

A Revision of *Protophotopsis* Schuster (Hymenoptera: Mutillidae)

ROBERTO A. CAMBRA T. AND DIOMEDES QUINTERO A.

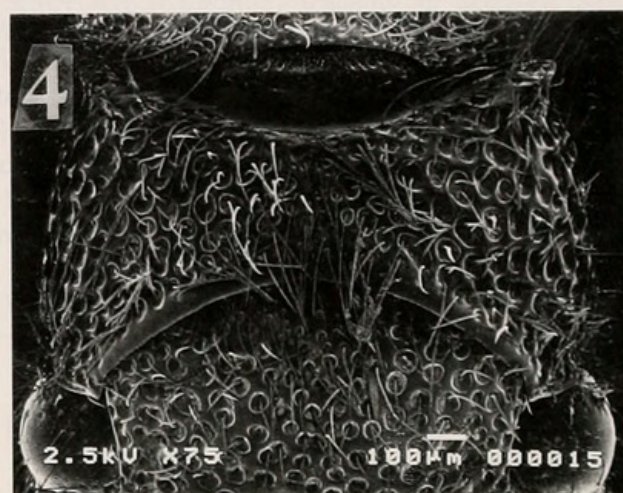
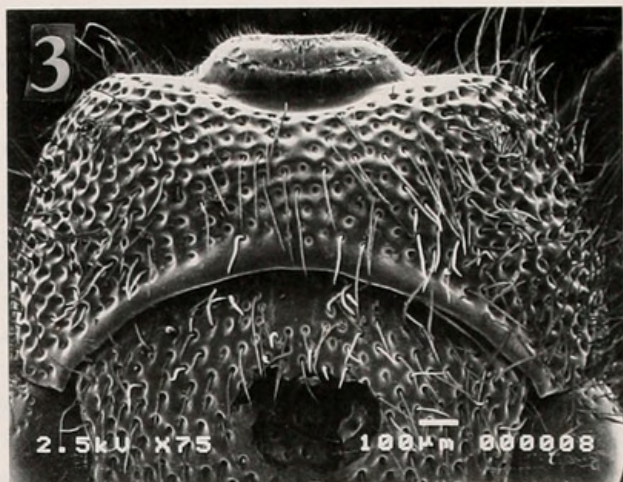
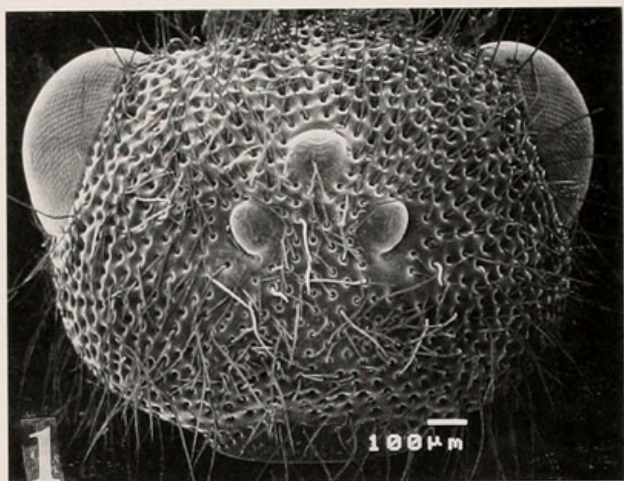
(RAC, DQ) Museo de Invertebrados G.B. Fairchild, Estafeta Universitaria,
Universidad de Panamá, Panamá, PANAMA; (DQ) Smithsonian Tropical Research Institute,
P.O. Box 2072, Balboa, Ancón, PANAMA

Abstract.—*Protophotopsis*, a rare and incompletely known genus of Sphaerophthalmina, is revised. The following new synonymies are established: *Huacotilla* Casal, female = *Protophotopsis* Schuster, male; *Huacotilla diaguita* Casal, female, and *Huacotilla hepperi* Casal, female = *Protophotopsis* (*Protophotopsiella*) *humeralis* Schuster, male; *Protophotopsis* (*Protophotopsiella*) *humeralis* *rugosa* Schuster, male = *Protophotopsis* (*Protophotopsiella*) *sulcifrons* (André), female, new combination for *Ephuta sulcifrons* André, incertae sedis; *Protophotopsis* (*Protophotopsis*) *scudderi* Schuster, male = *Protophotopsis* (*Protophotopsis*) *venenaria* (Melander), female. *Protophotopsis* (*Protophotopsis*) *clauseni* n. sp., described and illustrated from Costa Rica and Panama, is the first known Neotropical species of the nominotypical subgenus. A key for the two subgenera and for the males and females of the four species of *Protophotopsis* s. s. is provided. *Protophotopsis* (*Protophotopsiella*) *sulcifrons* and *P.* (*Protophotopsis*) *venenaria* are recorded for the first time from Bolivia and Mexico respectively. The inferred generic relationships are discussed.

