

A Revision of the Genus  
*Leptonema* Guerin (Trichoptera:  
Hydropsychidae: Macronematinae)

OLIVER S. FLINT, Jr., J. FRANK McALPINE,  
and  
HERBERT H. ROSS

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## ABSTRACT

Flint, Oliver S., Jr., J. Frank McAlpine, and Herbert H. Ross. A Revision of the Genus *Leptonema* Guérin (Trichoptera: Hydropsychidae: Macronematinae). *Smithsonian Contributions to Zoology*, number 450, 193 pages, 798 figures, 31 maps, 1 dendrogram, 1987.—The genus *Leptonema* Guérin is revised, resulting in 105 species being recognized, 2 of which are composed of 2 subspecies each, 2 additional species being placed to species group only, and 2 more species remaining nomina dubia. We describe 48 species and 2 subspecies as new, and divide the genus into 15 new species groups. For the 105 species fully recognized, the male genitalia, and other selected characters, are figured, and known distributions mapped. The genus is known in the New World from southwestern United States to central Argentina, including the Greater and Lesser Antilles, and in the Old World from subsaharan Africa and Madagascar. The phylogenetic relationships of the genus are discussed and a phylogeny of the species groups proposed. The genus *Neoleptonema* is a new synonym of *Leptonema* and its sole species, *aspersum* Ulmer, is placed in the *sparsum* group (new combination). *Macrostemum giganteum* Martynov (new combination), from India is removed from *Leptonema*. The following 6 new synonymies are made: *M. displicens* Navás under *L. affine* Ulmer; *L. bihoumi* Statzner and Gibon under *L. guineense* Gibbs; *L. silvestrinum* Navás under *L. columbianum* Ulmer; *L. grisolinum* Navás under *L. crassum* Ulmer; *Hydropsyche trilobata* Jacquemart under *L. agraphum* (Kolenati); and *Hydropsyche flagellata* Jacquemart under *L. pallidum* Guérin.

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# A Revision of the Genus *Leptonema* Guérin (Trichoptera: Hydropsychidae: Macronematinae)

*Oliver S. Flint, Jr., J. Frank McAlpine,  
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## Introduction

The caddisfly genus *Leptonema* is one of the larger genera in the order Trichoptera, with 107 species and 2 subspecies herein treated. Most species are also large for caddisflies, some species having a wingspread of 60 mm. They are often very abundant at lotic sites, where they comprise one of the major portions of insectan biomass. They inhabit all types of flowing water from spring brooks to large lowland rivers. In northern South America and southern Central America the diversity of species seems to be greatest in streams a meter or two in width in forested mountains.

When this study was initiated 30 years ago, the genus appeared to be limited primarily to the Neotropical and Afrotropical Realms, with possible outliers in Ceylon and southern India. This study has shown that the suspected members from Asia belong to other genera, thus restricting *Leptonema* to Tropical America and Africa, with a distinctive group found in Madagascar. Within these areas, however, the genus has radiated extensively, with 91 species known from the New World, 12 from Africa and another 6 from Madagascar.

This study was begun by McAlpine as a special project under Ross at Illinois in 1956. It was essentially completed in 1963, when both of the initial investigators accepted new positions and the manuscript was set aside. Shortly before Ross's death in 1978, McAlpine and Ross requested Flint to update and complete the paper, adding new species and records that had accumulated in his extensive new collections. The results presented herein follow the original man-

uscript as closely as possible, in order to maintain the contributions of McAlpine and Ross.

## HISTORICAL REVIEW

Guérin (1843) erected *Leptonema* as a genus related to, but distinct from, *Macronema* Pictet and described in it one new species, *pallidum* (as *pallida*), the type by monotypy. Walker (1852) listed the genus and the species, but he did not know either category, for in the same paper he described a closely related new species, *albovirens*, and he placed it in *Macronema*. Hagen (1861) compounded Walker's error by sinking *albovirens* (Walker) as a synonym of *pallidum* Guérin, and placing the latter in *Macronema*. These actions led to much confusion about the identities of *pallidum* and *albovirens*, and the status of *Leptonema*.

Ulmer (1905a-c, 1907a,b) brought together the 5 species of *Leptonema* described by earlier authors and added 9 new species. The last of these papers is the first revisionary study of the genus; it placed the taxonomy of the group on a firm basis and set an excellent pattern for latter students. Moseley's (1933) classical "Revision of the Genus *Leptonema*" is the latest and most comprehensive treatment of the group. In this work he treated 37 species, 24 of which were newly described, placed 1 in synonymy and left 14 as unrecognized; he provided 199 excellent figures, mostly of the male genitalia, and gave a complete bibliography. Most of his descriptions and figures of the species can scarcely be improved upon, and hence, we utilize many of his illustrations in this work. For a few species described by Moseley from "Biologia" material we have provided more precise data on the type localities, thanks to the gazetteer of place names used in the "Biologia Centrali America" by Selander and Vaurie (1962).

Scattered species of *Leptonema* have been described since

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1933 by various authors including Flint (1967a, 1968, 1974, 1978, 1981), Jacquemart (1962), Marlier (1947, 1961, 1965), Navás (1933a,b, 1934a,b), Schmid (1964), and Sykora (1964) but no further revisionary studies have appeared. Ulmer (1957), Marlier (1961, 1962), Flint (1964, 1968), Wiggins (1977), Flint and Wallace (1980), and Scott (1983) provided information on the morphology of the immature stages. Fischer (1963, 1972) presented a comprehensive catalog of the world literature on Hydropsychidae up to the end of 1960, in which are listed 52 species of *Leptonema*. Herein we have cited the original reference for each species and added only those that are not included in Fischer's catalog. For a full bibliography one should consult the latter.

Now, in 1986, 143 years after the establishment of the genus, we fully describe 105 species and 2 subspecies, of which 50 species and 2 subspecies are newly described, leaving 2 names unplaced beyond species group, 2 more as nomina dubia, and 13 placed in synonymy. Our intent has been to characterize the genus *Leptonema*, to describe and figure in as uniform a manner as possible the males of all species, to cluster the species into species groups, and to discuss the placement of the genus in the family and the phyletic arrangement of the species groups.

#### ACKNOWLEDGMENTS

We are indebted to many individuals and museums who provided material and other help during the course of this study and without whose wholehearted cooperation this study would not have been possible. We most especially wish to thank Dr. J.M. Kingsolver (now with the U.S. Department of Agriculture at the National Museum of Natural History) and Dr. J.D. Unzicker (Illinois Natural History Survey) for many services performed during the initial stages of this study at the Illinois Natural History Survey. We are grateful to Dr. R.M.A. Paulian for entrusting to us the Madagascan *Leptonema* material from his collection of caddisflies (placed in the Muséum National d'Histoire Naturelle, Paris) and to Dr. F. Schmid for making available to us many specimens of this genus from his collection (now placed in the Canadian National Collection, Ottawa). We thank Dr. H.M. André (Musée Royal de l'Afrique Centrale) for providing precise locality data for the material from Zaire. Most of the illustrations were prepared by the authors, but Dr. K.G.A. Hamilton of the Biosystematics Research Institute, Agriculture Canada and Mrs. Elaine R. Hodges of the Department of Entomology, Smithsonian Institution, provided a number of excellent habitus figures and other artistic support. We are most grateful to the Trustees of the British Museum (Natural History) for permission to reproduce the many excellent figures from Mosely (1933). We thank the reviewers of the manuscript, Drs. F. Schmid and J.S. Weaver III, for their many valuable

recommendations; the results are the total responsibility of the authors. Finally we gratefully acknowledge assistance provided us in this study by Agriculture Canada, the Illinois Natural History Survey, the Smithsonian Institution, and the U.S. National Science Foundation.

The disposition of material treated herein is indicated under each species according to the following acronyms.

AMG	Albany Museum, Grahamstown, South Africa
AMNH	American Museum of Natural History, New York
BMNH	British Museum (Natural History), London
CAS	California Academy of Sciences, San Francisco
CMP	Carnegie Museum, Pittsburgh, Pennsylvania
CNC	Canadian National Collection, Ottawa
CUI	Cornell University, Ithaca, New York
DEI	Institut für Pflanzenschutzforschung der Akademie der Landwirtschaftswissenschaften der DDR, Abteilung der Insekten (former Deutsches Entomologisches Institut), Eberswalde, DDR
FHCU	Facultad de Humanidades y Ciencias (Departamento de Artrópodos), Universidad de la Republica, Montevideo, Uruguay
IBUNAM	Instituto de Biología, Universidad Nacional Autónoma de México, Mexico City
IML	Instituto Miguel Lillo, Tucuman, Argentina
INHS	Illinois Natural History Survey, Urbana, Illinois
INPA	Instituto Nacional de Pesquisas da Amazonia, Manaus, Brazil
IRSNB	Institut Royal des Sciences Naturelles de Belgique, Brussels
ITZ	Instituut voor Taxonomische Zoölogie, Amsterdam, Netherlands
IZAM	Instituto de Zoología Agrícola, Maracay, Venezuela
LACM	Los Angeles County Museum of Natural History, California
MACN	Museo Argentino de Ciencias Naturales "Bernardino Rivadavia," Buenos Aires
MCZ	Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts
MDA	Museu do Dundo, Angola
MNHNP	Muséum National d'Histoire Naturelle, Paris, France
MNRJ	Museu Nacional, Rio de Janeiro, Brazil
MRAC	Musée Royal de l'Afrique Centrale, Tervuren, Belgium
MZB	Museo de Zoología, Barcelona, Spain
NMMNH	National Museum: Museum of Natural History, Prague, Czechoslovakia
NMW	Naturhistorisches Museum, Vienna, Austria
PAN	Polish Academy of Sciences, Warsaw
PUWL	Purdue University, W. Lafayette, Indiana
RNH	Rijksmuseum van Natuurlijke Historie, Leiden, Netherlands
SDNHM	San Diego Natural History Museum, California
UAMC	Universidad de Antioquia, Medellín, Colombia
UCB	University of California, Berkeley
UCR	University of California, Riverside
UKAL	University of Kansas, Lawrence
UNCMB	Universidad Nacional de Colombia, Medellín Branch
UNLP	Universidad Nacional de La Plata, Argentina
USNM	former United States National Museum, collections in the National Museum of Natural History, Smithsonian Institution, Washington, DC
USP	Universidade de Sao Paulo, Brazil
VPISU	Virginia Polytechnic Institute and State University, Blacksburg
ZIUH	Zoologisches Institut der Universität, Halle an der Saale, DDR
ZIUK	Zoologisches Institut Universität, Karlsruhe, F.R. Germany
ZSM	Zoologische Staatssammlung, München, F.R. Germany

ZSZMH Zoologisches Staatsinstitut und Zoologisches Museum, Hamburg, F.R. Germany

ADULTS

FIGURE 1

**Genus *Leptonema* Guérin**

*Leptonema* Guérin, 1843:396.—Ulmer, 1907b:44–61; 1907c:162, 163.—Mosely, 1933:1–69.—Marlier, 1962:133–135.—Fischer, 1963:165–174; 1972:156, 157.—Scott, 1982:389–398 [type-species, *Leptonema pallida* Guérin, monobasic].

*Neoleptonema* Ulmer, 1907b:61, 62.—Fischer, 1963:174.—Flint, 1974:103 [type-species, *Neoleptonema aspersum* Ulmer, monobasic; new synonymy]

Size from moderate (about 10 mm) to relatively large (about 30 mm); length of forewing 8–28 mm. Wings varying from uniformly, semi-transparent, milky whitish or greenish through dull ochraceous, to opaque, pale brown; often blotched, streaked or irrorated with yellow, brown, and/or black pubescence (Figures 776–788); colors subdued, and patterns, when present relatively obscure.

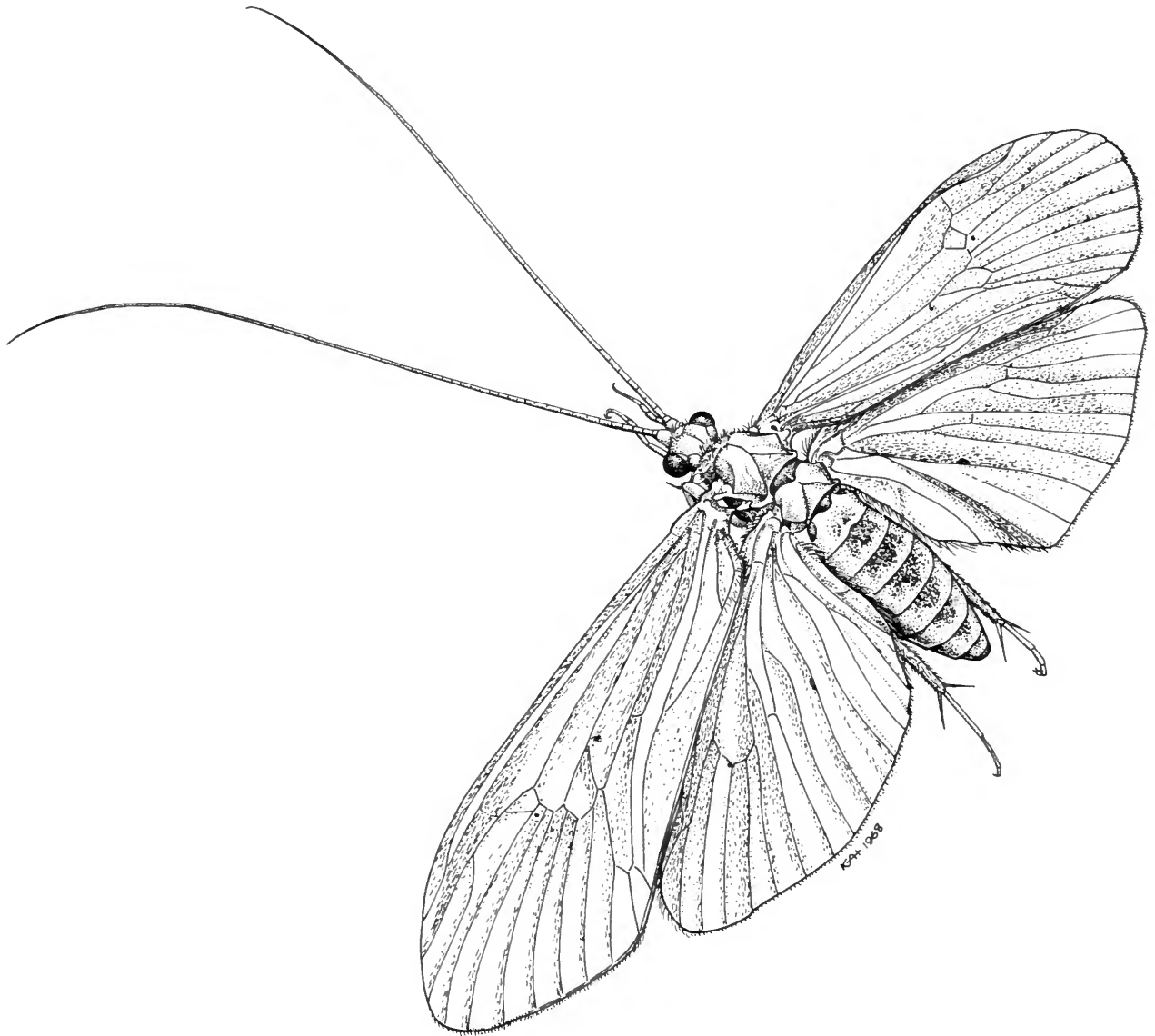


FIGURE 1.—Female of *Leptonema albovirens* (Walker).

Head (Figures 3, 5, 6): In shape usually higher than long. Face and frons rather densely setose with short, fine, mostly depressed setae. Anterior warts of frons indistinct; more or less continuous with each other and with the posterior warts, i.e., front warts not swollen nor clearly delineated as in *Macronema*; posterior warts more swollen and more clearly delineated. Frons without a raised, sclerotized plate; with a setose, rather bulging, lunulate callus immediately above and between the bases of the antennae. Malar space usually less than  $\frac{1}{3}$  eye height (Figure 5); occasionally, e.g., *crassum* group, very broad (Figure 2); bare except when very broad. Parafacial area usually narrower than malar space; with some short setae, at least anteriorly. Postocular area about same width as parafacial; almost always with a row of outstanding setae in front of some low setae. Antennae very long (Figure 1); usually longer than forewings. Maxillary palpi (Figures 2, 5) 5-segmented; first segment short; second segment longer than, or rarely equal to, third; third segment longer than fourth; fifth segment much longer than any other segment, with many transverse annulations. All segments with numerous, short, depressed, soft, yellowish setae. Labial palpi (Figures 2, 5) 3-segmented, with protuberant palpiger; second segment frequently broad and conspicuously flattened, apical segment longest. Ocelli absent.

Thorax: Prothoracic warts often divided into a larger sublateral and a smaller lateral wart.

Tibial spur formula usually 2, 4, 4; sometimes 1, 4, 4 (inner spur of anterior tibia undeveloped in this case). Front tibia with outer spur larger than inner one (Figure 676), except in *crassum* group where reverse is true; rarely with 2 subequal spurs. Middle tibia and metatarsus (Figure 3) sometimes much broadened and flattened: e.g., *crassum* group.

Forewings (Figures 1, 7, 8) broad with round apex. Posterior margin usually almost straight, often slightly convex, rarely slightly concave. Costal cell with 1 or 2 crossveins; discoidal cell short and broad, usually slightly longer than broad and always closed. Forks 1, 2, 3, 4, and 5 present; second fork and thyridial cell each with a small, thickened, gland-like callus, viz., a nygmatal spot. Hindwings (Figures 1, 7, 8) shorter, broader and paler than forewings; forks 1, 2, 3, and 5 present. Females of some species in *pallidum* group with a cluster of short, densely packed setae about in middle of second cubital vein (Figure 7).

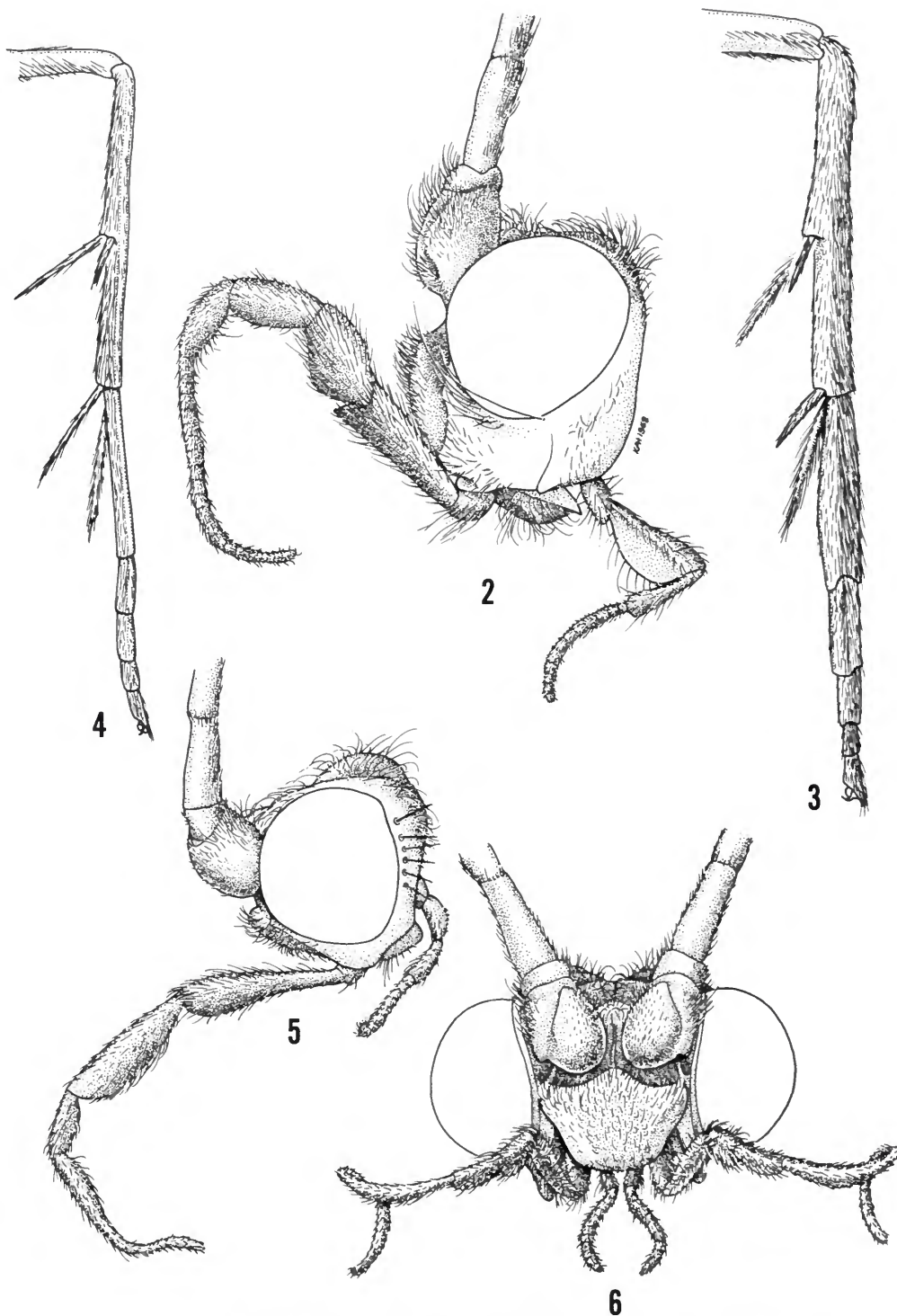
Abdomen: First abdominal sternum greatly reduced; largely internal, and therefore not apparent. Second sternum (= apparent basal sternum) with (Figure 644) or without (Figure 98) a median suture; third sternum sometimes with a short median suture. Some or all of sterna 2–8 with lateral sutures (Figure 544). Fifth sternum (Figures 27) with a pair of clear, raised, oval, boss-like structures, generally smaller in the female (Figure 523) than in the male (Figure 522); anterior end of each with a small pore leading to an

internal gland (Figure 411). Second tergum with or without a short median suture. Some or all of terga 1–8 with lateral sutures. Membrane on sides of abdomen often with tuft-like clusters of gill remnants (Barnard, 1934:358; Müller, 1921:549–554; Schmid, 1968:13–15) (Figure 544). (Adults of both sexes frequently bear one or more water mites attached to these processes and scars in these positions provide evidence that other adults previously bore mites somewhat as described for mosquitoes by Corbet, 1963).

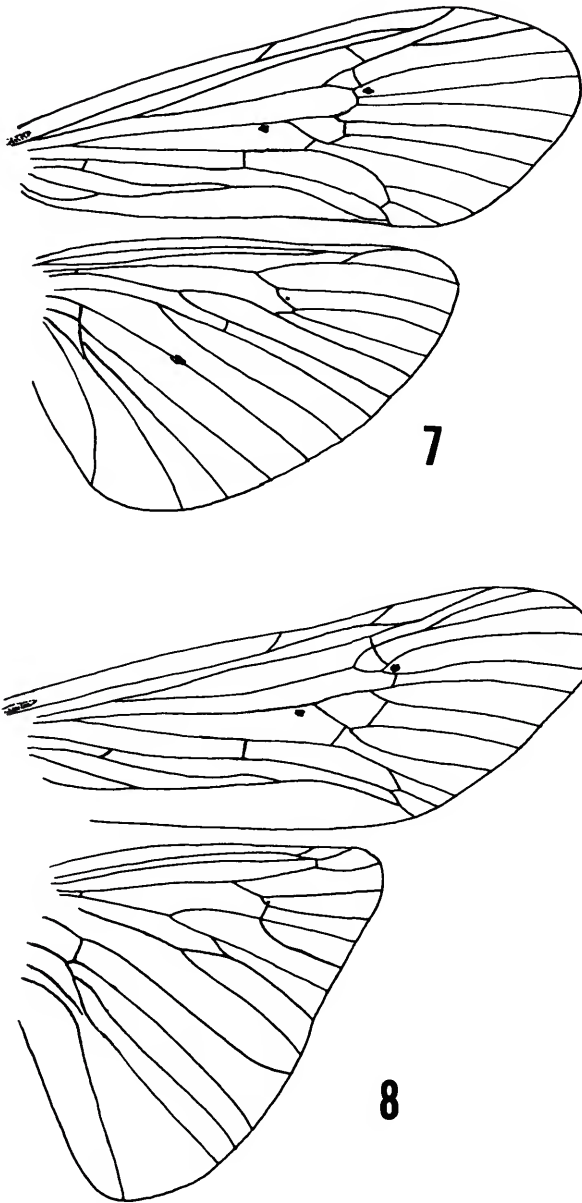
Male Genitalia: Ninth tergum in usually with a V-shaped dorsal keel bearing a row of long, stout setae along posterior margin (Figure 14). Tenth tergum (Figure 9) with elements of paired median and lateral lobes and three pairs of warts (warts *a*, *b*, and *c*) that vary in size, shape, reduction, duplication (warts  $a_1$  to  $a_2$ ,  $b_1$  to  $b_3$ ), depending on the species. Wart *a* (probably homologous with superior appendages of Nielsen, 1957 or preanal process of Schmid, 1968 and 1980) always present in some form; warts *b* and *c* sometimes not evident. Wart *a* in a sublateral, dorsal position near anterior margin of tenth tergum. Wart *b*, when present, usually appearing in a subapical or apical position caudolaterad of wart *a*. Wart *c*, when present, usually located laterally near the base of the tergum beneath wart *a*. Lateral lobes (LL) projecting posteriorly; usually relatively strongly sclerotized, especially along the lateral or lateroventral margins, and often blade-like. Median lobes (ML) arising from the mesal roots of the lateral lobes; usually relatively small and membranous. Claspers (inferior appendages of Nielsen, 1957, and Schmid, 1968, 1980) (Figure 15) two-segmented. Basal segment (coxopodite) longer and thicker than apical segment (harpago); with (Figure 622) or without (Figure 15) a basomedian lobe; often with a cluster of short, stout, setae on inner surface near apical third (Figure 235). Apical segment short (Figure 33) to long (Figure 570); usually with a mesal pad of short, dark, peg-like setae.

Phallus (Figures 10–12) elongate; comprised mainly of a strongly sclerotized outer wall, the phallosome, with basal section angled at about  $135^\circ$  to tubular middle section (or stem) in lateral view. Apical section (probably derived from sclerotized vestiges of the endotheca) varying from a simple, condyloid (Figure 347) or knob-like (Figure 18) structure to a very complex assemblage of hooks, spines, forks, etc. Phallosomal sclerites consisting of two tiny, heavily sclerotized, blackish points close together just inside the gonopore (Figure 23). They are conspicuous in dorsal view and sufficiently constant in shape and position to serve as bench marks for identifying other phallic processes. Process *a* unpaired, appearing as a dorsomedian tip or spout projecting above the phallosomal sclerites. Process *b* paired and arising from ventral apex of phallus. Process *c* paired and arising basolaterad on process *b*; usually projecting basoventrad. Process *d* paired and arising laterally near bases of processes *a* and *g*; in some groups, e.g., the *complexum* group, *d* armed with anterior and posterior branches. Proc-





FIGURES 2-6.—*Leptonema crassum* Ulmer: 2, head, lateral; 3, midleg of female, lateral. *Leptonema albovirens* (Walker): 4, midleg of female, lateral; 5, head, lateral; 6, head, frontal.



FIGURES 7, 8.—Wings: 7, *Leptonema albovirens* (Walker), female; 8, *L. crassum* Ulmer, male.

ess *e* paired and arising basad of root of process *d*. Process *f*, when present, forming a single dorsal process arising mesally between bases of processes *d* and *e*. Process *g* generally present and paired; arising ventrolaterally just basad of roots of processes *b* and *c* which in its most complex condition is feathered or spiculate as in *alceatum* (Figure 650). Process *j*, when present, forming a single median process arising dorsally from process *a*; sometimes in the

form of a simple tubercle, but more often in the form of a spike or fork (Figure 573).

Female Genitalia (Figure 13): Eighth sternum (8S) almost completely divided along midline into 2 ventral plates (Vt Pl). Ninth tergum (9T) saddle-shaped (numbering of segments follows Nielsen, 1980; Schmid, 1980, believes segment 9 is lacking and thus the segments present are 8, 10, and 11); posteriad with a row of strong setae, a narrow band of fine setae along posterior margin and a distinct, setose wart on each side; each posteroventral extremity with a conspicuous, and distinctively shaped clasper groove (Cl Gr) and receptacle (Cl Rec). Tenth tergum (10T) small, ending with 2 pairs of distinct papillae (Pap), between which the slimmer, darker, and indistinctly biarticulate cercus (Cer) is inserted. With complex internal sclerites (offering useful specific characteristics).

#### IMMATURE STAGES

Full, well-illustrated descriptions of larval and pupal stages are provided by Ulmer (1957), Marlier (1961, 1962), Wiggins (1977), Flint and Wallace (1980), Statzner and Gibon (1984), Boon (1985), and especially Scott (1983). The following summary of the most significant characters of *Leptonema* is adapted from these works.

Larva: Body densely setose or bristly; integument rough. Head short and rounded or elongate; without a carina. Labrum with a large anterolateral brush. Mandible broadly triangular, stout; teeth extending at least to middle of cutting edge. Left mandible with a brush on mesal surface. Maxillae not elongate. Genae with stridulatory grooves ventrally; gular sclerite clearly delineated by an

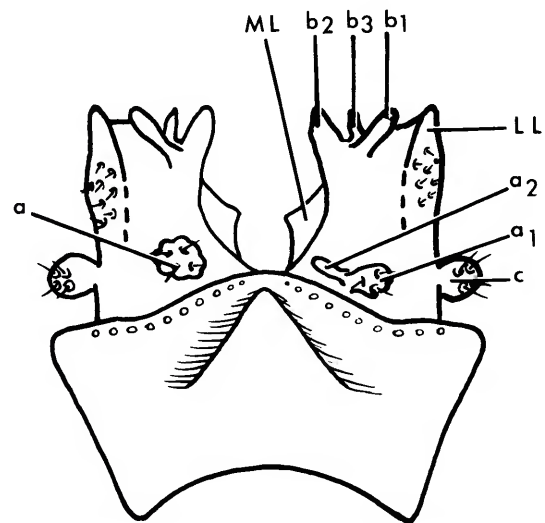
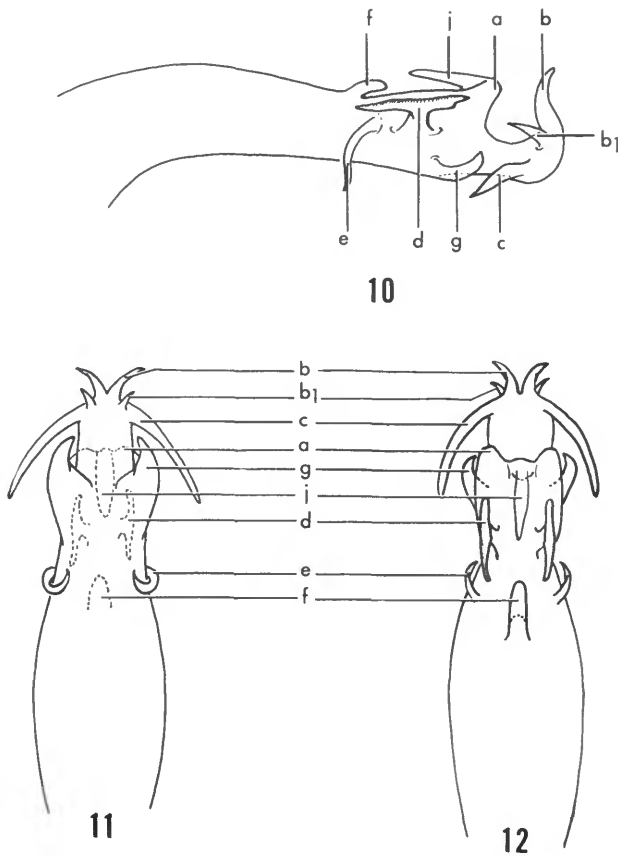


FIGURE 9.—Ninth and tenth terga, dorsal, of a hypothetical male *Leptonema*, showing warts (*a*, *b*, *c*), lateral lobe (LL), and median lobe (ML).





FIGURES 10–12.—Apex of phallus of a hypothetical male *Leptonema*, showing processes (a–j): 10, lateral; 11, ventral; 12 dorsal.

ecdysal line on both sides. Legs strongly bristled. Foreleg without a large, fan-like array of long, thin setae. Tarsal claw with a single strong basal spine. Anterior coxa with one or more processes on the inner margin. Trochantin of foreleg with a trianguloid process. Proventriculus with simple spines. Anal proleg relatively short and stout; setal fan well developed. Gill tufts on meso- (1 pair) and metasterna (2 pairs). Lateral abdominal gill tufts absent; with two or more rows of ventrolateral and ventral tufts on segments 1–7. Gills with filaments arising in whorls from a central stalk. Anal gills present, probably five (often only 4 or less are seen).

**Pupa:** Labrum with anterior margin semicircular with small basolateral lobes; with scattered small setae. Mandibles with inflated bases, outer face basally with dark setae; inner margin with teeth at midlength, beyond which the margin is serrate. Front of face with a paired cluster of large, dark, hooked setae and scattered small and long setae. Antennae longer than body, terminal segments coiled 2–3 times around apex of abdomen. Meso- and metanota each with a

few setae. Midlegs with setal fringes on both sides of tarsi. Abdomen with single (segment 3), or deeply bifid (segments 4–7), lateral, membranous lobes. Ventrally with paired, tufted gills on segments 2–7. Hook plates anteriorly on segments 2 or 3 to 8, posteriorly on 3. Segment 4 dorsally with long, dark setae, other segments with fewer, and usually shorter, setae. Apical appendages plump basally, apex constricted; with subapical lateral and/or mesal, long, apically hooked setae; apex upturned, covered ventrally with short spinous setae.

**Larval Retreat:** Retreats reportedly (Flint and Wallace, 1980; Scott, 1982) similar to those of typical *Hydropsyche*, covered with rock and sand grains, lined with silk. Catch nets of hydropsychine-type construction with a central seam; mesh size reported from  $40.5 \times 80 \mu\text{m}$  to  $430 \times 167 \mu\text{m}$ . Attached to solid substrate (wood, stones, bedrock, solid clay) in flowing water.

**Pupal Retreat:** Ovoid, of rock fragments with interstices filled with sand, or mostly sand, attached firmly to inner, silken lining. Usually attached by one side to substrate, in which case this side is silken only. Small openings left at both ends between sand and silk to allow water circulation.

#### BEHAVIOR

No reports are known on the eggs, oviposition, or most aspects of behavior of either adults or larvae. The adults come to light at night, both incandescent and ultraviolet, but the sex ratio is often strongly skewed toward the female sex. In the daytime, net collecting of adults generally produces a nearly equal sex ratio or a predominance of males. This is especially true in the more strongly marked species, where one rarely takes males at the light. This suggests that males, especially of the colorful species, are much more strongly day-active than the females.

#### GENERIC CHANGES

*Neoleptonema* Ulmer (1907b), erected for *aspersum* Ulmer, was distinguished from *Leptonema* by the presence of a common stalk at the base of the third fork in the forewing. Our studies, based on both sexes of *aspersum* and its sister species, *rostratum*, reveal that both have this characteristic, but both agree in all other diagnostic characteristics with *Leptonema*. Consequently, we regard *Neoleptonema* as a synonym of *Leptonema*, and place the species with this characteristic in a subgroup of the *sparsum* group.

On the basis of the description and figures provided, "*Leptonema*" *giganteum* Martynov (1935) from India does not belong in the genus *Leptonema*. In addition to differences in wing venation, it has an elongate third segment of the maxillary palpus, a reliable diagnostic character of *Macrostemum* (and related genera) to which it is herein transferred.

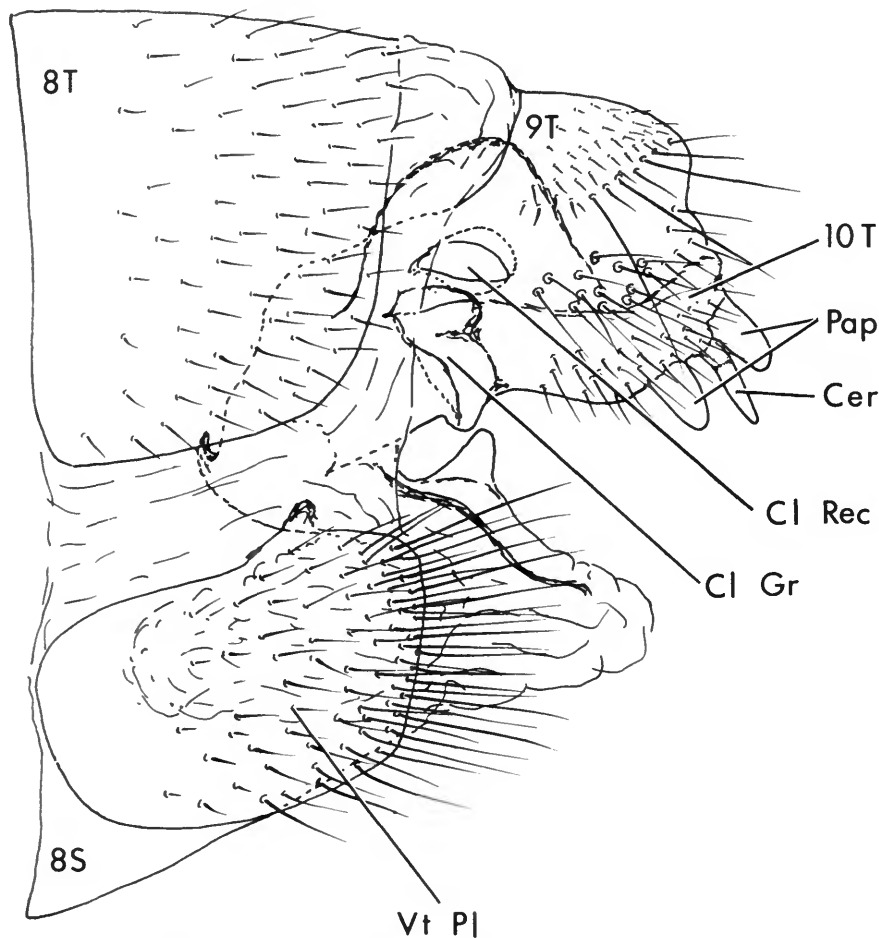


FIGURE 13.—*Leptonema albovirens* (Walker), apex of female abdomen, lateral, showing, abdominal terga (8T, 9T, 10T) and sternum (8S) with ventral plate (Vt Pl), clasper groove (Cl Gr), clasper receptacle (Cl Rec), papillae (Pap), and cercus (Cer).

Study of the male syntype of *Macronema ceylanicum* Hagen (1858), placed in *Leptonema* by Ulmer (1907a,b), showed that Mosely (1933) was correct in erecting a new genus (*Pseudoleptonema* Mosely, type *M. ceylanicum* Hagen, by original designation) for that species. *Pseudoleptonema* differs from *Leptonema* in many ways: the second segment of the maxillary palpus is shorter than the third (as in *Macrostemum*) and often produced apicad; the anterior warts of the head are well defined and larger than the posterior ones (as in *Macrostemum*); the color pattern of the forewing is like *Macrostemum*; but the wing venation, especially in the hindwing is distinctly different from any other genus (see Schmid 1958); the male genitalia (see Schmid 1958, pl. 19: figs. 7, 12, 15), especially the tenth tergum and apex of the phallus is simpler than in *Leptonema*, much as in *Macrostemum*. Based on these characteristics, we believe that *Pseudoleptonema* is a valid genus more closely related to *Macrostemum* than to *Leptonema*. Schmid (1958), who described 2

new Ceylonese species of *Pseudoleptonema*, independently arrived at the same conclusion and provided an excellent diagnosis of the genus.

#### TAXONOMIC KEYS

The first key that follows is a synoptic key to species groups of *Leptonema*. It serves to place species, hopefully including those still uncollected, in their respective groups and to summarize the main characters of these groups. It is as consistent with our concept of the phylogeny of the groups as we can achieve. The second key is for identifying known species and it is designed in a strictly utilitarian fashion. Both keys rely heavily on the characters of the male genitalia discussed above. With very few exceptions, it is essential to refer to these structures for correct placement and/or identification of species.

## Key to Species Groups

1. Tibial spurs 2, 4, 4 ..... 2  
Tibial spurs 1, 4, 4 ..... 12
2. Second (basal) abdominal segment with a median suture ..... 3  
Second abdominal segment without a median suture ..... 10
3. Phallus relatively simple, lacking processes [Figure 18] ..... *cinctum* group  
Phallus more complex, some of processes *b*, *c*, *d*, or *e* well developed [Figures 150, 347, 383, etc.] ..... 4
4. Male tenth tergum without wart *b*, wart *a* simple, situated near base; lateral lobe simple, elongate [Figure 324] ..... *speciosum* group  
Male tenth tergum with wart *b* and/or *c* in addition to *a*, but their position and shape variable; lateral lobe variable in size and shape ..... 5
5. Forewing with nygmatic spots surrounded by a ring of black hairs. Male tenth tergum with warts *a* and *b* low and tuberculate, *c* absent or rudimentary; phallic processes *b*, *c*, *d*, and *e*, when developed, strikingly “feathered” [Figure 417], often some of these processes weak [Figure 391] or absent [Figure 383] ..... *stigmatosum* group  
Nygmatic spots normal. Tenth tergum with or without wart *c*; processes of phallus not strongly feathered ..... 6
6. Phallic process *j* undeveloped ..... 7  
Phallic process *j* present, generally developed as a forked process [Figure 573], rarely a small lobe [Figure 613] ..... *simulans* group
7. Phallic processes *d* and *e* lacking as free processes [Figure 423] ..... *plicatum* group  
Phallic processes *d* and/or *e* present as free processes ..... 8
8. Basal segment of clasper with an area of enlarged setae on inner surface near apex [Figure 645]; phallus usually with processes *b* and *c* strongly barbed, process *d* with anterior or posterior branch (never both), process *g* strongly developed [Figure 641]. Hindwing of female often with a yellow, glandular thickening on Cu<sub>2</sub> [Figure 7] ..... *pallidum* group  
Basal segment of clasper without a spinulose area; phallus with processes *b* and *c* smooth, the former forming a strong apical hook, process *d* usually with both an anterior and posterior branch, process *g* weakly developed. Hindwing of female without a glandular thickening ..... 9
9. Tenth tergum with basoventral margin usually with a lateral projecting lobe [Figure 699]; process *d* of phallus with both anterior and posterior branches (often short) [Figure 701]; clasper usually without basomedian lobe [Figure 705] ..... *complexum* group  
Lateral lobe of tenth tergum with an elongate basoventral lobe [Figure 618]; process *d* of phallus reduced, posterior branch lacking [Figure 620]; clasper with an elongate basomedian lobe [Figure 622] ..... *insulanum* group
10. Forewing with transverse brown bands, costal cell filled with silvery hair [Figure 789] ..... *sparsum* group  
Forewing brown or green, rarely irrorate, never with a stripe of silver hair in costal cell ..... 11
11. Forewing with 2 dark brown spots, one at extreme base, other over humeral crossvein. Basal segment of male clasper with a cluster of stout setulae [Figure 220]. Female midtibia and tarsus strongly dilated [Figure 3] ..... *crassum* group  
Without dark basal spots. Male clasper without strong setulae on basal section [Figure 59]. Female midtibia and tarsus normal ..... *affine* group
12. Phallus simple, without spines or hooks ..... 13  
Phallus with various apical or subapical process, or divided ..... 14
13. Tenth tergum very simple [Figure 131] ..... *occidentale* group

- Tenth tergum more complex [Figure 264] . . . . . *amazonense* group  
 14. African . . . . . *normale* group  
 South American . . . . . *davisi* group

### Key to Species and Subspecies

(*Leptonema machadoi*, *serranum*, *naevosum*, *nygmosum*, are not placed in this key because they have been insufficiently described.)

1. Veins  $M_3$  and  $M_4$  of forewing with a basal stalk [Figure 788] . . . . . 2  
    Vein  $M_{3+4}$  of forewing branched at chord . . . . . 3
2. Apical segment of clasper very short, less than  $\frac{1}{5}$  length of basal segment [Figure 181] (Brazil to Venezuela) . . . . . *aspersum* (Ulmer), new combination  
    Apical segment of clasper long, almost half as long as basal segment [Figure 195] (Argentina to Brazil) . . . . . *rostratum*, new species
3. Spurs 2, 4, 4 . . . . . 4  
    Spurs 1, 4, 4 . . . . . 91
4. Phallus with one or more of processes  $b-j$  well developed and extending free . . . . . 5  
    Phallus lacking free processes, ending in a rounded lobe, usually with rounded dorsolateral lobes . . . . . 69
5. Phallus with process  $f$  present . . . . . 6  
    Phallus lacking process  $f$  . . . . . 20
6. Clasper with a basomesal process . . . . . 7  
    Clasper without a basomesal process . . . . . 10
7. Phallic process  $f$  a simple rounded lobe [Figure 632] (Colombia) . . . . .  
    . . . . . *uncatum* Mosely  
    Phallic process  $f$  an elongate, pointed process . . . . . 8
8. Phallic process  $f$  in dorsal aspect a single, elongate process . . . . . 9  
    Process  $f$  in dorsal aspect with apex tripartite [Figure 623] (Colombia, Venezuela) . . . . . *tripartitum*, new species
9. Lateral lobe of tenth tergum with a slender ventral process [Figure 618] (Venezuela) . . . . . *insulanum* Banks  
    Lateral lobe of tenth tergum lacking processes [Figure 768] (Ecuador, Peru) . . . . . *trifidum*, new species
10. Phallic process  $f$  a simple lobe, rounded or pointed apically . . . . . 11  
    Process  $f$  bifid or divided into 2 divergent processes . . . . . 16
11. Phallic process  $e$  an erect, well-marked process . . . . . 12  
    Phallic process  $e$  not developed as a free process . . . . . 14
12. Phallic process  $a$  large, massive, posterior face nearly vertical . . . . . 13  
    Phallic process  $a$  developed as an arched, finger-like lobe [Figure 711] (Panama, Colombia) . . . . . *cheesmanae* Mosely
13. Phallic process  $d$  with a distinct ventral stem, apical arm slender and pointed, process  $c$  attenuate, pointed [Figure 739] (Peru) . . . *harpagum*, new species  
    Phallic process  $d$  sessile, apical arm spade-like, process  $c$  with apex shallowly bifid [Figure 747] (Peru, Bolivia) . . . . . *inca* Mosely
14. Phallic processes  $d$  present, fused basomesally [Figure 761] (Colombia, Ecuador) . . . . . *rosenbergi* Mosely  
    Lacking phallic process  $d$  . . . . . 15
15. Phallic process  $j$  a small, triangular flap, process  $c$  very small and erect [Figure 610] (Guyana to Argentina) . . . . . *spinulum*, new species  
    Lacking process  $j$ , process  $c$  long, reflexed, reaching to base of process  $f$  [Figure 463] (Costa Rica, Panama) . . . . . *ekisi*, new species

16. Phallic process *f* a short, shallowly divided lobe, process *c* a simple, pointed lobe reaching to process *f* [Figure 471] (Panama) . . . . . **fortunum**, new species  
Process *f* usually deeply divided, and/or process *c* longer, divided or doubled . . . . . 17
17. Phallic process *c* a simple, long, slender process . . . . . 18  
Process *c* divided or doubled . . . . . 19
18. Phallic process *f* produced as a pair of spines directed laterad [Figure 539] (Panama, Colombia) . . . . . **sinuatum** Mosely  
Process *f* deeply divided, with arms directed, caliper-like toward apex of phallus [Figure 546] (Costa Rica) . . . . . **turrialbum**, new species
19. Phallic process *c* with a dorsal branch [Figure 561] (Panama) . . . . . **woldianum**, new species  
Process *c* with a second more slender process beneath it [Figure 479] (Costa Rica, Panama) . . . . . **hamuli**, new species
20. Tenth tergum lacking wart *b*, with wart *a* large, lateral lobe elongate . . . . . 21  
Tenth tergum with wart *b* present, warts *a* and *c* and lateral lobe variable . . . . . 29
21. Phallic process *e* present . . . . . 22  
Process *e* absent . . . . . 24
22. Phallic process *e* with posterior branch very short, barely recognizable [Figure 357] (Brazil) . . . . . **stigmaticum** Navás  
Process *e* with anterior and posterior branches almost equally long . . . . . 23
23. Branches of phallic process *e* arising ventrally on process [Figure 324] (Brazil) . . . . . **agraphum** (Kolenati)  
Branches of process *e* arising dorsally on process [Figure 364] (Brazil) . . . . . **tholloni** (Navás)
24. Phallic process *g* as long or longer than fused *b-c* lobe . . . . . 25  
Lacking process *g* . . . . . 28
25. Phallic process *g* a simple, elongate lobe . . . . . 26  
Process *g* with apex bifurcate [Figure 329] (Brazil) . . . **bifurcatum**, new species
26. Phallic lobe *b-c* a simple process . . . . . 27  
Lobe *b-c* divided into lateral lobes, each bearing 3 processes [Figure 336] (Brazil) . . . . . **boraceia**, new species
27. Phallic process *a* a narrow, arched lobe [Figure 368] (Brazil) . . . **tridens** Mosely  
Process *a* indistinguishable, a broadly rounded area [Figure 350] (Brazil) . . . . . **speciosum** (Burmeister)
28. With a small tripartite process ventromesally between base of *b-c* lobe [Figure 373] (Brazil) . . . . . **trispicatum**, new species  
With a small ventrolateral process at base of *b-c* lobe [Figure 344] (Brazil) . . . . . **eugnathum** (Müller)
29. Tenth tergum with warts *a* and *b* low, rounded, bearing setae arising from enlarged bases; phallic processes *b*, *d*, and *e* usually present and bearing combs of enlarged setae, rarely reduced to a few small points on the phallus . . . . . 30  
Tenth tergum with some warts produced on stalks; phallic processes various, but not with setal combs . . . . . 35
30. Phallic process *b* without setal comb, processes *d* and *e* reduced to a few spines [Figure 381] (Bolivia) . . . . . **auriculatum**, new species  
Phallic process *b* always with a setal comb, processes *d* and *e* usually with a comb, but may be reduced . . . . . 31
31. Phallic process *b* short, barely reaching ventral margin of phallus . . . . . 32  
Phallic process *b* elongate, extending well beyond ventral margin of phallus . . . . . 34
32. Phallic processes *d* and *e* reduced to a few small spines [Figure 396] (Argentina)



- ..... *boliviense plumosum*, new subspecies  
Phallic processes *d* and/or *e* larger, bearing a cluster of comb-like setae . . . 33
33. Phallic processes *d* and *e* both elongate, tipped with a small cluster of enlarged setae [Figure 391] (Peru to Argentina) . . . . . *b. boliviense* Mosely  
Phallic process *d* reduced to a few small spines, *e* a fan-like array of enlarged setae [Figure 397] (Colombia) . . . . . *neadelphus*, new species
34. Phallic process *e* an elongate, slender lobe bearing short, spine-like setae [Figure 405] (Venezuela to Bolivia) . . . . . *spirillum*, new species  
Phallic processes *d* and *e* united into a large fan-like array of large setae [Figure 414] (Venezuela to Ecuador) . . . . . *stigmatosum* Ulmer
35. Phallus with process *j* large, forked apicad . . . . . 36  
Phallus lacking process *j*, or with process differently shaped . . . . . 41
36. Phallic process *c* short and curled . . . . . 37  
Phallic process *c* long, reflexed and pointed . . . . . 38
37. Apical clasper segment short, barely more than 1/4 length of basal segment; process *j* comparatively short, and deeply forked [Figure 577] (Panama) . . . . .  
..... *campanum*, new species  
Apical clasper segment almost 1/2 length of basal segment; process *j* proportionately longer and less deeply forked [Figure 584] (Mexico, Guatemala) . . . . .  
..... *championi* Mosely
38. Clasper short, apical segment short (much less than 1/2 length of basal segment) and broad; phallic process *j* short and deeply forked [Figure 592] (Guatemala to Nicaragua) . . . . . *dyeri*, new species  
Clasper extending well above apex of tenth tergum, apical segment about 1/2 length of basal segment; process *j* long, forked for only 1/3 to 1/4 of its length . . . . . 39
39. Tenth tergum with apex of lateral plate distinctly twisted; apical segment of clasper slightly more than half length of basal segment; apex of phallic process *g* acuminate, pointed [Figure 569] (Costa Rica) . . . . .  
..... *ascelepium*, new species  
Tenth tergum with lateral plate unmodified; apical segment of clasper slightly less than half length of basal segment; apex of process *g* truncate, not sharply pointed . . . . . 40
40. Phallic process *j* with arms U-shaped, 1/3 to 1/2 depth of process [Figure 609] (Mexico to Nicaragua) . . . . . *simulans mayanum*, new subspecies  
Phallic process *j* with arms V-shaped, about 1/4 depth of process [Figure 603] (Costa Rica, Panama) . . . . . *s. simulans* Mosely
41. Phallus usually with process *g* and processes *b* and/or *c*; lacking processes *d* and *e* . . . . . 42  
Phallus with processes *d* and/or *e* in addition to abovementioned processes . . . . . 55
42. Phallus with process *g* a broad lobe, sometimes with dorsal margin serrate or bearing erect points . . . . . 43  
Phallus with *g* attenuate and pointed often with apex drawn out into a slender process, or lacking entirely . . . . . 50
43. Phallus with process *b* and *c* both present, one much shorter than other . . . 44  
Phallus with only process *b* present . . . . . 45
44. Phallus with dorsalmost of processes *b* and *c* longest; dorsal margin of *g* serrate [Figure 493] (Peru) . . . . . *inspiratum*, new species  
Phallus with ventralmost of processes *b* and *c* longest; dorsal margin of *g* smooth [Figure 508] (Mexico) . . . . . *michoacanense*, new species
45. Phallus with dorsal margin of process *g* bearing an erect, large tooth . . . . 46  
Phallus lacking a large tooth from dorsal margin of *g* . . . . . 47
46. Phallus with tooth of process *g* anteapical, dorsal margin of *b* serrate [Figure 554] (Costa Rica) . . . . . *vitum*, new species

- Phallus with tooth of *g* apical, dorsal margin of *b* smooth [Figure 525](Panama) ..... *salvini* Mosely
47. Phallus with a small, finger-like process on dorsal margin overlying *a*, *b* a semierect, short lobe [Figure 441] (Mexico) ..... *chiapense*, new species  
Phallus lacking a process above *a*, but *a* may appear in lateral aspect finger-like, *b* usually a long, reflexed process, but may be short and broad ..... 48
48. Phallus with process *b* a long, slender, reflexed process ..... 49  
Phallus with process *b* short, rather broad, with an apical point and directed basodorsally [Figure 532] (Ecuador) ..... *simplex* Mosely
49. Phallus with process *b* very long, extending well basad of base of process *g*; dorsum of phallus unmodified but with rows of points along side [Figure 449] (Mexico) ..... *chila* Flint  
Phallus with *b* barely longer than *g*; dorsum of phallus inflated subapically, lacking points along side [Figure 516] (Mexico, Guatemala) .....  
..... *plicatum* Mosely
50. Phallus with process *g* pointed, directed posteriad, *b* pointed, semierect [Figure 456] (Ecuador) ..... *coheni*, new species  
Phallus with process *g* and *b* differently formed ..... 51
51. Apex of phallus with 2 long, reflexed process (apex of *g* and *b*) [Figure 419] (Mexico, Guatemala) ..... *acutum* Mosely  
Apex with only a single, long, reflexed process ..... 52
52. Phallus with process *g* (?) bearing a basal filament that is curled around apex of phallus [Figure 424] (Ecuador) ..... *andrea*, new species  
Phallus with *g* lacking, or lacking a basal process curling around phallus ... 53
53. Dorsomesal margin of phallus apically with 2 short, digitate lobes, dorsal filament of *g* (?) twisted around these lobes [Figure 501] (Ecuador) .....  
..... *mastigion*, new species  
Dorsum of phallus without lobes, apical process simply reflexed ..... 54
54. With a small spine (? *g*) subtending apical process [Figure 430] (Venezuela) ...  
..... *araguense* Flint  
Lacking any spine beneath apical process [Figure 487] (Venezuela) .....  
..... *heppneri*, new species
55. Tenth tergum with wart *a* and *b* erect, elongate; clasper with basal segment lacking apicomesal pad of enlarged setae ..... 56  
Tenth tergum with wart *a* usually lacking, no warts erect and elongate; clasper with basal segment usually bearing an apicomesal pad of enlarged spines ..... 62
56. Phallus with all processes short, pointed, directed apicad or dorsad [Figure 435] (Colombia) ..... *bilobatum* Schmid  
Phallus with at least one arm of *d* very long, slender, and directed basad .. 57
57. Tenth tergum with a basoventral lobe; phallus with processes *d* completely separated basally in dorsal aspect ..... 58  
Tenth tergum without basoventral lobe; processes *d* fused basomesally, arising middorsally in dorsal aspect [Figure 754] (Costa Rica to Ecuador) .....  
..... *intermedium* Mosely
58. Phallus with process *e* deeply divided, process *d* with both anterior and posterior arms long and pointed [Figure 731] (Costa Rica) . *furciligerum*, new species  
Process *e* simple, serrate or bearing basal spines, process *d* with apical arm short or long, or variably ornamented ..... 59
59. Phallus with *b* a long, slender, reflexed process ..... 60  
Phallus with *b* short, often divided in several points directed apicad or dorsad ..... 61
60. Phallus with apical arm of *d* long, slender, pointed and with *e* serrulate apically but without processes [Figure 725] (Panama) ..... *forficulum* Mosely

- Phallus with apical arm of *d* very short often serrate apically with *e* bearing one or more elongate spines basally [Figure 718] (Costa Rica, Panama) . . . . . *complexum* Mosely
61. Phallus ending in 4 short spines, with process *d* almost totally lacking apical arm [Figure 706] (Colombia) . . . . . *banksi* Mosely  
Phallus ending in a short upturned lobe ending in a short, laterally direct point, process *d* with apical arm long and slender, bearing an erect spine [Figure 699] (Ecuador) . . . . . *album* Mosely
62. Clasper with a basomesal lobe or process . . . . . 63  
Clasper lacking basomesal process . . . . . 64
63. Clasper with a distinct basomesal process; phallus with *e* a distinct, free process [Figure 691] (circum-Amazonian, from Guyana to Andes, Argentina and Brazil) . . . . . *viridianum* Navás  
Clasper with basomesal process reduced to a truncate lobe; phallus lacking a free *e* [Figure 674] (Venezuela to Suriname) . . . . . *ramosum*, new species
64. Phallus with process *c* very long, extending far basad of base of *a* . . . . . 65  
Phallic process *c* present and directed basad, but shorter, reaching no more than base of *a* . . . . . 66
65. Tenth tergum with wart *b* a small lobe and lateral plate ending in a small process [Figure 669] (Brazil, Argentina) . . . . . *pallidum* Guérin  
Tenth tergum lacking *b*, lateral plate broadly rounded [Figure 655] (Dominica) . . . . . *archboldi* Flint
66. Phallus with *e* bearing long projections, directed basad . . . . . 67  
Phallus with *e* bearing small points, curving apicoventrad . . . . . 68
67. Phallus with *d* and *e* arising separately, *g* with many projections [Figure 647] (Peru, Bolivia) . . . . . *alceatum*, new species  
Phallus with *d* and *e* arising from a common base, *g* smooth [Figure 683] (Venezuela) . . . . . *spangleri*, new species
68. Phallus with *d* long, apex extending beyond ventral margin of phallus [Figure 637] (United States to Colombia and east to St. Vincent) . . . . . *albovirens* (Walker)  
Phallus with *d* very short, barely curved, not reaching ventrad of middle of phallus [Figure 660] (Mexico) . . . . . *moselyi*, new species
69. Thorax and usually head, laterally at least, covered with long, thin hair; base of forewing usually with 2 lateral dark spots . . . . . 70  
These areas with only a few hairs; forewing lacking basolateral spots . . . . . 76
70. Apex of phallus produced into a posteriorly directed, pointed lip [Figure 243] (Venezuela) . . . . . *guyanense*, new species  
Apex of phallus not produced . . . . . 71
71. Clasper with cluster of enlarged setae on mesal face of basal segment borne from near apex . . . . . 72  
Clasper with enlarged setae borne from a small protuberance near midlength [Figure 251] (Venezuela to Suriname) . . . . . *hirsutum* Flint
72. Tenth tergum with lateral lobe rounded apically, concave dorsally [Figure 776] (Brazil) . . . . . *lunatum*, new species  
Tenth tergum with lateral lobe ending in a sharp point, not concave dorsally . . . . . 73
73. Tenth tergum with lateral plate produced into an elongate plate directed posteriad, wart *b* either lacking or a small, knob at dorsal tip of lateral lobe . . . . . 74  
Tenth tergum a short point, directed dorsad or laterad, wart *b* large, long, overlying lateral lobe . . . . . 75
74. Tenth tergum with tip bifid [Figure 257] (Ecuador, Peru) . . . . . *mandibulatum*, new species

- Tenth tergum ending in a single point [Figure 219] (South America, except Chilean Subregion) . . . . . *columbianum* Ulmer
- 75. Phallus with ventral process of ejaculatory duct in lateral aspect sharply curved at base then straight to apex [Figure 234] (Venezuela to Ecuador, Costa Rica?) . . . . . *divaricatum*, new species
- Phallus with ventral process of ejaculatory duct straight from base to apex except for a small angle at midlength [Figure 226] (Central and South America, except Chilean Subregion) . . . . . *crassum* Ulmer
- 76. Tenth tergum with wart *a* large, wart *c* no more than a slightly protuberant area of setae . . . . . 77
- Tenth tergum lacking wart *a*, wart *c* represented by 1 or more knob-like protuberances . . . . . 83
- 77. Tenth tergum with lateral lobe broadly rounded with a hook-like ventral process [Figure 39] (Bolivia) . . . . . *piliferum* Schmid
- Tenth tergum with lateral lobe elongate, no ventral process . . . . . 78
- 78. Tenth tergum with lateral lobe bearing a long, dorsolateral invagination; tip of phallus with an erect lateral lobe [Figure 20] (Venezuela, Brazil) . . . . . *lacuniferum* Flint
- Tenth tergum lacking such an invagination; lateral lobe of phallus directed posteriad . . . . . 79
- 79. Tenth tergum with tip of lateral lobe elongate, and curved mesad, with a small basolateral pocket [Figure 52] (Venezuela) . . . . . *pseudostigmusum* Flint
- Tenth tergum with tip of lateral lobe not curved mesad, lacking a basolateral pocket . . . . . 80
- 80. Tenth tergum with lateral lobe bearing a rod-like lateral process; apical segment of clasper almost 1/3 length of basal segment [Figure 14] (Colombia, Ecuador) . . . . . *cinctum* Ulmer
- Tenth tergum with a lateral ridge that may bear some irregular lobes; apical segment less than 1/4 length of basal segment . . . . . 81
- 81. Tenth tergum with lateral lobe sharply defined dorsad, produced laterad in dorsal aspect; tip of phallus much produced apicoventrad [Figure 32] (Venezuela) . . . . . *menkei*, new species
- Tenth tergum with lateral lobe not defined dorsad nor produced laterad; tip of phallus only slightly produced apicoventrad . . . . . 82
- 82. Phallus with apical lobe produced well beyond tip of lateral lobe; fifth sternal lobes small, narrow [Figure 25] (Ecuador) . . . . . *lojaense*, new species
- Phallus with apical lobe barely extending beyond lateral lobe; fifth sternal lobes very large, round [Figure 45] (Colombia to Bolivia) . . . . . *pseudocinctum*, new species
- 83. Tenth tergum with a well-developed lateral lobe extending freely from mesal lobe . . . . . 84
- Tenth tergum with lateral lobe reaching apex of tergum, no free mesal lobe . . . . . 89
- 84. Apex of phallus with an elongate, lip-like lobe extending from middle [Figure 80] (Madagascar) . . . . . *milae* Sykora
- Apex lacking an elongate lobe . . . . . 85
- 85. Phallus broad subapically, then rapidly narrowed to stem; lateral lobe of tenth tergum broadly confluent to median lobe, directed wholly laterad in dorsal aspect [Figure 72] (Madagascar) . . . . . *madagascariense* Ulmer
- Phallus broad apically, then tapered regularly to stem; lateral lobe in dorsal aspect produced both posteriad and laterad . . . . . 86
- 86. Apical segment of clasper nearly 2/3 length of basal segment; tenth tergum with 2 lobes of each side basally [Figure 103] (Madagascar) . . *zahradni* Sykora
- Apical segment of clasper about 1/4 length of basal segment; tenth tergum with

- a single lobe basolaterally . . . . . 87
87. Apical segment of clasper in both lateral and ventral aspects narrowed almost to an apical point [Figure 64] (Madagascar) . . . . . *conicum*, new species  
Apical segment of clasper broader apically, in lateral aspect obliquely truncate . . . . . 88
88. Fifth sternal lobes more than half width of sternum; apical clasper segment in posterior aspect compressed [Figure 88] (Madagascar) . . . . .  
. . . . . *nupharum*, new species  
Fifth sternal lobes about  $\frac{1}{4}$  width of sternum; apical clasper segment in posterior aspect terete, slightly tapered [Figure 56] (Madagascar) . . . . . *affine* Ulmer
89. Apex of phallus with an almost circular lobe laterally, with a small dorsal point . . . . . 90  
Apex with lateral lobe twice as long as high, with an apicoventral point [Figure 203] (Venezuela) . . . . . *sancticaroli*, new species
90. Tenth tergum with a single basolateral lobe [Figure 211] (Panama to Argentina) . . . . . *sparsum* (Ulmer)  
Tenth tergum with two basolateral lobes [Figure 189] (Cuba) . . . . . *poeyi* (Banks)
91. Phallus terminating in a simple rounded lobe from which single mesal processes may extend for a short distance . . . . . 92  
Phallus bearing, somewhere, paired processes or divided for nearly half length into dorsal and ventral lobes . . . . . 101
92. Tip of phallus with an ovoid dorsomesal opening surrounded by a raised rim . . . . . 93  
Tip of phallus with a dorsal lobe covering opening, thereby deflecting the opening to a posterior position . . . . . 100
93. Base of clasper with a lobe bearing a brush of setae [Figure 279] (Venezuela to Surinam) . . . . . *irroratum* Flint  
Base of clasper lacking distinct lobes . . . . . 94
94. Basal segment of clasper with a linear patch of stout setae on inner face near apex; tenth tergum with elongate, dorsolateral lobes . . . . . 95  
Basal clasper segment lacking stout setae; wart *a* generally low and rounded if protuberant at all . . . . . 96
95. Tenth tergum with an erect basolateral lobe, and a broadly rounded apical lobe [Figure 264] (Venezuela, Brazil) . . . . . *amazonense* Flint  
Tenth tergum with 3 elongate lobes, all converging apicad [Figure 294] (Venezuela) . . . . . *neblinense*, new species
96. Tenth tergum with a distinct process from posterior . . . . . 97  
Tenth tergum simple, posterior margin curving, possibly ending in a small point . . . . . 98
97. Tenth tergum with a long, upcurved, pointed, posteroventral process, wart *a* large and protuberant, *b* distinct and slightly developed [Figure 107] (Ghana, Ivory Coast) . . . . . *guineense* Gibbs  
Tenth tergum with rod-like process from posterior margin, wart *a* scarcely protuberant, *b* lacking [Figure 131] (Ghana, Cameroons) . . . . .  
. . . . . *occidentale* Ulmer
98. Apical clasper segment  $\frac{1}{4}$  length of basal; lateral lobes of phallus elongate and reflexed slightly [Figure 115] (Zaire) . . . . . *marlieri*, new species  
Apical clasper segment distinctly less than  $\frac{1}{4}$  length of basal; lateral lobes of phallus rounded dorsally . . . . . 99
99. Phallus with phallotremal sclerites borne from near venter; apical segment of maxillary palpus about  $1\frac{1}{2}$  times length of basal 4 segments [Figure 139] (Zaire) . . . . . *vanderysti* Navás  
Phallotremal sclerites above middle of phallus; apical palpal segment as long as



- basal 4 segments [Figure 123] (South Africa) . . . . . *natalense* Mosely
100. Phallus relatively short and stout, apex with projecting mesal lobes both dorsally and ventrally [Figure 286] (Surinam, Brazil) . . . . . *maculatum* Mosely  
Phallus long and slender, apex with a single middorsal lobe and rounded lateral lobes [Figure 271] (Colombia) . . . . . *chocoense*, new species
101. Aedeagus divided for nearly half its length into tubular dorsal lobe overlying a more concave ventral lobe [Figure 147] (Ghana, Ivory Coast) . . . . .  
. . . . . *aberrans*, new species  
Aedeagus either bearing a series of paired apical processes, or tubular with a pair of dorsal processes subapically . . . . . 102
102. Aedeagus dorsally with a pair of short processes subapically [Figure 155] (Cameroons, Zaire) . . . . . *alatum* Marlier  
Aedeagus terminating in several pairs of elongate processes . . . . . 103
103. Apex of phallus with some processes directed basad . . . . . 104  
Apical processes of phallus directed apicad . . . . . 106
104. Apex of phallus with a pair of ventrolateral, reflexed hooks, and much more basad with a lateral, basally directed, blade-like process [Figure 317] (Venezuela) . . . . . *gadzus*, new species  
Apical region of phallus with 3 sets of processes, some of which are reflexed, no process much more basad than these . . . . . 105
105. Ninth segment with a large posterolateral lobe; with apical clasper segment half length of basal segment [Figure 309] (Venezuela) . . . . . *davisi*, new species  
Ninth segment with posterior margin nearly vertical; apical clasper segment less than a third length of basal segment [Figure 302] (Brazil) . . . . .  
. . . . . *aterrimum* Mosely
106. Tenth tergum with lateral lobe produced as a rod-like process [Figure 173] (Cameroons to Angola) . . . . . *normale* Banks  
Lateral lobe no more than a protuberant knob [Figure 163] (Ivory Coast) . . . . .  
. . . . . *latipenne* Marlier

### The *cinctum* Group

**DIAGNOSTIC CHARACTERS.**—Size moderate to very large; forewing 17–28 mm long. Color yellowish brown to brown, forewing often strikingly maculate. Tibial spurs 2, 4, 4. Middle tibia of female not broader than in male. Malar space moderately broad, bare. Basal abdominal sternum with a median suture. Male tenth tergum with wart *a* well developed, warts *b* and *c* intimately associated with lateral lobe and generally not recognizable; lateral lobe generally elongate, usually with a basolateral process, lobe or pocket. Basal segment of clasper without stout setulae or basomedian lobe. Phallus simple, without processes; apex rather rounded, inflated, with an upright, bifurcate mesal lobe.

**REMARKS.**—We place seven species in this group: *cinctum* Ulmer, *lacuniferum* Flint, *lojaense*, new species, *menkei*, new species, *piliferum* Schmid, *pseudocinctum*, new species, and *pseudostigmatosum* Flint.

**DISTRIBUTION.**—The Andes and the Guayanian Shield of northern and western South America from Venezuela to Bolivia.

### *Leptonema cinctum* Ulmer

FIGURES 14–19, 785; MAP 1

*Leptonema cinctum* Ulmer, 1905a:64, 65, pl.3: fig. 105. [holotype ♂, in PAN].—Fischer, 1963:167.—Flint, 1966:5, fig. 2j–m.

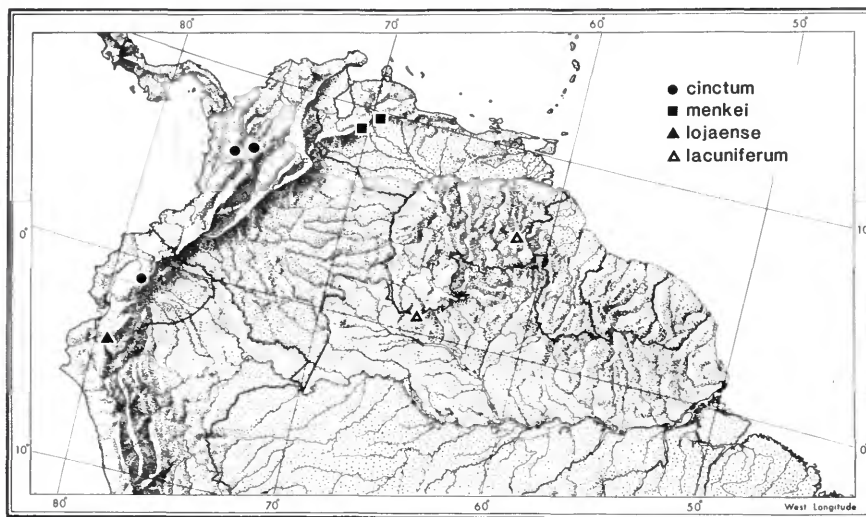
**TYPE-LOCALITY.**—Balzapamba, Ecuador.

**DISTRIBUTION.**—Colombia, Ecuador.

**MATERIAL EXAMINED.**—COLOMBIA, *Dpto. Antioquia*, Caldas, Oct 1973, R. Veléz, 1♂. *Dpto. Choco*, km 114, 6 km E El Siete, 17 Feb 1983, O.S. Flint, Jr., 1♂. ECUADOR, *Pcia. Cotopaxi*, 113 km W Latacunga, 4500', 1 Jul 1975, Langley and Cohen, 2♂. Material in USNM and UNCMB.

**REMARKS.**—This species was confused with *L. pseudocinctum*, new species, and *L. lojaense*, new species by Mosely (1933). The identity of *cinctum* was established by Flint (1966).

*Leptonema cinctum* is the smallest of the three aforementioned species with a forewing length of 15–19 mm, and differs in the shape of the apex of the phallus, the presence of a process ventrolaterally on the tenth tergum, and by the long apical segment of the clasper.



MAP 1.—Distributions of *Leptonema cinctum* Ulmer, *L. menkei*, new species, *L. lojaense*, new species, and *L. lacuniferum* Flint.

### *Leptonema lacuniferum* Flint

FIGURES 20–24; MAP 1

*Leptonema lacuniferum* Flint, 1978:384, 385, figs. 57–61 [holotype ♂, in USNM].

**TYPE-LOCALITY.**—Area of the end station, Rio Marauia, Brazil.

**DISTRIBUTION.**—Brazil, Venezuela.

**MATERIAL EXAMINED.**—BRAZIL, Gebeit Endstation, Rio Marauia, Bergbach II, 26 Jan 1963, E.J. Fittkau, holotype ♂. VENEZUELA, *Edo. Bolívar*, km 125 on El Dorado-Sta. Elena road, 1100 m, 28 Sep 1967, Rosales et al., 1♂. Material in IZAM and USNM.

**REMARKS.**—This species belongs in the *cinctum* group, and is most closely related to *pseudostigmosum*. It is easily distinguished by the very different tenth tergum, and the shape of the apex of the phallus, especially the erect, subapical, dorsal lobe and the outline of phallus in dorsal aspect.

### *Leptonema lojaense*, new species

FIGURES 25–31, 786; MAP 1

*Leptonema cinctum* Ulmer.—Mosely, 1933:19, 20, frontis., figs. 22–25 [misidentification].

**MALE.**—Color basically brown; forewing brown, distinctly maculate with fuscous blotches and streaks (see Mosely, 1933, frontis.). Length of forewing 26–28 mm.

Malar space broad,  $\frac{1}{3}$  height of eye. Parafacial area  $\frac{1}{2}$  width of malar; postocular area as wide as parafacial, with a row of 6–7 stout setae. Maxillary palpus rather short; fifth segment slightly longer than basal four segments. Process

of fifth sternum narrow, elongate, free end considerably raised above surface of sternum.

**Genitalia:** Tenth tergum with wart *a* large and erect; warts *b* and *c* lacking; lateral lobe elongate with a basolateral ridge; mesal lobe membranous. Clasper with apical segment short, terete, with a pad of short, stout setae mesally; base of clasper unmodified. Phallobase basally angled to axis of stem, ending in an enlarged apex (dorsum broken here in type); apex with an erect, bifid lobe.

**FEMALE.**—Unknown.

**TYPES.**—*Holotype* (male): “Env. de Loja, Equateur.”

**Paratype:** Marked only Coll. G.A. Poujade 1909, 1♂. In addition to this paratype, there is a female, apparently the same species, with the additional handwritten label Loja, Equateur; undoubtedly both specimens are from Loja.

Holotype in MCZ; paratype and female in MNHNP.

**REMARKS.**—This is the species figured by Mosely (1933) as *cinctum*, most probably the specimen here designated as paratype.

The lack of basolateral process from the tenth tergum, short but terete apical segment of the clasper, and narrow, projecting, finger-like process from the fifth sternum readily distinguish this species from the closely related *cinctum* and *pseudocinctum*.

### *Leptonema menkei*, new species

FIGURES 32–38; MAP 1

**MALE.**—Color pale greenish; forewing greenish, nygmata with tufts of fuscous hair. Length of forewing, 17–20 mm.

Malar space moderately broad, about  $\frac{1}{4}$  height of eye.

Parafacial and postocular areas about  $\frac{3}{4}$  as wide as malar; postocular with a row of 5–6 stout setae. Maxillary palpi with fifth segment slightly less than half length of basal 4 segments combined. Processes of fifth sternum narrow, free end raised above surface of sternum (as in *lojaense*).

**Genitalia:** Tenth tergum with wart *a* developed as a series of setae on protuberant bases; wart *b* elongate, subapical; lateral lobe produced as a rounded lobe apicodorsally, with a basoventral pocket. Clasper with apical lobe short, with a pad of mesal, short, stout setae, about  $\frac{1}{5}$  as long as basal segment; base of clasper unmodified. Phallus with base slightly angled to axis of stem, apex enlarged, especially posteroventrally; with posteromesal bifid lobe.

**FEMALE.**—Similar to male. Forewing 21 mm.

**TYPES.**—*Holotype* (male): VENEZUELA, *Edo. Lara*, Parque Nacional Yacambú, 6–8 Apr 1981, Menke and Hollenberg.

**Paratypes:** Same data, 1♀; same, but El Blanquito, 1350 m, 1–3 Aug 1976, Rosales and Joly, 1♀. *Edo. Barinas*, San Isidro, 14 km S La Soledad, 25 Sep 1975, R.E. Dietz, 1♂; same, but 31 May 1975, 1♀.

**Holotype** in USNM; **paratypes** in USNM and IZAM.

**REMARKS.**—The species is closely related to *pseudostigmosum*, and differs in the tenth tergum, claspers and phallus. In *menkei* wart *a* is poorly developed but *b* is distinct and the lateral lobe is distinctly produced dorsolaterally, the apical segment of the clasper is much shorter, and the apex of the phallus is strongly produced apicoventrad.

### *Leptonema piliferum* Schmid

FIGURES 39–44; MAP 2

*Leptonema piliferum* Schmid, 1964:318, 319, pl.22: figs. 1–3 [holotype ♂, in CNC].

**TYPE-LOCALITY.**—Alto Palmar, Cochabamba, Bolivia.

**DISTRIBUTION.**—Bolivia.

**MATERIAL EXAMINED.**—BOLIVIA, *Dpto. Cochabamba*, Alto Palmar, Nov 1960, J.E. Foerster, holotype ♂, paratype ♀. *Dpto. La Paz*, quebradas del Río Zongo, 1400 m, 24–30 Oct 1984, L.E. Peña G., 24♂, 10♀; Yungas La Paz, Pte. Mururata to Cusilloni, 1600 m, 26–28 Nov 1984, L.E. Peña G., 1♂. Types in CNC; material in USNM.

**REMARKS.**—The genitalia show this to be a member of the *cinctum* group, but it is remarkably different from the other described species. Especially noteworthy is the large, rounded, lateral lobe of the tenth tergum that lacks other processes.

### *Leptonema pseudocinctum*, new species

FIGURES 45–51; MAP 2

**MALE.**—Color basically brown; forewing brown, distinctly maculate with fuscous streaks and blotches (appear-

ing identical to Mosely, 1933, frontis.). Length of forewing 20–23 mm.

Malar space rather broad,  $\frac{1}{4}$  height of eye. Parafacial area half width of malar; postocular area width of parafacial, with an irregular row of 2–4 stout setae. Maxillary palpus with fifth segment long, only slightly shorter than basal four segments. Process of fifth sternum large, oblong, broader than long.

**Genitalia:** Tenth tergum with wart *a* large, erect, with setae borne from long papillae; warts *b* and *c* lacking; lateral lobe elongate, with a basolateral ridge; mesal lobe membranous. Clasper with apical segment very short, enlarged apically, with a dense pad of short, stout setae mesally; base of clasper unmodified. Phallobase basally angled obliquely to axis of stem, ending in an enlarged apex; apex with a small, erect, bifurcate process.

**FEMALE.**—Color similar to male, but forewing slightly larger: 20–25 mm.

**TYPES.**—*Holotype* (male): ECUADOR, *Pcia. Tungurahua*, 39 km E Banos, 4200', 25 Jan 1976, P.J. Spangler et al.

**Paratypes:** Same data, 1♂; same but 17 km E Banos, 28 May 1975, Cohen and Langley, 1♀. COLOMBIA, Paso del Quindini (probably in error for Quindio), 2000 m, Totsche, 1♂, 1♀. PERU, *Dpto. Cuzco*, "Pilco," side valley of Río Paucartambo, 2800 m, 14 Jan 1953, F. Woytkowski, 1♂; same, but 20 Jan 1953, 1♂; same, but "Sueca," 1700 m, 23 Dec 1952, 2♀. BOLIVIA, *Dpto. La Paz*, Río Zongo, 1900 m, 24–31 Oct 1984, L.E. Peña G., 1♂. *Dpto. Cochabamba*, Yungas de Corani, 2800 m, 11 Dec 1984, L.E. Peña G., 2♂; Río Ronquito, road to Villa Tunari, 1900 m, 10–11 Dec 1984, L.E. Peña G., 13♂; Incachaca, 2500 m, Steinbach, acc. 6873, 1♂, 5♀.

**Holotype** in USNM; **paratypes** in CMP, INHS, MCZ, and USNM.

**REMARKS.**—The examples from Peru and Bolivia differ slightly from the northern examples in the shape of the tenth tergum. These show a small point from the basolateral ridge, but it is very much smaller than the larger process in *cinctum*.

This species is closely related to *cinctum* and *lojaense*. From both species it is easily recognized by the very short, enlarged apical segment of the clasper. From *cinctum*, it differs in addition by the lack of the long basolateral process from the lateral plate of the tenth tergum and in the shape of the apex of phallus.

### *Leptonema pseudostigmosum* Flint

FIGURES 52–55; MAP 2

*Leptonema pseudostigmosum* Flint, 1981:20, 21, figs. 77–80 [holotype ♂, in MCZ].

**TYPE-LOCALITY.**—Rancho Grande, Aragua, Venezuela.

**DISTRIBUTION.**—Venezuela.





MAP 2.—Distributions of *Leptonema pseudocinctum*, new species, *L. pseudostigmosum* Flint, and *L. piliferum* Schmid.

**MATERIAL EXAMINED.**—VENEZUELA, *Edo. Aragua*, Rancho Grande, Aug 1943, Rene Lichy, holotype ♂; Carretera Maracay–Choroni, 900 m, 20 Apr 1972, Fernandez and Teran, paratype ♂; same, but 17 Jun 1975, R.E. Dietz, paratype ♂. Material in MCZ and IZAM.

**REMARKS.**—This is another species of the *cinctum* group as is shown by the general structure of the tenth tergum and phallus. The very long lateral lobes of the tenth tergum with their small basolateral pocket are distinctive.

#### The affine Group

**DIAGNOSTIC CHARACTERS.**—Medium sized species with brownish, generally irrorate wings; forewing length 11–18

mm. Malar space broad, generally about half height of eye, with numerous short setae along ventral margin; postocular row of stout setae well developed. Tibial spurs 2, 4, 4. Midtibia of female not or scarcely broader than in male. Basal abdominal sternum without a median suture. Fifth sternal process oval, generally very small. Male tenth tergum with wart *a* present and sometimes bearing additional scattered setiferous tubercles, wart *b* lacking; lateral lobe well developed, rather broad and truncate apically; median lobe very large and sclerotized, longer than lateral lobe. Basal segment of clasper unmodified; apical segment with an apical group of peg-like setae. Phallus with a simple, bulbous apex with projecting, dorsolateral lobes and a rimmed opening.

REMARKS.—This is a very tightly knit group of species. It is quite possible that further study of long series from numerous localities will result in synonymy of some of the species here recognized. We treat six species as distinct: *affine* Ulmer, *conicum*, new species, *madagascariense* Ulmer, *milae* Sykora, *nupharum*, new species, and *zahradniki* Sykora.

DISTRIBUTION.—The group is limited to the island of Madagascar.

*Leptonema affine* Ulmer

FIGURES 56–63, 96–98, 787; MAP 3

*Leptonema affine* Ulmer, 1905b:27, 28 [lectotype ♂, herein designated, in MNHNP].—Fischer, 1963:165.—Sykora, 1964:282, figs. 10–12.—Scott, 1983:397.

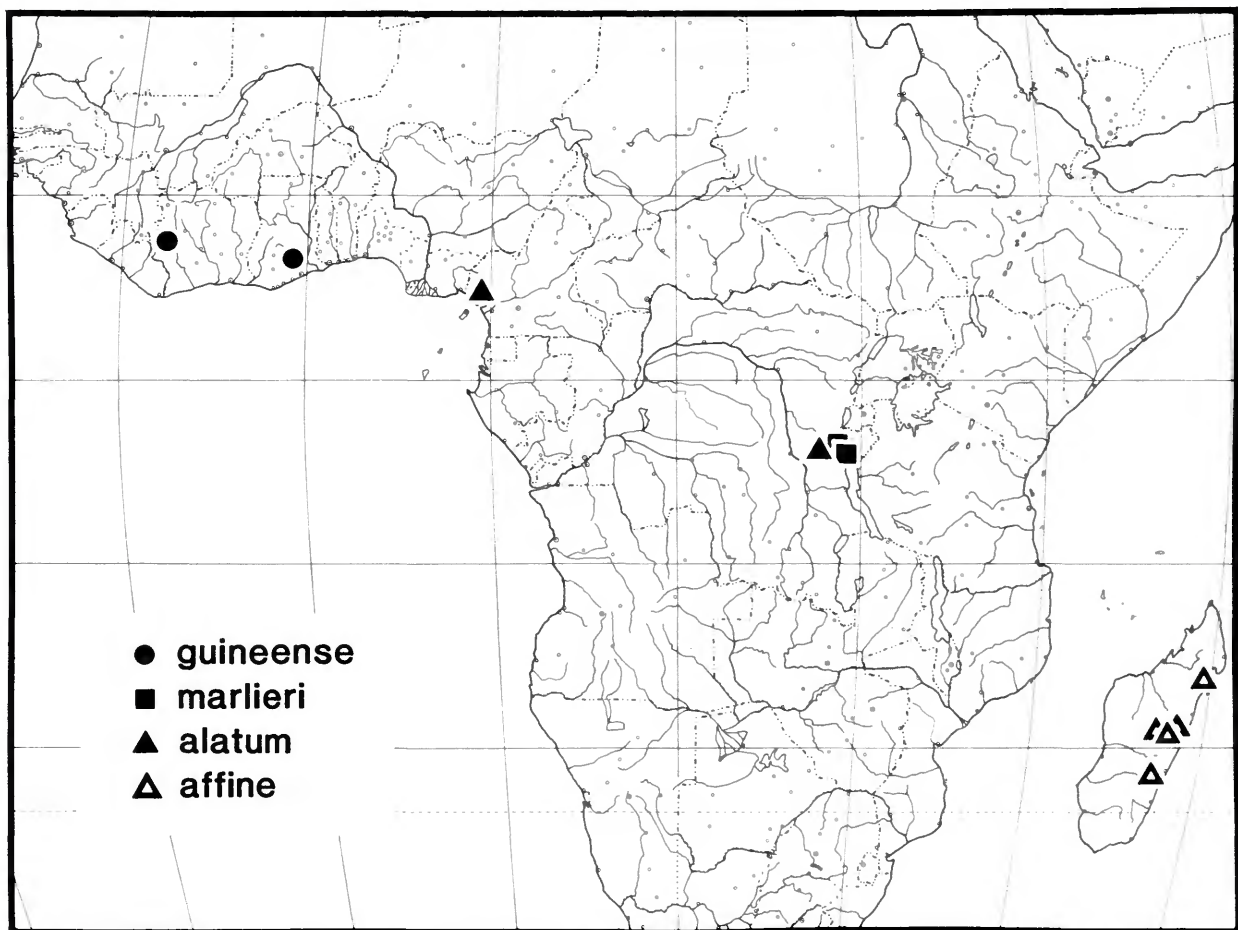
*Macronema displicens* Navás, 1934b:73, 74 [holotype male in MNHNP].—Fischer, 1963:183.—Sykora, 1964:281, figs. 13–16.—Scott, 1983:397 [new synonymy].

TYPE-LOCALITIES.—Of *affine*: Cote Ouest, Madagascar. Of *displicens*: Perinet, Madagascar.

DISTRIBUTION.—Madagascar.

MATERIAL EXAMINED.—Lectotype male, herein designated, MADAGASCAR, Cote Ouest, 13 Aug 1871, Grandier. Additional material: Same data, 2♀ paralectotypes. [Prov. Tamatave], Perinet, Dec 1930, ♂ holotype *displicens*; same, but Dec 1954, H.R. Paulian, 3♂, 1♀; 3 km E Perinet, 25 Apr 1963, E.D. Cashatt, 3♀; Ankaratra [Mts.], Manjakatampo, 1953, H.R. Paulian, 1♀; Sahafanjana, Manambato, Anove, Apr 1955, H.R. Paulian, 1♀; [Dist.] Moramanga, Sandrangato, Dec 1954, H.R. Paulian, 1♀. [Prov. Fianarantsoa], [Dist.] Ifanadiana, Ranomafana, Mar 1955, H.R. Paulian, 10♂, 1♀. Lectotype of *affine* and holotype of *displicens* in MNHNP; material in CNC, INHS, MNHNP, and USNM.

REMARKS.—This is a strongly marked species, although most of the coloration is easily lost in alcohol or with handling (Figure 787). In the male genitalia the tenth



MAP 3.—Distributions of *Leptonema guineense* Gibbs, *L. marlieri*, new species, *L. alatum* Marlier, and *L. affine* Ulmer.



tergum always bears a small angle between wart *a* and the lateral lobe, and the lateral lobe is well separated from the median lobe. The apical segment of the clasper is short, and rectangular apically in lateral aspect. The central opening at the tip of the phallus in posterior aspect is only about a third the width of the phallus and is produced to a slight degree middorsally.

***Leptonema conicum*, new species**

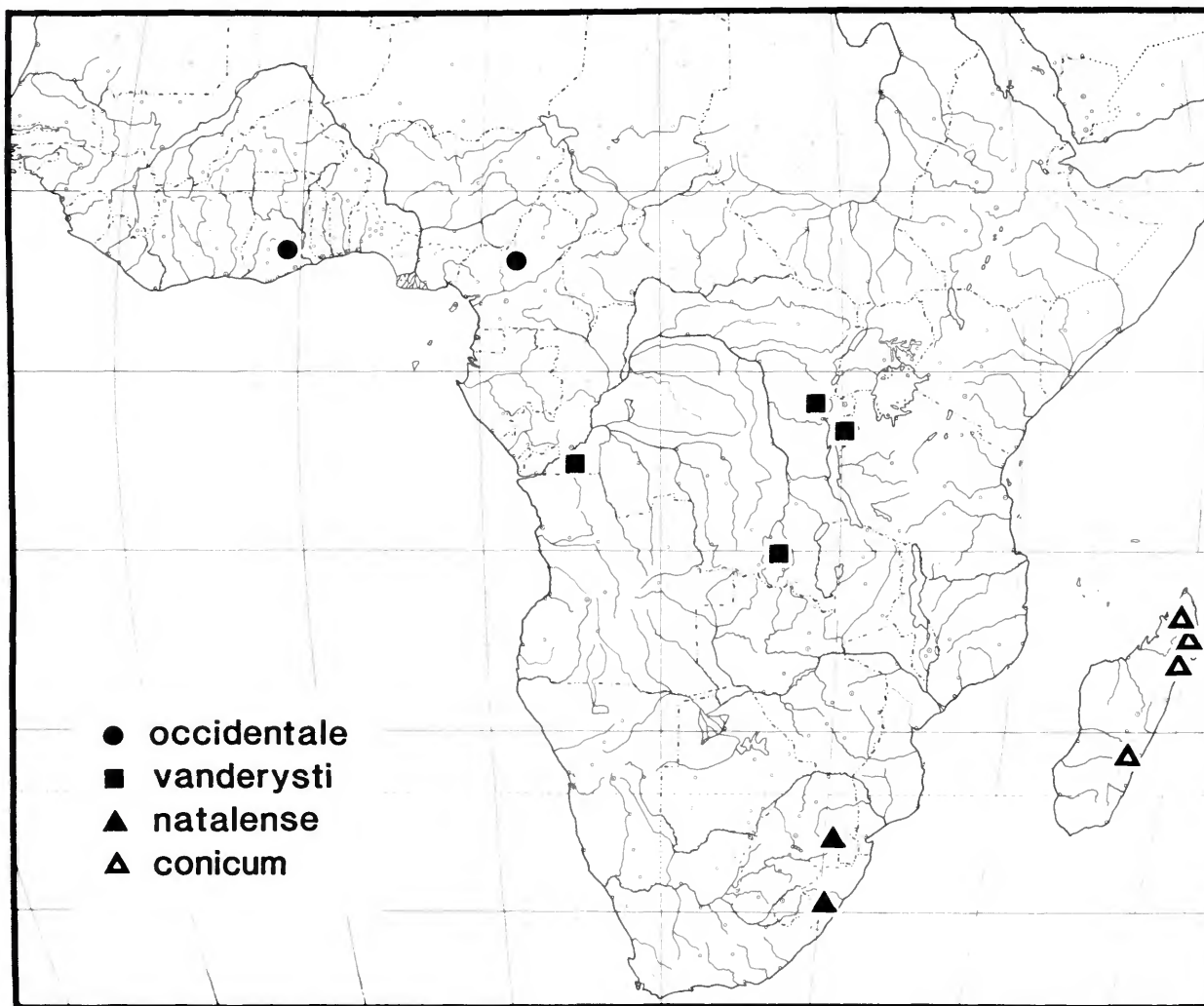
FIGURES 64–71, 99, 100; MAP 4

**MALE.**—Mottled yellowish brown above, legs and venter clear yellow; forewing yellow, abundantly spotted with

brownish fumose spots (much as in Figure 787), brown pterostigmal spot present but much encroached upon and irrorated with yellow. Length of forewing 13.5 mm.

Malar space almost half as wide as height of eye, with a band of short hairs ventrally. Parafacial area about  $\frac{3}{4}$  width of malar, with short hairs anteriad. Postocular area same width as parafacial, with 5 stout setae. Fifth segment of maxillary palpus distinctly shorter than basal 4 segments combined. Processes of fifth sternum very small.

**Genitalia:** Tenth tergum with an angulate projection between wart *a* and lateral lobe; lateral lobe well separated from median lobe; median lobe longer than lateral lobe, apex broadly rounded. Basal segment of clasper stocky, almost as thick at ends as in middle; apical segment strongly



MAP 4.—Distributions of *Leptonema occidentale* Ulmer, *L. vanderysti* Navás, *L. natalense* Mosely, and *L. conicum*, new species.

tapered from base to apex in both lateral and ventral aspects. Phallus with a slender stem that gradually widens to expanded apical portion; apex with rounded and slightly projecting dorsolateral lobes, apical opening simple, rather small.

**FEMALE.**—Size, color, and general habitus as in male; tarsus of midleg slightly broader; processes of fifth sternum smaller.

**Genitalia:** Clasper receptacle rather egg-shaped; caudal margin of the flange that overlies the anterior margin of the receptacle, step-shaped in outline; with a strong molar-like ridge arising ventromesad of clasper receptacle.

**TYPES.**—*Holotype* (male): MADAGASCAR, [Prov. Tamatave], Ambohimanakana, Manambato, Anove, Apr 1955, H.R. Paulian. *Paratypes*: Same data, 3♂, 1♀; [Dist.] Maroantsetra, Ambodivoahangy, 1977, J.V., 1♂, 1♀. [Prov. Fianarantsoa], [Dist.] Ifanadiana, Ranomafana, Mar 1955, R.H. Paulian, 1♀. [Provs. unknown], Mt. Tsaratanana, Jul 1955, R.H. Paulian, 2♂. Aohvoangy, Oct 1955, R.H. Paulian, 1♂.

Holotype in MNHNP; paratypes in CNC, INHS, MNHNP, and USNM.

**REMARKS.**—This species is very close to *affine*. It seems to differ in having a shorter, broader basal clasper segment, and especially in the conically shaped apical clasper segment. The phallus does not appear to offer any consistently different shape in the two species.

### *Leptonema madagascariense* Ulmer

FIGURES 72–79; MAP 5

*Leptonema madagascariense* Ulmer, 1905c:81, fig. 50. [holotype ♂, in NMW].—Fischer, 1963:170.—Scott, 1983:397.

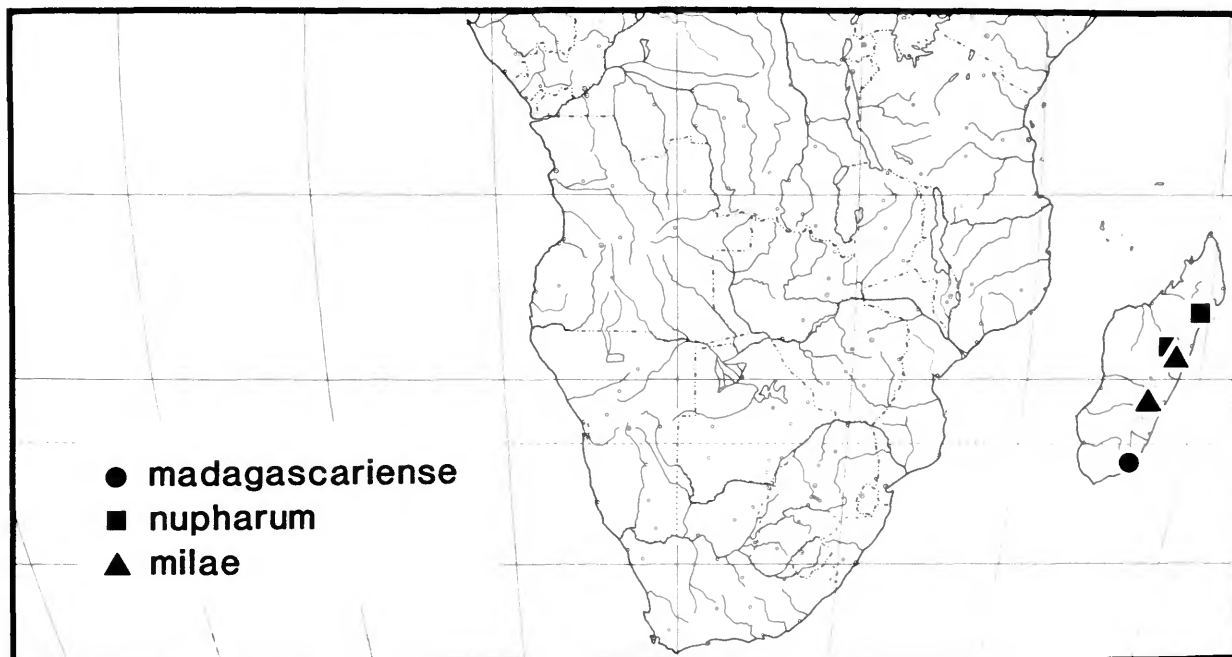
**TYPE-LOCALITY.**—Fort Dauphin, Madagascar.

**DISTRIBUTION.**—Madagascar.

**MATERIAL EXAMINED.**—MADAGASCAR, [Prov. Fort Dauphin], Fort Dauphin, Sikora, ♂ holotype. Holotype in NMW.

**REMARKS.**—The holotype of this species has been examined, and we find nothing else like it in our Madagascan material.

This is a small (forewing length 12 mm), uniformly dark species. Mosely's figures of the dorsal and lateral views of the genitalia are very accurate and are reproduced here. The species appears to be most closely related to *nupharum*, as is shown by the similar, somewhat flattened, apical segment of the clasper, and the general shape of the apex of the phallus. However, they are easily distinguished by the broadly confluent lateral lobes of the tenth tergum, proportionately longer apical segment of the clasper, broad basal segment of the clasper with a shorter basal attachment area, and details of the tip of the phallus. The lobes of the fifth sternum are larger in *madagascariense* than in most of the species, but a bit smaller than in *nupharum*.



MAP 5.—Distributions of *Leptonema madagascariense* Ulmer, *L. nupharum*, new species, and *L. milae* Sykora.

*Leptonema milae* Sykora

FIGURES 80-87; MAP 5

*Leptonema milae* Sykora, 1964:279-281, figs. 5-9 [holotype ♂, in NMMNH].—Scott, 1983:397.

