

## ***Pseudochalcura* (Hymenoptera: Eucharitidae), a New World genus of chalcidoids parasitic on ants**

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**ABSTRACT.** The genus *Pseudochalcura* Ashmead (Eucharitidae: Eucharitinae) is revised to include thirteen species which all share the complete fusion of the genae behind the mandibles and a loss of functional mouthparts. Eight Neotropical and one Nearctic species of *Pseudochalcura* are described as new: *atra* (Mexico), *condylus* (lesser Antilles), *excruciata* (Brazil), *frustrata* (Argentina), *liburna* (Florida, U.S.A.), *pauc*a (Argentina), *prolata* (Argentina), *sculpturata* (Brazil; Florida, U.S.A.), *septuosa* (Mexico). *P. chilensis* Kieffer is redescribed. The known distribution of *P. nigrocyan*ea Ashmead is extended to Uruguay and Venezuela. The known distribution of *P. americana* (Howard) [comb.n.] is extended to Panama, Columbia, Ecuador, Argentina and northward into the southern tip of Florida. All three previously described Nearctic species are synonymized under the name *P. gibbosa* (Provancher) with *P. arizonensis* (Crawford) and *P. californica* (Ashmead) as junior synonyms. Biological information is summarized providing new information on both plant and ant hosts. A phylogenetic hypothesis for the genus is presented.

### **Introduction**

*Pseudochalcura* was erected by Ashmead in 1904 for a group of five species. Kieffer included one additional species in 1905, but since then no further species have been added. The six species were based on a total of eleven specimens, with the three North American species each described on the basis of single specimens. Species of *Pseudochalcura* are now known to be widely distributed throughout the New World, ranging from Argentina and Chile to as far north as Alaska. In this paper, the three previously described North American species are synonymized, four species are redescribed and nine new species are described.

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This genus is easily recognizable by its robust form and distinct habitus; evidence for its monophyly is provided by the fusion of the genae behind the mandibles. *Pseudochalcura* appears to be most closely related to *Lophyrocera* Cameron. The placement of *Pseudochalcura* within the Eucharitinae (Eucharitidae) is justified by the reduced pronotum, prepectus fused to and in the same plane as the pronotum, an acicular ovipositor and the lack of a basal anellus on the antenna.

So far, the Eucharitidae have been shown to be parasitic solely upon ants, with parasitism taking place indirectly by ovipositing into plant tissue and the active first instar or planidium seeking out the host ant (Clausen, 1940, 1941). *Pseudochalcura gibbosa* (Prov.) has been reared from three species in two subgenera of *Cam-*

*ponotus* Mayr. How widespread this specificity on *Camponotus* is within other species of *Pseudochalcura* remains to be seen, but host specificity at the generic level for ants is not uncommon for other eucharitid genera (Wheeler & Wheeler, 1937; Clausen, 1941). Information on plant associations is scattered. Data labels make reference to several plant species from which species of *Pseudochalcura* have been collected but there are only three oviposition records: *P. nigrocyanea* Ashmead on *Eryngium* (Umbelliferae) and *P. gibbosa* on *Gossypium hirsutum* L. (Malvaceae) and *Arbutus* (Ericaceae). Other records from *Rhus glabra* L. (Anacardiaceae) and *Cordia macrostachya* (Ehritaceae) suggest that females oviposit into developing flower buds, as has been observed for *Stilbula* Spinola (Clausen, 1941) and *Kapala* Cameron (Heraty & Darling, 1984).

## Materials and Methods

Material referred to in the text was borrowed from the following institutions (curator's names in parentheses): AMNH, American Museum of Natural History, New York, NY (M. Favreau); ARG, Museo Argentino de Ciencias Naturales Bernardino Rivadavia, Buenos Aires, Argentina (A. O. Bachmann); ANSP, Academy of Natural Sciences of Philadelphia, Philadelphia, PA (D. Otte); BMNH, British Museum (Natural History), London, England (Z. Bouček & J. S. Noyes); BRI, Biosystematics Research Institute, Ottawa, Ont. (C. Yoshimoto); CAS, California Academy of Sciences, San Francisco, CA (W. Pulawski); COL, Colorado State University, Fort Collins, CO (H. E. Evans); GUE, University of Guelph, Guelph, Ont. (S. A. Marshall); IDA, University of Idaho, Moscow, ID (W. F. Barr); IOW, Iowa State University, Ames, IO (R. E. Lewis); KAN, University of Kansas, Lawrence, KA (G. W. Byers); LACM, Los Angeles County Museum of Natural History, Los Angeles, CA (R. R. Snelling); MLA, Fundacion Miguel Lillo, Instituto de Zoologia, San Miguel de Tucuman, Argentina (P. Fidalgo); MCZ, Museum of Comparative Zoology, Cambridge, MA (A. Newton); MISS, Mississippi Entomological Museum, Mississippi State MS (R. L. Brown); MON, Montana State University, Bozeman,

MT (S. Rose); MSU, Michigan State University, East Lansing, MI (R. L. Fischer); ORE, Oregon State University, Corvallis, OR (G. M. Stonedahl); PMU, Paris Museum, Paris, France (through Z. Bouček, BMNH); UBC, University of British Columbia, Vancouver, B.C. (S. G. Cannings); UCB, University of California, Berkeley, CA (L. E. Caltagirone); UCD, University of California, Davis, CA (R. O. Schuster); UCR, University of California, Riverside, CA (G. Gordh); UMS, University of Minnesota, St Paul, MN (P. J. Clausen); USNM, United States National Museum of Natural History, Washington, DC (E. E. Grissell).

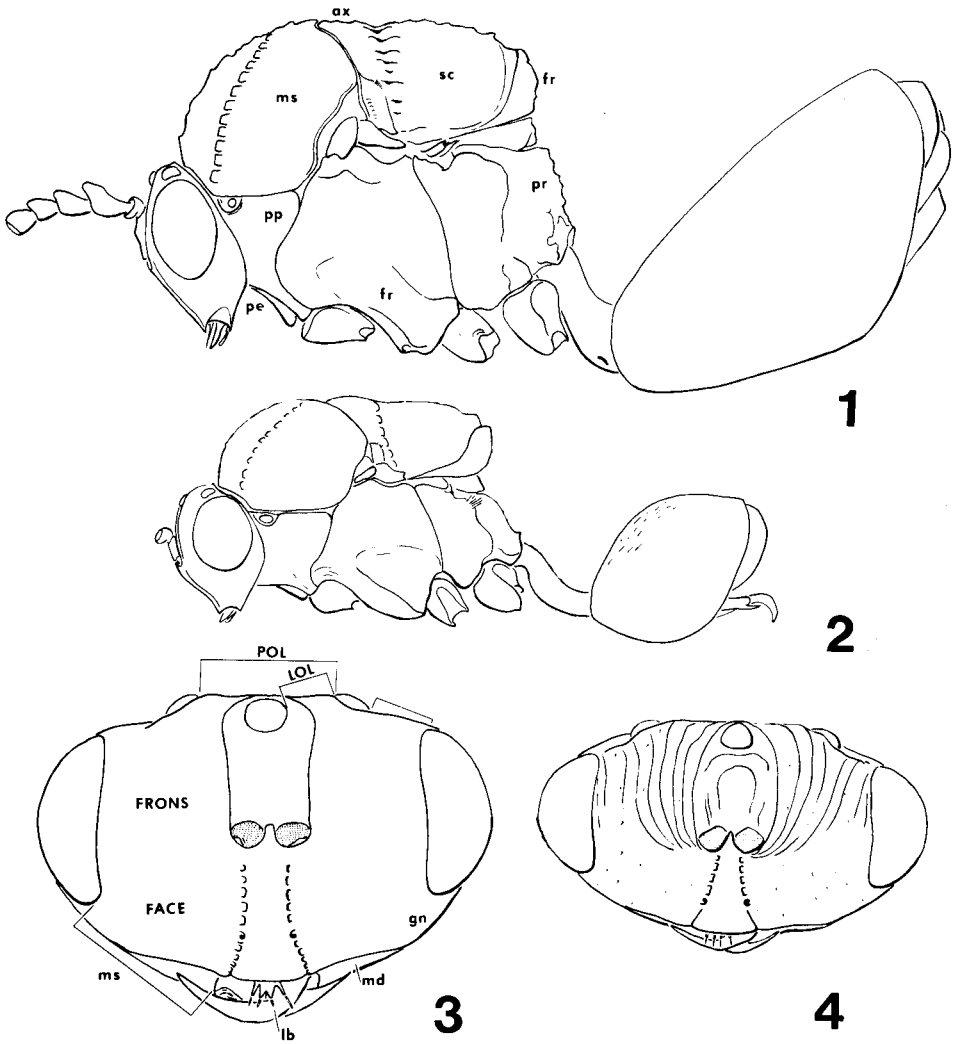
## Techniques

Eucharitids are hard-bodied insects (with the exception of the female abdomen when expanded with eggs), and air-dried museum specimens are usually in good condition with little or no distortion of body parts. Specimens received in alcohol were critical point dried using an alcohol intermediate. This method resulted in a cleaner and more flexible specimen with no collapse of the egg-swollen abdomens.

Male genitalia were dissected by placing the abdomen in 10% KOH and warming on a 60°C slide-warmer for 1–2 h. The genital capsule was dissected from the abdomen and either permanently mounted on a slide in Hoyer's medium or kept as a temporary mount in a drop of glycerin-jelly in a depression slide. Permanent wing-mounts were made by removing the wings from the specimen, immersing in water and mounting on a slide in Hoyer's medium.

Illustrations and measurements of specimens were made using a Leitz Wetzlar stereoscopic microscope equipped with a 20×20 ocular reticule. Illustrations of wings and male genitalia were drawn in ventral view with a camera lucida fitted to a compound microscope. Scanning electron micrographs were taken using an 'ETEC autoscan' after plating the specimen with gold-palladium.

The descriptions are based on the total number of specimens examined for both previously described and newly described species. Deviations from the descriptions in either the type material or material examined are covered in the remarks section accompanying each description.



FIGS. 1–4. 1–2, Habitus: 1, *P. gibbosa*, paratype ♀; 2, *P. sculpturata*, ♂ from Jatui, Brazil. 3–4, Frontal view of head: 3, *P. gibbosa*, paratype ♀; 4, *P. condylus*, ♀. ax, axilla; fg, frenal groove; fr, frenum; gn, gena; lb, labrum; LOL, lateral ocellar line; md, malar depression; ms, malar space; OOL, ocular ocellar line; pe, preepisternum; POL, posterior ocellar line; pp, prepectus; pr, propodeum; sc, scutellum; t, tegula.

Collection data for holotypes are presented as they appear on the specimen label with interpretations of short forms or missing information in square brackets. All type-material was examined unless otherwise stated. Label information which could not be accurately interpreted is followed by a '[?]'.

### Terminology

Terms used to describe adult morphology are based largely on Graham (1969) with some

deviation to follow terms used by Snodgrass (1911), Bucher (1948) and Masner (1980).

The term pedicel and prepectus are preferred to the terms pedicellus and postspiracular sclerite, respectively (Fig. 1). Mesosoma is used instead of thorax to include the propodeum or first abdominal segment as a part of the thorax (Masner, 1980). The metasoma is composed of both the petiole and gaster. Genal bridge is used to describe the fusion of the genae (=postgenae) behind the mandibles (Fig. 7). Malar depression is a new term for the depression in the malar

space adjacent to the oral fossa, which appears to receive the apical tip of the mandibles (Fig. 16). The labrum consists of a broad base which extends apically as elongate digits and the labral setae which arise from the apex of each digit (Fig. 32). In most specimens only the labral setae are visible externally. Disc of the propodeum defines the central area of the propodeum bounded laterally by the spiracles. Descriptive terms for sculptures follow Harris (1978) as closely as possible.

Relative terms such as weak, fine, prominent or strong were used within the descriptions to refer to carinae, separating walls of areolae or other sculpture types. The term weak was used in reference to carinae or like structures which are only slightly raised above the surrounding surface. Fine is usually used in reference to weak striae or areolae which are closely set with narrow interstices.

Setal nomenclature is not divided into separate terms for setal types, with most references being modifiers of the term 'seta' (i.e. long or short). Setae or sculpture not associated with a modifier are assumed average or moderate in size or density. Microtrichia is a term which is reserved for setae which are barely visible using light microscopy.

### Character variation of adults

More important aspects of character variation are dealt with as part of the descriptions; however, the following discussion refers to some general problems in variation which were encountered and can be readily referred to the Eucharitidae in general.

**Sexual dimorphism.** Adults are readily distinguishable from each other by the number of antennal segments, relative length of the petiole, shape of the abdomen, and the presence of an ovipositor or male genitalia which are usually visible externally. More subtle differences can also be found. The males are usually less robust than the females with the mesosoma slightly smaller in proportion to body size, striae of the face are usually more prominent, coloration is darker and metallic reflections, if present, tend to be more extensive. At the same time, strong sexual dimorphism is a relatively rare phenomenon and males and females can usually be readily associated.

**Head.** In some species, the sculpture of the face and particularly the clypeal area can range from smooth to strongly and densely striate. The number of antennal segments is variable within species and usually depends on the degree of fusion found in the ultimate and penultimate antennal segments. Mutations of the flagellomeres represented as fusions or distortions are commonly encountered. The structure of the genal bridge varies little within species and proved to be a good indicator of specific boundaries based on the degree of striation and prominence of the median emargination. However, in *P. americana* (Howard), the male and female genal bridge were completely different (Figs. 47, 48).

**Mesosoma.** Sculpture of the mesosomal dorsum is variable and is only used to differentiate between species when the differences are great. Minute differences in the depth of sculpture or fine details of the separating walls of areolae, among other characters, are not considered as reliable characters. Fine sculpture of the propisternum, metacoxa and metafemur are usually consistent. The shape, degree of coloration and setal pattern on the metafemur are reasonably stable characters within the species of *Pseudochalcura*, except where indicated in the species descriptions. The wing veins in many of the species lose all coloration and are discernable only as a raised surface or by changes in light reflection of the wing which makes the path of the vein traceable, but in the descriptions they are termed indiscernible.

**Metasoma.** The gaster is usually consistent in shape. There is little variation found in sculpture or distribution of minute setae often found on the first tergite. The length and breadth of the petiole are fairly variable but their sculpture patterns are usually consistent. Genital characters in eucharitids are not very useful for determination of specific or generic level relationships. There is little change from the basic ground plan of the genitalia, with only slight differences in general shape. The only character of the genitalia which differs significantly is the presence or absence of the median process of the basiparamere (Fig. 59). It was not considered worthwhile to destroy the abdomens of males in uncommon species to examine the genitalic characters.

***Pseudochalcura* Ashmead**

*Pseudochalcura* Ashmead, 1904: 268–269, 468.

Type-species: *Eucharis gibbosa* Provancher (by original designation).

**Generic diagnosis.** Head transverse, as broad as mesosoma. Median ocellus only slightly anterior to posterior ocelli; occipital carina strong medially, vertex rounded into occiput laterally; temple behind eye narrow; occiput vertical, flat. Antennal scrobe narrow, as deep as width of scape. Genae completely fused behind mandibles (genal bridge). Clypeus as long as wide, slightly shorter than supraclypeal area; base of clypeus without distinct groove. Mandibles large, falcate, apical tooth longer than width of clypeus. Mouthparts vestigial, not visible externally. Scape short, longer than broad, not reaching median ocellus; antenna non-geniculate and without ring segments, stout, apical flagellomeres not distinctly broader than basal segments, rounded apically basal flagellomeres serrate to ramose in female, flagellum shorter than width of head; basal four to seven flagellomeres ramose in male, rami decreasing in length from first.

