BULLETIN OF
THE CALIFORNIA INSECT SURVEY
VOLUME 15

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By
CHARLES L. HOGUE

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BERKELEY · LOS ANGELES · LONDON
1973

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Approved for publication April 14, 1972
Issued January 31, 1973

UNIVERSITY OF CALIFORNIA PRESS
BERKELEY AND LOS ANGELES

UNIVERSITY OF CALIFORNIA PRESS, LTD.
LONDON, ENGLAND

ISBN: 0-520-09454-9
LIBRARY OF CONGRESS CATALOG CARD NO.: 72-82224

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# THE NET-WINGED MIDGES
## OR
## BLEPHARICERIDAE OF CALIFORNIA

By

CHARLES L. HOGUE

## INTRODUCTION

ALL OF THE species in this family of nematocerous Diptera occur in mountainous regions in the immediate vicinity of rapidly flowing streams. The adults rest on vegetation, under fallen logs and overhanging rocks, in hollow trees, and in other protected, shady places. In flight they move swiftly, and during peak emergences numerous individuals may be seen hovering in the spray below waterfalls or darting between perches and capturing prey.

The ability of the adults to emerge from pupae submerged in swiftly flowing water is often cited as an extreme adaptation of insects to an aquatic habitat. Because its wings are fully developed and expanded within the pupa, the emerging imago has but to unfold them to render them functional. Thus it can take flight immediately, even while still in a teneral state, and escape into the air before being captured by the current.

The numerous creases in the perfect wing membrane (from which is derived the term "net-winged") result directly from the folding and compression of the wing into the confinement of the pupal wing case.

The female blephariceridnormally feeds on the blood of other small Diptera. With its long, heavy, serrate mandibles, the female macerates its prey and siphons the exuding body fluids. The females of a few forms lack mandibles; their food and that of the males, which consistently lack mandibles, is probably flower nectar.

The larvae, of which there are four instars, and pupae adhere in groups or singly to smooth rock surfaces in very swiftly flowing water, at the brink, within, or at the base of waterfalls and cataracts. Algae browsed from the substratum comprise the food of the former.

Blephariceridsare easily recognized in all stages. Of the several common types of stream-loving flies, the adults can be confused in the field only with crane flies (Tipulidae), which they somewhat resemble, but from which they may be easily distinguished by their stronger, more directional flight. Structurally they exhibit several characteristics that further identify them, namely, a completely detached vein $M_3$ in the wing, divided eyes, and stout hind legs. The ventrally flattened larvae are strongly constricted at the five intersegmental lines giving them a lobulate appearance. Each of the resulting six body divisions possesses hook-like apical prolegs and a ventromedian sucker which serve as holdfasts, enabling the larva to cling to smooth rock surfaces in the face of strong currents. The pupae might be likened to miniature flattened univalve molluscs such as limpets or abalone; they are usually jet black and have an anterior pair of four-leafed, erect, horn-like dorsal respiratory projections, the branchiae.

Because of the great size variation in different indi-

viduals of the same instar, the following criteria are offered to assist in distinguishing between mature and submature larvae:

(a) Presence of adult or pupal structures developing internally. Specimens showing discernible imaginal buds of legs and wings or pupal branchiae in the thoracic region are mature, fourth instar larvae.

(b) Presence of internal flanges representing the developing, strongly sclerotized posterior portion of the head capsule. These structures are apparent in larvae about to molt to a succeeding larval instar, and any specimens exhibiting them belong to a submature instar. Specimens with proportionately large ventral suckers (the latter may be contiguous or nearly so) have recently molted, and it is difficult to determine their instar without recourse to additional data.

(c) If the species or genus is known, the number of antennal segments and/or filaments in the ventrolateral gill tufts serve as indices to the instar number. Table 1 (p. 18) gives the values for these characters in third and fourth instar larvae of the California Blephariceridae.

The blephariceridfauna of California (table 1, 16 species) is the richest of any state. This fact is due primarily to the great latitudinal extent of the state whose boundaries include portions of most of the major mountain systems of western North America. It is with the histories of these systems that the evolution and dispersal of blephariceridsare correlated. Thus several species which may be regarded as intrusives because their distributions coincide with orogenic provinces mostly lying without the state (*Blepharicera jordani*—Cascade Ranges; *Dioptopsis dismalea*—Great Basin Ranges) mingle with autochthonous species whose ranges are expanding but have not yet reached beyond the state's boundaries (*Blepharicera micheneri*—Sierra Nevada and Transverse Ranges) and narrowly restrictive species situated on isolated mountains (*Philorus jacinto*—Mount San Jacinto).

The most important advance in our understanding of the family's higher classification was made by Alexander (1958). General information on the biology and anatomy of the family is available in the works of Alexander (1963), Bischoff (1928), Hogue (in press), Kitakami (1950) and Mannheims (1935).

This review can only be considered preliminary, being based on relatively few specimens (4,772). Our fauna, especially from the geographical and ecological standpoints, remains very incompletely known. No comprehensive treatment of the North American or California species exists, the works of Kellogg (1903) and Wirth and Stone (1956) being only fragmentary summaries of superficially analyzed and very limited material. Prior to the present study, very few of the immature stages were known and of these practically none correctly associated with the adults. At this time only the immature stages of *Bibiocephala nigripes* remains undiscovered.

## ACKNOWLEDGMENTS

All sizable insect collections were canvassed for specimens, and for the loan of their holdings I am indebted to the following institutions and their entomology curators:

C. P. Alexander, personal collection (ALEX); P. H. Arnaud, Jr., California Acadamy of Sciences (CAS); J. L. Bath, University of California, Riverside (UCR); J. N. Belkin, University of California, Los Angeles; G. E. Byers and N. Marston, University of Kansas (UK); J. G. Edwards, San Jose State College (SJS); P. H. Freytag, Ohio State University (OHSU); the late H. J. Grant, Jr., Academy of Natural Sciences of Philadelphia (ANSP); M. T. James, Washington State University (WSU); J. D. Lattin, Oregon State University (OSU); A. T. McClay and R. O. Schuster, University of California, Davis (UCD); L. L. Pechuman, Cornell University (CU); B. V. Peterson, Canada Department of Agriculture, Canadian National Collection (CNC); J. A. Powell, University of California, Berkeley, California Insect Survey Collection (CIS); H. H. Ross and R. T. Allen, Illinois Natural History Survey (INHS); G. B. Wiggins, Royal Ontario Museum (ROM); P. Wygodzinsky, American Museum of Natural History (AMNH); and A. Stone, Agricultural Research Service, USDA, United States National Museum (USNM). (LACM) denotes material in the Los Angeles County Museum of Natural History. Thanks also are due to D. Jamieson and R. Blair, Santa Clara Health Department, and R. L. Westcott for special allocations of specimens.

Without the invaluable assistance of Leonora McTernan, Betty Birdsall and Terri Kato in the preparation of graphic and statistical materials, this project would remain far from complete. For their assistance I thank them.

Finally, to C. P. Alexander, Amherst, Massachusetts, the dean of blephariceridtaxonomists, I express particular appreciation for his special help on this project in providing material and a wealth of helpful suggestions and articles of information on these flies which, in his words, are the "aristocrats of the Diptera."

# SYSTEMATICS

## KEY TO THE NORTH AMERICAN GENERA OF BLEPHARICERIDAE

### ADULTS

1. Radius with 4 branches, the second ($R_3$) fused apically with $R_{1+2}$ forming vein $R_{1-3}$ and a closed cell ($R_2$) (figs. 1, 34) . . . . . 2
   Radius with 3 branches, no closed cell formed by radial branches (fig. 45) . . . . . 3
2. Vein $R_3$ long, much exceeding the terminal fusion of $R_{1-3}$ (fig. 34). Fore femur strongly curved upward. Male genitalia with extremely large basistyles (at least 3 times the length of dististyle). Thoracic pleurites setose, hairs often black pilose . . . . . *Bibiocephala*
   Vein $R_3$ shorter than $R_{1-3}$ (fig. 1). Fore femur straight. Male genitalia normal, basistyles and dististyles about of same length. Thoracic pleurites largely glabrous . . *Agathon*
3. Basal sector of $M_{3+4}$ present, falsely simulating cross vein M-Cu (figs. 78, 136) . . . . . 4
   Basal sector of $M_{3+4}$ absent, no apparent cross vein M-Cu (fig. 45) . . . . . *Blepharicera*
4. Cell $R_4$ sessile (fig. 78). Smaller species (6 mm body length or less) . . . . . *Dioptopsis*
   Cell $R_4$ long-petiolate (fig. 136). Mostly larger species (8–10 mm body length) . . . . . *Philorus*

### PUPAE

1. Branchial lamellae spreading, consisting of thin, translucent, flexible, leafy projections (figs. 143, 152) . *Philorus*
   Branchial lamellae contiguous or nearly so, consisting of heavy, darkly opaque, rigid, erect hornlike projections (figs. 20–21) . . . . . 2
2. Body form ellipsoid, strongly convex dorsad. Size large (length approximately 9–10 mm). Antennal cases short, barely exceeding base of wing case, and strongly incurved. Vestigial gills present ventrad on abdomen (fig. 43) . . . . . *Bibiocephala*
   Body form ovate, moderately or only slightly convex dorsad. Size smaller (length usually not exceeding 7 mm). Antennal cases longer, extending approximately one-fourth the length of wing case, their apices paralleling margin of wing case, i.e., not strongly incurved. Gills entirely absent . . . . . 3
3. Alar sclerite and scutum rugose; branchial lamellae short, lengths never more than 1.5 widths . . . . *Dioptopsis*
   Alar sclerite and scutum smooth; *if* rugose, branchial lamellae long (lengths twice widths) . . . . . 4
4. Cephalic sclerite triangular (figs. 20, 31) . . . *Agathon*
   Cephalic sclerite hemispherical, dorsal apex broadly rounded (figs. 53, 64) . . . . . *Blepharicera*

### MATURE LARVAE

1. Dorsal pseudopods absent (at least, clearly from anal division of abdomen) (figs. 51–52) . . . *Blepharicera*
   Dorsal pseudopods present . . . . . 2
2. Ventral gill tufts composed of 6 filaments, arranged in a plane, hemi-rosette pattern (fig. 40) . . *Bibiocephala*
   Ventral gill tufts usually composed of 3–5 or 7–8 filaments, spreading and all directed generally cephalolaterad (figs. 7, 51) . . . . . 3
3. Dorsal sclerotized plates or tubercles present on abdominal segments, *or* if absent, at least a small dorsolateral tubercle above dorsal pseudopod on abdomen 1 . . . 4
   No dorsal sclerotized processes of any kind, *or* if present as conical processes, 2 transverse series of minute plates,

also across thoracic region of cephalic division . . . *Dioptopsis*

4. Dorsal pseudopods double, each with a subequal, elongate dorsal branch (fig. 151), *or* ventral gill tufts with 3 filaments (fig. 141) . . . . . *Philorus*

   Dorsal pseudopods single, each with only a small proximo-dorsal mammilate process or setate swelling (fig. 8). Ventral gill tufts with 5–8 filaments . . . . *Agathon*

## KEY TO THE CALIFORNIA SPECIES OF BLEPHARICERIDAE

### ADULTS

### *Agathon*

1. *General:* $R_3$ long, fusing with $R_{1+2}$ well beyond fork of $R_4$ and $R_5$ (fig. 1). *Male genitalia:* Eighth abdominal tergite strongly modified forming two mesally approximate lobes (fig. 4). *Female genitalia:* Apex of oviscapt acutiform (fig. 6) . . . . . *comstocki*

   *General:* $R_3$ very short, fusing with $R_{1+2}$ well before fork of $R_4$ and $R_5$ (figs. 12, 23). *Male genitalia:* Abdominal tergite 8 normal, without lobes of any kind. *Female genitalia:* Apex of oviscapt broad, bilobate . . . . . 2

2. *General:* Thoracic integument yellow-brown, blending with legs. Male: Ultimate antennal segment equal to penultimate (fig. 13). Female: Upper eye division much smaller than lower (fig. 14). *Male genitalia:* Ninth tergite lobes fused mesad. Dorsal lobe of outer dististyle large, extending caudad beyond ventral (fig. 15). *Female genitalia:* Setae of eighth sternite lobes short, numerous (20–30), and spreading nearly to anterior margin (fig. 17) *doanei*

   *General:* Thoracic integument grey, contrasting with yellow-brown legs. Male: Ultimate antennal segment shorter than penultimate (one-half to two-thirds length) (fig. 24). Female: Upper eye division subequal to lower (fig. 25). *Male genitalia:* Ninth tergite lobes distinct, elongate, incurved. Dorsal lobe of outer dististyle small, not reaching caudal margin of ventral lobe (fig. 26). *Female genitalia:* Setae of eighth sternite lobes long, fewer (less than 15), and restricted to outer, posterior margin (fig. 28) . . . . . *elegantulus*

### *Bibiocephala*

Only one species presently recognized in California, *nigripes*.

### *Blephariceru*

1. *General:* Small species (wing length 4.3 to 5.5 mm). Male: Upper eye division slightly larger than lower (fig. 68). Ultimate antennal segment ovoid (only about 2 times length penultimate) (fig. 68). Female: Upper eye division very small. Mandibles absent (fig. 69). *Male genitalia:* Inner dististyle bilobed; outer dististyle simple, apex broadly rounded (fig. 70). *Female genitalia:* spermathecae with sclerotized, obversely bulbous neck (fig. 72) . . . . . *ostensackeni*

   *General:* Medium-sized species (wing length 6.5 mm or greater). Male: Upper eye division decidedly smaller than lower (less than one-third surface area) (figs. 46, 57). Ultimate antennal segment elongate (4–5 times length penultimate). Female: Upper eye division at least one-half the size of lower. Mandibles present. *Male genitalia:* Inner dististyle simple; outer dististyle variously lobed, apex lobed, or acute. *Female genitalia:* Spermathecae simple, without obversely bulbous neck . 2

2. *General:* Male: Penultimate antennal segment diminutive, diameter less than that of adjoining segments (fig. 57). Female: No reliable characters presently known. *Male genitalia:* Outer dististyle diminutive, apex trilobate. Paramere broad, flattened, apically rounded (fig. 59). *Female genitalia:* Spermathecae globose. VIII sternite lobes truncate, intervening indentation shallow (fig. 61) . . . . . *micheneri*

   *General:* Male: Penultimate antennal segment small but not diminutive, diameter equal to that of adjoining segments (fig. 46). Female: No reliable characters presently known. *Male genitalia:* Outer dististyle elongate, apex acute and incurved, a conspicuous mesobasal lobe. Paramere narrow, attenuate (fig. 48). *Female genitalia:* Spermathecae ampulliform. VIII sternite lobes rounded, intervening indentation deep (fig. 50) . . . . *jordani*

### *Dioptopsis*

1. *General:* Wing membrane infuscated. Palpus four-segmented . . . . . *dismalea*

   *General:* Wing membrane hyaline. Palpus five-segmented . 2

2. *General:* Upper eye division at least one-fifth to one-fourth the area of lower in males (at least 11–12 rows of ommatidia), greater than lower in females . . . . . 3

   *General:* Upper eye division greatly reduced, much smaller than lower in both sexes, a small area of 4–7 rows of ommatidia . . . . . 4

3. *Male genitalia:* Paramere with conspicuous mesal spur (fig. 93). Mesal margin of IX tergite lobe produced into a nude flange (i.e., without micro- or macrochaetae) (fig. 92). *Female genitalia:* Spermathecae ovoid (fig. 94) . . *aylmeri* (in part)

   *Male genitalia:* Paramere simple, without spur. Mesal margin of IX tergite lobe not produced. *Female genitalia:* Spermathecae elongate-ovoid (fig. 129). . . *sequoiarum*

4. *General:* Antenna with 15 segments. Midtibial spur present though minute. *Male genitalia:* IX tergite lobe short, length only 2 times width (fig. 81). Lobe of outer dististyle short and projecting dorsomesad (fig. 81). . *alpina*

   *General:* Antenna with 14 segments or less. Midtibial spur entirely absent. *Male genitalia:* IX tergite lobe elongate, length 5–6 times width. Lobe of outer dististyle elongate and projecting subparallel to dististyle face . . . . . 5

5. *General:* Ultimate antennal segment smaller than penultimate. Female mandible reduced to absent. *Male genitalia:* Paramere with spur. *Female genitalia:* Spermathecae pear-shaped . . . . . *aylmeri* (in part)

   *General:* Ultimate antennal segment longer than penultimate. Female mandible normal-sized. *Male genitalia:* Paramere simple. *Female genitalia:* Spermathecae ovate (fig. 117) . . . . . *markii*

### *Philorus*

1. *General:* Wing vein $R_5$ branching off from continuous vein $R_4$ (figs. 145, 164) . . . . . 2
   *General:* Wing veins $R_4$ and $R_5$ forming a symmetrical fork and petiole ($R_{4+5}$) (figs. 136, 154) . . . . . 3
2. *General:* Male: Basal half of wing infuscated. Female: No reliable characters presently known. *Male genitalia:* Dorsal lobe of outer dististyle small, not reaching apex of dististyle (fig. 167). *Female genitalia:* Oviscapt tapering caudad (fig. 168) . . . . . *yosemite*
   *General:* Male: Wing membrane entirely hyaline. Female: No reliable characters presently known. *Male genitalia:* Dorsal lobe of outer dististyle large, extending well beyond apex of dististyle (fig. 148). *Female genitalia:* Oviscapt quadrangular (fig. 149) . . . . . *jacinto*
3. *General:* Larger species, wing length 9.0 mm. Scutellum with patches of bristles restricted to lateral corners. Fore tibia 1.5 length of basitarsus. *Male genitalia:* Dorsal lobe of outer dististyle broadly expanded, tip narrowed and curved with numerous normal bristles at apex (fig. 157). *Female genitalia:* Spermathecae elongate-ovoid (fig. 159) . . . . . *vanduzeei*
   *General:* Smaller species, wing length 6.7 mm. Scutellum with short bristles all along posterior border, connecting the caudolateral patches. Fore tibia 1.9 length of basitarsus. *Male genitalia:* Dorsal lobe of outer dististyle bifurcate, posterior fork tipped with two large bristles, anterior fork with two spiniforms (fig. 139). *Female genitalia* Spermathecae pear-shaped (fig. 140) . . . . . *californicus*

## PUPAE

### *Agathon*

1. Branchial sclerite strongly lobed beneath branchia (fig. 9), the latter projecting cephalad, the lamellae oval in outline, numbers 1 and 4 much more strongly developed than 2 and 3 and enclosing them (fig. 10) . *comstocki*
   Branchial sclerite weakly lobed or unlobed, branchia projecting dorsad and lamellae elongate and subequal (figs. 20–21, 31–32) . . . . . 2
2. Integument of alar sclerite and scutum smooth (figs. 31–32) . . . . . *elegantulus*
   Integument of alar sclerite and scutum rugose (figs. 20–21) . . . . . *doanei*

### *Bibiocephala*

Only one species presently recognized in California, *nigripes*.

### *Blepharicera*

1. Outline of whole pupa oval, width of abdomen at segment 3 distinctly greater than width of thorax (fig. 76). Small, length 3 to 4 mm . . . . . *ostensackeni*
   Outline of whole pupa ovoid, width of abdomen at segment 3 equal or slightly less than width of thorax (figs. 54, 65). Larger, length 4 to 6 mm . . . . . 2
2. Branchial lamellae gently incurved, those of two sides well separated (fig. 64) . . . . . *micheneri*
   Branchial lamellae strongly incurved, convergent, number 4 of two sides often overlapping (fig. 53) . . . *jordani*

### *Dioptopsis*

1. Branchial sclerite strongly lobed, projecting well beyond cephalic sclerite in lateral aspect (fig. 86) . . . *alpina*
   Branchial sclerite weakly lobed, cephalic sclerite visible from lateral aspect . . . . . 2
2. Branchial lamellae spreading, caudal pair strongly convergent, often overlapping (fig. 121) . . . . *markii*
   Branchial lamellae all subparallel . . . . . 3
3. Length/width of anteriormost branchial lamella 1.1 or larger . . . . . *dismalea*
   Length/width of anteriormost branchial lamella 1.0 or smaller . . . . . 4
4. Interbranchial index (=interbranchial distance at base of lamellae/width of anteriormost lamella) less than 0.7. Rugae of posterior region of scutum forming a line running parallel to hind margin of sclerite (fig. 134) . . . . . *sequoiarum*
   Interbranchial index greater than 1.0. Rugae of posterior region of scutum random, not forming a line (fig. 99) . . . . . *aylmeri*

### *Philorus*

1. Branchial lamellae flat, numbers 2 and 3 deeply incised (fig. 143). Color in life, brown . . . . . *californicus*
   Branchial lamellae convoluted, all entire (figs. 152, 162, 171). Color in life, black . . . . . 2
2. Branchial lamellae small, anteriormost barely projecting cephalad as far as cephalic sclerite (fig. 171) . *yosemite*
   Branchial lamellae large, anteriormost projecting well beyond anterior margin of pupa (figs. 152, 162) . . . . 3
3. Branchial lamella 2 oval in outline, lateral margins convex (fig. 162) . . . . . *vanduzeei*
   Branchial lamella 2 rhomboid in outline, lateral margins straight or concave (fig. 152) . . . . . *jacinto*

## MATURE LARVAE

### *Agathon*

1. Dorsal sclerotized processes entirely absent . . *comstocki*
   Dorsal sclerotized processes present . . . . . 2
2. Dorsal sclerotized processes in the form of transverse rectangular plates (figs. 18–19) . . . . . *doanei*
   Dorsal sclerotized processes in the form of conical protuberances (figs. 29–30) . . . . . *elegantulus*

### *Bibiocephala*

Only one species presently recognized in California, *nigripes*.

### *Blepharicera*

1. Pseudopods large, over two-thirds visible in dorsal view (figs. 73–74). Dark dorsal pigmentation forming a distinct variegated pattern . . . . . *ostensackeni*
   Pseudopods small, rarely only the extreme tips visible in dorsal view (figs. 51, 62). No distinct pattern of pigmentation . . . . . 2
2. Cephalolateral corners of body divisions produced into a tubular projection resembling a dorsal pseudopod. Antenna with extensive median membranous area. Anterior

ventral gill tufts composed of 5 filaments (figs. 51–52) *jordani*

Cephalolateral corners of body divisions only slightly produced, resembling caudolateral corners. Antenna with very small median membranous area. Anterior ventral gill tufts composed of 7 filaments (figs. 62–63) *micheneri*

### *Dioptopsis*

1. Dorsal tubercles and plates present . . . . . *alpina*
   Dorsal integument without tubercles or plates . . . . 2
2. Antenna indistinctly segmented, basal ¾ membranous. Ventral gill tuft of segment 6 diminutive, with only 2 filaments. Dorsal pseudopods gently curving cephalolaterad (fig. 119) . . . . . *markii*
   Antenna clearly 3-segmented, middle segment much smaller than others. Ventral gill tuft of segment 6 subequal to others, with 5 filaments. Dorsal pseudopods angular, tips project ventrolaterad (fig. 96) . . . . . *aylmeri, sequoiarum, dismalea*

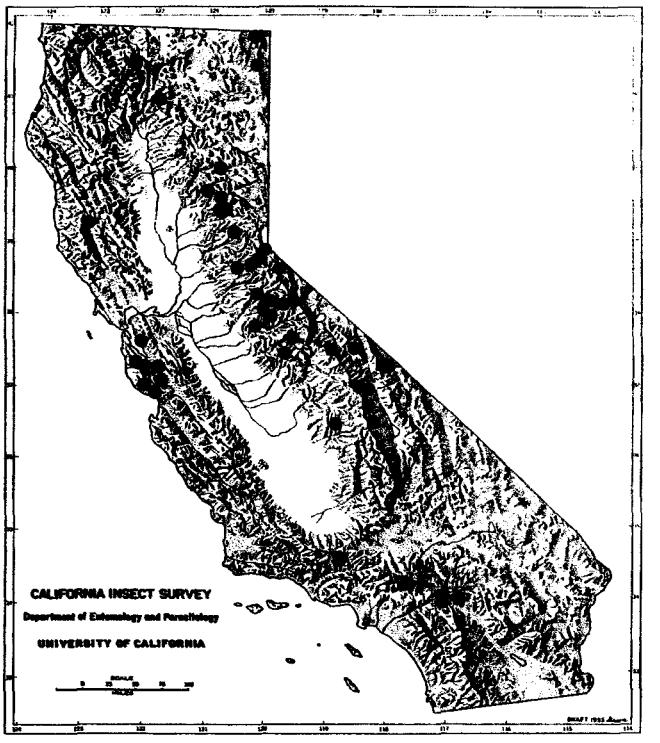
### *Philorus*

1. Dorsal sclerotized processes in the form of narrow, flat, transverse plates (figs. 141–142). Ventral gill tufts composed of 3 filaments . . . . . *californicus*
   Dorsal sclerotized processes in the form of projecting tubercles (figs. 151, 161, 170). Ventral tufts composed of 5 filaments . . . . . 2
2. Dorsal processes elongate, similar in size and shape to lateral processes; two on cephalic division (fig. 160) . *vanduzeei*
   Dorsal processes conical, much shorter and dissimilar in shape to lateral processes; four on cephalic division . . 3
3. Dorsal tubercles of abdominal segments subquadrate in position (nearly equidistant from each other, the distance between each anterior pair 4–5 times the tubercle diameter at its base) (fig. 169). Lateral processes of hindmost abdominal segment unequally bifurcate (fig. 169) . . . . . *yosemite*
   Dorsal tubercles of abdominal segments trapezoidal in position (each anterior pair much closer together than the posterior pair, the distance between the former slightly less than 2 times the tubercle diameter at its base) (fig. 150). Lateral processes of hindmost abdominal segment equally bifurcate (fig. 150) . . . *jacinto*

## Family BLEPHARICERIDAE

### Genus *Agathon* von Röder

All three North American species in this genus occur in California. They form a heterogeneous group, sharing only the dubiously homologous common presence of a short vein $R_3$ in the wing. Future comparative studies in the higher taxa of the family may very well indicate a revision in the generic placement of *doanei* and *comstocki*.




Map 1. California distribution of *Agathon comstocki* (Kellogg).

### *Agathon comstocki* (Kellogg)
(Figs. 1–11; Map 1)

*Bibiocephala comstocki* Kellogg, 1903, Proc. Cal. Acad. Sci., Ser. 3, 3:192 *et seq.*

"New California larva" Kellogg, 1903, *loc cit.:* 196, Pl. XXII, figs. 1–2. This is the third instar of *Agathon comstocki.*

*Bibiocephala (=Agathon) comstocki;* Kellogg, 1907, Genera Insectorum, 56:13.

*Bibiocephala canadensis* Garrett, 1922, Insec. Incit. Mens., 10: 89–90. Alexander, 1965, *in* Cat. Dip. Amer. N. Mex.: 99 (Synonymy).

*Agathon canadensis;* Garrett, 1927, Can. Ent., 59:116.

*Agathon comstocki;* Alexander, 1958, Proc. Tenth Int. Cong. Entomol., 1:817.

*Geographic range.* — California, Oregon, Washington, Idaho, Montana, Nevada, Alberta, British Columbia.

*California records.*—ALAMEDA CO.: Berkeley, Strawberry Canyon, III–23–41, 2 pupae, 1 larva (T. Aitken, USNM). Hills above Oakland, III–13–55, 1 pupa, 11 larvae (P. Wygodzinsky, AMNH). ALPINE CO.: Woodfords, 4 mi. w., VI–25–61, 96 males and females (A. Menke, UCD). Hope Valley, VII–18–48, 6 females (E. O. Essig, CIS). CALAVERAS CO.: Camp Wolfboro, VII–15–40, 2 females (N. F. Hardman and T. Aitken, CAS). Camp Wolfboro, nr. Sand Flat, n. fork Stanislaus River, 5,600 ft., VII–3–40, 6 females (N. F. Hardman, USNM). Sand Flat, 5,600 ft., VI–1–41, 1 pupa (T. Aitken, USNM). COLUSA CO.: Paradise Creek, 2,400 ft., IV–18–52, 5 males, 5 females, 4 pupae, 8 larvae (H. P.