TYPE-LOCALITY.—Madagascar.

DISTRIBUTION.—Madagascar.

MATERIAL EXAMINED.—MADAGASCAR, [Prov. Fianarantsoa], [Dist.] Ifanadiana, Ranomafana, Dec 1954, R.H. Paulian, 1♂. [Prov. Tamatave], km 57 route Anosibe, 1955, R.H. Paulian, 3♂. Material in CNC, INHS, MNHNP, and USNM.

REMARKS.—This is a large species with forewings yellow, with brown spots. It has a more distinct wart *a* on the tenth tergum than the other species. The most distinctive characteristic is the greatly prolonged dorsal margin of the opening at the tip of the phallus.

*Leptonema nupharum*, new species

FIGURES 88-95, 101, 102; MAP 5

MALE.—Dull, yellowish brown above, slightly paler below; forewing with an irregular, darker brown, fumose area in region of the chord, pterostigmal area very slightly darkened. Length of forewing 13.5 mm.

Malar space a bit more than 1/3 height of eye, sparsely hairy ventrad. Para-facial area about 1/2 width of malar, with short hairs anteriorly. Postocular area with a row of 5-7 stout setae with some short fine setae. Fifth segment of maxillary palpus slightly shorter than basal 4 segments combined. Processes of fifth sternum large, kidney-shaped.

*Genitalia*: Tenth tergum lacking any angle between wart *a* and lateral lobe; lateral lobe not strongly upturned in lateral aspect, in dorsal long, free of median lobe; median lobe barely longer than lateral, tip pointed in lateral aspect. Clasper with basal segment slightly swollen in middle; apical segment slightly constricted and bent mesad in middle, apex truncate. Phallus with stem narrow, enlarged apically; apex rounded with low, rounded, dorsolateral lobe, posterior opening very broad with a midventral strap-like process protruding from opening.

FEMALE.—Size and color similar to male; length of forewing 14 mm. Tarsus of midleg scarcely broader than in male. Process of fifth sternum much smaller and narrower than in male.

*Genitalia*: Dorsal cap haired at apex. Clasper receptacle oval in outline, rather deeply invaginated with entrance smaller than receptacle; with two flanges arising from margin and overhanging entrance: one on anterolateral margin larger, rather pointed, one on posterior margin smaller, gently curved; between these two flanges, a small, nipple-

like process anteriorly also projecting into entrance of receptacle.

TYPE.—*Holotype* (male): MADAGASCAR, [Prov. Tamatave], Ambohimanakana, Manambato, Anove, Apr 1955, H.R. Paulian.

*Paratype*: Perinet, Dec 1954, H.R. Paulian, 1♀.

Holotype and paratype in MNHNP.

REMARKS.—This is a member of the *affine* group with (apparently) weakly irrorate wings. It is the only species in the group with large processes on the fifth sternum and also shows a process projecting from the ventral margin of the genital aperture of the phallus. It also differs slightly from the other species in the shape of the tenth tergum, shape of the apical clasper segment, and size of the phallic opening.

*Leptonema zahradniki* Sykora

FIGURES 103-106

*Leptonema zahradniki* Sykora, 1964:277-279, figs. 1-4 [holotype ♂, in NMMNH].—Scott, 1983:398.

TYPE-LOCALITY.—Madagascar.

DISTRIBUTION.—Madagascar.

MATERIAL EXAMINED.—None.

REMARKS.—We know this species only from Sykora's description and figures. In no other species do the warts and lobes project as four distinct processes so strongly from the side of the tenth tergum. The apical segment of the clasper is nearly 40% as long as the basal segment, twice as long as in any other species.

The *occidentale* Group

DIAGNOSTIC CHARACTERS.—Size rather small to medium; forewing length 9-13 mm. Color generally dark, apparently not strongly marked. Malar space generally broad, from over 1/4 to 2/3 height of eye; sparsely hairy. Fourth segment of maxillary palpi as long as or longer than third; fifth segment longer than basal four segments combined. Tibial spurs 1, 4, 4. Middle tibiae of female not broader than in male. Basal abdominal sternum without a median suture. Fifth sternal process generally long, narrow, and set obliquely, rarely (*occidentale*) small, rounded. Male tenth tergum with wart *c* well developed, *a* usually represented by scattered, setiferous tubercles, *b* lacking; lateral lobe simple, blade-like. Clasper with basal segment unmodified. Phallus with a simple, bulbous apex with projecting, dorsolateral lobes and a rimmed dorsal opening.

REMARKS.—This is a very homogeneous group of 5 species that offer, in general, only slight differences in genital structure. It contains *guineense* Gibbs, *marlieri*, new species, *natalense* Mosely, *occidentale* Ulmer, and *vanderysti* Navás.

**DISTRIBUTION.**—The group is limited to Africa south of the Sahara.

***Leptonema guineense* Gibbs**

FIGURES 107–114; MAP 3

*Leptonema guineense* Gibbs, 1973:385, 386, figs. 56–59 [holotype ♂, in BMNH].—Scott, 1983:397.

*Leptonema bihoumi* Statzner and Gibon, 1984:131, 135, 136, fig. 6 [holotype ♂, in ZSM; new synonymy].

**TYPE-LOCALITY.**—Atewa Range, Ghana.

**DISTRIBUTION.**—Ghana, Ivory Coast.

**MATERIAL EXAMINED.**—GHANA, Atewa Range, 6 Oct 1967, D. Leston, 1♂, 1♀ paratypes. [IVORY COAST], waterfalls at Man, 10 Aug 1982, 1♂ paratype of *bihoumi*. Material in BMNH and ZIK.

**REMARKS.**—We have studied a paratype of *L. bihoumi* and find it agrees in most details with the figures of *guineense*. The only notable difference is in the proportionate length of the apical clasper segment. In *guineense* it is approximately  $\frac{1}{5}$  of the basal segment (Figure 108), but in *bihoumi* it is almost  $\frac{1}{4}$  as long (Figure 109). However, lacking apparent differences in other parts of the genitalia, this is considered to be most probably a populational difference.

The species is clearly a member of the *occidentale* group, and closest to *natalense* as is shown by the elongate lateral lobes of the tenth tergum and long oblique lobes of the fifth sternum. From the latter it differs in the shape of all lobes of the tenth tergum and apex of the phallus.

***Leptonema marlieri*, new species**

FIGURES 115–122; MAP 3

*Leptonemama natalense* Mosely.—Marlier, 1961:202–207, fig. 23A–D; 1962:138, fig. 77 [misidentification].

**MALE.**—Color in alcohol, brown; head, thorax, and abdomen very dark brown, abdomen and legs, and setiferous warts of head and thorax, pale yellowish; wings hairy, almost uniformly brown, with an indication of a darker color anteriorly and posteriorly. Length of forewing 13 mm.

Malar space wide, almost  $\frac{2}{3}$  height of eye, bare. Parafacial area almost  $\frac{3}{4}$  width of malar, with short setae. Postocular area as wide as malar, with many short setae, no enlarged setae. Maxillary palpus with apical segment slightly longer than basal four segments combined. Foretibia with a single apical spur. Process of fifth sternum elongate, narrowly ovoid, set obliquely.

**Genitalia:** Tenth tergum with wart *c* well developed, elongate, protuberant; lateral lobe broad, tip slightly upturned. Clasper with basal segment lacking processes; apical segment slender, slightly more than  $\frac{1}{4}$  length of basal segment, with spinous setae entire length of inner margin.

Phallus with basal section long, slender, at an obtuse angle to stem; apex separated from stem by a membranous region, with large dorsolateral lobes, slightly reflexed and acutely pointed, dorsal opening with a low rim, and with phallotremal complex near dorsal margin.

**FEMALE.**—Length of forewing 12 mm. Coloration as in male.

**TYPES.**—*Holotype* (male): ZAIRE, [Prov. Kivu], Terr. Uvira, Kahololo River, [upper Ulindi, 03° 12'S, 28° 51'E, see Marlier 1961:203], 2750 m, 26 Jan 1960 [N. Leleup].

**Paratypes:** Same data, 7♂, 1♀, (a pair of wings on a slide); Haute Kambekulu River, 2450 m, 20–23 Jun 1955, N. Leleup, 27♂, 2♀ (pair of wings, 1♂ abdomen, and 1♀ abdomen on slides); Riv. Ulindi, 28 Jan 1960, N. Leleup, 1♂; same, but, 2700 m, 25 Jan 1960, 1♂, 5♀; Riv. Bisange, route Kahololo, km 22, 24 Jan 1960, 1♂, 1♀ metamorphotype; Musondjo River, Masanga, 31 Oct 1943, 2♂ (1♂ abdomen and pair of wings on slide); Riv. Mugono/Mihomba, 28 Jan 1960, 3♂.

Holotype in MRAC; paratypes in MRAC and USNM.

**REMARKS.**—The species is a member of the *natalense* complex, with specific differences to be seen in the apex of the phallus and the apical segment of the clasper. The comparatively long and slender apical clasper segment is unique to *marlieri*, whereas it is much shorter and with the inner margin more or less angulate in *vanderysti* and *natalense*. The pointed and slightly reflexed dorsolateral lobes at the phallus apex are also distinctive, with the other two species having rounded lobes. The phallotremal sclerites are near the dorsum of the phallus in *marlieri* and *natalense*, but near the ventral margin in *vanderysti*.

***Leptonema natalense* Mosely**

FIGURES 123–130; MAP 4

*Leptonema natalense* Mosely, 1933:24, 25, figs. 43–48 [holotype ♂, in BMNH].—Fischer, 1963:170.—Scott, 1983:389–397, figs. 158–176, tables XIV, XV.

**TYPE-LOCALITY.**—Kloof, Natal [Republic of South Africa].

**DISTRIBUTION.**—Republic of South Africa (Natal, Transvaal).

**MATERIAL EXAMINED.**—[REPUBLIC OF SOUTH AFRICA], Natal, Kloof, 1500 ft, Sep 1926, R.E. Turner, 1♂ holotype; Pietermaritzburg, 2 Nov 1954, B.R. Stuckenberg, 1♂; same, but 27 Mar 1955, 1♂; Komba Stream, 30 Aug 1973, F.M. Chutter, 1♀ reared from larva, 1 larva. Transvaal, Lowveld, Gladdespruit, no date, 2♂.

Holotype in BMNH; material in AMG and USNM.

**REMARKS.**—The males from Natal are all in perfect agreement in genital structure. The examples from Transvaal differ slightly in not having the mesal margin of the



apical clasper segment so strongly produced, but the apex of the phallus is virtually identical in the two series. We consider these as all being the same species.

The species is very close to *vanderysti*, but is to be recognized by the phallotremal sclerites being positioned dorsad, just beneath the dorsal opening rather than at the venter of the phallus as in *vanderysti*. The Natalese material is further differentiated by having the mesal margin of the apical clasper segment strongly angulate.

### *Leptonema occidentale* Ulmer

FIGURES 131–138; MAP 4

*Leptonema occidentale* Ulmer 1907a:57, 58, fig. 87 [syntypes 12 ♂ and ♀, in IRSNB].—Fischer, 1963:170, 171.—Scott, 1983:398.

*Leptonema guineense* Gibbs.—Gibbs, 1973:385 [misidentification of some material from Atewa Range].

TYPE-LOCALITY.—Cameroon.

DISTRIBUTION.—Cameroon, Ghana.

MATERIAL EXAMINED.—CAMEROON, Rutherford, 1♂ syntype. GHANA, Atewa Range, 6 Oct 1967, D. Leston, 1♂. [Illegible label], 1♂ ex McLachlan Collection. Material in BMNH, CNC, and INHS.

REMARKS.—The Marlier (1961) and Jacquemart and Statzner (1981) records of this species are based on misidentifications, and are treated under *vanderysti*. This species is related to both *natalense* and *guineense*, but not as closely as they are to each other. The veins R<sub>1</sub> and Sc in the forewing are connected by a short crossvein, but then run free to the wing margin, a characteristic apparently unique to this species. The shape of the tenth tergum, claspers and to a lesser degree the apex of the phallus in the male genitalia offers distinctive characteristics in this species.

### *Leptonema vanderysti* Navás

FIGURES 139–146; MAP 4

*Leptonema vanderysti* Navás, 1930:330, 331, fig. 45 [holotype ♀, in MRAC].—Scott, 1983:398.—Fischer, 1963:171 [as synonym of *occidentale*].

*Leptonema occidentale* Ulmer.—Marlier, 1961:201, 202 [misidentification].—Jacquemart and Statzner 1981:14, pl. IX [larvae and pupae].

TYPE-LOCALITY.—Kisantu [Zaire].

DISTRIBUTION.—Zaire.

MATERIAL EXAMINED.—[ZAIRE, *Prov. Central Congo*], Kisantu [05°08'S, 15°19'E], Oct 1929, R.P. Vanderyst, 1♀ holotype. [*Prov. Katanga*], Kundelungu, source of the Lofoi [10°S, 27°E], 26 Oct 1951, G. Marlier, 1♀. [*Prov. Kivu*], Bunia-Kiri [Bunyakiri, 02°05'S, 28°35'E], Tshikenda [Tshinganda] River, 30 Mar 1950, G. Marlier, 1♂. BURUNDI, cascade Kiramera, 7 Jun 1959, 1♂ metamorphotype on 3 slides. Holotype in MRAC; material in MRAC.

REMARKS.—The abdomen of the female holotype has

been cleared and unquestionably belongs to a species close to *natalense*, but differs slightly from the females of either *marlieri* or *natalense*. The genitalia of the specimen from Kundelungu agrees in detail with that of the holotype. The male from Bunyakiri agrees in color and size with these females and is also very close to *natalense*. We believe that these examples represent the two sexes of this one species.

The male recorded by Marlier (1961) from Burundi and the partial basis (the 3♀ can not be found, Andre in lit.) for his record of *occidentale* from that country has been studied. The parts are on 3 slides and the genitalia badly distorted, but are clearly not *occidentale*. They appear to be the same as those of the male here described, but lack enough detail to absolutely rule out *natalense*. The larvae and pupae described by Jacquemart and Statzner (1981) were taken from the same river system as Marlier's male from Bunyakiri, but at a higher elevation (2110 m) than at Bunyakiri (1130 m). Although their true identity can not be settled on the basis of current knowledge, it seems more probable that they refer to the male here considered *vanderysti* than to *occidentale*.

The adults differ from *occidentale* in venation and the male also in its genitalia. The male genitalia are more similar to those of *natalense* with which it shares the rounded apicolateral lobes of the phallus. It differs in two manners: the apical segment of the clasper is not strongly broadened basally, and the phallotremal sclerites at the apex of the phallus are placed near the ventral surface of the phallus at the bottom of the central opening.

### The normale Group

DIAGNOSTIC CHARACTERS.—Size medium; forewing length 10–12 mm. Color pale, generally yellowish, unmarked. Malar space narrow, less than 1/3 height of eye, bare; postocular area without enlarged setae. Fourth segment of maxillary palpi larger than third; fifth segment generally shorter than basal four combined, in *aberrans* slightly longer. Tibial spurs 1, 4, 4. Middle tibiae of female not broader than in male. Basal abdominal sternum without a median suture. Processes of fifth abdominal sternum small, ovoid. Tenth tergum with wart *c* well developed (lacking in *alatum*), warts *a* and *b* lacking; lateral lobe elongate, slender apicad. Clasper with basal segment unmodified. Phallus with apex complex, bearing processes and lobes, of indeterminable homology.

REMARKS.—This is a rather heterogeneous group of four or five species. The species *normale* Banks, *latipenne* Marlier and *machadoi* Marlier are very similar genitally, with *alatum* Marlier and *aberrans*, new species, each equally distinct from all.

DISTRIBUTION.—The group is limited to Africa south of the Sahara, apparently in the Equatorial region.



*Leptonema aberrans*, new species

FIGURES 147–154; MAP 6

*Leptonema normale* Banks.—Gibbs, 1973:383–385, figs. 53–55 [misidentification].—Statzner and Gibon, 1984:135–137, figs. 5–7 [misidentification].

**MALE.**—Color in alcohol uniformly pale yellowish brown (“tawny yellow,” Gibbs, 1973:383). Length of forewing 12 mm.

Malar space narrow, about ¼ height of eye; bare. Para-facial area about ¾ width of malar, with a few short setae. Postocular area 1½ times as wide as malar, with a few short setae. Maxillary palpus with fifth segment longer than basal 4 segments combined. Foretibia with a single apical spur. Process of fifth sternum small, oval.

**Genitalia:** Tenth tergum with wart *c* well developed, protuberant; lateral lobe long, triangular, pointed apicad in lateral aspect; in dorsal, long, thin with tip slightly hooked laterad. Clasper short, broad; apical segment almost a third as long as basal, with spinous setae at tip; basal segment unmodified basally. Phallus with base enlarged, bulbous,

then sharply constricted, apical portion long, slender, divided near base into a pair of overlapping processes: ventral process slightly curved apicad, ending in a pair of upturned spines; dorsal process generally tightly appressed to dorsum of ventral process, membranous apicad, ending in a hooked, upturned sclerite, with ejaculatory duct internally.

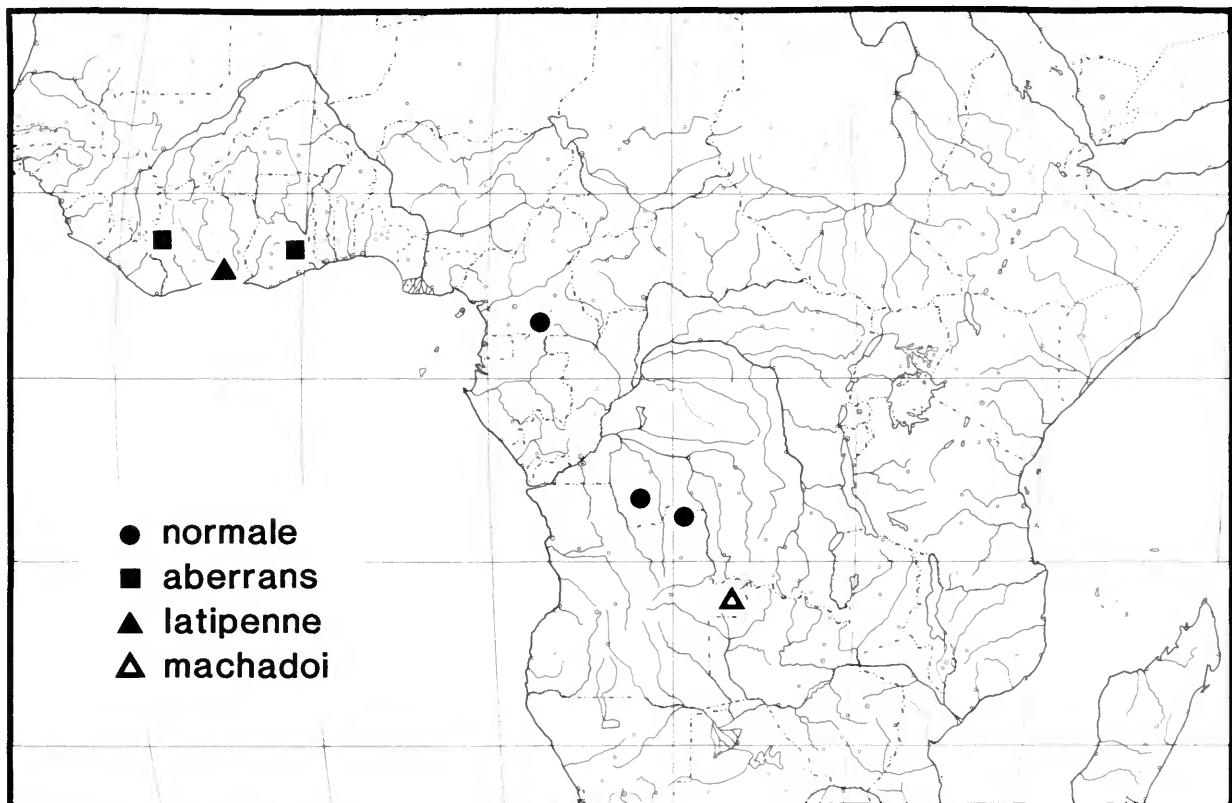
**FEMALE.**—Unknown.

**TYPES.**—*Holotype* (male): GHANA, Atewa Range, reared from pupa 11 Dec 1966, D.G. Gibbs.

*Paratypes:* Same, but 13 Nov 1966, 2♂. [IVORY COAST], waterfalls at Man, 10 Aug 1982, 2♂.

Holotype in BMNH; paratypes in BMNH, USNM, and ZIK.

**REMARKS.**—Although the structure of the ninth and tenth segments and claspers of the male genitalia is typical of species in the *normale* group, the deep division of the phallus into two, long, overlaying lobes with fairly simple apices is totally unlike anything elsewhere in the genus. Perhaps the division of the phallus is foreshadowed by the deep divisions and processes of the phallus in the *normale* subgroup, but the phallosome in these is perfectly typical.



MAP 6.—Distributions of *Leptonema normale* Banks, *L. aberrans*, new species, *L. latipenne* Marlier, and *L. machadoi* Marlier.

*Leptonema alatum* Marlier

FIGURES 155–162; MAP 3

*Leptonema alatum* Marlier, 1961:199, 200, fig. 22 [syntypes 3♂, 2♀, in MRAC].—Marlier, 1962:112.—Scott, 1983:397.

TYPE-LOCALITY.—Kitutu, Maniema, Kivu, Zaire.

DISTRIBUTION.—Cameroons, Zaire.

MATERIAL EXAMINED.—CAMEROONS, Muyuka [04°17'N, 09°25'E], 24–29 Jun 1949, B. Malkin, 3♂, 8♀. ZAIRE, *Prov. Kivu*, Dist. Maniema, Kitutu [03°17'S, 28°05'E], N. Leleup, 3♂, 2♀ syntypes. Types in MRAC; material in CNC, INHS, and USNM.

REMARKS.—The general structure of the male genitalia show this to be a species of the *normale* group. From the other known species it differs in the very long, slender claspers and especially in the structure of the phallus. The dorsum of the phallus for the apical third is membranous, and bears a pair of asymmetrical, sclerotized spines and the tip is upturned and tubular with a projecting, central, ejaculatory duct.

*Leptonema latipenne* Marlier

FIGURES 163–172; MAP 6

*Leptonema latipenne* Marlier, 1947:31, 32, figs. 1, 2 [syntypes 1♂, 1♀, in MNHNP].—Marlier, 1962:134.—Marlier and Botosaneanu, 1968:9, 10, fig. 5.—Fischer, 1972:156.—Scott, 1983:397.—Statzner and Gibon, 1984:134–136, fig. 6.

TYPE-LOCALITY.—Le Banco, Ivory Coast.

DISTRIBUTION.—Ivory Coast.

MATERIAL EXAMINED.—IVORY COAST, Reserve du Banco, 8 Jul [1945], R. Paulian and C. Delamare, 1♂, 2♀; same, but 25 Jul [1945], a la lumiere, 1♂, 1♀ syntypes. 17 km NW Abidjan, 12 Nov 1979, J.A. Gruwell, 1♂, 2♀. Syntypes in MNHNP; material in MNHNP and USNM.

REMARKS.—The abdomen of the topotypic male from Le Banco (Figures 163–170) was cleared and compared to that of the male from near Abidjan (Figures 171, 172). There are differences in most processes at the tip of the phallus between these examples. However, the overall structure is so similar in both that we believe these represent primarily populational differences, but are also partly due to the degree to which the membrane of the middorsal lobe is expanded. The Abidjan male agrees perfectly with the figures in Marlier and Botosaneanu, 1968.

The male genitalia show few differences from those of *normale* to which it is closely related. The tenth tergum in *latipenne* lacks the elongate lateral process, and the processes at the apex of the phallus, although identical in general, differ greatly in shape and length.

*Leptonema machadoi* Marlier

MAP 6

*Leptonema machadoi* Marlier, 1965:44, 45, fig. 15 [holotype ♂, in MDA].—Scott, 1983:397.

TYPE-LOCALITY.—Rives du Lac Calundo, Zambesi Basin, Angola.

DISTRIBUTION.—Angola.

REMARKS.—We have been unable to study the type of this species, and the original description, lacking figures of the genitalia, does not permit us to identify it with certainty. The description of the genitalia, size, and color are consistent with these structures in *normale*. If the type of *machadoi* can be found, it may show these species to be synonymous.

*Leptonema normale* Banks

FIGURES 173–180; MAP 6

*Leptonema normale* Banks, 1920:357, pl. VII: fig. 108 [holotype ♂, in MCZ].—Fischer, 1963:170.—Scott, 1983:397.

TYPE-LOCALITY.—Ja[Dja] River, Cameroons.

DISTRIBUTION.—Angola, Cameroons, Zaire.

MATERIAL EXAMINED.—ANGOLA, Dundo, 21 Sep 1949, B. Malkin, 1♂, 1♀. CAMEROONS, Ja River, Bitze, 1♂ holotype. ZAIRE, Dima, 15 Jan 1906, A. Koller, 1♀. Dist. Kwango, Terr. Feshi, Riv. Kwenge, 850m, Feb 1959, N. Leleup, 2♀. Holotype in MCZ; material in INHS and MRAC.

REMARKS.—The species is very close to *latipenne*, but easily distinguished by the lateral lobes of the tenth tergum and the comparative lengths and shapes of the processes at the apex of the phallus.

The *sparsum* Group

DIAGNOSTIC CHARACTERS.—Size relatively small; forewing 8–15 mm long. Color brown; forewing light brown, transversely banded, subcosta usually with a dark spot at humeral crossvein, costal cell with conspicuous silvery macrotrichiae, silvery band continuous on pronotum and head laterally. Tibial spurs 2, 4, 4. Midlegs of female with tibiae and tarsi flattened and much broadened. Malar space broad to narrow, bare. Basal abdominal sternum without or with a weak median suture. Male tenth tergum with wart *a* (doubled in *poeyi*), *c* and *b* apparently lacking; lateral lobe long, slender, and pointed. Basal segment of clasper usually with apicomeral patch of stout setae, lacking basomesal lobe. Phallus without processes, apex inflated, with a dorsal opening subtended by a small pointed flap.

REMARKS.—Five species, which we place in two subgroups belong in this group. The *sparsum* subgroup contains *poeyi* (Banks), *sancticaroli*, new species, and *sparsum* Ulmer and has a normal forewing venation, i.e.,  $M_{3+4}$  is branched at crossvein *m*. In the subgroup containing *aspersum* (Ulmer) and *rostratum*, new species, this vein is branched halfway to the wing margin. However, the structure of the two subgroups and their common, and rather unusual, coloration clearly place them in a close relationship.

**DISTRIBUTION.**—*Leptonema poeyi* is limited to Cuba, but the other species are widely distributed from southern Central America to northern Argentina. They are commonly taken in proximity to large rivers and streams.

***Leptonema aspersum* (Ulmer), new combination**

FIGURES 181–188, 788; MAP 7

*Neoleptonema aspersum* Ulmer, 1907b:61, 62, fig. 65 [holotype ♀, in NMW].—Fischer, 1963:175.—Flint, 1974:103, fig. 233, pl. 1D [Suriname]; 1978:386, fig. 65 [Venezuela].

**TYPE-LOCALITY.**—Santa Rita, Brazil.

**DISTRIBUTION.**—Brazil, Guyana, Suriname, Venezuela.

**MATERIAL EXAMINED.**—BRAZIL, *Edo. Mato Grosso*, Ar-

ipuana Dist., Reserva Humboldt, 10°11'S, 59°48'W, 14–15 Jul 1977, N.D. Penny, 2♂; same, but 17 May 1977, 1♂; same, but 8 Apr 1979, 1♂. GUYANA, Mallali, Mar, Parish, 3♂, 1♀. Bartica, Dec, Parish, 3♂. Demerara River, Mackenzie, 23–24 Jun 1927, Cornell Univ. Exp., 1♂. Potaro River, Tumatumari, 28 Jun 1927, Cornell Univ. Exp., 1♂, 2♀; same, but Aug 1913, 1♂, 1♀. Essequibo, Picrewana Island, 6 mi S Wineperu, 8–16 Mar 1969, Duckworth and Dietz, 1♂, 2♀. Confluence of Oronoque and New Rivers, 650', Sep–Dec 1937, 1♂. SURINAME, Paloemeu River, Pepejoe, 20 May 1952, D.C. Geijskes, 1♂. VENEZUELA, *Edo. Bolívar*, Río Caroni, Paso Caruachi, 9 Feb 1976, C.M. and O.S. Flint, Jr. 4♂; Río Caroni, Guri, 100 m, 9 Apr 1968, J. Salcedo, 3♂. *T.F. Amazonas*, San Carlos de Río Negro, 5–12 Mar 1984, Flint and Louton, 5♂, 8♀; same, but 6–12



MAP 7.—Distributions of *Leptonema aspersum* (Ulmer) and *L. rostratum*, new species.



Dec 1984, R.L. Brown, 1♂. Material in AMNH, BMNH, CUI, INPA, IZAM, and USNM.

**REMARKS.**—This and *rostratum* are indistinguishable in coloration, but differ remarkably in the male genitalia especially in the proportional lengths of the clasper segments. As a consequence it is not possible to assign females, without associated males, with any degree of security to either species. To compound the difficulty, the holotype of *aspersum* is a female from Santa Rita, Brazil, an area from which we have no other material. Because the only males figured as *aspersum* are this species, we apply the names in this manner.

### *Leptonema poeyi* (Banks)

FIGURES 189–194: MAP 8

*Macronema poeyi* Banks, 1938:299, 300, fig. 23 [lectotype ♂, in MCZ].—Fischer, 1963:194.

*Leptonema poeyi* (Banks).—Flint, 1967b:8, figs. 28–31 [transferred to *Leptonema*, lectotype].—Botosaneanu, 1979:47 [distribution].

**TYPE-LOCALITY.**—Coast below Pico Turquino, Cuba.

**DISTRIBUTION.**—Cuba.

**MATERIAL EXAMINED.**—CUBA, coast below Pico Turquino, 26–30 Jun 1936, Darlington, lectotype ♂, 13 ♂ paralectotypes; same, but south side Pico Turquino, 3000–5000 ft., Jun 1936, 1♀. Material in MCZ.

**REMARKS.**—This is the only species of the genus known for certainty from the Greater Antilles, although larvae of an unknown species have been taken in Puerto Rico.

The species is related to *sparsum* from South America and Panama. It is easily recognized by the tenth tergum, which bears two distinct warts in *poeyi* but only one in *sparsum*.

### *Leptonema rostratum*, new species

FIGURES 195–202: MAP 7

*Neoleptonema aspersum* Ulmer.—Flint, 1972:235 [misidentification, Argentina]; 1978:386 [misidentification of material from Argentina and Brazil].

**MALE.**—Color golden brown; forewing brown, transversely irrorate, with a dark subbasal spot on subcosta, anterior margin with a band silvery hair strongest basally and continuous on pronotum and head laterally; venation with  $M_{3+4}$  stalked in forewing. Length of forewing 10–15 mm.

Malar space broad, almost  $\frac{1}{3}$  height of eye, bare. Para-facial area as broad as malar, with short hairs anteriorly; postocular area half as wide as malar, with a row of 1–3 stout setae. Maxillary palpus with fifth segment  $\frac{1}{2}$  length of basal 4 segments combined. Processes of fifth sternum small, almost circular.

**Genitalia:** Tenth tergum with wart *a* large, protuberant;

lateral lobe long, slender, pointed. Clasper with apical segment long,  $\frac{3}{5}$  as long as basal segment; basal segment broad, basal extension reduced. Phallus with base at right angles to, and hardly broader than, base of stem; apex enlarged, especially produced dorsad, dorsal opening with apex produced, snout-like.

**FEMALE.**—Color as in male; smaller in size: forewing 7–13 mm. Middle leg with femur, tibia and tarsus very thin and broad.

**TYPES.**—*Holotype* (male): ARGENTINA, *Pcia. Entre Ríos*, Río Uruguay, Salto Grande, 16 Nov 1973, O.S. Flint, Jr.

*Paratypes:* Same data, 4♂, 13♀; same, but 10 Feb 1974, S. Coscaron, 16♂, 4♀. *Pcia. Corrientes*, Río Uruguay, Yapeyú, 17 Nov 1973, O.S. Flint, Jr., 1♂; Monte Caseros, 12–14 Feb 1959, A. Bennasar, 11♂, 3♀. *Pcia. Misiones*, Alto Paraná, 18 Jan 1920, Cornell Univ. Exp., 1♂; San Ignacio, Jul, Wagner, 1♂; Río Paraná, Puerto Rico, 4–8 Apr 1971, C.M. and O.S. Flint, Jr., 2♂, 8♀; Iguazú, 30 Jan–13 Mar 1945, Hayward et al., 2♂, 150♀; same, but Río Iguazú, Camp Nañdu, 25 Nov 1973, O.S. Flint, Jr., 4♀. BOLIVIA, *Dpto. Beni*, Cafetal Sobrerío Itenez, 13°30'S, 62°W, 7 Mar 1976, R.A. Ronderos, 1♂. BRAZIL, [*Edo. Amazonas*], Parintins, 2–10 Oct, Parish, 2♂, 1♀. [*Edo. Pará*], Obidos, 18–22 Aug 1919, Parish, 1♂, 1♀; same, but 9 Sep, 1♀; Santarem, 8–14 Aug 1919, Parish, 5♂, 1♀; same, but 11 Dec 1909, 1♂. *Terr. Roraima*, 1 km N Mucajai, 14 May 1977, N.D. Penny, 1♂. *Edo. Mato Grosso*, Aripuana Dist., Reserva Humboldt, 10°11'S, 50°48'W, 14 Jul 1977, N.D. Penny, 1♂; same, but 12 Apr 1979, 1♂. URUGUAY, *Dpto. Artigas*, San Gregorio, 29 Nov 1959, C.S. Carbonell, 2♂, 4♀; Costa Río Uruguay, Barra Arroyo Guaviyu, 22 Dec 1954, C.S. Carbonell, 1♀. *Dpto. Paysandú*, Puerto Pepi-Aji, 1 Dec 1959, C.S. Carbonell, 1♀. *Dpto. Salto*, Río Uruguay, Salto Grande, 10 Nov 1955, C.S. Carbonell, 1♀.

Holotype in USNM; paratypes in CMP, CNC, CUI, FHCU, IML, INHS, INPA, MCZ, UNLP, and USNM.

**REMARKS.**—This species agrees with *aspersum* in size and appearance, yet has a grossly different proportion to the clasper segments and lesser differences in the apex of the phallus. Although the two species ranges overlap greatly, *rostratum* seems to be the dominant in the south and *aspersum* in the north.

### *Leptonema sancticaroli*, new species

FIGURES 203–210: MAP 8

**MALE.**—Color pale brown; forewing brown, transversely irrorate with bands and spots of curly, brown and silvery hair, which are present also on head and thorax dorsally, with a dark spot basally on subcosta. Length of forewing, 8–8.5 mm.

Malar space narrow, about  $\frac{1}{6}$  height of eye, bare. Para-facial area about  $\frac{1}{2}$  width of malar; postocular area  $\frac{3}{4}$  width



MAP 8.—Distributions of *Leptonema sparsum* (Ulmer), *L. sancticaroli*, new species, and *L. poeyi* (Banks).

of malar, with a row of 2–5 stout setae and scattered small hairs. Maxillary palpus small, fifth segment less than half length of basal 4 segments combined. Basal abdominal segment with a short, indistinct, mesal suture. Processes of fifth sternum large, ovoid.

*Genitalia:* Tenth tergum with wart a large, protuberant, elongate to distinctly bilobate, dorsally with a small setiferous spot; lateral lobe ending in a dorsal point, directed laterad as a rounded lobe in dorsal aspect. Clasper with apical segment about  $\frac{1}{4}$  as long as basal segment, with inner



face densely packed with short, black setae; basal segment with a series of large, spinous setae subapically on inner face. Phallus with base long, enlarged, at right angles to stem; apex produced into elongate lateral lobes, united dorsally and ending in a small upturned point, narrowly divided ventrally, with an internal complex of sclerites.

**FEMALE.**—Similar to male in size and color.

**TYPES.**—*Holotype* (male): VENEZUELA, *T.F. Amazonas*, 2 km E San Carlos de Río Negro, 5–11 Mar 1984, O. Flint and J. Louton.

*Paratypes*: Same data, 2♂, 2♀ (blacklight); same, but 7 km E San Carlos de Río Negro, 10–12 Mar 1984, 1♂.

*Holotype* in USNM; *paratypes* in IZAM and USNM.

**REMARKS.**—This species is identical to *sparsum* in appearance and was taken together with it at the type-locality. It is only to be distinguished by the male genitalia, especially the very elongate apex of the phallus, which lacks a dorsal opening.

### *Leptonema sparsum* (Ulmer)

FIGURES 211–218, 789; MAP 8

*Macronema* (*Leptonema*?) *sparsum* Ulmer, 1905a:76, pl. II: fig. 64 [holotype ♂, in ZIUH]

*Leptonema sparsum* (Ulmer).—Fischer, 1963:172.—Flint, 1974:98, fig. 218, pl. 1A [Suriname]; 1978:384, 399, fig. 54 [Paraguay, Peru, Venezuela].

**TYPE-LOCALITY.**—Brazil [collectors Beske worked around Nova Friburgo, Edo. Rio de Janeiro].

**DISTRIBUTION.**—Argentina, Brazil, Ecuador, Guyana, Panama, Paraguay, Peru, Suriname, Venezuela.

**MATERIAL EXAMINED.**—ARGENTINA, *Pcia. Misiones*, Río Iguazú, Camp Nañdu, 25 Nov 1973, O.S. Flint, Jr., 1♂. BRAZIL, *Edo. Goias*, Goiana, CNPF, 7 Oct 1976, 1♂, 2♀; Fazenda Nova Orlandia, Jatai, Jan 1964, Martins et al., 1♂. *Terr. Rondonia*, Guajara Mirim, Seringal Barracao Jofre, Rio Cabixi, 36 km da foz c/Rio Guapore, 15–17 Apr 1976, S.A. Vanin, 1♂, 2♀. *Edo. Sao Paulo*, km 193, N Juquia, 22 Jan 1977, C.L. Hogue, 14♂, 6♀. *Distrito Federal*, Parque do Gama, 10 Oct 1971, Munroe and Brown, 1♂. *Edo. Santa Catarina*, Nova Teutonia, 28–31 Oct 1939, F. Plaumann, 15♀. [*Edo. Pará*], Pará [Belem], 14 Jul 1919, Parish, 1♀. *Edo. Amazonas*, 60 km N Manaus, 22 Nov 1976, N.D. Penny, 1♂, 2♀; Reserva Ducke, 26 km E Manaus, 1–5 Feb 1979, O.S. Flint, Jr., 3♂, 3♀; same, but 24 Nov 1976, N.D. Penny, 2♀; same, but 18–22 Apr 1972, E.G., I., and E.A. Munroe, 7♂, 22♀; Flores, near Manaus, 31 Jan 1979, O.S. Flint, Jr., 1♀; same, but 9–19 Nov, Parish, 1♂, 1♀; same, but Igarape Tarumanzinho, near Manaus, 27 Jan 1975, O.S. Flint, Jr., 1♂; AM 10 km 220, 48 km W Itacoatiara, 30 Jan 1979, O.S. Flint, Jr., 1♂; Río Negro, Apr 1929, 1♀. *Edo. Mato Grosso*, Chapada, H. Smith, 1♂; Buriti, Chapada do Guimaraes, 1200 m, 13–30 Jan 1972, E.G., I., and E.A. Munroe, 3♀.

ECUADOR, *Pcia. Napo*, 7 km N Lago Agrio, 27 Sep 1975, A. Langley, 2♂, 3♀; same, but 5 km N Lago Agrio, 26 Sep 1975, 2♀; stream 10 mi SW Limoncocha, 22 Dec 1979, J.C. Burne, 1♂. *Pcia. Pichincha*, 29 km W Santo Domingo de los Colorados, 6 May 1975, Spangler et al., 1♂, 1♀. *Pcia. Cotopaxi*, 133 km W Latacunga, 1080', 2 Jul 1975, Langley and Cohen, 1♂, 1♀. *Pcia. Pastaza*, 25 km N Puyo, 20 May 1977, Spangler and Givens, 1♂; same, but 27 km N Puyo, Estacion Fluviometrica, 4 Feb 1976, Spangler et al., 2♀; Tzapino, 400 m, 25 May 1976, J. Cohen, 2♂; 70 mi SW Limoncocha, 30 May 1976, J. Cohen, 2♂, 7♀.

GUYANA, Tukeit, 24 Jul 1911, 1♂. Essequibo, Mazaroni River, 39 km S Wineperu, 17–18 Mar 1969, Duckworth and Dietz, 4♀. *Potaro Dist.*, Takutu Mts., Takutu lumber camp (06°25'N, 59°00'W), 29 Dec 1982, W. Steiner, 2♀. PANAMA, *Canal Zone*, Madden Dam, 1 Feb 1946, A.O. Meyer, 1♂, 1♀. PARAGUAY, 2 km S Cerro Corá, 28 Nov 1973, O.S. Flint, Jr., 9♂, 6♀. Río Aquidabán, Cerro Corá, 29 Nov 1973, O.S. Flint, Jr., 1♀. Pirapo, 28–31 Dec 1971, L.E. Peña G., 2♂. PERU, *Dpto. Cuzco*, Hacienda Maria, Cosñipata Valley, 2700', 20–15 Feb 1952, F. Woytkowski, 2♂, 4♀; Quince Mil, 14–31 Aug 1962, L.E. Peña G., 1♂, 4♀; Pilcopata, 600 m, 11–14 Dec 1979, J.B. Heppner, 2♂, 1♀. *Dpto. Loreto*, Callicebus Res. Sta., Mishana, Río Nanay, 25 km SW Iquitos, 120 m, 10–17 Jan 1980, J.B. Heppner, 6♂, 15♀. *Dpto. Madre de Dios*, Río Tambopata Res., 30 air mi SW Puerto Maldonado, 290 m, 11–15 Nov 1979, J.B. Heppner, 1♂, 5♀. SURINAME, Koboeri Creek, 1st camp, 25 Mar 1971, D.C. Geijskes, 2♂.

VENEZUELA, *Edo. Bolívar*, Morichal Tauca, 22 km E Río Caura, 8–9 Feb 1976, C.M. and O.S. Flint, Jr., 1♂, 3♀; Río Caroni, Paso Caruachi, 9 Feb 1976, C.M. and O.S. Flint, Jr., 1♀; Río Caroni, Parque Llovizna, Ciudad Guayana, 13 Feb 1976, C.M. and O.S. Flint, Jr., 2♂, 3♀; Río Cuyuni, El Dorado, 10 Feb 1976, C.M. and O.S. Flint, Jr., 1♀; Kanarakuni, 450 m, 2–8 Feb 1967, Fernandez and D'Ascoli, 1♂, 3♀. *Edo. Monagas*, Uverito, 50 m, 19 Oct 1978, Rosales and Gonzalez, 1♀. *T.F. Amazonas*, Union Orinoco-Ugueto, 13 Oct 1951, Anduze, 1♂; San Carlos de Río Negro, 6–12 Dec 1984, R.L. Brown, 1♀; Río Cataniapo, 10 km S Puerto Ayacucho, 9 Mar 1984, O.S. Flint, Jr., 4♂, 1♀; Cerro de la Neblina, basecamp, 0°50'N, 66°09'W, Davis and McCabe, 1♂, 15♀; same, but 20–24 Mar 1984, Flint and Louton, 3♂, 1♀; same, but 26 Jan–28 Feb 1985, Spangler et al., 9♂, 21♀. Material in AMNH, CNC, INHS, IZAM, LACM, MCZ, and USNM.

**REMARKS.**—This distinctive little species is widespread over South America and southern Central America. The male genitalia show many small differences in all their parts between examples from different locations, but the differences seem to be connected by intermediates, seem to be associated independently and not to show any coherent distributional pattern. Thus, we still believe only a single species is represented.

It is clearly, and rather closely, related to *poeyi*, with which it seems to be identical in coloration. It is easily separated by the shape of the tenth tergum, *poeyi* having two conspicuous warts and *sparsum* only one.

### The *crassum* Group

**DIAGNOSTIC CHARACTERISTICS.**—Size moderately large; forewing length 15–28 mm. Color pale green or brown; forewing pale green, or brown with infuscations over chord and along apical margin, often with 2 dark spots near base. Tibial spurs 2, 4, 4. Middle tibiae and tarsi of females generally flattened and broadened. Malar space very broad and hairy; head and thorax hairy. Basal abdominal sternum without a median suture. Male tenth tergum with wart *a*, wart *b* either lacking or developed into an erect, rectangular lobe. Basal segment of clasper with a definite subapical brush of spinose setae on inner margin. Phallus with base enlarged, generally rounding into stem; apex enlarged, without usual processes, with a round dorsal opening variably extended above tip, apex of ejaculatory duct with a variable, apicoventral process that may be everted through dorsal opening.

**Remarks.**—The seven species assigned to this group may be divided into two subgroups, one containing *columbianum* Ulmer and *mandibulatum*, new species. These are more green and immaculate in life, and the dorsal opening of the phallus is modified into a pair of caliper-like lobes in posterior aspect and wart *b* of the tenth tergum is scarcely evident. The other subgroup contains *crassum* Ulmer, *divaricatum*, new species, *guayanense*, new species, *hirsutum* Flint, and *lunatum*, new species. This subgroup has brown wings that are irregularly infuscate, the dorsal opening of the phallus is raised on a cylindrical collar that may be produced apicomeresally, the ventral process of the ejaculatory duct is well marked, and wart *b* is erect and angulate in shape.

**DISTRIBUTION.**—The group is widespread from eastern Mexico south to the mouth of the Río Paraná in Argentina. The species often frequent large, lowland rivers, but are also found in the smaller rivers in mountainous areas.

### *Leptonema columbianum* Ulmer

FIGURES 219–225; MAP 9

*Leptonema columbianum* Ulmer, 1905a:61, 62, pl. III: fig. 104 [lectotype ♀, in PAN].—Tomaszewski, 1961:3.—Fischer, 1963:168.—Weidner, 1964:84.—Flint, 1966:5 [lectotype]; 1972:234, 235 [Argentina]; 1974:101, 102, fig. 224 [Suriname]; 1978:385, fig. 62 [Brazil]; 1982:31, 32, fig. 31 [Argentina].—Flint and Wallace, 1980:185–192, figs. 3, 4, 7, 8, 25–38 [larva, pupa].

*Leptonema externum* Banks, 1913:87 [holotype ♀, in MCZ].—Mosely, 1933:13 [synonymy].

*Leptonema cellare* Navás, 1927:41 [lectotype ♀, in DEI].—Flint, 1978:385 [synonymy].

*Leptonema silvestrinum* Navás, 1934a:168, 169, fig. 44 [holotype ♂, in DEI] [new synonymy].

**TYPE-LOCALITIES.**—Of *columbianum*, Colombia. Of *externum*, camp 41, 360 km from Porto Velho, Brazil. Of *cellare*, Minas Gerais, Brazil. Of *silvestrinum*, Corumba, Mato Grosso, Brazil.

**DISTRIBUTION.**—Argentina, Bolivia, Brazil, Colombia, Guyana, Paraguay, Peru, Suriname, Venezuela.

**MATERIAL EXAMINED.**—ARGENTINA, "Cordova," 1♀. *Pcia. Formosa*, 12 Dec, 2♂, 1♀. *Pcia. Santa Fé*, Las Garzas, Río Las Garzas, "25 km a l'O. D'Ocampo," 1903, E.R. Wagner, 1♀; Arroyo Saladillo, Santa Fé, 2 Apr 1971, C.M. and O.S. Flint, Jr., 4♀. *Pcia. Misiones*, Jan–Feb 1909, Jørgensen, 1♂. [*Pcia. Corrientes*], Río Paraná, Bella Vista, 22 Dec, H. Smith, 4♂, 2♀; Junction Río Paraná and Río Paraguay, 23 Dec, H. Smith, 1♂. [*Pcia. Entre Ríos*], Río Paraná, above La Paz, Dec, H. Smith, 1♀; Salto Grande, Río Uruguay, 16 Nov 1973, O.S. Flint, Jr., 5♂, 9♀. *Pcia. Buenos Aires*, Bernal, 25 Mar 1927, Kisliuk, 1♂. BOLIVIA, *Dpto. Santa Cruz*, Puerto Suarez, Oct 1959, 1♂, 2♀; same, but 150 m, J. Steinbach, Dec 1909, 3♀. BRAZIL, *Edo. Goiás*, Chapada dos Veadeiros, 18–24 km N Alto Paraiso, 1400–1500 m, 2–5 Oct 1985, S.E. Miller, 1♀. *Edo. Minas Gerais*, 24 May, Le Mout, lectotype ♀, *cellare*. *Edo. Mato Grosso*, Río Paraguay, P. Esperanca, 13–30 Dec 1919, Cornell Univ. Expedition, 1♂, 1♀; Corumbá, Mar, 1♂, 1♀; Corumbá, Sep 1900, F. Silvestri, holotype ♂, *silvestrinum*. [*Terr. Rondonia*], Camp 41, 360 km from Porto Velho, Mann, holotype ♀ *externum*, 1♀ paratype, 1♂. *Edo. Amazonas*, Lago Janauacá, Río Solimoes, 40 km W Manaus, 11 Apr 1972, E.G., I., and E.A. Munroe, 1♂; Reserva Ducke, 26 km E Manaus, 15–19 Apr 1972, E.G., I., and E.A. Munroe, 2♀; Mirapinima, Río Negro, 8 Apr 1972, E.G., I., and E.A. Munroe, 1♀; Solimoes River, 28 Nov, Parish, 4♀; Teffe, 30 Nov–4 Feb, Parish, 3♀; Hasoratará, 23 Oct, Parish, 1♀. *Edo. Bahía*, Santa Anna, Dec 1907, 2♂. *Edo. São Paulo*, Piracicaba, 11 Nov 1965, C.A. Triplehorn, 1♀; same, but 19 Dec 1965, 12♀; same, but 20 Jan 1965, 10♀; same, but 27 Jan 1966, 10♀; same, but 3 Feb 1966, 4♀; same, but 12 Mar 1965, 1♂. *Distrito Federal*, Estacao Florestal, Cabeça do Veado, 1100 m, 18 Oct. 1971, E.G., I., and E.A. Munroe, 1♂. *Edo. Pará*, Prainha, 14 Feb 1873, McLachlan Coll., 1♂; Gurupa, Jun 1935, G.V. Vredenburg, 1♂; Obidos, 27 Aug–13 Sep 1919, Parish, 3♂, 2♀.

COLOMBIA, [*Edo. Cundinamarca*], Bogotá, 1897, Dohrn, 1♂. *Edo. Choco*, Río Atrato, Quibdó–Golfo, 8–10 Oct 1983, U. Matthias, 5♂, 15♀. *Edo. Amazonas*, Leticia, 1–3 Feb 1969, 3♀. *Dpto. Caquetá*, Río Ortegua near Río Peneya, 14–18 Jan 1969, Duckworth and Dietz, 1♂, 6♀. *Dpto. Meta*, Río Guayabero, Caño Cabra, 29 Jan 1969, R.E. Dietz, 6♀. GUYANA, Essequibo, 6 mi S Wineperu, Picrewana Island, 8–16 Mar 1969, Duckworth and Dietz, 1♂, 8♀. PARAGUAY, Río Paraguay below Concepción, 31 Dec, H. Smith, 1♂. Río Paraguay above Asunción, 26 Dec, 1♂. Salto



MAP 9.—Distributions of *Leptonema columbianum* Ulmer, *L. mandibulatum*, new species, *L. hirsutum* Flint, and *L. lunatum*, new species.

de Guairá, 4 Dec 1971, L.E. Peña G., 4♂, 1♀. PERU, [Dpto. Loreto], Yurimaguas, 25 Mar, Parish, 1♂, 1♀; Río Ucayali, Cauchahraya, 10 Jan 1919, Parish, 1♂; Río Napo, 15 Jun, Parish, 1♂. VENEZUELA, Edo. Monagas, Uverito, 50 m, 19 Oct 1978, Rosales and Gonzalez, 1♂, 2♀; same, but 16 Nov 1978, 3♀. Edo. Barinas, Río Caparo Res. Sta., 32 km E El Canton, 3–5 Feb 1978, J.B. Heppner, 2♂, 17♀; Barrancas Res. Sta., Río Yuca, 400 ft., 1 Feb 1978, J.B. Heppner, 5♀. Edo. Guarico, Hato Masaguaral, 44 km S Calabozo, 3–10 May 1985, Menke and Carpenter, 2♂, 1♀. Material in BMNH, CMP, CNC, CUI, IZAM, MCZ, USP, and USNM.

**REMARKS.**—This species ranges widely throughout South America, except in the central Andean area of western

South America where it seems to be replaced by its sister species, *mandibulatum*, new species. *Leptonema columbianum* is smaller on the average, and is pale green in life. The only distinct genitalic difference we can find is in the tenth tergum, which ends in a sharp point in *columbianum*, but is distinctly bilobed in *mandibulatum*.

### *Leptonema crassum* Ulmer

FIGURES 226–233; MAP 10

*Leptonema crassum* Ulmer, 1905a:58, 59, Pl. 11: figs. 52, 53 [holotype ♂, in ZSMH, destroyed 1943].—Fischer, 1963:168; 1972:156.—Weidner, 1964:84.—Flint, 1966:5; 1972:235 [Argentina]; 1978:385.





MAP 10.—Distributions of *Leptonema guyanense*, new species, *L. crassum* Ulmer, and *L. divaricatum*, new species.

*Leptonema radiale* Navás, 1927:42 [holotype ♀, in DE1].—Flint, 1978:385 [synonymy].

*Leptonema grisolinum* Navás, 1933a:312, 313, fig. 23 [holotype ♂, in MNHNP] [new synonymy].

TYPE-LOCALITIES.—Of *crassum*, Espirito Santo, Brazil. Of *radiale*, Minas Gerais, Brazil. Of *grisolinum*, Caucaagua, Edo. Miranda, Venezuela.

DISTRIBUTION.—Argentina, Brazil, Colombia, Costa Rica, Guatemala, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Venezuela.

MATERIAL EXAMINED.—ARGENTINA, *Pcia. Misiones*, Puerto Rico, 4–8 Apr 1971, C.M. and O.S. Flint, Jr., 2♂, 3♀; Arroyo Saura, 9 km N L.N. Alem, 20 Nov 1973, O.S. Flint, Jr., 4♀; Río Iguazú, Camp Nañdu, 25 Nov 1973, O.S. Flint, Jr., 7♂, 3♀; Iguazú, 30 Jan–13 Mar 1945, Hayward et al., 5♂; Puerto Libertad, 24 Nov 1973, O.S. Flint, Jr., 24♂, 24♀; Arroyo Piray Guazú, N San Pedro, 22 Nov 1973, O.S. Flint, Jr., 1♂, 1♀; Arroyo Liso, 8 km W General Güemes, 19 Nov 1973, O.S. Flint, Jr., 1♀. *Pcia. Entre Rios*, Río Uruguay, Salto Grande, 16 Nov 1973, O.S. Flint, Jr., 1♀. BRAZIL, Madeira—Mamore R.R. Co. Camp 43, Mann and Baker, 2♂. *Edo. Mato Grosso*, Aripuana Dist., 10°11'S, 59°48'W, 17 Mar 1977, N.D. Penny, 1♂; Buriti, Chapada dos Guimaraes, 1200 m, 17–28 Jan 1972, E.G., I., and E.A. Munroe, 1♂, 1♀. *Edo. Goias*, Fazenda Nova Orlandia, Jatai, Jan 1964, Martins et al., 1♂. *Edo. Minas Gerais*, Serra do Cipó, km 110, 29 Oct 1974, C.G. Froehlich (#397), 20♂, 5♀. *Edo. São Paulo*, Piracicaba, 12 Oct 1965, C.A. Triplehorn, 1♂, 2♀. COLOMBIA, *Dpto. Meta*, Restrepo, 500 m, 7–10 Aug 1936, M. Bates, 1♂, 3♀.

COSTA RICA, [*Pcia. Limón*], Cairo, 21 Apr 1944, P. Knight, 1♂; Hamburg Farm, 28 Mar, C.W. Dodge, 2♂, 1♀. [*Pcia. Alajuela*], San Carlos, 1♂. [*Pcia. Guanacaste*], 10 mi NW Liberia, 25 Jul 1965, P.J. Spangler, 2♀. *Pcia. Heredia*, Puerto Viejo, 6 Apr 1969, D.C. Rentz, 1♂; Finca La Selva, near Puerto Viejo, 30 Jun 1967, D.R. Paulson, 2♂, 1♀; same, but 22–31 Jul 1969, D.H. Janzen, 1♀. GUATEMALA, [*Dpto. Izabal*], Los Amates, Kellerman, 4♂, 5♀; Cayuga, Sep 1915, Wm. Schaus, 1♀. HONDURAS, [*Dpto. Atlántida*], Lancetilla, Tela, 2 May, M. Bates, 2♂. [*Dpto. Colón*], Puerto Castilla, 21 Jun 1926, R.H. Painter, 1♀. *Dpto. Comayagua*, Las Limas, 2000', 20–13 May, J.B. Edwards, 4♂, 2♀. MEXICO, *Edo. Oaxaca*, Río Valle Nacional, Chiltepec, 25 May 1981, C.M. and O.S. Flint, Jr., 21♂, 3♀; Palomares, 16–21 Sep 1961, R. and K. Dreisbach, 1♀; San Mateo Yetla, 3 km S Valle Nacional, 25 May 1981, C.M. and O.S. Flint, Jr., 1♂, 1♀; Arroyo Choapan, Bethania, 31 km S Tuxtepec, 24 May 1981, C.M. and O.S. Flint, Jr., 2♀; Tuxtepec, 7 Nov 1934, J. Camelo G., 1♂; Uxpanapa, 27 Sep 1977, J. Bueno S., 10♂; Monte Flor, 19 May 1956, 1♂; Camelia Roja, 2 May 1975, J. Bueno S., 3♂; Finca San Carlos, Colonia Agrícola Progreso, Municipio Matias Romero, 28 May 1959, F. Medellín, 2♂. *Edo. Chiapas*, Cascada Misjolha, 20 km S Palenque, 17–18 May 1981, C.M. and

O.S. Flint, Jr., 1♀; Río Lacanjá, 22 km N Ocosingo, 19 May 1981, C.M. and O.S. Flint, Jr., 1♂; Bonampak, 3 May 1978, H. Brailovsky, 1♂; Sta. Elena, 20 km beyond Lagunas de Montebello, 8 Apr 1979, J. Bueno S., 1♀. *Edo. Tabasco*, Río Puyacatengo, E Teapa, 28–29 Jul 1966, Flint and Ortiz, 1♂.

NICARAGUA, [*Dpto. Nueva Segovia*], Río Coco, Ocotal, 31 Jul 1967, O.S. Flint, Jr., 1♂. PANAMA, [*Pcia. Panamá*], Taboga Island, 18 Feb 1912, A. Busck, 1♂. [*Pcia. Colón*], Alajuela [Alhajuella], 10–17 Apr 1911, A. Busck, 3♂, 12♀; Chilibre, 14 May, N. Banks, 1♂. [*Canal Zone*], Tabernilla, 4 May 1907, A. Busck, 1♂, 1♀. *Pcia. Veraguas*, Río Jorones, Jorones, 5 Jun 1983, P.J. Spangler, 2♀. *Pcia. Chiriquí*, Río San Felix, Las Lajas, 28 May 1983, P.J. Spangler, 1♂; Lino, Fassl, 1♂. *Pcia. Darién*, Río Tuira at Boca de Cupe, 18 Feb 1985, J. Louton, 6♂, 7♀; Río Tuira at Río Pucuro, 16–17 Feb 1985, J. Louton, 12♂, 3♀. *Com. San Blas*, Río Coatí Grande near coast, 2 Mar 1985, Flint and Louton, 42♂, 28♀. PARAGUAY, Bella Vista, Nov, F. Schade, 1♂. PERU, [*Dpto. Cuzco*], Quince Mil, 20–30 Oct 1962, L.E. Peña G., 1♂. VENEZUELA, *Edo. Barinas*, Barinitas, 22–23 Feb 1969, P. and P. Spangler, 5♂. *Edo. Miranda*, Caucaagua, Oct 1923, M. Grisoll, holotype ♂ *grisolinum*; valley Río Guira, SW Panaquire, 10°12'N, 66°17'W, 280 m, 18–21 Sep 1979, Fernandez and Clavijo, 3♂, 2♀. *Edo. Zulia*, Dist. Baralt, Río Pauji at Rt 3, between San Juan and San Antonio, 9–11 Oct 1979, H.M. Savage, 13♂, 4♀. Material in CNC, CUI, DE1, IBUNAM, IML, INHS, IZAM, MCZ, MNHNP, USNM, and USP.

REMARKS.—This species is very close to *divaricatum*, with which it is easily confused. The only distinctive difference appears to be in the tip of the phallus, which is discussed under *divaricatum*. In addition the species appears to be paler in color, more a yellow brown, rather than the more grayish brown of *divaricatum*, though some examples of the latter are as pale as the former.

The shape of the tip of the ejaculatory duct divides this species into two apparent populations. The one to the north (Colombia, Venezuela, and middle America) has this duct narrow below the apex, while the southern population (Brazil, Peru, and south) has it suddenly widened below the tip. However the lateral aspect remains virtually identical in both forms.

### *Leptonema divaricatum*, new species

FIGURES 234–242; MAP 10

*Leptonema crassum* Mosely, 1933:12, 13 [misidentification of examples from Cachabé, Ecuador, at least].—Fischer, 1945:313–315 [misidentification].—Schmid, 1964:317 [misidentification].—Flint, 1981:20, figs. 71, 72 [misidentification].

MALE.—Color brown, often with grayish overtone, or a more yellowish tone; forewing brown with two dark basal spots, one on costa other subbasally on subcosta, chord with



a wavy darker band, apex infusate. Length of forewing, 16–19 mm.

Malar space very broad, about  $\frac{1}{2}$  as wide as height of eye, densely hairy. Parafacial and postocular areas very broad below, narrow above, hairy; with a row of 3–5 stout setae in postocular area almost hidden in hairs. Maxillary palpus with fifth segment less than half as long as basal 4 segments combined. Processes of fifth sternum narrow, oblique.

**Genitalia:** Tenth tergum with wart *a* prominent, wart *b* elongate, dorsal in position; lateral plate produced into a dorsally directed point, in dorsal aspect generally appearing caliper-like, but occasionally sharply divergent. Clasper with basal segment less than 3 times as long as apical, with a large group of stout spines in mesal face subapically; without basomesal lobe. Phallus base broad, rounding into stem; apex enlarged ventrad, with a low dorsal lobe open dorsally, with ventral process of ejaculatory duct long, curved at base only, tip broad and truncate.

**FEMALE.**—Generally similar in size and color, but frequently a bit darker.

**TYPES.**—*Holotype* (male): ECUADOR, *Pcia. Pichincha*, 29 km W Santo Domingo de los Colorados, 6 May 1975, Spangler et al.

*Paratypes:* COLOMBIA(W), Río Yamata, Feb, 2♂, 2♀. *Dpto. Meta*, La Macarena, 26–27 Jan 1969, R.E. Dietz, 1V, 1♂. *Dpto. Cundinamarca*, Monterredondo, 21 Feb 1959, J.E. Foerster, 3♂; same, but 31 Jan 1959, 1♂; Río Sumapaz gorge, E Melgar, 1000 m, 3 Jan 1959, J.F.G. Clarke, 27♂, 25♀; Bogotá, 1877, Dohrn, 2♂. *Dpto. Antioquia*, quebrada al Río Samaná Cabernas del Nus, 400 m, 11 Jun 1983, U. Matthias, 3♂, 10♀. *Dpto. Caquetá*, Río Bodoquero, Morelia, 430 m, 19–20 Jan 1969, Duckworth and Dietz, 4♂, 4♀. ECUADOR, same data as holotype, 19♂, 11♀. [*Pcia. Esmeraldas*], Cachabé, (low c.), Nov 1896, Rosenberg, 3♂; San Mateo, 13 May 1955, J.E. Foerster, 1♂, 1♀; same, but 30 Aug 1956, 1♂, 1♀. *Pcia. Los Ríos*, Quevedo, F. Campos R., 1♂; same, but 11 May 1975, Spangler and Gurney, 38♂, 21♀; same, but 11 km S Quevedo, 3 Jul 1975, Langley and Cohen, 2♂, 5♀; Río Palenque Biol. Sta., 57 km N Quevedo, 8 Mar 1979, J. Anderson, 1♂; same, but, 22–26 Feb 1976, Wood and Shewell, 7♂; same, but 28–29 Jul 1976, J. Cohen, 5♂, 5♀. *Pcia. Napo*, Tena, 23–26 May 1977, Spangler and Givens, 3♂, 2♀; same, but 4 km S Tena, 26 May 1977, 1♀; Río Aguatico, 4 km W Lago Agrio, 20 Sep 1975, Langley and Cohen, 1♂. *Pcia. Pastaza*, Puyo, 6–17 May 1977, Spangler and Givens, 5♂, 6♀; same, but 1–7 Feb 1976, Spangler et al., 3♂, 1♀; same, but 1.5 km S Puyo, 8–21 May 1977, 4♂, 6♀; same, but 5 km E Puyo, 17 May 1977, 1♀; same, but 3 km N Puyo, 30 May 1975, Cohen and Langley, 1♂. *Pcia. Loja*, Macará 13 Aug 1977, L.E. Peña G., 1♂; same, but Macará/Catacocha, 650 m, 14 Aug 1977, 21♂, 1♀. *Pcia. El Oro*, Canton de Arenillas, Las Lajas, 600 m, 30 May 1979, J. Anderson, 9♂.

VENEZUELA, *Edo. Aragua*, Rancho Grande, 10–21 Feb 1969, Duckworth and Dietz, 1♂, 1♀. *Edo. Barinas*, Río Santo Domingo, Barinas, 17 Feb 1976, C.M. and O.S. Flint, Jr., 17♂, 1♀; Barinitas, 22–26 Feb 1969, Duckworth and Dietz, 10♂, 6♀; same, but 22–23 Feb 1969, P. and P. Spangler, 3♂; same, but Puente Parangula, 8 km S Barinitas, 18 Feb 1976, C.M. and O.S. Flint, Jr., 4♂. *Edo. Mérida*, El Vigía, 2 Jun 1976, Menke and Vincent, 1♂.

**Holotype** in USNM; **paratypes** in CNC, INHS, IZAM, MCZ, and USNM.

**REMARKS.**—In addition to the material listed above, there is a single male from Costa Rica, Guápiles, May, Wm. Schaus, with cleared genitalia that is this species. However, considering the known range of the species, we are concerned that possibly the specimen might be mislabelled or have the genitalia exchanged with some other specimen. The known range of the species is the Andean Ranges from northern Venezuela through Ecuador. *Leptonema crassum* appears to be a more lowland species, although it overlaps *divaricatum* in the foothills where the two coexist.

The species has been commonly confused with *crassum* to which it bears a great resemblance. It is only distinguishable with certainty by the structure of the ventral process of the ejaculatory duct at the tip of the phallus: in *crassum* this extends in lateral aspect more directly posteriad, is angulate near midlength, and the tip is pointed; in *divaricatum* this process is strongly curved basally, then extends at an even, slight curve to the apex, which is broad and truncate. There is considerable variation in the shape of the tenth tergum in both species in terms of the shapes and placements of the lobes, with both showing almost the same variations.

### *Leptonema guayanense*, new species

FIGURES 243–250; MAP 10

**MALE.**—Color golden brown; forewing with a dark spot subbasally on subcosta and another tuft of dark hair basally on axillary sclerite, posteroapical margin with an infusate band. Length of forewing 15–21 mm.

Malar space very broad, more than  $\frac{2}{3}$  as high as eye, very hairy. Parafacial area lacking; postocular area as broad below as malar, lacking above, densely hairy with 2–3 enlarged setae near eye. Maxillary palpus with fifth segment longer than basal 4 segments combined. Processes of fifth sternum long, narrow, very obliquely placed, with anterior margin reflexed over opening.

**Genitalia:** Tenth tergum with wart *a* small, rounded, wart *b* erect, basomesal in position; lateral lobe narrow, pointed, caliper-like in dorsal aspect. Clasper with basal segment about  $2\frac{1}{2}$  times as long as apical, with a cluster of mesal spines about third of length from apex; without basal lobe. Phallus with base broad, rounding into stem; apex

enlarged ventrad, with rounded lateral lobes, with a small apicodorsal opening, ventromesal margin of which is produced into a tongue-like lobe, ventral process of ejaculatory duct very long, apex pointed, either folded internally, or exerted from opening.

**FEMALE.**—Smaller in size, wings darker brown; forewing 14–15 mm in length.

**TYPES.**—*Holotype* (male): VENEZUELA, *Edo. Bolívar*, Kanarakuni, 450 m, 3 Feb 1967, F. Fernandez Y. and A. D'Ascoli.

*Paratypes*: Same, but 2–8 Feb 1967, 9♂, 8♀; Roraima, 3000 ft., 15 Sep 1974, B.V. Ridout, 2♂; Auyántepeú, Río Chirun, 24 Aug 1974, B.V. Ridout, 1♂; Camarata, 3000 ft., 6 Aug 1974, B.V. Ridout, 1♂.

*Holotype* in IZAM; *paratypes* in BMNH, IZAM, and USNM.

**REMARKS.**—This species is another member of the *crasum* group that is restricted to the area of the Guayana Shield. It is probably most closely related to *hirsutum* with which it coexists. There are distinct differences in the structure of the tenth tergum and claspers, but the most distinctive differences are in the shape and structure of the apex of the phallus especially the ventral process of the ejaculatory duct.

### *Leptonema hirsutum* Flint

FIGURES 251–256; MAP 9

*Leptonema hirsutum* Flint, 1974:102, figs. 228–232 [holotype ♂, in RNH].

**TYPE-LOCALITY.**—Tapanahoni River, Granholo Poeketi, Suriname.

**DISTRIBUTION.**—Guyana, Suriname, Venezuela.

**MATERIAL EXAMINED.**—GUYANA, Kamakusa, Dec 1922, 1♂. SURINAME, Tapanahoni River, Granholo Poeketi, 4 May 1954, D.C. Geijskes, 1♂ *paratype*. VENEZUELA, *Edo. Bolívar*, Kanarakuni, 450 m, 2–8 Feb 1967, Fernandez and D'Ascoli, 2♂, 2♀. *Territorio Federal Amazonas*, Culebra, 03°33'N, 65°65'W, 250 m, 21 Mar–2 Apr 1983, Exp. Marawaca, Fund. Terramar, 7♂; same, but 6–16 Oct 1983, 1♂. Material in AMNH, IZAM, and USNM.

**REMARKS.**—*Leptonema hirsutum* is closely related to *crasum*, but is distinguished by the more slender claspers with a setal patch borne nearly at midlength and the large ventral lobe at the apex of the phallus.

### *Leptonema lunatum*, new species

FIGURES 776–784; MAP 9

**MALE.**—Color light brown; forewing lacking basal spots, with indication of infuscation along chord. Length of forewing 24–28 mm.

Malar space broad, almost ½ as high as eye. Parafacial area almost as broad as malar; postocular area as broad

below as malar, very narrow above, with 5–8 enlarged setae near eye. Maxillary palpus with fifth segment slightly more than ¾ as long as basal 4 segments combined. Head dorsally and thorax densely setose. Processes of fifth sternum long, narrow, curved posteromesad, with a small, oblique opening at anterior end.

**Genitalia:** Tenth tergum with wart *a* a slightly produced, setiferous lobe in dorsolateral position; lateral lobe a large, broadly rounded plate, with dorsal surface shallowly cupped with anterodorsal margin a produced, setiferous ridge. Clasper with basal segment about 4½ times as long as apical, with inner margin bearing many spinous setae; without basal lobe. Phallus with base wider than, and rounding into stem; apex rounded posteroventrally, with large, rounded dorsolateral lobes, with apicodorsal opening small, a small ventromesal lobe in opening.

**FEMALE.**—Similar to male in size; color darker brown. Midtibiae and tarsi broad and flattened.

**TYPES.**—*Holotype* (male): BRAZIL, *Edo. Santa Catarina*, Corupa (Hansa Humboldt), Nov 1944, A. Maller.

*Paratypes*: Same data, 4♂; same, but Jan 1946, 2♂, 3♀.

*Holotype* in AMNH; *paratypes* in AMNH and USNM.

**REMARKS.**—The genitalia are very distinctive, especially the large, rounded, lateral lobes of the tenth tergum and the rounded, apicodorsal lobes of the phallus. The long, narrow, crescentic, fifth sternal lobes are unique, especially so as they curve mesally posteriad rather than laterad as those of the other species with narrow lobes.

### *Leptonema mandibulatum*, new species

FIGURES 257–263; MAP 9

**MALE.**—Ochraceous brown; forewings uniformly ochraceous brown, probably with greenish overtones in life, with 2 dark brown spots, one at base of costal margin, other on subcosta slightly distad. Forewing length 15–16 mm.

Malar space broad, almost ½ height of eye, covered with fine hairs. Parafacial and postocular areas, almost as broad ventrally as malar, much narrowed dorsad, with fine hair; postocular area with a row of 2–4 slightly enlarged setae. Maxillary palpus with fifth segment distinctly longer than basal 4 combined. Processes of fifth sternum, narrow, elongate, distinctly oblique.

**Genitalia:** Tenth tergum with wart *a* low; lateral plate produced into a point apically with a distinct dorsomesal point (wart *b*?). Clasper with basal segment about 6 times as long as apical, with a well-developed spiculate area apicomeresally, without basomesal process. Phallus with base broad, angled to stem that is slender; apex produced into a pair of dorsal, caliper-like lobes basad of which are a pair of short spines that may be more or less everted.

**FEMALE.**—Slightly larger, to 18 mm. Midtibia and tarsus very broad and flat; second tarsal segment ¾ as wide as long.

**TYPES.**—*Holotype* (male): PERU, *Dpto. Huanuco*, Tingo Maria, 19–25 Apr 1969, P. and P. Spangler.

*Paratypes*: Same data, 2♀; same, but 19 Nov 1949–25 Feb 1950, H.A. Allard, 12♀; same, but Monson Valley, 18 Sep–18 Dec 1954, Schlinger and Ross, 1♂, 40♀; Yurac, 67 mi E Tingo Maria, 16 Nov 1954, Schlinger and Ross, 1♀; Aguaytia/Huallaga, 400 m, 11–22 Feb 1961, J.E. Foerster, 1♂, 99♀. *Dpto. Cuzco*, Santa Isabel, Cosñipata Valley, 12 Dec 1951, F. Woytkowski, 1♂; same, but Hacienda Maria, Cosñipata Valley, 19–24 Feb 1952, 2♀; same, but Paucartambo, Cosñipata Valley, 26 Nov 1951, 1♀; Pilcopata, 600 m, 11–14 Dec 1979, J.B. Heppner, 2♂, 7♀. [*Dpto. Madre de Dios*], Avispas, [E Quincemil], 10–30 Oct 1962, L.E. Peña G., 2♂, 2♀. *Dpto. Puno*, Río Inambari, Loromayu, 5–6 Sep 1962, L.E. Peña G., 3♂, 29♀.

ECUADOR, *Pcia. Pastaza*, Puyo, 11–17 May 1977, Spangler and Givens, 3♂, 21♀; same, but 1–11 Feb 1976, P.J. Spangler, 2♀; same, but 29 May 1975, Cohen and Langley, 1♀; same, but 1.5 km S Puyo, 8–21 May 1977, Spangler and Givens, 1♂, 9♀; same, but 5 km E Puyo, 17 May 1977; 3♀; same, but 5 km S Puyo, 8 May 1977, 1♀; same, but 6 km W Puyo, 3 Feb 1976, 1♀. *Pcia. Napo*, Lago Agrio, 16–19 Sep 1975, A. Langley, 1♂, 21♀; same, but 5 km N Lago Agrio, 26 Sep 1975, 12♀; same, but 4 km NW Lago Agrio, 23 Aug 1975, Langley and Cohen, 1♀; same, but 4 km N Lago Agrio, 26 Aug 1975, 1♂, 8♀; same, but 18 km NW Lago Agrio, 30 Aug 1975, 8♀; same, but Río Aguarico, 18 km E Lago Agrio, 28 Aug 1975, Langley et al., 1♂, 1♀; same, but 3 km NE Lago Agrio, 17 May 1975, Spangler et al., 1♀. BOLIVIA, *Dpto. La Paz*, Quebradas del Río Zongo, 1400 m, 24–30 Oct 1984, L.E. Peña G., 3♂, 12♀; Río Coroico, 1200 m, 23–26 Nov 1984, L.E. Peña G., 9♂, 38♀.

*Holotype* in USNM; *paratypes* in CAS, CNC, INHS, and USNM.

**REMARKS.**—*Leptonema mandibulatum* and *columbianum* are very closely related, but the former is slightly larger in size and appears to be browner in color. The only certain distinguishing character is in the tenth tergum of the males: in *mandibulatum* the apex is distinctly bifid in either lateral or dorsal aspects, as opposed to being produced into a simple point as in *columbianum*. The second segment of the female midtarsus in *mandibulatum* tends to be narrower and more elongate than it is in *columbianum*, but this characteristic should not be relied upon in the absence of males from the area.

The species occupies a rather restricted range along the eastern slopes of the Andes from Ecuador to northern Bolivia. The range of *columbianum* appears to be more widespread throughout the lowlands of South America.

### The amazonense Group

**DIAGNOSTIC CHARACTERS.**—Size moderate; forewing from 11–16 mm long. Color brown, strongly maculate and

patterned. Tibial spurs 1, 4, 4. Middle tibiae of female not broader than in male. Malar space narrow and bare. Proportions of maxillary palpal segments variable. Basal abdominal sternum with suture either present, or usually, reduced, or rarely absent. Fifth sternal lobes variable in size and shape. Male genitalia with tenth tergum usually having warts *a* and/or *c* present; lateral lobe with ventral margin modified and produced, often with a distinct mesal lobe. Clasper usually bearing modified setae mesally on basal segment, rarely with a basomesal lobe. Phallus not bearing apical processes; apex usually rounded with a simple opening surrounded by a rim that is often strongly developed on one side.

**REMARKS.**—This is a group of five species that is divisible into 2 subgroups. The typical subgroup has the fifth segment of the maxillary palpus as long as, or longer than, the basal four segments and the opening at the apex of the phallus dorsal in position with the anterior margin of its rim produced. In the *maculatum* subgroup the apical palpal segment is much shorter than the basal segments and the phallic opening is directed posteriad with the, now, dorsal portion of the rim produced over the opening. The first group contains *amazonense* Flint, *irroratum* Flint, and *neblinense*, new species, the second subgroup *maculatum* Mosely and *chocoense*, new species.

**DISTRIBUTION.**—The species are only known from South America, especially the Amazon Basin and the rugged areas of the Guyanan Shield, but one is known from the western Andes.

### *Leptonema amazonense* Flint

FIGURES 264–270, 790; MAP 11

*Leptonema amazonense* Flint, 1978:399, figs. 130–134, 145 [holotype ♂, in INPA.

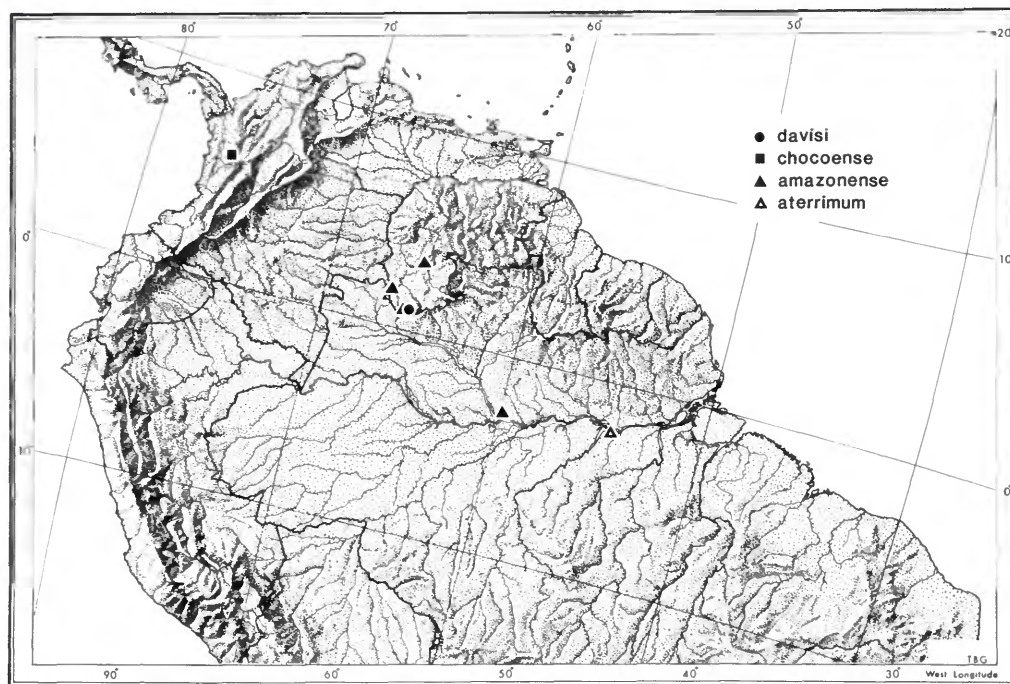
**TYPE-LOCALITY.**—Brazil, Amazonas, Manaus, Reserva Ducke.

**DISTRIBUTION.**—Brazil, Venezuela.

**MATERIAL EXAMINED.**—BRAZIL, *Edo. Amazonas*, Reserva Ducke, 26 km E Manaus, 24 Nov 1976, 1♂ paratype, 1♀. VENEZUELA, *T.F. Amazonas*, Cerro de la Neblina, basecamp, 0°51'N, 66°57'W, 140 m, 20–24 Mar 1984, Flint and Louton, 4♂, 4♀; same, but 13 Feb–10 Mar 1984, Davis and McCabe, 2♂, 3♀; same, but 4–8 Feb 1985, Spangler et al., 2♂, 2♀; same, but camp 111, 0°56'N, 66°3'W, 1820 m, 15–17 Feb 1984, D.R. Davis, 1♂, 1♀; same, but camp IV, 0°58'N, 65°57'W, 760 m, 15–18 Mar 1984, O.S. Flint, Jr., 2♀; San Carlos de Río Negro, 6–12 Dec 1984, R.L. Brown, 2♂; Marawaca (Talud cabeceras Caño Negro), 16 Jun 1983, Exp. Marawaca, Fundacion Terra-mar, 1♂. Material in IZAM and USNM.

**REMARKS.**—This species is now known from 3 localities, two in Venezuela and the type-locality in Brazil. The male





MAP 11.—Distributions of *Leptonema davisi*, new species, *L. chochoense*, new species, *L. amazonense* Flint, and *L. aterrimum* Mosely.

genitalia of specimens from each site differ in details of shape and proportions of parts, especially in the tenth tergum and to a lesser degree the apex of the phallus. The topotypic males are yellow on the basal third of the forewing, then the wing is strongly maculate. Both Venezuelan series and the female from Brazil are maculate to the forewing base. As with the other related species, these differences are considered to be no more than populational characteristics.

The basal abdominal sternum bears a short, indistinct mesal suture.

#### *Leptonema chochoense*, new species

FIGURES 271–278, 791; MAP 11

**MALE.**—Color greyish brown; forewing brown with transverse, darker, irroration, hindwing infusate, especially apicad. Length of forewing, 11 mm.

Malar space broad, almost  $\frac{1}{3}$  height of eye, bare. Parafacial area almost as broad as malar; postocular as broad as parafacial, with numerous short setae, and a single enlarged seta. Maxillary palpus with fifth segment less than half as long as basal four combined. Foretibia with only a single apical spur. Process of fifth sternum small, ovoid, clearly attached to the anterior margin.

**Genitalia:** Tenth tergum with wart *a* very large, occu-

pying most of the dorsal half of the tergum, bearing many spinous setae; wart *c* large, protuberant; lateral lobe with apicoventral margin produced into a lobe bearing short, reflexed spines. Clasper with apical segment about  $\frac{1}{4}$  as long as basal, with a small group of spinous setae on apex. Phallus with base at right angles to stem, very broad; apex with distinct lateral lobe and a thin, dorsal flap triangular in dorsal outline, beneath which apex is squarely truncate.

**FEMALE.**—Unknown.

**TYPE.**—*Holotype* (male): COLOMBIA, *Dpto. Choco*, km 130, 86 Km E Quibdo, 17 Feb 1983, O.S. Flint, Jr. *Holotype* in USNM.

**REMARKS.**—This very distinct species does not show clear relationship to any other known species. It is, perhaps, most similar to *maculatum* from which it is easily distinguished by the spinose lobes of the tenth tergum and the apicodorsal projection of the phallus.

#### *Leptonema irroratum* Flint

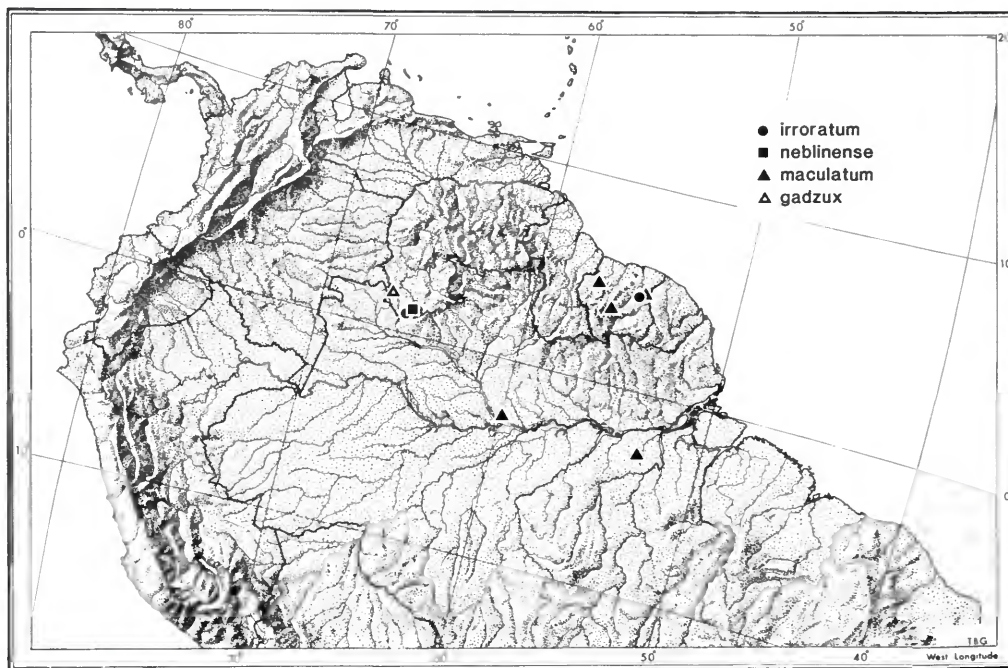
FIGURES 279–285, 792; MAP 12

*Leptonema irroratum* Flint, 1974:100, 101, figs. 220–223, pl. 1B [holotype ♂, in RNH].

**TYPE-LOCALITY.**—Suriname, Nassau Mountains, trail km. 11.2, north valley near large falls.

**DISTRIBUTION.**—Suriname, Venezuela.





MAP 12.—Distributions of *Leptonema irroratum* Flint, *L. neblinense*, new species, *L. maculatum* Mosely, and *L. gadzux*, new species.

**MATERIAL EXAMINED.**—SURINAME, Nassau Mountains, trail km 11.2, north valley near large falls, 24 Mar 1949, D.C. Geijskes, ♂ holotype. VENEZUELA, *T.F. Amazonas*, Cerro de la Neblina, camp IV, 0°58'N, 65°57'W, 760 m, 15–18 Mar 1984, O.S. Flint, Jr., 3♂, 2♀. Holotype in RNH; material in IZAM, USNM.

**REMARKS.**—Although this Venezuelan material agrees in general structure in all parts of the male genitalia with the holotype, almost every part differs slightly in shape or proportionate length. Perhaps it represents a distinct species, but lacking material from intermediate localities, and considering the variation apparent in *amazonense* and *maculatum*, we are considering this to be intraspecific variation.

The basal abdominal sternum bears an indistinct mesal suture in the Venezuelan material.

### *Leptonema maculatum* Mosely

FIGURES 286–293, 793; MAP 12

*Leptonema maculatum* Mosely, 1933:20, 21, figs. 26–31 [holotype ♂, in NMW].—Fischer, 1963:169.—Flint, 1974:100, fig. 219, pl. 1c [Suriname]; 1978:383, 399, fig. 53.

**TYPE-LOCALITY.**—[Brazil], Unt[er] Amaz[on] Taperinha b[ei] Santarem.

**DISTRIBUTION.**—Brazil, Suriname.

**MATERIAL EXAMINED.**—BRAZIL, *Edo Amazonas*, Re-

serva Ducke, 26 km E Manaus, 1–5 Feb 1979, O.S. Flint, Jr., 1♂; same, but 14 Mar 1977, N.D. Penny, 1♂. *Edo Pará*, 164 km W Altamira, 9 Nov 1974, J.F. Reinert, malaise trap, 1♀. SURINAME, Nassaugebergt, 11.2, 19 Mar 1949, D.C. Geijskes, 1♀. Nickerie River, Blanche Marie, 14 Feb 1971, at light, D.C. Geijskes, 1♀. Saramacca River, trail to Tafelberg, first camp, 26 Mar 1958, at light, D.C. Geijskes, 1♂, 1♀. Material in RNH and USNM.

**REMARKS.**—The males from Amazonas and Suriname at first sight appear to be quite different. The Surinamese male bears a large middorsal lobe on the tenth tergum (Flint, 1974, fig. 219) that is totally lacking in the other material. However, all the other parts of the male terminalia are virtually identical. Lacking sufficient material to assess these differences, we consider this to be most probably a populational characteristic.

### *Leptonema neblinense*, new species

FIGURES 294–301, 794; MAP 12

**MALE.**—Color greyish brown; forewing brown with transverse, darker irrorations; hindwing evenly infuscate. Length of forewing 11 mm.

Malar space broad, almost 1/3 height of eye, bare. Para-facial area 2/3 as broad as malar; postocular area slightly broader than malar, with many, short, dark setae. Maxillary

palpus with apical segment distinctly longer than basal 4 combined. Foretibia with only a single apical spur. Process of fifth sternum very large, ovoid, set obliquely.

*Genitalia*: Tenth tergum lacking obvious setal warts; with mesal lobe elongate, slender, with scattered setae, lateral lobe bipartite, a dorsal part somewhat flattened and broad, with ventral part more terete and slightly longer, both parts with scattered setae; between lateral and mesal lobes a broad, membranous plate. Clasper with apical segment less than  $\frac{1}{3}$  length of basal; basal segment with inner margin bearing a group of short, modified setae. Phallus with base at right angles to stem; apex with an erect, dorsal lobe, with opening apicodorsal in position.

FEMALE.—Identical in size and coloration.

TYPES.—*Holotype* (male): VENEZUELA, *T.F. Amazonas*, Cerro de la Neblina, Camp X,  $0^{\circ}54'N$ ,  $60^{\circ}2'W$ , 1690 m, 12 Feb 1985, R. McDiarmid. Caught at night on boulders by stream in copula with female.

*Paratypes*: Same data, 2♀; same, but Camp VII,  $0^{\circ}51'N$ ,  $65^{\circ}58'W$ , 1850 m, 2–4 Dec 1984, R.L. Brown, 1♂, 1♀.

Holotype in USNM; paratypes in IZAM and USNM.

REMARKS.—This very distinctive species is most similar to *irroratum*. It differs from that species and all others in the group by lacking any distinct setal warts on the tenth tergum, whose structure is also very distinctive with its elongate lobes.

### The *davisi* Group

DIAGNOSTIC CHARACTERS.—Size small; forewing from 7.5–8 mm. Color dark fuscous; forewing dark with paler irrorations. Tibial spurs 1, 4, 4. Middle tibiae of female not broader than in male. Malar space broad with a few short hairs. Third segment of maxillary palpus slightly longer than fourth. Basal abdominal sternum with median suture weak or lacking. Fifth sternal lobes large, ovoid. Male tenth tergum lacking obvious warts; lateral and/or mesal lobes elongate. Basal segment of clasper with mesal, stout spines. Phallus with apex complex, not readily homologized with other species; divided into longitudinal plates, each bearing processes.

REMARKS.—This is a group of three species, *aterrimum* Mosely, *davisi*, new species, and *gadzux*, new species.

DISTRIBUTION.—The species are found in the lowlands of South America, especially the northern Amazon Basin.

### *Leptonema aterrimum* Mosely

FIGURES 302–308, 795; MAP 11

*Leptonema aterrimum* Mosely, 1933:21–23, figs. 32–37 [holotype ♂, in NMW].—Fischer, 1963:167.—Flint, 1978:383.

TYPE-LOCALITY.—[Brazil], Unt[er] Amaz[on] Taperinha b[ei] Santarem.

DISTRIBUTION.—Brazil.

MATERIAL EXAMINED.—BRAZIL, [Edo. Pará], Unter Amazon, Taperinha near Santarém, 1–10 Jun 1927, Zerny, ♂ holotype. Holotype in NMW.

REMARKS.—We have studied the holotype whose abdomen is mounted on a slide, and prepared figures of the dorsal and ventral view of the phallus as best as can be made out. The original figures of Mosely seem to be accurate. The female paratype from Serra do Itatiaya, which was also studied, is clearly not this species, but possibly *maculatum*. The basal abdominal sternum appears to lack the mesal suture.

### *Leptonema davisi*, new species

FIGURES 309–316, 797; MAP 11

MALE.—Color greyish brown; forewing greyish brown with paler, more golden spots; hindwing infusate apically. Length of forewing, 7.5–8 mm.

Malar space broad, just over  $\frac{1}{4}$  height of eye, with a few short setae. Parafacial area more than half as broad as malar; postocular area as broad as malar, with numerous, short, dark setae. Maxillary palpus with fifth segment approximately  $\frac{3}{4}$  length of 4 basal segments combined. Foretibia with only a single apical spur. Process of fifth sternum very large, ovoid; with posterolateral margin much upraised and overlaying sternum.

*Genitalia*: Ninth segment broad dorsally and ventrally with posterolateral margin produced into a large lobe; lacking large dorsal setae. Tenth tergum lacking warts, with lateral lobe appressed to side of mesal lobe whose apex is produced into a broadly rounded lobe; ventral margin developed into a small process ending just beyond lateral lobe. Clasper with apical segment half length of basal segment, with a few mesal spines; basal segment with many mesal spines. Phallus complex (relationship of parts are still obscure even after dissection of one male), base broad, almost at right angles to stem that at midlength is divided into 3 plates: dorsal plate lightly sclerotized, overlaying most of basal areas of others and which is complexly related to phallocrypt and ventral rods of tenth tergum; a central plate ending in a divaricate sclerite bearing 2 pairs of slender, serrate processes directed basad and bearing mesally the phallosomal sclerites; the ventral plate ends in a lyre-shaped sclerite as best seen in ventral aspect.

FEMALE.—Similar in size and color to male.

TYPES.—*Holotype* (male): VENEZUELA, *T.F. Amazonas*, Cerro de la Neblina, basecamp,  $0^{\circ}50'N$ ,  $66^{\circ}10'W$ , 140 m, 23 Feb 1985, P.J. Spangler et al.

*Paratypes*: Same, but 14 Feb 1985, 1♂, 1♀; same, but 4–12 Feb 1984, Davis and McCabe, 1♀.

Holotype in USNM; paratypes in IZAM and USNM.

REMARKS.—This species in size and maculation appears to be identical to *aterrimum*. It appears, however, to be quite different in certain structures of the male genitalia, espe-

cially the clasper whose apical segment is much longer in *davisi* than in *aterrimum*. The structure of the phallus appears to be radically different in the two species, but the complexity of this structure and its obscurity in both may result in more apparent than real differences. The ventral plate appears to end in a reflexed process in *aterrimum*, but a lyre-shaped sclerite in *davisi*, and the central plate in a reflexed process and a semierect, truncate lobe in *aterrimum* as opposed to 2 pairs of reflexed processes in *davisi*.

### *Leptonema gadzux*, new species

FIGURES 317–323; MAP 12

**MALE.**—Color in alcohol brown; forewing denuded, brown with scattered, pale spots along the costal margin, especially near the chord, and to a lesser degree in centers of apical cells. Length of forewing 7.5 mm.

Malar space broad, over  $\frac{1}{4}$  height of eye, with a few short setae. Parafacial area half as broad as malar; postocular area as wide as malar with scattered, short, dark setae. Maxillary palpi lacking. Foretibia with a single apical spur. Processes of fifth sternum very large, ovoid; with posterolateral margin much upraised and overlaying sternum.

**Genitalia:** Ninth segment with posterolateral margin slightly expanded and flared laterad; with few dorsal and lateral setae. Tenth tergum lacking warts; with lateral and mesal lobes elongate, free; with an internal sclerite articulating with aedeagus at midlength. Clasper with apical segment  $\frac{1}{4}$  length of basal segment, with a few mesal spines; basal segment with a cluster of short spinous setae apicomesally, inner margin with scattered, long, spinous setae, base projecting apicomesally, with an erect, bilobate process mesally. Phallus with base elongate, only gradually angled to axis of stem, produced far basad beyond base of clasper to which it is attached by lateral sclerites; stem beyond bend deeply concave and membranous beneath with lateral margins sclerotized and produced ventrad, flange-like, base of flange produced into a large, pointed process, apex of flange developed into a ventral, recurved hook; from apex a membranous lobe bearing the phallotremal sclerites.

**FEMALE.**—Unknown.

**TYPE.**—*Holotype* (male): VENEZUELA, *T.F. Amazonas*, San Carlos de Río Negro,  $1^{\circ}56'N$ ,  $67^{\circ}03'W$ , 6–12 Dec 1984, R.L. Brown. *Holotype* in USNM.

**REMARKS.**—This most unusual species seems to be best placed in the *davisi* group, but the phallus is quite different from the other species. The presence of a mesobasal lobe on the clasper, the large apicolateral hooks and basolateral processes from the phallus are diagnostic for this species.

### The *speciosum* Group

**DIAGNOSTIC CHARACTERS.**—Size moderately large, forewing from 16–21 mm in length. Color variable, some

subgroups greenish with fuscous nygmata, others ochraceous and often strongly maculate. Tibial spurs 2, 4, 4. Middle tibia of female not broader than in male. Malar space narrow to rather broad, bare. Basal abdominal sternum with mesal suture. Male tenth tergum with wart *a* large and erect, warts *b* and *c* apparently lacking; lateral lobe narrow, elongate. Phallus rather simple, lacking most processes, but with *b* and *c* fused and strongly sclerotized, usually with *g* or *d* well developed. Clasper without specialized setulae or lobes on basal segment.

**REMARKS.**—This is a rather heterogeneous group of 10 species but it is held together by the remarkable similarity of the tenth tergum in all species, and the fused *b* and *c* lobes of the phallus. We recognize three subgroups. The first consists of *eugnathum* (Müller), and *trispicatum*, new species. They are characterized by the ovoid shape of the fused *b-c* lobe of the phallus. The second subgroup has the fused *b-c* lobe elongate and often pointed or bearing points, and the process *g* very long, often surpassing *b-c*. This subgroup contains *speciosum* (Burmeister), *tridens* Mosely, *bifurcatum*, new species, and *boraceia*, new species. The third subgroup containing *agraphum* (Kolenati), *tholloni* (Navás), *stigmaticum* Navás, and probably *serranum* Navás, is defined by the tripartite appearance of the fused *b-c* lobe, and strong development of process *d*. In addition the first and last subgroups are, in general, a bit smaller in size and rather uniformly colored (probably light green in life) than is the larger and rather strikingly colored middle group.

**DISTRIBUTION.**—Limited to the mountains of eastern Brasil.

### *Leptonema agraphum* (Kolenati)

FIGURES 324–328

*Macronema agraphum* Kolenati, 1859:148, 168 [misspelled as *agrophum*], 188, 238, 239, pl. 11: fig. 2 [holotype  $\delta$ , in NMW].

*Leptonema agraphum* (Kolenati).—Ulmer, 1957:339.—Fischer, 1963:165, 166.

*Hydropsyche trilobata* Jacquemart, 1962:1–5, figs. 1–4 [type  $\delta$ , in IRSNB] [new synonymy].

**TYPE-LOCALITIES.**—Of *agraphum*, Brasilia (Beske). Of *trilobata*, Edo. Rio de Janeiro, Bomanca.

**DISTRIBUTION.**—Brazil.

**MATERIAL EXAMINED.**—"Brasilia," holotype  $\delta$ . In NMW.

**REMARKS.**—Ulmer (1913) recorded this species from Argentina, Bolivia, and Peru. The male from Argentina (now in the ZSZMH) has been examined: it is *boliviense*. The male from Peru was made a paratype of *boliviense*. It is wholly unlikely that the Bolivian female is *agraphum*, but again probably *boliviense*.

