

A REVISION OF THE SPHAEROPHTHALMINE MUTILLIDAE OF AMERICA NORTH OF MEXICO

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This revisionary paper is the result of study of over thirty thousand specimens of Photopsidinae Mutillidae, including all but a few of the types. In view of its length, it has been divided into a number of sections, each of which will deal with one group.

Our knowledge of the group, as it is in the literature, is very incomplete. Perhaps less than one-half of the North American species have been described. Most of those that have been described have been so briefly characterized that correct determination is practically impossible. The existing keys, utilizing largely superficial characters of no or little phylogenetic value, make determination of the described species a matter of chance. For these reasons, brief characterizations of the described species, based on the type, giving the salient characters that have been omitted in the original descriptions are given. For a description of the color characters and other superficial characters, the student is referred to the original diagnoses.

Since many species probably still await description, and since the status of the described forms is often largely a matter of conjecture, above all, since the males and females have been correlated in but a very few cases, a monographic study of the group is out of the question at this time. However, in the present treatment, an entirely different classification of the group is adopted, whose ramifications will be discussed in the second part of this paper, and some attempt has been made to arrange the groups phylogenetically. There are still many points regarding the relationships of and within the group that have to be settled, and no final, lasting classification of the genera can be attempted until the males and females have been correlated. It is to be hoped that this study, making determination of the species possible, will stimulate enough collecting and field observation, that sufficient material and enough data will accumulate to make correlation of the sexes possible.

Discussion of the taxonomy of the group, and keys to the genera and subgenera will follow in the next paper in this series.

At this point I would like to acknowledge assistance and encouragement given by Dr. J. C. Bradley, Dr. C. E. Mickel, Captain Harvey I. Scudder, Mr. and Mrs. Noah A. Bower, and many others, who have helped by donating or loaning material. Appreciation is expressed to my wife, Olga M. Schuster, without whose consistent help and encouragement this series of papers would not have been possible. I would also like to acknowledge my indebtedness to Dr. Henry Dietrich, to Dr. Nathan Banks, of the Museum of Comparative Zoology, to Dr. H. K. Townes, and to Dr. E. A. Chapin, of the United States National

Museum, to Dr. H. F. Schwartz, of the American Museum of Natural History, to Mr. C. F. Harbison, of the San Diego Museum of Natural History, to Dr. H. B. Parks, of the Texas State Apicultural Laboratory, to Dr. W. Dwight Pierce, of the Los Angeles County Museum, and to Dr. O. F. Cartwright, of Clemson College, South Carolina, for loan of material in the group. To these men, and the institutions they represent, as well as to all others who have helped by the loan or donation of specimens, I wish to render my thanks.

Genus *Protophotopsis* n. gen.

In working over extensive collections of the nocturnal Photopsidine Mutillidae, several specimens of a diurnal black, male Mutillid wasp were found. These specimens, representing an undoubtedly discrete new genus and species, are of interest in that they appear to represent a species of a relict genus, standing near the stock, or ancestral form, of the round-eyed New World Mutillidae. In its several primitive characters it approaches the hypothetical ancestral form, perhaps an invasion from the Old World, from which have evolved our largely nocturnal genera (*Photopsis*, *Sphaerophthalma*, etc.) on one hand, and several distinct lines of diurnal genera (*Pseudomethoca*, *Lomachaeta*, *Hopломutilla*, *Dasymutilla*, etc.), on the other hand. The genitalia of the present genus are very generalized, as can be seen by inspection of the figure, and differentiate it from all other Photopsidine wasps. In fact, in the general facies of the genitalia (digitus vosellaris longer than cuspis) it approaches nearer *Pseudomethoca* than the Photopsidines.

The lack of complete parapsidal furrows, short flagella, with the articles largely broader than long, long felt lines of the second sternite, nodose petiole, close, even sculpture, small ocelli, lack of plumose hairs, convex, poorly developed clypeal region, all indicate that we are dealing with a relatively generalized form. The genus is side-wise specialized, however, in regard to the prominent hyaline setae of the apices of the abdominal segments, which serve to adequately differentiate it from all other Mutillid genera known to me, except only the entirely unrelated *Rhopalomutilla*, which may have similarly, but less prominently developed setae.