Chandler, CAS). S. fork Stony Creek, 1,800 ft., V-7-54, 22 males, 3 females (H. P. Chandler, CAS). El Dorado Co.: Kyburz, VII-19-53, 2 males, 2 females (J. D. Lattin, OSU); VI-19-60, 7 males, 5 females (S. G. Jewett, USNM). Lake Tahoe, VI-13-59, 18 males (G. E. Byers, KU). Pyramid Ranger Station, VII-12-48, 16 females (L. W. Quate, USNM). Riverton, American River, VI-27-50, 71 males and females, 1 larva, 11 pupae (P. C. Ting and L. W. Quate, CIS). Somerset, 4 mi. s., V-31-54, 10 males and females (E. I. Schlinger, UCD). Fred's Place, VII-15-50, 20 females (L. W. Quate, CIS). Inyo Co.: Lone Pine Creek, Whitney Portal, VII-12-66, 1 male, 1 female, 3 pupae, 12 larvae (C. L. Hogue, No. CLH 166B, LACM). Cottonwood Creek nr. pack station, VII-11-66, 8 pupae and skins (C. L. Hogue, LACM). Glacier Lodge, 1 mi. e., Sage Flat, Big Pine Creek, 6,800 ft., VII-13-66, 1 pupal skin (C. L. Hogue, LACM). Independence Creek, Gray's Meadow, VII-12-66, 2 larvae (C. L. Hogue, LACM). Los Angeles Co.: Fish Canyon, IV-26-49, 1 female (E. I. Schlinger, UCD). Marin Co.: Alpine Lake, IV-10-68, 1 male (J. Powell, CIS). Mariposa Co.: Wawona, VI-6-39, 1 female (M. Cazier and T. Aitken, CAS). Yosemite, VI-21-22, 1 female (E. C. Van Dyke, CAS); VII-5-27, 1 male (E. H. Nast, CAS); VI-29-47, 1 male (A. L. Melander, USNM); 4,000 ft., V-20-34, 1 male (Bryant; Lot 15, CAS). Mendocino Co.: Potters Valley, V-1-29, 1 female (E. H. Nast, CAS). Modoc Co.: Cedarville, V-29-39, 1 female (M. Cazier and T. Aitken, CAS). Pine Creek, 7,000 ft., VII-15-48, 4 males, 1 female, 20 pupae, 17 larvae (W. W. Wirth, USNM, CIS). Mono Co.: Laurel Creek, s. of Mammoth Region, VII-16-63, 3 larvae (M. Tunzi, USNM). Leavitt Meadow, 7,200 ft., VIII-7-64, 1 male, 1 female (H. B. Leech, CAS). Laurel Creek, 7,200 ft., VII-15-66, 6 pupal skins, 1 larva (C. L. Hogue, LACM). Tom's Place, 0.6 mi. w., Rock Creek, VII-14-66, 11 pupae and skins (C. L. Hogue, LACM). Nevada Co.: Cisco, VI-13-39, 16 males (M. Cazier, CAS). Plumas Co.: Feather River, V-16-48, 3 males (W. W. Wirth, USNM, CIS). Wolf Creek, Greenville, 2 mi. n., V-16-48, 2 larvae (W. W. Wirth, USNM). San Bernardino Co.: Camp Baldy Road, 6,500 ft., VI-26-56, 15 males and females (R. M. Bohart *et al.*, LACM, UCD). Crestline, VI-19-44, 9 females (A. L. Melander, USNM). Forest Home, VIII-23-44, 1 male (A. L. Melander, USNM). Mill Creek nr. Redlands, IV-27-50, 2 pupae (Belkin and Heid, LACM). Mountain Home Canyon, VI-8-24, 1 males (J. M. Aldrich, USNM). Seven Oaks, Santa Ana River, 5,000 ft., V-20-21-63, 1 male, 1 female (C. P. Alexander, ALEX). S. Fork Public Camp, Barton Flats Road, Santa Ana River, IV-27-50, 15 larvae (Belkin and Heid, LACM). Snow Crest Camp, Mt. Baldy, VI-17-52, 27 males and females (A. T. McClay, W. V. Garner, CIS, LACM, UCD). Strawberry Creek, 3,000 ft., IV-14-66, 3 males, 3 females (C. L. Hogue, LACM). San Mateo Co.: Corte de Madera Creek, 700 ft., 1-7, 21-67, 92 larvae (J. F. Emmel, LACM). Corte de Madera Creek, III-26-01, female dissected from pupal case, 5 pupae, 5 larvae (G. A. Coleman *et al.*, USNM). Los Trancos Creek, II-25-00, 1 larva (Van Dine, USNM). "Pelecinito Lake" [*sic*, Pilarcito Reservoir], IV-15-39, 1 larva (J. DuBois, CAS). Santa Clara Co.: Alum Rock Park, II-25-39, 7 larvae (T. Aitken and J. Downes, USNM); III-1-54, 2 larvae (G. F. Kraft, WSU). Guadalupe Creek, nr. San Jose, III-26-56, 1 larva (D. W. Tuff, SJS). Campbell Creek, IV-6-00, cotype male (V. L. Kellogg *et al.*), [lost—literature record: Kellogg, 1903:192]. Campbell Creek, III-V, 1900-1901, adults and pupae, (Kellogg *et al.*), [lost—literature record: Kellogg, 1903:192]. Los Gatos Creek, III-V, 1900-1901, adults and pupae (V. L. Kellogg), [lost—literature record: Kellogg, 1903: 192]. Stevens Creek, VI-7-41, 1 female (T. Aitken, CAS); I-6, 8-63, 6 larvae (J. Paulson, SJS); III-V, 1900-1901, adults and pupae (V. L. Kellogg *et al.*), [lost—literature record: Kellogg, 1903:192]. Santa Clara Co.: (?): Alembique Creek, III-V, 1900-1901, adults and pupae (V. L. Kellogg *et al.*), [lost—literature record: Kellogg, 1903:192]. Santa Cruz Co.: Bear Gulch, III-18-01, 1 pupa, 2 larvae (G. A. Coleman, USNM). Santa Cruz, VI-1-19, 1 female (E. P. Van Duzee, CAS). San Lorenzo River, III-21-53, 1 pupa, 4 larvae (W. C. Bentinck, CIS). Shasta Co.: Big Bend, VI-28-36, 1 female (J. DuBois, UCD). Sierra Co.: No locality, VI-1946, 6 females (M. A. Cazier, USNM). Gold Lake, VI-16-40, 8 males, 24 females (M. Cazier and T. Aitken, CAS, AMNH). Goodyears Creek, Downieville, 4.3 mi. w., V-27-50, 7 pupae (R. W. Coleman, USNM). Sierra City, Yuba River, VI-16-40, 8 males, 94 females (T. Aitken and M. Cazier, USNM, CAS). Siskiyou Co.: S. fork Sacramento River, VII-21-22-48, 5 females (W. W. Wirth, USNM). S. fork Sacramento River #7, #5, VII-8-9-53, 1 male, 2 females, 2 pupae (H. P. Chandler, CAS). Tehama Co.: Lower Mill Creek, 300 ft., V-3-52, 1 male, 1 female (H. P. Chandler, CAS). Tulare Co.: Sequoia National Park, Giant Forest, Marble Fork, Kings River Trail, 6,500 to 7,100 ft., VII-24-07, 10 pupal skins (J. C. Bradley; Johannsen Lot 2275, CU). Sequoia National Park, 4,000 ft., VI-6-35, 1 female (A. L. Melander, USNM). Tuolumne Co.: Dardenelle, 2 mi. n., VII-19-64, 3 males (D. C. and K. A. Rentz, CAS). Eleanor Lake, VII-2-51, 1 male (D. P. Lawfer, UCD). Sonora Pass, 8,000 ft., VII-21-51, 1 female (W. C. Bentinck, CIS). Strawberry, VII-8, 18-57, 2 males, 3 females (J. W. MacSwain and J. M. Burns, CIS).

This ubiquitous species is by far the most common and widely distributed blephariceрid in California and western North America.

## *Agathon doanei* (Kellogg)

(Figs. 12-22; Map 2)

*Liponeura doanei* Kellogg, 1900, Psyche, 9:39-41, figs. 1-2.

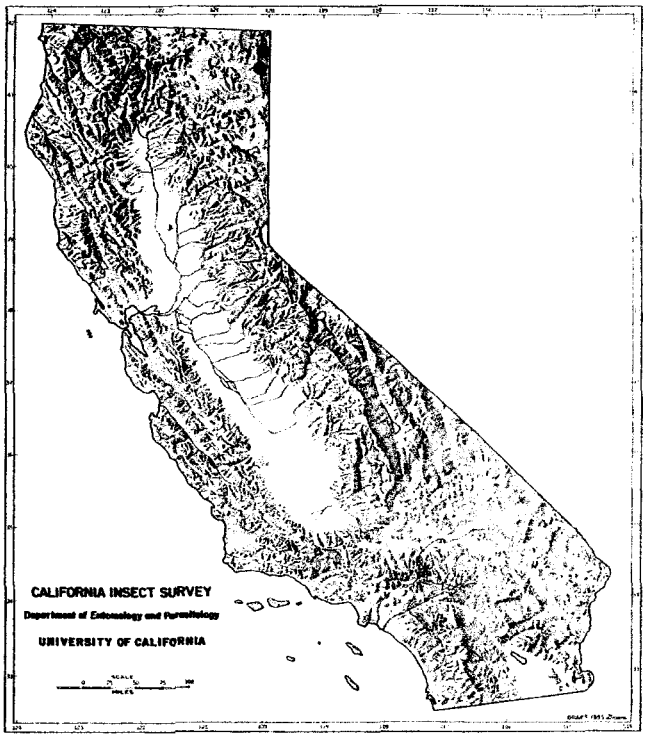
*Bibiocephala doanei;* Kellogg, 1903, Proc. Cal. Acad. Sci., Ser. 3, 3:194 *et seq.*

*Agathon doanei;* Walley, 1927. Can. Ent., 59:116.

*Geographic range.*—California.

*California records.*—Alameda Co.: Berkeley, Strawberry Canyon, III-9-41, 1 pupa, 2 larvae (T. Aitken, USNM). Colusa Co.: S. fork Stony Creek, 1,800 ft., V-7-54, 1 male (H. P. Chandler, CAS). S. fork Stony Creek, 1,700 ft., V-7-54, 5 larvae (H. P. Chandler, CAS). Contra Costa Co.: Mt. Diablo, IV-27-41, 2 pupae (W. Perry, USNM). Humboldt Co.: Dinsmore, 6 mi. w., VI-18-50, 6 larvae (L. W. Quate, USNM). Red Cap Creek, Hoopa Indian Reservation, VII-26-01, larvae and pupae (G. A. Coleman), [lost—literature record: Kellogg, 1903:195]. Mendocino Co.: U. C. Hopland Field St., IV-3-68, 25 larvae, 8 pupae (J. Powell, CIS). Monterey Co.: Cachagua Creek, VII-1-48, 9 larvae, 14 pupae (W. Wirth, USNM, CIS). Hastings Reservation, VII-9-58, 1 male (Alexander, ALEX). San Luis Obispo Co.: Salmon Creek, State Highway No. 1, VII-30-40, 5 pupae (T. Aitken, USNM). San Mateo Co.: Los Trancos Creek, II-25-00, 2 larvae (Van Dine, USNM). Los Trancos Creek, II-IV, 1900-1901, pupae (V. L. Kellogg), [lost—literature record: Kellogg, 1903: 195]. Corte de Madera Creek, II-IV, 1900-1901, pupae (V. L.


Map 2. California distribution of *Agathon doanei* (Kellogg).




Map 3. California distribution of *Agathon elegantulus* von Röder.

Kellogg), [lost—literature record: Kellogg, 1903:195]. SANTA CLARA CO.: Alum Rock Park, II-25-39, 5 pupae (T. Aitken and J. A. Downes, USNM). Campbell Creek, Saratoga, 2 mi. w., VII-8-49, 1 pupa (W. Wirth, USNM). Mt. Hamilton, VI-19-40, 4 males (B. Brookman *et al.*, USNM). Stevens Creek, IV-29-00, 2 larvae, 1 pupa (V. L. Kellogg, USNM); VII-23-40, 4 males 4 females (T. Aitken *et al.*, USNM); VI-7-41, 1 larva, 9 pupae (T. Aitken, USNM); II-IV, 1900-1901, pupae (V. L. Kellogg), [lost—literature record: Kellogg, 1903:195]. Los Gatos Creek, IV-1-01, 1 larva, 2 pupae, also II-IV, 1900-1901, pupae (V. L. Kellogg), [in part lost— literature record: Kellogg, 1903:195]. Campbell Creek, II-IV, 1900-1901, pupae (V. L. Kellogg), [lost—literature record: Kellogg, 1903:195]. Congress Springs, VII-24-95, 1 male, 2 females (R. W. Doane, CAS—male lost). Coyote Creek, nr. Gilroy Hot Springs, IV, immatures (V. L. Kellogg), [lost—literature record: Kellogg, 1903:195]. SOLANO CO.: Green Valley Falls Park, IV-27-41, 10 larvae, 11 pupae (B. Brookman and T. Aitken, USNM, LACM).

A species so far known only from California, *A. doanei* appears to be restricted to the Coast Ranges.

### *Agathon elegantulus* von Röder

(Figs. 23-33; Map 3)

*Agathon elegantulus* von Röder, 1890, Wien Ent. Zeit., 9:230, 232. Generotype.

*Bibiocephala snowi* Kellogg, 1903, Proc. Cal. Acad. Sci., Ser. 3, 3:211. Inadvertent proposal of new name.

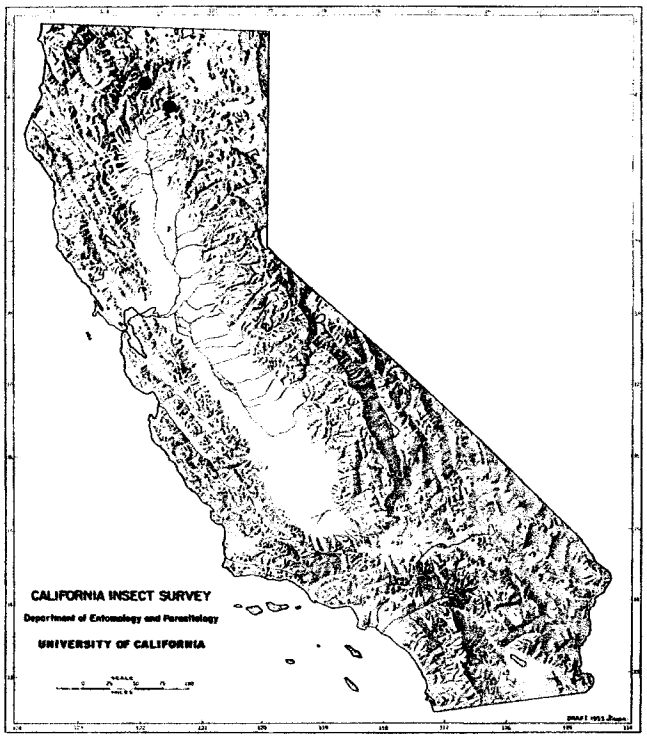
*Geographic range.*—California, Idaho, Colorado, Wyoming, Oregon, Washington, Nevada.

*California records.* — MODOC CO.: Cedar Pass, V-15-48, 61 larvae (W. Wirth, USNM); VI-12-61, 84 pupae (G. D. Hanna, CAS). Fandango Pass, Willow Creek, V-15-48, 1 larva (W. W. Wirth, USNM).

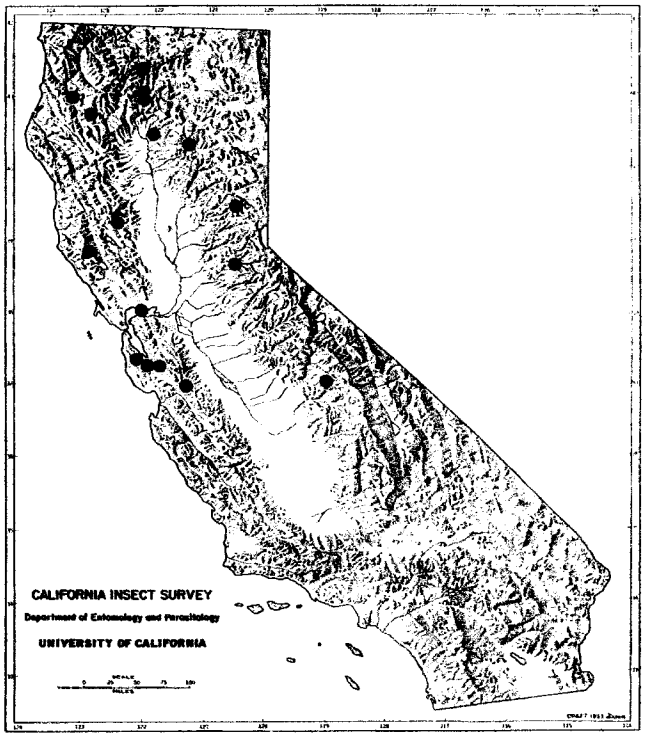
This widely distributed species barely enters the extreme northeastern corner of the state having been found so far only in the Warner Mountains, Modoc County.

### Genus *Bibiocephala* Osten Sacken

This genus above all others in North America needs taxonomic revision. It consists of a complex of very similar species (subspecies ?) which are devoid of clear-cut characters. Probably a statistical analysis will be necessary to set the limits of namable entities, but this must await the accumulation of much more material than is presently available. At this time most specimens should be referred to by the specific name *grandis* Osten Sacken, 1874. This is the oldest of three names applying to the most commonly encountered form from which are clearly separable only *nigripes* (by its melanic legs) and an undescribed species from New Mexico (by hairy eyes and other features). The immatures of none of the forms are definitely associated with the adults. So far, all adult specimens I have seen from California most clearly resemble the type of *nigripes* from Idaho.




Map 4. California distribution of *Bibiocephala nigripes* Alexander.




Map 5. California distribution of *Blepharicera jordani* (Kellogg).

### *Bibiocephala nigripes* Alexander

(Figs. 34–44; Map 4)

*Bibiocephala nigripes* Alexander, 1965, Great Basin Nat., 25:2–3.

*Geographic range.*—California, Idaho.

*California records.*—SHASTA Co.: Pit River, Dam 5, V-14-52, 1 female (H. P. Chandler, CAS). SISKIYOU Co.: Dunsmuir, 1 female (Wickham, USNM).

The figures referred to here are drawn from material probably of a species other than the *nigripes*, since the latter was not available in all stages. They will serve, however, to characterize the genus.

## Genus *Blepharicera* Macquart

This is the only genus of the family with species in eastern North America (Alexander, 1963). All the known western forms save *zionensis* Alexander from Utah occur in California. Probably several new species await discovery.

### *Blepharicera jordani* (Kellogg)

(Figs. 45–55; Map 5)

*Blepharocera jordani* Kellogg, 1903, Proc. Cal. Acad. Sci., Ser. 3, 3:189–190 *et seq.*

*Geographic range.*—California, Oregon.

*California records.*—COLUSA Co.: Paradise Creek, 2,400 ft., IV-18-52, 3 larvae (H. P. Chandler, CAS). S. fork Stony Creek, 1,700 ft., V-12-53, 4 pupae (H. P. Chandler, CAS). EL DORADO Co.: Riverton, VI-27-50, 1 pupa (P. C. Ting and L. W. Quate, CIS). FRESNO Co.: Kings River Canyon, VII-20-47, 1 male (W. W. Wirth, USNM). HUMBOLDT Co.: Willow Creek, VIII-12-48, 1 male (W. W. Wirth, USNM); VI-20-59, 18 males, 1 female (G. W. Byers, KU). MENDOCINO Co.: US Highway 101 and Ash Creek, VI-29-51, 1 male (W. C. Bentinck, CIS). PLUMAS Co.: Hot Springs Creek, IX-9-53, 1 larva (R. Coleman, USNM). SAN MATEO Co.: San Francisquito Creek, V-19-01, cotype male (V. L. Kellogg), [lost—literature record: Kellogg, 1903:190]. Los Trancos Creek, IV-VI, 1900-1901, pupae (V. L. Kellogg), [lost—literature record: Kellogg, 1903:190]. Corte de Madera Creek, IV-VI, 1900-1901, pupae (V. L. Kellogg), [lost—literature record: Kellogg, 1903:190]. SANTA CLARA Co.: Saratoga, 2 mi. w., Campbell Creek, VII-8-48, 2 pupae, 2 larvae (W. W. Wirth, USNM). Stevens Creek, VI-7-41, 6 pupae (T. Aitken, USNM). Campbell Creek, IV-VI, 1900-1901, pupae (V. L. Kellogg), [lost—literature record: Kellogg, 1903:190]. Coyote Creek, nr. Gilroy Hot Springs, pupae (V. L. Kellogg), [lost—literature record: Kellogg, 1903: 190]. Los Gatos Creek, IV-VI, 1900-1901, pupae (V. L. Kellogg), [lost—literature record: Kellogg, 1903:190]. Smiths Creek, nr. Mount Hamilton, immatures (V. L. Kellogg), [lost—literature record: Kellogg, 1903:190]. Stevens Creek, IV-VI, 1900-1901, pupae (V. L. Kellogg), [lost—literature record: Kellogg, 1903: 190]. SHASTA Co.: Castle Crags, 2,000 ft., VII-8-53, 5 males, 3 females (C. P. Alexander, USNM, ALEX). McCloud River, McCloud River bridge, 1 mi. n., V-29-56, 1 larva (W. Morrison, USNM). N. fork Cottonwood Creek, VI-14-49, 3 pupae (H. P.


Map 6. California distribution of *Blepharicera micheneri* (Alexander).

Chandler, CAS). SIERRA Co.: Sierra City, VIII-10-14-63, 20 males, 6 females (R. L. Westcott, LACM). SISKIYOU Co.: Mt. Shasta City, VI-18-59, 1 male, 1 female (G. W. Byers, KU). SOLANO Co.: Sears Point, VI-29-51, 1 female (W. C. Bentinck, CIS). TRINITY Co.: Nr. Del Loma, VI-20-59, 21 females (G. W. Byers, KU).

*B. jordani* occurs only in the northern half of the state (the southernmost record being in Fresno County) where it overlaps the broader distribution of *micheneri*. The close external similarity of the females of the two species make genitalia dissections necessary for correct determinations of specimens from sympatric areas.

Very few larvae of *jordani* are available and my association, based on geography and the process of elimination, could be in error. The close similarity of its presumed larva with that of *Dioptopsis markii* should be pointed out (figs. 51 and 118).

### *Blepharicera micheneri* (Alexander)

(Figs. 56–66; Map 6)

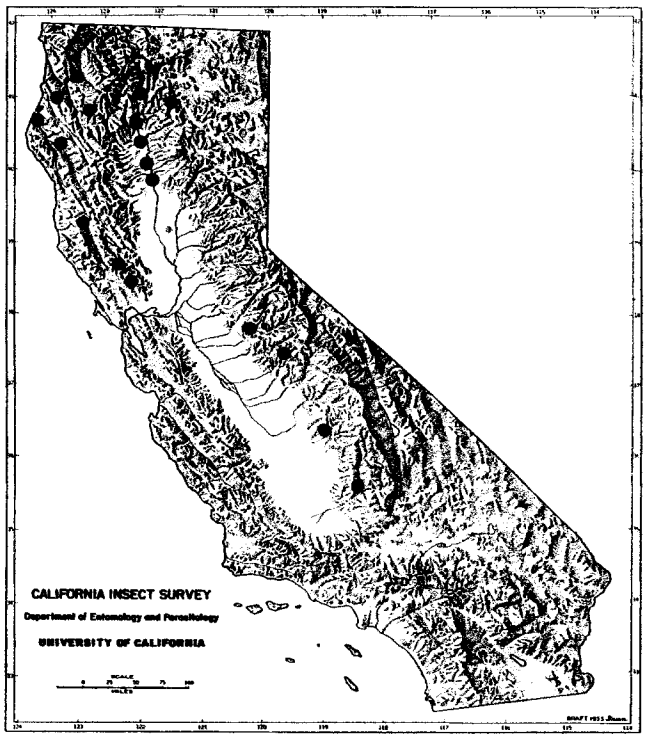
*Blepharocera micheneri* Alexander, 1959, Bull. Brooklyn Ent. Soc., 54:41–42.

*Geographic range.*—California.

*California records.*—EL DORADO Co.: No locality, VII-5-48, 1 female (R. C. Bynum, USNM). FRESNO Co.: Tollhouse along Dry Creek, VI-10-63, 7 males, 2 females (C. P. Alexander, LACM, ALEX). KERN Co.: Kern County Park, V-24-46, 3 females (B. Brookman, CAS). LOS ANGELES Co.: Upper Arroyo Seco Canyon, VII-10, 31-06, 17 pupae, 8 larvae (F. Grinnell, USNM). Crater Camp, IV-28-53, 3 larvae (LACM). San Gabriel Mountains, Ladybug Canyon, 4,000 ft., IV-24-63, 1 larva (C. L. Hogue, LACM). Malibu Creek above tunnel, IV-22-53, 5 larvae (J. N. Belkin, LACM). San Gabriel Mountains, Millard Canyon, V-4-66, 6 pupae (C. L. Hogue, LACM). Pasadena, VI-3-95, 1 female (R. W. Doane, WSU). San Gabriel Mountains, 3,000 ft., VI-16-09, 1 male (F. Grinnell, USNM). San Gabriel River, nr. Whittier, 1 larva, 1 pupa (E. Ewy; Johannsen Lot 2780, CU). Santa Monica Mountains, Stunt Canyon, V-12-62, 10 pupae, 14 larvae (C. L. Hogue, LACM). Switzer Camp, Arroyo Seco River, VI-1958, 4 pupae, 7 larvae (E. Mitchell, LACM); V-4-66, 2 females, 6 pupae, 9 larvae (C. L. Hogue, LACM). Santa Monica Mountains, Topanga Canyon, V-22-63, 2 pupae, 7 larvae (E. Fisher, LACM). Trail Canyon, San Gabriel Mountains, Big Tujunga Canyon, V-6 to VI-22-62, 21 males, 28 females, 76 pupae, 112 larvae (D. Gibo, LACM). Mill Creek, nr. Hidden Springs, San Gabriel Mountains, V-4-68, 3 males, 40 pupae, 36 larvae (C. L. Hogue, LACM). MONTEREY Co.: Arroyo Seco Creek above Santa Lucia Creek, Santa Lucia Mountains, V-20-62, 2 pupae (J. G. Edwards, SJS). Tassajara Hot Springs, 1,500 ft., V-26-54, 1 male. RIVERSIDE Co.: Strawberry Creek, 3,000 ft., San Jacinto Mountains, VI-29-65, 1 male, 3 females (P. A. Rauch, UCR); V-19-66, 3 males, 1 female (C. L. Hogue, LACM). Idyllwild, San Jacinto Mountains, V-22-40, holotype male (C. D. Michener, ALEX). SAN BERNARDINO Co.: Camp Baldy, VII-7-52, 1 female (R. M. Bohart, UCD). Crestline, VI-19-44, VII-4-42, 1 male, 3 females (A. L. Melander, USNM). Mill Creek nr. Redlands, IV-27-50, 13 pupae and skins (Belkin and Heid, LACM). Mill Creek Canyon, "VII-10," 2 males, 7 females (F. R. Cole, CIS). Mountain Home, VII-7-45, 1 male (A. L. Melander, USNM). SANTA CLARA Co.: Alum Rock Park, V-13-61, 3 pupae, 2 larvae; V-27-65, 2 males (D. Jamieson, collector). Mount Hamilton, VI-19-40, 3 males, 2 females (Brookman *et al.*, USNM, CAS). Stevens Creek, IV-29-00, 1 pupa (V. L. Kellogg, USNM); VII-23-40, 15 males, 41 females (Brookman *et al.*, USNM, CAS); VI-7-41, 81 larvae (T. Aitken, USNM, LACM). Stevens Creek area, V-24-25, VI-3-29, VII-15-65, 15 males, 16 females (D. Jamieson and R. Blair, collectors, LACM). Sveadal, VI-22-63, 1 female (R. Blair, collector). Wrights Station, VI-24-65, 1 male (D. Jamieson, collector). SHASTA Co.: Millville, 6 mi. e., V-10-61, 1 female (R. L. Langston, CIS). TULARE Co.: Sequoia National Park, VIII-6-40, 1 female (D. E. Hardy, KU). Kaweah River, VI-8-48, 2 females (R. Coleman, USNM). Bridge Inn, V-2, 11-39, 4 males, 2 females (T. Aitken, USNM, CAS). Coffee Camp, Sequoia National Forest, 2,000 ft., V-19-63, 2 males (C. P. Alexander, LACM, ALEX). Three Rivers, Kaweah River, V-30-63, 12 males, 3 females (C. P. Alexander, LACM, ALEX). Tule River, east of Lake Success, V-19-63, 6 males, 3 females (C. P. Alexander, LACM, ALEX). Sequoia National Park, 4,000 ft., VI-6-35, 6 males (A. L. Melander, USNM). TUOLUMNE Co.: Basin Creek Campground, VI-1-63, 2 males (P. H. Arnaud, CAS). Hell's Half Acre, Middle Fork Stanislaus River, VIII-27-47, 2 males, 1 female (P. H. Arnaud, USNM).

