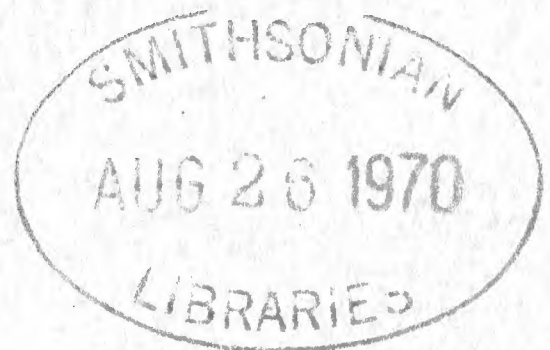


L
61
51
nt.

**Contributions
of the
American Entomological Institute**

Volume 6, Number 1, 1970



MOSQUITO STUDIES (Diptera, Culicidae)

XXI. The Culicidae of Jamaica.

By

John N. Belkin, Sandra J. Heinemann and William A. Page

CONTRIBUTIONS
of the
AMERICAN ENTOMOLOGICAL INSTITUTE

The Contributions are for larger papers on insects. Each paper is a separate number, with separate pagination and index. Separate numbers aggregating about 500 pages constitute a volume. Issues appear irregularly, as suitable manuscripts are available.

Copies are sold separately or in subscriptions to complete volumes. Complete volumes are \$12.00. The price of separate numbers varies. Subscribers are billed for each volume with its beginning number, and receive the parts as issued. Orders for separate numbers that total less than \$8.00 must be accompanied by payment. Address orders or correspondence to the American Entomological Institute, 5950 Warren Road, Ann Arbor, Michigan 48105, U. S. A.

Parts of Volume 1, with prices

- No. 1. Dasch, Clement E., 1964. The Neotropic Diplazontinae (Hymenoptera, Ichneumonidae). 75 pages, 69 figures. Price: \$2.25, postpaid.
- No. 2. Mosquito studies (Diptera, Culicidae), 1965.
I. Belkin, John N., et al. A project for a systematic study of the mosquitoes of Middle America.
II. Belkin, John N., et al. Methods for the collection, rearing and preservation of mosquitoes. 78 pages, 4 figures. Price: \$2.25, postpaid.
- No. 2a. Same as no. 2, but in Spanish. Price: \$2.25, postpaid.
- No. 3. Matthews, Robert W., 1965. The biology of *Heriades carinata* Cresson. (Hymenoptera, Megachilidae). 33 pages, 23 figures. Price: \$1.00, postpaid.
- No. 4. Mosquito studies (Diptera, Culicidae), 1965.
III. Ramalingam, Shivaji, and John N. Belkin. Two new *Aedes* from Tonga and Samoa.
IV. Belkin, John N. The mosquitoes of the Robinson-Peabody Museum of Salem expedition to the southwest Pacific, 1956. 34 pages, 3 figures. Price: \$1.00, postpaid.
- No. 5. Mosquito studies (Diptera, Culicidae), 1965.
V. Belkin, John N., Robert X. Schick, and Sandra J. Heinemann. Mosquitoes originally described from Middle America. 95 pages. Price: \$2.75 postpaid.
- No. 6. Mosquito studies (Diptera, Culicidae), 1966.
VI. Belkin, John N., Robert X. Schick, and Sandra J. Heinemann. Mosquitoes originally described from North America. 39 pages. Price: \$1.00, postpaid.
- No. 7. DeLong, Dwight M. and Paul H. Freytag, 1967. Studies of the world Gyponinae (Homoptera, Cicadellidae). A synopsis of the genus *Ponana*. 86 pages, 257 figures. Price: \$2.50, postpaid.
- No. 8. Contributions to the mosquito fauna of southeast Asia, 1967.
I. Delfinado, Mercedes D. The genus *Aedes*, subgenus *Neomacleaya* Theobald in Thailand. 55 pages, 20 figures. Price: \$1.75, postpaid.

Parts of Volume 2, with prices

- No. 1. Contributions to the mosquito fauna of southeast Asia, 1967.
II. Bram, Ralph A. The genus *Culex* in Thailand (Diptera: Culicidae). 296 pages, 104 figures. Price: \$9.00, postpaid.
- No. 2. Schuh, Toby, 1967. The shore bugs (Hemiptera: Saldidae) of the Great Lakes region. 35 pages, 30 figures. Price: \$1.25, postpaid.
- No. 3. Snider, Richard J., 1967. The chaetotaxy of North American *Lepidocyrtus* s. str. (Collembola: Entomobryidae). 28 pages, 57 figures. Price: \$1.00, postpaid.
- No. 4. Contributions to the mosquito fauna of southeast Asia, 1968.
III. Delfinado, Mercedes D. The genus *Aedes*, subgenus *Neomacleaya* Theobald of southeast Asia. 76 pages, 26 figures. Price: \$2.25, postpaid.
- No. 5. Contributions to the mosquito fauna of southeast Asia, 1968.
IV. Knight, Kenneth L. Species of the subgroup *Chrysolineatus* of group D, genus *Aedes*, subgenus *Finlaya* Theobald. 45 pages, 12 figures. Price: \$1.50, postpaid.

Parts of Volume 3, with prices

- No. 1. Mosquito studies (Diptera, Culicidae), 1968.
VII. Belkin, John N. The Culicidae of New Zealand. 182 pages, 30 figures. Price: \$5.50, postpaid.
- No. 2. Mosquito studies (Diptera, Culicidae), 1968.
VIII. Zavortink, Thomas J. A prodrome of the genus *Orthopodomyia*. 221 pages, 41 figures. Price: \$6.75, postpaid.
- No. 3. Fleming, Richard C., 1968. Head musculature of sphinx moths (Lepidoptera: Sphingidae). 32 pages, 37 figures. Price: \$1.00, postpaid.
- No. 4. Mosquito studies (Diptera, Culicidae), 1968.
IX. Belkin, John N. The type specimens of New World mosquitoes in European museums. 69 pages. Price: \$2.00, postpaid.

(Continued on back cover)

THE CULICIDAE OF JAMAICA^{1,2}

(Mosquito Studies. XXI)

By

John N. Belkin³, Sandra J. Heinemann³

and

William A. Page⁴

CONTENTS

INTRODUCTION	5
MATERIAL AND METHODS	6
ANALYSIS OF THE FAUNA	8
BIONOMICS AND MEDICAL IMPORTANCE	10
KEYS TO SUBFAMILIES	12
SUBFAMILY CULICINAE	13
Keys to Tribes and Genera	13
Tribe Anophelini, Genus <i>Anopheles</i>	20
Keys to Species	22
1. <i>Anopheles (Nys.) albimanus</i>	24
2. <i>Anopheles (A.) atropos</i>	27
3. <i>Anopheles (A.) crucians</i>	29
4. <i>Anopheles (A.) vestitipennis</i>	31
5. <i>Anopheles (A.) grabhamii</i>	34
Tribe Uranotaeniini, Genus <i>Uranotaenia</i>	36
Keys to Species	38
6. <i>Uranotaenia socialis</i>	39
7. <i>Uranotaenia cooki</i>	41
8. <i>Uranotaenia lowii</i>	43

¹Published simultaneously as Contributions of the American Entomological Institute, vol. 6, no. 1 and Bulletin of the Institute of Jamaica, Science Series, no. 20.

²Contribution from project "Mosquitoes of Middle America" supported by U.S. Public Health Service Research Grant AI-04379 and U.S. Army Medical Research and Development Command Research Contract DA-49-193-MD-2478. Part of field work was supported by travel grants from the Wellcome Trust to William A. Page, and from the Institute of Jamaica to John N. Belkin.

³Department of Zoology, University of California, Los Angeles, California 90024.

⁴Centre for Tropical Veterinary Medicine, University of Edinburgh, Scotland.

Tribe Culicini	45
Genus <i>Deinocerites</i>	45
Keys to Species	46
9. <i>Deinocerites cancer</i>	46
Genus <i>Culex</i>	50
Keys to Subgenera and Species	51
Subgenus <i>Culex</i>	57
10. <i>Culex</i> (<i>C.</i>) <i>bahamensis</i>	59
11. <i>Culex</i> (<i>C.</i>) <i>corniger</i>	61
12. <i>Culex</i> (<i>C.</i>) <i>chidesteri</i>	64
13. <i>Culex</i> (<i>C.</i>) <i>janitor</i>	66
14. <i>Culex</i> (<i>C.</i>) <i>secutor</i>	68
15. <i>Culex</i> (<i>C.</i>) <i>nigripalpus</i>	70
16. <i>Culex</i> (<i>C.</i>) <i>quinquefasciatus</i>	73
Subgenus <i>Melanoconion</i>	76
17. <i>Culex</i> (<i>Mel.</i>) <i>atratus</i>	78
18. <i>Culex</i> (<i>Mel.</i>) <i>opisthopus</i>	82
19. <i>Culex</i> (<i>Mel.</i>) <i>erraticus</i>	84
20. <i>Culex</i> (<i>Mel.</i>) <i>iolambdis</i>	86
21. <i>Culex</i> (<i>Mel.</i>) <i>inhibitor</i>	88
22. <i>Culex</i> (<i>Mel.</i>) <i>sp.</i> , <i>Jamaican form</i>	90
23. <i>Culex</i> (<i>Mel.</i>) <i>pilosus</i>	90
24. <i>Culex</i> (<i>Mel.</i>) <i>panocossa</i>	93
Subgenus <i>Micraedes</i>	95
25. <i>Culex</i> (<i>Micr.</i>) <i>arawak</i>	95
Tribe Mansoniini	97
Keys to Genera and Species	98
Genus <i>Coquillettidia</i>	100
26. <i>Coquillettidia</i> (<i>R.</i>) <i>nigricans</i>	100
Genus <i>Mansonia</i>	103
27. <i>Mansonia</i> (<i>M.</i>) <i>titillans</i>	103
28. <i>Mansonia</i> (<i>M.</i>) <i>flaveola</i>	107
29. <i>Mansonia</i> (<i>M.</i>) <i>dyari</i>	109
Tribe Orthopodomyiini, Genus <i>Orthopodomyia</i>	112
Key to Adults	112
30. <i>Orthopodomyia waverleyi</i>	113
Tribe Aedini	115
Genus <i>Psorophora</i>	115
Keys to Subgenera and Species	116
Subgenus <i>Psorophora</i>	120
31. <i>Psorophora</i> (<i>P.</i>) <i>ciliata</i>	121
Subgenus <i>Janthinosoma</i>	124
32. <i>Psorophora</i> (<i>J.</i>) <i>johnstonii</i>	124
33. <i>Psorophora</i> (<i>J.</i>) <i>ferox</i>	126
34. <i>Psorophora</i> (<i>J.</i>) <i>sp.</i> , <i>Jamaican form</i>	130
Subgenus <i>Grabhamia</i>	130
35. <i>Psorophora</i> (<i>G.</i>) <i>infinis</i>	131
36. <i>Psorophora</i> (<i>G.</i>) <i>jamaicensis</i>	134
37. <i>Psorophora</i> (<i>G.</i>) <i>insularia</i>	138
38. <i>Psorophora</i> (<i>G.</i>) <i>pygmaea</i>	140

Genus <i>Aedes</i>	143
Keys to Subgenera and Species	144
Subgenus <i>Ochlerotatus</i>	151
39. <i>Aedes</i> (<i>O.</i>) <i>taeniorhynchus</i>	152
40. <i>Aedes</i> (<i>O.</i>) <i>sollicitans</i>	155
41. <i>Aedes</i> (<i>O.</i>) <i>pertinax</i>	157
42. <i>Aedes</i> (<i>O.</i>) <i>hemisurus</i>	161
43. <i>Aedes</i> (<i>O.</i>) <i>tortilis</i>	165
44. <i>Aedes</i> (<i>O.</i>) <i>auratus</i>	168
45. <i>Aedes</i> (<i>O.</i>) <i>calumnior</i>	169
Subgenus <i>Finlaya</i>	171
46. <i>Aedes</i> (<i>F.</i>) <i>mediovittatus</i>	171
Subgenus <i>Howardina</i>	175
47. <i>Aedes</i> (<i>H.</i>) <i>walkeri</i>	175
48. <i>Aedes</i> (<i>H.</i>) <i>aurites</i>	178
49. <i>Aedes</i> (<i>H.</i>) <i>grabhami</i>	180
50. <i>Aedes</i> (<i>H.</i>) <i>inaequalis</i>	182
51. <i>Aedes</i> (<i>H.</i>) <i>stenei</i>	183
Subgenus <i>Stegomyia</i>	184
52. <i>Aedes</i> (<i>S.</i>) <i>aegypti</i>	184
Genus <i>Haemagogus</i>	187
53. <i>Haemagogus</i> (<i>L.</i>) <i>equinus</i>	188
Tribe Sabethini	190
Genus <i>Wyeomyia</i>	191
Keys to Species	195
54. <i>Wyeomyia</i> (<i>W.</i>) <i>nigritubus</i>	200
55. <i>Wyeomyia</i> (<i>W.</i>) <i>mittchellii</i>	205
56. <i>Wyeomyia</i> (<i>W.</i>) <i>vanduzeei</i>	210
57. <i>Wyeomyia</i> (<i>W.</i>) <i>luna</i>	213
58. <i>Wyeomyia</i> (<i>W.</i>) <i>stellata</i>	215
59. <i>Wyeomyia</i> (<i>W.</i>) <i>sp.</i> , Jamaican form A	217
60. <i>Wyeomyia</i> (<i>W.</i>) <i>corona</i>	218
61. <i>Wyeomyia</i> (<i>W.</i>) <i>juxtahirsuta</i>	220
62. <i>Wyeomyia</i> (<i>W.</i>) <i>hirsuta</i>	222
63. <i>Wyeomyia</i> (<i>W.</i>) <i>atrata</i>	227
64. <i>Wyeomyia</i> (<i>W.</i>) <i>sp.</i> , Jamaican form B	229
Genus <i>Limatus</i>	229
65. <i>Limatus</i> <i>hoffmani</i>	230
Tribe Toxorhynchitini, Genus <i>Toxorhynchites</i>	231
Keys to Species	232
66. <i>Toxorhynchites</i> (<i>L.</i>) <i>portoricensis</i>	233
SUBFAMILY CHAOBORINAE	237
Keys to Genera and Species	238
Tribe Chaoborini, Genus <i>Sayomyia</i>	240
67. <i>Sayomyia</i> <i>lanei</i>	240
Tribe Corethrellini, Genus <i>Corethrella</i>	242
68. <i>Corethrella</i> (<i>C.</i>) <i>appendiculata</i>	242
69. <i>Corethrella</i> (<i>C.</i>) <i>longitubus</i>	245
70. <i>Corethrella</i> (<i>C.</i>) <i>librata</i>	246

SUBFAMILY DIXINAE . . . . .	. 248
Keys to Genera and Species . . . . .	. 248
Genus <i>Dixella</i> . . . . .	. 249
71. <i>Dixella scitula</i> . . . . .	. 249
Genus <i>Mesodixa</i> . . . . .	. 251
72. <i>Mesodixa biambulacra</i> . . . . .	. 251
JA COLLECTION DATA. . . . .	. 255
REFERENCES CITED . . . . .	. 305
FIGURES . . . . .	. 317
TABLE OF DISTRIBUTIONS. . . . .	. 447
CONSPECTUS OF TAXONOMIC CHANGES . . . . .	. 450
SYSTEMATIC INDEX . . . . .	. 451

INTRODUCTION

The present review of the Culicidae of Jamaica is the first in a series of cooperative regional studies being undertaken in connection with a long-term project on the systematics of the mosquitoes of Middle America (Belkin, Schick et al, 1965, 1967). In January 1964 W.A. Page, then on the staff of the Zoology Department, University of the West Indies, undertook the supervision of a survey of the Jamaican mosquito fauna with emphasis on obtaining individually reared material of the species which were originally described from this island. Material from this cooperative survey, which was carried on sporadically through late September 1967, forms the basis of this review. Associated stages of all but 4 of the topotypic nominal species were obtained and several new species and records were added so that it is now possible to provide a sound taxonomic basis for future studies on the mosquitoes of the island. A really thorough knowledge of this fauna will require much additional work that can be accomplished only by local residents carrying on systematic surveys over a period of years or undertaking special studies to fill the numerous lacunae in our present knowledge.