Male: Head subquadrate, its width considerably less than that of the thorax, rather well-developed behind the eyes (length behind eyes considerably greater than length of eyes); mandibles obliquely tridentate apically, rather broad, carinate basally on dorsal margin, entire beneath, neither emarginate nor dentate; eyes subovate in outline, strongly convex, moderately large, distinctly faceted; clypeus convex, weakly developed, not produced anteriorly; antennal scrobes with a glabrous oblique tooth or ridge above; antennal tubercles prominent, not approximate; scape a sixth longer than the pedicel plus first two flagellar segments, with a strong, sharp carina running its entire length below; pedicel and first flagellar segments short, transverse, subequal in length, scarcely more than half as long as the elongate second flagellar segment; ocelli small, the maximum diameter of the posterior less than a fifth their distance from the eyes; punctures of head very close to confluent, moderately large, but not very coarse, deep, with well-defined narrow

intervals. *Thorax* evenly, closely punctured, with the pronotum provided with epaulets (a pair of micropunctate areas, somewhat depressed, bearing a rather prominent tuft of very fine silvery hairs, located somewhat mesad and apical of the humeri); mesonotum without a trace of parapsidal furrows; mesopleura evenly swollen, not evidently obliquely sulcate and divided into a dorsal and ventral region; mesosterna unarmed; metapleura with the dorsal depression on each side very marked, pit-like; tegulae small, convex, lacking any recurved or reflexed margin; propodeum evenly convex and closely coarsely punctured, not reticulated. *Abdomen* with the petiole considerably widened to apex (about two and one-fourth as wide at apex as at base), but moderately elongate (longer than wide apically), distinctly petiolate and nodose, the apical constriction of the tergite very marked, and the second tergite considerably narrowed to receive it; tergites one to five and sternites two to five each with a prominent subapical row of hyaline, colorless, curved, aciculate setae; the pubescence simple, sparse, erect; well-developed felt lines present on second sternite as well as on second tergite; puncturation of abdomen close, moderately coarse, deep. *Legs* with the paired white calcaria; the tibiae with the dorsal spines in apparently three rows of four or five to seven slender setae; tarsi with a weakly developed apical row of setae on each segment, but totally lacking any ventral rows of setae or spines. *Wings* with cell $R_1 + R_2$ less than half as wide as cell M_4 , less than two-fifths its area, not more than three-fifths its length; cell 2nd $R_1 + R_2$ acuminate apically, nearly three times as long as high; distance between origin of free part of vein M and the stigma scarcely over half the length of the stigma; free part of vein M one-third as long as $m-cu$; free part of M_{1+2} one-third as long as free part of M_{3+4} ; veins M_{1+2} beyond R_5 , M_1 and M_2 , and R_4 absent, or weakly indicated as color lines; cells R_6 and 1st M_2 thus not delimited; M_2 and m indicated as a color line.

Female: Unknown.

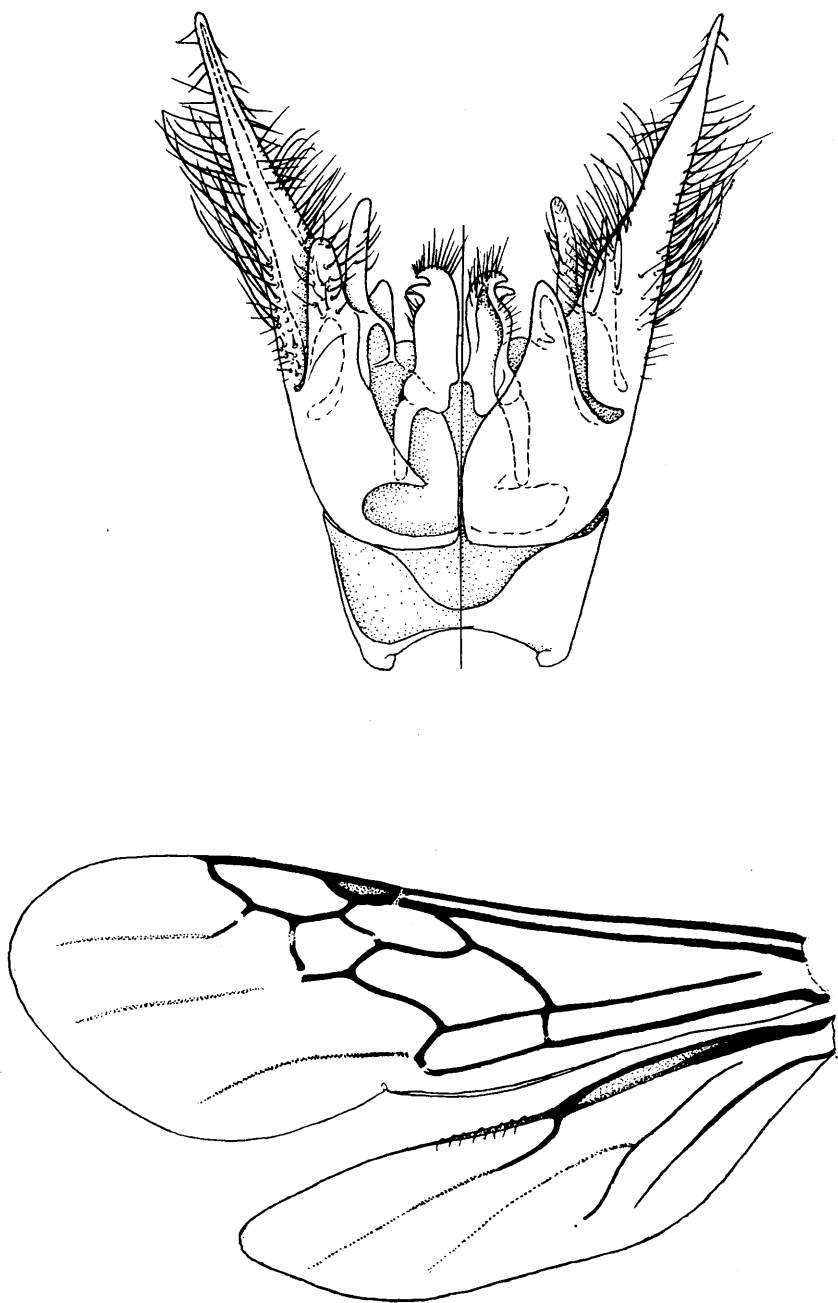
Genotype: *Protophopsis scudder*i, sp. n.