This species, *tholloni*, and *stigmaticum* are very closely related. The three species appear identical in the fifth sternal processes, ninth and tenth segments, claspers and basal region of the phallus. The only differences are in the form of process *d* of the phallus. In *agraphum* the apical



point is acute and upturned and the basal point arises laterally. In *tholloni* the apical and basal points both arise dorsolaterally and the apical point is curved ventrad. In *stigmaticum* the apical point is replaced by a broad, truncate lobe and the basal point arises dorsolaterally. The positions and directions of the points could be controlled by some sort of rotation of process *d*, but we have been unable to do so artificially. Therefore, we recognize the 3 species for now, but recognize the possibility that additional series from other localities may well show these differences to be variation.

### *Leptonema bifurcatum*, new species

FIGURES 329–335; MAP 13

*Leptonema speciosum* (Burmeister).—Mosely, 1933:15–17, figs. 13–16 [misidentification].

**MALE.**—Color brown; forewing brown, faded, apparently with a darker spot on the nygma and some darkened areas apically and mesally, but without apparent longitudinal dark streaks. Length of forewing, 16 mm.

Malar space narrow, about  $\frac{1}{5}$  height of eye. Parafacial area about  $\frac{3}{5}$  width of malar; postocular area about width of parafacial; type lacks all postocular setae. Basal segment of maxillary palpus  $\frac{3}{7}$  length of second, third  $\frac{3}{7}$  length of second, fourth  $\frac{3}{7}$  length of second, fifth segment lacking. Processes of fifth sternum small, rounded.

**Genitalia:** Tenth tergum with wart *a* large, rounded; warts *b* and *c* lacking; lateral lobe elongate, rounded apically;

mesal lobe membranous. Clasper with apical segment elongate, about  $\frac{1}{3}$  length of basal segment; base of clasper without processes. Phallobase short and broad, basal half at right angles to stem and greatly enlarged; process *a* slightly produced and serrate dorsally, process *g* large, with a small basolateral spine and bifurcate apically; fused *b-c* lobe hourglass shaped in ventral aspect with a pair of small basal spines and bifid apically, tip upturned in lateral aspect.

**FEMALE.**—Similar in color to male, but badly faded. Length of forewing 16 mm.

**TYPES.**—*Holotype* (male): BRAZIL, *Edo. Espírito Santo*, ex coll. Fruhstorfer.

*Paratype:* Same data, 1♀.

Types in NMW.

**REMARKS.**—This species has been confused with *speciosum* and was figured as such by Mosely (1933). Now, with the study of the type of *speciosum*, the distinctness of the two species is apparent.

The species is similar to *speciosum* and *tridens*, but can be distinguished by the structure of the phallus. The deeply bifid apex of process *g* in *bifurcatum* is diagnostic. The complex *b-c* is quite similar in lateral aspect to that of *tridens*, but its outline in dorsal or ventral aspect differs considerably in the two species.

### *Leptonema boraceia*, new species

FIGURES 336–343, 796; MAP 13

**MALE.**—Color brown; forewing brown, densely covered with short, fuscous hairs, producing distinct, longitudinal, dark marks in many cells, especially the apical ones. Length of forewing, 18–19 mm.

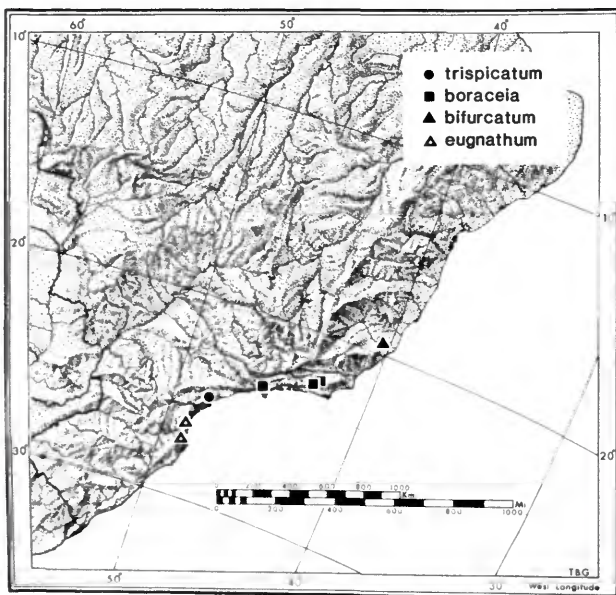
Malar space rather broad, slightly more than  $\frac{1}{4}$  height of eye. Parafacial area in middle about  $\frac{1}{2}$  width of malar; postocular area slightly wider than parafacial, with a row of 6 stout setae. Maxillary palpus with apical segment very long, as long as combined lengths of basal 4 segments. Process of fifth sternum large, rounded.

**Genitalia:** Tenth tergum with wart *a* large, rounded; warts *b* and *c* lacking; lateral lobe elongate, broadly rounded apically; mesal lobe membranous. Clasper with apical segment elongate, about  $\frac{1}{3}$  length of basal segment; base of clasper unmodified. Phallobase short, broad, ending bluntly; with processes *g* heavily sclerotized, divergent, upturned; *b-c* complex bearing laterally 2 basally directed and 2 apically directed processes, dorsalmost of each pair being shortest, with a ventromesal pointed process.

**FEMALE.**—Similar to male in size and maculation.

**TYPES.**—*Holotype* (male): BRAZIL, *Edo. São Paulo*, Estacao Biologica Boraceia, Mun. Salesópolis, 17–19 Jan 1957, L. and E. Buckup, M. Carrera and L. Travassos F.

*Paratypes:* Same data, 1♂; same, but Rib. Venerando, 27 Jan 1974, C. Froehlich, 1♂. *Edo. Rio de Janeiro*, Nova



MAP 13.—Distributions of *Leptonema trispicatum*, new species, *L. boraceia*, new species, *L. bifurcatum*, new species, and *L. eugnathum* (Müller).



Friburgo, 1000 m, 14 Oct 1985, S.E. Miller, 1♂, 5♀; Rio Macacu (N of Cachoeiras de Macacu), 650 m, 16 Oct 1985, S.E. Miller, 1♂.

Holotype in USP; paratypes in USNM and USP.

REMARKS.—This very distinctive species is clearly related to *speciosum* and *tridens*. Its is easily recognized by the structures of the lobes at the apex of the phallus.

### *Leptonema eugnathum* (Müller)

FIGURES 344–349; MAP 13

*Macronema eugnathum* Müller, 1921:536, 548, 552–554, figs. 187D, 199, 201A,B [type not designated].—Fischer, 1963:184.

*Leptonema ochraceum* Mosely, 1933:28–30, figs. 60–64 [holotype ♂, in ZSZMH, destroyed 1943].—Ulmer, 1957:341, 344 [synonymy].—Fischer, 1963:171; 1972:156.—Weidner, 1964:84.

*Leptonema eugnathum* (Müller).—Ulmer, 1957:336, 338, 341, 344.

TYPE-LOCALITIES.—Of *eugnathum*, Itajahy, [Sta. Catarina], Brazil. Of *ochraceum*, Boiteuxburgo, 800 m, Sta. Catarina, Brazil.

DISTRIBUTION.—Brazil.

MATERIAL EXAMINED.—Lectotype male, here designated, "Itajahy, Brazil, 20/2 79, Fr. Müller, *Macronema* A." Additional material: [Edo.] S. Catarina, Brazil, F. Müller, 1♂. Edo. Paraná, 8 km NE Banhado, 12 Feb 1972, E.G., I., and E.A. Munroe, 1♂. [no data], McLachlan collection, 1♂. Lectotype in MCZ; material in BMNH and CNC.

REMARKS.—We designate the above specimen as a lectotype, although the adult stage is no more than mentioned in passing by Müller. This specimen, probably reared, is labelled in Müller's hand, and we believe it to have been in front of him when he was describing the species. It was later sent to Hagen and placed in the collection of the MCZ together with examples of his other species.

This species is very closely related to *Leptonema trispicatum*, new species. It is distinguished by the proportionally shorter and broader phallus with the pair of ventrolateral spines (process *g*?) just before the fused *b-c* lobe.

### *Leptonema serranum* Navás

*Leptonema serranum* Navás 1933b:112, 113, fig. 8 [holotype ♀, in DEI].—Fischer, 1963:172.

TYPE-LOCALITY.—Alto da Serra, Edo. São Paulo, Brasil.

DISTRIBUTION.—Brazil.

MATERIAL EXAMINED.—BRAZIL, Est. São Paulo, Alto da Serra, 1 Nov 1926, Melsner, holotype ♀. In DEI.

REMARKS.—The unique female type has been seen and the genitalia cleared and studied. It is clearly a member of the *speciosum* group close to *agraphum*. However, there appear to be differences in the genitalia between this type and the few other females of the group available. We are, therefore, maintaining *serranum* but it may ultimately prove to be a synonym of one of the other species in the group.

### *Leptonema speciosum* (Burmeister)

FIGURES 350–356, 798; MAP 14

*Macronema speciosum* Burmeister, 1839:916 [lectotype ♂, in ZIUH].—Fischer, 1963:173.

TYPE-LOCALITY.—Brazil.

DISTRIBUTION.—Brazil.

MATERIAL EXAMINED.—Lectotype male, herein designated, "Bras.Besk.," "*Macronema*\* *Macronema* Pict. *speciosum*\*," "Lectotype *Macronema speciosum* Burm. By Flint, 1979." Additional Material: Same data, 2♀. Lectotype in ZIUH; material in NMW and ZIUH.

REMARKS.—We have been fortunate to have been able to borrow and clear the genitalia of the lectotype of this species. This has revealed a species distinctly different from that treated as *speciosum* by Mosely (1933). In fact, we have seen no examples of this species other than the type series. Bescke (or Beske), father and son, lived and worked around Nova Friburgo from 1822 to 1852. They sent material to Europe that was distributed to specialists by Winthem, and the son was visited by Burmeister from the end of 1850 to early 1851 (Papavero, 1971:87–89; 1973:292, 293). The types therefore probably originated in or around Nova Friburgo.

Together with *tridens* and *boraceia*, this species forms a very distinct subgroup of the *speciosum* group. The specific characters are found in the apex of the phallus. Process *a* is barely recognizable, process *g* is long, gently curved and sword-like, while the *b-c* complex is short, directed ventrad, and ends in a short, serrate, bifid lobe.



MAP 14.—Distributions of *Leptonema stigmaticum* Navás, *L. speciosum* (Burmeister), *L. tridens* Mosely, and *L. tholloni* (Navás).

***Leptonema stigmaticum* Navás**

FIGURES 357–363; MAP 14

*Leptonema stigmaticum* Navás, 1916a:30, 31, fig. 12 [holotype ♀, originally in Navás Collection, now destroyed].—Fischer, 1963:173.

TYPE-LOCALITY.—Nueva Friburgo [Nova Friburgo], Brazil.

DISTRIBUTION.—Brazil.

TYPES.—Neotype male, herein designated, BRAZIL, *Edo. Rio de Janeiro*, 26 km E Nova Friburgo, 25 Apr 1977, C.M. and O.S. Flint, Jr. Material: Same data, 3♂, 2♀; same, but 19 Apr 1977, 3♂, 3♀. Neotype in USP; topotypes in CNC and USNM.

REMARKS.—This material, taken near the type-locality, agrees in all particulars, especially the dark nygmal marks, with the original description, which its two congeners (*viridianum* and *pallidum*) taken at the same time do not. In the interest of nomenclatorial stability, we designate a neotype from this series. As outlined under *agraphum*, *stigmaticum* is a member of a small cluster of closely related species. *Leptonema stigmaticum* is to be recognized by the lack of an acute apical point from process *d* of the phallus.

***Leptonema tholloni* (Navás)**

FIGURES 364–367; MAP 14

*Macronema tholloni* Navás, 1922:48, 49 [holotype ♂, in MNHNP].

*Leptonema tholloni* (Navás).—Fischer, 1963:173.

TYPE-LOCALITY.—Gabon [Africa] [in error].

DISTRIBUTION.—Brazil.

MATERIAL EXAMINED.—[BRAZIL, *Edo. Rio de Janeiro*] Corcovado, Apr 1932, Haroldo T., 1♂. Brazil, Winthem and Hagen [no further data], 2♂, 1♀. Material in MCZ, INHS, and USNM.

REMARKS.—The discovery of examples from Brazil that agree with the figures of the type (Mosely, 1933, figs. 65–68), leads inevitably to the conclusion that the type is mislabelled.

As discussed under *agraphum*, the two species are virtually identical as stated by Mosely (1933). The acute apical point of process *d* is directed ventrad and the basal point is borne dorsolaterally in *tholloni*.

***Leptonema tridens* Mosely**

FIGURES 368–372; MAP 14

*Leptonema tridens* Mosely, 1933:17, 18, figs. 17–21 [holotype ♂, in BMNH].—Fischer, 1963:174.

*Leptonema speciosum* (Burmeister).—Navás, 1932:63 [misidentification].

TYPE-LOCALITY.—Parana, Brazil.

DISTRIBUTION.—Brazil (possibly Paraguay).

MATERIAL EXAMINED.—BRAZIL, *Edo. Rio de Janeiro*,

Barão Homem de Mello, 14 Feb 1928, Zikan, 1♂; Itatiaya (800 m elev.), C. Moreira, 3♂, 1♀; same, but Aug 1902, 1♀; same, but Dec 1903, 1♀; same, but Registro Pass, 1700 m, 18 Oct 1985, S.J. Miller, 1♂. *Edo. São Paulo*, C. Jordão, Eng. Lefevre, 1200 m, 26 Oct 1962, Rabello and Dente, 1♀; same, but 21 Dec 1962, Rabello and Madeiros, 1♀. PARAGUAY, Italyaia, F. Schade, 1♂, 1♀. Material in MCZ, MNRJ, MZB, USNM, and USP.

REMARKS.—We have studied the male from Barão Homem de Mello (near the present railroad stop, Itatiaya) that is the basis for the Navás (1932) record of *speciosum*, and found it to be a male *tridens*. The record of the species from Italyaia, Paraguay, is rather surprising on zoogeographical grounds. We are unable to find the locality in any gazetteer, and are struck by the visual similarity of the word to Itatiaya and believe that the original data was misinterpreted and the specimens are mislabelled (the labels are handwritten by N. Banks).

The species resembles both *speciosum* and *boraceia* both in maculation and genitalic structure. It may be recognized by the form of the processes *g* of the phallus, which in *tridens* are as long as the *b-c* lobe and rather bluntly pointed. The *b-c* lobe in lateral aspect is rather long, curved and pointed. Process *a* is bilobed in dorsal aspect and erect in lateral aspect.

***Leptonema trispicatum*, new species**

FIGURES 373–380; MAP 13

MALE.—Color of specimen in alcohol, pale brown. Length of forewing 17 mm.

Malar space rather broad, about ¼ width of eye. Parafacial area about ⅓ width of malar. Postocular area slightly narrower than malar; with a row of 6 stout setae. Maxillary palpus with apical segment very long, as long as combined length of other segments. Process of fifth sternum broad, round.

*Genitalia*: Tenth tergum with wart *a* large, rounded; warts *b* and *c* lacking; lateral lobe elongate, broadly truncate apically; mesal lobe membranous. Clasper with apical segment slender, about ¼ as long as basal segment; base of clasper unmodified. Phallus ending in a large, rounded, heavily sclerotized *b-c* lobe slightly divided apicomeresally and bearing 2 small pairs of lobes dorsally and a pair of ventrobasal lobes; phallobase ending in a midventral, trifid projection between the ventrobasal lobes of *b-c*.

FEMALE.—Unknown.

TYPE.—Holotype male, BRAZIL, *Edo. São Paulo*, Municipalidade de Iporanga, 1 Nov 1961, Lenko and Reichardt. Holotype in USP.

REMARKS.—The species is closely related to *eugnathum*, having similar ninth and tenth terga and claspers. However, there are several radical differences in the phallus, in spite of its overall similarity. The phallobase is proportionately

more slender and elongate in *trispicatum* and ends in a trifid, apicoventral process rather than a pair of divergent spines. The apical lobe of the phallus possesses a pair of basally directed ventral lobes, one on each side of the trifid process, in *trispicatum*.

### The *stigosum* Group

**DIAGNOSTIC CHARACTERS.**—Size large; forewing up to 25 mm long. Color uniformly rusty brown to pale yellow; nygmata surrounded by a ring of blackish hair. Tibial spurs 2, 4, 4. Middle tibia of female not broader than in male. Malar space relatively narrow; bare. Basal abdominal sternum with a median suture. Male tenth tergum with warts *a* and *b*, wart *c* not evident; lateral lobe present, flattened, blade-like; median lobe membranous. Basal segment of clasper without stout setulae or basomedian lobe. Phallus with paired processes, these usually "feathered," i.e., with abundant, quill-like vestiture; processes *f*, *g*, and *j* rudimentary or absent.

**REMARKS.**—Five species are placed in this group: *stigosum* Ulmer, *neadelphus*, new species, *spirillum*, new species, *auriculatum*, new species, and *boliviense* Mosely with subspecies *boliviense* and *plumosum*, new subspecies.

**DISTRIBUTION.**—The Andes of western South America from central Venezuela to northwestern Argentina.

### *Leptonema auriculatum*, new species

FIGURES 381–386; MAP 15

**MALE.**—Color ochraceous; forewing ochraceous slightly darker along chord and in cells, nygmata dark. Forewing length 19–20 mm.

Malar space relatively broad, almost  $\frac{1}{3}$  height of eye. Parafacial area  $\frac{2}{3}$  width of malar space; postocular area same width as parafacial; with 8–9 postocular setae. Processes of fifth sternum medium in size, oval in shape.

**Genitalia:** Clasper with moderately long apical segment, almost  $\frac{1}{2}$  length of basal. Tenth tergum with lateral lobe rather small, with setae borne on a convex lobe; warts *a* and *b* united, developed as a series of small lobes and large setae on protuberant bases. Phallus relatively simple; process *c* ear-like with *b* a small dorsal angle from it; processes *d* and *e* very small and rudimental, only a few small points each.

**FEMALE.**—Unknown.

**TYPES.**—*Holotype* (male): BOLIVIA, *Dpto. La Paz*, quebradas del Río Zongo, 1400 m, 24–30 Oct 1984, L.E. Peña G.

*Paratypes:* Same data, 18♂; Unduavi/Coroico, 2500 m, 19–25 Nov 1984, L.E. Peña G., 1♂. Yungas La Paz, Circuata to Cajuata, 2400 m, 3–5 Dec 1984, L.E. Peña G., 1♂. [*Dpto. Cochabamba*], Incachaca, 2500 m, J. Steinbach, Acc. 6873, 1♂.

Holotype in USNM; paratypes in CMP, CNC, and USNM.

**REMARKS.**—*Leptonema auriculatum* is most closely related to *boliviense*, but none of the phallic processes are "feathered," and *d* and *e* are reduced in size to only a few points as in *b. plumosum*. In addition *auriculatum* differs in possessing a long apical segment of the clasper and in having the tenth tergal lobes differently developed.

### *Leptonema boliviense boliviense* Mosely

FIGURES 387–391; MAP 16

*Leptonema boliviense* Mosely, 1933:36, 37, figs. 87–92 [holotype ♂, in ZSZMH, destroyed 1943].—Fischer, 1963:167.—Schmid, 1964:317 [in part].—Weidner, 1964:83.—Flint, 1975:570, fig. 1.

*Leptonema agraphum* (Kolenati).—Ulmer, 1913:393 [misidentification].

**TYPE-LOCALITY.**—Tipuani, Quellft d'Beni, Bolivia.

**DISTRIBUTION.**—Argentina, Bolivia, Peru.

**MATERIAL EXAMINED.**—ARGENTINA, *Pcia. Jujuy*, San Lorenzo, 1♂. *Pcia. Salta*, Rt 59, km 23.5, Cañada de la Gotera, 16–17 Oct 1973, O.S. Flint, Jr., 1♂, 2♀. BOLIVIA, [*Dpto. La Paz*], Yungas La Paz, Coripata, Río Santiago, 1600 m, 2 Dec 1984, L.E. Peña G., 3♂; Circuata to Cajuata, 2400 m, 2–5 Dec 1984, L.E. Peña G., 6♂, 1♀; Mururata to Cusilloni, 1600 m, 26–28 Nov 1984, L.E. Peña G., 28♂, 23♀; Nagalani River, 13 km from Sacramento Camp on Ingavi-Coroico Rd., 1400 m, 11 Jul 1964, B. Malkin, 1♂; Coroico, 2299 m, 23–24 Nov 1984, L.E. Peña G., 12♂, 13♀; quebradas del Río Zongo, 1400 m, 24–30 Oct 1984, L.E. Peña G., 37♂, 26♀; Coroico to Chulumani, 1800–2100 m, Nov–Dec 1984, L.E. Peña G., 1♂. *Dpto. Cochabamba*, Río Ronquito, road to Villa Tunari, Chapare, 1900 m, 10–11 Dec 1984, L.E. Peña G., 26♂, 35♀; Chapare, Alto Palmar, 1100 m, Nov 1960, J.E. Foerster, 5♂; same, but Apr 1959, 5♂, 3♀; same, but 16 Mar 1961, 1♂, 6♀; same, but 22 Mar 1962, 1♂. *Dpto. Chuquisaca*, Incahuasi, E Muyu Pampa, 1600 m, 23 Dec 1984, L.E. Peña G., 1♂. PERU, [*Dpto. Cuzco*], Aguascalientes [2 km N Machu Picchu], 2100 m, 16 Dec 1976, Hooghlemstra and v. Huis, 5♂, 1♀; Torentoy Canyon, base of Machu Picchu, forest trail night sweeping, 2000 m, 19–24 Jun 1964, B. Malkin, 1♂; same, but 3 July 1964, light, 8♂; same, but Machu Picchu, 6 Aug 1971, B.V. Ridout, 2♀; same, but 8000', 8 Aug 1973, 1♂, 2♀; same, but museum, 1385 m, 11–14 Aug 1971, C. and M. Vardy, light, 1♂, 5♀. Material in BMNH, CNC, ITZ, USNM, USP, and ZSZMH.

**REMARKS.**—The two subspecies are identical in all characteristics except that subspecies *plumosum* is a bit larger and darker and that processes *d* and *e*, which are elongate in *boliviense*, are reduced to points in *plumosum*.

### *Leptonema boliviense plumosum*, new subspecies

FIGURES 392–396; MAP 16

**MALE.**—Wings dull brown, discolored; with the usual 2 fuscous spots. Forewing 16 mm.





MAP 15.—Distributions of *Leptonema auriculatum*, new species, and *L. spirillum*, new species.

Malar space rather narrow, about  $\frac{1}{5}$  height of eye. Parafacial area  $\frac{2}{3}$  width of malar space; postocular area same width as parafacial; with 7–8 postocular setae. Processes of fifth sternum medium-sized.

*Genitalia*: Ninth segment, tenth tergum and claspers similar to those of *boliviense*. Phallus basically identical to that of *boliviense* except that processes *d* and *e* reduced to short points.

*FEMALE*.—Unknown.

*TYPES*.—*Holotype* (male): ARGENTINA, *Pcia. Tucumán*, Cumbre Taficillo, 10 Dec 1929.

*Paratypes*: Same data, 1♂; Quebrada la Toma de Tafi Viejo, 21 Dec 1950, R. Golbach, 1♂ (headless).

*Holotype* USNM; paratypes IML, CNC.

*REMARKS*.—In most respects this would appear to be typical *boliviense*. However, processes *d* and *e* of the phallus are reduced, being no more than a point or two directly attached to the sides of the phallus but in exactly the same position as in the typical subspecies. The internal structure and processes *b* and *c* of the phallus, and all other parts of the genitalia are identical in both subspecies, however. The distribution of *plumosum* is the southernmost of the *stigma-sum* group, and it would appear to be a restricted population isolated in a small mountain range just west of Tucumán, Argentina, somewhat to the south and east of the range of the nominal form.





MAP 16.—Distributions of *Leptonema stigosum* Ulmer, *L. neadelphus*, new species, *L. b. boliviense* Mosely, and *L. b. plumosum*, new subspecies.

### *Leptonema neadelphus*, new species

FIGURES 397–404; MAP 16

**MALE.**—Color rusty brown; forewing rusty brown with distinct clusters of fuscous hair around the nygmata. Length of forewing 19–21 mm.

Malar space moderately wide, slightly less than  $\frac{1}{3}$  height of eye. Parafacial area about  $\frac{1}{3}$  width of malar; postocular area width of parafacial; with a row of 5–7 stout setae. Maxillary palpus with fifth segment shorter than basal 4 combined. Processes of fifth sternum small, ovoid.

**Genitalia:** Tenth tergum like that of *stigosum*; except that warts *a* and *b* are well separated. Clasper unmodified; apical segment terete, with short, peg-like setae mesally, slightly less than  $\frac{1}{3}$  length of basal segment. Phallus with processes *b* and *c* united into a spinose fan, *e* reduced into a small lobe with a row of setae, *d* reduced to a few small points.

**FEMALE.**—Similar to male in size and color.

**TYPES.**—*Holotype* (male) COLOMBIA, *Dpto. Antioquia*, 10 km E Medellín, road to La Palma, 6 Feb 1983, O.S. Flint, Jr.

*Paratypes:* Same, but road to Santa Elena, 12 km E

Medellín, 6 Feb 1983, 1♂; same, but Quebrada la Garcia, 20 km NW Medellín, 13 Feb 1983, 1♂; same, but Quebrada la Mosca, 1 km W Guarne, 7 Feb 1983, 1♂; same, but Piedras Blancas, 10 km E Medellín, road to Guarne, Apr 1963, 1♂. VENEZUELA, *Edo. Mérida*, Mucuy Fish Hatchery, 7 km E Tabay, 6600 ft, 10–13 Feb 1978, J.B. Heppner, 2♂.

Holotype in USNM; paratypes in USNM, CNC, IZAM, UNCMB.

REMARKS.—The species is closely related to *stigmatosum*, but the two species are sympatric in Colombia and Venezuela. The primary differences are to be seen in the apex of the phallus whereon processes *c* and *e* are reduced to spinose fans and *d* is represented by only a few small points.

From *spirillum*, with which it shares the reduction of process *d* to only a few small points, *neadelphus* differs by having reduced the elongate lobes of processes *c* and *e* to clusters of spines.

### *Leptonema spirillum*, new species

FIGURES 405–413; MAP 15

*Leptonema stigmatosum* Ulmer.—Mosely, 1933:14, 15, figs. 8–12 [misidentification].

MALE.—Wings almost uniformly ochraceous-yellow, with 2 small dark spots, surrounded by fuscous hair. Forewing length 17–18 mm.

Malar space rather narrow, about 1/5 height of eye. Parafacial area barely 2/5 width of malar space; postocular area about width of parafacial; with 4–6 postocular setae. Maxillary palpus with fifth segment slightly more than 2/3 length of basal 4 segments combined. Processes of fifth sternum rather small.

*Genitalia*: Tenth tergum similar to that of *stigmatosum* except wart *b* is displaced apicad and well separated from *a*. Clasper similar to that of *stigmatosum*. Phallus with processes *b*, *c*, and *e*, well developed, “feathered” (process *e* in Ecuadorian material smaller and directed posteriad), process *d* present though rudimentary.

FEMALE.—Similar to male in size and color.

TYPES.—*Holotype* (male): PERU, *Dept. Cuzco*, Paucartambo, Cosñipata Valley, 17 Nov 1951, F. Woytkowski.

*Paratypes*: Same data, 15♂, 3♀; same, but 16 Nov 1951, 5♂; same, but 19 Nov 1951, 1♂, 2♀; same, but 20 Nov 1951, 2♂; same, but 26 Nov 1951, 1♂; same, but Santa Isabel, Cosñipata Valley, 16 Dec 1951, 5♂; same, but Hacienda Maria (tropical jungle), 2700', Cosñipata Valley, 21 Feb 1952, 2♂; same, but 11 Mar 1952, 2♂; same, but 19 Mar 1952, 1♂; same, but Callanga River Valley, “Callanga,” 1300 m, 26–27 Feb 1953, 3♂; same, but 19 Feb 1953, 1♂, 1♀; same, but 4 Mar 1953, 1♀; Quince Mil, 14–31 Aug 1962, L.E. Peña G., 32♂, 32♀. BOLIVIA, *Dpto. Cochabamba*, Alto Palmir, Nov 1960, J.E. Foerster, 11♂, 2♀. COLOMBIA,

*Dpto. Antioquia*, Andes, Aug 1955, N. Delgado, 1♂; Río Aurrá, km 50 near San Jerónimo, 14 Feb 1983, O.S. Flint, Jr., 1♂, 1♀. *Dpto. Meta*, 24 mi W Villavicencio, 12 Mar 1955, 9♂. *Dpto. Valle*, Topacio, 1600 m, 13 Sep 1985, A. Quintero, 1♂, 1♀; same, but Río Pance, Topacio, 1550 m, 5 Aug 1985, 1♂ with exuviae. ECUADOR, *Pcia. Tungurahua*, 17 km E Baños, 28 May 1975, Langley and Cohen, 1♂, 1♀; same, but 39 km E Baños, 4200', 25 Jan 1976, Spangler et al., 6♂, 13♀. *Pcia. Pastaza*, 16 km W Puyo, 3 Feb 1976, Spangler et al., 1♂, 3♀; same, but 22 km W Puyo, 5 Feb 1976, 1♂. *Pcia. Napo*, San Francisco de Borja, 15 May 1975, Spangler et al., 1♂. VENEZUELA, *Edo. Mérida*, Río Montalbán, rt 4, 19 km W Mérida, 20 Feb 1976, C.M. and O.S. Flint, Jr., 2♂, 2♀; same, but La Pedregosa, Mérida, 21 Feb 1976, 1♂, 1♀; same, but 31 May 1976, Menke and Vincent, 1♂, 1♀; same, but 6 km W Mérida, 5000', 9 Feb 1978, J.B. Heppner, 4♂, 15♀.

Holotype in USNM; paratypes in AMNH, CAS, CNC, INHS, IZAM, MCZ, UNCMB, and USNM.

REMARKS.—*Leptonema spirillum* is more similar to *stigmatosum* and *neadelphus* than to the other members of the *stigmatosum* group. It is easily identified by the characters of the phallus used in the key, and as discussed under the other two species.

### *Leptonema stigmatosum* Ulmer

FIGURES 414–418; MAP 16

*Leptonema stigmatosum* Ulmer, 1905a:60, pl. 3: fig. 10. [lectotype ♂, in PAN].—Fischer, 1963:173; 1972:157.—Schmid, 1964:317 [in part].—Weidner, 1964:84.—Flint, 1966:6, fig. 2n–q [lectotype].

TYPE-LOCALITY.—Balzapamba, Ecuador.

DISTRIBUTION.—Colombia, Ecuador, Venezuela.

MATERIAL EXAMINED.—COLOMBIA, *Dpto. Cundinamarca*, Monterredondo, 31 Jan 1959, J.E. Foerster, 1♂; same, but 22 Mar 1961, 1♀; same, but 1 Apr 1961, 1♂, 1♀; same, but 9 Apr 1961, 2♂; same, but alt. 1400 meters, 10 Apr 1961, 1♀. *Dpto. Antioquia*, Quebrada la Mosca, 1 km W Guarne, 7 Feb 1983, O.S. Flint, Jr., 1♂; Río Medellín, Est. Primavera, above Caldas, 1600 m, 30 Aug 1983, U. Matthias, 1♂; Medellín, 1♂. *Dpto. Valle*, Peñas Blancas, 1800 m, 17 Jan 1985, emerged in lab 22 Feb 1985, A. Quintero, 1♂, 1♀. VENEZUELA, *Edo. Barinas*, San Isidro, 14 km S La Soledad, 1500 m, 30–31 May 1964, R.E. Dietz, 1♂, 2♀. *Edo. Mérida*, Río Montalbán, rt 4, 19 km W Mérida, 20 Feb 1976, C.M. and O.S. Flint, Jr., 1♂, 2♀; Mucuy Fish Hatchery, 7 km E Tabay, 6600 ft, 10–13 Feb 1978, J.B. Heppner, 1♂. *Edo. Lara*, Yacambú Nat. Park, 13 km SE Sanare, 4800 ft, 4–7 Mar 1978, J.B. Heppner, 3♂; same, but 1200 m, 10 May 1981, H. Townes, 1♂. *Edo. Trujillo*, Bocanó, 12 Aug 1964, Osuna and Gelbes, 1♂. Material in USNM, CNC, IZAM.

REMARKS.—The lectotype of the species was designated

and illustrated by Flint (1966). The true *stigosum* is a different species from that figured by Mosely (1933), which is here described and named *spirillum*.

*Leptonema stigosum* is very similar to *neadelphus*, but is easily distinguished from that species by the following characters of the phallus: processes *d* and *e* are united forming a large and distinctly fan-shaped process, and processes *b* and *c* are united also, with *c* developed into an elongate "feathered" process.

From *spirillum*, another closely related species, *stigosum* can be separated by the differences in phallic process *e* which is reduced to only a few sessile points, and process *c* which is even more elongate process in *spirillum*. In addition warts *a* and *b* of the tenth tergum are closer together in *stigosum*.

### The *plicatum* Group

**DIAGNOSTIC CHARACTERS.**—Size moderately large; forewing 15–22 mm. Color green or greenish brown in life, fading to ochreous after death. Tibial spurs 2, 4, 4. Middle tibiae of female not broader than in male. Malar space narrow and bare. Fourth segment of maxillary palpus much shorter than third. Basal abdominal sternum with a median suture. Fifth sternal lobes usually very large, especially in males. Male tenth tergum with warts *a* and *b* elongate, projecting from behind lateral lobe; *a* usually, and *b* sometimes, divided into two lobes; wart *c* not recognizable; lateral lobe flattened, blade-like. Apical segment of clasper relatively long; basal segment without stout setulae or basomesal lobe. Phallus with processes *c* and sometimes *b* elongate and reflexed, *g* usually a broad lateral plate, often with points; *e*, *d*, and *j* lacking, *f* rarely present.

**REMARKS.**—This is a very large group of species closely related to the *simulans* group, which possesses a strongly developed process *j* of the phallus. We divide the *plicatum* group into two subgroups as follows.

The typical subgroup has the phallic process *g* produced, sometimes into a long process, processes *c* and often *b* are elongate, and processes *e* and *f* are lacking. The subgroup contains 15 species: *acutum* Mosely, *andrea*, new species, *araguense* Flint, *bilobatum* Schmid, *chiapense*, new species, *chila* Flint, *coheni*, new species, *heppneri*, new species, *inspiratum*, new species, *mastigion*, new species, *michoacanense*, new species, *plicatum* Mosely, *salvini* Mosely, *simplex* Mosely, and *vitum*, new species.

The *sinuatum* subgroup has similar developments of processes *b*, *c*, and *g*, but also has process *f* developed in some manner or other. The subgroup contains: *ekisi*, new species, *fortunum*, new species, *hamuli*, new species, *sinuatum* Mosely, *turrialbum*, new species, and *woldianum*, new species.

**DISTRIBUTION.**—The group is widely distributed in Mexico and Central America and along the Andes of northern

and western South America. The species are generally found in small, fast streams in the mountainous areas.

### *Leptonema acutum* Mosely

FIGURES 419–423; MAP 17

*Leptonema acutum* Mosely, 1933:61, 62, figs. 190–195 [holotype ♂, in BMNH].—Fischer, 1963:165.

**TYPE-LOCALITY.**—Pancina, Vera Paz [= Panimá, Baja Verapaz, Guatemala].

**DISTRIBUTION.**—Guatemala and Mexico.

**MATERIAL EXAMINED.**—[GUATEMALA], [Baja] Vera-paz, Pancina, Champion, ♂ holotype. MEXICO, Edo. Veracruz, Balzapote ["Los Tuxtlas"], 21 Dec 1976, J. Bueno S., 1♂; same, but Las Cabañas, "Los Tuxtlas," 8–15 May 1981, C.M. and O.S. Flint, Jr., 6♂, 2♀. Holotype in BMNH; material in IBUNAM and USNM.

**REMARKS.**—The type country given in the original description as "Panama" is incorrect. This was undoubtedly the result of misreading the locality Pancina on the label. The species is not known from Panama.

The species is a member of the typical *plicatum* subgroup. It is readily recognized by the long, slender process *b* and the even longer, reflexed, apical process *g* of the aedeagus and long slender lobes *a*, *b1* and *b2* of the tenth tergum.

### *Leptonema andrea*, new species

FIGURES 424–429; MAP 18

**MALE.**—Color pale greenish, fading to pale brown; forewing greenish with a slight indication of apical infuscation, Length of forewing, 14 mm.

Malar space intermediate in width, about 1/6 width of eye; parafacial and postocular areas about 3/4 width of malar; postocular area with a row of 4–5 setae. Maxillary palpus with apical segment 2/3 length of basal 4 segments combined. Process of fifth segment indistinct, but apparently large and ovoid.

**Genitalia:** Tenth tergum apparently lacking wart *a*, warts *b1* and *b2* elongate, *b2* displaced to posteroventral face; lateral lobe rounded apically. Clasper with apical segment long, terete; basal segment slightly more than 2 1/2 times length of apical, base unmodified. Phallobase elongate; with a strongly sclerotized, elongate, apicolateral plate (*g?*) bearing basoventrally a long filament wrapped around phallus.

**FEMALE.**—Unknown.

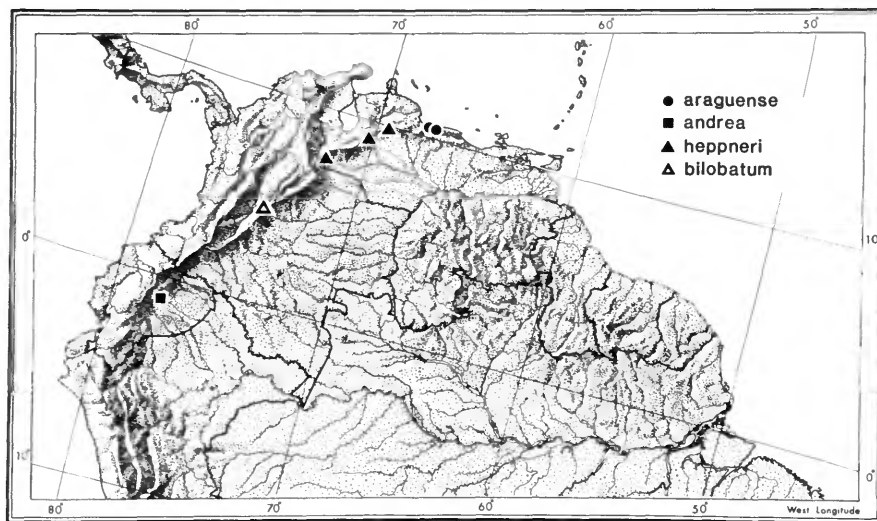
**TYPE.**—*Holotype* (male): ECUADOR, Pcia. Pastaza, Estacion Fluvio-metrico, 27 km N Puyo, 4 Feb 1976, P. Spangler, A. Langley, and J. Cohen. Holotype in USNM.

**REMARKS.**—This strange appearing species is a typical member of the *plicatum* group in all characters except the tip of the phallus, which is very unusual. No other species





MAP 17.—Distributions of *Leptonema acutum* Mosely, *L. chiapense*, new species, *L. chila* Flint, and *L. ekisi*, new species.



MAP 18.—Distributions of *Leptonema araguense* Flint, *L. andrea*, new species, *L. heppneri*, new species, and *L. bilobatum* Schmid.

has long filaments wound around the phallus. The species *mastigion* has long filaments from apicolateral plates of the phallus, that may be homologous and may represent a stage in the evolution of this structure.

### *Leptonema araguense* Flint

FIGURES 430-434; MAP 18

*Leptonema araguense* Flint, 1981:20, figs. 73-76 [holotype ♂, in USNM].

TYPE-LOCALITY.—Choroni Pass, 1400 m, Aragua, Venezuela.

DISTRIBUTION.—Venezuela.

MATERIAL EXAMINED.—No additional material seen beyond that recorded in original description.

REMARKS.—This species is very closely related to *Leptonema heppneri*, which is found in the next mountain range to the west of that of *araguense*. They are similar to *acutum* with which they share the form of the tenth tergum and rather simple development of the phallus. In all species process *b* of the phallus is long and slender, but in *araguense* process *g* is apparently reduced to a simple spine beneath *b*. In *heppneri* this spine is totally lost, while in *acutum* both *b* and *g* are very long, recurved processes.



*Leptonema bilobatum* Schmid

FIGURES 435–440; MAP 18

*Leptonema bilobatum* Schmid, 1964:318, pl.22: figs. 4–6 [holotype ♂, in CNC].

TYPE-LOCALITY.—Monterredondo, Cundinamarca, Colombia.

DISTRIBUTION.—Colombia.

MATERIAL EXAMINED.—COLOMBIA, *Dpto. Cundinamarca*, Monterredondo, 4 Jan 1960, J.E. Foerster, ♂ holotype; same, but 3 Mar 1957 to 16 Apr 1961, 4♂, 8♀. Holotype and paratypes in CNC.

REMARKS.—This is a very pale greenish species, but each forewing has 3 small flecks of fuscous setae: one on each of the nygmatic spots and one at the apex of the median cell. Although the male genitalia are distinctive, they show a relationship to *coheni*. In *bilobatum* the tenth tergum possesses a distinct basolateral flap, process *e* of the aedeagus is represented by a short, posterodorsally directed process, *d* by a small dorsolateral spiculate lobe, and the apicolateral surface of the phallus is irregularly sclerotized.

*Leptonema chiapense*, new species

FIGURES 441–448; MAP 17

MALE.—Color greenish brown; forewing greenish brown, with strong green overtones basally. Length of forewing 14–15 mm.

Malar space narrow; about  $\frac{1}{7}$  height of eye. Parafacial and postocular areas about  $\frac{3}{4}$  width of malar; postocular area with a row of 5–7 stout setae. Maxillary palpus with fifth segment slightly shorter than basal 4 segments combined. Process of fifth sternum very large, round, occupying almost entire width of sternum.

*Genitalia:* Tenth tergum with warts *a* and *b1* elongate, *b2* reduced to a small lobe and a series of enlarged setal bases. Clasper with apical segment terete; basal segment 4½ times as long as apical, base unmodified. Phallobase slightly enlarged, curving directly into stem; subapically with a darkened, constricted dorsolateral area; process *b* a short, erect spine arising from an enlarged base; process *g* pointed, produced dorsolaterally; with a dorsomesal thumb-like lobe overlying *a* (possibly *j*, but with free end directed posteriad).

FEMALE.—Similar to male in color; large, forewing length 15–16 mm.

TYPES.—*Holotype* (male): MEXICO, *Edo. Chiapas*, Cascada Misolja, 20 km S Palenque, 17–18 May 1981, C.M. and O.S. Flint, Jr.

*Paratypes:* Same data, 3♂, 2♀; same, but J. Bueno, 1♂, 2♀; Bonampak, 19–20 May 1984, A. Ibarra, 2♂, 1♀; same, but 20–25 May 1980, J. Bueno, 5♂, 3♀.

Holotype in USNM; paratypes in IBUNAM and USNM.

REMARKS.—The species at first sight seems similar to *simplex* Mosely. However, the dorsomesal process that in

lateral aspect appears to be process *a* proves on closer inspection to be a unique development that overlies the true process *a*. We suggest it may be process *j* with its free end directed apicad, rather than basad as is usual.

*Leptonema chila* Flint

FIGURES 449–455; MAP 17

*Leptonema chila* Flint, 1967a:15, 16, figs. 64–67 [holotype ♂, in USNM].

TYPE-LOCALITY.—Near Chilpancingo (route 95, km 297), Guerrero, Mexico.

DISTRIBUTION.—Mexico.

MATERIAL EXAMINED.—MEXICO, *Edo. Guerrero*, nr. Chilpancingo, rt 95, km 297, 15–16 May 1935, Flint and Ortiz, ♂ holotype, 1♂, 2♀ paratypes. *Edo. Chiapas*, Finca Vergel, 11 May 1935, A. Dampf, 1♂; same, but 12 May 1935, 1♂; same, but 19 May 1935, 1♂; same, but 8 June 1935, 1♂. Material in CNC, INHS, and USNM.

REMARKS.—The examples from Chiapas differ slightly from the types in that the apex of lobe *b* is not angled sharply laterad, nor is the spiculate ridge on the phallus as strongly developed in these examples. However, the other structures of the genitalia are identical.

It appears to be most closely related to *acutum*, but is immediately distinguished by the fact that the apex of process *g* is not developed into a long, recurved spine in *chila*.

*Leptonema coheni*, new species

FIGURES 456–462; MAP 19

MALE.—Color pale greenish, fading to pale brown; forewing greenish with a spot of fuscous setae at the thyridium, a wavy infuscation along the chord, and at the apex. Length of forewing 15 mm.

Malar space narrow, about  $\frac{1}{6}$  width of eye. Parafacial and postocular areas about  $\frac{1}{2}$  width of malar; postocular area with a row of 3–4 stout setae. Maxillary palpus with apical segment less than  $\frac{2}{3}$  length of basal 4 combined. Process of fifth sternum large, round.

*Genitalia:* Tenth tergum with wart *a* large, basally situated, with basal expansions, *b* small, single, apically situated; lateral lobe rounded apically. Clasper with apical segment long, terete; basal segment 3 times as long as apical, base unmodified. Phallobase elongate; *a* weakly bilobed; *b* a pointed, reflexed spine; *g* a sharp, spine-like process directed ventromesad.

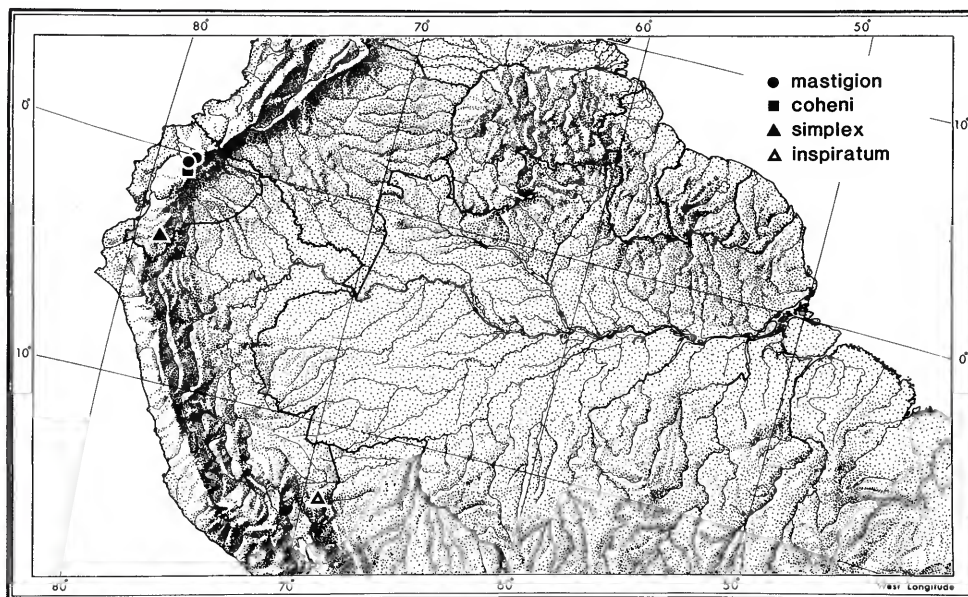
FEMALE.—Unknown.

TYPES.—Holotype male, ECUADOR, *Pcia. Cotopaxi*, 113 km W Latacunga, 4500', 1 Jul 1975, Langley and Cohen.

*Paratype:* Same data, 1♂.

Holotype and paratype in USNM.

REMARKS.—The species appears to be rather closely re-



MAP. 19—Distributions of *Leptonema mastigion*, new species, *L. coheni*, new species, *L. simplex* Mosely, and *L. inspiratum*, new species.

lated to *simplex*. They are easily distinguished by the shape of phallic process *b* and *g*. The latter in *coheni* is especially distinctive as it is sharply pointed and decurved, rather than broadly rounded as in *simplex*.

#### *Leptonema ekisi*, new species

FIGURES 463–470; MAP 17

*Leptonema salvini* Mosely, 1933:64 [misidentification of paratype ♂ from Orosi, Costa Rica].

**MALE.**—Wings and body medium brown; forewing with fuscous hair over nygmata and along chord. Forewing length 22 mm.

Malar space broad, slightly less than  $\frac{1}{3}$  height of eye. Parafacial and postocular areas  $\frac{3}{4}$  width of malar; postocular area with a row of 5–6 stout setae. Maxillary palpus with apical segment slightly more than  $\frac{1}{2}$  length of basal 4 segments combined. Processes of fifth sternum small, elongate.

**Genitalia:** Tenth tergum with wart *a* short, erect; warts *b1* and *b2* with short stalks; lateral lobe broadly rounded apically. Clasper with apical segment about  $\frac{1}{4}$  as long as basal segment; base of clasper unmodified. Phallobase elongate; *a* semierect in lateral view; *b* long, smooth, reflexed; *f* present, terete, about as long as broad in lateral view; *g* bearing a dorsal lobe with a pair of small apical points and a rounded apical lobe.

**FEMALE.**—Similar to male, slightly larger. Forewing length 25 mm.

**TYPES.**—*Holotype* (male): PANAMA, *Pcia. Chiriquí*, Bambito, 1500 m, 22 May 1973, G. Ekis.

*Paratypes:* Same data, 1♀. COSTA RICA, [*Pcia. Cartago*],

Orosi, Coll. Garlepp, 1♂. *Pcia. Alajuela*, Volcan Poás, 28 Apr 1984, Bueno and Barrera, 8♂, 12♀.

*Holotype* in USNM; paratypes in IBUNAM, MCZ, and USNM.

**REMARKS.**—This species would appear to be one of the simplest species of the *sinuatum* subgroup, probably most closely related to *fortunum*. It differs most noticeably in process *f* of the phallus, which is terete in *ekisi* but bifid in *fortunum*. Process *g* is also differently shaped in the two species, being bilobed in *ekisi* but irregular and pointed in *fortunum*.

#### *Leptonema fortunum*, new species

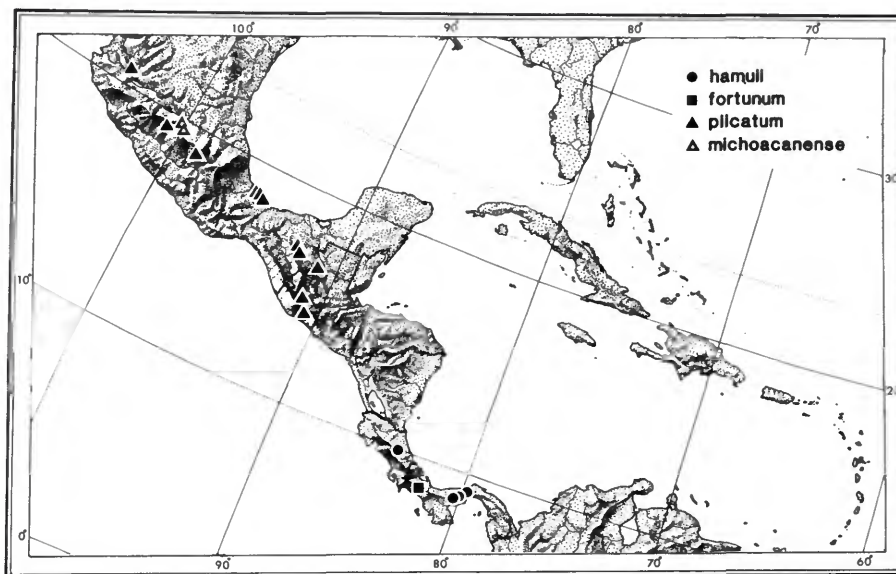
FIGURES 471–478; MAP 20

*Leptonema* undescribed species "A."—McElravy et al., 1981:153; 1982:307, 310, 312.

**MALE.**—Color in alcohol, uniformly brown. Forewing length 15–18 mm.

Malar space narrow, about  $\frac{1}{6}$  height of eye. Parafacial and postocular areas about  $\frac{3}{4}$  width of malar; postocular area with a row of 3–5 stout setae. Maxillary palpus with apical segment about  $\frac{4}{5}$  length of basal 4 segments combined. Fifth sternum with process large, elongate, ovoid.

**Genitalia:** Tenth tergum with wart *a* on a short stalk; warts *b1* and *b2* on long stalks; lateral lobe broadly rounded apically. Clasper with apical segment short, terete; basal segment about 4 times as long as apical, base unmodified. Phallobase elongate, slightly angulate; *a* slightly produced, with a small dorsal point; *b* elongate, reflexed, sinuate; *f* short, tip bifid; *g* developed into a pointed, erect, dorsal lobe and an apical lobe ending in a ventromesal point.



MAP 20.—Distributions of *Leptonema hamuli*, new species, *L. fortunum*, new species, *L. plicatum* Mosely, and *L. michoacanense*, new species.

FEMALE.—Unavailable.

TYPES.—*Holotype* (male): PANAMA, *Pcia. Chiriquí*, Río Chiriquí, Fortuna dam site, week 44 1978, H. Wolda (OTU #22).

*Paratypes*: Same, but various dates between Nov 1976 and Dec 1977, 874 ♂♀.

Holotype in USNM; paratypes in CNC, UCB, and USNM.

REMARKS.—This species is quite similar to *ekisi*. It differs by having phallic process *b* of moderate length, not strongly toothed, and distinctly sinuate in both dorsal and lateral aspect, *e* totally lacking, *f* short, but with a bifid tip, and *g* produced into dorsal and ventromesal points.

#### *Leptonema hamuli*, new species

FIGURES 479–486; MAP 20

MALE.—Wings and body pale brown (undoubtedly greenish in life); forewing with slight infuscation over chord. Length of forewing 12.5–14 mm.

Malar space very narrow, about  $\frac{1}{8}$  height of eye. Para-facial and postocular areas about  $\frac{3}{4}$  width of malar; postocular area with a row of 5–7 stout setae. Maxillary palpus with fifth segment barely more than half length of basal 4 segments combined. Process of fifth sternum large, ovoid.

*Genitalia*: Tenth tergum with wart *a* long, on a flexible base; warts *b1* and *b2* on long stalks, well separated from wart *a*; lateral lobe broadly rounded apically. Clasper with apical segment terete; basal segment about  $3\frac{1}{2}$  times length of apical segment, unmodified basally. Phallobase elongate; *a* mostly membranous; *b* and *c* both developed into long,

slender, basally directed processes; *f* developed into a pair of laterally directed spines arising from a conical base; *g* bearing a small dorsal tooth; dorsal margin between *a* and *f* bearing a pair of wing-like flaps (perhaps *d*).

FEMALE.—Unknown.

TYPES.—*Holotype* (male): PANAMA, *Canal Zone*, Barro Colorado Island, 20–23 May 1964, S.S. and W.D. Duckworth.

*Paratypes*: Same, but 1–9 May 1964, 1♂; same, but 10–17 May 1964, 1♂; same, but 9 Apr 1935, A. Friedman, 1♂; same, but 20–24 Oct, M. Bates, 1♂; same, but Jun 1960, J. Zetek, 2♂. [*Pcia. Panamá*], Cerro Campana, near Chica, 2–5 Apr 1965, S.S. and W.D. Duckworth, 3♂. [*Pcia. Coclé*], El Valle, 15 Jul 1967, O.S. Flint, Jr., 1♂. COSTA RICA, [*Pcia. Cartago*], Turrialba, 15–19 Jul 1965, P.J. Spangler, 1♂.

Holotype in USNM; paratypes in CNC, INHS, MCZ, and USNM.

REMARKS.—*Leptonema hamuli* is related to *sinuatum* but easily distinguished by the aedeagus. It is unique within the *plicatum* group in having both processes *b* and *c* developed and in having dorsolateral wing-like flaps between *a* and *f*.

#### *Leptonema heppneri*, new species

FIGURES 487–492; MAP 18

MALE.—Color pale brown (probably greenish brown in life), forewing brownish, immaculate. Length of forewing 16–19 mm.

Malar space narrow; about  $\frac{1}{7}$  height of eye. Para-facial and postocular areas about  $\frac{3}{4}$  width of malar; postocular area with a row of 5–6 stout setae. Maxillary palpus with



fifth segment only slightly shorter than basal four segments combined. Process of fifth sternum large, almost round.

**Genitalia:** Tenth tergum with warts *a* and *b1* elongate, erect; *b2* reduced to a small knob or setate spot on posteromesal face; lateral lobe rounded apically. Clasper with apical segment long, terete; basal segment 3 times as long as apical, base unmodified. Phallobase elongate, subapically expanded dorsad, dorsomesal surface concave, semimembranous; *b* a simple, slender, recurved spine, *g* lacking.

**FEMALE.**—Similar to male in color; larger, forewing length 18–20 mm.

**TYPES.**—*Holotype* (male): VENEZUELA, *Edo. Lara*, Yacambú National Park, 13 km SE Sanare, 4800 ft, cloud forest, 4–7 Mar 1978, J.B. Heppner.

**Paratypes:** Same data, 6♂, 6♀; same, but El Blanquito, 1350 m, 1–3 Aug 1976, Rosales and Joly, 2♂, 2♀. *Edo. Barinas*, La Chimenea, 5 km S La Soledad, 1500 m, 28–29 May 1975, R.E. Dietz, 1♂, 1♀. *Edo. Tachira*, Chorro del Indio, 1800 m, 17–18 Aug 1982, Chacon and Grance, 5♂, 4♀.

Holotype in USNM; paratypes in CNC, IZAM, and USNM.

**REMARKS.**—This species is virtually identical to *araguense*. The only significant difference is the loss in *heppneri* of a pair of spines that subtend phallic process *b* in *araguense*.

The distribution of this pair of species is interesting in that *araguense* appears to be limited to the cloud forests of the coastal range in Aragua, and *heppneri* occupies a similar position in the next ranges to the west. The two areas are separated by a region of drier, lower hills.

### *Leptonema inspiratum*, new species

FIGURES 493–500; MAP 19

**MALE.**—Color stramineous; forewing immaculate. Length of forewing 15.5 mm.

Malar space very narrow, about  $\frac{1}{8}$  height of eye. Parafacial and postocular areas about  $\frac{3}{4}$  width of malar; postocular area with a row of 5–6 stout setae. Maxillary palpus with apical segment  $\frac{7}{10}$  length of basal 4 segments combined. Process of fifth sternum large, ovoid.

**Genitalia:** Tenth tergum with wart *a* elongate, erect, wart *b1* shorter, *b2* barely discernible, displaced ventromesally; lateral lobe truncate apically, ventral margin strongly sclerotized, sinuate. Clasper with apical segment elongate, terete; basal segment unmodified basally. Phallobase elongate, slightly inflated dorsally before apex, lateral surface deeply indented, forming a concavity in which *b* rests; *b* a long arcuate process, giving rise to *c* basoventrally, which is shorter than *b* and curves more sharply ventrad; *g* coarsely serrate dorsally.

**FEMALE.**—Unknown.

**TYPE.**—*Holotype* (male): PERU, *Dpto. Puno*, Río Inam-

bari/Loromayu, 5–6 Sep 1967, L.E. Peña G. Holotype in CNC.

**REMARKS.**—This species appears very close to *michoacanense*, being separable only by the shape of the processes of the phallus. In *inspiratum* the process *c* is beneath process *b* and is longer and more sharply curved ventrad, and process *g* has its dorsal margin coarsely serrate.

### *Leptonema mastigion*, new species

FIGURES 501–507; MAP 19

**MALE.**—Color pale brown, probably green in life; forewing indistinctly fuscous over anastomosis. Length of forewing, 12 mm.

Malar space narrow, about  $\frac{1}{6}$  width of eye. Parafacial and postocular areas  $\frac{3}{4}$  width of malar; postocular area with a row of 3–4 stout setae. Maxillary palpus with apical segment about  $\frac{2}{3}$  length of basal 4 segments combined. Process of fifth sternum large, rounded.

**Genitalia:** Tenth tergum with 2 elongate warts, probably *a* and *b*; lateral lobe long, produced and bluntly pointed apically. Clasper with apical segment long, terete; basal segment about  $2\frac{1}{2}$  times as long as apical, base unmodified. Phallobase elongate, angled; *a* developed into a thin, erect process, *g* an erect apicolateral plate produced into a recurved, slender, whip-like filament; *j* a short, thin, erect process.

**FEMALE.**—Size and color in alcohol similar to male.

**TYPES.**—*Holotype* (male): ECUADOR, *Pcia. Los Ríos*, Río Palenque Biological station, 56 km N Quevedo, 250 m, 28–29 Jul 1976, J. Cohen.

**Paratypes:** Same data, 1♀. *Pcia. Pichincha*, 14 km E Santo Domingo de los Colorados, 5 Jul 1975, Langley and Cohen, 1♂; 47 km S Santo Domingo, Río Palenque Biological Station, 750 m, 28 July 1976, J. Cohen, 1♂; Tinalandia [E edge of Santo Domingo de los Colorados], 16 Feb 1982, G. and M. Wood, 1♂, 4♀.

Holotype in USNM; paratypes in CNC and USNM.

**REMARKS.**—This remarkable new species appears to show a relationship to *Leptonema andrea*. It is easily distinguished by the shorter apical, whip-like processes of the phallus, which are only reflexed, rather than wrapped around the tip.

### *Leptonema michoacanense*, new species

FIGURES 508–515; MAP 20

**MALE.**—Color brown; forewing indistinctly infuscate along chord. Length of forewing 15–19 mm.

Malar space broad, slightly less than  $\frac{1}{3}$  height of eye. Parafacial and postocular areas about  $\frac{1}{2}$  width of malar; postocular area with a row of 4–7 stout setae. Maxillary



palpus with apical segment  $\frac{1}{2}$  length of basal 4 segments combined. Process of fifth sternum large, ovoid.

**Genitalia:** Tenth tergum with wart *a* short, erect; warts *b1* and *b2* short; lateral lobe broad, apex rounded. Clasper with apical segment short, terete; basal segment  $4\frac{1}{2}$  times as long as apical, base unmodified. Phallobase elongate, expanded dorsad and laterad subapically; *a* barely produced, mostly membranous; *b* elongate, curving basad and ventrad; *c* short, arising basolaterally from *b*, barely surpassing *g* dorsally; *g* a large, lightly sclerotized, quadrate lobe.

**FEMALE.**—Similar to male. Forewing length 15–20 mm.

**TYPES.**—*Holotype* (male): MEXICO, *Edo. Michoacán*, San Lorenzo, rt 15, km 206, 19 July 1966, Flint and Ortiz.

*Paratypes:* Same data, 11♂, 10♀; same, but 14–15 Jul 1966, 31♂, 7♀. *Edo. México*, Valle de Bravo, 21 Dec 1979, J. Padilla, 1♂; Halinalco, 15 Nov 1980, H. Brailovsky, 5♂, 3♀.

Holotype in USNM; paratypes in CNC, IBUNAM, and USNM.

**REMARKS.**—This species is virtually identical to *plicatum*, differing only in characteristics of the genitalia. The apical segment of the clasper is noticeably shorter, and both processes *b* and *c* are present on the phallus of *michoacanense*. It also resembles *inspiratum*, however, processes *b*, *c*, and *g* are differently formed in these two species.

### *Leptonema plicatum* Mosely

FIGURES 516–524; MAP 20

*Leptonema plicatum* Mosely, 1933:58, 59, figs. 178–183 [holotype ♂, in BMNH].—Fischer, 1963:171.

**TYPE-LOCALITY.**—V. de Atilán [= Volcan de Atitlán, Dptos. Sololá and Suchitepéquez, Guatemala].

**DISTRIBUTION.**—Guatemala and Mexico.

**MATERIAL EXAMINED.**—GUATEMALA, *Dpto. Suchitepéquez*, Finca Mocá, 12 Jun 1966, Flint and Ortiz, 5♂. *Dpto. Escuintla*, Finca El Zapote, Zapote, 10 Jul 1948, R.D. Mitchell, 1♂. MEXICO, *Edo. Jalisco*, Tequila, 28 Jul 1934, A. Dampf, 9♂. *Edo. Michoacán*, Tacámbaro, en río entre mirador y lago, 30 May 1963, F. Pacheco, 2♂, 1♀. *Edo. Morelos*, Cuernavaca, San Antón Falls, 13 Jul 1965, Flint and Ortiz, 5♂. *Edo. Veracruz*, Río Tacalopán, rt 180, km 551, 25–26 Jul 1966, Flint and Ortiz, 5♂, 2♀; Estacion Biologica "Los Tuxtles," 19 Apr 1969, Carlos Romalo, 1♂; same, but 18 Jan 1980, E. Barrera, 4♂, 1♀; same, but 1 Mar 1970, 1♀; same, but 4–15 May 1981, C.M. and O.S. Flint, Jr, 1♂; "Los Tuxtles" area, Río Palma, above La Palma, 7–14 May 1981, C.M. and O.S. Flint, Jr., 2♂, 1♀; same, but Río Máquinas, 4–14 May 1981, 2♂, 1♀; same, but Las Cabanas, 8–15 May 1981, 1♂; same, but near Balzapote, 3–15 May 1981, 13♂; Coyame, Lake Catemaco, 16 Jul 1963, D.R. Whitehead, 1♂. *Edo. Chiapas*, Finca Cuauhtémoc, 13 Aug 1950, C.

Goodnight, 5♂, 2♀; Finca Esperanza, 24 May 1938, A. Dampf, 1♂; same, but 18 Jun 1938, 1♂; same, but 26 Jun 1938, 1♂; same, but 26–30 Apr 1939, 1♂; same, but 10 Jun 1939, 1♂; Finca Vergel, 5 Feb 1935, A. Dampf, 1♂. Mexico, A. Dampf [no further data], 3♂. Material in CNC, IBUNAM, INHS, and USNM.

**REMARKS.**—The species is most closely related to *michoacanense* from which it differs in the proportionately longer apical segment of the clasper and the loss of phallic process *c*.

### *Leptonema salvini* Mosely

FIGURES 525–531; MAP 21

*Leptonema salvini* Mosely, 1933:62–64, figs. 196–200 [holotype ♂, in BMNH].—Fischer, 1963:172.

**TYPE-LOCALITY.**—Volcan de Chiriqui, Panama.

**DISTRIBUTION.**—Panama.

**MATERIAL EXAMINED.**—PANAMA, *Pcia. Chiriquí*, 1♂. Boquete, 10 May, G.B. Fairchild, 2♂, 1♀; same, but 16–17 Jul 1967, O.S. Flint, Jr., 5♂, 6♀. Material in CNC, MCZ, RNH, and USNM.

**REMARKS.**—The male from Orosi, Costa Rica recorded by Mosely (1933:64) is a male of the species here described as *ekisi*; thus *salvini* has not yet been taken in Costa Rica.

The species is most closely related to *vitum*, from which it differs as follows: process *b* of phallus shorter, smooth, and with apex directed mesad, and with process *g* a simple, erect, point.

### *Leptonema simplex* Mosely

FIGURES 532–538; MAP 19

*Leptonema simplex* Mosely, 1933:57, 58, figs. 172–177 [holotype ♂, in BMNH].—Fisher, 1963:172.

**TYPE-LOCALITY.**—Loja, Ecuador.

**DISTRIBUTION.**—Ecuador.

**MATERIAL EXAMINED.**—ECUADOR, Loja, 11 Aug 1896, P. Dognin, 1♂ holotype. Holotype in BMNH.

**REMARKS.**—The species is the least complex member of the group and quite close to *plicatum*. It differs from the latter only in the apex of the phallus, especially in the more prominent process *a*, much shorter process *b*, and lack of dorsal, subapical swellings on the phallosome.

### *Leptonema sinuatum* Mosely

FIGURES 539–545; MAP 21

*Leptonema sinuatum* Mosely, 1933:59–61, figs. 184–189 [holotype ♂, in BMNH].—Fischer, 1963:172.

**TYPE-LOCALITY.**—Gorgona Island, Colombia.

**DISTRIBUTION.**—Colombia, Panama.

**MATERIAL EXAMINED.**—PANAMA, *Canal Zone*, Barro Colorado Island, 1–9 May 1964, S.S. and W.D. Duckworth, 1♂; same, but 10–17 May 1964, 1♂; same, but 20–23 May 1964, 1♂; same, but 12 Mar 1967, M.E. Irwin, 1♂; same, but 19 May 1977, Silberglied and Aiello, 1♂. [*Pcia. Panamá*], Cerro Campana, 11–14 Jul 1967, O.S. Flint, Jr., 2♂, 4♀. [*Pcia. Colón*], Porto Bello, 19 Feb 1911, A. Busck, 1♂; same, Feb 1911, 1♂. *Com. San Blas*, 2 km S Nusagandi, 3 Mar 1985, Flint and Louton, 1♂. Material in CNC, 1NHS, UCR, and USNM.

**REMARKS.**—This species is most closely related to *turrialbum*, but differs in that wart *a* of the tenth tergum arises close to wart *b*, phallic processes *f* are directed laterad over process *b*, and process *a* bears a pair of short, pointed projections.

### *Leptonema turrialbum*, new species

FIGURES 546–553; MAP 21

**MALE.**—Wings and body medium brown; forewing with indistinct fuscous marks over chord and in anal cell. Forewing length 14–16 mm.

Malar space very narrow, about  $\frac{1}{8}$  height of eye. Parafacial and postocular areas about  $\frac{3}{4}$  width of malar; postocular area with a row of 5–8 stout setae. Maxillary palpus with apical segment almost  $\frac{1}{2}$  length of basal 4 segments combined. Process of fifth sternum large, ovoid.

**Genitalia:** Tenth tergum with wart *a* long, on a flexible stalk; warts *b1* and *b2* on long stalks, well separated from wart *a*; lateral lobe broadly rounded apically. Clasper with apical segment about  $\frac{1}{2}$  length of basal segment; base of clasper unmodified. Phallus elongate; *a* mostly membra-

nous, tip darkened; *b* long, curving basad and ventrad; *e* represented by a linear row of teeth; *f* erect in lateral aspect, directed posteriad, bifid; *g* bearing a small dorsal tooth and an apical point hooked laterad.

**FEMALE.**—Similar to male, but darker brown, larger. Forewing length 15–17 mm.

**TYPES.**—*Holotype* (male): COSTA RICA, [*Pcia. Cartago*], Turrialba, 17–21 Feb 1965, S.S. and W.D. Duckworth.

**Paratypes:** Same data, 1♂, 6♀; same, but 3–17 Mar 1965, 3♂, 5♀; same, but 15–19 Jul 1965, P.J. Spangler, 3♂, 1♀; same, but 9 Jul 1965, M.G. Naumann, 1♂; Chitaria, 19 Jun 1967, Flint and Ortiz, 1♂. *Pcia. Alajuela*, Zarcero, 4 Jun 1972, E. Villalobos, 1♂.

Holotype in USNM; paratypes in CNC, 1BUNAM, UKAL, and USNM.

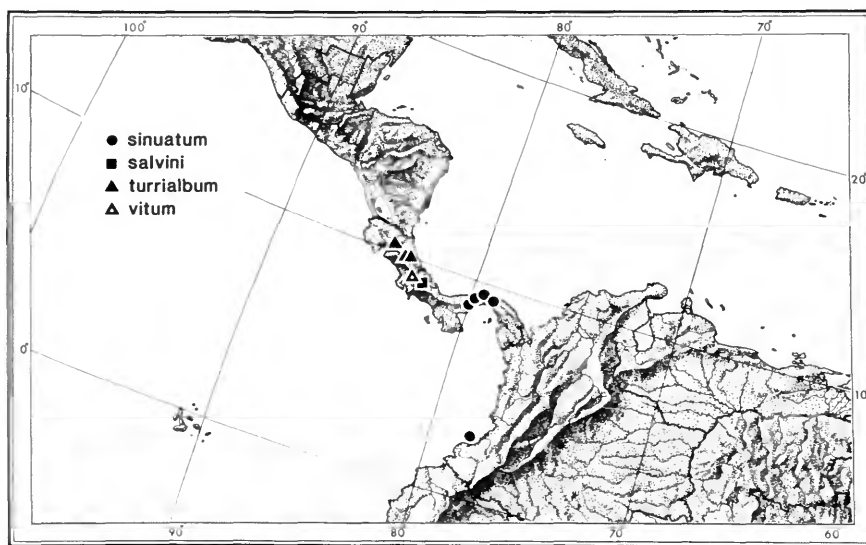
**REMARKS.**—This species is closely related to *sinuatum*. It differs by having warts *a* and *b* of the tenth tergum well separated, the points of phallic process *f* point posteriad, *e* reduced to a row of spines, *a* lacks the pair of pointed projections, and the tip of *g* is developed into a small, laterally directed hook.

### *Leptonema vitum*, new species

FIGURES 554–560; MAP 21

**MALE.**—Color brown (probably green when alive); forewing brown, slightly darker along chord. Length of forewing 14–15 mm.

Malar space narrow, about  $\frac{1}{2}$  height of eye. Parafacial area in middle about  $\frac{3}{4}$  width of malar. Postocular area slightly narrower than parafacial; with a row of 3–4 stout setae. Maxillary palpus with apical segment  $\frac{1}{2}$  length of



MAP 21.—Distributions of *Leptonema sinuatum* Mosely, *L. salvini* Mosely, *L. turrialbum*, new species, and *L. vitum*, new species.

basal 4 segments combined. Process of fifth sternum large, about as in *salvini*.

*Genitalia*: Tenth tergum with wart *a* short, erect; wart *b1* short, *b2* elongate, with a long stalk; lateral lobe broadly rounded apically. Clasper with apical segment  $\frac{1}{4}$  as long as basal segment; base of clasper unmodified. Phallobase elongate; process *a* semierect in lateral aspect; process *b* elongate, reflexed, with small points, tip directed ventrad; process *g* produced into a large, dorsally directed tooth basally, with apex serrate and directed mesad.

**FEMALE**.—Similar to male. Forewing length 16–17 mm.

**TYPES**.—*Holotype* (male): COSTA RICA, *Pcia. Puntarenas*, Las Cruces, near San Vito, 24 Apr 1965, S.S. and W.D. Duckworth.

*Paratypes*: Same data, 1♀; same, but 19–20 Mar 1965, 1♂.

Holotype and paratypes in USNM.

**REMARKS**.—This species is closely related to *salvini*. It differs in that processes *b* are long and sinuate with their tips directed ventrad, and bear small points on their surfaces, and processes *g* are produced into a serrate apicomeral lobe in addition to a large, basodorsal tooth.

### *Leptonema woldianum*, new species

FIGURES 561–568; MAP 22

*Leptonema* undescribed species "B."—McElravy et al., 1981:153; 1982:307.

**MALE**.—Color in alcohol, uniformly brown. Forewing length 15–17 mm.

Malar space narrow, about  $\frac{1}{6}$  height of eye. Parafacial and postocular areas about  $\frac{3}{4}$  width of malar; postocular area with a row of 4–6 stout setae. Maxillary palpus with

apical segment slightly less than  $\frac{2}{3}$  length of basal 4 segments combined. Process of fifth sternum large, elongate, ovoid.

*Genitalia*: Tenth tergum with wart *a* long, on a flexible stalk; *b1* and *b2* on long stalks, separated from *a*; lateral lobe rounded apically, with a shallow basolateral pocket. Clasper with apical segment terete, short; basal segment long, slender, over 4 times as long as apical, base unmodified. Phallobase elongate, basal section barely angled; *a* bearing a short dorsal point; *b* very long, recurved, with a dorsal branch from midlength; *e* represented by a few scattered spinules, with tip produced into a pointed dorsolateral flap; *f* developed into a pair of short, erect, dorsal points; *g* semierect, ending in a small point.

**FEMALE**.—Unknown.

**TYPE**.—*Holotype* (male): PANAMA, *Pcia. Chiriquí*, Río Chiriquí, Fortuna dam site, week 41 1977, H. Wolda (OTU #59).

*Paratypes*: Same, but various dates between Nov 1976 and Dec 1977, 11♂.

Holotype in USNM; paratypes in CNC, UCB, and USNM.

**REMARKS**.—This species belongs to the *sinuatum* subgroup, and is most closely related to *hamuli*. In *woldianum* the processes *e* and *f* are shorter than in *hamuli*, process *b* is forked and process *c* is absent.

### The *simulans* Group

**DIAGNOSTIC CHARACTERS**.—Size moderately large; forewing 15–20 mm. Color greenish with brown overtones to light brown, generally turning to ochraceous after death. Tibial spurs 2, 4, 4. Middle tibiae of female not broader



MAP 22.—Distributions of *Leptonema campanum*, new species, *L. woldianum*, new species, *L. asclepium*, new species, and *L. championi* Mosely.



than in male. Malar space narrow or of intermediate width, bare. Fourth segment of maxillary palpus much shorter than third. Basal segment of abdominal sternum with a median suture. Fifth sternal lobes variable in size and shape. Male tenth tergum with warts *a*, *b1*, and *b2* elongate, all clustered near apex of tergum, *c* not recognizable; lateral lobe flattened, apex rounded, often with ventral margin twisted laterad. Apical segment of clasper varying in length; basal segment without apicomeres or basal lobes. Phallus with processes *b* and *c* present, often reflexed; *e*, when present, a low, spinulate ridge; *f* rarely present; *g*, if present, a broad lateral plate, lacking in some species; *j* present, usually forked.

REMARKS.—This group of 6 species, one divided into 2 subspecies, is closely related to the *plicatum* group. It is easily recognized by the clustering of the warts near the apex of the tenth tergum and having phallic process *j* present. The group contains *asclepium*, new species, *campanum*, new species, *championi* Mosely, *dyeri*, new species, *simulans simulans* Mosely, *simulans mayanum*, new subspecies and *spinulum*, new species.

DISTRIBUTION.—The species are mostly found in the mountainous regions of southern Mexico and Central America, with one species widely distributed in South America.

#### *Leptonema asclepium*, new species

FIGURES 569–576; MAP 22

MALE.—Color pale brown, probably green in life; forewing with faint infuscation along chord. Forewing length 15 mm.

Malar space narrow, about  $\frac{1}{7}$  width of eye. Parafacial and postocular areas  $\frac{3}{4}$  width of malar; postocular area with a row of 6–8 stout setae. Maxillary palpus with apical segment slightly more than half length of basal 4 segments combined. Process of fifth sternum large, ovoid.

Genitalia: Tenth tergum with warts *a*, *b1*, and *b2* elongate, arising close together at apex of tergum; lateral lobe with apex twisted laterad, dorsal margin broadly and slightly produced, with basal area broad and dorsally continuous with wart *b2*. Clasper with apical segment very long, terete; basal segment not quite twice length of apical, base unmodified. Phallobase elongate, sharply angled; apex with process *b* long, pointed, reflexed basad, with process *c* short, arising from outer face of *b*; *e* fused to phallobase, produced into a rounded, spinulate knob dorsolaterally; *g* a narrow, pointed process; *j* furcate apically, arms at least  $\frac{1}{3}$  as long as basal part.

FEMALE.—Unknown.

TYPES.—*Holotype* (male): COSTA RICA, [*Pcia. Cartago*], Turrialba, 15–19 Jul 1965, P.J. Spangler.

*Paratype*: [*Pcia. San José*], Carillo, 7 May, Wm. Schaus, 1♂.

Holotype and paratype in USNM.

REMARKS.—This species, which co-exists with *simulans simulans*, is easily distinguished by characters of the genitalia. The twisted apex of the lateral plate of the tenth tergum, the very long apical segment of the clasper, and the position of process *c* on the phallus are diagnostic for the species. The depth of the fork and general appearance of process *j* is identical in *simulans mayanum* and *asclepium*, but clearly different from *simulans simulans* and *dyeri*. Although *asclepium* and *simulans simulans* have not yet been taken together, they are in general sympatric.

#### *Leptonema campanum*, new species

FIGURES 577–583; MAP 22

MALE.—Color pale greenish, fading to pale brown; forewing with an indication of light fuscous shading along chord. Length of forewing 13–15 mm.

Malar space narrow, about  $\frac{1}{8}$  height of eye. Parafacial and postocular areas about  $\frac{3}{4}$  width of malar; postocular area with a row of 5–7 setae. Maxillary palpus with apical segment  $\frac{2}{3}$  length of basal 4 segments combined. Process of fifth sternum large, ovoid (like that of *championi*).

Genitalia: Tenth tergum with warts *a*, *b1*, and *b2* arising close together at apex of tergum, each on a short stalk; lateral lobe bluntly pointed apically, posterior face broad and rather strongly sclerotized. Clasper with apical segment elongate, terete; basal segment almost 4 times as long as apical, base unmodified. Phallobase elongate, sharply angled; apex with process *b* finger-like, erect; *c* shorter, twisted; *e* fused to phallobase, in form of an elongate row of spicules ending in a rounded lobe dorsolaterally; *g* a membranous, rounded, ventrolateral lobe; *j* elongate, forked apically, arms of fork as long as basal stem.

FEMALE.—Similar to male in size and color.

TYPES.—*Holotype* (male): PANAMA, *Pcia. Panamá*, Cerro Campana, near Chica, 11–14 Jul 1967, O.S. Flint, Jr.

*Paratypes*: Same data, 9♂, 9♀; same, but 2–5 Apr 1965, S.S. and W.D. Duckworth, 9♂, 2♀. *Pcia. Coclé*, El Valle, 829 m, 25 May 1983, P.J. Spangler et al., 1♂, 2♀. *Canal Zone*, Barro Colorado Island, 20–23 May 1964, S.S. and W.D. Duckworth, 1♂, 1♀.

Holotype in USNM; paratypes in CNC, INHS, and USNM.

REMARKS.—This species and *championi* are closely related, and are to be distinguished by the male genitalia. In *campanum* the warts of the tenth tergum have shorter stalks, the apical segment of the clasper is distinctly shorter, process *g* of the phallus bears no mesal pointed lobe, and process *j* is shorter and more deeply forked.



*Leptonema championi* Mosely

FIGURES 584–591; MAP 22

*Leptonema championi* Mosely, 1933:35–36, figs. 81–86 [holotype ♂, in BMNH].—Fischer, 1963:167.

TYPE-LOCALITY.—Cahabon, [Baja] Vera Paz, Guatemala.

DISTRIBUTION.—Guatemala, Mexico.

MATERIAL EXAMINED.—GUATEMALA, *Dpto. [Baja] Verapaz*, Cahabón, Champion, holotype 1♂. *Dpto. Alta Verapaz*, Trece Aguas, Cacao, 22 Mar–23 Apr [1906], Schwarz and Barber, 1♂, 1♀. MEXICO, *Edo. Veracruz*, Río Jamapa, 6 km N Coscomatepec, 26 May 1981, C. and O. Flint, Bueno and Velasco, 6♂, 6♀. *Edo. Oaxaca*, Metates, Sierra de Juárez, 1600 m, 17 Apr 1983, Garcia and Ibarra, 4♂, 2♀; same, but 16 Sep 1982, A. Ibarra, 2♂; Rt 175, La Esperanza [40 km S Valle Nacional], 18 Apr 1983, Garcia and Ibarra, 1♂. Holotype in BMNH; material in IBUNAM and USNM.

REMARKS.—*Leptonema championi* and the new species *campanum* are closely related. The differences, more fully enumerated under *campanum*, are to be found in the tenth tergum, claspers, and aedeagal processes.

*Leptonema dyeri*, new species

FIGURES 592–599; MAP 23

MALE.—Pale green, fading to a very pale brown after death; forewing pale green or very pale brown. Forewing length 15–17 mm.

Malar space rather broad, almost  $\frac{1}{5}$  height of eye. Parafacial and postocular areas  $\frac{3}{4}$  width of malar; postocular area with a row of 6–7 bristles. Maxillary palpus with apical

segment almost  $\frac{1}{5}$  length of basal 4 segments combined. Processes of fifth sternum elongate-oval, rather narrow.

*Genitalia*: Tenth tergum with warts *a*, *b1*, and *b2* elongate, arising close together at apex of tergum; lateral plate elongate, apex obliquely truncate. Clasper with apical segment rather short and broad; basal segment short, broad, only slightly more than twice as long as apical, base unmodified. Phallobase elongate, sharply angled; apex with process *b* long, reflexed basad, barely attaining base of process *g*; *c* short and arising from outer face of *b*; *e* fused to phallobase, barely produced into a low dorsolateral knob; *g* narrow, apex rounded; *j* short, furcate apically, arms about  $\frac{1}{2}$  as long as stem.

FEMALE.—Similar to male in size and coloration.

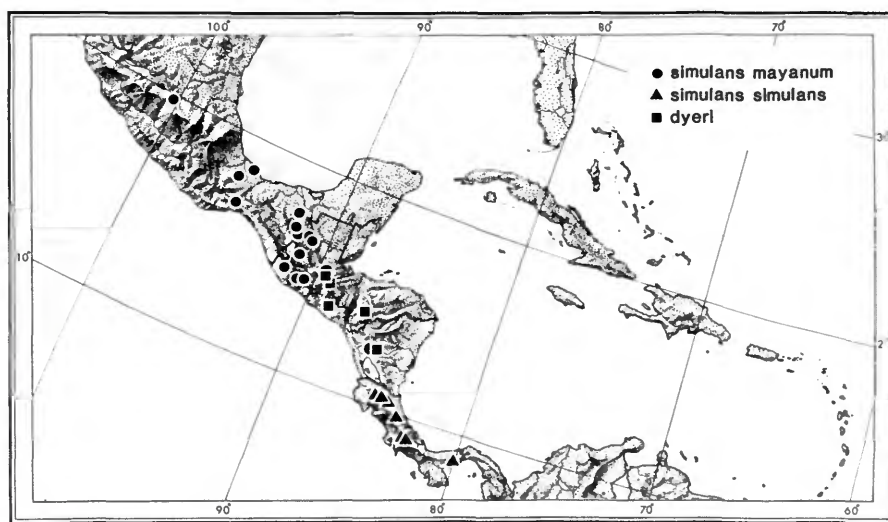
TYPES.—*Holotype* (male): HONDURAS, Tegucigalpa, 11 Dec 1919, F.J. Dyer.

*Paratypes*: NICARAGUA, *Dpto. Matagalpa*, 5.3 mi E Matagalpa, 30 Jul 1967, O.S. Flint, Jr., 3♂. EL SALVADOR, *Dpto. La Libertad*, Santa Tecla, 28–29 Oct 1967, E.L. Todd, 1♂. GUATEMALA, *Dpto. Chiquimula*, Padre Miguel, 19 Aug 1965, Flint and Ortiz, 1♂. *Dpto. Zacapa*, Paso Bica, near Teculután, 21 Aug 1970, T.W. Donnelly, 1♂, 1♀.

Holotype in USNM; paratypes in CNC and USNM.

REMARKS.—*Leptonema dyeri* is closely related to *simulans* and *asclepium*, and is to be distinguished by the male genitalia. The very short clasper, and especially the short, broad apical segment, and the very short process *j* that is deeply forked are the best distinguishing characteristics. The simple elongate lateral lobe of the tenth tergum separates this species from *asclepium* but not from *simulans*. Similarly, the posterior position of process *c* of the phallus distinguishes *dyeri* from *simulans*, but not *asclepium*.

The ranges of *dyeri* and *simulans mayanum* are basically



MAP 23.—Distributions of *Leptonema s. simulans* Mosely, *L. s. mayanum*, new subspecies, and *L. dyeri*, new species.

the same, and the two have, in fact, been taken together at one site in Nicaragua. However, it appears that most sites of *dyeri* are west of those of *mayanum*. This could mean that *dyeri* prefers the slightly drier and lower western areas, while *mayanum* prefers the wetter, higher eastern parts of the region.

***Leptonema simulans simulans* Mosely**

FIGURES 600–607; MAP 23

*Leptonema simulans* Mosely, 1933:32–34, figs. 74–78, 80 [holotype ♂, in BMNH].—Fischer, 1963:172; 1972:156.—Weidner, 1964:84.—McElravy et al., 1981:153; 1982:307, 310, 312.

TYPE-LOCALITY.—V. de Chiriquí, Panama, 200–300 ft.

DISTRIBUTION.—Panama, Costa Rica.

MATERIAL EXAMINED.—COSTA RICA, [*Pcia. Cartago*], Orosi, Garlepp, 1♂ paratype. *Pcia. San José*, San José, May 1940, A. Alfaro, 1♂. *Pcia. Guanacaste*, near Turin, (10°20'N, 84°50'W), 3 Feb 1960, C.W. Palmer, 1♂. *Pcia. Alajuela*, La Ceiba, 26 Dec 1980, L. Guevara, 1♂; Volcan Poás, 28 Apr 1984, Bueno and Barrera, 1♂. *Pcia. Puntarenas*, Monteverde area, 10°18'N, 84°49'W, 1400 m, 6–14 Jun 1973, Erwin and Hevel, 1♂, 1♀; same, but 9 Feb 1981, J. Bueno, 2♂, 1♀; Las Cruces, near San Vito, 24 Apr 1965, S.S. and W.D. Duckworth, 1♂, 2♀; same, but 19–20 Mar 1965, 2♀. PANAMA, *Pcia. Chiriquí*, El Volcán, 17 Feb 1936, Lutz and Gertsch, 1♂, 2♀. *Pcia. Coclé*, El Valle, 22 Apr 1965, S.S. and W.D. Duckworth, 2♂. Material in AMNH, CNC, IBUNAM, MCZ, and USNM.

REMARKS.—*Leptonema simulans*, *asclepium* and *dyeri* are three closely related species, to be distinguished only by characteristics of the tenth tergum, claspers and apex of the phallus. In *simulans* and *dyeri* the lateral plates of the tenth tergum are simple, elongate lobes, but in *asclepium* they are strongly twisted and modified. The length of the apical segment of the claspers is different in all three species, *dyeri* being the shortest and *asclepium* the longest. Process *c* in *dyeri* and *asclepium* is borne from the posterior face of *b*, but in *simulans* it is ventral in origin. Process *j* in *dyeri* is short and deeply forked, long and deeply forked in *asclepium* and *simulans mayanum*, and long and shallowly forked in *simulans simulans*.

Between the two subspecies of *simulans*, I can find consistent differences only in the depth of the fork of process *j*, and in the ranges of the two subspecies.

***Leptonema simulans mayanum*, new subspecies**

FIGURES 608–609; MAP 23

*Leptonema pallidum* (Ulmer).—Ulmer, 1907b:47 [misidentification of material from Soconusco, Mexico].—Weidner, 1964:84.

*Leptonema simulans* Mosely.—Mosely, 1933:34 [misidentification of material from Mexico and Guatemala].

ADULT.—Color pale greenish, becoming pale brown after death; forewing infusate along chord. Length of forewing 15–20 mm.

Malar space narrow, about 1/6 height of eye. Parafacial and postocular areas almost as wide as malar; postocular area with a row of 6–8 large setae. Maxillary palpus with apical segment almost 2/3 length of basal 4 segments combined. Processes of fifth sternum large, ovoid.

Genitalia: Identical to that of typical subspecies, except process *j* of aedeagus deeply forked, arms 1/2 to 2/3 length of stem.

FEMALE.—Similar to male in size and coloration.

TYPES.—*Holotype* (male): GUATEMALA, *Dpto. Huehuetenango*, 20 mi NW Huehuetenango, 9–10 Aug 1967, O.S. Flint, Jr.

*Paratypes*: Same data, 5♀. *Dpto. Quezaltenango*, Volcan Santa Maria, June, Schaus and Barnes, 1♂. *Dpto. Suchitepéquez*, Finca Mocá, 12 Jun 1966, Flint and Ortiz, 1♂. *Dpto. Chimaltenango*, Yepocapa, 8 and 15 May 1948, R.L. Wenzel, 2♂, 2♀. *Dpto. Baja Verapaz*, rt 17 km 125, Sierra las Minas, 22–26 Jun 1966, Flint and Ortiz, 1♂. [*Dpto. unknown*], Monte Grande, 29 May 1913, E.G. Smyth, 2♂. NICARAGUA, *Dpto. Matagalpa*, 5.3 mi E Matagalpa, 20 Jul 1967, O.S. Flint, Jr., 4♂, 5♀; Sta. Maria de Ostuma, 17 Jun 1974, T.W. Donnelly, 2♂, 1♀. MEXICO, *Edo. Chiapas*, Finca Esperanza, 7 Mar 1935, A. Dampf (MF4169), 1♂; same, but 24 May 1938 (MF5910), 1♂; Finca Lubeca, 21 Jun 1935, A. Dampf (MF4581), 1♂, 1♀; Finca Victoria, 11 May 1935, A. Dampf (4120), 1♂; same, but 16 May 1938 (MF6902), 1♂; Finca Vergel, 12 May to 3 Jun 1935, A. Dampf, 10♂, 2♀; Santa Elena, 25 km de Lagunas de Montebello, 11 Apr 1981, C.R. Beutelspacher, 1♂, 1♀; same but 20 km de Lagunas de Montebello, 8 Apr 1979, J. Bueno, S., 6♂, 2♀; 61 mi S Pichucalco, 1785m, 12 Jul 1983, Wolfe and Valverde, 1♂, 2♀. *Edo. Oaxaca*, San José, Ixtepec, 7 Mar 1935, A. Dampf (MF4169), 1♂; 8 km S Valle Nacional, 25 May 1981, Flint, et al., 2♂; Valle Nacional, 13 Sep 1982, A. Ibarra, 1♂. *Edo. Veracruz*, Cerro el Vigía, Santiago Tuxtla, Aug 1967, 1♂; same, but 7 Oct 1967, 1♂. *Edo. Michoacán*, San José Purúa, 28 Apr 1979, J. Bueno, 1♂, 1♀.

Holotype in USNM; paratypes in CNC, IBUNAM, INHS, SDMNH, and USNM.

REMARKS.—The difference between the two subspecies of *simulans* appears to be limited to the depth of the apical fork of process *j* of the phallus. In *mayanum* the process is more deeply forked, being 1/3 to more than 1/2 (example from Michoacán) of the total length of the process. The form of the other parts of the genitalia appears to be identical in the two subspecies.

The ranges of the two subspecies are distinct. The nominate subspecies is known only from Costa Rica and Panama. To the north it is separated from the range of *mayanum* by an apparently unsuitable lowlying area along the Costa Rican-Nicaraguan border. North of this area, *mayanum* is found in the highlands well into central Mexico.

*Leptonema spinulum*, new species

FIGURES 610–617; MAP 24

MALE.—Wings and body pale green, fading to brown; forewing slightly infuscate for apical third. Length of forewing 15–16 mm.

Malar space very narrow, about  $\frac{1}{8}$  height of eye. Parafacial and postocular areas about  $\frac{3}{4}$  width of malar; postocular area with a row of 5 setae. Maxillary palpus with fifth segment  $\frac{2}{3}$  length of basal 4 segments combined. Processes of fifth sternum large, ovoid.

MALE GENITALIA: Tenth tergum with warts *a*, *b1*, and *b2* elongate, arising in close proximity, *b2* deflexed into

ventromesal position; lateral lobe with a sinuate, sclerotized ventral margin, behind which is a distinct concavity and a more lightly sclerotized mesal lobe. Clasper with apical segment terete; basal segment straight, unmodified basally, over 4 times as long as apical segment. Phallobase elongate; *a* bilobed; *b* apically produced into an elongate, pointed apical lobe, and *c* a short, basally rounded lobe with a small dorsal point; *e* completely fused to phallobase, more or less outlined by a row of spinules; *f* present; *j* two-parted, one a short, nearly erect point basally, other a small apical lobe whose tip lies to one side or other.

FEMALE.—Similar to male in coloration; slightly larger, forewing 16–18 mm.



MAP 24.—Distributions of *Leptonema spinulum*, new species, *L. insulanum* Banks, *L. uncatum* Mosely, and *L. tripartitum*, new species.



**TYPES.**—*Holotype* (male): PERU, *Dpto. Cuzco*, Cosñipata Valley, Hacienda Maria (tropical jungle, 2700'), 24 Feb 1952, F. Woytkowski.

*Paratypes:* [*Dpto. Huanuco*], Huallaga/Aguaytia (400 m), [no date], L.E. Peña G., 1♂. [ARGENTINA, *Pcia. Corrientes*], Río Paraná, Bella Vista, 22 Dec, H. Smith, 1♂. BRAZIL, *Edo. Mato Grosso*, Buriti, Chapada dos Guimaraes, 1200 m, 28 Jan 1972, E.G., I., and E.A. Munroe, 1♂. *Distrito Federal*, Planaltina, 1000 m, 25–30 Sep 1985, S.E. Miller, 1♂, 1♀. GUYANA, *Potaro Dist.*, Takutu Mountins, 6° 15' N, 59° 5' W, 6 Dec 1983, Spangler et al., 1♂. VENEZUELA, *Edo. Bolívar*, Kanarakuni, Alto Caura (450 m), 13 Sep 1964, F. Fernandez Y., 1♂.

*Holotype* in USNM; *paratypes* in CNC, IZAM, MCZ, and USNM.

**REMARKS.**—This distinctive species is referred to the *simulans* Group with hesitation, as the genitalia appear quite different from the other species of the group. However, it does possess process *j* that is present only in this group.

### The *insulanum* Group

**DIAGNOSTIC CHARACTERS.**—Size moderate; forewing 12–15 mm. Color pale green, forewing generally with apical third slightly infuscate; green often fading to pale brown. Tibial spurs 2, 4, 4. Middle tibiae of female not broader than in male. Malar space narrow, bare. Male tenth tergum with warts *a* and *b* well developed, erect, lateral lobe elongate, blade-like with a well-developed basal process; mesal lobe well developed, surpassing lateral lobe, very broad in dorsal aspect. Basal segment of clasper without apicomeres spiculate lobe, with large, basomesal process. Phallus with base rather narrow, elongate, obliquely angled to axis of stem; apex with process *a* well developed, *b* pointed in lateral aspect, often very broad in dorsal, *c* lacking, *e* and generally *d* present and pointed, *f* well developed.

**REMARKS.**—This well-marked group of species is most closely related to the *complexum* group and contains three species: *insulanum* Banks, *tripartitum*, new species, and *uncatum* Mosely.

**DISTRIBUTION.**—The group is restricted to the Andes in northern and northwestern South America.

### *Leptonema insulanum* Banks

FIGURES 618–623; MAP 24

*Leptonema insulanum* Banks, 1924:455 [holotype ♂, in MCZ].—Fischer, 1963:169.—Flint, 1964:36–39, figs. 9j–k, 10a–d; 1967b:8; 1981:20, figs. 68–70.—Botosaneanu and Flint, 1982:16, figs. 17, 18 [larva].

*Leptonema ulmeri* Mosely, 1933:39–41, figs. 100–105 [holotype ♂, in BMNH].—Fischer, 1963:174.—Flint, 1964:36 [synonymy].

**TYPE-LOCALITIES.**—Of *insulanum*: San Juan, Puerto Rico [undoubtedly either mislabelled or label misinterpreted]. Of *ulmeri*: Venezuela.

**DISTRIBUTION.**—Venezuela.

**MATERIAL EXAMINED.**—VENEZUELA, *Edo. Anzoategui*, N Valle de Guanape, 900 m, 29 Nov–2 Dec 1983, Chacon and Andara, 1♀. *Edo. Aragua*, Tiara, 30 Jan 1982, O.S. Flint, Jr., 1♂; Estacion Experimental Cataurito, 32 km E Villa de Cura, 1100 m, 1 Feb 1982, O.S. Flint, Jr., 1♂, 1♀. *Edo. Miranda*, Valle Río Caira, SW Panaquire, approx. 10° 12' N, 66° 17' W, 280 m, 18–21 Sep 1979, Fernandez and Clavijo, 1♀. *Edo. Yaracuy*, Las Flores, Aroa, 1200 m, 16 Aug 1980, Garcia and Sanchez, 1♂. *Edo. Carabobo*, La Entrada, 250 m, 15 May 1981, L.D. Otero, 1♀. Material in CNC, IZAM, and USNM. Also see specimens examined by Flint (1981).

**REMARKS.**—This and *tripartitum* are sister species. The primary differences are to be found in the phallus of the two species, especially in processes *f* that are unitary rather than trifid. These species also appear to be allopatric, with *insulanum* being found in the Andes of central Venezuela, and *tripartitum* in the Andes in western Venezuela and Colombia.

### *Leptonema tripartitum*, new species

FIGURES 624–631; MAP 24

**MALE.**—Wings and body pale green; forewing pale green slightly infuscate for apical third. Forewing length 14–15 mm.

Malar space narrow, about 1/8 height of eye. Parafacial and postocular areas about 3/4 width of malar; postocular area with a row of 4–5 stout setae. Maxillary palpus with fifth segment about 2/3 length of basal 4 combined. Processes of fifth sternum ovoid, rather small.

**Genitalia:** Tenth tergum with wart *a* basal, low with enlarged setal bases, *b* semierect arising from inner face of lateral lobe subapically; lateral lobe blade-like with ventral margin bearing a narrow process; with a well developed inner lobe surpassing lateral lobe. Clasper with basal segment about 4 times as long as apical, without an apicomeres spinulose lobe; basomesal process well developed, pointed apically. Phallus with base narrow, elongate, obliquely angled to stem; apex apparently lacking processes *b* and *c*, apex modified into a pouch opening obliquely upward from which the end of the ejaculatory duct protrudes, beneath which protrudes a pair of flat lobes (*g* ?); *d* a simple, deflexed process; *e* a long, erect, apically serrate process; *f* elongate, trifid in dorsal aspect.

