

Studies of Gymnomyzinae (Diptera:  
Ephydridae), V: A Revision  
of the Shore-Fly Genus  
*Mosillus* Latreille

WAYNE N. MATHIS,  
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and  
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Studies of Gymnomyzinae (Diptera:  
Ephydridae), V: A Revision of the Shore-Fly  
Genus *Mosillus* Latreille

*Wayne N. Mathis, Tadeusz Zatwarnicki,  
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## ABSTRACT

Mathis, Wayne N., Tadeusz Zatwarnicki, and Marina G. Krivosheina. Studies of Gymnomyzinae (Diptera: Ephydriidae), V: A Revision of the Shore-Fly Genus *Mosillus* Latreille. *Smithsonian Contributions to Zoology*, number 548, 38 pages, 89 figures, 3 tables, 1993.—Species of *Mosillus*, which now number six, are revised. The following new species is described (type locality in parentheses): *Mosillus asiaticus* (China. Gansu: Ruo shui, S. Alashan', Gobi). The monophyly of *Mosillus* within the tribe Gymnomyzini is demonstrated, and a hypothetical phylogeny of the included species is generated from a matrix of 13 characters. From this phylogeny, a classification of two species groups, the *tibialis* and *subsultans* groups, is proposed and diagnosed. Species of the *tibialis* group occur in the New World and those of the *subsultans* group in the Old World. Maps, keys to subgenera and species, detailed distributional data, and illustrations (scanning electron micrographs, line, and scratchboard drawings) are provided to assist in the identification of the species.

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# Studies of Gymnomyzinae (Diptera: Ephydriidae), V: A Revision of the Shore-Fly Genus *Mosillus* Latreille

Wayne N. Mathis, Tadeusz Zatwarnicki,  
and Marina G. Krivosheina

## Introduction

Among genera now included in the Ephydriidae, only the genus-group name *Ochthera* Latreille (1802) was described before *Mosillus* Latreille (1804), the subject of this revision. Although both genera are now included in the Ephydriidae, they were originally proposed in the family Muscidae. Moreover, the senior synonym of the type species of *Mosillus*, *Syrphus subsultans* Fabricius, was first described in the family Syrphidae, as indicated by the original generic and species combination, and that species remained in the Syrphidae for several years thereafter. Schiner (1863), based on superficial and convergent similarities, mistakenly placed *Mosillus* in the family Chloropidae. That precedent was followed by several European workers, mostly in faunistic papers that usually cited Schiner or in which his keys were used. Most authors since Loew (1860) have recognized its correct affiliation within the shore-fly family Ephydriidae.

Although *Mosillus* is the second oldest genus-group name in the Ephydriidae, few valid species are now included in the genus. Here we include only six. During the nineteenth century, however, the genus-group name *Mosillus* and its junior

synonym, *Gymnopa* Fallén, were somewhat of a “dumping grounds” for species names of many small, shiny-black flies. As a result, a number of shore-fly species that are now in other genera were originally described in *Mosillus* or especially in *Gymnopa*, which was then the more commonly used genus-group name. Even today a number of names that were originally described in *Mosillus* or its synonyms and for which primary types are now lacking (lost or destroyed) are still listed as nomina dubia in this genus (see listing on p. 35). Although the zoological and nomenclatural status of these species and their names continues unresolved, it is doubtful that any, with the possible exception of *Gymnopa frontina* Costa, is a member of *Mosillus*. Thus, we have not considered them in this paper except to list them.

Our purpose in revising *Mosillus* is several fold. The first is to treat the genus and its included species on a comprehensive, worldwide basis. Although *Mosillus* is relatively widespread, with species occurring on most major continental areas that have temperate or tropical climates, the genus has never been treated on a worldwide basis. Another purpose for this revision is to clarify the phylogenetic position of the genus within the tribe Gymnomyzini, especially with related genera that may function as ecological equivalents in areas where *Mosillus* does not occur. As part of the phylogenetic study, and within that context, we also recharacterize the genus. Among other characters we use in the generic diagnosis and description are several synapomorphies that establish the monophyly of the genus.

As noted previously, the genus is relatively widespread in temperate or tropical climates. An exception to this generalization is its apparent absence, perhaps secondarily, in the Oriental and Australasian regions. In these regions, however, related genera in Gymnomyzini, such as *Chaetomosillus* Hendel, *Chlorichaeta* Becker, *Gymnopiella* Cresson, and *Hoploaegis* Cresson, may have replaced it as ecological equivalents.

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Although no comprehensive study of the genus exists, the following authors on a regional basis have treated *Mosillus*: Afrotropical (Cresson, 1946b), Nearctic (Cresson, 1922; Wirth, 1969), Neotropical (Cresson, 1946a), and Palearctic (Becker, 1896, 1926). Most of these studies are now badly out of date and include taxa that have been transferred to other genera.

The immature stages and natural history of *Mosillus* are virtually unknown except for information on habitats where adults occur. Collection records indicate that adults are found in an unusually wide variety of habitats from maritime beaches to high mountain meadows. The aquatic system from habitat to habitat likewise varies from being completely fresh water to highly saline or alkaline. Although we have collected specimens from nearly pristine habitats, we have found them more commonly where the environment is disturbed and sometimes highly polluted.

**METHODS.**—The methods used generally in this study were explained previously (Mathis 1986, Mathis and Zatwarnicki 1990a). Because specimens are small, usually less than 4 mm in length, study and illustration of the male terminalia required use of a compound microscope.

Although we have followed the terminology for most structures of the male terminalia that other workers in Ephydriidae have used (see references in Mathis, 1986, and Mathis and Zatwarnicki, 1990a, 1990b). Zatwarnicki (1992) advocated usage of the term dististylus rather than surstylus, largely based on an hypothesis advanced by Hennig (1936). The merits of Hennig's hypothesis are still being debated, and here we continue to use surstylus. In papers for which Zatwarnicki is first author, however, dististylus will be used. The terminology for structures of the male terminalia is provided directly on Figures 13–18 (*Mosillus bidentatus*) and is not repeated for comparable illustrations of other species.

Four ratios (two are venational) are used commonly in the descriptions and are defined here for the convenience of the user (ratios are averages of three specimens).

1. Frons width-to-length ratio: Frons length/frons width. The length is measured from the anterior margin of the frons to the posterior margin of the posterior ocelli. The width is measured at the level of the anterior ocellus. Both measurements are maximum distances.

2. Eye-to-cheek ratio: Genal height/eye height. Measurements are taken from the head in lateral view.

3. Costal vein ratio: The straight line distance between the apices of  $R_{2+3}$  and  $R_{4+5}$ /distance between the apices of  $R_1$  and  $R_{2+3}$ .

4. M vein ratio: The straight line distance along vein M between crossveins (r-m and dm-cu)/distance apicad of crossvein dm-cu.

The phylogenetic analysis was performed with the assistance of Hennig86 (copyrighted), a computerized algorithm that produces cladograms on the basis of parsimony. Before performing the analysis, the character data were arranged in

transformation series and then polarized, primarily using outgroup procedures.

**ACKNOWLEDGMENTS.**—Although this study was based in large part on specimens in the National Museum of Natural History, numerous others were borrowed, particularly type specimens of the species previously described. To our colleagues and their institutions listed below who loaned specimens, we express our sincere thanks. Without their cooperation this study could not have been completed.

- |      |  |
|------|--|
| AMNH | American Museum of Natural History, New York, New York (Dr. David A. Grimaldi and Mr. Julian Stark)                                    |
| ANSP | Academy of Natural Sciences of Philadelphia, Pennsylvania (Drs. Jon K. Gelhaus and Donald Azuma)                                       |
| BMNH | The Natural History Museum (formerly the British Museum (Natural History)), London, England (Dr. Brian Pitkin)                         |
| CAS  | California Academy of Sciences, San Francisco, California (Dr. P.H. Arnaud, Jr.)   |
| DBH  | Personal collection of Dr. David B. Herbst, Sierra Nevada Aquatics Research Laboratory, Mammoth, California                            |
| HNHM | Hungarian Natural History Museum, Budapest, Hungary (Dr. László Papp)  |
| MBP  | Personal collection of Dr. M. Barták, Prague, Czechoslovakia   |
| MCZ  | Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts (Dr. David G. Furth)                                       |
| MZUF | Museo Zoologica Università Firenze ("La Specola"), Florence, Italy (Ms. Sarah Mascherini)  |
| NMP  | Natal Museum, Pietermaritzburg, South Africa (Dr. Jason Londt and Mr. A.E. Whittington)  |
| NMW  | Naturhistorisches Museum, Vienna, Austria (Dr. Ruth Contreras-Lichtenberg)   |
| SMN  | Staatliches Museum für Naturkunde in Stuttgart, Stuttgart, Germany (Dr. Hans-Peter Tschorsnig)   |
| TAU  | Tel Aviv University, Tel Aviv, Israel (Dr. Amnon Freidberg)  |
| USNM | former United States National Museum, collections in the National Museum of Natural History, Smithsonian Institution, Washington, D.C. |
| USU  | Utah State University, Logan, Utah (Dr. W. Hanson)   |
| UTA  | University of Texas, Austin, Texas (collection on long-term loan at the Smithsonian Institution, Washington, D.C.)                     |
| UZMC | University Zoologisk Museum, Copenhagen, Denmark (Drs. L. Lyneborg and T. Pape)  |
| WSU  | Washington State University, Pullman, Washington (Dr. Richard Zack)  |



ZIL	Zoological Institute, Lund University, Lund, Sweden (Drs. Hugo Andersson and Roy Danielsson)
ZISP	Zoological Institute, Academy of Sciences, St. Petersburg, Russia (Dr. V. Zaitzev)
ZMHU	Zoologisches Museum, Humboldt Universität, Berlin, Germany (Dr. H. Schumann)
ZMUM	Zoological Museum of Moscow University, Moscow, Russia (Dr. A.L. Ozerov)
ZT	Personal collection of Dr. Tadeusz Zatwarnicki, Wroclaw, Poland

H.B. Williams prepared the distribution maps; Susann G. Braden and Vickie Godwin assisted with the scanning electron microscopy, and Victor Krantz assisted with production of the photographs; and Elaine R.S. Hodges inked line illustrations,

and using scratch board, prepared the illustrations of *M. stegmaieri* and *M. bracteatus* (Figures 20, 21, 64–66). For reviewing a draft of this paper, we thank R.V. Peterson. We are also grateful to David Challinor, former Assistant Secretary for Research, Smithsonian Institution, and Stanwyn G. Shetler, Deputy Director of the National Museum of Natural History, for financial support to conduct field work and study primary types through grants from the Research Opportunity Fund. Funding from a Short-term Visitors Grant provided T. Zatwarnicki with assistance for a month-long visit at the Smithsonian Institution to conduct the research resulting in this paper.

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### Tribe GYMNOMYZINI Latreille

#### Key to Genera of the Tribe Gymnomyzini

1. Anterior and posterior notopleural setae present . . . . . 2  
Anterior notopleural seta lacking . . . . . 6
2. Pseudopostocellar setae well developed, length subequal to inner vertical seta; arista with several short hairs along dorsum, none wider than basal arista width . . . . . *Chaetomosillus* Hendel  
Pseudopostocellar setae either greatly reduced or lacking; arista bearing 3–8 longer hairs along dorsum, longest hairs longer than width of anterior ocellus . . . . . 3
3. Anal lobe of wing almost straight . . . . . *Hoploaegis* Cresson  
Anal lobe of wing distinct, forming a rounded angle . . . . . 4
4. Alula wide, width greater than subcostal cell, and auriculate; face below antennal grooves evenly convex and completely transversely wrinkled to form series of depressions . . . . . *Cerometopum* Cresson  
Alula narrow, width less than subcostal cell; face usually with a mid facial prominence or if convex not wrinkled as above . . . . . 5
5. Fore femur with a stout seta along posteroventral surface toward apical  $\frac{1}{3}$ ; lacking prescutellar acrostichal setae . . . . . *Athyroglossa* Loew  
Fore femur lacking any stout setae along ventral surface; a prescutellar acrostichal seta present . . . . . *Trimerogastra* Hendel
6. Arista bearing 4–9 moderately long hairs along dorsal surface, length of hairs considerably greater than basal arista width; alula narrow . . . . . 7  
Arista appearing essentially bare, any hairs present short, length less than basal arista width; alula wide, auriculate . . . . . 9
7. Face in lateral view concave, lacking a median facial projection; knob of halter mostly black . . . . . *Platygyrnopa* Wirth  
Face in lateral view protrudent, with a median facial projection; knob of halter pale, mostly whitish . . . . . 8
8. Fore femur slightly enlarged, but not twice width of middle and hind femora; ocellar seta moderately well developed, length less than inner vertical seta; outer vertical seta absent . . . . . *Gymnopiella* Cresson  
Fore femur greatly swollen, width twice that of middle and hind femora; ocellar seta well developed, length greater than that of inner vertical seta; outer vertical seta present . . . . . *Stratiothyrea* de Meijere

9. Fore femur unarmed, lacking row of stout setae along posteroventral surface at apical  $1/4$ ; outer vertical seta absent; mesonotum with several setae in oblique row between postalar seta and base of scutellum . . . . . *Placopsidella* Kertész  
Fore femur bearing 5–10 stout setae along posteroventral surface at apical  $1/3$ ; inner and outer vertical setae present; mesonotum lacking setae between postalar seta and base of scutellum . . . . . 10
10. Gena short, eye-to-cheek ratio 0.20; parafacial narrow, less than width of anterior ocellus; wing generally faintly infusate, light brown . . . . .  
. . . . . species related to *Gymnopa beckeri* Cresson  
Gena high, eye-to-cheek ratio 0.45 or greater; parafacial moderately to very wide, width greater than that of anterior ocellus; wing generally appearing milky white . . . . . 11
11. Face appearing spotted, pitted, pits with silvery gray microtomentum; anterior surface of middle femur rounded, bare of microtomentum, shiny; fore femur with posteroventral margin produced ventrally to a pointed ridge bearing setae . . . . . *Chlorichaeta* Becker  
Face microsculptured but either bare or microtomentum in vertical stripes, unspotted; middle femur with anterior surface flat, densely microtomentose, microtomentum silvery white; fore femur bearing row of stout setae along apical half of posteroventral margin, these not arising from a pointed ridge . . . . .  
. . . . . *Mosillus* Latreille

### Genus *Mosillus* Latreille

*Mosillus* Latreille, 1804:196 [type species: *Mosillus arcuatus* Latreille, 1805 (= *Syrphus subsultans* Fabricius, 1794), subsequent monotypy, Latreille, 1805:390].—Schiner, 1863:234–235 [review, as a genus of Chloropinidae].—Dahl, 1959:158–159 [review, Sweden].—Wirth, 1965:734–735 [Nearctic catalog]; 1968:2–3 [Neotropical catalog]; 1969:147–152 [review of Nearctic species].—Papp, 1975:13–14 [review, Hungary].—Cogan and Wirth, 1977:322–323 [Oriental catalog].—Miyagi, 1977:26–27 [review, Japan species].—Cogan, 1980:656 [Afrotropical catalog]; 1984:128 [Palearctic catalog].—Canzoneri and Meneghini, 1983:224–227 [review, Italy].—Mathis, 1989:640 [Australasian and Oceanian catalog].

*Gymnomyza* Fallén, 1810:19 [type species: *Syrphus subsultans* Fabricius, 1794, subsequent designation, Mathis and Zatwarnicki, 1990b:895].—Mathis and Zatwarnicki, 1990b:895 [synonymy].

*Gymnopa* Fallén, 1820:10 [type species: *Gymnopa aenea* Fallén, 1820 (= *Syrphus subsultans* Fabricius, 1794), monotypy].—Meigen, 1830:135–138 [review].—Macquart, 1835:583–584 [review, Europe].—Loew, 1848:13–15 [discussion]; 1870:14–15 [discussion of generic names and family affiliation].—Zetterstedt, 1849:2678–2681 [review, Sweden].—Schiner, 1863:234 [synonymy].—Becker, 1896:124–127 [review, Palearctic Region].—Cresson, 1922:327–329 [revision, Nearctic Region]; 1925:230–234 [review]; 1942:106 [review, Nearctic Region]; 1946a:136 [review, Neotropical Region]; 1946b:246–247 [review, Afrotropical Region].

*Glabrinus* Rondani, 1856:132 [type species: *Glabrinus muroorum* Rondani, 1856 (= *Syrphus subsultans* Fabricius, 1794), original designation].—Becker, 1905:189 [synonymy].

**DIAGNOSIS.**—Small to moderately large shore flies, length 1.60–4.30 mm, mostly black, many surfaces subshiny to shiny; dorsum, especially thorax, sometimes somewhat microtomentose, appearing subshiny to dull.

**Head:** Setation generally weakly developed; fronto-orbital and ocellar setae greatly reduced or lacking but with numerous setulae present; both inner and outer vertical setae present, with outer seta slightly smaller than inner seta. Frons relatively

wide, at least as wide and usually wider than long. Arista comparatively short, at most slightly longer than combined length of first 3 segments, thickened basally, thereafter very gradually tapered to apex, appearing bare, hairs very short and inconspicuous. Face symmetrically grooved around midfacial protuberance; midfacial conical protuberance prominent; parafacial moderately wide, width conspicuously greater than width of anterior ocellus; parafacial immediately adjacent to face with a vertical row of horizontal grooves, usually with silvery-white microtomentose areas; gena generally bare and high, height usually about  $1/2$  eye height; posterior margin sharply angulate and marginate.

**Thorax:** Mesonotum mostly black, shiny, frequently with metallic luster, especially scutellum; mesonotal surface appearing microgranulose to various degrees to smooth. Notopleuron with 1 seta inserted near posteroventral angle; apical and frequently marginal scutellar setae arising from tubercles; intra-alar seta 1; lacking row of prominent setae between postalar seta and base of scutellum; halter pale, mostly white. Scutellum broadly U-shaped, rounded posteriorly, not pointed. Fore femur much more swollen than middle or hind femora, bearing a row of 4–5 stout setae along anterior half of posteroventral margin, first seta arising from ventral, midlength point moderately to conspicuously larger; middle tibia somewhat flattened anteroposteriorly, anterior surface appearing silvery white, densely microtomentose; basitarsomere color variable, apical 2–3 tarsomeres usually blackish brown. Wing milky white; vein  $R_{2+3}$  long, with length of costal section II not quite twice section III; vein  $CuA_1$  not extended to wing margin; alula wide, auriculate, alular marginal setulae much shorter than alular width.

**Abdomen:** Dorsal surface of terga black, shiny, mostly smooth, microsculpturing, if any, finer than on mesonotum, lacking bands; terga well sclerotized, lateral margins continued laterally and ventrally; 2nd tergum with median depression, linear to narrowly triangular, becoming wider toward base; sterna of male relatively weakly developed, usually as small sclerotized rectangular plates, 1st sternum of male oriented perpendicular to plane of body, sterna 2–4 parallel to plane of body; 5th sternum divided into 2 sternites, each longer than wide and oriented to form a V, with anterior vertex, sometimes fused at vertex; 5th tergum exposed but shorter than 4th, usually triangular or trapezoidal, with 2 dorsal pits toward posterior margin. Male terminalia: epandrium in lateral view narrowed dorsally, expanded laterally, in posterior view widest at level of cerci; cerci ovate with medial margin nearly straight, bearing short setae; hypandrium more or less V- or Y-shaped in posterior view with posterolateral arms fused with pregonite to form a relatively long structure, anteromedial portion forming vertex that is variously developed; surstyli broadly fused basally with ventral margin of epandrium, length variable; aedeagal apodeme more broadly developed in lateral view towards end that attaches to hypandrium; pregonite fused to hypandrium; postgonite usually longer than wide, shape specific to species, usually with subapical seta laterally; aedeagus simple, tubular, lacking processes or lobes, sometimes angulate, generally elongate, although length variable; ejaculatory apodeme present as a small, sclerotized rod attached to base of aedeagus by a membranous duct.

**DISTRIBUTION.**—Worldwide except in the Oriental and Australasian/Oceanian Regions and cold temperate and arctic habitats.

**Nomenclature.**—Schiner (1863) first recognized that *Mosillus* and *Gymnopa* are congeneric with the former having

priority, being 16 years older. Although older, *Mosillus* was not universally used, largely due to objections Loew (1870) raised on the basis of usage, i.e., *Gymnopa* had been in use for approximately 60 years, but also because Loew was of the opinion that *Mosillus* was not then well understood or characterized. Since Schiner and Loew, the group has been called by either name (see generic synonymy) depending on the view of the author. Cresson (1922:328–329) attempted to clarify the matter but overlooked Latreille’s (1805) designation of *Mosillus arcuatus* Latreille as the type species by subsequent monotypy. Latreille’s designation clearly establishes *Mosillus* as the senior synonym, a precedent that has been followed by recent authors (see generic synonymy, p. 4) and adopted here.

**DIAGNOSIS.**—*Mosillus* is distinguished from related genera of the tribe Gymnomyzini by the following combination of characters: body mostly shiny black although with considerable microtomentum on dorsal surfaces in some species; setation generally reduced (no apparent ocellar or fronto-orbital setae, although with setulae present); middle facial conical protuberance large; parafacial wide, with a vertical row of furrows; gena high, about one-half height of eye; apical scutellar setae usually arising from basal tubercles; wing lacteous; alula of wing broad, auriculate toward anal lobe; fore femur bearing a large ventral seta and 5–8 shorter setae along posteroventral margin at apical one-third (setae becoming smaller towards apex); middle tibiae with anterodorsal surface flattened and invested with silvery white microtomentum; 2nd tergum with a median depression, linear to narrowly triangular; fifth tergum of males and to a lesser degree in females with median dorsal depression towards posterior margin; lateral arms of hypandrium and pregonite fused; anterior margin of the hypandrium produced anteriorly to form a Y-shaped sternite with the two lateral arms.

**Key to Species of the Genus *Mosillus***

1. Mesonotum extensively microtomentose, whitish; middle tibia mostly yellowish orange; 2nd abdominal tergum with median depression narrow, linear posteriorly . . . . . 2  
     Mesonotum very sparsely microtomentose to mostly bare, shiny and frequently microsculptured; middle tibia mostly black; 2nd abdominal tergum with median depression broad basally, narrowly triangular . . . . . 4
2. Face bare except for microtomentose antennal grooves; parafacial with 2 small microtomentose spots at level of antenna; 5th tergum with dorsomedial area microsculptured, bearing setulae . . . . . *M. bidentatus* (Cresson)  
     Face, including antennal grooves, extensively microtomentose; parafacial with 1 vertically elongate microtomentose area; 5th tergum with dorsomedial area densely microtomentose . . . . . 3
3. Parafacial microtomentose area acutely pointed ventrally, length much greater than combined length of antennal segments; posterodorsal portion of anepisternum densely microtomentose, appearing whitish gray; scutellum with only 2 setae (rarely 3) on each side that arise from basal tubercles; fore tarsi black . . . . . *M. stegmaieri* Wirth

- Parafacial microtomentose area obtusely pointed ventrally, length subequal to combined length of antennal segments; posterodorsal portion of anepisternum with sparse microtomentum, inconspicuous; scutellum bearing 4–5 setae on each side that arise from basal tubercles; fore tarsi with basal 3–4 tarsomeres yellow . . . . . *M. tibialis* Cresson
4. Mesonotum densely microsculptured, with somewhat metallic greenish to bluish luster; hind basitarsomere black; spine-like setae along apicoventral margin of fore femur large, length of largest seta subequal to width of fore tibia . . . . . *M. bracteatus* Schiner
- Mesonotum smooth, mostly shiny black; hind basitarsomere yellowish orange; spine-like setae along apicoventral margin of fore femur small, length of largest seta at most  $\frac{1}{2}$  width of fore tibia . . . . . 5
5. Postgonite with setal bearing lobe short, no longer than secondary lobe, and spatulate; ventral portion of epandrium not sinuous . . . . . *M. subsultans* (Fabricius)
- Postgonite with setal bearing lobe long, almost twice length of secondary lobe, and angulate; ventral portion of epandrium in lateral view sinuous . . . . . *M. asiaticus*, new species

### The *tibialis* Group

SPECIES INCLUDED.—*Mosillus bidentatus* (Cresson), *M. stegmaieri* Wirth, and *M. tibialis* Cresson.

DIAGNOSIS.—This species group is distinguished by the following combination of characters: mesonotum extensively and densely microtomentose, microtomentum whitish gray to gray; middle tibia yellow; median depression on second abdominal tergum very narrow, linear posteriorly; epandrium and surstyli variable (the male terminalia of *M. bidentatus* are similar to those of the *subsultans* group; *M. tibialis* and *M. stegmaieri* have the epandrium well developed between cerci, and the surstyli are short, less than length of cerci, truncate ventrally, especially from a posterior view).

DISTRIBUTION.—NEW WORLD. Southern Canada south to Peru. Oceania. Hawaii (probably an introduction).

EEMARKS.—This species group is known only from the Western Hemisphere and is represented by three species. Wirth (1969) reviewed the species of this group when he described *M. stegmaieri*.

### *Mosillus bidentatus* (Cresson)

FIGURES 1–19

*Gymnopa bidentatus* Cresson, 1926:249; 1942:106 [review, Nearctic].—Wirth and Stone, 1956:466 [key, California].

*Mosillus bidentatus*.—Wirth, 1965:734 [generic combination; Nearctic catalog]; 1969:151–152 [review].—Cole, 1969:396 [list, California].