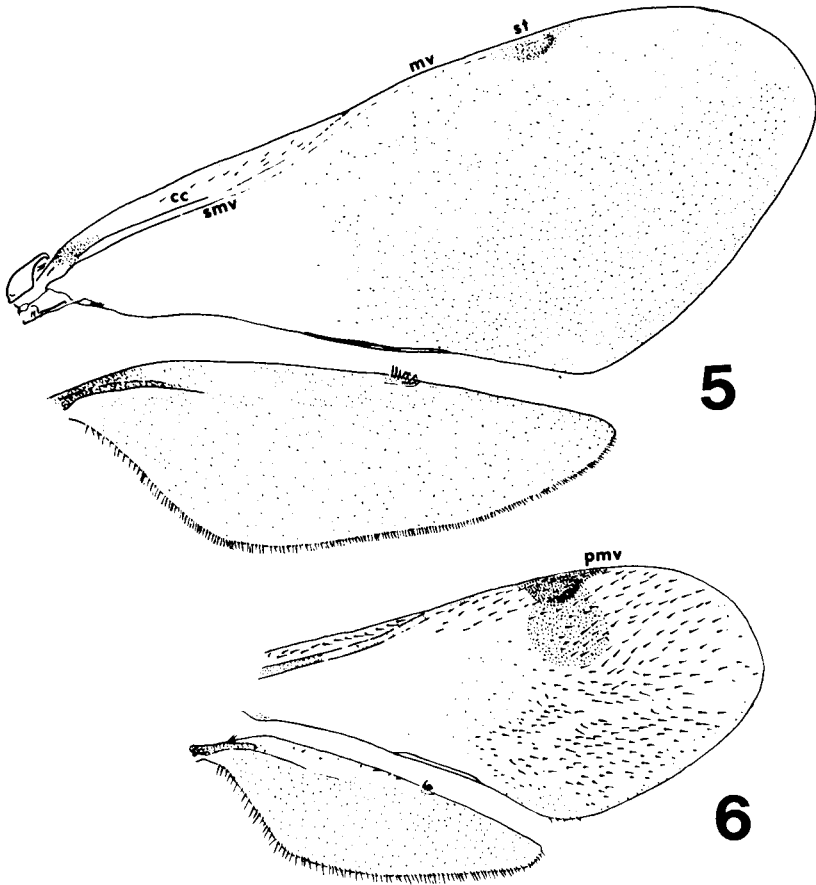
Mesosoma globose with areolate-rugose sculpture; notaulices broadly impressed, joining at posterior margin. Axillae broadly fused medially, joined posteriorly to scutellum across deep crenulate furrow. Scutellum broadly rounded narrower than mesoscutum; frenum truncate or rounded at apex, without apical processes. Disc of propodeum slightly rounded, rarely flat; propodeal processes lacking; postspiracular furrow broad and shallow; callus bulging, with 10–20 erect setae; metepisternum not distinct. Femoral groove usually deeply and broadly impressed, smooth ventrally. Prepectus fused to pronotum, without distinct suture or furrow, not reaching tegula; spiracle inset onto emargination of anterodorsal margin of prepectus, narrowly enclosed dorsally. Anterior margin of metasternum straight, not sharply produced forward between mesocoxae. Coxae globose, mesocoxa usually with sharp carina laterally. Marginal vein of hindwing vaguely discernible.

Petiole stout, longer than metacoxa. Gaster globose, first tergite covering following segments. Ovipositor acicular. Male genitalia (Figs.

13, 59) with digitus toothed; paramere long, with few long setae; median process long.

**Key to the species of *Pseudochalcura* Ashmead**

- 1 Dorsal setae on submarginal vein present; setae of forewing disc long or short; female first gastral tergite smooth; metatibial spur present ..... 2
- Dorsal setae on submarginal vein absent; setae of forewing disc very short, barely visible (Fig. 5); female first gastral sternite striate (Figs. 15, 30) or punctate; metatibial spur present or absent .... 6
- 2 Metacoxa bare; male antenna 12-segmented with 5–6 long basal rami; eyes bare ..... 3
- Metacoxa with erect lateral setae; male antenna 11-segmented with 3–4 short basal rami; eyes bare or setose ..... 4
- 3 Disc of propodeum with fairly dense, long setae; setae of forewing disc long (Fig. 6); wings usually with infusate spot below stigma  
*americana* (Howard)
- Disc of propodeum bare or with few isolated setae; setae of forewing disc very short in female, longer in male; wings without infusate markings  
*liburna* n.sp.
- 4 Digits of labrum long; petiole striate basally; setae of forewing disc long; genal bridge deeply emarginate; gaster with long appressed setae dorsally; eyes bare. Female unknown  
*excruciata* n.sp.
- Digits of labrum reduced (Fig. 32); petiole smooth; setae of forewing disc very short; genal bridge not or only slightly emarginate (Fig. 50); gaster with scattered short setae dorsally; eyes setose or bare 5
- 5 Eyes setose; dorsal mesosomal setae long  
*nigrocyanea* Ashmead
- Eyes bare; dorsal mesosomal setae short. Female unknown ..... *frustrata* n.sp.
- 6 Metatibial spur present (Fig. 11); POL/OOL < 3.5; female antenna lobate or serrate (Figs. 21, 22); male antennal rami basally arranged along dorsal midline (Fig. 26); head subtriangular, 1.5–1.7 times as broad as high (Fig. 3); mesosoma of males only slightly more elongated than females 7
- Metatibial spur absent (care has to be taken not to mistake long tibial setae for spurs, Fig. 12); POL/OOL > 3.5; female antenna ramose basally (Figs 23, 24); male antennal rami arranged alternately on either side of dorsal midline (Fig. 27); head strongly transverse, 1.8–1.9 times as broad as high (Fig. 4); mesosoma of males (Fig. 2) distinctly more elongated than females ..... 11
- 7 Lateral carina of mesocoxa absent or only barely visible (Fig. 9); costal cell forewing with row of ventral setae ..... 8



FIGS. 5–6. Wings: 5, *P. gibbosa*, ♀; 6, *P. americana*, ♂. cc, costal cell; mv, marginal vein; pmv, postmarginal vein; smv, submarginal vein; st, stigma.

- Lateral carina of mesocoxa distinct (Fig. 10); costal cell of forewing bare. .... 10
- 8 Metacoxa laterally, pro- and mesocoxae ventrally with several fine erect setae; lateral setae of femora long (Fig. 38); body, antenna, coxae and basal half of femora black; female antenna 11-segmented. Male unknown. .... *atra* n.sp.
- Coxae bare or at most with few short setae; lateral setae of femora short; body dark brown to black; antenna, coxae and basal half of femora brown; female antenna 10–11-segmented ..... 9
- 9 Female antenna 11-segmented, covered with dense placoid sensilla and few setae; petiole not pinched ventrally, 3.2 times as long as wide. Male unknown *septuosa* n.sp.
- Female antenna 10-segmented, rarely 9- or 11-segmented, covered with mixed placoid sensilla and setae; petiole distinctly pinched ventrally (Fig. 15), 1.7–3.0 times as long as wide. Male antenna 11-segmented, with 4 basal rami *gibbosa* Provancher
- 10 Female antenna 8-segmented; basal segments strongly serrated, becoming acuminate at tips (Fig. 23); metafemur abruptly expanded medially (Fig. 40); first gastral sternite of female granular, not striate; wings hyaline. Male unknown *pauca* n.sp.
- Female antenna 10-segmented, basal segments not strongly acuminate at tips; metafemur broadly expanded medially (Fig. 41); first gastral sternite of female finely striate; wings infusate or hyaline. Male antenna 11-segmented with 4 basal rami *chilensis* Kieffer
- 11 Basal flagellar segments of female antenna strongly ramose, rami several times as long as base (Fig. 24); petiole shagreened dorsally; large individuals, 3.3–3.5 mm long. Male unknown *prolata* n.sp.
- Basal flagellar segments of female antenna serrate to ramose, rami not more than 4 times as long as basal width (Fig. 23); petiole reticulate (Fig. 30); smaller individuals, less than 3.0 mm long .... 12
- 12 Basal flagellar segments of female lobate to serrate, not ramose; mesosoma uniformly dark, sculpture prominent dorsally; profile of face linear in

female and male. Male antenna 12-segmented, 6 long basal rami (Fig. 27); interstices and walls of areolae on mesosoma dorsum smooth; sometimes with faint metallic reflections dorsally

*condylus* n.sp.

- Basal flagellar segments of female lobate or ramose; female mesosoma patterned light and dark (Fig. 20) or completely yellow, sculpture shallow dorsally; face broadly concave below level of toruli (Fig. 23); sidelobes of mesoscutum shagreened. Male antenna 12-segmented, 7 long basal rami; male mesosoma uniformly dark, metallic reflections of mesosoma weak or absent; face not broadly concave; sculpture of mesosoma as in female ..... *sculpturata* n.sp.

### ***Pseudochalcura americana* (Howard)**

**comb.n.**

(Figs. 6, 10, 25, 34, 47, 48, 68)

*Chalcura americana* Howard, 1894: 85.

*Stilbula americana* (Howard) DeSantis, 1979: 102.

This species may be recognized by the presence of long wing setae in both sexes, dense long propodeal setae and a distinct stigmal spot usually present on the forewing.

*Female.* Length 2.3–2.7 mm. Dark brown to black and sometimes with faint metallic reflections dorsally; scape, pedicel, apical flagellomeres and legs testaceous. Forewing hyaline basally, infuscate below stigma, stigma brown.

Head 1.6–1.7 times as broad as high. POL 2.5–3.0 times LOL, POL 2.5–3.0 times OOL. Face smooth, faint indications of costae laterally, more prominent around antennal scrobe and along gena; margins of clypeus and supraclypeal area deeply foveate laterally; genal bridge with or without emargination (Figs. 47, 48). Eyes separated by 1.9–2.1 times their height. Malar space 0.7–0.8 times height of eye, malar depression deep, slightly less than half malar space. Labrum 8–10-digitate, digits long. Antenna 10–11-segmented, basal flagellomeres serrate and becoming lobate apically; flagellomeres with dense, long setae and placoid sensilla.

Mesosoma with shallow, widely spaced areolate-rugose sculpture, sometimes appearing longitudinally striate on scutellum; short, scattered setae dorsally; prepectus, disc of propodeum and callus with long, erect setae.

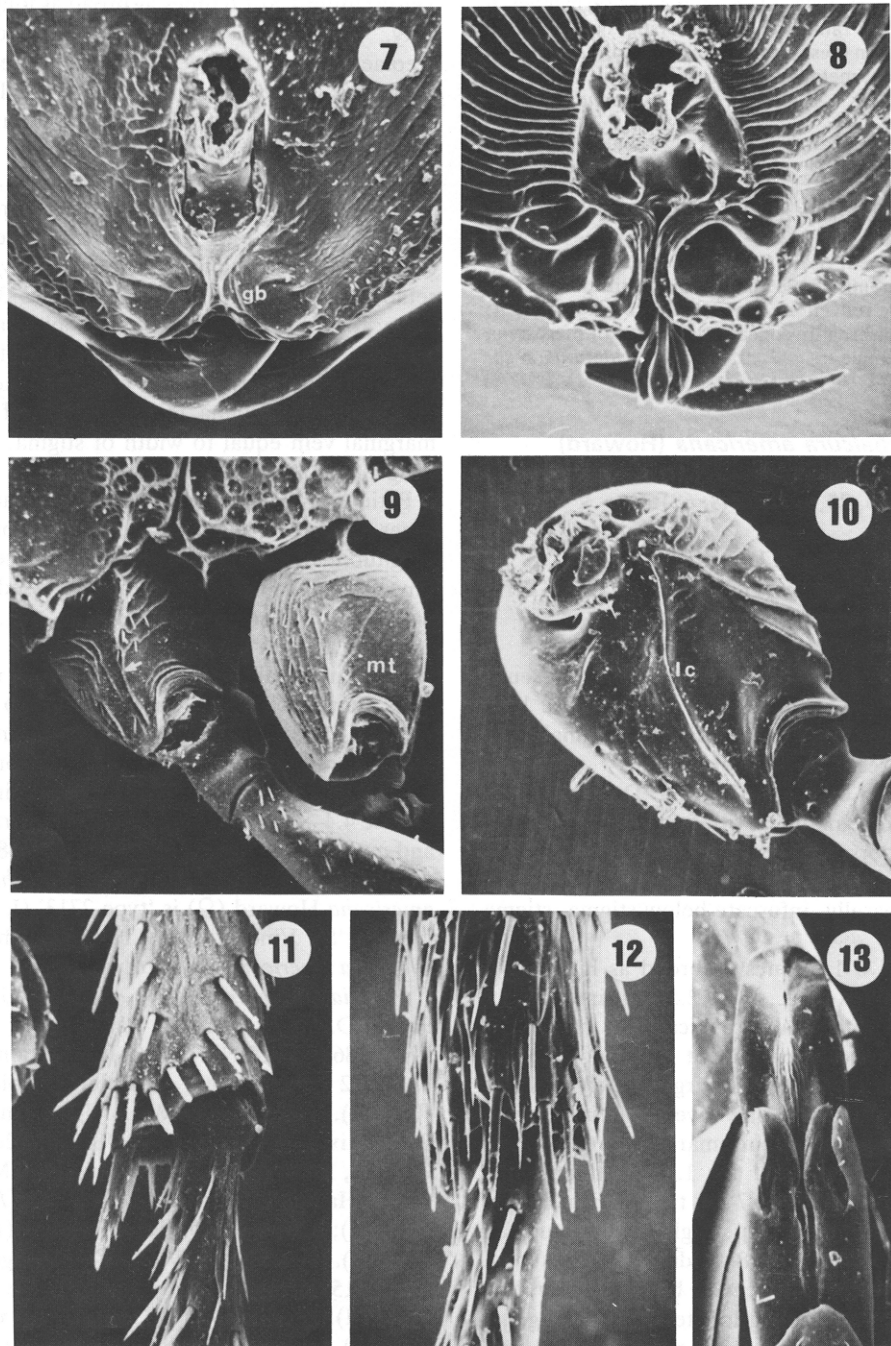
Mesoscutum 1.8–2.6 times as broad as long dorsally. Propodeum rounded, interstices of areolae large. Proepisternum areolate. Metacoxa glabrous; mesocoxa with lateral carina (Fig. 10). Legs slender; metafemur only slightly expanded medially, with sparse short erect setae (Fig. 34); metatibia with sparse, semi-erect setae; metatibial spur present. Forewing 2.3–2.4 times as long as broad; costal cell 0.4 times as long as wing, with single row of ventral setae; submarginal vein dorsally with 2–3 erect setae; row of scattered long setae below marginal vein; dense, long setae over disc of wing ventrally (Fig. 6); wing veins poorly defined but clearly visible, stigma round, length of post-marginal vein equal to width of stigma. Hindwing 2.8–3.6 times as long as broad.

Petiole 2.4–3.0 times as long as broad, 1.6 times as long as metacoxa; curved in profile; longitudinally aciculate. Gaster globose, 1.4 times as long as high; few short appressed setae dorsally; first sternite smooth.

*Male.* Length 2.5–3.4 mm. Colour as in female but usually darker with metallic reflections more extensive. Face smooth to completely and strongly striate. Antenna 12-segmented, flagellomeres 1–5 with long flat rami, sixth segment ramose to serrate (Fig. 25). Petiole 4.4–8.0 times as long as wide. Paramere and median process long, narrow (Fig. 68).

*Type material.* Holotype of *Chalcura americana* Howard (♀) is 'type 2713' (USNM) labelled 'St. Vincent, W.I., H. H. Smith, 209, *Chalcura americana* Howard, type'.

*Material examined.* 3♀, 13♂. U.S.A.: FLORIDA: 1♀, Royal Palm State Park, 29.vii.1860[?] (USNM); 1♂, Royal Palm Pk., 1.vi.1952 (*Kissinger*) palmetto blossom (USNM). DOMINICA W.I.: 1♀, Holmwood Est., 9.ix.1965 (*Jackson*) (USNM); 2♂, S. Chiltern, 18–19.viii.1965 (*Jackson*) (USNM); 1♀ Clarke Hall, Layou Vall., 10–17.ii.1965 (*Evans*) (USNM); 1♂, Cent. For. Res., 3.v.1965 (*Davis*) (USNM). TRINIDAD W.I.: 1♂, St. Augustine, 15.vii.–15.viii.1976 (*Noyes*) Malaise trap (BMNH). PANAMA: 1♂, El Valle, xi.1946 (*Krauss*) (USNM). COLUMBIA: 1♂, Choco, 450–500 m, 5° 45' N 76° 30' W, 14.iv.1973 (*Helava*) montane rain forest (BRI). ECUADOR: 5♂, Pichincha, 16 km SE Santo Domingo, Tinlandia, 680 m, 15–30.vi.1975 (*Peck*) (BRI); 4♂, (same locality) 500 m, 4–14.vi.1976 (*Peck*) (BRI); 2♂, Napo Tena,



FIGS. 7-13. 7, *P. gibbosa*, genal bridge, ♀. 8, *Lophyrocera* sp., genae almost fused. 9, *P. gibbosa*, mesocoxa with vague lateral carina (indicated by arrow), metacoxa (mt) striate laterally ♀. 10, *P. americana*, lateral carina (lc) of mesocoxa, ♂. 11, *P. gibbosa*, tibial spur of metafemur, ♂. 12, *P. condylus*, tibial spur of metafemur absent, ♂. 13, *P. gibbosa*, male genitalia, ventral view.



