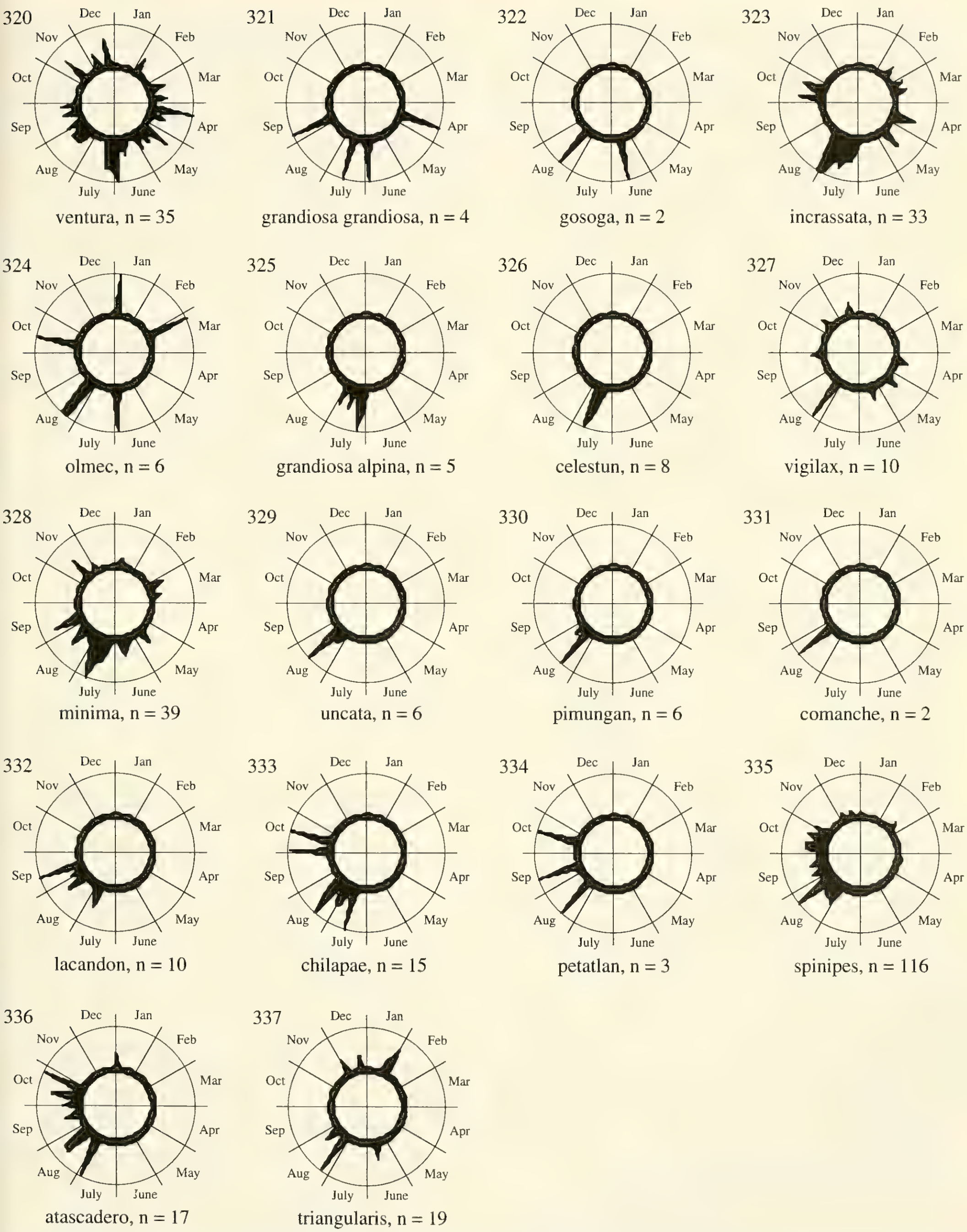
Records Examined. COSTA RICA *Guanacaste:* 4 km NW Cañas, La Pacifica, prey of *Trypargilum bensoni,* 10°27′N, 85°9′W, 29.i.1975 (R. E. Coville, MCZ); 4 km NW Cañas, La Pacifica, prey of *Trypargilum nitidum,* 10°27′N, 85°9′W, 1.ii.1975–2.iii.1975 (R. E. Coville, MCZ); 4 km NW Cañas, La Pacifica, prey of *Trypargilum tenoctitlan,* 10°27′N, 85°9′W, 1.ii.1975 (R. E. Coville, MCZ); 4 km NW Cañas, La Pacifica, wasp collected, 10°27′N, 85°9′W, 16.ii.1975 (R. E. Coville, MCZ); Bagaces, Palo Verde, 10°21′N, 85°21′W, 19.i.1978 (W. Eberhard, MCZ); ca. Cañas, 10°25′N, 85°7′W, 15.xi.1982 (W. Eberhard, MCZ); Cañas, 10°25′N, 85°7′W, 15.xi.1982 (W. Eberhard, MCZ). *Puntarenas:* Finca San Miento-Sialas, 10°9′N, 84°54′W, 5.ii.1976 (Roth & Schroepfer, AMNH). San José [?]: Santa María, 9°39′N, 83°58′W, 15.i.1930 (Dodge, MCZ). HONDURAS *Tegucigalpa:* Tegucigalpa, 14°6′N, 87°13′W, 1.vii.1948 (Clarke, AMNH). NICARAGUA *Managua:* Laguna de Jiloa, SW Managua, campsite, 12°13′N, 86°19′W, 8.vii.1970 (S. Riechert, SR).

38. *Metepeira jamaicensis* Archer
Figures 293–299, 313; Map 15

Metepeira jamaicensis Archer, 1958: 16, fig. 33, ♀. Female holotype from Port Henderson, St. Catherine Parish, Jamaica, in the AMNH, examined.

Metepeira minima:—Levi, 1977: 206, 208. Brignoli, 1983: 275. Erroneous synonymy.

Description. Female from Saint Mary's Parish, Strawberry Fields near Robin's Bay and Green Castle, Jamaica. Carapace dirty brown, white around eyes, central white wedge (Fig. 298). Legs whitish yellow; slight rings on legs II and III. Femur I with row of three to four macrosetae on anterior side; none or only a few very fine setae on anteroventral side. Dorsal folium lighter than in most species; fleur-de-lis white on speckled light gray (Fig. 298). Venter brownish gray with white margins. Wide median white line with pair of large white spots on either side of spiracle (Fig. 299). Sternum brownish black with wide, white line widening anteriorly, sometimes broken in center (Fig. 299). Ratio of eye diameters: posterior medians and anterior medians 1.0, anterior laterals 1.2, posterior laterals 1.1. Anterior median eyes separated by 1.4 diameters, posterior median eyes by 0.7, anterior median eyes separated from anterior laterals by 2 diameters of anterior lateral eyes, lateral eyes separated by 0.2 their diameters. Total length 5.1 mm. Carapace 2.1 mm long, 1.5 wide. First femur 2.1 mm, patella and tibia 2.2, meta-



Figures 320–337. Circular histograms depicting relative seasonal abundance of collecting events for mature spiders. 320–331, Primarily collected during the northern hemisphere summer season. 320, *Metepeira ventura*; 321, *Metepeira grandiosa gradiosa*; 322, *Metepeira gosoga*; 323, *Metepeira ventura*; 324, *Metepeira olmec*; 325, *Metepeira grandiosa alpina*; 326, *Metepeira celestun*; 327, *Metepeira vigilax*; 328, *Metepeira minima*; 329, *Metepeira uncata*; 330, *Metepeira pimungan*; 331, *Metepeira comanche*. 332–337. Primarily collected during the northern hemisphere fall season. 332, *Metepeira lacandon*; 333, *Metepeira chilapae*; 334, *Metepeira petatlan*; 335, *Metepeira spinipes*; 336, *Metepeira atascadero*; 337, *Metepeira triangularis*.

tarsus 1.8, tarsus 0.8. Second patella and tibia 1.9 mm, third 1.2, fourth 1.7.

Male from same locality as female. Male carapace, dorsum, venter, sternum darker and more contrasty version of female (Figs. 296, 297). All legs ringed. Femur I with row of three macrosetae on anterior side; none on anteroventral side. Ratio of eye diameters: posterior medians and anterior medians 0.9, anterior laterals 1.2, posterior laterals 1.2. Anterior median eyes separated by 1.3 diameters, posterior median eyes by 0.9, anterior median eyes separated from anterior laterals by 1.2 diameters of anterior lateral eyes, lateral eyes separated by 2.3 their diameters. Total length 2.3 mm. Carapace 1.2 mm long, 0.9 wide. First femur 1.4 mm, patella and tibia 1.3, metatarsus 1.0, tarsus 0.5. Second patella and tibia 1.2 mm, third 0.6, fourth 0.9.

Diagnosis. Unlike other members of the *M. minima* species group, *M. jamaicensis* and *M. pacifica* share very light pigmentation and the embolus in both species is needle-shaped (Figs. 286, 289, 291, 293, 296, 298). Unlike *M. pacifica,* the flagellae on the median apophysis of *M. jamaicensis* are set off on a long, thin stalk (Fig. 293) rather than a short, wide one (Fig. 286). A ventral view of the epigynum in *M. jamaicensis* shows a ridge under the scape that almost forms a straight line (Fig. 295), compared to a V-shape (Fig. 288).

Variation. Average body length of eleven females examined 5 mm, range 4.2 to 6.1 mm. Average body length of four males examined 2.4 mm, range 2.3 to 2.6 mm.

Natural History. Mature specimens have been collected in July through March (Fig. 313).

Distribution. Primarily in Jamaica and Haiti (Map 15), near sea level.

Records Examined. BRITISH WEST INDIES *Grand Cayman Island:* 19°20′N, 81°10′W, 15.ii.1960 (R. A. Lewin, MCZ). HAITI *Departement de L'Ouest:* Port-au-Prince, 18°32′N, 72°20′W, 19.vii.1955 (A. F. Archer, AMNH), 20.vii.1955 (A. F. Archer, AMNH). *Dept. de L'Artibonite:* Saint-Marc, 19°7′N, 72°42′W, 15.i.1913 (W. M. Mann, MCZ). JAMAICA *Cornwall:* Montego Bay, 18°28′N, 77°55′W, 1.iii.1984 (L. E. Schulten Jr, MCZ). *Middlesex:* 3 mi E Old Harbor, 17°56′N, 77°10′W, 21.x.1957 (A. M. Chickering, MCZ); Christiana, 18°10′N, 77°29′W, 13.xi.1957 (A. M. Chickering, MCZ), 15.vii.1960 (C. & P. Vaurie, AMNH), 17.vii.1960 (C. & P. Vaurie, AMNH); Strawberry Fields near Robin's Bay and Green Castle, 18°17′N, 76°48′W, 23.iii.1972 (H. W., L. & F. Levi, MCZ), 25.iii.1972 (H. W., L. & F. Levi, MCZ), 26.iii.1972 (H. W., L. & F. Levi, MCZ). *Saint Ann:* Roaring River, 18°24′N, 77°9′W [?], 8.ii.1946 (B. Heineman, AMNH); Saint Ann's Bay, 18°26′N, 77°8′W, 20.xi.1959 (A. M. Nadler, AMNH). *Saint Catherine:* E Green Harbour, S slope of Healthshire, 17°53′N, 76°51′W, 12.viii.1958 (A. F. Archer, AMNH). *St. Andrews:* Ferry, 9/10 mi on Spanishtown Road, 18°2′N, 76°53′W, 26.vii.1955 (A. F. Archer, AMNH). *Surrey:* Kingston, Mona Road, pasture, 17°59′N, 76°24′W, 10.x.1957 (A. M. Chickering, MCZ); Roselle Falls, 24 mi E Kingston, 17°59′N, 76°24′W, 29.x.1957 (A. M. Chickering, MCZ); Saint Andrew, 18°4′N, 76°45′W, 7.x.1957 (A. M. Chickering, MCZ). *Trelawny:* Falmouth, 18°30′N, 77°39′W, 20.vii.1960 (C. & P. Vaurie, AMNH). *Westmorland:* Negril, 18°16′N, 78°21′W, 24.iii.1955 (A. M. Nadler, AMNH); Whitehouse, 18°4′N, 77°58′W, 26.iii.1955 (A. M. Nadler, AMNH).

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Type Specimens of Recent Mammals in the Museum of Comparative Zoology

K. M. HELGEN AND T. L. McFADDEN

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TYPE SPECIMENS OF RECENT MAMMALS IN THE MUSEUM OF COMPARATIVE ZOOLOGY

K. M. HELGEN AND T. L. McFADDEN[1]

CONTENTS

[1] Mammal Department, Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts 02138.

ABSTRACT. The Mammal Department at the Museum of Comparative Zoology houses name-bearing types of 342 species-group taxa of Recent mammals. The type collection consists of 327 holotypes, 2 lectotypes, 4 complete syntype series, and 9 partial syntype series. This catalogue notes information on the type locality, collector, date of collection, present condition, original publication, and synonyms for all name-bearing types in the Mammal Department. Comments on the taxonomic and historical importance of many type specimens are included. Lectotypes for a number of taxa are designated for purposes of taxonomic consistency.

INTRODUCTION

"Some of them are more or less historic specimens," wrote the great mammalogist Glover M. Allen in 1931, "whose location has undoubtedly in many cases been lost sight of, so that it may be of value to make the present record" (1931: 230). Allen, then Curator of Mammals at the Museum of Comparative Zoology at Harvard University, was referring to the type specimens of mammals in the museum, the subject of a listing he published that year. Allen's words resound with even greater truth today than when they were written 70 years ago. Since that time, the museum's holdings of mammal type specimens have grown considerably. Furthermore, type specimens of mammals housed in the MCZ have sometimes been credited to the collections of other institutions or considered to no longer exist, making the need for a new catalogue obvious.

Type specimens are biological reference points that lend objectivity to taxonomy and are thus of critical importance in systematic investigations; accordingly, "every institution in which name-bearing types are deposited should publish lists of name-bearing types in its possession or custody" (International Commission on Zoological Nomenclature, 1999: 79). Our duty in this regard is thus long overdue, and this catalogue should serve to fulfill that obligation. Without doubt, it will alleviate confusion in the scientific community as to the whereabouts of certain specimens, thought to be lost, especially those type specimens that were acquired from Guillaume Grandidier. In addition, it should bring to light information, formerly unavailable, on this museum's very notable holdings of name-bearing types.

All taxonomic judgments in this work, including new name combinations and lectotype designations, reflect the decision of the first author (KMH) alone and should be cited accordingly.

AUTHORS OF TYPE DESCRIPTIONS

Four mammalogists authored the overwhelming majority of names based on type specimens in the MCZ: Glover Allen, Outram Bangs, Guillaume Grandidier, and Barbara Lawrence. Following are brief biographies of these four outstanding mammalogists.

Glover M. Allen (1879–1942)

Curator of Mammals at the MCZ from 1924 until his death in 1942, Glover Allen began his work in the Mammal Department in 1907. He was known as a careful, dependable researcher and an outstanding, patient teacher. His goal in all endeavors was to increase the sum total of knowledge about the mammals of the world. Although much of his career was spent in the museum studying, as he put it, "the dried remains of animals" (Barbour et al., 1943: 300), he also traveled widely throughout the world collecting specimens as well as observing and learning about living animals. He once commented that the actual knowledge of living creatures could all too often be summed up by saying "when we found it, it ran like hell, whereupon we shot it!" (Barbour et al., 1943: 300). He wrote prolifically; his bibliography of publications is 81 pages long, the first of which he published when he was only 11 years old (Lawrence 1947a: 1). Holotypes for 96 taxa, which Allen described alone or with colleagues, are deposited in the MCZ.

Outram Bangs (1863–1932)

Outram Bangs, Curator of Mammals from 1899 to 1924, "was one of those fortunate mortals, born with a love of nature and the outdoors which rule their entire lives" (Peters 1933: 265). Bangs authored 135 MCZ mammal names (only one coauthored!). He and brother Edward began collecting as boys using slingshots and horsehair nooses. He was an early ecologist, saving *Microtus breweri* by killing the feral cat population on Massachusetts' Muskeget Island and restocking the mouse from a tiny islet across the channel. Although his greatest passion was the natural history of birds, he was also fascinated with mammals and served as curator of both departments in the MCZ. He decided to systematically collect the mammals of eastern North America in about 1890. He began by trapping in New England and later made trips to the southeastern United States and Canada. Other collectors assisted Bangs, expanding the collection area to western North America and south to Central America. His precision and organization were legendary, and today his mammal collection of more than 10,000 specimens, donated to the Museum in 1899, remains one of the best curated and most informative in the department. A complete list of Bangs' scientific publications was compiled by Porter (1943).

Guillaume Grandidier (1873–1957)

French explorer and scientist Guillaume Grandidier, son of naturalist Alfred Grandidier, authored and coauthored descriptions of 13 taxa whose types were donated to the MCZ in 1947, along with his extensive personal collection of Malagasy mammals. The collection was purchased by Robert Barbour and donated to the MCZ in honor of his brother, MCZ director Thomas Barbour. Between 1898 and 1902, Grandidier explored the center and southern portions of Madagascar, collecting specimens and describing the geography of the area. Through his writings he brought the unique fauna of this remote region to the attention of the scientific world. He was known for his devotion to the careful acquisition of knowledge, whether it was geographical, historical, or scientific. His work was honored by both the scientific community and the French government (Chapus, 1953).

Barbara Lawrence (1909–97)

After graduating from Vassar College in 1931, Barbara Lawrence became a volunteer at the MCZ. She was encouraged by Dr. Glover Allen to do her own research, and in the late 1930s she made field trips to the Philippines and Sumatra to collect mammals. In 1952 she was appointed Curator of Mammals, a position she held until her retirement in 1976. Her areas of scientific interest were many, ranging from echolocation in whales to zooarchaeology, as well as the more traditional mammalogical pursuit of taxonomy. "She once wrote '. . . to know and love a bit of the world so well that you can give it to someone else . . . is a rare talent' " (Rutzmoser, 1999: 1049), certainly a talent Barbara Lawrence had in abundance. She authored or coauthored 20 MCZ names.

The specimens described by these authors and others are the result of worldwide collecting by numerous expeditions and individuals, listed in the accounts that follow. A handful of type specimens in the MCZ were formerly in the collection of the National Museum of Natural History in Washington, D.C. According to Glover Allen, these were obtained via exchanges "at a time when 'duplicates' were more freely disposed of, [and would] prove to be cotypes or even actual types" (1931: 229). The collections of the Boston Society of Natural History, once contained in the Boston Museum of Science, were transferred to the Museum of Comparative Zoology over the course of the 20th century. Several types are among these specimens, which consist primarily of mammals from the New England region.

DEFINITIONS AND ORGANIZATION

Type Categories

Type specimens are categorized as one of the following:

Holotype. The single specimen designated as name-bearer in the original published description of the species-group taxon (Article 73.1, International Commission on Zoological Nomenclature, 1999: 79).

Syntype. One of multiple specimens on which a species-group name is equally based, when no holotype is specified in the original description and no subsequent designation of a lectotype has been published (Article 73.2, International Commission on Zoological Nomenclature, 1999: 81).

Lectotype. One of multiple specimens upon which a species-group name is originally based, designated in a publication subsequent to the original description to become the unique name-bearer (Article 74, International Commission on Zoological Nomenclature, 1999: 82).

Neotype. A specimen chosen as the name-bearer of a species-group taxon, "if no holotype, lectotype, syntype, or prior neotype is believed to exist" (Article 75, International Commission on Zoological Nomenclature, 1999: 84). There are no neotypes in the MCZ mammal collection.

Paratype. A specimen other than the holotype (if designated originally) that is mentioned in the original description of a species-group taxon. Paratypes of species-group taxa whose holotypes are housed in other institutions are not mentioned in this catalogue, although many such specimens exist in this museum.

Paralectotype. If no holotype is designated, a specimen other than the lectotype (if designated subsequently) that is mentioned in the original description of a species-group taxon. Paralectotypes of species-group taxa whose lectotypes are housed in other institutions are discussed below, before the accounts for name-bearing types.

Locality

This category includes country, second-level geopolitical division (state, department, territory, province, or district), collection site, and altitude where available. The geographic name given for a type locality is that found in the original publication. When the description of the collection locality does not include current geopolitical divisions, that information is provided in parentheses. If an original name is no longer used, an equals sign (=) is included within the parentheses to designate an equivalent modern name. Where altitude was originally given in feet, it has been converted to meters and included in parentheses.

Sources used for the current names are from the most current available Gazetteers of the United States Board on Geographic Names, the 10th comprehensive edition of the Times Atlas of the World, the Columbia Gazetteer of the World, and the Ornithological Gazetteers of South America.

Account Organization

The type locality, collector, date of collection, and present condition of each specimen are noted. The publication of the original description is cited for each specimen. Many names have changed in rank or synonymy since their origin; in these cases, the name by which a taxon is known today is noted, with a citation of the publication in which that name combination was first employed for that taxon. Comments are offered for most entries to provide additional information or to dispel potential sources of confusion.

The format of this catalogue is largely borrowed from the most recent type catalogue of mammals in the American Museum of Natural History (Lawrence, 1993). For systematic consistency, the taxonomic judgments at the species-level by the authors of the chapters in Mammal Species of the World (Wilson and Reeder, 1993) are largely adhered to. However, in many cases alternate views are explored, and subsequent work by other authors is noted. The sequence of mammalian orders presented here is as follows: Didelphimorphia, Dasyuromorphia, Peramelia, Cingulata, Afrosoricida, Rodentia, Lagomorpha, Scandentia, Primates, Lipotyphla, Chiroptera, Artiodactyla, Carnivora, and Cimolesta. This sequence represents the ongoing understanding of higher mammalian relationships being produced by research in molecular phylogenetics (Waddell et al., 1999) as well as paleontological studies (McKenna and Bell, 1997). A number of these names are rather nontraditional; use of the names Cingulata (for armadillos) and Cimolesta (for pangolins) at ordinal rank follows McKenna and Bell (1997). Afrosoricida is used for an order including tenrecs and golden-moles (following Stanhope et al., 1998: 9971–9972). We use the ordinal name Lipotyphla in a restricted sense to refer to the Recent families Nesophontidae, Solenodontidae, Soricidae, and Talpidae (others have used the term "Eulipotyphla," e.g., Waddell et al., 1999). Cetaceans are included here within the order Artiodactyla (an assemblage often referred to as "Cetartiodactyla" in recent literature; see Graur et al., 1997).

To avoid unnecessary complexity, orders, families, and genera are the only ranks above the level of species that are listed, except for the large family Muridae, for which subfamilial distinctions are provided, in alphabetical order. Within each order, the sequence of families generally follows Simpson (1945), but Wilson and Reeder's (1993) order of rodent families and Simmons' (1998: 12) arrangement of the bats are observed. Within each genus, taxa are presented in alphabetical order by original name.

The format of this catalogue is as follows, with all the following information provided when possible:

Original binomen. Name of describer, date of description.
Citation of original publication.
=Presently used name, if different from original. Citation of publication in which this name combination was initially used for this taxon.

Type Category. Number of specimen.[2] Preparation of specimen (skin, skull, alcohol, etc.), age and sex.

Locality. Type locality. Date of collection.

Collector. Name of collector. Original number of specimen.

Condition. Current condition of the type material.

Type Series. Any paratypes, paralectotypes, or additional syntypes in existence are mentioned, with their preparation, sex, and age.

Comments. Additional comments regarding the systematic status or the history of the specimen.

TAXA INCLUDED IN THIS CATALOGUE

Unlike Allen's original type catalogue, fossil mammals are not considered here, but type specimens of Recent mammals known only from subfossil remains are discussed.

Several type specimens of Recent mammals that were included in Allen's catalogue are not considered here as name-bearing types. A number of syntype series in the MCZ have since Allen's time been rendered paralectotypes by the designation of a lectotype preserved in another institution; these are discussed in the section below on paralectotypes. Additionally, MCZ 14929, listed as a "cotype" of *Nycteris revoili* Robin, 1881 by G. M. Allen (1931: 235), is a paratype rather than a syntype and is not considered here.

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[2] Mammal specimens in the MCZ bear any of three kinds of numbers. A number preceded by "MCZ" can be found in the general collection in the Mammal Department. A number preceded by a "B" is part of the collection of E. A. and O. Bangs, also housed in the Mammal Department. A number preceded by "VP" designates that the specimen is stored in the Vertebrate Paleontology Department.

One other enigmatic specimen in the collection deserves some mention. When it was received by the Mammal Department, Guillaume Grandidier's personal collection contained specimens marked as types for 16 taxa, described by either Grandidier or M. L. Lavauden. Fifteen of these holotypes are discussed within this catalogue in separate accounts. The remaining specimen, a fruit bat, MCZ 45073, is marked exactly like the other type specimens, and both its skin and its skull tags bear the name "*Eidolon sakalava* nov. spec., G. Grandidier" in the scripted handwriting typical of Grandidier's specimens. The locality given for the specimen is Ankavandra, in west-central Madagascar. Though this specimen has been curated as a type specimen, I (KMH) can find no published description of this taxon or any reference to this name in the literature. This name is therefore invalid, barring a discovery in the future that it was indeed published and has since been overlooked. Whatever the published status of the name, it appears to me that this specimen should be considered as a young specimen of *Eidolon dupreanum* rather than a distinct species, and discussion of this mysterious binomial here should in no way be construed as a formal description of a new taxon.

ABBREVIATIONS

Abbreviations are used in the text to designate the following institutions.

AMNH American Museum of Natural History, New York
BMNH Natural History Museum, London
BSNH Boston Society of Natural History, Boston
FMNH Field Museum of Natural History, Chicago
MNHN Muséum National d'Histoire Naturelle, Paris
MVZ Museum of Vertebrate Zoology, Berkeley, California
RMNH Rijksmuseum van Natuurlijke Historie, Leiden
USNM National Museum of Natural History, Washington, D.C.
YPM Yale Peabody Museum of Natural History, New Haven, Connecticut

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PARALECTOTYPE SERIES

Hesperomys eremicus Baird, 1858 =*Peromyscus eremicus eremicus* (Baird, 1858). Lectotype, USNM 2575, designated by Osgood (1909: 241). MCZ 4310 and 5273 are paralectotypes.

Neotoma fuscipes Baird, 1858 =*Neotoma fuscipes fuscipes* Baird, 1858. Lectotype, USNM 22026, designated by Lyon and Osgood (1909: 99). MCZ 4336 and 5264 are paralectotypes.

Mus bairdii Hoy and Kennicott, 1857 =*Peromyscus maniculatus bairdii* (Hoy and Kennicott, 1857). Lectotype, number 750 in the Collection of the Academy of Natural Sciences of Philadelphia, designated by Osgood (1909: 80). MCZ 8073 is a paralectotype.

Pteropus lanigera [sic] H. Allen, 1890 =*Pteropus insularis* Hombron and Jacquinot, 1842. The corrected spelling of the original name is *Pteropus laniger* (see Andersen 1912: 297). H. Allen based the description of *Pteropus laniger* on two syntypes, USNM 19066 (skin)/37815 (skull) and MCZ 7023, a skin. Andersen (1912: 297–298) was unaware of the whereabouts of this latter specimen and based his evaluation of the systematic status of *P. laniger* solely on the USNM specimen in his taxonomic review of the Megachiroptera. Because it is represented by both a skin and a skull in good condition and because it has been used in past taxonomic treatments, USNM 19066/37815 is hereby designated as the lectotype of *Pteropus laniger* to ensure consistency between past and future taxonomic treatments of this name. MCZ 7023 is thus a paralectotype. The type locality of *laniger* is the Caroline Islands, as emended by Andersen (1912: 298), not Samoa, as originally described.

Sciurus castanotus Baird, 1855 and *Sciurus castanonotus* Baird, 1858 =*Sciurus aberti aberti* Woodhouse, 1853. Baird (1858: 266) noted that the name *castanotus*, used in his original description of this taxon, was a misprint for *castanonotus*. Lectotype, USNM 121/1107, designated by Lyon and Osgood (1909: 183). Though not explicitly stated by Lyon and Osgood, this specimen should serve as a lectotype for both names (*Sciurus castanotus* Baird, 1855 and *Sciurus castanonotus* Baird, 1858), for taxonomic consistency. MCZ 4692 is a paralectotype.

Spermophilus obsoletus Kennicott, 1863 =*Spermophilus spilosoma obsoletus* Kennicott, 1863. Lectotype, USNM 3222/27998, designated by A. H. Howell (1938: 130). See G. M. Allen (1931: 252) for a list of paralectotypes (then considered syntypes) in the MCZ.

Spermophilus parryi var. *kodiacensis* J. A. Allen, 1874 =*Spermophilus parryi kodiacensis* J. A. Allen, 1874. Lectotype, USNM 9242/38543, designated by A. H. Howell (1938: 103). See G. M. Allen (1931: 252) for a list of paralectotypes (then considered syntypes) in the MCZ.

Spermophilus tridecemlineatus var. *pallidus* J. A. Allen, 1874 =*Spermophilus tridecemlineatus pallidus* J. A. Allen, 1874. Lectotype, USNM 16237, designated by A. H. Howell (1938: 112). See G. M. Allen (1931: 253) for a list of paralectotypes (then considered syntypes) in the MCZ.

Tamias quadrivittatus var. *pallidus* J. A. Allen, 1874 =*Tamias minimus pallidus* J. A. Allen, 1874. Lectotype, USNM 11656/38311, designated by Cary (1906: 88). G. M. Allen (1931: 255) provided a list of paralectotypes.

ACCOUNTS OF NAME-BEARING TYPE SPECIMENS

Order DIDELPHIMORPHIA Gill, 1872

Family CALUROMYIDAE Kirsch and Reig, 1977

Genus *CALUROMYS* J. A. Allen, 1900

Philander cicur Bangs, 1898k

Proc. Biol. Soc. Washington, 12: 161, 10 August.
=*Caluromys lanatus cicur* (Bangs, 1898). See Cabrera (1958: 2).

Holotype. B8114. Skin and skull. Adult female.
Locality. Colombia: (Magdalena), Santa Marta Mountains, Pueblo Viejo, 8,000 ft (2,440 m). 27 March 1898.
Collector. W. W. Brown, Jr. Original number 123.
Condition. Skin and skull complete. Mandible disarticulated.
Type Series. 3 paratypes; B8036, skin and skull, adult male; B8115, skin and skull, adult male; B8116, skin and skull, adult male.

Family MARMOSIDAE Hershkovitz, 1992

Genus *MARMOSA* Gray, 1821

Marmosa robinsoni Bangs, 1898i

Proc. Biol. Soc. Washington, 12: 95, 30 April.
=*Marmosa robinsoni robinsoni* Bangs, 1898. See Cabrera (1958: 24).

Holotype. B7749. Skin and skull. Adult male.
Locality. Venezuela: (Nueva Esparta), Margarita Island. 12 July 1895.
Collector. W. Robinson. Original number 506.
Condition. Skin and skull complete. Mandible disarticulated.
Type Series. 2 paratypes, both in the USNM; USNM 63209, skin and skull, adult male; USNM 63210, skin and skull, adult female.
Comments. *M. robinsoni* was considered a valid species by Gardner (1993: 18) and Nowak (1999: 21).

Marmosa mitis Bangs, 1898k

Proc. Biol. Soc. Washington, 12: 162, 10 August.
=*Marmosa robinsoni robinsoni* Bangs, 1898. See Cabrera (1958: 24).

Holotype. B8123. Skin and skull. Adult male.
Locality. Colombia: (Magdalena), Santa Marta Mountains, Pueblo Viejo, 8,000 ft (2,440 m). 25 March 1898.
Collector. W. W. Brown, Jr. Original number 91.
Condition. Skin and skull complete. Mandible disarticulated.
Type Series. 26 paratypes; B8117–B8122, B8124–B8143; all represented by skin and skull, 15 females and 11 males. 5 paratypes are no longer in the MCZ (B8118 is at Wellesley College, B8124 and B8141 are at FMNH, and B8136 and B8138 are at USNM).

Marmosa fulviventer Bangs, 1901b
Amer. Nat., 35: 632, 22 August.
=*Marmosa robinsoni fulviventer* Bangs, 1901. See Handley (1966: 775).

Holotype. B8435. Skin and skull. Adult male.
Locality. Panama: (Panama), Gulf of Panama, San Miguel Island. 28 April 1900.
Collector. W. W. Brown, Jr. Original number 123.
Condition. Skin and skull complete. Mandible disarticulated.
Type Series. 3 paratypes; B8436, skin and skull, female (exchanged to FMNH in 1931); B8437, skin and skull, female; B8438, skin and skull, male.
Comments. M. r. fulviventer was retained as a valid subspecies by Hall (1981: 14) and O'Connell (1983: 1).

Family DIDELPHIDAE Gray, 1821

Genus *DIDELPHIS* Linnaeus, 1758

Didelphis marsupialis particeps Goldman, 1917
Proc. Biol. Soc. Washington, 30: 107, 23 May.

Holotype. B8439. Skin and skull. Adult male.
Locality. Panama: (Panama), Gulf of Panama, San Miguel Island. 8 May 1900.
Collector. W. W. Brown, Jr. Original number 165.
Condition. Skin and skull complete.
Type Series. 1 paratype; B8440, skin and skull, adult female.
Comments. Retained as a valid subspecies by Hall (1981: 4).

Didelphis virginiana pigra Bangs, 1898b
Proc. Boston Soc. Nat. Hist., 28: 172, 15 March.

Holotype. B3500. Skin and skull. Adult female.
Locality. (United States): Florida, Brevard County, Oak Lodge, East Peninsula opposite Micco. 31 January 1895.
Collector. O. Bangs.
Condition. Skin and skull complete.
Type Series. 11 paratypes; all represented by skin and skull, most still in the MCZ.
Comments. Retained as a valid subspecies by Hall (1981: 5) and McManus (1974: 1). The type description lists 31 January 1896 as the date of collection, but the date is written as "January 31, 1895" on the original specimen label and in Bangs' accession catalogue.

Order DASYUROMORPHIA Gill, 1872

Family DASYURIDAE Goldfuss, 1820

Genus *ANTECHINUS* Macleay, 1841

Antechinus mayeri misim Tate, 1947
Bull. Amer. Mus. Nat. Hist., 88: 130, 20 February.
=*Antechinus naso misim* Tate, 1947. See Laurie and Hill (1954: 7).

Holotype. MCZ 29924. Skin and skull. Adult male.
Locality. Papua New Guinea: Morobe Province, Mount Misim (=Missim), 5,850 ft (1,784 m). 14 April 1933.
Collector. H. Stevens.
Condition. Skin and skull complete. Mandible disarticulated.
Type Series. 1 paratype; MCZ 29923, skin and skull, adult female.
Comments. Tate, in the original description, erroneously listed 24 April 1933 as the date of collection. *A. n. misim* was retained as a valid subspecies by Flannery (1995a: 80), who also noted that the New Guinean species assigned to the genus *Antechinus* are not closely related to the Australian species of that genus and will be reassigned at the generic level pending a full taxonomic revision of the group.

Genus *MYOICTIS* Gray, 1858

Myoictis melas wavicus Tate, 1947
Bull. Amer. Mus. Nat. Hist., 88: 140, 20 February.
=*Myoictis melas wallacei* Gray, 1858. See Flannery (1990: 56).

Holotype. MCZ 28082. Skin and skull. Adult male.
Locality. Papua New Guinea (S. Morobe), Wau, 3,800 ft (1,159 m). 27 March 1932.
Collector. H. Stevens. Original number 1.
Condition. Skin and skull complete.
Type Series. Holotype only.
Comments. Stevens' original field label bears the following lament—"To my intense anguish I failed to retrieve the female, shot on recumbent, decayed log in undergrowth."

Order PERAMELIA Ameghino, 1889

Family PERORYCTIDAE Groves and Flannery, 1990

Genus *ECHYMIPERA* Lesson, 1842

Suillomeles hispida G. M. Allen and Barbour, 1909
Proc. New England Zool. Club, 4: 44, 12 July.
=*Echymipera kalubu kalubu* (Fischer, 1829). See Laurie and Hill (1954: 11).

Holotype. MCZ 7006. Skin and skull. Adult.

Locality. (Indonesia): Dutch New Guinea (=Irian Jaya), Doreh Bay, Manokwari, "not far from the foot of Mt. Arfak." 23 February 1907.
Collector. T. Barbour.
Condition. Skin complete. Skull partial (occipital region and two posterior upper molars on each side missing).
Type Series. Holotype only.
Comments. *S. hispida* is the type species of *Suillomeles* G. M. Allen and Barbour, 1909.

Echymipera rufescens australis Tate, 1948
Bull. Amer. Mus. Nat. Hist., 92: 334, 25 November.

Holotype. MCZ 29214. Skin and skull. Adult male.
Locality. Australia: Queensland, Cape York, near Coen, east slope of McIlwraith Ranges, Rocky River, "Rocky Scrub." 20 June 1932.
Collector. P. J. Darlington, Jr., Harvard Australian Expedition. Original number 209.
Condition. Skin complete, but tip of tail worn. Skull complete.
Type Series. Holotype only.
Comments. Tate (1952: 582) reported that the exact type locality is "in the dense rain forests of the upper Nesbit River on the east slopes of the McIlwraith Range." Retained as a valid subspecies by Flannery (1995a: 111). Darlington noted in his field notebook, regarding this specimen, "Animal about the fattest I have skinned—I shall dream of it!"

Order CINGULATA Illiger, 1911

Family DASYPODIDAE Gray, 1821

Genus *DASYPUS* Linnaeus, 1758

Dasypus novemcinctus hoplites G. M. Allen, 1911a
Bull. Mus. Comp. Zool., 54: 195, July.

Holotype. MCZ 8116. Skin, skull, and postcranial skeleton. Adult female.
Locality. Grenada: hills back of Gouyave. 7 September 1910.
Collector. G. M. Allen. Original number 26.
Condition. Skin, skull, and postcranial skeleton complete.
Type Series. 2 paratypes; MCZ 8117, skin and skull, adult male; MCZ 8118, skin and skull, adult male.
Comments. Retained as a valid subspecies by Hall (1981: 283) and McBee and Baker (1982: 1).

Order AFROSORICIDA Stanhope et al., 1998

Family CHRYSOCHLORIDAE Gray, 1825

Genus *CHRYSOCHLORIS* Lacépède, 1799

Chlorotalpa tropicalis G. M. Allen and Loveridge, 1927
Proc. Boston Soc. Nat. Hist., 38: 418, 23 December.
=*Chrysochloris stuhlmanni tropicalis* (G. M. Allen and Loveridge, 1927). See Meester (1974: 3).

Holotype. MCZ 22435. Skin and skull. Adult female.
Locality. Tanganyika Territory (=Tanzania): Uluguru Mountains, Bagilo. 5 October 1926.
Collector. A. Loveridge.
Condition. Skin complete. Skull slightly damaged (coronoid processes missing from both mandibular rami). Mandible disarticulated.
Type Series. Holotype only.
Comments. Included in *Chrysochloris stuhlmanni* by Meester (1974: 3) but recognized as distinct by Simonetta (1968: 42). Hutterer (1993: 75) noted that the systematic status of *tropicalis* merits further study.

Family TENRECIDAE Gray, 1821

Genus *GEOGALE* Milne-Edwards and A. Grandidier, 1872

Cryptogale australis G. Grandidier, 1928
Bull. Mus. Hist. Nat. Paris, 34: 64, 26 January.
=*Geogale aurita* Milne-Edwards and A. Grandidier, 1872. See Genest and Petter (1975: 3).

Holotype. MCZ 45057. Skull fragments.
Locality. Madagascar: (Toliary), south of Fort Dauphin (=Tolanaro), Andrahomana grotto. 1927.
Collector. R. Decary.
Condition. MCZ 45047 includes 18 partial crania and 8 mandibular rami. Fragmentary.
Type Series. All the type material of *C. australis* bears a single accession number.
Comments. *C. australis* is the type species of the genus *Cryptogale* G. Grandidier, 1928.

Geogale aurita orientalis G. Grandidier and Petit, 1930
Faune des Colonies Françaises, 4: 446.

Holotype. MCZ 45660. Body in alcohol, cranium separate.

Locality. Madagascar: (Toamasina), east coast, Fenerive (=Fenoarivo Atsinanana). April 1928.
Collector. R. Decary. Original number 12.
Condition. Alcoholic, cranium complete.
Type Series. Holotype only.
Comments. Retained as a valid subspecies by Genest and Petter (1975: 3). The holotype of *G. a. orientalis* seems to be the only record of *Geogale aurita* from the east coast of Madagascar.

Genus *MICROGALE* Thomas, 1882

Microgale decaryi G. Grandidier, 1928
Bull. Mus. Hist. Nat. Paris, 34: 69, 26 January.
=*Microgale principula* Thomas, 1926. See MacPhee (1987a: 9).

Holotype. MCZ 45049. Cranium. Adult.
Locality. Madagascar: (Toliary), south of Fort Dauphin (=Tolanaro), Andrahomana caves. 1926.
Collector. R. Decary.
Condition. Cranium partial (back of cranium missing posterior to parietals).
Type Series. Paratype material consists of MCZ 45408, which includes 3 partial crania and 5 mandibular rami, and MAD-1649, a partial skull in the collections of the Institut de Paléontologie, MNHN.

Microgale drouhardi G. Grandidier, 1934
Bull. Mus. Hist. Nat. Paris, 6: 474, 29 November.

Holotype. MCZ 45034. Body in alcohol, skull extracted. Juvenile female.
Locality. Madagascar: (Antsiranana), east coast, Diego-Suarez (=Antsiranana). May 1934.
Collector. M. E. Drouhard. Original number A.
Condition. Alcoholic, skull complete.
Type Series. 6 paratypes; MCZ 46007–MCZ 46012, all in alcohol. MCZ 46017, represented by a skull and postcranial skeleton, was collected at the same time and place as the type series but is not mentioned in the original description.
Comments. MCZ 45034 represents an immature animal (MacPhee 1987a: 7), not an adult as claimed in the original description. MacPhee (1987a: 9) synonymized *drouhardi* with *Microgale cowani*, an approach followed by Hutterer (1993: 71), but Jenkins et al. (1997: 6) argued that *M. drouhardi* is a distinct species.

Microgale parvula G. Grandidier, 1934
Bull. Mus. Hist. Nat. Paris, 6: 476, 29 November.

Holotype. MCZ 45465. Body in alcohol, skull extracted. Juvenile male.
Locality. Madagascar: (Antsiranana), east coast, Diego-Suarez (=Antsiranana). May 1934.
Collector. M. Drouhard.
Condition. Alcoholic, skull complete.
Type Series. Holotype only.
Comments. MCZ 45465 represents an immature animal (MacPhee 1987a: 7), not an adult as claimed in the original description. The holotype of *Microgale pulla* Jenkins, 1988 actually represents an adult specimen of *M. parvula* (Jenkins et al., 1996: 204). Considered a valid species by Hutterer (1993: 71) and Nowak (1999: 190).

Microgale prolixacaudata G. Grandidier, 1937
Bull. Mus. Hist. Nat. Paris, 9: 348, 25 November.
=*Microgale longicaudata* Thomas, 1882. See MacPhee (1987a: 9).

Holotype. MCZ 45035. Body in alcohol, skull extracted. Juvenile.
Locality. Madagascar: (Antsiranana), east coast, Diego-Suarez (=Antsiranana). May 1934.
Collector. M. Drouhard.
Condition. Alcoholic; skull partial (left tympanic bulla missing). Mandible disarticulated.
Type Series. 1 paratype; MCZ 46020, in alcohol.
Comments. This specimen represents an immature animal (MacPhee 1987a: 8), not an adult as claimed in the original description.

Paramicrogale occidentalis G. Grandidier and Petit, 1931
Bull. Soc. Zool. France, 56: 129, 15 June.
=*Microgale brevicaudata* G. Grandidier, 1899. See MacPhee (1987a: 9).

Holotype. MCZ 45047. Body in alcohol, skull extracted. Juvenile male.
Locality. Madagascar: (Antananarivo), northwest of Maintirano, Andriafeuelo. 1930.
Collector. M. A. de la Rue.
Condition. Alcoholic, skull complete.
Type Series. Holotype only, but see comments.
Comments. *P. occidentalis* is the type species of the genus *Paramicrogale* G. Grandidier and Petit, 1931. This specimen represents an immature animal (MacPhee 1987a: 7), not an adult as claimed in the original description. The original description mentions only a single specimen but describes extensively the skeleton of *P. occidentalis.* This is puzzling, as the skeleton has not been extracted from MCZ 45047 (MacPhee 1987a: 7).

Genus *SETIFER* Froriep, 1806

Dasogale fontoynonti G. Grandidier, 1930a

Bull. Acad. Malgache, n. ser., 11: 85 (for 1928).
=*Setifer setosus* (Schreber, 1777). See Poduschka and Poduschka (1982: 261).

Holotype. MCZ 45016. Skin, skull, and postcranial skeleton. Juvenile.
Locality. Madagascar: east coast. 1917.
Collector. Received by G. Grandidier from the Académie Malgache in 1917.
Condition. Skin represented by a small patch of fur. Skull partial (occipital region missing). Postcranial skeleton complete, partially articulated.
Type Series. 1 paratype; MCZ 45532, in alcohol.
Comments. Walker (1975: 110) commented that "the only specimen known of *D. fontoynonti* . . . is in the Paris Museum"; actually, the only material attributed to *Dasogale* is in the MCZ, a fact first noted in publication by Poduschka and Poduschka (1982: 253). *Dasogale* was often considered to be an extremely rare or recently extinct species until Poduschka and Poduschka (p. 261) and MacPhee (1987b: 135) demonstrated that the holotype is probably a juvenile *Setifer setosus. D. fontoynonti* is the type species of the genus *Dasogale* G. Grandidier, 1930.

Order RODENTIA Bowdich, 1821

Family APLODONTIDAE Brandt, 1855

Genus *APLODONTIA* Richardson, 1829

Aplodontia californica columbiana Taylor, 1916

Univ. California Publ. Zool., 12: 499, 6 May.
=*Aplodontia rufa rainieri* Merriam, 1899. See Dalquest (1948: 369).

Holotype. B1899. Skin and skull. Adult male.
Locality. (Canada): British Columbia, Hope, Roab's Ranch. 14 June 1894.
Collector. W. C. Colt. Original number 479.
Condition. Skin and skull complete.
Type Series. 8 paratypes; B1892–B1898, B1900; all represented by skin and skull, 3 females and 5 males.

Family SCIURIDAE Fischer de Waldheim, 1817

Genus *CALLOSCIURUS* Gray, 1867

Callosciurus baluensis medialis G. M. Allen and Coolidge, 1940

Bull. Mus. Comp. Zool., 87: 156, 31 December.

Holotype. MCZ 22265. Skin and skull. Adult female.
Locality. (Indonesia): Dutch Borneo, (Kalimantan), Mount Tibang (possibly =Bukit Tungun). 1925.
Collector. E. Mjoberg. Original number 6.
Condition. Skin complete. Skull partial (right parietal, right tympanic bulla, and lachrymal broken—bulla present). Mandible disarticulated.
Type Series. Holotype only.
Comments. Retained as a valid subspecies by Medway (1977: 90).

Callosciurus ferrugineus primus G. M. Allen and Coolidge, 1940

Bull. Mus. Comp. Zool., 87: 157, 31 December.
=*Callosciurus erythraeus* (Pallas, 1778). See Corbet and Hill (1992: 283).

Holotype. MCZ 35352. Skin and skull. Adult female.
Locality. Siam (=Thailand): Mae Wan River near Doi, Mount Souket (=Saket), 1,500 ft (458 m). 20 February 1937.
Collector. J. A. Griswold, Jr., Asiatic Primate Expedition. Original number 5.
Condition. Skin and skull complete. Mandible disarticulated.
Type Series. 1 paratype; MCZ 35353, skin and skull, adult male.

Sciurus castaneoventris haemobaphes G. M. Allen, 1912c

Proc. Biol. Soc. Washington, 25: 177, 24 December.
=*Callosciurus erythraeus haemobaphes* (G. M. Allen, 1912). See Hayman and Holt (1940: 359).

Holotype. MCZ 13693. Skin and skull. Male.
Locality. China: southeastern Yunnan, Chih-ping (=Shiping). 26 February 1911.
Collector. Kobayashi Collection. Original number 46.
Condition. Skin and skull complete. Mandible disarticulated.
Type Series. Only the holotype is mentioned in the original publication, but Allen had four other specimens of these squirrels at the time of description (MCZ 13692, 13694–13696; all represented by skin and skull, 3 males, 1 female).

Genus *DREMOMYS* Heude, 1898

Dremomys pernyi flavior G. M. Allen, 1912c

Proc. Biol. Soc. Washington, 25: 178, 24 December.

Holotype. MCZ 13691. Skin and skull. Male.
Locality. China: southeastern Yunnan, Mongtz (=Mengzi). 1911.
Collector. Kobayashi Collection. Original number 6/8.
Condition. Skin complete. Skull partial (squamosals missing, supraoccipital damaged, right jugal missing, palatine missing, tympanic bulla damaged).
Type Series. Holotype only.

Dremomys senex G. M. Allen, 1912b

Mem. Mus. Comp. Zool., 40: 229, August.
=*Dremomys pernyi senex* G. M. Allen, 1912. See Hayman and Holt (1940: 382).

Holotype. MCZ 7582. Skin and skull. Adult female.
Locality. China: Hupeh (=Hubei), Ichanghsien, Nantou. 5 February 1909.
Collector. W. R. Zappey. Original number 373.
Condition. Skin and skull complete. Mandible disarticulated.
Type Series. 1 paratype; MCZ 7583, skin and skull, adult male.

Genus *FUNISCIURUS* Trouessart, 1880

Funisciurus pyrrhopus victoriae G. M. Allen and Loveridge, 1942

Bull. Mus. Comp. Zool., 8: 180, February.
=*Funisciurus pyrrhopus akka* De Winton, 1899. See Amtmann (1975: 8).

Holotype. MCZ 39199. Skin and skull. Adult male.
Locality. Uganda: Toro, Kibale Forest, 4,200 ft (1,281 m). 16 December 1938.
Collector. A. Loveridge.
Condition. Skin and skull complete. Mandible disarticulated.
Type Series. Holotype only.

Genus *GLAUCOMYS* Thomas, 1908

Sciuropterus alpinus bangsi Rhoads, 1897

Proc. Acad. Nat. Sci. Philadelphia, 1897, p. 321 (footnote), July.
=*Glaucomys sabrinus bangsi* (Rhoads, 1897). See A. H. Howell (1918: 38).

Holotype. B6959. Skin and skull. Adult male.
Locality. (United States): Idaho, Idaho County. March 8, 1897.
Collector. Harbison and Bargamin.
Condition. Skin and skull complete.
Type Series. 1 paratype; B6960, skin and skull, adult male.
Comments. *G. s. bangsi* was retained as a valid subspecies by Hall (1981: 450).

Sciuropterus alpinus lascivus Bangs, 1899j

Proc. New England Zool. Club, 1: 69, 31 July.
=*Glaucomys sabrinus lascivus* (Bangs, 1899). See A. H. Howell (1918: 55).

Holotype. B9186. Skin and skull. Adult female.
Locality. (United States): California, El Dorado County, Tallac. 28 August 1898.
Collector. W. W. Price and P. O. Simons. Original number 1722.
Condition. Skin and skull complete.
Type Series. 2 paratypes, B9187, skin and skull, female; B9188, skin and skull, female.
Comments. *G. s. lascivus* was retained as a valid subspecies by Hall (1981: 451).

Sciuropterus sabrinus makkovikensis Sornborger, 1900

Ottawa Nat., 14: 48, 6 June.
=*Glaucomys sabrinus makkovikensis* (Sornborger, 1900). See A. H. Howell (1918: 34).

Syntypes. MCZ 10476: Skin and skull. Adult. MCZ 10477: Skin and skull. Adult. MCZ 10478: Skin and skull. Adult.
Locality. (Canada): Labrador Peninsula, Makkovik. 1899.
Collector. W. W. Perrett. Original number 1540.
Condition. MCZ 10476: Skin complete. Skull partial (base of skull missing). Mandible disarticulated. MCZ 10477: Skin partial (tail broken but present). Skull partial (base of skull missing). Mandible disarticulated. MCZ 10478: Skin partial (missing left hind foot and tail). Skull partial (occipital chipped). Mandible disarticulated.
Type Series. 3 syntypes only.
Comments. Sornborger's original description was based on three specimens, original numbers 1540, 1541, and 1542, now MCZ 10476, 10477, 10478, respectively. *G. s. makkovikensis* was retained as a valid subspecies by Hall (1981: 453).

Sciuropterus silus Bangs, 1896j

Proc. Biol. Soc. Washington, 10: 163, 28 December.
=*Glaucomys volans volans* (Linnaeus, 1758). See A. H. Howell (1918: 20).

Holotype. B4931. Skin and skull. Adult male.
Locality. (United States): West Virginia, Greenbri-

er County, White Sulphur Springs, top of Katis Mtn. 3,200 ft (976 m). 2 September 1895.
Collector. T. Surber. Original number 19.
Condition. Skin and skull complete. Mandible disarticulated.
Type Series. Holotype only.

Sciuropterus volans querceti Bangs, 1896j
Proc. Biol. Soc. Washington, 10: 166, 28 December.
=*Glaucomys volans querceti* (Bangs, 1896). See A. H. Howell (1918: 26).

Holotype. B2451. Skin and skull. Adult female.
Locality. (United States): Florida, Citrus County, Citronelle. 17 September 1894.
Collector. F. L. Small. Original number 1363.
Condition. Skin and skull complete. Mandible disarticulated.
Type Series. 2 paratypes; B2452, skin and skull, adult male; B2453, skin and skull, adult female.
Comments. *G. v. querceti* was retained as a valid subspecies by Hall (1981: 449).

Genus *HYLOPETES* Thomas, 1908

Pteromys (Hylopetes) alboniger orinus G. M. Allen, 1940
The Mammals of China and Mongolia, Natural History of Central Asia, 11: 723, 3 September.
=*Hylopetes alboniger alboniger* (Hodgson, 1836). See Ellerman and Morrison-Scott (1951: 469).

Holotype. MCZ 28086. Skin and skull. Adult female.
Locality. China: Yunnan, Likiang Range (=Lijiang), 7,800 ft (2,379 m). December 1931.
Collector. J. F. Rock.
Condition. Skin complete. Skull partial (most of right tympantic bulla missing, supraoccipital damaged). Mandible disarticulated.
Type Series. Allen examined 10 specimens in addition to the type, including 4 specimens from the BMNH, 3 from AMNH, and MCZ 28087, skin and skull, an unsexed adult.

Pteromys phayrei anchises G. M. Allen and Coolidge, 1940
Bull. Mus. Comp. Zool., 87: 153, 31 December.
=*Hylopetes phayrei anchises* (G. M. Allen and Coolidge, 1940). See Ellerman and Morrison-Scott (1951: 469).

Holotype. MCZ 35776. Skin and skull. Adult male.
Locality. Siam (=Thailand): (Chiang Mai) Mount Angka (=Doi Inthanon), 4,300 ft (1,312 m). 27 February 1937.
Collector. J. A. Griswold, Jr., Asiatic Primate Expedition. Original number 24.
Condition. Skin and skull complete. Mandible disarticulated.
Type Series. 3 paratypes; MCZ 35775, skin and skull, adult female; MCZ 35777, skin and skull, adult male; MCZ 35778, skin and skull, subadult male.

Genus *MARMOTA* Blumenbach, 1779

Arctomys flaviventer avarus Bangs, 1899j
Proc. New England Zool. Club, 1: 68, 31 July.
=*Marmota flaviventris avara* (Bangs, 1899). See A. H. Howell (1915: 41).

Holotype. B7299. Skin and skull. Juvenile female.
Locality. (Canada): British Columbia, Okanagan. 17 July 1897.
Collector. A. C. Brooks. Original number 969.
Condition. Skin and skull complete.
Type Series. 2 paratypes; B7298, skin and skull, juvenile male; B7300, skin and skull, juvenile female.
Comments. *M. f. avara* was retained as a valid subspecies by Hall (1981: 371).

Arctomys ignavus Bangs, 1899d
Proc. New England Zool. Club, 1: 13, 28 February.
=*Marmota monax ignava* (Bangs, 1899). See A. H. Howell (1915: 29).

Holotype. B7971. Skin and skull. Adult male.
Locality. (Canada): Labrador Peninsula, Black Bay. 13 July 1898.
Collector. E. Doane.
Condition. Skin and skull complete. Mandible disarticulated.
Type Series. 5 paratypes; B7968–B7970, B7972, B7973 (juvenile); all represented by skin and skull, 4 females and 1 male.
Comments. *M. m. ignava* was retained as a valid subspecies by Hall (1981: 370) and Kwiecinski (1998: 1).

Genus *MICROSCIURUS* J. A. Allen, 1895

Sciurus (Microsciurus) browni Bangs, 1902b
Bull. Mus. Comp. Zool., 39:24, April.
=*Microsciurus alfari browni* (Bangs, 1902). See J. A. Allen (1914:151).

Holotype. MCZ 10404. Skin and skull. Adult male.
Locality. Panama: Chiriqui, Bogaba, 600 ft (183 m). 15 July 1901.

Collector. W. W. Brown, Jr. Original number 631.
Condition. Skin and skull complete.
Type Series. 4 paratypes; MCZ 10405, adult female, 10406, adult female, 10407, adult female, 10408, juvenile male; all represented by skin and skull.
Comments. M. a. browni was retained as a valid subspecies by Hall (1981: 439).

Genus *PARAXERUS* Forsyth Major, 1893

Aethosciurus byatti laetus G. M. Allen and Loveridge, 1933

Bull. Mus. Comp. Zool., 75: 96, February.
=*Paraxerus vexillarius byatti* (Kershaw, 1923). See Amtmann (1975: 11).

Holotype. MCZ 26198. Skin and skull. Adult male.
Locality. Tanganyika Territory (=Tanzania): north end of Lake Nyasa, Ukinga Mountains, Madehani, 7,000 ft (2,135 m). 22 February 1930.
Collector. A. Loveridge.
Condition. Skin and skull complete.
Type Series. 9 paratypes; MCZ 26196, 26197, 26199–26202, 26204–26206; all represented by skin and skull, 4 females and 5 males.

Genus *SCIUROTAMIAS* Miller, 1901

Sciurotamias davidanus thayeri G. M. Allen, 1912b

Mem. Mus. Comp. Zool., 40: 231, August.
=*Sciurotamias davidianus consobrinus* (Milne-Edwards, 1868). See Moore and Tate (1965: 308).

Holotype. MCZ 8008. Skin and skull. Adult male.
Locality. China: western Szechwan (=Sichuan), Washan (=Wushan), 6,000 ft (1,830 m). 17 May 1908.
Collector. W. R. Zappey. Original number 163.
Condition. Skin complete. Skull partial (basioccipital and left maxilla damaged). Mandible disarticulated.
Type Series. Holotype only.
Comments. G. M. Allen (1912b: 231) noted in the original description of *thayeri* that "unfortunately, the skull of the type was lost." The skin and skull have been reunited subsequently.

Genus *SCIURUS* Linnaeus, 1758

Sciurus (Guerlinguetus) aestuans chiriquensis Bangs, 1902b

Bull. Mus. Comp. Zool., 39: 22, April.
=*Sciurus granatensis chiriquensis* Bangs, 1902. See Hershkovitz (1947: 7).

Holotype. MCZ 10044. Skin and skull. Adult male.
Locality. Panama: Chiriqui, Divala. 18 November 1900.
Collector. W. W. Brown, Jr. Original number 10.
Condition. Skin and skull complete.
Type Series. There is a large series of paratypes in the MCZ.
Comments. S. g. chiriquensis was retained as a valid subspecies by Hall (1981: 437) and Nitikman (1985: 1).

Sciurus carolinensis extimus Bangs, 1896j

Proc. Biol. Soc. Washington, 10: 158, 28 December.

Holotype. B4519. Skin and skull. Adult female.
Locality. (United States): Florida, Dade County, Miami. 12 March 1895.
Collector. L. Brownell. Original number 59.
Condition. Skin complete (with bald spots on ventrum). Skull complete.
Type Series. 7 paratypes; B3406, B4517, B4518, (all represented by skin and skull), B4520–B4523 (skins only); 4 females and 3 males.
Comments. Retained as a valid subspecies by Hall (1981: 417) and Koprowski (1994: 1).

Sciurus carolinensis var. *yucatanensis* J. A. Allen, 1877

In Coues and J. A. Allen, Monogr. N. Amer. Rodentia, U.S. Geol. Geograph. Survey Terr., Rep. 11: 705, August.
=*Sciurus yucatanensis* J. A. Allen, 1877. See Elliot (1896: 80).

Syntype. MCZ 5398. Skin. Adult male.
Locality. (Mexico): Yucatan, Merida. March 1865.
Collector. A. Schott. Original number 228. Formerly USNM 8502.
Condition. Skin complete.
Type Series. J. A. Allen referred to "four specimens of this variety before me" in the original description (1877: 705). Three specimens are mentioned by number: USNM 8502 (now MCZ 5398), 8503, and 8505. A juvenile referred to in the description (but not by number) corresponds to USNM 8504.
Comments. S. yucatanensis was considered a valid species by Hoffman et al. (1993: 443) and Nowak (1999: 1265). The syntype of *yucatanensis* in the MCZ was received from the USNM in March 1877. Poole and Schantz (1942: 554) state that USNM 8505 is no longer in the USNM.

Sciurus ludovicianus vicinus Bangs, 1896j

Proc. Biol. Soc. Washington, 10: 150, 28 December.
=*Sciurus niger vulpinus* Gmelin, 1896. See Barkalow (1954: 25).

Holotype. B5215. Skin and skull. Adult female.
Locality. (United States): West Virginia, Greenbri-

er County, White Sulphur Springs. 29 January 1896.
Collector. T. Surber. Original number 55.
Condition. Skin and skull complete.
Type Series. There is a series of paratypes in the MCZ.

Sciurus nesaeus G. M. Allen, 1902b
Proc. Biol. Soc. Washington, 15: 93, 25 April.
=*Sciurus granatensis nesaeus* G. M. Allen, 1902. See Hershkovitz (1947: 37).

Holotype. MCZ 10744. Skin. Adult female.
Locality. Venezuela: (Nueva Esparta), Margarita Island, El Valle. 8 July 1901.
Collector. A. H. Clark. Original number 619.
Condition. Skin complete. The lower incisors are present in the skin.
Type Series. Holotype only.
Comments. *S. g. nesaeus* was retained as a valid subspecies by Cabrera (1961: 367) and Nitikman (1985: 1).

Sciurus variabilis morulus Bangs, 1900d
Proc. New England Zool. Club, 2: 43, 20 September.
=*Sciurus granatensis morulus* Bangs, 1900. See Miller and Kellogg (1955: 257).

Holotype. B8420. Skin and skull. Adult female.
Locality. Panama: Canal Zone, Loma del Leon. 13 March 1900.
Collector. W. W. Brown, Jr. Original number 5.
Condition. Skin complete. Skull slightly damaged (left bulla broken).
Type Series. 5 paratypes; B8418, B8419, B8421–B8423 (juvenile); all represented by skin and skull, 3 females and 2 males.
Comments. *S. g. morulus* was retained as a valid subspecies by Hall (1981: 437) and Nitikman (1985: 1).

Sciurus variabilis saltuensis Bangs, 1898o
Proc. Biol. Soc. Washington, 12: 185, 16 November.
=*Sciurus granatensis saltuensis* Bangs, 1898. See Hershkovitz (1947: 15).

Holotype. B8144. Skin and skull. Adult female.
Locality. Colombia: Magdalena, Santa Marta Mountains, Pueblo Viejo, 8,000 ft (2,440 m). 26 March 1898.
Collector. W. W. Brown, Jr. Original number 112.
Condition. Skin and skull complete.
Type Series. 2 paratypes; B8145, skin and skull, adult male; B8244, skin and skull, adult female.
Comments. *S. g. saltuensis* was retained as a valid subspecies by Cabrera (1961: 368) and Nitikman (1985: 1).

Genus *SPERMOPHILUS* F. Cuvier, 1825

Citellus obscurus siccus G. M. Allen, 1925
Amer. Mus. Novitates, 163: 3, 2 April.
=*Spermophilus alashanicus* Büchner, 1888. See Hoffmann et al. (1993: 444).

Holotype. MCZ 19924. Skin and skull. Adult female.
Locality. China: Shansi (=Shenxi), 10 miles (16.1 km) west of Taiyuanfu. August 1921.
Collector. F. R. Wulsin. Original number 146.
Condition. Skin complete. Skull partial (parietals and basiooccipital missing, right tympanic bulla broken but present). Mandible disarticulated.
Type Series. Holotype only.

Spermophilus armatus Kennicott, 1863
Proc. Acad. Nat. Sci. Philadelphia, 15: 158, June.

Syntypes. MCZ 297: Skull. Male. Collected 11 April 1858. Original number 167, formerly USNM 4799. MCZ 4793: Skin and skull. Male. Collected 2 April 1858. Original number 140, formerly USNM 3478 (3373). MCZ 4790: Skin. Female. Collected 26 May 1858. Original number 455, formerly USNM 3470 (3470). MCZ 4794: Skull only (skin spoiled in repreparation, discarded). Male. Collected April 14, 1858. Original number 215, formerly USNM 3474 (3373).
Locality. (United States): Utah (now Wyoming), (Uinta County), near Fort Bridger, foothills of the Uinta Mountains, Camp Scott.
Collector. C. Drexler.
Type Series. See comments below.
Comments. Considered a valid species by Hoffmann et al. (1993: 444) and Nowak (1999: 1254). Kennicott does not designate a type in the original description; thus, "all the specimens from Fort Bridger collected by C. Drexler and in the collections [of the USNM] prior to 1863 are evidently cotypes [=syntypes] of this species" (Lyon and Osgood 1909: 163). The syntypes of *armatus* in the MCZ were received from the USNM in January 1874. These specimens possess USNM labels that bear numbers in discrepancy with the USNM catalogue; the numbers listed above are taken from the catalogue of the USNM, followed in parentheses by the number on the specimen label. A complete list of syntypes, most of the remainder of which are in the USNM, can be found in Poole and Schantz (1942: 504–505). The skin of MCZ 297, which formerly bore the number USNM 3472, is not to be found in the collections of either museum.

Spermophilus elegans Kennicott, 1863
Proc. Acad. Nat. Sci. Philadelphia, 15: 158, June.

Syntypes. MCZ 4791: Skin. Female. Collected 11 April 1858. Original number 168. Formerly USNM 3468. MCZ 4792: Skin. Male. Collected 11 April 1858. Original number 166. Formerly USNM 3473.
Locality. (United States): Utah (now Wyoming), (Uinta County), Fort Bridger.
Collector. C. Drexler.
Condition. Following their receipt, these specimens were spoiled in repreparation and discarded.
Type Series. See comments below.
Comments. These specimens are no longer in existence. Kennicott does not designate a type in the original description; thus, "all the specimens from Fort Bridger collected by C. Drexler and in the collections [of the USNM] prior to 1863 are evidently cotypes [=syntypes] of this species" (Lyon and Osgood 1909: 163). These syntypes of *elegans* were received from the USNM in January 1874. A complete list of syntypes can be found in Lyon and Osgood (1909: 166). G. M. Allen (1931: 251) erroneously included MCZ 4791 in a list of the type series of *Spermophilus armatus*. *S. elegans* is considered a valid species by Hoffmann et al. (1993: 446) and Nowak (1999: 1254).

Spermophilus (Ictidomys) tridecemlineatus badius Bangs, 1899c
Proc. New England Zool. Club, 1: 1, 8 February.
=*Spermophilus tridecemlineatus texensis* Merriam, 1898. See Hall and Kelson (1959: 347).

Holotype. B1682. Skin and skull. Adult male.
Locality. (United States): Missouri (Vernon County), Stotesbury. 17 April 1894.
Collector. T. Surber. Original number 81.
Condition. Skin and skull complete. Mandible disarticulated.
Type Series. 2 paratypes; B1683, skin and skull, adult male; B5609, skin and skull, adult male.
Comments. A. H. Howell (1938: 110) first synonymized *badius* with *texensis* under the genus *Citellus.*

Genus *SYNTHEOSCIURUS* Bangs, 1902

Syntheosciurus brochus Bangs, 1902b
Bull. Mus. Comp. Zool., 39: 25, April.

Holotype. MCZ 10402. Skin and skull. Adult male.
Locality. Panama: Chiriqui, Boquete (=Bajo Boquete), 7,000 ft (2,135 m). 30 April 1901.
Collector. W. W. Brown, Jr. Original number 415.
Condition. Skin complete. Skull partial (left supraoccipital damaged)
Type Series. 1 paratype; MCZ 10403, skin and skull, adult female.
Comments. Type species of the genus *Syntheosciurus* Bangs, 1902. Considered a valid species by Hoffman et al. (1993: 452) and Nowak (1999: 1268). Following a discussion with a collector employed by W. W. Brown, Jr., and a biological survey of Boquete, Enders (1953b: 509) recommended that the type locality be considered "the Cordillera about 8 miles [12.9 km] north of Boquete and not at Boquete which is on the lower slopes of El Volcan de Chiriqui."

Genus *TAMIAS* Illiger, 1811

Tamias cooperi Baird, 1855
Proc. Acad. Nat. Sci. Philadelphia, 7: 334, 24 April 24.
=*Tamias townsendii cooperi* Baird, 1855. See Baird (1858: 737).

Syntype. MCZ 4754. Skin only. Adult, unsexed.
Locality. (United States): Washington (Skagit County), Clickitat (=Klickitat) Pass, Cascade Mountains, 4,500 ft (1,373 m). July 1853. See comments.
Collector. J. G. Cooper. Formerly USNM 211/1182.
Condition. Skin complete.
Type Series. The other syntype is USNM 212/1183, skin and skull, unsexed adult.
Comments. No type is designated in the original description, but Baird subsequently explained that the two specimens listed above were those on which *cooperi* was based (1858: 301). Cooper (1869: 531) emended the type locality. The syntype of *cooperi* in the MCZ was received from the USNM in January 1874.

Tamias dorsalis Baird, 1855
Proc. Acad. Nat. Sci. Philadelphia, 7: 332, 24 April.
=*Tamias dorsalis dorsalis* Baird, 1855. See Hayman and Holt (1940: 435).

Syntype. MCZ 4759. Skin and mandible.
Locality. (United States): New Mexico (Grant County), "Fort Webster, Coppermines of the Mimbres" (near present Georgetown). 32°47′N, 108°41′W. 1851. See A. H. Howell (1929: 131).
Collector. J. H. Clark. Formerly USNM 119/3151.
Condition. Skin complete. Mandible partial (posterior of right mandibular ramus broken off and missing).
Type Series. The other syntype is USNM 120, skull within skin.
Comments. No type is designated in the original description, but Baird subsequently listed the two

specimens above as those on which *dorsalis* was based (1858: 300). The syntype of *dorsalis* in the MCZ was received from the USNM in January 1874.

Tamias quadrivittatus neglectus J. A. Allen, 1890
Bull. Amer. Mus. Nat. Hist., 3: 106, June.
=*Tamias minimus neglectus* (J. A. Allen, 1890). See Hayman and Holt (1940: 430).

Holotype. MCZ 1575. Skin and cranium.
Locality. (Canada): (Ontario), eastern end of Lake Superior (near mouth of Montreal River). 5 July 1848.
Collector. L. Agassiz.
Condition. Skin complete. Cranium partial (zygomatic arches, parietals, left tympanic bulla, and mandible missing).
Type Series. The description mentions 6 paratypes, including MCZ 1567, skin and skull; and 4 others at USNM.
Comments. Following A. H. Howell (1929: 54), Hayman and Holt (1940: 430) considered *T. m. neglectus* a synonym of *T. m. borealis.* However, *neglectus* was retained as a valid subspecies of *minimus* by Hall (1981: 346) under the genus *Eutamias.*

Tamias striatus venustus Bangs, 1896h
Proc. Biol. Soc. Washington, 10: 137, 28 December.

Holotype. B5478. Skin and skull. Adult male.
Locality. (United States): Indian Territory (=Oklahoma) (Adair County), Stilwell. 13 August 1896.
Collector. T. Surber. Original number 63.
Condition. Skin complete. Skull partial (condyle of left mandibular ramus missing).
Type Series. 2 paratypes; B5479, skin and skull, adult female; B5605, skin and skull, adult male.
Comments. Retained as a valid subspecies by Hall (1981: 340).

Genus *TAMIASCIURUS* Trouessart, 1880

Sciurus hudsonicus gymnicus Bangs, 1899f
Proc. New England Zool. Club, 1: 28, 31 March.
=*Tamiasciurus hudsonicus gymnicus* (Bangs, 1899). See Osgood (1938: 438).

Holotype. B4914. Skin and skull. Adult female.
Locality. (United States): Maine, Piscataquis County, Greenville, near Moosehead Lake. 1 December 1895.
Collector. C. H. Goldthwaithe. Original number 2.
Condition. Skin and skull complete.
Type Series. There is a series of paratypes in the MCZ.
Comments. *T. h. gymnicus* was retained as a valid subspecies by Hall (1981: 442) and Steele (1998: 1).

Sciurus hudsonicus loquax Bangs, 1896j
Proc. Biol. Soc. Washington, 10: 161, 28 December.
=*Tamiasciurus hudsonicus loquax* (Bangs, 1896). See A. H. Howell (1936: 1).

Holotype. B4270. Skin and skull. Adult male.
Locality. (United States): Connecticut, New London County, Liberty Hill. 24 December 1895.
Collector. O. Bangs. Original number 3.
Condition. Skin and skull complete.
Type Series. There is a large series of paratypes in the MCZ.
Comments. *T. h. loquax* was retained as a valid subspecies by Hall (1981: 443) and Steele (1998: 1).

Sciurus hudsonicus orarius Bangs, 1897i
Proc. Biol. Soc. Washington, 11: 281, 30 December.
=*Tamiasciurus douglasii mollipilosus* (Audubon and Bachman, 1841). See Hayman and Holt (1940: 347).

Holotype. B4978. Skin and skull. Adult female.
Locality. (United States): California, Mendocino County, Philo. 9 December 1895.
Collector. C. A. Allen. Original number 887.
Condition. Skin complete. Skull partial (right tympanic bulla broken).
Type Series. 13 paratypes; B4832, B4979–B4989, B5462; all represented by skin and skull, 9 females and 4 males.

Family CASTORIDAE Hemprich, 1820

Genus *CASTOR* Linnaeus, 1758

Castor caecator Bangs, 1913
Bull. Mus. Comp. Zool., 54: 513, July.
=*Castor canadensis caecator* Bangs, 1913. See G. M. Allen (1942: 62).

Holotype. B6979. Skull. Adult male.
Locality. (Canada): Newfoundland, near Bay St. George. 1896.
Collector. E. Doane.
Condition. Skull complete. Mandible disarticulated.

Type Series. Holotype only.
Comments. C. c. caecator was retained as a valid subspecies by Hall (1981: 602).

Family GEOMYIDAE Bonaparte, 1845

Genus *GEOMYS* Rafinesque, 1817

Geomys colonus Bangs, 1898b

Proc. Boston Soc. Nat. Hist., 28: 178, 15 March.
= *Geomys pinetis pinetis* Rafinesque, 1817. See Williams and Genoways (1980: 444).

Holotype. B5001. Skin and skull. Adult male.
Locality. (United States): Georgia, Camden County, Arnot Plantation, about 4 miles (6.4 km) west of St. Mary's. 21 March 1896.
Collector. O. Bangs. Original number 8.
Condition. Skin and skull complete.
Type Series. There is a series of paratypes in the MCZ.
Comments. Hall (1981: 505) recognized *Geomys colonus* as a valid species.

Geomys cumberlandius Bangs, 1898b

Proc. Boston Soc. Nat. Hist., 28: 180, 15 March.
= *Geomys pinetis pinetis* Rafinesque, 1817. See Williams and Genoways (1980: 444).

Holotype. B5016. Skin and skull. Adult male.
Locality. (United States): Georgia, Camden County, Cumberland Island, Stafford Place. 17 April 1896.
Collector. O. Bangs. Original number 1.
Condition. Skin and skull complete.
Type Series. There is a series of paratypes in the MCZ.
Comments. In the original description, Bangs lists B5015 as the type and gives its data. The data given fit B5016, not B5015. B5016 has "Type" written after the entry in Bangs' catalogue and should be considered the holotype, rather than B5015. Hall (1981: 505) and Laerm (1981: 150) supported the specific status of *Geomys cumberlandius.*

Geomys floridanus austrinus Bangs, 1898b

Proc. Boston Soc. Nat. Hist., 28: 177, 15 March.
= *Geomys pinetis pinetis* Rafinesque, 1817. See Williams and Genoways (1980: 444).

Holotype. B6983. Skin and skull. Adult male.
Locality. (United States): Florida, Pinellas County, Belleair. 3 August 1897.
Collector. W. S. Dickinson.
Condition. Skin and skull complete. Mandible disarticulated.
Type Series. 1 paratype, in the USNM.

Geomys tuza goffi Sherman, 1944

Proc. New England Zool. Club, 23: 38, 30 August.
= *Geomys pinetis goffi* Sherman, 1944. See Harper (1952: 37).

Holotype. B7222. Skin and skull. Adult male.
Locality. (United States): Florida, Brevard County, Eau Gallie. 18 March 1897.
Collector. O. Bangs. Original number 1.
Condition. Skin and skull complete.
Type Series. 12 paratypes; B7212–B7217, B7219–B7221; all represented by skin and skull, 5 females and 7 males.
Comments. Williams and Genoways (1980: 444) synonymized *goffi* with *G. pinetis pinetis;* however, Hall (1981: 504) maintained *G. p. goffi* as a valid subspecies. The IUCN designates *goffi* as extinct.

Genus *ORTHOGEOMYS* Merriam, 1895

Macrogeomys cavator Bangs, 1902b

Bull. Mus. Comp. Zool., 39: 42, April.
= *Orthogeomys cavator cavator* (Bangs, 1902). See Russell (1968a: 532).

Holotype. MCZ 10381. Skin and skull. Adult male.
Locality. Panama: Chiriqui, Boquete (=Bajo Boquete), 4,800 ft (1,464 m). 9 March 1901.
Collector. W. W. Brown, Jr. Original number 212.
Condition. Skin and skull complete. Mandible disarticulated.
Type Series. There is a large series of paratypes in the MCZ.
Comments. O. cavator was considered a valid species by Patton (1993: 470) and Nowak (1999: 1314).

Macrogeomys pansa Bangs, 1902b

Bull. Mus. Comp. Zool., 39: 44, April.
= *Orthogeomys cavator pansa* (Bangs, 1902). See Russell (1968a: 532).

Holotype. MCZ 10364. Skin and skull. Adult female.
Locality. Panama: Chiriqui, Bogaba, 600 ft (183 m). 6 July 1901.
Collector. W. W. Brown, Jr. Original number 567.
Condition. Skin complete. Skull partial (right tympanic bulla missing).
Type Series. There are 7 paratypes; MCZ 10362–10363, 10365–10369, 4 females and 3 males, all represented by skin and skull. MCZ 10362 and 10366 are now in the FMNH, and MCZ 10365 is in the USNM.
Comments. O. c. pansa was retained as a valid subspecies by Hall (1981: 513).

Orthogeomys grandis pluto Lawrence, 1933a
Proc. New England Zool. Club, 13: 66, 8 May.

Holotype. MCZ 29040. Skin and skull. Adult female.
Locality. Honduras: Francisco Morazan, north of Tegucigalpa, Cerro Cantoral. 20 July 1932.
Collector. C. F. Underwood. Original number 1100.
Condition. Skin and skull complete.
Type Series. 2 paratypes; MCZ 29038, skin and skull, juvenile female; MCZ 29039, skin and skull, unsexed juvenile.
Comments. Retained as a valid subspecies by Hall (1981: 509).

Genus *PAPPOGEOMYS* Merriam, 1895

Cratogeomys castanops rubellus Nelson and Goldman, 1934a
Proc. Biol. Soc. Washington, 47: 147, 13 June.
=*Pappogeomys castanops rubellus* (Nelson and Goldman, 1934). See Russell (1968b: 682).

Holotype. MCZ 20507. Skin and skull. Adult male.
Locality. Mexico: San Luis Potosí, near San Luis Potosí, Soledad, 6,400 ft (1,952 m). 1 August 1923.
Collector. W. W. Brown, Jr. Original number 231.
Condition. Skin and skull complete. Mandible disarticulated.
Type Series. There is a large paratype series in the MCZ.
Comments. *P. c. rubellus* was retained as a valid subspecies by Hall (1981: 520).

Genus *THOMOMYS* Wied-Neuwied, 1839

Thomomys umbrinus atrodorsalis Nelson and Goldman, 1934b
J. Mammal., 15: 111, 15 May.

Holotype. MCZ 20487. Skin and skull. Adult male.
Locality. Mexico: San Luis Potosí, Alvarez, 8,000 ft (2,440 m). 7 November 1923.
Collector. W. W. Brown, Jr. Original number 338.
Condition. Skin and skull complete. Mandible disarticulated.
Type Series. There is a large series of paratypes in the MCZ.
Comments. Retained as a valid subspecies by Hall (1981: 476).

Family HETEROMYIDAE Gray, 1868

Genus *DIPODOMYS* Gray, 1841

Dipodomys californicus pallidulus Bangs, 1899j
Proc. New England Zool. Club, 1: 65, 31 July.
=*Dipodomys californicus californicus* Merriam, 1890. See Kelt (1988: 1).

Holotype. B9147. Skin and skull. Adult female.
Locality. (United States): California, Colusa County, Sites. 27 June 1896.
Collector. P. O. Simons. Original number 222.
Condition. Skin complete. Skull partial (left jugal missing).
Type Series. 1 paratype; B9148, skin and skull, adult female.

Dipodops ordii palmeri J. A. Allen, 1891
Bull. Amer. Mus. Nat. Hist., 3: 276, 30 June.
=*Dipodomys ordii palmeri* (J. A. Allen, 1891). See Grinnell (1921: 96).

Syntypes. MCZ 5886: Skin and skull. Juvenile male. MCZ 5887: Skin and skull. Unsexed juvenile.
Locality. Mexico: San Luis Potosí, San Luis Potosí. 1 May 1878.
Collector. E. Palmer.
Condition. MCZ 5886: Skin complete. Skull partial (part of parietal, right occipital condyle, and tympanic bulla missing). MCZ 5887: Skin complete. Skull partial (left squamosal process missing). Mandible disarticulated.
Type Series. 2 syntypes only.
Comments. Allen did not specify a holotype in the original description, which he based on the two specimens above. *D. o. palmeri* was retained as a valid subspecies by Hall (1981: 569).

Genus *HETEROMYS* Desmarest, 1817

Heteromys repens Bangs, 1902b
Bull. Mus. Comp. Zool., 39: 45, April.
=*Heteromys desmarestianus repens* Bangs, 1902. See Goldman (1920: 115).

Holotype. MCZ 10356. Skin and skull. Adult female.
Locality. Panama: Chiriqui, Boquete (=Bajo Boquete), 4,000 ft (1,220 m). 8 April 1901.
Collector. W. W. Brown, Jr. Original number 264.
Condition. Skin complete. Skull partial (left jugal and process of squamosal missing).
Type Series. 5 paratypes; MCZ 10359, adult male, 10355, adult male, 10358, adult male, 10361, juvenile female, 10360, juvenile female.
Comments. *H. d. repens* was retained as a valid subspecies by Hall (1981: 597).

Genus *LIOMYS* Merriam, 1902

Heteromys alleni Coues, 1881

In J. A. Allen, Bull. Mus. Comp. Zool., 8: 187, March.
=*Liomys irroratus alleni* (Coues, 1881). See Goldman (1911: 56).

Holotype. MCZ 5889. Skin and skull. Male.
Locality. (Mexico): San Luis Potosí, Rio Verde, Hacienda Angostura. 26 February 1878.
Collector. E. Palmer.
Condition. Skin complete, skull within skin.
Type Series. Holotype only.
Comments. *L. i. alleni* was retained as a valid subspecies by Hall (1981: 590).

Genus *PEROGNATHUS* Wied-Neuwied, 1839

Perognathus longimembris bangsi Mearns, 1898

Bull. Amer. Mus. Nat. Hist., 10: 300, 31 August.

Holotype. B5304. Skin and skull. Adult female.
Locality. (United States): California, (Riverside County), Colorado Desert, Palm Springs, 450 ft (137 m). 13 April 1896.
Collector. E. C. Thurber. Original number 644.
Condition. Skin complete. Skull partial (teeth separate from skull). Mandible disarticulated.
Type Series. 2 paratypes; B5302, adult male, skin and skull; B5303, adult female, skin and skull.
Comments. Retained as a valid subspecies by Hall (1981: 537).

Family DIPODIDAE Fischer de Waldheim, 1817

Genus *ZAPUS* Coues, 1875

Zapus hudsonius hardyi Batchelder, 1899

Proc. New England Zool. Club, 1: 5, 8 February.
=*Zapus hudsonicus acadicus* (Dawson, 1856). See Krutzsch (1954: 432).

Holotype. MCZ 41681. Skin and skull. Adult female.
Locality. (United States): Maine, Hancock County, Mount Desert Island. 24 August 1898.
Collector. C. F. Batchelder. Original number 1597.
Condition. Skin and skull complete.
Type Series. There is a series of paratypes in the MCZ.

Zapus hudsonius ladas Bangs, 1899d

Proc. New England Zool. Club, 1: 10, 28 February.

Holotype. B4169. Skin and skull. Adult female.
Locality. (Canada): Labrador, Hamilton Inlet, Rigoulette. 18 July 1895.
Collector. C. H. Goldthwaite. Original number 2.
Condition. Skin and skull complete. Mandible disarticulated.
Type Series. There is a large series of paratypes, most of which are in the MCZ.
Comments. Retained as a valid subspecies by Hall (1981: 843).

Zapus orarius Preble, 1899

N. Amer. Fauna, 15: 29, 8 August.
=*Zapus trinotatus orarius* Preble, 1899. See Hooper (1944: 67).

Holotype. B250. Skin and skull. Adult male.
Locality. (United States): California, Marin County, Point Reyes. 14 May 1893.
Collector. C. A. Allen. Original number 618.
Condition. Skin and skull complete.
Type Series. 3 paratypes, not in MCZ; mentioned by locality in original description.
Comments. *Z. t. orarius* was retained as a valid subspecies by Hall (1981: 846) and Gannon (1988: 1).

Family MURIDAE Illiger, 1811

Subfamily ARVICOLINAE Gray, 1821

Genus *CHIONOMYS* Miller, 1908

Hypudaeus nivicola Schinz, 1845

Syst. Verzeichniss Säugethiere Synopsis Mammalium, 2: 236.
=*Chionomys nivalis* (Martins, 1842). See Musser and Carleton (1993: 507).

Syntype. MCZ 1291. Skin. Juvenile female.
Locality. Switzerland: St. Gotthard.
Collector. Received from L. Agassiz,
Condition. Skin complete.
Type Series. Schinz wrote that he had examined 16 specimens, "junge und alte."
Comments. G. M. Allen discussed the somewhat uncertain type status of this specimen (1931: 263). The original label bears the following: "Hypodaeus [sic] nivicola juv. ♀ sp. nov. du St. Gotthard et du Faulhorn." Louis Agassiz, a student of Schinz's, deposited the specimen in the MCZ.

Genus *CLETHRIONOMYS* Tilesius, 1850

Evotomys proteus Bangs, 1897g
In Bailey, Proc. Biol. Soc. Washington, 11: 137, 13 May.
=*Clethrionomys gapperi proteus* (Bangs, 1897). See Jackson (1938: 433).

Holotype. B4081. Skin and skull. Adult female.
Locality. (Canada): Labrador, Hamilton Inlet. 27 August 1895.
Collector. C. H. Goldthwaite. Original number 10.
Condition. Skin and skull complete. Mandible disarticulated.
Type Series. There is a large series of paratypes in the MCZ.
Comments. *C. g. proteus* was retained as a valid subspecies by Hall (1981: 783).

Genus *DICROSTONYX* Gloger, 1841

Dicrostonyx chionopaes G. M. Allen, 1914b
Proc. New England Zool. Club, 5: 62, 9 April.
=*Dicrostonyx torquatus chionopaes* G. M. Allen, 1914. See Ognev (1948: 507).

Holotype. MCZ 15263. Skin and skull. Adult male.
Locality. U.S.S.R. (=Russian Federation): eastern Siberia, Nijni Kolymsk (Nizhnekolymsk), near mouth of Kolyma River. 15 October 1911.
Collector. J. Koren. Original number 257.
Condition. Skin and skull complete. Mandible disarticulated.
Type Series. Holotype only.

Dicrostonyx exsul G. M. Allen, 1919a
Bull. Mus. Comp. Zool., 62: 532, February.

Holotype. MCZ 11885. Skin and skull. Adult male.
Locality. (United States): (Alaska), St. Lawrence Island. 24 June 1913.
Collector. J. Dixon. Original number 3267.
Condition. Skin complete. Skull partial (basioccipital and right tympanic bulla missing). Mandible disarticulated.
Type Series. 3 paratypes; MCZ 11883, skin and skull, female; MCZ 11884, skin and skull, female; USNM 232007, skin and skull, female.
Comments. Considered a valid species by Musser and Carleton (1993: 510) but included in *D. groenlandicus* by Nowak (1999: 1479).

Genus *EOTHENOMYS* Miller, 1896

Craseomys aquilus G. M. Allen, 1912b
Mem. Mus. Comp. Zool., 40: 216, August.
=*Eothenomys eva eva* (Thomas, 1911). See G. M. Allen (1940: 837).

Holotype. MCZ 7190. Skin and skull. Adult male.
Locality. China: Hupeh (=Hubei), Showlungtan. 17 May 1907.
Collector. W. R. Zappey. Original number 10.
Condition. Skin complete. Skull partial (hole in left parietal, occiput missing).
Type Series. 5 paratypes; MCZ 7189, 7191–7194, 7196; all represented by skin and skull, all female.

Microtus (Eothenomys) aurora G. M. Allen, 1912b
Mem. Mus. Comp. Zool., 40: 211, August.
=*Eothenomys melanogaster aurora* (G. M. Allen, 1912). See Hinton (1923: 149).

Holotype. MCZ 7788. Skin and skull. Male.
Locality. China: Hupeh (=Hubei), Changyanghsieh. 2 February 1909.
Collector. W. R. Zappey. Original number 372.
Condition. Skin and skull complete.
Type Series. 3 paratypes; MCZ 7185, skin and skull, female; MCZ 7186, skin and skull, male; MCZ 7188, skin and skull, male.
Comments. *E. m. aurora* was retained as a valid subspecies by Zhang et al. (1997: 229).

Microtus (Eothenomys) mucronatus G. M. Allen, 1912b
Mem. Mus. Comp. Zool., 40: 214, August.
=*Eothenomys melanogaster melanogaster* (Milne-Edwards, 1871). See G. M. Allen (1940: 806).

Holotype. MCZ 7789. Skin and skull. Adult female.
Locality. China: western Szechwan (=Sichuan), Tachiao, 12,000 ft (3,660 m). 11 August 1908.
Collector. W. R. Zappey. Original number 269.
Condition. Skin and skull complete. Mandible disarticulated.
Type Series. 3 paratypes; MCZ 7790, skin and skull, adult female (exchanged to the BMNH); MCZ 7791, skin and skull, adult female; MCZ 7803, skin and skull, juvenile female.

Genus *LEMMUS* Link, 1795

Lemmus paulus G. M. Allen, 1914b
Proc. New England Zool. Club, 5: 60, 9 April.
=*Lemmus sibiricus chrysogaster* J. A. Allen, 1903. See Ellerman and Morrison-Scott (1951: 656).

Holotype. MCZ 15268. Skin and skull. Adult male.
Locality. (Russian Federation): northeastern Siberia, Kalaschowo, near mouth of Kolyma River. 22 June 1912.
Collector. J. Koren. Original number 152.
Condition. Skin complete. Skull partial (left mandibular ramus missing).
Type Series. 1 paratype; MCZ 15267, skin, female.

Genus *MICROTUS* Schrank, 1798

Arvicola breweri Baird, 1858
Mammals, *in* Repts. Explor. Surveys Railr. to Pacific, 8(1): 525, 14 July.
=*Microtus breweri* (Baird, 1858). See Miller (1896: 83).

Syntype. MCZ 4365. Body in alcohol. Formerly USNM 2833.
Locality. (United States): Massachusetts, Nantucket County, off Nantucket Island, Muskeeget (=Muskeget) Island. July 1856.
Collector. T. M. Brewer.
Condition. Alcoholic.
Type Series. There are 5 other syntypes (see Poole and Schantz, 1942: 271–272), all of which were at one time in the USNM.
Comments. Poole and Schantz (1942: 271) noted that USNM 2829, a syntype of *breweri*, could not be found.

Arvicola riparia var. *longipilis* Baird, 1858
Mammals, *in* Repts. Explor. Surveys Railr. to Pacific, 8(1): 524, 14 July.
=*Microtus pennsylvanicus pennsylvanicus* (Ord, 1815). See Bailey (1900: 16).

Syntype. MCZ 5292. Skin and skull.
Locality. (United States): Illinois, (Cook County), West Northfield. Spring 1855.
Collector. R. Kennicott. Formerly USNM 745.
Condition. Skin complete. Skull partial (part of parietal, both tympanic bullae and palatine missing). Mandible disarticulated.
Type Series. See comments.
Comments. G. M. Allen (1931: 260), mentioned that "although no individuals are mentioned [in Baird's description], . . . [this] specimen was undoubtedly among those examined by Baird in preparing his diagnosis and, therefore, is a cotype [=syntype]." Baird's specimens were collected by Kennicott at West Northfield, Illinois, and by Hoy at Racine, Wisconsin, and were apparently deposited in the USNM. Lyon and Osgood (1909) and Poole and Schantz (1942) make no mention of other syntypes.

Arvicola rufidorsum Baird, 1858
Repts. Explor. Surveys Railr. to Pacific, 8(1): 526, 14 July.
=*Microtus pennsylvanicus pennsylvanicus* (Ord, 1815). See Bailey (1900: 16).

Holotype. MCZ 54372. Skin and skull.
Locality. (United States): Massachusetts, (Duke's County), Martha's Vineyard, Holmes Hole.
Collector. D. J. Wyman.
Condition. Skin and skull complete. Mandible disarticulated.
Type Series. Holotype only.
Comments. This specimen has formerly been BSNH 1949 and USNM 901.

Arvicola terraenovae Bangs, 1894a
Proc. Biol. Soc. Washington, 9: 129, 27 July.
=*Microtus pennsylvanicus terraenovae* (Bangs, 1894). See Davis (1936: 290).

Holotype. B1104. Skin and skull. Adult male.
Locality. (Canada): Newfoundland, Codroy. 27 November 1893.
Collector. E. Doane. Original number 4.
Condition. Skin and skull complete.
Type Series. There is a series of paratypes in the MCZ.
Comments. M. p. terraenovae was retained as a valid subspecies by Hall (1981: 796).

Microtus chrotorrhinus ravus Bangs, 1898p
Proc. Biol. Soc. Washington, 12: 188, 16 November.

Holotype. B7951. Skin and skull. Adult male.
Locality. (Canada): Labrador, Strait of Belle Isle, Black Bay. 15 July 1898.
Collector. E. Doane. Original number 4.
Condition. Skin and skull complete. Mandible disarticulated.
Type Series. Paratype material consists of Bangs' series from the type locality; B7952–7967, all represented by skin and skull, 10 females, 3 males, and 3 unsexed individuals. B7953 and B7955 were exchanged to MVZ in 1937; B7964 was exchanged to USNM in 1922.
Comments. Retained as a valid subspecies by Hall (1981: 811) and Kirkland and Jannett (1982: 1).

Microtus enixus Bangs, 1896g
Amer. Nat., 30: 1051, 1 December.
=*Microtus pennsylvanicus enixus* Bangs, 1896. See Davis (1936: 290).

Holotype. B3973. Skin and skull. Adult female.
Locality. (Canada): Labrador, Hamilton Inlet. 15 July 1895.
Collector. C. H. Goldthwaite. Original number 4.
Condition. Skin and skull complete.
Type Series. There is a large series of paratypes in the MCZ.
Comments. *M. p. enixus* was retained as a valid subspecies by Hall (1981: 793).

Microtus fontigenus Bangs, 1896d
Proc. Biol. Soc. Washington, 10: 48, 9 March.
=*Microtus pennsylvanicus fontigenus* Bangs, 1896. See Miller (1897: 14).

Holotype. B3837. Skin and skull. Adult female.
Locality. (Canada): Quebec, Lake Edward. 28 September 1895.
Collector. E. A. and O. Bangs. Original number 9.
Condition. Skin and skull complete. Mandible disarticulated.
Type Series. 7 paratypes; B3838–B3844; all represented by skin and skull, 2 females and 5 males.
Comments. *M. p. fontigenus* was retained as a valid subspecies by Hall (1981: 793).

Microtus koreni G. M. Allen, 1914b
Proc. New England Zool. Club, 5: 64, 9 April.
=*Microtus oeconomus koreni* G. M. Allen, 1914. See Ellerman and Morrison-Scott (1951: 706).

Holotype. MCZ 15213. Skin and skull. Adult female.
Locality. (Russian Federation): northeastern Siberia, Nijni Kolymsk (=Nizhnekolymsk), near mouth of Kolyma River. 1 November 1911.
Collector. J. Koren. Original number 132.
Condition. Skin complete. Skull partial (left tympanic bulla broken, right mandibular ramus missing).
Type Series. There is a large series of paratypes in the MCZ.

Microtus pennsilvanicus [sic] *shattucki* Howe, 1901
Proc. Portland Soc. Nat. Hist., 2: 201, 31 December.
=*Microtus pennsylvanicus shattucki* Howe, 1901. See Wyman (1922: 162).

Holotype. MCZ 10011. Skin and skull. Adult female.
Locality. (United States): Maine, Penobscot Bay, near Long Island, Tumble Down Dick Island. 10 July 1900.
Collector. R. H. Howe and G. C. Shattuck. Original number 31.
Condition. Skin and skull complete.
Type Series. There is a small series of paratypes in the MCZ.
Comments. Wyman (1922: 166) considered *M. p. shattucki* a synonym of *M. p. pennsylvanicus,* but Hall (1981: 796) retained it as a separate subspecies.

Microtus pennsylvanicus acadicus Bangs, 1897c
Amer. Nat., 31: 239, 1 March.

Holotype. B2155. Skin and skull. Adult female.
Locality. Canada: Nova Scotia, Digby. 22 July 1894.
Collector. O. Bangs.
Condition. Skin and skull complete.
Type Series. There is a series of paratypes in the MCZ.
Comments. Retained as a valid subspecies by Hall (1981: 792).

Microtus provectus Bangs, 1908
Proc. New England Zool. Club, 4: 20, 6 March.
=*Microtus pennsylvanicus provectus* Bangs, 1908. See Chamberlain (1954: 589).

Holotype. B9794. Skin and skull. Adult female.
Locality. (United States): Rhode Island, Block Island. 5 August 1899.
Collector. O. Bangs. Original number 11.
Condition. Skin complete. Skull partial (tympanic bullae broken). Mandible disarticulated and angular process chipped.
Type Series. There is a series of paratypes in the MCZ.
Comments. *M. p. provectus* was retained as a valid subspecies by Hall (1981: 796).

Genus *MYOPUS* Miller, 1910

Myopus thayeri G. M. Allen, 1914b
Proc. New England Zool. Club, 5: 58, 9 April.
=*Myopus schisticolor thayeri* G. M. Allen, 1914. See Ognev (1948: 526).

Holotype. MCZ 15264. Skin and skull. Adult male.
Locality. (Russian Federation): northeastern Siberia, Yakutsk, Nijni Kolymsk (=Nizhnekolymsk), near mouth of Kolyma River. 28 March 1912.
Collector. J. Koren. Original number 264.
Condition. Skin and skull complete. Mandible disarticulated.

Comments. 1 paratype; MCZ 15265, skin and skull, male.

Genus *ONDATRA* Link, 1795

Fiber obscurus Bangs, 1894b

Proc. Biol. Soc. Washington, 9: 133, 15 September.
=*Ondatra zibethicus obscurus* (Bangs, 1894). See Cameron (1959: 85).

Holotype. B1155. Skin and skull. Adult female.
Locality. (Canada): Newfoundland, Codroy. 14 May 1894.
Collector. E. Doane. Original number 3.
Condition. Skin and skull complete. Mandible disarticulated.
Type Series. There is a small series of paratypes in the MCZ.
Comments. O. z. obscurus was retained as a valid subspecies by Hall (1981: 827).

Fiber zibethicus aquilonius Bangs, 1899d

Proc. New England Zool. Club, 1: 11, 28 February.
=*Ondatra zibethicus aquilonius* (Bangs, 1899). See Miller (1912:231).

Holotype. B3957. Skin and skull. Adult male.
Locality. (Canada): Labrador, Hamilton Inlet, Rigoulette. 15 August 1895.
Collector. C. H. Goldthwaite. Original number 11.
Condition. Skin and skull complete. Mandible disarticulated.
Type Series. 3 paratypes; B7974, skin and skull, adult female; B7975, skin and skull, juvenile; B8704, skull, juvenile.
Comments. O. z. aquilonius was retained as a valid subspecies by Hall (1981: 825).

Fiber zibethicus rivalicius Bangs, 1895b

Proc. Boston Soc. Nat. Hist., 26: 541, 31 July.
=*Ondatra zibethicus rivalicius* (Bangs, 1895). See Davis and Lowery (1940: 212).

Holotype. B2719. Skin and skull. Adult male.
Locality. (Canada): Louisiana, Plaquemines Parish, Burbridge. 31 January 1895.
Collector. F. L. Small. Original number 1556/165.
Condition. Skin and skull complete.
Type Series. 4 paratypes; B2720, skin and skull, adult female; B2721, skin and skull, adult male; B2883, skin and skull, male; B2884, skin and skull, male.
Comments. O. z. rivalicius was retained as a valid subspecies by Hall (1981: 827).

Genus *PHENACOMYS* Merriam, 1889

Phenacomys celatus crassus Bangs, 1900c

Proc. New England Zool. Club, 2: 39, 20 September.
=*Phenacomys ungava crassus* Bangs, 1900. See A. B. Howell (1926: 27).

Holotype. B3959. Skin and skull. Adult male.
Locality. (Canada): Labrador, Hamilton Inlet, Rigoulette. 15 August 1895.
Collector. C. H. Goldthwaite. Original number 1.
Condition. Skin and skull complete.
Type Series. There is a small series of paratypes, most of which are no longer in the MCZ.
Comments. In the original description, "3946" is a misprint for 3964.

Genus *SYNAPTOMYS* Baird, 1858

Synaptomys fatuus Bangs, 1896d

Proc. Biol. Soc. Washington, 10: 47, 9 March.
=*Synaptomys cooperi cooperi* Baird, 1858. See Wetzel (1955:8).

Holotype. B3857. Skin and skull. Adult female.
Locality. (Canada): Quebec, Lake Edward. 28 September 1895.
Collector. E. A. and O. Bangs. Original number 3.
Condition. Skin and skull complete.
Type Series. 8 paratypes; B3854–B3856, B3858–B3862; all represented by skin and skull, 3 females and 5 males.

Synaptomys (Mictomys) innuitus medioximus Bangs, 1900c

Proc. New England Zool. Club, 2: 40, 20 September.
=*Synaptomys borealis medioximus* Bangs, 1900. See A. B. Howell (1927: 9).

Holotype. B8852. Skin and skull. Adult male.
Locality. (Canada): Labrador, Strait of Belle Isle, Lance (=L'anse) au Loup. 15 April 1899.
Collector. E. Doane. Original number 7.
Condition. Skin complete. Skull slightly damaged (hole in left parietal).
Type Series. 1 paratype; B3972, skin and skull, adult male.
Comments. S. b. medioximus was retained as a valid subspecies by Hall (1981: 834).

Subfamily CRICETINAE Fischer de Waldheim, 1817

Genus *CANSUMYS* G. M. Allen, 1928

Cansumys canus G. M. Allen, 1928
J. Mammal., 9: 245, 9 August.

Holotype. MCZ 23779. Skin and skull. Adult female.
Locality. China: southern Kansu (=Xinjiang), Choni. 9 December 1925.
Collector. R. B. Ekvall. Original number 79.
Condition. Skin complete. Skull partial (left jugal and occiput missing).
Type Series. 1 paratype; MCZ 23780, skin and skull, juvenile male.
Comments. Type species of *Cansumys* G. M. Allen, 1928. Considered a valid species by Musser and Carleton (1993: 537) and Nowak (1999: 1423). Known only by the type series and one additional specimen, FMNH 36067.

Subfamily CRICETOMYINAE Roberts, 1951

Genus *SACCOSTOMUS* Peters, 1846

Saccostomus cricetulus G. M. Allen and Lawrence, 1936
Bull. Mus. Comp. Zool., 79: 100, January.
=*Saccostomus mearnsi* Heller, 1910. See Hubert (1978: 51).

Holotype. MCZ 31475. Skin and skull. Subadult male.
Locality. Uganda: Sabei District, due north of Mount Elgon, south bank of Greek River (=Kelim River), 3,000 ft (915 m). 5 December 1933.
Collector. A. Loveridge.
Condition. Skin complete. Skull partial (right tympanic bulla missing). Mandible disarticulated.
Type Series. 1 paratype; MCZ 31474, skin and skull, adult female.

Subfamily DENDROMURINAE G. M. Allen, 1939

Genus *STEATOMYS* Peters, 1846

Steatomys pratensis nyasae Lawrence and Loveridge, 1953
Bull. Mus. Comp. Zool., 110: 39, June.

Holotype. MCZ 44213. Skin and skull. Adult male.
Locality. Nyasaland (=Malawi): foot of Mulanje Mountain, Likabula River, 2,100 ft (641 m). 29 July 1948.
Collector. A. Loveridge.
Condition. Skin and skull complete.
Type Series. 14 paratypes; MCZ 44214–44216, 44218–44228; all represented by skin and skull, 9 males and 5 females.
Comments. Retained as a valid subspecies by Ansell (1978: 77).

Subfamily GERBILLINAE Gray, 1825

Genus *TATERA* Lataste, 1882

Tatera flavipes G. M. Allen, 1914d
Bull. Mus. Comp. Zool., 58: 331, July.
=*Tatera valida kempi* Wroughton, 1906. See Bates (1988: 277).

Holotype. MCZ 14491. Skin and skull. Adult female.
Locality. Sudan: Blue Nile, north of (Er) Roseires, Aradeiba. 22 January 1913.
Collector. G. M. Allen and J. C. Phillips. Original number 69.
Condition. Skin and skull complete. Mandible disarticulated.
Type Series. Holotype only.

Tatera soror G. M. Allen, 1914d
Bull. Mus. Comp. Zool., 58: 333, July.
=*Tatera valida kempi* Wroughton, 1906. See Bates (1988: 277).

Holotype. MCZ 14492. Skin and skull. Adult female.
Locality. Sudan: Blue Nile, Fazogli. 16 January 1913.
Collector. G. M. Allen and J. C. Phillips. Original number 53.
Condition. Skin and skull complete. Mandible disarticulated.
Type Series. 1 paratype; MCZ 14493, skin and skull, juvenile male.

Genus *TATERILLUS* Thomas, 1910

Taterillus melanops G. M. Allen, 1912a
Bull. Mus. Comp. Zool., 54: 446, April.
=*Taterillus harringtoni* (Thomas, 1906). See Musser and Carleton (1993: 563).

Holotype. MCZ 8132. Skin and skull. Male.
Locality. British East Africa (=Kenya): arid plains by the Meru River. 11 August 1909.
Collector. G. M. Allen. Original number 108.
Condition. Skin and skull complete.
Type Series. Holotype only.

Subfamily MURINAE Illiger, 1811

Genus *APODEMUS* Kaup, 1829

Apodemus mystacinus euxinus G. M. Allen, 1915b
Bull. Mus. Comp. Zool., 59: 11, February.
=*Apodemus mystacinus mystacinus* (Danford and Alston, 1877). See Corbet (1978: 133).

Holotype. MCZ 14887. Skin and skull. Male.
Locality. Asia Minor (=Turkey): (Trabzon), near

Trebizond (=Trabzon), Scalita, 1,000 m. 25 November 1905.
Collector. A. Robert. Original number 2189.
Condition. Skin complete. Skull partial (right and left jugal missing, right tympanic bulla separated but present, right and left squamosal missing). Mandible disarticulated.
Type Series. Holotype only.

Genus *DASYMYS* Peters, 1875

Dasymys incomtus alleni Lawrence and Loveridge, 1953
Bull. Mus. Comp. Zool., 110: 53, June.

Holotype. MCZ 26322. Skin and skull. Adult male.
Locality. Tanganyika Territory (=Tanzania): (Mbeya), Ilolo, near Rungwe Mountains, 4,600 ft (1,403 m). 31 March 1930.
Collector. A. Loveridge.
Condition. Skin and skull complete. Mandible disarticulated and right coronoid process chipped.
Type Series. 11 paratypes, all represented by skin and skull, in the MCZ.
Comments. Retained as a valid subspecies by Ansell (1978: 83).

Genus *GRAMMOMYS* Thomas, 1915

Thamnomys ochraceus G. M. Allen, 1912a
Bull. Mus. Comp. Zool., 54: 442, April 1912.
=*Grammomys macmillani* (Wroughton, 1907). See Musser and Carleton (1993: 594).

Holotype. MCZ 8126. Skin and skull. Adult male.
Locality. British East Africa (=Kenya): Meru River, near junction with northern Guaso Nyiro (=Ewaso Ngiro). 8 August 1909.
Collector. G. M. Allen. Original number 103.
Condition. Skin and skull complete.
Type Series. Holotype only.

Genus *HYLOMYSCUS* Thomas, 1926

Hylomyscus alleni simus G. M. Allen and Coolidge, 1930
In Strong, The African Republic of Liberia and the Belgian Congo, 2: 599, October.
=*Hylomyscus alleni* (Waterhouse, 1838). See Heim de Balsac and Aellen (1965: 722).

Holotype. MCZ 24028. Skin and skull. Adult male.
Locality. Liberia: Merikay. 13 September 1926.
Collector. G. M. Allen and H. J. Coolidge, Jr. Original number 97.
Condition. Skin and skull complete. Mandible disarticulated.
Type Series. There is a series of paratypes in the MCZ.

Genus *MELOMYS* Thomas, 1922

Melomys levipes stevensi Rümmler, 1935
Z. Säugetierkunde, 10: 109, 31 December.
=*Melomys mollis* Thomas, 1913. See Flannery (1990: 226).

Holotype. MCZ 29890. Skin and skull. Adult male.
Locality. Papua New Guinea: Morobe, Mount Missim (=Missim), 6,700 ft (2,044 m). 17 April 1933.
Collector. H. Stevens.
Condition. Skin and skull complete. Mandible disarticulated.
Type Series. 11 paratypes; MCZ 29889, 29892–29899, 29901; all represented by skin and skull, 4 females and 7 males.

Melomys moncktoni alleni Rümmler, 1935
Z. Säugetierkunde, 10: 112, 31 December.
=*Melomys rubex alleni* Rümmler, 1935. See Tate (1951: 299).

Holotype. MCZ 29902. Skin and skull. Adult female.
Locality. Papua New Guinea: Morobe, Mount Missim (=Missim), 6,700 ft (2,044 m). 17 April 1933.
Collector. H. Stevens.
Condition. Skin and skull complete. Mandible disarticulated.
Type Series. 1 paratype; MCZ 29900, skin and skull, adult male.
Comments. Flannery (1995a: 308–309) did not list subspecies of *M. rubex*, noting, "It is a very variable species, and a taxonomic revision is needed in order to clarify the taxonomic status of many populations."

Genus *MUS* Linnaeus, 1758

Leggada bufo ablutus G. M. Allen and Loveridge, 1942
Bull. Mus. Comp. Zool., 89: 199, February.
=*Mus bufo* (Thomas, 1906). See Musser and Carleton (1993: 622).

Holotype. MCZ 40745. Skin and skull. Adult male.
Locality. Belgian Congo (=Democratic Republic of Congo): Kivu, Lake Kivu, Idjwi Island, Upper Mulinga, 6,500 ft (1,983 m). 24 February 1939.
Collector. A. Loveridge.

Condition. Skin and skull complete. Mandible disarticulated.
Type Series. 2 paratypes; MCZ 40746, skin and skull (no longer in MCZ); MCZ 40747, skin and skull, female.

Leggada gerbillus G. M. Allen and Loveridge, 1933
Bull. Mus. Comp. Zool., 75: 112, February.
=*Mus tenellus* (Thomas, 1903). See Musser and Carleton (1993: 629).

Holotype. MCZ 26586. Skin and skull. Adult male.
Locality. Tanganyika Territory (=Tanzania): Dodoma, Ugogo, 3,700 ft (1,129 m). 23 December 1929.
Collector. A. Loveridge.
Condition. Skin complete. Skull partial (right jugal missing). Mandible disarticulated and angular process of right ramus chipped.
Type Series. Holotype only.

Mus bactrianus tantillus G. M. Allen, 1927
Amer. Mus. Novitates 270: 9, 31 May.
=*Mus musculus tantillus* G. M. Allen, 1927. See Marshall (1977: 214).

Holotype. MCZ 23476. Skin and skull. Adult female.
Locality. China: Sze-chuan (=Sichuan), Wanhsien (=Wanxian). 14 November 1921.
Collector. W. W. Granger.
Condition. Skin complete. Skull partial (6 fragments). Mandible disarticulated.
Type Series. There is a series of paratypes in the AMNH, and 1 paratype in the MCZ; MCZ 23475 (formerly AMNH 56403), skin and skull, male.
Comments. This specimen was formerly AMNH 56416. The original description lists AMNH 56413 as the holotype, but this specimen is a juvenile, not an adult female, as Allen stated. The collection date and measurements of the holotype in the original description fit MCZ 23476 rather than any other specimens in the type series at the AMNH, which are all immatures (Lawrence 1993: 136).

Genus *MYOMYS* Thomas, 1915

Praomys fumatus oweni Setzer, 1956
Proc. U.S. Nat. Mus., 106: 525, 28 November.
=*Myomys fumatus* (Peters, 1878). See Musser and Carleton (1993: 631).

Holotype. MCZ 45883. Skin and skull. Adult male.
Locality. Anglo-Egyptian Sudan (=Sudan): Equatoria Province, Torit District, Murukurun, 50 miles (80.5 km) east of Torit, 2,000 ft (610 m). 9 May 1950.
Collector. J. S. Owen. Original number 1030.
Condition. Skin and skull complete.
Type Series. There is a series of paratypes in the MCZ.

Genus *NIVIVENTER* Marshall, 1976

Epimys zappeyi G. M. Allen, 1912b
Mem. Mus. Comp. Zool., 40: 225, August.
=*Niviventer confucianus* (Milne-Edwards, 1871). See Musser and Carleton (1993: 633).

Holotype. MCZ 7607. Skin and skull. Adult male.
Locality. China: western Szechwan (=Sichuan), Washan Mountains (=Wu Shan), 9,000 ft (2,745 m). 26 October 1908.
Collector. W. R. Zappey. Original number 305.
Condition. Skin and skull complete. Mandible disarticulated.
Type Series. Holotype only.

Genus *OENOMYS* Thomas, 1904

Oenomys hypoxanthus talangae Setzer, 1956
Proc. U.S. Nat. Mus., 106: 505, 28 November.

Holotype. MCZ 45315. Skin and skull. Adult female.
Locality. Anglo- Egyptian Sudan (=Sudan): Equatoria Province, Imatong Mountains, Talanga Forest, 3,000 ft (915 m). 10 July 1950.
Collector. J. S. Owen. Original number 1338.
Condition. Skin and skull complete.
Type Series. 1 paratype; MCZ 45284, skin and skull, male.

Genus *PRAOMYS* Thomas, 1915

Praomys tullbergi melanotus G. M. Allen and Loveridge, 1933
Bull. Mus. Comp. Zool., 75: 106, February.
=*Praomys delectorum* (Thomas, 1910). See Musser and Carleton (1993: 642).

Holotype. MCZ 26287. Skin and skull. Adult male.
Locality. Tanganyika Territory (=Tanzania): northwest end of Lake Nyasa, Poroto Mountains, Nyamwanga, 6,400 ft (1,952 m). 21 March 1930.
Collector. A. Loveridge.
Condition. Skin complete. Skull partial (left tympanic bulla missing). Mandible disarticulated.
Type Series. 23 paratypes; MCZ 26259, 26285, 26286, 26288–26293, 26295–26297, 26387–26394, 26411, 26497, 26498; all represented by skin and skull.

Comments. Van der Straeten and Dieterlen (1987: 9) and Van der Straeten and Dudu (1990: 81) treated *melanotus* as a species within the *Praomys delectorum* species complex.

Genus *PSEUDOHYDROMYS* Rümmler, 1934

Pseudohydromys murinus Rümmler, 1934
Z. Säugetierkunde, 9: 48, 30 December.

Holotype. MCZ 29904. Skin and skull. Adult male.
Locality. Papua New Guinea, Morobe, Mount Misim (=Missim), 7,000 ft (2,135 m). 8 March 1933.
Collector. H. Stevens.
Condition. Skin complete, with small bald spots. Skull complete. Mandible disarticulated.
Type Series. Holotype only.
Comments. Type species of *Pseudohydromys* Rümmler, 1934. Considered a valid species by Flannery (1995a: 255), Musser and Carleton (1993: 644), and Nowak (1999: 1612).

Genus *STENOMYS* Thomas, 1910

Stenomys niobe stevensi Rümmler, 1935
Z. Säugetierkunde, 10: 117, 31 December.
=*Stenomys niobe niobe* (Thomas, 1906). See Flannery (1995a: 339).

Holotype. MCZ 29915. Skin and skull. Adult male.
Locality. Papua New Guinea: Morobe, Mount Misim (=Missim), 7,000 ft (2,135 m). 16 January 1933.
Collector. H. Stevens. Original number 8.
Condition. Skin and skull complete. Mandible disarticulated.
Type Series. Holotype only.
Comments. Taylor et al. (1982: 193) first synonymized *stevensi* with *niobe,* under the genus *Rattus.*

Stenomys verecundus mollis Rümmler, 1935
Z. Säugetierkunde, 10: 116, 31 December.

Holotype. MCZ 29905. Skin and skull. Adult female.
Locality. Papua New Guinea: Morobe, Mount Misim (=Missim), 5,850 ft (1,784 m). 14 April 1933.
Collector. H. Stevens.
Condition. Skin and skull complete. Mandible disarticulated.
Type Series. Holotype only.
Comments. Retained as a valid subspecies by Flannery (1995a: 346).

Genus *THAMNOMYS* Thomas, 1907

Thamnomys venustus kivuensis G. M. Allen and Loveridge, 1942
Bull. Mus. Comp. Zool., 89: 192, February.

Holotype. MCZ 39151. Skin and skull. Adult female.
Locality. Belgian Congo (=Democratic Republic of Congo): (Sud-Kivu), Lake Kivu, Idjwi Island, Upper Mulinga, 6,500 ft (1,983 m). 2 March 1939.
Collector. A. Loveridge.
Condition. Skin complete. Skull partial (separated between nasal and frontal). Right and left angular processes of mandible chipped.
Type Series. Holotype only.

Subfamily NESOMYINAE Forsyth Major, 1897

Genus *NESOMYS* Peters, 1870

Nesomys lambertoni G. Grandidier, 1930c
Bull. Acad. Malgache, n. ser., 11: 95 (for 1928).

Holotype. MCZ 45941. Skull and postcranial skeleton. Adult male.
Locality. Malagasy Republic (=Madagascar): west coast, vicinity of Maintirano.
Collector. No collection data available. Received by G. Grandidier from Académie Malgache, 1928.
Condition. Skull partial (left zygomatic arch missing, right jugal missing, several small holes). Postcranial skeleton complete (small foot bones presumably preserved in skin).
Type Series. 2 paratypes, MCZ 45933 and 45934, poorly prepared skins (with partial skulls within), both male.
Comments. The skin belonging to the holotype is in the MNHN, Paris (M. Carleton, personal communication). Considered a valid species by Nowak (1999: 1434).

Subfamily OTOMYINAE Thomas, 1897

Genus *OTOMYS* F. Cuvier, 1824

Otomys anchietae lacustris G. M. Allen and Loveridge, 1933
Bull. Mus. Comp. Zool., 75: 120, February.
=*Otomys lacustris* G. M. Allen and Loveridge, 1933. See Dieterlen and Van der Straeten (1992: 385).

Holotype. MCZ 26358. Skin and skull. Adult female.
Locality. Tanganyika Territory (=Tanzania): north end of Lake Nyasa, Ukinga Mountains, Madehani, 7,000 ft (2,135 m). 21 February 1930.

Collector. A. Loveridge.
Condition. Skin complete. Skull partial (left tympanic bulla damaged). Mandible disarticulated and left coronoid process chipped.
Type Series. 17 paratypes; MCZ 26326, 26344–26351, 26353–26357, 26359, 26654, 26658; all represented by skin and skull.
Comments. Included in *O. anchietae* by Musser and Carleton (1993: 680) but treated as a full species by Nowak (1999: 1439).

Otomys barbouri Lawrence and Loveridge, 1953

Bull. Mus. Comp. Zool., 110: 63, June.

Holotype. MCZ 31369. Skin and skull. Adult male.
Locality. Uganda: Mount Elgon, Kaburomi, 1°14′N, 34°31′E, 10,500 ft (3,203 m). 28 December 1933.
Collector. A. Loveridge.
Condition. Skin and skull complete.
Type Series. 9 paratypes; MCZ 31371–31372, 31376, 31421–31425, 31438 (4 males, 4 females, and 1 unsexed individual).
Comments. Considered a valid species by Dieterlen and Van der Straeten (1992: 385) and Nowak (1999: 1439) but included in *O. anchietae* by Musser and Carleton (1993: 680).

Otomys uzungwensis Lawrence and Loveridge, 1953

Bull. Mus. Comp. Zool., 110: 61, June.
=*Otomys typus uzungwensis* Lawrence and Loveridge, 1953. See Hanney (1965: 626).

Holotype. MCZ 26645. Skin and skull. Adult female.
Locality. Tanganyika Territory (=Tanzania): Iringa District, Uzungwa Mountains, Dadaga, 6,000 ft (1,830 m). 31 December 1929.
Collector. A. Loveridge.
Condition. Skin and skull complete.
Type Series. There is a series of paratypes in the MCZ.
Comments. *O. t. uzungwensis* was retained as a valid subspecies by Ansell (1978: 78).

Subfamily SIGMODONTINAE Wagner, 1843

Genus *ISTHMOMYS* Hooper and Musser, 1964

Megadontomys flavidus Bangs, 1902b

Bull. Mus. Comp. Zool., 39: 27, April.
=*Isthmomys flavidus* (Bangs, 1902). See Hooper and Musser (1964: 12).

Holotype. MCZ 10331. Skin and skull. Adult male.
Locality. Panama: Chiriqui, Boquete (=Bajo Boquete), 4,000 ft (1,220 m). 12 April 1901.
Collector. W. W. Brown, Jr. Original number 28.
Condition. Skin complete, with small bald spots. Skull complete. Mandible disarticulated.
Type Series. There is a large series of paratypes in the MCZ.
Comments. Type species of *Isthmomys* Hooper and Musser, 1964. *I. flavidus* was considered a valid species by Musser and Carleton (1993: 706) and Nowak (1999: 1357).

Genus *NECTOMYS* Peters, 1861

Nectomys squamipes amazonicus Hershkovitz, 1944

Misc. Pub., Mus. Zool., Univ. Mich., 58: 47, 4 January.

Holotype. MCZ 30820. Skin and skull. Male.
Locality. Brazil: (Para), Rio Tapajos, Tauary (=Tauari). 23 January 1934.
Collector. A. M. Olalla. Original number 7312.
Condition. Skin and skull complete. Mandible disarticulated.
Type Series. Hershkovitz examined 28 specimens, in the MCZ, AMNH, and FMNH.
Comments. Retained as a valid subspecies by Ernest (1986: 1).

Genus *NEOTOMA* Say and Ord, 1825

Neotoma abbreviata Goldman, 1909

Proc. Biol. Soc. Washington, 22: 140, 25 June.
=*Neotoma lepida abbreviata* Goldman, 1909. See Burt (1932: 182).

Holotype. MCZ 12260. Skin and skull. Adult male.
Locality. (Mexico): Lower (=Baja) California, San Francisco Island. 22 February 1909.
Collector. W. W. Brown, Jr. Original number 22.
Condition. Skin and skull complete.
Type Series. 9 paratypes; MCZ 12256–12259, 12261–12265; all represented by skin and skull, 5 females and 4 males. MCZ 12265 is now in the USNM.
Comments. *N. l. abbreviata* was retained as a valid subspecies by Hall (1981: 755).

Neotoma bella Bangs, 1899j

Proc. New England Zool. Club, 1: 66, 31 July.
=*Neotoma lepida lepida* Thomas, 1893. See Goldman (1932: 62).

Holotype. B5308. Skin and skull. Adult male.
Locality. (United States): California, Riverside County, Palm Springs. 12 April 1896.
Collector. E. C. Thurber. Original number 623.
Condition. Skin and skull complete. Mandible disarticulated and left angular process chipped.

Type Series. Holotype only.

Neotoma distincta Bangs, 1903a
Proc. Biol. Soc. Washington, 16: 89, 25 June.
=*Neotoma mexicana distincta* Bangs, 1903. See Hall (1955: 329).

Holotype. B9819. Skin and skull. Adult male.
Locality. Mexico: Vera Cruz, near Jalapa, Texolo. 8 March 1899.
Collector. S. N. Rhoads. Original number 295.
Condition. Skin and skull complete.
Type Series. 4 paratypes; B9818, skin and skull, male, B9820, skin and skull, female; B9821, skin and skull, male (exchanged to USNM); B9822, skin and skull, male.
Comments. N. m. distincta was retained as a valid subspecies by Hall (1981: 761) and Cornely and Baker (1986: 1).

Neotoma floridana rubida Bangs, 1898b
Proc. Boston Soc. Nat. Hist., 28: 185, 15 March.

Holotype. B2872. Skin and skull. Adult male.
Locality. (United States): Louisiana, Terrebonne Parish, Gibson. 4 April 1895.
Collector. F. L. Small. Original number 1751.
Condition. Skin and skull complete. Mandible disarticulated.
Type Series. 2 specimens are mentioned by number in the original description: B2871, skin and skull, adult male, and B2873, skin and skull, adult female.
Comments. Retained as a valid subspecies by Hall (1981: 749).

Genus *NYCTOMYS* de Saussure, 1860

Nyctomys nitellinus Bangs, 1902b
Bull. Mus. Comp. Zool., 39: 30, April.
=*Nyctomys sumichrasti nitellinus* Bangs, 1902. See Goldman (1916: 155).

Holotype. MCZ 10249. Skin and skull. Adult female.
Locality. Panama: Chiriqui, Boquete (=Bajo Boquete), 4,000 ft (1,220 m). 8 February 1901.
Collector. W. W. Brown, Jr. Original number 119.
Condition. Skin and skull complete.
Type Series. 5 paratypes; MCZ 10245, skin and skull, adult male; MCZ 10246, skin and skull, adult male; MCZ 10247, adult female, skin and skull; MCZ 10248, skin and skull, adult female; MCZ 10250, skin and skull, juvenile female.
Comments. N. s. nitellinus was retained as a valid subspecies by Hall (1981: 630).

Genus *OECOMYS* Thomas, 1906

Oecomys trabeatus G. M. Allen and Barbour, 1923
Bull. Mus. Comp. Zool., 65: 262, February.
=*Oecomys bicolor trabeatus* G. M. Allen and Barbour, 1923. See comments.

Holotype. MCZ 19837. Skin and skull. Male.
Locality. Panama: Rio Jesusito. 10 April 1922.
Collector. T. Barbour and W. S. Brooks. Original number 2027.
Condition. Skin complete. Skull partial (right zygomatic arch broken). Mandible disarticulated.
Type Series. Holotype only.
Comments. Following Hershkovitz (1960: 533), *O. b. trabeatus* was retained as a valid subspecies by Hall (1981: 619) under the genus *Oryzomys.* The use of *Oecomys* as a generic name follows Musser and Carleton (1993: 715).

Oryzomys flavicans illectus Bangs, 1898k
Proc. Biol. Soc. Washington, 12: 164, 10 August.
=*Oecomys flavicans illectus* (Bangs, 1898k). See comments.

Holotype. B8101. Skin and skull. Adult female.
Locality. Colombia: Magdalena, Santa Marta Mountains, Pueblo Viejo, 8,000 ft (2,440 m). 24 March 1898.
Collector. W. W. Brown, Jr. Original number 89.
Condition. Skin complete. Skull partial (right jugal missing).
Type Series. There is a small series of paratypes in the MCZ.
Comments. The use of *Oecomys* as a generic name follows Musser and Carleton (1993: 715).

Genus *OLIGORYZOMYS* Bangs, 1900

Oryzomys navus Bangs, 1899a
Proc. Biol. Soc. Washington, 13: 9, 31 January.
=*Oligoryzomys fulvescens* (Saussure, 1860). See Carleton and Musser (1989: 70).

Holotype. B8107. Skin and skull. Adult male.
Locality. Colombia: Magdalena, Santa Marta Mountains, Pueblo Viejo, 8,000 ft (2,440 m). 26 March 1898.
Collector. W. W. Brown, Jr. Original number 154.
Condition. Skin and skull complete. Mandible disarticulated.
Type Series. 9 paratypes; B8223–B8231; all represented by skin and skull, except B8228 (skin only); 2 females and 7 males. B8224 is now in the USNM,

and B8223, B8226, B8230, and B8231 are now in the AMNH.

Comments. *Oryzomys navus* is the type species of *Oligoryzomys* Bangs, 1899.

Oryzomys (Oligoryzomys) vegetus Bangs, 1902b

Bull. Mus. Comp. Zool., 39: 35, April.
= *Oligoryzomys vegetus* (Bangs, 1902). See Musser and Carleton (1993: 718).

Holotype. MCZ 10298. Skin and skull. Adult female.

Locality. Panama: Chiriqui, Volcan de Chiriqui, Boquete, 4,000 ft (1,220 m). 16 April 1901.

Collector. W. W. Brown, Jr. Original number 304.

Condition. Skin complete. Skull partial (left jugal missing). Mandible disarticulated.

Type Series. 12 paratypes; MCZ 10295 (now in USNM), 10297, 10300–10306, 10308–10310, 2 females and 10 males, all represented by skin and skull except for 10308 (skin only).

Comments. Considered a valid species by Musser and Carleton (1993: 718) and Nowak (1999: 1368). Carleton and Musser (1995) provided distributional information and support of specific status for *O. vegetus*.

Genus *ORYZOMYS* Baird, 1858

Oryzomys devius Bangs, 1902b

Bull. Mus. Comp. Zool., 39: 34, April.

Holotype. MCZ 10324. Skin and skull. Adult female.

Locality. Panama: Chiriqui, Volcan de Chiriqui, Boquete (=Bajo Boquete), 5,000 ft (1,525 m). 29 January 1901.

Collector. W. W. Brown, Jr. Original number 73.

Condition. Skin and skull complete. Mandible disarticulated.

Type Series. 3 paratypes; MCZ 10325, skin and skull, adult female; MCZ 10326, skin and skull, adult female; MCZ 10340, skin and skull, adult male.

Comments. Considered a valid species by Musser and Carleton (1993: 722) and Nowak (1999: 1366).

Oryzomys palustris coloratus Bangs, 1898b

Proc. Boston Soc. Nat. Hist., 28: 189, 15 March.
= *Oryzomys palustris natator* Chapman, 1893. See Wolfe (1982: 1).

Holotype. B4470. Skin and skull. Adult male.

Locality. (United States): Florida, Monroe County, Cape Sable. 17 April 1895.

Collector. C. L. Brownell. Original number 148.

Condition. Skin and skull complete.

Type Series. There is a series of paratypes in the MCZ.

Oryzomys rostratus carrorum Lawrence, 1947b

Proc. New England Zool. Club, 24: 101, 29 May.

Holotype. MCZ 41280. Skin, skull, and postcranial skeleton. Adult male.

Locality. Mexico: Tamaulipas, Rio Soto la Marina, Rancho Santa Ana, 8 miles (12.9 km) southwest of Padilla. 21 December 1941.

Collector. G. H. Pournelle, Third University of Florida Mexican Expedition. Original number 196.

Condition. Skin and skull complete. Mandible disarticulated. Postcranial skeleton partial (right forelimb, hindlimbs, pelvis, ribs, vertebral column).

Type Series. 2 paratypes; MCZ 41281, skin, skull, and postcranial skeleton, female; MCZ 41282, skin, skull, and postcranial skeleton, male.

Comments. Retained as *Oryzomys melanotis carrorum* by Hall (1981: 614). Musser and Carleton (1993: 724) regarded *O. rostratus* as distinct from *O. melanotis*.

Genus *PEROMYSCUS* Gloger, 1841

Hesperomys gossypinus LeConte, 1853

Proc. Acad. Nat. Sci. Philadelphia, 6: 411, 25 October.
= *Peromyscus gossypinus gossypinus* (LeConte, 1853). See Rhoads (1896b: 189).

Lectotype. MCZ 5275. Skin and skull. Adult male.

Locality. (United States): Georgia, Liberty County, Riceboro, probably on the LeConte Plantation near Riceboro. 13 September 1847.

Collector. J. E. LeConte. Formerly USNM 546.

Condition. Skin complete. Skull partial (basioccipital and tympanic bullae broken). Mandible disarticulated.

Type Series. Poole and Schantz (1942: 320) listed potential "cotypes," meaning syntypes. Osgood (1909: 136) mentioned that a specimen, number 752 in the collection of the Academy of Natural Sciences in Philadelphia, possibly possessed type status, but this specimen was not mentioned by Koopman (1976).

Comments. In the original description of *gossypinus*, measurements were given for a single specimen only; however, in addition to this specimen, LeConte made reference to the coloration of "younger individuals." The measurements given correspond to MCZ 5275 rather than to any other of LeConte's specimens still in the USNM (see G. M. Allen, 1931: 262; Poole and Schantz, 1942: 320). In addition, MCZ 5275 was the only specimen of *Peromyscus gossypinus* from Georgia mentioned in Baird's Mammals of North America (1858: 469). Because LeConte did not specify a holotype, MCZ 5275, which seems to be the specimen discussed and described by measurement in the original publication and the only adult specimen mentioned, is here designated as lectotype. *P. gossypinus* was considered a valid species by Musser and Carleton (1993: 730) and Nowak (1999: 1361).

Hesperomys leucopus arcticus Mearns, 1890

Bull. Amer. Mus. Nat. Hist., 2: 285, 21 February.
Name preoccupied by *Hesperomys arcticus* Coues, 1877

Peromyscus maniculatus borealis Mearns, 1911

Proc. Biol. Soc. Washington, 24: 102, 15 May. (Replacement name for *Hesperomys leucopus arcticus* Mearns, 1890)

Holotype. MCZ 5555. Skin and skull. Adult male.
Locality. Canada: Northwest Territories, MacKenzie, Fort Simpson. 7 September 1859.
Collector. R. Kennicott. Original number 157. Formerly USNM 4531.
Condition. Skin complete. Skull partial (left jugal and process of squamosal missing, right process of squamosal missing, basioccipital and palatine missing). Mandible disarticulated and both angular process missing.
Type Series. Holotype only.
Comments. *P. m. borealis* was retained as a valid subspecies by Hall (1981: 672).

Hesperomys sonoriensis nebrascensis Coues, 1877

In Coues and J. A. Allen, Monographs N. Amer. Rodentia, U.S. Geol. Geogr. Survey Terr. Rep. Washington, 11: 79, August.
=*Peromyscus maniculatus nebrascensis* (Coues, 1877). See Osgood (1909: 75).

Syntype. MCZ 5528. Skin and skull.
Locality. Nebraska (now Wyoming): (Converse County), Deer Creek. 19 January 1860.
Collector. F. V. Hayden. Original no. 80. Formerly USNM 4310.
Condition. Skin complete. Skull partial (posterior missing from parietal to palatine; both jugal and process of squamosal broken). Left angular process of mandible chipped, right side broken at cheek teeth.
Type Series. 1 other syntype, present location unknown, formerly in the USNM.
Comments. *Hesperomys sonoriensis nebrascensis* Baird, 1858 is a *nomen nudum.* Osgood (1909: 78) and Mearns (1911: 102) designated Deer Creek, Nebraska, as the type locality. Jones (1958: 107–111) reviewed the systematic history of *nebrascensis,* and Jones and Mursaloglu (1961: 101–103) reported the discovery of one of the two original syntypes in the MCZ. The location of the other syntype, if it still exists, is unknown.

Peromyscus anastasae Bangs, 1898b

Proc. Boston Soc. Nat. Hist., 28: 195, 15 March.
=*Peromyscus gossypinus anastasae* Bangs, 1898. See Osgood (1909: 141).

Holotype. B7179. Skin and skull. Adult female.
Locality. (United States): Florida, St. Johns County, Anastasia Island, Point Romo. 15 February 1897.
Collector. O. Bangs. Original number 2.
Condition. Skin complete, skull partial (premaxilla to frontal in fragments). Right mandible missing, left present.
Type Series. There is a small series of paratypes in the MCZ.
Comments. *P. g. anastasae* was retained as a valid subspecies by Hall (1981: 689).

Peromyscus bellus Bangs, 1896h

Proc. Biol. Soc. Washington, 10: 137, 28 December.
=*Peromyscus attwateri* J. A. Allen, 1895. See Schmidly (1973: 125).

Holotype. B5483. Skin and skull. Adult male.
Locality. (United States): Indian Territory (=Oklahoma), (Adair County), Stilwell. 15 August 1896.
Collector. T. Surber. Original number 67.
Condition. Skin and skull complete. Mandible disarticulated.
Type Series. 1 paratype; B5484, skin and skull, adult female.

Peromyscus cacabatus Bangs, 1902b

Bull. Mus. Comp. Zool., 39: 29, April.
=*Peromyscus mexicanus* (Saussure, 1860). See Huckaby (1980: 15).

Holotype. MCZ 10225. Skin and skull. Adult female.
Locality. Panama: Chiriqui, Boquete (=Bajo Boquete), 5,000 ft (1,525 m). 22 April 1901.
Collector. W. W. Brown, Jr. Original number 331.
Condition. Skin complete. Skull partial (left jugal missing). Mandible disarticulated.
Type Series. There is a very large series of paratypes in the MCZ.

Peromyscus canadensis abietorum Bangs, 1896d

Proc. Biol. Soc. Washington, 10: 49, 9 March.

=*Peromyscus maniculatus abietorum* Bangs, 1896. See Osgood (1909: 45).

Holotype. B2205. Skin and skull. Adult female.
Locality. (Canada): Nova Scotia, James River. 8 August 1894.
Collector. C. H. Goldthwaite.
Condition. Skin complete. Skull partial (right jugal missing).
Type Series. There is a series of paratypes in the MCZ.
Comments. *P. m. abietorum* was retained as a valid subspecies by Hall (1981: 670).

Peromyscus canadensis argentatus Copeland and Church, 1906

Proc. Biol. Soc. Washington, 19: 122, 6 September.

=*Peromyscus maniculatus argentatus* Copeland and Church, 1906. See Osgood (1909: 46).

Holotype. MCZ 54627. Skin and skull. Adult male.
Locality. (Canada): New Brunswick, Grand Manan Island, Grand Harbor. 19 September 1905.
Collector. M. L. Church and M. Copeland. Original number 168.
Condition. Skin and skull complete.
Type Series. There is a large series of paratypes in the MCZ.
Comments. *P. m. argentatus* was retained as a valid subspecies by Hall (1981: 671).

Peromyscus crinitus scitulus Bangs, 1899j

Proc. New England Zool. Club, 1: 67, 31 July.

=*Peromyscus crinitus crinitus* (Merriam, 1891). See Osgood (1909: 229).

Holotype. B9175. Skin and skull. Adult male.
Locality. (United States): Nevada, Douglas County, Gardnerville. 13 July 1898.
Collector. W. W. Price and P. O. Simons. Original number 1571.
Condition. Skin complete. Skull partial (right and left jugal missing).
Type Series. 7 paratypes; B9177–B9180, B9183–B9185; all represented by skin and skull, 4 females and 3 males.

Peromyscus gossypinus nigriculus Bangs, 1896e

Proc. Biol. Soc. Washington, 10: 124, 5 November.

=*Peromyscus gossypinus gossypinus* (LeConte, 1853). See Osgood (1909: 136).

Holotype. B2731. Skin and skull. Adult female.
Locality. (United States): Louisiana, Plaquemines Parish, Burbridge. 30 January 1895.
Collector. F. L. Small. Original number 1547/156.
Condition. Skin and skull complete. Mandible disarticulated.
Type Series. There is a very large series of paratypes in the MCZ.

Peromyscus gossypinus palmarius Bangs, 1896e

Proc. Biol. Soc. Washington, 10: 124, 5 November.

Holotype. B3224. Skin and skull. Adult female.
Locality. (United States): Florida, Brevard County, Oak Lodge on East Peninsula opposite Micco. 23 February 1895.
Collector. O. Bangs.
Condition. Skin and skull complete.
Type Series. There is a very large series of paratypes in the MCZ.
Comments. Retained as a valid subspecies by Hall (1981: 690).

Peromyscus insulanus Bangs, 1898b

Proc. Boston Soc. Nat. Hist., 28: 196, 15 March.

=*Peromyscus gossypinus anastasae* Bangs, 1898. See Osgood (1909: 141).

Holotype. B6438. Skin and skull. Adult male.
Locality. (United States): Georgia, Camden County, Cumberland Island, north end. 10 April 1897.
Collector. W. W. Brown, Jr. Original number 804.
Condition. Skin complete. Skull partial (right jugal missing).
Type Series. There is a large series of paratypes in the MCZ.

Peromyscus leucopus ammodytes Bangs, 1905a

Proc. New England Zool. Club, 4: 14, 28 February.

Holotype. B828. Skin and skull. Adult male.
Locality. (United States): Massachusetts, Barnstable County, Monomoy Island. 28 December 1893.
Collector. G. S. Miller, Jr. and O. Bangs. Original number 8.
Condition. Skin and skull complete.

Type Series. There is a series of paratypes in the MCZ.
Comments. Retained as a valid subspecies by Hall (1981: 685).

Peromyscus leucopus fusus Bangs, 1905a

Proc. New England Zool. Club, 4: 13, 28 February.

Holotype. B9737. Skin and skull. Adult male.
Locality. (United States): Massachusetts, Dukes County, Martha's Vineyard, W. Tisbury. 17 June 1899.
Collector. O. Bangs. Original number 1.
Condition. Skin and skull complete.
Type Series. There is a small series of paratypes in the MCZ.
Comments. Retained as a valid subspecies by Hall (1981: 686).

Peromyscus oreas Bangs, 1898f

Proc. Biol. Soc. Washington, 12: 84, 24 March.

Holotype. B3696. Skin and skull. Adult female.
Locality. Canada: British Columbia, near boundary of Whatcom County, Washington, 49th parallel, Mount Baker Range, 6,500 ft (1,983 m). 29 August 1896.
Collector. A. C. Brooks. Original number 745.
Condition. Skin and skull complete.
Type Series. There is a large series of paratypes in the MCZ.
Comments. Considered a valid species by Musser and Carleton (1993: 734) and Nowak (1999: 1361).

Peromyscus phasma Bangs, 1898b

Proc. Boston Soc. Nat. Hist., 28: 199, 15 March.
=*Peromyscus poloniotus phasma* Bangs, 1898. See Osgood (1909: 107).

Holotype. B7175. Skin and skull. Adult female.
Locality. (United States): Florida, St. Johns County, Anastasia Island, Point Romo. 14 February 1897.
Collector. O. Bangs. Original number 3.
Condition. Skin complete. Skull partial (parietal, tympantic bulla, left jugal, and process of squamosal broken). Mandible disarticulated.
Type Series. There is a series of paratypes in the MCZ.
Comments. *P. p. phasma* was retained as a valid subspecies by Hall (1981: 668).

Peromyscus subgriseus arenarius Bangs, 1898b

Proc. Boston Soc. Nat. Hist., 28: 202, March.
Name preoccupied by *Peromyscus eremicus arenarius* Mearns, 1896.

Peromyscus subgriseus baliolus Bangs, 1898n

Science, n. ser., 8: 215, 19 August.
(Replacement name for *Peromyscus subgriseus arenarius* Bangs, 1898)
=*Peromyscus polionotus polionotus* (Wagner, 1843). See Osgood (1909: 104).

Holotype. B5925. Skin and skull. Adult male.
Locality. (United States): Georgia, Scriven County, Hursman's Lake (Savannah River), near Bascom. 15 December 1896.
Collector. W. W. Brown, Jr. Original number 60.
Condition. Skin and skull complete.
Type Series. There is a large series of paratypes in the MCZ.

Peromyscus subgriseus rhoadsi Bangs, 1898b

Proc. Boston Soc. Nat. Hist., 28: 201, 15 March.
=*Peromyscus polionotus rhoadsi* Bangs, 1898. See Osgood (1909: 107).

Holotype. B6980. Skin and skull. Adult male.
Locality. (United States): Florida, Hillsborough County, head of Anclote River. 23 May 1895.
Collector. W. S. Dickinson.
Condition. Skin and skull complete.
Type Series. There is a series of paratypes in the MCZ.
Comments. *P. p. rhoadsi* was retained as a valid subspecies by Hall (1981: 669).

Peromyscus texanus saturatus Bangs, 1897a

Amer. Nat. 31: 75, 1 January.
=*Peromyscus maniculatus saturatus* Bangs, 1897. See Osgood (1909: 61).

Holotype. B2581. Skin and skull. Adult male.
Locality. Canada: British Columbia, Saturna Island. 31 January 1894.
Collector. W. C. Colt. Original number 128.
Condition. Skin and skull complete.
Type Series. There is a series of paratypes in the MCZ.
Comments. *P. m. saturatus* was retained as a valid subspecies by Hall (1981: 682).

Genus *REITHRODONTOMYS* Giglioli, 1873

Reithrodontomys australis vulcanius Bangs, 1902b

Bull. Mus. Comp. Zool., 39: 38, April.
=*Reithrodontomys sumichrasti vulcanius* Bangs, 1902. See Hooper (1952: 83).

Holotype. MCZ 10281. Skin and skull. Adult male.
Locality. Panama: Chiriqui, Volcan de Chiriqui, 10,300 ft (3,142 m). 26 May 1901.
Collector. W. W. Brown, Jr. Original number 500.
Condition. Skin and skull complete. Mandible disarticulated.
Type Series. Holotype only.
Comments. *R. s. vulcanius* was retained as a valid subspecies by Hall (1981: 644).

Reithrodontomys creper Bangs, 1902b

Bull. Mus. Comp. Zool., 39: 39, April.

Holotype. MCZ 10284. Skin and skull. Adult female.
Locality. Panama: Chiriqui, Volcan de Chiriqui, 11,000 ft (3,355 m). 2 June 1901.
Collector. W. W. Brown. Original number 504.
Condition. Skin and skull complete. Mandible disarticulated. Left lower incisor missing.
Type Series. Holotype only.
Comments. Considered a valid species by Musser and Carleton (1993: 740) and Nowak (1999: 1364).

Reithrodontomys lecontii impiger Bangs, 1898m

Proc. Biol. Soc. Washington, 12: 167, 10 August.
=*Reithrodontomys humulis humulis* (Audubon and Bachman, 1841). See Hall and Kelson (1959: 584).

Holotype. B7784. Skin and skull. Adult male.
Locality. (United States): West Virginia, Greenbriar County, White Sulphur Springs, 2,000 ft (610 m). 27 February 1898.
Collector. T. Surber. Original number 466.
Condition. Skin and skull complete. Mandible disarticulated.
Type Series. 2 paratypes; B6931 (*not* B6932, as stated in the original description), skin and skull, adult male; B7785, skin and skull, adult female.

Genus *SCOTINOMYS* Thomas, 1913

Akodon teguina apricus Bangs, 1902b

Bull. Mus. Comp. Zool., 39: 40, April.
=*Scotinomys teguina apricus* (Bangs, 1902). See Thomas (1913: 409).

Holotype. MCZ 10236. Skin and skull. Adult female.
Locality. Panama: Chiriqui, Boquete (=Bajo Boquete), 4,000 ft (1,220 m). 24 February 1901.
Collector. W. W. Brown, Jr. Original number 192.
Condition. Skin and skull complete. Mandible disarticulated.
Type Series. 4 paratypes; MCZ 10234, skin and skull, adult male; MCZ 10235, skin, adult female; MCZ 10237, skin and skull, adult female; MCZ 10238, skin and skull, adult female.
Comments. *S. t. apricus* was retained as a valid subspecies by Hooper (1972: 21) and Hall (1981: 734).

Akodon xerampelinus Bangs, 1902b

Bull. Mus. Comp. Zool., 39: 41, April.
=*Scotionomys xerampelinus* (Bangs, 1902). See Thomas (1913: 409).

Holotype. MCZ 10240. Skin and skull. Adult male.
Locality. Panama: Chiriqui, Volcan de Chiriqui, 10,300 ft (3,142 m). 26 May 1901.
Collector. W. W. Brown, Jr. Original number 501.
Condition. Skin complete. Skull partial (right jugal missing). Mandible disarticulated.
Type Series. 2 paratypes; MCZ 10239, skin and skull, adult male; MCZ 10241, skin and skull, adult male.
Comments. *S. xerampelinus* was considered a valid species by Musser and Carleton (1993: 746) and Nowak (1999: 1355).

Genus *SIGMODON* Say and Ord, 1825

Sigmodon austerulus Bangs, 1902b

Bull. Mus. Comp. Zool., 39: 32, April.
=*Sigmodon hispidus borucae* J. A. Allen, 1897. See Hall and Kelson (1959: 672).

Holotype. MCZ 10288. Skin and skull. Adult male.
Locality. Panama: Chiriqui, Volcan de Chiriqui, 10,000 ft (3,050 m). 1 June 1901.
Collector. W. W. Brown, Jr. Original number 503.
Condition. Skin complete. Skull partial—according to original description, "unfortunately it [the skull] was broken by the trap directly across the orbits."
Type Series. Holotype only.
Comments. For comments regarding the type locality, see Enders (1953a: 508–509), who suggested that a native helper of W. W. Brown, Jr., transplanted a specimen of *S.* [*h.*] *borucae*, trapped during a trip to his home in the lowlands near Boruca, to the top of the Volcan, "after Brown had promised a bottle of wine to any man who captured a *Sigmodon* at that altitude."

Sigmodon hispidus exsputus G. M. Allen, 1920b

J. Mammal., 1: 236, 4 December.

Holotype. MCZ 18100. Skin and skull. Adult male.
Locality. (United States): Florida, Monroe County, Big Pine Key. 16 April 1920.
Collector. W. S. Brooks. Original number 1936.

Condition. Skin and skull complete. Mandible disarticulated.
Type Series. 1 paratype; MCZ 18101, skin and skull, adult male.
Comments. Retained as a valid subspecies by Hall (1981: 737).

Sigmodon hispidus furvus Bangs, 1903b
Bull. Mus. Comp. Zool., 39: 158, July.

Holotype. MCZ 10665. Skin and skull. Male.
Locality. Honduras: Atlantida, La Ceiba. 16 January 1902.
Collector. W. W. Brown, Jr. Original number 4.
Condition. Skin and skull complete.
Type Series. Holotype only.
Comments. Retained as a valid subspecies by Hall (1981: 738). *Sigmodon hispidus fervidus* Lydekker, 1904 (p. 34) was a misspelling and thus accidental renaming of *Sigmodon hispidus furvus* Bangs, 1903.

Sigmodon hispidus spadicipygus Bangs, 1898b
Proc. Boston Soc. Nat. Hist., 28: 192, 15 March.

Holotype. B4477. Skin and skull. Adult female.
Locality. (United States): Florida, Monroe County, Cape Sable. 18 April 1895.
Collector. C. L. Brownell. Original number 153.
Condition. Skin and skull complete. Mandible disarticulated.
Type Series. There is a series of paratypes in the MCZ.
Comments. Retained as a valid subspecies by Hall (1981: 739).

Sigmodon sanctae-martae Bangs, 1898q
Proc. Biol. Soc. Washington, 12: 189, 30 December.
=*Sigmodon hispidus hirsutus* (Burmeister, 1854). See Cabrera (1961: 508).

Holotype. B8105. Skin and skull. Adult male.
Locality. Colombia: (Magdalena), (Santa Marta Mountains), Pueblo Viejo (not far from the source of Rio Ancho), 8,000 ft (2,440 m). 23 March 1898.
Collector. W. W. Brown, Jr. Original number 73.
Condition. Skin and skull complete. Mandible disarticulated.
Type Series. 1 paratype; B8250, skin and skull, adult male.

Genus *THOMASOMYS* Coues, 1884

Oryzomys (Erioryzomys) monochromos Bangs, 1900b
Proc. New England Zool. Club, 1: 97, 23 February.
=*Thomasomys monochromos* (Bangs, 1900). See Gardner and Patton (1976: 26).

Holotype. B8348. Skin and skull. Adult male.
Locality. Colombia: Magdalena, Santa Marta Mountains, Paramo de Macotama, 11,000 ft (3,355 m). 7 March 1899.
Collector. W. W. Brown, Jr. Original number 93.
Condition. Skin complete. Skull partial (right jugal missing). Mandible disarticulated.
Type Series. 4 paratypes; B8248, juvenile male, B8345, adult female, B8346, adult female, B8347, adult male; all represented by skin and skull.
Comments. Considered a valid species by Musser and Carleton (1993: 750) and Nowak (1999: 1362). Paramo de Macotama is in La Guajira (Paynter 1997: 261).

Genus *ZYGODONTOMYS* J. A. Allen, 1897

Zygodontomys seorsus Bangs, 1901b
Amer. Nat., 35: 642, 22 August.
=*Zygodontomys brevicauda cherriei* (J. A. Allen, 1895). See Voss (1991: 59).

Holotype. B8490. Skin and skull. Adult male.
Locality. Panama: Gulf of Panama, San Miguel Island, Isla del Rey. 5 May 1900.
Collector. W. W. Brown, Jr. Original number 147.
Condition. Skin and skull complete. Mandible disarticulated.
Type Series. Bangs based the description on a series of 68 specimens, most of which are still in the MCZ.

Family PEDETIDAE Gray, 1825

Genus *PEDETES* Illiger, 1811

Pedetes cafer taborae G. M. Allen and Loveridge, 1927
Proc. Boston Soc. Nat. Hist., 38: 438, 23 December.
=*Pedetes capensis* (Forster, 1778). See Misonne (1974: 8).

Holotype. MCZ 23080. Skin and skull. Adult female.
Locality. Tanganyika Territory (=Tanzania): Tabora, Unyamwezi, 4,000 ft (1,220 m). 18 November 1921.
Collector. A. Loveridge. Original number R6915.

Condition. Skin complete, with small bald spots on dorsum. Skull complete.
Type Series. Holotype only.

Family MYOXIDAE Gray, 1821

Genus *GRAPHIURUS* Smuts, 1832

Aethoglis hueti argenteus G. M. Allen, 1936

J. Mammal., 17: 293, 14 August.
=*Graphiurus hueti argenteus* (G. M. Allen, 1936). See Hayman and Holt (1940: 608).

Holotype. MCZ 17920. Skin and skull. Adult female.
Locality. Cameroons (=Cameroon): (Kribi), Lolodorf. 17 March 1911.
Collector. G. Schwab. Original number 1.
Condition. Skin and skull complete.
Type Series. 2 paratypes; MCZ 17607, skin and skull, adult female; and a specimen in the USNM, number 125434.
Comments. Rosevear considered *G. h. argenteus* "possibly valid as a race" (1969: 501).

Claviglis soleatus collaris G. M. Allen and Loveridge, 1933

Bull. Mus. Comp. Zool., 75: 122, February.
=*Graphiurus lorraineus* Dollman, 1910. See Holden (1993: 764).

Holotype. MCZ 26373. Skin and skull. Adult female.
Locality. Tanganyika Territory (=Tanzania): (Iringa), north end Lake Nyasa, Ukinga Mountains, Madehani, 7,000 ft (2,135 m). 24 February 1930.
Collector. A. Loveridge.
Condition. Skin and skull complete. Mandible disarticulated.
Type Series. 2 paratypes; MCZ 26374, skin and skull, male; MCZ 26375, skin and skull, female.

Graphiurus microtis griseus G. M. Allen, 1912a

Bull. Mus. Comp. Zool., 54: 440, April.
=*Graphiurus murinus griseus* G. M. Allen, 1912. See Hayman and Holt (1940: 610).

Holotype. MCZ 8244. Skin and skull. Adult male.
Locality. British East Africa (=Kenya): northern Guaso Nyiro River (=Ewaso Ngiro), 4,000 ft (1,220 m). 25 July 1909.
Collector. G. M. Allen. Original number 51.
Condition. Skin and skull complete.
Type Series. 2 paratypes; MCZ 8248, skin and skull, male; MCZ 8249, skin and skull, adult female.

Graphiurus schwabi G. M. Allen, 1912a

Bull. Mus. Comp. Zool., 54: 441, April.
=*Graphiurus surdus* Dollman, 1912. See Holden (1993: 765).

Holotype. MCZ 8607. Skin and skull. Juvenile.
Locality. Cameroun (=Cameroon), Kribi. 1911.
Collector. G. Schwab.
Condition. Skin and skull complete.
Type Series. Holotype only.

Family BATHYERGIDAE Waterhouse, 1841

Genus *CRYPTOMYS* Gray, 1864

Cryptomys hottentotus occlusus G. M. Allen and Loveridge, 1933

Bull. Mus. Comp. Zool., 75: 125, February.
=*Cryptomys hottentotus whytei* (Thomas, 1897). See Honeycutt et al. (1991: 51).

Holotype. MCZ 26557. Skin and skull. Adult male.
Locality. Tanganyika Territory (=Tanzania): (Iringa), Ugungwe Mountains, Kigogo, 6,000 ft (1,830 m). 18 January 1930.
Collector. A. Loveridge.
Condition. Skin and skull complete. Mandible disarticulated.
Type Series. 15 paratypes; MCZ 26558–26572, all represented by skin and skull.

Genus *HETEROCEPHALUS* Rüppell, 1842

Heterocephalus stygius G. M. Allen, 1912a

Bull. Mus. Comp. Zool., 54: 444, April.
=*Heterocephalus glaber* Rüppell, 1842. See Hollister (1919: 160).

Holotype. MCZ 12470. Body in alcohol, skull extracted. Adult female.
Locality. British East Africa (=Kenya): northern Guaso Nyiro (=Ewaso Ngiro), Neumann's Boma. 6 August 1909.
Collector. G. M. Allen.
Condition. Alcoholic. Skull complete. Mandible disarticulated.
Type Series. Holotype only.

Family ERITHIZONTIDAE Bonaparte, 1845

Genus *ERITHIZON* F. Cuvier, 1822

Erethizon dorsatus picinus Bangs, 1900c

Proc. New England Zool. Club, 2: 37, 20 September.
=*Erithizon dorsatum dorsatum* (Linnaeus, 1758). See Harper (1961: 90).

Holotype. B8839. Skin and skull. Adult male.
Locality. (Canada): Labrador, Strait of Belle Isle, Lance (=L'anse) au Loup. 16 February 1899.
Collector. E. Doane.
Condition. Skin and skull complete.
Type Series. 15 paratypes; B8832–B8838, B8840–B8847; all represented by skin and skull, 8 females and 7 males. Bangs had also a skull of *picinus* (B8831) from Black Bay, Labrador, at the time of description, not mentioned in the original publication.

Family DASYPROCTIDAE Gray, 1825

Genus *DASYPROCTA* Illiger, 1811

Dasyprocta callida Bangs, 1901b

Amer. Nat., 35: 635, 22 August.
=*Dasyprocta punctata callida* Bangs, 1901. See Kellogg (1946: 59).

Holotype. B8443. Skin and skull. Adult male.
Locality. Panama: (Panama), San Miguel Island. 8 May 1900.
Collector. W. W. Brown, Jr. Original number 171.
Condition. Skin and skull complete.
Type Series. 5 paratypes; B8442, B8444–B8447; all represented by skin and skull, 3 females and 2 males.
Comments. D. p. callida was retained as a valid subspecies by Hall (1981: 860).

Dasyprocta colombiana Bangs, 1898k

Proc. Biol. Soc. Washington, 12: 163, 10 August.
=*Dasyprocta punctata colombiana* (Gray, 1898). See Cabrera (1961: 589).

Holotype. B8008. Skin and skull. Adult female.
Locality. Colombia: Magdalena, Santa Marta. 6 January 1898.
Collector. W. W. Brown, Jr. Original number 37.
Condition. Skin and skull complete.
Type Series. 1 paratype; B8113, skin and skull, juvenile male.
Comments. D. p. colombiana was retained as a valid subspecies by Cabrera (1961: 589).

Dasyprocta noblei G. M. Allen, 1914e

Proc. New England Zool. Club, 5: 69, 7 October.
=*Dasyprocta leporina noblei* G. M. Allen, 1914. See Woods (1993: 781).

Holotype. MCZ 15936. Skin and skull (and atlas). Adult female.
Locality. Guadeloupe Island: Goyave. 22 August 1914.
Collector. G. K. Noble.
Condition. Skin complete. Skull partial (bone missing from nasal and frontal).
Type Series. 1 paratype; MCZ 15937, skin and skull, subadult female.

Dasyprocta punctata nuchalis Goldman, 1917

Proc. Biol. Soc. Washington, 30: 113, 23 May.

Holotype. MCZ 10081. Skin and skull. Adult female.
Locality. Panama: Chiriqui, Divala. 30 November 1900.
Collector. W. W. Brown, Jr. Original number 17.
Condition. Skin and skull complete.
Type Series. 4 paratypes; MCZ 10080, skin and skull, adult male; 10084, skull; 10175, skin and skull, adult female; 10176, skin and skull, adult male.
Comments. Retained as a valid subspecies by Hall (1981: 860).

Family AGOUTIDAE Gray, 1821

Genus *AGOUTI* Lacépède, 1799

Agouti paca virgatus Bangs, 1902b

Bull. Mus. Comp. Zool., 39: 47, April.

Holotype. MCZ 10079. Skin and skull. Adult male.
Locality. Panama: Chiriqui, Divala. 16 December 1900.
Collector. W. W. Brown, Jr. Original number 21.
Condition. Skin and skull complete.
Type Series. Holotype only.
Comments. Retained as a valid subspecies by Hall (1981: 858) and Pérez (1992: 1).

Family OCTODONTIDAE Waterhouse, 1839

Genus *TYMPANOCTOMYS* Yepes, 1941

Octomys barrerae Lawrence, 1941

Proc. New England Zool. Club, 18: 43, 28 January.
=*Tympanoctomys barrerae* (Lawrence, 1941). See Yepes (1942: 75).

Holotype. MCZ 39716. Skin and skull. Adult male.
Locality. Argentina: Mendoza Province, La Paz. April 1939.

Collector. J. M. de la Barrera. Original number A31.
Condition. Skin and skull complete.
Type Series. Holotype only.
Comments. Type species of *Tympanoctomys* Yepes, 1941. *T. barrerae* was considerd a valid species by Woods (1993: 789) and Nowak (1999: 1683).

Family ECHIMYIDAE Gray, 1825

Genus *BOROMYS* Miller, 1916

Boromys torrei G. M. Allen, 1917a
Bull. Mus. Comp. Zool., 61: 6, January.

Holotype. VP 9601. Palate.
Locality. Cuba: Matanzas Province, cave in Sierra de Hato Nuevo.
Collector. C. de la Torre.
Condition. Condition as described in original—"palate with root of right zygomatic arch, pm^4 and alveolar row of right side, m^1 and posterior part of alveolar row of left side."
Type Series. Paratype material consists of 8 lower jaws and 2 separate lower molars; in the MCZ.
Comments. Considered a valid species by Woods (1993: 799) and Nowak (1999: 1703) but almost certainly extinct. This specimen is stored in the Vertebrate Paleontology Department of the MCZ.

Genus *DIPLOMYS* Thomas, 1916

Loncheres labilis Bangs, 1901b
Amer. Nat., 35: 638, 22 August.
=*Diplomys labilis* (Bangs, 1901). See Thomas (1916: 296).

Holotype. B8480. Skin and skull. Adult male.
Locality. Panama: (Panama), Gulf of Panama, San Miguel Island. 26 April 1900.
Collector. W. W. Brown, Jr. Original number 103.
Condition. Skin and skull complete.
Type Series. There is a small series of paratypes in the MCZ and FMNH.
Comments. *D. labilis* was considered a valid species by Woods (1993: 791) and Nowak (1999: 1695).

Genus *PROECHIMYS* J. A. Allen, 1899

Proechimys burrus Bangs, 1901b
Amer. Nat., 35: 640, 22 August.
=*Proechimys semispinosus burrus* Bangs, 1901. See Goldman (1920: 120).

Holotype. B8458. Skin and skull. Adult male.
Locality. Panama: (Panama), Gulf of Panama, San Miguel Island. 30 April 1900.
Collector. W.W. Brown, Jr. Original number 130.
Condition. Skin and skull complete. Right dentary broken at pm_1.
Type Series. There is a large series of paratypes in the MCZ.
Comments. *P. s. burrus* was retained as a valid subspecies by Hall (1981: 873).

Proechimys gorgonae Bangs, 1905b
Bull. Mus. Comp. Zool., 46: 89, June.

Holotype. MCZ 10828. Skin and skull. Adult male.
Locality. Colombia: (Cauca), Gorgona Island. 2 July 1904.
Collector. W. W. Brown, Jr. Original number 25.
Condition. Skin and skull complete.
Type Series. 6 paratypes; MCZ 10829–10834, all represented by skin and skull, 1 female and 5 males. MCZ 10830 and 10834 are now in the FMNH.
Comments. Treated as a separate species by Woods (1993: 796) but included in *P. cayennensis* by Nowak (1999: 1689).

Proechimys guyannensis hyleae Moojen, 1948
Univ. Kansas Publ. Mus. Nat. Hist., 1: 361, 10 December.
=*Proechimys cayennensis hyleae* Moojen, 1948. See comments.

Holotype. MCZ 30887. Skin and skull. Adult male.
Locality. Brazil: Para, Porto de Moz, Rio Tapajoz (=Tapajos), Tauari (=Tauary), 87 km south of Santarem. 19 January 1934.
Collector. A. M. Olalla. Original number 7288.
Condition. Skin and skull complete. Mandible disarticulated.
Type Series. 20 paratypes (19 at MCZ and 1 at FMNH), represented by skin and skull.
Comments. Retained as a valid subspecies by Cabrera (1961: 521). The use of the specific name *cayennensis* over *guyannensis* follows Woods (1993: 795).

Family CAPROMYIDAE Smith, 1842

Genus *CAPROMYS* Desmarest, 1822

Capromys pilorides relictus G. M. Allen, 1911a
Bull. Mus. Comp. Zool., 54: 207, July.

Holotype. MCZ 10996. Skin and skull. Adult male.
Locality. Cuba: Isle of Pines (=Isla de Pinos), Nueva Gerona, Casas Mountains. 10 March 1902
Collector. W. R. Zappey.
Condition. Skin complete. Skull partial (bone missing from palatine to occipital).
Type Series. 1 paratype; MCZ 10997, skin and skull.
Comments. Retained as a valid subspecies by Hall (1981: 863).

Genus *GEOCAPROMYS* Chapman, 1901

Geocapromys cubanus G. M. Allen, 1917a
Bull. Mus. Comp. Zool. 61: 9, January.
=*Geocapromys columbianus* (Chapman, 1892). See G. M. Allen (1918b: 145).

Holotype. VP 9602. Part of right lower ramus. Juvenile.
Locality. Cuba: Matanzas Province, cave in Sierra de Hato Neuvo.
Collector. C. de la Torre.
Condition. Portion of ramus includes incisor and three anterior cheekteeth.
Type Series. Allen mentions in the original description, "Five palates with teeth, about 15 jaw fragments mostly with teeth, and numerous other fragments." This material is in the MCZ.
Comments. The type material of *cubanus* is stored in the Vertebrate Paleontology Department of the MCZ.

Geocapromys ingrahami abaconis Lawrence, 1934
Occas. Pap. Boston Soc. Nat. Hist., 8: 190, 7 November.

Holotype. VP 2108. Left lower ramus. Adult.
Locality. Bahamas: Great Abaco Island, Hole in the Wall, Imperial Lighthouse Caves. 1934.
Collector. F. Rainey.
Condition. Ramus intact.
Type Series. The paratype series is a collection of cranial and mandibular fragments, described in the original description and housed in the MCZ.
Comments. G. i. abaconis was retained as a valid subspecies by Hall (1981: 866) under the genus *Capromys*. Woods (1993: 800) employed the genus *Geocapromys*. *G. i. abaconis* is extinct. The type material of *abaconis* is stored in the Vertebrate Paleontology Department of the MCZ.

Geocapromys ingrahami irrectus Lawrence, 1934
Occas. Pap. Boston Soc. Nat. Hist., 8: 190, 7 November.

Holotype. VP 2107. Right lower ramus. Adult.
Locality. Bahamas: Crooked Island, Gordon Hill Caves, "Burial Cave No. 1." 1934.
Collector. F. Rainey.
Condition. Ramus intact.
Type Series. The paratype series is a collection of cranial and mandibular fragments, described in the original description and housed in the MCZ.
Comments. G. i. irrectus was retained as a valid subspecies by Hall (1981: 866) under the genus *Capromys*. Woods (1993: 800) employed the genus *Geocapromys*. *G. i. irrectus* is extinct. The type material of *irrectus* is stored in the Vertebrate Paleontology Department of the MCZ.

Genus *MESOCAPROMYS* Varona, 1970

Capromys nana G. M. Allen, 1917b
Proc. New England Zool. Club, 6: 54, 28 March.
=*Mesocapromys nanus* (G. M. Allen, 1917). See Kratochvíl et al. (1978: 15).

Holotype. VP 9864. Right mandible.
Locality. Cuba: Matanzas, cave in Sierra de Hato Nuevo. March 1917.
Collector. T. Barbour.
Condition. Mandible partial—coronoid and angular processes broken off.
Type Series. A series of paratype material is stored at the MCZ.
Comments. G. M. Allen supplemented his description of *Capromys nanus* after Thomas Barbour provided him with a freshly killed specimen in 1918 (1918b: 140–145). Type species of the subgenus *Paracapromys* Kratochvíl, Rodriguez, and Barus, 1978. *M. nanus* was considered a valid species by Woods (1993: 801) and Nowak (1999: 1703). The type series is stored in the Vertebrate Paleontology Department of the MCZ.

Genus *PLAGIODONTA* F. Cuvier, 1836

Plagiodonta araeum Ray, 1964
Breviora, Mus. Comp. Zool., 203: 2, 10 April.

Holotype. VP 7675. Left upper cheektooth, originally described as "almost certainly the fourth (deciduous) premolar."
Locality. Dominican Republic: San Rafael Province, Hondo Valle Municipality, unnamed cave 2 km southeast of Rancho de La Guardia. April 1963.
Collector. R. Allen and C. E. Ray.
Condition. Condition of tooth as originally described—"damaged slightly along the posterolabial wall."
Type Series. Holotype only.
Comments. Considered a valid species by Woods (1993: 804) and Nowak (1999: 1708). Complete cranial and dentary material of *araeum* has been collected in Haiti and deposited in the Florida Museum of Natural History (Woods 1993: 804). This species is extinct. This specimen is stored in the Vertebrate Paleontology Department of the MCZ.

Order LAGOMORPHA Brandt, 1855

Family OCHOTONIDAE Thomas, 1897

Genus *OCHOTONA* Link, 1795

Ochotona cuppes Bangs, 1899g

Proc. New England Zool. Club, 1: 40, 5 June.
=*Ochotona princeps cuppes* Bangs, 1899. See A. H. Howell (1924: 27).

Holotype. B7389. Skin and skull. Adult male.
Locality. (Canada): British Columbia, Gold Range, Monishee Divide, 4,000 ft (1,220 m). 2 August 1897.
Collector. A. C. Brooks. Original number 1030.
Condition. Skin and skull complete. Mandible disarticulated.
Type Series. 3 paratypes; MCZ 7390–7392; all represented by skin and skull, all female. MCZ 7390 is now at FMNH.
Comments. *O. p. cuppes* was retained as a valid subspecies by Hall (1981: 289) and Smith and Weston (1990: 1).

Ochotona saxatilis Bangs, 1899g

Proc. New England Zool. Club, 1: 41, 5 June.
=*Ochotona princeps saxatilis* Bangs, 1899. See A. H. Howell (1924: 27).

Holotype. MCZ 2703. Skin. Adult male.
Locality. (United States): Colorado, Park County, Snowy Range, near Mount Lincoln, Montgomery. 27 July 1871.
Collector. J. A. Allen, Rocky Mountain Expedition. Original number 945.
Condition. Skin complete.
Type Series. Large paratype series; MCZ 209, 243–263, skulls; B41 and B42, each represented by skin and skull; MCZ 2673–2703, skins.
Comments. *O. p. saxatilis* was retained as a valid subspecies by Hall (1981: 291) and Smith and Weston (1990: 1).

Family LEPORIDAE Fischer de Waldheim, 1817

Genus *LEPUS* Linnaeus, 1758

Lepus (Macrotolagus) alleni palitans Bangs, 1900a

Proc. New England Zool. Club, 1: 85, 23 February.

Holotype. B9096. Skin and skull. Adult female.
Locality. Mexico: Sinaloa, Aguacaliente (about 40 miles [64.4 km] southeast of Mazatlán). 7 August 1897.
Collector. P. O. Simons. Original number 157.
Condition. Skin and skull complete. Mandible disarticulated; left ramus chipped; two holes in right ramus.
Type Series. 1 paratype; B9097, skin, adult male.
Comments. Retained as a valid subspecies by Hall (1981: 332) and Best and Henry (1993: 1).

Lepus americanus struthopus Bangs, 1898e

Proc. Biol. Soc. Washington, 12: 81, 24 March.

Holotype. B2025. Skin and skull. Adult female.
Locality. (Canada): Nova Scotia, Digby. 4 August 1894.
Collector. O. Bangs. Original number 9.
Condition. Skin and skull complete.
Type Series. There is a series of paratypes in the MCZ.
Comments. Retained as a valid subspecies by Hall (1981: 318).

Lepus arcticus bangsii Rhoads, 1896a

Amer. Nat., 30: 236, 6 March.

Holotype. B3752. Skin and skull. Adult female.
Locality. (Canada): Newfoundland, Codroy. 3 August 1895.
Collector. E. Doane. Original number 1.
Condition. Skin and skull complete.
Type Series. There is a series of paratypes in the MCZ.
Comments. Retained as a valid subspecies by Hall (1981: 320).

Lepus bairdii Hayden, 1869

Amer. Nat., 3: 115, May.
=*Lepus americanus bairdii* Hayden, 1869. See J. A. Allen (1875: 431).

Syntype. MCZ 5501. Skin and skull. Adult.
Locality. (United States): Wyoming, (Fremont County), summit of Wind River Mountains, near Fremont Peak. 4 June 1860.
Collector. F. V. Hayden. Original number 90. Formerly USNM 4264.
Condition. Skin and skull complete.
Type Series. 2 other adult syntypes; USNM 4262/38001, skin and skull, male; USNM 4263/4273, skin and skull; see Poole and Schantz (1942: 210).
Comments. No type is designated in the original description, which is based on 6 individuals collected by Hayden—3 adults and 3 juveniles, originally deposited in the USNM (Poole and Schantz 1942: 210).

Lepus bairdi cascadensis Nelson, 1907

Proc. Biol. Soc. Washington, 20: 87, 11 December.

=*Lepus americanus cascadensis* Nelson, 1907. See Racey and Cowan (1936: H18).

Holotype. B1886. Skin and skull. Adult male.
Locality. Canada: British Columbia, near Hope, Roab's Ranch. 12 June 1874.
Collector. W. C. Colt. Original number 476.
Condition. Skin complete. Skull slightly damaged (supraoccipital and occipital chipped).
Type Series. Holotype only.
Comments. *L. a. cascadensis* was retained as a valid subspecies by Hall (1981: 315).

Genus *SYLVILAGUS* Gray, 1867

Lepus (Tapeti) incitatus Bangs, 1901b

Amer. Nat., 35: 633, 22 August.

=*Sylvilagus brasiliensis incitatus* (Bangs, 1901). See Hershkovitz (1950: 352).

Holotype. B8441. Skin and skull. Adult female.
Locality. Panama: (Panama), Bay of Panama, San Miguel Island. 30 April 1900.
Collector. W. W. Brown, Jr. Original number 127
Condition. Skin and skull complete.
Type Series. Holotype only.
Comments. *S. b. incitatus* was retained as a valid subspecies by Hall (1981: 296).

Lepus paludicola Miller and Bangs, 1894

Proc. Biol. Soc. Washington, 9: 105, 9 June.

=*Sylvilagus palustris paludicola* (Miller and Bangs, 1894). See Nelson (1909: 269).

Holotype. B1451. Skin and skull. Adult female.
Locality. (United States): Florida, (Citrus County), Fort Island, near Crystal River. 28 January 1894.
Collector. F. L. Small. Original number 1150.
Condition. Skin and skull complete.
Type Series. 3 paratypes; B1452, skin and skull, adult male; B1453, skin and skull, adult male; B1454, skin and skull, adult female.
Comments. *S. p. paludicola* was retained as a valid subspecies by Hall (1981: 299) and Chapman and Willner (1981: 1).

Lepus sylvaticus alacer Bangs, 1896h

Proc. Biol. Soc. Washington, 10: 136, 28 December.

=*Sylvilagus floridanus alacer* (Bangs, 1896). See Lyon (1904: 336).

Holotype. B5480. Skin and skull. Adult female.
Locality. (United States): Indian Territory (=Oklahoma), (Adair County), Stilwell. 14 August 1896.
Collector. T. Surber. Original number 65.
Condition. Skin and skull complete. Mandible disarticulated.
Type Series. 3 paratypes; B1677, skin and skull, B1678, skin and skull, adult male; B5481, skin and skull, adult female.
Comments. *S. f. alacer* was retained as a valid subspecies by Hall (1981: 301) and Chapman et al. (1980: 1).

Lepus sylvaticus transitionalis Bangs, 1895a

Proc. Boston Soc. Nat. Hist., 26: 405, 31 January.

=*Sylvilagus transitionalis* (Bangs, 1895). See Nelson (1909: 195).

Holotype. B2407. Skin and skull. Adult female.
Locality. (United States): Connecticut, New London County, Liberty Hill. 6 November 1894.
Collector. O. Bangs.
Condition. Skin and skull complete. Mandible disarticulated.
Type Series. There is a series of paratypes in the MCZ.
Comments. *S. transitionalis* was considered a valid species by Hoffman (1993: 827) and Nowak (1999: 1727).

Order SCANDENTIA Wagner, 1855

Family TUPAIIDAE Gray, 1825

Genus *TUPAIA* Raffles, 1822

Tana tana griswoldi Coolidge, 1938

Proc. New England Zool. Club, 17: 45, 6 May.

=*Tupaia tana paitana* (Lyon, 1913). See Medway (1965: 76).

Holotype. MCZ 36416. Skin, skull, and baculum. Subadult male.
Locality. (Malaysia): British North Borneo (=Sabah), Mount Kinabalu, Kenokok River, Kiau (=Kampong Kiau), 3,300 ft (1,007 m). 9 August 1937.
Collector. J. A. Griswold, Jr., Asiatic Primate Expedition. Original number 684.
Condition. Skin and skull complete. Mandible disarticulated.
Type Series. Holotype only.

Order PRIMATES Linnaeus, 1758

Family INDRIDAE Burnett, 1828

Genus *PROPITHECUS* Bennett, 1832

Propithecus perrieri Lavauden, 1931

Compt. Rend. Acad. Sci. Paris, 193: 77, 6 July.
=*Propithecus diadema perrieri* Lavauden, 1931. See W. C. O. Hill (1953: 568).

Holotype. MCZ 44857. Skin, skull, and postcranial skeleton. Adult male.
Locality. Malagasy Republic (Madagascar): (Toliary), Ifotaka, vicinity of Ambovombe. Probably 1928.
Collector. M. Perrier. Original number 1. Grandidier Collection.
Condition. Skin and skull complete. Postcranial skeleton partial (right humerus broken, foot bones left in skin).
Type Series. 3 paratypes; MCZ 44858, skin, skull, and postcranial skeleton, adult female; MCZ 44859, skin and skull, juvenile; MCZ 46001, skin and leg bones, adult.
Comments. *P. d. perrieri* was retained as a valid subspecies by Tattersall (1982: 103).

Family DAUBENTONIIDAE Gray, 1863

Genus *DAUBENTONIA* É. Geoffroy, 1795

Cheiromys madagascariensis laniger G. Grandidier, 1930d

Bull. Acad. Malgache, n. ser., 11: 106 (for 1928).
=*Daubentonia madagascariensis* (Gmelin, 1788). See G. M. Allen (1939: 134).

Holotype. MCZ 45947. Skull and postcranial skeleton. Adult male.
Locality. Madagascar: Forest of the East.
Collector. Received by G. Grandidier from the Académie Malgache, 1927–28.
Condition. Skull complete. Postcranial skeleton incomplete (hands and feet missing, presumably intact within mounted skin).
Type Series. Holotype only.
Comments. The mounted skin of the holotype is in the collection of the Académie Malgache (Antananarivo Museum). Grandidier named *laniger* as a new subspecies on account of its woolly pelage, but it is probably just a molting individual (Schwarz 1931: 428).

Family GALAGONIDAE Gray, 1825

Genus *GALAGOIDES* A. Smith, 1833

Galago demidovii orinus Lawrence and Washburn, 1936

Occ. Pap. Boston Soc. Nat. Hist., 8: 259, 8 January.
=*Galagoides orinus* (Lawrence and Washburn, 1936). See Honess (1996: 58).

Holotype. MCZ 22453. Skin and skull. Adult male.
Locality. Tanganyika Territory (=Tanzania): Morogoro, Uluguru Mountains, Bagilo, 5,000 ft (1,525 m). 17 September 1926.
Collector. A. Loveridge.
Condition. Skin and skull complete.
Type Series. Holotype only.

Family CEBIDAE Bonaparte, 1831

Genus *ALOUATTA* Lacépède, 1799

Alouatta palliata luctuosa Lawrence, 1933b

Bull. Mus. Comp. Zool., 75: 337, November.
=*Alouatta pigra* Lawrence, 1933. See Smith (1970: 363).

Holotype. MCZ 24059. Skin and skull. Adult male.
Locality. British Honduras (=Belize): Cayo District, Mount Cow. 12 April 1928.
Collector. O. L. Austin, Jr. Original number 723.
Condition. Skin and skull complete.
Type Series. Holotype only.

Alouatta palliata trabeata Lawrence, 1933b

Bull. Mus. Comp. Zool., 75: 328, November.

Holotype. MCZ 29545. Skin and skull. Adult male.
Locality. Panama: Herrera Province, Capina. March 1933.
Collector. T. Barbour. Original number 4.
Condition. Skin and skull complete.
Type Series. Lawrence mentions examining 19 specimens of *trabeata* and lists them by locality (1933: 330). 9 of these are in the MCZ; other than the holotype, they are MCZ 27784, 27785, 28735, 28736, 29543, 29544, 29546, and 29548. 1 paratype, MCZ 29547, has been exchanged to the Museu Palista, São Paolo, Brazil.
Comments. Retained as a valid subspecies by Hall (1981: 263).

Genus *CEBUS* Erxleben, 1777

Cebus curtus Bangs, 1905b
Bull. Mus. Comp. Zool., 46: 91, June.
=*Cebus capucinus curtus* Bangs, 1905.
See Cabrera (1917: 240).

Holotype. MCZ 10824. Skin and skull. Adult male.
Locality. Colombia: (Cauca), Gorgona Island. 2 July 1904.
Collector. W. W. Brown, Jr. Original number 27.
Condition. Skin and skull complete.
Type Series. 1 paratype; MCZ 10825, skin and skull, adult female.
Comments. C. c. curtus was retained as a valid subspecies by Cabrera (1958: 169) and Napier (1976: 36).

Family HYLOBATIDAE Gray, 1870

Genus *HYLOBATES* Illiger, 1811

Hylobates lar carpenteri Groves, 1968
Proc. Biol. Soc. Washington, 81: 625, 30 December.

Holotype. MCZ 41430. Skin and skeleton. Adult male.
Locality. Thailand: Chiengmai District, Mount Angka (=Doi Inthanon), 3,400 ft (1,037 m). 14 March 1937.
Collector. H. J. Coolidge, Jr., Asiatic Primate Expedition. Original numbers 21 and 185.
Condition. Skin, skull, and skeleton complete.
Type Series. Groves examined a series of 144 skins, skulls, and skeletons of this subspecies that were collected by the Harvard Asiatic Primate Expedition in 1937 from Chiengmai District, Thailand, "mostly in the Museum of Comparative Zoology, Harvard, but a few of the osteological specimens in the Anthropology Department, University of California at Berkeley." He examined also 18 specimens in the USNM and 1 in the AMNH, all represented by skin and skull.
Comments. Retained as a valid subspecies by Jenkins (1990: 15) and Geissman (1995: 474).

Family HOMINIDAE Gray, 1825

Genus *GORILLA* I. Geoffroy, 1853

Troglodytes gorilla Savage and Wyman, 1847
Boston J. Nat. Hist., 5: 417, December.
=*Gorilla gorilla gorilla* (Savage and Wyman, 1847). See Rothschild (1923: 176).

Lectotype. MCZ 9587. Skull and postcranial skeleton. Adult male.
Locality. Gabon: Gabon Estuary, Mpongwe country. 1847.
Collector. T. S. Savage. Original number 28 (of J. Wyman).
Condition. Postcranial skeleton partial (includes pelvis, sacrum, scapulae, humeri, radii, left ulna, femora, left tibia, and 7 vertebrae: 2 cervical, 3 dorsal, 2 lumbar). Head of right humerus and left femur bisected.
Type Series. The original description mentions "four skulls, two males and two females, one of each in a perfect condition, and all of them adult; a male and female pelvis, the long bones of the upper and lower extremities, and a few vertebrae and ribs." However, measurements and illustrations of only two of these specimens, an adult male and female, each represented by a skull and partial postcranial skeleton, are provided. These two, presumably the specimens originally described as being "in a perfect condition," are the only specimens of the original four to be noted in Wyman's personal notebook of osteology (unpublished, now in the library of the Boston Museum of Science) and the only original specimens of which there is any record at all. These two specimens were transferred from the Boston Society of Natural History to the MCZ in 1915–16. They bear MCZ numbers 9587 (male) and 9311 (female). The skull of the female was sawed in half (hemisected), probably by Wyman. The adult male specimen, MCZ 9587, possesses an intact skull. MCZ 9587 is the only intact specimen of the syntype series known to exist, and its measurements and an illustration of its skull are included in the original publication. Additionally, it is the only syntype whose measurements are included in Coolidge's revision of the genus *Gorilla* (1929: 325), although it is erroneously listed in that work as MCZ 9586. For these reasons, MCZ 9587 is hereby designated as lectotype of *Troglodytes gorilla* Savage and Wyman, 1847; this should ensure taxonomic consistency between past and future treatments of this name.
Comments. Type species of the genus *Gorilla* I. Geoffroy, 1853. The original description is occasionally attributed in error to Wyman (1847). *G. gorilla* was considered a valid species by Groves (1993: 276) and Nowak (1999: 618).

Order LIPOTYPHLA Haeckel, 1866

Family NESOPHONTIDAE Anthony, 1916

Genus *NESOPHONTES* Anthony, 1916

Nesophontes micrus G. M. Allen, 1917a
Bull. Mus. Comp. Zool., 61: 5, January.

Holotype. VP 9600. Right ramus.
Locality. Cuba: Matanzas Province, cave in Sierra de Hato Neuvo.
Collector. C. de la Torre.

Condition. Condition as originally described—"posterior half of the right ramus, containing a part of pm_4, m_1, m_2, and the roots of m_3."
Type Series. Holotype only.
Comments. Considered a valid species by Hutterer (1993: 70) and Nowak (1999: 201); almost certainly extinct. This specimen is stored in the Vertebrate Paleontology Department of the MCZ.

Family SOLENODONTIDAE Gill, 1872

Genus *SOLENODON* Brandt, 1833

Antillogale marcanoi Patterson, 1962
Breviora, Mus. Comp. Zool., 165: 3, 22 August.
=*Solenodon marcanoi* (Patterson, 1962). See Varona (1974: 8).

Holotype. VP 7261. Right lower ramus.
Locality. Dominican Republic: San Rafael Province (=Elias Pina), Hondo Valle Municipality, unnamed cave 2 km southeast of Rancho La Guardia. Summer 1958.
Collector. C. E. Ray and A. S. Rand.
Condition. Condition as originally described—"incomplete right ramus of mandible with P_3–M_2 and alveoli of other teeth."
Type Series. 5 paratypes; 7262, left ramus, 7263, right humerus, 7264, left humerus, 7265, right ulna, 7266, left ramus, juvenile; all partial.
Comments. *A. marcanoi* is the type species of the genus *Antillogale* Patterson, 1962. *Antillogale* was first synonymized with *Solenodon* by Van Valen (1967: 255). Considered a valid species by Hutterer (1993: 69) and Nowak (1999: 199). *S. marcanoi* is probably extinct. This specimen is stored in the Vertebrate Paleontology Department of the MCZ.

Solenodon poeyanus Barbour, 1944
Proc. New England Zool. Club, 23: 6, March 7.
=*Solenodon cubanus poeyanus* Barbour, 1944. See Aguayo (1950: 131).

Holotype. MCZ 6597. Mounted skin and skull.
Locality. Cuba: Oriente (=Holguin), near Nipi Bay (=Nipe Bay).
Collector. Bought by A. Agassiz from H. A. Ward, 1891.
Condition. Skin complete. Skull partial (basioccipital plate and tympanic bullae missing, parietals damaged). Mandible disarticulated.
Type Series. In the original description, Barbour includes a photograph of a "living example of *Solenodon poeyanus* now in Zoological Garden, Havana, Cuba, from vicinity of Baracoa."
Comments. The number of this specimen is 6597, *not* 6957 as stated in the original description. *S. c. poeyanus* was retained as a valid subspecies by Hall (1981: 22).

Family SORICIDAE Fischer von Waldheim, 1817

Genus *BLARINA* Gray, 1838

Blarina brevicauda aloga Bangs, 1902a
Proc. New England Zool. Club, 3: 76, 31 March.

Holotype. B9727. Skin and skull. Adult male.
Locality. (United States): Massachusetts, Dukes County, Martha's Vineyard, West Tisbury. 25 June 1899.
Collector. O. Bangs. Original number 2.
Condition. Skin and skull complete. Mandible disarticulated.
Type Series. 9 paratypes, B9725, B9726, B9728–B9734, all represented by skin and skull, 3 females and 6 females.
Comments. Retained as a valid subspecies by Hall (1981: 54) and George et al. (1986: 1).

Blarina brevicauda compacta Bangs, 1902a
Proc. New England Zool. Club, 3: 77, 31 March.

Holotype. B9705. Skin and skull. Adult male.
Locality. (United States): Massachusetts, (Nantucket County), Nantucket (Island). 10 July 1899.
Collector. O. Bangs. Original number 3.
Condition. Skin and skull complete. Mandible disarticulated.
Type Series. 6 paratypes; B9701–B9704, B9706, B9708; all represented by skin and skull, 4 females and 2 males.
Comments. Retained as a valid subspecies by Hall (1981: 56) and George et al. (1986: 1).

Genus *CROCIDURA* Wagner, 1832

Crocidura bicolor tephragaster Setzer, 1956
Proc. U.S. Nat. Mus., 106: 458, 28 November.
=*Crocidura fuscomurina* (Heuglin, 1865). See Hutterer (1983: 223).

Holotype. MCZ 44773. Skin and skull. Adult male.
Locality. Anglo-Egyptian Sudan (=Sudan): (Eastern) Equatoria, Torit. 25 April 1950.
Collector. J. S. Owen. Original number 1158.
Condition. Skin and skull complete.
Type Series. Setzer mentions that he examined 18 specimens of *tephragaster*, 8 of which are in the MCZ.

Crocidura hildegardeae phaios Setzer, 1956

Proc. U.S. Nat. Mus., 106: 460, 28 November.

Holotype. MCZ 45855. Skin and skull. Adult female.
Locality. Anglo-Egyptian Sudan (=Sudan): Equatoria, Imatong Mts, Gilo, 6,500 ft (1,983 m). 12 June 1950.
Collector. J. S. Owen. Original number 1266.
Condition. Skin and skull complete. Mandible disarticulated.
Type Series. 3 paratypes; 1 from the MCZ; MCZ 45856, skin and skull, male.
Comments. Retained as a valid subspecies, *C. gracilipes phaios,* by Heim de Balsac and Meester (1977: 16); included in *Crocidura hildegardeae* by Hutterer (1993: 87).

Genus *CRYPTOTIS* Pomel, 1848

Cryptotis avia G. M. Allen, 1923a

Proc. New England Zool. Club, 8: 37, 12 February.
=*Cryptotis thomasi* (Merriam, 1897). See Woodman (1996: 414).

Holotype. MCZ 20091. Skin and skull. Adult.
Locality. Colombia: (probably Cundinamarca), El Verjon (see coments). October 1922.
Collector. N. Maria.
Condition. Skin complete. Skull partial (most of skull from frontals to occiput missing). Left ramus of mandible missing.
Type Series. Holotype only.
Comments. Considered a valid species by Hutterer (1993: 108) and Nowak (1999: 209) but synonymized as noted above. The locality "El Verjon" is not shown on any maps available to us but is possibly equivalent to "Paramo Cruz Verde" (Paynter 1997: 463).

Genus *MYOSOREX* Gray, 1838

Crocidura maurisca geata G. M. Allen and Loveridge, 1927

Proc. Boston Soc. Nat. Hist., 38: 417, 23 December.
=*Myosorex geata* (G. M. Allen and Loveridge, 1927). See Heim de Balsac (1967: 610).