**FEMALE.**—Pale green; slightly larger, 15–17 mm. Hindwing lacking yellow cellule.

**TYPE.**—*Holotype* (male): COLOMBIA, *Dpto. Antioquia*, Quebrada Honda, 12 km SW Fredonia, 1450 m, 22 Feb 1983, O.S. Flint, Jr.

*Paratypes:* Same data 6♂, 4♀. *Dpto. Magdalena*, stream near Minca, Sierra de Santa Marta, 2000 m, 13 Jul 1983, U. Matthias, 1♂. VENEZUELA, *Edo. Táchira*, Río Frio, 12



Dec 1982, Exp. Inst. Zool. Agr., 1♂, 1♀.

Holotype in USNM; paratypes in IZAM, UNCMB, and USNM.

REMARKS.—The species is very closely related to *insulanum*. In *tripartitum* the basomesal process of the clasper is shorter, process *d* of the phallus shorter and decumbent, and process *f* is tripartite in dorsal aspect rather than a simple lobe.

### *Leptonema uncatum* Mosely

FIGURES 632–636; MAP 24

*Leptonema uncatum* Mosely, 1933:41–42, figs. 106–111 [holotype ♂, in MCZ].—Fischer, 1963:174.

TYPE-LOCALITY.—Sozonoco, Colombia.

DISTRIBUTION.—Colombia.

MATERIAL EXAMINED.—COLOMBIA, Sozonoco, 800 m, Jun, E. Candelli, holotype ♂. *Edo. Meta*, Quebrada Blanca, 3 km W Restrepo, 11 Feb 1982, O.S. Flint, Jr., 1♂. Holotype in MCZ; material in USNM.

REMARKS.—The type-locality is not found in any gazetteer available to us. The label is handwritten by N. Banks and is probably an orthographic error for Susumaco. De Marmels (1985) has recently discovered this locality on the road from Bogotá to Villavicencio near the boundary line between the Departments of Cundinamarca and Meta, which is very close to the locality of the other known example.

The form of the male tenth tergum, clasper, and aedeagus show that this species is clearly a member of the group, however, it is more distantly related to the other two than they are to each other. The processes of the phallus are quite different in *uncatum* as is the shorter and very broad basomesal lobe of the clasper.

### The *pallidum* Group

DIAGNOSTIC CHARACTERS.—Size intermediate; forewing 11–20 mm. Color pale greenish, generally turning pale ochreous after death. Hindwing of females of many species with a yellow cell composed of densely packed, yellowish, scale-like hairs on each side of Cu<sub>2</sub>. Tibial spurs 2, 4, 4. Middle tibia not broader in female than in male. Malar space narrow and bare. Fourth segment of maxillary palpus much shorter than third. Basal segment of abdominal sternum with a median suture. Fifth sternal lobe of intermediate to large size. Male tenth tergum with warts *a* and *b* generally present, short, contiguous and apical in position; lateral lobe elongate, apex rounded. Clasper with basal segment bearing a cluster of short, blunt spines near apex on inner surface, often with an elongate basomesal lobe; apical segment short. Phallus with process *a* prominent, processes *b* and *c* usually

elongate, processes *d*, *e*, and *g* usually present; all processes, except *a* and *g* spiculate.

REMARKS.—The following eight species comprise the *pallidum* group: *albovirens* (Walker), *alceatum*, new species, *archboldi* Flint, *moselyi*, new species, *pallidum* Guérin, *ramosum*, new species, *spangleri*, new species, and *viridianum* Navás.

DISTRIBUTION.—The group is the most widespread of any in the genus in the New World. Species have been taken from southwestern United States to northern Argentina, including the lesser antillean islands as far north as Dominica. They are often found in warmer lowland waters, providing the streams are reasonably shallow and fast-flowing with a rocky bottom.

### *Leptonema albovirens* (Walker)

FIGURES 1, 4–6, 13, 637–646; MAP 25

*Macronema albovirens* Walker, 1852:76 [lectotype ♂, in BMNH].

*Leptonema albovirens* (Walker).—Fischer, 1963:166.—Flint, 1967b:8, 1968:31, 32; 1981:19.—Bueno Soria and Flint, 1978:208, 209.—Harrison and Rankin, 1976:275–311.

*Leptonema guatemalum* Banks, 1913:89, Pl. IV: figs. 9, 11. [holotype ♂, in MCZ].—Flint, 1967b:8 [synonymy].

TYPE-LOCALITY.—Of *albovirens*: Venezuela. Of *guatemalum*: Olas de Moka, Dpto. Solola, Guatemala.

DISTRIBUTION.—USA (Texas), Mexico, Guatemala, Belize, Honduras, Nicaragua, Costa Rica, Panama, Colombia, Venezuela, Trinidad, Tobago, Grenada, St. Vincent. Mosely (1933:47) lists British Guiana: these specimens are *ramosum*, new species.

MATERIAL EXAMINED.—Material is too numerous to list, but we have seen thousands of specimens, at least a few from each country listed above. Map 25 gives the outline of the known distribution of *albovirens*, but omits many localities in the central part of the range. In fact, *albovirens* is the “weed” species of the genus.

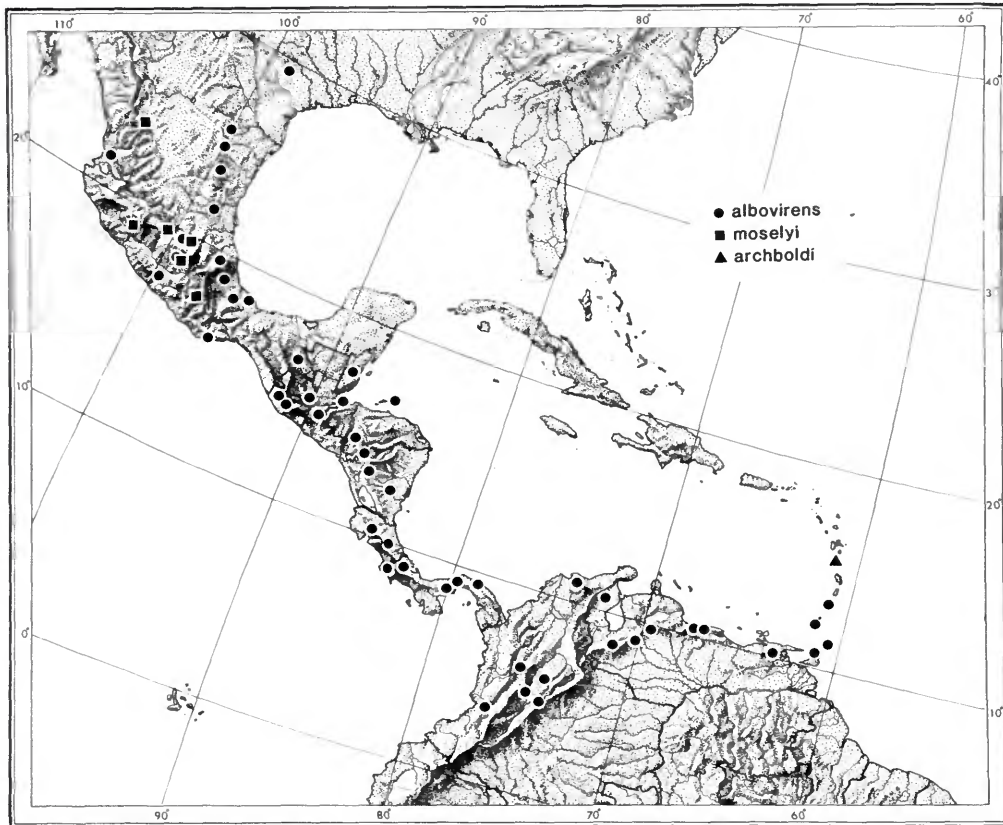
REMARKS.—The species is very closely related to *moselyi* and we still have doubts as to the validity of the two species. However, because the males differ in the degree of development of the processes *d* and *e* of the phallus and the size of the fifth sternal processes, the females in presence or absence of the yellow cell in the hind wing, and that Flint collected both forms at the same sheet on the same night (Mexico, Morelos, Xochitipeç, 12–14 Jul 1965), we are herein treating the two as distinct species.

### *Leptonema alceatum*, new species

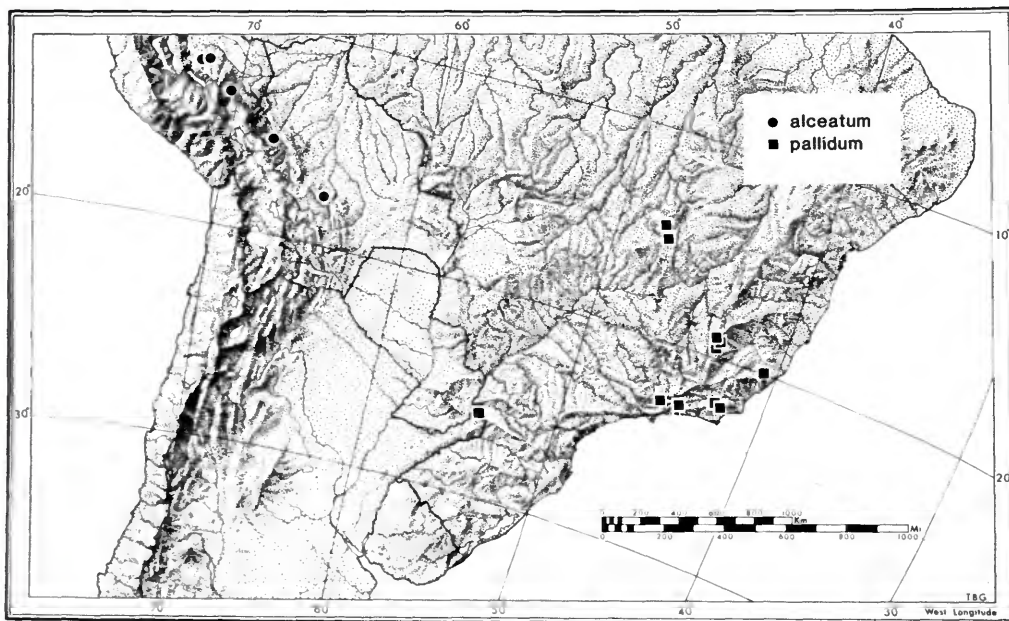
FIGURES 647–654; MAP 26

MALE.—Wings unicolorous, pale sandy-brown, probably greenish in life. Forewing length 13–15 mm.

Malar space narrow, about 1/2 height of eye. Parafacial



MAP 25.—Distributions of *Leptonema albovirens* (Walker), *L. moselyi*, new species, and *L. archboldi* Flint.



MAP 26.—Distributions of *Leptonema alceatum*, new species, and *L. pallidum* Guérin.

and postocular areas about as wide as malar; postocular area with a row of 5–7 stout setae. Maxillary palpus with fifth segment less than half as long as basal 4 segments combined. Processes of fifth sternum pyriform, of intermediate size.

**Genitalia:** Tenth tergum lacking warts; lateral lobe elongate, apex projecting and rounded, ventral margin sclerotized and twisted with a finger-like process (of variable length) directed posteriad. Clasper relatively short and stout; apical segment short, basal segment about 5 times as long as apical with a few spinulose setae apicomeseally, base without processes but transverse. Phallus with base broad, angled to stem; process *a* semierect, with a mesodorsal fimbriate crest, in dorsal aspect bilobed; *b* long, reflexed, strongly divided and fimbriate; *c* not distinguishable from *b*; *d* a decurved, spinulose process; *e* a membranous lobe bearing large setae; *g* elongate, slender, reflexed with many serrations.

**FEMALE.**—Larger, 15–16 mm. Hindwing with yellow cellule on Cu<sub>2</sub>.

**TYPE.**—*Holotype* (male): PERU, *Dpto. Cuzco*, Santa Isabel, Cosñipata Valley, 1 Jan 1952, F. Wyotkowski.

**Paratypes:** Same data, 1♂, 1♀; same, but Hacienda Maria (tropical jungle, 2700'), 19 Feb 1952, 2♂; same, but Paucartambo, 17 Nov 1951, 1♂, 1♀; Quince Mil, Aug 1962, L.E. Peña G., 8♂, 2♀; same, but Nov 1962, 1♂. BOLIVIA, *Dpto. La Paz*, Santa Barbara, Coroico, 1100 m, 4 Jan 1976, L.E. Peña G., 1♂; Río Coroico, 1200 m, 23–26 Nov 1984, L.E. Peña G., 13♂, 9♀. *Dpto. Cochabamba*, Chapare, Alto Palmar, 1100 m, 16 Mar 1961, J.E. Foerster, 1♂.

**Holotype** in USNM; **paratypes** in CNC, INHS and USNM.

**REMARKS.**—This species is closely related to *spangleri* from western Venezuela. In *alceatum* the tenth tergum lacks all signs of warts, process *d* of the phallus is attached to the phallobase, and process *g* is strongly reflexed and spinulate.

### *Leptonema archboldi* Flint

FIGURES 655–659; MAP 25

*Leptonema archboldi* Flint, 1968:29–31 [holotype ♂, in USNM].

**TYPE-LOCALITY.**—Dominica, 0.5 mi S Pont Casse.

**DISTRIBUTION.**—Dominica.

**MATERIAL EXAMINED.**—Material listed in Flint 1968; no further material available. Material in USNM.

**REMARKS.**—This species is currently known only from the Lesser Antillean island of Dominica, but probably will be found on Guadeloupe and possibly other adjacent islands to the south.

It is very closely related to *pallidum*, and is only to be recognized by differences in the tenth tergum and claspers. In *archboldi* the tergum is rounded apically with no sign of wart *a* or *b*, but wart *c* is well developed (in *pallidum* this is represented by a small tuft of setae). The apical segment of

the clasper is longer and there is no apicomeseal lobe bearing the spinose setae of the basal segment in *archboldi*.

The female of this species lacks the yellow cellule in the hindwing.

### *Leptonema moselyi*, new species

FIGURES 660–668; MAP 25

*Leptonema albivirens* (Walker).—Mosely, 1933:46, fig. 130 [in part, variant ♂ from Cuernavaca, Mexico].

**MALE.**—Wings and body uniformly pale greenish, rapidly fading to brownish white. Forewing 11–13 mm.

Malar space very narrow, scarcely 1/9 height of eye. Parafacial and postocular areas about as wide as malar; postocular area with a row of 2–6 stout setae. Maxillary palpus with fifth segment almost 1/2 length of basal 4 segments combined. Processes of fifth sternum relatively small, elongate.

**Genitalia:** Tenth tergum with warts *a* and *b* small, apical in position; lateral lobe blade-like, extending as a flat plate beyond warts, apex obliquely truncate. Clasper with basal segment slightly more than three times as long as apical segment, with a few apicomeseal spinose setae, without a basomesal lobe. Phallus with base angled; *a* protruding, bilobed in dorsal aspect; *b* erect or reflexed, serrate; *c* rather short, reflexed, serrate; *d* short, deflexed; *e* short, generally hooked apicad; *g* rounded, knob-like in both lateral and ventral aspects.

**FEMALE.**—Larger, forewing 15–17 mm. Lacking yellow cellule on vein Cu<sub>2</sub>.

**TYPES.**—*Holotype* (male): MEXICO, *Edo. Morelos*, Xochitepec, 12–14 Jul 1965, Flint and Ortiz.

**Paratypes:** Same data, 4♂, 2♀; Cuautla, 27 Jul 1937, A. Dampf (MF6247), 2♂, 3♀; same, but 28 Aug 1937, MF6248, 1♂, 3♀; same, but 30 Aug 1937, MF6249, 1♂, 6♀; same, but 31 Aug 1937, MF6250, 2♂, 6♀; same, but 2 Sep 1937, MF6259, 4♂, 3♀; same, but 23 Sep 1937, 1♂, 11♀; Cuernavaca, 26 Mar 1932, A. Dampf (MF2492), 1♂; same, but 13 May 1932, MF2570, 1♂; 15 mi S Cuernavaca, 15 Dec 1946, E.S. Ross, 1♂; Camomilas, 9 May 1942, A. Dampf (MF9697), 1♂; Sn. Rafael Vicente Aranda, 26 Mar 1982, H. Velasco, 5♂, 4♀; same, but 2 Oct 1982, 3♂; Río Amacuzac, Huajintlán, 28 May 1983, Porrás and Castelrejon, 23♂; Ticumán, 8 Jan 1981, J. Bueno, 5♂; same, but 13–14 Mar 1981, 6♀; Morelos, 15 Mar 1977, 1♂. *Edo. México*, Chapingo, 13 Jun 1924, A. Dampf (MF203), 2♂. *Edo. Michoacán*, San José de Purúa, 28 Apr 1979, J. Bueno, 8♂, 3♀; 5 mi W Apatazingán, 1200', 13 Aug 1941, H. Hoogstraal, 1♂, 1♀; same, but la Majada, moist jungle, 12 Aug 1941, 1♂. *Edo. Oaxaca*, Tamazulapán, 7–8 Jun 1967, Flint and Ortiz, 7♂, 1♀. *Edo. Durango*, 23 mi S Durango, 6000', 3 Jul 1964, W.R.M. Mason, 1♂; Rt 45, Río Melones, Nombre de Dios, 17 Aug 1977, J. Bueno S., 10♂, 2♀. Mexico, [no further



locality], A. Dampf (MF1704, 1738, 1557), 3♂.

Holotype in USNM; paratypes in CAS, CNC, IBUNAM, INHS, and USNM.

**REMARKS.**—The species is very closely related to *albovirens*. The range of *moselyi* is totally enclosed in that of the *albovirens*. The type series was collected intermingled at the sheet with *albovirens* from which it was not distinguished at the time.

The males differ by having the fifth sternal processes noticeably smaller in *moselyi*, and by having a more truncate lateral lobe of the tenth tergum and by having the processes of the phallus much reduced. The females are easily distinguished as *moselyi* lacks the yellow cell in the hindwing.

### *Leptonema pallidum* Guérin

FIGURES 669–673; MAP 26

*Leptonema pallidum* Guérin, 1843:396 [sex, disposition, and existence of type unknown].—Fischer, 1963:171.

*Leptonema furcatum* Ulmer, 1905a:57, 58, figs. 50, 51 [lectotype ♂, in PAN].—Fischer, 1963:169.—Weidner, 1964:84.—Flint, 1966:5, 6 [lectotype designated].

*Hydropsyche flagellata* Jacquemart, 1962:6–10, figs. 5–8 [holotype ♂, in IRSNB] [new synonymy].

**TYPE-LOCALITIES.**—Of *pallidum*: Brazil. Of *furcatum*: Espírito Santo, Brazil. Of *flagellata*: Bomanca, Edo. de Rio.

**DISTRIBUTION.**—Argentina, Brazil.

**MATERIAL EXAMINED.**—ARGENTINA, *Pcia. Misiones*, Dept. Frontera, San Antonio, Dec 1961, Martinez, 1♂. BRAZIL, *Distrito Federal*, Parque do Gama, 10 Oct 1971, Munroe and Brown, 1♂. *Edo. Rio de Janeiro*, km 54, 26 km E Nova Friburgo, 19 Apr 1977, C.M. and O.S. Flint, Jr., 4♂, 1♀; same, but 25 Apr 1977, 5♂, 9♀; Cachoeiras de Macacu, 800 m, 15 Oct 1985, S.E. Miller, 1♂; Rio Macacu, N Cachoeiras de Macacu, 650 m, 16 Oct 1985, S.E. Miller, 1♀; Fazenda Japuhya, Angra dos Reis, 6 Jul–22 Sep 1945, L. Travassos F., 2♂, 7♀. *Edo. Espírito Santo*, Fazenda Santa Clara, 15 km SE Santa Teresa, 22 Apr 1977, C.M. and O.S. Flint, Jr., 1♀. *Edo. Goiás*, 24 km E Formosa, 14–29 May 1956, F.S. Truxal, 7♂; Chapada dos Veadeiros, 18–24 km N Alto Paraíso, 1400–1500 m, 2–5 Oct 1985, S.E. Miller, 1♀. *Edo. São Paulo*, 10 km N Rio Preto, 13 Jan 1977, L. Knutson, 1♂. *Edo. Minas Gerais*, Serra do Cipó, km 110, 23 Sep 1976, C.G. Froehlich, 1♀; same, but 5–8 Oct 1975, 1♂, 4♀; same, but 21 Dec 1974, 1♀; same, but km 117, 18 Dec 1973, 1♂; same, but Rio Capivara, 6 Feb 1974, 1♂, 1♀; same, but 18 Apr 1975, 1♂; same, but 18 Dec 1973, 1♂, 1♀; same, but caminho da usina, afl. Rio Capivara, 19 Apr 1975, 1♂, 3♀; same, but 21 Sep 1976, 3♂, 2♀; same, but 22 Sep 1976, 1♂, 1♀; same, but 20 Dec 1974, 1♂, 1♀; same, but Rio Branquinho, 7 May 1974, 1♂. Material in CNC, LACM, MACN, USNM, and USP.

**REMARKS.**—Mosely (1933:7, 8) gives an extensive analysis of the range of this species, and concludes that all records

of the species from Mexico and Central America are erroneous. We also accept his conclusion (Mosely, 1939) that *pallidum* and *furcatum* are synonyms. Flint's experience with live examples in Brazil verifies the color of the living examples as being pale greenish.

The females of this species generally have the yellow cell on vein Cu<sub>2</sub> in the hindwing, but many examples from some localities lack it entirely.

This species seems to be very variable in the comparative lengths of the processes of the phallus and lobes of the tenth tergum. Individuals from each locality differ to some degree from examples from other sites. However, all contain the same processes arising from the same position, although one locality has reduced processes *b* and *b1* to short truncate knobs. A male from Serra do Cipó has even lost the pointed, basally directed process *d*, and the round lobe associated with its base.

### *Leptonema ramosum*, new species

FIGURES 674–682; MAP 27

*Leptonema albovirens* (Walker).—Mosely, 1931:170 [misidentification]; 1933:47 [misidentification of material from British Guiana only].

*Leptonema dissimile* Mosely.—Flint, 1974:101, figs. 225–227 [misidentification].

*Leptonema viridianum* Navás.—Flint, 1978:384, figs. 55, 56 [misidentification of example from Rio Marauã, Brazil].

**MALE.**—Wings and body uniformly pale greenish, rapidly fading to brownish white. Forewing 10–14 mm.

Malar space narrow, about 1/6 height of eye. Parafacial and postocular areas 3/4 as wide as malar space; postocular area with a row of 3–5 stout setae. Maxillary palpus with fifth segment less than half as long as basal 4 segments combined. Processes of fifth sternum moderately large, round.

**Genitalia:** Tenth tergum with warts *a* and *b* small, apical; lateral lobe elongate, rounded apically, apex with a pocket on inner side into which wart *b* is set. Clasper with a small patch of spines near apex of inner face, basal segment 4 times as long as apical; with a basomesal lobe that is truncate in either lateral or posterior aspect. Phallus with base large, angled to axis of stem; process *a* arched, with a middorsal crest; *b* and *c* long, reflexed, spinulate; *d*, pointed, decurved; *e* reduced to a row of spinules on phallobase; *g* a pointed lobe, produced caliper-like across the venter.

**FEMALE.**—Similar, pale greenish; hind wing with a yellow cell on vein Cu<sub>2</sub>. Length of forewing 13–15 mm.

**TYPES.**—*Holotype* (male): VENEZUELA, *Edo. Bolívar*, 10 km S of km 88, Piedra de Virgen, 20 Mar 1982, G.F. and J.F. Hevel.

**Paratypes:** Same data, 1♂; Salto Pará, Rio Caura, 250 m, 20–22 Nov 1978, A. Chacon H., 8♂, 10♀; Kanarakuni, 450 m, 2 Feb 1967, Fernandez and D'Ascoli, 1♂, 1♀. [*T.F. Amazonas*], Mt. Duida, 15–22 Nov 1929, Tate Expedition,



MAP 27.—Distributions of *Leptonema spangleri*, new species, *L. ramosum*, new species, and *L. viridianum* Navás.

3♂, 1♀. SURINAME, Litani River, Waremapan rapids, 30 Jul 1939, D.C. Geijskes, 2♂, 2♀. GUYANA, Mazaruni-Potaro Dist., Takutu Mts., 6°15'N, 59°5'W, 11–15 Dec 1983, Spangler et al., 2♂.

*Other Material:* GUYANA, Kieteur, 26 May 1920, J. Ogilvie, 1♀. Issororo, N.W.D., Dec 1918, G.E. Bodkin, 1♀.

Holotype in USNM; paratypes in AMNH, IZAM, RNH, and USNM; material in BMNH.

**REMARKS.**—This species is the sister species of *viridianum*. It differs in not having the basomesal lobe of the clasper produced into a point, in the phallus by lacking process  $\epsilon$  as a free hook, and in lesser degree in the lobes of the tenth tergum.

### *Leptonema spangleri*, new species

FIGURES 683–690; MAP 27

**MALE.**—Uniformly pale green; wings unicolorous, pale greenish. Forewing length 12–13 mm.

Malar space narrow, about  $\frac{1}{6}$  height of eye. Para-facial area as wide as malar, postocular area narrower; postocular area with a row 3–4 stout setae. Maxillary palpus with fifth segment slightly more than  $\frac{1}{3}$  length of basal 4 segments combined. Processes of fifth segment ovoid, small, anterior margin slightly elevated.

**Genitalia:** Tenth tergum with a single rectangular wart middorsally ( $a$  ?); lateral lobe rounded, in dorsal aspect with

apex rectangularly produced, ventral margin sclerotized and twisted with a small basoventral pocket. Clasper with apical segment short; basal segment almost 4 times as long as apical, with a few apicomeral blunt setae, no basomesal process. Phallus with base broad, angled to axis of stem that is slightly sinuate; process *a* arched, in dorsal aspect with a small apical excision; *b* long, reflexed, spinulose with a strong basal spine (*c* ?); *d* a long, spinulose process arising from base of *e*; *e* a membranous lobe bearing large setae; *g* elongate, slender, semierect.

**FEMALE.**—Similar, pale green, larger, forewing 14–15 mm. Hindwing with yellow cell.

**TYPES.**—*Holotype* (male): VENEZUELA, *Edo. Barinas*, Barinitas, 22–23 Feb 1969, P. and P. Spangler.

*Paratypes*: *Edo. Tachira*, Río Frio, 12 Dec 1982, Exp. Fac. Agron. U.C.V., 2♂, 4♀.

*Holotype* in USNM; *paratypes* in IZAM and USNM.

**REMARKS.**—This very closely related to *alceatum* and is found to north of the range of the latter. It is easily recognized by the large middorsal wart of the tenth tergum, and phallic process *a* lacking the dorsal crest and *d* arising directly from *e*, which is wholly free of the phalotheca.

### *Leptonema viridianum* Navás

FIGURES 691–698; MAP 27

*Leptonema viridianum* Navás, 1916a:31–33, fig. 13 [type in collection Navás, now lost].—Fischer, 1963:166, 167 [as synonym of *albovirens*].—Flint, 1978:384.

*Leptonema dissimile* Mosely, 1933:43–45, figs. 117–122 [holotype ♂, in MCZ].—Fischer, 1963:168.—Flint, 1972:235; 1978:384 [synonymy].

**TYPE-LOCALITIES.**—Of *viridianum*: Bahia, Brazil. Of *dissimile*: Pcia. Sara, Bolivia.

**DISTRIBUTION.**—Argentina, Bolivia, Brazil, Colombia, Ecuador, Guyana, Paraguay, Peru, and Venezuela.

**MATERIAL EXAMINED.**—ARGENTINA, *Pcia. Misiones*, Mbopicua, 6–7 Apr 1971, C.M. and O.S. Flint, Jr., 2♂, 2♀; Puerto Libertad, 24 Nov 1973, O.S. Flint, Jr., 1♀. BOLIVIA, *Pcia. Sara*, Steinbach, holotype ♂ of *dissimile*. BRAZIL, *Distrito Federal*, Estacao Florestal, Cabeça do Veado, 1100 m, 14–27 Oct 1971, E.G. L. and E.A. Munroe, 4♀; Parque do Gama, 10 Oct 1971, Munroe and Brown, 1♀; Planaltina, 1000 m, 25–30 Sep 1985, S.E. Miller, 2♂, 4♀. *Edo. Rio de Janeiro*, 26 km E Nova Friburgo, 410 m, 25 Apr 1977, C.M. and O.S. Flint, Jr., 5♂; same but 19 Apr 1977, 1♂; Cachoeiras de Macacu, 800 m, 15 Oct 1985, S.E. Miller, 2♂. *Edo. Goias*, 24 km E Formosa, 4–13 Jun 1956, F.S. Truxal, 2♂, 1♀; Goiania, CNPAF, 5 Dec 1976, 1♂; Fazenda Nova Orlandia, Jatai, Jan 1964, Martins et al., 1♂, 1♀. *Edo. Minas Gerais*, Rio Bandeira, Feb 1932, J. Blaser, 1♀; Serra do Cipó, km 110, 29 Apr 1973, C.G. Froehlich, 1♂; same, but 29 Oct 1974, 1♀; same, but caminho da usina, afl. Rio Capivara, 21 Sep 1976, 1♂; same, but 20 Dec 1974, 1♀; Nova Lima, 850 m, 8–9 Oct 1985, S.E. Miller, 1♀. COL-

OMBIA, *Dpto. Meta*, Restrepo, 500 m, 7–10 Aug 1936, J. Bequaert, 1♂. *Dpto. Caquetá*, Morelia, Río Bodoquero, 430 m, 19–20 Jan 1969, Duckworth and Dietz, 1♂.

ECUADOR, *Pcia. Pastaza*, Puyo, 3280', 30 Jan 1976, Spangler et al., 1♀; same, but 1–11 Feb 1976, Spangler et al., 5♂, 10♀; same, but 29 May 1975, Cohen and Langley, 1♂, 1♀; same, but 5–17 May 1977, Spangler and Givens, 8♂, 25♀; same, but 5 km S Puyo, 8 May 1977, 2♀; same, but 1.5 km NE Puyo, 14 May 1977, 1♂; same, but 1.5 km S Puyo, 14 May 1977, 1♂; same, but 21 May 1977, 2♂, 4♀; same, but 3 km N Puyo, 30 May 1975, Langley and Cohen, 2♂; Road between Puyo and Puerto Napo, Feb 1964, C. Gregoire, 2♂, 1♀. *Pcia. Zamora-Chinchipec*, Zamora, 31 May 1976, Langley et al., 1♀; Cumbaratza, 12 Jun 1976, Langley et al., 1♂. *Pcia. Napo*, Tena, 23–29 May 1977, Spangler and Givens, 9♂, 12♀.

GUYANA, *Mazaruni-Potaro Dist*, Takutu Mts., 6°15'N, 59°5'W, 8–12 Dec 1983, P.J. Spangler et al., 5♂. PARAGUAY, 2 km S Cerro Corá, 28 Nov 1973, O.S. Flint, Jr. 2♂. PERU, [*Dpto. Huanuco*], Tingo Maria, Monson Valley, 26 Oct, 10 Dec, and 18 Dec 1954, Schlinger and Ross, 3♂, 5♀; Aguaytia/Huallaga, 400 m, 14 Feb 1961, J.E. Foerster, 1♀. *Dpto. Cuzco*, Quince Mil, Aug to Nov 1962, L.E. Peña G., 1♂, 14♀. *Dpto. Madre de Dios*, Río Tambopata Reserve, 30 air km SW Puerto Maldonado, 290 m, 6–30 Nov 1979, J.B. Heppner, 14♂, 20♀. *Dpto. Puno*, Río Inambari, Loro-mayu, 5–6 Sep 1962, L.E. Peña G., 1♀. VENEZUELA, *T.F. Amazonas*, Cerro de la Neblina, Agua Blanca, 0°49'N, 66°08'W, 160 m, 20–21 Mar 1984, Flint and Louton, 4♂, 1♀; same, but Basecamp, 0°50'N, 66°10'W, 140 m, 10–28 Feb 1985, Spangler et al., 4♂. *Holotype dissimile* in collection MCZ; material in CAS, CNC, INHS, LACM, MCZ, and USNM.

**REMARKS.**—The identity of *viridianum* and the synonymy of *dissimile* were discussed by Flint (1978:384).

The species is similar in size and color to *albovirens*, *ramosum*, and several of the other species of the group. It is easily distinguished from all by the elongate, pointed baso-medial lobe of the claspers, and the details of the processes of the phallus. The female of this species possesses the yellow cell on vein Cu<sub>2</sub> in the hindwing.

### The complexum Group

**DIAGNOSTIC CHARACTERS.**—Size moderate; forewing length to 15 mm. Color pale green; forewing generally green, often with apical third slightly infuscate; green generally fading to pale brown. Tibial spurs 2, 4, 4. Middle tibiae and tarsi of females of some species distinctly dilated. Malar space narrow, bare. Basal abdominal segment without a median suture. Male tenth tergum with warts *a* and *b* well developed, generally broad and divided, with apex very broad in dorsal aspect; lateral lobe ovoid, dorsal margin distinct, apex generally surpassed in lateral aspect by median



lobe, ventral margin basally with a distinct groove, often with an associated lobe to one side. Basal segment of clasper without apicomeral spiculate lobe, base generally without lobe (present in *trifidum*). Phallus with base narrow to broad; apex with processes *b*, *c*, *d*, and *e* usually present and well developed, process *f* rarely present.

REMARKS.—The 11 species comprising this group may be easily divided into two distinct species groups: the *inca* subgroup consists of *inca* Mosely and *harpagum*, new species; and the *complexum* subgroup of *album* Mosely, *banksi* Mosely, *cheesmanae* Mosely, *complexum* Mosely, *forficulum* Mosely, *furciligermum*, new species, *intermedium* Mosely, *rosenbergi* Mosely, and *trifidum*, new species. The *inca* subgroup is most easily recognized by the form of the phallus, espe-

cially the strong process *f* and the truncate shape of process *a*. In general the other subgroup lacks *f* (present in *cheesmanae*, *rosenbergi*, and *trifidum*) and always has process *a* formed as an arched, free lobe.

DISTRIBUTION.—The group is found along the Andes of western and northern South America from Bolivia to Venezuela, and north in southern Central America as far as Costa Rica.

### *Leptonema album* Mosely

FIGURES 699–705; MAP 28

*Leptonema album* Mosely, 1933:49–51, figs. 142–147 [holotype ♂, in ZS/ZMH].—Fischer, 1963:167.—Weidner, 1964:83.



MAP 28.—Distributions of *Leptonema harpagum*, new species, *L. inca* Mosely, *L. album* Mosely, and *L. banksi* Mosely.

TYPE-LOCALITY.—Ecuador.

DISTRIBUTION.—Ecuador.

MATERIAL EXAMINED.—ECUADOR, [*Pcia. Esmeraldas*], Cachabé, Rosenberg, 1♂; 12 km SE San Lorenzo, 22–24 Mar 1979, Anderson and Minnick, 1♂; La Union, 3 Feb 1979 J.J. Anderson, 1♂. *Pcia. Cotopaxi*, 133 km W Latacunga, 1080', 3 Jul 1975, Langley and Cohen, 1♂. *Pcia. El Oro*, near Santa Rosa, 23 Jan 1955, Schlinger and Ross, 3♂, 1♀; Victoria/Arenillas, 150 m, 18–19 Aug 1977, L.E. Peña G., 1♂. *Pcia. Loja*, Río Puyango, 300 m, 17–18 Aug 1977, L.E. Peña G., 1♂. *Pcia. Los Rios*, 11 km S Quevedo, 3 Jul 1975, Langley and Cohen, 1♂; Quevedo [no more data], 1♂, 1♀; Playas de Montalvy, 15 m, Mar, MacIntyre, 1♂. *Pcia. Pichincha*, 29 km W Santo Domingo de los Colorados, 6 May 1975, Spangler et al., 2♂, 1♀; same but 14 km E Santo Domingo de los Colorados, 5 Jul 1975, Langley and Cohen, 2♂; Tinalandia [E edge of Santo Domingo de los Colorados], 16 Feb 1982, G. and M. Wood, 1♂; via Puerto Quito at km 113, 24 Jun 1976, J. Cohen, 3♂. Material in CAS, MCZ, and USNM.

REMARKS.—This pale greenish species has a rather distinctive variation of the *complexum*-type genitalia. The outstanding features that distinguish it from related species are: median lobe of tenth tergum well developed; clasper with a very long apical segment; phallic process *c* very rudimentary, but processes *d* and *e* longer than in most species, the latter process arising almost dorsomesally; no evidence of process *f*.

### *Leptonema banksi* Mosely

FIGURES 706–710; MAP 29

*Leptonema banksi* Mosely, 1933:55–57, figs. 166–171 [holotype ♂, in MCZ].—Fischer, 1963:167.

TYPE-LOCALITY.—Bogota [Colombia].

DISTRIBUTION.—Colombia.

MATERIAL EXAMINED.—[COLOMBIA], Bogotá, 77, Schon, holotype ♂. Holotype in MCZ.

REMARKS.—The species is very distinctive and seems most closely related to *complexum* and *forficulum*. However, the apical segment of the clasper is shorter than in either of these species, and, from the phallus, process *e* arises from the base of process *d*; whereas in *forficulum* and *complexum* it arises further mesad and is much less closely associated with *d*.

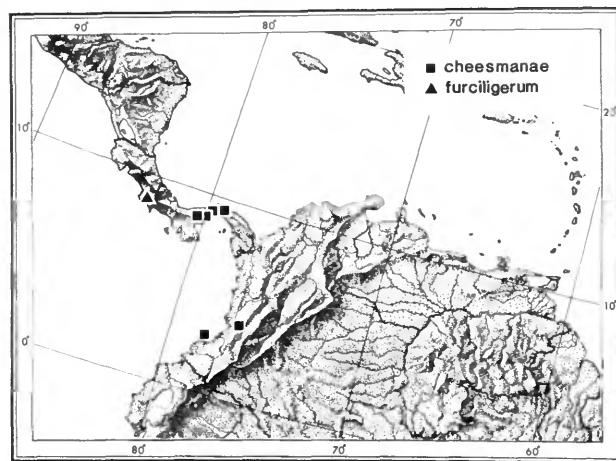
### *Leptonema cheesmanae* Mosely

FIGURES 711–717; MAP 29

*Leptonema cheesmanae* Mosely, 1933:51, 52, figs. 148–153 [holotype ♂, in BMNH].—Fischer, 1963:167.—McElravy et al., 1981:153; 1982:307.

TYPE-LOCALITY.—Gorgona Island, Colombia.

DISTRIBUTION.—Colombia, Panama.



MAP 29.—Distributions of *Leptonema cheesmanae* Mosely and *L. furciliggerum*, new species.

MATERIAL EXAMINED.—COLOMBIA, Gorgona Island, Jul 1924, L.E. Cheesman, 1♂ topotypic paratype. *Dpto. Valle*, Cali on Río Anchicayá, 5 Mar 1984, J. Martinez R., 1♂; Topacio, 1600 m, 13 Sep 1985, A.D. Quintero, 1♂, 1♀. PANAMA, Canal Zone, Barro Colorado Island, 20–23 May 1964, S.S. and W.D. Duckworth, 1♂. *Pcia. Panamá*, Cerro Campana, near Chicá, 2–5 Apr 1965, S.S. and W.D. Duckworth, 1♂. *Pcia. Coclé*, El Potroso, 10 km NE El Copé, 2500', 3 Nov 1980, student collection, 2♂, 2♀. *Com. San Blas*, Río Cartí Grande, 2 km W Nusagandi, 5 Mar 1985, Flint and Louton, 1♂. Paratype in BMNH; material in SDMNH and USNM.

REMARKS.—The specimens from Panama are similar to the Colombian examples except that process *e* is longer and decumbent. Mosely's (1933) figure 153, does not appear to show process *f*, although it is clearly present in figure 152 (it is present).

The species is closely related to *harpagum* with which it shares the presence of process *f* on the phallus. The apical area of the phallus is more extended and all of the processes are much more elongate in *cheesmanae* than in *harpagum*.

### *Leptonema complexum* Mosely

FIGURES 718–724; MAP 30

*Leptonema complexum* Mosely, 1933:54, 55, figs. 160–165 [holotype ♂, in BMNH].—Fischer, 1963:168.

TYPE-LOCALITY.—Bugaba, Panama.

DISTRIBUTION.—Costa Rica, Panama.

MATERIAL EXAMINED.—COSTA RICA, Pedregoso, 2100', Feb, D.L. Rounds, 1♂. *Pcia. Alajuela*, Chachagua, 24 Feb 1982, H. Brailovsky, 4♂. *Pcia. Limon*, Guapiles, 18 Aug 1964, G.C. Eickwort, 1♂. [*Pcia. Cartago*], Turrialba, 17–21 Feb 1965, S.S. and W.D. Duckworth, 1♂. PANAMA,



MAP 30.—Distributions of *Leptonema complexum* Mosely, and *L. forficulum* Mosely.

*Pcia. Coclé*, El Valle, 15 Jul 1967, O.S. Flint, Jr., 1♂, 1♀. *Pcia. Panamá*, Cerro Campana, near Chica, 11–14 Jul 1967, O.S. Flint, Jr., 1♂; same, but 12 Jun 1967, Triplehorn and DeLong, 2♂, 1♀. *Canal Zone*, Barro Colorado Island, Apr 1940, J. Zetek, 1♂; same, but 24 May 1940, 1♂; same, but 8 Apr 1935, A. Friedman, 1♂; same, but 25 Nov, M. Bates, 3♀; same, 4 Dec, 1♂, 1♀; same, but 28–30 Apr 1964, S.S. and W.D. Duckworth, 2♂; same, but 1–9 May 1964, 2♂; same, but 10–17 May 1964, 1♂, 1♀; same, but 7 Jan 1929, C.H. Curran, 1♂; Cabima, 24 May 1911, A. Busck, 1♂. [*Pcia. Colón*], Porto Bello, 24 Feb 1911, A. Busck, 1♂ paratype of *forficulum*. *Com. San Blas*, Río Cartí Grandi, 2 km W Nusagandi, 5 Mar 1985, Flint and Louton, 2♂. Material in AMNH, CNC, IBUNAM, UKAL, MCZ, and USNM.

**REMARKS.**—The species is very close to *forficulum* from which it differs in possessing one or several small dorsal processes from the base of phallic process *e*, and in having the apically directed lobe of process *d* broad, obliquely truncate and with the ventral margin serrate.

### *Leptonema forficulum* Mosely

FIGURES 725–730; MAP 30

*Leptonema forficulum* Mosely, 1933:52–54, figs. 154–159 [as *L. forficula*; holotype ♂, in MCZ].—Fischer, 1963:168.

**TYPE-LOCALITY.**—Cabima, Panama.

**DISTRIBUTION.**—Panama.

**MATERIAL EXAMINED.**—PANAMA, [*Canal Zone*], Cabima, 26 May 1911, A. Busck, holotype ♂, 1♂ topotype; Río Agua Salud, pipeline road, 8–12 Jul 1967, Flint and Ortiz, 1♂, 1♀; Barro Colorado Island, Jun 1940, J. Zetek, 1♂. *Com. San Blas*, Río Cartí Grande, 2 km W Nusagandi, 5 Mar 1985, Flint and Louton, 2♂; Quebrada Pingandi, 9 km N Nusagandi, 1–2 Mar 1985, Flint and Louton, 1♂. Holotype in MCZ; material in USNM.

**REMARKS.**—This species is very close to *complexum*, and

may be no more than a variant of it. However, material from both Cabima and Barro Colorado Island, Panama, can be segregated into both forms with no doubt. Based on the coexistence of the two at the same locality, then, we hold them as distinct species.

In *forficulum* process *e* of the phallus lacks any dorsal spine or spines, and the apical lobe of process *d* is long and slender.

### *Leptonema furciligerum*, new species

FIGURES 731–738; MAP 29

**MALE.**—Wings and body pale green; forewing pale green slightly infusate for apical third. Forewing length 14 mm.

Malar space narrow, about  $\frac{1}{4}$  height of eye. Parafacial and postocular areas about  $\frac{3}{4}$  width of malar; postocular area with a row of 5–7 stout setae. Maxillary palpus with fifth segment slightly more than  $\frac{2}{3}$  as long as basal 4 segments combined. Process of fifth sternum large, oval.

**Genitalia:** Tenth tergum with wart *a1*, high laterad, connected to *a2*, which extends mesad across tergum; *b1* erect, *b2* an irregular setate mound; lateral lobe blade-like, ventromesal margin with a parallel, setate, mesal ridge, ventrally with a thumb-like process. Clasper with basal segment  $2\frac{1}{2}$  times as long as apical, without a spinulose lobe apicomesally; lacking basomesal process. Phallus with base narrow, elongate, obliquely angled to stem; apex with *a* erect, with tip shallowly divided in dorsal aspect; *b* and *c* elongate, slender, apices directed dorsad; *d* with basal arm long, slender, sparsely serrate apicad, apical arm, elongate, tip pointed; *e* directed basoventrally, deeply divided, ventral arm may have apex divided.

**FEMALE.**—Unknown.

**TYPE.**—*Holotype* (male): COSTA RICA, *Pcia. Puntarenas*, Golfito, 25–28 Apr 1965, S.S. and W.D. Duckworth. Holotype in USNM.

**REMARKS.**—This species is very closely related to *com-*



*plexum* and *forficulum*. It is most easily recognized by the processes of the apex of the phallus, especially the elongate, pointed apical arm of process *d* and the position and form of process *e*.

***Leptonema harpagum*, new species**

FIGURES 739–746; MAP 28

MALE.—Color in alcohol, pale brown. Length of forewing 14.5 mm.

Malar space narrow, about  $\frac{1}{8}$  height of eye. Parafacial and postocular areas about  $\frac{3}{4}$  width of malar; postocular area with a row of 4 stout setae. Maxillary palpus with fifth segment not quite half length of basal 4 combined. Processes of fifth sternum large, almost round.

*Genitalia*: Tenth tergum with wart *a* a large, squat, basal lobe, wart *b* a slender, elongate apical lobe; lateral plate elongate, rounded apically, dorsal margin not well delimited, with a distinct, turned-up, ventrolateral lobe. Clasper with basal segment more than 3 times as long as apical segment; basal segment with neither apicomeral spiculate patch nor basomesal lobe. Phallus with base enlarged, angled to axis of stem; process *a* prominent, truncate apically, slightly bilobate in dorsal aspect; *b* and *c* elongate, narrow, pointed, semierect; *d* with a distinct base, basal arm long, serrate apicad, apical arm shorter, pointed; *e* an erect process, curved over dorsum; *f* a long, slender lobe.

FEMALE.—Unknown.

TYPE.—*Holotype* (male): PERU, [Dept. Huanuco], Monson Valley, Tingo Maria, 23 Sep 1954, E.I. Schlinger and E.S. Ross. Holotype in CAS.

REMARKS.—The species is very closely related to *inca*, but has been taken to the north of the latter. The apical segment of the clasper is shorter in *harpagum*, and phallic process *c* is shorter and pointed and *d* consists of a very distinct ventral stem with the apical arm more slender and pointed.

***Leptonema inca* Mosely**

FIGURES 747–753; MAP 28

*Leptonema inca* Mosely, 1933:38, 39, figs. 93–99 [holotype ♂, in ZSZMH].—Fischer, 1963:169.—Weidner, 1964:84.—Schmid, 1964:317.

TYPE-LOCALITY.—Pachitea, Peru.

DISTRIBUTION.—Bolivia, Peru.

MATERIAL EXAMINED.—BOLIVIA, Dpto. Cochabamba, Alto Palmar, Apr 1959, J.E. Foerster, 16♂, 17♀; same, but Oct–Nov 1960, 15♂, 6♀; same, but 20–21 Mar 1961, 3♀; road to Villa Tunari, Chapare, 1300 m, 8–10 Dec 1984, L.E. Peña G., 1♂; Cristal Mayu, Oct 1949, L.E. Peña G., 1♂. Dpto. La Paz, Coroico, 2200 m, 23–24 Nov 1984, L.E. Peña G., 1♂; Río Coroico, 1200 m, 23–26 Nov 1984, L.E. Peña G., 2♂; Yungas La Paz, Coripata, Río Santiago, 1600

m, 2 Dec 1984, L.E. Peña G., 1♂; Yungas La Paz, Puente Mururata to Cusilloni, 1600 m, 26–28 Nov 1984, L.E. Peña G., 1♂. PERU, Dpto. Puno, Río Inambari, Loromayu, 5–6 Sep 1962, L.E. Peña G., 1♂. Dpto. Cuzco, Quince Mil, Aug 1962, L.E. Peña G., 3♂, 3♀; Paucartambo, Cosñipata Valley, 20–26 Nov 1951, F. Woytkowski, 5♂, 3♀; same, but Santa Isabel, Cosñipata Valley, 12–16 Dec 1951, 2♂; same, but 1–9 Jan 1952, 5♂, 2♀; same, but “Callanga,” Callanga River Valley, 1300 m, 14–27 Feb 1953, 8♂, 2♀; same, but 4 Mar 1953, 1♂. Material in CNC, INHS, and USNM.

REMARKS.—This is the sister species of *harpagum*. Differences are only to be found in the male genitalia, and are enumerated under *harpagum*. The range of *inca* is distinctly to the south of that of *harpagum*.

***Leptonema intermedium* Mosely**

FIGURES 754–760; MAP 31

*Leptonema intermedium* Mosely, 1933:48, 49, figs. 137–141 [holotype ♂, in ZSZMH].—Fischer, 1963:169; 1972:156.—Weidner, 1964:84.—McElravy et al., 1981:153; 1982:307, 310, 312.

TYPE-LOCALITY.—Chimbo, Ecuador.

DISTRIBUTION.—Colombia, Costa Rica, Ecuador, Panama.

MATERIAL EXAMINED.—COLOMBIA, [Dpto. Valle], Cali, 1000 m, Fassel, 3♂. COSTA RICA, Pedregoso, 2100', Feb, D.L. Rounds, 5♂, 4♀. Pcia. Alajuela, Chachagua, 24 Feb 1982, H. Brailovsky, 1♂. Pcia. Cartago, Turrialba, 17–21 Feb 1965, S.S. and W.D. Duckworth, 29♂, 31♀; same, but 27–28 Feb 1965, 5♂, 6♀; same, but 1–6 Mar 1965, 3♂, 3♀; same, but 15–19 Jul 1965, P.J. Spangler, 2♂, 1♀; km 10, Turrialba–Siquirres road, 27 Apr 1984, E. Barrera, 2♂, 4♀; La Suiza, 17 Jun 1967, Flint and Ortiz, 3♂, 1♀. Pcia. Heredia, 2 mi E Puerto Viejo, 100 m, 7 Jul 1965, M.G. Naumann, 2♂. Pcia. San José, Río General, Pacuare, 1 Jul 1967, Flint et al., 2♂, 2♀. ECUADOR, Chimbo, Rosenberg, 2♂ topotypes. Paramba, 4000', 1♂. [Pcia. Azuay], Río Leon, 1700 m, 21–22 Mar 1965, L.E. Peña G., 1♂, 2♀. [Pcia. Chimborazo], Huigra, 15–17 Jun 1914, H.S. Parish, 1♂, 1♀. Pcia. Pichincha, Santo Domingo de los Colorados, 22 Sep 1970, R.E. Dietz, 2♂, 1♀; same, but 23 Feb 1955, Schlinger and Ross, 2♂, 3♀; same, but 27–30 Jun 1980, A.F. Beck, 3♂, 2♀; same, but 14 km E Santo Domingo de los Colorados, 5 Jul 1975, Langley and Cohen, 3♂, 2♀; Nanegal, 1100 m, 19–20 Sep 1977, L.E. Peña G., 1♂, 10♀; via Puerto Quito at km 113, 24 Jun 1976, J. Cohen, 1♂. Pcia. Cotopaxi, 133 km W Latacunga, 1080', 2 Jul 1975, Langley and Cohen, 1♂.

PANAMA, Pcia. Coclé, El Valle, 18 Jun, G.F. Fairchild, 1♂, 1♀; same, but 22 Apr 1965, S.S. and W.D. Duckworth, 4♂; El Potroso, 10 km NE El Copé, 2500', 3–4 Nov 1980, student collection, 15♂, 10♀. Pcia. Panamá, Cerro Azul, 1 Jul 1967, Flint and Ortiz, 1♂. Com. San Blas, Río Cartí Grande, 2 km W Nusagandi, 5 Mar 1985, Flint and Louton, 13♂, 7♀; Nusagandi (09°20'N, 78°56'W), 1–6 Mar 1985,



MAP 31.—Distributions of *Leptonema intermedium* Mosely, *L. trifidum*, new species, and *L. rosenbergi* Mosely.

Flint and Louton, 1♂, 1♀. Material in CAS, CNC, CU, IBUNAM, INHS, MCZ, RNH, UKAL, USNM, and VPISU.

REMARKS.—In many ways *intermedium* is similar to *rosenbergi*; they agree in size and color and in most characteristics of the male genitalia. However, *intermedium* does not have phallic process *f*, while *rosenbergi* does, but *intermedium* does have process *e* while *rosenbergi* does not.

The midtibia and tarsus of female *intermedium* are distinctly broader than those of the fore and hindlegs, as noted by Fischer (1945).

#### *Leptonema rosenbergi* Mosely

FIGURES 761–767; MAP 31

*Leptonema rosenbergi* Mosely, 1933:47, 48, figs. 131–136 [holotype ♂, in ZSMH].—Fischer, 1963:172; 1972:156.—Weidner, 1964:84.

TYPE-LOCALITY.—Cachabé, Ecuador.

DISTRIBUTION.—Colombia, Ecuador.

MATERIAL EXAMINED.—COLOMBIA, Dpto. Valle, An-

chicayá, 400m, 17–20 Feb 1970, D.M. Wood, 1♂; carretera a Anchicayá, km 67, 1000 m, 22 Feb 1985, A. Quintero, 4♂; Cali on Río Anchicayá, 5 Mar 1984, J. Martínez R., 1♂, 1♀. [ECUADOR, Pcia. Esmeraldas], Cachabé, Rosenberg, 1♂ topotype. Pcia. Pichincha, via Puerto Quito at km 113, 24 Jun 1976, J. Cohen, 2♂. Material in CNC, RNH, SDMNH, and USNM.

REMARKS.—The topotype available to us shows a very small process *e* laterally near the base of process *f*, otherwise Mosely's figures seem very accurate. Fischer (1945) states that the females in the topotypic series possess dilated mid-legs in this species as well as in *intermedium*.

As mentioned under *intermedium*, these are sister species. The presence of phallic process *f* in *rosenbergi* distinguishes it from *intermedium* where this process is lacking.

#### *Leptonema trifidum*, new species

FIGURES 768–775; MAP 31

MALE.—Color pale green; forewings greenish with some apical infuscation. Length of forewing 12–14 mm.

Malar space moderate, about  $\frac{1}{5}$  height of eye. Parafacial and postocular areas about  $\frac{3}{4}$  width of malar; postocular area with a row of 3–5 stout setae. Maxillary palpus with fifth segment about  $\frac{1}{2}$  length of basal 4 segments combined. Processes of fifth sternum small, ovoid.

**Genitalia:** Tenth tergum with wart *a* low, with enlarged setal bases, in dorsal aspect elongate and often partially divided, wart *b* apical in position also divided; lateral plate elongate, ovoid, ventral margin with a basal groove. Clasper with basal segment 3 times as long as apical; with a pointed basomesal lobe, but no apicomesal lobe. Phallus with base enlarged, angled to stem; apex with process *a* prominent; processes *b* and *c* slender, pointed; *d* trifid, with 2 caudally and 1 anteriorly directed arms (their precise lengths and curves, very variable); *e* directed basad, long and serrate; *f* a long, slender spike.

**FEMALE.**—Similar in size and coloration to male.

**TYPES.**—*Holotype* (male): ECUADOR, *Pcia. Napo*, Tena, 23 May 1977, Spangler and Givens.

**Paratypes:** PERU, *Dpto. Cuzco*, Hacienda Maria, Cosñipata Valley, 2700' tropical jungle, 19–21 Feb 1952, F. Woytkowski, 3♂; same, but 11–12 Mar 1952, 3♂; Quince Mil, 14–31 Aug 1962, L.E. Peña G., 14♂, 7♀.

Holotype in USNM; paratypes in CNC, INHS, and USNM.

**REMARKS.**—This is a very distinctive member of the *complexum* group. It differs from all other species of this group by having an extra lobe from phallic process *d* and process *f* as long as the basal lobe of process *d*.

### Nomina Dubia

#### *Leptonema naevosum* Navás

*Leptonema naevosum* Navás, 1916b:66, 67, fig. 7 [type ♀, type disposition not stated].—Fischer, 1963:170.

**TYPE-LOCALITY.**—Colombia, Coachí.

**DISTRIBUTION.**—Colombia.

**REMARKS.**—No specimens under this name were found in either MZB or the remnants of the Navás collection in Zaragoza, when they were searched for caddisfly types in 1974; they have presumably been destroyed. It is impossible to recognize the species, or to be certain if it belongs to the *stigmatosum* group, as stated by Navás, or to the *cinctum* group, which is suggested by the presence of the nygmatal spots mentioned in the original description. We do not have material from this region of Colombia to help ascertain its identity.

Although he did not specify the disposition of the type material in his usual manner for this species, he did notate the figure "Coll. F(is) Apollinaris." It is unknown if any material from the Apollinaris collection survives.

#### *Leptonema nygmosum* Navás

*Leptonema nygmosum* Navás, 1916b:65–66, fig. 6 [type ♂, in collection Navás, presumably lost].—Fischer, 1963:170.

**TYPE-LOCALITY.**—Colombia, Coachí.

**DISTRIBUTION.**—Colombia.

**REMARKS.**—Except that Navás specifically mentioned that the type was in his collection, "(Coll. m.)," the remarks under *naevosum* apply equally well here.

### Phylogenetic Considerations

The problem of formulating a family tree to express our concept of the evolutionary history of a group resolves itself ultimately into finding out what conditions of each character are the primitive ones and which ones are the derived conditions in the group under study. The best clues to these attributes can only come from knowing their conditions in related taxa. An early step in attempting to unravel the evolution of *Leptonema*, therefore, was to analyse its relationship to other genera in its subfamily and family.

*Leptonema* belongs in the the subfamily Macronematinae, in the family Hydropsychidae. Ross (1956:10) recognized four subfamilies but did not explore their affinities, only defining and listing them in assumed order of evolutionary complexity, namely: Arctopsychinae, Diplectroninae, Hydropsychinae, and Macronematinae. The Arctopsychinae are frequently considered to be an independent family (Martynov 1924, Schmid 1980), but are placed in essentially the same phylogenetic position.

The Arctopsychinae contain only two genera, *Arctopsyche* McLachlan and *Parapsyche* Betten, exhibiting many primitive characters: the fore- and hindwings are both elliptical; postcostal cell short and wide; antenna thick and about as long as forewing; the male genitalia have long intermediate appendages (derived from the epiprocts of the eleventh abdominal segment); the larval head has a large gular area completely separating the genal halves; and the abdominal gills are branched primarily at their tips. On the basis of these characters the Arctopsychinae are a more primitive group than the other three. In male Arctopsychinae, however, the two segments of the claspers are partially fused, a derived condition. These conditions in the Arctopsychinae, therefore, appear to be clear evidence of the first known branching of the evolutionary line in the Hydropsychidae. In the branch leading to the Arctopsychinae most of the characters remained primitive, but the claspers became specialized through partial fusion of their segments. In the branch leading to the ancestral form, which ultimately evolved into the other three subfamilies, the claspers remained distinctly two-segmented, but the shape and venation of the hindwing became increasingly different from the forewing and the postcostal cell of the forewing became



long and narrow and the intermediate appendages in the male genitalia disappeared (Weaver 1985). In the larva the genal areas of the head became pinched together, thereby dividing the gular area, and each abdominal gill gained more whorls of branches.

Certain genera of the Diplectroninae, notably *Oropsyche* Ross and *Homoplectra* Ross, show few specializations other than those just mentioned and, in addition, have a relatively complete wing venation. They appear to be the most primitive genera of the Diplectroninae. In the hindwings of these two genera the apices of the subcostal and radial veins curve slightly forward; in other genera of the subfamily this feature becomes greatly exaggerated. Wing coupling in the Diplectroninae is apparently accomplished with a jugum, as it is in the Arctopsychinae and in many other primitive genera in other families. In the larva the posterior portion of the divided gular sclerite is still relatively large.

The Hydropsychinae have the same type of larval gills as do the Diplectroninae, but the posterior portion of the gular sclerite is reduced further in size to no more than a small point. However, they exhibit two specializations in their wings. In the hindwing the apex of vein Sc<sub>1</sub> has fused with the apex of vein R<sub>1</sub>, and the fused veins continue as a single straight vein to the margin of the wing. In the forewing the under side of vein IA possesses a short row of fairly stout hairs that function as part of the wing-coupling mechanism. The forewings are markedly narrower than the hindwings, a trait apparently associated with more rapid flight.

In the Macronematinae the anterior margin of the hind wing has a long row of hamuli that hook into a linear crease just anterior to the anal vein of the forewing (which has no row of hairs beneath vein IA such as is found in the Hydropsychinae). In the hindwing, fusion of the tips of the anterior veins has progressed even further than in the Hydropsychinae, involving a fusion of R<sub>2</sub> as well as R<sub>1</sub>. In fact, the venation becomes very complex in certain genera of the subfamily (e.g., Polymorphanisini), primarily by irregular fusion of the veins, not by their loss, and the anal area of the hindwing is greatly expanded in the male. These conditions being specializations for faster flight than in the Hydropsychinae (Schmid, in litt.). In addition, each of the abdominal gills of the larva has about 6 whorls of gill branches. *Leptonema* possesses these characters.

Two alternative interpretations of all these factors appear to be the only logical explanations of the evolution of the groups involved. All three subfamilies, the Diplectroninae, Hydropsychinae, and Macronematinae, could have evolved from an ancestor that was similar to *Oropsyche* in all respects except the slightly bent vein tips. It is necessary simply to postulate that in the Hydropsychinae line the wing-coupling setae evolved on vein IA of the forewing, whereas in the Macronematinae line the wing-coupling setae evolved on

the front margin of the hindwing, and that the branching of the larval abdominal gills became more complex. Such an arrangement would represent a trichotomy arising from an ancestor immediately common to all three lines. However, since in both the Hydropsychinae and Macronematinae the front wings became narrower and the tips of the apical veins became fused in the hindwings, it is perhaps more probable that the hydropsychine-macronematine line arose from this common ancestor and that this line later divided and evolved into the two subfamilies Hydropsychinae and Macronematinae. Thus, according to one alternative, the Macronematinae arose directly from a primitive diplectronine-like ancestor, according to the other alternative it arose indirectly from a diplectronine-like ancestor in which the forewings had become narrower, some fusion of vein tips has occurred in the hindwing, and flight was more rapid.

*Leptonema* has been considered an anomalous genus within the Macronematinae by many authors, and a number of its discrepant characters were outlined in detail by Ulmer (1957) and Marlier (1962). A comparison of these and other characters of the genus with other genera of other subfamilies, revealed its most probable phylogenetic position within this subfamily. In our comparisons the following characteristics of *Leptonema* were instructive: the second segment of the maxillary palpus is usually much longer than the third or fourth segment; the posterior warts on the head, situated almost on the posterior margin are longer and more distinctly delineated than the anterior warts, which are very poorly defined; the wing venation is extremely primitive compared with that of the other macronematines; the larval proventriculus possesses only simple spines, the vestiture of the larval abdomen is markedly diplectronine as is the head shape, which lacks the carinae or specialized structures present in the larvae of many other genera of the Macronematinae. Since these characters are either common in, or distinctive of, primitive genera of the other subfamilies of Hydropsychidae (e.g., *Smicridea* in the Hydropsychinae, and most Diplectroninae and Arctopsychinae), it seems probable that they typified the ancestor of the Macronematinae. We believe these data indicate that *Leptonema* is a little-changed representative of a very early branch of the Macronematinae. Unfortunately we are unable to discover any derived characters that serve to prove the monophyletic nature of the genus *Leptonema*.

#### Phylogeny of *Leptonema* Species Groups

In a perusal of 105 adequately known species of *Leptonema*, one is impressed with the existence of two large groups based on the structure of the phallus and tenth tergum. One-third of the species have these structures rather simple (Figures 14–146, 181–301); the other two-thirds have additional processes on these parts and in many

species they have become highly complex (Figures 324–775). This raises questions concerning the delineation of the genus itself, especially so considering that we were unable to discover any apomorphic characters to prove monophyly. However, because the species share so many characters of wing venation, maxillary palpi, warts of the head, tibial spurs, abdominal sterna, and other parts and they collectively differ from other macronematine genera in the same characters so decidedly, that we believe they form a monophyletic unit and are able to derive all the species groups from a common ancestral form.

A major problem concerning the phylogeny of these species is the determination of whether the complex type of phallus and tenth tergum represents the primitive type for the genus (from which simpler types arose through simplification and reduction), or whether the simple type was the primitive form from which the complex types evolved. A comparison of these structures in *Leptonema* with the same structures in other genera of Hydropsychidae suggests the latter alternative is more likely, because many of the simple types of copulatory organs are remarkably similar to those found in other genera of the subfamily Macronematinae, as well as to simpler types found in other subfamilies of the Hydropsychidae, such as the genera *Diplectrona*, *Potamyia*, *Cheumatopsyche*, *Calosopsyche*, and *Hydropsyche* (s.s.). From such comparisons we provisionally accepted that the relatively simple structures of the male genitalia were primitive in *Leptonema* and that the complicated structures evolved through addition or division of parts.

With this hypothesis as a basis, an attempt was made to arrange the species according to logical steps in a progression from the simple to the complex type. This attempt exposed two major difficulties. First, many complex phallic organs are very different from each other, indicating that probably several different lines of specialization occurred within these types. Secondly, it was difficult to know which of the simpler types exemplified the probable ancestral condition from which the complicated types evolved. This led to a search for additional characters in the genus that might throw light on either of these two problems.

A character was discovered that appears to divide the entire genus into two primary groups. In one large group, the second abdominal sternum (the first apparent or basal sternum) has a pronounced median suture that represents an internal phragma (Figure 644). Almost all species with this suture have a relatively complex phallus and tenth tergum and conversely, all those species lacking the suture have a relatively simple phallus. The suture is also present in most other genera of the Macronematinae, in some Arctopsychinae, and in many, especially the primitive, genera of the Diplectroninae and Hydropsychinae. These data suggest that the possession of a suture is the primitive condition and that the loss of the suture is a derived condition, and that the species lacking it may form a single branch

of the genus. Because practically all of the species lacking the suture also have the simple genitalia, it is believed that the loss of this suture may indicate the earliest branching of *Leptonema*.

The large group of species with the suture includes only a small number that have a rather simple type of male tenth tergum and phallus. The remaining species possess some sort of addition or specialization of these structures. By a series of trial and error sortings, based on the relative development of a variety of homologous characters, mainly of the tenth tergum and phallus, we have arranged these in what appears to be monophyletic groups whose primitive forms differ from group to group in the addition of new, distinctive parts and/or modifications of existing parts.

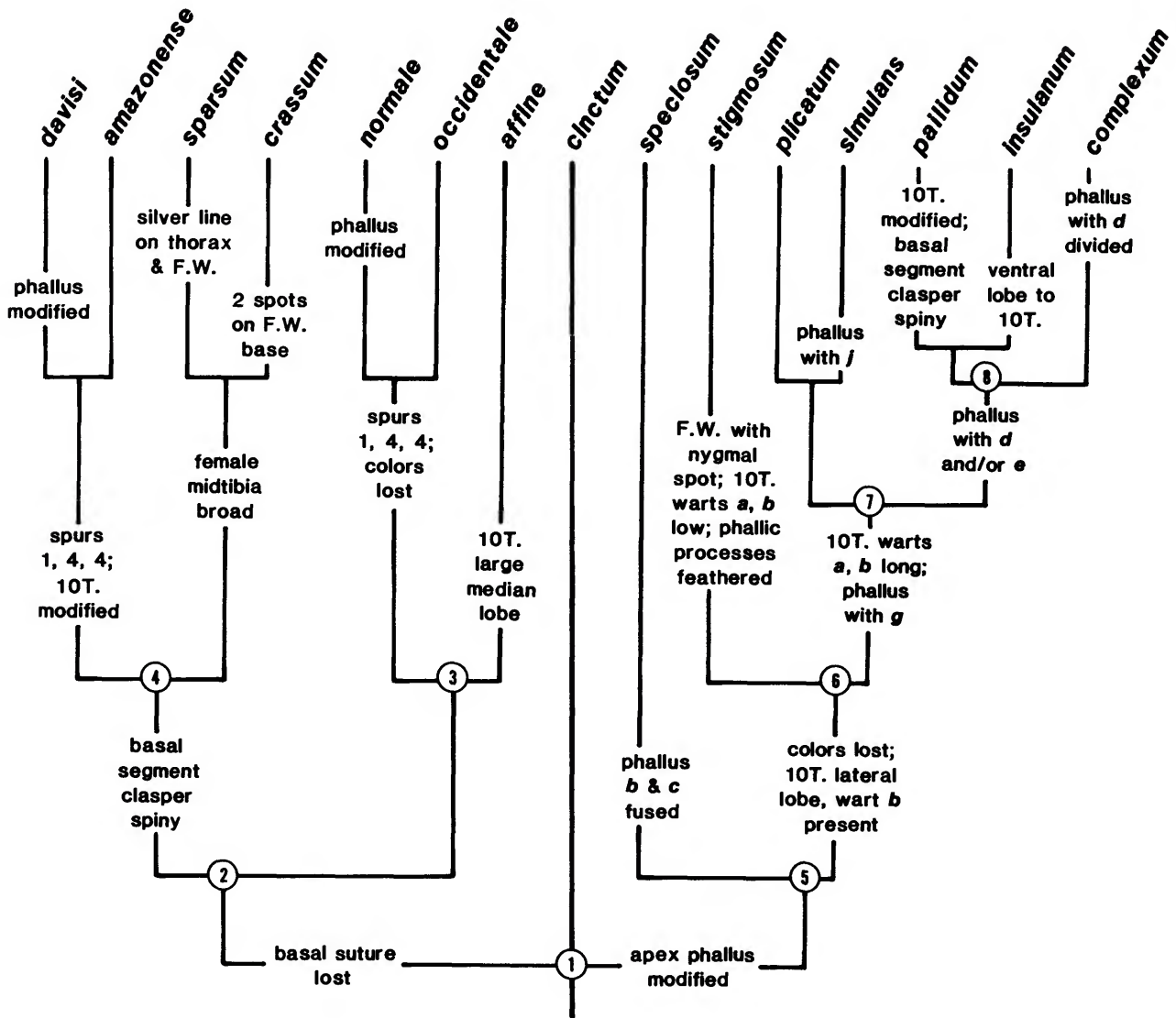
The species lacking the suture on the second abdominal sternum present fewer distinctive features of the genitalia that can be used as a basis for grouping the species. Using other characters, however, including the number of tibial spurs, shape of the female midtibia and tarsus, the vestiture of the body, plus some characters of the phallus and claspers, it is possible to group these species, also, into what appear to be monophyletic clusters.

On the basis of the evidence before us we propose the following as the general trends of evolution of the various species groups in the genus *Leptonema*. This is not intended to be a cladistic analysis for we have no derived characters to define many of the lines. But we hope it may be of value to others to have our ideas on record, tentative as they may be.

The ancestor of *Leptonema* (Dendrogram, ancestor 1) probably had a suture on the second abdominal sternum, a simple tenth tergum and phallus, two spurs on the foretibia, and colored and patterned forewings. The *cinctum* group could well be a little-changed descendant of ancestor 1, because it possesses all of these primitive characters.

From ancestor 1, one lineage specialized in the loss (or near loss, as some specimens or species in a few groups still show an incomplete suture) of the suture of the second sternum, while retaining a comparatively simple tenth tergum and phallus: this leads to ancestor 2. A second lineage from ancestor 1 became more specialized and complex in the structure of the phallus, and most groups also developed a more complex tenth tergum, but lost the complex color pattern while retaining the suture on the second sternum (leading through ancestor 5).

From ancestor 2, one line leading to ancestor 3 retains the primitive states of two front tibial spurs, relatively strongly colored and often patterned forewings, a simple phallus, and the tenth tergum has wart *a* large. The *affine* group consisting of six species, all limited to Madagascar, is characterized by an unusually large median lobe to the tenth tergum, a distinctive specialization. The second line from ancestor 3 lost one apical spur on the foreleg and the color pattern in the forewings. However, the tenth tergum remains rather unmodified, especially so in the *occidentale*



DENDROGRAM.—Proposed relationship of species groups of *Leptonema*. Ancestral stages indicated by numbers enclosed in circles. Derived characters listed on tree.

group, and changing but slightly in the *normale* group. In the latter group the apex of the phallus becomes modified, but in manners totally different from that of the New World species.

A second line arose from ancestor 2, specializing by the development of coarse setulae from near the apex of the basal clasper segment, and giving rise to ancestor 4. From here arose a line in which the female midtibiae and tarsi became broadened. The *crassum* group further specialized by losing the wing patterning, but developed two strong, dark spots at the base of the forewing and the body became hairy. The *sparsum* group specialized in developing a dis-

tinctive color pattern: a band of silver-colored hair in the costal cell of the forewing and along the lateral margins of the pronotum and head, the rest of the forewing being regularly irrorate.

The second line arising from ancestor 4 specialized in the reduction of the spurs on the foreleg to one and the development of new lobes and odd conformations of the tenth tergum. The *amazonense* group changed little from this ancestral form, although producing more bizarre forms to the tenth tergum and modifying the phallic opening to some degree in the various species. In the *davisii* group the modification of the phallic apex reaches a complexity match-



ing that of any other lineage, but does not seem to be homologous to any of them.

Now we return to the lineage derived from ancestor 1, which retained the basal abdominal suture. The line leading to ancestor 5 offers one strong apomorphic characteristic, the apex of the phallus develops some sort of processes. The *speciosum* group is a good example of this stage, differing only in this characteristic from the *cinctum* group, but from the remainder of the lineage in the manner of fusion of the new lobes of the phallus. The other descendant line lost the colored wing pattern and developed a blade-like lateral lobe and wart *b* on the tenth tergum at ancestor 6.

From this ancestral form the *stimosum* group developed by the production of a ring of dark hairs around the nygmata, the low, rounded warts *a* and *b* on the tenth tergum, and of setae, either short or long, on the processes of the phallus. The other line giving rise to ancestor 7 developed elongate warts *a* and *b* on the tenth tergum and the phallus developed process *g*.

One descendant line from ancestor 7 changed little from this pattern, but within it, the species offer all sorts of variations on the development of phallic processes *b*, *c*, *g*, and *f*. One specialized offshoot of this line that developed a process *j*, usually long and furcate, is recognized as the *simulans* group. The other line without *j* is recognized as the *plicatum* group. The other line descending from 7 developed processes *d* and/or *e* on the phallus, giving rise to ancestor 8.

From 8, two descendant lines arose differing in whether phallic process *d* is divided into anterior and posterior arms, or is simple. The divided state gave rise to the *complexum* group. The simple state of *d* gave rise to two groups. In the *insulanum* group the ventral margin of the lateral lobe of the tenth tergum developed a process, but warts *a* and *b* remained long and in a typical position. In the *pallidum* group the apex of the basal clasper segment developed a patch of enlarged setulae, and the warts *a* and *b* were displaced apicad on the tenth tergum, and reduced in size or totally lost and the lobes became modified.

### Historical Biogeography

Two circumstances concerning the known distribution of *Leptonema* are of paramount importance. First, all known species occur on two widely separated continents, Africa (including Madagascar) and neotropical America. Second, all extant species occur in tropical or near-tropical portions

of these continents. Because of this latter circumstance, all information indicates that the genus has been a tropical one during its entire evolutionary history. Taken in conjunction with the distribution of the genus, if this probability is true, then it becomes very improbable that dispersal could have taken place through temperate or arctic regions. Thus, the possibility of a fragmented Gondwanan distribution becomes more likely.

When the geographic distribution of the species groups are added to the family tree of *Leptonema* several items become apparent. First, the large branch including all the progeny of ancestors 5 through 8 almost certainly evolved in neotropical America because all its known species are American. If species of this branch dispersed to or from other areas, no evidence of it has yet come to light. The same is true of that branch arising from ancestor 2, which embraces the *crassum*, *sparsum*, *amazonense*, and *davisi* groups. By the same reasoning, the other branch arising from ancestor 2 and embracing the *affine*, *occidentale*, and *normale* groups probably evolved in the African area.

In the absence of fossil evidence, the only method of estimating the time at which ancestor 2 occurred are by (1) measuring the amount of change that has come about in daughter lineages and (2) establishing the number of species that have differentiated from it. The first is not necessarily associated in direct proportion to the passage of time (Simpson, 1944; Ross, 1956), nor is the latter (Ross, 1962). Hence all that can be said concerning the age of ancestor 2 is that it probably existed early in the evolution of *Leptonema*. Because *Leptonema* is the oldest offshoot of a line that has since evolved into a large, widespread, and varied assemblage of genera (the more specialized Macronematinae), an early form of *Leptonema* could conceivably have lived in the Cretaceous on Gondwanaland. During the Cretaceous with the breakup of Gondwanaland (Dietz and Holden, 1970) ancestor 3 was probably isolated on the African block, or dispersed thereto across the incipient South Atlantic. Similarly one daughter lineage from ancestor 3 was isolated on, or dispersed to, Madagascar at a somewhat later date.

A recent trans-Atlantic dispersal event, such as has been shown to be possible by Williams (1958), was at first thought to exist in *Leptonema*. The type of *L. tholloni* (Navás) is labelled to be from Gabon (West Africa), but the species is a closely related member in the *agraphum* species group that is otherwise only known from Brazil. However, we have recently discovered a few more examples of *tholloni* from Brazil. It is now apparent that the type must have been mislabelled, and that the species does not occur in Africa.

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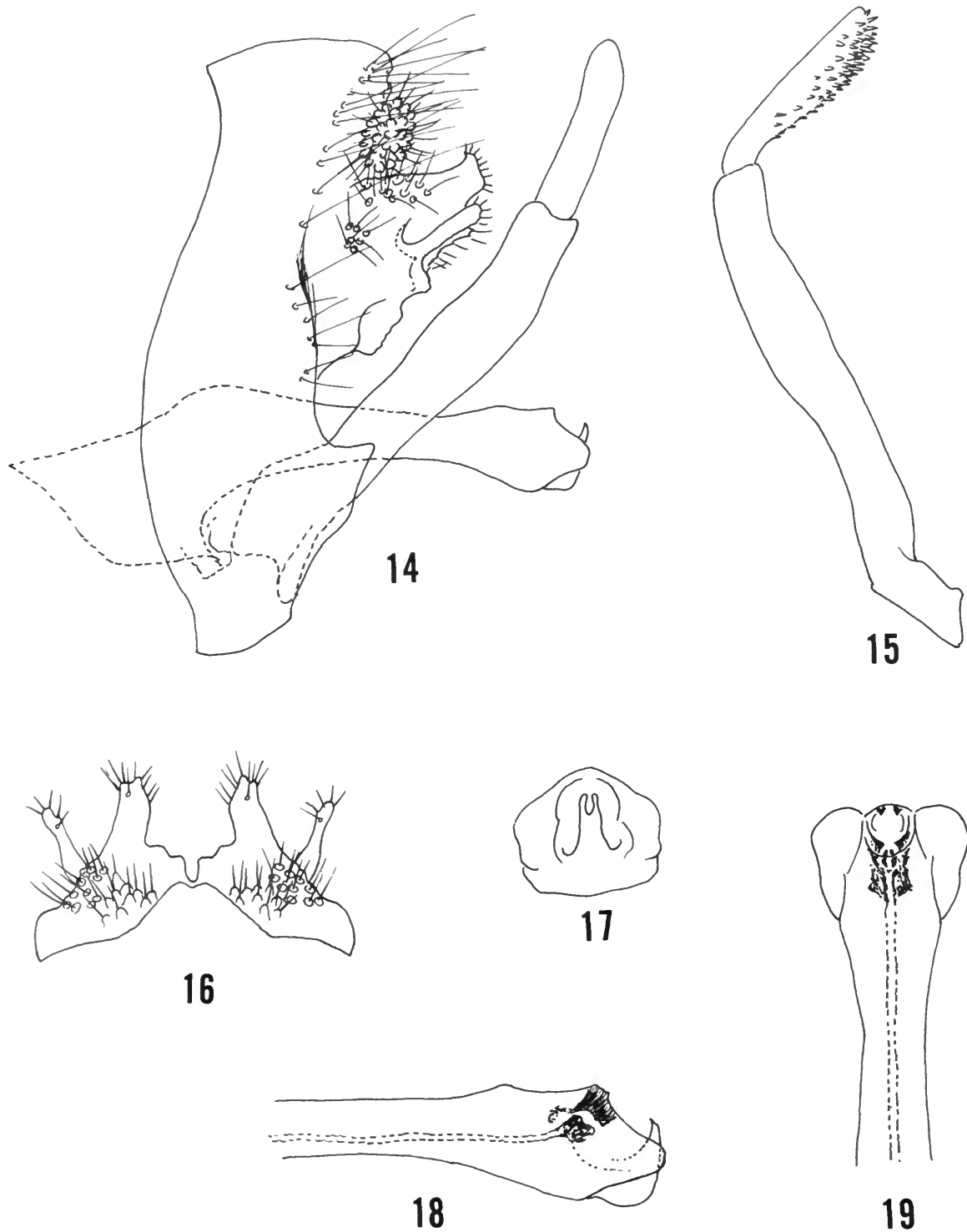
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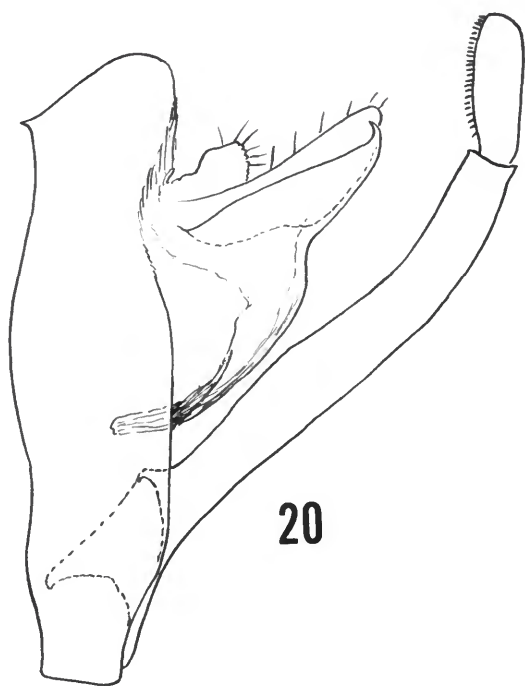
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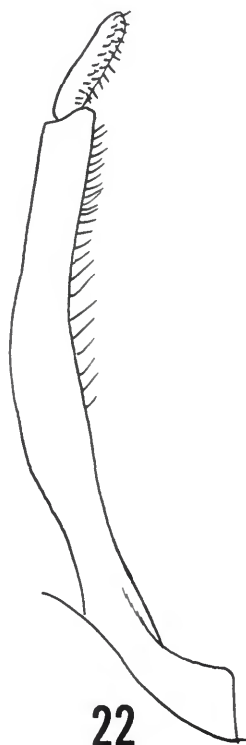
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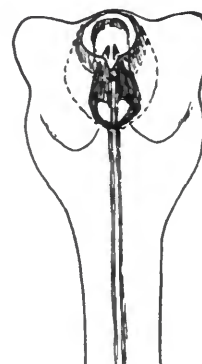
FIGURES 14-19.—*Leptonema cinctum* Ulmer, male: 14, genitalia, lateral; 15, clasper, posteroventral; 16, tenth tergum, dorsal; 17, apex of phallus, posterior; 18, same, lateral; 19, same, dorsal.



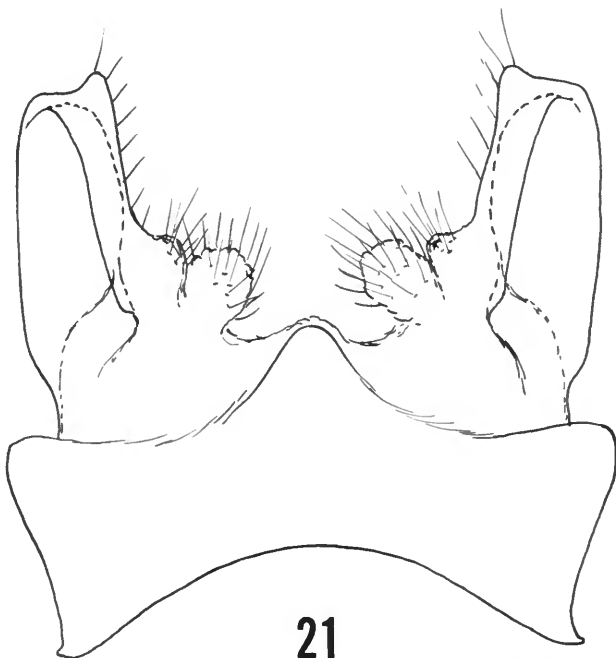
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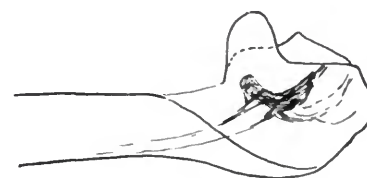
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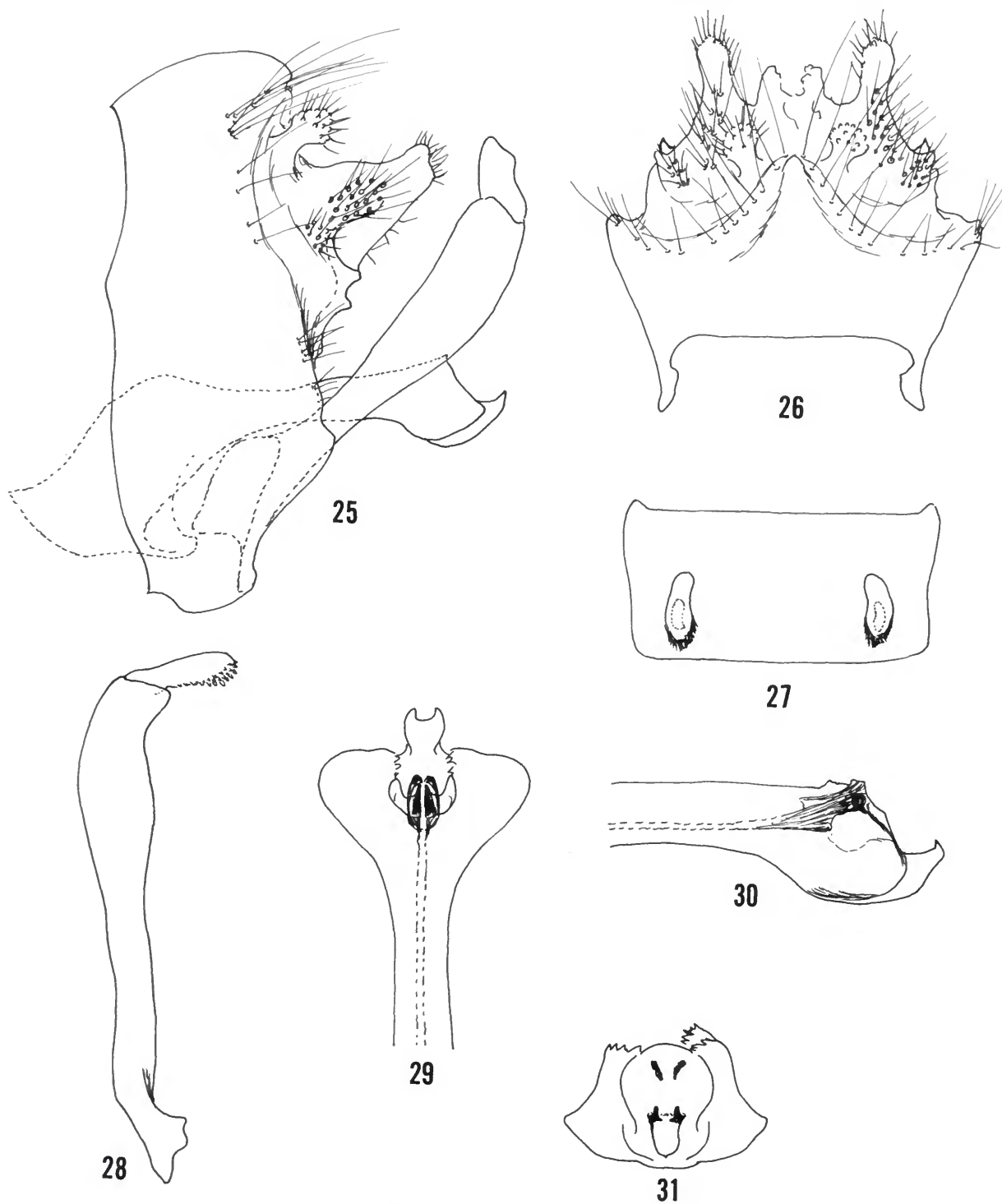
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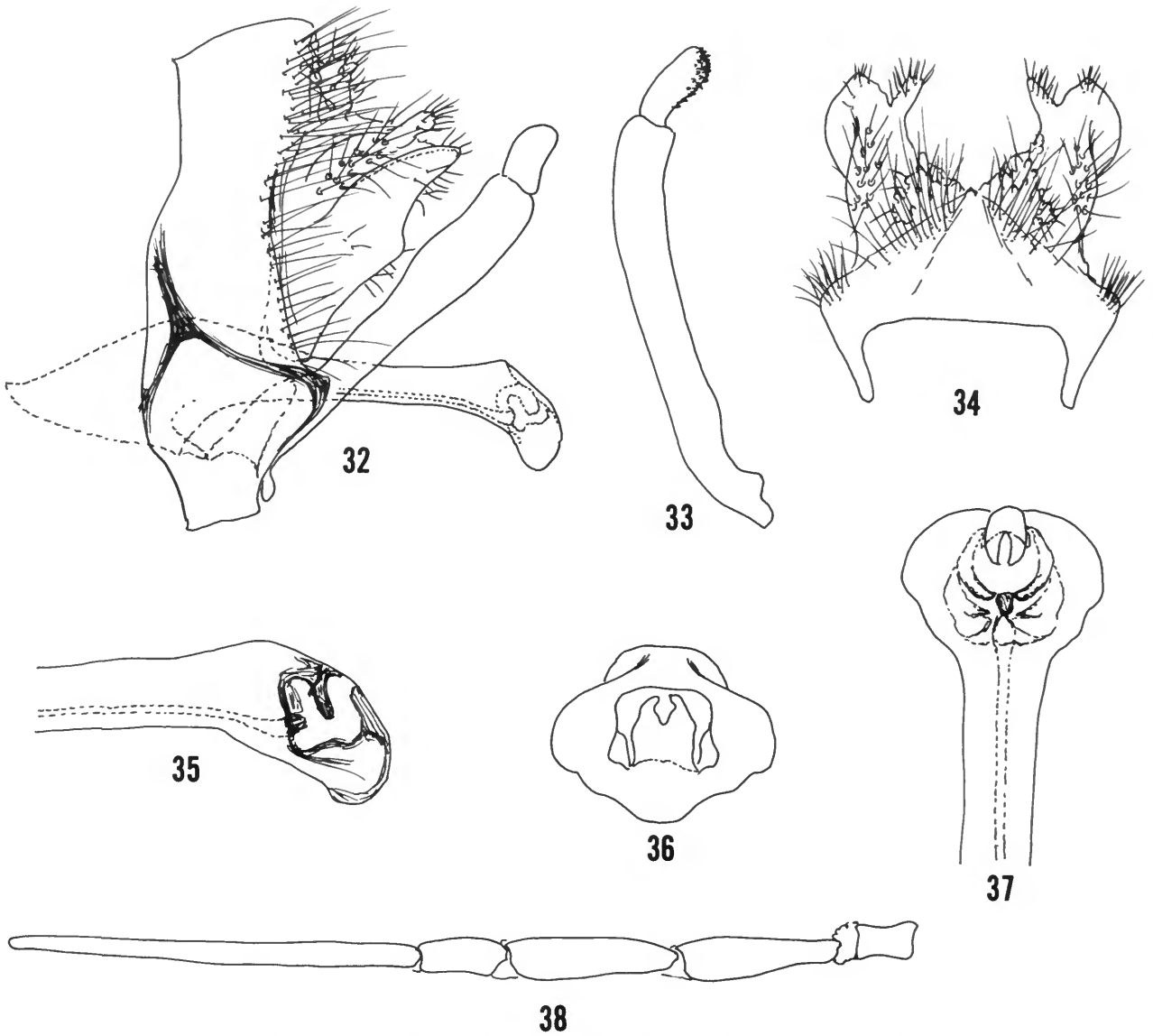
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FIGURES 20-24.—*Leptonema lacuniferum* Flint, male: 20, genitalia, lateral; 21, ninth and tenth terga, dorsal; 22, clasper, posteroventral; 23, apex of phallus, dorsal; 24, same, lateral.

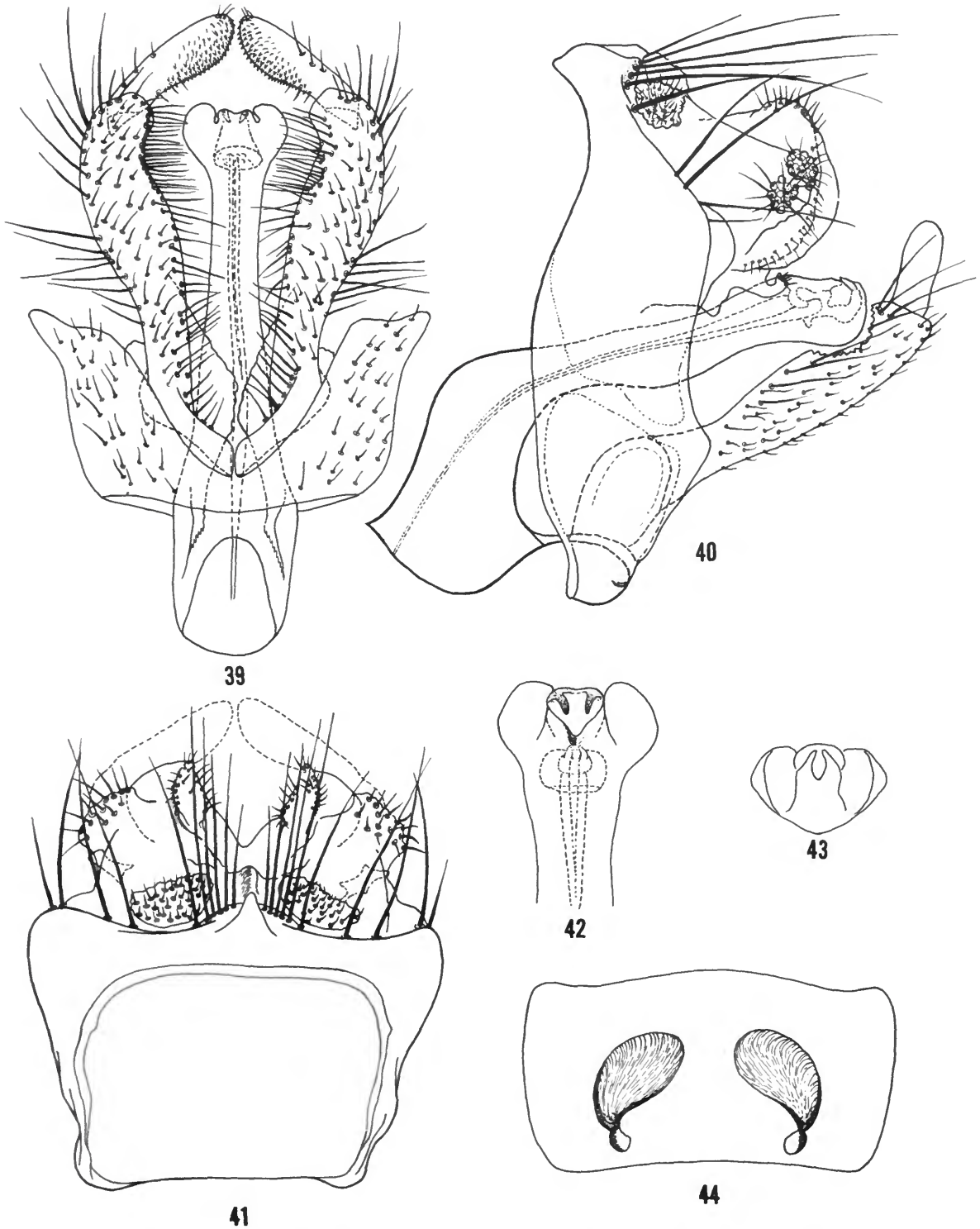




FIGURES 25-31.—*Leptonema lojaense*, new species, male: 25, genitalia, lateral; 26, ninth and tenth terga, dorsal; 27, fifth sternum, ventral; 28, clasper, posteroventral; 29, apex of phallus, dorsal; 30, same, lateral; 31, same, posterior.

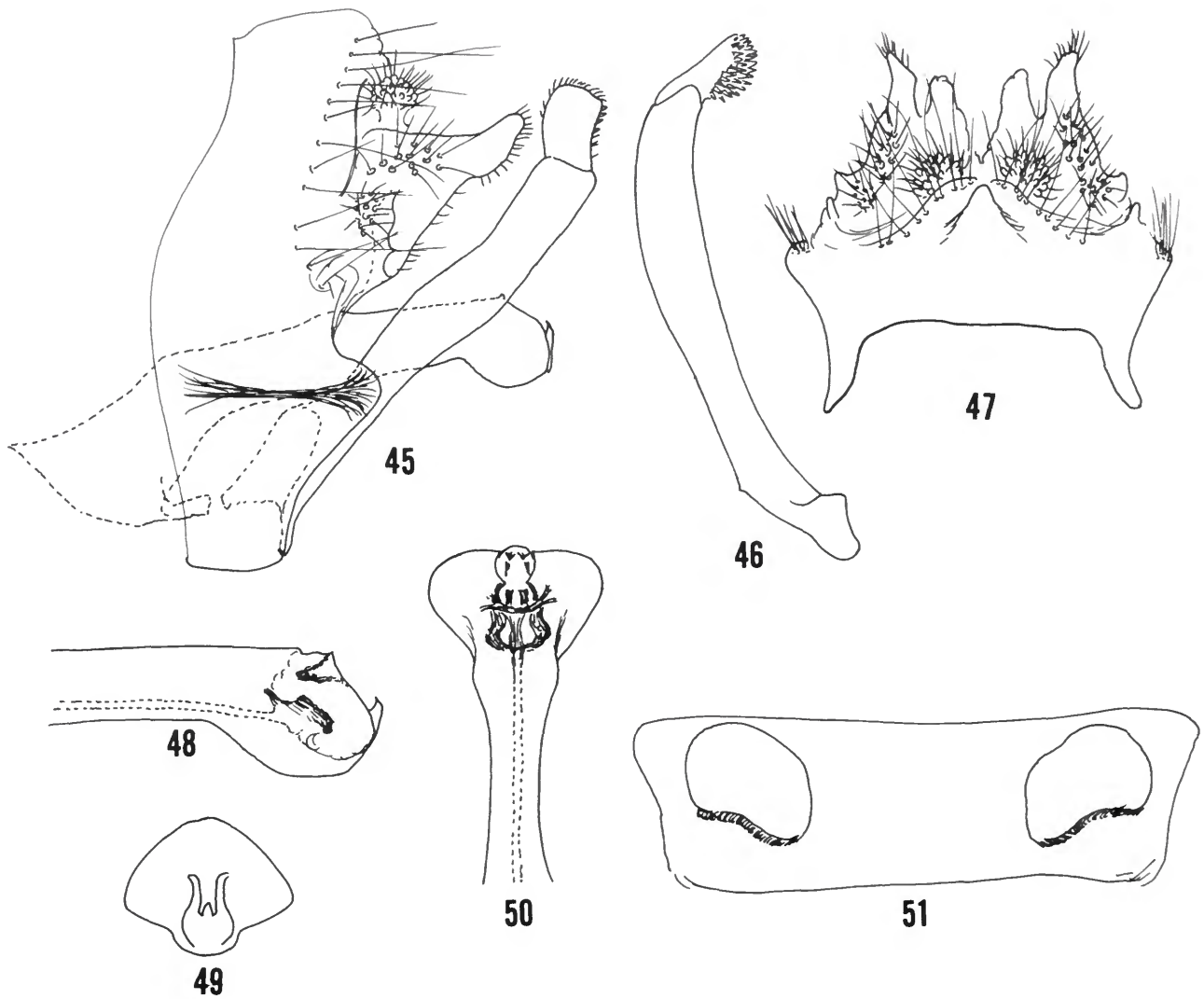


FIGURES 32-38.—*Leptonema menkei*, new species, male: 32, genitalia, lateral; 33, clasper, posteroventral; 34, ninth and tenth terga, dorsal; 35, apex of phallus, lateral; 36, same, posterior; 37, same, dorsal; 38, maxillary palpus, lateral.