The difficulty of separating the females of this species from those of the preceding has already been noted (see the discussion under *jordani*).

This is the only *Blepharicera* in southern California. The size of the subanal pouch and apodeme of the penis




Map 7. California distribution of *Blepharicera ostensackeni* (Kellogg).

bulb in the male genitalia is variable, and two males from Hell's Half Acre, Tuolumne County, exhibit somewhat differently proportioned genitalia (extra-long inner lobe of the dististyle and long median finger on the outer lobe), possibly representing a subspecifically distinct population.

A partial account of the biology in the San Gabriel Mountains is given by Gibo (1964).

### *Blepharicera ostensackeni* (Kellogg)

(Figs. 67–77; Map 7)

*Blepharocera ostensackeni* Kellogg, 1903, Proc. Cal. Acad. Sci., Ser. 3, 3:191 *et seq.*

*Blepharocera shastensis* Alexander, 1959, Bull. Brooklyn Ent. Soc., 54:42–43. NEW SYNONYMY.

*Geographic range.*—California, Oregon.

*California records.*—HUMBOLDT Co.: Eureka, VIII–12–53, 1 male (P. H. Arnaud, CAS). US Highway 299, Redwood Creek, IX–15–46, 3 pupae (H. P. Chandler, CAS). Van Duzen River, VIII–11–48, 3 pupae, 2 larvae (W. W. Wirth, CIS); VIII–11–50, 1 pupa, 4 larvae (W. W. Wirth, USNM). Tributary n. fork Salmon River, nr. Sawyers Bar, larvae, pupae (V. L. Kellogg), [lost–literature record: Kellogg, 1903:191]. KERN Co.: McClure, VII–1946, 3 males (R. Brookman, USNM). Kernville, VII–21–48, 1 male (R. Coleman, USNM). LAKE Co.: St. Helena Creek, VIII–17–48, 16 pupae, 10 larvae (W. W. Wirth, CIS). MARIPOSA Co.: Wawona, 4,000 ft., VII–17–46, 8 pupae, 15 larvae (H. P. Chandler, CAS). MENDOCINO Co.: Russian River, south of Ukiah, VII–28–48, 3 larvae, 11 pupae (W. W. Wirth, USNM). NAPA Co.: Nr. Mount St. Helena, larvae, pupae (V. L. Kellogg), [lost–literature record: Kellogg, 1903:191]. SHASTA Co.: Creek nr. Castella, VIII–28–01, lectotype male (dissected from pupa), 4 larvae, 4 pupae (R. Coleman, USNM). Castle Crags State Park, along Sacramento River, 2,000 ft., VII–29–58, holotype male, allotype female, male and female paratypes "*B. shastensis*" (C. P. Alexander, ALEX, USNM). N. fork Cottonwood Creek, VI–14–49, 3 larvae (H. P. Chandler, CAS). Pit River, Power House 5, 1,900 ft., X–7–53, 5 males (H. P. Chandler, CAS, USNM). Pit River, No. 4 Dam–Power House, 2,100 ft., IX–12–53, 1 male, 1 pupa, 2 larvae (H. P. Chandler, CAS). Redding, 15 mi. w., Clear Creek, 1,000 ft., IX–17–45, 1 pupa (H. P. Chandler, CAS). TEHAMA Co.: Sacramento River, nr. Red Bluff, VIII–8, 12–13–56, 12 pupae, 16 larvae (S. S. R., ANSP). Nr. Richfield, Thomes Creek, VI–20–50, 2 larvae (M. B. and R. W. Coleman, USNM). TRINITY Co.: Nr. Del Loma, VI–20–59, 2 males (G. Byers *et al.*, KU). TULARE Co.: Lemon Cove, 5 mi. s., Kaweah River, VII–7–47, 1 male (W. W. Wirth, USNM). Three Rivers, 800 ft., VIII–6–7–27, 1 male (Cornell University, Lot 542, Sub. 321, CU). TUOLUMNE Co.: Tuolumne River, Jacksonville, VIII–20–61, 3 pupae, 3 larvae (C. M. Murvosh, OHSU).

This species finds its closest relatives among the eastern *Blepharicera*. With them it forms a distinct complex separable from *B. micheneri* and *jordani* as follows:

| | *ostensackeni et al.* | *micheneri-jordani* |
|---|---|---|
| Larvae: | Prolegs large, extending well beyond lateral margin of segment. | Prolegs small, at most only barely visible in dorsal view beyond lateral margin of segment. |
| | Integument with pigment pattern. | Integument concolorous, uniformly pigmented. |
| Male genitalia: | Dististyle small and simple. | Dististyle secondarily lobed and enlarged. |
| | IX tergite lobes rounded or quadrate simple, flat and separate. | IX tergite lobes triangular, fused mesad curving ventrad laterally. |

Like *jordani*, this species inhabits only the northern and central parts of the state. I have examined specimens studied by C. P. Alexander from Mt. Shasta and

considered by him to represent a distinct species, *shastensis*, and have compared them with the small portion of the type series of *ostensackeni* still extant (in USNM from Stanford Collection) and have found them to be identical. One male specimen, particularly, exhibits the genitalia and head in good condition and all significant characteristics of both match those of the holotype of *shastensis*. This slide-mounted specimen, which I here formally designate as the LECTOTYPE[1], bears the following data: "creek near Castella, Shasta Co. CALIF. 28 Aug. 1901 Coleman col." It was dissected from a mature pupa, portions of the case of which accompany the imago under the same coverslip.

Alexander originally described his species without having seen the type material of *ostensackeni* (then presumed lost) and not critically questioning Kellogg's description, which I believe to contain a gross error. It is clear to me, on the basis of the following reasoning, that Kellogg transposed the sexes when writing his description, i.e., he described the male as the female and vice versa.

In the only definitive part of Kellogg's description (the remainder except size could apply to any *Blepharicera*), he states, "Eyes of female contiguous, and bisected by an unfacetted stripe; eyes of male separated by a considerable space, and bisected by a line, the upper or large-facetted portion including a much larger part of the eye in the females than in the males, this part in the female (Pl. XVIII, fig. 2) being unusually small (as compared with other species)." After having studied many specimens of adult *Blepharicera* from California, I can find no insect that fits this set of characteristics. However, if the references to the sexes are transposed, Alexander's species and the lectotype designated above both agree perfectly.

The females of Alexander's *shastensis* exhibit the unusual features among North American *Blepharicera* of lacking mandibles and having small upper eye divisions while the males have very large upper eye divisions (see figures 68 and 69). Since the opposite conditions occur in the heads of all other *Blepharicera* with which Kellogg was familiar, it is plausible that he confused the sexes when setting down his remarks, perhaps writing them while referring to his figure (Pl. XVIII, fig. 2) of the "male" which clearly shows an absence of mandibles and is actually the head of a female. His correct larval and pupal descriptions plus the all-important existence of some of his original material show conclusively that he made this error.

[1] All of Kellogg's species were based originally on syntype series, most of which are now incomplete or totally lost. Lectotypes or neotypes need to be selected for these. In this work, only the lectotype of *ostensackeni* has been selected in order to clarify a case of synonymy.


Map 8. California distribution of *Dioptopsis alpina* Hogue.

## Genus *Dioptopsis* Enderlein

All of the North American species in this genus except *arizonica* Alexander occur in California.

### *Dioptopsis alpina* Hogue

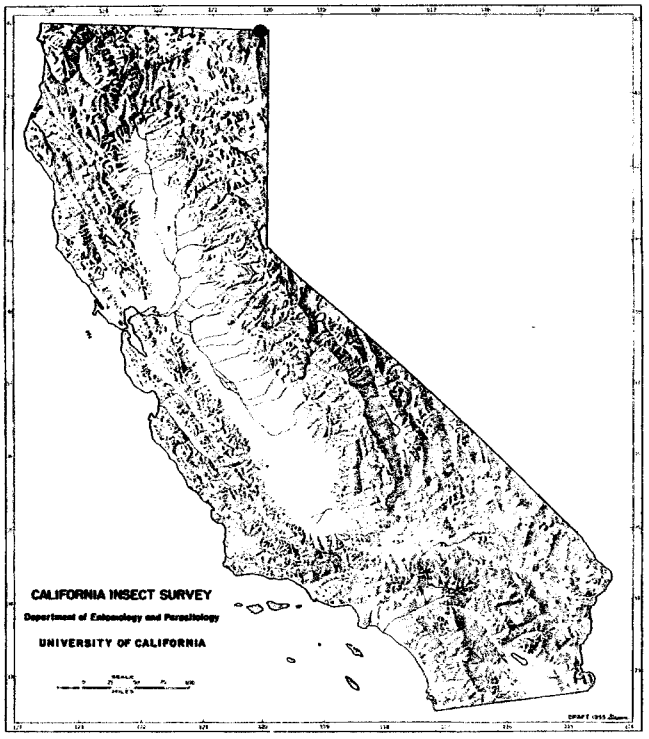
(Figs. 78–88; Map 8)

*Dioptopsis alpina* Hogue, 1966. L. A. County Mus. Cont. Sci., 120:1–5.

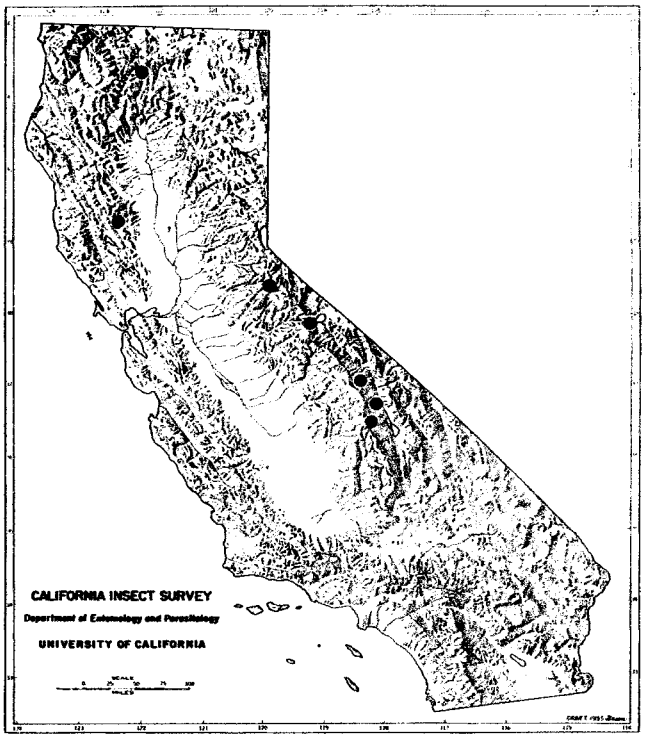
*Geographic range.*—California.

*California records.*—ALPINE Co.: Lake Alpine, VII–15–50, holotype male, allotype female (L. W. Quate, USNM), 1 male, 1 female, 13 pupae and pupal skins (CIS, LACM). EL DORADO Co.: Fred's Place, VII–5–50, 16 pupal skins (L. W. Quate, CIS). LOS ANGELES Co.: South fork Big Rock Creek, 2.9 mi. e. junction highway 39-Angeles Crest highway, 7,300 ft., VI–1–68, 4 larvae, 3 pupae (G. Challet, LACM). Little Rock Creek, Buckhorn Flats, 6,600 ft., VII–8–68, 2 pupae (J. Honey, LACM). SAN BERNARDINO Co.: O-ongo Creek, near Running Springs, San Bernardino Mountains, 6,000 ft., VIII–28–69, 1 pupa (C. L. Hogue, LACM). Snow Crest Camp, VII–18–52, 1 male (W. V. Garner, CIS). Vivian Creek, Mt. San Gorgonio, 6,800–7,000 ft., VII–2–68, 2 males, 6 females, 78 pupae and pupal skins, 181 larvae (C. L. Hogue, LACM). San Antonio Creek, 6,200–6,400 ft., VI–20–68, 1 female, 66 pupae and pupal skins, 3 larvae (C. L. Hogue, LACM).

This species' closest relative is *D. arizonica*, known only from the type male. The two species constitute a distinctive division of the genus characterized by




Map 9. California distribution of *Dioptopsis aylmeri* (Garrett).




Map. 10. California distribution of *Dioptopsis dismalea* Hogue.

nearly undivided eyes in both sexes, IX tergite lobes of the male genitalia apically truncate and very short (nearly as broad as long), spermathecae elongate and midtibia with only one, tiny apical spur (Hogue, 1966*b*:5).

### *Dioptopsis aylmeri* (Garrett)

(Figs. 89–100; Map 9)

*Philorus aylmeri* Garrett, 1923, Can. Ent. 55:244.

*Philorus cheaini* Garrett, 1925, Seventy new Diptera. Privately published, Cranbrook, B. C. p. 5. NEW SYNONYMY.

*Dioptopsis aylmeri;* Alexander, 1958, Proc. Tenth Int. Cong. Entomol., 1:822.

*Geographic range.*—California, Washington, Wyoming, British Columbia.

*California records.*—ALPINE Co.: Lake Alpine, VII–15–50, 48 pupal skins (L. W. Quate, CIS). COLUSA Co.: Paradise Creek, 2,400 ft., IV–18–52, 2 larvae (H. P. Chandler, CAS). [Determination in question]. INYO Co.: Big Pine Creek, Glacier Lodge, 1 mi. e., Sage Flat, 6,800 ft., VII–13–66, 7 pupae, 13 larvae (C. L. Hogue, LACM). Glacier Lodge, 1 mi. w., s. fork Big Pine Creek, 8,000 ft., VII–13–14–66, 1 male, 44 pupae (C. L. Hogue, LACM). Big Pine, 3 mi. w., Big Pine Creek, VII–13–66, 1 pupa (C. L. Hogue, LACM). Kearsarge Pack Station, s. fork Independence Creek, 9,100–9,300 ft., VII–12–66, 4 males, 1 female, 17 pupae and skins, 3 larvae (C. L. Hogue; CLH 167A, LACM). Lone Pine Creek, Whitney Portal, VII–11–66, 9 pupae and skins (C. L. Hogue, LACM). MONO Co.: Tioga Pass, Glacier Creek, 9,800 ft., VII–15–66, 47 pupae, 111 larvae (C. L. Hogue, LACM). Tioga Pass, Warren Fork, Leevining Creek, 9,400 ft., VII–15–66, 11 pupae and skins (C. L. Hogue, LACM). SISKIYOU Co.: Mt. Shasta City, 10 mi. s.w., s. fork Sacramento River, VII–21–48, 20 pupal skins (W. W. Wirth, USNM). S. fork Sacramento River No. 7, 4,000 ft., VII–8–53, 3 males, 5 pupae (H. P. Chandler, CAS).

All female specimens of this species from the eastern slope of the Sierra Nevada lack mandibles and exhibit other modifications of head structure (most notably reduced upper eye divisions) that parallel the type of head found in normal female *Blepharicera ostensackeni* and *Dioptopsis dismalea.* In other respects, these specimens and the males and immatures are indistinguishable from typical *aylmeri* from other localities with the exception of one female from the Grand Tetons of Wyoming which is likewise amandibulate.

The larva of this species is presently indistinguishable from those of *sequoiarum* and *dismalea.* The sclerites (head and prolegs) of *aylmeri* larvae tend to be yellow as opposed to brown or black in *sequoiarum* and *dismalea,* but there are exceptions. Detailed study of the chaetotaxy may yield reliable characters when long series of definitely associated specimens become available.

Through the kindness of B. V. Peterson and C. P. Alexander the types of *aylmeri* (male, CNC) and *cheaini* (female, ALEX) were made available for study. I

found them to bear characteristics[2] agreeing with males and females dissected from pupae collected together in a single location (s. fork Sacramento River) as well as with similar material collected by me in several streams draining the eastern slopes of the Sierra Nevada in Inyo and Mono counties. Including details of genitalic structure, all females in the latter collections, apart from the aberrant head anatomy discussed above, agree with typical *aylmeri* discussed above. These, I feel, are not indicative of a genotype sufficiently different from that of typical *aylmeri* (normal heads) to isolate them reproductively.

### *Dioptopsis dismalea* Hogue

(Figs. 101–111; Map 10)

*Dioptopsis dismalea* Hogue, 1970. L. A. County Mus. Cont. Sci., 178:1–10.

*Geographic range.*—California, Nevada.

*California records.* – Modoc Co.: Dismal Swamp, 7,200 ft., VII–15–16–68, holotype male, allotype female (J. Emmel and O. Shields, LACM, USNM). Creek just west of Dismal Creek, 7,300 ft., VII–15–16–68, 8 males, 65 pupae and skins (J. Emmel and O. Shields, LACM). Dismal Creek, VII–16–68, 103 pupae (J. Emmel and O. Shields, LACM). Stream west slope Mount Bidwell, 1 mi. s. Dismal Swamp, 8,000 ft., VII–16–68, 3 pupae (J. Emmel and O. Shields, LACM). Dismal Swamp, 8,000 ft., VII–15–48, 50, 66 pupae, 75 larvae (W. W. Wirth, USNM, CIS).

The females of *dismalea* lack mandibles as do those of only one other North American species, *Blepharicera ostensackeni*, and populations of *Dioptopsis aylmeri* from the eastern drainage of the Sierra Nevada.

### *Dioptopsis markii* (Garrett)

(Figs. 112–123)

*Philorus markii* Garrett, 1925, Seventy new Diptera. Privately published, Cranbrook, B. C., p. 5.

*Dioptopsis markii;* Alexander, 1958, Proc. Tenth Int. Cong. Entomol., 1:822.

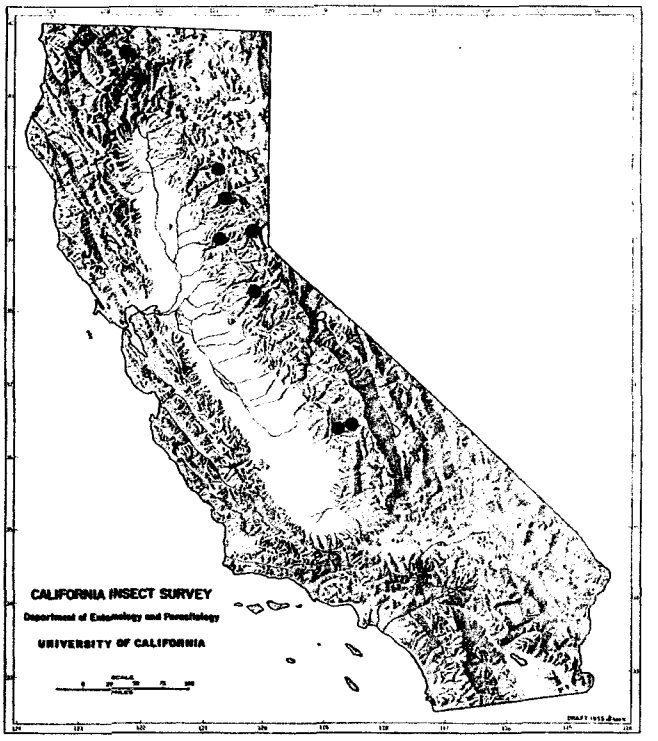
*Geographic range.*—California, Montana, Idaho, British Columbia.

*California Records.* – ? County: Elizabeth Lake, VII–2–34, 2 larvae, 1 pupa (R. H. Torbutan, INHS).

Unfortunately, the collector of the few immatures representing this species in California neglected to specify which of the ten California lakes named Elizabeth was involved. Probably the specimens come from a very northerly part of the state.

The similarity of the larva to that of *Blepharicera jordani* has already been noted.

[2] Garrett's tibial spur formula "0–1–2" is in error. The type actually bears two spurs on the midtibia, making the correct formula 0–2–2.




Map 11. California distribution of *Dioptopsis sequoiarum* (Alexander).

### *Dioptopsis sequoiarum* (Alexander)

(Figs. 124–135; Map 11)

*Philorus sequoiarum* Alexander, 1952, Bull. Brooklyn Entomol. Soc., 47:91.

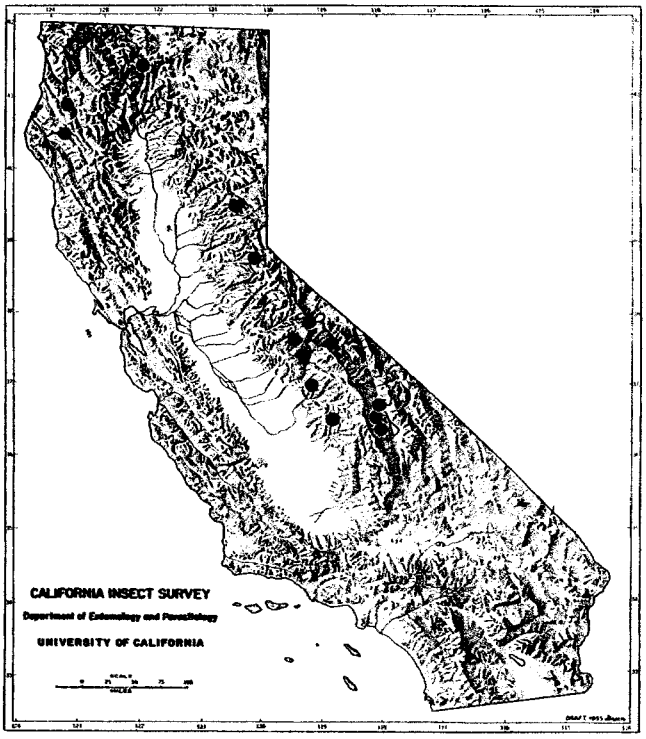
*Dioptopsis sequoiarum;* Alexander, 1958, Proc. Tenth Int. Cong. Entomol., 1:822.

*Geographic range.*—California, ? Wyoming, ? British Columbia.

*California records.*—Calaveras Co.: Sand Flat, 5,600 ft., VI–1–41, 36 larvae, 3 pupae (T. Aitken, USNM). Mokelumne River, VI–1948, 8 larvae (R. Coleman, USNM). Placer Co.: Dutch Flat, VI–20–52, 1 female (E. Schlinger, UCD). The Cedars, n. fork American River, VII–10–50, 50 pupae and skins (M. B. and R. W. Coleman, USNM). Plumas Co.: Greenville, 2 mi. n., Wolf Creek, V–16–48, 25 pupae, 16 larvae (W. W. Wirth, USNM). Sierra Co.: Gold Lake, VI–16–40, 5 females (M. Cazier and T. Aitken, USNM, CNC). Siskiyou Co.: Scott Lake Drainage, summer 1948, 8 larvae (R. Coleman, USNM). Mt. Shasta City, 10 mi. sw., s. fork Sacramento River, VII–21–48, 5 pupal skins (W. W. Wirth, USNM). Tulare Co.: Giant Forest, Marble Fork, Kings River Trail, Sequoia National Park, 6,500–7,100 ft., VII–24–07, 5 larvae (J. C. Bradley, USNM). Sequoia National Park, Dorst Campground, 6,500 ft., VII–3–50, holotype female, paratype female (C. P. Alexander, ALEX).

## Genus *Philorus* Kellogg

Oddly, no specimens of this genus have been taken in North America outside California, although it also occurs in Japan, India, Korea, and Formosa. The reasons




Map 12. California distribution of *Philorus californicus* Hogue.


Map 13. California distribution of *Philorus jacinto* Hogue.

for this disjunct distributional pattern are not known but are probably in large part due to lack of collecting in areas where it might be expected. A review of the regional species has been published by Hogue (1966*a*).

### *Philorus californicus* Hogue

(Figs. 136–144; Map 12)

*Philorus* n. sp. Gibo, 1964, Bull. So. Calif. Acad. Sci., 63:44.

*Philorus californicus* Hogue, 1966, L. A. County Mus. Cont. Sci., 99:7–10, figs. 3–4, 21–27.

*California records.*—El Dorado Co.: Riverton, VI–27–50, 3 larvae (Ting and Quate, CIS). Fresno Co.: Granite Creek, Kings River Canyon, VII–13–30 (?) –03 (?), 2 larvae, 3 pupae (V. L. Kellogg, USNM). Humboldt Co.: Dinsmore, 6 mi. w., VI–18–50, 11 larvae (L. W. Quate, CIS). Willow Creek, VIII–12–48, 9 larvae, 1 pupa (W. W. Wirth, USNM). Inyo Co.: Independence Creek, Kearsarge Pack Station, 9,300 ft., VII–12–66, 1 larva (C. L. Hogue; No. CLH 167B, LACM). Lone Pine Creek, Lone Pine, 5 mi. w., VII–12–66, 3 larvae, 1 pupa (C. L. Hogue, LACM). Whitney Portal, VIII–31–51, 39 pupae (R. Coleman, USNM); VII–11–12–66, 19 pupae, 70 larvae (C. L. Hogue; No. CLH 166A, LACM). Madera Co.: Mugler Meadow, VII–31–46, holotype male, paratype male (CAS). Mariposa Co.: Yosemite, VII–2–47, paratype female (A. L. Melander, USNM). Mono Co.: McGee Campground, McGee Creek, VII–14–66, 3 larvae (C. L. Hogue, LACM). Sardine Creek, 8,500 ft., VI–28–51, 18 larvae (E. L. Silver, LACM). Tioga Pass, Glacier Creek, 9,800 ft., VII–15–66, 1 larva (C. L. Hogue, LACM). Sierra Co.: Sierra City, VI–16–40, 102 larvae, 83 pupae (T. Aitken and M. Cazier, AMNH). Sierra City, Yuba River, VIII–10–14–63, allotype female, 5 paratype males (R. Westcott, LACM). Siskiyou Co.: Mt. Shasta City, 10 mi. sw., s. fork Sacramento River, VII–21–22–48, paratype male, 2 males, 3 females (dissected from pupae), 60 pupae, 66 larvae (W. W. Wirth, USNM, CIS). S. fork Sacramento River, 4,000 ft., VIII–4–53, 2 paratype females (H. P. Chandler, CAS). Tulare Co.: Giant Forest, Marble Fork, Sequoia National Forest, Kings River Trail, 6,500–7,100 ft., VII–24–07, 3 larvae (J. C. Bradley, CU).