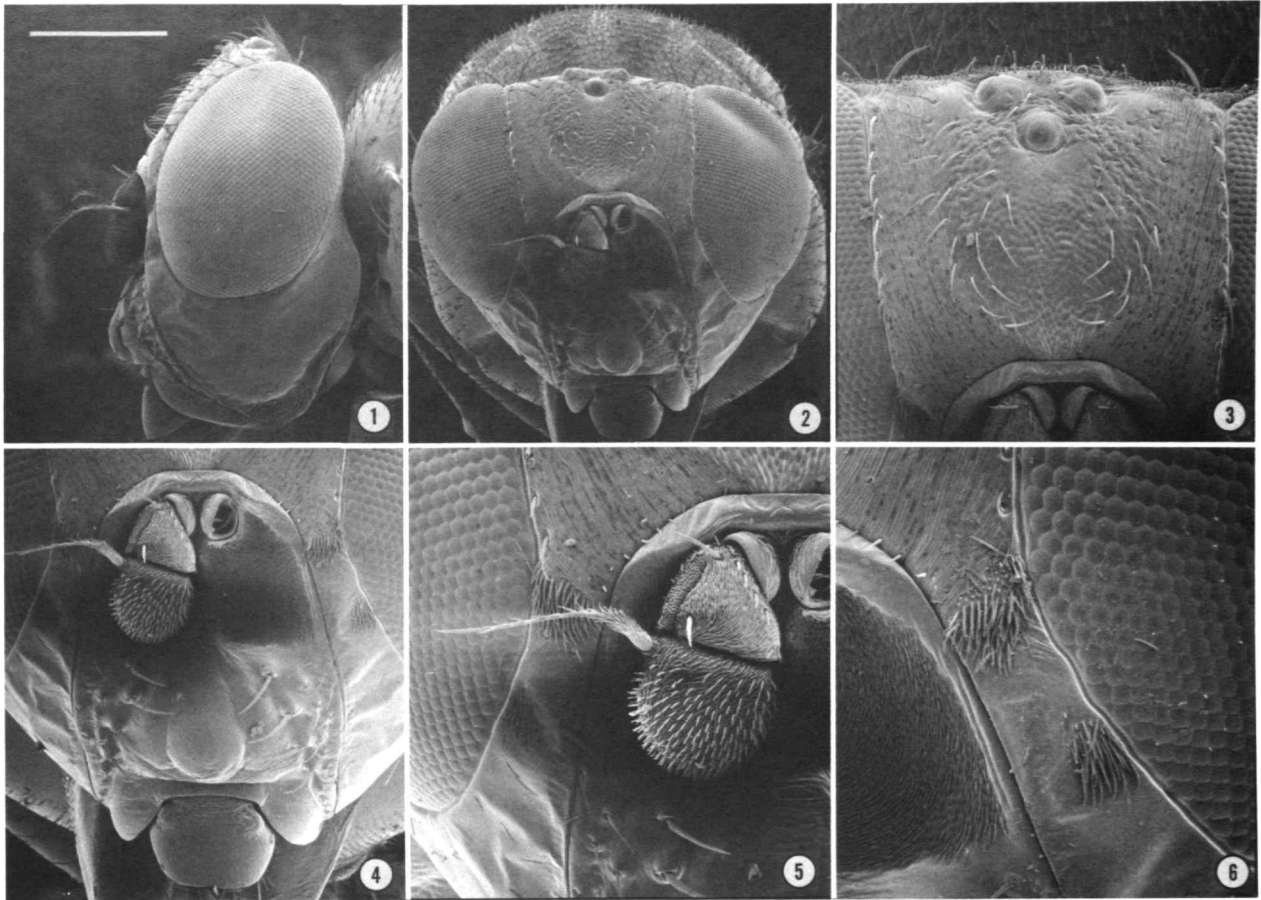
DESCRIPTION.—Moderately small to medium-sized shore flies, length 2.10 to 3.25 mm.

**Head** (Figures 1–6): Frons wider than long, frons width-to-length ratio averaging 0.74; mesofrons U-shaped, bare of microtomentum, more coarsely microsculptured than parafrons, appearing somewhat granulose; parafrons with very fine

microsculpturing, mostly smooth. Antenna, including arista, black; flagellomere 1 with moderately dense vestiture of grayish black pubescence. Face, except for silvery gray microtomentose in antennal grooves, bare of microtomentum; lateral surfaces of face coarsely grooved and pitted; clypeus finely microsculptured; anteriormost facial projection tear-drop shaped, mostly smooth; ventral margin of antennal grooves evenly rounded, lacking prominence. Parafacial wide, width subequal to twice width of anterior ocellus; parafacial at level of antenna with 2 silvery gray microtomentose patches, dorsal patch slightly larger. Gena with a few shallow wrinkles toward anterior margin, otherwise bare, shiny, very smooth; gena high, eye-to-cheek ratio averaging 0.52.

**Thorax** (Figures 7–12): Mesonotum extensively and moderately densely microtomentose, microtomentum mostly whitish gray or a shade thereof but with 3 stripes (median and where dorsocentral setae would be) of bronzish microtomentum with faint metallic luster, also bare linear area as short medial extension from dorsal angle of notopleuron; scutellum broadly trapezoidal, posterior margin very shallowly convex; lateral scutellar setae 2, each arising from a tubercle; anepisternum coarsely microsculptured, a few to several mostly vertical striae on a granular background, with faint metallic, mostly bronzish luster. Spine-like setae of fore femur small; fore tibia mostly black, apex with silvery gray vestiture of microtomentum; middle tibia yellowish orange; basal 3 tarsomeres of fore tarsi yellow; hind basitarsomere yellow. Wing costal vein ratio averaging 0.42; vein M ratio averaging 0.65.

**Abdomen** (Figures 13–18): Generally shiny, with moderately sparse setulae; 2nd abdominal tergum with median depression narrow, linear posteriorly; 5th tergum with dorsomedial area slightly microsculptured, bearing dense setulae and microtomentum. Male terminalia (Figures 13–18) as follows: epandrium comparatively short, anterior extension in



FIGURES 1–6.—Scanning electron micrographs of *Mosillus bidentatus* (Nebraska, Cherry County; scale length in parenthesis; scale for all photographs = Figure 1): 1, head, lateral aspect (0.33 mm); 2, head, anterior aspect (0.38 mm); 3, frons, anterodorsal aspect (200  $\mu$ m); 4, face, anterior aspect (231  $\mu$ m); 5, right antenna, anterior aspect (136  $\mu$ m) 6, parafacial, anterior aspect (100  $\mu$ m).

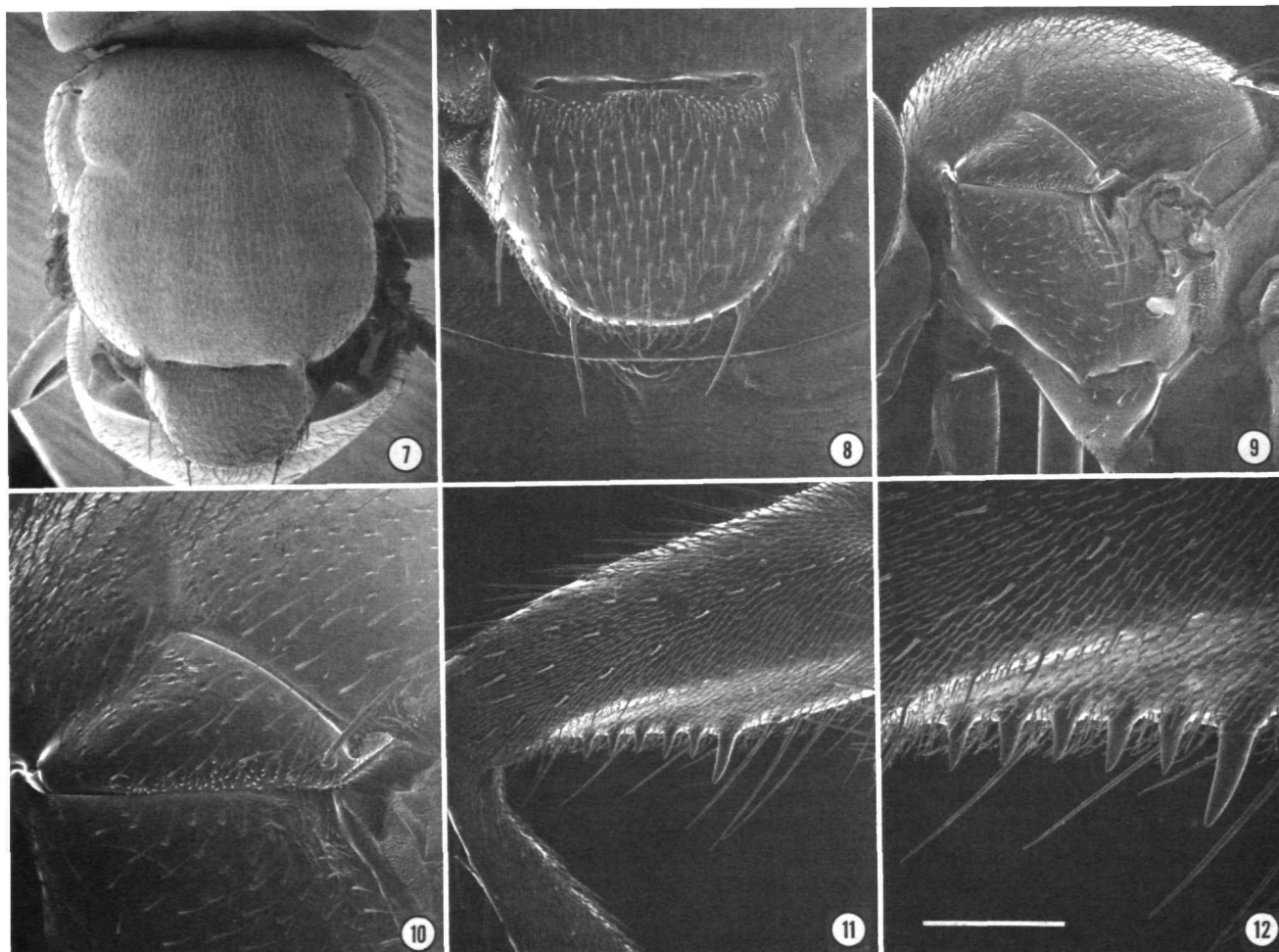
lateral view extended to about ventral margin of cerci; surstylus tapered to moderately rounded ventral margin, both margin in lateral view more or less straight; postgonite in lateral view with large, dorsal, secondary lobe, setal bearing lobe short, attached toward base; aedeagus distinctly angulate, with distinct posterior projection medially, apical portion tapered to acute pointed apex; aedeagal apodeme more or less evenly triangular in lateral view; hypandrium bare, moderately elongate, anterior margin truncate, not invaginated anteriorly to form a pocket.

**TYPE MATERIAL.**—The holotype male is labeled “[USA. Salt Lake County] Saltair VII [Jul] 08 [1908] Utah JM Aldrich /♂/TYPE *Gymnopa BIDENTATA* E.T. Cresson, Jr. 6318 [species name and holotype number handwritten, maroon]/ ANSP [yellow].” The holotype is double mounted (minuten in a rectangular piece of cardboard), is in good condition (left wing slightly torn), and is deposited in the ANSP (6318).

**OTHER SPECIMENS EXAMINED.**—*MEXICO*. *Baja California Sur*: Isla San Jose (S end, landlocked lagoon), 2 Apr 1974, J.T. Doyen, L. Cheng (2♂, 1♀; CAS). Angel de la Guardia Island, Pond Island Bay, Gulf California, 20 Jun 1921, E.P. Van Duzee (4♂, 1♀; CAS).

*CANADA*. *British Columbia*. Kamloops (alkali lake), 2 Jul 1968, W.W. Wirth (5♂, 2♀; USNM); Vernon, 22 Jul 1947, H.B. Leech (1♀; USNM).

*UNITED STATES*. *California*: Alameda Co., Berkeley, 31 Aug 1949, L.W. Quate (2♀; USNM); Oakland, 20 Jun–4 Aug 1949, L.W. Quate (2♀; USNM). Imperial Co., Salton Sea, 9 Mar 1950, A.H. Sturtevant (1♀; USNM); Salton Sink, 29 Mar 1929, A.H. Sturtevant (1♀; USNM); San Felipe, 20 Jun–8 Jul 1932 (1♂, 1♀; ANSP, USNM). Inyo Co., Lone Pine, 28 Jul 1940, R.H. Beamer (2♂, 1♀; USNM). Lake Co., Borax Lake, 14 May–8 Aug 1911, 1922, 1948, J.M. Aldrich, E.P. Van Duzee, W.W. Wirth (4♂, 10♀; ANSP, USNM). Los Angeles

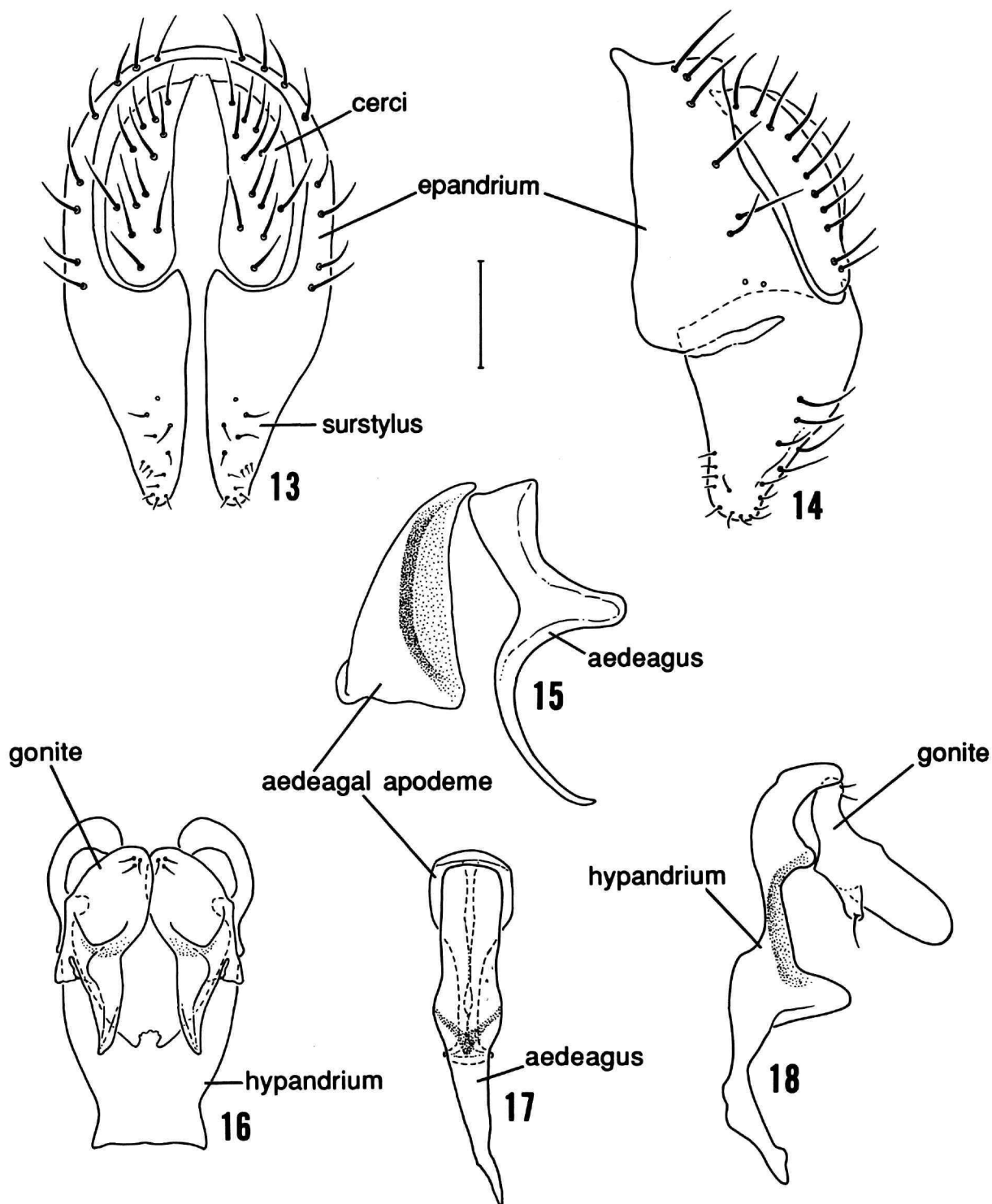


FIGURES 7-12.—Scanning electron micrographs of *Mosillus bidentatus* (Nebraska, Cherry County; scale length in parenthesis; scale for all photographs = Figure 12): 7, mesonotum, dorsal aspect (0.46 mm); 8, scutellum, dorsal aspect (250  $\mu$ m); 9, thorax, lateral aspect (0.38 mm); 10, notopleuron, lateral aspect (176  $\mu$ m); 11, fore femur, posterior aspect (60  $\mu$ m); 12, fore femur, posterior aspect (60  $\mu$ m).

Co., Claremont (near mountains), C.F. Baker (1♀; USNM); Redondo, 23 May 1898 (1♀; ANSP). Mono Co., Black Lake (shore), 13 Aug 1988, D.B. Herbst (10♂, 4♀; DBH); Mono Lake (S and W shore), 22 Jun-12 Aug 1974, 1980, W.N. Mathis, R.S. Zack (5♂, 1♀; USNM, WSU). Orange Co., Laguna Beach, C.F. Baker (1♀; USNM). Riverside Co., Andreas Canyon, 23 Mar-27 Oct 1934, 1951, A.L. Melander (2♂; USNM); Elsinore, 19 Feb 1950 (4♂, 5♀; UTA); Elsinore Lake, 19 Feb-2 Aug, 1911, 1950, J.M. Aldrich, A.L. Melander, A.H. Sturtevant (10♂, 20♀; USNM); Indio (near), 23 Feb 1949, A.L. Melander (1♂; USNM); Joshua Tree National Monument, Hidden Valley, 18 May 1946, A.L. Melander (1♂; USNM); Palm Springs, 17 Mar 1949, A.L. Melander (1♂; USNM). San Bernardino Co., Joshua Tree National Monument, Quail Spring, 5 Oct 1934, A.L. Melander (4♂, 3♀;

ANSP, USNM); Trona, 31 Mar 1953, A.H. Sturtevant (1♀; USNM). San Diego Co., Borrego, 16 Mar 1950, G.H. and J.D. Sperry (1♂, 1♀; USNM); Carlsbad, 1 Jun 1954, J.C. Hall (1♂, 1♀; USNM); El Cajon, 28 Jun 1945, A.L. Melander (1♀; USNM); Palm Canyon, 7 Nov 1934, A.L. Melander (1♂; USNM); San Diego, 11 Mar 1897, W.M. Wheeler (1♀; AMNH); Yaqui Wells, 20 Mar 1951, A.H. Sturtevant (1♂; USNM). Santa Clara Co., Palo Alto, 29 Apr 1906, J.M. Aldrich (5♂, 3♀; ANSP, USNM); C.F. Baker (1♂; USNM). Siskiyou Co., Lower Klamath Lake, 16 Aug 1963, J. Schuh (1♂, 2♀; WSU).

*Colorado:* Denver Co., Denver, 9 Aug 1939 (1♂; ANSP). Garfield Co., Rifle (5400 ft. = 1646 m), 19-21 Jul 1919 (1♀; AMNH). *Idaho:* Butte Co., Craters of the Moon National Monument, 2 Aug 1964, D.S. Horning (1♀; USNM). Camas



FIGURES 13-18.—*Mosillus bidentatus*: 13, external structures of the male terminalia (epandrium, cerci, surstyli), posterior aspect; 14, external structures of the male terminalia (epandrium, cerci, surstyli), lateral aspect; 15 aedeagal apodeme and aedeagus, lateral aspect; 16, gonites and hypandrium, posterior aspect; 17, aedeagus and aedeagal apodeme, posterior aspect; 18, gonite and hypandrium, lateral aspect. (Scale = 0.1 mm.)

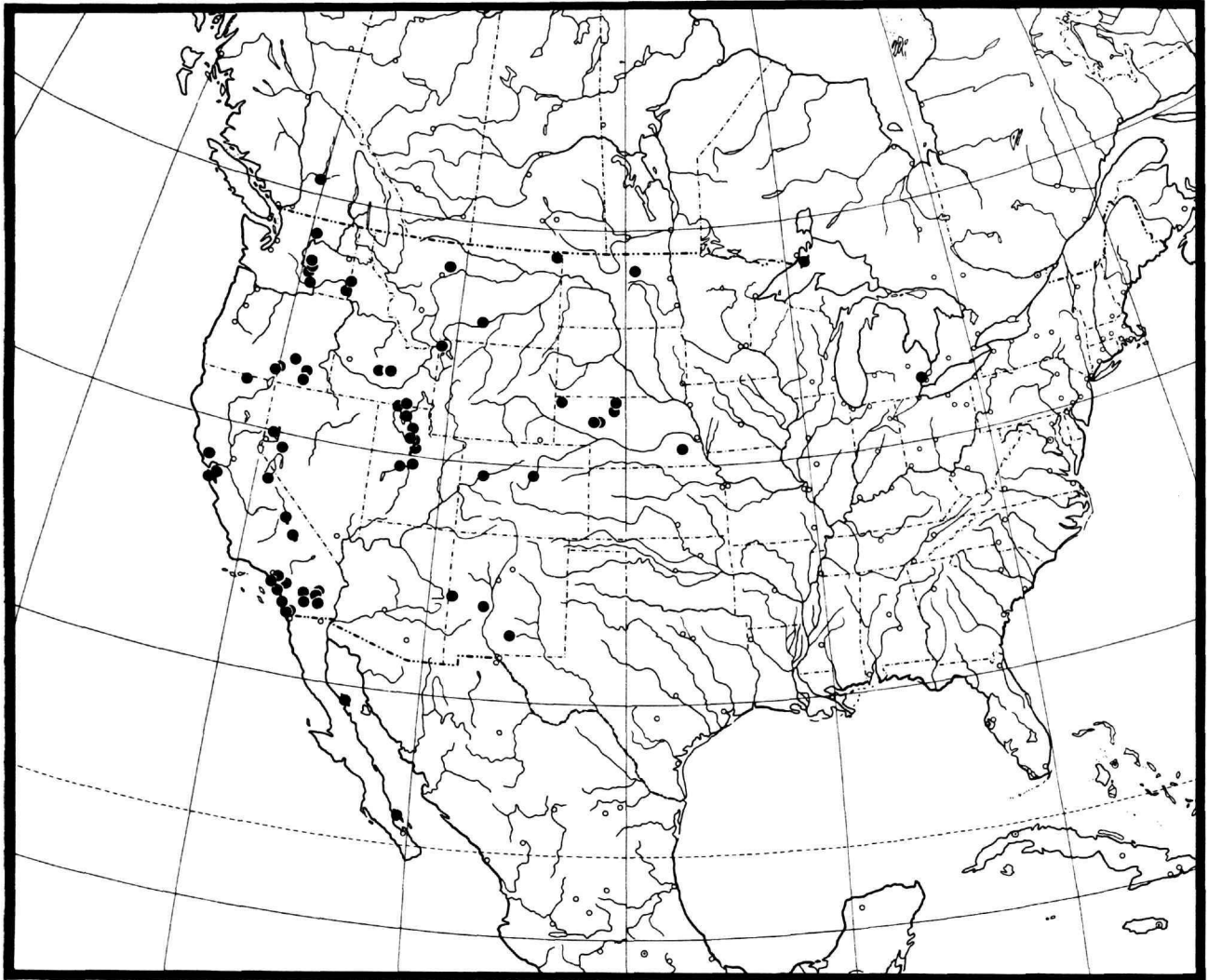


FIGURE 19.—Distribution map for *Mosillus bidentatus*.

Co., Magic Reservoir, 2 Jul 1973, G.E. Bohart (1♀; USU). Latah Co., Moscow, 10 Sep 1922, A.L. Melander (1♀; USNM). Oneida Co., Rock Creek, 13 Jul 1972, G.F. Knowlton (1♀; USU); Twin Springs, 10 Aug 1972, G.F. Knowlton (1♀; USU). *Michigan*: Keweenaw Co., Isle Royale, 3–7 Aug 1936, C.W. Sabrosky (1♀; USNM). Wayne Co., Detroit, 16 Aug 1930, G.C. Steyskal (1♂, 3♀; ANSP, USNM). *Montana*: Chouteau Co., Geraldine, F.T. Cowan (1♂; USNM). Sheridan Co., Medicine Lake, 9 Jun 1969, W.W. Wirth (1♂; USNM). Yellowstone Co., Billings, 17 Aug 1914 (4♂, 3♀; AMNH). *Nebraska*: Cherry Co., Twin Lake (alkali lake), 2 Jun 1969, W.W. Wirth (2♂, 2♀; USNM). Grant Co., Hyannis, 3 Sep 1969, C.D. Michener (3♂, 3♀; USNM). Hooker Co., Mullen, 31 Jul 1953, R.R. Dreisbach (2♀; USNM). Kimball Co., Kimball (5000 ft), 6 Aug 1934, H.A. Scullen (1♂; USNM).

Lancaster Co., Lincoln, 9 Aug 1914, E.M. Partridge (1♀; USNM). Sioux Co., Glen Canyon, 28 Aug 1959, O.W. Isakson, W.E. LaBerge (1♂; USNM). C.V. Riley (1♂; USNM). *Nevada*: Churchill Co., Soda Lake (6 mi [9.6 km] NW Fallon, Alkaline), 28 Aug 1983, R.S. Zack (5♂; WSU). Washoe Co., Pyramid Lake, 25 Jun 1970, R.F. Lagier (1♂; WSU).