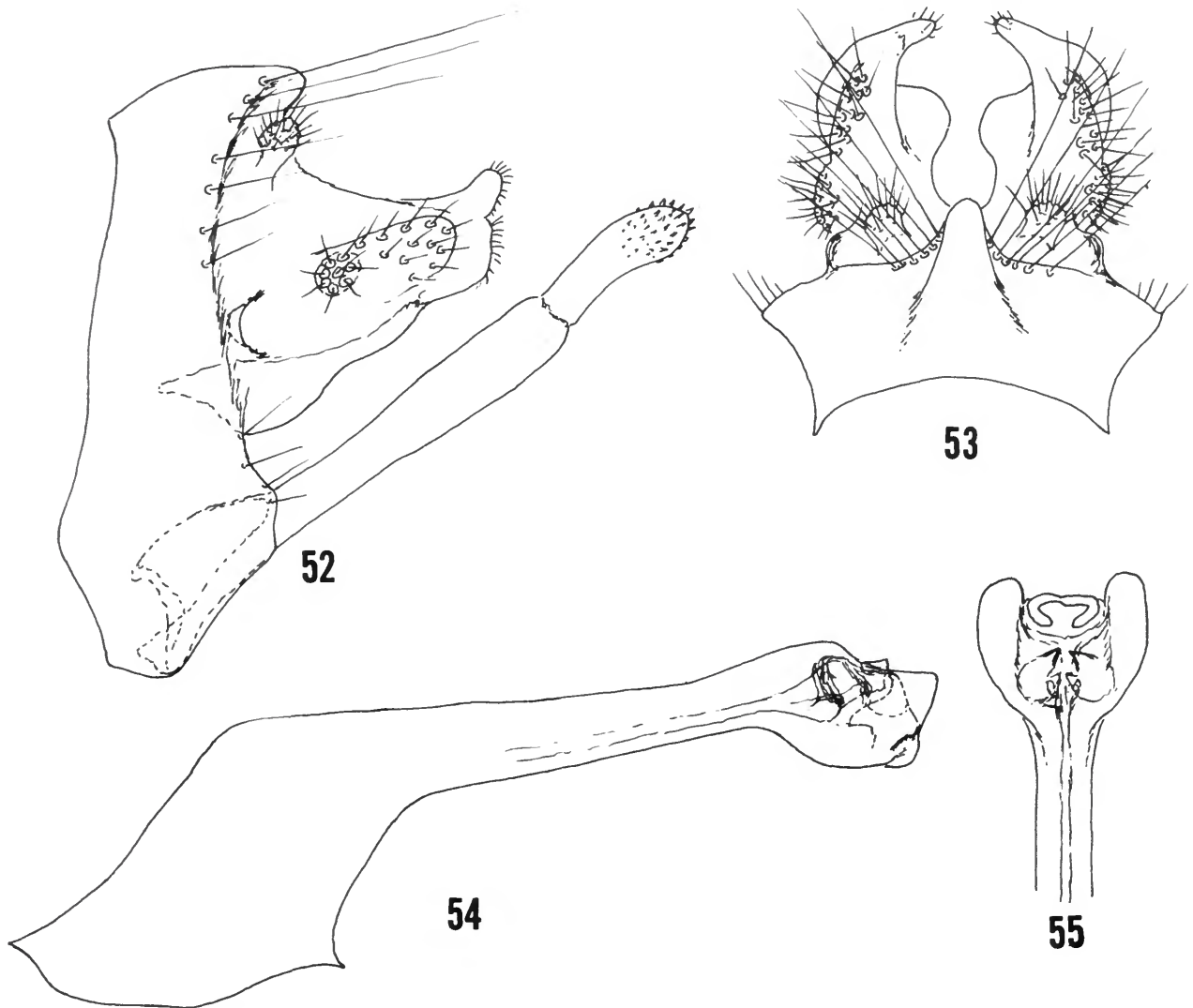


FIGURES 39-44.—*Leptonema piliferum* Schmid, male: 39, genitalia, ventral; 40, same, lateral; 41, same, dorsal; 42, apex of phallus, dorsal; 43, same, posterior; 44, fifth sternum, ventral.

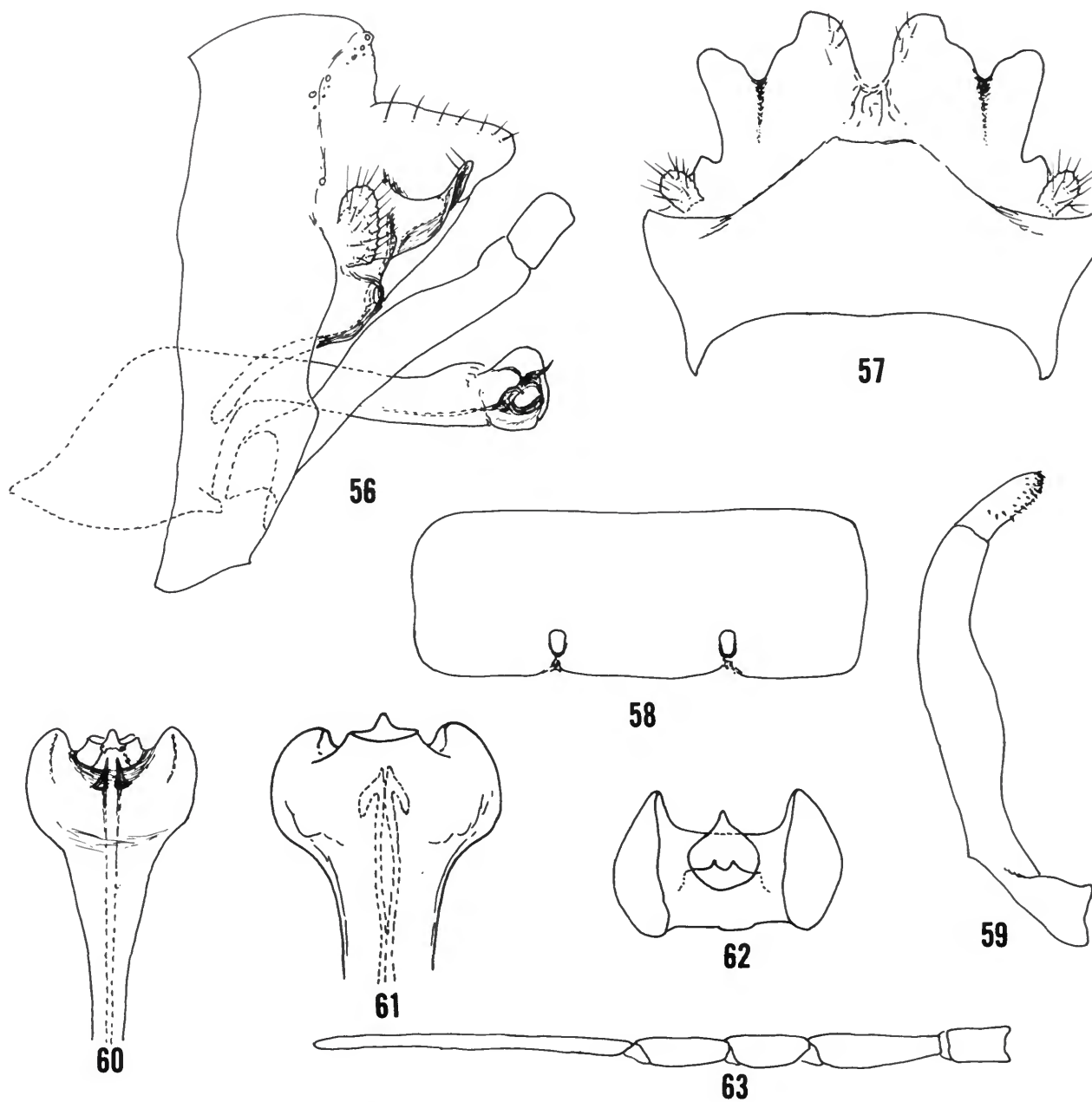




FIGURES 45-51.—*Leptonema pseudocinctum*, new species, male: 45, genitalia, lateral; 46, clasper, postero-ventral; 47, ninth and tenth terga, dorsal; 48, apex of phallus, lateral; 49, same, posterior; 50, same, dorsal; 51, fifth sternum, ventral.

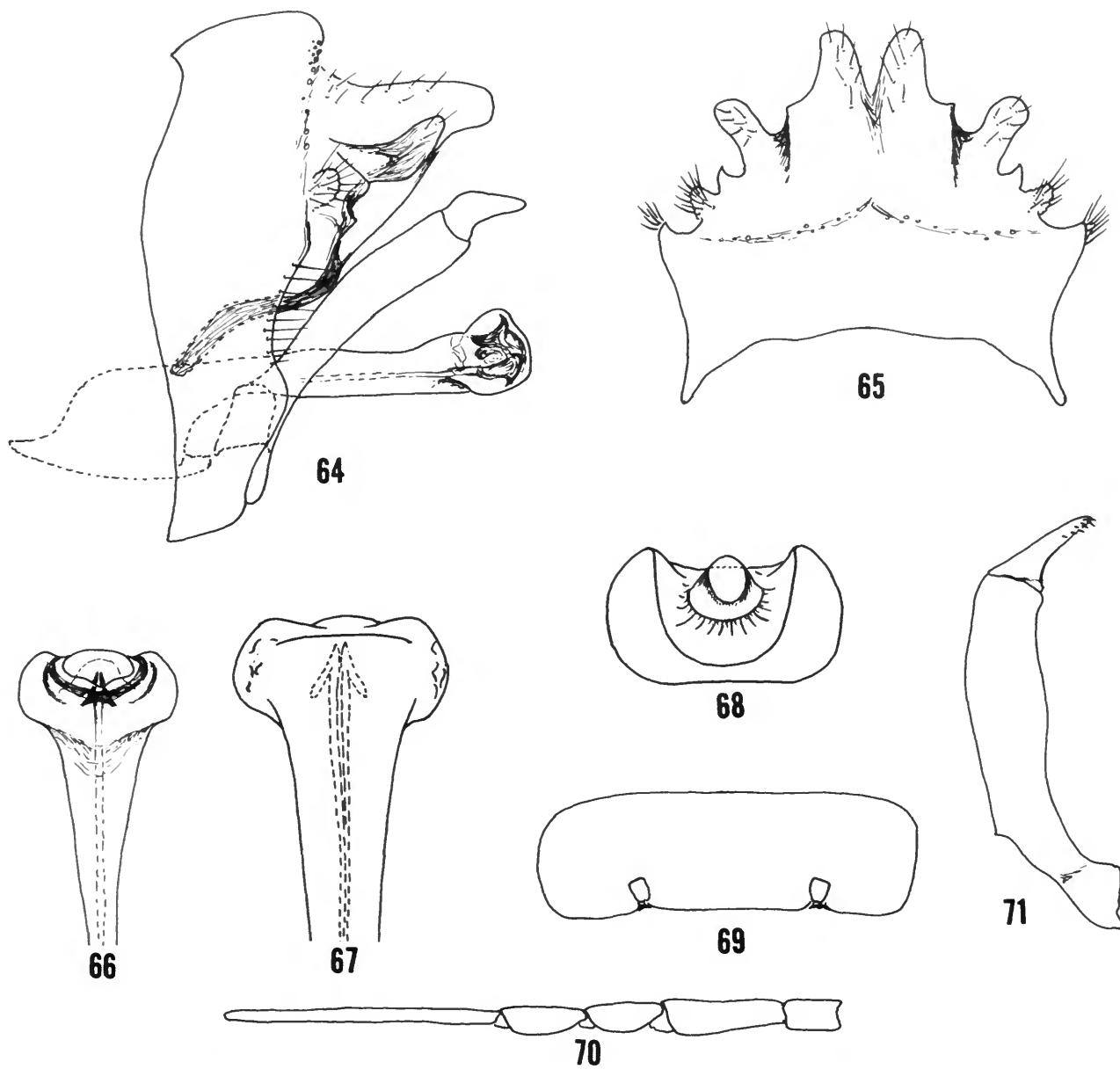


FIGURES 52-55.—*Leptonema pseudostigmatosum* Flint, male: 52, genitalia, lateral; 53, ninth and tenth terga, dorsal; 54, phallus, lateral; 55, same, dorsal.

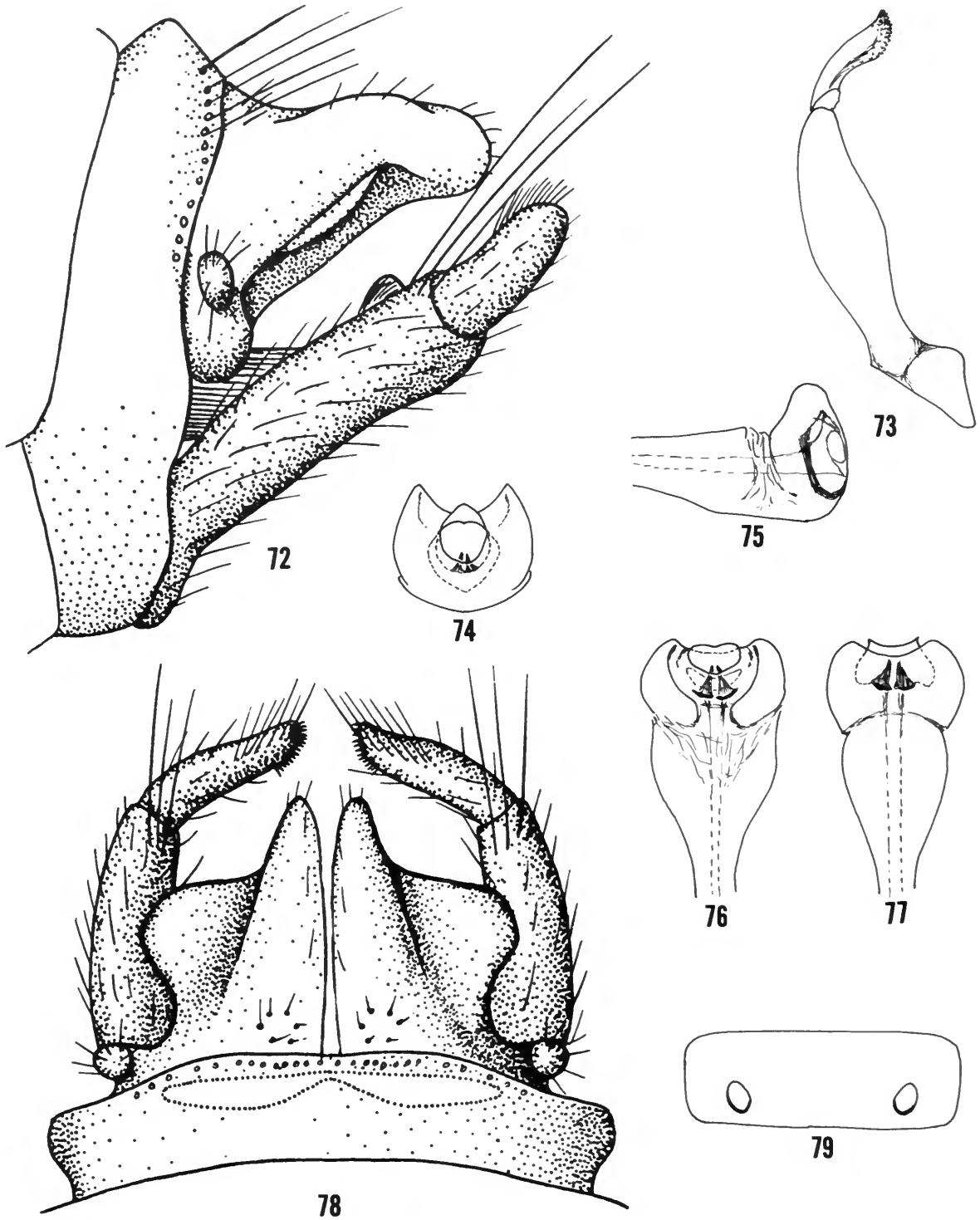


FIGURES 56-63.—*Leptonema affine* Ulmer, male: 56, genitalia, lateral; 57, ninth and tenth terga, dorsal; 58, fifth sternum, ventral; 59, clasper, posteroventral; 60, apex of phallus, dorsal; 61, same, ventral; 62, same, posterior; 63, maxillary palpus, lateral.

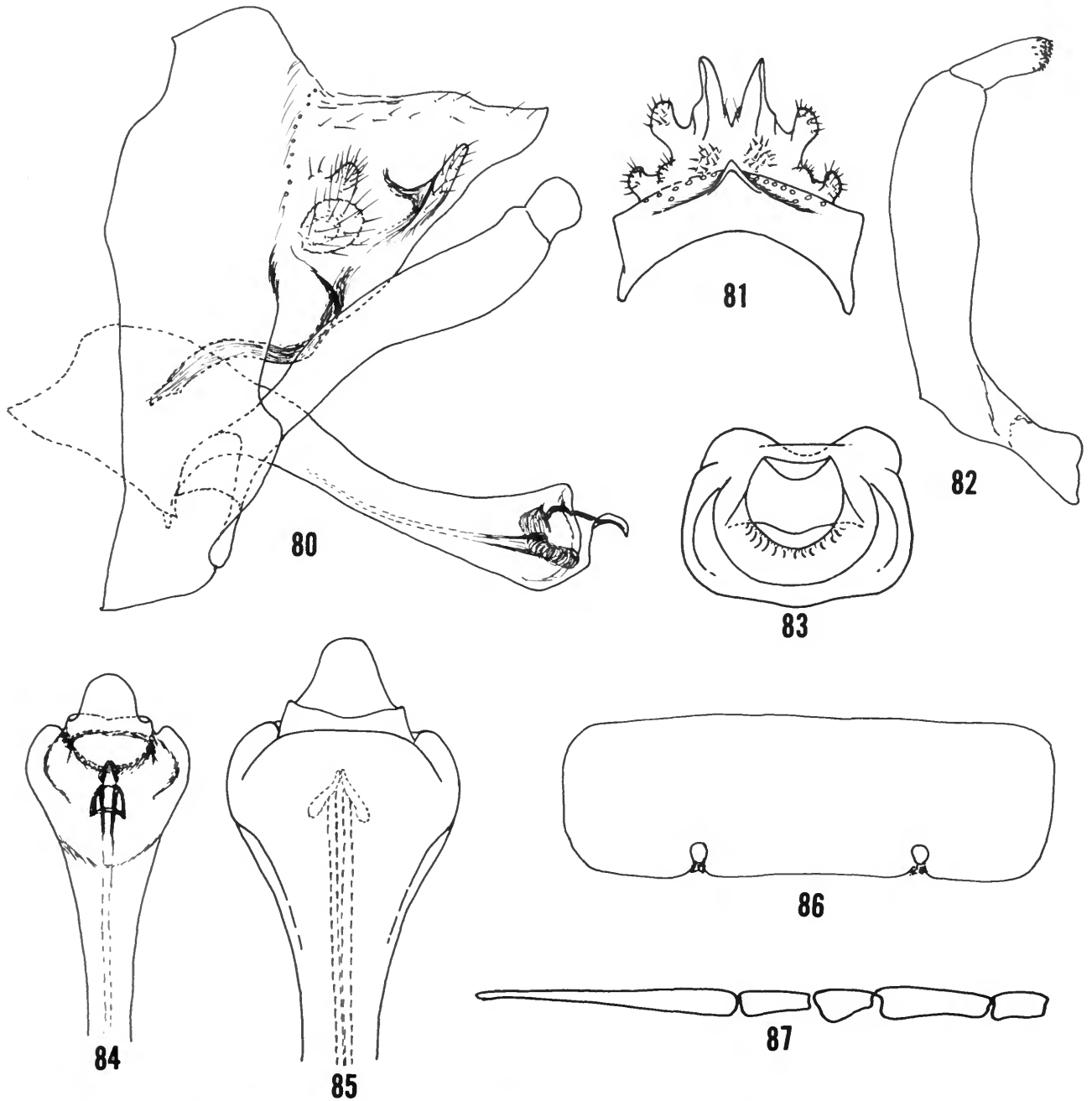




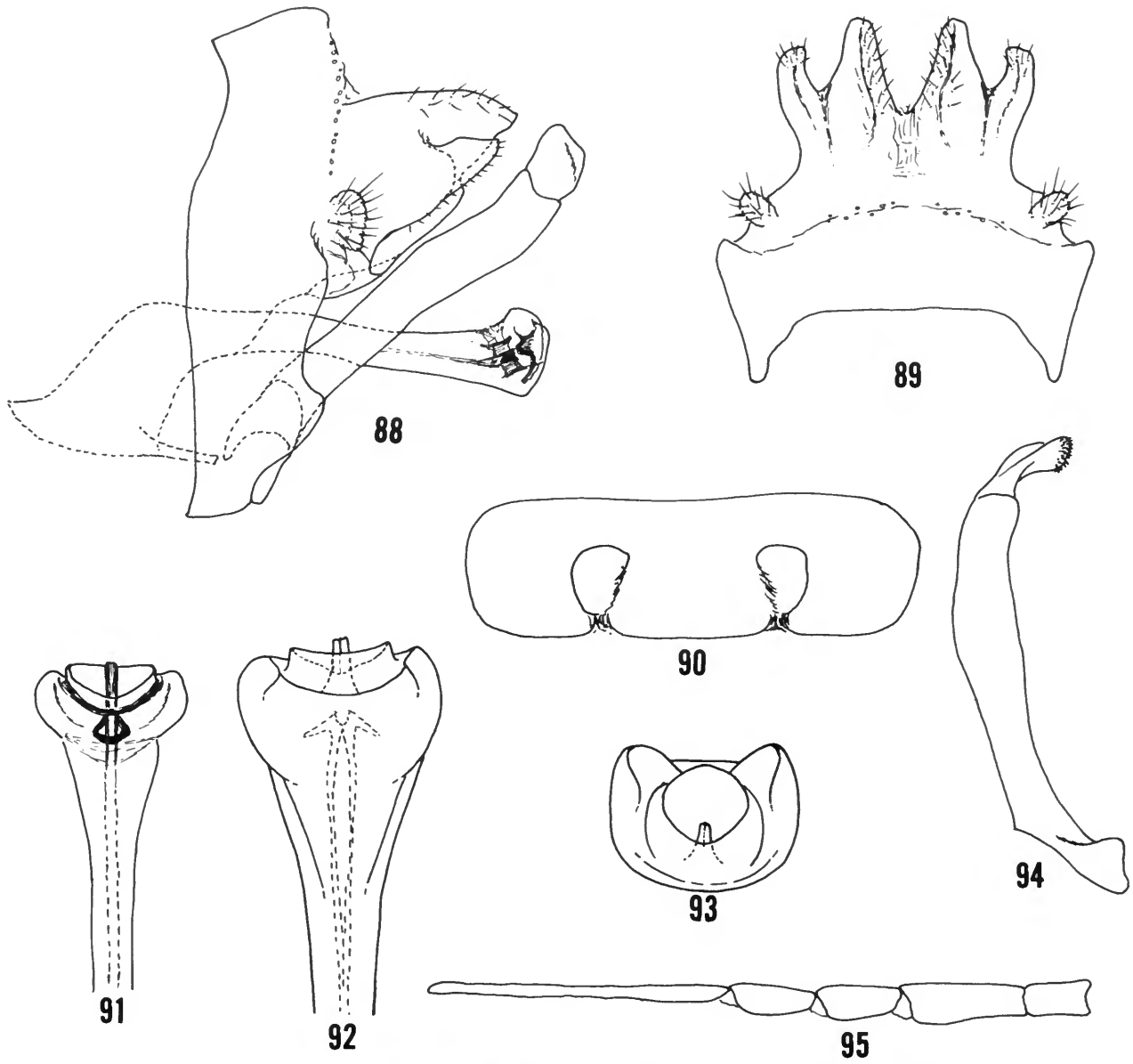
FIGURES 64-71.—*Leptonema conicum*, new species, male: 64, genitalia, lateral; 65, ninth and tenth terga, dorsal; 66, apex of phallus, dorsal; 67, same, ventral; 68, same, posterior; 69, fifth sternum, ventral; 70, maxillary palpus, lateral; 71, clasper, posteroventral.



FIGURES 72-79.—*Leptonema madagascariense* Ulmer, male: 72, genitalia, lateral; 73, clasper, posteroventral; 74, apex of phallus, posterior; 75, same, lateral; 76, same, dorsal; 77, same, ventral; 78, genitalia, dorsal; 79, fifth sternum, ventral.

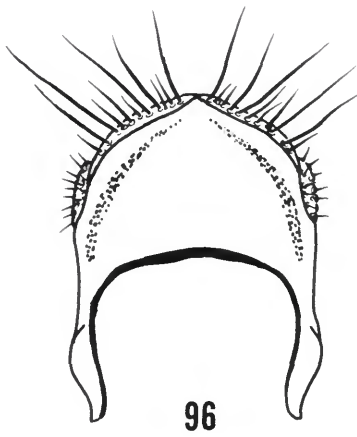


FIGURES 80-87.—*Leptonema milae* Sykora, male: 80, genitalia, lateral; 81, ninth and tenth terga, dorsal; 82, clasper, posteroventral; 83, apex of phallus, posterior; 84, same, dorsal; 85, same, ventral; 86, fifth sternum, ventral; 87, maxillary palpus, lateral.

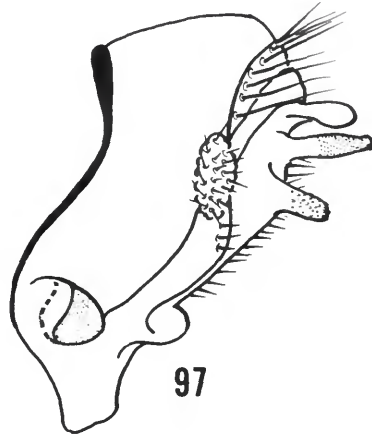


FIGURES 88-95.—*Leptonema nupharum*, new species, male: 88, genitalia, lateral; 89, ninth and tenth targa, dorsal; 90, fifth sternum, ventral; 91, apex of phallus, dorsal; 92, same, ventral; 93, same, posterior; 94, clasper, posteroventral; 95, maxillary palpus, lateral.

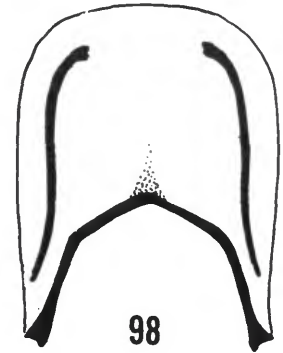




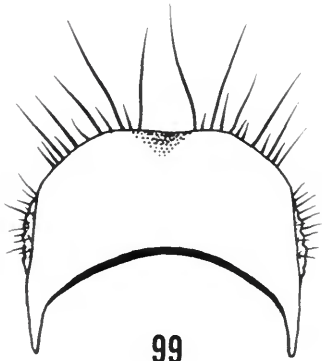
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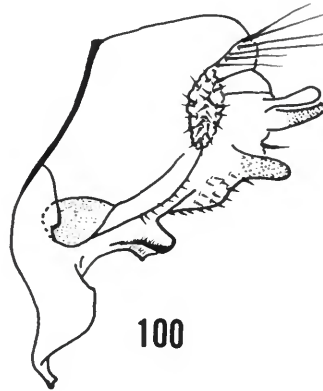
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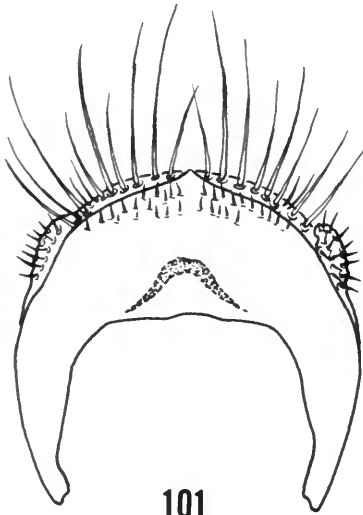
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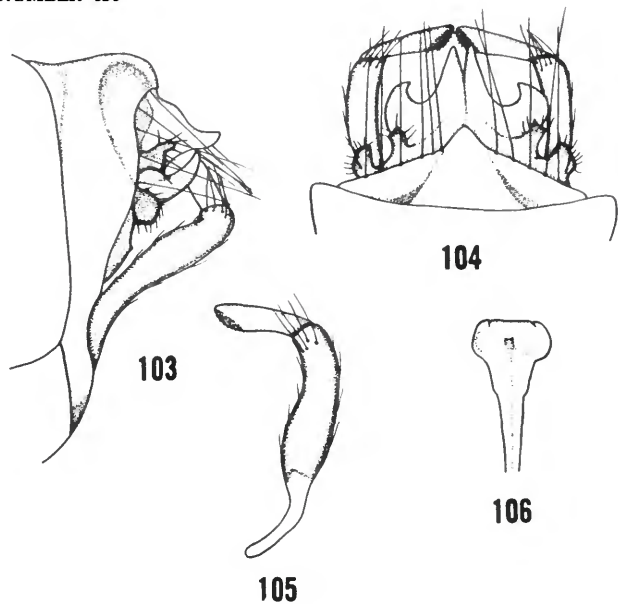


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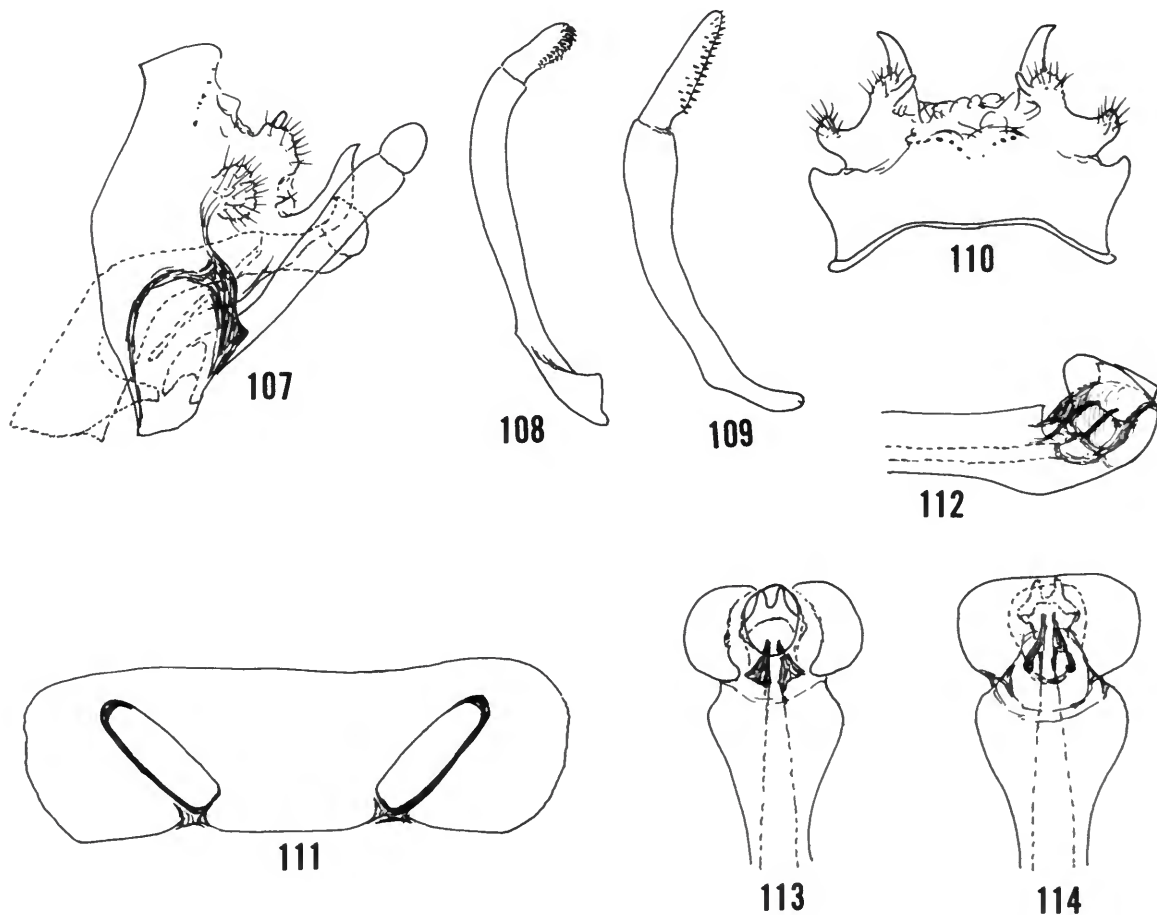
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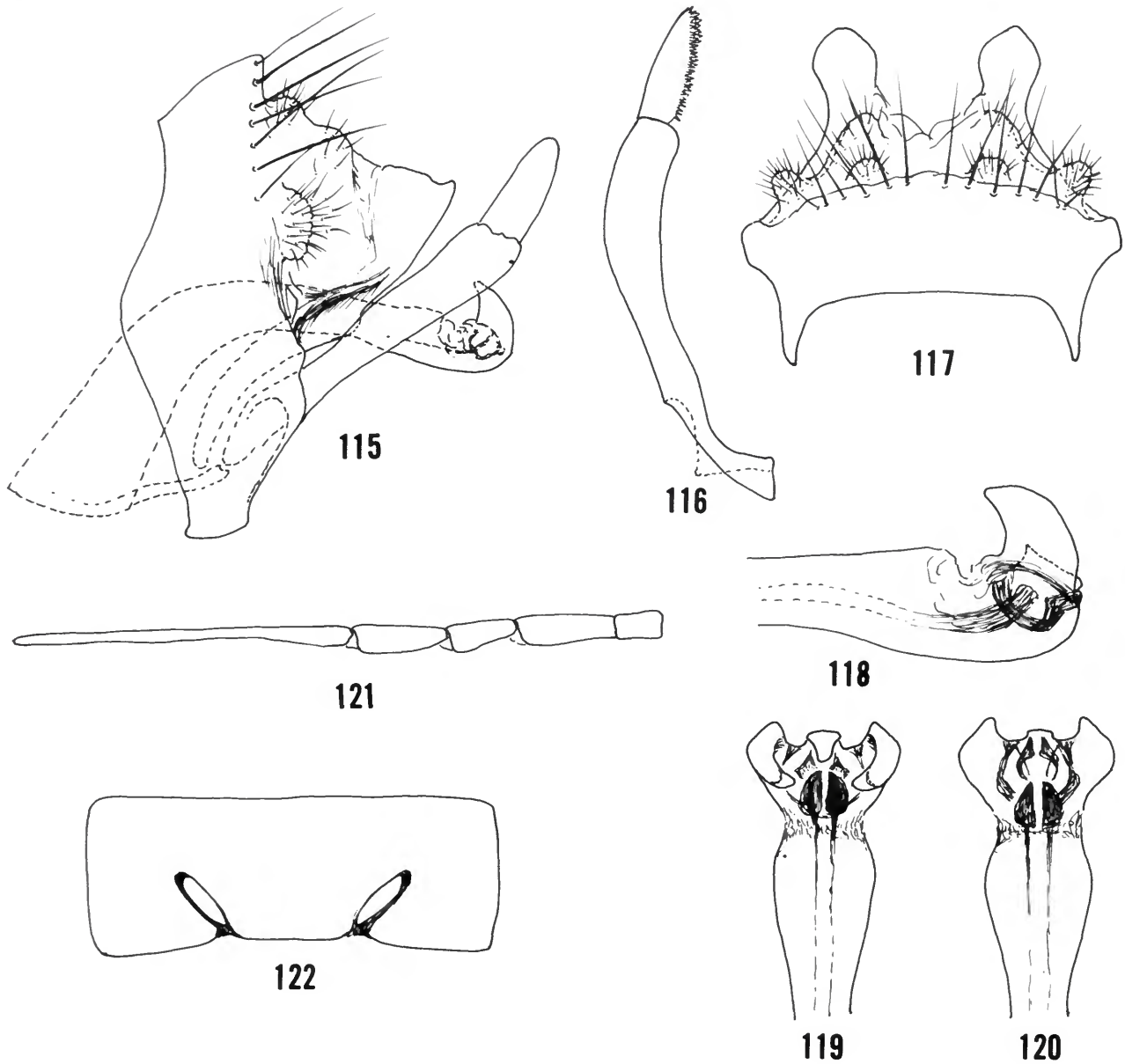
FIGURES 96-102.—*Leptonema affine* Ulmer, female: 96, ninth tergum, dorsal; 97, ninth and tenth terga, lateral; 98, basal abdominal sternum, ventral. *Leptonema conicum*, new species, female: 99, ninth tergum, dorsal; 100, ninth and tenth terga, lateral. *L. nupharum*, new species: 101, ninth tergum, dorsal; 102, ninth and tenth terga, lateral.



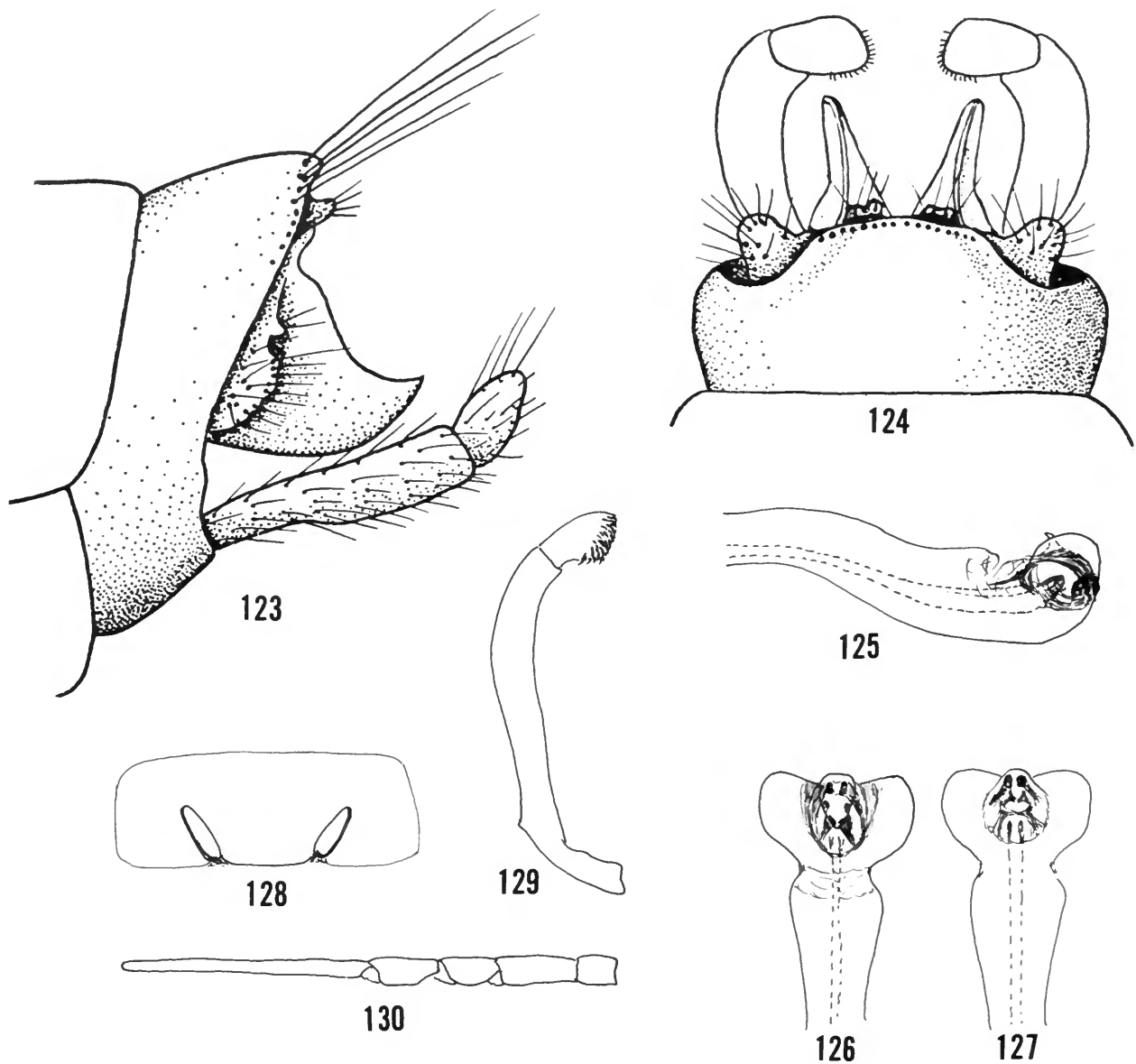
FIGURES 103-106.—*Leptonema zahradniki* Sykora, male: 103, genitalia, lateral; 104, ninth and tenth terga, dorsal; 105, clasper, posteroventral; 106, apex of phallus, dorsal.

FIGURES 107-114.—*Leptonema guineense* Gibbs, male: 107, genitalia, lateral; 108, clasper, posteroventral; 109, same, example from Ivory Coast; 110, ninth and tenth terga, dorsal; 111, fifth sternum, ventral; 112, apex of phallus, lateral; 113, same, dorsal; 114, same, ventral.



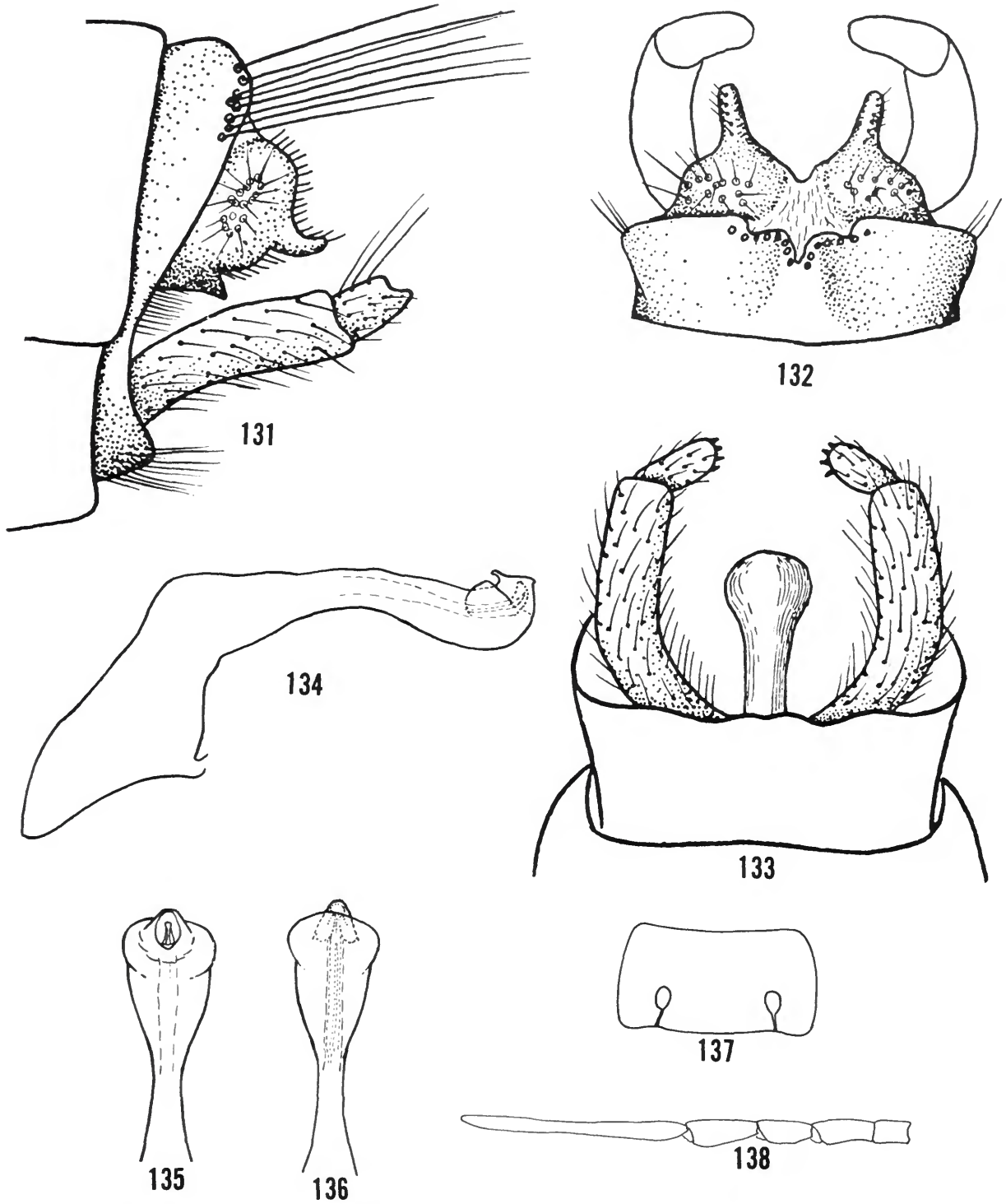


FIGURES 115–122.—*Leptonema martieri*, new species, male: 115, genitalia, lateral; 116, clasper, postero-ventral; 117, ninth and tenth terga, dorsal; 118, apex of phallus, lateral; 119, same, dorsal; 120, same, ventral; 121, maxillary palpus, lateral; 122, fifth sternum.

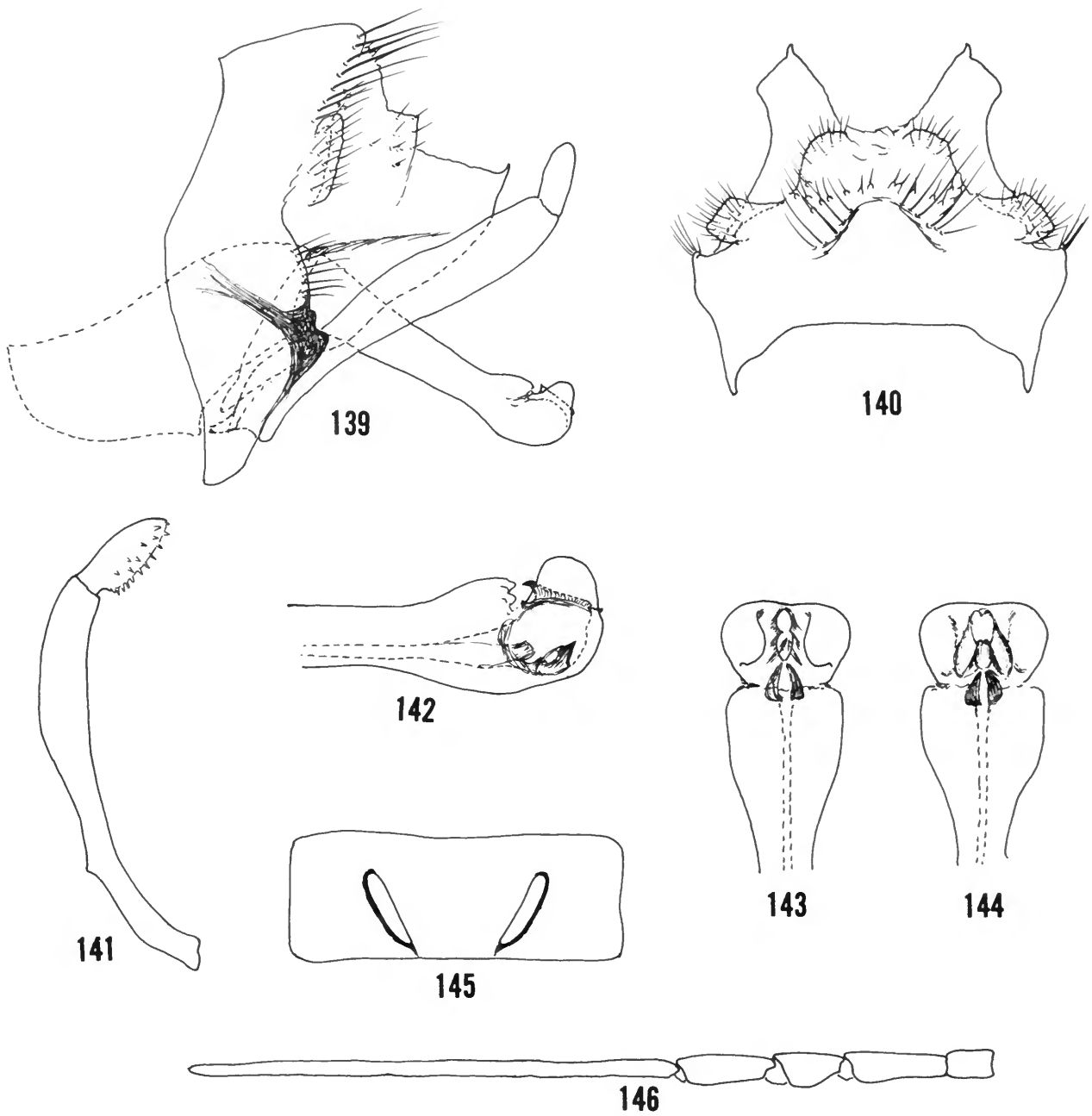


FIGURES 123-130.—*Leptonema natalense* Mosely, male: 123, genitalia, lateral; 124, same, dorsal; 125, apex of phallus, lateral; 126, same, dorsal; 127, same, ventral; 128, fifth sternum, ventral; 129, clasper, posteroventral; 130, maxillary palpus, lateral.

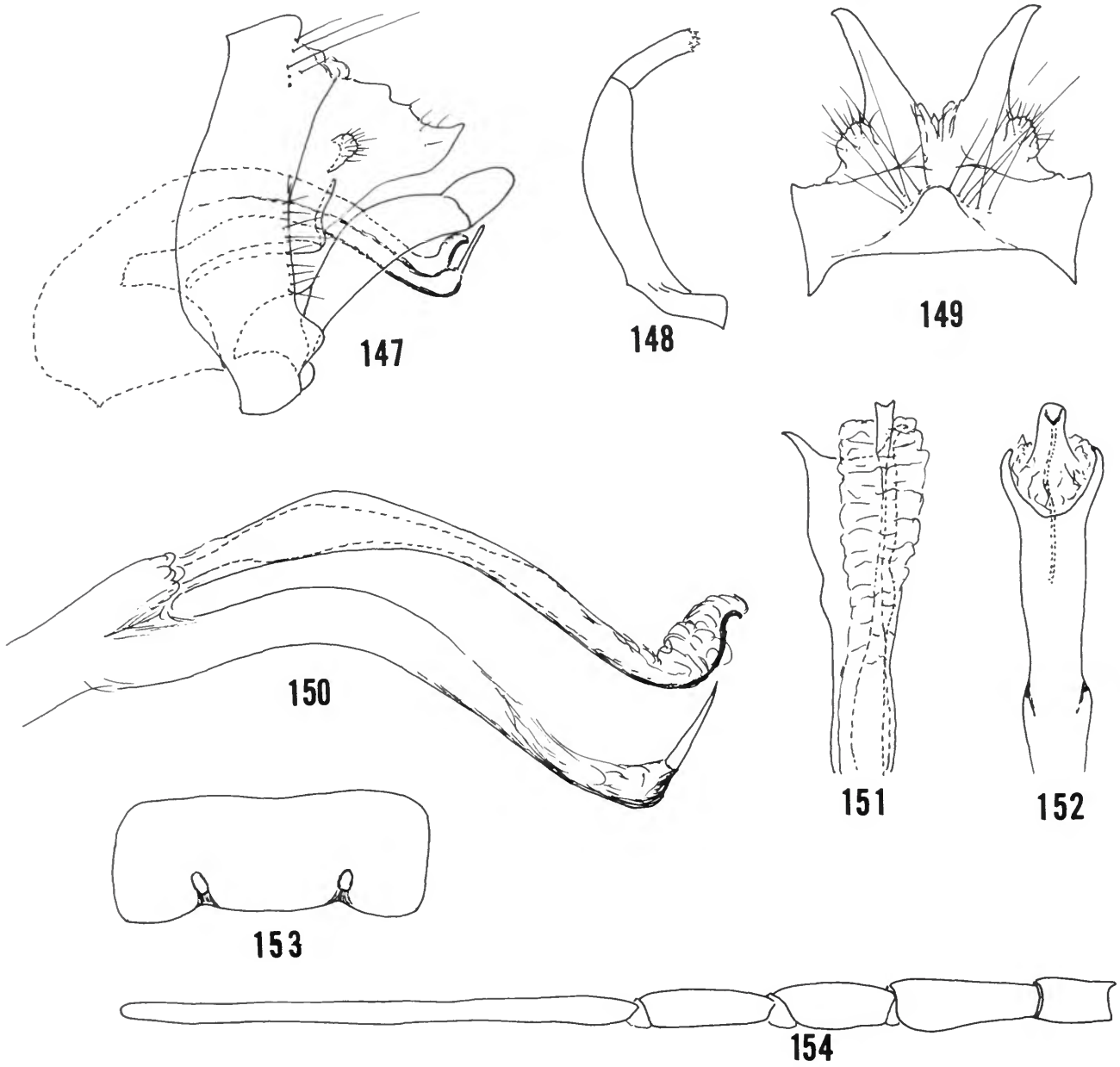




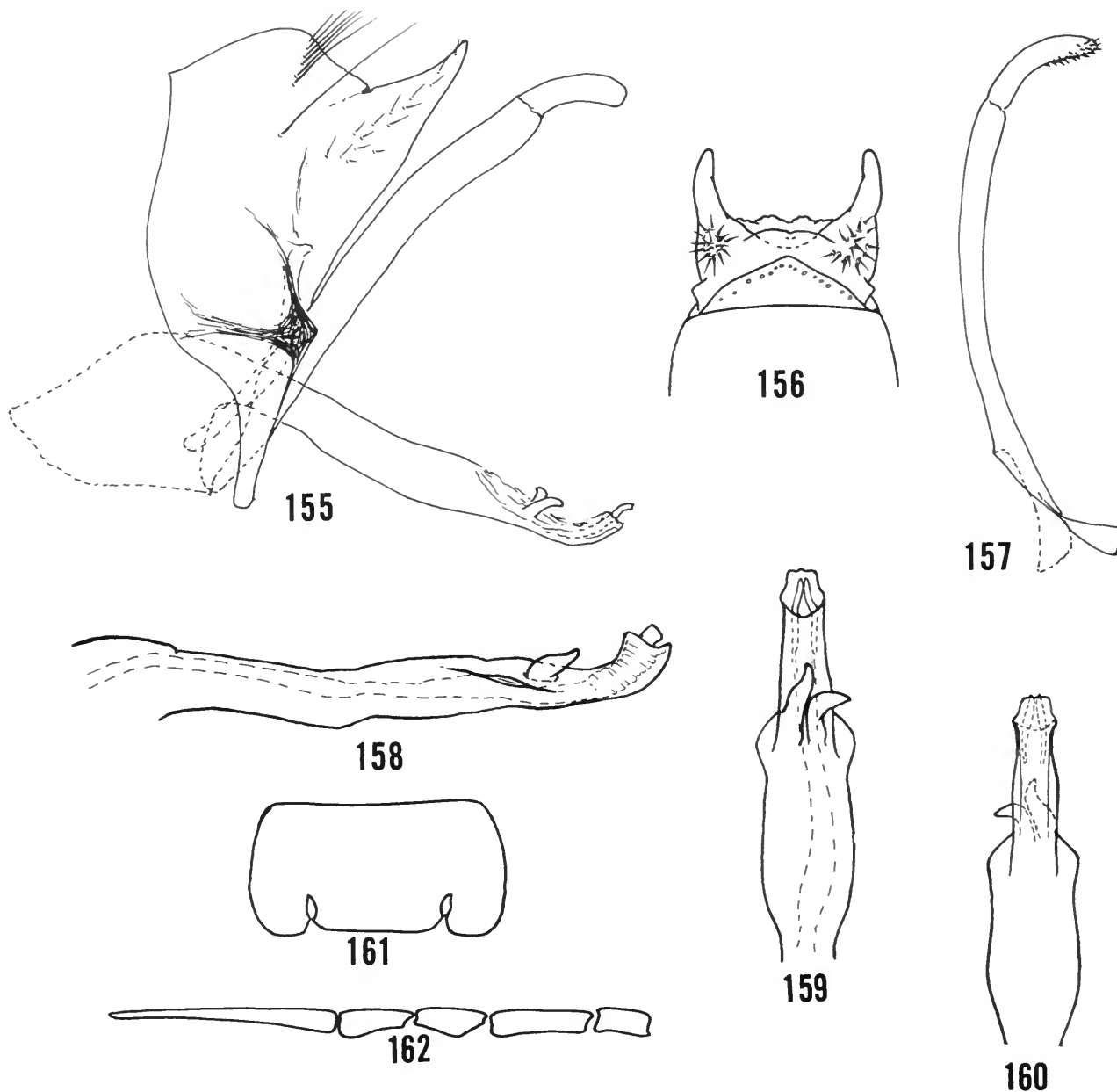
FIGURES 131-138.—*Leptonema occidentale* Ulmer, male: 131, genitalia, lateral; 132, ninth and tenth terna, dorsal; 133, genitalia, ventral; 134, phallus, lateral; 135, same, dorsal; 136, same, ventral; 137, fifth sternum, ventral; 138, maxillary palpus, lateral.



FIGURES 139-146.—*Leptonema vanderysti* Navás, male: 139, genitalia, lateral; 140, ninth and tenth terga, dorsal; 141, clasper, posteroventral; 142, apex of phallus, lateral; 143, same, dorsal; 144, same, ventral; 145, fifth sternum, ventral; 146, maxillary palpus, lateral.

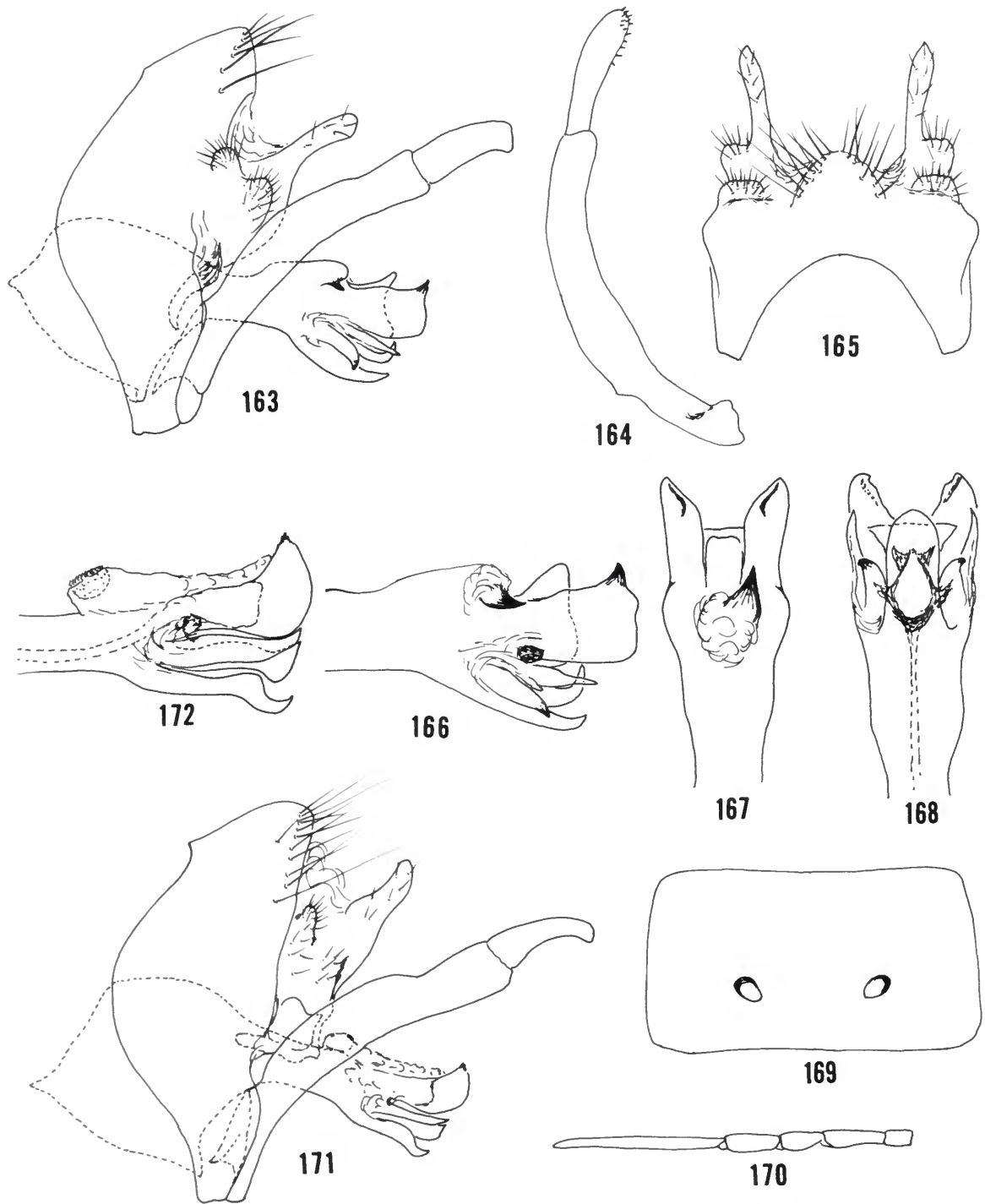


FIGURES 147-154.—*Leptonema aberrans*, new species, male: 147, genitalia, lateral; 148, clasper, postero-ventral; 149, ninth and tenth terga, dorsal; 150, phallus, lateral; 151, same, dorsal; 152, same, ventral; 153, fifth sternum, ventral; 154, maxillary palpus, lateral.

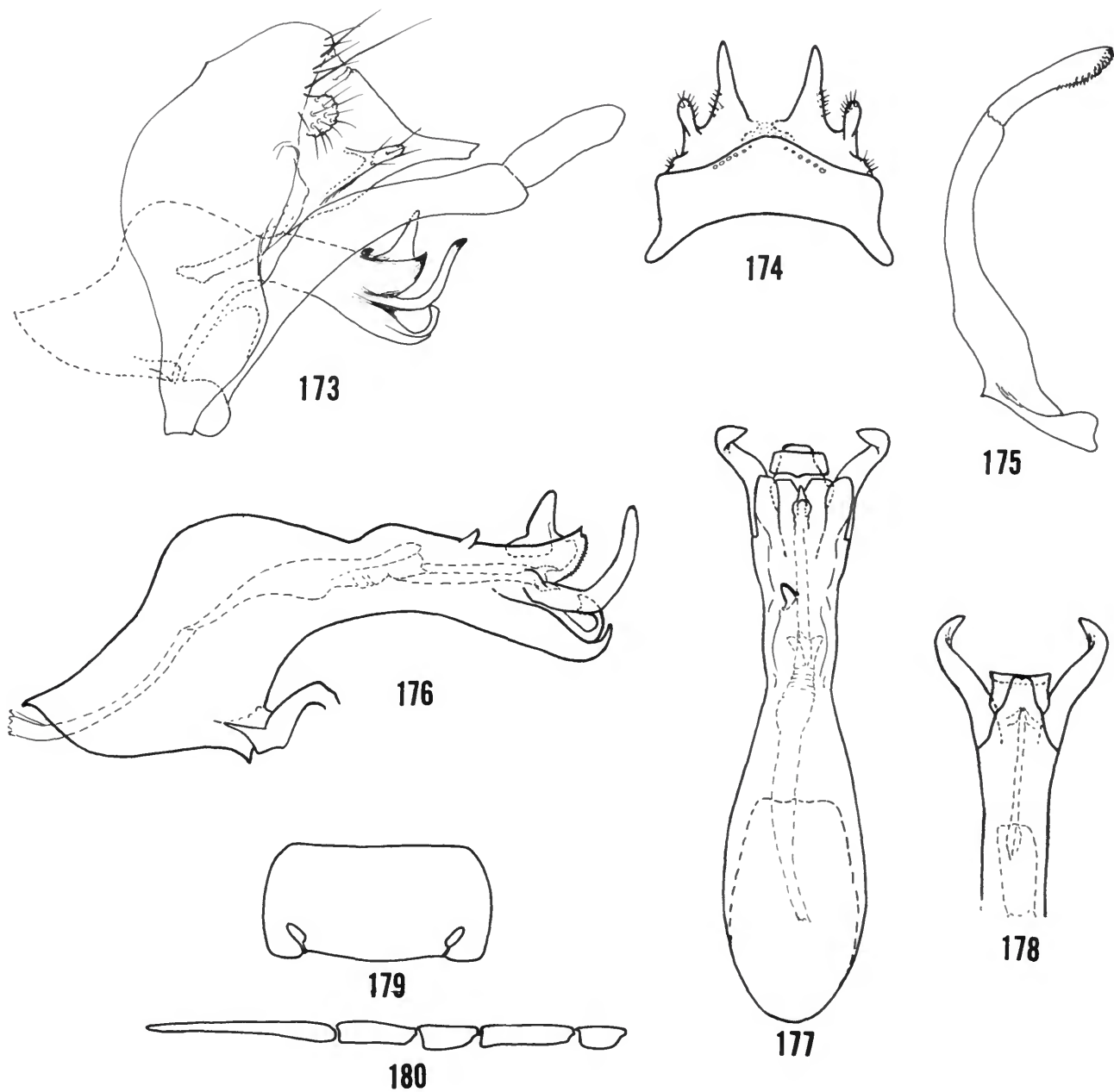


FIGURES 155-162.—*Leptonema alatum* Marlier, male: 155, genitalia, lateral; 156, ninth and tenth terga, dorsal; 157, clasper, posteroventral; 158, apex of phallus, lateral; 159, same, dorsal; 160, same, ventral; 161, fifth sternum, ventral; 162, maxillary palpus, lateral.

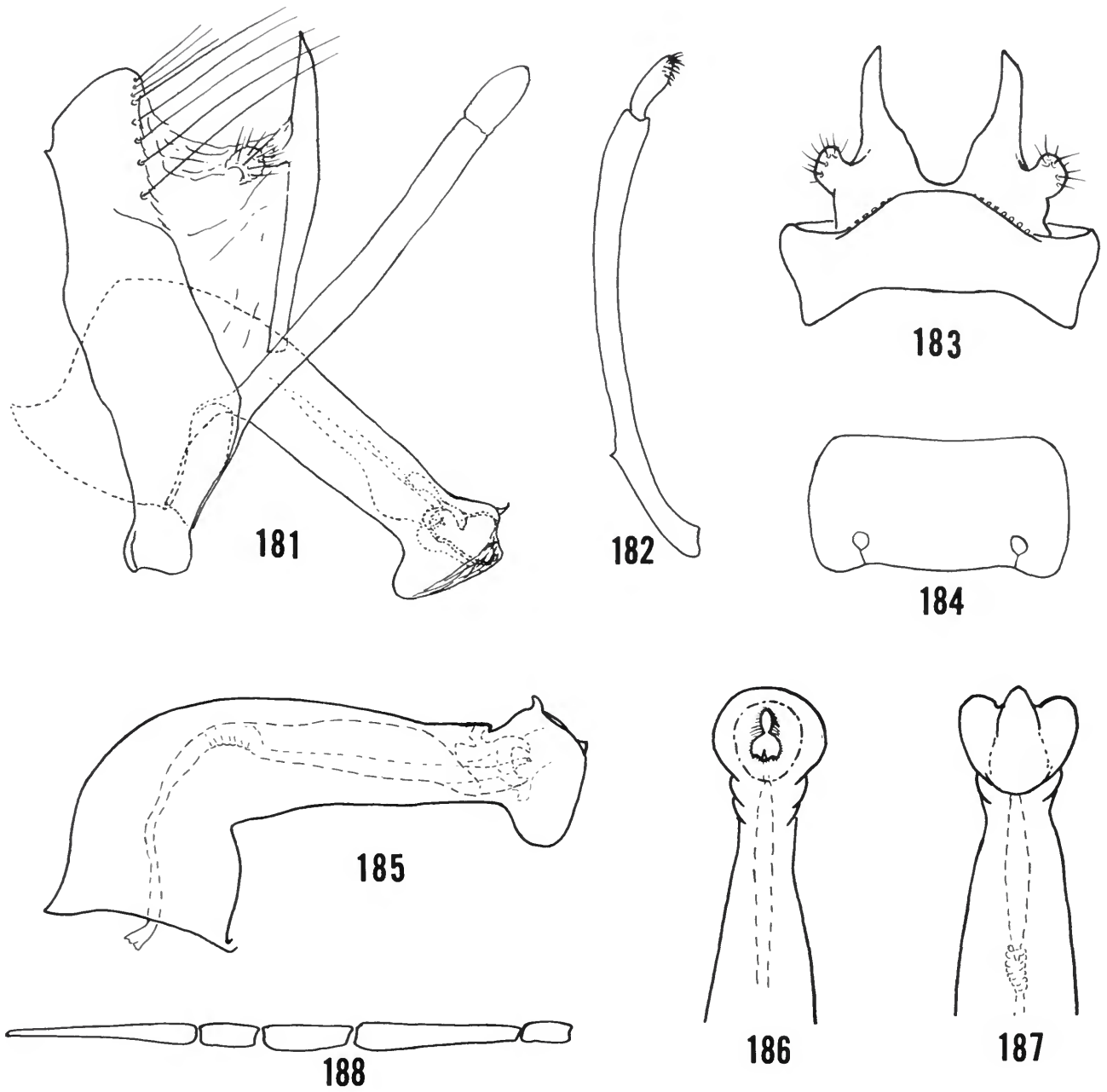




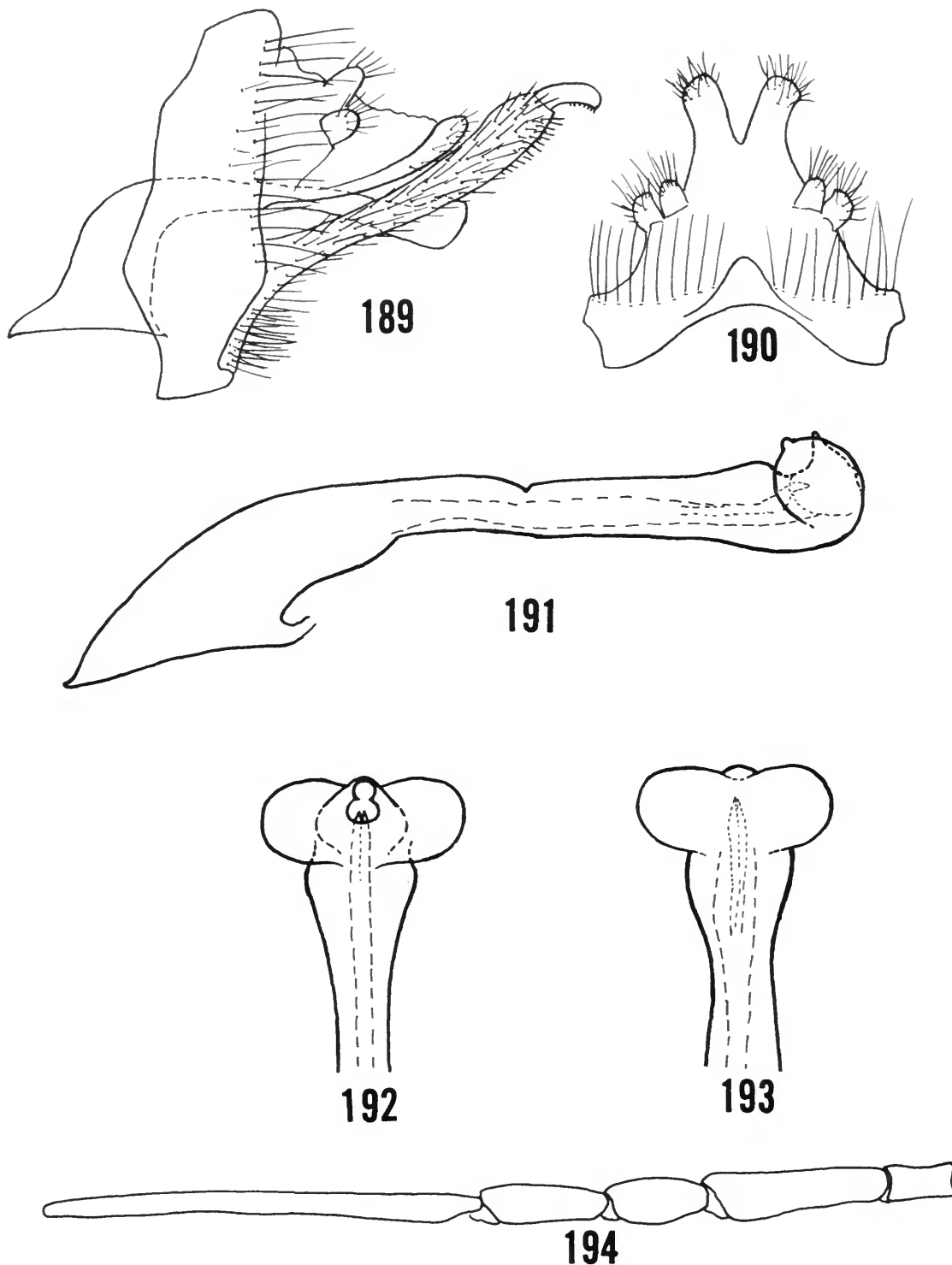
FIGURES 163–172.—*Leptonema latipenne* Marlier, male: 163, genitalia, lateral; 164, clasper, posteroventral; 165, ninth and tenth terga, dorsal; 166, apex of phallus, lateral; 167, same, dorsal; 168, same, ventral; 169, fifth sternum, ventral; 170, maxillary palpus, lateral. Male from Abidjan: 171, genitalia, lateral; 172, apex of phallus, lateral.



FIGURES 173-180.—*Leptonema normale* Banks, male: 173, genitalia, lateral; 174, ninth and tenth terga, dorsal; 175, clasper, posteroventral; 176, phallus, lateral; 177, same, dorsal; 178, same, ventral; 179, fifth sternum, ventral; 180, maxillary palpus, lateral.

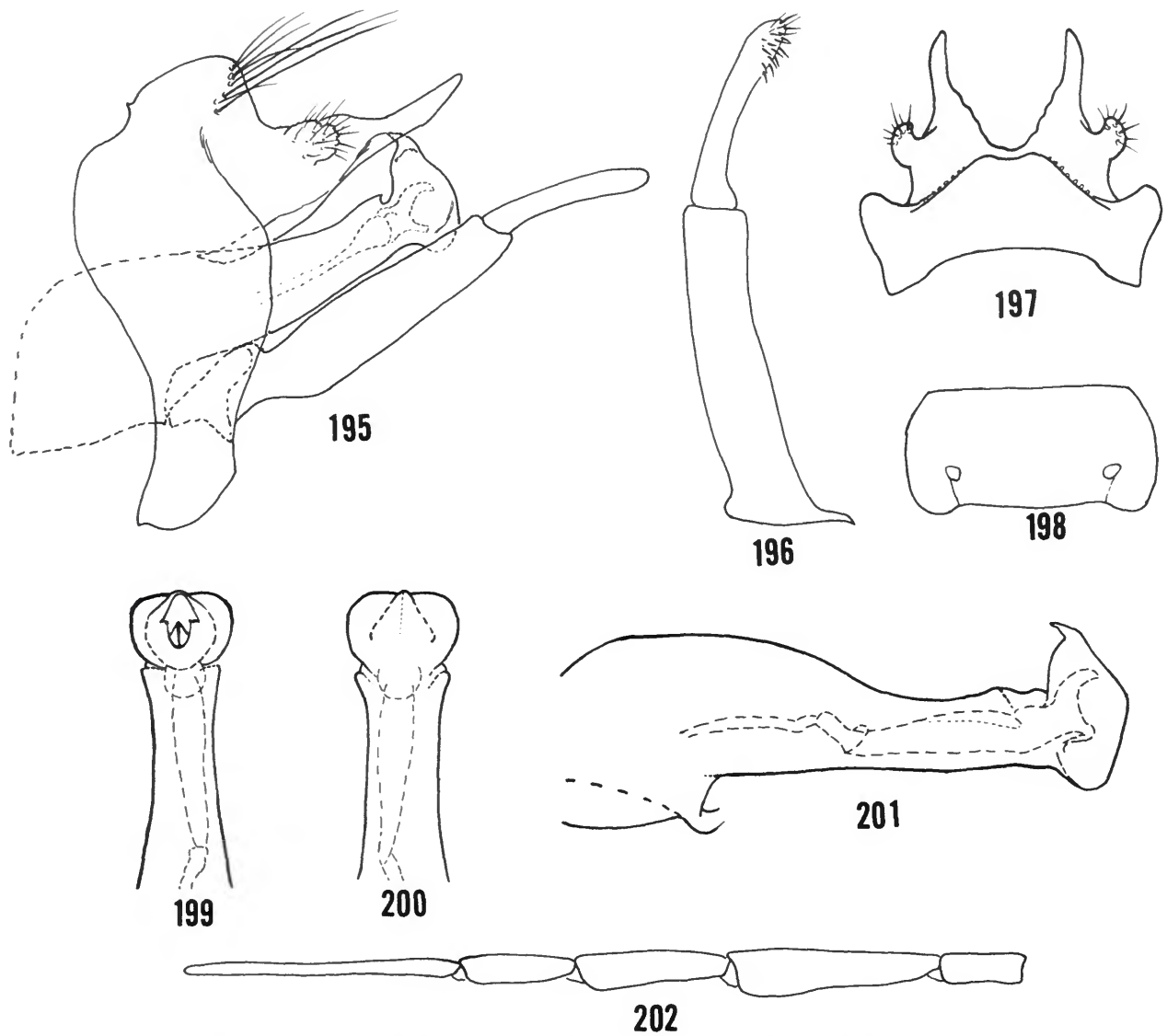


FIGURES 181–188.—*Leptonema aspersum* (Ulmer), male: 181, genitalia, lateral; 182, clasper, posteroventral; 183, ninth and tenth terga, dorsal; 184, fifth sternum, ventral; 185, phallus, lateral; 186, same, dorsal; 187, same, ventral; 188, maxillary palpus, lateral.

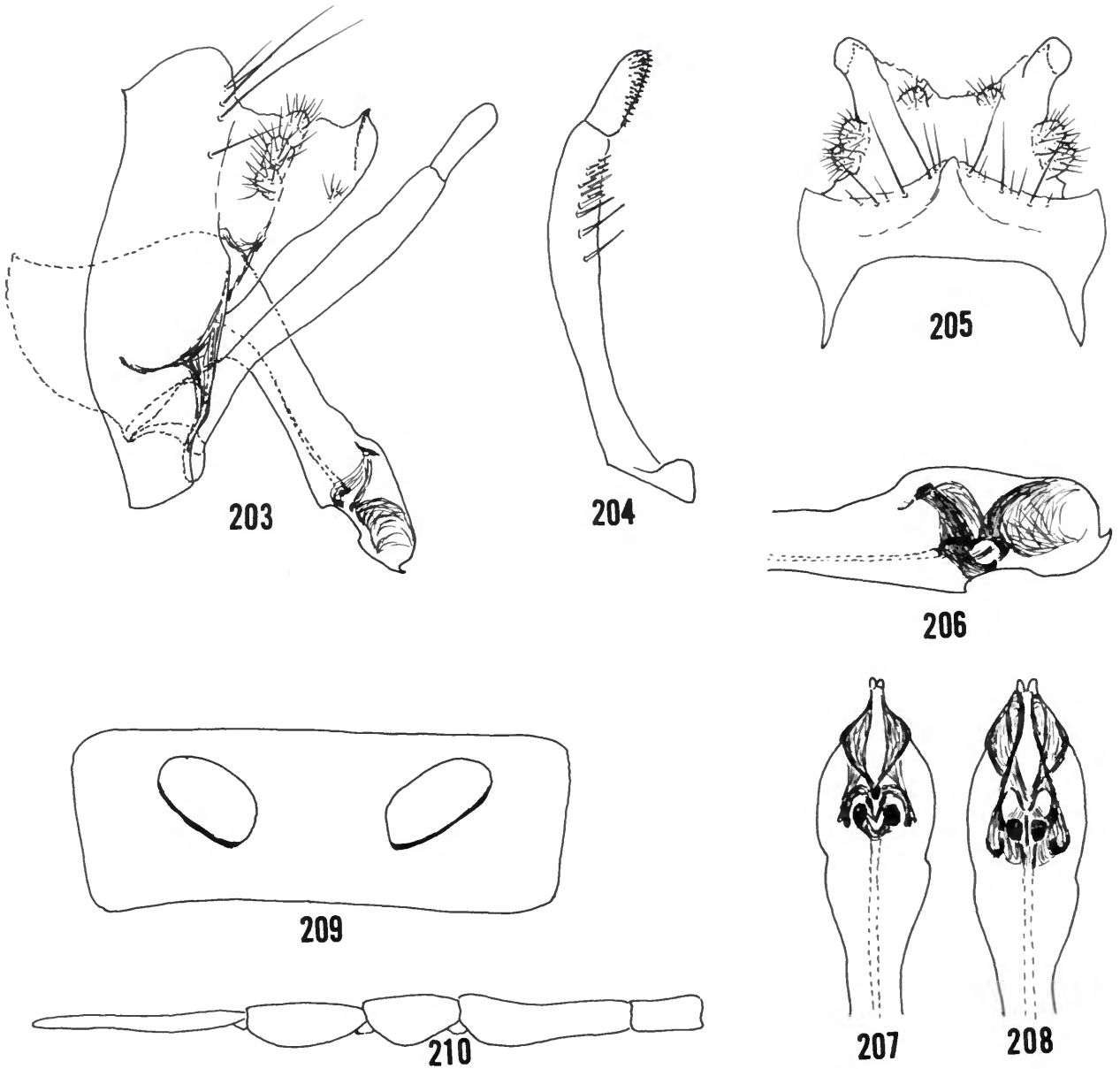


FIGURES 189-194.—*Leptonema poeyi* (Banks), male: 189, genitalia, lateral; 190, ninth and tenth terga, dorsal; 191, phallus, lateral; 192, same, dorsal; 193, same, ventral; 194, maxillary palpus, lateral.

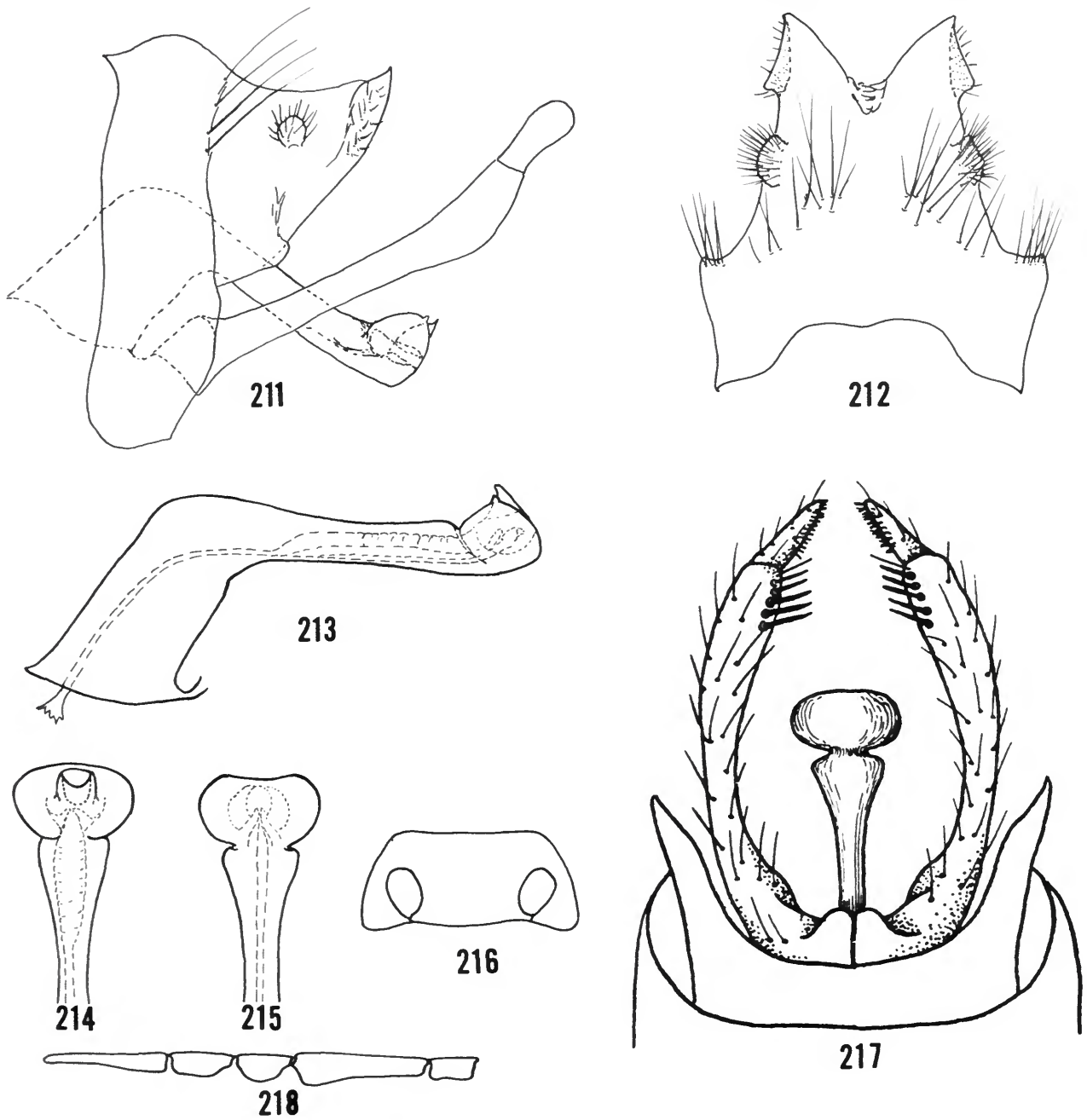




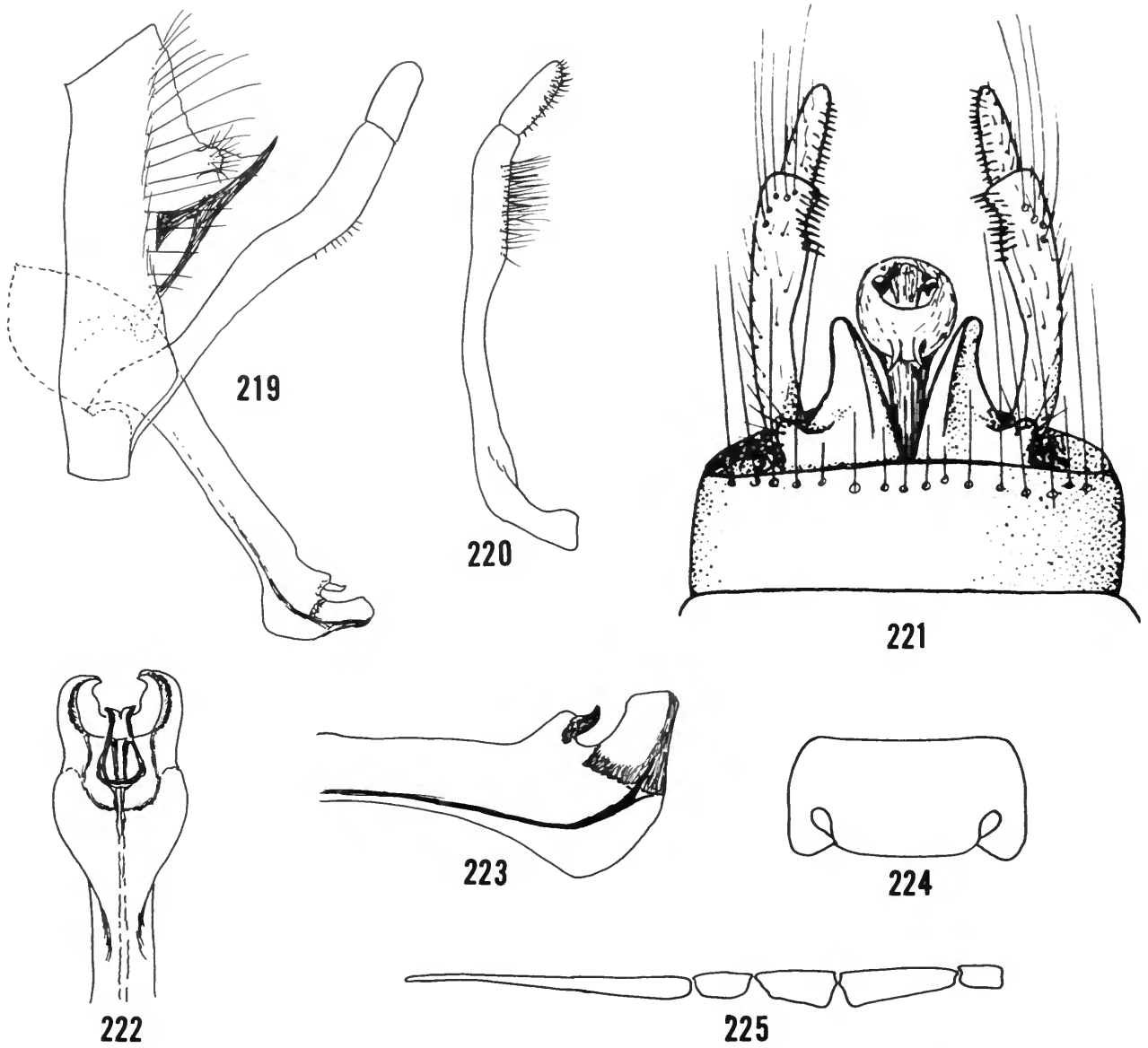
FIGURES 195-202.—*Leptonema rostratum*, new species, male: 195, genitalia, lateral; 196, clasper, postero-ventral; 197, ninth and tenth terga, dorsal; 198, fifth sternum, ventral; 199, apex of phallus, dorsal; 200, same, ventral; 201, same, lateral; 202, maxillary palpus, lateral.



FIGURES 203-210.—*Leptonema sancticaroli*, new species, male: 203, genitalia, lateral; 204, clasper, postero-ventral; 205, ninth and tenth terga, dorsal; 206, apex of phallus, lateral; 207, same, dorsal; 208, same, ventral; 209, fifth sternum, ventral; 210, maxillary palpus, lateral.

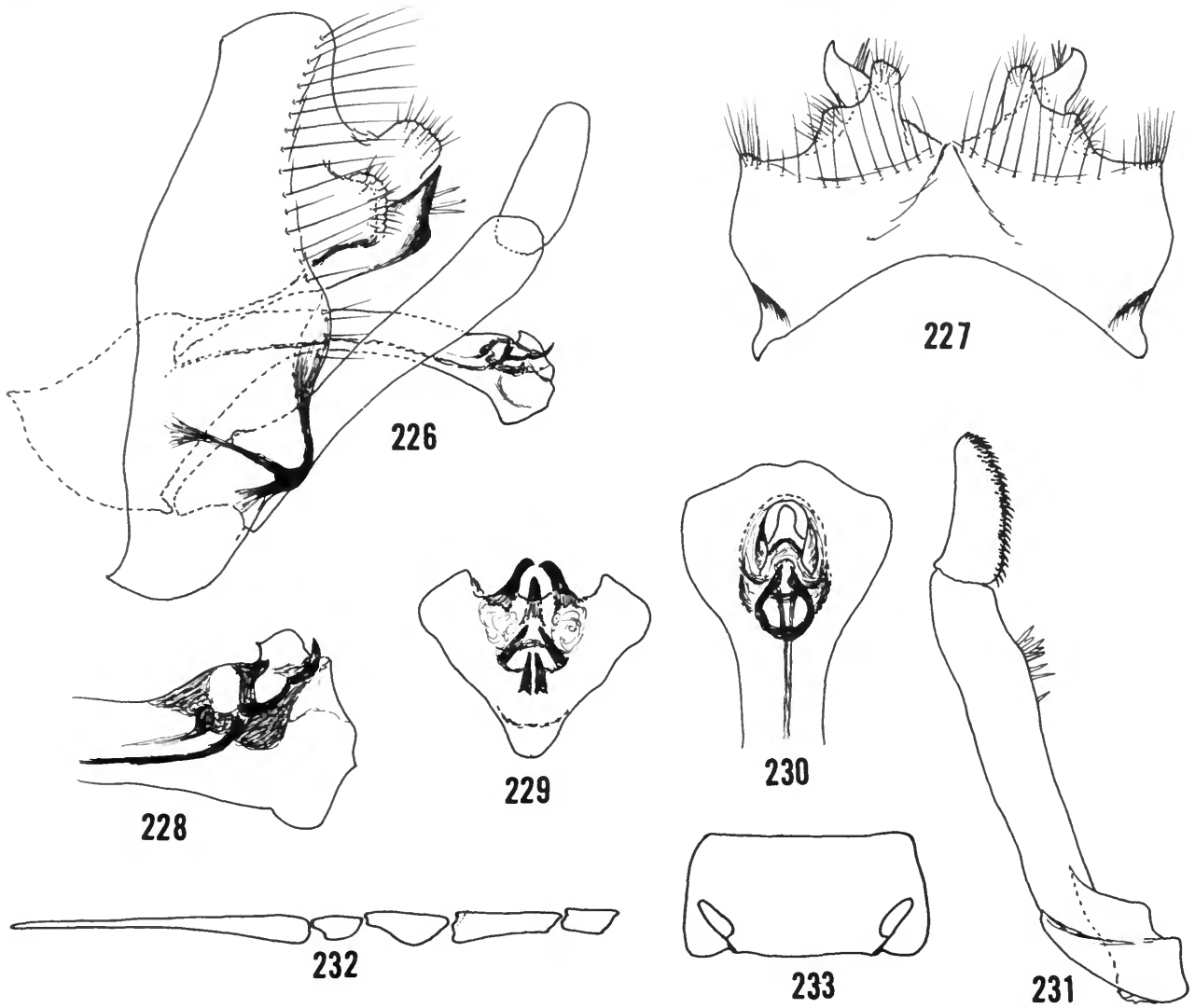


FIGURES 211-218.—*Leptonema sparsum* (Ulmer), male: 211, genitalia, lateral; 212, ninth and tenth terga, dorsal; 213, phallus, lateral; 214, same, dorsal; 215, same, ventral; 216, fifth sternum, ventral; 217, genitalia, ventral; 218, maxillary palpus, lateral.

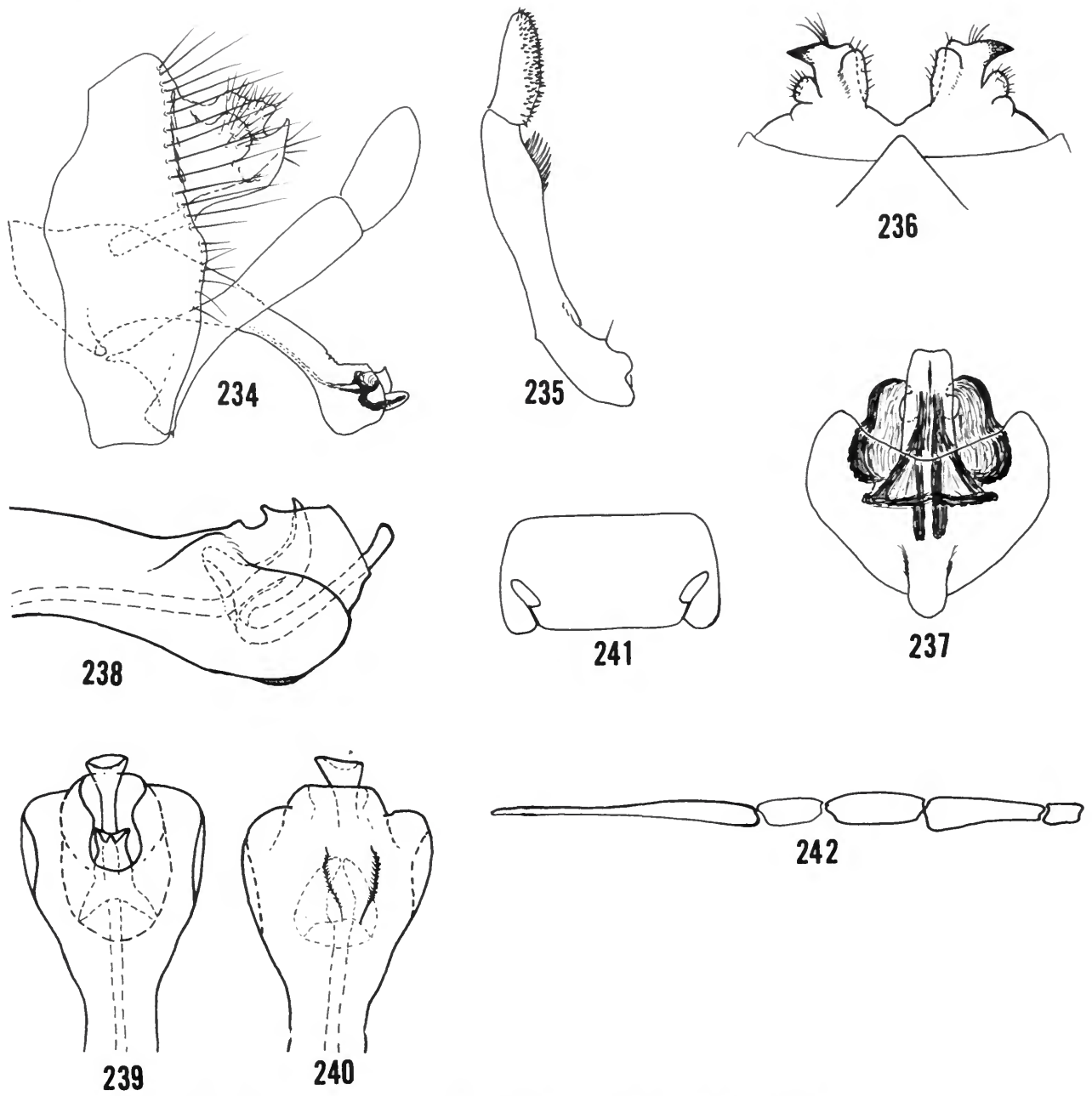


FIGURES 219–225.—*Leptonema columbianum* Ulmer, male: 219, genitalia, lateral; 220, clasper, posteroventral; 221, genitalia, dorsal; 222, apex of phallus, dorsal; 223, same, lateral; 224, fifth sternum, ventral; 225, maxillary palpus, lateral.