### *Philorus jacinto* Hogue

(Figs. 145–153; Map 13)

*Philorus jacinto* Hogue, 1966, L. A. County Mus. Cont. Sci., 99:5–6, figs. 14–15.

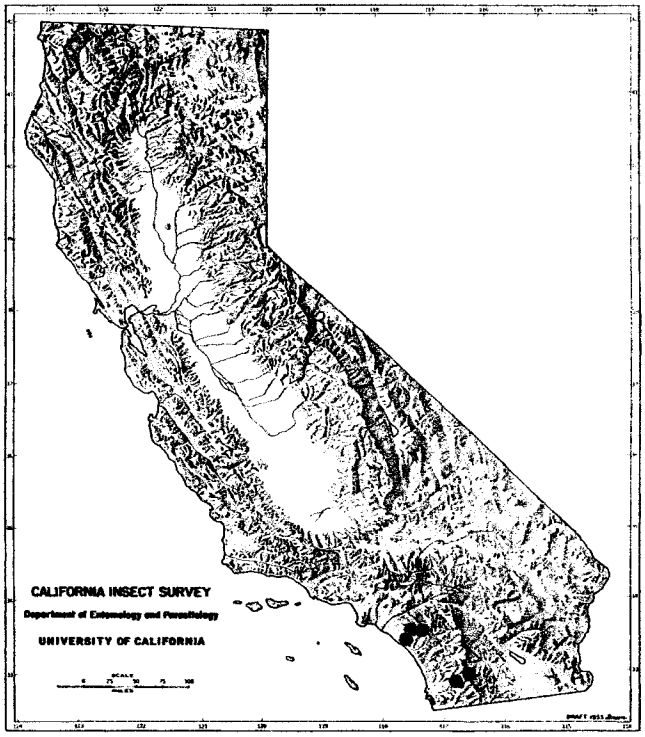
*California records.*—Riverside Co.: Idyllwild, V–14–39, 1 larva (T. Aitken, USNM). Strawberry Creek, 3,000 ft., San Jacinto Mountains, VI–29–65, holotype male, allotype female, 3 paratype males, 3 paratype females (P. A. Rauch, UCR, LACM); IV–14–66, 221 pupae, 155 larvae (C. L. Hogue; No. CLH 158, LACM); V–19–66, 24 males, 59 females, 14 pupae, 2 larvae (C. L. Hogue; No. CLH 165, LACM).

### *Philorus vanduzeei* Alexander

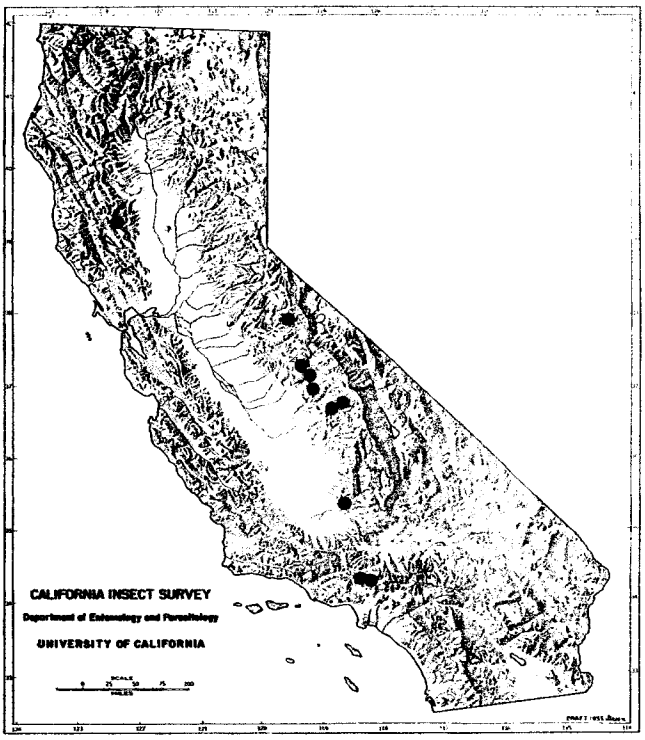
(Figs. 154–163; Map 14)

***Philorus vanduzeei* Alexander, 1966, Bull. Brooklyn Entomol. Soc., 58:134–135.**

*California records.*—Orange Co.: San Juan Creek, 1,600 ft., II–8–67, 4 larvae (G. Challet and J. Caton, UCR). Riverside Co.: Long Canyon Creek nr. jct. San Juan Canyon Creek, Santa Ana Mountains, IV–16–66, 31 pupae and skins, 66 larvae (J. Dixon, LACM); IV–29–67, 21 pupae, 45 larvae (C. L. Hogue,




Map 14. California distribution of *Philorus vanduzeei* Alexander.




Map 15. California distribution of *Philorus yosemite* (Osten Sacken).

LACM). Long Canyon and Decker Creek, ½ mi. n., Santa Ana Mountains, IV-22-66, 3 males, 5 females (C. L. Hogue; No. 160, LACM). San Juan Canyon Creek nr. jct. Lion Canyon Creek, Santa Ana Mountains, IV-16-66, 25 pupae, 11 larvae (J. Dixon, LACM). SAN DIEGO Co.: Cold Stream, Pasa Pacacho Campground, 2 mi. s., Cuyamaca State Park, IV-1, 23-66, 15 pupae, 96 larvae (C. L. Hogue; No. CLH 155, 161A, LACM). Alpine, IV-9-15, holotype male, allotype female, 1 male, 1 female (M. C. Van Duzee, ALEX, CU).

## *Philorus yosemite* (Osten Sacken)

(Figs. 164-172; Map 15)

***Blepharocera yosemite*** Osten Sacken, 1877, Bull. U. S. Geol. Survey Terr., 3:194-196. Type species (Coquillett, 1910, Proc. USNM 37:588).

***Blepharocera ancilla*** Osten Sacken, 1878. Cat. Des. Dip. N. Amer., Smith. Misc. Coll. 16:266-267. Hogue, 1965, *in* Cat. Dip. Amer. N. Mex.: 100; 1966, L. A. County Mus. Cont. Sci., 99:1 (Synonymy).

*Liponeura yosemite;* Osten Sacken, 1878, Deutsche Ent. Zeit., 22:408-410.

*Philorus yosemite;* Kellogg, 1903, Proc. Cal. Acad. Sci., Ser. 3 3:199.

*California records.*—COLUSA Co.: Paradise Creek, 2,400 ft., VII-24-53, 3 pupae (H. P. Chandler, CAS). FRESNO Co.: Big Creek nr. Huntington Lake, 3,500 ft., VI-9-63, 5 males, 1 female (C. P. Alexander, ALEX, LACM). Small stream w. General Grant Grove, Route 180, Sequoia National Park, 4,900 ft., VI-7-63, 1 male (C. P. Alexander, ALEX). West cliff along Route 180, Kings Canyon National Park, VI-21-63, 8 pupal skins (C. P. Alexander, ALEX). Kings Canyon Road, Route 180, Horseshoe Bend, 3,500 ft., V-31-VI-1-63, 6 males, 2 females (C. P. Alexander, ALEX, LACM). Tollhouse along Dry Creek, VI-10-63, 1 male (C. P. Alexander, ALEX). KERN Co.: Tributary to Kern River, e. side Kern Canyon, IV-6-63, 21 larvae, 13 pupae (C. L. Hogue; No. CLH 79, LACM). LOS ANGELES Co.: Ladybug Canyon, 4,000 ft., San Gabriel Mountains, IV-24-63, 2 larvae (C. L. Hogue, LACM). Big Tujunga Canyon, Trail Creek, IV-22-V-27-62, 22 males, 16 females, 48 larvae, 64 pupae and skins (D. Gibo, LACM). MARIPOSA Co.: Middle fork Chowchilla River, bridge e. Bootjack, IV-13-60, 2 larvae (R. C. Jorgensen, SJS). Upper Yosemite Falls, Yosemite Valley, VI-6-76, lectotype male (C. R. Osten Sacken, MCZ). TUOLOMNE Co.: Tiltill Creek, Yosemite National Park, VI-11-61, 1 larva (G. B. Wiggins, ROM).

A partial account of the biology in the San Gabriel Mountains is given by Gibo (1964).

TABLE 1

List of California Species of Blephariceridae and Numbers of III and IV Larval Instar Antennal Segments and Gill Filaments

| Species | Number of filaments in ventrolateral gill | | Number of antennal segments | |
|---|---|---|---|---|
| | Instar III | IV | Instar III | IV |
| *Agathon comstocki* (Kellogg, 1903) | 3 | 5 | 2 | 3 |
| *A. doanei* Kellogg, 1900 | 3 | 6–7 | 2 | 3 |
| *A. elegantulus* von Röder, 1890 | 3 | 5 | 2 | 2 |
| *Bibiocephala nigripes* Alexander, 1965 | 4* | 6* | 2* | 2* |
| *Blepharicera jordani* Kellogg, 1903 | 4(3)** | 6(4) | 2 | 2 |
| *B. micheneri* Alexander, 1959 | 4 | 7 | 2 | 2 |
| *B. ostensackeni* Kellogg, 1903 | 4 | 7 | 2 | 2 |
| *Dioptopsis alpina* Hogue, 1966 | 3 | 5 | 2 | 3 |
| *D. dismalea* Hogue, 1970 | unavailable | 5(4) | unavailable | 3 |
| *D. aylmeri* (Garrett, 1923) | 3(2) | 4–5(3–4) | 2 | 3 |
| *D. markii* (Garrett, 1923) | 2(1) | 3–4(2–3) | 1 | 2 |
| *D. sequoiarum* (Alexander, 1952) | 3 | 4 | 2 | 3 |
| *Philorus californicus* Hogue, 1966 | 0 | 3 | 2 | 3 |
| *P. jacinto* Hogue, 1966 | 3 | 5 | 2 | 3 |
| *P. vanduzeei* Alexander, 1966 | 3 | 5 | 2 | 3 |
| *P. yosemite* (Osten Sacken, 1877) | 3 | 5 | 2 | 3 |

* From *Bibiocephala* sp.

** Values in parentheses for gill tuft on abdominal division 6 only.

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# PLATES

PLATE I

Figs. 1–6. *Agathon comstocki*, adult. 1, wing; 2, 3, male and female head; 4, 5, male genitalia; 6, female genitalia.

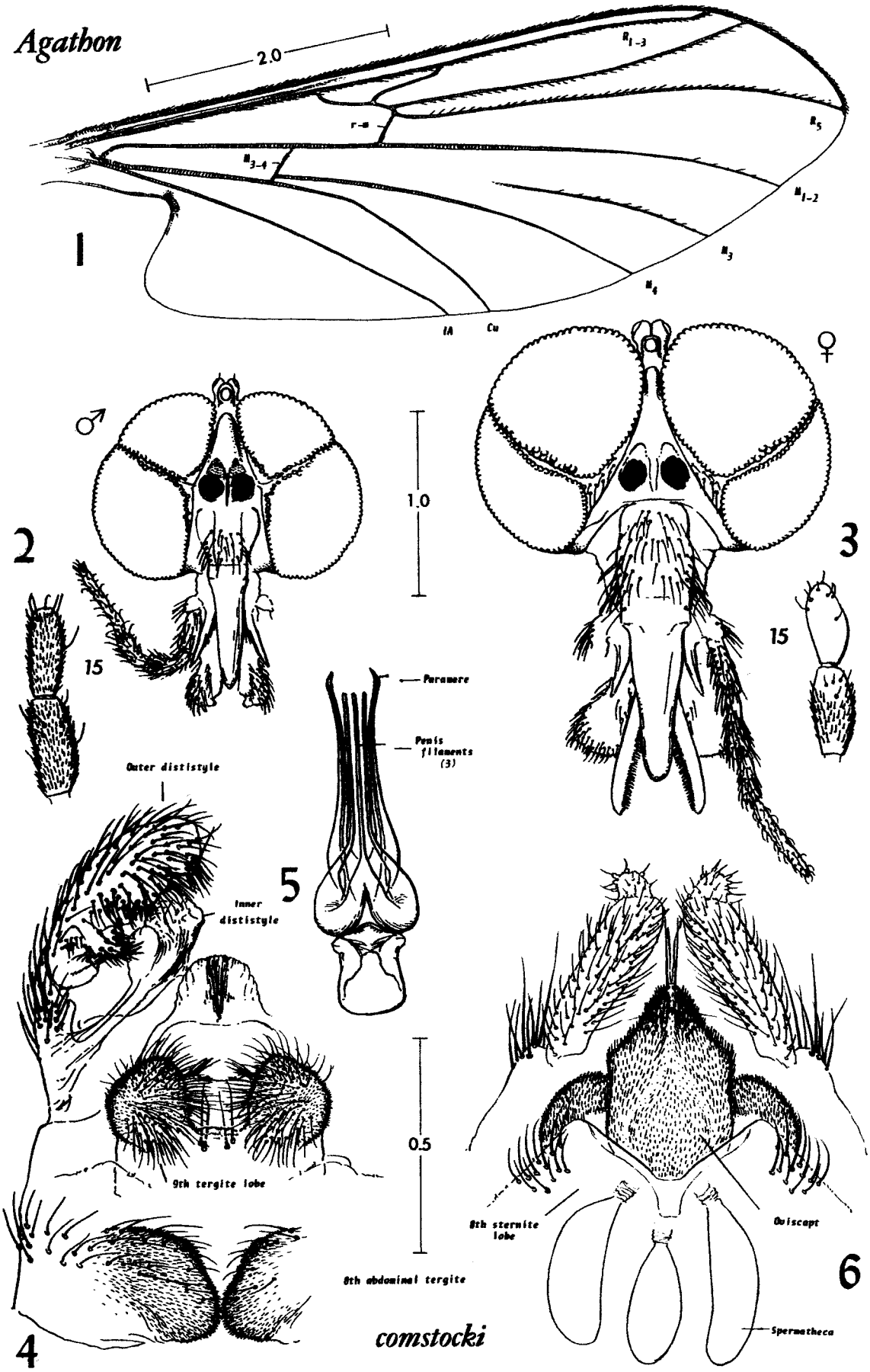

Agathon
2.0
$R_{1-3}$
r-m
$R_5$
$M_{3-4}$
$M_{1-2}$
$M_3$
$M_4$
IA
Cu
1
♂
2
15
1.0
♀
3
15
Paramere
Penis filaments (3)
5
Outer dististyle
Inner dististyle
9th tergite lobe
0.5
8th abdominal tergite
4
8th sternite lobe
Cuiscapt
6
Spermatheca
comstocki

PLATE II

Figs. 7–11. *Agathon comstocki*, larva and pupa. (Left half of figures 7, 9, 11 shows dorsal view, right half ventral view. Figures 8, 9, show lateral aspect.) 7, 8, larva; 9–11, pupa.

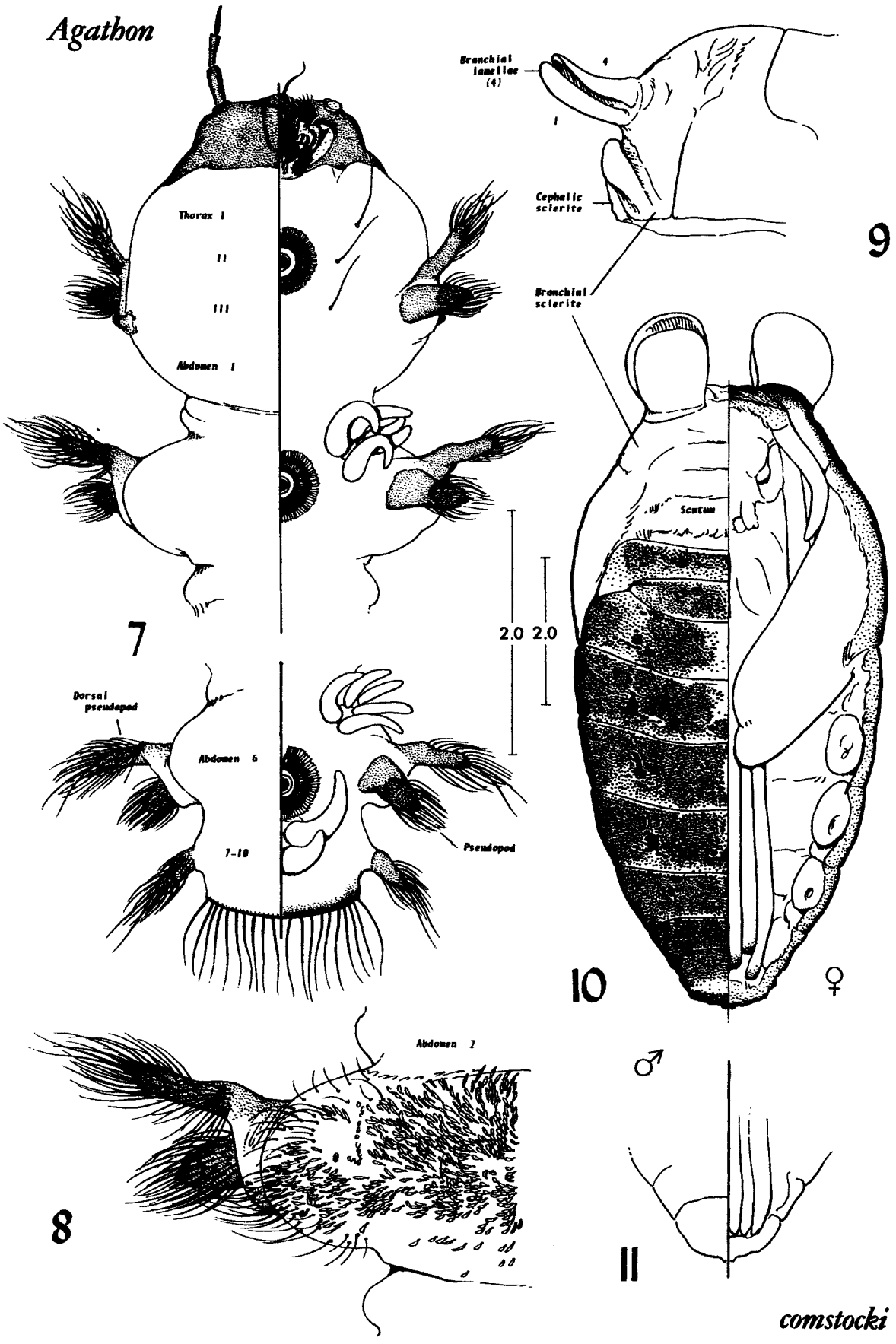

Agathon
Thorax I
II
III
Abdomen I
7
Dorsal pseudopod
Abdomen 6
7-10
Pseudopod
2.0 2.0
8
Abdomen 2
Branchial lamellae (4)
4
1
Cephalic sclerite
Branchial sclerite
9
Scutum
10
♀
♂
11
comstocki

PLATE III

Figs. 12–17. *Agathon doanei*, adult. 12, wing; 13, 14, male and female head; 15, 16, male genitalia; 17, female genitalia. (See plate I for explanation of structural detail.)

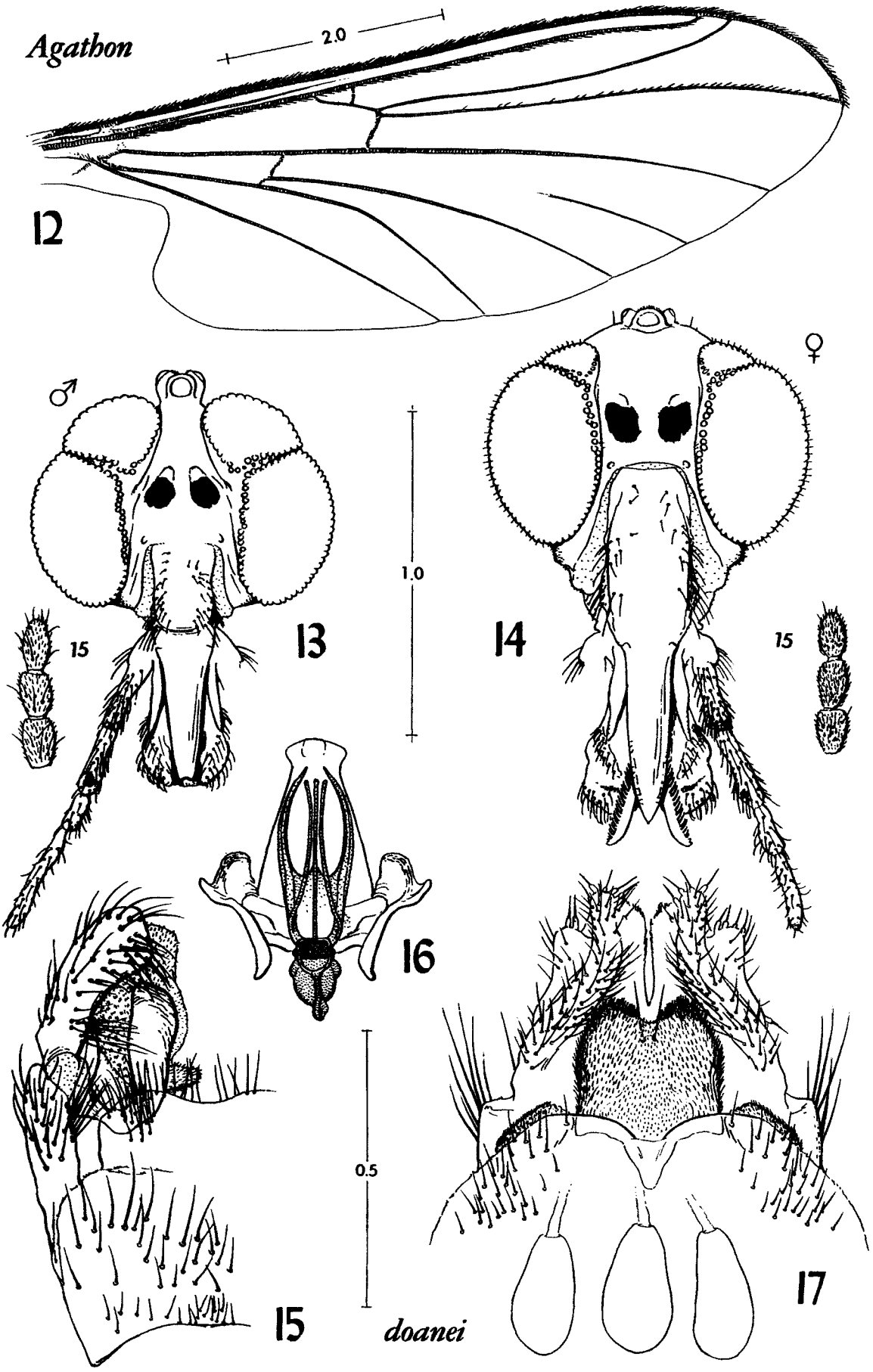
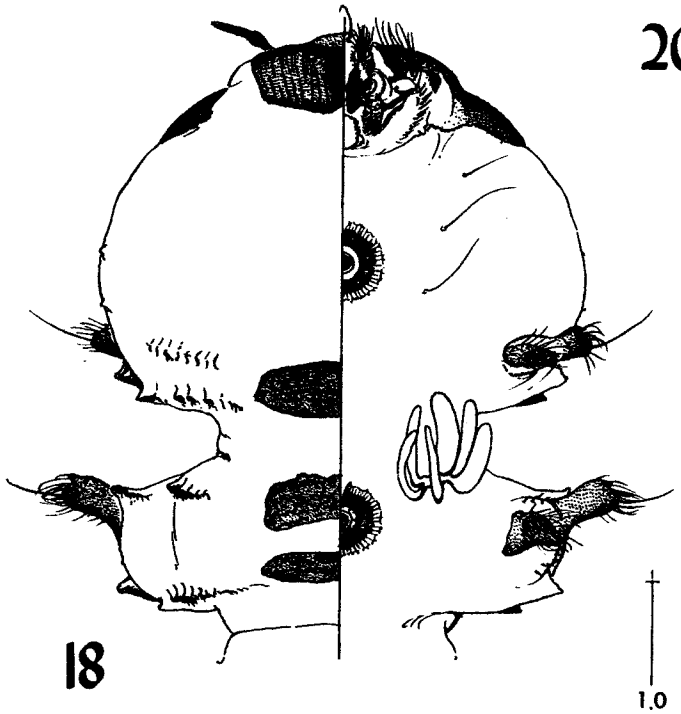

Agathon
2.0
12
♂
13
15
1.0
♀
14
15
16
0.5
15
doanei
17

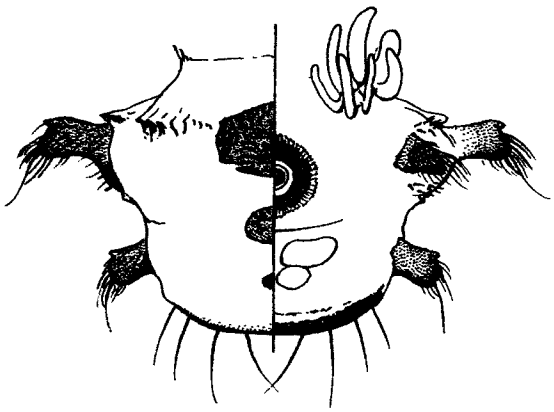
PLATE IV

Figs. 18–22. *Agathon doanei*. 18, 19, larva; 20–22, pupa. (See plate II for explanation of structural detail.)

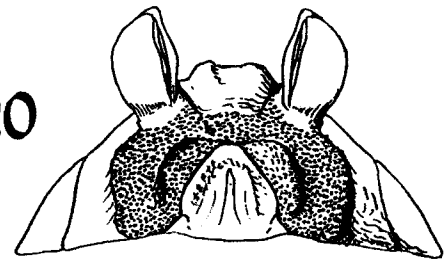
*Agathon*



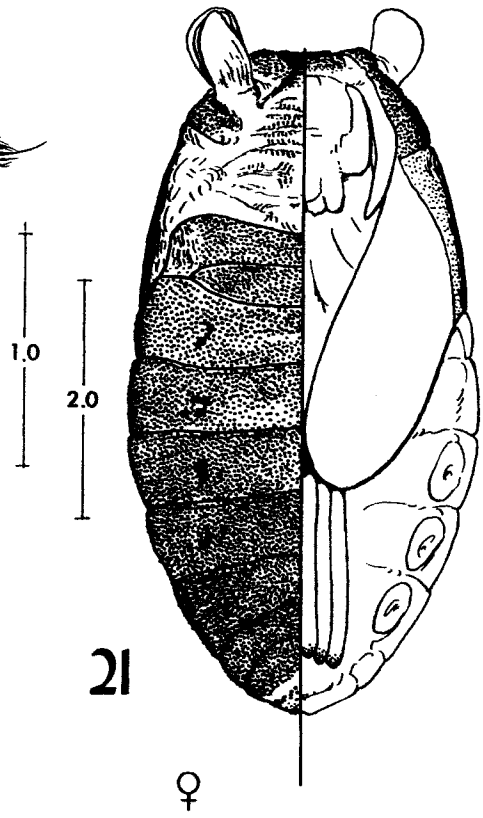
18



19



20

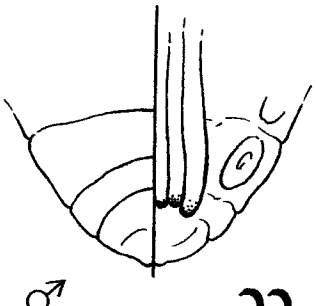


1.0

2.0

21

♀



♂

22

*doanei*

PLATE V

Figs. 23–28. *Agathon elegantulus,* adult. 23, wing; 24, 25, male and female head; 26, 27, male genitalia; 28, female genitalia. (See plate I for explanation of structural detail.)