***Protophopsis scudder*i, sp. n.**

Male: Length 6.2 mm. Entirely black, with moderate, rather sparse evenly distributed erect silvery pubescence (except that of the notum of the thorax, and vertex of the head, and the apical tergites in large part infuscated); body evenly, densely, scarcely coarsely punctured.

Head subquadrate-rounded, its width slightly less than width of thorax at tegulae, well-developed behind eyes, closely, in part subconfluently punctured, rounded behind, the gula and genae and posterolateral angles not carinate. Mandibles and clypeus as in generic diagnosis, the latter distinctly punctured. Antenna short, none of the segments, except the scape and apical segment, more than a fourth longer than wide, the pedicel and first flagellar segments subequal, short, transverse; scape strongly, acutely, longitudinally carinate beneath, the rest of its surface densely hirsute and punctate. The eyes subovate, about a tenth longer than high, distinctly faceted, moderately large, quite convex. Ocelli very small, scarcely evident.

Thorax black, with rounded humeral angles, the pronotum rounded



Protophotosis scudderii. Fig. 1. Genitalia of paratype. Fig. 2. Wing venation (color lines indicated by dotted lines; heavily pigmented areas stippled).

into the side pieces, coarsely, closely punctured. Humeral epaulets distinct, a similar tuft of fine hairs on the side pieces of the pronotum on each side, near its posterior margins. Mesonotum convex, closely punctate, lacking parapsidal furrows; the swollen mesopleura evenly convex, lacking an oblique sulcus (i.e., not divided into dorso-anterior and ventro-posterior halves). Tegulae scale-like, small, evenly convex, polished on disk, the edges hirsute and punctate. Scutellum somewhat swollen medially, hardly gibbous, with large punctures (similar in size to those of mesonotum) on the central area, separated by polished intervals; the lateral areas on each side depressed, with some fine silvery pubescence. Metanotum medially nearly continuous with both scutellum and propodeum, and there with some coarse punctures separated by polished intervals; laterally depressed, very closely punctulate, with dense silvery appressed, fine hairs. Metapleura coarsely and irregularly punctured below, glabrous above and channeled, ending in a deep pit-like depression. Propodeum evenly rounded, closely, coarsely, but rather shallowly punctate, locally nearly reticulate, the punctures coarser than those of thorax; dorso-medially also with some scattered punctulations, bearing sparse silvery, decumbent hairs. Legs black, partly dark mahogany or dark piceous, with moderate silvery pubescence and white calcaria. Wings weakly infuscated, with dark brown veins and stigma, the venation as in the generic diagnosis.

Abdomen closely punctured, the apical sternites (except hypopygium) noticeably less coarsely so. Petiole as in generic diagnosis, ventrally coarsely, rather closely punctured, convex, anteriorly strongly laterally compressed and thus produced as a subdentiform, anteriorly directed, punctate ridge; not at all carinate ventrally. Tergites 1-5 and sternites 2-5 each with a distinct row of decumbent, apically twisted or bent setae, in addition to the sparse erect pubescence. Second tergite and sternite with silvery felt-lines, those of the sternites scarcely one-third the length of the segment, situated opposite the posterior half of those of the second tergite; thus not much over half as long as the latter. Second sternite not at all flattened, distinctly convex. Apical tergites closely, coarsely punctured, including the strongly convex last tergite, which has a narrow lateral and posterior margin that is nearly reflexed. Hypopygium coarsely, rather sparsely punctured, flat, the truncate anterior margin nearly impunctate and polished, however; basally, medially strongly depressed to form a transverse pit-like area at its juncture with the seventh sternite.