Holotype. MCZ 22447. Skin and skull. Adult male.
Locality. Tanganyika Territory (=Tanzania): Morogoro, Uluguru Mountains, Nyingwa, 7,500 ft (2,288 m). 19 October 1926.
Collector. A. Loveridge.
Condition. Skin and skull complete. Mandible disarticulated.
Type Series. 1 paratype; MCZ 22448, skin and skull, adult female.
Comments. M. geata was considered a valid species by Hutterer (1993: 99) and Nowak (1999: 217).

Genus *SOREX* Linnaeus, 1758

Neosorex palustris acadicus G. M. Allen, 1915a

Proc. Biol. Soc. Washington, 28: 15, 12 February.
Name preoccupied by *Sorex acadicus* Gilpin, 1867.

Sorex palustris gloveralleni Jackson, 1926

J. Mammal., 7: 57, 15 February.
(Replacement name for *Neosorex palustris acadicus* G. M. Allen, 1915)

Holotype. B2046. Skin and skull. Adult female.
Locality. (Canada): Nova Scotia, Digby. 26 July 1894.
Collector. O. Bangs. Original number 3.
Condition. Skin and skull complete. Mandible disarticulated.
Type Series. 1 paratype; B2053, exchanged to the USNM in 1922.
Comments. Retained as a valid subspecies by Hall (1981: 41) and Beneski and Stinson (1987: 1).

Sorex araneus ultimus G. M. Allen, 1914b

Proc. New England Zool. Club, 5: 51, 9 April.
=*Sorex tundrensis* Merriam, 1900. See Hutterer (1993: 121).

Holotype. MCZ 15000. Skin and skull. Adult male.
Locality. (Russian Federation): northeastern Siberia, Nijni Kolymsk (=Nizhnekolymsk), near mouth of Kolyma River. 6 November 1911.
Collector. J. Koren. Original number 136.
Condition. Skin and skull complete. Mandible disarticulated.
Type Series. There is a series of paratypes, most of which are housed in the MCZ.

Sorex macropygmaeus koreni G. M. Allen, 1914b

Proc. New England Zool. Club, 5: 56, 9 April.
=*Sorex caecutiens koreni* G. M. Allen, 1914. See Yudin (1989: 281).

Holotype. MCZ 15085. Skin and skull. Adult female.
Locality. (Russian Federation): northeastern Siberia, Nijni Kolymsk (=Nizhnekolymsk), near mouth of Kolyma River. 19 October 1911.
Collector. J. Koren. Original number 50.

Type Series. 5 paratypes; MCZ 15003–15007, all represented by skin and skull; 4 males, 1 female. MCZ 15004, a male, was exchanged to the FMNH in 1931.

Condition. Skin and skull complete. Mandible disarticulated.

Sorex macrurus Batchelder, 1896

Proc. Biol. Soc. Washington, 10: 133, 8 December.

Name preoccupied by *Sorex macrourus* Lehmann, 1822.

Sorex dispar Batchelder, 1911

Proc. Biol. Soc. Washington, 24: 97, 15 May. (Replacement name for *Sorex macrurus* Batchelder, 1896)

Holotype. MCZ 41744. Skin and skull. Adult male.

Locality. (United States): New York, Essex County, Keene Heights, Beede's (see comments). 9 September 1895.

Collector. C. F. Batchelder. Original number 1384.

Condition. Skin and skull complete. Mandible disarticulated.

Type Series. 1 paratype; MCZ 41745, skin and skull, adult male.

Comments. *S. dispar* was considered a valid species by Hutterer (1993: 114) and Nowak (1999: 205). The type locality was redescribed by Martin (1966: 131) as "0.6 mile south and 0.5 mile east of Saint Huberts, Essex County, New York, lat. 44°09′, long. 73°46′."

Sorex personatus miscix Bangs, 1899d

Proc. New England Zool. Club, 1: 15, 28 February.

=*Sorex cinereus miscix* Bangs, 1899. See Jackson (1925: 56).

Holotype. B8651. Skin and skull. Adult male.

Locality. (Canada): Labrador, Black Bay. 10 October 1898.

Collector. E. Doane. Original number 1.

Condition. Skin and skull complete. Mandible disarticulated.

Type Series. Bangs based his description on 39 specimens; corresponding to B7931–B7950 and B8651–B8669; all represented by skin and skull.

Comments. *S. c. miscix* was retained as a valid subspecies by Hall (1981: 29).

Sorex sanguinidens G. M. Allen, 1914b

Proc. New England Zool. Club, 5: 54, 9 April.

=*Sorex daphaenodon sanguinidens* G. M. Allen, 1914. See Yudin (1989: 198).

Holotype. MCZ 15012. Skin and skull. Adult female.

Locality. (Russian Federation): northeastern Siberia, Nijni Kolymsk (=Nizhnekolymsk), near mouth Kolyma River. 11 December 1911.

Collector. J. Koren. Original number 221.

Condition. Tail separate from skin. Skull complete. Mandible disarticulated.

Type Series. There is a large series of paratypes, most of which are still in the MCZ.

Sorex vir G. M. Allen, 1914b

Proc. New England Zool. Club, 5: 52, 9 April.

=*Sorex roboratus* Hollister, 1913. See Hoffman (1985: 17).

Holotype. MCZ 15068. Skin and skull. Adult female.

Locality. (Russian Federation): northeastern Siberia, Nijni Kolymsk (=Nizhnekolymsk), near mouth of Kolyma River. 19 December 1911.

Collector. J. Koren. Original number 230.

Condition. Skin and skull complete. Mandible disarticulated.

Type Series. There is a large series of paratypes, most of which are still in the MCZ.

Genus *SUNCUS* Ehrenberg, 1832

Suncus ater Medway, 1965

Mammals of Borneo, J. Malay. Branch R. Asiat. Soc., 36: 38, December.

Holotype. MCZ 36574. Skin, skull, and postcranial skeleton. Adult female.

Locality. Malaysia: northern Borneo, Sabah, Mount Kinabalu, Lumu Lumu, 5,500 ft (1,678 m). 7 July 1937.

Collector. J. A. Griswold, Jr. Original number 462.

Condition. Skin complete. Skull partial (tympanic bullae missing), and mandible disarticulated. Postcranial skeleton complete.

Type Series. Holotype only.

Comments. Considered a valid species by Hutterer (1993: 101) and Nowak (1999: 223).

Suncus varilla minor G. M. Allen and Loveridge, 1933

Bull. Mus. Comp. Zool., 75: 57, February.

Holotype. MCZ 26754. Skin and skull. Adult female.

Locality. Tanganyika Territory (=Tanzania): Urungu, Kitungulu, 4,500 ft (1,373 m). 14 May 1930.

Collector. A. Loveridge.

Condition. Skin and skull complete. Mandible disarticulated.

Type Series. Holotype only.

Comments. Retained as a valid subspecies by Heim de Balsac and Meester (1977: 6).

Family TALPIDAE Fischer de Waldheim, 1817

Genus *NEUROTRICHUS* Günther, 1880

Neurotrichus gibbsi hyacinthinus Bangs, 1897d

Amer. Nat., 31: 240, 1 March.

Holotype. B1240. Skin and skull. Adult female.
Locality. U.S.A. (United States): California, Marin County, Nicasio. 10 March 1894.
Collector. C. A. Allen. Original number 694.
Condition. Skin and skull complete. Mandible disarticulated.
Type Series. 1 paratype; B1241, skin and skull, adult male.
Comments. Retained as a valid subspecies by Hall (1981: 67) and Carraway and Verts (1991: 1).

Genus *SCALOPUS* Desmarest, 1804

Scalops anastasae Bangs, 1898b

Proc. Boston Soc. Nat. Hist., 28: 212, 15 March.
=*Scalopus aquaticus anastasae* (Bangs, 1898). See Jackson (1915: 39).

Holotype. B7192. Skin and skull. Adult male.
Locality. U.S.A. (United States): Florida, St. Johns County, Anastasia Island, Point Romo. 16 February 1897.
Collector. O. Bangs. Original number 10.
Condition. Skin and skull complete. Mandible disarticulated.
Type Series. 4 paratypes; B7193–B7196; all represented by skin and skull, 2 females and 2 males.
Comments. S. a. anastasae was retained as a valid subspecies by Hall (1981: 72).

Scalops texanus aereus Bangs, 1896h

Proc. Biol. Soc. Washington, 10: 138, 28 December.
=*Scalopus aquaticus aereus* (Bangs, 1896). See Miller (1912: 8).

Holotype. B5475. Skin and skull. Adult female.
Locality. (United States): Indian Territory (=Oklahoma) (Adair County), Stilwell. 13 August 1896.
Collector. T. Surber. Original number 64.
Condition. Skin and skull complete. Mandible disarticulated.
Type Series. Holotype only.
Comments. S. a. aereus was retained as a valid subspecies by Hall (1981: 72).

Genus *SCAPANUS* Pomel, 1848

Scapanus californicus minusculus Bangs, 1899j

Proc. New England Zool. Club, 1: 70, 31 July.
=*Scapanus latimanus minusculus* Bangs, 1899. See Grinnell and Swarth (1912: 133).

Holotype. B9189. Skin and skull. Adult female.
Locality. (United States): California, El Dorado County, Fyffe. 10 June 1897.
Collector. W. W. Price and E. M. Nutting. Original number 15.
Condition. Skin and skull complete. Mandible disarticulated.
Type Series. Holotype only.
Comments. S. l. minusculus was retained as a valid subspecies by Hall (1981: 70).

Order CHIROPTERA Blumenbach, 1779

Family PTEROPODIDAE Gray, 1821

Genus *AETHALOPS* Thomas, 1923

Aethalops aequalis G. M. Allen, 1938b

J. Mammal., 19: 497, 14 November.
=*Aethalops alecto aequalis* G. M. Allen, 1938. See Hill (1961: 639).

Holotype. MCZ 36582. Skin, skull, and postcranial skeleton. Adult female.
Locality. (Malaysia): British North Borneo (=Sabah), Mount Kinabalu, Luma Luma, 5,500 ft (1,678 m). 12 July 1937.
Collector. J. A. Griswold, Jr., Asiatic Primate Expedition. Original number 510.
Condition. Skin, skull, and postcranial skeleton complete.
Type Series. 3 paratypes; MCZ 36583, skin, skull and skeleton, female; MCZ 36584, skin and skull, female; MCZ 36586, skin and skull, female.
Comments. A. a. aequalis was retained as a valid subspecies by Koopman (1994: 35).

Genus *EONYCTERIS* Dobson, 1873

Eonycteris spelaea glandifera Lawrence, 1939

In Barbour, Lawrence, and Peters, Bull. Mus. Comp. Zool., 86: 38, November.

Holotype. MCZ 35159. Skin and skull. Adult male.
Locality. Philippines: Luzon, (Nueva Ecija), Rizal, Montalban caves near Manila. 27 February 1937.
Collector. B. Lawrence. Original number 253.
Condition. Skin and skull complete.
Type Series. In the original description, Lawrence

implies the existence of several specimens in addition to the holotype; she collected 18 specimens of *glandifera* during her 1936–37 expedition to the Philippines, all of which are in the MCZ.
Comments. Retained as a valid subspecies by Maharadatunkamsi and Kitchener (1997: 59).

Genus *HAPLONYCTERIS* Lawrence, 1939

Haplonycteris fischeri Lawrence, 1939
In Barbour, Lawrence, and Peters, Bull. Mus. Comp. Zool., 86: 33, November.

Holotype. MCZ 35258. Skin and skull. Adult male.
Locality. Philippines: Mindoro (Oriental), Mount Halcon, Bignay. 26 April 1937.
Collector. F. S. Rivera. Original number BL 502.
Condition. Skin and skull complete.
Type Series. Holotype only.
Comments. Type species of the genus *Haplonycteris* Lawrence, 1939. Considered a valid species by Koopman (1993: 142) and Nowak (1999: 292).

Genus *PTEROPUS* Erxleben, 1777

Pteropus anetianus aorensis Lawrence, 1945
Proc. New England Zool. Club, 23: 66, 26 March.

Holotype. MCZ 42183. Skin and skull. Adult male.
Locality. (Vanuatu): New Hebrides, off southwest corner of Espiritu Santo Island, Aore Island. 8 April 1944.
Collector. O. L. Austin, Jr. Original number 5.
Condition. Skin complete. Skull partial (basioccipital missing), right ramus of mandible broken.
Type Series. 1 paratype; MCZ 42182, skin and skull, adult male.
Comments. Retained as a valid subspecies by Koopman (1994: 25) and Flannery (1995b).

Pteropus ariel G. M. Allen, 1908
Bull. Mus. Comp. Zool., 52: 28, July.
=*Pteropus giganteus ariel* G. M. Allen, 1908. See Hill (1958: 5).

Holotype. MCZ 10565. Skin and skull. Adult male.
Locality. Maldive Islands: Male Atoll. 24 December 1901.
Collector. H. B. Bigelow, A. Agassiz Expedition.
Condition. Right wing of skin damaged. Skull intact, with 2 small holes in braincase.
Type Series. 1 paratype; MCZ 10566, skin and skull, juvenile female.
Comments. *P. g. ariel* was retained as a valid subspecies by Koopman (1994: 26).

Pteropus austini Lawrence, 1945
Proc. New England Zool. Club, 23: 59, 26 March.
=*Pteropus woodfordi* Thomas, 1888. See Sanborn and Beecher (1947: 389).

Holotype. MCZ 42166. Skin and skull. Subadult female.
Locality. Solomon Islands: Florida Island (Nggela Group). 20 February 1944.
Collector. O. L. Austin, Jr. Original number 2.
Condition. Skin and skull complete.
Type Series. 1 paratype; MCZ 42167, skin and skull, subadult male.
Comments. Lawrence referred to the holotype as an adult in the original description, but Sanborn and Beecher (1947: 389) recognized it as a subadult.

Pteropus rayneri monoensis Lawrence, 1945
Proc. New England Zool. Club., 23: 63, 26 March.

Holotype. MCZ 42191. Skin and skull. Adult male.
Locality. Solomon Islands: Treasury (Mono) Island. 11 October 1944.
Collector. O. L. Austin, Jr. Original number 27.
Condition. Skin and skull complete.
Type Series. 2 paratypes; MCZ 42192, skin and skull, adult male; MCZ 42193, skin and skull, adult male.
Comments. Retained as a valid subspecies by Koopman (1994: 24) and Flannery (1995b: 285).

Genus *ROUSETTUS* Gray, 1821

Rousettus madagascariensis G. Grandidier, 1930b
Bull. Acad. Malgache, n. ser., 11: 91 (for 1928).

Holotype. MCZ 45432. Alcoholic and skull. Adult male.
Locality. Malagasy Republic (Madagascar): (Antananarivo), between Tananarive (=Antananarivo) and Andevoranto, Grand forest de Est, near Beforona.
Collector. Received by G. Grandidier from the Académie Malgache, 1917.
Condition. Alcoholic, skull complete.
Type Series. Holotype only.
Comments. Considered a valid species by Koopman (1993: 153) and Nowak (1999: 261). In his review of known material of *R. madagascariensis*, Bergmans (1977: 67) commented in error that the holotype was in the Académie Malgache, Antananarivo, Madagascar.

Family EMBALLONURIDAE Gervais, 1855

Genus *PEROPTERYX* Peters, 1867

Peropteryx canina phaea G. M. Allen, 1911a

Bull. Mus. Comp. Zool., 54: 222, July.
= *Peropteryx macrotis phaea* G. M. Allen, 1911. See Sanborn (1937: 342).

Holotype. MCZ 8101. Skin and skull. Adult female.
Locality. Grenada: Point Saline(s). 29 August 1910.
Collector. G. M. Allen. Original number 15.
Condition. Skin and skull complete. Mandible disarticulated.
Type Series. There is a series of paratypes in the MCZ.
Comments. P. m. phaea was retained as a valid subspecies by Hall (1981: 82) and Koopman (1994: 47).

Genus *RHYNCHONYCTERIS* Peters, 1867

Rhynchiscus naso priscus G. M. Allen, 1914c

Proc. Biol. Soc. Washington, 27: 109, 10 July.
= *Rhynchonycteris naso* (Wied-Neuwied, 1820). See Sanborn (1937: 326).

Holotype. MCZ 13208. Skin and skull. Adult.
Locality. Mexico: Quintana Roo, Xcopen. 18 February 1912.
Collector. J. L. Peters. Original number 13.
Condition. Skin and skull complete. Mandible disarticulated.
Type Series. 3 paratypes; MCZ 13209, skin and skull, adult male; MCZ 14637, alcoholic, adult male; MCZ 14638, alcoholic, adult female.

Family NYCTERIDAE Van der Hoeven, 1855

Genus *NYCTERIS* G. Cuvier and É. Geoffroy, 1795

Nycteris madagascariensis G. Grandidier, 1937

Bull. Mus. Nat. Hist. Paris, 9: 353, 25 November.

Holotype. MCZ 45433. Body in alcohol, skull extracted.
Locality. Madagascar: (Antsiranana), Diego-Suarez (=Antsiranana), Valley of the Rodo, north of Pirkana near the Ankarana, 12°5′–13°0′S, 49°5′E. June 1910.
Collector. Grandidier collection.
Condition. Alcoholic, skull complete.
Type Series. 1 paratype, MCZ 45434, in alcohol, skull extracted, female.
Comments. N. madagascariensis was included in *N. macrotis* by Koopman (1993: 162) but retained as a valid species by Peterson et al. (1995: 63).

Nycteris nana tristis G. M. Allen and Lawrence, 1936

Bull. Mus. Comp. Zool., 79: 47, January.
= *Nycteris nana* (Andersen, 1912). See Hayman and Hill (1971: 19).

Holotype. MCZ 31156. Skin and skull. Adult female.
Locality. Kenya: (W. Nyanza), Kakamega District, Kaimosi. 13 February 1934.
Collector. A. Loveridge.
Condition. Skin and skull complete. Mandible disarticulated.
Type Series. Holotype only.

Family RHINOLOPHIDAE Gray, 1825

Genus *HIPPOSIDEROS* Gray, 1831

Hipposideros curtus G. M. Allen, 1921

Rev. Zool. Africaine, 9: 194, December.

Holotype. MCZ 19305. Body in alcohol. Female.
Locality. Cameroons (=Cameroon): (Littoral), Sakbayeme. 1920.
Collector. G. Schwab.
Condition. Alcoholic. Skull extracted but not cleaned (still in alcohol).
Type Series. Holotype only.
Comments. H. curtus was considered a valid species by Koopman (1993: 172) and Nowak (1999: 333).

Hipposideros erigens Lawrence, 1939

In Barbour, Lawrence, and Peters, Bull. Mus. Comp. Zool., 86: 56, November.
= *Hipposideros bicolor erigens* Lawrence, 1939. See Hill (1963: 28).

Holotype. MCZ 35197. Skin and skull. Adult male.
Locality. Philippines: Mindoro, (Oriental) Tabucala cave near Calapan, northern base of Mount Halcon. 7 March 1937.
Collector. B. Lawrence. Original number 307.
Condition. Skin complete. Skull partial (occiput missing), and mandible disarticulated.
Type Series. 3 paratypes; MCZ 35195, skin and skull, adult female; MCZ 35196, skin and skull, adult male; MCZ 35198, skin and skull, adult female.
Comments. H. b. erigens was retained as a valid subspecies by Koopman (1994: 61).

Hipposideros turpis Bangs, 1901a
Amer. Nat., 35: 561, 31 July.
=*Hipposideros turpis turpis* Bangs, 1901. See Hill (1963: 94).

Holotype. MCZ 10003. Skin and skull. Adult female.
Locality. (Japan): Ryukyu Islands, southern group of Liu Kiu Islands, Ishigaki Island. 10 May 1899.
Collector. I. Zensaku.
Condition. Skin complete. Skull partial (occipital region missing).
Type Series. 2 paratypes; MCZ 10002, skin and skull, adult female; MCZ 10004, skin and skull, adult male.
Comments. *H. turpis* was considered a valid species by Koopman (1993: 175) and Nowak (1999: 334).

Genus *RHINOLOPHUS* Lacépède, 1799

Rhinolophus megaphyllus ignifer G. M. Allen, 1933
J. Mammal., 14: 149, 15 May.
=*Rhinolophus megaphyllus megaphyllus* Gray, 1834. See Koopman (1984: 9).

Holotype. MCZ 29078. Skin and skull. Adult male.
Locality. Australia: Queensland, Cape York, Coen. 12 June 1932.
Collector. P. J. Darlington, Jr., Harvard Australian Expedition. Original number 185.
Condition. Skin and skull complete. Mandible disarticulated.
Type Series. 1 paratype; MCZ 29079, skin and skull, adult male.

Rhinolophus philippinensis alleni Lawrence, 1939
In Barbour, Lawrence, and Peters, Bull. Mus. Comp. Zool., 86: 46, November.

Holotype. MCZ 35097. Skin and skull. Adult female.
Locality. Philippines: Mindoro, (Oriental) Tabucala cave near Calapan, northern base of Mount Halcon. 7 March 1937.
Collector. B. Lawrence. Original number 302.
Condition. Skin and skull complete. Mandible disarticulated.
Type Series. 2 paratypes; MCZ 35098, skin and skull, adult female; MCZ 35099, skin and skull, adult female.
Comments. Retained as a valid subspecies by Koopman (1994: 57).

Genus *TRIAENOPS* Dobson, 1871

Triaenops aurita G. Grandidier, 1912
Bull. Mus. Hist. Nat. Paris, 18: 8, 25 January.

Holotype. MCZ 45080. Mummy.
Locality. Malagasy Republic (=Madagascar): (Antsiranana), Diego-Suarez (=Antsiranana). 1910.
Collector. Dr. Mazieres.
Condition. Mummy (dried carcass), complete.
Type Series. Holotype only.
Comments. Traditionally included in *Triaenops furculus*, as in G. M. Allen (1939: 82) and Koopman (1993: 175), but retained as distinct by Peterson et al. (1995: 81) pending further material from the area of the type locality. Known only from the holotype.

Family MORMOOPIDAE de Saussure, 1860

Genus *PTERONOTUS* Gray, 1838

Chilonycteris parnellii pusillus G. M. Allen, 1917c
Proc. Biol. Soc. Washington, 30: 168, 23 October.
=*Pteronotus parnellii pusillus* (G. M. Allen, 1917). See Smith (1972: 67).

Holotype. MCZ 16468. Skin and skull. Female.
Locality. Dominican Republic: Santo Domingo, Arroyo Salado. 7 March 1916.
Collector. J. L. Peters. Original number 227.
Condition. Skin complete. Skull partial (left wall of braincase broken, left tympanic bulla missing).
Type Series. 2 paratypes; MCZ 16599, female; MCZ 16600, female; both in alcohol.
Comments. *P. p. pusillus* was retained as a valid subspecies by Hall (1981: 92) and Koopman (1994: 71).

Chilonycteris torrei G. M. Allen, 1916a
Proc. New England Zool. Club, 6: 4, 8 February.
=*Pteronotus quadridens quadridens* (Gundlach, 1840). See Silva-Taboada (1976: 7).

Holotype. MCZ 11672. Body in alcohol, skull extracted. Adult female.
Locality. Cuba: (Guantanama), Baracoa, La Cueva de la Majana. 15 June 1915.
Collector. V. J. R. Verrier. Presented to the MCZ by Carlos de la Torre.
Condition. Alcoholic, skull complete.
Type Series. 2 paratypes; MCZ 11670, male; MCZ 11671, female; both in alcohol.

Family PHYLLOSTOMIDAE Gray, 1825

Genus *AMETRIDA* Gray, 1847

Ametrida minor H. Allen, 1894
Proc. Boston Soc. Nat. Hist., 26: 240, 16 May.
=*Ametrida centurio* Gray, 1847. See Peterson (1965: 5).

Holotype. MCZ 11274. Body in alcohol, skull extracted. Adult male.

Locality. Suriname: Paramaribo. Collected sometime between 1832 and 1839.
Collector. F. W. Cragin.
Condition. Alcoholic, skull complete.
Type Series. Holotype only.
Comments. For comments on the type locality and date of acquisition, see G. M. Allen (1902a: 88). *A. minor* actually represents the male specimens of *A. centurio.*

Genus *ARTIBEUS* Leach, 1821

Artibeus femurvillosum Bangs, 1899k
Proc. New England Zool. Club, 1: 73, 24 November.
=*Artibeus lituratus palmarum* J. A. Allen and Chapman, 1897. See Hershkovitz (1949: 445).

Holotype. B8314. Skin and skull. Adult male.
Locality. Colombia: (La Guajira), La Concepcion, 3,000 ft (915 m). 21 March 1899.
Collector. W. W. Brown, Jr. Original number 31.
Condition. Skin and skull complete.
Type Series. Holotype only.

Genus *EROPHYLLA* Miller, 1906

Erophylla sezekorni syops G. M. Allen, 1917c
Proc. Biol. Soc. Washington, 30: 167, 23 October.

Holotype. MCZ 13713. Body in alcohol, skull extracted. Adult male.
Locality. Jamaica: (St. James), Montego Bay. 14 March 1912.
Collector. J. A. Cushman.
Condition. Alcoholic, skull complete.
Type Series. 7 paratypes; MCZ 13709–13712, 13714–13716, all alcoholic. MCZ 13709 and 13712 were sent in exchange to the USNM.
Comments. Retained as a valid subspecies by Hall (1981: 171) and Koopman (1994: 79).

Genus *GLOSSOPHAGA* É. Geoffroy, 1818

Glossophaga longirostris Miller, 1898
Proc. Acad. Nat. Sci. Philadelphia, 1898, p. 330, 2 August.
=*Glossophaga longirostris longirostris* Miller, 1898. See Miller (1913: 422).

Holotype. B8046. Skin and skull. Adult female.
Locality. Colombia: (Magdalena), Santa Marta Mountains, near Santa Marta. 10 February 1898.
Collector. W. W. Brown, Jr. Original number 60.
Condition. Skin complete. Skull partial (left zygomatic arch missing).
Type Series. Holotype only.
Comments. *G. longirostris* was considered a valid species by Koopman (1993: 184) and Nowak (1999: 368).

Genus *LONCHOPHYLLA* Thomas, 1903

Lonchophylla hesperia G. M. Allen, 1908
Bull. Mus. Comp. Zool., 52: 35, July.

Holotype. MCZ 7011. Body in alcohol, skull extracted. Adult male.
Locality. Peru: (Contralmirante Villar), Tumbes, Zorritos.
Collector. F. H. Bradley.
Condition. Alcoholic, skull complete.
Type Series. 2 paratypes; in the YPM; 1034 and 1035; both in alcohol.
Comments. Considered a valid species by Koopman (1993: 181) and Nowak (1999: 372). This rarely collected bat is known by only two museum specimens in addition to the type series: USNM 283177 and LSUMZ 14121 (Gardner 1976: 5).

Genus *PLATYRRHINUS* de Saussure, 1860

Vampyrops umbratus Lyon, 1902
Proc. Biol. Soc. Washington, 15: 151, 20 June.
=*Platyrrhinus umbratus* (Lyon, 1902). See Koopman (1993: 191).

Holotype. B8180. Skin and skull. Adult male.
Locality. Colombia: (LaGuajira), San Miguel. 8 June 1898.
Collector. W. W. Brown, Jr. Original number 234.
Condition. Skin and skull complete.
Type Series. 2 paratypes; B8300, skin, male; B8301, skin, male.
Comments. *P. umbratus* was considered a valid species by Koopman (1993: 191) and Nowak (1999: 389). *Platyrrhinus* has priority over the genus name *Vampyrops* (Gardner and Ferrell 1990: 501–503).

Vampyrops zarhinus H. Allen, 1891
Proc. Acad. Nat. Sci. Philadelphia, 1891, p. 400, 22 September.
=*Platyrrhinus helleri* (Peters, 1866). See Hall and Kelson (1959: 131).

Holotype. MCZ 3211. Body in alcohol, skull extracted. Adult female, pregnant.
Locality. Panama: Canal Zone, Obispo. 1872. See comments.
Collector. Hassler Expedition.
Condition. Alcoholic, skull complete.
Type Series. Holotype only.

Comments. In the original description, H. Allen reported that this specimen had been collected in Brazil by the Thayer expedition. G. M. Allen emended this apparently erroneous locality to Obispo, Panama, in accordance with the accession catalogue of the MCZ (1931: 236–237). In support of Allen's decision, Rouk and Carter (1972: 4) stated, after examining the holotype of *zarhinus,* that it is "quite like specimens of [*Platyrrhinus*] *helleri* from Mexico and Central America, and unlikely to have come from Brazil." For the use of the genus *Platyrrhinus* over *Vampyrops,* see Gardner and Ferrell (1990: 501–503).

Genus *VAMPYRODES* Thomas, 1900

Vampyrodes major G. M. Allen, 1908

Bull. Mus. Comp. Zool., 52: 38, July.
=*Vampyrodes caraccioli major* G. M. Allen, 1908. See Handley (1966: 766).

Holotype. MCZ 6756. Body in alcohol. Adult female.
Locality. Panama: San Pablo (now covered by Gatun Lake). Date unrecorded.
Collector. A. Lesley.
Condition. Alcoholic.
Type Series. Holotype only.
Comments. V. c. major was retained as a valid subspecies by Koopman (1994: 88).

Family MOLOSSIDAE Gervais, 1855

Genus *MOPS* Lesson, 1842

Chaerephon leucostigma G. M. Allen, 1918a

Bull. Mus. Comp. Zool., 61: 513, February.
=*Mops condylurus leucostigma* (G. M. Allen, 1918). See Koopman (1994: 141).

Holotype. MCZ 16344. Skin and skull. Adult female.
Locality. Malagasy Republic (Madagascar): (Antananarivo), Tananarive (=Antananarivo). December 1915.
Collector. F. R. Wulsin.
Condition. Skin partial (bare spot on ventrum). Skull damaged (right and left zygomatic arch missing; supraoccipital chipped).
Type Series. 1 paratype; MCZ 16345, skin and skull, male.
Comments. Peterson et al. (1995: 168) used the name *Tadarida leucostigma.*

Mops angolensis orientis G. M. Allen and Loveridge, 1942

Bull. Mus. Comp. Zool., 89: 166, February.
=*Mops condylurus orientis* G. M. Allen and Loveridge, 1942. See Koopman (1994: 141).

Holotype. MCZ 38829. Skin and skull. Adult male.
Locality. Tanganyika Territory (=Tanzania): Mtwara, Ruvuma River, Kitaya, 300 ft (92 m). 3 April 1939.
Collector. A. Loveridge.
Condition. Skin and skull complete.
Type Series. 9 paratypes; MCZ 38826–38828, 38830–38835, all represented by skin and skull, 4 females and 5 males.

Genus *OTOMOPS* Thomas, 1913

Otomops papuensis Lawrence, 1948

J. Mammal., 29: 413, 31 December.

Holotype. MCZ 45769. Body in alcohol, skull extracted. Adult female.
Locality. Papua New Guinea: Vailala River.
Collector. Bought from Ward's Natural Science Establishment, April 1948.
Condition. Alcoholic, skull partial (right zygomatic arch missing).
Type Series. Holotype only.
Comments. Considered a valid species by Koopman (1993: 239) and Nowak (1999: 482). According to Flannery (1995a: 481), *O. papuensis* has been collected on only two occasions and, other than the holotype, is known by only 10 specimens; 2 in the BMNH, the remainder in the biological collections of the University of Papua New Guinea.

Family VESPERTILIONIDAE Gray, 1821

Genus *EPTESICUS* Rafinesque, 1820

Eptesicus darlingtoni G. M. Allen, 1933

J. Mammal., 14: 150, 15 May.

Holotype. MCZ 29113. Skin and skull. Adult female.
Locality. Australia: Queensland, Queensland National Park, MacPherson Ranges, 3,000 ft (915 m). 10 March 1932.
Collector. P. J. Darlington, Jr., Harvard Australian Expedition. Original number 30.
Condition. Skin and skull complete.
Type Series. 1 paratype; MCZ 29120 (now Queensland Museum J 5476), skin and skull, adult female.
Comments. McKean et al. (1978: 533) and Koopman (1993: 203) included *darlingtoni* in *Eptesicus pumilus.* However, Koopman also used the name *Pipistrellus darlingtoni* (1994: 116). Hoye (1995:

537) considered *darlingtoni* to be a valid species of *Vespadelus,* to which he gave full generic rank.

Genus *HARPIOCEPHALUS* Gray, 1842

Harpiocephalus rufulus G. M. Allen, 1913
Proc. Biol. Soc. Washington, 26: 214, 20 December.
=*Harpiocephalus harpia rufulus* G. M. Allen, 1913. See Ellerman and Morrison-Scott (1951: 187).

Holotype. MCZ 14206. Skin and skull. Adult male.
Locality. Vietnam: Tonkin, Lao-Kai (=Lao Cai). 3 January 1912.
Collector. Kobayashi Collection. Original number 14.
Condition. Skin complete. Skull partial (parietals broken).
Type Series. Holotype only.
Comments. H. h. rufulus was retained as a valid subspecies by Koopman (1994: 133).

Genus *IDIONYCTERIS* Anthony, 1923

Corynorhinus phyllotis G. M. Allen, 1916b
Bull. Mus. Comp. Zool., 60: 352, April.
=*Idionycteris phyllotis phyllotis* (G. M. Allen, 1916). See Tumlison (1993: 418).

Holotype. MCZ 5943. Skin and skull. Adult.
Locality. Mexico: San Luis Potosí. 24 March 1878.
Collector. E. Palmer.
Condition. Skin and skull complete.
Type Series. Holotype only.
Comments. I. phyllotis was considered a valid species by Koopman (1993: 205) and Nowak (1999: 457).

Genus *LASIURUS* Gray, 1838

Atalapha brachyotis J. A. Allen, 1892
Bull. Amer. Mus. Nat. Hist., 4: 47, 25 March.
=*Lasiurus borealis brachyotis* (J. A. Allen, 1892). See Niethammer (1964: 595).

Holotype. MCZ 11143. Body in alcohol. Male.
Locality. (Ecuador), Galapagos Islands: Chatham Island. 23 June 1891.
Collector. G. Baur.
Condition. Alcoholic. The specimen was received without a skull.
Type Series. Holotype only.
Comments. Lasiurus brachyotis has often been accorded specific status, as in Nowak (1999: 451). Included in *L. borealis* as a valid subspecies by Koopman (1994: 129).

Genus *MYOTIS* Kaup, 1829

Myotis abbotti nugax G. M. Allen and Coolidge, 1940
Bull. Mus. Comp. Zool., 87: 137, 31 December.
=*Myotis muricola nugax* G. M. Allen and Coolidge, 1940. See Koopman (1994: 104).

Holotype. MCZ 36076. Skin and skull. Adult male.
Locality. Malaysia: north Borneo, Sabah, Mount Kinabalu, Bundutuan, 3,500 ft (1,068 m). 25 July 1937.
Collector. J. A. Griswold, Jr., Asiatic Primate Expedition. Original number 626.
Condition. Skin and skull complete. Mandible disarticulated.
Type Series. 16 paratypes, MCZ 36072–36075, 36077–36080, 36082–83, 36085–89, 36091; all represented by skin and skull, 12 females and 4 males.

Myotis albicinctus G. M. Allen, 1919b
J. Mammal., 1: 2, 28 November.
=*Myotis lucifugus carissima* Thomas, 1904. See Miller and G. M. Allen (1928: 50).

Holotype. MCZ 11747. Skin and skull. Adult male.
Locality. (United States): California, (Tulare County), Mount Whitney, 11,000 ft (3,355 m). 14 July 1915.
Collector. G. M. Allen. Original number 1.
Condition. Skin and skull complete. Mandible disarticulated.
Type Series. 1 paratype, probably at USNM.
Comments. The skull of the holotype, which had been mislaid at the time that *albicinctus* was described, has subsequently been found and reunited with its skin.

Myotis sodalis Miller and G. M. Allen, 1928
Bull. U.S. Nat. Mus., 144: 130, 25 May.

Holotype. MCZ 10988. Skin and skull. Adult female.
Locality. (United States): Indiana, (Crawford County), Wyandotte cave. 7 March 1904.
Collector. J. O. Sibert.
Condition. Skin and skull complete. Mandible disarticulated.
Comments. Considered a valid species by Koopman (1993: 215) and Nowak (1999: 419).
Type Series. Miller and Allen based their description on an examination of 443 specimens, described by locality in the original description (1928: 133). 30 paratypes are in the MCZ, the others are in the FMNH, USNM, AMNH, and BMNH.

Genus *NYCTICEIUS* Rafinesque, 1819

Nycticeius africanus G. M. Allen, 1911b
Bull. Mus. Comp. Zool., 54: 328, December.
=*Nycticeius schlieffeni albiventer* Thomas and Wroughton, 1908. See Hayman and Hill (1971: 36).

Holotype. MCZ 8272. Skin and skull. Male.
Locality. British East Africa (=Kenya): Meru River, effluent of northern Guaso Nyiro (=Ewaso Ngiro). 11 August 1909.
Collector. G. M. Allen. Original number 113.
Condition. Skin and skull complete.
Type Series. Holotype only.

Genus *PIPISTRELLUS* Kaup, 1829

Eptesicus phasma G. M. Allen, 1911b
Bull. Mus. Comp. Zool., 54: 327, December.
=*Pipistrellus rendalli phasma* (G. M. Allen, 1911). See Koopman (1994: 117).

Holotype. MCZ 8279. Skin and skull. Male.
Locality. British East Africa (=Kenya): Meru River, effluent of northern Guaso Nyiro (=Ewaso Ngiro). 6 August 1909.
Collector. G. M. Allen. Original number 94.
Condition. Skin and skull complete.
Type Series. There is a small series of paratypes in the MCZ.

Scabrifer notius G. M. Allen, 1908
Bull. Mus. Comp. Zool., 52: 46, July.
=*Pipistrellus capensis notius* (G. M. Allen, 1908). See Koopman (1994: 117).

Holotype. MCZ 4555. Alcoholic, skull extracted. Adult male.
Locality. South Africa: (Western Cape), Cape Town.
Collector. Received from E. L. Layard, August 1864.
Condition. Alcoholic, skull partial (right and left zygomatic arches missing; supraoccipital chipped).
Type Series. Holotype only.

Genus *PLECOTUS* É. Geoffroy, 1813

Plecotus sacrimontis G. M. Allen, 1908
Bull. Mus. Comp. Zool., 52: 50, July.
=*Plecotus auritus sacrimontis* G. M. Allen, 1908. See Ognev (1928: 607).

Holotype. MCZ 6932. Body in alcohol. Adult male.
Locality. Japan: (Honshu), Mount Fuji. 4 December 1906.
Collector. A. Owston.
Condition. Alcoholic.
Type Series. Holotype only.
Comments. *P. a. sacrimontis* was retained as a valid subspecies by Koopman (1994: 110).

Genus *SCOTOPHILUS* Leach, 1821

Scotophilus altilis G. M. Allen, 1914d
Bull. Mus. Comp. Zool., 58: 350, July.
=*Scotophilus leucogaster* (Cretzschmar, 1826). See Koopman (1993: 227).

Holotype. MCZ 14463. Skin and skull. Adult male.
Locality. Sudan: Blue Nile, north of (Er) Roseires, Aradeiba. 22 January 1913.
Collector. G. M. Allen, Phillips Sudan Expedition. Original number 73.
Condition. Skin and skull complete.
Type Series. 3 paratypes; MCZ 14462, skin and skull, male, exchanged to FMNH; and 14610 and 14611, both males in alcohol.

Family THYROPTERIDAE Miller, 1907

Genus *THYROPTERA* Spix, 1823

Thyroptera tricolor albigula G. M. Allen, 1923c
Proc. New England Zool. Club, 9: 1, 10 December.
=*Thyroptera tricolor albiventer* (Tomes, 1856). See Dunn (1931: 430).

Holotype. MCZ 20143. Body in alcohol, skull extracted. Adult female.
Locality. Panama: Gutierrez, 25 miles (40.2 km) inland from Chiriquiscito on trail from Chiriqui Lagoon, Bocas del Toro to Boquete, Chiriqui. August 1923.
Collector. E. R. Dunn and C. B. Duryea.
Condition. Alcoholic, skull complete.
Type Series. 3 paratypes; MCZ 20144, adult male; MCZ 20145, juvenile; MCZ 20146, juvenile; all in alcohol.

Order ARTIODACTYLA Owen, 1848

Family TAYASSUIDAE Palmer, 1897

Genus *PECARI* Reichenbach, 1835

Tayassu crusnigrum Bangs, 1902b
Bull. Mus. Comp. Zool., 39: 20, April.
=*Pecari tajacu crusnigrum* (Bangs, 1902). See Hershkovitz (1951: 567).

Holotype. MCZ 10163. Skin and skull. Adult male.
Locality. Panama: Chiriqui, Boquete (=Bajo Boquete), 4,000 ft (1,220 m). 13 April 1901.

Collector. W. W. Brown, Jr. Original number 290.
Condition. Skin and skull complete.
Type Series. 2 paratypes; MCZ 10162, adult female; MCZ 10164, juvenile female.
Comments. P. t. crusnigrum was retained as a valid subspecies by Hall (1981: 1080) under the genus *Dicotyles.*

Tayassu torvus Bangs, 1898k

Proc. Biol. Soc. Washington, 12: 164, 10 August.

=*Pecari tajacu torvus* (Bangs, 1898). See comments.

Holotype. B8038. Skin and skull. Adult male.
Locality. Colombia: Magdalena, Santa Marta. 26 January 1898.
Collector. W. W. Brown, Jr. Original number 50.
Condition. Skin and skull complete.
Type Series. Holotype only.
Comments. Retained as a valid subspecies by Cabrera (1961: 319) under the genus *Tayassu.* Use of the genus *Pecari* follows Grubb (1993: 380).

Family MONODONTIDAE Gray, 1821

Genus *DELPHINAPTERUS* Lacépède, 1804

Beluga declivis Cope, 1865

Proc. Acad. Nat. Sci. Philadelphia, 17: 278.

=*Delphinapterus leucas* (Pallas, 1776). See Hershkovitz (1966: 111).

Holotype. MCZ 1195. Skull and postcranial skeleton.
Locality. "Arctic Seas" (probably Greenland).
Collector. E. K. Kane.
Condition. Skull partial (right mandibular ramus missing). Postcranial skeleton complete except for missing left flipper. Right flipper and tail are uncleaned, with tissue largely intact.
Type Series. Holotype only.
Comments. Hershkovitz (1966: 111) erroneously stated that the holotype of *declivis* was deposited in the Academy of Natural Sciences in Philadelphia, and the holotype of *Beluga concreta* Cope, 1865 was in the MCZ. The opposite is in fact true; Philadelphia holds the type of *B. concreta.*

Family PHOCOENIDAE Gray, 1825

Genus *NEOPHOCAENA* Palmer, 1899

Neomeris asiaeorientalis Pilleri and Gihr, 1972

Invest. Cetacea, 4: 126.

=*Neophocaena phocaenoides asiaorientalis* (Pilleri and Gihr, 1972). See van Bree (1973: 17).

Holotype. MCZ 19998 (but see comments). Skull and postcranial skeleton. Adult male.
Locality. China: Kiangsu (=Jiangsu), Kiangyin, 80 miles (129 km) northwest of Shanghai. 7 April 1922.
Collector. F. R. Wulsin.
Condition. Skin and postcranial skeleton complete.
Type Series. Holotype only.
Comments. For a discussion of the nomenclature and synonymy of this form, consult van Bree (1973). Because *Neomeris asiaorientalis* Pilleri and Gihr, 1972 is in fact a replacement name for the preoccupied name *Delphinus melas* Schlegel, 1841, the holotype of this new name is the same as that of Schlegel's name, RMNH 23079.

Family CERVIDAE Goldfuss, 1820

Genus *ODOCOILEUS* Rafinesque, 1832

Cariacus osceola Bangs, 1896b

Proc. Biol. Soc. Washington, 10: 26, 25 February.

=*Odocoileus virginianus osceola* (Bangs, 1896). See Lydekker (1915: 148).

Holotype. B2394. Skin and skull. Adult female.
Locality. (United States): Florida, Citrus County, Citronelle. 29 December 1893.
Collector. F. L. Small. Original number 1107.
Condition. Skin and skull complete. Mandible disarticulated.
Type Series. 4 paratypes; B2391, adult male, B2392, adult male, B2393, adult female, B2395, juvenile male, all represented by skin and skull.
Comments. O. v. osceola was retained as a valid subspecies by Hall (1981: 1096) and Smith (1991: 1).

Odocoeleus [sic] *virginianus louisianae* G. M. Allen, 1901

Amer. Nat., 35: 449, 28 June.

=*Odocoileus virginianus macroura* (Rafinesque, 1817). See Miller and Kellogg (1955: 804).

Holotype. B9111. Skin and skull. Adult male.
Locality. (United States): Louisiana, Morehouse Parish, Mer Rouge. 8 November 1898.
Collector. B. V. Lilly.
Condition. Skin and skull complete. Mandible disarticulated.
Type Series. 3 paratypes; B9112, B8622, B8623, all males represented by skin and skull.

Odocoileus americanus borealis Miller, 1900

Bull. New York State Mus. 8: 83, 21 November.

=*Odocoilus virginianus borealis* Miller, 1900. See Trouessart (1905: 704).

Holotype. B4999. Skin and skull. Adult male.
Locality. (United States): Maine, (Hancock County), Bucksport. 12 December 1895.

Collector. A. G. Dorr.
Condition. Skin and skull complete. Mandible disarticulated.
Type Series. Holotype only.
Comments. *O. v. borealis* was retained as a valid subspecies by Hall (1981: 1092) and Smith (1991: 1).

Odocoileus virginianus clavium Barbour and G. M. Allen, 1922
J. Mammal., 3: 73, 9 May.

Holotype. MCZ 19120. Skull and head skin. Adult male.
Locality. (United States): Florida, (Monroe County), Big Pine Key. Winter 1920.
Collector. T. Barbour.
Condition. Skin and skull complete. Mandible disarticulated.
Type Series. 2 paratypes, MCZ 18497, skin and skull, juvenile male; MCZ 18060, skin and skull, juvenile male.
Comments. Retained as a valid subspecies by Hall (1981: 1093) and Smith (1991: 1).

Genus *RANGIFER* Hamilton Smith, 1827

Rangifer arcticus caboti G. M. Allen, 1914a
Proc. New England Zool. Club, 4: 104, 24 March.
= *Rangifer tarandus caribou* (Gmelin, 1788). See Banfield (1962: 70).

Holotype. MCZ 15372. One shed antler. Adult male.
Locality. Canada: northeast coast of Labrador, about 30 miles (48.3 km) north of Nachvak. 1909.
Collector. O. Bryant.
Condition. Single antler; complete.
Type Series. Holotype only.

Rangifer terraenovae Bangs, 1896f
Preliminary Description of the Newfoundland Caribou, Boston, p. 1, 11 November.
= *Rangifer tarandus caribou* (Gmelin, 1788). See Banfield (1962: 70).

Holotype. B3778. Skull and head skin. Adult male.
Locality. Canada: Newfoundland, Codroy. 8 September 1895
Collector. E. Doane.
Condition. Skull and head skin complete.
Type Series. Bangs remarks that he has "secured a series of this fine caribou," corresponding to B3779–B3781 and B5757–B5760.
Comments. J. A. Allen published a description of *Rangifer terraenovae* on 21 November 1896, specifying AMNH 11775, a mounted specimen of a male adult, as the holotype (1896: 233). Bangs' description of this taxon pre-dates J. A. Allen's by 10 days and thus has priority.

Family BOVIDAE Gray, 1821

Genus *DAMALISCUS* Sclater and Thomas, 1894

Damaliscus phillipsi Harper, 1939
Proc. Biol. Soc. Washington, 50: 90, 5 June.
= *Damaliscus pygargus phillipsi* Harper, 1939. See comments.

Holotype. MCZ 35443. Skull and skin. Adult male.
Locality. South Africa: Orange Free State. 23 July 1935.
Collector. P. Andreka. Original number 1958d.
Condition. Skin complete. Skull partial (most of palate, left maxilla, and left mandibular ramus missing).
Type Series. Paratype material consists of MCZ 35444, skin and skull of an adult female as well as the following, which Harper examined in the collection of the Academy of Natural Sciences of Philadelphia: "a mounted head, a skull, and a set of horns purchased in Kimberley, Cape Province; a mounted head and a set of horns from 'South Africa'; and two skins and skulls from the Zoological Society of Philadelphia."
Comments. Ansell (1972: 55) used the name *Damaliscus dorcas phillipsi.* For the use of *pygargus* over *dorcas,* see Rookmaaker (1991: 190).

Order CARNIVORA Bowdich, 1821

Family CANIDAE Fischer de Waldheim, 1817

Genus *CANIS* Linnaeus, 1758

Canis lupus beothucus G. M. Allen and Barbour, 1937
J. Mammal., 18: 230, 14 May.

Holotype. MCZ 351. Skull and postcranial skeleton. Adult, probably male.
Locality. Canada: Newfoundland. About 1865.
Collector. J. M. Nelson.
Condition. Skull and postcranial skeleton complete.
Type Series. 4 paratypes; 348, skull, adult male; 349, skull, adult, probably male; 350, skull, adult female; MCZ 28726, skin.
Comments. *C. l. beothucus* became extinct around 1911. Retained as a valid subspecies by Hall (1981: 930).

Pachycyon robustus J. A. Allen, 1885
Mem. Mus. Comp. Zool., 10: 4, December.
=*Canis familiaris* Linnaeus, 1758. See G. M. Allen (1920a: 498).

Holotype. MCZ 7091. Postcranial skeleton.
Locality. (United States): Virginia, Lee County, Ely Cave. Probably 1875.
Collector. N. S. Shaler.
Condition. Skeleton partial (right scapula, right humerus, right femur, right tibia, pelvis).
Type Series. Holotype only.
Comments. This specimen is a domesticated dog of Native Americans. *C. lupus familiaris* is the name now widely used for the domestic dog (Wozencraft 1993: 281). *P. robustus* is the type species of *Pachycyon* J. A. Allen, 1885. *Pachycyon* is a synonym of *Canis* Linnaeus, 1758, which is commonly overlooked, for example, in Wozencraft (1993) and McKenna and Bell (1997).

Genus *CERDOCYON* Hamilton Smith, 1839

Cerdocyon thous germanus G. M. Allen, 1923b
Proc. Biol. Soc. Washington, 36: 55, 28 March.

Holotype. MCZ 19850. Skin and skull. Adult.
Locality. Colombia: high savannah of Bogotá, 9,000 ft (2,745 m).
Collector. N. Maria. Original number 25.
Condition. Skin and skull complete.
Type Series. 5 paratypes; MCZ 19849, skin and skull, juvenile; MCZ 20097, skin and skull, juvenile male; 3 specimens from the AMNH are also mentioned in the description.
Comments. Retained as a valid subspecies by Berta (1982: 1).

Urocyon aquilus Bangs, 1898h
Proc. Biol. Soc. Washington, 12: 93, 30 April.
=*Cerdocyon thous aquilus* (Bangs, 1898). See Langguth (1969: 178).

Holotype. B8001. Skin and skull. Adult male.
Locality. Colombia: (Magdalena), Santa Marta Mountains, between 2,000 and 3,000 ft (610–915 m). 10 February 1898.
Collector. W. W. Brown, Jr. Original number 58.
Condition. Skin and skull complete. Mandible disarticulated.
Type Series. 1 paratype; B8002, skin and skull, adult female.
Comments. Retained as a valid subspecies by Berta (1982: 1).

Genus *UROCYON* Baird, 1858

Urocyon cinereoargenteus furvus G. M. Allen and Barbour, 1923
Bull. Mus. Comp. Zool., 65: 266, February.

Holotype. MCZ 19774. Skin and skull. Probably female.
Locality. Panama: Canal Zone, 3 miles (4.8 km) west of Balboa. April 1922.
Collector. T. Barbour and W. S. Brooks.
Condition. Skin and skull complete. Mandible disarticulated.
Type Series. Holotype only.
Comments. Retained as a valid subspecies by Hall (1981: 943) and Fritzell and Haroldson (1982: 1).

Urocyon cinereoargenteus ocythous Bangs, 1899h
Proc. New England Zool. Club, 1: 43, 5 June.

Holotype. B4290. Skin and skull. Adult female.
Locality. (United States): Wisconsin, Grant County, Platteville. 25 January 1896.
Collector. N. E. France.
Condition. Skin and skull complete. Mandible disarticulated.
Type Series. Holotype only.
Comments. Retained as a valid subspecies by Hall (1981: 943) and Fritzell and Haroldson (1982: 1).

Genus *VULPES* Frisch, 1775

Vulpes deletrix Bangs, 1898d
Proc. Biol. Soc. Washington, 12: 36, 24 March.
=*Vulpes vulpes rubricosa* Bangs, 1898. See Churcher (1960: 359).

Holotype. B6967. Skin and skull. Adult female.
Locality. (Canada): Newfoundland, Bay St. George. 24 April 1897.
Collector. E. Doane.
Condition. Skin and skull complete.
Type Series. There is a series of paratypes in the MCZ.

Vulpes pennsylvanica vafra Bangs, 1897f
Proc. Biol. Soc. Washington, 11: 53, 16 March.
Name preoccupied by *Vulpes vafer* Leidy, 1869.

Vulpes pennsylvanica rubricosa Bangs, 1898a

Science, n. ser., 7: 271, 25 February. (Replacement name for *Vulpes pennsylvanica vafra* Bangs, 1897) =*Vulpes vulpes rubricosa* Bangs, 1898. See Churcher (1960: 359).

Holotype. B116. Skin and skull. Adult female.
Locality. (Canada): Nova Scotia, Digby. 3 November 1893.
Collector. O. Bangs.
Condition. Skin and skull complete.
Type Series. 4 paratypes; B1991, skin and skull, and B2001, skull, both adult males; B1992, skin and skull, and B2002, skull.
Comments. *V. v. rubricosa* was retained as a valid subspecies by Hall (1981: 939). *Vulpes fulvus rubricatus* Miller, 1900 (p. 128) was a misspelling and thus accidental renaming of *Vulpes pennsylvanica rubricosa* Bangs, 1898.

Vulpes rubricosa bangsi Merriam, 1900

Proc. Washington Acad. Sci., 2: 667, 28 December 28. =*Vulpes vulpes rubricosa* Bangs, 1898. See Churcher (1960: 359).

Holotype. B8880. Skin and skull. Juvenile female.
Locality. (Canada): Labrador, Lance (=L'anse) au Loup. 2 October 1899.
Collector. E. Doane.
Condition. Skin and skull complete. Mandible disarticulated.
Type Series. 1 paratype; B8879, skin and skull, adult male.

Family URSIDAE Fischer de Waldheim, 1817

Genus *URSUS* Linnaeus, 1758

Ursus (Euarctos) americanus sornborgeri Bangs, 1898j

Amer. Nat., 32: 500, July. =*Ursus americanus americanus* Pallas, 1780. See Bangs (1909: 467).

Holotype. B7411. Skull. Adult, probably female.
Locality. Canada: Labrador, Okkak (=Okak). Summer 1897.
Collector. J. D. Sornborger, obtained "from the Eskimo."
Condition. Skull complete.
Type Series. 2 paratypes; B7412, skull, female; B7413, skull, female.
Comments. A skull from Hopedale, Labrador (MCZ 7365), has in the past been erroneously labeled as the holotype of *sornborgeri;* B7411, the true holotype of *sornborgeri,* is now correctly labeled as such.

Family PROCYONIDAE Gray, 1825

Genus *PROCYON* Storr, 1780

Procyon gloveralleni Nelson and Goldman, 1930

J. Mammal., 11: 453, 11 November. =*Procyon lotor* (Linnaeus, 1758). See Corbet and Hill (1991: 104).

Holotype. MCZ 18591. Skin and skull. Juvenile male.
Locality. Barbados. 1920.
Collector. F. Watts.
Condition. Skin and skull complete
Type Series. Holotype only.
Comments. Considered a valid species by Wozencraft (1993: 335) and Nowak (1999: 698) but almost certainly introduced to Barbados in the 17th century (Helgen and Wilson, in prep.). The last raccoon on Barbados was seen in 1964, and the population is probably extinct.

Procyon lotor elucus Bangs, 1898b

Proc. Boston Soc. Nat. Hist., 28: 219, 15 March.

Holotype. B3502. Skin and skull. Adult male.
Locality. (United States): Florida, Brevard County, Oak Lodge, east peninsula opposite Micco. 15 February 1895.
Collector. O. Bangs.
Condition. Skin complete. Skull partial (condyle, coronoid, and angular processes of left mandibular ramus broken). Mandible disarticulated.
Type Series. There is a series of paratypes in the MCZ.
Comments. Retained as a valid subspecies by Hall (1981: 968).

Procyon maynardi Bangs, 1898g

Proc. Biol. Soc. Washington, 12: 92, 30 April. =*Procyon lotor* (Linneaus, 1758). See Koopman et al. (1957: 164).

Holotype. B7750. Skin and skull. Juvenile male.
Locality. Bahamas: New Providence Island, Nassau. August 1897.
Collector. H. L. Claridge.
Condition. Skin complete. Skull partial (broken from frontals to occiput). Mandible disarticulated.
Type Series. Holotype only.
Comments. Considered a valid species by Wozencraft (1993: 336) and Nowak (1999: 698) but undoubtedly a recent introduction to New Providence Island (see Olson and Pregill, 1982: 5).

Family MUSTELIDAE Fischer de Waldheim, 1817

Genus *LONTRA* Gray, 1843

Lutra degener Bangs, 1898d

Proc. Biol. Soc. Washington, 12: 35, 24 March.
=*Lontra canadensis canadensis* (Schreber, 1776). See van Zyll de Long (1972: 81).

Holotype. B6965. Skin and skull. Adult male.
Locality. Canada: Newfoundland, Bay St. George. 23 April 1897.
Collector. E. Doane.
Condition. Skin and skull complete.
Type Series. Paratype material consists of B6966, skin and skull of an adult female, mentioned by number in the original description, as well as "two extra skulls," corresponding to B3755 and B3799, and "a large series of unsexed otter skulls from Newfoundland," corresponding to MCZ 494–508.

Lutra hudsonica vaga Bangs, 1898b

Proc. Boston Soc. Nat. Hist., 28: 224, 15 March.
=*Lontra canadensis laxatina* F. Cuvier, 1823. See van Zyll de Long (1972: 81).

Holotype. B5749. Skin and skull. Adult male.
Locality. (United States), Florida, Brevard County, Micco. 17 March 1897.
Collector. F. R. Hunter.
Condition. Skin and skull complete.
Type Series. 4 paratypes; B4995, skin and skull, adult female; B4998, skin and skull, adult male; B6092, skin and skull, adult male; B6093, skin and skull, adult female.

Genus *MARTES* Pinel, 1792

Mustela atrata Bangs, 1897b

Amer. Nat., 31: 162, 1 February.
=*Martes americana atrata* (Bangs, 1897). See G. M. Allen (1942: 166)

Holotype. B5752. Skin and skull. Adult female.
Locality. Canada: Newfoundland, Bay St. George. 29 September 1896.
Collector. E. Doane. Original number 2.
Condition. Skin and skull complete.
Type Series. 12 paratypes; B5751, skin and skull, adult female; MCZ 492–93, 509–517, unsexed skulls.
Comments. *M. a. atrata* was retained as a valid subspecies by Hall (1981: 983).

Mustela brumalis Bangs, 1898j

Amer. Nat., 32: 502, July.
=*Martes americana atrata* (Bangs, 1897). See Clark et al. (1987: 1).

Holotype. B7417. Skull. Adult, probably male.
Locality. Canada: Labrador, Okkak (=Okak). Summer 1897.
Collector. J. D. Sornborger, obtained "from the Eskimo."
Condition. Skull complete.
Type Series. 2 paratypes; B7418, skull; B7419, skull; both probably male.

Genus *MUSTELA* Linnaeus, 1758

Mustela cicognanii mortigena Bangs, 1913

Bull. Mus. Comp. Zool., 54: 511, July.
=*Mustela erminea richardsonii* Bonaparte, 1838. See Hall (1951: 110).

Holotype. B3745. Skin and skull. Adult male.
Locality. Canada: Newfoundland, Bay St. George. 27 September 1895.
Collector. E. Doane. Original number 1.
Condition. Skin and skull complete.
Type Series. There is a series of paratypes in the MCZ.

Putorius frenatus neomexicanus Barber and Cockerell, 1898

Proc. Acad. Nat. Sci. Philadelphia, 1898, p. 188, May.
=*Mustela frenata neomexicana* (Barber and Cockerell, 1898). See Miller (1912: 100).

Holotype. MCZ 10475. Skin with extra tail, and skull. Adult male.
Locality. (United States): New Mexico, (Dona Ana County), Mesilla, shore of Armstrongs' Lake, 3,800 ft (1,159 m). 1 February 1898.
Collector. A. C. Tyson. Original number 58.
Condition. Skin complete, but tail poorly prepared. The tail belonging to a discarded topotype is tied to the holotype as an example. Skull complete.
Type Series. A topotype taken at the same time as the holotype was partially decomposed and discarded; the tail of this specimen is included with MCZ 10475. The original description also refers to "a specimen, without any history, in alcohol . . . in the collection of the New Mexico Agricultural College."
Comments. *M. f. neomexicana* was retained as a valid subspecies by Hall (1981: 995).

Putorius (Arctogale) longicauda oribasus Bangs, 1899m

Proc. New England Zool. Club, 1: 81, 27 December.

=*Mustela frenata oribasus* (Bangs, 1899). See Hall (1936: 105).

Holotype. B9058. Skin and skull. Adult female.
Locality. Canada: British Columbia, source of Kettle River, 7,500 ft (2,288 m). 10 September 1898.
Collector. A. C. Brooks. Original number 1368.
Condition. Skin and skull complete.
Type Series. Holotype only.
Comments. *M. f. oribasus* was retained as a valid subspecies by Hall (1981: 998).

Putorius (Lutreola) lutensis Bangs, 1898b

Proc. Boston Soc. Nat. Hist., 28: 229, 15 March.

=*Mustela vison lutensis* (Bangs, 1898). See Hollister (1913: 474).

Holotype. B7225. Skin and skull. Adult male.
Locality. (United States), Florida, St. Johns County, salt marsh opposite Matanzas Inlet. 16 February 1897.
Collector. O. Bangs. Original number 7.
Condition. Skin and skull complete.
Type Series. There is a series of paratypes in the MCZ.
Comments. *M. v. lutensis* was retained as a valid subspecies by Hall (1981: 1003) and Larivière (1999: 1).

Putorius (Arctogale) muricus Bangs, 1899j

Proc. New England Zool. Club, 1: 71, 31 July.

=*Mustela erminea muricus* (Bangs, 1899). See Hall (1945: 77).

Holotype. B9146. Skin and skull. Juvenile male.
Locality. (United States): California, El Dorado County, Echo, 7,500 ft (2,288 m). 15 July 1897.
Collector. W. W. Price and E. M. Nutting. Original number 266.
Condition. Skin and skull complete. Mandible disarticulated.
Type Series. Holotype only.
Comments. *M. e. muricus* was retained as a valid subspecies by Hall (1981: 990) and King (1983: 1).

Putorius noveboracensis notius Bangs, 1899i

Proc. New England Zool. Club, 1: 53, 9 June.

=*Mustela frenata noveboracensis* (Emmons, 1840). See Hall (1936: 104).

Holotype. B2678. Skin and skull. Juvenile male.
Locality. (United States): North Carolina, Buncombe County, Weaverville. 10 July 1892.
Collector. J. S. Cairns. Original number 2214.
Condition. Skin complete. Skull partial (two fragments only, premaxilla–lachrymal). Mandible disarticulated.
Type Series. 2 paratypes; AMNH 1247, adult male; USNM 32239, adult male.

Putorius occisor Bangs, 1899i

Proc. New England Zool. Club, 1: 54, 9 June.

=*Mustela frenata occisor* (Bangs, 1899). See Hall (1936: 104).

Holotype. B9102. Skin and skull. Adult male.
Locality. (United States): Maine, Hancock County, Bucksport, near mouth of Penobscot River. 15 January 1899.
Collector. A. G. Dorr.
Condition. Skin complete. Skull slightly damaged (left zygomatic arch broken).
Type Series. There is a series of paratypes in the MCZ.
Comments. *M. f. occisor* was retained as a valid subspecies by Hall (1981: 997).

Putorius rixosus Bangs, 1896a

Proc. Biol. Soc. Washington, 10: 21, 25 February.

=*Mustela nivalis rixosa* (Bangs, 1896). See Reichstein (1958: 169).

Holotype. B642. Skin and skull. Adult female.
Locality. Canada: Saskatchewan, Osler. 15 July 1893.
Collector. W. C. Colt. Original number 79/181.
Condition. Skin complete. Skull slightly damaged (left zygomatic arch broken).
Type Series. Three specimens other than the holotype are mentioned by number in the original description; MCZ 5532, USNM 4231, probably female, and USNM 13904, probably male. All are unsexed skins.
Comments. *M. n. rixosa* was retained as a valid subspecies by Hall (1981: 993) and Sheffield and King (1994: 1).

Putorius vison energumenos Bangs, 1896c

Proc. Boston Soc. Nat. Hist., 27: 5, March.

=*Mustela vison energumenos* (Bangs, 1896). See Miller (1912: 101).

Holotype. B3555. Skin and skull. Adult male.
Locality. Canada, British Columbia, Sumas. 23 September 1895.
Collector. A. C. Brooks. Original number 514.
Condition. Skin and skull complete.

Type Series. 1 paratype; B3556, skin and skull, juvenile male.
Comments. M. v. energumenos was retained as a valid subspecies by Hall (1981: 1001) and Larivière (1999: 1).

Putorius (Lutreola) vulgivagus Bangs, 1895b

Proc. Boston Soc. Nat. Hist., 26: 539, 31 July.
=*Mustela vison vulgivaga* (Bangs, 1895). See Miller (1912: 102).

Holotype. B2751. Skin and skull. Adult male.
Locality. (United States): Louisiana, Plaquemines Parish, Burbridge. 10 January 1895.
Collector. F. L. Small. Original number 1439/54.
Condition. Skin and skull complete.
Type Series. 10 paratypes; B2752–B2761, all represented by skin and skull, 9 males and 1 female.
Comments. M. v. vulgivaga was retained as a valid subspecies by Hall (1981: 1004) and Larivière (1999: 1).

Putorius xanthogenys mundus Bangs, 1899i

Proc. New England Zool. Club, 1: 56, 9 June.
=*Mustela frenata munda* (Bangs, 1899). See Hall (1936: 107).

Holotype. B5459. Skin and skull. Adult male.
Locality. (United States): California, Marin County, Point Reyes. 19 June 1896.
Collector. C. A. Allen. Original number 931.
Condition. Skin complete. Skull slightly damaged (left zygomatic arch broken).
Type Series. 1 paratype, B8632 (*not* B8631, mentioned erroneously in the original description), skin and skull, male.
Comments. M. f. munda was retained as a valid subspecies by Hall (1981: 995).

Family MEPHITIDAE Bonaparte, 1845

Genus *MEPHITIS* É. Geoffroy and G. Cuvier, 1795

Mephistis avia Bangs, 1898c

Proc. Biol. Soc. Washington, 12: 32, 24 March.
=*Mephitis mephitis avia* Bangs, 1898. See Hall (1936: 65).

Holotype. B5747. Skin and skull. Adult male.
Locality. (United States): Illinois, Mason County, San Jose. 10 March 1897.
Collector. H. H. and C. S. Brimley. Original number 2500.
Condition. Skin and skull complete.
Type Series. 1 paratype; B5783, skin and skull, adult male.
Comments. M. m. avia was retained as a valid subspecies by Hall (1981: 1019) and Wade-Smith and Verts (1982: 1).

Mephitis mephitica elongata Bangs, 1895b

Proc. Boston Soc. Nat. Hist., 26: 531, 31 July.
=*Mephitis mephitis elongata* Bangs, 1895. See A. H. Howell (1921: 39).

Holotype. B3051. Skin and skull. Adult male.
Locality. (United States): Florida, Brevard County, Micco. 5 March 1895.
Collector. O. Bangs.
Condition. Skin and skull complete.
Type Series. There is a series of paratypes in the MCZ.
Comments. Retained as a valid subspecies by Hall (1981: 1019) and Wade-Smith and Verts (1982: 1).

Mephitis mephitica scrutator Bangs, 1896i

Proc. Biol. Soc. Washington, 10: 141, 28 December.
=*Mephitis mephitis mesomelas* Lichtenstein, 1832. See Hall (1936: 66).

Holotype. B2889. Skin and skull. Adult male.
Locality. (United States): Louisiana, Acadia Parish, Cartville. 25 May 1895.
Collector. F. L. Small. Original number 1842.
Condition. Skin and skull complete. Mandible disarticulated.
Type Series. 1 paratype, B2886, skin and skull, adult female.

Mephitis spissigrada Bangs, 1898c

Proc. Biol. Soc. Washington, 12: 31, 24 March.
=*Mephitis mephitis spissigrada* Bangs, 1898. See Hall (1936: 67).

Holotype. B3699. Skin and skull. Adult female.
Locality. Canada: British Columbia, Sumas. 30 September 1895.
Collector. A. C. Brooks. Original number 518.
Condition. Skin and skull complete. Mandible disarticulated.
Type Series. 3 paratypes; B3700, skin and skull, adult female, and B5548, skin and skull, adult male; B7435, skull, adult male.
Comments. M. m. spissigrada was retained as a valid subspecies by Hall (1981: 1022) and Wade-Smith and Verts (1982: 1).

Genus *SPILOGALE* Gray, 1865

Spilogale ambarvalis Bangs, 1898b

Proc. Boston Soc. Nat. Hist., 28: 222, 15 March.
=*Spilogale putorius ambarvalis* Bangs, 1898. See Van Gelder (1953: 255).

Holotype. B3481. Skin and skull. Adult male.
Locality. (United States): Florida, Brevard County, Oak Lodge, east peninsula opposite Micco. 30 January 1895.
Collector. O. Bangs. Original number 11.
Condition. Skin and skull complete.
Type Series. There is a large series of paratypes in the MCZ.
Comments. S. p. ambarvalis was retained as a valid subspecies by Hall (1981: 1014) and Kinlaw (1995: 1).

Family VIVERRIDAE Gray, 1821

Genus *EUPLERES* Doyere, 1835

Eupleres major Lavauden, 1929

Compt. Rend. Acad. Sci. Paris, 189: 198, 22 July 22.
=*Eupleres goudotii major* Lavauden, 1929. See Albignac (1973: 23).

Syntypes. MCZ 45691: Skin, skull, and postcranial skeleton. Subadult female. MCZ 45962: Skin, skull, and postcranial skeleton. Subadult male.
Locality. Madagascar: (Antsiranana), foot of the Massif Tsaratanna (=Tsaratanana), Upper Sombirano Valley, above village of Beangona, 1,500 m. April 1929.
Collector. Lavauden.
Condition. MCZ 45691: Skin complete, with bald spot on dorsum and tail slightly damaged. Skull and skeleton complete. Mandible disarticulated. Teeth removed from skull but present. MCZ 45962: Skin complete. Skull and skeleton complete. Mandible disarticulated. Teeth removed from skull but present.
Type Series. 2 syntypes, described above.
Comments. These are the two specimens from G. Grandidier's personal collection on which Lavauden based his original description of *Eupleres major.* Albignac (1973: 23) wrote that these type specimens were "introuvable [nowhere to be found]."

Family HERPESTIDAE Bonaparte, 1845

Genus *GALIDICTIS* I. Geoffroy, 1839

Galidictis grandidiensis [sic] Wozencraft, 1986

J. Mammal. 67: 561, 8 August.
=*Galidictis grandidieri* Wozencraft, 1986. See Wozencraft (1987: 198).

Holotype. MCZ 45983. Skin, skull, and postcranial skeleton. Adult.
Locality. Madagascar (no further data available). The locality of the paratype, stored in the AMNH, is "Madagascar, Lac Tsimanampetsotsa, 24°08′ S, 43°46′ E."
Collector. No collection data available. The holotype is part of the collection of G. Grandidier.
Condition. Skin prepared flat; incomplete (ventrum missing). Skull complete.
Type Series. 1 paratype; AMNH 100478, skin and skull, adult male.
Comments. G. grandidieri was considered a valid species by Wozencraft (1993: 300) and Nowak (1999: 769).

Family FELIDAE Fischer de Waldheim, 1817

Genus *LEPTAILURUS* Severtzov, 1858

Felis capensis phillipsi G. M. Allen, 1914d

Bull. Mus. Comp. Zool., 58: 337, July.
=*Leptailurus serval phillipsi* (G. M. Allen, 1914). See comments.

Holotype. MCZ 14908. Skin and skeleton. Adult male.
Locality. Sudan: Blue Nile, El Garef. 10 January 1913.
Collector. J. C. Phillips.
Condition. Skin and skull complete.
Type Series. Holotype only.
Comments. G. M. Allen (1939: 241) used the name *Felis serval phillipsi.* The use of the genus *Leptailurus* follows Wozencraft (1993: 292). *L. s. phillipsi* was retained as a valid subspecies by Smithers (1975: 7).

Genus *LYNX* Kerr, 1792

Lynx (Cervaria) fasciatus oculeus Bangs, 1899e

Proc. New England Zool. Club, 1: 23, 31 March.
=*Lynx rufus californicus* Mearns, 1897. See Grinnell and Dixon (1924: 346).

Holotype. B8633. Skin and skull. Adult male.
Locality. (United States): California, Marin County, Nicasio. 11 December 1898.
Collector. C. A. Allen. Original number 981.
Condition. Skin and skull complete.
Type Series. 1 paratype; B4789, skin and skull, adult male.

Lynx gigas Bangs, 1897e

Proc. Biol. Soc. Washington, 11: 50, 16 March.
=*Lynx rufus gigas* Bangs, 1897. See Peterson and Downing (1952: 11).

Holotype. B4951. Skin and skull. Adult male.
Locality. Canada: Nova Scotia, 15 miles (24.1 km) back of Bear River. 11 December 1895.

Collector. D. R. Ritchie.
Condition. Skin and skull complete.
Type Series. Holotype only.
Comments. *L. r. gigas* was retained as a valid subspecies by Hall (1981: 1054).

Lynx subsolanus Bangs, 1897e

Proc. Biol. Soc. Washington, 11: 49, 16 March.
=*Lynx canadensis subsolanus* Bangs, 1897. See Elliot (1901: 296).

Holotype. B1190. Skin and skull. Adult male.
Locality. Canada: Newfoundland, Codroy. 13 June 1894.
Collector. E. Doane.
Condition. Skin and skull complete.
Type Series. 2 paratypes; B5754, skin and skull, juvenile female; B3798, skull, adult male.
Comments. *L. c. subsolanus* was retained as a valid subspecies by Hall (1981: 1051).

Genus *PUMA* Jardine, 1834

Felis bangsi Merriam, 1901

Proc. Washington Acad. Sci., 3: 595, 11 December.
=*Puma concolor bangsi* (Merriam, 1901). See comments.

Holotype. B8413. Skin and skull. Adult male.
Locality. Colombia: (La Guajira), Dibulla. 8 October 1899.
Collector. W. W. Brown, Jr.
Condition. Skin and skull complete.
Type Series. 3 paratypes; B8147, skin and skull, adult female, and "two skulls from Peru, in the American Museum of Natural History."
Comments. Nelson and Goldman (1929: 347) used the name *Felis concolor bangsi.* The use of the genus *Puma* follows Wozencraft (1993: 296). Retained as a valid subspecies by Currier (1983: 1).

Felis bangsi costaricensis Merriam, 1901

Proc. Washington Acad. Sci., 3: 596, 11 December.
=*Puma concolor costaricensis* (Merriam, 1901). See comments.

Holotype. MCZ 10118. Skin and skull. Adult female.
Locality. Panama: Chiriqui, Boquete (=Bajo Boquete), 4,000 ft (1,220 m). 22 April 1901.
Collector. W. W. Brown, Jr. Original number 337.
Condition. Skin and skull complete.
Type Series. There is a series of paratypes in the MCZ.
Comments. Nelson and Goldman (1929: 347) used the name *Felis concolor costaricensis.* The use of the genus *Puma* follows Wozencraft (1993: 296). Retained as a valid subspecies by Currier (1983: 1).

Felis coryi Bangs, 1899b

Proc. Biol. Soc. Washington, 13: 15, 31 January.
=*Puma concolor coryi* (Bangs, 1899). See comments.

Holotype. B7742. Skin and skull. Adult male.
Locality. (United States): Florida, Brevard County, "wilderness back of Sebastian". 1 January 1898
Collector. F. R. Hunter.
Condition. Skin and skull complete.
Type Series. 5 paratypes; B5489, adult female, B5650, adult female, B6992, adult male, B7743, adult female, B7744, juvenile female; all represented by skin and skull.
Comments. Nelson and Goldman (1929: 347) used the name *Felis concolor coryi;* the use of the genus *Puma* follows Wozencraft (1993: 296). *Felis coryi* Bangs, 1899 is a replacement name for *Felis concolor floridana* Cory, 1896 (1896: 109). Retained as a valid subspecies by Currier (1983: 1).

Felis improcera Phillips, 1912

Proc. Biol. Soc. Washington, 25: 85, 4 May.
=*Puma concolor improcera* (Phillips, 1912). See comments.

Holotype. MCZ 12704. Skin and skull. Adult male.
Locality. (Mexico): Lower (=Baja) California, Calmalli. 3 September 1911.
Collector. E. W. Funcke. Original number 10.
Condition. Skin and skull complete.
Type Series. Holotype only.
Comments. Nelson and Goldman (1929: 347) used the name *Felis concolor improcera.* The use of the genus *Puma* follows Wozencraft (1993: 296). Retained as a valid subspecies by Currier (1983: 1).

Order CIMOLESTA McKenna, 1975

Family MANIDAE Gray, 1873

Genus *PHATAGINUS* Rafinesque, 1821

Phataginus tricuspis mabirae G. M. Allen and Loveridge, 1942

Bull. Mus. Comp. Zool., 89: 178, February.

Holotype. MCZ 39417. Skin, skull, and postcranial skeleton. Adult male.
Locality. Uganda: (Buganda), Chagwe, Mabira Forest, Mubango. 12 November 1938.
Collector. A. Loveridge.
Condition. Skin and skull complete. Postcranial skeleton partial (includes atlas, right tibia, and right fibula).
Type Series. Holotype only.

Comments. Retained as a valid subspecies by Meester (1972: 2).

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A New Species of Lizard Related to *Stenocercus caducus* (Cope) (Squamata: Iguanidae) From Peru and Bolivia, With a Key to the "*Ophryoessoides* Group"

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A NEW SPECIES OF LIZARD RELATED TO *STENOCERCUS CADUCUS* (COPE) (SQUAMATA: IGUANIDAE) FROM PERU AND BOLIVIA, WITH A KEY TO THE "*OPHRYOESSOIDES* GROUP"

JOHN E. CADLE[1]

CONTENTS

ABSTRACT. A new species of iguanid lizard, *Stenocercus prionotus*, is described from eastern Peru and Bolivia (known range from San Martín Department, Peru, to northern La Paz and El Beni departments, Bolivia). Most localities are in the Andean foothills and immediately adjacent lowlands. *Stenocercus prionotus* is similar to several other species of *Stenocercus* with large posterior head scales, an enlarged row of supraoculars, and keeled ventral scales. These similar species are referred to as the "*Ophryoessoides* group" without implying that it is a monophyletic assemblage. Based on their common possession of a unique scaly flap concealing a portion of the posthumeral mite pocket, the new species is apparently closely related to *S. caducus* (Cope), which is known from central Bolivia south to northern Argentina and Paraguay. *Stenocercus prionotus* is distinguished from *S. caducus* by having a more prominent vertebral crest and a pattern of alternating light and dark bars on the throat (rarely observed in *S. caducus*, which usually has light throat spots). These two species also occupy different physiographic regions (western Amazonian rainforest for *S. prionotus*; chaco for *S. caducus*).

Populations of *S. prionotus* from northern Peru have a higher vertebral crest than those in southern Peru and Bolivia. Northern populations are also broadly sympatric with two other species of the "*Ophryoessoides* group," *S. aculeatus* and *S. fimbriatus*. However, in southern Peru *S. prionotus* is not known to be sympatric with other species of that group. I postulate that the higher vertebral crest in northern populations of *S. prionotus* functions as a species recognition signal in the multispecies assemblages. A key to species of the "*Ophryoessoides* group" is provided and distributions of the species in Peru and Bolivia are summarized.

RESUMEN. Se describe una nueva especie de lagartija iguanida, *Stenocercus prionotus*, del Perú Oriental y de Bolivia. Se conoce la nueva especie desde el departamento de San Martín, Perú, hasta el norte de los departamentos La Paz y El Beni en Bolivia. La mayoría de las localidades se encuentran en las estribaciones andinas y adyacentes tierras bajas. *Stenocercus prionotus* es similar a varias otras especies de *Stenocercus* con grandes escamas sobre el posterior de la cabeza, una fila amplia de supraoculares, y escamas ventrales quilladas. Se refiere estas especies como el "grupo *Ophryoessoides*," sin implicar su monophyletismo. Basada en su posesión de un lóbulo escamoso único que oculta una porción del bolsillo antehumeral, se considera la nueva especie cercanamente relacionada a *Stenocercus caducus* (Cope), que se conoce desde Bolivia central hasta el norte de la

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Argentina y del Paraguay. *Stenocercus prionotus* se distingue de *S. caducus* al tener una cresta vertebral más prominente y un patrón de alternativas barras claras y oscuras sobre la garganta (un patrón raramente observado en *S. caducus,* que usualmente tiene manchas claras sobre la garganta).

Las poblaciones de *Stenocercus prionotus* del norte del Perú tienen una cresta vertebral más alta que la cresta en poblaciones del sur de Perú y Bolivia. Las poblaciones del norte de Perú también son ampliamente simpátricas con dos otras especies del "grupo *Ophryoessoides,*" *S. aculeatus* y *S. fimbriatus.* Sin embargo, en el sur del Peru y Bolivia no se conocen localidades donde se encuentra *S. prionotus* simpátrica con otras especies del grupo. Postulo que la cresta vertebral más alto en las poblaciones norteñas de *S. prionotus* functiona como un señal para reconocimiento de especies en comunidades donde hay varias especies simpátricas. Se provee una clave para las especies del "grupo *Ophryoessoides*" y se resumen las distribuciones de las especies Peruanas y Bolivianas.

INTRODUCTION

Stenocercus sensu Frost (1992), including the nominal genera *Ophryoessoides* and *Proctotretus,* is a moderately diverse assemblage of South American iguanid lizards (*sensu* Macey et al., 1997; Schulte et al., 1998) with about 50 species currently recognized. Most of the species are in the Andes and adjacent lowlands of Colombia, Ecuador, and Peru, but a few are primarily Amazonian or have distributions in the physiographically diverse terrain south of the Amazon basin. Although new species of *Stenocercus* continue to be discovered in the field, others have been known from old collections and are only now being described (e.g., Cadle, 1991, 1998; Avila-Pires, 1995). In this category is a new species from the lowlands of eastern Peru and Bolivia that has been referred erroneously to the names *aculeatus* O'Shaughnessy (1879) or *caducus* Cope (1862) in previous literature, and associated with the genera *Leiocephalus* or *Ophryoessoides* before the current understanding of these names came into use (see Etheridge, 1966; Frost, 1992). Rodriguez and Cadle (1990) left the new species nameless in a checklist pending resolution of its status. The new species is apparently closely related to *Stenocercus caducus* (Cope) and is described herein.

MATERIALS AND METHODS

Frost (1992; see especially footnote 5) and Cadle (1991) discussed reasons for referring new species such as the one described here to *Stenocercus* Duméril and Bibron *sensu lato* (including *Ophryoessoides* Duméril and *Proctotretus* Duméril and Bibron). Externally, the new species is similar to those species that Fritts (1974) placed in *Ophryoessoides,* that is, those species with keeled ventral scales, large posterior head scales (usually including well-differentiated interparietal, parietals, postparietals, and occipitals), and one moderately to greatly enlarged supraocular row. In addition to the new species described here, species included in the "*Ophryoessoides* group" are *aculeatus* O'Shaughnessy, 1879; *caducus* Cope, 1862; *dumerilii* Steindachner, 1867; *erythrogaster* Hallowell, 1856; *fimbriatus* Avila-Pires, 1995; *huancabambae* Cadle, 1991; *iridescens* Günther, 1859; *limitaris* Cadle, 1998; *scapularis* Boulenger, 1901; *tricristatus* Duméril, 1851; and two undescribed species noted later in this paper under *Key to Species of the* "Ophryoessoides *group*" *of* Stenocercus. I use the term "*Ophryoessoides* group" as a convenience to refer to this group of phenotypically similar species without implication as to its status as a monophyletic or nonmonophyletic assemblage within *Stenocercus.*

General descriptive protocols follow Cadle (1991), who defined terminology of the scales, neck folds, and mite pockets used herein, based in part on Frost (1992). Bilateral scale counts (e.g., subdigitals) were made only on one side (the left, unless it was damaged), except for the holotype, for which both left and right counts were recorded (l, r). A summary of selected scutellational and qualitative characters for the new species and similar species from eastern Peru and Bolivia is presented in Table 1.

All measurements are in millimeters. The abbreviation SVL refers to the head–body length, from snout to vent. The con-

TABLE 1. COMPARISON OF THE SPECIES OF STENOCERCUS WITH KEELED VENTRAL SCALES ("*OPHRYOESSOIDES*" *SENSU* FRITTS, 1974) IN EASTERN PERU AND BOLIVIA. QUANTITATIVE CHARACTERS ARE GIVEN AS RANGE FOLLOWED BY MEAN ± 1 SD. FOR SOME CHARACTERS (E.G., INTERNASALS AND SUPRAOCULARS) THE MODE OR PERCENTAGE OF SPECIMENS WITH A PARTICULAR CHARACTER STATE, RATHER THAN MEANS, IS GIVEN. SAMPLE SIZES (*N*) ARE GIVEN AT THE TOP OF EACH COLUMN EXCEPT WHERE THEY VARIED FOR INDIVIDUAL MEASURES (*N* ADDED PARENTHETICALLY). DATA FOR *S. HUANCABAMBAE* ARE FROM CADLE (1991). DATA FOR *S. ACULEATUS* INCLUDE BOTH ECUADORIAN AND PERUVIAN SPECIMENS, WHICH DIFFER IN SOME QUALITATIVE AND QUANTITATIVE CHARACTERS (SEE *IS THE DISTRIBUTION OF* STENOCERCUS ACULEATUS *DISJUNCT?*).

	Stenocercus prionotus new species N = 55	*Stenocercus caducus* (Cope) N = 43	*Stenocercus fimbriatus* Avila-Pires N = 33	*Stenocercus aculeatus* (O'Shaughnessy) N = 26	*Stenocercus huancabambae* Cadle N > 100	*Stenocercus scapularis* (Boulenger) N = 11
Midbody scales	36–48	34–44	39–51	34–45	37–53	59–70
	40.8 ± 3.02	38.2 ± 2.10 (42)	43.8 ± 7.83	40.2 ± 3.04	43.9 ± 3.20	62.8 ± 2.86
Vertebral scales	27–39	30–43	37–52	32–46	37–51	42–52
	34.2 ± 2.69	35.9 ± 5.59 (41)	43.7 ± 3.24	40.9 ± 3.57 (25)	43.4 ± 3.40	48.4 ± 2.66
Gular scales	15–22	16–23	17–25	16–23	18–28	22–27
	18.5 ± 2.69	18.6 ± 1.41 (40)	20.1 ± 2.29	19.7 ± 1.85	20.9 ± 1.64	24.5 ± 1.75
Internasals	7 (60%), 6 (25%), 5 (11%), rarely 8	7 (55%), 6 (45%)	6 (40%), 5 (29%) 7 (17%), rarely 4	4 (24%), 5 (20%) 6 (40%), 7 (16%)	6 (70%), 5 (28%) rarely 4 or 7	6 (64%), 5 (36%)
Supraoculars	5, occasionally 6 (rarely 7)	5–6 (rarely 4)	4 (rarely 5 or 6)	4 (rarely 3 or 5)	3–6 (mode = 5)	3–5 (mode = 4)
Fourth finger sub-	16–21	15–21	14–18	17–21	14–20	18–23
digitals	18.8 ± 1.30	17.6 ± 1.16	16.1 ± 0.83	19.2 ± 1.16	16.8 ± 1.41	20.5 ± 1.51
Fourth toe subdigitals	24–31	23–30	22–26	22–29	20–28	25–29
	26.6 ± 3.64	26.0 ± 1.59	23.4 ± 1.17	25.2 ± 1.79	24.6 ± 1.56	27.2 ± 1.33
Tail/total length[1]	0.69–0.74	0.69–0.73	0.64–0.67	0.68–0.73	0.65–0.71	0.69–0.71
	0.72 ± 0.012 (30)	0.70 ± 0.015 (21)	0.66 ± 0.010 (8)	0.71 ± 0.019 (6)	0.68 ± 0.01	0.69 ± 0.01 (6)
Maximum size (mm), SVL (total length)						
Males	89 (323)	72 (193+)[2]	74 (208)	93 (340)	95 (—)[3]	80 (249)
Females	93 (329)	93 (349)	91 (—)[3]	91 (295)	75 (231)	92 (297)
Posthumeral pocket	Type 4 with scaly flap	Type 4 with scaly flap	Type 4 no flap	Type 4 no flap	Type 4 no flap	Type 4 no flap
Postfemoral pocket	Type 1	Type 1	Type 1	Type 2, 3, or 5[4]	Type 5	Type 3 (high frequency of Type 5)

[1] Juveniles < 50 mm snout–vent (SVL) were excluded because tail length seems to scale positively with body size in *Stenocercus*.
[2] See text (*Comparison of* Stenocercus prionotus *with* S. caducus) for discussion of apparent size dimorphism in *S. caducus*.
[3] Tail broken.
[4] See text for discussion of this variation.

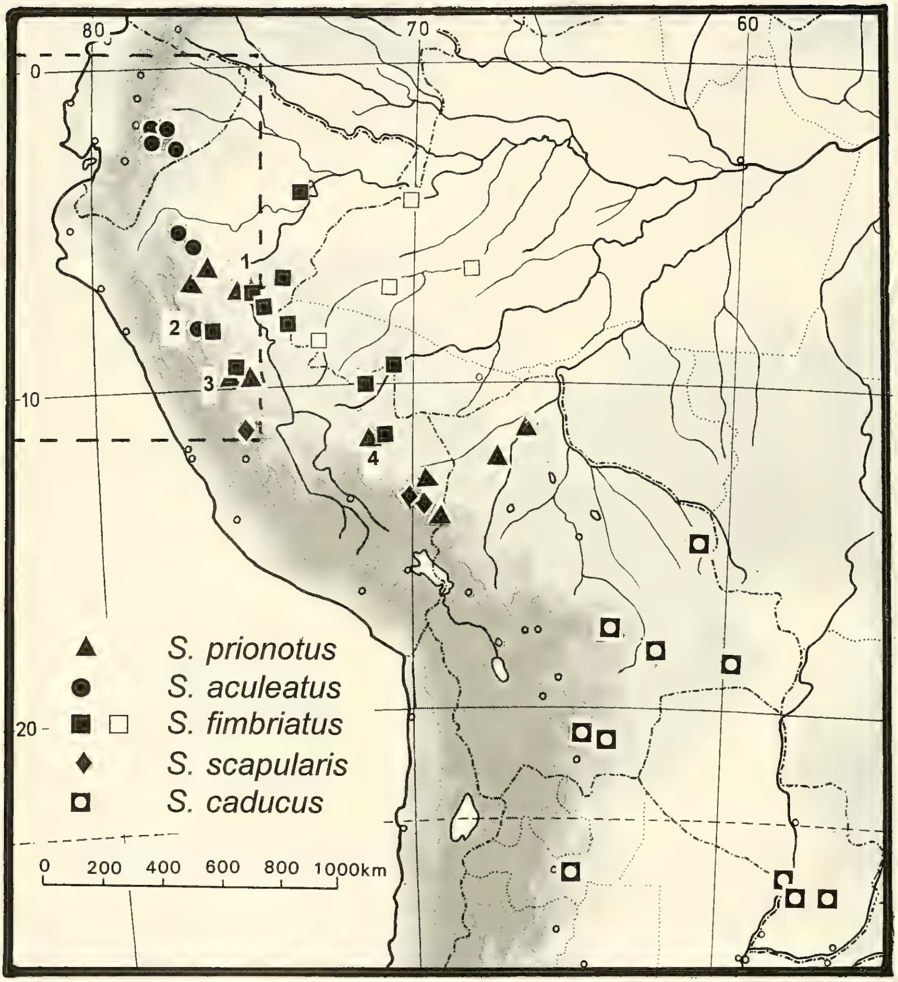

Figure 1. Distribution of species of *Stenocercus* emphasized in this paper (western South America, Ecuador to Paraguay and northern Argentina). Open symbols for *S. fimbriatus* are literature records from Avila-Pires (1995); locality for *S. caducus* in northern Argentina is the southernmost locality in Argentina reported by Cei (1993). Otherwise, all records are based on specimens examined. Numbered localities are documented or suspected cases of sympatry referred to in the text and noted in the Appendix: 1, Pampa Hermosa; 2, Pampa Seca, Río Mixiollo; 3, Tingo Maria; 4, Manu National Park. Upper left quadrant outlined with dotted line is the area shown in greater detail in Figure 2.

figurations of neck folds and mite pockets vary considerably among species of *Stenocercus* and are useful in distinguishing species. The most important qualitative characteristics of these features used herein are the following, which are discussed more fully by Cadle (1991):

Neck and Body Folds and Crests. In contrast to many species of *Stenocercus*, neck folds are usually absent or weakly developed in the "*Ophryoessoides* group." When present, they are better characterized as crests rather than folds because they are usually indicated by strongly keeled rows of scales instead of actual folds of skin. The position of such crests corresponds to the position of folds seen in other species of *Stenocercus*, but only two are commonly seen in the "*Ophryoessoides* group": an antehumeral crest, which is a more or less vertical row of strongly keeled scales immediately anterior to the forelimb insertion, and usually highlighted with white scales; and a supra-auricular crest, a strongly keeled horizontal row of scales extending from the posterior temporal region to the shoulder region. All species of the "*Ophryoessoides* group" have a distinct vertebral crest formed by the strongly keeled, and often projecting, scales of the vertebral row. In addition, some of these species have a more or less prominent dorsolateral crest formed by a row of strongly keeled scales separating the flanks from the dorsum proper. The dorsolateral crest varies in length. In some species it is exceptionally long, extending from the proximal portion of the tail to the neck region, where it is confluent with the supra-auricular crest. In other species it is present only anteriorly or posteriorly.

Posthumeral (Axillary) and Postfemoral Mite Pockets. Type 1—pocket absent; no skin modification. Type 2—rudimentary pocket manifested by skin modification, such as bare skin, a series of wrinkles, or a shallow depression lined with scales different from surrounding body scales. Type 3—similar to Type 2, but with an overhanging fold of skin or a thickened border. Type 4—a deep pocket, usually with a broad circular opening, whose depth is greater than half the diameter of its opening. Type 5—a deep pocket with a narrow, slit-like opening and a depth greater than half the diameter of its opening. In two species discussed herein the posthumeral pocket is partially concealed by a scaly flap of skin, which I term a posthumeral or axillary flap. This structure is described more fully later.

Angulate temporal scales are distinctly enlarged, keeled scales posterior to, and in line with, the superciliary scales. When present, they form a distinct border between the posterior head scales and the lateral temporal scales, and they are morphologically distinguishable from these series (Cadle, 1991: 6–7; see Fig. 4). Angulate temporal scales are equivalent to supratemporals as used in some literature (e.g., Avila-Pires, 1995). In several species of *Stenocercus* the angulate temporals are not only keeled but they bear a projecting bladelike vane from the keels; in such cases I refer to the scales as "projecting."

Coordinates for localities were obtained from the ornithological gazetteers of the Neotropics (Stephens and Traylor, 1983; Paynter, 1989, 1992, 1993, 1997), and from Lamas (1976), Morales and McDiarmid (1996), Schulenberg and Awbrey (1997b), and Peruvian department maps produced by the Instituto Geográfico Nacional, Lima. I also consulted the on-line versions of the Peru and Bolivia gazetteers of the U.S. Board on Geographic Names at the GEOnet® Names Server: http://164.214.2.59/gns/html/index.html. Bracketed data in localities are inferences from these or other cited sources. Distributions of the new species and others emphasized in this paper are given in Figures 1 and 2. Institutional abbreviations are given at the beginning of the Appendix.

DESCRIPTION OF A NEW SPECIES OF *STENOCERCUS*

Stenocercus prionotus[2] new species

Figures 3–7, Figure 12; Table 1

Liocephalus caducus (Cope, 1862): Boulenger (1898), specimen from "Barraca, Rio Madidi" [Bolivia] (BMNH 98.6.9.4) and probably two other northern Bolivian localities discussed in the text.

Ophryoessoides caducus (Cope, 1862): Fugler (1989: 63), specimens from San Marcos Ranch, El Beni Department, Bolivia, including ROM 12815.

Ophryoessoides aculeatus (O'Shaughnessy, 1879): Fugler (1983, 1986, 1989), specimens from Tumi Chucua, El Beni Department, Bolivia (USNM paratypes).

Ophryoessoides sp.: Rodriguez and Cadle (1990), specimen from Cocha Cashu, Manu National Park, Madre de Dios Department, Peru (MCZ 150243).

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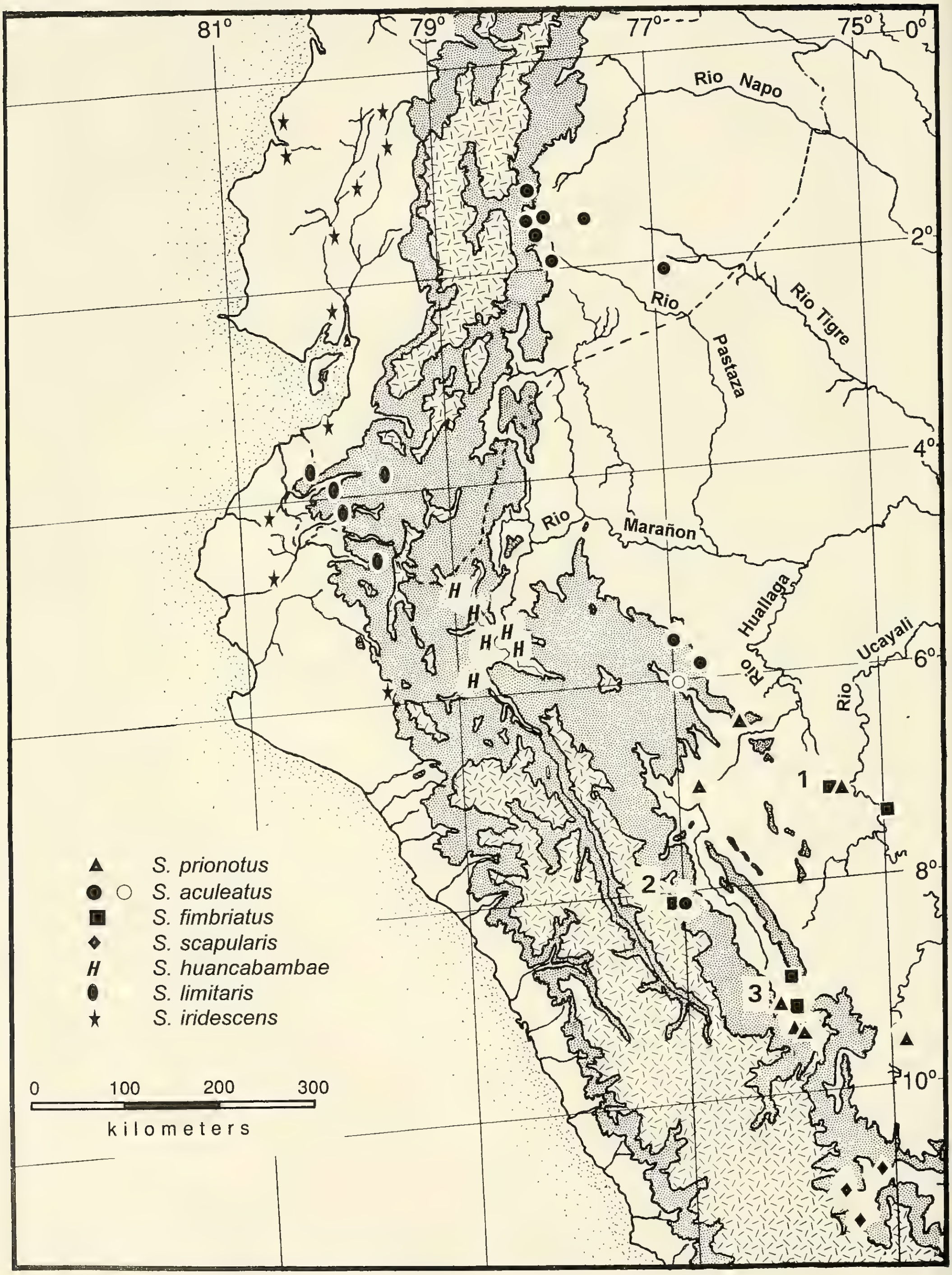
[2] *Stenocercus prionotus* was recognized as new by R. Etheridge, P. E. Vanzolini, and E. E. Williams many years ago. Vanzolini and Williams applied the unpublished name *Stenocercus dorsatus* to labels of many specimens in various collections.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Rio Pastaza
Rio Marañon
Rio Huallaga
Rio Ucayali
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1
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S. prionotus
S. aculeatus
S. fimbriatus
S. scapularis
S. huancabambae
S. limitaris
S. iridescens
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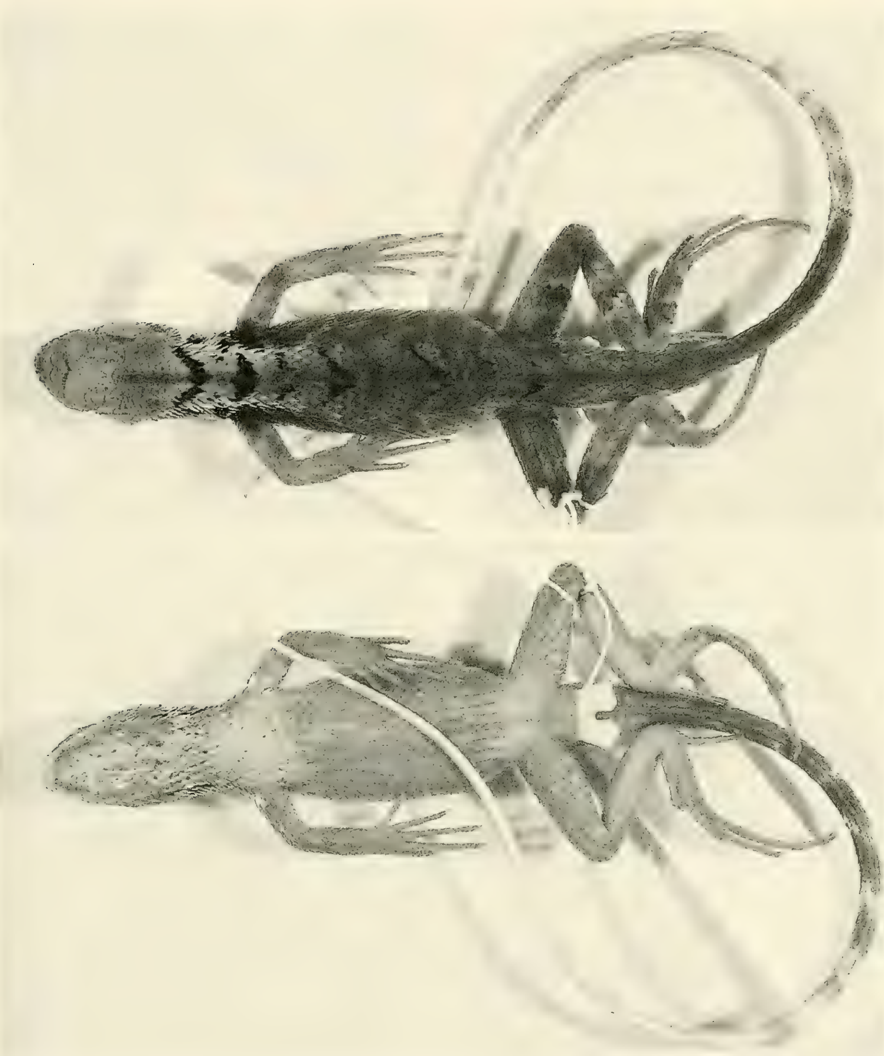


Figure 3. Dorsal and ventral views of the holotype of *Stenocercus prionotus* (USNM 193683). Approximately ×0.87.

←

Figure 2. Northern Peru and Ecuador (see Fig. 1) showing distributions of species in the "*Ophryoessoides* group." Numbered localities are documented or suspected cases of sympatry referred to in the text and the Appendix (see Fig. 1 for names). Open circle at 06°S, 77°W is the type locality for *Stenocercus aculeatus* (Moyabamba, San Martín Department). All other localities are based on specimens examined; see Cadle (1991, 1998) for *S. iridescens, S. limitaris,* and *S. huancabambae.* The known distributions of all species are indicated by the localities plotted; however, the distribution of *S. iridescens* continues farther north in western Ecuador than the area covered by the map.

Holotype (Figs. 3–5). **United States National Museum of Natural History (USNM) 193683** (field number WCS 2421). **PERU: Depto. Huánuco:** Jardín Botánico de la Universidad Agraria de la Selva, Tingo Maria, vicinity of Río Huallaga, 670 m elevation [09°18′S, 75°59′W]. Adult male collected 29 June 1966 by Wade C. Sherbrooke.

Paratypes from the Vicinity of the Type Locality. **PERU: Depto. Huánuco:** Ca. 2 mi. by trail W. Tingo Maria, west bank of Río Huallaga in vicinity of confluence with Río Monzón, 670 m elevation (9 October 1966, W. C. Sherbrooke), **USNM 193685.** Universidad Agraria de la Selva, Tingo Maria, Río Huallaga, 670 m elevation (18 August 1967, unknown collector for W. C. Sherbrooke), **USNM 193686.** Vicinity of Cueva de las Lechuzas, ca. 3 mi. SW Tingo Maria, Río Monzón, ca. 700 m elevation (17 April 1968, Vito Yaringano for W. C. Sherbrooke), **USNM 193687.** Picuriacu, ca. 2 mi. NW Tingo Maria, Río Huallaga (20 April 1968, W. C. Sherbrooke), **USNM 193688.**

Other Paratypes. **PERU: Depto. Huánuco:** Buena Vista, Valley of the Chimchao [=Río Chinchao] [approximately 9°31′S, 75°52′W] (1–15 September 1923, E[dmund] Heller), **FMNH 5582–83.** Hacienda Pampayacu [09°33′S, 75°54′W] (17 July–16 August 1936, Dr. Snonge), **MCZ 43758–59, 43761–62.** Río Llullapichis, 4–5 km upstream from Río Pachitea, 200 m elevation [09°37′S, 74°55′W] (January 1969, Hans W. Koepcke), **KU 179058. [Depto. Loreto]:** E[astern] Peru, Pampa Hermosa, near mouth of Río Cushabatay, Río Ucayali Valley, 500 ft. [152 m] [07°12′S, 75°17′W] (date unknown, H[arvey] Bassler), **AMNH 56760–64. Depto. Madre de Dios:** Cocha Cashu Biological Station, Manu National Park [11°51′S, 71°19′W] (July 1975, John W. Fitzpatrick), **MCZ 150243.** Explorer's Inn, Tambopata Reserve, ca. 30 km (straight line) SSW Puerto Maldonado, 280 m [12°50′S, 69°17′W] (2 September–7 October 1983, native collectors), **USNM 247468–69, 247680;** (23 May 1986, Victor R. Morales), **USNM 269022. Depto. Puno:** Prov. Sandia: Tambopata, San Juan [del Oro], 1520 m or 5000 ft. [14°12′S, 69°08′W][3] (22 November–20 December 1950, Hilda H. Heller), **FMNH 64788–92, 64794–811. [Depto. San Martín]:** Juanjui [07°11′S, 76°45′W] (collector and date unknown), **MCZ 121233.** Tarapoto, 370 m [06°30′S, 76°25′W] (25 July 1984, Rainer Schulte), **KU 212629.**

BOLIVIA: Depto. Beni: Provincia Vacadiez, Tumi Chucua [176 m; 11°08′S, 66°10′W] (23 October–18 November 1981, Charles M. Fugler), **USNM 280246–51.** Puerto Cruzeiro, San Marcos Ranch at confluence of Ríos Isiboro and Ichoa [15°17′S, 65°45′W] (10 February 1977, J. Lovisek), **ROM 12815. [Depto. La Paz]:** Barraca, Río Madidi [12°35′S, 67°02′W] (1893, Luigi Balzan), **BMNH 98.6.9.4.**

Distribution (Fig. 1). Stenocercus prionotus is known from the lowlands and Andean foothills of eastern Peru and adjacent Bolivia (San Martín department, Peru, south to the Río Beni in northern Bolivia). The known elevational range is 176–1,520 m, but the highest recorded elevation is more than twice the elevation of the next lower one. Most localities in Peru are adjacent to or near the Andean foothills, and several localities in La Paz and El Beni departments, Bolivia, are unconfirmed. No specimens are known from a broad geographic hiatus between central and southern Peru (Fig. 1). See *Distribution Patterns in* Stenocercus prionotus for further discussion.

Etymology. The epithet *prionotus* is de-

[3] Hilda Heller's notes on this collection in the Karl P. Schmidt archives of the FMNH describe San Juan as the site of an agricultural station on "the left side of the Río Tambopata at 5000 feet." With some hesitancy I identify Heller's locality as the town known as San Juan del Oro, which is on the left bank of the Río Tambopata at approximately the elevation given by Heller. I have located only two other places named San Juan in Puno Department, but neither is on the Río Tambopata.

rived from the Greek adjective *prionotos* meaning jagged or serrate. The name refers to the strongly serrate vertebral crest of *Stenocercus prionotus,* which is the most obvious character distinguishing this species from its apparent closest relative, *S. caducus.*

Data on the Holotype. Adult male, hemipenes partially everted. SVL, 83 mm. Tail length, 201 mm. Total length, 284 mm. Tail/total length, 0.71. Vertebral scales between the occipital and the posterior margin of the hind limb, 31. Midbody scales, 42. Gular scales between the ears, 16. Internasals, 6. Subdigital scales on fourth fingers and toes, respectively, 18–18, 25–25. Color pattern well preserved: top of head brown with narrow dark brown interorbital bar extending laterally onto supraoculars; dorsum brown with narrow blackish chevrons middorsally (1 on neck, 1 above forelimbs, 2 others anterior to midbody; posterior chevrons poorly defined); dark brown scapular blotch bordered anteriorly by white antehumeral stripe; ill-defined grayish dorsolateral streaks between ear and anterior body; throat grayish with poorly defined oblique light grayish stripes; venter brown without distinct pattern.

Definition. A species of *Stenocercus* characterized by the following features: (1) Dorsal head scales subimbricate and strongly keeled to multicarinate; temporals keeled, imbricate or subimbricate. (2) Posterior head scales larger than anterior ones, with distinct interparietal, a pair of parietals, a pair of postparietals, and a large median occipital (often surrounded by several small irregular scales). (3) Internasals usually 7, but pattern irregular and may be 5 or 6. (4) One row of supraoculars distinctly enlarged. (5) One canthal on each side between the superciliaries and the lateralmost internasal. (6) A pair of strongly keeled angulate temporals in line on each side (rarely, 3 angulate temporals are present), each with a low projecting blade; partially or completely separated from enlarged posterior head scales by a single row of small scales. (7) Anterior and posterior gular scales strongly keeled. (8) Parietal eye distinct. (9) Neck folds absent; a vertical, strongly keeled row of scales in the antehumeral region and occasionally a much less distinct raised series in the supra-auricular region. (10) Dorsal and ventral body scales imbricate, mucronate, strongly keeled; dorsal scales at midbody 36–48. (11) Vertebral row continuous, bearing a strongly projecting serrate crest in adults; a dorsolateral crest present on posterior body and the base of the tail. (12) Deep posthumeral pocket (Type 4) partially concealed by a scaly posthumeral flap originating on its anteroventral border; postfemoral pocket absent (Type 1). (13) Scales of posterior thigh imbricate, keeled. (14) Tail strongly compressed in adults, anteriorly with low vertebral and dorsolateral crests continuous with those of the body. (15) Dorsal coloration of males in preservative (Figs. 3, 6) brown with or without distinct chevrons; a distinct white vertical antehumeral stripe extending ventrally to the proximal ventral surface of forelimb; a large dark scapular blotch; in well-preserved specimens the throat bears oblique alternating dark and light stripes (see *Description*); females similar but pattern elements often more subdued.

DIAGNOSIS AND COMPARISONS

In having enlarged posterior head scales, an enlarged row of supraoculars, and strongly keeled ventral scales, *Stenocercus prionotus* is like other species in the "*Ophryoessoides* group" of *Stenocercus.* These are the species most likely to be confused with *S. prionotus.* Five other described species of the "*Ophryoessoides* group" occur in eastern Peru or Bolivia: *S. aculeatus* (O'Shaughnessey, 1879); *S. caducus* (Cope, 1862); *S. fimbriatus* Avila-Pires, 1995; *S. huancabambae* Cadle, 1991; and *S. scapularis* (Boulenger, 1901). An undescribed species occurs in the Río Marañon valley of eastern Peru (see *Key to Species of the* "Ophryoessoides *Group*" *of* Stenocercus). *Stenocercus prionotus* and *S. caducus* are unique among known species of *Stenocercus* (perhaps unique within iguanids) in having deep posthumeral mite pockets (Type 4) that are partially concealed anteroventrally by a scaly flap, which may be termed a posthumeral or axillary flap (Fig. 5). *Stenocercus prionotus* and *S. caducus* are compared in greater detail below, but *S. prionotus* is distinguished from *S. caducus* (characteristics in parentheses) by: (1) a strongly projecting, serrate vertebral crest (low and scarcely projecting); (2) 2 (usually) or 3 enlarged, strongly keeled, projecting angulate temporal scales on each side (scales not greatly enlarged, less projecting); and (3) a gular pattern consisting, when evident, of oblique alternating dark and light lines or bars, or oblique light lines on a dark ground color (usually light spots on a darker ground color, unicolor, or [rarely] a pattern similar to that of *S. prionotus*).

Readily determined characters distinguishing *Stenocercus prionotus* from the other four species of the "*Ophryoessoides* group" known from eastern Peru and Bolivia include the extent of keeling on dorsal head and body scales, relative development of the postfemoral pockets, and the number of midbody scale rows (Table 1 and key presented later herein). *Stenocercus fimbriatus* and *S. aculeatus* are known to be sympatric with *S. prionotus* at several localities in eastern Peru. In addition to having a posthumeral flap (absent in *S. fimbriatus* and *S. aculeatus*), *S. prionotus* is distinguished from *S. fimbriatus* (characteristics in parentheses; see Avila-Pires, 1995) in having strongly keeled dorsal scales in adults (smooth or weakly keeled), a dorsolateral crest prominent only on the posterior body (prominent anteriorly and continuous with antehumeral and supra-auricular folds or crests), and in lacking "fimbriate" scales on the posterior distal portion of the thigh (present). *Stenocercus prionotus* is distinguished from *S. aculeatus* (characteristics in parentheses) in lacking a postfemoral pocket (moderate to deep); in having strongly keeled, often multicarinate, head scales (smooth or weakly striated in adults, wrinkled in juveniles); 5–7 internasals (4–5); and only moderately enlarged supraoculars, usually 5–6 supraoculars across the widest part of the orbit (greatly enlarged, usually 4 across the orbit).

Stenocercus prionotus differs from *S. scapularis* (characteristics in parentheses) in lacking squarish or rectangular projecting superciliary scales (present) and in having fewer than 50 midbody dorsal scale rows (59–70 rows). *Stenocercus prionotus* differs from *S. huancabambae* (characters in parentheses) in lacking a postfemoral pocket (deep, Type 5) and in having prominent dorsolateral crests on the posterior body (weak, restricted to anterior body when present).

Two species of *Stenocercus* from western Ecuador and Peru, *S. iridescens* and *S. limitaris,* have enlarged posterior head scales and supraoculars. In contrast to *Stenocercus prionotus, S. iridescens* has smooth head plates, 2 canthals, a poorly developed posthumeral pocket (Type 1 or 2), and lacks keeled angulate temporals and dorsolateral crests on the body (see Cadle, 1991, fig. 10). *Stenocercus limitaris* has a deep postfemoral pocket (Type 5), 2 canthals, a single strongly keeled (but nonprojecting) angulate temporal, and lacks dorsolateral crests.

Other non-Peruvian species of the "*Ophryoessoides* group" can be distinguished from *Stenocercus prionotus* by features in the key presented later and other superficial characters, such as the presence of 2 canthals and 4 internasals (usually) in *S. erythrogaster* (1 and 5–7 in *S. prionotus*), and enlarged, projecting pyramidal or conical postsuperciliary scales in *S. dumerilii* and *S. tricristatus* (Avila-Pires, 1995).

Other species of *Stenocercus* are distinguished from *S. prionotus* by a combination of features such as smaller head plates, smooth ventrals, and absence of dorsolateral crests. Most species of *Steno-*

cercus except the "*Ophryoessoides* group" have smooth or weakly keeled head plates. Other characters, such as the number of dorsal scale rows, morphology of the posthumeral and postfemoral mite pockets, extent of sexual dimorphism, and degree of differentiation of the vertebral scale row and crest also aid in distinguishing the species (see descriptions and discussion in Fritts, 1974; Cadle, 1991, 1998).

Apart from *Stenocercus fimbriatus*, *S. scapularis*, and *S. aculeatus*, two other species of *Stenocercus* are known from localities close to or sympatric with known populations of *S. prionotus*: *S. crassicaudatus* and *S. roseiventris*. These species are distinguished from *S. prionotus* by lacking prominent serrate vertebral crests (low crests may be present), having smooth ventral scales, and having prominently spinose tails with the spines arranged in distinct whorls.

DESCRIPTION

Head (Fig. 4). Dorsal head scales subimbricate (a tendency to be more juxtaposed posteriorly); strongly keeled to multicarinate or wrinkled. Rostral in contact with first supralabial, first lorilabials, and a series of postrostrals. Usually 7 elongate, strongly keeled internasals between the nasals dorsally; however, the anterior dorsal head scales are very irregular and occasionally only 5 or 6 internasals are present. One canthal scale between the anterior superciliary and the lateralmost internasal, separated from the nasals by tiny postnasals. Canthus very strongly angled. Nostril in posterior portion of an elongate nasal scale, which may contact the rostral scale anteriorly or be separated from it by small postrostrals. Four or 5 strongly overlapping, elongate anterior superciliaries followed by 2 or 3 shorter posterior superciliaries slightly overlapping in the reverse direction (but more or less in a straight line). One supraocular row moderately enlarged, 2 mediocentral scales much larger than the others. Five or 6 scales across the supraocular area at its widest part. Interparietal distinct and elongate, diamond-shaped or pentagonal (apex posteriorly). Parietal eye visible. A pair of parietals in contact behind the interparietal, flanked posterolaterally by a postparietal on each side. Postparietals separated medially by a single median transversely elongate occipital; occasionally 1 or 2 small scales are intercalated at the juncture of the parietal, postparietal, and/or occipital (e.g., Fig. 4).

Lateral temporal scales strongly keeled, imbricate to subimbricate; separated from posterior dorsal head scales on each side by 2 (occasionally 3) elongate, strongly keeled angulate temporal scales bearing a low projecting vane. Keels of adjacent angulate temporals aligned. Posterior angulate temporals separated from postparietals by 2 or 3 small scales in a longitudinal row. Anterior angulate temporals may contact postparietal and one other larger posterior head scale or be separated from them by small scales. Anterior border of ear weakly denticulated; posterior border rounded, bordered with keeled imbricate scales.

Anterior and posterior gulars strongly keeled. Mental smooth, in contact with first pair of postmentals and first pair of infralabials. Enlarged postmentals 3 or 4 on each side, only the first pair in contact medially.

Neck and Body. Dorsal and lateral scales of neck and body imbricate, mucronate, strongly keeled. Vertebral row produced into a prominent projecting serrate crest in adults of both sexes that is continuous from the nuchal region to the base of the tail, gradually disappearing on the anterior ¼ to ⅓ of tail. Dorsolateral crest (a raised, strongly keeled row of scales) on posterior ⅓ of body, continuing onto base of tail. The dorsolateral crest occasionally appears very indistinctly farther anteriorly on the body, but only on the posterior body does it sharply delimit the dorsolateral (paradorsal) scales from the flank scales. Three rows of scales between dorsolateral and vertebral crests at anterior

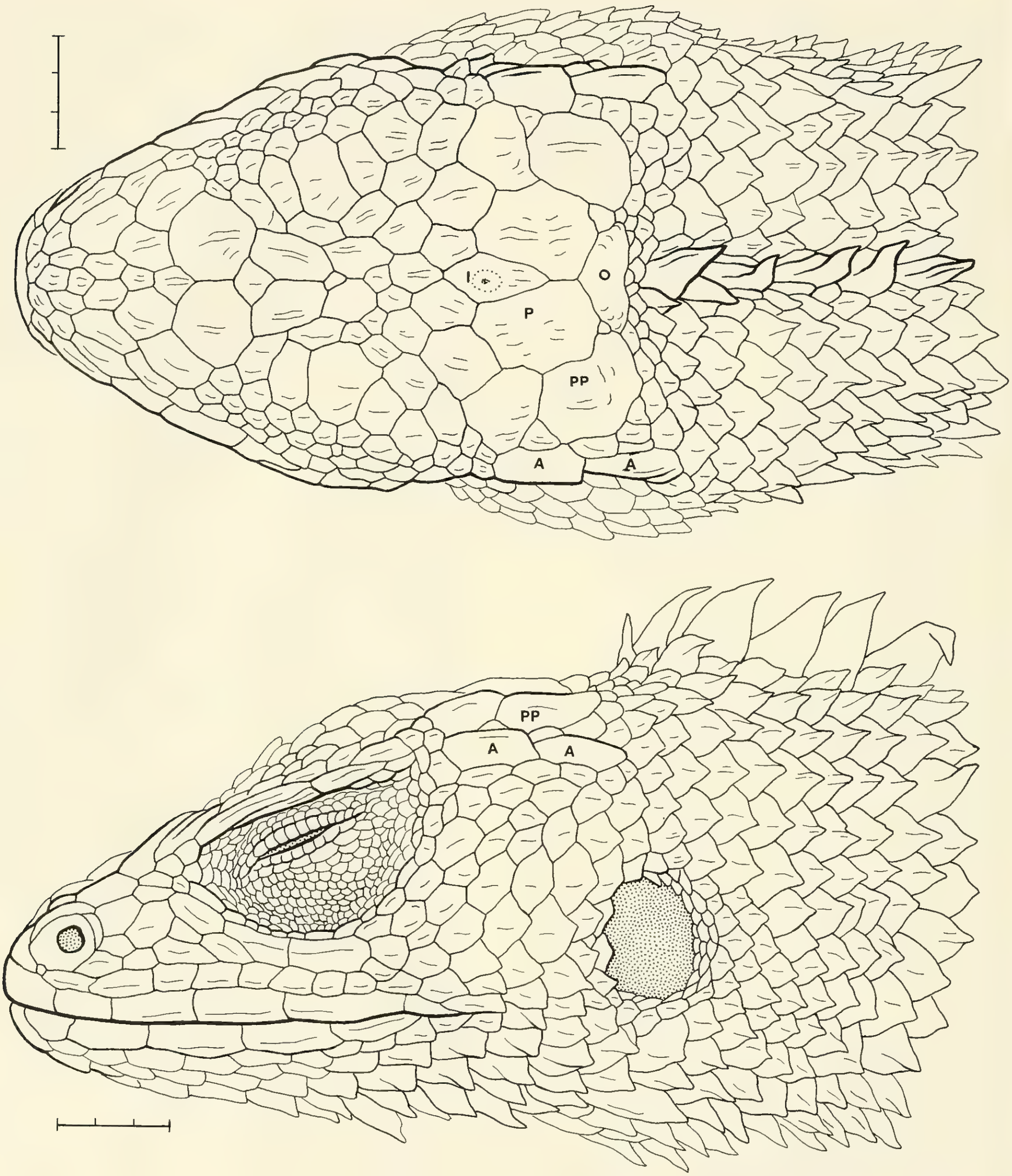


Figure 4. Head scales of the holotype of *Stenocercus prionotus* (USNM 193683) in dorsal and lateral views. Scale bars = 3 mm. To facilitate coordination with the text, the following scales are indicated on one side (interparietal and occipital are median scales): A, angulate temporal; I, interparietal; O, occipital; P, parietal; PP, postparietal.

edge of dorsolateral crest (i.e., just anterior to the pelvic region), 2 rows posteriorly (dorsal to hindlimbs); scales between the crests strongly imbricate and keeled only on posterior part of scale. Flank scales mostly fully keeled (sometimes only the posterior part of each scale), imbricate, mucronate, slightly smaller than dorsolateral scales. Ventral body scales mucronate, strongly keeled (keels running the length of the scales). Ventrals approximately the same size as the dorsolateral scales, larger than flank scales.

Neck Folds. Distinct neck folds absent. Poorly developed antehumeral crest present.

Tail. Tail strongly compressed, anteriorly bearing low projecting vertebral and dorsolateral crests continuous with those of the body. Dorsal scales moderately keeled, ventral scales strongly keeled.

Limbs. Dorsal and ventral scales of forelimbs, hindlimbs, and posterior thigh strongly keeled, unicarinate, mucronate; some scales of the shank larger than any thigh scales. Supradigitals and subdigitals unicarinate. Palmar scales strongly multicarinate. Plantar scales strongly unicarinate.

Posthumeral and Postfemoral Mite Pockets. Posthumeral mite pocket a deep cavity (Type 4) with a prominent axillary flap concealing the anteroventral aspect (Fig. 5). Postfemoral pocket absent (Type 1).

The flap associated with the posthumeral pocket projects from the anteroventral and ventral edges of the pocket. Anterodorsally, a similar but much smaller flap is present in some specimens (e.g., Fig. 5). The posthumeral flap consists of a fleshy ridge covered anteriorly and posteriorly (or externally and internally when the flap is lying flat against the body) by keeled imbricate scales. Externally, usually 3 or 4 larger scales cover the flap ventrally and a series of much smaller scales is present dorsally. One or 2 of the larger scales are sometimes highlighted with white. When appressed against the body (i.e., against

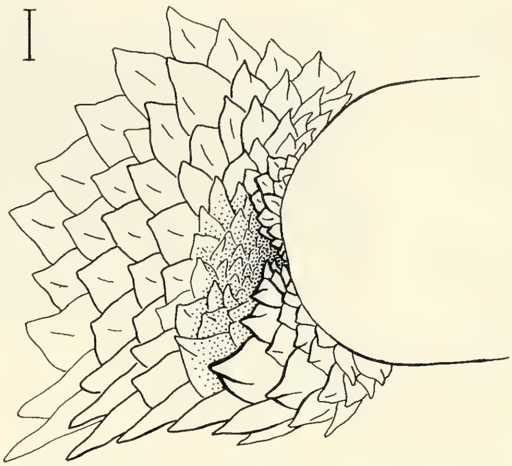


Figure 5. Posthumeral (axillary) flap of *Stenocercus prionotus* (USNM 193683, holotype). Anterior to the right. The broad oval on the right is the deflected forelimb and the posthumeral mite pocket is the heavily stippled cavity deep to the flap. The posterior border of the axillary flap is marked by the scales with heavily outlined posterior borders and it extends anteriorly to the ventral part of the forelimb. A smaller dorsal flap is also present in this specimen (small patch of heavily outlined scales on anterodorsal edge of the pocket; see text). Scale bar = 1 mm.

the opening of the posthumeral pocket) the flap conceals approximately the ventral ⅓ to ½ of the vertical dimension of the pocket. The flap is equally prominent in adults of both sexes and is proportionally as well developed in subadults (including hatchlings) as in adults.

Size and Proportions. Largest male (USNM 193683) 89 mm SVL, 323 mm total length (sample size of males with SVL ≥70 mm = 13). Largest female (KU 212629) 93 mm SVL, 329 mm total length (sample size of females with SVL ≥70 mm = 16). Tail relatively long, 69–74% of total length in adults (67–71% in juveniles).

Coloration and Pattern of Adult Males in Life. The following color descriptions are paraphrased from the field notes of Wade C. Sherbrooke. USNM 193683 (holotype):

> Lower half of side between limbs is lavender-brown. This color extends from both sides across the belly approximately ⅓ of the way on each side, leaving a tan-brown central strip down the belly. General base color of the body is brown, darkest

Figure 6. Lateral view of *Stenocercus prionotus* from northern Peru (USNM 193685; male, snout–vent length 76 mm). Note the high vertebral crest and the following pattern elements: dark subocular bar, dark blotches on the dorsal and lateral surfaces of the neck, pale antehumeral bar, indistinct pale dorsolateral stripe, and indistinct oblique bars on the trunk.

> near the hind legs and tan just in from of the forelegs. A distinct white line runs dorsally from the top of each foreleg to three quarters of the way to the dorsal crest; it runs through a large black patch just above the forelimb. Head markings consist of a dark brown line running between the eyes on the top of the head; this continues through the eye to broaden slightly at the rear portion of the jaw. The gular area is streaked by several light cream lines. Very slight lavender tinge to all of body behind forelimbs. [Sketch in notes shows black middorsal patches that don't extend to flanks].

USNM 193685 (WCS 2543):

> This specimen closely resembles [USNM 193683] in color, with one exception. There are several green spots on . . . the right dorsal surface between the limbs and on the dorsal portions of the tail behind the hind limbs and the dorsal tibio-fibula portion of the right hind leg.

Coloration of Adult Females in Life. Unknown.

Coloration in Preservative (Figs. 3, 6, 7). Specimens of *Stenocercus prionotus* vary greatly in coloration due mainly to variation in initial preservation and the length of time in preservative. Poorly preserved specimens may be more or less uniform brown all over, although obscure pattern elements are usually present. Well preserved specimens are brown dorsally with darker brown to blackish chevrons middorsally. One chevron dorsal to each pair of limbs and one on the neck are usually evident, and these are darker than others that may be present. Three to five middorsal chevrons are between the limbs. Dark spots or an additional chevron are often present on the dorsal neck and usually on the base of the tail. The light antehumeral/humeral line is universally present and evidence of the dark shoulder patch is usually present (often very prominent). Flanks usually unicolor and somewhat darker than the dorsum between the dorsolateral crests; however, some specimens (e.g., KU 179058, USNM 280246) have distinct dirty white vertical bars or chevrons on the flanks (five between the limbs), and such bars appear occasionally, but more obscurely in other specimens (see Fig. 6). The dorsolateral crest is often highlighted for a variable length with a distinct or indistinct light line, giving the impression of a light dorsolateral stripe. Forelimbs more or less unicolor brown or with obscure pattern; hindlimbs brown with darker brown bands. Dark subocular bar distinct. Top of head often with an obscure or distinct dark brown interocular bar. Oblique bars on throat (Fig. 7) often visible but throat may be unicolor or have an obscure pattern. Venter of most specimens unicolor, dirty white, gray, or beige; however, some specimens (e.g., USNM 280246) have a series of irregular longitudinal dark brown streaks.

Scale Counts and Qualitative Features (Table 1). Stenocercus prionotus has relatively low midbody, vertebral, and gular scale counts. The scales are relatively large and strongly keeled over most of the body.

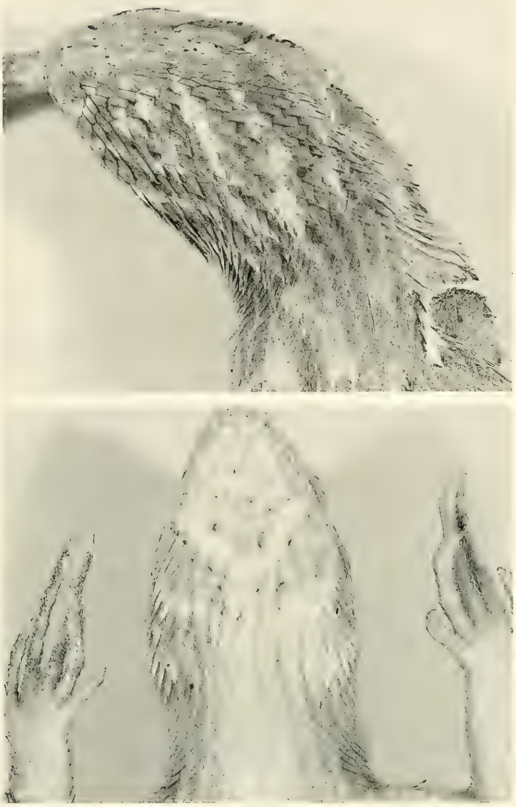


Figure 7. Gular patterns in *Stenocercus prionotus*. Top, typical throat pattern (oblique view) consisting of light and dark stripes that extend medially to the midline (USNM 193687). Bottom, specimen in which the ground color is lighter and therefore the contrasting pale stripes are less distinct (USNM 193685).

Sexual Dimorphism. Stenocercus prionotus does not exhibit strong sexual dimorphism. Males and females attain approximately the same size and have the same general pattern, but whether the coloration in life reported above for adult males pertains to females as well is unknown. The vertebral crest is only slightly more developed in males than in females of the same population but this character shows strong clinal variation (northern populations with higher crests; further discussed below). Other characters that sometimes vary between the sexes in *Stenocercus* show little variation in *S. priontotus*. Neither standard meristic counts (Table 1) nor the relative development of the posthumeral and postfemoral pockets (Types 4 and 1, respectively, in adults of both sexes and in subadults) show obvious sexual dimorphism.

DISTRIBUTION PATTERNS IN *STENOCERCUS PRIONOTUS*

Absence of Stenocercus prionotus *from Lowland Localities in Eastern Peru. Stenocercus prionotus* is widespread in the lowlands along the Andean front from northern Peru to northern Bolivia (Fig. 1). However, all Peruvian localities are close to the Andean foothills and south of the broad extension of the Cordillera Oriental separating the great bend of the Río Marañon from upper reaches of the Río Huallaga (Fig. 2). The absence of specimens in comprehensive collections from the Iquitos region (Dixon and Soini, 1986), Balta (Ucayali Department; specimens at LSUMNS and University of Arizona), and Cuzco Amazonico (Madre de Dios Department; Duellman and Salas, 1991) suggest that *S. prionotus* may be absent from the lowlands distant from the Andean foothills, at least in Peru. Similarly, collections from northern Loreto Department (Duellman and Mendelson, 1995) and northern Amazonas Department (J. E. Cadle and R. W. McDiarmid, unpublished data from the Río Cenepa and Río Santiago) suggest that *S. prionotus* does not occur north of the Río Marañon.

However, these sites have been sampled unevenly. For example, species accumulation curves for lizards at Cuzco Amazonico (Duellman and Koechlin, 1991) reached an asymptote after about 15 person-weeks of effort, whereas only 5 person-weeks were expended in northern Loreto and the species accumulation curve for the total herpetofauna showed no asymptote (Duellman and Mendelson, 1995; data not presented for lizards only). Quantitative data are not available for the other sites, but large collections are available for the Iquitos region, including more than 1,000

TABLE 2. PATTERNS OF PRESUMED SYMPATRY OF *STENOCERCUS* IN EASTERN PERU. ONLY SPECIES OF THE "*OPHRYOESSOIDES* GROUP" AND THE SUPERFICIALLY SIMILAR SPECIES, *S. ROSEIVENTRIS*, ARE LISTED.[1] LOCALITIES ARE LISTED ROUGHLY NORTH TO SOUTH; FOR PRECISE LOCALITIES SEE THE APPENDIX AND LOCALITIES FOR THE TYPE SERIES OF *S. PRIONOTUS*..

	Iquitos Region	San Martin/ W. Loreto[2]	Pampa Hermosa	Río Mishollo	Tingo Maria	Manu[3]	Balta	Cuzco Amazonico	Explorer's Inn
S. prionotus		×	×		×	×			×
S. aculeatus		×		×					
S. fimbriatus	×		×	×	×	×	×		
S. roseiventris	×					×		×	×

[1] The only other species of *Stenocercus* known from primarily the lowlands and lower Andean foothills in this region is *S. crassicaudatus*, which lacks a projecting vertebral crest and has a very spiny tail.
[2] The distributions of *S. prionotus* and *S. aculeatus* overlap both altitudinally and latitudinally in northern Peru but they have not been taken together at the same locality. See Figure 2 for localities.
[3] In Manu National Park, *S. fimbriatus* and *S. roseiventris* are sympatric at Pakitza, whereas *S. prionotus* is known only from Cocha Cashu.

lizards obtained by Dixon and Soini (1986) and additional collections from the region made by Harvey Bassler and deposited in the AMNH. Similarly large collections resulted from the efforts of Cadle and McDiarmid in Amazonas (specimens in the MVZ and USNM). Thus, barring artifacts introduced by the difficulties of collecting cryptic rainforest lizards, *S. prionotus* seems to be absent from these sites.

Documenting and explaining patterns of absence is always difficult, but the apparent absence of *Stenocercus prionotus* from the lowlands distant from the Andes in Peru is not due to failure to collect *Stenocercus* at these localities because at least one other species of *Stenocercus* is known from each (Table 2). However, no lowland locality is known in which more than two species of the "*Ophryoessoides* group" of *Stenocercus* are sympatric. Of interest in this connection is that *S. prionotus* has not been taken in the upper reaches of the Río Perene and its tributaries (Junín Department), although it is known from north and south of that region. Numerous specimens of *Stenocercus* of at least five species (*S. boettgeri, S. crassicaudatus, S. formosus, S. scapularis,* and *S. variabilis*[4]) have been collected along an elevational

[4] Based on examination of two of the three syntypes of *Stenocercus variabilis* Boulenger (BMNH 1946.8.11.89, 1946.8.11.91) I concur with Fritts (1974: 66) that Boulenger (1901: 553) erred in ascribing these specimens to "Palca, Bolivia" rather than Palca (Junín Department), Peru. One specimen I collected near Palca, Peru (MCZ 178166) is nearly identical with BMNH 1946.8.11.91 in scale counts, pattern, and qualitative characters (both of these specimens differ considerably from BMNH 1946.8.11.89 in color pattern). However, the attribution of the specimens to Peru is not without some equivocation. The types were collected by P. O. Simons (see Cadle, 1998: footnote 6), who collected in the vicinity of Palca, Peru, in March and April, 1900, although that specific locality is not listed in his published itinerary (Chubb, 1919). However, Simons's itinerary places him at "Palca, 18 miles E of La Paz" [Bolivia] on 9 November 1900 (Chubb, 1919: 5). Simons's field tags attached to the syntypes record simply "Palca 3000 m," which is close to the elevation of Palca, Peru (2,740 m), but not that in Bolivia (4,600 m). Adding to the confusion are entries in the BMNH registries for the syntypes, concerning which Colin J. McCarthy provided the following comments via e-mail:

> Boulenger originally wrote "Palca Peru 3000m" but later struck through Peru and wrote "Bolivia." There are two sheets of notes (presumably from Simons) stuck in at this page of the register about the localities in the batch. With regard to Palca he has written "Palca, just S. of La Paz, Bolivia." I assume it was that information that caused Boulenger to alter his original entry!

Thus, the confusion may have originated with the note that Simons provided subsequent to cataloguing of the collection at the BMNH. In any case, no specimens resembling *S. variabilis* are definitely known from Bolivia and the only species of the genus definitely known to occur above 4,000 m is *Stenocercus chrysopygus* from northern Peru.

transect along this well-traveled route (Fritts, 1974; Cadle, 1991 and unpublished data). Thus, analysis of circumstantial distributional data suggests that the distribution of *S. prionotus* in the lowlands of eastern Peru may be influenced by the number of sympatric species of *Stenocercus.* At all localities from which *S. prionotus* has been taken, only one other species of *Stenocercus* is known (Table 2). These patterns of sympatry are discussed in the next section with reference to patterns of geographic variation in *S. prionotus.*

In contrast, the apparent restriction of *Stenocercus prionotus* to the Andean foothills and immediately adjacent lowlands in Peru does not seem related to the distribution of any major habitat type or physiographic region. Most of the extensively sampled localities (e.g., Iquitos and Cuzco Amazonico) include a variety of lowland habitats characteristic of western Amazonia. *Stenocercus prionotus* is known from both floodplain forests (Cocha Cashu) and more upland forests on river terraces in southeastern Peru (Explorer's Inn); Foster (1990) and Dallmeier et al. (1996) described these floristic communities in southeastern Peru. Thus, the apparent absence of *S. prionotus* at the localities discussed above is not due to some simple relation to local habitat availability. For example, it is unclear why *S. prionotus* was not obtained at Pakitza (Morales and McDiarmid, 1996), even though it occurs at nearby Cocha Cashu. On a broader geographic scale, the restriction of *S. prionotus* to lowlands and foothills adjacent to the Andes may be related to the present or historical influence of the Andes on the climate and vegetation (rainfall, temperature, and major soil types) of neighboring regions.

A curious and unexplained hiatus in the distribution of *Stenocercus prionotus* occurs between the vicinity of Tingo Maria–Río Llullapichis (Huánuco Department) and Cocha Cashu in Manu National Park (Madre de Dios Department), a gap of some 600 km that includes the entire upper reaches of the Río Ucayali–Urubamba–Ene system. Additionally, populations north and south of this gap differ in some qualitative and quantitative characters (see *Patterns of Sympatry and Geographic Variation in* Stenocercus prionotus, *and the Need for Additional Fieldwork*). Scattered collections (e.g., maps in Fritts, 1974; Avila-Pires, 1995), but no comprehensive herpetofaunal surveys or collections, are available from this vast region. Thus, whether the geographic hiatus is real or a sampling artifact cannot be discerned. Efforts to resolve this issue need to be made.

Unconfirmed Bolivian Localities for Stenocercus prionotus. Because of the previous confusion of *Stenocercus prionotus* with *S. caducus,* specimens perhaps referable to *S. prionotus* from several localities in Bolivia are unconfirmed. Boulenger (1898) reported specimens of "*Liocephalus caducus,* Cope" in the Museo Civico Storia Naturale Giacomo Doria in Genoa collected by Luigi Balzan from four localities (Balzan, 1931). I have not attempted to verify the existence of these specimens. However, one of Balzan's specimens from "Barraca, Rio Madidi" was exchanged to the BMNH (now BMNH 98.6.94), and is confirmed as *S. prionotus.* The "*Leiocephalus caducus*" specimens from the other three Balzan localities are outside the known distribution of *S. caducus* but are close to other known localities for *S. prionotus* in northern Bolivia (Fig. 1). I suspect these are *S. prionotus* based on geographic location. The localities are, as listed by Boulenger (1898) (see Fig. 1), (1) "Coroico and Chulumani, Prov. Yungas, 1,600 metres alt." [La Paz Department; Coroico, 1,725 m, 16°10′S, 67°44′W; Chulumani, 1,905 m, 16°24′S, 67°31′W]. (2) "Reyes, right bank of Rio Beni" [El Beni Department, 232 m; 14°19′S, 67°23′W]. (3) "Missiones [sic] Mosetenes" [approximately 15°31′S, 67°25′W].[5] These

[5] The Moseten Indians inhabited upper reaches of the Río Beni and its tributaries in the Andean foothills of the present department of La Paz (Métraux,

localities would not be unusual for *S. prionotus,* although the first two localities are the highest elevations recorded for the species (the species occurs at 1500 m in nearby Puno Department, Peru). All are in the upper reaches of the Río Beni, whereas the two confirmed Bolivian localities for *S. prionotus* are farther north in the same drainage.

Burt and Burt (1931: 273) listed two specimens of "*Leiocephalus* [=*Stenocercus*] *scapularis*" (AMNH 22450, 22532) from Rurrenabaque, Bolivia [El Beni Department; 14°28′S, 67°34′W]. These were reidentified in 1971 by Thomas H. Fritts as *Stenocercus caducus* but they are presently missing from the AMNH collection (Linda Ford, in litt., February 1999). Rurrenabaque is very close to Balzan's locality (2) above. Based solely on presumed habitats and presently known distributions of *S. prionotus* and *S. caducus* in eastern Bolivia (see text; Fig. 1), I suspect that AMNH 22450 and 22532 are most likely *S. prionotus.* They should be reexamined if they are ever located. As an outside possibility, any of the unverified specimens from these Bolivian localities could represent *S. fimbriatus,* which is now known from southern Peru (Appendix).

PATTERNS OF SYMPATRY AND GEOGRAPHIC VARIATION IN *STENOCERCUS PRIONOTUS,* AND THE NEED FOR ADDITIONAL FIELDWORK

Stenocercus prionotus varies geographically in several characters, most notably in the height of the vertebral crest. Because of the potential role of the crest in either intra- or interspecific communication it seems appropriate to discuss patterns of geographic variation in *S. prionotus* in the context of the distribution of other species of the "*Ophryoessoides* group." In this regard, patterns of sympatry among species of this group in Peru and Bolivia are especially relevant.

Patterns of Sympatry of Species in the "Ophryoessoides *Group.*" The most complex distributional patterns for the "*Ophryoessoides* group" are in northern and central Peru, where six species occur (*Stenocercus aculeatus, S. fimbriatus, S. prionotus, S. huancabambae, S. scapularis,* and an undescribed species; Fig. 2). In contrast to the other species, *S. huancabambae* and the undescribed species occur in comparatively dry deciduous forests west of the known distributions for the other species. Their distributions probably do not overlap the other species and they will not be considered further here. Based on known latitudinal and elevational distributions, three species (*S. aculeatus, S. fimbriatus,* and *S. prionotus*) are probably broadly sympatric in northern Peru, although sympatry is documented only for pairs of these at three localities (Fig. 2; Table 2). The habitat preferences of the species in the region of sympatry are unknown.

Whether *Stenocercus scapularis* is sympatric with *S. prionotus* is less clear. *Stenocercus scapularis* is known from two widely separated areas in Huánuco and Puno departments (Peru) (Fig. 1; Appendix), and it seems to be elevationally parapatric to *S. prionotus* in northern Peru (Huánuco Department). In this area, *S. scapularis* occurs above 1,000 m and *S. prionotus* is not known above 700 m. In Puno Department, *S. prionotus* is known from a series obtained by Hilda Heller at San Juan del Oro (1,520 m elevation), which elevationally overlaps the distribution of *S. scapularis* in the same region (1,000–1,830 m). However, these two species have not been taken at the same lo-

1942). According to Métraux (1942: 15), by the end of the 19th century when Balzan collected his specimens the decimated population of the Mosetenes was concentrated in the three "Misiones Mosetenes" of San Miguel de Muchanes (15°14′S, 67°39′W), Santa Ana (15°31′S, 67°30′W), and Covendo (15°49′S, 67°06′W). The approximate coordinates given in the text are the average for these three sites. According to several maps with elevational contours indicated, Muchanes and Covendo are between 500 and 1,000 m and Santa Ana is less than 500 m in elevation. Mathews (1879) also discusses these missions.

cality in southern Peru. Interestingly, although the largest series of *S. prionotus* available from a single locality (San Juan del Oro) is in the elevational range of *S. scapularis,* no specimens of that species were obtained by Heller during a monthlong stay at the site.

In southern Peru and Bolivia, *Stenocercus prionotus* is not known to be sympatric with other members of the "*Ophryoessoides* group." However, based on the occurrence of *S. prionotus* and *S. fimbriatus* at two nearby localities within Manu National Park (Cocha Cashu and Pakitza,[6] respectively), sympatry for these two species is expected along the Andean front in this region. In southern Peru and Bolivia, *S. prionotus* is also broadly sympatric with *S. roseiventris,* a large terrestrial species that is superficially similar to species of the "*Ophryoessoides* group." However, these species have been taken together at only one locality, Explorer's Inn.

To summarize these patterns of sympatry, the distributions of three species of the "*Ophryoessoides* group" overlap broadly in northern Peru. *Stenocercus prionotus* is known to be sympatric with at least one other species of the group in Huánuco and Loreto departments. No species of the "*Ophryoessoides* group" are known to be sympatric in southern Peru and Bolivia.

Geographic Variation. Geographic variation pertains to both quantitative and qualitative characters in *Stenocercus prionotus.* Specimens from the northern part of the range have higher average counts of midbody scales than southern specimens, which is shown graphically in Figure 8. However, there is broad overlap in the counts from opposite ends of the range. A reverse trend (lower counts in the north), occurs in the number of vertebral (dorsal crest) scales (Fig. 9); this reflects the reduced prominence, and hence smaller scales, of the crest in southern populations. None of these differences in scale counts is statistically significant.

The height of the vertebral crest shows strong clinal variation in *Stenocercus prionotus.* Populations from northern and central Peru have higher crests than those from southern Peru and Bolivia (Fig. 10). However, the absence of specimens between Huánuco Department in central Peru and Manu National Park (Madre de Dios Department) in southern Peru (Fig. 1) makes it impossible to analyze this trend in detail. Specimens from the former region have a high crest typical of all specimens from that area and farther north, whereas specimens from Madre de Dios Department and farther south have distinctly lower crests. The crest is not strongly sexually dimorphic in either region.

Whether the transition in crest height is abrupt or gradual between central and southern Peru is unclear. Indeed, it is unclear whether intervening populations of *Stenocercus prionotus* exist. Both patterns of clinal variation have been extensively documented empirically and theoretically for many organisms (Endler, 1977). The pattern of geographic variation in *S. prionotus* could conform to any of several in Endler's (1977: 4) classification scheme. However, present knowledge of distributions and character variation is most similar to Endler's "differentiated disjunction" pattern, wherein disjunct populations of a species diverge in one or more characters. Further speculation is not fruitful in the absence of more extensive collections from the region of disjunction in eastern Peru.

A Hypothesis of Causation for Geographic Differentiation in the Vertebral Crest of Stenocercus prionotus. Variation in the height of the vertebral crest is a prominent distinction between northern and southern populations of *Stenocercus prionotus.* This variation calls for an explanation while at the same time recognizing that, in the absence of experimental or field studies, ascribing causation to pat-

[6] The record of *Stenocercus fimbriatus* from Pakitza (Appendix) extends the known range for this species south by approximately 200 km from Balta in Ucayali Department, Peru (Avila-Pires, 1995).

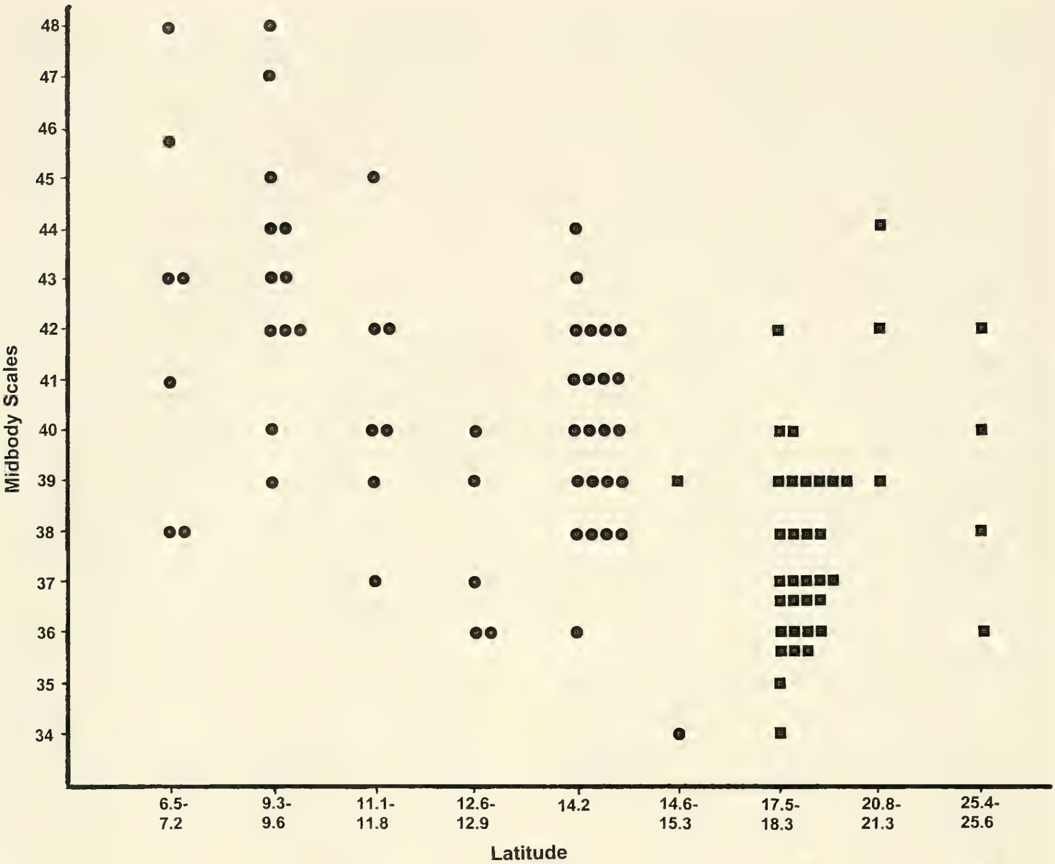


Figure 8. Geographic variation in the number of midbody scales in *Stenocercus prionotus* (●) and *S. caducus* (■). Each symbol represents one specimen; counts for all specimens examined are plotted. The horizontal axis represents degrees south latitude for each locality converted to a decimal value (e.g., 17°30′ converted to 17.5); geographically contiguous localities were arbitrarily combined to yield the latitudinal ranges given. The *S. caducus* specimens examined were biased toward Bolivian specimens.

terns of geographic variation is difficult. Vertebral crests in iguanids are visual signals. The crests in sexually dimorphic species are involved in intraspecific behavioral encounters, especially intrasexual aggression (e.g., Watkins, 1998). Nonetheless, despite strong geographic differentiation, the vertebral crest in *Stenocercus prionotus* is not strongly sexually dimorphic in any part of its range. Thus, a role in intrasexual behavioral signaling seems unlikely to be the primary function of the crest in this species. Intersexual signalling is a possibility, but this would not explain why northern and southern populations differ so strongly in this character.

Populations of *Stenocercus prionotus* with the highest vertebral crests occur in the area of highest species density and documented sympatry for the "*Ophryoessoides* group" (Table 2 and above discussion). Not only do northern populations of *S. prionotus* have the highest vertebral crests within this species, but in northern and central Peru *S. prionotus* has a much more prominent vertebral crest than other species of the "*Ophryoessoides* group" (*S. aculeatus* approaches it most closely). In

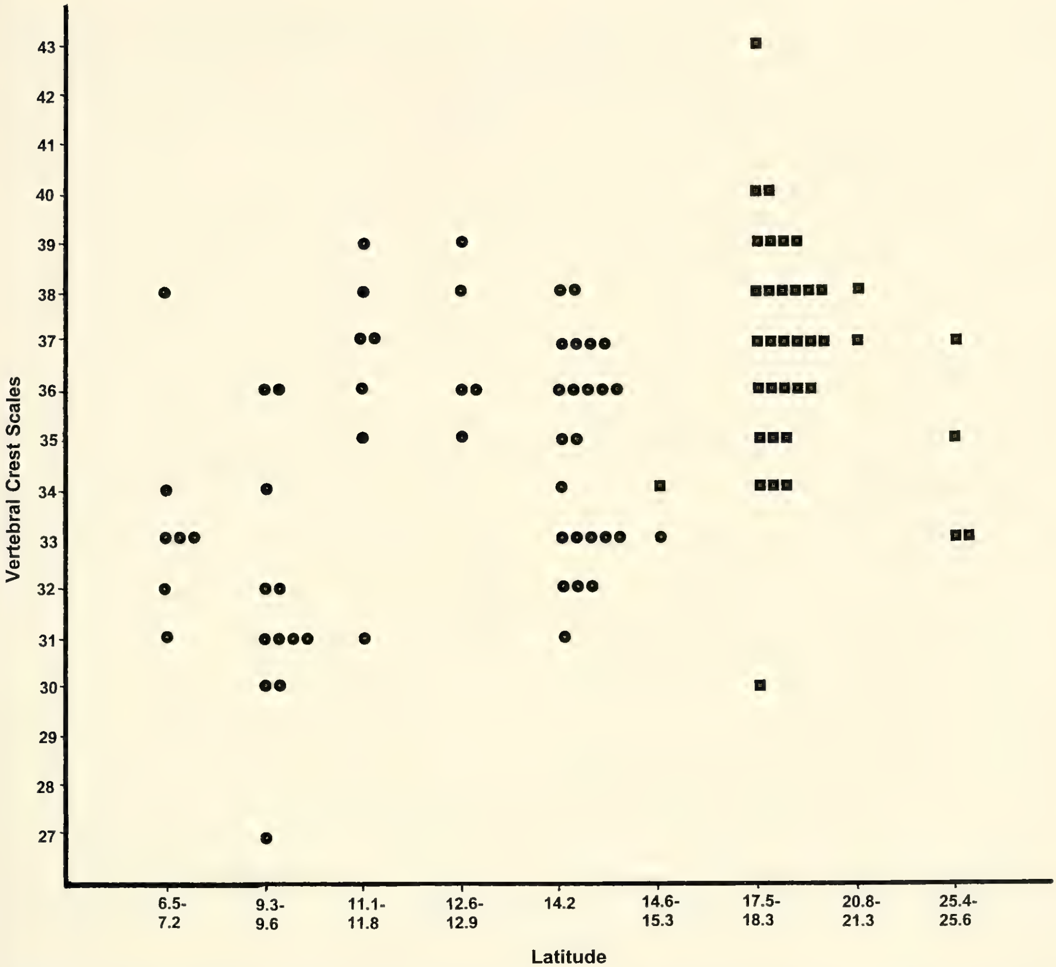


Figure 9. Geographic variation in the number of vertebral crest scales in *Stenocercus prionotus* and *S. caducus.* Symbols and axes are the same as Figure 8.

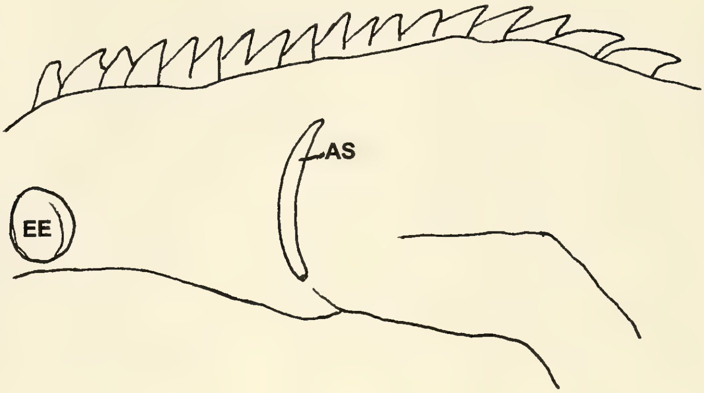
contrast, in southern Peru and northern Bolivia the distribution of *S. prionotus* overlaps only *S. scapularis* and (perhaps) *S. fimbriatus* of the "*Ophryoessoides* group," but *S. prionotus* is not known to be sympatric with either of these species.[7]

[7] The only case of sympatry of any of these with other species of *Stenocercus* of which I am aware involves *S. prionotus* and *S. roseiventris* at Explorer's Inn (cf. Table 2), but *S. roseiventris* is phenotypically dissimilar to species of the "*Ophryoessoides* group" in having shorter limbs, different color pattern, spiny tail, and different body form.

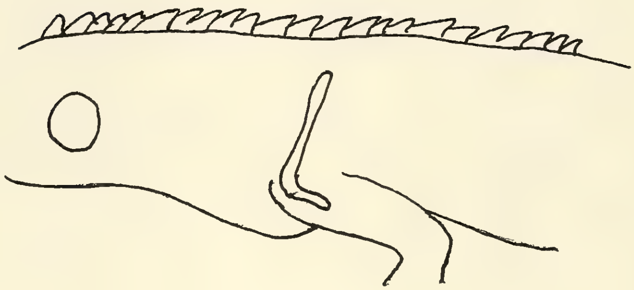
The vertebral crest of *S. prionotus* in southern Peru and northern Bolivia is similar in development to that in allopatric populations of *S. aculeatus.*

I conjecture that the strongly developed vertebral crests of *Stenocercus prionotus* in northern Peru may be related to the presence of multiple sympatric congeners in that part of the range, and that the crest functions as a species recognition character. If true, this explanation for variation in crest height would have no precedent among lizards. The only analogous situa-

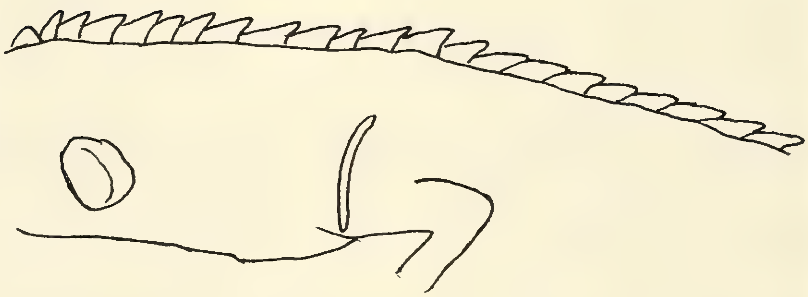
(a) *prionotus*
Huánuco, Peru
67 mm



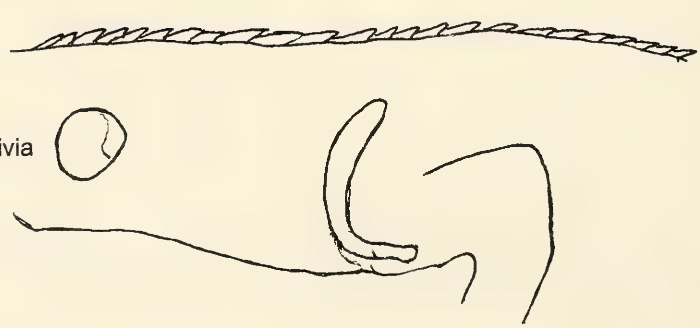
(b) *prionotus*
Puno, Peru
73 mm



(c) *prionotus*
Beni, Bolivia
81 mm



(d) *caducus*
Sta. Cruz, Bolivia
72 mm



tion seems to be dewlaps in *Anolis,* in which species recognition has been postulated as a biological role for dewlap color and size in complex assemblages of these lizards (Williams and Rand, 1977; Losos and Chu, 1998).

The Need for Additional Fieldwork. Only field observations and experimental studies of the function of the vertebral crest in *Stenocercus prionotus* can determine whether the functional hypothesis advanced here is correct. Ideally, parallel studies should be conducted in the area of sympatry with other species of the "*Ophryoessoides* group," as well as in the area with no known sympatric species of that group. That design would permit an evaluation of any context-dependent use of the crest in these populations. Two sympatric species are known from the vicinity of Tingo Maria (Huánuco Department; Table 2), a very accessible area for study.

Two other reasons for additional comprehensive fieldwork on these species are indicated. First, we need documentation of the extent to which species of the "*Ophryoessoides* group" are sympatric or syntopic. Particular targets should be the northern part of the range of *Stenocercus prionotus,* where *S. aculeatus* and *S. fimbriatus* are known to have overlapping ranges; and Manu National Park in southern Peru, a reasonably accessible area where *S. fimbriatus* and *S. prionotus* are known to be closely allopatric (but not sympatric) on a microgeographic scale (Table 2). Second, the character differences between the northern populations of *S. prionotus* and those of southern Peru and Bolivia could indicate that two or more species reside within my concept of this species. Fieldwork concentrated in the geographic gap between Tingo Maria and vicinity (Huánuco Department) and Cocha Cashu (Madre de Dios department), the two most proximate localities of the northern and southern population groups, is needed to verify whether intermediate populations occur. The possibility that these might be two allopatric species separated by a broad geographic gap should not be dismissed without further evaluation.

NATURAL HISTORY OF *STENOCERCUS PRIONOTUS*

Few natural history observations exist for *Stenocercus prionotus.* Wade C. Sherbrooke (field notes) found the holotype running in the relatively open floor of a bamboo garden at about 1200 h. USNM 193685 was taken along a trail within rainforest. Brief notes associated with the series from Explorer's Inn (Madre de Dios Department, Peru; USNM 247468–69, 247680, 269022) indicate that specimens were obtained during the day on the ground from clearings around the lodge, although USNM 269022, an adult female (91 mm SVL), was on a leaf 40 cm above the ground. MCZ 150243 was retrieved from a mist net near the edge of tall floodplain forest at Cocha Cashu. In the dry season (September–December) of a lowland rainforest in the vicinity of Tumi Chucua (Beni Department, Bolivia), Fugler (1986: table 5) found *Stenocercus prionotus* (reported as *Ophryoessoides aculeatus*) in varzea (seasonally inundated rainforest) but not in terra firme rainforests of the area; females with enlarged eggs were found in early November (Fugler, 1986: table 4).

Hilda H. Heller provided the following

←

Figure 10. Diagrammatic representation of geographic and size-related variation in the height of the vertebral crest in *Stenocercus prionotus* and *S. caducus.* Drawings were made with a camera lucida to emphasize the form and height of the vertebral crest. Sketches are drawn to an approximately uniform interval between the external ear opening (EE) and the white antehumeral stripe (AS). For each specimen the geographic location and the SVL are given (all specimens are adult males): (a) MCZ 43759, (b) FMNH 64799, (c) USNM 280250, (d) CM 970. Note especially the differences between the northern specimen of *S. prionotus* (a) compared to southern ones (b and c), especially given the size differences among these; and the differences between size-matched specimens of *S. prionotus* and *S. caducus* (b and d).

notes on the San Juan [del Oro] locality from which she obtained a series of *Stenocercus prionotus* in the early 1950s (K. P. Schmidt archives, FMNH):

> Steep forest with deep undergrowth. Steep fields. Rainfall probably somewhat greater than at Pampa Grande,[8] due to its colder climate and steep exposure; I have no figures. Brushy second growth may be burned in fairly wide patches in August, and [the] resort is frequently made to burning, indicating a moderately dry winter period.

As of the mid-1980s very little undisturbed forest was left in the vicinity of San Juan del Oro (personal observations). Although Heller provided detailed notes on some of the snakes and frogs from her collection, she makes no specific comments about the lizards.

Most observations suggest that *Stenocercus prionotus* prefers open habitats, such as areas of human disturbance and light gaps within forests (e.g., created by trails), rather than deep rainforests. Alternatively, the observations may simply indicate the ease of observation and capture in more open habitats. A combination of cryptic coloration and escape behavior (rapid flight followed by immobility) possibly makes *S. prionotus* very difficult to observe in closed-canopy rainforest, as reported for the similar species, *S. fimbriatus* (Dixon and Soini, 1986; Avila-Pires, 1995) and *S. caducus* (Scrocchi et al., 1985).[9] However, we currently lack observations to support these statements for *S. prionotus*.

COMPARISON OF *STENOCERCUS PRIONOTUS* WITH *S. CADUCUS*

A scaly flap associated with the posthumeral pockets is a unique and unquestionably derived character shared by *Stenocercus prionotus* and *S. caducus*, which suggests that these are sister species (Figs. 5, 11).[10] I am unaware of a similar structure in any other lizards. Some individual variation in the precise form and size of the flap occurs in both species but it seems extremely improbable that these structures are not homologous in the two species.

Moreoever, *Stenocercus prionotus* and *S. caducus* are similar in standard meristic characters (Table 1; Figs. 8, 9), and the similarity among Bolivian populations of both species has caused confusion about the identity of particular populations (see citations in the synonymy of *S. prionotus*). Geographic, ontogenetic, or individual variation of some characters within both species, especially the height of the vertebral crest and the number of midbody scale rows (Fig. 8), further clouds the distinctions between them. Differentiating the northern populations of *S. prionotus* from *S. caducus* is unequivocal and facile based solely on the size of the vertebral crest and on associated meristic counts. However, specimens of *S. prionotus* from southern Peru and northern Bolivia are more difficult to distinguish from *S. caducus*. For example, animals from populations of *S. prionotus* in southern Peru and Bolivia have less prominent vertebral crests (hence, higher vertebral scale counts), and generally lower numbers of midbody scale rows, than do specimens from northern populations (Figs. 8, 9); in these respects they are more similar to *S. caducus*. Nevertheless, even accounting for these difficulties, a combination of three qualitative characters is sufficient to distinguish *S. prionotus* from *S. caducus*, and the species

[8] I have been unable to localize Pampa Grande.

[9] Cei (1993) claimed that *Stenocercus caducus* was arboreal, but Scrocchi et al. (1985) reported the behavior of this species in more detail and stated that it was terrestrial.

[10] In my comparisons I have emphasized Bolivian specimens referred to *Stenocercus caducus*, whereas the type locality is "Paraguay." I have not fully convinced myself that specimens referred to this species from Bolivia, Paraguay, and Argentina are, in fact, all the same taxon. Considerable variation exists in some aspects of coloration and scale characters in these specimens. However, my concept of *S. caducus* corresponds to that used in current literature (e.g., Gallardo, 1959; Scrocchi et al., 1985; Cei, 1993). Only a thorough study of *S. caducus* across its range will resolve this issue.

may differ in patterns of sexual size dimorphism.[11]

The Form of the Vertebral Crest. Despite geographic variation in the prominence of the vertebral crest, males and females of *Stenocercus prionotus* have a distinctly projecting serrate vertebral crest extending from the nuchal region to the anterior portion of the tail (Figs. 6, 10, 12). The scales of the crest are strongly triangular in lateral view, are flaplike (i.e., they bend easily), project vertically from the dorsum, and are strongly differentiated from the adjacent dorsal scales. Although the crest is somewhat less developed in females, it is prominent in both sexes. Specimens from northern Bolivia and southern Peru have a substantially lower crest than specimens from central and northern Peru (Fig. 10). Nonetheless, the form and projection angle of the crest scales is the same as in the northern populations.

In contrast, the scales of the vertebral crest in *Stenocercus caducus* are only moderately differentiated from adjacent dorsal scales in being more strongly keeled and mucronate. The crest in *S. caducus* is only slightly projecting in males (Fig. 10) and even less so in females (Fig. 12); the crest is mainly apparent on the neck and anterior body. In *S. caducus,* the scales of the crest are stiff and prismatic, and the main axis of projection is posterior rather than vertical, as in *S. prionotus.*

Crest height in *Stenocercus* varies positively with size and thus it is critical to compare similar-sized specimens when documenting differences among population samples or species. This realization has been critical to differentiating *Stenocercus prionotus* from *S. caducus* in southern Peru and Bolivia. Large adult males of *S. prionotus* from southern populations are scarce in collections. For example, although only 18 specimens of *S. prionotus* are available from northern Peru, one half of these are males with SVL ≥60 mm. In

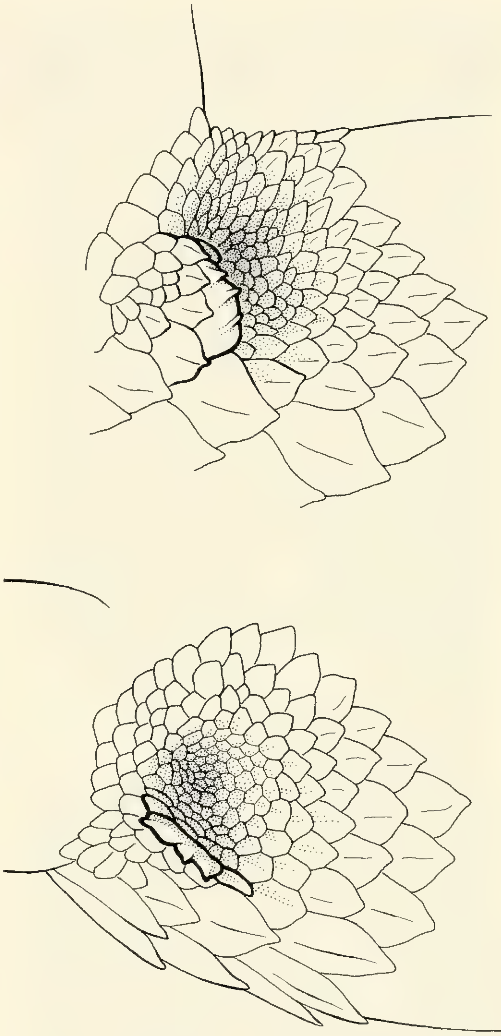


Figure 11. Axillary region of *Stenocercus caducus* showing the posthumeral flap (MCZ 34215). Anterior to the left. The posthumeral flap comprises the heavily outlined scales posteroventral to the forelimb. The opening of the posthumeral pocket is the heavily stippled area deep to the flap. Top, Posthumeral flap in its normal orientation covering the anteroventral portion of the pocket. Bottom, the flap deflected ventrally, with its posterior scales viewed from their tips. Approximately ×8.5.

[11] I am uncertain how Fugler (1983, 1986, 1989) distinguished Bolivian specimens he referred to *Stenocercus aculeatus* and *S. caducus.* In 1983 and 1986 he referred specimens from Tumi Chucua (Beni, Bolivia) to *S. aculeatus.* In 1989 he listed these again, along with ROM specimens from San Marcos Ranch (Beni, Bolivia) identified as *S. caducus.* Fugler specimens from these localities that I have examined are all *S. prionotus* (see list of paratypes).

contrast, twice as many specimens each of *S. prionotus* and *S. caducus* are available from southern Peru and Bolivia. Yet, only one third of the available specimens of either species from these areas are males ≥60 mm SVL, and no males of *S. caducus* were >72 mm SVL.

Figure 10 shows differences in the height of the vertebral crest in a series of males of *Stenocercus prionotus* from southern Peru and Bolivia compared with similar-sized specimens of *S. prionotus* from northern Peru and with *S. caducus* (the largest males of *S. caducus* studied were 72 mm SVL; see also Fig. 6). The trend toward lower crests in *S. prionotus* from the southern part of its range is evident, as is the difference between *S. caducus* and *S. prionotus*. A comparison of all specimens suggests that the difference in the height of the vertebral crest between *S. prionotus* and *S. caducus* males begins to be apparent by approximately 65 mm SVL and becomes pronounced at around 70–75 mm SVL. No males of *S. caducus* >72 mm SVL were among the specimens examined, despite the availability of a large number of specimens from southern Bolivia, including a series of 31 specimens (10 males ≥60 mm SVL) from the vicinity of Santa Cruz. A similar contrast in crest height appears in females of the two species (Fig. 12).

Angulate Temporal Scales. Stenocercus prionotus has two (occasionally three) very strongly keeled, projecting angulate temporal scales on each side (Fig. 4). These are much larger than adjacent scales on the head and they are partially or completely separated from the large posterior head scales (parietals, postparietals, and occipital) by one row of small keeled scales (occasionally partially doubled). *Stenocercus caducus* usually has two (occasionally three) angulate temporals that are smaller and less projecting than those in *S. prionotus*. In *S. caducus* the angulate temporals may or may not be larger than adjacent posterior head scales and they are not strongly differentiated from other posterior head scales.

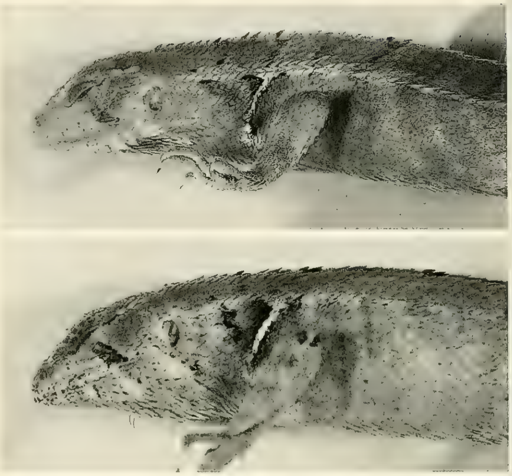


Figure 12. Size-matched females of *Stenocercus prionotus* and *S. caducus* from Bolivia. Top, *S. prionotus* (USNM 269022, snout–vent length [SVL] 91 mm). Bottom, *S. caducus* (UTA 38046, SVL 93 mm). Note the subtle difference in crest height between the two specimens and their otherwise similar patterns.

Color Pattern of the Gular Region. Many specimens of *Stenocercus prionotus* have a regular pattern of alternating diagonal light and dark stripes on the throat. These usually converge closely toward the midline (Fig. 7) and are most easily visualized in preserved specimens submerged in alcohol. This pattern consists of a dark stripe beginning at a point on the lower labials in line with, but broader than, the subocular dark bar. The stripe projects posteromedially, gradually fading and blending with the ventral ground color on the neck anterior to the pectoral region. The dark stripe is bordered on either side by a distinct pale stripe. Anteriorly, this series is preceded by another dark and another pale stripe. The dark stripes are usually approximately twice as wide as the pale ones, although not always (e.g., the dark stripes are only slightly wider than the pale ones in MCZ 150243). In life the pattern may manifest itself as a series of pale stripes on a darker background (e.g., the "gular area streaked by several light cream colored lines" in the life colors of the holotype).

The gular region appears uniform in many preserved specimens of *Stenocercus prionotus,* but I suspect this is a preservation artifact. Occasional specimens have pale spots in the pectoral region, and others are essentially unicolor and without apparent pattern (again, probably a preservation artifact).

On the other hand, the throat pattern of *Stenocercus caducus* is highly variable and irregular. When a distinctive pattern is present, it most often consists of light spots rather than alternating stripes (Fig. 13). Cope (1862) described the holotype of *S. caducus* from Paraguay as having a dark throat that was "light varied" (i.e., variegated, or spotted), and some specimens I examined have this pattern (Fig. 13). None of several color descriptions for Argentinian specimens of *S. caducus* mention stripes or spots on the throat. Scrocchi et al. (1985) described living examples as having pale spots in parallel transverse rows in the pectoral region or with pale spots on the abdomen, but did not comment on the throat pattern; Gallardo (1959) described the ventral coloration as "pale olive with some scattered pale spots; throat darker"; and Cei (1993) described the venter as "dark brownish with series of rounded pale spots, sometimes anastomosing along the length of a median line." Although no authors mention alternating light and dark stripes on the throat in *S. caducus,* UTA 38046 does have this pattern (Fig. 13). But in this specimen the stripes are confined to the lateral edges of the throat (i.e., do not closely approach the midline as in *S. prionotus*). Apart from the throat pattern, the coloration of *S. prionotus* and *S. caducus* seems to be very similar judging from descriptions of *S. caducus* in the literature (Gallardo, 1959; Scrocchi et al., 1985; Cei, 1993).

A Possible Difference in Sexual Size Dimorphism. Data presented in Table 1 suggests another contrast between *Stenocercus prionotus* and *S. caducus*: *S. prionotus*

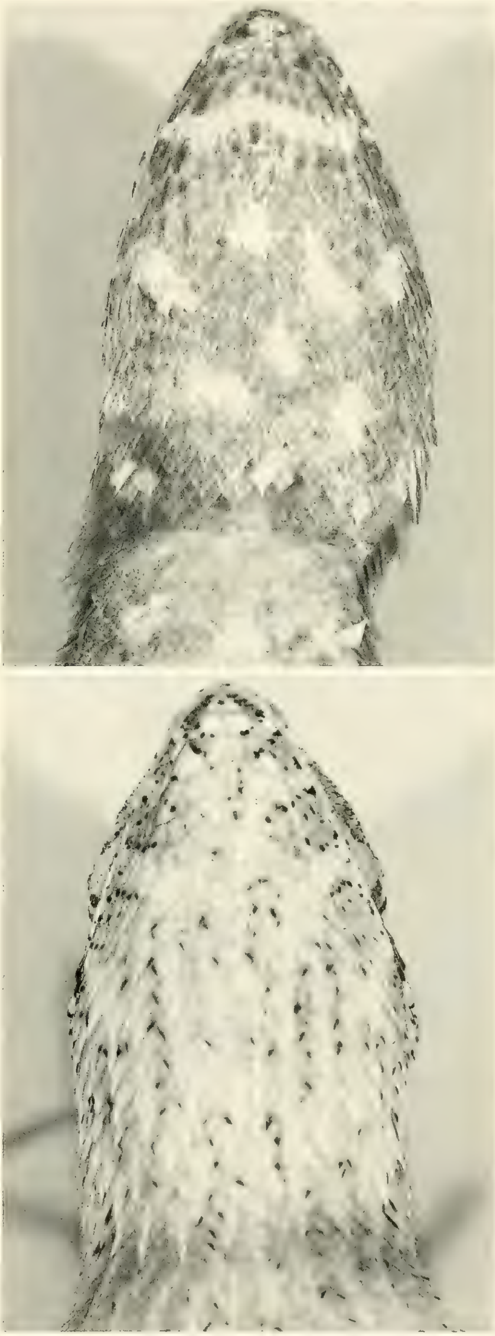


Figure 13. Gular patterns in *Stenocercus caducus.* Top, typical throat pattern consisting of light spots on a dark background (BMNH 1927.8.1.163). Bottom, variant pattern consisting of stripes confined to the lateral portion of the throat (UTA 38046). Compare to Figure 7.

is not dimorphic in the maximum sizes attained by males and females, whereas females of *S. caducus* apparently attain about 20 mm greater SVL than males. However, estimating maximum size is subject to considerable sampling error so this distinction should be considered to be only provisional. Nonetheless, males of *S. prionotus* with SVL >80 mm are known from the northern (USNM 193685) and southern (USNM 280250, BMNH 98.6.9.4) portions of its range, even though the three largest males from the largest population sample (23 specimens in FMNH from Puno Department, Peru) had an SVL of 73 mm (this sample included six adult females with an SVL of 78–89 mm).

In contrast, a sample of 39 *Stenocercus caducus* from Bolivia included 12 adult males, none of which had an SVL >72 mm; in the total sample of *S. caducus* (*N* = 43) 17 females had an SVL ≥80 mm (range 80–93 mm).[12] Thus, unless a systematic collecting bias against males exists, the different pattern of sexual size dimorphism provides another character distinguishing *S. prionotus* and *S. caducus*. Data presented in Table 1 suggests that other species of the "*Ophryoessoides* group" may be size dimorphic (*S. fimbriatus, S. huancabambae,* and ?*S. scapularis*) or not (*S. aculeatus*), and either males (*S. huancabambae*) or females (*S. caducus* and *S. fimbriatus*) may attain a larger body size.

DISTRIBUTIONS OF *STENOCERCUS PRIONOTUS* AND *S. CADUCUS* IN EASTERN BOLIVIA

The ranges of *Stenocercus prionotus* and *S. caducus* approach one another in eastern Bolivia, but do not overlap.[13] Currently, the two closest documented localities are, for *S. prionotus*, near the junction of the Río Madidi and the Río Beni (BMNH 98.6.9.4), and for *S. caducus*, many specimens from the vicinity of Santa Cruz de la Sierra (see above discussion for *S. prionotus* and Appendix; Fig. 1). *Stenocercus caducus* is also known from the Bolivia–Brazil border in the region of the Serranía de Huanchaca in northern Santa Cruz Department, Bolivia.[14]

I am aware of no specimens of *Stenocercus* referable to either *S. caducus* or *S. prionotus* between the Río Beni valley and roughly a line connecting Santa Cruz and the vicinity of Serranía de Huanchaca. Southeast of the Río Beni, the central part of the Beni basin (the Llanos de Mojos) is characterized by flooded savanna grasslands, palm savannas, swamps, and other habitats that are inundated for significant portions of the year; terra firme forests are restricted to somewhat elevated levees along rivers (Clapperton, 1993: 196; Hanagarth, 1993). *Stenocercus prionotus* or *S. caducus* seem unlikely to occur in this area except possibly in these gallery forests, although Fugler (1986) reported *S. prionotus* (as *Ophryoessoides aculeatus*) in seasonally flooded forest during the dry season.

Stenocercus prionotus and *S. caducus* probably are segregated by habitat in Bolivia and their distributions may not overlap. *Stenocercus prionotus* is associated

[12] These sizes are somewhat larger than those previously reported (81 mm; Gallardo, 1959; Scrocchi et al., 1985; Marcus, 1986). Cei (1993) stated that *S. caducus* reaches only 75 mm SVL in Argentina. Sexes were not given for any individual or sexed specimens in these reports.

[13] All references to "*Ophryoessoides aculeatus*" in Bolivia (e.g., Fugler, 1983, 1986) that I verified have referred to *Stenocercus prionotus*. However, given the general confusion of species in this complex, some records not traced will have to be checked to rule out the possibility that they do not refer to *S. caducus* or perhaps some other species of the "*Ophryoessoides* group," such as *S. fimbriatus* or *S. scapularis* (see *Distribution Patterns in* Stenocercus prionotus).

[14] See the Appendix, UTA 38048. Michael Harvey (personal communication) recently obtained specimens of *Stenocercus caducus* at El Refugio, a lowland locality at the southern end of the Serranía de Huanchaca (14°44′S, 61°01′W).

with upper Amazonian and lower montane rainforests with annual rainfall greater than 2,000 mm in both Peru and Bolivia. On the other hand, confirmed localities of *S. caducus* are within the physiographic domain broadly referred to as chaco, including a mixture of dry forests, palm savannas, gallery forests, deciduous forests, and ecotonal areas (Scrocchi et al., 1985; Marcus, 1986; Cei, 1993). Short (1975) and Parker et al. (1993) described the diversity of chaco habitats. Gallardo (1979: table 12.1) listed *S. caducus* as a species "basically restricted to the chaco." Average annual rainfall in this area is less than 1,000 mm. *Stenocercus caducus* is known from Parque Nacional Noel Kempff Mercado and vicinity in Bolivia (see footnote 14; Harvey, 1998). This area is characterized by a complex mixture of habitat types, including deciduous forests and cerrado enclaves, and with an annual rainfall of 1,400–1,500 mm (Killeen, 1998). Harvey (1998) encountered *S. caducus* at granitic outcrops covered by semideciduous forests and more open habitats. The herpetofauna of this site is a mixture of species that are typical of Amazonian and of chaco environments (Harvey, 1998; personal observations).

The range of *Stenocercus caducus* extends outside the strictly defined chaco region (see Short, 1975, and Clapperton 1993, for discussion) on the southeastern edge of its range east of the Río Paraguay and in the Andean foothills of southern Bolivia and northern Argentina (Fig. 1). Harvey (1997) reported *S. caducus* from "subtropical wet forests" (1,150–2,050 m elevation) in southern Bolivia. He characterized *S. caducus* as a "Chacoan species that invade[s] the Andean foothills . . . [including] those distributed within the Gran Chaco or that occur in dry forests surrounding the Gran Chaco" (Harvey, 1997: 35). The montane wet forests (yungas) of this area are restricted to ridges high enough for cloud formation during much of the year (generally >1,500 m elevation), and they are surrounded by deciduous dry forest (Schulenberg et al., 1997). The climate of this area is generally dry and it receives only about 1,200 mm of rainfall per year (Holst, 1997).

The transition between the wet rainforests of Peru and northern Bolivia (range of *Stenocercus prionotus*) and the chaco habitats (range of *S. caducus*) occurs in a very broad ecotone consisting of savannas, evergreen shrublands, and gallery forests of the Beni basin and Río Mamore drainage, from which no specimens of either *S. prionotus* or *S. caducus* have been reported. The piedmont forests of the Andes between the known ranges of *S. prionotus* and *S. caducus*, which are wetter than adjacent lowland forests because of the moderating effect of the Andes, provide one potential route for contact or overlap of their ranges.

The eastern distributional limits of *Stenocercus caducus* along the Bolivia–Brazil frontier are not well understood. I am unaware of verified records from Brazil, although the species does occur close to the Brazilian border in the vicinity of the Serranía de Huanchaca in Parque Nacional Noel Kempff Mercado. Some references to "*Stenocercus caducus*" from western Brazil (e.g., Mato Grosso State; Cope, 1887; Boulenger, 1903) likely refer instead to an undescribed species very similar to *S. caducus* (P. E. Vanzolini and E. E. Williams, personal communication; personal observations). However, the ranges of *S. caducus* and the undescribed species in eastern Bolivia–Paraguay and western Brazil are not well defined; the two species may be separated by the seasonally inundated savannas of the pantanal. Additionally, few specimens of *S. caducus* apparently exist from the chaco of northwestern Paraguay, although Aquino et al. (1996) reported specimens from Parque Nacional Defensores del Chaco (approximately 20°30′S, 60°20′W), as well as other Paraguayan localities in more mesic regions east of the Río Paraguay.

IS THE DISTRIBUTION OF *STENOCERCUS ACULEATUS* DISJUNCT?

In the process of diagnosing *Stenocercus prionotus* I reviewed the characters and distribution of *S. aculeatus*. In addition to variation in some characters of uncertain significance, some aspects of the distribution of *S. aculeatus* seem peculiar (Fig. 2). First, the distribution of *S. aculeatus* appears to be disjunct between northern Peru and eastern Ecuador. Although the type locality is in northern Peru (Moyabamba, San Martín Department), most specimens are from eastern Ecuador (Fig. 2). The two areas from which specimens are known (Fig. 2) are separated by a broad geographic gap through which courses the main tributary of the upper Amazon, the Río Marañon. Neither *S. aculeatus* nor any other species of *Stenocercus* was obtained during herpetofaunal surveys in northern Loreto Department, Peru (Duellman and Mendelson, 1995), northern Amazonas Department, Peru (Río Cenepa and Río Santiago; J. E. Cadle and R. W. McDiarmid, unpublished data), or during a rapid biological assessment of the Cordillera del Condor region of southeastern Ecuador and northern Peru (Schulenberg and Awbrey, 1997a). *Stenocercus aculeatus* is known from many localities in adjacent regions of Ecuador.

Second, all Ecuadorian localities for *Stenocercus aculeatus* are in the drainages of the Río Pastaza and the Río Curaray. No specimens are known from the Río Napo drainage just to the north, even though no recognized physiographic or faunal break seems to separate the Río Napo drainage from the Río Curaray drainage. However, all localities that have been sampled comprehensively from the Río Napo are on the left (northern) bank of the river (e.g., Duellman, 1978; Vitt and De la Torre, 1996; unpublished list from a large collection from the Jatun Sacha Biological Station assembled and under study by Gregory Vigle). The absence of *S. aculeatus* from Santa Cecilia (Duellman, 1978) is probably real rather than sampling error, given the intensity of collecting over several years at the site. Thus, *S. aculeatus* possibly does occur on the right (south) bank of the Río Napo and will be recorded once large collections are made there.

The apparent geographic disjunction of *Stenocercus aculeatus* between northern Peru and eastern Ecuador may correspond to some character differences among samples that should be studied more thoroughly (Cadle, unpublished data). For example, Peruvian specimens of *S. aculeatus* have very deep postfemoral pockets (Type 5) in both sexes, whereas the postfemoral pockets are more weakly developed in specimens from Ecuador (Type 2 or 3 in both sexes). Ecuadorian specimens also appear to have more scales in the vertebral row and fewer subdigital scales on the fourth toe than do Peruvian specimens. All of these impressions are based on small sample sizes (Appendix).

The significance of these differences is unclear without a more detailed study of variation among populations of *Stenocercus aculeatus*. However, one possibility is that two or more species are represented in specimens currently referred to *S. aculeatus*, in which case the distributions of individual taxa may be not be contiguous. This is analogous to the previous confusion of *S. fimbriatus* and *S. prionotus* with *S. aculeatus*. Taxonomic recognition of *S. fimbriatus* and *S. prionotus* has concomitantly reduced the geographic distribution understood for *S. aculeatus*. Consequently, a more comprehensive systematic analysis of *S. aculeatus* with special reference to a comparison of Ecuadorian and Peruvian populations is warranted. If two species are recognized, the name *Liocephalus angulifer* Werner (1901) is available for the Ecuadorian populations.

KEY TO SPECIES OF THE "*OPHRYOESSOIDES* GROUP" OF *STENOCERCUS*

Because of the general confusion about the species considered herein (e.g., see the synonymy of *Stenocercus prionotus*), I provide the following key as a guide for identifications. The key will work for those species of *Stenocercus* in Peru or Bolivia with keeled ventral scales, enlarged posterior head scales, and one row of moderately to greatly enlarged supraoculars ("*Ophryoessoides* group" as used herein). I have also included the three other currently recognized species having these characteristics, *S. erythrogaster* (Hallowell), *S. dumerilii* (Steindachner), and *S. tricristatus* (Duméril), although these are not known from Peru or Bolivia and are unlikely to occur there. Character and distributional data in the key for *S. dumerilii* and *S. tricristatus* follow Avila-Pires (1995).

I also include in the key an undescribed species with keeled ventrals and enlarged head plates and supraoculars from Amazonas Department, Peru, but I am unaware of other undescribed species of the "*Ophryoessoides* group" from Peru or Bolivia. However, an undescribed species similar to *Stenocercus caducus* (but lacking a posthumeral flap) is known from western Brazil (Mato Grosso) and is not included in the key. Additional study of *S. iridescens* from the Pacfic lowlands of Peru and Ecuador is needed (Cadle, 1998: footnote 4) and, as indicated above, a thorough modern study of variation in *S. aculeatus* (Amazonian Ecuador and Peru) is also warranted. Other undescribed species may reside within either of these named taxa. The key will permit identification of all Peruvian and Bolivian taxa previously confused with *S. aculeatus* (e.g., Dixon and Soini, 1975, 1986 [*S. fimbriatus*]; Fugler, 1983, 1986, 1989 [*S. prionotus*]) and *S. iridescens* (e.g., *S. huancabambae* and *S. limitaris*; see Cadle, 1991, 1998). The key also should work for Ecuadorian species, with the caveat that I have paid less attention to Ecuadorian *Stenocercus* except as necessary in conjunction with work on Peruvian species. Of the species covered, only *S. aculeatus, S. iridescens,* and *S. limitaris* are definitely known from Ecuador.

The key should be viewed as a means of identifying a set of phenotypically similar, but not necessarily closely related, species within *Stenocercus* in the broad sense. All other species of *Stenocercus* in Peru and Bolivia have smooth (or at most only very weakly keeled) ventrals and more fragmented supraoculars and head plates; see Fritts (1974), Frost (1992), and Cadle (1991, 1998) for discussion and illustrations. Many of these species also have granular scales on the body or posterior surface of the thigh, neither of which is present in species covered by the key. The keys and discussions in Fritts (1974) and Cadle (1991, 1998) are useful for identifying these other species.