The sphaerophthalmine genus *Protophotopsis* was established by Schuster in 1947 for *P. scudderi* Schuster, based on five males collected in Texas and Colorado, USA (he mentioned one additional male from Kansas in 1949). Schuster (1949) and Krombein (1979: 1301), thought that *Mutilla venenaria* Melander, 1903, might be the female sex of *Protophotopsis scudderi*, based on coincident geographic distributions. Schuster described (1949) a South American subgenus of *Protophotopsis*, *Protophotopsiella*, with one additional species with two subspecies: *P. humeralis humeralis* Schuster, from Argentina, and *P. humeralis rugosa* Schuster, from Brazil; their females were unknown. Based on an unspecified "larger number of features in common," Schuster (1958) considered *Protophotopsis* to be closer to his nebulous "Dasymutilline and Pseudomethocine complexes" instead of his "Sphaerophthalmine complex" (*Sphaerophthalma*), as suggested in 1949. Brothers (1975) included *Protophotopsis* in the subtribe Sphaerophthalmina of the tribe

Sphaerophthalmini. The present revision, the first of this poorly collected genus, is based on 31 specimens in addition to the 16 previously known (including Casal's females of *Huacotilla*).

We follow the scutum terminology suggested by Menke (1993) instead of parapsidal furrows (Schuster 1958). We use calcaria to refer to tibial spurs, following previous usage for mutillids. Acronyms for institutions where specimens are deposited are: University of Minnesota Insect Collection (UMIC); American Museum of Natural History, New York (AMNH); U.S. National Museum of Natural History, Smithsonian Institution, Washington D.C. (USNM); The James Entomological collection, Washington State University (WSU); Museum of Comparative Zoology, Harvard University (MCZ); Museo de Invertebrados G.B. Fairchild (MIUP); Muséum National d'Histoire Naturelle, Paris (MNHN); Instituto Nacional de Biodiversidad, Heredia, Costa Rica (INBio).



Figs. 1–2. Head of *Protophotopsis* (*Protophotopsis*), males, dorsal view. 1, *P. clauseni*. 2, *P. venenaria*.

Figs. 3–4. Pronotum of *Protophotopsis*, male, dorsal view. 3, *P. (Protophotopsis) clauseni*. 4, *P. (Protophotopsiella) sulcifrons*.

Protophotopsis Schuster

Protophotopsis Schuster 1947:693–694. Type species: *Protophotopsis (Protophotopsis) scuderi* Schuster 1947, by original designation and monotypy.

Huacotilla Casal 1962:259–261. Type species: *Huacotilla diaguila* Casal 1962, by original designation. **New Synonymy.**

Diagnosis.—*Protophotopsis* is the only genus in the Sphaerophthalmina with males that have the anterior pronotal margin distinctly emarginate (Figs. 3, 4). The females of *Protophotopsis* are recognized by the following combination of characters: smooth pygidial area not delimited by lateral carinae, segment I of the gaster sessile with the second (Figs. 7, 8), mandibles bidentate distally, and integument of head and thorax punctate.

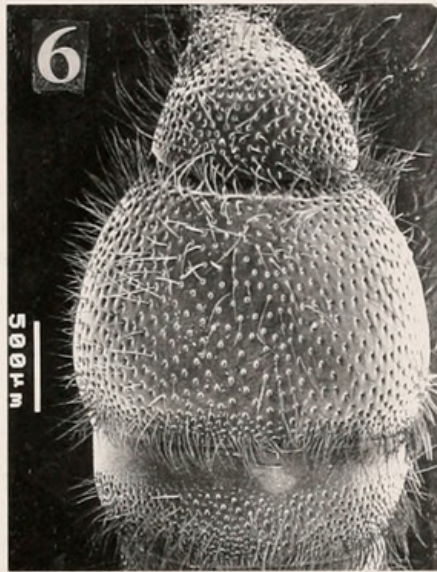
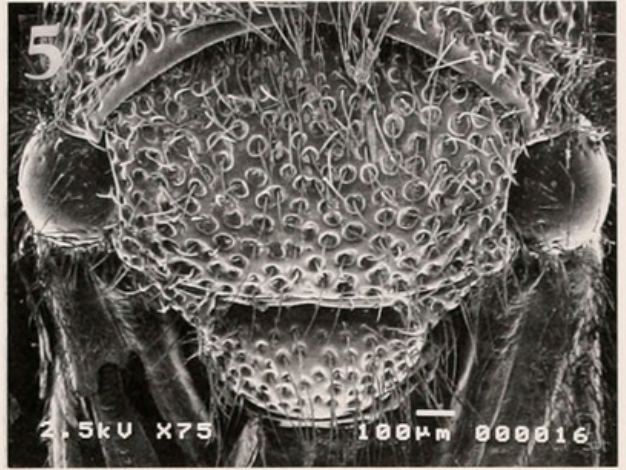
Females of the sister genus *Nanotopsis* Schuster (1949) differ from those of *Protophotopsis* in having mandibles edentate distally and the integument of head and thorax reticulate. The diurnal males of both genera share the following characters: felt line on sternum II, and body pubescence of simple and microserrated setae (serrations are visible only at high magnification). The males of *Nanotopsis* are recognized by the following apomorphy: integument of basal half of tergum II finely, longitudinally striate.

The following additional characters will help to recognize *Protophotopsis* within the Sphaerophthalmina: males with anterior margin of clypeus without teeth; mandibles tridentate distally, without a

ventral basal tooth; parapsidal lines and notauli absent (Fig. 5); mesosterna without teeth or projections; gastral segment I distinctly petiolate (Fig. 6); penis valve with two large apical teeth (Figs. 11–14). Females with genal carinae absent; anterior margin of clypeus without teeth; proboscidal fossa large, extending to base of mandibles; thorax subrectangular (Figs. 7, 8); pubescence simple and microserrate.