Genitalia: Parameres thick, cylindrical-tapering, heavy at base; basal section with long, strong setose hairs on the outer-lower face, the inner edges with much finer, but still rather long, equally dense vestiture. Aedeagus rather slender, at apex with two strong, sharp teeth, downward turned; at base ending in long slender falcate apodemes. Digitus volsellaris finger-like, cylindrical, about two-thirds longer than the short, more or less conical lobe-like cuspis volsellaris; the digitus not more than two-fifths the length of the parameres, however. Dorsal parameral plate ending in an obliquely truncate apical lobe on each side.

Holotype: Fedor, Lee Co., Texas, May 29, 1902 (Birkman), in the collection of the Museum of Comparative Zoology. Two paratopotypes, with the same data, one in the collection of the Museum of Comparative

Zoology, one in the author's collection. One paratype, Regnier, Colorado, June 6-8, 1919 (about 37 degrees north, 102 degrees, 50 seconds west, and 4500 feet altitude), in the collection of the American Museum of Natural History; one paratype, Cotulla, Texas, April 5, 1906 (F. C. Pratt), in collection of United States National Museum.

The genitalia ally this genus with the *Pseudomethocine* wasps in some ways, as can be seen by referring to the figures given by Mickel (Proc. U. S. Nat. Mus., 64: (Art. 15), pls. 1-4, 1924) but in the present genus the aedeagus appears to be better developed, the digitus (sagitta) is comparatively better developed, compared with the cuspis (volsella), nor are the two ever fused at base, as the drawings of Mickel indicate to be the case in *Pseudomethoca*. The general facies of the genitalia, as well as the similarity in shape of the cuspis volsellaris and the parameres indicates that this genus is perhaps allied to the primitive species of *Pseudomethoca*. *Sphaerophthalma* and its allies, can at once be told from both these genera by the fact that the cuspis is always distinctly longer than the digitus, and by the primitively slenderer parameres.

RELATIONSHIP WITH OTHER GENERA

The genus *Protophotopsis* combines a number of primitive characteristics, occurring in both *Sphaerophthalma* and its allied supra-specific groups, on one hand, and in *Pseudomethoca*, *Lomachaeta*, and *Dasymutilla*, on the other hand. The small ocelli, short flagellum, lack of plumose hairs, general structure of the genitalia suggest a distinct relationship with the latter group of genera. The total absence of any ventral mandibular excision or tooth, which is certainly to be interpreted as a secondary condition, allies it to our other diurnal Mutillid genera, except *Lomachaeta*, which in the ventral emargination of the mandibles occupies a very isolated position, as regards the Dasymutilline-Pseudomethocine complex of genera; the total absence of parapsidal furrows also allies *Protophotopsis* to the diurnal complex of genera. From all of these it differs strikingly in the well-developed felt lines of the second abdominal sternite, which ally it to the *Sphaerophthalmine* wasps. We are dealing here, however, with possibly isolated retention of a very primitive characteristic—the ventral felt lines—while there has been much divergence in other characters. The form of the petiole, the sculpture, the erect vestiture, mostly silvery and sparse, all give the genus a distinct resemblance to the *Sphaerophthalmines*—at least to the more primitive forms with close sculpture that lack plumose hairs and have very short, incomplete parapsidal furrows.

It is thus apparent that we are dealing with a relict genus here, that has independently retained the felt lines of the second sternite—a characteristic it shares only with the *Sphaerophthalmines*, with *Pseudophotopsis*, and with a very few other of the genera with small tegulae and round or oval, non-emarginate eyes. The fact that a single species is known, and that the genus will certainly consist of no more than a very few species, when fully known, also indicates that we are dealing with a relict, isolated generic type, evidently not very successful and apparently not very able to compete with other groups today.

The possession of ventral felt lines places the genus in a position somewhat near the base of the Dasymutilline-Pseudomethocine develop-

mental lines, as well as somewhat near the Sphaerophthalmine line of development. The fact that in its lack of specialization towards a nocturnal condition *Protophotopsis* is more generalized than the Sphaerophthalmines has been the cause for selecting the present name. At the same time a direct ancestral relationship to the Sphaerophthalmines is not implied: the writer simply wishes to indicate that in many of its characters the new generic type lies close to the ancestral type of *Sphaerophthalma* and *Photopsis* and the rest of that complex. In the loss of all trace of a ventral mandibular excision *Protophotopsis* must certainly be regarded as more specialized than the Sphaerophthalmines.