We have included in our review not only the true mosquitoes of the subfamily Culicinae but also the subfamilies Chaoborinae and Dixinae which were not treated in the 2 previous reviews of the mosquitoes of Jamaica (Theobald, 1905a; Hill and Hill, 1948). We have also tried to increase the usefulness of this work by including in the keys all the genera, and whenever possible all the species, reported from the Greater Antilles. Brief discussions are also given for some of these species, particularly those that we believe may occur in Jamaica.

We are most grateful to Professor I.M. Goodbody, Department of Zoology, University of the West Indies, for providing laboratory facilities and other support, and to D.C. Watson, a student at the University, for valuable assistance in the field and laboratory. We also thank Dr. H.B. Johnston, H.L. Tucker and other members of the Mosquito Control Organization of the Ministry of Health, Jamaica, for assistance and cooperation in the field. To the Wellcome Trust we are indebted for a 3-month travel grant to W.A. Page to continue the field work in Jamaica. We thank Dr. T.H. Farr, Science Museum, Institute of Jamaica, for valuable advice and assistance in the field.

Nearly all the staff, past and present, of the project "Mosquitoes of Middle America" has participated in the preparation of this review. We are particularly indebted to the following: A.J. Adames, O.G.W. Berlin and T.J. Zavortink for expert advice on *Deinocerites*, *Aedes* (*Howardina*) and *Orthopodomyia* respectively; W.A. Powder and L.G. Woodley for the preparation of the material; S. Barr, S.L. Burmeister, S.A. Dieckmann, N. Kitamura, L.M. Kowalczyk, and N.L. Martsch for the illustrations; S.E. Bernstein for typing some of the early drafts of the manuscript and C.L. Abrams for the later drafts and the final copy for lithoprinting.

We also thank Alan Stone of the U.S. National Museum and Peter F. Mattingly of the British Museum (Nat. Hist.) for the loan of material and for comparing specimens with types.

Finally we wish to thank Director C. Bernard Lewis of the Institute of Jamaica for his interest, encouragement and cooperation. It was at his request that we undertook the preparation of this review for publication and this could not have been achieved without his assistance in obtaining funds for some of the field work and illustrations.

All the illustrations for this work are original except for the following: figs. 1-6

which are reproduced in a slightly modified form from volume 2 of the "Mosquitoes of the South Pacific" (Belkin, 1962:figs. 406-408,410-412) with the permission of the University of California Press; and figs. 34,48, in part (Berlin, 1970), 54,55 (Zavortink, 1968) and 82-91 (Berlin, 1969), which have appeared in the Contributions of the American Entomological Institute.

Although all 3 of us share the responsibility for the entire study and the authorship of the new species, each one was primarily responsible for certain aspects of the work. W.A. Page devoted his efforts primarily to the field work and the recording of the data on the bionomics and distribution. S.J. Heinemann made all the preliminary identifications, prepared the genitalia slides, recorded all the material, supervised the preparation of the illustrations and did the final taxonomic study of the genus *Wyeomyia*. The final taxonomic studies of the other groups and the general organization of the study were done by J.N. Belkin with the assistance of S.J. Heinemann.

MATERIAL AND METHODS

MATERIAL. This study is based primarily on material collected and reared under the supervision of W.A. Page for the project "Mosquitoes of Middle America" using the methods developed for the project by Belkin, Hogue et al (1965, 1967). The data for these and a few special and miscellaneous collections are given in a separate section following the taxonomic treatment. These collections were primarily undertaken to obtain associated stages of the 38 nominal species originally described from Jamaica in order to determine unequivocally their identity. The bulk of this material will remain at the University of California, Los Angeles [UCLA] and representative series will be deposited at the U.S. National Museum [USNM], British Museum (Nat. Hist.) [BM] and the Institute of Jamaica [JAM].

Additional material examined for this study came from the collections of the USNM, JAM and BM, consisting largely of small remnants of important collections by Michael Grabham (1899-1907), Rolla B. Hill and Claire McDowell Hill (1941-1945), W.H.W. Komp (1940) and G.A. Thompson and associates (1944-1946), as well as more recent collections of T.A. Farr [JAM], R.H. Hochman and W.W. Wirth [USNM]. A valuable collection made by T.H.G. Aitken in December 1962 [UCLA] came to our attention too late for inclusion in the distribution data.

Michael Grabham's collections are of particular interest since they included the first rearings made on the island and because the majority of the species originally described from Jamaica were based on his material. The earlier collections (1899-1904) form the basis for the first review of the mosquitoes of Jamaica which apparently was originally undertaken as a cooperative study but was entirely written by Theobald (1905a) although the title page states "With descriptions of some of the various stages by M. Grabham" and there are a few such descriptions quoted in the text. Except for some specimens now in the USNM, the material received by Theobald from Grabham is still in the BM collection, including the types of all the species described by Theobald from this material.

In 1905 Grabham stopped sending material to Theobald and began publishing independently on the Jamaican fauna. He was apparently preparing a second edition of Theobald's paper (Grabham, 1907:25) when his collection was destroyed in the earthquake of 1907 (Dyar and Knab, 1908:56). Fortunately Grabham sent material during this period to Washington for study by Howard, Dyar and Knab

for their monograph on the mosquitoes of North and Central America and the West Indies (1913-1917). This material, now in the USNM, contains specimens from the type series of all the species described by Grabham except *johnstonii* and *aureostriatus* and from its lectotypes have been designated by previous workers or by us here.

The Hill and Hill material formed the basis for the second review of the mosquito fauna of the island (Hill and Hill, 1948). All that remains of this material in Jamaica are a few slides, unlabelled or with a collection number only. These will be deposited in the Institute of Jamaica. Mrs. Hill informs us that the collection records were left in Jamaica but we could not locate them anywhere. There are a few Hill and Hill specimens in the USNM collection but these carry no locality data; there are also some specimens in the Komp material.

The Komp material from Jamaica consists of specimens apparently collected by Komp himself in January 1940 and some collections made by the Hills, Thompson and others. The bulk of this material is in very poor condition but is provided with dates and sometimes localities; it will remain in the USNM collection.

The G.A. Thompson material is represented by a small number of well-labelled pinned specimens in the JAM collection and a larger number of specimens in the USNM collection, the pinned material largely without specific locality labels and the slides usually with nothing but a number. Apparently the bulk of this material was collected in the southern half of Clarendon parish. Associated in the collection of some of this material were W.H.W. Komp, H.D. Pratt and A.E. Pritchard.

We examined more than 27,000 specimens from Jamaica (3,689 males, 6,440 females, 10,800 larvae, 6,267 pupae), representing 70 of the 72 species recognized here and including 4,332 individual rearings of 56 species (1,436 larval, 2,330 pupal, 566 incomplete). We were not able to find any material of *Mansonia (M.) flaveola* and *Psorophora (J.) johnstonii* from Jamaica.

METHODS OF STUDY AND PRESENTATION. The methods of study and presentation are essentially similar to those used by Belkin (1962). The general descriptive terminology is illustrated in figs. 1-3 for the adults, fig. 4 for the pupa, and figs. 5 and 6 for the larva. A few special terms introduced here are explained and illustrated under the groups involved.

We have devoted special attention to the species originally described from Jamaica that we consider to be valid. For these, the descriptions are more detailed and the illustrations include the complete larva as well as the pupa and male genitalia. For Jamaican species originally described from elsewhere the treatment is briefer and only details of the larva are illustrated in addition to the complete pupa and male genitalia; whenever possible all of these from the Jamaican populations.

The taxonomic and other bibliographic references are selective and include primarily works dealing with the Jamaican species, the major standard reference works and major taxonomic revisions. For widespread species, the synonyms given are restricted to those described from Jamaica or neighboring areas.

In the distribution sections, the localities are listed in alphabetical sequence under the parishes which are also arranged alphabetically. For simplicity we have combined the Kingston and St. Andrew parishes into one. The number or numbers following a locality refer to our collections; the data for these are given in a separate section following the taxonomic treatment.

ANALYSIS OF THE FAUNA

COMPOSITION. We are reporting here 72 species of the family Culicidae from Jamaica; 4 of these remain unnamed because of insufficient material (*Culex (Mel.) sp. 22*, *Psorophora (J.) sp. 34*, *Wyeomyia (W.) sp. 59* and *Wyeomyia (W.) sp. 64*); we have not been able to confirm the record of *Mansonia (M.) flaveola* by Porter (1967:40) but include it as this species may be present on the island. At the completion of the study we found 1 male (without abdomen) of an undescribed species of *Aedes* which is possibly endemic to Jamaica. This species is excluded from the following account but is briefly discussed under the genus *Aedes*.

The subfamily Dixinae is reported for the first time from Jamaica by 2 new species, 1 in the new genus *Mesodixa*, the other tentatively placed in *Dixella*. Both genera belong to the tribe Paradixini, the only one known at present from the New World tropics.

The subfamily Chaoborinae is represented by both tribes known from the New World tropics, (1) the Chaoborini, not previously reported from the island, by a new species in the genus *Sayomyia*, and (2) the Corethrellini by 3 species in the genus *Corethrella*, 2 of them new.

The largest number of species, 66, belong to the subfamily Culicinae which is represented by 8 of the 10 tribes (in the sense of Belkin, 1962:117) known from the New World. To the previous records we have added *Limatus hoffmani* and *Uranotaenia cooki*, the 4 unnamed species mentioned above, and 5 new species of *Wyeomyia*. We have also made several changes in the taxonomic interpretation of previously recorded species, including the recognition of 2 new species for the forms previously reported as *Mansonia (M.) indubitans* and *Aedes (O.) obturbator*. In the review of Hill and Hill (1948) a total of 48 species of Culicinae was reliably recorded from Jamaica.

Nearly every species recorded from Jamaica belongs to a separate phyletic line or group. There appear to be only 4 groups that are represented by more than 1 species. Among the ground pool breeders these are (1) the Scapularis Group of *Aedes (Ochlerotatus)* represented by *hemisurus*, *tortilis* and *auratus*, and (2) possibly *Culex (Mel.) inhibitor* and *Culex (Mel.) sp. 22*. Among the container breeders are 2 endemic species groups, (1) the Aurites Group of *Aedes (Howardina)* with *aurites*, *grabhami*, *inaequalis* and *stenei*, and (2) the Hirsuta Group of *Wyeomyia* with *luna*, *stellata*, *sp. 59*, *corona*, *juxtahirsuta*, *hirsuta*, *atrata* and *sp. 64*.

CHARACTER AND AFFINITIES. As can be seen from the outline above the culicid fauna of Jamaica is well balanced and diversified. It is essentially an isolated continental fauna and not a miscellaneous assemblage of chance immigrants over extensive ocean barriers.

Although the Jamaican fauna is still very poorly known and although our knowledge of the faunas of the rest of the Greater Antillean area and Central America is even more fragmentary, general patterns of affinities can be discerned. These are derived primarily from the known distributions of the species reported from Jamaica which are summarized in the Table of Distributions (p. 447). There are obvious gaps and probably many errors in these distributions and therefore the inferences presented here can be only tentative.

Two of the 72 species reported from Jamaica are definitely introduced, the Old World *Culex (C.) quinquefasciatus* and *Aedes (S.) aegypti*. The 70 indigenous species seem to fall into 5 more or less distinct groups: Jamaican Endemic (JE), Greater Antillean (GA), Middle American (MA), North American (NA) and Widespread

(WG, WN, WS).

The endemic Jamaican element may include all of the 25 species (36%) listed below, but further collecting and study of related forms may reduce or increase the number: *Uranotaenia socialis* (doubtful), *Culex* (Mel.) sp. 22, *Culex* (Micr.) arawak, *Orthopodomyia waverleyi*, *Psorophora* (J.) sp. 34, *Aedes* (O.) auratus, *Aedes* (O.) calumnior, *Aedes* (H.) walkeri, *Aedes* (H.) aurites, *Aedes* (H.) grabhami, *Aedes* (H.) inaequalis, *Aedes* (H.) stenei, *Wyeomyia* (W.) luna, *Wyeomyia* (W.) stellata, *Wyeomyia* (W.) sp. 59, *Wyeomyia* (W.) corona, *Wyeomyia* (W.) juxtahirsuta, *Wyeomyia* (W.) hirsuta, *Wyeomyia* (W.) atrata, *Wyeomyia* (W.) sp. 64, *Sayomyia lanei*, *Corethrella* (C.) longitubus, *Corethrella* (C.) librata, *Dixella scitula*, *Mesodixa biambulacra*.