Remarks.—It is clear that a sister group relationship exists between *Protophotopsis* and *Nanotopsis* (we are conducting a worldwide phylogenetic analysis of the genera of Sphaerophthalmina). Only one additional genus in the Sphaerophthalmina has females with segment I of the gaster sessile with the second: *Photomorphus* Viereck (1903), which most likely is the sister group of (*Protophotopsis* + *Nanotopsis*). These three genera form a holophyletic group. The males of *Photomorphus* differ from those of *Protophotopsis* and *Nanotopsis* in having a basal ventral tooth on each mandible, and a modified mesosternum, with teeth or tubercles. Females of *Photomorphus* differ in having the pygidial area well delimited laterally, and with the surface sculptured.

Synonymy.—The discovery of an undescribed species of *Protophotopsis* (*Protophotopsis*) in Costa Rica and Panama, permitted us to recognize the female sex of this genus. We then discovered that this female was congeneric with females of *P. venenaria* (Melander) and with females of the Argentinian genus *Huacotilla* Casal (1962) (a genus including two nominal species, and known only from three female specimens). Examination of the female type of *Ephuta sulcifrons* (André), incertae sedis recognized here as a *Proto-*



Figs. 5–6. 5, Mesonotum and scutellum of *Protophotopsis* (*Protophotopsiella*) *sulcifrons*, male, dorsal view. 6, Gaster of *Protophotopsis* (*Protophotopsis*) *clauseni*, male, terga 1 to 3, dorsal view.

photopsis, and representing a new distribution record for that species, from Bolivia, helps us clarify the distribution of the genus.

Distribution.—*Protophotopsis* ranges from Colorado, southern Arizona, and Texas, south to Brazil and Argentina. Krombein (1979) lists California for *P. venenaria* but we have not been able to locate specimens from that state.

KEY TO MALES OF *PROTOPHOTOPSIS*

- 1. Humerus conspicuously, sharply produced (Fig. 4), armed with sharp ventral carina; genitalia with distinct process on lateral half of penial valve, basad to distal teeth (Fig. 11); apical tooth of penis valve shorter than subapical one (Figs. 11 and 14); South America *Protophotopsis (Protophotopsiella)* 2
- . Humerus not at all produced, not carinate (Fig. 3); genitalia with penial valve bidentate, without distinct lobe or ventro-lateral process basad to distal teeth (Fig. 12); apical tooth of penis valve longer than subapical one (Figs. 12 and 13); North and Central America *Protophotopsis (Protophotopsis)* 3
- 2. Tubercle of antennal scrobes with delicately margined, truncate, outer face; sculpture of frons and vertex punctate, punctures nearly confluent; Argentina *humeralis* Schuster
- . Tubercle of antennal scrobes dentiform, not margined, outer face not truncate; sculpture of frons and vertex exceedingly coarse, more or less rugose; Brazil and Bolivia *sulcifrons* (André)
- 3. Metanotum punctate throughout; hind ocelli very small (Fig. 2), maximum diameter $0.14\times$ own distance from inner eye margin; hind ocelli with near vertical insertion, on postero-lateral margin of low ocellar tubercle (Fig. 2); scutellum slightly gibbous; USA, Mexico *venenaria* (Melander)
- . Metanotum with median, smooth area; hind ocelli larger (Fig. 1), maximum diameter $0.2\times$ own distance from inner eye margin; hind ocelli with oblique insertion on very low ocellar tubercle (Fig. 1); scutellum totally flat; Costa Rica and Panama *clauseni* Cambra and Quintero, n. sp.

KEY TO FEMALES OF *PROTOPHOTOPSIS*

- 1. Dorsal face of propodeum with transverse row of denticles, lateral margins with two small denticles (Figs. 7, 9); tergum III with pair of lateral, pale integumental spots; South America *Protophotopsis (Protophotopsiella)* 2
- . Dorsal face of propodeum without transverse row of denticles (Fig. 8), lateral margins without denticles; tergum III with or without pair of lateral, pale integumental spots; North and Central America *Protophotopsis (Protophotopsis)* 3
- 2. Sides of propodeum almost smooth, with only few, sparse punctures; integument red under sparse pale pubescent band on posterior margin of tergum I; tergum II red ... *humeralis* Schuster
- . Sides of propodeum densely punctured; integument pale under dense pale pubescent band on posterior margin of tergum I; tergum II black *sulcifrons* (André)
- 3. Humeral angles of pronotum with sharp carina (Fig. 8); tergum III with pair of lateral, pale integumental spots; apex of tergum I with pale pubescence; integument of tergum II red; head covered with dense pale-golden pubescence *venenaria* (Melander)
- . Humeral angles of pronotum without a sharp carina; tergum III without pale integumental spots; apex of tergum I with black pubescence; integument of tergum II red, except the apical third, black; head covered with sparse pale-golden pubescence *clauseni* Cambra and Quintero, n. sp.