400 m, ii.1983 (Sharkey) (BRI). ARGENTINA: ? Horco Molle, Tuc., 1–5.i.1968 (Porter) [badly damaged specimen] (USNM).

**Biology.** No biology is known except for an association of the Florida male with a palmetto blossom.

**Variation.** There is considerable variation in size, shape and colour, all of which can be seen in a single series. In the series from Ecuador, individual males range from dark and robust with distinct infusate wing markings to slender forms which are lighter in colour and lack wing markings. In all of the specimens examined, long wing hairs, propodeal disc setae, laterally bare metafemur, and male petiole more than 4.0 times as long as wide, were present. The variation in the one Ecuador series makes it difficult to place specific limits on this group and there may be a species complex involved here.

***Pseudochalcura liburna* sp.n.** (Figs. 35, 49)

Differs from *P.americana* in having long erect setae on the metafemur, lacking long, dense propodeal setae, fewer labral setae, and except for the associated male, the absence of long ventral setae on the wing disc. In the male, the propodeal setae are absent and the petiole is shorter and stouter than is usually found in *P.americana*.

**Female.** Length 2.6–3.0 mm. Dark brown to black; antenna and legs testaceous. Wings hyaline, stigma clear.

Head 1.5–1.6 times as broad as high. POL 2.5–2.6 times LOL, POL 2.3–2.6 times OOL. Frons and face smooth laterally, finely costate around scape and laterad to clypeus, clypeus smooth or costate, genal bridge emarginate (Fig. 49). Eyes separated by twice their height. Malar space 0.8 times height of eye; malar depression deep, slightly less than length of malar space. Labrum 6-digitate. Antenna 10-segmented; strongly serrate basally; flagellomeres with dense, long setae and placoid sensilla.

Mesosoma with shallow, widely spaced areolate-rugose sculpture; sparse erect setae on dorsum, prepectus, callus, and 2–4 setae scattered on disc of propodeum. Mesoscutum 2.4–2.6 times as broad as long dorsally. Propodeum rounded, interstices of areolae large. Proepisternum areolate. Metacoxa glabrous or striate; mesocoxa with lateral carina. Legs slender; metafemur only slightly expanded medially,

with long erect setae laterally (Fig. 35); metatibia with sparse, semi-erect setae; metatibial spur present. Forewing 2.3–2.4 times as long as broad; costal cell 0.4 times as long as wing, with single row of ventral setae; submarginal vein dorsally with 2–3 erect setae; disc of wing with microsetae ventrally; wing veins poorly defined; stigma round, length of postmarginal vein slightly longer than width of stigma. Hindwing 3.3 times as long as broad.

Petiole 2.0–2.4 times as long as broad, 1.3–1.7 times as long as metacoxa; slightly curved in profile; longitudinally striate. Gaster globose, 1.4–1.5 times as long as high; bare dorsally; first sternite smooth.

**Male.** Length 2.8 mm. Colour as in female but darker. Antenna 12-segmented, flagellomeres 1–5 with long, slightly flattened rami, flagellomere 6 slightly serrate. Disc of forewing with long setae. Petiole stout, 3.2 times as long as broad, finely striate and micropunctate.

**Holotype**, ♀, FLORIDA: Monroe Co., Big Pine Key, 9.vii.1971, W. H. Pierce. Deposited in BRI.

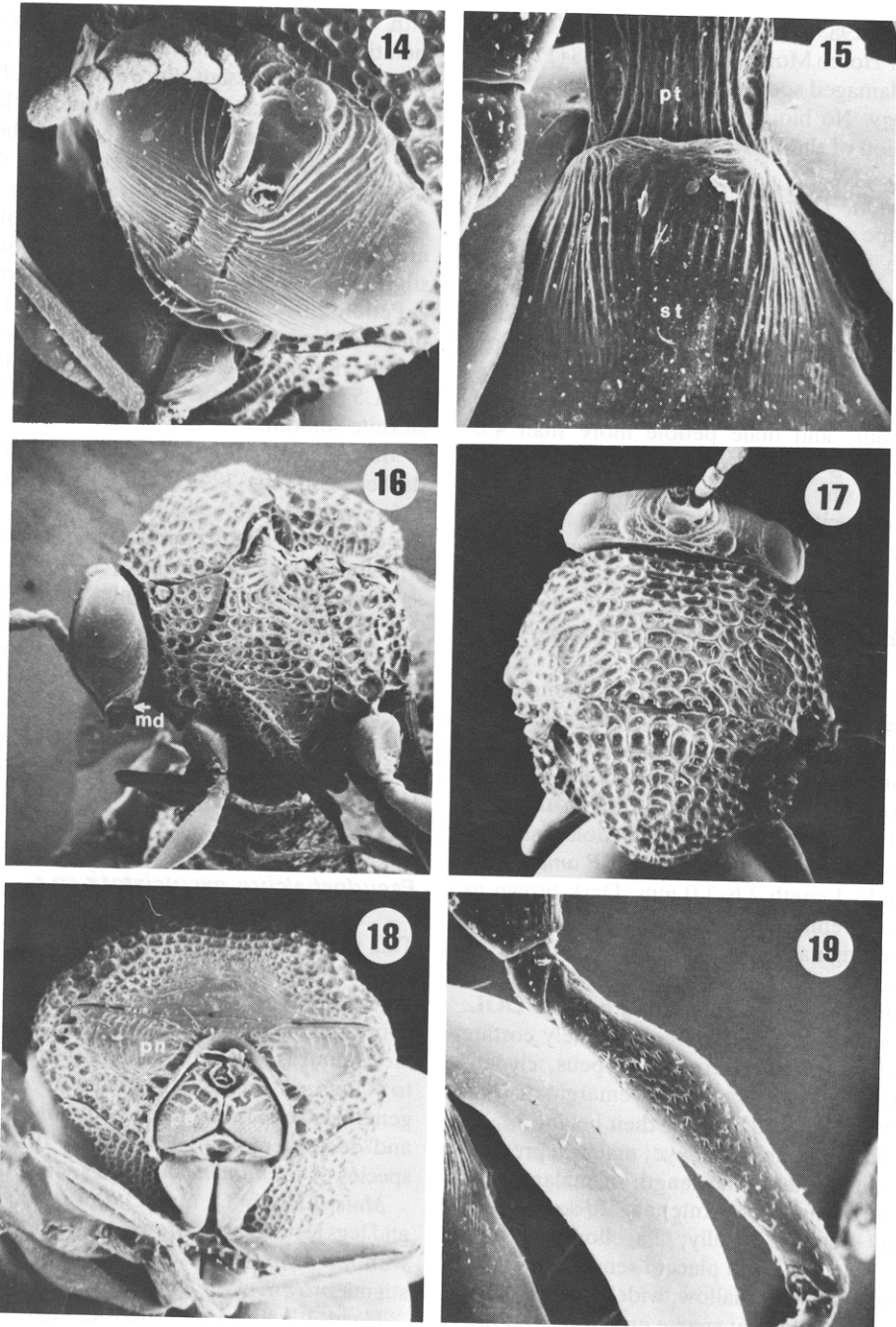
**Paratypes**, U.S.A. FLORIDA: 1♂, Key Largo, 27.iii.1957 (Weems Jr) (USNM); 1♀ Monroe Co., Key Largo, 7.ix.1963 (Krauss) (USNM).

***Pseudochalcura excruciatata* sp.n.**

This is the only species with three short basal rami in the male and, other than the three species forming the *prolata*-group, has the long appressed setae on the first gastral tergite. The metafemur is similar in setal pattern and shape to *P.nigrocyanea* but is completely yellow. The genal bridge is finely striate, and more broadly and deeply emarginate than any of the other species of *Pseudochalcura* (Figs. 46–58).

**Male.** Length 3.1 mm. Dark brown; antenna and legs testaceous. Forewing infusate apically, without distinct infusate spot below stigma, stigma brown.

Head 1.7 times as broad as high. POL 3.0 times LOL, POL 1.7 times OOL. Frons and face including clypeus striate, margin of clypeus and supraclypeal area deep foveate laterally; gena broadly rounded ventrally; genal bridge broadly and deeply emarginate. Eyes separated by 2.1 times their height. Malar space 0.8 times height of eye; malar depression deeply impressed,



FIGS. 14–19. *P. gibbosa*, ♀: 14, head in frontal view; 15, gaster in ventral view; 16, head and mesosoma in lateral view; 17, head and mesosoma in dorsal view; 18, mesosoma in frontal view, head removed; 19, metafemur, lateral view, shows setae present which are not easily discernible through light microscopy. pe, propisternum; pn, pronotum; t, petiole; st, first sternite.

equal to one-third malar space. Labrum 8-digitate, digits long. Antenna 11-segmented, apical two segments partially fused; three short basal rami.

Mesosoma with areolate-rugose sculpture; few short scattered setae dorsally; prepectus, callus with long erect setae, disc of propodeum with few short setae. Mesoscutum 1.8 times as broad as long dorsally. Propodeum rounded. Proepisternum areolate. Metacoxa glabrous; mesocoxa with lateral carina. Legs slender; metafemur only slightly expanded medially, with long erect setae laterally; metatibial setae dense, semi-erect; metatibial spur present. Forewing 2.3 times as long as broad; costal cell 0.4 times as long as wing, with row of ventral setae; submarginal vein dorsally with 2–3 erect setae; without row of scattered setae below marginal vein, dense long setae over disc of wing ventrally and apically; wing veins poorly defined but clearly visible, stigma round, length of post-marginal vein equal to width of stigma. Hindwing 2.8 times as long as broad.

Petiole 5.8 times as long as broad 2.4 times as long as metacoxa; lightly striate basally to glabrous apically. Gaster with long appressed setae dorsally (as in Fig. 2).

*Holotype*, ♂, Brazil, Caruaru, Pernambuco, iv.1972 (*Alvarenga*). Deposited in BRI.

***Pseudochalcura nigrocyanea* Ashmead**  
(Figs. 32, 36, 50)

*Pseudochalcura nigrocyanea* Ashmead, 1904: 468.

This species is most closely related to *P. frustrata* with which it shares reduced labral setae (Fig. 74; 7), a smooth petiole (Fig. 74; 8) and dorsal mesosomal setae. The main difference between the two species is the absence of setae on the eyes and reduced metafemoral setae of *P. frustrata*. There are further minor differences in the length of the facial setae and mesosomal setae, which are both longer and more erect in *P. nigrocyanea*.

*Female*. Length 2.4–3.5 mm. Body brown to black, with strong or faint metallic reflections, basal half of femora brown; antenna and rest of legs dark testaceous. Wings hyaline, stigma clear or white.

Head 1.5–1.7 times as broad as high. POL 2.4–3.1 times LOL, POL 2.2–2.9 times OOL. Frons and face including clypeus and supra-clypeal area costate, supraclypeal area not margined laterally; gena broadly rounded ventrally; scattered long setae on frons, face and eyes; genal bridge not or slightly emarginate (Fig. 50). Eyes separated by 1.6–2.1 times their height. Malar space 0.5–0.8 times height of eye, malar depression shallow, slightly less than half of malar space. Labrum 6-digitate, digits reduced (Fig. 32). Antenna 10–11-segmented; serrate basally; flagellomeres with dense setae and few placoid sensilla.

Mesosoma with shallow areolate to rugose sculpture; sparse short setae over mesosoma dorsally, setae longer and denser on prepectus and around mesoscutum laterally. Mesoscutum 2.1–2.3 times as broad as long dorsally. Propodeum rounded. Femoral groove shallow. Proepisternum areolate to rugulose. Metacoxa smooth with few setae laterally; mesocoxa with lateral carina. Legs slender; metafemur only slightly expanded medially, with dense semi-erect setae laterally (Fig. 36); metatibia with dense, appressed setae; metatibial spur present. Forewing 2.4–2.8 times as long as broad; costal cell 0.3–0.4 times as long as wide, with row of short setae ventrally; submarginal vein with three to several setae dorsally; disc of wing with microtrichia ventrally; wing veins not discernible; stigma round. Hindwing 3.5–3.7 times as long as broad.

Petiole 2.8–3.7 times as long as broad, 1.8–2.1 times longer than metacoxa; only slightly curved in profile; smooth except for few faint basal striae. Gaster globose, 1.5–1.7 times as long as high; few appressed short setae near base of first tergite; first sternite smooth.

*Male*. Length 3.0 mm. Colour as in female but antenna dark brown to black, legs darker. Costae of face prominent. Antenna 11-segmented, flagellomeres 1–4 with slightly flattened rami only slightly decreasing in length from the first. Mesosoma slightly elongate. Petiole 5.0–5.3 times as long as wide.

*Type material*. Lectotype of *Pseudochalcura nigrocyanea* Ashmead (here designated) (♂) is 'type 8082' (USNM) labelled 'May, Chapada, H. H. Smith' [BRAZIL]. Paralectotypes are 3♀ and 1♂ with same data except collected in April. A sixth specimen cited in Ashmead (1904) was not seen.

FIG. 20. *P. sculpturata*, habitus, ♀.

*Material examined.* 4♀, 1♂. BRAZIL: 1♂, Lavras, M.G., 1.iii.1979 (Fronk) (COL). URUGUAY: 3♀, Montevideo, SM. Amer. Parasit. Lab., 23.ix.1944 (Parker) [1♀ with label 'on *Eryngium* laying eggs'] (USNM). VENEZUELA: 1♀, Conuco, El Mirador, Caripe, 2.vii.1973 (BRI).

*Biology.* A single female from Uruguay has been recorded as ovipositing on *Eryngium* (Umbelliferae).

*Variation.* The type material differs slightly from the other material in having the OOL>LOL, the mesosoma rugose instead of shallow areolate and with a prominent cyaneous coloration. As well, the specimen from Venezuela is approximately one-third the size of

the others and lacks the prominent facial striae. This female may represent a separate species but a lack of a clear apomorphy makes it easier to include it for the present. The single male from Lavras most closely resembles the females from Montevideo and has a much darker antenna than the type males. The variation between the series is outweighed by the presence of eye setae, bulging gena, coxal and gastral setae, and smooth petiole.

***Pseudochalcura frustrata* sp.n.**

This species is most closely related to *P. nigrocyanea* but lacks setae on the eyes. A further discussion is given in the remarks for *P. nigro-*

*cyanea*. The setal pattern, coloration and shape of the metafemur are similar to *P.septuosa* (Fig. 39). The genal bridge is similar to that found in *P.nigrocyanea* (Fig. 50).

**Male.** Length 3.2 mm. Body dark brown to black, with weak metallic reflections on head and mesosoma; antenna and basal half of femora brown; rest of legs testaceous. Wings hyaline, stigma clear.

Head 1.6 times as broad as high. POL 2.9 times LOL, POL 2.9 times OOL. Frons and face including clypeus and supraclypeal area costate, supraclypeal area not margined laterally; genae straight, not broadly rounded ventrally; scattered setae on frons and face, eyes bare; genal bridge slightly emarginate. Eyes separated by 2.0 times their height. Malar space 0.8 times height of eye, malar depression shallow, slightly less than half of malar space. Labrum 5-digitate, digits reduced. Antenna 11-segmented, flagellomeres 1–4 with slightly flattened rami only slightly decreasing in length from the first; flagellomeres with dense setae, without placoid sensilla.

Mesosoma with rugose-areolate sculpture, longitudinally striate on axillae and scutellum; sparse short setae over mesosoma dorsally, setae longer and denser on prepectus and mesoscutum laterally. Mesoscutum 2.1 times as broad as long dorsally. Propodeum rounded. Femoral groove strongly impressed. Proepisternum areolate. Metacoxa smooth with few erect setae laterally; mesocoxa with lateral carina. Legs slender; metafemur only slightly expanded medially, with appressed setae laterally; metatibia with dense, appressed setae; metatibial spur present. Forewing 2.3 times as long as broad; costal cell 0.4 times as long as wing, with row of short setae ventrally; submarginal vein with few fine setae dorsally; disc of wing with microtrichia ventrally, bare dorsally; wing veins not discernible; stigma round. Hindwing 3.5–3.7 times as long as broad.

Petiole 6.3 times as long as broad, 2.7 times longer than metacoxa, linear, not curved in profile, smooth. Gaster 1.6 times as long as high; few appressed setae dorsally.