The Greater Antillean element consists of about 21 species (30%) whose distributions are centered in the Greater Antilles but may sometimes variously extend into Mexico, Florida, the Bahamas and the northern islands of the Lesser Antilles but not beyond. It is possible that some of these species may actually belong to the Middle American class. *Anopheles* (A.) grabhamii, *Uranotaenia cooki*, *Culex* (C.) bahamensis, *Culex* (C.) janitor, *Culex* (C.) secutor, *Culex* (Mel.) atratus, *Culex* (Mel.) inhibitor, *Mansonia* (M.) flaveola, *Psorophora* (J.) johnstonii, *Psorophora* (G.) infinis, *Psorophora* (G.) jamaicensis, *Psorophora* (G.) insularia, *Psorophora* (G.) pygmaea, *Aedes* (O.) pertinax, *Aedes* (O.) hemisurus, *Aedes* (O.) tortilis, *Aedes* (F.) mediovittatus, *Wyeomyia* (W.) mitchellii, *Wyeomyia* (W.) vanduzeei, *Limatus hoffmani*, *Toxorhynchites* (L.) portoricensis.

The Middle American element is composed of about 11 species (16%) whose distributions include at least Central America and Panama, the core of the Middle American area, and may extend into northern South America. *Haemagogus equinus* is a typical representative as it has a distribution encompassing almost the entire area; the other species have more restricted distributions. This element is composed of the following species: *Anopheles* (N.) albimanus, *Anopheles* (A.) vestitipennis, *Deinocerites cancer*, *Culex* (C.) chidesteri, *Culex* (Mel.) opisthopus, *Culex* (Mel.) iolambdis, *Culex* (Mel.) panocossa, *Coquillettidia* (R.) nigricans, *Mansonia* (M.) dyari, *Haemagogus equinus*, *Wyeomyia* (W.) nigratubus.

The North American element is represented by only 3 species (4%) which have extensive North American distributions and do not invade the tropics south of the Greater Antilles and Mexico: *Anopheles* (A.) atropos, *Anopheles* (A.) crucians and *Aedes* (O.) sollicitans.

The widespread element consists of about 10 species (14%) with extensive distributions in the New World. We have divided this element into 3 subclasses. The Widespread General (WG) group consists of 5 species with extensive distributions in both North and South America: *Uranotaenia lowii*, *Culex* (C.) nigripalpus, *Psorophora* (J.) ferox, *Aedes* (O.) taeniorhynchus and *Corethrella* (C.) appendiculata. The Widespread Northern (WN) group consists of 3 species with more extensive distributions in North America than in South America: *Culex* (Mel.) erraticus, *Culex* (Mel.) pilosus and *Psorophora* (P.) ciliata. The Widespread Southern (WS) group includes only *Culex* (C.) corniger and *Mansonia* (W.) titillans which have more extensive distributions in South America than in North America. It is very likely that a thorough study of these widespread species will reveal that many consist of complexes of species. Jamaican populations tentatively assigned to some of these are more or less clearly differentiated but it is impossible to determine the taxonomic significance of these differences without extensive comparative studies of populations from the entire reported range of these species.

Outside of some of the widespread species there is practically nothing in common between Jamaica (and the Greater Antilles and the Bahamas) and the Windward Islands of the Lesser Antilles. Another striking feature of the culicid fauna of Jamaica and the Antillean area is the absence of some dominant elements present in Central America, notably *Culex (C.) coronator* Dyar & Knab, 1906.

BIONOMICS AND MEDICAL IMPORTANCE

BREEDING SITES. In the Table of Distributions (p. 447) we have indicated the principal type of breeding habitat used by every species reported from Jamaica; in the few cases where this is not known we have assigned a habitat by analogy with related species. Only the 70 indigenous species are considered here; for the introduced domestic *quinquefasciatus* and *aegypti* see the discussions of the bionomics under these species.

A surprisingly large number of species, 46 (66%), utilize ground waters (G). The largest number of species, 28 (all *Anopheles*, *Uranotaenia*, *Coquillettidia*, *Mansonia*; most *Culex*; *Sayomyia*, *Corethrella librata*, *Dixella*, *Mesodixa*), are primarily found in permanent or semipermanent ground waters (GP) such as streams, ponds, swamps, ditches and impoundments (*Culex (Mel.) opisthopus* may breed in solution holes in coral limestone). Temporary ground pools (GT) of various types are the normal breeding sites of 13 species, all but 1 species each in the genus *Psorophora* and the subgenus *Ochlerotatus* of *Aedes*. Three species (*Psorophora (G.) insularia*, *Aedes (O.) calumnior* and *Corethrella (C.) longitubus*) are apparently largely, if not entirely, confined to breeding in rockholes (GR), and *Psorophora (G.) infinis* (included in GT above) may also prefer this type of breeding site; 2 species (*Deinocerites cancer* and *Culex (C.) janitor*) are restricted to crabholes (GC).

The plant container breeders (C) number only 24, constituting a smaller percentage (34%) of the total fauna than is normal in the American tropics and particularly on islands. The largest group of these (CA) breeds in the leaf axils of bromeliads and aroids and the flower bracts of heliconias and includes 10 of the 11 species of *Wyeomyia*, 3 species of the subgenus *Howardina* of *Aedes* (*aurites*, *grabhami*, *stenei*) and *Culex (Micr.) arawak*. Seven species breed in treeholes or bamboo (CT): *Orthopodomyia waverleyi*, *Aedes (F.) mediovittatus*, *Aedes (H.) inaequalis*, *Haemagogus (L.) equinus*, *Wyeomyia (W.) nigratubus*, *Toxorhynchites (L.) portoricensis*, *Corethrella appendiculata*. Two additional species utilize a wide array of plant container habitats (XX) and may occasionally be found in rock pools or rockholes with large amounts of decaying vegetation (*Culex (C.) corniger*, *Aedes (H.) walkeri*); a third species, *Limatus hoffmani*, whose breeding sites are still unknown, is included with these for it may breed in plant material (leaves, fruits) on the ground, in treeholes or in bamboo.

Relatively few species in Jamaica have been noted to breed in moderately to highly saline waters: *Anopheles (A.) atropos*, *Deinocerites cancer*, *Culex (C.) bahamensis*, *Culex (C.) nigripalpus*, *Psorophora (G.) insularia*, *Psorophora (G.) pygmaea*, *Aedes (O.) taeniorhynchus*, *Aedes (O.) sollicitans*, *Aedes (O.) pertinax* and *Aedes (O.) tortilis*. Some of the more common lowland ground pool breeders such as *Anopheles (N.) albimanus*, *Culex (Mel.) atratus*, *Psorophora (G.) jamaicensis* and probably others tolerate brackish water.

There appear to be no geographical and relatively little altitudinal differentiation in the culicid fauna of Jamaica. The few obligate brackish water breeders are

restricted to the immediate coast but most species found in the coastal plain occur to elevations of 350 m or more. A small number of species are restricted to higher elevations, particularly *Culex (C.) secutor*. Many of the bromeliad breeders are found primarily at intermediate or high elevations with lower temperatures and higher rainfall, but they occur also in narrow wooded river valleys where similar conditions prevail.

BLOOD FEEDING. Probably the original hosts for the bloodsucking Culicinae of Jamaica were primarily birds. At the present time, in addition to the introduced domestic pests (*quinquefasciatus* and *aegypti*), the most common species attacking man, as determined by Page (1967), in the coastal plain are *Aedes (O.) taeniorhynchus*, *Aedes (O.) hemisurus* (as *scapularis*), *Culex (C.) nigripalpus*, *Psorophora (G.) jamaicensis* (as *confinnis*), *Aedes (O.) tortilis*, *Anopheles (N.) albimanus* and *Psorophora (G.) pygmaea*.

MEDICAL IMPORTANCE. Malaria, now eradicated from Jamaica, was probably transmitted on this island primarily by *Anopheles (N.) albimanus* as concluded by Boyd and Aris (1929:309-399), but all the other species of *Anopheles* present on the island are also potential malaria vectors. At least *albimanus* and *grabhamii* populations are high enough at present to be a source of concern in the event that malaria is reintroduced on the island.

Nocturnal periodic Bancroftian filariasis is transmitted in the West Indies primarily, if not solely, by *Culex (C.) quinquefasciatus*. The extent and importance of this infection in Jamaica at the present time are not known to us.

The arboviruses are probably the most important pathogens of the future transmissible by mosquitoes in Jamaica. Although yellow fever is not now present in the area, its vector, *Aedes (S.) aegypti*, is widespread and abundant and is periodically responsible for the transmission of the dengue fever virus. In recent years St. Louis Encephalitis virus has been isolated twice in Jamaica from *Culex (C.) nigripalpus* (Belle, Grant and Page, 1964; L.S. Grant, personal communication) and other arboviruses not known to be pathogenic to humans have been recovered from *Anopheles (A.) grabhamii*, *Culex (C.) nigripalpus*, *Mansonia (M.) titillans*, *Psorophora (G.) jamaicensis*, *Psorophora (G.) pygmaea*, *Aedes (O.) taeniorhynchus* and *Aedes (O.) hemisurus* [as *tortilis* and *scapularis*] (op. cit.).

KEYS TO SUBFAMILIES

ADULTS

1. Mouthparts long, labium subequal in length to forefemur Culicinae
 Mouthparts short, labium much shorter than forefemur 2
- 2(1). Wing veins with only a few short inconspicuous hairs, fringe composed of
 hairs; antennal flagellum with 14 segments Dixinae
 Wing veins with numerous long hairs or hairlike scales, fringe composed of
 scales; antennal flagellum with 13 segments Chaoborinae

MALE GENITALIA

1. A distinct paramere developed between basal piece and aedeagus
 Culicinae
 Aedeagal sclerites articulating directly with basal piece 2
- 2(1). Phallosome very simple, consisting of a poorly developed basal piece and
 projecting aedeagal sclerites (penis valve) Chaoborinae
 Phallosome complex, basal piece strongly developed, prosophallus or op-
 isthophallus or both strongly developed, aedeagal sclerites located in a
 pouch Dixinae

PUPAE

1. Abdominal tergites with conspicuous incomplete submedian transverse ridges
 Dixinae
 Abdominal tergites without submedian transverse ridges 2
- 2(1). Paddles fused or not articulated at base or trumpet coarsely reticulate
 Chaoborinae
 Paddles always separate and articulated at base and trumpet with tracheoid
 or finely rugose Culicinae

LARVAE

1. Venter of abdominal segments I or I and II with short unsegmented paired
 prolegs; thoracic segments subequal in width to abdominal . . . Dixinae
 Venter of abdominal segments without prolegs; thoracic segments distinctly
 wider than abdominal 2
- 2(1). Mouthbrushes completely absent or represented at most by about 5 long
 bristlelike spicules Chaoborinae
 Mouthbrushes always well developed, usually very numerous, rarely reduced
 to 10 heavy long flattened filaments Culicinae

SUBFAMILY CULICINAE

The Mosquitoes

The mosquitoes, characterized by the development of an elongate proboscis in the adults, are treated here as a subfamily of the Culicidae in a broad sense rather than a family distinct from the Dixidae and Chaoboridae of some recent authors (Stone, Knight and Starcke, 1959; Stone, 1965). Although there is a basic morphological similarity in all stages and particularly in the immature stages with the other subfamilies, the Culicinae are readily separated by the combination of features given in the keys to the subfamilies.

The Culicinae form the dominant element of the culicid fauna in Jamaica as elsewhere in the New World tropics. Of the 10 tribes (in the sense of Belkin, 1962: 117) recognized in the New World, only 2 (Aedeomyiini and Culisetini) are not known from Jamaica. A total of 66 species is recorded here from Jamaica, 4 of the species are very poorly known and not named, and 1 (*Mansonia flaveola*) is included on the basis of an unconfirmed record. The representation of the tribes is as follows: (1) Anophelini with 5 species, all in the genus *Anopheles*; (2) Uranotaeniini with 3 species in the genus *Uranotaenia*; (3) Culicini with a total of 17 species, 1 in *Deinocerites* and 16 in *Culex*; (4) Mansoniini with a total of 4 species, 1 in *Coquillettidia* and 3 in *Mansonia*; (5) Orthopodomomyiini with 1 species of *Orthopodomomyia*; (6) Aedini with a total of 23 species, 8 in *Psorophora*, 14 in *Aedes* and 1 in *Haemagogus*; (7) Sabethini with a total of 12 species, 11 in *Wyeomyia* and 1 in *Limatus*; and (8) Toxorhynchitini with 1 species of *Toxorhynchites*. An additional endemic species of *Aedes* may also be present (see genus).

We have included in the keys the other 2 New World tribes since both have been recorded from Cuba: (1) Culisetini by *Culiseta (C.) inornata* (Williston, 1893) which has a wide distribution in North America including northern Mexico; it is very unlikely that this species will be found in Jamaica; and (2) Aedeomyiini by *Aedeomyia squamipennis* (Lynch Arribalzaga, 1879) which is widely distributed in the New World tropics and may actually consist of a complex of species; this species may be present in Jamaica, most likely in the western part of the island.