Subgenus **Protophotopsis** s. s.***Protophotopsis (Protophotopsis)*
*clauseni*** Cambra and Quintero,
New Species
(Figs. 1, 3, 6, 10, 12, 13, 15)

Description of male.—Integument black, clothed with long, erect and recumbent white pubescence, except the last tergum of gaster with some infuscated setae. Head rounded—subquadrate, its width slightly less than width of thorax (Fig. 1); clypeus convex, without denticles; scape with a strong longitudinal carina beneath; pedicel and flagellomere I subequal, short, transverse; front, vertex and genae coarsely punctate; ocelli small, its maximum diameter $0.2\times$ its distance from the inner eye margin; hind ocelli with oblique insertion on very low ocellar tubercle (Fig. 1). Thorax with close punctures (Fig. 3), about the size of those on head, except the metanotum, with a median, smooth area; propodeum strongly reticulate; tegulae smooth; scutellum totally flat; coxae without teeth or keels; calcaria pale. Gaster with segments I and II with median punctures, mostly 2 puncture diameters apart (Fig. 6); segments III to VI with small, close punctures; apical half of pygidium smooth; felt line on tergum II $0.54\times$ as long as lateral margin of tergum; felt line on sternum II $0.36\times$ as long as lateral margin of sternum; wings infuscated; forewing with two well defined submarginal cells and traces of a third. Parameres as in Fig. 10, penis valve as in Figs. 12 and 13, apical tooth distinctively longer than subapical. Length: 7.2 mm.