*New Mexico*: Catron Co., Zuni Salt Lake (20 mi [32 km] W Quemado), 2 Jul 1953, W.W. Wirth (1♂; USNM). Otero Co., Tularosa (25 mi [40 km] W), 1 Jul 1940, L.J. Lipovsky (4♂, 3♀; USNM). Socorro Co., Magdalena Mountains (19 Aug 1951, E.L. Kessel (1♀; USNM). *North Dakota*: Benson Co., Leeds (alkali lake), 5 Jul 1969, W.W. Wirth (10♂, 5♀; USNM). *Oregon*: Harney Co., Borax Lake (4.5 mi [7.2 km] NE Fields), 29 Jul 1975, W.N. Mathis (1♀; USNM); Harney Hot Spring, 23 May 1975, W.N. Mathis (12♂, 5♀; USNM); Mann



Lake (19 mi [30.4 km] SW Oregon Route 78), 12 Sep 1981, R.S. Zack (1♀; WSU). Lake Co., Abert Lake, 16 Aug–9 Sep 1931, 1954, 1982, K. Gray, D.B. Herbst, J. Schuh, A.H. Sturtevant (5♂, 6♀; USNM, WSU); Alkali Lake (NW shore), 12 Jul 1974, W.N. Mathis (3♂; USNM).

*Utah*: Box Elder Co., Antelope Island, 8 Jul 1970, G.F. Knowlton, D. Davis (1♂; USU); Clear Creek Canyon, Raft River Mountains, 5 Jul 1974, G.E. Bohart (1♂; USU); Corinne, 12 Jun 1929, G.F. Knowlton (1♂, 1♀; ANSP, WSU); Promotory Point, 11 Jul 1911, J.M. Aldrich (2♂; USNM); Snowville, 12 Aug 1972, G.E. Bohart (2♀; USU). Millard Co., Delta, 27 Jul 1927, G.F. Knowlton (1♂; AMNH). Salt Lake Co., Garfield, 9 Jul 1911, J.M. Aldrich (1♂, 1♀; USNM); Great Salt Lake, Saltair, 5–31 Jul–13 Aug 1908, 1950, J.M. Aldrich (12♂, 13♀; ANSP, USNM, UTA); Great Salt Lake (beach), 31 Jul 1908, J.M. Aldrich (1♂; ANSP); Midvale, 2 Sep 1953, W.J. Hanson, G.W. Knowlton, J.B. Plant (1♂; USNM); Salt Lake causeway to Antelope Island, 21 Aug 1982, R.S. and V.L. Zack (1♂, 4♀; WSU); Salt Lake City, 26 Jun–18–20 Jul 1917, J.M. Aldrich, H.S. Barber (2♂, 2♀; USNM). Sanpete Co., Moroni, 27 Jun 1940, A.L. Melander (1♂, 1♀; USNM). Utah Co., Provo, 29 Jul–1 Aug 1920 (1♂; AMNH). Weber Co., Ogden, 25 Jul 1920 (1♂; AMNH); Utah Hot Spring, J Jun 1967, G.F. Knowlton (1♀; USU).

*Washington*: Adams Co., Columbia National Wildlife Refuge, Lower Crab Creek near Black Lake, 28 Aug 1980, R.S. Zack (1♂; WSU); Columbia National Wildlife Refuge, Black Lake (1.5 mi [2.4 km] S, alkalie pond), 30 Jul 1978, R.S. Zack (3♂; WSU); Washtucna (12 mi [19.2 km] W), Sand Hills County Park, 28 Mar 1978, R.S. Zack (2♀; WSU). Asotin Co., Asotin, 4 Jun 1930, J.M. Aldrich (1♂; USNM). Benton Co., West Richland, 8 Jun 1974, N.E. Woodley (1♀; WSU). Grant Co., Columbia National Wildlife Refuge, Juvenile Pond, 17–28 Aug 1977, 1980, R.S. and V.L. Zack (3♂, 4♀; WSU); Moses Lake, 7 Aug 1956, C. Johansen (1♂; WSU); Royal City (5.1 mi [8.2 km] W, irrigation pond), 13 Jul 1978, R.S. Zack (1♂; WSU); Soap Lake, 17–22 Jul–20 Aug 1919, 1922, 1949, 1968, M.T. James, W.N. Mathis, A.L. Melander (30♂, 36♀; AMNH, ANSP, USNM). Okanogan Co., Penley Lake (5 mi [8 km] SE Okanogan), 22 Jul 1983, R.D. Akre, R.S. Zack (1♀; WSU). *Wyoming*: Yellowstone National Park., Madison Junction, 27 Jul 1923, A.L. Melander (1♀; ANSP).

**DISTRIBUTION** (Figure 19).—NEW WORLD. Nearctic: Canada (BC, MB (unverified)), Mexico (BCS), USA (CA, CO, ID, MI, MT, NB, ND, NM, NV, OR, UT, WA, WY).

**DIAGNOSIS**.—This species is distinguished from congeners, especially those from North America, by the following combination of characters: face bare except for microtomentose antennal grooves; parafacial with 2 small microtomentose spots at level of antenna; mesonotum extensively microtomentose, microtomentum mostly white or a shade thereof; middle tibiae mostly yellowish orange; 2nd abdominal tergum with median depression narrow, linear posteriorly; and 5th tergum with dorsomedial area microsculptured, bearing setulae.

**REMARKS**.—This species demonstrates more plesiomorphous characters than the other two New World species, particularly the triangular shape of the surstylus, which is more similar to males of the *subsultans* group and other species of the *Mosillus* clade. Although somewhat intermediate, mostly in plesiomorphous characters, we place this species in the *tibialis* group as the sister group to the next two species.

### *Mosillus stegmaieri* Wirth

FIGURES 20–37

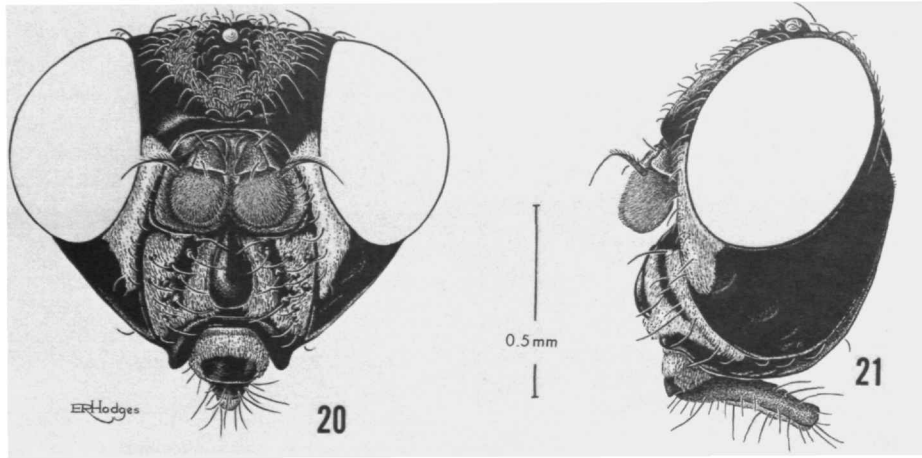
*Mosillus stegmaieri* Wirth, 1969:147.

**DESCRIPTION**.—Moderately small to medium-sized shore flies, length 2.50 to 3.15 mm.

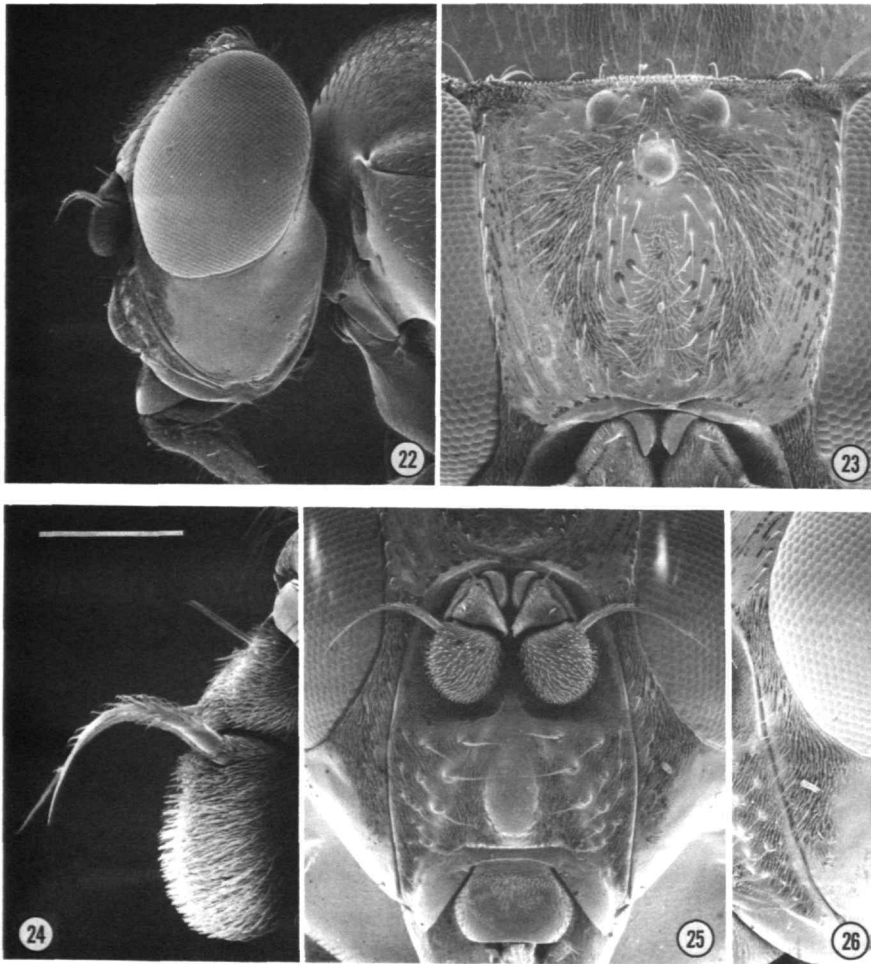
**Head** (Figures 20–26): Frons wider than long, frons width-to-length ratio averaging 0.86; mesofrons narrowly U-shaped, microtomentum very sparse, coarsely microsculptured, appearing mostly granulose, bearing numerous setulae; parafrons mostly smooth, appearing satiny. Antenna, including arista, black; flagellomere 1 with moderately dense vestiture of grayish black pubescence. Face, including antennal grooves, extensively microtomentose, obscuring most microsculpturing beneath, microtomentum as 2 broad, vertical stripes on either side of midfacial prominence, lateralmost sometimes connected with microtomentum in antennal groove; anteriormost facial projection tear-drop shaped; clypeus mostly bare medially, extensively microtomentose laterally and along dorsum. Parafacial wide, conspicuously wider at narrowest point than width of anterior ocellus; parafacial at level of antenna with 1 large, vertically elongate microtomentose area, acutely pointed ventrally, length greater than combined length of antennal segments. Gena with 1–2 wrinkles anteriorly, otherwise completely bare of microtomentum, smooth, shiny; gena high, eye-to-cheek ratio averaging 0.56.

**Thorax** (Figures 27–30): Mesonotum extensively and densely microtomentose, microtomentum mostly brownish gold (more so laterally) to mostly whitish gray, sometimes in a pattern with darker color as a medial stripe or with posterior  $\frac{1}{3}$  with microtomentum sparser; short, linear, transverse bare areas extended from dorsal angle of notopleuron; scutellum broadly rounded; scutellum bearing 2 setae on each side, each arising from a tubercle; anepisternum with large area of microtomentum on posterodorsal  $\frac{1}{3}$  to  $\frac{1}{2}$ , otherwise sparsely microtomentose. Spine-like setae of fore femur small; fore tibia reddish yellow; middle tibia yellowish orange; fore tarsi mostly blackish brown, basitarsomere at most faintly lighter; hind basitarsomere yellow. Costal vein ratio averaging 0.41; vein M ratio averaging 0.60.

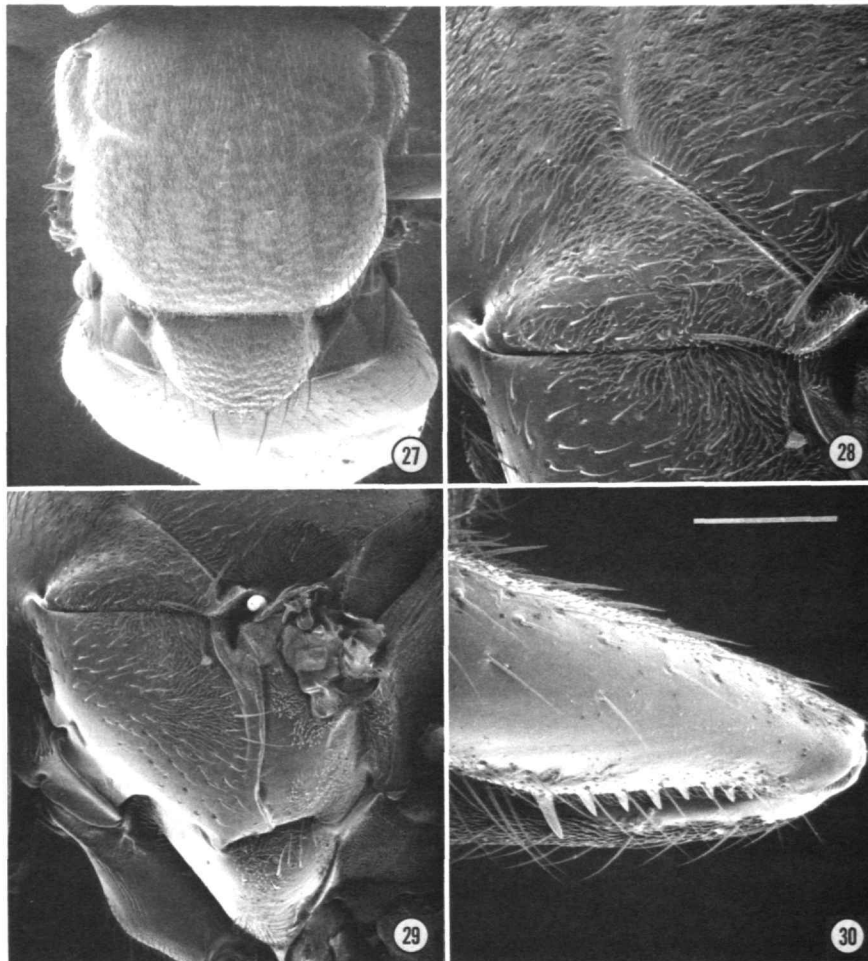
**Abdomen**: Generally shiny, smooth, setulae sparse; 2nd abdominal tergum with median depression narrow, linear posteriorly; 5th tergum with dorsomedial area moderately densely microtomentose and bearing numerous setulae. Male terminalia (Figures 31–36): epandrium comparatively long, extended along anterior margin to well below cerci externally



FIGURES 20, 21.—*Mosillus stegmaieri*: 20, head, anterior aspect; 21, head, lateral aspect. (Scale = 0.5 mm.)



FIGURES 22–26.—Scanning electron micrographs of *Mosillus stegmaieri* (Belize, Stann Creek District; scale length in parenthesis; scale for all photographs = Figure 24): 22, head, lateral aspect (0.38 mm); 23, frons, dorsal aspect (200  $\mu\text{m}$ ); 24, antenna, lateral aspect (100  $\mu\text{m}$ ); 25, face, anterior aspect (250  $\mu\text{m}$ ); 26, parafacial, anterior aspect (231  $\mu\text{m}$ ).



FIGURES 27-30.—Scanning electron micrographs of *Mosillus stegmaieri* (Belize, Stann Creek District; scale length in parenthesis; scale for all photographs = Figure 30): 27, mesonotum, dorsal aspect (0.43 mm); 28, notopleuron, lateral aspect (150  $\mu$ m); 29, pleura, lateral aspect (0.27 mm); 30, fore femur, posterior aspect (136  $\mu$ m).

to merger with basal margin of surstylus; surstylus appearing comparatively short externally, distinctly less than length of cerci, ventral dististylar margin truncate, produced more at medial angle, shallowly concave, ventromedial surface bearing longer setulae; lateroventral projection of surstylus pointed; postgonite slightly narrowed medially in lateral view, apex rounded, not bearing secondary lobe; aedeagus long, shallowly sinuous, gradually tapered to acute apex, length almost twice that of aedeagal apodeme; aedeagal apodeme with ventral flange gradually produced, inner surface distinctly concave, pentagonal in dorsal view; hypandrium bare, elongate, with shallow pocket anteriorly.

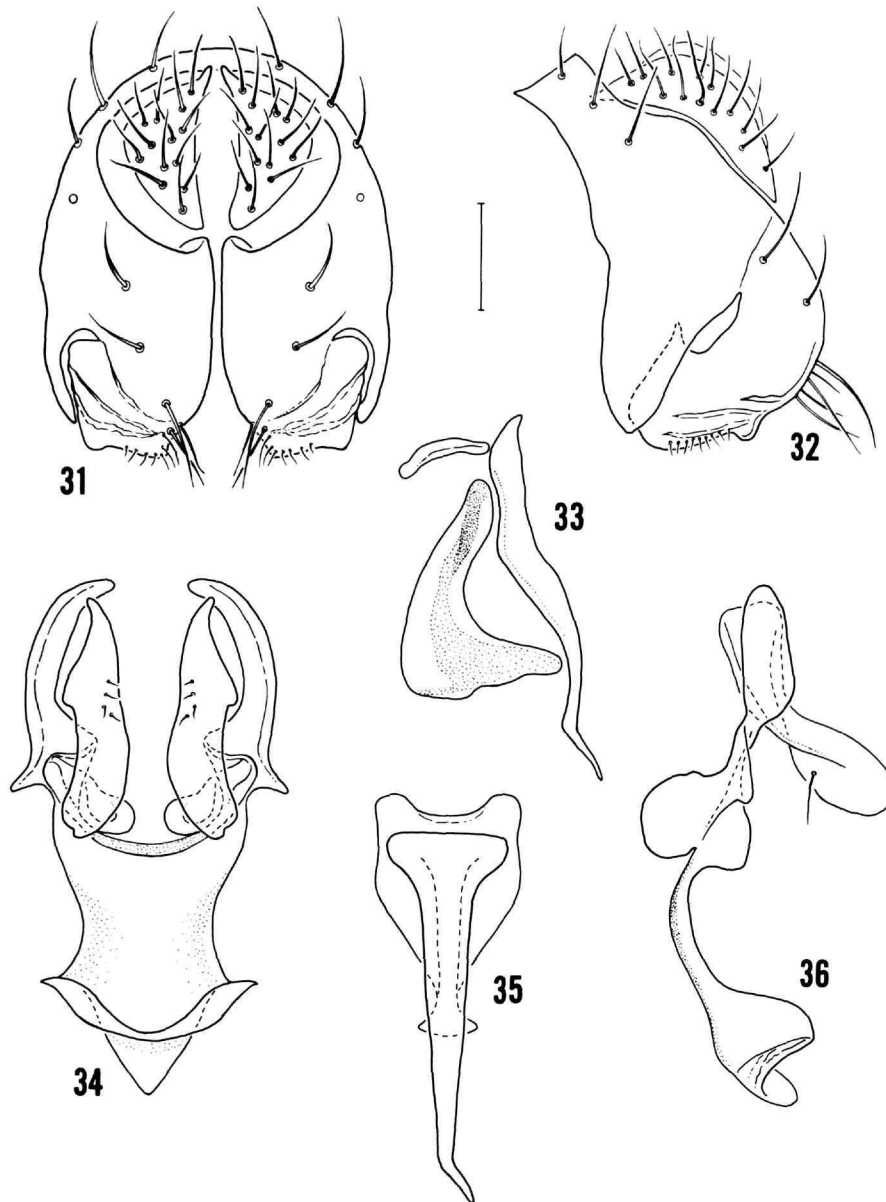
**TYPE MATERIAL.**—The holotype male is labeled “FLORIDA Miami, Dade Co Dodge Is IV-[Apr]/14-67 [14 1967] CESTegmaier swept from grasses on seashore 67-11886 [field note or USDA lot number]/HOLOTYPE *Mosillus stegmaieri*

W.W. Wirth [red, species name handwritten].” The holotype is double mounted (glued to a paper point), is in relatively good condition (scutellar setae missing), and is deposited in the USNM (70438).

**OTHER SPECIMENS EXAMINED.**—**BAHAMAS.** Andros: Andros Town, 7-13 Mar 1966, O.L. Cartwright (1♀; USNM).

**TURKS and CAICOS ISLANDS.** Grand Turk Island, 19 Feb 1953, E.B. Hayden, L. Giovannoli (1♂; AMNH). North Bimini Island, 3 Jun 1950, M. Cazier and F. Rindge (1♂; AMNH).

**BELIZE.** Stann Creek District: Carrie Bow Cay, 18 Mar-30 Jul 1985, 1988, 1989, 1990, W.N. Mathis, H.B. Williams (35♂, 22♀; USNM); Coco Plum Cay, 31 Jul 1989, W.N. Mathis (1♂, 1♀; USNM); Man of War Cay, 24 Jun-31 Jul 1989, 1990, W.N. Mathis, H.B. Williams (1♂, 3♀; USNM); Round Cay (near Coco Plum Cay), 23 Mar 1988, W.N. Mathis



FIGURES 31-36.—*Mosillus stegmaieri*: 31, external structures of the male terminalia (epandrium, cerci, surstyli), posterior aspect; 32, external structures of the male terminalia (epandrium, cerci, surstyli), lateral aspect; 33 aedeagal apodeme, ejaculatory apodeme, and aedeagus, lateral aspect; 34, gonites and hypandrium, posterior aspect; 35, aedeagus and aedeagal apodeme, posterior aspect; 36, gonite and hypandrium, lateral aspect. (Scale = 0.1 mm.)

(1♂, 2♀; USNM); Twin Cays (south end of East Island), 25 Jul 1988, 1989, W.N. Mathis, H.B. Williams (6♂, 2♀; USNM); Wee Wee Cay, 24-25 Mar 1988, W.N. Mathis (7♂, 2♀; USNM).

**BERMUDA.** St. George Parish: St. George, 3 Feb 1934, A.L. Melander (1♀; USNM); near Agriculture Station, Jan, W.S.

Brooks (2♂, 2♀; MCZ). Cavendish, Jan (1♂, 1♀; MCZ). "Bermuda," 4-30 Jul 1905-1919, C.W. Johnson, T.K. Kincaid (1♂, 1♀; MCZ).

**ECUADOR.** Guayas, Palmar, 10 Oct 1954, R.L. Cadillo (1♀; USNM).

**MEXICO.** Chiapas: Boca de Cielo (7 km S Puerto Arista) 18

May 1985, A. Freidberg, W.N. Mathis (10♂, 5♀; USNM); Puerto Arista, 18 May 1985, A. Freidberg (1♂; USNM). *Nayarit*: San Blas, 20 Jul 1951, P.D. Hurd (2♂; USNM). *Sinaloa*: Mazatlan, 22 Jul 1954, M. Cazier, W. Gertsch (1♂, 2♀; AMNH, USNM). *Yucatán*: Progreso, 11 Jul–7 Aug 1907, 1964, J.C. and D. Pallister (2♂; AMNH, USNM).

**UNITED STATES.** *Alabama*: Mobile Co., Coden, 22 Oct 1916, A.H. Sturtevant (1♀; USNM). *Florida*: Charlotte Co., Placida, 11 May 1952, J.R. Vockeroth (1♂; USNM); Punta Gorda, 15 Nov 1911 (3♂, 4♀; AMNH, ANSP). Dade Co., Biscayne Bay, A.T. Slosson (2♂; AMNH); Matecumbe [Key], 1 Feb 1932, A.L. Melander (1♂; USNM); Miami (grasses on seashore), 14 May 1967, G.E. Stegmaier (4♂, 1♀; USNM). Duval Co., Mayport, 26 Jun 1952, A.H. Sturtevant (1♀; USNM). Lee Co., Sanibel Island, 7 Apr–11 May 1973, 1977, L. Knutson, W.W. Wirth (4♀; USNM); Sanibel Island, Lighthouse Park, 17 Apr 1989, W.N. and D. Mathis (3♂; USNM); Fort Myers, 24 Apr 1950, A.L. Melander (1♂; USNM). Manatee Co., Anna Maria, 19 Jun 1953, M.R. Wheeler (3♂; UTA); Bradenton, Mar, M.C. Van Duzee (2♀; ANSP). Monroe Co., Key West, 1–3 May–23 Jun 1915, 1953, A.H. Sturtevant, M.R. Wheeler (2♂; USNM, UTA). Pinellas Co., St. Petersburg, 15 Feb–21 Dec 1924, 1932, 1964, C.B. Bennett, E.T. Cresson, Jr., A.L. Melander (7♂, 3♀; ANSP, USNM). Sarasota Co., Casey Key (near Osprey), 20 Jun 1953, M.R. Wheeler (2♂; UTA).

*Georgia*: Chatham Co., Tybee Island, 26 Jun 1913 (1♂; ANSP). *New Jersey*: Cape May Co., Wildwood, 18 Jul 1908, E.T. Cresson, Jr. (8♂, 2♀; ANSP). *North Carolina*: Carteret Co., Bogue Island, 17 Oct 1974, G.C. Steyskal (4♀; USNM). *Texas*: Brazoria Co., Freeport, 3 Sep 1951 (1♂; UTA). Calhoun Co., Indianola, 28 Apr 1951 (1♂, 1♀; UTA); Olivia, 22 Jan 1953 (1♂, 1♀; UTA). Galveston Co., Galveston, 10 Jul 1917, J.M. Aldrich (1♂; USNM). Kleberg Co., Riviera, 23 Mar 1951 (1♀; UTA). Nueces Co., Packery Channel Park near Corpus Christi (along beach), 11 Dec 1984, R.S. Zack (2♂, 1♀; WSU).