Protophotopsis differs from all of the North American genera in the possession of distinct, hyaline, colorless curled setae, occurring in regular rows, one per abdominal segment. The setae are very similar to those found in some *Tiphiidae* (*Paratiphia*) and to those occurring in *Rhopalomotilla* (or at least some species of that genus). In the possession of subapical rows of setae of the abdominal tergites and sternites the present genus agrees with *Lomachaeta* Mickel. It differs from *Lomachaeta* entirely in the nature of these setae, as well as in other significant characters.

Mickel, in his original diagnosis of *Lomachaeta* (Annals Ent. Soc. Amer., Vol. 29, p. 289, 1936) says that this genus is "related to *Dasytomutilla* and *Pseudomethoca*"; examination of two males and a single female, kindly loaned by Dr. Mickel, also brings out the fact that there is some relationship to the Sphaerophthalmines, though less close. The original generic diagnosis of *Lomachaeta* only brings out the following differences from *Protophotopsis*: *Lomachaeta* has the mandibles emarginate below, *Protophotopsis* has them entire; eyes subovate in *Lomachaeta*, nearly circular in *Protophotopsis*; felt lines of second sternite absent in *Lomachaeta*, well-developed in *Protophotopsis*; stigma of fore-wings of *Lomachaeta* much reduced, well-developed in *Protophotopsis*.

In view of the brevity of the original diagnosis of *Lomachaeta*, it thus seems worth-while to indicate what additional differences there exist between the two genera, which are not at all closely related, and to stress certain other generic characters of *Lomachaeta* not brought out in the original description.

The female of *Lomachaeta* is strikingly different from other related genera in that the head is nearly globose; the very coarse sculpture and reticulation of the dorsum of the head and thorax are different from all other North American forms except that those of certain Sphaerophthalmines; the shape of the petiole also is quite similar to that found in some Sphaerophthalmine males and females. A somewhat indefinite indication of a suture, immediately anterior to the metathoracic tubercles bearing the spiracles, as seen in the allotype of *L. hicksi*, appears to be primitive, and differentiates it from the Sphaerophthalmines. The shape of the thorax (elongate-obpyriform) is similar to that of some females of *Sphaerophthalma*.

The males examined (paratypes of *L. hicksi* and *coloradensis*) also have the head quite inflated, but dorsoventrally so, the head looming far above the eyes, as seen from a lateral view; seen from above, the head is quite transverse, and the temples are not at all full; the head is extremely short behind the eyes, the length of the vertex behind the

eyes being less than a fourth the length of the prominent eyes. The eyes are very large, oval-hemispherical (much more prominent than in *Protophotopsis*). In *Protophotopsis*, on the other hand, the head is much fuller in the temples, and transverse-rectangular in dorsal outline; the vertex behind the eyes is longer than the length of the eye; the head is not evidently swollen. The sculpture of the head in *Lomachaeta* males varies from rather distant and very coarse to rather close to confluent and very coarse; in both cases the punctures are not sharply defined; in *Protophotopsis* the punctures are small, regularly and evenly distributed, close, and well-defined.

The thorax of both genera agrees in that the parapsidal furrows of the mesonotum are absent; a fact not brought out in the original diagnosis of *Lomachaeta*. Both genera agree with the other, more or less closely related genera in the group (*Photopsis*, *Sphaerophthalma*, *Pseudomethoca*, *Dasymutilla*) in that the anterodorsal margin of the pronotum has a tuft of fine, backward decumbent, silvery hairs, slightly mesad of the humeral angles; these I term the "epaulets." The epaulets appear to be of great significance in the taxonomy of the group; the position of similar areas, near the dorso-posterior corners of the side pieces of the prothorax in some groups (notably some species of *Photopsis* and *Dasymutilla*) is significant. The form, number and position of the epaulets separate the North American round-eyed Mutillidae (except Myrmilloides) from the *Pseudophotopsidinae*, which have depressed areas bearing fine hairs near the lower edge of the side-pieces of the prothorax, and from numerous other Old World genera of *Mutillinae*, that lack them.

The petiole of *Protophotopsis* is much more elongate and strongly nodose, by comparison to the shorter, subsessile petiole of *Lomachaeta*; the latter has the petiole small, not strongly convex, and separated by a very slight constriction from the second tergite. The setae occurring at the apices of the abdominal segments of *Protophotopsis* are entirely different in nature from the hairs occurring just basad of them, and do not intergrade with them; they are furthermore hyaline, twisted, apicad-directed, and decurved or curled under at the tips. In *Lomachaeta*, on the other hand, the setae are clearly derived from hairs; they are black, directed mesad, nearly straight except that their insertion is oblique and they are down curved basally, but straight apically; they are much larger on tergites 2-3 than those of *Protophotopsis*, but on the apical tergites and on all the sternites are scarcely distinct in size from the regular hairs, and differ from them only in being decumbent. The regular rows, of both tergite and sternite, of hyaline apical setae, directed backward, of *Protophotopsis* thus cannot be compared to the sparser, opaque, black setae of *Lomachaeta* that decrease in size as one approaches the lateral margins of the tergites, are directed mesad, and form a distinct V medially; the derivation of these setae from regular hairs is perfectly apparent on the ventral segments, and on the apical tergites.