KEYS TO TRIBES AND GENERA

ADULTS

Toxorhynchitini

- 1. Proboscis rigid, with attenuate and caudally recurved distal part **Toxorhynchites**
- Proboscis flexible, more or less uniform in width or swollen apically, not recurved caudad 2

Anophelini

- 2(1). Scutellum evenly rounded on caudal margin; female palpus subequal in length to proboscis; male palpus club shaped **Anopheles**
- Scutellum trilobed on caudal margin; female palpus less than 0.6 of proboscis; male palpus sometimes swollen apically but not club shaped 3

Uranotaeniini

- 3(2). Vein R_{2+3} more than 3.0 of vein R_2 ; mesonotum with streak of whitish or iridescent blue scales laterally from wing root **Uranotaenia**
 Vein R_{2+3} subequal to or shorter than vein R_2 ; mesonotum without streak of whitish or iridescent blue scales laterally from wing root . . 4
- 4(3). Base of hindcoxa in line with base of meron or slightly above it; meron very small; postnotum always with bristles and sometimes scales (*Sabethini*) 5
 Base of hindcoxa distinctly ventrad of base of meron; meron large; postnotum rarely with bristles 8

Sabethini

- 5(4). Occiput with line of conspicuous black erect scales (*longipes*, Cuba; see tribe) *Trichoprosopon*
 Head without erect scales 6
- 6(5). Mesonotal scales dull bronzy, with only slight metallic sheen
 **Wyeomyia**
 Mesonotal scales with brilliant metallic sheen or with strong contrasting color 7
- 7(6). Mesonotum with pattern of gold and violet scales; spiracular bristles replaced by scales (**65. hoffmani**) **Limatus**
 Mesonotal scaling uniform, smooth and with strong metallic green sheen; spiracular bristles distinct; midleg with "paddle" of very long scales on tibia and base of tarsus (*bipartipes*, Hispaniola; see tribe). . . *Sabethes*

Culisetini

- 8(4). Base of vein Sc on lower surface of wing with patch of strong bristles (*inornata*, Cuba; see subfamily) *Culiseta*
 Base of vein Sc on lower surface of wing with scales only 9

Aedini

- 9(8). Mesonotum without any bristles on disc (no acrostichals, dorsocentrals or prescutellars), vestiture of smooth metallic scales; anterior pronotal lobes (*apn*) enlarged and approximated over midline back of head and overlapping vertex (**53. equinus**) **Haemagogus**
 Mesonotum with at least prescutellar bristles developed, vestiture varied but not as above; anterior pronotal lobes normal, not approximated or overlapping vertex 10
- 10(9). Postspiracular bristles present 11
 Postspiracular bristles absent 13
- 11(10). Spiracular bristles present **Psorophora**
 Spiracular bristles absent 12
- 12(11). Plume scales of dorsal surface of veins R_2 and R_3 narrow; apex of abdomen of female more or less pointed **Aedes**

Mansoniini

Plume scales of dorsal surface of veins R₂ and R₃ very broad; apex of abdomen of female truncate **Coquillettidia, Mansonia**

Orthopodomyiini

13(10). Mesonotum with conspicuous pattern of narrow white scaled lines; segment 4 of foretarsus and midtarsus of female shorter than segment 5 **Orthopodomyia**
 Mesonotum without pattern of narrow white scaled lines; segment 4 of foretarsus and midtarsus of female longer than segment 5 14

Aedeomyiini

14(13). Apex of midfemur with large tuft of outstanding scales; mesonotum with broad scales; dorsal wing scales all broad, in an irregular but conspicuous dark and white pattern (*squamipennis*, Cuba; see subfamily) *Aedeomyia*
 Midfemur without tuft of erect scales; mesonotum with narrow scales; some dorsal wing scales narrow, not in contrasting pattern of dark and white (Culicini) 15

Culicini

15(14). First flagellar segment of antenna subequal to or shorter than clypeus **Culex**
 First flagellar segment of antenna at least twice as long as clypeus **Deinocerites**

MALE GENITALIA

1. Proctiger strongly developed, paraproct with a transverse comblike crown of at least 6 subequal spines or patch of numerous spines, denticles, or spicules; sidepiece with subapical lobe bearing specialized setae (Culicini) 2
 Proctiger variously developed, paraproct if distinct usually with not more than 5 irregular spines, denticles or teeth; sidepiece without such subapical lobe 3

Culicini

2(1). Ninth tergite consisting primarily of greatly developed lateral lobes articulating with sternite **Deinocerites**
 Ninth tergite lobes dorsal or submedian not articulating with sternite **Culex**

3(1). Proctiger nearly completely membranous distally, without distinct paraproct 4
 Proctiger with distinct sclerotized paraproct usually ending in a sharp point or 1-5 denticles, rarely rounded on apex 6

Anophelini

4(3). Aedeagus long and slender except at base, surrounded by complex claspette **Anopheles**

- Aedeagus broad, claspette not developed 5
- Aedeomyiini*
- 5(4). Spiniform of clasper pectinate; aedeagus without conspicuous spines (*squamipennis*, Cuba; see subfamily) *Aedeomyia*
- Uranotaeniini*
- Spiniform of clasper simple; aedeagus with conspicuous spines
. **Uranotaenia**
- 6(3). Tergite VIII with distinct median caudal lobe 7
Tergite VIII without distinct median caudal lobe 8
- Orthopodomyiini, Culisetini*
- 7(6). Spiniform of clasper pectinate **Orthopodomyia**
Spiniform of clasper simple (*inornata*, Cuba; see subfamily) . . *Culiseta*
- Mansoniini*
- 8(6). Tergite IX membranous and without setae **Mansonia**
Tergite IX partially or completely sclerotized, with setae 9
- 9(8). Tergite IX with conspicuous median caudal process between lobes; claspette (basal mesal lobe) with a pair of closely appressed flattened apical setae. **Coquillettidia**
Tergite IX without conspicuous median caudal process between lobes; claspette (basal mesal lobe, mesal plate) varied, without pair of flattened apical setae 10
- Toxorhynchitini*
- 10(9). Aedeagus bulbous at base and with very long slender apical process; basolateral sclerotization of proctiger poorly developed, not forming conspicuous dorsal lobe **Toxorhynchites**
Aedeagus varied, apical process if present much broader; basolateral sclerotization of proctiger strongly developed, forming conspicuous dorsal lobe sternad of tergite IX 11
- 11(10). Aedeagus with lateral sclerotizations bearing a pair of distally joined submedian arms forming a narrow tergal bridge, and a pair of distally approximated apical arms (Sabethini) 12
Aedeagus with single cylindrical or troughlike sclerotization, or if with distinct lateral sclerotizations the tergal bridge broad and apical (Aedini) 15
- Sabethini*
- 12(11). Clasper simple, very long and slender (*longipes*, Cuba; see tribe)
. *Trichoprosopon*
Clasper complex, with lobes on head 13
- 13(12). Aedeagus elongate, subcylindrical **Wyeomyia**
Aedeagus broad, subglobular 14

- 14(13). Aedeagus widest beyond middle; paramere without long sternal process
(bipartipes, Hispaniola; see tribe). *Sabethes*
 Aedeagus broadest near base; paramere with long sternal process (65.
hoffmani). **Limatus**

Aedini

- 15(11). Apex of sternomesal margin of sidepiece with long striated scales (53.
equinus) **Haemagogus**
 Sternomesal margin of sidepiece without striated scales 16

- 16(15). Clasper irregular in outline, with distinct expansion or small lobe at mid-
 dle or beyond **Psorophora**
 Clasper usually regular in outline, at most with slight expansion at base
 or middle **Aedes**

PUPAE

Anophelini

1. Hair 9-III-VI at or very near caudolateral angle of tergite, usually distinct-
 ly spiniform at least at base; meatus of trumpet deeply slit to near base .
 **Anopheles**
 Hair 9-III-VI distinctly removed cephalad of caudolateral angle of tergite;
 meatus of paddle at most narrowly slit a short distance from pinna. . 2

- 2(1). Trumpet meatus with a distinct tracheoid extending a considerable dis-
 tance from base 3
 Trumpet meatus without any indication of tracheoid or at most faintly
 tracheoid at extreme base 7

Mansoniini

- 3(2). Trumpet without pinna, apex specialized for piercing plant tissue
 **Coquillettia, Mansonia**
 Trumpet with distinct open pinna 4

- 4(3). Cephalothoracic hair 8-C closer to base of trumpet than to 9-C, at or near
 level of trumpet 5
 Cephalothoracic hair 8-C closer to 9-C than to base of trumpet, removed
 far caudad of latter (*Culicini*) 6

Uranotaeniini, Aedeomyiini

- 5(4). Paddle hair 1-P very short; inner part of paddle distinctly widened near
 middle **Uranotaenia**
 Paddle hair 1-P very long, subequal to paddle length; inner part of paddle
 slightly widened in distal third (*squamipennis, Cuba; see subfamily*) . .
 *Aedeomyia*

Culicini

- 6(4). Paddle hair 1-P subequal to or longer than paddle length . . **Deinocerites**
 Paddle hair 1-P much shorter than paddle **Culex**

Toxorhynchitini

- 7(2). Anal segment with conspicuous cercal hair 1-X **Toxorhynchites**
 Cercal hair 1-X not developed 8
- 8(7). Hairs 9-VII, VIII subequal, both large and with numerous branches; paddle small and without hairs (Sabethini) 9
 Hair 9-VII rarely subequal to 9-VIII, then both with few branches; paddle normal and with 1-P present 12

Sabethini

- 9(8). Abdominal hair 5-III very strongly developed, longer than tergite following (*longipes*, Cuba; see tribe) *Trichoprosopon*
 Abdominal hair 5-III relatively weak, much shorter than tergite following 10
- 10(9). Abdominal hair 4-IV caudad of level of hair 3 (*65. hoffmani*) **Limatus**
 Abdominal hair 4-IV cephalad of level of hair 3 11
- 11(10). Caudolateral angle of tergite VIII produced as a conspicuous rounded lobe over outer base and outside of paddle (*bipartipes*, Hispaniola; see tribe) *Sabethes*
 Posterior margin of tergite VIII nearly straight from tergite IX to caudolateral angle or at most slightly sinuous **Wyeomyia**
- 12(8). Cephalothoracic hairs 8-C and 9-C in a line perpendicular to middorsal ridge; paddle without marked infuscation near external buttress and apex 13
 Cephalothoracic hair 8-C usually distinctly more anterior than 9-C; if rarely the 2 hairs in line perpendicular to middorsal ridge then paddle with marked infuscation near external buttress and apex (*Aedini*) 14

Culisetini, Orthopodomyiini

- 13(12). Abdominal hair 1-VI laterad of hairs 2 and 3 (*inornata*, Cuba; see subfamily) *Culiseta*
 Abdominal hair 1-VI mesad of hairs 2 and 3 **Orthopodomyia**

Aedini

- 14(12). Abdominal hair 5-II mesad of hair 4 or paddle deeply infuscated near external buttress and apex **Psorophora**
 Abdominal hair 5-II laterad of hair 4 and paddle not infuscated as above 15
- 15(14). Abdominal hair 5 short, weak and single on segments II and III (*53. equinus*) **Haemagogus**
 Abdominal hair 5 moderately to strongly developed or branched on both segments **Aedes**

LARVAE

Anophelini

1. Spiracular apparatus sessile, siphon not developed **Anopheles**
 Spiracular apparatus on apex of sclerotized siphon 2
- 2(1). Ventral brush of anal segment composed of 1 pair of hairs (*Sabethini*) . 3
 Ventral brush of anal segment composed of at least 4 pairs of hairs. . . 6

Sabethini

- 3(2). Head capsule with normal circular foramen magnum bounded by distinct collar, without caudolateral slit (*longipes*, Cuba; see tribe)
 *Trichoprosopon*
 Head capsule without distinct collar, foramen magnum extended as a slit on caudolateral angle 4
- 4(3). Inner apical angle of maxilla produced into long dark spine (*bipartipes*, Hispaniola; see tribe) *Sabethes*
 Inner apical angle of maxilla rounded, not produced into spine 5
- 5(4). Caudolateral slit of head capsule short and broad; comb scales usually less than 7 (**65. hoffmani**) **Limatus**
 Caudolateral slit of head capsule long and narrow; comb scales at least 8, usually numerous. **Wyeomyia**

Mansoniini

- 6(2). Median dorsal valve of siphon very long, ankylosed and with serrated dorsal margin; siphon short and conical. **Coquillettidia, Mansonia**
 Median dorsal valve of siphon short, free and never with serrated dorsal margin; siphon more or less cylindrical 7
- 7(6). Siphon without any indication of pecten teeth 8
 Siphon with at least 1 pair of pecten teeth 10

Toxorhynchitini

- 8(7). Dorsal and ventral abdominal hairs in groups of 3-5 on large common sclerotized plates; mouthbrushes reduced to about 12 broad flat simple filaments **Toxorhynchites**
 Dorsal and ventral abdominal hairs arising separately and without strong basal plates; mouthbrushes of at least 40 thin cylindrical simple or pectinate filaments 9

Orthopodomyiini, Aedeomyiini

- 9(8). Antenna simple, much shorter than head capsule; labial plate of head capsule much longer than wide **Orthopodomyia**
 Antenna strongly curved and longer than head capsule; labial plate of head capsule short, about as long as basal width (*squamipennis*, Cuba; see subfamily) *Aedeomyia*
- 10(7). Siphon with accessory hairs in addition to usual hairs 1,2-S (Culicini). 11

Siphon without accessory hairs; 1-S sometimes very small and indistinct
 12

Culicini

- 11(10). Base of mandible with spiculate lobe; head capsule widest near level of
 antenna **Deinocerites**
 Base of mandible without such lobe; head capsule widest in caudal half . .
 **Culex**

Culisetini

- 12(10). Hair 1-S at extreme base of siphon; distal pecten teeth hairlike, very long
 and markedly different from proximal (*inornata*, Cuba; see subfamily) .
 *Culiseta*
 Hair 1-S never at base of siphon, sometimes very small and indistinct; dis-
 tal pecten teeth not markedly different from proximal 13

Uranotaeniini

- 13(12). Maxillary suture of head capsule not differentiated; labial plate very long
 (Uranotaeniini) **Uranotaenia**
 Maxillary suture of head capsule always complete and reaching posterior
 tentorial pit; labial plate short or moderate (Aedini) 14

Aedini

- 14(13). Ventral brush usually with at least 4 strongly developed precratal hairs
 piercing complete saddle; if saddle incomplete precratal tufts extend
 to at least basal 0.5 of segment **Psorophora**
 Ventral brush with precratal tufts not piercing complete saddle; if saddle
 incomplete then precratal tufts not developed or small and confined to
 vicinity of grid 15
- 15(14). Anal saddle incomplete and hairs 5-7-P with small separate tubercles and
 12-I present (**53. equinus**) **Haemagogus**
 Anal saddle complete or incomplete; when incomplete then hairs 5-7-P on
 common tubercle and/or 12-I absent **Aedes**

TRIBE ANOPHELINI

GENUS ANOPHELES

The tribe Anophelini is represented in Jamaica, as well as elsewhere in the West Indies, only by the genus *Anopheles* which is readily recognized from the other Culicinae by the following features. In the adults the posterior margin of the scutellum is evenly rounded; in the females the palpus is subequal in length to the proboscis and the abdominal segments have at most small patches of scales; in the males the palpus is distinctly clubbed apically. In the pupae the meatus of the trumpet is deeply slit; abdominal hair 9 is inserted at the posterolateral corner on tergites II-VII and is usually spiniform at least near its base. The larvae are immediately recognized by the absence of a distinct siphon, the spiracular lobe being sessile; the head is longer than wide and has hairs 5-7-C in a transverse line; abdominal hair

1 is developed as a palmate tuft on some of the segments.

Only 5 species of *Anopheles* are currently known from Jamaica, all breeders in ground waters. The subgenus *Nyssorhynchus* is represented only by *albimanus*, the principal malaria vector of the Caribbean area. The remaining 4 species we have retained in the subgenus *Anopheles* although it is evident that there are several distinct major New World phyletic lines represented in the current interpretation of this subgenus in the world catalog (Stone, Knight and Starcke, 1959) some of which will probably be segregated into distinct subgenera in the future. Two Jamaican species assigned to the nominate subgenus undoubtedly belong respectively to the *atropos* and *crucians* complexes of North America but their exact identity is uncertain because of inadequate material; they are provisionally assigned to these species; *crucians* in Jamaica may possibly be represented by 2 forms. The third species, *vestitipennis*, appears to be similar to its typical populations in Central America and to other populations in the northern West Indies. Finally, there is no question about the identity of *grabhamii* since its type locality is Jamaica; this species appears to be restricted to the northern West Indies.