Description of female.—Integument red, except the apical third of tergum II, black. Head with deep, close punctures; antennal tubercles set distinctly apart; flagellomere I short, $0.73\times$ as long as flagellomere II; head covered with sparse pale-golden pubescence. Alitrunk with moderate, dense punctures, except metapleuron, smooth; humeral angle of pronotum

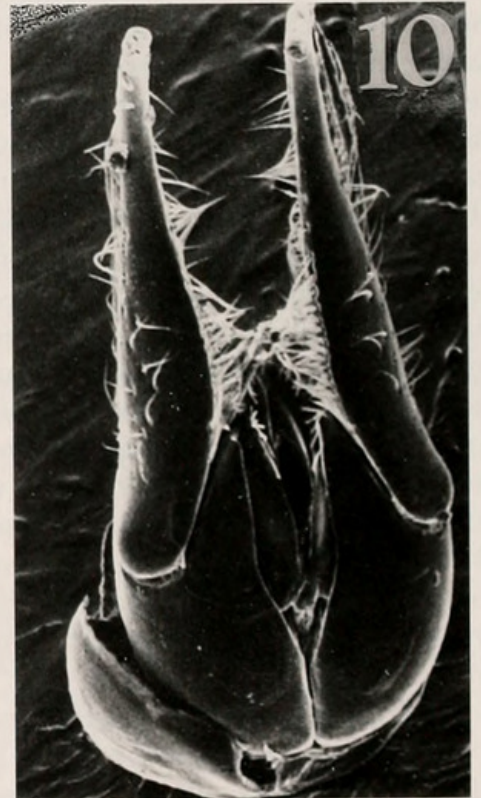
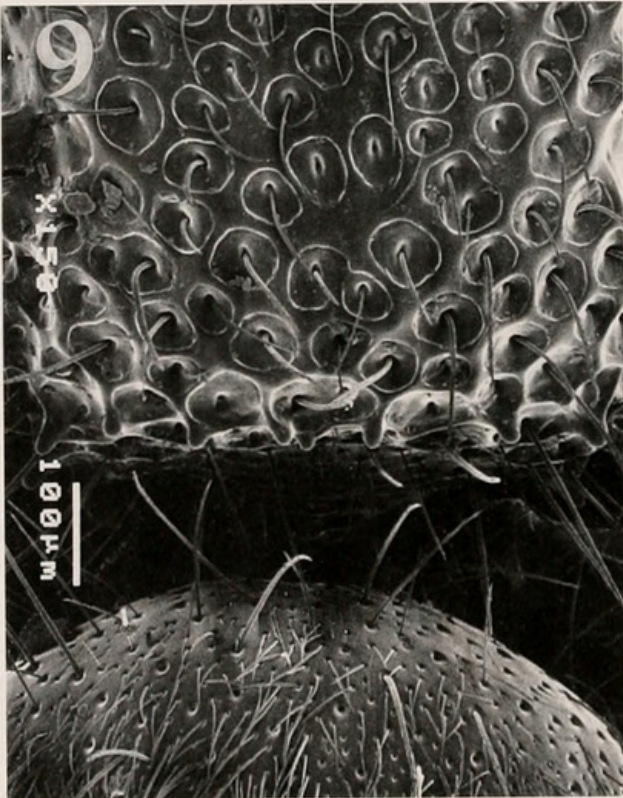
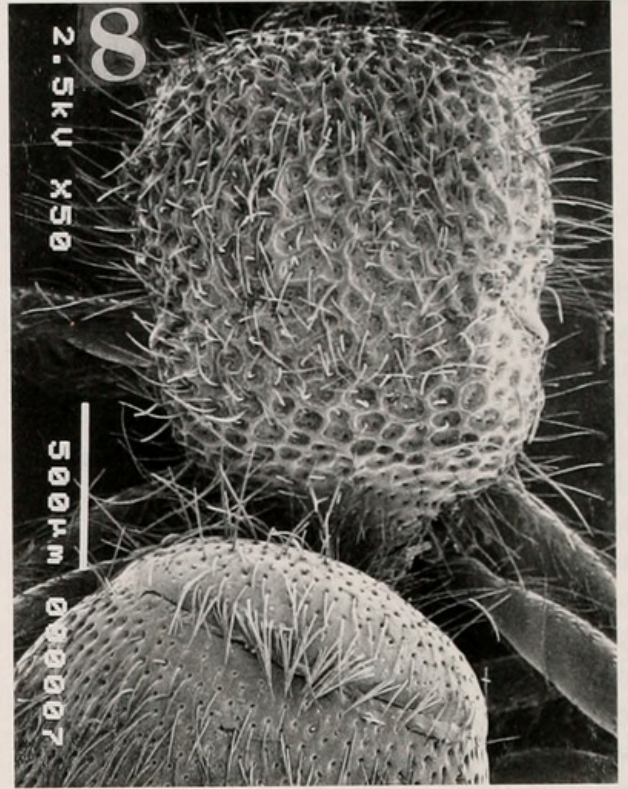
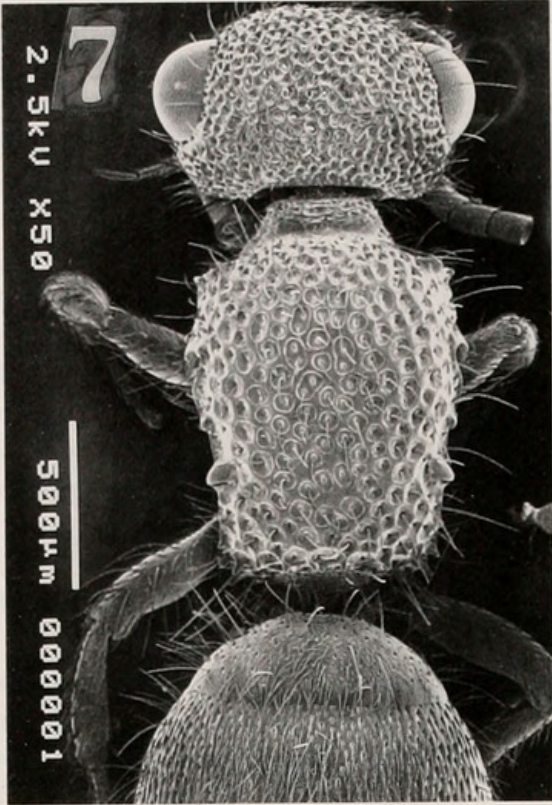
without a sharp carina; sides of mesonotum and propodeum without denticles; coxae without teeth or carinae; alitrunk and legs covered with sparse pale-golden pubescence, except the posterior half of pronotum and metanotum with sparse black pubescence. Gaster with terga and sterna I–II with dense, near confluent, median punctures; terga and sterna III–V with fine, close punctures; tergum III without pale integumental spots; sternum I with a strong elevated, median, longitudinal carina; gaster with pale-golden pubescence, except the apex of tergum I and apical third of tergum II (the apical fringe pale-golden pubescence) with black pubescence. Length: 6.3 mm.