**VENEZUELA:** Tacariqua Mir., 1 Mar 1945, M. Villegas (1♀; USNM).

**WEST INDIES.** *Anguilla*. Mead's Bay (18°13'N, 63°08'30"W), 26 Mar 1992, W.E. Steiner, J.M. Swearingen (1♀; USNM). *Barbuda*. Cocoa Pt, 28 Apr 1958, J.F.G. Clarke (1♀; USNM). *Jamaica*. Milk River Bath (mangroves), 11 Mar 1970, T. Farr, W.W. Wirth (1♂; USNM); Pt. Henderson (bay shore), 24 Feb 1969, W.W. Wirth (1♀; USNM). *Virgin Islands*. St. Croix (at airport), fall 1967, W.H. Pierce (1♂; USNM).

**DISTRIBUTION** (Figure 37).—**NEW WORLD.** Nearctic: Bermuda, USA (AL, FL, GA, NC, NJ, TX). Neotropical: Bahamas, Belize, Mexico (CHI, NAY, SIN, YUC), Venezuela, West Indies (Anguilla, Barbuda, Jamaica, Virgin Islands).

**NATURAL HISTORY.**—The sites where this species occurs on Belizean cays are primarily associated with man and man-made debris; perhaps this species could serve as an indicator of this type of disturbance and pollution.



FIGURE 37.—Distribution map for *Mosillus stegmaieri*.

**DIAGNOSIS.**—Three species of *Mosillus* are known from the Western Hemisphere, and *M. stegmaieri* can be distinguished from the other two by the following external characters: face, including antennal grooves, extensively microtomentose; parafacial with 1 vertically elongate microtomentose area that is acutely pointed ventrally, length much greater than combined length of antennal segments; posterodorsal portion of anepisternum densely microtomentose, appearing whitish gray; scutellum with only 2 setae on each side that arise from basal tubercles; 5th tergum with dorsomedial area densely microtomentose.

**REMARKS.**—This species is unquestionably the sister group of *M. tibialis*, and externally and internally these two species are very similar. Although the distributions of the two species demonstrate some overlap, this species occurs primarily in the subtropics and tropics, and *M. tibialis* has a more northern range that is more temperate in climate.

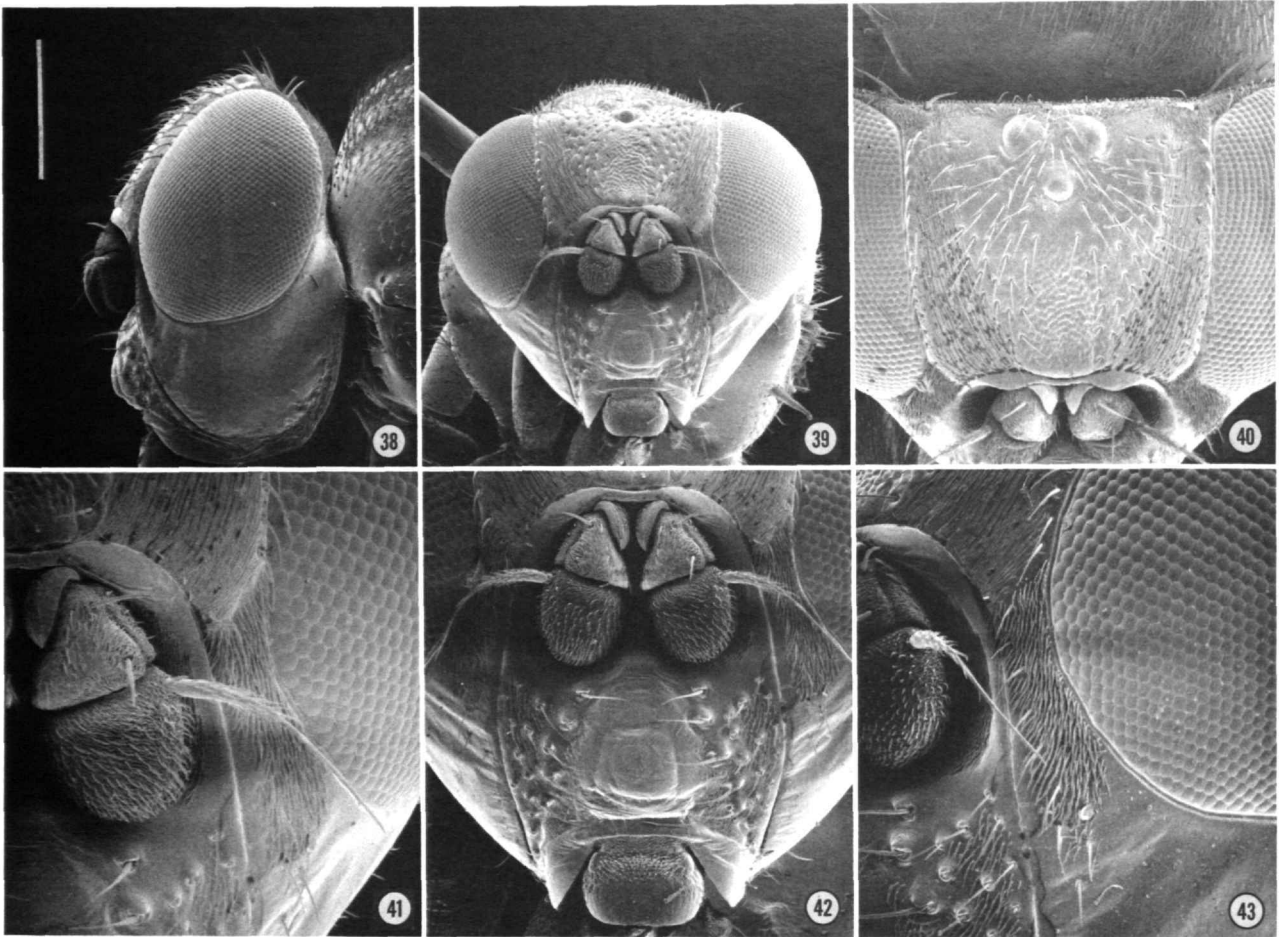
### *Mosillus tibialis* Cresson

FIGURES 38–56

*Mosillus tibialis* Cresson, 1916:149.—Wirth, 1965:734 [Nearctic catalog]; 1968:3 [Neotropical catalog]; 1969:150–151 [review].—Cole, 1969:396 [list, California].—Tenorio, 1980:270 [review, Hawaii].—Mathis, 1989:640 [Australasian/Oceanian catalog].

*Gymnopa tibialis* Cresson, 1922:329 [generic combination]; 1942:106 [review, Nearctic]; 1946a:136 [review, Neotropical].—Cole, 1923:478 [list, Gulf of California].—Wirth and Stone, 1956:466 [key, California].

**DESCRIPTION.**—Small to medium-sized shore flies, length



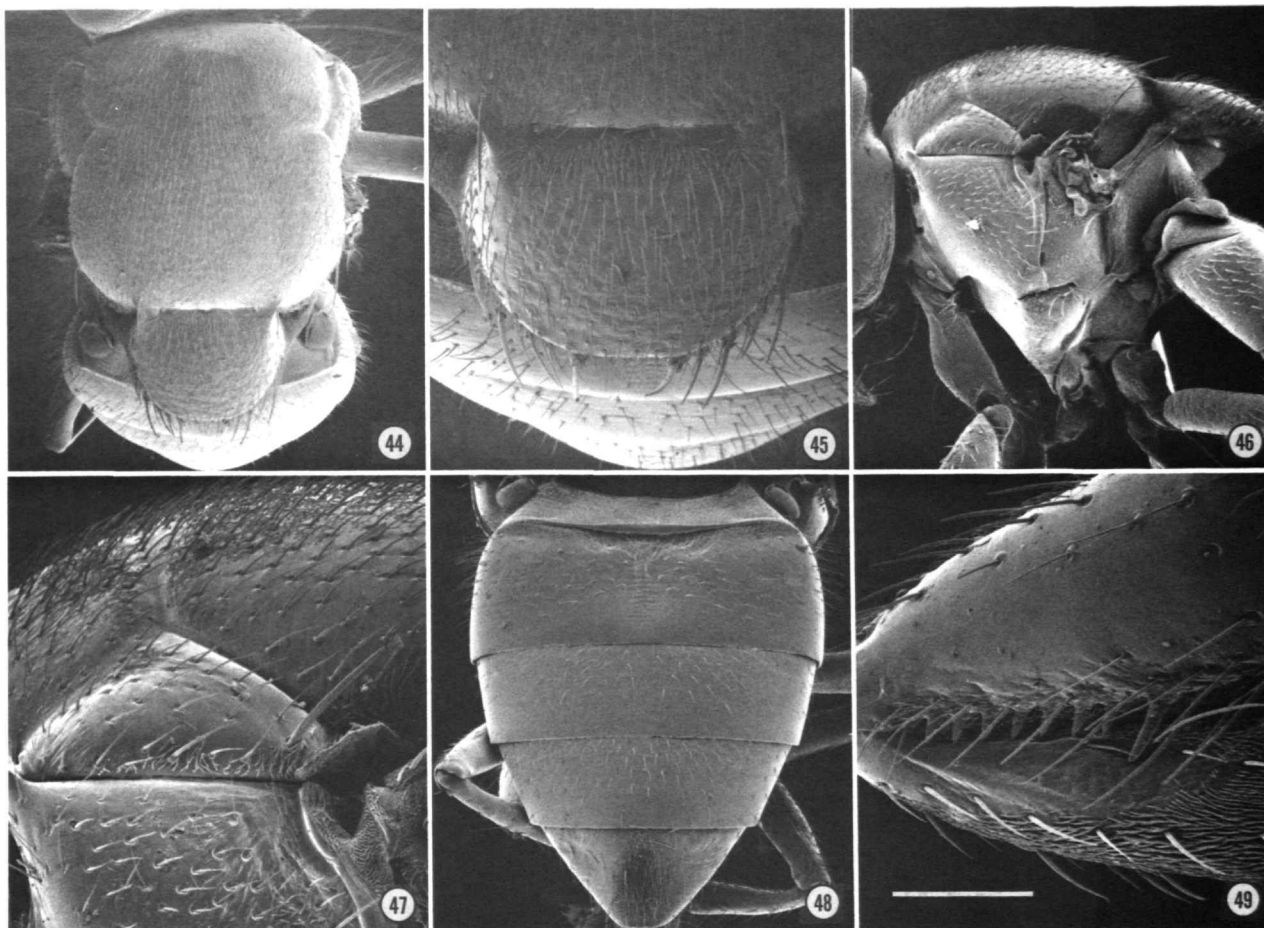
FIGURES 38–43.—Scanning electron micrographs of *Mosillus tibialis* (Washington, Franklin County; scale length in parenthesis; scale for all photographs = Figure 38): 38, head, lateral aspect (0.30 mm); 39, head, anterior aspect (0.38 mm); 40, frons, dorsal aspect (231  $\mu$ m); 41, antenna, lateral aspect (120  $\mu$ m); 42, face, anterior aspect (200  $\mu$ m); 43, parafacial, anterior aspect (136  $\mu$ m).

1.90 to 3.75 mm.

**Head** (Figures 38–43): Frons wider than long, frons width-to-length ratio averaging 0.85; mesofrons narrowly U-shaped, microtomentum very sparse, coarsely microsculptured, appearing mostly granulose, bearing numerous setulae; parafrons mostly smooth, appearing satiny. Antenna, including arista, black; flagellomere 1 with moderately dense vestiture of grayish black pubescence. Face, including antennal grooves, extensively microtomentose, obscuring most microsculpturing beneath, microtomentum as 2 broad, vertical stripes on either side of midfacial prominence, lateralmost sometimes connected with microtomentum in antennal groove; anteriormost facial projection bluntly tear-drop shaped, bulbous ventral portion wide; clypeus mostly bare of microtomentum, very finely microsculptured, appearing mostly smooth. Parafacial wide, conspicuously wider at narrowest point than width of

anterior ocellus; parafacial at level of antenna with 1 large, vertically elongate microtomentose area, obtusely pointed ventrally, length subequal to combined length of antennal segments. Gena with 1 or 2 wrinkles anteriorly, otherwise completely bare of microtomentum, smooth, shiny; gena high, eye-to-cheek ratio averaging 0.59.

**Thorax** (Figures 44–49): Mesonotum extensively and densely microtomentose, microtomentum mostly brownish gold (more so laterally) to mostly whitish gray, sometimes in a pattern with darker color as a medial stripe or with posterior  $1/3$  with microtomentum sparser; short, linear, transverse bare areas extended from dorsal angle of notopleuron; scutellum broadly trapezoidal, with posterior angles rounded and posterior margin very shallowly convex; scutellum bearing 4–5 setae on each side that arise from basal tubercles; anepisternum with small patch of microtomentum at posterodorsal corner,



FIGURES 44–49.—Scanning electron micrographs of *Mosillus tibialis* (Washington, Franklin County; scale length in parenthesis; scale for all photographs = Figure 49): 44, mesonotum, dorsal aspect (0.43 mm); 45, scutellum, dorsal aspect (200  $\mu$ m); 46, thorax, lateral aspect (0.43 mm); 47, notopleuron, lateral aspect (150  $\mu$ m); 48, abdomen, dorsal aspect (0.38 mm); 49, fore femur, posterior aspect (100  $\mu$ m).

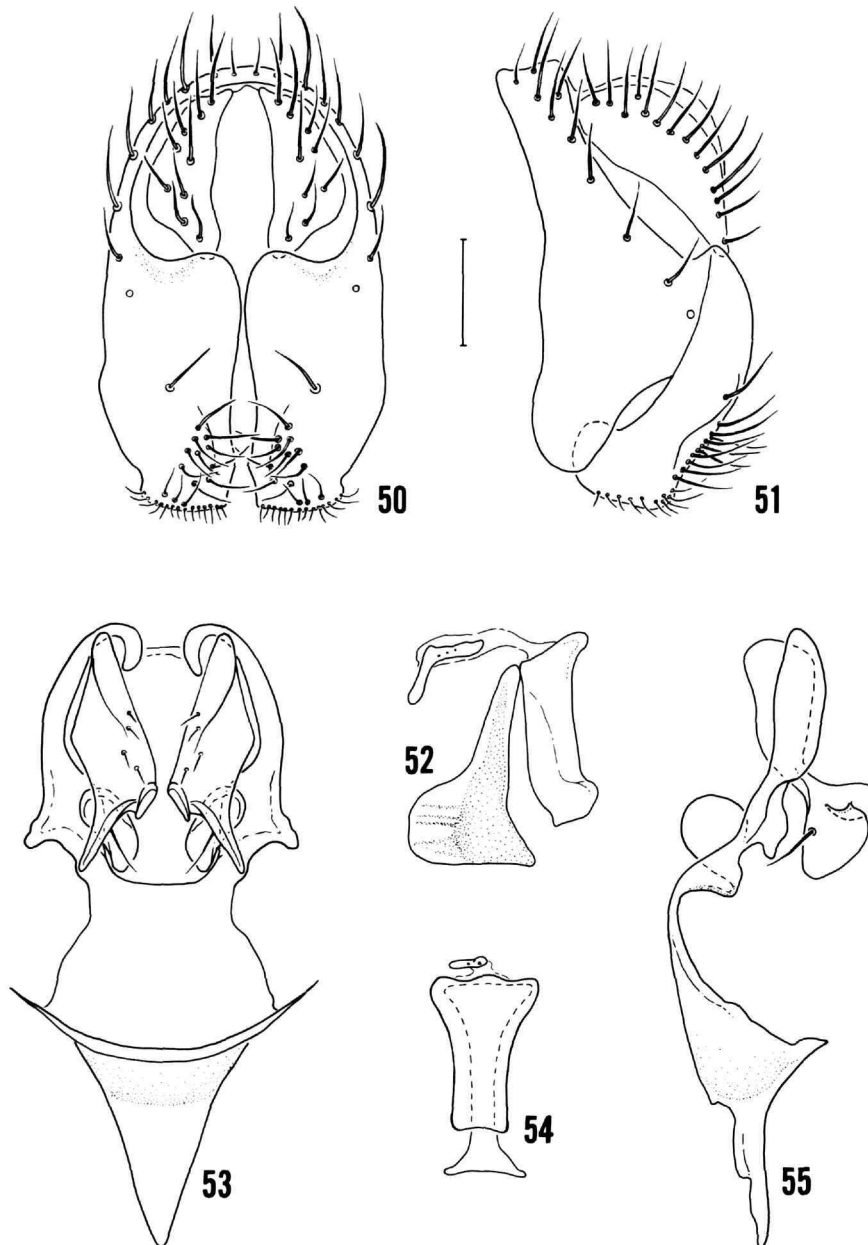
otherwise very sparsely microtomentose. Spine-like setae of fore femur small; fore tibia reddish yellow; middle tibia yellowish orange; fore basitarsomere yellow, others dark, mostly blackish brown; hind basitarsomere yellow. Costal vein ratio averaging 0.41; vein M ratio averaging 0.60.

**Abdomen:** Generally shiny, smooth, setulae sparse; 2nd abdominal tergum with median depression narrow, linear posteriorly; 5th tergum with dorsomedial area very densely microtomentose and bearing numerous setulae. Male terminalia (Figures 50–55): epandrium comparatively long, extended along anterior margin to well below cerci externally to merge with basal margin of surstylus; surstylus appearing comparatively short externally, distinctly less than length of cerci, ventral dististylar margin truncate, ventromedial surface bearing longer setulae; lateroventral projection of surstylus rounded; postgonite narrowed medially in lateral view, apical

lobe bearing seta slightly flared laterally in dorsal view; dorsal lobe smaller than setal bearing lobe; aedeagus short, length subequal to that of aedeagal apodeme, trapezoidal in dorsal view; aedeagal apodeme with ventral flange abruptly produced; hypandrium bare, elongate, with deep pocket anteriorly.

**TYPE MATERIAL.**—The holotype male of *Mosillus tibialis* is labeled “[USA. Cape May County] Wildwood NJ VII, 18, 1908 [18 Jul 1908]/♂/Holo-TYPE *Mosillus tibialis* ♂ E.T. Cresson Jr. [species name and gender symbol handwritten, dark red]/ANSP [yellow].” The holotype is double mounted (minuten in a rectangular piece of cardboard), is in good condition, and is deposited in the ANSP (6103).

**OTHER SPECIMENS EXAMINED.**—**CANADA.** *British Columbia:* Vancouver Island, Cowichan Bay, 12 Jul 1924, A.L. Melander (2♂, 3♀; ANSP, USNM). Nelson, 17 Jul 1910 (1♂; USNM).



FIGURES 50-55.—*Mosillus tibialis*: 50, external structures of the male terminalia (epandrium, cerci, surstyli), posterior aspect; 51, external structures of the male terminalia (epandrium, cerci, surstyli), lateral aspect; 52 aedeagal apodeme, ejaculatory apodeme, and aedeagus, lateral aspect; 53, gonites and hypandrium, posterior aspect; 54, aedeagus, aedeagal apodeme, and ejaculatory apodeme, posterior aspect; 55, gonite and hypandrium, lateral aspect. (Scale = 0.1 mm.)

*ECUADOR. Manabi*: Bahía, 10 Jan 1978, W.N. Mathis (1♂, 2♀; USNM).

*GUATEMALA. Coban, Alta Vera Paz*, 14 May 1926, J.M. Aldrich (1♀; USNM).

*MEXICO. Baja California Norte*: Estero Beach (9 km S

Ensenada), 5 Jul 1973, P.H. Arnaud, Jr. (1♂; CAS). Turnoff highway 1 to Motel Durado (3 km S Ensenada), 18 Jul 1977, D. Weissman, C. Mullinex (4♀; CAS). *Baja California Sur*: Aqua Caliente (San Carlos; 18.5 km east of Maneadero), 6 Jul 1973, P.H. Arnaud, Jr. (6♂; CAS). Mulegé, 14 May 1921, E.P. Van



Duzee (3♂, 3♀; CAS, USNM). Sierra de la Giganta (22 km W Loreto, Rancho Vinateria), 9 Aug 1975, W.E. and W. Savary, C.L. Mullinex (2♂; CAS). *Chiapas*: Finca Prusia (33 km S Jaltenango, 1000 m), 10–12 May 1985, W.N. Mathis (20♂, 31♀; USNM); San Cristobal de las Casas, 13 Aug 1959, N.L.H. Krauss (1♂; USNM). *Chihuahua*: Chihuahua, 12 Aug 1951, P.D. Hurd (1♀; USNM). *Distrito Federal*: Milpa Alta, 8 Jul 1953, R. Nettel F. (1♂, 2♀; USNM). *Jalisco*: Guadalajara, 27 Jun 1969, S.C. Williams (1♀; CAS). *México*: Texcoco, 28 Feb 1957, W.W. Gibson (2♀; USNM); Texcoco, El Batán, 4 Jan 1957, J.L. Carrillo (1♀; USNM). *Oaxaca*: L.O. Howard (1♀; USNM). *Sonora*: Rocky Point (marsh), 21 Apr 1947, A.L. Melander (1♂, 5♀; USNM). *Veracruz*: Xico, 7 Sep 1951, A.H. Sturtevant (1♂, 1♀; USNM).

*PERU*. Lima: Lima (Lagunas de Villa), 14 Feb–30 Aug 1984, 1988, W.N. Mathis (15♂, 13♀; USNM).

*UNITED STATES*. *Alabama*: Mobile Co., Kushla, 11 Jun–24 Oct, 1914, 1916, 1924, A.H. Sturtevant (11♂, 5♀; USNM). *Arizona*: Apache Co., Adamana, 12 Jun 1950 (1♀; UTA). Coconino Co., Bill Williams Forest, Aug, F.H. Snow (7♂, 9♀; 2ex; ANSP); Supai, Havasu Canyon (3500 ft, = 1067 m), 2 Aug 1934, F.E. Lutz (2♂; AMNH); The Gap, 17 Jun 1950, A.H. Sturtevant (2♂, 1♀; USNM); Todds Lodge (Oak Creek Canyon), 9 May 1950, J. Sperry (1♀; USNM). Maricopa Co., Tempe, 11 May 1942, A.L. Melander (7♂, 1♀; USNM). Pima Co., Organ Pipe National Monument, Alamo Canyon, 16 Apr 1947, A.L. Melander (2♀; USNM); Organ Pipe National Monument, Rincon Spring, 18 Apr 1947, A.L. Melander (5♂, 4♀; USNM). Yuma Co., Dateland, 6 May 1948, A.L. Melander (2♀; USNM); Yuma, 26 Jun 1917, J.M. Aldrich (2♀; USNM). Squaw Spring, 24 Jul (1♀; USNM).

*California*: Alameda Co., Berkeley, 31 Aug 1944, L.W. Quate (1♂; USNM); Berkeley Hills, 20 Apr 1908 (6♂, 2♀; ANSP); Oakland, 11 Jul 1937, M.A. Cazier (1♂; AMNH). Alpine Co., Hope Valley, 11 Sep 1938, M.A. Cazier (1♂; AMNH). Calaveras Co., Milton, 21 Oct 1917, J.C. Bradley (2♂; USNM). Contra Costa Co., Antioch, 25 Jun 1947, A.L. Melander (2♂; USNM); Jewell Lake, 4 Oct 1947, W.W. Wirth (1♂, 1♀; USNM); Pittsburg, 25 Nov 1923, E.P. Van Duzee (1♂; USNM). Del Norte Co., Smith River, 22 Jun 1932, J.M. Aldrich (1♀; USNM). Humboldt Co., Trinidad, 18 Sep 1934, A.L. Melander (1♂; ANSP). Imperial Co., Salton Sea Beach, 30 Apr 1953, J.C. Hall (1♀; USNM). Inyo Co., Deep Spring, 16 Aug 1953, E.I. Schlinger (1♂; USNM); Lone Pine, 28 July 1940, R.H. Beamer (2♂; USNM); Panamint Spring, 15 Aug 1953, E.I. Schlinger (1♀; USNM). Kern Co., Richbar (5 mi [8 km] S Democrat Springs), 6 Feb 1948, W.W. Wirth (1♂; USNM). Lake Co., Clear Lake, 18 Jun 1935, A.L. Melander (4♂, 2♀; ANSP, USNM). Los Angeles Co., Claremont, C.F. Baker, Metz (2♀; USNM); El Monte, 8 Jun 1911, P.H. Timberlake (1♀; USNM); Long Beach, A.L. Melander (5♂; USNM); Long Beach (Los Angeles River), 18–24 Jun 1952, 1954, M.T. James (3♂, 1♀; WSU); Lovejoy Lake, 10 May 1944, A.L. Melander (9♂, 4♀; USNM); Malibu Beach, 8

May 1952, A.H. Sturtevant (1♂; USNM); Pasadena, May–30 Sep 1944, 1949, A.H. Sturtevant (5♂, 3♀; USNM, UTA); Rivera, 17 Jun 1889 (1♂, 3♀; ANSP); Rosemead, 23 Jun 1943, J. Schuh, K. Gray (1♀; WSU); Saugus (5 mi [8 km] E), 10 Apr 1953, A.H. Sturtevant (2♂; USNM); Saugus (10 mi [16 km] NE), 10 Apr 1953, A.H. Sturtevant (1♀; USNM); Tanbark Flat, 24 Jun 1952, J.K. Hester (1♀; USNM); Whittier, 5 Jan–5 Oct 1960, A.L. Melander (1♂, 1♀; USNM).