The present knowledge of the *Anopheles* of Jamaica is surprisingly fragmentary. Except for *albimanus* and *grabhamii* there is very little material in collections; for *atropos* and *crucians* males are unknown and the immature stages of *atropos* have not been collected. For these 2 species we have depended on extralimital material of the unknown stages for the keys, descriptions and illustrations. These may not be reliable since there is a possibility, at least for *crucians*, that the Jamaican form may be distinct from the typical North American populations. The Jamaican populations of *albimanus*, *crucians*, *grabhamii* and *vestitipennis* resemble in general adult features other populations referred to these species we have examined from Cuba, Grand Cayman, Hispaniola and Central America but there appear to be some differences even between the populations of *albimanus* from Jamaica and Grand Cayman. No attempt is made here to differentiate these populations because of the lack of adequate material of the immature stages of the extralimital as well as the Jamaican populations.

The only other *Anopheles* reported from the northern West Indies is *walkeri* Theobald, 1901 (type locality, Ontario, Canada), which was identified in Cuba on the basis of larvae by Montchadsky and Garcia (1966:33). We have included this species in the keys and have provided illustrations of the larva of this complex from Florida (fig. 8) since a form of this complex may be present in Jamaica and could easily be confused with *atropos*. The current interpretation of *walkeri* may include 2 forms, the typical northern one with a dark scaled knob of the haltere and a southern one with a light scaled knob (Stone, 1953:209).

Members of the genus *Anopheles* are the only known vectors of human malarial parasites. There is no doubt that *albimanus* was the principal vector of malaria in Jamaica prior to its eradication, as was concluded by Boyd and Aris (1929:309-399) after a careful malaria survey of the island. However all the other species of *Anopheles* recorded from Jamaica are known either on this island or elsewhere to feed on man and to be capable of transmitting human malaria organisms. Cache Valley virus has been isolated twice from *grabhamii* in Jamaica.

The breeding sites of all the species of *Anopheles* known from the northern West Indies are essentially ground waters; *grabhamii* has been found occasionally in large artificial containers.

KEYS TO SPECIES

ADULTS

1. Mesonotum with general sparse vestiture of broad silvery gray decumbent scales; hindtarsus with broad white ring from middle of segment 2 to apex of segment 4 (*Nyssorhynchus*) 1. **albimanus**
 Mesonotum with general vestiture of hairs, distinct scales narrow, present only on anterior promontory, humeral angle and wing root; hindtarsus completely dark or with narrow light rings on some segments (*Anopheles*).
 2
- 2(1). Frontal tuft of head dark; wing scales all dark 3
 Frontal tuft of head white; wing with some scales white or whitish 4
- 3(2). Legs without knee spots; haltere knob dark scaled; palpus without distinct white bands 2. **atropos**
 Legs with distinct knee spots; haltere knob light scaled; palpus with distinct narrow white bands (Cuba; see genus) *walkeri*
- 4(2). Legs entirely or largely dark, without conspicuous spotting or speckling on femora or tibiae and without distinct light tarsal markings . . . 3. **crucians**
 Legs with conspicuous light markings on femora, tibiae and/or tarsi . . . 5
- 5(4). Wing predominantly dark scaled, scales all narrow 4. **vestitipennis**
 Wing predominantly white scaled, dark scales very broad, nearly circular . .
 5. **grabhamii**

MALE GENITALIA

1. Sidepiece with 1 parbasal seta and 2 accessory setae; ventral part of claspette fused distally into single lobe (*Nyssorhynchus*) 1. **albimanus**
 Sidepiece with 2 parbasal setae and no accessory setae; ventral part of claspette distinctly separated from its mate mesally (*Anopheles*). 2
- 2(1). Claspette not differentiated into dorsal and ventral lobes; all claspette setae pointed. 3. **crucians**
 Claspette differentiated into dorsal lobe and ventral lobe; dorsal lobe of claspette with flattened apically rounded setae 3
- 3(2). Phallosome with 3-5 pairs of leaflets 4
 Phallosome with 1 or 2 pairs of leaflets 5
- 4(3). Apical leaflet of phallosome about 2.0 length of subapical 2. **atropos**
 Apical leaflet of phallosome about 1.2 length of subapical (Cuba; see genus) .
 *walkeri*
- 5(3). Only 1 pair of very long phallosome leaflets; setae of dorsal lobe of claspette usually 3, 2 of which are strongly dilated apically; ninth tergite lobe long, strongly angled laterad 4. **vestitipennis**

Leaflets of phallosome usually 2 pairs; setae of dorsal lobe of claspette usually 2, neither strongly dilated apically; ninth tergite lobe short, slightly angled laterad **5. grabhamii**

PUPAE

1. Hair 9-VIII usually single, rarely forked apically; 1-IV-VII all single and about as long as tergite following (*Nyssorhynchus*) **1. albimanus**
Hair 9-VIII with thickened shaft and many lateral branches; 1-IV-VII usually all branched and shorter than tergite following (*Anopheles*) 2
- 2(1). Trumpet with 2 clefts in meatus and with a conspicuous caudal lobe **4. vestitipennis**
.
Trumpet with only 1 cleft in meatus and without caudal lobe 3
- 3(2). Paddle with coarse blunt teeth on external margin (Cuba; see genus)
. *walkeri*
Paddle without strong coarse blunt teeth on external margin 4
- 4(3). Abdominal hairs 0-III-V usually with at least 3 branches; external and internal margins of paddle smooth in distal 0.2 **3. crucians**
Abdominal hairs 0-III-V usually single, rarely forked; external and internal margins of paddle with filamentous spicules in distal part 5
- 5(4). Abdominal hair 9-IV at least 0.5 of 9-V; paddle hair 1-P with 3 or 4 forks near middle **2. atropos**
Abdominal hair 9-IV at most 0.3 of 9-V; paddle hair 1-P thickened and single **5. grabhamii**

LARVAE

1. Submedian prothoracic hairs 1,2-P on large common tubercle; palmate hairs all with unnotched leaflets (*Nyssorhynchus*) **1. albimanus**
Submedian prothoracic hairs 1,2-P not on common tubercle; strongly developed palmate hairs with notched or serrated leaflets (*Anopheles*) 2
- 2(1). Abdominal hair 0 very large and multiple, subequal to hair 2 on segment IV **3. crucians**
.
Abdominal hair 0 small, inconspicuous, single or with a few branches, always much smaller than hair 2 on all segments 3
- 3(2). Antennal hair 1-A more than 0.5 length of antennal shaft; abdominal hair 1-I with flattened leaflets 4
Antennal hair 1-A less than 0.5 length of antennal shaft; abdominal hair 1-I simple, without flattened leaflets 5
- 4(3). Antennal hair 1-A strong, with more than 12 branches; hair 9-P usually triple **4. vestitipennis**
.
Antennal hair 1-A weak, with less than 7 branches; hair 9-P single (Cuba; see genus) *walkeri*

- 5(3). Outer clypeal (3-C) with not more than 10 short apical branches; prothoracic hair 1-P usually single; abdominal hair 1-III with only a few leaflets **2. atropos**
- Outer clypeal (3-C) with more than 20 strong dendritic branches; prothoracic hair 1-P with 5-8 lateral branches; abdominal hair 1-III a fully developed palmate hair **5. grabhamii**

1. *Anopheles* (Nys.) *albimanus* Wiedemann

Figs. 7,8,9

1820. *Anopheles albimanus* Wiedemann, 1820:10. TYPE: Holotype female, Santo Domingo (Dominican Republic) [NMW].
1901. *Anopheles argyrotarsis* (!) *albipes* Theobald, 1901a:125-128. TYPE: Lectotype male, Jamaica, 16 Dec 1899, M. Grabham [BM; designation of Belkin, 1968b:8-9]. Synonymy with *albimanus* by Coquillett (1906b:8,13).
1905. *Cellia tarsimaculata* Goeldi, 1905:133. TYPE: Same as for *albipes* above [BM; designation of Belkin, 1968b:8-9]. Unjustified emendation for *albipes* Theobald, 1901.
- For complete synonymy see Stone, Knight and Starcke (1959:30).

Anopheles (*Nyssorhynchus*) *albimanus* of Dyar (1922a:103; 1928:434-435); Kumm (1929:6-7); Boyd and Aris (1929); Carley (1931); Edwards (1932:45); Komp (1941:92-97; 1942:5,67-69, 115-117,154-156); Rozeboom (1941:99-101); Simmons (1941:124-125); Simmons and Aitken (1942:80-84); Ross and Roberts (1943:35-36); Matheson (1944:115-116); Carpenter, Middlekauff and Chamberlain (1946:80-83); Penn (1949:68-69); Vargas and Martinez Palacios (1950:119-123; 1956:119-122); Lane (1953:256-259); Carpenter and LaCasse (1955:55-57); Horsfall (1955:172-177); Perez Viguera (1956:180-189); Stone, Knight and Starcke (1959:30); Forattini (1962:371-376); Montchadsky and Garcia (1966:32); Porter (1967:36).

Anopheles albimanus of Howard, Dyar and Knab (1917:979-984); Johnson (1919:424); Gowdey (1926:74); Russell, Rozeboom and Stone (1943:30); King, Bradley and McNeel (1944:39); Hill and Hill (1945a:3; 1948:36-37); Thompson (1947:78); Foote and Cook (1959:112-113).

Cellia albimana of Coquillett (1906b:13); Theobald (1907:106-109; 1910:69-70).

Cellia albipes of Theobald (1905a:15-17; 1905b:11); Prout (1909:487).

Anopheles albipes of Theobald (1903a:110-113).

Cellia argyrotarsis (!) of Theobald (1905a:14; 1905b:11; 1907:105; 1910:68, records from Jamaica); Prout (1909:487).

Anopheles argyrotarsis (!) of Theobald (1901a:123-125, record from Jamaica); Johnson (1919:425).

FEMALE (fig. 7). Wing about 3.5-4.0 mm. Grayish species, wing with contrasting black and white markings, hindtarsus with broad white band from about middle of segment 2 to end of segment 4. *Head*: All scales of vertex and occiput light; frontal tuft conspicuous, white. Flagellar segment 1 with conspicuous tuft of white scales. Palpus predominantly dark scaled; apex of segments 2 and 3 with a narrow band of white scales; segment 5 with white scales only. *Thorax*: Mesonotal integument gray or grayish brown with 3 conspicuous black spots; sparse vestiture of silvery white broad decumbent scales, narrow and outstanding in front of wing root, anterior promontory and humeral angle; some dark outstanding scales below humeral angle. *Apn* with patch of outstanding dark scales in upper part; *pra* and upper and lower *stp* with a few light scales. *Legs*: Forefemur predominantly dark, light at base and on apical 0.3 on lower surface; foretibia dark above and light below and on

apex. Foretarsal segments 1,2,3 with apical whitish bands, distinct above; lower surface of segment 1 pale throughout. Mid and hindfemora predominantly dark on anterior surface except at base, with subapical and apical white spots and an indistinct narrow longitudinal pale streak; lower and posterior surfaces pale. Midtibia dark on anterior surface except at apex, posterior and lower surfaces predominantly pale; midtarsal segment 1 with indistinct apical dorsal pale band, lower surface pale; midtarsal segments 2-5 usually entirely dark. Hindtibia and hindtarsal segment 1 dark above except for narrow apical light band, white and broader on tibia, lower surfaces pale; hindtarsal segment 2 pure white from just before middle, segments 3 and 4 entirely pure white; segment 5 dark at base and white apically, extent of white scaling variable, usually less than distal 0.5 dorsally in Jamaican population. *Wing*: Anterior part predominantly dark, posterior light; vein C with following light spots, usually 3 basal, sectoral, subcostal, preapical and apical, all small except preapical and sometimes apical. *Haltere*: Stem pale, knob dark scaled. *Abdomen*: Pregenital tergites with pale scales in middorsal triangular patches; tergite III with a few apical lateral dark scales, these more numerous, longer and more outstanding on IV-VII and extending toward midline. Pregenital sternites with a few scattered pale scales laterally, a conspicuous submedian patch on II, and with an apical median triangular patch of dark scales, progressively larger on distal segments.

MALE. In general similar to female but somewhat lighter in coloration.

MALE GENITALIA (fig. 9). Ninth tergite unsclerotized, without lateral lobe. Sidepiece with lateral scales; 1 parbasal seta with slightly hooked rounded apex, 2 accessory setae with hooked apex; internal seta slender, apically attenuate; subapical seta similar to internal but straighter. Claspette divided; dorsal lobe with 3 foliform setae; the 2 ventral lobes fused in distal half, apex of fused lobe deeply emarginate in the middle. Aedeagus long, narrow, with slightly expanded bulbous membranous apex; leaflets not developed.

PUPA (fig. 9). Chaetotaxy as figured; diagnostic characters as in the key. Trumpet simple, meatus with 1 cleft only; uniformly moderately pigmented. Abdominal hair 0 usually with at least 2 branches on all segments except VIII; hair 9-II,III very short; 9-IV apically rounded, about 2.0 of 9-III and about 0.33 of 9-V; hairs 9-V-VIII all long, single and with attenuate apex; 1-IV-VII, 5-V-VII all long and single. Paddle uniformly unpigmented except for external buttress and midrib; both external and internal margins with very faint, widely spaced filamentous spicules; hair 1-P single, strong; 2-P very thin, single or double.

LARVA (fig. 8). Diagnostic characters as in the key. Inner clypeal (2-C) and usually outer clypeal (3-C) both strongly barbed; the 2 inner clypeals separated by a distance usually greater than 0.5 of that between inner and outer clypeals on one side. Antenna with very strong short spicules on inner surface; antennal hair (1-A) in basal 0.33 of shaft, only slightly longer than diameter of shaft, usually with 2-4 branches. Submedian prothoracic group (1-3-P) with large common tubercle for hairs 1 and 2, alveolus of 3-P not on tubercle; 1-P large, with flattened expanded shaft and numerous side branches. Prothoracic pleural group (9-12-P) with hair 9 always branched (usually 4). Mesothoracic hair 1-M with elongate flattened shaft. Metathoracic hair 1-T a distinct palmate hair with poorly pigmented leaflets. Abdominal hair 0 well developed and branched on all segments except VIII. Hair 1 a distinct palmate hair with pigmented simple (nonserrated) leaflets on all segments, smaller on I and II. Hairs 2-IV,V and 6-IV-VI all usually single and long.