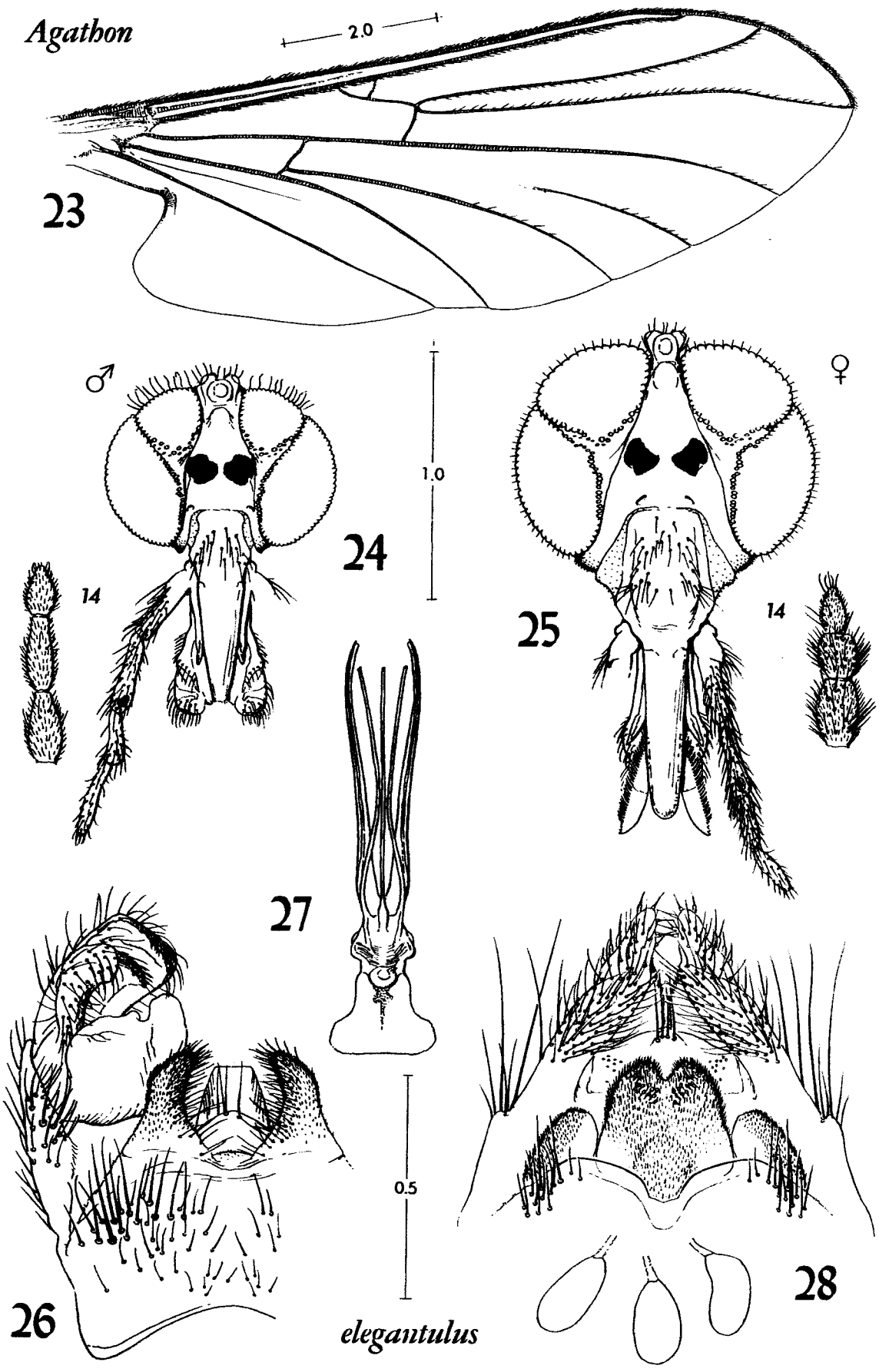
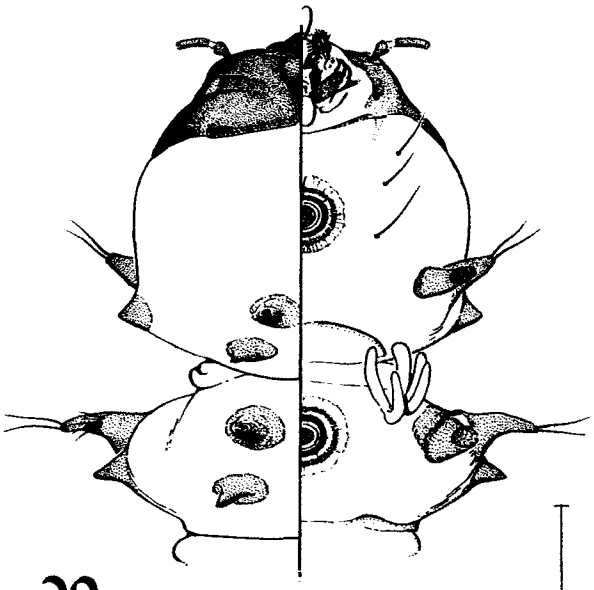

Agathon
2.0
23
♂
1.0
24
14
♀
25
14
27
0.5
26
28
elegantulus

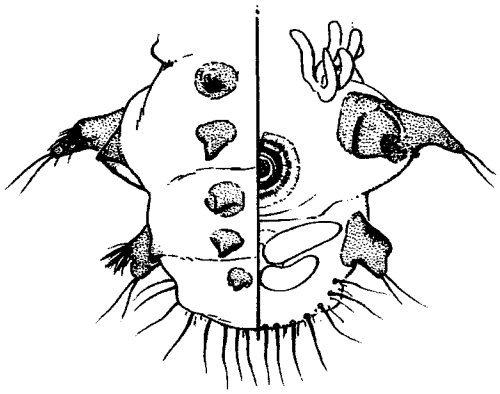
PLATE VI

Figs. 29–33. *Agathon elegantulus.* 29, 30, larvae; 31–33, pupa. (See plate II for explanation of structural detail.)

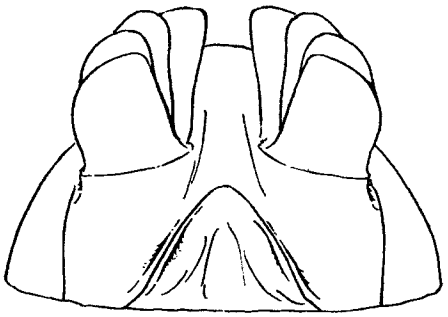
*Agathon*



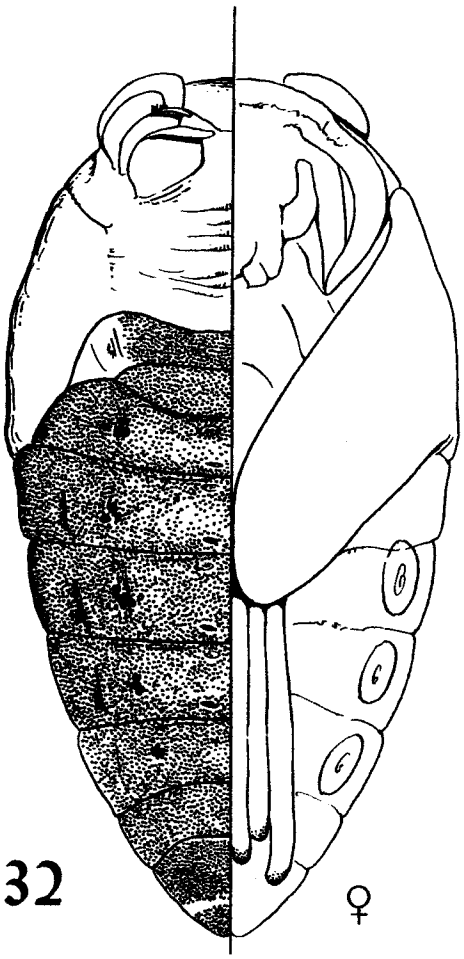
29



30



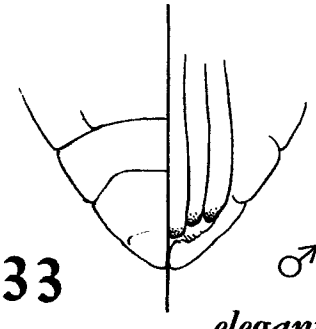
31



32 ♀

2.0

2.0



33 ♂

*elegantulus*

PLATE VII

Figs. 34–39. *Bibiocephala* sp., adult. 34, wing; 35, 36, male and female head; 37, 38, male genitalia; 39, female genitalia. (See plate I for structural detail.)

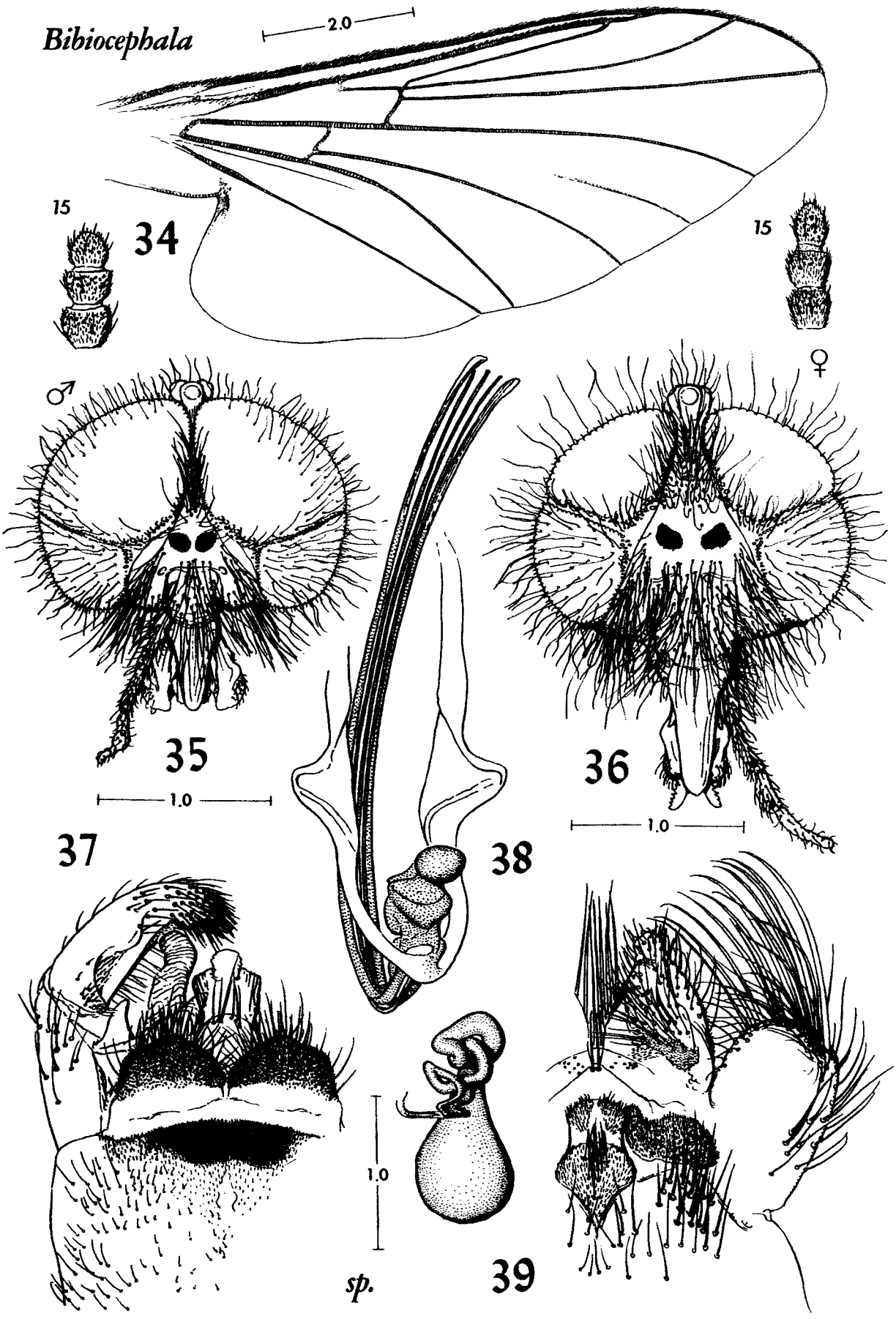
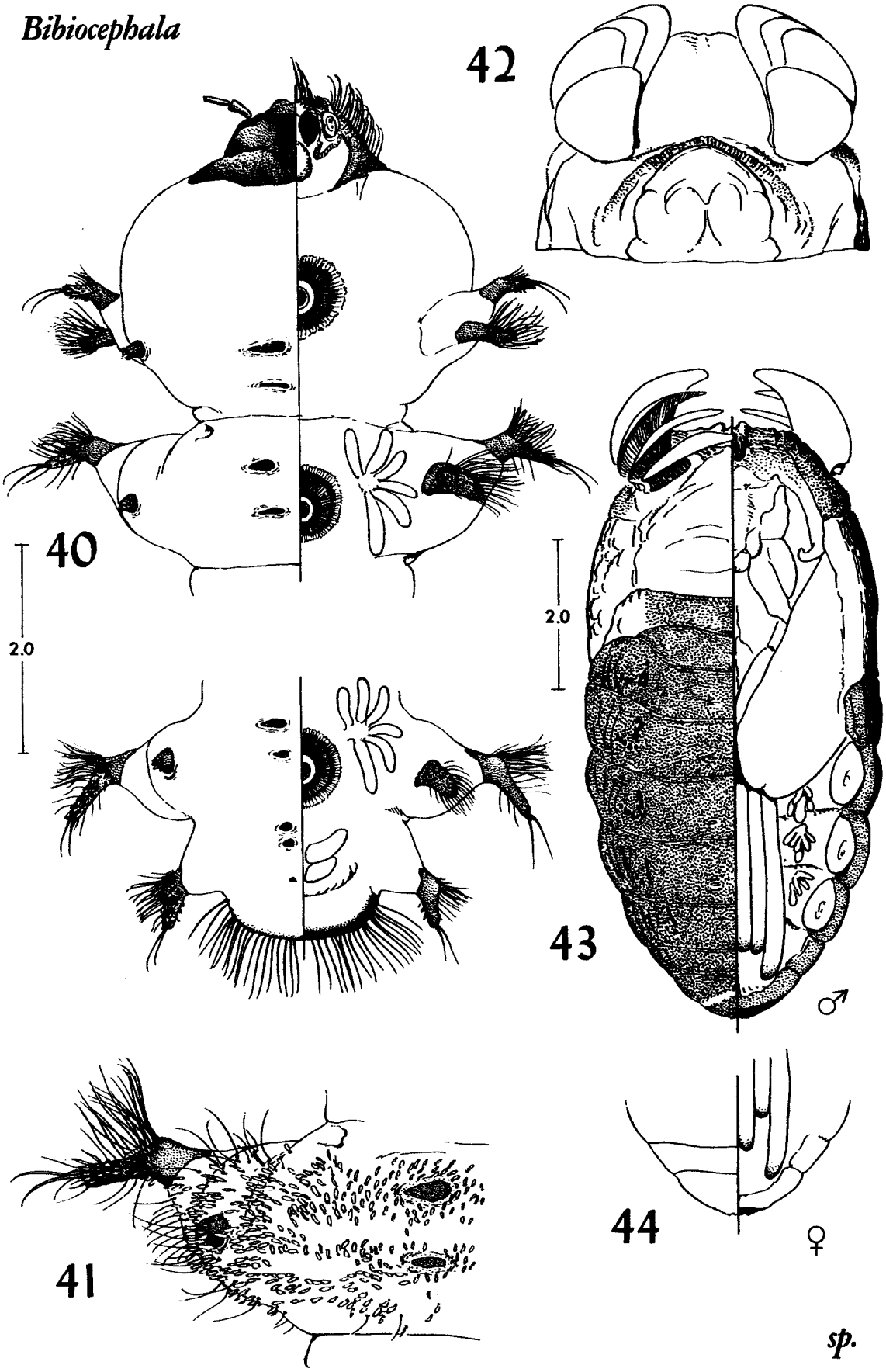

Bibiocephala
2.0
15
34
15
♂
♀
35
1.0
36
1.0
37
38
1.0
sp.
39

PLATE VIII

Figs. 40–44. *Bibiocephala* sp. 40, 41, larva; 42–44, pupa. (See plate II for structural detail.)

*Bibiocephala*



## PLATE IX

Fig. 45–50. *Blepharicera jordani,* adult. 45, wing; 46, 47, male and female head; 48, 49, male genitalia; 50, female genitalia. (See plate I for structural detail.)

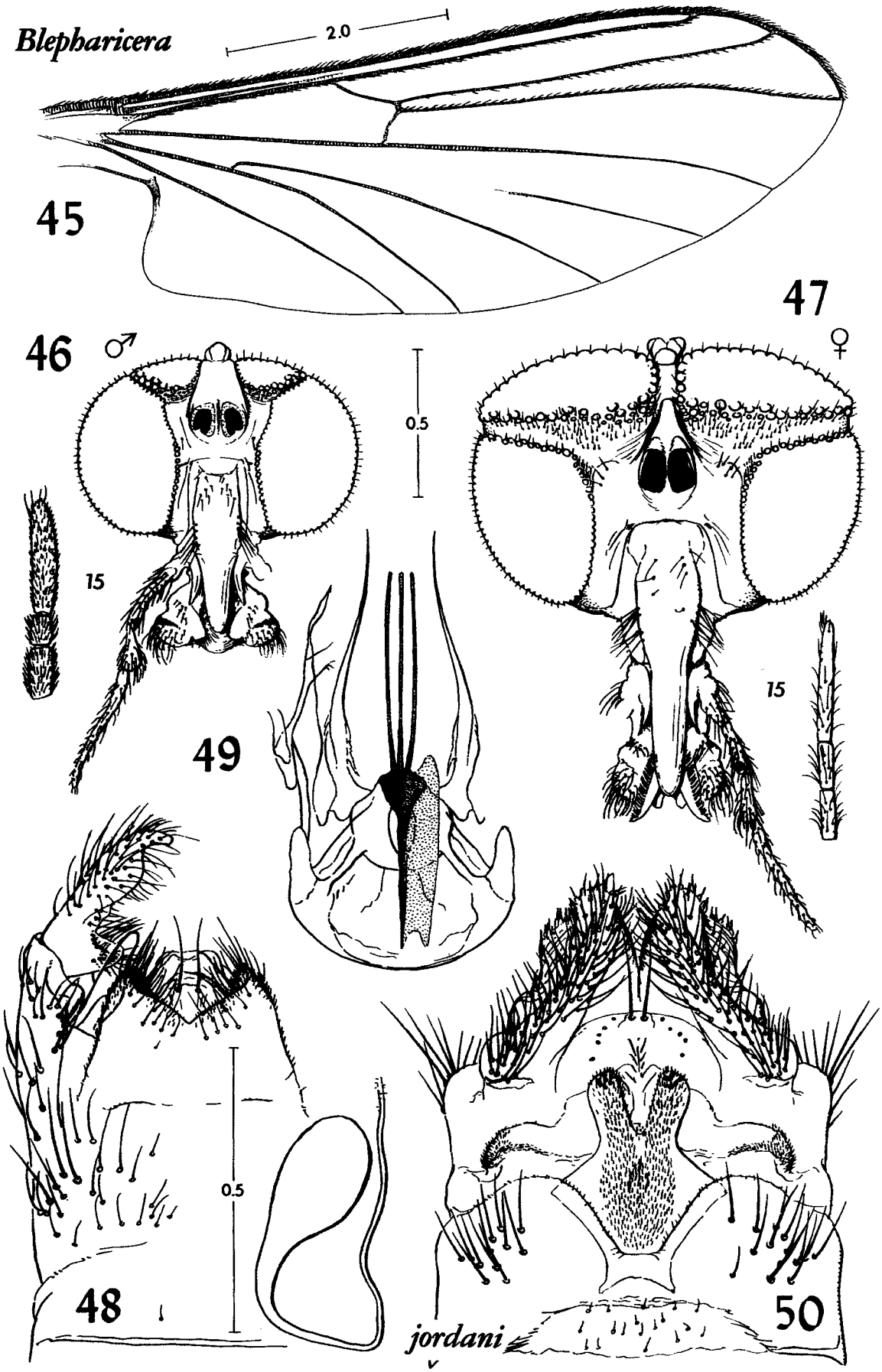
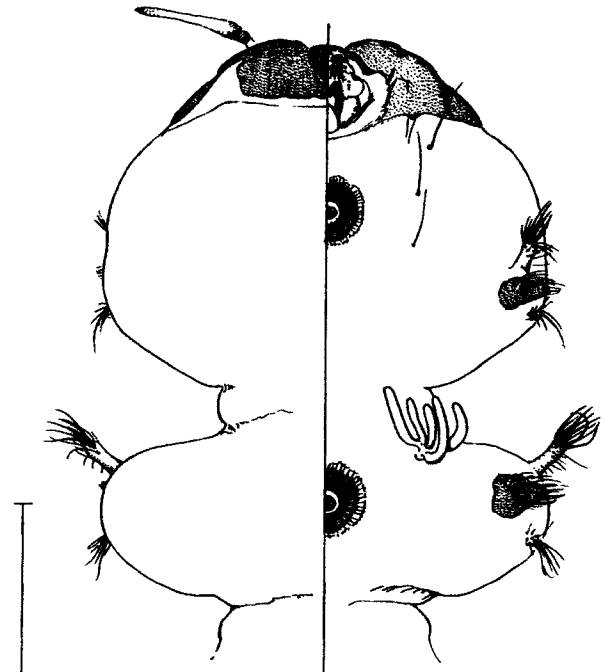

Blepharicera
2.0
45
47
46
♂
♀
0.5
15
15
49
0.5
48
50
jordani

PLATE X

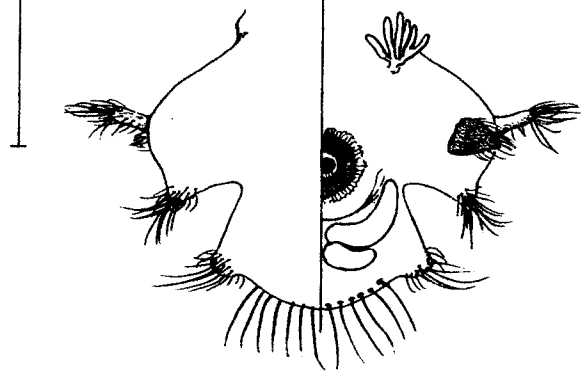
Figs. 51–55. *Blepharicera jordani.* 51, 52, larva; 53–55, pupa. (See plate II for structural detail.)

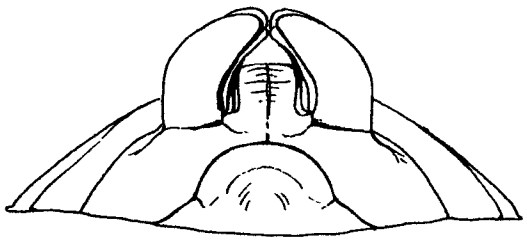
## *Blepharicera*



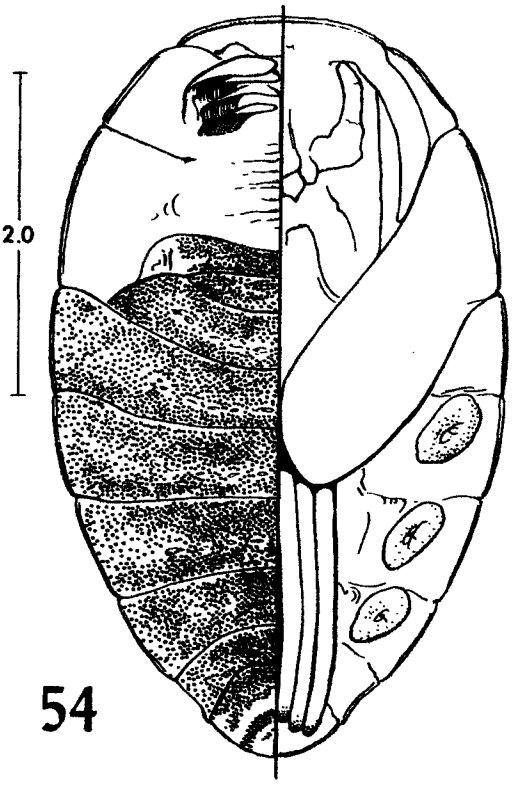
2.0

51





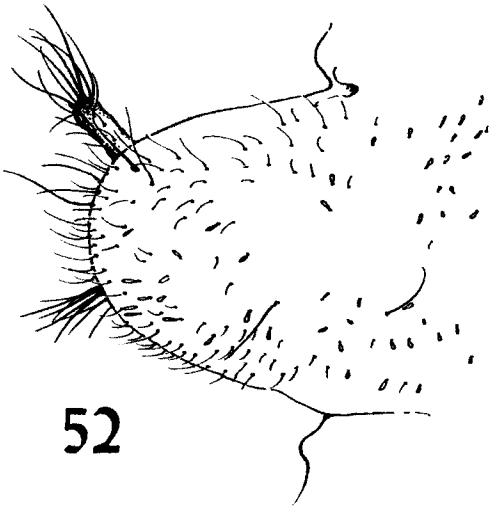
53



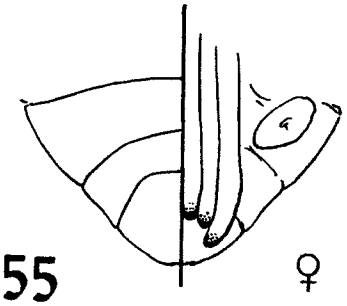
2.0

54

♂



52



55

♀

*jordani*

## PLATE XI

Figs. 56–61. *Blepharicera micheneri*, adult. 56, wing; 57, 58, male and female head; 59, 60, male genitalia; 61, female genitalia. (See plate I for structural detail.)