Mono Co., Mammoth Lakes, 29 Jul 1940, E.E. Kenaga, L.J. Lipovsky (1♂, 2♀; USNM); Mono Lake (NW shore), 12 Aug 1980, R.S. Zack (1♀; WSU); Topaz Lake, 17 Aug 1951, E.I. Schlinger (1♀; USNM). Monterey Co., Spreckels, 27 Jun 1916, C.F. Stahl (1♀; USNM). Orange Co., Buena Park, 19 May 1944, A.L. Melander (3♂, 2♀; USNM); Corona del Mar, 27 Aug 1943, A.L. Melander (10♂, 8♀; USNM); Green River Camp, Lower Santa Ana Canyon, 9 May 1933, E.P. Van Duzee (1♂, 1♀; USNM); Laguna Beach, F.R. Cole (1♀; USNM). Riverside Co., Andreas Canyon, 31 Mar 1951, A.L. Melander (1♀; USNM); Burnt Valley, 13 Apr 1989, A. Freidberg (1♂; USNM); Desert Beach, Salton Sea, 2 Jan 1953, P.H. Arnaud, Jr. (7♂, 3♀; USNM); Elsinore, 19 Feb 1950, A.H. Sturtevant (3♂, 4♀; USNM, UTA); Elsinore Lake, 25 Jan–21 Nov, 1934, 1935, 1950, A.J. Basinger, S. Fromer, A.L. Melander (36♂, 31♀; ANSP, USNM); Indio, 10 Jun 1950, A.H. Sturtevant (1♂; UTA); Little Lake, 25 Jul 1940, D.E. Hardy (1♀; USNM); Palm Springs, 4 Mar–18 Nov 1943, 1949, A.L. Melander (5♂, 8♀; USNM); Riverside, 18 May–22 Dec 1934, 1935, 1954, 1963, J.C. Hall, N.L.H. Krauss, A.L. Melander (15♂, 13♀; ANSP, USNM); Temecula, 4 Apr–27 Jun 1949, 1950, A.L. Melander, W.W. Wirth (4♂, 1♀; USNM).

San Bernardino Co., Jenks Lake, 7 Jun–7 Sep 1950, 1954, 1956, A.L. Melander (2♂, 3♀; USNM); Mt. Home Canyon, 22 Sep 1953, A.L. Melander (1♂, 1♀; USNM); Needles, 10 Mar 1922, J.A. Kusche (1♂; USNM); Twenty-nine Palms, 29 Aug 1934, P.H. Timberlake (1♂; USNM); Victorville, 10–22 May 1945, 1952, A.L. Melander, A.H. Sturtevant (3♂, 2♀; USNM). San Diego Co., Borrego, 15 Mar–5 May, 1946, 1950, J.L. Sperry (1♂, 3♀; USNM); Carlsbad, 1 Jun 1954, J.C. Hall (1♀; USNM); Desert Edge, 17 Apr 1915, M.C. Van Duzee (1♂, 1♀; ANSP, USNM); El Capitan Reserve, 25 Sep 1955, P.H. Arnaud, Jr. (1♀; USNM); Jacumba Spring, J.M. Aldrich (1♀; USNM); Lake Henshaw, 10 Mar 1930, A.H. Sturtevant (2♂; USNM); Lakeside, 4 Aug 1932, J.M. Aldrich (2♂, 1♀; USNM); San Diego, 20 Apr–13 Dec 1915, 1916, H.G. Dyer, M.C. Van Duzee (5♂, 1♀; ANSP, USNM); Yaqui Wells, 20 Mar 1951, A.H. Sturtevant (1♀; USNM). San Francisco Co., Golden Gate Park (1♂; ANSP); San Francisco, 7 Aug–5 Nov 1908, 1925, 1972, F.E. Blaisdell, H.H. Keifer, P. Rubtzoff (1♂, 2♀; CAS, ANSP, USNM). San Luis Obispo Co., Oceano Beach, 19 Aug 1948, W.W. Wirth (1♂; USNM); Oso Flaco Lake, 23 Jun 1948, W.W. Wirth (1♀; USNM); Paso Robles, 26 Sep 1934, A.L. Melander (1♀; USNM); San Simon, 14 Sep 1980, A. Freidberg (1♂, 4♀; USNM). San Mateo Co.,

Pescadero (S of), 16 Aug 1951, A.H. Sturtevant (1♀; USNM); Redwood City, 31 Aug–15 Sep 1959, 1963, P.H. Arnaud, Jr. (2♂, 3♀; USNM). Santa Barbara Co., Carpinteria, 3–11 Aug 1950, A.L. Melander (12♂, 12♀; USNM); Point Arguello, 23 Aug 1962, R.R. Sanders (2♂; USNM); Seven Oaks, 18 Sep 1953, A.L. Melander (3♂, 1♀; USNM). Santa Clara Co., San Jose, 25 Oct 1967, R.R. Pinger (10♂, 4♀; USNM). Santa Cruz Co., Palo Alto, 1 Aug 1957, P.H. Arnaud (3♀; USNM); Santa Cruz (beach and lagoon), 15–17 Jun 1950, M.R. James (3♂, 3♀; USNM, WSU). Siskiyou Co., Lower Klamath Lake, 22 Jun 1957, J. Schuh (1♂; WSU). Stanislaus Co., San Joaquin River, Newman, 15 Jun 1924, J.M. Aldrich (2♀; USNM). Ventura Co., Hueneme (salt marsh), 17 Jun 1948, W.W. Wirth (2♂, 1♀; USNM); Point Mugu, 1 Aug 1952, R.R. Sanders (1♂; USNM); San Nicolas Island, 13 Sep 1962, R.R. Sanders (1♂; USNM). Dyerville, 20 Jun 1935, A.L. Melander (1♂; USNM). Kern River, 28 Aug 1949, A.H. Sturtevant (1♀; UTA).

*Colorado:* Boulder Co., Boulder (5500 ft, = 1676 m), 7–17 Aug 1911, 1919, S.A. Rohwer (3♂, 1♀; AMNH, USNM). Denver Co., 1 Aug 1939 (3♂, 1♀; ANSP, WSU). Garfield Co., Rifle (5400 ft, = 1646 m), 19–21 Jul 1919 (1♂, 2♀; AMNH). Jefferson Co., Golden, 17 Jun 1940, A.L. Melander (1♂; USNM). Larimer Co., Fort Collins (on *Melilotus*), Baker (2♀; ANSP, USNM); Loveland, 18 Aug 1934, C.W. Sabrosky (1♀; ANSP). Logan Co., Sterling, 20 Jul 1923, G. Sandhouse (1♂; USNM). Mesa Co., Grand Junction, 14 Jun 1927, J.M. Aldrich (3♂; ANSP, USNM). Otero Co., La Junta (4100 ft, = 1250 m), 12 Aug 1920 (3♂, 1♀; AMNH); Rocky Ford, 12 Oct 1910, McMillan (1♂, 1♀; USNM). *Delaware:* New Castle Co., Wilmington, 23 Aug 1947 (1♀; USNM). *District of Columbia:* Washington, Jun (1♀; USNM). *Florida:* Dade Co., Biscayne Bay, A.T. Slosson (1♂, 1♀; USNM). Duval Co., Jacksonville, 26 Jun 1957, P.H. Thompson (1♂; USNM). Hillsborough Co., Tampa, 29 Mar 1933, A.L. Melander (1♂, 1♀; ANSP, USNM). Orange Co., Orlando, 5 Feb 1932, A.L. Melander (1♂; ANSP). Seminole Co., Sanford, 1 Mar 1927, F.M. Uhler (1♂; USNM). *Georgia:* Chatham Co., Savannah (privy trap), Mar–Apr 1953, J.W. Kilpatrick (2♂, 1♀; WSU). Thomas Co., USPHS, 8 Jun 1948 (3♂, 3♀; USNM). *Hawaii:* Maui: Kanaha Pond, 5 Sep 1970, J.A. Tenorio (2♂, 1♀; USNM, WSU). Oahu: Fort Kam, 4 Jul 1944, D.G. Hall (2♂, 3♀; USNM); Kailua, Enchanted Lakes, 8 Sep 1969, J.A. Tenorio (1♀; WSU). *Idaho:* Latah Co., Moscow, 5–23 Aug 1912, J.M. Aldrich (2♂; USNM); Troy, Jul 1931 (1♂; USNM). Nez Perce Co., Lewiston, 12 May–1 Jun, 1901, 1919, A.L. Melander (1♂, 4♀; ANSP, USNM). *Indiana:* Porter Co., Indiana Dunes, 19 Jul 1933, A.L. Melander (1♂; ANSP). Tippecanoe Co., LaFayette, 21 Aug–5 Sep, J.M. Aldrich (4♂, 6♀; USNM).

*Kansas:* Sedgwick Co., Maize, 29 Jun 1934, C.W. Sabrosky (1♀; ANSP). *Louisiana:* St. Landry Par., Opelousas, Mar 1897 (1♀; USNM). *Maryland:* Baltimore Co., Hart-Miller Island, 31 May 1987, W.E. Steiner, J.M. Swearingen (2♂, 2♀; USNM).

Calvert Co., Chesapeake Beach, 2 Aug–17 Nov 1914, 1920, 1923, J.M. Aldrich, J.R. Malloch, R.C. Shannon (7♂, 4♀; ANSP, USNM). Prince Georges Co., College Park, 7 Aug 1938, C.T. Greene (1♀; USNM). Queen Annes Co., Kent Narrows, Jul 1954, M.R. Wheeler (1♂; USNM). *Massachusetts:* Barnstable Co., Pocasset, 26 Jul 1950, A.H. Sturtevant (2♂, 3♀; USNM). Bristol Co., New Bedford, 26 Aug 1896, Hough (1♀; USNM). Dukes Co., Pasque Island, 8 Aug 1954, A.H. Sturtevant (1♂; USNM); Vinyard Haven, 17 Aug 1954, A.H. Sturtevant (1♂; USNM). Nantucket Co., Nantucket, 21 Sep 1915, A.H. Sturtevant (1♀; USNM). *Minnesota:* Anoka Co., Moore's Lake, 14 Jul 1925, C.B. Phillip (1♂; ANSP). *Mississippi:* Humphreys Co., Belzoni, 5 Aug, H.S. Barber (1♀; USNM). *Missouri:* Boone Co., Columbia, 11 Jul–4 Oct 1967, 1974, W.S. Craig, F.D. Parker (7♂, 10♀; USNM).

*Montana:* Flathead Co., Columbia Falls, 22 Aug 1967, F.D. Parker (1♂; USNM). *Nebraska:* Sheridan Co., Hay Springs, 17 Sep 1952, A.H. Sturtevant (1♂, 1♀; USNM). *Nevada:* Churchill Co., Fallon (4000 ft, = 1219 m), 10 Jun 1930, E.L. Bell (1♀; AMNH). Clark Co., Mesquite, 23 Sep 1980, A. Freidberg (1♂, 1♀; USNM). Mineral Co., Walker Lake, 1933, Wickham (several ♂♀; ANSP, USNM). Nye Co., Carrant, 24 May 1954, M.A. Cazier (1♂, 1♀; AMNH). Washoe Co., Pyramid Lake, 16 Jul 1911, J.M. Aldrich (1♂; USNM); Reno, Sky Ranch, 14 Jul 1952, E.I. Schlinger (1♀; USNM); Sparks, 18 Jul 1953, E.I. Schlinger (1♀; USNM); Winnemucca Lake, 17 Jul 1911, J.M. Aldrich (1♀; USNM).

*New Jersey:* Camden Co., Cramer Hill, 24 Aug (1♀; ANSP). Cape May Co., Wildwood, 18 Jul 1908, E.T. Cresson, Jr. (11♂, 2♀; ANSP). Essex Co., Newark, Jul 1964 (2♀; USNM). Monmouth Co., Avon by the Sea, 27 Sep 1908 (1♂, 1♀; ANSP). Ocean Co., Manahawkin, 5 Sep 1909 (1♂; ANSP). *New Mexico:* Bernalillo Co., Albuquerque, 14 Aug 1947 (3♀; USNM). Chaves Co., Roswell, Aug, T.D.A. Cockerell (3♂; USNM). Dona Ana Co., Las Cruces, 13 Jun 1893, 1917, 1950, J.M. Aldrich, T.D.A. Cockerell (4♂, 3♀; USNM, UTA). Santa Fe Co., Espanola, 11 Aug–28 Sep 1953, T.D.A. Cockerell, W.B. Heed (1♂, 1♀; USNM). *New York:* Nassau Co., Sea Cliff, N. Banks (1♂; ANSP). Suffolk Co., Cold Spring Harbor, Jul (1♂, 1♀; ANSP, USNM); Hampton Bays, 14 Sep 1953, L. Wilcox (1♀; USNM); Oak Island, Jul (1♂; USNM); Orient, 29 Sep 1948, R. Latham (1♀; USNM); Riverhead, 24 Jul 1933, F.S. Blanton (3♀; AMNH); Sag Harbor, 4 Aug 1948, R. Latham (1♂; USNM); Speonk, 26 Sep 1953, L. Wilcox (1♀; USNM). Westchester Co., Dobbs Ferry, 20 Aug–19 Sep 1958, C. Olsen (1♂, 1♀; USNM).

*North Carolina:* Forsyth Co., (sewer sludge), 15 Aug 1962, C.G. Wright (1♂, 1♀; USNM). Guilford Co., Greensboro, 21 Oct 1922, T.D.A. Cockerell (6♂, 4♀; USNM). Moore Co., Southern Pines, Apr, A.H. Manee (1♂; ANSP). *Oklahoma:* Kingfisher Co., Kingfisher, 13 Sep 1952, A.H. Sturtevant (2♂; UTA). *Oregon:* Douglas Co., Umpqua River mouth (3 km S), 11 Oct 1981, L. and I. Cederholm (1♀; ZIL). Harney Co.,

Manns Lake (19 mi [30.4 km] SW Oregon route 78), 12 Sep 1981, R.S. Zack (1♂; WSU). Lake Co., Summer Lake, 28 Jul 1930, H.A. Scullen (1♂; USNM). Wasco Co., The Dalles, 15 Jun 1938, J. Schuh, K. Gray (1♀; USNM).

*Pennsylvania*: Cumberland Co., West Fairview, Jul 1954, M.R. Wheeler (1♂; UTA). Delaware Co., Swarthmore, 13 Jun 1909, E.T. Cresson, Jr. (1♀; ANSP). *Texas*: Cameron Co., Rio Hondo, 15 Feb 1950 (1♀; UTA). El Paso Co., El Paso, 5 Apr 1902 (2♂, 1♀; ANSP). Galveston Co., Galveston, 5 Apr–10 Jun 1900, 1917, J.M. Aldrich, F.H. Snow, W.M. Wheeler (10♂, 12♀; AMNH, ANSP, USNM). Hays Co., San Marcos, 8 Nov 1962, A.H. Sturtevant (2♂, 3♀; USNM). Hildalgo Co., 26 Jul 1946, H.R. Dodge (1♂; USNM). Presidio Co., Marfa, 13 Jun 1917, J.M. Aldrich (1♀; USNM). Travis Co., Austin, 20 Jan–7 Oct 1899, 1901, 1954, W.M. Wheeler (3♂, 1♀; AMNH, USNM, UTA). Victoria Co., Victoria, 10 May 1914, F.C. Bishop (8♂, 12♀; USNM). Ardmore Island, 12 Mar 1907, F.C. Bishop (2♀; USNM).

*Utah*: Box Elder Co., Bear River Canyon, 16 Aug 1953, G.F. Knowlton (1♂; USNM); Brigham City, Bear River Refuge, 23 Jul 1962, K.J. Capelle (1♂, 1♀; USNM); Corinne, 16 Aug 1953, G.F. Knowlton (1♀; USNM); Garland, 25 May 1953, G.F. Knowlton (3♀; USNM). Cache Co., Wellsville, 28 Aug 1938, G.F. Knowlton, D.E. Hardy (1♀; USU). Emery Co., Greenriver (3 mi [4.8 km] N, 38°59'N, 110°09'W), 5 Aug 1992, D. and W.N. Mathis (1♂; USNM). Kane Co., Kanab, 14 Jul 1948, G.F. Knowlton (4♂, 3♀; USNM). Millard Co., Delta, 11 Jun 1969, G.F. Knowlton (1♀; USU); Leamington, 24 Jun 1933, G.F. Knowlton (1♂; ANSP). Salt Lake Co., Roy, 30 Jun 1927, G.F. Knowlton (2♀; AMNH). San Juan Co., Blue Creek, 14 Sep 1930, G.F. Knowlton (1♂; ANSP). Sevier Co., Monroe, 21 Sep 1929, D.E. Fox (1♂; USNM); Richfield, 27 Jun 1927, G.F. Knowlton (1♂, 1♀; AMNH). Utah Co., Goshen Warm Springs (4.3 mi [6.9 km] W Santiquen), 4 Aug 1992, D. and W.N. Mathis (2♂, 2♀; USNM); Lehi, 25 Jul 1927, G.F. Knowlton (1♀; AMNH); Provo, 12–25 Jul 1927, G.F. Knowlton (2♂; AMNH); Spanish Fork, D.E. Hardy (1♂, 2♀; ANSP, USNM). Wayne Co., Hanksville, 2 Jun 1966, G.F. Knowlton (1♀; USU). Weber Co., Odgen, 1 Aug 1911 (1♂, 1♀; USNM); Plain City, 18 Jul 1937, D.E. Hardy (1♀; ANSP).

*Virginia*: Accomack Co, Assateague Island, 22 Jul 1967, G.C. Steyskal (1♂; USNM). Albemarle Co., Greenwood, 17 Oct 1907 (1♂, 1♀; USNM). Stafford Co., Potomac Creek, 22 May 1896 (1♀; ANSP). *Washington*: Adams Co., Columbia National Wildlife Refuge, Black Lake (1.5 mi [2.4 km] S, alkalie pond), 30 Jul 1978, R.S. Zack (2♂, 4♀; WSU); Columbia National Wildlife Refuge, Lower Crab Creek near Black Lake, 28 Aug 1980, R.S. Zack (3♂; WSU); Lind, 18 Aug 1919, F.W. Carlson (1♀; WSU); Othello (3.2 mi [5.1 km] W, farm pond), 22 Jun–23 July 1978, 1992, D. and W.N. Mathis, R.S. Zack (9♂, 3♀; WSU, USNM); Washtucna (12 mi [14.4 km] W), Sand Hills County Park, 29 Jul–10 Sep 1977,

1978, R.S. Zack (5♂, 2♀; WSU). Asotin Co., Asotin, (3♂; USNM); Clarkston, 8 Jun 1924, A.L. Melander (1♂; USNM). Benton Co., Kennewick, 7 Jun 1916, A.L. Melander (4♂, 3♀; ANSP, USNM); Plymouth (7 mi [11.2 km] W, irrigation pond), 9 Jul 1978, R.S. Zack (2♂, 2♀; WSU); Prosser, 14–23 Apr 1948, E.C. Klostermeyer (1♂, 1♀; WSU); Richland, 10 Apr–19 Jun 1954, 1974, M.T. James, N.E. Woodley (3♂, 1♀; WSU). Chelan Co., Chelan, Siwash, Wapato's shore, 25 Jun 1918, A.C. Burrill (3♀; WSU). Clallam Co., Blyn, 10 Aug 1921, A.L. Melander (1♂; ANSP); Dungeness, 24 Aug 1910 (2♂, 1♀; ANSP, USNM); Port Angeles, 8 Feb 1951 (1♀; UTA). Clark Co., Vancouver Lake (5–7 km E Vancouver), 1 Jul 1988, W.N. and D. Mathis (2♂; USNM). Franklin Co., Eltopia (7 mi [11.2 km] WSW), 1975, W.N. Mathis (13♂, 4♀; USNM); Lake Kahlottus (46°39'N, 118°32'W), 25 Jul 1992, D. and W.N. Mathis (4♂, 2♀; USNM); Pasco (2 mi E [3.2 km]), 3 Aug 1972, W.N. Mathis (5♂, 2♀; USNM); Ringold (Columbia River), 2 Jul 1988, W.N. and D. Mathis (2♂, 3♀; USNM); Ringold (Columbia River, 3 km N), 2 Jul 1988, W.N. and D. Mathis (2♂, 2♀; USNM); Sacajawea State Park, 12 Jul 1988, W.N. and D. Mathis (3♂, 4♀; USNM). Garfield Co., Lower Granite Dam (4 mi [6.4 km] NW, sand dunes), 9 Aug 1983, W.J. Turner (2♂, 1♀; WSU).

Grant Co., Columbia National Wildlife Refuge, Migrane Lakes, 16 Jun 1978, R.S. Zack (1♂, 2♀; WSU); Columbia National Wildlife Refuge, Soap Lake, 16 Jun 1978, W.J. Turner (2♂; WSU); Columbia National Wildlife Refuge, Warden Lake, 16 Aug 1977, R.S. Zack (1♂, 2♀; WSU); Coulee City, 3 Sep 1920, R.C. Shannon (1♂; USNM); Royal City, 6 Oct 1968, R.C. Sanders (1♀; USU); Royal City (5.1 mi [8.2 km] W, irrigation pond), 13 Jul 1978, R.S. Zack (3♂, 1♀; WSU); Soap Lake, 24 Jul–22 Aug, 1922, 1924, A.L. Melander (11♂, 6♀; ANSP, USNM); Soap Lake (N shore, 47°26'N, 119°15'W), 23 Jul 1992, D. and W.N. Mathis (4♂, 4♀; USNM). Jefferson Co., Quilcene, 16 Aug 1910 (1♀; USNM). Kittitas Co., Vantage, 8 May 1951 (1♂; UTA). Klickitat Co., Glenwood, Klickitat River, 17 Jun 1917, A.L. Melander (3♀; ANSP, USNM). Lincoln Co., Fishtrap Lake, 8 Jul, J.M. Aldrich (2♀; USNM); Lake Lenore (N end, 10 mi [16 km] N Soap Lake), 23 Jul 1983, R.S. Zack (4♂, 2♀; WSU). Okanogan Co., Soap Lake (11 mi [17.6 km] SW Okanogan), 23 Jul 1983, R.S. Zack (3♂, 1♀; WSU). Pend Oreille Co., Indian Island near Furport, 23 Jun 1982, R.S. Zack (1♀; WSU). Pierce Co., Mt. Rainier National Park, Longmire's Spring, 2 Aug 1905 (1♂; USNM). San Juan Co., Olga, 26 Jul 1909 (1♂, 1♀; ANSP, USNM). Walla Walla Co., Lowden, 22 Jun 1921, A.L. Melander (1♀; USNM). Whitman Co., Almota, 24 Jun–15 Oct 1977, 1978, A.L. Melander, R.S. Zack (3♂, 1♀; USNM, WSU); Almota (Almota Creek, 650 ft (= 198 m), on *Solidago occidentalis*), 10 Sep 1975, W.J. Turner (1♀; WSU); Kamiac Butte (1♂; ANSP, USNM); Pullman (pig excrement), 1955, M. Coffey (2♂, 1♀; WSU); Pullman (stream 5 mi [8 km] SW), 18 Aug 1978, R.S.

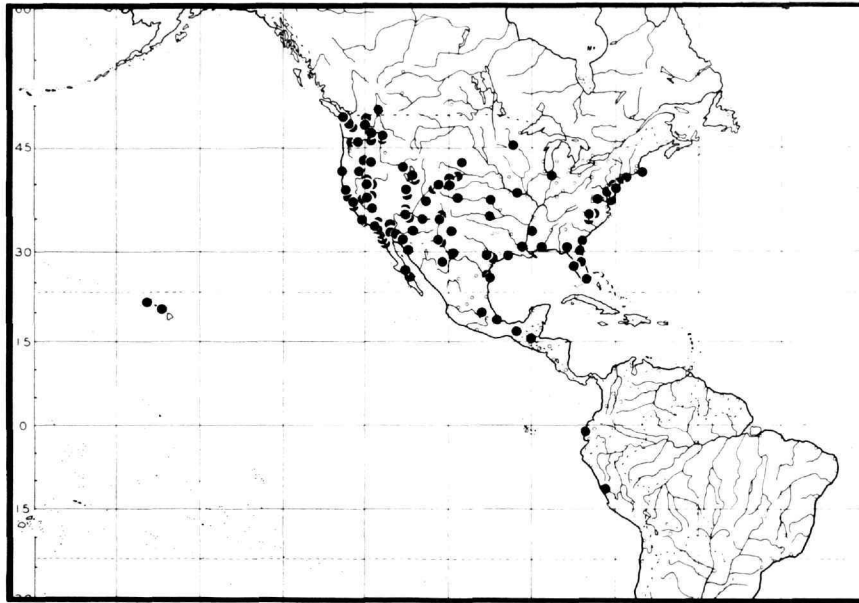


FIGURE 56.—Distribution map for *Mosillus tibialis*.

Zack (3♂; WSU); Riparia, 8 Apr 1908 (1♀; USNM); Rock Lake (S shore), 25 Jun 1982, R.D. Akre, R.S. Zack (1♀; WSU); Wawawai, 7 Apr 1954, M.T. James, J. Quist (1♂; WSU). Yakima Co., Toppenish, 19 Jun 1923, A.L. Melander (1♂, 2♀; ANSP, USNM); Yakima, J.M. Aldrich (6♂, 3♀; ANSP, USNM).