The key assumes familiarity with characters of the mite pockets, head scales, and neck folds and crests outlined in Cadle (1991) (see also *Materials and Methods*). In most cases I have used characters that show minimal sexual dimorphism so that specimens of either sex can be identified; exceptions are noted. It is useful to keep in mind that, in most species of *Stenocercus,* scales of juveniles are more prominently keeled than in adults, even when the corresponding scales of adults, such as head scales and dorsal body scales, are smooth. Instances of possible confusion in the key are indicated. The extent of development of posthumeral and postfemoral mite pockets varies according to sex and size in many species of *Stenocercus,* although such variation seems less extensive in this set of species than in many others; I have indicated the range of variation including juveniles and adults of both sexes in the key. Summary geographic distributions are given for each species as a rough guide to known occurrences. However, these should be used cautiously as ancillary information in identifying specimens because distributions of species are sometimes poorly circumscribed. For greatest utility the key should be used in conjunction with illustrations herein and in Cadle (1991, 1998) and Avila-Pires (1995).

1. Canthal and supraciliaries forming a pronounced crest that ends in an enlarged, erect, postsupraciliary that may be distinctly pointed or blunt. Posthumeral and postfemoral mite pockets absent (Type 1 in both instances) 2

   Canthals and supraciliaries not forming a pronounced crest; no enlarged, erect postsupraciliary. Posthumeral pocket absent (Type 1) to deep (Type 4). Postfemoral pocket absent (Type 1) to deep (Type 5) 3

2. Enlarged postsupraciliary distinctly pointed. Two enlarged scales above ear opening. Tibia approximately equal to thigh length .... *Stenocercus dumerilii* (Steindachner) (northeastern Pará, Brazil)

   Enlarged postsupraciliary blunt. No enlarged scales above ear opening; tibia distinctly shorter than thigh .... *Stenocercus tricristatus* (Duméril) (known only from the holotype, probably from the state of Minas Gerais, Brazil)

3. Superciliary scales projecting laterally shelf-like above the orbit in adults, rectangular in dorsal view.[15] Midbody dorsal scale rows more than 55 (59–70). Postfemoral pocket well developed (Type 3 or 5) .... *Stenocercus scapularis* (Boulenger) (intermediate elevations on the Andean slopes of central and southern Peru; known elevations greater than 1,000 m)

   Superciliary scales not projecting laterally, the anterior ones elongate, strongly overlapping. Midbody dorsal scale rows fewer than 55 (30–53). Postfemoral pocket variable (Type 1, 2, 3, or 5) 4

4. Posthumeral mite pocket deep (Type 4) and with an associated scaly flap extending from its anteroventral border and partally concealing it 5

   Posthumeral mite pocket absent to deep (Type 1, 2, 3, or 4) but without an associated flap 6

5. Vertebral crest strongly projecting in both sexes, serrate, extending from the nuchal region to the proximal portion of the tail; its individual scales triangular, flaplike. Throat often with alternating oblique dark and light stripes. Two enlarged, strongly keeled and projecting angulate temporal scales on each side .... *Stenocercus prionotus* Cadle (rainforested lowlands and Andean foothills of eastern Peru and northern Bolivia)

   Vertebral crest low, nonprojecting in both sexes (slightly higher in males), evident mainly on neck and anterior body; its individual scales prismatic and lying more or less flat. Throat pattern variable, but usually consisting of light spots on a darker background when evident. Angulate temporal scales keeled, but not greatly enlarged, and nonprojecting .... *Stenocercus caducus* (Cope) (deciduous woodlands and ecotonal areas of southern Bolivia, northern Argentina, and the chaco of Paraguay)

6. A fringe of enlarged fimbriate scales on the distal posterodorsal surface of thigh. Several longitudinally oblique rows of large, strongly keeled scales on shank.[16] Scales between vertebral and dorsolateral crests smooth or occasionally very weakly keeled. .... *Stenocercus fimbriatus* Avila-Pires (lowlands of eastern Peru and central western Amazonian Brazil)

   No fringe of fimbriate scales on thigh or strongly keeled oblique scales on shank. Scales between vertebral and dorsolateral crests moderately to strongly keeled at least posteriorly; dorsolateral crest may be weakly developed, but dorsal scales still strongly keeled 7

7. Posthumeral mite pocket variable (Type 1, 2, 3, or 4). Postfemoral mite pocket variable (Type 1, 2, 3, or 5). Head scales smooth or keeled. Angulate temporal scales keeled, may be projecting and bladelike. Internasals usually 4 or more (occasionally 3, never 2), often irregular in pattern and shape. 8

   Posthumeral mite pocket absent or weakly developed (Type 1 or 2). Postfemoral mite pocket absent (Type 1). Head scales smooth. Angulate temporal scales smooth; none bladelike and projecting. Two polygonal internasals in contact on the midline, each broader laterally than medially. .... *Stenocercus iridescens* (Günther) (Pacific lowlands and intermediate elevations of western Ecuador and northwestern Peru)

8. One to 3 strongly keeled, but nonprojecting, angulate temporal scales in line with the superciliary row between the lateral tem-

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[15] The superciliaries in juveniles of *Stenocercus scapularis* have a more typical shape. The extent of shelf-like projection and change to a more rectangular shape seem positively correlated with body size and thus develop with age. The number of dorsal scale rows and the development of the postfemoral pocket are useful clues for subadults.

[16] The fimbriate scales form a projecting fringe on the distal portion of the thigh. Both the fimbriate scales and the oblique scales on the shank are relatively more prominent in juveniles than adults.

porals and the posterior dorsal head scales. Two subequal canthal scales on each side. Head scales keeled, at least posteriorly 9

Two projecting bladelike angulate temporals in line with superciliary row. A single canthal on each side (rarely, 2 are present but in that case 1 is much larger than the other). Head scales smooth or keeled. 11

9. Posthumeral pocket moderately developed in males (Type 2 or 3), absent in females (Type 1). Postfemoral pocket absent in females (Type 1), moderate to deep in males (Type 3 or 5). Anterior gular scales weakly to strongly keeled. .... *Stenocercus erythrogaster* (Hallowell) (northern Colombia)

Posthumeral and postfemoral pockets deep in both sexes (Types 4 and 5, respectively).[17] Anterior gular scales smooth to weakly keeled. 10

10. Interparietal indistinct, parietal eye not visible. Three occipitals. Dark subocular bar absent. Three angulate temporals separated from large posterior head scales by a row of tiny scales ..... *Stenocercus* new species (known from a single specimen [Appendix] from the inter-Andean valley of the Río Marañon near Balsas, Amazonas Department, Peru)

Interparietal distinct, parietal eye visible. Two occipitals. Dark subocular bar present. One angulate temporal much larger than others and in contact with at least 1 other enlarged posterior head scale. .... *Stenocercus limitaris* Cadle (intermediate elevations [600–2,200 m] of the Andes on the Pacific versant of southwestern Ecuador and northwestern Peru)

11. Head scales smooth to slightly wrinkled in adults; weakly keeled, wrinkled, or rugose in juveniles. Prominent dorsolateral crest on body from neck to base of tail and continuous with both supra-auricular crest and antehumeral crest. Postfemoral pocket moderate to deep (Type 2, 3, or 5). .... *Stenocercus aculeatus* (O'Shaughnessy) (rainforested lowlands and intermediate elevations of northern Peru adjacent to the Andes and in eastern Ecuador)

Head scales strongly keeled or multicarinate in juveniles and adults. Dorsolateral crest, when present, weak and restricted to neck and anterior body. Postfemoral pocket deep (Type 5). .... *Stenocercus huancabambae* Cadle (dry inter-Andean valleys of the upper Río Marañon in Cajamarca and west central Amazonas departments, northern Peru)

[17] An undescribed species in the next couplet of the key is known only from a single adult male. The distributions of species in couplets 9 and 10 should be used as ancillary data for identification.

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APPENDIX: SPECIMENS EXAMINED

Institutional abbreviations are as follows:

AMNH	American Museum of Natural History, New York
ANSP	Academy of Natural Sciences of Philadelphia
BMNH	The Natural History Museum, London
CM	Carnegie Museum of Natural History, Pittsburgh, Pennsylvania
FMNH	The Field Museum, Chicago
KU	Natural History Museum, University of Kansas, Lawrence
LSUMNS	Louisiana State University Museum of Natural Science, Baton Rouge
MCZ	Museum of Comparative Zoology, Harvard University, Cambridge
ROM	Royal Ontario Museum, Toronto
USNM	National Museum of Natural History, Washington, D.C.
UTA	University of Texas at Arlington

Bracketed information was inferred from sources listed in the *Materials and Methods*. For specimens of other species of the "*Ophryoessoides* group" examined (*S. huancabambae*, *S. iridescens*, and *S. limitaris*), see Cadle (1991, 1998). Boldface numbered localities 1–4 are known or suspected areas of sympatry between the species listed and *Stenocercus prionotus*. They correspond to numbered localities in Figures 1 and 2 and in the text discussion.

Stenocercus aculeatus

ECUADOR: Prov. Morona-Santiago: Chiguaza [ca. 1,000 m; 01°59′S, 77°58′W] (USNM 200882–84). **[?Prov. Napo/Tungurahua]:** Llanganates area[18] (FMNH 23527). **Prov. Pastaza:** Río Pastaza, Abitagua [01°23′S, 78°05′W] (FMNH 25803–05, 26892, 28011, 28057 [=17 specimens]). Río Pastaza, Alpayacu [01°28′S, 78°07′W] (FMNH 3926–27; MCZ 8081). Canelos [01°35′S, 77°45′W; 530 m] (MCZ 38530). Montalvo, Río Bobonaza [314 m; 02°04′S, 76°58′W] (USNM 200892). **[?Prov. Pastaza]:** Baños, Mera Trail [? = between Baños and Mera[19]; approximately 01°30′S, 78°10′W] (FMNH 28012).

PERU: [Depto. La Libertad]: E Peru, Pampa Seca, Río Mixiolla [=Río Mishollo] Valley, Upper Huallaga region, 4300 ft [**2,** 1,311 m; approximately 08°16′S, 76°58′W][20] (AMNH 57085). **[Depto. Lor-**

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[18] I have been unable to localize this. The Cordillera de los Llanganates is a high range (to >4,500 m) in the Cordillera Oriental north of the Río Pastaza (Paynter, 1993). The locality may refer to lower elevations in this range.

[19] Baños is a famous collecting locality at the foot of Volcán Tungurahua at 1,820 m. That would be an altitudinal record for *Stenocercus aculeatus*. I interpret the locality as stated in the FMNH catalogues as being on the trail between Baños and Mera, which is at 1,160 m. See Brown (1941) and Chapman (1926) for discussion.

[20] Harvey Bassler collected *Stenocercus* for the AMNH at two localities on the Río Mixiolla (=Río Mishollo): Pampa Seca and La Pinita (see *Stenocercus fimbriatus*), as listed in AMNH catalogues. The Río Mishollo originates in southeastern La Libertad Department, flows eastward, and joins the Río Huallaga in southwestern San Martín Department. The elevations given for these localities, 1,067 m and 1,311 m, indicate that they lie in the narrow stretch of the valley that straddles the boundary between La Libertad and San Martín departments (departmental maps produced by the Instituto Geográfico Nacional, Lima). I identify these localities as Pampaseca and Piñita, respectively, in extreme southeastern La Libertad Department, as indexed by Stiglich (1922). Both localities are in Ongón District and the coordinates given are those for the town of Ongón. Stiglich (1922) states that Piñita is a small village on the Quebrada Pedernal, a left tributary of the Río Mishollo. Apart from indicating that Pampaseca is a farm,

ETO]: NE Peru, Front Range between Moyabamba and Cahuapanas, 3000 ft [915 m; approximately 05°37′S, 77°00′W] (AMNH 57083). Northeastern Peru: Icuta on Balsapuerto–Moyabamba trail, 3500 ft [1,067 m; 05°58′S, 76°40′W; given as "Icuto" or "Icuto Cuesta" by Lamas, 1976] (AMNH 56413).

Stenocercus caducus

BOLIVIA: NO SPECIFIC LOCALITY: BMNH 1946.8.29.76 (holotype of *Leiocephalus bolivianus* Boulenger); CM 4583–84. **DEPTO. CHUQUISACA:** Sud Cinti, trail from Rinconada Bufete to El Palmar [1,170–2,000 m; approximately 20°50′S, 64°21′W] (UTA 39102). **DEPTO. SANTA CRUZ:** Buena Vista, ca. 500 m [17°27′S, 63°40′W] (MCZ 20625–26, 29023; FMNH 16165, 21486, 21511; BMNH 1927.8.1.163–164; CM 4527, 4550–51, 4558, 4587–88, 4605, 4607, 4616, 4626, 4634–36, 4641). Las Yuntas [=Las Juntas;[21] 18°38′S, 63°08′W] (CM 970). Provincia Chiquitos, Santiago (Serranía and nearby), 700–750 m [18°19′S, 59°34′W] (FMNH 195983). [Provincia] Chiquitos, Canton El Cerro, Finca Dos Milanos, 17°27′30″S, 62°20′00″W (UTA 38046). Provincia Sara, eastern Bolivia, 600 m [17°27′S, 63°40′W] (BMNH 1907.10.31.7–8). Provincia Sara, Santa Cruz de la Sierra [17°48′S, 63°10′W] (CM 966, 969, 13018). Provincia Sara, Río Surutu W of Buena Vista [17°24′S, 63°51′W] (CM 4590). Provincia Sara, Río Colorado [17°38′S, 63°54′W] (CM 4598). [Provincia] Velasco, Inselbergs near Florida [14°38′S, 61°15′W] (UTA 38048). **[DEPTO. TARIJA]:** Villa Montes [21°15′S, 63°30′W] (MCZ 28634). Misión San Francisco [21°15′S, 63°30′W] (BMNH 98.7.7.5; specimen collected by Alfredo Borelli, whose San Francisco = Villa Montes fide Paynter, 1992).

PARAGUAY: [DEPTO. CAAGUAZÚ]: Pastoreo [approximately 25°23′S, 55°52′W] (MCZ 34214–15). **[DEPTO. CENTRAL]:** Asunción [25°16′S, 57°40′W] (FMNH 9496). Colonia Nueva Italia [25°37′S, 57°30′W] (FMNH 42281).

Stenocercus erythrogaster

COLOMBIA: [DEPTO. MAGDALENA]: Río Frio [30–450 m; 10°55′N, 74°10′W] (MCZ 29707). Santa Marta Mountains [approximately 10°50′N, 73°40′W] (MCZ 11303). Río Toribio, Hacienda "Papare," second river on road from Cienaga to Santa Marta [11°03′N, 74°14′W] (FMNH 165153). **[DEPTO. SANTANDER]:** San Gil [1,095 m; 06°33′N, 73°08′W] (ANSP 24136, MCZ 36877).

Stenocercus fimbriatus

PERU: NO SPECIFIC LOCALITY: (FMNH 56070). **DEPTO. HUÁNUCO:** ca. 35 km NE Tingo Maria, Hcda. Santa Elena, ca. 1000 m [approximately 08°57′S, 76°02′W] (LSUMNS 26966–67). Approximately ½ mile E Universidad Agraria de La Selva, Tingo Maria, vicinity of Río Huallaga [**3**, 09°18′S, 75°59′W], USNM 193684. **[DEPTO. LA LIBERTAD]:** E Peru, La Pinita, Río Mixiolla, tributary of upper [Río] Huallaga, 3500 ft [1,067 m; approximately 08°16′S, 76°58′W; see footnote 20] (AMNH 56797–98). **[DEPTO. LORETO]:** E Peru, Contamana, Ucayali River valley [134 m; 07°15′S, 74°54′W] (AMNH 56803). E Peru, E of Contamana on trail to Contaya, 700 ft [213 m; approximately 07°15′S, 74°54′W] (AMNH 56781–82). E Peru, Pampa Hermosa, mouth of Río Cushabatay, 500 ft [152 m] [**1**, 07°12′S, 75°17′W] (AMNH 56788, 56790–92, 56794–96, 56801–02). Mishana, Río Nanay, Estación Biológica Cauicebus, 150 m [03°53′S, 73°27′W] (USNM 222377). Mishuana [=Mishana; 150 m, 03°53′S, 73°27′W] (KU 212628). **DEPTO. MADRE DE DIOS:** Pakitza Station [Río Manu], Manu National Park [**4**, 11°56′S, 71°17′W] (Victor R. Morales 18235). **DEPTO. UCAYALI:** Río Curanja, Balta, approximately 300 m [approximately 10°08′S, 71°13′W] (LSUMNS 17519, 25402–04, 26720–23). Alto [Río] Purús, Alto [Río] Curanja, Igarape Champuiaco [9°34′S, 70°36′W] (MCZ 61226). Peru/Brazil frontier, Utoquinia Region, 1000 ft. [305 m; approximately 08°00′S, 74°00′W][22] (AMNH 56789, 56799–800).

Stenocercus scapularis[23]

PERU: NO SPECIFIC LOCALITY: (FMNH 56444). **[DEPTO. JUNÍN]:** Chanchamayo, 1200 m [approximately 11°03′S, 75°47′W] (FMNH 40608–11). Perene, 1200 m [10°58′S, 75°13′W] (MCZ 49580–81). Tarma, Chanchamayo, 1300 m [11°25′S, 75°42′W] (FMNH 45522). **[DEPTO. PUNO]:** Sagrario, Río Quitún [approximately 1,020 m; 13°55′S, 69°41′W]

Stiglich (1922) gives no further information about its location.

[21] The specimen was collected in November or December 1913 by José Steinbach, who collected at a locality known as "Las Juntas" during that same period (Paynter, 1992). The two localities are assumed to be the same. The variant spelling "Yuntas" does not appear in any sources consulted.

[22] The region referred to is north to northeast of Pucallpa. The variant spellings Utoquinia, Utoquinea, and Uroquinea are in the literature and are applied to a right-bank tributary of the Río Ucayali, a village on the Río Ucayali, and an airstrip on the Río Utoquinia near the Brazilian border. The entire region is less than 500 m in elevation except for a small raised area near the Brazilian border that attains nearly 800 m and that is apparently the source of the Río Utoquinia.

[23] The occurrence of *Stenocercus scapularis* at Rurrenabaque, El Beni Department, Bolivia, as reported for two specimens in the AMNH (Burt and Burt, 1931: 273) is apparently based on a misidentification. These specimens are probably either *S. prionotus* (most likely) or *S. caducus* (see *Distribution Patterns in* Stenocercus prionotus).

(FMNH 40408). "Camp 4" [between Santo Domingo and La Pampa; approximately 13°44′S, 69°37′W][24] (FMNH 40409). Juliaca, Lake Aracona, 16,600 ft. [shipping point only; correct locality is on the right bank of the Río Inambari, 1,830 m, 13°30′S, 70°00′W][25] (AMNH 1701).

[24] According to the field catalogue in the FMNH Mammal Division the collector, Colin Sanborn, was in Santo Domingo on 20 October 1941 and in La Pampa on 23 October (see also notes in Stephens and Traylor, 1983). The specimen FMNH 40409 was collected 21 October, and thus "Camp 4" is assumed to be between these points.

[25] The specimen was collected in 1900 by H. H. Keays, who collected many mammals and other vertebrates in southern Peru, primarily for the American Museum of Natural History. It is clear that most of the specimens labeled with the locality "Juliaca" (a town on the Peruvian altiplano near Lake Titicaca) actually came from farther north in the Río Inambari valley. Allen (1900: 219; 1901: 41) provides the following information:

> The Museum has recently received two small collections of mammals made by Mr. H. H. Keays, at Juliaca, in southeatern Peru, a little to the westward of Lake Titicaca. Mr. Keays writes: "Our camp is situated in the loop of the Inambary River. The country is very broken, with deep narrow cañons, and is covered with a dense undergrowth of shrubs and vines, with here or there a palmetto or a cedar rising above the surrounding vegetation." He gives the altitude as 6000 feet [1,830 m], and the position as latitude 13°30′ S., longitude 70° W.
>
> . . . it is necessary to correct a misleading statement in my former paper in respect to the locality where the . . . collections were made. Mr. Keays's post-office address was Juliaca, and through lack of explicit information, it was inferred that the Inca Mines, where he collected, were in the immediate vicinity of Juliaca . . . the Inca Mines are situated about 200 miles northeast of Juliaca, on the east side of the Andes, on the Inambary River, a tributary of the Amazon, and at a much lower altitude than Juliaca. The altitude and geographical position were correctly given in the former paper, but in place of Juliaca, . . . read Inca Mines.

Keays's information quoted by Allen places the locality on the right bank of the Río Inambari in the foothills of an outlying Andean spur separating the Río Inambari from upper tributaries of the Río Tambopata. I have not located a Lake Aracona and suspect that this is an error for Lake Aricoma, a high Andean lake on the route between Juliaca and the location of Keays's camp. However, it is not at all clear why this name is associated with the locality. No notes or correspondence of Keays are in the AMNH mammal department archives for further clarification (R. S. Voss, personal communication). Stephens and Traylor (1983) discuss "Inca Mines" under their entry for Santo Domingo, a settlement on the Limbani–Asterillo road, which was apparently close to the Inca Mines. See also Vaurie (1972).

Stenocercus sp.

PERU: DEPTO. AMAZONAS: 17 km ENE Balsas [06°49′S, 78°00′W] (ROM 16458).

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On the Subfamily Xylophagainae

(Family Pholadidae, Bivalvia, Mollusca)

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ON THE SUBFAMILY XYLOPHAGAINAE (FAMILY PHOLADIDAE, BIVALVIA, MOLLUSCA)

RUTH D. TURNER[1]

CONTENTS

EDITORIAL NOTE. Professor *Emerita* Ruth Dixon Turner died on 30 April 2000 and was for the last several months of her life severely disabled; in fact, her active work as a researcher was considerably foreshortened by medical problems beginning in about 1995. Among her *Nachgelassene Werke* was an important manuscript on the systematics of the deep-sea pholadid bivalve genera *Xylophaga, Xyloredo,* and *Xylopholas,* a manuscript that she had been preparing for a number of years and one that had the active support of the U.S. Department of Defense's, then, Office of Naval Research (ONR). Professor Turner was unquestionably a leading world authority on these taxa and had posted this document, in its preliminary draft form, on a Web site; after her retirement and the beginning of the illnesses that plagued her, the manuscript was removed from the Web site with the intent of readying it for formal publication. Two outside authorities, Dr. Jorgen Knudsen of the Zoologisk Museum, Københavns Universitet, København, Denmark, and Dr. K. Elaine Hoagland, then at the Association for Systematic Collections, Washington, D.C., were solicited to make criticisms, and these, along with my own, were incorporated into a more advanced revision of the text prepared by Ms. Helene Ferranti, a long time coworker and associate of Professor Turner. Ms. Ferranti agreed to revise this *Nachlass* in accordance with the comments of the reviewers and to update its content and organization. Having collaborated with Professor Turner on the subject of deep-sea bivalves, Ms. Ferranti is credited herein as the person responsible for the final completion and revision of this valuable text. The new species described, for which specimens are available for study in the Museum of Comparative Zoology (MCZ), and the taxonomic suggestions incorporated into the text are to be credited to Professor Turner.

Kenneth J. Boss
Editor

ABSTRACT. The provisional grouping of the species of the bivalve genus *Xylophaga* suggested by Turner and Culliney is further elaborated, with 37 species assigned to six groups depending on characteristics of

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the mesoplax, siphons, muscle scars, and method of reproduction. Three cases of variation in species of *Xylophaga* are discussed: variation in response to different substrates, variation that possibly is genetic, and variation in a normal growth series. Some observations are made regarding the ecology of deep-sea wood borers based on experiments carried out with wood panels; these support the hypothesis that wood contributes to the growth and diversity of deep-sea organisms and that the Xylophagainae contribute significantly to the food chain by converting wood to a usable form. A section on systematics considers 19 species of *Xylophaga,* of which 7 are new, as well as the monospecific genus *Xylopholas* and three species of *Xyloredo.* Detailed descriptions are given of new species.

INTRODUCTION

The Xylophagainae, a subfamily of the Pholadidae, is composed of the genera *Xylophaga* Turton, 1822, *Xyloredo* Turner, 1972, and *Xylopholas* Turner, 1972. Species in the genus *Xylophaga* range in depth from just below low tide (*X. dorsalis* Turton) to depths of 7,000 m (*X. grevei* Knudson), whereas species in *Xyloredo* and *Xylopholas* are restricted to the deep sea (depths of 239 to more than 2,000 m). Species in *Xyloredo* range in depth from 1,737 to more than 2,000 m (*X. nooi* Turner, 1972) and species in *Xylopholas* range from 239 to 366 m (*X. altenai* Turner, 1972), with one lot dredged in 2,550 m off Port Victoria, São Tomé, Gulf of Guinea. However, the São Tomé specimens were boring in coconut shells and may not have been living at that depth.

The Xylophagainae are marine, cosmopolitan, and range from moderate to abyssal depths. All of the Xylophagainae, so far as known, are wood borers, and all are sublittoral. Only in high latitudes do they compete with shipworms (Teredinidae) in cold boreal waters. So far as known, the Xylophagainae do not occur intertidally, or in floating wood. Wood containing specimens of the Xylophagainae usually has been obtained by dredging. Occasionally, specimens may be obtained from waterlogged wood that has been brought up and thrown ashore during a storm after being on the bottom for some time.

Until recently, the Xylophagainae were considered to be deep-sea organisms of little or no economic importance. They were rare curiosities, of interest mostly in their role of recycling wood on the continental shelf and slope and in the abyss, largely beyond the depth range of the teredinids. The Xylophagainae often were referred to as shipworms and because of the ephemeral, patchy distribution of wood in the deep sea were thought to have little impact on ecological processes. With the extension of human activities into the deep sea for fishing (especially trap fishing for lobsters and crabs), as well as for archaeology, mining, monitoring currents, and other activities, these borers are now generally considered to be pests.

Species in the genus *Xylophaga* (*Xylo* = wood, *phaga* = eating) are restricted to wood, woody plants, and structures made of wood found in the deep sea. In common with the teredinids (shipworms), they have symbiotic bacteria in their gills (Waterbury et al., 1983). These bacteria are believed to have the ability to digest cellulose and probably to fix nitrogen. Collaborative work with Dr. Waterbury, microbiologist at Woods Hole Oceanographic Institute, was unable to culture cellulose-digesting bacteria from the gills of *X. atlantica,* but evidence was found of cellulose enzymes in the gill tissue.

The three genera of Xylophagainae may be briefly characterized as follows:

Genus *Xylophaga* Turton. Siphons relatively short, of equal length or with the excurrent siphon truncated, and often capable of retraction between the valves. Burrow seldom more than five times the length of the valves and often with a chimney of fecal pellets lining the posterior end of the burrow.

Genus *Xylopholas* Turner. Shell typical but with the animal extended and with lateral plates on the siphons.

Genus *Xyloredo* Turner. Shell typical but animal elongated and producing a teredinidlike burrow that is lined with a calcareous tube marked with distinct growth rings and margined anteriorly with a periostracal band.

The Xylophagainae are often confused with teredinids, but the gills and digestive and reproductive organs in the Xylophagainae do not extend posteriorly beyond the valves. In addition, the Xylophagainae do not have pallets to close the entrance to their burrows or apophyses for the attachment of the foot muscles. In common with the teredinids, but unlike species in the pholadid genera *Martesia* and *Lignopholas,* the only other genera of wood-boring pholadids, the Xylophagainae have a large wood-storing cecum and probably utilize the wood in which they bore as food. For details of anatomy, see Purchon (1941) for *Xylophaga dorsalis* Turton, and Turner (1955) for *X. atlantica.*

SPECIES GROUPS IN THE GENUS *XYLOPHAGA*

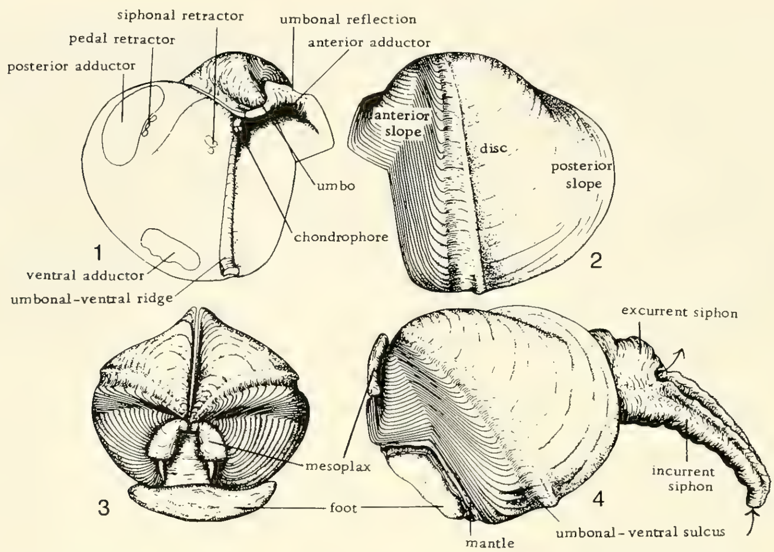
Genus *Xylophaga* Turton. *Xylophaga* Turton, 1822, Conchylia Insularum Britanicarum, p. 253 (type species, *Teredo dorsalis* Turton, 1819).

Species in this genus are characterized by teredolike shells that lack apophyses and have a divided mesoplax that is variable in shape and size. A chrondrophore and internal ligament are present. The siphons are variable, united for part or all of their length, with the excurrent siphon often truncated. The visceral mass and gills do not extend beyond the valves posteriorly. The wood-storing cecum is large.

In his discussion of the taxonomy of *Xylophaga,* Knudsen (1961) believed that the use of subgenera was not feasible and would only lead to the creation of a large number of monotypic subgenera that would be of limited value. This is still partially true but new species described in this report and the additional material now available concerning other species have made possible a provisional grouping of the species, as suggested by Turner and Culliney (1971). See also Hoagland and Turner (1981) and Hoagland (1983). This grouping is helpful when discussing relationships and geographic distribution. The characters used for grouping the species are those mainly of the mesoplax and siphons in conjunction with the muscle scars and methods of reproduction (see Text-Fig. 1). The mesoplax is a transverse plate, usually wider than long, that straddles the valves at the umbos and partially or completely covers the posterior end of the anterior adductor muscle. The mesoplax may be composed of one or two parts. The important character of the mesoplax is the presence or absence of a ventral portion and tubes; the more detailed characters, such as the presence of lobes, seem to be of specific value only. Siphonal characters include the relative length of the two siphons, the presence or absence of cirri at the apertures, and the type of siphonal folds, which may or may not have lappets or fringes.

Not all characters are known for all species and a few species seem to be transitional between groups. There is no question that more material is needed before definite statements can be made concerning the formal use of subgenera. However, the grouping of species as presented here does offer an opportunity to speculate on the possible origin and evolution of the genus and to focus attention on the types of information that should be considered in future studies. Comparative anatomical and molecular studies are greatly needed but it probably will be some time before these can be completed because well-preserved specimens of deep-sea *Xylophaga* are rare and difficult to obtain.

If we consider species with simple siphons of equal length and a mesoplax of two simple flat to slightly curved plates to be the basic type, it is possible to group the species in what appears to be a developmental series of six groups. This list does not include all nominal *Xylophaga.* The groups may be characterized as follows:



Text-Figure 1. Nomenclature of parts of *Xylophaga*. (1) Internal view of left valve showing relative position of muscle scars. (2) External view of left valve. (3) Dorsal view of animal with siphons retracted. (4) Lateral view of entire animal with siphons extended.

Group 1. Mesoplax composed of two simple flat or slightly curved plates located posterior to the anterior adductor muscle and standing erect. Siphons of equal length or with the excurrent siphon slightly shorter, cirri on one or both siphons present or absent. Group 1 includes *X. erecta* Knudsen, *X. concava* Knudsen, and *X. gerda* Turner n. sp.

Group 2. Mesoplax composed of two plates that may be curved, flat, sculptured, or smooth, set at an acute angle to each other, lack dorsal tubes and a ventral portion, but cover the anterior adductor muscle dorsally. Siphons of the same length or with the excurrent siphon slightly shorter and with large cirri on the sides of the excurrent siphon and small cirri at the incurrent siphon. Group 2 includes *X. grevei* Knudsen, *X. wolffi* Knudsen, *X. hadalis* Knudsen, *X. galatheae* Knudsen, *X. murrayi* Knudsen, *X. africana* Knudsen, *X. panamensis* Knudsen, and *X. clenchi* Turner and Culliney.

Group 3. Mesoplax composed of two nearly flat plates set at an acute angle to each other forming an inverted V, with tubes extending from the posterior dorsal surface or longitudinally folded with anterior lobes or pores. Mesoplax lacking a ventral portion and set in a tentlike fashion over the anterior adductor muscle. Siphons nearly the same length and usually with small cirri on both openings. Group 3 includes *X. supplicata* Taki and Habe, *X. lobata* Knudsen, *X. tubulata* Knudsen, *X. bruuni* Knudsen, *X. obtusata* Knudsen, *X. whoi* Turner n. sp., and *X. profunda* Turner n. sp.

Group 4. Mesoplax composed of two plates that have a small to large ventral portion, the dorsal portion being smooth, folded, or lobed. Siphons of the same length or with the excurrent siphon slightly shorter and with cirri or papillae at one or both openings. Group 4 includes *X. abyssorum* Dall, *X. duplicata* Knudsen, *X. muraokai* Turner n. sp., *X. foliata* Knudsen, and *X. atlantica* Richards.

Group 5. Mesoplax composed of two plates that are more or less triangular in outline, with a ventral portion ranging from very narrow to more than one half the width of the dorsal portion. The excurrent siphon may vary in length from one half to three quarters that of the incurrent siphon and have cirri, or it may be truncated just posterior to the valves and have dorsal lobes or folds extending from the truncation along the dorsal surface of the incurrent siphon for part or all of its length. Group 5 includes *X. washingtona* Bartsch, *X. rikuzenica* Taki and Habe, *X. aurita* Knudsen, *X. turnerae* Knudsen, and *X. praestans* E. A. Smith.

Group 6. Mesoplax composed of two more or less ear-shaped plates somewhat coiled posteriorly. Excurrent siphon truncated near the posterior end of the valves, continuing as lateral lobes extending from the truncation along the dorsal surface of the incurrent siphon. These lobes may vary in width but are always fringed. Group 6 includes *X. dorsalis* Turton, *X. depalmai* Turner n. sp., *X. guineensis* Knudsen, *X. mexicana* Dall, *X. tipperi* Turner n. sp., *X. bayeri* Turner n. sp., *X. globosa* Sowerby, *X. japonica* Taki and Habe, and *X. indica* Smith.

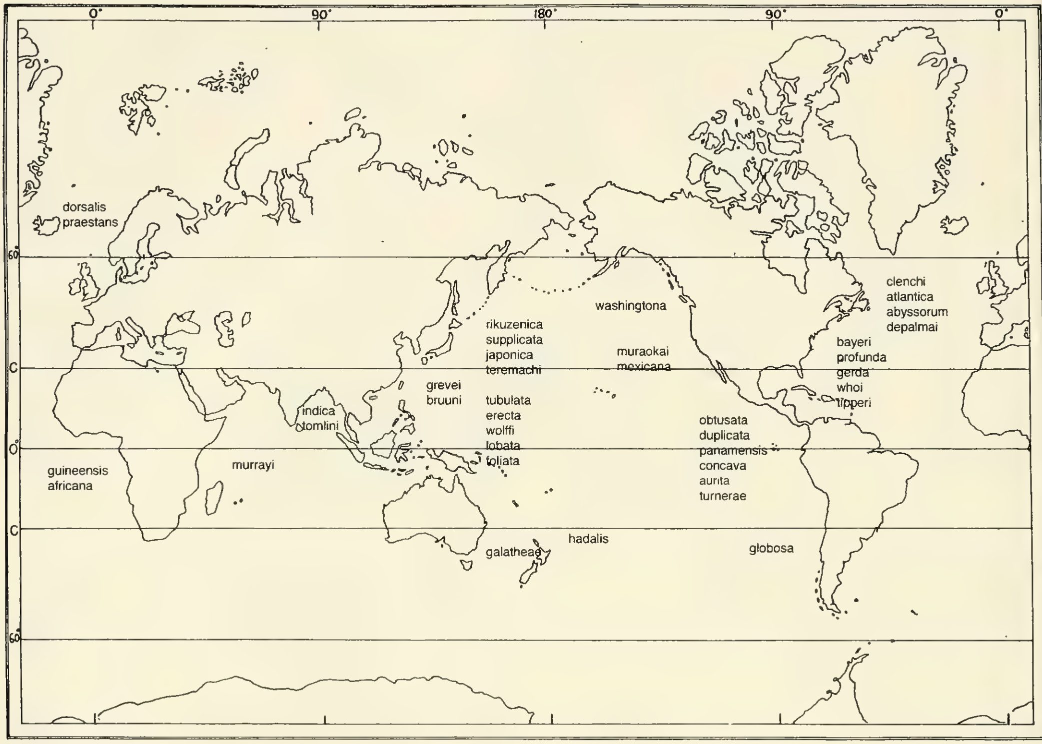
Most species are known only from the type series and these have all been studied by the author except *X. indica,* and the species described by Taki and Habe. However, paratype specimens received through the kindness of Dr. Habe are in the collection of the MCZ. They include *X. japonica, X. rikuzenica, X. teramachi,* and *X. supplicata,* although unfortunately all lack the mesoplax except the last. Two species, *X. teramachi* Taki and Habe (Taki and Habe, 1950) and *X. tomlini* Prashad (Prashad, 1932); are known only from the valves and remain unassigned. A map showing the distribution of species of *Xylophaga* is provided in Text-Figure 2.

Nineteen of the 37 species of *Xylophaga* listed in the groups above as well as the monospecific genus *Xylopholas* and the three species of *Xyloredo* are considered in the section on systematics. Some species are discussed more fully than others but the distinctive characters have been given for all. For example, *Xylophaga mexicana* Dall and *Xylophaga abyssorum* Dall are fully described because these names were based on valves only and were virtually *nomina dubia.* By matching the valves of the holotypes with complete specimens, it has been possible to fix the names of these species. If additional characters or records are given for a well-described species, a reference is made to the original description. Detailed descriptions are given for new species.

VARIATION

Knudsen (1961) aptly stated that very little was known about variation in species of *Xylophaga.* Unfortunately, large series of any one species seldom have been available for study because material usually is obtained from small pieces of wood or other plant material that has been dredged or occasionally thrown ashore as driftwood. Of the 30 species listed by Knudsen and the 7 species described as new in this paper, 24 are known from fewer than 10 specimens; only 7 species are known from series of more than 100 specimens. Most are known from only one or two localities and often all specimens are from a single piece of wood, and may all be of the same set, that is, have settled at the same time. Consequently, it is not surprising that all specimens in any one lot are quite similar. Only since the beginning of deep-sea testing and the use of the submersible DSV *Alvin* to place experimental wood islands at great depths has it been possible to obtain sufficient material to study intraspecific variation in this subfamily.

The earliest work of this sort was done by the U.S. Naval Civil Engineering Laboratory (USNCEL) and the Navy Oceanographic Office (NOO). Three cases of variation based on this material are re-



Text-Figure 2. Distribution map of species of *Xylophaga*.

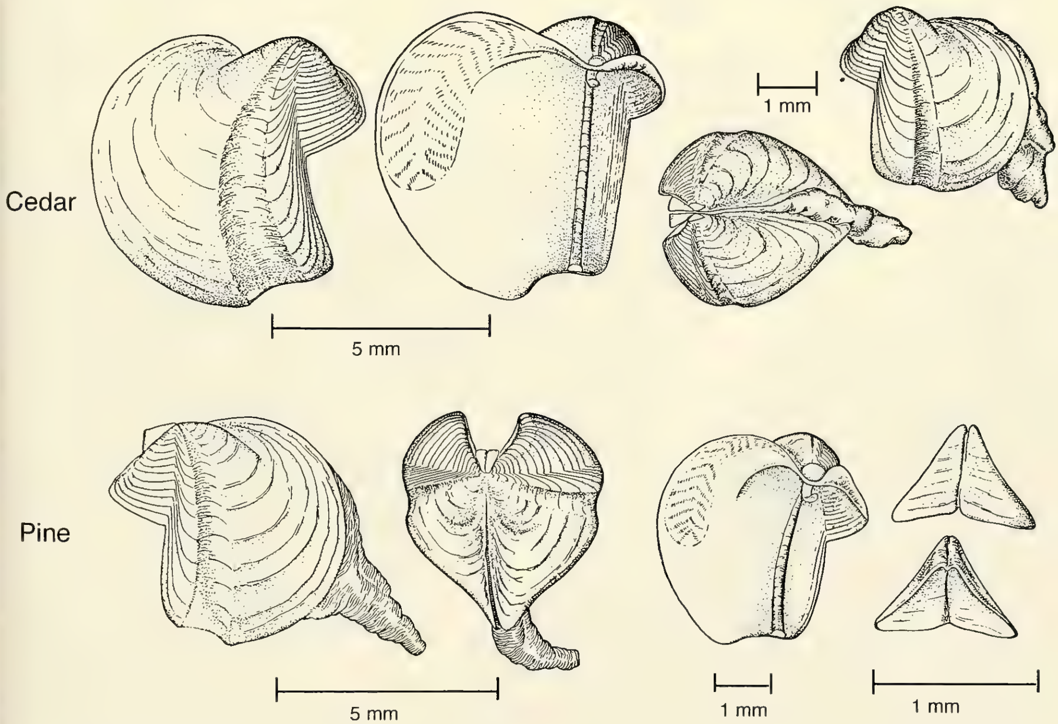
ported here. The first case involves variation in response to different substrata, the second case exhibits variation that possibly is genetic because the substrate and all other parameters were as nearly uniform as possible, and the third case illustrates variation in a normal growth series.

Variation Due to Different Substrates. Variation in *Xylophaga washingtona* in response to the substrate can be demonstrated with material from the USNCEL tests. A series of 10 panels of different types of wood were attached to a submersible test unit (STU) that was submerged from April 1965 to May 1966 off San Miguel Island, California (34°06′N, 120°42′W) at 2,370 ft (730 m) (see Table 1 and Text-Figs. 3–9). The 2 × 6 × 0.5-in (50.8 × 152.4 × 12.7-mm) wood panels were all attached to the same rack on the STU so that they would be resting just above the mudline. Consequently, all factors affecting the borers were as nearly identical as possible except the substrate (i.e., the species of wood) on which the borer larvae settled and into which they would bore. Text-Figures 3–8 illustrate typical specimens from each of the wood panels; Text-Figure 9 shows specimens from a phenolic laminated rod. It is interesting to note that the dorsal plates in all specimens are remarkably uniform, varying only slightly in length/width proportions. Even the specimens taken from the phenolic laminated rod could be identified by the dorsal plates.

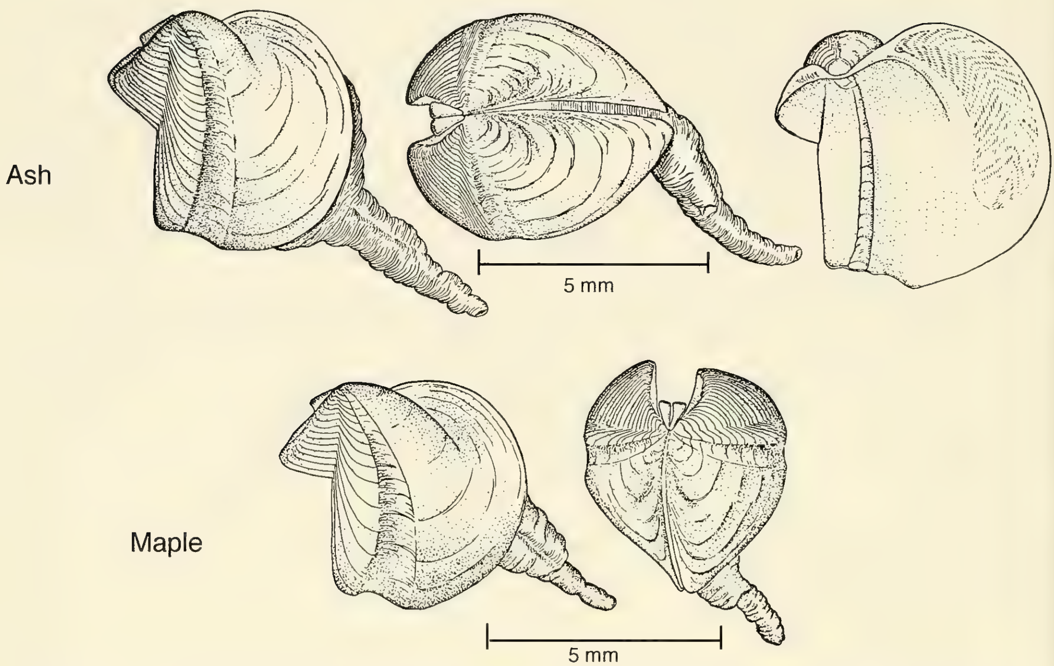
The general shape of the valves with the high posterior slope also remained rather constant except in the extremely stenomorphic (stunted) specimens from *Afambeau* and the phenolic laminated rod. It is difficult to explain the proportionate size of the larval valves on specimens boring into harder materials except that these specimens had not greatly increased in di-

TABLE 1. VARIATION OF *XYLOPHAGA WASHINGTONA* BURROWS IN DIFFERENT TYPES OF WOOD.

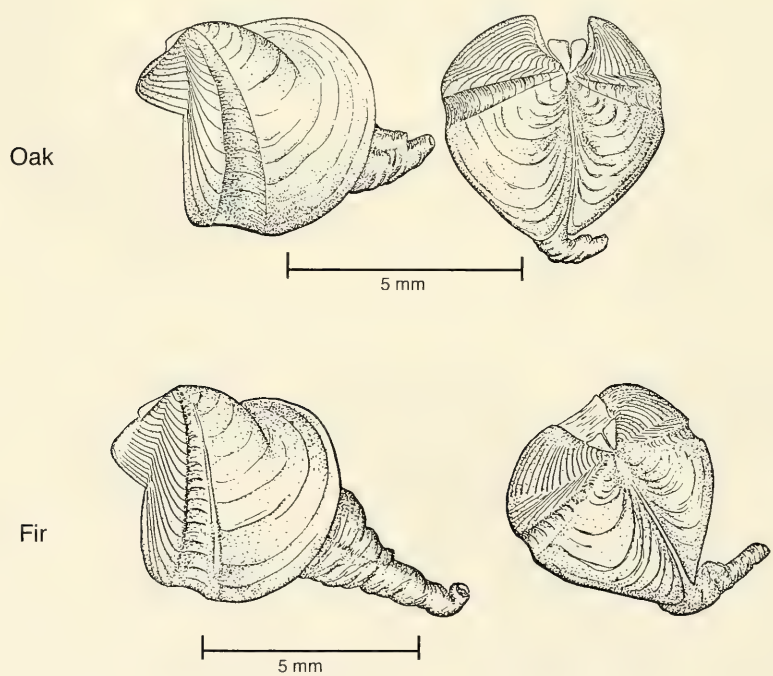
Wood	No. Specimens Examined	Burrow Length (mm)	Burrow Diameter (mm)	Remarks
Cedar	50	25.0	4.5	many dead, often three or four specimens in one enlarged cavity where burrows ran together. Heavily attacked, particularly at one end.
Ash	125	21.0	5.0	many dead, burrows running together, panel heavily attacked, particularly at one end.
Maple	75	11.0	5.5	well distributed, with a little more concentration around the hole at one end.
Pine	35	15.0	5.0	clustered at one end, newly settled to adult.
Oak	±50	15.0	6.0	evenly distributed, shells yellowish-green from wood.
Fir	46	12.0	4.5	many newly settled, often cut into burrows of other specimens.
Redwood	46	14.0	4.5	specimens stained dark red brown by wood.
Greenheart	75	2.75	1.75	concentrated around edges.
Afambeau	19	0.75	0.05	concentrated at one end, all very small, many in umbo stage veliger, 15 small depressions without animals.
Antidesma pulvinatum	150	0.10	0.05	many newly settled, just beginning metamorphosis.



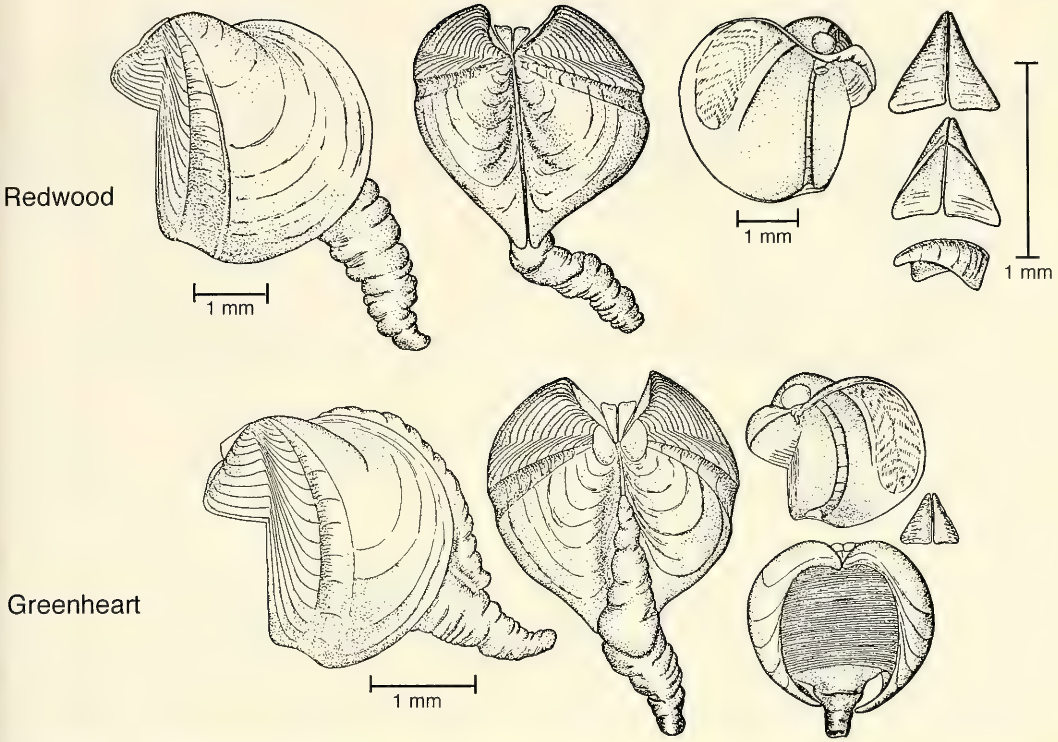
Text-Figure 3. Typical specimens of *Xylophaga washingtona* collected from submerged cedar (top) and pine (bottom).



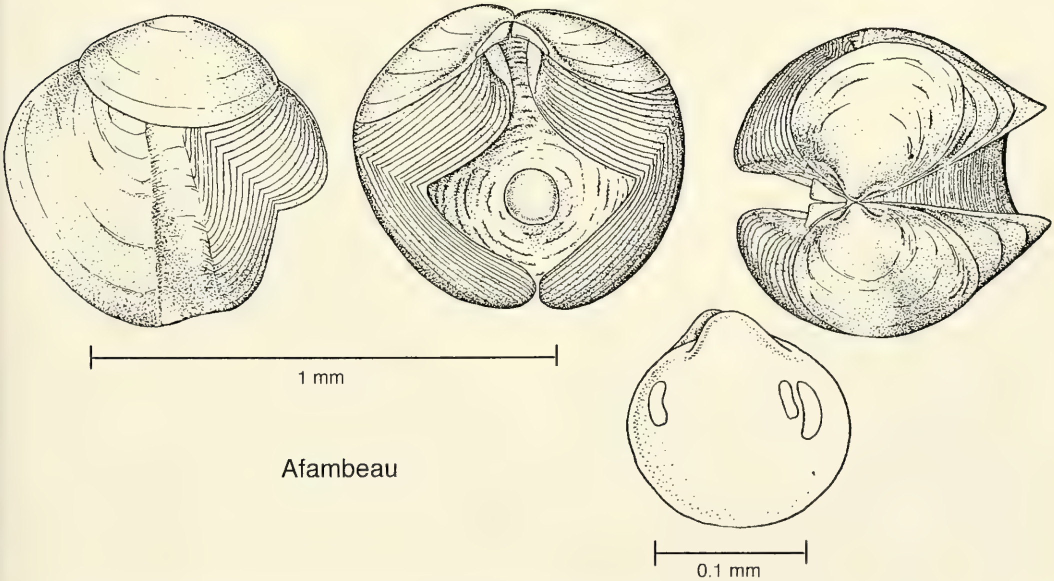
Text-Figure 4. Typical specimens of *Xylophaga washingtona* collected from submerged ash (top) and maple (bottom).



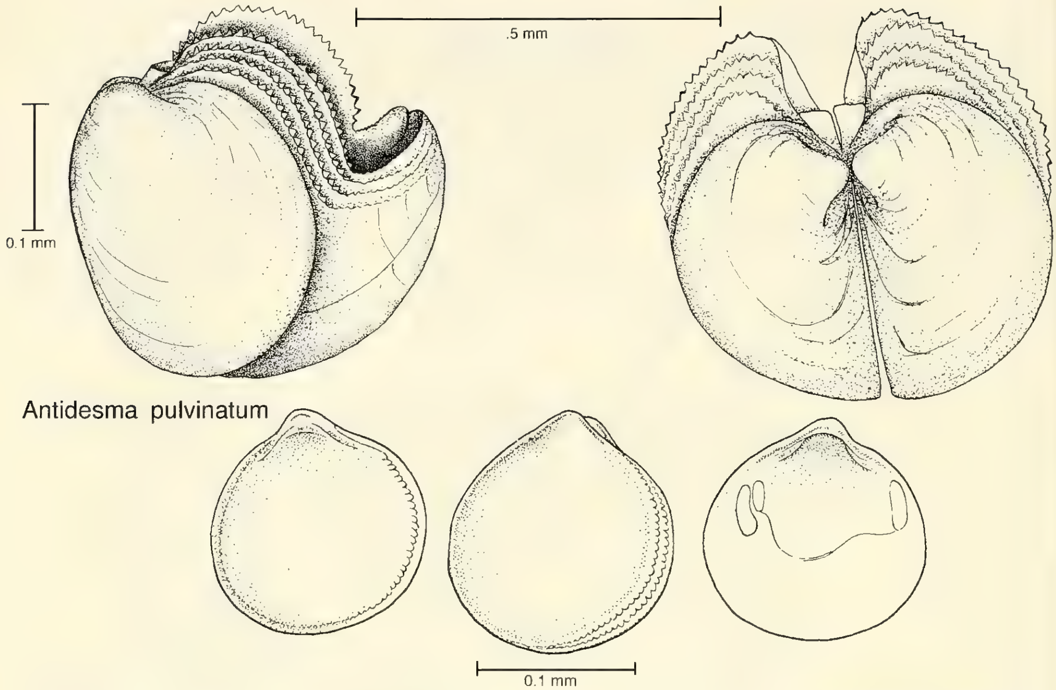
Text-Figure 5. Typical specimens of *Xylophaga washingtona* collected from submerged oak (top) and fir (bottom).



Text-Figure 6. Typical specimens of *Xylophaga washingtona* collected from submerged redwood (top) and greenheart (bottom).



Text-Figure 7. Typical specimens of *Xylophaga washingtona* collected from a submerged panel of *Afambeau*.

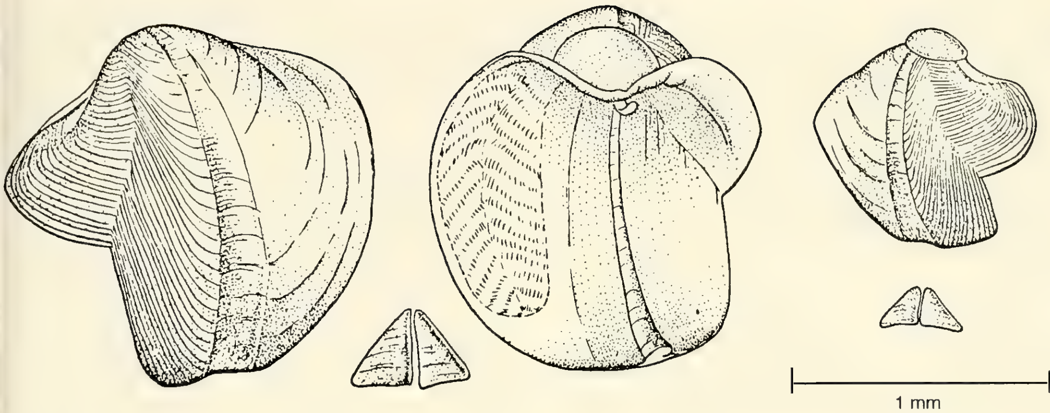


Text-Figure 8. Typical specimens of *Xylophaga washingtona* collected from a submerged panel of *Antidesma pulvinatum.*

ameter as they bored so that the larval valves were not inturned with the growth of the umbos. Evidently little or no attrition had occurred at the umbonal area or the embryonic valves would have been worn away.

The most variable characters in this series are the size of the valves and the number of denticulated ridges on the anterior slope in relation to the length of the valves. Specimens from cedar, pine, ash, maple, oak, and fir (Text-Figs. 3–5) all were drawn to the same scale, as shown by the 5-mm scale bar, and are arranged in order of decreasing size. The number of denticulated ridges on the anterior slope of these specimens varies from 12 to 20. Specimens from redwood, greenheart, *Afambeau,* and *Antidesma pulvinatum* (Text-Figs. 6–8) were drawn to their own scales and, although these specimens are much smaller, they have as many or more ridges on the anterior slope. The specimen removed from the phenolic laminated rod (Text-Fig. 9) has 44 denticulated ridges. Correlated with the increased hardness of the substrate and the additional denticulated ridges is a proportional increase in the size of the posterior adductor muscle and its scar. This suggests the enlargement of the posterior adductor muscle in response to increased activity of boring. The general shape and sculpturing of the muscle scar was similar in all specimens. No noticeable variation was found in the siphons, except size, regardless of the substrate. However, specimens that were able to bore deeply into the wood usually formed a chimney composed of compacted fecal material lining the posterior end of the burrow.

Two periods of settlement apparently occurred on some of the panels, because specimens of two age groups could be found. However, it is impossible to say whether the specimens removed from the *Antidesma* were of the second set or if



Phenolic Laminated Rod

Text-Figure 9. Typical specimens of *Xylophaga washingtona* collected from a submerged phenolic rod.

they had simply been unable to increase in size because of the hardness, chemical composition, or both of the wood. Because the specimens apparently were alive at the time the wood was removed from the water and because only a few rows of denticulated ridges were present, the inference was made that these specimens probably belonged to a second set. Certainly the larval shells shown in Text-Figure 8 must be from a second set. The number of specimens examined and the maximum length and diameter of the burrows for each type of wood are given in Table 1.

Variation in the Mesoplax of Xylophaga depalmai *Turner* n. sp. Approximately 300 specimens of *X. depalmai* n. sp. were obtained from tests conducted by the NOO about 2–3 miles east of Fort Lauderdale, Florida (26°04′N, 80°04′W) in depths from 100 to 500 ft (30.5 to 152.5 m) (see Table 14 under the description of *X. depalmai* n. sp. for information giving panel numbers, depth, and dates of exposure). In this species, the general shape of the valves, the siphons, and the muscle scars show little variation but the mesoplax is extremely variable. The mesoplax is typically bilaterally symmetrical, ear-shaped, longer than wide, with the two halves coiled inward at the posterior end, and with a long medial line where the two halves meet (Plate 24, Figs. 16, 17). In numerous specimens, the mesoplax was not bilaterally symmetrical, but one half was considerably shorter than the other and often appeared malformed (Plate 24, Figs. 11–15). In several specimens, the ventral surface of the two halves of the mesoplax was fused by the periostracal covering, although the dorsal surface still appeared divided. In other specimens, the mesoplax was elongated, the coiled posterior ends, instead of curling inward toward each other, remained nearly straight or curled slightly outward, with the ventral surface being completely fused (Plate 24, Figs. 1–5). In two specimens, the two halves of the mesoplax had completely fused dorsally and ventrally, although the lines of fusion remained clearly visible. The tapered posterior end of this cornucopialike mesoplax coiled slightly ventral and to the left.

Such variation is in marked contrast to the uniformity seen in the mesoplax of *X. washingtona* Bartsch. It is impossible to say whether this variation is genetic or ecologic but we are able to say that all types of the mesoplax of *X. depalmai* were found in a single panel retrieved from a depth of approximately 300 ft (91.44 m). Variation in the mesoplax is a factor that must be taken into consideration when evaluating species in this genus.

Variation Exhibited in Growth Series. In most species of *Xylophaga,* the dorsal plate is quite simple and the mesoplax of the young is similar to that of the adult, as seen for *X. washingtona.* Dons (1929a,b) described briefly and illustrated a similar situation in *X. praestans* Smith and *X. dorsalis* Turton.

Some species have more elaborate dorsal plates and for some of these (i.e., *X. muraokai* Turner n. sp., *X. bayeri* Turner n. sp., and *X. abyssorum* Dall), it is possible to build up what appears to be growth series. All begin with a simple posterior covering to the anterior adductor muscle that is difficult to differentiate among the species in the young stage. As calcification of the periostrascal covering progresses, the adult form gradually appears. In the three species mentioned, the characters of the valves and the siphons of the young agree with those of the adult specimens. Therefore, although living material has not been available and developmental studies have not been possible, it seems reasonable to consider these as growth series. *Xylophaga muraokai* (Plate 19, Fig. 3) is relatively simple, with the dorsal portion becoming thickened and joining laterally with the basal portion while the ventral flanges enlarge. In *X. bayeri* (Plate 31, Fig. 3), the broad transverse dorsal portion becomes very conspicuous and in *X. abyssorum* (Plate 15, Figs. 4, 5), the dorsal incurving of the lateral arms produce an elaborately lobed mesoplax. Nothing is known of the allometric changes that take place during growth of the peculiar dorsal plates of *X. tubulata* Knudsen, *X. bruuni* Knudsen, *X. obtusata* Knudsen, and *X. whoi* Turner n. sp.

Detailed studies of these growth series will have to await improved techniques for handling living material under deep-sea conditions, and the ability to rear deep-sea species in the laboratory. In the meantime, it seems best to consider these forms as members of growth series rather than different species, particularly because the series in each case was built up from material taken from a single piece of wood.

PRELIMINARY REPORT ON THE RESULTS OF EXPERIMENTS ON THE ECOLOGY OF DEEP-SEA WOOD BORERS AND THE ROLE OF WOOD IN THE DEEP SEA

The results of the first exposures of wood panels at the Woods Hole Oceanographic Institution (WHOI)–*Alvin* permanent bottom station south of Woods Hole (39°46′N, 70°41′W, in 1,830 m) were reported in 1973 (Turner, 1973). At that time, the Xylophagainae were postulated to be the most important deep-sea organisms involved in converting woody plant material to an available food source for other organisms.

Pursuing this theory and to continue the studies of the ecology and life history of the Xylophagainae, wood panels were exposed at the *Alvin* permanent station in the Tongue of the Ocean, Bahama Islands, on 19–22 January 1974 (*Alvin* dives 492, 493, 494, and 495) at a depth of 2,032 m. The first of these panels was picked up on 7 March 1974, frozen immediately, and returned to Woods Hole where it was examined. Newly settled larvae and metamorphosing *Xylophaga* with one to two rows of denticulated ridges were removed from the panel. The specimens were approximately 300 μm in length and the greatest penetration was about twice the depth of the shell. The debris rings surrounding the burrows were much coarser than those made by teredinids. The distribution of the entrance holes was somewhat patchy and varied from 5 to 20 cm^2. The specimens were too young to identify because none of the dorsal plates had been formed but examination with scanning electron microscopy showed a well-developed distinctive sculpture on the larval shell.

This first panel from the Tongue of the Ocean established that *Xylophaga* were just beginning to settle on the wood a maximum of 48 days after it was implanted in the bottom and that settlement of larvae could occur in early March, at least at this site.

Three more panels were removed from the Tongue of the Ocean station (Tower 1—west arm) on 19 April 1975 during *Alvin* dive 552. I was an observer on this dive and as we approached the panels I noticed an increase in the number of shrimp and galatheid crabs. The panels had numerous crabs crawling all over them. Some of the crabs had crawled under the plastic mesh bags covering the panels and had grown so large they could not escape. (Note: After the near loss of the panels at the northern station because of the heavy attack of borers, the decision was made to put the panels in plastic mesh bags so that the pieces could be retrieved if they began to disintegrate.) The specimens inside the bag were carried to the surface with the panels. When the panel was disturbed, the specimens on the outside of the mesh fell off. The largest of the 12 crabs was 43 mm in length. The diamond-shaped opening of the mesh was 5 × 10 mm. The smallest crab measured 8 mm in length; others measured 40, 33, 32, 30, and 24 mm. It is obvious that the crabs were finding sufficient food either in or on the wood to grow at a fairly rapid rate.

The first young crabs to find the wood may have fed on the newly settled *Xylophaga* larvae and this might explain the patchy distribution of the borers in the panels. However, the larger crabs would not have stayed on the wood unless there was something for them to eat. The crabs had to be under 10 mm in length to get under the mesh and if the larvae were not settling until early March it would be at least early May before the borers had grown sufficiently to be a good food source for the crabs. Therefore, I think we can postulate that the largest crab measured grew at least 33 mm in a period of 10 months.

Examination of the panels showed a rather heavy attack of three species of Xylophagainae. These included *Xyloredo nooi* Turner and two *Xylophaga* species, *Xylophaga clenchi* Turner and Culliney and *X. profunda* Turner n. sp. The *X. nooi* were typical with valves that reached 5 mm in length and burrows that were 18–22 mm in length. The calcareous lining of the burrow of the largest specimen was 13 mm long and 2.5 mm in diameter at its anterior end. The smaller species of *Xylophaga, X. clenchi* Turner and Culliney, also had been obtained previously from wood exposed in the Tongue of the Ocean by John DePalma of the NOO. This is a fairly small species. The valves were 8–10 mm in length and several of the specimens were carrying larvae on the umbonal area of the valves. The larvae measured 0.2 mm in length. The large species of *Xylophaga, X. profunda* Turner n. sp., had not been seen before. The valves were 14 mm in length, and one specimen measured 40 mm to the tip of the siphons. The burrows were 45–50 mm in length. Both *X. clenchi* and *X. profunda* lined the posterior end of their burrows with consolidated fecal pellets and the burrows of all dead specimens contained one or more specimens of capitellid worms that were feeding on the pellets as well as the remains of the *Xylophaga.* Often the spaces between the valves of the borers were filled with the smaller fecal pellets of the worms. Breaking these balls of pellets apart, I always found one or two capitellid worms. In the *Xylophaga* burrows and on the surface of the wood, I also found two other polychaete worms. One belonged to the family Chrysopetalidae and the other to a family of polynoid worms.

A preliminary examination of the stomach contents of a broken specimen of a galatheid showed that the crab had ingested some fine chips of wood because identifiable cells remained in the material. Consequently, we can postulate that the crabs were feeding on the *Xylophaga,* probably dead ones. The tissues of the *Xylophaga* are so soft that they are unrecognizable in such a preliminary examination. The crab's stomach also contained setae of the chrysopetalid worms, a small nematode, and some sponge spicules. The chrysopetalids probably were feeding on the capitellid worms.

I think five points are worthy of notice: 1) *Xylophaga* in the Tongue of the Ocean as well as at the northern *Alvin* station are growing much faster than one would expect. 2) The larvae of *X. profunda* n. sp. were settling in early March. 3) *Xylophaga clenchi* broods its young and was carrying young in mid-April. 4) Probably the crabs and worms were also growing faster than normal for the deep sea. 5) A food chain based on wood and *Xylophaga* was being developed.

This lends support to my hypothesis that wood is an important source of enrichment in the deep sea, that it contributes to both the diversity of organisms in a given area and to their rate of growth, and that the Xylophagainae are the most important organisms involved in converting the wood to a usable form. To my knowledge, this is the first documented food chain for invertebrates in the deep sea. On the basis of these simple experiments, it now seems conceivable that the slow growth rates usually attributed to deep-sea animals may be due to lack of food, at least for epifaunal forms, rather than being an inherent characteristic of the species involved.

SYSTEMATIC ACCOUNT

GENUS *XYLOPHAGA* TURTON 1822

Xylophaga concava Knudsen
Plate 1

Xylophaga concava Knudsen, 1961, *Galathea* Report, 5: 167–169, figs. 4, 5 (*Galathea,* station 726, Gulf of Panama [5°49′N, 78°52′W] in 3,270–3,672 m). Holotype, Zoological Museum, University of Copenhagen; paratype, MCZ 235796.

Distinctive Characters. Posterior slope of valves concave when viewed dorsally. Mesoplax composed of two rather wide, erect, curved plates that extend above the umbos. Siphons nearly the same length, excurrent slightly shorter with a few large cirri, incurrent siphon with many small cirri (Plate 1, Figs. 2, 3). Chimney apparently lacking, not mentioned by Knudsen and not found with the single specimen reported here.

Remarks. At the time Knudsen described this species he had 4 specimens from *Galathea* station 726 and 25 specimens from *Galathea* station 739. Both of these stations were given as in Gulf of Panama. However, station 726 is about 95 miles west of the Gulf of Tibuga, Colombia, whereas station 739 is about 90 miles west of Ensenada Guayabo, Panama. A single specimen of *X. concava* was taken by the R/V *Pillsbury* at station 526. This locality is about midway between the two *Galathea* stations.

The *Pillsbury* specimen agrees closely with the description and figures given by Knudsen (1961) except that the incurrent siphon has a double row of about 25 small cirri around the aperture and the excurrent siphon has 6 large cirri (Plate 1, figs. 2, 3). Concerning the siphons, Knudsen stated that "both openings are at the distal end, close together, and around them 15–16 small cirri are present." In Knudsen's illustration, the distal ends of the siphons appear to be contracted; neither the two openings nor the cirri are apparent. The contracted condition of Knudsen's specimens probably accounts for the differences noted here.

Xylophaga concava is closely related to *Xylophaga gerda* Turner n. sp. but differs in the size of the mesoplax, the type of siphonal openings, and the chimney. (See Remarks under *x. gerda.*) *Xylophaga concava* also is related to *X. erecta* Knudsen (1961) from the Sulu Sea. Knudsen (1961) reported that no cirri were visible on the siphons of *X. erecta,* that the posterior adductor scar was much broader in *X. concava,* and that the posterior slope of the valve viewed dorsally was convex in *X. erecta* rather than concave. Knudsen's description of *X. erecta* was based on 20 specimens and unfortunately no further records have been obtained.

Range. From off Ensenada Guayabo, Panama, south to off the Gulf of Tibuga, Colombia, in depths from about 915 to 3,670 m.

Specimens Examined. COLOMBIA: *Galathea*, station 739, Gulf of Panama, about 90 miles W of Ensenada Guayabo (7°22′N, 79°32′W) in 915–975 m (dried specimens); *Pillsbury*, station 526, about 110 miles W of Cabo Marzo (6°53′N, 79°27′W) in 3,193–3,211 m; *Galathea*, station 726, Gulf of Panama (5°49′N, 78°52′W) in 3,270–3,670 m.

Xylophaga gerda[2] Turner new species
Plates 2, 3

Holotype. MCZ 328378. Paratypes, MCZ 316741, 316742.

Type Locality. Gerda, station 499, about 3 miles off Southwest Point, Great Bahama Island, Bahama Islands (26°37′N, 78°56′W) in 155 fathoms (283.96 m).

Distinctive Characters. Posterior slope of valves concave when viewed dorsally. Mesoplax composed of two narrow, erect curved plates at the posterior end of the anterior adductor muscle. Siphons of equal length, with a periostracal sheath and four or five cirri surrounding the apertures. Chimney composed of fecal material agglutinized to a periostracal base (Plate 2, Fig. 7).

Description. Shell globose, fragile, reaching 3.0 mm in length and 2.8 mm in height, umbos inflated. Pedal angle 110–115°. Anterior slope with up to 45 rather evenly spaced denticulated ridges. Umbonal–ventral sulcus narrow and only slightly depressed. Disc and posterior slope sculptured with fine, incised growth lines. Posterior slope high, flaring, and somewhat ear-shaped.

Inner surface of valves smooth and glistening. Umbonal–ventral ridge low and indistinct except near the wide, low ventral condyle. Chondrophore and internal ligament small. Posterior adductor muscle scar large with faint transverse impressions, which are best seen externally on an entire specimen. Disc separated from posterior slope by a shelflike ridge (Plate 3, figs. 2–5). Pedal and siphonal retractor scars not visible.

TABLE 2. MEASUREMENTS OF *XYLOPHAGA GERDA*.

Length (mm)	Height (mm)	Location
1.1	1.0	*Gerda*, station 266
1.5	1.4	*Gerda*, station 266
1.8	2.0	*Gerda*, station 266
2.5	2.3	paratype
3.0	2.5	holotype
3.0	2.8	*Pillsbury*, station 328
3.3	3.0	*Pillsbury*, station 944
3.8	3.5	*Pillsbury*, station 944

Mesoplax composed of two erect, narrow, curved, slightly calcified plates, located just posterior to the anterior adductor muscle and not extending above the umbos.

Siphons long, probably not capable of retraction between the valves, of equal length, united nearly to the tip, with a thin periostracal sheath. Siphonal apertures of about equal size, each with four or five comparatively large cirri, which appear as a common ring of cirri when the siphons are retracted. A brown periostracal cylinder containing fecal material may extend nearly one half the length of the excurrent siphon (Plate 2, Figs. 1–4). Chimney built in sections, composed of fine fecal material agglutinized on a periostracal lining with "leaves" of periostracum extending to the outer surface (Plate 2, Figs. 6, 7). Arrangement of the gills and labial palps typical for the genus, foot large but not muscular, cecum very large and showing through the foot (Plate 2, Fig. 5). Pedal and siphonal retractor muscles weak, their arrangement typical for the genus.

Measurements. See Table 2.

Remarks. On the basis of the shell and the mesoplax, this species is closely related to *X. concava* Knudsen from the Gulf of Panama. It differs in being much smaller

[2] Named for R/V *Gerda*, Rosenstiel School of Marine and Atmospheric Sciences, University of Miami, Miami, Florida, whose station 499 is the type locality.

(none of the 19 specimens reached 4 mm in length, whereas Knudsen gives 8.6 mm for *X. concava*) and in having a narrow mesoplax that does not extend above the umbos. In addition, the excurrent and incurrent siphons of *X. gerda* are the same length, are separate at the tip, and the apertures of both siphons have four or five relatively large cirri. In *X. concava,* the siphons are joined for their entire length and the excurrent siphon is slightly shorter. The type of chimney produced by *X. gerda* is unlike any other known to date in this genus.

Unfortunately, all the specimens of *X. gerda* are small, extremely fragile, and rather poorly preserved. Consequently, it has been impossible to do anatomical work beyond that mentioned in the description. One specimen from which the valves were removed appeared to have an accessory genital organ similar to that described by Purchon (1941).

Range. Probably throughout the Caribbean in depths from about 283 to 2,072 m.

Specimens Examined. BAHAMA ISLANDS: *Gerda,* station 499, about 3 miles off Southwest Point, Great Bahama Island (26°37′N, 78°56′W) in 155 fathoms (283 m). UNITED STATES, FLORIDA: *Gerda,* station 266, off Fowey Rocks, Florida Keys (25°39′N, 79°58′W) in 185–187 fathoms (338–342 m). LESSER ANTILLES: *Pillsbury,* station 944, 45 miles N of Port Louis, Guadeloupe Island (16°32.2′N, 61°36.8′W) in 364–421 m. PANAMA: *Pillsbury,* station 328, about 25 miles N of Punta San Blas, Gulf of San Blas (9°55.8′N, 78°59.8′W) in 2,069–2,072 m.

Xylophaga grevei Knudsen
Plate 4

Xylophaga grevei Knudsen, 1961, *Galathea* Report, 5: 176, figs. 16–18 (*Galathea,* station 495, Banda Trench, south of Ceram [5°26′S, 130°58′E] in 7,250–7,290 m). Holotype, Zoological Museum, University of Copenhagen.

Distinctive Characters. Mesoplax composed of two triangular plates that are flat dorsally, in contact the length of their median edge, bent downward on their outer edge to meet the umbonal reflection, and lack a ventral portion. Posterior adductor muscle scar with oblique radiating impressions. Siphons nearly the same length, the aperture of the excurrent siphon much smaller in diameter than the incurrent siphon and with about 6 cirri; incurrent siphon with about 35 small cirri. Young carried on the umbonal area of the adult.

TABLE 3. MEASUREMENTS OF *XYLOPHAGA GREVEI.*

Length (mm)	Height (mm)	Location
1.9	1.6	*Galathea,* station 444
12.5	11.0	holotype

Measurements. See Table 3.

Remarks. Through the kindness of Jorgen Knudsen, it was possible to borrow the preserved dredged wood from the Zoological Museum, University of Copenhagen. In a small piece taken by the *Galathea* at station 444, I found several additional specimens of *X. grevei.* They are much smaller than that figured by Knudsen, the anterior slope is much narrower, and the denticulated ridges are more widely spaced. However, they appear to be young but sexually mature specimens of that species. From one to five rather large young were attached posterior to the umbos on the dorsal surface of the parent shells.

Xylophaga wolffi Knudsen, based on only two specimens, also was from *Galathea,* station 444. It has valves, muscle scars, and siphons similar to those of *X. grevei.* The outstanding difference between these species is the flat plates of the mesoplax of *X. wolffi,* which are set in tentlike fashion at an acute angle to each other. It has not been possible to compare the type of *X. wolffi* with this new material from *Galathea,* station 444, but it appears that these two forms (i.e., *X. grevei* and *X. wolffi*) may be equivalent to the condition found in *X. clenchi* Turner and Culliney, where occasional specimens have a bent, flat-topped mesoplax (Plate 4, Figs. 5, 6). Further collecting may show *X. grevei* and *X. wolffi* to be forms of a single species. The denticles on the ventral edge of the mesoplax of *X. wolffi* described by Knudsen may be an age factor but more material is needed to prove this.

Range. Mindanao Sea south to the Banda Trench, Banda Sea in depths from about 545 to 7,290 m.

Specimens Examined. PHILIPPINE ISLANDS: *Galathea*, station 444, Sulu Sea, W of Basilan Island (7°54′N, 121°30′E) in 5,050 m.

Xylophaga clenchi[3] Turner and Culliney Plates 5–8

Xylophaga clenchi Turner and Culliney, 1971, American Malacological Union Annual Report for 1970, p. 66 (U.S. NOO test site, Tongue of the Ocean, about 4 miles off northeastern tip of Andros Island, Bahama Islands [24°54′N, 77°49′W] in 1,737 m). Holotype, MCZ 316743; paratypes, MCZ 316744, 316745.

Distinctive Characters. Mesoplax small, composed of triangular, nearly flat plates lacking a basal portion; the two plates usually meeting at an acute angle in frontal view. Burrow lined with a chimney of coarse, loosely consolidated fecal pellets. Young held on posterior dorsal surface of the adult. Excurrent siphon shorter than incurrent siphon and with two large papillae on either side.

Description. Shell globose, reaching 14 mm in length and 13.5 mm in height, thin, fragile, with a thin, light brown periostracum that is thickened along the dorsal and posterior margin of the valves. Umbos prominent and strongly incurved. Pedal gape angle about 108°. Beaked portion of the anterior slope sculptured with numerous denticulated ridges that are widely spaced in the young, becoming increasingly compacted toward the ventral margin in older specimens. Specimens 5 mm in length have up to 25 ridges. Posterior portion of the anterior slope rather narrow. Umbonal–ventral sulcus moderately to deeply impressed becoming shallower with age and bounded posteriorly by a broad, low, rounded ridge. Disc and posterior slope sculptured with uniform, rather pronounced growth ridges that are particularly prominent in young specimens.

Inner surface of valves smooth and glistening. Umbonal–ventral ridge prominent, distinctly segmented, and with a large ventral condyle. Chondrophore and internal ligament well developed. Posterior adductor muscle scar kidney-shaped in outline and with irregular transverse, often anastomosing impressions that become more numerous with age. Pedal retractor scar more or less oval in outline and located just anterior to the embayment in the posterior adductor scar. Siphonal retractor scars small, not impressed, located just posterior to the umbonal–ventral ridge about midway between the umbo and the ventral condyle.

Mesoplax small, composed of two flat to slightly arched triangular plates lacking a ventral portion, set in a tentlike fashion and held in place by the periostracum and the anterior adductor muscle. Plates usually meet dorsally at 90° (Plate 5, Fig. 3), occasionally at an obtuse angle. They are rarely bent longitudinally (Plate 8, Fig. 3). Outer surface of plates sculptured with ridges paralleling the anterior margin and lining up with the denticulated ridges of the valves where they come in contact.

Siphons short, extending only about one third the length of the valves. Excurrent siphon about one half the diameter of and slightly shorter than the incurrent siphon, with a well-developed sphincter muscle surrounding the aperture and two large papillae on each side (Plate 7, Fig. 3). Incurrent siphon has minute cirri surrounding the aperture and a second set of larger cirri anterior to them within the siphon (Plate 6, Fig. 4).

Posterior end of burrow lined with coarse, loosely compacted fecal pellets. Young held by byssus threads on the posterior dorsal surface of the adult shell (Plate 7, Figs. 1, 2).

Measurements. See Table 4.

Remarks. This species is most closely related to *X. africana* Knudsen from the

[3] Named for Dr. William J. Clench, Curator of Mollusks, 1926–1966, Museum of Comparative Zoology, Harvard University.

TABLE 4. MEASUREMENTS OF *XYLOPHAGA CLENCHI*.

Length (mm)	Height (mm)	Location
2.3	2.1	*Ingolf*, station 67
3.2	2.0	*Atlantis II*, station 124
3.5	3.5	holotype
4.0	3.5	Tongue of the Ocean
5.0	4.8	Tongue of the Ocean
10.0	9.5	Tongue of the Ocean
10.0	10.0	*Pillsbury*, station 104
14.0	13.5	*Pillsbury*, station 394

Gulf of Guinea, West Africa (1°42′N, 7°51′E in 2,550 m), but the mesoplax differs in having a longer median line where the two plates meet, a weaker sculpture, and in lacking the rounded nodule on the ventral surface. Unfortunately, the valves of the two known specimens of *X. africana* were too fragmentary to allow comparisons on this basis. The siphons of these two species are similar but *X. clenchi* differs in having only two rather than three large cirri on either side of the excurrent siphon and in having two rings of small cirri bordering the aperture of the incurrent siphon. The incurrent siphon of *X. africana* lacks cirri, according to Knudsen (1961). Two other species, *X. wolffi* Knudsen from the Sulu Sea and *X. murrayi* Knudsen from off Zanzibar, also have similar dorsal plates. The former differs from *X. clenchi* in having denticles on the basal margin of the mesoplax with corresponding denticles on the umbonal reflection. In addition, on each side of the excurrent siphon of *X. wolffi* there are "7 finger-like tentacles on a common base and somewhat larger tentacle dorsally." The siphons of *X. murrayi* differ in having a circle of about 35 "short tentacles" surrounding both openings. Knudsen (1961) compared *X. wolffi* with *X. supplicata* Taki and Habe but examination of paratypes of *X. supplicata* received from Habe showed that species to have tubules on the mesoplax. (See also under *X. supplicata* Taki and Habe.)

Xylophaga clenchi Turner and Culliney also appears to be closely related to *X. panamensis* Knudsen but the latter differs in having the plates of the mesoplax smooth. The posterior adductor muscle scar of *X. panamensis* is oval and irregularly lobed anteriorly, the weak umbonal–ventral ridge is bounded posteriorly by a groove, and the condyles are lacking. The siphons of *X. panamensis* are unknown.

The variation in the mesoplax of *X. clenchi* is interesting and presents some problems. In most specimens, the plates are flat or nearly so and none has a ventral portion or cavity of any kind. The angle at which the plates meet dorsally is typically acute; however, specimens from shallower waters (i.e., less than 900 m) occasionally have plates that meet at an obtuse angle. Two of the five specimens from *Atlantis II*, station 124, have the dorsal plate bent longitudinally at a right angle (Plate 8, Fig. 3), whereas others are typical. Because the shell characteristics of these specimens fit within the range of variation of the typical forms, they are considered to be ecologic variants. Unfortunately, none of the specimens from shallower water has extended siphons, so comparisons cannot be made on that basis.

Although the holotype of *X. clenchi* is small, it was selected because it was the most nearly perfect and the only specimen for which dorsal plates, young, siphons, and chimney all were present. The large specimen from R/V *Pillsbury*, station 394, and the two from *Pillsbury*, station 104, were dead when collected. At least one specimen from all other localities was alive at the time of collection. The specimens from the Tongue of the Ocean were from test panels submerged by the NOO from 4 April 1962 to 17 February 1965. For a description of the test site see DePalma (1969). One specimen taken by the R/V *Atlantis II* at station 119 and three specimens taken at station 131 were from epibenthic sled hauls in which no wood or plant material was found. The specimens were alive and apparently normal although they were badly crushed, for they were minute and very delicate. This raises the question as to whether or not at least some species of *Xylophaga* can survive in a firm muddy bottom if wood is not available. So far as known, these are the only living specimens of *Xylophaga* not taken from wood or other plant material, except those that were boring in plastic at the navy test site off California and possibly those specimens of *Xylophaga foliata* Knudsen that came from a station in Macassar Strait from which it was reported that no wood was taken. The specimens from off Iceland were removed from wood dredged by the *Ingolf* Expedition in 1896. All specimens were small, the largest being 2.5 mm in length. Many had from 1 to 10 large young attached to the valves in the umbonal area (Plate 7, Fig. 2). This record extends the range of the species far to the north but it has been impossible to find any characters to distinguish these specimens from those occurring to the south.

The difference in the size of the young attached to the dorsal surface of the specimens figured in Plate 5, Figures 1 and 2, and Plate 7, Figures 1 and 2, reflects the age of the larvae, with those in the latter plate having well-developed umbos and appearing fully mature. It is interesting to note the position of the larvae on the two adults and to speculate that perhaps the larvae move gradually toward the umbos as they mature.

Range. From off Iceland south to Venezuela in depths ranging from 35 to 4,862 m.

Specimens Examined. ICELAND: *Ingolf,* station 67, S of Eyrabakki (61°30′N, 22°30′W) in 1,836 m. UNITED STATES, NEW JERSEY: *Albatross,* station 2550, about 160 miles E of Barnegat Bay (39°44′N, 70°30′W) in 1,977 m. VIRGINIA: *Albatross,* station 2731, off Cape Henry (36°45′N, 74°28′W) in 1,428 m. NORTH CAROLINA: *Atlantis II,* station 131, about 420 miles E of Currituck Sound (36°28.9′N, 67°58.2′W) in 2,178 m; off Cape Hatteras (35°44′N, 75°15′W) in 35 m. GEORGIA: *Pillsbury,* station 104, about 80 miles SE of Brunswick (31°00′N, 79°50′W) in 247 m. BAHAMA ISLANDS: Tongue of the Ocean, about 4 miles off NE tip of Andros Island (24°54′N, 77°49′W) in 1,737 m; Tongue of the Ocean (24°53.2′N, 77°40.2′W) in 2,066 m. BERMUDA: *Atlantis II,* station 124, about 750 miles E of Cape Charles (due N of Bermuda) (37°26′N, 63°59′W) in 4,862 m; *Atlantis II,* station 119, just S of Bermuda (32°15′N, 64°32′W) in 2,095–2,223 m. PANAMA: *Pillsbury,* station 328, about 25 miles off Punta San Blas, Gulfo San Blas (9°55.8′N, 78°59.8′W) in 420–640 m. VENEZUELA: *Pillsbury,* station 719, about 100 miles N of Pertigalete Bay (11°35′N, 64°35.4′W) in 770–890 m.

TABLE 5. MEASUREMENTS OF *XYLOPHAGA SUPPLICATA.*

Length (mm)	Height (mm)	Location
8.5	8.8	paratype MCZ 194820

Xylophaga supplicata Taki and Habe
Plate 9

Metaxylophaga supplicata Taki and Habe, 1950, Illustrated Catalogue of Japanese Shells No. 7, p. 47, text-figs. 1, 2 (Tosa Bay, Shikoku, Japan, in 100 fathoms). Holotype, T. Habe Collection; paratype, MCZ 194820; Knudsen 1961, *Galathea* Report, 5: 188.

Distinctive Characters. Mesoplax composed of two flat triangular plates set at a sharp angle to each other, dorsal margin more than one half the total length, and with minute tubules at the posterior end. The tubules sit deep within the cavity formed by the umbos and cannot be seen when the shell is viewed anteriorly. Chondrophore of left valve with a large tooth (Plate 9, Figs. 5, 6).

Measurements. See Table 5.

Remarks. Taki and Habe (1950) described the dorsal plate of *X. supplicata* simply as a "small triangular protoplax [=mesoplax]" that is attached vertically. A paratype received from Dr. Habe has small tubes on the dorsal posterior end of the mesoplax.

Xylophaga bruuni Knudsen, 1961, from the Mindanao Sea is very close to if not synonymous with *X. supplicata.* Unfortunately, Taki and Habe did not mention the tubes in their original description and Knudsen did not see the types. Also, unfortunately, Knudsen had only a single specimen; hence, it will be necessary to obtain more material before a definite statement can be made concerning the status of *X. bruuni*. (See also Remarks under *Xylophaga whoi* Turner n. sp.)

Specimens Examined. JAPAN: Tosa Bay, Shikoku, in 100 fathoms (183 m).

Xylophaga whoi[4] Turner new species
Plates 10, 11

Holotype. MCZ 275015.

Type Locality. R/V *Atlantis*, station 3471, off Cardenas, Matanzas Province, Cuba (23°21′N, 80°56′W) in 500 fathoms (914 m).

Distinctive Characters. Mesoplax composed of two flat triangular plates with a short median line, set at a sharp angle to each other and with a large hollow tube extending outward from the posterior dorsal surface of each plate.

Description. Shell globose, reaching 7 mm in length and 6.2 mm in height, thin, fragile, and with a very thin, light tan periostracum. Pedal gape angle about 95°. Beaked portion of the anterior slope sculptured with numerous low denticulated ridges; the posterior portion with fine indistinct ridges. Umbonal–ventral sulcus only slightly impressed and irregularly sculptured. Sculpture on the disc and posterior slope consisting of pronounced growth ridges. Umbonal reflection narrow, closely impressed near the umbos, free and vertical anteriorly.

Inner surface of valves smooth and shining. Umbonal–ventral ridge becoming evident only near the ventral margin but rapidly increasing in size to a large ventral condyle. Chondrophore and internal ligament well developed; chondrophore of the left valve with a small tooth on the posterior upper margin. Posterior adductor muscle scar large, elongate, oval in outline, irregularly sculptured, set high on the posterior slope and well in from the posterior margin. Pedal retractor scar rather large, elongate, somewhat irregular, and located just anterior to the posterior adductor scar. Siphonal retractor scar not impressed.

[4] An acronym for Woods Hole Oceanographic Institution, whose research vessel *Atlantis* collected the holotype.

Table 6. Measurements of *Xylophaga whoi*.

Length (mm)	Height (mm)	Location
2.5	2.3	*Gerda*, station 266
3.1	3.0	*Gerda*, station 266
6.9	6.2	holotype
7.0	6.8	*Pillsbury*, station 394
7.2	7.0	*Pillsbury*, station 944
9.5	9.0	*Pillsbury*, station 944
12.5	11.5	*Pillsbury*, station 944
13.8	13.1	*Pillsbury*, station 944
14.9	14.0	*Pillsbury*, station 944

Mesoplax composed of two triangular plates that are set at an acute angle to each other dorsally and have two large, hollow, tubular projections extending from the posterior dorsal margin (Plate 10, Figs. 3–10). Length of dorsal margin less than one half the length of the plate, outer surface sculptured with distinct ridges paralleling the anterior margin; inner surface smooth, with a small internal opening into the tube (Plate 10, Figs. 11, 12).

Siphons short, of about equal length, and probably not capable of extending more than one half the length of the shell. Aperture of incurrent siphon large and apparently lacking cirri, that of the excurrent siphon small and with a few fine cirri on each side ventrally.

Measurements. See Table 6.

Remarks. Knudsen (1961) described three species of *Xylophaga* with tubulate mesoplaxes, and studies for this report have shown that *X. supplicata* Taki and Habe also is tubulate. Three of these species are from the western Pacific (*X. tubulata* Knudsen from Macassar Strait, *X. bruuni* Knudsen from the Mindanao Sea, and *X. supplicata* Taki and Habe from Japan), and one from the eastern Pacific (*X. obtusata* Knudsen from the Gulf of Panama). *Xylophaga whoi* Turner n. sp. is the first tubulate species reported from the Atlantic. It is most closely related to *X. bruuni* Knudsen from the Mindanao Sea but differs in that the mesoplax has a proportionately shorter dorsal margin and larger tubes. In addition, the posterior adductor muscle scar is set well in from the posterior margin and the umbonal–ventral ridge is evident only near the ventral margin of the shell but increases rapidly to a large condyle. *Xylophaga whoi* Turner n. sp. differs from *X. obtusata* Knudsen in the position of the posterior adductor scar, the shape of the mesoplax, the larger tubes on the mesoplax, the narrower anterior slope, and smaller umbonal reflection. The third tubulate species described by Knudsen, *X. tubulata* from Macassar Strait, differs from *X. whoi* in having very large tubules that extend to the anterior margin of the mesoplax and in having the plates bent longitudinally at a right angle so they are flat dorsally rather than meeting at an acute angle. Examination of a paratype specimen of *X. supplicata* Taki and Habe, 1950, from Japan shows that this species has minute tubes on the mesoplax similiar to those in *X. bruuni* and it may be synonymous with that species. (See also under *X. supplicata* Taki and Habe.)

The specimen of *X. whoi* Turner n. sp. taken by the R/V *Pillsbury* from off Punta Piedras, Colombia, had 13 young attached to the umbonal area (Plate 11, Fig. 2). Among the other species in this group (Group 3), Knudsen (1961) reported that the type of *X. obtusata* had two young and the type of *X. bruuni* had four young on the dorsal surface of the adult shell, whereas *X. tubulata* had five young at the ventral base of the siphons in a depression of the mantle tissue. The young at the base of the siphons of *X. tubulata* were very small, about one half the size of those on *X. bruuni*. They possibly had only recently been extruded from the excurrent siphon of the adult and had not yet crawled to the dorsal surface of the adult. It has not been proven that the juveniles clinging to the mantle and shells of adult *Xylophaga* are definitely the young of the specimen to which they are attached, and this has been questioned by some workers. However, until the species concerned are cultured in the laboratory, it is the only assumption that can be made safely. The only way the young of another specimen or species could get into the burrow would be via the incurrent siphon. For the veliger larvae of another specimen to get to the umbonal area, they either would have to pass through the gills into the epibranchial chamber and then out the excurrent siphon, or go through the digestive tract to the excurrent siphon. Neither of these alternatives seems likely. It is, of course, possible that the young of *X. tubulata* complete their development at the base of the siphons of the parent.

Range. From off southern Florida to Colombia in depths from about 336 to 910 m.

Specimens Examined. UNITED STATES, FLORIDA: *Gerda,* station 266, off Fowey Rocks (25°39′N, 79°58′W) in 185–187 fathoms (338–345 m). CUBA: *Atlantis,* station 3471, off Cardenas, Matanzas Province (23°21′N, 80°56′W) in 500 fathoms (914 m). LESSER ANTILLES: *Pillsbury,* station 944, 45 miles N of Port Louis, Guadeloupe Island (16°32.2′N, 61°36.8′W) in 364–421 m. COLOMBIA: *Pillsbury,* station 394, off Punta Piedras (9°28′N, 76°26′W) in 230–350 fathoms (419–640 m).

Xylophaga profunda Turner new species
Plates 12, 13

Holotype. MCZ 316751.

Type Locality. Tongue of the Ocean, off NE tip of Andros Island, Bahama Islands (25°54′N, 77°49′W) in 1,722 m. From test panel submerged from 26 July 1962 to 17 February 1965.

Distinctive Characters. Valves with a well-impressed umbonal–ventral sulcus, bounded posteriorly by a low broadly rounded ridge. Posterior slope sculptured with narrow, concentric grooves. Mesoplax of two triangular plates, lacking a basal portion, set at an acute angle to each other, folded longitudinally with the anterior margin bent inward and with a small pore in each anteriorly. Umbonal–ventral ridge on inner surface of valves narrow, high, and strongly segmented.

Description. Shell globose, reaching about 11 mm in length, thin, fragile, and

TABLE 7. MEASUREMENTS OF *XYLOPHAGA PROFUNDA*.

Length (mm)	Height (mm)	Location
5.9	5.6	holotype
8.0	7.9	Tongue of the Ocean, off NE tip of Andros Island, Bahama Islands
9.5	8.8	Tongue of the Ocean, off NE tip of Andros Island, Bahama Islands
10.0	9.8	Tongue of the Ocean, off NE tip of Andros Island, Bahama Islands
10.9	10.8	Tongue of the Ocean, off NE tip of Andros Island, Bahama Islands

with a relatively heavy, light brown periostracum. Pedal gape angle about 95°. Beaked portion of anterior slope sculptured with numerous strong, denticulated ridges that are more closely spaced toward the ventral margin in adults. Umbonal–ventral sulcus narrow, deep, bounded posteriorly by a low, broad, rounded ridge. Posterior slope sculptured with widely spaced, incised grooves. Umbonal reflection narrow, high, and strongly segmented. Incised grooves of posterior slope expressed internally as faint ridges just posterior to the umbonal–ventral ridge giving a "back bone and ribs effect." Posterior adductor muscle scar broadly oval, set high on the posterior slope, and lightly marked with irregularly anastomosing depressions. Pedal retractor scar lightly impressed, dumbell-shaped, and located just anterior to the midportion of the posterior adductor. Siphonal retractor scar large, elongate, lightly impressed, and located about midway between the posterior adductor and the umbonal–ventral ridge. Chondrophore large, that of the left valve with two small teeth on the posterior edge.

Mesoplax composed of two triangular plates lacking a basal portion, set at an acute angle to each other, folded longitudinally with the anterior margin bent inward and with a small pore in each anteriorly at the outer edge of the fold.

Measurements. See Table 7.

Remarks. This species is superficially similar to *X. abyssorum* Dall but differs in having a low, broad, rounded ridge posterior to the umbonal–ventral sulcus, in lacking the deep groove posterior to the umbonal–ventral ridge on the inner surface, in having a pronounced sculpture on the posterior slope, and in being larger. In addition, the mesoplax of *X. profunda* lacks a ventral portion, has only a single pore in each plate, does not produce tubes, and appears narrow when viewed anteriorly.

Xylophaga profunda Turner n. sp. is probably most closely related to *X. lobata* Knudsen from the Sulu Sea. *Xylophaga profunda* differs in having a mesoplax that is much longer than wide, whereas in *X. lobata* the structure is wider than long. Both species have a strongly segmented umbonal–ventral ridge and a similarly marked posterior adductor scar, although in *X. profunda* the markings are more extensive and elaborate. Knudsen (1961) compared his *X. galatheae* from the Tasman Sea with *X. lobata,* noting differences in the mesoplax and muscle scars. Unfortunately, he had only a single complete specimen of *X. galatheae,* so he could not determine range of variation. *Xylophaga galatheae* possibly is a young *X. lobata* but more material from intervening areas is needed to ascertain this.

On the basis of the general shape and attachment of the dorsal plates, *X. profunda,* along with *X. lobata* and *X. galatheae,* appear to belong in species Group 3, although *X. profunda* is not closely related to any species in the group and is placed here tentatively. The major differences include the sculpturing of the posterior adductor muscle scar, the presence of anterior pores, and the lack of posterior tubes on the mesoplax. The chondrophore of the left valve of *X. profunda* has two small teeth, a character that relates it to *X. whoi* and *X. supplicata,* both of which have a single large tooth. Unfortunately, Knudsen did not mention the presence of teeth in the three tubulate species he described. Consequently, it cannot be stated definitely that this is characteristic of the group.

The siphons of *X. profunda* are short,

probably of the same length and capable of complete retraction within the valves. Unfortunately, none of the specimens was sufficiently well preserved for anatomical work. Four specimens carried young on the umbonal area, the smallest had 5 and the largest had 75. The young have pronounced umbos, distinct concentric sculpture, and measure about 0.30 mm in length.

Xylophaga profunda Turner n. sp. is known from five specimens taken from one panel submerged in the Tongue of the Ocean at 25°54′N, 77°49′W, and from 14 specimens taken from an asbestos-backed panel submerged at 24°53.2′N, 77°40.2′W.

Specimens Examined. BAHAMA ISLANDS: Tongue of the Ocean, off NE tip of Andros Island (25°54′N, 77°49′W) in 1,722 m; Tongue of the Ocean, Tower 3 (24°53.2′N, 77°40.2′W) in 2,066 m.

Xylophaga abyssorum Dall
Plates 14–16

Xylophaga abyssorum Dall, 1886, Bulletin Museum of Comparative Zoology, 12: 317, pl. 9, fig. 7, 7a (*Blake*, station 215, off St. Lucia, Lesser Antilles [13°51′N, 61°03′W] in 226 fathoms). Holotype, MCZ 8135; Turner, 1955, Johnsonia, 3(34): 156, pl. 93.

Distinctive Characters. Valves with a prominent ridge just posterior to the umbonal–ventral sulcus and with a slightly to strongly concave profile posterior to the ridge when viewed dorsally. Umbonal–ventral ridge on the inner surface developed only near the ventral condyle and bounded posteriorly by a deep groove. Mesoplax composed of two more or less triangular plates having a ventral portion and a variously lobed dorsal portion; lobes varying with age and coalescing to form pores or tubes (Plate 15, Figs. 4, 5).

Description. Shell globose but appearing constricted posteriorly when viewed dorsally, reaching 5.5 mm in length, thin, fragile, and with a thin, light brown periostracum. Pedal gape angle about 95°. Beaked portion of the anterior slope sculptured with fine, denticulated ridges, widely spaced in young specimens but compacted toward the ventral margin in older specimens. Umbonal–ventral sulcus narrow, rather shallow, and with a narrow prominent ridge just posterior to it. Profile of valves concave posterior to the ridge when viewed dorsally. Posterior slope sculptured with faint concentric growth lines, umbonal reflection erect, the ventral margin of the mesoplax meeting it and attached by a periostracal fold. Umbos inflated, particularly in young specimens.

Inner surface of valves white and glazed. Muscle scars well marked. Posterior adductor scars somewhat pear-shaped, set well in from the posterior margin, and marked with irregular, elongate depressions extending inward from the posterior margin. Anterior adductor scar covering most of the umbonal reflection. Pedal retractor scar nearly circular and located just anterior to the widest position of the posterior adductor scar. Siphonal retractor scar small, elongate, lightly impressed, and located anterior and ventral to the pedal retractor. Umbonal–ventral ridge not well developed except near the ventral condyle but bounded posteriorly by a deep groove that is a reflection of the external ridge. Chondrophore well developed, internal ligament strong.

Mesoplax variable, with a well-developed, more or less triangular basal portion, occasionally with lateral notches in young specimens. Dorsal portion developing and varying with age; in young specimens, consisting of lobes extending anteriorly from the posterior ends of the plates (Plate 14, Fig. 2) followed by lobed lateral folds (Plate 14, Figs. 3–5, 7), which grow and eventually coalesce to form pores or short tubes (Plate 15, Figs. 4, 5, and Plate 16, Figs. 4, 5). Aperture of the tubes in living specimens covered by a periostracal membrane.

Siphons short, about equal in length, and capable of complete retraction within the valves. Diameter of the incurrent siphonal aperture about twice that of the excurrent siphon. The margins of both appear to have cirri.

TABLE 8. MEASUREMENTS OF *XYLOPHAGA ABYSSORUM.*

Length (mm)	Height (mm)	Location
3.0	2.6	*Pillsbury*, station 944
3.0	2.9	Tongue of the Ocean, off NE tip of Andros Island, Bahama Islands
3.3	3.0	*Pillsbury*, station 944
3.9	3.2	*Pillsbury*, station 944
4.0	3.5	holotype
4.0	3.6	*Gerda*, station 266
5.4	4.5	*Pillsbury*, station 944

Measurements. See Table 8.

Remarks. Dall based his description of *X. abyssorum* on two isolated valves of a dead specimen, with the main distinguishing character being the pronounced ridge posterior to the umbonal–ventral sulcus. All specimens that have been assigned to this species since that time have been so named on the basis of this ridge. Among the specimens taken from boards submerged in the Tongue of the Ocean off Andros Island, Bahama Islands, by the U.S. NOO (DePalma, 1969), was a single specimen the valves of which coincided with those of the holotype. Two specimens were taken from wood dredged off Guadeloupe Island, Lesser Antilles. All of these specimens have a pronounced ridge, concave posterior slope, and lobed mesoplax. With this new material, it has been possible to redescribe *X. abyssorum* giving the characters of the mesoplax and a range of variation. Plate 14, Figure 6, illustrates the dorsal view of the right valve of the holotype of *X. abyssorum*; Figure 3 illustrates the dorsal view of the right valve of the specimen from the Tongue of the Ocean. These two valves so closely resemble each other that, except for a slight difference in size, they could be from the same specimen. Variations in the valves and dorsal plates of specimens from Florida and Guadeloupe Island are illustrated on Plates 14–16. Plate 15, Figure 5, illustrates the position in which the young are carried on the adult. The largest number of young on any one specimen was five; the average measurement of the young was 0.3 mm in length.

Xylophaga abyssorum has a small shell but is a distinctive species, particularly in the adult stage. It is probably most closely related to *X. lobata* Knudsen from the Sulu Sea but differs in having a sharp ridge posterior to the umbonal–ventral sulcus and a far more elaborately lobed mesoplax in the adult. From *X. profunda* Turner n. sp., the only other species with lobes on the dorsal portion of the mesoplax, *X. abyssorum* differs in having broad dorsal plates with two or more pores or tubes in each. In addition, *X. profunda* is a much larger species, the umbonal–ventral ridge on the outer surface of the valves is broad and rounded, and the deep groove on the inner surface is lacking. The posterior adductor muscle scars of *X. profunda* are lightly and irregularly marked, whereas the muscle scars of *X. abyssorum* are well marked. In the young stage, the mesoplax of *X. abyssorum* is similar to that of *X. bayeri* Turner n. sp. and *X. profunda*, but the valves of these species do not have a pronounced ridge. The shape of the valves of *X. abyssorum* somewhat resembles those of *X. japonica* Taki and Habe but the mesoplax of that species is ear-shaped and not lobed. (See under *X. japonica.*)

Range. Based on the valves of dead specimens lacking a mesoplax, the range of this species extends from off Atlantic City, New Jersey, south to St. Lucia, Lesser Antilles (Turner, 1955: 157). Living specimens are known only from Florida, the Bahamas, and Guadeloupe Island, Lesser Antilles, in depths ranging from 342 to 1,722 m.

Specimens Examined. UNITED STATES, FLORIDA: *Gerda*, station 266, off Fowey Rocks (25°38′N, 79°58′W) in 185–187 fathoms (338.3–342 m). BAHAMA ISLANDS: Tongue of the Ocean, about 4 miles off NE tip of Andros Island (24°54′N, 77°47′W) in 1,722 m. LESSER ANTILLES: *Pillsbury*, station 944, 4.5 miles N of Port Louis, Guadeloupe Island (16°32.2′N, 61°36.8′W) in 360–420 m.

TABLE 9. MEASUREMENTS OF *XYLOPHAGA DUPLICATA*.

Length (mm)	Height (mm)	Location
3.7	3.5	holotype
5.2	5.0	Gulf of Tehuantepec, Mexico
5.5	5.0	Gulf of Tehuantepec, Mexico

Xylophaga duplicata Knudsen
Plate 17

Xylophaga duplicata Knudsen, 1961, *Galathea* Report, 5: 175, figs. 14, 15 (*Galathea*, station 745, Gulf of Panama [7°15'N, 79°25'W] in 915 m). Holotype, Zoological Museum, University of Copenhagen.

Distinctive Characters. Plates of the mesoplax elongate oval, with a large ventral portion, somewhat inflated, diverging anteriorly, and standing off from the surface of the valves. Anterior adductor muscle extending into the cavity of the mesoplax. Anterior slope sculptured with numerous exceedingly fine, closely set denticulated ridges. Umbonal reflection narrow and erect. Umbonal–ventral sulcus narrow, slightly impressed, and bounded posteriorly by a faint, rounded ridge. Posterior adductor muscle scar oval and smooth. Umbonal–ventral ridge narrow, high, and segmented; ventral condyle small. Siphons of equal length, united except at the tip, the posterior three-fourths covered with a brown periostracal sheath; siphonal openings (apertures set on two short tubes) each with six to eight cirri.

Measurements. See Table 9.

Remarks. At the time Knudsen described this species he had only two specimens from the Gulf of Panama. Two additional specimens received from D. Shasky were taken by the San Juan Expedition at station N-12 from a sunken log dredged in 60 fathoms (109 m) in the Gulf of Tehuantepec, Mexico (15°08'N, 93°28'W). Although the specimens were in rather poor condition, the valves and siphons agree with those described by Knudsen. The mesoplax stands off from the surface of the shell and, as stated by Knudsen, is double, that is, has a basal portion, and the anterior muscle extends into the cavity of the mesoplax. The siphons are the same length, combined in a common sheath except at the tip, and are covered with a thin, brown periostracum. The white spots mentioned by Knudsen are not evident, but the few cirri surrounding the siphonal openings are similar.

Range. This record extends the geographic range of the species about 500 miles to the north. The depth range is from 109 to 915 m.

Xylophaga muraokai[5] Turner new species
Plates 18, 19

Holotype. MCZ 316746; paratypes, MCZ 316747, 316748, 316749, 316750.

Type Locality. U.S. Naval Civil Engineering Laboratory Test Site I, about 81 miles SW of Port Hueneme, California, or about 25 miles S of San Miguel Island, Santa Barbara Islands (33°44'N, 120°45'W) in 5,640 ft (1,720 m). The holotype was taken from a panel exposed on STU I-2 from October 1963 to October 1965.

Distinctive Characters. Plates of the mesoplax wedge-shaped, the basal portion large and the small dorsal portion covering only the posterior part of the muscle. Siphons smooth, of unequal length, the excurrent slightly shorter and with 8–10 prominent cirri.

Description. Shell globose, valves reaching 14 mm in length and 13 mm in height; the width of apposed valves about 12 mm. Valves thin but strong, white, with a thin clear, transparent to bright yellow periostracum. Angle of the pedal gape about 115°. Anterior slope sculptured with narrow, finely denticulated ridges that are widely spaced during early growth, becoming more closely spaced toward the ventral margin in older specimens. Holotype with 17 ridges on the anterior slope. Umbonal–ventral sulcus rather narrow, only slightly

[5] Named for James Muraoka, Biologist, U.S. Naval Engineering Laboratory, Port Hueneme, California.

depressed and sculptured with fine growth lines. Disc and posterior slope sculptured with growth lines only.

Inner surface of valves smooth and shining. Umbonal–ventral ridge narrow and marked with distinct transverse ridges that appear knobby in some specimens. Chondrophore and internal ligament well developed. Posterior adductor muscle scar large, elliptical, covering most of the posterior slope, and marked with irregular, faint depressions that generally cross the short axis of the scar. Pedal retractor muscle scar broadly oval in outline and located just anterior to and about midway on the posterior adductor scar. In some specimens, the two scars appear to be adjacent. Siphonal retractor muscle scars not clearly defined but located just posterior to the umbonal–ventral ridge about midway dorsoventrally. Ventral adductor muscle scar long, narrow, and traversing the ventral end of the umbonal–ventral ridge. Anterior adductor muscle scar covering the umbonal reflection and the ventral flange of the mesoplax.

Mesoplax small and divided. The ventral portion is a large, curved, wedge-shaped shield, fitting closely against the surface of the valves. Posteriorly, the mesoplax curves upward and forward covering the posterior portion of the anterior adductor muscle (Plate 18, Figs. 3–6).

Siphons smooth, united, and capable of extending over three times the length of the valves. Excurrent siphon only slightly shorter than the incurrent siphon. Aperture of the incurrent siphon bordered by 18–22 long, slender cirri that, in preserved specimens, curl inward and are not easily seen. At the base of these are numerous small cirri and, anterior to them on the inner wall of the siphon, 8–10 broad, branched cirri. Distal margin of excurrent siphon with two broad, short cirri on each side adjacent to the incurrent siphon, and 8–10 long, slender cirri, the longest located middorsally, with those on either side becoming progressively shorter.

The anterior adductor muscle inserts both on the anterior reflection and on the basal portion of the mesoplax. Siphonal retractor muscles straplike, extending anteriorly from the base of the siphons along the midportion and over the outer surface of the visceral mass to insert on the valves just posterior to the umbonal–ventral ridge. Ventral adductor muscle, formed as a thickened area of the fused mantle margin, inserts over and to each side of the ventral condyles. Pedal retractor muscles pass through the visceral mass and insert just anterior to the posterior adductor muscle.

Table 10. Measurements of *Xylophaga muraokai.*

Length (mm)	Height (mm)	Location
6.5	6.2	paratype
8.5	8.0	paratype
11.8	12.0	paratype
12.0	11.5	paratype
12.0	11.9	paratype
12.8	12.8	holotype
14.0	13.0	paratype

Measurements. See Table 10.

Remarks. The young of *X. muraokai* Turner n. sp. superficially resemble those of *X. concava* Knudsen, found in the Gulf of Panama, but differ in having a mesoplax with a large ventral portion, in having the excurrent siphon slightly shorter than the incurrent siphon, and in having a few large cirri on the excurrent siphon. From *X. duplicata* Knudsen, also from the Gulf of Panama, *X. muraokai* differs in lacking the brown periostracal sheath covering the siphons, in having an elongate rather than nearly circular posterior adductor scar, and in having the dorsal portion of the mesoplax reduced, covering only the posterior portion of the anterior adductor muscle.

As with all *Xylophaga* known to date, specimens of *X. muraokai* show considerable variation in size and sculpture depending on the type of wood in which they are boring. A specimen boring in greenheart with valves only 6 mm in length had 45 closely spaced denticulated ridges on the anterior slope, whereas a specimen of the same size in white pine had only 7 ridges. Although it is impossible to tell the exact age of these specimens, we know that the greenheart panel was exposed for 35 months and the white pine panels were exposed for 24 months. Other specimens in a white pine panel (exposed on the same rack for the same length of time as the greenheart panel) reached 12 mm in length and had only 24 ridges.

Large numbers of *X. muraokai* were taken from panels submerged for 2 years at 5,640 ft (1,720 m). The openings of the burrows averaged about 1 mm in diameter and increased rapidly. When specimens were uncrowded, the anterior end of burrows that had reached 15 mm in length averaged 12 mm in diameter; burrows 55 mm long averaged about 15 mm in diameter anteriorly. The tunnels often ran together and frequently two to six specimens occupied a large irregular cavity. Apparently, several specimens occasionally used a single opening to the surface.

Xylophaga muraokai Turner n. sp. is known only from the USNCEL Test Site I. It has never been taken from panels submerged at Test Site II, which is just north of San Miguel Island in about 2,370 ft (722 m). Differences in temperature, dissolved oxygen content of the water, and hydrostatic pressure between the two sites are probably the responsible factors. It is impossible to say whether or not they are all of equal importance.

Xylophaga washingtona Bartsch, a species of wide geographic and depth range, has been taken from wood exposed at Test Site I. It is the only species found at Test Site II, where it is abundant. For a comparison of the test sites, see Table 11. For a description of the test sites, see Muraoka (1964, 1965, 1966a, 1966b, 1966c, 1967).

Range. Known only from USNCEL Test Site I.

Specimens Examined. UNITED STATES, CALIFORNIA: USNCEL Test Site I (33°44′N, 120°45′W) about 81 nautical miles SW of Port Hueneme (about 25 miles S of San Miguel Island, Santa Barbara Islands); STU I-1 at 5,300 ft (1615.4 m) exposed March 1962–February 1965; STU I-2 at 5,640 ft (1,720 m) exposed October 1963–October 1965; STU I-4 at 6,800 ft (2,072.6 m) exposed June 1964–7 July 1965; STU I-5 at 6,000 ft (1,828.8 m) exposed 25 August 1965–12 February 1966.

TABLE 11. COMPARISON OF THE U.S. NAVAL CIVIL ENGINEERING LABORATORY TEST SITES (AVERAGE VALUES TAKEN FROM MURAOKA, 1967).

Locality	Depth (ft)	Temperature (°C)	Dissolved Oxygen (ml/L)	Hydrostatic Pressure (psi)
Test Site I	5,640	2.5	1.26	2,482
Test Site II	2,370	5.0	.30	1,043

Xylophaga atlantica Richards
Plate 20

Xylophaga atlantica Richards, 1942, Nautilus, 56: 68, pl. 6, fig. 4 (east coast of the United States). Holotype, Academy of Natural Sciences Philadelphia 178741; Turner 1955, Johnsonia, 3(34): 152–154, pl. 91, figs. 1–6 (type locality, Mount Desert Island, Maine). (See Turner, 1955: 153.) [Not Turner, 1954, Johnsonia, 3(33): 5–6, pl. 4 = *X. clenchi* Turner and Culliney; see below.]

Distinctive Characters. Mesoplax small, anterior to and between the umbos, composed of two triangular plates that are in contact the length of the dorsal margin and meet at a broadly obtuse angle. Ventral portion of the mesoplax narrow, forming a small posterior cavity into which the posterior end of the anterior adductor muscle extends. Umbonal–ventral sulcus shallow with a median threadlike groove. Posterior adductor muscle scar elongate and irregularly marked. Excurrent siphon slightly shorter than the incurrent, the excurrent aperture with 15–20 large papillae, incurrent aperture with a double row of numerous minute papillae (Plate 20, Fig. 3).

Remarks. Between 16 June 1964 and 16 July 16 1965, the U.S. NOO submerged test panels off Mark Island, Penobscot Bay, Maine, in water 200 ft in depth. The panels were set in a vertical array at depths of 50, 100, 150, and 195 ft. Dissection of these panels showed that the bottom one had 85 specimens of *X. atlantica,* the one at 150 ft had six specimens, and the one at 100 ft had only one specimen. This suggests that, like *X. washingtona* Bartsch, *X. muraokai* Turner n. sp., *X. depalmai* Turner n. sp., and probably all *Xylophaga,* the larvae of this species do not rise very high in the water column and that the greatest decrease in attack occurs within a few feet of the bottom. Probably a panel touching or partially submerged in the substrate at this locality would have been heavily attacked. These tests also showed that the valves of *X. atlantica* may reach a length of at least 10.5 mm in a year. Several specimens removed from wood dredged off Ipswich, Massachusetts, in about 80 m averaged 14 mm in length. The maximum length for *X. atlantica* appears to be 15 mm.

The Ipswich specimens were well preserved and allow a more detailed description of the siphons than that given in the paper by Turner (1955) cited above. The siphons can be extended 1.5–2 times the length of the valves. The excurrent siphon is slightly shorter than the incurrent siphon and is combined with it for most of its length. The excurrent aperture is surrounded by 15–20 relatively large papillae that on the dorsal surface appear to be grouped in two lobes. The incurrent siphon is surrounded by an outer rim of small papillae and an inner one of slightly larger, stouter papillae (Plate 20, Figs. 1, 2).

Xylophaga atlantica is oviparous and does not brood its young. The reproduction and larval development of *X. atlantica* are fully discussed by Culliney and Turner (1976); they detail methods of laboratory culture and illustrate the various larval and growth stages. A reexamination of the specimen reported by Turner (1954: 5–6, pl. 4) has shown it to be *X. clenchi* Turner and Culliney, a species that usually is found with young attached to the parent. The adult of *X. clenchi* differs from that of *X. atlantica* in having a mesoplax that lacks a ventral portion, in the shape and type of marking on the posterior adductor muscle scar, in having a broad, rounded ridge posterior to the umbonal–ventral sulcus, and in the arrangement of the papillae on the siphons.

On the basis of the material then available, I formerly considered this species most closely related to *X. washingtona* Bartsch (Turner, 1956). It is now evident that these species belong to two different species groups. In *X. atlantica,* the excurrent siphon is only slightly shorter than the incurrent siphon and cirri surround the aperture of both siphons (Plate 20, Figs. 1–3). In addition, the posterior adductor scar is irregularly marked, whereas that of *X. washingtona* has regular herringbone markings.

Range. From Newfoundland south to Cape Henry, Virginia, in depths ranging from about 15 to 1,242 m.

Specimens Examined (New Records Since Turner, 1955). CANADA, NEWFOUNDLAND: ½ miles off Argentia in 18.3 m (test panel). NOVA SCOTIA: North Bay, Cape Breton Island (46°20′N, 61°50′W) in 128 m. UNITED STATES, MAINE: off Mark Island, Penobscot Bay, in 15.2 m, 30.5 m, 45.7 m, and 59.5 m (test panels). MASSACHUSETTS: 15 miles off Ipswich in 73 m; NE of Cape Cod Light off Truro in 40 m; E of Nantucket Island (41°23′N, 68°46′W).

Xylophaga washingtona Bartsch
Plate 21

Xylophaga washingtona Bartsch, 1921, Proceedings of the Biological Society of Washington, 34: 32 (San Juan Island, Washington). Holotype, U.S. National Museum (USNM) 334478; Turner, 1955, Johnsonia, 3(34): 154, pl. 92; Turner, 1956, Nautilus, 70: 10; Tipper, 1968, Ecological Aspects of Two Wood-Boring Molluscs from the Continental Terrace Off Oregon, Thesis, Department of Oceanography, Oregon State University, pp. 8–13, 64–118.

Distinctive Characters. Mesoplax small, anterior to and between the umbos, composed of two triangular plates that are in contact for the length of the dorsal margin and are set at a moderately obtuse angle to each other. Ventral portion of the mesoplax usually greater than one half the width of the dorsal portion and keeled. Umbonal–ventral sulcus broad and shallow. Posterior adductor muscle scar elongate oval in outline with regular herring-

TABLE 12. PENETRATION INTO WOOD OF *XYLOPHAGA WASHINGTONA* AT VARIOUS DEPTHS AND EXPOSURE TIMES.

Locality	Depth (m)	Exposure	Reference
3 miles off Oceanside, California	109	4 months	Turner, 1956
STU* II (1 and 2), California	722	6.5, 13.4 months	Muraoka, 1965, 1967
STU* I (1–4), California	1,615–2,066	4, 13, 25, and 35 months	Muraoka, 1964, 1966a, 1966b, 1966c
19 miles off Depoe Bay, Oregon	200	38 and 72 days	Tipper, 1968
25 miles off Depoe Bay, Oregon	500	2 months	Tipper, 1968
40 miles off Depoe Bay, Oregon	1,000	2 months	Tipper, 1968

* STU, submersible test unit.

bone markings. Proximal end of the combined siphons usually having a thin periostracal sheath. Excurrent siphon one third to one half the length of the incurrent siphon, truncated, and having a narrow ridge extending from each side for a short distance along the dorsal surface of the incurrent siphon. Excurrent siphonal opening small, located at the end of a short tube extending between the lateral ridges, and apparently lacking papillae (Plate 21, Figs. 2, 3). Incurrent siphonal opening margined by 15 inwardly extending papillae (Plate 21, Fig. 4).

Remarks. In recent years a great deal has been added to our knowledge of the distribution of *X. washingtona,* and interesting observations have been made concerning its ecology and variation. The many specimens taken from the STU panels exposed by the USNCEL off San Miguel Island, California, have shown that a great deal of variation exists in the shape and sculpture of the valves as well as the size of the posterior adductor muscle in response to the hardness of the substrate in which they are boring. This is discussed in the section on Variation. From these tests we have also learned that larval and adult *X. washingtona* can tolerate a wide range in dissolved oxygen concentration. They were the only borers taken from the STU II test site where the concentration was 0.30 ml/L. The temperature at this site was 5.0° C (Muraoka, 1965). Based on adults dissected from new wood exposed at various sites with known dates and depth of submergence, it has been possible to determine the depth at which the larvae can successfully penetrate. These data are summarized in Table 12.

A single large specimen was taken in 18.3 m from wood that had been removed from old street cars and used to make Hermosa Reef, ½ mile west of Hermosa Beach, Santa Monica Bay, California. This is the shallowest record known for the settlement of larvae. The apparent scarcity of specimens suggests that this is the upper limit of the depth range. Living specimens have been taken from a fir log dredged from 73 m off Vancouver Island, British Colombia. Although no testing has been done in this area, it is likely that, in these colder waters, *X. washingtona* could occur at shallower depths.

Muraoka (1966c) found that "wood specimens which were exposed near the sediment were damaged considerably more severely than those specimens which were exposed about 3 feet above the sediment." This, he said, "indicates that the deep sea borers are very active in large numbers immediately above the sediment layer and that their numbers tend to decrease in seawater as the distance from the sediment layer increases." Tipper (1968) showed that the settlement of larvae of *X. washingtona* off Depoe Bay, Oregon, was densest in proximity to the sea–sediment interface and that the drop in borer penetration usually occurred within the first 6 cm upward from the interface. He also showed that, from the initial penetration very close to the sea–sediment interface, the attack progressed upward with increasing time of exposure. Analyses of these data suggest that 1) the free-swimming larvae of *X. washingtona* probably do not rise more than 10–25 ft above the sea floor; 2) as the attack increases, competition occurs for space; and 3) the second crop of larvae, prevented from settling on the lower levels because of the activity of the siphons of specimens already in the wood, are kept swimming and eventually settle on surfaces higher up in the water column.

Tipper (1968) also pointed out that the depth of penetration decreased with increased density of the wood. Cedar, pine, fir, and oak panels exposed for 50 days at a depth of 200 m showed an average penetration of 3.8 mm in cedar, 3 mm in pine, 1.5 mm in fir, and 0.5 mm in oak. Decrease in depth of penetration also is related to increase in depth of exposure. This, he postulated, may be correlated with lower temperatures resulting in slower growth rates or with the increased density of the wood from compression at great depth.

These observations agree with those obtained from the tests off southern California (see section on Variation in the Introduction). From the STU samples we found that the softer the wood (except balsa), the deeper the *Xylophaga* penetrated and the greater was the development of the chimney of fecal pellets. In a cedar panel exposed on STU I-5 for 6 months, two sets of *X. washingtona* were found; the earlier set had tunnels averaging 10–12 mm in length, and the second set had tunnels averaging 5 mm in length. Another panel on STU I-1 exposed for 35 months had specimens with tunnels reaching 35 mm in length. These tunnels averaged 10 mm in diameter at the anterior end; a chimney of rather coarse fecal pellets lined the posterior 15 mm of the burrow. Considering the greater depth of the STU panels and realizing that the rate of growth decreases with age, these growth rates agree with those reported by Tipper (1968).

Based on data gathered to date from test panels, it would appear that *X. washingtona* probably breeds throughout the year and that the entire larval life is spent in the sea. Young specimens have never been found attached to the shells of the hundreds of adults examined.

Range. From Vancouver Island, British Columbia, south to the Santa Barbara Islands, California, in depths ranging from 20 to 2,000 m.

Specimens Examined (New Records Since Turner, 1955). CANADA, BRITISH COLOMBIA: Satellite Channel, between Saltspring and Vancouver Islands in 93 m (C. Carl). UNITED STATES, OREGON: about 30 miles W of Seaside (46°00′N, 124°48′W) in 464.5 m; about 50 miles W of Tillamookhead (45°54′N, 125°09′W) in 1,554.4 m; about 40 miles W of Silver Point (45°52′N, 124°54′W) in 822.9 m (all Oregon State University); 19 miles W of Depoe Bay (44°52′N, 124°54′W) in 200 m; 25 miles W of Depoe Bay (44°52′N, 124°36′W) in 500 m; 40 miles W of Depoe Bay (44°52′N, 125°01′W) in 1,000 m (all R. Tipper). CALIFORNIA: Hermosa Reef, ½ mile off Hermosa Beach in 18.3 m (J. Fitch); 3 miles off Camp Pendleton pier, Oceanside, in 100 m (F. Snodgrass); USNCEL STU II (1 and 2), 75 miles W of Port Hueneme or about 5 mi NW of San Miguel I., Santa Barbara Islands (34°06′N, 120°42′W) in 722 m; USNCEL STU I (1, 4, and 5), 81 miles SW of Port Hueneme or 25 miles SW of San Miguel Island, Santa Barbara Islands (33°44′N, 120°45′W) in 1,524–2,066 m (both J. Muraoka); Allan Hancock station 1372–41, about ¾ mile E of Empire Landing, Santa Catalina Island, Santa Barbara Islands (33°25′50″N, 118°24′50″W) in 84 m (Allan Hancock Foundation); 2 miles off Eel Point, San Clemente Island, Santa Barbara Islands in 72.2 m (F. Snodgrass).

Xylophaga rikuzenica Taki and Habe
Plate 22

Xylophaga rikuzenica Taki and Habe, 1945, Japanese Journal of Malacology (Venus), 14: 112 (off Rikuzen, Honshu, Japan). Holotype, T. Habe Collection; paratype, MCZ 194821. *Neoxylophaga rikuzenica* (Taki and Habe) 1950, Illustrated Catalogue of Japanese Shells, no. 7, p. 46, text-figs. 4, 5.

Distinctive Characters. Mesoplax composed of two inflated triangular plates with a large basal portion and ventral keel; plates in contact both dorsally and ventrally for the length of the medial margin (Plate 22, Figs. 5–7). Posterior adductor muscle scar elongate oval, tapering dorsally, and with regular herringbone markings. Valves and dorsal plates covered with a heavy, brown periostracum. Umbonal–ventral sulcus wide and deep (Plate 22, Figs. 2, 4).

Remarks. Taki and Habe (1945) briefly described this species in Japanese but included no figures. In 1950, they created the genus *Neoxylophaga* with *rikuzenica* as the type species, mentioning the small, triangular mesoplax and thick, brown periostracum as generic characters. Turner (1956) related *X. rikuzenica* to *X. washingtona* Bartsch on the basis of the dorsal plates. A paratype specimen, received through the kindness of Dr. Habe, shows that the posterior adductor muscle scar is similar to that of *X. washingtona* Bartsch, *X. praestans* Smith, and *X. aurita* Knudsen, the other species in this group with simple, unfringed lappets extending from the truncation of the excurrent siphon. *Xylophaga rikuzenica* is closely related to but differs from *X. washingtona* mainly in having a heavy, brown periostracum covering the valves and mesoplax as well as in having a much wider, deeper umbonal–ventral sulcus. Unfortunately, the siphons of *X. rikuzenica* are unknown so comparisons cannot be made on that basis. However, all species with regular herringbone markings on the posterior adductor scar known to date have similar siphons so *X. rikuzenica* can be assumed to belong to the same group. No *Xylophaga* have been taken north of Vancouver, British Columbia, but continuous collecting across the north Pacific may show that *X. rikuzenica* merges with *X. washingtona.* Until this is done, the two species are being maintained because they are recognizable and may not merge.

Range. Known only from off Rikuzen and Toyama Bay, Honshu, Japan, in depths ranging from 100 to 700 fathoms (183 to 1,270 m) (Taki and Habe, 1950).

Specimens Examined. JAPAN: off Rikuzen, Honshu in 183 m.

Xylophaga depalmai[6] Turner new species
Plates 23, 24

Holotype. MCZ 316735.

Type Locality. 3.2 miles off Fort Lauderdale, Florida (26°04′N, 80°04′W) in 152.4 m (500 ft) in a test panel.

Distinctive Characters. Shell globose, anterior slope with fine, closely set, denticulated ridges; umbonal–ventral sulcus shallow and bounded posteriorly by an indistinct ridge; posterior slope smooth. Umbonal–ventral ridge narrow and high. Muscle scars barely impressed and smooth. Mesoplax composed of two inflated, elongate plates that are coiled posteriorly, vary in shape, and are occasionally fused. Excurrent siphon truncate; lappets on dorsal surface of incurrent siphon with exceedingly fine serrations.

Description. Shell globose, valves reaching 9.8 mm in length and 9 mm in height, thin, fragile, and with a thin transparent periostracum. Pedal gape angle about 95–105°. Anterior slope sculptured with exceedingly fine, closely set, denticulated ridges; specimens 8 mm long had 40–66 ridges. Posterior portion of the anterior slope rather wide and the ridges extending to the umbonal–ventral sulcus more coarsely denticulate. Umbonal–ventral sulcus barely impressed, nearly smooth, and bounded posteriorly by a fine, indistinct ridge. Disc and posterior slope faintly marked with growth lines. Posterior slope with a low, smoothly curved dorsal margin that is not reflected.

Inner surface of valves smooth and glistening. Umbonal–ventral ridge narrow, high, and not enlarging at the ventral margin to form a knoblike condyle. Posterior adductor muscle scar barely impressed, rather small, oval, smooth, and set high on the posterior slope. Pedal retractor scar dumbbell-shaped or as two adjacent cir-

[6] Named for John DePalma, U.S. Naval Oceanographic Office, who was responsible for the tests off Fort Lauderdale, Florida; in the Tongue of the Ocean, Bahama Islands; and in Penobscot Bay, Maine.

Table 13. Measurements of *Xylophaga depalmai.*

Length (mm)	Height (mm)	Location
6.0	5.5	off Fort Lauderdale, Florida
7.6	7.0	off Fort Lauderdale, Florida
8.0	7.5	holotype
8.2	8.2	off Fort Lauderdale, Florida
8.5	7.0	off Fort Lauderdale, Florida
9.8	9.0	off Fort Lauderdale, Florida

cles just anterior to the posterior adductor scar. Ventral adductor scar large, elongate, irregularly oval, located posterior to the umbonal–ventral ridge and paralleling the ventral margin of the valve. Siphonal retractor scar small, broadly oval, and located just posterior to the umbonal–ventral ridge at the level of the pedal retractor scar. Anterior adductor scar covering the umbonal reflection and the lower surface of the mesoplax. Chondrophore and internal ligament well developed.

Mesoplax composed of two inflated, posteriorly coiled plates that may be asymmetrical, have a well-developed ventral portion, are longer than wide, with the medial margin of the plates parallel and occasionally with the two parts fused (Plate 24, Figs. 3–17).

Burrow length of specimens with valves 4–8 mm in length varying from 1.5 to 4 times the length of the valves. Posterior end of the burrows usually with a smooth, firmly packed chimney composed of fine wood fragments.

Siphons capable of complete retraction within the valves. Excurrent siphon truncated just posterior to the valves and lacking cirri. Finely serrated lappets extend from the truncation along either side of the dorsal surface of the incurrent siphon. Incurrent siphon with fine cirri surrounding the aperture. Base of the siphons covered by a fine periostracal sheath that extends along the sides of the siphons and contains fine, irregular, glasslike granules (Plate 23, Figs. 1, 4, 5).

Measurements. See Table 13.

Remarks. This species is most closely related to *X. guineensis* Knudsen from the Gulf of Guinea, West Africa. *Xylophaga depalmai* differs in being larger, having an elongate mesoplax, the posterior end of which fits between the umbos, and in having more coarsely serrated lappets on the siphons. (See also Remarks under *X. guineensis.*) From *X. tipperi* Turner n. sp., to which it is also related, *X. depalmai* differs in having an elongate inflated mesoplax that fits between the umbos rather than a broad flattened one that covers them, in having finely serrated lappets on the siphons, in having the granules on the siphons only in the periostracum rather than being embedded in the tissue, and in producing a chimney. From *X. mexicana* Dall, which it also somewhat resembles, *X. depalmai* differs in the shape of the mesoplax, in having narrower, more finely fringed lappets on the siphons, an inconspicuous ridge posterior to the umbonal–ventral sulcus, and an exceedingly thin periostracum. In addition, the granular inclusions on the siphons of *X. mexicana* are coarse, chalky, white, and arranged in a single line extending nearly the length of the siphons.

Variation exhibited in the mesoplax of *X. depalmai* is unusual and unexpected, for in most species of *Xylophaga* the mesoplax is remarkably uniform unless the specimen is injured or stenomorphic. The extreme forms (Plate 24, Figs. 11–15) are sufficiently different to be considered of specific value in this genus. However, in the more than 300 specimens obtained from the test site off Fort Lauderdale, connecting forms exist between them. The characters of the shell, the siphon, and soft parts are similar in all specimens. Consequently, because the large majority are typical (Plate 24, Figs. 16, 17), the extremes are considered to be variants.

Xylophaga depalmai Turner n. sp. was the most common species occuring in the Fort Lauderdale test. It ranged from 1 to 3.2 miles off shore and occurred in boards placed near the bottom in depths from 100

TABLE 14. DATA FOR ALL OF THE SPECIMENS OF *XYLOPHAGA DEPALMAI* N. SP. FOUND IN THE COLLECTING PANELS OFF FORT LAUDERDALE, FLORIDA.

Panel no.	Distance From Shore (miles)	Bottom Depth in Feet (m)	Depth of Panel in Feet (m)	Date of Submergence	Date of Removal	No. Specimens Examined
2 panels without numbers	2.5	300 (91.44)	on bottom	Sept. 1961	June 1962	±250
W44	1.8	100 (30.48)	on bottom	Jan. 1964	Oct. 1964	1
H50	2.3	200 (60.96)	100 (30.48)	Jan. 1964	Oct. 1964	2
H56	2.3	200 (60.96)	on bottom	Jan. 1964	Sept. 1964	5
G62	2.6	300 (91.44)	200 (60.96)	Jan. 1964	Sept. 1964	6
G68	2.6	300 (91.44)	on bottom	Jan. 1964	Sept. 1964	31
J59	2.3	200 (60.96)	on bottom	24 Jan. 1964	4 Jan. 1965	3
492	3.2	500 (152.4)	200 (60.96)	20 Oct. 1965	13 Oct. 1965	3
493	3.2	500 (152.4)	200 (60.96)	20 Oct. 1965	13 Oct. 1966	10
497	3.2	500 (152.4)	300 (91.44)	20 Oct. 1965	13 Oct. 1966	5
498	3.2	500 (152.4)	300 (91.44)	20 Oct. 1965	13 Oct. 1966	7
500	3.2	500 (152.4)	400 (121.92)	20 Oct. 1965	13 Oct. 1966	3
501	3.2	500 (152.4)	400 (121.92)	20 Oct. 1965	13 Oct. 1966	2
502	3.2	500 (152.4)	400 (121.92)	20 Oct. 1965	13 Oct. 1966	3
504	3.2	500 (152.4)	on bottom	20 Oct. 1965	13 Oct. 1966	8
505	3.2	500 (152.4)	495	20 Oct. 1965	13 Oct. 1966	6

to 500 ft (30.5 to 152.4 m). In addition, a few specimens were found in boards 100, 200, and even 300 ft off the bottom, which means that, in this species at least, the larvae range well up in the water column. As can be seen from Table 14, panels on the bottom in 300 ft (91.4 m) were the most heavily attacked. This may reflect cyclic variation in population density because the panels were exposed at different times, or that, because of the configuration of the bottom and the currents, more wood was available on the bottom in this vicinity, supporting a native population and a ready source of larvae. However, this also may indicate that this is the optimum depth for this species.

According to DePalma (1969), the salinity at the test site was uniformly high and the temperature of the water ranged from 24 to 30° C at the surface, from 20 to 25° C at 100 m, and from 7 to 9.5° C at 153 m. The northward-flowing Florida Current averaged 1.5 knots.

Range. From Florida north to Massachusetts in depths ranging from about 30 to 174 m.

Specimens Examined. UNITED STATES, FLORIDA: off Fort Lauderdale (26°04′N, 80°04′W). See Table 14. Additional records include: FLORIDA: 160

miles W of Tampa, OTEC station 3089 in 126 m; and OTEC station 3086 in 96 m. RHODE ISLAND: From rosewood panels tied to lobster pot set at 39°57′N, 69°19′W in 45.7 m (Knutton, from Al Eagle's ship *Reliance*). MASSACHUSETTS: *Delaware II*, station 369 (42°37′N, 66°27′W) from wood dredged from 174 m.

Xylophaga guineensis Knudsen
Plates 25, 26

Xylophaga guineensis Knudsen, 1961, *Galathea* Report, 5: 195–196, fig. 38 (*Galathea*, Station 52, off West Africa, 01°42′N, 07°51′E in 2,550 m). Holotype, Zoological Museum, University of Copenhagen.

Distinctive Characters. Valves globose, with exceedingly fine, closely spaced, denticulated ridges; umbonal–ventral sulcus barely impressed, bounded by a weak anterior ridge and a well-marked, narrow posterior ridge. Mesoplax composed of two inflated cornucopialike plates.

Description. Valves globose, reaching 2.2 mm in length, thin, and fragile. Pedal gape angle about 90°. Anterior slope sculptured with exceedingly fine, evenly spaced, denticulated ridges, there being about 45 in a specimen 2 mm long. Umbonal–ventral sulcus only slightly impressed, bounded anteriorly by a low, inconspicuous, rounded ridge and posteriorly by a narrow, well-defined ridge, occasionally almost bladelike. Disc and posterior slope smooth.

Inner surface of valves smooth and glistening. Muscle scars barely visible. Posterior adductor scar smooth, lobed anteriorly with the small pedal retractor just anterior to it in the upper embayment. Umbonal–ventral ridge and condyle prominent, with a parallel groove posterior to the ridge. This groove is the internal expression of the ridge bounding the sulcus on the outer surface.

Mesoplax composed of two smooth, inflated, cornucopialike plates, the horns of which curl toward each other (Plate 25, Figs. 3, 6, 8, 9); the two halves usually equal and mirror images but occasionally unequal and varying in size and shape.

Siphons about equal to the length of the shell, capable of complete retraction within the valves. Excurrent siphon truncated, about one third the length of the incurrent siphon, with narrow and minutely serrated lappets extending from the truncation along the dorsal surface of the incurrent siphon. Base of siphons covered by a filmy periostracal sheath with fine, irregular, whitish granules imbedded in it along the sides of the siphons (Plate 25, Figs. 1, 2).

Measurements. See Table 15.

Table 15. Measurements of *Xylophaga guineensis*.

Length (mm)	Height (mm)	Location
0.9		*Pillsbury*, station 260
1.3	1.2	*Pillsbury*, station 260
1.3	1.5	paratype (estimated from Knudsen, 1961, fig. 38b)
1.5	1.3	*Atlantique Sud*, station 33
2.2	2.2	*Atlantique Sud*, station 33

Remarks. When Knudsen described *X. guineensis* he had only "very fragmented shells of 5–6 individuals removed from a piece of wood; not a single complete shell present." One specimen had a complete mesoplax although only the umbonal area of the valves was present. The species was diagnosed on the basis of the mesoplax and the large sculptured, bright yellow prodissoconch.

In the course of examining wood dredged from off the western coast of Africa, I obtained four dead specimens, one with a complete mesoplax (*Atlantique Sud*, station 33), and seven small living specimens, two complete (*Pillsbury*, station 260), all of which appear to be this species. The two plates of the mesoplax of these specimens are mirror images of each other (Plate 26, Figs. 2–4). As shown under *X. depalmai* (Plate 24, Figs. 11, 12), the mesoplax is not always bilaterally symmetrical. Therefore, these new specimens from off the western coast of Africa are being considered *X. guineensis* and a description of the species based on entire specimens is given.

Although stenomorphs are commonly found in *Xylophaga* (see section on Variation), the specimens dissected from the wood dredged by the *Atlantique Sud* Expedition and the *Pillsbury* did not appear to be stunted or malformed in any way. They were not crowded and the wood was not particularly hard. Consequently, on the basis of the large number of evenly spaced ridges on the anterior slope, the well-developed mesoplax, the strength of the ridge bounding the umbonal–ventral sulcus posteriorly, and the small size of the specimens, I consider this to be a small species.

All the major characters of the siphons mentioned in the description could be seen with a dissection scope at 250×. However, the fringe on the lappets could only be detected under a compound microscope at 430×. It was impossible to determine whether or not the fringe extended the entire length of the lappet on the two specimens that had extended siphons. The siphons appear similar to those of *X. depalmai.*

Xylophaga guineensis is most closely related to *X. depalmai* taken from waters off Florida and the Bahamas. *Xylophaga guineensis* differs in being smaller; in having a smooth mesoplax composed of inflated, tubular, cornucopialike plates; in having more numerous and closely spaced, denticulated ridges on the anterior slope when comparing specimens of equal size; and in having a larger, more prominent, strongly sculptured prodissoconch. (See also Remarks under *X. depalmai.*)

The specimens that Knudsen described were taken from wood dredged in 2,550 m but the three lots of new material were from 147, 145, and 46 m. Although *X. guineensis* may extend into deep water, it is probably a fairly shallow water species, and this would agree with the known depth range of *X. depalmai*, the species to which it is most closely related. The fact that Knudsen's specimens were all dead and fragmented further substantiates the possibility that the wood was carried into deeper water after it was invaded by *X. guineensis.* The continental shelf in this area is narrow and such a movement of wood on the bottom could easily take place.

Range. Gulf of Guinea, West Africa, in depths ranging from 46 to 147 m (living material) and in 2,550 m (dead).

Specimens Examined. CAMEROONS: *Pillsbury*, station 260, off Santa Isabel Island (3°45′N, 9°05′E) in 46 m. GABON: *Atlantique Sud*, station 146, about 46 miles NNE of Port Gentil (0°03′S, 9°07′E) in 147 m; *Atlantique Sud*, station 33, 35 miles W of Ambrizette (7°16′S, 12°17′E) in 145 m.

Xylophaga mexicana Dall
Plates 27, 28

Xylophaga mexicana Dall, 1908, Bulletin Museum of Comparative Zoology, 43(6): 425 (*Albatross*, station 3422, off Acapulco, Mexico [16°47′N, 99°59′W] in 141 fathoms [257.9 m]). Holotype USNM 122947; Turner, 1955, Johnsonia, 3(34): 150, pl. 90.

Distinctive Characters. Umbonal–ventral sulcus bounded posteriorly by a narrow, sharp ridge. Mesoplax ear-shaped, inflated, the two halves not meeting medially except at the posterior end. Excurrent siphon truncated; lappets extending along the dorsal surface of the incurrent siphon finely fringed. Siphons with a single row of opaque white granules imbedded along the sides. Posterior quarter of the incurrent siphon papillose.

Description. Shell globose, valves reaching 10.5 mm in length and 9.5 mm in height, thin, fragile, and with a thin, light straw-colored periostracum on the posterior slope. Pedal gape angle about 110°. Anterior slope with exceedingly fine, closely set, denticulated ridges. Umbonal–ventral sulcus rather narrow, moderately deep, and bounded posteriorly by a narrow, sharp ridge. Disc and posterior slope sculptured with fine growth lines. Posterior margin broadly rounded. Posterior slope becoming proportionately more elongate with increased size and age, as indicated in the measurements. Umbonal reflection free and recurved anteriorly, appressed posteriorly, and covering the anterior portion of the umbonal area.

Inner surface of the valves white, smooth, and glazed. Umbonal–ventral ridge narrow, slightly segmented, and broadening only slightly toward the ventral margin to form the condyle. Posterior adductor muscle scar well impressed, smooth, broadly oval in outline, set high on the posterior slope and at the posterior margin of the valve. Pedal retractor scars nearly circular, double, and adjacent to the embayment on the anterior margin of the posterior adductor scar. Ventral adductor scar large, irregularly oval in outline, and well posterior to the umbonal–ventral ridge. Siphonal retractor scar small, bilobed, and located posterior to the umbonal–ventral ridge at a level corresponding to the pedal retractor scars. Anterior adductor scar covering the umbonal reflection. Chondrophore and internal ligament well developed.

Mesoplax somewhat variable but usually slightly longer than wide, with the medial margin of the two halves diverging. Plates ear-shaped, inflated, coiled posteriorly, and covering the umbos.

Siphons capable of complete retraction within the valves and of extension to at least 1.5 times the length of the valves. Excurrent siphon truncated, about one third the length of the incurrent siphon, and lacking cirri. Lappets extending from the truncation of the excurrent siphon finely fringed. Posterior portion of the incurrent siphon papillose; inner edge of siphonal opening margined with numerous minute cirri. Siphons with thin periostracal sheath posteriorly and with a single row of white, opaque, irregular granules embedded along the sides.

Measurements. See Table 16.

Remarks. Xylophaga mexicana Dall was described on the basis of two right valves that were in rather poor condition and lacked a mesoplax. Consequently, it has been impossible up to now to relate it to other species. Valves of living specimens taken off California agree with those of the holotype of *X. mexicana*. Dall's specimen was from much deeper water (141 fathoms) than the Californian series (about 19 fathoms) but it could have been advectitious at that depth. *Xylophaga mexicana* Dall could, of course, be considered a *nomen dubium* but this would necessitate describing the Californian specimens. Because the valves of these specimens resemble the holotype of *X. mexicana* sufficiently well to carry the name, it seems best to establish that taxon firmly on the basis of this new material.

TABLE 16. MEASUREMENTS OF *XYLOPHAGA MEXICANA*.

Length (mm)	Height (mm)	Location
4.8	4.5	Malibu Reef, California
5.0	4.2	holotype
7.5	7.3	Malibu Reef, California
8.0	7.3	Santa Monica Reef, California
9.0	9.5	Hermosa Reef, California
10.5	9.0	Santa Monica Reef, California

The size of the beaks, the smooth muscle scars, and the narrow, rather deep umbonal–ventral sulcus with a pronounced ridge at its posterior margin relate *X. mexicana* to *Xylophaga globosa* Sowerby from Chile (Turner, 1955). *Xylophaga mexicana* differs from *X. globosa* in having a much finer fringe on the lappets, in having a series of irregular, opaque granules along the sides of the siphons, and in having the posterior portion of the incurrent siphon papillose. In addition, the mesoplax of *X. mexicana* is proportionately much smaller than that of *X. globosa*, and the two plates diverge medially. In his original description, Dall (1908) did not relate *X. mexicana* to any other species in the genus. One year later (Dall, 1909), he gave the range of *X. globosa* Sowerby as from Panama to Chile but cited no specific localities. The Panamanian specimens on which he based this range may well have been *X. mexicana*. I have not seen a specimen of *X. globosa* from north of Chiloe Island, Chile. The valves of *X. duplicata* somewhat resemble those of *X. mexicana*; however, the siphons of these two species place them in different groups. (See also Remarks under *X. tipperi* Turner n. sp. and *X. japonica*, the species to which *X. mexicana* is most closely related.)

Through the kindness of John Fitch and Charles Turner of the California State Fisheries Laboratory, Terminal Island, California, I received 55 specimens of *X. mexicana* taken from test panels exposed on the "replication reef experiments" conducted by that laboratory. Old streetcars, automobile bodies, concrete shelters, and rocks were dumped offshore in several localities to serve as settling areas for marine organisms and to make the area more attractive to fish. Within a short time, the test panels and wooden portions of the streetcars were attacked by teredinids and *Xylophaga*. Because all the specimens had been dissected from the wood, it is impossible to say whether or not they produced a chimney.

Range. Living specimens known only from Santa Monica Bay, California, in about 35 m.

Specimens Examined. MEXICO: Bocochibampo, Sinaloa (dead). UNITED STATES, CALIFORNIA: All from "replication reefs" off Hermosa, Malibu, Redondo, and Santa Monica (about 33°50′N, 118°30′W) in about 35 m.

Xylophaga tipperi Turner new species
Plate 29

Holotype. MCZ 316736; paratype, MCZ 316737.

Type Locality. 3.2 miles off Fort Lauderdale, Florida (26°04′N, 80°04′W) in 152.4 m (500 ft) in a U.S. NOO test panel, submerged from October 1965 to October 1966.

Distinctive Characters. Umbonal–ventral sulcus bounded by low rounded ridges. Mesoplax ear-shaped, slightly longer than wide, compressed, and with a sharp peripheral keel. Excurrent siphon truncated; lappets on dorsal surface of incurrent siphon with a coarse fringe. Siphons with a single row of minute glasslike plaques embedded along the side and with knobby pustules at the posterior end.

Description. Shell globose, reaching 9 mm in length and 8.5 mm in height, thin, fragile, with prominent umbos and a dull, light brown periostracum. Pedal gape angle about 110°. Anterior slope sculptured with numerous close-set, denticulated ridges, there being 25 on the holotype. Umbonal–ventral sulcus slightly depressed, bounded by a threadlike rounded ridge anteriorly and a somewhat heavier one posteriorly. Posterior slope low and sculptured with distinct growth lines. Umbonal reflection free for most of its length, the ventral edge of the mesoplax fitting beneath it anteriorly.

Inner surface of the valves smooth and glistening. Umbonal–ventral ridge very prominent, nearly smooth, and not greatly enlarged ventrally at the condyle. Chondrophore and internal ligament well developed. Posterior adductor muscle scar oval, tapering dorsally, only slightly impressed, and smooth. Pedal retractor scar kidney-shaped and located adjacent to the anterior margin of the posterior adductor scar, about midway dorsoventrally. Siphonal retractor scar lightly impressed, located just posterior to the umbonal–ventral ridge at the level of the ventral margin of the beak. Ventral adductor scar usually not visible but located near the ventral margin posterior to the umbonal–ventral ridge.

Mesoplax large, ear-shaped, covering the umbos, longer than wide, compressed dorsoventrally, with a sharp peripheral keel, and a coiled early portion.

Siphons united, excurrent siphon truncated, about one third the length of the incurrent siphon. Lappets extending from the truncation along the dorsal surface of the incurrent siphon with a coarse fringe. Incurrent siphon papillose posteriorly, with a single row of glasslike plaques imbedded along the side at the juncture of the lappets and the excurrent siphon and with numerous small, broad papillae surrounding the inner rim of the aperture.

TABLE 17. MEASUREMENTS OF *XYLOPHAGA TIPPERI*.

Length (mm)	Height (mm)	Location
2.0	2.0	off Fort Lauderdale, Florida
4.6	4.1	off Fort Lauderdale, Florida
7.5	7.0	off Fort Lauderdale, Florida
8.2	7.5	off Fort Lauderdale, Florida
9.0		holotype

Burrows reaching 20 mm in length. Fecal pellets not formed into a chimney.

Measurements. See Table 17.

Remarks. This species is closely related to *X. mexicana* Dall from California but differs in having a compressed, sharply keeled mesoplax; in having glasslike rather than white, chalky plaques imbedded in the siphons; and in having much more coarsely fringed lappets on the siphons. *Xylophaga tipperi* differs from *Xylophaga dorsalis* Turton in having a definitely sculptured mesoplax, an excurrent siphon one third to one half the length of the incurrent (in *X. dorsalis* it is truncated at the posterior end of the valves), and in having glasslike plaques imbedded in the walls of the siphons. In addition, on the basis of the limited material now available, *X. tipperi* apparently does not build a chimney. *Xylophaga tipperi* differs from *X. depalmai* Turner n. sp., also from off Fort Lauderdale, in having a compressed, sharply keeled mesoplax, a much coarser fringe on the lappets, and in having glasslike plaques imbedded in a single line along the sides of the siphons. In addition, the posterior end of the incurrent siphon of *X. tipperi* is papillose. *Xylophaga bayeri* Turner n. sp., which also is found in Florida and the West Indies, differs from *X. tipperi* and all other species in Group 6 in having a broad, horizontal mesoplax (Plate 31, Fig. 3).

Only eight specimens of *X. tipperi* Turner n. sp. were obtained. They were all from panel 505 and were collected along with *X. depalmai* Turner n. sp. The specimens, even the smallest, were consistent in having a broad, compressed mesoplax as well as in the characteristics of the siphons. For data on the testing site, see information under *X. depalmai.*

Range. Known only from off Fort Lauderdale, Florida, in 152.4 m.

Specimens Examined. UNITED STATES, FLORIDA: 3.2 miles off Fort Lauderdale (26°04′N, 80°04′W) in 152.4 m (500 ft) in a test panel.

Xylophaga bayeri[7] Turner new species
Plates 30, 31

Holotype. MCZ 316738; paratype, MCZ 316739.

Type Locality. U.S. NOO test site, about 3.2 miles off Fort Lauderdale, Florida (26°04′N, 80°04′W) in 152.4 m (500 ft). From test panels submerged from October 1965 to October 1966.

Distinctive Characters. Posterior margin of the umbonal–ventral sulcus bounded by a pronounced, sharp ridge. Mesoplax of adult much broader than long, extending laterally as wings and with a sharp peripheral margin. Excurrent siphon truncated, about one third the length of the incurrent siphon. Lappets extending along the dorsal surface of incurrent siphon finely fringed.

Description. Shell globose, reaching 8 mm in length, thin, fragile, with prominent umbos and a heavy, golden-brown periostracum covering the shell and the mesoplax. Pedal gape angle about 120°. Beaked portion of anterior slope sculptured with numerous, closely set, denticulated ridges, there being 32 on the holotype. Posterior portion of the anterior slope narrow, the ridges very closely packed. Umbonal reflection broad, closely appressed over the umbos, free anteriorly, and with a funnel-like pit beneath. Umbonal–ventral sulcus moderately impressed, sculptured with growth lines, and bounded posteriorly by a pronounced, sharp ridge. Posterior slope rather low and sculptured with well-marked growth lines.

[7] Named for Frederick M. Bayer, Rosenstiel School of Marine and Atmospheric Sciences, University of Miami, Miami, Florida, who kindly loaned material collected by the research vessels *Pillsbury* and *Gerda*.

TABLE 18. MEASUREMENTS OF *XYLOPHAGA BAYERI*.

Length (mm)	Height (mm)	Location
8.0	7.5	holotype
4.2	4.0	off Mona Island, Puerto Rico
5.4	4.9	*Gerda*, station 266
6.0	5.2	*Gerda*, station 266
6.0	5.8	*Gerda*, station 266
6.2	6.0	*Gerda*, station 266
6.8	6.0	*Gerda*, station 266
8.0	8.2	*Gerda*, station 266

Inner surface of valves smooth and glistening. Umbonal–ventral ridge very prominent and distinctly segmented but not greatly enlarged ventrally at the condyle. Chondrophore and internal ligament well developed. Posterior adductor muscle scar elongate oval in outline, tapering dorsally, and smooth. Pedal retractor scar broadly oval and contiguous with the anterior margin of the posterior adductor. Ventral adductor scar large, located adjacent to the groove margining the umbonal–ventral ridge posteriorly. Siphonal retractor scar lightly impressed and located just posterior to the umbonal–ventral ridge on a level with the ventral margin of the beak. Anterior adductor scar well marked and covering most of the umbonal reflection.

Mesoplax in young specimens composed of a large ventral plate with a small, triangular dorsal portion (Plate 31, Fig. 5). Dorsal plate of the adult is much wider than long, with a sharp perphery (Plate 31, Figs. 2, 3) and pronounced concentric sculpture.

Siphons capable of complete retraction within the valves and of extension probably not more than the length of the valves. Excurrent siphon truncated, about one third length of the incurrent siphon. Lappets extending from the truncation along the dorsal surface of the incurrent siphon, finely fringed. Periostracal sheath, if present, extremely thin and lacking calcareous or glasslike inclusions.

Measurements. See Table 18.

Remarks. Xylophaga bayeri Turner n. sp. is a distinctive species apparently not closely related to any other species in this genus. Its smooth muscle scars, ear-shaped mesoplax, truncated excurrent siphon, and fringed lappets place it in Group 6 and the lack of granular inclusions in the periostracal sheath of the siphons places it more closely to *X. globosa* and *X. dorsalis* than the others in the group. The mesoplax of *X. bayeri* is basically like that of *X. dorsalis* but is greatly extended laterally.

Only two specimens were obtained from the panels placed off Fort Lauderdale, Florida, and unfortunately these were not sufficiently well preserved for detailed anatomical work. The 14 specimens taken from wood dredged off Fowey Rocks were *in situ*, but all were dead and the soft parts had disintegrated, although the mesoplax was in place. All had typical valves but some had unusually wide dorsal plates (Plate 31, Figs. 2, 3). Four complete specimens and about 25 dead and disarticulated specimens were extracted from the wood dredged off Mona Island. These were remarkably uniform in the characters of the shell and dorsal plates.

Range. From off the coast of Florida probably throughout the Caribbean, in depths ranging from 150 to 365 m.

Specimens Examined. UNITED STATES, FLORIDA: 3.2 miles off Fort Lauderdale (26°04′N, 80°04′W) in 152.4 m (500 ft) in test panel; *Gerda*, station 266, off Fowey Rocks (25°39′N, 79°58′W) in about 340 m. PUERTO RICO: Johnson–Smithsonian Expedition, station 37, midway between Mona and Desecho islands (18°11′55″N, 67°42′50″W) in about 365 m.

Xylophaga japonica Taki and Habe
Plate 32

Xylophaga japonica Taki and Habe, 1950, Illustrated Catalogue of Japanese Shells, No. 7, p. 45, text-figs. 6, 7 (Tosa Bay, Shikoku, Japan, in about 100 fathoms). Holotype, T. Habe Collection; paratype, MCZ 194822.

Distinctive Characters. Posterior slope elongate in adult specimens. Umbonal–ventral sulcus well impressed, bounded by an inconspicuous ridge anteriorly and a high narrow ridge posteriorly. Posterior adductor muscle scar smooth. Mesoplax

TABLE 19. MEASUREMENTS OF *XYLOPHAGA JAPONICA*.

Length (mm)	Height (mm)	Location
13.2	10.8	holotype (from Taki and Habe, 1950)
5.8	5.0	paratype Tosa Bay, Shikoku, Japan
3.8	3.0	off Clara Island, South Burma
2.0	1.8	off Java

large, covering the upper one half of the anterior area, extending over the umbos, ear-shaped, moderately inflated, with a narrowly rounded periphery and distinct concentric sculpture (Plate 32, Figs. 2–5). Siphons capable of extending two to three times the length of the shell. Excurrent siphon about one third the length of the incurrent, lappets extending along the dorsal surface of the incurrent siphon finely fringed, opaque white granules imbedded along the sides of the siphons. Chimney of coarse fecal pellets lining the burrow.

Measurements. See Table 19.

Remarks. At the time Taki and Habe (1950) described this species, they did not have the soft parts and therefore could not describe the siphons. However, it is clear from their description and figures that the species belongs to the *dorsalis* group (Group 6). Taki and Habe related their species to *X. indica* Smith, but noted its more elongate posterior area. It further differs from *X. indica* in its broad mesoplax for, according to Knudsen (1961), the mesoplax of *X. indica* is "oblong pear-shaped" and his figure [of it] shows it to be nearly three times as long as wide. *Xylophaga indica* is probably more closely related to *X. guineensis* and *X. depalmai* n. sp., but because the siphons are unknown, this cannot be stated definitely.

Xylophaga japonica appears to be most closely related to *X. mexicana* Dall but differs in having a larger, more highly sculptured mesoplax that extends over the umbos; in having the posterior slope more elongate; and in having the ridge bounding the umbonal–ventral sulcus more pronounced.

Unfortunately, the material from off Java and South Burma noted in the records below was poorly preserved, but it was possible to ascertain the basic characters of the siphons. The specimens from Java had been kept in alcohol since they were collected by Mortensen in 1929. The specimens from South Burma, dredged by the *Anton Bruun* and taken from a small piece of wood and the husk of a nut, had been allowed to dry.

Range. From Tosa Bay, Japan, south and west to Burma and Java, in depths ranging from 183 to 384 m.

Specimens Examined. JAPAN: Tosa Bay, Shikoku, in 183 m. JAVA: Danish Java–South African Expedition, station 10, off SE tip of Java (08°36′S, 114°34′E) in 300 m. BURMA: *Anton Bruun,* station 23, about 77 miles W of Clara Island, South Burma (10°30′N, 96°35′E) in 384 m.

GENUS *XYLOPHOLAS* TURNER 1972

Xylopholas Turner, 1972, Basteria, 36(2): 97–99.

Type Species. Xylopholas altenai Turner, original designation.

Distinctive Characters. Valves and mesoplax typical for the genus *Xylophaga.* Animal long, not capable of retraction within the valves, with a periostracal siphonal sheath posterior to the valves and a pair of lateral, chitonlike, siphonal plates at the posterior end. Siphons short, extending between the plates, the siphonal retractor muscles inserted on their inner surface. Gills and visceral mass contained between the valves as in typical *Xylophaga.* Wood-storing cecum large.

Remarks. This genus differs from *Xylophaga* in having extended excurrent and incurrent canals contained in a common sheath with siphonal plates at the posterior extremity. These plates probably arose independently but may be homologous with the siphonoplax of other pholads (i.e., *Pholadidea*), which was carried posteriorly as the animal elongated. However, the siphonal retractor muscles of these species insert on the valves rather than on the siphonoplax. The siphonal plates of *Xylopholas* probably function as do the pallets of the Teredinidae and the siphonoplax of other pholadids to close the end of the burrow. Embryological studies are needed to prove the affinities of the plates.

From *Xyloredo, Xylopholas* differs in having siphonal plates, a periostracal sheath on the animal posterior to the valves, and in not lining the burrow with a chitonlike or calcareous tube.

Range. To date the genus is known only from the type species found off the Lower Florida Keys in the western Atlantic and in the Gulf of Guinea in the eastern Atlantic in depths from 239 to 366 m. (Two specimens were dredged in 2,550 m but these may have been advectitious.)

Xylopholas altenai Turner 1972
Plates 33, 34

Xylopholas altenai Turner, 1972, Basteria, 36(2): 99–103, figs. 1–12 (*Gerda*, station 66, about 13 miles SE of Fowey Rocks, Florida [25°25′N, 79°59′] in 366 m). Holotype, MCZ 279315.

Distinctive Characters. Animal elongate, not capable of retraction within the valves, and with lateral, paddlelike siphonal plates at the posterior end. Shell similar to that of *Xylophaga*. Mesoplax composed of two flat, elongate plates that are held in place by the periostracum extending between the beaks dorsally. Posterior adductor muscle scar large and with transverse forking impressions. Young carried on the ventral surface just posterior to the valves.

Description. Shell globose, reaching 2.5 mm in length, thin, fragile, and with a relatively heavy, golden-brown periostracum covering the valves and mesoplax. Pedal gape angle about 90°. Beaked portion of the anterior slope recurved dorsally and sculptured with numerous strong, denticulated ridges. Umbonal reflection narrow. Umbonal–ventral sulcus narrow and only slightly impressed. Disc and posterior slope sculptured with fine growth lines only.

Inner surface of valves smooth and glistening. Umbonal–ventral ridge low, indistinct except near the ventral margin, slightly segmented, and with a small ventral condyle. Chondrophore and internal ligament well developed. Posterior adductor muscle scar large, covering most of the posterior slope, elongate oval in outline and marked with transverse, forking impressions. Pedal retractor scar irregularly and broadly oval and located about midway on the anterior margin of the posterior adductor scar. Siphonal retractor muscles inserted on the siphonal plates and collar.

Mesoplax small, not filling the gape between the beaks, composed of two flat, elongate, subrectangular plates, somewhat pointed posteriorly, sculptured with fine transverse ridges, covering the dorsal surface of the anterior adductor muscle and held in place by the periostracum.

Animal long, with a periostracal sheath covering the portion posterior to the valves and with a pair of lateral, paddle-shaped, chitonlike plates at the posterior end (Plate 33, Fig. 4). The siphons extend between the plates, and the siphonal retractor muscles insert on the inner surface of them. Siphons separate, excurrent siphon longer than the incurrent siphon, the apertures of both with fine cirri.

Gills and visceral mass contained entirely between the valves, the portion of the animal extending beyond the valves composed of a dorsal excurrent and a ventral incurrent canal combined in a common muscular and periostracal sheath, with a chitinous collar and two lateral, paddle-shaped plates posteriorly.

Measurements. See Table 20.

Remarks. Isolated valves of this species would be difficult if not impossible to distinguish from several species of *Xylophaga*; however, its reduced, flat mesoplax, elongate soft parts, and siphonal plates readily distinguish it from all other species in the Xylophagainae. Nothing is known of the biology of the species except that it has a large wood-storing cecum and, therefore, probably utilizes wood as food. The young are held within the burrow to the late ve-

TABLE 20. MEASUREMENTS OF *XYLOPHOLAS ALTENAI.*

Length (mm)	Height (mm)	Location
1.8	1.8	holotype
1.0	1.0	*Atlantique Sud,* station 147
1.5	1.4	*Galathea,* station 52
1.2	1.1	*Gerda,* station 66
1.9	1.8	*Gerda,* station 266
2.0	2.1	*Gerda,* station 266
2.0	2.5	*Gerda,* station 266
2.5	2.5	*Gerda,* station 266

liger stage when the foot has developed. They are attached to the ventral surface of the animal just posterior to the valves. The number of attached young ranged from two to eight and they averaged 0.28 mm in length. The hinge plate of the young is well developed, with two teeth and a socket in the right valve and a corresponding single tooth and two sockets in the left valve (Plate 33, Figs. 1, 2).

About 60 specimens were taken at the three stations off Florida and 10 specimens were taken from the three stations in the Gulf of Guinea. The shells of many of the specimens were in poor condition and the valves had largely dissolved, possibly a result of the wood being very acid. However, the characteristic siphonal plates readily identified the species. The two specimens taken from a coconut husk dredged off São Tomé in 2,550 m may have been advectitious; this species may not typically occur at that depth. Neither specimen carried young. The shelf in this area is very narrow and steep so that plant material could easily be carried into deep water. All other records are from depths of 239–366 m.

Range. Known only from off the Florida Keys in the western Atlantic and the Gulf of Guinea in the eastern Atlantic in depths ranging from 239 to 2,550 m.

Specimens Examined. Western Atlantic: UNITED STATES, FLORIDA: *Gerda,* station 266, off Fowey Rocks, about 16 miles SE of Miami (25°39′N, 79°58′W) in 340 m; *Gerda,* station 66, off Turtle Reef, about 13 miles SE of Fowey Rocks (25°25′N, 79°59′W) in 366 m; *Gerda,* station 220, about 30 miles S of Alligator Reef (24°25′N, 80°33.5′W) in 311 m. Eastern Atlantic: GABON: *Galathea,* station 52, off Port Victoria, São Tomé Island (1°42′N, 7°51′E) in 2,550 m (in coconut shell); *Atlantique Sud,* station 147, about 45 miles N Port Gentil, Cape Lopez (0°S, 8°58′E) in 250 m; *Atlantique Sud,* station 154, about 35 miles NE of Port Gentil (0°15′S, 8°47′E) in 239 m.

GENUS *XYLOREDO* TURNER 1972

Xyloredo Turner, 1972, Breviora, 397: 3 (type species, *Xyloredo nooi* Turner, original designation); Turner, 1973, Science, 180: 1377–1379.

Distinctive Characters. Species in this genus are characterized by having typical *Xylophaga* shells, which lack apophyses and have a mesoplax composed of two flat plates, and by making a long teredolike burrow. The posterior two thirds of the burrow has a thin calcareous lining, marked with distinct growth lines and covered with periostracum that extends to the calcareous portion anterior as a band. The part of the animal extending beyond the valves into the calcareous tube is covered by a golden-brown periostracal sheath that is continuous anteriorly with the covering of the valves and posteriorly with the periostracum of the tube. A fold of the mantle is attached to the growing end of the tube where both periostracum and calcium are added. In young specimens the tube may be composed entirely of periostracum.

Posterior to the valves, the combined incurrent and excurrent canals extend the length of the tube and are attached lightly to it at the base of the short separate siphons. Two dorsolateral ridges within the incurrent canal appear to be ciliated and possibly aid in water transport.

Remarks. Members of this genus differ from *Xylophaga* and *Xylopholas* in making a burrow that may reach more than 30 times the length of the shell and is lined with a calcareous tube. Several species of *Xylophaga* make a burrow more than five times the length of the shells and form a chimney composed of mucous-cemented fecal pellets at the posterior end of the burrows. These are not homologous with the calcareous tubes of *Xyloredo* but rather with the chimney of rock-boring pholads, as in *Parapholas* Conrad (Turner, 1955: 123).

The discovery of this teredolike genus in the Pholadidae requires a reexamination of the fossil teredinids, especially those recorded as having ringed tubes. On the basis of our present knowledge, it may be impossible to distinguish *Xyloredo* from teredinids in fossilized wood. However, if tubes are present, a microscopic analysis of their structure may aid in distinguishing between them because teredinid tubes are amorphous, whereas tubes of *Xyloredo* have a definite structure with growth rings and periostracum. Certainly *Xyloredo* should be considered when examining drilled wood thought to have come from a deep water fossilized deposit.

Although *Xyloredo* superficially resemble the Teredinidae, this is entirely convergent and does not in any way indicate relationship, nor does it suggest the evolution of the Teredinidae from the Xylophagainae. The latter lack apophyses and pallets, and have a mesoplax. In addition, none of the visceral mass or gills of the Xylophagainae extend beyond the valves posteriorly as they do in the Teredinidae.

Range. To date three species of *Xyloredo* are known, two in the western Atlantic and the other in the eastern Pacific. All occur at depths greater than 1,500 m.

Xyloredo nooi Turner
Plate 35

Xyloredo nooi Turner, 1972, Breviora, 397: 5–7, pls. 1, 2 (Tongue of the Ocean, about 4 miles off northeast tip of Andros Island, Bahama Islands [25°54′N, 77°49′W] in 1,737 m). Holotype, MCZ 279631; paratypes from the same and other panels exposed at the same locality, MCZ 279632, 279633, 279634, and 279635, and the Zoological Museum, University of Copenhagen; Turner, 1973, Science, 180: 1377–1379.

Distinctive Characters. Burrow long, teredinidlike, lined with a thin calcareous tube marked with growth rings and covered with periostracum. Shell similar to *Xylophaga,* anterior slope narrow, umbonal–ventral sulcus lightly impressed, posterior slope high and reflected dorsally. Posterior adductor muscle scar subelliptical, set high on the posterior slope, and divided into two distinct areas. Disc separated from the posterior slope by a groove on the inner surface of the valves. Mesoplax small, the two flat triangular plates composed almost entirely of periostracum. Periostracal sheath between the valves and the tube smooth.

Description. Shell globose, valves reaching 10 mm in length and 10.5 mm in height, thin, fragile; umbos prominent. Periostracum relatively thick, golden-brown, glistening, and covering entire valve. Pedal gape angle about 110°. Anterior slope sculptured with numerous denticulated ridges, there being 24 on the holotype. Umbonal–ventral sulcus narrow, slightly impressed, and sculptured with fine, irregular growth lines. Posterior slope high, reflected near the dorsal margin, and sculptured with fine growth lines. Umbonal reflection rather wide, thin, adhering to the valves in the umbonal area, free anteriorly.

Inner surface of valves smooth and glistening. Umbonal–ventral ridge narrow, high, and segmented. Chondrophore and internal ligament prominent. Disc separated from the posterior slope by a pronounced narrow groove extending from the umbo to the posterior ventral margin. Posterior adductor muscle scar large, elliptical, and divided into two areas, the upper part marked with irregular impressions, the lower with regular chevron-shaped impressions. Anterior adductor scar covering most of the umbonal reflection. Pedal retractor scars elongate, the muscles inserting in the groove separating the disc from the posterior slope.

Mesoplax small, flat, the two broadly triangular plates composed almost entirely of periostracum and located anterior to the umbos.

Burrow long, teredinidlike, and lined with a thin calcareous tube that is sculptured with distinct growth rings and covered with periostracum that extends as a

TABLE 21. MEASUREMENTS OF *XYLOREDO NOOI*.

Length (mm)	Height (mm)	Location
5.0	5.1	paratype
6.7	6.9	paratype
7.2	7.8	paratype
9.5	9.8	paratype
9.5	10.0	holotype

border at the anterior end. Tube in very young specimens composed entirely of periostracum. Between the valves and the anterior end of the tube the animal is covered with a smooth periostracal sheath, which is continuous anteriorly with the covering of the valves and posteriorly with the tube. Siphons short, separate, and apparently with a few small cirri.

Measurements. See Table 21.

Remarks. Xyloredo nooi is related to both *Xyloredo naceli* Turner from the eastern Pacific and *X. ingolfia* Turner from the North Atlantic. *Xyloredo nooi* differs from them in having a much thinner burrow lining, a high, reflected posterior slope on the valves, and a proportionately smaller, more highly placed and divided posterior adductor muscle scar. In addition, the periostracal sheath extending between the valves and the calcarious tube is smooth.

The larvae of *X. nooi* apparently do not rise very high in the water column, inasmuch as a panel 25 ft off the bottom showed no trace of them, whereas the panel directly beneath it on the bottom was riddled. On the basis of the prodissoconch still visible on some of the specimens, it would appear that the larvae are similar to those of *Xylophaga.* No evidence was found in the three riddled panels examined that the young were brooded or held in the tubes.

The burrows resemble those of teredinids and intertwine with each other but basically follow the grain of the wood. They may reach 200 mm in length and 15 mm in diameter at the anterior end. The largest tube with intact shells and animal remaining was 145 mm long; the valves were 9.5 mm in length and 10 mm in height. The panels in the Tongue of the Ocean were submerged for 34 months and inasmuch as the larger burrows were empty or contained only fragments of shells, the length of life may be about 2–2.5 years. The calcareous lining of a burrow 122 mm long extends to about 30 mm from the anterior end, thus leaving room for boring activities and changing the direction of the burrow.

Range. Known only from the type locality.

Specimens Examined. BAHAMA ISLANDS: Tongue of the Ocean, about 4 miles off NE tip of Andros Island (24°54′N, 77°49′W) in 1,737 m.

Xyloredo ingolfia Turner
Plates 36, 37

Xyloredo ingolfia Turner, 1972, Breviora, 397: 7–9, pls. 3–5 (from wood dredged by the *Ingolf* Expedition at station 67, south of Eyrabakki, Iceland [61°30′N, 22°30′W] in 975 fathoms [1,783 m]). Holotype, MCZ 279636; paratypes, MCZ 279637, and the Zoological Museum, University of Copenhagen; Turner, 1973 *Science* 180: 1377–1379.

Description. Shell globose, valves reaching 2.5 mm in length and 2.0 mm in height, thin, fragile, with prominent umbos; thin, glistening, almost colorless periostracum covering disc and posterior slope. Beaked portion of anterior slope wide, extending more than one half distance to ventral margin; sculptured with close-set and very finely denticulated ridges. Posterior portion of anterior slope about two thirds width of beak, sculptured with close-set ridges that extend to very slightly impressed umbonal–ventral sulcus. Disc sculptured with well-marked growth lines. Posterior slope small, low, and not clearly demarcated on outer surface of valve. Umbonal reflection thick, narrow, short, and free except at posterior end.

Inner surface of valves smooth, slightly shiny to chalky (perhaps owing to long preservation). Umbonal–ventral ridge wide, flattened, often varying in width, irregularly segmented, and not enlarged at ventral condyle. Chondrophore and internal liga-

TABLE 22. MEASUREMENTS OF *XYLOREDO INGOLFIA*.

Length (mm)	Height (mm)	Location
2.5	2.3	holotype
2.5	2.0	paratype
2.1	2.0	paratype
2.0	1.9	paratype
1.5	1.4	paratype
1.5	1.2	paratype

ment large. Disc not clearly separated from posterior slope. Posterior adductor muscle scar large, slightly raised, elliptical, extending nearly to ventral margin, with irregular, transverse impressions. Anterior adductor muscle scar covering umbonal reflection. Siphonal retractor muscle scars not impressed. Pedal retractor muscle scar small, elongate to oval, and located just anterior to posterior adductor muscle scar. Mesoplax of two very small, narrow, subrectangular, flat, calcified plates lying on dorsal surface of anterior adductor muscle.

Burrow 10–15 times length of valves; calcareous tubular lining three fourths length of burrow. Tube relatively heavy, marked with uniform, close-set, raised rings, and covered with light tan periostracum that extends anteriorly as border. Portion of animal between valves and tube covered by thin, irregularly ridged periostracal sheath. Siphons short; incurrent siphon slightly longer than excurrent siphon. Protoconch large, medium golden-brown, and sculptured with fine, concentric ridges.

Measurements. See Table 22.

Remarks. This species differes from *Xyloredo naceli* in having a less well-developed posterior slope, a shallow, indistinct umbonal–ventral groove, a flattened umbonal–ventral ridge, and in having the valves longer than high. It differs from *X. nooi* in having valves longer than high, in having a low, rounded posterior slope, in lacking the distinct groove on the inner surface separating the disc from the posterior slope, and in having the plates of the mesoplax subrectangular and well calcified.

Range. Known only from the type locality.

Specimens Examined. ICELAND: *Ingolf* Expedition, station 67, S of Eyrabakki (61°30′N, 22°30′W) in 1,783 m.

Xyloredo naceli Turner
Plate 38

Xyloredo naceli Turner, 1972, Breviora, 397: 9–11, pl. 6, figs. 1–5 (USNCEL STU I-4 about 30 miles S of San Miguel Island, off Port Hueneme, Santa Barbara Islands, California [33°46′N, 120°45′W] in 6,800 ft [2,072.6 m] from panels submerged from June 1964 to July 1965). Holotype, MCZ 279638; paratype, 279639.

Distinctive Characters. Burrow teredinidlike, lined with a thin calcereous tube marked with growth rings and covered with periostracum. Shell similar to *Xylophaga,* with a narrow, slightly impressed umbonal–ventral sulcus. Posterior adductor muscle scar elliptical, almost completely covering the posterior slope and uniformly marked with transverse impressions. Mesoplax small, the two flat, triangular plates composed largely of periostracum. Periostracal sheath covering the animal between the valves and the tube papillose.

Description. Shell globose, reaching 1.5 mm in length, thin, fragile, white, with a thin, pale yellow periostracum. Pedal gape angle about 100°. Anterior slope sculptured with 8–12 widely spaced, pronounced, denticulated ridges. Umbonal–ventral sulcus narrow and only slightly impressed. Discs and posterior slope sculptured with fine growth lines only.

Inner surface of valves smooth and glistening. Umbonal–ventral ridge narrow, high, and indistinctly segmented. Chondrophore and internal ligament well developed. Posterior adductor muscle scar elliptical, extending from the dorsal nearly to the ventral margin of the posterior slope and regularly marked with transverse impressions. Pedal retractor scar not impressed. Ventral adductor only lightly impressed and located just posterior to the

TABLE 23. MEASUREMENTS OF *XYLOREDO NACELI*.

Length (mm)	Height (mm)	Location
1.1	1.2	holotype
1.0	1.0	paratype
1.2	1.3	paratype
1.5	1.5	paratype

umbonal–ventral ridge. Siphonal retractor muscles inserting on the tube.

Mesoplax small, thin, set between and anterior to the umbos, the two triangular plates composed almost entirely of periostracum. Burrow of largest specimen about six times the length of the shell. Calcareous tube lining the burrow thin, distinctly marked with growth rings, and covered with periostracum that extends as a border anteriorly. Aperture of the burrow small, round, the white lining visible within. The portion of the animal between the valves and the calcareous tube covered with a papillose periostracal sheath that is continous with the periostracum covering the valves anteriorly and the periostracal border of the tube posteriorly. Siphons short, of equal length, and apparently lacking cirri.

Measurements. See Table 23.

Remarks. This species is most closely related to *X. nooi* Turner from the western Atlantic. Only eight specimens of *X. naceli* were found and they were all very small, but these appear to be sufficiently distinct to consider them members of a separate species. *Xyloredo naceli* differs from *X. nooi* in having a heavier tube that is calcareous, even in very young specimens; and a posterior adductor muscle scar that is proportionately larger and not divided into two areas. In addition, it lacks the pronounced internal groove separating the disc from the posterior slope, and the periostracal sheath covering the animal anterior to the tube is papillose.

Nothing is known of the biology of the species except that at the sites where they were collected the temperature of the water was 2.1° C, the salinity was 34.52‰, the dissolved oxygen content was 1.26 ml/L, the pH was 7.84, and the hydrostatic pressure 3000 psi (Muraoka, 1966b).

The embryonic valves still visible on some of the specimens suggest that the mature larvae are similar to those in *Xylophaga*. *Xylophaga muraokai* was the most common borer in the panels from which the *X. naceli* were taken.

Range. Known only from the type locality.

Specimens Examined. UNITED STATES, CALIFORNIA: USNCEL STU I-4 S of San Miguel Island, Santa Barbara Islands (33°46′N, 120°45′W) in 2,072 m.

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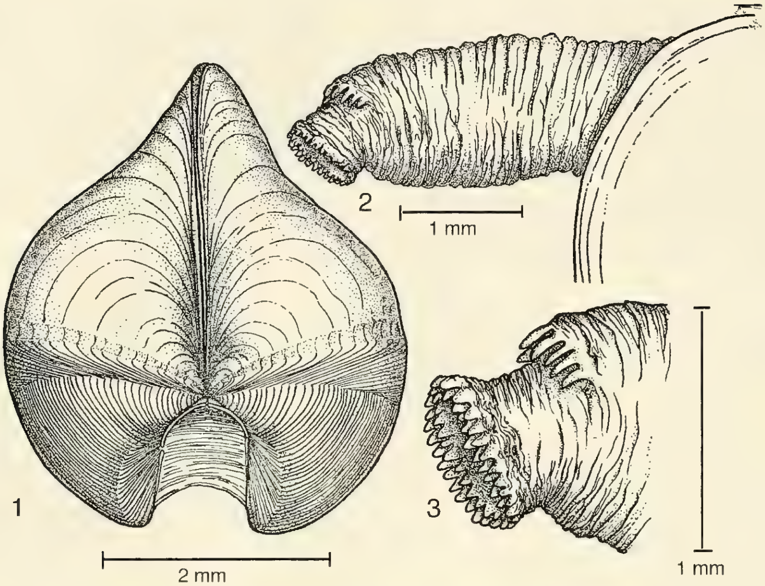


Plate 1. *Xylophaga concava* Knudsen from *Pillsbury,* station 526.

Figure 1. Dorsal view of apposed valves showing the concave posterior slope and erect mesoplax. Figure 2. Posterior end of valve and siphons. Figure 3. Enlargement of the siphonal openings to show the six large cirri on the excurrent siphon and the double row of small cirri on the incurrent siphon.

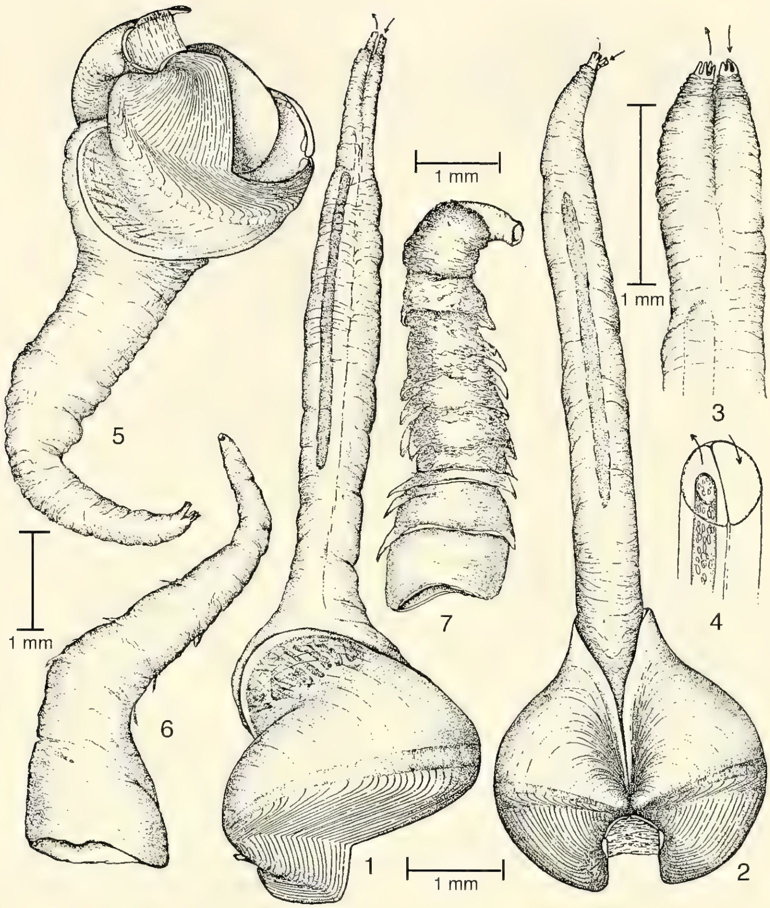


Plate 2. *Xylophaga gerda* Turner n. sp. from *Gerda,* station 499.

Figure 1. Lateral view of holotype showing the attachment of the posterior adductor muscle through the thin valve, the mesoplax that does not extend above the umbos, and the fecal cylinder in the excurrent canal. Figure 2. Dorsal view of the holotype showing the mesoplax. Figure 3. Enlargement of the posterior end of the siphons. Figure 4. Diagrammatic cross-section through the siphons and the fecal cylinder. Figure 5. Three-quarter view of holotype showing the inflated umbos and the simple curved plates of the mesoplax. Figure 6. A relatively smooth chimney composed largely of periostracum, with a thin coating of fecal material. Figure 7. A thick chimney, built in sections with "leaves" of periostracum extending at the anterior end of each section.

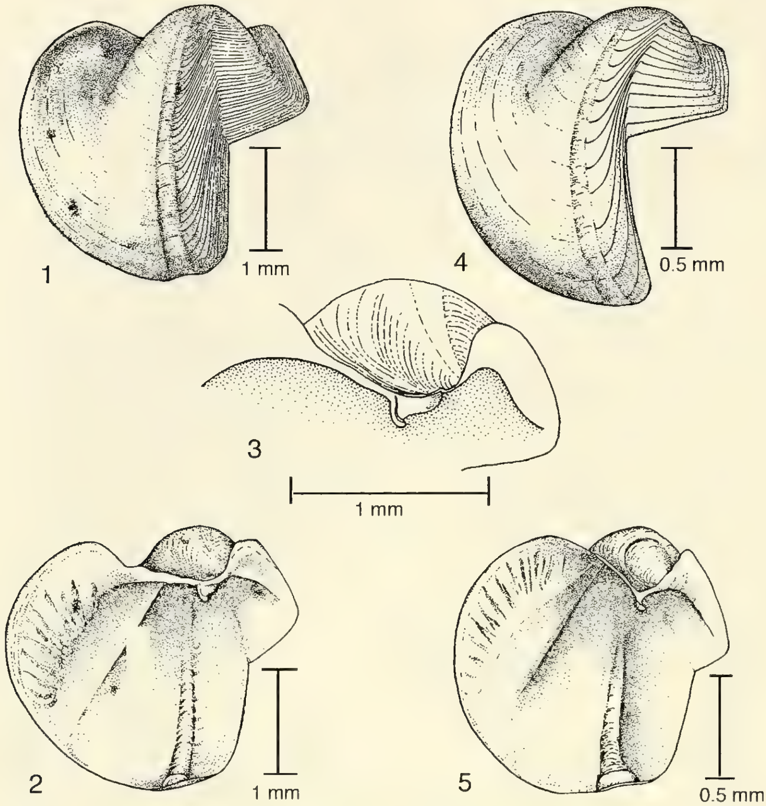


Plate 3. *Xylophaga gerda* Turner n. sp. from *Pillsbury,* station 944.

Figure 1. Outer view of right valve. Figure 2. Inner view of left valve, showing posterior adductor muscle scar and low umbonal–ventral ridge. Figure 3. Enlargement of the hinge area of left valve to show the chondrophore and anterior adductor muscle scar. Figure 4. Outer view of right valve of a young specimen. Figure 5. Inner view of left valve of young specimen showing the prodissoconch, chondrophore, and muscle scars.

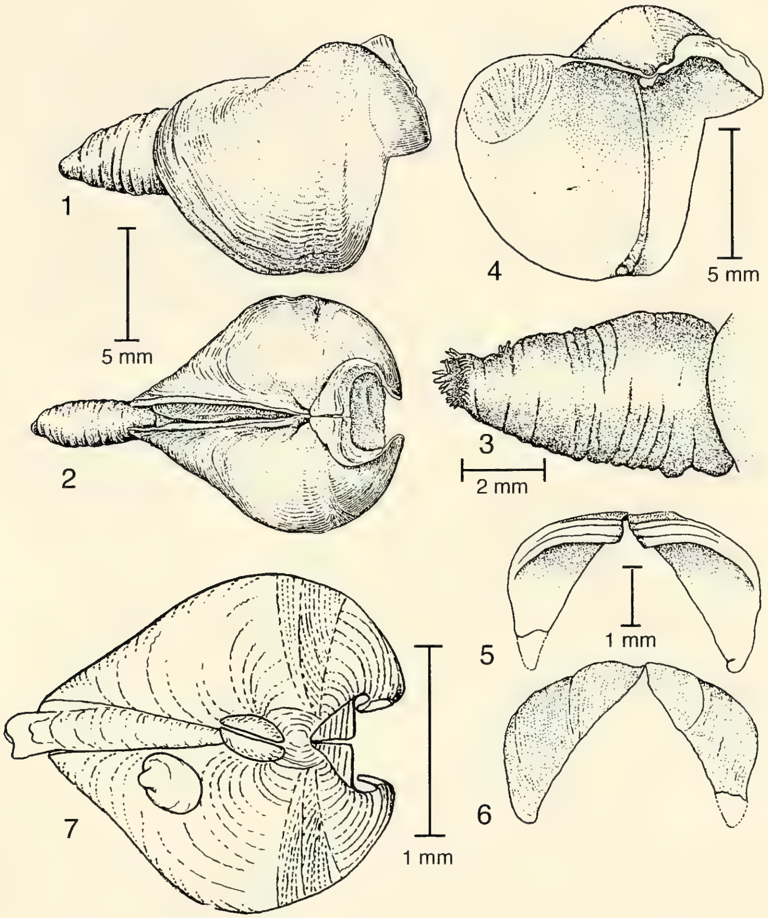


Plate 4. *Xylophaga grevei* Knudsen (Figs. 1–6 from Knudsen, 1961: 176–177).

Figures 1–4. Holotype. Figure 1. Right side of entire specimen showing siphons and mesoplax. Figure 2. Dorsal view. Figure 3. Enlargement of the siphons showing the cirri around the incurrent aperture (35) and the excurrent aperture (6). Figure 4. Internal view of left valve of the holotype showing the broadly oval posterior adductor muscle scar set high on the posterior slope. Figures 5, 6. Ventral and dorsal view of the mesoplax. Figure 7. Small specimen carrying two young from *Galathea,* station 444.