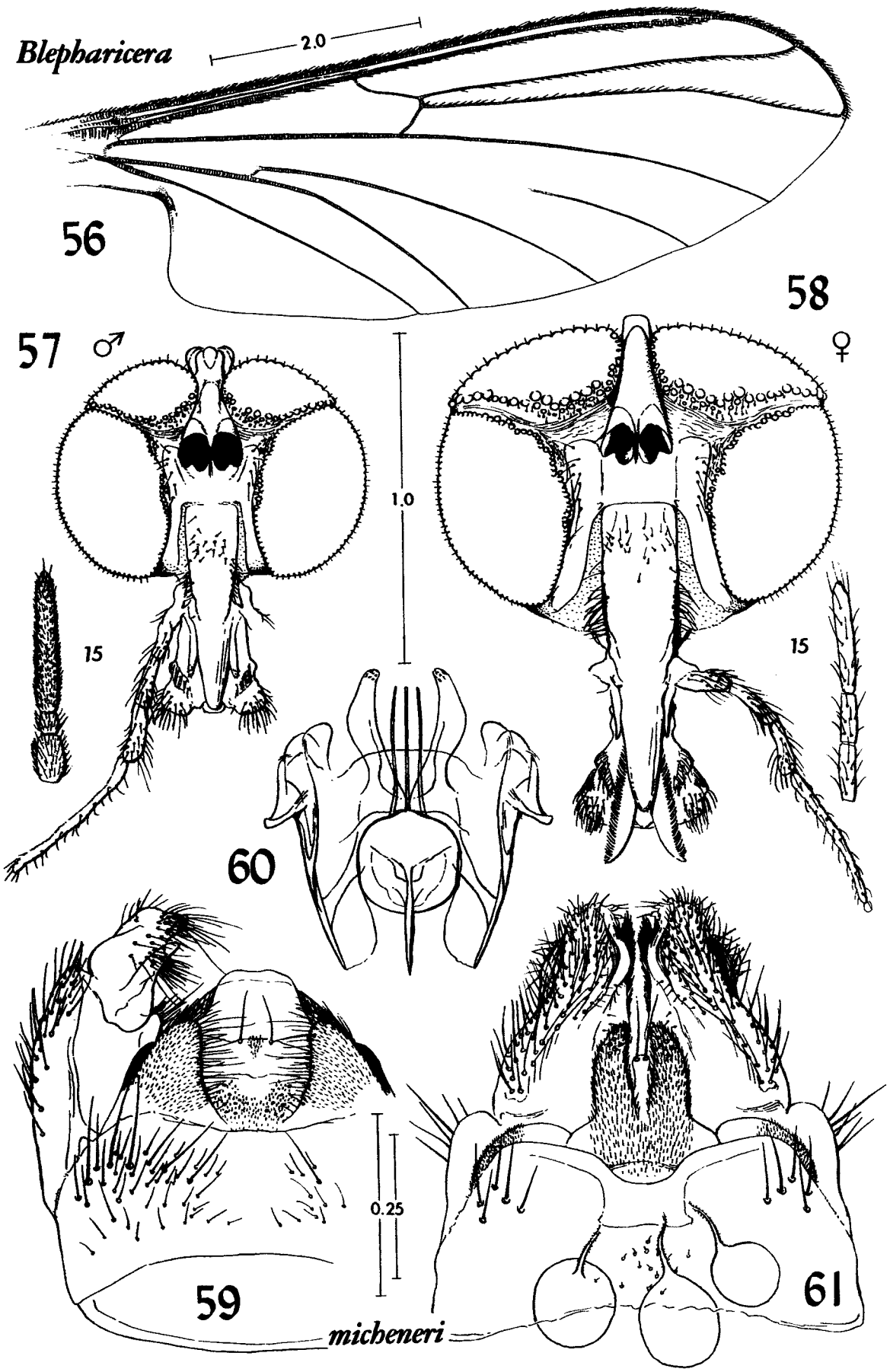
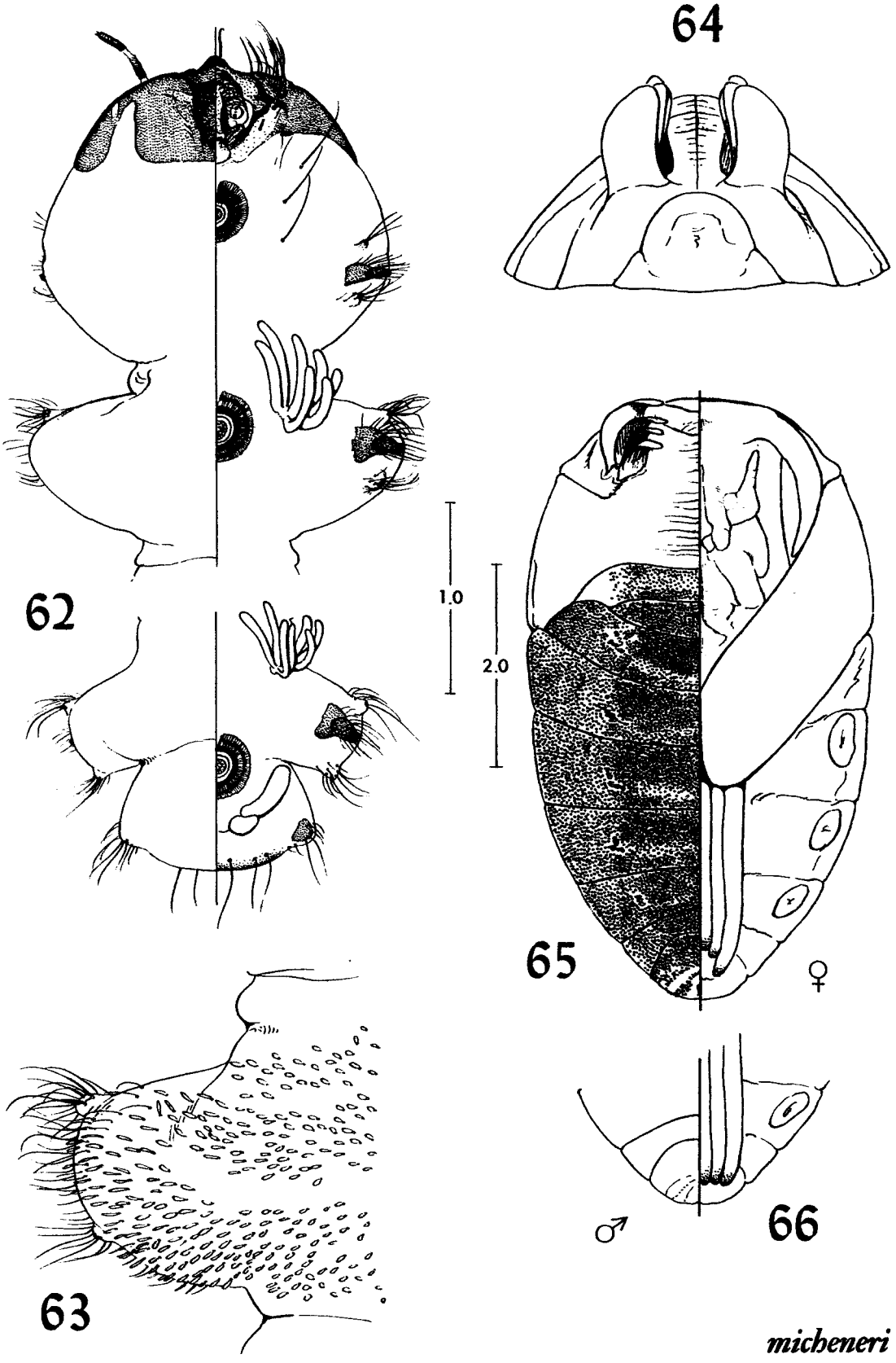

Blepharicera
2.0
56
57 ♂
58 ♀
1.0
15
15
60
0.25
59
61
micheneri

PLATE XII

Figs. 62–66. *Blepharicera micheneri.* 62, 63, larva; 64–66, pupa. (See plate II for structural detail.)

## *Blepharicera*




*micheneri*

PLATE XIII

Figs. 67–72. *Blepharicera ostensackeni*, adult. 67, wing; 68, 69, male and female head; 70, 71, male genitalia; 72, female genitalia. (See plate I for structural detail.)

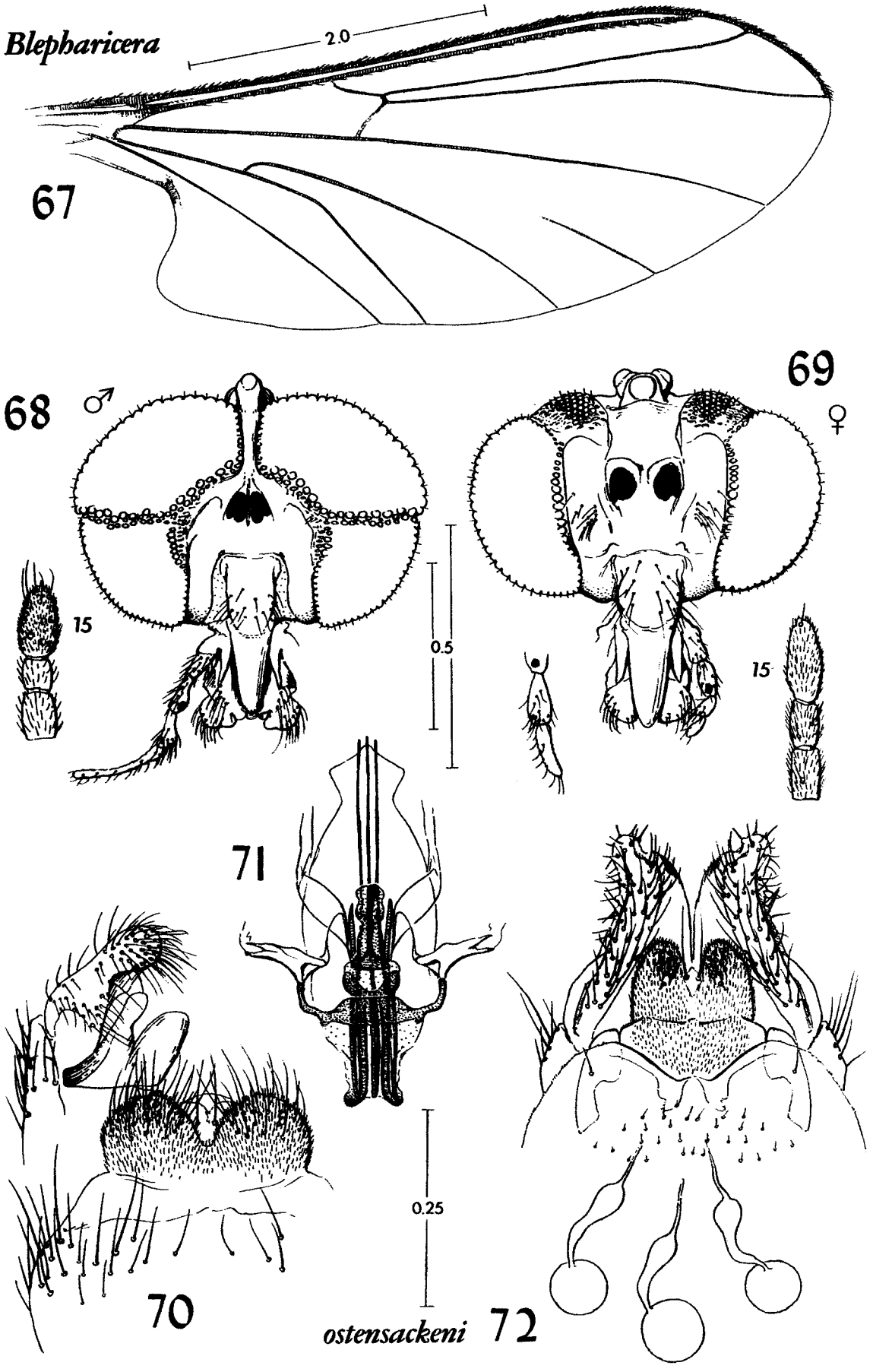
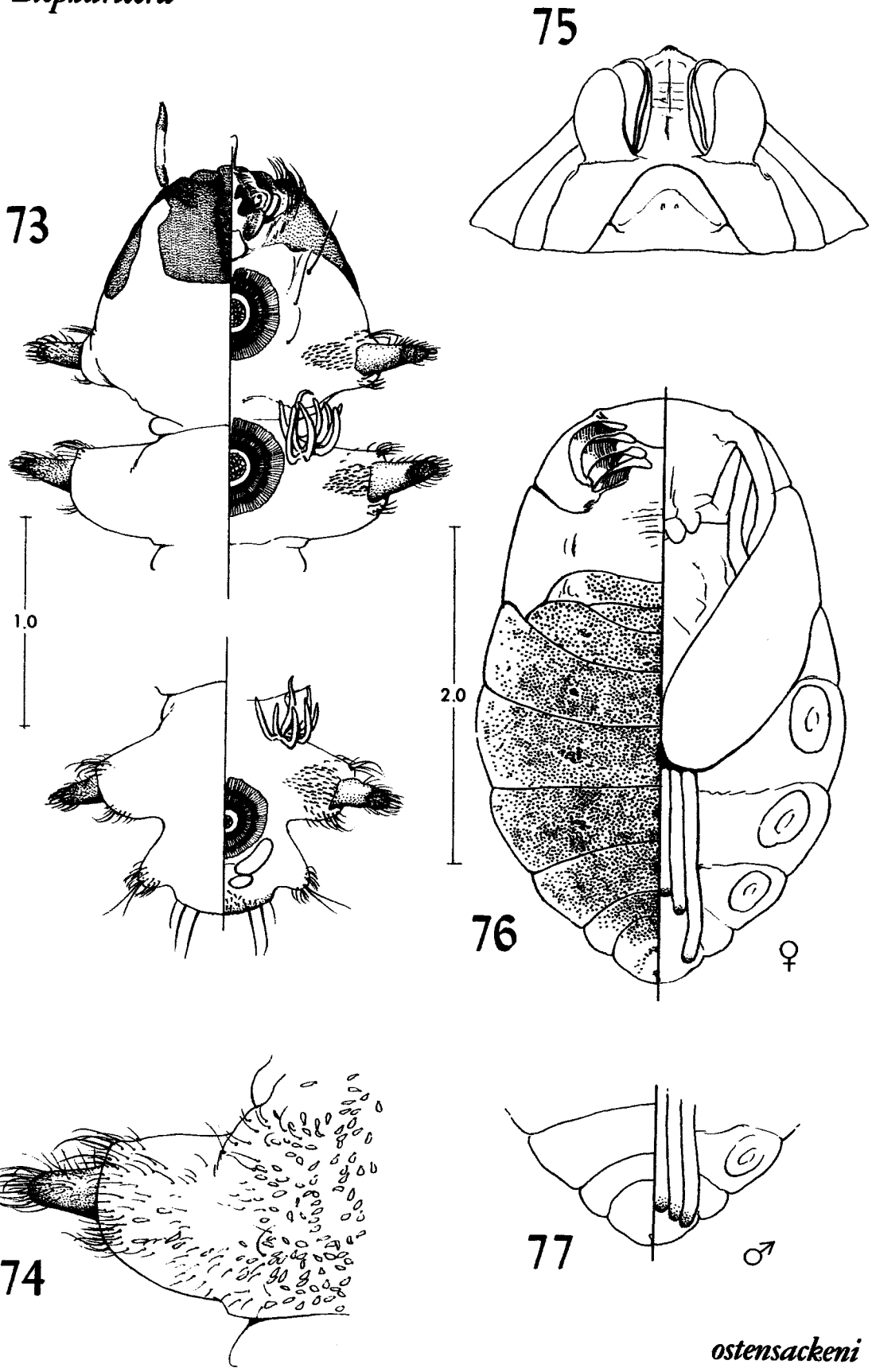

*Blepharicera*
2.0
67
68
♂
15
0.5
69
♀
15
71
0.25
70
*ostensackeni* 72

PLATE XIV

Figs. 73–77. *Blepharicera ostensackeni.* 73, 74, larva; 75–77, pupa. (See plate II for structural detail.)

## *Blepharicera*




*ostensackeni*

PLATE XV

Figs. 78–83. *Dioptopsis alpina*, adult. 78, wing; 79, 80, male and female head; 81, 82, male genitalia; 83, female genitalia. (See plate I for structural detail.)

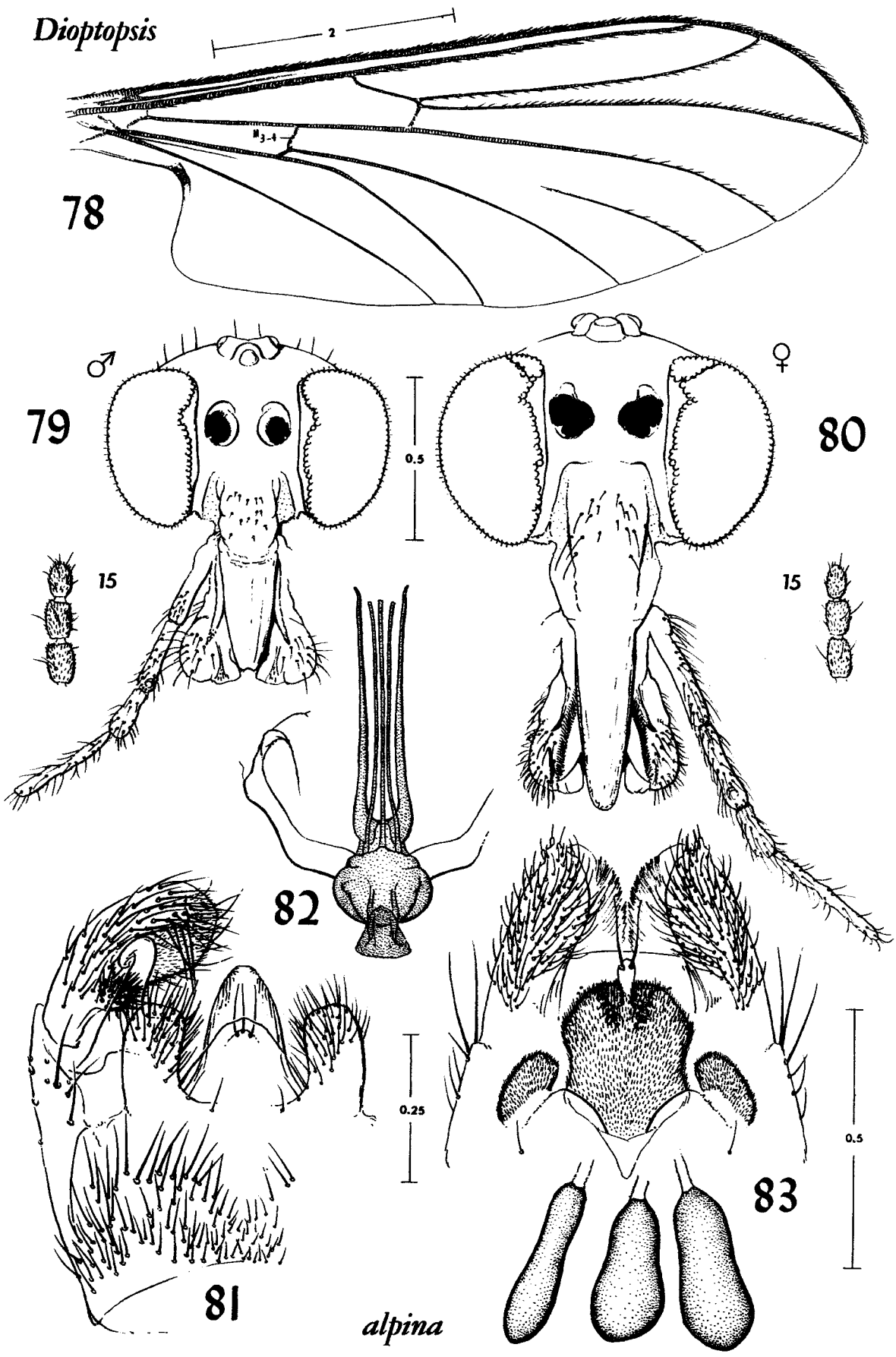

Dioptopsis
2
M3-4
78
♂
79
0.5
15
♀
80
15
82
0.25
81
83
0.5
alpina

PLATE XVI

Figs. 84–88. *Dioptopsis alpina.* 84, 85, larva; 86–88, pupa. (See plate II for structural detail.)

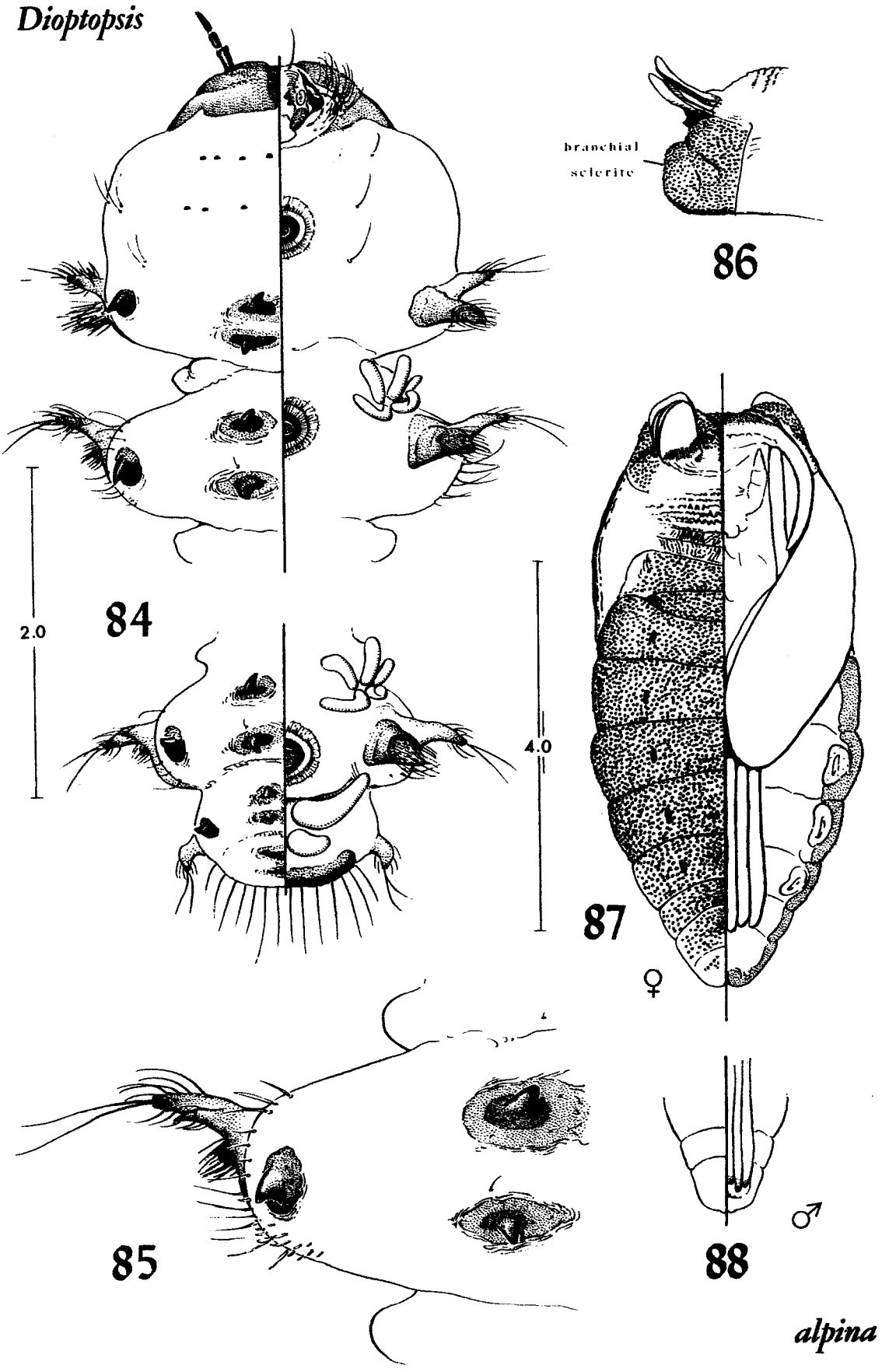
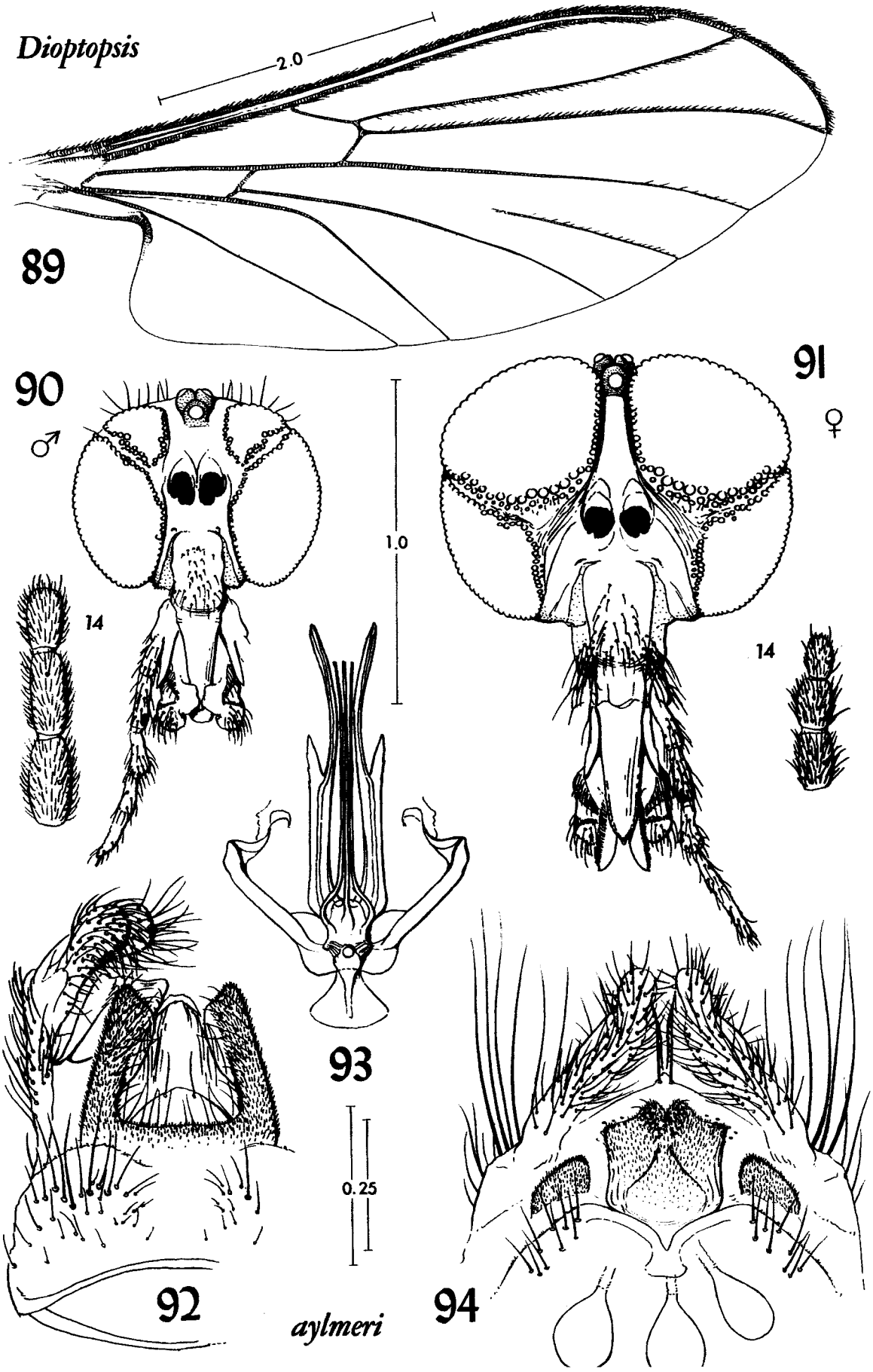

Dioptopsis
branchial sclerite
86
2.0
84
4.0
87
♀
85
88
♂
alpina

PLATE XVII

Figs. 89–94. *Dioptopsis aylmeri*, adult. 89, wing; 90, 91, male and female head; 92, 93, male genitalia; 94, female genitalia. (See plate I for structural detail.)


Dioptopsis
2.0
89
90
♂
14
1.0
91
♀
14
93
0.25
92
94
aylmeri

## PLATE XVIII

Figs. 95–100. *Dioptopsis aylmeri.* 95, 96, larva; 97–100, pupa. (See plate II for structural detail.)