**Holotype.** ♂, RA CATAMARCA, El Suncho [ARGENTINA], 1850 m, 8–18.ii.1957, Col. R. Golbach, COLECCION Fundacion M. Lillo, 4000 SM Tucuman, TUCUMAN-ARGENTINA. Deposited in MLA.

### ***Pseudochalcura gibbosa* (Provancher)**

**comb.n.** (Figs. 1, 3, 5, 7, 9, 11, 13–19, 21–22, 26, 28, 37, 46, 59–67, 69)

*Eucharis gibbosa* Provancher, 1881: 292.

*Chalcura californica* Ashmead, 1892: 356. **syn.n.**

*Pseudochalcura gibbosa* (Provancher) Ashmead, 1904: 268.

*Chalcura arizonensis* Crawford, 1914: 29. **syn.n.**

*Pseudochalcura arizonensis* (Crawford) Muesebeck *et al.*, 1951: 515.

*Pseudochalcura californica* (Ashmead) Muesebeck *et al.*, 1951: 515.

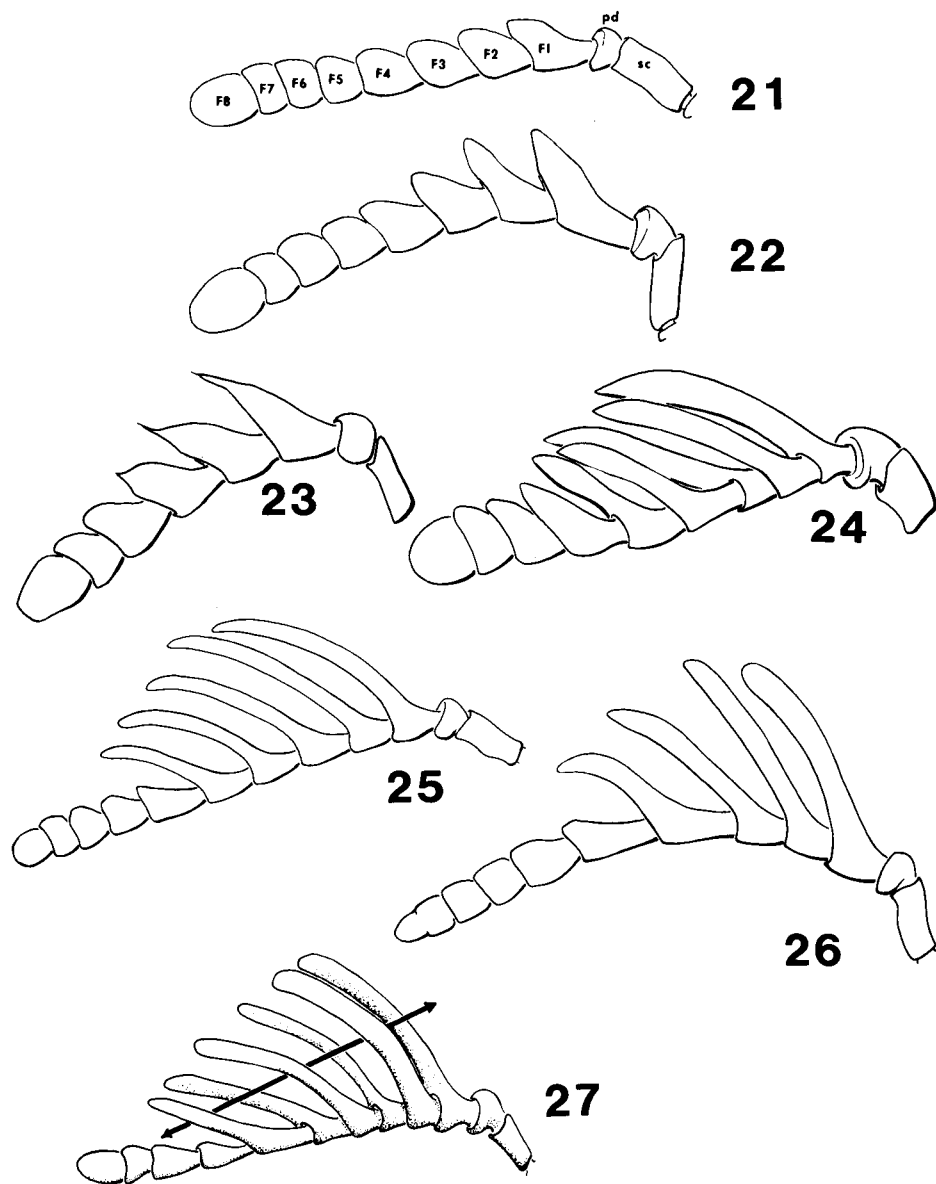
This species is recognized by the lack of a lateral carina on the mesocoxa, a row of ventral setae in the costal cell of the forewing and the base of the petiole pinched ventrally in the female.

**Female.** Length 2.8–4.5 mm. Dark brown to black; scape, pedicel and legs testaceous, femora usually darker basally. Wings hyaline or infusate, stigma white.

Head 1.5–1.6 times as broad as high (Fig. 3). POL 2.4–3.2 times LOL, POL 2.0–3.0 times OOL. Frons and face costate (Fig. 14), with scattered short setae, clypeus smooth or striate; genal bridge deeply emarginate (Figs. 7, 46). Eyes separated by 1.9–2.0 times their height. Malar space 0.8–1.0 times height of eye, malar depression shallow, less than one-third length of malar space. Mandibles as in Fig. 28. Labrum 4–6 digitate (Fig. 3). Antenna 10-segmented (rarely 11), weakly to strongly serrate basally (Figs. 21, 22); flagellomeres with dense, short setae and placoid sensilla.

Mesosoma rugose (Figs. 16, 17), with scattered short setae. Mesoscutum 2.0–2.3 times as broad as long dorsally. Propodeum rounded. Proepisternum areolate (Fig. 18) or smooth. Metacoxa lightly striate laterally or glabrous; mesocoxa without lateral carina (Fig. 9). Metafemur only slightly expanded with scattered short setae laterally (Figs. 19, 37); metatibia with fine, dense, appressed setae; metatibial spur present (Fig. 11). Forewing 2.0–2.5 times as long as broad; costal cell 0.4 times as long as wing, with single row of ventral setae; submarginal vein and basal area of wing bare; disc of wing covered by microtrichia ventrally (Fig. 5); wing veins not discernible; stigma oval. Hindwing 3.2–4.5 times as long as broad.

Petiole 1.7–3.0 times as long as broad, 1.4–2.1 times as long as metacoxa; only slightly curved in



FIGS. 21-27. 21-24, Female antenna: 21-22, *P. gibbosa*, different females from same series at Lone Pine, CA; 23, *P. pauca*; 24, *P. sculpturata*; 24, *P. prolata*. 25-27, Male antenna: 25, *P. americana*; 26, *P. gibbosa*; 27, *P. condylus*, arrow shows alternate basal orientation of rami. F1-8, flagellomeres 1-8; pd, pedicel; sc, scape.

profile; finely, longitudinally striate; pinched ventroapically (Fig. 15). Gaster globose, 1.3-1.7 times as long as high; short, fine appressed setae dorsally; first sternite with fine longitudinal striae across base (Fig. 15).

**Male.** Length 2.7-4.0 mm. Colour as in female but usually darker. Antenna 11-segmented (rarely 10 or 12), flagellomeres 1-4 with slightly

flattened rami only slightly decreasing in size from first (Fig. 26). Petiole 3.4-8.0 times as long as wide, 2.1-3.3 times as long as metacoxa. Genitalia as in Figs. 13, 59-67.

**Type material.** Lectotype of *Eucharis gibbosa* Provancher (♀) bears the label 'Provancher no. 623; Lectotype no. 462, 1940' (Burks, 1963) and is presently housed at Laval University campus

in Ste. Foy, Quebec. The lectotype and paralectotype (BRI) [examined] were designated by Gahan & Rohwer (1917). The lectotype is in poor condition (Gahan & Rohwer, 1917; Burks, 1963) and it did not seem necessary to borrow the specimen. The eastern forms of this species differ little in morphology and the paralectotype was not an atypical specimen.

The holotype of *Chalcura californica* Ashmead (♂) is 'type 2139' (USNM) labelled 'Sta. Cruz Mts., Cal., Type'.

The holotype of *Chalcura arizonensis* Crawford (♀) is 'type 16702' (USNM) labelled 'Stone Cabin Cañon, S. Rita Mts., VIII 26-13 Ar., ovipositing in *Thurberia* bud, W. D. Pierce coll.'

**Material examined.** 97♀, 205♂. CANADA. ALBERTA: 2♀, 2♂, McMurray, 28, 29.vii.1953 (*Ball*) (BRI); 1♀, Edmonton, 14.vii.1941 (*Strickland*) (BRI); 1♂, Slave L., 4.viii.1924 (*Bryant*) (CAS); 1♂, Mildred Lake 57° 03'N 111° 35'W, 23-27.vi.1979 (*Hilchie*) Malaise trap (GUE). BRITISH COLUMBIA: 7♀, 9♂, Squamish, Diamond Head Trail, 3200 ft, 1, 4, 5, 13, 15, 23, 26, 28, 31.viii.1953 (*Spencer*) (BRI); 1♀, Diamond Head Trail, Garibaldi Pk., 4000 ft, 28.viii. 1953 (*Spencer*) (BRI); 11♂, Fernie, 12, 25.vii.1934 (*Leech*) on *Salix* leaves (UMS); 1♂, Nanaimo, 25.viii.1949 (BRI); 1♀, 1♂, Victoria, viii.1897 (*Taylor*) (BRI); 1♂, Long Beach, 12.viii.1948 (*Wadell*) (BRI); 8♂, Seton Lake, 5.viii.1933 (*McDunnough*) (BRI); 1♂, Hope, viii.1931 (*Beamer*) (KAN); 1♀, 1♂, Allison Pass, Manning Pk, 7.viii.1959, (*Scudder*) (UCB); 1♀, Manning Park, 27.viii.1961 (*Scudder*) (UCB); 1♀, 2♂, Salmon Arm, 4.viii.1925 (*Dennys*) (BRI); 1♀, Fry Creek, 23.vii.1903 (*Currie*) (USNM). MANITOBA: 1♀, Churchill, 12.viii.1952 (*Chillcott*) (BRI); 1♀, Gillam, 20.vii.1950 (*Brown*) (BRI); 1♀, The Pas, 31.vii.1937 (*Dennings*) (UMS). NEW BRUNSWICK: 2♂, Kouchibouguac N.P., 30.viii.1977 (*Miller*) (BRI). NORTHWEST TERRITORIES: 1♂, Yellowknife, 10.viii.1949 (*Ball*) (BRI); 3♀, 2♂, Yellowknife, 16.viii.1949 (*Cashman*) (BRI). ONTARIO: 1♀, Hamilton, 14-22.vii.1982 (*Sanborne*) (GUE); 1♀, Dundas, 22.vii.1975 (*Umphrey*) (GUE); 1♀, 20 mi N Red Lake Rd, 11.viii.1960, (*Kelton & Whitney*) (BRI); 1♂, Elfrida, 21.vii.1955 (*Kelton*) (BRI); 1♂, Bergland, 3.viii.1960 (*Clarke*) (BRI); 1♂, One Sided Lake, 26.vii.1960 (*Kelton & Whitney*)

(BRI); 1♂, Jordan, 25.vii.1919 (*Ross*) (BRI); 3♂, Aylmer, 10, 16.viii.1926 (*R.P.*) (BRI); 3♂, Tillsonburg, 20.vii.1955 (*Kelton*) (BRI); 1♂, Dorset, 21.viii.1977 (*Wallis*) (GUE). QUEBEC: 1♀, Forestville, 9.viii.1950 (*deRuelle*) (BRI); 2♂, Cascapedia, 16.viii.1933 (*Brown*) (BRI); 1♂, Laniel, 8-9.viii.1963, (*Kelton*) (BRI). SASKATCHEWAN: 2♂, Harlan, 11.viii.1940 (*Brooks*) (BRI); 1♀, Saskatoon, 9.vii.1957 (*Brooks*) (BRI). YUKON: 1♀, 3♂, Snag, 25.vii.1948 (*Mason & Hughes*) (BRI). U.S.A.: ALASKA: 1♀, Shaw Crk., mi 289 Rich Hwy, 11.vii.1951 (*Mason & McGillis*) (BRI). ARIZONA: 1♀, Molino Basin, 22 mi NE Tucson, Pima Co., 14.vii.1961 (*Eickwort*) (MISS); 1♂, Portal, 2-3.viii.1977 (*Masner*) (BRI); 1♂, Herb Martyr Lake nr Portal, 14.ix.1978 (*Gordh*) (RIV); 1♀, Oak Cr. Cyn., Coconino Co., 26.vii.1966 (*Westcott*) (IDA). CALIFORNIA: 2♀, Yosemite N.P., Nevada Falls, 5907 ft, 29.vi.1946 (*Chandler*) (CAS); 1♀, Soda Spr., Tuolumne Meadows, Yos. Nat'l Park, 26-27.vi.1939 (*Usinger*) (UCB); 8♀, 32♂, Lone Pine Cr., 4000 ft, Inyo Co., 30.viii.1969 (*Grissell*) (UCD); 4♀, 13♂, Inyo Co., Glacier Camp 8000 ft nr Big Pine, 10.v.1957 (*Martin*) (ORE); 6♂, Blodgett Forest, El Dorado Co., 10.viii.1979, ex sticky trap on *Pinus* with scolytids and *Camponotus laevigatus* (GUE); 1♂, Lake Tahoe, 28.viii.1947 (*Hagen*) (UCB); 1♂, Topaz Lake, Mono Co., 17.viii.1960 (*Menke*) (UCD); 2♂, Kings R. Canyon, Fresno Co., 4.vii.1910 (*Van Dyke*) (CAS); 1♀, So. Fork, Kings R., 8.vii.1910 (*Van Dyke*) (CAS); 1♂, Sugar Pine, Tuolumne Co., 21.vii.1973 (*Silvera*) maple (USNM); 1♂, Mt Hermon, Santa Cruz Co., 19.vii.1922 (*Blaisdell*) (CAS); 1♀, Berkeley, 12.vii.1935 (UCD); 1♀, Strawberry Valley, El Dorado Co., 5.viii.1912 (*Van Dyke*) (CAS); 1♂, Fallen Leaf Lake, El Dorado Co., vii.1931 (*Sweezy*) (CAS); 3♀, Sequoia N.P., 6.viii.1935 (*DeLeon*) *Pinus jeffryi* (USNM); 1♀, Sagehen nr Hobart Mills, 3.viii.1962 (*Toschi*) (UCB); 1♂, San Bernardino, 2 mi NW Running Springs, 5000 ft, 20.vii.1974 (*Griswold & Greeze*?) (UCB); 3♂, Modoc N.F., 27.vii.1938 (*Salman*) *Pinus ponderosa* (USNM); 1♂, Big Pine Flat Campground, San Bernardino Co., 13-14.viii.1955 (*Menke Jr.*) (LACM); 1♂, Fawnskin, San Bernardino Co., 29.vii.1961 (*Eickwort*) (MISS); 1♀, Fawnskin, San Bernardino Co., 29.vii.1975 (*Johnson*) (IDA); 2♂,