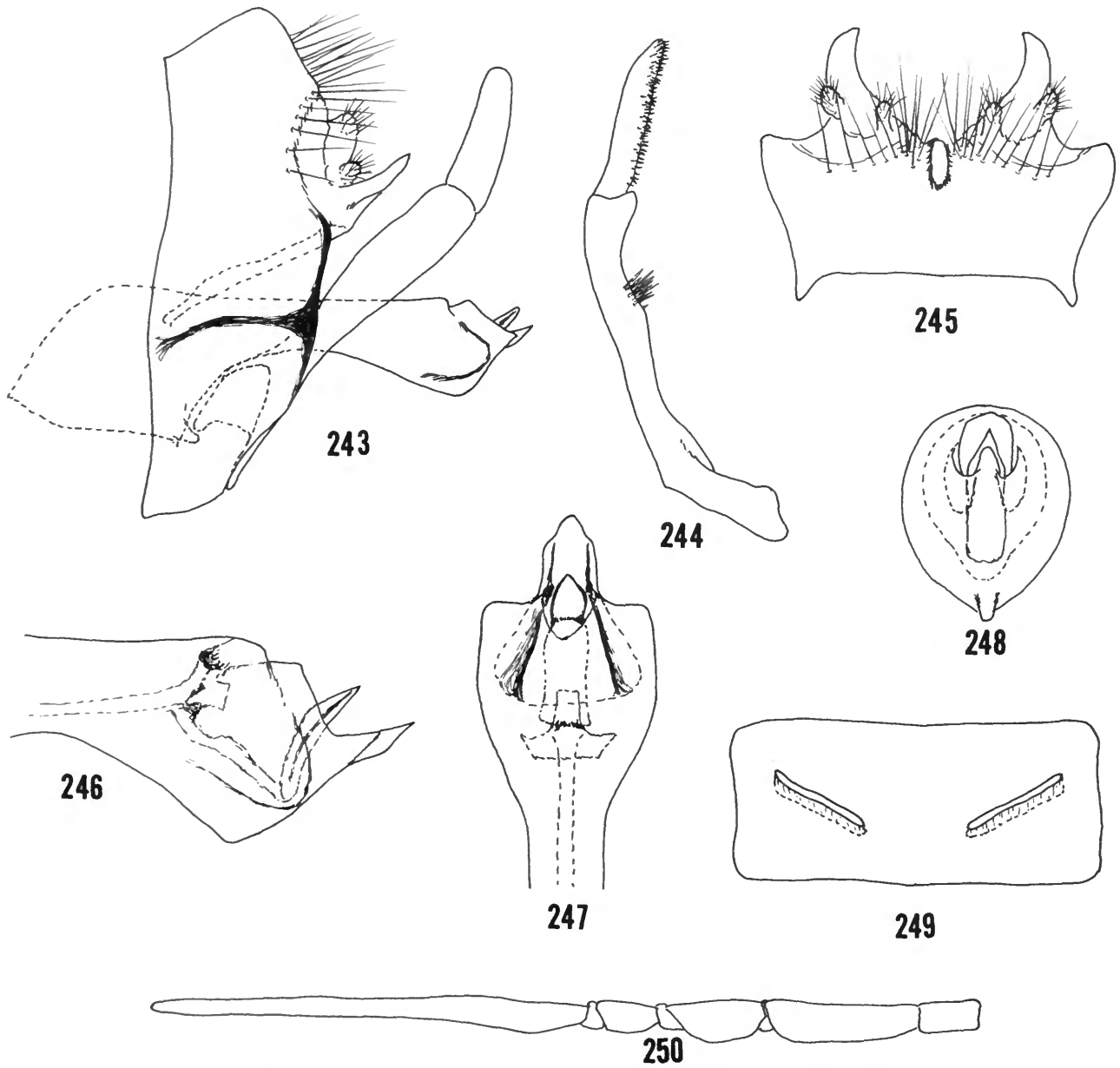




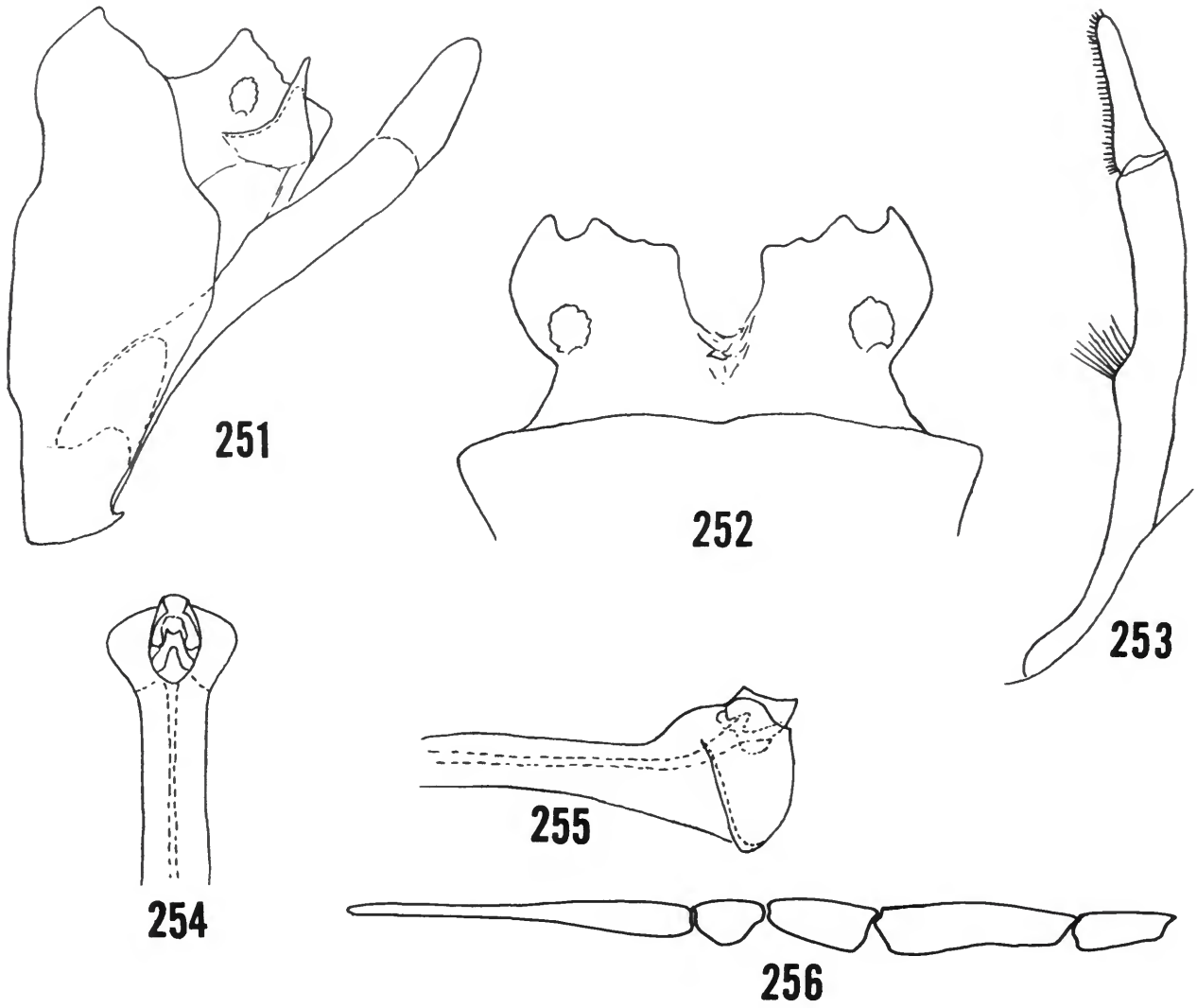
FIGURES 226-233.—*Leptonema crassum* Ulmer, male: 226, genitalia, lateral; 227, ninth and tenth terga, dorsal; 228, apex of phallus, lateral; 229, same, posterior; 230, same, dorsal; 231, clasper, posteroventral; 232, maxillary palpus, lateral; 233, fifth sternum, ventral.



FIGURES 234-242.—*Leptonema divaricatum*, new species, male: 234, genitalia, lateral; 235, clasper, poster-  
oventral; 236, ninth and tenth terga, dorsal; 237, apex of phallus, posterior; 238, same, lateral; 239, same,  
dorsal; 240, same, ventral; 241, fifth sternum, ventral; 242, maxillary palpus, lateral.

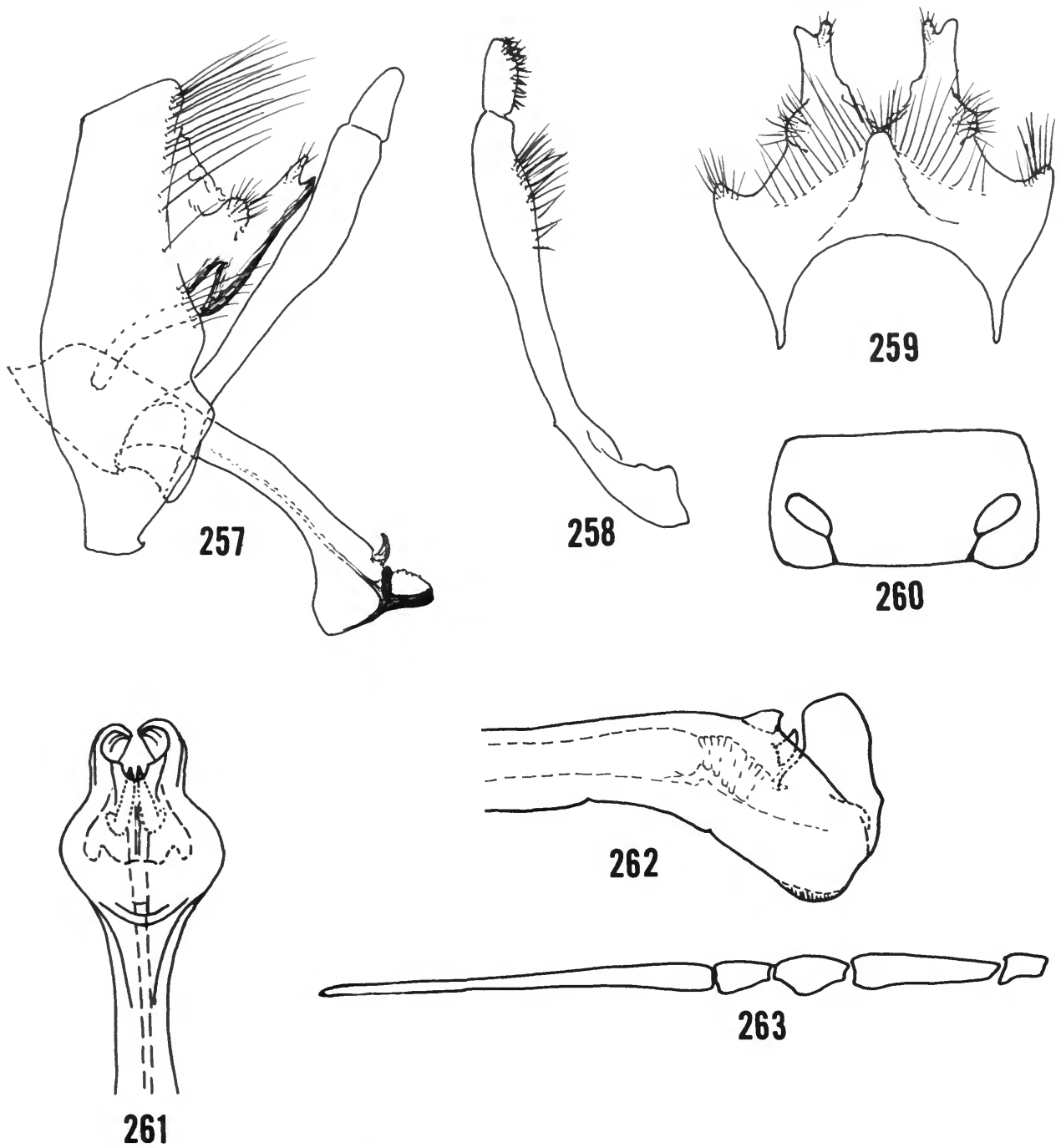


FIGURES 243-250.—*Leptonema guyanense*, new species, male: 243, genitalia, lateral; 244, clasper, poster-  
oventral; 245, ninth and tenth terga, dorsal; 246, apex of phallus, lateral; 247, same, dorsal; 248, same,  
posterior; 249, fifth sternum, ventral; 250, maxillary palpus, lateral.

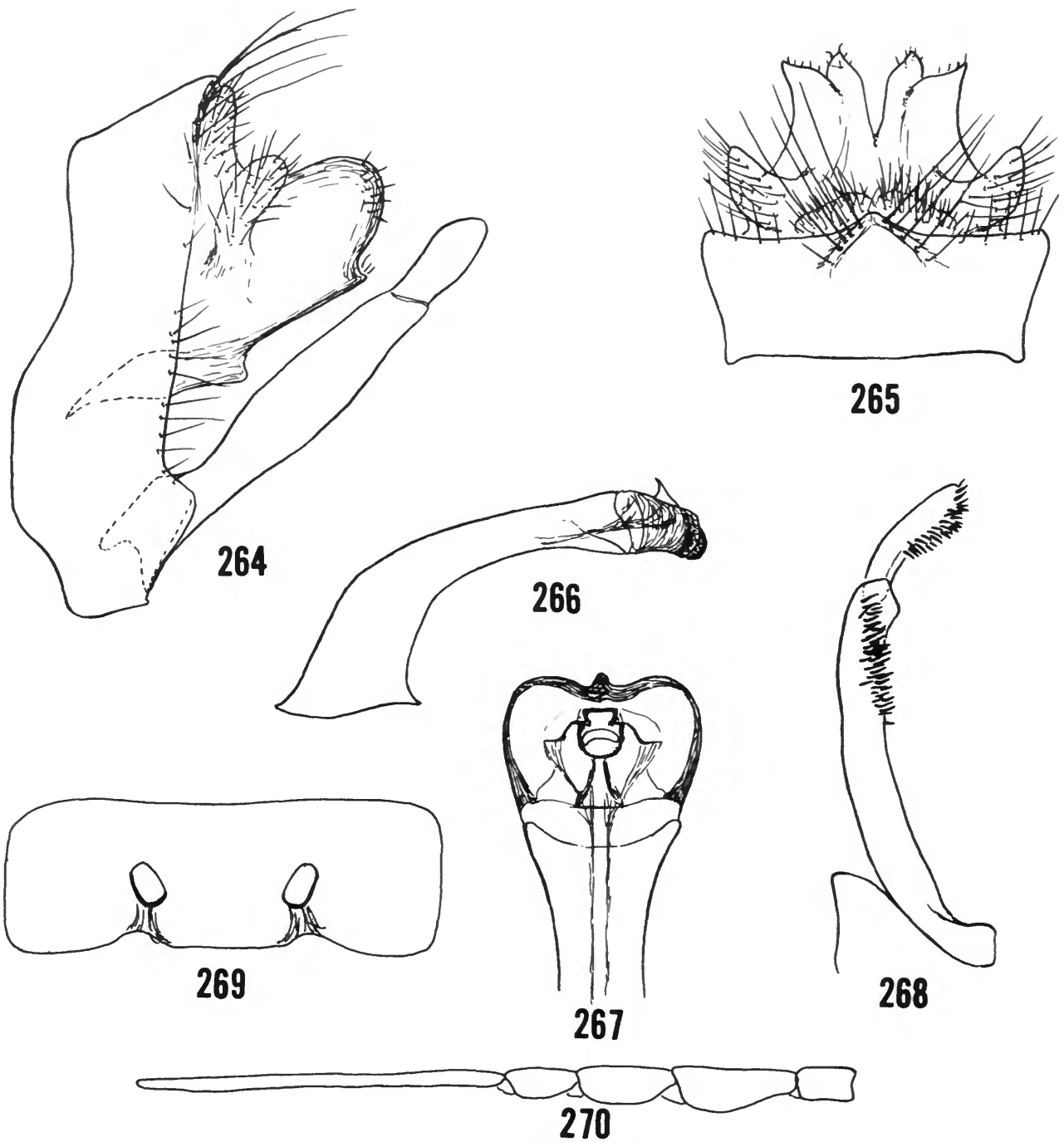


FIGURES 251-256.—*Leptonema hirsutum* Flint, male: 251, genitalia, lateral; 252, ninth and tenth terga, dorsal; 253, clasper, posteroventral; 254, apex of phallus, dorsal; 255, same, lateral; 256, maxillary palpus, lateral.

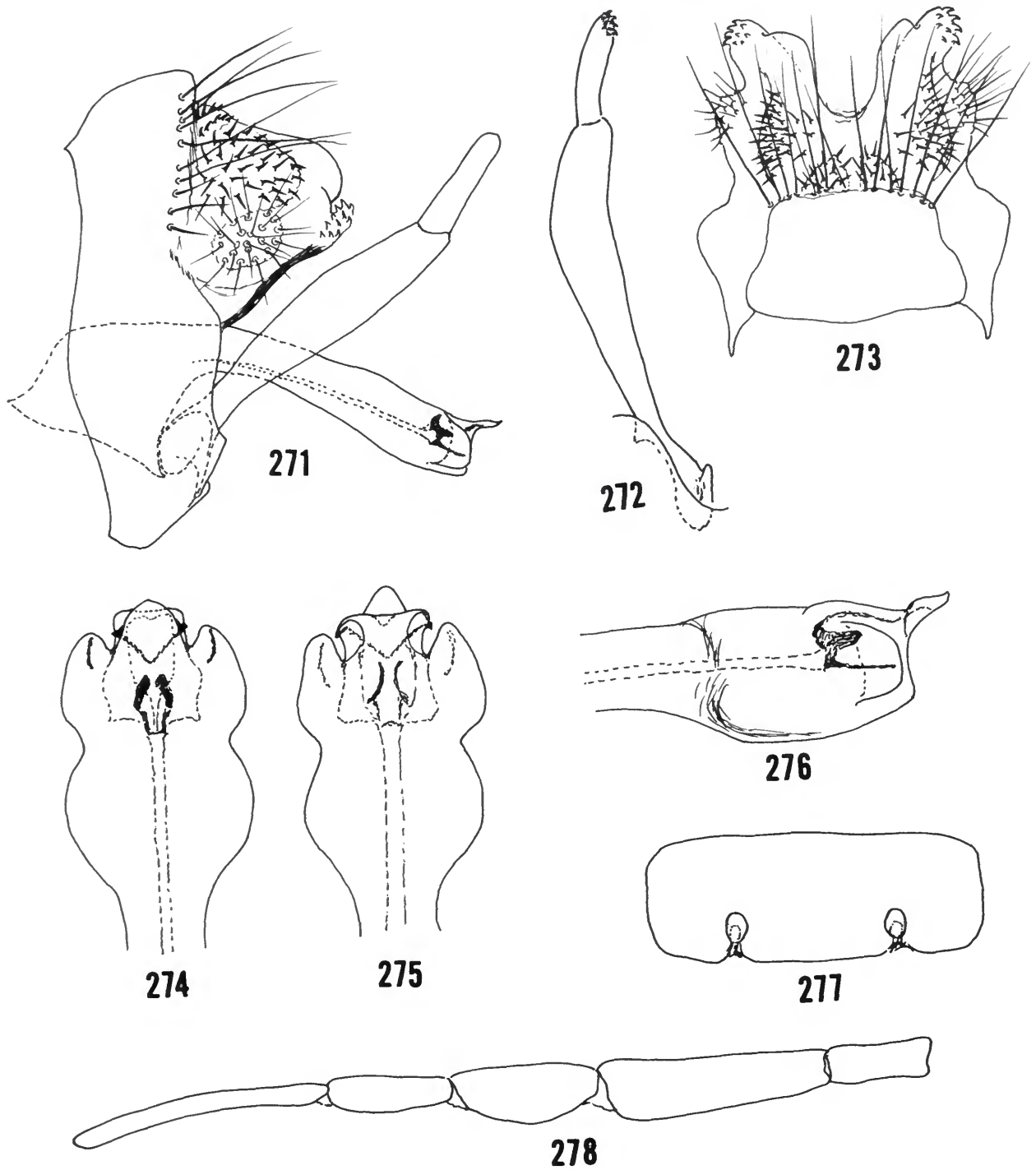




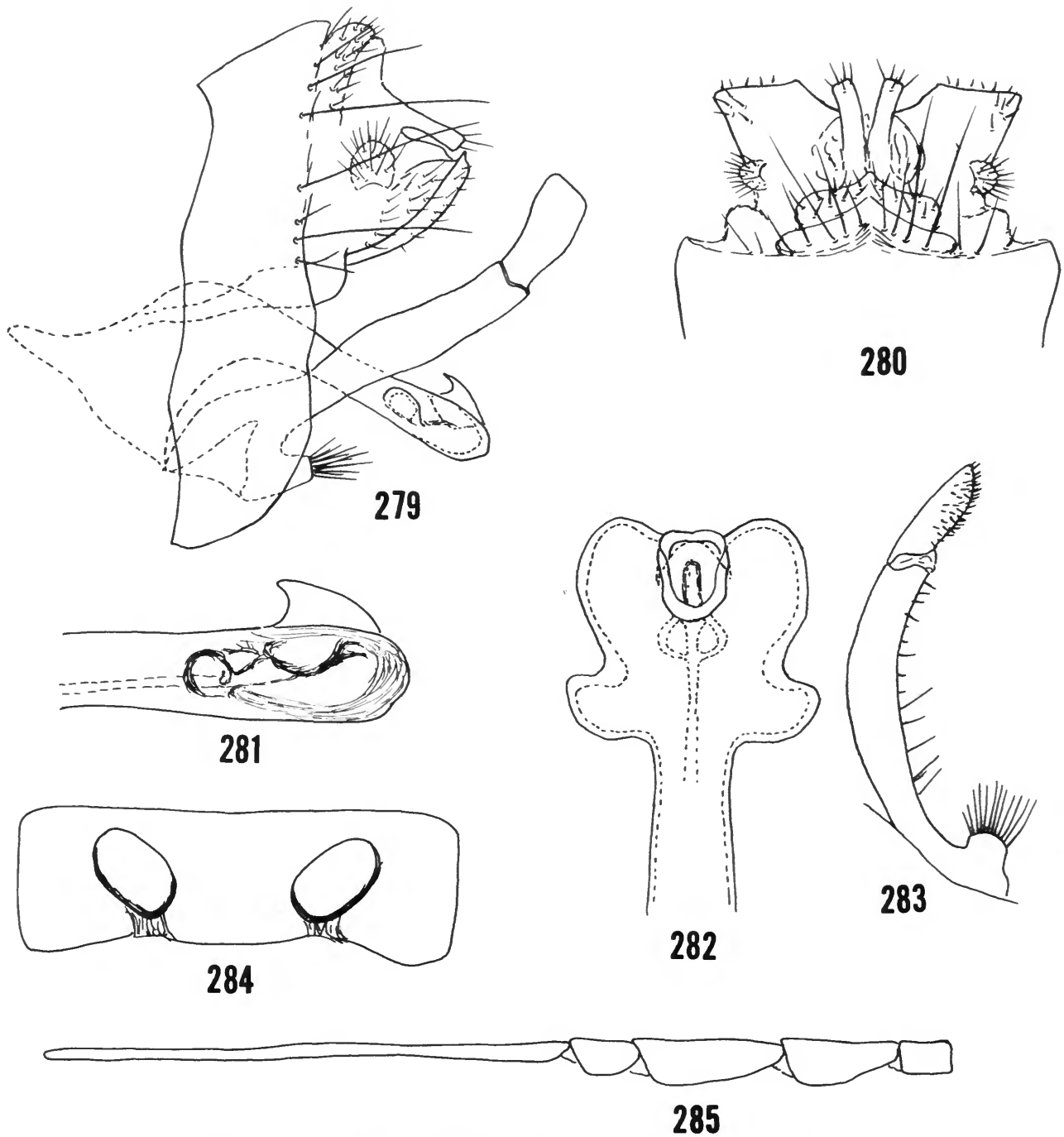
FIGURES 257-263.—*Leptonema mandibulatum*, new species, male: 257, genitalia, lateral; 258, clasper, posteroventral; 259, ninth and tenth terga, dorsal; 260, fifth sternum, ventral; 261, apex of phallus, dorsal; 262, same, lateral; 263, maxillary palpus, lateral.



FIGURES 264-270.—*Leptonema amazonense* Flint, male: 264, genitalia, lateral; 265, ninth and tenth terga, dorsal; 266, phallus, lateral; 267, same, dorsal; 268, clasper, posteroventral; 269, fifth sternum, ventral; 270, maxillary palpus, lateral.

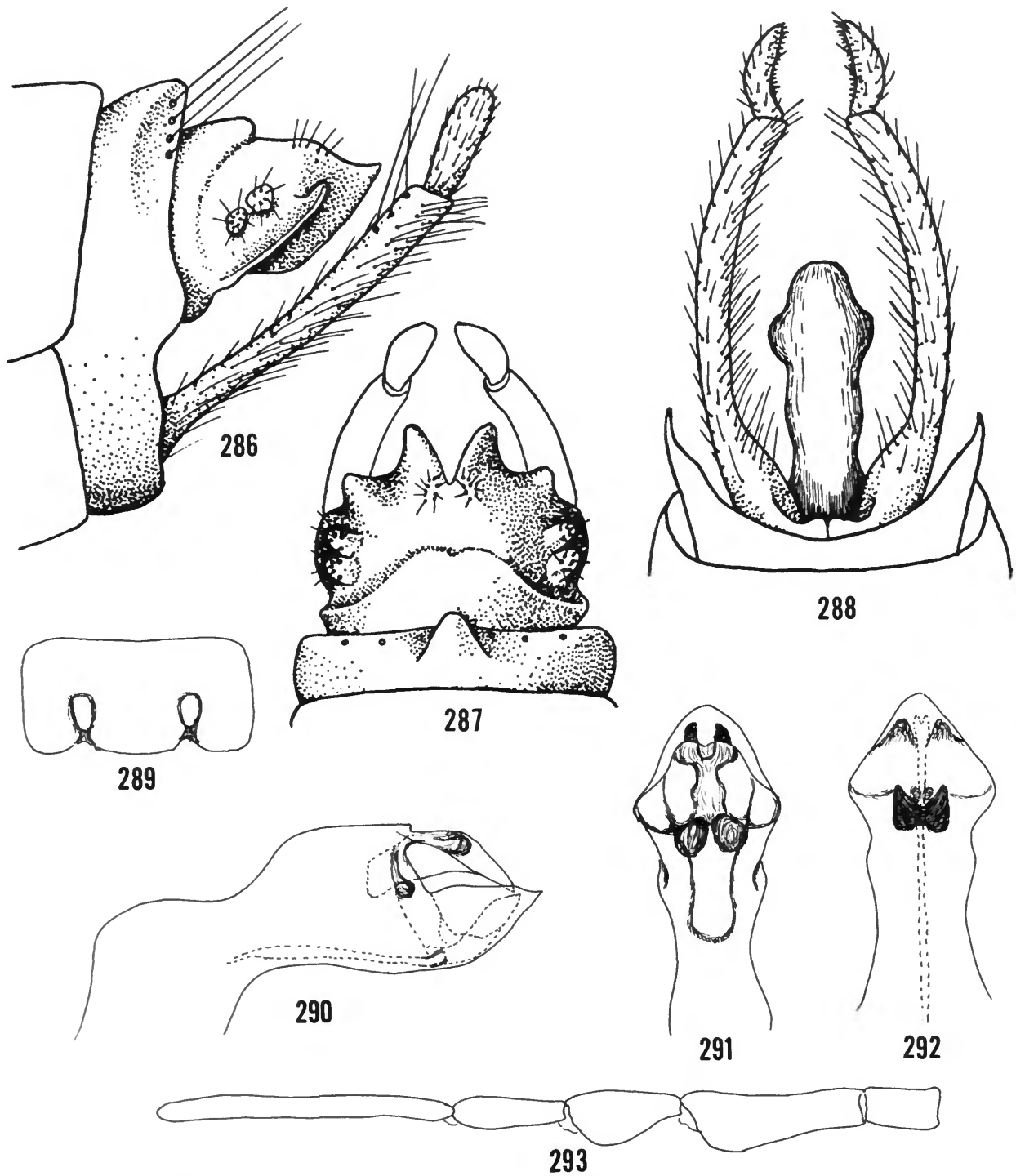


FIGURES 271-278.—*Leptonema chochoense*, new species, male: 271, genitalia, lateral; 272, clasper, postero-ventral; 273, ninth and tenth terga, dorsal; 274, apex of phallus, dorsal; 275, same, ventral; 276, same, lateral; 277, fifth sternum, ventral; 278, maxillary palpus, lateral.

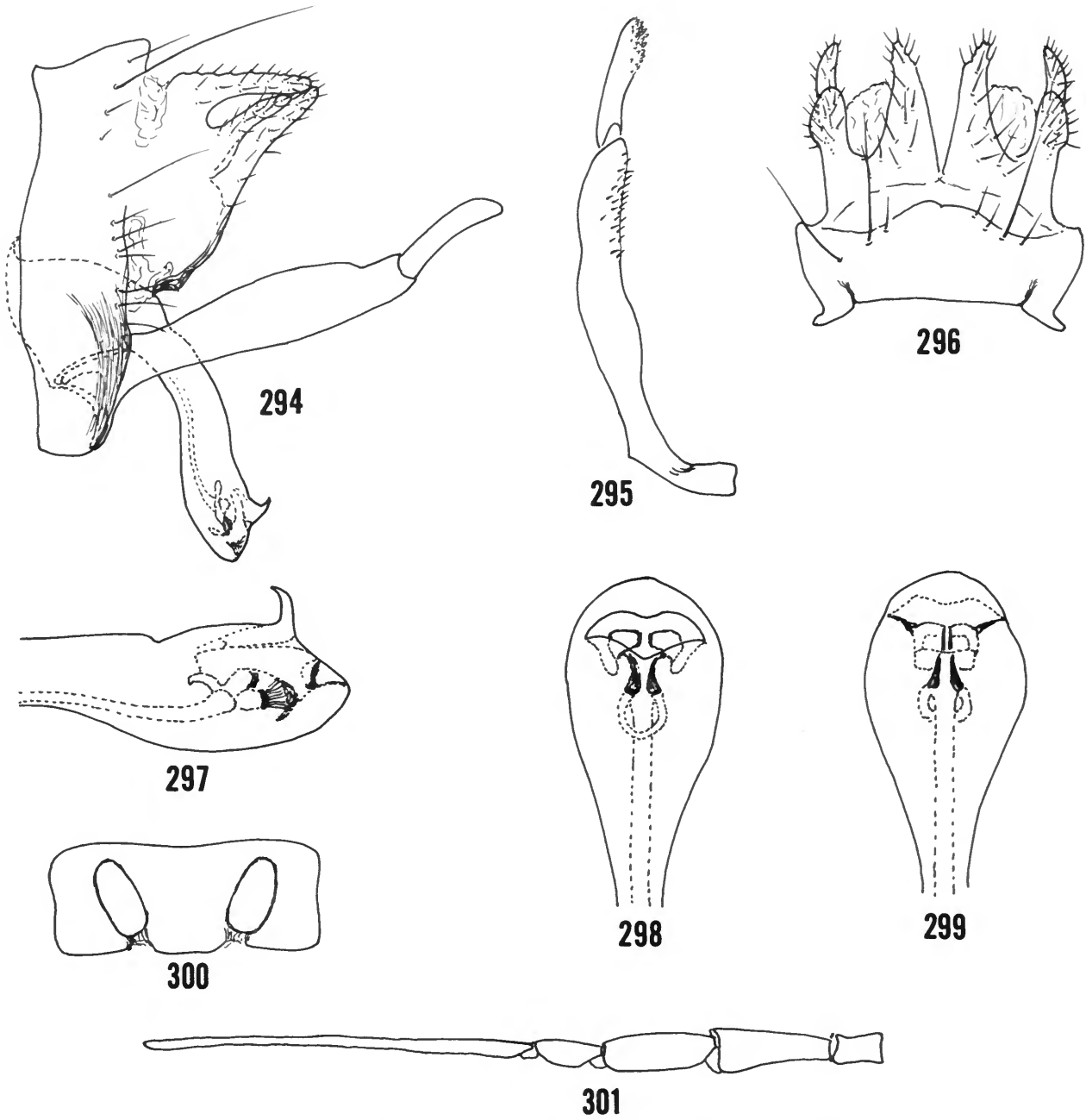


FIGURES 279-285.—*Leptonema irroratum* Flint, male: 279, genitalia, lateral; 280, ninth and tenth terga, dorsal; 281, apex of phallus, lateral; 282, same, dorsal; 283, clasper, posteroventral; 284, fifth sternum, ventral; 285, maxillary palpus, lateral.

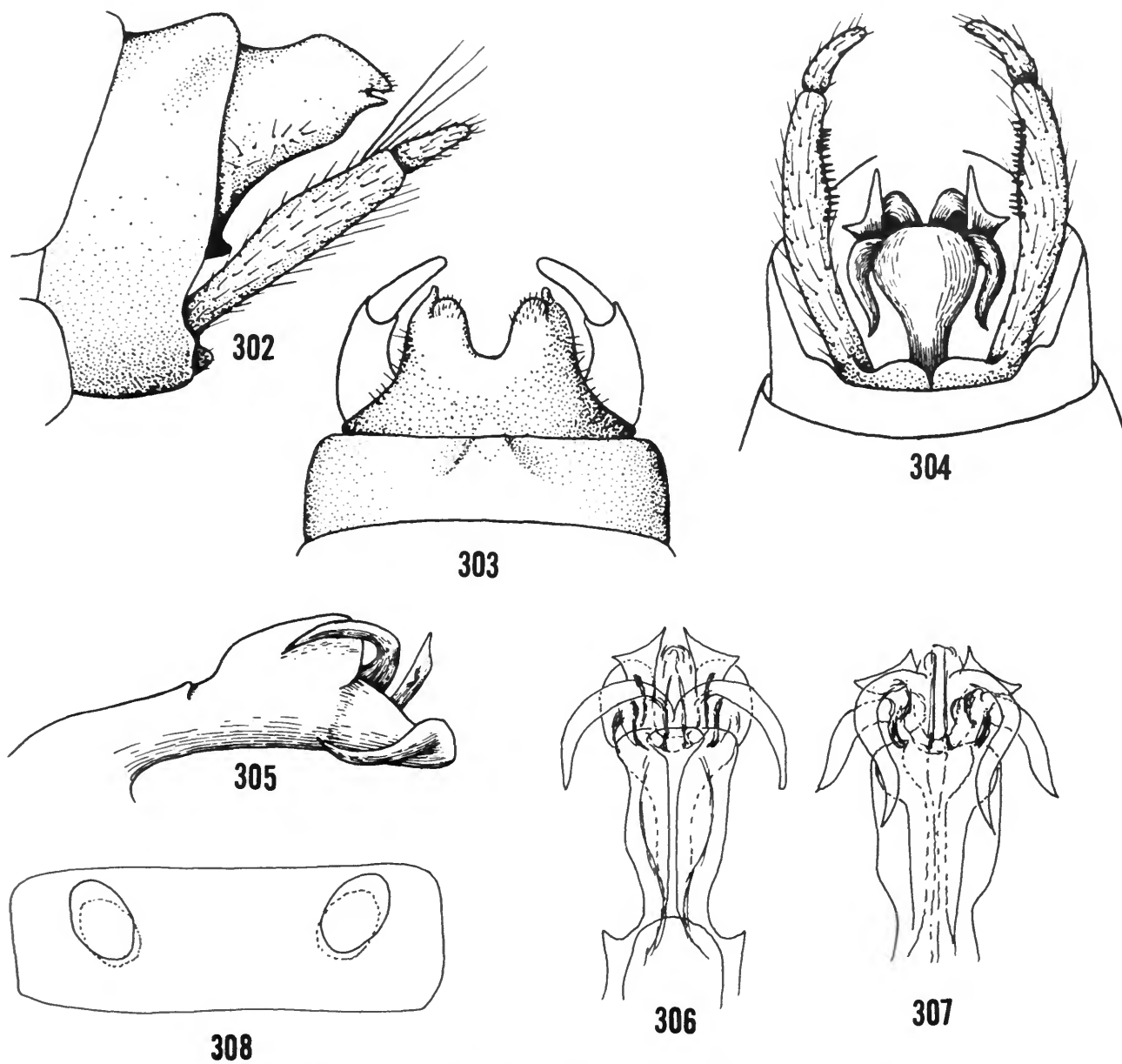




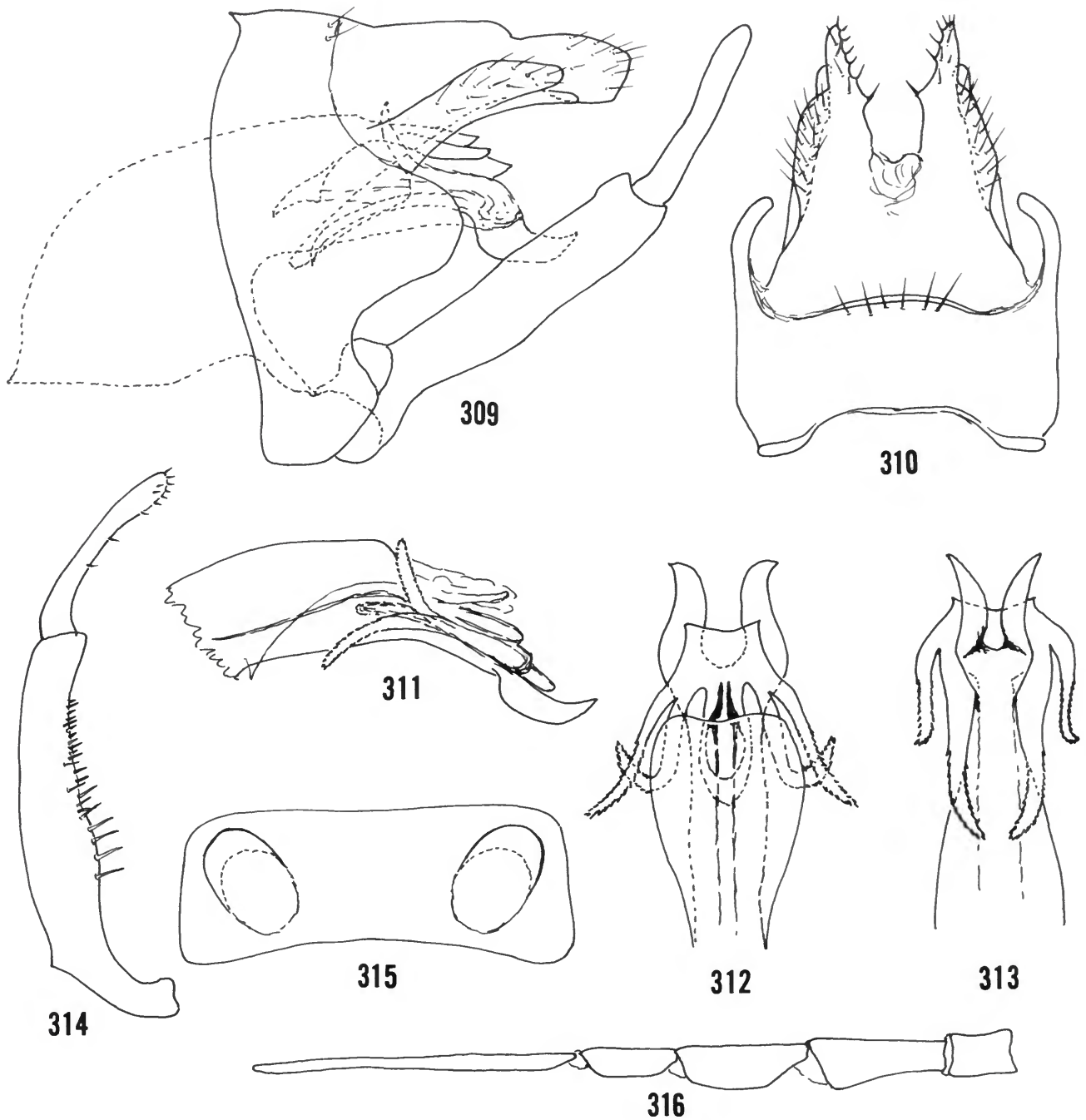
FIGURES 286-293.—*Leptonema maculatum* Moseley, male: 286, genitalia, lateral; 287, same, dorsal; 288, same, ventral; 289, fifth sternum, ventral; 290, apex of phallus, lateral; 291, same, dorsal; 292, same, ventral; 293, maxillary palpus, lateral.



FIGURES 294-301.—*Leptonema neblinense*, new species, male: 294, genitalia, lateral; 295, clasper, poster-  
oventral; 296, ninth and tenth targa, dorsal; 297, apex of phallus, lateral; 298, same, dorsal; 299, same,  
ventral; 300, fifth sternum, ventral; 301, maxillary palpus, lateral.

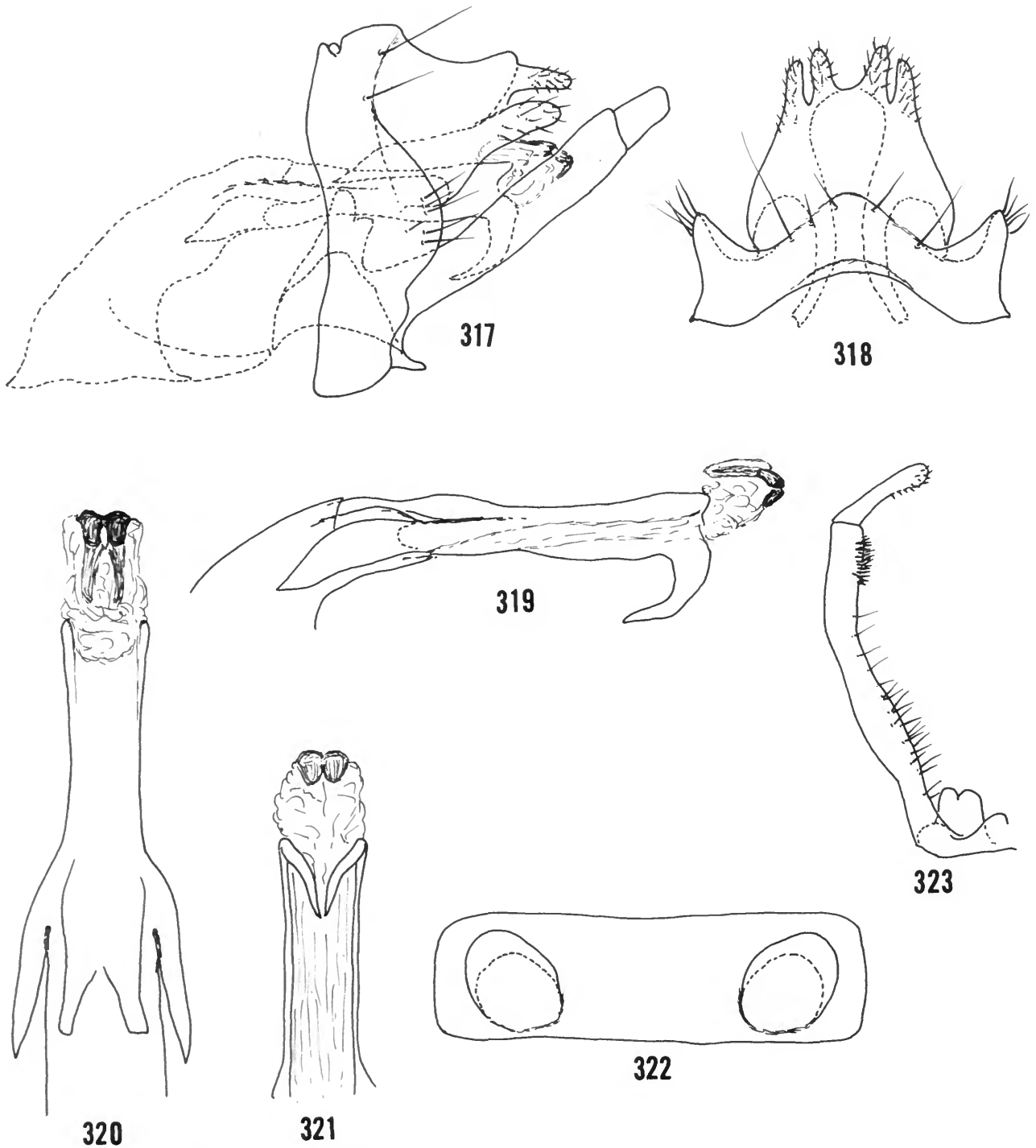


FIGURES 302-308.—*Leptonema aterrimum* Mosely, male: 302, genitalia, lateral; 303, same, dorsal; 304, same, ventral; 305, apex of phallus, lateral; 306, same, dorsal; 307, same, ventral; 308, fifth sternum, ventral.

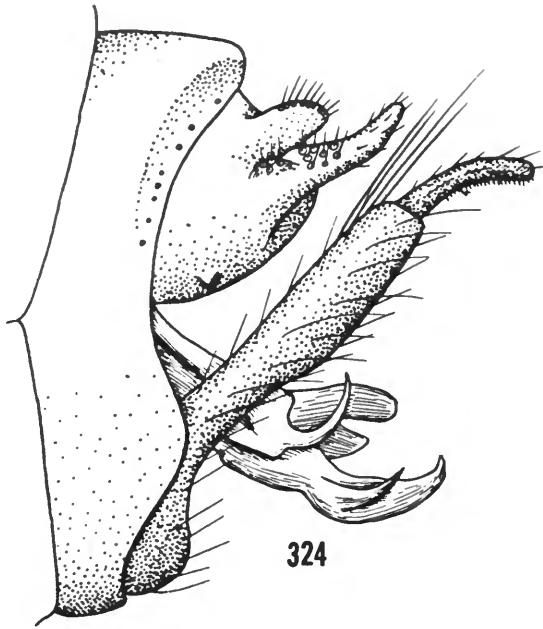


FIGURES 309–316.—*Leptonema davisi*, new species, male: 309, genitalia, lateral; 310, ninth and tenth terga, dorsal; 311, apex of phallus, lateral; 312, same, dorsal; 313, same, ventral; 314, clasper, posteroventral; 315, fifth sternum, ventral; 316, maxillary palpus, lateral.





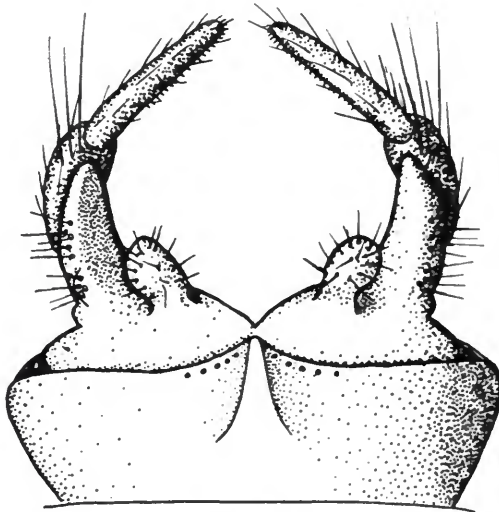
FIGURES 317-323.—*Leptonema gadzux*, new species, male: 317, genitalia, lateral; 318, ninth and tenth terga, dorsal; 319, apex of phallus, lateral; 320, same, dorsal; 321, same, ventral; 322, fifth sternum, ventral; 323, clasper, posteroventral.



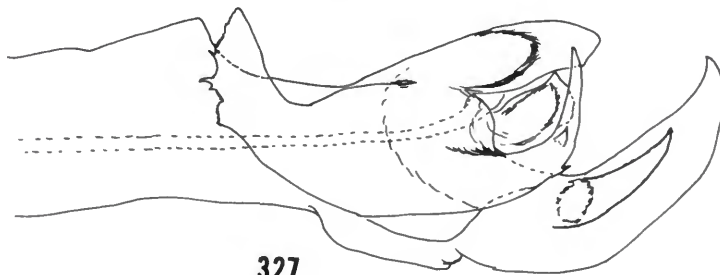
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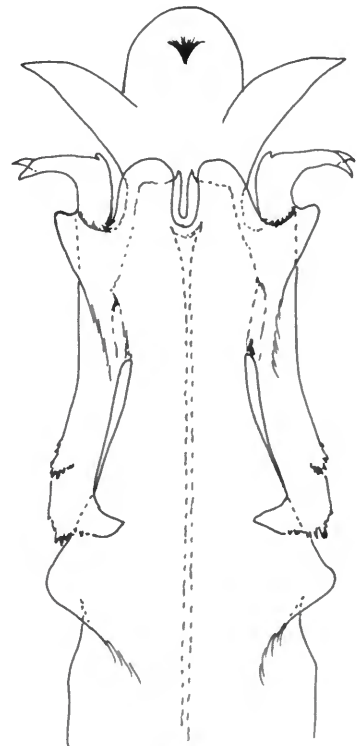
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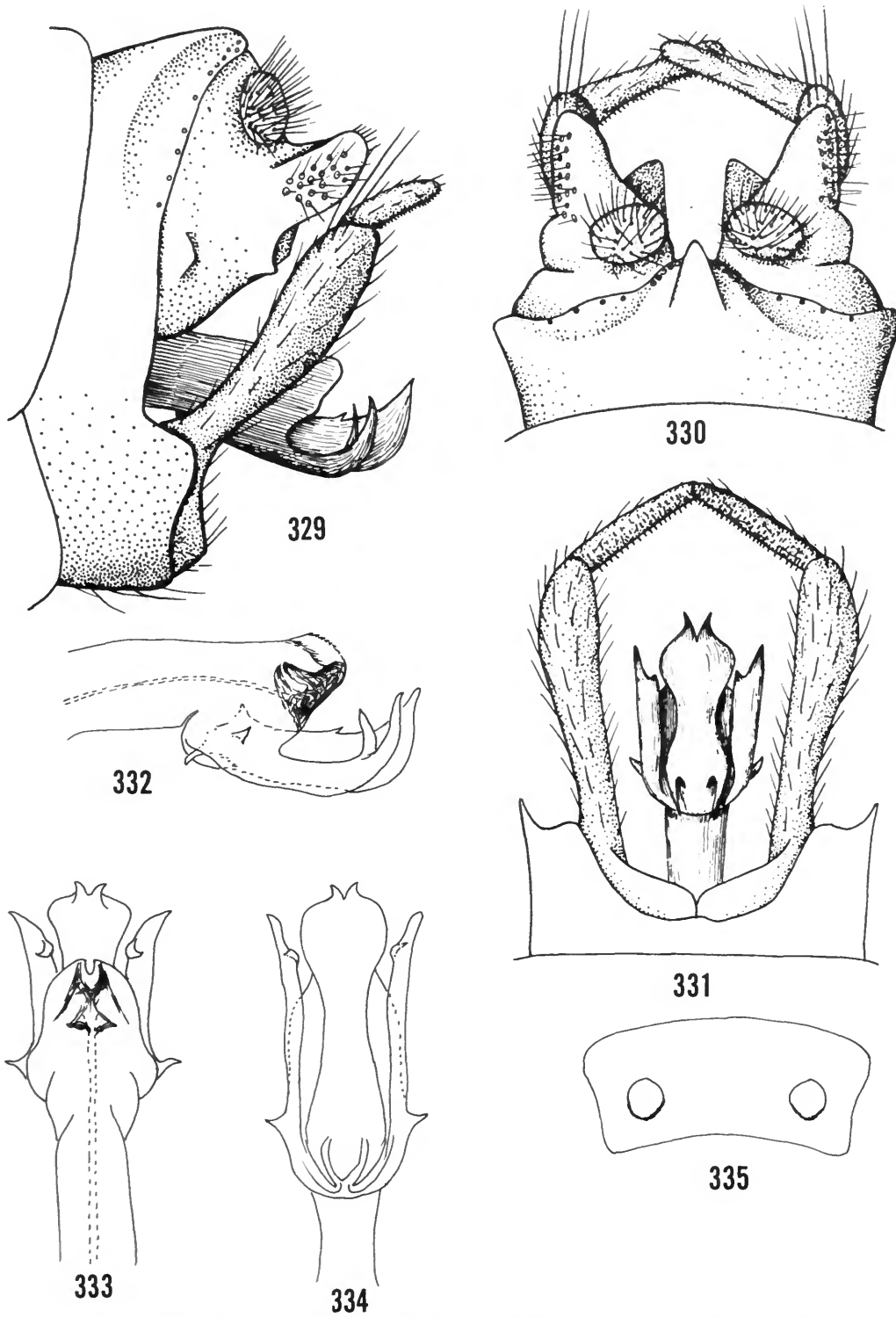


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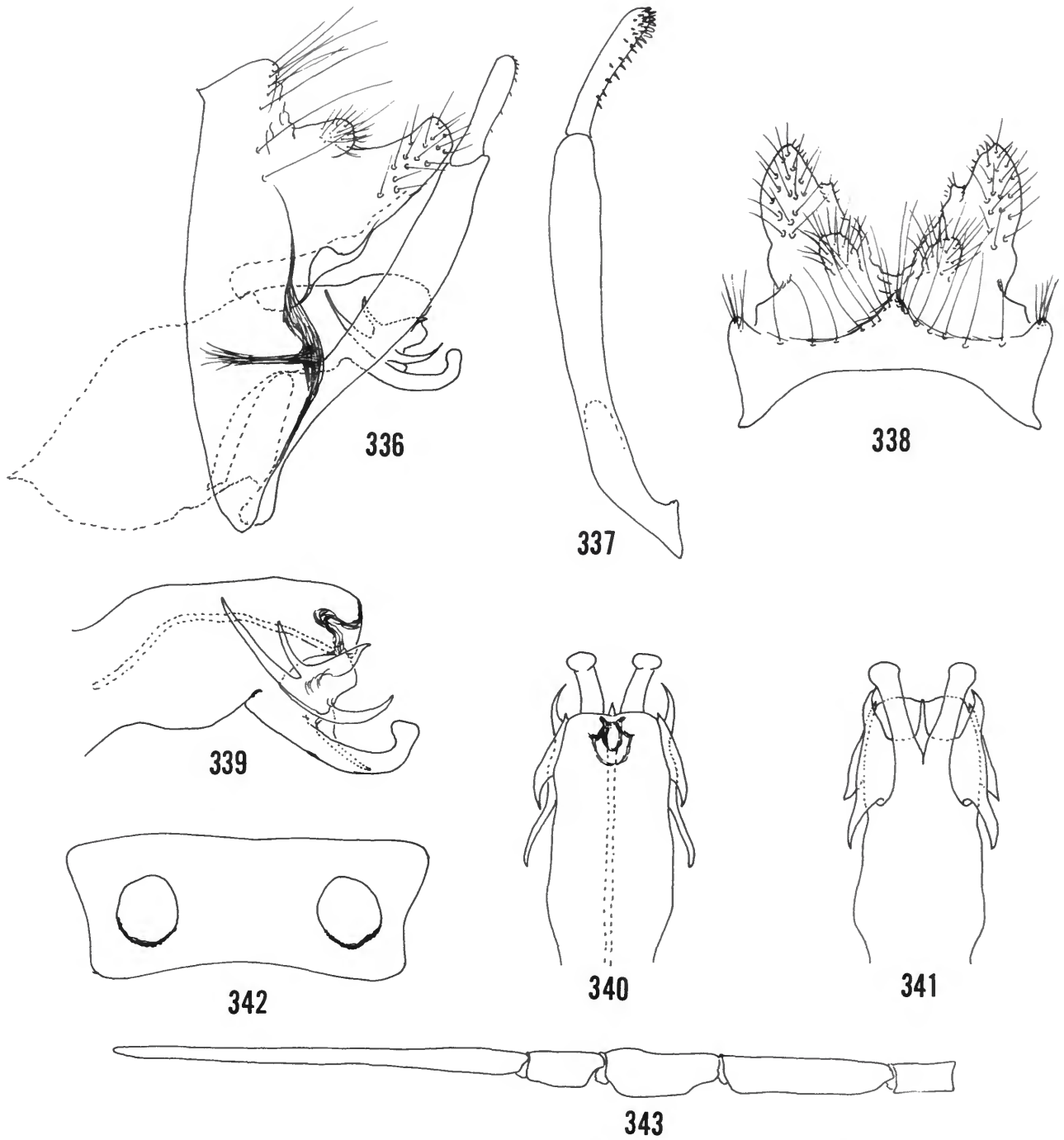


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FIGURES 324-328.—*Leptonema agraphum* (Kolenati), male: 324, genitalia, lateral; 325, same, ventral; 326, same, dorsal; 327, apex of phallus, lateral; 328, same, dorsal.

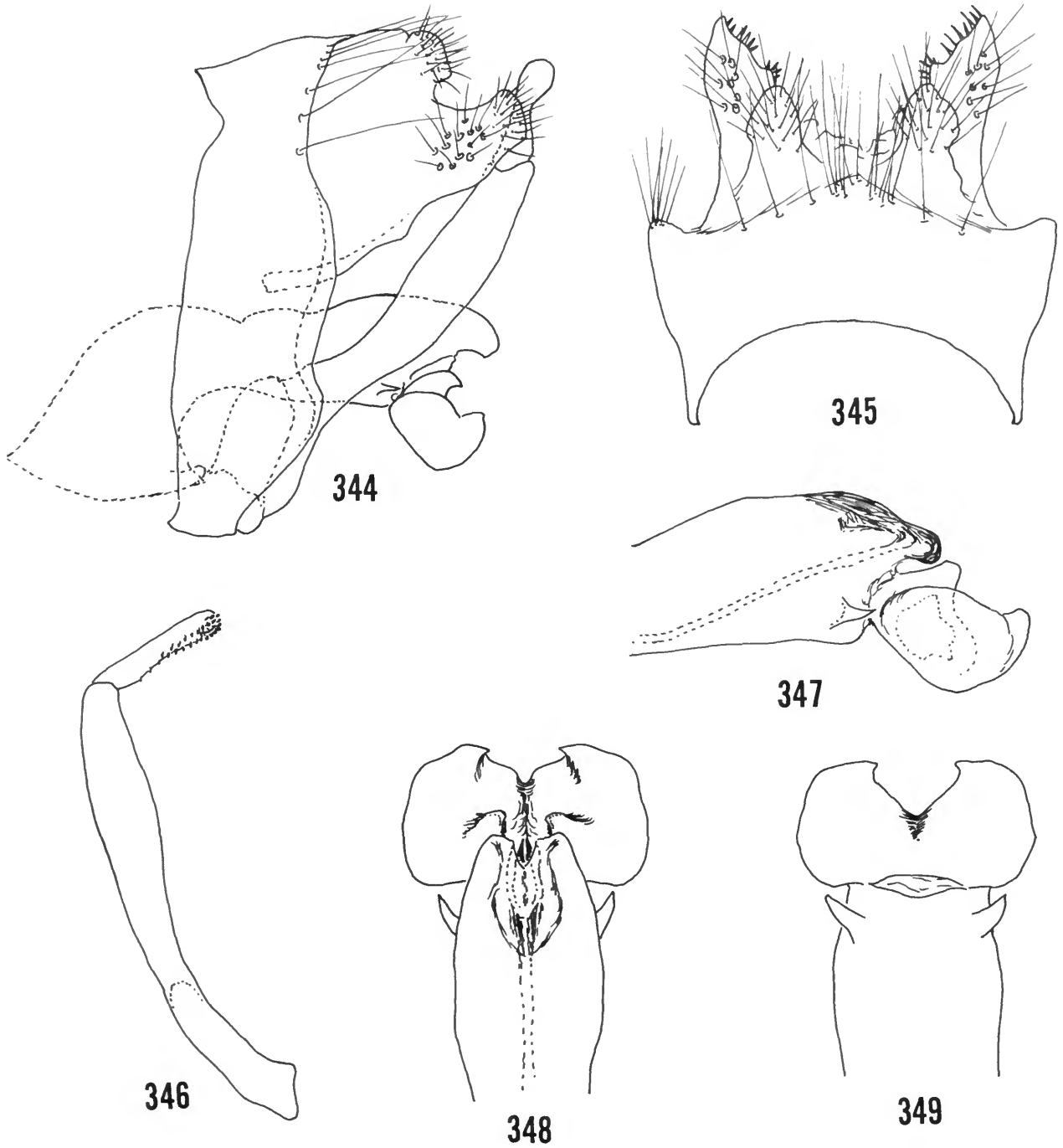


FIGURES 329-335.—*Leptonema bifurcatum*, new species, male: 329, genitalia, lateral; 330, same, dorsal; 331, same, ventral; 332, apex of phallus, lateral; 333, same, dorsal; 334, same, ventral; 335, fifth sternum, ventral.

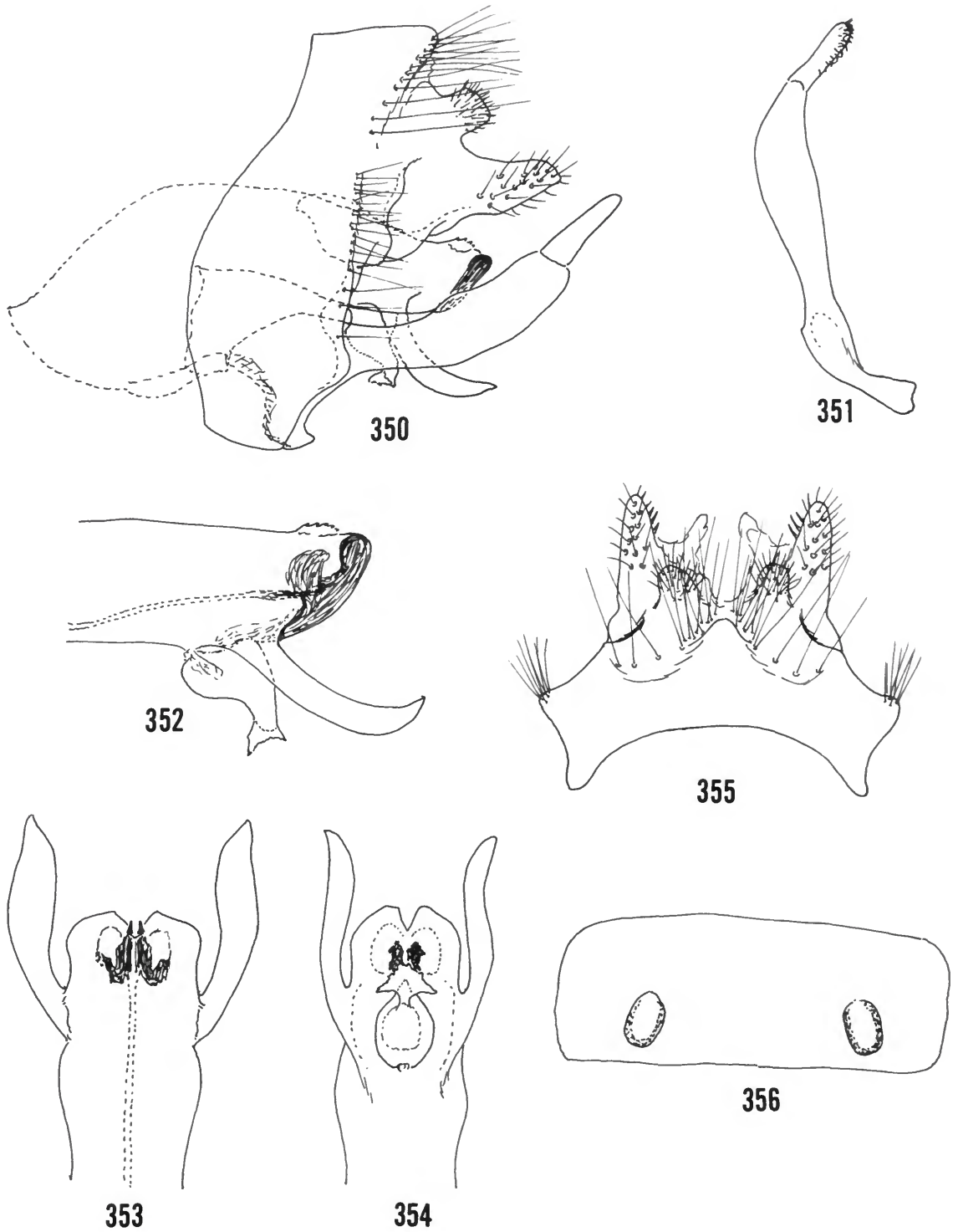


FIGURES 336-343.—*Leptonema boraceia*, new species, male: 336, genitalia, lateral; 337, clasper, postero-ventral; 338, ninth and tenth terga, dorsal; 339, apex of phallus, lateral; 340, same, dorsal; 341, same, ventral; 342, fifth sternum, ventral; 343, maxillary palpus, lateral.

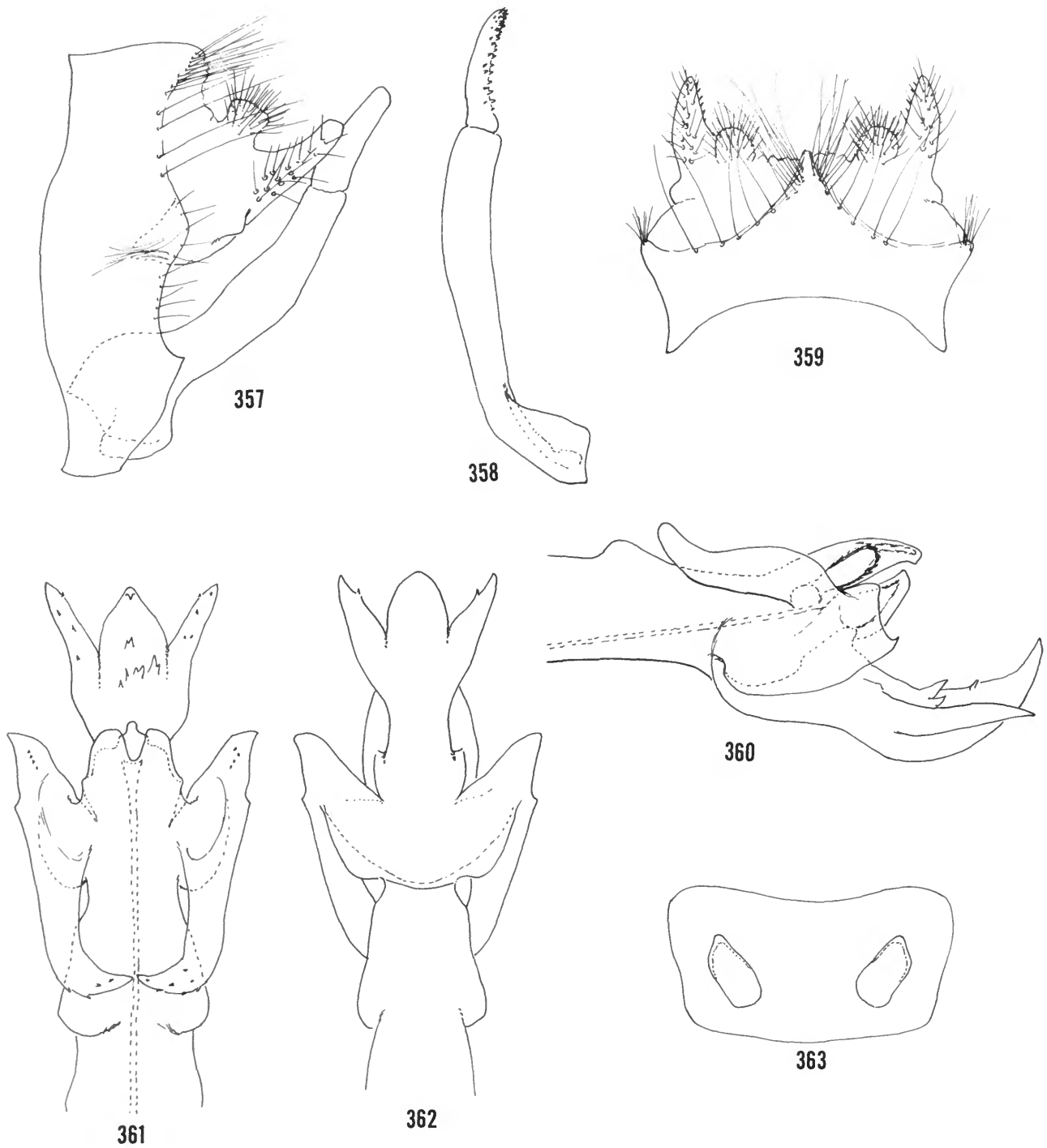




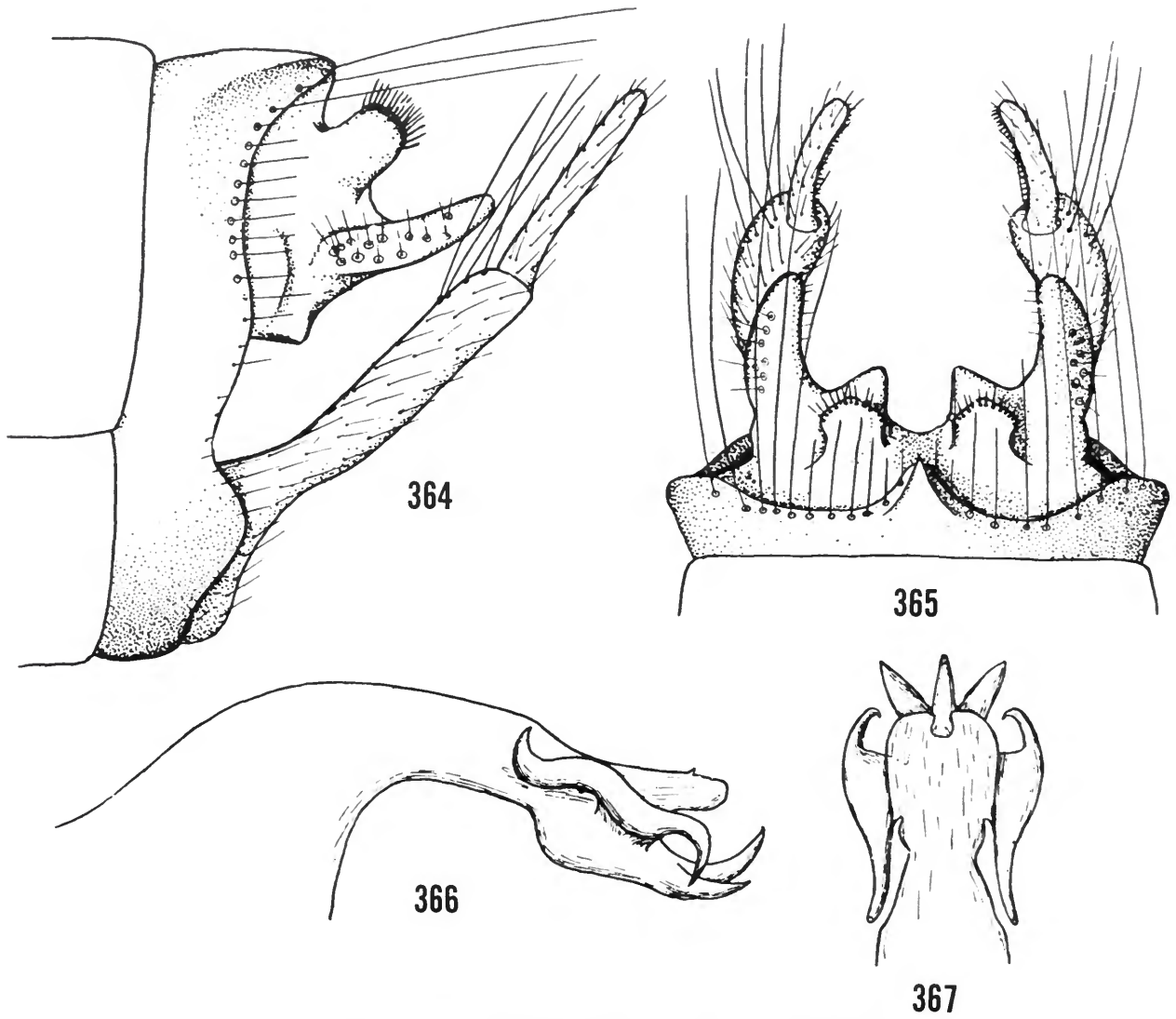
FIGURES 344-349.—*Leptonema eugnathum* (Müller), male: 344, genitalia, lateral; 345, ninth and tenth terga, dorsal; 346, clasper, posteroventral; 347, apex of phallus, lateral; 348, same, dorsal; 349, same, ventral.



FIGURES 350-356.—*Leptonema speciosum* (Burmeister), male: 350, genitalia, lateral; 351, clasper, poster-oventral; 352, apex of phallus, lateral; 353, same, dorsal; 354, same, ventral; 355, ninth and tenth terga, dorsal; 356, fifth sternum, ventral.

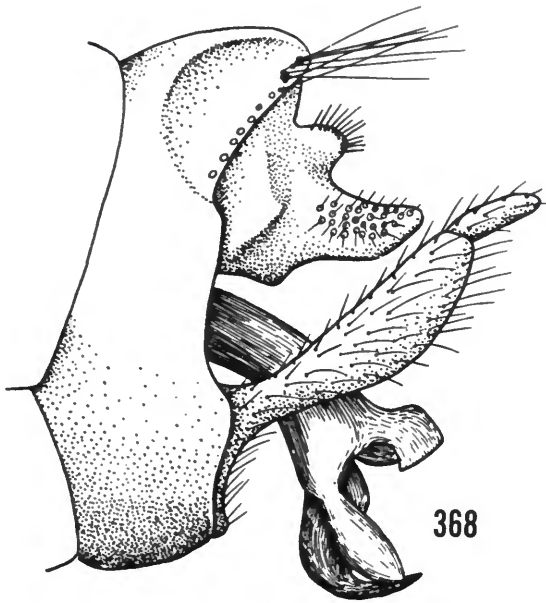


FIGURES 357-363.—*Leptonema stigmaticum* Navás, male: 357, genitalia, lateral; 358, clasper, posteroventral; 359, ninth and tenth terga, dorsal; 360, apex of phallus, lateral; 361, same, dorsal; 362, same, ventral; 363, fifth sternum, ventral.

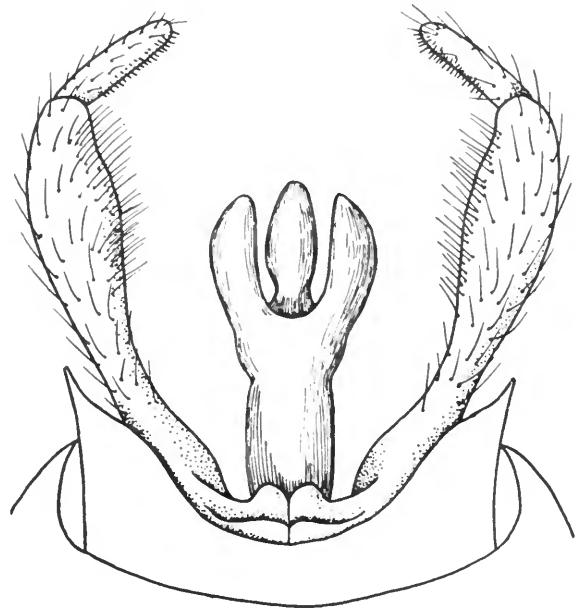


FIGURES 364-367.—*Leptonema tholloni* (Navás), male: 364, genitalia, lateral; 365, same, dorsal; 366, apex of phallus, lateral; 367, same, dorsal.

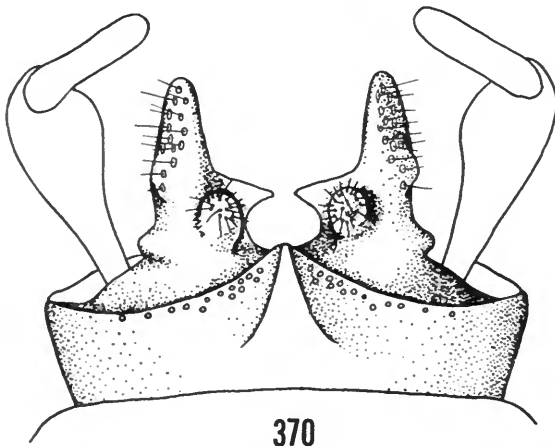




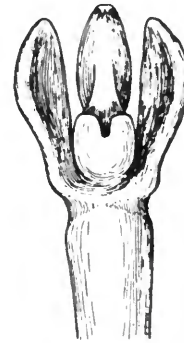
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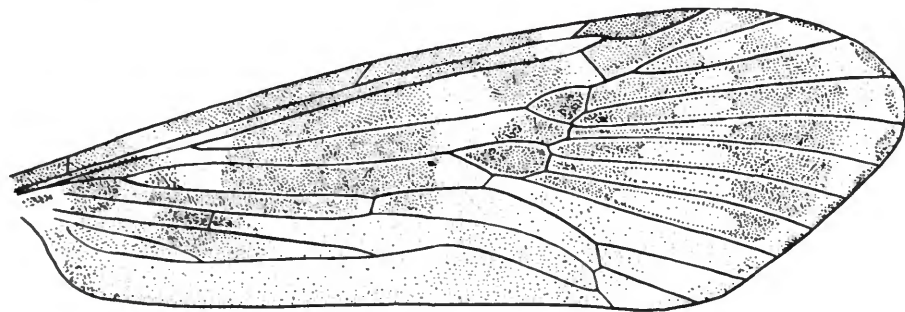
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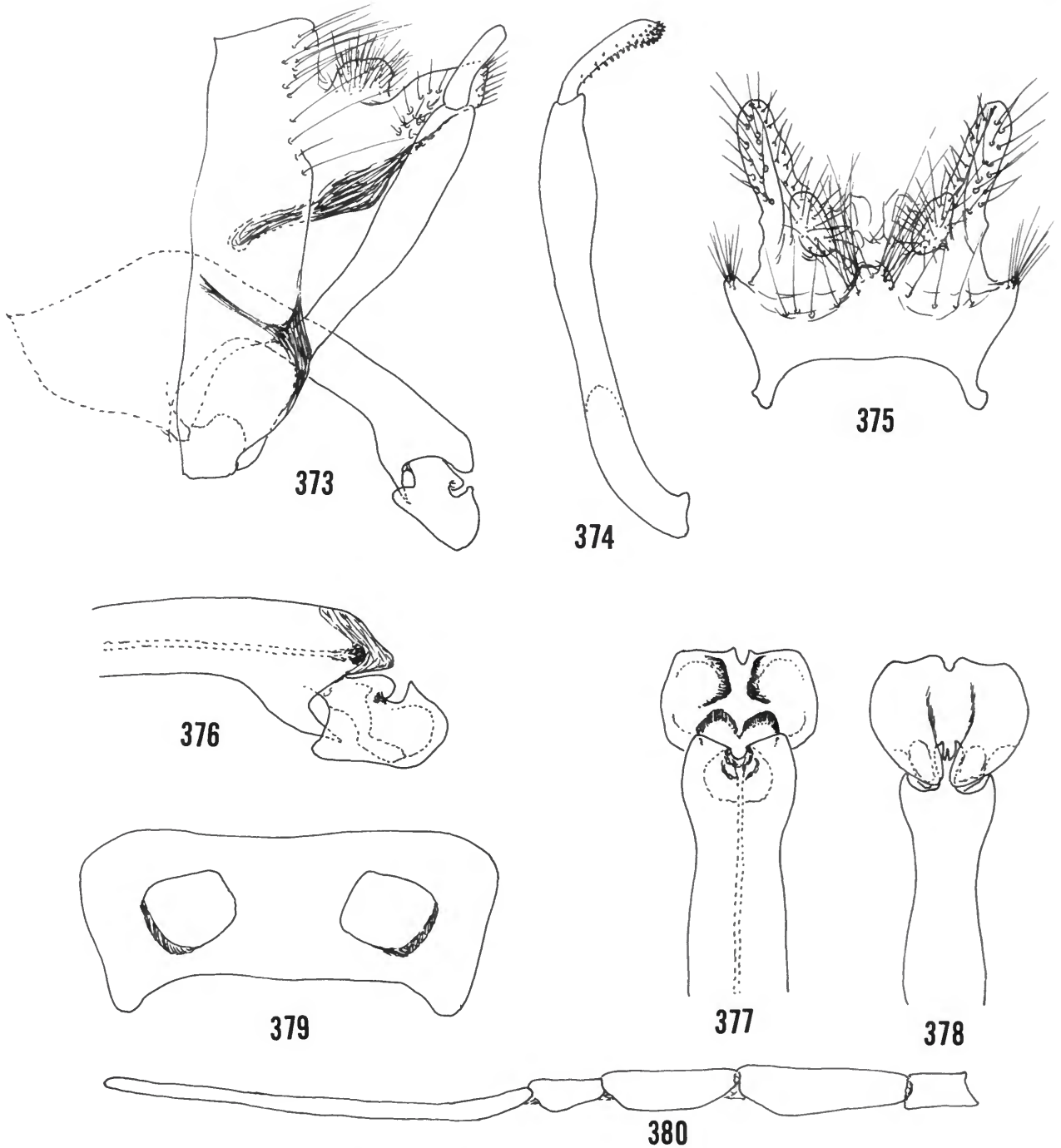


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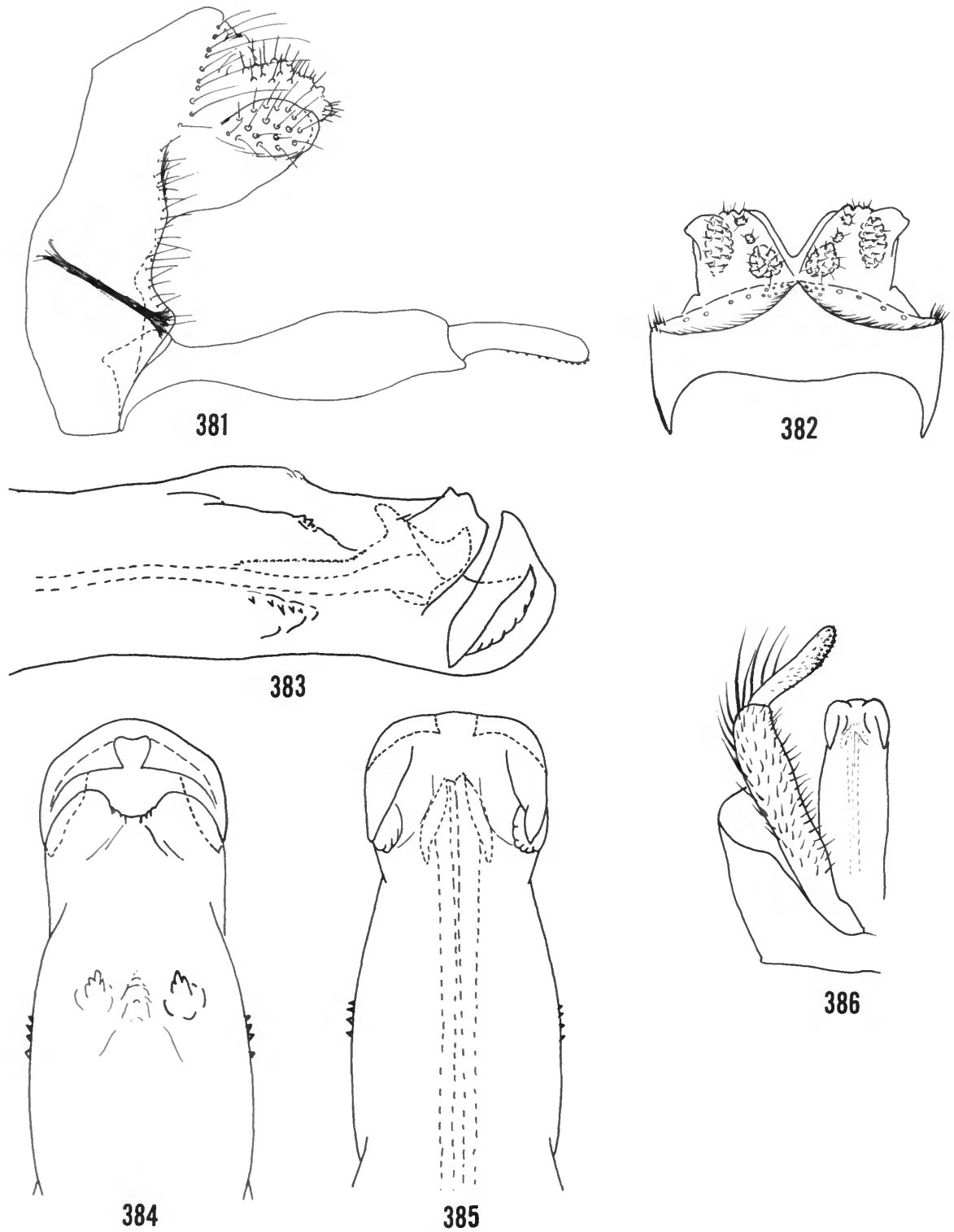


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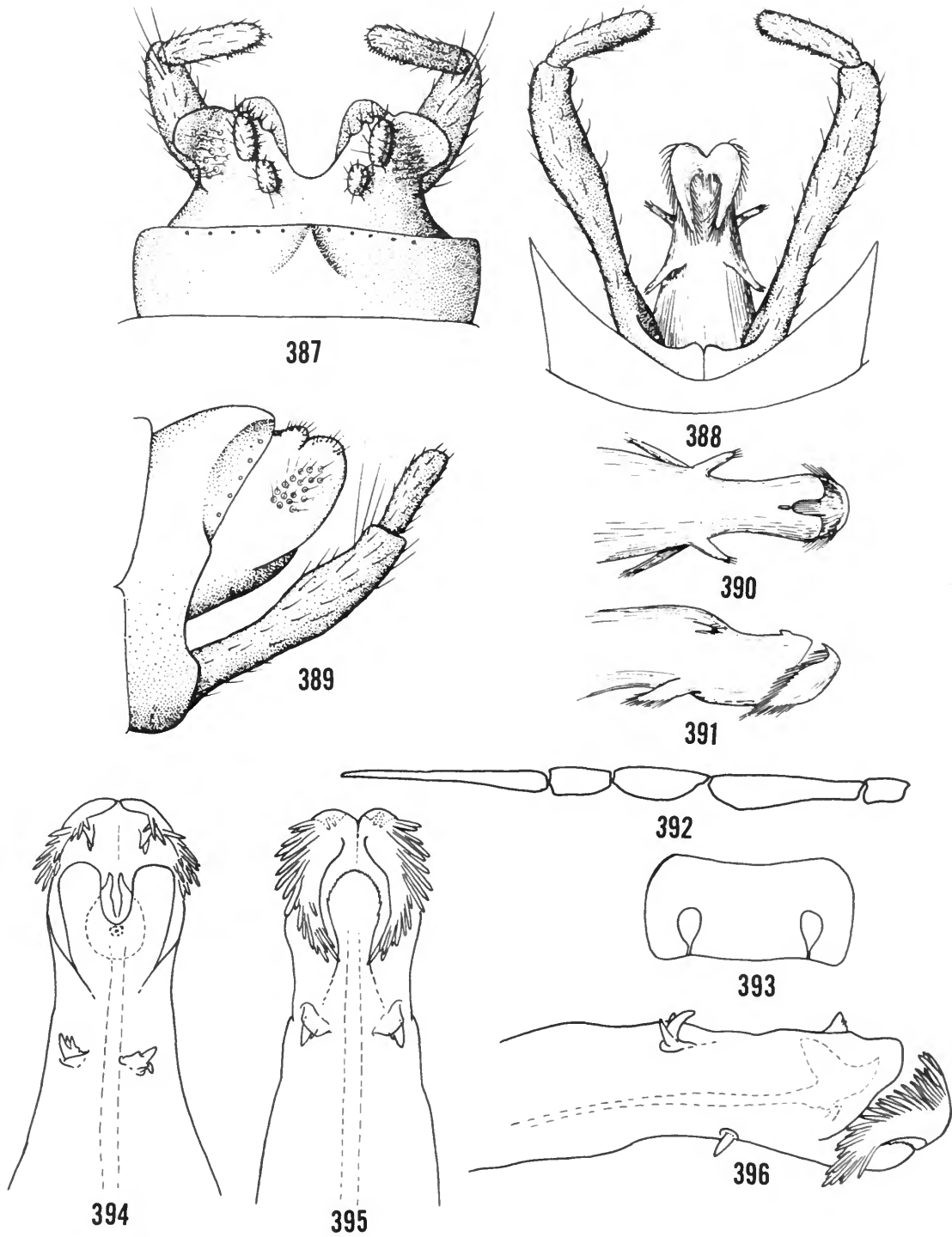
FIGURES 368-372.—*Leptonema tridens* Mosely, male: 368, genitalia, lateral; 369, same, ventral; 370, same, dorsal; 371, apex of phallus, dorsal; 372, forewing.



FIGURES 373-380.—*Leptonema trispicatum*, new species, male: 373, genitalia, lateral; 374, clasper, poster-  
oventral; 375, ninth and tenth terga, dorsal; 376, apex of phallus, lateral; 377, same, dorsal; 378, same,  
ventral; 379, fifth sternum, ventral; 380, maxillary palpus, lateral.

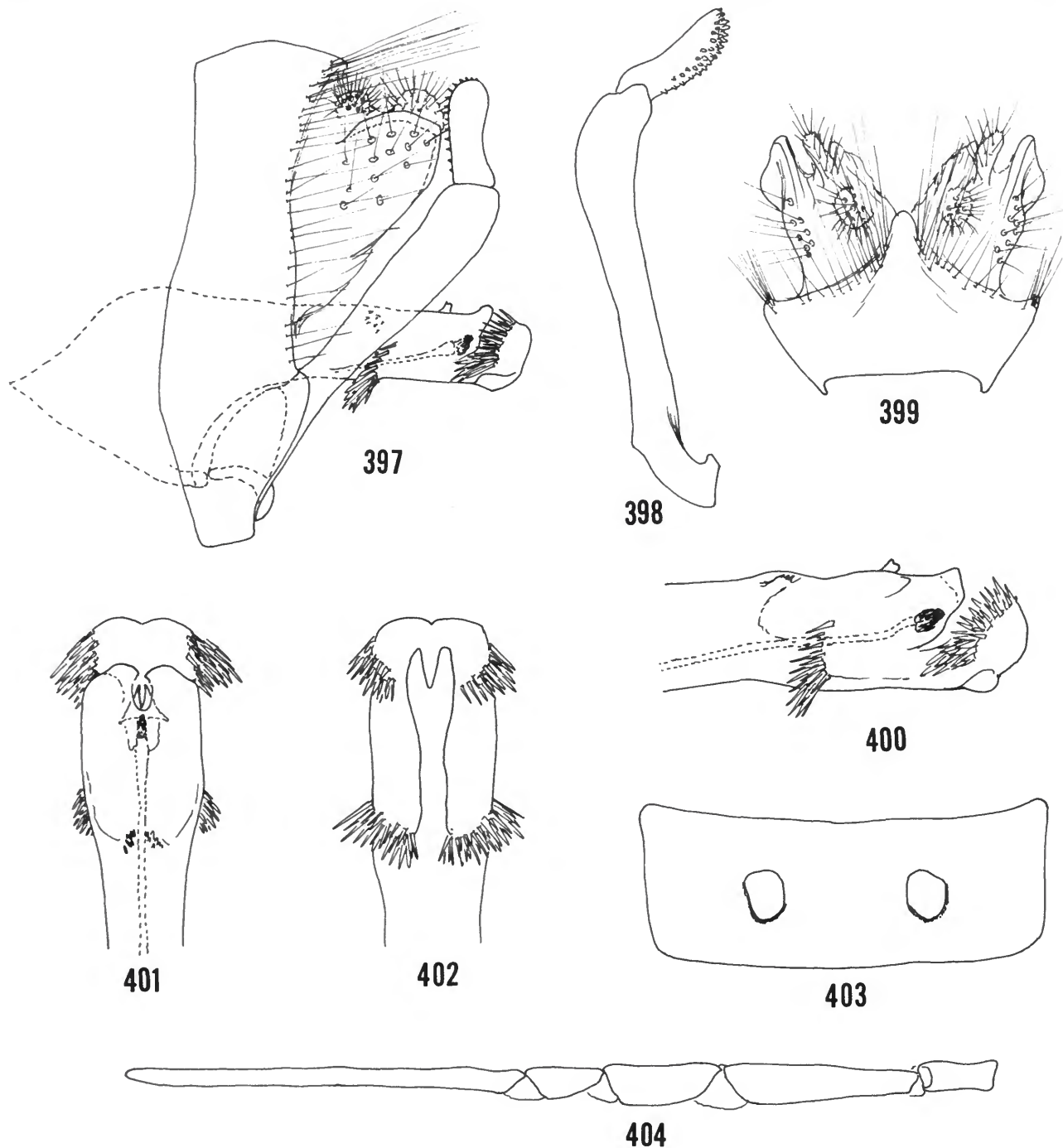


FIGURES 381–386.—*Leptonema auriculatum*, new species, male: 381, genitalia, lateral; 382, ninth and tenth terna, dorsal; 383, apex of phallus, lateral; 384, same, dorsal; 385, same, ventral; 386, genitalia, ventral.

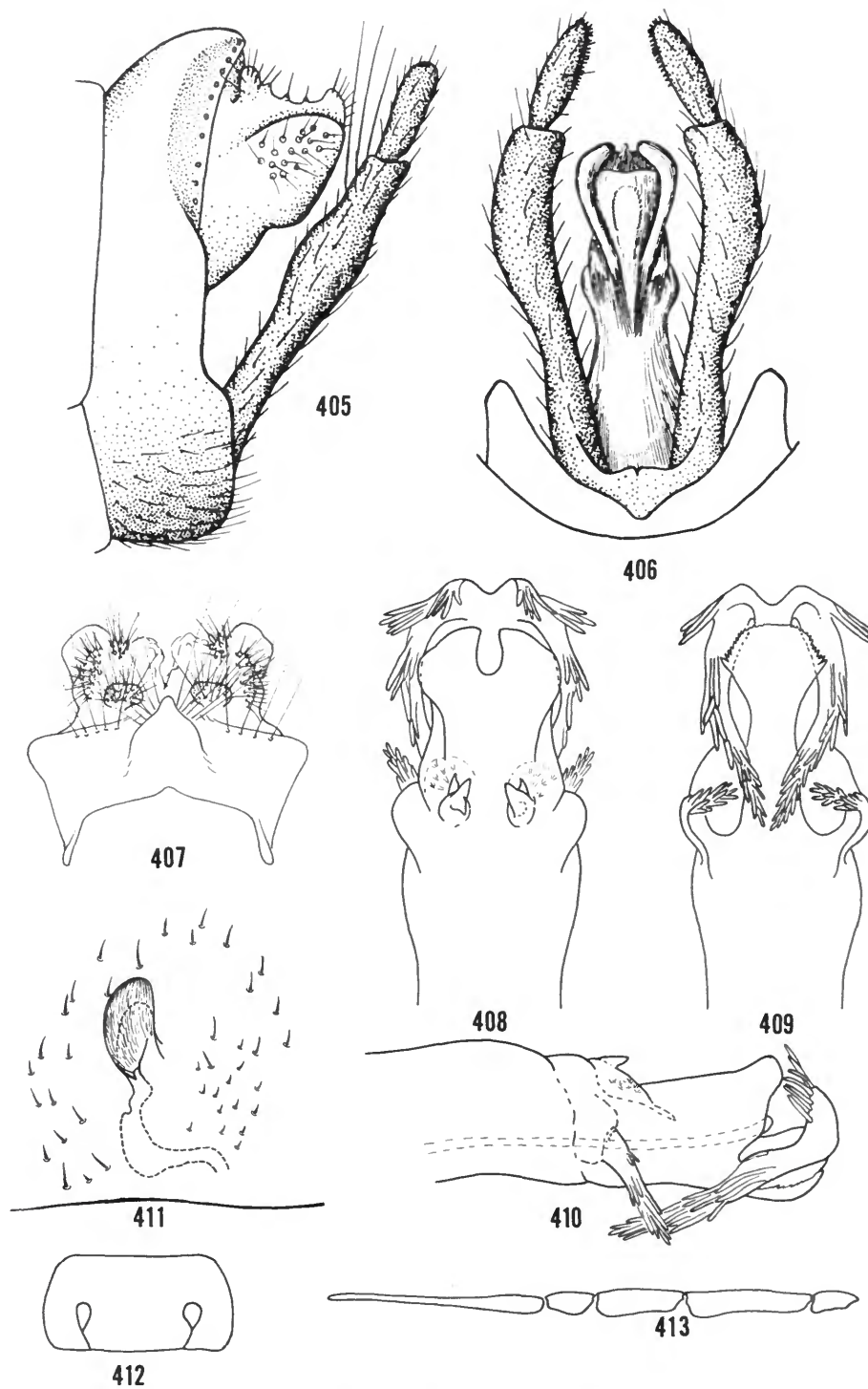


FIGURES 387-396.—*Leptonema b. boliviense* Mosely, male: 387, genitalia, dorsal; 388, same, ventral; 389, same, lateral; 390, apex of phallus, dorsal; 391, same, lateral. *Leptonema b. plumosum*, new subspecies, male: 392, maxillary palpus, lateral; 393, fifth sternum, ventral; 394, apex of phallus, dorsal; 395, same, ventral; 396, same, lateral.

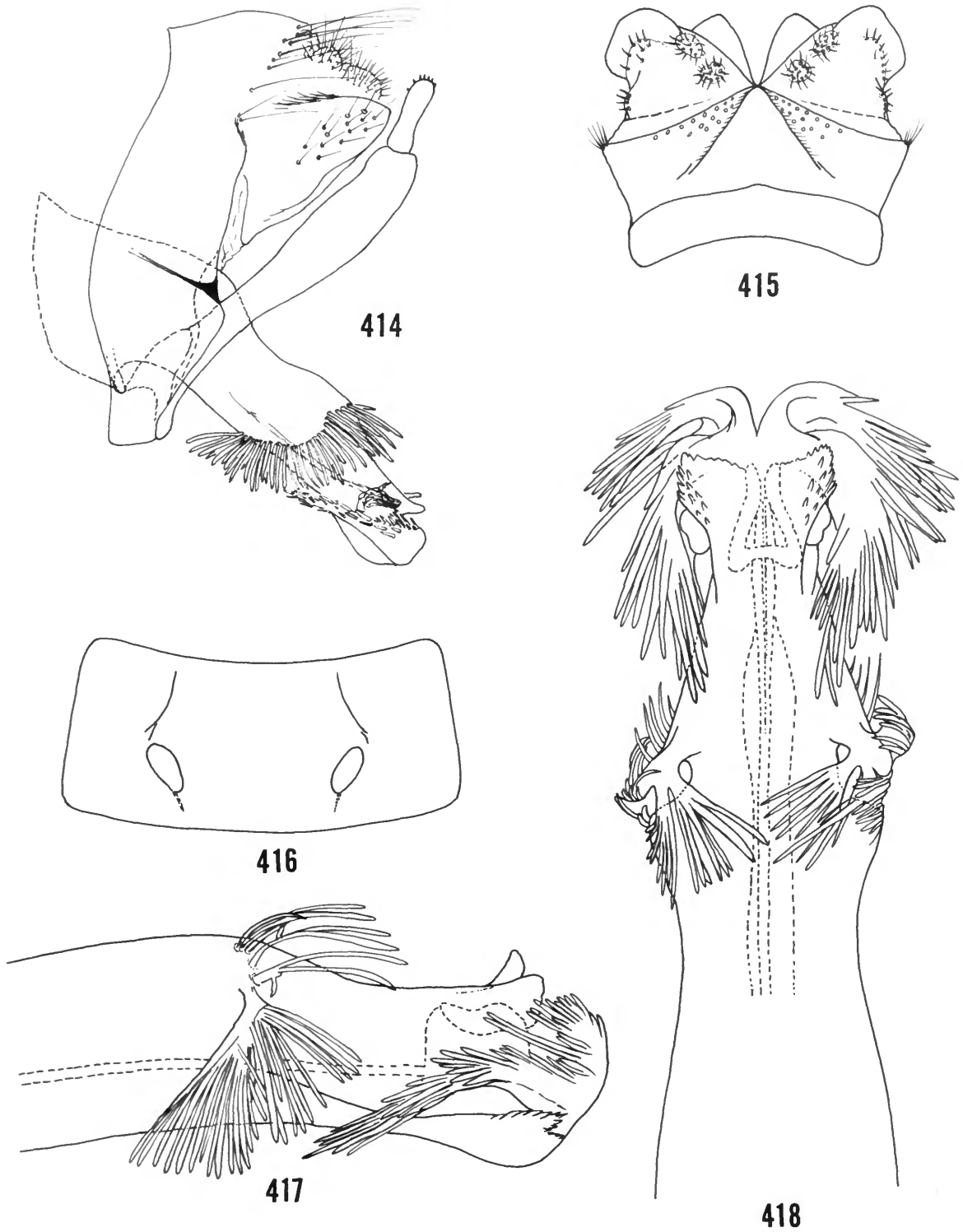




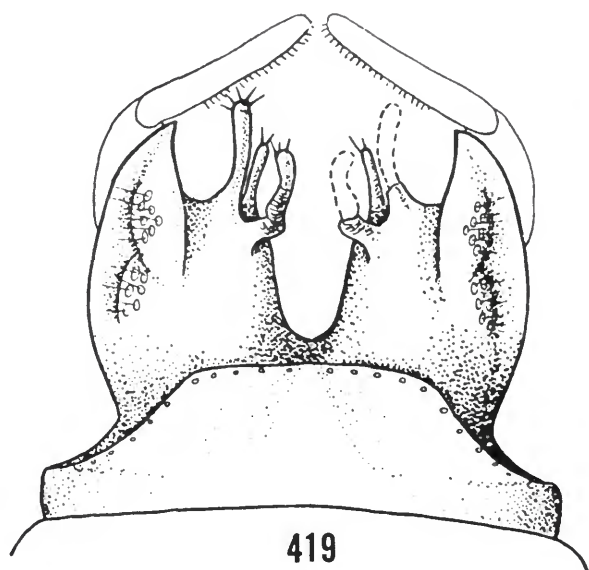
FIGURES 397-404.—*Leptonema neadelphus*, new species, male: 397, genitalia, lateral; 398, clasper, poster-  
oventral; 399, ninth and tenth terga, dorsal; 400, apex of phallus, lateral; 401, same, dorsal; 402, same,  
ventral; 403, fifth sternum, ventral; 404, maxillary palpus, lateral.



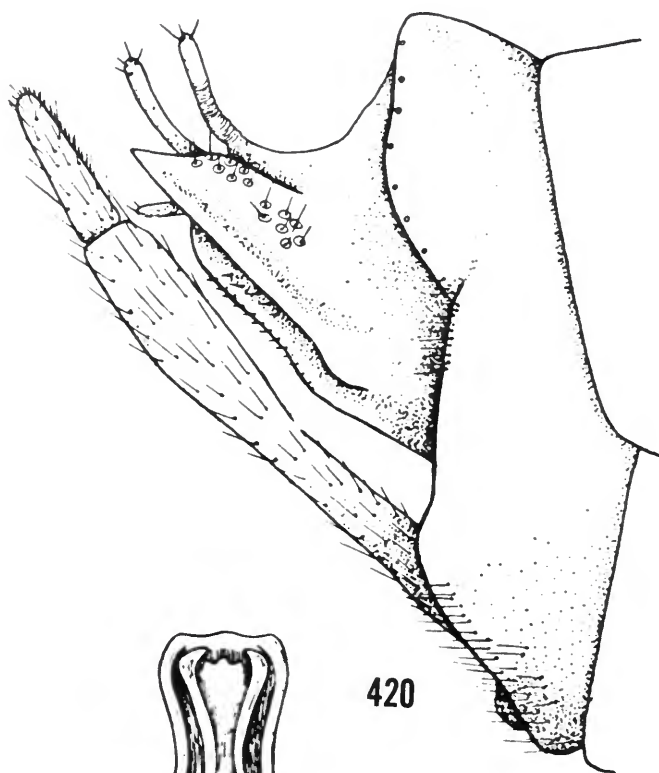
FIGURES 405-413.—*Leptonema spirillum*, new species, male: 405, genitalia, lateral; 406, same, ventral; 407, ninth and tenth terga, dorsal; 408, apex of phallus, dorsal; 409, same, ventral; 410, same, lateral; 411, process of fifth sternum showing internal gland, ventral; 412, fifth sternum, ventral; 413, maxillary palpus, lateral.