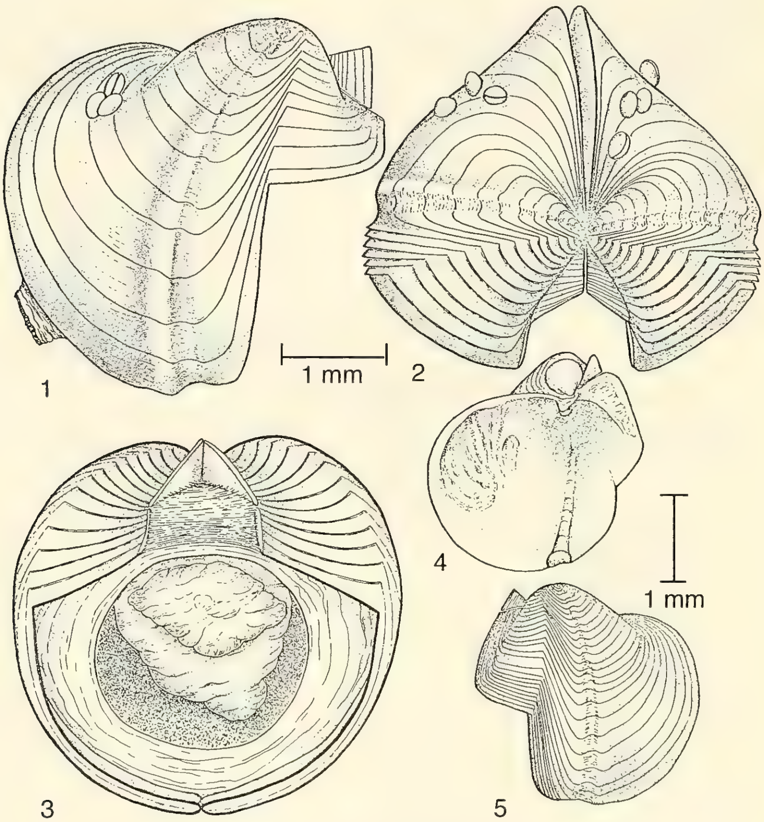


Plate 5. *Xylophaga clenchi* Turner and Culliney.

Figures 1–3. Side, dorsal, and anterior views of the holotype, showing the widely space ridges on the anterior slope of specimens boring in soft wood and the position of young and the dorsal surface. Figures 4, 5. Inner and outer views of left valve of a specimen from *Atlantis II,* station 124, showing the muscle scar and large number of ridges on the anterior slope of a specimen from hard wood.

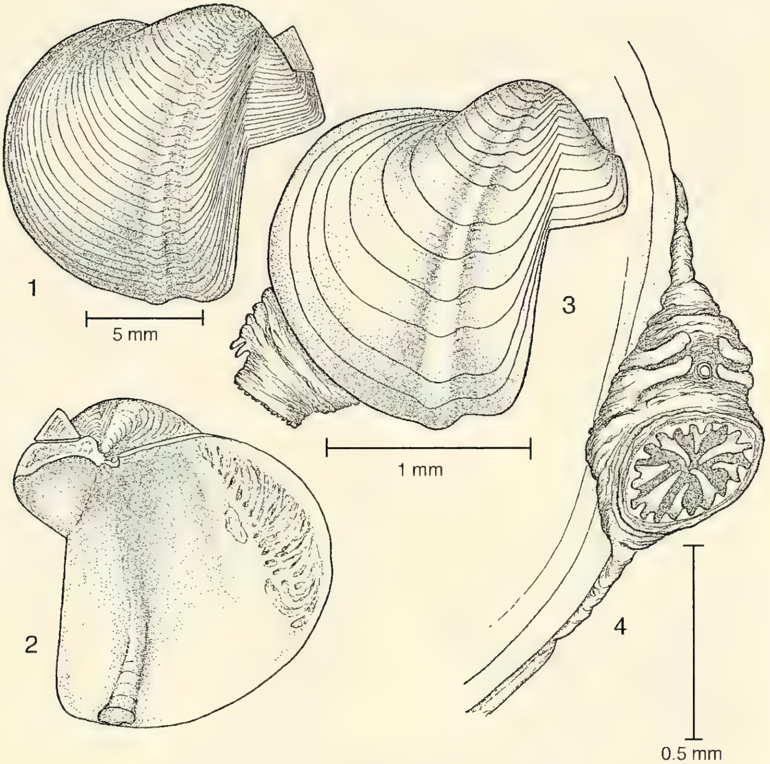


Plate 6. *Xylophaga clenchi* Turner and Culliney.

Figures 1, 2. Outer and inner views of the right valve of a large specimen with mesoplax in place, dredged by the *Pillsbury*, station 394. Figure 3. Lateral view of an entire specimen from the Tongue of the Ocean showing relative size of siphons. Figure 4. Enlargement of the siphons, posterodorsal view, to show the incurrent and excurrent apertures and the cirri around them.

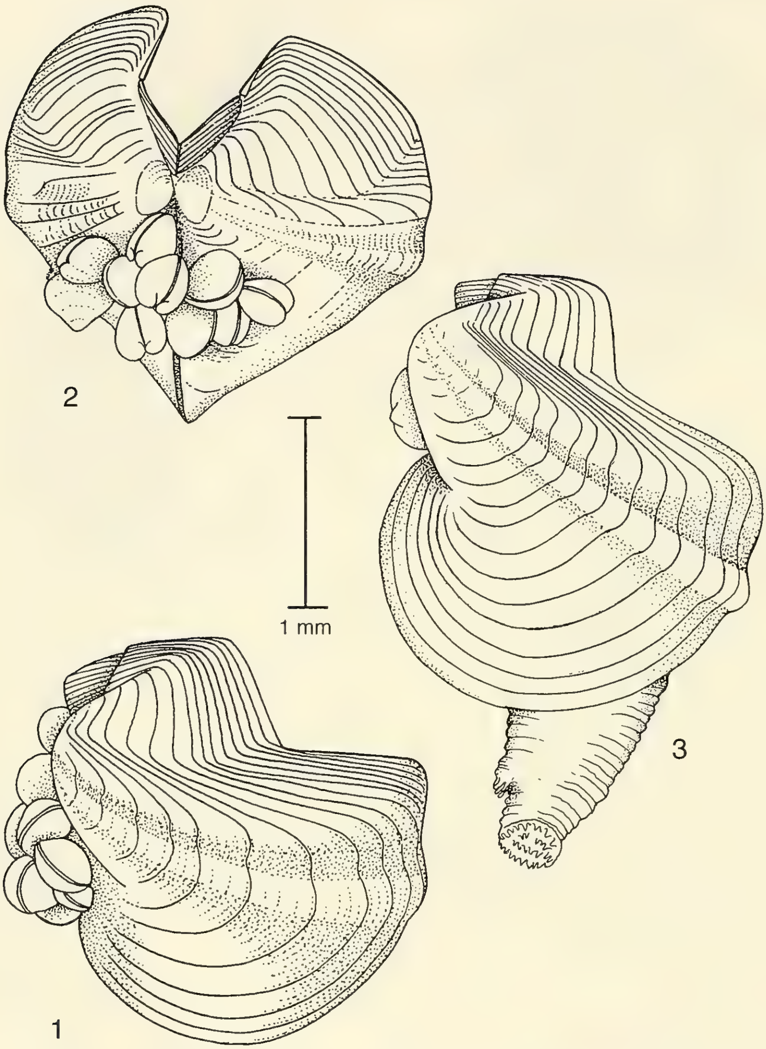


Plate 7. *Xylophaga clenchi* Turner and Culliney from *Ingolf* Expedition, station 67.

Figure 1. Lateral view of right valve with mesoplax in place and young attached to dorsal surface. Figure 2. Dorsal view of same specimen showing the prodissoconch. Figure 3. Lateral view of specimen with extended siphon.

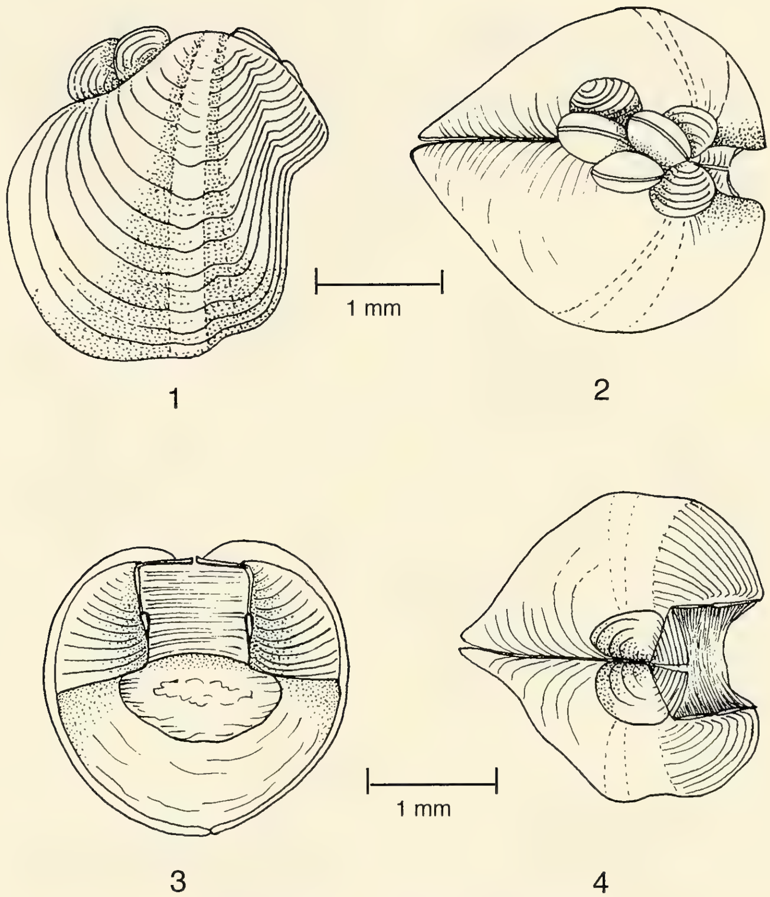


Plate 8. *Xylophaga clenchi* Turner and Culliney.

Figures 1, 2. From *Pillsbury,* station 238. Figure 1. Lateral view of right valve. Figure 2. Dorsal view of opposed valves showing prodissoconch, four young attached posterior to the umbos, and an atypical elongate, longitudinally folded mesoplax. Figures 3, 4. Specimen from *Atlantis II,* station 124. Figure 3. Anterior view of specimen with mesoplax bent at a right angle. Figure 4. Dorsal view of same specimen showing prodissoconch and mesoplax.

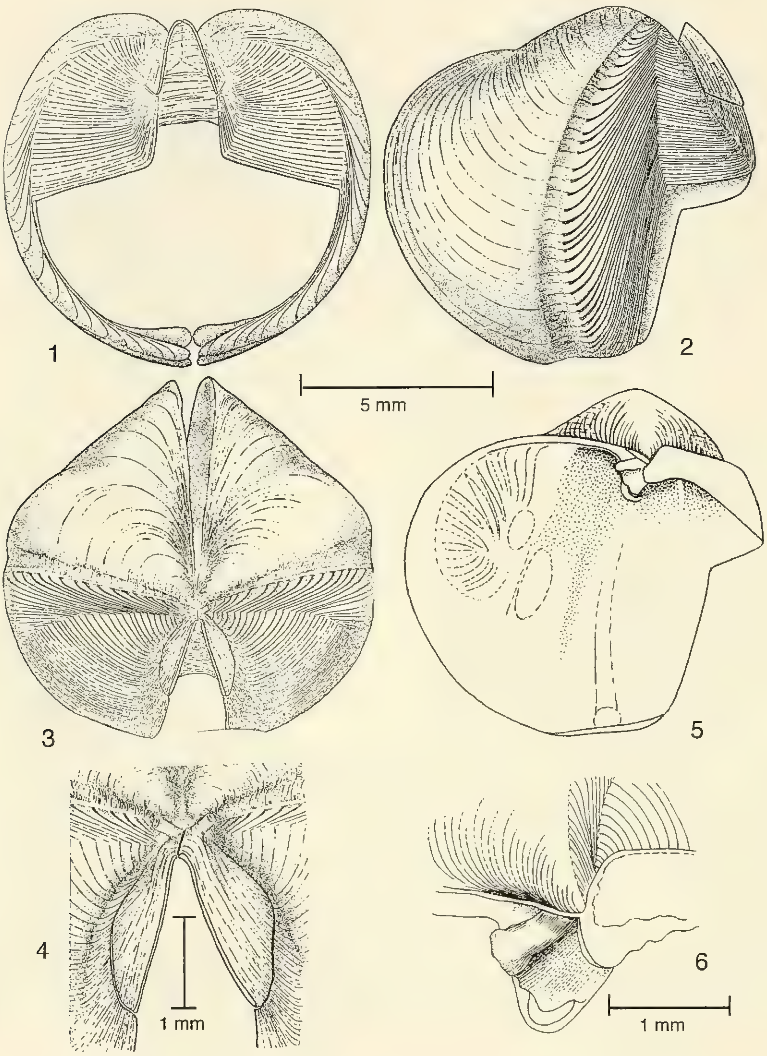


Plate 9. *Xylophaga supplicata* Taki and Habe from Tosa Bay, Shikoku, Japan.

Figure 1. Anterior view of opposed valves with mesoplax in place. Figure 2. Lateral view of entire specimen from the right with mesoplax in place. Figure 3. Dorsal view of opposed valves tipped slightly forward to show the minute tubes at the posterior end of the mesoplax. Figure 4. Enlargement of mesoplax and umbonal area, looking down into the cavity formed by the incurving of the umbos. Figure 5. Inner view of left valve showing chondrophore with large tooth. Figure 6. Enlargement showing chondrophore with large tooth.

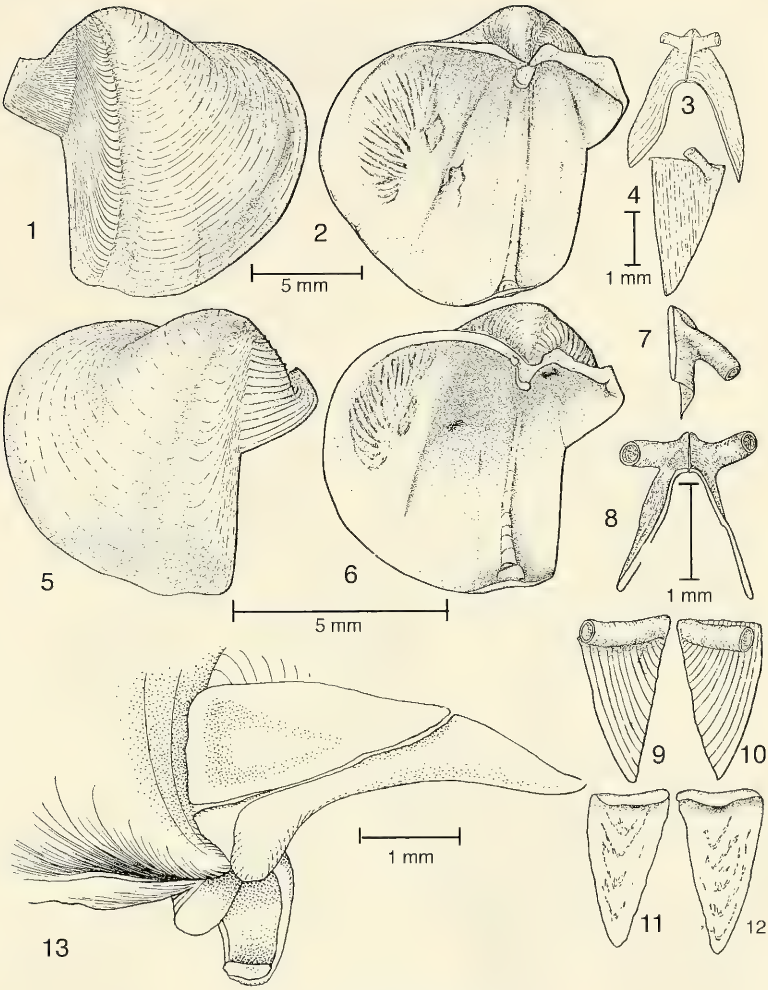
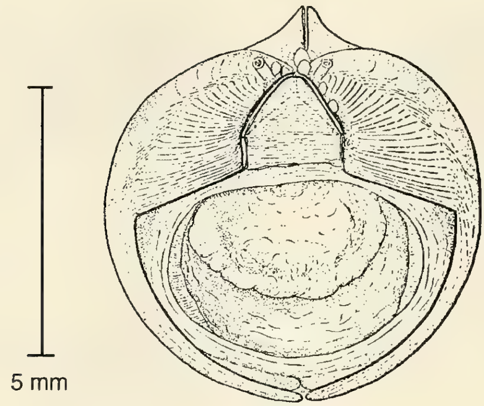


Plate 10. *Xylophaga whoi* Turner n. sp.

Figures 1–4. Specimen from *Pillsbury,* station 944. Figures 1, 2. Outer and inner views of the left valve. Figure 3. Frontal view of mesoplax with smallest tubes seen. Figure 4. Side view of left plate of mesoplax. Figures 5–12. Holotype. Figure 5. Outer view of right valve. Figure 6. Inner view of left valve. Figure 7. Dorsal view of left plate of mesoplax. Figure 8. Frontal view of mesoplax. Figures 9, 10. Outer surface of left and right plates of mesoplax with average-size tubes. Figures 11, 12. Inner surface of left and right plates of the mesoplax showing the curvature at the dorsal margin and the pore to the inner surface just below it. Figure 13. Enlargement of the hinge area of the left valve to show the chondrophore with a large tooth on it posterior dorsal margin, the umbonal reflection, and the inner surface of the mesoplax.



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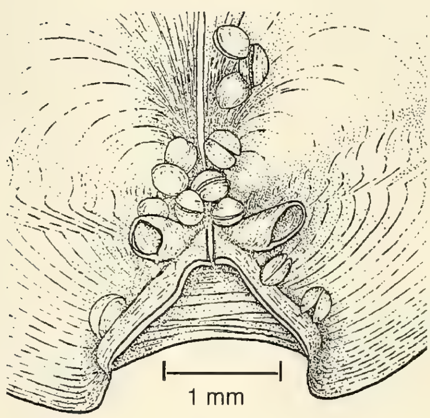

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Plate 11. *Xylophaga whoi* Turner n. sp. from *Pillsbury,* station 394.

Figure 1. Anterior view of entire animal showing mesoplax in place, the anterior adductor muscle, the pedal opening of the mantle, the retracted foot, and young on the dorsal surface of the valves. Figure 2. Enlargement of the umbonal area, mesoplax, and attached young.

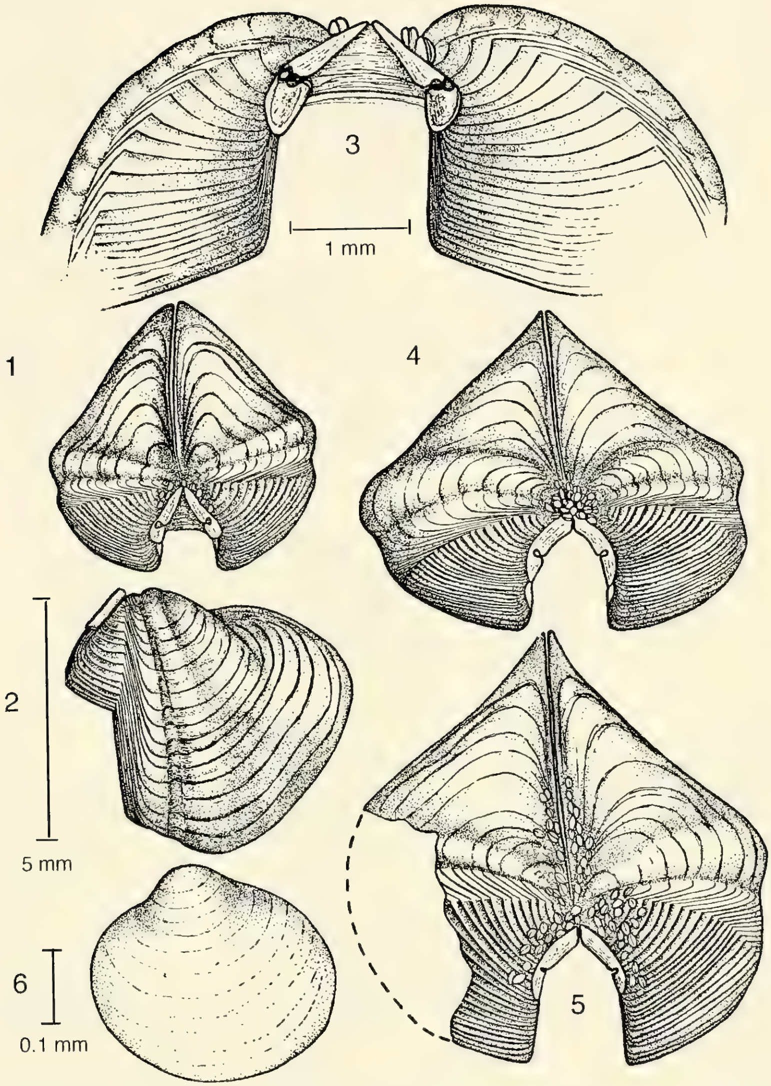

Plate 12. *Xylophaga profunda* Turner n. sp. from U.S. Naval Oceanographic Office test site, Tongue of the Ocean, Andros Island, Bahama Islands.

Figures 1–3. Holotype. Figure 1. Dorsal view showing round ridge posterior to the umbonal–ventral sulcus, the mesoplax, and attached young. Figure 2. Side view of left valve. Figure 3. Enlarged anterior view of dorsal area to show mesoplax. Figures 4, 5. Dorsal view of paratypes to show range of length–width relationships, concavity of posterior slope, as well as arrangement and number of young. Figure 6. Enlarged young.

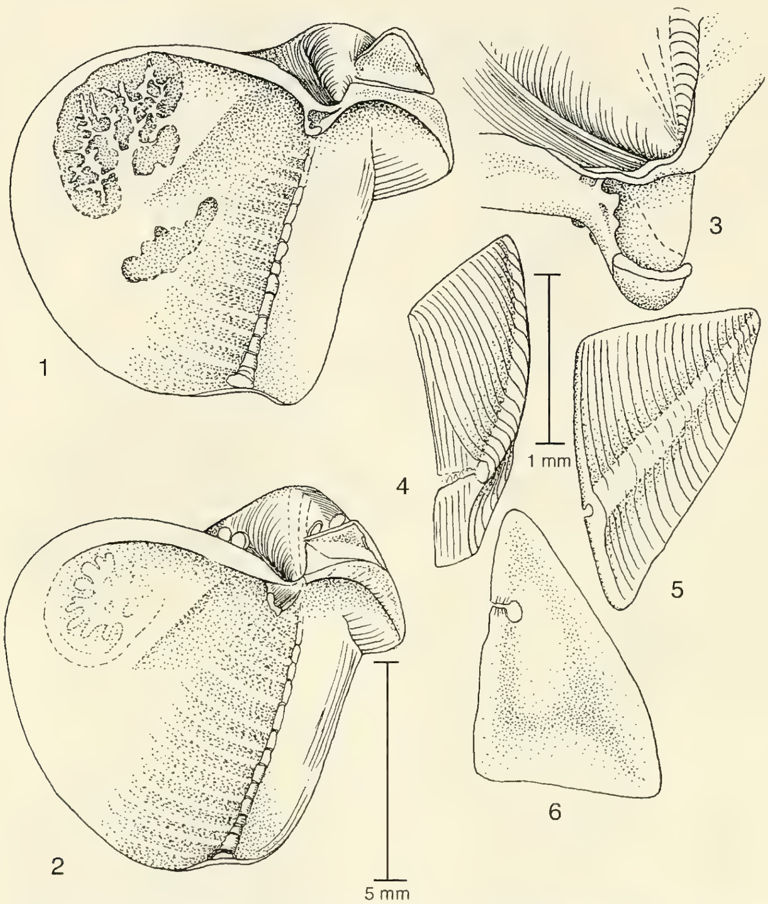

Plate 13. *Xylophaga profunda* Turner n. sp. from U.S. Naval Oceanographic Office test site Tongue of the Ocean, Andros Island, Bahama Islands.

Figures 1, 2. Inner view of left valve of two specimens to show differences in intensity of muscle scar impressions, the riblike ridges extending from the umbonal–ventral ridge, the placement of the mesoplax, and the chondrophore. Figure 3. Enlargement of the hinge area of the left valve to show the chondrophore. Figures 4–6. Anterior, dorsal, and ventral view of mesoplax.

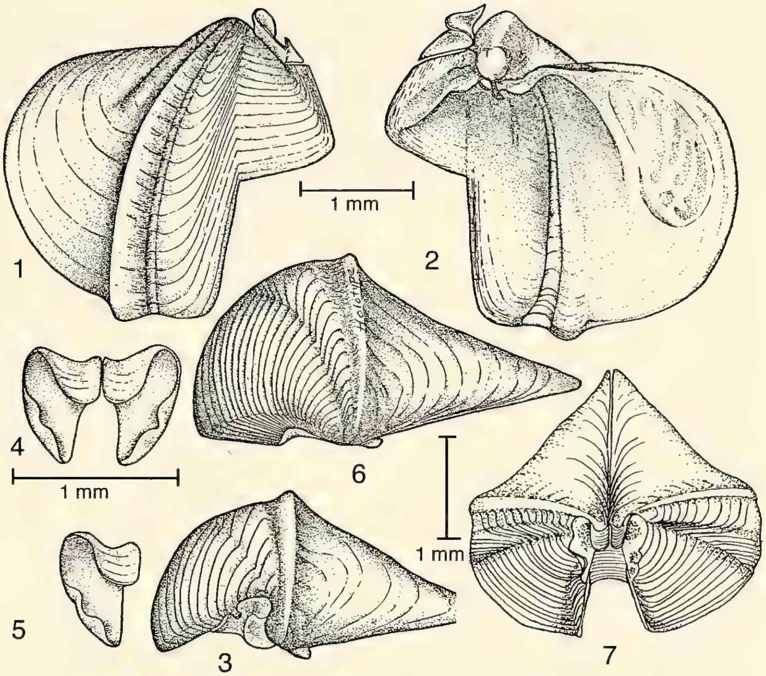

Plate 14. *Xylophaga abyssorum* Dall.

Figures 1–5. Specimens from U.S. Naval Oceanographic Office test site, Tongue of the Ocean, Andros Island, Bahama Islands. Figure 1. Outer view of right valve of immature specimen with mesoplax in place and showing ridge posterior to umbonal–ventral sulcus. Figure 2. Inner view of same valve, showing groove posterior to umbonal–ventral ridge, ligament, and characteristic muscle scar of young specimen. Figure 3. Dorsal view of same valve with mesoplax in place. Figures 4, 5. Mesoplax of young specimen with large ventral portion. Figure 6. Dorsal view of right valve of holotype of *Xylophaga abyssorum* for comparison with Figure 3. Figure 7. Dorsal view of young specimen from *Gerda,* station 266, with mesoplax developing lobes on dorsal portion.

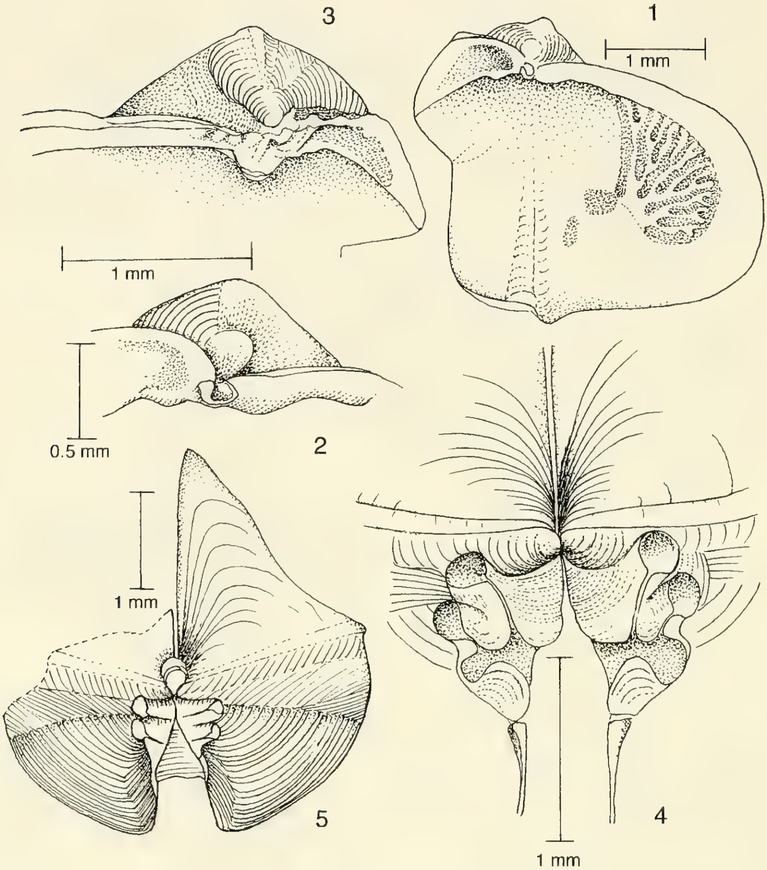

Plate 15. *Xylophaga abyssorum* Dall.

Figures 1–4. Specimens from *Pillsbury,* station 944. Figure 1. Inner view of right valve showing muscle scars, deep groove posterior to the umbonal–ventral ridge, and the small chondrophore. Figure 2. Enlargement of hinge area of same specimen. Figure 3. Hinge area of left valve. Figure 4. Dorsal view of umbonal area with mesoplax in place. This is the most elaborate mesoplax observed, having two tubes and a third developing. Figure 5. Dorsal view of specimen from *Gerda,* station 266, with two tubes formed on each plate of the mesoplax and with two young just posterior to the umbos.

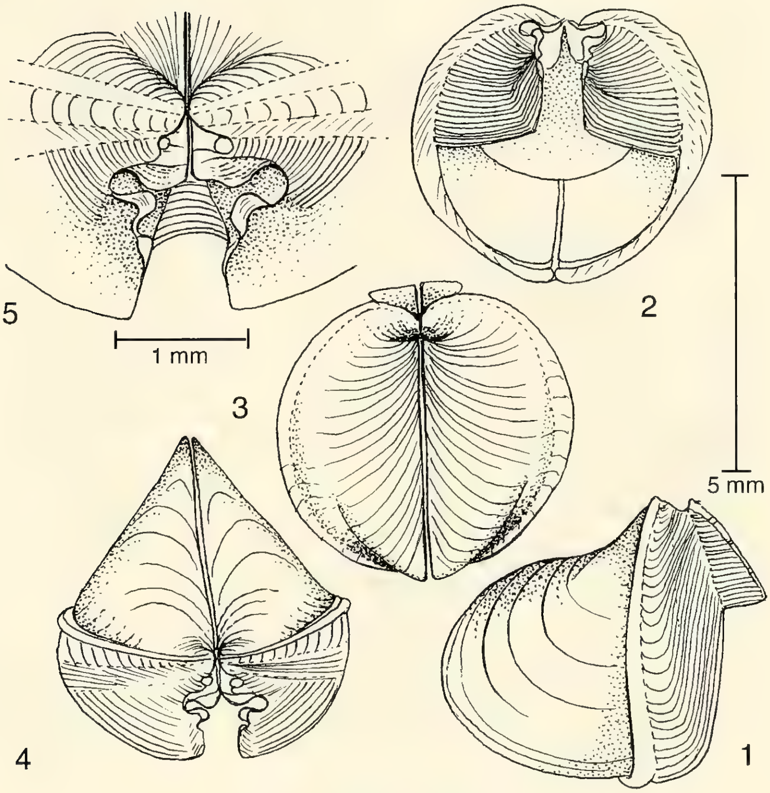

Plate 16. *Xylophaga abyssorum* Dall.

Figures 1–5. Specimen from *Pillsbury,* station 944. Figure 1. Lateral view of right valve. Figure 2. Anterior view of opposed valves with mesoplax in place. Figure 3. Posterior view of opposed valves with mesoplax in place and showing the inflated umbos and ridge. Figure 4. Dorsal view of opposed valves. Figure 5. Enlarged view of mesoplax and umbonal area.

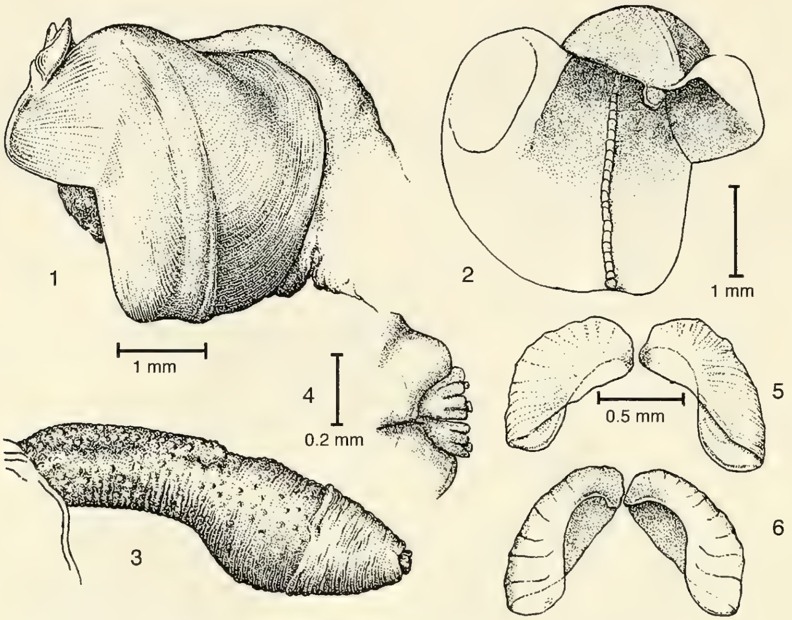

Plate 17. *Xylophaga duplicata* Knudsen from *Galathea,* station 745, Gulf of Panama (all from Knudsen, 1961: 175).

Figure 1. Lateral view of left side of holotype, showing the mesoplax in place, standing off from the surface of the valves. Figure 2. Inner view of left valve of a paratype showing the small smooth posterior adductor muscle scar. Figure 3. Left side of extended siphon of a paratype. Figure 4. Enlarged view of posterior end of the siphon. Figure 5. Dorsal view of the mesoplax. Figure 6. Ventral view of mesoplax.

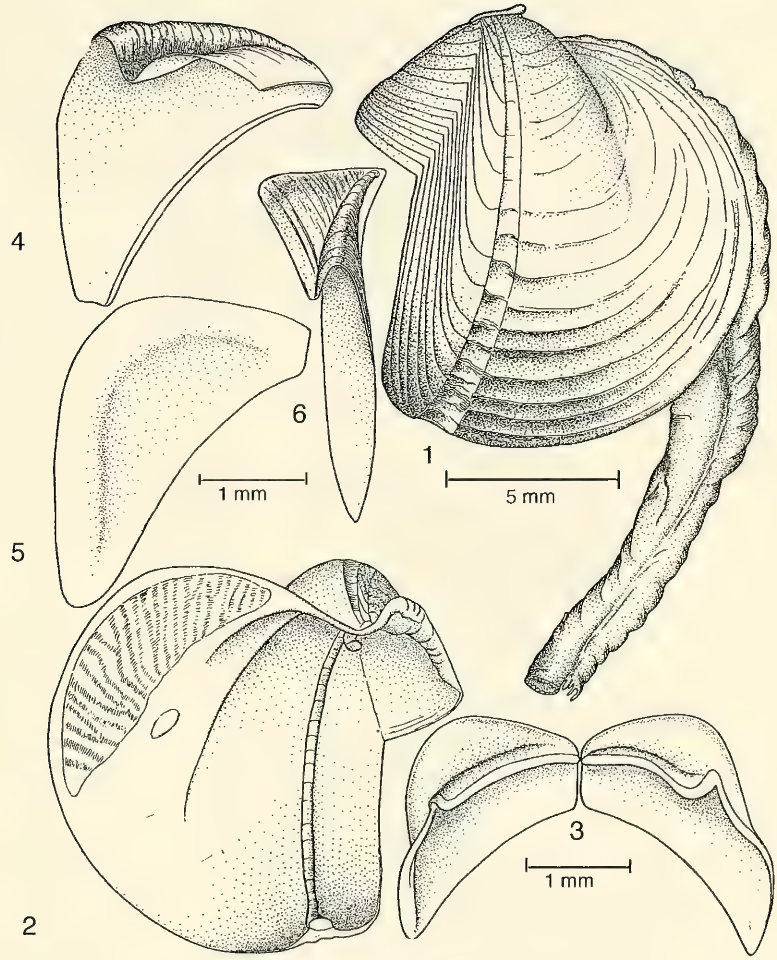

Plate 18. *Xylophaga muraokai* Turner n. sp. from U.S. Naval Civil Engineering Laboratory Test Site I.

Figure 1. Lateral view of holotype showing siphons. Figure 2. Inner view of left valve showing muscle scar and simple chondrophore. Figure 3. Dorsal view of the two plates of the mesoplax of a mature specimen showing large basal portion. Figure 4. Dorsal view of right plate of mesoplax. Figure 5. Ventral view of left plate of mesoplax. Figure 6. Lateral view of left plate of mesoplax.

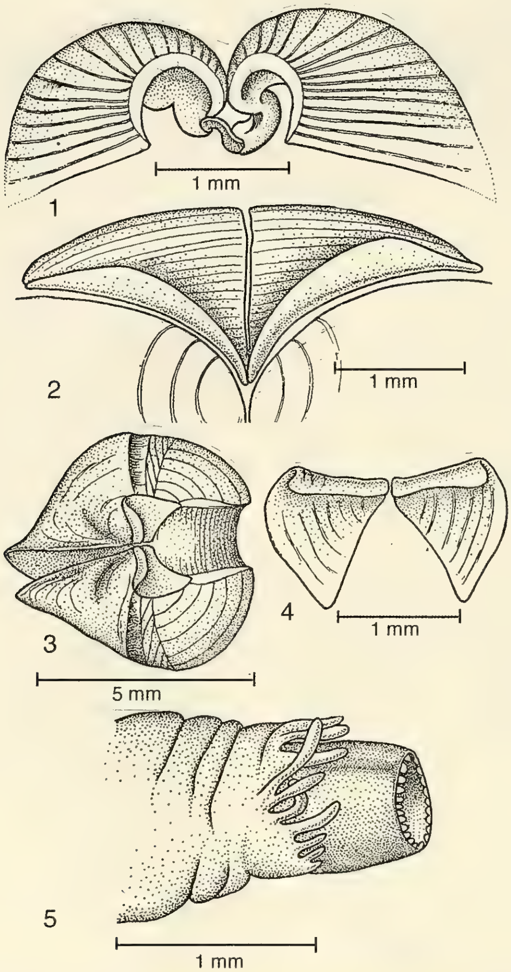

Plate 19. *Xylophaga muraokai* Turner n. sp. from U.S. Naval Civil Engineering Laboratory Test Site I.

Figure 1. Anterior view of hinge area showing chondrophore and internal ligament. Figure 2. Posterior view of mesoplax fitting between the umbos. Figure 3. Dorsal view of young specimen with partially developed mesoplax. Figure 4. Mesoplax of young specimen. Figure 5. Enlargement of posterior end of siphons showing cirri around the siphonal apertures.

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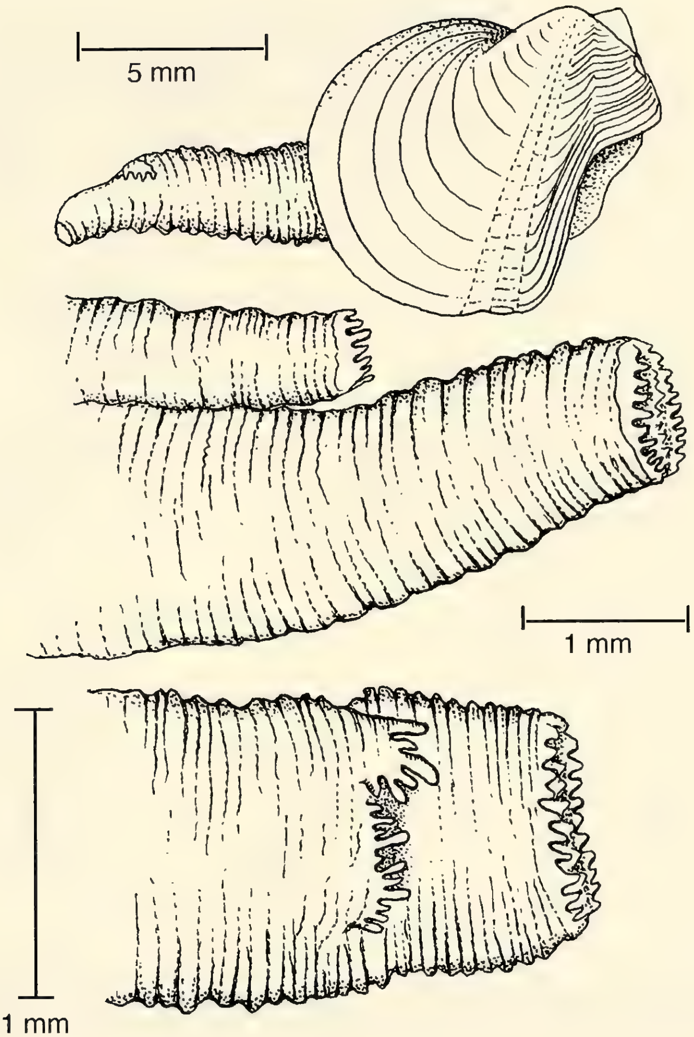

Plate 20. *Xylophaga atlantica* Richards from about 15 miles off Ipswich, Massachusetts, in 73 m.

Figure 1. Entire specimen with siphons extended, showing relative lengths. Figure 2. Enlargement of the posterior end of the siphons, lateral view. Figure 3. Enlargement of the posterior end of siphons dorsal view showing the numerous small cirri surrounding the incurrent siphonal aperture and the larger, less numerous cirri of the excurrent siphon.

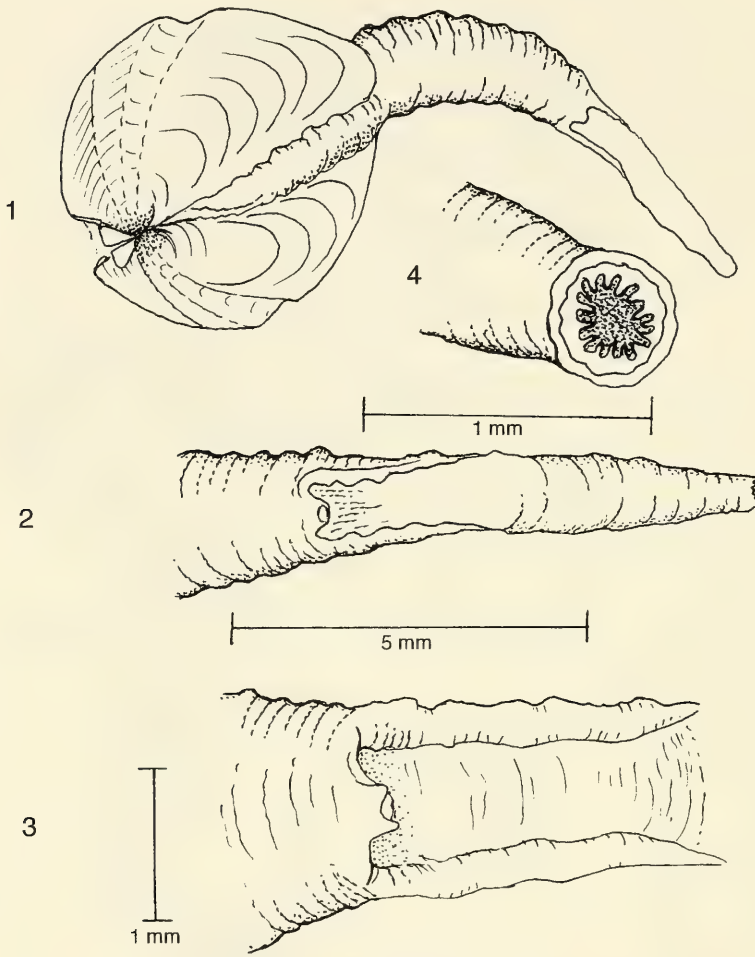

Plate 21. *Xylophaga washingtona* Bartsch.

Figures 1–3. Specimen from U.S. Naval Civil Engineering Laboratory Test Site I. Figure 1. Dorsal view of entire specimen showing the relative length of the siphons. Figure 2. Dorsal view of siphons from just anterior to the truncation of the excurrent siphon. Figure 3. Dorsal view of siphons in area of truncation to show contracted aperture of the excurrent siphon of a short tube, and the short lateral lobes extending from the truncation. Figure 4. Specimen from about 40 miles W of Silver Point, Oregon. Aperture of incurrent siphon showing cirri.

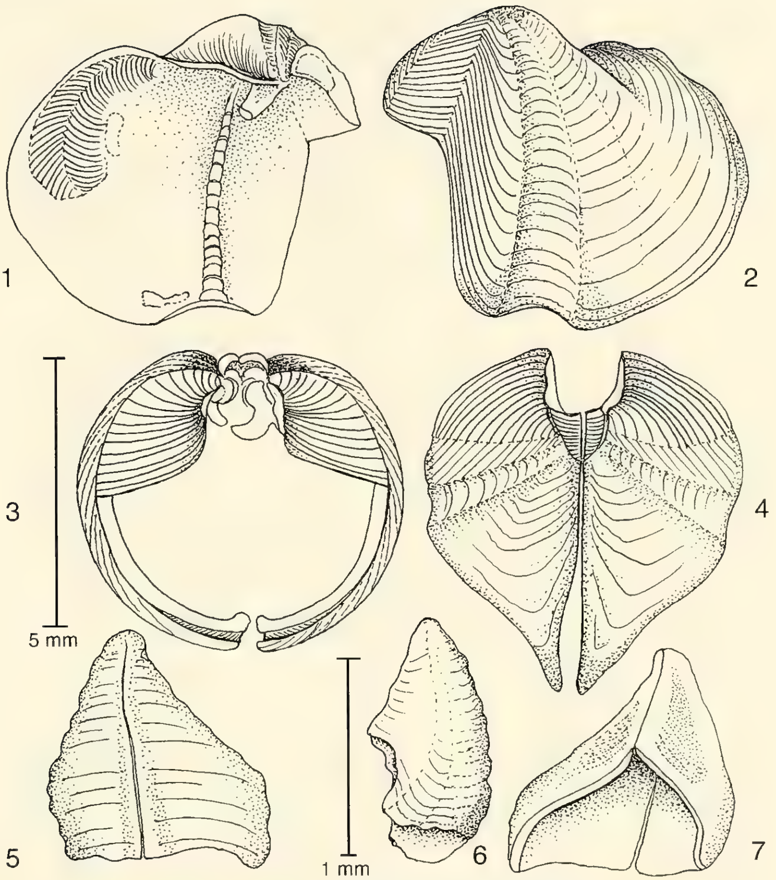

Plate 22. *Xylophaga rikuzenica* Taki and Habe from off Rikuzen, Honshu, Japan. Paratype, Museum of Comparative Zoology 194821.

Figure 1. Inner view left valve showing posterior adductor muscle with herringbone markings. Figure 2. Outer view of left valve showing broad ventral sulcus. Figure 3. Anterior view of opposed valves showing mesoplax in place, the condyles, and chondrophore. Figure 4. Dorsal view of opposed valves showing mesoplax in place, umbonal reflection, and broad, deep umbonal–ventral sulcus. Figures 5–7. Dorsal, lateral, and ventral views of the mesoplax showing the large ventral portion.

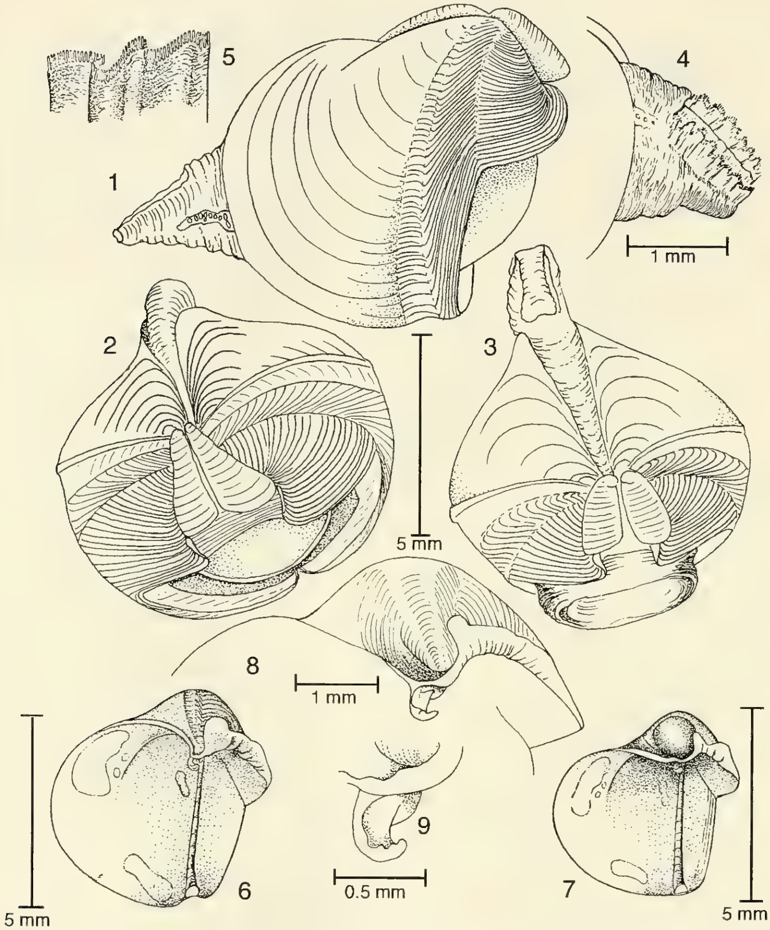

Plate 23. *Xylophaga depalmai* Turner n. sp. from U.S. Naval Oceanographic Office test site off Fort Lauderdale, Florida.

Figure 1. Lateral view of holotype showing siphons with lateral periostracal sheath containing clusters of irregular glasslike granules. Figure 2. Dorsal view of holotype showing mesoplax that is only slightly coiled posteriorly. Figure 3. Dorsal view of specimen with slightly more coiled mesoplax. Figure 4. Siphons showing fringed lappets. Figure 5. Enlargement of fringe. Figure 6. Inner view of left valve showing muscle scars. Figure 7. Inner view of left valve showing prodissoconch. Figure 8. Enlargement of hinge area of left valve showing umbonal reflection and chondrophore. Figure 9. Enlargement of chondrophore.

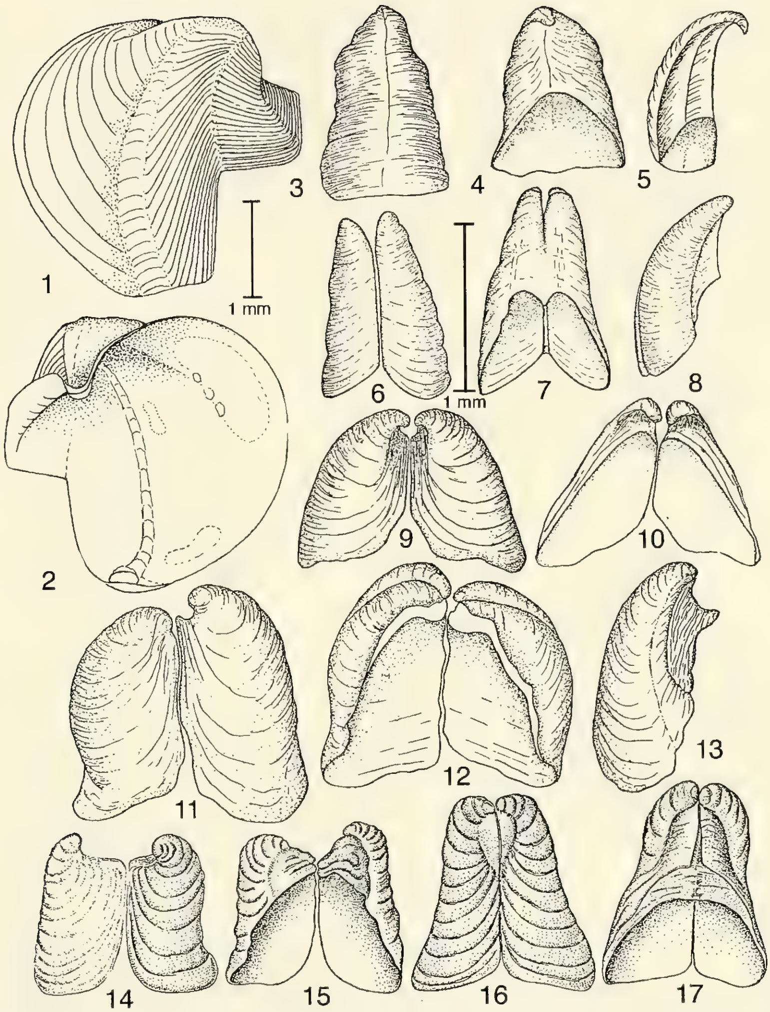

Plate 24. *Xylophaga depalmai* Turner n. sp. from U.S. Naval Oceanographic Office test site off Fort Lauderdale, Florida.

Figures 1–5. Specimen with the two plates of mesoplax fused. Figure 1. Outer view of right valve. Figure 2. Inner view of right valve showing lightly impressed muscle scars. Figure 3. Dorsal view of fused plates of mesoplax. Figure 4. Ventral view of mesoplax. Figure 5. Lateral view. Figures 6–8. Dorsal, ventral, and lateral view of mesoplax with plates partially fused ventrally. Figures 9, 10. Dorsal and ventral views of a mesoplax, which is broadened anteriorly and has a reduced ventral portion. Figures 11–13. Dorsal, ventral, and lateral views of an unusually broad mesoplax with unequal plates and reduced ventral portion. Figures 14, 15. Dorsal and ventral views of a broad mesoplax strongly coiled posteriorly, with a widened median area that separates the coils. Figures 16, 17. Dorsal and ventral views of a typical mesoplax with only the periostracal portion of the ventral portion fused.

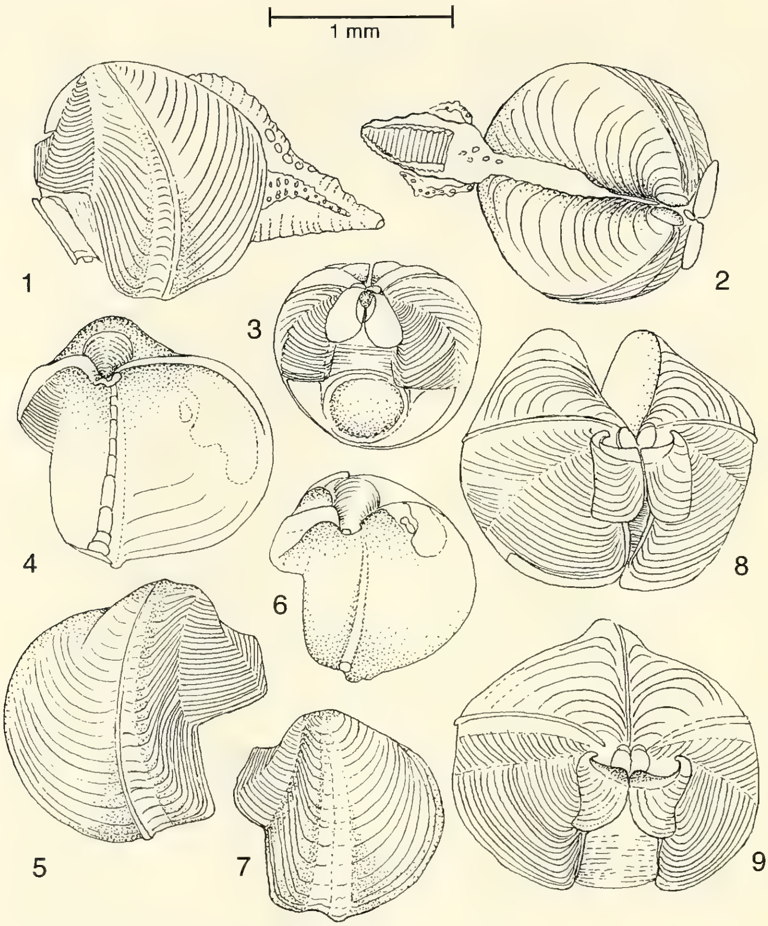

Plate 25. *Xylophaga guineensis* Knudsen.

Figures 1–3. Specimen from *Pillsbury,* station 260. Figure 1. Lateral view of entire animal showing foot, siphons, and periostracal sheath with fine whitish granules. Figure 2. Dorsal view showing siphons, prodissoconch, mesoplax, and loose periostracal sheath with granules. Figure 3. Anterior view showing foot, anterior adductor muscle, and mesoplax in place. Figures 4, 5. Specimen from *Atlantique Sud,* station 33. Figure 4. Inner view of right valve showing specimen with high flaring posterior slope, prodissoconch, posterior adductor muscle scar, and deep groove bounding the umbonal–ventral ridge. Figure 5. Outer view of right valve showing wide anterior slope and narrow, bladelike ridge posterior to the shallow umbonal–ventral sulcus. Figures 6–9. Specimens from *Atlantique Sud,* station 146. Figure 6. Inner view of right valve of specimen with low, rounded posterior, small posterior adductor muscle scar set very high. Figure 7. Outer view of left valve with very closely set ridges on anterior slope. Figures 8, 9. Dorsal views to show variation in the mesoplax in place.

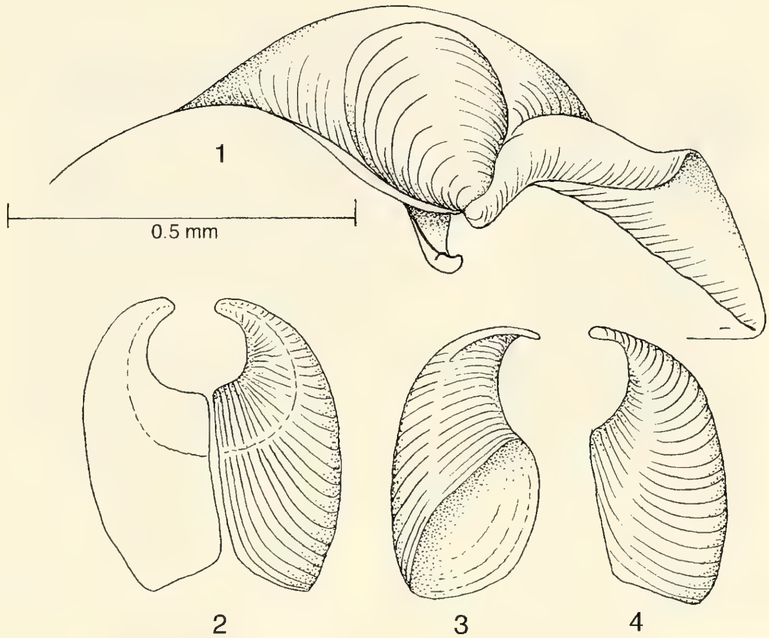

Plate 26. *Xylophaga guineensis* Knudsen.

Figure 1. Specimen from *Atlantique Sud* station 146. Umbonal area showing chondrophore, prodissoconch, and umbonal reflection. Figures 2–4. Specimens from *Atlantique Sud,* station 33. Figure 2. Dorsal view of opposed plates of mesoplax. Figure 3. Ventral view of right plate of the mesoplax to show long cornucopialike shape. Figure 4. Dorsal view of right plate of mesoplax.

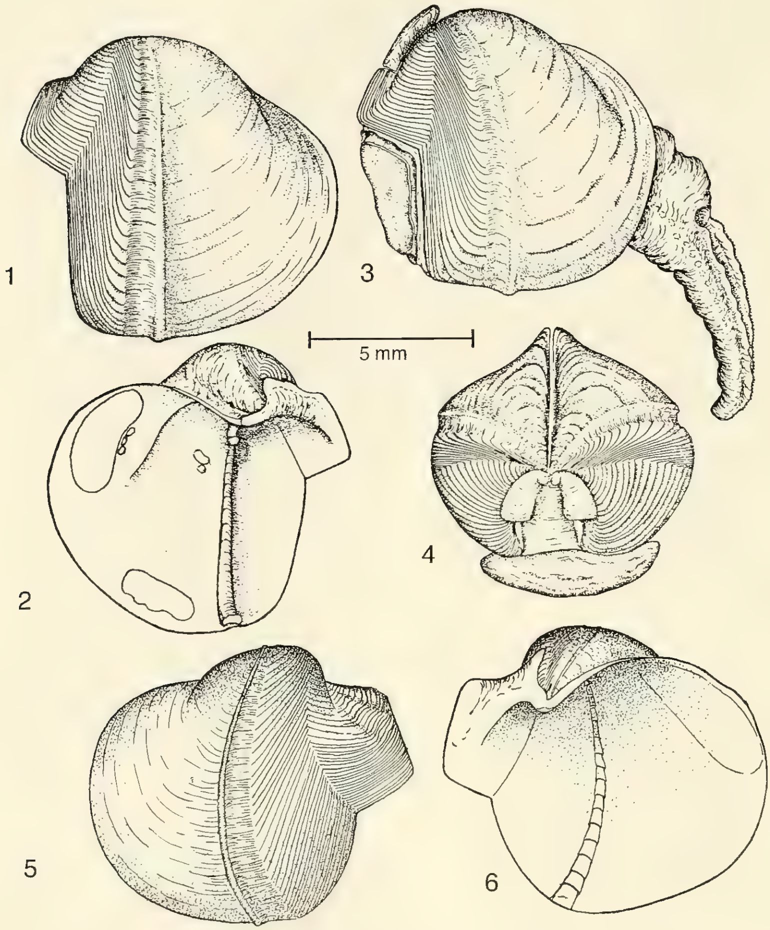

Plate 27. Xylophaga mexicana Dall.

Figures 1–4. Specimens from "replication reef," Santa Monica Bay, California. Figures 1, 2. Outer and inner views of left valve of specimen close to the holotype. Figure 3. Lateral view of entire specimen showing inflated mesoplax and siphons. Figure 4. Dorsal view of entire specimen showing mesoplax and expanded foot. Figures 5, 6. Outer and inner view of right valve of the holotype (from Turner, 1955, pl. 90).

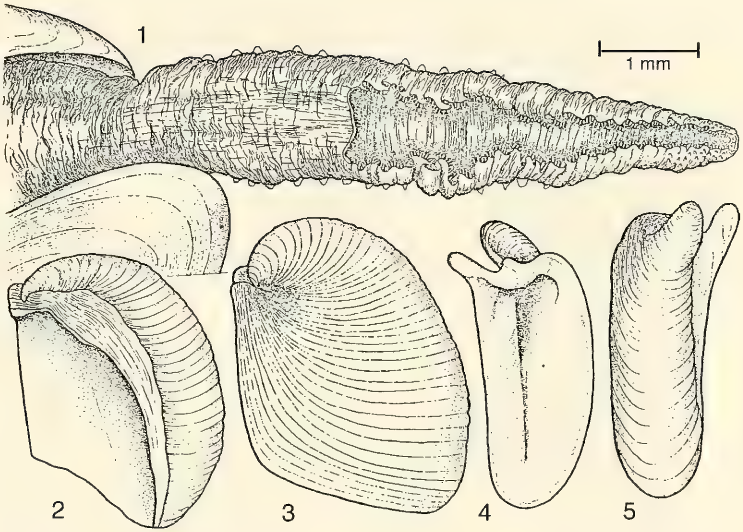

Plate 28. *Xylophaga mexicana* Dall from "replication reef," Santa Monica Bay, California.

Figure 1. Enlargement of the siphons to show the truncation of the excurrent siphon, the finely fringed lappets, granules embedded along the side of the siphon, and the papillose end of the incurrent siphon. Figures 2, 3. Ventral and dorsal view of mesoplax. Figures 4, 5. Inner and outer lateral views of mesoplax showing flange that fits down between the umbos.

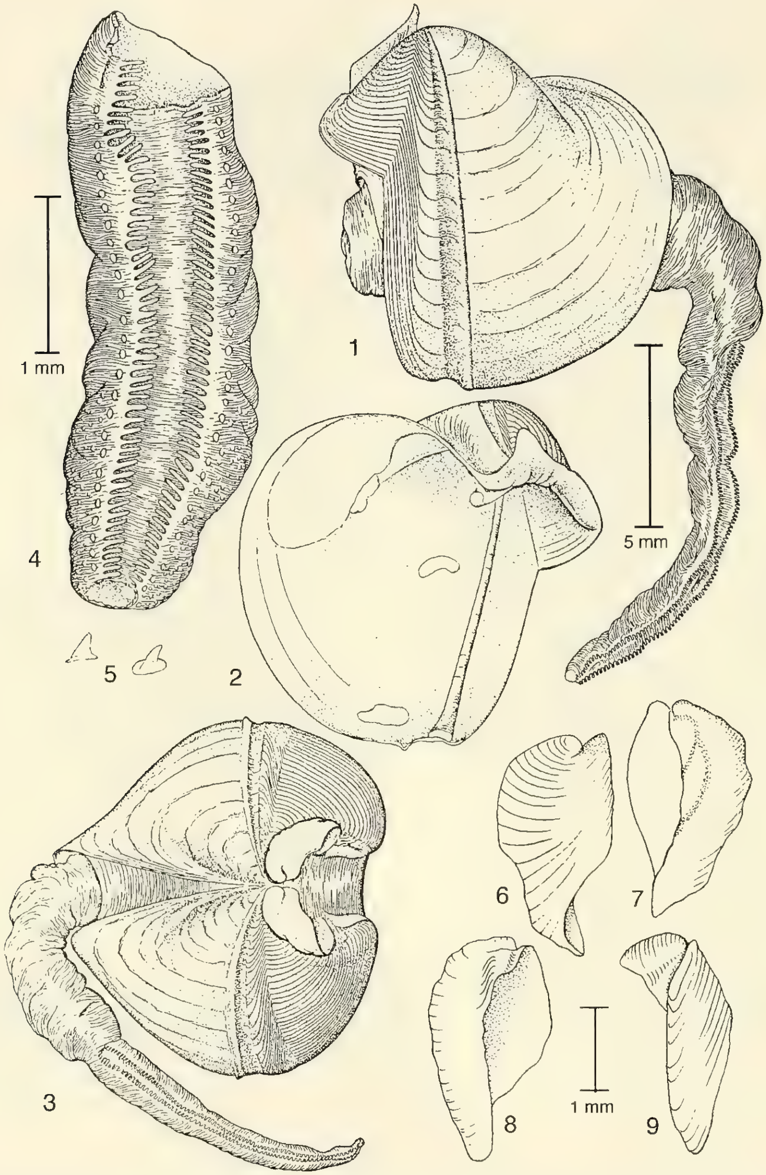

Plate 29. *Xylophaga tipperi* Turner n. sp. from U.S. Naval Oceanographic Office test site off Fort Lauderdale, Florida.

Figure 1. Lateral view of holotype showing foot and extended siphons. Figure 2. Inner view of left valve to show smooth posterior adductor muscle scar. Figure 3. Dorsal view showing mesoplax in place. Figure 4. Enlargement of posterior end of incurrent siphon to show the fringed lappets and the single row of glasslike plaques along the side. Figure 5. Lateral and three-quarters view of glasslike plaques. Figures 6–9. Mesoplax. Figure 6. Dorsal view of right plate showing flat surface and faint sculpture. Figures 7, 8. Ventral view of right and left plates. Figure 9. Lateral view of right plate to show the compressed main portion and the posterior ventral flange that extends down between the umbos.

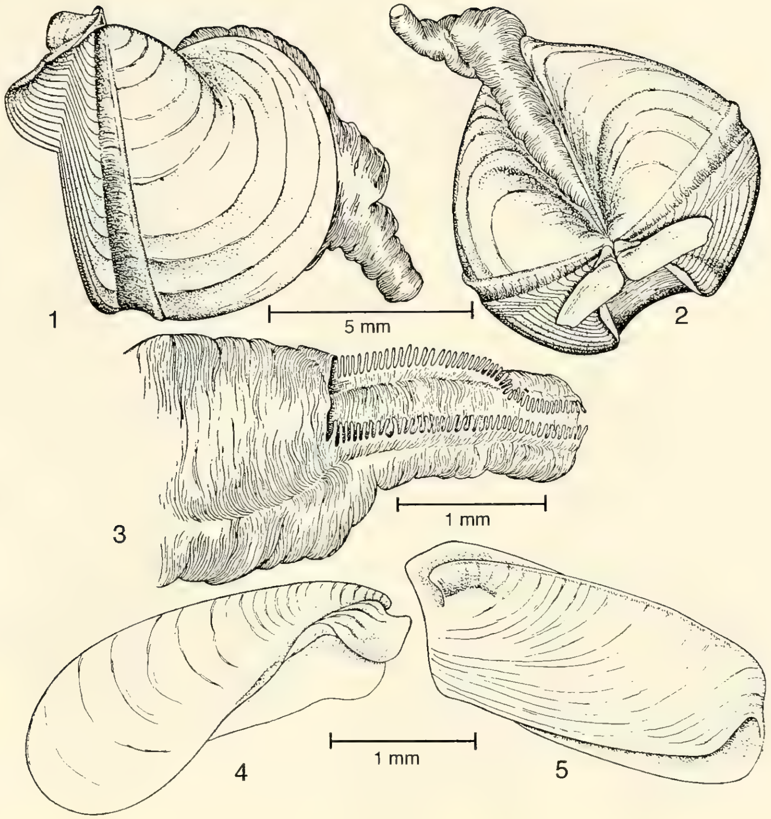

Plate 30. *Xylophaga bayeri* Turner n. sp. from U.S. Naval Oceanographic Office test site off Fort Lauderdale, Florida.

Figure 1. Lateral view of holotype showing siphons and mesoplax in place. Figure 2. Dorsal view of holotype, showing the lateral extension of the mesoplax. Figure 3. Enlargement of the siphons showing the truncated excurrent siphon and the fringed lappets. Figure 4. Ventral view of the mesoplax. Figure 5. Dorsal view of the mesoplax.

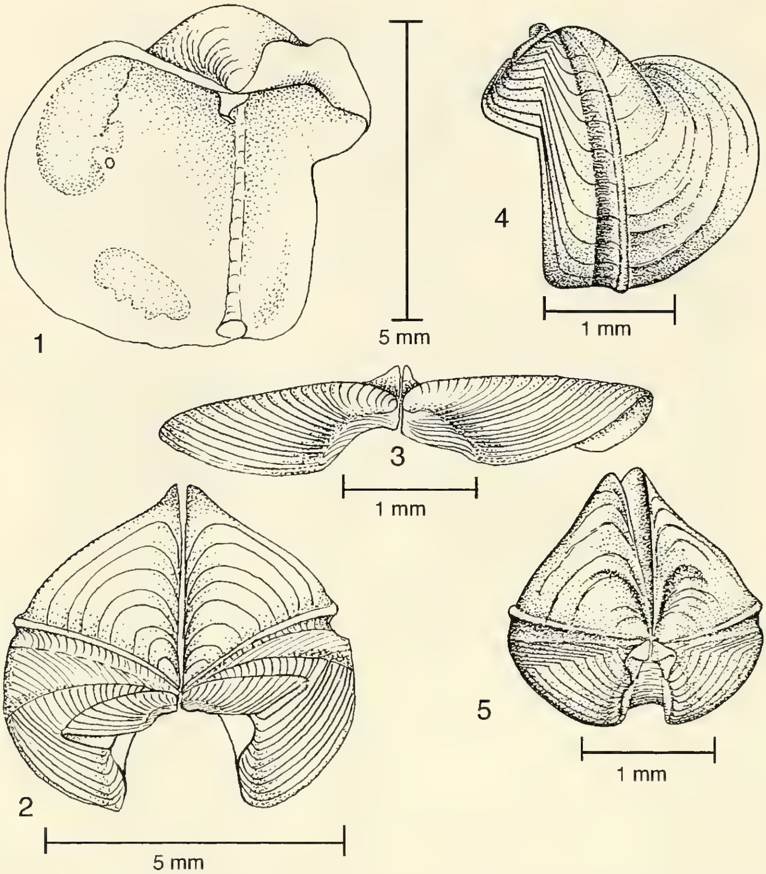

Plate 31. *Xylophaga bayeri* Turner n. sp.

Figures 1–3. Specimen from *Gerda,* station 266. Figure 1. Inner view of valves showing smooth muscle scar; narrow, high umbonal–ventral ridge, and broad, recurved umbonal reflection that adheres to the valve. Figure 2. Dorsal view of specimen showing broad umbonal reflection and the mesoplax. Figure 3. Enlargement of the mesoplax, dorsal view. Figures 4, 5. Specimen from U.S. Naval Oceanographic Office test site off Fort Lauderdale, Florida. Figure 4. Lateral view of a young specimen with partially developed mesoplax. Figure 5. Dorsal view of a young specimen with partially developed mesoplax.

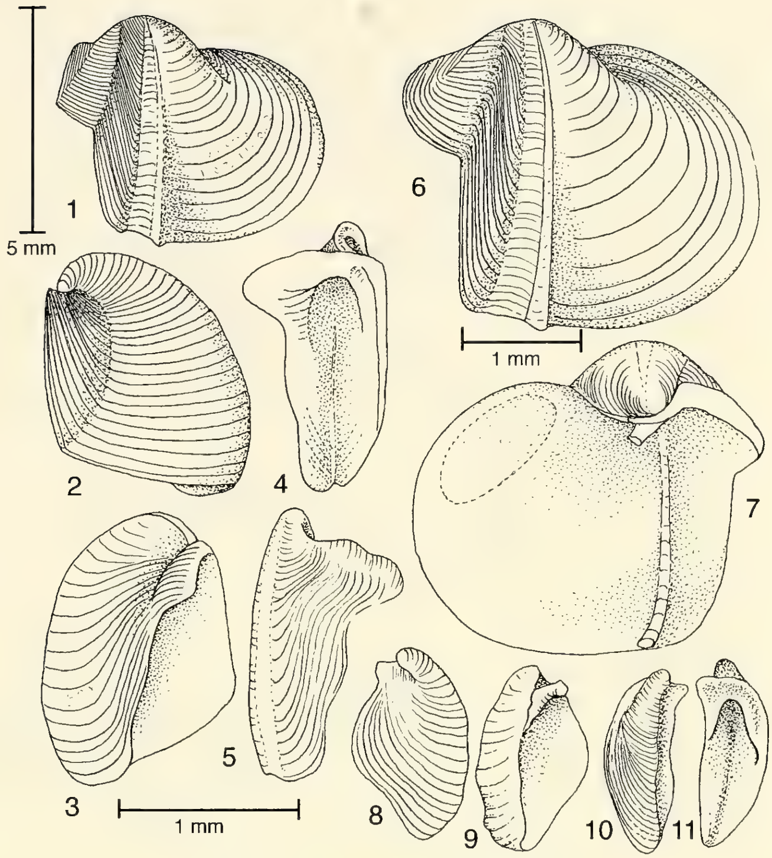

Plate 32. *Xylophaga japonica* Taki and Habe.

Figures 1–5. Paratype from Tosa Bay, Shikoku, Japan. Figure 1. Outer view of left valve showing thin ridge posterior to umbonal–ventral sulcus and elongate posterior slope. Figure 2. Dorsal view of mesoplax with distinct concentric sculpture. Figure 3. Ventral view of mesoplax showing flange that fits between umbos. Figure 4. Inner lateral view. Figure 5. Outer lateral view showing flange. Figures 6–11. Specimens from *Anton Bruun,* station 23. Figure 6. Outer view of left valve. Figure 7. Inner view of right valve showing chondrophore and smooth posterior adductor muscle scar. Figure 8. Outer view of mesoplax of a small specimen. Figure 9. Inner view of mesoplax of a small specimen. Figure 10. Outer lateral view of mesoplax of a small specimen. Figure 11. Inner lateral view of mesoplax of a small specimen.

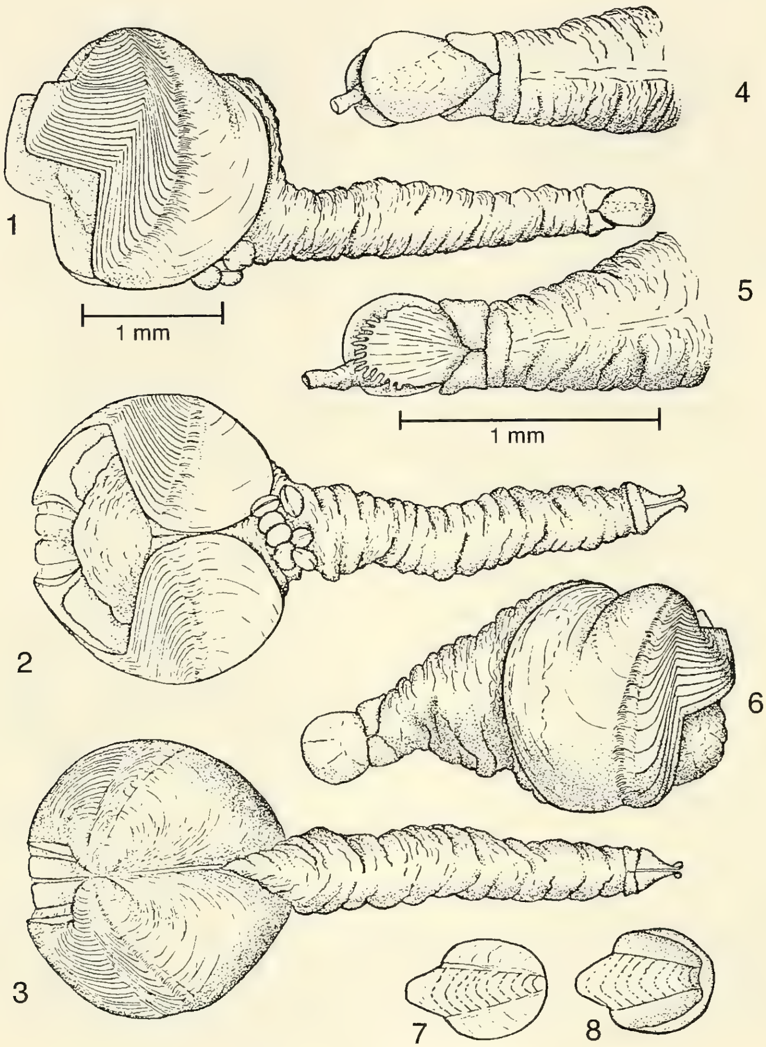

Plate 33. *Xylopholas altenai* Turner from *Gerda,* station 66.

Figures 1–3. Holotype. Figure 1. Lateral view of entire animal with the anterior adductor muscle relaxed so that the mesoplax is flattened and not visible, showing siphonal plates and young carried on ventral surface. Figure 2. Ventral view showing the mesoplax held in place by periostracum, the ventrally carried young, and the recurving of the siphonal plates. Figure 3. Dorsal view showing the mesoplax in place and the umbonal reflection. Figure 4. Enlargement of posterior end with the incurrent siphon projecting beyond the siphonal plate. Figure 5. Posterior end with left plate removed to show the muscle that extends into the cavity of the plate to which the siphonal retractor muscles attach. Figure 6. Lateral view of a very small specimen, contracted anteriorly so that the plates of the mesoplax are folded upward. Figure 7. Outer view of siphonal plate. Figure 8. Inner view of siphonal plate.

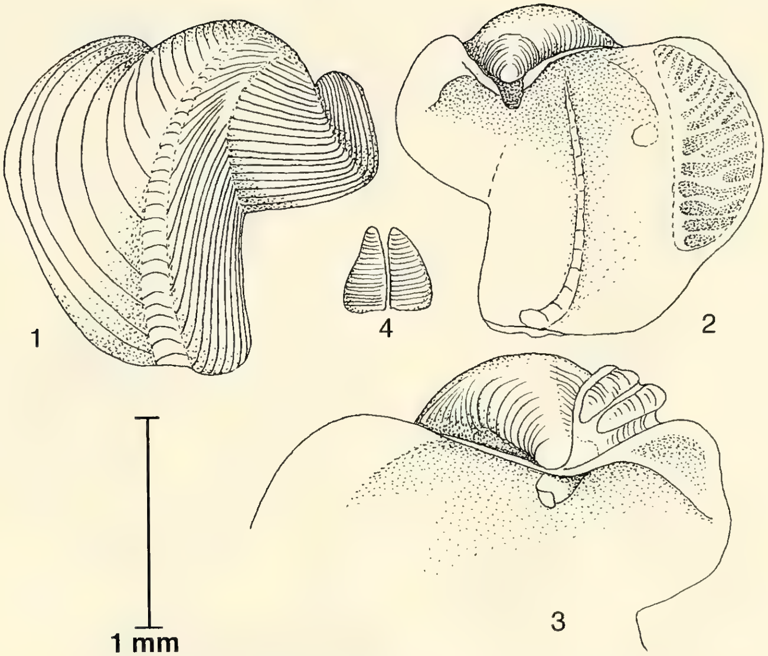

Plate 34. *Xylopholas altenai* Turner from *Gerda,* station 66.

Figure 1. Outer view of right valve showing beaked portion of the anterior slope. Figure 2. Inner view of right valve showing the large posterior adductor muscle scar, pedal retractor scar, prodissoconch, and ligament. Figure 3. Inner view of upper part of left valve to showing the chondrophore and the mesoplax in its periostracal membrane. Figure 4. Dorsal view of the two plates of the mesoplax.

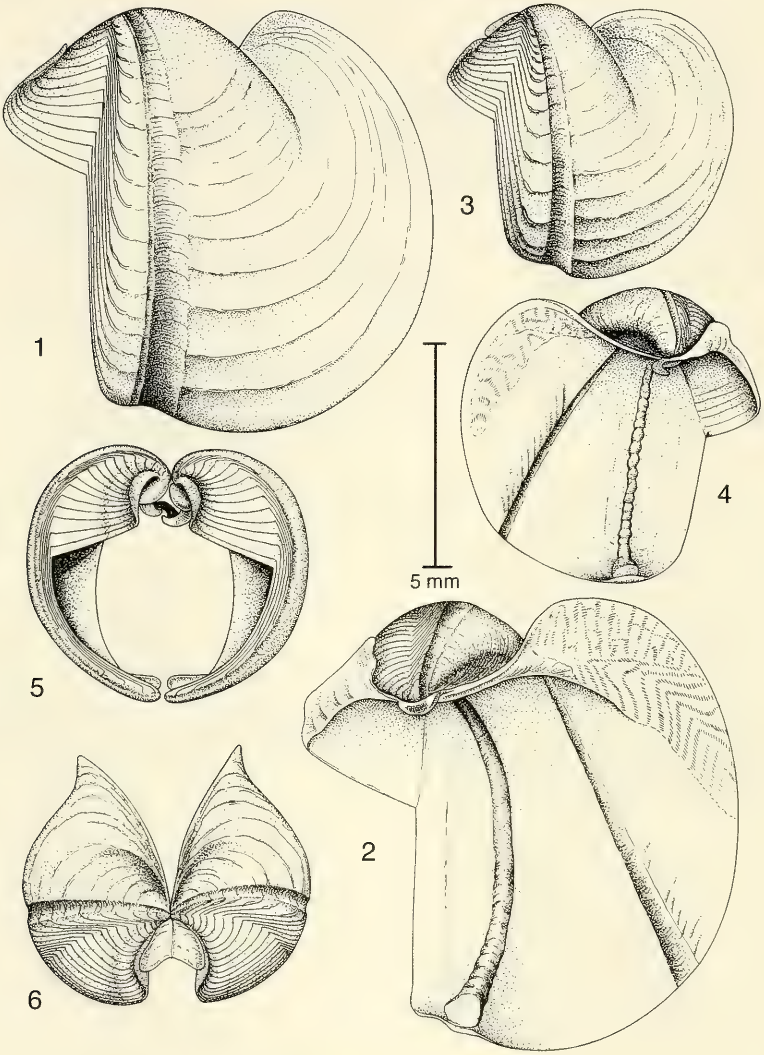

Plate 35. *Xyloredo nooi* Turner from U.S. Naval Oceanographic Office test site, Tongue of the Ocean, Bahama Islands.

Figure 1. Inner view of left valve showing divided muscle scar. Figure 2. Outer view of left valve. Figure 3. Outer view of left valve of holotype showing the flaring posterior dorsal margin. Figure 4. Inner view of right valve of holotype showing the divided posterior adductor muscle scar, the deep groove separating the disc from the posterior slope, and the umbonal reflection. Figure 5. Anterior view of opposed valves, showing the chondrophore and internal ligament. Figure 6. Dorsal view showing the thin mesoplax.

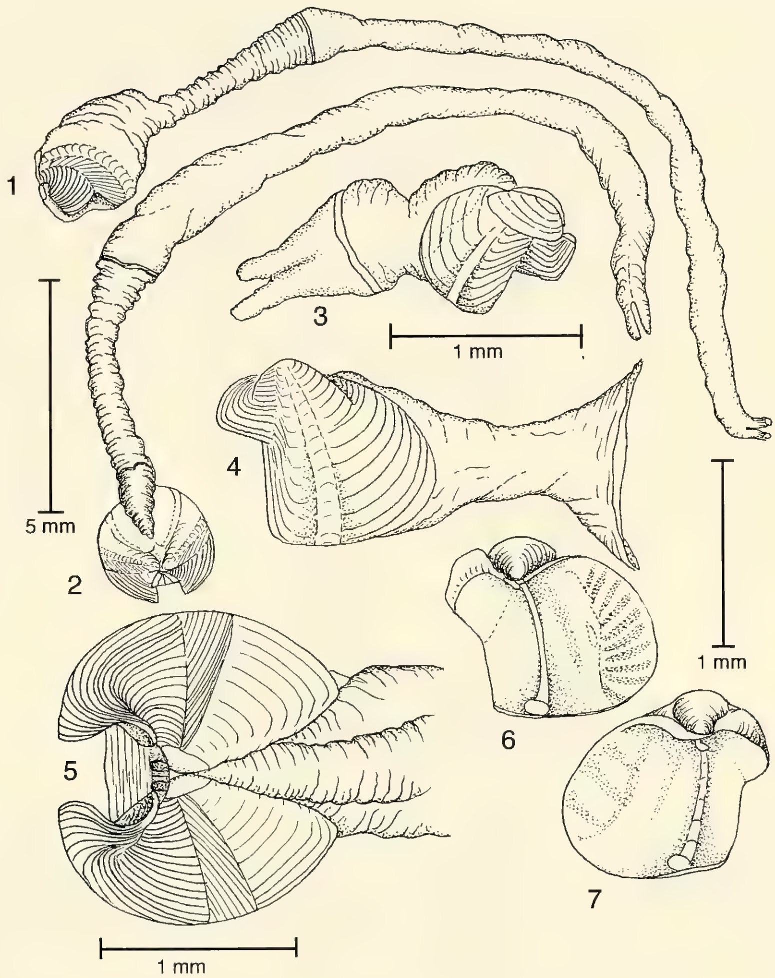

Plate 36. *Xyloredo ingolfia* Turner from *Ingolf* Expedition, station 67.

Figure 1. Lateral view of an entire animal, showing the periostracal sheath, the extended anal and siphonal canals, and the short siphons. Figure 2. Dorsal view of an entire animal, showing the periostracal sheath, the extended anal and siphonal canals, and the short siphons. Figure 3. Lateral view of a very young specimen showing the large prodissoconch and the produced beaked portion of the anterior slope. Figure 4. Lateral view of left valve with periostracal sheath attached. Figure 5. Dorsal view showing the produced, recurved beaks, the umbonal reflection, and the mesoplax with only the central portion of each plate calcified. Figure 6. Inner view of right valve with well-marked posterior adductor muscle scar. Figure 7. Inner view of left valve with lightly marked scar and large prodissoconch.

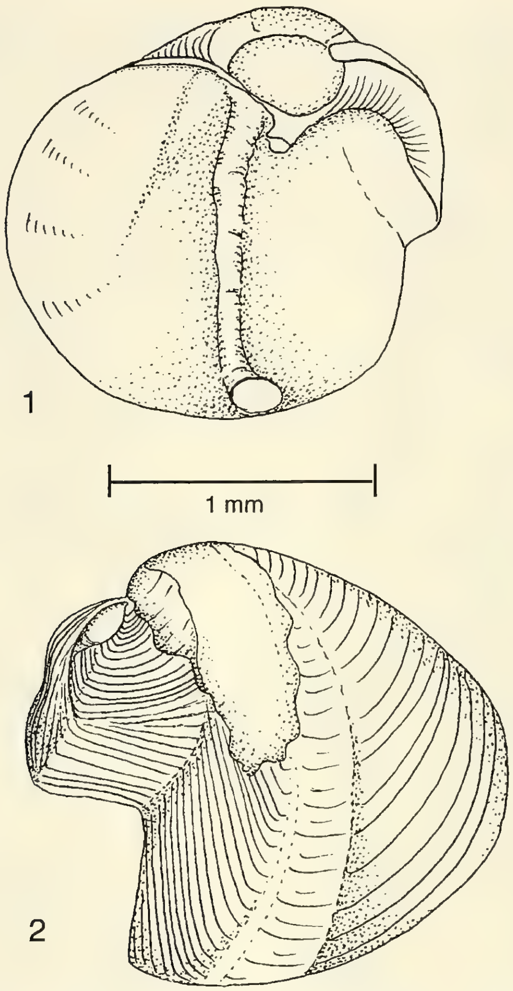

Plate 37. *Xyloredo ingolfia* Turner from *Ingolf* Expedition, station 67.

Figure 1. Inner view of left valve showing large prodissoconch, strong umbonal–ventral ridge, reduced posterior slope, and lightly impressed posterior adductor muscle scar. Figure 2. Outer view of left valve showing the produced beak and rounded low posterior slope.

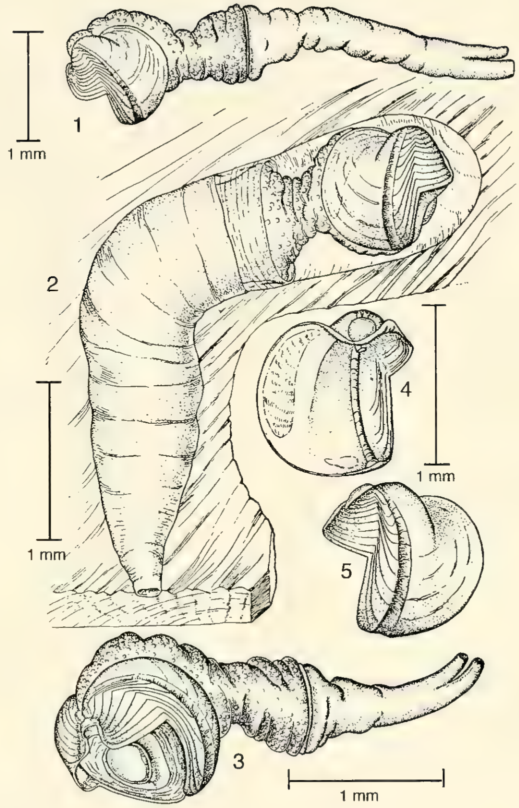

Plate 38. *Xyloredo naceli* Turner from U.S. Naval Civil Engineering Laboratory Test Site I (submersible test unit I-4).

Figure 1. Lateral view of holotype. Figure 2. Lateral view of specimen partially dissected from the wood showing the calcereous tube with the anterior periostracal margin and the papillose periostracal sheath covering the animal between the tube and the valves. Figure 3. Anterior-lateral view of entire specimen showing foot and mesoplax. Figure 4. Inner view of left valve showing muscle scars and chondrophore. Figure 5. Outer view of left valve.

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Taxon names are printed in italics. Page numbers in bold refer to illustrations; those in italics refer to species descriptions; t indicates table.

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THE BOLAS SPIDERS OF THE GENUS *MASTOPHORA* (ARANEAE: ARANEIDAE)

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Plate 1. Upper left, *Mastophora diablo* new species (Argentina, photo J. Abalos). Upper right, *M. stowei* new species (Kentucky, photo K. F. Haynes and K. V. Yeargan). Middle left, *M. yeargani* new species (Kentucky, photo K. F. Haynes and K. V. Yeargan). Lower left, *M. alvareztoroi* Ibarra and Jiménez new species (Texas, photo M. Stowe). Lower right, *M. fasciata* Reimoser (Costa Rica, photo W. Eberhard).

THE BOLAS SPIDERS OF THE GENUS *MASTOPHORA* (ARANEAE: ARANEIDAE)

HERBERT W. LEVI[1]

ABSTRACT. Of 48 species of bolas spiders (*Mastophora*) found in the Americas, 22 are new. Of that number, nine new species and six previously known species are North American. The North American *Mastophora bisaccata* is a group of species of similar appearance. We can expect additional finds of new species of these rare and specialized spiders. The species range from New Hampshire in the United States to central Argentina. No species are known from tropical Amazon or the northwestern states of the United States. The greatest abundance of species is in warm temperate areas of southeastern North America and southern Brazil and northern Argentina. *Agatostichus* is synonymized with *Mastophora*. Within this paper, Ibarra and Jiménez describe a new species from Chiapas and Texas. Evidence from palpal morphology indicates a relationship of *Kaira* with *Taczanowskia* and *Mastophora*, suggesting that insect attractants may have evolved only once.

Epeiroides fasciolata, erroneously placed in *Mastophora*, is a *Kaira*, the male of *Kaira altiventer*. The related Asian genus *Euglyptila* is synonymized with *Ordgarius*.

INTRODUCTION

Female bolas spiders spend the day resting on leaves and branches, usually mimicking bird droppings and sometimes berries, snails, or leaf buds. At night, the bolas spider feeds on male moths attracted by the spider's scent; the scent mimics the sex attractant of the female moth. This pheromone was first suggested by Hutchinson (1903). Evidence of this pheromone was found by Eberhard (1977), and chemical analyses were conducted by Stowe et al. (1987) and Gemeno et al. (2000). An approaching male moth is caught with a silken thread bearing a viscid drop, the bolas, hurled at the moth. Moths stick to the bolas, whereas detachable wing scales permit moths to escape from most orb webs. The unusual behavior of *Mastophora,* first observed by Hutchinson (1903), has attracted the attention of researchers, including taxonomists (Eberhard, 1981; Stowe, 1986; Stowe et al., 1987; Yeargan, 1988, 1994, 1997). Unlike most American orb weavers, the genus *Mastophora* has been revised in the past. That is, the described species were compared and illustrated and keys were made. Mello-Leitão (1931) first reviewed all known species, and in the same year Canals (1931) revised all Argentinean species. Both authors relied on differences in the shape of the horns on the cephalothorax. The presence of horns is a character of the genus and is difficult to use for differentiating species. Genitalia were not illustrated until Gertsch (1955) revised the North American species. Unfortunately, Gertsch's illustrations were poorly labeled. Those with legends indicating an internal view of the epigynum actually were the cleared posterior of the epigynum. Gertsch correctly reported that the diversity of egg sacs from Florida suggested overlooked species.

Most of our knowledge of the biology of these spiders comes from a few species, mostly from North America. All late-instar and adult female bolas spiders spin a horizontal line composed of multiple threads, and then attach a bolas to it. The bolas consists of one, rarely several, balls of sticky glue drops on a line. A moth attracted by the spider's scent is caught by a swing of the leg holding the bolas; the ad-

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hesive is strong enough to hold moths. The moth is wrapped and usually the spider builds a new bolas and continues hunting before eating. After approximately 20 minutes or more of hunting, when the bolas has not been used, the spider pulls it back and ingests the silk and glue and spins a new bolas.

The bolas of spiders in the genus *Mastophora* is held with the first leg and swung at prey. Members of the Australasian genus *Ordgarius* and the African genus *Cladomelea* use the second leg and whirl the bolas (Stowe, 1986; Yeargan, 1994; Leroy et al., 1998).

Only male moths are attracted. Stowe et al. (1987) showed that *M. cornigera* produces several of the pheromone components produced by females of the moth prey species. Gemeno et al. (2000) showed that *M. phrynosoma* produces prey pheromone components in proportions that represent an attractive blend. Attractants are released only while hunting (Gemeno et al., 2000). In one study, *M. dizzydeani* captured 2.2 moths per night, although a moth approached the spider as it hunted about once every 6 minutes (Eberhard, 1981). Different species of moths that mate at different times and that produce entirely different pheromones are caught at different times during the night. Lists of moth species captured were reported by Stowe (1988), Yeargan (1994), and Stowe et al. (1995).

Early instars of *Mastophora* of both sexes and the minute adult males rest on the edges of leaves and feed mostly on male nematoceran flies, primarily Psychodidae (moth midges), which also are attracted by scent (Yeargan and Quate, 1996, 1997). The flies are captured with the first two pairs of legs, without the use of silk. The legs are armed with rows of strong setae (Figs. 5, 6). The spiderlings do not feed on each other (Stowe, 1986; Yeargan, 1994). In later instars, females lose these bristles and start to use a bolas.

North American species have only 150–250 eggs in each of one to five brown egg sacs (Figs. 445–465). Each egg sac is the size of the female. *Mastophora cornigera* makes more egg sacs. Female *Mastophora* in the northeastern states die in autumn. More eggs have been reported from other species. *Mastophora extraordinaria* was found to produce 530 eggs (Brèthes, 1909) and *M. dizzydeani* produced 826 eggs (Eberhard, 1981). Oviposition of *M. hutchinsoni* (a North American species) takes place in fall and spiderlings emerge in May (Yeargan, 1988). This differs for *M. cornigera*. Clutch sizes for *M. hutchinsoni* ranged from 178 to 275. The sex ratio approached one to one (an unusual exception was observed in one egg case of *M. phrynosoma*, see below). Males and females are similar in size at hatching but females grow to be much larger than males. Males mature in June, at about 1.7 mm total length, two months before females become mature.

The scent may come from the integument (Lopez, 1998). The horns of the carapace of *Mastophora* contain midgut diverticula (Lopez et al., 1985). The silk glands were described by Lopez and Stowe (1985).

The females rest in exposed places during the day with legs drawn in, often on a small pad of silk. All species are cryptic and uncommon, and difficult to find when present. The clustered egg sacs are suspended by strong threads on branches, and are noticed more often than the spiders, particularly in deciduous forests after leaves have fallen. When a spider is picked up, it rolls in the hand rather than holding on, and when first disturbed may regurgitate fluid that has a pungent odor (Eberhard, 1981). A summary of research was reported by Yeargan (1994).

METHODS AND ACKNOWLEDGMENTS

The collections of the following institutions and individuals were used.

AMNH American Museum of Natural History, New York (N. Platnick, L. Sorkin)

BMNH	Natural History Museum, London, United Kingdom (P. Hillyard, J. Margerison)
CAS	California Academy of Sciences, San Francisco, California (C. Griswold, D. Ubick)
CNC	Canadian National Collections, Ottawa, Canada (C. Dondale)
CUAC	Clemson University Arthropod Collection, Clemson, South Carolina (J. Moore, D. Carnagey)
CUC	Cornell University collection, kept in AMNH (N. Platnick, L. Sorkin)
DMNS	Denver Museum of Nature and Science, Denver, Colorado (P. Cushing)
DU	D. Ubick, San Francisco, California
ECOTAR	El Colegio de la Frontera Sur, Tapachula, Chiapas, Mexico (G. Ibarra)
FCMU	Facultad de Ciencias, Seccion Entomología, Montevideo, Uruguay (M. Simó)
FMLT	Fundacion Miguel Lillo, Tucumán, Argentina (S. Z. Turk, J. A. L. Haedu)
FSCA	Florida State Collection of Arthropods, Gainesville, Florida (G. B. Edwards)
IBSP	Instituto Butantan, São Paulo, Brazil (A. Brescovit)
INHS	Illinois Natural History Survey, Urbana, Illinois (C. Favret)
IRSNP	Institut Royal des Sciences Naturelles de Belgique, Brussels, Belgium (L. Baert)
JAB	J. Beatty, Carbondale, Illinois
JK	J. Kaspar, Oshkosh, Wisconsin
JM	J. Murphy, London, United Kingdom
KVY	K. V. Yeargan, Lexington, Kentucky
MACN	Museo Argentino de Ciencias Naturales, Buenos Aires, Argentina (M. E. Galiano, C. L. Scioscia)
MCN	Museu de Ciências Naturais, Fundação Zoobotânica do Rio Grande do Sul, Porto Alegre, Rio Grande do Sul, Brazil (E. H. Buckup, M. A. L. Marques)
MCP	Museu de Ciências, Pontifícia Universidade Católica do Rio Grande do Sul, Porto Alegre, Rio Grande do Sul, Brazil (A. A. Lise)
MCZ	Museum of Comparative Zoology, Cambridge, Massachusetts
MKS	M. K. Stowe, Gainesville, Florida
MLJ	M. L. Jiménez, La Paz, Mexico
MLP	Museo de Universidad Nacional, La Plata, Argentina (C. Ituarte, L. A. Pereira)
MNHN	Muséum National d'Histoire Naturelle, Paris, France (C. Rollard)
MNRJ	Museu Nacional, Rio de Janeiro, Brazil (A. B. Kury)
MUSM	Museo de Historia Natural, Universidad Nacional Mayor de San Marcos, Lima, Peru (Diana Silva D.)
MZAQ	Museu, Departamento de Zoologia da Escola Superior de Agricultura "Luis de Queiroz," Piraciba, São Paulo State, Brazil (G. J. de Moraes)
MZSP	Museu de Zoologia, Universidade de São Paulo, São Paulo, São Paulo, Brazil (E. M. Cancello, R. Pinto da Rocha)
NHMW	Naturhistorisches Museum, Vienna, Austria (J. Gruber)
NMB	Naturhistorisches Musuem, Basel, Switzerland (A. Hänggi)
NMP	Natal Museum, Pietermaritzburg, South Africa (D. A. Barraclough, C. Conway)
OSU	Ohio State University, Marion, Ohio (R. A. Bradley)
QMB	Queensland Museum, Brisbane, Queensland, Australia (R. J. Raven)
TAMU	Texas A&M University, College

Station, Texas (A. Dean, E. Riley)

USNM National Museum of Natural History, Smithsonian Institution, Washington, D.C. (J. Coddington, L. Lopardo)

ZMUC Zoological Museum of the University of Copenhagen, Copenhagen, Denmark (N. Scharff)

Brazilian colleagues Erica H. Buckup and Arno Lise encouraged me to revise *Mastophora.* The revision was made possible with the help of numerous South American colleagues with loan of collections, including many old specimens, and advice. Especially helpful were C. Scioscia and the late M. Galiano of Buenos Aires, and the Brazilians E. H. Buckup, A. Brescovit, R. Pinto da Rocha, G. J. de Moraes, and A. B. Kury. I also thank G. S. Oxford, K. V. Yeargan, M. K. Stowe, W. Eberhard, J. Leroy, and A. Leroy for help and advice and Eric J. Olson for translating difficult Spanish. L. Leibensperger was helpful in the laboratory. L. R. Levi and the editor, B. L. Clauson, polished the writing. W. Eberhard read the introduction and improved the wording. K. Yeargan and M. K. Stowe read the manuscript and suggested many improvements and corrections. Much appreciated are the comments of two anonymous readers of the manuscript.

Gifts of *Mastophora* to the MCZ collections were received from C. Hieber, G. Ibarra (from Chiapas, Mexico), J. M. Maes (from Nicaragua), M. K. Stowe, and K. V. Yeargan. G. Ibarra N. and M. L. Jiménez sent specimens of a new species with complete descriptions and finished illustrations. *Mastophora alvareztoroi* is described here with the names of Ibarra and Jimenez as authors.

The project was started with the help of National Science Fooundation grant BMS 75-05719. The Wetmore–Colles Fund covered publication costs in part.

For examination of spiders, I followed the procedures described by Levi (1993a). For examination and illustration of the small and difficult genitalia of *Mastophora,* additional methods were employed.

After illustrating ventral and posterior views of the female, the epigynum was cut off from the body and the soft tissues were carefully removed (Fig. 2). The epigynum was placed on the dry end of a dish with white paraffin, and extra alcohol was removed with a bit of tissue. The epigynum was then placed in a conical pit in the paraffin (Fig. 3) containing two drops of Hoyer's medium.[2] Placement was so that the anterior end faced the bottom; the flat posterior was parallel with the surface (Fig. 3). The viscous nature of Hoyer's medium makes it an ideal clearing medium and keeps the epigynum in position, although presumably other clearing agents, such as oil of cloves or glycerol, could be used. The genitalia were carefully examined and illustrated from at least one specimen of each species; several epigyna were cleared for abundant and variable species.

Male spiders for which determination was known were placed in a drop of tincture of iodine and left overnight before examining them the next morning in 80% alcohol. Tincture of iodine gives a good stain, which may not be permanent, and it is easy to obtain in pharmacies. Tincture of iodine is isotonic with alcohol and does not expand the palpus or warp sclerites.

Gertsch (1955) in his revision did not interpret the two original descriptions by Banks (1898) of *Ordgarius obesus* and *O. corpulenta.* The holotypes were placed in the California Academy of Science and were destroyed in the 1906 earthquake. The specimens, with others, were given to Banks from the Marx Collections after George Marx died. Banks (1898) pointed out at the time:

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[2] Hoyer's medium is made by dissolving 15 g of gum arabic (clear flakes) in 25 ml of distilled water at room temperature. Seventy-five grams of chloral hydrate is added, and the mixture is allowed to stand for 1–2 days, until all solids have dissolved. Five milliliters of glycerol is then added and the mixture is filtered through glass wool and stored in a glass-stoppered bottle.

> Anyone familiar with Dr. Marx's methods of work will not be surprised to learn that many of the specimens, when sent to me, bore no locality label whatever. Doubtless he knew where they came from, but left no clew [sic] that others might use. Some of the species were numbered, and by examining several of his series of numbers it was possible to find localities and his name for the species.

However, Banks published illustrations of the two species that can be identified if one disregards the localities stated.

DISCUSSION

Determination of members of the genus *Mastophora* is the most difficult of araneid spiders. By using morphological characters, 48 presumed species were separated, of which 22 species are new. Eleven of these new species are known from a single female. However, additional specimens were found of species earlier described from only a single specimen.

All females are between 7 and 17 mm and most are approximately 12 mm total length. Most of the species that lack humps on the abdomen seem to be found in North America. A few species of *Mastophora* are slightly smaller and have different tubercles or horns on the carapace; these were placed in *Agatostichus* in the past, but males and females do not differ in other characters from *Mastophora*.

Adult males of all species are approximately 1.7 mm total length. Males of related genera in Asia, Australia, and Africa are the same length. Males of the same species as females with abdominal humps coming from different egg sacs may have humps or not; females without humps may have males with or without humps. The males can be matched to females only by raising them from an egg sac from a determined female. Some males apparently emerge from the egg sac as mature adults (*M. cornigera* and perhaps *M. gasteracanthoides*), but most take at least two instars to mature. The males of only a few species are known, because only W. Eberhard, Mark K. Stowe, and Ken V. Yeargan have raised individuals. The males of most southern South American species remain unknown. The palpi of different species are surprisingly similar and the determination of males presents a challenge.

Immatures coming out of the egg sac have visible median tubercles and horns on the carapace and are approxinately 1.2–1.6 mm total length. They may have abdominal humps.

Some egg sacs can be determined. Those of *M. hutchinsoni* are unique and are attached by their base (Figs. 453, 454), whereas all others are hanging. Some have a thick stalk (*M. bisaccata*; Fig. 446), extra long flaps (*M. phrynosoma*; Figs. 449, 450), or may lack flaps altogether (*M. cornigera*; Fig. 455). However, not enough determined egg sacs were available to make a key.

The epigyna of females are much reduced. Females are separated by their coloration and shape of the abdomen, as well as by their genitalia. However, with so few specimens available of most species, generalizations on appearance are a guess. The most common North American species, *M. bisaccata*, was found to be a group of species with similar abdominal markings. Gertsch (1955) missed this because he relied on coloration and did not carefully examine the genitalia of all specimens. Members of the *M. bisaccata* species group also differ slightly in average size, with *M. bisaccata* being the largest. Gertsch (1955) and Yeargan (1994) suspected *M. bisaccata* to be a group of species.

The epigynum lacks a scape and has no ventral features permitting the palpus to be held in place (Figs. 12, 19, 26). A posterior edge (Figs. 12, 19, 26) may be present. Whatever diagnostic features exist are on the posterior face, which has two slits, a plate between, and a plate to the side (Figs. 13, 20, 27). The plates are usually weakly sclerotized. The slits lead into a ventral, or sometimes dorsal, atrium (Fig. 4), which empties into the seminal receptacles (Fig. 4). The slits vary in direction in different species (Figs. 13, 27). The slits may be in depressions or may have unique sculpturing along the edges, or a lip (Fig. 20). I considered these to be useful characters for determination of species.

The palpi of males are lightly sclerotized. A median apophysis, a radix, the embolus, and a terminal apophysis holding the embolus are present (Fig. 7). The conductor, a structure that arises from the tegulum facing the embolus, is absent, although it seems to be present in *Cladomelea* species (Fig. 443). The different species of *Ordgarius* and *Cladomelea* show greater morphological differences from each other than do those of *Mastophora.*

Different American species show some variation in genitalia and morphology in different specimens. Perhaps this is associated with the rarity of individuals and wide distribution of species.

All books on venoms list *M. gasteracanthoides* among the venomous American spiders (Schmidt, 2000). These citations all come from Escomel (1918), who described the venom from specimens found in grapes in southern Peru. Farmers working in grapes were bitten on the hands and legs. He considered the bites to be "cutanéo-hémolytique gangrénieux" and gave detailed description of the signs, which were necrotic skin lesions at the site of the bite. B. A. Houssay and J. J. Carbonnel checked the specimens at the time. In borrowed material, Escomel's specimens were found in both the Buenos Aires and in the Paris museums. Examination showed them to be a new species of *Mastophora* (*M. escomeli*), close to *M. gasteracanthoides.* No other evidence of human envenomation appeared with any labels on specimens of other species examined. Gertsch (1955) believed that the responsibility for the bites should be awarded to some other spider or arthropod. I suspect that *M. escomeli,* unlike others, is more aggressive and more readily bites human skin than other species. No recent reports exist of venomous bites from *M. escomeli. Mastophora escomeli* may have been abundant in 1917 and then become rare again. Escomel (1918) also found that extracts from eggs, injected into guinea pigs, were toxic.

Relationship. Mastophora Holmberg, 1876, shares carapace outgrowths with Australasian *Ordgarius* Keyserling, 1886 (Figs. 422–433), and African *Cladomelea* Simon, 1895 (Figs. 434–444). Both *Ordgarius* and *Cladomelea* species handle the bolas with the second leg and, unlike *Mastophora,* which swings the bolas in a pendulumlike motion, they whirl the bolas, *Ordgarius* when a moth approaches, and *Cladomelea* for 15 minutes at a time when hunting, at approximately 150 rotations per minute (Leroy et al., 1998).

The carapace outgrowths also are shared with the African *Acantharachne* Tullgren, 1910,[3] Madagascan *Coelossia* Simon, 1895, Madagascan *Exechocentrus* Simon, 1889, and immatures of *Euglyptila* Simon, 1908, from northern Vietnam (Tonkin). *Euglyptila* is synonymized below with *Ordgarius.* The males of these and their habits are not known, but females were illustrated and described by Emerit (1980, 2000). The genus *Agatostichus* Simon, 1895, is synonymized below with *Mastophora,* and *Dicrostichus* Simon, 1895, has been synonymized with *Ordgarius* by Davies (1988). The *Mastophora, Ordgarius, Dicrostichus, Cladomelea* group is absent from European, Mediterranean, and central Asian faunas.

When males are found, African *Acantharachne* and *Coelossia* should probably be synonymized with *Cladomelea* or *Ordgarius.* However, *Exechocentrus* differs in having a long eye projection, a long median tubercle, and a pair of long, posterior tubercles on the carapace (Emerit, 1978, 1980, 2000).

Eberhard (1981), Stowe (1986), and Yeargan (1994) studied the relationships with other genera. Scharff and Coddington

[3] Roewer (1942) and Platnick (2001) cited the genus under the name *Acantharanea* Strand, 1929. The name *Acantharachne* Tullgren, 1910, is not preoccupied, as thought by Strand (Neave, 1939a: 9; Bonnet, 1955: 124).

constructed a cladogram (1998). The results of Eberhard (1981), Stowe (1986), and Yeargan (1994) are summarized in Table 1; examination of these results showed a close relationship of *Mastophora* to *Taczanowskia* Keyserling, 1880. Members of the genus *Mastophora* seem related to genera lacking carapace tubercles (*Taczanowskia, Celaenia, Kaira, Cyrtarachne, Poecilopachys,* and *Pasilobus*; Table 1). Robinson and Robinson (1975) first suggested that the web of *Pasilobus* was intermediate between orb webs and bolas. My own studies of genitalia of *Taczanowskia* (Levi, 1997) showed that *Taczanowskia* is related to *Celaenia* and *Kaira.* The distal pocket of the epigynal scape of *Taczanowskia* correlates with the large hook on the median apophysis of the palpus of the male (Levi, 1997, fig. 19). Unequal claw lengths and armed femora, which are synapomorphies, relate *Taczanowskia* and *Celaenia.* The denticles next to a tooth on the side of the median apophysis of *Taczanowskia* also are found in *Kaira* species and *Metepeira.* Such median apophysis denticles are unique to several genera and I consider such a row of denticles as a synapomorphy of *Kaira, Metepeira,* and *Taczanowskia.* One of the synapomorphies of most genera allied to *Araneus* is a spine or tooth on the median apophysis. In contrast, males that have a paramedian apophysis in the palpus rarely have a tooth or spine on the median apophysis (e.g., *Alpaida, Eriophora, Ocrepeira, Acacesia, Cyrtophora,* and many others). The shape of the median apophysis of the palpus of *Pasilobus* also probably is derived from a median apophysis similar to that of *Kaira.* The presence of a spine on the median apophysis of all these genera with carapace outgrowths indicates a distant relationship with *Araneus.* All these genera have a terminal apophysis (Fig. 7) in the palpus, which was erroneously labeled as a conductor by some authors. The evidence from the study of genitalia thus shows that attraction of insects in *Kaira* and *Mastophora* most likely evolved only once, not twice as thought previously (Stowe, 1986; Table 2). The homology of secreting glands of the insect attractant in *Mastophora* and *Kaira* remains uncertain.

TAXONOMIC SECTION

Mastophora Holmberg

Mastophora Holmberg, 1876: 112. Type species *M. extraordinaria* Holmberg by monotypy. The gender of the name is feminine. Neave, 1940: 55. It is not preoccupied as claimed by Bonnet, 1957: 1995. Mello-Leitão, 1931: 65. Canals 1931: 17. Roewer, 1942: 900. Gertsch, 1955: 223. Platnick, 2001.

Heterocephala Holmberg, 1876: 143. Type species *H. conifera* Holmberg by monotypy. The gender of the name is feminine. Neave, 1939b: 634. It is not preoccupied.

Glyptocranium Simon, 1895: 885. Type species *G. cornigerum* Hentz designated by Simon. Neave, 1939b: 484. The gender of the name is neuter. Bonnet, 1957: 1995. First synonymized by Brèthes, 1909.

Agatostichus Simon, 1895: 885. Type species *A. leucacantha* Simon by original designation and monotypy. Neave, 1939a: 86. Gertsch, 1955: 250. NEW SYNONYMY.

Agathostichus:—Simon, 1895: 473. Roewer, 1942: 900. Bonnet, 1955: 181. Platnick, 1998, 2001.

Note. Simon spelled the generic name *Agatostichus* with and without "h," but the first revisor of the genus, Gertsch (1955), spelled the genus without "h." Subsequent users must follow the first revisor (*International Code of Zoological Nomenclature,* art. 24.2 [International Commission on Zoological Nomenclature, 1999]). The genus is synonymized here because the type species *M. leucacantha* has long median tubercles on the carapace (Fig. 316). The second species described, *M. leucabulba* Gertsch, lacks these but has a tubercle between the posterior median eyes and is relatively small (Fig. 288). Gertsch thought small size was diagnostic for the genus, but this is not the case for the third species, *M. alvareztoroi,* and also not for the type species. Tubercles also are found between eyes in *M. corpulenta* (Figs. 336, 337).

A revision of all species of the genus was made by Mello-Leitão (1931) and a revision of Argentinian species was made by Canals (1931). Both authors had shared information. I could not find dates of pub-

TABLE 1. THE FOOD OF IMMATURES AND ADULTS, STICKINESS OF SILK TO MOTHS, SILK PULLING BEHAVIOR AND WEB (SEE EBERHARD, 1981), RESTING PLACE, EGG SAC SHAPE, AND REGURGITATION OF *MASTOPHORA* AND RELATED GENERA (DATA FROM CLYNE, 1973; EBERHARD, 1981; EMERIT, 1978; MIYASHITA ET AL., 2001; ROBINSON AND ROBINSON, 1975; STOWE, 1986; YEARGAN, 1994; LEROY, PERSONAL COMMUNICATION). REGARDING SILK PULLING BEHAVIOR AND THE WEB, EBERHARD (1981) STATED: "ALL ACTIVELY PULL STICKY SILK FROM THEIR SPINNERETS WHILE HANGING MORE OR LESS VERTICALLY BELOW A HORIZONTAL THREAD (E.G. FIG. 4B IN ROBINSON AND ROBINSON 1975)." "THE *M. DIZZYDEANI* WEB WHICH HAD SEVERAL BALLS HANGING FROM A SINGLE HORIZONTAL THREAD IS SIMILAR TO A *PASILOBUS* WEB: IF ONE BREAKS THE LOW-SHEAR JOINTS AT THE ENDS OF *PASILOBUS* SPINNING THREADS SO THAT THEY HANG FROM THE MIDLINE, THE WEBS ARE NEARLY IDENTICAL. THE WEB OF *CYRTARACHNE* SP. . . . IS VERY SIMILAR TO THAT OF *POECILOPACHYS*, AS IS ITS BUILDING BEHAVIOR."*

Genus	Food of Immatures	Food of Adults	Sticky Silk	Silk Pulling	Web	Resting Place	Egg Sac Shape	Regurgitation
Mastophora	♂ psychodid flies	♂ moths	bolas slung leg 1	+	+	usually exposed	drop-shaped	+
Ordgarius		♂ moths	bolas whirled leg 2		+	retreat in leaves or exposed	drop or spindle shaped	not observed
Cladomelea akermani	small flies	♂ moths	bolas whirled leg 2		+	exposed	drop-shaped	not observed
Pasilobus		moths	sticky silk in web sticks to moths	+	+	exposed		
Poecilopachys		usually small moths	sticky silk in web sticks to moths	+	+	exposed	spindle-shaped	
Cyrtarachne sp.		moths	sticky silk in web sticks to moths		+	exposed	spindle-shaped	+
Celaenia	♂ psychodid flies	♂ moths	use legs: femur and claws modified		no web	same as hunting position	drop-shaped	−
Taczanowskia		♂ moths	use legs: femur and claws modified		no web	same as hunting position	drop-shaped	
Kaira		♂ moths	use legs				soft cover, spherical	−

* +, character present; −, character absent; blank, no observation.

TABLE 2. MORPHOLOGICAL DATA FOR *MASTOPHORA* AND RELATED GENERA, INCLUDING LEG MODIFICATION OF ADULT FEMALE (LACK OF MACROSETAE [MS], ARMED FEMUR, LONG TARSAL CLAW); VENTER OF EPIGYNUM (BARE, WITH ONLY POSTERIOR LIP, AN UNSCLEROTIZED SCAPE); POSTERIOR OF EPIGYNUM (TWO SLITS, WITH OVAL MEDIAN PLATE, AND OTHERWISE); PERCENTAGE OF MALE CARAPACE WIDTH OF FEMALE CARAPACE; NUMBER OF PALPAL PATELLAR SETAE; THE PRESENCE AND SHAPE OF CONDUCTOR IN PALPUS (ABSENT, A LOBE, OR A SCLERITE); MEDIAN APOPHYSIS (WITH SPINE, TWO THIN SPINES, AND ROW OF DENTICLES); EMBOLUS (DAGGER-SHAPED OR FILAMENTOUS); PRESENCE AND SIZE OF TERMINAL APOPHYSIS. THE PALPI OF ALL HAVE A RADIX, NONE HAS A PARAMEDIAN APOPHYSIS. ALL LACK AN ENDITE TOOTH, USUALLY PRESENT IN MALES OF ARANEIDAE, BUT ABSENT IN *ARGIOPE, MECYNOGEA* and *CYRTOPHORA* AND ALSO IN DWARF MALES (FROM MY OWN DATA WITH THE HELP OF TEXT AND ILLUSTRATIONS BY CLYNE, 1973; EMERIT, 1977; DAVIES, 1988; LEVY, 1997; LEROY ET AL., 1998.*

Genus and Species	Leg Modification	Venter of Epigynum	Posterior of Epigynum	♂ % ♀ Carapace Width	Number Palpal Patellar Setae	Palpus Conductor	Palpus Median Apophysis	Palpus Embolus	Terminal Apophysis
Mastophora	no MS	bare	2 slits	15	0/1	–	spine	dagger-shaped	+
Ordgarius magnificus	no MS	bare	2 slits	12	0	–	spine	dagger-shaped	+
Cladomelea akermani	no MS	bare	2 slits	14	0	lobe	spine	filament	+
Pasilobus bufonicus	MS	bare	2 slits	34	0	lobe	spine	dagger-shaped	+
Poecilopachys bispinosa	MS?	bare	2 slits, oval median	36	1	–	spine	dagger-shaped	+
Celaenia excavata	denticulated femur, unequal claws	bare, hard lobe	hard posterior plate	20	0	–	spine	dagger-shaped	+
Taczanowskia striata	denticulated femur, unequal claws	soft scape	2 slits oval median	32	1	lobe	spine, teeth	dagger-shaped	+
Kaira alba	MS	soft scape	2 slits oval median	22	0	lobe	two spined teeth	dagger-shaped	large
Cyrtarachne ixodoides	MS	bare	2 slits	47	1	lobe	spine	filament	–

* +, character present; –, character absent.

lication of the two 1931 articles, but Mello-Leitão's must have been published first, because Canals cites the page numbers of Mello-Leitão. Gertsch (1955) revised the North American species, and first illustrated the genitalia of the species of his region.

Diagnosis. Mastophora differs from other araneid genera by having the carapace with tubercles and having horns (Fig. 8), and lacking macrosetae on legs (Figs. 5, 6, 421). Early instars and males have rows of setae on distal articles of first and second legs (Figs. 5, 6). *Mastophora* differs from *Cladomelea* and *Ordgarius*, which may have horns (Fig. 423), by using the first pair of legs to handle the bolas; *Cladomelea* and *Ordgarius* use the second pairs.

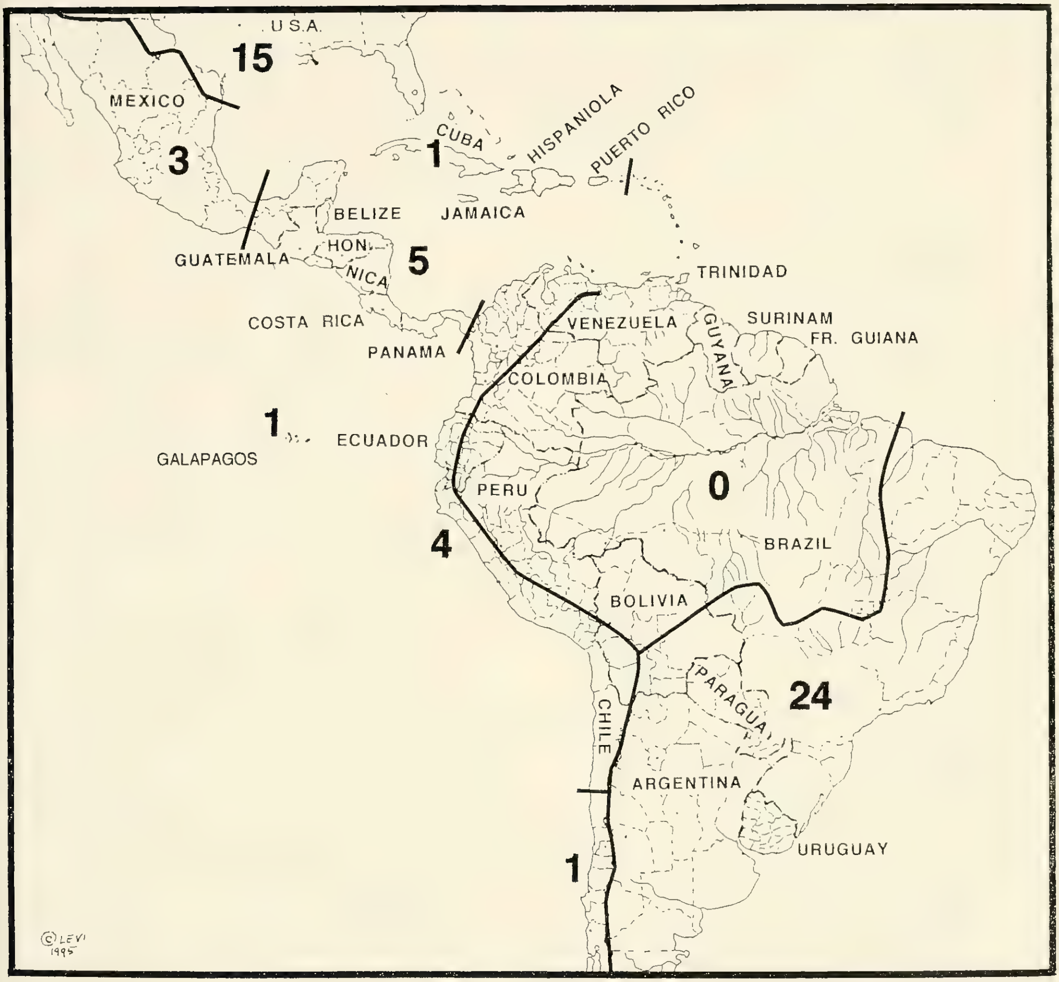
Description. Female. Carapace color variable, often uniform orange to strongly marked. Legs usually not banded. Abdomen often darker anteriorly, lighter posteriorly, venter often with a median white square or rectangle (black in *M. hutchinsoni* and some *M. phrynosoma*). Carapace about as wide as long. Eyes small, subequal. Anterior median eyes slightly larger, lateral eyes smallest. Median ocular trapezoid always longer than wide, widest at posterior median eyes, rarely almost square. Lateral eyes and medians usually on a bulge. Clypeus higher than two anterior median eye diameters. Carapace very high, with median tubercles, a pair of horns, usually biforked, and laterally with medium to less large tubercles (Figs. 8, 9), sometimes with short white setae. Chelicerae with two or three teeth on the anterior margin, one on the posterior margin (*M. bisaccata* has two or three teeth; Fig. 1). Legs without macrosetae, early instars with row of setae on legs as in mature males (Fig. 5). Length of first patella and tibia about 1.1 to 1.8 times width of carapace. Second leg longer than first, third shortest. Abdomen wider than long usually with a pair of humps, and a pair of sclerotized discs between humps and anterior margin (Fig. 10), sometimes with additional tubercles or scattered clumps of setae or setose. Some species (*M. alvareztoroi, M. felis,* and *M. haywardi*) have carapace and abdomen hirsute (Figs. 107–109). The tubercles on the carapace and on horns are not perfectly symmetrical and show individual differences. The abdominal humps of some species (*M. gasteracanthoides*) are of variable length.

Male. Mature after only two instars or emerging as adult from egg sac (*M. cornigera*), all about 1.7 mm total length. Dirty orange color, sometimes with white spots on carapace or abdomen. Carapace as wide as long with eyes on bulges as in female. Carapace with two median tubercles and minute horns. Legs without macrosetae but with row of soft setae on first two pairs of legs, slightly shorter than in females (Figs. 5, 6). Total length of first patella and tibia about 1.1 times width of carapace. Abdomen with or without humps, often in the same species, regardless of the presence of humps on the female abdomen.

Female genitalia. The epigynum has plates on the ventral side, and differs only slightly from other species in posterior view (Figs. 2, 13, 20, 27) but has lost all copulatory structures. The posterior has two slits with shadows of atria.

Male genitalia. Palpus of male has a pointed median apophysis, an embolus with a simple terminal apophysis (Fig. 7), but no distinct conductor.

One group of *Mastophora* is distinct: the species close to *M. gasteracanthoides* (*corpulenta, rabida, escomeli, obtusa, felis, holmbergi, reimoseri, satan,* and *diablo*). Their carapace is high with vertical sides (Fig. 408); the sides of the thorax have tubercles (Fig. 409), with short, white setae between; and the abdomen may have high, tube-shaped horns (Fig. 413). The abdomen of all is dark and species can be separated only by studying the genitalia. They have been referred to in Spanish as the cat's head spiders (araña cabeza de gato) because of their resemblance to the head of a cat, as can be seen in Figure 421.



Map 1. Approximate number of species in various American regions.

Relationship. Relationships with other genera are discussed above.

Natural History. Mastophora all are uncommon and difficult to find. Females rest on branches or leaves of trees, usually 1.5–3 m high. M. K. Stowe (personal communication) has seen egg cases 10 m up and thinks that *M. bisaccata* seeks out branches high up in trees. They often are found on trees and bushes in orchards, gardens, or along fences. M. K. Stowe (personal communication) reported that most species in Florida are found in forests.

Distribution. Mastophora are only found in America (Map 1).

Misplaced Species. Mastophora fasciolata erroneously placed in *Mastophora* (Levi, 1991: 180) is a *Kaira.* See below.

KEY TO FEMALE *MASTOPHORA*

1. Abdomen without humps (Figs. 10, 24, 88, 130); swellings may be visible in profile (Fig. 11) 2
– Abdomen with distinct humps or tubercles (Figs. 137, 145, 298, 331, 401) ... 15

2(1). North America (Map 2) 3
– South America (Maps 3, 4) 11

3(2). Abdomen subtriangular, with anterior lateral swellings (Fig. 88); posterior of epigynum with lateral and ventral lips (Fig. 91); eastern United States (Map 2D) .... *phrynosoma*

– Abdomen without anterior lateral swellings (Figs. 10, 17, 24); epigynum without posterior lips (except *apalachicola*) 4

4(3). Posterior of epigynum with slits framed by lateral lips (Fig. 20); southeastern United States (Map 2C) .... *apalachicola*

– Slits without lips (Figs. 13, 27) 5

5(4). Slits short, their length distant from ventral margin (Fig. 80); eastern United States (Map 2A) .... *yeargani*

– Slits approaching close to ventral margin (Figs. 13, 27) 6

6(5). Dorsum of abdomen with *bisaccata* pattern, anterior orange to gray with spaces and lines (Figs. 42, 53, 65) 7

– Abdomen marked otherwise (Figs. 10, 24) 9

7(6). Slits approaching each other ventrally, atria their diameter or less apart (Figs. 56, 57); eastern United States (Map 2B) .... *bisaccata*

– Slits parallel or separating ventrally (Figs. 45, 68) 8

8(7). Slits parallel (Fig. 45), atria visible in ventral view (Figs. 44); Florida (Map 2G) .... *alachua*

– Atria slightly separating ventrally (Figs. 68–70), atria not visible ventrally (Figs. 67); eastern United States (Map 2C) .... *stowei*

9(6). Atria separating from each other ventrally (Figs. 34, 35); legs ringed; Virginia to Florida (Map 2A) .... *timuqua*

– Atria approaching each other (Figs. 13, 27); Florida 10

10(9). Abdomen black on anterior and sides (Figs. 24, 25); atria anterior of seminal receptacles, seminal receptacles their diameter distant from ventral border (Fig. 28); southern Florida (Map 2A) .... *felda*

– Abdomen with only anterior median area black (Fig. 10); atria at level with large seminal receptacles, seminal receptacles less than their diameter distant from ventral border (Fig. 14); Florida (Map 2C) .... *satsuma*

11(2). Abdomen hirsute (Figs. 109, 110), slits and atria separating ventrally (Figs. 112, 113); Tucumán, Argentina (Map 3C) .... *haywardi*

– Abdomen with few setae (Figs. 102, 116); atria otherwise (105, 119) 12

12(11). Abdomen with many black spots and dark lines (Figs. 130, 131); southern Brazil (Map 3B) .... *carpogastra*

– Abdomen marked otherwise (Figs. 102, 116, 123) 13

13(12). Abdomen with light longitudinal lines (Figs. 102, 103); atria approaching each other ventrally (Fig. 105); Santa Catarina, southern Brazil (Map 3C) .... *catarina*

– Abdomen marked otherwise (Figs. 116, 123) 14

14(13). Abdomen marked with pair of black rings, open anteriorly (Fig. 116); São Paulo, Brazil (Map 3C) .... *corumbatai*

– Abdomen with two black discs (Fig. 123); Lara, Venezuela (Map 3A) .... *lara*

15(1). Abdomen with many dorsal or lateral humps (Figs. 267, 298, 300, 310, 331, 332) 16

– Abdomen with one pair of humps (Figs. 155, 171), rarely median area of abdomen swollen (Fig. 325) 19

16(15). Humps anterior on each side of abdomen (Fig. 267); Santiago del Estero, Argentina (Map 3E) .... *abalosi*

– Humps or tubercles dorsally (Figs. 298, 310, 331) 17

17(16). Carapace with short tubercles (Figs. 329, 330); abdomen with numerous small dorsal tubercles (Figs. 331, 332): northern Argentina to Buenos Aires Province (Map 3G) .... *conifera*

– Carapace with large tubercles (Figs. 297, 309) 18

18(17). Carapace with median tubercles spine-shaped (Fig. 309); Panama (Map 2F) .... *soberiana*

– Carapace with median tubercles cone-shaped (Fig. 297); Texas to Chiapas (Map 2F) .... *alvareztoroi*

19(15). Carapace median tubercles same size or longer than horns (Figs. 288, 316, 323) 20

– Carapace with median tubercles smaller than horns (Figs. 136, 381) 22

20(19). Median tubercles spine-shaped, very long (Fig. 316); Bahia to Rio de Janeiro, Brazil (Map 3G) .... *leucacantha*

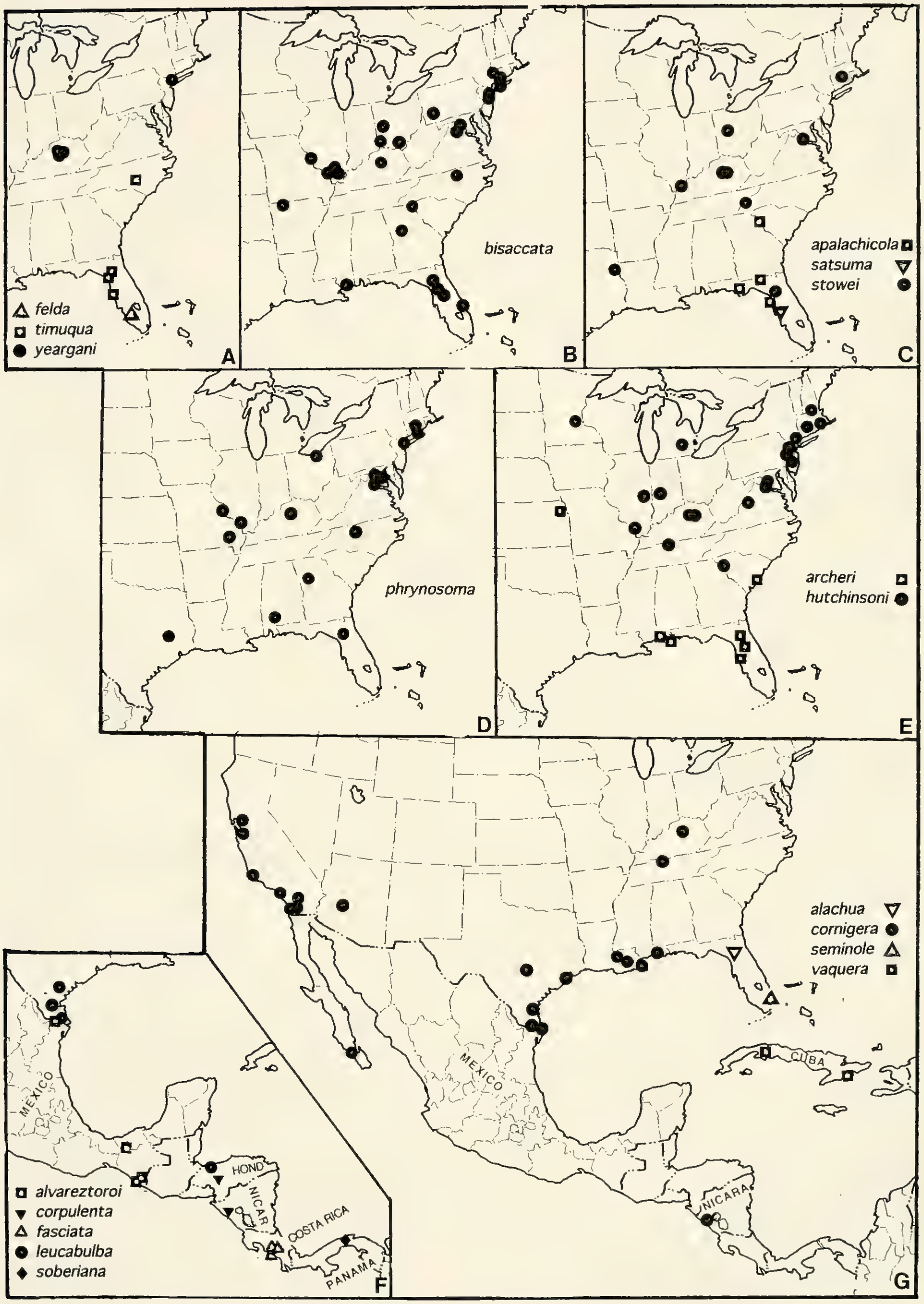
– Median tubercles otherwise (Figs. 288, 323) 21

21(18). Median tubercles cone-shaped (Fig. 323); Rio Grande do Sul, Brazil (Map 3G) .... *brescoviti*

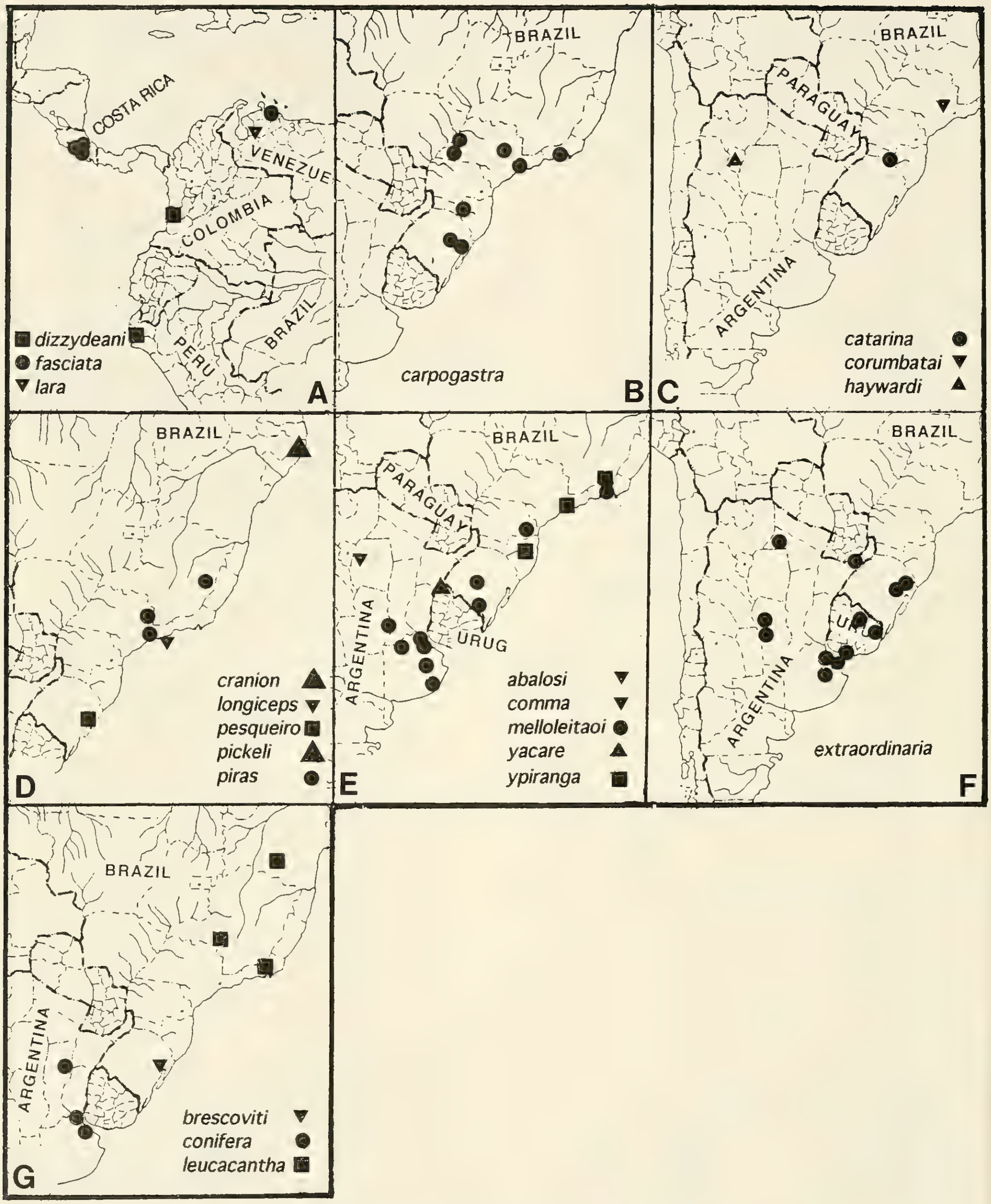
– Carapace tubercles large, rounded on dark carapace (Fig. 288); Texas, Mexico (Map 2F) .... *leucabulba*

22(19). Carapace with sides vertical (Figs. 366, 380), sides with tubercles (Figs. 367, 381); Mexico to South America (Map 4) 39

– Carapace with sides slanting (Figs. 135, 169); sides with few or no tubercles (Figs. 136, 170; Maps 2, 3) 23

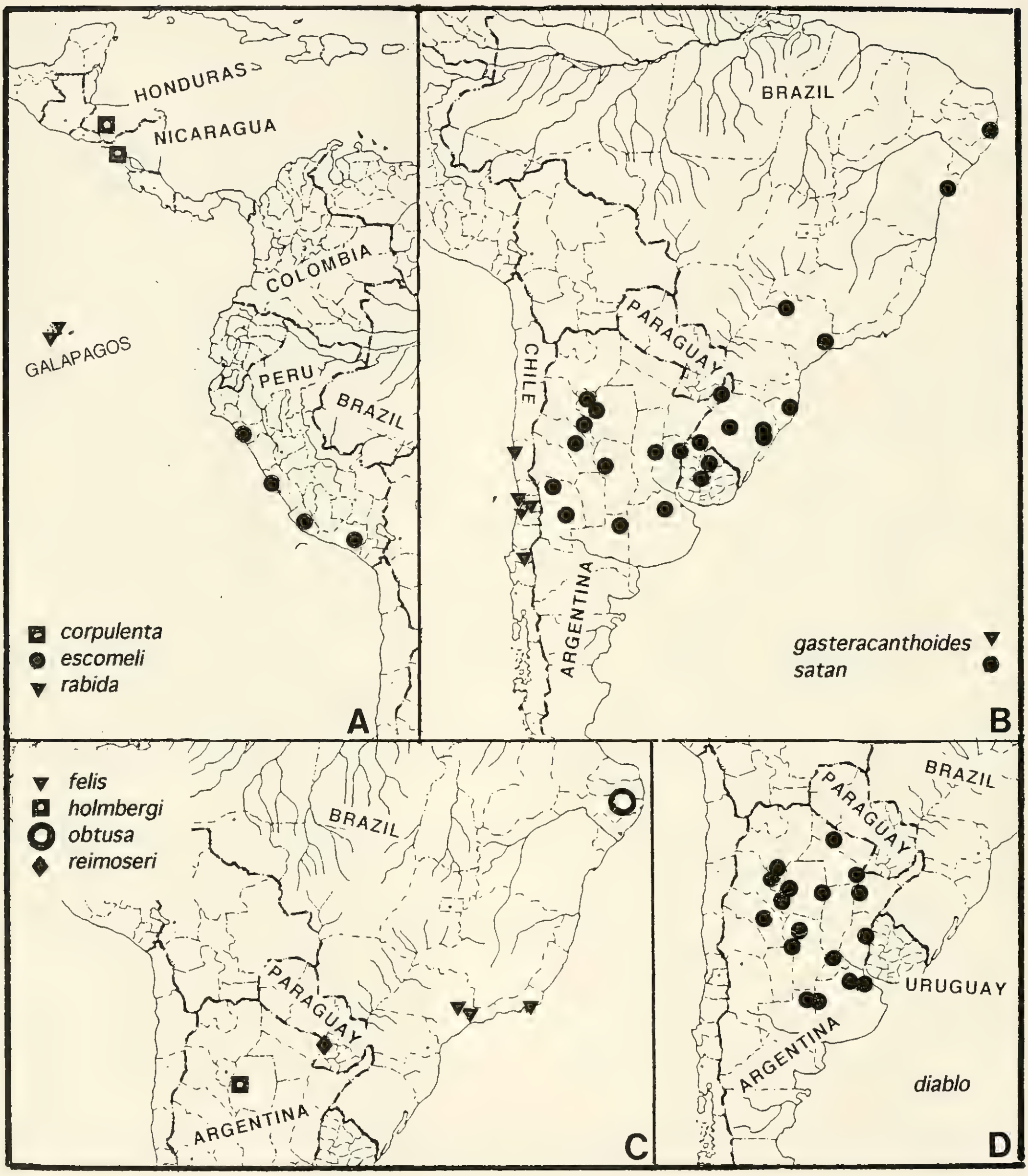


Map 2. Distribution of *Mastophora* species of North and Central America.



Map 3. Distribution of *Mastophora* species of South America.

23(22). North America and Cuba (Map 2) 24
– Central and South America (Map 3) ... 28
24(23). Cuba (Map 2G); abdomen with anterior, lateral swellings (Figs. 145, 146) .... *vaquera*
– Continental North America; abdomen without lateral swellings (Figs. 137, 155) 25
25(24). Posterior of epigynum with slits and atria approaching each other ventrally (Figs. 159, 160); northeastern United States (Map 2E) .... *hutchinsoni*
– Slits and atria otherwise (Figs. 140, 174, 188) 26
26(25). Posterior of epigynum with slits framed by a lip on each side (Fig. 188); southeastern United States (Map 2E) *archeri*
– Slits without lips (Figs. 140, 174) 27
27(26). Slits parallel and approach ventral border (Fig. 174); eastern United States to California and Honduras (Map 2G) .... *cornigera*
– Slits short, their length apart from ventral border (Fig. 140); southern Florida .... *seminole*
28(23). Central America and northern South America to Peru 29
– Southern South America, from Pernambuco State, Brazil, in the north 30
29(28). Humps of abdomen broad swellings (Fig. 196); slits on posterior of epigynum approaching each other (Fig. 199); Costa Rica to Venezuela (Map 3A) .... *fasciata*
– Humps of abdomen narrow (Fig. 207); slits separating ventrally (Fig. 210); Colombia to Peru (Map 3A) .. *dizzydeani*
30(28). Humps of abdomen extended to a point (Figs. 271, 272); Santiago del Estero, Argentina (Map 3E) .... *comma*
– Humps distally rounded (Figs. 277, 284) 31
31(30). Each side of abdomen with a pair of narrow dark-framed longitudinal, white marks (Figs. 239, 240); humps small (Fig. 240); Rio Grande do Sul, Brazil (Map 3D) .... *pesqueiro*
– Abdomen without such marks 32
32(31). Posterior of epigynum with a lip on each side between slits and ventral margin (Fig. 263); Uruguay (Map 3E) ..... *yacare*
– Posterior of epigynum without such lips (Figs. 279, 286) 33
33(32). Epigynal slits appear forked (Figs. 235, 236); carapace horns unusually thick and laid back (Figs. 230, 231); São Paulo, Brazil (Map 3D) .... *longiceps*
– Epigynal slits simple (Figs. 249, 256); horns small (Figs. 245, 252) 34
34(33). Epigynal slits separating ventrally (Figs. 228, 249) 35
– Epigynal slits and atria approaching each other ventrally (Figs. 256, 286) 36
35(34). Abdomen with a pair of dorsal stippled dark spots (Fig. 225); Pernambuco State, Brazil (Map 3D) .... *cranion*
– Anterior of abdomen black (Fig. 246); Minas Gerais, São Paulo states, Brazil (Map 3D) .... *piras*
36(34). Anterior of abdomen light, light area bordered posteriorly by dark (Fig. 283); epigynum as in Fig. 286; southern Brazil, northern Argentina (Map 3F) .... *extraordinaria*
– Anterior of abdomen black (Figs. 218, 253, 276) 37
37(36). Atria their diameter or less apart (Figs. 256, 257); Rio de Janeiro to Santa Catarina, Brazil (Map 3E) .... *ypiranga*
– Atria more than their diameter apart (Figs. 221, 222, 279, 280) 38
38(37). Atria with median knobs facing each other (Fig. 280); Paraná to Buenos Aires, Argentina (Map 3E) .... *melloleitaoi*
– Atria without knobs (Fig. 222); Pernambuco, Brazil (Map 3D) .... *pickeli*
39(22). Central America (Map 4A); posterior of epigynum with dark patch dorsally in each of pair of depressions (Fig. 341) .... *corpulenta*
– Other regions 40
40(39). Galapagos (Map 4A); abdomen with only tiny humps (Fig. 346); epigynum slits each with a loop ventrally (Figs. 348, 349) .... *rabida*
– Other regions; abdomen with larger humps 41
41(40). Peru (Map 4A); posterior of epigynum, between slits, with median area having a bulge on each side (Fig. 355) *escomeli*
– Other regions 42
42(41). Chile (Map 4B); posterior of epigynum with a dark spot dorsally in each adjacent depression (Fig. 415) .... *gasteracanthoides*
– Brazil to Argentina 43
43(42). Abdomen with humps placed on swollen area (Figs. 364, 365); Pernambuco State, Brazil (Map 4C) .... *obtusa*
– Humps not placed on swollen area (Figs. 368, 369) 44
44(43). Dark patch (atria) placed dorsal or middle of seminal receptacles (Figs. 392, 404) 45
– Atria absent or placed ventrally of seminal receptacles (Figs. 372, 379, 386) 46
45(44). Posterior of epigynum with dark patch (atria) dorsal within a depression (Figs. 392, 394, 395); Pernambuco, Brazil, to central Argentina (Map 4B) .... *satan*



Map 4. Distribution of *Mastophora* species of the *M. gasteracanthoides* group.

– Atria lateral, placed outside of depression (Fig. 404); northern, central Argentina (Map 4D) .... *diablo*

46(44). Posterior of epigynum with slits with a ventral bend (Fig. 385); Paraguay (Map 4C) .... *reimoseri*

– Slits without such bend (Figs. 371, 378) 47

47(46). Posterior of epigynum with slits separating ventrally and with lateral lip (Figs. 371, 372); Rio de Janeiro, São Paulo, Brazil (Map 4C) .... *felis*

– Slits parallel (Fig. 378); Paraguay, Santiago del Estero (Map 4C) ...... *holmbergi*

KEY TO KNOWN NORTH AMERICAN MALE *MASTOPHORA*

1. Space surrounded by median apophysis, in ectal view of palpus, longer than wide (Figs. 50, 62, 74, 164, 168) 2
– Space surrounded by median apophysis wider than long (Figs. 39, 85, 96, 99, 179, 182); terminal apophysis usually shorter than embolus (Figs. 37, 83, 94) 5
2(1). Terminal apophysis shorter than embolus (Fig. 48); median apophysis of palpus very short (Figs. 48–50); Florida (Map 2G) .... *alachua*
– Terminal apophysis as long or longer than embolus (Figs. 7, 60) 3
3(2). Base of embolus large (Figs. 60, 61); eastern United States (Map 2B) .... *bisaccata*
– Base of embolus small (Figs. 72, 73) 4
4(3). Base of median apophysis rounded (Figs. 162, 166); in ectal view, narrow part of median apophysis shorter than base (Figs. 164, 168); northeastern United States (Map 2E) .... *hutchinsoni*
– Base of median apophysis angular (Fig. 72, 73); in ectal view, narrow part of median apophysis as long or longer than width of base (Fig. 74); eastern United States (Map 2C) .... *stowei*
5(1). Terminal apophysis almost as long as embolus (Figs. 94, 177, 180) 6
– Terminal apophysis about half length or less of embolus (Figs. 83, 191) 7
6(5). Base of median apophysis longer than wide (Figs. 177, 180); southern United States to California and Central America (Map 2G) .... *cornigera*
– Base of median apophysis short (Figs. 94, 98); eastern United States (Map 2D) .... *phrynosoma*
7(5). Base of median apophysis large, touching embolus (Figs. 83, 84); eastern United States (Map 2A) .... *yeargani*
– Base of median apophysis small (Figs. 37, 191) 8
8(7). Length of narrow part of median apophysis as wide as base in ectal view (Fig. 193); Gulf Coast, Kansas (Map 2E) .... *archeri*
– Length of narrow part of median apophysis longer than width of base (Fig. 39); Virginia to North Carolina (Map 2A) .... *timuqua*

Kaira altiventer (O. P.-Cambridge), new combination

Epeiroides fasciolata O. P.-Cambridge, 1889: 15, pl. 8, fig. 5, ♂. Male from Bugaba, Panama, in BMNH, examined; now lost. Keyserling, 1893: 309, pl. 16, fig. 228, ♂. Male from Guatemala.
Kaira altiventer O. P.-Cambridge, 1889: 56, pl. 3, fig. 13, ♀. Female from Veragua [Veraguas Prov.], Panama, in BMNH, examined. Levi, 1993b, 213, figs. 3–22, ♀, ♂. NEW SYNONYMY.
Aranea fasciolata: —F. P.-Cambridge, 1904: 519, pl. 51, fig. 5, ♂. Claims that Keyserling's specimen is lost and probably was misidentified according to F. P.-Cambridge, 1904.

Note. *Epeiroides fasciolata* is a *Kaira.* My unpublished illustration of the holotype of *E. fasciolata* shows the distinct large median apophysis tooth at the base of the flagella, the characteristic curved, long, soft conductor, and the drop-shaped, sclerotized terminal apophysis of *Kaira altiventer* (Levi, 1993b, figs. 20, 21).

I examined the type in 1967, when visiting the BMNH, and made a drawing of the palpus of the male, thinking erroneously that the species is a *Mastophora,* But the palpus is not that of *Mastophora.* Neither O. P.-Cambridge, F. P.-Cambridge, or Keyserling showed carapace tubercles. I overlooked the species when revising *Kaira.* Since 1967, the holotype has been misplaced and cannot be found.

Mastophora satsuma new species
Figures 8–14; Map 2C

Holotype. Female holotype from Riverview, 11 mi. [17.6 km] SE of Tampa, on Highway 301, Hillsborough Co., Florida, on satsuma, *Citrus nobilis* (tangerine tree), 23 Aug. 1966 (E. R. Simmons), in FSCA. The specific name is a noun in apposition after the tree on which the holotype was collected.

Description. Female holotype. Carapace orange-brown. Chelicerae, labium, endites light brown. Sternum grayish orange. Coxae and distal leg articles brown. Abdomen dorsum whitish with dark gray frame having a lobe extending posteriorly to midline (Fig. 10); venter gray with white square. Carapace, with few tubercles (Figs. 8, 9) and short white setae. Abdomen without humps (Fig. 10). Total length 9.6 mm.

Carapace 4.4 mm long, 4.0 wide in thoracic region, 2.4 wide at lateral eyes. First femur 4.1 mm, patella and tibia 5.2, metatarsus 3.5, tarsus 1.0. Second patella and tibia 4.0 mm, third 2.3, fourth 3.6. Length of first patella and tibia 1.1 times width of carapace.

Males are not known.

Variation. The epigynum is asymmetrical: the left slit is more curved than the right one and the left seminal receptacles are larger than the right ones (Fig. 14). Both seminal receptacles are oval.

Diagnosis. Mastophora satsuma is distinguished from *M. felda* (Figs. 22–28) by being smaller, by differences in dorsal pattern (Fig. 10), by having larger seminal receptacles (Fig. 14), and also by the larger depression in the midline of the epigynum (Fig. 14).

Distribution. Central Florida (Map 2C).

Specimens Examined. No other specimens have been found.

Mastophora apalachicola new species
Figures 15–21; Map 2C

Holotype. Female holotype from ravine, Bristol, Calhoun Co., Florida, 29 Dec. 1939 (A. F. Archer), in AMNH. The specific name is a noun in apposition after the name of the river at the locality.

Description. Female holotype. Carapace contrastingly marked, sides dark brown, dorsum light brown anteriorly, pair of forks lightest brown (Figs. 15, 16). Chelicerae yellow-white with a dark patch on sides. Labium, endites dark brown. Sternum anterior light, posterior dark brown. Coxae dusky brown, fourth darkest. Distal leg articles yellow-white, femora and patellae with brown bands. Abdomen white (Fig. 17), dorsum with a pair of black spots, venter with white square containing three pairs of black dots. Carapace with few tubercles, with very large forked horns and with short white setae on sides (Figs. 15, 16). Median eyes on bulge, lateral eyes on bulges. Abdomen without humps and with large distinct dorsal pair of discs (Fig. 17). Total length 8.8 mm. Carapace 3.5 mm long, 3.4 wide in thoracic region, 2.2 wide at lateral eyes. First femur 3.3 mm, patella and tibia 4.4, metatarsus 3.2, tarsus 1.0. Second patella and tibia 3.3 mm, third 1.8, fourth 3.0. Length of first patella and tibia 1.3 times width of carapace.

Males are not known.

Variation. Total length of females 8.8 to 9.0 mm. The specimen from Levy County has the atria larger and more spherical than those of the holotype (Fig. 21); the one from Hamilton Co. has the atria larger and the seminal receptacles much larger. The illustrations were made from the holotype.

Diagnosis. Mastophora apalachicola is distinguished from others by the contrasting carapace coloration (Figs. 15, 16), the abdomen lacking humps, lacking dorsal color pattern, and having large dorsal discs (Fig. 17). The horns (Fig. 15) are larger than those of *M. timuqua* (Fig. 29) and *M. satsuma* (Fig. 8). The epigynum, unlike that of similar species, has a lip on each side; the slits are in a slight depression (Fig. 20). The epigynal slits and atria are almost parallel (Figs. 20, 21).

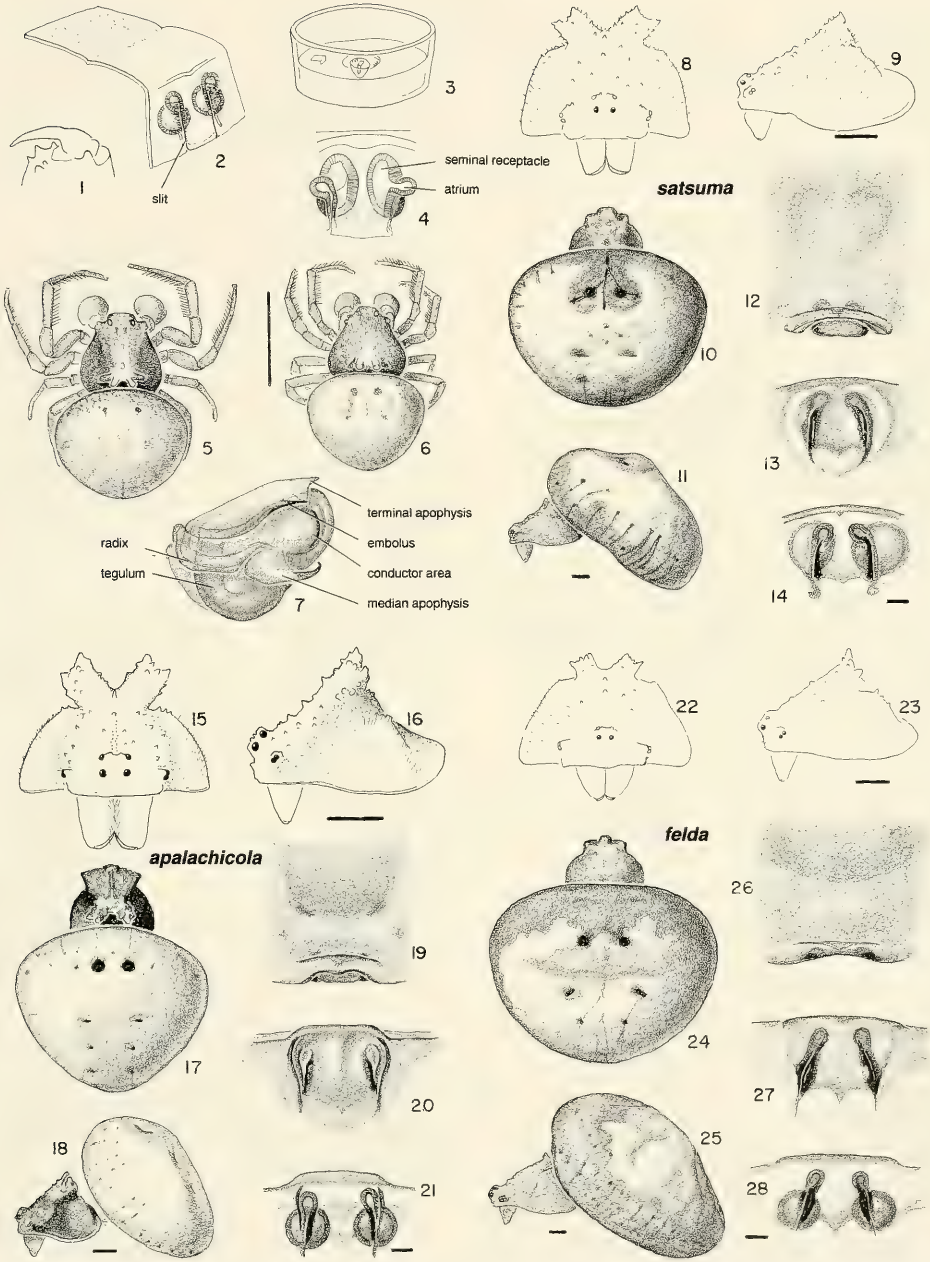
Distribution. South Carolina to northern Florida (Map 2C).

Paratypes. SOUTH CAROLINA *Anderson Co.:* Simpson Agric. Exp. Station, 16 Aug. 1974, 1 imm. (R. Paigler, CUAC). FLORIDA *Hamilton Co.:* nr. White Springs, Big Shoals State Forest, 25 Nov. 1991, 1♀ (M. K. Stowe 2116, FSCA). *Levy Co.:* Manatee Springs State Park, 10 Nov. 1992, 1♀ (M. K. Stowe 2114, MCZ).

Mastophora felda new species
Figures 22–28; Map 2A

Holotype. Female holotype from near Felda, Hendry Co., Florida, in orange grove, 8 March 1993 (D. Smith), in FSCA. The specific name is a noun in apposition after the type locality.

Description. Female holotype. Carapace dark orange-brown. Chelicerae dusky brown. Labium, endites dusky brown. Sternum brownish orange. Coxae orange-brown, lighter than sternum and legs. Distal leg articles dark orange-brown. Abdomen anterior, sides, and venter gray (Fig. 24), center and posterior whitish; venter



Figures 1–7. *Mastophora.* 1–4, female. 1, *M. bisaccata,* left tip of chelicera and fang from posterior. 2, epigynum, diagrammatical. 3, dish with paraffin to examine epigyna. 4, *M. diablo,* epigynum cleared, in posterior view, showing ducts. 5–7, male. 5, *M. gasteracanthoides.* 6, *M. bisaccata.* 7, *M. gasteracanthoides* left palpus without cymbium, mesal view.

Figures 8–14. *M. satsuma* new species, female. 8, 9, carapace and chelicerae. 8, frontal. 9, lateral. 10, 11, carapace and abdomen. 10, dorsal. 11, lateral. 12–14, epigynum. 12, ventral. 13, posterior. 14, posterior, cleared.

Figures 15–21. *M. apalachicola* new species, female. 15, 16, carapace and chelicerae. 15, frontal. 16, lateral. 17, 18, carapace and abdomen. 17, dorsal. 18, lateral. 19–21, epigynum. 19, ventral. 20, posterior. 21, posterior, cleared.

Figures 22–28. *M. felda* new species, female. 22, 23, carapace and chelicerae. 22, frontal. 23, lateral. 24, 25, carapace and abdomen. 24, dorsal. 25, lateral. 26–28, epigynum. 26, ventral. 27, posterior. 28, posterior, cleared.

Scale lines. 1.0 mm; genitalia, 0.1 mm.

with median white square. Carapace with few tubercles and with short, white setae (Figs. 22, 23). Median eyes on bulge, lateral eyes on bulges. Abdomen without humps (Fig. 24). Total length 12.3 mm. Carapace 5.3 mm long, 5.4 wide in thoracic region, 3.0 wide at lateral eyes. First femur 5.2 mm, patella and tibia 6.7, metatarsus 4.6, tarsus 1.2. Second patella and tibia 5.1 mm, third 2.7, fourth 4.8. Length of first patella and tibia 1.2 times width of carapace.

Males are not known.

Variation. The holotype has only seven eyes; it lacks the left posterior median eye.

Diagnosis. Mastophora is distinguished from *M. bisaccata* by the different coloration of the abdomen (Fig. 24), by the epigynum having only a thin rim in ventral view (Fig. 26), and by the small dorsal knobs in the depression on the posterior of the epigynum (Fig. 27). The atria bend toward each other (Fig. 28), but are farther apart than those of *M. bisaccata* (Fig. 57).

Distribution. South-central Florida (Map 2A).

Specimens Examined. No other specimens have been found.

Mastophora timuqua new species
Figures 29–39, 445; Map 2A

Holotype. Female holotype from Devil's Millhopper State Park, Gainesville, Alachua Co., Florida, 19 Nov. 1983 (M. K. Stowe 107A), in MCZ. The specific name is a noun in apposition after an extinct, northern Florida Indian tribe.

Description. Female holotype. Carapace light brown, with sides and eye areas darker brown and white mark in center (Figs. 29, 30). Chelicerae, labium, endites brown. Sternum light brown. Coxae lighter than sternum, distal leg articles with dark brown rings. Abdomen gray with anterior darker (Fig. 31), venter with indistinct white square. Thorax with short white setae, a distinct narrow line around margin; lacking large tubercles on sides of thoracic region (Figs. 29, 30). Median eyes on a bulge, lateral eyes on bulges. Abdomen without humps. Total length 8.5 mm. Carapace 3.5 mm long, 3.4 wide in thoracic region, 1.8 wide at lateral eyes. First femur 2.9 mm, patella and tibia 4.1, metatarsus 2.7, tarsus 0.8. Second patella and tibia 3.3 mm, third 1.8, fourth 2.7. Length of first patella and tibia 1.2 times width of carapace.

Male allotype. Carapace orange with white median patch. Sternum orange. Coxae, legs lighter orange. Abdomen dusky orange. Abdomen with two adjacent humps. Total length 1.6 mm. Carapace 0.88 mm long, 0.79 wide in thoracic region, 0.53 wide at lateral eyes. First femur 0.78 mm, patella and tibia 0.78, metatarsus 0.45, tarsus 0.28. Second patella and tibia 0.69 mm, third 0.40, fourth 0.55. Length of first patella and tibia same as width of carapace.

Note. Males were raised from egg sac of *M. timuqua.*

Variation. The illustrations were made from the female holotype and male allotype.

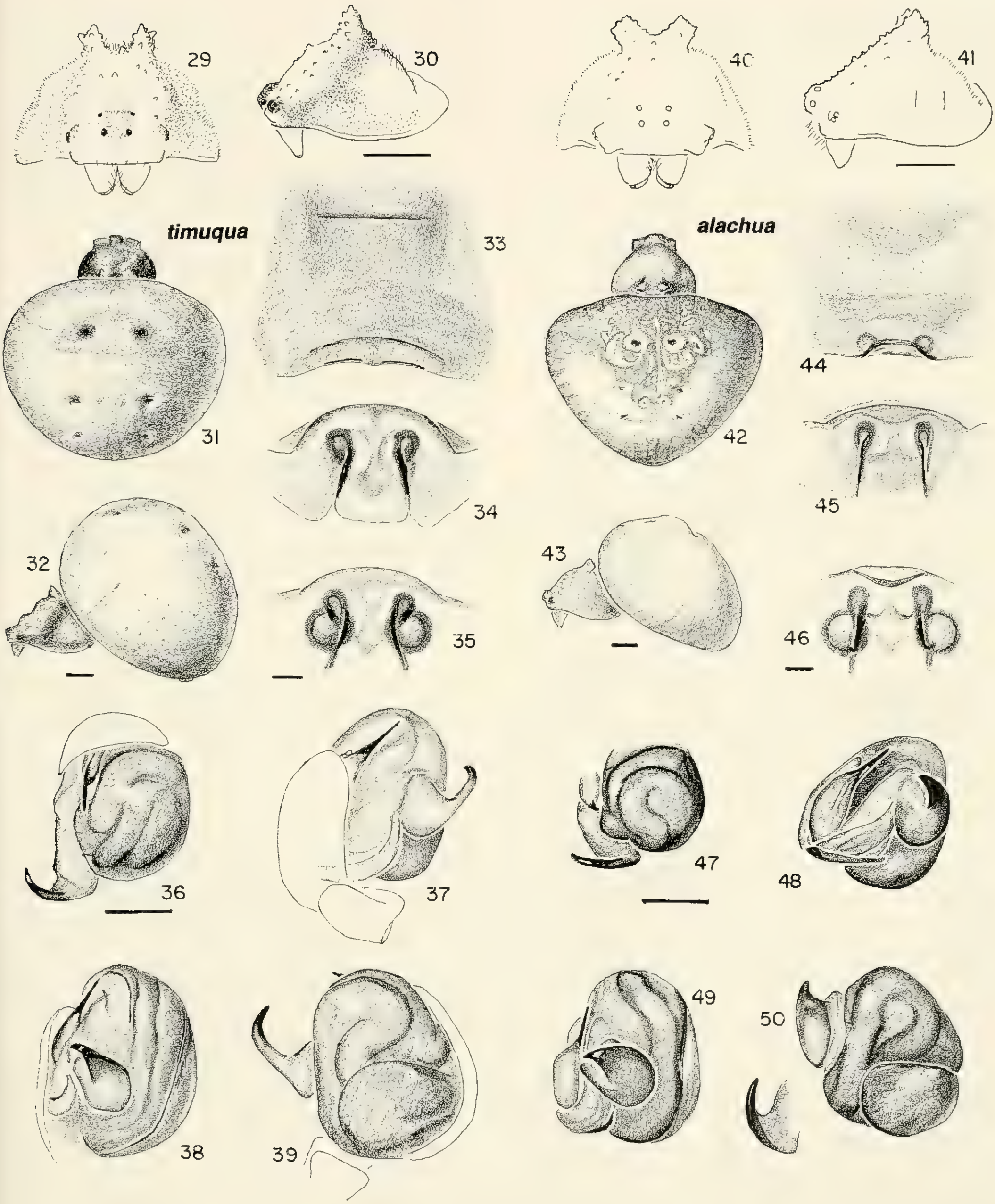
Diagnosis. Mastophora timuqua is distinguished from both *M. bisaccata* and *M. pisgah* by lacking dorsal abdominal pattern (Fig. 31), by having ringed legs, by having the posterior of the epigynum with atria separated, and by having a ridge in the midline (Fig. 34).

The male has a wide space enclosed by the median apophysis (Fig. 39) and differs from the male of *M. cornigera* by the proximal position of the radix (Fig. 37).

The egg sac is shown in Figure 445.

Distribution. North Carolina to northern Florida (Map 2A).

Paratypes. NORTH CAROLINA *Moore Co.:* reared from egg sac in spring 1941, 3♂ (J. Perry, M. K. Stowe 2113, MCZ). FLORIDA *Alachua Co.:* Devil's Millhopper State Park, reared spring 1992, ♂ allotype, 11 paratypes (M. K. Stowe 2101, MCZ, AMNH); spring 1992, raised 3♂ (M. K. Stowe 2106, FSCA). *Levy Co.:* Manatee Springs State Park, 5 Nov. 1987, 1♀ (M. K. Stowe 2111, AMNH). *Hillsborough Co.:* Pinecrest Alderman Ford County Park, 9 May 1988, egg sac (M. K. Stowe 21050, FSCA).



Figures 29–39. *Mastophora timuqua* new species. 29–35, female. 29, 30, carapace and chelicerae. 29, frontal. 30, lateral. 31, 32, carapace and abdomen. 31, dorsal. 32, lateral. 33–35, epigynum. 33, ventral. 34, posterior. 35, posterior, cleared. 36–39, male left palpus, stained. 36, apical. 37, mesal. 38, ventral. 39, ectal.

Figures 40–50. *M. alachua* new species. 40–46, female. 40, 41, carapace and chelicerae. 40, frontal. 41, lateral. 42, 43, carapace and abdomen. 42, dorsal. 43, lateral. 44–46, epigynum. 44, ventral. 45, posterior. 46, posterior, cleared. 47–51, male left palpus, stained. 47, apical. 48, mesal. 49, ventral. 50, ectal.

Scale lines. 1.0 mm; genitalia, 0.1 mm.

Mastophora alachua new species
Figures 40–50; Map 2G

Holotype. Female holotype from Devil's Millhopper State Park, Gainesville, Alachua Co., Florida, 19 Nov. 1983 (Mark K. Stowe 107B), in MCZ. The species is named after the type locality.

Description. Female holotype. Carapace orange. Chelicerae, labium, endites orange. Sternum orange. Coxae and distal leg articles orange. Abdomen orange with a dorsal, anterior dusky area containing some bare patches, and a transverse gray line posteriorly (Fig. 42); venter with white square. Carapace granular rather than tubercular, sides of carapace with short white setae; no tubercles on lateral thoracic region (Fig. 41). Abdomen subtriangular, without humps (Fig. 43). Total length 8.0 mm. Carapace 3.4 mm long, 3.4 wide in thoracic region, 2.2 wide at lateral eyes. First femur 3.5 mm, patella and tibia 4.5, metatarsus 3.2, tarsus 1.0. Second patella and tibia 3.5 mm, third 1.8, fourth 2.9. Length of first patella and tibia 1.3 times width of carapace.

Male allotype. Carapace dusky orange with median white patch. Sternum, legs, abdomen dusky orange. Abdomen with pair of adjacent humps. Total length 1.6 mm. Carapace 0.78 mm long, 0.67 wide in thoracic region, 0.52 wide at lateral eyes. First femur 0.67 mm, patella and tibia 0.78, metatarsus 0.42, tarsus 0.11. Second patella and tibia 0.65 mm, third 0.38, fourth 0.54. Length of first patella and tibia 1.1 times width of carapace.

Note. The male was raised from an egg sac.

Variation. Total length of females 8.0–9.2 mm, males 1.6–1.7. The illustrations were made from female holotype, corrected with the paratypes. The male illustrated was the only one available, the allotype, whose palpus was expanded, and thus the median apophysis (Figs. 47–50) may not be at the same angle as in the contracted palpus.

Diagnosis. Mastophora alachua is distinguished by the abdomen, slightly triangular in shape and having markings like those of *M. bisaccata* (Fig. 42), and by the epigynum, in ventral view showing two dark areas, the atria, on the posterior margin, and a narrow double margin (Fig. 45), and on the posterior, parallel slits, slightly closer ventrally, and between, next to each other, two shallow U-shaped shadows (Fig. 45).

Distribution. Northern Florida (Map 2G).

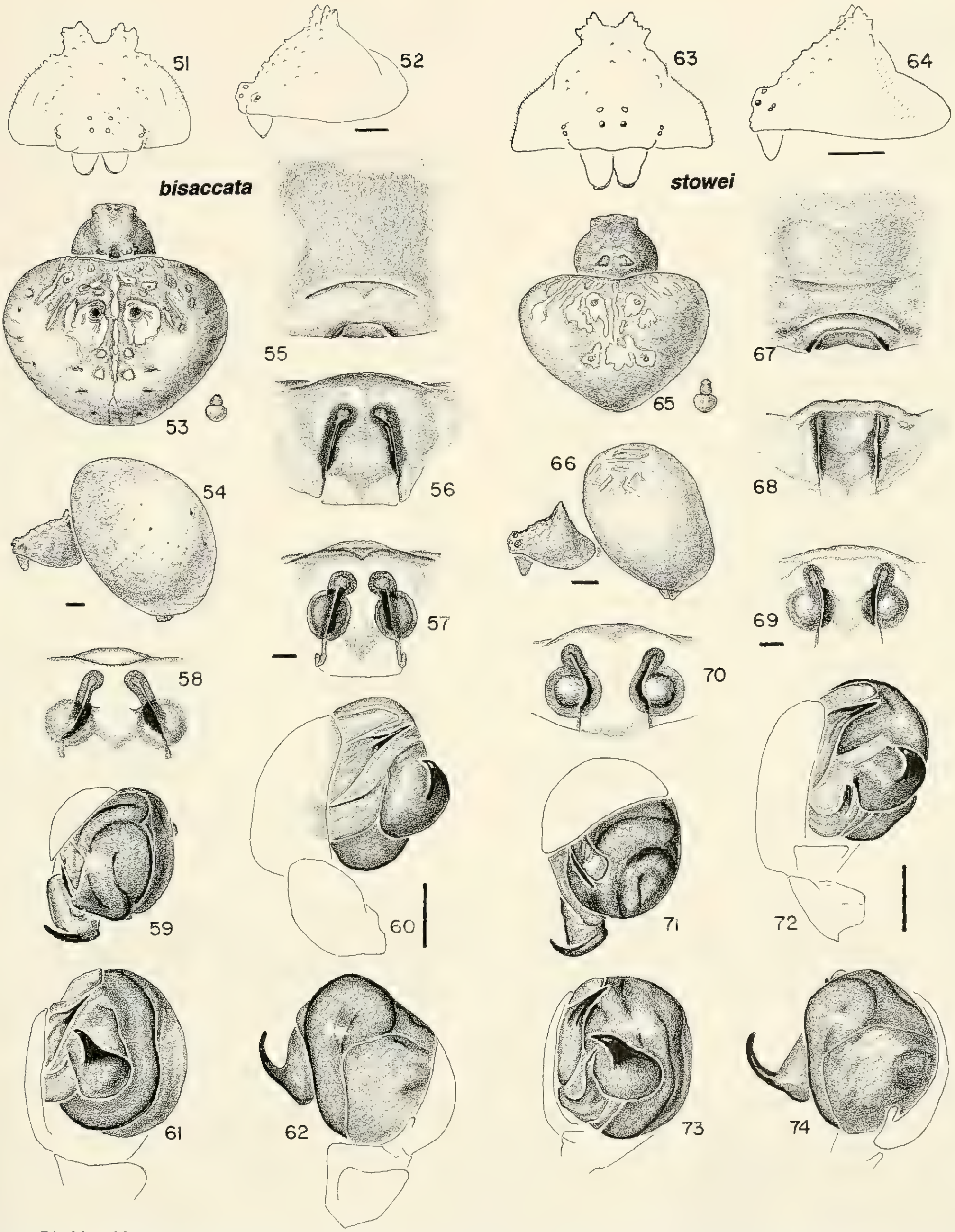
Paratypes. FLORIDA *Alachua Co.*: Devil's Millhopper State Park, 21 Nov. 1983, 1♀ (M. K. Stowe 106, MCZ); no date, prob. 1984, allotype ♂ (M. K. Stowe 2102, MCZ); Gainesville, 1 Nov. 1990, 1♀ (M. K. Stowe 2115, FSCA).

Mastophora bisaccata (Emerton)
Figures 51–62, 446; Map 2B

Cyrtarachne bisaccata Emerton, 1884: 325, pl. 34, fig. 11, ♀, pl. 38, fig. 12, egg sac. Female holotypes from beech tree, New Haven, Connecticut, in MCZ, examined.
C. multilineata Atkinson, 1888: 546. Two syntypes presumably from near Chapel Hill, North Carolina, lost. First synonymized by Banks (1910).
Ordgarius bisaccata:—Keyserling, 1892: 42, pl. 2, fig. 35, ♀. McCook, 1894: 198, pl. 12, figs. 2, 3, ♀.
Glyptocranium bisaccatum:—Bonnet, 1957: 1996.
Ordgarius obesus Banks, 1898: 250, pl. 15, fig. 9, ♀. Two female syntypes from La Chuparosa [Chuparrosa, San Luis Potosí], Mexico, in CAS, destroyed. NEW SYNONYMY.
Mastophora bisaccata:—Mello-Leitão, 1931: 71. Roewer, 1942: 900. Kaston, 1948: 232, figs. 737–740. Gertsch, 1955: 242, pls. 3–5, pl. 6, figs. 1, 4; text figs. 19–23, 35, 43, 44, ♀, ♂. Platnick, 1997: 513. Platnick, 2001.

Note. Atkinson did not tell how *Cyrtarachne multilineata* differs from *bisaccata,* although he mentioned the latter species. The large size, total length 11 and 13 mm, abdomen 13 and 15 mm wide, suggest he had *M. bisaccata.* The name was first synonymized by Banks (1910).

Ordgarius obesus differs from *bisaccata,* according to Banks, by being larger in size and having the cephalothorax truncate. The illustration shows the dorsal abdominal pattern of *M. bisaccata.* The size is within the range of *M. bisaccata* and the carapace, unlike most *Mastophora,* is truncate. There is no doubt that this was *M.*



Figures 51–62. *Mastophora bisaccata* (Emerton). 51–58, female. 51, 52, carapace and chelicerae. 51, frontal. 52, lateral. 53, 54, carapace and abdomen. 53, dorsal with male. 54, lateral. 55–58, epigynum. 55, ventral. 56, posterior. 57, 58. posterior, cleared. 57, (Virginia). 58, (Florida). 59–62, male left palpus, stained. 59, apical. 60, mesal. 61, ventral. 62, ectal.

Figures 63–74. *M. stowei* new species. 63–70, female. 63, 64, carapace and chelicerae. 63, frontal. 64, lateral. 65, 66, carapace and abdomen. 65, dorsal, with male. 66, lateral. 67–70, epigynum. 67, ventral. 68, posterior. 69, 70, posterior, cleared. 69, (Florida). 70, (North Carolina). 71–74, male left palpus, stained. 71, apical. 72, mesal. 73, ventral. 74, ectal.

Scale lines. 1.0 mm; genitalia, 0.1 mm.

bisaccata. The locality of this specimen is doubtful, because it came from the Marx collection (see Banks, 1898).

Description. Female from Rhode Island. Carapace orange-brown. Sternum dark orange-yellow. Legs orange yellow, first femur darker ventrally. Abdomen white, anterior dorsally gray with characteristic pattern (Fig. 53), venter with white square. Carapace with very small tubercles, and small eye projections (Figs. 51–53). Abdomen without humps (Fig. 53). Total length 14.2 mm. Carapace 5.2 mm long, 5.4 wide in thoracic region, 2.8 wide at lateral eyes. First femur 4.4 mm, patella and tibia 6.3, metatarsus 4.3, tarsus 1.2. Second patella and tibia 4.7 mm, third 2.7, fourth 4.6. Length of first patella and tibia 1.2 times width of carapace.

Male from Arkansas. Carapace orange-brown with white line in middle, branching posteriorly into tubercles (Fig. 6). Sternum white. Lateral eyes smaller than median. Legs colorless yellowish. Abdomen white. Abdomen with slight, indistinct tubercles (Fig. 6). Total length 1.8 mm. Carapace 0.88 mm long, 0.81 wide in thoracic region, 0.55 wide at lateral eyes. First femur 0.92 mm, patella and tibia 0.93, metatarsus 0.48, tarsus 0.27. Second patella and tibia 0.79 mm, third 0.47, fourth 0.59. Length of first patella and tibia 1.1 times width of carapace.

Note. Examined males include males raised from egg sacs by K. Yeargan and males collected in the same locality as females.

Variation. The holotype has the epigynal slits farther apart than in the specimen illustrated. Total length of females 9.0–15.3 mm. Males may have humps on the abdomen. The illustrations were made from the female holotype and males from Arkansas and Ohio. An egg sac collected with female at Bushnell, Florida, lacked flaps and was smooth.

Diagnosis. The female of *M. bisaccata* is distinguished from the similar *M. alachua, M. stowei,* and *M. yeargani* by being larger, and having the atria approaching each other in posterior view of the epigynum (Figs. 56–58).

The male has a narrow space encircled by the median apophysis in ectal view (Fig. 62), and the median apophysis has a longer base (Fig. 60) than in *M. hutchinsoni.*

The egg sac has a heavier stalk than in other *Mastophora* species (Fig. 446).

Natural History. Mastophora bisaccata has been collected from bittersweet in Connecticut, field of cemetery in Illinois, and on dogwood in Florida. Females rest under leaves, and sometimes neighboring leaves are stitched together; the females may look like leaf galls in Florida (M. Stowe, personal correspondence); in North Carolina they may resemble tree snails (Atkinson, 1888).

Distribution. Eastern United States (Map 2B).

Specimens Examined. CONNECTICUT *Litchfield Co.:* Kent, on bittersweet, Sept. 1937, 1♀ (AMNH). NEW YORK *Nassau Co.:* Long Island: Sea Cliff, 1♂ (MCZ). NEW JERSEY *Elizabeth Co.:* Roselle Park, 25 Sep. 1910, 1♀ (AMNH). *Middlesex Co.:* New Brunswick, July 1930, 1♀ (AMNH). PENNSYLVANIA *Westmoreland Co.:* 4.8 km S Rector, 13 Sep. 1966, 1♀ (B. Vogel, DMNS). OHIO *Jackson Co.:* Oak Hill, 1♀ (R. A. Reller, OSU). *Logan Co.:* Cantwell Cliffs, 8 Sep. 1935, 1♀ (OSU). *Butler Co.:* Bachelor Woods, Oxford, 11 July 1998, 1♂ (D. M. Golden, OSU). DISTRICT OF COLUMBIA Washington, Sept., 1♂ (Fox, CUC, AMNH); summer 1935, 1♀ (H. E. Ewing, USNM). VIRGINIA Falls Church, 1♀, 1♂ (MCZ). *Powhatan Co.:* Powhatan, Sep. 1984, 1♀ (A. Moreton, MCZ); 1985, 1♀ (A. Moreton, MKS). KENTUCKY *Jessamine Co.:* imm., 7♂ raised spring 1995 (K. V. Yeargan, KVY). SOUTH CAROLINA *Oconee Co.:* Clemson College, 1♀ (MCZ). *Lexington Co.:* Batesburg, 1♀ (MCZ). GEORGIA *Fulton Co.:* Atlanta, 2 Aug. 1937, 1♀ (F.

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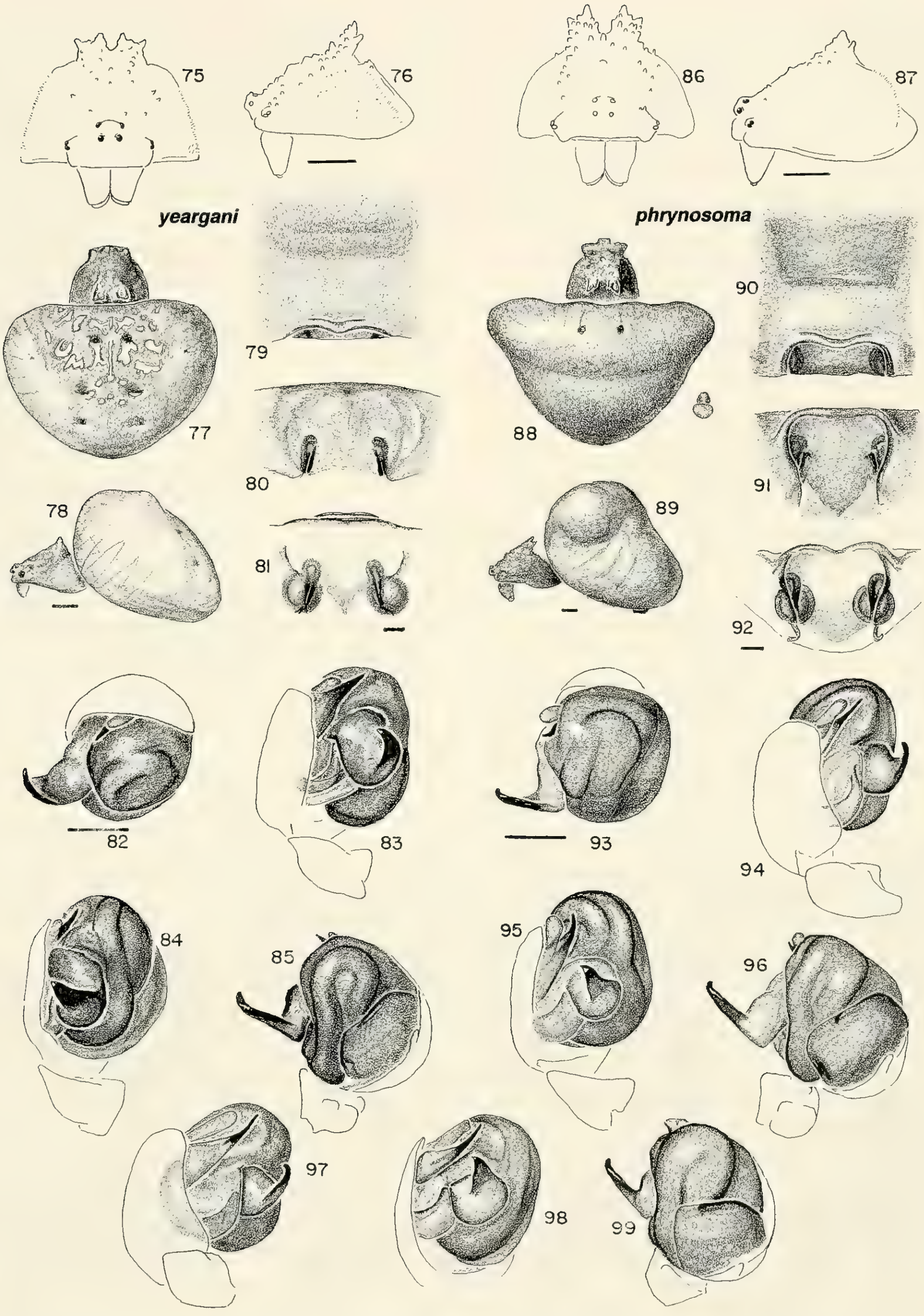
Figures 75–85. *Mastophora yeargani* new species. 75–81, female. 75, 76, carapace and chelicerae. 75, frontal. 76, lateral. 77, 78, carapace and abdomen. 77, dorsal. 78, lateral. 79–81, epigynum. 79, ventral. 80, posterior. 81, posterior, cleared. 82–85, male left palpus, stained. 82, apical. 83, mesal. 84, ventral. 85, ectal.



Figures 86–99. *M. phrynosoma* Gertsch. 86–92, female. 86, 87, carapace and chelicerae. 86, frontal. 87, lateral. 88, 89, carapace and abdomen. 88, dorsal, with male. 89, lateral. 90–92, epigynum. 90, ventral. 91, posterior. 92, posterior, cleared. 93–99, male left palpus, stained. 93–96, (Kentucky). 97–99, (Florida). 93, apical. 94, 97, mesal. 95, 98, ventral. 96, 99, ectal.

Scale lines. 1.0 mm; genitalia, 0.1 mm.

W. Fattig, AMNH). FLORIDA *Alachua Co.:* Devil's Millhopper State Park, July, Aug. 1978–1981, 5♀ (M. K. Stowe, MKS); June, July 1981, 7♀ (M. K. Stowe, MKS); 19 Nov. 1983, 1♀; Gainesville, 26 July 1980, penult. (C. Hieber, MCZ); High Springs, Oct. 1935, 1♀ (H. H. Simpson, USNM). *Indian River Co.:* Sebastian, Apr. 1944, 1♀ (G. Nelson, MCZ). *Lake Co.:* Umatilla, Sep. 1954, 1♀ (M. W. Tyler, AMNH). *Sumter Co.:* Bushnell, 24 Oct. 1979, 1♀ (W. Edwards, FSCA). ILLINOIS *Franklin Co.:* Zeigler, 10 May 1928, 1♀ (J. K. Carlovic, MCZ). *Jackson Co.:* Little Grand Canyon, S. Murphysboro, 5 Sep. 1971, 1♂ (N. Magnuson, JAB). *Williamson Co.:* Canterville, field of cemetery, 14 Oct. 1978, 1♀ (R. Reith, JAB). MISSOURI *St. Louis Co.:* 17 Feb. 1940, 1♂ paratypes of *M. archeri* (W. M. Gordon, AMNH). ARKANSAS *Carroll Co.:* Berryville, July 1942, 1♂ (C. Wilton). MISSISSIPPI *Harrison Co.:* Gulfport, 1♀ (AMNH).

Mastophora stowei new species
Plate 1; Figures 63–74, 447; Map 2C

Holotype. Female holotype from American Entomological Institute, Gainesville, Alachua Co., Florida, 29°36.0′N, 82°22.0′W, 7 Dec. 1987 (M. Stowe 07001), in MCZ. The species is named after the collector, Mark Stowe, who has contributed much to our knowledge of *Mastophora.*

Description. Female holotype. Carapace orange-brown, dusky in eye region (Fig. 65). Chelicerae light orange, labium, endites dusky orange. Sternum orange. Legs light orange, dusky dorsally. Abdomen dorsum whitish with gray pattern anteriorly, having distinct white spots and streaks (Fig. 65); venter with white square. Carapace with indistinct tubercles; horns almost rectangular in anterior view (Figs. 63, 64). Abdomen without humps and slightly pointed posteriorly (Fig. 65). Total length 8.0 mm. Carapace 3.5 mm long, 3.4 wide in thoracic region, 2.1 wide at lateral eyes. First femur 3.4 mm, patella and tibia 4.5, metatarsus 2.8, tarsus 1.0. Second patella and tibia 3.4 mm, third 2.0, fourth 3.2. Length of first patella and tibia 1.3 times width of carapace.

Male allotype. Carapace gray-orange with a white median patch. Sternum orange. Legs orange, dusky dorsally. Abdomen dusky orange, with humps. Total length 1.7 mm. Carapace 0.80 mm long, 0.68 wide in thoracic region, 0.48 wide at lateral eyes. First femur 0.67 mm, patella and tibia 0.78, metatarsus 0.41, tarsus 0.29. Second patella and tibia 0.65 mm, third 0.39, fourth 0.53. Length of first patella and tibia 1.1 times width of carapace.