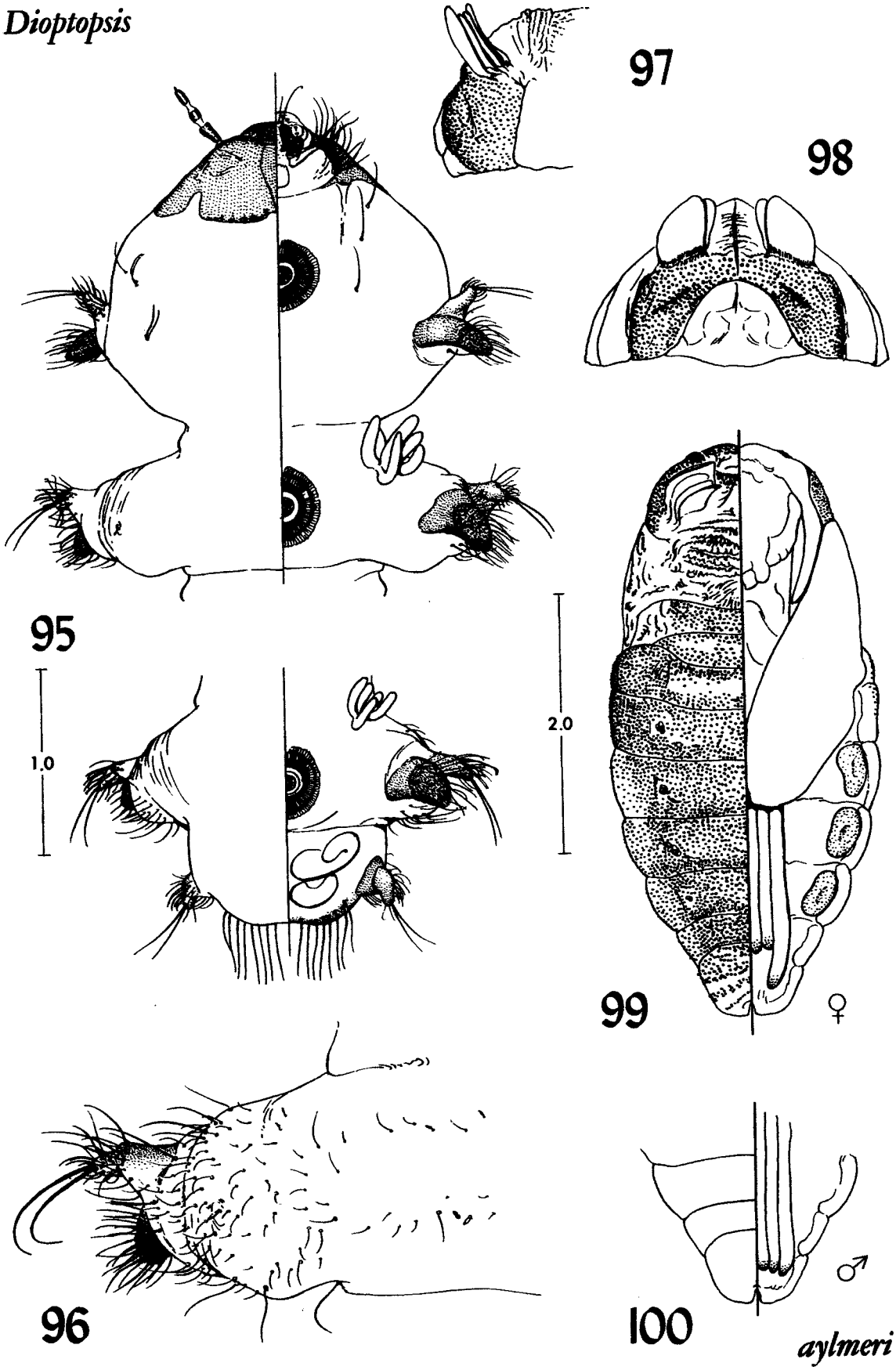

Dioptopsis
97
98
95
1.0
2.0
99
♀
96
100
♂
aylmeri

PLATE XIX

Figs. 101–106. *Dioptopsis dismalea,* adult. 101, wing; 102, 103, male and female head; 104, 105, male genitalia; 106, female genitalia. (See plate I for structural detail.)

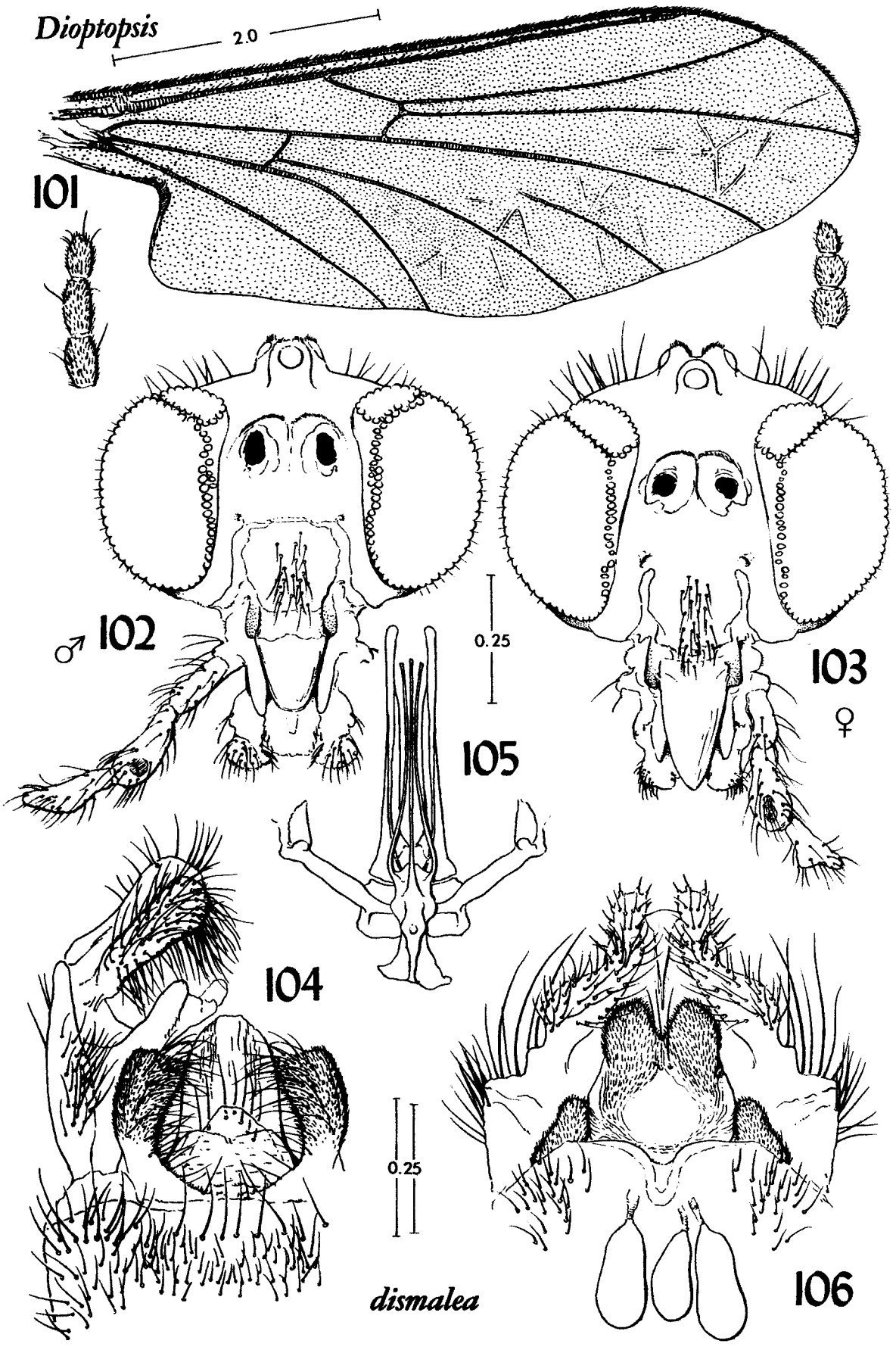

Dioptopsis
2.0
101
♂ 102
0.25
103
♀
105
104
0.25
106
dismalea

PLATE XX

Figs. 107–111. *Dioptopsis dismalea.* 107, 108, larva; 109–111, pupa. See plate II for structural detail.)

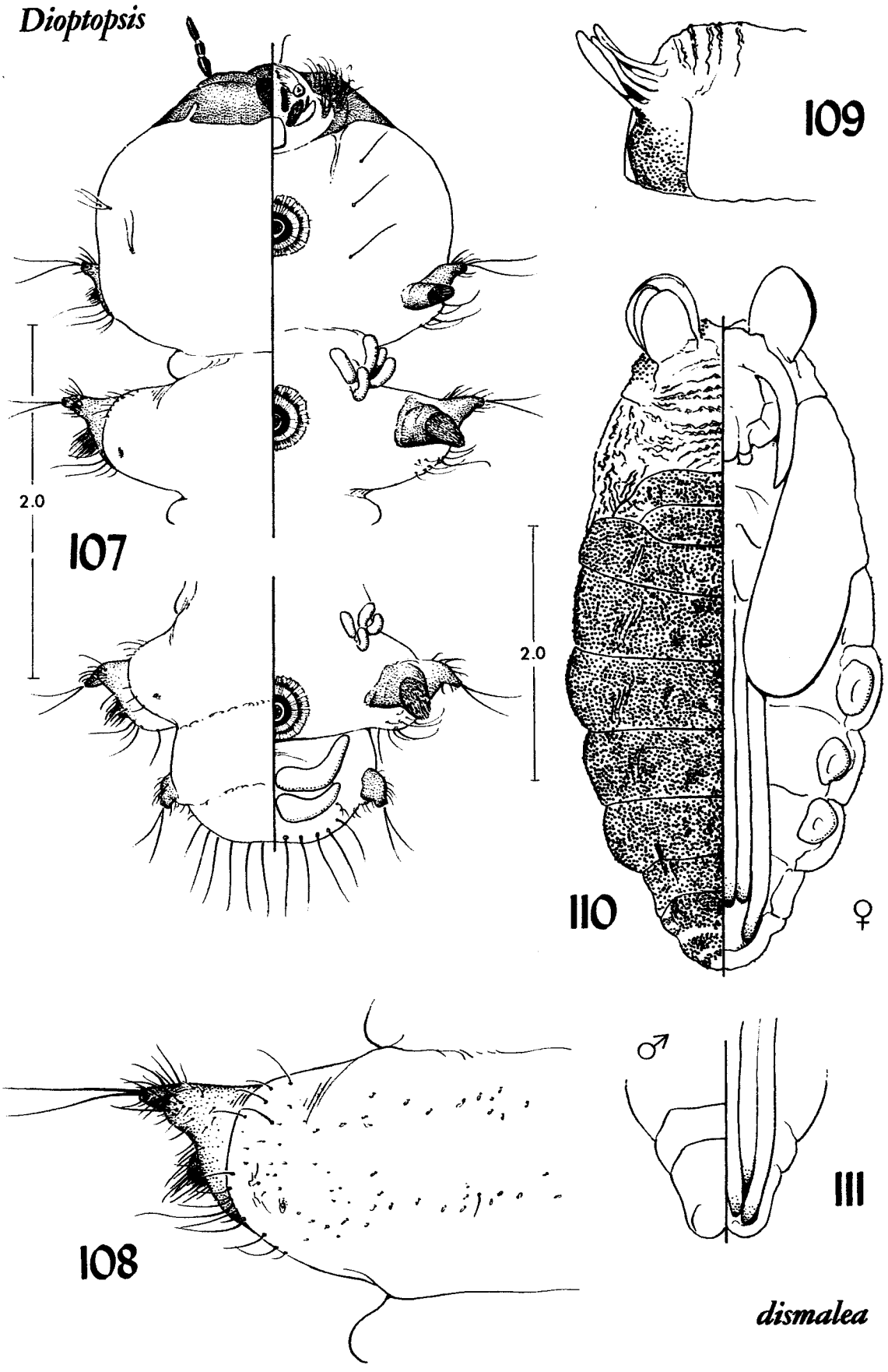
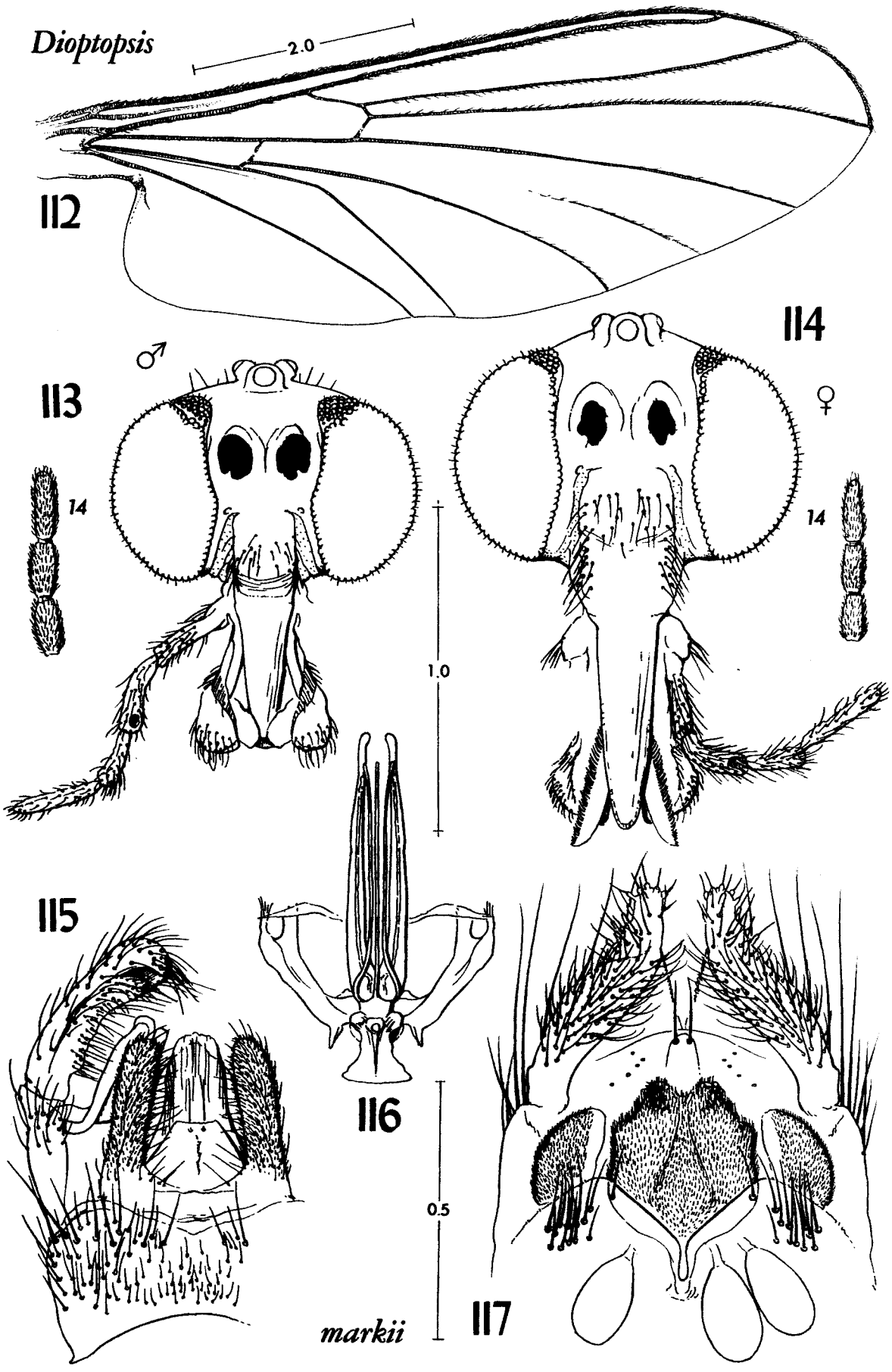

Dioptopsis
109
2.0
107
2.0
110
♀
108
♂
111
dismalea

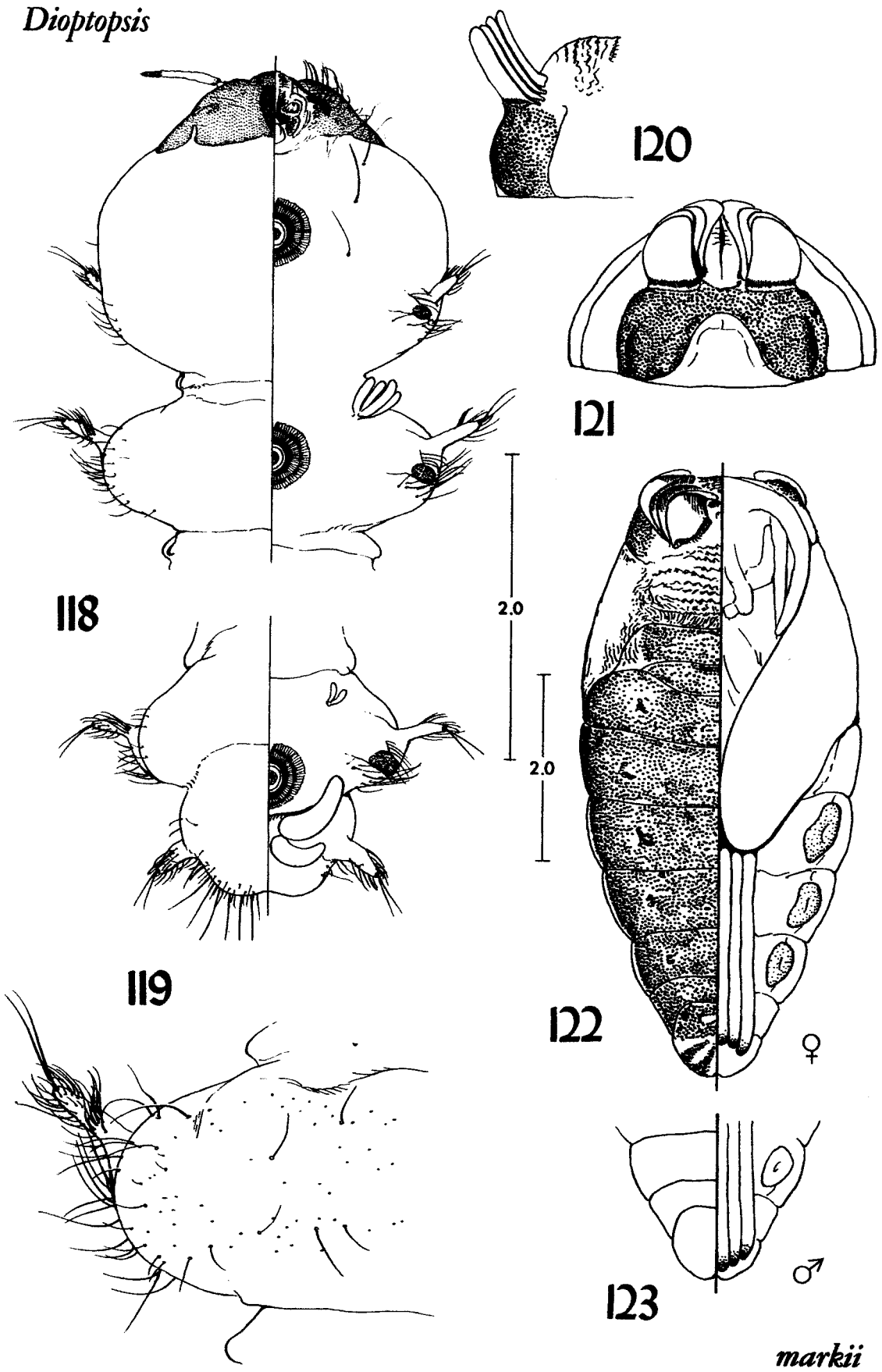
PLATE XXI

Figs. 112–117. *Dioptopsis markii*, adult. 112, wing; 113, 114, male and female head; 115, 116, male genitalia; 117, female genitalia. (See plate I for structural detail.)


Dioptopsis
2.0
112
113
♂
14
1.0
114
♀
14
115
116
0.5
117
markii

## PLATE XXII

Figs. 118–123. *Dioptopsis markii.* 118, 119, larva; 120–123, pupa. (See plate II for structural detail.)


Dioptopsis
120
121
118
2.0
2.0
122
♀
119
123
♂
markii

## PLATE XXIII

Figs. 124–129. *Dioptopsis sequoiarum*, adult. 124, wing; 125, 126, male and female head; 127, 128, male genitalia; 129, female genitalia. (See plate I for structural detail.)

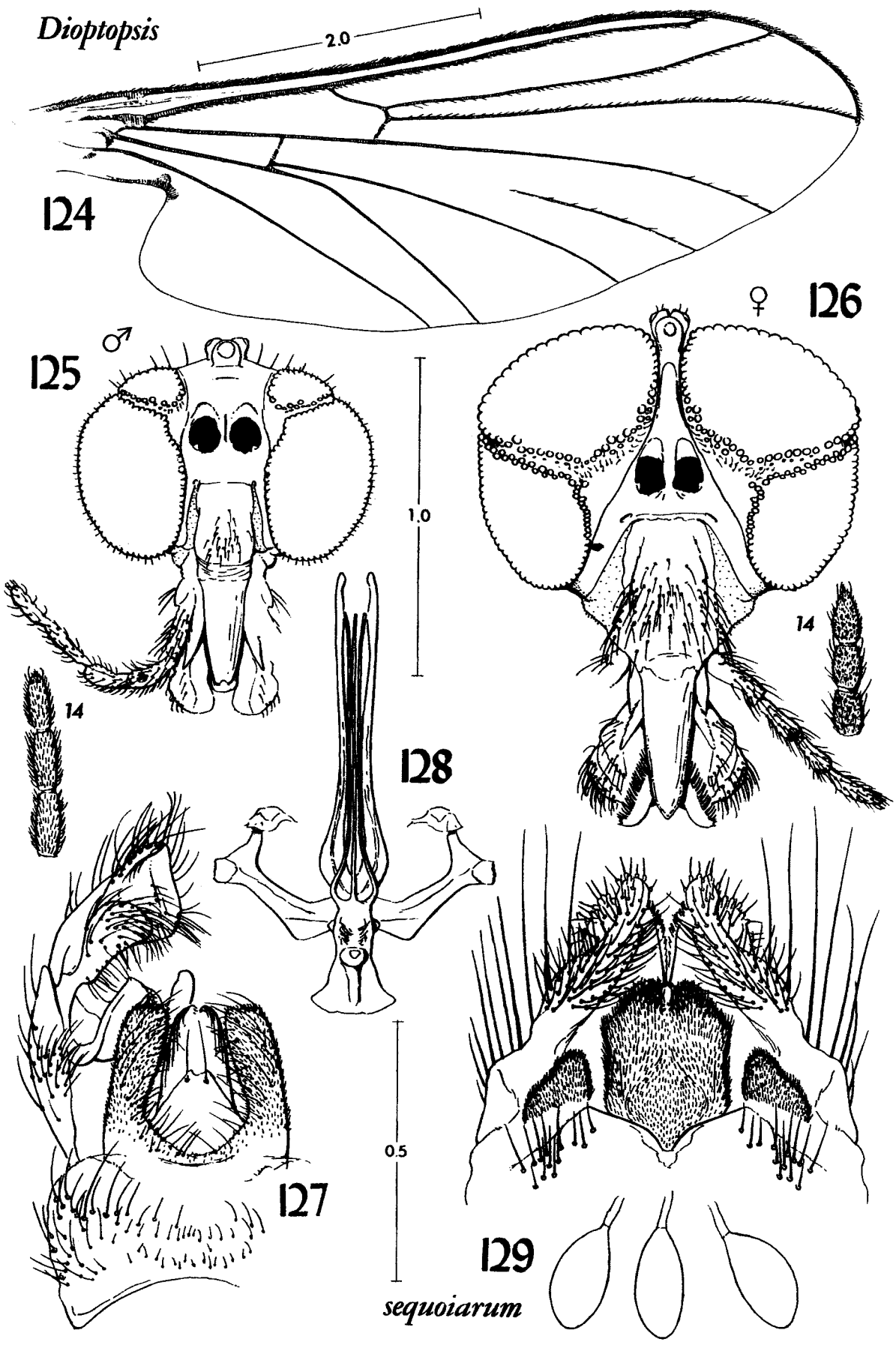

Dioptopsis
2.0
124
♂
125
♀ 126
1.0
14
14
128
0.5
127
129
sequoiarum

PLATE XXIV

Figs. 130–135. *Dioptopsis sequoiarum*. 130, 131, larva; 132–135, pupa. (See plate II for structural detail.)

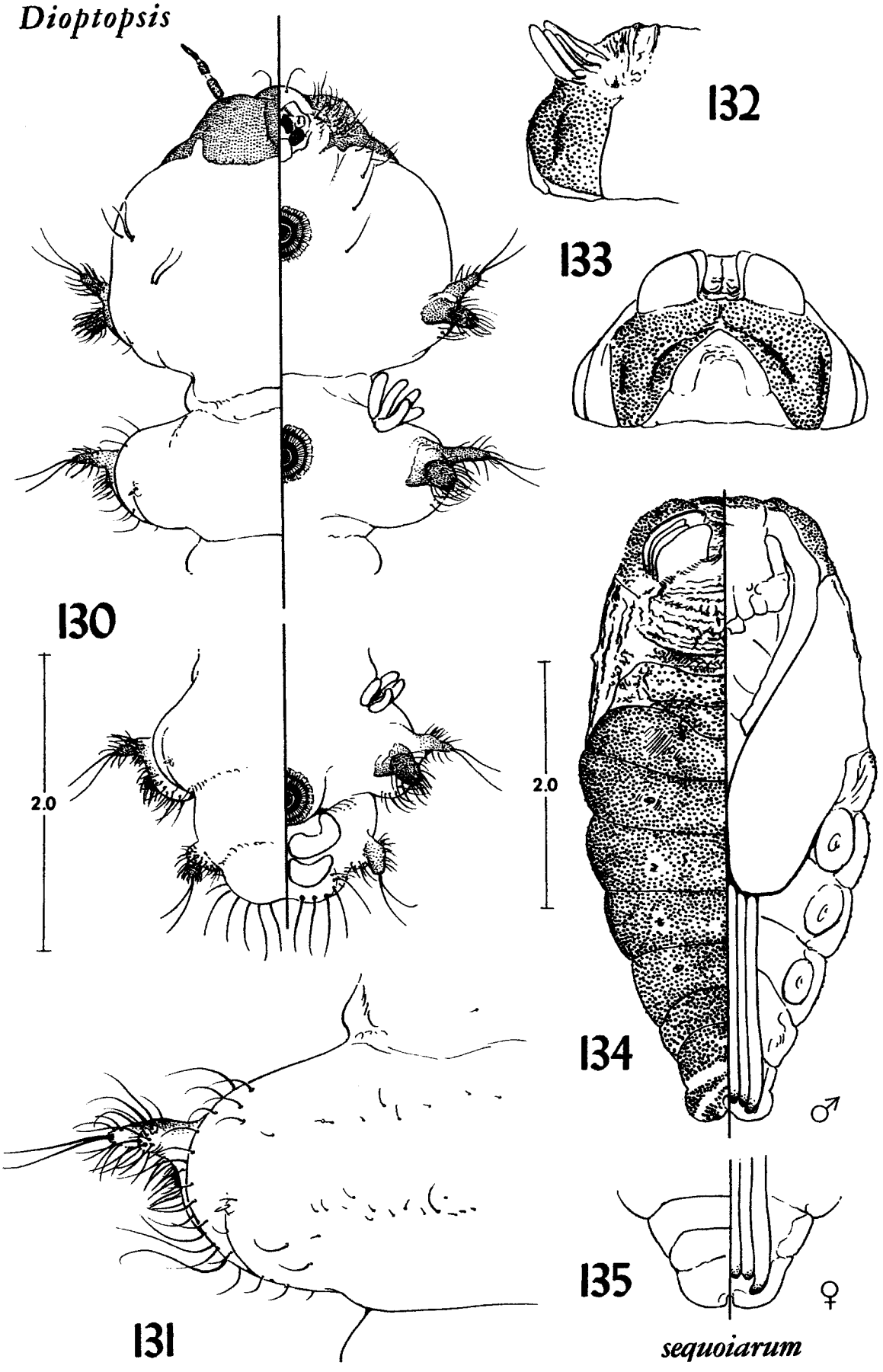

Dioptopsis
132
133
130
2.0
2.0
134
♂
131
135
♀
sequoiarum

PLATE XXV

Figs. 136–140. *Philorus californicus*, adult. 136, wing; 137, 138, male and female head; 139, male genitalia; 140, female genitalia. (See plate I for structural detail.)