SYSTEMATICS. The *albimanus* population on Jamaica does not appear to be strongly differentiated in the adult stage but there is a tendency for hindtarsal seg-

ment 5 to be darker than usual; some females have the white scaling restricted to the extreme apex dorsally. In the larva there is considerable variation in the outer clypeals (3-C) which are sometimes nearly bare or only finely barbed.

The record of *argyrotarsis* (!) from Jamaica is erroneous and undoubtedly pertains to *albimanus*. It is based, as stated by Theobald (1905a:14), on specimens collected by Grabham in 1899. Such specimens are recorded in Theobald (1901b:360-361) under collections 37 ("much damaged") and 53 ("good condition"). It is probable that the damaged specimens form the basis for the record of *argyrotarsis* whereas some of the specimens from collection 53 are mentioned in the original description of *albipes* (= *albimanus*) and 1 of these has been designated as its lectotype (Belkin, 1968b:8-9).

BIONOMICS. During our survey, *albimanus* was found breeding most frequently in the following sites: margins of streams (30%) and ditches (21%), ground pools (16%), ponds (9%) and swamp margins (8%). The breeding sites were usually of a permanent nature but some were temporary; a slow current was frequently present. The water was usually fresh but *albimanus* may tolerate some salinity as larvae were taken within a few feet of the sea. There was a decided preference for breeding sites exposed to full sunlight. An almost universal feature of the breeding sites was the presence of algae, either floating on the surface in mats or lining the bottom. When algae were absent, grassy or herbaceous vegetation breaking the water surface was present. In permanent and semipermanent breeding sites, *Anopheles grabhamii*, *Culex* (*C.*) *nigripalpus* and *Culex* (*Mel.*) *atratus* were common associates and *Uranotaenia socialis* and *U. lowii* occasional ones. In ponds with fluctuating water levels *albimanus* was at times found associated with temporary pool breeders such as *Psorophora* (*G.*) *jamaicensis*, *Aedes* (*O.*) *taeniorhynchus*, *Aedes* (*O.*) *hemisurus* and *Aedes* (*O.*) *tortilis*.

Females of *albimanus* bite man freely out-of-doors and may also enter houses to feed but do not rest there. They come readily to human or donkey bait about sunset, and to donkey-baited stable traps and light traps.

Anopheles albimanus is widely distributed over the island. It is most common on the coastal plains where suitable breeding sites are most numerous. It is less common in the interior and in the mountains, being rare at elevations above 350 m. Its altitudinal limit may be near 450 m, the elevation of our collection at Heritage Dam (JA 390). Although fluctuations in its population size do occur, *albimanus*, because of the permanent nature of many of its breeding sites, is found throughout the year.

MEDICAL IMPORTANCE. *Anopheles albimanus* was regarded as the principal vector of malaria in Jamaica before the disease was eradicated on the island (Boyd and Aris, 1929). The reported natural infection rates of this species in Jamaica was very low (1 specimen with oocysts and 2 with sporozoites in about 717 dissections), possibly because many of the specimens dissected were caught after intensive control measures were well under way (Carley, 1931). Because of its close contact with human populations and its still relatively high population level throughout the year, *albimanus* should be regarded as a potentially dangerous species in Jamaica.

DISTRIBUTION. *Anopheles albimanus* has a typical lowland Middle American distribution except for a truncation in the southeastern part of the region. On the Pacific side it extends from the state of Sinaloa in Mexico through to the southern shores of the Gulf of Guayaquil in northern Peru (Tumbes). On the Atlantic side it extends from the southwestern corner of Texas through Mexico, Central America,

Panama, Colombia, Venezuela to Carupano, the Greater Antilles, the Florida keys, Bahamas (according to Porter, 1967:39), Puerto Rico, the Virgin Islands and the Leeward Islands of the Lesser Antilles. It is absent from the Windward Islands (except perhaps Guadeloupe), Trinidad, eastern Venezuela and southward.

JAMAICA. *Anopheles albimanus* is the commonest *Anopheles* in Jamaica and has been reported from every parish on the island even in early surveys (Boyd and Aris, 1929:374). We are listing here only the records of material we have examined. *Clarendon*: Milk River Bath (868). *Kingston and St. Andrew*: Ferry (347,350,781,896). Hermitage Dam gateway (390). Kingston, various dates 1902-1906, M. Grabham, 8 M, 7 F [USNM]. Newstead (962). Temple Hall (46,47,48). Upper Mt. View, 21 Oct 1946, G.A. Thompson, 3 F [JAM]. *St. Ann*: Claremont (742). Delight (757). Runaway Bay (766). *St. Catherine*: Caymanas (1,2,4,29,30,32,210,743,744,746,747). Central Village (759). Congrieve Park (22). Grange Farm (20). Great Salt Pond Farm (26). Gregory Park (16-18). Naggo Head (8,10,11,23). Passage Fort (12). Port Henderson (9). Rio Cobre Dam (819). Spanish Town (24,25,27,35,36). *St. Elizabeth*: Luana (357). *St. Mary*: Castleton Botanical Gardens (807). Fort Stewart (808). *St. Thomas*: Albion (803,873). Amity Hall (58). Chiswick (65). Dalvey (91,148). Duckenfield Hall (54,55). Golden Grove (56,63). Grants Pen (75,77,413,800,813,814,871,872). Hampton Court (149). Holland Bay (57). White Bay (121,169). Winchester House (67,205). Locality not specified, Mar 1928, M.F. Boyd, 5 M, 10 F [USNM]. *Westmoreland*: Crab Pond Bay (782,785). Negril (231,935). *Parish not Specified*: Locality not specified, M.F. Boyd, 5 L, 1 p [USNM].

Material Examined: 557 specimens; 79 males, 107 females, 196 larvae, 175 pupae; 150 individual rearings (58 larval, 70 pupal, 22 incomplete).

2. *Anopheles (A.) atropos* Dyar & Knab

Figs. 8,10

1828. *Anopheles ferruginosus* Wiedemann, 1828:12-13. TYPE: Lectotype female, New Orleans, Louisiana, U.S.A., Thomas Say [NMW; designation of Belkin, 1968b:9-10]. *Nomen oblitum* according to Art 23(b) of present International Code of Zoological Nomenclature; synonymy with *atropos* by Belkin (loc. cit.); formerly considered conspecific with *Culex quinquefasciatus* Say, 1823.
1906. *Anopheles atropos* Dyar and Knab, 1906b:160. TYPE: Lectotype female, Florida Keys (Monroe Co.), Florida, U.S.A., Hiram Byrd [USNM, 10029; designation of Stone and Knight, 1956b:276].

Anopheles atropos of Howard, Dyar and Knab (1917:1032-1033); Dyar (1922a:106-107; 1928:455); Edwards (1932:37); King and Bradley (1941a:69-70; 1941b:73); Komp (1941:92-97); Rozeboom (1941:107); Simmons (1941:113-114); Simmons and Aitken (1942:11-12); Ross and Roberts (1943:17-18); Russell, Rozeboom and Stone (1943:21); King, Bradley and McNeel (1944:37-38); Matheson (1944:109-110); Hill and Hill (1945a:3; 1948:37); Carpenter, Middlekauff and Chamberlain (1946:52-55); Thompson (1947:78); Perez Viguera (1948:300-301; 1956:216-221); Penn (1949:57-58); Carpenter and LaCasse (1955:31-32); Horsfall (1955:61-62); Stone, Knight and Starcke (1959:15); Forattini (1962:470-473); Montchadsky and Garcia (1966:32); Porter (1967:36).

FEMALE. Wing about 3.5-4.0 mm. Almost entirely uniformly dark brown species. Head scales all dark, including frontal tuft. Palpus entirely dark scaled except for very inconspicuous lighter scales on apices of segments 3 and 4. Mesonotum without distinct scales except a few hairlike scales on anterior promontory and humeral angle; pleuron without scales. Legs dark scaled, without light knee spots; apices of tibiae with inconspicuous lighter scales; tarsal joints inconspicuously nar-

rowly lighter. Wing scales all dark, no distinct dark spots present. Haltere stem light, knob dark scaled. Abdomen without scales.

MALE. Unknown for Jamaican population but probably essentially as in the female except for the usual sexual characters.

MALE GENITALIA (fig. 10). Description and figure from specimens from Louisiana, 30 Sept 1922, G.E. Beyer and Key Largo, Florida, 23 July 1944, W.W. Wirth [USNM]. Ninth tergite lobe moderately long, slender, tapered, pointed or rounded at tip. Sidepiece without or with a few scales; 2 apically attenuate parbasal setae; internal seta longer than width of sidepiece. Claspette with dorsal and ventral lobes separated; dorsal lobe usually with 2 or 3 flattened, apically rounded or slightly capitate setae; ventral lobe with 1 flattened apically pointed seta and 1 or 2 smaller simple setae. Aedeagus long, slender, with 3 or 4 simple leaflets, apical one about 2.0 of subapical.

PUPA (fig. 10). Description and figure from specimens from Fort George, Florida, 16 Aug 1945, A.E. Pritchard, 104,105 [USNM]. Chaetotaxy as figured; diagnostic characters as in the key. Trumpet simple. Abdominal hair 0 single, short; 9-V short, not more than 5.0 its diameter; 9-VII short and stout, its apex not gradually tapering, distinctly longer than 9-VI; hair 9-VIII with 12 or more lateral branches. Paddle with inconspicuous fringe of short fine spicules on external margin; paddle hair 1-P with 3 or 4 forks near middle.

LARVA (fig. 8). Description and figure from specimens from Key Largo, Florida, 23 July 1944, W.W. Wirth [USNM]. Inner clypeals (2-C) close at base but sometimes separated by distance greater than 1 basal tubercle; simple or sparsely finely barbed near apex; outer clypeal (3-C) with 5-10 weak apical branches. Antennal hair 1-A short, weak and with a few apical branches. Prothoracic submedian group (1-3-P) without distinct basal tubercles, 1-P single, subequal to or shorter than 3-P; hairs 9,10,12-P all single; mesothoracic hair 1-M without markedly flattened stem; metathoracic hair 3-T small, with a few transparent unnotched leaflets. Abdominal hair 0 minute and single on all segments; 1-I simple, usually forked, 1-II with a few slightly flattened transparent branches, 1-III a poorly developed palmate hair with transparent unnotched leaflets (much smaller than 1-IV), 1-IV-VII fully developed palmate hair with pigmented, notched leaflets; antepalmate hair (2) long and usually single, rarely double, on IV,V; hair 6-IV,V usually at least triple.

SYSTEMATICS. We have not been able to locate the larvae of *atropos* collected by Hill and Hill (1948:37) at Falmouth and our description of *atropos* from Jamaica is based entirely on a few females. Although these agree very well with topotypic *atropos* from Florida and there is little doubt that the 2 populations are conspecific, males and the immature stages are needed for definite confirmation of this identification and to establish any possible racial differences between these populations. We have seen females from the Cayman Islands that agree well with Jamaican specimens.

The conspecificity of *ferruginosus* and *atropos* was not recognized until 1968 (Belkin, 1968b:9-10) and the earlier name is now a *nomen oblitum* as it has remained unused as a senior synonym of *atropos* for more than 50 years. The case is being referred to the International Commission on Zoological Nomenclature with a request to place *ferruginosus* in the Official Index of Rejected Specific Names.

BIONOMICS. Hill and Hill (1948:37) reported larvae of *atropos* from a mangrove swamp with abundant shade in Falmouth and females caught on animal bait from the vicinity of this swamp. This species appears to be very uncommon in Jamaica.

Elsewhere, *atropos* has been found breeding in salt marshes in permanent salt and brackish water pools with NaCl content of 1-12%, often in very shallow water (Carpenter and LaCasse, 1955:32). Females are vigorous biters even in broad sunlight and are readily attracted to light traps.

MEDICAL IMPORTANCE. Although capable of transmitting human malarial parasites experimentally, *atropos* is not considered to be an important vector. Because of its restriction to salt marshes or mangroves this species probably seldom comes in contact with man and is of little economic importance.

DISTRIBUTION. *Anopheles atropos* is a North American coastal species reported from the Atlantic and Gulf seaboard from New Jersey through Texas. It has not been reported from Mexico but may be present along its eastern coasts. The intrusion of *atropos* into the West Indies is apparently very limited. It has been reported only from Cuba and Jamaica, and we have seen specimens from the Cayman Islands.

JAMAICA. *St. Catherine:* Little Goat Island, Portland Bight, June 1945, G.A. Thompson, 1 F [USNM]. *Trelawny:* Falmouth, 1942, females, larvae (Hill and Hill, 1948:37). *Westmoreland:* Savanna-La-Mar, 1942, females (Hill and Hill, 1948:37). *Parish not Specified:* Locality not specified, 1943, Hill and Hill, 2 F [USNM].

Material Examined: 3 females only.

3. *Anopheles (A.) crucians* Wiedemann

Figs. 7,8,11

1828. *Anopheles crucians* Wiedemann, 1828:12. TYPE: Lectotype female, New Orleans (Louisiana), U.S.A. [NMW; designation of Belkin (1968b:9)].

Anopheles crucians of Coquillett (1906b:12); Howard, Dyar and Knab (1917:1023-1026); Johnson (1919:424); Dyar (1922a:107; 1928:451); Gowdey (1926:74); Boyd and Aris (1929); Matheson (1929:90-91; 1944:106-108); Carley (1931); Edwards (1932:38); King and Bradley (1941a:69-70; 1941b:73-74); Komp (1941:92-97; 1942:5,48-49,89-91,137-139); Rozeboom (1941:104-105); Simmons (1941:113-114); Simmons and Aitken (1942:13-18); Ross and Roberts (1943:19-20); Russell, Rozeboom and Stone (1943:21); King, Bradley and McNeel (1944:34-35); Hill and Hill (1945a:3; 1948:37-38); Carpenter, Middlekauff and Chamberlain (1946:60-64); Thompson (1947:78); Penn (1949:63-64); Vargas and Martinez Palacios (1950:68-71; 1956:69-72); Carpenter and LaCasse (1955:35-37); Horsfall (1955:75-79); Perez Viguera (1956:190-197); Stone, Knight and Starcke (1959:17); Foote and Cook (1959:117); Forattini (1962:318-320); Montchadsky and Garcia (1966:33); Porter (1967:36).

?*Anopheles punctipennis* of Theobald (1905a:12-13); Prout (1909:487); Johnson (1919:425).