Note. Males were raised from the egg sac of the holotype.

Variation. Total length of females 6.3–10.5 mm. Males may lack humps. The illustrations were made from the female holotype, except Figure 70 from a North Carolina specimen, and the male from the allotype.

Diagnosis. Mastophora stowei is distinguished from *M. bisaccata* by being smaller in size and having the atria of the epigynum ventrally departing from each other (Figs. 68–70). The egg sac is shown in Figure 447.

Natural History. Females have been collected from trees along farm fences in Kentucky, and on a carpet of silk on a maple leaf in Virginia.

Distribution. Widespread in the eastern United States (Map 2C).

Paratypes. CONNECTICUT *Hartford Co.:* Rainbow nr. Windsor, 9 Aug. 1939, 1♀ (A. de Caprio, USNM). OHIO *Logan Co.:* Old Man's Cave, 12 Sep. 1924, 1♂ (OSU). VIRGINIA *Arlington Co.:* Arlington, 7 Sept. 1953, 1♀ (K. V. Krombein, AMNH). ILLINOIS *Pope Co.:* Dixon Spring State Park, 7 Sept. 1974, 1♀ (J. A. Beatty, JAB). KENTUCKY *Fayette Co.:* Lexington, Oct. 1997, 1♀, egg sac (K. V. Yeargan, KVY); 6 Aug. 1998, 14♂ (K. Yeargan, KVY); Cold Stream farm fence, 16 Oct. 1998, 3♀ (K. Yeargan, KVY). *Jessamine Co.:* 3 Aug. 1995, 7♂ (K. Yeargan, KVY). NORTH CAROLINA *Haywood Co.:* Canton, 1♀ (Holden, MCZ). GEORGIA 1♀ (MNHN 210). FLORIDA *Alachua Co.:* Gainesville, male allotype and 1 penultimate paratype from egg sac of holotype,

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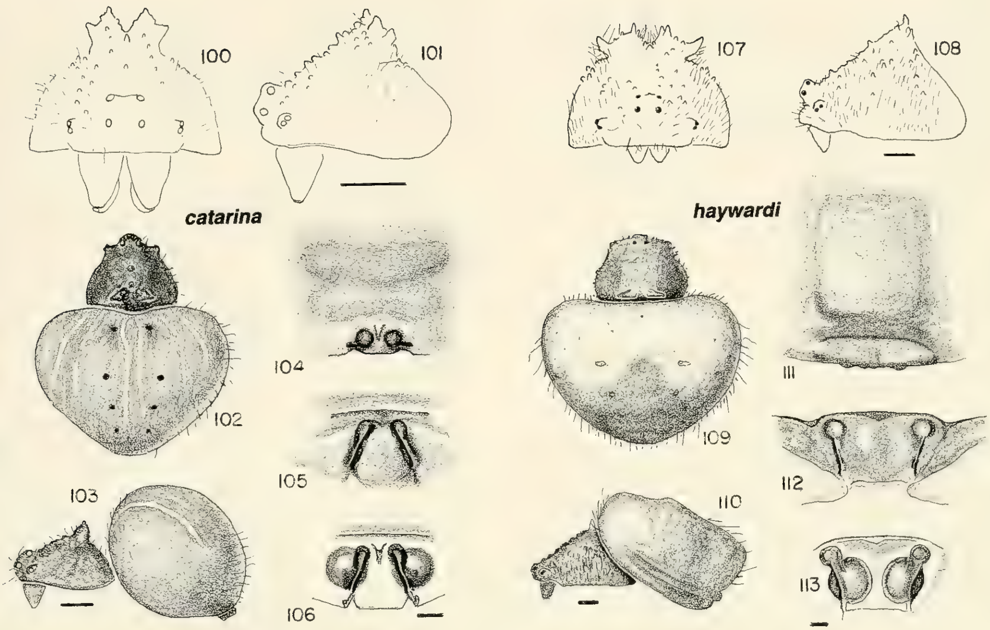
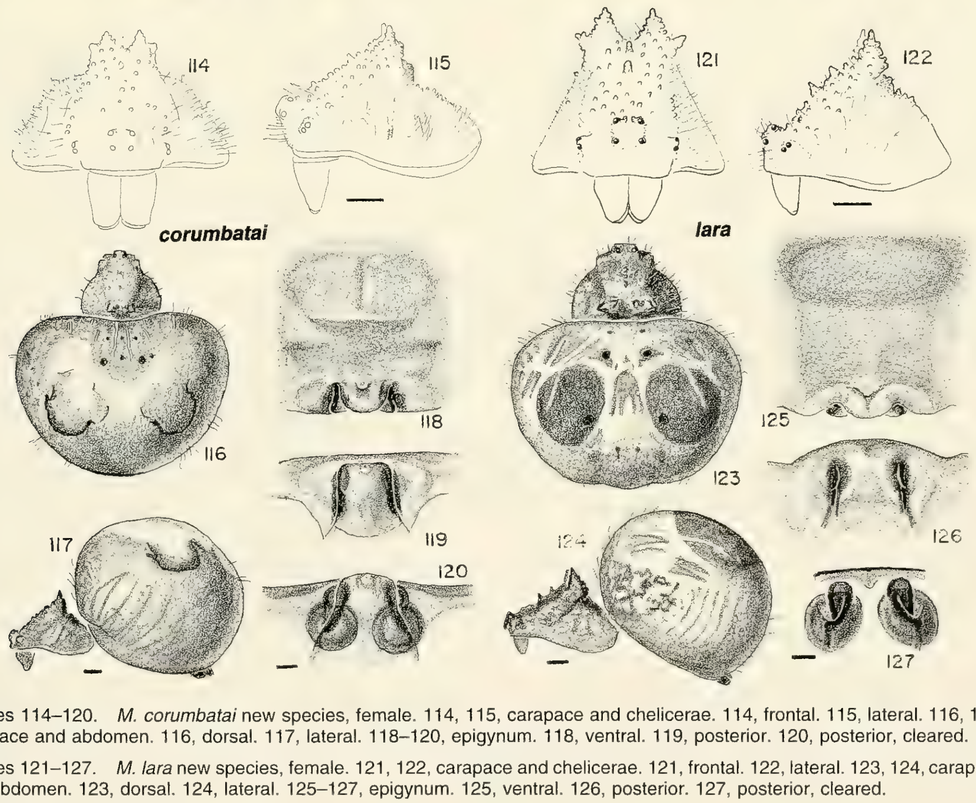
Figures 100–106. *Mastophora catarina* new species, female. 100, 101, carapace and chelicerae. 100, frontal. 101, lateral. 102, 103, carapace and abdomen. 102, dorsal. 103, lateral. 104–106, epigynum. 104, ventral. 105, posterior. 106, posterior, cleared.

Figures 107–113. *M. haywardi* Birabén, female. 107, 108, carapace and chelicerae. 107, frontal. 108, lateral. 109, 110, carapace and abdomen. 109, dorsal. 110, lateral. 111–113, epigynum. 111, ventral. 112, posterior. 113, posterior, cleared.





Figures 114–120. *M. corumbatai* new species, female. 114, 115, carapace and chelicerae. 114, frontal. 115, lateral. 116, 117, carapace and abdomen. 116, dorsal. 117, lateral. 118–120, epigynum. 118, ventral. 119, posterior. 120, posterior, cleared.

Figures 121–127. *M. lara* new species, female. 121, 122, carapace and chelicerae. 121, frontal. 122, lateral. 123, 124, carapace and abdomen. 123, dorsal. 124, lateral. 125–127, epigynum. 125, ventral. 126, posterior. 127, posterior, cleared.

Scale lines. 1.0 mm; genitalia, 0.1 mm.

hatched 27 Apr. to 15 May 1988, preserved 18 July 1988 (M. Stowe 20181, 20183, MCZ, AMNH, FSCA). TEXAS *Harrison Co.:* Marshall, 5 July 1991, 1♀ (S. G. Wellso, JK).

Mastophora yeargani new species
Plate 1; Figures 75–85; 448; Map 2A

Holotype. Female holotype from Coldstream Farm fence, Lexington, Kentucky, 26 Oct. 1998, male allotype and 11 male and 4 female paratypes emerged 24 May 1999, preserved in fall (K. V. Yeargan), in MCZ. The species has been named after the collector, who has contributed much to our knowledge of *Mastophora* ecology.

Description. Female holotype. Carapace light brown. Chelicerae, labium, endites yellow. Sternum yellow underlain by white pigment granules. Coxae and distal leg articles yellow. Abdomen anterior of dorsum gray with white marks anteriorly (Fig. 77), posterior white, venter whitish with white square. Carapace shiny. Abdomen with pair of very slight dorsal swellings. Total length 10.0 mm. Carapace 4.2 mm long, 4.2 wide in thoracic region, 2.3 wide at lateral eyes. First femur 3.9 mm, patella and tibia 5.4, metatarsus 3.8, tarsus 1.2. Second patella and tibia 4.0 mm, third 2.4, fourth 3.7. Length of first patella and tibia 1.3 times width of carapace.

Male allotype. Carapace brown with white triangle in center. Chelicerae, labium, endites orange. Sternum orange. Coxae and distal leg articles orange. Abdomen whitish with pair of humps. Total length 1.7 mm. Carapace 0.78 mm long, 0.78 wide in thoracic region, 0.52 wide at lateral eyes. First femur 0.87 mm, patella and tibia 0.88, metatarsus 0.52, tarsus 0.34. Second patella and tibia 0.75 mm, third 0.39, fourth 0.60. Length of first patella and tibia 1.1 times width of carapace.

Note. Males have been raised from egg sac of female *M. yeargani* (by K. Yeargan).

Variation. Total length of females 10.0–11.5 mm. The illustrations were made from the holotype and allotype.

Diagnosis. Mastophora yeargani is distinguished from *M. bisaccata* and *M. stowei,* which have similar abdominal markings, by the short slits of the epigynum, which are almost parallel and their length distant from the ventral margin (Figs. 80, 81). The female also lacks duskiness on the dorsum of the femora and gray pigment on the clypeus, both of which are present in *M. stowei.*

The male differs from *M. bisaccata* (Fig. 62) by having a longer median apophysis (Fig. 85) and from *M. cornigera* (Figs. 177, 179) by having only a short terminal apophysis in the palpus (Figs. 82, 83), and by having the median apophysis of a different shape, and the embolus wider (Figs. 83, 84).

Distribution. From New York to Kentucky (Fig. 448).

Paratypes. NEW YORK nr. New York City, on *Amalanchier* sp., 1♀ (AMNH). KENTUCKY *Mercer Co.:* Feb. 1995 egg sacs, 29 Sept. 1995, 7 imm., 4♂ (K. V. Yeargan, KVY). *Garrard Co.:* Feb. 1995, egg sacs, Sept. 1995, 6 imm., 16♂ (K. V. Yeargan, KVY).

Mastophora phrynosoma Gertsch
Figures 86–99, 449, 450; Map 2D

Mastophora phrynosoma Gertsch, 1955: 245; pl. 6, fig. 5, text figs. 24–27, 31, ♀. Female holotype from Burlington, North Carolina, in AMNH, examined. Brignoli, 1983: 273. Platnick, 2001.

Description. Female holotype. Carapace orange-brown. Sternum orange-brown. Legs orange-brown, indistinctly ringed. Abdomen anteriorly gray, posteriorly white (Fig. 88), venter with white square. Carapace with tubercles very small (Figs. 86, 87). Median eyes on bulge, lateral eyes on bulges. Abdomen subtriangular with a

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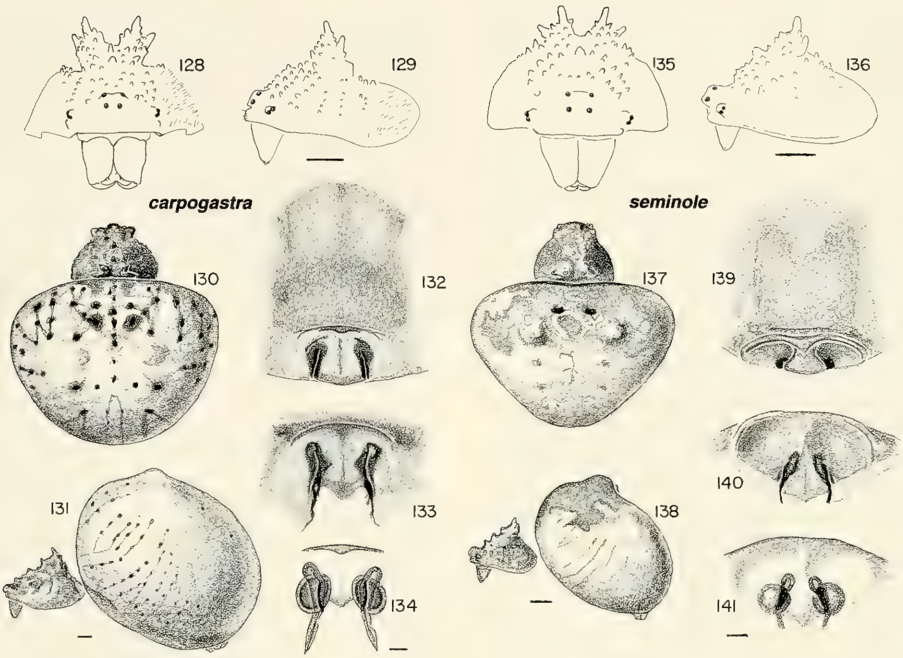
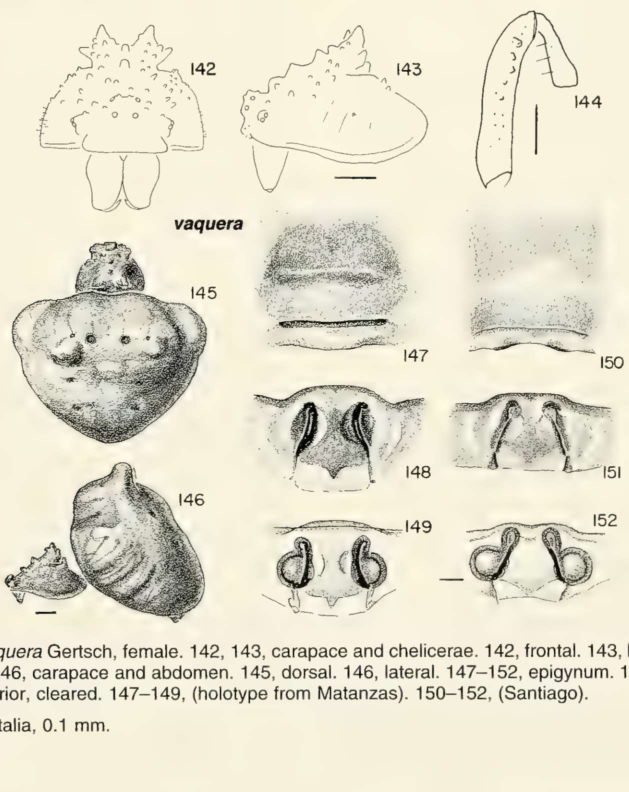
Figures 128–134 *Mastophora carpogastra* Mello-Leitão, female. 128, 129, carapace and chelicerae. 128, frontal. 129, lateral. 130, 131, carapace and abdomen. 130, dorsal. 131, lateral. 132–134, epigynum. 132, ventral. 133, posterior. 134, posterior, cleared.

Figures 135–141. *M. seminole* new species, female. 135, 136, carapace and chelicerae. 135, frontal. 136, lateral. 137, 138, carapace and abdomen. 137, dorsal. 138, lateral. 139–141, epigynum. 139, ventral. 140, posterior. 141, posterior, cleared.





Figures 142–152. *M. vaquera* Gertsch, female. 142, 143, carapace and chelicerae. 142, frontal. 143, lateral. 144, left first femur and patella, mesal. 145, 146, carapace and abdomen. 145, dorsal. 146, lateral. 147–152, epigynum. 147, 150 ventral. 148, 151, posterior. 149, 152, posterior, cleared. 147–149, (holotype from Matanzas). 150–152, (Santiago).

Scale lines. 1.0 mm; genitalia, 0.1 mm.

swelling on each anterior lateral side and indistinct sclerotized discs (Fig. 88). Total length 12.3 mm. Carapace 4.6 mm long, 4.4 wide in thoracic region, 2.7 wide at lateral eyes. First femur 4.6 mm, patella and tibia 6.5, metatarsus 4.7, tarsus 1.3. Second patella and tibia 4.5 mm, third 2.4, fourth 4.1. Length of first patella and tibia 1.5 times width of carapace.

Male from Kentucky. Carapace orange-brown, median triangle enclosing horns and two tubercles lighter. Sternum orange. Legs orange-brown. Abdomen both sides orange-white. Carapace slightly rugose, with two median tubercles and four posterior horns. Abdomen with small dorsal humps. Total length 1.8 mm. Carapace 0.81 mm long, 0.80 wide in thoracic region, 0.55 wide at lateral eyes. First femur 0.91 mm, patella and tibia 0.93, metatarsus 0.46, tarsus 0.31. Second patella and tibia 0.78 mm, third 0.45, fourth 0.60. Length of first patella and tibia 1.2 times width of carapace.

Note. Males have been raised by M. K. Stowe and K. V. Yeargan from egg sacs that were determined to be from *M. phrynosoma.*

Variation. Total length of females 8.3–12.3 mm, males 1.5–1.7. The lateral swellings of a specimen from Falls Church are less distinct. The carapace of a female from Missouri is blackish brown, sternum and coxae black, legs ringed, and abdominal venter black. The venter of several individuals is black. The illustrations were made from the female holotype and from the reared male.

Diagnosis. Mastophora phrynosoma is distinguished by the subtriangular shape of the abdomen, the small, dorsal sclerotized discs (Fig. 88), and by the posterior of the epigynum having a lip surrounding the slits on three sides (Figs. 90–92).

The palpus of the male has the space enclosed by the median apophysis wider than long and the prong straight (Figs. 96, 99), and has the base of the median apophysis almost as wide as long (Figs. 94, 98). It differs from that of *M. archeri* by having a longer terminal apophysis (Figs. 93, 94), and wider radix (Figs. 95, 98).

The egg sac is distinct, having longer flaps than in other species (Figs. 449, 450).

Natural History. A female was collected on elm bush, 1.5 m high, in Texas; in Missouri, a female was collected hanging on a silk strand on canebrake (*Arundinaria gigantea*) at night at 0200 h. Males were collected crawling on a table in the laboratory, and in low branches of hawthorn in Ohio. Immature spiderlings attract psychodid flies (*Psychoda phalaenoides*) (Yeargan and Quate, 1996). The female always rests on the upper leaf surfaces, which often accumulate a silk pad that may be visible under the spider. The spiders look like bird droppings in Florida (M. Stowe, personal communication). The moths captured in Kentucky and Florida, observed by M. K. Stowe and K. V. Yeargan, were reported by Yeargan (1994).

An egg sac raised by K. V. Yeargan produced only male spiderlings. A suggestion has been made that the sex chromosome system might be different from that of other spiders (G. Oxford, in letter). Perhaps this skewed sex ratio was due to the mortality of females.

Distribution. Eastern United States (Map 2D).

Specimens Examined. CONNECTICUT *New Haven Co.:* Mount Carmel, 4 Sept. 1946, 1♀ (K. M. Somerman, INHS 4748). *Meriden Co.:* South Meriden, Oct. 1945, 1♀ (H. L. Johnson, USNM). NEW YORK New York City, on *Prunus,* 1♀ (AMNH). OHIO *Cuyahoga Co.:* Sagmore Picnic, Sagmore Hills, Buckeye Trail area, 16 Sept. 1999, 1♀ (K. Bradley, OSU). MARYLAND *Anne Arundel Co.:* Annapolis, 21 Sep. 1941, 1♀ (M. H. Muma, AMNH). *Howard Co.:* Colombia, Snowden River Parkway, 26 Sep. 1994, 1♀ (M. Harden, USNM). *Montgomery Co.:* Cabin John, 10 Nov. 1943, egg sacs (I. N. Hoffman, USNM). VIRGINIA Falls Church, 2♀ (N. Banks, MCZ). KENTUCKY *Fayette Co.:* Lexington, Raven Run, 1989, 1♀ (K. V. Yeargan, KVY); 17 May 1999, egg sacs with only ♂♂ (K. V. Yeargan, KVY, MCZ). GEORGIA *Fulton Co.:* Atlanta, 21 Aug. 1944, 1♀ (F. W. Fattig, AMNH). FLORIDA *Alachua Co.:* Gainesville, Apr. 1988, 1♂ (M. K. Stowe, MKS); Devil's Millhopper State Park, 15 July 1980, 1♀ (M. K. Stowe, MKS); spring 1992, 2♂ (M. K. Stowe, MKS); spring 1994, 8♂ (M. K. Stowe, MKS). ALABAMA

Monroe Co.: Randon's Creek, 19 Oct. 1941, 1♀ (A. F. Archer, AMNH). INDIANA 1♀ (A. Petrunkevitch, NHMW). ILLINOIS *Jackson Co.:* Carbondale, in woods at night, 4 Aug. 1967, 1♀ (J. M. Nelson, AMNH). MISSOURI *Wayne Co.:* Markham Spring, Mark Twain National Forest, 14 Oct. 2000, 1♀ (E. L. Quinter, AMNH). *St. Louis Co.:* 17 July 1940, 1♂ paratype of *M. archeri* (W. M. Gordon, AMNH). TEXAS *Walker Co.:* Huntsville State Park, on elm bush, 27 Sep. 1987, 1♀ (W. R. Martin, TAMU).

Mastophora catarina new species
Figures 100–106; Map 3C

Holotype. Female from Pinhal, Est. Santa Catarina, Brazil, Dec. 1948 to Jan. 1949 (A. Maller), in AMNH. The specific name is a noun in apposition after the locality.

Description. Female holotype. Carapace dark orange-brown (Fig. 102). Sternum dark orange. Chelicerae dark in front, orange on sides. Endites, labium, sternum, coxae orange; coxae lighter than sternum. Legs dark brown. Abdomen gray-brown, dorsally with three pairs of white longitudinal lines (Fig. 102); venter with a white square. Eyes distinct. Lateral eyes 0.8 diameter of median eyes. Abdomen without humps (Fig. 102). Carapace, legs, and abdomen with some long white hair. Total length 7.2 mm. Carapace 3.3 mm long, 3.2 wide in thoracic region, 1.8 wide at lateral eyes. First femur 3.5 mm, patella and tibia 4.4, metatarsus 3.0, tarsus 1.0. Second patella and tibia 3.3 mm, third 1.7, fourth 2.7. Length of first patella and tibia 1.4 times width of carapace.

Males are not known.

Diagnosis. Mastophora catarina is separated from others by the abdomen lacking humps and having six white lines (Fig. 102), by the epigynum having the atria approaching each other (Figs. 105, 106), and by the paired notches at the edge of the epigynum (Fig. 106).

Distribution. Santa Catarina State, Brazil (Map 3C).

Specimens Examined. No other specimens have been found.

Mastophora haywardi Birabén
Figures 107–113; Map 3C

Mastophora haywardi Birabén, 1946: 327, figs. 1–3, ♀. Female holotype, from Tucumán, Argentina, in MLP, examined. Brignoli, 1983: 274. Platnick, 2001.

Description. Female holotype in poor condition. Carapace brown, with a lighter square area in thoracic region (Fig. 109), and with long white setae. Sternum lighter. Legs brown. Abdomen brown (the holotype has an injury, a large transverse gash anteriorly), posterior and sides darker gray than anterior (Fig. 109), with some long white setae and indistinct humps visible only from side; venter light. Total length 11.0 mm. Carapace 5.5 mm long, 4.7 wide in thoracic region, 3.1 wide in cephalic region. First femur 4.7 mm, patella and tibia 7.6, metatarsus 5.8, tarsus 1.5. Second patella and tibia 5.2 mm, third 3.0 (from Birabén, 1946), fourth 4.5. Length of first patella and tibia 1.3 times width of carapace.

Males are not known.

Diagnosis. This species is separated from others by being the only setose species without distinct humps (Fig. 109), and by having the slits and the atria in the posterior view of the epigynum ventrally separated (Figs. 112, 113).

Distribution. Known only from Tucumán, Argentina (Map 3C).

Specimens Examined. No other specimens have been collected.

Mastophora corumbatai new species
Figures 114–120; Map 3C

Holotype. Female holotype from Corumbataí, Est. São Paulo [40 km N Rio Claro], Brazil, 15 July 1935 (Syilvio Bariau), in IBSP no. 1203A. The specific name is a noun in apposition after the locality.

Description. Female holotype. Carapace red-brown with white rim (Fig. 116). Chelicerae, labium, endites, sternum, coxae, proximal ends of femora orange. Distal leg articles brown. Abdomen light brown, with colorless butterfly-shaped light area dorsally and pair of large dark, open rings (Fig. 116); venter light brown with white square. Carapace with various sized, droplet-shaped tubercles, sides with long white setae, some curled (Figs. 114, 115). Abdomen without humps, with scattered long, white setae (Fig. 116). Total length 14.0 mm. Carapace 5.6 mm long, 5.5 wide in thoracic region, 3.0 wide at lateral eyes. First femur 5.5 mm, patella and tibia 7.5, metatarsus 4.9, tarsus 1.6. Second patella and tibia 5.3 mm, third 3.2, fourth 4.8. Length of first patella and tibia 1.4 times width of carapace.

Males are not known.

Diagnosis. Mastophora corumbatai is distinguished by carapace tubercles that look like oil droplets (Figs. 114, 115), by lack of humps and distinctive color pattern on abdomen (Fig. 116), and by the epigynum with its posterior median plate projecting, almost scapelike in ventral view (Figs. 118–120).

Distribution. Santa Catarina State, Brazil (Map 3C).

Specimens Examined. No other specimens have been collected.

Mastophora lara new species
Figures 121–127; Map 3A

Holotype. Female holotype from Hato Arriba, 1,400 m, Lara, Venezuela, May 1970 (J. M. Osorio), in FSCA. The specific name is a noun in apposition after the locality.

Note. The type locality Hato Arriba is probably at or near Quebrada Arriba, 1,600 m, 10°14′N, 70°32′W, close to the border with Falcón, Zulia, and Lara, 52 km W Carora.

Description. Female holotype. Carapace dark brown, lighter behind, in center and in area on sides. Chelicerae, labium, endites orange-brown. Sternum orange-brown. Coxae and distal leg articles orange-brown, distally darker. Abdomen gray with anterior dorsal pattern of spots and two large brown discs, each dissected by a lateral light line (Fig. 123); venter light brown with white longitudinal rectangle. Carapace with tubercles and scattered long white setae (Figs. 121, 122). Legs with some long white setae. Abdomen without humps, blunt behind, each side slightly swollen, long white setae on each side anteriorly (Fig. 123). Total length 11.5 mm. Carapace 5.0 mm long, 5.0 wide in thoracic region, 2.7 wide at lateral eyes. First femur 5.2 mm, patella and tibia 6.7, metatarsus 4.5, tarsus 1.3. Second patella and tibia 5.1 mm, third 3.0, fourth 4.5. Length of first patella and tibia 1.3 times width of carapace.

Males are not known.

Diagnosis. Mastophora lara differs by the high almost conical carapace (Figs. 121, 122), by the pattern on the abdomen (Fig. 123), and by the posterior of the epigynum having a pair of depressions (Figs. 125–127).

Distribution. This species is known only from the type locality in west-central Venezuela (Map 3A).

Specimens Examined. No other specimens have been collected.

Mastophora carpogastra Mello-Leitão
Figures 128–134, 451; Map 3B

Mastophora carpogastra Mello-Leitão, 1925: 460. Two female syntypes from Rio de Janeiro, Brazil, in MNRJ, 672, examined. Mello-Leitão, 1931: 72, fig. 3, 15, ♀.

Glyptocranium fagoides Vellard, 1926: 327, figs., ♀, egg sac. Female holotype from Butantan, São Paulo, Brazil, in IBSP, lost. First synonymized with *carpogastra* by Mello-Leitão (1931).

Mastophora carpogastera:—Roewer, 1942: 900.

Glyptocranium carpogastrum:—Bonnet, 1957: 1996.

Mastophora carpogaster:—Platnick, 1993: 447. Platnick, 2001.

Note. Roewer (1942) changed the name *carpogastera* and listed *fagoides* as a synonym of *M. corpulenta* Banks. The name change *carpogaster* of Platnick (1993, 2001) is not needed because previous revisors (Mello-Leitão, 1931; Gertsch, 1955) kept the original spelling.

Description. Female from São Paulo. Carapace reddish brown. Chelicerae, labium, endites brown. Sternum light brown. Legs brown. Abdomen white with symmetrical brownish black patches and less distinct lines dorsally (Fig. 130); venter with a median white square containing eight black spots, sides white with black spots. Carapace glossy above, sides with long white setae, some setae on clypeus (Fig. 129). Legs with long white setae. Abdomen oval with scattered setae and barely visible pair of dorsal tubercles (Fig. 131). Total length 16.5 mm. Carapace 6.4 mm long, 6.0 wide in thoracic region, 3.3 wide behind posterior lateral eyes. First femur 5.3 mm, patella and tibia 7.6, metatarsus 5.7, tarsus 1.6. Second patella and tibia 5.5 mm, third 3.3, fourth 5.2. Length of first patella and tibia 1.3 times width of carapace.

Males are not known.

Variation. Mello-Leitão (1925) described the species as orange to raspberry-red when alive. Total length of females 11.2–18.0 mm. The female holotype of *M. carpogastra* is 20 mm total length. The illustrations were made of specimens from São Paulo.

Diagnosis. The spots and black lines and lack of humps of the abdomen (Fig. 130) distinguish the species from all others. In the cleared epigynum, the atria separate ventrally (Figs. 133, 134).

The egg sac lacks flaps and has a short stalk (Fig. 451).

Natural History. The spider mimics a berry. According to Vellard (1926) the species has a preference for orange trees. It makes three to five egg sacs, each a little sphere with four white spots below the midline, 10 mm in diameter, hanging on a stalk about 3 mm long. The venom is not active (for mammals?). From the collections available, *M. carpogastra* seems locally more common than other *Mastophora* species.

Distribution. Southeastern Brazil, from Rio de Janeiro State to Rio Grande do Sul (Map 3B).

Specimens Examined. BRAZIL Bahra [?Bahia], 1♀ (MNHN 18669). *Rio de Janeiro:* Rio de Janeiro, 2♀ (NHMW); Aug. 1937, 1 imm. (Mello-Leitão, MACN 515). *São Paulo:* Agua da Figueira Maracaí, 9 Feb. 1967, 1♀ (G. Brisolla, IBSP 2064); Barueri, Apr. 1963, 1♀, 5 egg sacs (K. Lenko, MZSP 3069); 16 Mar. 1966, 1 imm. (K. Lenko, MZSP 5265); Diadema, June 1986, 1♀ (R. Snignani, IBSP 4992); Embu, Sept. 1982, 1♀, egg sac (A. L. Prestes, IBSP 3501); Jandira, May 1980, 1♀ (C. Luiz, IBSP 963); Osasco, 25 Mar. 1974, 1♀ (F. Ramirez, IBSP 2721); Pacaembu, Nov. 1942, 1♀ (Braudas, MZSP 357); Perdizes, 26 Aug. 1951, 1♀ (H. Camargo, MZSP 7496); Ribeirão Pires, May 1975, 1♀ (F. B. Lopes, IBSP 3591); Rio Claro, July 1941, 1♀ (P. Pereira, MZSP 4552); 4 May 1942, 1 imm. (Clareteano, MZSP 4402); Sacoma, 7 Sep. 1943, 1♀ (J. Lima, MZSP 4403); São Paulo, July 1921, 1♀ (MZSP 8068); Feb. 1928, 1♀ (J. Lima, MZSP 8070); 31 Jan. 1934, 1♀ (M. Oliveira, IBSP 1920); 26 Feb. 1936, 1♀ (S. Remetente, IBSP 3598); 3 Oct. 1951, 1♀ (R. Vieira, IBSP 586); 17 Mar. 1955, 1♀, 2 egg sacs (J. Navas, IBSP 1176); June 1960, 2♀ (J. London, IBSP 1552); June 1960, 1♀ (L. Zodiygansky, IBSP 1516); 21 Dec. 1960, 1♀ (W. Andrade, IBSP 1618), 10 July 1962, 1♀ (R. R. Guiduglin, IBSP 1775); 21 Dec. 1961, 1♀ (F. V. Boas, IBSP 1620); 18 July 1962, 1♀ (E. Botelho, IBSP 1776); 1 Apr. 1963, 1♀ (Merck Co., IBSP 1834); 2 Aug. 1965, 1♀ (S. Remetente, IBSP 1949); 16 Dec. 1971, 1♀ (E Rafael de Simone, IBSP 309); June 1975, 1♀ (J. S. Gomes, IBSP 3594); Feb. 1976, 1♀ (M. Uchiyama, IBSP 3597); July 1975, 1♀ (G. P. Treu, IBSP 3595); Feb. 1976, 1♀ (E. I. Yamane, IBSP 17789); Feb. 1982, 1♀, egg sac (D. Zammataro, IBSP 3025); 26 Feb. 1982, 1♀, egg sac (M. C. Franco, IBSP 14279); 22 Jan. 1986, 1♀ (E. Steiner, IBSP 8471); 21 Mar. 1986, 1♀ (D. R. Bizzachi, IBSP 14424); 1 Feb. 1991, 1♀ (J. Batista, IBSP 14398); Oct. 1992, 1♀ (C. M. Nerici, IBSP 5827); 7 Oct. 1996, 1♀ (A. Fallatti, IBSP 14192); 11 Aug. 1997, 1♀ (S. M. Carnelho, IBSP 14012); 18 Mar. 1998, 1♀ (A. Pastore, IBSP 16208); Brooklin, Feb. 1962, 1♀ (L. Travassos, MZSP 4347); Hato Museu Paulista, Feb. 1951, 1♀ (C. Rabello, MZSP 6609); Ipiranga, Nov. 1906, Oct. 1912, 2♀ (Ihering, L. M. Torre, MZSP 3047); Mar. 1924 (J. Lima, MZSP 3048); 15 Mar. 1961, 1♀, 5 egg sacs (Almeida and Cautero, MZSP 4359); 4 May 1961, 1♀, 2 egg sacs (N. C. Oliveira, MZSP 4340); 23 Jan. 1984, 1 imm. (C. R. F. Brandão, MZSP 435); Magi das Cruzes, Ranch das Carmelitas, June 1976, 1♀ (C. Torrus, S. Filho, MZSP 11433). *Santa Catarina:* Caçador, 1982, 1♀ (D. Lorenzato, IBSP 3539). *Rio Grande do Sul:* Porto Alegre, 1♀, 1 egg sac (P. Buck, MNRJ 1831); 7 July 1986, 1♀ (S. Oresco, MCN 15236); S. Leopoldo, 24 May 1964, 1♀ (C. Valle, MZSP 4233); 14 Oct. 1965, 1♀ (C. Valle, MZSP 5422).

Mastophora seminole new species
Figures 135–141; Map 2G

Holotype. Female holotype from Hollendale, Broward Co., Florida, 11 June 1987 (W. Birch), in FSCA. The specific name is a noun in apposition after the name of the local Indian tribe.

Description. Female holotype. Carapace olive-brown. Chelicerae, labium, endites olive-brown. Sternum orange-olive. Coxae and distal leg articles olive, distally darkest. Abdomen anteriorly gray, posteriorly light gray with dark pattern on each side (Fig.

137); in anterior view, dark area forming a triangle as wide as humps above, pointed to carapace below, each side white. Venter olive gray with white longitudinal rectangle. Carapace glossy and with tubercles (Figs. 135, 136). Abdomen with a pair of dorsal humps and triangular (Figs. 137, 138). Total length 11.6 mm. Carapace 4.4 mm long, 4.3 wide in thoracic region, 2.7 wide at posterior lateral eyes. First femur 3.8 mm, patella and tibia 5.2, metatarsus 3.7, tarsus 1.2. Second patella and tibia 3.8 mm, third 2.2, fourth 3.3. Length of first patella and tibia 1.2 times width of carapace.

Males are not known.

Diagnosis. Mastophora seminole has a humped, somewhat triangular abdomen (Figs. 137); the epigynum is as in the humpless *M. yeargani,* with the slits dorsally at some distance from the ventral borders of large shallow depressions (Figs. 140, 141).

Distribution. Southern Florida (Map 2G).

Specimens Examined. No other specimens have been collected.

Mastophora vaquera Gertsch
Figures 142–152, 452; Map 2G

Mastophora vaquera Gertsch, 1955: 240: figs. 15–18, ♀. Female holotype from Torriente, Matanzas, Cuba, in AMNH, examined. Brignoli, 1983: 274. Platnick, 2001.

Description. Female holotype. Carapace orange-brown, bald dorsally with some white setae on sides. Sternum, legs orange-brown. Median eyes on bulge, lateral eyes on bulges. Abdomen light orange-brown with darker area anteriorly between swellings (Fig. 145); venter with white square. Abdomen with humps and an anterior, lateral swelling on each side (Figs. 145, 146). First femur with distal, anteriorly small tubercles (Fig. 144). Total length 10.5 mm. Carapace 3.6 mm long, 3.5 wide in thoracic region, 2.3 wide at lateral eyes. First femur 3.2 mm, patella and tibia 4.7, metatarsus 3.2, tarsus 1.1. Second patella and tibia 3.4 mm, third 2.0, fourth 3.1. Length of first patella and tibia 1.3 times width of carapace.

Males are not known.

Variation. Total length of females 8.5–10.5 mm. The tubercles on the femur of the Cuabitas specimens are smaller, less distinct. Although the shape of the abdomen and their coloration are similar, the epigyna of the two specimens differ (Figs. 147–152). The illustrations (Figs. 142–149) were made from the female holotype.

Diagnosis. Mastophora vaquera is distinguished from others by the shape of the abdomen, humps, and two pairs of swellings, and by the dorsal oval depressions of the opening slits on the posterior of the epigynum (Figs. 148, 151).

The egg sac has only minute flaps (Fig. 452).

Distribution. Cuba (Map 2G).

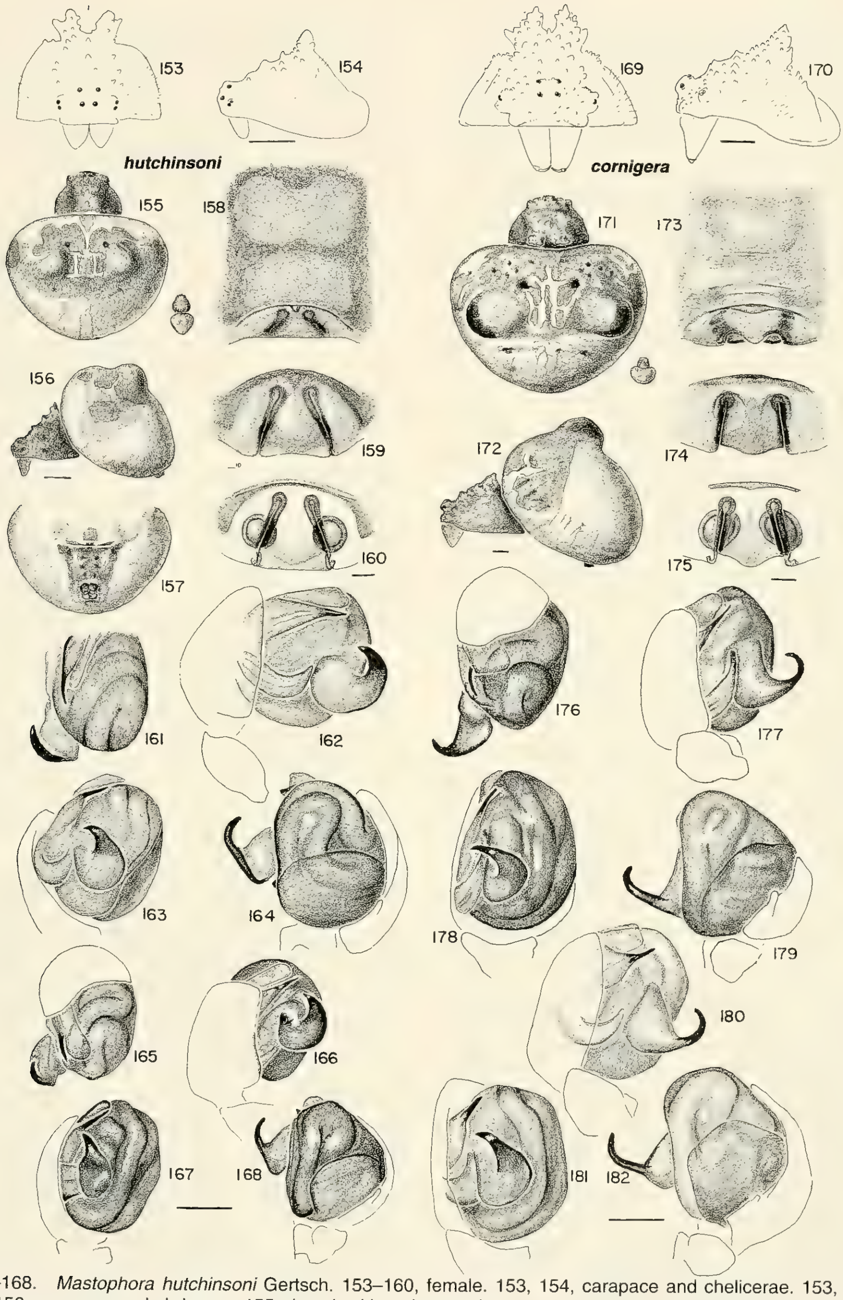
Specimens Examined. CUBA *Santiago:* Cuabitas, Oriente [20°04′N, 75°48′W], 20 Aug. 1949, 1♀ (AMNH). *Holquin:* Bañes, 1–3 Aug. 1955, egg sac (A. F. Archer, AMNH).

Mastophora hutchinsoni Gertsch
Figures 153–168, 453, 454; Map 2E

Cyrtarachne cornigera:—McCook, 1890: 98, 99, fig. 81, egg sacs. Kaston, 1948: 231, figs. 741, 742, 2039 (misidentification).

Mastophora hutchinsoni Gertsch, 1955: 236, pl. 6, fig. 3, text figs. 10–14, 39, 47, 48, ♀, ♂. Female holotype, from Somers [Westchester Co.], New York State, in AMNH, not examined. Brignoli, 1983: 273. Yeargan, 1988: 524. Gemeno et al., 2000: 1235. Haynes et al., 1996: 76. Platnick, 2001.

Description. Female from Virginia. Carapace brown, sides and posterior much darker than median and cephalic region, short setae on sides and no rim. Abdomen with transverse black band with characteristic light lines (Fig. 155); venter black including behind spinnerets and anterior of pedicel, with four white spots on each side between epigynum and spinnerets (Figs. 157). Abdomen with two humps (Figs. 155, 156). Total length 7.3 mm. Carapace 3.3 mm long, 2.7 wide in thoracic region, 2.3 wide at lateral eyes. First femur 2.5 mm, patella and tibia 3.6, metatarsus 2.8, tarsus 0.8. Second patella and tibia 2.7



Figures 153–168. *Mastophora hutchinsoni* Gertsch. 153–160, female. 153, 154, carapace and chelicerae. 153, frontal. 154, lateral. 155, 156, carapace and abdomen. 155, dorsal, with male. 156, lateral. 157, abdomen, ventral. 158–160, epigynum. 158, ventral. 159, posterior. 160, posterior, cleared. 161–168, male left palpus, stained. 161–164, (New Hampshire). 165–168, (Kentucky). 161, 165, apical. 162, 166, mesal. 163, 167, ventral. 164, 168, ectal.

Figures 169–182. *M. cornigera* (Hentz). 169–175, female. 169, 170, carapace and chelicerae. 169, frontal. 170, lateral. 171, 172, carapace and abdomen. 171, dorsal, with male. 172, lateral. 173–175, epigynum. 173, ventral. 174, posterior. 175, posterior, cleared. 176–182, male left palpus, stained. 176–179, (California). 180–182, (Texas). 176, apical. 177, 180, mesal. 178, 181, ventral. 179, 182, ectal.

Scale lines. 1.0 mm; genitalia, 0.1 mm.

mm, third 1.6, fourth 2.4. Length of first patella and tibia 1.3 times width of carapace.

Male from New Hampshire. Prosoma beige with two median tubercles and forks. Abdomen whitish with paired humps. Total length 1.7 mm. Carapace 0.86 mm long, 0.71 wide in thoracic region, 0.53 wide at lateral eyes. First femur 0.80 mm, patella and tibia 0.91, metatarsus 0.41, tarsus 0.27. Second patella and tibia 0.80 mm, third 0.42, fourth 0.63. Length of first patella and tibia 1.3 times the width of carapace.

Note. The male was matched with females because of its northerly collecting site. They have also been collected at sites for females in Kentucky and South Carolina.

Variation. Total length of females 6.2–10.4 mm. The males may lack humps. The illustrations were made from a female from Rhode Island, the male from southern New Hampshire, and a male from Kentucky.

Diagnosis. The humps of the abdomen (Fig. 155) and the black median coloration of the venter, sometimes containing two longitudinal white patches (Fig. 157), separate the species from *M. bisaccata.* Unlike *M. cornigera,* which has humps, the slits on the posterior of the epigynum approach each other ventrally (Figs. 158, 160), as they do in *M. bisaccata.*

The palpus (Figs. 161–168) is similar to that of *M. bisaccata* (Figs. 59–62), with a narrow space surrounded by the median apophysis in ectal view (Figs. 164, 168) but differs in the shape of the round base of the median apophysis (Figs. 162, 166).

The egg sacs are unique compared with those of other species. They are attached by the broad base with the funnel facing away from the attachment (Figs. 153, 154).

Natural History. In Ohio, females were found in a house yard on a variety of low branches of a variety of trees, including crab apple, redbud, hawthorn, burr oak (R. Bradley, in letter). Spiders were collected primarily from hackberry (*Celtis occidentalis* L.) and wild cherry (*Prunus serotina* Ehrgard) in Kentucky (Yeargan, 1988), on an abandoned apple tree in Virginia, in a peach orchard in South Carolina, and in an apple orchard in Illinois. Prey caught in Kentucky were reported by Yeargan and Quate (1996).

Although the egg sacs look like hazelnuts or a small broken branch, the species may be found by searching for the egg sacs in autumn and winter after the leaves have fallen.

Distribution. Northeastern United States from New Hampshire and South Carolina to Minnesota (Map 2E).

Specimens Examined. NEW HAMPSHIRE *Hillsborough Co.:* Ponemah [in Amherst], Aug. 1912, 1♂ (E. B. Bryant, MCZ). MASSACHUSETTS 1♀ (Sanborn, MCZ). *Middlesex Co.:* Pepperell, 15 July 1978, 1 imm. ♂, 1.5 mm (F. J. Murphy, JM). RHODE ISLAND Providence, 1♀ (N. Banks, MCZ). CONNECTICUT *Hartford Co.:* Rocky Hill, 23 Oct. 1940, 1♀ (A. Morgan, USNM). NEW JERSEY *Burlington Co.:* Riverton, Sept. 1926, 2 imm., 1♂ (R. J. Sim, OSU). *Hunterdon Co.:* White House Station, Sept. 1917, 1♀ (J. J. Brochon, USNM). *Morris Co.:* Dover, 8 Dec. 1950, egg sacs (USNM). OHIO *Delaware Co.:* 5 km W of Delaware Dam, 40.37°N, 83.10°W, Oct. 2001, 2♀, egg sacs (R. Bradley, OSU). DISTRICT OF COLOMBIA Washington, yard, 18 Oct. 1920, 1♀ (USNM). VIRGINIA Falls Church, 5♀, 2 imm. (N. Banks, MCZ). *Augusta Co.:* Augusta, 14 June 1976, 1♂; 6 Oct. 1976, 1♀ (J. P. McCaffrey, CNC). SOUTH CAROLINA *Anderson Co.:* Simpson Agric. Exp. Station, 10 July 1978, 1♂; 13 Aug. 1979, 1♀; 19 Sep. 1978, 1♀ (G. Lee, CUAC). KENTUCKY *Fayette Co.:* Lexington, 7 Sep. 1990, 1♀ (K. V. Yeargan, MCZ); 20 Sep. 1990, 1♀ (K. V. Yeargan, KVY); 2 Oct. 1999, 1♀ (K. V. Yeargan, MCZ). *Clark Co.:* Feb. 1996, egg sac, 4♂ (K. V. Yeargan, KVY). TENNESSEE Ashburn, 30 mi. N. Nashville, 17 July 1933, 1♂ (W. Ivie, AMNH). MICHIGAN *Livingston Co.:* E. S. George Reserve, 22 July 1951, 1 imm. (H. K. Wallace, FSCA). INDIANA *Putnam Co.:* Greencastle, 1♀ (N. Banks, MCZ). ILLINOIS *Champaign Co.:* Univ. Illinois apple orchard, Sept. 1993, 1♀ (S. D. Gaimari, INHS). *Jackson Co.:* 8 km S Carbondale on avocado plant, Oct. 1976, 1♀ (JAB). MINNESOTA *Hennepin Co.:* Minneapolis, 1 Nov. 1931, 1♀ (W. J. Gertsch, AMNH).

Mastophora cornigera (Hentz)
Figures 169–182, 455; Map 2G

Epeira cornigera Hentz, 1850: 20, pl. 3, fig. 8, ♀. Immature female holotype from Alabama, destroyed. Hentz, 1875: 123, pl. 14, fig. 8, ♀.

Cyrtarachne bicurvata Becker, 1879: 77, pl. 2, figs. 16–19, ♀. Female holotype from peach tree, Donaldsonville, Louisiana, in IRSNB, examined. First synonymized by Marx (1890).
Cyrtarachne cornigera:—Keyserling, 1880: 300, pl. 4, fig. 4, ♀. McCook, 1890: 98, fig. 80 (in part).
Ordgarius cornigerus:—Marx, 1890: 541. McCook, 1894: 197, pl. 12, fig. 1, ♀.
Glyptocranium cornigerum:—Simon, 1895: 882, 885. Bonnet, 1957: 1996.
Mastophora cornigera:—Mello-Leitão, 1931: 70, figs. 9, 20. Gertsch, 1955: 233, pl. 6, fig. 2, text figs. 1–5, 37, 41, 42, ♀, ♂. Platnick, 1997: 513. Platnick, 2001.

Description. Female from Alabama. Carapace evenly colored orange. Chelicerae, endites, labium orange. Sternum orange. Legs orange, darker above. Abdomen with black caps on humps, anterior gray with light lines, posterior light (Fig. 171); venter with a white square. Carapace granular with many small tubercles and dark spots on sides (Figs. 169, 170). Abdomen with pair of humps (Fig. 171). Total length 12.0 mm. Carapace 5.6 mm long, 4.6 wide in thoracic region, 3.0 wide at lateral eyes. First femur 4.2 mm, patella and tibia 6.0, metatarsus 4.0, tarsus 1.2. Second patella and tibia 4.7 mm, third 2.6, fourth 4.3. Length of first patella and tibia 1.3 times width of carapace.

Male from California. Carapace beige with median dorsal white band including median horns, no tubercles. Sternum, legs golden yellow. Abdomen white, anteriorly dusky; venter dark yellow. Carapace granulate. Total length 1.7 mm. Carapace 0.88 mm long, 0.79 wide in thoracic region, 0.52 wide behind posterior lateral eyes. First femur 0.66 mm, patella and tibia 0.79, metatarsus 0.40, tarsus 0.28. Second patella and tibia 0.68 mm, third 0.41, fourth 0.54. Length of first patella and tibia 1.1 times width of carapace.

Note. Males came from California, an area from which only one species of *Mastophora, M. cornigera,* is known.

Variation. Total length of females 8.8–14.0 mm, males 1.6–1.7. The illustrations were made from the female from Alabama (Figs. 169–175) and males from California (Figs. 176–179) and Texas (Figs. 180–182). Adult males may lack humps.

Diagnosis. Unlike most other North American species, *M. cornigera* has distinct humps on the abdomen, often with a black cap or slightly sclerotized (Fig. 173), and the epigynum differs from that of *M. hutchinsoni* (Figs. 159, 160) by having almost parallel slits, only slightly converging ventrally, on the posterior face of the epigynum (Figs. 174, 175), and by lacking the lip surrounding the slits as in *M. archeri* (Fig. 188).

The male differs from other North American species by having the space within the curl of the median apophysis in ectal view wider than long (Figs. 179, 182), and from *M. yeargani* by the base of the embolus, which, in mesal view, is longer than wide (Figs. 177, 180).

The egg sac has small flaps or none and a relatively wide stalk (Fig. 455).

Natural History. Unlike other North American species, *M. cornigera* is active in California all year. Also, unlike other North American species, the males emerge from the egg sac as mature individuals. This species was found on cycad leaf in full sun in San Diego, and on *Jatropha curcas* euphorbia in Nicaragua.

Distribution. From Kentucky and Tennesse west to California and south to Central America (Map 2G).

Specimens Examined. KENTUCKY *Fayette Co.:* Univ. Kentucky Maine Chance farm, Sept. 1996, 1♀ (K. V. Yeargan, KVY). TENNESSEE Ashburn, 30 mi. N Nashville, 17 July 1933, 1♀ (W. Ivie, AMNH). ALABAMA *Mobile Co.:* Mobile, 1♀ (N. Banks, MCZ); 1932, 1♀ (H. P. Loding, MCZ). LOUISIANA *East Baton Rouge Par.:* Baton Rouge, Apr. 1916, 1♀ (Newell, MCZ). *Orleans Par.:* New Orleans, 1918, 1♀ (H. E. Hubert, USNM); 1 Oct. 1935, 1♀ (T. E. Snyder, MCZ); 26 Sep. 1936, 1♀ (J. N. Cowanloch, USNM). TEXAS *Travis Co.:* Shellberg Tract, 30°25′N, 97°52′W, 18–19 Apr. 1994, 3♂ (Dunlap et al., TAMU). *Galveston Co.:* Texas City, 1921?, 2♀ (S. W. Bilsing, MCZ). *San Patricio Co.:* Welder Wildlife Refuge, 11.8 km NE Sinton, 17 Oct. 1967, 1♂ (C. Parrish, CAS). *Hidalgo Co.:* Edinburg, Oct. 1934, 3♀, 1♂; 1935, 1♀ (S. Mulaik, AMNH); 7 Dec. 1935, 1♂ (M. Welch, AMNH), 2 imm., 1♂ (S. Mulaik, AMNH); 18 km SE Pharr, Santa Ana Wildlife Refuge, 1 Oct. 1977, 1♀ (O. Ahrenholtz, AMNH); 20

Dec. 1983, 1♀ (M. K. Stowe, MKS); 27 June 1984, 1♀ (M. K. Stowe, MKS); Mercedes, 10 Apr. 1986, egg sac, 70 imm., 59♂ (D. A. Dean, TAMU). *Cameron Co.:* Brownsville, 9 Apr. 1986, hatched 2 June 1986, 1 egg sac, 64 imm., 62♂ (D. A. Dean, TAMU); Harlingen, Feb. 1980, 1♀, 64 imm., 63♂ (C. W. Agnew et al., TAMU); E of Harlingen, 3 Jan. 1936, 1♀ (L. I. Davis, M. Stegmeier, AMNH). ARIZONA *Maricopa Co.:* Phoenix, Apr. 1941, 1♀ (AMNH). CALIFORNIA *Contra Costa Co.:* Walnut Creek, Sydney Drive, July 1992, 1♀, 1♂ (T. Trosin, J. Fraser, CAS). *Santa Clara Co.:* Palo Alto, 1914, 1♀ (H. Heath, MCZ). *Santa Barbara Co.:* Santa Barbara, 5 Oct. 1948, 1♀ (H. Shantz, AMNH). *Los Angeles Co.:* Claremont, 1♀ (N. Banks, MCZ); Glendale, 1♀, many ♂ (C. E. Hutchinson, AMNH, MCZ); Los Angeles, 1♀ (MNHN, 3059); 10 Oct. 1942, 5♂ (J. H. Branch, AMNH); East Los Angeles, 1943, 1♀ (C. Cowles, AMNH); Malibu, Nov. 1968, 1♀, 3 egg sacs (USNM); Westwood Village, Aug.–Oct. 1942, 1♀ (P. Verrity et al., FSCA). *Orange Co.:* Santa Ana, 4♂ (R. K. Bishop, USNM); San Juan Capistrano, 25 Sept. 1952, 1♀, 7 egg sacs (R. E. Ryckman, AMNH). *San Bernardino Co.:* San Bernardino, 1880, 1♀ (J. B. Parish, MCZ). *San Diego Co.:* San Diego, 2♀ (USNM), 4 Oct. 1974, 1♀ (D. Bishop, USNM); San Diego, Vista, 8 June 1989, 1 imm. (J. W. Schott, MCZ); Chula Vista, 5 Dec. 1981, 1♀ (H. V. Weems, FSDA); 10 mi. NE Ramona, 22 July 1982, 1♀ (J. Halstead, DU); Lakeside, 1♀ (C. Kingery, USNM); Feb. May 1968, egg sacs, ♂♂ (C. Kingery, USNM). MEXICO *Baja California Sur:* 44 km W La Paz, 0.2 km S km 44, on Highway 1, 31 Dec. 1978, 1♀ (D. Weissman, R. Love et al., CAS). NICARAGUA *Managua:* Mateare, 12 Sep. 1995, 1♀ (C. Grimm, M. Maes, MCZ).

Mastophora archeri Gertsch
Figures 183–193, 456; Map 2E

Mastophora archeri Gertsch, 1955: 239: figs. 6–9, 36, 45, 46, ♀, ♂. Female holotype from Fruitland Park, Florida, in AMNH, examined. Brignoli, 1983: 273. Platnick, 2001.

Description. Female holotype. Carapace orange-brown. Sternum dark orange. Legs orange-brown, indistinctly ringed. Abdomen anteriorly gray, posteriorly white; venter with white square. Carapace with short tubercles (Figs. 183, 184). Median eyes on bulge, lateral eyes on bulges. Abdomen with small humps (Fig. 185). Total length 11.5 mm. Carapace 4.2 mm long, 4.3 wide in thoracic region, 2.7 wide at lateral eyes. First femur 3.8 mm, patella and tibia 5.6, [metatarsus 3.5, tarsus 1.5, after Gertsch, 1955]. Second patella and tibia 4.1 mm, third 2.3, fourth 3.7. Length of first patella and tibia 1.3 times width of carapace.

Male allotype. Carapace orange, darkest on sides, a median white line and median of forked tubercles white. Sternum orange. Legs orange. Abdomen orange-white without marks. Carapace with two small asymmetrical tubercles in addition to forked tubercles. Abdomen with indistinct humps. Total length 1.7 mm. Carapace 0.86 mm long, 0.78 wide in thoracic region, 0.53 wide at lateral eyes. First femur 0.79 mm, patella and tibia 0.87, metatarsus 0.44, tarsus 0.33. Second patella and tibia 0.74 mm, third 0.54, fourth 0.71. Length of first patella and tibia 1.1 times width of carapace.

Note. A male from Gainesville, Florida, was raised from the egg sac. The match of the male allotype is uncertain.

Variation. Total length of females 9.4–14.8 mm. The illustrations were made from the female holotype (Figs. 183–189) and the raised male from Gainesville (Figs. 190–193).

Diagnosis. Mastophora archeri is distinguished from *M. cornigera* by the smaller tubercles on the carapace (Figs. 183, 184) and left and right lip on the posterior of the epigynum (Figs. 188, 189), and from *M. hutchinsoni* by having a white square on the venter and by the sculpturing of the epigynum.

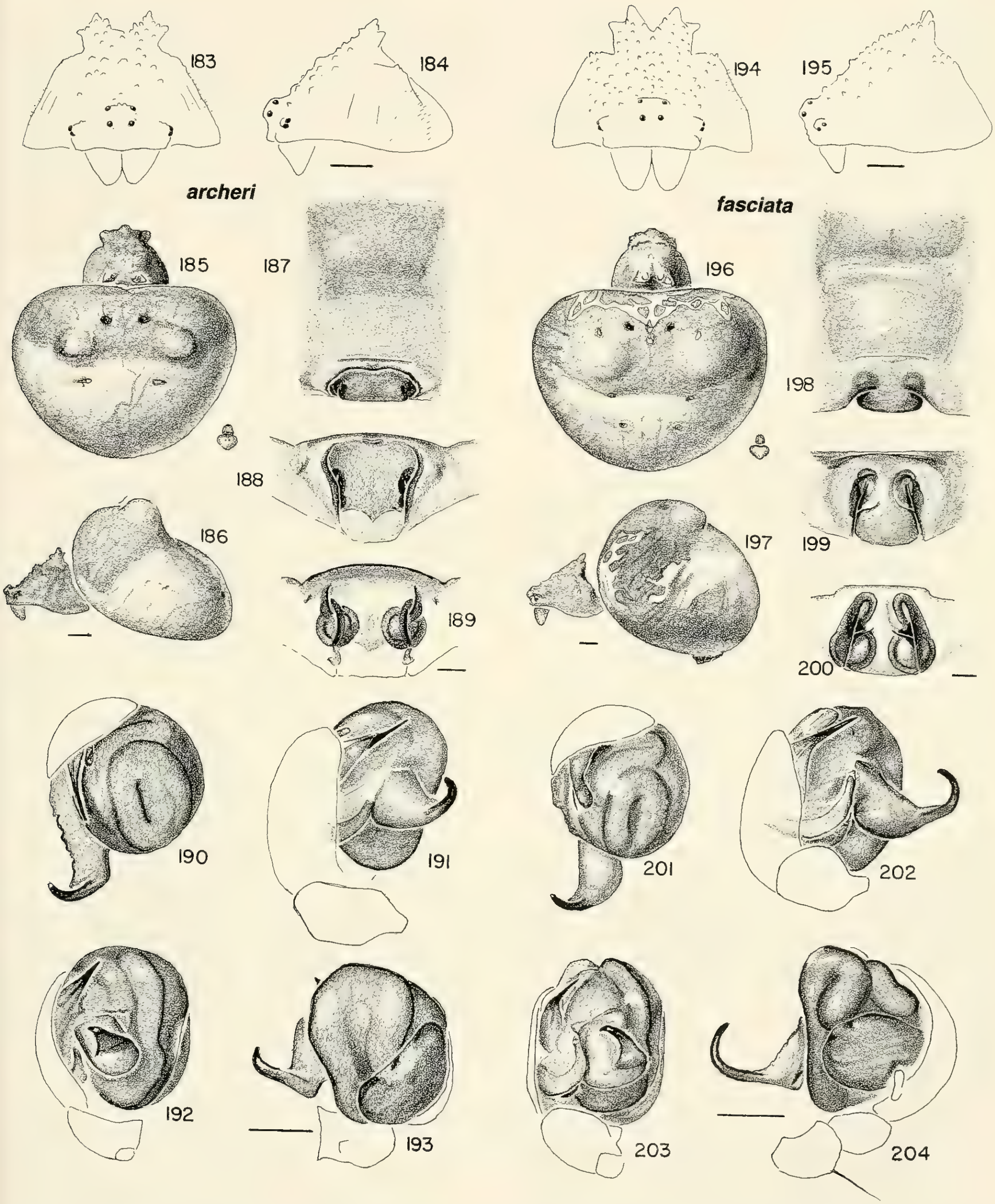
The palpus of the male has the space surrounded by the median apophysis wider than long (Fig. 193) and differs from *M. phrynosoma* and *M. hutchinsoni* by having only a minute terminal apophysis (Figs. 190, 191). It differs from *M. phrynosoma* by the narrow radix (Fig. 191).

The egg sac has small flaps and a relatively long stalk of median thickness (Fig. 456).

Natural History. Collected from *Myrica* in hammock woods in Alabama.

Distribution. Southern United States from South Carolina, Florida, and Alabama to Kansas (Map 2E).

Paratypes. ALABAMA *Baldwin Co.:* Lagoon, 29



Figures 183–193. *Mastophora archeri* Gertsch. 183–189, female. 183, 184, carapace and chelicerae. 183, frontal. 184, lateral. 185, 186, carapace and abdomen. 185, dorsal, with male. 186, lateral. 187–189, epigynum. 187, ventral. 188, posterior. 189, posterior, cleared. 190–193, male left palpus, stained. 190, apical. 191, mesal. 192, ventral. 193, ectal.

Figures 194–204. *M. fasciata* Reimoser. 194–200, female. 194, 195, carapace and chelicerae. 194, frontal. 195, lateral. 196, 197, carapace and abdomen. 196, dorsal, with male. 197, lateral. 198–200, epigynum. 198, ventral. 199, posterior. 200, posterior, cleared. 201–204, male left palpus, stained. 201, apical. 202, mesal. 203, ventral. 204, ectal.

Scale lines. 1.0 mm; genitalia, 0.1 mm.

Sep. 1949, 1♂ allotype (A. F. Archer). KANSAS *Douglas Co.:* 22 Sept. 1948, 1♀ (R. H. Beaner, AMNH).

Specimens Examined. SOUTH CAROLINA Charleston, Oct. 1941, 1♀ (E. B. Chamberlain, USNM). FLORIDA *Alachua Co.:* Devil's Millhopper State Park, reared spring 1992, 4♂ (M. K. Stowe, MKS). *Hillsborough Co.:* Thonotosassa, 11 Dec. 1969, 1♀ (D. A. Vaughn, FSCA). ALABAMA *Mobile Co.:* Mobile, 12 Nov. 1939, 1♀ (A. C. Cole, AMNH); Mt. Vernon, Oct. 1941, 1♀ (H. P. Löding, AMNH).

Mastophora fasciata Reimoser
Plate 1; Figures 194–204, 457; Maps 2F, 3A

Mastophora fasciata Reimoser, 1940: 356, fig. 8, ♀. Female holotype, from Orosi, Prov. Cartago, central plain [12 km SE Cartago], Costa Rica, in NMW, examined. Roewer, 1942: 900. Platnick, 2001.

Mastophora pickeli occidentalis Schenkel, 1953: 29. Female holotype from Pozón [Falcón], Venezuela, in NMB, examined. Brignoli, 1983: 274. Platnick, 2001.

Note. Mastophora p. occidentalis has the same small lobe on the posterior margin of the epigynum, and the same shadows on the posterior face as in *M. fasciata.* They also share the very broad humps of the abdomen and the posterior light band.

Description. Female from Costa Rica. Carapace light orange-brown. Sternum brown. Legs lighter brown. Abdomen white with black and gray marks (Fig. 196); venter light brown, center barely lighter than sides. (Reimoser described a posterior, transverse, yellow-red band, which has disappeared from the holotype, but is light in other specimens.) Humps broad (Fig. 196). Holotype total length 11.5 mm. Carapace 4.7 mm long, 5.0 wide in thoracic region, 3.0 wide at lateral eyes. First femur 4.3 mm, patella and tibia 6.3, metatarsus 4.4, tarsus 1.2. Second patella and tibia 4.6 mm, third 2.7, fourth 4.0. Length of first patella and tibia 1.3 times width of carapace.

Male from Costa Rica. Carapace yellow-brown with white, central mark covering median tubercles. Legs light yellow-brown. Abdomen dorsally white, ventrally yellow-brown. Eyes without pigment. Carapace rugose with posterior median forked tubercles. Abdomen subtriangular without humps. Palpal patella with one macroseta. Total length 1.6 mm. Carapace 0.74 mm long, 0.65 wide in thoracic region, 0.46 wide behind posterior lateral eyes. First femur 0.55 mm, patella and tibia 0.65, metatarsus 0.35, tarsus 0.26. Second patella and tibia 0.59 mm, third 0.28, fourth 0.48. First patella and tibia as long as width of carapace.

Note. Males were collected with females at San Antonio de Escazú.

Variation. Total length of females 11.5–14.5 mm. Both males and shriveled females have a triangular abdomen, whereas that of a well-fed female is more rounded. The illustrations were made from the female holotype (Figs. 194–200) with a specimen from Puntarenas Province, Costa Rica.

Diagnosis. The female is distinguished from other species by the many small carapace tubercles (Figs. 194, 195), by the broad humps of the abdomen (Fig. 196), and by the ventrally converging slits of the epigynum (Figs. 199, 200).

The male has a median apophysis that is longer than that of other species (Figs. 202, 204) and more rounded than that of *M. leucabulba* (Figs. 293, 295) and *M. alvareztoroi* (Fig. 306, 307). The median apophysis is almost as long as the diameter of the bulb (Fig. 204).

The egg sac lacks flaps (Fig. 457).

Natural History. Males are mature when they leave the egg sac.

Distribution. The species is known from Costa Rica and Venezuela (Maps 2F, 3A).

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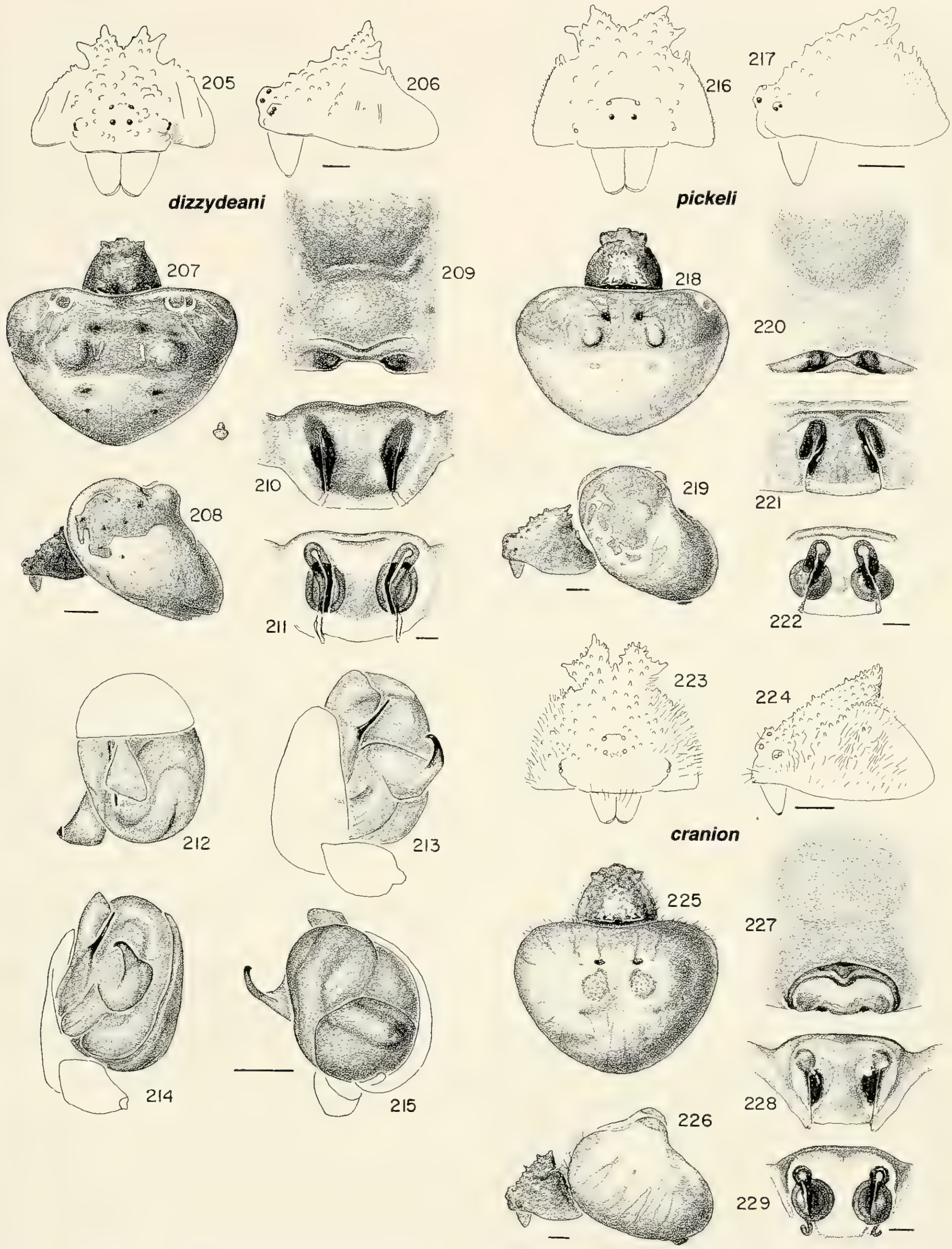
Figures 205–215. *Mastophora dizzydeani* Eberhard. 205–211, female. 205, 206, carapace and chelicerae. 205, frontal. 206, lateral. 207, 208, carapace and abdomen. 207, dorsal, with male. 208, lateral. 209–211, epigynum. 209, ventral. 210, posterior. 211, posterior, cleared. 212–215, male left palpus, stained. 212, apical. 213, mesal. 214, ventral. 215, ectal.



Figures 216–222. *M. pickeli* Mello-Leitão, female. 216, 217, carapace and chelicerae. 216, frontal, 217, lateral. 218, 219, carapace and abdomen. 218, dorsal. 219, lateral. 220–222, epigynum. 220, ventral. 221, posterior. 222, posterior, cleared.

Figures 223–229. *M. cranion* Mello-Leitão, female. 223, 224, carapace and chelicerae. 223, frontal. 224, lateral. 225, 226, carapace and abdomen. 225, dorsal. 226, lateral. 227–229, epigynum. 227, ventral. 228, posterior. 229, posterior, cleared.

Scale lines. 1.0 mm; genitalia, 0.1 mm.

Specimens Examined. COSTA RICA *San José:* San José, 1♀ (Tristan, MCZ); San Antonio de Escazú, 1,350 m, May 1980, 1♀ (W. Eberhard S31, MCZ); 7 Sept. 1980, imm., ♀, many ♂ (W. Eberhard SJ1–26, MCZ); 11 Oct. 1980, 1♀ (W. Eberhard S31, MCZ). *Puntarenas:* Parrita, 30 m, 12 Jan. 1987, 3♀, 2♂ (W. Eberhard FN9–40ff, MCZ).

Mastophora dizzydeani Eberhard
Figures 205–215; Map 3A

Mastophora dizzydeani Eberhard, 1981: 144, figs. 1–9, ♀, ♂. Female holotype from field of Melendez campus of the Universidad del Valle on the southern edge of Cali, Colombia, in MCZ, examined. Platnick, 1989: 340. Platnick, 2001.

Description. Female holotype. Carapace dark brown. Sternum orange-brown. Legs brown. Abdomen white anteriorly, dorsally with transverse gray band, posteriorly dusky white (Figs. 207, 208); venter with a median white square. Carapace heavily sclerotized, grooves on sides, many tubercles flat and wide (Figs. 205, 206). Abdomen subtriangular with pair of dorsal humps (Fig. 207). Total length 13.3 mm. Carapace 5.7 mm long, 5.3 wide in thoracic region, 3.3 wide at lateral eyes. First femur 4.8 mm, patella and tibia 6.7, metatarsus 4.7, tarsus 1.5. Second patella and tibia 5.0 mm, third 2.8, fourth 4.4. Length of first patella and tibia 1.2 times width of carapace.

Male allotype from eastern edge of Lago Calima. Yellowish white with longitudinal white thoracic mark, and dorsum of abdomen white with a couple of indistinct gray patches anteriorly. Height of clypeus about 1.3 diameters of anterior median eye. Abdomen with a pair of humps. Palpal patella with one weak macroseta. Total length 1.6 mm. Carapace 0.75 mm long, 0.74 wide in thoracic region, 0.55 wide at lateral eyes. First femur 0.71 mm, patella and tibia 0.72, metatarsus 0.41, tarsus 0.26. Second patella and tibia 0.65 mm, third 0.36, fourth 0.51. Length of first patella and tibia about same length as width of carapace.

Note. Males and females have been collected together at Cali, Colombia.

Variation. Total length of females 10.8–13.3 mm. The illustrations were made from specimens from Cali.

Diagnosis. Females are distinguished by the wide heart-shaped abdomen with two humps (Fig. 207) and the distinctly shaped dark marks around the slits on the posterior of the epigynum (Fig. 210). The atria separate from each other ventrally (Fig. 211).

Males have a smaller median apophysis (Fig. 213) than that of *M. fasciata,* in ectal view surrounding a rounded space (Fig. 215).

Natural History. The spiders rest on exposed sites: on the barb of a barbed wire, fence posts, and upper surface of leaves. Specimens also were collected on a guayoba tree in a yard and in sugar cane areas. Moths caught include *Spodoptera frugiperda* (a sugar cane pest) and *Leucania* sp. (Eberhard, 1977, 1981).

Distribution. Colombia to northern Peru (Map 3A).

Specimens Examined. COLOMBIA *Valle:* S of Cali, on plants, 6 June 1948, 1♀ (E. M. Poulsen, ZMUC); nr. Cali, Jan. 1977, imm. ♀ (W. Eberhard, MCZ); Aug. 1977, 1♀, 4♂ (W. Eberhard, MCZ); Lago Calima, 1,400 m, 19 Nov. 1977, 1♀ (W. Eberhard EG 3–20, MCZ); Río Tulua, 1,100 m, Aug. 1977, 2♂ (W. Eberhard, MCZ). PERU *Piura:* Mallagra, Río Chira, 8 June 1941, 2♀, imm. (D. L. Frizzell and H. E. Frizzell, AMNH, CAS).

Mastophora pickeli Mello-Leitão
Figures 216–222; Map 3D

Mastophora pickeli Mello-Leitão, 1931: 73, figs. 6, 18, 24, 25, ♀. Female holotype from Tapera, Pernambuco, Brazil, in MNRJ, 395, examined. The specific name is a noun in apposition after the locality. Roewer, 1942: 901. Platnick, 2001.
Glyptocranium pickeli:—Bonnet, 1957: 1998.

Note. Vanzolini and Papavero (1968) listed three localities with the name Tapero in Pernambuco. I assume this locality is the only one also listed in the *Index to Map of Hispanic America* (American Geographical Society of New York, 1944), a railroad station, west of Recife.

Description. Female holotype. Carapace, chelicerae, labium, endites, brown. Sternum patchy orange-brown. Coxae and distal leg articles brown. Abdomen black anteriorly enclosing white streaks, white posteriorly (Fig. 218); ventrally with indistinct white square on gray. Carapace with shallow tubercles, glossy, with short setae on sides (Figs. 216, 217). Abdomen without setae, with a pair of wide humps bearing distinct smaller humps dorsally (Figs. 218, 219) and slight swellings on side (Fig. 219). Total length 9.5 mm. Carapace 4.4 mm long, 3.7 wide in thoracic region, 2.4 wide at lateral eyes. First femur 3.4 mm, patella and tibia 4.8, metatarsus 3.3, tarsus 0.9. Second patella and tibia 3.4 mm, third 2.0, fourth 3.2. Length of first patella and tibia 1.1 times width of carapace.

Males are not known.

Diagnosis. This species is distinguished by distinct small humps on a larger swelling of the abdomen (Figs. 218, 219) and the epigynum with atria approaching each other (Figs. 221, 222). It differs from *M. ypiranga,* which has a similar epigynum, by having the carapace, viewed from anterior, wider and more swollen, the anterior median eyes facing slightly laterally and ventrally, and the forked tubercles laid back, with their tips facing posteriorly (Fig. 217).

Distribution. Known only from the type locality (Map 3D).

Specimens Examined. No other specimens have been found.

Mastophora cranion Mello-Leitão
Figures 223–229; Map 3D

Mastophora cranion Mello-Leitão, 1928: 49, pl. 1, ♀. Female holotype from Tapera, Est. Pernambuco, Brazil, in MNRJ no. 00394, examined. Mello-Leitão, 1931: 72, figs. 2, 14, ♀. Roewer, 1942: 955. Platnick, 2001.
Glyprocranium cranion:—Bonnet, 1957: 1997.

Note. For locality information, see note under *M. pickeli.*

Description. Female holotype. Carapace orange-brown, black pigment between anterior median eyes. Chelicerae, labium, endites brown. Sternum uneven white and brown. Coxae and distal leg articles light brown. Abdomen white with a pair of dorsal dark spots, each consisting of stippled black dots (Fig. 218); venter whitish with white square, spinnerets brown. Carapace with long white setae on sides and on clypeus and many small tubercles (Figs. 223, 224). Abdomen with wide humps, anterior edge with long setae (Figs. 225, 226). Total length 10.8 mm. Carapace 4.7 mm long, 4.3 wide in thoracic region, 2.8 wide at lateral eyes. First femur 4.0 mm, patella and tibia 6.3, metatarsus 4.7, tarsus 1.1. Second patella and tibia 4.3 mm, third 2.4, fourth 3.7. Length of first patella and tibia 1.5 times width of carapace.

Males are not known.

Diagnosis. Mastophora cranion is distinguished from others by black spots on the wide humps of the abdomen (Figs. 225, 226), its long white setae, and its epigynum with the atria in line with the outer margin of the seminal receptacles (Fig. 229).

Distribution. Known only from the type locality (Map 3D).

Specimens Examined. No other specimens have been found.

Mastophora longiceps Mello-Leitão
Figures 230–236; Map 3D

Mastophora longiceps Mello-Leitão, 1940: 57, fig. 5, ♀. Female holotype from Ilha São Sebastião, Est. São Paulo, Brazil, in MNRJ, examined. Brignoli, 1983: 273. Platnick, 2001.
Glyptocranium longiceps:—Bonnet, 1957: 1998.

Description. Female holotype. Carapace beige in center, dark brown on sides. Chelicerae, labium, endites, sternum orange-brown. Coxae and distal leg articles orange-brown. Abdomen contrastingly marked black and white (Figs. 232, 233); venter gray with a pair of light patches. Carapace shiny with short setae on sides, both black and white; forked horns thick, fingerlike (Figs. 230, 231). Legs with short black and white setae. Eyes indistinct without dark pigment. Abdomen bald with wide humps (Figs. 232, 233). Total length 13.0 mm. Carapace 7.5 mm long, 6.0 wide in thoracic region, 3.8 wide at lateral eyes. First femur 6.3 mm, patella and tibia 9.2, metatarsus 6.4, tarsus 1.6. Second patella and tibia 6.5 mm, third 3.5, fourth 5.6. Length of first patella and tibia 1.5 times width of carapace.

Diagnosis. The thick horns (Figs. 230, 231) and wide median plate on the posterior of the epigynum (Fig. 235) separate this species from *M. melloleitaoi* (Figs. 274–280).

Distribution. Known only from the type locality (Map 3D).

Specimens Examined. No other specimens have been found.

Mastophora pesqueiro new species
Figures 237–243; Map 3D

Holotype. Female holotype from Pesqueiro, Montenegro, Rio Grande de Sul, Brazil, 14 June 1977 (M. F. Beurmann), in MCN no. 5730. The specific name is a noun in apposition after the locality in Montenegro.

Description. Female holotype. Carapace light brown to dark red-brown, glossy, with two lines of white setae posteriorly on each side and a white edge. Chelicerae, labium, endites, sternum, coxae light brown. Distal leg articles light brown, darker ventrally, with white setae. Abdomen marked with two darker framed white patches on each side and a transverse dusky line anteriorly in a median white area (Figs. 239, 240); venter light brown with white square. Carapace glossy with posterior horns pointed and two small median tubercles (Figs. 237, 238). Abdomen with small, pointed humps (Figs. 239, 240). Total length 10.5 mm. Carapace 4.7 mm long, 4.6 wide in thoracic region, 2.3 wide at lateral eyes. First femur 4.3 mm, patella and tibia 6.9, metatarsus 4.6, tarsus 1.4. Second patella and tibia 5.0 mm, third 2.7, fourth 4.7. Length of first patella and tibia 1.5 times carapace width.

Males are not known.

Diagnosis. Mastophora pesqueiro is distinguished by the conical horns on the smooth carapace (Figs. 237, 238), the four white marks on the abdomen, and the distinctly shaped humps (Figs. 239, 240). The epigynum has a median bulge on its posterior face (Figs. 241–243).

Distribution. Known only from the type locality (Map 3D).

Specimens Examined. No other specimens have been found.

Mastophora piras new species
Figures 244–250; Map 3D

Holotype. Female holotype from Emas, Pirassunga, Est. São Paulo, Brazil, 2 Nov. 1952 (Pietracatelli, Werner, and Dionisio), in MZSP, 4339. The specific name is an arbitrary combination of letters.

Description. Female holotype. Carapace dark brown. Chelicerae light brown. Labium, endites, sternum light brown. Coxae and distal leg articles brown with indistinct darker blotches. Abdomen anterior black enclosing some white anterior loops, posterior white (Figs. 246, 247); venter with indistinct white square on gray-brown. Carapace heavily sclerotized, shiny, with sides thinner with a punctuate pattern of tiny tubercles. Abdomen triangular heart-shaped with lateral bulges and distinct small humps (Figs. 246, 247). Total length 13.8 mm. Carapace 6.5 mm long, 5.9 wide in thoracic region, 3.3 wide at lateral eyes. First femur 5.3 mm, patella and tibia 7.7, metatarsus 4.8, tarsus 1.6. Second patella and tibia 5.5 mm, third 3.3, fourth 4.8. Length of first patella and tibia 1.2 times width of carapace.

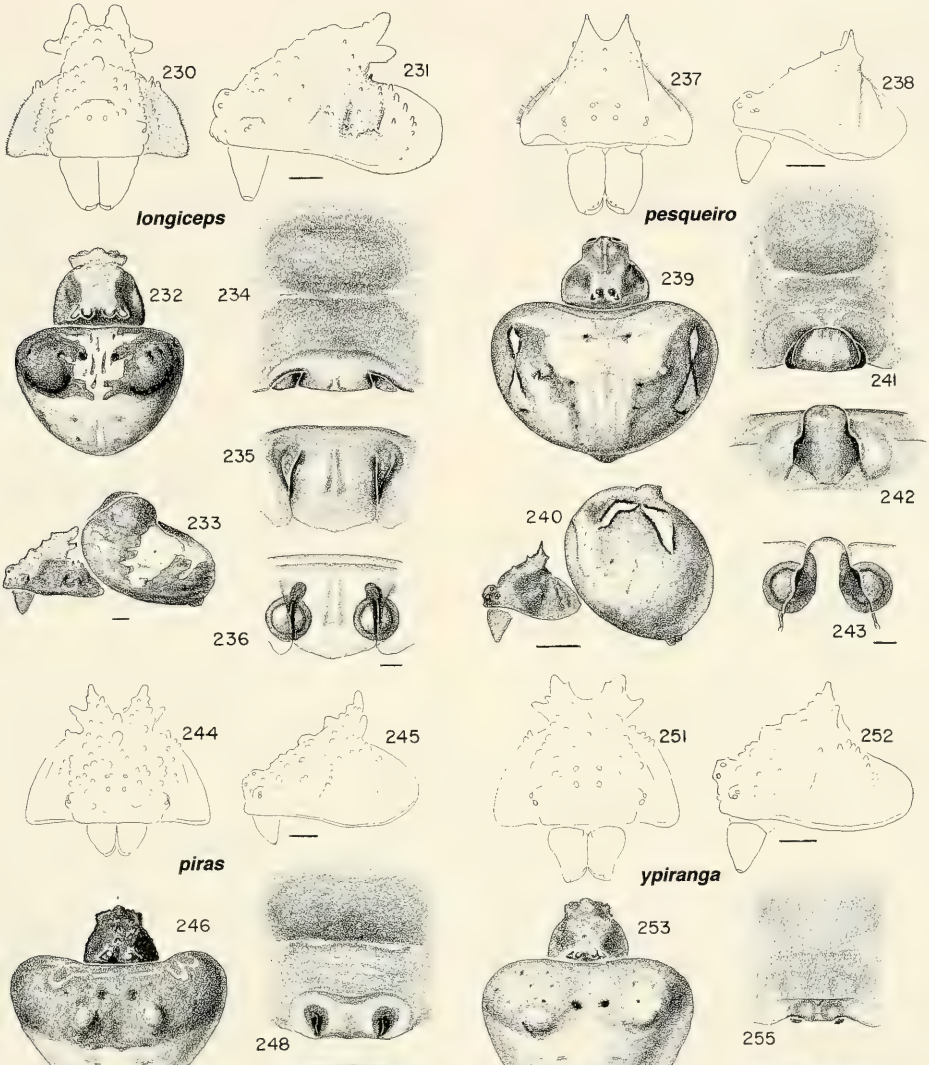
Males are not known.

Variation. Total length of females 13.0–13.8 mm. The paratype has some long, white setae on sides of carapace, clypeus,

→

Figures 230–236. *Mastophora longiceps* Mello-Leitão, female. 230, 231, carapace and chelicerae. 230, frontal. 231, lateral. 232, 233, carapace and abdomen. 232, dorsal. 233, lateral. 234–236, epigynum. 234, ventral. 235, posterior. 236, posterior, cleared.

Figures 237–243. *M. pesqueiro* new species, female. 237, 238, carapace and chelicerae. 237, frontal. 238, lateral. 239, 240, carapace and abdomen. 239, dorsal. 240, lateral. 241–243, epigynum. 241, ventral. 242, posterior. 243, posterior, cleared.



Figures 244–250. *M. piras* new species, female. 244, 245, carapace and chelicerae. 244, frontal. 245, lateral. 246, 247, carapace and abdomen. 246, dorsal. 247, lateral. 248–250, epigynum. 248, ventral. 249, posterior. 250, posterior, cleared.

Figures 251–257. *M. ypiranga* new species, female. 251, 252, carapace and chelicerae. 251, frontal. 252, lateral. 253, 254, carapace and abdomen. 253, dorsal. 254, lateral. 255–257, epigynum. 255, ventral. 256, posterior. 257, posterior, cleared.

Scale lines. 1.0 mm; genitalia, 0.1 mm.

legs, and anterior of abdomen; the abdomen is all dark, perhaps because of poor preservation. The illustrations were from the holotype.

Diagnosis. Mastophora piras is distinguished from *M. melloleitaoi* by the heart-shaped abdomen with small humps (Figs. 246, 247) and by the wider median area of the epigynum in posterior view (Fig. 249).

Distribution. Minas Gerais and São Paulo states of southern Brazil (Map 3D).

Paratypes. BRAZIL *Minas Gerais:* Gavernador Valadares, 14/15 Oct. 1981, 1 imm. (N. Sorkin, T. Spitzman, AMNH). *São Paulo:* São Bernardo, Nov. 1926, 1♀ (H. Bakkenist, MZSP 8069).

Mastophora ypiranga new species
Figures 251–257; Map 3E

Holotype. Female holotype from Ypiranga, Cap. [city of São Paulo], Est. São Paulo, Brazil, 1898, in MZSP, 5791. The specific name is a noun in apposition after the locality.

Description. Female holotype. Carapace orange-brown. Chelicerae yellow-brown. Labium, endites, sternum light brown. Coxae and distal leg articles light brown. Abdomen anterior black, posterior white (Figs. 253, 254); venter grayish white with white square. Carapace with low tubercles, with some short white setae on sides (Figs. 251, 252). First femur with S-shaped curvature. Abdomen with two humps (Figs. 253, 254). Total length 12.7 mm. Carapace 4.7 mm long, 4.2 wide in thoracic region, 2.7 wide at lateral eyes. First femur 3.7 mm, patella and tibia 5.4, metatarsus 3.3, tarsus 1.1. Second patella and tibia 3.8 mm, third 2.2, fourth 3.6. Length of first patella and tibia 1.2 times width of carapace.

Males are not known

Variation. Total length of females 9.7–12.7 mm. The illustrations were made from the holotype.

Diagnosis. Mastophora ypiranga differs from *M. pickeli* and *M. melloleitaoi* by the shape of the abdomen (Figs. 253, 254) and by the narrower, almost triangular median plate of the epigynum and the atria approaching each other (Figs. 256, 257). Other differences are that the carapace appears less swollen when viewed from anterior, the anterior median eyes are directed forward, and the horns are erect with the tips pointing dorsally (Fig. 252). The anterior of the abdomen, which overhangs the carapace, is white.

Distribution. Minas Gerais to Santa Catarina states of southern Brazil (Map 3E).

Paratypes. BRAZIL *Minas Gerais:* Vicosa, 1931, 1♀ (E. J. Hambleton, AMNH). *São Paulo:* São Paulo, July 1928, 1♀ (R. Cassalo, IBSP 4530). *Santa Catarina:* June 1919, 1♀ (Luederwaldt, MZSP 8067).

Mastophora yacare new species
Figures 258–264; Map 3E

Holotype. Female holotype from Rincori del Yacaré, Artigas, Uruguay, 20 Jan. 1957, in FCMU. The specific name is a noun in apposition after the locality.

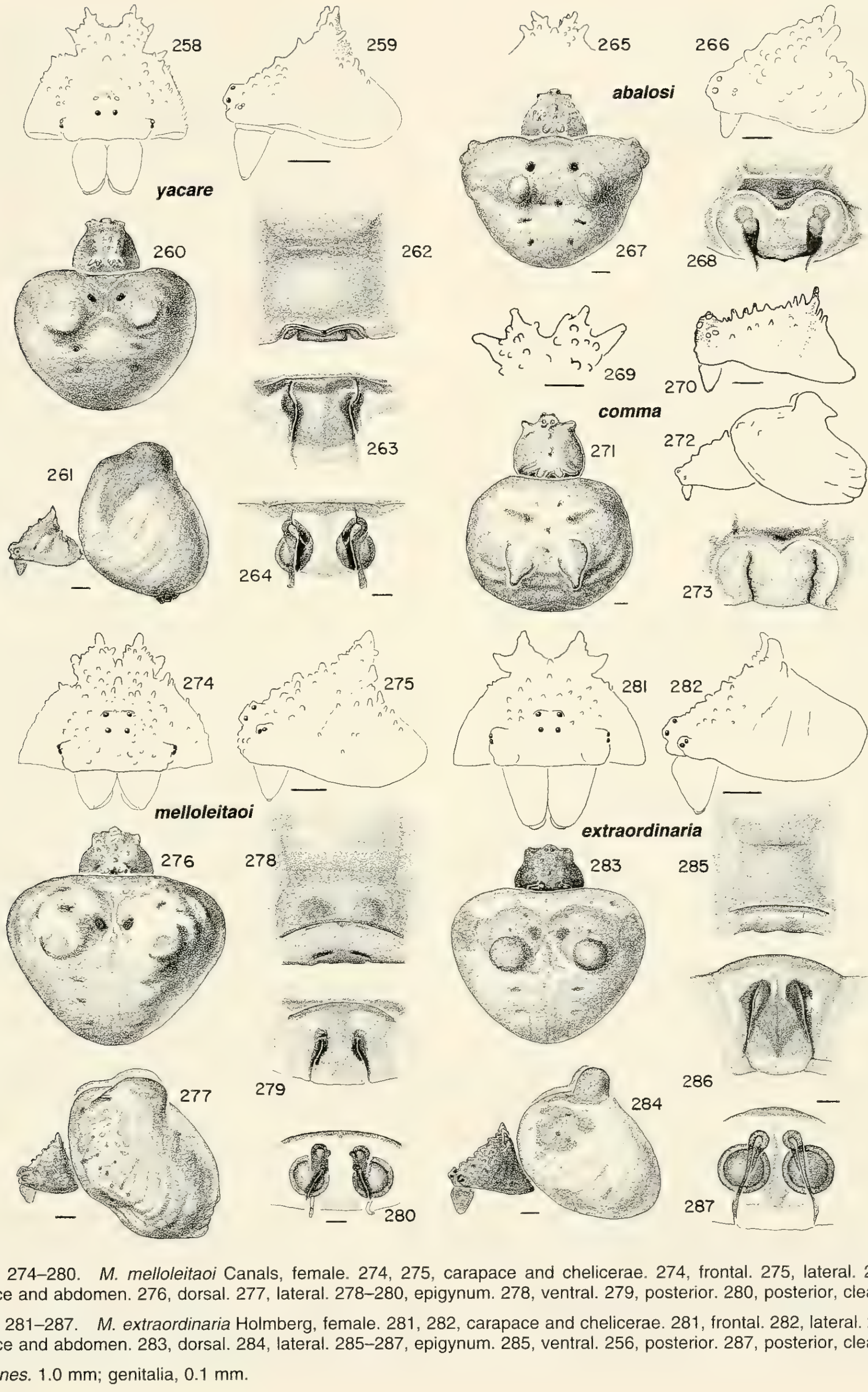
Description. Female holotype. Carapace light brown. Chelicerae, labium, endites brown. Sternum orange, underlain by white pigment. Legs brown, femora lightest. Abdomen black over humps, whitish posteriorly (Figs. 260, 261); venter light brown with white square containing two rows of three black spots; spinnerets dark brown. Abdomen with a pair of wide, dorsal humps (Figs. 260, 261). Total length 11.5 mm. Carapace 4.1 mm long, 4.0 wide in thoracic region, 2.6 wide behind posterior lateral eyes. First femur 3.5 mm, patella and tibia 5.1, metatarsus 3.5, tarsus 1.1. Second patella and tibia 3.8 mm, third

→

Figures 258–264. *Mastophora yacare* new species, female. 258, 259, carapace and chelicerae. 258, frontal. 259, lateral. 260, 261, carapace and abdomen. 260, dorsal. 261, lateral. 262–264, epigynum. 262, ventral. 263, posterior. 264, posterior, cleared.

Figures 265–268. *M. abalosi* Urtubey and Báez, female, after authors. 265, horns of carapace, frontal. 266, carapace and chelicerae, lateral. 267, carapace and abdomen, dorsal. 268, epigynum, posterior.

Figures 269–273. *M. comma* Báez and Urtubey, female, after authors. 269, horns of carapace. 270, carapace and chelicerae, lateral. 271, 272, carapace and abdomen. 271, dorsal. 272, lateral. 273, epigynum, posterior.



Figures 274–280. *M. melloleitaoi* Canals, female. 274, 275, carapace and chelicerae. 274, frontal. 275, lateral. 276, 277, carapace and abdomen. 276, dorsal. 277, lateral. 278–280, epigynum. 278, ventral. 279, posterior. 280, posterior, cleared.

Figures 281–287. *M. extraordinaria* Holmberg, female. 281, 282, carapace and chelicerae. 281, frontal. 282, lateral. 283, 284, carapace and abdomen. 283, dorsal. 284, lateral. 285–287, epigynum. 285, ventral. 256, posterior. 287, posterior, cleared.

Scale lines. 1.0 mm; genitalia, 0.1 mm.

2.0, fourth 3.3. Length of first patella and tibia 1.3 times width of carapace.

Males are not known.

Diagnosis. Mastophora yacare is distinguished from *M. melloleitaoi* by its epigynum and the atria, which separate and face sideways (Fig. 264).

Distribution. Known only from the type locality (Map 3E).

Specimens Examined. No other specimens have been found.

Mastophora abalosi Urtubey and Báez
Figures 265–268, 458; Map 3E

Mastophora abalosi Urtubey and Báez, 1983: 3, figs. 1–11, ♀. Female holotype and seven paratypes from the city of Santiago del Estero, Argentina, in the Inst. Animales Venenosos, Santiago del Estero, unavailable. Platnick, 1989: 340. Platnick, 2001.

Description. Female (after Urtubey and Báez, 1983). Carapace brown. Chelicerae yellowish. Labium, endites yellow-white. Sternum spotted orange-yellow. Sternum dark orange. Legs yellowish. Abdomen anterior clear yellow followed by dark band that covers humps (Fig. 267), posteriorly pale yellow; venter with light yellow. Carapace with numerous tubercles, setae only on sides; tubercles with light tips. Abdomen with humps (Fig. 267). Total length 12.5 mm. Carapace 5.6 mm long, 5.4 wide in thoracic region. First femur 4.8 mm, patella and tibia 6.8, metatarsus 5.1, tarsus 1.3. Second patella and tibia 5.2 mm, third 2.6, fourth 4.8. Length of first patella and tibia 1.3 times width of carapace.

Males are not known.

Diagnosis. Mastophora abalosi is distinguished from *M. extraordinaria* by some morphological characters (Urtubey and Báez, 1983). The posterior of the epigynum was illustrated (Fig. 268) and shows the atria slightly to the lateral of the slits.

The egg sac has flaps (Fig. 458).

Distribution. Santiago del Estero in northern Argentina (Map 3E).

Specimens Examined. No specimens were available.

Mastophora comma Báez and Urtubey
Figures 269–273, 459; Map 3E

Mastophora comma Báez and Urtubey, 1985: 3, figs. 1–9, ♀. Female holotype from the city of Santiago del Estero, Argentina, and seven paratypes in the Instituto de Animales Venenosos, Santiago del Estero, unavailable. Platnick, 1989: 340. Platnick, 2001.

Description. Female (after Báez and Urtubey, 1985). Carapace brown. Chelicerae yellow. Sternum orange. Legs orange-yellow. Abdomen dusky yellow covered with many tiny maroon spots with white setae, spotted with brown spots and a few darker maroon spots, and posteriorly with a few transverse bands (Fig. 271); venter yellow, spinnerets maroon. Intense yellow area between epigastric groove and spinnerets, with a few small maroon spots. Carapace with tubercles (Figs. 269, 270). Abdomen with a pair of dorsal humps tipped by nipples (Figs. 271, 272). Total length 12.0 mm. Carapace 3.7 mm long, 4.8 wide in thoracic region. First femur 3.9 mm, patella and tibia 6.4, metatarsus 5.0, tarsus 1.2. Second patella and tibia 4.6 mm, third 2.4, fourth 3.9. Length of first patella and tibia 1.3 times width of carapace.

Males are not known.

Diagnosis. This species differs from others by the unusual structure of the abdomenal humps (Fig. 272) and by the two parallel slits on the posterior face of the epigynum (Fig. 273).

The egg sac lacks flaps and has a short stalk (Fig. 459).

Distribution. Santiago del Estero in northern Argentina (Map 3E).

Specimens Examined. No specimens of this species were available.

Mastophora melloleitaoi Canals
Figures 274–280; Map 3E

Mastophora Mello-Leitãoi Canals, 1931: 20, figs. 1–4, pl. 2, fig. 4, ♀. Female holotype, from Rosas, Prov. Buenos Aires, Argentina, in MACN, examined.

Mastophora mello-leitão:—Mello-Leitão, 1931, 73: figs, 5, 17, ♀.

Mastophora mello-leitaoiae:—Roewer, 1942: 900.

Glyptocranium melloleitaoi:—Bonnet, 1957: 1998.

Mastophora melloleitaoi:—Platnick, 2001.

Note. Roewer's (1942) spelling appears to be an error.

Description. Female from Balcarce. Carapace light brown, not shiny. Chelicerae, endites, labium light brown. Sternum light brown. Legs brown. Abdomen light brown, anterior gray. Near midline anteriorly a light V-shaped mark, followed by a light upside-down V. Carapace bald, except for some setae posteriorly. Abdomen humps wide (Figs. 276, 277). Total length 13.0 mm. Carapace 5.5 mm long, 4.8 wide in thoracic region, 3.2 wide at lateral eyes. First femur 4.2 mm, patella and tibia 6.3, metatarsus 4.2, tarsus 1.3. Second patella and tibia 4.5 mm, third 2.7, fourth 4.2. Length of first patella and tibia 1.3 times width of carapace.

Males are not known.

Variation. Total length of females 9.0–12.8 mm. The total length of the holotype is 12.8 mm, carapace 4.6 mm wide, patella and tibia 5.8. Humps may have black caps. The illustrations (Figs. 274–278) were made from a female from Balcarce; Figures 279 and 280 are from the holotype.

Diagnosis. The female differs from *M. extraordinaria* in that the carapace is not shiny (Fig. 274), in having the anterior of the abdomen dark (Figs. 276, 277), and in having the slits on the posterior of the epigynum almost parallel (Fig. 279). *Mastophora melloleitaoi* also lacks the dark median dorsal area on the posterior of the epigynum present in *M. extraordinaria* (Fig. 286). If cleared, each atrium shows a small median lobe (Fig. 280) not present in other species.

Distribution. From Paraná State, southern Brazil, to Buenos Aires Province, Argentina (Map 3E).

Specimens Examined. BRAZIL *Rio de Janeiro:* Vassouras, Fazenda de São Sebastião, March 1871, 1♀ (B. P. Mann, MCZ). *Paraná:* Curitiba, 21 Jan. 1965, 1 imm. (C. Valle, MZSP 4326). *Rio Grande do Sul:* Rodeio Bonito, Bagé, 10 Feb. 1967, 1♀ (C. de Oliveira, MCN 473); Santa Maria, 9 May 1973, 1♀ (D. Link, MCN 01659). ARGENTINA *Córdoba:* Cruz Alta, 15 Aug. 1948, 1♀ (J. P. Duret, MACN). *Buenos Aires:* Ascensión, 1♀ (B. Gerschman, MACN); Balcarce, 16 Feb. 1950, 1♀ (Cuccioli, MACN); Burzaco, 1♀ (F. C. S., MACN); San Isidro, 19 Apr. 1949, 1♀ (N. Konmilev, MACN); Zelaya, 2 imm. (J. Pereyra, MACN 523).

Mastophora extraordinaria Holmberg
Figures 281–287, 460; Map 3F

Mastophora extraordinaria Holmberg, 1876: 113. Female from Buenos Aires, Argentina, lost. Brèthres, 1909: 163, figs. 1, 2, ♀, egg sacs. Canals, 1931: 17, figs. 1–5, pl. 1, fig. 1. Mello-Leitão, 1931: 70, figs. 7, 19. Roewer, 1942: 900. Platnick, 2001.

Glyptocranium extraordinaria:—Bonnet, 1957: 1997.

?*Mastophora cinerea* Mello-Leitão, 1943: 105, fig. 4, imm. Immature holotype from Córdoba, Argentina, in MLP, examined. DOUBTFUL NEW SYNONYMY.

Mastophora intermedia Mello-Leitão, 1945: 240, figs. 14–17, ♀. One female holotype from Pindapoy, Misiones Prov., Argentina, in MLP, examined. Brignoli, 1983: 274. NEW SYNONYMY.

Note. Holmberg described the size of the prominences of the abdomen and the two brown spots.

Mastophora cinerea is a light-colored immature with slightly elongate humps. Its placement is doubtful. (Do immature *M. extraordinaria* have longer humps?)

Mastophora intermedia has humps rounded, as wide as long, and has the same internal genitalia as does *M. extraordinaria.* The differences are a slight median notch of the posterior rim of the epigynum in ventral view, and absence of the median dark area posterior in the epigynum (Fig. 286).

Description. Female from Chascomús. Carapace dark brown with narrow white rim. Legs brown, slightly ringed. Abdomen white with a pair of dorsal black patches (Fig. 283). Carapace shiny on tips with low tubercles and three grooves on each side. Abdomen with few setae on sides with one pair of humps; venter with white square. Total length 12 mm. Carapace 4.8 mm long, 4.6 wide in thoracic region, 2.8 wide at posterior lateral eyes. First femur 3.9 mm, patella and tibia 5.5, metatarsus 3.5, tarsus 1.2. Second patella and tibia 4.5 mm, third 2.7, fourth 4.1. Length of first patella and tibia 1.1 times width of carapace.

Males are not known.

Variation. The epigynum is variable in width and the abdominal humps may be wider or higher. Total length of females 9.5–14 mm. The illustrations were made from the female from Chascomús.

Diagnosis. Compared with *M. melloleitaoi,* the carapace has low, flat tubercles; the horns of the carapace are relatively smooth and shiny (Figs. 281, 282); and the bulge bearing the median eyes is indistinct. The anterior of the abdomen is usually white (Fig. 284). The median plate of the epigynum is flat dorsally, sclerotized, and darker than ventrally (above on Fig. 286); it is raised in the middle in *M. melloleitaoi.* The atria approach each other (Fig. 287), unlike those of *M. melloleitaoi* (Fig. 280).

Natural History. The egg sac is drop-shaped, 11 mm wide, almost the size of the female abdomen (Fig. 460). A female from Gonzáles Catán was found on a citrus tree. An immature in Uruguay was collected at night "from regular web."

Distribution. From Rio Grande do Sul State, southern Brazil, to Buenos Aires Province, west to Chaco and Córdoba provinces, Argentina (Map 3F).

Specimens Examined. BRAZIL *Rio Grande de Sul:* Canela, 12 Feb. 1966, 1♀ (A. Lise, MCN 0119); Garibaldi, 30 Oct. 1974, 1♀ (O. Simonaggio, MCN 2381). URUGUAY Montevideo, 1♀ (J. Canosa, MACN 4182); 1♀ (E. Cordero, MNRJ 14011); Puntas Arroyo Laureles, Tacuarembó, 1 imm. (FCMU 293); Treinta y Tres, 20 Aug. 1971, 1♀ (FCMU 295). ARGENTINA *Chaco:* Sáenz Peña, Sept. 1933, 1♀ (B. Ohneiser, MACN 31331). *Córdoba:* Córdoba, 2♀ (M. J. Viana, AMNH, MACN 1106); Calamuchita, Dec. 1940, 4♀ (J. M. Viana, MACN 1005); Dec. 1941, 2♀ (J. M. Viana, MACN 1106); Agus do Oro, Mar. 1940, 1 imm. (J. A. De Carlo). *Buenos Aires:* Buenos Aires, 1♀ (Scly., MNHN 23388); Chascomús, Oct. 1934, 1♀ (I. Dor, MACN 35983); Cap. Federal, 1 imm. (E. Pizarro, MACN 12782); Florencio Varela, 1 May 1949, 1♀ (O. de Ferrarini, MLP 13549); Gonzáles Catán, 6 June 1949, 1♀ (Touson); Hurlingham, Jan. 1954, 1♀ (Giai, MACN 4359); La Plata, 1♀ (M. Birabén, MLP 16178); 1♀ (M. Birabén, BMNH); Moreno, Feb. 1939, 1♀ (Schiapelli, Gerschman, MACN); 14 Nov. 1943, 1♀ (S. M. Doello Jurado; MACN 1361); Rosas, 1930, 1♀ (J. B. Daguerre, MACN 4185).

Mastophora leucabulba (Gertsch), new combination
Figures 288–295; Map 2F

Agatostichus leucabulba Gertsch, 1955: 250: figs. 34, 38, 40, ♀. Female holotype from Harlingen, Texas, in AMNH, destroyed.
Agathostichus leucabulba:—Brignoli, 1983: 255.
Agathostichus leucabulbus:—Platnick, 2001.

Note. Platnick's change of spelling is not required.

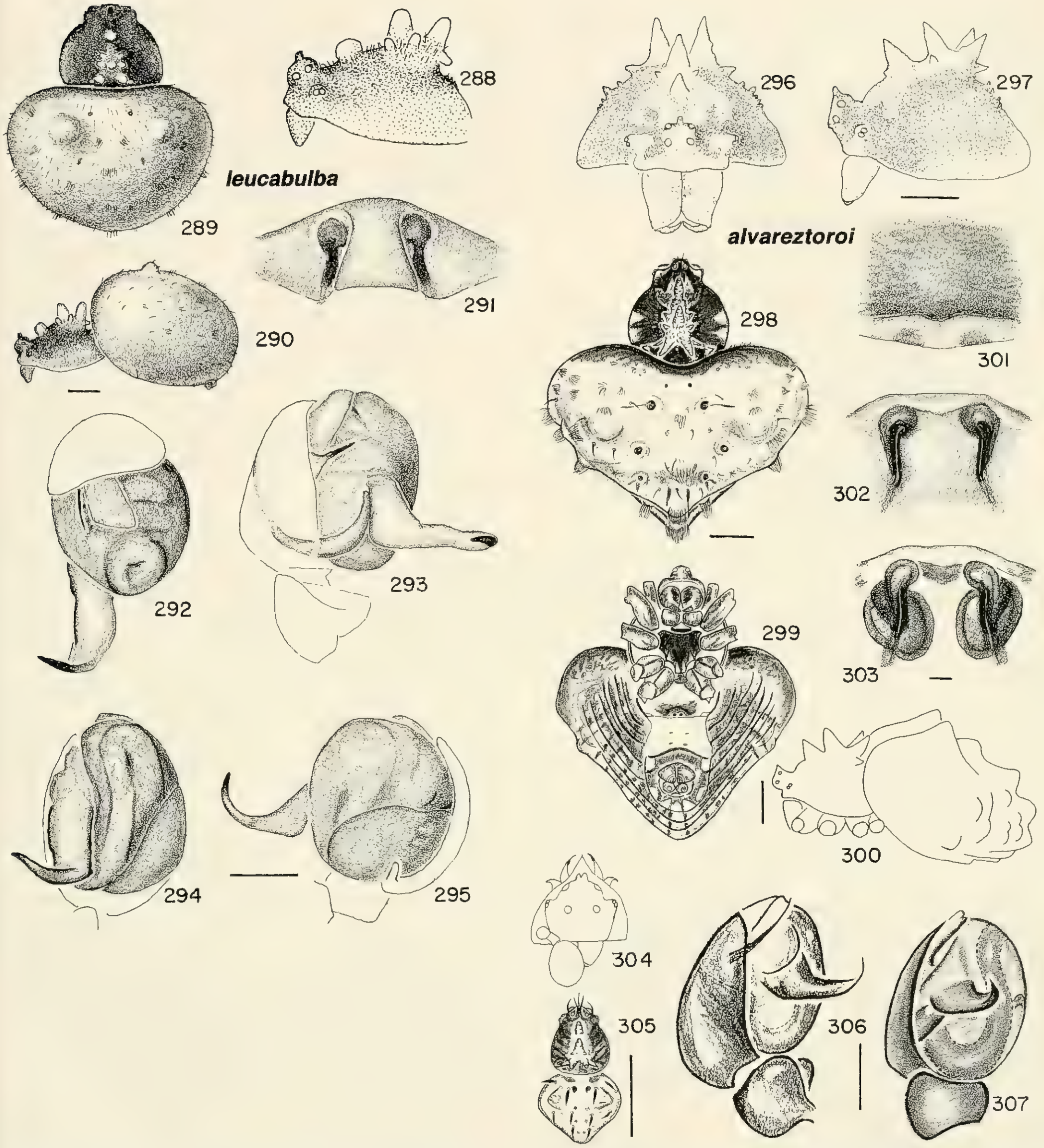
Description. Female (after Gertsch, 1955). Carapace reddish brown except for yellow rim and orange median patch enclosing tubercles; tubercles tipped white. Chelicerae brownish at base. Labium, endites yellowish. Sternum yellowish. Coxae yellowish and distal leg articles yellowish to light brown with faint brown markings on first leg. Abdomen yellowish to whitish above with dusky flecks, black around the base (Fig. 289). Carapace with woolly setae, one large bulb behind median eyes, a large median bulb flanked by a pair of small bulbs on the side, behind bifid horns, sides with dark warts and cephalic area coarsely roughened, hidden by mat of wooly hairs. Lateral eyes on connate tubercles, median eyes on large elevated tubercle at the posterior edge of which is a small tubercle. Abdomen with long humps. Total length 6.7 mm. Carapace 2.8 mm long, 2.9 wide in thoracic region. First femur 3.6 mm, patella and tibia 4.9, metatarsus 3.6, tarsus 1.0. Second patella and tibia 3.4 mm, third 1.9, fourth 2.6. Length of first patella and tibia 1.7 times width of carapace.

Diagnosis. Mastophora leucabulba is distinguished by the enlarged tubercle between the median eyes (Figs. 288, 290) and the large blunt tubercles and dark coloration of the carapace (Figs. 289, 290).

Doubtful males, considered and labeled *M. cornigera* by W. Ivie, and listed under that species by Gertsch, may be this species (Figs. 292–295).

Distribution. Southern Texas to Honduras (Map 2F).

Specimens Examined. TEXAS *Duval Co.:* San Di-



Figures 288–295. *Mastophora leucabulba* Gertsch. 288–291, female, after Gertsch. 288, carapace and chelicerae, lateral. 289, 290, carapace and abdomen. 289, dorsal. 290, lateral. 291, epigynum, posterior. 292–295, left palpus of presumed male. 292, apical. 293, mesal. 294, ventral. 295, ectal.

Figures 296–307. *M. alvareztoroi* Ibarra and Jiménez new species. 296–303, female. 296, 297, carapace and chelicerae. 296, frontal. 297, lateral. 298–300, carapace and abdomen. 298, dorsal. 299, ventral. 300, lateral. 301–303, epigynum. 301, ventral. 302, posterior. 303, posterior, cleared. 304–307, male. 304, carapace, chelicera and right palpus. 305, dorsal. 306–307, left palpus. 306, mesal. 307, ventral.

Scale lines. 1.0 mm; genitalia, 0.1 mm.

ego, 29 Apr. 1895, 2♂, imm. doubtful determination (USNM). *Wilson Co.:* Floresville, 29 Apr. 1895, 1 imm., 4♂, doubtful determination (AMNH). MEXICO *Tamaulipas:* 64 km S Linares, imm., 1.9 mm long (Gertsch, 1955, AMNH, destroyed, not examined). HONDURAS E of Tela Beach, 6 July 1929, imm. (A. M. Chickering, MCZ).

Mastophora alvareztoroi Ibarra and Jiménez new species
Plate 1; Figures 296–307; Map 2F

Holotype. Female holotype from Rancho Alejandria, Municipio Estación Juárez, Chiapas, Mexico, 25 Sept. 1975 (M. Alvarez del Toro), in MCZ. The species has been named after the collector, the late Miguel Alvarez del Toro, who dedicated his life to the study and protection of the Chiapas fauna and is the author of a book on Chiapas spiders (Alvarez del Toro, 1992).

Agathostichus sp. Alvarez del Toro, 1992: 173, fig. 121, ♀, photo.

Description. Female from Rosaria Izapa. Carapace horns white, sides dark brown with eyes, clypeus, and rim yellowish (Figs. 296–298). Chelicerae yellowish with a pair of dark patches. Labium, endites dark brown, distally light. Sternum dark brown. Coxae and distal leg articles yellowish; first femur with fine black ring and distally with ventral dark patch. Abdomen yellow, dark brown on anterior border, and brown on some hump tips (Fig. 298); venter light brown with white square; a dark brown patch on epigynal area, and no pigment in spinneret area. Carapace hirsute with cone-shaped white tubercles (Figs. 296, 297). Posterior median eyes 0.8 diameter of anterior medians, laterals 0.7. Anterior median eyes 1.7 diameters apart. Ocular trapezoid rectangular, slightly wider than long. Chelicerae with one anterior tooth and three posterior teeth. Abdomen heart-shaped, three pairs of dark spots dorsally and sparse black setae, hirsute with tufts on white setae on dorsum. A pair of dorsal humps, followed by a series of four median, conical humps and several smaller lateral humps on each side. Setae, also tufts of white setae on small circular and convex white areas, scattered on dorsum of abdomen, with scattered dark brown setae, especially on anterior half, also with a few feather-shaped symmetrically arranged dark brown setae (Fig. 298). Total length 8.9 mm. Carapace 3.4 mm long, 3.3 wide in thoracic region, 1.7 wide at lateral eyes. First femur 4.3 mm, patella and tibia 5.5, metatarsus 4.2, tarsus 1.1. Second patella and tibia 3.8 mm, third 2.3, fourth 3.5. Length of first patella and tibia 1.6 times width of carapace.

Male weakly sclerotized, perhaps just molted. Carapace reddish brown except for white median light patch enclosing white horns. Chelicerae dark yellow. Sternum dark brown. Coxae, distal leg articles yellowish. Abdomen whitish. Carapace elevated behind, second midline tubercle slightly longer than first, lateral horns about half length of median horns, separation between median and lateral horns greater than width of laterals at base; each transverse horn with translucent seta on tip; carapace with woolly white setae. Chelicerae with three posterior median teeth and one posterior tooth. Abdomen with two dorsal paired humps; four anterior, four median, and two posterior feather-shaped setae (Fig. 305). Total length 1.7 mm. Carapace 0.8 mm long, 0.8 wide in thoracic region. First femur 1.1 mm, patella and tibia 1.1, metatarsus 1.1, tarsus 1.03. Second patella and tibia 0.8 mm, third 0.4, fourth 0.6. Length of first patella and tibia 1.4 times width of carapace.

Note. Males and females were matched

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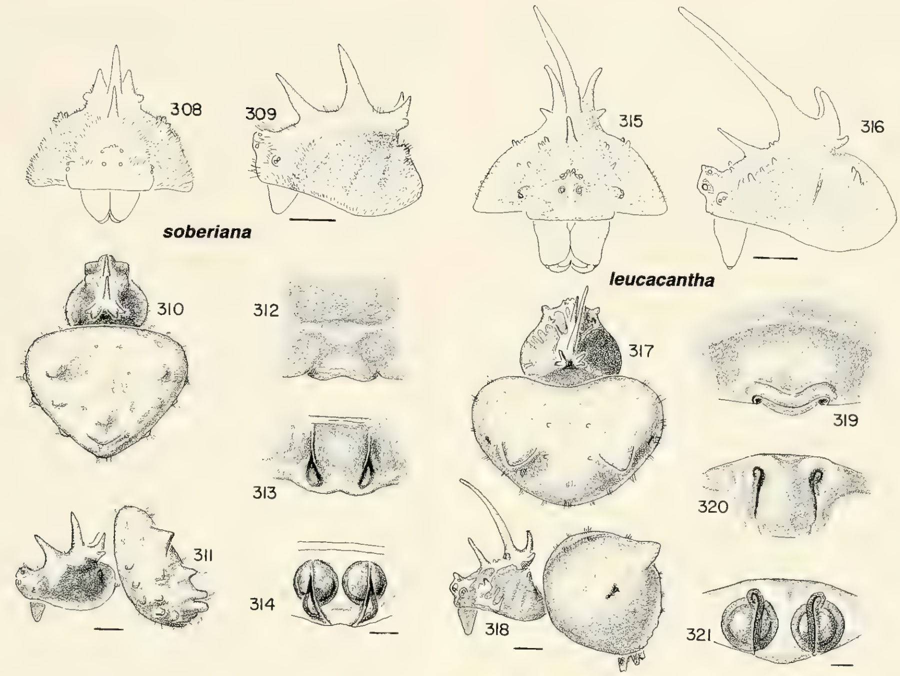
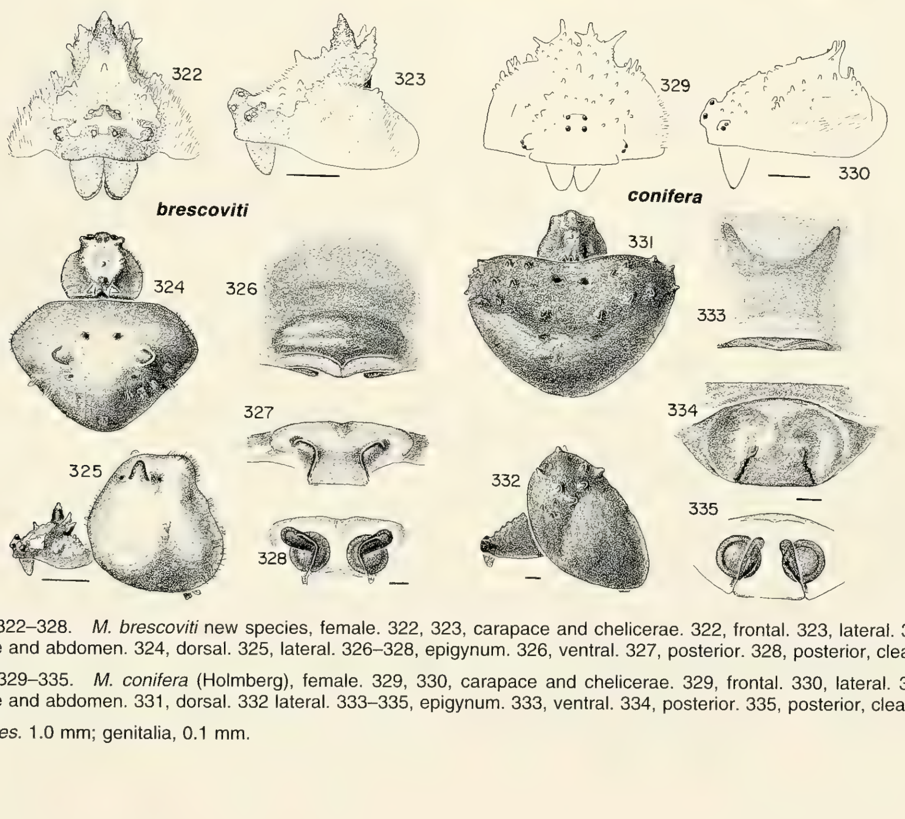
Figures 308–314. *Mastophora soberiana* new species, female. 308, 309, carapace and chelicerae. 308, frontal. 309, lateral. 310, 311, carapace and abdomen. 310, dorsal. 311, lateral. 312–314, epigynum. 312, ventral. 313, posterior. 314, posterior, cleared.

Figures 315–321. *Mastophora leucacantha* (Simon), female. 315, 316, carapace and chelicerae. 315, frontal. 316, lateral. 317, 318, carapace and abdomen. 317, dorsal. 318, lateral. 319–321, epigynum. 319, ventral. 320, posterior. 321, posterior, cleared.





Figures 322–328. *M. brescoviti* new species, female. 322, 323, carapace and chelicerae. 322, frontal. 323, lateral. 324, 325, carapace and abdomen. 324, dorsal. 325, lateral. 326–328, epigynum. 326, ventral. 327, posterior. 328, posterior, cleared.

Figures 329–335. *M. conifera* (Holmberg), female. 329, 330, carapace and chelicerae. 329, frontal. 330, lateral. 331, 332, carapace and abdomen. 331, dorsal. 332 lateral. 333–335, epigynum. 333, ventral. 334, posterior. 335, posterior, cleared.

Scale lines. 1.0 mm; genitalia, 0.1 mm.

because they were collected in the same area in Chiapas, have similar cone-shaped carapace tubercles and horns, and both sexes have feather-shaped setae.

Variation. Living females look all woolly. Total length of females 8.6–8.9 mm, carapace 3.3–4.0 mm wide. An immature, 4.3 mm total length, is similar to the adult female in relative proportions, horns, and pointed abdomen, but has fewer abdominal humps (only the pair and the four in midline). As in males of the genus, a row of long setae is present on the anterior of the first and second metatarsi and tarsi. The illustrations (Figs. 298–300) were made from the paratype collected with the holotype.

Diagnosis. Mastophora alvareztoroi is distinguished from *M. leucabulba* by the shape and humps of abdomen (Figs. 298–300), by the cone-shaped tubercles on the carapace (Figs. 296, 297), by having feather-shaped setae (Figs. 298, 305), and by the epigynum having atria bent toward each other (Figs. 302, 303).

Natural History. Some specimens came from coffee groves in Finca Irlanda and Rosario Izapa. The specimens were between 1 and 2 m above the ground. Mark Stowe (in correspondence) wrote that this fuzzy spider bears a strong resemblance to congregations of fuzzy scale insects in the same habitat in Texas.

Distribution. Southern Texas and Chiapas, Mexico (Map 2F).

Paratypes. MEXICO *Chiapas:* Rancho Alejandria, Municipio Estación Juárez, 25 Sept. 1975, 1♀ (M. Alvarez del Toro, MLJ); Finca Irlanda, 870 m, 15°10′N, 92°21′W, 65 km NNW of Tapachula, 12 Aug. 1987, 1♂ (G. Ibarra, A. García, M. Moreno, ECOTAR); Rosario Izapa, Municipio Tuxtla Chico, 430 m, 14°59′N, 92°09′W, 18 km ENE of Tapachula, 25 Aug. 1995, 1♀ (A. Ventura, ECOTAR).

Specimens Examined. TEXAS *Hidalgo Co.:* Santa Ana Natl. Wildlife Refuge, 18 Dec. 1983, 1♀ (M. K. Stowe 112, MKS). MEXICO *Chiapas:* Finca Hamburgo, ca. 15°10′N, 92°19′W, 950 m, Municipio de Tapachula, 16 Nov. 1994, 1 imm. (G. Ibarra, ECOTAR).

Mastophora soberiana new species
Figures 308–314; Map 2F

Holotype. Female holotype from Pipeline Road, Canal Zone [in Soberiana National Park, Panama], 26 July 1976 (Y. Lubin, G. G. Montgomery), in MCZ. The specific name is a noun in apposition after the locality.

Description. Female holotype (in poor physical condition). Carapace yellowish, sides of thorax dark brown, a wide, light rim and tubercles with white pigment (Figs. 308, 309). Chelicerae, labium, endites yellowish. Sternum brown. Coxae, distal leg articles yellowish. Abdomen white dorsally (Fig. 310), white ventrally, except for yellowish genital area and spinnerets. Carapace with spine-shaped tubercles and white setae (Figs. 308, 309). Abdomen with three median humps and numerous small lateral humps, with tufts of white setae (Figs. 310, 311). Total length 8.3 mm. Carapace 3.7 mm long, 3.4 wide in thoracic region, 1.8 wide behind posterior lateral eyes. First femur 4.7 mm, patella and tibia 5.8, tarsi lost. Second patella and tibia 4.2 mm, third 2.3, fourth 3.5. Length of first patella and tibia 1.7 times width of carapace.

Males are not known.

Diagnosis. This species is distinguished from *M. alvareztoroi* by the longer carapace tubercles and by having the atria of the epigynum located dorsally (Fig. 314).

Distribution. Panama (Map 2F).

Specimens Examined. No other specimens have been found.

Mastophora leucacantha (Simon), new combination
Figures 315–321; Map 3G

Agatostichus leucacantha Simon, 1895: 885, fig. 947, carapace. Immature holotype from Rio Salobro, Bahia, Brazil, in MNHN, 8486, examined. Mello-Leitão, 1931: 67. Gertsch, 1955: 250.

Agathostichus leucacantha:—Simon, 1897: 473. Roewer, 1942: 900.

Agathostichus leucacanthus:—Bonnet, 1955: 182. Platnick, 2001.

Note. In his publications, Simon (1895, 1897) did not include the female symbol as he did for other species, indicating that the specimen was immature. Roewer (1942) and Gertsch (1955) cited it as female.

Platnick (2001) considered the name of Simon (1895) to be a nomen nudum because the description was shared by the genus and species. But this is valid for 19th century descriptions (*International Code of Zoological Nomenclature*, art. 12.2.6 [International Commission on Zoological Nomenclature, 1999]).

Description. Female from the Organ Mountains. Carapace yellowish white with white marks and median white tubercles, brown triangle on posterior slope; anterior point of triangle dark between forked tubercles (Fig. 315). Chelicerae yellowish. Labium dark brown, endites yellowish. Sternum dark brown. Coxae and distal leg articles yellowish white. Abdomen yellowish white with a small black mark on each side (Fig. 317); venter yellowish white with white square surrounded by a gray line; dorsum and sides with indistinct gray marks. Carapace with woolly setae and long tubercles (Figs. 315–317). Median eyes on a swelling, each lateral pair on a swelling. Median ocular trapezoid almost square. Chelicerae with three anterior teeth, one posterior tooth. Legs with white setae. Abdomen with a pair of dorsal humps and tufts of white setae (Figs. 317, 318). Total length 8.3 mm. Carapace 3.7 mm long, 3.6 wide in thoracic region, 2.2 wide at lateral eyes. First femur 3.6 mm, patella and tibia 4.6, metatarsus 3.3, tarsus 1.0. Second patella and tibia 3.6 mm, third 2.1, fourth 3.2. Length of first patella and tibia 1.3 times width of carapace.

Males are not known.

Variation. The immature holotype, total length 4.0 m, has carapace tubercles shorter and lacks some lateral ones; venter of abdomen with black square. The illustrations were made from the adult female from Organ Mountains. The tufts of setae on the abdomen were prominent on the female from Organ Mountains when first examined (by the author in 1969), but have mostly been lost as result of handling.

Diagnosis. Mastophora leucacantha is distinguished by the long median horn that is almost as long as the carapace, and differs from *M. alvareztoroi* by having the abdomen rounded behind, whereas *M. alvareztoroi* has the abdomen lobed behind, and differs from *M. leucabulba* by having all tubercles behind the eyes and from *M. soberiana* by the shape of the epigynum (Fig. 320).

Distribution. Bahia to Rio de Janeiro states, Brazil (Map 3G).

Specimens Examined. Rio de Janeiro: Cachoeirinha, Montaigne Orgues [Serra Orgãos, Organ Mountains], 1902, 1♀ (E. R. Wagner, MNHN 26035).

Mastophora brescoviti new species
Figures 322–328; Map 3G

Holotype. Female holotype from Jardim Botânico, Porto Alegre, Rio Grande do Sul, Brazil (A. D. Brescovit), in MCN no. 26135. The species has been named after the collector and arachnologist A. D. Brescovit.

Description. Female holotype. Carapace with symmetrical white lines on head region, sides of cephalic area dark brown, sides of thorax light brown with dark streaks and speckles, and many downy white setae (Figs. 322, 323). Chelicerae patchy brown. Labium, endites, sternum dark brown. Coxae light brown and distal leg articles yellowish with narrow brown rings. Abdomen light brown, darker anteriorly between humps and pedicel, darker patches on each side, humps darkest, with bunches and individual white setae (Fig. 324); venter light brown. Lateral eyes on bulges. Carapace with median tubercle longest. Abdomen dorsally with a pair of humps and a median swelling bearing white setae (Figs. 324, 325). Total length 9.2 mm. Carapace 3.7 mm long, 3.4 wide in thoracic region, 1.8 wide behind posterior lateral eyes. First femur 4.0 mm, patella and tibia 5.1, metatarsus 3.7, tarsus 1.2. Second patella and tibia 3.8 mm, third 2.3, fourth 3.3.

Males are not known.

Diagnosis. Mastophora brescoviti is distinguished by the long posterior, median tubercle, and unusual shape of the abdomen with a median swelling behind the humps (Figs. 324, 325). The posterior of the epigynum has a pair of diagonal swellings (Fig. 327) not present in other species.

Distribution. Only known from Porto Alegre, Brazil (Map 3G).

Specimens Examined. No other specimens have been found.

Mastophora conifera (Holmberg)
Figures 329–335; Map 3G

Heterocephala conifera Holmberg, 1876: 143. Female from Boradero [Prov. Buenos Aires], Argentina, lost.
Mastophora conifera:—Canals, 1931: 18, figs. 1–5, pl. 1, fig. 2. Mello-Leitão, 1931: 71, figs. 4, 16. Roewer, 1942: 900. Platnick, 2001.
Glyptocranium coniferum:—Bonnet, 1957: 1996.

Description. Female from Tigre [in poor condition]. Carapace, sternum, legs orange-brown. Abdomen anteriorly black, posteriorly lighter gray, with some black streaks (Figs. 331, 332); venter black with a pair of white spots. Carapace with tips of horns thin, setae on sides of thoracic area (Figs. 329, 330). Anterior median eyes largest, laterals smallest. Abdomen with numerous dorsal tubercles (Figs. 331, 332). Total length 12.0 mm. Carapace 5.3 mm long, 4.6 wide in thoracic region, 2.8 wide at lateral eyes. First femur 4.3 mm, patella and tibia 5.3, metatarsus 3.8, tarsus broken. Second patella and tibia 4.3 mm, third 2.4, fourth 3.7. Length of first patella and tibia equals 1.2 times width of carapace.

Males are not known.

Diagnosis. Mastophora conifera is distinguished by the tubercular abdomen (Figs. 331, 332) and by the epigynum, which in posterior view has a pair of depressions containing short, ventrally converging slits (Fig. 334).

Distribution. Santa Fé and Buenos Aires provinces, Argentina (Map 3G).

Specimens Examined. ARGENTINA *Santa Fé:* Colonia Macias, Nov. 1942, imm. shriveled (J. M. Viana, MACN). *Buenos Aires:* Tigre, 1902, 1♀, once dried up (J. Brèthes, MACN 5896).

Mastophora corpulenta (Banks)
Figures 336–342, 461; Maps 2F, 4A

Ordgarius corpulentus Banks, 1898: 251, pl. 15, fig. 8. Female holotype from San José del Cabom Baja California, Mexico, in CAS, destroyed. Neotype here designated the holotype of *M. lenca.*
Mastophora corpulenta:—Roewer, 1942: 900. Platnick, 2001.
Mastophora lenca Gertsch, 1955: 247, figs. 28–30, 32, 33, ♀. Female holotype from Zamorano [?Zambrano], Honduras, in AMNH, examined. Brignoli, 1983: 274. Platnick, 2001. NEW SYNONYMY.
Glyprocranium corpulentum:—Bonnet, 1957: 1997.

Note. Banks (1898) described and pictured (fig. 8) elongated tubercles on the abdomen and lateral tubercles on the side of the carapace. The only North American or Central American species known to have both these characters is *M. lenca.* The type locality of *Ordgarius corpulentus* is uncertain, because, as Banks himself pointed out, the collection was handled by G. Marx before being turned over to Banks after Marx's death, and Marx locality labels are confused.

Description. Female holotype. Carapace dark brown, with short white setae not covering tubercles; tubercles with light tips (Figs. 336, 337). Sternum dark orange. Legs dark brown. Median eyes on bulge, lateral eyes on bulges. Abdomen gray, with long humps (Fig. 339); venter with white square. First tarsus with S-shaped curva-

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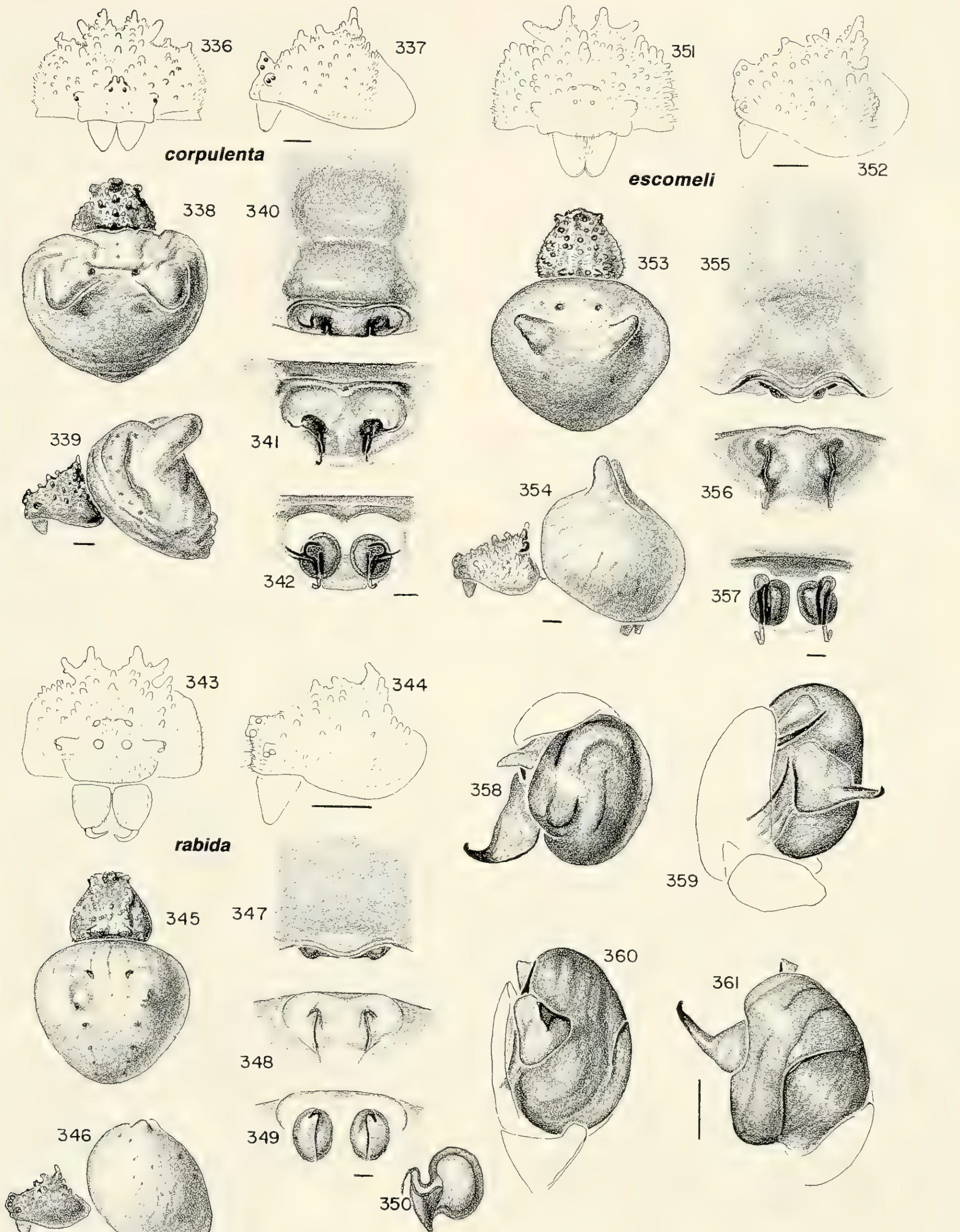
Figures 336–342. *Mastophora corpulenta* (Banks), female. 336, 337, carapace and chelicerae. 336, frontal. 337, lateral. 338, 339, carapace and abdomen. 338, dorsal. 339, lateral. 340–342, epigynum. 340, ventral. 341, posterior. 342, posterior, cleared.

Figures 343–350. *M. rabida* new species, female. 343, 344, carapace and chelicerae. 343, frontal. 344, lateral. 345, 346, carapace and abdomen. 345, dorsal. 346, lateral. 347–350, epigynum. 347, ventral. 348, posterior. 349, posterior, cleared. 350, seminal receptacle, median.



Figures 351–361. *M. escomeli* new species. 351–357, female. 351, 352, carapace and chelicerae. 351, frontal. 352, lateral. 353, 354, carapace and abdomen. 353, dorsal. 354, lateral. 355–357, epigynum. 355, ventral. 356, posterior. 357, posterior, cleared. 358–360, male left palpus, stained. 358, apical. 359, mesal. 360, ventral. 361, ectal.

Scale lines. 1.0 mm; genitalia, 0.1 mm.

ture. Total length 11.0 mm. Carapace 5.4 mm long, 5.2 wide in thoracic region, 2.8 wide behind posterior lateral eyes. First femur 4.7 mm, patella and tibia 7.6, metatarsus 5.4, tarsus 1.4. Second patella and tibia 4.8 mm, third 2.4, fourth 4.1.

Males are not known.

Diagnosis. *Mastophora corpulenta* is distinguished from *M. diablo* by the small dorsal knobs in the depression of the posterior of the epigynum (Fig. 341).

The egg sac is fig-shaped, lacks lateral flaps, and has a thick stalk (Fig. 461).

Distribution. Central America (Map 4A).

Specimens Examined. NICARAGUA León, Abangasca, 13 Dec. 1994, 1 subadult ♀ (J. M. Maes, MCZ).

Mastophora rabida new species
Figures 343–350; Map 4A

Holotype. Female holotype and immature female paratype from Rábida Island, Galapagos Islands, Ecuador, 12 May 1981 (Y. D. Lubin, 319), in MCZ. The specific name is a noun in apposition after the locality

Note. The female holotype is a penultimate instar, ready to molt. The exuvium is loose above the epigynum. The epigynum is mature but not sclerotized.

Description. Female holotype. Carapace dark orange. Chelicerae, labium, endites orange. Sternum orange with white pigment. Coxae and distal leg articles dark dusky orange. Abdomen white with some faint gray marks (Fig. 345); venter with white square. Carapace appearing downy, covered with tubercles; tubercles with light tips (Figs. 343, 344). Median eyes on bulge, lateral eyes on bulges. Abdomen slightly wider than long with small humps (Figs. 345, 346). Total length 7.7 mm. Carapace 3.1 mm long, 2.9 wide in thoracic region, 1.8 wide at lateral eyes. First femur 2.8 mm, patella and tibia 4.2, metatarsus 3.2, tarsus 1.0. Second patella and tibia 3.0 mm, third 1.7, fourth 2.8. Length of first patella and tibia 1.4 times width of carapace.

Males are not known.

Diagnosis. *Mastophora rabida* is distinguished by the ventral loops of the slits on the posterior of the epigynum (Figs. 348, 349).

Natural History. From Y. Lubin (personal correspondence): "#319. nocturnal araneid on orb web. During day sits on twigs. 1 female, 1 juvenile. [NB: maybe it was the juvenile on an orb web? I didn't specify in the notes. YL]. #510. Tagus Cove, Isabella [This is a mangrove area]." Notes from field book 19: 30: "on Croton bush, hanging from thread with legs 3,4. Legs 1,2 held outwards, flexed. No bolas. Spider stretches legs forward when I hum, then moves to edge of leaf and adopts same posture."

Distribution. Galapagos Islands (Map 4A).

Paratypes. Galapagos Islands: Isabella Island, Tagus Cove, on *Croton scouleri* at night, 13 May 1983, 1 imm. (Y. Lubin 510, MCZ).

Mastophora escomeli new species
Figures 351–361; Map 4A

Glyptocranium gasteracanthoides:—Escomel, 1918, 136 (misidentification).

Holotype. Female holotype from Valle de Majes, nr. Arequipa, Depto. Arequipa, Peru, 1920 (E. Escomel), in MNHN. The species has been named after the collector and author of a paper on the venoms of *Mastophora.*

Note. A similar specimen examined by

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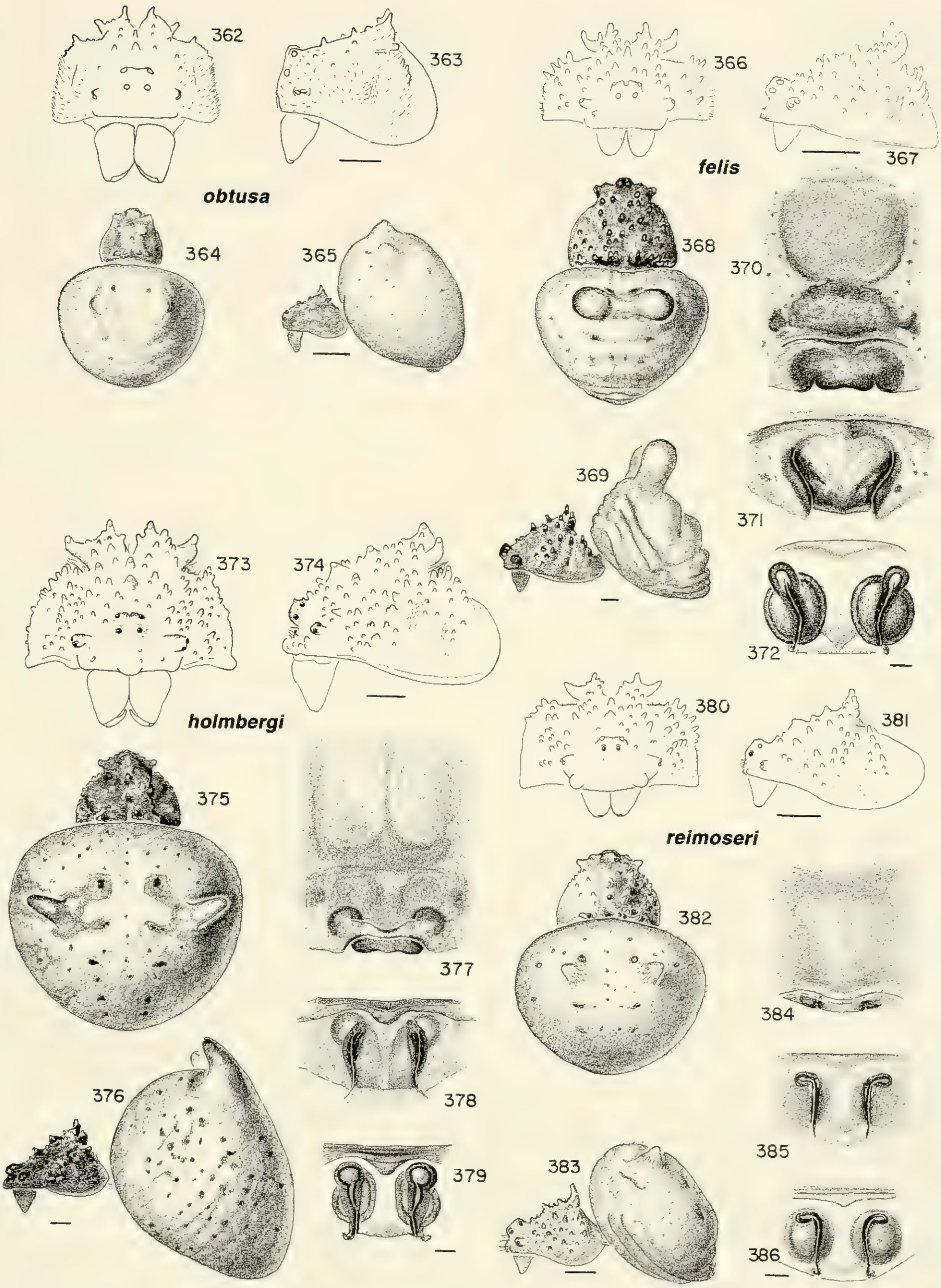
Figures 362–365. *Mastophora obtusa* Mello-Leitão, immature female. 362, 363, carapace and chelicerae. 362, frontal. 363, lateral. 364, 365, carapace and abdomen. 364, dorsal. 365, lateral.

Figures 366–372. *M. felis* Piza, female. 366, 367, carapace and chelicerae. 366, frontal. 367, lateral. 368, 369, carapace and abdomen. 368, dorsal. 369, lateral. 370–372, epigynum. 370, ventral. 371, posterior. 372, posterior, cleared.

Figures 373–379. *M. holmbergi* Canals, female. 373, 374, carapace and chelicerae. 373, frontal. 374, lateral. 375, 376, carapace and abdomen. 375, dorsal. 376, lateral. 377–379, epigynum. 377, ventral. 378, posterior. 379, posterior, cleared.



Figures 380–386. *M. reimoseri* new species, female. 380, 381, carapace and chelicerae. 380, frontal. 381, lateral. 382, 383, carapace and abdomen. 382, dorsal. 383, lateral. 384–386, epigynum. 384, ventral. 385, posterior. 386, posterior, cleared.

Scale lines. 1.0 mm; genitalia, 0.1 mm.

Canals (MACN) was labeled *M. satan*, presumably because of its long first legs.

Description. Female holotype. Carapace orange-brown. Chelicerae brown. Labium, endites, sternum orange. Coxae orange, distal leg articles brown. Abdomen brownish, underlain by some white patches (Figs. 353, 354); venter with white square. Carapace with many large tubercles, tubercles on sides; tubercles with light tips, with short white setae between, but not covering tubercles, and longer white setae on sides (Figs. 351, 352). Median eyes on a bulge; lateral eyes on bulges. First tarsus with S-shaped curvature. Abdomen with long humps (Figs. 353, 354). Total length 13.5 mm. Carapace 5.0 mm long, 5.0 wide in thoracic region, 3.0 wide at lateral eyes. First femur 4.6 mm, patella and tibia 7.7, metatarsus 6.3, tarsus 1.6. Second patella and tibia 4.8 mm, third 2.7, fourth 4.3. Length of first patella and tibia 1.5 times width of carapace.

Male of uncertain affiliation. Color and shape as in other males. Total length 1.7 mm. Carapace 0.83 mm long, 0.81 wide in thoracic region, 0.54 wide at lateral eyes. First femur 0.72 mm, patella and tibia 0.81, metatarsus 0.49, tarsus 0.13. Second patella and tibia 0.71 mm, third 0.39, fourth 0.54. Length of first patella and tibia 1.0 times width of carapace.

Note. Affiliation of males with females is uncertain.

Variation. Total length of females 12.0–13.5 mm. Length of first patella and tibia 1.5–1.7 times width of carapace. The female from Ica is more setose, with long setae on the legs and many shorter setae on the abdomen. The depressions of the female epigynum are larger and the bulge between the slits is less distinct. The illustrations were made from the female holotype.

Diagnosis. Mastophora escomeli is distinguished from *M. gasteracanthoides* by having a swelling between the slits on the posterior of the epigynum (Fig. 356) and having the atrium ventral to the seminal receptacles (Fig. 357). In *M. gasteracanthoides*, the slits are in a shared depression and the atria are dorsal to the seminal receptacles (Figs. 415, 416).

Natural History. Specimens were found on grapevines near Arequipa, and were known to readily bite grape workers as they pruned the plants, causing necrotic lesions.

Distribution. Dry coastal region of Peru (Map 4A).

Paratypes. PERU *Lima:* Lomas de Lachay, 26 May 1996, 1♀ (N. Llerana Martínez, MUSM). *Arequipa:* Arequipa, 1912, 2♀ (E. Escobal, MNHN); 1♀ (E. Escobal, MACN 4198).

Specimens Examined. PERU *Ica:* Ica, 1992, 1♀ (Cascavilca-Rubio, MACN). *La Libertad:* Cerro Campana, N Trujillo, 23 May 1989, many ♂, imm. (A. Salas, MUSM).

Mastophora obtusa Mello-Leitão
Figures 362–365; Map 4C

Mastophora obtusa Mello-Leitão, 1936: 134, fig. 2, imm. Immature holotype from Pesqueira, Pernambuco, Brazil, in MNRJ, 41845, examined. Roewer, 1942: 955. Platnick, 2001.

Glyptocranium obtusum:—Bonnet, 1957: 1998.

Note. Pesqueira is located in the note with the description of *M. pickeli*.

Description. Female holotype. Carapace reddish brown with white rim. Chelicerae, labium, endites brown. Sternum light brown. Coxae and distal leg articles brown. Abdomen very light brown; venter with white square. Carapace with short white setae on sides (Figs. 363, 364). Abdomen high with a pair of humps. Total length 4.8 mm. Carapace 1.8 mm long, 1.7 wide in thoracic region, 1.2 wide at lateral eyes. First femur 1.6 mm, patella and tibia 2.3, metatarsus 1.3, tarsus 0.5. Second patella and tibia 1.7 mm, third 0.8, fourth 1.8. Length of first patella and tibia 1.4 times width of carapace.

Diagnosis. Although the type is immature, *M. obtusa* is distinguished from many other species by the high abdomen and the humps on a joined swelling (Fig. 364). The high sides of the carapace, the shape of the tubercles, and the lack of pigment pattern on the abdomen suggest that the species belongs to the *M. gasteracanthoi-*

des group of species. Perhaps this is an immature of *M. satan*.

Specimens Examined. No other specimens have been found.

Mastophora felis Piza
Figures 366–372; Map 4C

Mastophora felis Piza, 1976: 83, fig. 1. Female holotype from Piracicaba, São Paulo, Brazil, in MZAQ no. A0105, examined. Brignoli, 1983: 273. Platnick, 2001.

Note. The holotype was embedded in difficult-to-remove fungal mycelium.

Description. Female holotype. Carapace dark brown with tips of tubercles light and a thin white rim, each posterior median eye in a light patch. Chelicerae brown. Labium, endites brown. Sternum brown. Coxae and distal leg articles orange-brown. Abdomen brownish gray (Figs. 368, 369); venter with a median white square. Carapace with long tubercles, the median of the horn's base with multiple tubercles (Figs. 366, 367), covered with short white setae between tubercles. Median and lateral eyes on bulges. Legs with white setae. Abdomen with a pair of long dorsal humps (Fig. 369). Total length 13.0 mm. Carapace 6.3 mm long, 6.4 wide in thoracic region, 3.8 wide at lateral eyes. First femur 5.8 mm, patella and tibia 10.6, metatarsus 8.8, tarsus 2.3. Second patella and tibia 6.7 mm, third 3.6, fourth 5.5. Length of first patella and tibia 1.6 times width of carapace.

Males are not known.

Variation. Total length of females 11.3–13.0 mm. Length of first patella and tibia 1.4–1.6 times width of carapace. The illustrations were made from the female holotype.

Diagnosis. Mastophora felis is distinguished from all others having long wide humps and carapace with tubercles on sides and by having the atria of the epigynum ventral to the seminal receptacles (at 11 and 1 h in Fig. 372) and the slits with a lateral lip (Fig. 371). The carapace tubercles are longer than those of *M. satan* and the posterior eyes are on light patches.

Distribution. Rio de Janeiro and São Paulo states, Brazil (Map 4C).

Paratypes. BRAZIL *Rio de Janeiro:* Santo Antônio, Rio Bonito [22°42′S, 42°37′W], 1933, 1♀ (S. Rementente, IBSP 418). *São Paulo:* ?Campinas, July 1982, 1♀ (C. Froelich, IBSP 4968).

Mastophora holmbergi Canals
Figures 373–379; Map 4C

Mastophora Holmbergi Canals, 1931: 22, figs. 1–5, pl. 3, fig. 5; pl. 4, figs. 7, 8, ♀. Female from km 701, Santiago del Estero, in MACN, 24133 [7140], examined.
Mastophora holmbergi:—Mello-Leitão, 1931, 73, figs. 10, 21, ♀. Roewer, 1942, 900. Platnick, 2001.
Glyptocranium holmbergi:—Bonnet, 1957, 1997.

Description. Female holotype. Carapace dark red-brown to black, light transverse band in front of posterior median eyes. Sternum orange. Legs orange-brown. Abdomen with faint pattern (Figs. 375); venter with white square. Carapace with many tubercles with light tips especially on sides, and a few downy setae; lateral eyes on bulges (Figs. 373, 374). First tarsus slightly S-shaped. Abdomen with narrow humps. Total length 11.0 mm. Carapace 5.2 mm long, 5.3 wide in thoracic region, 3.0 wide at lateral eyes. First femur 5.7 mm, patella and tibia 10.0, metatarsus 9.2, tarsus 2.0. Second patella and tibia 6.2 mm, third 3.2, fourth 5.0. Length of first patella and tibia 1.9 times width of carapace.

Males are not known.

Variation. Total length of females 11.0–15.3 mm. The illustrations were made from the female holotype.

Diagnosis. Unlike *Mastophora reimoseri, M. holmbergi* has long first legs. In the epigynum the atria are visible in ventral view (Fig. 377) and the slits are parallel, but at their ventral ends the slits bend toward each other (Fig. 378).

Distribution. Paraguay, to Santiago del Estero, Argentina (Map 4C).

Specimens Examined. PARAGUAY Rca. del . . . [illegible], Nov. 1940, 1♀ (Cranwell-Giai, MACN 1630).

Mastophora reimoseri new species
Figures 380–386; Map 4C

Holotype. Female holotype from Asuncion, Paraguay, 1908 (E. Reimoser), in NHMW. The species has been named after the collector and Austrian arachnologist, E. Reimoser.

Description. Female holotype. Specimen faded. Carapace yellow-brown. Chelicerae, labium, endites yellow-brown. Sternum, legs golden brown. Carapace with many tubercles and short setae, clypeus with longer setae (Figs. 380, 381). Median eyes and lateral eyes on bulges. First femora bent at their distal ends with long setae at point of greatest curvature. Abdomen with distinct humps and short setae, base of humps with longer setae (Figs. 382, 383). Total length 8.5 mm. Carapace 4.0 mm long, 4.0 wide in thoracic region, 2.3 wide at lateral eyes. First femur 3.7 mm, patella and tibia 6.2, metatarsus 4.5, tarsus 1.2. Second patella and tibia 4.0 mm, third 2.1, fourth 3.5. First patella and tibia 1.6 times width of carapace.

Males are not known.

Diagnosis. The species is distinguished by the musical note–shaped marks of the slits in the epigynum (Fig. 385), and by having shorter legs than *M. holmbergi.*

Distribution. Known only from Asuncion, Paraguay (Map 4C).

Specimens Examined. No other specimens have been found.

Mastophora satan Canals
Figures 387–398, 462, 463; Map 4B

Mastophora satan Canals, 1931: 25, figs. 1–5, pl. 3, fig. 6, ♀. Female holotype from La Rioja, Argentina, in MACN, 5260, examined. Mello-Leitão, 1931: 73, figs. 11, 22, ♀. Roewer, 1942: 901. Platnick, 2001.
Glyptocranium satan:—Bonnet, 1957: 1998.

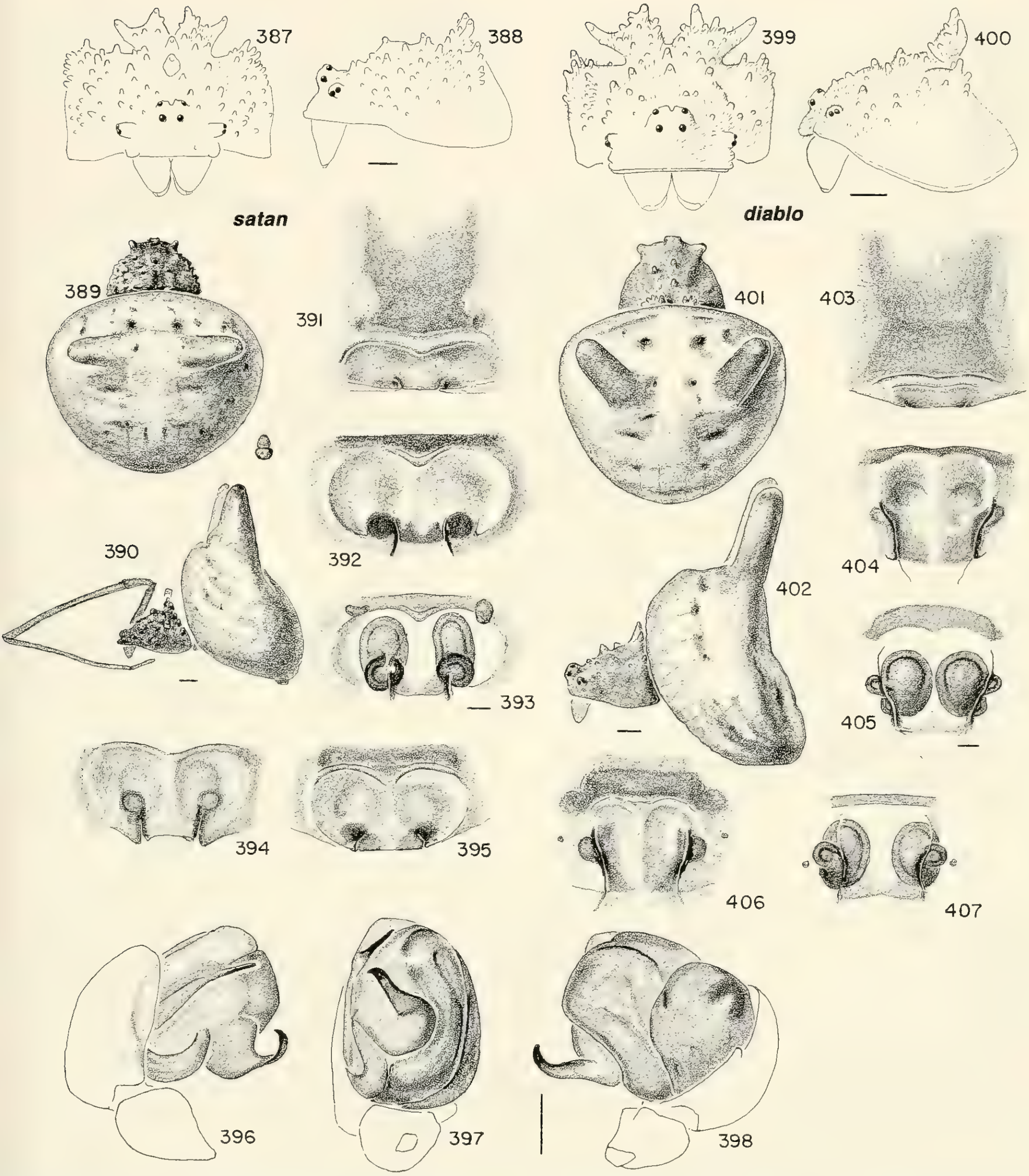
Description. Female from Córdoba. Carapace dark brown with many short light setae and narrow white rim. Sternum red-brown. Legs red-brown with long white setae. Abdomen whitish with duskiness on humps and sides (Fig. 389); venter with white square. Carapace with many tubercles, lateral eyes on bulges, median eyes on bulge (Figs. 387, 388). Abdomen humps very long (Figs. 389, 390). Total length 14.0 mm. Carapace 6.4 mm long, 6.6 wide in thoracic region, 3.5 wide at lateral eyes. First femur 7.0 mm, patella and tibia 11.5, metatarsus 10.0, tarsus 2.2. Second patella and tibia 7.0 mm, third 3.3, fourth 5.7. Length of first patella and tibia 1.7 times width of carapace.

Male from Rio Grande do Sul, Brazil. Carapace beige with a triangular white patch. Sternum, legs beige. Abdomen whitish. Carapace with four tubercles, abdomen with two humps. Total length 1.7 mm. Carapace 0.92 mm long, 0.81 wide in thoracic region, 0.58 wide at lateral eyes. First femur 0.87 mm, patella and tibia 0.92, metatarsus 0.49, tarsus 0.31. Second patella and tibia 0.74 mm, third 0.44, fourth 0.55.

Note. The association of male and female is uncertain. The male is placed with the most common species in the area; also, a female of the species has been collected at the collecting site.

Variation. Total length of females 9.7–17.5 mm. The holotype is 11.2 mm total length, carapace 5.7 mm wide and long, the first patella and tibia 9.7. Length of first patella and tibia 1.4–1.6 times carapace width in females from Brazil, 1.7 in specimens from Uruguay, 1.5 from Mendoza, 1.6 from La Pampa, 1.5 from Entre Rios. The illustrations were made of a female from Córdoba Province, Argentina, a female from La Rioja Province (Fig. 394), a female from Tucumán Province (Fig. 395), and of the male from Rio Grande do Sul, Brazil.

Diagnosis. Mastophora satan is separated from *M. gasteracanthoides* and *M. diablo* by the long first tibia and metatarsus, each 9.7 mm or longer. The epigynum differs from that of *M. diablo* by showing the atria as a dark patch in the dorsal slope of a depression (Figs. 392, 394, 395), whereas in *M. satan,* atria are outside and lateral to the depression (Figs. 404, 406). The epigynum is similar to that of *M. gasteracanthoides* but differs in ventral view, where



Figures 387–398. *Mastophora satan* Canals. 387–395, female. 387, 388, carapace and chelicerae. 387, frontal. 388, lateral. 389, 390, carapace and abdomen. 389, dorsal, with male. 390, lateral. 391–395, epigynum. 391, ventral. 392, 394, 395, posterior. 393, posterior, cleared. 392, 393, (Córdoba). 394, (holotype from La Rioja). 395, (Tucumán). 396–398, male left palpus. 396, mesal. 397, ventral. 398, ectal.

Figures 399–407. *M. diablo* new species, female. 399, 400, carapace and chelicerae. 399, frontal. 400, lateral. 401, 402, carapace and abdomen. 401, dorsal. 402, lateral. 403–407, epigynum. 403, ventral. 404, 406, posterior. 405, 407, posterior, cleared. 404, (Chaco). 406, 407, (Santiago del Estero).

Scale lines. 1.0 mm; genitalia, 0.1 mm.

M. gasteracanthoides has a distinct sclerite a short distance anterior to the posterior edge (Fig. 414), whereas *M. satan* has the whole median area slightly sclerotized (Fig. 391).

The median apophysis of the palpus of the male (Fig. 398) is more curved than that of *M. gasteracathoides* (Fig. 420).

The egg sac lacks flaps and has only a short stalk (Figs. 462, 463).

Distribution. From Pernambuco State, eastern Brazil, to La Pampa Province, Argentina (Map 4B).

Specimens Examined. BRAZIL *Pernambuco:* Tapera, 1♀ (B. Pickel, MNRJ 391). *Bahia:* Feiora de Santana, July 1994, 1♀ (S. D. Cunha, IBSP 16246). *São Paulo:* Santo André, 16 June 1965, 1♀ (L. Daga, IBSP 1931); Seminario Santa Terezinha, Tietê, 5 May 1953, 1♀ (IBSP 887); São José do Rio Preto, 9 Feb. 1964, 1♀ (Vizotto, MZSP 3471); 1 June 1964, 1 egg sac, 1♀ (Vizotto, MZSP 3470). *Santa Catarina:* Blumenau, 1♀ (NHMW). *Rio Grande do Sul:* 1♀ (P. Buck, MNRJ 41644); Rodeio Bonito, Bogé, 5 June 1980, 1♀ (E. W. Aguiar, MCN 9103); Canela, 10 Feb. 1966, 2♀ (A. A. Lise, MCN 0752); São Leopoldo, 5 Mar. 1965, 1♀ (C. Valle, MZSP 4797); Porto Alegre, 12 Apr. 1926, 1♀ (R. Gliesch, MNRJ 392); Parque Zoologico, Sapucaia do Sul, 9 Dec. 1985, 2♀ (A. E. Tovares, MZSP 14079); Porto Alegre, 17 Mar. 1955, 1 imm. (T. de Lema, MCN 01628); 16 June 1963, 1♀ (A. Lise, MCN 01820); 6 Oct. 1988, 1♀ (R. Villanova, MCP 105); Belem Velho, Porto Alegre, 17 July 1979, 1♀ (V. Mott, MCN 2608); Morro Santana, Porto Alegre, 5 May 1984, 1♂ (S. M. Silva, MCN 12204); 13 Sept. 1984, 1♀ (A. A. Lise, MCN 29426); Santa Maria, Aug. 1986, 1♀ (MCP 10340); Santo Antônio da Patulha, 30 Oct. 1980, 1♀ (T. K. Moreira, MCN 9456). URUGUAY Villasboas, 1953, 1♀ (L. Lecour, FCMU); Paso del Cerro (Artigas), May 1956, 1♀ (C. Fuques, FCMU); Artigas, Sept. 1959, 1♀ (C. Fuques, FCMU); Mar. 1965, 1♀ (C. Fuques, FCMU 1965); Ruta 3, Salto, 3 Aug. 2001, 1♀ (V. Vázquez, Williams, FCMU 562); Cuareim, Espinillares, Artigas, 12 Mar. 1956, 1♀ (C. Fuques, FCMU 296). ARGENTINA *Misiones:* 1940, 1♀ (Exp. Zotla. Armanini, MACN 2050). *Catamarca:* Siján, Nov. 1964, 1♀ (Ahumada, MACN). *La Rioja:* 2♀ (Sr. Giacomelli, MACN 4186). *Tucumán:* Tucumán, 12 Dec. 1984, 1♀ (FMLT 2159). *Santiago del Estero:* Santiago del Estero, 20 Apr. 1958, 1♀ (J. W. Abalos, MACN); La Banda, 1958, 1♀ (J. Abalos, MACN); July 1958, 1♀ (D. Bravo, MACN); Tabla Redonda, Depto. Banda, 23 Dec. 1959, 1♀, egg sacs, imm. (J. W. Abalos, MACN). *Mendoza:* Mendoza, 1907, 1♀ (E. Reimoser, NHMW); San Rafael, Feb. 1940, 1♀ (D. Pereyra, MACN 1799). *Córdoba:* Mina Clavero, April 1973, 1♀ (Stirbel, MACN). *Entre Ríos:* Concordia, 1931, 1♀ (MNRJ 57953). *Santa Fé:* Santa Fé, 1931, 1♀ (M. Birabén, MNRJ 522). *Buenos Aires:* Ireneo Portela, 30 April 1922, 1♀ (Scheimer, MACN). *La Pampa:* General Pico, Feb. 1952, 1♀ (Williamson, MACN); 30 Mar. 1958, 2♀, doubtful determination (Williamson, MACN).

Mastophora diablo new species
Plate 1; Figures 399–407, 464; Map 4D

Holotype. Female holotype from Colonia Benítez, Chaco, Argentina, Sept. 1959 (Bachmann) in MACN, no. 5432.

Mastophora gasteracanthoides:—Mello-Leitão, 1931: 69, in part. Canals, 1931: 19 (misidentified *gasteracanthoides* Nicolet).

Note. Most specimens of this species had been misidentified as *M. gasteracanthoides* in collections.

Description. Female holotype. Carapace brown, with many downy short setae and narrow white rim. Sternum brown. Legs brown with long white setae. Abdomen brownish white; venter with white square. Abdomen humps long (Figs. 401, 402). Total length 13.0 mm. Carapace 5.3 mm long, 5.8 wide in thoracic region, 3.2 wide at lateral eyes. Abdomen 15 mm high. First femur 5.5 mm, patella and tibia 8.6, metatarsus 6.3, tarsus 1.3. Second patella and tibia 5.7 mm, third 3.0, fourth 4.8. Length of first patella and tibia 1.5 times width of carapace.

Males are not known.

Variation. Total length of females 10.3–16.7 mm. Length of first patella and tibia 1.3–1.5 times width of carapace. Figures 399–405 were made from the female holotype; Figures 406 and 407 were from specimens from Santiago del Estero.

Diagnosis. Differs from *M. satan* in having first tibia less than 9 mm total length and from both *M. satan* and *M. gasteracanthoides* by having the atria outside and lateral to the depressions in posterior view of the epigynum (Figs. 404–407).

The egg sac lacks flaps and has a heavier stalk (Fig. 464) than that of *M. satan.*

Natural History. A large syrphid fly (14 mm total length) was collected in Moreno, Buenos Aires, with one adult.

Figures 408–421. *Mastophora gasteracanthoides* (Nicolet). 408–416, 421, female. 408, 409, carapace and chelicerae. 408, frontal. 409, lateral. 410–413, carapace and abdomen. 410, 412, dorsal, with male. 411, 413, lateral. 410, 411, (Santiago). 412, 413, (Chillán). 414–416, epigynum. 414, ventral. 415, posterior. 416, posterior, cleared. 417–420, male left palpus. 417, apical. 418, mesal. 419, ventral. 420, ectal. 421, female, frontal view with right legs.

Scale lines. 1.0 mm; genitalia, 0.1 mm.

Distribution. Northern and central Argentina to La Pampa Province (Map 4D).

Paratypes. ARGENTINA *Formosa:* Las Lomitas, Oct. 1966, 1♀ (A. Vogt, MACN). *La Rioja:* 2♀ (Prof. Gómez, MACN 4187). *Tucumán:* El Timbó, 27 May 1952, 2♀ (J. Campos, FMLT 994); Los Bosques, 1♀ (BMNH); Dept. Burruyaco, El Haranjo, 13 June 1964, 1♀ (M. Inés Cortez, FML 1693). *Santiago del Estero:* El Zanjón, 5 June 1960, 1♀ (J. W. Abalos, MACN); Fernández, 4 Apr. 1960, 1♀ (J. W. Abalos, MACN); Frías, 2 Oct. 1970, 1♀ (J. W. Abalos, MACN); La Banda, 24 May 1958, 1♀ (J. Areas, MACN); Los Juries, March 1959, 1♀ (L. Remedi, MACN); Santiago del Estero, 18 Sept. 1958, 1♀ (D. Luna, MACN); 1959, 1♀ (J. W. Abalos, MACN). *Corrientes:* Bella Vista, Nov. 1944, 1♀ (Silberman, MACN). *Entre Ríos:* Basavilbaso, 1♀ (U. Podesta, MACN 4189). *Santa Fé:* Roldán, June 1943, 1♀ (Escuela 230, MACN). *Córdoba:* Argüello, Feb. 1946, 1♀ (J. A. De Carlo, MACN 1657); Bajo Grande, 1♀ (MLP 15563). *Buenos Aires:* Castela, 27 July 1958, 1♀ (Ing. Favret); Moreno, Jan. 1946, 1♀ (R. D. Schiapelli, MACN 1658). *La Pampa:* Mira Pampa, April 1949, 1♀ (C. Vigliorcho, MLP 16638); General Pico, March 1951, 1♀ (C. Ballani, MLP 13642).

Mastophora gasteracanthoides (Nicolet)
Figures 7, 408–421, 464; Map 4B

Epeira gasteracanthoides Nicolet, 1849: 485, pl. 5, fig. 7a, b, ♀. Specimens from gardens and fields of central provinces, Santiago, Chile, in MNHN, lost.
Glyptocranium gasteracanthoides:—Simon, 1895: 882, fig. 946, ♀. Bonnet, 1957: 1997.
Mastophora gasteracanthoides:—Porter, 1918: 139. Roewer, 1942: 901. Archer, 1963: 19. Platnick, 2001.
Mastophora gasteracanthoides oxalidis Archer, 1963: 16. Female holotype, males, and imm. from Loma de Peñuelas, 6 km al sur de La Serena, Coquimbo, in AMNH, examined. Platnick, 2001. NEW SYNONYMY.

Note. The short humps of recently collected specimens from Santiago (Figs. 410, 411) differ from those of the specimens illustrated by Nicolet (1849) and Simon (1895), which have higher humps. Older specimens kept in MNHN from Chillan (Figs. 412, 413) had longer humps but genitalia and carapace similar to those of recently collected specimens.

The subspecies named by Archer (1963) had no diagnosis.

Description. Female from Santiago. Carapace brown, tubercles lighter. Chelicerae lighter. Sternum brown. Legs lighter brown. Abdomen brownish white with some asymmetrical darker patches and humps (Figs. 410, 411); venter with white square. Total length 12 mm. Carapace 4.8 mm long, 4.8 wide in thoracic region, 2.5 wide at lateral eyes. First femur 4.0 mm, patella and tibia 6.3, metatarsus 4.8, tarsus 1.3. Second patella and tibia 4.3 mm, third 2.6, fourth 4.0. Length of first patella and tibia 1.3 times width of carapace.

Male. Carapace brown, with white median band covering the two median tubercles and the pair of horns. Sternum, legs brown. Abdomen dusky white anterior, venter with indistinct white spots. Abdomen without humps (Fig. 7). The palpus has one weak patellar seta. Total length 2.3 mm. Carapace 0.9 mm long, 0.9 wide in thoracic region, 0.7 wide at lateral eyes. First femur 0.9 mm, patella and tibia 1.0, metatarsus 0.6, tarsus 0.3. Second patella and tibia 0.9 mm, third 0.5, fourth 0.7. Length of first patella and tibia 1.1 times width of carapace.

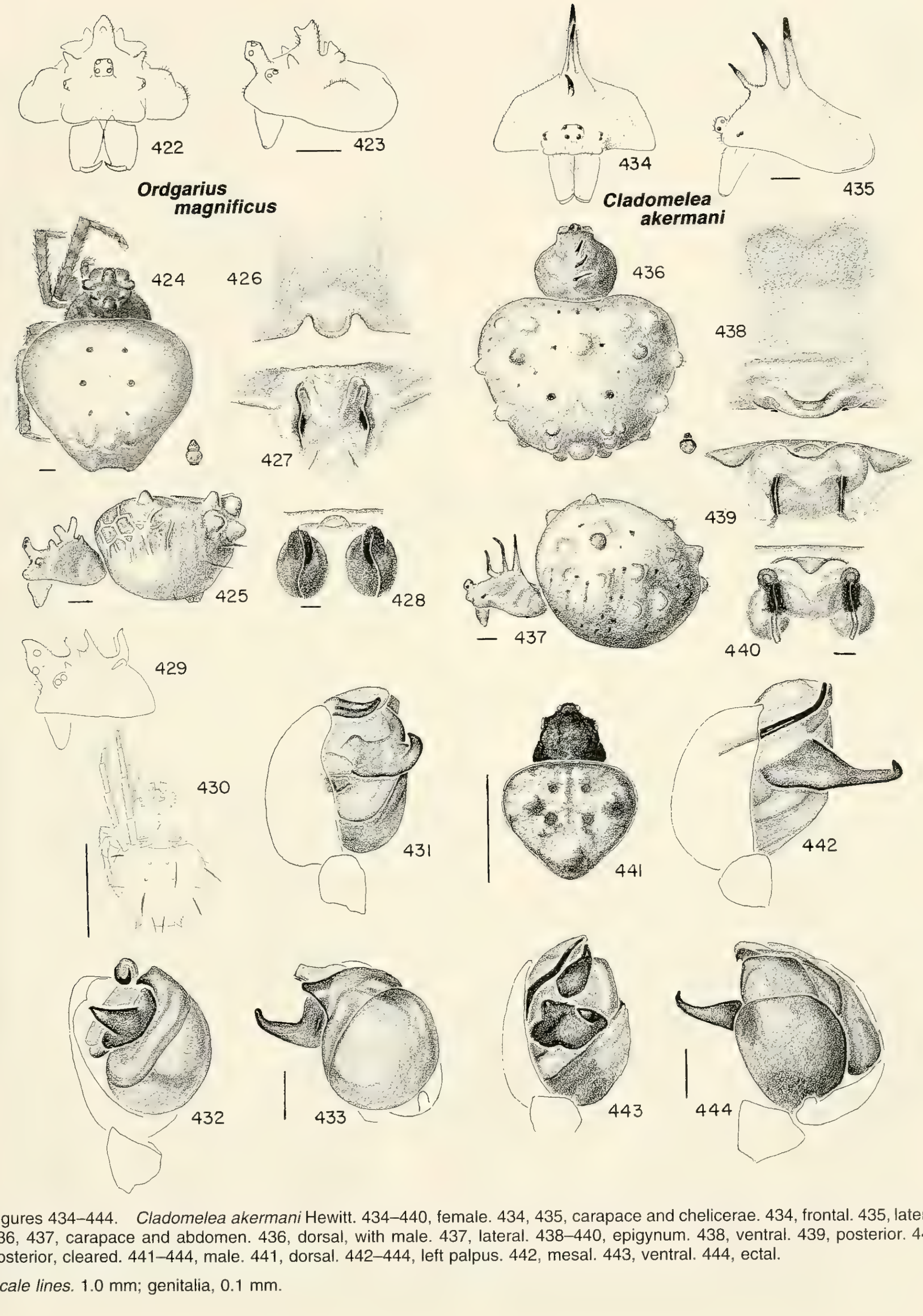
Note. Males came out of an egg sac collected with females.

Variation. Total length of females 9.6–13.5 mm. The illustrations of the female are made from a female from Santiago, except Figures 412 and 413, which are of a female from Chillan.

Diagnosis. Mastophora gasteracanthoides differs from *M. diablo* by having the atria show as dark spots in the posterior slope of the depression in posterior view of the epigynum (Fig. 415), and from *M.*

→

Figures 422–433. *Ordgarius magnificus* (Rainbow). 422–428, female. 422, 423, carapace and chelicerae. 422, frontal. 423, lateral. 424, 425, carapace and abdomen. 424, dorsal, with male. 425, immature, lateral. 426–428, epigynum. 426, ventral. 427, posterior. 428, posterior, cleared. 429–433, male. 429, carapace and chelicerae, lateral. 430, dorsal. 431–433, left palpus. 431, mesal. 432, ventral. 433, ectal.



Figures 434–444. *Cladomelea akermani* Hewitt. 434–440, female. 434, 435, carapace and chelicerae. 434, frontal. 435, lateral. 436, 437, carapace and abdomen. 436, dorsal, with male. 437, lateral. 438–440, epigynum. 438, ventral. 439, posterior. 440, posterior, cleared. 441–444, male. 441, dorsal. 442–444, left palpus. 442, mesal. 443, ventral. 444, ectal.

Scale lines. 1.0 mm; genitalia, 0.1 mm.

satan by having shorter first legs and a distinct sclerotized plate on the epigynum, anterior of the posterior margin, in ventral view (Fig. 414).

The palp of the male has a median apophysis straighter (Fig. 420) than that of *M. satan* (Fig. 398).

The egg sac (Fig. 465) lacks flaps and has a thin stalk.

Distribution. Central Chile (Map 4B).

Specimens Examined. CHILE 1♀ (MNHN, 114). *Coquimbo:* 6 km S of La Serena, 23–30 Nov. 1961, 1♀, egg sac with ♂ and imm. ♀ (A. F. Archer, AMNH). *Valparaiso:* Quilput [Quilpué], 1904, 1♀ (C. Porter, MNHN 23457). *Metropolitana:* Santiago, 4 June 1947, 1 imm. (R. Donoso, AMNH); Feb. 1955, 1♀ (I. Pedag., AMNH); Quilicura, Oct. 1979, 1♀ (L. Peña, AMNH), Aug.–Sept., 2 imm. (L. E. Peña, AMNH); Renca, W of Santiago, 2 Oct. 1984, 1♀ (L. E. Peña, AMNH); Los Espejo, 6 Nov. 1973, 1♀ (C. L. Cartagena, MCZ). *Ñuble:* Chillan, 1♀ (Delfin, MNHN, 23520).

Ordgarius Keyserling

Ordgarius Keyserling, 1886: 114. Type species by monotypy, *M. monstrosus* Keyserling, 1886, from Queensland, Australia. Neave, 1940: 453. Roewer, 1942: 902. Bonnet, 1958: 3200. Davies, 1988: 318, figs. 36, 37, ♀, ♂.

Euglyptila Simon, 1908: 151. Type species designated by Bonnet, 1956, *E. acanthonotata* from Tonkin [northern Vietnam]. Neave, 1939b: 325. Roewer, 1942: 903. Bonnet, 1956: 1810. NEW SYNONYMY.

Note. Two species of *Euglyptila* were described by Simon, both from immatures. *Euglyptila acanthonotata* is in MNHN, lost; the other, *E. nigrithorax,* 2.5 mm total length was found, described, and illustrated by Emerit (1980). It is an immature of *Ordgarius sexspinosus* Thorell, 1894, total length 14 mm, and is illustrated by Yin, 1997: 384. NEW SYNONYMY.

Ordgarius magnificus (Rainbow)
Figures 422–433, 466

Dicrostichus magnificus Rainbow, 1897: 523, pl. 17, fig. 8, ♀. Holotype from Mount Kembla, New South Wales, Australia, not examined. Roewer, 1942: 900.

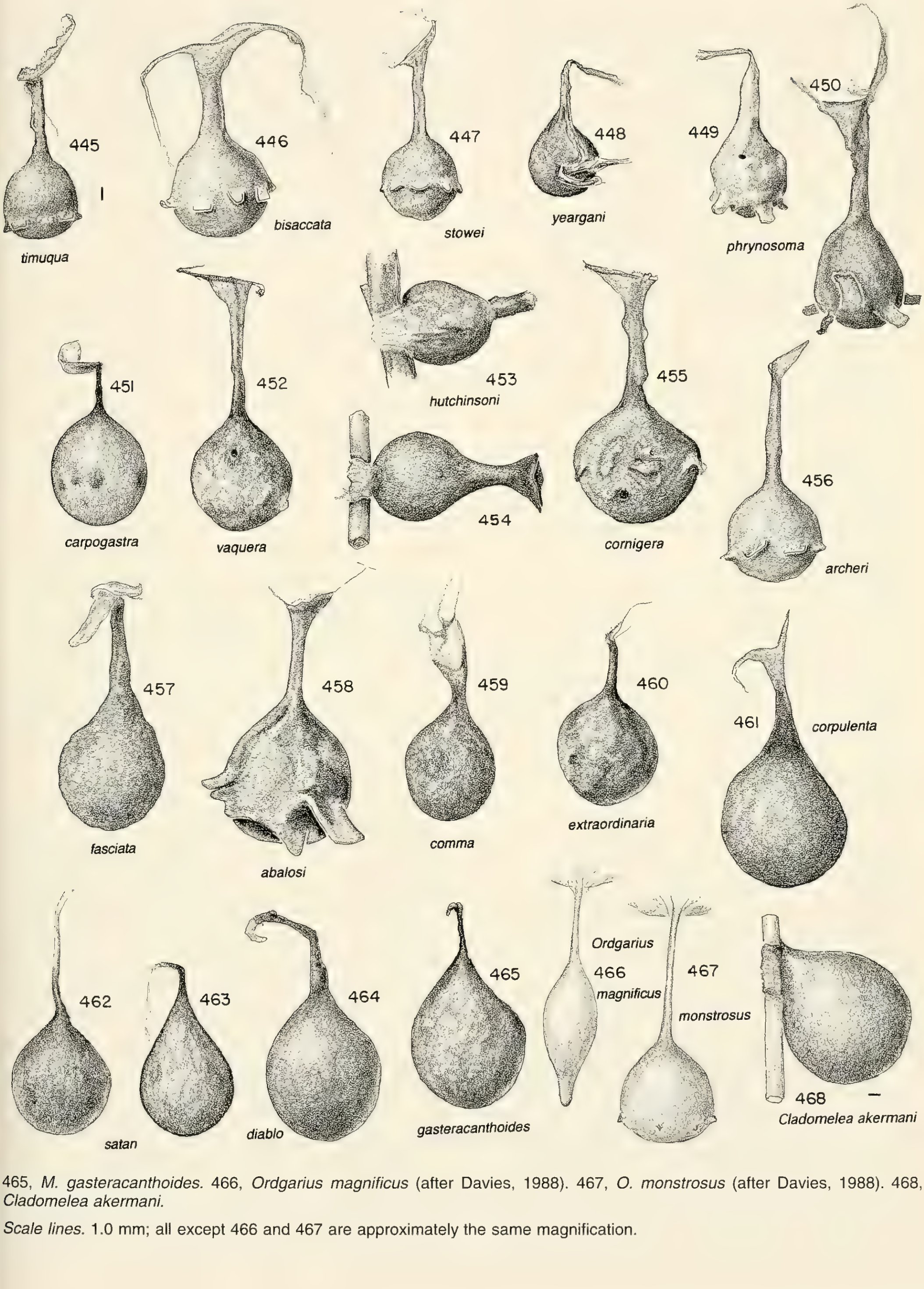
Ordgarius magnificus:—Davies, 1988: 316.

Description. Female. Carapace yellowish, dark brown in groove between cephalic and thoracic areas, a dark band above eyes, tubercles white. Sternum light orange. Coxae and distal leg articles light orange. Abdomen yellowish white with ventral white square. Carapace with median eyes on stalk, with horns quite small (Figs. 422, 423). Eyes subequal, median eye area almost square. Chelicerae fang groove with three anterior teeth, one small posterior tooth. Abdomen narrowing to posterior end, with tubercles (Figs. 424, 425). Total length 13.5 mm. Carapace 6.3 mm long, 6.7 wide in thoracic region, 3.3 wide at lateral eyes. First femur 6.0 mm, patella and tibia 7.3, metatarsus 4.7, tarsus 1.4. Second patella and tibia 7.0 mm, third 3.9, fourth 5.8. Length of first patella and tibia 1.1 times width of carapace.

Male. Carapace beige, white pigment spots at base of spines. Sternum dark brown. Legs light beige. Dorsum of abdomen white, venter black. Carapace (Fig. 429), abdomen as in Figure 430. Row of setae on tarsi as in male *Mastophora.* Palpal patella with no setae. No endite tooth, no coxal hook. Total length 1.7 mm. Carapace 0.88 mm long, 0.81 wide in thoracic region, 0.52 wide at lateral eyes. First femur 0.78 mm, patella and tibia 0.89, metatarsus 0.57, tarsus 0.30. Second patella and tibia 0.78 mm, third 0.39, fourth 0.59. Length of first patella and tibia 1.1 times width of carapace.

→

Figures 445–468. Egg sacs of *Mastophora* species, including species of *Ordgarius* and *Cladomelea.* 445, *M. timuqua.* 446, *M. bisaccata.* 447, *M. stowei.* 448, *M. yeargani.* 449, 450, *M. phrynosoma.* 449, (Kentucky). 450, (Florida). 451, *M. carpogastra.* 452, *M. vaquera.* 453, 454, *M. hutchinsoni.* 453, (after Kaston, 1981). 454, (New Jersey). 455, *M. cornigera.* 456, *M. archeri.* 457, *M. fasciata.* 458, *M. abalosi* (after Urtubey and Báez, 1983). 459, *M. comma* (after Báez and Urtubey, 1985). 460, *M. extraordinaria.* 461, *M. corpulenta.* 462, 463, *M. satan.* 462, (Santiago del Estero). 463, (Rio Grande do Sul). 464, *M. diablo.*



465, *M. gasteracanthoides*. 466, *Ordgarius magnificus* (after Davies, 1988). 467, *O. monstrosus* (after Davies, 1988). 468, *Cladomelea akermani*.

Scale lines. 1.0 mm; all except 466 and 467 are approximately the same magnification.

Genitalia. The epigynum like *Mastophora* in having only a posterior lobe ventrally (Fig. 426) and having two slits and diagnostic sculpturing on the posterior face (Fig. 427) and having indistinct atria (Fig. 428). The palpus of the male has no conductor but has the tip of the tegulum sclerotized (at 11 h in Fig. 433) and the median apophysis more sclerotized than that of *Mastophora* (Figs. 431–433).

Variation. The female examined came from Olderley, Brisbane, Queensland, the male from Mulgowie, SE Queensland (QMB).

Natural History. Unlike most *Mastophora,* this species ties leaves together and may have a diurnal retreat. The female uses the second leg to swing a bolas. The egg sac of *O. magnificus* is spindle-shaped (Fig. 466), that of *O. monstrosus* resembles those of *Mastophora* and has minute flaps (Fig. 467).

Distribution. Australia.

Cladomelea Simon

Cladomelea Simon, 1895: 886, figs. 949, 950. Type species by original designation *Cyrtarachne longipes* O. P.-Cambridge, 1877: 559, from West Africa. Neave, 1939a: 750. Roewer, 1942: 900. Bonnet, 1956: 1097.

Note. Cladomelea longipes is very similar to *C. akermani.*

Cladomelea akermani Hewitt
Figures 434–444, 468

Cladomelea akermani Hewitt, 1923: 63, figs. 4, 5, ♀. Female holotype from Pietermaritzburg, Natal, not examined. Roewer, 1942: 500. Leroy, Jocqué, and Leroy, 1998: 1, ♀, ♂.

Description. Female. Carapace light orange-brown, distal ends of projections black. Chelicerae, labium, endites orange. Sternum light orange-brown. Coxae orange-brown; legs brown. Dorsum of abdomen whitish with a pair of brown tubercles (Fig. 436); venter whitish with a median, transverse, white rectangle. Carapace with median eyes on a bulge, three projections and long white setae, no horns (Figs. 434, 435). Height of clypeus equals about five diameters of anterior median eye. Abdomen widest in middle, dorsum with numerous rounded tubercles, not completely symmetrical (Figs. 436, 437). Total length 15.5 mm. Carapace 5.4 mm long, 5.2 wide, 2.3 wide at lateral eyes. First femur 6.7 mm, patella and tibia 10.8, metatarsus 8.4, tarsus 1.4. Second patella and tibia 7.3 mm, third 3.3, fourth 4.7. Length of first patella and tibia 1.9 times width of carapace.

Male. Carapace, labium, endites, sternum dark brown. Coxae, distal leg articles light. Dorsum of abdomen maculated black, gray, and white (Fig. 441); venter dark brown. Carapace rugose, without tubercles, posterior area swollen. Height of clypeus equals 1.8 diameters of anterior median eye. Endite without tooth. Palpal patella without macroseta. First coxa without hook. Row of setae on tarsi, as in male *Mastophora.* Abdomen widest in middle, dorsum sclerotized with three humps and two pairs of sclerotized discs (Fig. 441). Total length 1.6 mm. Carapace 0.94 mm long, 0.72 wide, 0.51 wide at lateral eyes. First femur 0.80 mm, patella and tibia 0.91, metatarsus 0.48, tarsus 0.34. Second patella and tibia 0.70 mm, third 0.41, fourth 0.57. Length of first patella and tibia 1.3 times width of carapace.