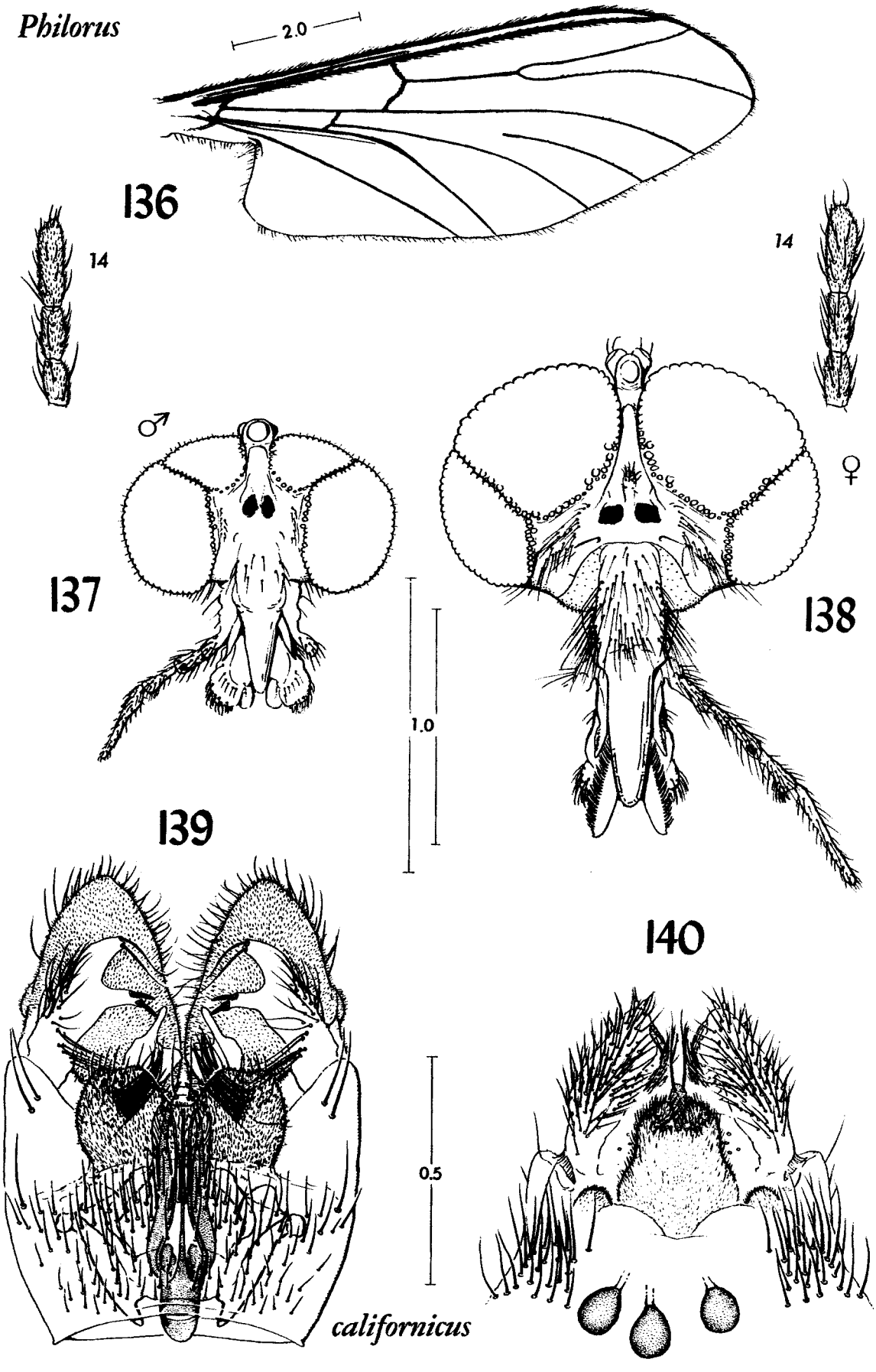

Philorus
2.0
136
14
14
♂
♀
137
138
1.0
139
140
0.5
californicus

PLATE XXVI

Figs. 141–144. *Philorus californicus.* 141, 142, larva; 143, 144, pupa. (See plate II for structural detail.)

## *Philorus*

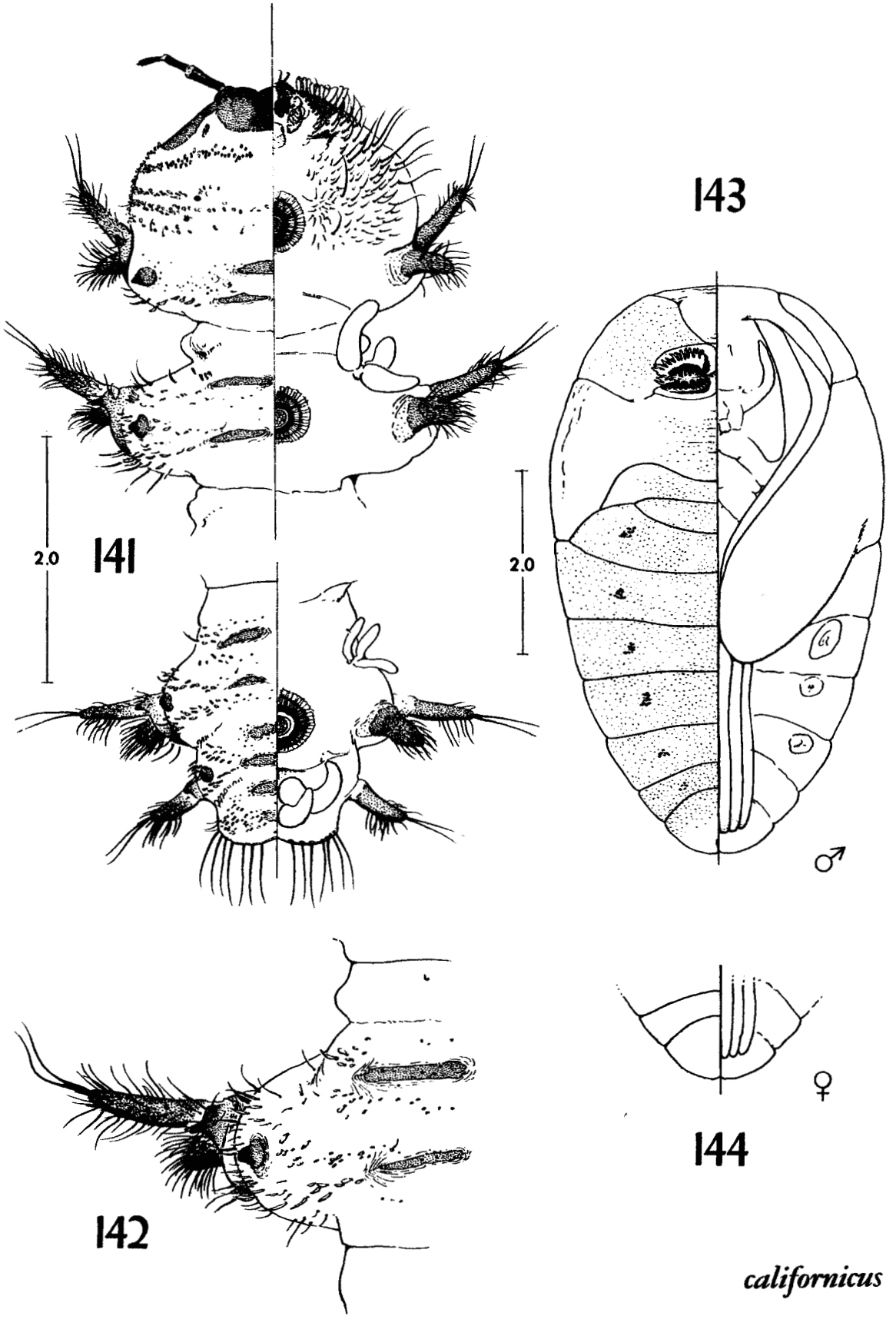


PLATE XXVII

Figs. 145–149. *Philorus jacinto*, adult. 145, wing; 146, 147, male and female head; 148, male genitalia; 149, female genitalia. (See plate I for structural detail.)

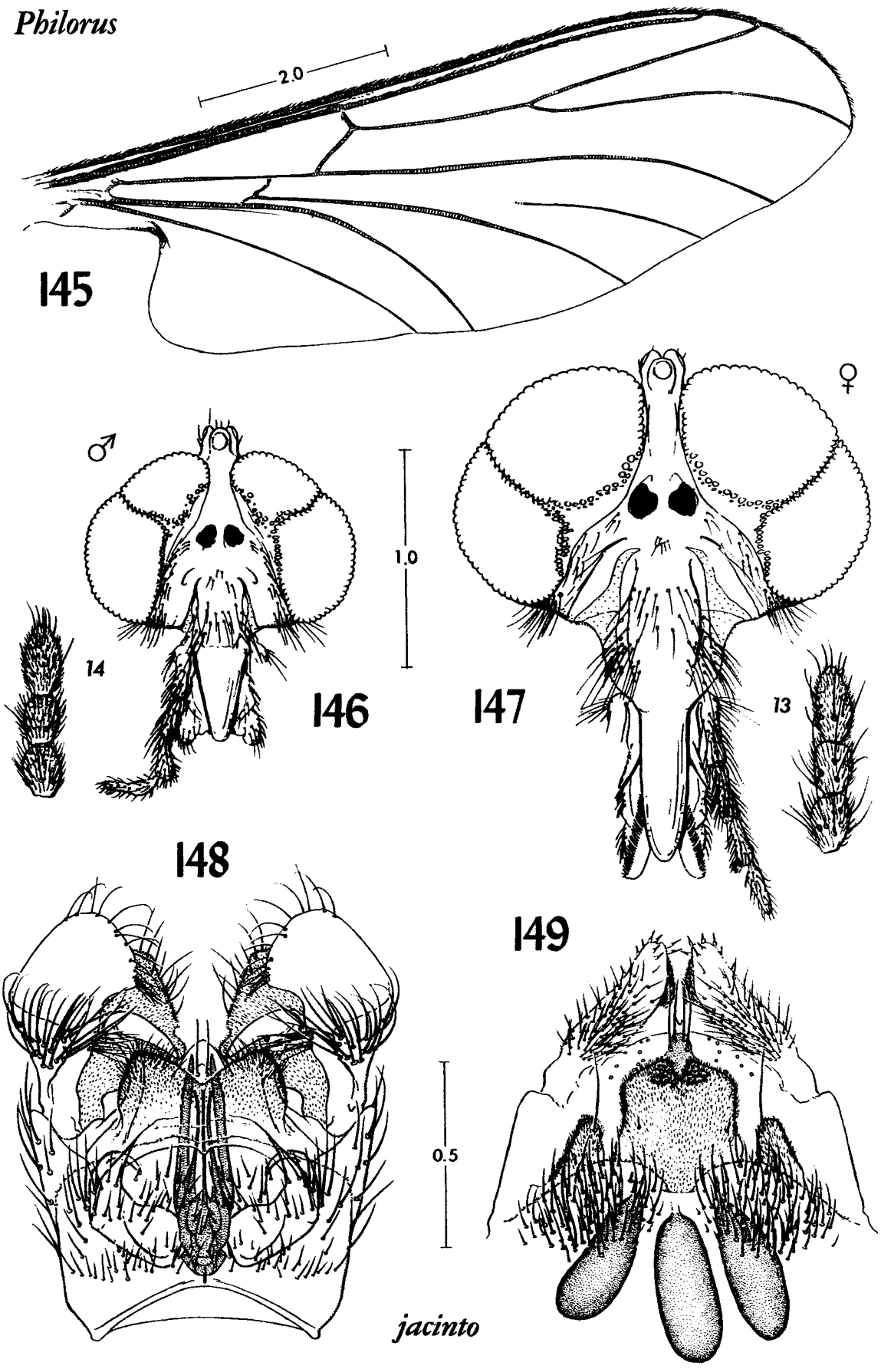

Philorus
2.0
145
♂
♀
1.0
14
13
146
147
148
149
0.5
jacinto

PLATE XXVIII

Figs. 150–153. *Philorus jacinto.* 150, 151, larva; 152, 153, pupa. (See plate II for structural detail.)

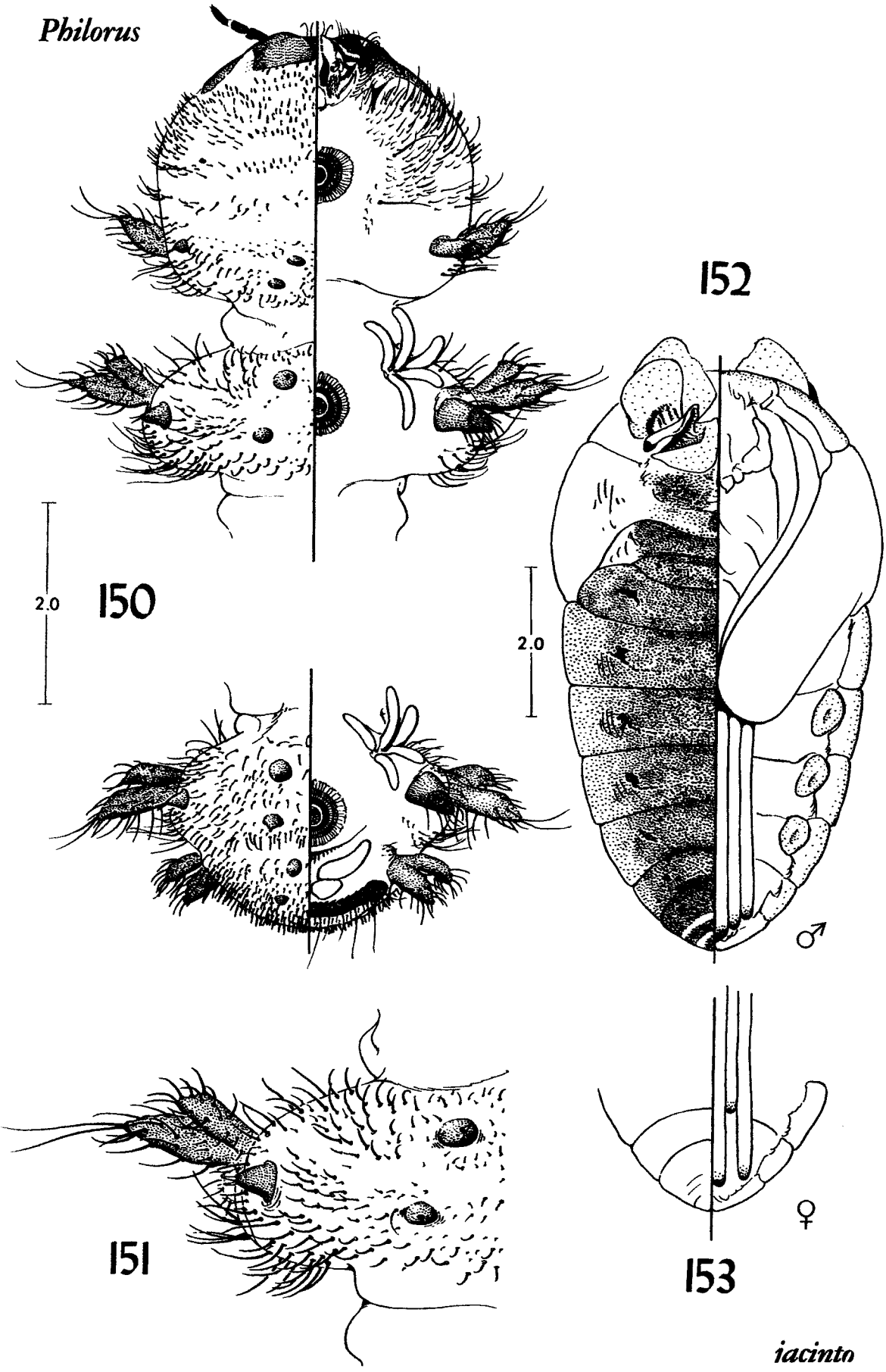

Philorus
150
2.0
151
152
2.0
♂
153
♀
iacinto

PLATE XXIX

Figs. 154–159. *Philorus vanduzeei,* adult. 154, wing; 155, 156, male and female head; 157, 158, male genitalia; 159, female genitalia. (See plate I for structural detail.)

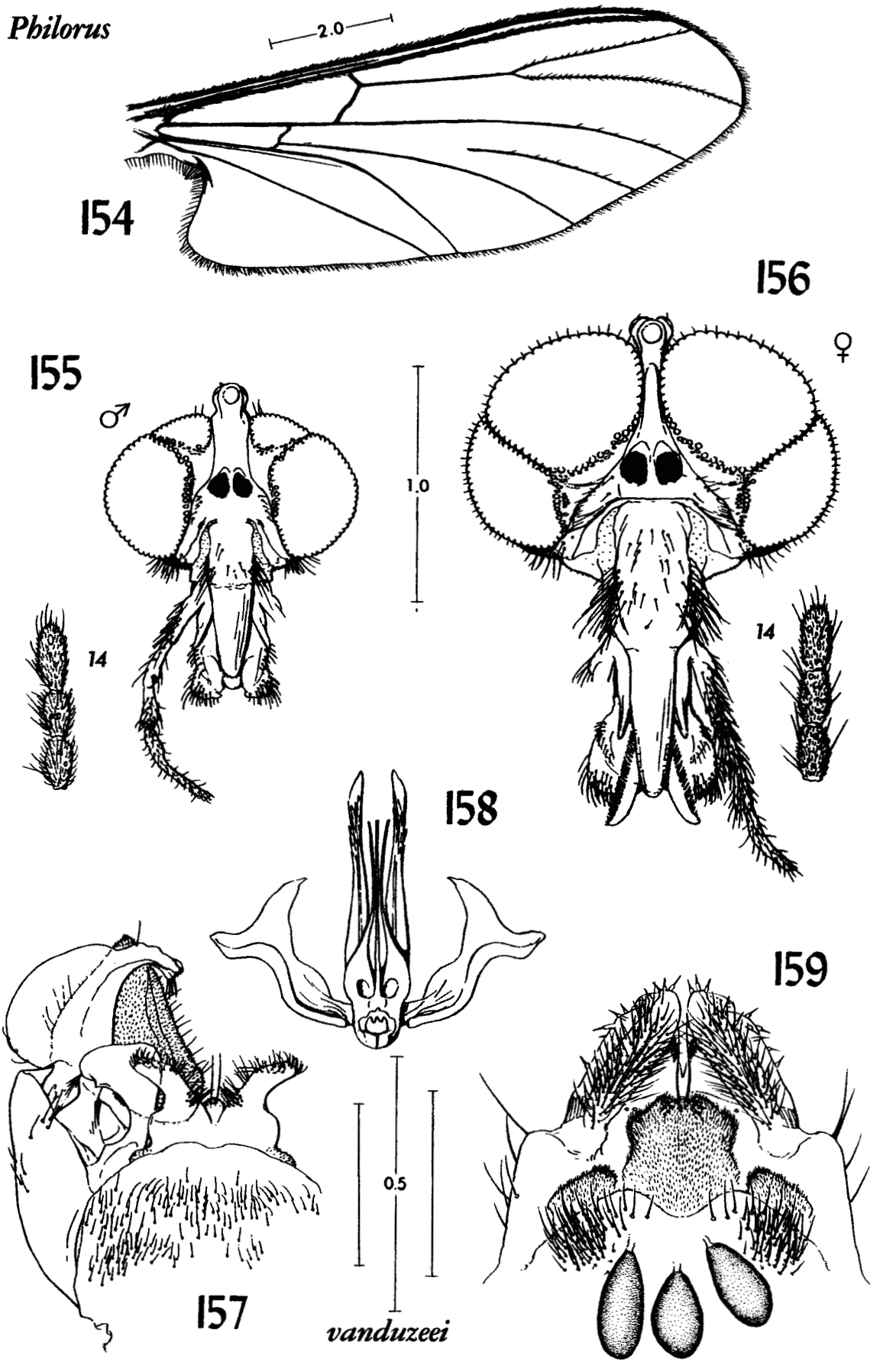

Philorus
2.0
154
156
155
♂
1.0
♀
14
14
158
159
0.5
157
vanduzeei

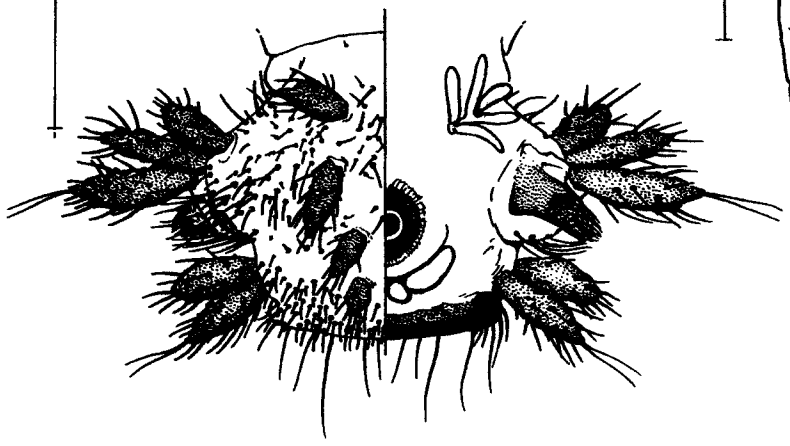
PLATE XXX

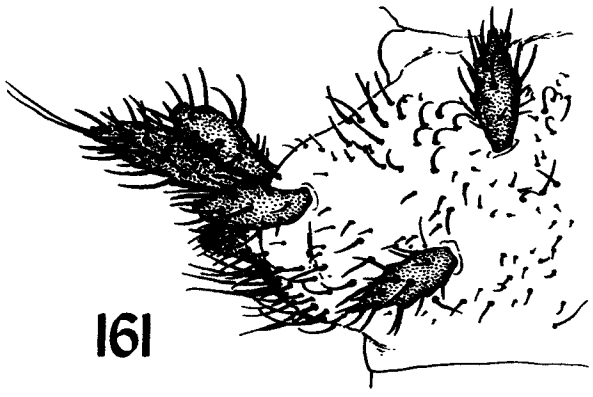
Figs. 160–163. *Philorus vanduzeei.* 160, 161, larva; 162, 163, pupa. (See plate II for structural detail.)

## *Philorus*

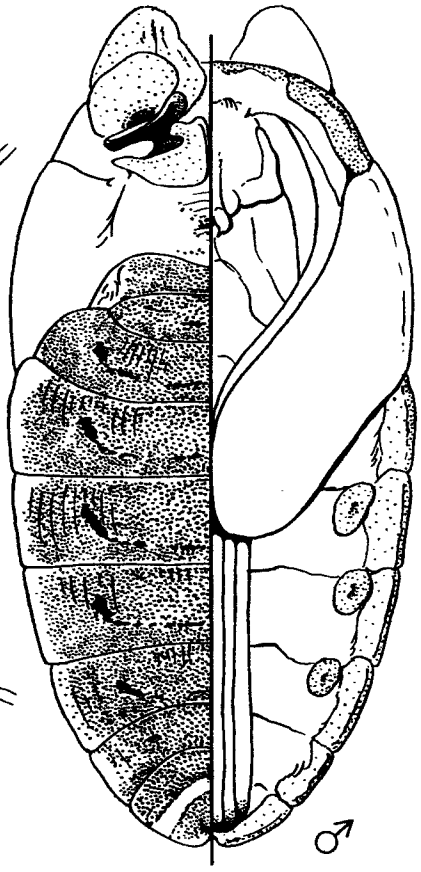
2.0

160





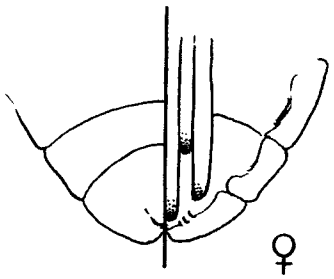
161



2.0

162

♂



♀

163

***vanduzeei***

PLATE XXXI

Figs. 164–168. *Philorus yosemite*, adult. 164, wing; 165, 166, male and female head; 167, male genitalia; 168, female genitalia. (See plate I for structural detail.)

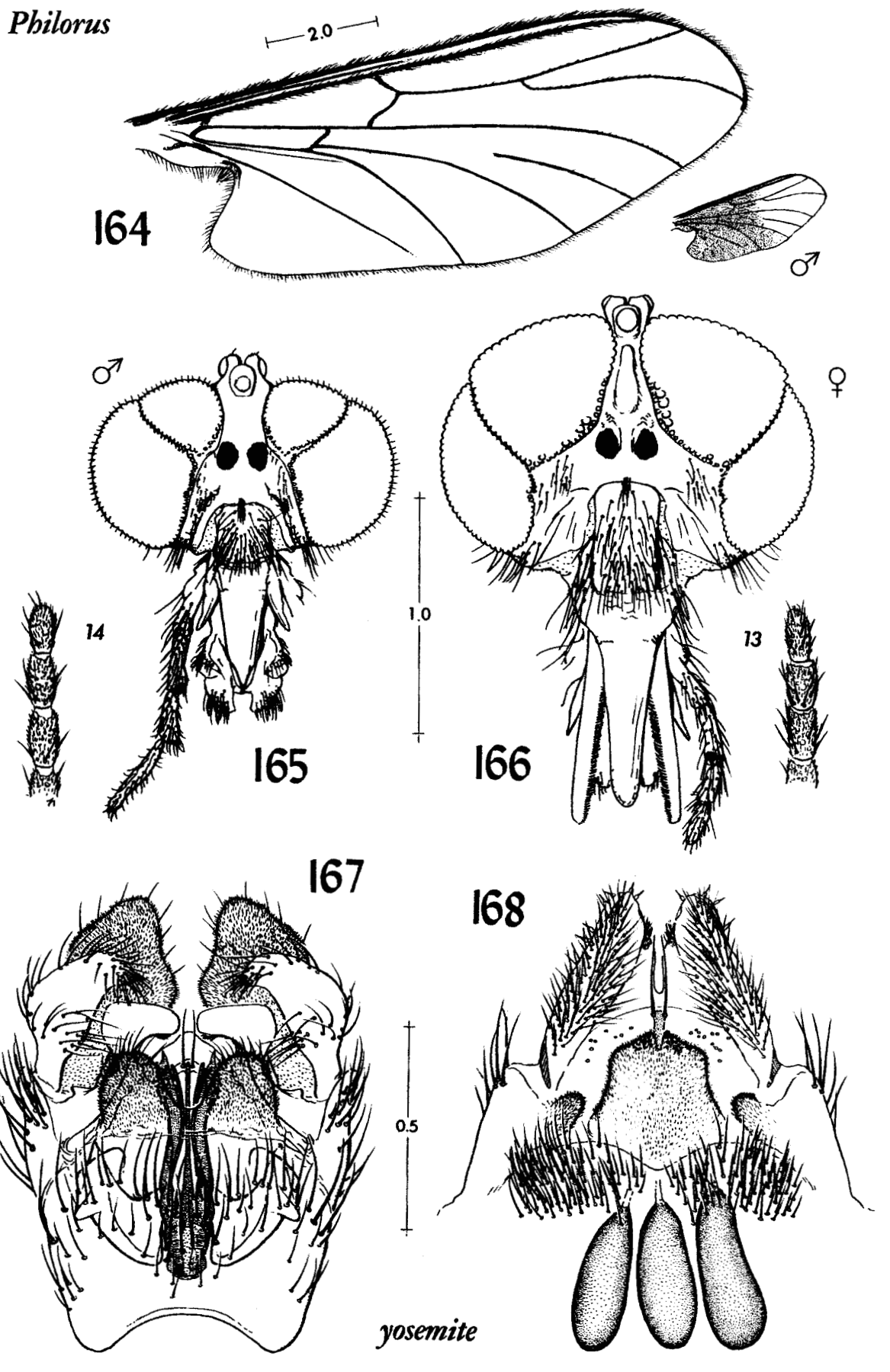

Philorus
2.0
164
♂
♂
♀
14
13
1.0
165
166
167
168
0.5
yosemite

PLATE XXXII

Figs. 169–172. *Philorus yosemite*. 169, 170, larva; 171, 172, pupa. (See plate II for structural detail.)

*Philorus*