**DISTRIBUTION** (Figure 56).—**NEW WORLD.** Nearctic: Canada (BC), USA (AL, AZ, CA, CO, DC, DE, FL, GA, ID, IN, KS, LA, MA, MD, MN, MO, MS, MT, NB, NC, NJ, NM, NV, NY, OK, OR, PA, TX, UT, VA, WA). Neotropical: Ecuador, Guatemala, Mexico (BCN, BCS, CHI, CHU, JAL, MEX, OXA, SON, VRC), Peru. Oceanian: Hawaii (Maui, Molokai, Oahu).

**NATURAL HISTORY.**—We suspect that the occurrence of this species on the Hawaiian Islands is adventive, probably through commerce from the West Coast of North America.

**DIAGNOSIS.**—This species is distinguished from related congeners, especially those from the Western Hemisphere, by the following combination of characters: face, including antennal grooves, extensively microtomentose; parafacial with 1 vertically elongate microtomentose area that is obtusely pointed ventrally, length subequal to combined length of antennal segments; posterodorsal portion of anepisternum with sparse microtomentum, inconspicuous; scutellum bearing 4–5 setae on each side that arise from basal tubercles; 5th tergum with dorsomedial area densely microtomentose.

**REMARKS.**—This is a widespread species in temperate North America, but there are a few records from the subtropics and

tropics. Some of the latter, the Hawaiian records in particular, may represent recent introductions.

#### The *subsultans* Group

**SPECIES INCLUDED.**—*Mosillus asiaticus*, new species (China and Mongolia), *M. bracteatus* Schiner, and *M. subsultans* (Fabricius).

**DIAGNOSIS.**—This species group is distinguished by the following combination of characters: mesonotum sparsely microtomentose to mostly bare, shiny and frequently microsculptured; fore and middle tibiae mostly black; 2nd abdominal tergum with median depression broad basally, narrowly triangular; epandrium not evident between cerci and dististylar bases; surstyli elongate, equal to or greater than length of cerci, tapered and somewhat pointed ventrally.

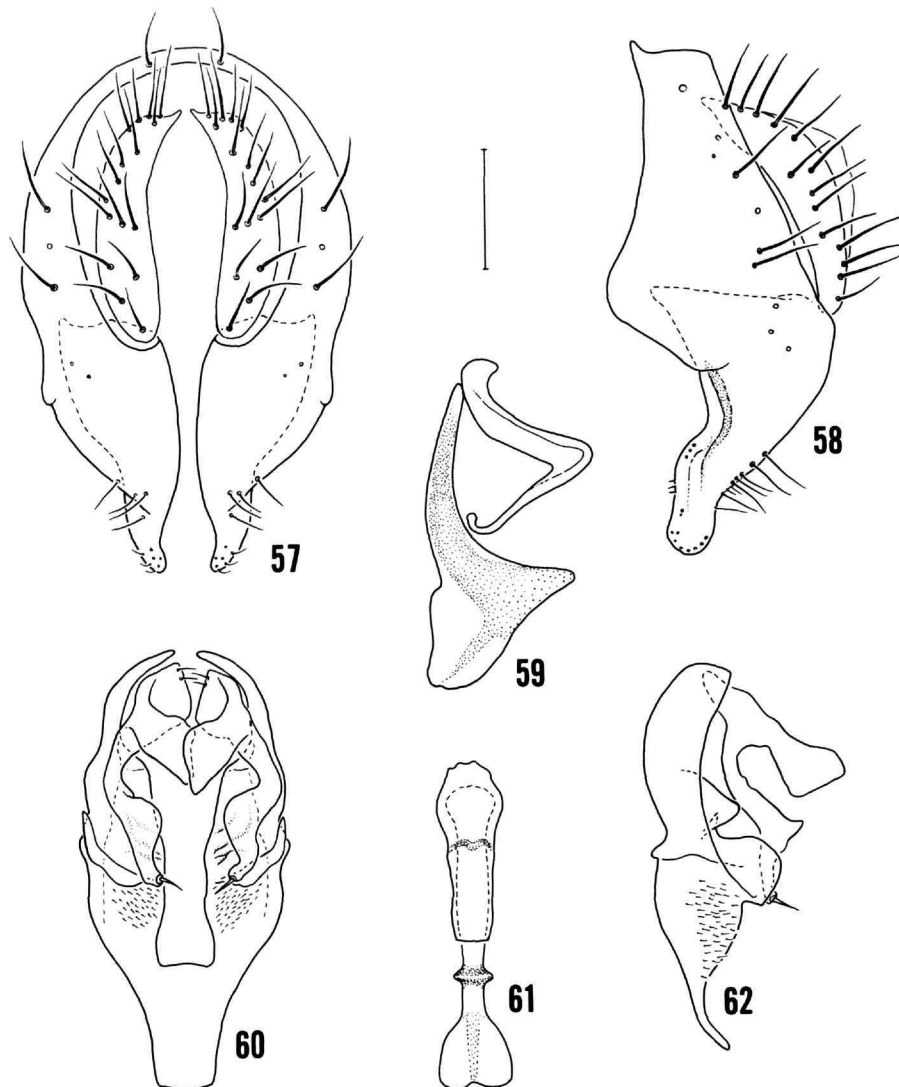
**DISTRIBUTION.**—Old World in the Palearctic and Afrotropical regions. Apparently lacking, perhaps secondarily, in the Oriental, Australasian, and Oceanian regions.

**REMARKS.**—Although widespread in the Old World, no species of this group is known to occur in the tropics nor are any species now found in the Australasian or Oriental regions.

#### *Mosillus asiaticus*, new species

FIGURES 57–63

**DESCRIPTION.**—Moderately small shore flies, length 2.20 to 2.85 mm.



FIGURES 57-62.—*Mosillus asiaticus*: 57, external structures of the male terminalia (epandrium, cerci, surstyli), posterior aspect; 58, external structures of the male terminalia (epandrium, cerci, surstyli), lateral aspect; 59, aedeagal apodeme and aedeagus, lateral aspect; 60, gonites and hypandrium, posterior aspect; 61, aedeagus and hypandrium, posterior aspect; 62, gonite and hypandrium, lateral aspect. (Scale = 0.1 mm.)

**Head:** Frons wider than long, frons length-to-width ratio averaging 0.80; frons bare of microtomentum; parafrons with very faint microsculpturing, appearing mostly smooth; mesofrons indicated by shallow furrow but otherwise smooth, differing little from parafrons. Antenna black; arista dark, basal portion black, apex dark brown. Face, except for deep antennal grooves, lacking microtomentum; lateral surfaces of face with a few shallow pits and striae; clypeus mostly smooth; anteriormost projection of face tear-drop shaped; ventral margin of antennal grooves evenly rounded. Parafacial moderately wide, slightly more than width of anterior ocellus;

parafacial at level of antenna with 2 microtomentose, silvery gray patches, dorsal patch triangular. Gena mostly smooth, shiny, moderately high, eye-to-cheek ratio averaging 0.37.

**Thorax:** Thorax mostly smooth, shiny black, microtomentum almost entirely lacking; scutellum broadly rounded; lateral scutellar setae 2, each arising from a tubercle. Legs: spine-like setae along apicoventral margin of fore femur small, length of largest seta at most  $\frac{1}{2}$  width of fore tibia; tibia black; fore tibia with apex partially invested with silvery-gray microtomentum; hind basitarsomere black. Wing: costal vein ratio averaging 0.41; vein M ratio averaging 0.59.

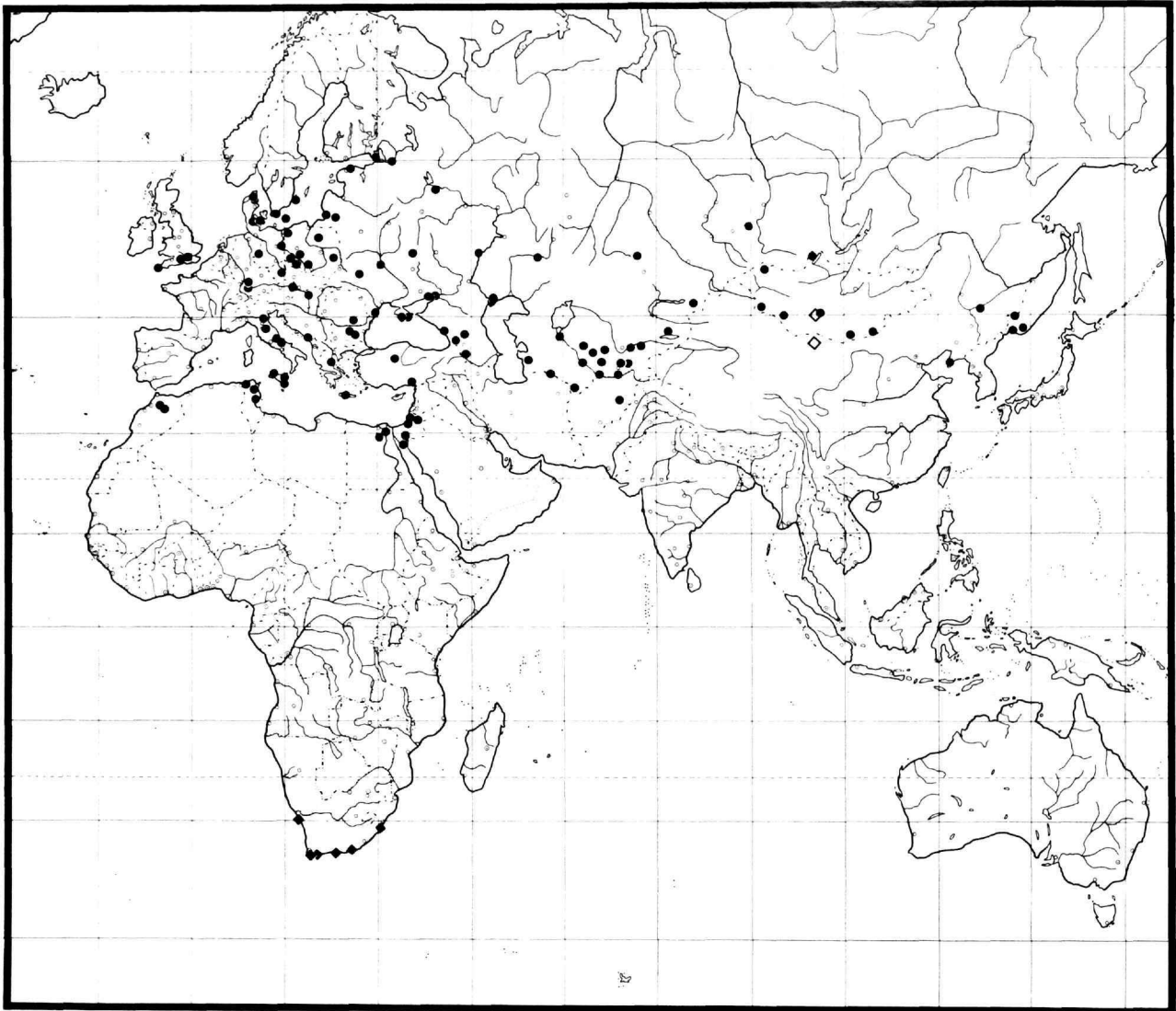


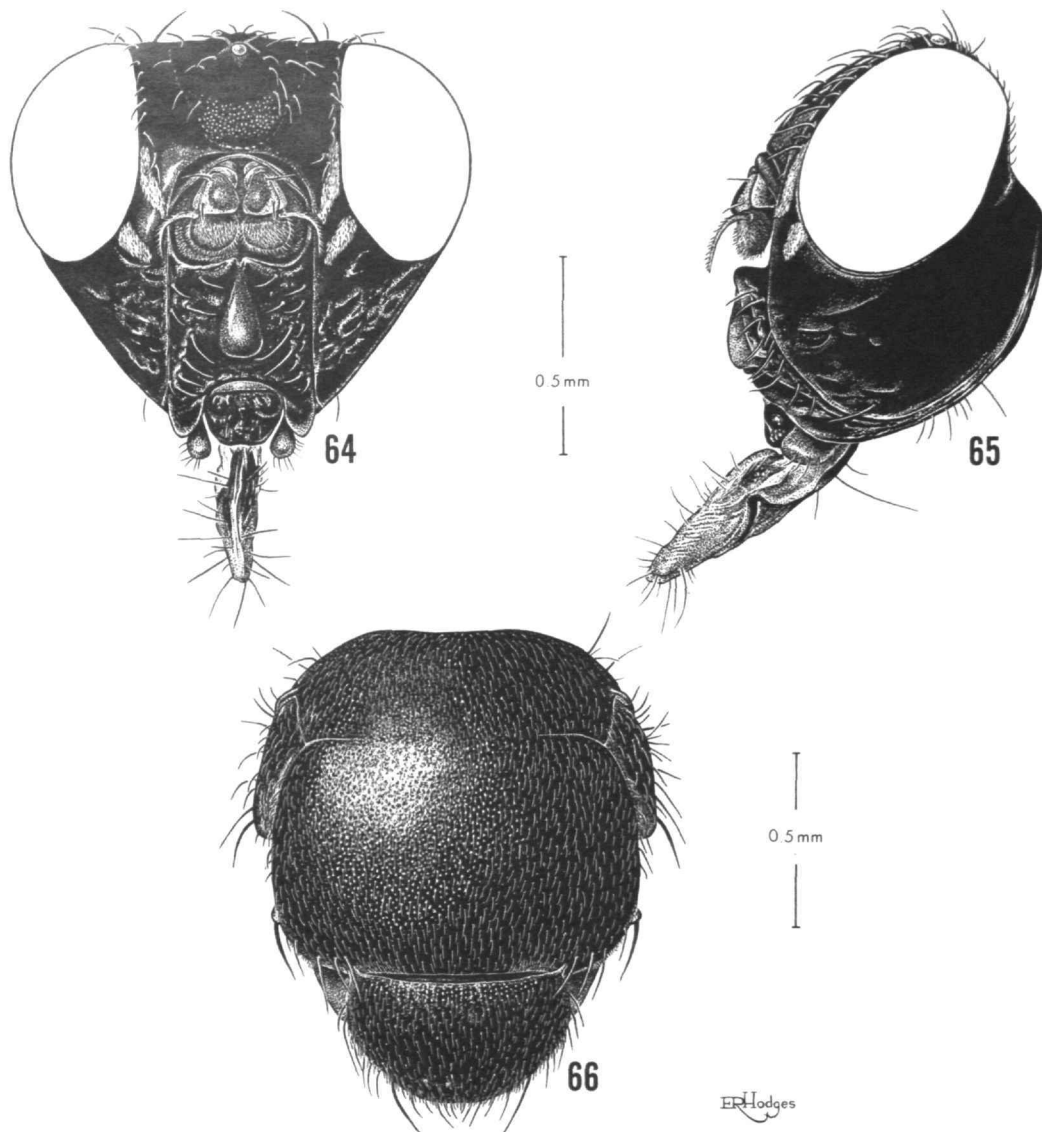
FIGURE 63.—Distribution map for *Mosillus asiaticus* (open diamonds), *M. bracteatus* (closed diamonds), and *M. subsultans* (dots).

**Abdomen:** 2nd abdominal tergum with median depression narrowly triangular, microsculptured.

**Male terminalia (Figures 57–62):** epandrium comparatively short, anteroventral extension not extended ventrally past ventral margin of cerci; surstylus tapered ventrally, ventral portion in lateral view sinuous, and more narrowly produced; postgonite with setal bearing lobe long, almost twice length of secondary lobe, and angulate; aedeagus distinctly angulate medially, with angle moderately produced, apical portion gradually tapered to a pointed apex; aedeagal apodeme with flange abruptly produced; hypandrium moderately elongate, setulose, anterior margin in dorsal view tapered to truncate margin.

**TYPE MATERIAL.**—The holotype male is labeled:

Эцзин-гол с.Алашань, Гоби Козлов  
14-15.III. [1]908 [China. Gansu: Etsin-gol (= Ruo shui), S. Alashan', Gobi, P.K. Kozlov 14–15 Mar 1908; the field notes of Kozlov indicate that collections on the 14th and 15th were made along the shore of lake Sogo-Nur/ЗИН [ZIN = ZISP]/[red rectangular label]/HOLOTYPE *Mosillus asiaticus* ♂ Mathis, Zatwarnicki, Krivosheina [handwritten, red].” The holotype is double mounted (glued to a paper point), is in moderately good condition (some dirt on dorsum), and is deposited in ZISP. Four paratypes (4♂; USNM, ZISP) bear the same label data as the holotype. Other paratypes are as follows: China. Gansu: Gobi, r. Etsin-Gol-Orok-nor, 14 Jul 1926, P.K.



FIGURES 64–66.—*Mosillus bracteatus*: 64, head, anterior aspect; 65, head, lateral aspect; 66, mesonotum, dorsal aspect. (Scale = 0.5 mm.)

Kozlov (3♂, 2♀; ZISP). Mongolia. Bajan Khongorsk aimak: Orog-nuur (N shore), 15–16 Aug 1967, A.F. Emeljanov, I.M. Kerzhner, V.F. Zaitzev (3♂, 2♀; ZISP).

**DISTRIBUTION** (Figure 63).—Old World. Palearctic: China and Mongolia.

**ETYMOLOGY**.—The species epithet, *asiaticus*, is a Latinized adjective that refers to the Asiatic distribution of this species.

**DIAGNOSIS**.—This species is similar to *M. subsultans* and is best distinguished from the latter by characters of the male terminalia, i.e., the elongate postgonite has an especially long setal bearing lobe, almost twice the length of the secondary lobe and is angulate; ventral portion of surstylus in lateral view is sinuous along both margins.

**REMARKS**.—Although this species is only known from the

few localities noted, it may be more widespread. It is the sister species to *M. subsultans*, and distinguishing between these two species will necessitate study of the structures of the male terminalia.

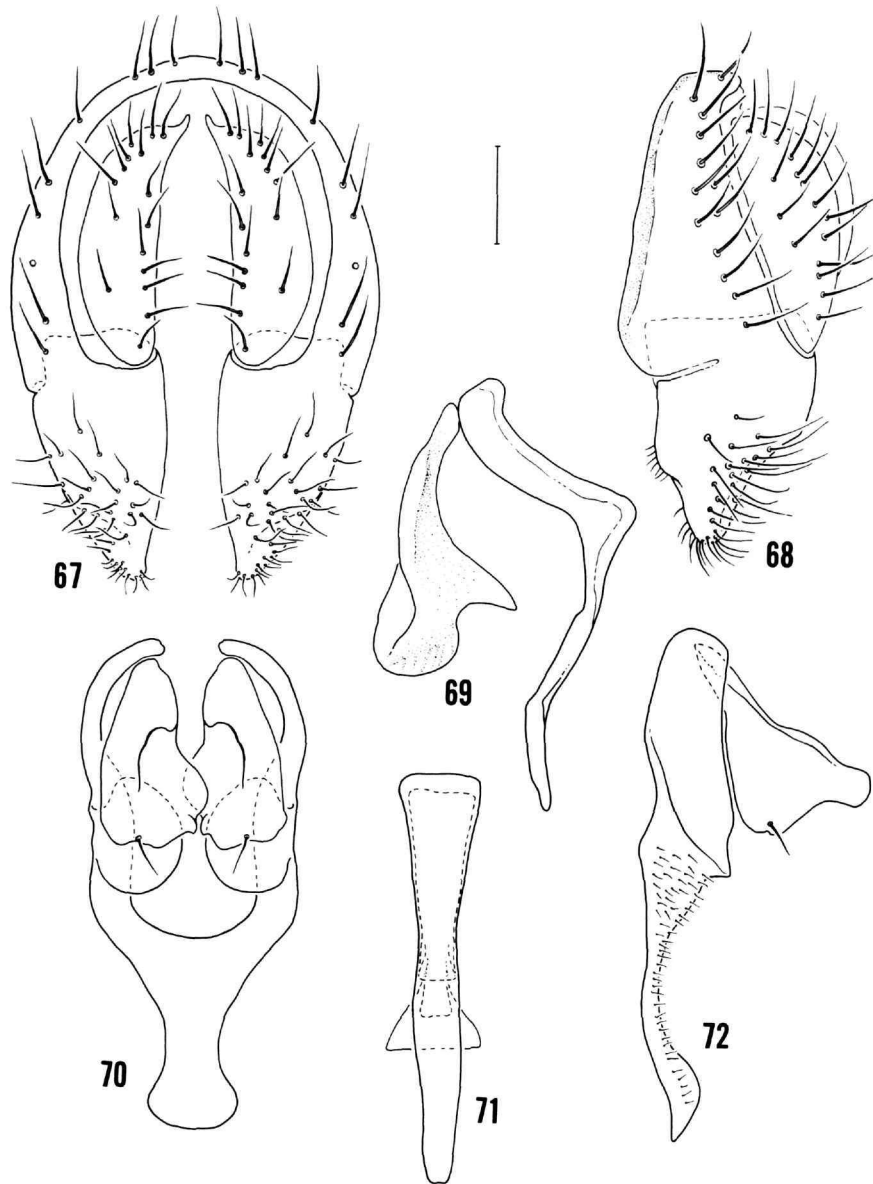
### *Mosillus bracteatus* Schiner

FIGURES 63–72

*Mosillus bracteatus* Schiner, 1868:244.—Cogan, 1980:656 [Afrotropical catalog].

*Gymnopa bracteata*.—Cresson, 1925:232 [generic combination]; 1946b:246–247 [review].

**DESCRIPTION**.—Moderately small to moderately large shore flies, length 2.60 to 4.30 mm.



FIGURES 67-72.—*Mosillus bracteatus*: 67, external structures of the male terminalia (epandrium, cerci, surstyli), posterior aspect; 68, external structures of the male terminalia (epandrium, cerci, surstyli), lateral aspect; 69, aedeagal apodeme and aedeagus, lateral aspect; 70, gonites and hypandrium, posterior aspect; 71, aedeagus and aedeagal apodeme, posterior aspect; 72, gonite and hypandrium, lateral aspect. (Scale = 0.1 mm.)

**Head** (Figure 64-66): Frons about as long as wide (slightly longer than wide in a few specimens), frons width-to-length ratio averaging 1.00; frons bare of microtomentum; parafrons satin like, mostly smooth; mesofrons distinct from parafrons, densely microsculptured, microrugose to granulose. Antenna black; flagellomere 1 invested with grayish pubescence; arista with basal portion black, apical portion white, bearing whitish

hairs. Face, except for deep antennal grooves, lacking microtomentum; lateral surfaces of face and clypeus macrosculptured, mostly pitted and striate; anteriormost facial projection tear-drop shaped, mostly smooth; ventral margin of antennal grooves with 2 median, short, dorsal projections. Parafacial wide, 2-3 times width of anterior ocellus; parafacial at level of antenna with 2 microtomentose, silvery gray stripes,



both obliquely oriented, ventral one slightly wider. Gena with striae on anterior half, otherwise, bare and mostly smooth; gena high, eye-to-cheek ratio averaging 0.67.

**Thorax:** Mesonotum and posterodorsal portion of anepisternum essentially bare of microtomentum but densely and finely microsculptured, appearing granulose with somewhat bronzy to bluish metallic luster; scutellum roughly trapezoidal, posterior margin somewhat flattened; lateral scutellar setulae numerous, 8–11, each arising from a tubercle. Spine-like setae along apicoventral margin of fore femur large, length of largest seta subequal to width of fore tibia; tibia black; fore tarsi black; hind basitarsomere black.

Wing costal vein ratio averaging 0.53; vein M ratio averaging 0.61.

**Abdomen:** Generally shiny, lightly microsculptured, surface shallowly shagreened; 2nd abdominal tergum with median depression narrowly triangular, microsculptured. Male terminalia (Figures 67–72): epandrium comparatively short, anteroventral extension not extended ventrally past ventral margin of cerci; surstylus evenly tapered toward ventral margin, apex pointed, posterior margin in lateral view shallowly concave on ventral portion, anterior margin slightly produced medially; postgonite gradually becoming wider toward apex, dorsoapical angle projected, truncate in lateral view; aedeagus angulate medially in lateral view, angle not distinctly projected, apical portion gradually tapered; aedeagal apodeme with anterior flange abruptly produced, opposite corner acutely angulate; hypandrium elongate, setulose, anterior portion spatulate, not invaginated to form pocket.

**TYPE MATERIAL.**—The lectotype ♀ of *Mosillus bracteatus* Schiner (designated by Cresson, 1925:232) is labeled “Novara-R. [South Africa: Cape of Good Hope] Cap. [“Cap” handwritten]/TYPE [red]/bracteatus Alte Sammlung/Mosillus bracteatus Sch. [handwritten].” The lectotype is directly pinned, is in good condition, and is deposited in the NMW. There are also five paralectotypes (1♂, 4♀) in the NMW and one (♂) in the ANSP.

**OTHER SPECIMENS EXAMINED.**—**SOUTH AFRICA.** *Cape Province:* Bredascorp District, Arniston Coastal Dunes, 22–23 Oct 1964, B. and P. Stuckenberg (3♂, 4♀; NMP); Cape of Good Hope Nature Reserve, 7–10 Mar 1968, P.J. Spangler (3♂, 4♀; USNM); Plettenberg Bay, 11 Sep 1983, A. Freidberg (2♂, 2♀; TAU, USNM); Port Elizabeth, Zwartkops River (coastal dunes), 29 Oct 1964, B. and P. Stuckenberg (3♂, 9♀; NMP); Port Elizabeth, Humewood, 30 Sep 1954, E. McGCallan (1♂; BMNH); Bredasopp District, Arniston (coastal dunes), 22–23 Oct 1964, B. and P. Stuckenberg (2♂, 8♀; NMP); Ysterfontein Point (coastal dunes, 15 m), 18 Sep 1972, M.E. Irwin (1♀; NMP); Port Nolloth (sea level), 6 Sep 1972, M.E. and B.J. Irwin (1♂; NMP); Vermont (near Onrus; dune vegetation on sandy road), 6 Apr 1979, J. Londt, B. Stuckenberg (1♀; NMP). *Natal:* Umkomaas (coast), 11 Oct 1983, A. Freidberg (1♂, 2♀; USNM).