FEMALE (fig. 7). Wing about 4.0 mm. Dark species with restricted light scaling on head, palpus, wing and sometimes basal segments of legs; tarsi dark. *Head:* Vertex with small anterior median patch of white erect and decumbent scales, remainder dark scaled; frontal tuft white. Palpus subequal to proboscis in length; with narrow basal and apical white scaled rings on segments 3 and 4, segment 5 with white scales only. *Thorax:* Mesonotum very dark gray brown, with pruinose lines; vestiture of short dark hairs (some light bronzy) except for elongate whitish hairlike scales on anterior promontory and humeral angle. *Apn* with a few outstanding dark scales in upper part; remainder of pleuron without scales. *Legs:* Largely dark scaled. Knee spots usually not developed, rarely slightly indicated on hindlegs. Tibial apices usually all dark, slightly indicated on hindlegs. Tarsi entirely dark

scaled. *Wing*: Dorsal scaling predominantly dark. Whitish or yellow scales forming: (1) a small apical costal spot, including tips of R_1 and R_2 , (2) elongate streak in distal 0.6 of R_{2+3} and (3) elongate subbasal streak on 1A. Dingy grayish scales forming variable patches or spots as follows: (1) elongate streak on distal 0.5 of R_s , (2) variable spot on R_3 , usually in distal 0.5, (3) elongate streak between *m-cu* and furcation of *M*, (4) variable median streaks on M_{1+2} and M_{3+4} , (5) variable dark gray submedian streak on Cu_1 , (6) light gray subapical streak on 1A. Vein 1A predominantly dark. *Haltere*: Stem light, knob dark scaled. *Abdomen*: Without distinct scales.

MALE. Not available for Jamaican population but probably with more extensive light scaling of wing veins than in female.

MALE GENITALIA (fig. 11). Description and figure from specimens from Wilson Dam, Alabama [UCLA]. Ninth tergite lobe very long and slender. Sidepiece with scales laterally; 2 apically attenuate slender parbasal setae; internal seta slender, longer than diameter of sidepiece. Claspette not differentiated into dorsal and ventral lobes, with 1 or 2 pointed differentiated large apical setae, 1 long slender mesal seta and 1-3 lateral setae. Aedeagus long, slender, with 3 or 4 slender leaflets.

PUPA (fig. 11). Chaetotaxy as figured; diagnostic characters as in the key; integument moderately to very lightly pigmented. Trumpet simple; moderately uniformly pigmented. Abdominal hair 0 double or triple on III-VII, usually single on II, VIII; hairs 9-IV-VII all short and stout, with bluntly rounded apices; 9-VI, VII subequal in length; 9-VIII with about 16 lateral branches. Paddle margins smooth in distal 0.2; paddle hair 1-P single, thickened basally and attenuate in distal 0.67.

LARVA (fig. 8). Inner clypeals (2-C) separated at base by less than diameter of 1 tubercle, single and without barbs; outer clypeal (3-C) densely dichotomously branched beyond a short basal stem. Antennal hair short and weak, usually with 4 or 5 branches. Prothoracic submedian group (1-3-P) without distinct basal tubercles, 1-P single or apically forked, subequal to hair 3-P, hair 2-P with simple shaft; hairs 9, 10, 12-P all single; mesothoracic hair 1-M strong, with distinctly flattened shaft; metathoracic hair 3-T a small palmate hair with poorly developed unpigmented, unnotched leaflets. Abdominal hair 0 always branched (2-4) and short on segments II, VII, VIII, multiple and subequal to hair 2 on other segments; 1-I with a few flattened, unpigmented, unnotched leaflets, 1-II a rudimentary palmate hair with stiff, partially pigmented simple leaflets, 1-III-VII fully developed palmate hair with pigmented, notched leaflets; antepalmate hair (2) usually about 6-branched on segments IV, V; hair 6-IV usually at least triple, 6-V double to quadruple.

SYSTEMATICS. The Jamaican population of the *crucians* complex may be a distinct species but the material available for this study is too scanty to establish this definitely. The females are much darker than those of the typical populations from the southern United States but there is considerable variation in the light scaling of the wing in Jamaican specimens. Somewhat similar dark winged forms of the *crucians* complex occur in the Gulf coast of Mexico, in British Honduras, and on the east coast of Guatemala and Honduras.

Our very limited material of immature stages from Jamaica conforms in breeding sites and in general morphology to typical *crucians* from the United States but there appear to be slight differences in chaetotaxy which cannot be evaluated without additional material.

There is a possibility that 2 forms or species of the *crucians* complex exist in Jamaica. We have not been able to locate any of the material of immature stages collected by Hill and Hill (1948:37) in mangrove swamps. Such a habitat suggests

a form similar to *bradleyi* King, 1939 while our freshwater material conforms with the habitat of typical *crucians*. The species of the complex can be differentiated with certainty only in the immature stages.

It is very probable that the specimens of *punctipennis* from Port Antonio, Jamaica, mentioned by Theobald (1905a:12) actually were *crucians*, although the description of the adult is that of *punctipennis*. Howard, Dyar and Knab (1917:1014) explain the probable misidentification of these specimens. We believe that "The specimen sent me by Dr. Grabham was quite normal" (Theobald, loc. cit.) was not from Jamaica but probably *punctipennis* from New Mexico, U.S.A. where M. Grabham collected with T.D.A. Cockerell a number of mosquitoes mentioned in a paper by Theobald (1903c).

BIONOMICS. Our 4 collections of immature stages of *crucians* were from 2 ditches, a drain and a stream margin. All were in the coastal plain in full sunlight in fresh water containing algae and floating or submerged vegetation. The associated species were *Anopheles (Nys.) albimanus*, *Uranotaenia socialis*, *Culex (C.) nigripalpus* and *Culex (C.) atratus*. Hill and Hill (1948:37) state that *crucians* "breeds in mangrove swamps near the coast, the water probably being slightly brackish". This is contrary to our limited experience and to the much more extensive surveys reported by Boyd and Aris (1929:377,379) who also found *crucians* only in fresh water. The difference in breeding sites suggest that another member of the *crucians* complex may be present on Jamaica.

In Jamaica, females of *crucians* feed primarily on domestic animals but will bite man around sunset. They enter donkey baited stable traps and both sexes are attracted to light traps. The species is widespread on the island but common only locally.

MEDICAL IMPORTANCE. Boyd and Aris (1929:394) concluded that "*A. crucians* may be a vector of malaria on the island, but owing to its limited geographical distribution, and relative scarcity, it cannot be of great importance". Since that time *crucians* has been found to be more widespread on Jamaica but it has never been considered to be an important vector. One natural sporozoite infection in 234 dissections was reported from Cuba by Carr and Hill (1942) but none from Jamaica by Carley (1931).

DISTRIBUTION. The *crucians* complex is primarily eastern North American in distribution, occurring north to Massachusetts and west to Kansas and New Mexico. Of the 3 forms currently recognized in the complex, only *crucians* proper has been reported south of the United States, from Mexico through Nicaragua in Central America, and from the Bahamas (Porter, 1967:39), Cuba, Jamaica, Hispaniola (here confirmed for the Dominican Republic) and questionably from Puerto Rico (Tulloch, 1937:153; repeated by others).

JAMAICA. Adults of *crucians* have been collected by the Mosquito Control Organization in all parishes of the island except Hanover and St. Mary. As few collections were made in the latter parishes, it is not unlikely that *crucians* occurs there also. We list below only the material we have seen. *St. Catherine*: Port Henderson (6). Spanish Town (34,36). *St. Elizabeth*: Black River, 2 mi E (794). Luana (357,358). Locality not specified, Feb 1928, M.F. Boyd, 10 F [USNM].

Material Examined: 34 specimens; 27 females, 4 larvae, 3 pupae; 3 individual larval rearings.

4. *Anopheles (A.) vestitipennis* Dyar & Knab

Figs. 7,8,12

1906. *Anopheles vestitipennis* Dyar and Knab, 1906a:136. TYPE: Lectotype female, Cacao,

Trece Aguas (Alta Verapaz), Guatemala, 7-14 Apr 1906, E.A. Schwarz and H.S. Barber [USNM, 9976; designation of Stone *in* Russell, Rozeboom and Stone, 1943:34].

Anopheles vestitipennis of Howard, Dyar and Knab (1917:989-990); Johnson (1919:424); Gowdey (1926:74); Dyar (1928:458-459); Boyd and Aris (1929); Carley (1931); Edwards (1932:43); Komp (1941:92-97; 1942:5,53-55,97-99,142-143); Rozeboom (1941:106); Simmons (1941:123-124); Simmons and Aitken (1942:78-79); Russell, Rozeboom and Stone (1943:34-35); Hill and Hill (1945a:3; 1948:38-39); Thompson (1947:78); Vargas and Martinez Palacios (1950:96-99; 1956:96-99); Lane (1953:172-175); Horsfall (1955:165-166); Perez Viguera (1956:206-215); Stone, Knight and Starcke (1959:29); Foote and Cook (1959:139); Forattini (1962:351-353); Montchadsky and Garcia (1966:33); Porter (1967:36).

Anopheles maculipes of Johnson (1919:424); Gowdey (1926:74).

Arribalzagia maculipes of Theobald (1905a:13-14); Prout (1909:487).

FEMALE (fig. 7). Wing about 4.0-4.5 mm. Blackish species with whitish spotted femora and tibiae, white rings on fore and hindtarsus and predominantly black wings with very small white spots. *Head*: Erect scales of vertex predominantly dark except usually a varied number of light scales in front; a few white decumbent scales in front extending into interocular space as semierect scales but not forming a conspicuous frontal tuft. Palpus usually slightly shorter than proboscis, with shaggy dark vestiture, sometimes a few whitish scales at base of segments 3, 4 and 5. *Thorax*: Mesonotal integument blackish brown; vestiture of bronzy and coppery hairs; hairlike lighter golden scales in front of wing root; anterior promontory with small patch of golden hairlike scales; humeral angle with extensive but sparse patch of erect, apically widened dark scales. *Apn* with large patch of dark erect scales in upper part; lower and upper *stp* with a few light scales. *Legs*: Femora and tibiae with small discrete whitish or light yellowish spots; knee spots not developed. Foretarsus with distinct white dorsal bands over the joints between segments 1, 2, 3 and 4, less distinct on ventral surface; segment 1 with 2-5 small white spots on dorsal surface. Midtarsus usually with only 1-3 light spots on dorsal surface of segment 1 and usually without dorsal light bands on distal segments. Hindtarsus with distinct apical whitish rings on segments 1-4; segment 1 with several narrow dorsal light bands, some extending to ventral surface. *Wing*: Predominantly dark scaled, with very small spots of creamy scales on dorsal surface of all veins; vein 1A usually with 5 light spots. *Haltere*: Stem light, knob dark scaled. *Abdomen*: Sometimes with 1 or 2 small broad dark scales on sides of pregenital tergites; pregenital sternites usually with a few scattered similar dingy scales.

MALE. Essentially as in female except for usual sexual characters. Light scaling of palpus, legs and wing usually much more extensive than in female.

MALE GENITALIA (fig. 12). Ninth tergite unsclerotized but long and prominent; lateral lobe conspicuous, narrow, directed laterad at angle of about 45°, apex rounded. Sidepiece with scales laterally; 2 parbasal setae, both with tapered apex, outer thinner, longer and with more attenuate apex; internal seta usually about 1.4 of diameter of sidepiece. Claspette divided; dorsal lobe with 3 flattened setae, 2 with curved expanded apex, other rounded apically; ventral lobe with 1 long and 2 medium setae near apex. Aedeagus long, slender; apex with only 1 pair of very long leaflets.

PUPA (fig. 12). Chaetotaxy as figured; diagnostic characters as in the key; pigmentation moderate to strong. Trumpet complex; meatus with 2 clefts, pinna with a conspicuous caudal lobe; uniformly darkly pigmented. Abdominal tergites II-VII with small but distinct sharp spicules on caudal margins; hair 0 usually single on all

segments, rarely forked; 9-II,III very short; 9-IV a little less than 3.0 of 9-III and about 0.7 of 9-V; hairs 9-V-VII subequal and all with blunt apex; 9-VIII with about 15 lateral branches. Hair 1-X present, long but without alveolus, sometimes branched. Paddle deeply irregularly pigmented; both inner and outer margins with long fine filamentous spicules closely packed and usually in double row so that they appear to be branched; hair 1-P strong and with 3 or 4 distal forks; 2-P single.

LARVA (fig. 8). Diagnostic characters as in the key. Inner clypeals (2-C) separated at base by more than width of tubercle, with a few fine barbs beyond middle; outer clypeal (3-C) usually with less than 15 irregular dendritic branches starting at about middle. Antennal hair (1A) in basal 0.25 of shaft, very strong, more than 0.5 of shaft length, with about 12 long lateral branches. Submedian prothoracic group (1-3-P) essentially as in *grabhamii*. Prothoracic pleural group (9-12-P) with hair 9-P usually triple. Mesothoracic hair 1-M with shaft barely thickened in basal half. Metathoracic palmate hair (3-T) moderately developed, leaflets flat and tapered but not pigmented. Abdominal hair 0 minute on all segments, usually single. Hair 1-I,II a rudimentary palmate hair with a few flattened tapered unpigmented leaflets, 1-III-VII fully developed palmate hairs with pigmented serrated leaflets. Hair 2-IV,V usually triple from near base; 6-IV,V usually double or triple.

SYSTEMATICS. The Jamaican population of *vestitipennis* does not appear to differ significantly from most other Antillean or Central American populations but the material available for this study is very limited and differences may actually exist. In Puerto Rico, females of *vestitipennis* collected in mangrove swamps are much darker than those collected inland, some showing practically no light scales on the wings. A remarkable feature of the pupa of the Jamaican population is the presence of hair 1-X (cercal hair). This appears to be a fixed anomaly since this hair does not have an alveolus. As we have no pupal material from other populations, it is not known if this feature is characteristic of the species as a whole.

Theobald's (1905a:13) description of *maculipes* agrees in general features with *vestitipennis* and there is no question that Theobald misidentified the material from Jamaica as he fails to list it under *maculipes* at a later date (Theobald, 1910:49).

BIONOMICS. Only 6 collections of immature stages were made during our survey; these were on the edges of rice fields and swamps, in ditches and in a pond. All the breeding sites were in the lowlands, none above 30 m above sea level, in rather scrubby areas near the sea. The water was clear, fresh and stagnant, usually with grass, rice, reeds or cattails. Associated species were *Anopheles (A.) grabhamii*, *Culex (C.) nigripalpus* and *Culex (Mel.) pilosus*.

Females of *vestitipennis* bite man, both in the evening and during the day in overcast weather. However, they prefer to feed on domestic animals and large numbers have been taken in donkey-baited stable traps.

Adults are particularly abundant in St. Elizabeth and Westmoreland parishes at the southwest end of Jamaica where there are large tracts of freshwater swamps and much rice is grown and it may be that swamp rice fields form highly suitable breeding places for this species.