Genitalia. The epigynum is as in *Mastophora,* having only a posterior lip ventrally (Fig. 438) and having two slits and diagnostic sculpturing on the posterior face (Fig. 439) and tiny atria (Fig. 440). The palpus of the male has a distinct conductor supporting the embolus (at 1 h in Fig. 443) and the median apophysis more sclerotized than that of *Mastophora* (Figs. 442–444).

Variation. A second female from Pietermaritzburg, Natal (AMNH), examined had the height of the clypeus only four diameters of the anterior median eye. Female examined and illustrated from Umgeni Valley Reservation, Kwa–Zulu–Natal, South Africa, the male came from Umgeni Valley project near Howick, South Africa (NMP).

Natural History. The spider is found in grasslands on grass of the Kwa–Zulu–Natal area around Pietermaritzburg, South Africa (Leroy et al., 1998). The egg sac is drop-shaped and attached to a grass blade (Fig. 468). The female handles the bolas with a second leg and swings it in a horizontal plane.

Distribution. South Africa.

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A MONOGRAPHIC REVISION OF THE ANT GENUS *PRISTOMYRMEX* (HYMENOPTERA: FORMICIDAE)

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A MONOGRAPHIC REVISION OF THE ANT GENUS *PRISTOMYRMEX* (HYMENOPTERA: FORMICIDAE)

MINSHENG WANG[1]

CONTENTS

ABSTRACT. The ant genus *Pristomyrmex* is revised as a whole for the first time. The genus is redefined, and seven species groups are erected and discussed. Illustrations are present for all 52 species. A key to the worker caste is provided. Twenty-one new species are described: 20 from the Oriental region and one from Mauritius. Thirteen names are newly synonymized, and two former infraspecific taxa are elevated to species rank.

INTRODUCTION

Pristomyrmex, an ant genus of moderate size, contains 52 living species, but fossils

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have not been discovered. *Pristomyrmex* occurs primarily in the Oriental region, but six endemic species are present in the eastern rainforest of Australia and five endemic species in Africa. In addition, in Mauritius there are three native species, one of which also occurs on Reunion Island. Lastly, one species, *Pristomyrmex punctatus,* has invaded temperate China, Korea, and Japan. This species has also been detected at two entry ports in the United States and thus shows potential for spread via human commercial actions.

Pristomyrmex belongs to the subfamily Myrmicinae. It possesses a raised transverse ridge or a few toothlike prominences on the dorsal labrum in all female castes, including workers, ergatoid queens, and queens. This character is also shared by the myrmicine genera *Acanthomyrmex, Myrmecina,* and *Perissomyrmex.* As a result, these four living genera are grouped together in the tribe Myrmecinini (Bolton, 1994, 1995, personal communication; Brown, 1971). *Pristomyrmex* is unique in the tribe because it is the only genus possessing 11 antennal segments in all three female castes and 12 segments in the male.

Most *Pristomyrmex* species dwell in the rainforest, foraging as predators or scavengers. An Asian species, *P. punctatus,* however, occurs in open and disturbed habitats (e.g., bare hills, agricultural areas, and beaches). These ants prefer to nest in soil, litter, or rotten wood; in rotten parts of living trees; in dead standing trees; or around plant roots.

Pristomyrmex is of great interest because it exhibits several unusual biological and evolutionary phenomena. The absence of morphologically normal queens and reproduction primarily by unmated workers in *P. punctatus* (=*P. pungens*) is a highly unusual life history in the Formicidae. It has attracted much attention from those who hope to obtain insight into the nature of reproductive conflict within colonies since, in this species, reproductive division of labor occurs among morphologically identical workers (Itow et al., 1984; Mizutani, 1980, 1982; Peeters, 1993; Tsuji, 1988a,b,c, 1990a,b, 1994, 1995; Tsuji and Itô, 1986). Ergatoid queens, a special wingless female caste morphologically intermediate between the queen and the worker, are present in at least four species: *P. punctatus, P. africanus, P. wheeleri,* and *P. mandibularis*; two of them (*P. africanus* and *P. wheeleri*) possess both queen and ergatoid queen castes. Character displacement, showing that two species possess a greater difference in sympatric than allopatric populations, has also been reported in this genus by Taylor (1965). In addition, simulating death, slowness of movement, and nocturnal foragers are also recorded in *Pristomyrmex* (Donisthorpe, 1946; Taylor, 1965; Weber, 1941). Colony size varies greatly among species, ranging from about a dozen to several thousand workers (Donisthorpe, 1946; Itow et al., 1984; Mann, 1919; Taylor, 1965, 1968).

Although *Pristomyrmex* is biologically promising, the taxonomic foundation of the genus is poor. Much of the literature on *Pristomyrmex* is more than 50 years old and consists of isolated descriptions of species or infraspecific forms. Only a handful of papers present more comprehensive studies of the Australian and African subfaunas, respectively (Bolton, 1981; Taylor, 1965, 1968). The tropical Asian region, however, containing the bulk of the described taxa, has been in taxonomic chaos, for many years obscuring a better understanding of the evolution and radiation of this interesting group.

This survey takes the whole *Pristomyrmex* into consideration. I believe that only after that the entire genus covering all zoogeographical regions is comprehensively investigated can a full set of characters to define the genus be summarized, the species groups correctly erected, and the relationships between species properly analyzed and then the possible origin and the evolution of the genus hypothesized.

I present a detailed description of the taxonomic characters for the worker caste of each species. These characters not only are useful for the species identity but also provide important information for a further study on the phylogeny within the genus. I also include illustrations and descriptions of males for many species as possible. This was done for three reasons. First, two species (*P. pollux* and *P. reticulatus*) were described, each from a single male specimen, many years ago. Without examining other available males, I would not be able to assign these two species to their appropriate species group, and the discovery of other new species would then be impeded. Second, the males of most ant genera are very poorly characterized and thus cannot be curated properly in museum collections. Finally, I feel that these males contain some clues for the study of the phylogenetic relationships of the genus.

COLLECTIONS

AMNH American Museum of Natural History, New York, N.Y., U.S.A.
ANIC Australian National Insect Collection, Canberra City, Australia
BMHH Bishop Museum, The State Museum of Natural and Cultural History, Honolulu, Hawaii, U.S.A.
BMNH Natural History Museum, London, U.K.
CASC California Academy of Sciences, San Francisco, California, U.S.A.
IZAS Institute of Zoology, Academy of Sinica, Beijing, China
IZUA Institute of Zoology, Ukrainian National Academy of Sciences, Kiev, Ukraine
LACM Natural History Museum of Los Angeles County, Los Angeles, California, U.S.A.
MCSN Museo Civico di Storia Naturale "Giacomo Doria", Genoa, Italy
MCZC Museum of Comparative Zoology, Harvard University, Cambridge, Mass., U.S.A.
MHNG Muséum d'Histoire Naturelle, Geneva, Switzerland
MNHA Museum of Nature and Human Activities, Sanda, Hyogo, Japan
MNHN Muséum National d'Histoire Naturelle, Paris, France
MNHU Museum für Naturkunde der Humboldt-Universität zu Berlin, Berlin, Germany
NACA National Arthropod Collection, Mount Albert Research Center, Auckland, New Zealand
NHMB Naturhistorisches Museum, Basel, Switzerland
NHMV Naturhistorisches Museum, Vienna, Austria
NHPS Naturhistoriska Piksmuseet, Stockholm, Sweden
OXUM Oxford University Museum, Oxford, U.K.
SAMC South African Museum, Cape Town, South Africa
USNM National Museum of Natural History, Washington, D.C., U.S.A.

MEASUREMENTS AND INDICES

Head Width (HW). Maximum width of head, in full-face view, excluding the eyes (Fig. 1).

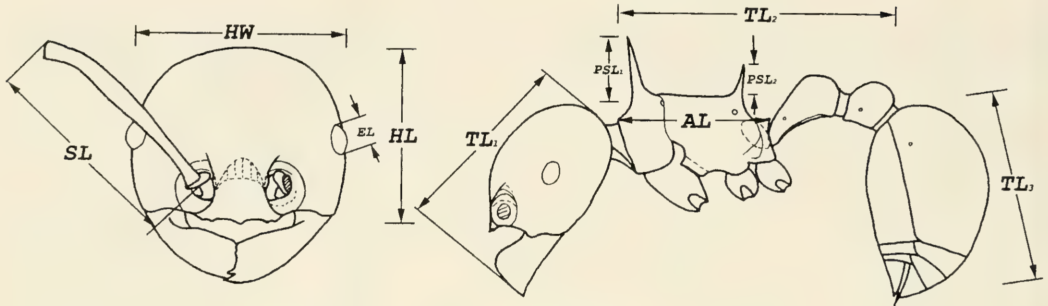
Head Width Including the Eyes (HWE). Maximum width of head across the eyes, in full-face view. This measurement is used only in the male.

Head Length (HL). Length of the head in full-face view, excluding the mandibles (Fig. 1), measured from the midpoint of a straight line across the occipital margin to either the apex of the median tooth (if it is present) of the anterior clypeal margin or the midpoint of a line connecting the apexes of the two lateral teeth (if the median tooth is absent) of the anterior clypeal margin or the midpoint of the anterior clypeal margin (if the anterior margin lacks any teeth).

Cephalic Index (CI). HW/HL × 100.

Scape Length (SL). Length of the antennal scape, including the lamella encircling the base of the scape but excluding the basal condyle (Fig. 1).

Scape Index (SI). SL/HW × 100.



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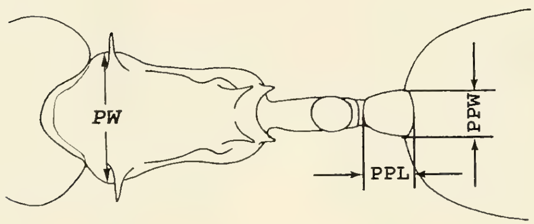

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Figures 1–3. Measurements illustrated for this study (worker of *Pristomyrmex longispinus* sp. n.). 1: Head, full-face view; 2: Entire body, lateral view; 3: Dorsal view of alitrunk, petiole, and postpetiole.

Pronotal Width (PW). Maximum width of the pronotum in dorsal view (Fig. 3).

Alitrunk Length (AL). Diagonal length of the alitrunk in lateral view, from the anteriormost point of the pronotum to the apex of the metapleural lobe (Fig. 2).

Eye Length (EL). Maximum length of the eye.

Total Length (TL). TL1 + TL2 + TL3 (see Fig. 2). (Note: The measurements of TL do not deal with those individuals whose gasters are abnormally contracted or prolonged or whose petioles are raised too high or too low.) TL1: A line measured from the apex of the closed mandibles to the midpoint of a straight line across the occipital margin, in full-face view. TL2: A straight line from the anteriormost point of the pronotum to the point at which the posterior margin of postpetiole meets the uppermost point of an articulation. TL3: A line from the anterior-uppermost point of the articulation to the apex of gaster.

Pronotal Spine Length (PSL1). A straight distance from the base to the apex of pronotal spine (see Fig. 2).

Propodeal Spine Length (PSL2). A straight distance from the base to the apex of propodeal spine (see Fig. 2).

Postpetiole Index (PPI). PPW/PPL × 100 (PPW: maximum width of the postpetiole in dorsal vies; PPL: length of the postpetiole in dorsal view).

All measurements are taken in millimeters.

Note: For the Australian species, my measurements differ slightly from Taylor's (1965, 1968). For the maximum measurable width of head, I have excluded the eyes, which were included by Taylor.

A BRIEF HISTORY OF THE GENUS *PRISTOMYRMEX*

The genus *Pristomyrmex*, when erected by Mayr (1866), contained one species, *P. pungens* Mayr (=a junior synonym of *P.*

punctatus (F. Smith)), a member of the present *punctatus* group. At that time, Mayr did not realize that five species described by F. Smith (1858, 1860, 1861, 1863, 1865), that is, *Myrmica fuscipennis, Myrmica punctata, Myrmica trachylissa, Myrmica umbripennis,* and *Solenopsis laevis,* also belonged in the new genus. Mayr (1866) provided a description of the genus, which actually was simply derived from some characters of the species *P. punctatus* (F. Smith). A second member of the *punctatus* group was introduced by Santschi (1916) when he transferred *Tetramorium* (*Xiphomyrmex*) *fossulatum* Forel to *Pristomyrmex.*

The content of the genus *Pristomyrmex* expanded for the first time when Mayr (1886) transferred *Myrmica trachylissa* F. Smith to *Pristomyrmex. Pristomyrmex trachylissus* is now a member of the *quadridens* group. After that, many species of the *quadridens* group were discovered (Bolton, 1981; Donisthorpe, 1949c; Emery, 1887, 1895, 1897, 1900; Forel, 1914; Karavaiev, 1931, 1933; Taylor, 1965, 1968), and several more names were added to the group when *Odontomyrmex* André and *Hylidris* Weber were designated by Forel (1915) and Brown (1953) as a subgenus and a synonym of *Pristomyrmex,* respectively. But, Mann (1919) found no evidence supporting the subgenus *Odontomyrmex.*

The members of the third species group (i.e., *umbripennis* group) of *Pristomyrmex* were recognized first by Emery. He described a new species (*Pristomyrmex picteti*) in 1893 and transferred a species (*Myrmica fuscipennis* F. Smith) to *Pristomyrmex* in 1901. Donisthorpe expanded the *umbripennis* group: He transferred *Myrmica umbripennis* F. Smith and *Solenopsis laevis* F. Smith to *Pristomyrmex* and described *Pristomyrmex pollux* and *Pristomyrmex reticulatus* (1932, 1946, 1949a).

When Emery (1897) described *Pristomyrmex coggii, Pristomyrmex levigatus,* and *Pristomyrmex lucidus,* representatives of the present *levigatus* group were added to the genus for the first time. *Pristomyrmex cribrarius,* the sole member of the *cribrarius* group, was described by Arnold (1926). Lastly, Brown (1971) synonymized the genus *Dodous* Donisthorpe, adding species belonging to the present *trispinosus* group to the genus. Thus, the genus *Pristomyrmex* became clearly delimited and assumed its modern form.

GENUS ***PRISTOMYRMEX*** MAYR

Pristomyrmex Mayr, 1866: 903. Type species: *Pristomyrmex pungens* Mayr, op. cit.: 904 [=*Myrmica punctata* F. Smith, 1860: 108; =*Pristomyrmex punctatus* (F. Smith)]; by monotypy.

Odontomyrmex André, 1905: 207. Type species: *Odontomyrmex quadridentatus* André, op. cit.: 208; by monotypy. [As a subgenus, thus synonym, of *Pristomyrmex* by Forel, 1915: 53.]

Hylidris Weber, 1941: 190. Type species: *Hylidris myersi* Weber, loc. cit. (=*Pristomyrmex africanus* Karavaiev); by original designation. [Synonymy by Brown, 1953: 9.]

Dodous Donisthorpe, 1946: 145. Type species: *Dodous trispinosus* Donisthorpe, loc. cit.; by original designation. [Synonymy by Brown, 1971: 3.]

Diagnosis of worker, queen, and ergatoid queen. Combination of the following asterisked four characters (i.e., characters 2, 7, 11, and 29 in the worker caste) separating *Pristomyrmex* from other myrmicine genera.

Definition: Worker. Possessing the following combination of characters:

1. Small (TL 1.74, HL 0.46, HW 0.46) to large-sized (TL 7.06, HL 1.68, HW 1.74) monomorphic myrmicine ants.

*2. Mandible somewhat subtriangular; masticatory margin of mandible with three to five teeth, which have one or the other of the following six basic arrangements:

(1) the strongest apical + the second strongest preapical + the smallest third + the acute basal tooth, diastema lacking, as in *levigatus* group and in *profundus* group, or

(2) the strongest apical + the second strongest preapical + two smaller teeth of similar size, diastema indistinct or lacking, as in *umbripennis* group, or

(3) the strongest apical + the second

strongest preapical + a shorter (first) diastema (sometimes the first diastema is not distinct) + a small denticle + a longer (second) diastema + a small basal denticle, as in both *P. bispinosus* and *P. trispinosus,* or

(4) the apical + the preapical + a longer diastema + a small denticle + a shorter diastema (sometimes the second diastema is indistinct) + a small basal denticle, as in *P. browni,* or

(5) the strongest apical + the second strongest preapical + a distinct diastema + a basal tooth (which is sometimes formed by the fusion of the two small teeth) or two (or three) small teeth of similar size, as in *punctatus* group, *cribrarius* group, and most members of the *quardridens* group, or

(6) the strongest apical + the second strongest preapical + an intercalary tooth + a very short diastema (or this diastema indistinct) + two small teeth of similar size, as shown in *P. trachylissus.*

3. Basal margin of mandible with a broad-based triangular or an acute and prominent tooth, or only curved, not forming tooth, or almost straight.

4. Median part of clypeus shieldlike, projecting posteriorly between the bases of the antennae; lateral parts of clypeus in front of antennal insertions usually reduced to ridges but rarely (in the two Oriental species *P. divisus* and *P. pulcher*) developed so that the antennal fossae do not reach the lateral anterior margins of clypeus.

5. Anterior clypeal margin usually with a median tooth and one to three pairs of lateral denticles (or crenulate shapes) but sometimes the median tooth rudimentary (as in some species of the *levigatus* group) and sometimes anterior clypeal margin lacking any distinct denticles (as in *P. profundus, P. divisus,* and *P. pulcher*).

6. Ventral surface of clypeus with a median tooth or two lateral teeth, or with a transverse ridge, or without any ridge or tooth.

*7. Dorsal labrum with a raised transverse ridge or a few toothlike prominences, present on the anterior portion of labrum in most species.

8. Palp formula 1,2, 1,3, 2,2, 2,3, 4,3, or 5,3.

9. Frontal lobes absent in *punctatus* and *trispinosus* groups or weak, as in *levigatus, profundus,* and *quadridens* groups, or somewhat expanded, as in *umbripennis* group; as a result, the articulations of the antennae are mostly or entirely exposed in full-face view.

10. Frontal carinae usually developed, extending to the level of the posterior margins of eyes, but sometimes frontal carinae absent or very short, as in the *trispinosus* group, in *P. trogor,* and in *P. longispinus.*

*11. Antennae with 11 segments; apical three segments forming a distinct club.

12. Base of each antennal scape encircled by a narrow lamella, except in *P. profundus*; this lamella usually with a broad and deep notch on the center of dorsal surface in the *umbripennis* group but entire in the other species groups.

13. Antennal scrobes usually absent or weakly developed, but in *P. profundus,* the scrobes are deep and well developed.

14. Eyes present in all known species, situated approximately at the midlength of the sides of the head; usually moderate-sized, but small in the several species (*P. boltoni, P. coggii, P. longus, P. eduardi, P. picteti,* and *P. pollux*).

15. Alitrunk usually lacking dorsal sutures, but in the three species of the *trispinosus* group, a promesonotal suture or impression present.

16. Pronotum unarmed, or armed with a pair of tubercles, teeth, or spines of varying sizes.

17. Mesonotum usually unarmed, but with a pair of thick, blunt, and digitlike short prominences in *P. trispinosus,* and sometimes weakly tuberculated in *P. bispinosus* and *P. browni.*

18. Propodeum armed with a pair of teeth or spines, except in *P. inermis.*

19. Metapleural lobes usually subtriangular, or each with a blunt-rounded to semicircular apex, but indistinct in *P. profundus.*

20. Fore tibial spurs pectinate. Middle and hind tibiae sometimes without any spur, sometimes with either simple or hairlike spurs.

21. Propodeal spiracles circular and high-positioned on the lateral surfaces of the propodeum.

22. Metapleural gland bullae large, separated from the propodeal spiracles, and positioned above the posterior lower corners of propodeum.

23. Petiole in profile nodiform or wedge-shaped, pedunculate, usually with a long anterior peduncle.

24. Subpetiole sometimes without a ventral process, sometimes bearing a narrow semitranslucent lamella. In *P. acerosus,* a pinlike process is present.

25. Postpetiole in profile nodiform, usually rounded dorsally.

26. Petiole spiracle, postpetiole spiracle, and first gastral spiracle visible.

27. Dorsal surfaces of head and alitrunk smooth, or possessing either scattered foveolate punctures, or foveolate-reticulate sculpture, or developed rugoreticulum, or regular striate sculpture. Gaster unsculptured.

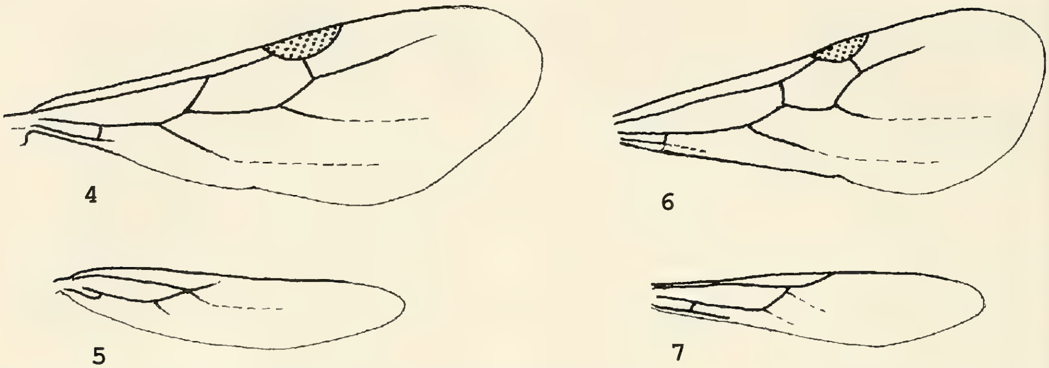
28. Dorsal surfaces of head and alitrunk usually with numerous hairs, but only a few hairs present on the dorsal alitrunk in *P. fossulatus, P. orbiceps,* and *P. trogor.* Petiole and postpetiole each usually with one to three pairs of hairs, but sometimes more pairs of hairs present; sometimes petiole and postpetiole lacking hairs. First gastral tergite usually without hairs or with a few sparse hairs, but sometimes first gastral tergite covered with numerous, evenly distributed, erect or suberect hairs.

*29. Anterior clypeal margin lacking a median seta at the midpoint of the margin, instead usually having two to three pairs of long, forward-projecting hairs flanking the midpoint of margin.

30. Sting slender and long.

Female. Usually alate, but in some species (*P. punctatus, P. mandibularis*), only ergatoid queens have been found. In some species (*P. wheeleri, P. africanus*), both alate and ergatoid queens exist.

Alate Queen. Characters similar to those of worker in the structure and shape of mandible, palp formula, clypeus, frontal lobes, frontal carinae, antennae, metapleural lobes, tibial spurs, petiole node, postpetiole, and sting as well as in the sculpture of body. But larger, with slightly or much larger eyes, than in the conspecific worker; three ocelli present. The alitrunk with wings and flight sclerites; well-marked dorsal sutures present. Pronotal spines usually absent, but in some species, the pronotum is armed with a pair of teeth that are much shorter than in conspecific worker; propodeal teeth or spines usually shorter than those of conspecific worker. Wing venation as shown in Figures 4–5. On the forewings, the marginal cell (see Hölldobler and Wilson, 1990: 9) is always open; *R* + *Sc* thick (for the explanation of symbols used, see Brown and Nutting, 1950); *A* short, far from the anal angle; *A, Cu-A, Mf*2+3 usually reduced to vestigial lines distally; cross-vein *m-cu* and *r-m* absent; cross-vein *cu-a* usually present but sometimes broken in larger species (such as *P. picteti, P. umbripennis*) and sometimes rudimentary or very weak in some samples of a few smaller species (e.g., *P. orbiceps, P. lucidus*); 1*r* absent; anal lobe usually indistinct in smaller species but present in larger species. Hind wings without anal lobe. (Note: The venation of the both fore and hind wings of alates, in *Pristomyrmex,* is rather stable, with only slight variations within the different species. For example, on the forewings, *Mf*2+3, sometimes becomes an almost entirely vestigial line, but sometimes it is distinct and rather long; *Rsf*4 + *Rsf*5 is rather thick and long in some larger species but thin and short in some smaller species).



Figures 4–7. General forewing and hindwing venation of alate queens and males of *Pristomyrmex*. 4: Forewing of alate queens; 5: Hindwing of alate queens; 6: Forewing of males; 7: Hindwing of males.
[The forewing and hindwing venation of the alate queens of the following 13 *Pristomyrmex* species was examined: *P. brevispinosus, P. collinus, P. orbiceps, P. quadridens, P. quindentatus, P. sulcatus, P. levigatus, P. lucidus, P. obesus, P. fuscipennis, P. picteti, P. pollux,* and *P. umbripennis.* The males of 16 *Pristomyrmex* species were examined: *P. brevispinosus, P. flatus, P. trogor, P. longispinus, P. orbiceps, P. quadridens, P. quadridentatus, P. sulcatus, P. browni, P. trispinosus, P. obesus, P. levigatus, P. picteti, P. pollux, P. umbripennis,* and *P. punctatus.*]

Ergatoid Queen. General characters, including the pronotal prominences and size of body, similar to those of the conspecific worker. Ocellus present (one ocellus in *P. mandibularis* but three ocelli in *P. punctatus, P. wheeleri,* and *P. africanus*); apterous, but mesonotum more convex than in conspecific worker; pro-mesonotal suture present in *P. mandibularis* but represented by an impression in *P. punctatus, P. wheeleri,* and *P. africanus.*

Male. Possessing the following combination of characters (summarized according to 54 specimens falling into at least 17 species):

1. Small to moderate size (TL 2.40–6.04, HL 0.48–0.94, HW 0.51–0.98, HWE 0.62–1.10), usually smaller than the conspecific queen.

2. Head, in full-face view, across and including the eyes, usually broader than long (Figs. 261–269).

3. Mandibles vestigial, very small, rounded or toothlike, far from meeting, as indicated by an arrow in Figure 262.

4. Anterior margin of labrum broadly concave at center; dorsum of labrum without any transverse ridge or toothlike prominences (see Figs. 262, 264, 269).

5. Eyes very large, well developed, and convex, situated at the sides of head.

6. Antennae filiform, 12 segments, lacking a lamella encircling the base. Scapes short, usually distinct shorter than the maximum length of eye; of the other 11 funicular segments, the first segment shortest, the apical segment longest, the remaining nine segments much longer than their broad.

7. Three ocelli conspicuous and well developed, situated on the vertex of the head.

8. Antennal sockets set back from the posterior margin of the clypeus.

9. Antennal scrobes absent.

10. Frontal carinae absent or very short and weak.

11. Frontal lobes absent so that the articulations of the antennae are completely exposed in full-face view.

12. Palp formula as in the conspecific worker in seven species examined (i.e., *P. punctatus, P. quadridens, P. curvulus, P. brevispinosus, P. sulcatus, P. picteti,* and *P. pollux*).

13. Clypeus convex in the middle, not projecting posteriorly upward between the bases of antennae; its shape transverse, or

somewhat semicircular; its anterior margin entire, without any denticles, usually rather straight but sometimes arched.

14. Cheeks very short.

15. Alitrunk robust, with wings, well-developed flight sclerites, and well-marked sutures.

16. Pronotum narrow in middle, overhung by mesoscutum in lateral view, lacking any armaments.

17. Mesonotum well developed, consisting of a large mesoscutum, a rather large mesoscutellum, and two small axillae. Notauli usually distinct, forming a Y shape, but sometimes they show a V shape, and sometimes they are absent or very weak. Parapsidal furrows usually absent, but sometimes they are superficially impressed.

18. Metanotum transverse, narrow, overhung by mesoscutellum.

19. Propodeum showing a sloping dorsal surface; propodeal armaments absent or present; if present, they are usually shorter than in the conspecific worker.

20. Metapleural lobes present, subtriangular, or toothlike, or blunt-rounded to semicircular.

21. Venation (Figs. 6–7) as in alate queen.

22. Legs slender; fore tibial spurs pectinate; middle and hind tibiae usually lacking any spurs but sometimes simple spurs are present.

23. Petiole with a long or a rather long anterior peduncle. In dorsal view, sides of petiole subparallel. Petiole node low, lower than in the conspecific worker and queen; subpetiole lacking any lamella or toothlike projection.

24. Postpetiole node rather low, lower than in the conspecific worker and queen. In profile, subpostpetiole usually lacking any projections, but sometimes bearing a small tooth.

25. Positions of spiracles on propodeum, petiole, postpetiole, and first gastral segment similar to those in the conspecific worker and queen.

26. Usually much less sculptured than conspecific worker and queen.

27. Numerous hairs present on the entire dorsal surfaces of body.

(Note: The genitalia of males is not dissected.)

The male of *Pristomyrmex* can be distinguished within the tribe Myrmecinini by the following characters:

Pristomyrmex
- Antennae: 12 segments
- Mandibles: Very small, toothlike, not meeting
- Petiole: With a long anterior peduncle
- Forewing: Without *m-cu* cross-vein; marginal cell open

Acanthomyrmex
- Antennae: 13 segments
- Mandibles: Subtriangular, with six to eight teeth, meeting when they are closed
- Petiole: Similar to that of *Pristomyrmex*
- Forewing: ?With *m-cu* cross-vein; marginal cell closed

Myrmecina
- Antennae: 13 segments
- Mandibles: Similar to those of *Pristomyrmex*
- Petiole: Without an anterior peduncle
- Forewing: Without *m-cu* cross-vein; marginal cell closed

Perissomyrmex
- Antennae: ?10 segments
- Mandibles: Unknown
- Petiole: Unknown
- Forewing: Unknown

Larva. According to Wheeler and Wheeler's (1954, 1960, 1973, 1976) studies, the larva of *Pristomyrmex* has the following combination of characters:

1. Stout and rather short.
2. Head extremely long and narrow.
3. Thorax more slender than abdomen and forming a neck, which is curved ventrally. Diameter greatest near middle of abdomen, decreasing gradually toward head; posterior end rounded.
4. Body without tubercles.

5. Mandibles subtriangular, without medial blade; apical tooth curved medially and usually acute; subapical medial tooth small.

6. Body hairs numerous, with five or six types, including anchor-tipped hairs. Head hair few, short to moderately long.

7. Gula spinulose.

8. Anterior surface of labium densely spinulose.

9. Palps lateral.

Pupa. Not enclosed in cocoons (Wheeler and Wheeler, 1976).

LIST OF *PRISTROMYRMEX* NAMES WITH SYNONYMIES

(Currently valid names are in boldface)

acerosus: **sp. n.**
africanus: ***Pristomyrmex africanus*** Karavaiev
=*beni*
=*mbomu*
=*myersi*
=*primus*
aruensis: *Pristomyrmex quadridens* var. *aruensis* Karavaiev
=***quadridens***
beni: *Hylidris myersi* subsp. *beni* Weber
=***africanus***
bicolor: **stat. n.**: *Pristomyrmex trachylissa* var. *bicolor* Emery
=*taurus* **syn. n.**
bispinosus: *Dodous bispinosus* Donisthorpe
boltoni: **sp. n.**
brevispinosus: ***Pristomyrmex brevispinosus*** Emery
=*yaeyamensis* **syn. n.**
browni: **sp. n.**
castaneicolor: *Pristomyrmex castaneicolor* Donisthorpe
=***umbripennis***
castor: *Pristomyrmex castor* Donisthorpe
=***umbripennis***
coggii: ***Pristomyrmex coggii*** Emery
collinus: **sp. n.**
costatus: **sp. n.**
cribrarius: ***Pristomyrmex cribrarius*** Arnold
curvulus: **sp. n.**
divisus: **sp. n.**
eduardi: ***Pristomyrmex eduardi*** Forel
erythropygus: ***Pristomyrmex erythropygus*** Taylor
flatus: **sp. n.**
formosae: *Pristomyrmex brevispinosus* r. *sulcatus* var. *formosae* Forel, 1912: 54.
unavailable name
fossulatus: *Tetramorium (Xiphomyrmex) fossulatum* Forel
foveolatus: ***Pristomyrmex foveolatus*** Taylor
fuscipennis: *Myrmica fuscipennis* F. Smith
hirsutus: **sp. n.**
inermis: **sp. n.**
japonicus: *Pristomyrmex japonicus* Forel
=***punctatus***
laevigatus: *Hylidris laevigatus* Weber
=***orbiceps***
laevis: *Solenopsis laevis* F. Smith
=***umbripennis***
largus: **sp. n.**
levigatus: ***Pristomyrmex levigatus*** Emery
=*mendanai* **syn. n.**
longispinus: **sp. n.**
longus: **sp. n.**
lucidus: ***Pristomyrmex lucidus*** Emery
mandibularis: ***Pristomyrmex mandibularis*** Mann
mbomu: *Hylidris myersi* subsp. *mbomu* Weber
=***africanus***
melanoticus: *Pristomyrmex obesus* subsp. *melanoticus* Mann
=***obesus***
mendanai: *Pristomyrmex mendanai* Mann
=***levigatus***
minusculus: **sp. n.**
modestus: **sp. n.**
myersi: *Hylidris myersi* Weber
=***africanus***
nitidissimus: ***Pristomyrmex nitidissimus*** Donisthorpe
obesus: ***Pristomyrmex obesus*** Mann
=*melanoticus* **syn. n.**

=*pegasus* **syn. n.**
***occultus*: sp. n.**
orbiceps: *Xiphomyrmex orbiceps* Santschi
=*laevigatus*
orbiculatus: *Pristomyrmex orbiculatus* Donisthorpe
=***quadridens***
parumpunctatus: *Pristomyrmex parumpunctatus* Emery
=***umbripennis***
parvispina: *Pristomyrmex parvispina* Emery, 1900: 678. **Nomen nudum**
pegasus: *Pristomyrmex pegasus* Mann
=***obesus***
picteti: ***Pristomyrmex picteti*** Emery
=*tingiana* **syn. n.**
pollux: ***Pristomyrmex pollux*** Donisthorpe
primus: *Hylidris myersi* subsp. *primus* Weber
=***africanus***
***profundus*: sp. n.**
***pulcher*: sp. n.**
punctatus: *Myrmica punctata* F. Smith
=*japonicus*
=*pungens* **syn. n.**
pungens: *Pristomyrmex pungens* Mayr
=***punctatus***
quadridens: ***Pristomyrmex quadridens*** Emery
=*aruensis* **syn. n.**
=*orbiculatus* **syn. n.**
quadridentatus: *Odontomyrmex quadridentatus* André
=*queenslandensis*
queenslandensis: *Pristomyrmex* (*Odontomyrmex*) *quadridentatus* var. *queenslandensis* Forel
=***quadridentatus***
***quindentatus*: sp. n.**
reticulatus: ***Pristomyrmex reticulatus*** Donisthorpe
***rigidus*: sp. n.**
***simplex*: sp. n.**
***sulcatus*: stat. n.**: *Pristomyrmex brevispinosus* subsp. *sulcatus* Emery
taurus: *Pristomyrmex taurus* Stitz
=***bicolor***
thoracicus: ***Pristomyrmex thoracicus*** Taylor
tingiana: *Pristomyrmex picteti* var. *tingiana* Stitz
=***picteti***
trachylissus: *Myrmica trachylissa* F. Smith
trispinosus: *Dodous trispinosus* Donisthorpe
trogor: ***Pristomyrmex trogor*** Bolton
umbripennis: *Myrmica umbripennis* F. Smith
=*castaneicolor* **syn. n.**
=*castor* **syn. n.**
=*laevis* **syn. n.**
=*parumpunctatus* **syn. n.**
wheeleri: ***Pristomyrmex wheeleri*** Taylor
wilsoni: ***Pristomyrmex wilsoni*** Taylor
yaeyamensis: *Pristomyrmex yaeyamensis* Yamane and Terayama
=***brevispinosus***

KEY TO THE WORLD SPECIES OF *PRISTOMYRMEX* (WORKERS)

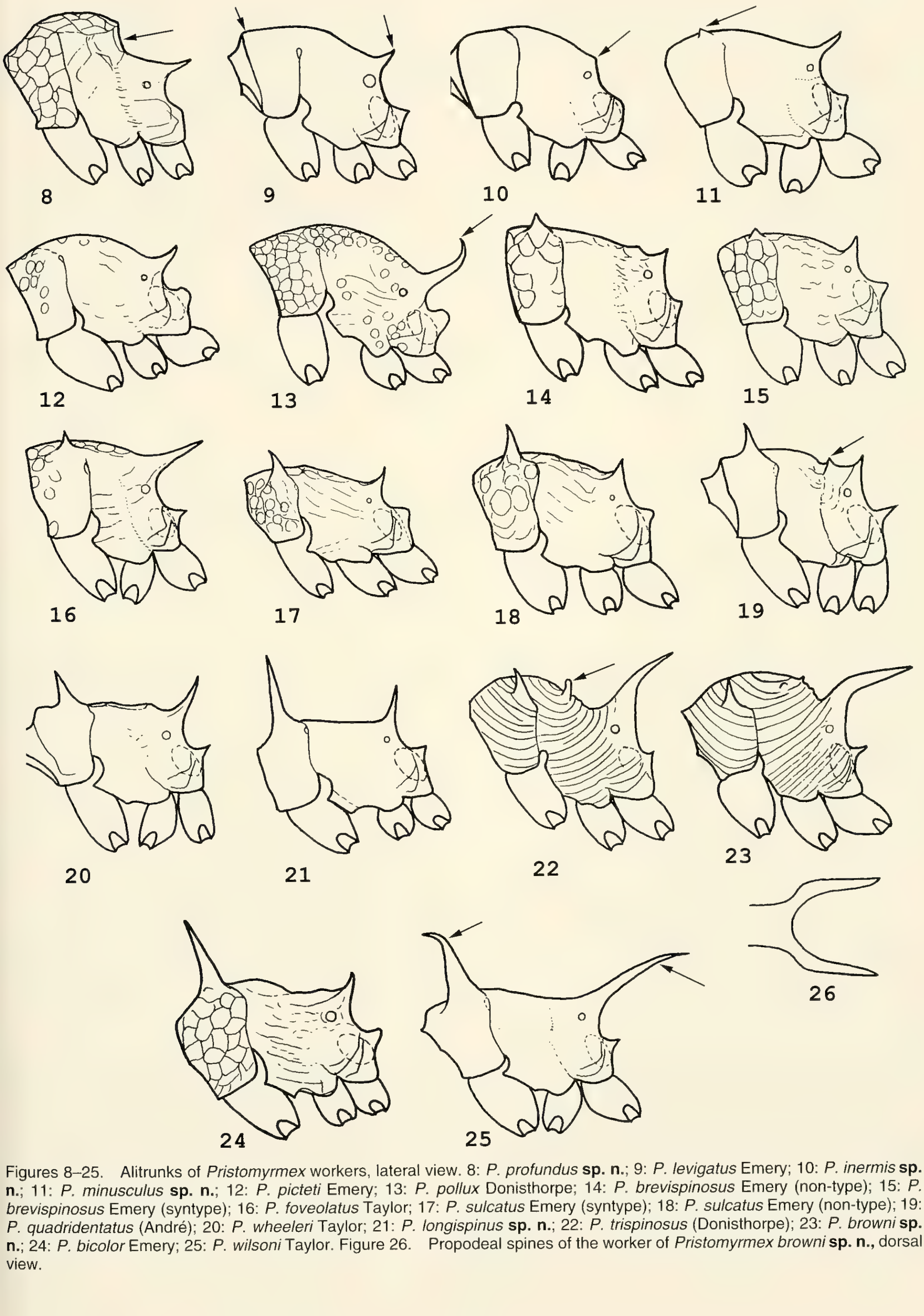
Note: ***P. fuscipennis*** and ***P. reticulatus***, whose worker castes are presently unknown, are not included in the key.

1. Dorsum of alitrunk in profile not arched, with mesonotum much higher than propodeal dorsum, that is, a vertical cliff present between mesonotum and propodeal dorsum (Fig. 8). Antennal scrobes well developed and deep. Basal margin of mandible with a strong tooth adjacent to the basal tooth of masticatory margin so that five teeth are set close together (Fig. 27). Base of antennal scape without a circling lamella (Fig. 80) (*profundus* group; Asia: Sabah) .... ***profundus*** (p. 515)
   Dorsum of alitrunk in profile, excluding armaments, more or less arched-shaped, never showing a vertical cliff between mesonotum and propodeal dorsum (Figs. 9–25). Antennal scrobes absent or shallow. Tooth on basal margin of mandible either absent or present; if present, it is on about midway, not adjacent to the basal tooth of masticatory margin (Figs. 28, 29, 35). Base of antennal scape with a circling lamella (Figs. 81, 82) 2

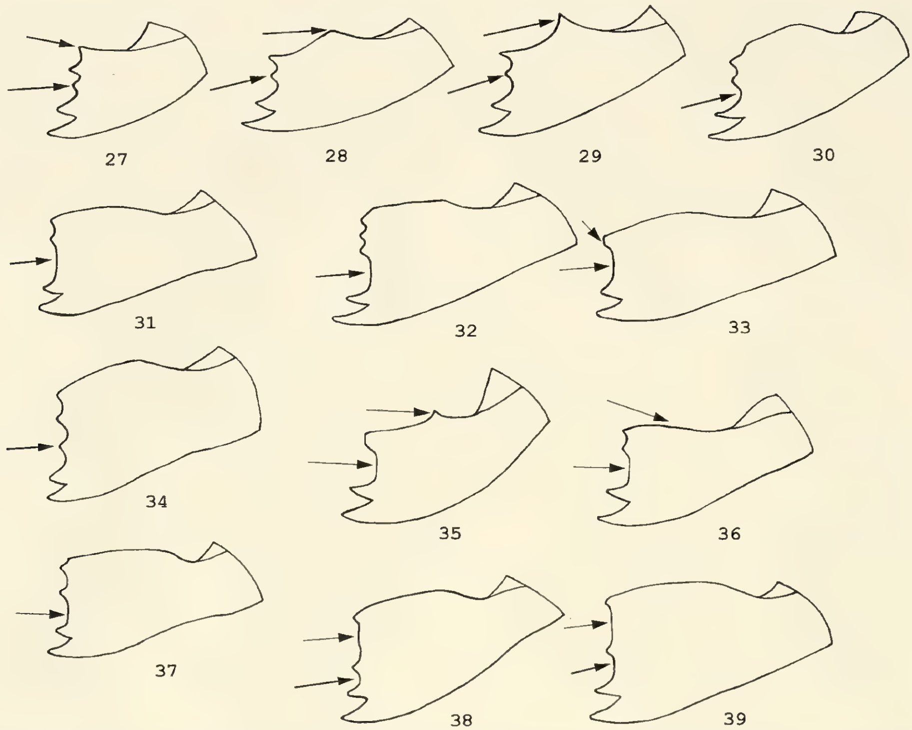
TABLE 1. A LIST OF *PRISTOMYRMEX* SPECIES AND THEIR BIOGEOGRAPHIC DISTRIBUTION.

Species Group	Species Name	ORI	PAL	AUS	AFR	IOI
punctatus group	*P. divisus* sp. n.	+				
	P. fossulatus (Forel)				+	
	P. pulcher sp. n.	+				
	**P. punctatus* (F. Smith)	+	+			
	P. rigidus sp. n.	+				
cribrarius group	*P. cribrarius* Arnold				+	
quadridens group	*P. africanus* Karavaiev				+	
	P. bicolor Emery	+				
	P. brevispinosus Emery	+				
	P. collinus sp. n.	+				
	P. costatus sp. n.	+				
	P. curvulus sp. n.	+				
	P. eduardi Forel	+				
	P. erythropygus Taylor			+		
	P. flatus sp. n.	+				
	P. foveolatus Taylor			+		
	P. hirsutus sp. n.	+				
	P. longispinus sp. n.	+				
	P. modestus sp. n.	+				
	P. nitidissimus Donisthorpe	+				
	P. occultus sp. n.	+				
	P. orbiceps (Santschi)				+	
	P. quadridens Emery	+				
	P. quadridentatus (André)			+		
	P. quindentatus sp. n.	+				
	P. sulcatus Emery	+				
	P. thoracicus Taylor			+		
	P. trachylissus (F. Smith)	+				
	P. trogor Bolton				+	
	P. wheeleri Taylor			+		
	P. wilsoni Taylor			+		
trispinosus group	*P. bispinosus* (Donisthorpe)					+
	P. browni sp. n.					+
	P. trispinosus (Donisthorpe)					+
levigatus group	*P. acerosus* sp. n.	+				
	P. boltoni sp. n.	+				
	P. coggii Emery	+				
	P. inermis sp. n.	+				
	P. largus sp. n.	+				
	P. levigatus Emery	+				
	P. longus sp. n.	+				
	P. lucidus Emery	+				
	P. mandibularis Mann	+				
	**P. minusculus* sp. n.	+		+		
	P. obesus Mann	+				
	P. simplex sp. n.	+				
profundus group	*P. profundus* sp. n.	+				
umbripennis group	*P. fuscipennis* (F. Smith)	+				
	P. picteti Emery	+				
	P. pollux Donisthorpe	+				
	P. reticulatus Donisthorpe	+				
	P. umbripennis (F. Smith)	+				
Total number of species		38	1	7	5	3
Total number of the endemic species		36		6	5	3

Notes: ORI, PAL, AUS, AFR, and IOI are abbreviated, respectively, from the Oriental region, the Palaearctic region, Australia, Africa, and Indian Ocean Islands. AFR refers to the African continent only. *Pristomyrmex* has not been recorded from Madagascar. "*" symbol indicates that *P. punctatus* and *P. minusculus* occur in the two regions, respectively.



Figures 8–25. Alitrunks of *Pristomyrmex* workers, lateral view. 8: *P. profundus* **sp. n.**; 9: *P. levigatus* Emery; 10: *P. inermis* **sp. n.**; 11: *P. minusculus* **sp. n.**; 12: *P. picteti* Emery; 13: *P. pollux* Donisthorpe; 14: *P. brevispinosus* Emery (non-type); 15: *P. brevispinosus* Emery (syntype); 16: *P. foveolatus* Taylor; 17: *P. sulcatus* Emery (syntype); 18: *P. sulcatus* Emery (non-type); 19: *P. quadridentatus* (André); 20: *P. wheeleri* Taylor; 21: *P. longispinus* **sp. n.**; 22: *P. trispinosus* (Donisthorpe); 23: *P. browni* **sp. n.**; 24: *P. bicolor* Emery; 25: *P. wilsoni* Taylor. Figure 26. Propodeal spines of the worker of *Pristomyrmex browni* **sp. n.,** dorsal view.



Figures 27–39. Mandibles of *Pristomyrmex* workers. 27: *P. profundus* **sp. n.**; 28: *P. levigatus* Emery; 29: *P. mandibularis* Mann; 30: *P. picteti* Emery; 31: *P. quadridens* Emery; 32: *P. quindentatus* **sp. n.**; 33: *P. quadridentatus* (André); 34: *P. trachylissus* (F. Smith); 35: *P. rigidus* **sp. n.**; 36: *P. punctatus* (F. Smith); 37: *P. browni* **sp. n.**; 38: *P. trispinosus* (Donisthorpe); 39: *P. bispinosus* (Donisthorpe).

2. Masticatory margin of mandible with four teeth; the third tooth, counting from the apex, smallest, distinctly smaller than the basal one; diastema absent between the preapical and the third tooth (Figs. 28–29) (*levigatus* group; Asia, Australia) 3

– Masticatory margin of mandible with three to five teeth; if four teeth present, then the third tooth, counting from the apex, similar in size to the basal one; diastema either present or indistinct between the preapical and the third tooth (Figs. 30–39) ... 14

3. Propodeum unarmed (Fig. 10). Petiole node in profile wedge-shaped (Fig. 45) (Asia: Papua New Guinea) .... ***inermis*** (p. 496)

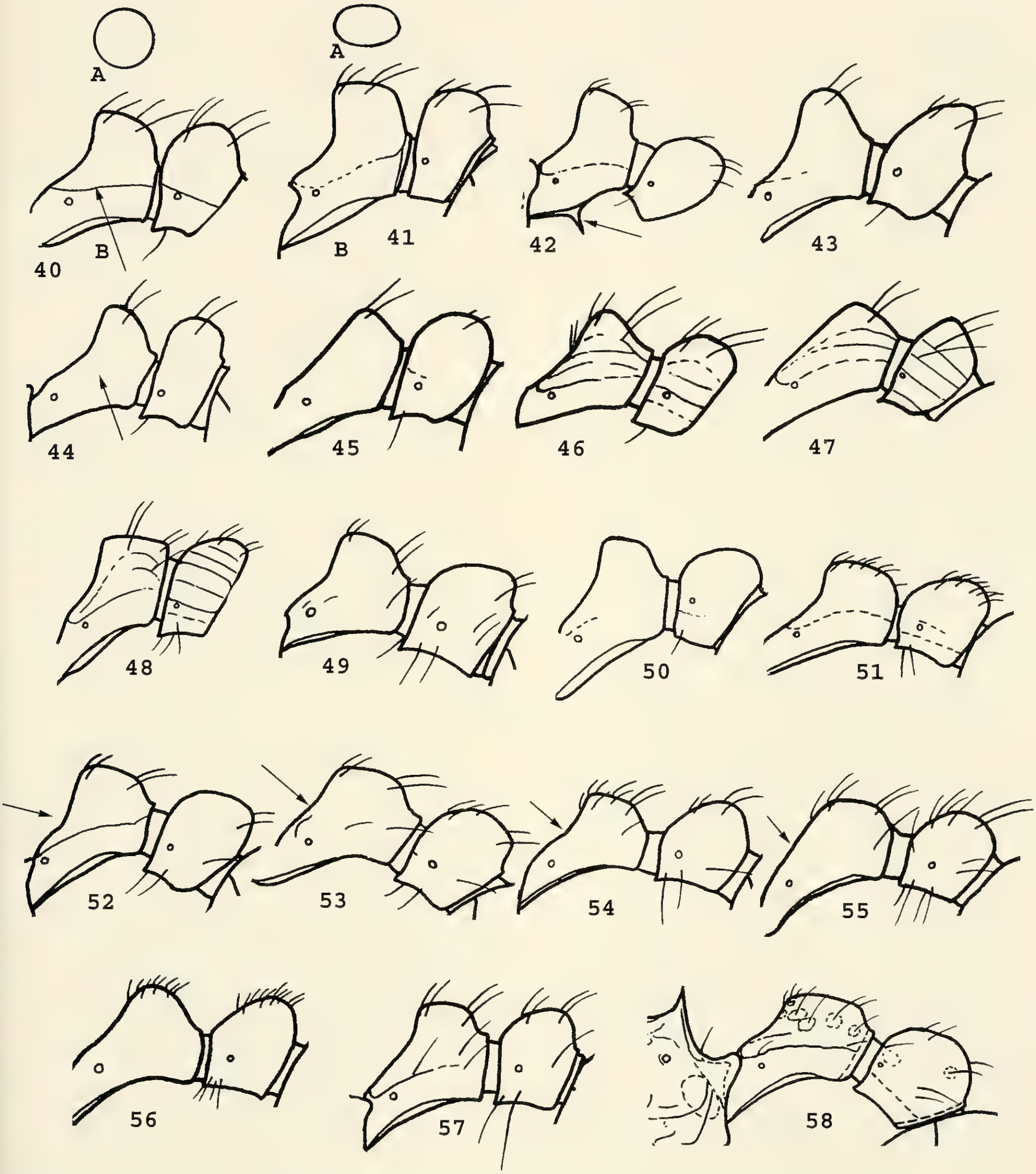
– Propodeum armed with a pair of teeth or spines (Figs. 9, 11). Petiole node in profile nodiform, not wedge-shaped (Figs. 40–44) 4

4. Pronotum armed with a pair of teeth (Fig. 11) (Asia and Pacific Is.: Papua New Guinea; Indonesia; Pohnpei Is.; Palau Is.; Yap I.; Tonga Is.; Wallis Is.; found rarely in N. Queensland, Australia) ..... ***minusculus*** (p. 507)

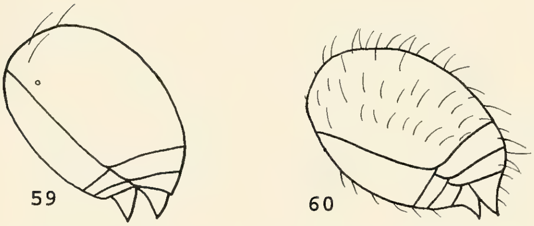
– Pronotum unarmed (Fig. 9) 5

5. Postpetiole in profile with an arched anterior face and a steeply sloping posterior face and the apex of postpetiole pointing posterior-upwardly (Fig. 43); in dorsal view, postpetiole usually longer than broad, very rarely about as long as broad. Petiole node with a single evenly blunt-rounded apex (Fig. 43). Head broader; HW mostly >1.00 (Asia: Papua New Guinea) ..... ***lucidus*** (p. 503)

– Postpetiole in profile with a somewhat evenly convex dorsum, lacking an abruptly steep posterior face (Figs. 40–42, 44) and in dorsal view broader than long. Petiole node in profile with a distinct anterodorsal angle (Figs. 40–42, 44). Head narrower; HW <1.00 6

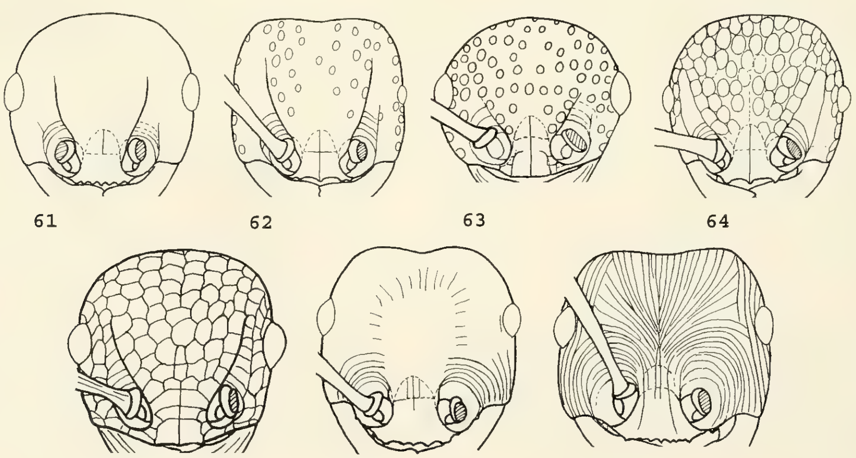


Figures 40–58. Petiole nodes and postpetioles of *Pristomyrmex* workers. 40A: Dorsal surface of the petiole node of *P. obesus* Mann, dorsal view; 41A: Dorsal surface of the petiole node of *P. longus* **sp. n.**, dorsal view; 40B, 41B, 42–58: Petiole nodes and postpetioles, lateral view: 40B: *P. obesus* Mann; 41B: *P. longus* **sp. n.**; 42: *P. acerosus* **sp. n.**; 43: *P. lucidus* Emery; 44: *P. mandibularis* Mann; 45: *P. inermis* **sp. n.**; 46: *P. punctatus* (F. Smith); 47: *P. rigidus* **sp. n.**; 48: *P. cribrarius* Arnold; 49: *P. quadridens* Emery; 50: *P. africanus* Karavaiev; 51: *P. nitidissimus* Donisthorpe; 52: *P. collinus* **sp. n.**; 53: *P. flatus* **sp. n.**; 54: *P. curvulus* **sp. n.**; 55: *P. longispinus* **sp. n.**; 56: *P. hirsutus* **sp. n.**; 57: *P. sulcatus* Emery; 58: *P. modestus* **sp. n.**



Figures 59–60. Gasters of *Pristomyrmex* workers, lateral view. 59: Gaster of *P. simplex* **sp. n.**; 60: Gaster of *P. obesus* Mann.

6. Dorsum of petiole node laterally compressed and in dorsal view distinctly longer than broad (Fig. 41A) (Asia: New Guinea) .... ***longus*** (p. 502)
   Dorsum of petiole node not laterally compressed and in dorsal view about as broad as or broader than long, not longer than broad (Fig. 40A) 7
7. Dorsum of alitrunk unsculptured, smooth and shining. Dorsum of head between frontal carinae usually smooth and shining (Fig. 61), except for a few punctures bordering frontal carinae 8
   Dorsum of alitrunk with some scattered foveolate punctures. Dorsum of head between frontal carinae with scattered foveolate punctures or foveolate-reticulate sculpture (Figs. 62–64) 12
8. Eyes smaller, with two to three ommatidia in the longest row (Asia: New Guinea) .... ***boltoni*** (p. 492)
   Eyes larger, usually with five to seven ommatidia in the longest row 9
9. Larger species, with HW 0.90–0.96 and HL 0.90–0.90 (Pacific Is.: Pohnpei I.) .... ***largus*** (p. 497)
   Smaller species; HW < 0.80, HL < 0.80 10
10. Ventral surface of petiole with a long pinlike process (Fig. 42) (Pacific Is.: New Hebrides) .... ***acerosus*** (p. 491)
   Ventral surface of petiole without a long pinlike process (Figs. 40, 41, 44) 11
11. Each side of petiole with a longitudinal carina that separates the tergite from the sternite (Fig. 40). Basal margin of mandible with a short, broad tooth (Fig. 28) (Asia and Pacific Is.: Papua New Guinea, Solomon Is., Nama Is., New Britain Is.) .... ***levigatus*** (p. 499)
   Sides of petiole unsculptured and smooth, lacking a longitudinal carina (Fig. 44). Basal margin of mandible with a prominent tooth (Fig. 29) (Pacific Is.: Fiji) .... ***mandibularis*** (p. 505)
12(7). Entire first gastral tergite evenly clothed with numerous erect or suberect hairs (Fig. 60) (Pacific Is.: Solomon Is.) .... ***obesus*** (p. 509)
   Only a few hairs present usually near the



Figures 61–67. Characters on the sculpture of the dorsal heads of *Pristomyrmex* workers, full-face view, excluding a portion of the mandibles. 61: Smooth head; 62–63: Scattered foveolate punctures; 64: Foveolate-reticulate sculpture; 65: Rugoreticulum; 66: Regular striations around the antennal fossae and on the genae; 67: Regular striations on the entire dorsum of the head.

base of the first gastral tergite (Fig. 59) 13

13. Dorsum of head, except for the scrobes, with foveolate-reticulate sculpture; punctures often aligned so that it seems that several longitudinal rugae appear between frontal carinae. Eyes smaller, EL = 0.06–0.08, with three to four ommatidia in the longest row (Asia: Papua New Guinea) .... ***coggii*** (p. 493)

Dorsum of head between frontal carinae with some scattered foveolate punctures; space between foveolae smooth. Eyes larger, EL = 0.09–0.12, usually containing five (rarely four) ommatidia in the longest row (Asia: Papua New Guinea) .... ***simplex*** (p. 512)

14(2). Masticatory margin of mandible with four teeth, lacking a distinct diastema (Fig. 30). Lamella, circling the base of antennal scape, with a broad and deep notch on the center of the dorsal surface (Fig. 82). Petiole node in profile longer than high (*umbripennis* group; Asia) 15

Masticatory margin of mandible with three to five teeth; usually with a distinct diastema (Figs. 31–33, 35–39); if (very rarely) diastema indistinct, masticatory margin with five teeth (Fig. 34). Lamella, circling the base of antennal scape, entire, without a notch on the center of the dorsal surface (Fig. 81). Petiole node in profile usually higher than long 17

15. Eyes larger, usually consisting of 20 or more ommatidia, containing six to seven ommatidia in the longest row. Propodeum with a pair of toothlike armaments that are shorter than the distance between their bases. About one-third of antennal scape usually laterally compressed near the base (Asia: Papua New Guinea, Indonesia) .... ***umbripennis*** (p. 525)

Eyes smaller, generally consisting of less than 10 ommatidia, with three to four ommatidia in the longest row. Propodeum with a pair of spines that are longer than the distance between their bases. Antennal scape not laterally compressed near the base 16

16. Propodeal spines longer and strongly upcurved at their apices (Fig. 13). Larger species with HL 1.42–1.54, HW 1.42–1.58 (Asia: W. Malaysia, N. Borneo) .... ***pollux*** (p. 521)

Propodeal spines shorter and not strongly upcurved at their apices (Fig. 12). Smaller species with HL 1.04–1.36, HW 1.02–1.40 (Asia: Papua New Guinea, Indonesia, Singapore, Malaya, Sabah, Brunei, Philippines) .... ***picteti*** (p. 518)

17(14). Pronotum unarmed. Eyes larger, usually containing seven or more (very rarely six) ommatidia in the longest row. Dorsal surfaces of head and alitrunk with well developed rugoreticulum or many foveolate punctures (*punctatus* group; Asia, Africa) 18

Pronotum usually with a pair of teeth or spines; if (very rarely) pronotal teeth or spines absent, then either eyes smaller, with two to five ommatidia in the longest row, or dorsal surfaces of alitrunk and head between frontal carinae unsculptured and smooth 22

18. Dorsum of alitrunk with well developed coarse reticulum. Propodeum armed with a pair of long spines. Antennal scapes longer, usually >0.78; one-sixth to one-fifth of the length of the scapes projecting beyond the occipital margin. Palp formula 5,3 19

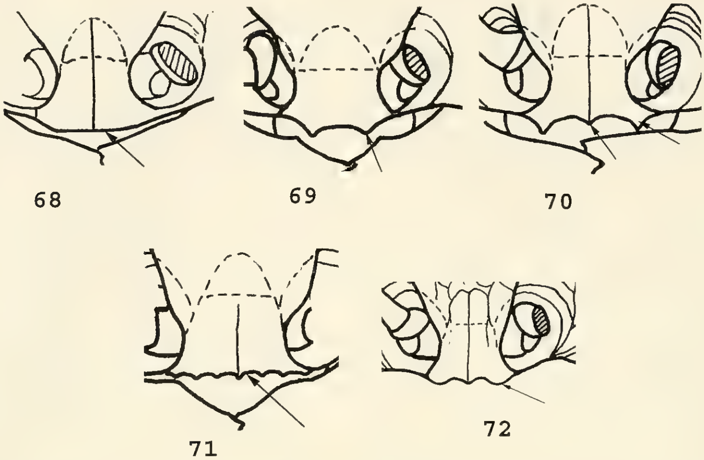
Dorsum of alitrunk with scattered foveolate punctures. Propodeum armed with a pair of short spines. Antennal scapes shorter, with the length 0.54–0.60, only close to the occipital margin. Palp formula 4,3 (South Africa) .... ***fossulatus*** (p. 406)

19. Lateral portions of clypeus, in front of antennal fossae, developed and not reduced to narrow margins (Figs. 73, 74). Anterior clypeal margin lacking distinct denticles (Figs. 65, 68). Median portion of clypeus not flat 20

Lateral portions of clypeus reduced to a narrow margin in front of the antennal fossae (Fig. 75). Anterior clypeal margin with five to seven denticles. Median portion of clypeus more or less flat 21

20. Dorsum of head with scattered foveolate punctures; spaces between foveolae smooth (Fig. 63). Frontal carinae short, not extending to the level of the posterior margins of eyes in full-face view. Alitrunk in dorsal view with a deep longitudinal furrow at middle (Asia: Philippines) .... ***divisus*** (p. 404)

Dorsum of head entirely sculptured with coarse reticulum (Fig. 65). Frontal carinae long, extending to the level of the posterior margins of eyes in

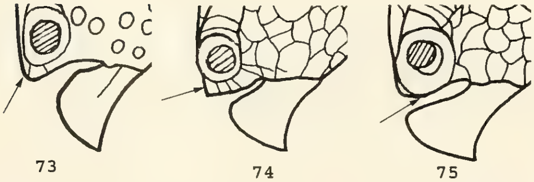


Figures 68–72. Characters on the anterior clypeal margins of *Pristomyrmex* workers. 68: Anterior clypeal margin entire; 69: Anterior clypeal margin with two teeth; 70: Anterior clypeal margin with three teeth; 71: Anterior clypeal margin with seven teeth; 72: Anterior clypeal margin with three prominences.

full-face view. Alitrunk in dorsal view lacking a deep longitudinal furrow at the midline (Asia: Malaya) .... ***pulcher*** (p. 408)

21(19). Two or more pairs of erect hairs present on the dorsum of petiole node (Fig. 46). Basal margin of mandible almost straight, without a distinct tooth (Fig. 31). Ventral surface of clypeus lacking toothlike prominences. Dorsal alitrunk more or less depressed, with marginate sides. Sculpture of the sides of pedicel segments lighter and finer (widespread in the east and south of Asia; occasionally intercepted at entry ports in North America) .... ***punctatus*** (p. 410)

A pair of hairs present on the dorsum of petiole node (Fig. 47). Basal margin of mandible with an acute or broad-based triangular tooth (Fig. 35). Ventral surface of clypeus usually with two minute toothlike prominences. Dorsal alitrunk convex, not depressed. Sculpture of the sides of pedicel segments more coarse (Asia: Thailand, Malaya, Sarawak, Sabah, Brunei, Sumatra) .... ***rigidus*** (p. 415)



Figures 73–75. Lateral portions of the clypei of *Pristomyrmex* workers in front of antennal fossae. 73: *P. divisus* **sp. n.**; 74: *P. pulcher* **sp. n.**; 75: *P. punctatus* (F. Smith).

22(17). Promesonotal suture present. Propodeal spines developed and long, in dorsal view joining together at base and forming a "fork" (Fig. 26). Alitrunk in profile with a convex promesonotum and a deeply concave propodeal dorsum (Figs. 22, 23). Dorsum of head, at least on the genae and around the antennal sockets, with regular striate sculpture, lacking foveolate punctures or rugoreticulum (Figs. 66, 67) (*trispinosus* group; Indian Ocean Islands) 23

Promesonotal suture absent. Propodeal armaments in dorsal view usually well separated at the base and not resembling a fork. In rare case, where the propodeal spines are set close together at the base, the dorsum of alitrunk, in profile, lacks a deeply concave propodeum (Fig. 25). Dorsum of head smooth or sculptured with foveolate punctures or with rugoreticulum, but never showing regular striate sculpture 25

23. Propodeal spines in dorsal view divergent, in profile almost straight. Larger species with HW > 1.00, HL > 1.10, SL > 1.30 24

Propodeal spines in dorsal view subparallel (Fig. 26), in profile view bent at about a right angle near the base (Fig. 23). Smaller species with HW 0.82–0.90, HL 0.88–1.01, SL 0.80–0.97 (Indian Ocean Is.: Mauritius, Reunion I.) .... ***browni*** (p. 485)

24. Dorsum of head and alitrunk entirely covered with regular long coarse striations (Fig. 67). Mesonotum with a pair of strong, blunt digitlike prominences (Fig. 22) (Indian Ocean Is.: Mauritius) .... ***trispinosus*** (p. 488)

Dorsum of head smooth and shining, with rugae only present around the antennal fossae, on the genae and sometimes around the centrical disc of dorsal head (Fig. 66). Dorsum of alitrunk smooth and shining. Mesonotum lacking well-developed digitlike prominences (Indian Ocean Is.: Mauritius) .... ***bispinosus*** (p. 484)

25(22). Sides of postpetiole with several coarse longitudinal rugae (Fig. 48). In profile view, the posterodorsal and posteroventral corners of the petiole node right-angled. Palp formula 4,3 (*cribrarius* group; Africa: Mozambique, South Africa) .... ***cribrarius*** (p. 418)

Sides of postpetiole unsculptured or at most with a single longitudinal ruga (Figs. 49–58). In profile view, the posterodorsal and posteroventral corners of the petiole node not right-angled. Palp formula 1,3 or 2,2 or 2,3 (*quadridens* group; Asia, Australia, Africa) 26

26. Mandibular dentition arranged as an apical tooth + a preapical + a diastema + three small denticles of similar size (Fig. 32). Sometimes, the three small denticles are fused together so that they are not clearly visible, but the length of the masticatory margin covered by the three small denticles is slightly longer than that of diastema. Pronotum either unarmed or armed with a pair of short triangular spines that are shorter than the propodeal spines 27

Mandibular dentition arranged as an apical + a preapical + a diastema + one or two denticles, and the length of the masticatory margin covered by the one or two denticles is distinctly shorter than that of diastema (Figs. 31, 33, 35). If (very rarely) mandibular dentition not as described previously but arranged as an apical + a preapical + a small denticle + a very short diastema (or diastema indistinct) + two small denticles (Fig. 34), then the pronotum is armed with a pair of long robust spines that are much longer than propodeal spines (Fig. 24) 29

27. Pronotum unarmed. Eyes smaller, with three ommatidia in the longest row (Asia: Sumatra) .... ***eduardi*** (p. 440)

Pronotum armed with a pair of short triangular spines. Eyes larger, usually with five to six (rarely with four) ommatidia in the longest row 28

28. Dorsal surfaces of head and alitrunk only with scattered shallow foveolate punctures; dorsum of alitrunk with a smooth and unsculptured median longitudinal strip (Asia: Indonesia) .... ***quindentatus*** (p. 467)

Dorsal surfaces of head, except for scrobal areas, and alitrunk entirely covered with well developed coarse rugoreticulum (Asia: Sarawak, Sabah) .... ***occultus*** (p. 455)

29(26). Dorsal surfaces of both alitrunk and head between frontal carinae either smooth or with some scattered foveolate punctures but lacking foveolate-reticulate sculpture or rugoreticulum 30

Dorsal surfaces of both alitrunk and head with foveolate-reticulate sculpture or rugoreticulum 42

30. Area of dorsal head between frontal carinae unsculptured and smooth. Dorsum of alitrunk without foveolate punctures 31

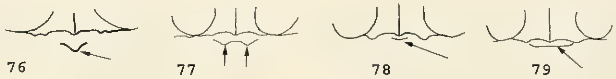
Dorsal surfaces of both alitrunk and head between frontal carinae with some scattered foveolate punctures 40

31. Alitrunk, in dorsal view, with a transverse ridge at the approximate position of metanotal groove (Fig. 19). Anterior clypeal margin with three strong teeth (Fig. 70) 32

Alitrunk, in dorsal view, unsculptured, lacking a transverse ridge at the approximate position of metanotal groove. Anterior clypeal margin usually with five to seven small denticles (Fig. 71) 34

32. First gastral tergite with numerous, evenly distributed, suberect hairs. Alitrunk in dorsal view with several short rugae present at the juncture between the pronotum and the mesonotum (Australia: New South Wales) .... ***erythropygus*** (p. 441)

First gastral tergite lacking any suberect



Figures 76–79. Characters on the ventral surfaces of the clypei of *Pristomyrmex* workers. 76: A tooth; 77: Two toothlike prominences; 78: A short ruga; 79: A long transverse ridge.

hairs. Alitrunk in dorsal view without rugae at the juncture between the pronotum and the mesonotum 33

33. Propodeal spines longer, subequal to or longer than pronotal spines (Fig. 20). Ventral center of clypeus with a weak and short ruga (Fig. 78). Head broader, with HW 0.97–1.34 and CI 103–116 (Australia: New South Wales, SE Queensland) .... ***wheeleri*** (p. 478)

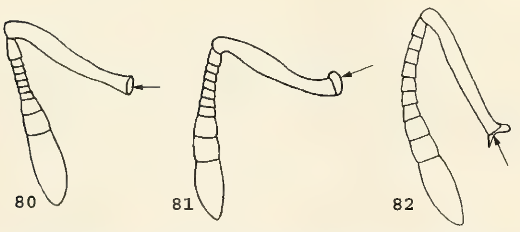
Propodeum with a pair of teeth or short spines, much shorter than pronotal spines (Fig. 19). Ventral surface of clypeus with a long, well-developed transverse ridge (Fig. 79). Head narrower, with HW 0.80–1.08 and CI 93–101 (Australia: New South Wales, Queensland) .... ***quadridentatus*** (p. 463)

34(31). Pronotum tuberculate, lacking teeth or spines (Africa: Ivory Coast, Ghana, Nigeria, Cameroon, Gabon, Congo and Angola) .... ***orbiceps*** (p. 456)

Pronotum armed with a pair of teeth or spines 35

35. Petiole and postpetiole without erect hairs (Fig. 50). Frontal carinae absent. Pronotum with a pair of triangular short spines. Ventral surface of clypeus with two toothlike prominences (Fig. 77) (Africa: Zaire) .... ***trogor*** (p. 476)

Petiole and postpetiole with at least one to two pairs of hairs (Figs. 49, 52). Frontal carinae present and usually extending to the level of the posterior margins of eyes. In rare cases where the frontal carinae are very short or absent, the pronotum is armed with a pair of well-developed, long spines that are longer than the distance between their bases (Fig. 21). Ventral surface of clypeus either with a transverse ruga, or with a tooth at center, or without any ruga or tooth, but never showing two toothlike prominences 36



Figures 80–82. Lamella, circling the base of the antennal scape of the *Pristomyrmex* worker, absent (80), entire (81), or with a broad and deep notch (82).

36. Pronotum with a pair of triangular short spines, much shorter than the distance between their bases 37

Pronotum with a pair of long spines, longer than distance between their bases (Figs. 21, 25) 38

37. Petiole node in profile lacking distinct anterior face distinguishable from the upper surface of peduncle (Fig. 53). Larger species, with HW 0.98–1.04, HL 0.94–1.02, EL 0.22–0.24 (Asia: Philippines) .... ***flatus*** (p. 443)

In profile, anterior face of petiole node distinct from the dorsal surface of peduncle (Fig. 52). Smaller species, with HW 0.77–0.94, HL 0.82–0.94, EL 0.14–0.18 (Asia: Philippines) .... ***collinus*** (p. 432)

38(36). Propodeal spines short or moderately long, much shorter and slender than pronotal spines (Fig. 21) 39

Propodeal spines exceptionally long, subequal in length to or slightly longer than pronotal spines (Fig. 25) (Australia: Queensland) .... ***wilsoni*** (p. 481)

39. Petiole node in profile lacking distinct anterior face distinguishable from the upper surface of peduncle (Fig. 55). Clypeus unsculptured, lacking a median longitudinal carina. Frontal carinae short, not extending to the level of the posterior margins of eyes (Asia: Philippines) .... ***longispinus*** (p. 450)

In profile, anterior face of petiole node distinct from the dorsal surface of peduncle (Fig. 54). Clypeus with a median longitudinal carina. Frontal carinae long, extending to the level of the posterior margins of eyes (Asia: Philippines) .. ***curvulus*** (p. 437)

40(30). Petiole and postpetiole lacking erect hairs (Fig. 50). Ventral surface of clypeus with two toothlike prominences (Figs. 77) (Africa: Ghana, Cameroon, Gabon, Angola, Kenya, Zaire, Sudan) .... ***africanus*** (p. 423)

Petiole and postpetiole, respectively, with one to five pairs of erect hairs. Ventral surface of clypeus either with a transverse ruga (Figs. 78, 79) or with a toothlike prominence (Fig. 76) 41

41. Smaller species (HW 0.82–1.02, HL 0.82–1.02, EL 0.14–0.20). Ventral center of clypeus with a toothlike prominence. Usually one to two pairs of hairs present, respectively, on the dorsal surfaces of petiole node and postpetiole (Asia and Pacific Is.: Papua New Guinea; Indonesia; Pohnpei Is.) .... ***quadridens*** (p. 459)

Larger species (HW 1.22–1.24, HL 1.10–1.16, EL 0.24–0.25). Ventral surface of clypeus with a transverse ruga, lacking a toothlike prominence at center. Four to five pairs of short hairs present, respectively, on the dorsal surfaces of petiole node and postpetiole (Fig. 51) (Asia: New Guinea) .... ***nitidissimus*** (p. 453)

42(29). First gastral tergite with numerous, evenly distributed, erect or suberect hairs. Petiole node with a single evenly blunt-rounded apex (Fig. 56) (Asia: Philippines) ... ***hirsutus*** (p. 449)

First gastral tergite lacking erect hairs. Petiole node not showing a single evenly blunt-rounded apex but with a higher anterodorsal angle than the posterodorsal (Fig. 57) 43

43. Masticatory margin of mandibles with five teeth; diastema very short or indistinct between the preapical and the third tooth (Fig. 34). Basal margin of mandible with a central, broadly curved lobe. Anterior clypeal margin with three prominences, that is, a median tooth and a broad, low convex lobe on each side (Fig. 72) (Asia: Sarawak, Sabah, Borneo) .... ***trachylissus*** (p. 474)

Masticatory margin of mandibles with three to four teeth; diastema distinct and long, present between the preapical and the third tooth (Figs. 31, 33). Basal margin of mandible almost straight, without a distinctly curved lobe. Anterior clypeal margin usually with five to seven denticles (Fig. 71) 44

44. Pronotal spines exceptionally long, usually exceeding 0.40 (very rarely 0.37), usually longer than the distance between the bases of two pronotal spines (Fig. 24) (Asia: Sumatra, Java, Malaya, Sarawak, Sabah, Borneo, Philippines) ***bicolor*** (p. 425)

Pronotum armed with a pair of teeth or spines (≤0.32; Figs. 14, 15, 17, 18) that are always shorter than the distances that separate their bases 45

45. Propodeal spines long (0.19–0.30), much longer than the pronotal armaments (Fig. 16), palp formula 2,3 46

Propodeal spines short (0.04–0.13), usually shorter than but sometimes slightly longer than the pronotal armaments (Figs. 14, 15), palp formula 1,3 47

46. Postpetiole in dorsal view much broader than long, with PPI 133–150. Antennal scapes shorter (SL 0.70–0.82, SI 81–93) (Australia: Queensland) .... ***foveolatus*** (p. 446)

Postpetiole in dorsal view slightly broader than long, with PPI 109–121. Antennal scapes longer (SL 0.86–0.98, SI 97–103) (Australia: Queensland) .... ***thoracicus*** (p. 473)

47(45). Petiole node in profile slightly longer than high, with the anterodorsal angle on approximately the same level as or weakly higher than the posterodorsal; dorsum and sides of petiole node with seven to eight foveolate punctures (Fig. 58) (Asia: Sarawak) .... ***modestus*** (p. 452)

Petiole node in profile higher than long, with the anterodorsal angle distinctly elevated above the posterodorsal; dorsum and sides of petiole node without foveolate punctures (Fig. 57) 48

48. Ventral surface of clypeus lacking a central prominent tooth but usually bearing a transverse ruga (Asia: Malaya, Singapore, Sarawak, Borneo, Sabah, Philippines) ... ***costatus*** (p. 434)

Ventral surface of clypeus with a central prominent tooth (Fig. 76) 49

49. Pronotum with a pair of moderately long spines (0.14–0.20), usually much longer (sometimes slightly longer) than the propodeal armaments (0.07–0.13) (Figs. 18) (Asia: Malaya, Thailand, Nepal, Burma, China) .... ***sulcatus*** (p. 469)

Pronotum with a pair of teeth or short spines (0.06–0.10), usually similar in length to or slightly shorter than the propodeal armaments (0.04–0.12)

(Figs. 14, 15) (Asia: Sumatra, Sulawesi, Malaya, Sarawak, Sabah, Thailand, Philippines, Taiwan, Japan) ---- ---------------------------- **brevispinosus** (p. 428)

THE *PUNCTATUS* GROUP

Worker. Small to medium sized (HL 0.62–0.98, HW 0.64–0.94, TL 2.62–3.44), with the following combination of characters:

(1) Masticatory margin of mandibles with three to four teeth arranged as the strongest apical + the second strongest preapical + a long diastema + two small basal denticles of similar size (or a broad basal tooth).

(2) Palp formula 5,3 in four Oriental species and 4,3 in the single South African species.

(3) Frontal carinae present.

(4) Lateral portions of clypeus reduced to a narrow margin in front of the antennal fossae in three species (*P. punctatus, P. rigidus,* and *P. fossulatus*) but developed in the other two species (*P. divisus* and *P. pulcher*).

(5) Frontal lobes indistinct or absent.

(6) Lamella that encircles the base of antennal scape, entire.

(7) Alitrunk in profile showing a continuous convex dorsum and in dorsal view lacking sutures.

(8) Pronotum unarmed.

(9) Propodeum with a pair of spines.

(10) Petiole node in profile more or less wedge-shaped, lacking distinct anterior face distinguishable from the upper surface of peduncle.

This group has five species. Four occur in the Oriental region, one of which (*P. punctatus*) has spread to warm-temperate areas in the eastern Palaearctic. The remaining species (*P. fossulatus*) is confined to South Africa. *Pristomyrmex punctatus* is a unique species within the genus. It is the only *Pristomyrmex* extending its range to the temperate zone, and it is further characterized by the possession of a unique life history that may preadapt it for dispersal by natural and human transport.

The *punctatus* group is closely related to the *cribrarius* and *quadridens* groups because all female castes of these species groups possess a distinct diastema after the preapical tooth on the masticatory margin of mandibles (except in *P. trachylissus,* which has five teeth on the masticatory margin). Though sharing the previously described mandibular character, the *trispinosus* group is relatively distant from the *punctatus* group because it possesses so many autapomorphic characters, for example, frontal carinae absent, dorsal alitrunk with a promesonotal suture or impression, propodeal spines in dorsal view showing a "fork", some regular striation present on the dorsal surfaces of head and alitrunk.

The *punctatus* group differs from the *cribrarius* group by lacking a pair of pronotal spines in the workers and by showing the anterior face of the petiole node not distinct from the upper surface of peduncle in the female castes. The *punctatus* group differs from the *quadridens* group by possessing palp formulae of 5,3 and 4,3 (the *quadridens* group possesses palp formulae of 2,2, 1,3 and 2,3).

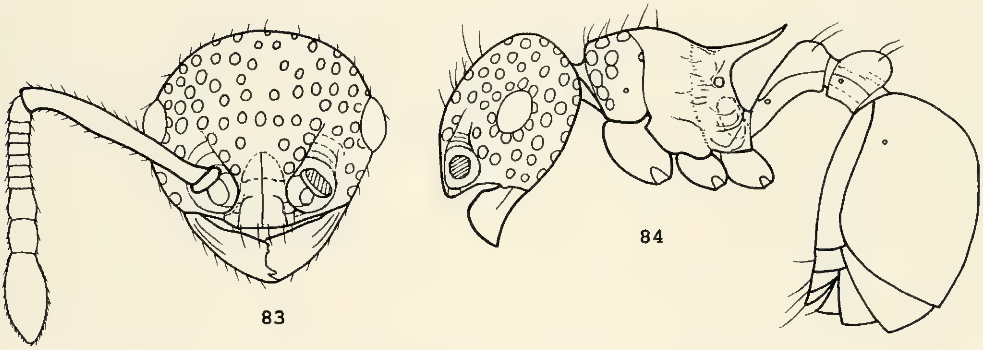
Pristomyrmex divisus sp. n.
Figures 83–84

Diagnosis (Worker). Lateral portions of clypeus in front of antennal fossae, developed, not reduced to margins, so that the antennal fossae are placed well behind the anterior clypeal margin; dorsal head only with scattered foveolate punctures.

Holotype Worker (MCZC). TL 3.06, HL 0.76, HW 0.80, CI 105, SL 0.82, SI 103, EL 0.22, PW 0.56, AL 0.74. Paratypes, 35 workers (MCZC, BMNH, ANIC, MHNG).

Worker. TL 3.06–3.40, HL 0.72–0.82, HW 0.74–0.86, CI 98–111, SL 0.78–0.90, SI 98–110, EL 0.21–0.24, PW 0.53–0.64, AL 0.72–0.80, PPW 0.26–0.30, PPL 0.18–0.22, PPI 123–156 (n = 20).

Mandibles with a few longitudinal rugae but smooth near the masticatory margin. Dentition of the masticatory margin of

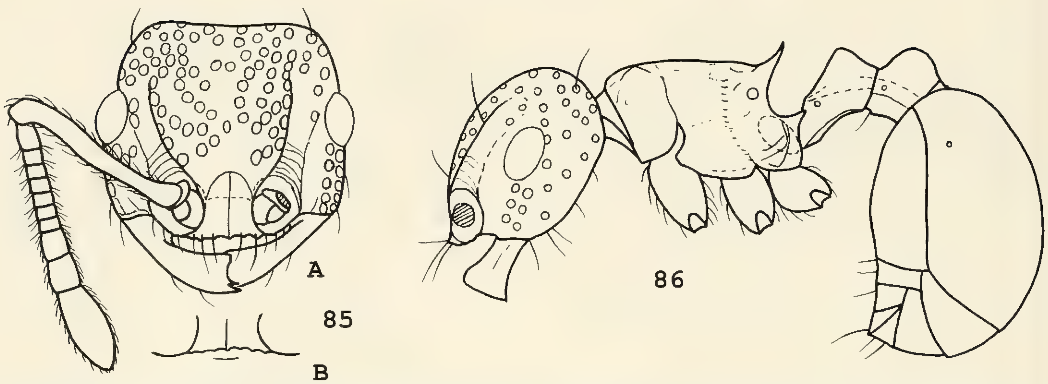


Figures 83–84. *Pristomyrmex divisus* **sp. n.** 83: Worker head, full-face view; 84: Worker, lateral view.

mandible: the strongest apical tooth + the second strongest preapical + a long diastema + a broad, truncated basal tooth (or two minute denticles). A weak minute prominence present about midway on the basal margin of mandible. Clypeus with a strong median longitudinal carina extending through the frontal area; on each side of the median clypeal carina, a few additional rugae are usually present. Anterior clypeal margin lacking denticles. Median portion of clypeus higher than frontal area; lateral portions of clypeus developed, not reduced to margins. Ventral surface of clypeus lacking any toothlike prominences but usually with a few rugae. Palp formula 5,3. Frontal carinae short, not extending to the level of the posterior margins of eyes. Antennal scrobes absent. Frontal lobes absent; thus, the antennal articulations are completely exposed. Antennal scapes, when lying on the dorsal head, surpassing the occipital margin of head by one-sixth to one-fifth of their length. Eyes large and prominent, containing 8 to 10 ommatidia in the longest row. Dorsum of alitrunk in dorsal view marginated, more or less depressed, and usually with a deep longitudinal furrow at middle. Pronotum unarmed. Propodeal spines well developed, acute and long, much longer than the distance between their bases. Metapleural lobes small, dentiform, and acute. Petiole in profile with a long peduncle; dorsum of peduncle, together with the anterior face of petiole node, forming a long declivity that reaches the top of petiole node. Ventral surface of petiole lacking any process. Postpetiole in profile with a convex dorsum, in dorsal view somewhat transverse-rectangular and much broader than long. Dorsum of head with numerous large and shallow foveolate punctures; space between foveolae smooth; ventral head with denser foveolate punctures. Dorsal surface of alitrunk with reticulate rugae. Petiole always, and postpetiole usually, with a coarse longitudinal ridge on each side. In dorsal view, petiole node and postpetiole each usually bounded by a rim; dorsums of both petiole and postpetiole, except for rims, very smooth and polished. Gaster unsculptured. Dorsal surfaces of head and alitrunk with numerous erect to suberect short hairs. A pair of hairs present, respectively, near the top of both petiole node and postpetiole. First gastral tergite without hairs. Two or three pairs of long, forward-projecting hairs present near the anterior clypeal margin. Scapes and tibiae with some erect to suberect short hairs. Color uniform reddish-brown; appendages sometimes slightly lighter.

Queen and Male. Unknown.

Comments. This species is so far known only from the Philippines, and its closest relative without doubt is *P. pulcher*, from Malaysia. The workers of two species share the following three characters that are not seen in the other three members of the



Figures 85–86. *Pristomyrmex fossulatus* (Forel). 85A: Worker head, full-face view; 85B: Showing a short transverse ruga on the ventral clypeus; 86: Worker, lateral view, hairs omitted from the petiole node and postpetiole.

punctatus group (*P. punctatus, P. rigidus,* and *P. fossulatus*): (1) lateral portions of clypeus, in front of the antennal fossae, developed, making the antennal fossae well behind the anterior clypear margins; (2) anterior clypeal margin lacking distinct denticles; and (3) the median portion of clypeus not flat but somewhat concave. In the workers of *P. punctatus, P. rigidus,* and *P. fossulatus,* the anterior clypeal margin is equipped with five to seven denticles, and the lateral portions of clypeus in front of the antennal fossae are reduced to margins (in other words, the antennal fossae reach the lateral anterior margins of clypeus), and the median portion of clypeus is more or less flat.

The workers of *P. divisus* are easily separated from those of *P. pulcher.* The cephalic dorsum shows rugoreticulum in *P. pulcher* but scattered foveolate punctures in *P. divisus*; the frontal carinae do extend to the level of the posterior margins of eyes in *P. pulcher* but not so in *P. divisus*; a pronounced median longitudinal furrow is present on the dorsal surface of alitrunk in *P. divisus* but absent in *P. pulcher.*

Holotype Worker. Philippines: Dumaguete, 1949, J. W. Chapman.

Paratypes. 18 workers with same data as holotype; 14 workers, Philippines: Dumaguete (J. W. Chapman); three workers, Philippines: Dumaguete, Silliman University, 9.v.1949 (Domingo Empeso).

Ecological Information. Unknown.

Pristomyrmex fossulatus (Forel)
Figures 85–86

Tetramorium (Xiphomyrmex) fossulatum Forel, 1910: 428. Syntype workers, South Africa: Natal, Will Broak (Wroughton) (MHNG) [examined].
Pristomyrmex fossulatus (Forel) Santschi, 1916: 51.

Diagnosis (Worker). Masticatory margin of mandible with a long diastema after the preapical tooth; palp formula 4,3; eyes with 8 to 10 ommatidia in the longest row; pronotum lacking teeth or spines; dorsal surfaces of head and alitrunk with scattered foveolate punctures.

Worker. TL 2.63–2.92, HL 0.62–0.71, HW 0.64–0.75, CI 98–106, SL 0.56–0.61, SI 81–88, EL 0.17–0.18, PW 0.44–0.50, AL 0.64–0.74, PPW 0.26–0.28, PPL 0.16–0.19, PPI 147–163 (n = 5).

Mandibles smooth and shining. Dentition of the masticatory margin of mandible: an apical tooth + a preapical tooth + a long diastema + a truncated basal tooth. Basal margin of mandible lacking a tooth-like prominence or curved lobe. Clypeus with a strong median longitudinal carina. Anterior clypeal margin with a median denticle and two to three others on each side, but sometimes two lateral denticles are fused together. Lateral portions of clypeus reduced to margins, and antennal fossae reaching the lateral anterior margins of clypeus. Ventral center of clypeus with a short transverse ruga. Palp formula 4,3. Frontal carinae extending to the level of the posterior margins of eyes. Antennal scrobe short, shallow, but distinct, margined by the frontal carina and a longitudinal ruga. Frontal lobes absent; thus, the antennal articulations are completely exposed. Antennal scapes, when lying on the dorsal head, close to the occipital margin of head. Eyes large, containing 8 to 10 ommatidia in the longest row. Pronotum with a pair of blunt tubercles, lacking teeth or spines. Propodeum armed with a pair of spines, about as long as the distance between their bases. Metapleural lobes subtriangular. Petiole node in profile wedge-shaped, with a triangular apex. Subpetiole with a narrow flange. Postpetiole in profile higher than long, with a rounded dorsum, in dorsal view transverse-rectangular and much broader than long. Dorsum of head, except for the scrobal areas, with numerous scattered foveolate punctures. Similar but sparser punctures present on the dorsal surface of alitrunk. Petiole and postpetiole each usually with a longitudinal ruga on each side. Gaster unsculptured. Several pairs of hairs present on the dorsum of head beyond the level of the antennal insertions. A row of forward-projecting hairs present on the anterior clypeal margin. Hairs on the rest of the body as follows—mesonotum (one pair), petiole (zero to one pair), and postpetiole (one to two pairs dorsally)—frequently lost by abrasion (Bolton, 1981: p. 286). First gastral tergite lacking erect or suberect hairs. Scapes and tibiae with short hairs. Color reddish-brown; appendages yellow-brown.

Queen. I have not seen the queen of this species, but Menozzi (1942: 172) gave a description of this caste.

Male. Unknown.

Comments and Discussion. The position of *P. fossulatus* within *Pristomyrmex* is somewhat complicated. *Pristomyrmex fossulatus* occurs only in South Africa and shares certain character states with *P. orbiceps*, an African member of the *quadridens* group. The workers of *P. fossulatus* are similar to those of *P. orbiceps* in (1) the masticatory margin of mandible with a diastema, (2) the pronotum with a pair of broad and blunt tubercles, (3) the size of eyes, (4) the length of propodeal spines, and (5) hairs on the head and body (e.g., two to three pairs of erect hairs along the frontal carinae behind the level of antennal insertions, a pair on the occipital corners, a pair on the mesonotum). But it is very hard for me to place *P. fossulatus* into the *quadridens* group because this species has four segments of the maxillary palpi in the workers. In the 25 members of the *quadridens* group, the maxillary palp of 18 species examined, including *P. orbiceps*, is one or two segments.

Pristomyrmex fossulatus, however, shares important similarities with four Asian species of the *punctatus* group (*P. divisus*, *P. pulcher*, *P. punctatus*, and *P. rigidus*). These critical characters, as shown in the workers, include (1) a high palp formula, (2) the masticatory margin of mandible with a diastema after the preapical tooth, (3) pronotum without teeth or spines, (4) anterior face of the petiole node indistinguishable from the upper surface of its anterior peduncle, and (5) postpetiole in dorsal view much broader than long. Thus, *P. fossulatus* is assigned to the *punctatus* group. *P. fossulatus* can be separated from the four species as follows: In the workers of *P. fossulatus*, the propodeal spines are moderately long; the antennal scapes, falling into the range 0.56 to 0.61 (SI 81–88), are only close to the occipital margin of head, when laid on the dorsal head; the dorsum of the alitrunk has only scattered foveolate punctures. In *P. divisus*, *P. pulcher*, *P. punctatus*, and *P. rigidus*, the propodeal spines are well developed and long, much longer than the distance between their bases; the antennal scapes, with the length 0.70 to 0.94 (usually above 0.78) and SI 91–118 (usually above 98), obviously surpass the occipital margin of head; the dorsum of the alitrunk is covered fully with a developed rugoreticulum. It is possible that *P. fossulatus* evolved from the *P. divisus-P. pulcher-P. punctatus-P. rigidus* ancestor but later was divergent from the clade consisting of the four Asian species.

It must be pointed out that if *P. fossulatus* is designated as a member of the *quadridens* group, the *cribrarius* group, also possessing 4,3 palp formula, would become insignificant. As a result, *P. cribrarius* (another African species) would fall into the *quadridens* group.

Pristomyrmex fossulatus differs from two African species of the *quadridens* group (*P. orbiceps* and *P. africanus*) in the workers as follows:

P. fossulatus
- Palp formula 4,3
- Dorsum of head between frontal carinae with numerous foveolate punctures
- Dorsum of alitrunk with some foveolate punctures
- Petiole node in profile wedge-shaped, with a triangular apex

P. orbiceps
- Palp formula 1,3
- Dorsum of head between frontal carinae smooth and shining, except for few punctures bordering frontal carinae
- Dorsum of alitrunk smooth and shining
- Petiole node in profile relatively massive, and broad-rounded dorsally

P. fossulatus
- Palp formula 4,3
- Ventral surface of clypeus with a weak transverse ruga
- Eyes larger, with 8 to 10 ommatidia in the longest row
- Petiole node in profile wedge-shaped, with a triangular apex, lacking a distinct concave between the anterior face of the node and the dorsal surface of the peduncle
- Pronotum with a pair of tubercles
- Dorsal head behind the level of antennal insertions with three to four pairs of hairs; dorsal alitrunk at most with a pair of hairs

P. africanus
- Palp formula 1,3
- Ventral surface of clypeus with two strong toothlike prominences
- Eyes smaller, with four to five ommatidia in the longest row
- Petiole node in profile not wedge-shaped; a distinct concave present between the anterior face of the node and the dorsal surface of the peduncle
- Pronotum usually with a pair of teeth or spines but sometimes with a pair of tubercles
- Dorsal head behind the level of antennal insertions with numerous (at least 10 pairs of) hairs; dorsal alitrunk with several pairs of hairs

Distribution. This species was previously known only from the type series collected from South Africa (Bolton, 1981). Two more specimens (ANIC, MCZC) examined here add the following records: South Africa: Cape Province, Grahamstown, Old P. E. Road (L. H. Weatherill).

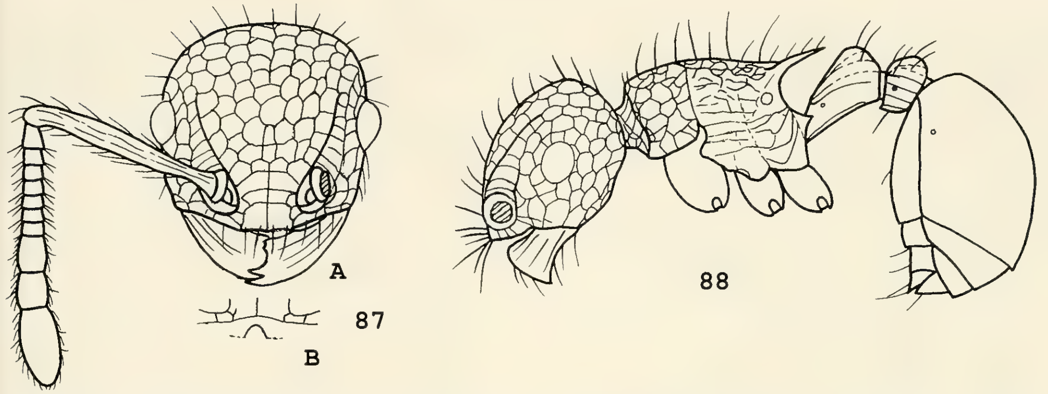
Ecological Information. Unknown.

Pristomyrmex pulcher sp. n.
Figures 87–88

Diagnosis (Worker). Lateral portions of clypeus in front of antennal fossae, developed, not reduced to margins, so that the antennal fossae are placed well behind the anterior clypeal margin; dorsal surfaces of head and alitrunk, as well as the sides of pronotum, with well-developed coarse rugoreticulum.

Holotype Worker (BMNH). TL 2.96, HL 0.76, HW 0.72, CI 95, SL 0.82, SI 114, EL 0.20, PW 0.53, AL 0.76. Paratypes, 11 workers (BMNH, MCZC, ANIC).

Worker. TL 2.70–3.04, HL 0.70–0.77, HW 0.69–0.77, CI 95–100, SL 0.76–0.84, SI 103–114, EL 0.19–0.21, PW 0.50–0.54, AL 0.70–0.78, PPW 0.25–0.29, PPL 0.17–0.20, PPI 135–156 (n = 11).



Figures 87–88. *Pristomyrmex pulcher* **sp. n.** 87A: Worker head, full-face view; 87B: Showing a curved ruga on the ventral clypeus; 88: Worker, lateral view.

Mandibles usually with a few longitudinal rugae but smooth near the masticatory margin. Dentition of the masticatory margin of mandible: the strongest apical tooth + the second strongest preapical + a long diastema + a broad basal tooth usually fused by two small denticles. A broad-based triangular short tooth present about midway on the basal margin of the mandible. Clypeus with sculpture consisting of a strong median longitudinal carina, a transverse carina (sometimes curved or weak or broken), and a few additional short carinae. Anterior clypeal margin lacking distinct denticles. Lateral portions of clypeus, in front of antennal fossae, developed, not reduced to narrow margins. Ventral surface of clypeus usually with a somewhat "∩" ruga that is sometimes interrupted at the middle. Palp formula 5,3. Frontal carinae strong, extending to the level of the posterior margins of eyes. Slightly impressed scrobal areas present lateral to the frontal carinae. Frontal lobes nearly absent; thus, the antennal articulations are completely exposed. Antennal scapes, when lying on the dorsal head, surpassing the occipital margin of head by one-sixth to one-fifth of their length. Eyes large and prominent, containing seven to nine ommatidia in the longest row. Occipital margin straight or feebly concave. In dorsal view, dorsum of the alitrunk marginated and rather depressed. Pronotum unarmed. Propodeal spines well developed, acute, and long, much longer than the distance between their bases. Metapleural lobes triangular. Pedicel segments as in Figure 88. Dorsum of petiole peduncle, together with the anterior face of the node, forming a long declivity that reaches the apex of the node. Ventral surface of petiole without any appendages or with only a very narrow rim. Postpetiole in profile convex dorsally, in dorsal view transverse-rectangular and much broader than long. Dorsal surfaces of head and alitrunk, as well as the sides of pronotum, with developed coarse rugoreticulum. Sides of the rest of the alitrunk irregularly rugulose. Antennal scapes with a few longitudinal rugae. Sides of both petiole and postpetiole usually with a few coarse longitudinal rugae. In dorsal view, petiole and postpetiole each bounded by a rim; dorsal surfaces of petiole and postpetiole, except for rims, very smooth and polished. Gaster unsculptured. Dorsal surfaces of head and alitrunk with numerous erect or suberect hairs. A pair of similar hairs present bilaterally near the top of petiole and two pairs usually on the dorsal postpetiole as in Figure 88. Two or three pairs of long, forward-projecting hairs present near the anterior clypeal margin. Scapes and tibiae with some scattered erect or suberect hairs. Gaster lacking erect or suberect hairs. Femurs, tibiae light-yellow, in contrast with head, antennae, alitrunk, tarsi, pedicel segments, and gaster, which are reddish-brown.

Queen and Male. Unknown.

Comments. Although *P. pulcher,* an Oriental species, is very similar, in appearance of the workers, to *P. punctatus,* the two species are in fact not closely related within the *punctatus* group. *Pristomyrmex pulcher,* together with *P. divisus,* constitutes a clade that is the sister group of the clade formed by the species *P. rigidus* and *P. punctatus.* The separation of the two clades is summarized under *P. divisus.* Additional characters separating the workers of *P. pulcher* from those of *P. punctatus* are as follows:

P. pulcher

- A broad, short tooth present on the basal margin of mandible
- Dorsum of petiole node with only a pair of erect hairs
- Leg bicolored, with femur and tibia light-yellow and tarsus reddish-brown
- Sculpture on the dorsal surfaces of head and alitrunk, and the sides of petiole and postpetiole relatively coarse
- Propodeal spines shorter, more robust, and slightly bent basally

P. punctatus

- Tooth of the basal margin absent or inconspicuous
- Dorsum of petiole node with two or more pairs of hairs
- Leg uniformly colored, light-red or reddish-brown
- Sculpture on the dorsal surfaces of head and alitrunk, and the sides of petiole and postpetiole relatively fine
- Propodeal spines relatively slender, and straight

The separation of *P. pulcher* from *P. divisus* is discussed under *P. divisus.*

Holotype Worker. Malaysia: Negri Sembilan, Pasoh For. Res., primary forest, litter sample, 3.iv.1994 (L. Ficken).

Paratypes. Five workers with same data as holotype; three workers, Malaysia: Negri Sembilan, Pasoh For. Res., litter sample, 3.iv.1994 (M. Brendell, K. Jackson and L. Ficken); three workers, Malaysia: Neg. Sembilan, Pasoh For. Res., litter sample, xi.1994 (M. Brendell, K. Jackson, and S. Lewis).

Ecological Information. This species has been collected from a little sample taken in primary forest.

Pristomyrmex punctatus (F. Smith) Figures 89–93

Myrmica punctata F. Smith, 1860: 108. Syntype workers, Indonesia: Bachian I. (A. R. Wallace) (OXUM) [examined].

Pristomyrmex punctatus (F. Smith) Mayr, 1886: 361.

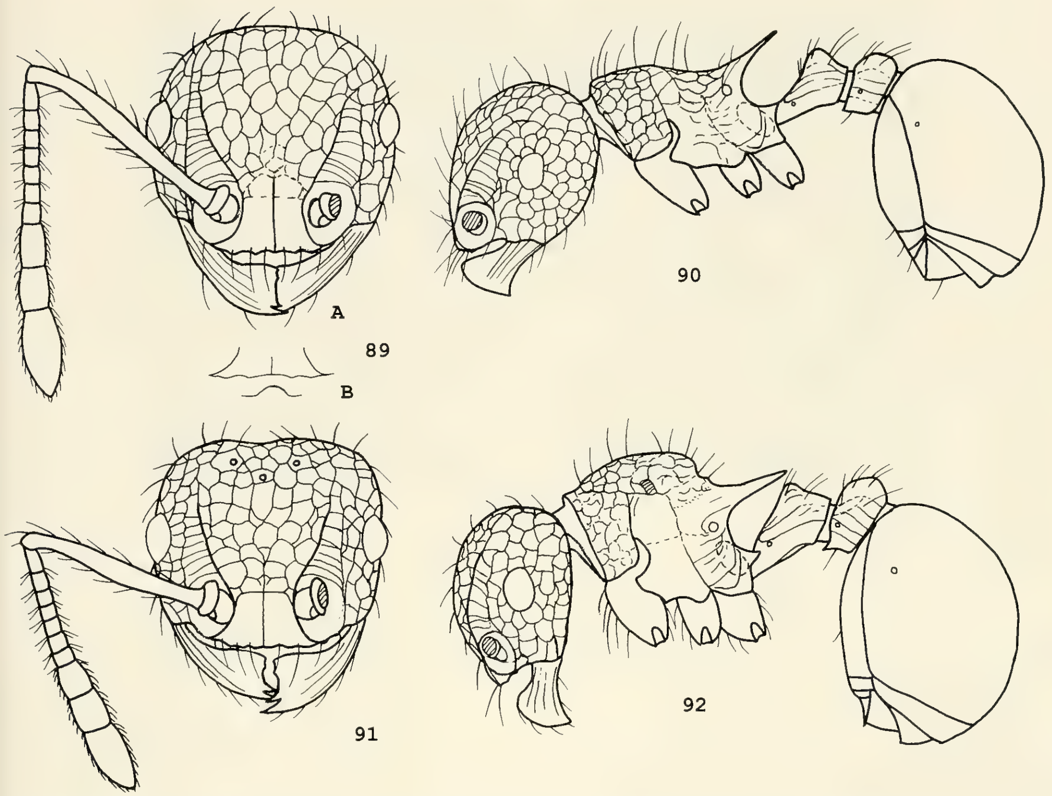
Pristomyrmex pungens Mayr, 1866: 904. Holotype worker, Malaysia: Malacca (?) (NHPS) [examined]. **Syn. n.**

Pristomyrmex japonicus Forel, 1900: 268. Syntype workers, Japan: Osaka (K. Yamada) (MHNG) [examined]. [Synonymy by Viehmeyer, 1922: 207].

Diagnosis (Worker). Eyes with eight or more ommatidia in the longest row; pronotum unarmed; propodeal spines straight, and long, much longer than the distance between their bases; dorsal surfaces of both head and alitrunk covered fully with rugoreticulum; dorsum of petiole node with two or more pairs of hairs.

Worker. TL 2.62–3.22, HL 0.70–0.84, HW 0.68–0.84, CI 94–105, SL 0.78–0.86, SI 102–118, EL 0.15–0.18, PW 0.48–0.56, AL 0.70–0.84, PPW 0.24–0.27, PPL 0.17–0.20, PPI 126–163 (n = 70).

Mandibles usually with a few fine longitudinal rugae but smooth near the masticatory margin. Dentition of the masticatory margin of mandible: the strongest apical tooth + the second strongest preapical + a long diastema + a broad basal tooth (or two small basal denticles). Basal margin of mandible rather straight, lacking a distinct tooth. Clypeus shieldlike, more or less depressed, with a median longitudinal carina extending posteriorly through the frontal area. In some specimens, a few short weak rugae present on each side of the median carina of the clypeus. Anterior clypeal margin equipped with a row of



Figures 89–92. *Pristomyrmex punctatus* (F. Smith). 89A: Worker head, full-face view; 89B: Showing a curved ruga on the ventral clypeus; 90: Worker, lateral view; 91: Ergatoid queen head, full-face view; 92: Ergatoid queen, lateral view.

denticles, but sometimes median denticle indistinct or absent or becoming a broad-truncated lobe. Lateral portions of clypeus reduced to margins, so that the antennal fossae reach the anterior clypeal margin. Ventral surface of clypeus usually with a curved ruga as in Figure 89B. Palp formula 5,3. Frontal carinae distinct, extending to the level of the posterior margins of eyes. Antennal scrobes weak. Frontal lobes almost completely absent; thus, the antennal articulations are entirely exposed. Antennal scapes, when lying on the dorsal head, surpassing the occipital margin of head by one-sixth to one-fifth of their length. Eyes large, with eight or more ommatidia in the longest row. Occipital margin feebly concave. Dorsum of the alitrunk in dorsal view marginated and more or less depressed (Fig. 93). Pronotum unarmed. Propodeal spines long, acute, but slender. Metapleural lobes dentiform and acute. Petiole node in profile wedge-shaped, with a triangular apex. Postpetiole in profile convex dorsally; in dorsal view transverse-rectangular, much broader than long, and also broader than the petiole. Dorsal surfaces of head and alitrunk as well as sides of pronotum covered fully with rugoreticulum, but scrobal areas with only several transverse rugae. Sides of the rest of the alitrunk with numerous irregular rugae. Sides of petiole and postpetiole usually with a few fine longitudinal rugae; sometimes rugae very weak and broken. Gaster unsculptured. Dorsal surfaces of head and alitrunk with numerous erect to suberect long hairs. Two (or more) pairs of hairs

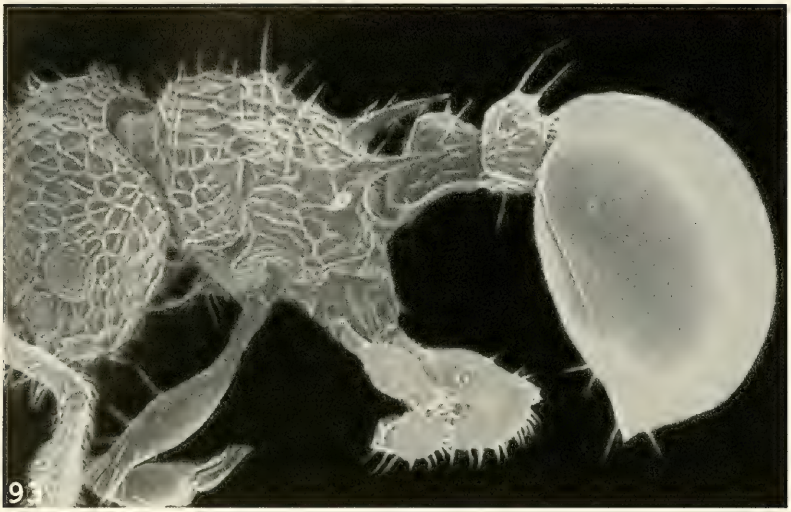


Figure 93. Showing that the worker of *Pristomyrmex punctatus* (F. Smith) has a more or less depressed dorsum of alitrunk.

present, respectively, bilaterally on the dorsums of petiole node and postpetiole, of which usually a pair shorter and the other pair longer. First gastral tergite lacking erect or suberect hairs. A few pairs of long, forward-projecting hairs present near the anterior clypeal margin that are symmetrical on the two sides of the midpoint. Scapes and tibiae with numerous erect to suberect short hairs. Color reddish-brown, but sometimes the gaster much darker or the appendages slightly lighter.

Ergatoid Queen. TL 3.60, 3.72; HL 0.86, 0.88; HW 0.94, 0.94; CI 107, 109; SL 0.89, 0.91; SI 97, 97; EL 0.23, 0.23; PW 0.66, 0.68; AL 0.94, 0.96; PPW 0.31, 0.32; PPL 0.23, 0.24; PPI 133, 135 (*n* = 2).

Closely resembling the worker in the structure of mandibles, clypeus, petiole, postpetiole and gaster and also in sculpture, color, and pilosity. But the head with three ocelli; eyes larger; pronotum and propodeum narrower than those of worker; mesonotum more convex; an impression present at the approximate positions of promesonotal suture and of metanotal groove, respectively; propodeal spines stronger than in worker. Wing absent, but the rudimentary vestige of a wing is present on the each lateral margin of the mesonotum.

Queen. Unknown.

Male. TL 3.22, HL 0.60, HW 0.57, CI 95, SL 0.18, SI 32, HWE 0.79, EL 0.32, PW 0.74, AL 1.04, PPW 0.26, PPL 0.17, PPI 153 (*n* = 1; one specimen [MCZC] collected from Nara, Japan, by Silvestri on July 21, 1925, was examined).

Head, including the eyes, broader than long. Clypeus transverse, with a median short carina. Frontal area with a median longitudinal carina. Frontal carinae short, slightly beyond the posterior margins of antennal sockets. Palp formula 5,3. On the mesoscutum, notauli pronounced, forming a Y shape; parapsidal furrows superficially impressed. Propodeum with a pair of teeth. Metapleural lobes subtriangular. Middle and hind tibiae each with a simple spur. Petiole node wedge-shaped, with a triangular apex; dorsum of petiole peduncle forming a declivity that reaches the top of the node. Postpetiole in profile rounded dorsally, in dorsal view transverse-rectangular and distinctly broader than long. Dorsum of head smooth and shining, except for few short rugae present behind the posterior margin of clypeus. Pronotum and mesoscutum smooth, except for those marked sutures, but mesoscutellum and propodeum sculptured with several longitudinal rugae. Sides of petiole with a few rugae. All dorsal surfaces with abundant erect or suberect hairs, but hairs on the legs and on the scapes somewhat appressed. Colour reddish-brown; wing light-yellow.

Comments and Discussion. The separation of *P. punctatus* from both *P. divisus* and *P. pulcher* is summarized in the discussions of both *P. divisus* and *P. pulcher.* The following characters can be used to separate the workers of *P. punctatus* from those of its closest relative, *P. rigidus*:

P. punctatus

- Dorsum of petiole node with two or more pairs of hairs
- Tooth absent or inconspicuous from basal margin of mandible
- Dorsal surfaces of head and alitrunk, and the sides of petiole and postpetiole more finely sculptured
- Propodeal spines relatively slender
- Clypeus with a median longitudinal carina that meets the anterior clypeal margin
- Dorsum of alitrunk in dorsal view, marginated, and more or less depressed
- Ventral surface of clypeus with a curved ruga but lacking distinct toothlike prominences

P. rigidus

- Dorsum of petiole node only with a single pair of hairs
- In type specimens, a strongly prominent tooth present on basal margin of mandible
- Dorsal surfaces of head and alitrunk, and the sides of petiole and postpetiole more coarsely sculptured
- Propodeal spines relatively robust
- Median clypeal carina often not reaching the anterior clypeal margin
- Dorsum of alitrunk in dorsal view, convex
- Ventral surface of clypeus usually with two minute toothlike prominences

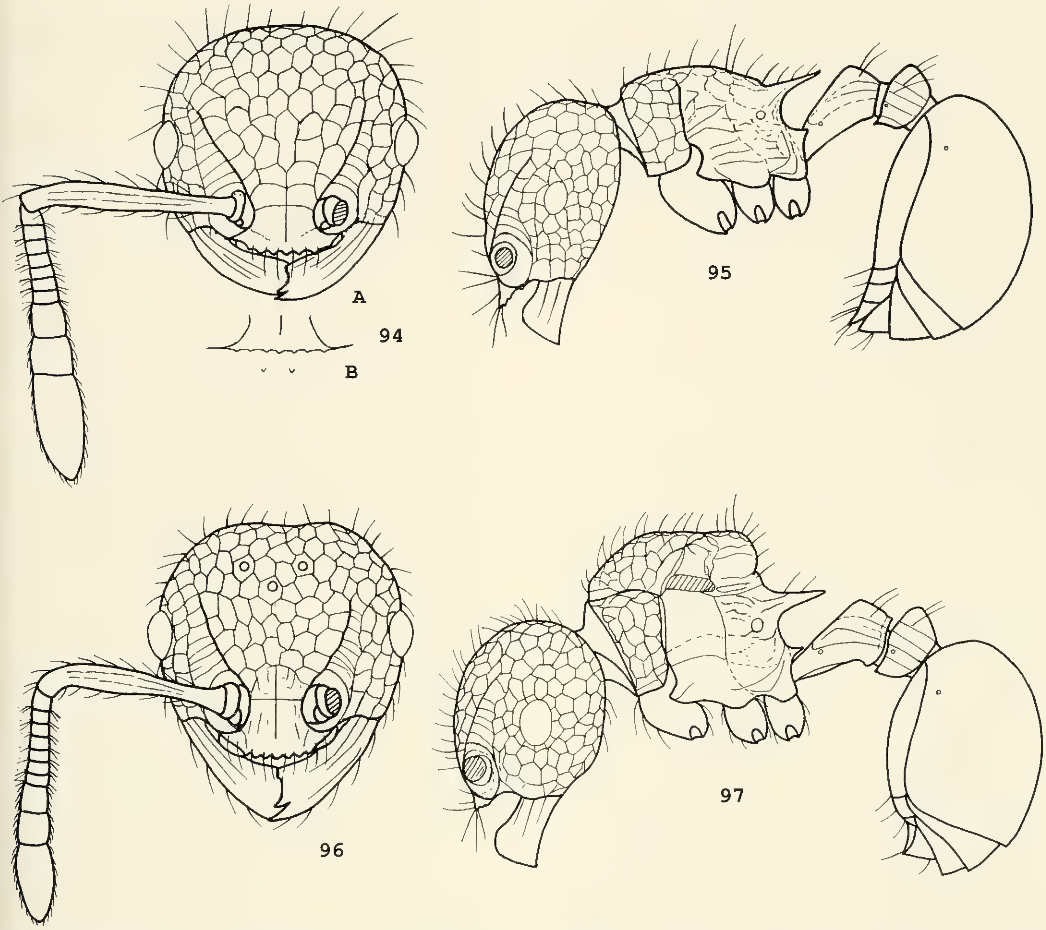
In addition, an ergatoid queen caste is present in *P. punctatus* but not seen in *P. rigidus,* while a normal queen caste exists in *P. rigidus* but has not been found in *P. punctatus.*

Without a doubt, *P. punctatus* originated in the subtropics or tropics of Asia, as its three close relatives, *P. rigidus, P. pulcher,* and *P. divisus,* are restricted to Sumatra, Malaysia, Brunei, Thailand, and the Philippines, respectively. But *P. punctatus* has a very large range, from New Guinea, Indonesia to Malaysia, Thailand, and then north to China and Japan, indicating its exceptional dispersal ability and tolerance of temperate climates. *Pristomyrmex punctatus* has shown some tendency for dispersal by humens. Interception records from ports in North America suggest that humen commerce may have played a role in this species' spread in temperate Asia.

The chromosome numbers of this species, reported by Imai (1966) and Itow et al. (1984), are $2n$ (diploid) = 24 in the cerebral ganglion cells of the workers and n (haploid) = 12 in the spermatocytes of the males. The larva of this species was described by Wheeler and Wheeler (1954).

Biology. It appears that *P. punctatus* occurs in open habitats. My impression stems from field experience in China as well as from data associated with specimens. This species lacks a normal queen caste; mature colonies usually contain several thousand workers and a few males, but ergatoid queens are rarely found. Eggs are normally laid by workers and can develop into workers or males. Ergatoid queens, when present, can also lay eggs. Brood production begins in April and lasts until the end of September. Young workers remain inside the nest and lay eggs. Older workers forage but lose the ability to lay eggs. Nests are often constructed in leaf litter from June to August but in the soil around trees from September to October. Sometimes arboreal nests are constructed on dead standing trees or in partially dead parts of living trees. The nest entrances of the arboreal nests and those under rotten wood are often covered with soil particles. See the following references for information on these and other aspects of the biology of *P. punctatus* (Itow et al., 1984; Mizutani, 1980, 1982; Tsuji, 1988a, 1988b, 1988c, 1990a, 1990b, 1994, 1995; Tsuji and Itô, 1986).

Material Examined (ANIC, AMNH, BMHH, BMNH, IZAS, LACM, MCZC, NHMV, USNM). New Guinea: Trian Jaya Ransik (Shah); NETH. Vogelkop, Danowaria (J. L. Gressitt); Vogelkop, Manokwari, 75 m (D. Elmo Hardy); Vogelkop, Fak Fak, S. coast of Bomberai, 10 to 100 m (J. L. Gressitt). Borneo: Sarawak, Nanga Pelagus near Kapit, 180 to 585 m (T. C. Maa); Sarawak, Merirai Valley (T. C. Maa); Sarawak, Bau, Lake Area (T. C. Maa); North Borneo, Tawau, Quoin Hill, Cocoa Res. Sta. (K. J. Kuncheria); North Borneo, Forest Camp, 19 km N of Kalabakan (K. J. Kuncheria); North Borneo (SE), Forest Camp, 9.8 km SW of Tenom (Y. Hirashima). Java: S. Coast, Sukawayani, 2 m, jungle remnant (J. L. Gressitt). Philippines: Samar (McGregor); Mindoro, San Jose (E. S. Ross); P.R. Mindanao, Talacogon, 8.32°N, 125.39°E, relict rainforest, on Agusan River (B. B. Lowery). Singapore (H. Overbeck). Thailand: Chiang Mai Prov., Chiang Rai, Fang Hort. Res. Sta.(D. G. Furth); Chiang Mai Prov., 18.70°N 98.82°E, Mae Wang Dist., Ban Huai Thong, 360 m, agricultural area (orchard), #96-116 (foragers on bamboo shoot) (R. R. Snelling and Saowapa Sonthichai). Vietnam: Perfume Pagoda (P. Jolivet); Cuc Phuong Forest (P. Jolivet). China: Hainan Is. (J. L. Gressitt); Guangxi, Xingping (D. G. Furth); Guangxi, Guilin, Qixing Park (D. G. Furth); Hong Kong, N.T., Campus C.U.H.K., Shatin, 22.38°N, 114.18°E, ca. 20 m, #96-6 (R. R. Snelling); Hong Kong, in bank of mixed orchard (R. Winney); Taipo (G. P. Tung); Shatin (Silvestri); Guangdong Prov., 60 km W of Guangzhou, Ding-Hu Mts. (Boucek); Back Liang (S. F. Light); Fujian Prov., Jiangle (Minsheng Wang); Yenping (S. Ling); Zhejiang Prov., Mokanshan (N. Gist Gee); Shanghai (Silvestri); Soochow (N. Gist Gee); Nanking (G. P. Tung); Hubei Prov., Xiangfan (Minsheng Wang); Guizhou, Leishan (Minsheng Wang); Guizhou, Jiangkou (Minsheng Wang); Szechwan Prov., Hsinching A F (W. L. Brown); Szechuen, near Mt. Ormel (D. C. Graham); Szechuen, Suifu (D. C. Graham); Szechuen, Jang Chen Pu near Mt. Omei (D. C. Graham); Taiwan, Suisha (R. Takahashi); Taiwan, Kosempo (H. Sauter); Taiwan, Bukai (L. Gressitt); Taiwan, Taihoku (J. Sonan, T. Shiraki); Taiwan, Hassenzan (?); Taiwan, Nantou, Lan Wa Chu (D. G. Furth); Taiwan, Nantou, Sung Kang (D. G. Furth); Taiwan, Nantou, Hueisun (D. G. Furth); Taiwan, Nantou, Wushe (D. G. Furth); Taiwan, Taipei, Aukung (D. G. Furth). Japan: Okinawa, Kunigami (Yonaha-dake), under chips (F. G. Werner); Ryukyu, Okinawa (S. M. Fullerton); Amami-Oshima, Loochoo Is. (R. Takahashi); Kagoshima (Silvestri); Kumamotu (Silvestri); Kyushu, Amakusa, Tomioka (S. Murakami); Kyushu Is., Klyamacho, Kakinohara (D. G. Furth); Kyushu Is., Mt. Hikosan, Soeda Notoge Pass (D. G. Furth); Kyushu Is., Mt. Hikosan, Biol. Sta. (D. G. Furth); Fukuoka Pref.,Izuka-machi, Jorogahara (D. G. Furth); Shikoku Is., Tokushima, Kawamata (M. Azuma); Hyogo, Mt. Rokko (M. Azuma); Hyogo, Takarazuka, Namaze (M. Tanaka); 8 mi N. of Kyoto (P. Hammond); Idzu (S. Akiyama); Kyoto (Silvestri); Mt. Maya (Silvestri); Michino-o (Silvestri); Nara (Silvestri); Kuwana (?); Honshu, Toyama Pref., Toyama city (D. G. Furth and K. Suzuki); Nagano Pref., Matsumoto, Shimauchi-Shimoda (D. G. Furth); Kamakura (H. Nagase); Kanagawa Pref., Kamakura (H. Nagase); Kanagawa Pref., Odawara (M. Kubota); Tokyo (L. Gressitt); Tokyo Pref., Hachioji, Minami-Asakawa (D. G. Furth); Yokohama (?); Chiba Pref., Ichikawa, Konodai (D. G. Furth); Bonin Is., Chichi-jima (H. Ikeda); Bonin Is., Chichi-jima, Omura, Camp beach (F. M. Snyder); Bonin Is., Chichi-jima, Yatsuse R., Gen.'s beach (F. M. Snyder); Bonin Is., Chichijima, Miyanchama,



Figures 94–97. *Pristomyrmex rigidus* **sp. n.** 94A: Worker head, full-face view; 94B: Showing two small denticles on the ventral clypeus; 95: Worker, lateral view; 96: Queen head, full-face view; 97: Queen, lateral view.

Jack Wm's beach (F. M. Snyder); Bonin Is., Chichijima, Sakai-ura, Bull beach (F. M. Snyder).

I have also examined 11 workers collected at the two entry ports of the United States (USNM): nine of them, by Harley and Albrecht, on November 20, 1928, from Philadelphia, Pennsylvania, in lily bulbs imported from Japan; the other two specimens, by J. F. Byrnes, on September 25, 1967, from Anchorage, Alaska, on *Gerberia sp.* imported from Japan. It appears, however, that *P. punctatus* has not yet become established in the United States (Cover, personal communication).

In addition, this species has also been reported from North Korea and South Korea (Collingwood, 1976, 1981; Kim and Kim, 1982; Kim and Kim, 1983).

Pristomyrmex rigidus sp. n.
Figures 94–97

Diagnosis (Worker). Antennal fossae reaching the anterior clypeal margin; eyes with six to eight ommatidia in the longest row; pronotum unarmed; dorsal surfaces of head and alitrunk covered fully with well-developed coarse rugoreticulum; dorsum of petiole node with a pair of hairs.

Holotype Worker (BMNH). TL 3.40, HL 0.98, HW 0.94, CI 96, SL 0.91, SI 97, EL 0.17, PW 0.64, AL 0.86. Paratypes: 11 workers (MHNG, BMNH, MCZC).

Worker. TL 2.73–3.44, HL 0.75–0.98, HW 0.74–0.94, CI 93–102, SL 0.70–0.94, SI 91–103, EL 0.14–0.17, PW 0.50–0.64, AL 0.70–0.86, PPW 0.24–0.30, PPL 0.16–0.20, PPI 144–167 (n = 32).

Mandibles with a few coarse longitudinal rugae that usually do not reach to the vicinity of the masticatory margin. Dentition of the masticatory margin of mandible: the strongest apical tooth + the second strongest preapical + a long diastema + a truncated basal tooth (or two small denticles). A strongly developed tooth or a broad, subtriangular short prominence present about midway on the basal margin of mandible. Clypeus shield shaped, more or less depressed, with a median longitudinal carina that usually does not reach to the anterior clypeal margin; sometimes a few additional weak rugae are present on the clypeus. Anterior clypeal margin usually with a median denticle and three others on each side, but sometimes with a lateral denticle indistinct or two lateral small denticles fused into a larger one. Lateral portions of clypeus reduced to margins, and antennal fossae reaching the anterior clypeal margin. Ventral surface of clypeus usually with two minute toothlike prominences (Fig. 94B), but sometimes the prominences are very weak. Palp formula 5,3. Frontal carinae extending to the level of the posterior margins of eyes. Antennal scrobes indistinct. Frontal lobes absent, so that the antennal articulations are entirely exposed. Antennal scapes, when lying on the dorsal head, surpassing the occipital margin of head by one-sixth to one-fifth of their length. Eyes containing six to eight ommatidia in the longest row. Occipital margin rather straight or slightly concave. Dorsal surface of alitrunk somewhat convex. Pronotum unarmed. Propodeal spines robust, acute, and long, much longer than the distance between their bases. Metapleural lobes triangular and acute. Pedicel segments in profile as in Figure 95. In profile, anterior face of the petiole node, together with the dorsal surface of petiole peduncle, forming a long declivity that reaches the top of the node. Petiole node in profile with an approximately right-angled apex. Dorsum of postpetiole in profile sometimes angulate but sometimes rounded. In dorsal view, postpetiole transverse-rectangular, much broader than long and also broader than the petiole node. Dorsal surfaces of head and alitrunk as well as the sides of pronotum fully covered with coarse rugoreticulum. Sides of the rest of alitrunk with numerous irregular coarse rugae. Sides of petiole node and postpetiole usually with a few rims as illustrated in Figure 95, but sometimes some of the rims rather weak. Petiole and postpetiole in dorsal view, except for rims, very smooth and polished. Gaster unsculptured. Dorsal surfaces of head and alitrunk with numerous erect or suberect long hairs. A pair of similar hairs present on the dorsal petiole, and usually two pairs on the postpetiole as shown in Figure 95. Two or three pairs of long, forward-projecting hairs present near the anterior clypeal margin. Scapes and tibiae with numerous erect or suberect hairs. First gastral tergite lacking erect or suberect hairs. Color uniformly reddish-brown.

Queen. TL 3.30–4.02, HL 0.85–1.10, HW 0.86–1.10, CI 100–102, SL 0.76–0.88, SI 80–91, EL 0.18–0.24, PW 0.66–0.86, AL 0.84–1.08, PPW 0.28–0.36, PPL 0.20–0.22, PPI 140–164 (n = 6).

Generally similar to worker, except for caste differences; in addition, the sculpture of mesoscutum is weaker and sparse.

Male. Unknown.

Comments. Pristomyrmex rigidus occurs in the Oriental region. It is closely related to *P. punctatus.* These two species constitute a clade. The separation of the two species is summarized under *P. punctatus.* Characters separating *P. rigidus* from the

P. divisus-P. pulcher clade are given under *P. divisus*.

Discussion. The material that I have examined may contain two species. Specimens from Thailand possess an anterodorsally angulate postpetiole in profile, a strongly prominent tooth on the basal margin of the mandible, and a truncated basal tooth on the masticatory margin of the mandible. Specimens from Indonesia, Malaysia, and Brunei have a rounded dorsal surface of the postpetiole, a weak tooth on the basal margin of the mandible, and two small basal denticles on the masticatory margin. But a single, variable species is maintained for the present because available material is still limited. Further collecting and studying are needed.

Holotype Worker. Thailand: 26. Kaeng Krachan NP., 19.xi.1985 (Löbl and Burckhardt).

Paratypes. 11 workers with same data as holotype.

Additional Material Examined (ANIC, BMNH, MCZC, MHNG, NHMV). Thailand: Khao Sabap NP. (Löbl and Burckhardt). Brunei: Ulu Belalong, W. ridge, 500 ft (R. Levy). Malaysia: Sabah, Tawan Quoin Hill, 750 ft, rainforest, leaf mold, berlesate (R. W. Taylor); Sabah, Poring Hot Springs, 500 to 900 m (Burckhardt and Löbl); Sabah, Poring Hot Springs, Langanan Falls, 950 m (Löbl and Burckhardt); Sabah, Batu Punggul Resort, primary forest, sifting (?); Sarawak, 4th Division, Gn. Mulu NP., limestone forest, 200 m, pitfall trap (H. Vallack); Sarawak, Gn Matang, 20 km W Kuching, 800 m, submontane forest (Löbl and Burckhardt); Negri Sembilan, Pasoh For. Res., litter, primary forest (L. Ficken; M. Brendell, K. Jackson, and L. Ficken); Kuala, Lumpur (B. Bolton); Upper Gombak Val., near K. Lumpur, rainforest, berlesate, ca. 1,500 ft (R. W. Taylor); Kedah State, Gunong Jeral, 5.48N, 100.62E, 550 m, rainforest, berlesate (R. W. Taylor and R. A. Barrett); Pahang, Batu Caves N Kuala, Lumpur (Löbl and Calame); Pahang Gombak, forest litter (Löbl and Calame). Indonesia: Sumatra, Liwa, 5.04S, 104.03E, rainforest, litter (M. S. Harvey).

Ecological Information. This species occurs in rainforest and has been taken in litter berlesates and pitfall traps.

THE ***CRIBRARIUS*** GROUP

Worker. Medium sized, with the following combination of characters.

(1) Masticatory margin of mandibles with a long diastema between the preapical and the basal tooth.

(2) Palp formula 4,3 (Bolton, 1981).

(3) Frontal carinae present.

(4) Lateral portions of clypeus reduced to a margin, and the antennal fossae reaching the anterior clypeal margin.

(5) Frontal lobes absent.

(6) Lamella that encircles the base of antennal scape, entire.

(7) Dorsum of alitrunk convex, not depressed; pro-mesonotal suture absent.

(8) Pronotum armed with a pair of strong, acute, short spines.

(9) Propodeal spines well developed and long; in dorsal view not forming a "fork".

(10) Petiole node thick in profile; its anterodorsal, posterodorsal, and posteroventral corners showing right angles approximately.

This group contains one species, *P. cribrarius*, from South Africa and Mozambique.

Pristomyrmex cribrarius probably evolved from an Oriental ancestor of the *punctatus* group because *P. cribrarius* is similar, in the workers, to some Oriental species of the *punctatus* group in the following characters: (1) a high palp formula; (2) well-developed, long propodeal spines; and (3) a few coarse longitudinal rugae present on the petiole and on the postpetiole, respectively. However, I erect the *cribrarius* group to accommodate this species instead of placing it in the *punctatus* group because it possesses a distinct petiole node in the workers and queens (i.e., in profile, the anterodorsal, posterodorsal, and posteroventral corners of the node right-angled), which is not seen in the other species groups. In addition, the workers of *P. cribrarius* possess a pair of robust pronotal spines that are absent in the *punctatus* group.

Without a higher palp formula (4,3), *P. cribrarius* would fall into the *quadridens* group. The *quadridens* group now contains 25 species, but the palp formulae of 18 species examined are 2,3, 2,2, and 1,3. If *P. cribrarius* were placed in the *quadridens* group, the *punctatus* group (differing from the *quadridens* group primarily by its high palp formula) would have no grounds to exist, as two species of the *quadridens* group, *P. eduardi* and *P. orbiceps,* also lack pronotal armaments.

Pristomyrmex cribrarius is also somewhat similar to the three members of the *trispinosus* group, from Mauritius. They all possess robust, acute, but short pronotal spines; long, well-developed propodeal spines; and a very convex dorsum of the alitrunk in the workers. The similarity, however, is superficial. *Pristomyrmex cribrarius* differs from the *trispinosus* group in the workers in several important characters: The frontal carinae are absent in the *trispinosus* group but extend to the level of the posterior margins of eyes in *P. cribrarius*; the promesonotal suture is present in the *trispinosus* group but absent in *P. cribrarius*; the propodeal spines in dorsal view are fused together at the base in the *trispinosus* group, as opposed to be separated at the base in *P. cribrarius*; palp formula is lower (1,2) in the *trispinosus* group but higher (4,3) in *P. cribrarius*; foveolate punctures on the dorsal surfaces of the head and the alitrunk are absent in the *trispinosus* group but dense in *P. cribrarius*; and numerous hairs are present on the first gastral tergite in the *trispinosus* group but not seen in *P. cribrarius*.

Finally, *P. cribrarius* possesses (1) a long diastema on the masticatory margin of mandible separating the preapical tooth from the basal tooth, (2) a higher palp formula (4,3), and (3) a pair of robust spines on the pronotum in the workers, showing it is not closely related to the *levigatus*, *profundus*, and *umbripennis* groups.

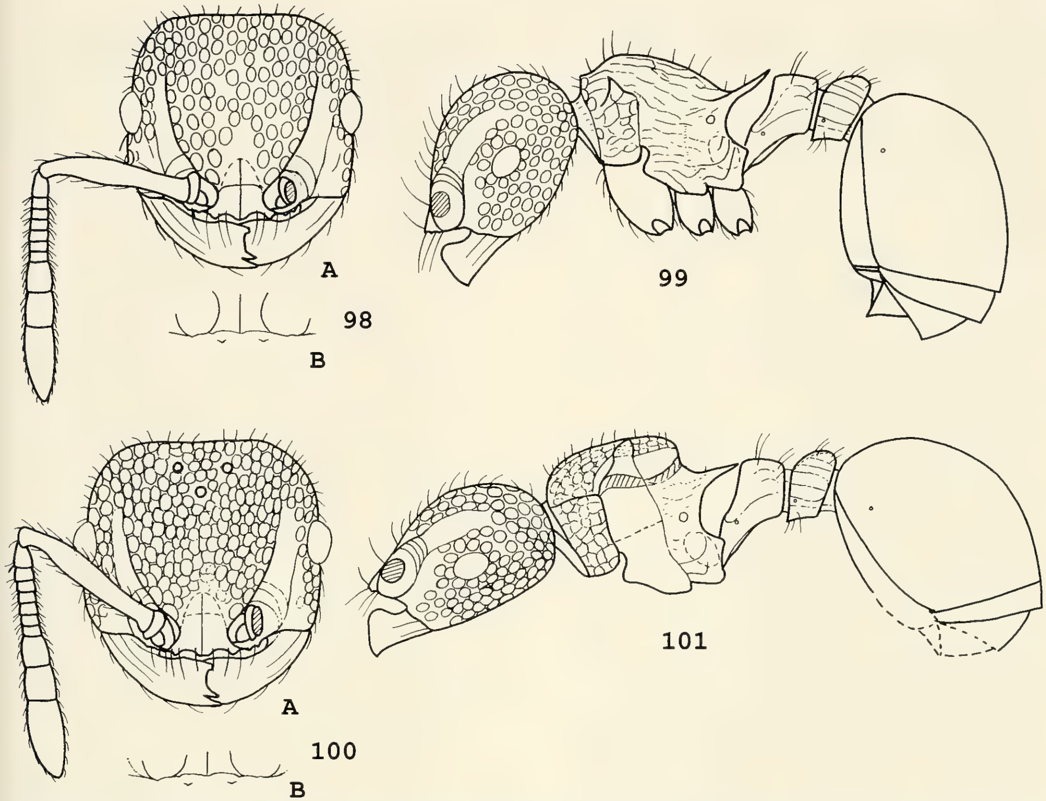
Pristomyrmex cribrarius Arnold
Figures 98–101

Pristomyrmex cribrarius Arnold, 1926: 281. Holotype queen, Mozambique: Amatongas Forest (G. Arnold) (SAMC) [examined].

Diagnosis (Worker). See characters 8 and 10 under the group; additional characters including dorsal surfaces of head and alitrunk with foveolate-reticulate sculpture and postpetiole with a few coarse longitudinal rugae on each side.

Worker. TL 3.10–3.54, HL 0.82–0.96, HW 0.89–1.02, CI 106–110, SL 0.72–0.80, SI 78–82, EL 0.19–0.22, PW 0.55–0.64, AL 0.80–0.90, PPW 0.30–0.36, PPL 0.20–0.22, PPI 143–167 (n = 4).

Mandibles with a few longitudinal basal rugae. Masticatory margin of mandible with an apical tooth + a preapical tooth + a long diastema + a broad and truncated basal tooth. Basal margin of mandible lacking a toothlike prominence or curved lobe. Clypeus with a strong median longitudinal carina. Anterior clypeal margin with a median truncated lobe and usually three to four denticles on each side. Ventral surface of clypeus with two weak toothlike prominences, or unarmed. Palp formula 4,3 (Bolton, 1981). Frontal carinae extending to the level of the posterior margins of eyes. Antennal scrobes slightly concave. Antennal articulations entirely exposed. Antennal scapes, when lying on the dorsal head, not reaching the occipital margin of head. Eyes with 9 to 10 ommatidia in the longest row. Profile shape of alitrunk and pedicel segments as in Figure 99. Dorsum of alitrunk, in profile, strongly convex. Pronotum with a pair of robust short spines, ca. 0.06 to 0.08. Propodeal spines well developed and long, ca. 0.25 to 0.30, much longer than the distance between their bases. Metapleural lobes small and triangular. Petiole node high and thick in profile; its anterodorsal, posterodorsal, and posteroventral corners showing right angles approximately. Postpetiole high in



Figures 98–101. *Pristomyrmex cribrarius* Arnold. 98A: Worker head, full-face view; 98B: Showing two minute denticles on the ventral clypeus; 99: Worker, lateral view; 100A: Queen head, full-face view; 100B: Showing two minute denticles on the ventral clypeus; 101: Queen, lateral view.

profile, curved dorsally; in dorsal view, transverse-rectangular and much broader than long. Dorsum of head, except for the scrobal areas, with foveolate-reticulate sculpture. Dorsum of alitrunk entirely sculptured with coarse longitudinal rugae and blunt foveolate punctures between rugae. Sides of alitrunk irregularly rugulose. Each side of petiole node and postpetiole with a few coarse longitudinal rugae. Gaster unsculptured. Dorsal surfaces of head and alitrunk with numerous erect or suberect hairs. Petiole and postpetiole each with a few pairs of hairs dorsally. First gastral tergite lacking hairs. Anterior clypeal margin with a row of forward-projecting hairs. Scapes and tibiae with erect or suberect short hairs. Color reddish-brown, but gaster darker.

Queen. TL 3.84, HL 0.98, HW 1.04, CI 106, SL 0.80, SI 77, EL 0.26, PW 0.82, AL 1.05, PPW 0.36, PPL 0.23, PPI 157 (n = 1).

Generally similar to worker, except for caste differences; in addition, pronotal armaments absent, eyes larger than in conspecific worker.

Male. Unknown.

Comments and Discussion. At first sight, *P. cribrarius* somewhat resembles two Australian species of the *quadridens* group, *P. thoracicus* and *P. foveolatus*: Their workers all possess a pair of short pronotal spines, a pair of long propodeal spines, foveolate-reticulate sculpture on the dorsal head, and a transversely broad postpetiole in dorsal view. However, *P. cribrarius* is rather different from *P. thoracicus* and *P. foveolatus.* In the workers of *P. cribrarius,* palp formula is 4,3; the ventral surface of clypeus shows two minute teeth; the dorsum of alitrunk is very convex; the petiole and the postpetiole are sculptured with a few coarse longitudinal rugae; the eyes are larger, with 8 to 10 ommatidia in the longest row; and the petiole node, in profile, shows three right angles. But in the workers of *P. thoracicus* and *P. foveolatus,* palp formula is 2,3; the ventral surface of clypeus only has a single distinct tooth at the center; the dorsum of alitrunk is somewhat depressed; the petiole and the postpetiole are unsculptured; the eyes are smaller, with four to six ommatidia in the longest row; and the petiole node in profile lacks an acute posterodorsal angle.

In the African *Pristomyrmex* fauna, *P. cribrarius* is easily recognized by the coarse longitudinal rugae on the dorsal alitrunk and on the sides of the petiole and the postpetiole; its very convex dorsal alitrunk; its well-developed, long propodeal spines; its distinct petiole node; and the numerous erect hairs on the alitrunk, petiole, and postpetiole.

Distribution. South Africa, Mozambique (Bolton, 1981).

Ecological Information. Specimens have been collected by W. L. and D. E. Brown in South Africa on sand, in coast vine forest; by J. C. Faure, in South Africa (Zululand, St Lucia Lake), "by sifting the detritus and damp decaying leaves found under bushes (Arnold, 1948)"; and the holotype by G. Arnold on a tree trunk (Arnold, 1926).

THE ***QUADRIDENS*** GROUP

Worker. Usually medium- to large-sized ants (HL 0.73–1.46, HW 0.68–1.62, TL 2.90–6.48) with the following combination of characters.

(1) Masticatory margin of mandibles with three to five teeth, which have one of the following three arrangements:

a. the strongest apical + the second strongest preapical + a long diastema + two small teeth of similar size (or one basal tooth, which is sometimes formed by the fusion of the two small teeth) or
b. the strongest apical + the second strongest preapical + a diastema + three small teeth of similar size or
c. the strongest apical + the second strongest preapical + an intercalary small tooth + a very short diastema (or this diastema indistinct) + two small teeth of similar size (i.e., as shown in *P. trachylissus*).

(2) Anterior clypeal margin with five or more denticles in most species, but several species having only three teeth or prominences.

(3) Lateral portions of clypeus in front of antennal fossae reduced to a margin, and the antennal fossae reaching the anterior clypeal margin.

(4) Palp formula 1,3 (in 11 species), or 2,2 (three species), or 2,3 (four species).

(5) Frontal carinae usually extending to the level of the posterior margins of eyes, with the exception in *P. erythropygus, P. longispinus, P. trogor,* and *P. wilsoni.*

(6) Frontal lobes indistinct or very weak.

(7) Antennal scrobes shallow or absent.

(8) Lamella, encircling the base of antennal scape, entire.

(9) Dorsum of alitrunk lacking pro-mesonotal suture.

(10) Pronotum armed with small teeth to well-developed spines, except in *P. eduardi* and *P. orbiceps.*

(11) Petiole node in profile usually high, with the anterodorsal angle elevated above the posterodorsal, but sometimes showing other forms.

(12) Dorsum of head without sculpture, with scattered foveolate punctures, or with foveolate-reticulate sculpture or rugoreticulum.

This group currently contains 25 species, accounting for almost half the genus. Of them, three occur in Africa, six in Australia and 16 in the Oriental region. In fact, like many *Pristomyrmex*, many species in this group have a restricted geographic range.

The *quadridens* group species are closely related to the *cribrarius* and *punctatus* groups but differ from them, most importantly by their reduced palp formulae: 1,3, or 2,2, or 2,3 (4,3 in the *cribrarius* group and 4,3 or 5,3 in the *punctatus* group).

The *quadridens* group differs from the *trispinosus* group because in the workers of the *quadridens* group, a promesonotal suture (or impression) is absent, the dorsum of the propodeum in profile is not deeply concave, the propodeal spines in dorsal view do not form a fork, and regular striation is absent from the dorsal surfaces of the head and the alitrunk.

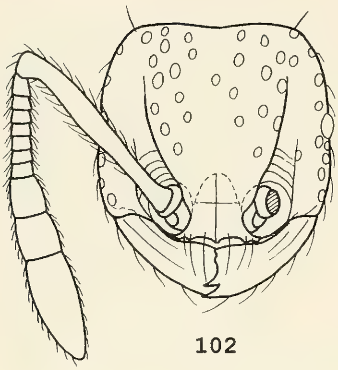
The *quadridens* group differs from the *levigatus*, *profundus*, and *umbripennis* groups by possessing a distinct diastema on the masticatory margin of mandible in the workers and queens, with the exception of *P. trachylissus*; but in the workers of *P. trachylissus*, five teeth are present on the masticatory margin, and the pronotum is armed with a pair of well-developed, long spines, which are not seen in the *levigatus*, *profundus*, and *umbripennis* groups.

The evolution of mandibular dentition in the workers and queens is one of the reasons of the diversity of the *quadridens* group. The dental formula "apical tooth + a preapical + a long diastema + two small basal teeth of similar size", possessed by many species of the group, is probably an "ancestral character". It has given rise to three apomorphic dental formulae in the group: (1) an apical + a preapical + an intercalary small tooth + two small teeth of similar size, as in *P. trachylissus*; (2) an apical + a preapical + a diastema + three small teeth of similar size, as in *P. eduardi*, *P. occultus*, and *P. quindentatus*; and (3) an apical + a preapical + a long diastema + a basal tooth (which evolved through the fusion of the two small teeth), as in *P. erythropygus*, *P. quadridentatus*, and *P. wheeleri*.

The pronotal armaments in the workers of this group seem to show an evolutionary tendency to increase in size. For example, in *P. brevispinosus*, the pronotum is armed with teeth shorter than or about as long as propodeal armaments. In *P. costatus*, the pronotum is armed with a pair of short spines longer than the propodeal armaments, but much shorter than the distance between the bases of two pronotal spines. In *P. bicolor*, the pronotal spines are very long, much longer than the propodeal armaments and usually much longer than the distance between the bases of two pronotal spines.

In the workers and queens of the *quadridens* group, foveolate punctures on the dorsal head between the frontal carinae show continuous variation, from a complete absence to several punctures present to foveolate-reticulate sculpture (or dense assemblages similar to alveolate sculpture) or rugoreticulum. For example, *P. collinus* and *P. flatus* workers almost completely lack foveolate punctures on the dorsum of head between the frontal carinae. *Pristomyrmex quadridens* workers have scattered foveolate punctures on the dorsum of head between the frontal carinae, but the spaces between foveolae are smooth. *Pristomyrmex brevispinosus* workers have rugoreticulum or foveolate-reticulate sculpture. Some populations, only with foveolate-reticulate sculpture behind the eyes, are considered intermediate forms and are grouped into *P. brevispinosus*.

The males of eight species of this group are known (Figs. 261–266, 270–276). These males are more similar to those of the both *trispinosus* and *levigatus* groups than to the male of *P. punctatus* (*punctatus* group) in palp formula, propodeal armaments, and the shape of petiole or to those of the *umbripennis* group in the size, propodeal armaments, and the shape and sculpture of petiole.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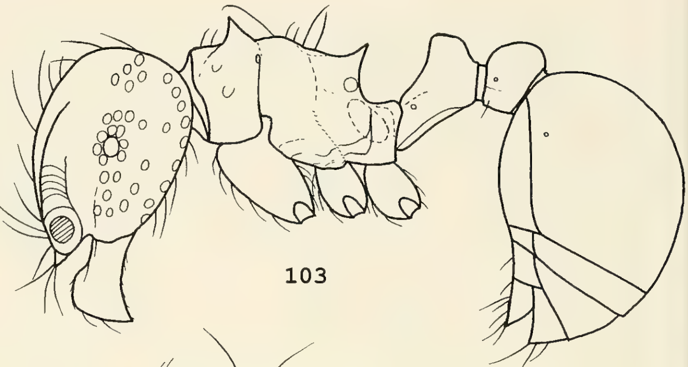
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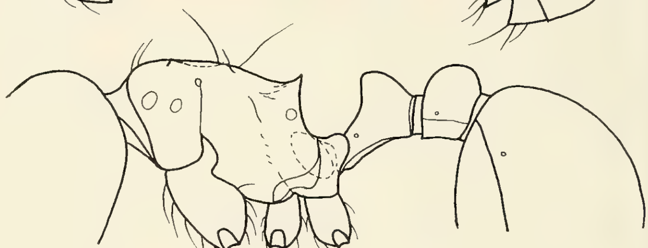
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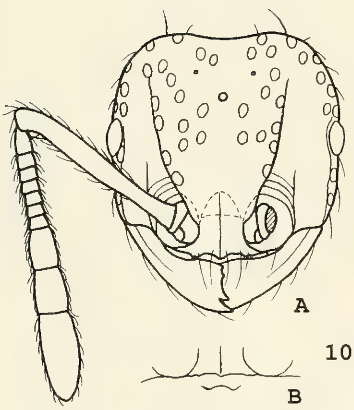

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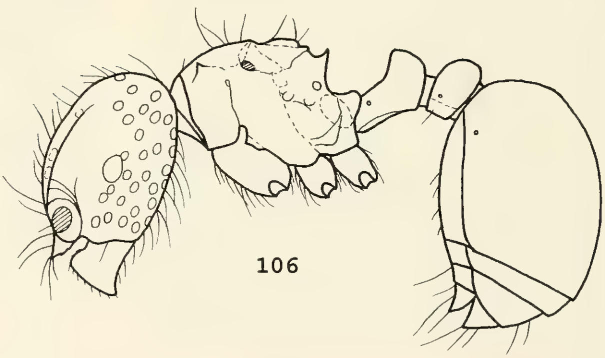
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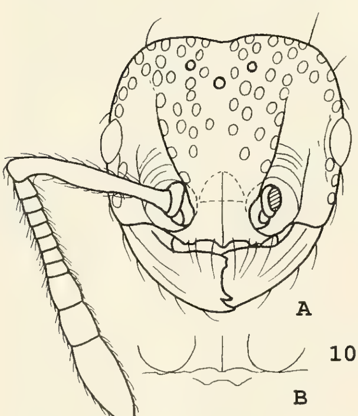

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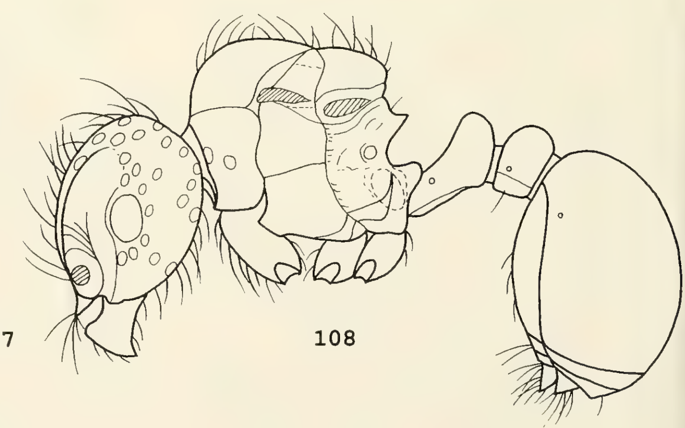
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Pristomyrmex africanus Karavaiev
Figures 102–108

Pristomyrmex africanus Karavaiev, 1931: 47. Holotype worker, Kenya: Mabira (Dogiel) (UENC) [examined].

Hylidris myersi Weber, 1941: 190. Syntype workers, Sudan: Equatoria, Aloma Plateau, Khor Aba, 3,700 ft, Lat. 3°47′N/Long. 30°37′E (N. A. Weber) [one syntype (MCZC) examined]. [Synonymy by Bolton, 1981].

Hylidris myersi subsp. *mbomu* Weber, 1952: 19. Holotype worker, Central African Republic: Ubangishari, Bas Mbomu, 5 mi W of Bangassau (N. A. Weber) (AMNH). [Synonymy by Bolton, 1981].

Hylidris myersi subsp. *primus* Weber, 1952: 19. Holotype worker, Zaire: Stanleyville (N. A. Weber) (AMNH). [Synonymy by Bolton, 1981].

Hylidris myersi subsp. *beni* Weber, 1952: 20. Syntype workers, Zaire: 15 mi N of Beni (N. A. Weber) [one syntype (MCZC) examined]. [Synonymy by Bolton, 1981].

Diagnosis (Worker). Masticatory margin of mandible with a long diastema after the preapical tooth; ventral surface of clypeus with two toothlike prominences; eyes containing four to five ommatidia in the longest row; dorsal surfaces of head between the frontal carinae and alitrunk with scattered foveolate punctures; petiole and postpetiole without hairs.

Worker. TL 2.76–3.40, HL 0.74–0.90, HW 0.74–0.93, CI 98–104, SL 0.68–0.83, SI 86–95, EL 0.08–0.12, PW 0.48–0.58, AL 0.68–0.85, PPW 0.22–0.27, PPL 0.18–0.22, PPI 110–135 (n = 27).

Mandibles with a few longitudinal basal rugae. Masticatory margin of mandible with an apical tooth + a preapical tooth + a long diastema + a broad and truncated (or somewhat midconcave) basal tooth. Basal margin of mandible almost straight, lacking a toothlike prominence or curved lobe. Clypeus possessing or lacking a median longitudinal carina. Anterior clypeal margin with a median denticle and two others on each side, but two lateral denticles are usually fused into one prominence. Ventral surface of clypeus with two toothlike prominences. Palp formula 1,3. Frontal carinae extending to the level of the posterior margins of eyes. Antennal scrobes indistinct or very weak. Frontal lobes absent; thus, the antennal articulations are entirely exposed. Antennal scapes, when lying on the dorsal head, close to, or slightly surpassing, the occipital margin of head. Eyes containing four to five ommatidia in the longest row. Promesonotum, in dorsal view, sometimes slightly concave. Profile shape of alitrunk and pedicel segments as in Figures 103–104. Pronotum usually with a pair of teeth or short spines but rarely with a pair of tubercles. Propodeum with a pair of teeth or short spines. Metapleural lobes rounded. Petiole node high in profile, higher than long, with a long anterior peduncle; its anterodorsal angle distinctly higher than the posterodorsal one that is usually rounded. Subpetiole with a narrow flange. Postpetiole in profile higher than long, rounded dorsally, in dorsal view broadening from front to back and broader than long. Dorsum of head between the frontal carinae and the sides of head, with numerous scattered foveolate punctures; sometimes the punctures are shallow and sparse. Dorsum of alitrunk smooth, except for a few foveolate punctures shallow or conspicuous, present on each side of the mesonotum. Petiole, postpetiole, and gaster smooth and shining. Dorsum of head between the frontal carinae, with some erect or suberect hairs. Promesonotum with a few pairs of hairs. Propodeum, dorsal surfaces of petiole and postpetiole, and first gaster tergite lacking erect or suberect hairs. A few pairs of forward-projecting hairs present on the anterior clypeal mar-

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Figures 102–108. *Pristomyrmex africanus* Karavaiev. 102: Worker head, full-face view; 103: Worker, lateral view; 104: Showing that pronotal prominences are very weak in some specimens; 105A: Ergatoid queen, full-face view; 105B: Showing two small denticles on the ventral clypeus; 106: Ergatoid queen, lateral view; 107A: Queen head, full-face view; 107B: Showing two small denticles on the ventral clypeus; 108: Queen, lateral view.

gin. Scapes and tibiae with decumbent hairs. Color reddish-brown, but gaster darker.

Ergatoid Queen. TL 3.70, HL 0.94, HW 1.00, CI 106, SL 0.85, SI 85, EL 0.16, PW 0.60, AL 0.92, PPW 0.30, PPL 0.20, PPI 150 (n = 1).

General shape as in Figures 105–106. Similar to worker; color and pilosity as in worker. Sculpture, except for mesonotum where a few rugae present, as in worker. The head with three ocelli; eyes larger, with six to seven ommatidia in the longest row; pronotum armed with a pair of acute minute spines; propodeum with a pair of short spines; mesonotum more convex, and metanotal groove present. Flight sclerites and wings lacking, but a black speck is present on the each lateral margin of mesonotum.

Queen. TL 3.40–3.82, HL 0.84–0.96, HW 0.86–1.02, CI 102–107, SL 0.74–0.88, SI 82–89, EL 0.20–0.21, PW 0.70–0.74, AL 0.90–1.04, PPW 0.28–0.30, PPL 0.20–0.22, PPI 132–143 (n = 5).

General shape as in Figures 107–108, with normal caste differences from the conspecific worker. Eyes larger. Pronotum lacking teeth or spines but sometimes with a pair of blunt tubercles. Mesonotum with more hairs than in worker. Other characters similar to worker.

Male. Unknown.

Comments. This African species is closely related to the Asian *P. quadridens.* Both worker and queen of *P. africanus* differ from those of *P. quadridens* in having two teeth on the ventral surface of clypeus and lacking erect or suberect hairs on both petiole and postpetiole. The separation of *P. africanus,* together with *P. trogor,* from the other two Oriental species, *P. flatus* and *P. collinus,* is provided under *P. flatus.* The workers of *P. africanus* and *P. trogor* differ from the workers of three Australian species, *P. wheeleri, P. erythropygus,* and *P. quadridentatus* as follows:

P. africanus **and** ***P. trogor***

- Dorsum and sides of both petiole and postpetiole lacking erect or suberect hairs
- Metapleural lobes rounded
- Dorsal alitrunk lacking a transverse ridge at the position of metanotal groove

P. wheeleri, P. erythropygus, and ***P. quadridentatus***

- Dorsum and sides of both petiole and postpetiole with erect or suberect hairs
- Metapleural lobes elongate-triangular, with an apex
- Dorsal alitrunk with a transverse ridge at the approximate position of matanotal groove

In addition, in *P. africanus* and *P. trogor* the denticles of the anterior clypeal margin are smaller but larger and stronger in *P. wheeleri, P. erythropygus,* and *P. quadridentatus. Pristomyrmex africanus* and *P. trogor* possess two toothlike prominences on the ventral clypeus that are not seen in *P. wheeleri* and *P. erythropygus. Pristomyrmex erythropygus* has several short rugae on the juncture between the pronotum and the mesonotum and has erect or suberect hairs on the first gastral tergite that are absent in *P. africanus* and *P. trogor. Pristomyrmex trogor* lacks a longitudinal median carina on the clypeus, possessed by *P. wheeleri, P. erythropygus,* and *P. quadridentatus.*

The workers of *P. africanus* can be separated from those of the other four African *Pristomyrmex* species as follows: (1) *P. africanus* possesses numerous foveolate punctures on the dorsal head between the frontal carinae that are not seen in *P. trogor* and *P. orbiceps*; (2) *P. africanus* has eyes containing four to five ommatidia in the longest row, as compared with eight or more usually present in *P. orbiceps, P. fossulatus,* and *P. cribrarius*; (3) *P. africanus* has two teeth on the ventral clypeus that are absent in *P. orbiceps* and *P. fossulatus*; (4) *P. africanus* lacks coarse longitudinal rugae and erect or suberect hairs on the petiole and the postpetiole that are present in *P. cribrarius.*

Distribution. Ghana, Cameroon, Gabon, Kenya, Zaire, and Angola (Bolton, 1981). Some more records, including some ecological information, added here (MCZC, ANIC): Zaire: Ituri F. Beni-Irumu (N. A. Weber). Sudan: Equatoria, Imatong Mts. (N. A. Weber). Angola: Falls R. Chicapa, Saurimo, 9.39°S, 20.24°E, gallery forest, berlesate (Luna de Carvalho); R. Kahingo, 7.39°S, 20.51°E, gallery forest, berlesate (Mwaoka); Dundo, R. Mussungue, gallery for., berlesate (Luna de Carvalho); Dundo, dry forest (Luna de Carvalho); Dundo, Carrisso Park, R. Luachimo, 7.22°S, 20.50°E, gallery forest, berlesate (Luna de Carvalho); R. Camudembele, gallery forest, berlesate (Luna de Carvalho); Ghana: E.R., Mt. Atewa, rainforest, Berlesate (R. W. Taylor); E.R., Nkwanda For., near Enyiresi, rainforest, Berlesate (R. W. Taylor); Tafo, Eastern Reg., rainforest, Berlesate (R. W. Taylor).

Ecological Information. Weber (1941: 192; 1952: 18–20) noted that "workers were in rainforest of a luxuriant type referred to as gallery forest"; they were among the leaf and humus cover on the forest floor and were slow moving in habit; "when disturbed they became motionless, 'feigning death' momentarily".

Pristomyrmex bicolor Emery **stat. n.**
Figures 109–112

Pristomyrmex trachylissa var. *bicolor* Emery, 1900: 678. Syntype workers, Sumatra: Si-Rambé, xii.1890–iii.1891 (E. Modigliani) (MCSN, NHMV, USNM) [examined].

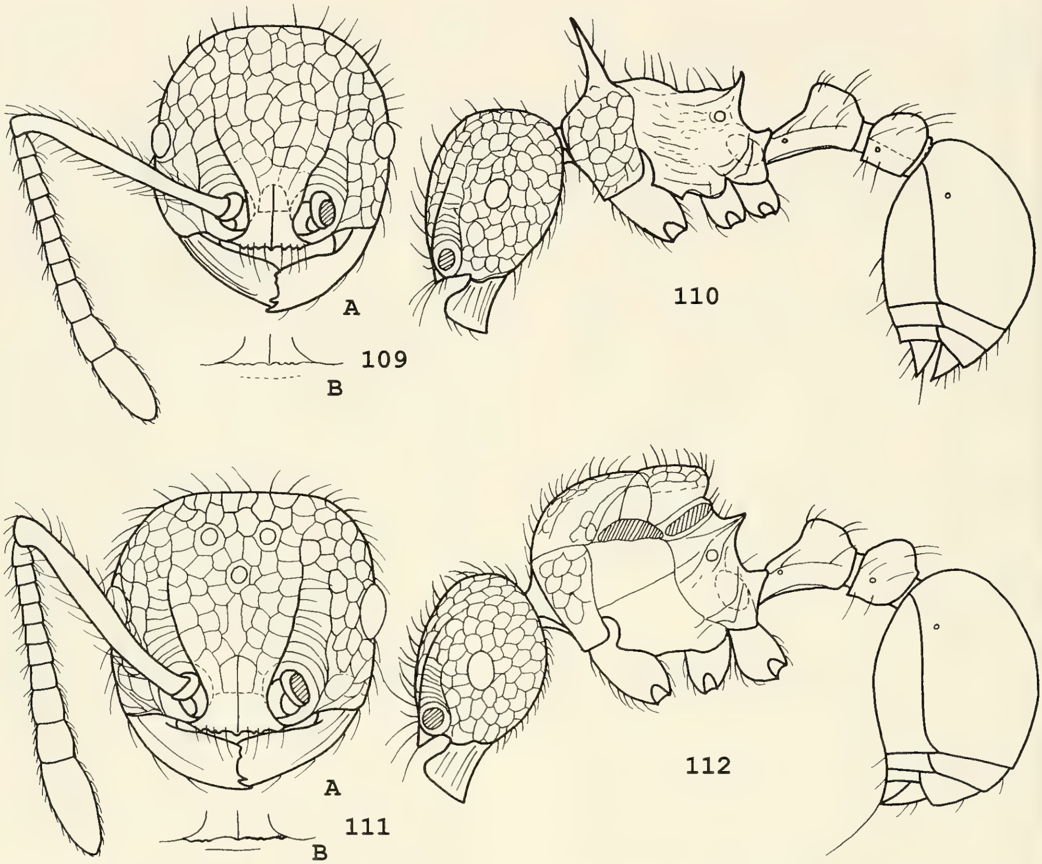
Pristomyrmex taurus Stitz, 1925: 120. Holotype worker, Philippines: N. Palawan, Binaluan, xi.–xii.1913 (G. Boettcher) (MNHU) [examined]. **Syn. n.**

Note: The unique holotype of *P. taurus* differs from the syntypes of *P. bicolor.* In the former, the pronotal spine length is 0.58, and the anterior half of the dorsum of the alitrunk is smooth and shining. In the latter, the pronotal spine length is 0.36 to 0.40, and sometimes only a rather narrow smooth area is present between the bases of two pronotal spines. *Pristomyrmex taurus,* however, is here regarded as a junior synonym of *P. bicolor* because, after examining all the specimens available, I find that the pronotal spine length is continuously variable in the range of 0.36 to 0.66, and sculpture on the anterior half of the dorsal alitrunk also shows continuous variation. I cannot use any lines to separate this composite at the present. The size of the holotype of *P. taurus* is HL 1.10, HW 1.08, CI 98, SL 1.14, SI 106, EL 0.20, PW 0.74, AL 1.18, PSL2 0.24. The sizes of three syntype workers of *P. bicolor* are HL 1.20–1.28, HW 1.24–1.32, CI 103–107, SL 1.38–1.46, SI 108–111, EL 0.24–0.26, PW 0.84–0.90, AL 1.40–1.44, PSL2 0.10–0.12.

Diagnosis (Worker). Masticatory margin of mandible with four teeth and a long diastema after the preapical tooth; pronotal spines exceptionally long (usually 0.40–0.66), much longer than propodeal armaments (teeth or short spines); dorsum of head sculptured with coarse rugoreticulum.

Worker. TL 4.58–6.14, HL 1.04–1.42, HW 1.08–1.46, CI 98–109, SL 1.14–1.58, SI 106–120, EL 0.20–0.26, PW 0.65–0.96, AL 1.18–1.64, PPW 0.33–0.40, PPL 0.38–0.48, PPI 77–93 (n = 83).

Mandibles usually with several longitudinal rugae, varying from superficial to rather coarse. Masticatory margin of mandible with four teeth arranged as: two adjacent strong apical teeth + a long diastema + two small basal teeth that are roughly the same size. Basal margin of mandible lacking a distinctly curved lobe or tooth. Clypeus with a strong median longitudinal carina. Anterior clypeal margin sometimes with seven denticles: a median denticle and three others on each side, but sometimes one or a few are weak or indistinct, or two to three of the lateral denticles are fused into a larger one. Ventral center of clypeus usually with a transverse ruga of varying length, sometimes with a very weak prominence at middle and sometimes without either of these characters. Palp formula 1,3. Frontal carinae strong,



Figures 109–112. *Pristomyrmex bicolor* Emery. 109A: Worker head, full-face view; 109B: Showing a weak transverse ruga on the ventral clypeus; 110: Worker, lateral view; 111A: Queen head, full-face view; 111B: Showing a transverse ruga on the ventral clypeus; 112: Queen, lateral view.

extending to the level of the posterior margins of eyes. Slightly concave scrobal areas present. Frontal lobes absent; thus, the antennal articulations are entirely exposed. Antennal scapes, when lying on the dorsal head, usually surpassing the occipital margin by one-third to one-fourth of their length. Eyes usually containing 10 to 12 ommatidia in the longest row. Profile shape of alitrunk and pedicel segments as in Figure 110. Pronotal spines well developed and exceptionally long, varying in length, usually 0.40 to 0.66, but in a few specimens they are 0.37 to 0.39. Propodeum usually with a pair of acute short spines, which are 0.12 to 0.20, much more slender and much shorter than the pronotal ones. Propodeal armaments occasionally reduced to a pair of teeth. Both pronotal and propodeal spines upward pointed. Metapleural lobes subtriangular. In profile, petiole node high, with a long anterior peduncle; its anterodorsal angle elevated above the posterodorsal. In dorsal view, crest of petiole node rounded. Postpetiole in profile convex dorsally, in dorsal view longer than broad and broadening from front to back. Dorsum of head with well-developed coarse rugoreticulum. Dorsal surface of alitrunk variably sculptured: At one extreme, in a series from North Borneo (SE, Forest Camp, 9.8 km

SW of Tenom), the dorsum of alitrunk is entirely rugoreticulate. In a few other series, the rugoreticulum is absent between the bases of two pronotal spines, and some weak rugae or a smooth (broad or narrow) area are present there. At the other extreme, the sculpture is completely absent, and the area is smooth and shining on the anterior half of the dorsum, but the rest of the dorsal alitrunk is coarsely rugulose. Sides of pronotum with a rugoreticulum or many large coarse foveolate punctures. Sides of the rest of alitrunk irregularly coarsely rugulose. Dorsal surfaces of petiole node and postpetiole smooth and shining, but a longitudinal ruga present on each side of petiole. Gaster unsculptured, smooth, and shining. Dorsal surfaces of head and alitrunk with numerous erect or suberect hairs. Petiole node with a few (usually two to three) pairs of hairs dorsally. Dorsum of postpetiole with at least a pair of hairs. First gastral tergite lacking erect or suberect hairs. A row of forward-projecting hairs present near the anterior clypeal margin. Scapes and tibiae with some erect or suberect hairs. Color usually reddish-brown but sometimes black-brown.

Queen. TL 6.54, 6.56; HL 1.34, 1.44; HW 1.38, 1.50; CI 103, 104; SL 1.48, 1.51; SI 99, 109; EL 0.32, 0.34; PW 1.20, 1.24; AL 1.72, 1.82; PPW 0.41, 0.43; PPL 0.48, 0.48; PPI 85, 90 (n = 2).

General shape as in Figures 111–112, with normal caste differences from the conspecific worker; pronotum unarmed. Other characters similar to worker.

Male. Unknown.

Comments and Discussion. Pristomyrmex bicolor occurs in the Oriental region. It possesses a pair of exceptionally long pronotal spines, which implies that this species may have evolved from the ancestor of *P. costatus.* Only slight differences separate the workers of *P. bicolor* and of *P. costatus,* as follows:

P. bicolor

Pronotal spines well developed and exceptionally long, usually 0.40 to 0.66 (rarely 0.37–0.39), and usually longer than the distance between their bases

Dorsal surfaces of petiole node and postpetiole usually with one to three pairs of hairs

Area between the bases of the pronotal spines smooth or sculptured; if sculptured, pronotal spine length is over 0.40

Larger species (HW usually 1.20–1.46, rarely 1.04–1.19; HL usually 1.20–1.42, rarely 1.08–1.19)

P. costatus

Pronotal spines moderately long, usually 0.18 to 0.27 (rarely 0.32), and shorter than the distance between their bases

Dorsal surfaces of petiole node and postpetiole with five or more pairs of hairs

Entire dorsum of alitrunk with developed rugoreticulum

Smaller species (HW 0.90–1.16, HL 0.91–1.16)

Another alternative is that *P. bicolor* may be derived from a *P. curvulus*–like ancestor. Characters separating *P. bicolor* from *P. curvulus* are provided under *P. curvulus.*

Pristomyrmex bicolor is also very similar in appearance to *P. trachylissus.* The two species are all from the Oriental region. The separation of the two species is summarized under *P. trachylissus.*

It must be pointed out that *P. bicolor* is a highly variable species. I cannot separate any more sibling species from this mass at the present time. Further collecting and study will help clarify the situation.

Material Examined (ANIC, BMHH, BMNH, LACM, MCZC, NHMV). Indonesia: W. Java, 9 km W Djasinga, Dungus Iwul, lowland rainforest (W. L. Brown); Java, Bali I., Tjanoi Kuning (J. Winkler); Borneo: Kalimantan Timur, ITCI Timber Camp, via Balikpapan, on fallen trees (N. Johnson); SE Borneo, 17 to 46 km W Batulitjin, rainforest (W. L. Brown). Malaysia: North Borneo (SE), Forest Camp, 9.8 km SW of Tenom (Y. Hirashima); Sabah, Batu

Punggul Resort, primary forest, sifting (?); Sarawak, Genting Highlands (B. Bolton); Sarawak, 4th Div., G. Mulu Nat. Pk., RGS Expd., Long pala, lowland rainforest, on fallen tree and on rotten log (B. Bolton; P. M. Hammond and J. E. Marshall); Sarawak, Mt. Penrissen, 4,500 ft (E. Mjöberg); Sarawak, Mt. Poi (E. Mjöberg); Malaya, Sq. Patani (G. H. Lowe); Selangor, Ulu Gombak For. Reserve, hill forest, Tree lookout area, ca. 450 m (R. Crozier); Selangor, Genting Highlands, below Sri Layan, 900 m, hill forest (W. L. Brown); Neg. Sembilan, Pasoh For. Res. (M. Brendell, K. Jackson, and S. Lewis). Philippines: Luzon, Lagunas, Mt. Banahaw above Kinabuhayan, 600 to 700 m (J. Kodada and B. Rigova).? : Tjibodas, 1,500 m (?).

Ecological Information. This species occurs in rainforest and has been collected on fallen trees and rotten logs.

Pristomyrmex brevispinosus Emery
Figures 113–118, 261, 270

Pristomyrmex brevispinosus Emery, 1887: 451. Syntype workers and male, Sumatra: Mt. Singalang, Luglio, 1878 (O. Beccari) [syntype workers (MCSN, NMMV, USNM) examined].

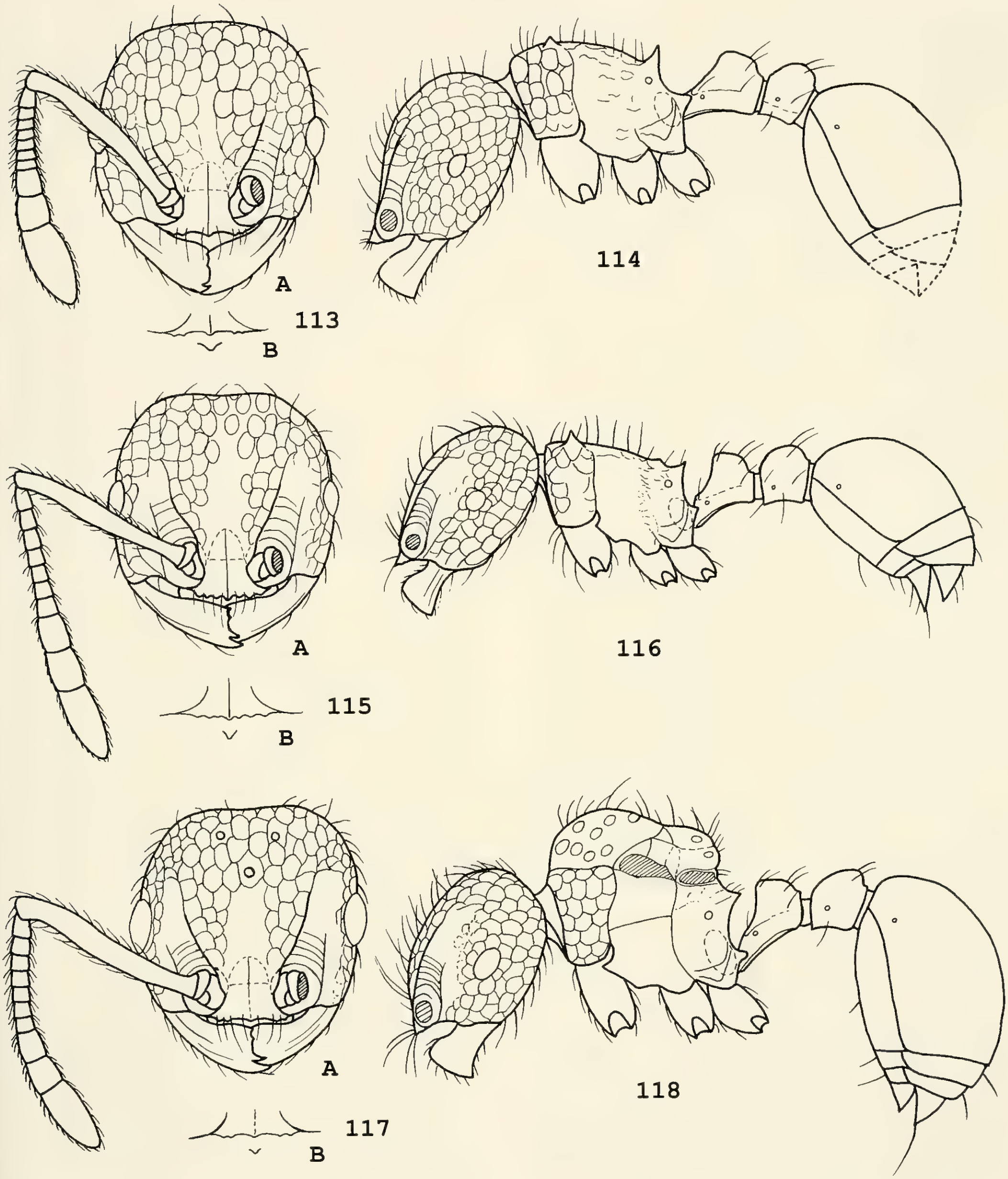
Pristomyrmex yaeyamensis* Yamane and Terayama, 1999: 17. Holotype worker, Japan: Okinawa Pref., Yaeyama Is., Iriomote-jima, 7.viii.1985 (K. Kinomura) (MNHA). **Syn. n.

Diagnosis (Worker). Masticatory margin of mandible with at most four teeth; pronotal armaments toothlike, about long as propodeal armaments that are a pair of triangular teeth or short spines; dorsum of head, at least behind the level of eyes, with foveolate-reticulate sculpture or rugoreticulum.

Worker. TL 3.00–4.26, HL 0.73–1.04, HW 0.68–1.04, CI 93–102, SL 0.64–1.06, SI 94–108, EL 0.14–0.19, PW 0.48–0.68, AL 0.76–1.10, PPW 0.21–0.27, PPL 0.18–0.30, PPI 86–113 (n = 100).

Mandibles generally rather smooth but sometimes with a few longitudinal rugae. Dentition of the masticatory margin of mandible arranged as: the strongest apical + the second strongest preapical + a long diastema + two small teeth of similar size (or a broad tooth with two points). Basal margin of mandible almost straight, lacking a distinctly curved lobe or tooth. Clypeus with a median longitudinal carina that is sometimes interrupted. Anterior clypeal margin with a median denticle and two to three others on each side. Ventral center of clypeus usually with an acute tooth, but sometimes this tooth somewhat low and broad. Palp formula 1,3. Frontal carinae strong, extending to the level of the posterior margins of eyes. Antennal scrobes indistinct, but in some specimens shallow scrobal areas present lateral to the frontal carinae. Frontal lobes very weak; thus, the antennal articulations are almost entirely exposed. Antennal scapes, when lying on the dorsal head, slightly surpassing the occipital margin of head. Eye usually containing seven to eight ommatidia in the longest row. Profile of alitrunk and pedicel segments as in Figures 114 and 116. Pronotum armed with a pair of toothlike armaments that vary in length, approximately from 0.06 to 0.10. Propodeum with a pair of triangular teeth or short spines varying from 0.04 to 0.12. Metapleural lobe subtriangular or with a somewhat rounded apex. Shape of petiole varying: In some populations, the anterior face of the petiole node in profile is almost inseparable from the upper surface of the peduncle (Fig. 114), but in other populations, the anterior face of the petiole node is distinct from the upper surface of the pedun-

* Note: I have seen photographs of *Pristomyrmex yaeyamensis* from Japanese Ants Image Database (which were placed under the name *Pristomyrmex brevispinosus sulcatus*). I propose *Prystomyrmex yaeyamensis* as a junior synonym of *P. brevispinosus* for the following reason: Although *P. yaeyamensis* possesses an ergatoid queen caste (Yamane and Terayama, 1999), this condition, at this moment, is not enough to separate *P. yaeyamensis* from *P. brevispinosus* because the type specimens of *P. brevispinosus* contain only workers and male. In other words, it is not known, at the present, whether *P. brevispinosus* possesses a normal queen caste, an ergatoid queen caste, or both. (In *Pristomyrmex*, some species, e.g., *P. wheeleri* and *P. africanus*, contain both castes.) Thus, further ecological investigation is needed.



Figures 113–118. *Pristomyrmex brevispinosus* Emery. 113A: Syntype worker head, full-face view; 114: Syntype worker, lateral view; 115A: Non-type worker head, full-face view; 116: Non-type worker, lateral view, showing some variation in the shape of petiole node and in the length of pronotal armaments; 117A: Queen head, full-face view; 118: Queen, lateral view; 113B, 115B and 117B: A tooth present on the ventral center of clypeus of syntype worker, non-type worker, and queen, respectively.

cle, as shown in Figure 116. Anterodorsal angle of petiole node higher than the posterodorsal. Postpetiole in profile convex dorsally, in dorsal view broadening from front to back. Density and intensity of cephalic sculpture variable: The dorsum of head is covered fully with coarse forveolate-reticulate sculpture in type series, but with rugoreticulum in the some other series and sometimes with foveolate-reticulate sculpture only behind the eyes. Dorsum of the alitrunk showing similar sculptural variation but usually possessing a few longitudinal coarse carinae. Petiole, postpetiole, and gaster smooth and shining. Dorsal surfaces of head and alitrunk with numerous erect or suberect hairs. Two pairs of hairs usually present bilaterally on the dorsum of petiole node. Usually, a pair, but sometimes two to three pairs, of hairs on the dorsum of postpetiole. First gastral tergite lacking erect or suberect hairs. A few pairs of forward-projecting hairs present near the anterior clypeal margin. Scapes and tibiae with some erect to suberect short hairs. Color reddish-brown to blackish-brown.

Queen. TL 3.42–4.81, HL 0.82–1.09, HW 0.79–1.10, CI 93–106, SL 0.76–1.06, SI 93–101, EL 0.20–0.27, PW 0.66–0.89, AL 0.94–1.30, PPW 0.24–0.32, PPL 0.24–0.33, PPI 90–111 (n = 16).

General shape as in Figures 117–118, with normal caste differences from the conspecific worker, pronotum unarmed; other characters similar to worker.

Ergatoid queen. This caste was reported (Onoyama, 1976; see also Yamane and Terayama, 1999).

Male (Figs. 261, 270). Two male specimens, together with 31 workers and six queens, constitute a series, collected in Indonesia (SE Celebes, 1–2 km E of Wolasi, 42 km S. Kendari, ca. 350 m), by W. L. Brown, and each of the two males was originally mounted, respectively, with a worker on the same pin: TL 3.10, 3.36; HL 0.60, 0.62; HW 0.61, 0.62; CI 102, 105; SL 0.21, 0.22; SI 35, 39; HWE 0.77, 0.80; EL 0.31, 0.32; PW 0.78, 0.84; AL 1.06, 1.16; PPW 0.21, 0.21; PPL 0.22, 0.22; PPI 95, 95 (n = 2).

Head, including the eyes, distinctly broader than long. Clypeus convex, without a median longitudinal carina. Palp formula 1,3. Frontal carinae weak and short, just reaching the level of the posterior margins of antennal insertions. Maximum diameter of the median ocellus 0.10 to 0.11. On the mesonotum, notauli pronounced, forming a Y shape; parapsidal furrows indistinct. Scuto-scutellar sulcus with 12 to 13 narrow longitudinal ridges. Middle and hind tibiae without any spurs. Propodeum slightly tuberculate, lacking teeth or spines. Metapleural lobe with a somewhat rounded apex. Petiole node in profile low and rounded dorsally, with a fairly long anterior peduncle. Postpetiole in profile low and rounded dorsally and in dorsal view slightly longer than broad. Dorsum of head smooth and shining. Alitrunk smooth and shining, except for those marked sutures. Petiole, postpetiole, and gaster smooth and shining. All dorsal surfaces with abundant erect or suberect hairs. Scapes and tibiae with numerous erect or suberect hairs. Body reddish-brown; funicular segments of antennae light-yellow and wings slightly infuscated. In general, the male of *P. brevispinosus* is extremely similar to the males of both *P. quadridens* and *P. sulcatus.*

Comments and Discussion. Pristomyrmex brevispinosus is the most widely distributed species in the *quadridens* group. So far, it has been found in Sumatra, Celebes, Malaya, Sarawak, Sabah, Thailand, the Philippines, Taiwan, and Japan.

It is obvious that *P. brevispinosus* has evolved from a *P. quadridens*–like ancestor. *Pristomyrmex brevispinosus* possesses densely assembled forveolate punctures (i.e., foveolate-reticulate sculpture) or rugoreticulum on the cephalic dorsum in the workers and queens, on the dorsal alitrunk in the workers, and on the sides of the pronotum in the workers and queens. But *P. quadridens* has only scattered foveolate punctures in these areas.

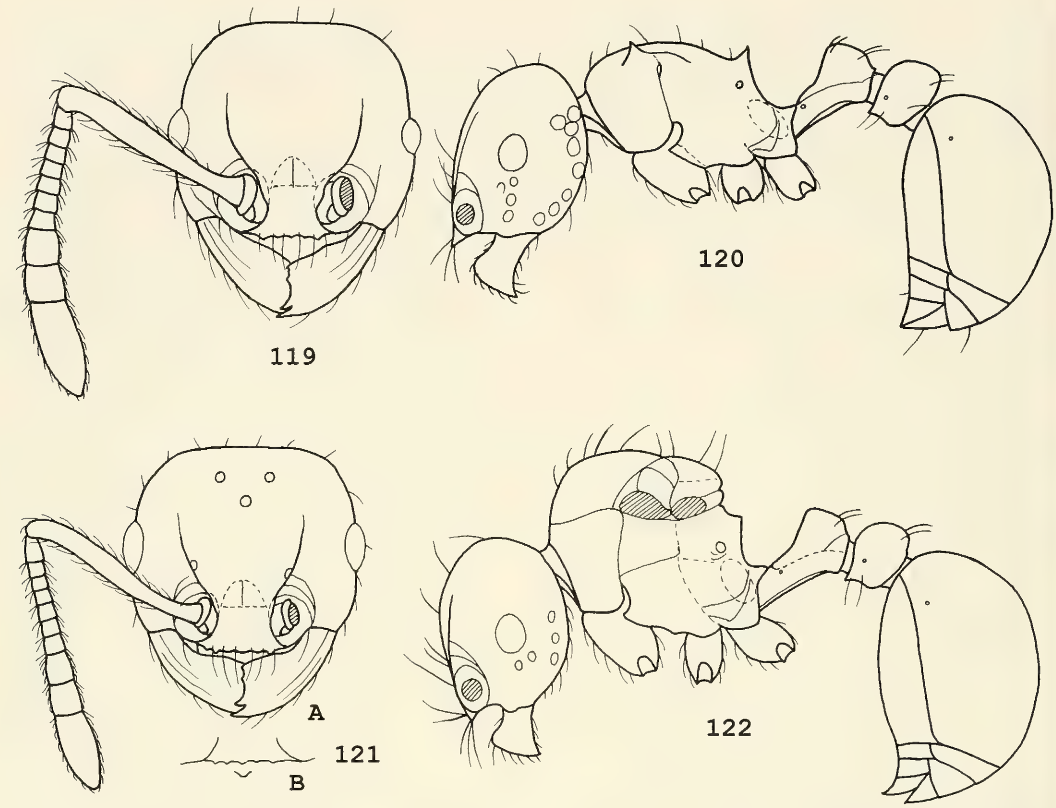
Some intermediate forms are present between *P. brevispinosus* and *P. quadridens,* but they may be easily assigned to either of the two species as follows: Those populations possessing a few coarse longitudinal carinae or some coarse rugae on the dorsum of the alitrunk or possessing foveolate-reticulate sculpture only behind the eyes should be assigned to *P. brevispinosus,* but those possessing only foveolate punctures and lacking coarse longitudinal carinae or rugae on the dorsal alitrunk should be assigned to *P. quadridens.*

The male of *P. brevispinosus* is indistinguishable at present from that of *P. quadridens*; this strengthens the conclusion that these two species are closely related. Another close relative of *P. brevispinosus* is *P. sulcatus*; their differentiation is discussed under *P. sulcatus.* Characters separating *P. brevispinosus* from the two Australian species, *P. foveolatus* and *P. thoracicus,* are provided under *P. foveolatus.*

Pristomyrmex brevispinosus may be split into two species in the future. One species would show that the anterior face of the petiole node, in profile, is inseparable from the upper surface of its anterior peduncle, and the other species would show that the anterior face of the petiole node, in profile, is distinct from the upper surface of the peduncle and that a concave shape is present between the two faces. However, at this moment, I cannot use this single line to separate the composite.

Note: Lin and Wu (1998) elevated *P. brevispinosus sulcatus* var. *formosae* Forel to species rank. As an infrasubspecific taxon, "*formosae*" is not an available name in the genus, according to the International Code of Zoological Nomenclature (also see Bolton, 1995: 365). If the specimens assigned to "*formosae*" represent a good species differing from *P. brevispinosus,* the correct procedure would be to describe it as new to science. I have, however, examined three syntypes of "*formosae*", and they fit comfortably with *P. brevispinosus* as defined in this revision.

Material Examined (ANIC, BMHH, BMNH, LACM, MCZC, MHNG, NHMV, USNM). Indonesia: Sumatra, Pematang, Siantar (Mann); Si-Rambé (E. Modigliani); Sulawesi Tengah, near Morowali, Ranu River Area (M. J. D. Brendell); Sulawesi Utara, Dumoga-Bone N.P., lowland forest, 200 to 400 m, litter (?); Sulawesi, Dumoga-Bone N.P. (D. F. and A. K. Roche); S. Celebes, Balampesoang Forest, 5 to 8 km NE Tanete, 400 m, degraded rainforest (W. L. Brown); SE Celebes, 1 to 2 km E of Wolasi, 42 km S Kendari, ca. 350 m, rainforest, rotten wood (W. L. Brown); N. Celebes, Mt. Tangkoko-Batuangus Res. 10 to 200 m, tropical evergreen forest, under bark log (W. L. Brown); N. Celebes, SW slope Mt. Klabat, 400 to 600 m, rainforest, rotten wood (W. L. Brown). Malaysia: Malaya, Genting, Highlands (B. Bolton); Selangor, Ulu Gombak For. Reserve, Univ. Malaya Field Studies Center, ca. 260 m, rainforest (R. Crozier); Negri Sembilan, Sungei Menyala For. Res., near Port Dickson, lowland rainforest (W. L. Brown and Tho Yow Pong); Perak, Sungei, Simei Falls, Cameron Hlds (T. Jaccoud and P. Marcuard); Trengganu, Kuala Buka near Trengganu, berlesate (T. Jaccoud and P. Marcuard); Sarawak, Semengoh For. Reserve, 11 mi SW Kuching, rainforest, nest ex rotten log (R. W. Taylor); Sarawak, Gn Matang, 20 km E Kuching, 850 m, submontane forest (Löbl and Burckhardt); N. Borneo (E. Mjoberg); N. Borneo, W. coast Residency, Ranau, 500 m (T. C. Maa); Sabah, Poring Hot Springs, 500 m (Burckhardt and Löbl); Sabah, 7 km N Tambunan, 700 m (Löbl and Burckhardt); Sabah, Batu Punggul Resort, primary forest, sifting (?); Sabah, Crocker Range NP., Gg. Emas Highland Res., 1,500 to 1,700 m (?); Neg. Sembilan Pasoh For. Res. (M. Brendell, K. Jackson, and S. Lewis); Pahang, Genting, Highlands Awana, 1,150 m (Löbl and Calame); Pahang, Ringlet, ravine, 1,250 m (Löbl and Calame); Pahang, Batu Caves N Kuala, Lumpur (Löbl and Calame). Philippines: P.R. Mindanao, 2 km N Malaybalay, 670 m, 8.09°N/125.05°E, reforestation area (B. B. Lowery). Thailand:



Figures 119–122. *Pristomyrmex collinus* **sp. n.** 119: Worker head, full-face view; 120: Worker, lateral view; 121A: Queen head, full-face view; 121B: Showing a tooth on the ventral clypeus; 122: Queen, lateral view.

Trang Prov.: Khao Chong Nature Education Center, lowland tropical rainforest, (07.35°N/99.46°E, misc stray foragers, sifted leaf in mixed forest; 07.55°N/99.58°E, misc stray foragers) (R. R. Snelling and Saowapa Sonthichari). Taiwan: Pilam (H. Sauter).

Ecological Information. This species occurs in rainforest and has been collected on rotten logs.

Pristomyrmex collinus sp. n.

Figures 119–122

Diagnosis (Worker). Pronotum and propodeum each with a pair of short spines; dorsal surfaces of head and alitrunk unsculptured, smooth, and highly polished; petiole node with one to two pairs of hairs, and with the anterior face of the node distinct from the upper surface of peduncle; HW 0.77–0.94 and HL 0.82–0.94.

Holotype Worker (MCZC). TL 3.51, HL 0.88, HW 0.84, CI 95, SL 0.86, SI 102, PW 0.59, AL 0.91. Paratypes, 40 workers and nine queens (MCZC, BMNH, MHNG).

Worker. TL 3.36–3.84, HL 0.82–0.94, HW 0.77–0.94, CI 93–103, SL 0.80–0.94, SI 98–110, EL 0.14–0.18, PW 0.54–0.62, AL 0.86–1.00, PPW 0.25–0.26, PPL 0.25–0.28, PPI 89–100 (n = 40).