Types.—Holotype δ : PANAMA, Panama Prov.: Chorrera, Rio Perequete, Corr. Playa Leona (in hard clay trail, yellow trap), 27 Feb 1991, R. Cambra (MIUP). Paratypes: PANAMA, Panama Prov.: same data as holotype, 1 δ (UMIC); same data but: 18–20 Mar 1991, 3 δ (USNM, AMNH, MIUP); 25 Jan 1992, I. Henry, 1 δ (MIUP); 26 Feb 1991, R. Cambra, 1 δ (MIUP); 17 Jan 1992, R. Cambra, 2 δ (MIUP, MNHN-Paris). COSTA RICA, Guanacaste Prov.: 3 km NO of Nacaome, 100 m, P.N. Barra Honda, Mar 1993, M. Reyes, 4 δ (INBio, MIUP); P.N. Barra Honda, 100m, Nov 1993, M. Reyes, 1 δ (INBio); Est. Palo Verde, 10 m, P. N. Palo Verde, 25 Mar–21 Apr 1992, A. Gutiérrez, 1 δ (INBio).

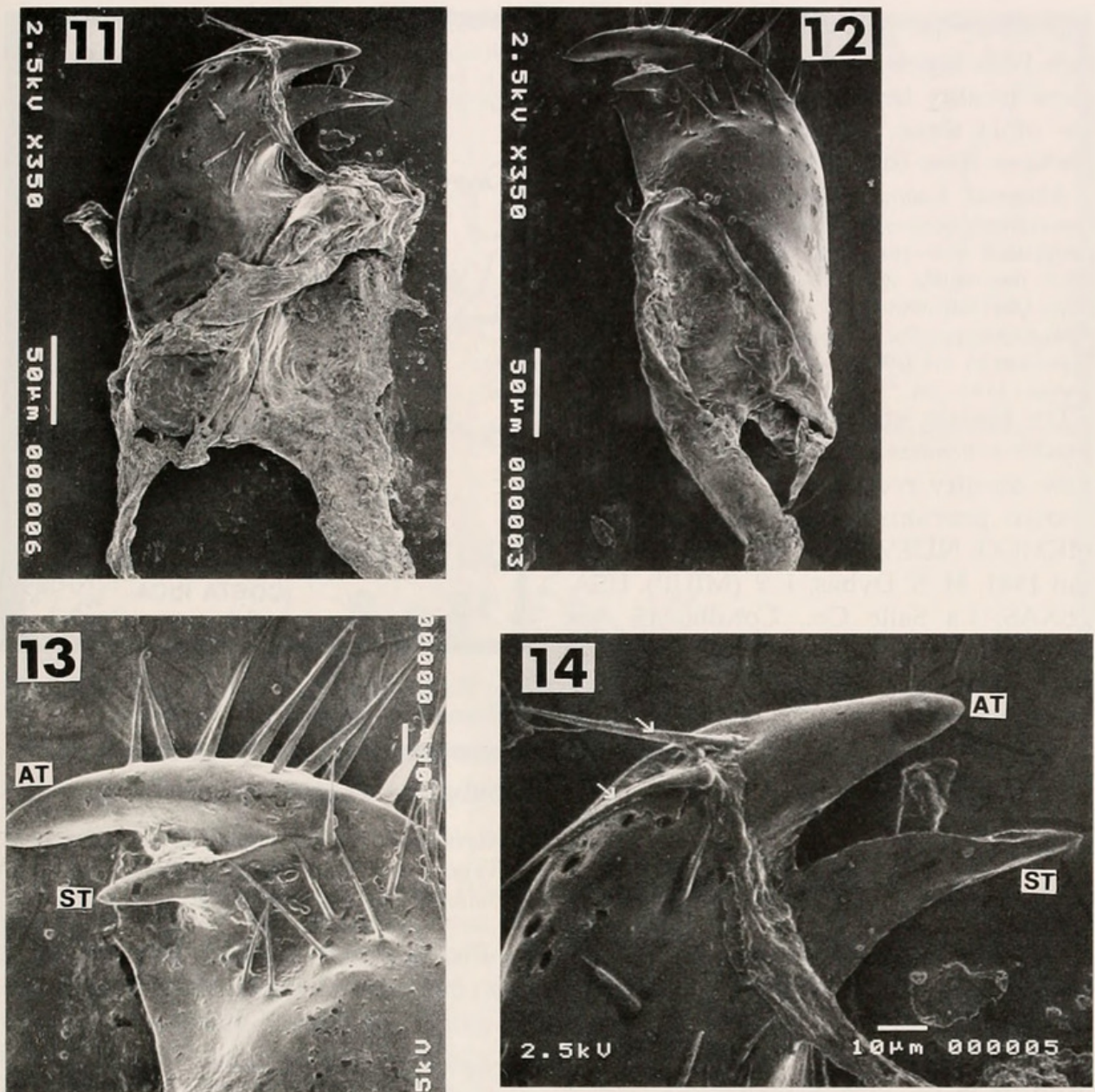
Distribution (Fig. 15).—Known from lowlands on the Pacific slopes of Costa Rica and Panama.

Remarks.—*Protophotopsis clauseni* was found in open areas with patches of dry forest, close to or in cattle fields (potreros), in Panama and Costa Rica. This new species of *Protophotopsis* is the first Neotropical species reported for the nominotypical subgenus, *Protophotopsis*. The 14 male types vary in body length from 5.1 to 7.2 mm, and lack any noticeable variations in structure and coloration.

Etymology.—Named in honor of Dr.



Figs. 7-10. 7, *Protophotopsis* (*Protophotopsiella*) *humeralis*, female, head, thorax, first and second gastral terga, dorsal view. 8, *Protophotopsis* (*Protophotopsis*) *venenaria*, female, thorax, first and second gastral terga, dorsal view. 9, *Protophotopsis* (*Protophotopsiella*) *humeralis*, female, details of propodeum with transverse row of denticles and lateral margins with two denticles, dorsal view. 10, Male genitalia of *Protophotopsis* (*Protophotopsis*) *clauseni*, dorsal view.



Figs. 11–14. Penis valves of *Protophotopsis*, males, dorsal view. 11, *P. (Protophotopsiella) sulcifrons*. 12, *P. (Protophotopsis) clauseni*. 13–14, detail of anterior half. AT = apical tooth; ST = subapical tooth. 13, *P. (Protophotopsis) clauseni*. 14, *P. (Protophotopsiella) sulcifrons*, setae removed except for two, marked with arrows.

Philip Clausen, Insect Collection, University of Minnesota, for his great encouragement to our research, for providing numerous loans of mutillids for many years, and for his hospitality during two visits by the junior author.

Protophotopsis (Protophotopsis)
venenaria (Melander)
(Figs. 2, 8, 15)

Mutilla venenaria Melander 1903:320. Fedor [Lee Co.], Texas, Rev. G. Birkman col. Lec-

totype ♀ (Fedor, Texas, April 29 1898), MCZ-Harvard Type 8978, present designation.

Protophotopsis (Protophotopsis) scudderi Schuster 1947:694–697. Holotype ♂: Fedor [Lee Co.], Texas, May 29 1902, Birkman col. (MCZ-Harvard University, Type 30514), and 2 paratopotypes. **New synonymy.**

Notes on Synonymy.—Schuster (1949) mentioned that *venenaria* might be the female of *scudderi*. The synonymy is based on the fact that this is the only known

species of the genus in North America, that both types were collected from the same locality in Texas, and that none of the other three known species of *Protophotopsis* lives in sympatry.