**DISTRIBUTION** (Figure 63).—**OLD WORLD.** Afrotropical:

South Africa (Cape Province and Natal).

**DIAGNOSIS.**—This is the most distinctive species of the genus and is easily distinguished from congeners by its larger size, some specimens are over 4 mm in length, and the following combination of characters: mesonotum essentially bare of microtomentum but densely microsculptured, with somewhat metallic bronzy to bluish reflections; tibiae black; hind basitarsomere black; spine-like setae along apicoventral margin of fore femur large, length of largest seta subequal to width of fore tibia; and 2nd abdominal tergum with median depression triangular, microsculptured.

**REMARKS.**—This species is the giant of the genus and tribe and perhaps has the most restricted distribution, only being found in southern Africa.

### *Mosillus subsultans* (Fabricius)

FIGURES 63, 73–88

*Syrphus subsultans* Fabricius, 1794:304.

*Eristalis subsultans.*—Fabricius, 1805:246 [generic combination].

*Gymnopa subsultans.*—Meigen, 1830:137 [generic combination].—Macquart, 1835:584 [review].—Loew, 1848:13–15 [discussion]; 1870:8 [list].—Becker, 1896:127 [review, Palearctic]; 1907a:396 [list, Tunisia]; 1907b:47 [list, Tibet].—Encobet, 1912:157, 232 [list, Spain].—Cresson, 1925:231 [review, list, Austria].—Séguy, 1930:181 [list, Morocco].—Frey, 1949:37 [list, Madeira].—Giordani Soika, 1956:101 [list, Egypt].

*Mosillus subsultans.*—Frey, 1921:133–134 [generic combination mouthparts]; 1945:82 [list, Azores].—Becker, 1926:21 [review].—Wahlgren, 1927:330 [review, Sweden].—Bastin, 1931:178 [list, Belgium].—Séguy, 1934:409 [review, France].—de Meijere, 1939:162 [list, Netherlands].—Duda, 1942:10 [discussion].—Dahl, 1959:159 [review, Sweden]; 1973:355 [list, Afghanistan].—Beschovski, 1966:271 [list, Bulgaria].—Steyskal and El-Bialy, 1967:31 [list, Egypt].—Nartshuk, 1970:369 [list, European Russia].—Papp, 1975:14 [review, Hungary].—Cogan, 1976:83 [list, Great Britain]; 1984:128 [palearctic catalog].—Miyagi, 1977:27 [review, Japan].—Hackman, 1980:127 [list, Finland].—Ursu and Pärvu, 1982:22 [list, Romania].—Canzoneri and Meneghini, 1983:225–227 [review, Italy].—Canzoneri, 1985:104 [list, Malta].—Kamecká, 1987:225 [list, Czechoslovakia].—Gosseries, 1991:165 [list, Belgium].—Vitte, 1991:31 [list, Morocco].—Zatwarnicki, 1991:220 [list, Poland].

*Gymomyza subsultans.*—Mathis and Zatwarnicki, 1990b:895 [generic combination].

*Mosillus arcuatus* Latreille, 1805:390.—Schiner, 1863:234 [synonymy].—Moragues y de Manzanos, 1894:86 [list, Majorca].

*Mosillus coronatus* Becker, 1926:21 [misspelling of *M. arcuatus* Latreille].

*Gymnopa aenea* Fallén, 1820:10.—Zetterstedt, 1849:2679 [review, Sweden].—Loew, 1848:14 [synonymy].

*Ulidia aenea.*—Zetterstedt, 1846:2679 [generic combination].

*Mosillus aeneus.*—Schiner, 1863:235 [generic combination].—Moragues y de Manzanos, 1894:86 [list, Majorca].

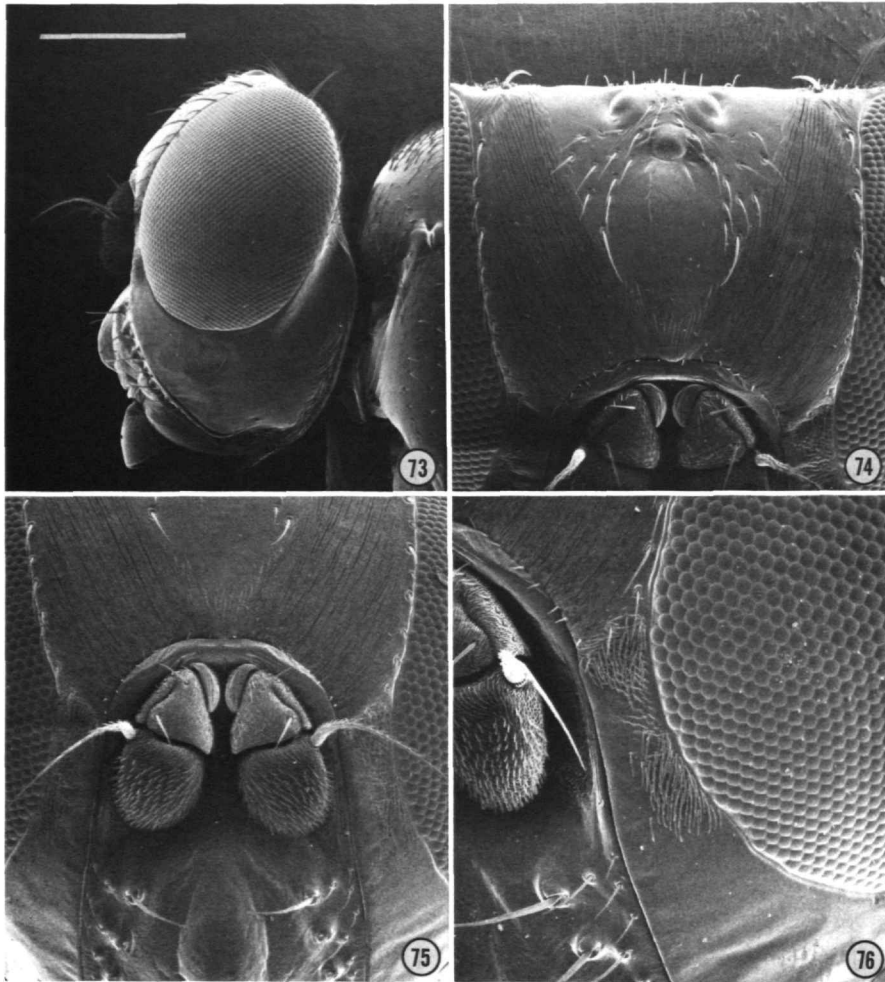
*Gymnopa nigra* Meigen, 1830:137.—Loew, 1848:14 [synonymy].

*Glabrinius murorum* Rondani, 1856:132.—Becker, 1896:127 [synonymy].

*Mosillus murorum.*—Becker, 1905:190 [generic combination].

**DESCRIPTION.**—Small to medium-sized shore flies, length 1.60 to 3.50 mm.

**Head** (Figures 73–76): Frons wider than long, frons length-to-width ratio averaging 0.74; frons bare of microtomentum; parafrons with very faint microsculpturing, appearing mostly smooth; mesofrons indicated by shallow furrow but



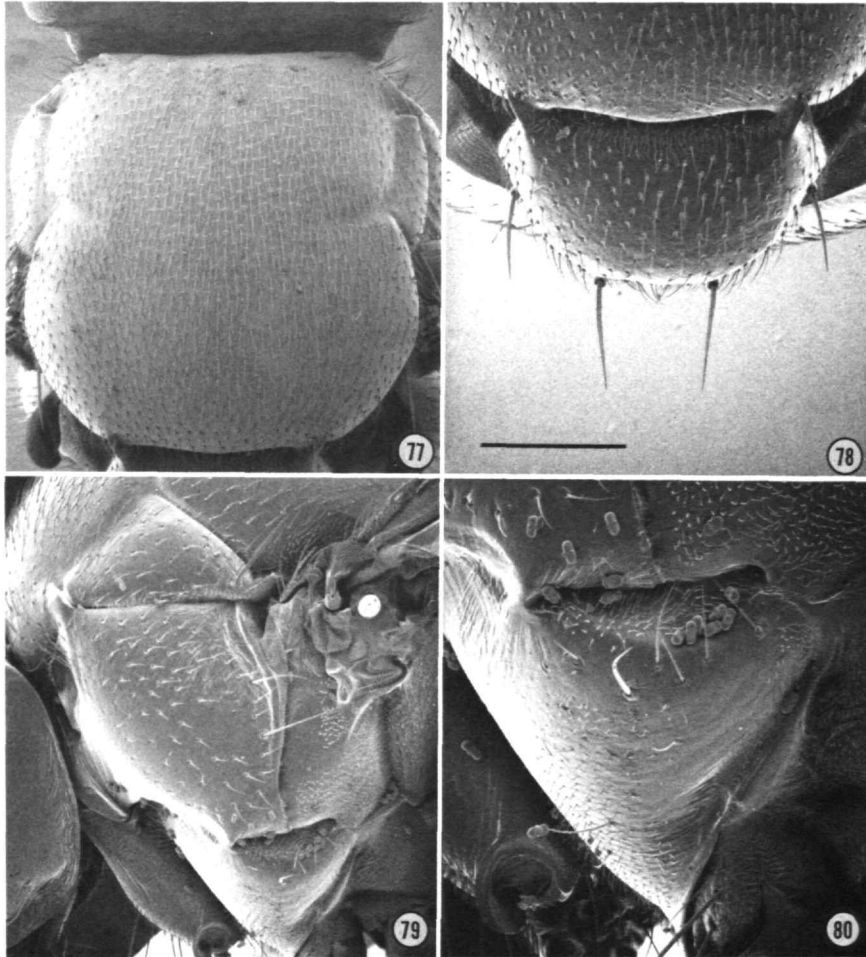
FIGURES 73–76.—Scanning electron micrographs of *Mosillus subsultans* (scale length in parenthesis; scale for all photographs = Figure 73): 73, head, lateral aspect (0.33 mm); 74, frons, dorsal aspect (200  $\mu$ m); 75, antennae and dorsal half of face, anterior aspect (200  $\mu$ m); 76, parafacial, anterior aspect (136  $\mu$ m).

otherwise smooth, differing little from parafrons. Antenna black; arista dark, basal portion black, apical portion dark brown. Face, except for deep antennal grooves, lacking microtomentum; lateral surfaces of face with a few shallow pits and striae; clypeus mostly smooth; anteriormost projection of face tear-drop shaped; ventral margin of antennal grooves evenly rounded. Parafacial moderately wide, slightly more than width of anterior ocellus; parafacial at level of antenna with 2 microtomentose, silvery gray patches, dorsal patch triangular. Gena mostly smooth, shiny; gena high, eye-to-cheek ratio averaging 0.51.

**Thorax** (Figures 77–82): Thorax mostly smooth, shiny black, microtomentum almost entirely lacking; scutellum broadly rounded; lateral scutellar setae 2, each arising from a tubercle. Legs: spine-like setae along apicoventral margin of

fore femur small, length of largest seta at most  $1/2$  width of fore tibia; tibiae black; fore tibia with apex partially invested with silvery-gray microtomentum; hind basitarsomere black. Wing: costal vein ratio averaging 0.38; vein M ratio averaging 0.60.

**Abdomen:** Generally shiny; 2nd abdominal tergum with median depression narrowly triangular, microsculptured. Male terminalia (Figures 83–88): epandrium comparatively short; anteroventral extension not extended ventrally past ventral margin of cerci; surstylus tapered ventrally, apex moderately narrowly rounded, ventral portion of epandrium with margins continuous, not sinuous; postgonite with setal bearing lobe short, no longer than secondary, dorsal lobe, and spatulate; aedeagus distinctly angulate medially, with angle moderately produced, apical portion gradually tapered to a pointed apex; aedeagal apodeme with flange abruptly produced; hypandrium



FIGURES 77–80.—Scanning electron micrographs of *Mosillus subsultans* (Israel, Mt. Hermon; scale length in parenthesis; scale for all photographs = Figure 78): 77, mesonotum, dorsal aspect (0.38 mm); 78, scutellum, dorsal aspect (0.27 mm); 79, pleura, lateral aspect (30 mm); 80, katapisternum, lateral aspect (136  $\mu$ m).

moderately elongate, setulose, anterior margin in dorsal view tapered to just before apex, thereafter abruptly extended laterally, producing short lobes before broadly rounded apex.

**TYPE MATERIAL.**—The lectotype female of *Syrphus subsultans* (designated here) is labeled “[TYPE [red]/E[r]istalis]. subsultans [handwritten]/LECTOTYPE ♀ *Syrphus subsultans* Fab. By W.N. Mathis 1991 [handwritten except for “LECTOTYPE” and “By”, black submarginal border].” The lectotype is directly pinned, is in poor condition, and is deposited in the UZMC. Fabricius stated that the type material is from [Denmark] “Hafniae” [= Copenhagen].

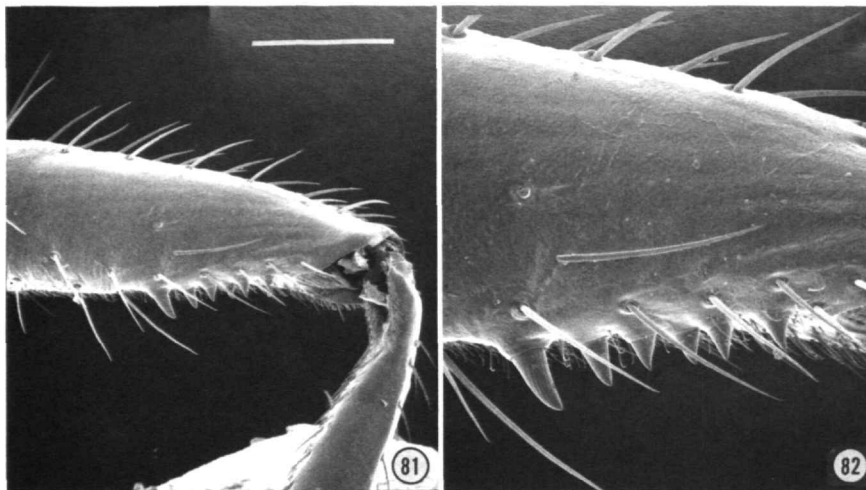
The primary type(s) of *Mosillus arcuatus* [not given (? France); T, MNHN (apparently lost)].

The primary types of *Gymnopa aenea* [not given (? Sweden); ST ♂, NRS (we did not examine the primary type(s) of this

name)].

The lectotype male of *Gymnopa nigra* (designated here), is labeled “2717 40 [handwritten on a circular label] Meigen [handwritten on the underside of the circular label]/*Gymnopa nigra* ♂ [handwritten on a square label]/LECTOTYPE ♂ *Gymnopa nigra* Meigen By Mathis et al. [species name and gender and designators handwritten, black submarginal border].” The locality where this specimen was collected is not stated explicitly by Meigen but is presumably in Germany. The lectotype is double mounted (pin in a rectangular card), is in poor condition (very dirty but intact), and is deposited in the MNHN. There is also a paralectotype female (designated here) in the MNHN.

Cresson (1925:231) noted the possibility of a type in NMW, which is a ♀ from the Winthem collection that is labeled



FIGURES 81, 82.—Scanning electron micrographs of *Mosillus subsultans* (Israel, Mt. Hermon; scale length in parenthesis; scale for all photographs = Figure 81): 81, fore femur, posterior aspect (136  $\mu$ m); 82, same, enlarged (60  $\mu$ m).

“nigra” and three other specimens from the Winthem collection with similar labels although with different localities and no determination labels (the specific localities are difficult to decipher but they seem to have been collected during the month of August).

The lectotype female of *Glabrinus murorum* (designated here), is labeled “2112 [red lettering on an oval label]/ LECTOTYPE *Glabrinus murorum* ♀ By Mathis, Zatwarnicki, Krivosheina [species name and gender and designators hand-written, black submarginal border].” The lectotype is directly pinned, is in poor condition (dirty, somewhat covered by hyphae), and is deposited in the MZUF (2112).

**OTHER SPECIMENS EXAMINED.**—**AFGHANISTAN.** *Kabul:* Bini Hesar (6 km SE Kabul, 1820 m), 1 Jun 1974, L. Papp (1♂, 1♀; HNHM); Aliabad (1850–1920 m), 4 May–13 Jun 1974, L. Papp (2♂; HNHM); Darulaman [Dr ol Amn], 18 Jun 1974, L. Papp (1♂; HNHM). *Parwan:* Estalef (1950 m), 15 Apr 1974, L. Papp (1♂, 1♀; HNHM).

**ARMENIA.** Gekhard, 23 Aug 1971, V.A. Richter (1♂; ZISP).

**AUSTRIA.** *Bergenland:* Podersdorf, 17 Jul 1923, H. Zerny (1♂; ANSP). Wien, 8–14 Oct 1883, A. Handlirsch, J. Mik (2♂; ANSP).

**BULGARIA.** *Burgas:* Kiten (oak wood+pig farm; 42°14'N, 27°48'E), 17 Jul 1987, M. Barták (2♂, 1♀; MBP). *Pazardzhik:* Velingrad (W, dry forested hillside above narrow stream), 10 Jul 1969, B.H. and M.C. Cogan, R.I. and R. Vane-Wright (1♀; BMNH). *Sliven:* Sliven (5 km N; along brook; 42°45'N, 26°17'E, 400 m), 21 Jul 1987, M. Barták (1♀; MBP).

**CHINA.** *Heilungkiang:* Harbin, 20 May 1938, M.A. Weymarn (2♀; USNM). *Liaoning:* Liaotung Peninsula, Lüshun, 27 Jul 1904, Chernyshev (1♂; ZISP).

**CZECH REPUBLIC.** Praha-Troja, Apr 1976, Tsabal (1♂; MBP).

**DENMARK.** *Åbenrå-Soenderborg:* Soenderborg, 29 Jun–28 Aug 1897, 1901, Wüstnei (2♀; UZMC). *Bornholm:* Bornholm (1♀; UZMC). *Mariibo:* Boetoegaard, 6 Aug 1950, S. Berdén (1♀; ZIL). *Nordjylland:* (1♀; UZMC). *Randers:* Randers, 10 Jun 1889, Jacobsen (2♀; UZMC). *Skanderborg:* Horsens (1♂, 1♀; UZMC). *Svendborg:* Langeland, R.W. Schlick (10♂, 22♀; UZMC).

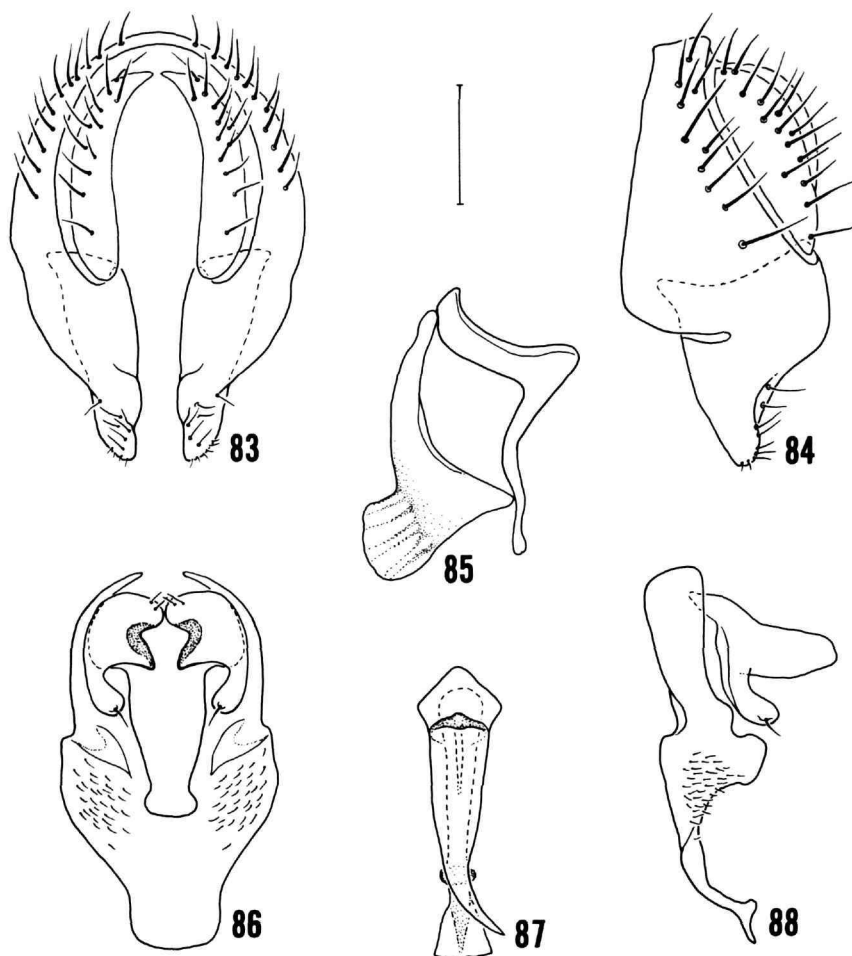
**EGYPT.** Cairo, 23 Jan 1951 (2♂; USNM). Saqqara, 10 May 1966, P.M. Marsh (1♂, 1♀; USNM). Sinai: Bir Tamade, 8 Sep 1977, D. Simon (1♀; TAU); Dahab, 23 May 1981, A. Freidberg (1♂, 2♀; TAU, USNM); Mitle, 13 Apr 1973, F. Kaplan (1♂; TAU); Quseima, 24 May 1981, A. Freidberg, W.N. Mathis (60♂, 14♀; TAU, USNM).

**ESTONIA.** Station Peedu, 1 Aug 1951, A.A. Stackelberg (1♂; ZISP).

**GEORGIA.** Novyj Afon, 19 Aug 1953, W. and B. Rohdendorf (1♀; ZISP). Tiflis, 6 May 1907, N. Satunin (1♀; ZISP).

**GERMANY.** Frankfurt/Oder, M.P. Riedel (1♂; ZMHU). Heidelberg, 6 Oct, R. Osten-Sacken (1♂; ZISP). Iifeld, 8 Sep 1914 (8♂; ZMHU). St. Wendel (Rheinl), 6 Apr 1913, O. Duda (1♂, 1♀; ZMHU).

**GREAT BRITAIN.** *Cornwall:* Bodmin, 10 Sep 1930 (1♀; BMNH); Bude, 10 Jul 1905, J.J.F.X. King (3♂, 1♀; BMNH); Carbis Bay, 14 Jan–20 Nov 1933, 1935, A. Thornley (6♂, 4♀; BMNH). *Hampshire:* New Forest, 15 Aug 1901, F.C. Adams (6♀; BMNH); New Forest, Brokenhurst, 13 Aug 1911, J.J.F.X. King (1♂, 3♀; BMNH); New Forest, Lyndhurst, Hants., 12 Aug–8 Sep 1907, F.C. Adams (1♂, 3♀; BMNH). *Surrey:* Woking, 10 May 1915, G.C. Champion (1♂; BMNH).



FIGURES 83–88.—*Mosillus subsultans*: 83, external structures of the male terminalia (epandrium, cerci, surstyli), posterior aspect; 84, external structures of the male terminalia (epandrium, cerci, surstyli), lateral aspect; 85, aedeagal apodeme and aedeagus, lateral aspect; 86, gonites and hypandrium, posterior aspect; 87, aedeagus and aedeagal apodeme, posterior aspect; 88, gonite and hypandrium, lateral aspect. (Scale = 0.1 mm.)

**GREECE. Crete:** Kritsá, 16 May 1979, D.M. Ackland (1♂; BMNH). **Macedonia:** Struma Valley, Oct 1933, R.C. Shannon (1♂, 2♀; USNM). Pieria, Mt. Olympus, Prioni, 21 Jun 1982, R. Danielson (2♀; ZIL).

**HUNGARY.** Aranyosgadány, 8 Apr–23 Jun 1970, 1971, L. Papp (2♂; USNM). Budapest, 3 Apr, K. Kertész (2♂; USNM). Csákvár, 7 Mar 1961, F. Mihályi (1♂, 1♀; USNM). Hortobágy halastó, 16 Jul 1961, S. Tóth (1♀; USNM). Kalocsa, 18 May 1902, Thalhammer (1♂; BMNH). Pakazd (3 km S), SW shore Velencei-tó, 23 Aug 1986, W.N. Mathis (1♂; USNM).