Mandibles usually smooth and shining but sometimes with a few longitudinal rugae. Dentition of the masticatory margin of mandible: the strongest apical + the second strongest preapical + a long diastema + two small teeth that are subequal in size. Basal margin of mandible somewhat straight, lacking a distinct tooth. Clypeus depressed and smooth, usually unsculptured but very rarely with a longitudinal median carina. Anterior clypeal margin usually with a median denticle and two others on each side but sometimes with a lateral denticle indistinct or two lateral denticles fused into a larger one. Ventral surface of clypeus with a low, broad-based, central tooth. Palp formula 1,3. Frontal carinae extending to the level of the posterior margins of eyes. Antennal scrobes absent. Frontal lobes weak; thus, the antennal articulations are almost entirely exposed. Antennal scapes, when lying on the dorsal head, slightly surpassing the occipital margin of head. Eyes moderate, usually containing six to seven ommatidia in the longest row. Pronotum with a pair of short but acute spines that are slightly variable in length. Propodeum armed with a pair of short spines that are about equal to or slightly longer than the pronotal ones. Metapleural lobes subtriangular. In both profile and dorsal view, the dorsum of alitrunk convex, that is, pronotum plus mesonotum forming a convex dorsum. Petiole node in profile with a fairly long anterior peduncle, its anterodorsal angle higher than the posterodorsal. Postpetiole in profile rounded dorsally, in dorsal view slightly longer than broad, or about as long as broad, but always slightly broadening from front to back. Dorsum of head, except for a few punctures bordering the frontal carinae, smooth and highly polished. Dorsum of alitrunk unsculptured and highly polished. Very rarely, the dorsal surfaces of head and alitrunk with a few feeble punctures. Petiole, postpetiole, and gaster smooth and shining. A weak longitudinal ruga usually present on each side of the petiole but absent in few specimens. Dorsal surfaces of head and alitrunk with some sparse erect or suberect hairs. One or two pairs of hairs present on the dorsal surfaces of petiole node and postpetiole, respectively. First gastral tergite lacking hairs. Three pairs of forward-projecting hairs present near the anterior clypeal margin. Scapes and tibiae with erect to suberect short hairs. Color uniformly reddish-brown.

Queen. TL 4.04–4.38, HL 0.87–0.94, HW 0.85–0.96, CI 94–105, SL 0.84–0.94, SI 98–102, EL 0.22–0.26, PW 0.76–0.84, AL 0.92–1.26, PPW 0.27–0.30, PPL 0.26–0.29, PPI 100–111 (n = 8).

Generally similar to worker, except for normal caste differences. In addition, pronotum unarmed; propodeal armaments toothlike, shorter than those of the conspecific worker.

Male. Unknown.

Comments. This species is known only from the Philippines so far. It has a number of relatives. Two of them occur in Southeast Asia: *P. flatus,* also from the Philippines, and *P. quadridens,* from New Guinea, Indonesia, and Pohnpei. Of its more distant five relatives, two, *P. africanus* and *P. trogor,* occur in Africa; and the other three, *P. quadridentatus, P. wheeleri,* and *P. erythropygus,* are endemic to Australia.

The following characters can be used to separate the workers of *P. collinus* from those of *P. flatus*:

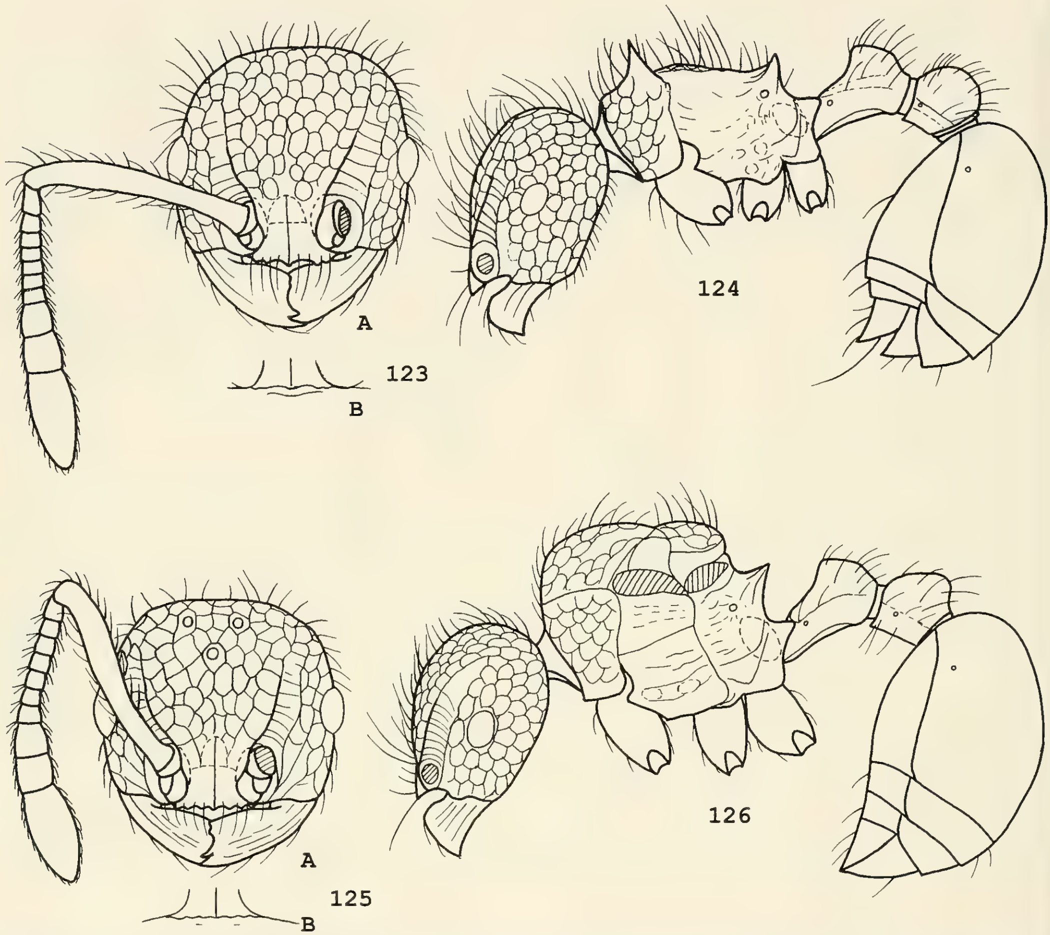
P. collinus

- Promesonotum in dorsal view showing a convex dorsum
- Anterior face of petiole node, in profile, distinct from the upper surface of its anterior peduncle
- Smaller species, with HW 0.77–0.94, HL 0.82–0.94, EL 0.14–0.18

P. flatus

- Promesonotum in dorsal view depressed or shallow-concave
- Anterior face of petiole node not distinct from the upper surface of the peduncle
- Larger species, with HW 0.98–1.04, HL 0.94–1.02, EL 0.22–0.24

A list of characters separating *P. collinus* and *P. flatus* from *P. quadridens* and from



Figures 123–126. *Pristomyrmex costatus* **sp. n.** 123A: Worker head, full-face view; 123B: Showing a transverse ruga on the ventral clypeus; 124: Worker, lateral view; 125A: Queen head, full-face view; 125B: Ventral clypeus without a toothlike prominence; 126: Queen, lateral view.

two African and from three Australian species is provided under *P. flatus*.

Holotype Worker. Philippines: Dumaguete (J. W. Chapman).

Paratypes. 40 workers and nine queens with same data as holotype.

Additional Material Examined (BMHH, USNM, NHMV, MCZC). Philippines: Dumaguete, Horns of Negros, 3,600 ft (J. W. Chapman); Dumaguete, Camp (J. W. Chapman); Los Banos (F. X. Williams); Luzon, Mt. Makiling (F. X. Williams; L. Quate and C. Yoshimoto); Luzon, Laguna, Mt. Makiling, 500 to 1,144 m (H. Zettel); Luzon, Laguna, Mt. Banahaw above Kinabuhayan, 600 to 700 m (J. Kodada and B. Rigova); Romblon Prov., Tablas, S. Agustin, Dubduban, Busai Falls (H. Zettel); Panay Is., forest, 300 m (R. C. Mcqregor).

Ecological Information. This species occur in forest, according to the present records.

Pristomyrmex costatus **sp. n.**
Figures 123–126

Diagnosis (Worker). Ventral surface of clypeus lacking a developed tooth, but usually with a transverse ruga; pronotal spines fairly long, ca. 1.5 to 2 times the length of propodeal armaments, but distinctly shorter than the distance between the bases of two pronotal spines; dorsal surfaces of head and alitrunk sculptured with coarse rugoreticulum; petiole node lacking foveolate punctures; first gastral tergite lacking erect or suberect hairs.

Holotype Worker (BMNH). TL 4.14, HL 0.99, HW 0.96, CI 97, SL 0.96, SI 100, EL 0.21, PW 0.68, AL 1.12, PPW 0.30, PPL 0.30, PPI 100. Paratypes, 3 workers (MCZC): TL 4.48–4.54, HL 1.04–1.08, HW 0.98–1.02, CI 94–94, SL 1.07–1.12, SI 108–110, EL 0.20–0.20, PW 0.68–0.72, AL 1.18–1.24, PPW 0.30–0.31, PPL 0.33–0.34, PPI 91–94.

Mandibles usually with several longitudinal rugae. Masticatory margin of mandible with four teeth arranged as two adjacent strong apical teeth + a long diastema + two small basal teeth of similar size. Basal margin of mandible lacking a distinctly curved lobe or tooth. Clypeus with a strong median longitudinal carina. Anterior clypeal margin with a median denticle and two to three others on each side. Ventral surface of clypeus possessing or lacking a transverse ruga, never armed with a developed, acute tooth. Palp formula 1,3. Frontal carinae strong, extending to the level of the posterior margins of eyes. Slightly concave scrobal areas present lateral to the frontal carinae. Frontal lobes weak so that the antennal articulations are almost entirely exposed. Antennal scapes, when lying on the dorsal head, slightly surpassing the occipital margin of head. Eyes containing 9 to 10 ommatidia in the longest row. Profile shape of alitrunk and pedicel segments as in Figure 124. Pronotum armed with a pair of strong and fairly long spines that are ca. 0.19 to 0.27, 1.5 to 2 times the length of propodeal armaments, but distinctly shorter than the distance between the bases of two pronotal spines. Propodeum with a pair of acute short spines that are ca. 0.10 to 0.16 and more slender than the pronotal ones. Metapleural lobes subtriangular. Petiole node in profile, slightly higher than long, with a fairly long anterior peduncle; its anterodorsal angle is on a higher level than the posterdorsal. Postpetiole in profile rounded dorsally, in dorsal view broadening from front to back. Dorsum of head, except for the scrobal areas where there are only some transverse rugae, with well-developed coarse rugoreticulum. Similar sculpture present on the sides of pronotum and the dorsum of alitrunk. Petiole with a coarse longitudinal ruga on each side, but dorsum of petiole node unsculptured and smooth. Dorsum of postpetiole unsculptured and smooth. Gaster smooth and shining. Dorsal surfaces of head and alitrunk with numerous erect or suberect long hairs. Sides and dorsum of petiole node and postpetiole with five or more pairs of hairs in the type specimens. First gastral tergite lacking erect or suberect hairs. Several pairs of forward-projecting hairs present near the anterior clypeal margin. Scapes and tibiae with some erect to suberect hairs. Color reddish-brown.

Queen. Two queens, respectively, from N. Borneo and Sarawak, with the following measurements: TL 5.24, 5.26; HL 1.12, 1.20; HW 1.16, 1.22; CI 102, 104; SL 1.18, 1.20; SI 98, 102; EL 0.28, 0.31; PW 1.00, 1.10; AL 1.44, 1.62; PPW 0.38, 0.44, PPL 0.40, 0.44, PPI 95, 100.

General shape as in Figures 125–126, with normal caste differences from the worker, pronotum unarmed; other characters similar to worker.

Male. Unknown.

Comments and Discussion. Pristomyrmex costatus is extremely similar in appearance to the another Oriental species, *P. sulcatus.* The workers and queens of the two species can be separated as follows: In *P. costatus,* the ventral surface of the clypeus lacks a toothlike prominence, usually with a transverse ruga; in *P. sulcatus,* the ventral center of the clypeus has an acutely prominent tooth and no transverse ruga.

The separation of *P. costatus* from *P. modestus* and from *P. bicolor* is summarized under the latter names.

Figure 127. Distributions of *Pristomyrmex costatus* and *Pristomyrmex sulcatus.*

Whether or not *P. costatus* and *P. sulcatus* have a relationship of allopatric distribution needs further studies. According to the present records, as shown in Figure 127, *P. costatus* occurs in Negri Sembilan of Malaya, Singapore, Sabah, Sarawak, Borneo, and the Philippines but *P. sulcatus* in Pahang of Malaya, Thailand, Nepal, Burma, and China. Further, whether *P. sulcatus, P. costatus,* and *P. brevispinosus* evolved from the results of character displacement also needs further studies (*P.*

costatus is more distant to sympatric *P. brevispinosus* than to *P. sulcatus*).

The following additional material shows some interesting variation: In nine workers, the dorsums of petiole node and postpetiole have five or more pairs of hairs, but the ventral surface of clypeus has only a short ruga. Four workers from Singapore have two pairs of hairs on the dorsum of petiole node and a pair on the dorsum of postpetiole. In a worker from Sabah, the anterodorsal angle of the petiole node in profile is not distinctly higher than the posterodorsal. In three workers, one from Sarawak and the other two from Sabah, the ventral center of clypeus lacks any transverse ruga but possesses a minute prominence instead of an acute tooth, and the dorsal surfaces of petiole and postpetiole have more than seven pairs of hairs. A single specimen, from the Philippines, shows reduced sculpture of the dorsal surfaces of head and alitrunk. The measurements of the previously described specimens are TL 3.94–4.54, HL 0.91–1.18, HW 0.90–1.13, CI 89–103, SL 0.96–1.21, SI 100–112, EL 0.18–0.24, PW 0.60–0.76, AL 0.98–1.30 (n = 18).

In addition, a series from Borneo appears to be intermediate in size between *P. costatus* and *P. bicolor* by possessing the following worker measurements: TL 4.64–5.62, HL 1.00–1.14, HW 1.03–1.14, CI 98–104, SL 1.14–1.22, SI 103–113, EL 0.20–0.22, PW 0.70–0.78, AL 1.16–1.37, PSL1 0.28–0.32, PSL2 0.10–0.16 (n = 25).

It is possible that the previously described material may comprise one or more sibling species. Further collecting and biological investigation are needed to resolve this possibility.

Holotype Worker. Malaysia: Neg. Sembilan, Pasoh For. Res., xi.1994, (M. Brendell, K. Jackson, and S. Lewis).

Paratypes. Three workers, N. Borneo (E. Mjöberg).

Records of the Previously Examined Non-Type Material (ANIC, BMHH, BMNH, MCZC, MHNG, NHMV). Singapore: Nee Soon, Swamp forest, rainforest, nest ex rotten log (R. W. Taylor); Bukit Timah Nat. Res., degraded coastal hill forest, on granite (D. H. Murphy). SE Borneo: 17 to 46 km W Batulitjin, lowland rainforest (W. L. Brown); Borneo: Pajan (E. Mjöberg). Sarawak: Gunong Matang 120 m (T. C. Maa); 4th Div., G. Mulu Nat. Pk., RGS Expd., Long pala, lowland rainforest, on rotten log and in leaf litter (B. Bolton); Semengoh NSG, 30 km S Kuching (H. Zettel). Sabah: Batu Punggul Resort primary forest, sifting (?); 43 mi, labuk Rd. ex Sandakan (Lungmanis) (R. W. Taylor); 7 km N Tambunan, 700 m (Löbl and Burchhardt); N. Borneo, Tutu River (E. Mjöberg); N. Borneo, (SE) Forest Camp, 9.8 km SW of Tenom (K. J. Kuncheria). Philippines: Mindanao, Davao Province, Mt. McKinley, E. slope, 3,300 ft, under bark (F. G. Werner).

Note: An unusual worker (BMNH), collected from Sabah (K. K.-Tambunan, Crocker Range, 1,600 m), having a smooth patch present between the bases of two shorter pronotal spines, is tentatively placed under *P. costatus*; the size of the specimen is TL 3.84, HL 0.96, HW 0.92, CI 96, SL 0.96, SI 104, EL 0.18, PW 0.64, AL 0.96, PSL1 ca. 0.16, PSL2 ca. 0.08.

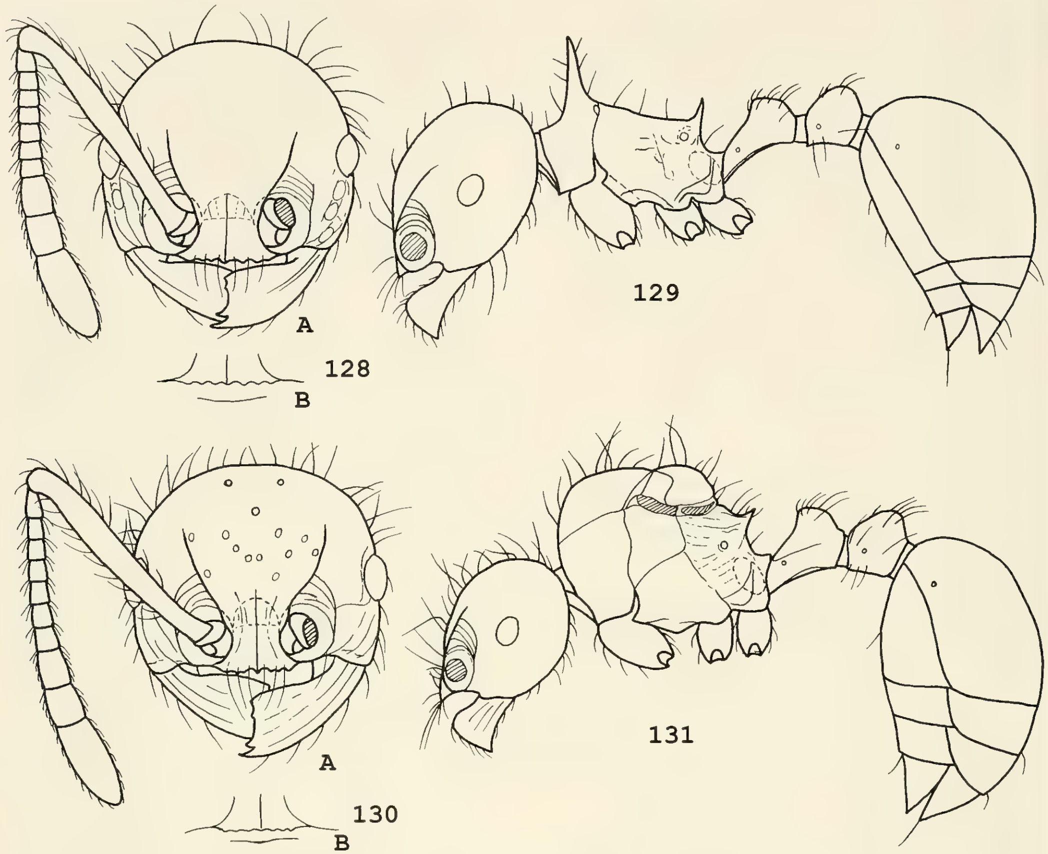
Ecological Information. See the section "Records of the Previously Examined Non-Type Material".

Pristomyrmex curvulus **sp. n.**
Figures 128–131

Diagnosis (Worker). Pronotal spines exceptionally long, about 0.38 to 0.44; propodeal spine length ca. 0.12 to 0.16; anterior face of petiole node distinctly separable from the upper surface of peduncle; dorsal surfaces of head and alitrunk smooth and shining.

Holotype Worker (MCZC). TL 5.24, HL 1.18, HW 1.20, CI 102, SL 1.36, SI 113, EL 0.22, PW 0.79, AL 1.26. Paratypes, 34 workers and one queen (MCZC, BMNH, LACM, MHNG).

Worker. TL 4.62–5.30, HL 1.08–1.26, HW 1.08–1.25, CI 97–105, SL 1.22–1.41, SI 106–117, EL 0.20–0.26, PW 0.74–0.82,



Figures 128–131. *Pristomyrmex curvulus* **sp. n.** 128A: Worker head, full-face view; 128B: Showing a transverse ruga on the ventral clypeus; 129: Worker, lateral view; 130A: Queen head, full-face view; 130B: Showing a transverse ruga on the ventral clypeus; 131: Queen, lateral view.

AL 1.16–1.40, PPW 0.30–0.34, PPL 0.35–0.40, PPI 78–94 (n = 20).

Mandibles generally smooth and shining, with a few basal longitudinal rugae. Masticatory margin of mandible with four teeth: an apical + a preapical + a long diastema + two small denticles that are roughly the same size. Basal margin of mandible lacking a toothlike prominence. Clypeus shining, with a median longitudinal carina; sometimes a few additional superficial rugae present. Ventral surface of clypeus usually with a long transverse ruga. Anterior clypeal margin usually with seven denticles (a median one and three others on each side), but in some specimens, one to two denticles weak or rudimentary. Palp formula 1,3. Frontal carinae just extending to the level of the posterior margins of eyes. Slightly concave scrobal areas present lateral to the frontal carinae. Frontal lobes weak so that the antennal articulations are almost entirely exposed. Antennal scapes long, surpassing the occipital margin by one-fourth to one-third of their length. Eyes usually containing over 10 ommatidia in the longest row. Profile shape of alitrunk and pedicel segments as in Figure 129. Pronotum armed with a pair of exceptionally long spines that are about 0.38 to 0.44 and longer than the distance between their bases. Propodeum with a pair of acute short spines that are ca. 0.12 to 0.16, about as long as the distance between their bases, and shorter than 0.5 times pronotal spine length. Both pronotal and propodeal spines directed upward. Metapleural lobes subtriangular. Petiole in profile nodiform, with a long anterior peduncle; the anterior face of the node distinctly separable from the upper surface of its anterior peduncle, and its dorsum sloping somewhat downward posteriorly. Postpetiole in profile rounded dorsally, in dorsal view distinctly longer than broad and broadening from front to back. Dorsum of head generally smooth and shining, but gena with a few foveolate punctures, and frontal area usually with a few weak short rugae. Dorsal alitrunk, petiole, and postpetiole unsculptured, smooth, and shining. Gaster unsculptured. Dorsal surfaces of head and alitrunk with numerous erect or suberect hairs. Petiole node and postpetiole each with some hairs as shown in Figure 129. Antennal scapes and tibiae with numerous erect or suberect hairs. First gastral tergite without erect or suberect hairs. A few pairs of forward-projecting hairs present near the anterior clypeal margin. Color reddish brown but light yellow in a few specimens.

Queen. TL 6.16, HL 1.18, HW 1.28, CI 108, SL 1.37, SI 107, EL 0.29, PW 1.12, AL 1.62, PPW 0.40, PPL 0.44, PPI 91 (n = 1).

General shape as in Figures 130–131, with normal caste differences from conspecific worker; pronotum unarmed; petiole with a lateral longitudinal ruga on each side. Other characters similar to worker.

Male. Unknown.

Comments and Discussion. This species is closely related to *P. longispinus*, also from Dumaguete, Philippines, but the workers of these two species can be separated by the following characters:

P. curvulus

- Anterior face of petiole node, in profile, distinct from the upper surface of peduncle
- Clypeus with a median longitudinal carina
- Frontal carinae extending to the posterior margins of eyes
- Propodeal spines shorter, about as long as the distance between their bases.
- Anterior clypeal margin usually with seven small denticles

P. longispinus

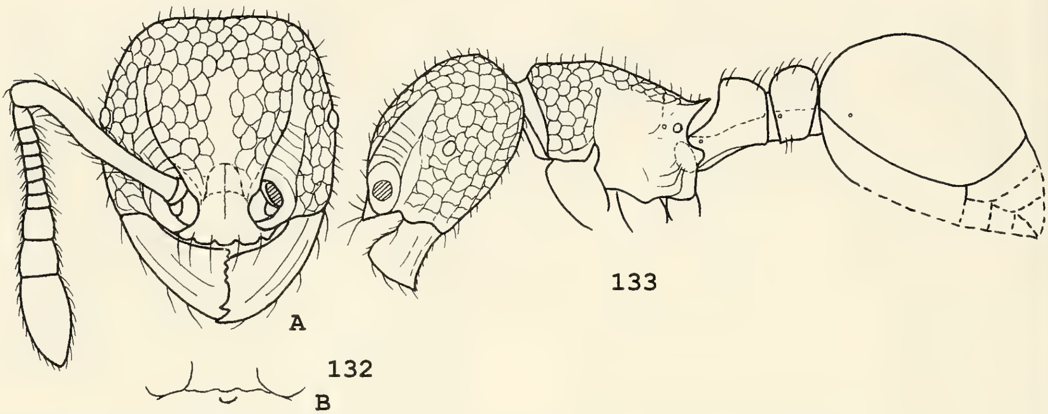
- Anterior face of petiole node, in profile, not distinct from the upper surface of peduncle
- Clypeus lacking a median longitudinal carina
- Frontal carinae not extending to the posterior margins of eyes
- Propodeal spines longer, about two to three times the distance between their bases in length
- Anterior clypeal margin usually with three to five denticles

Pristomyrmex curvulus may also have a close relationship with *P. bicolor.* The workers and queens of the two species can be separated as follows: In *P. curvulus,* the dorsal surfaces of the head and the alitrunk are smooth and shining, with only a few shallow foveolate punctures present on the genae and a few short rugae on the frontal area, whereas in *P. bicolor,* the dorsum of the head is entirely covered with coarse rugoreticulum, and the dorsum of the alitrunk is also strongly sculptured with coarse rugae.

It is possible that *P. curvulus* is derived from a *P. collinus*–like ancestor. The worker of *P. curvulus,* apart from the exceptionally long pronotal spines, a transverse ruga on the ventral surface of the clypeus, and its larger size, is similar to that of *P. collinus.* The queen of *P. curvulus* is also similar to that of *P. collinus,* but in the former it is larger, and the ventral surface of the clypeus has a transverse ruga, not a toothlike prominence as in *P. collinus.*

Holotype Worker. Philippines: Dumaguete (J. W. Chapman).

Paratypes. Philippines: two workers, Dumaguete, 7.vi.1942 (J. W. Chapman);



Figures 132–133. *Pristomyrmex eduardi* Forel. 132A: Worker head, full-face view; 132B: Showing a toothlike prominence on the ventral clypeus; 133: Worker, lateral view.

two workers, Dumaguete, 14.vi.1942 (J. W. Chapman); 12 workers, Dumaguete, 10.v.1947 (J. W. Chapman); two workers, Dumaguete, 4.v.1948 (J. W. Chapman); one worker, Dumaguete, 1949 (J. W. Chapman); two workers and one queen, Dumaguete, 1950 (J. W. Chapman); 11 workers, Dumaguete, Horns of Negros, 3,600 ft (J. W. Chapman); two workers, Dumaguete, Horns of Negros, 3,600 ft (Domingo Empeso).

Additional Material Examined (MCZC). Some specimens, also collected in Dumaguete, Philippines, by J. W. Chapman, are not included in the type series because they are badly mounted or damaged.

Ecological Information. Unknown.

Pristomyrmex eduardi Forel
Figures 132–133

Pristomyrmex eduardi Forel, 1914: 232. Holotype worker, Sumatra Oriental, Bah Boelian (M. v. Buttel) (MHNG) [examined].

Diagnosis (Worker). Masticatory margin of mandible with five teeth; pronotum unarmed; eyes with three to four ommatidia in the largest row.

Worker. TL 2.9, HL 0.77, HW 0.74, CI 96, SL 0.68, SI 92, EL 0.07, PW 0.50, AL 0.78 (n = 1).

Mandibles smooth and shining, except for a few longitudinal rugae. Masticatory margin of mandible with five teeth arranged as the strongest apical + the second strongest preapical + a diastema + three small denticles of similar size; the length of diastema is about equal to the distance covered by three small denticles. Basal margin of mandible lacking a toothlike prominence. Clypeus depressed, with a short median carina that does not reach the anterior clypeal margin but runs through the frontal area. Anterior clypeal margin with five toothlike prominences; the median three somewhat truncated. Ventral center of clypeus with a prominent tooth. Frontal carinae strong, extending to the level of the posterior margins of eyes and forming the dorsal margins of the shallow scrobes. Frontal lobes weak. Eye small, with three to four ommatidia in the longest row. Occipital margin in full-face view feebly concave. Profile of alitrunk and pedicel segments as in Figure 133. Pronotum unarmed, lacking a pair of teeth or spines. Propodeum armed with a pair of acute short spines. Metapleural lobes prominent and rounded. Petiole in profile view with a fairly long anterior peduncle; the anterodorsal angle of the node high, and its dorsum sloping downward posteriorly. Postpetiole in profile with a rounded dorsum. Dorsum of head with coarse rugoreticulum, except for a smooth, median longitudinal strip. Dorsum of alitrunk, as well as two sides of pronotum, with developed rugoreticulum. Petiole and postpetiole smooth and shining. Gaster unsculptured. Dorsal surfaces of head and alitrunk with numerous erect or suberect short hairs. Two pairs of the similar hairs present on the dorsum of petiolar node and three pairs on the dorsum of postpetiole as shown in Figure 133. First gastral tergite lacking erect or suberect hairs. A few pairs of forward-projecting hairs present near the anterior clypeal margin. Scapes and tibiae with some erect to suberect short hairs. Color reddish-brown.

Queen and Male. Unknown.

Comments. This species is known only from the holotype. Its two close relatives are *P. quindentatus,* from Indonesia, and *P. occultus,* from Indonesia and Malaysia. *Pristomyrmex eduardi* can be separated from *P. quindentatus* and *P. occultus* because it lacks pronotal armaments and possesses smaller eyes (EL = 0.07, with three to four ommatidia in the longest row) in the workers.

Though it was considered by Forel (1914) to be similar to *P. punctatus* (=*P. pungens* = *P. japonicus*), *P. eduardi* cannot be placed in the *punctatus* group because (1) it has five teeth present on the masticatory margins of the mandibles, (2) its eyes are very small, (3) the ventral center of the clypeus is equipped with a prominent tooth, and (4) the petiole node has a distinct anterior face. In addition, its propodeal spines are much shorter than those in the four Oriental species of the *punctatus* group. Incidentally, the palp formula of *P. eduardi* cannot be determined from the unique holotype and thus remains unknown at this time.

Ecological Information. Unknown.

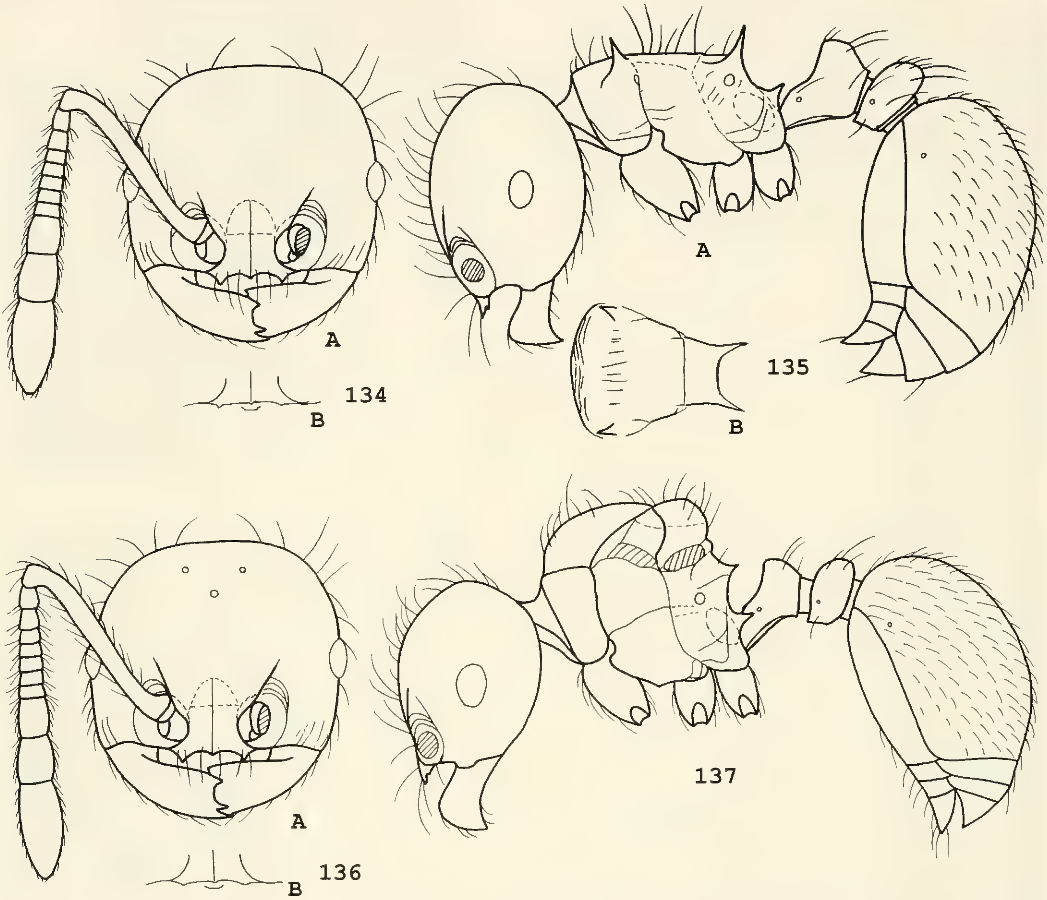
Pristomyrmex erythropygus Taylor
Figures 134–137

Pristomyrmex erythropygus Taylor, 1968: 65. Holotype worker, Australia: NE. New South Wales, Acacia Plateau, near Old Koreelah, ca. 28°24′S, 152°25′E, in rotten logs, xi.1957 (Darlingtons) (ANIC) [examined].

Diagnosis (Worker). Masticatory margin of mandible with three teeth; anterior clypeal margin with three strong teeth; propodeal armaments, ca. 0.13 to 0.20, usually slightly longer than pronotal spines; dorsum of head smooth, but dorsal alitrunk with several longitudinal rugae present at the juncture between the pronotum and the mesonotum; first gastral tergite usually with erect or suberect hairs.

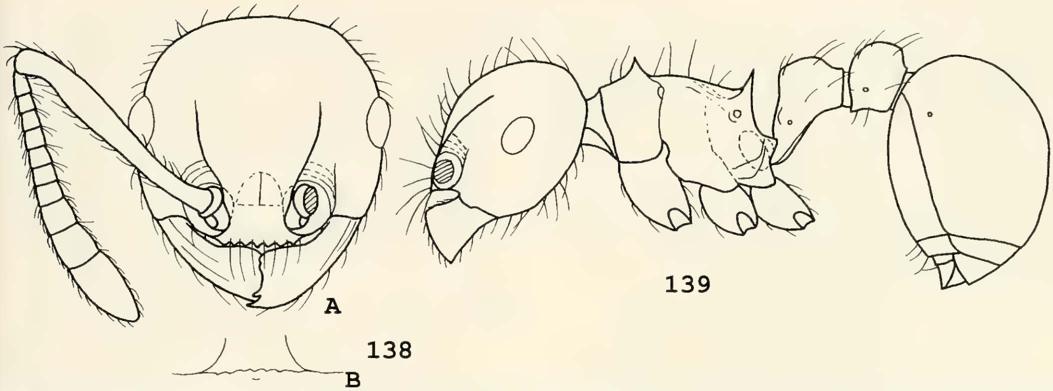
Worker. TL 3.48–3.90, HL 0.90–1.08, HW 0.94–1.18, CI 104–110, SL 0.92–1.00, SI 88–97, EL 0.16–0.20, PW 0.56–0.66, AL 0.84–0.98, PPW 0.24–0.30, PPL 0.19–0.23, PPI 114–130 (n = 8).

Mandibles generally smooth and shining, but sometimes with a few basal longitudinal rugae. Dentition of the masticatory margin of mandible: an apical tooth + a preapical + a long diastema + a somewhat truncated basal tooth. Basal margin of mandible lacking a distinctly curved lobe or tooth. Clypeus with a median longitudinal carina. Anterior clypeal margin with three teeth: a median denticle and one on each side. Ventral surface of clypeus with a short transverse carina or with a low, broad prominence. Palp formula 2,2. Frontal carinae short, not extending to the level of the posterior margins of eyes. Antennal scrobes absent. Frontal lobes absent; thus, the antennal articulations are entirely exposed. Antennal scapes, laid on the dorsal head, slightly surpassing the occipital margin of head. Eyes containing eight to nine ommatidia in the longest row. Profile shape of alitrunk and pedicel segments as in Figure 135A. Pronotum armed with a pair of moderately long spines, varying in length from 0.08 to 0.13. Propodeal spines usually slightly longer than pronotal ones, varying in length from 0.13 to 0.20. Metapleural lobes triangular and much shorter than propodeal spines. Petiole node in profile with the anterodorsal angle higher than the posterodorsal. Anterior and dorsal faces of the postpetiole in pro-



Figures 134–137. *Pristomyrmex erythropygus* Taylor. 134A: Worker head, full-face view; 134B: Showing a short transverse carina or a low, broad prominence on the ventral clypeus; 135A: Worker, lateral view; 135B: Dorsum of the worker alitrunk, dorsal view; 136A: Queen head, full-face view; 136B: Showing a short transverse ruga, or a low, broad prominence on the ventral clypeus; 137: Queen, lateral view.

file forming a single curved surface; in dorsal view, postpetiole distinctly broader than long. Dorsum of head smooth and shining, except for a few short rugae present below the frontal carinae around the antennal fossae and on the genae. Dorsum of alitrunk possessing (1) several short rugae present approximately at the juncture between the pronotum and the mesonotum (but weak in a smaller specimen), (2) a few transverse rugae present near the anterior pronotal margin, and (3) a transverse ridge present at the approximate position of metanotal groove. Petiole, postpetiole, and gaster smooth and shining. Dorsal surfaces of head and alitrunk with numerous erect or suberect hairs. Dorsal surfaces of petiole node and postpetiole, respectively, with a pair of bilaterally distributed long hairs; sometimes the crests of petiole node and postpetiole with additional one to two pairs of short hairs. First gastral tergite with numerous, evenly distributed, erect or suberect hairs. (Note: In three specimens placed under *P. erythropygus,* several longitudinal rugae are present at the juncture between the pronotum and the mesonotum, but erect or



Figures 138–139. *Pristomyrmex flatus* **sp. n.** 138A: Worker head, full-face view; 138B: Showing a very short ruga on the ventral clypeus; 139: Worker, lateral view.

suberect hairs are absent from the first gastral tergite. Are these hairs artificially erased? Further collecting is needed to clarify this question.) A few pairs of forward-projecting hairs present near the anterior clypeal margin. Scapes and tibiae with some erect to suberect short hairs. Color reddish-brown to blackish-brown.

Queen. TL 4.40, HL 1.14, HW 1.27, CI 111, SL 1.02, SI 80, EL 0.22, PW 0.86, AL 1.20, PPW 0.34, PPL 0.24, PPI 142 (n = 1).

General shape as in Figures 136–137, with normal caste differences from the conspecific worker; pronotum unarmed; pro-mesonotum lacking longitudinal rugae; propodeal spines distinctly shorter than those in conspecific worker; other characters similar to those in the conspecific worker.

Male. Unknown.

Comments. Pristomyrmex erythropygus is a sibling species of *P. wheeleri* and also related to *P. quadridentatus.* The three species are all from Australia. *Pristomyrmex erythropygus* differs from *P. wheeleri* and *P. quadridentatus* because the former possesses numerous erect or suberect hairs on the first gastral tergite and several short longitudinal rugae at the juncture between the pronotum and the mesonotum in the workers that are absent in the latter two species. In addition, the propodeal spines are usually slightly longer than the pronotal ones in the workers of *P. erythropygus* but much shorter than the pronotal spines in *P. quadridentatus.*

The differences between *P. erythropygus* and the two Oriental species (*P. flatus* and *P. collinus*) and between *P. erythropygus* and the two African species (*P. africanus* and *P. trogor*) are mentioned under *P. flatus* and *P. africanus,* respectively.

Material Examined (ANIC, MCZC). Australia: New South Wales, Acacia Plateau, in rotten logs (Darlingtons); NE New South Wales, Nothofagus Mt., via Woodenbong, *Nothofagus* forest, 1,100 m, sieved litter, Q. M. Berlesale No. 414 (G. Monteith and G. Thompson); NE New South Wales, Gibraltar Range N.P., rainforest, granite, sieved litter, QM. Berlesate No. 270 (G. B. Monteith); New South Wales, Gibraltar Range Nat. Pk., 920 m, 29.31°S/152.22°E, Berlesate ANIC 836, closed forest litter (L. Hill); New South Wales, 10.5 km W of Gibraltar Ra N.P. (HQ), rainforest, sieved litter, QM. Berlesate No. 213 (G. B. Monteith).

Ecological Information. This species occurs in rainforest and has been collected in rotten logs and in litter berlesates.

Pristomyrmex flatus **sp. n.**

Figures 138–139

Diagnosis (Worker). Pronotum and propodeum each with a pair of short spines;

dorsal surfaces of head and alitrunk smooth and unsculptured; petiole node with at least two pairs of hairs; anterior face of petiole node indistinguishable from the upper surface of its anterior peduncle; HW 0.98–1.04 and HL 0.94–1.02.

Holotype Worker (MCZC). TL 3.94, HL 1.02, HW 1.04, CI 102, SL 1.10, SI 106, EL 0.24, PW 0.66, AL 1.03. Paratypes, three workers (MCZC, BMNH).

Worker. TL 3.79–4.14, HL 0.94–1.02, HW 0.98–1.04, CI 102–106, SL 1.02–1.12, SI 104–108, EL 0.22–0.24, PW 0.64–0.67, AL 1.02–1.08, PPW 0.28–0.30, PPL 0.28–0.30, PPI 93–100 (n = 4).

Mandibles generally smooth and shining, with a few basal short rugae. Dentition of the masticatory margin of mandible: the strongest apical tooth + the second strongest preapical + a long diastema + two small denticles that are about equal in size. Basal margin of mandible lacking a toothlike prominence. Clypeus depressed and smooth, but the frontal area with a median carina that extends a little to the clypeus. Anterior clypeal margin usually with a median denticle and three other small denticles on each side, but sometimes one of the lateral denticles very weak and indistinct. Ventral center of clypeus with a weak, toothlike prominence. Palp formula 1,3. Frontal carinae approximately reaching to the level of the posterior margins of eyes. Antennal scrobes absent. Frontal lobes very weak so that the antennal articulations are almost completely exposed. Antennal scapes rather long, when lying on the dorsal head, surpassing the occipital margin by one-fifth to one-fourth of their length. Eyes containing eight to nine ommatidia in the longest row. Pronotum armed with a pair of short robust spines as in Figure 139. Propodeum with a pair of slender acute spines that are directed upward and slightly longer than the pronotal ones. Metapleural lobes subtriangular. Pronotum and mesonotum in dorsal view slightly concave between the pronotal spines and between the two lateral margins of mesonotum, respectively. Petiole node massive; its anterior face in profile indistinguishable from the upper surface of petiole peduncle (Fig. 139). Dorsum of petiole node in dorsal view about rounded. Postpetiole in profile convex dorsally, in dorsal view slightly longer than broad or about as long as broad, broadening from front to back. Dorsum of head usually smooth and shining, but some small and shallow hair pits present. Dorsum of alitrunk unsculptured, smooth and shining. Sides and dorsum of petiole and postpetiole smooth and shining. Gaster unsculptured. Dorsal surfaces of head with numerous erect or suberect hairs. Dorsum of alitrunk with sparse erect to suberect hairs. Two pairs of hairs present on the dorsum of petiole node, and two to three pairs on the dorsum of postpetiole. First gastral tergite lacking erect or suberect hairs. A few pairs of forward-projecting hairs present near the anterior clypeal margin. Scapes and tibiae with numerous erect to suberect short hairs. Color reddish-brown but sometimes yellow-brown.

Queen. Unknown.

Male. See the following note.

Comments. Like *P. collinus*, *P. flatus* is also known only from the Philippines. *Pristomyrmex flatus* is similar to *P. collinus*, *P. quadridens*, *P. africanus*, *P. trogor*, *P. quadridentatus*, *P. wheeleri*, and *P. erythropygus*. The workers of *P. flatus* can be immediately recognized; because in *P. flatus*, the anterior face of the petiole node is not distinct from the upper surface of its anterior peduncle, which is different in the previously mentioned species.

A more detailed discussion of the separation of *P. flatus* from *P. collinus* is provided under *P. collinus*.

Pristomyrmex flatus and *P. collinus* differ from *P. quadridens* in the workers as follows:

P. flatus **and** ***P. collinus***

Dorsum of alitrunk unsculptured, smooth, and shining

Dorsum of head smooth and shining,

except for a few punctures bordering the frontal carinae

P. quadridens
Dorsum of alitrunk with scattered foveolate punctures; sometimes some short rugae present
Dorsum of head with a few to many foveolate punctures, except for those bordering the frontal carinae

Pristomyrmex flatus and *P. collinus* differ from two African species, *P. africanus* and *P. trogor*, in the workers as follows:

P. flatus and ***P. collinus***
Ventral center of clypeus with a short ruga or small toothlike prominence
At least one to two pairs of hairs present on the petiole node and postpetiole
Metapleural lobes triangular

P. africanus and ***P. trogor***
Ventral surface of clypeus with two teeth
Petiole and postpetiole lacking erect or suberect hairs
Metapleural lobes rounded

The other differences include that the anterior face of the petiole node is distinct from the upper surface of the peduncle in the workers of *P. africanus* and *P. trogor* but almost indistinct in *P. flatus*; the dorsum of the alitrunk in dorsal view is convex in the workers of *P. collinus* but distinctly shallowly concave in *P. africanus* and *P. trogor*; the dorsum of the head is sculptured with scattered foveolate punctures in the workers of *P. africanus* but is generally smooth and shining in *P. flatus* and *P. collinus*; the frontal carinae extend to the level of the posterior margins of eyes in the workers of *P. flatus* and *P. collinus* but not so in *P. trogor*.

Pristomyrmex flatus and *P. collinus* differ from three Australian species *P. quadridentatus*, *P. wheeleri*, and *P. erythropygus* in the workers as follows:

P. flatus and ***P. collinus***
Anterior clypeal margin with five to seven smaller denticles
Clypeus unsculptured
Masticatory margin of mandible with four teeth, consisting of an apical, a preapical, and two small basal denticles
Palp formula 1,3.
Alitrunk in dorsal view unsculptured

P. quadridentatus, P. wheeleri, and ***P. erythropygus***
Anterior clypeal margin with three strong and larger teeth
Clypeus sculptured with a strong median carina
Masticatory margin of mandible with three teeth, consisting of an apical, a preapical, and a basal tooth
Palp formula 2,2
Alitrunk in dorsal view with a transverse ridge present at the approximate position of metanotal groove

In addition, the anterior face of the petiole node, in profile, is distinct from the upper surface of the peduncle in the workers of *P. quadridentatus*, *P. wheeleri*, and *P. erythropygus* but almost indistinct in *P. flatus*; the dorsum of the alitrunk is convex in the workers of *P. collinus* but almost flat or shallowly concave in *P. quadridentatus*, *P. wheeleri*, and *P. erythropygus*.

Holotype Worker. Philippines: Luzon I., Bauqui; xi.1923. (R.C.Mcq.).

Paratypes. Three workers with same data as holotype.

Ecological Information. Unknown.

Note: The following five male specimens, with same data as holotype and paratypes, may represent the male of this species. I tentatively place these males under *P. flatus*, which needs further confirmation.

Male (Figs. 262, 271). TL 3.62–3.94, HL 0.64–0.68, HW 0.56–0.59, CI 85–91, SL 0.22–0.25, SI 39–43, HWE 0.98–1.04, EL 0.48–0.51, PW 0.74–0.80, AL 1.16–1.24, PPW 0.24–0.24, PPL 0.24–0.24, PPI 100–100 (n = 5).

Head, including the eyes, much broader than long; while excluding the eyes, distinctly longer than broad. Eyes very large and prominent; their length is about three-fourths of the head length. Clypeus convex, somewhat semicircular, its anterior margin straight and posterior one semicircular. Palp formula 1,3. Frontal carinae absent or short, slightly beyond the anterior margins of antennal insertions. Frontal area usually with a median longitudinal carina. Ocelli developed; maximum diameter of median ocellus 0.16 to 0.18. On the mesoscutum, notauli distinct, forming a Y shape, but usually without distinct ridges in them; parapsidal furrows absent. Scutoscutellar sulcus usually with 9 to 10 narrow ridges. Propodeum lacking armaments. Metapleural lobes subtriangular. Middle and hind tibiae without any spurs. Petiole node in profile low, with a subtriangular apex and a rather long anterior peduncle; anterior face of the node, together with the dorsal surface of its anterior peduncle, forming a long declivity, which reaches the top of the node. Postpetiole in profile low, rounded dorsally, in dorsal view about as broad as long. Dorsum of head smooth and shining, except for a few short rugae present on the posterior margin of clypeus. Alitrunk generally smooth and shining, except for those marked sutures. Petiole, postpetiole, and gaster unsculptured, smooth, and shining. All dorsal surfaces with abundant long hairs. Scapes and tibiae with numerous erect or suberect short hairs. Color reddish-brown; hairs reddish-brown; antennae sometimes yellow-brown; wings somewhat infuscated.

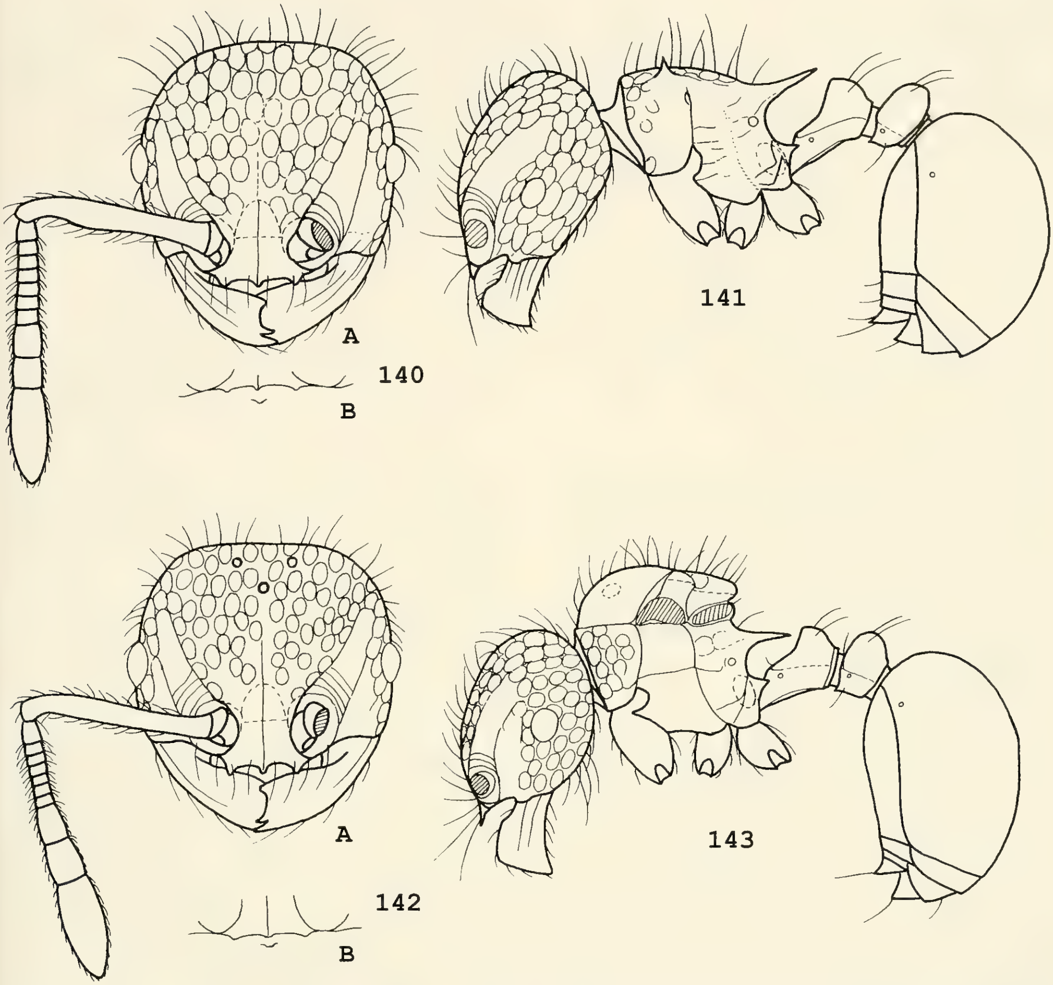
Pristomyrmex foveolatus Taylor
Figures 140–143

Pristomyrmex foveolatus Taylor, 1965: 38. Holotype worker, Australia: N. Queensland, west of Tully, Clump Point, rainforest, a few feet above sea level, 25.vi.1962 (R. W. Taylor) (MCZC) [examined].

Diagnosis (Worker). Pronotum with a pair of triangular short spines (ca. 0.06–0.13); propodeal spines long (ca. 0.20–0.30); dorsum of head, except for the antennal scrobes, with foveolate-reticulate sculpture; postpetiole unsculptured; PPI 133–150; SL 0.70–0.82 and SI 81–93.

Worker. TL 2.74–3.26, HL 0.78–0.92, HW 0.80–0.96, CI 100–108, SL 0.70–0.82, SI 81–93, EL 0.11–0.14, PW 0.50–0.62, AL 0.68–0.86, PPW 0.23–0.27, PPL 0.16–0.20, PPI 133–150 (n = 74).

Mandibles usually with a few longitudinal rugae. Masticatory margin of mandible with three teeth: an apical + a preapical + a long diastema + a truncated basal tooth. Basal margin of mandible lacking a distinctly curved lobe or tooth. Clypeus with a strong median carina. Anterior clypeal margin with a median denticle and usually two to three others on each side; two or three lateral denticles are often fused into one prominence. Ventral center of clypeus with a low, broad, toothlike prominence. Palp formula 2,3. Frontal carinae well developed, beyond the level of the posterior margins of eyes. Scrobal areas shallow, present below the frontal carinae. Frontal lobes almost completely absent so that the antennal articulations are entirely exposed. Antennal scapes, when lying in the antennal scrobes, close to or just reaching the occipital margin of head. Eyes containing five to six ommatidia in the longest row. Profile shape of alitrunk and pedicel segments as in Figure 141. Pronotum armed with a pair of short spines (ca. 0.06–0.13). Propodeal spines long, ca. 0.20 to 0.30, usually straight but sometimes slightly upcurved along their length. Metapleural lobe small-triangular, usually with an acute apex. Petiole node in profile higher than long, with a long anterior peduncle, its anterodorsal angle forming an apex and its dorsum sloping downward posteriorly. Postpetiole in profile much higher than long, with a rounded dorsum; in dorsal view, postpetiole transverse-rectangled, much broader than long, with the two sides subparallel. Dorsum of head, except for the antennal scrobes where there are only a few transverse rugae, with well-developed foveolate-reticulate sculpture. Dorsum of alitrunk usually with foveolate-reticulate sculpture and a few coarse longitudinal rugae. Sides of



Figures 140–143. *Pristomyrmex foveolatus* Taylor. 140A: Worker head, full-face view; 140B: Showing a toothlike prominence on the center of ventral clypeus; 141: Worker, lateral view; 142A: Queen head, full-face view; 142B: Showing a toothlike prominence on the center of ventral clypeus; 143: Queen, lateral view.

pronotum with a few foveolate punctures; sides of the rest of alitrunk with some irregularly superficial rugae. Petiole node and postpetiole smooth and shining. Gaster unsculptured. Dorsal surfaces of head and alitrunk with numerous erect or suberect long hairs. Dorsal surfaces of petiole node and postpetiole with a pair of long hairs, respectively, as shown in Figure 141. First gastral tergite lacking erect or suberect hairs. A few pairs of forward-projecting hairs present near the anterior clypeal margin. Scapes and tibiae with some erect to suberect short hairs. Color reddish-brown.

Queen. TL 3.20, HL 0.83, HW 0.86, CI 104, SL 0.74, SI 86, EL 0.16, PW 0.66, AL 0.87, PPW 0.25, PPL 0.16, PPI 139 (n = 1).

General shape as in Figures 142–143, with normal caste differences from the conspecific worker; pronotum unarmed;

other characters similar to worker; propodeal spine length 0.25.

Male. Unknown.

Comments. Pristomyrmex foveolatus is extremely similar to *P. thoracicus,* also from Australia, in many characters in the workers and queens, such as (1) the dentition of the masticatory margin of mandible, (2) palp formula, (3) structure and shape of the clypeus, (4) length and shape of the pronotal and propodeal spines, and (5) sculpture of the dorsal surfaces of the head and the alitrunk. The differences between the workers of these two species are slight, as follows:

P. foveolatus

Antennal scapes shorter (SL 0.70–0.82, SI 81–93)

Postpetiole in dorsal view much broader than long, PPI 133–150, with the two sides subparallel, showing a transverse rectangle

P. thoracicus

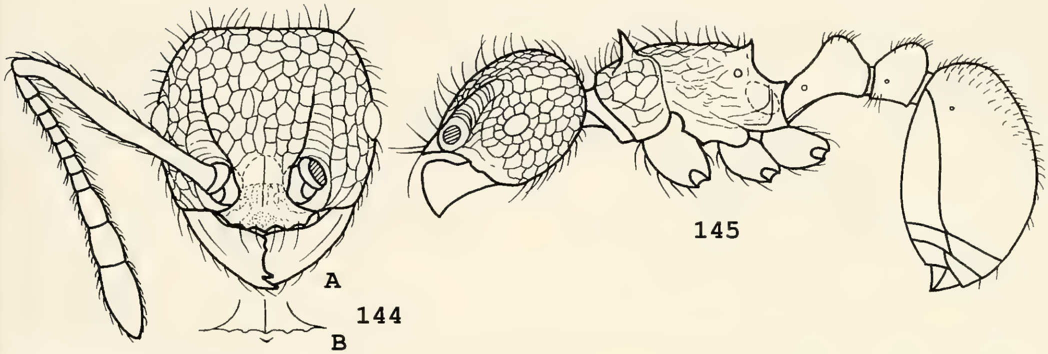
Antennal scapes longer (SL 0.86–0.98, SI 97–103)

Postpetiole in dorsal view slightly broader than long, PPI 109–121, with the two sides not subparallel, showing a trapezoid

Without doubt, *P. foveolatus* and *P. thoracicus* are closely related to *P. brevispinosus,* from the Oriental region. The workers of these three species all show the following characters: (1) a pair of short pronotal spines, (2) a toothlike prominence on the ventral center of the clypeus, (3) a similar structure and shape of petiole node in both profile and dorsal views, (4) a similar structure and shape of postpetiole in profile, (5) well-developed foveolate-reticulate sculpture on the dorsal head, and (6) dorsal alitrunk with a few coarse longitudinal rugae. But *P. foveolatus* and *P. thoracicus* can be separated from *P. brevispinosus* as follows: The former two species have a pair of long propodeal spines (ca. 0.19–0.30), two segments of maxillary palpi, and a truncated basal tooth on the masticatory margin of mandible in the workers and queens, while *P. brevispinosus* has a pair of short propodeal spines or teeth (ca. 0.04–0.12), one segment of maxillary palp, and usually two small basal teeth on the masticatory margin of mandible.

The separation of both *P. foveolatus* and *P. thoracicus* from the African *P. cribrarius* (a member of the *cribrarius* group) is provided under *P. cribrarius.*

Material Examined (ANIC, MCZC). Australia: N. Queensland, Clump Point, rainforest floor, ex small wood fragment (R. W. Taylor); Q., Clump Point, <20 m, berlesate (Taylor and Feehan); N. Q., NW of Daintree, Mt. Alexander, rainforest (P. F. Darlington); Q., Alexandra Bay, 16.12°S, 145.26°E, rainforest, <50 m, berlesate (Taylor and Feehan); Q. NE, Road, summit on Alexandra, Ra. Daintree, 16.15°S, 145.26°E, rainforest, 250 m, berlesate, sieved litter (G. Monteith); Q., Kuranda, Black Mt. Rd. 360 m, 17.47°S, 145.39°E, rainforest, berlesate, sieved litter (G. Monteith); Q., Kuranda, Black Mt. Rd. 430 m, 16.45 × 145.35, rainforest, berlesate (Taylor and Feehan); Q., 4 km W of Kuranda, 450 m, 16.49 × 145.36, rainforest, berlesate (Taylor and Feehan); Q., 1 km W of Kuranda, closed forest litter, berlesate (J. Doyen); N Q., Kuranda, RF, in log (B. B. Lowery); Q., NE, C. Tribulation, 16.08°S, 145.28°E, 20 m, rainforest, berlesate, sieved litter (G. Monteith); Q., NE, Cape Tribulation, Noah Ck, 5 m (G. B. Monteith); NE Q., 1.5 km W of Cape Tribulation (Site 3), 16.05°S, 145.28°E, 150 m, rainforest, berlesate, sieved litter (Monteith, Yeates, and Thomson); NE Q., 2.0 km WNW of Cape Tribulation (Site 2), 16.05°S, 145.28°E, 50 m, rainforest, berlesate, sieved litter (Monteith, Yeates, and Thomson); Q., near Cape Tribulation, 16.06°S, 145.28°E, 50 m, rainforest, berlesate (Taylor and Feehan); Q., Thorton Range, 16.14°S, 145.26°E, 100 to 150 m, rainforest, berlesate (Taylor and Feehan); Q., 20 km N of Cairns, rainforest (B. B. Lowery); NE Q., Lyons Lookout, Rex Hwy, Mossman, 400 m, rainforest, berlesate, sieved litter (G. Monteith and D.



Figures 144–145. *Pristomyrmex hirsutus* **sp. n.** 144A: Worker head, full-face view; 144B: Showing a toothlike prominence on the ventral clypeus; 145: Worker, lateral view.

Cook); NE Q., Hinchinbrook Is., Gayundah Creek, 18.22°S, 146.13°E, 10 to 80 m, rainforest, berlesate, sieved litter (Monteith, Davies, Thompson, and Gallon); Q., NE, Mossman Gorge, 16.25°S, 145.20°E, rainforest, berlesate, sieved litter (G. Monteith); NE Q., Bakers Blue Mt., 17 km W Mt. Molloy, 1,000 m, rainforest, berlesate, sieved litter (G. Monteith and D. Cook); Q., Mt. Cook, Nat. Pk., 15.29°S, 145.16°E, rainforest, berlesate (A. Calder and J. Feehan); Q., Gap Creek, 15.50°S, 145.20°E, 5 km ESE of Mt. Finnigan, rainforest, berlesate (A. Calder and J. Feehan); Q., N Pingin Hill (J. Holt); Q., Mt. Windsor Tableland, ca. 850 m, 16.18°S, 145.05°E, rainforest, berlesate (R. W. Taylor); N Q., 28 km NNW Mt. Carbine, Windsor Tableland, 900 m, rainforest, berlesate, sieved litter (Monteith, Yeates, and Cook); Q., ME, Cannon Vale, 20.16°S, 148.43°E, 10 m, dry rainforest, berlesate, stick brushing (G. Monteith); Q., ME, Mt. Dryander, 20.15°S, 148.33°E, 500 to 650 m, rainforest, berlesate, stick brushing (G. Monteith); Q., ME, Brandy Ck Rd, Conway SF, 20.20°S, 148.42°E, 60 m, rainforest, berlesate, sieved litter and stick brushing (G. Monteith); Q., Finch Hatton Gorge, 21.04°S, 148.38°E, 470 m, mesophyll notophyll vine forest, berlesate (A. Gillison); Q., Finch Hatton Gorge, 21.05°S, 148.38°E, 200 m, rainforest, berlesate (R. W. Taylor and T. A. Weir); N Q., 15.50°S, 145.20°E, 12-mi scrub Gap Creek, complex mesophyll vine for. (Davies and Raven); N Q., 20 km N of Cairns, lowland RF, creek between rocks (B. B. Lowery).

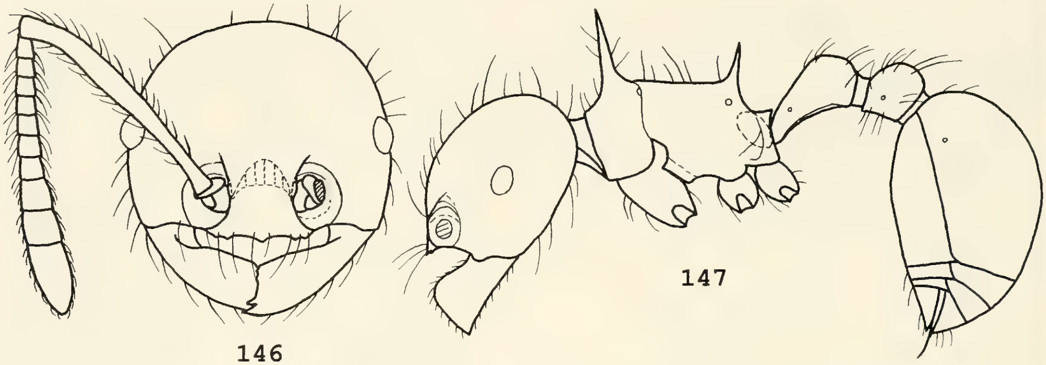
Ecological Information. This species occurs only in rainforest in North Queensland, Australia, and has been collected in litter berlesates; its nests are constructed in rotting logs (Taylor, 1965).

Pristomyrmex hirsutus sp. n.
Figures 144–145

Diagnosis (Worker). Masticatory margin of mandible with a long diastema; dorsal head with a well-developed rugoreticulum; petiole node in profile high, with a single evenly blunt-rounded apex; first gastral tergite with numerous erect or suberect short hairs.

Holotype Worker (BMHH). TL 5.78, HL 1.38, HW 1.40, CI 101, SL 1.60, SI 114, EL 0.28, PW 0.90, AL 1.52, PPW 0.38, PPL 0.42, PPI 90.

Mandibles smooth and shining. Masticatory margin of mandible with four teeth arranged as two adjacent strong apical teeth + a long diastema + two basal denticles of similar size. Basal margin of mandible lacking a toothlike prominence. Clypeus somewhat uneven, with a few weak short rugae. Anterior clypeal margin with a median denticle and two others on each side (but one of them appears to be fused by two small denticles). Frontal ca-



Figures 146–147. *Pristomyrmex longispinus* **sp. n.** 146: Worker head, full-face view; 147: Worker, lateral view.

rinae extending to the level of the posterior margins of the eyes. Antennal scrobes shallow, approximately ending at the level of the posterior margins of eyes. Frontal lobes weak so that the antennal articulations are almost entirely exposed. Antennal scapes long, when laid on the dorsal head, surpassing the occipital margin by about one-third of their length. Profile shape of alitrunk and pedicel segments as in Figure 145. Pronotum armed with a pair of spines (ca. 0.19). Propodeum with a pair of somewhat elongate-triangular teeth (ca. 0. 09). Metapleural lobes subtriangular. Petiole node in profile high (ca. 0.46), with a single evenly blunt-rounded apex. Postpetiole in profile rounded dorsally, in dorsal view longer than broad and broadening from front to back. Dorsum of head, except for the scrobal areas, with well-developed coarse rugoreticulum. Similar sculpture present on the dorsum of the alitrunk and the two sides of the pronotum. Sides of the rest of the alitrunk with irregular coarse rugae. Petiole, postpetiole, and gaster smooth and shining. All dorsal surfaces of body, including head, alitrunk, petiole node, postpetiole, and gaster, with numerous erect or suberect hairs, as shown in Figure 145. A few pairs of forward-projecting hairs present near the anterior clypeal margin. Scapes and tibiae with erect or suberect hairs. Color reddish-brown.

Queen and Male. Unknown.

Comments. Though only a single specimen is available so far, it undoubtedly represents a good species because it has numerous erect or suberect hairs on the first gastral tergite, which is possessed only by this new species in the Oriental fauna of the *quadridens* group. In addition, this species has an uneven clypeus and a distinct petiole node (bearing a single evenly blunt-rounded apex) that is not seen in the other Oriental species of the group.

Holotype Worker. Philippines: Misamis or Mt. Balatukan, 15 km SW of Gingoog, 1,000 to 2,000 m, 1–5.v.1960 (H. Torrevillas).

Note: The holotype of this species is an old specimen, and many hairs have obviously been removed from its first gastral tergite. Therefore, the figure can not accurately show this character.

Ecological Information. Unknown.

Pristomyrmex longispinus sp. n.
Figures 146–147, 263, 272

Diagnosis (Worker). Frontal carinae short, usually not extending to the level of the posterior margins of eyes; pronotal spines exceptionally long (0.42–0.50); propodeal spines moderately long (0.18–0.26); anterior face of petiole node, in profile, indistinguishable from the upper surface of its anterior peduncle.

Holotype Worker (MCZC). TL 5.30, HL

1.21, HW 1.28, CI 106, SL 1.34, SI 1.05, EL 0.24, PW 0.80, AL 1.26. Paratypes, 73 workers and three males (BMNH, LACM, MCZC, MHNG, USNM).

Worker. TL 4.52–5.62, HL 1.09–1.26, HW 1.15–1.35, CI 103–109, SL 1.26–1.40, SI 103–113, EL 0.21–0.26, PW 0.76–0.86, AL 1.14–1.32, PPW 0.31–0.35, PPL 0.36–0.40, PPI 84–89 (n = 20).

Mandibles generally unsculptured, smooth, and shining. Masticatory margin of mandible with four teeth: the strongest apical + the second strongest preapical + a long diastema + two small teeth that are roughly the same size. Basal margin of mandible lacking a toothlike prominence. Clypeus depressed, unsculptured, and shining; its anterior margin with a median denticle and usually two others on each side, but sometimes two lateral denticles are fused into one prominence. Ventral center of clypeus with a short transverse ruga or a broad-based weak prominence. Palp formula 1,3. Frontal carinae short, usually not extending to the level of the posterior margins of the eyes. Antennal scrobes absent. Frontal lobes very weak so that the antennal articulations are almost entirely exposed. Antennal scapes long, when lying on the dorsal head, surpassing the occipital margin by about one-fifth to one-fourth of their length. Head in full-face view subglobal. Profile shape of alitrunk and pedicel segments as in Figure 147. Pronotum armed with a pair of exceptionally long spines that are about 0.42 to 0.50 and longer than the distance between their bases. Propodeum with a pair of moderately long spines that are 0.18 to 0.26 and over two times the distance between their bases. Both pronotal and propodeal spines acute and directed upward. Metapleural lobes subtriangular. Dorsum of alitrunk sometimes slightly concave. Anterior face of petiole node, in profile, indistinguishable from the dorsal surface of its anterior peduncle (i.e., the anterior face of petiole node and the dorsal surface of peduncle forming a long declivity from the base of peduncle to the top of petiole node). Postpetiole in profile rounded dorsally, in dorsal view longer than broad. Dorsum of head generally smooth and shining, but a few weak short rugae present on the frontal area and sometimes a few foveolate punctures on the genae. Alitrunk smooth and polished. Petiole, postpetiole, and gaster unsculptured, smooth, and shining. Dorsal surfaces of head and alitrunk with some erect or suberect long hairs. Usually two to three pairs of similar hairs present on the dorsal surfaces of petiole node and postpetiole, respectively. First gastral tergite usually lacking erect or suberect hairs, rarely with few hairs. A few pairs of forward-projecting hairs present near the anterior clypeal margin. Scapes and tibiae with some erect or suberect hairs. Color reddish-brown.

Queen. Unknown.

Male (Figs. 263, 272). Three male specimens, together with 48 workers, collected in Dumaguete, Philippines, by J. W. Chapman, constitute a series; and two of the three males were originally mounted, respectively, with a worker on the same pin: TL 4.42–4.54, HL 0.67–0.73, HW 0.64–0.66, CI 88–96, SL 0.20–0.22, SI 31–34, HWE 0.94–0.98, EL 0.43–0.46, PW 0.88–0.93, AL 1.32–1.44, PPW 0.28–0.30, PPL 0.24–0.26, PPI 115–117 (n = 3).

Head, including the eyes, distinctly broader than long. Clypeus convex, without a median longitudinal carina. Palp formula 1,3. Frontal carinae sometimes absent but sometimes present, just reaching the level of the posterior margins of antennal insertions. Maximum length of the median ocellus 0.12 to 0.12. On the mesonotum, notauli pronounced, forming a Y shape; parapsidal furrows absent. Scutoscutellar sulcus with 12 to 13 narrow ridges. Middle and hind tibiae without any spurs. Propodeum slightly tuberculate, lacking spines and teeth. Metapleural lobes prominent and subtriangular. Petiole node in profile low, with a subtriangular apex and a rather long anterior peduncle; anterior face of the node, together with the dorsal surface of the peduncle, forming a long declivity that reaches the top of the node. Postpetiole in profile low, rounded dorsally, and in dorsal view broader than long. Dorsum of head smooth and shining, but frontal area usually with a median longitudinal carina. Alitrunk smooth and shining, except for those marked sutures. Petiole, postpetiole, and gaster unsculptured, smooth, and shining. All dorsal surfaces with abundant erect or suberect hairs. Scapes and tibiae with numerous erect or suberect short hairs. Color reddish-brown; hairs reddish-brown; wings somewhat infuscated.

Comments and Discussion. Pristomyrmex longispinus is closely related to *P. curvulus.* The former is very similar in the workers to the latter in the shape of pronotal and propodeal spines as well as in the size, sculpture, hair, and color of body. The differences between the two species are provided under *P. curvulus.*

Pristomyrmex longispinus may have evolved from a *P. flatus*–like ancestor. Except for the well-developed pronotal spines, its larger size, and shorter frontal carinae, the workers of *P. longispinus* are similar to those of *P. flatus.*

It is possible that a *P. collinus*–like ancestor may have split into the four species *P. collinus, P. flatus, P. curvulus,* and *P. longispinus* because morphological characters show that (1) *P. collinus* and *P. flatus* are a pair of sibling species, (2) *P. curvulus* and *P. longispinus* are another pair of sibling species, and (3) *P. curvulus* seems to be derived from a *P. collinus*–like ancestor (see the discussion under *P. curvulus*). This hypothesis also obtains support from biogeographic data. The four species are all endemic to the Philippines. *Pristomyrmex curvulus* and *P. longispinus* are found only in Dumaguete and *P. flatus* only in Luzon. But *P. collinus* has a larger range; it occurs sympatrically with *P. curvulus* and *P. longispinus* in Dumaguete and with *P. flatus* in Luzon.

Holotype Worker. Philippines: Dumaguete (J. W. Chapman).

Paratypes. Philippines: 48 workers and three males with same data as holotype; four workers, Dumaguete, Horns of Negros (J. W. Chapman); two workers, Dumaguete, 1942 (J. W. Chapman); one worker, Dumaguete, 7.xi.43 (J. W. Chapman); two workers, Dumaguete, v.1947 (J. W. Chapman); one worker, Dumaguete, 13.v.1947 (J. W. Chapman); one worker, Dumaguete, Silliman University, 1948 (Domingo Empeso); 13 workers, Dumaguete, 1949 (J. W. Chapman); one worker, Dumaguete, 18.vi.49. (J. W. Chapman).

Additional Material Examined. More than two dozen specimens from Camp, Dumaguete, Philippines, are treated as non-type material because of in a poor situation.

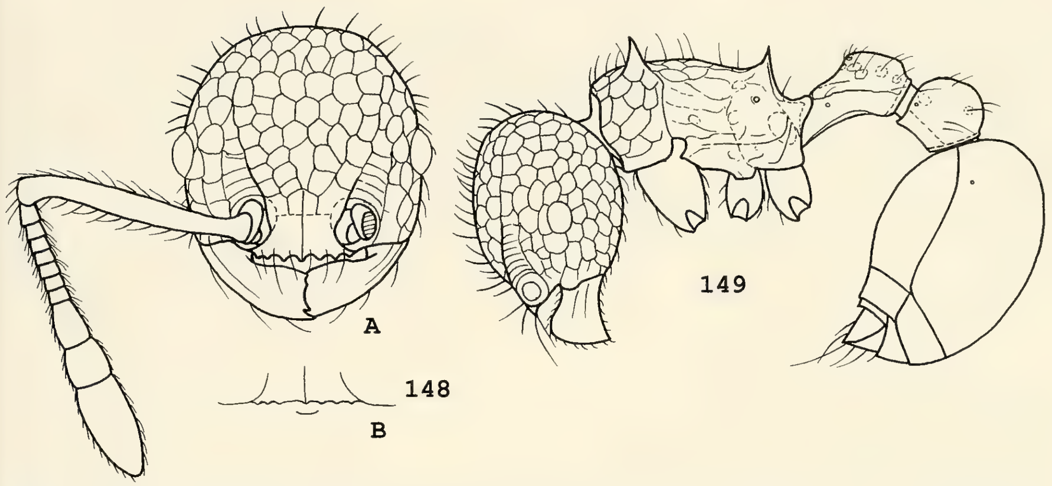
Ecological Information. Unknown.

Pristomyrmex modestus **sp. n.**
Figures 148–149

Diagnosis (Worker). Pronotum with a pair of moderately long, robust spines; dorsal surfaces of head and alitrunk, as well as the two sides of pronotum, with a coarse rugoreticulum; petiole node in profile somewhat transrectangular, slightly longer than high, with seven to eight foveolate punctures.

Holotype Worker (BMNH). TL 4.00, HL 0.99, HW 0.92, CI 93, SL 0.95, SI 103, EL 0.19, PW 0.64, AL 1.04, PPW 0.35, PPL 0.35, PPI 100.

Mandibles with a few longitudinal rugae. Masticatory margin of mandible with two adjacent strong apical teeth + a long diastema + one broad, somewhat concave basal tooth. Basal margin of mandible lacking a distinctly curved lobe or tooth. Clypeus with a strong median carina. Anterior clypeal margin with a median denticle and three others on each side. Ventral surface of clypeus with a short transverse ruga. Frontal carinae strong, extending to the level of the posterior margins of the eyes. Antennal scrobes indistinct. Frontal lobes weak so that the antennal articulations are almost entirely exposed. Antennal scapes, laid on the dorsal head, slightly surpassing the occipital margin of head. Eyes rather



Figures 148–149. *Pristomyrmex modestus* **sp. n.** 148A: Worker head, full-face view; 148B: Showing a short transverse ruga on the ventral clypeus; 149: Worker, lateral view.

large. Profile shape of alitrunk and pedicel segments as in Figure 149. Pronotal spines robust, ca. 0.14, shorter than the distance between their bases. Propodeal spines acute, slender, ca. 0.11. Metapleural lobes developed, prominent, ca. 0.14, each with a rounded apex. In profile view, petiole node slightly longer than high, somewhat transrectangular, with the anterodorsal angle on approximately the same level as or weakly higher than the posterodorsal; in dorsal view, petiole node longer than broad. Postpetiole in profile rounded dorsally; in dorsal view, approximately quadrate and about as long as broad. Dorsal surfaces of head and alitrunk, as well as the two sides of pronotum, entirely sculptured with coarse rugoreticulum. Dorsum and the sides of petiole node with seven to eight large foveolate punctures. Postpetiole with a few shallow foveolate punctures. Gaster unsculptured, smooth, and shining. Dorsal surfaces of head and alitrunk with numerous erect or suberect hairs. Petiole node and postpetiole each with a few pairs of hairs, as shown in Figure 149. First gastral tergite lacking erect or suberect hairs. A few pairs of forward-projecting hairs present near the anterior clypeal margin. Scapes and tibiae with sparse erect or suberect hairs. Color reddish-brown.

Queen and Male. Unknown.

Comments. This species must have evolved from the ancestor of *P. costatus.* It differs from *P. costatus* in the workers as follows:

P. modestus

- Petiole node in profile longer than high, somewhat rectangular, with the anterodorsal angle on approximately the same level as the posterodorsal
- Dorsum and sides of petiole node with seven to eight foveolate punctures

P. costatus

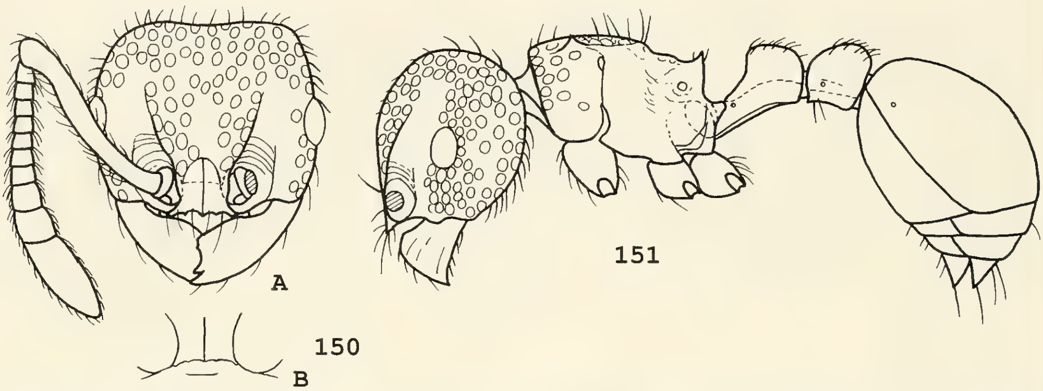
- Petiole node in profile higher than long; its anterodorsal angle is distinctly higher than the posterdorsal
- Dorsum and sides of petiole node without foveolate punctures

Holotype Worker. Malaysia: Sarawak, 4th Division, Gn. Mulu N.P., Kerangas for., leaf litter, 19.iii.1978 (H. Vallack).

Ecological Information. The holotype is collected from a forest.

Pristomyrmex nitidissimus Donisthorpe Figures 150–151

Pristomyrmex nitidissimus Donisthorpe, 1949: 411. Holotype worker, New Guinea: Maffin Bay, ix.1944 (E. S. Ross) (CASC) [examined].



Figures 150–151. *Pristomyrmex nitidissimus* Donisthorpe. 150A: Worker head, full-face view; 150B: Showing a short transverse ruga on the ventral clypeus; 151: Worker, lateral view.

Diagnosis (Worker). Pronotum armed with a pair of teeth; dorsal surfaces of head and alitrunk with numerous scattered foveolate punctures; ventral surface of clypeus with a coarse transverse carina; larger size (HL 1.10–1.16, HW 1.22–1.24, and EL 0.24–0.25).

Worker. TL 4.58, 4.69; HL 1.10, 1.16; HW 1.22, 1.24; CI 107, 111; SL 1.14, 1.16; SI 93, 94; EL 0.24, 0.25; PW 0.75, 0.78; AL 1.20, 1.30 ($n = 2$).

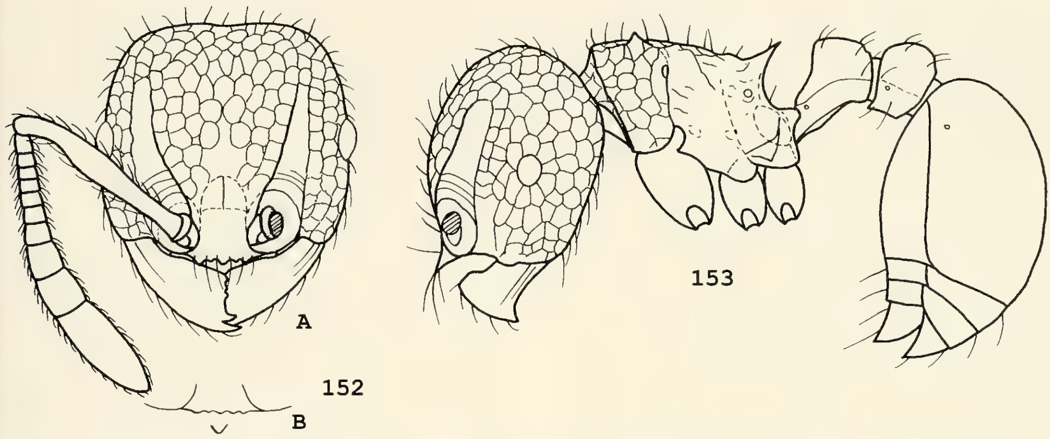
Mandibles with a few longitudinal rugae. Dentition of the masticatory margin of mandible: the strongest apical + the second strongest preapical + a short diastema + a broad basal tooth showing two minute points (which is formed by the fusion of two basal denticles). Basal margin of mandible with a central, broadly curved lobe. Clypeus with a median longitudinal carina. Anterior clypeal margin with a median denticle and two others on each side. Ventral surface of clypeus with a transverse ridge. Frontal carinae extending to the level of the posterior margins of eyes. Antennal scrobe indistinct, but a smooth area present below the frontal carina. Frontal lobes very weak so that the antennal articulations are almost entirely exposed. Antennal scapes, laid on the dorsal head, slightly surpassing the occipital margin of head. Eyes large. Pronotum armed with a pair of teeth. Propodeum with a pair of subtriangular short spines that are slightly longer than the pronotal teeth. Metapleural lobes each with a subtriangular apex. Petiole node in profile as in Figure 151, with a fairly long anterior peduncle, in dorsal view longer than broad. Postpetiole in profile rounded dorsally, in dorsal view slightly longer than broad. Dorsum of head with numerous rather large, scattered foveolate punctures; space between foveolae usually smooth. Similar foveolate punctures present on the dorsal surface of alitrunk, but promesonotum with a smooth, unsculptured median strip. Petiole, postpetiole, and gaster smooth and shining. Dorsal surfaces of head, alitrunk, petiole node, and postpetiole with numerous erect or suberect hairs. First gastral tergite lacking erect or suberect hairs. A few pairs of forward-projecting hairs present near the anterior clypeal margin. Scapes and tibiae with some erect to suberect short hairs. Color blackish-brown.

Queen and Male. Unknown.

Comments. At first glance, *P. nitidissimus* appears to resemble *P. quadridens* very much, but after being compared in detail, the workers of the two species are separable as follows:

P. nitidissimus

Ventral surface of clypeus with a coarse transverse ruga, lacking a toothlike prominence



Figures 152–153. *Pristomyrmex occultus* **sp. n.** 152A: Worker head, full-face view; 152B: Showing a tooth on the center of ventral clypeus; 153: Worker, lateral view.

Larger species, with HW 1.22–1.24, HL 1.10–1.16, EL 0.24–0.25
Basal margin of mandible with a central, broadly curved lobe
Four to five pairs of short hairs present on the dorsums of both petiole node and postpetiole

P. quadridens
Ventral center of clypeus with a toothlike prominence
Smaller species, with HW 0.82–1.02, HL 0.82–1.02, EL 0.14–0.20
Basal margin of mandible almost straight, without a distinctly convex lobe
Usually one to two pairs of hairs present on the dorsums of both petiole node and postpetiole

The workers of *P. nitidissimus* are obviously different from those of the African *P. africanus* because the latter are smaller (HW < 1.00, HW < 1.00, EL < 0.14) and lack hairs on the dorsal surfaces of the petiole node and the postpetiole. The workers of *P. africanus* also possess two toothlike prominences on the ventral surface of the clypeus and have a concave dorsum of the alitrunk and an almost straight basal margin of the mandible.

Material Examined (CASC). One worker, with same data as holotype: New Guinea: Maffin Bay, ix.44 (E. S. Ross).

Ecological Information. Unknown.

***Pristomyrmex occultus* sp. n.**
Figures 152–153

Diagnosis (Worker). Masticatory margin of mandible with five teeth; pronotum with a pair of triangular short spines; dorsal surfaces of head and alitrunk, as well as the two sides of pronotum, with coarse rugoreticulum.

Holotype worker (BMNH). TL 3.10, HL 0.84, HW 0.81, CI 96, SL 0.72, SI 89, EL 0.10, PW 0.56, AL 0.80. Paratypes, three workers (MHNG, MCZC).

Worker. TL 3.04–3.23, HL 0.84–0.88, HW 0.80–0.84, CI 93–98, SL 0.72–0.75, SI 87–93, EL 0.10–0.13, PW 0.52–0.56, AL 0.76–0.80, PPW 0.22–0.24, PPL 0.20–0.22, PPI 109–120 (n = 5).

Mandibles generally smooth and shining, with a few basal longitudinal rugae. Masticatory margin of mandible with five teeth arranged as the strongest apical + the second strongest preapical + a diastema + three small denticles of similar size of which the middle one is sometimes weak (i.e., smaller than the two others) or worn down, but the length of the masticatory margin covered by the three denticles is longer than the diastema. Basal margin of mandible lacking a toothlike prominence. Clypeus depressed, smooth, and shining. Anterior clypeal margin with a median denticle and two to three others on each side. Ventral center of clypeus with a strongly prominent tooth. Frontal carinae strong, extending to the level of the posterior margins of eyes. Antennal scrobes shallow. Frontal lobes weak; thus, the antennal articulations are almost entirely exposed. Antennal scapes, laid on the dorsal head, just reaching to the occipital margin of head. Eyes moderately sized, containing five to six ommatidia in the longest row. Occipital margin in full-face view feebly concave. Pronotum armed with a pair of triangular short spines. Propodeal spines acute, about two times the length of the pronotal teeth. Metapleural lobes prominent and rounded. Dorsum of alitrunk in dorsal view somewhat depressed. Petiole node high in profile, with a fairly long anterior peduncle; its anterodorsal angle higher than the posterodorsal. Subpetiole with a narrow, long, semitranslucent lamella. Postpetiole in profile rounded dorsally, in dorsal view slightly broader than long. Dorsal surfaces of head and alitrunk, as well as the two sides of pronotum, with coarse, strongly sculptured rugoreticulum, but the scrobal areas lacking this sculpture. Petiole and postpetiole smooth and shining, except for a lateral longitudinal carina on each side that separates the tergite from the sternite. Gaster unsculptured. Dorsal surfaces of head and alitrunk with numerous erect or suberect hairs. Two pairs of hairs present on the dorsum of petiole node and usually two to three pairs on the dorsum of postpetiole. First gastral tergite lacking erect or suberect hairs. A few of forward-projecting hairs present near the anterior clypeal margin. Scapes and tibiae with some erect to suberect short hairs. Color reddish-brown.

Queen and Male. Unknown.

Comments. Pristomyrmex occultus is a sibling species of *P. quindentatus.* The two species are all from the Oriental region. The separation of the two species is discussed under *P. quindentatus.*

Pristomyrmex occultus is also very similar in appearance to *P. brevispinosus.* But in the workers of *P. occultus,* the masticatory margin of the mandible possesses five teeth, the length of the masticatory margin covered by three small denticles is slightly longer than that of diastema, and the propodeum is armed with a pair of fairly long spines. In *P. brevispinosus,* the masticatory margin of the mandible has four teeth, the length of the masticatory margin covered by two basal denticles is not longer than that of diastema, and the propodeum is armed with a pair of triangular teeth.

Holotype Worker. E. Malaysia: Sarawak, confl. Sun Oyan and Mujong riv., E Kapit 50 m, 18.v.1994 (Löbl and Burchhardt).

Paratypes. Three workers, Malaysia: Sabah, Poring Hot Springs, 600 m, 9.v.1987 (Burckhardt and Löbl).

Additional Material Examined. Two workers (BMNH, MCZC), collected in Malaysia (Sabah, Poring Hot Springs, 500 m), by Burckhardt and Löbl on 7.v.1987, show only four distinct teeth on the masticatory margin of the mandible. But the length of the masticatory margin covered by two small basal denticles is slightly longer than that of diastema.

Ecological Information. Unknown.

Pristomyrmex orbiceps (Santschi)
Figures 154–157, 264, 273

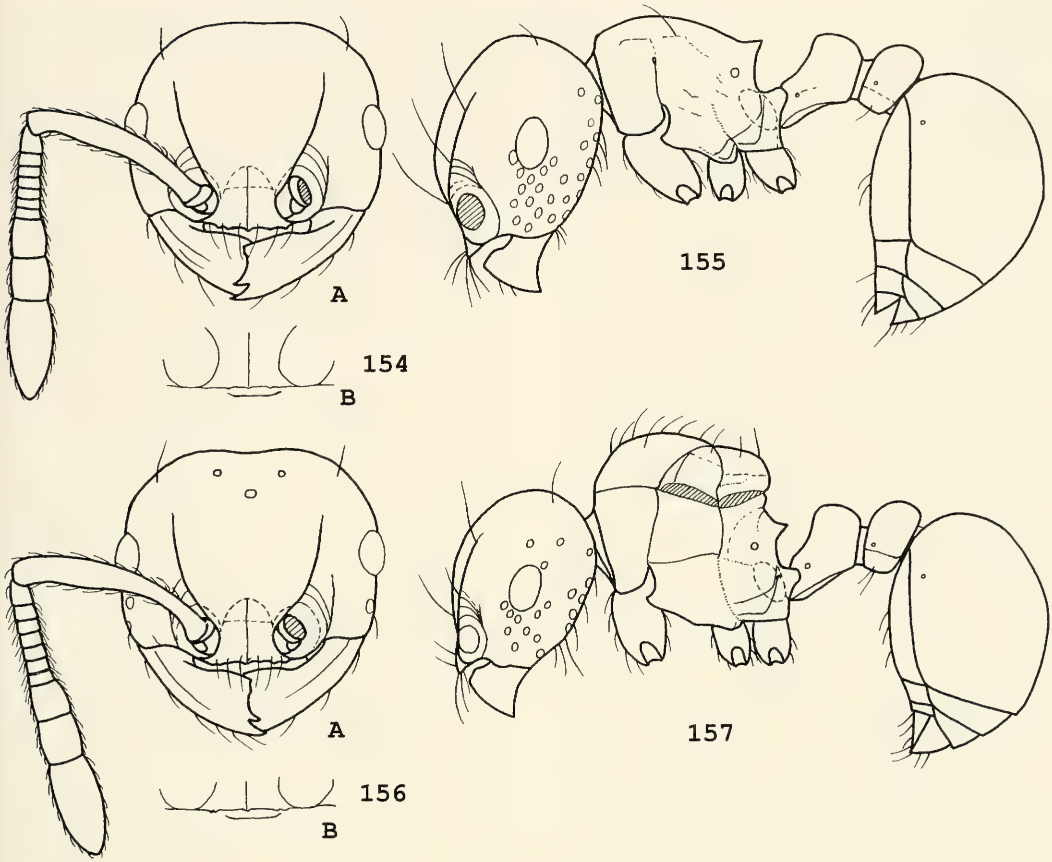
Xiphomyrmex orbiceps Santschi, 1914: 367. Syntype workers, Cameroon: Victoria (F. Silvestri); and Ghana: Aburi (F. Silvestri) (NHMB) (Bolton, 1981).

Pristomyrmex orbiceps (Santschi) Santschi, 1916: 51.

Hylidris laevigatus Weber, 1952: 20. Holotype worker, Zaire: 13 mi S of Asa, lat. 4°40′N, long. 25°40′E (N. A. Weber) (AMNH). [Synonymy by Bolton, 1981].

Note: I have not seen the type material, but I did view some specimens of this species, which has been compared with the type by B. Bolton.

Diagnosis (Worker). Masticatory margin of mandible with a diastema, after the



Figures 154–157. *Pristomyrmex orbiceps* (Santschi). 154A: Worker head, full-face view; 154B: Showing a transverse ruga on the ventral clypeus; 155: Worker, lateral view; 156A: Queen head, full-face view; 156B: Showing a transverse ruga on the ventral clypeus; 157: Queen, lateral view.

preapical tooth; pronotum lacking teeth or spines; dorsal surfaces of head between the frontal carinae and alitrunk unsculptured, smooth, and shining; petiole and postpetiole lacking erect or suberect hairs.

Worker. TL 2.66–3.40, HL 0.78–0.92, HW 0.80–0.98, CI 100–110, SL 0.68–0.80, SI 79–85, EL 0.14–0.21, PW 0.51–0.60, AL 0.68–0.80, PPW 0.24–0.30, PPL 0.18–0.22, PPI 125–144 (n = 35).

Mandibles smooth, at most with two longitudinal basal rugae. Masticatory margin of mandible with an apical tooth + a preapical tooth + a diastema + a broad, truncated (or sometimes somewhat mid-concave) basal tooth. Basal margin of mandible lacking a toothlike prominence or curved lobe. Clypeus possessing or lacking a longitudinal median carina. Ventral surface of clypeus with a long transverse ridge. Anterior clypeal margin with a median denticle and two to three others on each side, but some of the denticles are usually vestigial or very weak; sometimes, the margin without any distinct denticles. Palp formula 1,3. Frontal carinae extending to the level of the posterior margins of eyes. Antennal scrobes absent. Frontal lobes absent. Antennal scapes, when lying on the dorsal head, close to the occipital margin of head. Eyes containing six to nine ommatidia in the longest row. Pronotum tuberculate, lacking teeth or spines. Propodeum armed with a pair of triangular teeth or short spines. Metapleural lobes rounded. In profile view, petiole node massive, higher than long, with a robust anterior peduncle; its anterodorsal and posterodorsal angles rounded, but the former is higher than the latter (Fig. 155). In dorsal view, petiole node slightly broader than long. Postpetiole in profile higher than long, rounded dorsally, in dorsal view broadening from front to back and distinctly broader than long. Dorsum of head between the frontal carinae smooth and shining. A few foveolate punctures present on the sides of the dorsal head and sometimes bordering the frontal carinae. Alitrunk, petiole, postpetiole, and gaster unsculptured, smooth, and shining. Dorsum of head beyond the level of antennal insertions with about four pairs of hairs: three pairs on the frontal carinae and one pair on the occipital corners. Dorsal surface of alitrunk with only a pair of hairs present on the mesonotum. Petiole, postpetiole, and first gastral tergite lacking erect or suberect hairs. Several pairs of forward-projecting hairs present near the anterior clypeal margin. Scapes and tibiae with appressed hairs. Color blackish-brown.

Queen. TL 3.24–3.59, HL 0.85–0.90, HW 0.91–0.99, CI 106–110, SL 0.74–0.79, SI 80–85, EL 0.23–0.26, PW 0.70–0.77, AL 0.90–1.00, PPW 0.29–0.32, PPL 0.21–0.24, PPI 129–145 (n = 8).

General shape as in Figures 156–157, with normal caste differences from conspecific worker; eyes larger; mesonotum with more hairs than in the conspecific worker. Other characters similar to worker.

Male. (Figs. 264, 273). Two male specimens, one collected in Ghana (Tafo, twig in leaf litter), by B. Bolton, and the second male in Ivory Coast (Orston Expt. Sta., 17 km. W. of Abidjan), by W. L. Brown, were originally mounted, respectively, together with one and two workers on the same pins: TL 2.58, 2.76; HL 0.48, 0.50; HW 0.47, 0.48; CI 96, 100, SL 0.18, 0.18; SI 38, 38; HWE 0.63, 0.66; EL 0.24, 0.26; PW 0.57, 0.58; AL 0.87, 0.92; PPW 0.20, 0.21; PPL 0.17, 0.18; PPI 117, 118 (n = 2).

Head, including the eyes, distinctly broader than long. Clypeus narrow, convex in middle; anterior clypeal margin transverse. Maximum diameter of the median ocellus 0.08 to 0.09. On the mesoscutum, notauli distinct, forming a Y shape; parapsidal furrows absent. Scuto-scutellar sulcus with 8 to 11 short ridges. Propodeum slightly tuberculate, lacking teeth or spines. Metapleural lobes subtriangular. Petiole node low in profile, with a fairly long anterior peduncle; its anterior face, together with the dorsal surface of the peduncle, forming a declivity. Postpetiole in profile low, rounded dorsally, and in dorsal view slightly broader than long. Dorsum of head generally smooth and shining, but with about 8 to 10 short rugae on the posterior clypeal margin. A few short rugae present on the frontal area. A weak, curved ruga present above the antennal insertion. Alitrunk generally smooth and shining, except for those marked sutures. Petiole, postpetiole, and gaster smooth and shining. All dorsal surfaces with abundant erect or suberect hairs. Scapes and tibiae with numerous suberect short hairs. Body reddish-brown; wings white or light-yellow.

Comments and Discussion. Pristomyrmex orbiceps occurs in Africa. It is somewhat similar, in appearance of the workers, to *P. fossulatus,* a member of the *punctatus* group, also from Africa. The workers of the two species all lack pronotal teeth or spines. But they can be separated as follows: (1) *P. orbiceps* possesses a single segment of maxillary palp, in contrast with four segments in *P. fossulatus*; (2) *P. fossulatus* has a wedge-shaped petiole node that is not seen in *P. orbiceps*; and (3) the dorsal surfaces of the head and the alitrunk are smooth in *P. orbiceps* but sculptured with scattered foveolate punctures in *P. fossulatus.*

Pristomyrmex orbiceps belongs to the

quadridens group. The absence of the pronotal teeth or spines in the workers should not impede this species from being assigned to the group. *P. africanus*, a distinct member of the *quadridens* group, sometimes also possesses only a pair of tubercles on the pronotum, like *P. orbiceps*.

Pristomyrmex orbiceps is easily recognized in the *quadridens* group. It differs from the other species of the group, except for *P. eduardi* and sometimes *P. africanus*, in the workers in lacking a pair of pronotal teeth or spines. *Pristomyrmex orbiceps* differs from *P. eduardi* and *P. africanus* in the workers as follows: The masticatory margin of the mandible possesses five teeth in *P. eduardi* but three teeth in *P. orbiceps*; the eyes contain three to four ommatidia in the longest row in *P. eduardi* and four to five ommatidia in *P. africanus* but six to nine ommatidia in *P. orbiceps*; the dorsal surfaces of the head and the alitrunk are smooth in *P. orbiceps* but sculptured with scattered foveolate punctures in *P. africanus* and with rugoreticulum in *P. eduardi*; the ventral surface of the clypeus bears a central tooth in *P. eduardi*, two prominent teeth in *P. africanus*, but a long transverse ridge in *P. orbiceps*; the dorsum of the alitrunk has only one pair of hairs in *P. orbiceps* but numerous in both *P. eduardi* and *P. africanus*.

Distribution. Ivory Coast, Ghana, Nigeria, Cameroon, Gabon, and Angola (Bolton, 1981). The following records (MCZC, ANIC) are added here: Angola: Dundo, Carrisso Park, R. Luachimo, 7.22°S, 20.50°E, gallery forest, berlesate (native collector); Dundo, R. Luachimo (Rte. Turismo), 7.025°S, 20.51°E, gallery forest, berlesate (native collector). Ivory Coast: Divo, rainforest, litter (L. Brader); Gagnoa, rainforest, litter (L. Brader). People's Rep. Congo: 25 k NW Boha, 30 k SE Lac Telle (Gary Alpert). French Equatorial Africa: Ubangi-Shari, Bas Mbomu (N. A. Weber). Ghana: E.R. Mt. Atewa, rainforest, Berlesate (R. W. Taylor); E.R. Scarp Forest, near Bosuso, rainforest, Berlesate (R. W. Taylor); E.R. Nkwanda For., near Enyiresi, rainforest, Berlesate (R. W. Taylor); Tafo, Eastern Reg., rainforest, Berlesate (R. W. Taylor).

Ecological Information. This species occurs in rainforest and has been collected in litter berlesates (also see Weber, 1952: 21).

Pristomyrmex quadridens Emery
Figures 158–161, 274

Pristomyrmex quadridens Emery, 1897: 584. Lectotype worker, New Guinea: Friedrich-Wilhelmshafen et Berlinhafen (L. Biró) (MCSN), here designated, [examined].

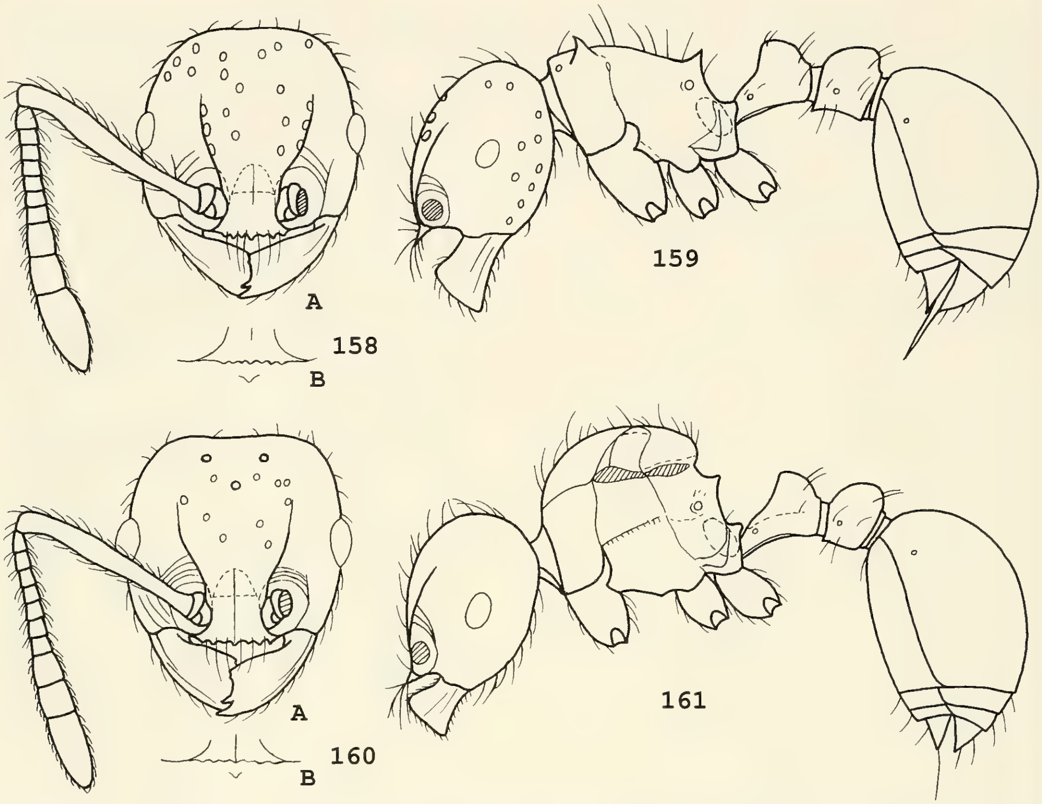
Pristomyrmex quadridens var. *aruensis* Karavaiev, 1933: 270. Holotype worker, Indonesia: Aru Is., Wammar (W. Karawajew) (UENC) [examined]. **Syn. n.**

Pristomyrmex orbiculatus Donisthorpe, 1948: 306. Syntype workers, queens and males, New Guinea: Maffin Bay, 20.vi.1944 (E. S. Ross) [syntype workers (BMNH, LACM, USNM) examined]. **Syn. n.**

Diagnosis (Worker). Pronotum and propodeum each with a pair of short spines; dorsal surfaces of alitrunk and head between the frontal carinae with scattered foveolate punctures; petiole node and postpetiole each with at least a pair of hairs; HW 0.82–1.02, HL 0.82–1.02.

Worker. TL 3.34–4.10, HL 0.82–1.02, HW 0.82–1.02, CI 96–102, SL 0.86–1.00, SI 96–105, EL 0.14–0.20, PW 0.54–0.70, AL 0.82–1.04, PPW 0.24–0.28, PPL 0.26–0.30, PPI 86–100 (n = 30).

Mandibles usually smooth and shining but sometimes with a few fine longitudinal rugae. Dentition of the masticatory margin of mandible: the strongest apical tooth + the second strongest preapical + a long diastema + two small teeth that are roughly the same size; sometimes two small basal teeth are fused, forming a broad tooth with two points. Basal margin of mandible lacking a distinct toothlike prominence. Clypeus depressed and smooth, with a median longitudinal carina, but sometimes this median carina weak or absent. Anterior clypeal margin usually with a median denticle and two to three others on each side. Ventral surface of clypeus with a toothlike prominence at the center. Palp



Figures 158–161. *Pristomyrmex quadridens* Emery. 158A: Worker head, full-face view; 158B: Showing a tooth on the center of ventral clypeus; 159: Worker, lateral view; 160A: Queen head, full-face view; 160B: Showing a tooth on the center of ventral clypeus; 161: Queen, lateral view.

formula 1,3. Frontal carinae distinct, extending to the level of the posterior margins of eyes. Antennal scrobes shallow and short. Frontal lobes weak; thus, the antennal articulations are almost entirely exposed. Antennal scapes, when lying on the dorsal head, slightly surpassing the occipital margin of head. Eyes usually containing seven to eight ommatidia in the longest row. Occipital margin feebly concave. Profile of alitrunk and pedicel segments as in Figure 159. Pronotum armed with a pair of acute short spines. Propodeum with a pair of triangular teeth or short spines that are about equal in length to the pronotal armaments. Metapleural lobes rounded or with a subtriangular apex. Petiole node in profile nodiform; its anterodorsal angle high, and the dorsum sloping downward posteriorly. Postpetiole in profile rounded dorsally, in dorsal view broadening from front to back and usually longer than broad but sometimes about as long as broad. Dorsum of head between the frontal carinae with scattered foveolate punctures; intensity and number of punctures very variable: The punctures are sometimes dense and large but sometimes few, small, and shallow. Dorsum of alitrunk with scattered foveolate punctures, varying from a few to many. Petiole, postpetiole, and gaster unsculptured, smooth, and shining. Dorsal surfaces of head and alitrunk with numerous erect or suberect hairs. Two pairs of hairs usually present on the dorsum of petiole node and a pair usually on the dorsum of postpetiole. First gastral tergite without erect or suberect hairs. A few pairs of forward-projecting hairs present near the anterior clypeal margin. Scapes and tibiae with abundant erect to suberect short hairs. Color varying from light yellow-brown to dark-brown; in some specimens, a darker circular patch present on the dorsum of head just above the frontal area; sometimes gaster darker than head and alitrunk.

Queen. TL 3.82–4.72, HL 0.90–1.10, HW 0.94–1.11, CI 98–105, SL 0.88–1.02, SI 90–99, EL 0.23–0.28, PW 0.74–0.88, AL 1.06–1.26, PPW 0.26–0.32, PPL 0.29–0.34, PPI 88–97 (n = 7).

General shape as in Figures 160–161, with normal caste differences from the conspecific worker; pronotum unarmed. Other characters similar to worker.

Male (Fig. 274). Two male specimens, together with 12 workers and two queens, constitute a series collected in Indonesia (Seram, above Haruru, near Masohi, 50–150 m) by W. L. Brown; each of the two males was originally mounted with a worker on the same pin: TL 3.30, 3.52; HL 0.60, 0.62; HW 0.60, 0.62; CI 100, 100; SL 0.23, 0.24; SI 38, 39; HWE 0.80, 0.82; EL 0.32, 0.33; PW 0.79, 0.82; AL 1.20, 1.20; PPW 0.22, 0.22; PPL 0.25, 0.27; PPI 81, 88 (n = 2).

Head, including the eyes, distinctly broader than long. Clypeus somewhat transverse, convex, and unsculptured. Palp formula 1,3. Frontal carinae absent. Maximum diameter of the median ocellus 0.11 to 0.12. On the mesoscutum, notauli pronounced, forming a Y shape; parapsidal furrows very weak. Scuto-scutellar sulcus with 10 narrow longitudinal ridges. Propodeum tuberculate, lacking teeth or spines. Metapleural lobes somewhat rounded. Petiole node in profile low and rounded dorsally, with a fairly long anterior peduncle. Postpetiole low, in dorsal view distinctly longer than broad. Dorsum of head smooth and shining. Alitrunk smooth and shining, except for those marked sutures. Petiole, postpetiole, and gaster smooth and shining. All dorsal surfaces with abundant long hairs. Scapes and tibiae with numerous erect or suberect short hairs. Color blackish-brown; hairs reddish-brown; wings somewhat infuscated.

Comments and Discussion. This species occurs in New Guinea, some islands near New Guinea, and Pohnpei Island. One of its closely related species, *P. brevispinosus*, is distributed in Indonesia, Malaysia, Thailand, the Philippines, Taiwan, and Japan; in other words, *P. brevispinosus* occurs to the northwest of *P. quadridens* (see Fig. 162). The differences between the workers of the two species are as follows: The dorsal surfaces of the head and the alitrunk possess scattered foveolate punctures in *P. quadridens* but foveolate-reticulate sculpture or rugoreticulum in *P. brevispinosus*.

Characters separating *P. quadridens* from *P. nitidissimus* of New Guinea are presented under *P. nitidissimus*. A discussion of separating *P. quadridens* from the Asian *P. collinus* and *P. flatus* is provided under *P. flatus*. The separation of *P. quadridens* from the African *P. africanus* is given under the latter name. The three Australian species, *P. wheeleri*, *P. erythropygus*, and *P. quadridentatus*, differ from *P. quadridens* in the workers in having three strong teeth on the anterior clypeal margin, three teeth on the masticatory margin of the mandible, longer pronotal armaments, palp formula of 2,2, and lacking foveolate punctures on the dorsal surfaces of the head and the alitrunk.

Material Examined (MCZC, BMNH, ANIC, LAMN, USNM, NHMV, BMHH). Papua New Guinea: Gulf Prov., Ivimka Camp, Lakekamu Basin, 7.7°S, 146.8°E, 120 m el, lowland wet forest, #96-205, #96-232 (nest in rotting tree limb), #96-234 (misc. strays), #96-300 (in rotten branch on ground), #96-330 (foragers on log) (R. R. Snelling); N. Dist., Sangara (P. M. Room); N. Dist., 12 m N Popondetta (B. B. Lowery); Brown R., rainforest, lowland (B. B. Lowery); Bewani Rd. near Vanimo ca. 7 to 10 km, 240 to 380 m, rain-

Figure 162. Distributions of *Pristomyrmex brevispinosus* and *Pristomyrmex quadridens*.

forest (W. L. Brown); ca. 12 km SE Vanimo, virgin hill, rainforest, 150 m (W. L. Brown); Nadzab, dry evergreen forest (E. O. Wilson); Huon Peninsula, Lower Busu R., lowland rainforest (E. O. Wilson); near Dobodura, Samboga R. 400 ft, rainforest (B. B. Lowery); Bulolo 2600 ft, rainforest (B. B. Lowery); 12 mi N of Popondetta, Bisicocoa Plan., 400 ft, rainforest (B. B. Lowery); Lae, Busu R. area, rainforest (B. B. Lowery); Lae, Markham R. Bridge, rainforest (B. B. Lowery); near Lae, <50 m (R. W. Taylor); ca. 16 km NW Lae, "Timber Track", ca. 220 m, rainforest, ex rotting log (R. W. Taylor); Hayfield near Maprik ca. 150 m (R. W. Taylor); 13 km NW Lae, Bubia, lowland rainforest (E. O. Wilson); Finsch Harbor (L. Wagner); Maffin Bay (E. S. Ross); Hollandia (H. A. Levy); NW Japan I., SSE Sumberbaba, Dawai R., jungle (H. Holtmann). Indonesia: Amboina, Ambon (Mann); N. C. Seram, Manusela N.P., Wae Mual Plain (M. J. D. Brendell); Seram, above Haruru, near Masohi, 50 to 150 m, rainforest (W. L. Brown); Irian Jaya, km 12 S of Sorong, forest fragment (W. L. Brown); Irian Jaya, PT. Freeport Concession, Siewa Camp., 03.04°S, 136.38°E, 200 ft, lowland second rainforest, #98-33 and #98-48 (on rotten log), #98–63 (strays in leaf litter), #98-83 (under loose bark of log, Venom Voucher) (R. R. Snelling). Micronesia: Ponape Is., Mt. Kubersoh, 1,900 ft (P. A. Adams); Ponape Is., S. E., Tolotom, 1,700 ft (P. A. Adams); Ponape Is., Mt. Dolennankap, 1,700 to 2,000 ft (H. K. Townes); Ponape Is., near Colonia (Townes); Pohnpei, Malen, above Kepirohi Falls, 350 m (Ron Close); Pohnpei, Mall Island, in coconut husk litter (Ron Clouse); Pohnpei, Quarter Mile, upriver from Mahnd, nest in rotten tree fern stump (Ron Clouse); Pohnpei, above Kepirohi Falls, 350 m, both in rotten log and on bracket fungus (Ron Clouse).

Ecological Information. This species occurs in rainforest and has been collected in litter, in rotten branch, and under the bark of a log.

Pristomyrmex quadridentatus (André)
Figures 163–166, 265, 275

Odontomyrmex quadridentatus André, 1905: 208. Lectotype worker, designated by Taylor (1965: 43), Australia: Sydney (Duchaussoy) (MNHN) (Taylor, 1965). [Note: *Odontomyrmex quadridentatus* André was automatically transferred to *Pristomyrmex quadridentatus* (André), when Forel (1915: 53) designated *Odontomyrmex* as a subgenus of *Pristomyrmex*].

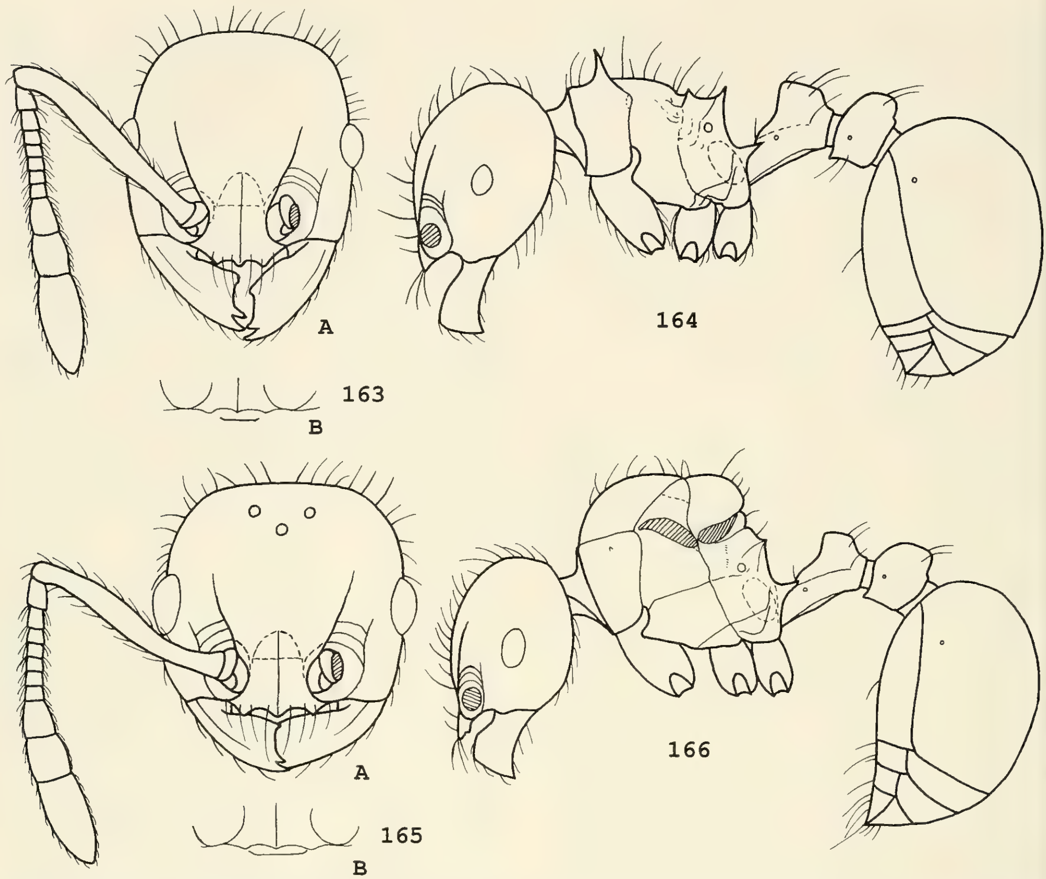
Pristomyrmex (*Odontomyrmex*) *quadridentatus* var. *queenslandensis* Forel, 1915: 53. Syntype workers, Australia: Queensland, Mt. Tambourine, 1913 (Mjöbergs) (MHNG) [examined]. [Synonymy by Taylor, 1965].

Notes: (1) Although I did not examine the lectotype of *P. quadridentatus,* I had access to some specimens that have been compared with it by R. W. Taylor. (2) A lectotype and a paralectotype of *P. quadridentatus,* designated by Taylor, belong to self-colored golden-brown form (Taylor, 1965). But the three syntypes of *P. quadridentatus* var. *queenslandensis,* seen by myself, belong to the bicolored form, with head, gaster, and appendages golden-brown to reddish-brown but alitrunk, petiole, and postpetiole dark-brown. (3) Taylor (1965) mentioned that "judging from subsequent records the Sydney type-locality may be outside the true range of this species and should be regarded with reservation as a distributional record until confirmed."

Diagnosis (Worker). Pronotal spines ca. 0.15 to 0.24, much longer and more robust than propodeal armaments (ca. 0.06–0.09); dorsal surfaces of head and alitrunk smooth and shining, but a transverse ridge present at the approximate position of metanotal groove; petiole node and postpetiole each with at least one pair of erect or suberect hairs; ventral surface of clypeus usually with a long transverse ridge.

Worker. TL 3.34–4.42, HL 0.86–1.12, HW 0.80–1.08, CI 93–101, SL 0.86–1.16, SI 97–113, EL 0.16–0.20, PW 0.52–0.67, AL 0.83–1.10, PPW 0.22–0.26, PPL 0.22–0.28, PPI 93–109 (n = 52).

Mandibles usually smooth and shining but sometimes with a few longitudinal rugae, varying from superficial to distinct. Masticatory margin of mandible with three teeth arranged as the strongest apical + the second strongest preapical + a long diastema + a truncated basal tooth. Basal margin of mandible almost straight, lacking a toothlike prominence. Clypeus with a strong median longitudinal carina. Anterior clypeal margin with three teeth: a median tooth and one on each side. Ventral surface of clypeus usually with a long transverse ridge but sometimes showing only two toothlike prominences. Palp formula 2,2. Frontal carinae usually extend-



Figures 163–166. *Pristomyrmex quadridentatus* (André). 163A: Worker head, full-face view; 163B: Showing a transverse ridge on the ventral clypeus; 164: Worker, lateral view; 165A: Queen head, full-face view; 165B: Showing a transverse ridge on the ventral clypeus; 166: Queen, lateral view.

ing to the level of the posterior margins of eyes, but sometimes they are not so. Weak scrobal impressions present lateral to the frontal carinae. Frontal lobes weak; thus, the antennal articulations are almost entirely exposed. Antennal scapes, lying on the dorsal head, slightly surpassing the occipital margin of head. Between the second and seventh funicular segments of antennae, the second is longest. Eyes usually containing seven to eight ommatidia in the longest row. Occipital carina distinct. Profile shape of alitrunk and pedicel segments as in Figure 164. Pronotal spines, ca. 0.15 to 0.24, much longer and more robust than propodeal armaments, which are a pair of teeth or short spines (ca. 0.06–0.09). Metapleural lobes usually elongate-triangular, usually longer than propodeal armaments. Petiole node in profile, with the anterodorsal angle higher than the posterodorsal; in dorsal view, crest of the node convex. Anterior and dorsal faces of the postpetiole in profile forming a single curved surface. Postpetiole in dorsal view broadening from front to back. Dorsum of head smooth and shining, except for a short carina present below the antennal scrobe, subparallel to frontal carina. Dorsum of alitrunk smooth and shining, with a distinct transverse carina on the anterior margin of the pronotum and a transverse ridge present at the approximate position of metanotal groove. Petiole and postpetiole smooth and shining. Gaster unsculptured. Dorsal surfaces of head and alitrunk with numerous erect or suberect hairs. Petiole node and postpetiole each with bilaterally distributed hairs, as shown in Figure 164. First gastral tergite lacking erect or suberect hairs. A few pairs of forward-projecting hairs present near the anterior clypeal margin. Scapes and tibiae with some erect to suberect short hairs. Body self-colored (golden-brown) or bicolored (i.e., head, gaster, and appendages golden-brown to reddish-brown but alitrunk and pedicel segments blackish-brown).

Queen. TL 3.56–5.02, HL 0.93–1.16, HW 0.90–1.12, CI 93–100, SL 0.93–1.12, SI 96–103, PW 0.68–0.82, AL 1.02–1.30, PPW 0.29–0.32, PPL 0.28–0.36, PPI 89–111 (n = 7).

General shape as in Figures 165–166, with normal caste differences from the conspecific worker; pronotum with a pair of tubercles or minute teeth or sometimes unarmed; propodeum with a pair of tubercles or minute teeth; other characters similar to worker.

Male (Figs. 265, 275). Four male specimens are examined; two of them, collected in New South Wales (New England Nat. Park, Platypus Creek, STRF) by Nicholls, were originally mounted with two and three self-colored workers, respectively; one male, collected in SE Queensland (Rathdowney, Lever's Plateau, Philp's Farm) by J. B. Williams, and one in Queensland (National Pk.), by F. A. Perkins, were originally mounted with a bicolored worker, respectively.

TL 3.63–4.14, HL 0.60–0.68, HW 0.62–0.72, CI 103–106, SL 0.22–0.26, SI 34–37, HWE 0.84–0.93, EL 0.32–0.34, PW 0.82–0.86, AL 1.22–1.36, PPW 0.24–0.28, PPL 0.26–0.30, PPI 92–100 (n = 4).

Head, including the eyes, distinctly broader than long. Clypeus convex, lacking a median longitudinal carina, but with several short rugae present on the posterior clypeal margin. Anterior clypeal margin straight. Palp formula 2,2; the second segments of maxillary and labial palps rather long. Frontal carinae absent. Maximum diameter of the median ocellus 0.08 to 0.10. On the mesoscutum, notauli absent or weakly impressed or fairly distinct; parapsidal furrows absent or superficially impressed. Scuto-scutellar sulcus with 15 to 16 low, short ridges. Propodeum lacking armaments. Metapleural lobes subtriangular. Middle and hind tibiae without any spurs. Petiole node in profile low and rounded dorsally, with a long anterior peduncle. Postpetiole low, in dorsal view usually longer than rarely as long as broad. Posterior face of postpetiole almost entirely attached to the first gastral segment. Dorsum of head smooth and shining, but frontal area usually with a median longitudinal carina. Alitrunk smooth and shining, except for those marked sutures. Petiole, postpetiole, and gaster smooth and shining. All dorsal surfaces with abundant long hairs. Scapes and tibiae with numerous erect or suberect short hairs. Color reddish-brown to blackish-brown; wings infuscated.

Comments and Discussion. Pristomyrmex quadridentatus occurs in Australia. It is closely related to *P. wheeleri,* also from Australia. The workers of the two species share the following critical characters: (1) the masticatory margin of mandible with three teeth arranged as an apical + a preapical + a long diastema + a truncated basal tooth; (2) palp formula 2,2; (3) the anterior clypeal margin with three strong teeth; (4) the clypeus with a median longitudinal carina; (5) the pronotum with a pair of fairly long spines; (6) the dorsum of alitrunk smooth and shining but with a transverse carina present at the approximate position of metanotal groove; and (7) first gastral tergite lacking erect or suberect hairs. *Pristomyrmex quadridentatus* differs from *P. wheeleri* in the workers and queens, as follows:

P. quadridentatus

Propodeum with a pair of teeth or short spines, ca. 0.06 to 0.09, much shorter than pronotal spines (worker). Propodeum tuberculate (queen)

Ventral face of clypeus with a long transverse ridge or two toothlike prominences (worker and queen)

Head relatively narrow (worker: CI 93–101, HW 0.80–1.08; queen: CI 93–100, HW 0.90–1.12)

Pronotum unarmed or with a pair of minute teeth (queen)

P. wheeleri

Propodeum with a pair of fairly long spines, ca. 0.18 to 0.28, about equal in length to or longer than pronotal spines (worker); propodeum with a pair of spines (queen)

Ventral center of clypeus usually with a short transverse carina; sometimes, this carina weak or indistinct (worker and queen)

Head relatively broad (worker: CI 103–116, HW 0.97–1.34; queen: CI 107–115, HW 1.18–1.42)

Pronotum armed with a pair of acute short spines (queen)

Characters separating *P. quadridentatus* from *P. erythropygus*, from the two African species *P. africanus* and *P. trogor*, and from the two Oriental species *P. flatus* and *P. collinus* are provided under *P. erythropygus*, under *P. africanus*, and under *P. flatus*, respectively.

Taylor observes that there are two color forms of *P. quadridentatus*. One is a uniform reddish-brown and occupies the southern portion of its geographic range. The other is bicolored (head, gaster, and appendages reddish-brown but alitrunk, petiole, and postpetiole dark-brown) and occurs in more northern localities. Taylor found no evidence of sympatry of the two forms; thus, he postulated that the bicolored form might be result of character displacement where *P. quadridentatus* co-occurs with *P. wheeleri* (Taylor, 1965, 1968). However, six specimens, collected by P. Ward in 1976, have the same records of locality (New South Wales: Whian Whian, SF, 28.39S/153.20E, rainforest, 200 m). The six specimens consists of two workers of each color form of *P. quadridentatus* and two workers of *P. wheeleri*. This collection implies that two forms of *P. quadridentatus* partly overlap in their distribution (in other words, character displacement is not the cause of the bicolored form in areas of sympatry with *P. wheeleri*). Of course, these data need to be further confirmed because they come from the labels on only a few specimens.

Taylor (1965) also proposed that the two color forms "might prove ultimately to be good biological species", although there are no other detectable morphological differences between them. This question will be clarified by further collecting: If the two forms are never found to coexist in the same colony, they represent two good species; otherwise, they belong to the same species. (Note: To date, these two forms have not been collected in the same colony.)

The larva of *P. quadridentatus* was described by Wheeler and Wheeler (1973).

Material Examined (ANIC, MCZC). Self-colored form: Australia: New South Wales: Grafton, Pt. lookout, rainforest (P. F. Darlington); New England National Park, Platypus Crk., STRF, in log (Nicholls); Dorrigo, 3,000 ft (W. Heron); Dorrigo NP, W end, Blackbutt Tr., subtropical rainforest, 790 m (A. Newton and M. Thayer); East foot hills, Barrington Tops near Cobark, rainforest, 400 ft (B. B. Lowery); Brunswick Heads, faunal reserve, RF, sea level, under bark sheath of Bangalow Palm (B. B. Lowery); Macksville, Warrell Crk. area, RF valley, 150 ft, red rotten log (B. B. Lowery); ca. 5 mi NW of Bruxner Pk. (D. H. Colless); Upr. Allyn Val. near Eccleston, rainforest, ca. 2,000 ft, ex rotten log and nocturnal strays (Taylor and Brooks); Whian Whian, SF, 28.39°S, 153.20°E, rainforest, 200 m, ca. 8 m above ground, in epiphytic fern on tree, acc. no. 1721, 17.vi.1976 (P. Ward); Coffs Harb., Bruxner Pk., ca. 70 m (R. W. Taylor); Royal Nat. Park, rainforest, 50 m, 34.09°S/151.01°E, ex rotten log (P. Ward). Bicolored form: Australia: Queensland: Mt. D'Aguilar Range, 2,000 ft, ex rotten log (R. W. Taylor); Stradbroke Is. (H. Hacker); Tamborine Mt. (A. M. Lea); Tamborine Mt., 1,800 ft (W. L. Brown); Tamborine Mt., Cedar Creek, rotting logs (W. L. Brown); Tamborine Mt., near Witches Falls, 27.57°S, 153.10°E (R. J. Kohout); Tamborine Mt., RF, 2,000 ft, rotten log (B. B. Lowery); 6 km SSW North Tamborine, 27°56′S/153°11′E, 500 m, #9828 (P. S. Ward); Binna Burra: 2,600 ft, rotten logs (R. W. Taylor); Lamington N.P., Coomera Gorge, ex rotten log (R. W. Taylor); Below Springbrook, Upper Tallebudgera Ck, RF, 550 m (Monteith, Thompson and Cook); Numinbah Arch, rainforest, 1,500 ft, ex rotten log (B. B. Lowery); Joalah Nat. Park, 27.55°S, 153.12°E, ca. 380 m (R. W. Taylor and R. Kohout); Rathdowney, Lever's Plateau, Philp's Farm (J. B. Williams); National Park (F. A. Perkins); Cooloola, rainforest (P. J. M. Greenslade). New South Wales: Wiangaree SF, Brindle Ck., 740 m, subtropical rainforest (A. Newton and M. Thayer); Mt. Warning, rainforest, ex rotten log (B. B. Lowery); Mt. Warning, rainforest, ca. 1,000 ft, under bark sheath of Bangalow Palm (B. B. Lowery); Nobby's Crk., 10 mi NW Murwillumbah, rainforest, ca. 1,500 ft, under bark sheath of Bangalow Palm (B. B. Lowery); Whian Whian SF, 28.39°S, 153.20°E, 200 m, acc. no. 1709, 16.vi.1976 (P. Ward); Tomewin, rainforest, 1,200 ft, on Trunk of fig, 8 ft off ground, (B. B. Lowery); Acacia Plateau (J. Armstrong); 14 km W Urbenville, Tooloom Plateau, 28.29°S/152.24°E (I. D. Naumann).

Ecological Information. This species occurs in rainforest. It forages nocturnally in the open on logs, tree trunks, and low foliage. Nests are located in rotting logs and under the bark sheaths of Bangalow palms (Taylor, 1965, 1968).

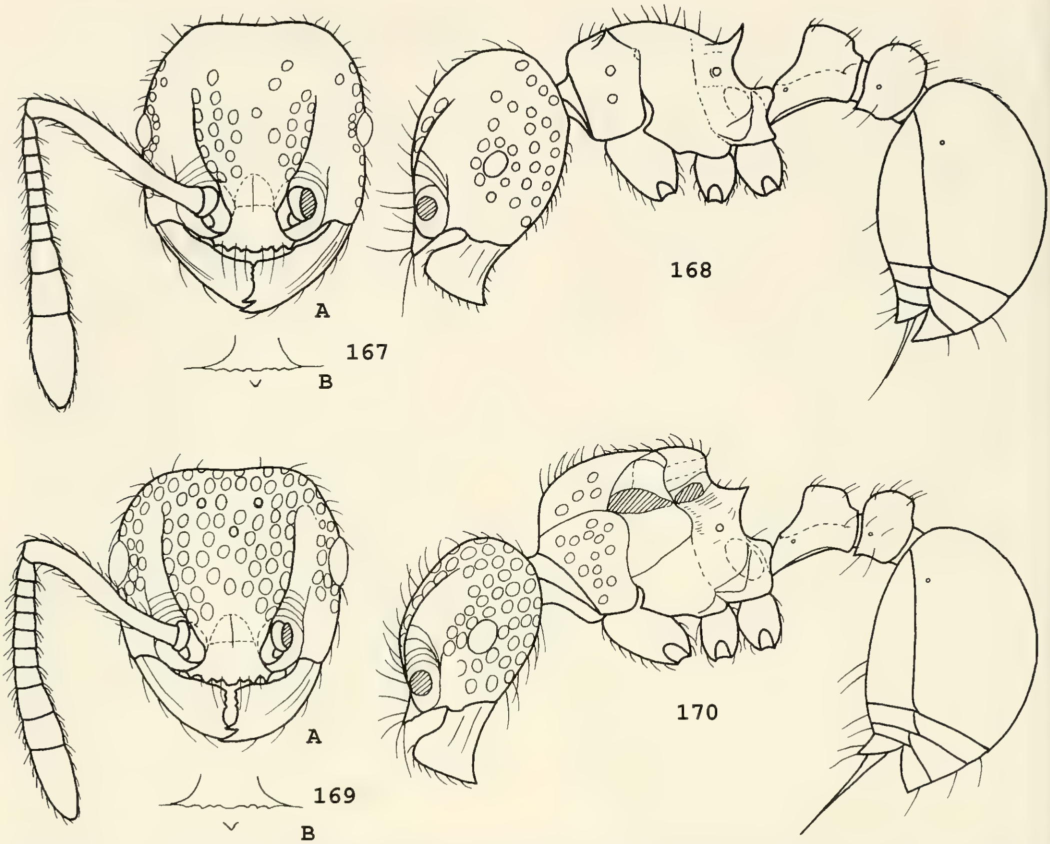
Pristomyrmex quindentatus **sp. n.**
Figures 167–170

Diagnosis (Worker). Masticatory margin of mandible with five teeth; pronotum with a pair of triangular teeth; dorsal surfaces of head and alitrunk with scattered foveolate punctures.

Holotype Worker (MCZC). TL 3.54, HL 0.86, HW 0.84, CI 98, SL 0.79, SI 94, EL 0.12, PW 0.56, AL 0.83. Paratypes, five workers and two queens (MCZC).

Worker. TL 3.10–3.54, HL 0.81–0.86, HW 0.79–0.84, CI 96–98, SL 0.76–0.80, SI 94–100, EL 0.11–0.12, PW 0.53–0.56, AL 0.78–0.86, PPW 0.22–0.23, PPL 0.21–0.22, PPI 100–105 (n = 6).

Mandibles smooth and shining, except for a few longitudinal rugae. Masticatory margin of mandible with five teeth arranged as the strongest apical + the second strongest preapical + a diastema + three small denticles of similar size (sometimes three small denticles are fused together so that they are not clearly visible; or, one of them is weak or worn down, but the length of diastema is slightly shorter than the distance covered by these three teeth). Basal margin of mandible lacking toothlike prominences. Clypeus depressed and smooth, but the median carina of the frontal area extending a little to the clypeus. Anterior clypeal margin usually with a broad, truncated median denticle and two to three others on each side. Ventral center of clypeus with a prominent tooth. Palp formula 1,3. Frontal carinae strong, extending to the level of the posterior margins of eyes. Slightly impressed scrobal areas present lateral to the frontal carinae. Frontal lobes weak; thus, the antennal articulations are almost entirely exposed. Antennal scapes, laid on the dorsal head, just surpassing the occipital margin of head. Eyes moderately sized. Occipital margin feebly concave. Pronotum with a pair of triangular teeth. Propodeum with a pair of short spines that are about two to three times the length of pronotal armaments. Metapleural lobes somewhat rounded.



Figures 167–170. *Pristomyrmex quindentatus* **sp. n.** 167A: Worker head, full-face view; 167B: Showing a tooth on the center of ventral clypeus; 168: Worker, lateral view; 169A: Queen head, full-face view; 169B: Showing a tooth on the center of ventral clypeus; 170: Queen, lateral view.

Petiole node in profile with a fairly long anterior peduncle; its anterodorsal angle is on a higher level than the posterodorsal (Fig. 168). Postpetiole in profile rounded dorsally, in dorsal view about quadrate. Dorsum of head, except for the shallow scrobes, with numerous scattered foveolate punctures. Dorsum of alitrunk possessing scattered foveolate punctures, usually with a smooth and unsculptured median strip. Petiole smooth and shining, with a weak longitudinal ruga on each side. Postpetiole and gaster unsculptured. Dorsal surfaces of head and alitrunk with numerous erect or suberect short hairs. Two pairs of hairs usually present on the dorsum of petiole node, and a few pairs on the dorsum of postpetiole, as illustrated in Figure 168. First gastral tergite lacking or bearing few suberect hairs. A few pairs of forward-projecting hairs present near the anterior clypeal margin. Scapes and tibiae with numerous erect to suberect short hairs. Color reddish-brown.

Queen. TL 3.64, 3.70; HL 0.83, 0.83; HW 0.82, 0.83; CI 99, 100; SL 0.72, 0.78; SI 88, 94; EL 0.18, 0.19; PW 0.64, 0.64; AL 0.97, 1.00; PPW 0.23, 0.23; PPL 0.22, 0.23; PPI 100, 105 (n = 2).

Generally similar to worker, except for normal caste differences. In addition, pronotum unarmed; propodeal armaments toothlike, shorter than those in the conspecific worker, and the dorsum of alitrunk lacking an unsculptured median longitudinal strip.

Male. Unknown.

Comments. Pristomyrmex quindentatus is closely related to *P. occultus.* The two species occur in the Oriental region. Their workers share a critical character, that is, the masticatory margin of mandible with an apical tooth + a preapical tooth + a diastema + three small denticles of similar size; this dentition is not seen in all other *Pristomyrmex* species, except in *P. eduardi.* But *P. quindentatus* and *P. occultus* can be separated from *P. eduardi* in the workers in having a pair of pronotal teeth.

The worker of *P. quindentatus* differs from that of *P. occultus* as follows:

P. quindentatus
- Dorsal surfaces of head and alitrunk only with scattered, shallow foveolate punctures; dorsum of alitrunk with an unsculptured median longitudinal strip
- Anterior clypeal margin with a truncated median tooth
- A lateral carina lacking or vestigial on each side of the petiole node
- SL 0.76–0.80, SI 94–100

P. occultus
- Dorsal surfaces of head and alitrunk entirely covered with coarse rugoreticulum
- Median tooth on the anterior clypeal margin not truncated
- Petiole node with a lateral longitudinal carina on each side
- SL 0.72–0.75, SI 87–93

Pristomyrmex quindentatus may have evolved from the ancestor of *P. quadridens. Pristomyrmex quindentatus* can be separated from *P. quadridens* as follows: the masticatory margin of the mandible possesses five teeth in the workers and queens of *P. quindentatus* but at most four teeth in *P. quadridens*; in addition, the propodeum is armed with a pair of short spines in the workers of *P. quindentatus* but a pair of teeth in *P. quadridens.*

Holotype Worker. Indonesia: Seram, above Haruru, near Masohi, rainforest, 50 to 150 m, 18.iii.1981 (W. L. Brown).

Paratypes. Five workers and two queens with same data as holotype.

Additional Material Examined (MCZC). A worker collected in Indonesia (Blawan, Idjen, Dammerman, 950 m) has the following measurements: TL 3.50, HL 0.97, HW 0.95, CI 99, SL 0.84, SI 88, EL 0.14, PW 0.62, AL 0.94. It shows some variation: (1) The propodeum is armed with a pair of triangular teeth, (2) the dorsum of the head possesses dense foveolate punctures, (3) a longitudinal carina is present on each side of the petiole, and (4) three small denticles on the masticatory margin of the mandible are worn down and are not clearly visible.

Ecological Information. This species has been collected in rainforest.

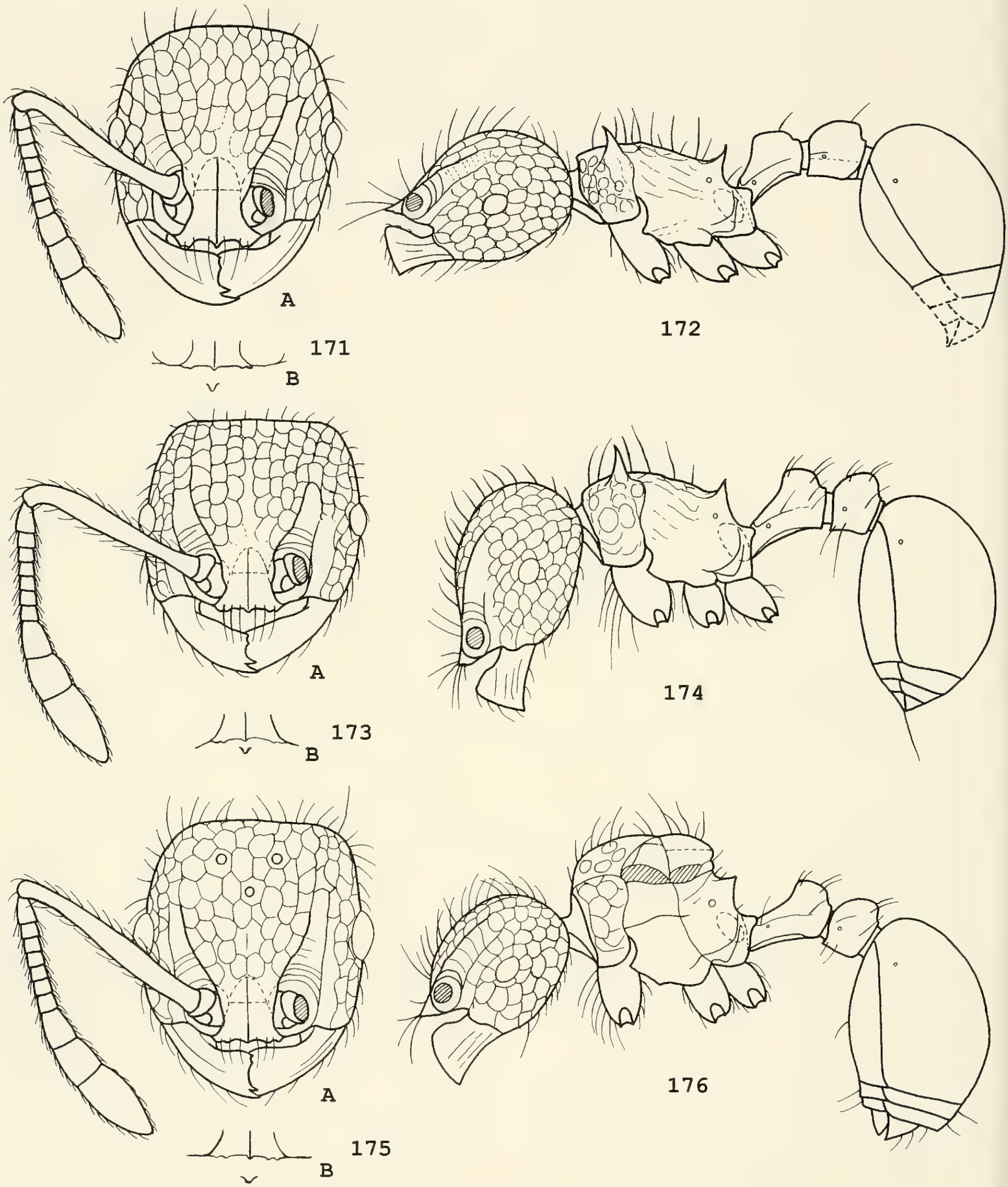
Pristomyrmex sulcatus Emery stat. n.
Figures 171–176, 266, 276

Pristomyrmex brevispinosus sulcatus Emery, 1895: 464. Syntype workers, queen, Burma: Carin Cheba, 500 to 1,000 m, xii.1887 (L. Fea) [syntype workers (MCSN, NHMV) examined].

Diagnosis (Worker). Ventral surface of clypeus with a strongly prominent tooth at the center; pronotum with a pair of moderately long spines (0.14–0.20), usually longer than propodeal armaments (0.07–0.13); dorsum of head with foveolate-reticulate sculpture or rugoreticulum; petiole node lacking foveolate punctures; first gastral tergite lacking erect or suberect hairs.

Worker. TL 3.98–4.74, HL 0.98–1.16, HW 0.96–1.10, CI 93–105, SL 1.02–1.15, SI 101–111, EL 0.14–0.19, PW 0.64–0.75, AL 0.98–1.18, PPW 0.26–0.30, PPL 0.26–0.32, PPI 90–100 (n = 30).

Mandibles usually with some longitudinal rugae, varying from superficial to distinct. Masticatory margin of mandible with four teeth arranged as the strongest apical + the second strongest preapical + a long diastema + two small basal teeth of similar size that are fused together. Basal margin of mandible almost straight, lacking a distinctly convex lobe or tooth. Clypeus with



Figures 171–176. *Pristomyrmex sulcatus* Emery. 171A: Syntype worker head, full-face view; 172: Syntype worker, lateral view; 173A: Non-type worker head, full-face view; 174: Non-type worker, lateral view; 175A: Queen head, full-face view; 176: Queen, lateral view; 171B, 173B and 175B: Showing that a prominent tooth is present on the ventral center of the clypeus in the syntype worker, non-type worker and queen, respectively.

a median longitudinal carina. Anterior clypeal margin with a median denticle and two to three others on each side; but sometimes two lateral denticles are fused into a larger tooth. Ventral center of clypeus with a strongly prominent tooth. Palp formula 1,3. Frontal carinae strong, extending to the level of the posterior margins of eyes, forming the dorsal margins of the shallow antennal scrobes. Frontal lobes very weak; thus, the antennal articulations are almost entirely exposed. Antennal scapes, when lying on the dorsal head, slightly surpassing the occipital margin. Eyes usually containing six to seven ommatidia in the longest row. Profile shape of alitrunk and pedicel segments as in Figures 172 and 174. Pronotum with a pair of spines, varying in length from 0.14 (in the type series) to 0.20. Propodeum with a pair of teeth or short spines varying from 0.07 to 0.13. Metapleural lobes subtriangular or somewhat rounded. Petiole node in profile high, with a fairly long anterior peduncle; its anterodorsal angle is on a higher level than the posterodorsal. Postpetiole in profile rounded dorsally, in dorsal view broadening from front to back, about as long as or slightly longer than broad. Dorsum of head, except for the scrobal areas where rugae are somewhat weak, with course rugoreticulum or dense alveolate punctures. Similar but slightly sparse sculpture present on the dorsum of alitrunk and often on the two sides of pronotum. Petiole, postpetiole, and gaster smooth and shining. Dorsal surfaces of head and alitrunk with numerous erect or suberect hairs. Usually, two pairs of hairs present on the dorsum of petiole node and one to two pairs on the dorsum of postpetiole. First gastral tergite lacking erect or suberect hairs. A few pairs of forward-projecting hairs present near the anterior clypeal margin. Scapes and tibiae with some erect to suberect hairs. Color reddish-brown.

Queen. TL 4.26–5.00, HL 0.98–1.10, HW 1.00–1.14, CI 102–106, SL1.01–1.12, SI 98–101, EL 0.22–0.26, PW 0.77–0.90, AL 1.16–1.30, PPW 0.28–0.32, PPL 0.29–0.32, PPI 97–100 (n = 4)

General shape as in Figures 175–176, with normal caste differences from the conspecific worker; pronotum usually unarmed but rarely with a pair of minute spines. Other characters similar to worker. The queens of *P. sulcatus* are almost indistinguishable from those of *P. brevispinosus* at present.

Male (Figs. 266, 276). One male specimen (MCZC), collected in Thailand (Nakhon Ratchasima Prov., Khao Yai Nat. Park, 750 m, hill forest) by I. Burikam and W. L. Brown, was originally mounted with a worker on the same pin; it has the following measurements: TL 3.90, HL 0.58, HW 0.61, CI 105, SL 0.22, SI 36, HWE 0.83, EL 0.33, PW 0.82, AL 1.18, PPW 0.24, PPL 0.24, PPI 100 (n = 1).

Head, including the eyes, distinctly broader than long. Clypeus convex, without a median longitudinal carina. Palp formula 1,3. Frontal carinae weak and short, just reaching the level of the posterior margins of antennal insertions. Maximum diameter of the median ocellus 0.10. On the mesonotum, notauli strongly marked, forming a Y shape; parapsidal furrows absent. Scuto-scutellar sulcus rather broad, with 10 ridges that expand at the upper end. Propodeum slightly tuberculate, lacking teeth or spines. Metapleural lobes subtriangular. Middle and hind tibiae without any spurs. Petiole node in profile low, with a fairly long anterior peduncle. Postpetiole low, in dorsal view about as long as broad. Dorsum of head generally smooth and shining but with a median longitudinal carina present on the frontal area and several short rugae on the posterior clypeal margin. Alitrunk smooth and shining, except for those marked sutures. Petiole, postpetiole, and gaster smooth and shining. All dorsal surfaces with abundant erect or suberect hairs. Scapes and legs with erect or suberect short hairs. Body reddish-brown; funicular segments of antennae white and wings slightly light-yellow. At the present, the male of *P. sulcatus* is almost indistinguished from the males of *P. brevispinosus* and *P. quadridens*.

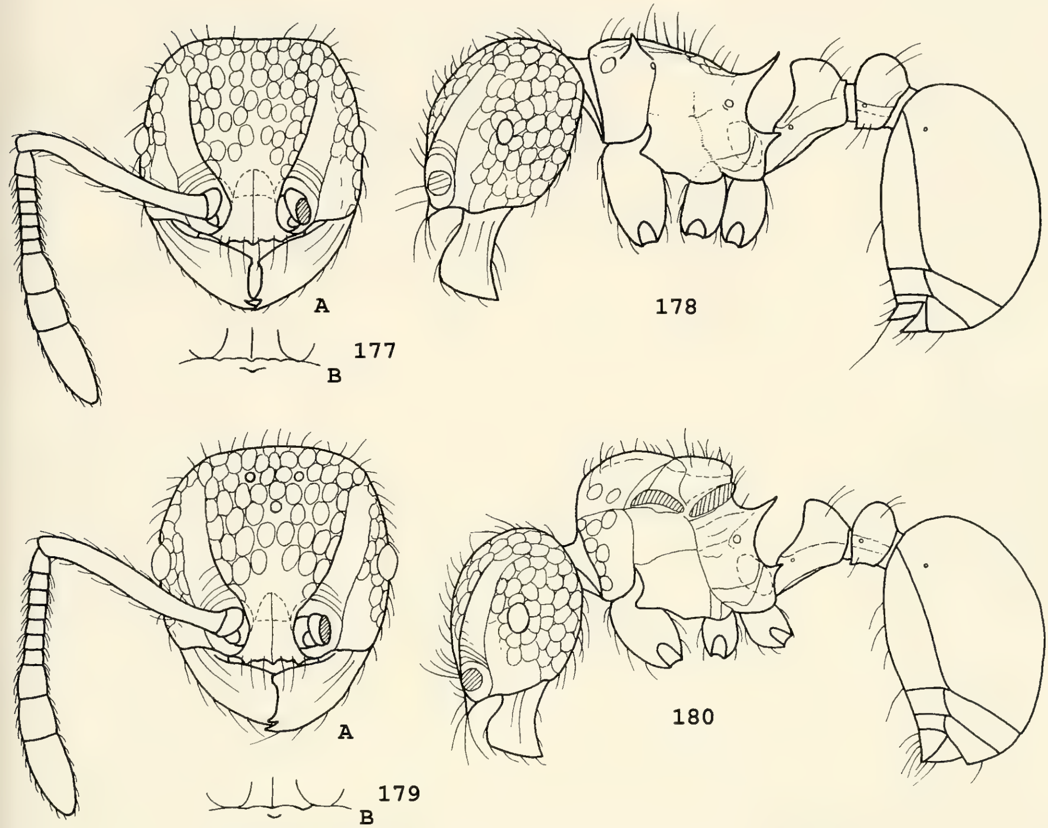
Discussion and Comments. Taxonomic status of "*sulcatus*" is somewhat complicated. The syntype workers of *P. brevispinosus sulcatus* differ from those of *P. brevispinosus* by possessing a pair of fairly long pronotal spines (0.15–0.16), as compared with a pair of teeth (0.06) in the latter. However, after examining all available material, I find that the length of the pronotal armaments is continuously variable (from 0.06, as in the syntypes of *P. brevispinosus,* to 0.20, as in the specimens from Khao Yai Nat. Park, Thailand). The syntype workers of "*sulcatus*", in fact, are intermediates between the two extreme ends (i.e., in one extreme, the pronotal teeth are slightly shorter than or about as long as the propodeal teeth; in the other extreme, the pronotal spines are two to three times as long as the propodeal armaments; see Figs. 114, 172, 174). I keep "*sulcatus*" as a valid name (i.e., raise it to the rank of species instead of assigning it as a junior synonym of *P. brevispinosus*) because more ecological work must be done before the status of "*sulcatus*" becomes clarified. With this tentative proposal, *P. sulcatus* comprises those populations with pronotal spines (ca. 0.14–0.20), distributed in Pahang (1,300–1,720 m), Malaya, and in northwest and central Thailand, Burma, Nepal, and southwest China. *Pristomyrmex brevispinosus* comprises populations with toothlike pronotal armaments (ca. 0.06–0.10), occurring in Pahang (1,250 m), Malaya, and Trang Province of South Thailand (07.55°N) and in the Philippines, Taiwan, and Japan. In other words, *P. sulcatus* may be a northerly replacement of *P. brevispinosus* along the Malay peninsula.

The separation of *P. sulcatus* from *P. costatus* is provided under *P. costatus*. The worker of *P. sulcatus* differs from that of *P. hirsutus* by its petiole node with the anterodorsal angle higher than the posterodorsal and its first gastral tergite lacking erect or suberect hairs. The worker of *P. sulcatus* differs from that of *P. modestus* by its petiole node higher than long and lacking distinct foveolate punctures. The worker of *P. sulcatus* differs from that of *P. occultus* by its masticatory margin of the mandible possessing at most four teeth and its propodeal armaments not longer than the pronotal spines. The queen of *P. sulcatus* differs from that of *P. bicolor* by possessing a strongly prominent tooth on the ventral center of the clypeus. The worker and queen of *P. sulcatus* differ from those of the Australian *P. foveolatus* and *P. thoracicus* as follows:

P. sulcatus
- Pronotal spines longer than or about as long as the propodeal armaments (worker)
- Propodeum with a pair of teeth (Fig. 176) (queen)
- Maxillary palp with one segment (worker and queen)

P. foveolatus **and** ***P. thoracicus***
- Pronotal spines much shorter than the propodeal spines (worker)
- Propodeum with a pair of fairly long spines (Figs. 143, 180) (queen)
- Maxillary palp with two segments (worker and queen)

Material Examined (ANIC, BMNH, IZAS, LACM, MCZC, MHNG, NHMV, USNM). Thailand: Nakhon Ratchasima Prov., Khao Yai Nat. Park, 700 to 750 m, hill forest, rotten wood (I. Burikam and W. L. Brown); Khao Yai Nat. Park (Löbl and Burckhardt); Chiang Mai (54 km NE Chiang Mai), Mae Nang Kaeo, 900 m (Burckhardt and Löbl); Chiang Mai Pr., Doi Suthep NP (7), near Ruesse Care, 900 to 1,000 m (Zettel); Chiang Mai Prov., Chiang Dao Wildlife Sanctuary, 19.22°N 98.97°E, 470 to 500 m elevation (Saowana Sonthichai). Nepal: Khandbari District, Arun River at Num 1,500 to 1,600 m (A. and Z. Smetana). Burma: Carin Cheba (L. Fea). China, Yunnan Prov. (?). W. Malaysia: Pahang, Cameron Highls, Gunung Jasar, 1,720 m (Löbl and Calame); Malaysia: Pahang, Cameron Highlands, Tanah Rata



Figures 177–180. *Pristomyrmex thoracicus* Taylor. 177A: Worker head, full-face view; 177B: Showing a tooth on the center of ventral clypeus; 178: Worker, lateral view; 179A: Queen head, full-face view; 179B: Showing a toothlike prominence on the center of ventral clypeus; 180: Queen, lateral view.

Umg., Gn. Jasar, 1300 m (Schuh and Lang)?: Kabu, 400 ft (Abor Exped.).

Ecological Information. This species has been collected in forests.

Pristomyrmex thoracicus Taylor
Figures 177–180

Pristomyrmex thoracicus Taylor, 1965: 41. Holotype worker, Australia: N. Queensland, Lake Eacham National Park, rainforest, 2,500 ft, 6.vi.1962 (R. W. Taylor) (MCZC) [examined].

Diagnosis (Worker). Pronotum with a pair of triangular short spines (ca. 0.06–0.08); propodeal spines long (ca. 0.19–0.24); dorsum of head, except for the antennal scrobes, with foveolate-reticulate sculpture; postpetiole unsculptured; PPI 109–121; SL 0.86–0.98 and SI 97–103.

Worker. TL 3.22–3.72, HL 0.86–0.96, HW 0.86–0.96, CI 97–101, SL 0.86–0.98, SI 97–103, EL 0.10–0.13, PW 0.54–0.60, AL 0.84–0.96, PPW 0.23–0.26, PPL 0.20–0.22, PPI 109–121 (n = 24).

Mandibles with a few longitudinal rugae. Masticatory margin of mandible with three teeth arranged as an apical + a preapical + a long diastema + a truncated basal tooth. Basal margin of mandible lacking a distinct curved lobe or tooth. Clypeus with a strong median longitudinal carina. Anterior clypeal margin with a median denticle and usually two others on each side, but sometimes two lateral denticles are fused into a larger tooth. Ventral center of clypeus with a low, broad, toothlike prominence. Palp formula 2,3. Frontal carinae well developed, beyond the level of the posterior margins of the eyes. Scrobal areas shallow, present lateral to the frontal carinae in full-face view. Frontal lobes almost completely absent so that the antennal articulations are entirely exposed. Antennal scapes usually slightly surpassing the occipital margin of head when lying in the antennal scrobes. Eyes with five to six ommatidia in the longest row. Profile shape of alitrunk and pedicel segments as in Figure 178. Pronotum with a pair of triangular short spines, ca. 0.06 to 0.08. Propodeal spines long, ca. 0.19 to 0.24, usually slightly upcurved at their apices. Metapleural lobe small-triangular with a rather acute apex. Petiole node in profile higher than long, with a long anterior peduncle, its anterodorsal angle forming an apex and its dorsum sloping downward posteriorly. In dorsal view, crest of petiole node strongly convex. Postpetiole in profile rounded dorsally, in dorsal view broader than long and broadening from front to back. Dorsum of head between the frontal carinae, as well as the two sides of the dorsal head, with foveolate-reticulate sculpture. Antennal scrobes rather smooth, with only a few weak rugae. Dorsum of antennal scape with a longitudinal carina. Dorsum of alitrunk with a rugoreticulum. Petiole and postpetiole smooth and shining. Gaster unsculptured. Dorsal surfaces of head and alitrunk with numerous erect or suberect hairs. Dorsal surfaces of petiole node and postpetiole each with a pair of hairs. First gastral tergite lacking erect or suberect hairs. A few pairs of forward-projecting hairs present near the anterior clypeal margin. Scapes and tibiae with some erect to suberect short hairs. Color reddish-brown.

Queen. TL 3.84–4.10, HL 0.94–0.96, HW 0.94–0.96, CI 100–100, SL 0.94–0.96, SI 98–100, EL 0.16–0.18, PW 0.70–0.72, AL 1.06–1.14, PPW 0.25–0.27, PPL 0.22–0.22, PPI 114–123 (n = 5).

General shape as in Figures 179–180, with normal caste differences from the conspecific worker; pronotum unarmed; crest of petiole node in dorsal view feebly convex; other characters similar to worker.

Male. Unknown.

Comments. *Pristomyrmex thoracicus* is so far known only from North Queensland, Australia. It is a sibling species of *P. foveolatus,* also from North Queensland. Their differences are given under *P. foveolatus.* Characters separating *P. thoracicus* from the Asian *P. brevispinosus,* and from the African *P. cribrarius* (a member of the *cribrarius* group) are provided under *P. foveolatus* and under *P. cribrarius,* respectively.

Material Examined (MCZC, ANIC). Australia: Queensland, Lake Eacham, rainforest, 2,500 ft, nest ex rotten log (R. W. Taylor); N.Q., Kuranda, rainforest, 1,100 ft, stray floor (R. W. Taylor); N.Q., Crawford's Lookout, Beatrice River (Darlingtons); N.Q., Malanda, rainforest, rotten log (W. L. Brown); N.Q., 3.2 km E of Lake Barrine, ca. 700 m, rainforest, ex rotten log (R. W. Taylor and J. Feehan); N.Q., Lake Barrine Nat. Pk., 760 m, 17.15°S, 148.38°E, rainforest, ex rotting log (R. W. Taylor and T. A. Weir); N.Q., Palmerston N.P., ca. 1,000 ft, rainforest, nest in soil under log (R. W. Taylor).

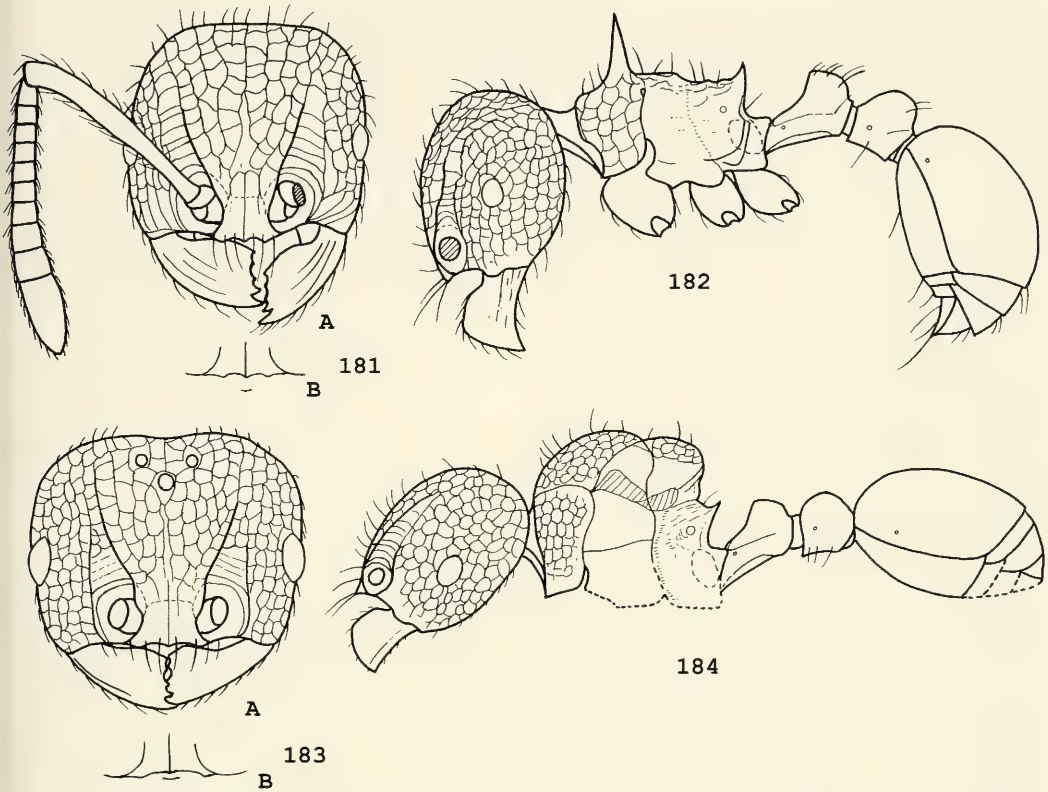
Ecological Information. This species occurs in rainforest nesting in rotting logs and in soil under logs (Taylor, 1965, 1968).

Pristomyrmex trachylissus (F. Smith)
Figures 181–184

Myrmica trachylissa F. Smith, 1858: 126. Holotype queen, Borneo (A. R. Wallace) (BMNH) [examined].

Pristomyrmex trachylissus (F. Smith) Mayr, 1886: 359.

Diagnosis (Worker). Large size (HL > 1.36, HW > 1.45); masticatory margin of mandible with five teeth; pronotum with a pair of exceptionally long spines that are



Figures 181–184. *Pristomyrmex trachylissus* (F. Smith). 181A: Worker head, full-face view; 181B: Showing a short ruga on the ventral clypeus; 182: Worker, lateral view; 183A: Queen head, full-face view, antennae missing; 183B: Showing a short ruga on the ventral clypeus; 184: Queen, lateral view.

about as long as the distance between their bases.

Worker. TL 5.58–6.48, HL 1.36–1.46, HW 1.45–1.62, CI 107–114, SL 1.40–1.50, SI 90–98, EL 0.22–0.24, PW 0.92–1.02, AL 1.50–1.64, PPW 0.35–0.39, PPL 0.44–0.48, PPI 76–83 (n = 6).

Mandibles generally smooth and shining, except for a few superficial rugae. Masticatory margin of mandible with five teeth arranged as the strongest apical + the second strongest preapical + a small third tooth + a short diastema (or this diastema indistinct) + two small basal teeth. Basal margin of mandible with a central, broadly curved lobe. Clypeus with a strong median longitudinal carina. Anterior clypeal margin with a median denticle and a broad prominence on each side. Ventral surface of clypeus generally smooth and shining but sometimes with a weak, short, transverse ruga at the center. Frontal carinae strong, extending to the level of the posterior margins of the eyes. Antennal scrobes shallow, present lateral to the frontal carinae. Frontal lobes weak; thus, the antennal articulations are almost entirely exposed. Antennal scapes, laid on the dorsal head, slightly surpassing the occipital margin of head. Eyes with 10 to 11 ommatidia in the longest row. Profile shape of alitrunk and pedicel segments as in Figure 182. Pronotum armed with a pair of robust, exceptionally long spines, ca. 0.40 to 0.50, about as long as the distance between their bases. Propodeum with a pair of short spines, ca. 0.12 to 0.18, shorter than or at most about as long as the distance between the bases of two propodeal spines. Metapleural lobes each with a somewhat blunt-rounded apex. Petiole node in profile high, with a long anterior peduncle; its anterodorsal angle is on a higher level than the posterodorsal. Postpetiole in profile rounded dorsally, in dorsal view longer than broad and broadening from front to back. Dorsum of head entirely sculptured with well-developed coarse rugoreticulum. Similar sculpture present on the dorsum of alitrunk and on the two sides of pronotum, except for the space between the bases of two pronotal spines, which is rather smooth. Petiole smooth and shining but with a lateral longitudinal carina on each side. Postpetiole and gaster unsculptured, smooth, and shining. Dorsal surfaces of head and alitrunk with numerous erect or suberect hairs. A few pairs of hairs present on the dorsum of petiole node and at least a pair on the postpetiole, as shown in Figure 182. First gastral tergite lacking erect or suberect hairs. A few pairs of forward-projecting hairs present near the anterior clypeal margin. Scapes and tibiae with some erect or suberect hairs. Color reddish-brown, but the masticatory margins and the basal margins of mandibles and the funiculi of antennae black-brown.

Queen. TL 7.55, HL 1.84, HW 2.14, CI 116, SL- (antennal scapes missing), SI-, PW 1.52, AL 2.10 (n = 1).

General shape as in Figures 183–184, with normal caste differences from the conspecific worker; pronotum unarmed; other characters similar to worker.

Male. Unknown.

Comments. Pristomyrmex trachylissus must have evolved from the ancestor of *P. bicolor.* It is extremely similar in appearance of the workers and queens to *P. bicolor.* The two species may occur sympatrically in Sarawak and in Sabah. Their workers and queens can be separated by the following characters:

P. trachylissus

- Masticatory margin of mandible with five teeth; diastema indistinct or very short
- Basal margin of mandible with a central, broadly curved lobe
- Anterior clypeal margin with a median tooth and a broad, short prominence on each side
- SI < 100 (only in worker).

P. bicolor

- Masticatory margin of mandible with four teeth; a long diastema present between the preapical and the third tooth
- Basal margin of mandible lacking a distinctly curved lobe
- Anterior clypeal margin usually with seven denticles, but in some specimens, two or three lateral denticles fused into a broadly convex lobe
- SI > 105 (only in worker).

Material Examined (BMNH, MCZC, ANIC). East Malaysia: Sarawak, 4th Div., G. Mulu Nat. Pk., RGS Expd., Long pala, lowland rainforest, on log and on rotten log (B. Bolton); North Borneo (SE), Forest Camp, 19 km N of Kalabakan 180 m (Y. Hirashima).

Ecological Information. This species occurs in rainforest and has been collected on a rotten log.

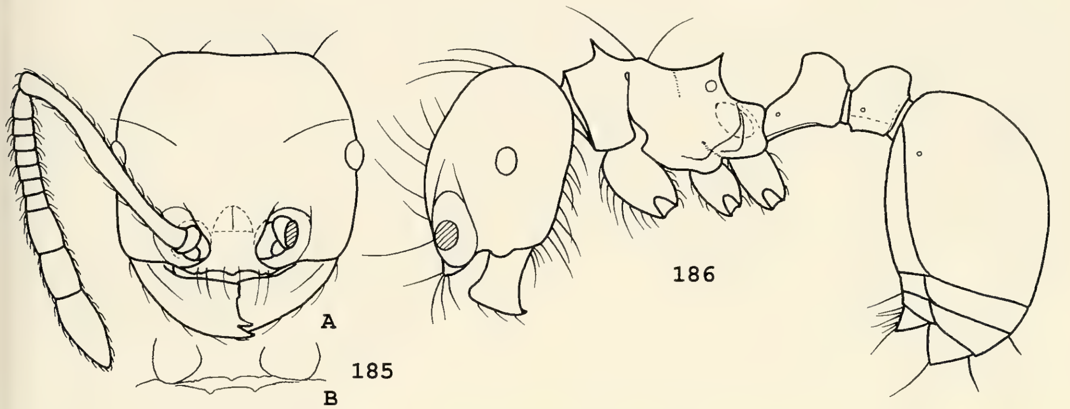
Pristomyrmex trogor Bolton
Figures 185–186

Pristomyrmex trogor Bolton, 1981: 287. Holotype worker, Zaire (B. Congo on the label): S slope of Mt. Kahuzi, 1,900 m, 5.ix.1957 (E. S. Ross and R. E. Leech) [CASC (Bolton, 1981)]; [five paratype workers (MCZC) examined].

Diagnosis (Worker). Frontal carinae absent; ventral surface of clypeus with two toothlike prominences; pronotum with a pair of short spines; dorsal surfaces of head and alitrunk smooth and shining; petiole and postpetiole lacking hairs.

Worker. TL 3.42–3.98, HL 0.88–1.00, HW 0.92–1.02, CI 102–105, SL 0.96–1.06, SI 100–104, EL 0.14–0.16, PW 0.56–0.62, AL 0.84–0.94, PPW 0.23–0.26, PPL 0.22–0.26, PPI 100–106 (n = 5).

Mandibles smooth, with only a few weak longitudinal basal rugae. Masticatory mar-



Figures 185–186. *Pristomyrmex trogor* Bolton. 185A: Worker head, full-face view; 185B: Showing two toothlike prominences on the ventral clypeus; 186: Worker, lateral view.

gin of mandible possessing the strongest apical tooth + the second strongest preapical tooth + a diastema + two small basal denticles that are often fused into a broad, short tooth. Basal margin of mandible lacking a toothlike prominence or curved lobe. Clypeus lacking a median longitudinal carina. Ventral surface of clypeus with two strongly prominent teeth. Anterior clypeal margin with a median tooth and two lateral denticles on each side; sometimes two small lateral denticles are fused into one prominence. Palp formula 2,3 (Bolton, 1981). Frontal carinae absent. Antennal scrobes absent. Frontal lobes indistinct. Antennal scapes, when lying on the dorsal head, just reaching or slightly surpassing the occipital margin of head. Eyes containing five to six ommatidia in the longest row. Promesonotum in dorsal view weakly concave. Pronotum and propodeum each with a pair of short spines (Fig. 186). Metapleural lobes rounded. In profile view, petiole node high, higher than long, with a long anterior peduncle, its anterodorsal angle higher than the posterodorsal. In dorsal view, petiole node about as broad as long. Postpetiole in profile higher than long, rounded dorsally, in dorsal view broadening from front to back. All dorsal surfaces unsculptured, smooth, and shining. Dorsum of head with some fine long hairs. Dorsal surface of alitrunk with only one to two pairs of hairs that arise from the lateral margins of the mesonotum. Petiole node, postpetiole, and first gastral tergite lacking erect or suberect hairs. A row of fine, forward-projecting hairs present near the anterior clypeal margin. Scapes and tibiae with some fine, appressed or decumbent, or suberect hairs. Color reddish-brown.

Queen. Unknown.

Male. One paratype male has the same data as holotype and was originally mounted together with two paratype workers on the same pin: TL 2.92, HL 0.55, HW 0.57, CI 104, SL 0.30, SI 53, HWE 0.74, EL 0.28, PW 0.82, AL 1.16 (n = 1).

Head, including the eyes, distinctly broader than long. Clypeus narrow and convex, its anterior margin rather straight. Frontal carinae absent. Maximum diameter of the median ocellus 0.10. Scapes longer than the other antennal segments, except for the apical ones. On the mesoscutum, notauli distinct, forming a Y shape; parapsidal furrows absent. Scutoscutellar sulcus with about 10 narrow short ridges. Propodeum weakly tuberculate, lacking teeth or spines. Metapleural lobes subtriangular. Middle and hind tibiae without any spurs. Waist abnormally shaped, with a huge segment formed by the fusion of petiole and postpetiole; entire posterior face of the waist attached to first gastral segment. Dorsum of head smooth and shining, but frontal area with a median longitudinal carina; a short ruga present below each antennal socket. Alitrunk generally smooth and shining, except for those marked sutures. Petiole, postpetiole, and gaster smooth and shining. All dorsal surfaces with abundant long hairs. Scapes and tibiae with numerous erect or suberect short hairs. Color somewhat blackish-brown; wings white.

Comments. Pristomyrmex trogor is similar to another African species, *P. africanus,* in many characters of the workers, such as dentition of the masticatory margin of mandible; two teeth present on the ventral clypeus; promesonotum in dorsal view shallowly concave or flat; pronotum and propodeum each with a pair of short spines; the structure and shape of petiole, postpetiole, and metapleural lobes; as well as the distribution of hairs. But *P. trogor* is easily distinguished from *P. africanus* and from the other African species of the genus because *P. trogor* is the only species lacking frontal carinae in the workers. In addition, the dorsum of the head is smooth and shining in the workers of *P. trogor* but has foveolate punctures in *P. africanus, P. fossulatus,* and *P. cribrarius*; the pronotum possesses a pair of short spines in the workers of *P. trogor* that is not seen in *P. fossulatus* and *P. orbiceps.*

The separation of *P. trogor* from the two Asian species (*P. flatus* and *P. collinus*) and from the three Australian species (*P. wheeleri, P. erythropygus,* and *P. quadridentatus*) is given under *P. flatus* and under *P. africanus,* respectively.

Distribution. Zaire (known only from the type series).

Ecological Information. Unknown.

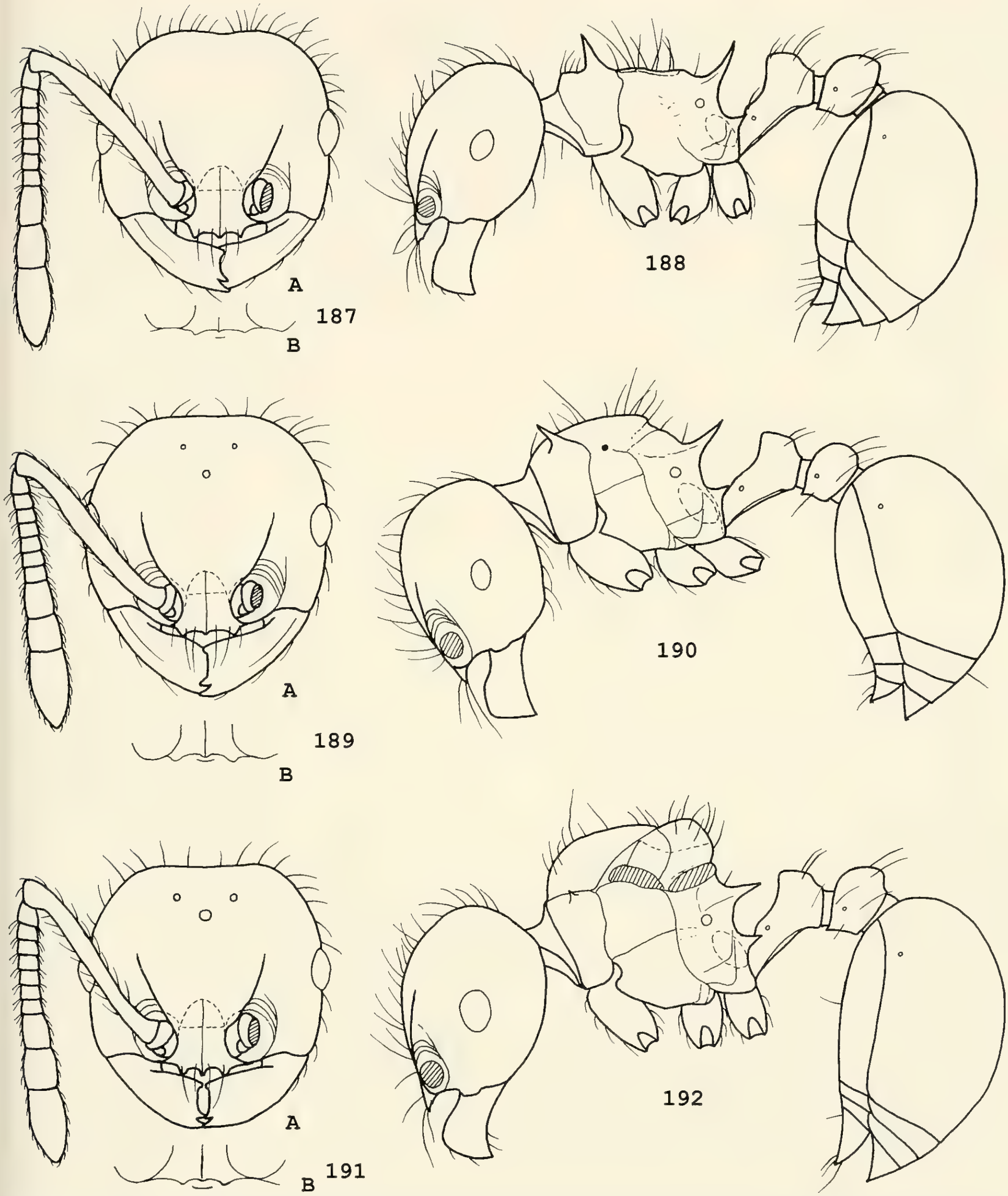
Pristomyrmex wheeleri Taylor
Figures 187–192

Pristomyrmex wheeleri Taylor, 1965: 48. Holotype worker, Australia: SE Queensland, ca. Binna Burra, rainforest, 2,800 to 3,000 ft, nest under stone, 21–25.v.1962 (R. W. Taylor) (MCZC) [examined].

Diagnosis (Worker). Masticatory margin of mandible with three teeth; anterior clypeal margin at most with three teeth; propodeal spine length ca. 0.18 to 0.28, about equal to or slightly longer than pronotal spines; dorsum of alitrunk smooth, but with a transverse ridge present at the approximate position of metanotal groove; petiole node and postpetiole dorsally with some hairs; first gastral tergite lacking hairs.

Worker. TL 3.26–4.54, HL 0.92–1.17, HW 0.97–1.34, CI 103–116, SL 0.94–1.18, SI 88–100, EL 0.17–0.24; PW 0.56–0.74, AL 0.88–1.08, PPW 0.24–0.31, PPL 0.22–0.28, PPI 104–122 (n = 40).

Mandibles usually smooth and shining, except for some small hair pits. Masticatory margin of mandible with three teeth arranged as an apical + a preapical + a long diastema + a somewhat truncated basal tooth. Basal margin of mandible lacking a curved lobe or tooth. Clypeus with a median longitudinal carina. Anterior clypeal margin usually with three strong teeth: a median tooth and one on each side, but sometimes the median tooth weak or vestigial. Ventral surface of clypeus usually with a short transverse carina. Palp formula 2,2. Frontal carinae not or just extending to the level of the posterior margins of the eyes. Antennal scrobes absent. Frontal lobes nearly completely absent; thus, the antennal articulations are almost entirely exposed. Antennal scapes, laid on the dorsal head, slightly surpassing the occipital margin. Eyes usually containing eight to nine ommatidia in the longest row. Profile shape of alitrunk and pedicel segments as in Figure 188. Pronotal spines varying in length, from 0.12 to 0.28. Propodeal spines (ca. 0.18–0.28) equal to or slightly longer than the pronotal spines. Metapleural lobes small, usually triangular. Petiole node in profile with a long anterior peduncle; its anterodorsal angle is on a higher level than the posterodorsal; some-



Figures 187–192. *Pristomyrmex wheeleri* Taylor. 187A: Worker head, full-face view; 187B: Showing a short ruga on the ventral clypeus; 188: Worker, lateral view; 189A: Ergatoid queen, full-face view; 189B: Showing a short ruga on the ventral clypeus; 190: Ergatoid queen, lateral view; 191A: Queen head, full-face view; 191B: Showing a short ruga on the ventral clypeus; 192: Queen, lateral view.

times posterodorsal angle indistinct, showing a single curved surface. Postpetiole in profile as in Figure 188, in dorsal view slightly broader than long and broadening from front to back. Dorsum of head smooth and shining. Dorsum of alitrunk smooth, but with a transverse ridge present at the approximate position of metanotal groove. Petiole, postpetiole, and gaster smooth and shining. Dorsal surfaces of head and alitrunk with numerous erect or suberect long hairs. A pair of long hairs bilaterally distributed on the dorsum of petiole node and on the postpetiole, respectively; sometimes the crests of both petiole node and postpetiole with additional one to two pairs of short hairs. First gastral tergite lacking erect or suberect hairs. Usually, three pairs of forward-projecting hairs present near the anterior clypeal margin. Scapes and tibiae with some erect to suberect short hairs. Color: head deep reddish-brown; alitrunk, pedicel segments, and gaster yellow-brown to reddish-brown.

Ergatoid Queen. TL 4.06, HL 1.08, HW 1.16, CI 107, SL 1.06, SI 91, EL 0.21, PW 0.68, AL 1.06, PSL1 0.18, PSL2 0.25, PPW 0.28, PPL 0.26, PPI 108 (n = 1. Note: This is a paratype).

General shape as in Figures 189–190. Similar to worker; color and pilosity as in worker, but head with three ocelli and promesonotum convex. Flight sclerites and wings lacking, but a black speck is present on each lateral margin of the mesonotum.

Queen. TL 4.62–5.06, HL 1.09–1.28, HW 1.18–1.42, CI 107–115, SL 1.06–1.20, SI 82–90, EL 0.22–0.28, PW 0.80–0.90, AL 1.14–1.34, PPW 0.30–0.36, PPL 0.26–0.30, PPI 107–133 (n = 5).

General shape as in Figures 191–192, with normal caste differences from the conspecific worker; a pair of acute minute spines present on the humeral angles of the pronotum; propodeal spines rather long, ca. 0.20 to 0.24; other characters similar to worker.

Male. Unknown.

Comments. Pristomyrmex wheeleri occurs in East Australia. Its two close relatives are *P. erythropygus* and *P. quadridentatus*, also from East Australia. Characters separating *P. wheeleri* from *P. erythropygus* and from *P. quadridentatus* are provided under *P. erythropygus* and under *P. quadridentatus*, respectively. The differences between *P. wheeleri* and the two Asian species (*P. flatus* and *P. collinus*) and between *P. wheeleri* and the two African species (*P. africanus* and *P. trogor*) are given under *P. flatus* and *P. africanus*, respectively.

Material Examined (ANIC, MCZC). Australia: SE Queensland: Mt. D'Aguilar Range, 2,000 ft, rainforest, ex rotten log (R. W. Taylor); Cunningham's Gap, 3,000 ft, rainforest floor, ex small wood fragment (R. W. Taylor); Cunningham's Gap, rainforest, 2,500 ft, nest under stone (B. B. Lowery); National Pk. (H. Hacker); Tamborine Mt., rotting leaves (A. M. Lea); Tamborine Mt., S side, Curris Falls, rainforest, berlesate leaf mold (T. E. Woodward); Tamborine Mt., rainforest, 2,000 ft, nest between stones (B. B. Lowery); ca. Binna Burra, rainforest, 2,600 to 3,000 ft, nest under stone (R. W. Taylor); M'Pheraon Rge, v. Binna Burra, rainforest, 2,600 to 3,600 ft (P. F. Darlington); Binna Burra, Lamington Nat. Pk., leaf and log litter (J. and N. Lawrence); Lamington Nat. Park (O'Reillys), 28.14°S, 153.08°E, rainforest, ca. 920 m, ex small fragment rotten wood (R. W. Taylor and R. Kohout); Mt. Chinghee, 12 km SE Rathdowney, 28.19°S, 152.58°E, 720 m, rainforest, stick brushing (Monteith, Yeates, and Thompson). New South Wales: Unumgar Forest (Darlingtons); Woodenbong, rainforest (Darlingtons); Tooloom Range, ca. 2,000 ft (Darlingtons); Mt. Warning, rainforest, 800 to 3,500 ft, under and between rocks/nest in red-rotten log but 2 inches below ground (B. B. Lowery); Mt. Warning, 10 mi from Murwillumbah, RF, ca. 3,000 ft, between rocks (B. B. Lowery); Whian Whian S. F., 28.39°S, 153.20°E, rainforest, 200 m, under stone, acc. no. 1699, 16.vi.1976 (P. Ward); Tomewin, rainforest, 1500 ft, under stone (B. B. Lowery); Blue Knob Mt., Nightcap Ranges, rainforest, 2,800 to 3,000 ft (B. B. Lowery); Bilambil, N of Tumbulgum, rainforest (B. B. Lowery); Hills above Tumbulgum, 800 ft, near Murwillumbah, rainforest (B. B. Lowery); Bonalbo, Sandy Crk., RF, 3000 ft, under rock (E. G. Kearney).

Ecological Information. This species occurs in rainforest, nesting in the soil, usually under or between rocks, often in a tangle of small plant roots; it probably restricts its foraging activity to the soil and leaf litter (Taylor, 1965, 1968).

An additional 11 specimens, including nine workers, a queen, and an ergatoid queen, are examined here. They show the following some differences from the above "examined material": (1) The ventral center of the clypeus possesses a toothlike prominence in these 11 specimens, but a short transverse carina in the previous "Material Examined" section; (2) in the nine workers, the juncture between the pronotum and the mesonotum bears several short longitudinal rugae, varying from superficial to rather distinct (but is smooth and shining in *P. wheeleri*); (3) in the queen, the petiole node in profile is wedge-shaped, and the propodeal spines (ca. 0.13) are shorter than those (ca. 0.20–0.24) in *P. wheeleri*; and (4) in the ergatoid queen, only one ocellus is present; PSL1 and PSL2 are not shorter than 0.08 and 0.13, respectively (in *P. wheeleri*, three ocelli are distinct; PSL1 and PSL2 are ca. 0.18 and ca. 0.25, respectively). Further collecting and studying will help determine whether these differences are significant or not.

These 11 specimens have the following measurements: Worker: TL 3.50–4.76, HL 0.90–1.05, HW 0.94–1.12, CI 104–108, SL 0.85–1.01, SI 89–93, EL 0.16–0.20, PW 0.60–0.68, AL 0.88–0.96, PSL1 0.10–0.14, PSL2 0.16–0.20, PPW 0.24–0.29, PPL 0.21–0.23, PPI 104–126 (n = 9). Queen: TL 3.84, HL 1.22, HW 1.32, CI 108, SL 1.07, SI 81, EL 0.25, PW 0.74, AL 1.18, PSL2 0.13, PPW 0.36, PPL 0.28, PPI 129 (n = 1). Ergatoid queen: TL 3.84, HL 0.96, HW 1.08, CI 113, SL 0.88, SI 81, EL 0.20, PW 0.64, AL 0.94, PSL1 0.08, PSL2 0.13, PPW 0.25, PPL 0.21, PPI 118 (n = 1).

Collecting Data for the 11 Specimens (ANIC). Australia: New South Wales, Tuckers Knob, 21 km SW Coffs. Hbr., rainforest, 760 m, ANIC Berlesate No. 201 (N. I. Mitchell); New South Wales, Bellangry, F'st, rainforest, ca. 3000 ft, iv.1958 (Darlingtons); New South Wales, Up. Allyn R., near Eccleston, 32.08°S, 151.29°E, rainforest, 400 m, acc. no. 316 (P. Ward); New South Wales, Upr. Allyn Val., near Eccleston, rainforest, ca. 2,000 ft, fallen epiphyte masses, ANIC Berlesate 45, 11–14.xii.1967 (Taylor and Brooks); New South Wales, Comboyne plat., 2 to 2,800 ft, under rocks, x.1957 (Darlingtons).

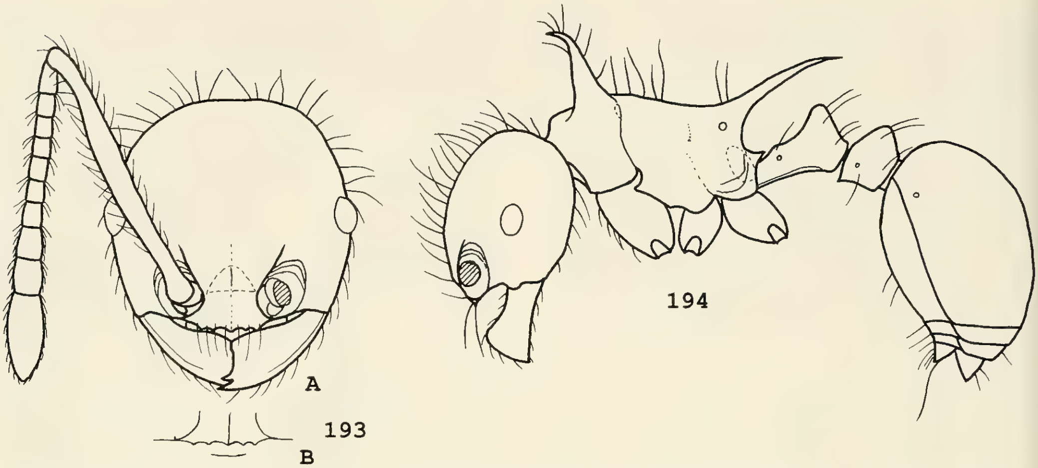
Pristomyrmex wilsoni Taylor
Figures 193–194

Pristomyrmex wilsoni Taylor, 1968: 63. Holotype worker, Australia: N. Queensland, Mt. Lewis, ca. 3,000 ft, near Julatten, rainforest, ground strays, 30–31.x.1966 (R. W. Taylor) [ANIC (Taylor, 1968)]; [one paratype worker (MCZC) examined].

Diagnosis (Worker). Pronotal spines and propodeal spines exceptionally long (ca. 0.66–0.88).

Worker. TL 4.14–4.92, HL 0.96–1.11, HW 0.96–1.12, CI 96–104, SL 1.21–1.46, SI 125–133, EL 0.19–0.22, PW 0.65–0.76, AL 1.14–1.30, PPW 0.28–0.32, PPL 0.30–0.32, PPI 93–100 (n = 13).