Material Examined.—Three of the original four syntype females were located: two females (one designated lectotype, and one paralectotype), in MCZ; one female, in WSU (Type 145), without locality label but with a Melander identification label, a paralectotype. The paratype of *P. scudderi* listed as deposited in the USNM was not found there, and appears to be lost.

The finding of *Protophotopsis* (*Protophotopsis*) *venenaria* in Mexico represents a new country record, as this species was known previously only from the USA. MEXICO: NUEVO LEON: Monterrey, 15 Jun 1941, H. S. Dybas, 1 ♀ (MIUP). USA: TEXAS: La Salle Co., Cotulla, 15 Apr 1906, F.C. Pratt col, 1 ♂ (UMIC); Bastrop Co., Duval col., 1 ♀ (UMIC); COLORADO: Boulder, Jul 12 1910, T.D.A. Cockerell col, 1 ♀ (UMIC); ARIZONA: Sta. Rita Mts, May 15 1940, Bryant col, 1 ♀, without head (UMIC); Cochise Co., Texas Canyon, 11 mi. W. Apache, Aug 8 1967, E. S. Schlinger col, 1 ♂, without head (UCRC).

Distribution (Fig. 15).—USA (Texas, Colorado, Arizona) and Mexico (Nuevo León).

Remarks.—Schuster's (1947) composite drawing of the male genitalia of *P. venenaria* (as *P. scudderi*), erroneously shows that the apical tooth of the penis valve is shorter than the subapical one. Using dissections and the SEM, we have found that the apical tooth is longer than the subapical one in *venenaria*. The single female specimen of *venenaria* collected in Mexico, some 320 km south of the closest known specimen from the USA, Cotulla, Texas, measures 3.8 mm in body length. Two females from the USA measured 5.2 mm (Texas) and 6.0 mm (Colorado). Although it is shorter in body length, we have been unable to recognize in the Mexican female any differences in structure and coloration from *venenaria* specimens from the USA.

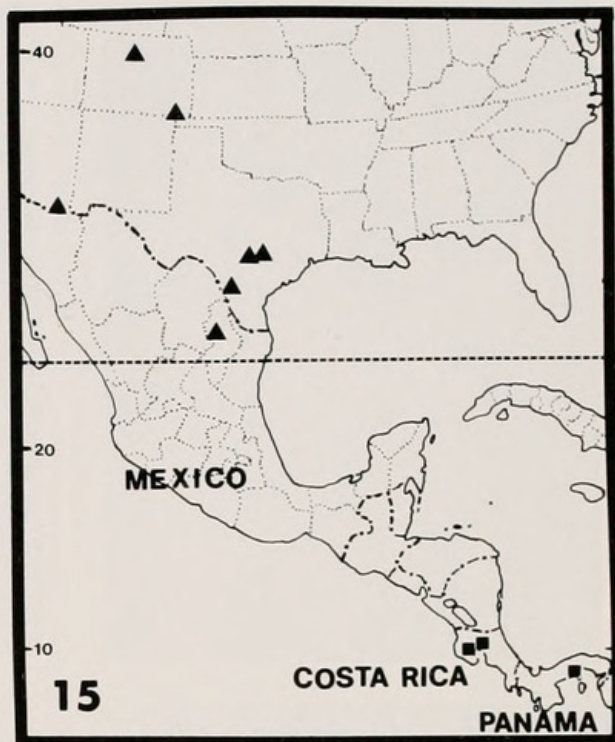


Fig. 15. Distribution of *Protophotopsis* (*Protophotopsis*): *venenaria* (triangles); *clauseni* (squares).

Subgenus *Protophotopsiella* Schuster

Protophotopsis (*Protophotopsiella*) Schuster 1949.
Type species: *Protophotopsis* (*Protophotopsiella*) *humeralis humeralis* Schuster.

Protophotopsis (*Protophotopsiella*) *humeralis* Schuster, New Status (Figs. 7, 9, 16)

Protophotopsis (*Protophotopsiella*) *humeralis humeralis* Schuster 1949:85–89. Holotype ♂: Capilla de Monte, Córdoba, Argentina (Zoologische Staatssammlung, Munich, Germany).
Huacotilla hepperi Casal 1962:261–263. Holotype ♀: Argentina, Córdoba, Morteros (AMNH), examined. **New synonymy.**
Huacotilla diaguita Casal 1962:263–265. Holotype ♀: Argentina, La Rioja Prov., Patquía (AMNH), examined. **New synonymy.**

Notes on Synonymy.—*Protophotopsis* (*Protophotopsiella*) *humeralis* Schuster is the only species of *Protophotopsis* known from Argentina, and the recognition of the female sex was based on coincident geographic distribution. A study of the female type specimens of *Huacotilla hepperi* Casal and *Huacotilla diaguita* Casal convinced us



Fig. 16. Distribution of *Protophotopsis* (*Protophotopsiella*): *sulcifrons* (triangles); *humeralis* (circles).

that they are synonymous. Casal (1962) points out that *H. diaguaita* differs from *H. hepperi* in the following trivial coloration differences: head integument coloration, ochreous with tints of pale red, while *H. hepperi* is dark red, almost black; tergum III lacks integumental maculae, present in *H. hepperi*, and tergum II has two inconspicuous maculae of pale pubescence, longitudinally oval, while *H. hepperi* lacks these inconspicuous maculae. The head integument coloration is variable even among specimens from a single locality, from red to dark brown, near black; the holotype of *H. diaguaita* has a pair of pale integumental maculae on tergum III, thus the description given by Casal is erroneous; in two of four females from Alemania, Salta, and in two of three females from Cordoba, we found that the highly inconspicuous pubescent maculae on tergum II are absent. Thus, we consider these variations in coloration and pubescence as

part of the intraspecific variability of the species.