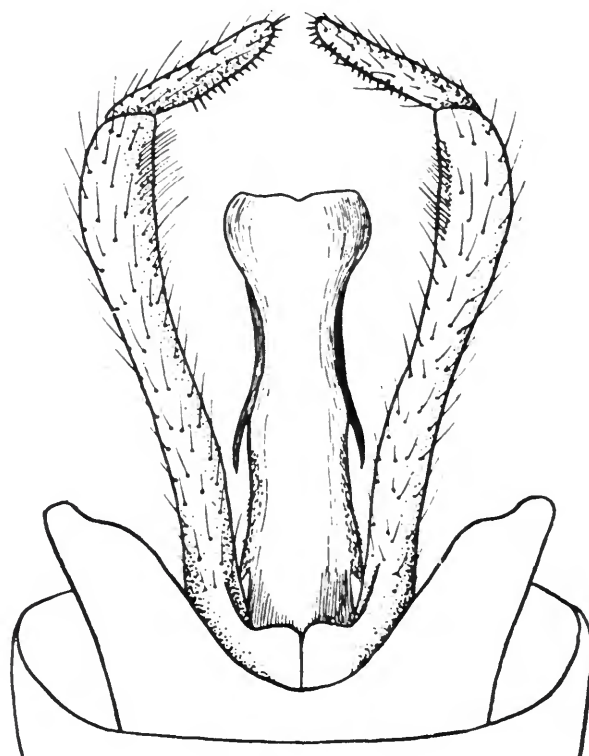
FIGURES 414-418.—*Leptonema stigosum* Ulmer, male: 414, genitalia, lateral; 415, ninth and tenth terga, dorsal; 416, fifth sternum, ventral; 417, apex of phallus, lateral; 418, same, dorsal.



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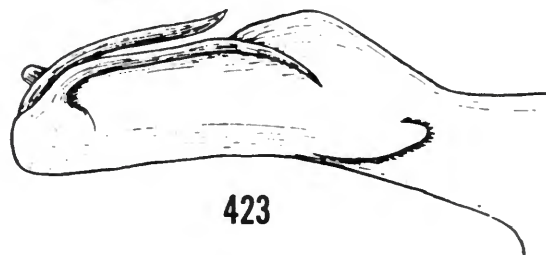
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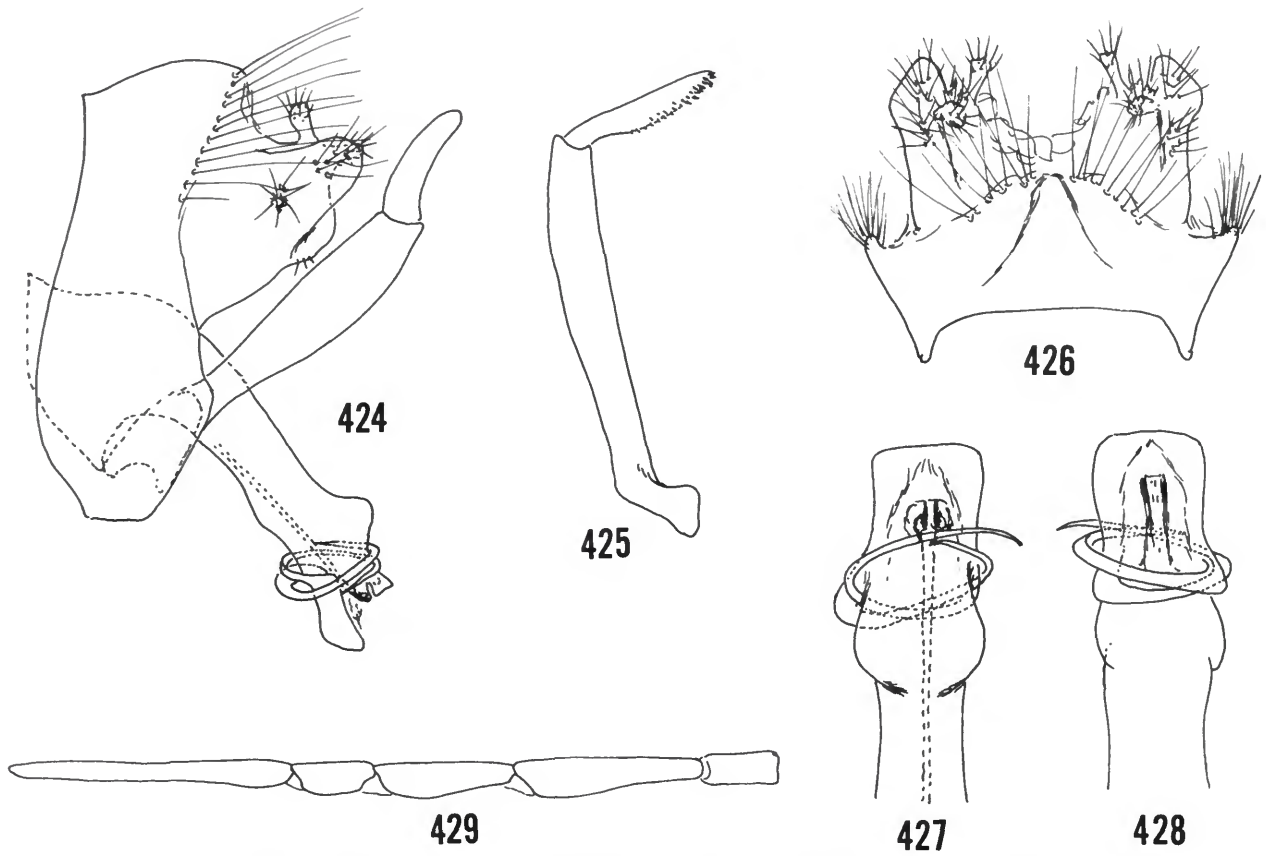
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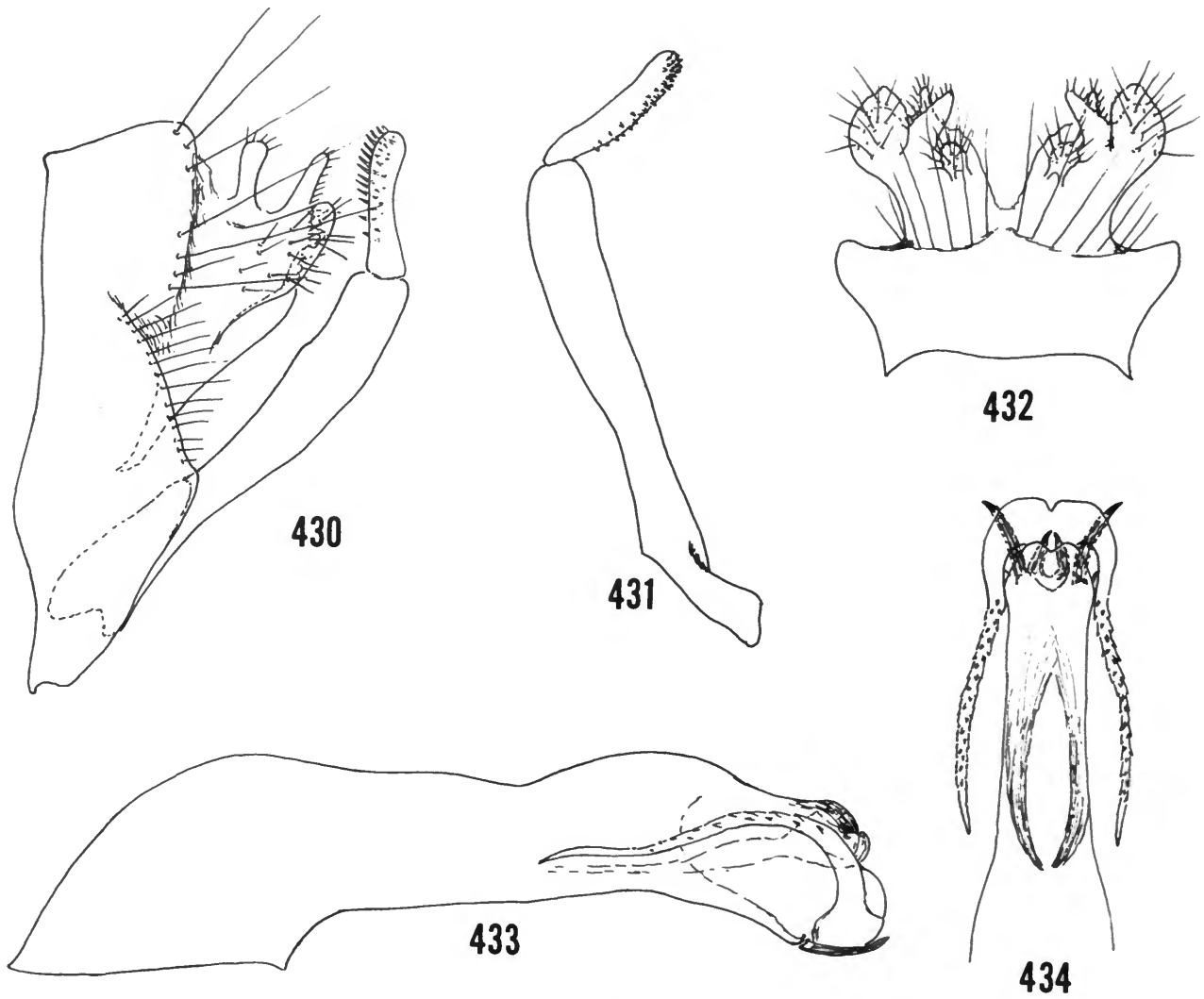
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FIGURES 419-423.—*Leptonema acutum* Mosely, male: 419, genitalia, dorsal; 420, same, lateral; 421, same, ventral; 422, apex of phallus, dorsal; 423, same, lateral.

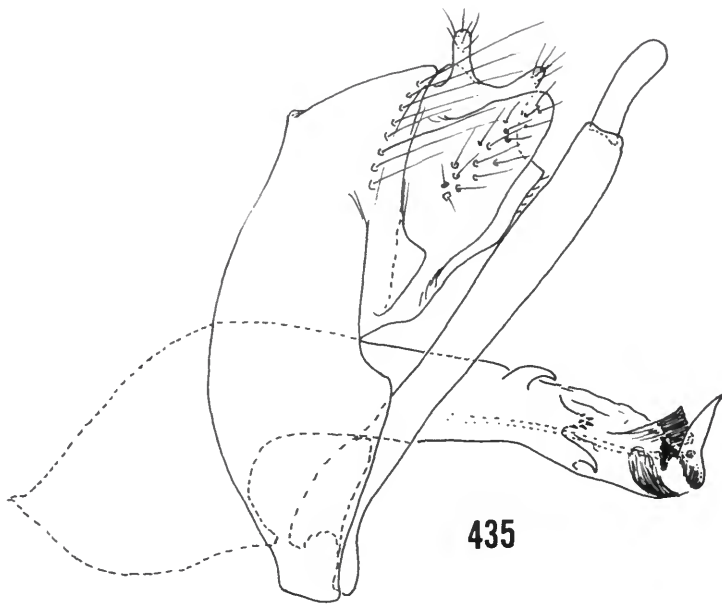




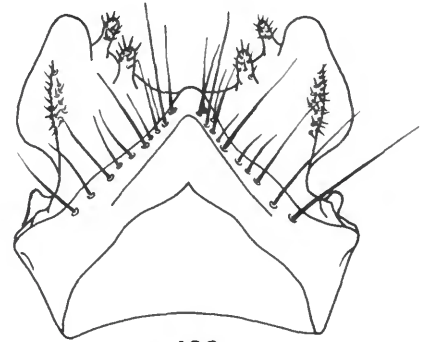
FIGURES 424-429.—*Leptonema andrea*, new species, male: 424, genitalia, lateral; 425, clasper, posteroventral; 426, ninth and tenth terga, dorsal; 427, apex of phallus, dorsal; 428, same, ventral; 429, maxillary palpus, lateral.



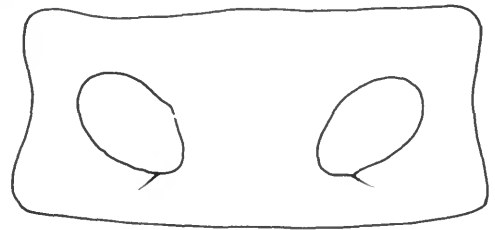
FIGURES 430-434.—*Leptonema araguense* Flint, male: 430, genitalia, lateral; 431, clasper, posteroventral; 432, ninth and tenth terga, dorsal; 433, phallus, lateral; 434, same, dorsal.



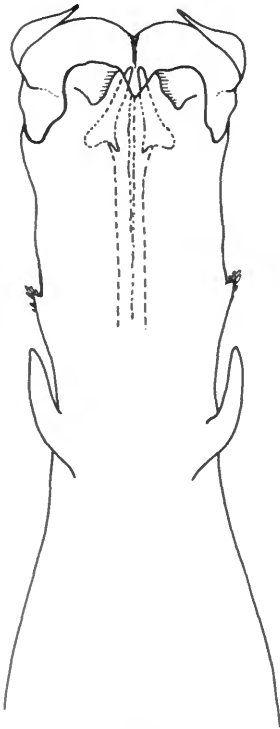
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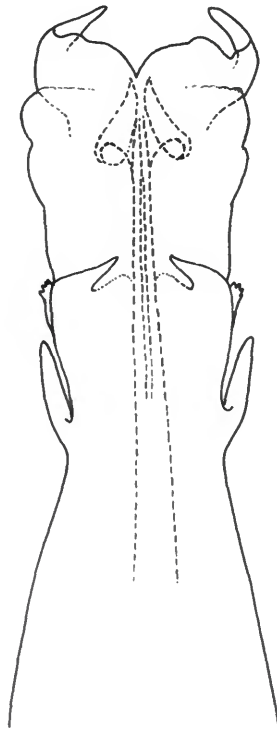
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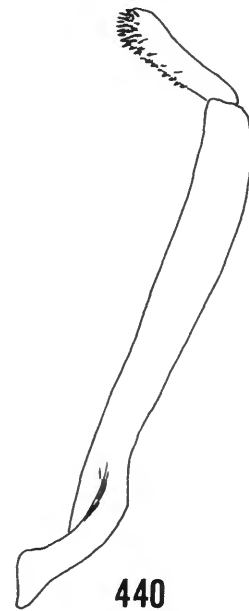
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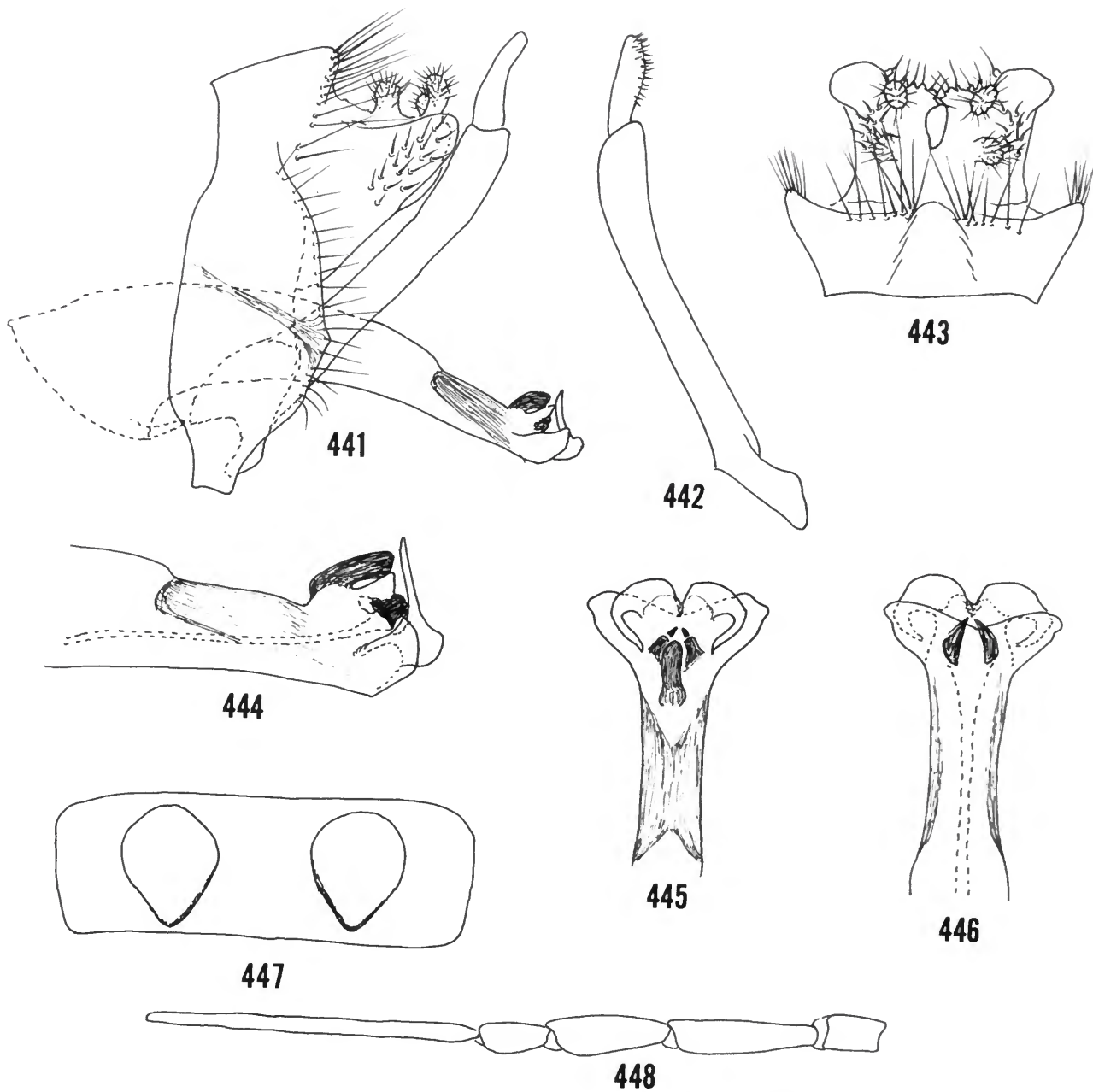


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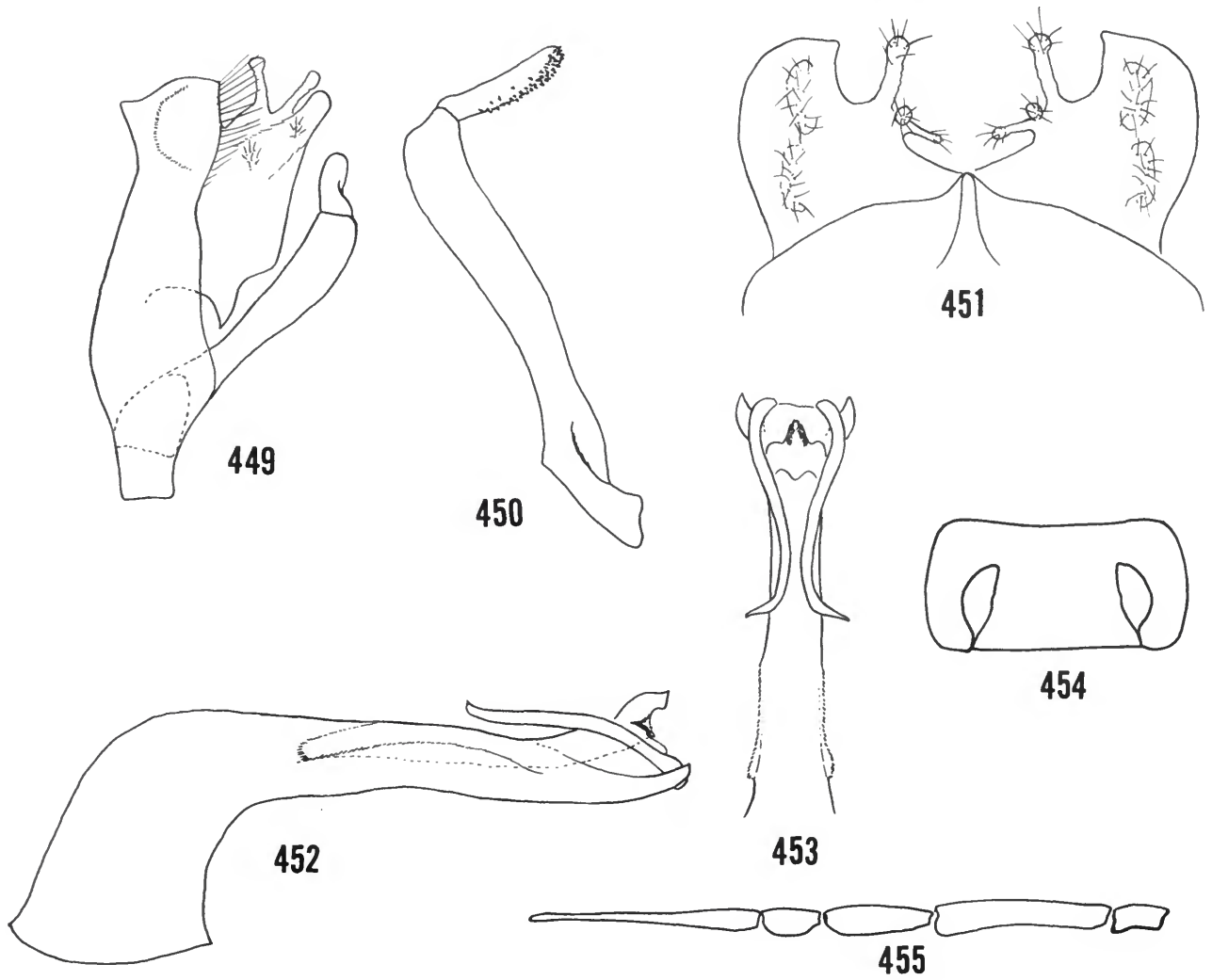
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FIGURES 435-440.—*Leptonema bilobatum* Schmid, male: 435, genitalia, lateral; 436, ninth and tenth terga, dorsal; 437, fifth sternum, ventral; 438, apex of phallus, dorsal; 439, same, ventral; 440, clasper, postero-ventral.

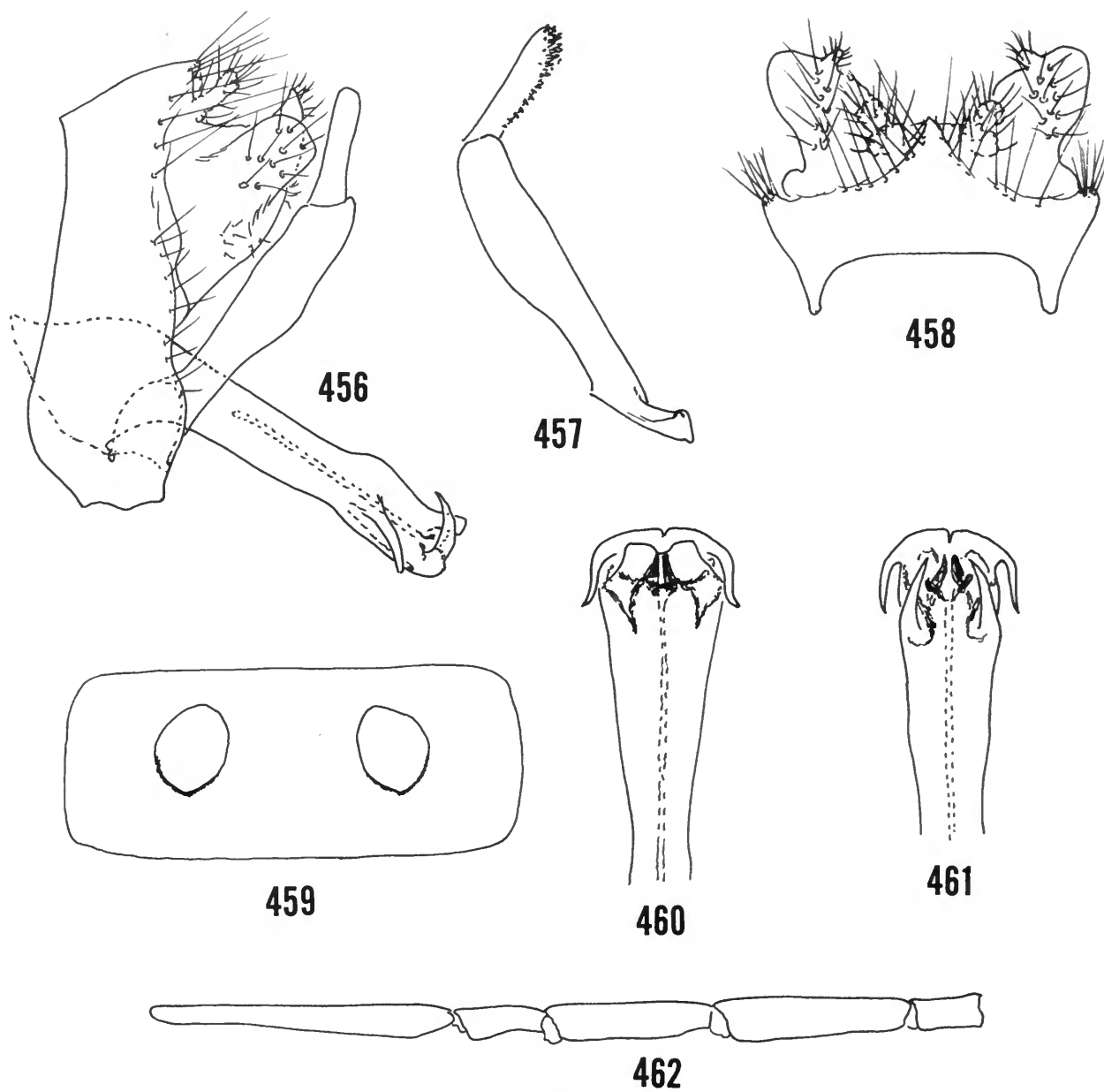


FIGURES 441-448.—*Leptonema chiapense*, new species, male: 441, genitalia, lateral; 442, clasper, postero-ventral; 443, ninth and tenth terga, dorsal; 444, apex of phallus, lateral; 445, same, dorsal; 446, same, ventral; 447, fifth sternum, ventral; 448, maxillary palpus, lateral.

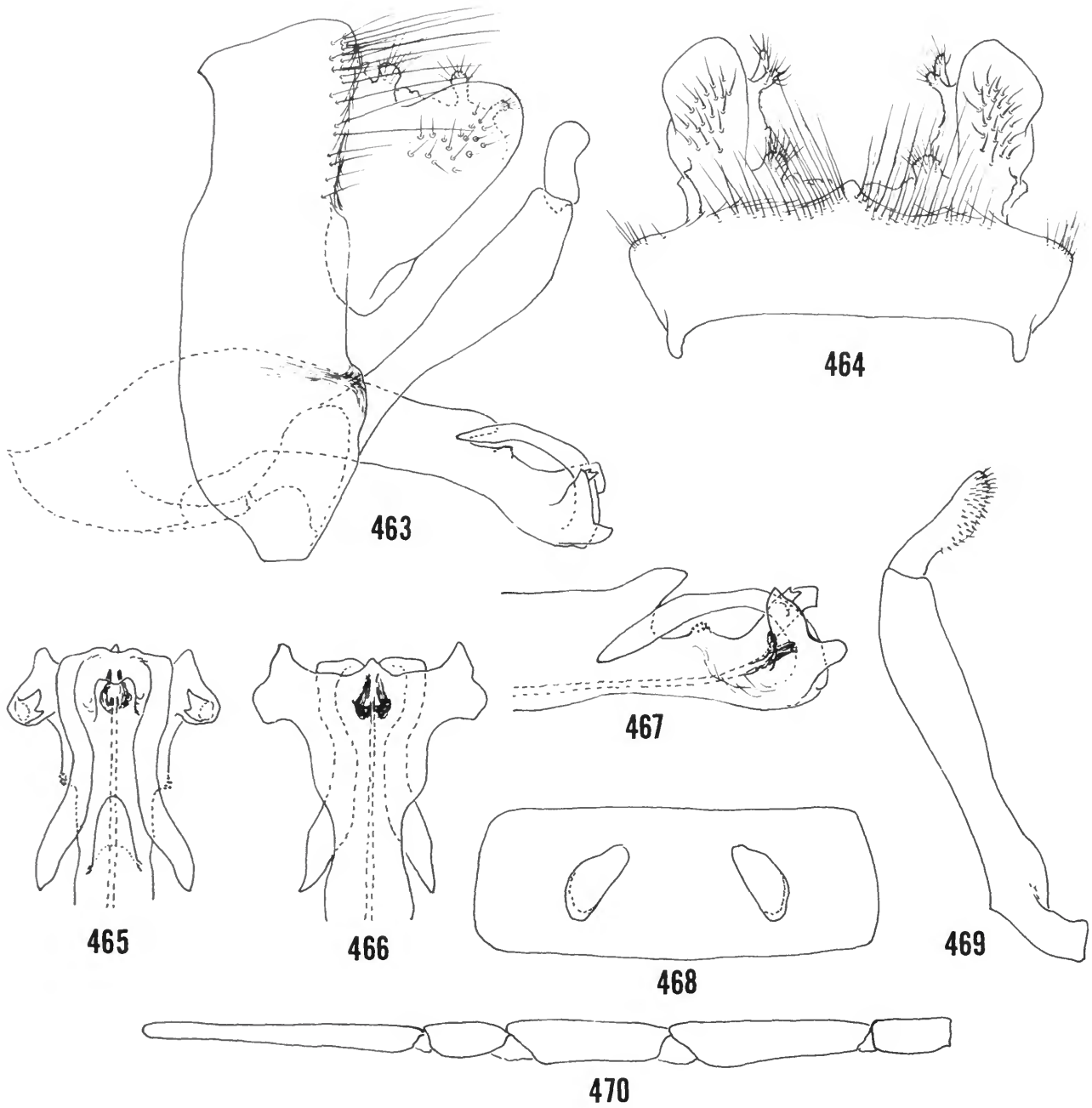




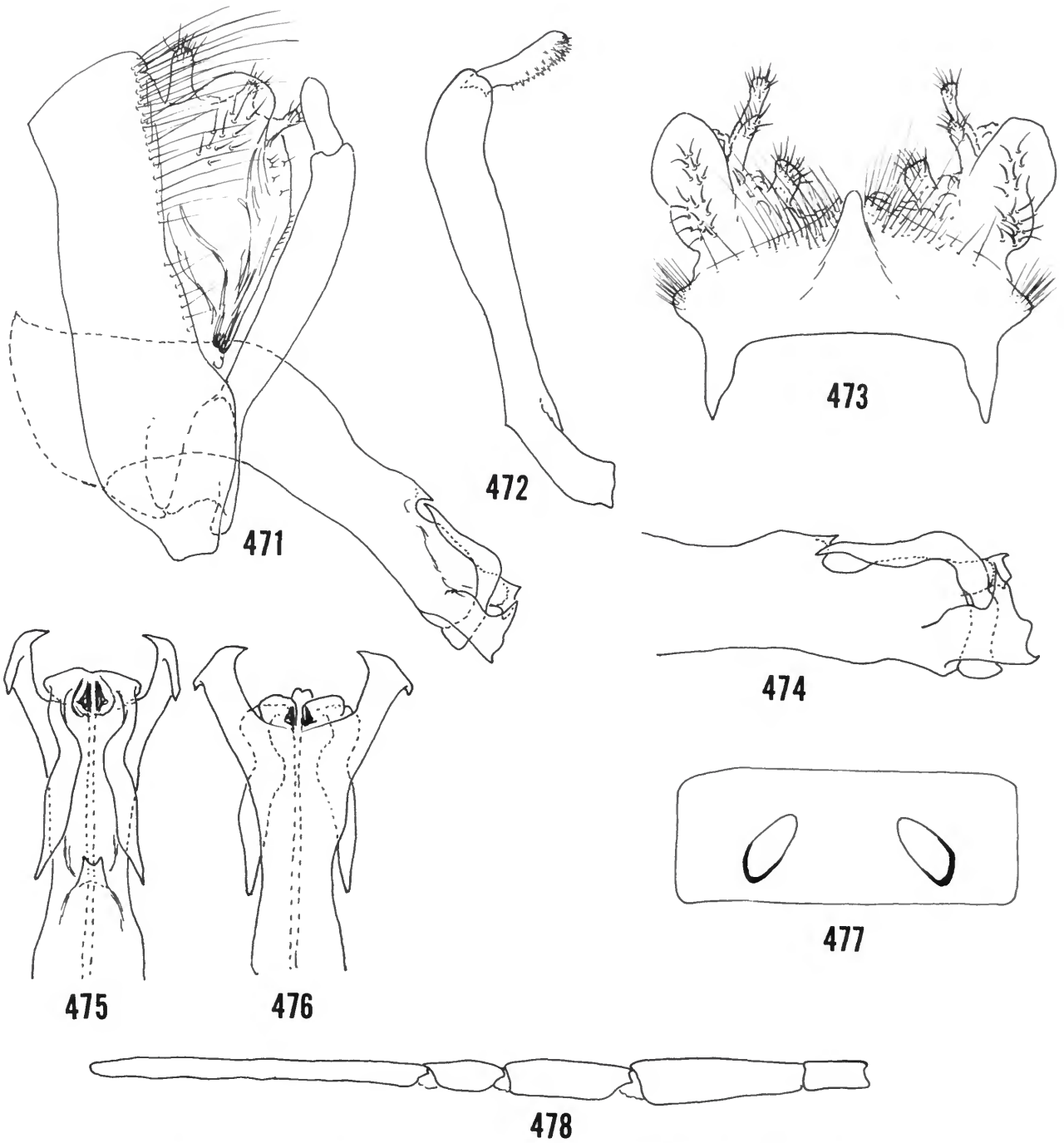
FIGURES 449-455.—*Leptonema chila* Flint, male: 449, genitalia, lateral; 450, clasper, posteroventral; 451, ninth and tenth terga, dorsal; 452, phallus, lateral; 453, same, dorsal; 454, fifth sternum, ventral; 455, maxillary palpus, lateral.



FIGURES 456–462.—*Leptonema coheni*, new species, male: 456, genitalia, lateral; 457, clasper, posteroventral; 458, ninth and tenth terga, dorsal; 459, fifth sternum, ventral; 460, apex of phallus, dorsal; 461, same, ventral; 462, maxillary palpus, lateral.

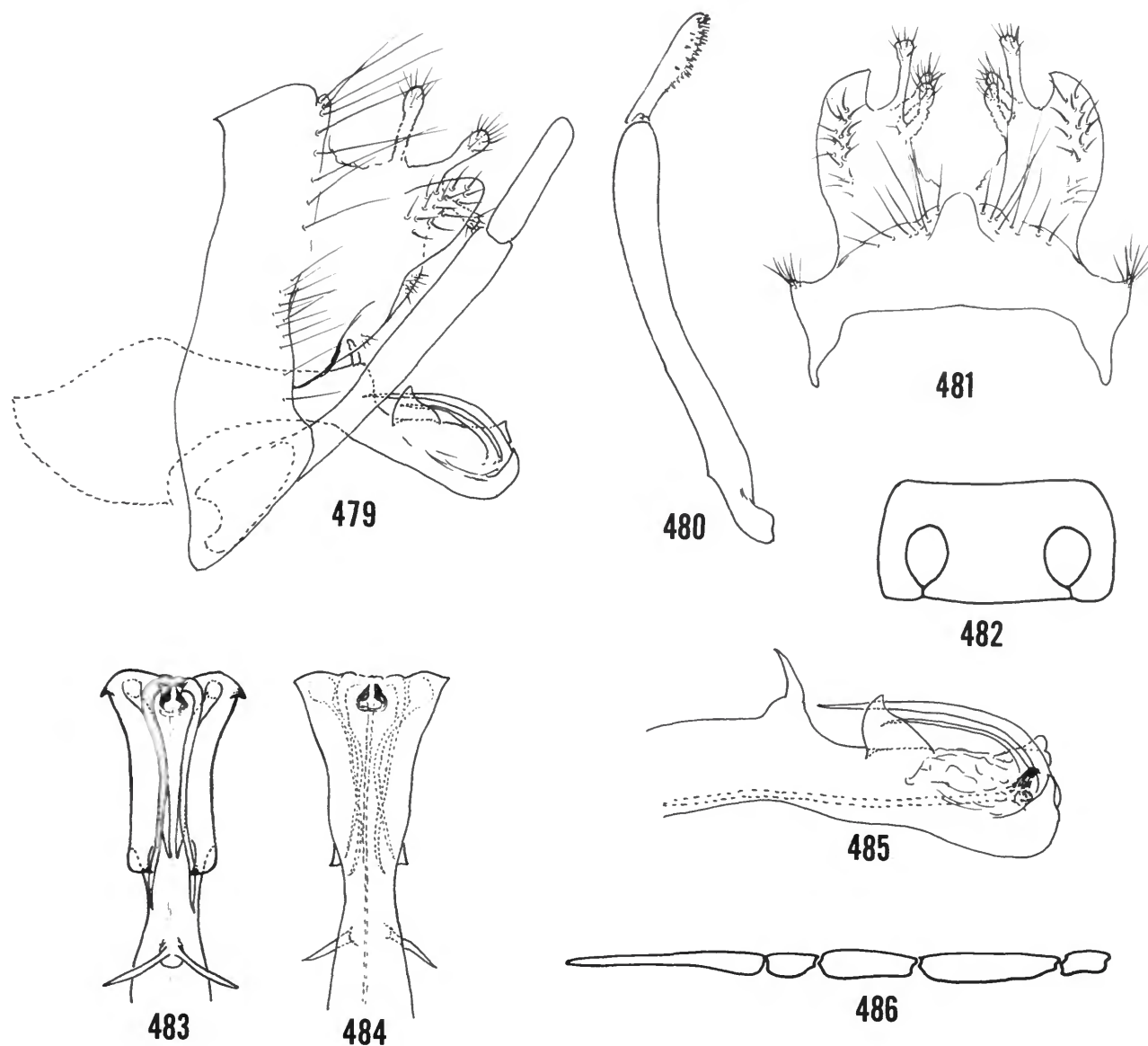


FIGURES 463-470.—*Leptonema ekisi*, new species, male: 463, genitalia, lateral; 464, ninth and tenth terga, dorsal; 465, apex of phallus, dorsal; 466, same, ventral; 467, same, lateral; 468, fifth sternum, ventral; 469, clasper, posterioventral; 470, maxillary palpus, lateral.

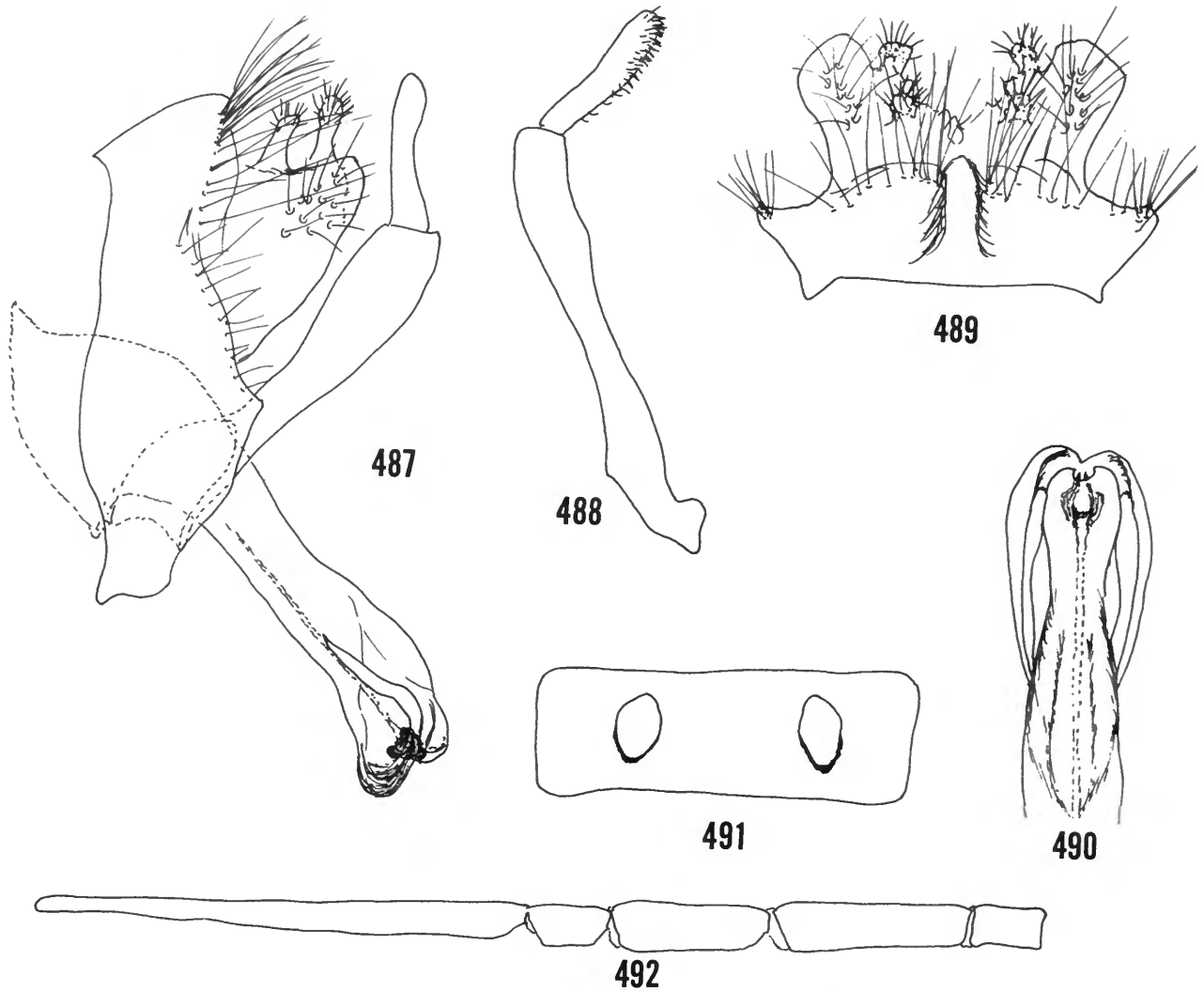


FIGURES 471-478.—*Leptonema fortunum*, new species, male: 471, genitalia, lateral; 472, clasper, postero-ventral; 473, ninth and tenth terga, dorsal; 474, apex of phallus, lateral; 475, same, dorsal; 476, same, ventral; 477, fifth sternum, ventral; 478, maxillary palpus, lateral.

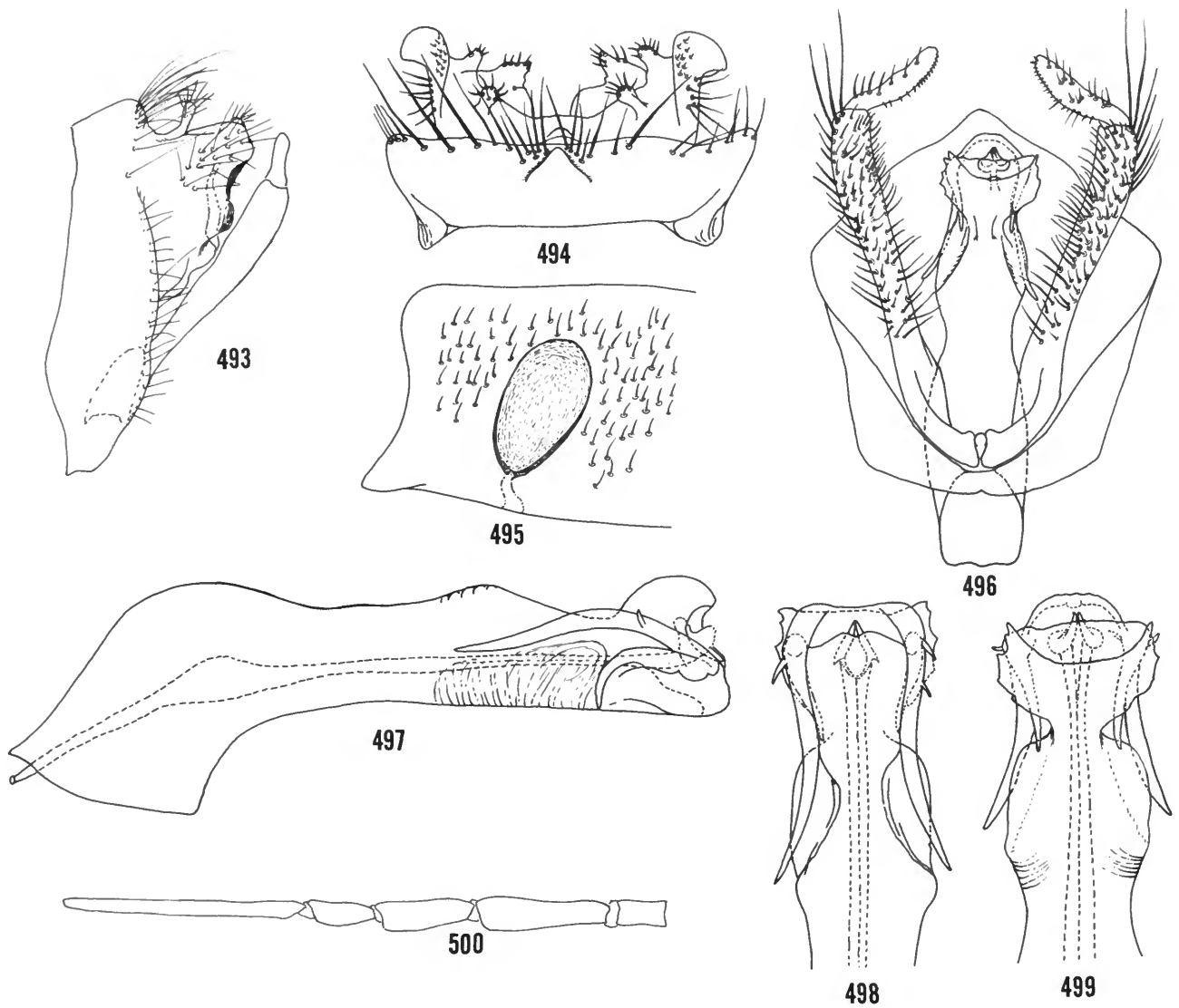




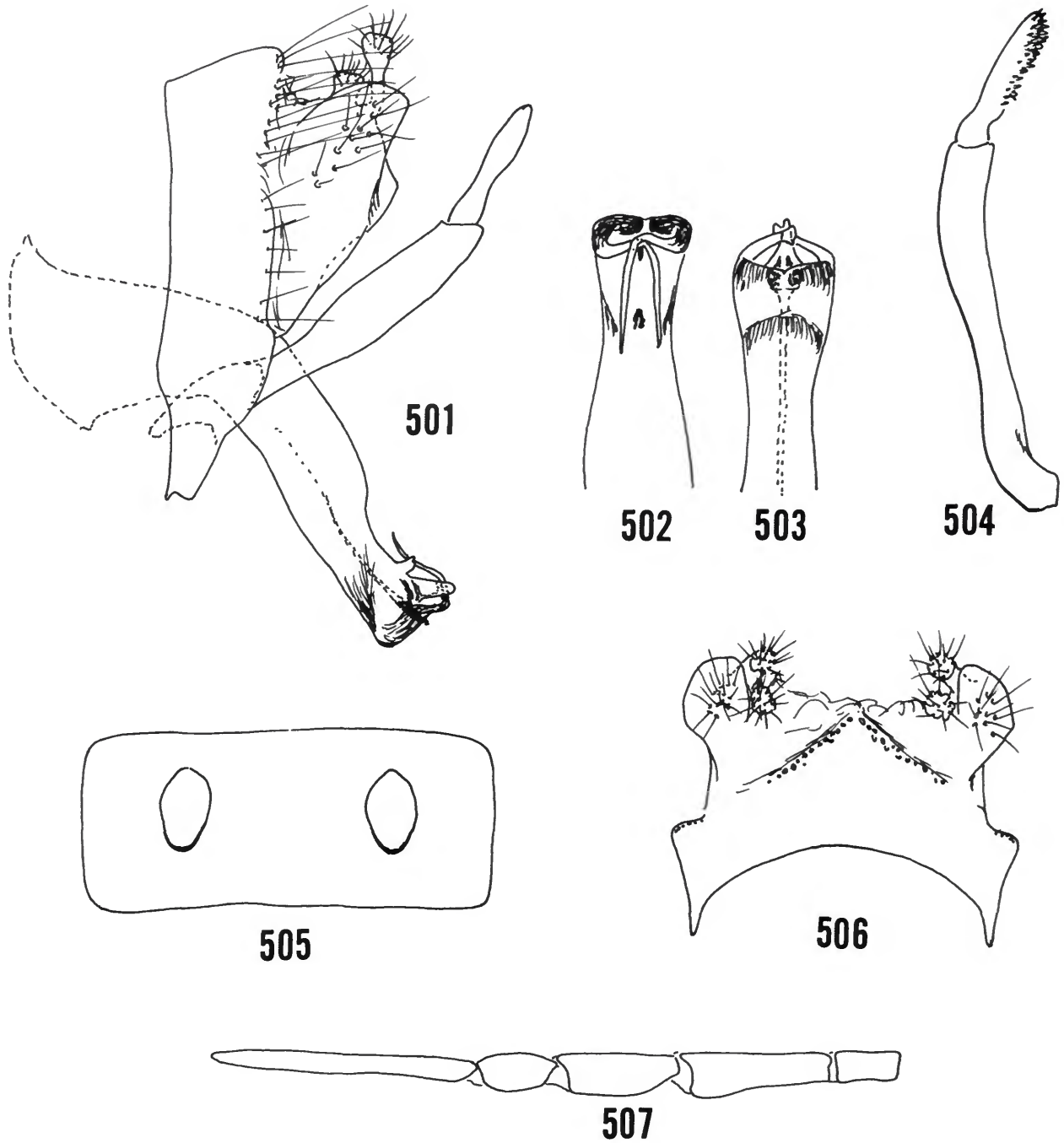
FIGURES 479–486.—*Leptonema hamuli*, new species, male: 479, genitalia, lateral; 480, clasper, posteroventral; 481, ninth and tenth terga, dorsal; 482, fifth sternum, ventral; 483, apex of phallus, dorsal; 484, same, ventral; 485, same, lateral; 486, maxillary palpus, lateral.



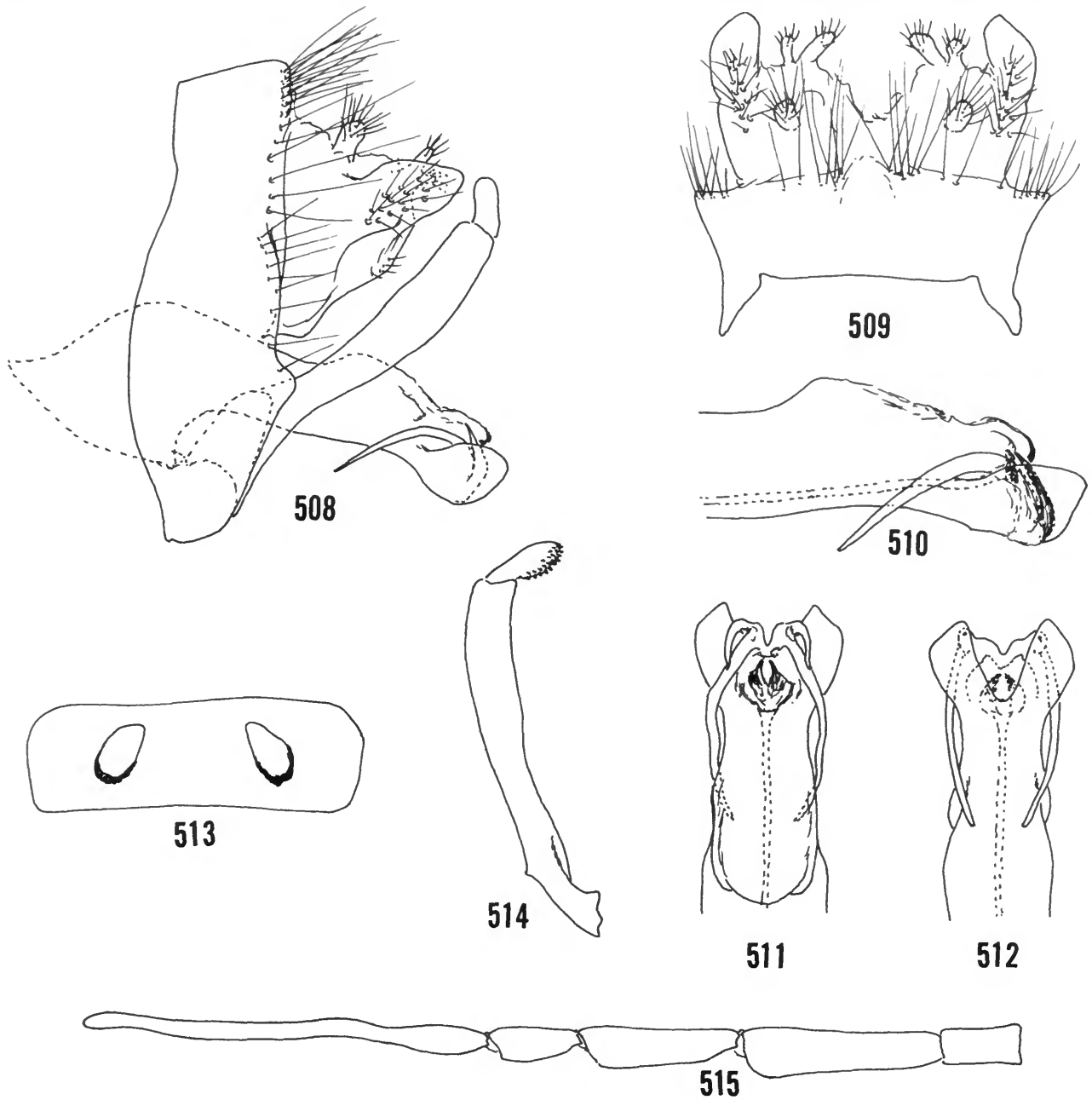
FIGURES 487-492.—*Leptonema heppneri*, new species, male: 487, genitalia, lateral; 488, clasper, postero-ventral; 489, ninth and tenth terga, dorsal; 490, apex of phallus, dorsal; 491, fifth sternum, ventral; 492, maxillary palpus, lateral.



FIGURES 493-500.—*Leptonema inspiratum*, new species, male: 493, genitalia, lateral; 494, ninth and tenth terga, dorsal; 495, process of fifth sternum, ventral; 496, genitalia, ventral; 497, phallus, lateral; 498, same, dorsal; 499, same, ventral; 500, maxillary palpus, lateral.

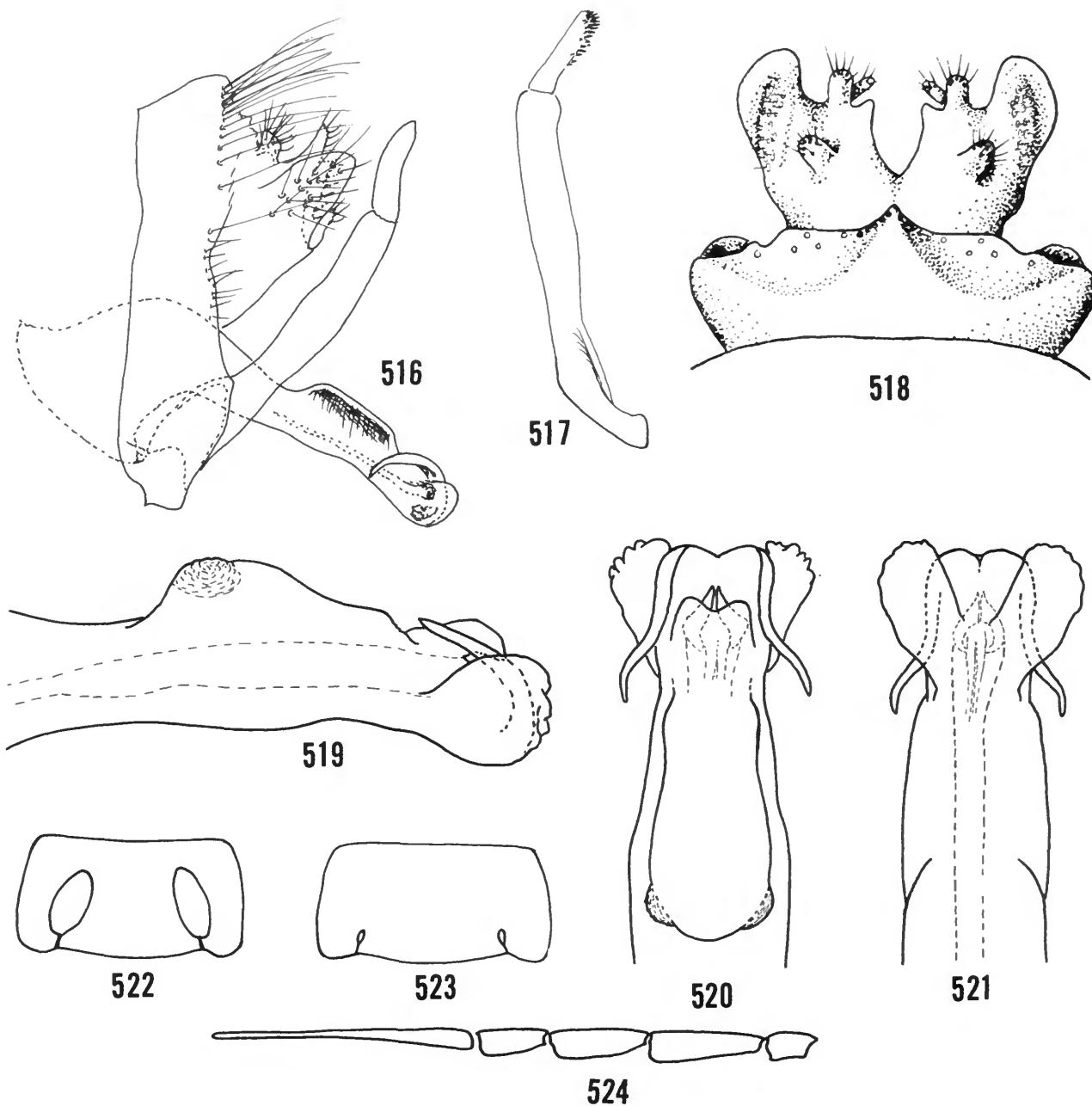


FIGURES 501-507.—*Leptonema mastigon*, new species, male: 501, genitalia, lateral; 502, apex of phallus, dorsal; 503, same, ventral; 504, clasper, posteroventral; 505, fifth sternum, ventral; 506, ninth and tenth terga, dorsal; 507, maxillary palpus, lateral.

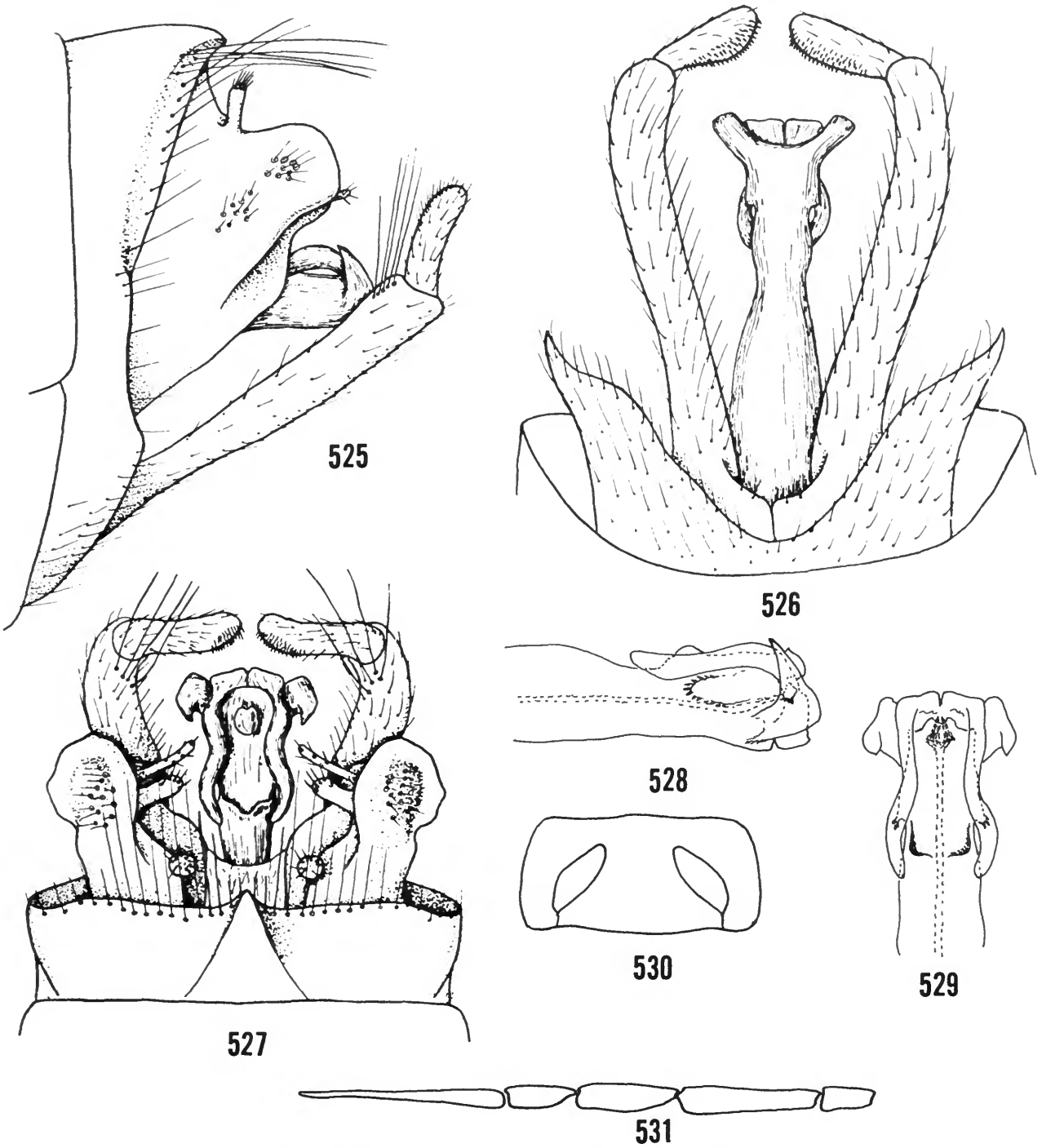


FIGURES 508-515.—*Leptonema michoacanense*, new species, male: 508, genitalia, lateral; 509, ninth and tenth terga, dorsal; 510, apex of phallus, lateral; 511, same, dorsal; 512, same, ventral; 513, fifth sternum, ventral; 514, clasper, posteroventral; 515, maxillary palpus, lateral.

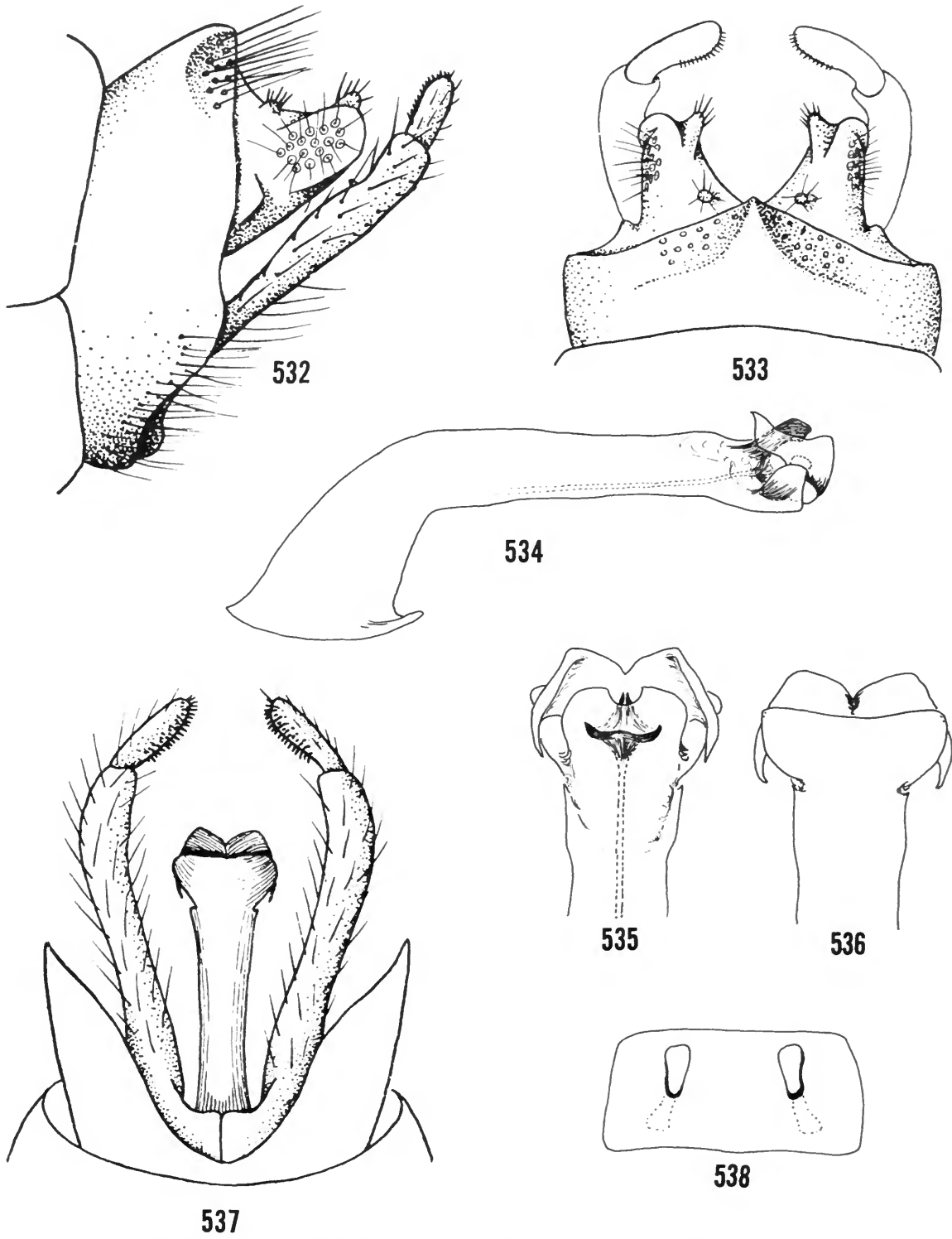




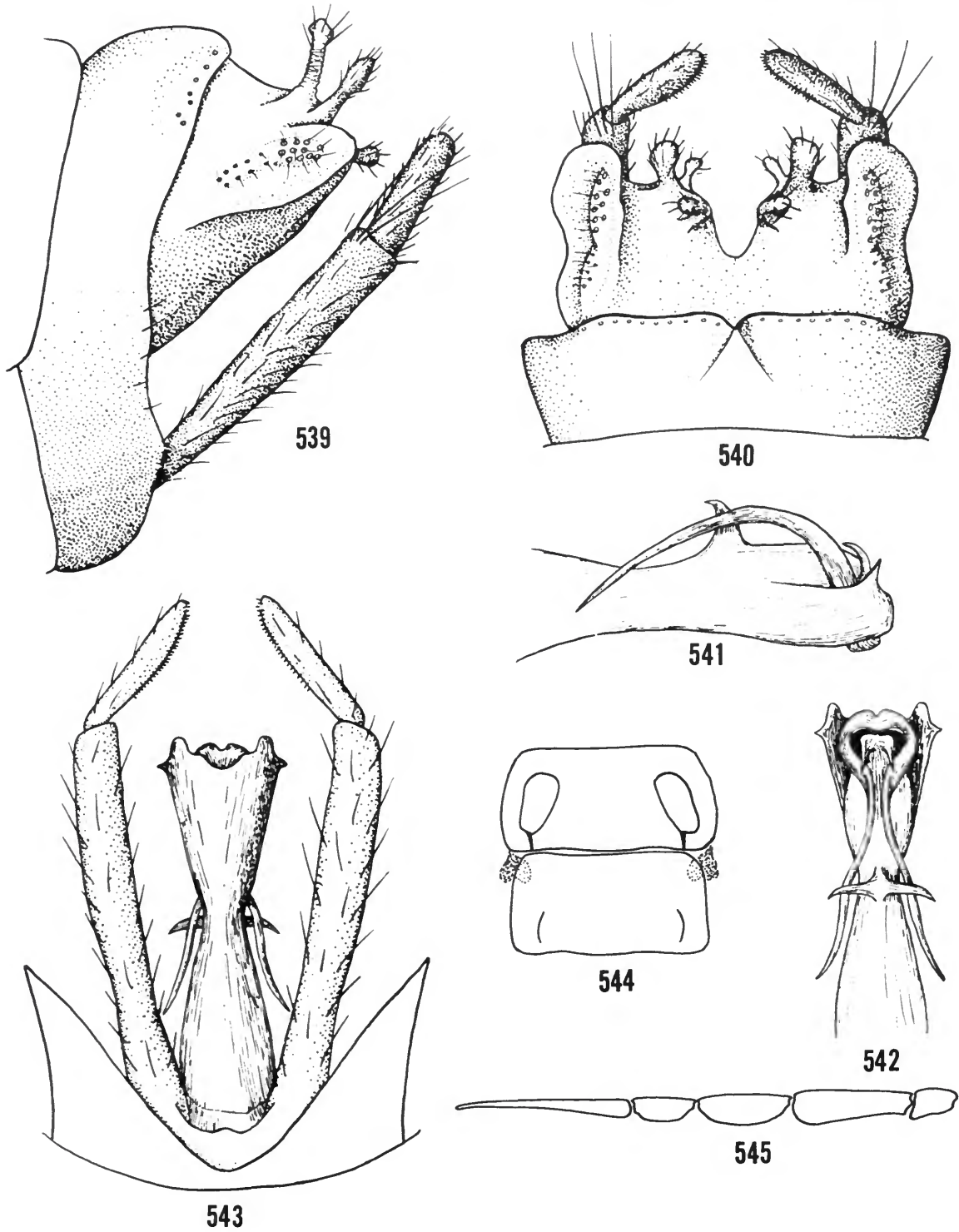
FIGURES 516-524.—*Leptonema plicatum* Mosely, male: 516, genitalia, lateral; 517, clasper, posteroventral; 518, ninth and tenth terga, dorsal; 519, apex of phallus, lateral; 520, same, dorsal; 521, same, ventral; 522, fifth sternum, ventral; 523, fifth sternum of female, ventral; 524, maxillary palpus, lateral.



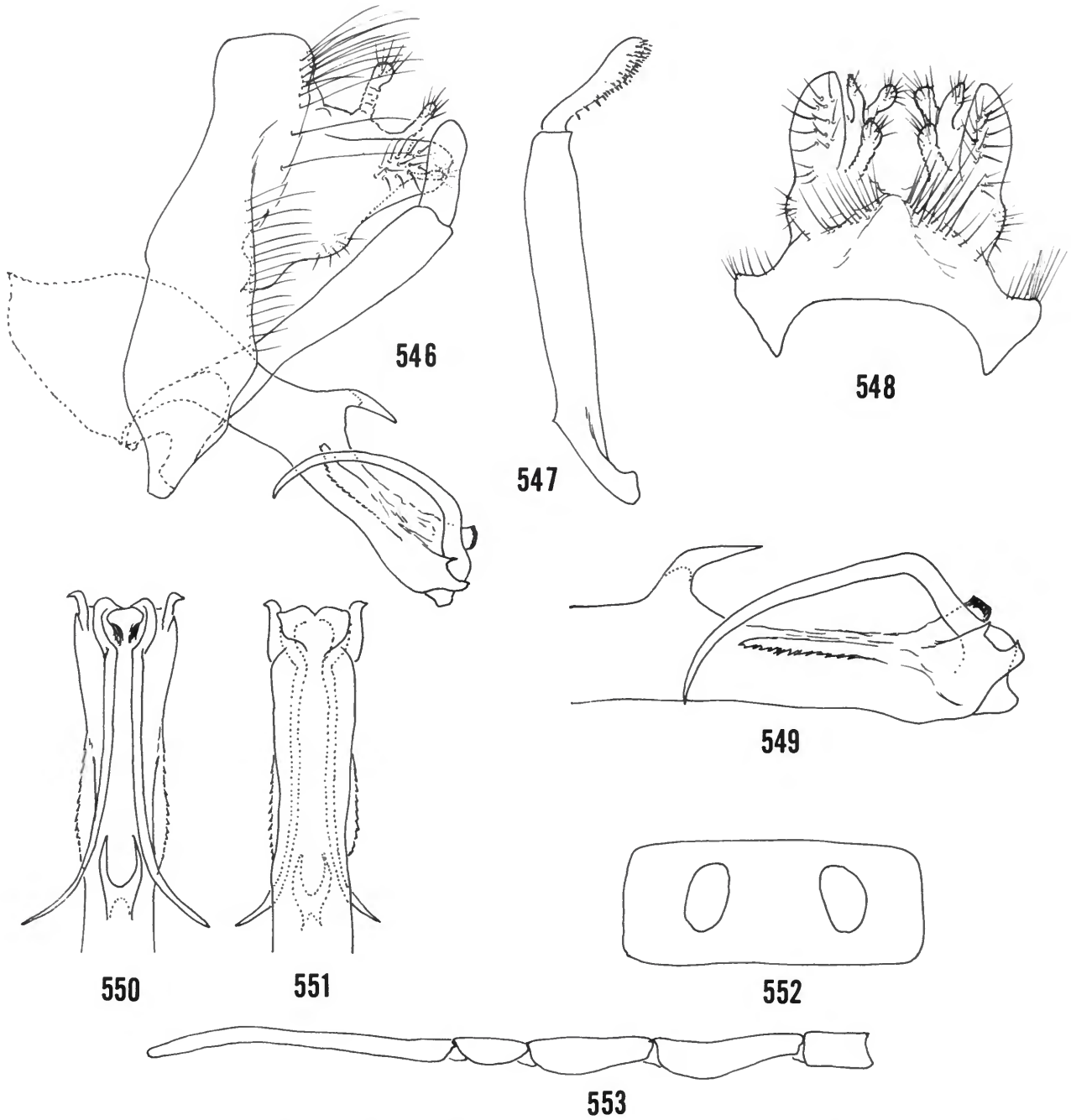
FIGURES 525-531.—*Leptonema salvini* Mosely, male: 525, genitalia, lateral; 526, same, ventral; 527, same, dorsal; 528, apex of phallus, lateral; 529, same, dorsal; 530, fifth sternum, ventral; 531, maxillary palpus, lateral.



FIGURES 532-538.—*Leptonema simplex* Mosely, male: 532, genitalia, lateral; 533, same, dorsal; 534, phallus, lateral; 535, same, dorsal; 536, same, ventral; 537, genitalia, ventral; 538, fifth sternum, ventral.

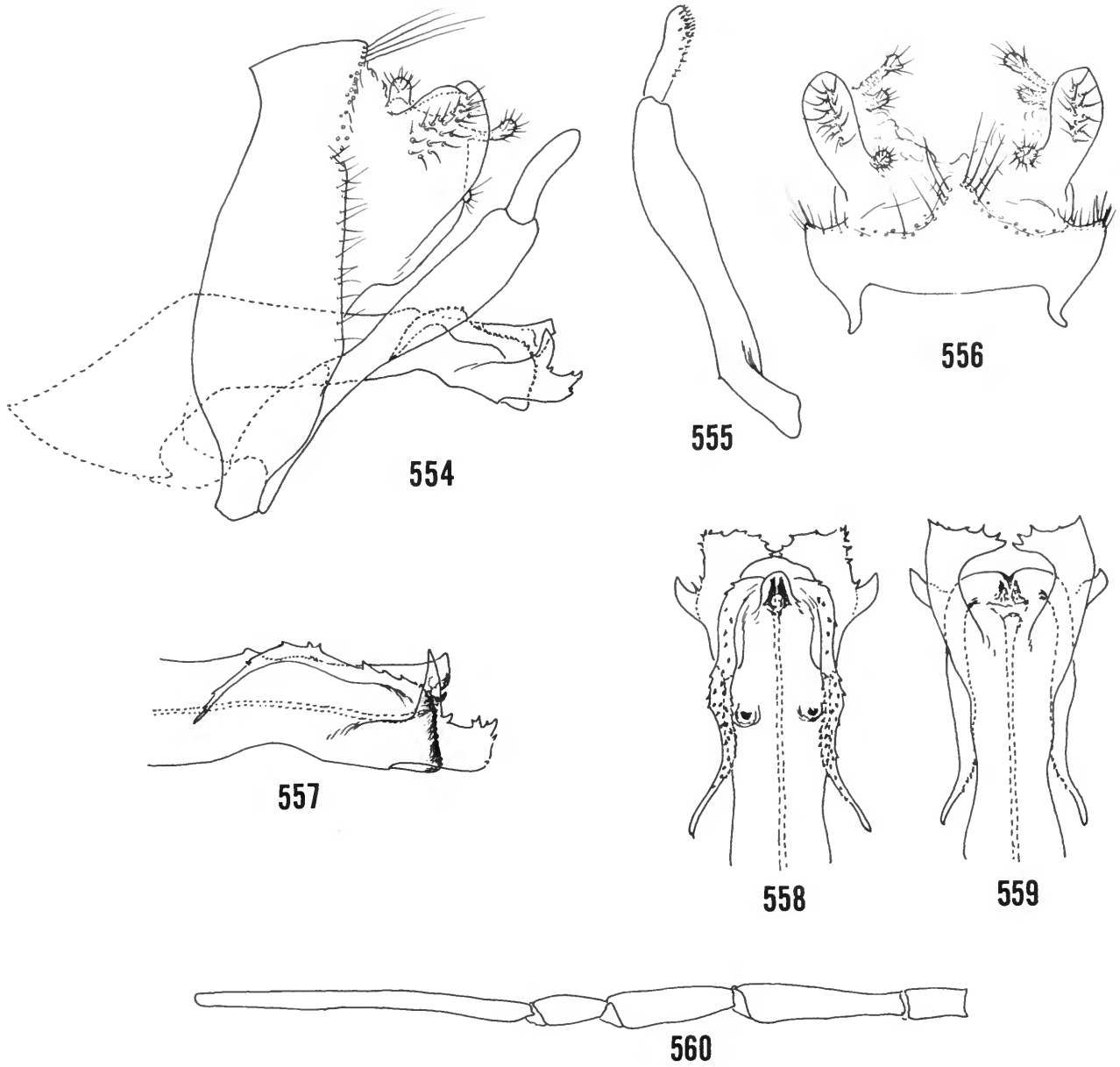


FIGURES 539-545.—*Leptonema sinuatum* Mosely, male: 539, genitalia, lateral; 540, same, dorsal; 541, apex of phallus, lateral; 542, same, dorsal; 543, genitalia, ventral; 544, fourth and fifth sternum, ventral; 545, maxillary palpus, lateral.

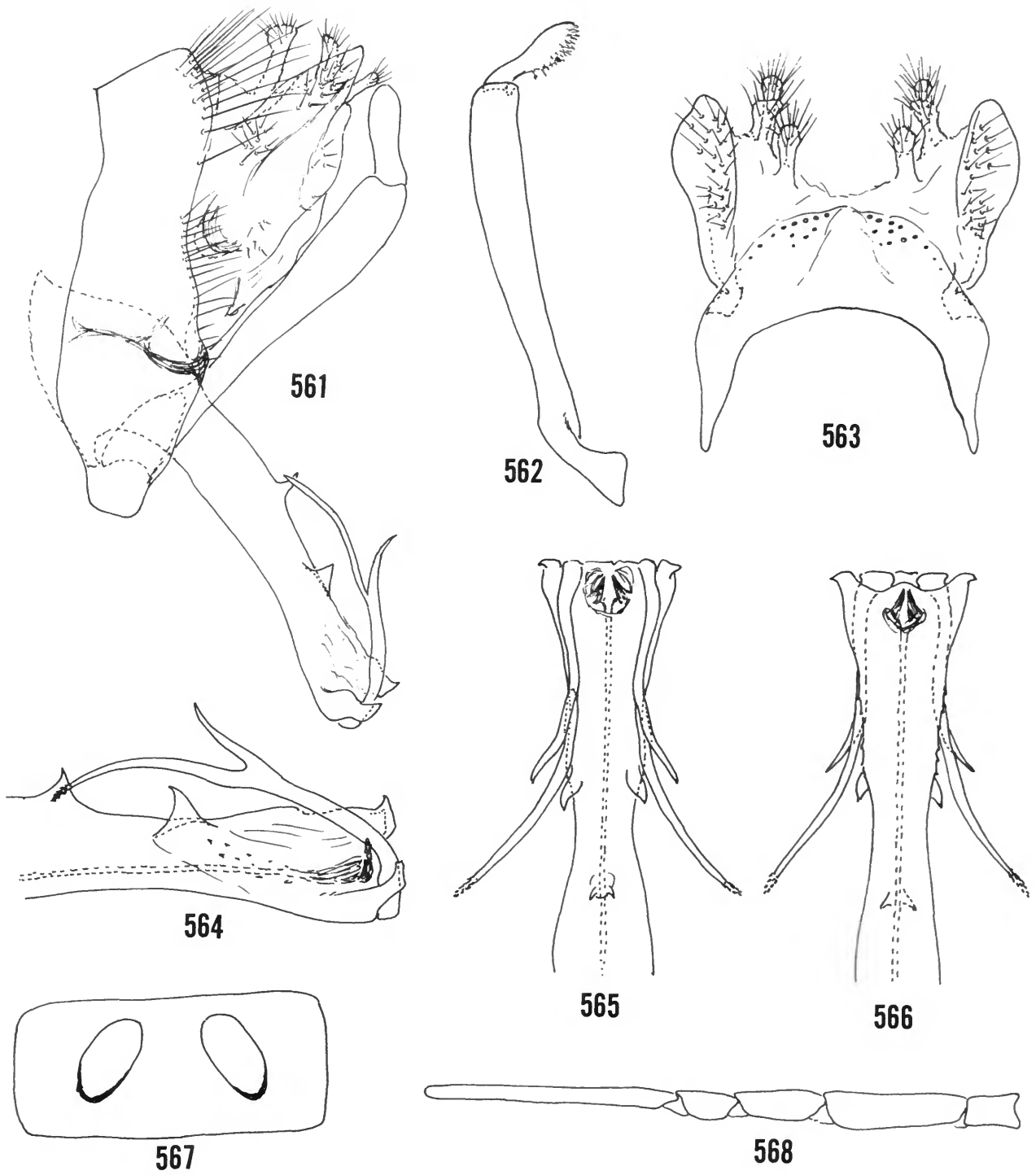


FIGURES 546-553.—*Leptonema turrialbum*, new species, male: 546, genitalia, lateral; 547, clasper, poster-oventral; 548, ninth and tenth terna, dorsal; 549, apex of phallus, lateral; 550, same, dorsal; 551, same, ventral; 552, fifth sternum, ventral; 553, maxillary palpus, lateral.

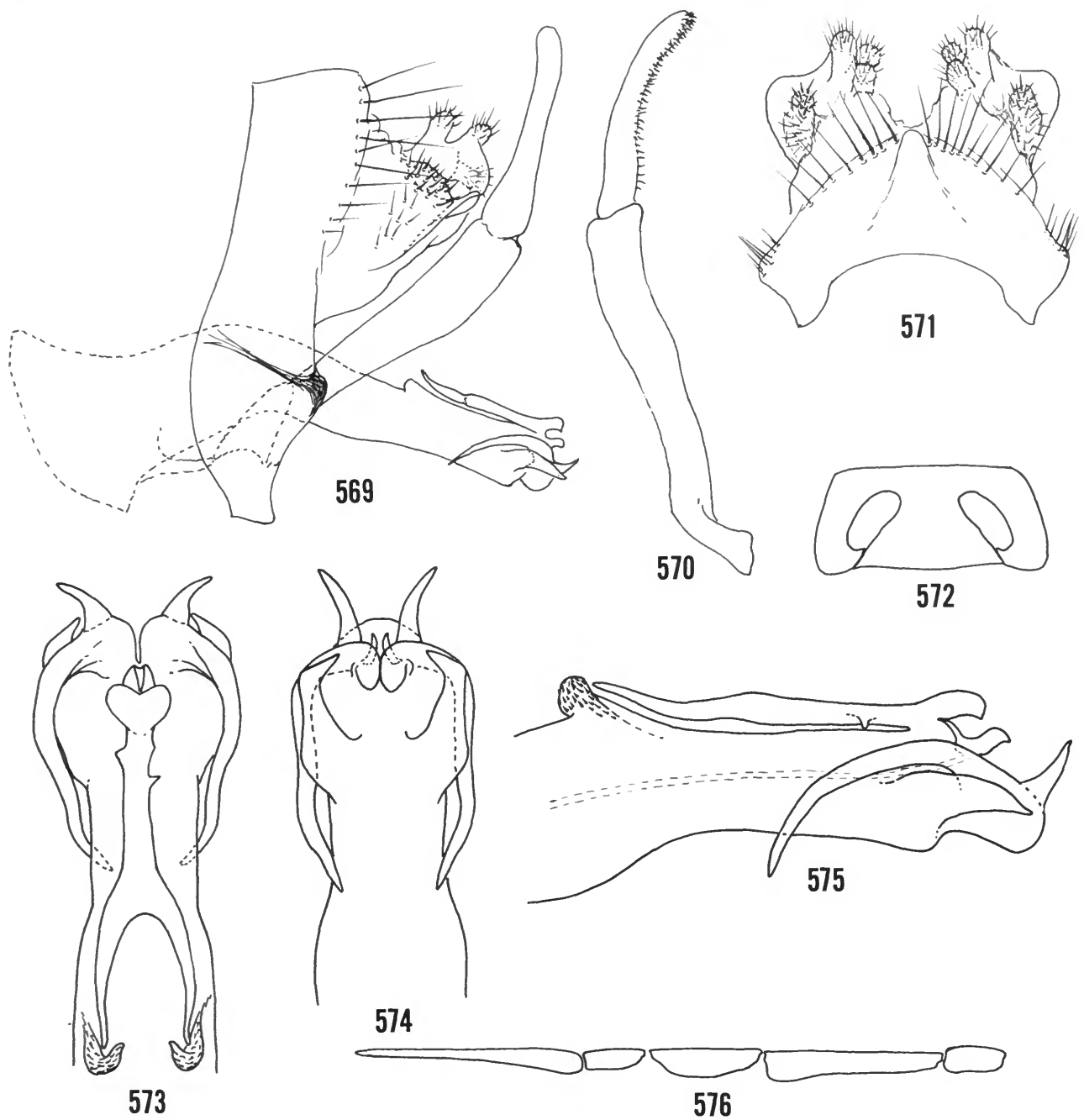




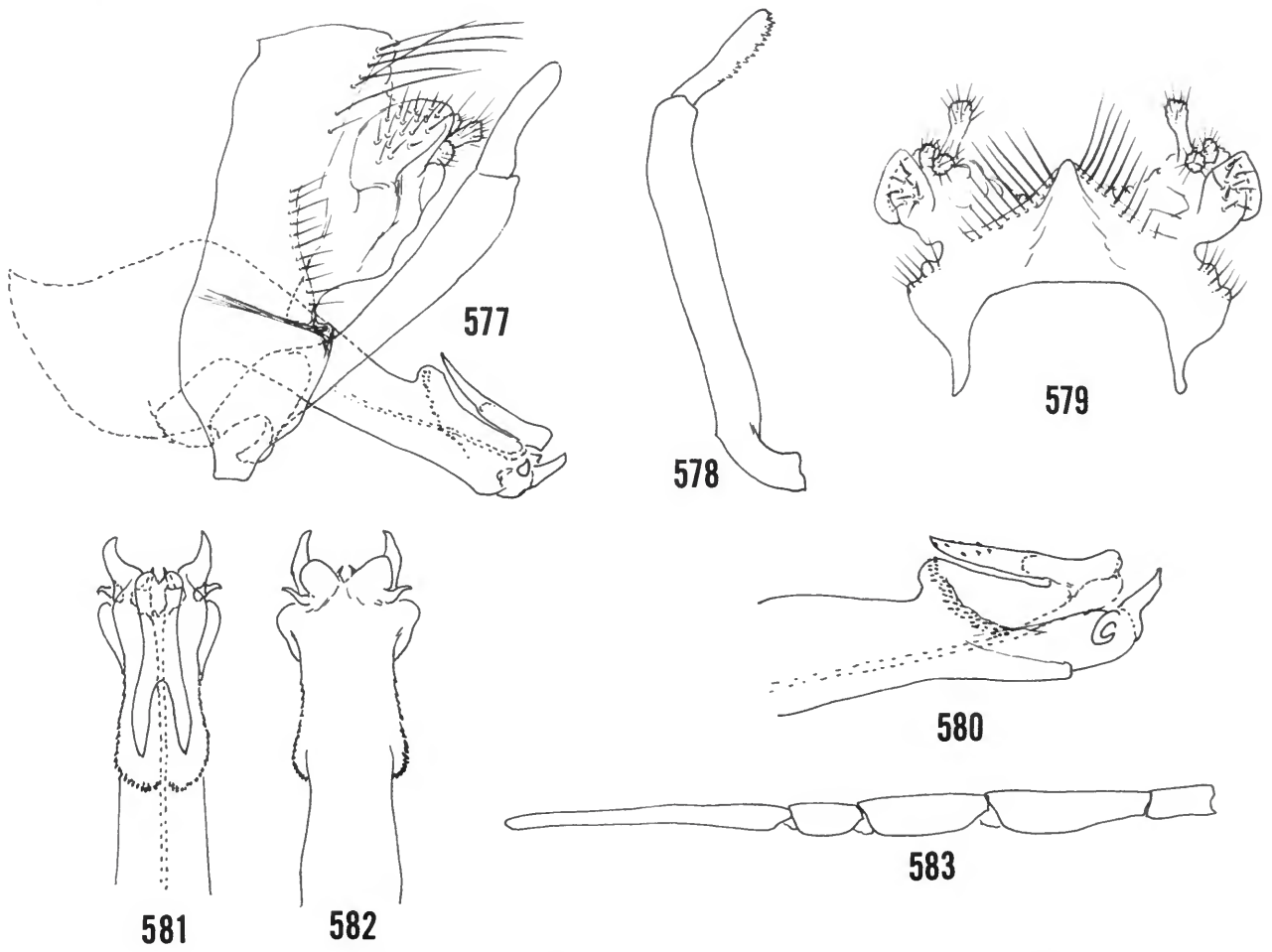
FIGURES 554-560.—*Leptonema vitum*, new species, male: 554, genitalia, lateral; 555, clasper, posteroventral; 556, ninth and tenth terga, dorsal; 557, apex of phallus, lateral; 558, same, dorsal; 559, same, ventral; 560, maxillary palpus, lateral.



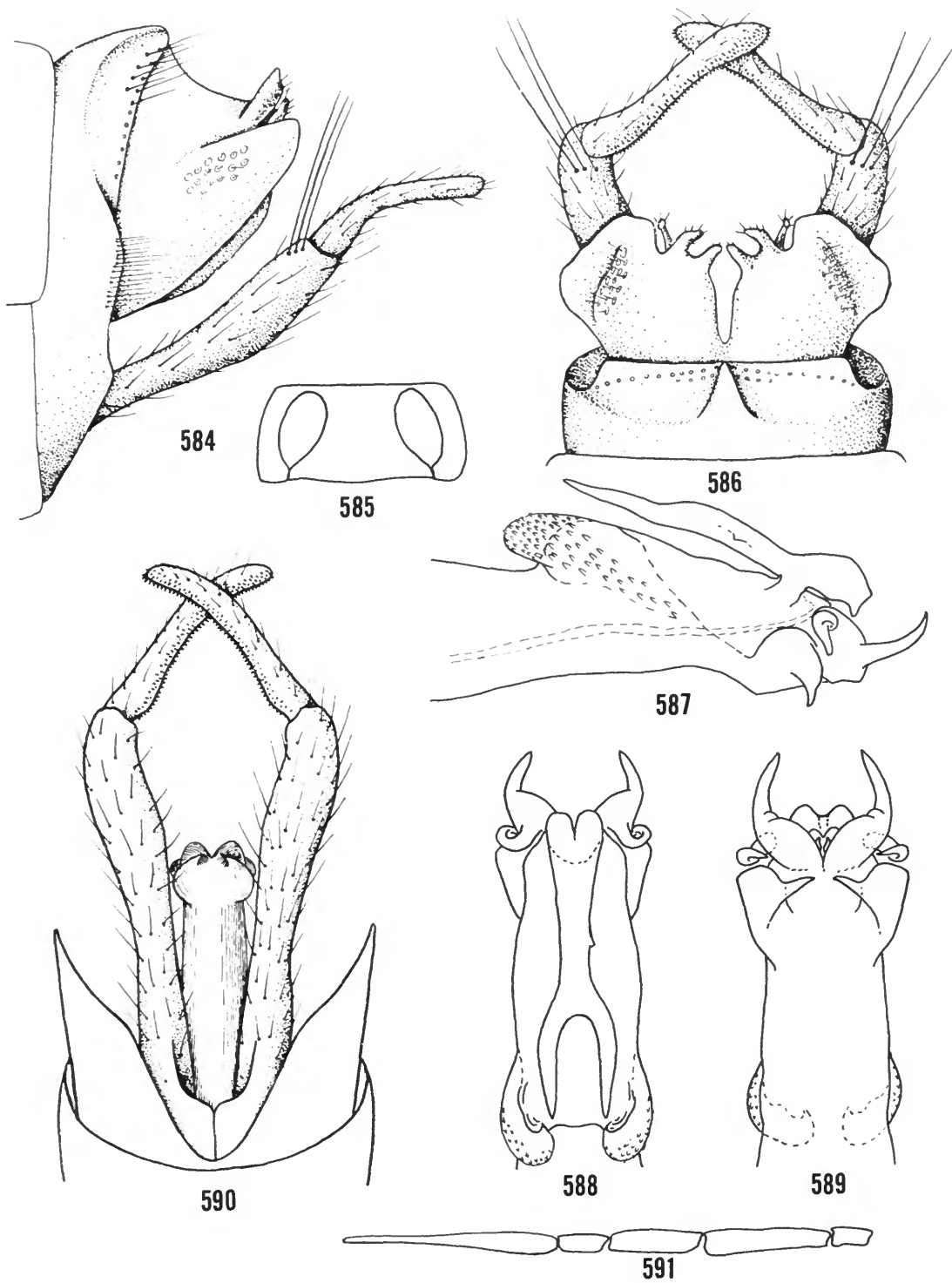
FIGURES 561–568.—*Leptonema woldianum*, new species, male: 561, genitalia, lateral; 562, clasper, poster-  
oventral; 563, ninth and tenth terga, dorsal; 564, apex of phallus, lateral; 565, same, dorsal; 566, same,  
ventral; 567, fifth sternum, ventral; 568, maxillary palpus, lateral.



FIGURES 569–576.—*Leptonema asclepium*, new species, male: 569, genitalia, lateral; 570, clasper, postero-ventral; 571, ninth and tenth terga, dorsal; 572, fifth sternum, ventral; 573, apex of phallus, dorsal; 574, same, ventral; 575, same, lateral; 576, maxillary palpus, lateral.

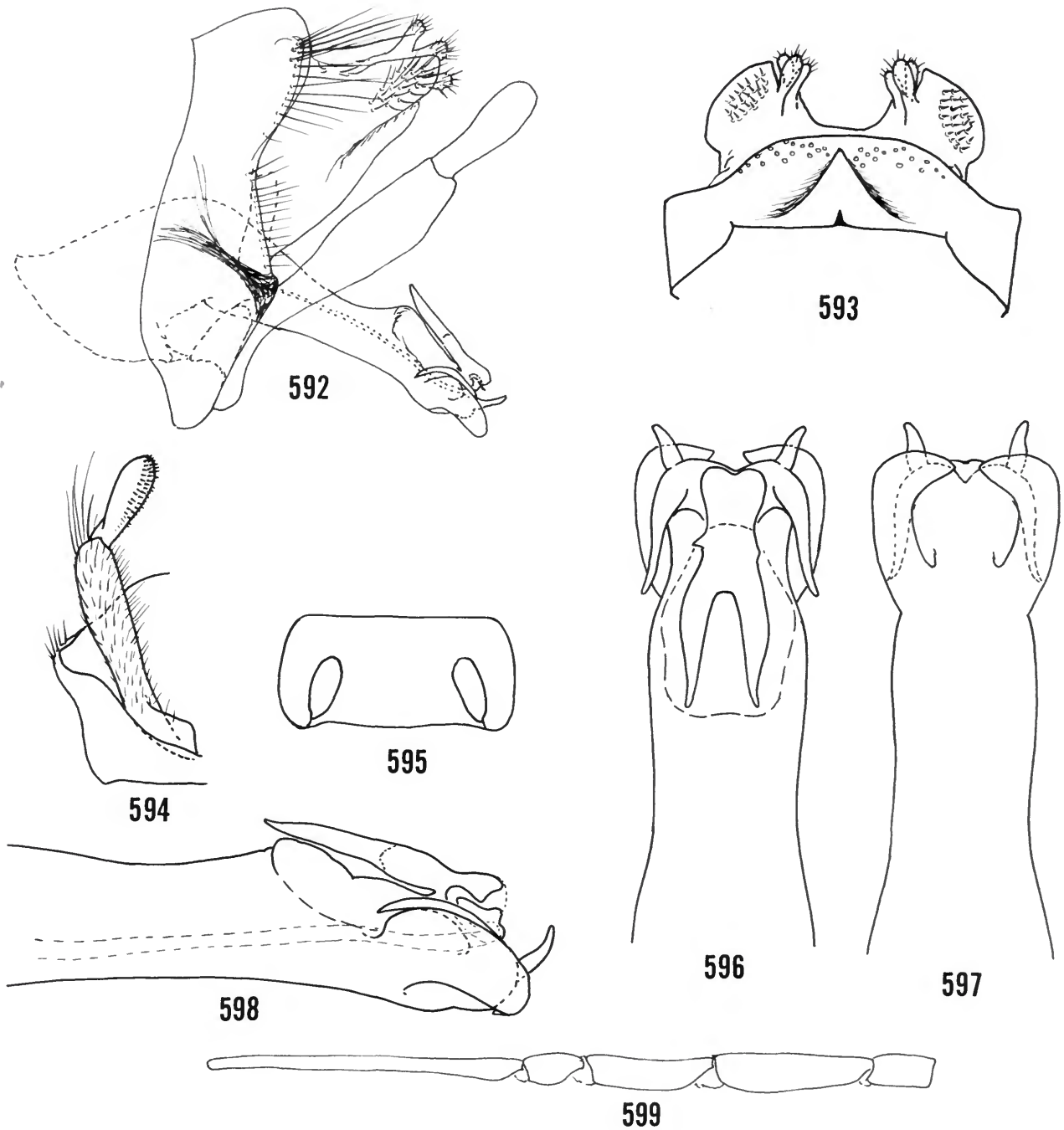


FIGURES 577-583.—*Leptonema campanum*, new species, male: 577, genitalia, lateral; 578, clasper, poster-  
oventral; 579, ninth and tenth terga, dorsal; 580, apex of phallus, lateral; 581, same, dorsal; 582, same,  
ventral; 583, maxillary palpus, lateral.