The sculpture of the abdomen of *Lomachaeta*, especially of segments one and two, is very sparse, very coarse, and consists of poorly defined punctures; the abdomen of *Protophotopsis*, like the rest of the body, is closely, regularly, finely punctured.

THE POSITION OF THE GENUS AND ARRANGEMENT OF
THE NEW WORLD MUTILLIDAE¹

The neogaenic Mutillidae may be tentatively arranged as in the following table. This arrangement leaves most of the Old World types out of consideration (unless they have a direct bearing on the classification of our genera). The position of these groups will be more fully treated in a separate contribution, in which the comparative morphology of the genitalia will be discussed.

The above relationship may be outlined as follows, in accordance with the lettering used in the following table:

TABLE A
RELATIONSHIP OF SOME OF THE CHIEF MUTILLID TYPES, AND OF
THE NEW WORLD GENERA²

M U T I L L I D A E <i>Apterogyninae</i>		h'	<i>Apterogynini</i> <i>Apterogyna</i>		
				h	i' { <i>Chyphotes</i> <i>Typhoctes</i> ?	
	a'	S P H A E R O P H T H A L M I N A E	d''..... <i>Anommotilla</i>			
			-d	eSphaerophthalmine complex— <i>Sphaerophthalma</i>	
				e' <i>Protophlopsis</i>	
				e''Pseudomethocine complex. { <i>Pseudomethoca</i> <i>Myrmilloides</i> <i>Hoplomotilla</i> <i>Pappognatha</i> <i>Hoplocrates</i> etc.	
	a	P S E U D O P H T O P S I D I N A E		c	e'''Dasymutilline complex..... { <i>Dasymutilla</i> <i>Traumatomutilla</i>
			b		e'''' <i>Lomachaeta</i>
					d'...? <i>Rhopalomutilla</i> (position doubtful)
	E	M U T I L I N A E	c'	f		
					g'	g { <i>Timulla</i> (and the entire Timulline-Smicro- myrmine-Mutilline complex with sessile petioles and large tegulae and emarginate facetted eyes).
					g' { <i>Ephu- tomma</i> <i>Ephuta</i>	

¹There has been no general attempt at a classification of the Mutillidae since the disastrous attempt by Ashmead (1903-1904) and the scarcely more satisfactory arrangement by Andre (1903), excepting only the regional classifications of Bradley (1916) and Bischoff (1920). Since there is no accepted classification of the

Mutillidae.—Primitively with felt lines of both second tergite and sternite; mandibles primitively ventrally excised; tegulae primitively small, subcircular, impunctate, not reaching beyond mesonotum; parapsidal furrows primitively absent or incomplete; tarsal claws primitively armed with a tooth within; anal lobe of hind wings primitively present. Female primitively wingless, with the pro-mesothoracic suture distinct, and with distinct ocelli; tarsal claws armed.

- a. Petiole formed by both tergite and sternite, the tergite extending to base of segment; ocelli of female retained; pro-mesothoracic suture of female retained; anal lobe of male retained; aculeus of hypopygium not present in male; long felt lines of both tergite and sternite retained, at least in male; male with extensive depressed, densely felted area at lower angles of side-pieces of thorax. (*Male retains tooth on inner side of tarsal claw*),

Pseudophotopsidinae (including only **Pseudophotopsis**)

- b. Tooth of tarsal claws lost in male; anal lobe of male hind-wings lost; extensive felt-like area (epaulets) of lower angle of side pieces of male prothorax lost (or never developed).
- c. Petiole remains primitively slender, petiolate; eyes with emargination not developed as a sharp notch (except for *Rhopalomutilla*, which may belong elsewhere); tegulae never becoming large and conchiform, remaining rounded and small; eyes usually losing strongly developed facetation,

Sphaerophthalminae

- d. Eyes totally losing any indication of a notch of inner orbits; middle tibiae retain two calcaria; antennal tubercles retained; felt lines not totally lost.
- e. Felt lines of sternite two of abdomen primitively retained; petiole except secondarily) remains more or less nodose; antennal scrobes develop a small tooth or tubercle in male; parapsidal furrows more or less distinct; plumose hairs generally developed; largely nocturnal; ventral mandibular excision retained,