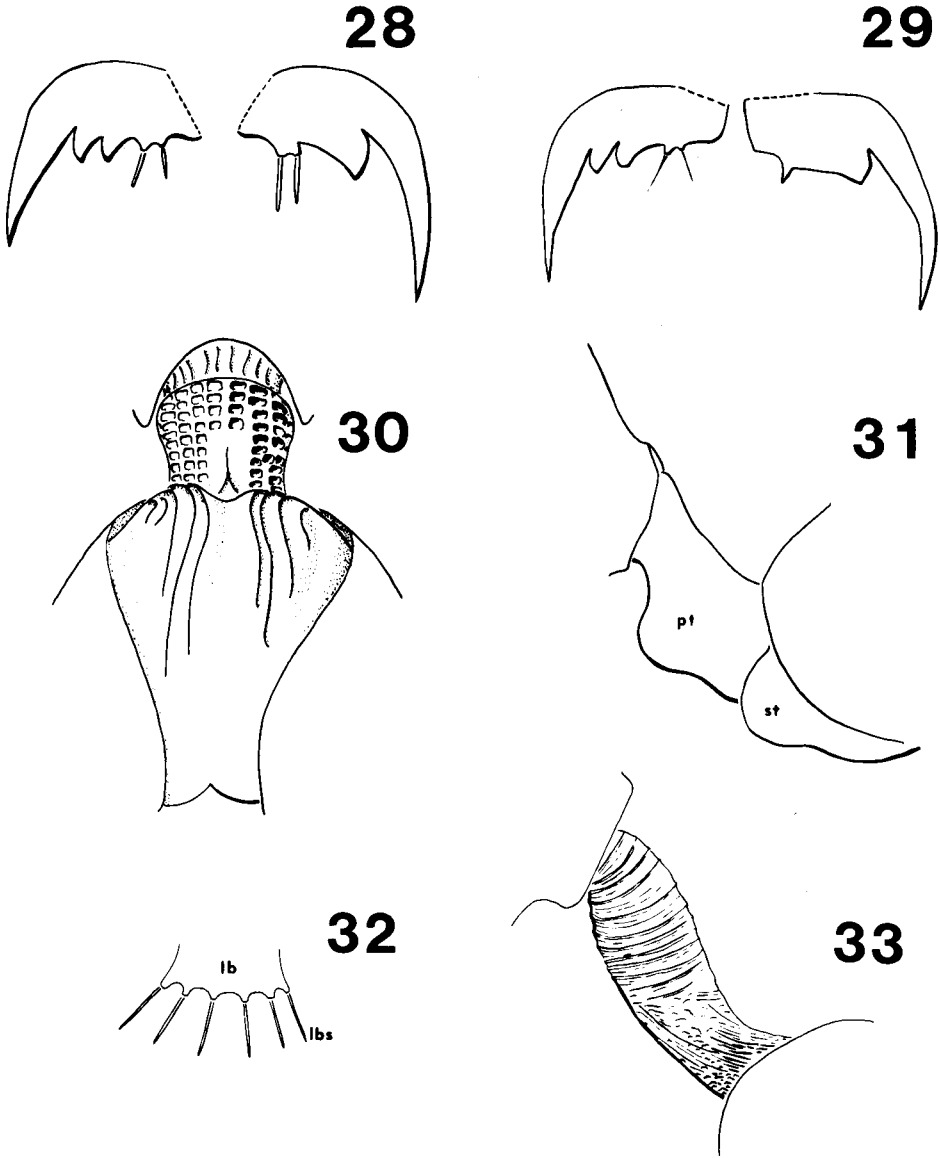
Napa Co., 5.5 km NW Moskowite Corner, Capell Creek, 200m, 3.ix.1977 (*Arnaud Jr*) (CAS); 1♂, Strawberry, 23.viii.1962 (*Bedard*) flight trap (USNM); 2♂, Tuolumne Co., Strawberry, 16.viii.1979 (*Johnson*) on *Salix* (IDA); 1♂, Tom's Place, Mono Co., 13.viii.1975 (*Johnson*) (IDA); 1♀, 1♂, Mono Co., Tom's Place, 1 mi SW, 13.viii.1963 (*Tauber & Toschi*) (UCB); 2♂, Richardson's Grove, 7 mi S Garberville, Humboldt Co., 16.vii.1977 (*Johnson*) (IDA); 1♀, 2♂, Bullard's Bar, Yuba Co., 27.viii.1975 (*Johnson*) ex *Camponotus* (IDA); 10♂, Leavitt Mdw., Mono Co., 11.viii.1960 (*Toschi*) (UCB); 1♀, 1♂, Leavitt Mdw., Mono Co., 7.viii.1975 (*Johnson*) (IDA); 1♀, Waterwheel Falls, Yos. Nat'l Park, 28.vii.1939 (*Usinger*) (UCB); 1♀, Dobbins, 22.ix.1954[?], ovip. in *Arbutus* bud (UCB). COLORADO: 3♀, 4♂, Science Lodge (USNM); ♂ Nederland, Science Lodge, 9500ft, 29.vii.1961 (*Stainer*) (BRI); 3♂, Boulder, 24.viii.1938, Hopk., *Pinus ponderosa* (USNM); ♀ 'Colo' 1214 (*Baker*) (USNM). IDAHO: 1♂, Fish Creek Pass, Bannock Co., 31.vii.1972 (*Ulrich*) (IDA); 1♂, Moscow (*Piper*) (WAS); 1♀, Grizzly Mtn, Cuern'd Al, 6000 ft, 7.viii.1932 (*Terrell*) flight trap. MICHIGAN: 1♀, Cheboygan Co., 29.vii.1938 (*Kenaga*) (MISS); 1♀, Iosco Co., 27.vii.1957 (*Driesback*) (USNM); 3♀, Marquette, 30-31.vii (USNM); 1♀, Dickinson Co., 6.ix.1967 (*Baker*) sandy beach (IDA); 17♂, Iron Co., 12.viii.1953 (*Dreisback*) (MISS); 1♀, Porcupine Mtns, 12.viii.1904, in ♀ cocoon of *Camponotus novaboracensis* Fitch [W. M. Wheeler] (USNM); 1♂, Emmet Co., 23.vii.1935 (*Sanderson*) (KAN); 1♀, Schoolcraft Co., 18.vi.1955 (*Dreisback*) (USNM); 1♂, Iron Co., 12.viii.1972 (*Johnson*) (IDA). MINNESOTA: 1♂, Laporte, 8.viii.1932 (*Denning*) (UMS); 2♂, Park Rapids, 29.viii.1938 (*Tuthill*) (IOW). MISSISSIPPI: 1♀, Oktibbeha Co., Starkville, 20.viii.1975 (*Cross*) black light trap nr edge of deciduous woods (MISS). MISSOURI[?]: 2♂, 'c. MO', July on oak (USNM) [questionable data, not included on distribution map]. MONTANA: 1♀, Aitkin Co. 7.viii.1973 (*Rau*) (UMS); 1♀, 89 mi W Anaconda, Deer Lodge Co., 25.vii.1956 (*Froeschner*) (MON); 1♀, Thompson Falls 2458 ft, 13.viii.1926 (*Haegle*) (USNM). NEVADA: 1♀, Eastgate, 1 mi W Churchill Co., 11.viii.1958 (*Linsley*) honeydew on *Chrysothamnus* (UCB). NEW

HAMPSHIRE: 3♀, 2♂, Hanover, Cooper collection (USNM). NEW MEXICO: 5♀, Las Vegas, 6, 9.viii (*Barber & Schwarz*) (USNM); 2♀, 2♂, Wootton, Ruido Crk, 10.vii, 6600 gr[?], on *Rhus glabra* (USNM); 2♀, Beulah, 19.vii (*Cockerell*) (USNM). OREGON: 1♀, 1♂, Saddleback Mt, Lincoln Co., 6.viii.1960 (*Dirks-Edmunds*) (USNM). OKLAHOMA: 1♂, Norman, 1927 (*Brown*) (USNM). TEXAS: 1♀, 1♂, Austin, x.1969 (*Doby*) in house (USNM); 1♀, Trans Mtn Rd, El Paso, 6.ix.1972 (*Grissell*) (UCD); 1♂, 'Texas' (USNM); 1♂, Davis Mts, 2.viii.1937 (*Knull*) (USNM); 2♂, Edinburg, iii-v.1934 (*Mulaik*) (UMS). WASHINGTON: 1♂, Summit Lk., 16.viii.1931 (*Wilcox*) (ORE); 2♂ Stewart[?] Isl., vi[?] (USNM); 1♀, Chelan Co., Malaga, 7.viii.1970, Colochum Research Unit (WAS). WISCONSIN: 4♀, 3♂, Squaw Lake, Vilas Co., 19.viii.1954 (*Lafoon*) collected in tamarack bog (IOW); 3♂, Brule, 16.viii.1939 (*Beamer*) (KAN). UTAH: 1♀, Emery, 16.viii.1929 (*Beamer*) (KAN); 1♀, Bear Lk., Rich Co., 5.ix.1974 (*Johnson*) (IDA).

**Biology.** *Pseudochalcura gibbosa* has been associated with a number of plant hosts, but only two records exist for an oviposition: an *Arbutus* (Ericaceae) bud in California, and *Gossypium hirsutum* (= *Thurberia thespisoides*) (Malvaceae) in Arizona (Pierce & Morrill, 1914). Another record on *Rhus glabra* (Anacardiaceae) in New Mexico, although probably an error in identification (only *Rhus copallina* L. extends as far west as Texas (Gleason & Cronquist, 1963)), points to oviposition on a plant with flowers in a dense panicle, as in *Arbutus menziesii* Pursh. The other plant records indicate diverse associations, with a tamarack bog in Wisconsin, *Chrysothamnus* (Compositae) in Nevada, and at least two species of *Pinus*, a species of *Salix* and a maple in California. The specimens collected at Inyo Co., 4000 ft in California were collected from a scrub bush on the banks of a drywash (Dr E. E. Grissell, pers. comm.).

*Pseudochalcura gibbosa* is the only species of the genus which has been reared from an ant host. W. M. Wheeler was the first to rear this species from *Camponotus novaboracensis* Fitch (Wheeler, 1910). Two other rearing records from California were from *Camponotus laevigatus* (F. Smith) at two locations and *Camponotus* (*Taenaemyrmex*) poss. *vicinus* Mayr from another.

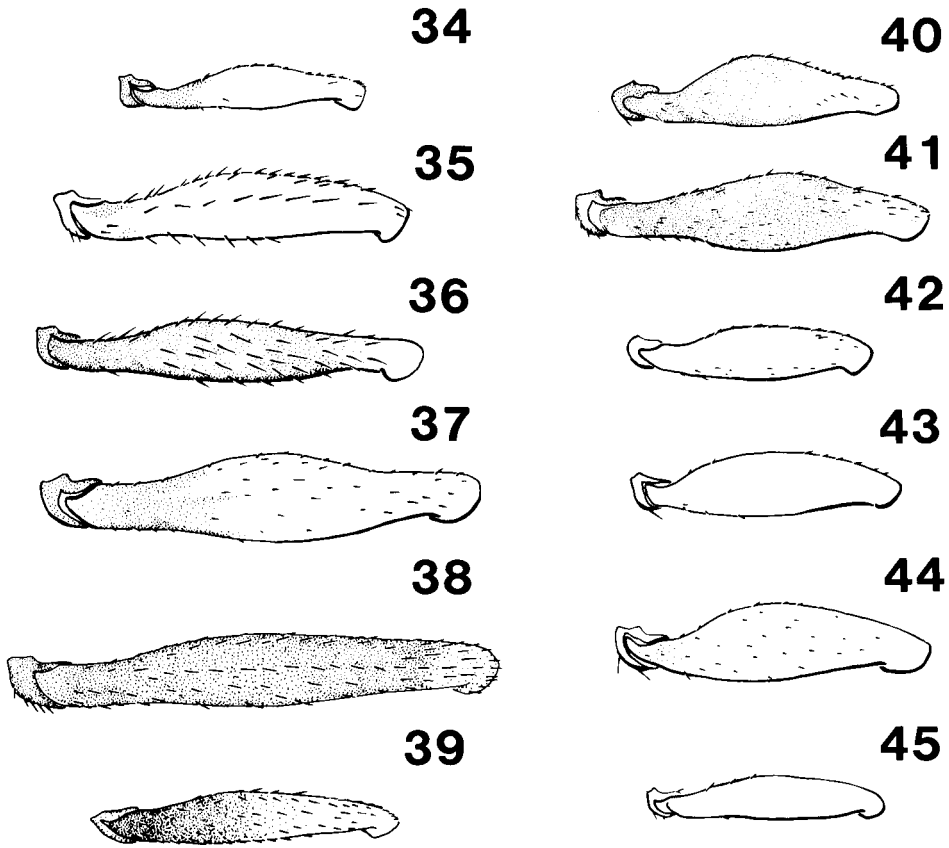




FIGS. 28–33. 28, *P. gibbosa*, mandibles; 29, *P. sp. stat. uncert.*, mandibles. 30–31, *P. condylus*, ♀, petiole and first sternite: 30, ventral view; 31, lateral view of petiole. 32, *P. nigrocyanea*, labrum. 33, *P. sp. stat. uncert.*, lateral view of petiole. lb, labrum; lbs, labral setae; pt, petiole; st, sternite.

*Discussion.* *Pseudochalcura* is widespread in North America (Fig. 69). There is a classical Boreal element which reaches from New Brunswick to Alaska with well-defined southern limits in Wisconsin, Michigan and Ontario. The southern Ontario distribution represents a more southern extension of the Boreal region than is usually suggested (see Scudder, 1979). The western distribution, although seemingly dis-

junct, fits a Rocky Mountain element which extends from British Columbia down through California in the west, and Utah, Colorado and New Mexico in the east. The Rocky Mountain distribution is basically a mixture of the Cordilleran and Central Californian forests as proposed by Gleason and Cronquist (in Scudder, 1979). The Boreal and Rocky Mountain collection localities are consistent with the distribution



FIGS. 34–45. Metafemora, lateral view: 34, *P.americana*, ♀; 35, *P.liburna*, ♀; 36, *P.nigrocyanea*, ♀; 37, *P.gibbosa*, ♀; 38, *P.atra*, ♀; 39, *P.septuosa*, ♀; 40, *P.pauca*, ♀; 41, *P.chilensis*, ♀; 42, *P.sculpturata*, ♀; 43, *P.condylus*, ♀; 44, *P.prolata*, ♀; 45, *P. sp. stat. uncert.*, ♂.

of coniferous forests as figured by Kuechler (1965)

Two other less well defined distributions occur to the south. A 'Sonoran' element is formed by the collection localities of Arizona, Texas and southern California (Fig. 69). The Arizona and at least the western Texas locality could be extensions of the Rocky Mountain element and the Californian might be more closely associated with the northern records from the Cascades. The Arizona localities are coincident with isolated patches of coniferous forests (Kuechler, 1965), with the collection locality at Herb Martyr Lake at Portal being a mixture of pine and scrub oak (transition forest or Pinon-Juniper zone) at about a 5000 ft elevation. It is difficult to associate the southern Texas locality (Edinburg, most southern locality, Fig. 69) with the Rocky Mountain element. However,

Weaver and Clements do show an extension of montane and subalpine forest which passes through New Mexico and western Texas as far south as Edinburg (Scudder, 1979). The three remaining localities in central Texas, Arkansas and Mississippi can be considered as part of either a Central Grassland or Eastern Deciduous Forest zone. These localities may be coincident with isolated patches of coniferous forest. The collection sites from three of the Texas localities (excluding Edinburg) and the southern Californian records can be associated with Pinon-Juniper zone forests which are evident throughout the Rocky Mountains (National Atlas, 1970). The Arkansas and Mississippi localities can be associated with oak-hickory and oak-pine forest zones, respectively (National Atlas, 1970).

All of the specimens of Nearctic *Pseudochalcura* were originally examined under the

hypothesis that three species existed (*P.gibbosa*, *P.californica* and *P.arizonensis*) which are representatives of the Boreal, Rocky Mountain and Sonoran zones. In searching for characters to separate the three groups it was found that a high degree of variability existed for a number of character states. The shape of the basal flagellomeres (Figs. 21, 22) and petiole, presence or absence of infusate wings, or the type and degree of sculpture on the face and mesosoma were variable both within and among series. Dissections of male genitalia from several series were not helpful because of variability in the number of teeth on the digitus and setae on the paramere (Figs. 60–67). As with other characters assessed, the shape of the parameres, median process and overall shape of the male genitalia were uniform and could be used to distinguish *P.gibbosa* from *P.americana* (Fig. 68), but not series from each other. Variation was high enough in all of the characters observed that there was no consistent continuous or discrete measure which would isolate individuals from one geographical area or another.

There are some morphological trends which seemed to separate some geographical populations. There is a higher proportion of individuals in the Rocky Mountain region with infusate wings and longer serrations of the basal flagellomeres of females. The female petioles also appear to be longer and the metafemur less infusate in the Sonoran region. These character states along with others are not consistent within series or locations and if a certain character state is present in a higher proportion in one region, it will likely be present in a lower proportion in another. Further evidence (albeit weak) to justify a separation of species lies with the isolated rearings from *Camponotus novaboracensis* in Michigan (Boreal) and *Camponotus laevigatus* in California (Rocky Mountain).

A study of the variation in 146 individuals from nineteen geographical locations in North America was undertaken in Heraty (1984). It was considered that the variability of characters would be less obvious if a large number of character states were considered together and that more subtle and stable differences could be extracted from a numerical analysis of a large data set from series collected over the Nearctic range of *Pseudochalcura*. An analysis of twenty-two continuous (measured) and seven discrete (qualified) characters using cluster analysis

(UPGMA) failed to yield any distinct grouping which could be indicative of any geographical (and hence possible species) grouping. The conclusion based on the analysis was that there existed only a single wide-ranging species, *P.gibbosa*.