**ISRAEL.** Aqua-Bella, 18 May 1965, J. Margalit (1♂; TAU). Abu-Kabir, 28 May 1981, A. Freidberg (24♂, 17♀; TAU, USNM). Aman Delta, 14 Apr 1932 (1♀; TAU). Bar'am, 11–14 Nov 1977, A. Freidberg (2♂; USNM). Eilot, 24 May 1981, W.N. Mathis (12♂, 3♀; USNM). Ein Shibli (3 km SE Beit

Hasan), 31 May 1981, W.N. Mathis (5♂, 4♀; USNM). Golam Aniam, 18 May 1983, A. Freidberg (1♀; TAU). Gonen, 15 Mar 1975, F. Kaplan (1♂; TAU). HaGosherim, Hazbani River, 19 May 1981, W.N. Mathis (1♀; USNM). Jerusalem, 12 Jun–15 Oct 1963, J. Margalit, Blomd (2♀, TAU). Jerusalem, Mt. Scopus, 20 Aug 1930, O. Theodor (2♀; ANSP, TAU). Kefar Shammay, 18 May 1981, W.N. Mathis (1♂, 1♀; USNM). Kiryat Anavim, 3 May 1968, S. Bleszynski (1♂; TAU). Ma'agan Michael (N Taninim Spill), 20 Apr 1986, A. Freidberg (1♀; TAU). Mashabei-Sade, 31 Mar–21 Jul 1975, 1986, A. Freidberg, F. Kaplan (2♀; TAU). Montfort, 2 Jun 1981, A. Freidberg, W.N. Mathis (4♂, 5♀; TAU, USNM). Mt. Hermon (1400, 1600, 2000 m), 19 May–8 Aug 1973, 1980, 1981, 1985, 1987, A. Freidberg, F. Kaplan, W.N. Mathis, I. Nussbaum (61♂, 24♀; TAU, USNM). Mt. Meron, 28 May–4 Aug 1965, 1973, 1974, 1981, F. and M. Kaplan, J. Kugler,

W.N. Mathis (7♂, 9♀; TAU, USNM). Nahal Amud (3 km W Zefat), 28 May–17 Sep 1981, A. Freidberg, W.N. Mathis (1♂, 2♀; TAU, USNM). Nahal El-Al, 3 Feb 1984, I. Nussbaum (1♂; TAU); Nahal Oren, 4 Mar 1975, F. Kaplan (1♀; TAU). Nahal. Ye'elim (3 km E Arad), 30 Apr 1987, A. Freidberg (1♀; TAU). Panyas, 12 Apr–26 Nov 1978, 1981, 1983, A. Freidberg, W.N. Mathis (1♂, 2♀; TAU, USNM). Plugot, 21 Nov 1972, M. Kaplan (1♀; TAU). Qalya, 13 Feb 1975, F. Kaplan (1; TAU). Tel Aviv, 19 Mar–8 Oct 1972, 1976, A. Freidberg (2♂, 3♀; TAU). Wadi Ara, 24 Jan 1976, A. Freidberg (10♂; TAU). Wadi Faria, 1 Mar 1973, A. Freidberg (3♀; TAU). V. Pazel, 19 Feb 1984, I. Nussbaum (6♂; TAU). Wadi Qeltt, 14 Jun–4 Nov 1973, 1982, D. Furth, I. Nussbaum (1♂, 2♀; TAU). Yeroham, 3 Feb 1981, A. Freidberg (1♂; TAU).

**ITALY.** *Emilia-Romagna:* Fiume Po, Pontelagoscuro, 27 May 1953, A. Giordani Soika (1♂; BMNH). *Marches:* Acquasanta, 6 Aug 1917 (2♂, 1♀; ANSP). San Benedetto (10 km N, damp valley, 42°58'N, 13°53'E), 3 Aug 1988, M. Barták (3♂; MBP); Macerata, 14 Mar 1896, M. Bezzi (4♂; USNM). *Sicily:* Castellammare, 18 Jul 1972, A. Freidberg (1♂; USNM); Mt. Etna (2000 m), 1 Sep 1982, A. Freidberg (2♂, 2♀; USNM); Siracusa, 1–4 May 1921, H. Zerny (1♂; ANSP).

**JORDAN.** *Aman:* Baqa'a Valley (15 km NW Amman, sewage ditch), 13 Jun 1987, R.S. Zack (5♂; WSU). *Irbid:* Dier Alla (4 km N, small stream), 4–8 Jun 1987, R.S. Zack (5♂, 1♀; WSU); North Shuneh (6 km S, small stream), 3 Jun 1987, R.S. Zack (13♂, 5♀; WSU).

**KAZAKHSTAN.** Alma-Ata, 12–30 Sep 1936, A. Birulja (1♂, 1♀; ZISP). Sasykkol Lake (near W shore of lake, vegetation in saline area), 8 Aug 1970, V.N. Tanasijtsjuk (1♀; ZISP). Tselinograd, 20–21 Jun 1932, V. Popov (7♂, 7♀; 1 ex; ZISP).

**KIRGHIZIA.** Belovod, 17 Jul 1931, L.S. Zimin (1♀; ZISP).

**LITHUANIA.** Kaunas, Jurbarkas, 25 Apr 1904, P. Winogradoff (2♀; ZISP). Nida, 4–5 Aug 1940, O. Duda (3♂, 5♀; ZMHU). **MONGOLIA.** *Bajan Khongorsk aimak:* Dzun-Mod, 70 km S Shine-Dzhist, 10–11 Aug 1969, V.F. Zaitzev (1♀; ZISP); Shine-Dzhinst (55 km SSW), 28 Aug 1970, E.P. Nartshuk (1♂; IZSP); Toroin-Bulak, 13 km E Tsagan-Bulak, 16 Aug 1969, V.F. Zaitzev (1♂; ZISP). *Dornogovi aimak:* Tal-Khongoryn-Khuduk (25 km NE), 30 Jul 1971, I.M. Kerzhner (1♀; ZISP). *Gobi-Altay aimak:* Cogt (12 km SW), 15 Jul 1970, I.M. Kerzhner (1♂; ZISP); rodn. Ushijn-Bulak, Targalant (30 km NW), 13 Jul 1970, E.P. Nartshuk (8♂, 2♀; ZISP). *Kobdos aimak:* ur. Elchon (20 km SE Altaj to Bodonchiyn Gol), 27 Jul 1970, E.P. Nartshuk (1♂; ZISP); r. Bodonchiyn Gol (12 km SW Altaj S), 22 Jul 1970, E.P. Nartshuk (1♂, 1♀; ZISP); Uench (10 km N), 28 Jul 1970, E.P. Nartshuk (1♂, 1♀; ZISP). *Ömnögovi aimak:* Nomgon (40 km SSE), 9 Aug 1967, I.M. Kerzhner (♀; ZISP). *Ubsunursk aimak:* Khjargas (10 km N), 10 Aug 1970, E.P. Nartshuk (1♂; ZISP). Ulan goj, 1877, G.N. Potanin (1♀; ZISP). Orog Nuur, northern

Gobi, 4–6 Jun 1926 (1♀; ZISP).

**MOROCCO.** Haut Atlas, Jbel Ayachi: Mikdane (stream III, S of road), 18 Jul 1963, A.C. Pont (1♂, 3♀; BMNH). Ifrane (1650 m), Jun 1960, N.L.H. Krauss (3♀; USNM). Mikdane, Maison Forestière (cedar forest S, 2700 m), 10 Jul 1963, A.C. Pont (2♂; BMNH). Rio Jaffaar (N of source, 0–1500 m), 7 Aug 1963, A.C. Pont (3♂, 4♀; BMNH).

**POLAND.** Czermina (District Leszno), 10 Apr 1983, T. Zatwarnicki (3♂, 1♀; ZT). Gliwice-Labedy, 1 Jul 1935, O. Duda (1♂, 1♀; ZMHU). Legnica, Jun, T. Becker (1♀; ZMHU). Lublin, 30 Jul 1918, Pongrácz (1♂, 2♀; HNHM). Ostróda, 24 Jul 1973, Bajza, L. Papp (1♀; HNHM). Niemcza, 31 Jul 1911, O. Duda (4♀; ZMHU). Rudna, 12 Jul–13 Aug 1930, 1932, O. Duda (4♂, 7♀; ZMHU). Szczecin, 25 May–Jun 1898, 1902, T. Pergande, E. Schmidt (2♂; 1ex; MIZW, USNM).

**ROMANIA.** Comana Vlasca, A.L. Montandon (1♂, 1♀; BMNH).

**RUSSIA.** *Astrakhan:* Selitr (village), 13 Jul 1911, V.V. Chemavin (2♀; ZISP). Volga delta, "Oranzher prom.," 26 Jun 1911, L'ukash (1♀; ZISP). *Jaroslav:* Jaroslav, 17 Aug 1907, A.I. Jakovlev (1♀; ZMUM); 1–2 Jun 1895, N. Kokuev (1♂; ZMUM); 16–18 Mar 1882, N.P. Vagner (1♂; ZISP). *Kursk:* Kursk. bad., 22 Apr 1907, V. Malysheva (1♀; ZISP). *Orenburg:* Verkhnedreprovka, left bank of Ural river before Orenburg, 1 Aug 1934 (1♀; ZISP). *Primorski Krai* (Maritime Territory): Kamen-Rybolov, Chanka lake, 11 Jul 1927, A.A. Stackelberg (3♀; ZISP); Lazo (40 km NW Valentin), 2–26 Aug 1986, 1987, A.L. Ozerov (14♂, 4♀; ZMUM); Vladivostok, 22 Mar 1909, N.M. Berger (2♀; ZISP). *Rostov na Donu:* Rostov na Donu, 16 Sep–6 Dec 1923, 1924, D. Davydov (2♀; ZISP); Taganrog, 16 Apr–4 Oct 1921, 1922, 1925, 1927, C. Ahnger (12♂, 17♀; USNM, ZISP). *Stavropolski Krai:* Azgen River near Teberda, 30 Nov 1915, B. Kat'kov (1♂; ZISP); Kislovodsk, 1 Dec 1947, V. Popov (1♀; ZISP); Pjatigorsk, Mashuk, 13 Jun 1964, K.B. Gorodkov (1♀; ZISP); Teberda, TG3, 27 Oct 1954, Arens (1♂; ZISP). *St. Petersburg:* Jashchera, Luzhsk., 25–26 Jul–14 Aug 1967, 1970, A.A. Stackelberg (1♂, 2♀; ZISP); Ligovo, 9 May 1957, K.B. Gorodkov (1♀; ZISP); Zielenogorsk, Yu.N. Vagner (1♀; ZISP).

**SWEDEN.** (1♀; UZMC). *Halland:* Ö. Karup, Eskilstorp, B. Tjeder (1♀; ZIL). *Öland:* Resmo alvar, 21 Aug 1953, P. Ardö (1♂; ZIL). *Skåne:* Ystad, 21 Sep 1907, I. Ammitzböll (1♂, 2♀; 1ex; ZIL).

**SWITZERLAND.** *Vaud:* Lutry, 16 Jun–15 Jul 1876, Woldstadt (1♂, 1♀; ZISP).

**TADZHIKISTAN.** Daré-Kul', down Vachs, A.A. Stackelberg (1♂; ZISP). Dushanbe, 10 Jan–6 Jun 1942, 1943, 1945, V.V. Gussakovskij, A.A. Stackelberg, V. Popov (4♂, 4♀; ZISP). Kondara (1100 m) near Varzob, 7 Aug–20 Sep 1938, 1940, 1945, V.V. Gussakovskij (4♂, 5♀; ZISP). Murgab (E Pamir; on feces), 24 Jul 1962, V.I. Sytshevskaja (1♀; ZISP). "Staraja Pristan", environs of Dzhilikul, 17 Jun 1944, Vachsh, V.V. Gussakovskij (1♂; ZISP). Turkestan Ridge (near Shurab, on drying algae, 4000–5000 ft, = 1219–1524 m), 22–30 Aug

1963, P.M. Wootton (15♀; BMNH). Tashkepri on Murgab, 4 Jun 1954, V.I. Tobias (1♂; ZISP). "Tigrovaja balka" NP (= zapovednik), environs of Dzhilikul, 25 Apr 1988, M. Krivosheina (2♂, 1♀; ZMUM).

**TUNISIA.** Jendouba (40 km W), 17 May 1988 (1♂, 2♀; UZMC). Kairouan, F. Santchi (1♀; USNM). Sfax, 21 May 1949, P. Biolo (1♂, 3♀; BMNH). Tabarka area, 7–18 May 1988 (1♂, 3♀; UZMC). Tabarka, Qued Ghezal, 17 Jun 1951 (1♂; BMNH).

**TURKEY.** Ankara, Kirikkale (16 km W), 29 Jun 1960, Guichard and Harvey (1♀; BMNH). Tarsus (Adana), 25 May 1961, A. Giordani Soika (1♂, 1♀; BMNH).

**TURKMENISTAN.** Imam-baba Merv. u. Zakasp. o., 3–8 May 1912, I.V. Kozhanchikov (1♂; ZISP). Krasnovodsk, 19 Jul 1934, V. Popov (2♀; ZISP); Ashchabad: Firyuza (Kopetdag, 30 km W Ashchabad), 18 May–26 Sep 1933, P.A. Petrishcheva, Vlasov (6♂, 5♀; ZISP); Tshulli (Kopetdag), 11 Jun 1914, A. Hohlbeck (1♂; ZISP); Station Dzhebel, 7 Jun–13 Jul 1934, V. Popov (4♂, 6♀; ZISP). Chardzhou: Chardzhou, 25 Apr 1990, A.L. Ozerov (1♂; ZMUM); Karljuk near Mukry, Amu-Darja river, 8 Jun 1934, P.A. Petrishcheva (1♀; ZISP); Repetek, 18 Apr–13 May 1990, A.L. Ozerov (5♂, 8♀; ZMUM). Station Akhcha-Kujyma (between Nebit-Dag and Kazandzik), 5 Jul 1934, V. Popov (1♂; ZISP).

**UKRAINE.** Charkov: Charkov vicinity, 18 Apr 1883, Jaroshevski (1♂; ZISP). Kiev: Korostyshev, 11 Jul 1905, Yu.N. Vagner (1♀; ZISP). Odessa: Vilkovo (50 km E Izmail), 22 May–22 Jun 1911, V.V. Chernavin (3♂, 1♀; ZISP). Podole: Proskurov, 11 Oct 1895, Zubovskij (= Chmelnickij) (1♀; ZISP). Simferopol (Crimea): Station Belbek, Sevastopol railway, 4–21 Jun 1897, N. Kuznetsov (3♂, 4♀; ZISP); Alushta, environs of Generalskoe, 18 Aug 1971, D.R. Kasparian (1♀; ZISP); Alushta, Tauria, 4 Aug 1955, B. Rohdendorf (1♂; ZMUM); Sudak, 6 Apr 1971, V. Kovalev, 1♂; ZISP); Mukhalatka, 11 Jul 1902, N. Kuznecov (5♂, 1♀; ZISP), 7 Jul 1900, Aggeenko (1♂; ZISP); Mukhalatka (southern shore of Crimea), 7 Jul 1908, Aggeenko (1♀; ZISP); Karakau to Jajl'a, Burgalm (S shore of Crimea) (1♂; ZISP); Crimea, 13 Jul 1926, L.S. Zimin (1♀; ZISP).

**UZBEKISTAN.** Angren (in grass), 8 Jun 1959, V.I. Sychevskaja (1♀; ZISP). Changir near Khatyrchi (NW Buchara), 11–17 Jun 1929, 1930, L.S. Zimin (3♂, 1♀; ZISP). Chiva, Karamysh, 13 Jul 1927, L.S. Zimin (11♂, 8♀; ZISP). Kumak, Kattakurgan (NW Samarkand), 13 May 1929, L.S. Zimin (1♀; ZISP). Nukus, 14 Sep 1874, Dohrandt (1♂; ZISP). Tashkent vicinity, 4 Apr 1928, L.S. Zimin (2♂, 2♀; ZISP). Vanch, Darvaz, 5 Sep 1943, A.A. Stackelberg (1♂; ZISP).

**YUGOSLAVIA.** Montenegro: Budva (by small stream), 26 Apr–3 May 1970, A.E. Stubbs (3♂; BMNH).

**DISTRIBUTION.**—OLD WORLD. Palearctic: Afghanistan, Armenia, Austria, \*Azores, \*Belgium, Bulgaria, \*Canary Islands, China (Manchuria, NE Tibet), Czech Republic, Denmark, Egypt, Estonia, \*Finland, \*France, Georgia, Germany, Great Britain, Greece, Hungary, Israel, Italy, Jordan,

Kazakhstan, Kirghizia, Lithuania, \*Madeira, \*Majorca, \*Malta, Mongolia, Morocco, Netherlands, Poland, Romania, Russia, \*Spain, Sweden, Switzerland, Tadzhikistan, Tunisia, Turkey, Turkmenistan, Ukraine, Uzbekistan, Yugoslavia (\* = literature records).

**DIAGNOSIS.**—This species is distinguished from congeners by the following combination of characters: mesonotum smooth, mostly shiny black, essentially bare of microtomentum even if microsculptured; all tibiae black; hind basitarsus yellowish orange; spine-like setae along apicoventral margin of fore femur small, length of largest seta at most  $1/2$  width of fore tibia; and 2nd abdominal tergum with median depression triangular, microsculptured.

**REMARKS.**—This is the most widespread species of the genus, and some variation is evident. The variation is slight, however, and is not deemed to be significant at the species level.

### Phylogenetic Considerations

*Mosillus* is similar and closely related to *Chlorichaeta* and a group of species related to *Gymnopa beckeri* (the three groups are hereafter referred to as the *Mosillus* clade). The genus is more distantly related to *Placopsidella* and possibly to *Chaetomosillus*. The monophyly of the *Mosillus* clade is established by the following synapomorphies:

1. The ocellar setae are reduced or lacking. In other genera of Gymnomyzini the ocellar setae are distinct even though varying in size from small to well developed.
2. The fore femur bears 5–8 stout setae, with the first one or two setae being the largest. In most genera of Gymnomyzini the fore femur is either unarmed (as in species of *Placopsidella*), produced posteroventrally, usually forming a pointed, narrow ridge (as in species of *Chaetomosillus* and *Stratiothyrea*) or there are only 1–2 stout setae (as in species of *Athyroglossa*).
3. The hypandrium, especially the lateral arms, is fused with the pregonites, a character unique to the *Mosillus* clade.
4. The anterior margin of the hypandrium is produced anteriorly to form a Y-shaped sternite with two lateral arms. In other genera the hypandrium is truncate to broadly rounded, but not produced anteriorly.

Although not resolved to our complete satisfaction, the available evidence suggests that the outgroup of the *Mosillus* clade is *Placopsidella*, as demonstrated by the following synapomorphies:

1. Arista appearing bare or with very short hairs (length of arisal hairs usually not greater than basal arisal width).
2. Anterior notopleural seta lacking.
3. Fore femur slightly swollen, especially compared to femora of middle and hind legs.

In the presentation on species relationships that follows, the characters used in the analysis are noted first. Each character is immediately followed by a discussion to explain its states and

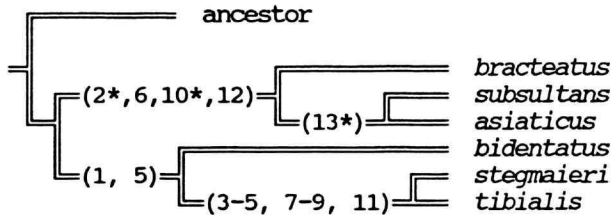


FIGURE 89.—Hypothetical phylogeny for species of *Mosillus* (numbers correspond with those used in text).

to provide perspective and any qualifying comments about that character. After presentation of the information on character evidence, an hypothesis of the cladistic relationships is presented and discussed. The cladogram (Figure 89) is the primary mode to convey relationships, and the discussion is to supplement the cladogram and is intended only to complement the latter. In the discussion of character data, a "0" indicates the state of the outgroup; a "1" or "2" indicate the respectively more derived states except for specific characters that are nonadditive. The coding for nonadditive characters is reviewed on a character by character basis as discussed in the text. The numbers used in the presentation are the same as those on the cladogram (Figure 89), and the sequence is the same as noted in the character matrix (Table 1).

Characters Used in the Phylogenetic Analysis.

HEAD

1. Microsculpturing of mesofrons: 0 = mostly plain, similar to adjacent parafrons, at most sparsely microsculptured; 1 = densely microsculptured, appearing microrugose; 2 = densely microsculptured, appearing granulose. We were unsure about the transformation series and polarization of this character and treated it as nonadditive in the analysis.
2. Vestiture of parafacial: 0 = one microtomentose area; 1 = two spots or areas of dense microtomentum. Elsewhere in the tribe the parafacial is usually microtomentose, frequently as a ventral extension from the fronto-orbits. The division of the parafacial microtomentum into two spots or areas is considered derived.
3. Vestiture of face: 0 = microtomentum restricted to antennal grooves; 1 = face, including antennal grooves, much more extensively microtomentose.

TABLE 1.—Character matrix for species of *Mosillus*.

Taxon	Head	Thorax	Abdomen
<i>ancestor</i>	000	0000	000000
<i>stegmaieri</i>	201	1112	210100
<i>tibialis</i>	201	1102	210100
<i>bidentatus</i>	210	0101	102001
<i>subsultans</i>	010	0010	002011
<i>asiaticus</i>	010	0010	002011
<i>bracteatus</i>	110	0010	001010

THORAX

4. Color of fore tibia: 0 = entirely to mostly (sometimes apices pale) black; 1 = pale, reddish yellow. Fore tibiae that are reddish yellow are unique within the tribe and a synapomorphy.
5. Color of middle tibia: 0 = black; 1 = pale, reddish yellow. The middle tibiae are generally black in taxa of Gymnomyzini, and a pale, reddish yellow tibia, which is common to species of the *tibialis* group, is unique and a synapomorphy.
6. Color of fore basitarsomere: 0 = yellow; 1 = black.
7. Vestiture of mesonotum: 0 = microtomentum sparse to absent; 1 = moderately microtomentose; 2 = densely microtomentose.

ABDOMEN

8. Sculpturing and vestiture of 5th tergum: 0 = 2 circular depressions; 1 = 1 area with fine microsculpturing and bearing dense patch of setulae; 2 = 1 area of dense microtomentum and setulae.
9. Size and shape of surstyli: 0 = large, more or less triangular, ventral margin pointed; 1 = short, ventral margin truncate.
10. Shape of aedeagus: 0 = relatively straight; 1 = angulate, with vertex of angle not projected; 2 = angulate, with angle distinctly projected at vertex.
11. Shape of hypandrium: 0 = relatively flat; 1 = with deep pocket toward anterior margin.
12. Vestiture of hypandrium: 0 = bare of microtrichia; 1 = bearing numerous, short, microtrichia.
13. Shape of postgonite: 0 = a simple process, lacking secondary lobes, etc.; 1 = bearing a secondary lobe.

A single tree (Figure 89) resulted from the implicit

TABLE 2.—Analysis of characters used to generate the cladogram. First line = character number; 2nd line = number of steps; 3rd line = consistency index; 4th line = retention index.

Character	1	2	3	4	5	6	7	8	9	10	11	12	13
Steps	2	2	1	1	1	2	2	2	1	4	1	1	2
Consistency Index	100	50	100	100	100	50	100	100	100	50	100	100	50
Retention Index	100	50	100	100	100	50	100	100	100	50	100	100	50



TABLE 3.— Characters and weights after successive weighing.

Character	1	2	3	4	5	6	7	8	9	10	11	12	13
Weight	10	2	10	10	10	2	10	10	10	2	10	10	2

enumeration (ie\*) option of Hennig86. The tree has a length of 22 steps and consistency and retention indices of 0.76 and 0.80, respectively. The analysis of the characters is given in Table 2. Using the successive weighing technique (ie\*, xsteps w, cc), we further analyzed the characters to determine their contribution or weight for this tree topology (Table 3).

The topology of the tree is symmetrical with two identical clades. Both clades, here recognized as species groups, comprise three species and are restricted to either the New (The *tibialis* Group) or Old World (The *subsultans* Group).

Although coincidental, a symmetry of sorts also occurs among the species relationships within each clade. Two species in the *tibialis* group, *M. stegmaeri* and *M. tibialis*, are very similar to each other and are closely related (synapomorphies 3–5, 7–9, 11), and this lineage is rather distantly related to *M. bidentatus*, which is quite dissimilar and easily distinguished. This same pattern is evident in the *subsultans* group, with *M. asiaticus* and *M. subsultans* being closely related (synapomorphies 6, 12, 13) and very similar (separable only by characters of the male genitalia) and *M. bracteatus* being somewhat divergent morphologically and apparently not closely related.

#### Annotated Catalog of Nomina Dubia

The following five species names are available and may be valid, although primary types are apparently unavailable to verify their status. We have listed these names alphabetically

and have adopted the format that will be used in a forthcoming world catalog of shore flies. Annotations, as appropriate, are also provided within brackets.

*gutticosta* Walker. Australasian/Oceanian: Borneo (Sarawak).

*Gymnopa gutticosta* Walker, 1856:136 [Borneo. Sarawak; T, BMNH (apparently lost). If this species ever proves to be a gymnomyzine, it will undoubtedly be a member of a genus other than *Mosillus*, such as *Chlorichaeta*.]

*Mosillus gutticostus*.—Cogan and Wirth, 1977:322 [generic combination; listed as an unrecognized species].

*frontina* Costa. Palearctic: Italy.

*Gymnopa frontina* Costa, 1854:89 [Italy. Napolitano; T, (apparently lost). If this is a species of *Mosillus*, it is undoubtedly conspecific with and thus a junior synonym of *M. subsultans*.]

*infusa* Walker. Australasian/Oceanian: Borneo (Sarawak).

*Gymnopa infusa* Walker, 1856:136 [Borneo. Sarawak; T, BMNH (apparently lost). If this species ever proves to be a gymnomyzine, it will undoubtedly be a member of a genus other than *Mosillus*, such as *Chlorichaeta*.]

*Mosillus infusus*.—Cogan and Wirth, 1977:323 [generic combination; listed as an unrecognized species].

*nigroaenea* Walker. Nearctic: USA.

*Gymnopa nigroaenea* Walker, 1853:413 [USA; T, BMNH (apparently lost)].—Cresson, 1922:330 [suggested to be a species of *Psilopa*].

*tarsalis* Walker. Nearctic: USA.

*Gymnopa tarsalis* Walker, 1853:413 [USA; T, BMNH (apparently lost)].—Cresson, 1922:330 [suggested to be a species of *Psilopa*].

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