Sphaerophthalmine complex (**Sphaerophthalma**)

- e'. Felt lines of sternite two retained; parapsidal furrows absent; hyaline curled setae developed on abdomen; petiole remains nodose; ventral mandibular excision lost; no scrobal tooth; diurnal; antennae short, first flagellar transverse. **Protophotopsis** n. g.
- e". Felt lines of sternite two lost; petiole becomes sessile; parapsidal furrows absent (generally); mandibular excision lost; antennal scrobes carinate but not toothed, occasionally not carinate; no special vestiture developed on abdomen (but with tendency to develop spatulate hairs); head usually large and quadrate, with well-developed tendency to develop gular and hypostomal processes; antennae not with first flagellar transverse, short,

Pseudomethocine complex.

(**Pseudomethoca**, **Myrmilloides**, **Hoplocrates**, **Pappognatha**, **Hoplomutilla**, **Tilluma**, **Attilum**, **Euspinolia**, etc.).

- e"". Felt lines of second sternite lost; petiole remains slender, more or less petiolate; parapsidal furrows absent; mandibular excision lost; antennal scrobes of male not defined above; never with special

family the following is proposed as a tentative arrangement, for the criticism of the co-workers on the group. The use of the presence of an inner tooth of the tarsal claws, or its absence, the nature of the epaulets, or their absence, and several other characters represent innovations; these have thrown further light on relationships within the group, which, together with the accumulated perspective of the last generation make a new attempt at a classification of some value. More emphasis on the nature and development of the felt lines, the ventral mandibular tooth, the tegula size, development of anal lobes of the wings, and the eye-shape also result in an entirely different arrangement than heretofore given.

²This table utilizes a number of new concepts in the relationships existing within the family; these concepts will be discussed at greater length and in more detail in a separate forthcoming paper.

vestiture anywhere; head not becoming large and quadrate, no tendency for ventral processes or carinae; antennae with first flagellar not transverse,

Dasymutilline complex, (**Dasymutilla**, **Traumatomutilla**)

- e^{'''}. Felt lines of second sternite lost; petiole remains slender, petiolate; parapsidal furrows absent; mandibular excision retained; antennal scrobes not defined above; with development of unique abdominal stiff bristles; head not becoming large, more or less globose; no tendency for ventral processes or carinae; first flagellar segment like pedicel, transverse. **Lomachaeta**

- d'. Eyes develop a deep notch, but petiole stays slender, nodose in male; tegulae small; felt lines totally lost in both sexes; antennal tubercles normal; middle tibiae retain two calcars (Exotic),

Rhopalomutilla (position doubtful)

- d^{''}. Eyes reniform-oval, as is *Pseudophotopsis*, shallowly and broadly emarginate on inner orbits; antennal tubercles become obsolete; one calcar of middle tibiae lost; felt lines of second sternite lost; petiole slender; tegulae small,

Anommutilla (position doubtful, perhaps belonging in separate family)

- c'. Tegulae becoming large, more or less conchiform or expanded, often with slightly revolute edges, reaching to or beyond apex of mesonotum; petiole becoming broad and sessile, transverse; eyes always with strong facetation, ovate or reniform, sharply notched within. **Mutillinae** (s. str.)³
(f. Petiole slender, nodose; felt lines entirely lost; tegulae small; female loses all trace of ocelli and dorsal sutures of thorax; felt lines lost,

Rhopalomutilla (position doubtful, in all probability in or near *Sphaerophthalminae*).

- f'. Petiole stout, broad, strongly dilated (in the single isolated genus *Ephula* secondarily becoming small, but there cylindrical and not nodose); felt lines of both tergite and sternite retained; tegulae very large; female retains pro-mesothoracic suture and to a lesser degree the metathoracic-propodeal suture) and ocelli; at least second tergite retains some indication of felt lines, in some species of all genera. . . **Mutillinae**: the archaic genus **Ephutomma** (exotic; ancestral to the following two types).⁴

- g. Petiole remains strongly dilated and sessile; felt lines of second sternite primitively retained, those of second tergite unmodified; male with abdominal tergites not longitudinally, medially

³The separation into two basic developmental lines, based on tegula size and essential petiole shape, is believed to be fundamental. Correlated with these characters is the nature of the eye, which is always distinctly faceted, more or less ovate to reniform in shape in the Mutillinae. Whether these two developmental lines, each of which includes several tribes, or generic complexes, should be given subfamily rank is very doubtful. The name *Photopsidinae* could be used for the round-eyed complex with small tegulae were it not for the fact that *Photopsis* is not generically distinct from *Sphaerophthalma* as will be shown elsewhere. This matter will be discussed at greater length in a future contribution.