Mandibles usually smooth and shining but sometimes with one to two longitudinal rugae. Masticatory margin of mandible with three teeth arranged as an apical + a preapical + a long diastema + a broad, truncated basal tooth. Basal margin of mandible lacking a distinctly curved lobe or tooth. Clypeus usually with a median longitudinal carina, but sometimes this median carina is interrupted or indistinct. Anterior clypeal margin with a median denticle and two others on each side, but sometimes two lateral denticles are fused into one prominence. Ventral surface of



Figures 193–194. *Pristomyrmex wilsoni* Taylor. 193A: Worker head, full-face view; 193B: Showing a ruga on the ventral clypeus; 194: Worker, lateral view.

clypeus with a short transverse carina. Palp formula 2,3. Frontal carinae short, not beyond, or just reaching to the level of the posterior margins of eyes; sometimes frontal carinae absent. Antennal scrobes absent. Frontal lobes absent; thus, the antennal articulations are entirely exposed. Antennal scapes long, when laid on the dorsal head, surpassing the occipital margin by about one-third of their length. Eyes containing 10 to 11 ommatidia in the longest row. Profile shape of alitrunk and pedicel segments as in Figure 194. Pronotal spines exceptionally long (ca. 0.66–0.88), curved at their apices, diverging toward the outsides in dorsal view. Propodeal spines exceptionally long (ca. 0.66–0.82), as illustrated in Figure 194; in dorsal view, they are somewhat joined together at the base but are divergent posteriorly, Metapleural lobes small-triangular, each with an apex. Petiole with a fairly long anterior peduncle. Petiole node and postpetiole in profile higher than long, in dorsal view each with a somewhat conical apex. Postpetiole in dorsal view usually longer than broad, broadening from front to back. Dorsum of head usually smooth and shining, except for a few foveolate punctures present on the genae and sometimes bordering the frontal carinae. Dorsum of alitrunk unsculptured and highly polished. Petiole, postpetiole, and gaster smooth and shining. Dorsal surfaces of head and alitrunk with numerous erect or suberect long hairs. A pair of similar long hairs bilaterally distributed on the dorsum of petiole node and on the postpetiole, respectively. First gastral tergite lacking erect or suberect hairs. A few pairs of forward-projecting hairs present near the anterior clypeal margin. Scapes and tibiae with some erect to suberect short hairs. Color reddish-brown to blackish-brown.

Queen and Male. Unknown.

Comments and Discussion. Pristomyrmex wilsoni occurs only in North Queensland, Australia. It is a unique species in the genus that possesses both exceptionally long pronotal and propodeal spines and thus can be immediately recognized.

Pristomyrmex wilsoni may be derived from the common ancestor of the clade consisting of *P. curvulus* and *P. longispinus* of the Philippines. The workers of *P. wilsoni* are similar to those of *P. curvulus* and *P. longispinus* in possession of long pronotal spines and long antennal scapes and in the size and sculpture of body. *Pristomyrmex wilsoni* differs from *P. curvulus* and *P. longispinus* in the workers as follows:

P. wilsoni

Propodeal spines exceptionally long, ca. 0.66 to 0.82; in dorsal view, they are close to each other at the base
Maxillary palp with two segments
Masticatory margin of mandible with a broad, truncated basal tooth
Petiole node and postpetiole, in dorsal view each with a somewhat conical apex
A pair of hairs present near the apex of petiole node

P. curvulus and ***P. longispinus***

Propodeal spines short to moderately long, ca. 0.12 to 0.26; in dorsal view, they are separated at the base
Maxillary palp with one segment
Masticatory margin of mandible with two small basal teeth
Petiole node and postpetiole in dorsal view each lacking a conical apex
Two or more pairs of hairs present on the dorsal surface of petiole node

An alternative is that *P. wilsoni* might evolved from the ancestor of the Australian *P. wheeleri* because of the following characters being similar: (1) masticatory margin of mandible with three teeth, (2) maxillary palp with two segments, (3) body smooth, and (4) ventral surface of clypeus with a short transverse carina. However, the workers of *P. wilsoni* obviously differ from those of *P. wheeleri* as follows:

P. wilsoni

Pronotal and propodeal spines exceptionally long (ca. 0.66–0.88)
Antennal scapes relatively long (SL 1.21–1.46; SI 125–133)
Petiole node and postpetiole in dorsal view each with a conical apex
Dorsum of alitrunk unsculptured
Labial palp with three segments

P. wheeleri

Pronotal and propodeal spines moderately long (ca. 0.12–0.28)
Antennal scapes relatively short (SL 0.94–1.18; SI 88–100)
Petiole node and postpetiole in dorsal view lacking a conical apex
A transverse ridge present at the approximate position of metanotal groove
Labial palp with two segments

Material Examined (ANIC, MCZC). Australia: N. Queensland, Mt. Lewis, 1,000 m, RF (R. W. Taylor); Queensland, Mt. Lewis, 960 m, 16.35°S, 145.17°E, rainforest, acc. no. 76.349 (R. W. Taylor and T. A. Weir); NE Queensland, 2.5 km N Mt. Lewis via Julatten, 1,040 m, RF, Pyrethrum knockdown (D. K. Yeates and G. I. Thompson); N. Queensland, 2 km SE Mt. Spurgeon via Mt. Carbine, 1,100 m, Pyrethrum tree logs (Montelth and Thompson); NE Queensland, McDowall Ra, 17 km N Daintree, 16.06°S, 145.20°E, rainforest, 520 m, sieved litter, QM Berlesate No. 684 (G. Montelth); NE Queensland, Table Mt., 10 km S of Cape Tribulation, 16.09°S, 145.26°E, rainforest, 320 m, sieved litter, QM Berlesate No. 542 (G. B. Montelth and D. Cook).

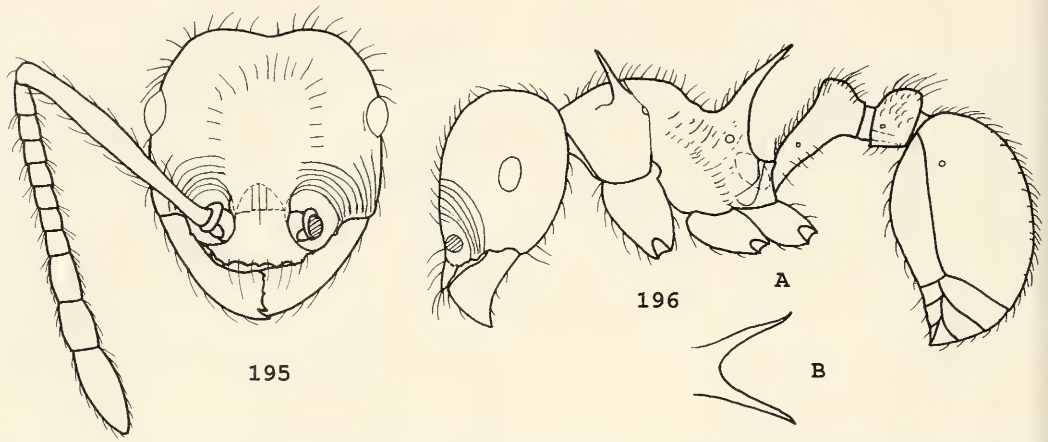
Ecological Information. Taylor (1968) reports that this species occurs in rainforest; it has been collected at an elevation of about 915 m in little berlesates and on the surfaces of rocks and logs. "Collections were made on two overcast days but not on a third, which was brightly sunny. Strays were not seen during several hours night collecting (to about four hours after sunset) at the same locality" (Taylor, 1968).

THE ***TRISPINOSUS*** GROUP

Worker. Medium-sized ants (HL 0.88–1.22, HW 0.82–1.16, TL 3.24–4.82) with the following combination of characters:

(1) Masticatory margin of mandibles with four teeth that have one of the following two arrangements:

a. the strongest apical + the second strongest preapical + a relatively short (first) diastema + a small denticle + a relatively long (second) di-



Figures 195–196. *Pristomyrmex bispinosus* (Donisthorpe). 195: Worker head, full-face view; 196A: Worker, lateral view; 196B: Propodeal spines, dorsal view.

astema + a small basal denticle, as in *P. bispinosus* and *P. trispinosus* (in *P. trispinosus,* sometimes the first diastema is somewhat indistinct) or

b. the apical + the preapical + a relatively long (first) diastema + a small denticle + a relatively short (second) diastema + a small basal denticle, as in *P. browni*; sometimes the second diastema is indistinct.

(2) Anterior margin of the median portion of clypeus with at least five denticles. Two ends of the anterior clypeal margin each with a developed subtriangular tooth. Lateral portions of clypeus reduced to a margin; thus, the antennal fossae reach the anterior clypeal margin.

(3) Palp formula 1,2.

(4) Frontal carinae absent.

(5) Frontal lobes almost completely absent.

(6) Antennal scrobes absent.

(7) Lamella that encircles the base of antennal scape entire.

(8) Dorsum of alitrunk with a promesonotal suture or impression.

(9) Alitrunk in profile with a convex promesonotum and a deeply concave propodeal dorsum.

(10) Pronotum with a pair of robust, short to moderately long spines.

(11) Propodeal spines long, in dorsal view joined together at the base so that they form a fork.

(12) Petiole with a long anterior peduncle that is longer than the length of the node.

(13) Foveolate punctures completely absent, but regular striations are present on the dorsal surfaces of the head and the alitrunk in *P. trispinosus* and *P. browni* and present on the genae and around the antennal sockets in *P. bispinosus.*

(14) First gastral tergite with numerous hairs.

This is a monophyletic group because it possesses many autapomorphic characters, such as characters 3, 4, 8, 9, 11, and 13. This group contains three native Mauritian species.

Pristomyrmex bispinosus (Donisthorpe) Figures 195–196

Dodous bispinosus Donisthorpe, 1949: 272. Lectotype worker, Mauritius: Le Pouce Mt., 2.xi.1948 (R. Mamet) (BMNH), here designated, [examined].

Pristomyrmex bispinosus (Donisthorpe) Brown, 1971: 3.

Diagnosis (Worker). Dorsal surfaces of head and alitrunk mostly unsculptured; mesonotum unarmed, at most weakly tuberculate; alitrunk in profile with a convex promesonotum and a deeply concave propodeal dorsum; propodeal spines in dorsal view forming a divergent fork.

Worker. TL 4.36–4.82, HL 1.14–1.20, HW 1.08–1.16, CI 90–100, SL 1.32–1.40, SI 118–130, EL 0.22–0.24, PW 0.70–0.75, AL 1.14–1.20, PPW 0.28–0.32, PPL 0.26–0.28, PPI 107–115 (n = 11).

Mandibles smooth and shining. Masticatory margin of mandible with four teeth arranged as the strongest apical + the second strongest preapical + a relatively short diastema + a small denticle + a relatively long diastema + a small basal denticle. Basal margin of mandible lacking a tooth-like prominence. Anterior margin of the median portion of clypeus with at least five denticles, but sometimes two lateral denticles are fused into a broad, truncated lobe. Two ends of anterior clypeal margin each with a strong, subtriangular tooth. Ventral surface of clypeus usually with a transverse ruga. Clypeus usually unsculptured, but frontal area usually with three to four short carinae that often extend to the posterior clypeal margin. Palp formula 1,2. Frontal carinae absent. Antennal scrobes absent. Frontal lobes nearly completely absent so that the antennal articulations are almost entirely exposed. Antennal scapes long, when lying on the dorsal head surpassing the occipital margin by about one-fourth of their length. Eyes usually containing 11 to 12 ommatidia in the longest row. Occipital margin slightly concave. Alitrunk in profile with a convex pro-mesonotum and a deeply concave propodeal dorsum. Pronotum armed with a pair of fairly long, acute spines. Propodeum with a pair of long spines that, in dorsal view, are joined together at the base but are divergent along their length so that they form a fork (Fig. 196B). Mesonotum unarmed but sometimes with tubercles. Promesonotal suture or impression present. Metapleural lobes dentiform. Petiole in profile with a long anterior peduncle; anterodorsal angle of the node is higher than the posterodorsal. Postpetiole in profile usually with a curved anterior and dorsal surface, in dorsal view slightly broader than long. Dorsum of head mostly smooth and shining but with some regular short rugae present around the antennal fossae, on genae and sometimes around the centrical disc. Dorsum of alitrunk as well as the sides of pronotum usually smooth and shining, but the sides of the rest of alitrunk usually with some regular short rugae. Petiole unsculptured. Dorsum of postpetiole smooth and shining. Gaster unsculptured. All dorsal surfaces with numerous erect or suberect hairs. A row of forward-projecting hairs present near the anterior clypeal margin. Scapes and tibiae with some short hairs. Color yellow-brown, but sometimes reddish-brown.

Queen and Male. Unknown.

Comments. This species occurs in Mauritius. It can be easily separated from its two relatives, *P. trispinosus* and *P. browni,* in the workers, as follows: In *P. bispinosus,* the dorsal surfaces of the head and the alitrunk are smooth and shining, except for some short rugae around the antennal fossae, on the genae, and sometimes around the centrical disc of the head; but in *P. trispinosus* and *P. browni,* the dorsal surfaces of the head and the alitrunk are entirely sculptured with regular striations.

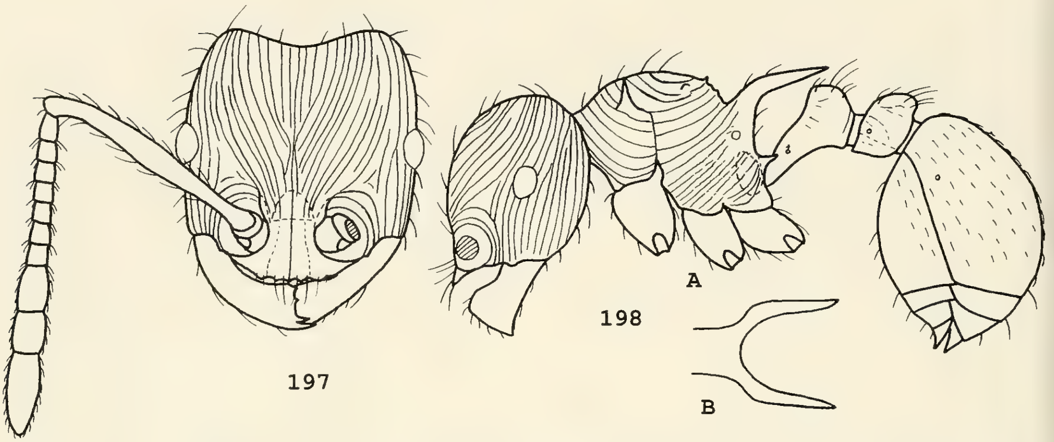
Material Examined (MCZC, ANIC, MNHN). Mauritius: Le Pouce Mt., 700 to 800 m, native forest (W. L. Brown); Le Pouce, 700 m, 20°12′S, 57°31′E, ex closed forest, on low vegetation (P. S. Ward); Le Pouce Mt. (Ray Mamet).

Ecological Information. This species occurs in a forest and has been collected on the trees and on the main path (Brown, 1971).

Pristomyrmex browni **sp. n.**

Figures 197–198

Diagnosis (Worker). Dorsal surfaces of head and alitrunk with dense regular striations; propodeal spines in dorsal view joined together at base and subparallel along their length; HW 0.82–0.90 and HL 0.88–1.01.



Figures 197–198. *Pristomyrmex browni* **sp. n.** 197: Worker head, full-face view; 198A: Worker, lateral view; 198B: Propodeal spines, dorsal view.

Holotype Worker (MCZC). TL 3.50, HL 0.92, HW 0.84, CI 91, SL 0.88, SI 105, PW 0.46, AL 0.90. Paratypes, 11 workers and one male (MCZC, ANIC, BMNH).

Worker. TL 3.42–3.78, HL 0.92–1.00, HW 0.82–0.90, CI 87–94, SL 0.86–0.97, SI 98–111, EL 0.14–0.19, PW 0.44–0.50, AL 0.84–0.96, PPW 0.26–0.28, PPL 0.22–0.24, PPI 117–127 (n = 11).

Mandibles smooth and shining. Masticatory margin of mandible with four teeth arranged as the strongest apical + the second strongest preapical + a relatively long (first) diastema + a small denticle + a relatively short (second) diastema + a small basal denticle; sometimes the second diastema indistinct. Basal margin of mandible almost straight, lacking a toothlike prominence. Anterior margin of the median portion of clypeus with at least five toothlike prominences, but sometimes two lateral denticles are fused into a broad lobe. Two ends of the anterior clypeal margin each with a strong subtriangular tooth. Ventral surface of clypeus lacking toothlike prominences. Clypeus usually with a few weak longitudinal rugae. Palp formula 1,2. Frontal carinae absent. Antennal scrobes absent. Frontal lobes nearly completely absent so that the antennal articulations are almost entirely exposed. Antennal scapes, when lying on the dorsal head, slightly surpassing the occipital margin by about one-eighth to one-seventh of their length. Eyes moderately sized. Occipital margin medially deeply emarginate. Alitrunk in profile with a convex pro-mesonotum and a deeply concave propodeal dorsum. Pronotum with a pair of acute short spines. Mesonotum lacking spines or teeth but usually with three blunt small tubercles that are present on the posterior end and on the two sides, respectively. Propodeal spines in profile well developed, long, bent at about a right angle near the base. In dorsal view, propodeal spines somewhat laterally compressed; they are joined together at the base but subparallel along their length (Fig. 198B). Metapleural lobes small, triangular. Petiole node in profile nodiform with a long anterior peduncle; its anterodorsal angle is higher than the posterodorsal. Postpetiole in profile with a single curved anterior and dorsal surface, in dorsal view slightly broader than long and also broader than the petiole node. Dorsum of head entirely covered with regular coarse striations that consist of longitudinal rugae and a few rugae around the antennal fossae. Sides and dorsum of alitrunk sculptured with coarse circular striations evenly, but the center of mesonotum with a few coarse longitudinal rugae. Sides of petiole and postpetiole usually with a few superficial rugae. Gaster smooth and shining. Dorsal surfaces of head, alitrunk, petiole, and postpetiole with some erect or suberect hairs. First gastral tergite with numerous recumbent hairs. A row of forward-projecting hairs present near the anterior clypeal margin. Scapes and tibiae with numerous suberect short hairs. Color reddish-brown.

Queen. Unknown.

Male. One paratype male, collected in Mauritius by W. L. Brown, was originally mounted together with a worker on the same pin: TL 3.04, HL 0.58, HW 0.48, CI 83, SL 0.20, SI 42, HWE 0.76, EL 0.38, PW 0.73, AL 1.08, PPW 0.24, PPL 0.20, PPI 120 (n = 1).

Head, including the eyes, broader than long. Clypeus convex without a median longitudinal carina. Anterior clypeal margin transverse. Frontal carinae absent. Scapes only slightly longer than the first funicular segments but distinctly shorter than the rest of the funicular segments. On the mesoscutum, notauli distinct, showing a V shape; parapsidal furrows very superficial. Scuto-scutellar sulcus with six narrow ridges. Propodeum weakly tuberculate, lacking teeth or spines. Metapleural lobes triangular. Middle and hind tibiae without any spurs. Petiole node in profile with a fairly long anterior peduncle; anterior face of the node, together with the dorsal surface of the peduncle, forming a declivity. Postpetiole in profile low and rounded dorsally and in dorsal view broader than long. Dorsum of head smooth and shining, but frontal area with a median longitudinal carina. Pronotum and mesoscutum rather smooth and shining, except for those marked sutures, but mesoscutellum with some longitudinal and reticulate rugae. Petiole smooth and shining but with a longitudinal carina present on each side of the dorsal surface. Postpetiole and gaster smooth and shining. All dorsal surfaces with abundant erect or suberect hairs. Scapes and tibiae with numerous erect or suberect short hairs. Color reddish-brown; wings slightly smoky.

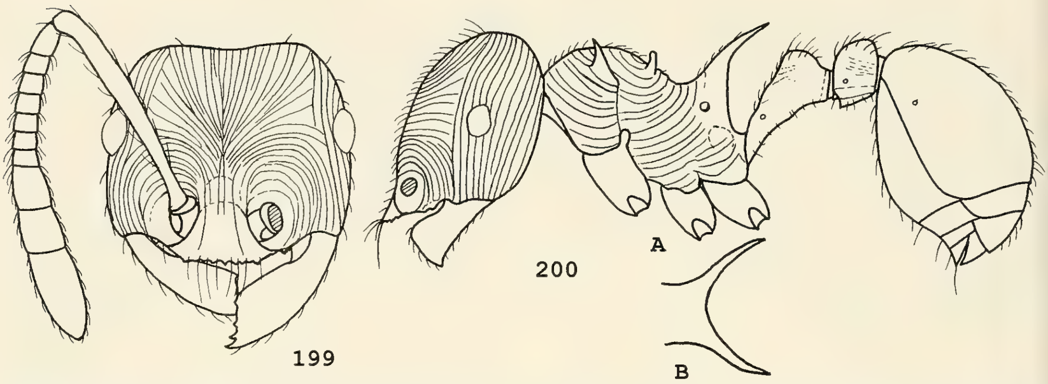
Comments. This new species occurs in Mauritius and Reunion Island. It is closely related to the Mauritian *P. bispinosus* and *P. trispinosus.* Characters separating *P. browni* from *P. bispinosus* and *P. trispinosus* are provided under *P. bispinosus* and *P. trispinosus,* respectively. The following additional characters should also be mentioned: In the workers of *P. browni,* the sculpture of the dorsal head consists mostly of longitudinal rugae, except for a few rugae around the antennal fossae; the two sides of the mesonotum each has a small tubercle. In *P. trispinosus,* many striations present on the dorsal head spread out from the center to the two sides; the mesonotum possesses a pair of strong digitlike prominences. In the type worker specimens of *P. browni,* the first gastral tergite possesses only recumbent hairs, and the occipital margin of the head in full-face view is deeply concave, which are different in *P. bispinosus* and *P. trispinosus.*

One non-type specimen shows the following variations: (1) The first gastral tergite possesses some erect or suberect hairs, (2) the occipital margin of the head in full-face view is feebly concave, (3) the sides of the mesonotum lack any tubercles, (4) the two small basal denticles on the masticatory margin of the mandible are indistinct, (5) the dorsum of the petiole peduncle in profile is obviously curved, and (6) the rugae are very superficial on the clypeus and on the sides of the petiole. This specimen has the following measurements: TL 3.24, HL 0.88, HW 0.84, CI 95, SL 0.80, SI 95, EL 0.14, PW 0.40, AL 0.77.

Holotype Worker. Mauritius: Le Pouce Mt., 700 to 800 m, native forest, 1.iv.1969 (W. L. Brown).

Paratypes. Mauritius: Le Pouce Mt., 700 to 800 m, native forest, 4.iii.1977 (W. L. Brown).

Additional Non-Type Worker Examined. Indian Ocean, Reunion I., Mare Longue,



Figures 199–200. *Pristomyrmex trispinosus* (Donisthorpe). 199: Worker head, full-face view; 200A: Worker, lateral view; 200B: Propodeal spines, dorsal view.

near St. Philippe, primitive forest, 580 m, 15.i.1975 (D. Schauenberg) (MCZC).

Ecological Information. This species occurs in native forest.

Pristomyrmex trispinosus (Donisthorpe) Figures 199–200

Dodous trispinosus Donisthorpe, 1946: 145. Syntype workers and males, Mauritius: Cocotte Mt., 27.xii.1941 and 6.ii.1943 (R. Mamet) (BMNH, LACM, MCZC) [examined].

Pristomyrmex trispinosus (Donisthorpe) Brown, 1971: 3.

Diagnosis (Worker). Pronotum, mesonotum, and propodeum each with a pair of strong prominences; dorsal surfaces of head and alitrunk with dense regular striations; propodeal spines in dorsal view divergent; HW and HL > 1.10.

Worker. TL 4.50–4.68, HL 1.16–1.22, HW 1.11–1.18, CI 91–97, SL 1.33–1.44, SI 117–122, EL 0.20–0.24, PW 0.66–0.70, AL 1.16–1.26, PPW 0.27–0.30, PPL 0.24–0.26, PPI 108–115 (n = 6).

Mandibles smooth and shining. Masticatory margin of mandible with four teeth arranged as the strongest apical + the second strongest preapical + a short diastema (sometimes, this diastema is not distinct) + a small denticle + a long diastema + a small basal denticle. Basal margin of mandible lacking a toothlike prominence. Anterior margin of the median portion of clypeus with at least five denticles, but sometimes two lateral denticles are fused into a broad lobe. Two ends of the anterior clypeal margin each with a developed prominence. Ventral surface of clypeus lacking toothlike prominences. Clypeus usually with a few longitudinal rugae. Palp formula 1,2. Frontal carinae absent. Antennal scrobes absent. Frontal lobes absent so that the antennal articulations are completely exposed. Antennal scapes long, when lying on the dorsal head surpassing the occipital margin by one-fourth to one-third of their length. Eyes usually containing 11 to 12 ommatidia in the longest row. Occipital margin in full-face view slightly concave. Alitrunk in profile with a convex pro-mesonotum and a deeply concave propodeal dorsum. Pronotum armed with a pair of moderately long acute spines. Mesonotum with a pair of thick, blunt, digit-like short prominences. Propodeum with a pair of developed long spines that, in dorsal view, are joined together at the base but divergent along their length so that they form a fork (Fig. 200B). Metapleural lobes dentiform. Petiole node in profile nodiform with a long anterior peduncle. Postpetiole in profile rounded anterodorsally but usually with a distinct posterodorsal angle; in dorsal view, postpetiole slightly broader than long. Entire dorsum of head with regular coarse striations: many striations spread out from the center to the two sides and to the occipital margin; some are around the antennal fossae, the rest are some longitudinal rugae present on the sides of the head. Sides and the dorsum of alitrunk with numerous evenly distributed, circular coarse striations. Center of mesonotum with a few coarse short rugae. Petiole and postpetiole rather smooth and shining, but sometimes their sides with a few superficial short rugae. Gaster unsculptured. All dorsal surfaces with numerous erect or suberect hairs. Scapes and tibiae with numerous erect or suberect short hairs. A row of forward-projecting hairs present near the anterior clypeal margin. Color yellow-brown, but sometimes reddish-brown.

Queen. Unknown.

Male. One syntype male (BMNH), together with a number of syntype workers, constitutes a series (see Donisthorpe, 1946): TL 4.46, HL 0.72, HW 0.70, CI 97, SL 0.20, SI 29, EL 0.22, PW 0.90, AL 1.42 [n = 1].

Head, including the eyes, broader than long. Clypeus somewhat transverse, convex in middle. On the mesoscutum, notauli indistinct. Scuto-scutellar sulcus wide, separated into small cells by narrow ridges. Propodeum weakly tuberculate, lacking teeth or spines. Metapleural lobes subtriangular. Petiole node in profile low with a fairly long anterior peduncle. Postpetiole in profile rounded dorsally. Dorsum of head smooth and shining. Mesoscutum smooth and shining, but mesoscutellum with some rugae and a few foveolate punctures. Petiole node rather smooth. Postpetiole and gaster unsculptured, smooth, and shining. All dorsal surfaces with abundant erect or suberect long hairs. Scapes and tibiae with numerous erect or suberect short hairs. Color reddish-brown; wings somewhat dusky.

Comments. Pristomyrmex trispinosus is known only from Mauritius. It differs from *P. bispinosus* in the workers in having regular coarse striations on the entire dorsal surfaces of the head and the alitrunk and a pair of strong, digitlike prominences on the mesonotum. The workers of *P. trispinosus* and *P. bispinosus* are separable from those of *P. browni* by the following characters:

P. trispinosus and ***P. bispinosus***

- Propodeal spines in dorsal view divergent, not laterally compressed; in profile rather straight
- A relatively short diastema present between the preapical and the third tooth on the masticatory margin of the mandible
- Larger species with HW > 1.08, HL > 1.14, SL > 1.32, PW > 0.68, TL > 4.36

P. browni

- Propodeal spines in dorsal view subparallel, somewhat laterally compressed; in profile, bent at about a right-angle near the base
- A relatively long diastema present between the preapical and the third tooth on the masticatory margin of the mandible
- Smaller species with HW 0.82–0.90, HL 0.88–1.01, SL 0.80–0.97, PW 0.40–0.50, TL 3.24–3.78

Material Examined (MCZC). Mauritius: Cocotte Mt. (R. Mamet).

Ecological Information. A nest of *P. trispinosus* was found under a flat stone, and about 30 to 40 workers, two males, larvae, and pupae were collected; this species, when disturbed, simulates death (Donisthorpe, 1946).

THE *LEVIGATUS* GROUP

Worker. This group shows the following combination of characters:

(1) Usually small-sized species: HW: 0.60–0.96 in 11 species, 0.98–1.26 in one species (*P. lucidus*). HL: 0.60–0.90 in 11 species, 0.92–1.16 in *P. lucidus.* TL: 2.20–3.49 in 11 species, 3.71–4.84 in *P. lucidus.*

(2) Masticatory margin of mandible with four teeth arranged as the strongest apical + the second strongest preapical +

the smallest third + an acute basal tooth that is larger than the third tooth but smaller than the apical and preapical teeth; masticatory margin lacking a distinct diastema.

(3) A tooth that is short and broad or prominent, present about midway on the basal margin of mandible.

(4) Lateral portions of clypeus in front of antennal insertions reduced to a narrow margin.

(5) Lamella that encircles the base of antennal scape entire.

(6) Anterior clypeal margin with at most three denticles (i.e., a median denticle and one on each side), but sometimes the median tooth is indistinct so that only two denticles are seen on the margin.

(7) Ventral surface of clypeus smooth or bearing a weak transverse ruga but lacking toothlike prominences.

(8) Palp formula 1,3 in 10 species examined.

(9) Frontal carinae extending to the level of the posterior margins of eyes.

(10) Well-developed scrobes absent.

(11) Dorsum of alitrunk in profile more or less arched, in dorsal view without any sutures.

(12) Pronotum usually unarmed but with a pair of small teeth in one species (*P. minusculus*).

(13) Petiole node in profile high, higher than the length of the node, usually with a distinct anterior face, but in *P. inermis*, the anterior face of the petiole node is inseparable from the dorsal surface of the peduncle.

(14) Dorsal surfaces of head and alitrunk smooth or with scattered foveolate punctures or with foveolate-reticulate sculpture.

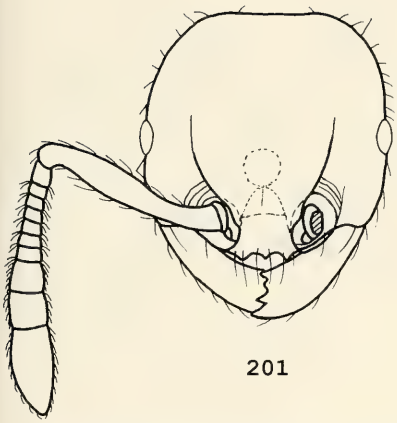
This is a monophyletic group, containing 12 species. They are endemic in the Oriental region, except for one species (*P. minusculus*) entering in North Queensland, Australia. Further, most of the species of this group occur in Papua New Guinea and some nearby islands.

Obviously, this group, together with the *profundus* group, constitutes a monophyletic lineage because the workers and queens of the two groups possess a synapomorphy, that is, the masticatory margin of the mandible with four teeth (the strongest apical + the second strongest preapical + the smallest third + an acute basal tooth) but lacking a diastema. The workers of the group are easily distinguished from those of the *profundus* group by lacking well-developed antennal scrobes and possessing (1) two to three teeth on the anterior clypeal margin, (2) a more or less arched dorsum of the alitrunk, and (3) a tooth present about midway on the basal margin of the mandible but not adjacent to the basal tooth of the masticatory margin.

The dentition of the masticatory margin of the mandible in the workers and queens of the *levigatus* group is a critical character separating the *levigatus* group from other five (i.e., *cribrarius, punctatus, quadridens, trispinosus,* and *umbripennis*) groups.

In the workers and queens of the *levigatus* group, foveolate punctures show continuous variation on the dorsum of the head between the frontal carinae. I treat this case as follows: (1) *P. levigatus* almost completely lacks distinct foveolate punctures on the dorsum of the head between the frontal carinae; (2) *P. simplex* assembles those populations with some scattered foveolate punctures, but spaces between foveolae are usually smooth; and (3) *P. coggii* shows foveolate-reticulate sculpture; some populations, only with foveolate-reticulate sculpture behind the eyes, are considered intermediate forms and also grouped into *P. coggii.* In fact, this similar continuous variation also occurs in the other two (i.e., *quadridens* and *umbripennis*) groups.

An ergatoid queen caste has been found in *P. mandibularis* of the group. This caste is also present in the *punctatus* and *quadridens* groups. Pronotal armaments, widely occurring in the *cribrarius, quadridens,* and *trispinosus* groups, appear in the



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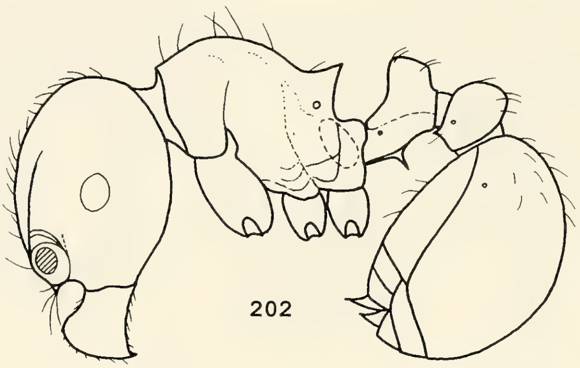

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Figures 201–202. *Pristomyrmex acerosus* **sp. n.** 201: Worker head, full-face view; 202: Worker, lateral view.

workers of one species (*P. minusculus*) of the *levigatus* group. These facts indicate that ergatoid queens and pronotal armaments have arisen several times in *Pristomyrmex*, respectively.

Pristomyrmex acerosus sp. n.

Figures 201–202

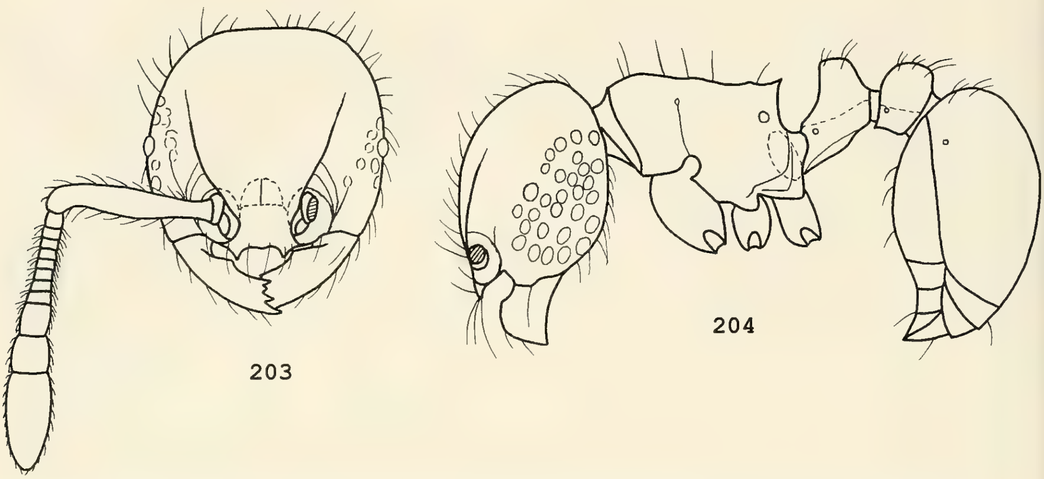
Diagnosis (Worker). Masticatory margin of mandible lacking a diastema and possessing four teeth, of which the third tooth, counting from the apex, smallest; subpetiole with a pinlike long process.

Holotype Worker (BMHH). TL 2.80, HL 0.76, HW 0.75, CI 99, SL 0.66, SI 88, EL 0.12, PW 0.48, AL 0.76, PPW 0.22, PPL 0.17, PPI 129.

Mandibles smooth and shining. A broad-based short tooth present about midway on the basal margin of the mandible. Clypeus depressed, unsculptured, its anterior margin with three denticles: a median tooth and one on each side. Frontal carinae just extending to the level of the posterior margins of eyes. Antennal scrobes absent. Frontal lobes weakly expanded basally. Eyes moderately sized. Occipital margin feebly concave in full-face view. Dorsum of alitrunk in profile convex. Pronotum unarmed. Propodeum with a pair of subtriangular short spines. Metapleural lobes rounded. Petiole node in profile high, with the anterodorsal angle higher than the posterodorsal, its anterior face subparallel to the posterior one, anterior peduncle of the node about as long as the node. Subpetiole with a semitranslucent pinlike long process. Postpetiole with a rounded dorsum. In dorsal view, petiole node subrounded; postpetiole broader than long, somewhat transrectangular. Dorsal surfaces of head and alitrunk smooth and shining, except for some small, shallow hair pits. Petiole, postpetiole, and gaster unsculptured, smooth, and shining. Dorsal surface of head with numerous erect to suberect hairs. Dorsum of alitrunk with sparse hairs. Two pairs of hairs present on the dorsum of petiole node. A few on the dorsum of postpetiole and on the first gastral tergite, respectively. Three pairs of forward-projecting hairs present near the anterior clypeal margin. Scapes and tibiae with some suberect short hairs. Color lightly yellow-brown.

Queen and Male. Unknown.

Comments and Discussion. This is the only species in the genus that has so far been found to have a semitranslucent, pinlike, long process on the ventral surface of the petiole. However, further collecting is required. If this long process is present in other specimens, this holotype represents a good species; otherwise, this holotype



Figures 203–204. *Pristomyrmex boltoni* **sp. n.** 203: Worker head, full-face view; 204: Worker, lateral view.

would be an aberrant specimen, and *P. acerosus* would become a junior synonym of *P. levigatus*.

Holotype Worker. New Hebrides: Malekoula I. (N), Vao Isl, 0 to 20 m, 7.ix.1979 (W.C. Gagne, G. M. Nishida, and G. A. Samuelson).

Ecological Information. Unknown.

Pristomyrmex boltoni sp. n.
Figures 203–204

Diagnosis (Worker). Masticatory margin of mandible lacking a diastema and possessing four teeth, of which the third tooth, counting from the apex, smallest; eyes very small, with two to three ommatidia in the longest row; dorsal surfaces of head between frontal carinae and alitrunk smooth and shining.

Holotype Worker (LAMN). TL 2.48, HL 0.66, HW 0.66, CI 100, SL 0.52, SI 79, EL 0.08, PW 0.42, AL 0.62, PPW 0.18, PPL 0.16, PPI 113. Paratypes, two workers (LAMN, MCZC).

Worker. TL 2.40, 2.40; HL 0.65, 0.66; HW 0.66, 0.66; CI 100, 102; SL 0.55, 0.55; SI 83, 83; EL 0.08, 0.08; PW 0.44, 0.44; AL 0.60, 0.61; PPW 0.18, 0.18; PPL 0.16, 0.16; PPI 113, 113 (n = 2).

Mandibles smooth and shining but with few longitudinal rugae in the paratypes. A broad-based short tooth present about midway on the basal margin of the mandible. Frontal area concave with a median carina. Clypeus flat, unsculptured, smooth, and shining, its anterior margin with two lateral teeth, but in the two paratypes, an additional weak median tooth present. Frontal carinae distinct, extending to the level of the posterior margins of eyes. Scrobal impressions shallow, present lateral to the frontal carinae in full-face view. Frontal lobes weak so that the antennal articulations are almost entirely exposed. Antennal scapes, when lying on the head, close to the occipital margin. Eyes very small, with two to three ommatidia in the longest row. Pronotum unarmed. Propodeum with a pair of triangular teeth. Metapleural lobes rounded. Petiole node in profile high with the anterodorsal angle higher than the posterodorsal, its anterior peduncle about as long as the node. Postpetiole in profile higher than long with a rounded dorsum. In dorsal view, petiole node subrounded, about as broad as long; postpetiole broader than long. Dorsum of head between the frontal carinae smooth and shining but with some foveolate punctures present around the eyes. Dorsum of alitrunk smooth and shining. Petiole and postpetiole smooth and shining. Gaster unsculptured. Dorsal surfaces of head and alitrunk with numerous erect or suberect hairs. Two pairs of hairs present on the dorsum of petiole node, three pairs on the dorsum of postpetiole, and a few on the base of the first gastral tergite. A few pairs of forward-projecting hairs present near the anterior clypeal margin. Scapes and tibiae with some erect or suberect short hairs. Color reddish-brown.

Queen and Male. Unknown.

Comments. Pristomyrmex boltoni is a sibling species of *P. longus* and *P. coggii.* The three species are all from New Guinea. Their workers possess very small eyes. *Pristomyrmex boltoni* differs from *P. longus* and *P. coggii* as follows: The dorsum of the petiole node in dorsal view is slightly broader than long or about as broad as long in the workers of *P. boltoni,* but long-oval and distinctly longer than broad in *P. longus.* The dorsal surfaces of the head between the frontal carinae and the alitrunk are smooth in the workers of *P. boltoni* but are covered with numerous foveolate punctures in *P. coggii.*

The workers of *P. boltoni* are also similar in appearance to those of *P. levigatus,* but they can be separated by the following characters:

P. boltoni

Eyes smaller, with the maximum diameter 0.08, containing two to three ommatidia in the longest row

P. levigatus

Eyes larger, with the maximum diameter 0.12 to 0.16 (rarely 0.10), containing five to seven ommatidia in the longest row

Holotype Worker. New Guinea: Gulf Prov., Ivimka Camp, Lakekamu Basin, 7.73°S, 146.76°E, 120 m, #96-235, lowland wet forest, ex sifted leaf litter, 28.x.1996 (R. R. Snelling).

Paratypes. Two workers, New Guinea: Gulf Prov., Ivimka Camp, Lakekamu Basin, 7.7°S, 146.8°E, 140 m elevation, #96-280, lowland wet forest, ex sifted leaf litter, 6.xi.1996 (R. R. Snelling).

A non-type specimen (ANIC), collected in New Guinea (Brown R., lowland RF, under log) by B. B. Lowery, has the following measurements: HW 0.66, HL 0.66, SL 0.56, EL 0.08, PW 0.44, AL 0.60.

Ecological Information. This species occurs in lowland forest and has been collected in litter samples.

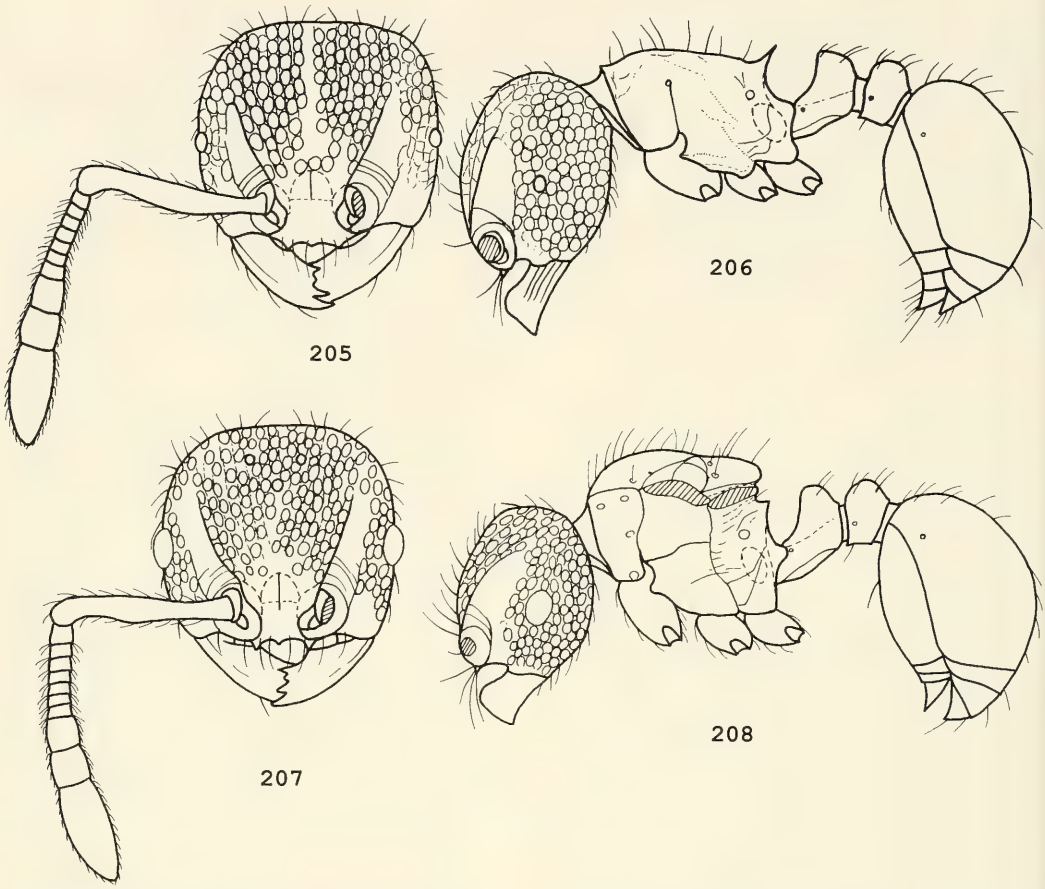
Pristomyrmex coggii Emery
Figures 205–208

Pristomyrmex coggii Emery, 1897: 584. Lectotype worker, New Guinea: Montes Hansemanni et Berlinhafen (Biró) (MCSN), here designated, [examined].

Diagnosis (Worker). Masticatory margin of mandible lacking a diastema and possessing four teeth, of which the third tooth, counting from the apex, smallest; eyes with two to four ommatidia in the longest row; dorsal surface of head, except for the scrobal areas, with foveolate-reticulate sculpture; dorsum of petiole node in dorsal view about as long as broad or slightly broader than long; first gastral tergite with only a few hairs.

Worker. TL 2.20–2.86, HL 0.60–0.74, HW 0.60–0.76, CI 98–104, SL 0.48–0.64, SI 74–86, EL 0.05–0.09, PW 0.40–0.48, AL 0.60–0.77, PPW 0.16–0.20, PPL 0.12–0.17, PPI 118–133 (n = 20).

Mandibles usually smooth and shining but sometimes with a few superficial longitudinal rugae. A broad and short or strongly prominent tooth present about midway on the basal margin of mandible. Clypeus flat, its anterior margin sometimes with three denticles: a median denticle and one on each side, but sometimes the median denticle absent or weak so that only two teeth are present there. Frontal area concave, with a median carina that usually extends to the clypeus. Ventral center of clypeus lacking any rugae or prominences. Palp formula 1,3. Frontal carinae distinct, extending to the level of the posterior margins of eyes. Scrobal impressions smooth and shallow, present lateral



Figures 205–208. *Pristomyrmex coggii* Emery. 205: Worker head, full-face view; 206: Worker, lateral view; 207: Queen head, full-face view; 208: Queen, lateral view.

to the frontal carinae. Frontal lobes weakly expanded so that the antennal articulations are almost completely exposed. Eyes small, usually with two to three, rarely four, ommatidia in the longest row. Occipital margin straight or feebly concave in full-face view. Pronotum unarmed. Propodeum with a pair of triangular short spines. Metapleural lobes rounded. Petiole node in profile high, with the anterodorsal angle higher than the posterodorsal, its anterior peduncle about as long as the node. In dorsal view, dorsum of petiole node subrounded, about as long as broad, or transoval, slightly broader than long. Subpetiole with a narrow, long, semitranslucent lamella. Postpetiole in profile rounded dorsally, in dorsal view somewhat transverse-rectangular and broader than long. Dorsum of head, except for the scrobal areas, with dense foveolate punctures that form foveolate-reticulate sculpture; sometimes the punctures are almost aligned so that it seems that the several longitudinal rugae appear between the frontal carinae. Dorsum of alitrunk with sparse foveolate punctures. Petiole, postpetiole, and gaster unsculptured, smooth, and shining. Dorsal surfaces of head and alitrunk with numerous erect to suberect hairs. Dorsal surfaces of petiole node and postpetiole usually with two pairs of hairs, respectively. A few hairs present on the base of the first gastral tergite. A few pairs of forward-projecting hairs present near the anterior clypeal margin. Scapes and tibiae with numerous erect to suberect short hairs. Color reddish-brown.

Queen. TL 2.94–3.16, HL 0.72–0.78, HW 0.72–0.82, CI 100–105, SL 0.56–0.66, SI 77–83, EL 0.15–0.17, PW 0.55–0.64, AL 0.78–0.96, PPW 0.21–0.24, PPL 0.17–0.18, PPI 122–133 (n = 3).

Generally similar to worker, except for normal caste differences. In addition, foveolate punctures shallow on the mesonotum, propodeal armaments slightly shorter than those in conspecific worker.

Male. Unknown.

Comments and Discussion. Pristomyrmex coggii is closely related to *P. boltoni* and *P. longus.* The three species occur in New Guinea. Characters separating *P. coggii* from *P. boltoni* are provided under the latter name. *Pristomyrmex coggii* differs from *P. longus* because the dorsum of the petiole node in dorsal view is about as long as broad or broader than long in the workers of *P. coggii* but longer than broad in *P. longus.*

Pristomyrmex coggii differs from *P. obesus* of Solomon Islands as follows: The workers of *P. coggii* possess only a few hairs on the first gastral tergite and have smaller eyes containing two to three, rarely four, ommatidia in the longest row. But in the workers of *P. obesus,* the entire first gastral tergite is evenly covered with erect or suberect hairs, and the eyes contain five to seven (rarely four) ommatidia in the longest row. *Pristomyrmex coggii* differ from *P. simplex* of New Guinea and the Philippines because the dorsum of the head between the frontal carinae bears foveolate-reticulate sculpture in the workers of *P. coggii* but only scattered foveolate punctures in *P. simplex*; in addition, the eyes usually contain five ommatidia in the longest row in the workers of *P. simplex* but usually two to three in *P. coggii.*

It must be pointed out that the material I have examined may resolve into two species with further study. Additional collecting will help clarify the situation.

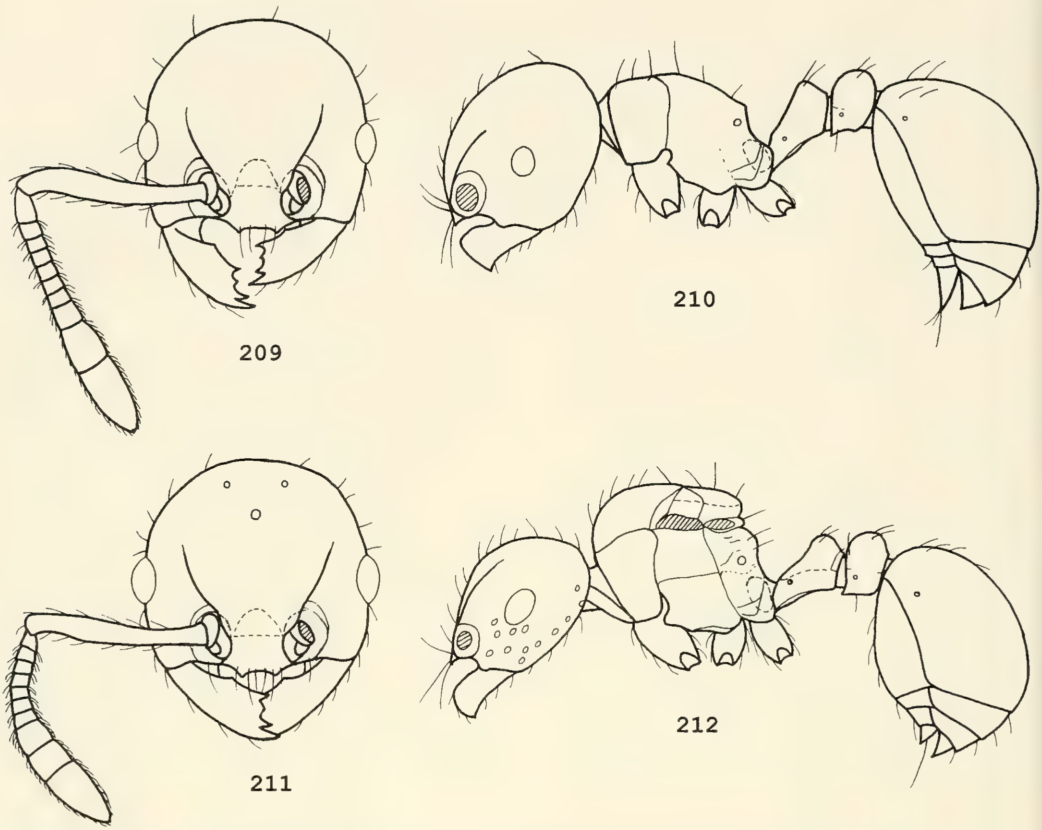
Material Examined (MCZC, ANIC, LAMN, BMNH, NHMV). Papua New Guinea: Gulf Prov., Ivimka Camp, Lakekamu Basin, lowland wet forest, #96-291 (7.73°S, 146.76°E, 120 m, ex sifted leaf litter), #96-350 (7.7°S, 146.8°E, 400 m elevation, sifted leaf litter and debris from rotten log) (R. R. Snelling); W. Highlands, Baiyer R., 4,000 ft (S. Peck); Rinona (R. Vane-Wright); New Guinea (Biró); Nadzab, dry evergreen forest (E. O. Wilson); Huon Pen., lower Busu R., lowland rainforest (E. O. Wilson); Wau, Kilolo Creek (J. Balogh); Lae, rainforest, leaf mold (T. E. Woodward); Lae, Busu R., lowland rainforest, in rotten wood on ground (B. B. Lowery); NW Lae, "Timber Track" ca. 16 km, rainforest, ca. 220 m, berlesate (R. W. Taylor); near Popondetta, <50 m (R. W. Taylor); 8 km S of Kokoda, 800 m, rainforest (R. W. Taylor).

Ecological Information. This species occurs in rainforest and has been collected in litter samples and in rotten wood on the ground.

Note: I have examined additional 25 specimens, including 19 workers and 6 queens. In these workers, the eyes are slightly larger than those in *P. coggii;* they contain four to five ommatidia in the longest row. Further collecting and studying are needed.

These 25 specimens have the following measurements: Worker: TL 2.76–3.00, HL 0.73–0.80, HW 0.73–0.82, CI 100–106, SL 0.58–0.64, SI 74–82, EL 0.09–0.10, PW 0.48–0.52, AL 0.68–0.82 (n = 19). Queen: TL 2.92–3.34, HL 0.72–0.80, HW 0.72–0.82, CI 100–103, SL 0.56–0.62, SI 73–82, EL 0.15–0.17, PW 0.55–0.62, AL 0.80–0.92 (n = 6).

Collecting Data for the 25 Specimens (MCZC, ANIC, BMNH). New Guinea: Morobe Dist., Bulolo (B. B. Lowery); Bulolo, rainforest, 3,500 ft (B. B. Lowery); NE New Guinea, 6 km NE of Wau, Bulolo R. valley, rainforest, 1,100 m, berlesate, leaf mold (R. W. Taylor); Wau, Bishop Mu-



Figures 209–212. *Pristomyrmex inermis* **sp. n.** 209: Worker head, full-face view; 210: Worker, lateral view; 211: Queen head, full-face view; 212: Queen, lateral view.

seum Station, 1,200 m, rainforest, rotten log (R. W. Taylor); Wau, 4,000 ft, forest litter (S. Peck); N. Wau, on Bulolo Rd., 650 m (S. Peck); Wau, Kunai Creek, rainforest, ca. 1,400 m, berlesate (R. W. Taylor); Tapini, 1,000 to 1,200 m, rainforest, rotten log (R. W. Taylor).

Pristomyrmex inermis sp. n.
Figures 209–212

Diagnosis (Worker). Propodeum lacking a pair of teeth or spines.

Holotype Worker (LAMN). TL 2.86, HL 0.72, HW 0.70, CI 97, SL 0.64, SI 91, EL 0.14, PW 0.50, AL 0.72. Paratypes, 17 workers and three queens (ANIC, LACM, MCZC, BMNH).

Worker. TL 2.65–3.36, HL 0.70–0.84, HW 0.69–0.84, CI 96–103, SL 0.62–0.76, SI 83–92, EL 0.12–0.16, PW 0.46–0.58, AL 0.63–0.80, PPW 0.23–0.27, PPL 0.17–0.21, PPI 128–142 (n = 18).

Mandibles smooth and shining but sometimes with a few superficial small punctures. Masticatory margin of mandible with four teeth arranged as the strongest apical + the second strongest preapical + the smallest third + a basal tooth; a distinct diastema lacking. A broad-based triangular short tooth present about midway on the basal margin of mandible. Frontal area concave. Clypeus flat, smooth, and shining, its anterior margin with three denticles: a weak median tooth and one on each side, but sometimes the median tooth indistinct or lacking so that only two teeth are present there. Ventral surface of clypeus lacking any distinct rugae or teeth. Palp formula 1,3. Frontal carinae just extending to the level of the posterior margins of the eyes. Antennal scrobes absent. Frontal lobes very weak. Eyes moderately sized. Occipital margin feebly convex in full face view. Dorsum of alitrunk in profile arched. Pronotum unarmed. Propodeum lacking a pair of teeth or spines but usually with a pair of blunt small tubercles. Metapleural lobes small, usually bluntly rounded, but sometimes toothlike. Petiole node in profile wedge-shaped, usually with a blunt triangular apex; sometimes the apex somewhat bluntly rounded. Subpetiole with a narrow rim. Postpetiole in profile slightly higher than the petiole node, with a convex dorsum. In dorsal view, petiole node and postpetiole broader than long. Cephalic dorsum between the frontal carinae highly polished but usually with a few foveolate punctures bordering frontal carinae. A few foveolate punctures present on the genae and many on the ventral surface of the head. Dorsum of alitrunk, petiole, and postpetiole smooth and shining. Gaster unsculptured. Dorsal surfaces of head, alitrunk, petiole, and postpetiole with sparse erect to suberect hairs. A few hairs present on the first gastral tergite. A few pairs of forward-projecting hairs present near the anterior clypeal margin. Scapes and tibiae with some suberect hairs. Color varying from light yellow-brown to blackish-brown, gaster usually darker than alitrunk; sometimes alitrunk lighter than head and gaster so that the specimens show a bicolored form.

Queen. TL 3.23–3.52, HL 0.80–0.81, HW 0.76–0.85, CI 95–106, SL 0.66–0.74, SI 87–92, EL 0.18–0.20, PW 0.64–0.72, AL 0.86–0.94, PPW 0.26–0.30, PPL 0.18–0.24, PPI 125–144 (n = 3).

General shape as in Figures 211–212; except for normal caste differences, other characters similar to worker.

Male. Unknown.

Comments. This species can be easily recognized because it lacks a pair of propodeal teeth or spines in the workers, which is unique within *Pristomyrmex.* In addition, in the *levigatus* group, *P. inermis* has a characteristic shape of the petiole node in the workers and queens: wedge-like in profile view with an apex. This character has originated independently at least twice in the genus because it is also seen in *P. fossulatus* and *P. punctatus* of the *punctatus* group.

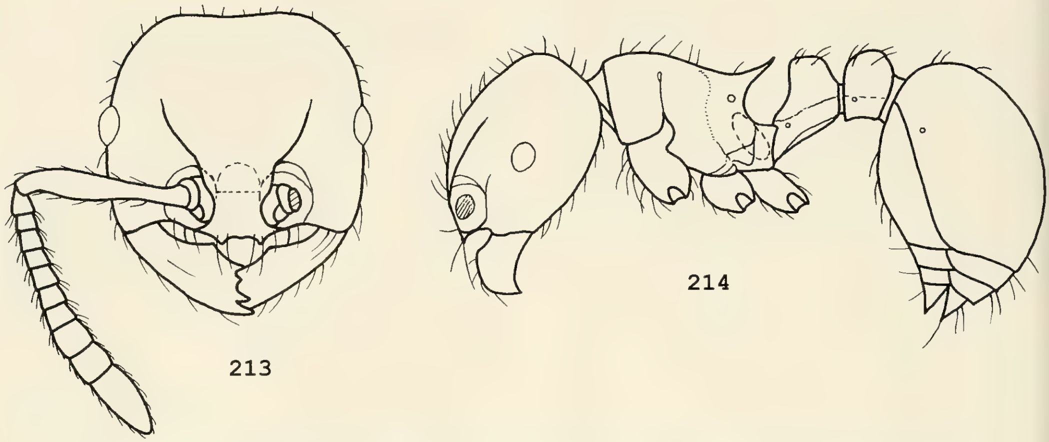
Holotype Worker. Indonesia: Irian Jaya, PT. Freeport Concession, Siewa Camp., 03.04°S 136.38°E, 200 ft, lowland secondary rainforest, #98-71 (stray foragers in leaf litter), 12.iv.1998 (R. R. Snelling).

Paratypes. One queen with same data as holotype; one queen with same data as holotype but date 7.iv.1998, and number #98-48 (stray on log); two workers with same data as holotype but date 7.iv.1998 and number #98-44 (ex sifted leaf litter); three workers, Papua New Guinea: Bulolo, 2,300 ft, rainforest, 19.xii.1967 (B. B. Lowery); three workers, Papua New Guinea: Bulolo, 2,300 ft, rainforest, 27.xii.1967 (B. B. Lowery); three workers, Papua New Guinea: Bulolo, 2,600 ft, rainforest, 25.xii.1970 (B. B. Lowery); one worker, Papua New Guinea: Bulolo, 2,800 ft, rainforest, 1.i.1971 (B. B. Lowery); three workers, Papua New Guinea: Bulolo, 3,000 ft, rainforest, 5.i.1971 (B. B. Lowery); one queen, New Guinea: Bulolo (Morobe Dist), 8.i.1971 (B. B. Lowery); two workers, New Guinea: near Vanimo, rainforest, ca. 50 m, ex rotting log, 10–11.vii.1972 (R.W.T.).

Ecological Information. This species occurs in rainforest and has been collected in litter samples and on logs.

Pristomyrmex largus **sp. n.**
Figures 213–214

Diagnosis (Worker). Masticatory margin of mandible lacking a diastema and possessing four teeth, of which the third tooth, counting from the apex, smallest;



Figures 213–214. *Pristomyrmex largus* **sp. n.** 213: Worker head, full-face view; 214: Worker, lateral view.

HW and HL ≥ 0.90; petiole node in profile with the anterodorsal angle higher than the posterodorsal.

Holotype Worker (ANIC). TL 3.38, HL 0.90, HW 0.96, CI 107, SL 0.78, SI 81, EL 0.14, PW 0.61, AL 0.92, PPW 0.24, PPL 0.20, PPI 120. Paratypes, 34 workers and one queen (MCZC, R. Clouse's personal collection).

Worker. TL 3.40, HL 0.90, HW 0.90, CI 100, SL 0.81, SI 90, EL 0.14, PW 0.60, AL 0.90, PPW 0.25, PPL 0.20, PPI 125 (*n* = 1).

Mandibles smooth and shining. A broad-based triangular short tooth present about midway on the basal margin of the mandible. Clypeus flat, unsculptured, smooth, and shining; its anterior margin with three denticles: a weak median tooth and one prominent lateral tooth on each side, sometimes the median tooth indistinct. Ventral surface of clypeus unsculptured and smooth. Palp formula 1,3. Frontal carinae just extending to the level of the posterior margins of eyes. Antennal scrobes absent. Frontal lobes weakly expanded. Eyes moderately sized. Occipital margin straight or feebly concave in full-face view. Pronotum unarmed. Propodeum with a pair of long spines that are about 1.5 times the distance between their bases. Metapleural lobes subtriangular. Dorsum of alitrunk in dorsal view rather flat. Petiole node in profile high, with the anterodorsal angle higher than the posterodorsal, its anterior face sometimes subparallel to the posterior one; anterior peduncle of the node about as long as the node, and subpetiole with a narrow semitranslucent rim. In dorsal view, petiole node transoval. Postpetiole in profile higher than long, rounded dorsally, in dorsal view broader than long and somewhat transrectangular. Both dorsal and ventral surfaces of head smooth and shining but with few small, shallow punctures present on the genae. Dorsum of alitrunk smooth and shining. Petiole and postpetiole smooth and shining, except for a lateral longitudinal carina on each side that separates the tergite from the sternite. Gaster unsculptured. Dorsal surfaces of head and alitrunk with some erect to suberect short hairs. Petiole node and postpetiole each with two pairs of hairs as illustrated in Figure 214. A few hairs present near the base of the first gastral tergite. A few pairs of forward-projecting hairs present near the anterior clypeal margin. Scapes and tibiae with abundant erect to suberect short hairs. Color yellow-brown to reddish-brown.

Queen. TL 3.94, HL 0.94, HW 0.95, CI 101, SL 0.80, SI 84, EL 0.22, PW 0.74,

AL 1.01, PPW 0.30, PPL 0.23, PPI 130 (n = 1).

Generally similar to worker, except for normal caste differences; in addition, propodeum with a pair of short spines, shorter than those in the conspecific worker, first gaster tergite with numerous hairs.

Male. Unknown.

Comments. Pristomyrmex largus is the second largest species in the *levigatus* group after *P. lucidus. Pristomyrmex largus* must have evolved from the ancestor of *P. levigatus. Pristomyrmex largus* can be separated from *P. levigatus* by the following characters in the workers:

P. largus

- Larger species with HW ≥ 0.90, and HL ≥ 0.90
- Propodeal spines relatively long, longer than the distance between their bases
- Ventral surface of head smooth, with only a few small hair pits

P. levigatus

- Smaller species with HW < 0.80, and HL < 0.80
- Propodeal armaments relatively short, shorter than or about as long as the distance between their bases
- Ventral surface of head with numerous foveolate punctures

Holotype Worker. Ponape I., Mt. Tolenkiup; vi-ix.50 (P. A. Adams).

Paratypes. One worker, Micronesia: Pohnpei I., Hilltop campsite near Mt. Nanalaud, 400 m, on an old ivory nut, 3.v.1995 (Ron Clouse); 33 workers and one queen, Pohnpei I., Nahnal aud cave, around camp (#155–158, under dead leaves, on ground; #161, under rotting leaves; #167, under dead leaves; #178–180, leaves, under rotten), 24.iii.2000 (Ron Clouse).

Ecological Information. All paratypes of this species have been collected in high-elevation rainforest, under the rain-soaked leaf litter, and inside a rotten ivory nut on the forest floor (R. Clouse, personal communication).

Note: I do not illustrate the queen of this species because this caste, together with 33 workers, collected by Mr. Ronald Clouse, reached me after my manuscript was completed.

Pristomyrmex levigatus Emery
Figures 215–218, 277, 281

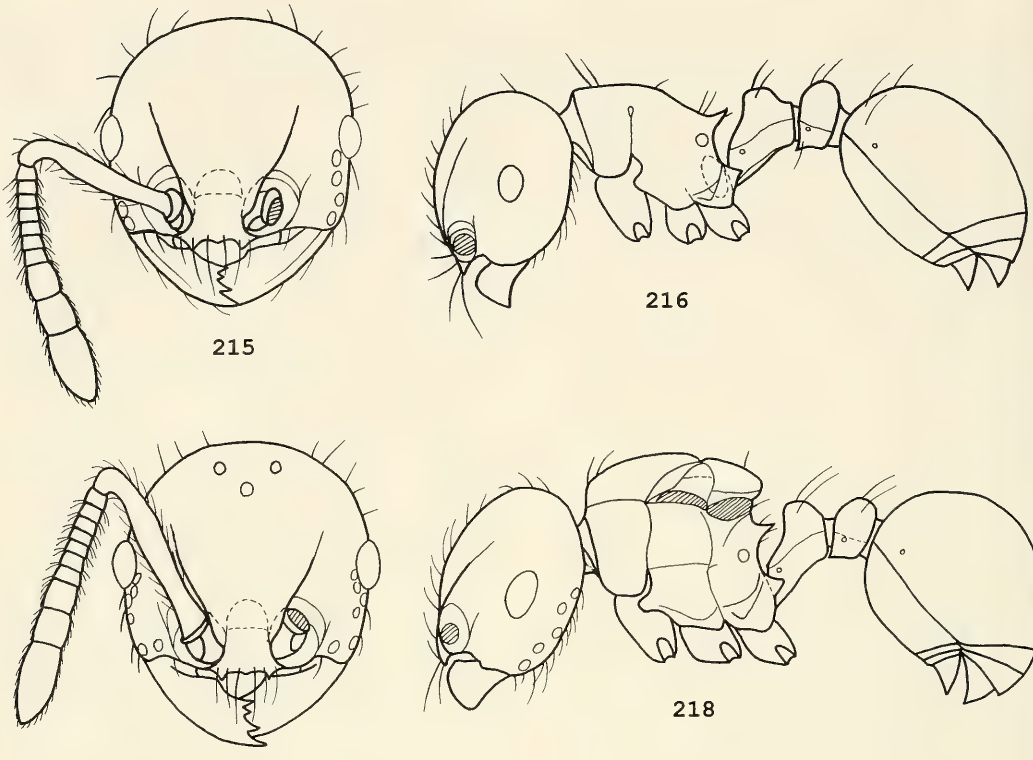
Pristomyrmex levigatus Emery, 1897: 583. Lectotype worker, New Guinea: near Friedrich-Wilhelmshafen et Berlinhafen (Biró) (MCSN), here designated, [examined].

Pristomyrmex mendanai Mann, 1919: 341. Two syntype workers, Solomon Is.: Santa Cruz Is., Graciosa Bay, 19.v.–24.xi.1916 (W. M. Mann) (MCZC, USNM) [examined]. **Syn. n.**

Note: The lectotype of *P. levigatus* shows some fine differences from the two syntypes of *P. mendanai.* In the former, the metapleural lobes are subtriangular; the dorsum of the alitrunk is rather flat, with two sides somewhat margined; the propodeum is armed with a pair of short spines that are not subtriangular but somewhat incurved at their apices. In the latter, the metapleural lobes are rounded; the dorsum of the alitrunk is convex, and its sides are not distinctly margined; the propodeal armaments are subtriangular, not distinctly incurved at their apices. However, the presence of some intermediate forms suggests that they belong to the same species for the present.

Diagnosis (Worker). Masticatory margin of mandible lacking a diastema and possessing four teeth, of which the third tooth, counting from the apex, smallest; HW 0.62–0.78, HL 0.64–0.78; eyes with five to eight ommatidia in the longest row; pronotum unarmed; propodeum with a pair of teeth or short spines; petiole with a lateral longitudinal carina on each side; subpetiole lacking a pinlike long process; dorsal surfaces of head and alitrunk smooth and shining.

Worker. TL 2.36–2.96, HL 0.64–0.78, HW 0.62–0.78, CI 96–106, SL 0.50–0.65, SI 78–89, EL 0.12–0.16 (very rarely 0.10), PW 0.41–0.52, AL 0.54–0.75, PPW 0.20–0.22, PPL 0.14–0.18, PPI 122–143 (n = 30).



Figures 215–218. *Pristomyrmex levigatus* Emery. 215: Worker head, full-face view; 216: Worker, lateral view; 217: Queen head, full-face view; 218: Queen, lateral view.

Mandibles usually smooth and shining but with a few fine longitudinal rugae in some specimens. A broad-based triangular short tooth present about midway on the basal margin of the mandible. Frontal area concave, usually unsculptured, but sometimes with a weak median carina. Clypeus flat, unsculptured, smooth, and shining; its anterior margin with a median denticle and two lateral teeth, but sometimes the median tooth is weak or absent. Ventral surface of clypeus lacking any rugae or toothlike prominences. Palp formula 1,3. Frontal carinae distinct, extending to the level of the posterior margins of eyes. Scrobal impressions shallow, present lateral to the frontal carinae. Frontal lobes weak so that the antennal articulations are almost entirely exposed. Antennal scapes, when lying on the head, close to the occipital margin. Eyes moderately sized, with five to eight ommatidia in the longest row. Dorsum of alitrunk in dorsal view flat in the lectotype but convex in some specimens. Pronotum unarmed or at most with blunt tubercles, lacking teeth or spines. Propodeum with a pair of triangular teeth or short spines that are slender, slightly incurved at their apices in the lectotype. Metapleural lobes subtriangular or rounded. Petiole node in profile nodiform with the anterodorsal angle higher than the posterodorsal; its anterior peduncle about as long as the node. Subpetiole with a narrow long flange. In dorsal view, the dorsum of petiole node transoval and broader than long. Postpetiole in profile higher than long, with a rounded dorsum, in dorsal view somewhat transverse-rectangular and broader than long. Dorsum of head smooth and shining but sometimes with a few foveolate punctures bordering the frontal carinae; sometimes a few foveolate punctures present on the genae and around the eyes. Dorsum of alitrunk unsculptured, smooth, and shining. Petiole and postpetiole smooth and shining, each with a longitudinal carina on each side that separates the tergite from the sternite. Gaster unsculptured. Dorsum of head with numerous erect to suberect hairs. Dorsum of alitrunk with some erect or suberect hairs. Dorsal surfaces of petiole node and postpetiole usually with one to two pairs and one to three pairs of hairs, respectively. A few hairs present at the base of the first gastral tergite. A few pairs of forward-projecting hairs present near the anterior clypeal margin. Scapes and tibiae with erect to suberect short hairs. Color golden-brown or reddish-brown.

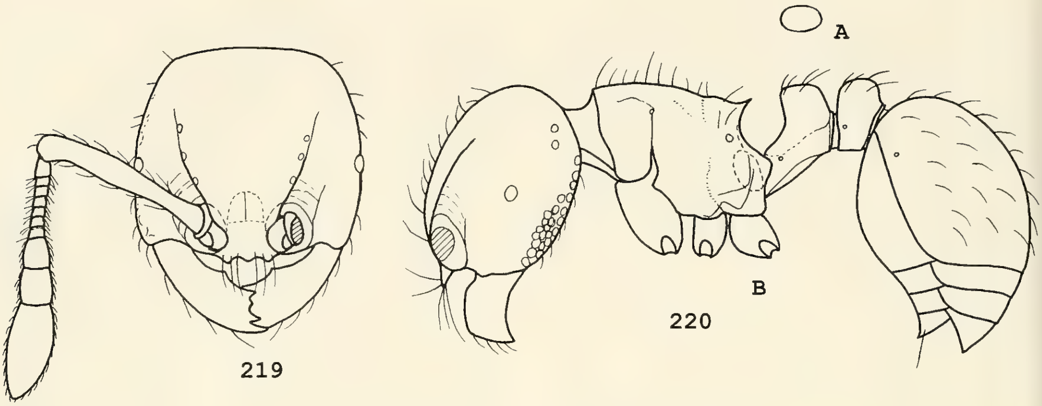
Queen. TL 2.92–3.34, HL 0.74–0.75, HW 0.76–0.81, CI 101–108, SL 0.60–0.65, SI 79–83, EL 0.18–0.19, PW 0.54–0.66, AL 0.80–0.92, PPW 0.23–0.26, PPL 0.18–0.20, PPI 128–133 (n = 5).

Generally similar to worker, except for normal caste differences. Propodeal armaments tuberculate or denticulate, slightly shorter than those in the conspecific worker.

Male (Figs. 277, 281). Two male specimens, together with 13 workers and two queens, collected in New Guinea (Nadzab, #1083) by E. O. Wilson, constitute a series; each of the two males was originally mounted together with a worker or with a worker and a queen on the same pin: TL 2.48, 2.54; HL 0.50, 0.51; HW 0.53, 0.53; CI 105, 106; SL 0.16, 0.18; SI 30, 34; HWE 0.63, 0.64; EL 0.23, 0.25; PW 0.60, 0.63; AL 0.82, 0.84; PPW 0.18, 0.19; PPL 0.15, 0.16; PPI 119, 120 (n = 2).

Head, including the eyes, broader than long. Clypeus lacking a median longitudinal carina; anterior clypeal margin rather straight. Frontal carinae reaching the level of the posterior margins of antennal insertions. Mesoscutum lacking distinct notauli and parapsidal furrows. Scuto-scutellar sulcus with nine narrow longitudinal ridges. Propodeum weakly tuberculate, lacking teeth or spines. Metapleural lobes with a blunt or somewhat rounded apex. Middle and hind tibiae without any spurs. Petiole node in profile low, nodiform, having an anterior face and a long anterior peduncle. Postpetiole in profile low and rounded dorsally, in dorsal view subrectangular and broader than long. Dorsum of head smooth and shining, but frontal area with a median longitudinal carina. Dorsal alitrunk generally smooth and shining, except for those marked sutures. Dorsal surfaces of petiole and postpetiole smooth and shining. Gaster unsculptured. All dorsal surfaces with abundant rather long hairs. Legs and scapes with numerous erect or suberect short hairs. Color blackish-brown. Wings infuscated.

Comments and Discussion. Pristomyrmex levigatus occurs in New Guinea, Nama Is., Solomon Is., New Georgia, and New Britain Is. It appears to be a basal species within the *levigatus* group. Many species, such as *P. acerosus, P. boltoni, P. inermis, P. largus, P. lucidus, P. mandibularis, P. minusculus, P. obesus,* and *P. simplex,* may have evolved from a *P. levigatus*–like ancestor. The workers of these species are separable from those of *P. levigatus* as follows: *P. levigatus* differs from both *P. simplex* and *P. obesus* by lacking foveolate punctures on the dorsal surfaces of the alitrunk and the head between the frontal carinae. In *P. levigatus,* the eyes are larger, usually containing five to eight ommatidia in the longest row but two to three in *P. boltoni. Pristomyrmex levigatus* is smaller (HW < 0.80, HL < 0.80) than *P. largus* and *P. lucidus* (HW > 0.90, HL > 0. 90). *Pristomyrmex minusculus* bears a pair of pronotal teeth that are not seen in *P. levigatus.* A pair of propodeal teeth or short spines are present in *P. levigatus,* but absent in *P. inermis. Pristomyrmex levigatus* possesses a longitudinal ruga on each side of the petiole node that is not seen in *P.*



Figures 219–220. *Pristomyrmex longus* **sp. n.** 219: Worker head, full-face view; 220A: Showing the dorsum of the petiole node of the worker, in dorsal view, is long-oval and longer than broad; 220B: Worker, lateral view.

mandibularis. Finally, the subpetiole of *P. levigatus* does not have a pinlike long process that is distinct in *P. acerosus.*

Material Examined (ANIC, BMNH, LAMN, MCZC). New Guinea: Nadzab, #1083, dry evergreen forest (E. O. Wilson); Gogol Val. ca. 24 km W. Madang, ca. 50 m, rainforest, rotten wood, ex small fragment (R. W. Taylor); Bulolo, rainforest, 2,300 ft (B. B. Lowery); Yawasora near Wewak, ca. 50 m, rainforest, berlesate (R. W. Taylor); Gulf Prov., Ivimka Camp, Lakekamu Basin, 7.73°S, 146.76°E, 110 m, #96-345 (R. R. Snelling); Port Moresby, Brown River (J. Baloph); N.D. Papua, Sangara (G. Baker); (P. M. Room). Nama Is. near Truk (R. W. L. Potts). Solomon Is.: New Georgia (E. S. Brown). New Britain Is. (L. Weatherill).

Ecological Information. This species occurs in rainforest and has been collected in a litter sample.

Pristomyrmex longus **sp. n.**
Figures 219–220

Diagnosis (Worker). Masticatory margin of mandible lacking a diastema and possessing four teeth, of which the third tooth, counting from the apex, smallest; eyes small, with only two to three ommatidia in the longest row; dorsum of petiole node in dorsal view long-oval and longer than broad; first gastral tergite with numerous hairs.

Holotype Worker (MCZC). TL 2.51, HL 0.67, HW 0.66, CI 99, SL 0.55, SI 83, EL 0.07, PW 0.44, AL 0.66. Paratypes, 14 workers (MCZC, ANIC, BMNH).

Worker. TL 2.22–2.68, HL 0.63–0.70, HW 0.62–0.70, CI 95–100, SL 0.52–0.56, SI 80–87, EL 0.05–0.10, PW 0.40–0.46, AL 0.60–0.70, PPW 0.17–0.18, PPL 0.16–0.16, PPI 104–113 (n = 15).

Mandibles usually smooth and shining. A broad-based short tooth present about midway on the basal margin of the mandible. Clypeus flat, its anterior margin with a median tooth and two lateral teeth; sometimes the median tooth is weak. Frontal area concave, with a median carina that usually extends to the clypeus. Ventral surface of clypeus smooth, lacking any rugae or prominences. Palp formula 1,3. Frontal carinae distinct, extending to the level of the posterior margins of eyes. Scrobal impressions shallow, smooth, present lateral to the frontal carinae. Frontal lobes weakly expanded. Antennal scapes, when lying on the head, close to the occipital margin. Eyes very small, consisting of 4 to 10 ommatidia, with only two to three ommatidia in the longest row. Occipital margin straight or feebly concave in full-face view. Profile of alitrunk and pedicel segments as in Figure 220B. Pronotum unarmed. Propodeum with a pair of triangular teeth. Metapleural lobes rounded. Petiole node in profile high with the anterodorsal angle higher than the posterodorsal, its anterior face subparallel to the posterior one; anterior peduncle of the node about as long as or slightly shorter than the node; subpetiole with a narrow semitranslucent lamella. In dorsal view, dorsum of petiole node long-oval and distinctly longer than broad. Postpetiole in profile rounded dorsally, in dorsal view slightly broader than long or about as long as broad. Dorsum of head between the frontal carinae mostly smooth but usually with some sparse, small, and shallow punctures. Some foveolate punctures present on the genae and around the occipital corners of head. Dorsum of alitrunk, petiole, postpetiole, and gaster usually unsculptured, smooth, and shining. Dorsal surfaces of head, alitrunk, and gaster with numerous erect to suberect hairs. Two pairs of hairs usually present on the dorsal surfaces of petiole node and postpetiole, respectively, as illustrated in Figure 220B. A few pairs of forward-projecting hairs present near the anterior clypeal margin. Scapes and tibiae with numerous erect to suberect short hairs. Color yellow-brown to reddish-brown.

Queen and Male. Unknown.

Comments. The workers of *P. longus* are quickly recognizable by the following: In the *levigatus* group, only three species, *P. boltoni, P. coggii,* and *P. longus,* possess small eyes. Only two species, *P. longus* and *P. obesus,* have numerous hairs evenly distributed on the entire first gastral tergite. But in only one species (*P. longus*) is the dorsum of the petiole node in dorsal view long-oval and longer than broad; in the other members of the *levigatus* group, the dorsum of petiole node is subrounded or transverse-oval (i.e., about as long as broad or broader than long).

Holotype Worker. New Guinea: Huon Pen., Lower Busu R., lowl. rainfor., 5.v.1955, #957 (E. O. Wilson).

Paratypes. Eight workers with same data as holotype; one worker, New Guinea: Huon Pen., Lower Busu R., lowland rainforest, 6.v.1955, #978 (E. O. Wilson); five workers, New Guinea: 13 km NW Lae, Bubia, lowland rainforest, 26.iii.1955, #688 (E. O. Wilson).

Ecological Information. This species has been collected in lowland rainforest.

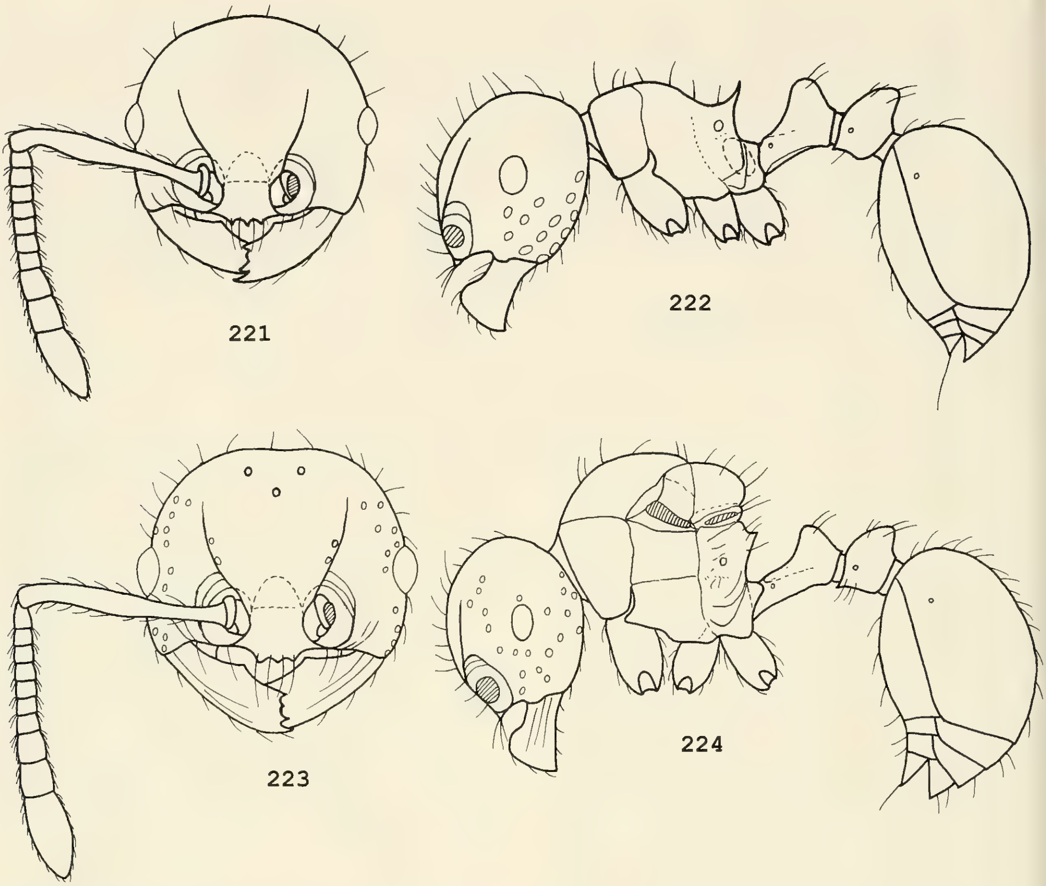
Pristomyrmex lucidus Emery
Figures 221–224

Pristomyrmex lucidus Emery, 1897: 584. Holotype worker, New Guinea: Berlinhafen (Biró) (MCSN) [examined].

Diagnosis (Worker). Masticatory margin of mandible lacking a diastema and possessing four teeth, of which the third tooth, counting from the apex, smallest; HW 0.98–1.26, HL 0.92–1.16; postpetiole in dorsal view longer than broad or as long as broad, in profile with an arched anterior face and a steeply sloping posterior face; petiole node in profile with a single evenly rounded blunt apex.

Worker. TL 3.71–4.84, HL 0.92–1.16, HW 0.98–1.26, CI 104–111, SL 0.90–1.16, SI 89–98, EL 0.16–0.20, PW 0.62–0.79, AL 0.90–1.28, PPW 0.24–0.28, PPL 0.26–0.31, PPI 84–100 (n = 55).

Mandibles smooth and shining but sometimes with a few longitudinal rugae superficial or distinct. A broad-based short tooth present about midway on the basal margin of the mandible. Clypeus with a short median longitudinal carina that usually does not reach to the anterior clypeal margin; sometimes this carina indistinct; sometimes a few additional short rugae present. Anterior clypeal margin with a median tooth and two lateral teeth; sometimes the median tooth is smaller than the others. Ventral surface of clypeus lacking any rugae or teeth. Palp formula 1,3. Frontal carinae extending to the level of the posterior margins of eyes. Antennal scrobes absent. Frontal lobes slightly expanded basally. Eyes containing 7 to 10 ommatidia in the longest row. Profile of alitrunk and pedicel segments as in Figure 222. Pron-



Figures 221–224. *Pristomyrmex lucidus* Emery. 221: Worker head, full-face view; 222: Worker, lateral view; 223: Queen head, full-face view; 224: Queen, lateral view.

otum at most with a pair of blunt tubercles, lacking teeth or spines. Propodeum with a pair of armaments, varying from broadly based minute teeth to moderately long acute spines. Metapleural lobes triangular or each with a blunt-rounded apex. Petiole node in profile high, with a single evenly blunt-rounded apex and a long anterior peduncle. Postpetiole in profile high (slightly higher than petiole), with an arched anterior face and a steeply sloping posterior face, its apex pointing posterior-upwardly. In dorsal view, postpetiole broadening from front to back, mostly longer than broad, rarely about as long as broad. Cephalic dorsum between the frontal carinae highly polished but usually with a few foveolate punctures bordering the frontal carinae. Sometimes a few foveolate punctures present on the genae and many on the ventral surface of the head. Dorsum of alitrunk, petiole, and postpetiole unsculptured and highly polished. Gaster smooth and shining. Dorsal surfaces of head and alitrunk with sparse erect to suberect moderately long hairs. A pair of hairs present on the dorsum of petiole node and one to two pairs on the dorsum of postpetiole. First gastral tergite with a few hairs. A few pairs of forward-projecting hairs present near the anterior clypeal margin. Scapes and tibiae with numerous suberect to erect short hairs. Body uniform yellow-brown or blackish-brown or bicolored (i.e., alitrunk and pedicel segments lighter than head and gaster).

Queen. TL 5.12, 5.22; HL 1.13, 1.14; HW 1.22, 1.27; CI 108, 111; SL 1.06, 1.13; SI 87, 89; EL 0.26, 0.28; PW 0.96, 1.00; AL 1.40, 1.42; PPW 0.31, 0.36; PPL 0.32, 0.38; PPI 95, 97 (n = 2).

Generally similar to worker, except for normal caste differences. In addition, propodeal armaments usually shorter than those in the conspecific worker; first gastral tergite sometimes with numerous erect or suberect hairs.

Male. Unknown.

Comments. The workers of *P. lucidus* can be easily recognized by the following characters: (1) The postpetiole, in profile view, shows an arched anterior face and a steeply sloping posterior face, with the apex pointing posterior-upwardly. This shape is unique in the *levigatus* group. Furthermore, the postpetiole in dorsal view is longer than or as long as broad. In the other 11 species of the group, the postpetiole, in dorsal view, is distinctly broader than long. (2) The petiole node in profile view bears a single evenly blunt-rounded apex that is not seen in the other 11 species of the *levigatus* group. (3) *P. lucidus* has the largest head width (HW) in the *levigatus* group: In the 55 specimens measured, HW is 1.00 to 1.26 but 0.98 in only one individual. In the other species of the *levigatus* group, HW is less than 0.90, except in one species, *P. largus*, in which, HW falls into the range 0.90 to 0.96.

Material Examined (ANIC, MCZC, LAMN, USNM, CASC, BMNH). Papua New Guinea: Tapini, 1,000 to 1,200 m, rainforest, acc. 2249 (rtw. wood fragment), acc. 2252 and 2262 (nest in soil under log) (R. W. Taylor); near Vanimo, rainforest, ca. 50 m (ex rotting log) (R. W. Taylor); Yawasora near Wewak, <50 m, rainforest, ex rotting wood piece (R. W. Taylor); 6 km NE of Wau, Bulolo R. Valley, rainforest 1,100 m, under bark of rotten log (R. W. Taylor); 8 km S of Kokoda, rainforest, 800 m, vial 4-36 (ground strays) and vial 37-191 (ex rotting wood piece) (R. W. Taylor); Wau, Bishop Museum Station, 1,200 m, ex soil under rotten branch (R. W. Taylor); 9 mi on Lae, side of Mumeng, 3,500 ft, rainforest (B. B. Lowery); Bulolo, 4,000 ft, rainforest (B. B. Lowery); Bulolo Gorge, 2,800 ft, rainforest (B. B. Lowery); along Kokoda Rd., 400 to 1,000 ft, rainforest (B. B. Lowery); 2 mi N Kokoda, ca. 1,000 ft, rainforest (B. B. Lowery); Wau Gorge, 3,000 ft, rainforest (B. B. Lowery); Wau, 4,000 ft, rainforest (B. B. Lowery); ca. 12 km SE Vanimo, 150 m Virgin hill rainforest (W. L. Brown); Wau N on Bulolo Rd. B-278, 650 m (S. Peck); Bewani Rd., near Vanimo km 2 quarry, 40 m, lowland rainforest (W. L. Brown); Maffin Bay (E. S. Ross). Indonesia: Irian Jaya, PT. Freeport Concession, Wapoga Camp., 03.14°S, 136.57°E, 3,450 ft, #98-230 (Montane primary rainforest, ex rotten stick in litter) (R. R. Snelling).

Ecological Information. This species occurs in rainforest and has been collected in soil under a log, under the bark of a rotten log, in litter samples, and on the ground.

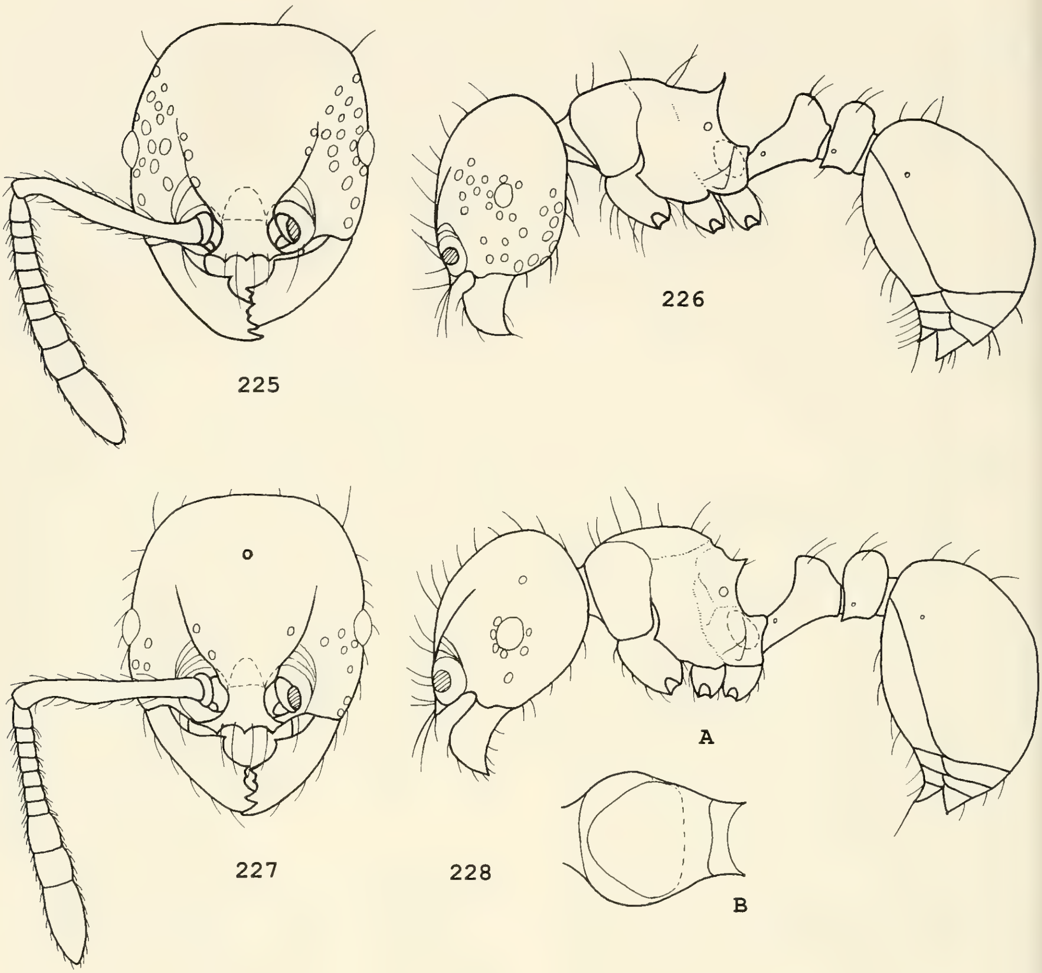
Pristomyrmex mandibularis Mann
Figures 225–228

Pristomyrmex mandibularis Mann, 1921: 444. Syntype workers, Fiji Is.: Viti Levu, Nadarivatu, 1915–1916 (W. M. Mann) (AMNH, LACM, MCZC, USNH) [examined].

Diagnosis (Worker). Masticatory margin of mandible lacking a diastema and possessing four teeth, of which the third tooth, counting from the apex, smallest; a strongly prominent tooth present about midway on the basal margin of mandible; petiole lacking a lateral longitudinal carina on each side; dorsum of head between frontal carinae usually smooth and shining.

Worker. TL 2.68–3.49, HL 0.74–0.84, HW 0.76–0.88, CI 95–107, SL 0.61–0.74, SI 80–93, EL 0.11–0.14, PW 0.48–0.60, AL 0.68–0.90, PPW 0.20–0.25, PPL 0.16–0.19, PPI 121–133 (n = 33).

Mandibles usually smooth and shining.



Figures 225–228. *Pristomyrmex mandibularis* Mann. 225: Worker head, full-face view; 226: Worker, lateral view; 227: Ergatoid queen head, full-face view; 228A: Ergatoid queen, lateral view; 228B: Dorsum of the ergatoid queen alitrunk, dorsal view.

A prominent tooth present about midway on the basal margin of mandible. Clypeus flat and unsculptured. Anterior clypeal margin with a median tooth and two lateral teeth; the median tooth, in size, similar to or smaller than the others. Ventral surface of clypeus usually with a weak transverse ruga. Palp formula 1,3. Frontal carinae extending to the level of the posterior margins of the eyes. Antennal scrobes absent. Frontal lobes slightly expanded. Eyes moderately sized. Occipital margin straight or feebly concave in full-face view. Pronotum unarmed. Propodeum with a pair of short to moderately long spines. Metapleural lobes triangular. Petiole node in profile high, higher than long, with the anterodorsal angle being an apex and the dorsum posteriorly rounding into the posterior surface, its anterior peduncle slightly longer than or about as long as the node. Postpetiole in profile high, about two times as high as long, rounded dorsally. In dorsal view, postpetiole transrectangular. Dorsum of head between the frontal carinae usually smooth and shining but sometimes with a few small and shallow punctures. Sometimes a few foveolate punctures bordering the frontal carinae, present on the genae and around the eyes. Dorsum of alitrunk smooth and shining. Petiole and postpetiole smooth and shining, each lacking a lateral longitudinal carina on each side. Gaster unsculptured. Dorsal surface of head with numerous erect to suberect long hairs. Some of similar hairs present on the dorsum of alitrunk, a pair on the petiole, one to two pairs on the postpetiole, and a few on the first gastral tergite. A few pairs of forward-projecting hairs present near the anterior clypeal margin. Scapes and tibiae with numerous erect to suberect hairs. Color reddish-brown to blackish-brown.

Ergatoid Queen. TL 3.32, 3.40; HL 0.84, 0.84; HW 0.82, 0.82; CI 98, 98; SL 0.66, 0.73; SI 80, 89; EL 0.14, 0.15; PW 0.54, 0.56; AL 0.78, 0.82; PPW 0.23, 0.24; PPL 0.19, 0.21; PPI 114, 121 (n = 2).

Generally similar to worker, color and pilosity as in the worker, but the head with one ocellus, alitrunk in dorsal view with a pro-mesonotal suture, mesonotum more convex, and propodeal armaments shorter than in the conspecific worker.

Queen and Male. Unknown.

Comments. Pristomyrmex mandibularis is endemic in Fiji and is the only *Pristomyrmex* species so far occurring there. It possesses an ergatoid queen caste, which is not seen in the other species of the *levigatus* group; furthermore, its ergatoid queen has only one ocellus.

Pristomyrmex mandibularis is closely related to *P. levigatus* and *P. largus,* also from the Oriental region. The differences between the workers of *P. mandibularis* and those of *P. levigatus* and *P. largus* are as follows:

P. mandibularis

Petiole and postpetiole each lacking a lateral longitudinal carina on each side

Basal margin of mandible with a strongly prominent tooth

Anterior clypeal margin usually with a distinct median tooth

P. levigatus and ***P. largus***

Petiole and postpetiole each with a longitudinal carina on each side that separates the tergite from the sternite

Basal margin of mandible with a broad-based short tooth

A median tooth, on the anterior clypeal margin, usually lacking or very weak

Material Examined (ANIC, MCZC, USNM, BMNH, MHNG). Fiji: Nausori Highlands, #424 (rotting stick in litter) (W. L. and D. E. Brown); Viti, Nadarivatu, rainforest, acc. 83 (berlesate, leaf mold) and acc. 66.51 (forest floor, colony in small crevice, rotting branch fragment) (R. W. Taylor); Nadarivatu (W. M. Mann); Lasema (W. M. Mann); Viti, Levu, Nadarivatu Reserve, 17.34′S, 177.57′E, Rainforest 800 m, Q. M. Berlesate No. 775, sieved litter (G. Monteith); Kadavu, 2 km SE Vunisea, 19.04′S, 178.10′E, rainforest 20 m, Q. M. Berlesate No. 770, sieved litter (G. Monteith).

Ecological Information. This species occurs in rainforest and has been collected in litter berlesates; it nests beneath stones in small colonies (Mann, 1921).

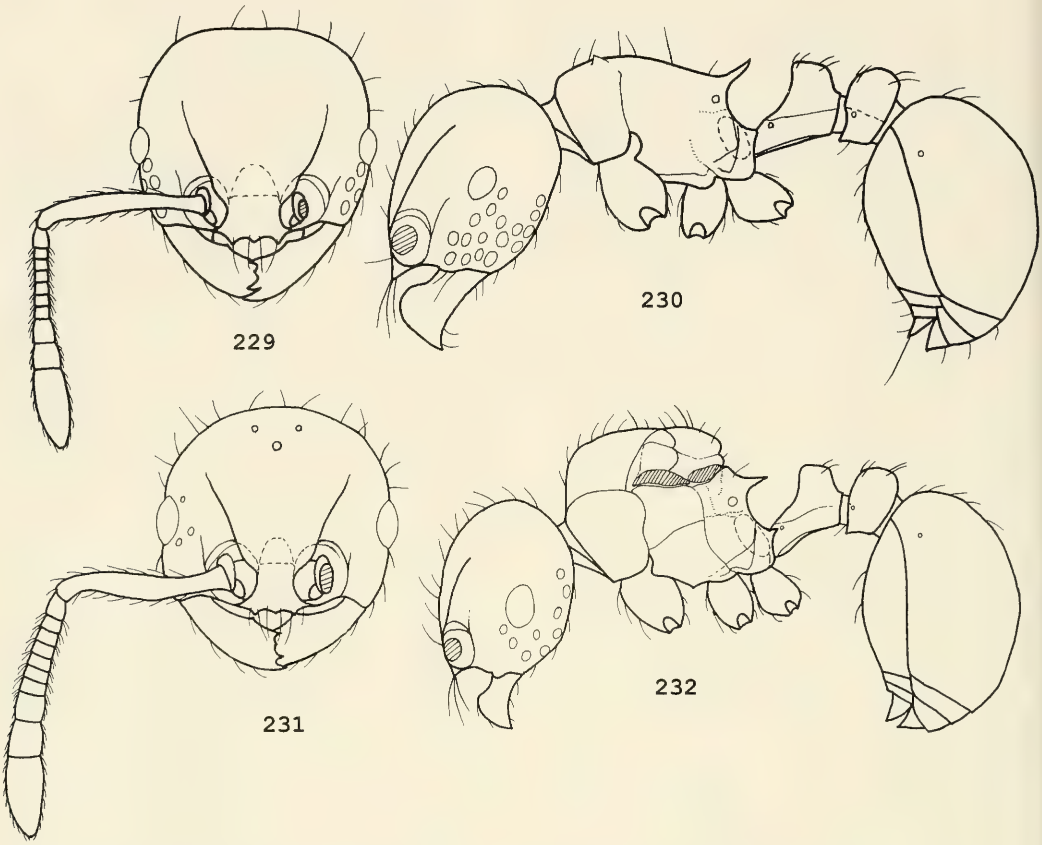
Pristomyrmex minusculus sp. n.
Figures 229–232

Diagnosis (Worker). Masticatory margin of mandible lacking a diastema and possessing four teeth, of which the third tooth, counting from the apex, smallest; pronotum with a pair of teeth.

Holotype Worker (MCZC). TL 3.02, HL 0.76, HW 0.80, CI 105, SL 0.66, SI 83, EL 0.14, PW 0.52, AL 0.78. Paratypes, 16 workers and one queen (MCZC, ANIC, BMNH, NACA).

Worker. TL 2.52–3.02, HL 0.66–0.78, HW 0.66–0.80, CI 99–106, SL 0.54–0.66, SI 77–84, EL 0.10–0.14, PW 0.45–0.52, AL 0.59–0.74, PPW 0.20–0.24, PPL 0.14–0.19, PPI 126–143 (n = 16).

Mandibles usually smooth and shining but sometimes with a few small shallow



Figures 229–232. *Pristomyrmex minusculus* **sp. n.** 229: Worker head, full-face view; 230: Worker, lateral view; 231: Queen head, full-face view; 232: Queen, lateral view.

punctures. A broad-based short tooth present about midway on the basal margin of the mandible. Clypeus unsculptured. Anterior clypeal margin with a median tooth and two lateral teeth, but the median tooth often smaller than the others, sometimes the median tooth indistinct. Ventral surface of clypeus with a weak transverse ruga. Palp formula 1,3. Frontal carinae extending to the level of the posterior margins of the eyes. Scrobal areas shallow, short, present lateral to the frontal carinae in full-face view. Frontal lobes weakly expanded. Eyes moderately sized. Occipital margin feebly concave. Alitrunk in dorsal view more or less flat. Pronotum with a pair of acute small teeth; in some small specimens, this pair of teeth are very weak but visible, and in dorsal view they become a pair of sharp points on the two sides of the pronotum. Propodeum armed with a pair of spines, varying in length and shape, straight to slightly upcurved along their length. Metapleural lobes subtriangular, but rarely with a rounded apex. Petiole node in profile high with the anterodorsal angle higher than the posterodorsal, its anterior surface usually subparallel to the posterior one, its anterior peduncle about as long as the node. Subpetiole with a narrow rim. Postpetiole in profile high, rounded dorsally. Petiole node and postpetiole in dorsal view broader than long. Dorsum of head between the frontal carinae smooth and shining but sometimes with a few foveolate punctures bordering the frontal carinae, present on the genae and around the eyes. Dorsum of alitrunk smooth and shining. Petiole and postpetiole each with a lateral longitudinal ruga on each side that separates the tergite from the sternite. Gaster unsculptured. Dorsal surfaces of head and alitrunk with sparse erect to suberect hairs. Dorsal surfaces of petiole node and postpetiole each usually with two pairs of hairs and first gastral tergite with a few hairs, as in Figure 230. A few pairs of forward-projecting hairs present near the anterior clypeal margin. Scapes and tibiae with some erect to suberect short hairs. Color yellow-brown to reddish-brown; appendages lighter.

Queen. TL 3.08, HL 0.72, HW 0.74, CI 103, SL 0.60, SI 81, EL 0.17, PW 0.60, AL 0.82, PPW 0.24, PPL 0.18, PPI 133 (n = 1).

Generally similar to worker, except for normal caste differences. In addition, pronotal armaments absent; propodeum with a pair of teeth or short spines that are shorter than those in the conspecific worker.

Male. Unknown.

Comments. This species has a wide distribution in the Oriental region. It is also dispersed to North Queensland, Australia. *Pristomyrmex minusculus* must be derived from a *P. levigatus*–like ancestor. It is indistinguishable, in the queen, from *P. levigatus* at present. The workers of *P. minusculus* have almost same appearance as those of *P. levigatus,* except for a derived character—the pronotum with a pair of small teeth. In the *levigatus* group, this critical character is possessed only by the workers of *P. minusculus,* thus making them easily recognizable.

Holotype Worker. Palau Is: Peleliu I., east coast, 26.i.1948 (H. S. Dybas).

Paratypes. Nine workers and one queen with same data as holotype; one worker, Wallis Is.: NukuTapu I., 28.iii.1965 to 1.iv.1965 (G. Hunt). Two workers, Indonesia: Seram, above Haruru, near Masohi, 50 to 150 m, 18.iii.1981 (W. L. Brown); one worker, Indonesia: Irian Jaya, 12 km S of Sorong, forest fragment, 1.v.1981 (W. L. Brown); two workers, Tonga Is.: Falehau, Niuatoputapu, moss + lichen, from coconut tree trunks, 1.ix.1971 (W. and G. Rogers); two workers, YapGroup, vii–viii.50. (R. J. Goss).

The following additional (non-type) specimens have a pair of very weak pronotal prominences. They have the following measurements: Worker: HW 0.60–0.72, HL 0.62–0.72, CI 97–103, SL 0.52–0.60, SI 77–87, EL 0.10–0.12, PW 0.42–0.48, AL 0.57–0.73, PPW 0.19–0.21, PPL 0.14–0.16, PPI 125–150 (n = 12). Queen: HW 0.76, 0.76; HL 0.76, 0.76; CI 100, 100; SL 0.62, 0.62; SI 82, 82; EL 0.18, 0.18; PW 0.62, 0.62; AL 0.82, 0.88; PPW 0.24, 0.24; PPL 0.17, 0.17; PPI 141, 141 (n = 2).

Collecting Data for These Non-Type Specimens (ANIC, USNM, BMNH). Papua New Guinea: Kiunga (J. Balogh); Bisianumu near Sogeri, rainforest, 500 m (E. O. Wilson); Maffin Bay (E. S. Ross). Micronesia: Pohnpei, Agric. and Trade School, in leaf litter (in Ylang-Ylang grove) and in rotting coconut tree (Ron Clouse). Australia: N. Queensland, Cape York, Lockerbie (G. B. Monteith); N.Q., Iron Ra. rainforest, berlesate (R. W. Taylor and J. Feehan).

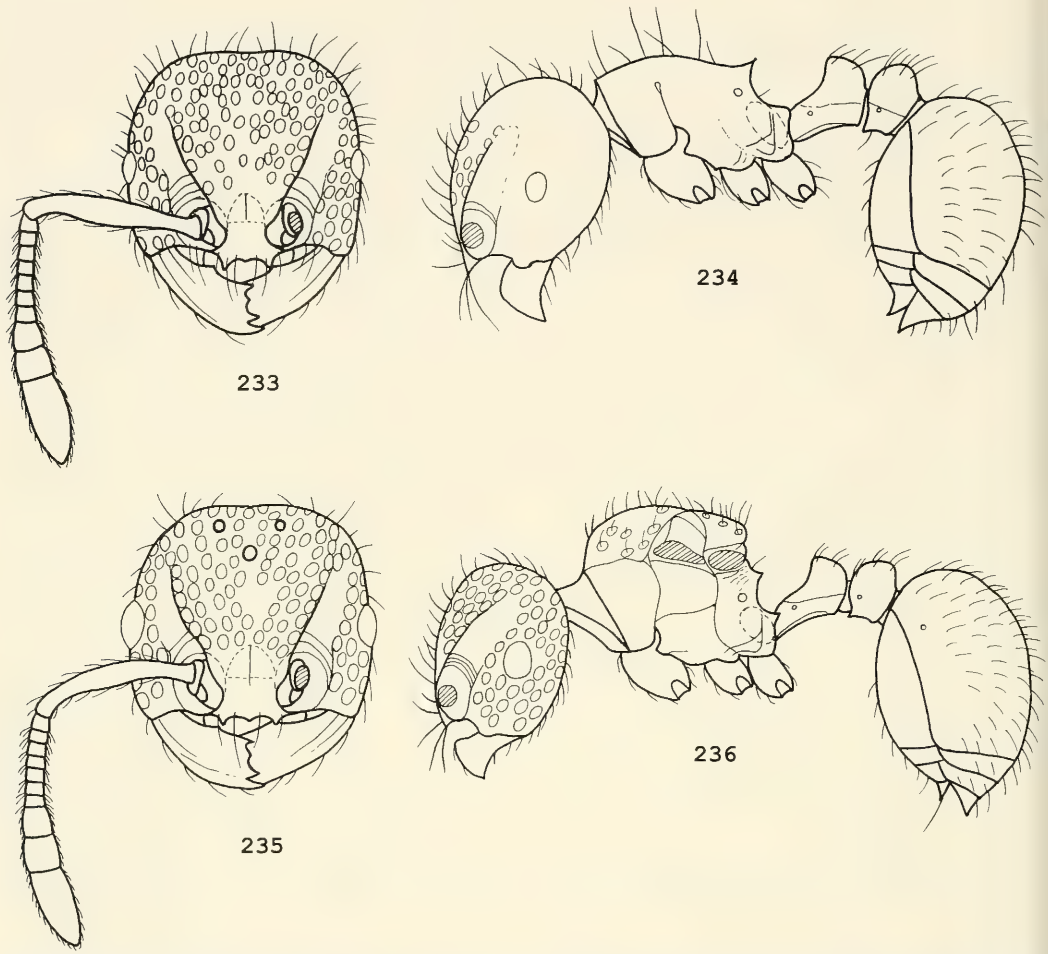
Ecological Information. This species occurs in rainforest and has been collected in litter samples, and in a rotting tree.

Pristomyrmex obesus Mann
Figures 233–236, 267, 278

Pristomyrmex obesus Mann, 1919: 339. Syntype workers, queen and male, Solomon Is.: Ysabel, Fulakora; Malaita, Auki; Three Sisters, Malapaina; 19.v.–24.xi.1916 (W. M. Mann) (MCZC, USNM, AMNH) [examined].

Pristomyrmex pegasus Mann, 1919: 338. Holotype worker, Solomon Is.: Santa Cruze: Graciosa Bay, 19.v.–24.xi.1916 (W. M. Mann) (USNM) [examined]. **Syn. n.**

Pristomyrmex obesus subsp. *melanoticus* Mann, 1919: 340. Syntype workers, Solomon Is.: San Cristoval, Pamua; Wai-ai; 19.v.–4.xi.1916 (W. M. Mann) (MCZC, USNM) [examined]. **Syn. n.**



Figures 233–236. *Pristomyrmex obesus* Mann. 233: Worker head, full-face view; 234: Worker, lateral view; 235: Queen head, full-face view; 236: Queen, lateral view.

Note: *Pristomyrmex pegasus* and *P. obesus* were described as two new species in Mann's (1919) paper, on pages 338 and 339, respectively (i.e., *P. pegasus* appeared before *P. obesus*; see also the previous citation). However, when proposing that these two names are synonymic, I choose *P. obesus* instead of *P. pegasus* as a valid specific name for the following two reasons: (1) Mann (1919) mentioned the presence of the elevated sides of the mesothorax, and the absence of a median tooth on the anterior clypeal margin are characteristic of *P. pegasus*. However, "the elevated sides of the mesothorax" are not shown in the unique holotype of *P. pegasus*, and "the absence of the median tooth on anterior border of clypeus" is actually an individual variation. (2) *P. obesus* possesses about a dozen syntypes, including a female and a male, but *P. pegasus* has only a single type specimen (i.e., holotype). If the holotype of *P. pegasus* is lost or destroyed in the future, it would be very inconvenient to those people who want to see it. Thus, *P. obesus* is selected as a valid name here.

Diagnosis (Worker). Masticatory margin of mandible lacking a diastema and possessing four teeth, of which the third tooth, counting from the apex, smallest; eyes containing four to seven ommatidia in the longest row; dorsum of head, except for the scrobes, usually with dense foveolate punctures; entire first gastral tergite evenly covered with numerous erect or suberect hairs.

Worker. TL 2.24–3.22, HL 0.63–0.86, HW 0.61–0.86, CI 94–104, SL 0.52–0.75, SI 79–88, EL 0.09–0.14, PW 0.41–0.55, AL 0.58–0.88, PPW 0.18–0.24, PPL 0.16–0.20, PPI 105–125 (n = 90).

Mandibles usually smooth and shining but sometimes with a few superficial short rugae or a few hair pits. A broad-based triangular short tooth present about midway on the basal margin of the mandible. Clypeus flat, smooth, but the median carina of frontal area usually extending to the clypeus. Anterior clypeal margin with a median denticle and two lateral teeth, but the median denticle often smaller than the others; sometimes the median denticle lacking; thus, only two teeth are present there. Ventral surface of clypeus lacking toothlike prominences or rugae. Palp formula 1,3. Frontal carinae extending to the level of the posterior margins of eyes. Scrobal impressions broad, shallow, present lateral to the frontal carinae. Frontal lobes slightly expanded. Eyes moderately sized, usually containing five to seven (rarely four) ommatidia in the longest row. Profile of alitrunk and pedicel segments as in Figure 234. Pronotum unarmed. Propodeum with a pair of triangular short spines. Metapleural lobes rounded. Dorsum of alitrunk in dorsal view usually with a longitudinal impression or furrow at middle, but sometimes this longitudinal impression indistinct. Petiole node in profile high with the anterodorsal angle higher than the posterodorsal, its anterior peduncle nearly as long as the node. Subpetiole with a narrow semitranslucent lamella. Postpetiole in profile rounded dorsally. In dorsal view, dorsum of petiole node subrounded, about as long as broad; postpetiole somewhat transversally rectangular and slightly broader than long. Dorsum of head, except for the scrobes, usually with dense foveolate punctures. Dorsum of alitrunk with scattered foveolate punctures. Petiole, postpetiole, and gaster smooth and shining. Dorsal surfaces of head and alitrunk with numerous erect to suberect long hairs. Two pairs of hairs usually present on the dorsum of petiole node and two to three pairs usually on the dorsum of postpetiole. Entire first gastral tergite covered with numerous, evenly distributed erect or suberect hairs. A few pairs of forward-projecting hairs present near the anterior clypeal margin. Scapes and tibiae with numerous erect to suberect short hairs. Color reddish-brown.

Queen. TL 2.69–3.40, HL 0.69–0.82, HW 0.67–0.85, CI 97–104, SL 0.54–0.68, SI 78–85, EL 0.15–0.19, PW 0.54–0.64, AL 0.76–0.94, PPW 0.20–0.26, PPL 0.18–0.22, PPI 111–122 (n = 15).

Generally similar to worker, except for caste differences. In addition, foveolate punctures shallow on the mesonotum; propodeal armaments slightly shorter than those in the conspecific workers; dorsum of alitrunk lacking a longitudinal furrow.

Male (Figs. 267, 278). A syntype male, together with about a dozen workers and a queen, collected in Fulakora, Solomen I., by W. M. Mann on 19.v.–24.xi.1916, constitutes a series. A second male specimen, together with five workers, collected in Guadalcanal, Solomen I., by P. Greenslade, constitutes another series. Each of the two males was originally mounted with two or three workers, respectively, on the same pin. TL 2.92; HL 0.52, 0.53; HW 0.53, 0.54; CI 102, 102; SL 0.20, 0.22; SI 38, 41; HWE 0.66, 0.68; EL 0.25, 0.26; PW 0.58, 0.60; AL 0.90, 0.92; PPW 0.18; PPL 0.18; PPI 100 (n = 2).

Head, including the eyes, broader than long. Clypeus convex, without a median longitudinal carina. Anterior clypeal margin transverse. Frontal carinae weak or indistinct. On the mesoscutum, notauli distinct, forming a Y shape; parapsidal furrows absent. Scuto-scutellar sulcus rather broad, with five narrow longitudinal ridges. Propodeum weakly tuberculate, lacking teeth and spines. Metapleural lobes somewhat rounded. Petiole node in profile low, rounded dorsally. Postpetiole in profile low, rounded dorsally, in dorsal view subquadrate. Dorsum of head unsculptured and shining, except for a median longitudinal carina present on the frontal area. Dorsal surface of alitrunk smooth and shining but with well-marked sutures. Petiole, postpetiole, and gaster smooth and shining. Dorsal surfaces of head, alitrunk and gaster with abundant long hairs. Legs with numerous hairs. Body blackish-brown; wings infuscated.

Comments. Pristomyrmex obesus occurs on Solomon Is. It is similar in the workers to *P. simplex* of New Guinea but can be separated from the latter by possessing numerous erect or suberect hairs evenly distributed on the entire first gaster tergite. In the *levigatus* group, this character is present only in two species, *P. obesus* and *P. longus*; in the other species, the first gastral tergite has a few or no hairs. In addition, foveolate punctures on the dorsal head are denser in the workers of *P. obesus* than in *P. simplex*.

Material Examined (ANIC, MCZC, BMHH, USNM, BMNH). Solomon Is.: Ysabel, Fulakora (W. M. Mann); Guadalcanal, Mt. Austen (P. Greenslade); Guadalcanal, Kukum (P. Greenslade); Guadalcanal, Gold Ridge, 2,000 ft (P. Greenslade); Guadalcanal, Mt. Jonapau, 2,600 to 3,500 ft (P. Greenslade); Guadalcanal, Nalimbiu R. (P. Greenslade); Guadalcanal, Balesuna R. (P. Greenslade); Guadalcanal, Visale (P. Greenslade); Guadalcanal, Umasani R., 1,000-ft ridge, leaf litter (P. N. Lawtence); San Cristoval, Warahito R., 275 ft (P. Greenslade); San Cristoval, forest, 250 ft (P. Greenslade); Malaita, Small Malaita (P. Greenslade); Malaita, Dala (P. Greenslade); New Georgia, Kolombangara, Hunda (P. Greenslade); New Georgia, Kolombangara, S. Kusi (P. Greenslade); New Georgia, Kolombangara, N of Kuzi, 500 ft, forest litter (P.N.L.); New Georgia, Vella Lavella, Bara koma (P. Greenslade); New Georgia, Vangunu I. (P. Greenslade); Choiseul, Wagina I. (P. Greenslade); Russell Is., Luavic (P. Greenslade); Nggela (P. Greenslade); Isabel, Buala (P. Greenslade); Vanikord (P. Greenslade); Bougainville I., Panguna, 600 to 800 m (J. L. Gressitt).

Ecological Information. This species has been collected in forest litter. Mann (1919) found a colony composed of less than a dozen workers, a dealated queen, and one male under a stone.

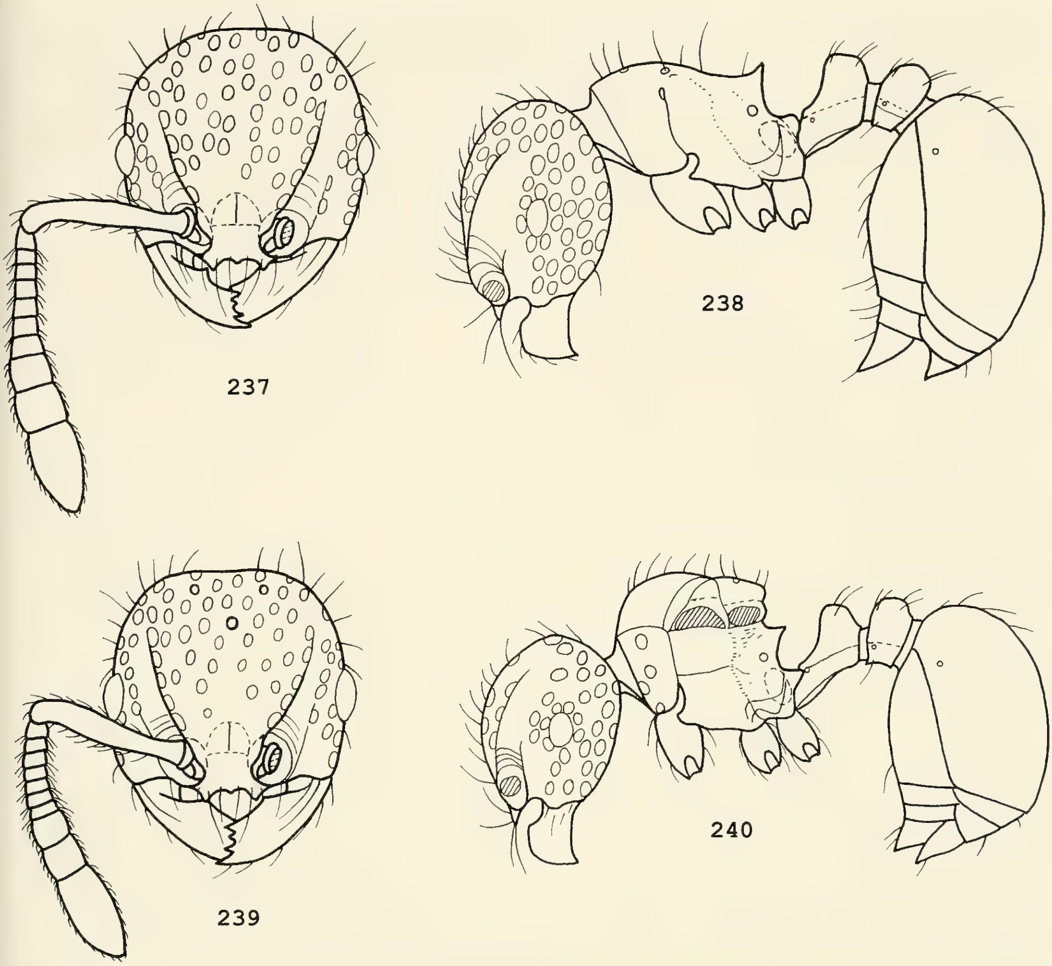
Pristomyrmex simplex **sp. n.**
Figures 237–240

Diagnosis (Worker). Masticatory margin of mandible lacking a diastema and possessing four teeth, of which the third tooth, counting from the apex, smallest; dorsal surfaces of alitrunk and head between the frontal carinae with scattered foveolate punctures; eyes usually containing five (rarely four) ommatidia in the longest row; a few hairs present on the first gastral tergite.

Holotype Worker (ANIC). TL 2.48, HL 0.66, HW 0.69, CI 105, SL 0.52, SI 75, EL 0.12, PW 0.46, AL 0.58. Paratypes, six workers and three queens (MCZC, ANIC, BMNH).

Worker. TL 2.42–2.64, HL 0.65–0.68, HW 0.66–0.70, CI 100–105, SL 0.52–0.54, SI 74–79, EL 0.09–0.12, PW 0.44–0.46, AL 0.58–0.66, PPW 0.18–0.20, PPL 0.14–0.16, PPI 119–129 (n = 6).

Mandibles usually smooth and shining but sometimes with a few small shallow hair pits and a few superficial short rugae. A broad-based triangular short tooth present about midway on the basal margin of the mandible. Clypeus flat, smooth, and shining, usually unsculptured but sometimes the median carina of the frontal area extending to the clypeus. Anterior clypeal margin with a median denticle and two lateral teeth; the median denticle is often smaller than the others; sometimes the median denticle is absent so that the only two teeth are present there. Ventral sur-



Figures 237–240. *Pristomyrmex simplex* **sp. n.** 237: Worker head, full-face view; 238: Worker, lateral view; 239: Queen head, full-face view; 240: Queen, lateral view.

face of clypeus lacking rugae or toothlike prominences. Palp formula 1,3. Frontal carinae distinct, extending to the level of the posterior margins of eyes. Scrobal areas slightly concave, present lateral to the frontal carinae. Frontal lobes weakly expanded. Eyes moderately sized, about 0.14 to 0.17 × HW, usually containing five (sometimes four) ommatidia in the longest row. Occipital margin feebly concave in full-face view. Profile of alitrunk and pedicel segments as in Figure 238. Pronotum unarmed. Propodeum with a pair of triangular teeth. Metapleural lobes rounded. Petiole node in profile high with the anterodorsal angle higher than the posterodorsal, its anterior peduncle about as long as the node. Subpetiole with a narrow rim. Postpetiole in profile rounded dorsally. In dorsal view, dorsum of petiole node transoval and dorsum of postpetiole somewhat transversely rectangular. Dorsum of head between the frontal carinae with scattered foveolate punctures, varying from a few feeble punctures to numerous distinct ones; spaces between foveolae often smooth. Dorsum of alitrunk with a few to some scattered foveolate punctures. Petiole, postpetiole, and gaster smooth and shining. Dorsal surfaces of head and alitrunk with numerous erect to suberect hairs. Two pairs of hairs usually present on the dorsal surfaces of petiole node and postpetiole, respectively, and a few near the base of the first gastral tergite. A few pairs of forward-projecting hairs present near the anterior clypeal margin. Scapes and tibiae with some erect to suberect short hairs. Color reddish-brown.

Queen. TL 2.51–2.84, HL 0.66–0.70, HW 0.66–0.71, CI 100–101, SL 0.51–0.58, SI 76–82, EL 0.14–0.16, PW 0.50–0.55, AL 0.66–0.81, PPW 0.19–0.21, PPL 0.15–0.18, PPI 114–133 (n = 3).

Generally similar to worker, except for caste differences. In addition, mesoscutum rather smooth and shining, but mesoscutellum with a few foveolate punctures; propodeal armaments slightly shorter than those in the conspecific worker.

Male. Unknown.

Comments. This species occurs in New Guinea. It is closely related to *P. levigatus* and *P. obesus*. It is separable from *P. levigatus* by possessing some foveolate punctures on the dorsum of the alitrunk in the workers and on the dorsal head between the frontal carinae in the workers and queens. It differs from *P. obesus* because the workers of *P. simplex* have only a few hairs on the first gastral tergite. *Pristomyrmex simplex* differs from *P. coggii* by the following characters: The eyes usually contain five (sometimes four) ommatidia in the longest row in the workers of *P. simplex* but two to three ommatidia in *P. coggii*; the dorsum of the head has foveolate-reticulate sculpture in the workers and queens of *P. coggii* but scattered foveolate punctures in *P. simplex*.

Holotype. Papua: 8 km S of Kokoda, 800 m, rainforest, ANIC Berleasate, No. 382, 1.vi.1972 (R. W. Taylor).

Paratypes. One worker with same data as holotype; two workers, Papua: Karema, Brown R., lowl. rainfor., 8–11.iii.1955 (E. O. Wilson); three workers and one queen, Papua New Guinea: Port Moresby, Brown River, 2.x.1969 (J. Balogh); one queen, Papua: N. Dist., 27.xii.1971 (P. M. Room); one queen, Papua: N. Dist., Debelou, 23.vi.1973 (P. M. Room).

Non-Type Material Examined. A worker (NHMV), collected in the Philippines (Luzon, Lagunas, Mt. Banahaw above Kinabuhayan, 600–700 m) by J. Kodada and B. Rigova, has the following measurements: TL 2.98, HL 0.84, HW 0.84, CI 100, SL 0.70, SI 83, EL 0.10, PW 0.54, AL 0.74. A second worker (LAMN), collected in New Guinea (Gulf Prov., Ivimka Camp, Lakekamu Basin, 7.73°S, 146.76°E, 120 m, #96-291, lowland wet forest, ex sifted leaf litter) by R. R. Snelling, bears a few small, feeble, shallow punctures on the dorsal alitrunk; this specimen possesses TL 2.48, HL 0.68, HW 0.69, CI 101, SL 0.58, SI 84, EL 0.09, PW 0.45, AL 0.62.

Ecological Information. This species occurs in rainforest and has been collected in litter samples.

THE *PROFUNDUS* GROUP

Worker. Small sized, with the following combination of characters.

(1) Masticatory margin of mandible lacking a diastema and possessing four teeth (i.e., the strongest apical + the second strongest preapical + the smallest third + an acute basal tooth); basal margin of mandible with a strongly prominent tooth that is adjacent to the basal tooth of the masticatory margin; as a result, five teeth are set close together.

(2) Lateral portions of clypeus in front of antennal fossae reduced to margins.

(3) Antennal scrobes broad, deep, and extending close to the occipital corners.

(4) Base of antennal scape lacking a circling lamella.

(5) Mesonotum much higher than propodeal dorsum so that the dorsum of alitrunk in profile is not continuously arched.

(6) Metapleural lobes vestigial and indistinct.

The *profundus* group is closely related to the *levigatus* group. The form of dentition of the masticatory margin of the mandible is a critical character shared by the workers and queens of the two groups. Possessing so many autapomorphic characters, including that a tooth on the basal margin of the mandible is adjacent to the basal tooth of the masticatory margin, as well as the previously mentioned characters 3 to 6, the *profundus* group is easily separable from the *levigatus* group and all other *Pristomyrmex* species groups.

This group contains only a single species, *P. profundus* of Malaysia.

Pristomyrmex profundus sp. n.
Figures 241–244

Diagnosis (Worker). See characters 1 and 5 under the *profundus* group.

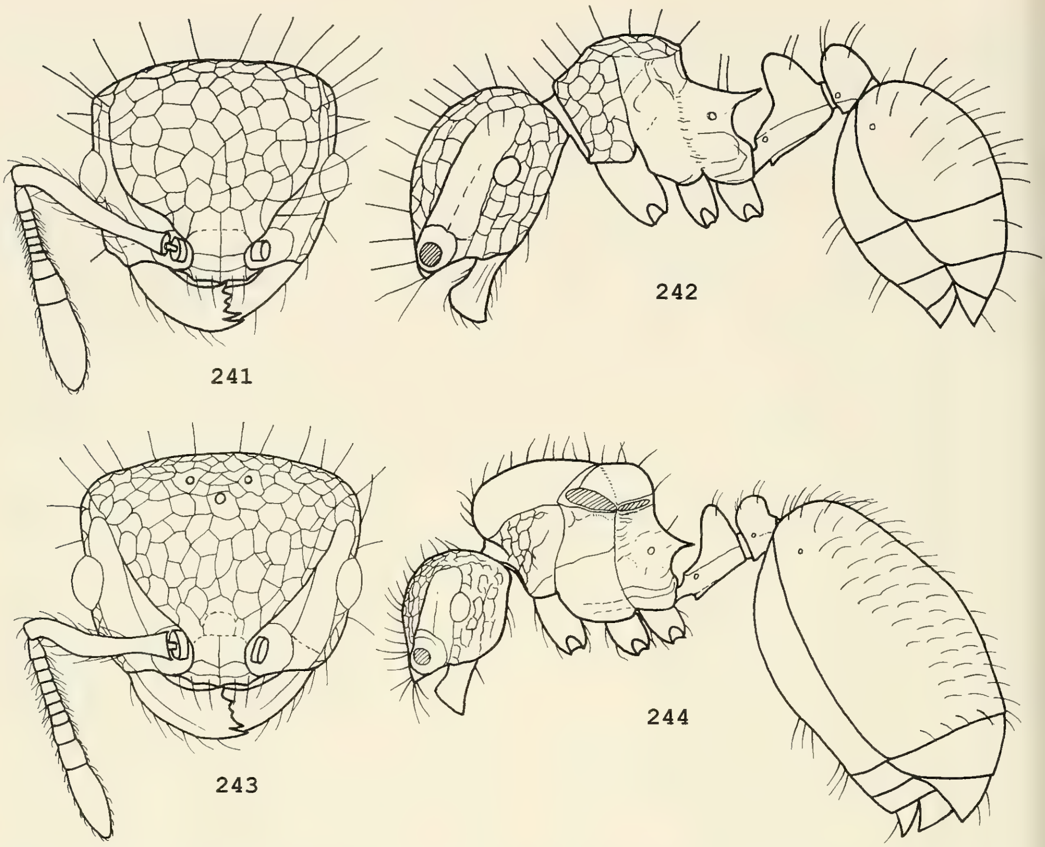
Holotype Worker (BMNH). TL 2.86, HL 0.64, HW 0.74, CI 119, SL 0.44, SI 59, EL 0.13, PW 0.52, AL 0.68, PPW 0.24, PPL 0.16, PPI 150. Paratypes, 19 workers and three queens (BMNH, MCZC, MHNG, ANIC, LAMN).

Worker. TL 1.74–2.86, HL 0.46–0.66, HW 0.46–0.74, CI 96–119, SL 0.36–0.44, SI 59–79, EL 0.09–0.14, PW 0.34–0.52, AL 0.44–0.68, PPW 0.15–0.24, PPL 0.11–0.16, PPI 123–164 (n = 20).

Mandibles usually smooth and shining but sometimes with a few weak, short, basal rugae. Clypeus not depressed, usually with a median longitudinal carina and two transverse carinae. Anterior clypeal margin lacking any distinct denticles. Ventral surface of clypeus lacking any toothlike prominences but usually with a weak transverse ruga. Palp formula undissected. Frontal carinae divergent, extending beyond the level of the posterior margins of eyes and close to the occipital margin. Frontal lobes completely absent. Antennal scrobes deep, wide, present between the frontal carinae and the eyes for the reception of the scapes and funiculi of antennae. Antennal scapes, when lying in the scrobes, close to the occipital margin of head. Eyes containing five to eight ommatidia in the longest row. In full-face view, head widest near the occipital corners; occipital margin rather straight. Dorsum of alitrunk in profile not continuously arched, with the mesonotum much higher than the propodeal dorsum (i.e., a vertical cliff present between the mesonotum and the propodeal dorsum). Pro-mesonotum forming a single convex. Sometimes the mesonotum higher than the pronotum; thus, in dorsal view, a promesonotal impression is seen. Pronotum unarmed. Propodeum with a pair of moderately long spines. Metapleural lobes vestigial and indistinct. In profile view, petiole node high, ca. 0.21 to 0.29, much higher than long and also higher than postpetiole, with a single evenly blunt-rounded apex and a long anterior peduncle. Subpetiole with a narrow lamella. Postpetiole in profile high, ca. 0.15 to 0.23, distinctly higher than long, with a rounded dorsum. In dorsal view, postpetiole transoval and much broader than long. Dorsum of head, except for the antennal scrobes, fully covered with rugoreticulum. Similar sculpture present on the pro-mesonotum. Propodeal dorsum with a few longitudinal rugae. Petiole smooth and shining, usually with a longitudinal carina on each side. Postpetiole and gaster smooth and shining. Dorsal surfaces of head, alitrunk, and gaster with numerous erect, thick, long hairs; sometimes some hairs somewhat clavate. A pair of hairs present on the dorsum of petiole node and usually two pairs on the dorsum of postpetiole. A few pairs of forward-projecting hairs present near the anterior clypeal margin. Scapes and tibiae with some erect or suberect moderately long hairs. Color light yellow to yellow brown.

Queen. TL 3.48–3.92, HL 0.62–0.63, HW 0.76–0.77, CI 123–124, SL 0.44–0.46, SI 57–61, EL 0.15–0.16, PW 0.66–0.70, AL 0.92–0.98, PPW 0.28–0.29, PPL 0.18–0.20, PPI 140–161 (n = 3).

General shape as in Figures 243–244, with normal caste differences from the conspecific worker; mesonotum unsculptured, smooth, and shining; anterior end of mesoscutum medially slightly concave. Other characters similar to worker.



Figures 241–244. *Pristomyrmex profundus* **sp. n.** 241: Worker head, full-face view; 242: Worker, lateral view; 243: Queen head, full-face view; 244: Queen, lateral view.

Male. Unknown.

Comments. This is a distinct species because many characters possessed by its workers and queens are unique in the genus. In the entire *Pristomyrmex* fauna, three species (*P. profundus, P. divisus,* and *P. pulcher*) do not possess any denticles on the anterior clypeal margin, but the latter two species belong to the *punctatus* group.

Holotype Worker. Malaysia: Sabah, Poring Hot Springs, 500 m, 7.v.1987 (Burckhardt and Löbl).

Paratypes. Seventeen workers and three queens with same data as holotype; two workers with same data as holotype but date 6.v.1987.

Ecological Information. Unknown.

THE *UMBRIPENNIS* GROUP

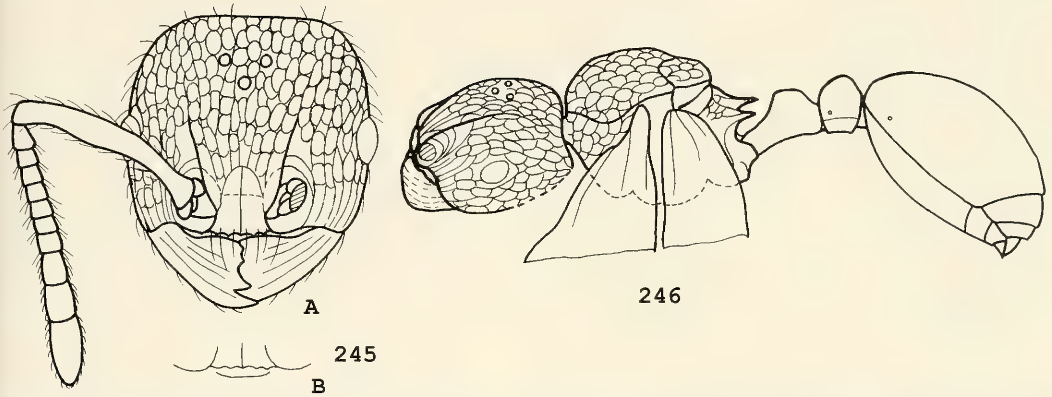
Worker. Medium to large sized (HL 1.04–1.68, HW 1.02–1.74, TL 4.10–7.06) with the following combination of characters.

(1) Masticatory margin of mandibles with four teeth arranged as the strongest apical + the second strongest preapical + two broad-based short teeth of similar size; diastema lacking or indistinct.

(2) Basal margin of mandible with a central, broad-based, prominent lobe.

(3) Lateral portions of clypeus in front of antennal fossae reduced to a margin.

(4) Anterior margin of the median portion of clypeus usually with five to seven



Figures 245–246. *Pristomyrmex fuscipennis* (F. Smith). 245A: Queen head, full-face view; 245B: Showing a transverse carina on the ventral clypeus; 246: Queen, lateral view.

denticles; lateral portions of anterior clypeal margin in front of antennal fossae with a few weak blunt denticles.

(5) Ventral surface of clypeus with a transverse ridge.

(6) Frontal lobes present, partly covering the condylar bulbs of holding antennal scapes.

(7) Frontal carinae extending to the level of the posterior margins of eyes.

(8) Lamella that encircles the base of antennal scape usually with a broad and deep notch on the center of the dorsal surface.

(9) Palp formula 1,3.

(10) Eyes small; EL is about 0.040 to 0.064 × HW in *P. picteti* and *P. pollux* and 0.069 to 0.108 × HW in *P. umbripennis*.

(11) Alitrunk in profile, not including propodeal spines, with a regularly arched dorsum, in dorsal view without any sutures.

(12) Pronotum unarmed.

(13) Metapleural lobes bluntly rounded.

(14) Petiole node in profile longer than high, with a long anterior peduncle; its anterodorsal angle is on approximately the same level as the posterodorsal.

(15) Foveolate punctures or foveolate-reticulate sculpture present on the dorsal surfaces of the head and the alitrunk.

This is a monophyletic group, containing five valid species. It is easily recognizable by possessing characters 1, 2, 5, 8, and 14. This group is endemic in the Oriental region and restricted to the Philippines, Malaya, Singapore, Brunei, Sabah, Borneo, Indonesia, and Papua New Guinea.

The males of the *umbripennis* group are easily distinguished from the other known *Pristomyrmex* males by possessing the following characters: (1) medium to large size; (2) palp formula 1,3; (3) propodeum with a pair of broad-based, robust spines (Figs. 256, 279, 280); and (4) the sides of petiole with some longitudinal or reticulate rugae (Figs. 256, 279, 280).

Pristomyrmex fuscipennis (F. Smith)
Figures 245–246

Myrmica fuscipennis F. Smith, 1861: 46. Holotype queen, Indonesia: Celebes, Tondano (A. R. Wallace) (OXUM) [examined].

? *Pristomyrmex fuscipennis* (F. Smith) Emery, 1901: 567.

Pristomyrmex fuscipennis (F. Smith) Donisthorpe, 1932: 468.

Queen. TL 6.92, HL 1.62, HW 1.64, CI 101, SL 1.46, SI 89, EL 0.32, PW 1.32, AL 1.98 (n = 1).

Comments and Discussion. This species, described from a single queen, obviously belongs to the *umbripennis* group by possessing the following characters: (1) masticatory margin of mandible with four teeth (an apical + a preapical + two broad-based short teeth of similar size), lacking a distinct diastema; (2) basal margin of mandible with a central, broad-based, prominent lobe; (3) frontal lobes partially covering the condylar bulbs of holding antennal scapes; (4) lamella that encircles the base of antennal scape with a broad and deep notch on the center of the dorsal surface; (5) a coarse transverse carina present on the ventral surface of clypeus; and (6) anterodorsal angle of petiole node in profile on approximately the same level as the posterodorsal.

This queen differs from the queens of *P. picteti, P. pollux,* and *P. umbripennis* as follows: In *P. fuscipennis,* the dorsum of the head possesses foveolate-reticulate sculpture; many foveolate punctures between the frontal carinae are almost aligned so that it seems that several longitudinal rugae are present there. These longitudinal rugae are indistinct or absent in *P. picteti, P. pollux,* and *P. umbripennis.* In *P. picteti* and *P. umbripennis,* the dorsum of the head possesses scattered foveolate punctures. In addition, in *P. fuscipennis,* the antennal scapes lack longitudinal carinae along their dorsal margins, a median longitudinal carina runs through the entire clypeus and frontal area, and only five teeth are present on the anterior margin of the median portion of the clypeus, which are different from those in *P. pollux.*

Pristomyrmex fuscipennis may be a sibling species of *P. picteti* because the queen of *P. fuscipennis* is very similar to that of *P. picteti,* except for possessing foveolate-reticulate sculpture and longitudinal rugae on the dorsal head. In addition, I have examined several workers that may belong to *P. fuscipennis.* The cephalic sculpture of these workers is similar to that of the queen of *P. fuscipennis,* but the other characters of the workers are identical with those of the workers of *P. picteti.*

Finally, I feel that *P. fuscipennis* may represent an incipient species. Further collecting and ecological investigations are needed.

Ecological Information. Unknown.

Pristomyrmex picteti Emery
Figures 247–250, 268, 279

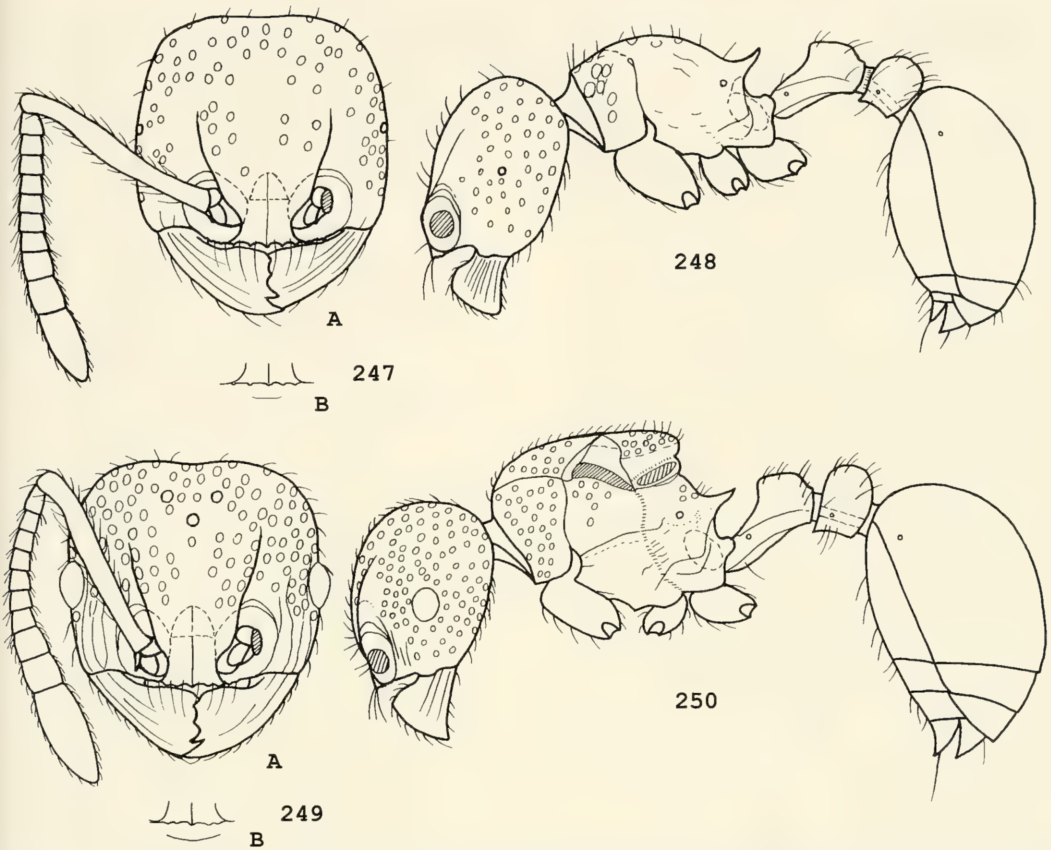
Pristomyrmex picteti Emery, 1893: 190. Lectotype worker, Sumatra: Deli (Bedot) (MCSN), here designated, [examined].

Pristomyrmex picteti var. *tingiana* Stitz, 1925: 120. Syntype workers, Philippines: N. Palawan, Binaluan, xi–xii 1913 (G. Boettcher) (MNHU, MCZC) [examined]. **Syn. n.**

Diagnosis (Worker). Masticatory margin of mandible with four teeth (an apical + a preapical + two broad-based short teeth of similar size), lacking a distinct diastema; eyes small, with three to four ommatidia in the longest row; propodeal spines fairly long, about 1.3 to 1.5 × the distance between their bases, not strongly upcurved at their apices.

Worker. TL 4.10–5.84, HL 1.04–1.36, HW 1.02–1.40, CI 96–108, SL 0.92–1.26, SI 85–97, EL 0.05–0.09, PW 0.68–0.88, AL 1.12–1.58, PPW 0.30–0.41, PPL 0.27–0.36, PPI 100–120 (n = 40).

Mandibles rather smooth or sometimes with a few longitudinal rugae. Basal margin of mandible with a broad-based, subtriangular, short prominence or a somewhat curved lobe. Clypeus smooth and shining, except for a median longitudinal carina that usually crosses the entire clypeus but sometimes does not reach the posterior clypeal margin. Anterior margin of the median portion of clypeus (not including the margins in front of the antennal fossae) with a median denticle and two (sometimes three) lateral denticles on each side. Ventral surface of clypeus with a coarse, transverse, long carina. Palp formula 1,3. Frontal carinae usually beyond the eyes. Antennal scrobes indistinct. Frontal lobes present, partially covering the condylar bulbs of holding antennal scapes. Antennal scapes, when lying on the dorsal head, just reaching or slightly beyond the occipital margin. Lamella, encircling the base of antennal scape, usually



Figures 247–250. *Pristomyrmex picteti* Emery. 247A: Worker head, full-face view; 247B: Showing a transverse carina on the ventral clypeus; 248: Worker, lateral view; 249A: Queen head, full-face view; 249B: Showing a long transverse carina on the ventral clypeus; 250: Queen, lateral view.

with a broad and deep notch on the center of the dorsal surface, but in several specimens (from Palawan I., Philippines), this lamella is entire, without a notch. Eyes very small, usually with three, at most four, ommatidia in the longest row. Occipital margin straight or very feebly concave in full-face view. Alitrunk in profile with a convex dorsum. Pronotum unarmed. Propodeum with a pair of fairly long spines, ca. 1.3 to 1.5 × the distance between their bases; sometimes the spines are weakly upcurved at their apices. Metapleural lobes rounded or somewhat truncated. Petiole node in profile slightly longer than high, with a fairly long anterior peduncle; its anterodorsal angle is usually on approximately the same level as the posterodorsal, but sometimes the former is slightly higher than the latter. Subpetiole with a narrow, semitranslucent lamella. Postpetiole in profile higher than long, rounded dorsally, in dorsal view broadening from front to back. Dorsal and ventral surfaces of head, dorsum of alitrunk, as well as the sides of pronotum with numerous foveolate punctures; space between foveolae often smooth. Antennal scapes smooth, or with one to two longitudinal rugae along their margins. Petiole smooth and shining, except for a longitudinal ruga on each side. Postpetiole and gaster smooth and shining.

Dorsal surfaces of head and alitrunk with numerous erect or suberect short hairs. Two or more pairs of hairs present on the dorsal surfaces of petiole node and postpetiole, respectively. A few of forward-projecting long hairs present near the anterior clypeal margin. Scapes and tibiae with numerous erect or suberect short hairs. First gastral tergite lacking erect or suberect hairs. Color reddish-brown.

Queen. TL 6.20–7.02, HL 1.32–1.64, HW 1.42–1.69, CI 103–113, SL 1.21–1.56, SI 85–92, EL 0.29–0.34, PW 1.14–1.42, AL 1.74–2.14, PPW 0.41–0.52, PPL 0.36–0.42, PPI 110–125 (n = 13).

General shape as in Figures 249–250, with normal caste differences from the conspecific worker; eyes much larger, usually containing more than 17 ommatidia in the longest row; other characters similar to worker.

Male (Figs. 268, 279). TL 4.46–5.28, HL 0.68–0.78, HW 0.69–0.80, CI 95–108, SL 0.30–0.42, SI 40–56, HWE 0.85–0.94, EL 0.35–0.39, PW 0.92–1.14; AL 1.44–1.78, PPW 0.30–0.38, PPL 0.28–0.34, PPI 103–114 (n = 5).

Head in full-face view, including the eyes, broader than long. Clypeus convex, lacking a median longitudinal carina. Palp formula 1,3. Frontal carinae distinct, extending to the level of the posterior margins of antennal insertions. Maximum diameter of the median ocellus 0.10 to 0.12. Scapes longer than the other antennal segments, except for the apical ones. On the mesoscutum, notauli rather wide, forming a V shape, separated into several cells by narrow transverse ridges; parapsidal furrows absent. Scuto-scutellar sulcus wide, usually with five to six narrow longitudinal ridges. Propodeum armed with a pair of robust, triangular short spines. Metapleural lobes subtriangular. Middle and hind tibiae without any spurs. Petiole node in profile low, slightly longer than high, with a fairly long anterior peduncle. Postpetiole in profile rounded dorsally, in dorsal view somewhat transversely rectangular and slightly broader than long. Dorsum of head with some small punctures, varying from scattered and shallow to dense and somewhat coarsely incised. Pronotum with dense foveolate punctures. Mesonotum with punctures, varying from a few scattered to numerous and from feeble, small to rather large. Propodeum rugulose. Sides of petiole with a few longitudinal rugae as well as some foveolate punctures between them. Sides of postpetiole with some shallow foveolate punctures. Gaster unsculptured. All dorsal surfaces with numerous blackish-brown long hairs; sometimes hairs somewhat stiff. Color blackish-brown; wings dusky.

Note: The previously described male is assigned to the species *P. picteti* for the following three reasons: (1) It belongs to the *umbripennis* group because it is very similar to the males of *P. pollux, P. reticulatus,* and *P. umbripennis* but rather different from the other known males of *Pristomyrmex* in the structure and shape of propodeal spines, petiole, notauli, and scuto-scutellar sulcus and in body size, sculpture, and hairs. (2) It differs from the males of the other species of the *umbripennis* group as follows: In the male of *P. picteti,* CI is 95–108, EL is 0.35–0.39, the propodeal spines are shorter, the postpetiole in dorsal view is slightly broader than long (PPI 103–114), and the notauli form a V shape; but in *P. pollux,* CI is 80, EL is 0.44, the propodeal spines are longer, the postpetiole is distinctly longer than broad (PPI 80–90), and the notauli form a Y shape. The male of *P. picteti* (HW 0.69–0.80, HL 0.68–0.78, and EL 0.35–0.39) is smaller than that of *P. umbripennis* (HW 0.98, HL 0.94, and EL 0.47). A distinct rugoreticulum is seen on the dorsal head and also on the mesonotum in *P. reticulatus* but not so in the male of *P. picteti.* (3) Two male specimens were collected in Dumaguete, Philippines, by J. W. Chapman on May 30, 1950, and each of them was originally mounted together with one worker or one queen of *P. picteti,* respectively, on the same pin.

Comments. Pristomyrmex picteti occurs

in Papua New Guinea, Borneo, Sabah, Brunei, Malaya, Singapore, and the Philippines. It is closely related to the other several species of the *umbripennis* group. A discussion regarding the relationship between *P. picteti* and *P. fuscipennis* is provided under *P. fuscipennis.* Characters separating *P. picteti* from *P. umbripennis* are listed under *P. umbripennis.* The workers of *P. picteti* differ from those of *P. pollux* as follows:

P. picteti

- Propodeal spines relatively short, not strongly upcurved at their apices
- Smaller species with HL 1.04–1.36, HW 1.02–1.40 and SL 0.92–1.26
- Dorsum of head with scattered foveolate punctures; space between foveolae often smooth
- Anterior margin of the median portion of clypeus usually with fewer than seven denticles

P. pollux

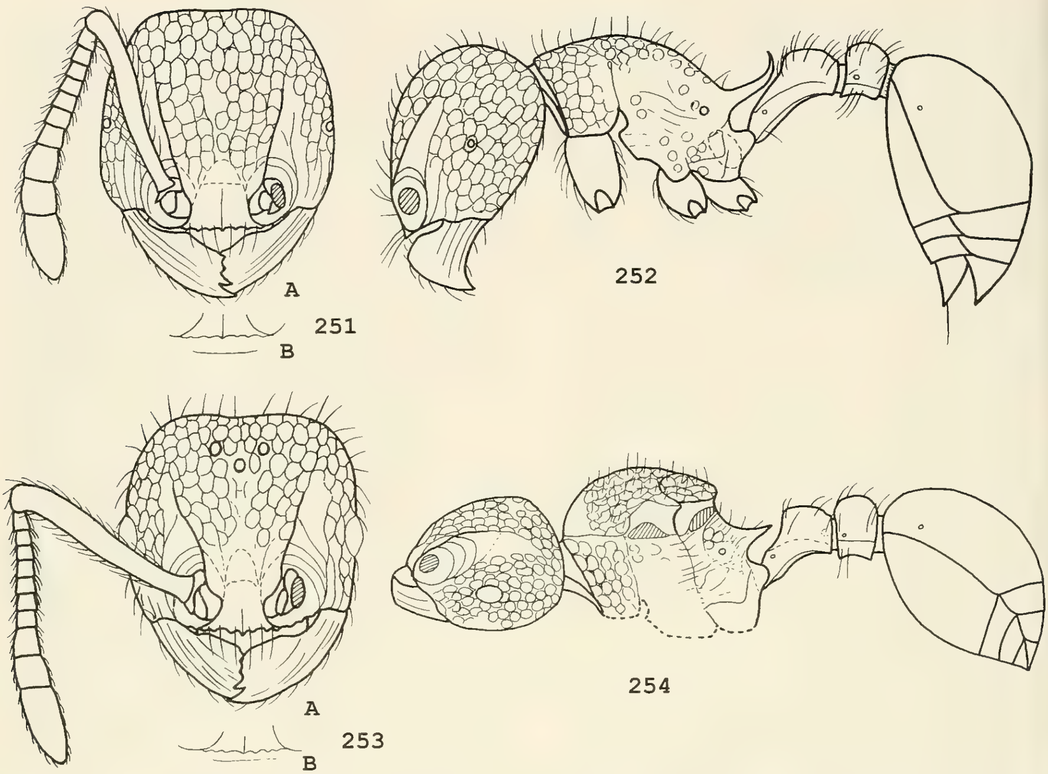
- Propodeal spines relatively long, strongly upcurved at their apices
- Larger species with HL 1.42–1.54, HW 1.42–1.58, and SL 1.40–1.52
- Dorsum of head with foveolate-reticulate sculpture
- Anterior margin of the median portion of clypeus usually with seven denticles

Material Examined (ANIC, BMHH, BMNH, LAMN, MCZC, NHMV). Papua New Guinea: Gulf Prov., Ivimka Camp, Lakekamu Basin, 7.7°S, 146.8°E, 120 m elevation, lowland wet forest, #96-395 (nest in wet rotten log), #96-404 (in rotted log debris) (R. R. Snelling); NETH. Genjam, 40 km W of Hollandia, 100 to 200 m (T. C. Maa); 24 km N Madang, 80 m, 5°01′S, 145°46′E, rainforest, ex rotten log (P. S. Ward); Yawasora near Wewak, <50 m, rainforest, ex rotting log (R. W. Taylor); along Kokoda Rd., rainforest, 400 to 1,000 ft (B. B. Lowery); Lae, Didiman CK., lowland rainforest (E. O. Wilson); Lae, Busu R., lowland rainforest, in rotten wood on ground (B. B. Lowery); Lae, Markham R. Bridge, lowland rainforest, in log (B. B. Lowery); Lae 300 ft, above Bumbu Crk., edge of rainforest, wet gully, in rotten wood (B. B. Lowery); Tage L. Kutubu 2,700 ft, forest margin, ex leaves (J. H. Barrett); Papua, Brown Riv., lowland rainforest, ex rotten wood fragment (R. W. Taylor). Indonesia: Irian Jaya, PT. Freeport Concession, Siewa camp., 03.04°S, 136.38°E, 200 ft, #98-86, lowland secondary rainforest, under loose bark of dead log (R. R. Snelling); Borneo, West Kalimantan, Gunung Palung Nat. Pk. Cabang Panti Res. Sta. 100 to 400 m, 1°15′S, 110°5′E, primary forest (Datling, Rosichon, Sutrisno); Borneo, Sandakan (Baker). N. Borneo: Tawau, Quoin Hill, Forest Camp 1, 3 to 5 km WSW of Cocoa Res. Sta. (Y. Hirashima). Brunei: Belait District, Manilas, Ulu Belait (D. E. Hardy). Malaysia: Malaya, Gombak (B. Bolton); Pahang, Kuala Tahan 200 m (J. L. Gressitt); Sg. Patani (G. H. Lowe). Singapore (Baker). Philippines: Mt. Montalban, Rizal Wa-wa Dam, 150 to 200 m (H. M. Torrevillas); Mt. Apo 5 to 6,000 m (C. F. Clagg); N. Palawan, Binaluan (G. Boettcher); Palawan, 14 km S Puerto Princesa (9.44°N, 118.44°E), rainforest 0 to 250 m (B. B. Lowery); Palawan, Iwahig Penal Col., ca. Puerto Pricesa (9.44°N, 118.44°E), coffee plantation, 60 m, edge of rainforest, foraging on ground (B. B. Lowery); Luzon, Los Banos, Mt. Makiling 600 m (14.1°N, 121.11°E), rainforest, in very wet log (B. B. Lowery); Los Banos (F. X. Williams); Mt. Makiling (Baker; A. T. Cencho); Laguna, Mt. Makiling, 150 to 500 m (H. Zettel); Luzon I., Bauqui (R.C.Mcq.); Luzon, Mt. Banahao (?); Dumaguete, 4,500 ft (J. W. Chapman); Horns of Negros, 3,600 ft (J. W. Chapman); Camp (J. W. Chapman).

Ecological Information. This species occurs in rainforest, nesting in rotten logs. It has been collected on the ground, on rotten wood, and under loose bark of a log.

Pristomyrmex pollux Donisthorpe
Figures 251–254, 269, 280, 282

Pristomyrmex pollux Donisthorpe, 1944: 83. Holotype male, Malaysia: Penang, 6.xi.1913 (G. E. Bryant) (BMNH) [examined].



Figures 251–254. *Pristomyrmex pollux* Donisthorpe. 251A: Worker head, full-face view; 251B: Showing a transverse carina on the ventral clypeus; 252: Worker, lateral view; 253A: Queen head, full-face view; 253B: Showing a transverse ruga on the ventral clypeus; 254: Queen, lateral view.

Note: This species was described only from a single male, which created the difficulty of associating female castes with the male. I place the following workers under *P. pollux* for three reasons: (1) In MCZC, two males of *P. pollux* appear to belong to the same series as the following examined 28 workers bearing labels with the same locality and collector and with the absence of collecting date. (2) This male (i.e., the holotype of *P. pollux*) belongs to the *umbripennis* group because it is very similar to the males of *P. picteti*, *P. reticulatus*, and *P. umbripennis* but rather different from the other known males of *Pristomyrmex* in the structure and shape of propodeal spines, petiole, notauli, and scuto-scutellar sulcus and in body size, sculpture, and hairs. (3) After all available males of *Pristomyrmex* are examined, it seems that, in *Pristomyrmex*, the propodeal armaments of the male are usually shorter than those of the conspecific worker. The male of *P. pollux* has a pair of well-developed propodeal spines (which are actually the strongest and longest among all known *Pristomyrmex* males). The following workers also possess a pair of long propodeal spines, which matches with those in the male of *P. pollux* closely.

Diagnosis (Worker). Masticatory margin of mandible with four teeth (an apical + a preapical + two broad-based short teeth of similar size), lacking a distinct diastema; eyes small, with three to four ommatidia in the longest row; propodeal spines long, strongly upcurved at their apices.

Worker. TL 6.26–6.80, HL 1.42–1.54,

HW 1.42–1.58, CI 95–104, SL 1.40–1.52, SI 96–101, EL 0.06–0.08, PW 0.90–0.96, AL 1.58–1.90, PPW 0.39–0.43, PPL 0.39–0.43, PPI 100–105 (n = 28).

Mandibles with a few longitudinal rugae. Basal margin of mandible with a broad, short, somewhat truncated, prominent lobe. Clypeus with a median longitudinal carina that does not reach the posterior clypeal margin. Frontal area unsculptured. Anterior margin of the median portion of clypeus with a median denticle and three (sometimes two) others on each side. Ventral surface of clypeus with a coarse transverse carina. Palp formula 1,3. Frontal carinae strong, extending to the level of the posterior margins of eyes. Scrobal areas smooth, present lateral to the frontal carinae. Frontal lobes present, partially covering the condylar bulbs of holding antennal scapes. Antennal scapes, when lying on the dorsal head, just beyond the occipital margin. Lamella, encircling the base of antennal scape, with a broad and deep notch on the center of the dorsal surface. Eyes small, usually with three, at most four, ommatidia in the longest row. Occipital margin straight or feebly concave in full-face view. Pronotum unarmed. Propodeum with a pair of long spines that are strongly upcurved at their apices (i.e., hooklike) and laterally compressed. Metapleural lobes prominent and somewhat rounded. Petiole node in profile distinctly longer than high, with a long anterior peduncle; its anterodorsal angle is on approximately the same level as the posterodorsal. In dorsal view, petiole node longer than broad. Subpetiole with a narrow, semitranslucent lamella. Postpetiole in profile higher than long, rounded dorsally, in dorsal view broadening from front to back. Dorsum of head, except for scrobal areas and frontal area, with foveolate-reticulate sculpture. Antennal scapes with longitudinal rugae along their dorsal margins. Dorsum of alitrunk as well as the sides of pronotum with numerous foveolate punctures that are often close to each other. Sides of the rest of alitrunk with some scattered punctures. Petiole smooth and shining, but with a longitudinal ruga on each side. Postpetiole and gaster smooth and shining. Dorsal surfaces of head, alitrunk, petiole, and postpetiole with numerous erect or suberect hairs. A row of forward-projecting long hairs present near the anterior clypeal margin. Scapes and tibiae with some erect or suberect short hairs. First gastral tergite lacking erect or suberect hairs. Color yellow-brown to reddish-brown.

Queen. A single queen (BMNH) was examined. It was collected in Penang, Malaysia, by G. E. Bryant in October 1913 (i.e., the collecting locality and the collector name for this specimen are the same as the holotype male of *P. pollux*): TL ca. 7.66, HL 1.64, HW 1.69, CI 103, SL 1.56, SI 92, EL 0.29, PW 1.42, AL 2.14.

This queen possesses the following characters: (1) dentition of the masticatory margin and basal margin of mandible as in the previously mentioned worker; (2) dentition of the anterior clypeal margin as in the previously mentioned worker; (3) clypeus with a median carina that does not reach the posterior clypeal margin; (4) ventral surface of clypeus with a transverse ruga; (5) frontal lobes and frontal carinae as in the previously mentioned worker; (6) lamella encircling the base of antennal scape as in the previously mentioned worker; (7) antennal scapes with longitudinal rugae along their dorsal margins; (8) propodeum with a pair of robust, rather long spines that are longer than the distance between their bases; (9) metapleural lobes as in the previously mentioned worker; (10) petiole and postpetiole as in the previously mentioned worker; and (11) dorsum of head, except for the scrobal areas, with foveolate-reticulate sculpture. In other words, except for normal caste differences and the propodeal spines that are neither laterally compressed nor upcurved at their apices, other characters are generally similar to those in the previously mentioned worker.

Male (Figs. 269, 280, 282). TL 5.60–

5.92, HL 0.85–0.88, HW 0.68–0.70, CI 80–80, SL 0.38–0.41, SI 54–60, HWE 0.86–0.88, EL 0.44–0.44, PW 1.26–1.36, AL 2.00–2.20, PPW 0.35–0.38, PPL 0.42–0.44, PPI 80–90 (n = 3).

Head in profile high and thick, in full-face view, excluding eyes, much longer than broad, and including the eyes about as long as broad. Clypeus convex and arched in middle without a median longitudinal carina. Palp formula 1,3; maxillary palp long. Maximum diameter of the median ocellus 0.12. Scapes longer than the other antennal segments, except for the apical ones. On the mesonotum, notauli rather wide and deep, showing a Y shape, separated into small cells by narrow transverse ridges; parapsidal furrows absent. Scuto-scutellar sulcus wide, separated into small cells by seven to eight narrow ridges. Propodeum with a pair of robust, broad-based, rather long spines. Metapleural lobes prominent and somewhat rounded. Petiole node in profile distinctly longer than high with a long anterior peduncle. Postpetiole in profile slightly longer than high with a convex dorsum, in dorsal view rectangular and distinctly longer than broad. Subpostpetiole with a blunt, tooth-like prominence. Dorsum of head with numerous small foveolate punctures that sometimes are coarse and dense. Pronotum with small, coarse, and dense foveolate punctures. Mesoscutum with some scattered, small, shallow foveolate punctures. Mesoscutellum with dense, coarse foveolate punctures. Propodeum with some irregular coarse rugae. Middle and hind tibiae without any spurs. Each side of petiole with a coarse longitudinal ruga, a few irregular short rugae, and some foveolate punctures. Sides of postpetiole with some small, weak foveolate punctures. All dorsal surfaces with abundant erect or suberect stiff long hairs. Color blackish-brown; hairs blackish-brown; wings rather smoky. (Note: In the holotype, the right antenna is abnormal, with 11 segments, while the left one has 12.)

Comments. *Pristomyrmex pollux* is known from Malaya and Sabah. It must have evolved from a *P. picteti*–like ancestor. The workers of this species can be immediately recognized by possessing a pair of distinct propodeal spines that are long, strongly upcurved at their apices (i.e., hooklike), and laterally compressed. This character is unique in the genus *Pristomyrmex.*

Material Examined (MCZC, USNM, ANIC, BMNH, NHMV). N. Borneo: Mt. Dubit, 3,000 ft (E. Mjöberg).

Biological Information. Unknown.

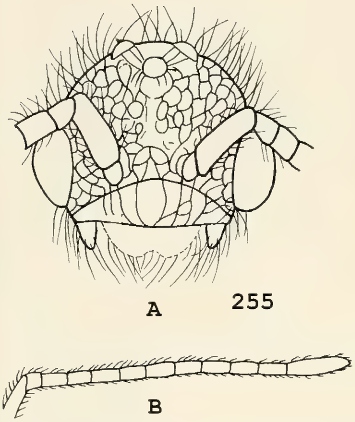
Pristomyrmex reticulatus Donisthorpe
Figures 255–256

Pristomyrmex reticulatus Donisthorpe, 1949: 750. Holotype male, New Guinea: Finschhafen, 27.iv.1944 (E. S. Ross) (CASC) [examined].

Male. TL 4.86, HL 0.82, HW 0.83, CI 101, SL 0.34, SI 41, EL 0.38, PW 1.04, AL 1.64 (n = 1).

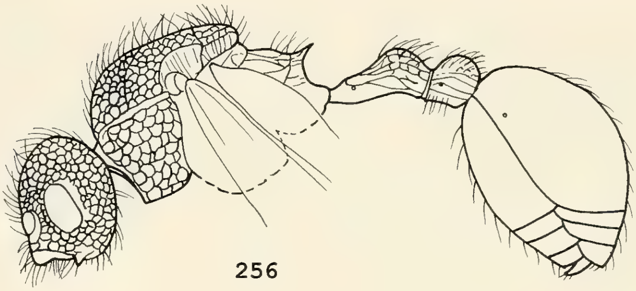
Head, including the eyes, distinctly broader than long. Clypeus convex in middle; its anterior margin transverse. On the mesoscutum, notauli forming a Y shape, with several transverse rugae. Scuto-scutellar sulcus wide, separated into small cells by several longitudinal ridges. Propodeum armed with a pair of fairly long spines. Metapleural lobes somewhat rounded. Petiole node in profile longer than high with a long anterior peduncle. Postpetiole in profile rounded dorsally, in dorsal view subquadrate. Dorsum of head with a developed rugoreticulum, except for a narrow, long median strip that is smooth and unsculptured. Clypeus with some longitudinal rugae. Promesonotum with strongly developed rugoreticulum. Sides of petiole with rugoreticulum. Sides of postpetiole with a few longitudinal rugae as well as a few superficial foveolate punctures between them. Gaster unsculptured, smooth, and shining. All dorsal surfaces with numerous long hairs; hairs stiff on the head and alitrunk. Body and hairs blackish-brown; wings dusky.

Comments and Discussion. This species, described from a single male, belongs to



A 255

B



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Figures 255–256. *Pristomyrmex reticulatus* Donisthorpe. 255A: Male head, full-face view; 255B: Male antenna; 256: Male, lateral view.

the *umbripennis* group because it is very similar to the males of *P. picteti, P. pollux,* and *P. umbripennis* in the structure and shape of propodeal spines and petiole and in body size, sculpture and hairs.

This male differs from the males of the other three species (*P. pollux, P. umbripennis,* and *P. picteti*) of the *umbripennis* group as follows: In *P. pollux,* the head, in full-face view, is rather narrow and long (CI = 80) with numerous small foveolate punctures; the mesoscutum possesses some scattered, small and shallow foveolate punctures; the postpetiole in dorsal view is distinctly longer than broad. But in *P. reticulatus,* CI is 101, the dorsal head and the mesonotum have a developed rugoreticulum, and the postpetiole in dorsal view is subquadrate.

The male of *P. umbripennis* is larger (HL 0.94, HW 0.98, EL 0.47, PW 1.28, AL 1.98, and TL 6.04) than that of *P. reticulatus.* In addition, the dorsum of the head between the eyes is sculptured with a rugoreticulum in *P. reticulatus* but is rather smooth in *P. umbripennis.*

The male of *P. picteti* possesses a few to some small foveolate punctures on the dorsal surfaces of the head and the mesonotum, in contrast with a rugoreticulum in *P. reticulatus.*

Whether *P. reticulatus* represents the male of *P. fuscipennis* is so far unknown. Thus, *P. reticulatus* is tentatively maintained as a valid species until enough evidence is obtained.

Ecological Information. Unknown.

Pristomyrmex umbripennis (F. Smith)
Figures 257–260

Myrmica umbripennis F. Smith, 1863: 21. Holotype queen, Indonesia: Mysol (A. R. Wallace) (OXUM) [examined].

Pristomyrmex umbripennis (F. Smith) Donisthorpe, 1932: 471.

Solenopsis laevis F. Smith, 1865: 75. Holotype worker, Indonesia: Morty Island (A. R. Wallace) (OXUM) [examined]. **Syn. n.**

Pheidologeton laevis (F. Smith) Emery, 1922: 213.

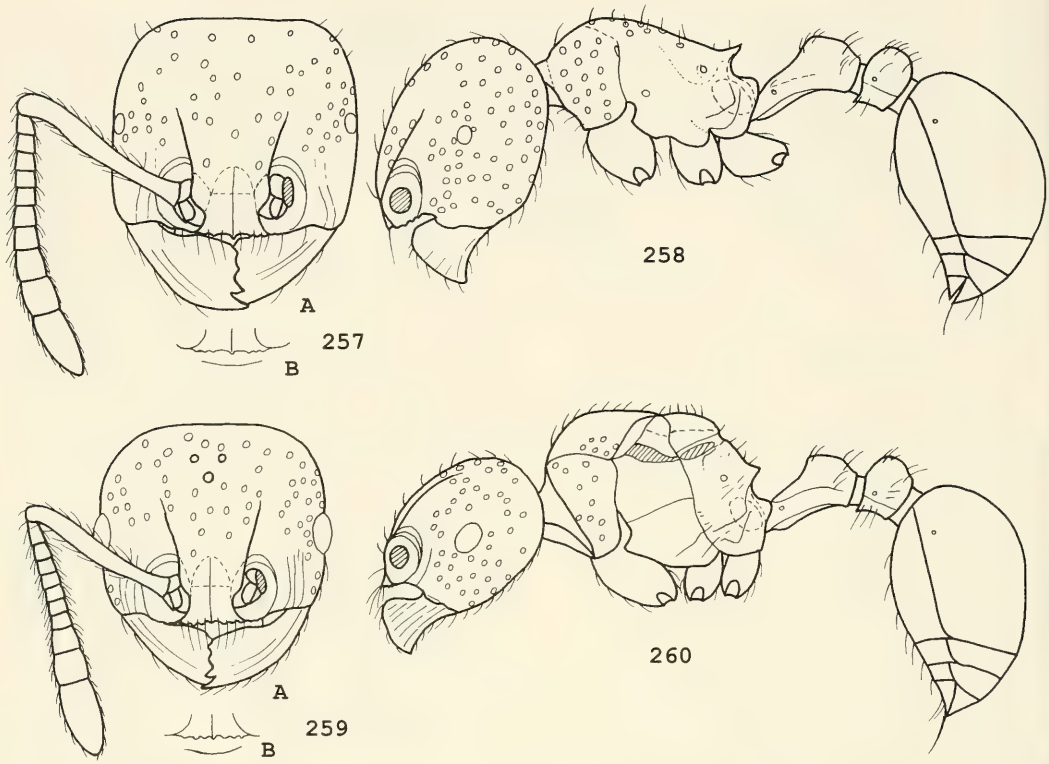
Pristomyrmex laevis (F. Smith) Donisthorpe, 1932: 473.

Pristomyrmex parumpunctatus Emery, 1887: 452. Lectotype worker, New Guinea: Andai (L. M. D'Albertis) (MCSN), here designated, [examined]. **Syn. n.**

Pristomyrmex castor Donisthorpe, 1944: 81. Lectotype queen, New Guinea: Papua, Kokoda, 1,200 ft, x.1933 (L. E. Cheesman) (BMNH), here designated, [examined]. **Syn. n.**

Pristomyrmex castaneicolor Donisthorpe, 1949: 412. Syntype workers, New Guinea: Maffin Bay, ix-1944 (E. S. Ross) (BMNH, CASC, LACM, MCZC, USNM) [examined]. **Syn. n.**

Diagnosis (Worker). Masticatory margin of mandible with four teeth (an apical + a preapical + two broad-based short teeth of similar size), lacking a distinct diastema;



Figures 257–260. *Pristomyrmex umbripennis* (F. Smith). 257A: Worker head, full-face view; 257B: Showing a transverse ridge on the ventral clypeus; 258: Worker, lateral view; 259A: Queen head, full-face view; 259B: Showing a transverse ridge on the ventral clypeus; 260: Queen, lateral view.

eyes generally with six to seven (rarely five) ommatidia in the longest row; propodeum with a pair of elongate triangular teeth.

Worker. TL 5.48–7.06, HL 1.32–1.68, HW 1.30–1.74, CI 98–109, SL 1.20–1.52, SI 81–92, EL 0.12–0.18, PW 0.86–1.16, AL 1.46–1.88, PPW 0.33–0.47, PPL 0.32–0.44, PPI 103–113 (n = 52).

Mandibles with a few longitudinal rugae that often reach to the masticatory margin. Basal margin of mandible with a central, broadly curved prominence. Clypeus smooth and shining with a strong median longitudinal carina. Anterior clypeal margin usually with seven denticles: a median denticle and three others on each side; sometimes one to two lateral denticles are indistinct; sometimes, two lateral denticles are fused into a broad lobe. Ventral surface of clypeus with a coarse transverse ridge. Palp formula 1,3. Frontal carinae extending to the level of the posterior margins of eyes. Antennal scrobes absent. Frontal lobes present, partially covering the condylar bulbs of holding antennal scapes. One third to one half of the antennal scapes usually laterally compressed near the bases. Antennal scapes, when lying on the dorsal head, just beyond the occipital margin. Lamella encircling the base of the antennal scape with a broad and deep notch on the center of the dorsal surface. Eyes generally containing more than 20 (rarely 15) ommatidia, with six to seven (rarely five) in the longest row. Occipital margin straight or feebly concave in full-face view. Alitrunk, in profile, with a convex dorsum, in dorsal view without any sutures. Pronotum unarmed. Propodeum with a pair of slightly elongate triangular teeth. Metapleural lobes prominent and rounded. Petiole node in profile longer than high with a long anterior peduncle; its anterodorsal angle is on approximately the same level as the posterodorsal. Subpetiole with a narrow, semitranslucent lamella. Postpetiole in profile higher than long, rounded dorsally, in dorsal view slightly broadening from front to back. Dorsal surfaces of head and alitrunk and the sides of pronotum with scattered foveolate punctures, varying from shallow, small, and few to distinct, rather large and many; space between foveolae usually smooth. Petiole, postpetiole, and gaster smooth and shining. Dorsal surfaces of head and alitrunk with some erect or suberect short hairs. Usually two to three pairs of hairs present on the dorsal surfaces of petiole node and postpetiole, respectively. A row of forward-projecting hairs present near the anterior clypeal margin. Scapes and tibiae with numerous suberect short hairs. First gastral tergite lacking erect or suberect hairs. Color reddish-brown, but the masticatory margin of mandible black-brown.

Queen. TL 8.00–8.25, HL 1.80–2.02, HW 2.00–2.25, CI 99–118, SL 1.52–1.65, SI 73–79, EL 0.40–0.42, PW 1.50–1.60, AL 2.26–2.40, PPW 0.52–0.52, PPL 0.48–0.50, PPI 104–108 (n = 4).

General shape as in Figures 259–260, with normal caste differences from the conspecific worker; propodeal armaments toothlike; other characters similar to worker.

Male. A single male specimen (BMNH), collected in Papua (Kokoda, 1,200 ft) by L. E. Cheeman in August 1933, has the following measurements: TL ca. 6.04, HL 0.94, HW 0.98, CI 104, SL 0.35, SI 36, EL 0.47, PW 1.28, AL 1.98.

Head, including the eyes, distinctly broader than long. Clypeus narrow, transverse, convex in the middle, its anterior margin almost straight. Frontal carinae short. Eyes large and prominent. On the mesoscutum, notauli rather wide, forming a Y shape with several coarse rugae. Scuto-scutellar sulcus wide, separated into small cells by longitudinal ridges. Propodeum armed with a pair of strong triangular teeth. Metapleural lobes rounded. Petiole node in profile low, distinctly longer than high, with a long anterior peduncle. Postpetiole in profile slightly longer than high and rounded dorsally. Dorsum of head behind the level of the posterior margins of eyes with some foveolate-reticulate sculpture, but the centrical disc of the dorsal head, under the median ocellus, smooth and shining. Each side of the dorsal head, between the eye and the frontal carina, with several transverse rugae; spaces between the rugae smooth and shining. Promesonotum with somewhat coarse foveolate-reticulate sculpture. Sides of petiole node with foveolate-reticulate sculpture. Postpetiole rather smooth, only with few superficial short rugae on each side. Gaster unsculptured, smooth, and shining. Body blackish-brown, but gaster and scapes reddish-brown.

Note: This male is assigned to the species *P. umbripennis* for the following reasons: (1) It belongs to the *umbripennis* group because it is similar to the males of *P. picteti*, *P. pollux*, and *P. reticulatus* but different from the other known males of *Pristomyrmex* in the structure and shape of propodeal spines, petiole, notauli, and scuto-scutellar sulcus and in body size, sculpture, and hairs. (2) It cannot be placed in the other species of the *umbripennis* group. It differs from the male of *P. pollux* because the former has a wider head (HW 0.98, CI 104) than the latter (HW 0.68–0.70, CI 80). This male is larger (HW 0.98, HL 0.94, EL 0.47) than the males of *P. picteti* and *P. reticulatus* (HW $<$ 0.85, HL $<$ 0.85, EL $<$ 0.40). In fact, it is the largest male specimen so far found in *Pristomyrmex*. This matches with the workers and queens of *P. umbripennis*, which are the largest in the genus. (3) The collecting locality and the collector name for this male are the same as the other two queens of *P. umbripennis.*

Comments. Pristomyrmex umbripennis occurs in New Guinea and some islands of Indonesia. It is closely related to *P. pollux* and *P. picteti,* but their workers and queens can be separated by the following characters:

P. umbripennis

- Eyes larger, generally consisting of 20 or more ommatidia and containing six to seven (rarely five) ommatidia in the longest row (worker)
- Propodeum with a pair of triangular toothlike armaments that are shorter than the distance between their bases (worker and queen)
- One-third to one-half of the antennal scape usually laterally compressed near the base (worker and queen)

P. pollux* and *P. picteti

- Eyes smaller, generally consisting of 10 or less ommatidia, and containing two to three (rarely four) ommatidia in the longest row (worker)
- Propodeum with a pair of fairly long or long spines that are longer (or much longer) than the distance between their bases (worker) or with a pair of short spines (queen)
- Antennal scape not laterally compressed near the base (worker and queen)

Material Examined (ANIC, MCZC, LAMN, BMNH, BMHH). Papua New Guinea: Gulf Prov., Ivimka Camp, Lakekamu Basin, 7.7°S, 146.8°E, 120 m, #96-266 (R. R. Snelling); NETH. Santani, 90+ m (T. C. Maa); NE Eloa River 488 to 518 m (S. Cutleck); N. Dist. of Papua, Kokoda (P. M. Room); N. Dist. of Papua, Saiho (P. M. Room); N. Dist. of Papua, Lejo Rd (P. M. Room); Papua, Brown Riv., lowland rainfor., ground, rotten tree stump (R. W. Taylor); Maffin Bay (E. S. Sepik Province, ca. 2 to 3 km S of Wirui, S of Wewak 50 to 100 m, 03.36°S, 143.37°E (R. J. Kohout); Lae, Bupu River, wet rotten log (B. B. Lowery); Bulolo, 3,000 ft, rainforest, in rotten log (B. B. Lowery); near Popondetta, <50 m, rainforest, ex trunks and low foliage (R. W. Taylor); 4 mi S of Popondetta, rainforest (B. B. Lowery); Sangara N.D. (G. Baker). Indonesia: Amboina (Biró); Irian Jaya, 50 km S Manokwari, Arfak Mtns. Nature Reserve 25 m, second rainforest, ex log (G. D. Alpert); Irian Jaya, PT. Freeport Concession, Siewa camp., 03.04°S 136.38°E, 200 ft, lowland secondary rainforest, #98-62 and #98-86, under loose bark of log (R. R. Snelling); Seram I., Solea (M. Brendell).

Ecological Information. This species occurs in rainforest and has been collected in and on rotten logs and under loose bark of a log.

NOMEN NUDUM

Pristomyrmex parvispina Emery

Emery (1900) mentioned the name *Pristomyrmex parvispina* but provided neither an indication such as "n.sp." (or its equivalent, e.g., "sp. nov.") nor a description and designated no types. *Pristomyrmex parvispina* is thus a nomen nudum. Emery (1922: 233) cited *P. parvispina* Emery as a synonym of *P. brevispinosus* Emery, but this was incorrect because *P. parvispina* was not a valid name. In addition, Emery (1922: 233) cited the original publication date incorrectly as 1901 [see Bolton's (1995) catalog for the dating of the original paper].

Figure 261. Head of the male of *Pristomyrmex brevispinosus* Emery, full-face view.

Figure 262. Head of the male of *Pristomyrmex ?flatus* (see the text), full-face view; mandible indicated by an arrow.

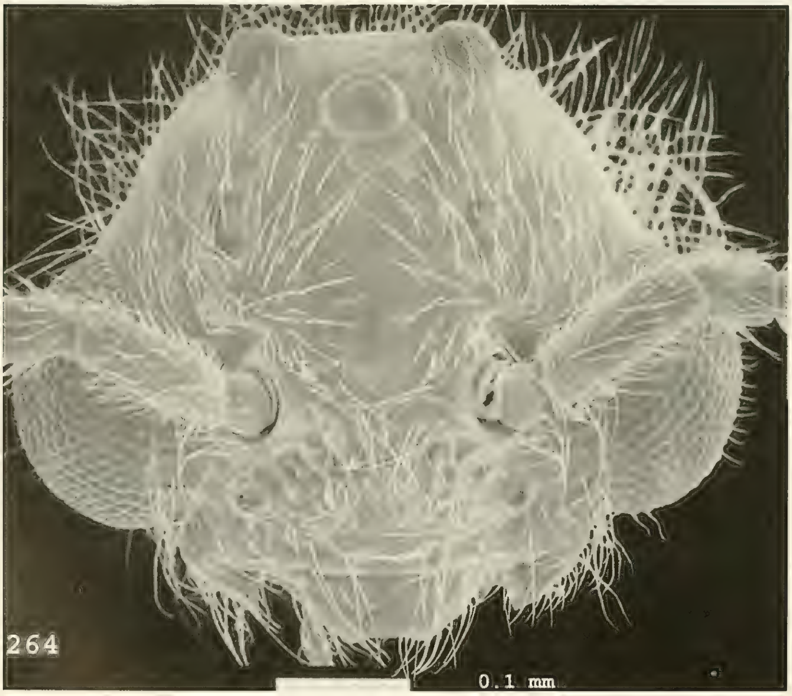


Figure 263. Head of the male of *Pristomyrmex longispinus* **sp. n.,** full-face view.
Figure 264. Head of the male of *Pristomyrmex orbiceps* (Santschi), full-face view.

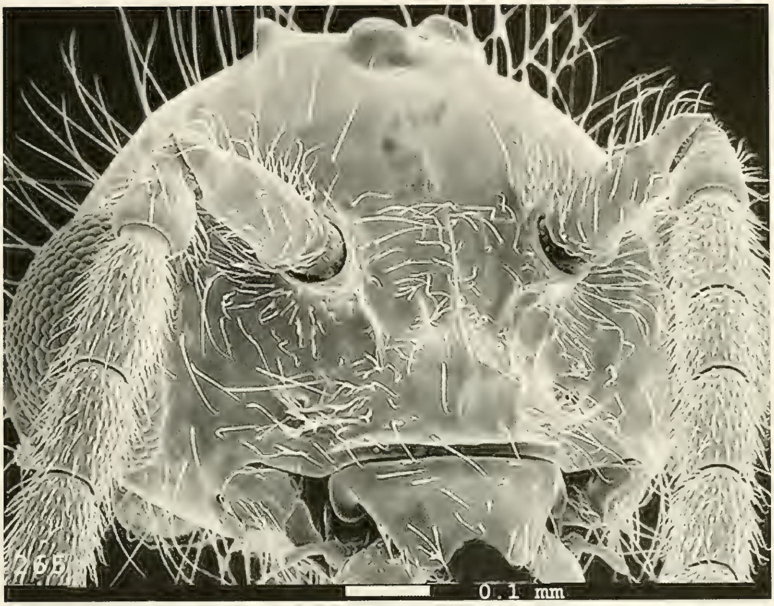


Figure 265. Head of the male of *Pristomyrmex quadridentatus* (André), full-face view.

Figure 266. Head of the male of *Pristomyrmex sulcatus* Emery, full-face view.

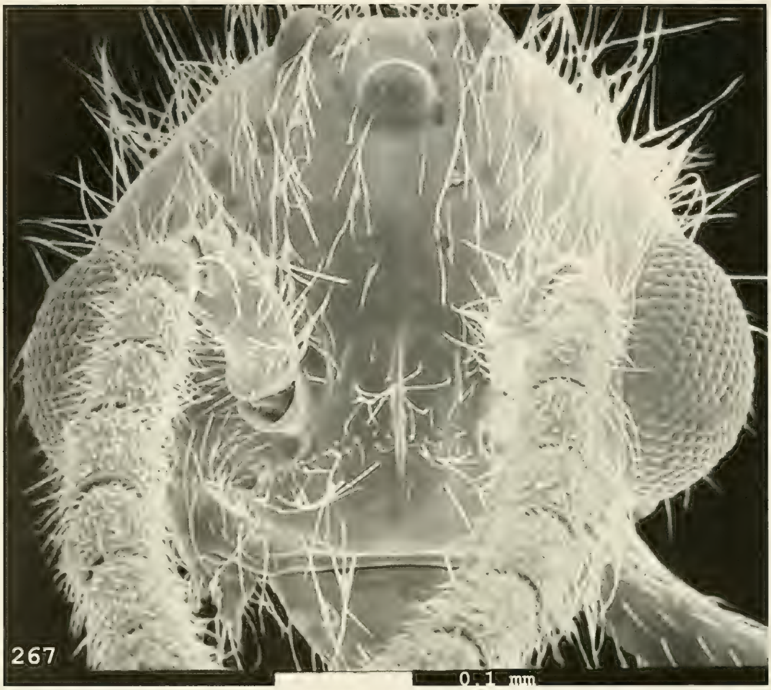


Figure 267. Head of the male of *Pristomyrmex obesus* Mann, full-face view.

Figure 268. Head of the male of *Pristomyrmex picteti* Emery, full-face view.

Figure 269. Head of the male of *Pristomyrmex pollux* Donisthorpe, full-face view (antennae missing).

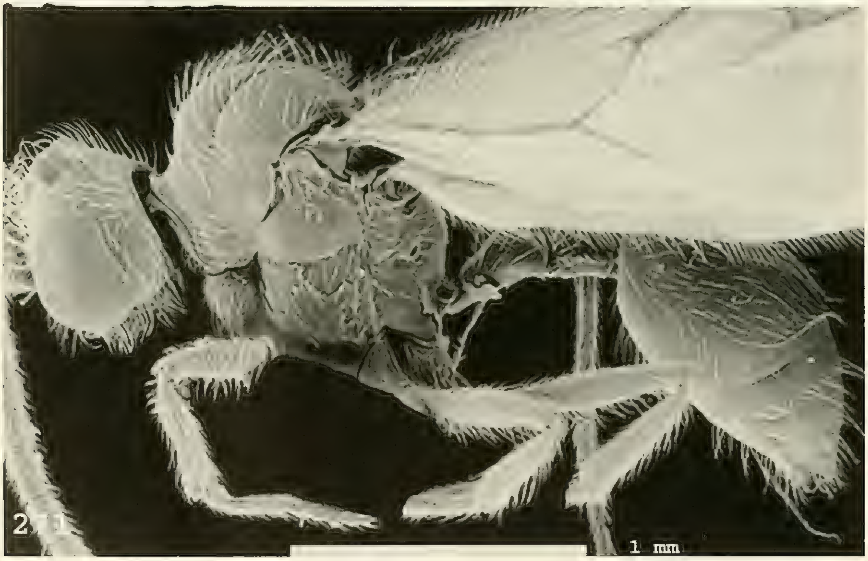


Figure 270. Male of *Pristomyrmex brevispinosus* Emery, lateral view.

Figure 271. Male of *Pristomyrmex* ?*flatus* (see the text), lateral view.

Figure 272. Male of *Pristomyrmex longispinus* **sp. n.,** lateral view.
Figure 273. Male of *Pristomyrmex orbiceps* (Santschi), lateral view.

Figure 274. Male of *Pristomyrmex quadridens* Emery, lateral view.

Figure 275. Male of *Pristomyrmex quadridentatus* (André), lateral view.

Figure 276. Male of *Pristomyrmex sulcatus* Emery, lateral view.

Figure 277. Alitrunk and petiole node of the male of *Pristomyrmex levigatus* Emery, lateral view.

Figure 278. Head, alitrunk and petiole node of the male of *Pristomyrmex obesus* Mann, lateral view.

Figure 279. Male of *Pristomyrmex picteti* Emery, lateral view; propodeal spine and petiole node indicated by an arrow, respectively.

Figure 280. Male of *Pristomyrmex pollux* Donisthorpe, lateral view; propodeal spine and petiole node indicated by an arrow, respectively.

Figure 281. Mesonotum of the male of *Pristomyrmex levigatus* Emery, dorsal view.

Figure 282. Mesonotum of the male of *Pristomyrmex pollux* Donisthorpe, dorsal view.

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