The Boreal distribution of *P.gibbosa* is almost identical with that of *Camponotus novaboracensis* which extends into the Rocky Mountains as far south as Oregon (Wheeler, 1910). This shows an absence of at least an effective host barrier between the Boreal and Rocky Mountain elements. *C.novaboracensis* is replaced by *C.laevigatus* which occupies the same habitat from Washington into California in the west and Colorado, Utah, New Mexico and Arizona to the east (Wheeler, 1910). These two species have essentially the same distribution as the North American *Pseudochalcura* (excluding Florida). *Camponotus (Tanaemyrmex) poss. vicinus* Mayr has also been found to be a host in California. The probable restrictions placed on the distribution of *Pseudochalcura* are related to climate as indicated by the coincident distribution with coniferous forests and not the ant host. The trends in morphological differences which can be found between the Boreal, Rocky Mountain and Sonoran regions could be indicative of environmental effects or possibly slight differences induced by different host ants.

### *Pseudochalcura septuosa* sp.n. (Figs. 39, 52)

This species is difficult to distinguish from *P.gibbosa*. The antenna is 11-segmented but the fusion of the inner side of the apical two segments could be more complete and the number reduced to ten. The sensilla of the flagellum are comprised of much denser placodea and fewer short setae than compared to *P.gibbosa*. The broad mesoscutum, narrower forewings and long petiole, not ventroapically pinched, can also be used to distinguish this species from *P.gibbosa*.

Female. Length 4.5 mm. Body black; coxae and basal half of femora brown; scape, pedicel, apex of antenna and rest of legs testaceous. Wings hyaline; stigma clear.

Head 1.6 times as broad as high. POL 2.8 times LOL, POL 2.8 times OOL. Frons and face including clypeus and supraclypeal area finely costate, with scattered short setae; margins of

clypeus and supraclypeal area foveate laterally; genal bridge emarginate (Fig. 52). Eyes separated by 2.1 times their height. Malar space 0.9 times height of eye; malar depression prominent, half as long as malar space. Labrum 4-digitate. Antenna 11-segmented; apical 2 segments fused on inner side; serrate basally; flagellomeres with dense placoid sensilla and few setae.

Mesosoma with shallow areolate-rugose sculpture, interstices small; scattered, short setae over dorsum. Mesoscutum 1.7 times as broad as long dorsally. Propodeum rounded. Femoral groove shallow. Proepisternum rugulose basally, smooth apically. Metacoxa glabrous; mesocoxa without lateral carina. Legs slender; metafemur only slightly expanded, with sparse, short lateral setae (Fig. 39); metatibia with dense, appressed setae; metatibial spur present. Forewing 2.7 times as long as broad; costal cell 0.4 times as long as wing, with single row of ventral setae; submarginal vein and basal area of wing bare; disc of wing with microsetae ventrally; wing veins not discernible; stigma round. Hindwing 3.9 times as long as broad.

Petiole 3.3 times as long as broad, 1.6 times as long as metacoxa; only slightly curved in profile; longitudinally aciculate. Gaster globose, 1.7 times as long as high; few short setae dorsally; first sternite finely striate.

*Holotype*. 1♀, 10 km E Chilpancingo, Gro., MEX [MEXICO], 5200 ft, 30.vii.62, H. E. Evans collector. Deposited in MCZ.

### *Pseudochalcura atra* sp.n. (Figs. 38, 51)

The noticeably black coloration, distinctly 11-segmented antenna and long scape separates this species from *P.gibbosa* and *P.septuosa*. All three species share the complete absence of a mesocoxal carina.

*Female*. Length 4.5 mm. Black; tibiae, tarsi, apex of antenna, and apical half of femora, brown. Wings hyaline, stigma clear.

Head 1.7 times as broad as high. POL 3.0 times LOL, POL 2.3 times OOL. Frons and face including clypeus and supraclypeal area finely costate, with scattered short setae; genal bridge emarginate (Fig. 51). Eyes separated by 1.9 times their height. Malar space 0.8 times height of eye; malar depression prominent, slightly less than half of malar space. Labrum 5-digitate. Antenna 11-segmented; scape long, 4.0 times as

long as wide, not reaching median ocellus; strongly serrate basally; flagellomeres with dense, short setae, without placoid sensilla.

Mesosoma with shallow areolate-rugose sculpture dorsally, interstices small; vaguely longitudinally reticulate laterally; sparse, short, fine setae dorsally. Mesoscutum 2.0 times as broad as long dorsally. Propodeum slightly rounded, callus pronounced. Proepisternum rugose. Metacoxa smooth with erect setae dorsolaterally; mesocoxa without lateral carina. Legs slender; metafemur only slightly expanded, with short, appressed lateral setae (Fig. 38); metatibia with dense, appressed setae, denser ventrally than dorsally; metatibial spur present. Forewing 2.6 times as long as broad; costal cell 0.4 times as long as wing, with single row of short ventral setae; submarginal vein and basal area of wing bare; disc of wing with microsetae ventrally; wing veins not discernible, stigma round. Hindwing 3.8 times longer than broad.

Petiole 2.6 times as long as broad, 1.8 times as long as metacoxa; not curved in profile; longitudinally finely striate. Gaster globose, 2.1 times as long as high; first tergite with scattered very short appressed setae dorsally; first sternite finely striate.

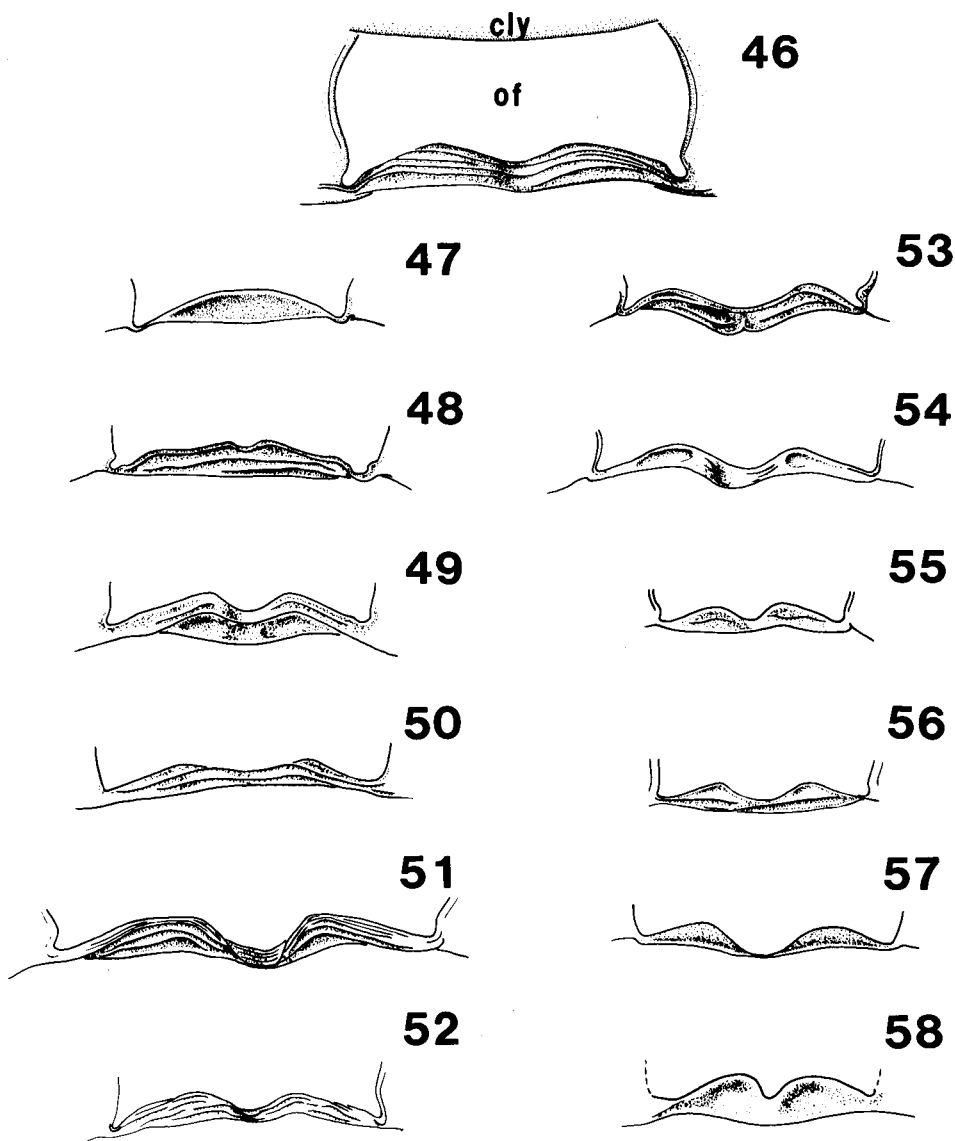
*Holotype*. 1♀, MEX [MEXICO]; Baja Cal. sur [California south], Cabo Falso, 7 km W Cabo San Lucas, 1.i.79. Deposited in USNM, courtesy of IDA.

### *Pseudochalcura pauca* sp.n. (Figs. 23, 40, 53)

The subtriangular head, slightly rounded propodeum and several other features appear to ally this species more with the *gibbosa*-group and *P.chilensis* than any other species. This distinctive species retains the plesiomorphic character state of the mesocoxal carina, has the derived loss of costal cell setae which are both found in *P.chilensis*, and also the apomorphic character states of a reduced number of antennal segments and punctate base of the first sternite.

*Female*. Length 3.0 mm. Black; basal half of legs brown; antenna and rest of legs testaceous. Wings hyaline, stigma clear.

Head 1.5 times as broad as high. POL 2.6 times LOL, POL 2.6 times OOL. Frons and face including clypeus and supraclypeal area finely costate, with short fine setae; genal bridge emarginate (Fig. 53). Eyes separated by 2.1

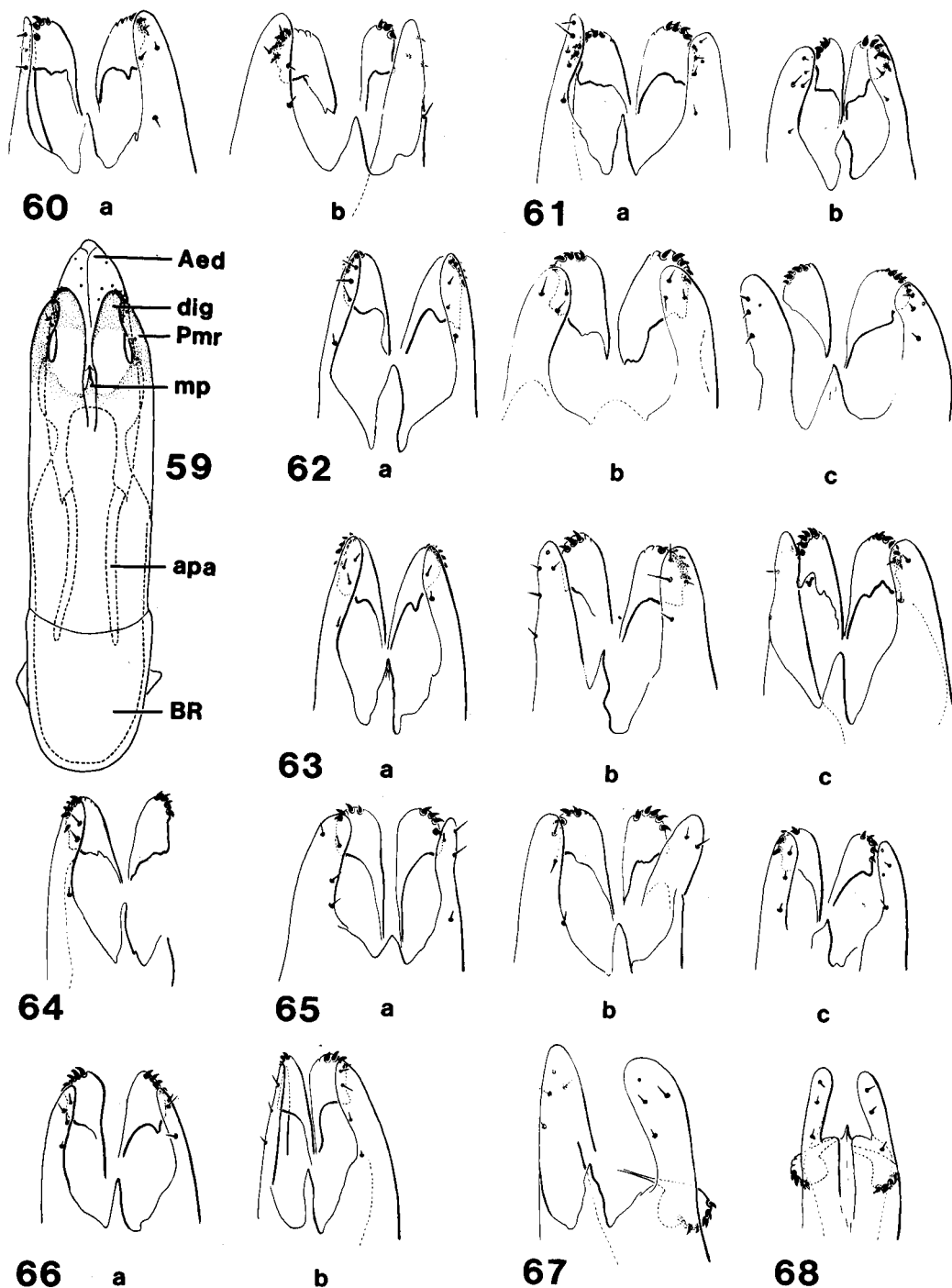


FIGS. 46–58. Genal bridges, ventral view: 46, *P. gibbosa*, ♀; 47–48, *P. americana*: 47, ♀, 48, ♂; 49, *P. liburna*, ♀; 50, *P. nigrocyanea*, ♀; 51, *P. atra*, ♀; 52, *P. septuosa*, ♀; 53, *P. pauca*, ♀; 54, *P. chilensis*, ♀; 55, *P. sculpturata*, ♀; 56, *P. condylus*, ♀; 57, *P. prolata*, ♀; 58, *P. sp. stat. uncert.*, ♂. cly, clypeus; of, oral fossa.

times their height. Malar space 1.0 times height of eye, malar depression absent. Antenna 8-segmented; basal flagellomeres strongly serrate, apex of serrate segments with a long apical seta (Fig. 23); flagellomeres with dense, short setae in scalloped depressions.

Mesosoma rugose, bare except for sparse short setae on mesoscutum. Mesoscutum 2.2 times as broad as long. Propodeum slightly rounded. Femoral groove deeply impressed.

Proepisternum areolate. Metacoxa glabrous; mesocoxa with lateral carina. Legs stout; metafemur expanded medially, with short appressed setae laterally (Fig. 40); metatibia with sparse semi-erect setae dorsally and dense, appressed setae ventrally; metatibial spur present. Forewing 2.4 times as long as broad; costal cell 0.4 times as long as wing, without setae; submarginal vein and basal area of wing bare; disc of wing with microsetae ventrally; wing



FIGS. 59-68. Male genitalia, ventral: 59-67, *P. gibbosa*: 59, male genitalia; 60-67, apex of genitalic capsule: 60a-b, Big Pine, Inyo Co., CA; 61a-b, Blodgett Forest, CA; 62a-c, Lone Pine, Inyo Co., CA; 63a-c, Squamish, B.C.; 64, Snag, Yukon; 65a-c, Iron Co., MI; 66a, Aylmer, Ont. b, Dorset, Ont.; 67, Edinburg, TX. 68, *P. americana*, Ecuador. Aed, aedeagus; apa, apodeme of aedeagus; BR, basal ring; dig, digitus; mp, median process of basiparamere; Pmr, paramere.

veins not discernible, stigma round. Hindwing 3.2 times as long as broad.

Petiole 2.0 times as long as broad, 1.5 times length of metacoxa; curved in profile; dense micropunctate. Gaster globose, 1.7 times as long as high; with few short setae dorsally; first gastral sternite dense micropunctate basally.

*Holotype*. 1♀, 5 mi N of Dean Funes, Cordoba, Arg. [ARGENTINA], 8.ii.51, Ross & Michelbachen collectors. Deposited in CAS.

***Pseudochalcura chilensis* Kieffer** (Figs. 41, 54)

*Pseudochalcura chilensis* Kieffer, 1905: 242.

This is the only species of *Pseudochalcura* collected from Chile. It is similar in morphology to *P. gibbosa* but has a distinct lateral carina of the mesocoxa and the costal cell setae are lacking.