⁴Bischoff (1920, p. 23) indicates that *Ephutomma* possesses an anal lobe in the male sex; he furthermore (p. 95) stresses the existence of exceedingly close relationship between the latter genus and *Pseudophotopsis*, and states: "Es wäre . . . zu erwägen, ob man nicht die Gattung *Ephutomma* besser also Untergattung zu *Pseudophotopsis* stellen würde. . . ." I do not find that there is any such close relationship between the two genera in question. The absence of an inner tooth of the tarsal claws in *Ephutomma*, the absence of any anal lobe in the male of that genus, as well as the large tegulae, more strongly notched eyes, and decidedly more strongly dilated, not sub sessile or subpetiolate first abdominal segment indicates that there is no close relationship, except for such as is inherent in both genera as regards retention of many primitive characteristics. How Bischoff arrived at the idea that *Ephutomma* has an anal lobe in the hind wing is inexplicable, unless, indeed, he has mistakenly included a species of *Pseudophotopsis* in *Ephutomma*, and based his key on this; however, he does not mention the existence of an anal lobe in his generic diagnosis of *Ephutomma* (o. c., pp. 146-148).

carinate. (Ocelli and all dorsal thoracic sutures of female lost),

Tribe *Mutillini*⁵

- g'. Petiole becomes subterete, much narrower than second segment, subcylindrical; felt lines lost (except for a retention of a modified felt line, in the form of a pit, in some species, on tergite two); male with abdominal tergites 5-7 at least longitudinally carinate. (Ocelli and all dorsal thoracic sutures of female lost.),

Tribe *Ephutini* (*Ephuta*)

- a'. First tergite reduced, absent anteriorly, the anterior part of the petiole formed by sternite one alone; ocelli of female lost; pro-mesothoracic suture of female retained throughout; anal lobe of male hind wings retained throughout; hypopygium of male always armed with an aculeus; felt lines strongly reduced to a small tuft in both male and female, on second tergite; male in all forms retains a distinct tooth of the inner side of the tarsal claws; epaulets lost; male lacks parapsidal furrows; ventral mandibular excision and tooth never developed (or lost). Subfamily **Apterogyninae**

- h. Wing venation not extremely reduced; second abdominal segment not strongly constricted at apex,

Tribe *Chyphotini* (*Chyphot*)

- h'. Wing venation extremely reduced, limited to basal third of wings; second abdominal segment strongly constricted at apex in both sexes,

Tribe *Apterogynini* (*Apterogyna*, exotic)

⁵Bischoff (1920, p. 23) recognizes three tribes here, the *Mutillini*, *Trogaspidini*, and *Smicromyrmini*. It is the writer's belief that the extreme abundance of closely allied types in these groups led Bischoff to attempt a separation here simply because the extreme development of this line in Africa made a separation of some sort desirable, purely as a matter of convenience; no such separation is at all warranted, and the tribal characteristics employed by Bischoff are in part not even of generic value, vide Bradley and Bequart, 1923.

THE LONG-HORNED BEETLES OF OHIO (COLEOPTERA: CERAMBYCIDAE), by JOSEF N. KNULL. Ohio Biol. Surv. Bull. 39, vol. 7, No. 4, pp. 133-354, Pls. 1-28. Ohio State University Studies. Columbus, Ohio, 1946. Price, \$1.00.

This work should be at the right hand of everyone who is interested in Coleoptera or who has occasion to identify Cerambycidae from Ohio or the surrounding states. It includes keys and descriptions of 262 species falling in 112 genera, of 46 tribes of the 6 subfamilies of North American Cerambycidae. Included are species known to occur in Ohio as well as many that are likely to occur. As a result of the geographical location of Ohio, its utility extends far beyond the bounds of the state. The descriptions are concise and comparative, designed for a maximum of usefulness. The synonymical bibliographies are presented in a somewhat unorthodox manner but the references cited, in general, include those which are most useful in understanding the species. The terminal bibliography will prove helpful to students of the Cerambycides anywhere in North America.

The work is beautifully illustrated and the drawings, from the pen of Mr. Knull himself, are a most valuable and lasting feature of the publication. To those who have had the privilege of seeing the beautifully mounted and meticulously arranged personal collection of Mr. Knull, this should come as no surprise. His collection reveals the fact that he is an artist! The illustrations include 118 drawings and 2 plates of photographs. The drawings in a few cases involve anatomical details but mostly represent the whole insect. The author has so well caught the facies peculiar to the various species that the specialist can readily recognize them without reference to the explanation of plates. The publication will be useful not only to advanced students of the Cerambycidae but should be an invaluable asset to beginners and to those unfamiliar with the family.

—E. G. LINSLEY.