Additional Material Examined.—ARGENTINA: Buenos Aires Prov.: Alberdi (sic, Alberti), Dec 11 1910, 1 ♂ (UMIC). Salta Prov.: Alemania, Jan 1983, Fritz, 1 ♀ (AMNH); Alemania, Feb 1983, Fritz, 4 ♀ (AMNH, MIUP). Córdoba Prov.: 3 ♀ (AMNH).

Distribution (Fig. 16).—Andean foothills and pampasic regions of Argentina, between 26 and 35 degrees of latitude South. Casal (1962) mentions that two females (as *H. hepperi*) were collected walking on grass in the gardens surrounding a private aerodrome, in Monteros, Argentina, about 3 PM.

Protophotopsis (*Protophotopsiella*)
sulcifrons (André), New Combination
(Figs. 4, 5, 11, 14, 16)

Ephuta sulcifrons André 1906:164–165. Holotype ♀: Brazil, Goiás (as Goyaz), Muséum National d'Histoire Naturelle, Paris, examined. *Incertae sedis*: Nonveiller 1990:89.

Protophopsis (Protophopsiella) humeralis rugosa Schuster 1949:89. Holotype ♂: Brazil, Chapada, Mato Grosso, about 14°8'S (Carnegie Museum, Pittsburgh), examined. **New Synonymy.**

Material Examined.—The finding of *Protophopsis (Protophopsiella) sulcifrons* in Bolivia represents a new country record, as this species was previously known only from the holotype from Brazil. BOLIVIA: El Beni, Beni Stn., Palm Camp, Savannah, 31 Jul 1988, 1 ♂ (MIUP).

Distribution (Fig. 16).—Known from Brazil and Bolivia.

Remarks.—The structural differences in integumental sculpturing on the sides of the propodeum in females and on the frons and vertex of males, are justification for recognizing *P. sulcifrons* and *P. humeralis* as separate species. Thus we consider *sulfifrons* to be a distinct species, and not just a subspecies of *humeralis*.

We have been unable to compare the genitalia of *sulfifrons* (Figs. 11, 14) with those of *humeralis* because we did not dissect the genitalia of the only male examined and, apparently, the genitalia of the holotype of *humeralis* was neither dissected nor discussed by Schuster.

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LITERATURE CITED

- André, E. 1906. Nouvelles espèces de Mutillides d'Amérique. (Hym.) *Zeitschrift für Systematische Hymenopterologie und Dipterologie* 6:161–169.
- Brothers, D. J. 1975. Phylogeny and classification of the Aculeate Hymenoptera, with special reference to Mutillidae. *The University of Kansas Science Bulletin* 50(11):483–648.
- Casal, O. H. 1962. Mutillidae Neotropicales XIV (Hymenoptera). Comentarios a propósito de *Huacotilla* gen. nov., con la descripción de dos especies nuevas. *Physis* 23:259–265.
- Krombein, K. V. 1979. Genus *Protophopsis*, p. 1301. In Krombein, K. V., P. D. Hurd, Jr., D. R. Smith, and B. D. Burks, eds. *Catalog of Hymenoptera North of Mexico*, Vol. 2 Apocrita (Aculeata). Smithsonian Institution Press, Washington, DC.
- Melander, A. L. 1903. Notes on North American Mutillidae, with descriptions of new species. *Transactions of the American Entomological Society* 29: 291–330.
- Menke, A. S. 1993. Notauli and Parapsidal lines: just what are they? *Sphecos* 24:9–11.
- Nonveiller, G. 1990. *Catalogue of the Mutillidae, Myrmosidae and Bradynobaenidae of the Neotropical Region including Mexico (Insecta: Hymenoptera)*. SPB Academic Publishing bv, the Netherlands, pp. 1–150.
- Schuster, R. M. 1947 (1946). A revision of the Sphaerophthalmine Mutillidae of America north of Mexico. *Annals of the Entomological Society of America* 39:692–703.
- Schuster, R. M. 1949. Contributions toward a monograph of the Mutillidae of the Neotropical Region. III. A key to the subfamilies represented and descriptions of several new genera (Hymenoptera). *Entomologica Americana* 24:59–140.
- Schuster, R. M. 1958. A Revision of the Sphaerophthalmine Mutillidae of America North of Mexico. II. *Entomologica Americana* 37:1–130.
- Viereck, H. L. 1903. A Group of Diurnal Mutillidae. *Entomological News* 13:249–251.



Cambra-Torok, Roberto A and Quintero, Diomedes. 1997. "A revision of Protophopsis Schuster (Hymenoptera: Mutillidae)." *Journal of Hymenoptera research* 6, 263–272.

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