*Female*. Length 3.0–3.5 mm. Body dark brown to mostly black; femora brown; tibiae, tarsi, apical flagellomeres, and extreme apex of femora testaceous. Wings infusate or hyaline, stigma clear.

Head 1.6–1.7 times as broad as high. POL 2.6–2.7 times LOL, POL 2.2–2.3 times OOL. Frons and face including clypeus and supra-clypeal area strongly costate, face with scattered short setae; genal bridge emarginate (Fig. 54). Eyes separated by 2.3–2.5 times their height. Malar space 1.0 times height of eye; malar depression shallow, equal to one-third of malar space. Antenna 10-segmented, strongly serrate basally to lobate or moniliform distally; flagellomeres with fine setae and dense placoid sensilla.

Mesosoma with shallow rugose sculpture; sparse, short setae dorsally. Mesoscutum 2.2–2.4 times as broad as long dorsally. Propodeum weakly rounded. Femoral groove deeply impressed. Proepisternum areolate. Metacoxa glabrous; mesocoxa with lateral carina. Legs robust; metafemur expanded medially, with short setae laterally (Fig. 41); metatibia with fine, appressed setae, denser ventrally than dorsally; metatibial spur present. Forewing 2.3 times as long as broad; costal cell 0.4 times as long as wing, without setae; submarginal vein and basal area of wing bare; disc of wing with microsetae ventrally; wing veins not discernible; stigma round to elongate. Hindwing 3.4–4.2 times as long as broad.

Petiole 2.3–2.8 times as long as broad, 1.4–1.8 times longer than metacoxa; not or only slightly curved in profile; longitudinally aciculate or striate. Gaster globose, 1.5–1.6 times as long as high; first tergite with fine appressed setae dorsally; first sternite dense striate.

*Male*. Length 3.3–3.5 mm. Colour as in female but darker; fore and mesotibia brown. Antenna 11-segmented, flagellomeres 1–4 with slightly flattened rami. Petiole 6.0 times as long as wide, lightly aciculate.

*Type material*. A male specimen on loan to Z. Bouček from the PMU is closest morphologically to the type description but does not have a data label referring to 'Chile (Pablo Herbst)' as cited in the original description; no paratype material was recorded by Kieffer. However, Kieffer did not necessarily give either the exact label information, or the number of specimens examined. This specimen which is housed at PMU along with the holotypes of other species described in the same publication, (Z. Bouček, pers. comm.) should be regarded as a syntype. This male, labelled 'Chili [CHILE], fôrets, 1863, O. Sichel (1867)' with a handwritten pink label '*Pseudochalcura chilensis* Kieff.' is hereby designated as lectotype.

*Material examined*. 6♀, 2♂. CHILE: 1♀, Concepc 1904 (*Herbst*) (MCZ); 1♀, Las Cabas, Ñuble, 10–23.xii.1954 (*Peña*) (BRI); 1♀, Tre-gualemu, Maule-Ñuble, 7.x.ii.1955[?] (*Peña*) (BRI); 3♀, El Canelo, Santiago, 26.xi.1954 (*Peña*) (BRI); 1♂, Chovellén, Maule, 5.xii.1955[?] (*Peña*) (BRI); 1♂, Malleco, Curacutin, Rio Blanco, i.1974 (*Peña*) (AMNH).

***Pseudochalcura prolata* sp.n.** (Figs. 24, 44, 57)

This species is closest to *P. sculpturata* and *P. condylus*. The long basal flagellar segments and dorsally shagreened petiole are diagnostic features of the females.

*Females*. Length 3.3–3.5 mm. Body black; antenna yellow to testaceous; legs testaceous, femora completely testaceous to entirely dark brown, petiole testaceous to dark brown. Wings hyaline, stigma white.

Head 1.7–1.8 times as broad as high. POL 2.6–2.7 times LOL, POL 3.6–4.1 times OOL. Frons and face finely costate, costae more prominent lateral to scrobe; clypeus and supra-clypeal area smooth, lateral margins foveate or

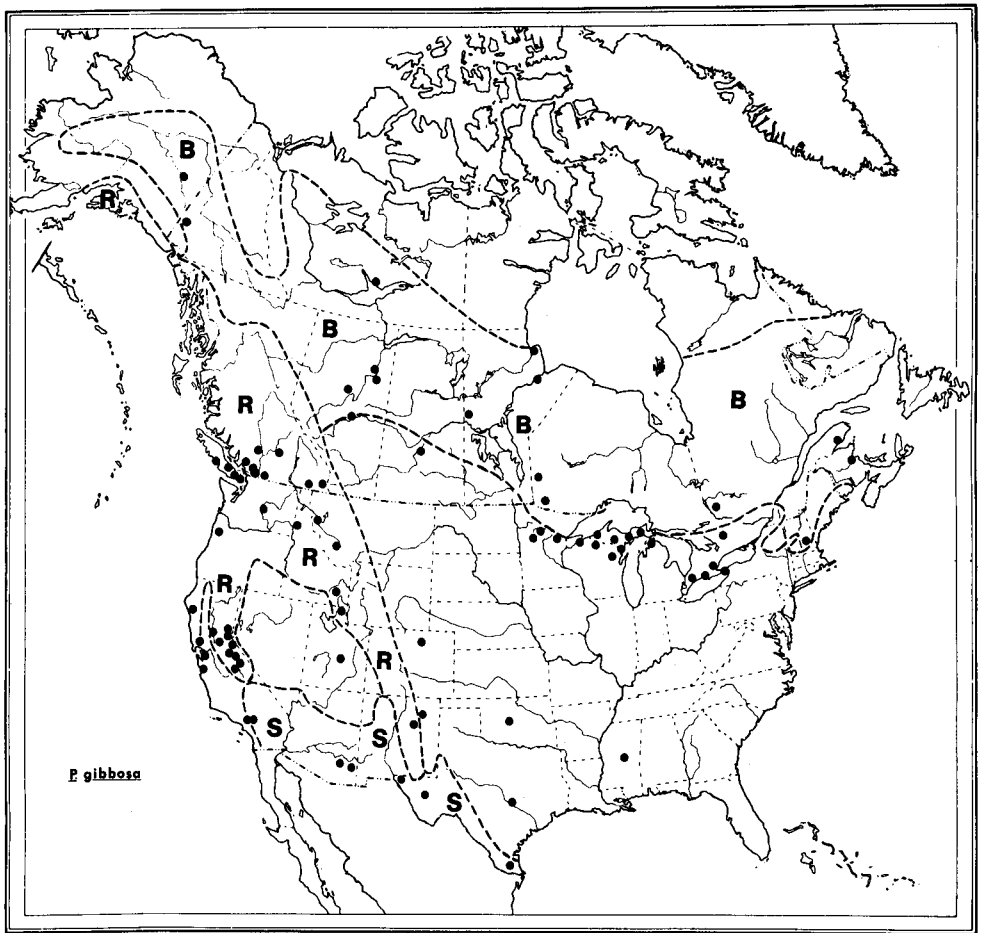


FIG. 69. Distribution of *P. gibbosa*. B=Boreal, R=Rocky Mountain, S=Sonoran (according to Gleason and Cronquist, in Scudder, 1979).

smooth; face with scattered short setae; genal bridge emarginate (Fig. 57). Eyes separated by 1.8–1.9 times their height. Malar space 0.6–0.7 times height of eye, malar depression absent. Antenna 8–11-segmented, basal 5–7 flagellomeres ramose, rami slightly staggered in origin from base (Fig. 24); flagellomeres with dense placoid sensilla in scalloped depressions. Mesosoma globose with shallow areolate-rugose sculpture, at least sidelobes finely shagreened; mesosoma bare except few long hairs on callus. Mesoscutum 2.1–2.4 times as broad as long dorsally. Disc of propodeum flat; sculpture areolate dorsally, reduced to several vertical striae ventrally, not shagreened. Femoral groove deeply impressed. Proepisternum smooth. Metacoxa globular, lightly striate laterally, bare; mesocoxa without lateral carina. Legs slender;

metafemur slightly expanded, not bulging, bare laterally (Fig. 44); metatibia with short appressed setae, sparse dorsally and dense ventrally; metatibial spur absent. Forewing 2.2–2.3 times as long as broad, costal cell 0.3–0.4 times as long as wing, without setae; submarginal vein and basal area of wing bare; disc of wing with microsetae ventrally; wing veins not discernible; stigma elongate, several times as long as broad. Hindwing 3.1–4.0 times as long as broad.

Petiole 1.6–1.8 times as long as broad, 1.0–1.5 times as long as metacoxa; only slightly curved in profile; shagreened. First tergite of gaster with long appressed setae; first sternite longitudinally striate with a broad raised central keel.

*Holotype*. ♀, ARGENTINA, Resistance[?] CHACO, M. J. Viana coec., 38421, 2D. Deposited in ARG.



**Paratypes.** ARGENTINA: 1♀, Prov. Rs. As., Bahía San Blas (*Daguerre*) NM.35594 (ARG). URUGUAY: 1♀, SM. Amer. Paras. Lab., Montevideo, 7.iii.1941 (*Silveira*) (USNM).

***Pseudochalcura condylus* sp.n.** (Figs. 4, 12, 27, 30, 31, 43, 56)

This species is closest to *P. sculpturata* from which it differs most strongly in the ventral expansion of the petiole, female antenna lobate to serrate and male antenna with only six basal rami.

**Female.** Length 2.6 mm. Dark brown to black with coppery reflections dorsally; antenna and legs light testaceous. Wings hyaline, stigma white.

Head strongly transverse, 1.8–1.9 times as broad as high (Fig. 4). POL 2.6–2.8 times LOL, POL 4.3–4.9 times OOL. Frons and face costate above and around toruli; scattered, fine-punctate below level of toruli; clypeus smooth, foveate laterally; face with scattered short setae; genal bridge broadly emarginate (Fig. 56). Eyes separated by 2.2–2.3 times their height. Malar space 0.9–1.1 times height of eye, malar depression absent. Labrum 4–6-digitate. Antenna 9-segmented, apical segment large, invaginated ventrally along fusion line of what would be segments 9 and 10; scape short, less than half distance between toruli and median ocellus; basal segments lobate to weakly serrate; flagellomeres with dense setae and few placoid sensilla basally.

Mesosoma globose; shallow areolate-rugose, interstices small, deeper sculpture on scutellum; bare, callus with only few short hairs. Mesoscutum 2.1 times as broad as long dorsally. Disc of propodeum flat, areolate sculpture very shallow. Femoral groove deeply impressed. Propisternum lightly sculptured. Metacoxae finely striate laterally, expanded dorsobasally; mesocoxa with weak lateral carina. Legs slender; metafemur broadly expanded, not bulging, bare laterally (Fig. 43); metatibia bare on outer side with short appressed setae on inner; metatibial spur absent. Forewing 2.2–2.3 times as long as broad; costal cell 0.3–0.4 times as long as wing, without setae; submarginal vein and basal area of wing bare; disc of wing with microsetae ventrally; wing veins not discernible;

stigma elongate 4.0 times as long as broad. Hindwing 3.1–3.4 times as long as broad.

Petiole 1.3–1.4 times as long as broad 1.1–1.2 times length of metacoxa; not curved in profile; foveolate (Fig. 30); strongly expanded mid-ventrally (Fig. 31). Gaster globose, 1.6 times as long as high, slightly compressed dorsoventrally; first tergite with few fine setae dorsally; first sternite with several strong longitudinal striae and wide, smooth central channel between striae (Fig. 30).

**Male.** Length 2.5 mm. Colour as in female, faint metallic reflections extending laterally. Antenna 12-segmented, flagellomeres 1–6 with long cylindrical rami, rami alternating in place of origin from base, apical segments cylindrical (Fig. 27). Mesosoma elongate; areolate-rugose; scutellum longer than broad. Disc of propodeum flat and narrow. Metatibia with or without spines on outer surface, if present, then much shorter than on inner side. Petiole 3.8 times as long as broad. Gaster with appressed setae on first tergite.

**Holotype.** ♀, paratype ♂, [double mount], Mating on foliage, St Augustine, Trinidad, BWI, 15.iv.1950, E. Mc. Callen[?], Id. Lot No. 50 606b. Deposited in USNM.

**Paratypes.** TRINIDAD, W.I.: 1♀, Tale, St Augustine ix.1946 (*Simmonds*) *Cordia macrostachya* fruit (USNM). ST KITTS, W.I.: 1♂, Brimstone, vi.1962 (*Maldonado*) (USNM). ST LUCIA, W.I.: 1♂, Univ. of Waterloo (10) (BRI). DOMINICA, W.I.: 1♂, Clarke Hall, 11–20.i.1965 (*Wirth*) Malaise trap (USNM).

**Biology.** A female collected from *Cordia macrostachya* may indicate the host plant or at least a habit of ovipositing into flower-buds, as for a species of *Kapala* in Trinidad (Heraty & Darling, 1984).

***Pseudochalcura sculpturata* sp.n.** (Figs. 2, 20, 42, 55)

See the remarks under *P. condylus* for distinguishing features. The yellow coloration of the mesosoma in this species is unique within *Pseudochalcura*. The pattern of coloration in the holotype female (Fig. 20) is almost identical to that found in *Obeza* and the Australasian species of *Stilbula*. A large number of other highly apomorphic characters suggests that this patterning is a reversal to the plesiotypic condition.

*Female.* Length 2.4–3.0 mm. Head black; rest of body patterned dark brown to black and testaceous with faint violaceous reflections dorsally in the darker patches of the mesoscutum (Fig. 20) or completely yellow; antenna testaceous. Wings hyaline, stigma white.

Head 1.6–1.7 times as broad as high, ventral angle of face concave in profile (Fig. 20). POL 2.5–2.6 times LOL, POL 3.7–4.9 times OOL. Frons lightly costate; face scattered fine-punctate, with scattered short setae; clypeus and supraclypeal area smooth, foveate laterally; genal bridge slightly emarginate (Fig. 55). Eyes separated by 2.1–2.4 times their height. Malar space 0.8–0.9 times height of eye, malar depression absent. Labrum 4–6-digitate. Antenna 9–10-segmented, apical two segments partially fused; lobate to short-ramose basally, if long, ramus of first flagellomere 3.0–6.0 times basal length, through serrate to lobate apically (Fig. 20); scape short, less than half distance between toruli and median ocellus; flagellomeres with dense, short setae in scalloped depressions.

Mesosoma globose; with shallow areolate sculpture; side-lobes weakly sculptured or shagreened; with or without scattered long, erect setae over dorsum and prepectus. Mesoscutum 2.0–2.5 times as broad as long dorsally. Disc of propodeum flat; sculpture reduced medially. Femoral groove deeply impressed. Proepisternum lightly sculptured, areolate basally. Metacoxa glabrous laterally, lightly scabriculous dorsally, only slightly expanded dorsobasally; mesocoxa with weak lateral carina. Legs slender; metafemur only slightly expanded medially, bare laterally (Fig. 42); metatibia with dense appressed setae on inner side and sparse short setae on outer; metatibial spur absent. Forewing 2.2–2.4 times as long as broad; costal cell 0.3 times as long as wing, without setae; submarginal vein and basal area of wing bare; disc of wing with microsetae ventrally; wing veins not discernible; stigma elongate, several times as long as broad. Hindwing 3.6–3.9 times as long as broad.

Petiole 1.3–2.0 times as long as broad, 1.2–1.3 times as long as metacoxa; not curved in profile, expanded mid-ventrally; mixed punctate and longitudinally striate. Gaster globose, not dorso-ventrally compressed; first gastral tergite with few long setae dorsolaterally, first sternite with several strong longitudinal striae, without a distinct smooth median channel.

*Male.* Length 2.5–2.8 mm. Head and mesosoma black with blue reflections, mesosoma with violaceous patches dorsally; coxae, petiole, gaster, and sometimes femora dark brown; antenna and legs light testaceous.

Head transverse, 1.6–1.8 times as broad as high; POL 2.3–2.6 times LOL, POL 3.5–5.2 times OOL. Sculpture of face as in female except finely rugulose around and in scrobe; scrobe with central carina from median ocellus to toruli. Antenna 12-segmented; flagellomeres 1–7 with long flat rami, rami alternating in place of origin from base; apical segments slightly to strongly laterally compressed.

Mesosoma elongate, 1.2–1.4 times as long as high (Fig. 2); sculpture fine-alveolate with smooth or verrucose surface; propodeum rugose; bare. Mesoscutum 1.8–1.9 times as broad as long dorsally. Scutellum longer than broad. Proepisternum rugulose. Coxae longitudinally aciculate. Legs robust; femora only slightly expanded medially, without lateral setae; metatibial spur absent.