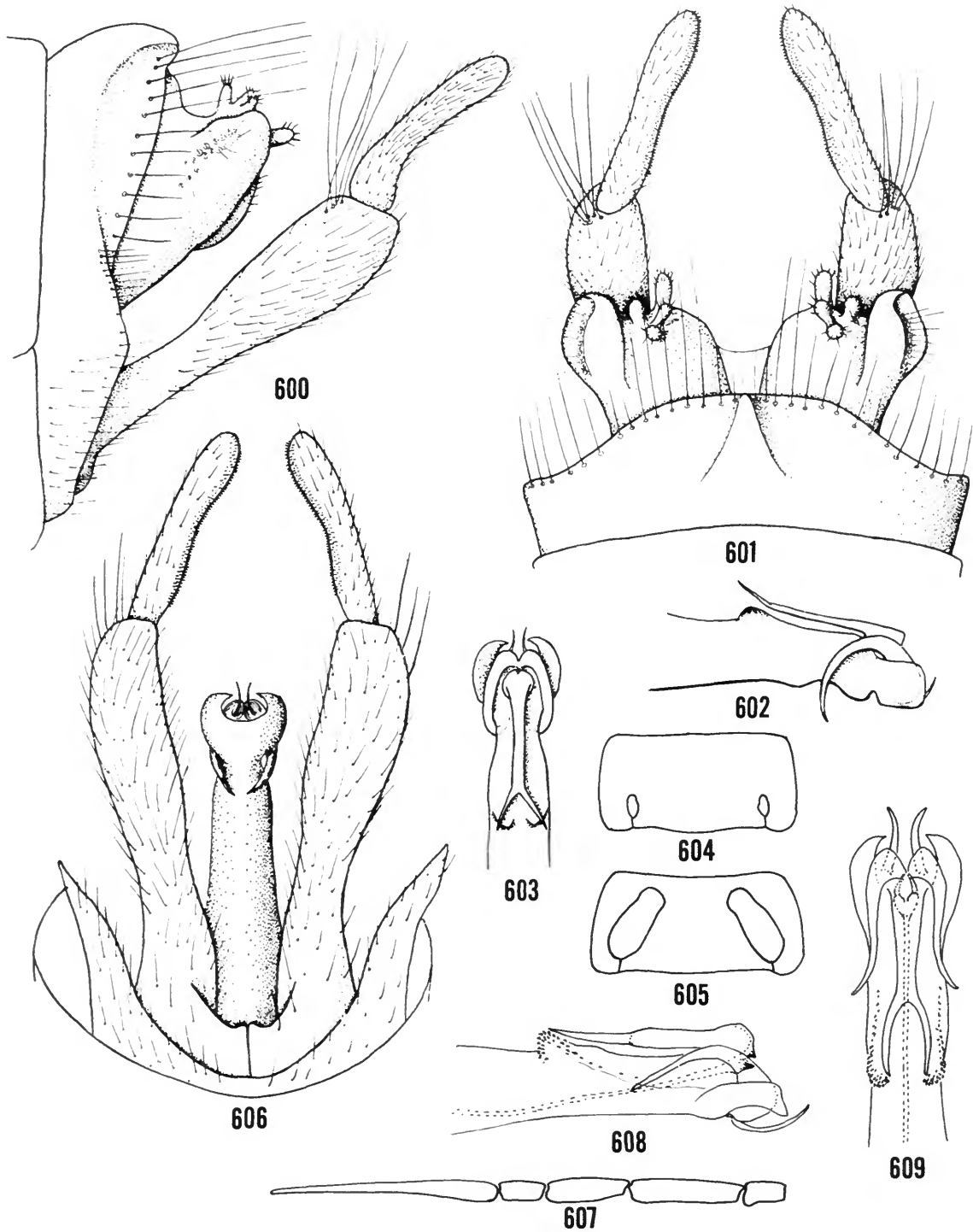


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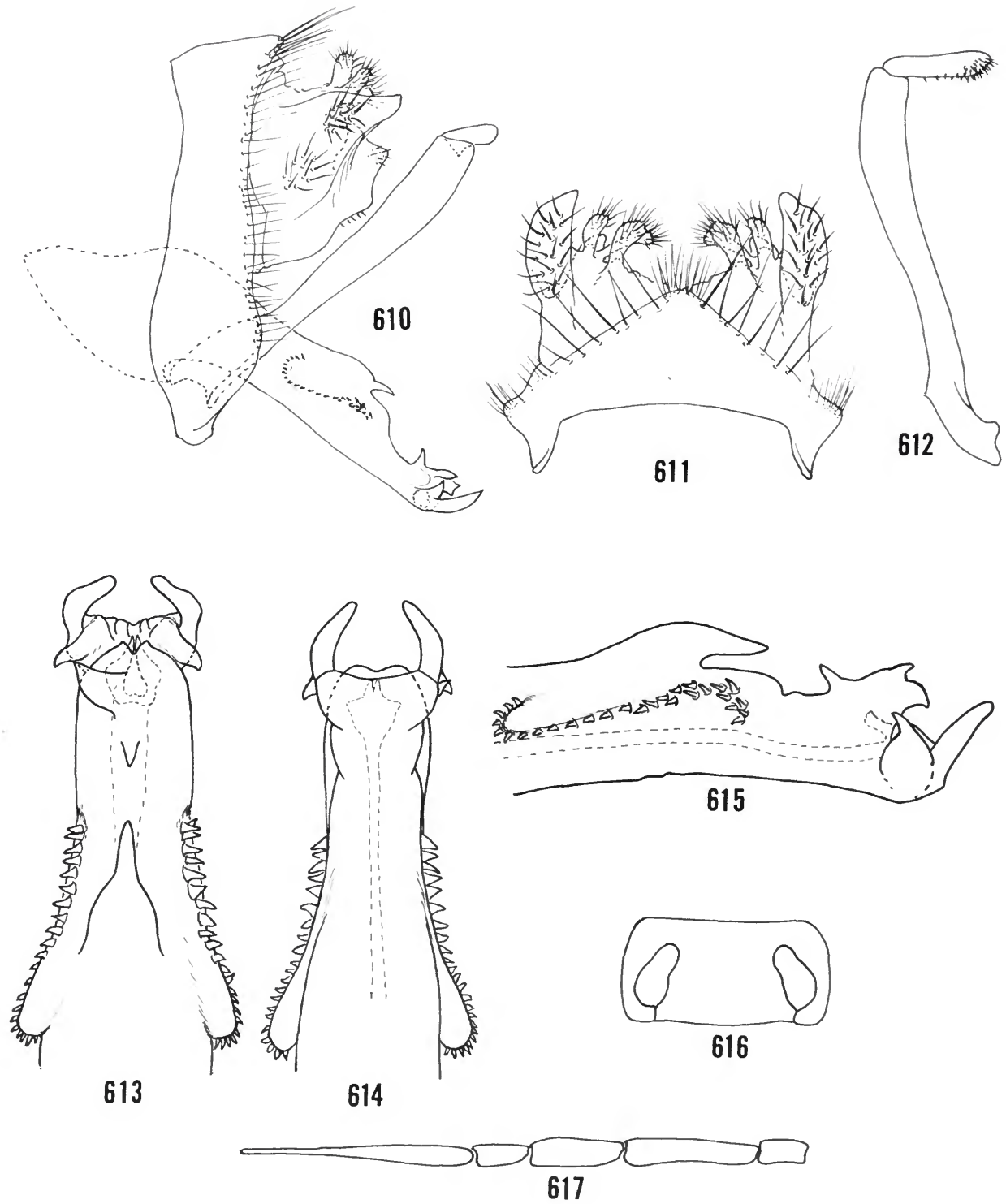




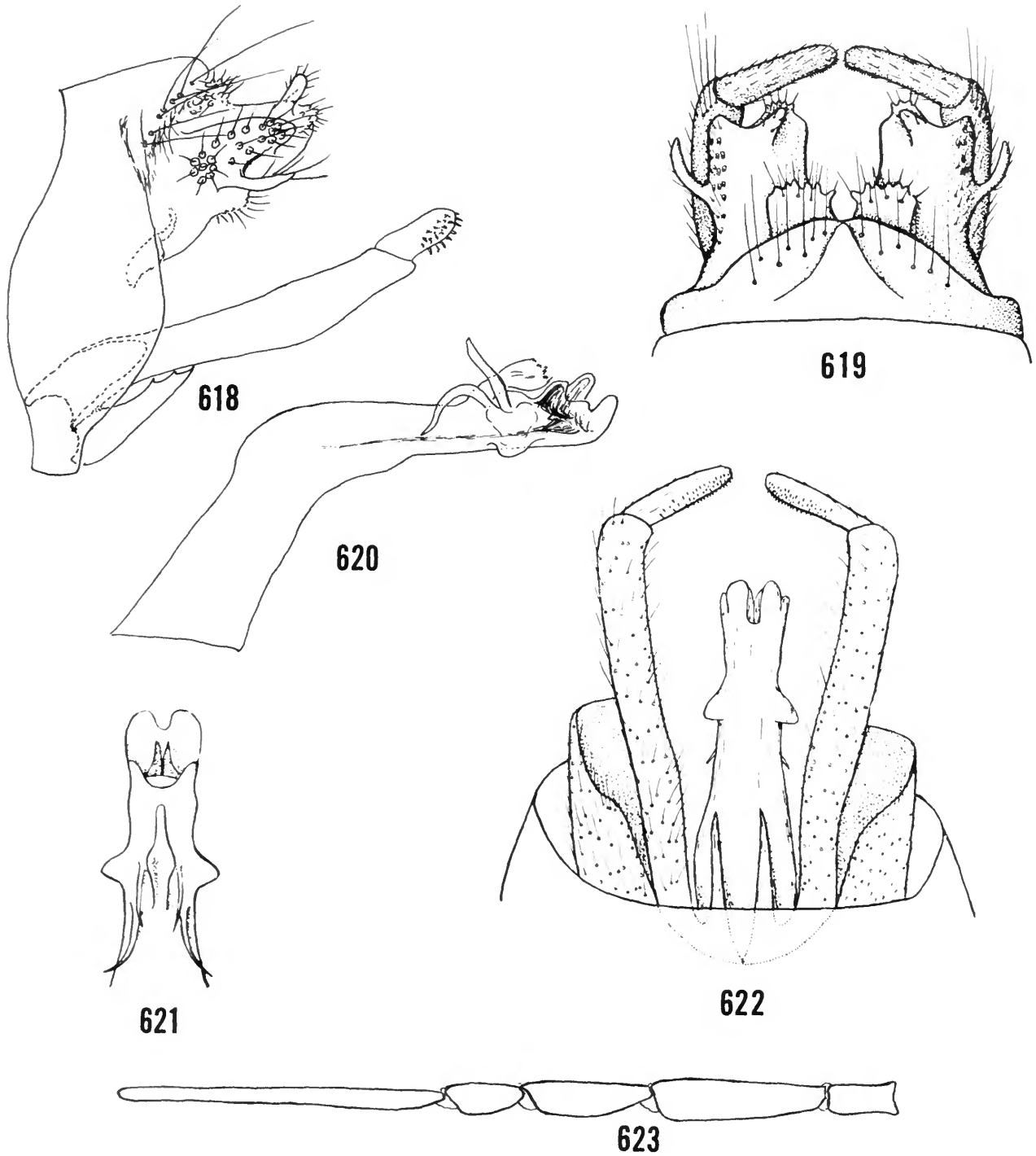
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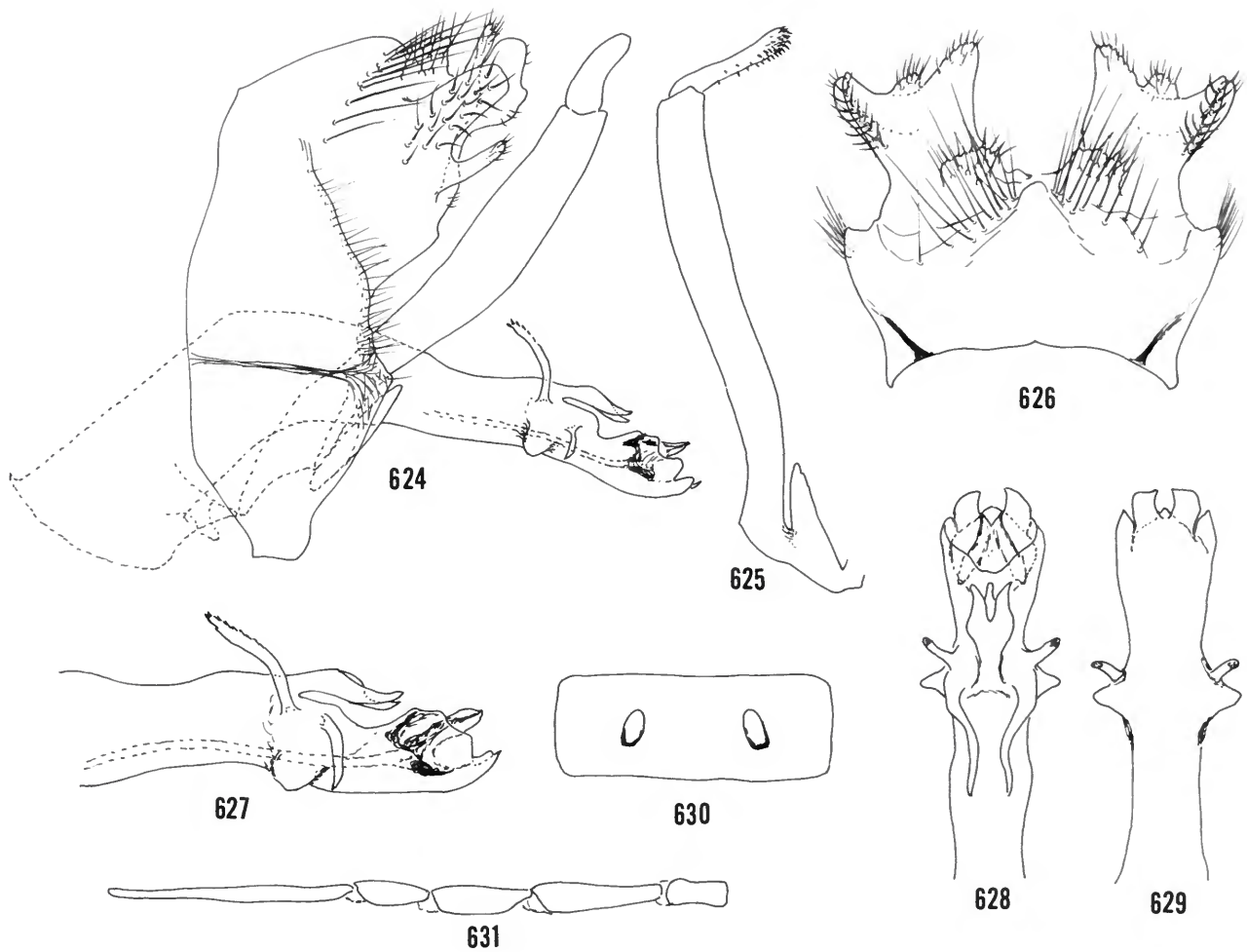
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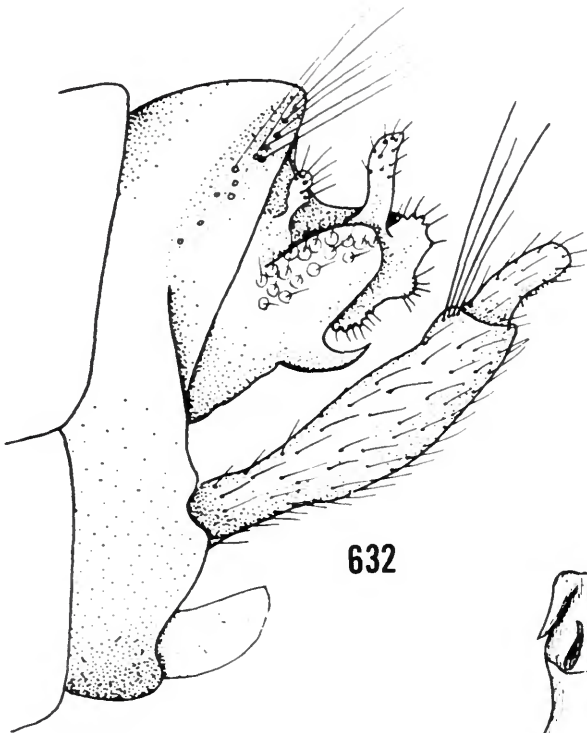


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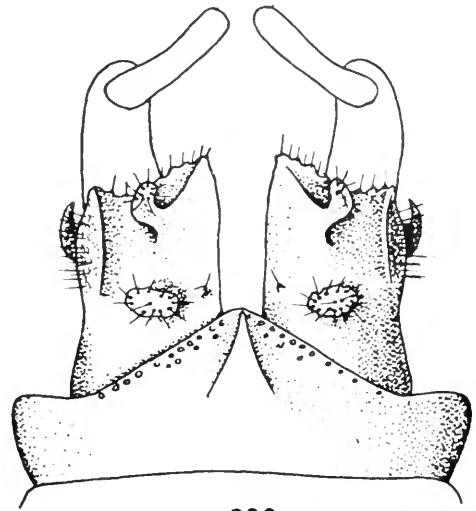


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ventral; 630, fifth sternum, ventral; 631, maxillary palpus, lateral.





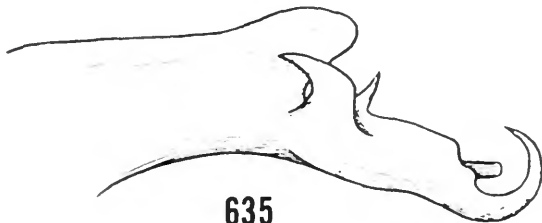
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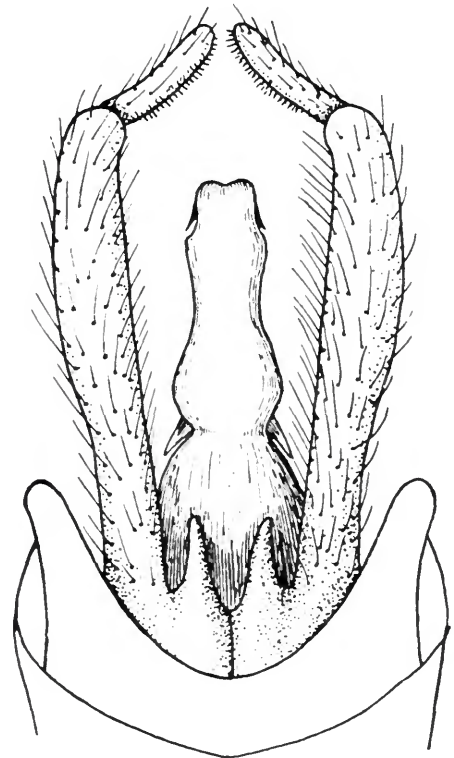
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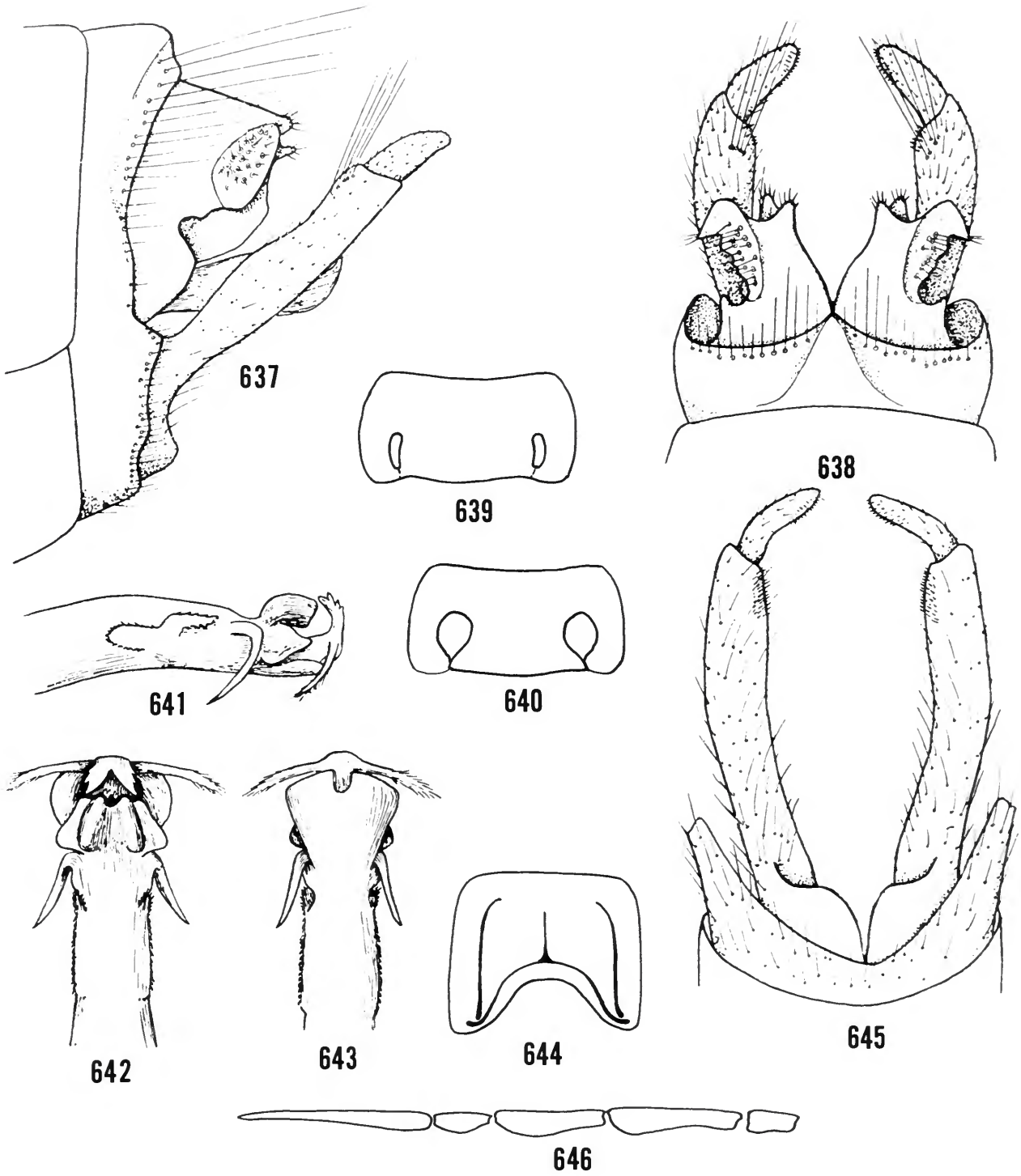


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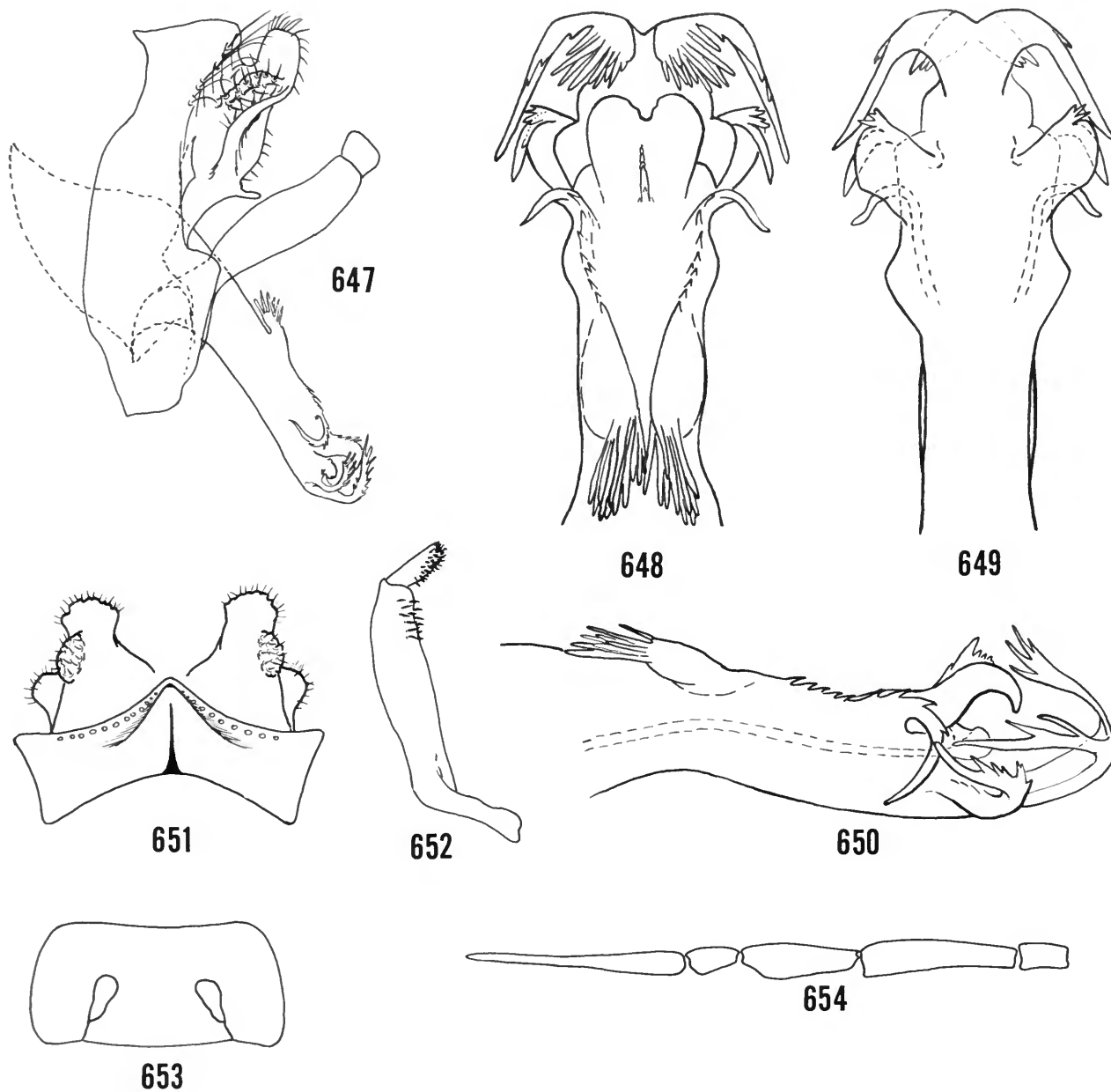


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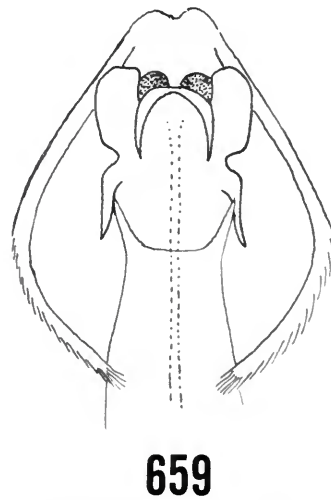
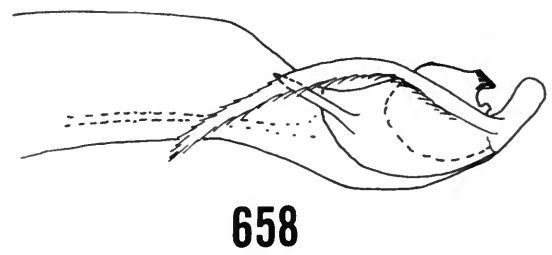
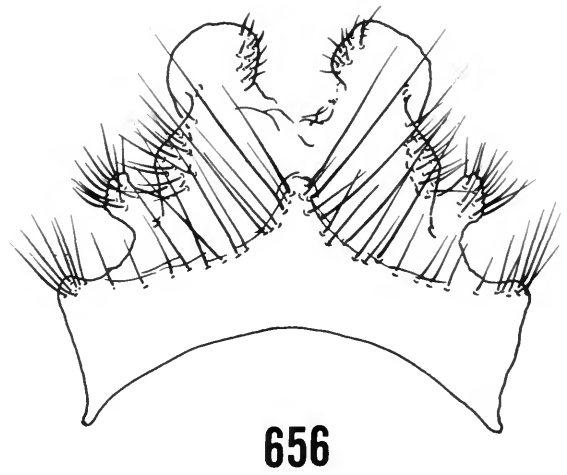
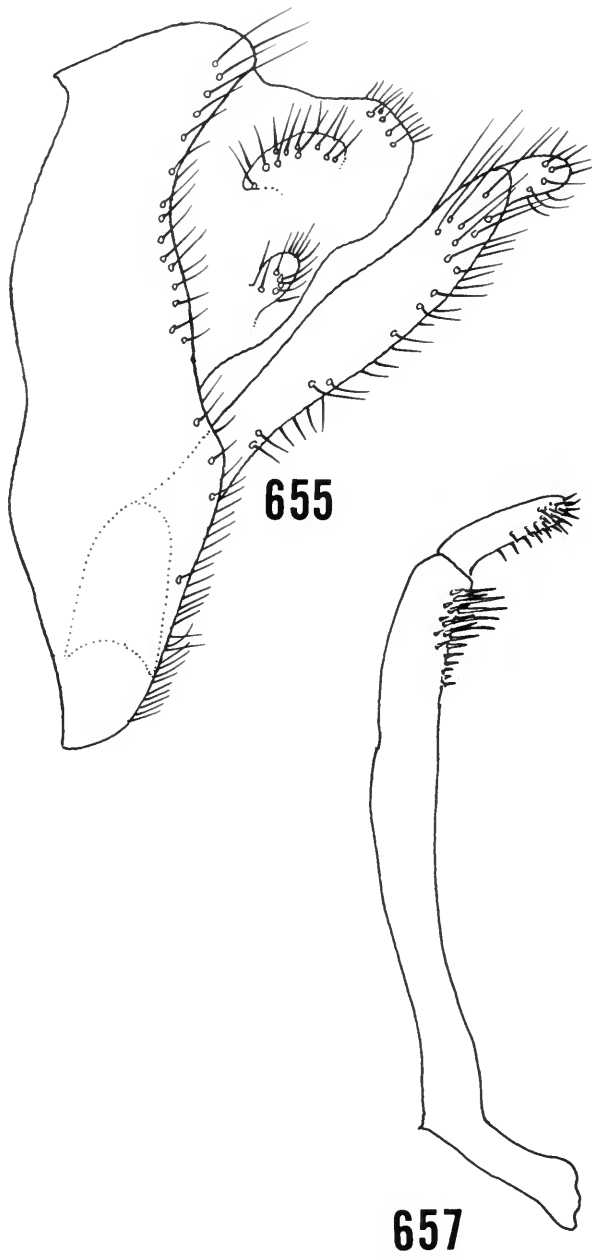
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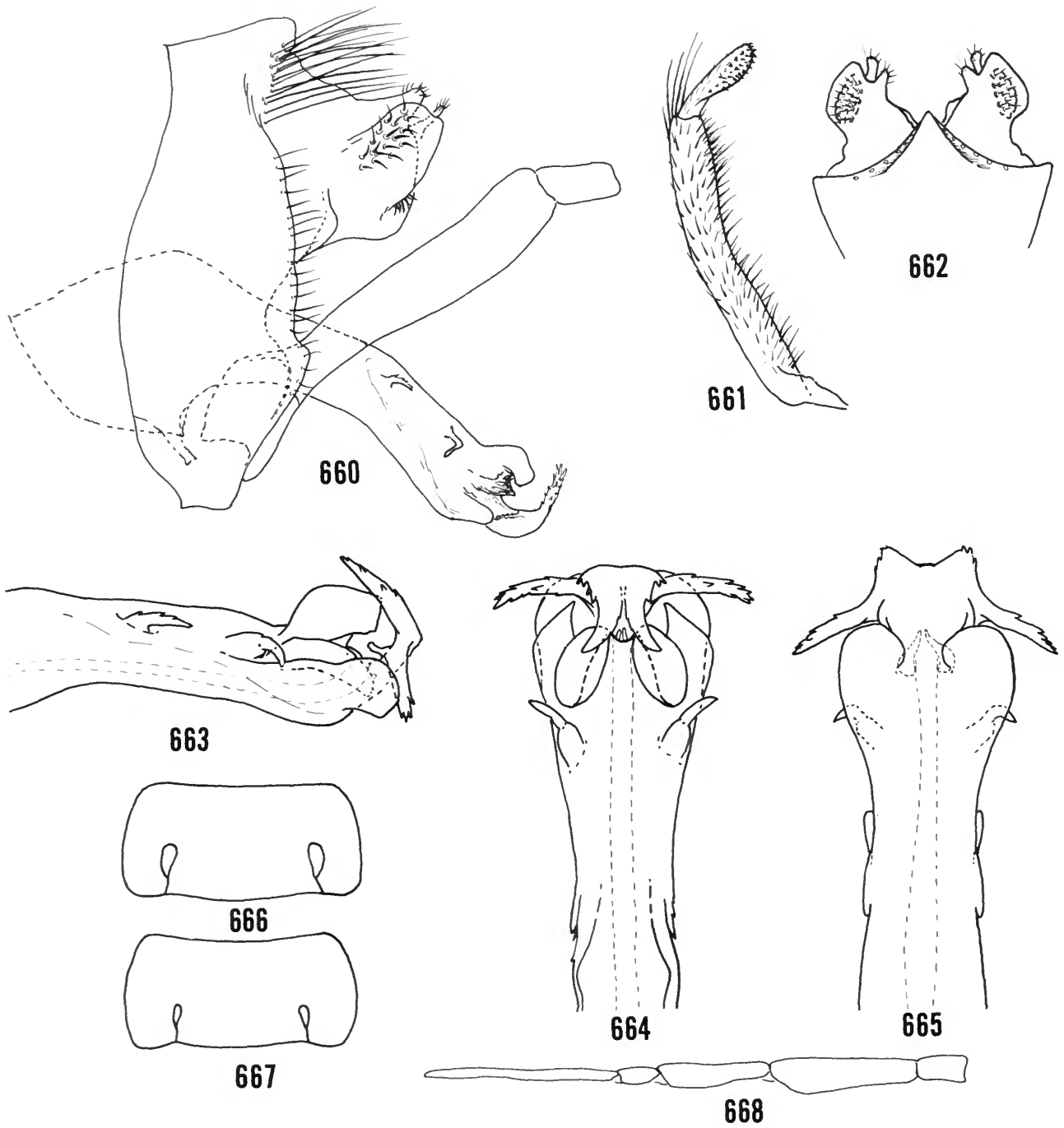
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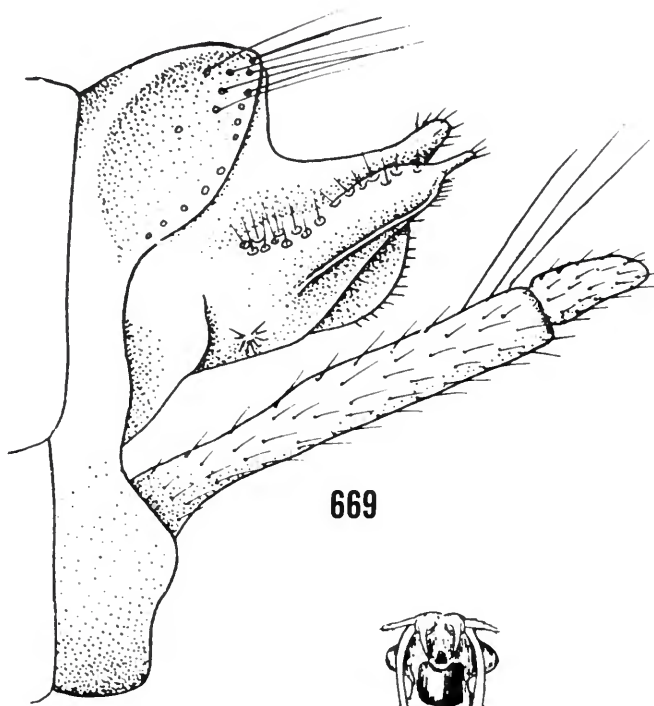


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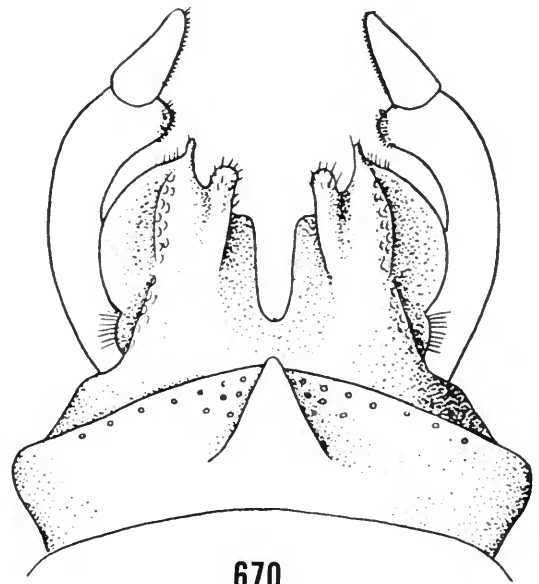


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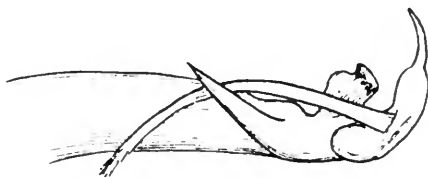
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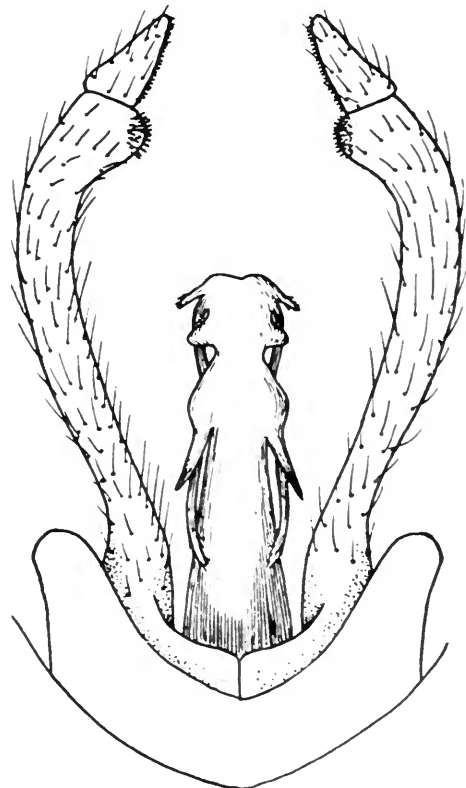
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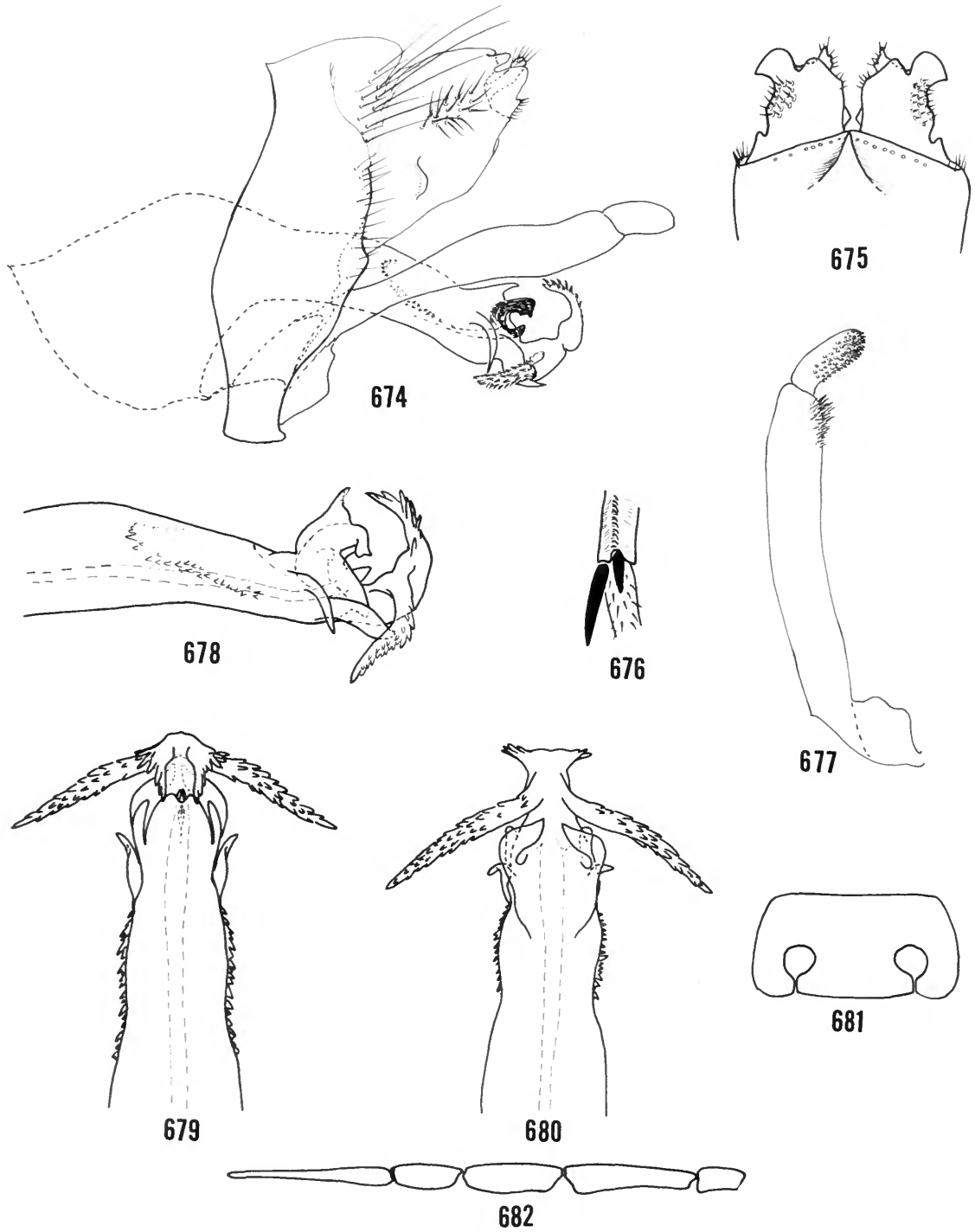


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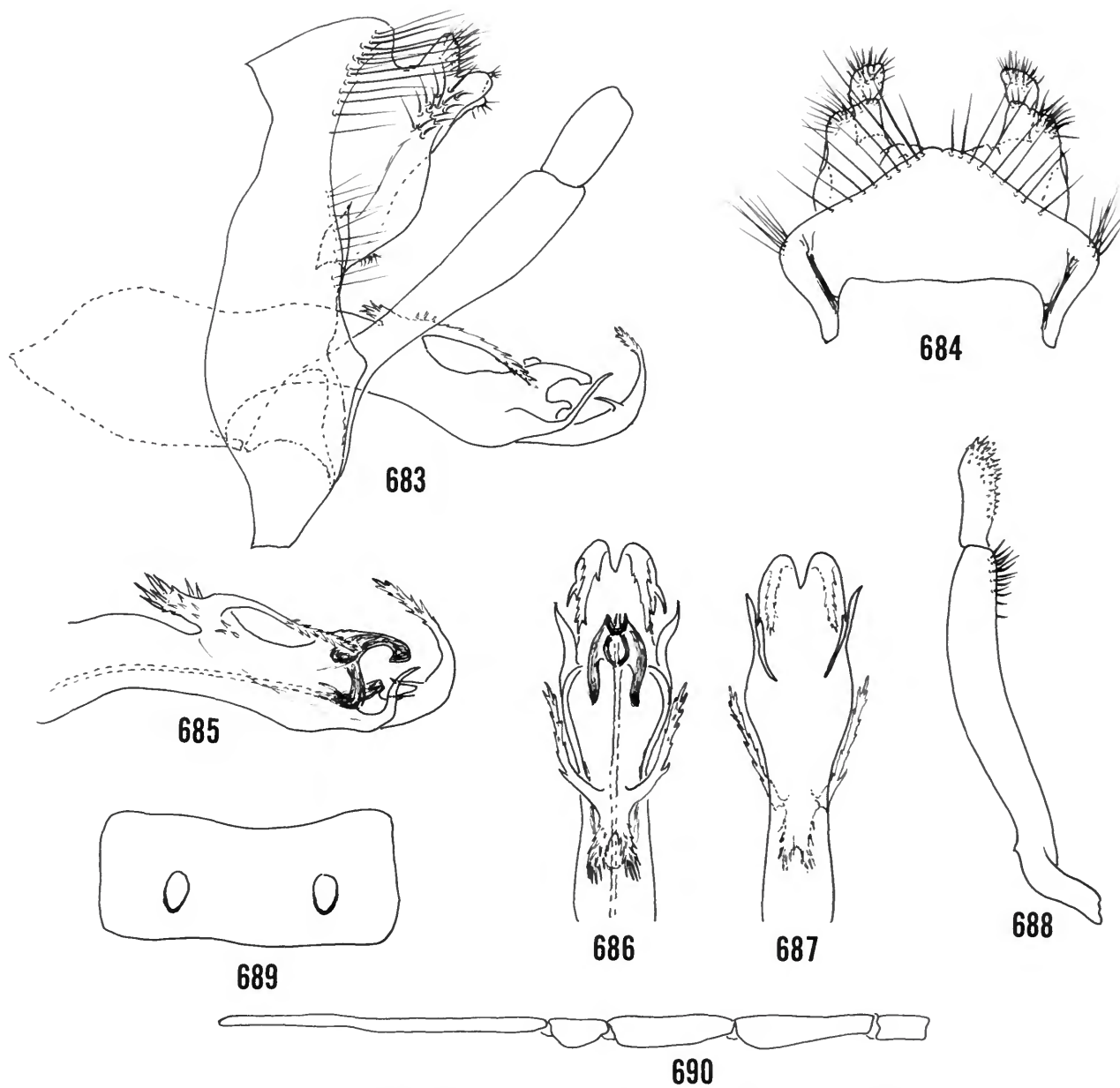


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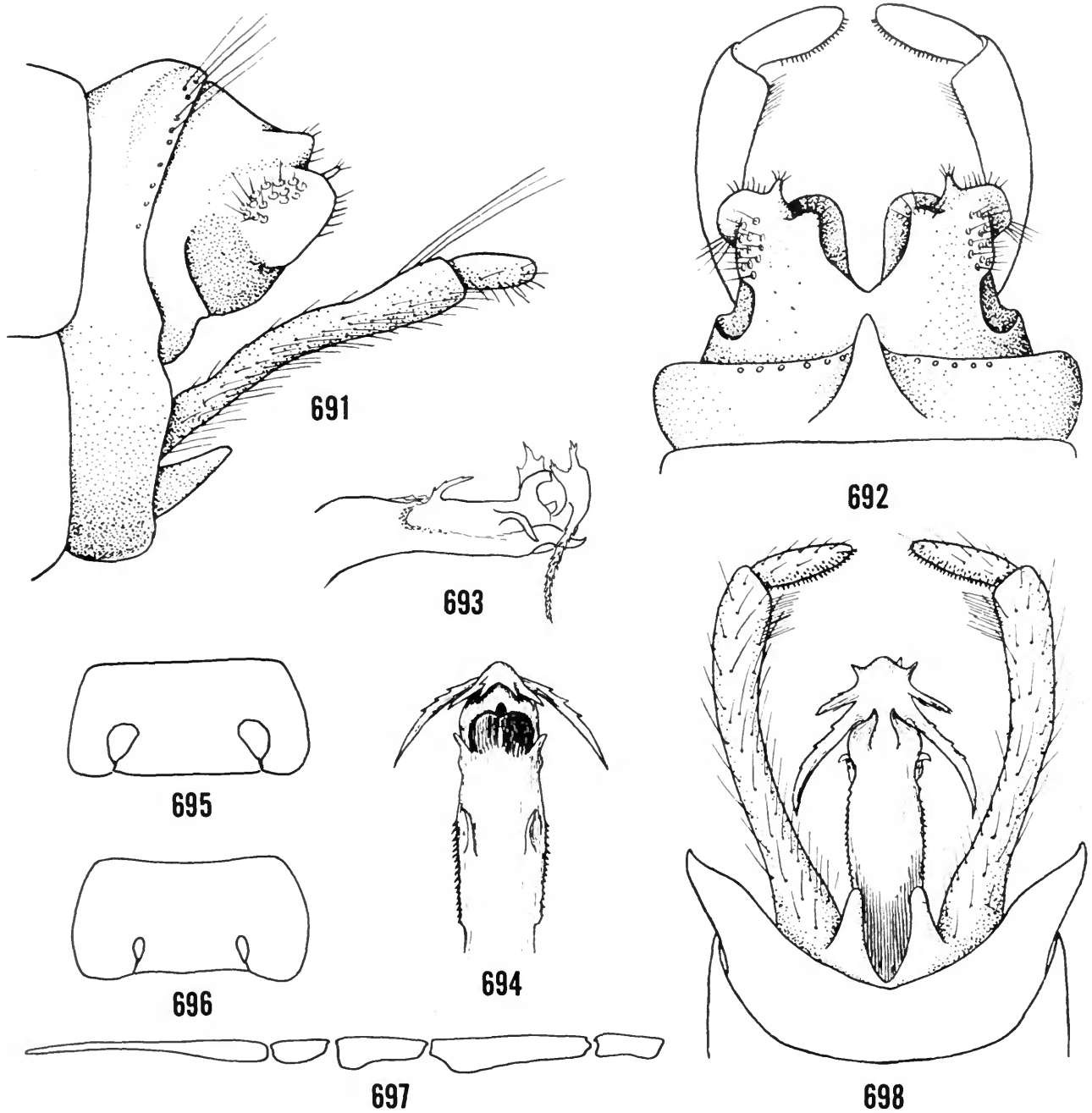
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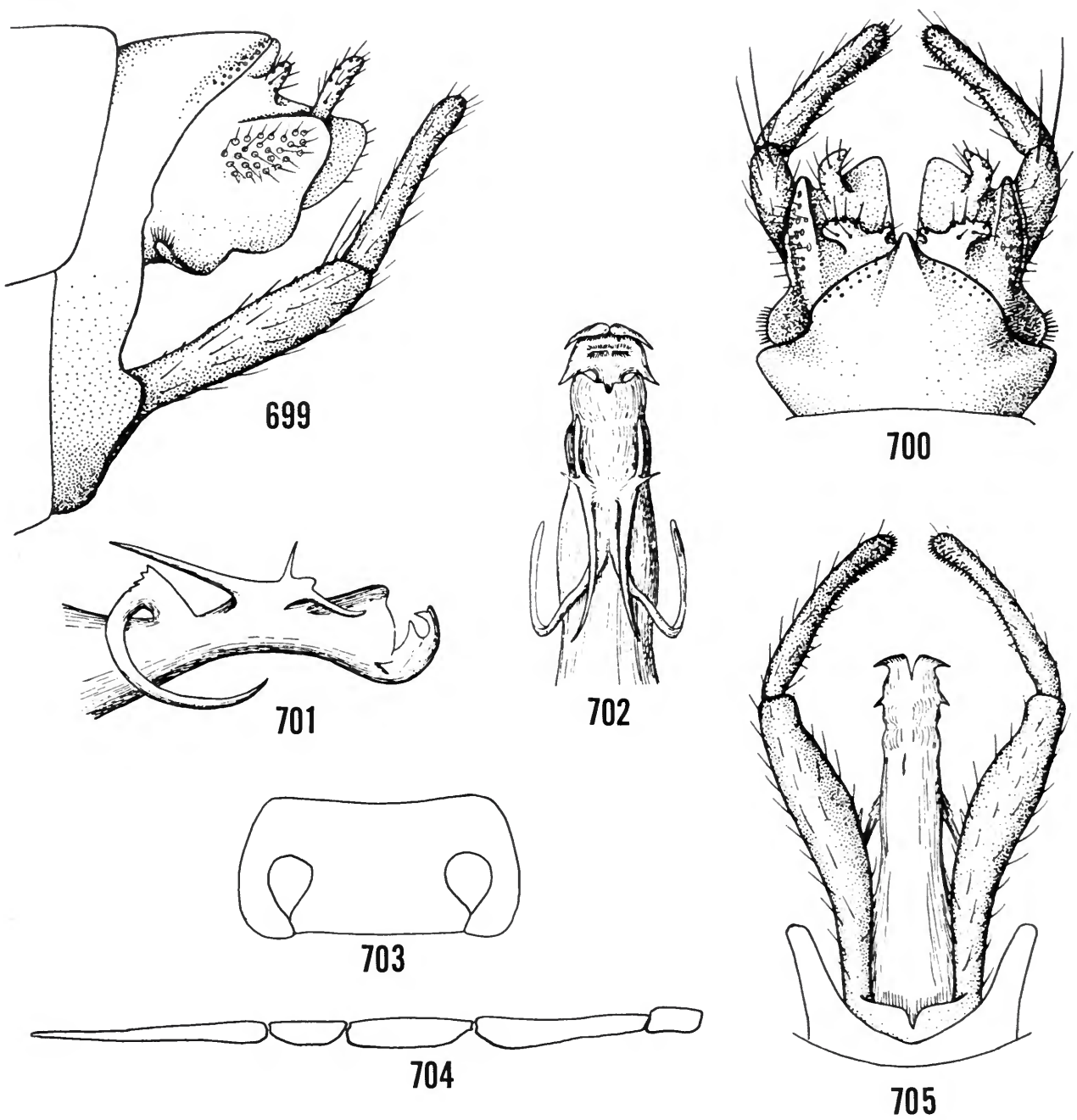
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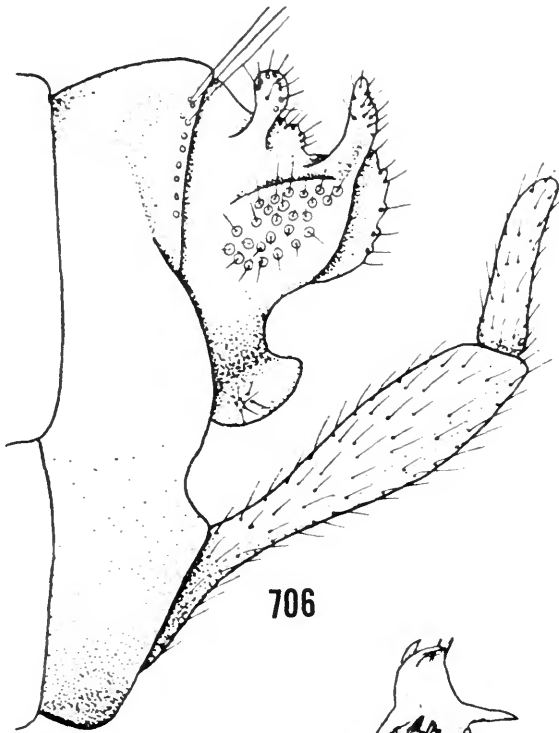


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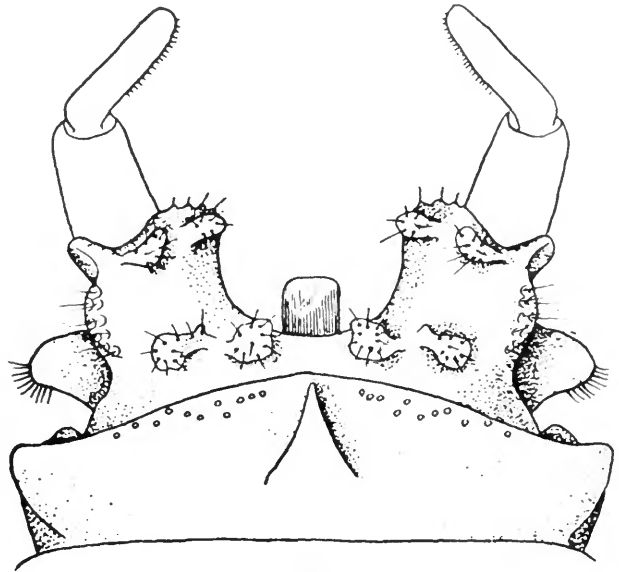


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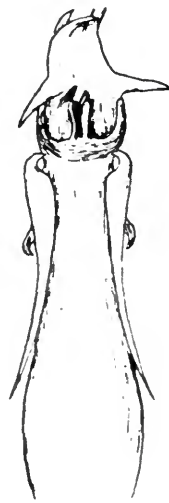




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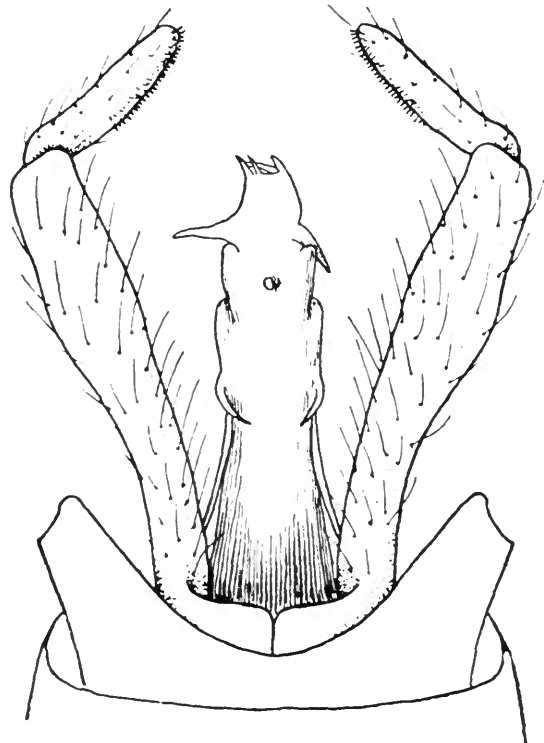
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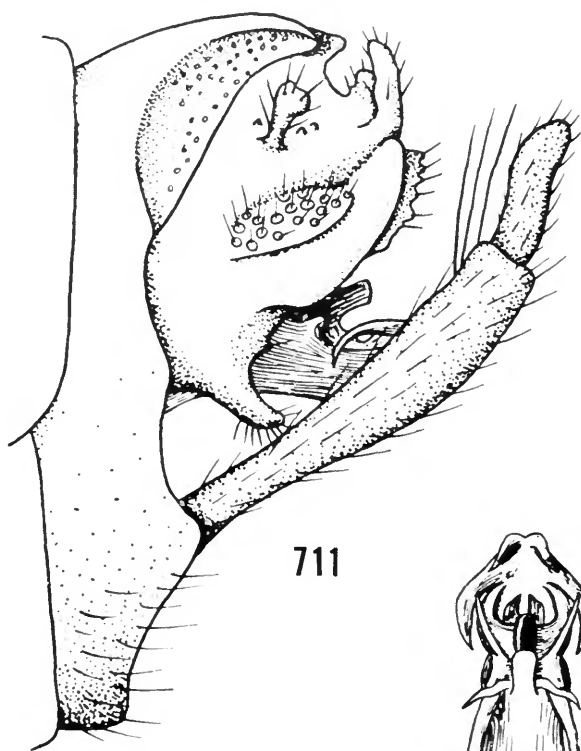


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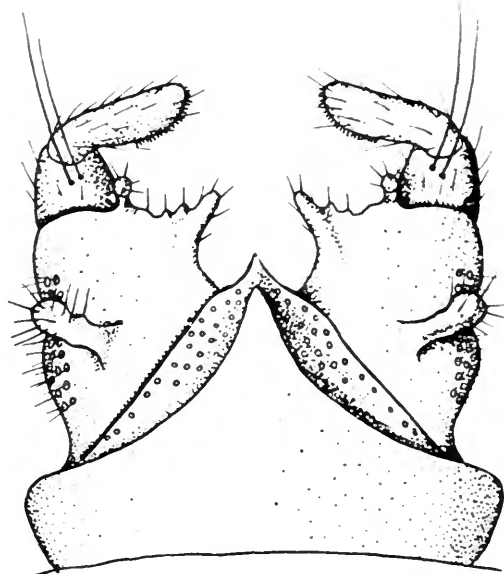


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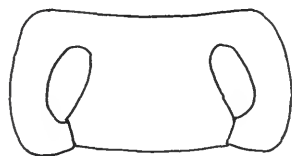
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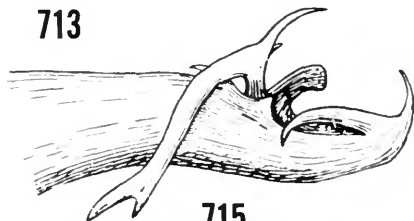
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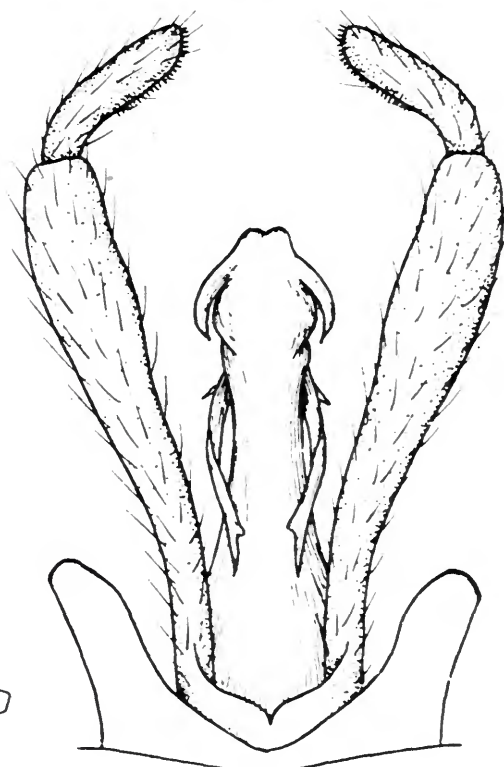
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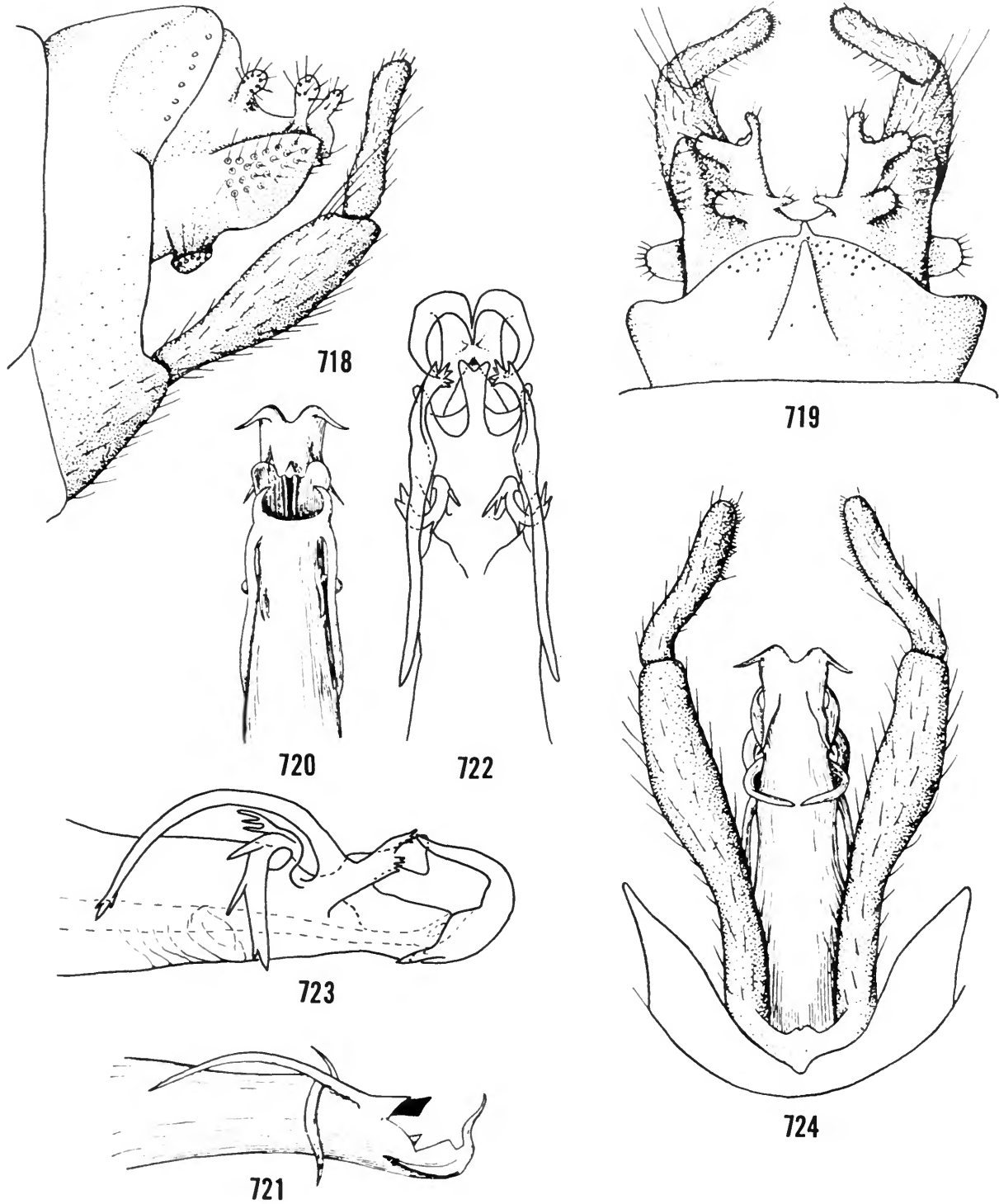


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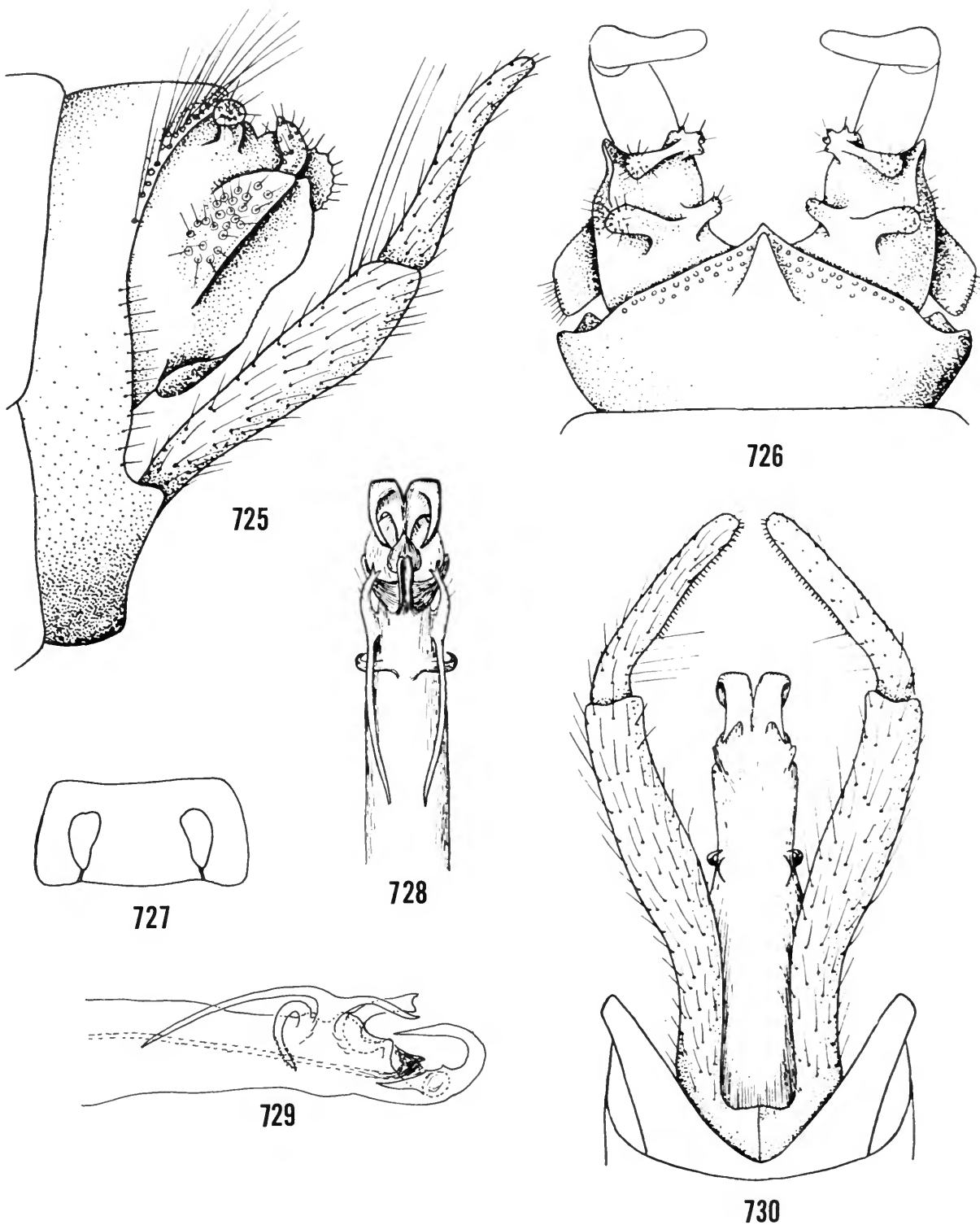


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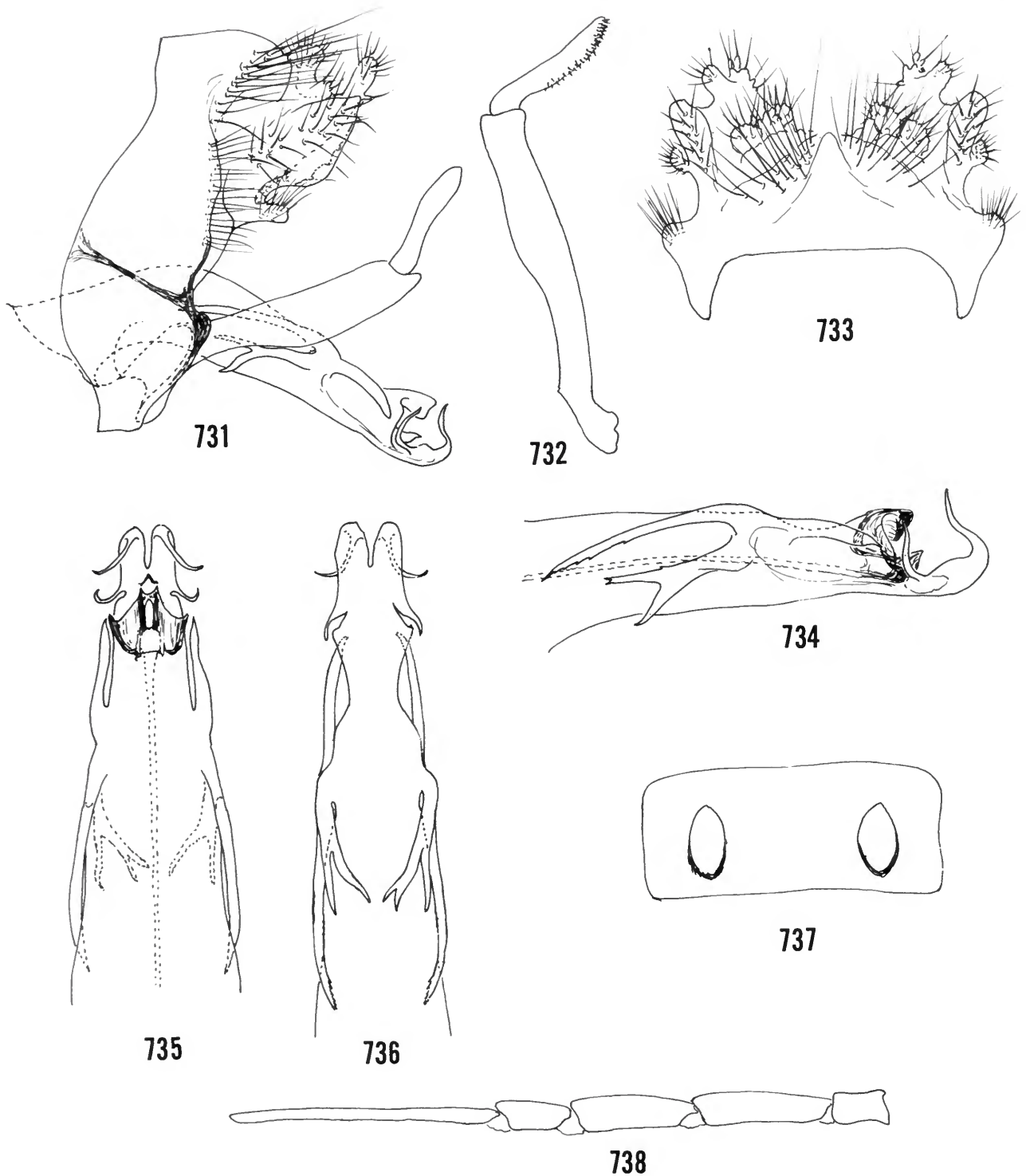
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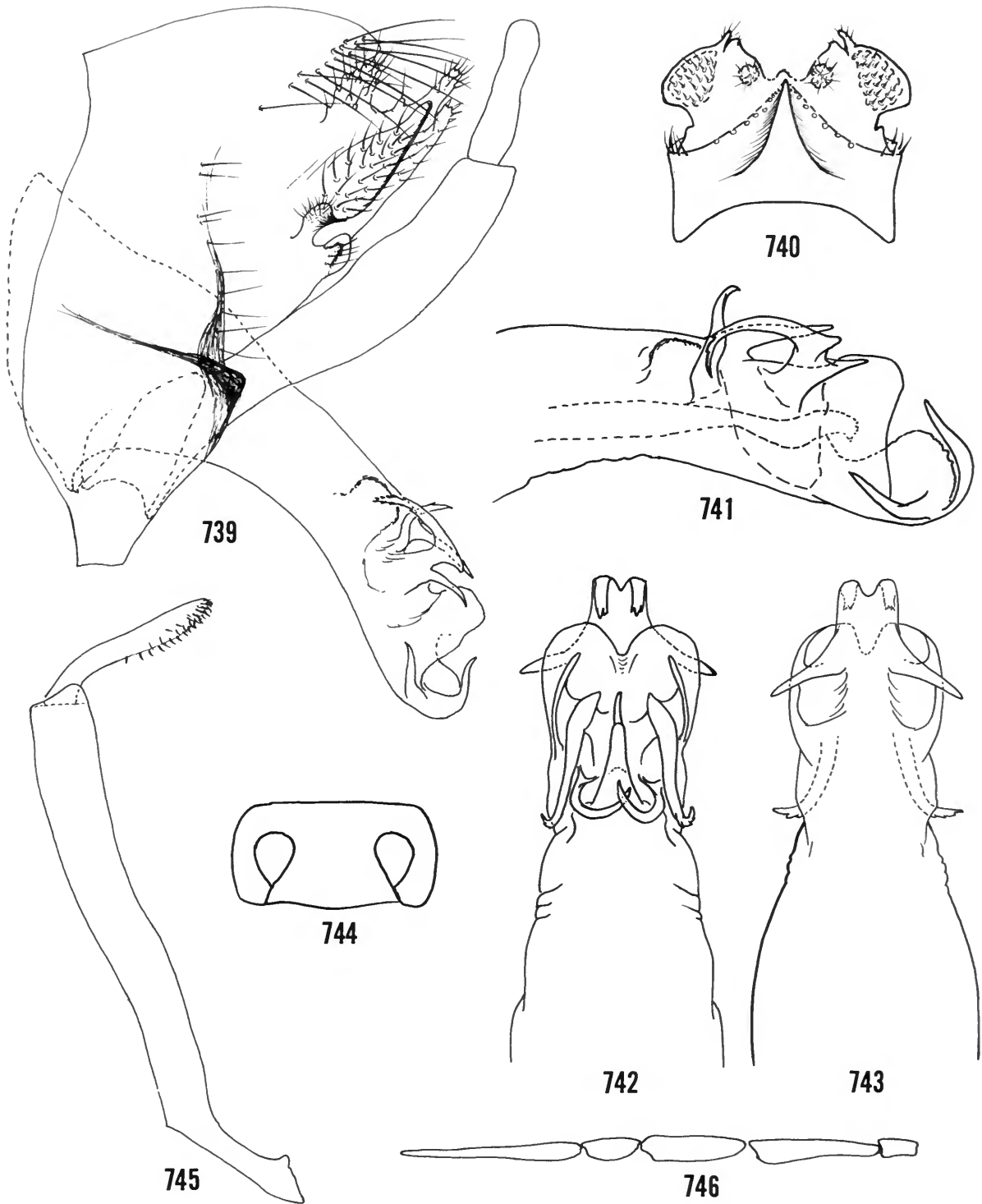


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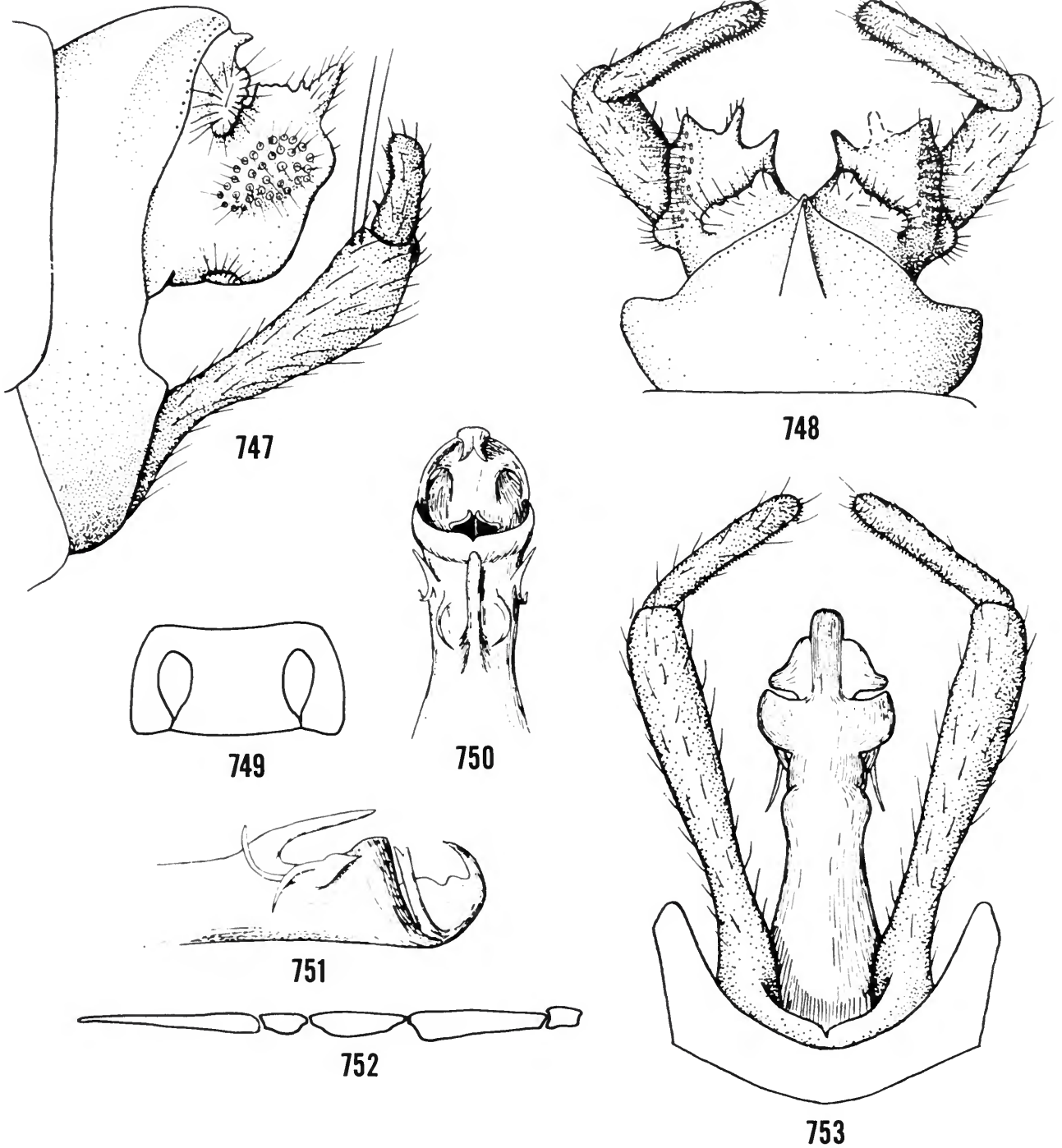


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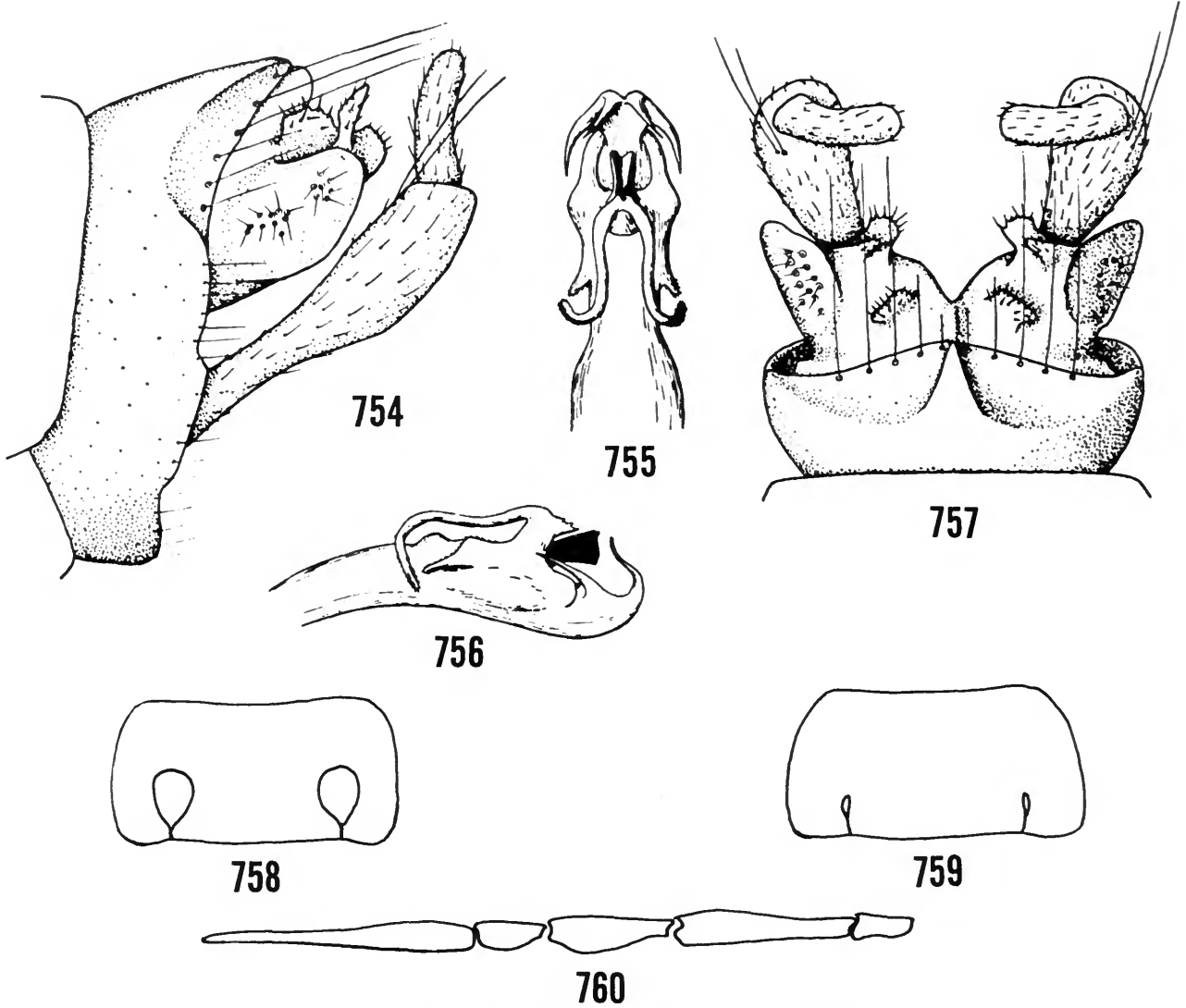




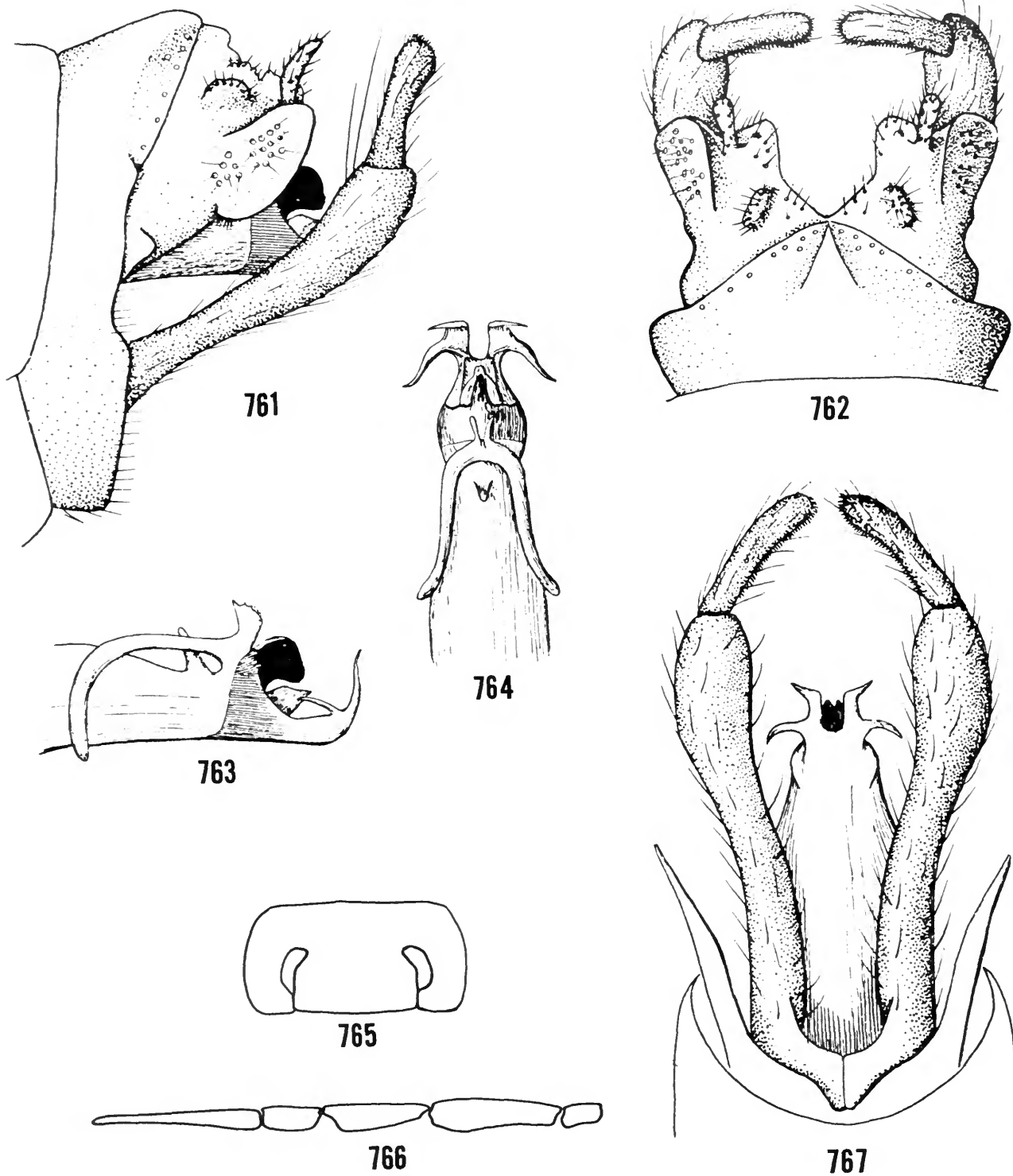
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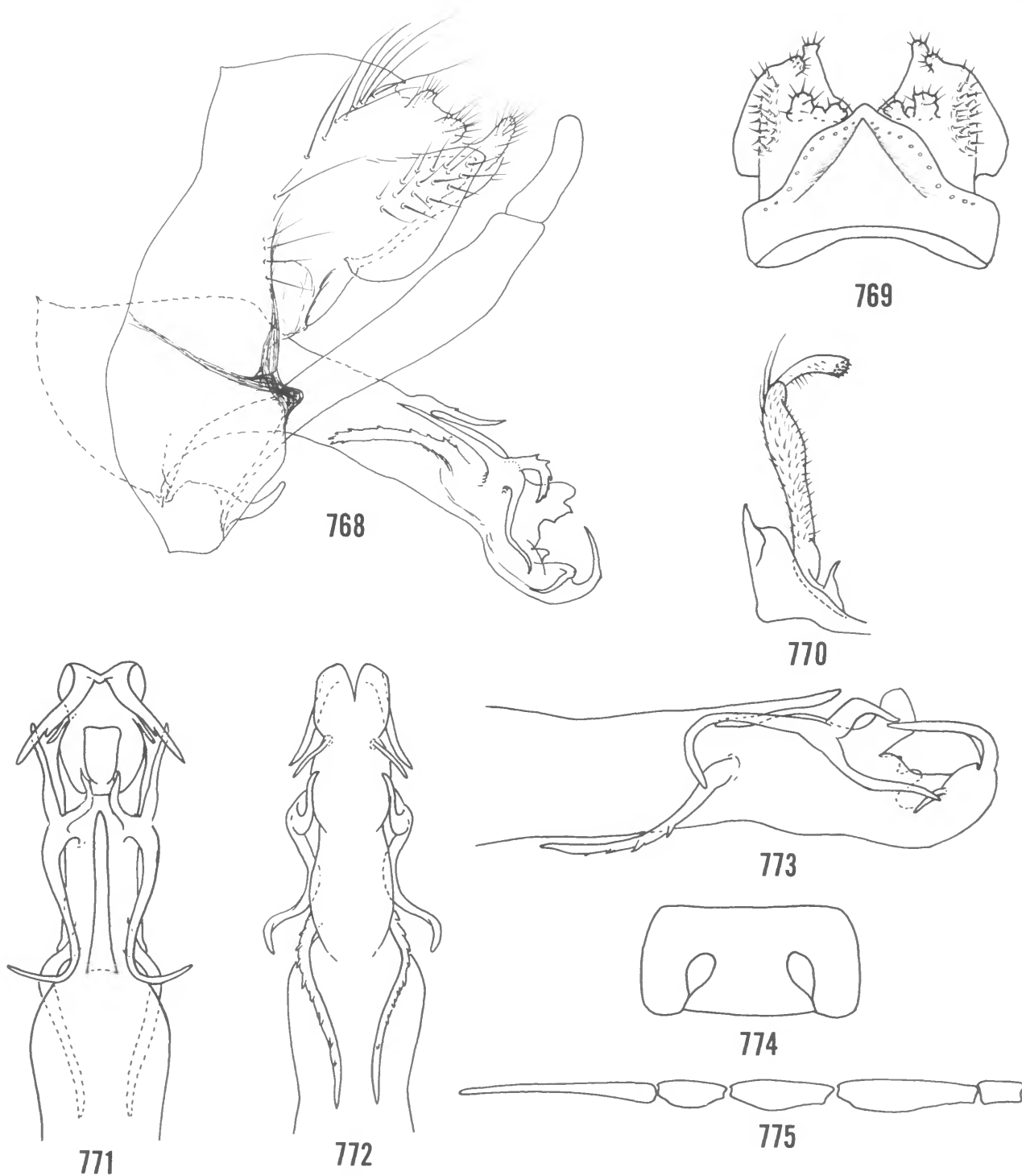
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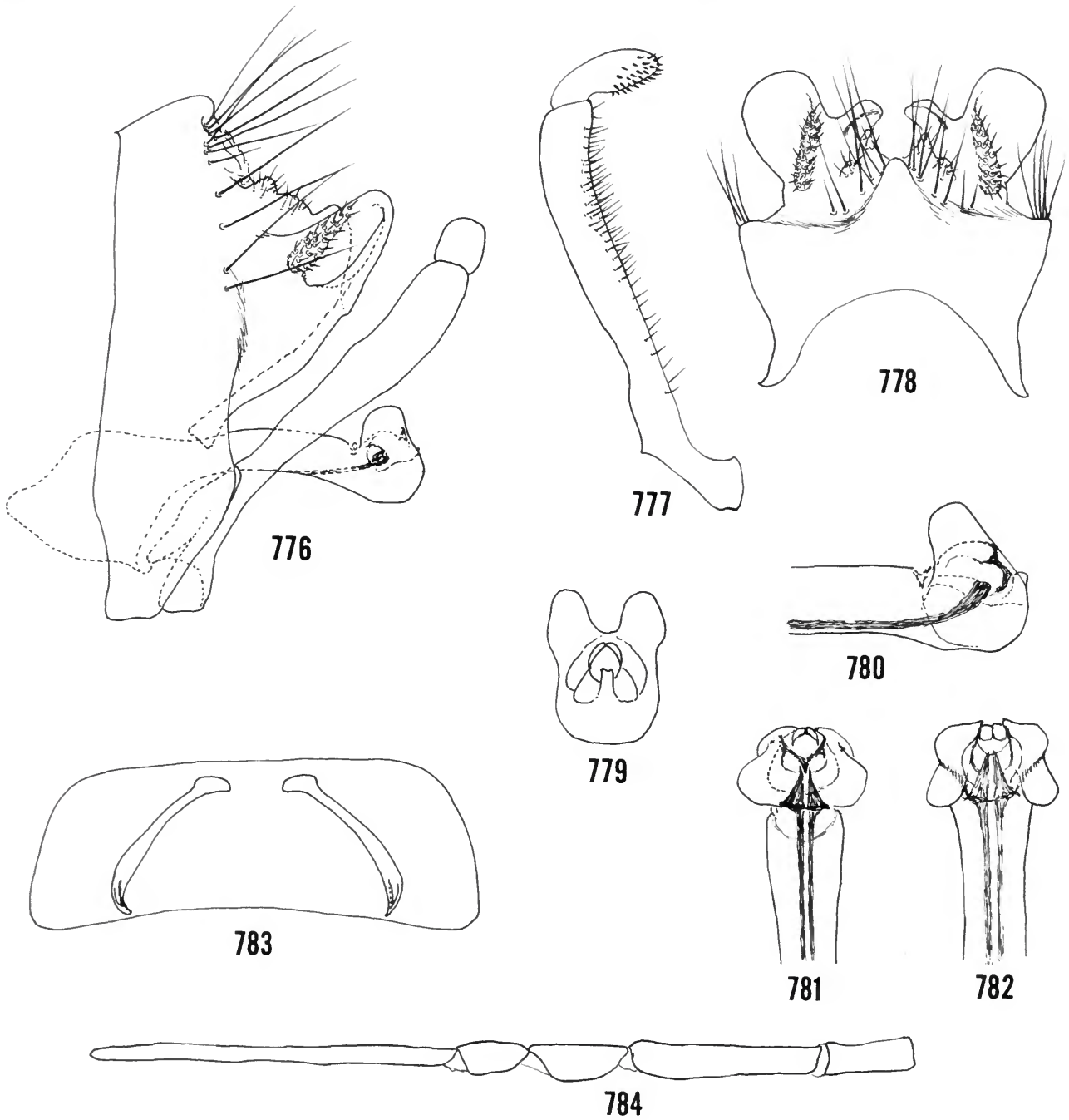


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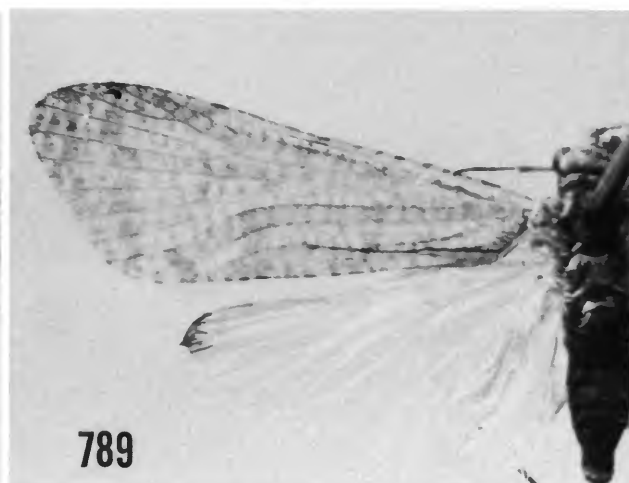
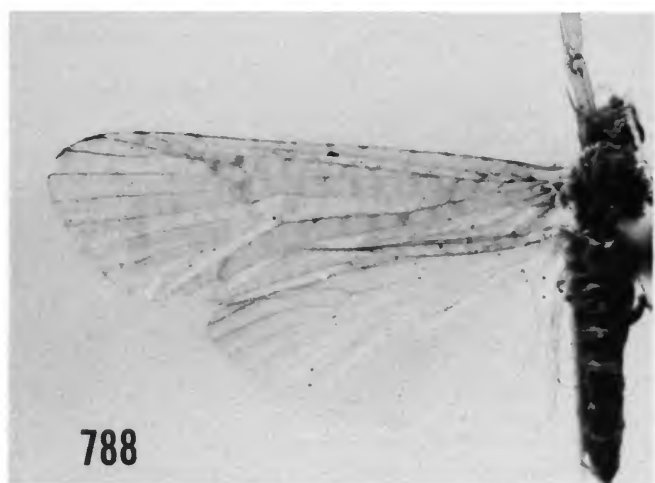
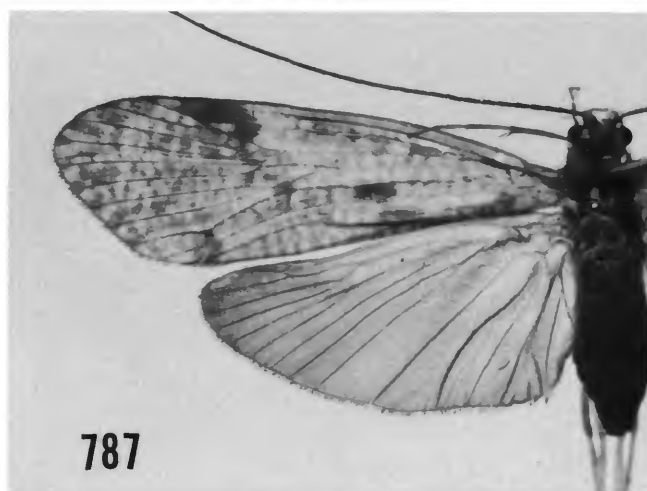


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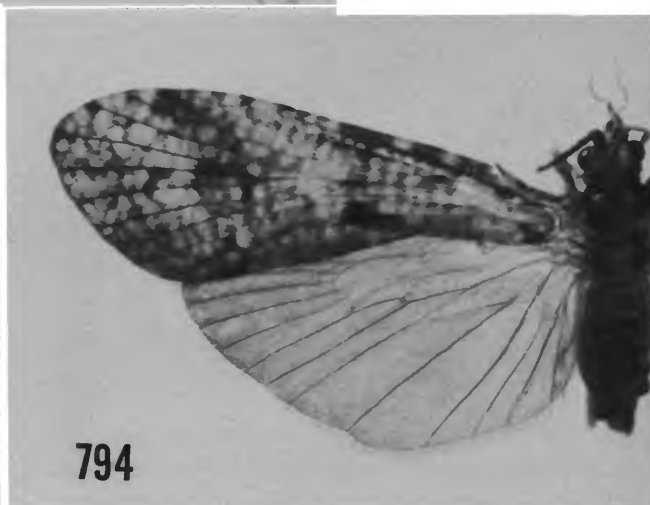
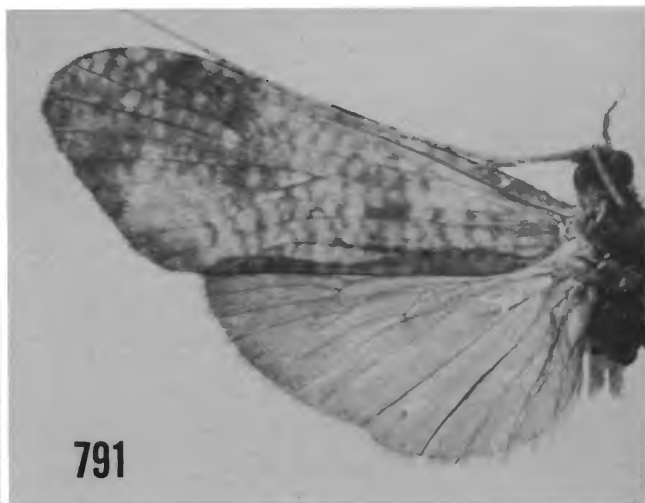




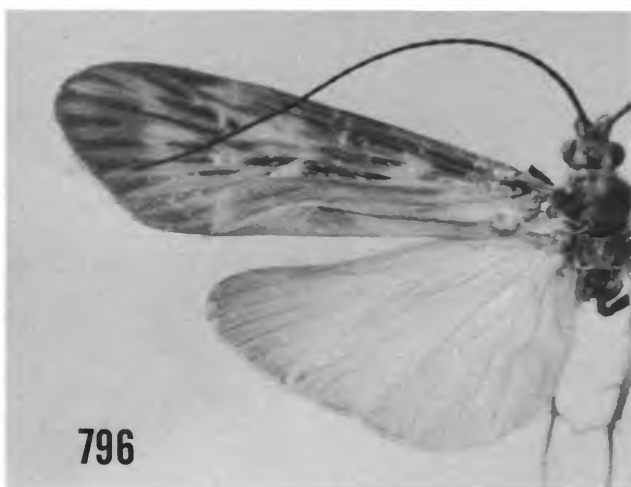
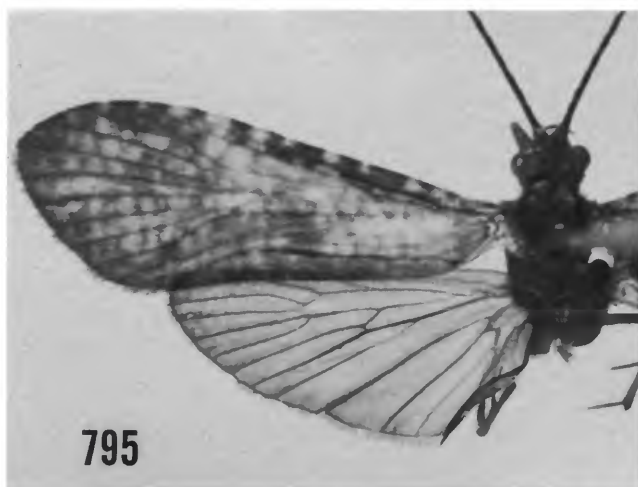
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