Petiole stout, 2.8–4.2 times as long as broad, 1.3–1.9 times length of metacoxa, sculpture coarse to fine irregular-punctate. Gaster globose, first tergite with long appressed setae medially (Fig. 2).

*Holotype.* ♀, Brazil, Caruaru, Pernambuco, 900 m, iv.1972, M. Alvarenga. Deposited in BRI.

*Paratypes.* BRAZIL: 1♀, 1♂, Jatai, Goias, xi.1972 (*Oliviera*) (BRI); 1♂ Poços de Caldas, Min. Gerais, vii.1972 (*Alvarenga*) sweep (BRI); 1♂, Sao Paulo, 12.i.1964 (*Alin*) (AMNH). U.S.A.: FLORIDA: 1♀, Everglades N.P., Royal Palm Hammock, 1.xi.84–3.iii.85 (*Peck*) Malaise trap (BRI).

*Variation.* The paratype female differs from the holotype by having the entire body other than the head completely yellow, the presence of erect setae on the mesosoma dorsally and has a generally less robust appearance. Although the Jatai female can be more readily associated with a male, the holotype was chosen for its more distinctive appearance. The patterned coloration occurs elsewhere in the Eucharitinae and the completely yellow form may represent an aberration.

The female from Florida is problematic in that it has a few of the characters which are attributed to *P. condylus* such as the basal flagellomeres being lobate and not ramose, the proepisternum

not distinctly areolate basally, the metacoxa bare dorsally, and the presence of only a few fine setae on the first gastral tergite. It is associated with the Brazilian *P. sculpturata* by the presence of a convex face (in profile), shallow sculpture of the mesosoma, gaster not dorsoventrally compressed, the pattern of testaceous and dark coloration of the mesosoma, and in general, the ratios of certain body measurements presented in the description. The differentiation of the species, *P. condylus* and *P. sculpturata*, are supported most strongly by the differences between the associated males and the Florida specimen does not affect the status of either species.

The description of the male is based largely on the specimen from Jatai with the other males differing by having the following characters: Poços de Caldas male with face not markedly concave, dorsal sculpture more granular, violaceous patches more restricted in area and more intense in colour; Sao Paulo male with apical flagellomeres strongly flattened, rami stouter, without violaceous patches dorsally, petiole shorter and stouter. Gastral setae longer than Jatai specimen in both males.

#### ***Pseudochalcura* species status uncertain** (Figs. 29, 33, 45, 58)

This specimen has several features that suggest a close relationship with *P. americana* and *P. liburna*. The number of basal rami, setose costal cell and propodeal setae are characters shared by these species. The dorsal submarginal setae are lacking and the antenna is 12-segmented. The single specimen is highly aberrant with the facial features distorted to one side and the mesosoma impressed anteriorly. The proepisternal sculpture and transversely striate petiole are not found elsewhere in *Pseudochalcura*. I hesitate to name this as a new species because of the aberrant nature of the single specimen.

**Male.** Length 2.3 mm. Dark brown; antenna and legs testaceous; rami of antenna brown. Wings hyaline, stigma infusate. Face lightly costate; row of setae across apex of clypeus; genal bridge slightly emarginate (Fig. 58). Malar depression less than half malar space, strongly impressed. Left mandible with broad basal tooth (Fig. 29). Labrum 6-digitate, digits reduced. Antenna 11-segmented; five long basal rami, sixth flagellomere with prolonged serration.

Mesosoma with deep areolate-rugose sculpture; dorsal setae lacking, propodeal disc with long setae. Proepisternum obliquely striate. Mesocoxa with lateral carina, coxae bare. Legs slender; metafemur bare (Fig. 45); metatibial spur present. Costal cell of forewing with row of ventral setae; basal area bare, submarginal without dorsal setae; short setae on disc of wing (larger than microsetae).

Petiole curved in profile, transversely striate (Fig. 33). Gaster bare dorsally.

**Material examined.** BRAZIL: 1♂, SP, Faz. Campininas, Mogi Guacu, 1-8.i.1970 (*Campbell*) (BRI).

#### **Phylogenetic analysis of *Pseudochalcura***

The cladogram shown in Fig. 70 depicts the proposed phylogenetic relationships within *Pseudochalcura*. Only synapomorphies are shown on the diagram and autapomorphies for the terminal taxa can be obtained from the descriptions in the text. The monophyly of *Pseudochalcura* is supported by the presence of two characters which are not found elsewhere in the Eucharitidae; basal four to seven flagellomeres ramose in the male (5), and genae completely fused behind the mandibles (4). Associated with the fusion of the genae is a total reduction of the functional mouthparts. The proposed sister group, used as the reference outgroup, is *Lophyrocera*. *Lophyrocera* is similar to *Pseudochalcura* in having a lateral carina on the mesocoxa, a closing of the genae behind the mandibles (without fusion and mouthparts present), and a single metatibial spur.

*Pseudochalcura americana* retains the highest number of plesiomorphies in *Pseudochalcura* and shares with *Lophyrocera* the presence of long ventral wing setae, prominent wing veins, dorsal submarginal setae, labrum with 8-10 digits, a smooth gastral sternite, and several other less distinctive character states. When characters varied within the ingroup and the outgroup, character state polarity was determined through reference to *Obeza* Heraty (=New World *Stilbula* Spinola, Heraty 1984) and *Stilbula* (from the Australasian region). Assuming that it is correct to accept *Lophyrocera* as the closest sister group, species of *Pseudochalcura* also share the apomorphic loss of the bifurcate frenular spines (1) and lateral propodeal processes (2).

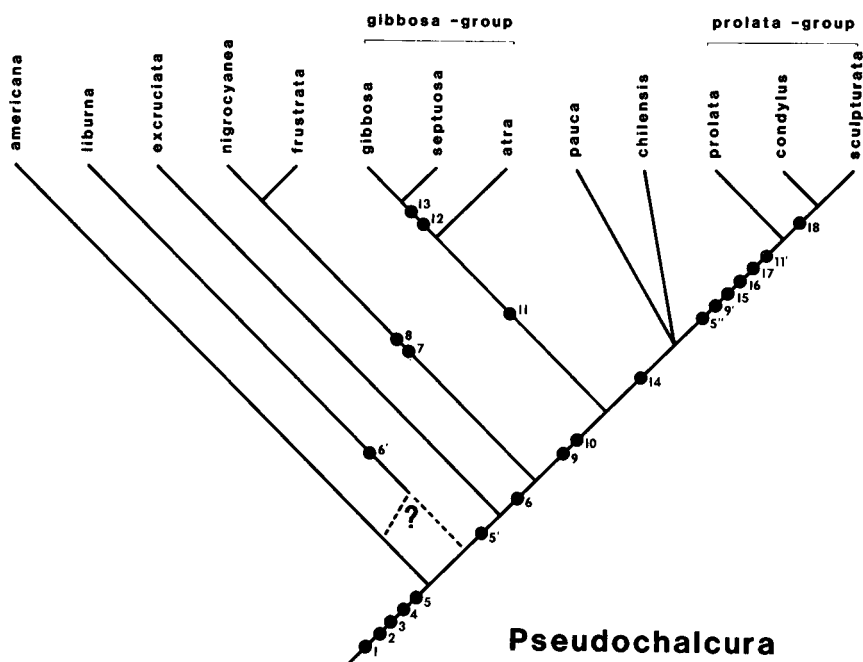


FIG. 70. Cladogram showing hypothetical relationships within *Pseudochalcura*. Apomorphic character states: 1, frenal spines lacking; 2, propodeal processes lacking; 3, mouthparts greatly reduced; 4, genae fused completely; 5, male with six to seven basal rami; 5', four basal rami; 5'', reversal to seven basal rami; 6, wing disc setae reduced; 6', wing setae reduced in female only; 7, digits of labrum reduced; 8, petiole completely smooth; 9, first gastral sternite striate; 10, dorsal submarginal setae lacking; 11, lateral carina of mesocoxa lacking; 11', convergent reduction of lateral carina; 12, metafemoral setae short; 13, coxae bare or with few short setae; 14, costal cell setae lacking; 15, POL/OOL > 3.5; 16, female antenna ramose; 17, metatibial spur lacking; 18, petiole reticulate.

The monophyly of almost all of the other species within *Pseudochalcura* is supported by a reduction of the setae on the disc of the forewing to microtrichia (6) which are small enough to be almost considered as absent, and the apparently associated character of the wing veins losing their colour and definition until only the stigmal spot remains. This synapomorphy is found in all of *Pseudochalcura* except *P.americana*, *P.excruciata* and *P.liburna* (male). The questionable placement of *P.liburna* in Fig. 70 requires that the apotypic reduction of long wing setae in the female of this species could have occurred independently from the other species in *Pseudochalcura*. The plesiomorphic character state of long wing setae is retained in *P.excruciata*, but this species has the apomorphic character state of a reduced number of rami (5') which is shared with most species of *Pseudochalcura* other than *P.americana* and *P.liburna*. Based on information given in the

original description, *P.liburna* is considered to be morphologically more similar to *P.americana* than to other species of *Pseudochalcura*. This, along with the restricted distribution of *P.liburna* in Florida, suggests that *P.americana* and *P.liburna* are sister species (suggested by the ? in Fig. 70).

A smooth first gastral sternite (assumed for the two species with females unknown) and the presence of dorsal submarginal setae are plesiomorphic states shared by *P.americana*, *P.liburna*, *P.excruciata*, *P.nigrocyanea* and *P.frustrata*. The remaining species share the apomorphic states of a striate first gastral sternite (9) and a loss of dorsal submarginal setae (10). In the *gibbosa*-group (*P.gibbosa*, *P.septuosa* and *P.atra*) and *P.chilensis*, the first sternite is finely striate. In *P.pauca*, only the very base of the first sternite is visible and it appears to be finely punctate instead of striate. In the *prolata*-group (*P.prolata*, *P.condylus* and

*P.sculpturata*), the first sternite has several robust carinae. The two types of striation, fine and robust, are considered here as variations of a single apomorphic character state (9). The robust striae of the *prolata*-group could have arisen independently of the other, but this would require a convergent loss of the dorsal submarginal setae (10) and costal cell setae (14).

The loss of the lateral mesocoxal carina (11) supports the monophyly of the *gibbosa*-group which are all found north of Central America. The reduction of the carina (11') in *P.condylus* and *P.sculpturata*, and the loss in *P.prolata* is assumed to be convergent with the loss in the *gibbosa*-group. *Pseudochalcura pauca* and *P.chilensis* retain the carina but share the loss of costal cell setae (14) with the *prolata*-group. The monophyly of *P.chilensis*+*P.pauca*, and the five species in the *prolata*-group is supported by the loss of costal cell setae (14) and the assumption that the differences in striation of the first sternite is a transformation of the same derived character state. If loss of the setae is considered to have occurred independently in *P.pauca*, *P.chilensis* and the *prolata*-group, *P.chilensis* is more closely related to the *gibbosa*-group based on the fine striation of the first sternite.

The monophyly of the *prolata*-group is supported by six synapomorphies of which the most important are the ramose female antennae (16) and loss of the metatibial spur (17). This group has undergone considerable change from the rest of *Pseudochalcura* with an increase in sexual dimorphism, changes in the basic structure of the male antenna, and the overall habitus. Its association with the rest of *Pseudochalcura* is supported mainly by the fusion of the gena (4), reduced wing venation (6) and the striate first sternite (9), and likely, a loss of frenal spines (1) and propodeal processes (2). The apomorphic loss of costal cell setae (14) which is shared with *P.pauca* and *P.chilensis*, along with the high degree of autapomorphic change from the other species of *Pseudochalcura*, suggests that the increased number of rami on the male flagellum (5') is a reversal to the plesiomorphic condition of a higher number of male antennal rami (5). The large degree of autapomorphic change found in the *prolata*-group has important implications when considering the many monotypic genera within the Eucharitidae.

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## References

- Ashmead, W.H. (1892) Notes on the eucharids found in the United States. *Proceedings of the Entomological Society of Washington*, **2**, 354–358.
- Ashmead, W.H. (1904) Classification of the superfamily Chalcidoidea. *Memoirs of the Carnegie Museum*, **1**, 225–556.
- Bucher, G.E. (1948) The anatomy *Monodontomerus dentipes* Boh., an entomophagous chalcid. *Canadian Journal of Research*, **26**, 230–281.
- Burks, B.D. (1963) The Provancher species of Chalcidoidea (Hymenoptera). *Canadian Entomologist*, **95**, 1254–1263.
- Clausen, C.P. (1940) The oviposition habits of the Eucharitidae (Hymenoptera). *Journal of the Washington Academy of Science*, **30**, 504–516.
- Clausen, C.P. (1941) The habits of Eucharitidae. *Psyche*, **48**, 57–69.
- Crawford, T.C. (1914) Two new parasitic Hymenoptera from Arizona. *Proceedings of the Entomological Society of Washington*, **16**, 29.
- De Santis, L. (1979) *Catálogo de los himenópteros Calcidoideos de américa al sur de los estados unidos*. Provincia de Buenos Aires Comisión de investigaciones científicas, La Plata.
- Gahan, A.B. & Rohwer, S.A. (1917) Lectotypes of the species of Hymenoptera (except Apoidea) described by Abbe Provancher. *Canadian Entomologist*, **49**, 391–400.
- Gleason, H.A. & Cronquist, A. (1963) *Manual of Vascular Plants of Northeastern United States and Adjacent Canada*. D. Van Nostrand Co., New York.
- Graham, M.W.R. de V. (1969) The Pteromalidae of north-western Europe (Hymenoptera: Chalcidoidea). *Bulletin of the British Museum (Natural History)*, *Entomological Supplement*, **16**, 1–908.
- Harris, R.A. (1978) A glossary of surface sculpturing. *Occasional Papers of Entomology, California Department of Food and Agriculture*, **28**, 1–31.
- Heraty, J.M. (1984) Systematic studies of the Nearctic Eucharitinae (Hymenoptera: Eucharitidae: Chalcidoidea). Unpublished M.Sc. thesis, University of Guelph.
- Heraty, J.M. & Darling, D.C. (1984) Comparative morphology of the planidial larvae of Eucharitidae and Perilampidae (Hymenoptera: Chalcidoidea). *Systematic Entomology*, **9**, 309–328.
- Howard, L.O. (1894) In: C. V. Riley, W. H. Ashmead and L. O. Howard. Report on the parasitic Hymenoptera of the island of St. Vincent. *Journal*

- of the Linnean Society of London, *Zoology*, **25**, 56–254.
- Kieffer, J.J. (1905) Neue Eucharinae and Chalcidinae. *Berliner Entomologische Zeitschrift*, **49** (1904), 240–265.
- Kuechler, A.W. (1965) *Potential natural vegetation*. [map] U.S. Geological Survey, Washington.
- Masner, L. (1980) Key to genera of Scelionidae of the holarctic region, with descriptions of new genera and species (Hymenoptera: Proctotrupoidea). *Memoirs of the Entomological Society of Canada*, **113**, 1–54.
- Muesebeck, C.F.W., Krombein, K.W. & Townes, H.K. (1951) *Hymenoptera of America North of Mexico Synoptic Catalog. VI*. U.S. Government Printing Office, Washington.
- National Atlas of the United States (1970) *Major Forest Types*. Plate 154. U.S. Dept Interior, Geological Survey, Washington, D.C.
- Pierce, W.D. & Morrill, A.W. (1914) Notes on the entomology of the Arizona wild cotton. *Proceedings of the Entomological Society of Washington*, **16**, 22.
- Provancher, L'Abbé (1881) Faune Canadienne les insectes hyménoptères. *Naturaliste Canadienne*, **12**, 291–304.
- Scudder, G.L. (1979) Present patterns in the flora and fauna of Canada. In Danks, H.V., Canada and its insect fauna. *Memoirs of the Entomological Society of Canada*, **108**, 87–179.
- Snodgrass, R.E. (1911) The thorax of the Hymenoptera. *Proceedings of the United States National Museum*, **39**, (1774), 37–91.
- Wheeler, G.C. & Wheeler, E.W. (1937) New hymenopterous parasites of ants (Chalcidoidea: Eucharidae). *Annals of the Entomological Society of America*, **30**, 163–175.
- Wheeler, W.M. (1910) The North American ants of the genus *Camponotus*. *Annals of the New York Academy of Sciences*, **20**, 295–354.

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