MEDICAL IMPORTANCE. Boyd and Aris (1929:394) suspected *vestitipennis* as a potential malaria vector on Jamaica owing to its inclination for human blood but did not consider this species to be important because of its limited distribution. The latter is actually not true but *vestitipennis* was not found to be naturally infected during the survey by Carley (1931) and was disregarded as a malaria vector on Jamaica. However it has been suspected as a vector in Cuba and British Honduras.

DISTRIBUTION. *Anopheles vestitipennis* is a Middle American species with a

more restricted distribution than *albimanus*. Its known range extends from the state of San Luis Potosi in Mexico through Central America to Panama and Colombia. In the West Indies it is known only from Cuba, Jamaica, Hispaniola (Haiti and Dominican Republic) and Puerto Rico.

JAMAICA. Adults of *vestitipennis* have been collected in every parish on the island, in greatest numbers in the southwest parishes of Westmoreland and St. Elizabeth. The following records are of the scanty material we have examined. *St. Catherine*: Passage Fort (14). Spanish Town (23,37, 38). *St. Elizabeth*: Luana (357). Maggoty (793). Locality not specified, Feb 1928, M.F. Boyd, 2 F [USNM]. *St. Thomas*: Albion (804). *Westmoreland*: Crab Pond Bay (790). Negril Swamp (232). *Parish not Specified*: Locality not specified, M.F. Boyd, 2 l, 1 p [USNM].

Material Examined: 30 specimens; 2 males, 16 females, 7 larvae, 5 pupae; 4 individual rearings (3 larval, 1 pupal).

5. *Anopheles* (A.) *grabhamii* Theobald

Figs. 7,13,14

1901. *Anopheles grabhamii* Theobald, 1901a:205-207. TYPE: Holotype female, Kingston, Jamaica, M. Grabham [BM].

Anopheles grabhamii of Howard, Dyar and Knab (1917:1006-1009); Johnson (1919:424); Gowdey (1926:74); Dyar (1928:457-458); Boyd and Aris (1929); Carley (1931); Edwards (1932:42); Komp (1941:92-97; 1942:5,52-53,96-97,141-142); Rozeboom (1941:104); Simmons (1941:123-124); Simmons and Aitken (1942:66-67); Russell, Rozeboom and Stone (1943:32); Hill and Hill (1945a:3; 1948:38); Thompson (1947:78); Lane (1953:177-179); Horsfall (1955:87); Perez Viguera (1956:198-205); Stone, Knight and Starcke (1959:19); Forattini (1962:360-362); Montchadsky and Garcia (1966:32); Porter (1967:36).

Cyclolepteron grabhamii of Theobald (1901b:312; 1903a:56-59; 1905a:17-18; 1905b:8); Coquillett (1906b:13); Prout (1909:487).

FEMALE (fig. 7). Wing about 3.5-4.0 mm. Brownish species with speckled femora and tibiae and narrowly banded tarsi; wing thinly scaled, predominantly light and speckled with large, nearly circular black scales. *Head*: Integument blackish. Scaling of vertex dark except for anterior median triangular patch of erect and decumbent white scales; frontal tuft white. Palpus entirely dark scaled, shaggy, subequal to proboscis in length. Antennal torus with mesal patch of small dark bronzy scales. *Thorax*: Mesonotal integument grayish brown, with pruinose lines; vestiture of golden hairs except for hairlike erect scales in front of wing root and in supraalar area, anterior promontory with outstanding narrow whitish scales, and humeral angle with patch of outstanding narrow dark scales. *Aprn* with small upper patch of dark outstanding scales; *pra* with a few outstanding light scales; *stp* usually without scales. *Legs*: Femora predominantly light scaled, speckled with dark scales; tibiae predominantly dark scaled, speckled with light scales. Tarsi predominantly dark scaled; segment 1 on all legs with some scattered pale scales; very inconspicuous basal pale rings on tarsal segments 1-3 and sometimes 4 on all legs. *Wing*: Very thinly scaled; scales predominantly light and with variable speckling of large nearly circular, ballon or teardrop shaped dark scales; vein C with small narrow dark scales except for very small yellowish subcostal spot and a large yellowish subapical spot involving also veins R_1 and R_2 and separated by a very small dark spot from a small apical light spot. *Haltere*: Stem light gray, knob with dense vestiture of intensely black scales. *Abdomen*: Without scales on pregenital segments.

MALE. Essentially as in female except for usual sexual characters. Palpal segments 4 and 5 with a few dingy white or pale scales at base.

MALE GENITALIA (fig. 13). Ninth tergite unsclerotized; lateral lobe small, narrow, prominent, apically rounded. Sidepiece with scales laterally; 2 parbasal setae, both with tapered apex, outer longer and straighter than inner; internal seta only slightly longer than diameter of sidepiece. Claspette divided; dorsal lobe with 2 flattened setae with rounded, slightly expanded apex; ventral lobe with 1 acuminate apical stout seta, 1 moderately long and 1 short simple setae. Aedeagus long, slender; leaflets 2 pairs, apical more than 2.0 of subapical.

PUPA (fig. 13). Chaetotaxy as figured; diagnostic characters as in the key; integumentary pigmentation variable, usually strong. Trumpet simple, meatus with 1 cleft; uniformly moderately pigmented except for slightly lighter base. Abdominal hair 0 usually single on all segments; 9-II,III very short; 9-IV only about 2.0 of 9-III and about 0.3-0.4 of 9-V; hairs 9-V,VI subequal; 9-VII distinctly longer than 9-V,VI and with tapered apex; 9-VIII with about 15-18 lateral branches. Paddle uniformly pigmented; inner and outer margins both with fine filamentous spicules distally; hair 1-P thickened, single, acuminate; 2-P usually double or triple.

LARVA (fig. 14). Chaetotaxy as figured; diagnostic characters as in the key. Head pigmentation varied from uniformly intensely dark to moderately blotchy; inner clypeals (2-C) separated at base by less than width of tubercle, apical half with a few barbs; outer clypeal (3-C) sparsely dendritic from a moderate basal shaft. Antennal hair (1-A) in basal 0.25 of shaft, about 0.3 of shaft length, usually with 3-6 branches. Prothoracic submedian group (1-3-P) with only a small tubercle at base of hair 2; hair 1-P slender, usually with 5-8 lateral branches; 2-P strong, with slender shaft and about 10-15 long lateral branches. Prothoracic pleural group (9-12-P) with all long hairs usually single, rarely 1 of these double. Mesothoracic hair 1-M with shaft only slightly thickened and flattened in basal half. Metathoracic palmate hair 3-T poorly developed, with unpigmented, smooth, slender leaflets. Abdominal hair 0 minute on all segments but usually double. Hair 1-I simple, usually with 3 or 4 stiff branches; 1-II not palmate, usually with about 10 thin branches similar to hair 2; hair 1-III-VII fully developed palmate tuft with pigmented serrated leaflets. Hair 2-IV,V usually double, rarely single; 6-IV,V usually double.

SYSTEMATICS. Few species of *Anopheles* are as readily recognized in the adult stage as *grabhamii* with its large circular black scales speckling the thinly clad predominantly light scaled wings. There is a great deal of variation in the pattern of the adults but we have made no attempt to correlate these with geographical and ecological differences. In the larva there is considerable variation in the development of hair 1 on abdominal segments I and II but in no case are the branches distinctly flattened as leaflets.

BIONOMICS. The immature stages of *grabhamii* were found during our survey primarily at the margins of streams, in pools in stream beds, in ground pools and ditches, occasionally at the margins of swamps and ponds, and in large artificial containers, such as horse troughs and large shallow barrels. This species breeds more commonly in permanent water but will also utilize temporary sites. The water of choice is fresh, clear and with no more than a slow current. In mountain streams, where the water is rapid, the immature stages are found along grassy margins or in pools with slower current. Vegetation in the breeding sites is either present or absent. All conditions of light are tolerated, from full sunlight to deep shade. This species also tolerates brackish water (Boyd and Aris, 1929:377).

In the lowlands, the immature stages of *grabhamii* are frequently associated with

those of *Anopheles (Nys.) albimanus*, *Culex (C.) nigripalpus* and *Culex (Mel.) atratus*; at higher elevations their common associates are *Culex (C.) secutor* and *Culex (Mel.) inhibitor*.

Anopheles grabhamii is probably the most widespread mosquito in Jamaica, occurring from near sea level to elevations as high as 1700 m (Clydesdale, 754). Although fairly common, *grabhamii* does not seem to attain as large populations or to show as strong seasonal fluctuations as *albimanus*.

Females of *grabhamii* feed on man in the open, but appear to prefer donkeys, mules and other domestic animals. They are readily captured in donkey-baited traps and will enter chicken-baited traps in small numbers. Both sexes are attracted to light traps.

MEDICAL IMPORTANCE. Boyd and Aris (1929:394) were of the opinion that *grabhamii* could be exonerated as a vector of malaria in Jamaica on epidemiological grounds (distribution and peak of incidence not coinciding with that of malaria) and relatively low attraction to humans. Carley (1931), however, found 1 naturally infected specimen with a mature oocyst in 125 dissections (higher rate than in *albimanus*). Because of its abundance and wide distribution, *grabhamii* may be an important reservoir species and occasionally a vector of pathogens to man. In recent years 2 isolations of Cache Valley virus and another one of an unidentified arbovirus have been made from *grabhamii* in Jamaica (Taylor, 1967:503; L.S. Grant, personal communication).

DISTRIBUTION. *Anopheles grabhamii* appears to be endemic to the West Indies where it is definitely known only from Cuba, Cayman Islands, Jamaica, Hispaniola (Haiti and Dominican Republic), Puerto Rico and the Virgin Islands. The record from Panama (Lane, 1953:179; Stone, Knight and Starcke, 1959:19) has not been confirmed and is probably erroneous.

JAMAICA. *Anopheles grabhamii* occurs throughout the island, from near sea level to elevations as high as 1700 m. The following records are of specimens seen by us. *Clarendon*: Milk River Bath (868). Yorks Pen (604). *Kingston and St. Andrew*: Cavaliers (41,43). Clydesdale (754). Ferry (769,797,798,857,860). Gordon Town (911,947). Hermitage Dam Road (739,828,851,852,891,893). Kingston, various dates, M. Grabham, 5 M, 7 F [USNM]. Mount Airy (51). Newcastle (832-836). Newstead (962). Temple Hall (44,46,47). University of the West Indies (209). *Portland*: Rio Grande River (921). *St. Ann*: Drax Hall (608). *St. Catherine*: Caymanas (29,30,32,210,743,744,746,747). Ft. Simonds, Jan 1946, G.A. Thompson, 1 F [USNM]. Recess Pen (225,226). Spanish Town (28,38). *St. Mary*: Castleton, 5 mi N (954). *St. Thomas*: Albion (873). Amity Hall (58). Chiswick (65). Dalvey (91). Golden Grove (56,63). Hampton Court (147,149). Hectors River (60). White Bay (121). Winchester House (67). Yallahs River (817). Locality not specified, Mar 1928, M.F. Boyd, 2 M, 6 F [USNM]. *Westmoreland*: Crab Pond Bay (785). Negril (231,232).

Material Examined: 404 specimens; 49 males, 87 females, 140 larvae, 128 pupae; 112 individual rearings (51 larval, 41 pupal, 20 incomplete).

TRIBE URANOTAENIINI

GENUS URANOTAENIA

The small, delicate mosquitoes of the genus *Uranotaenia* are readily recognized from other Culicidae in the West Indies by the following combination of characters: (1) in the adults; vein R_{2+3} more than 3 times as long as vein R_2 ; side of mesonotum with a streak of whitish or iridescent blue scales extending forward from

wing root; palpus extremely short in both sexes; labium usually distinctly swollen apically; (2) in the pupa; hair 6-C strongly developed and usually simple; tracheoid of trumpet present; 1-IX usually strong and conspicuous (except in *cooki*); and (3) in the larva; head longer than wide and with hairs 5,6-C single and spikelike; comb scales arising from a sclerotized lateral plate. In the male genitalia of *Uranotaenia*, the so-called "ninth tergite lobe" is undoubtedly developed from the basolateral sclerotization of the proctiger and is therefore termed here the **basal tergal lobe** of the proctiger. A similar lobe is developed in other Culicinae, notably in the tribes Culicini, Aedini and Sabethini.

Three species of *Uranotaenia* are now known from Jamaica, each representing a distinct phyletic line. The topotypic Jamaican *socialis* is considered here as a species distinct from the North American *sapphirina* following Galindo, Blanton and Peyton (1954) but it is questionable whether some of the extralimital populations of supposed *socialis* are really conspecific with the Jamaican population. The newly discovered Jamaican species we are assigning tentatively to *cooki* from Hispaniola (Haiti) but this needs confirmation. The third species we are retaining in *lowii*, although the Jamaican population shows a number of departures from the topotypic one from St. Lucia. It is evident that there is considerable local population differentiation in many species of *Uranotaenia* with wide reported distributions in the New World tropics but it is not possible to evaluate these without adequate material of associated stages. The material of Jamaican species is very scanty and in poor condition in the case of the immature stages.

We have included in the keys the 2 other species of *Uranotaenia* reported from the northern Antilles. *Uranotaenia sapphirina* (Osten Sacken, 1868) is easily confused with *socialis* and we have therefore provided detailed drawings of the former (figs. 16,20) from the southern United States with the hope that these will help to establish the identity of the species reported from Cuba, Hispaniola, Puerto Rico and the Virgin Islands. *Uranotaenia oteizai* Perez Viguera, 1956 is a member of the *U. leucoptera* (Theobald, 1907) complex recently described from Cuba. It has not been recognized outside of Cuba, where it is apparently uncommon, but the records of *leucoptera* from the state of Tabasco, Mexico (Martini, 1935:39) may actually pertain to *oteizai*. The larva described and figured by Perez Viguera (1956: 443-449) may be incorrectly associated with the adults as it does not conform to the type in *leucoptera* and appears to be very similar to *lowii* except for the most unusual feature of apparently unbranched hair 1 on most abdominal segments (possibly a drafting error). Lacking material of *oteizai* we have had to rely on the original description for the characters used in our keys.

New World species of *Uranotaenia*, as far as known, breed in ground waters only. The larvae are seldom collected as they are usually mistaken for the younger instars of other genera or unnoticed because of their sluggishness. They are also difficult to rear individually. Such rearings are essential since the differences between species are often obscure or minute and several species may be found breeding together in a single habitat.

Females of *Uranotaenia* are not usually attracted to warm-blooded vertebrates and are therefore not normally encountered in hand catches or baited traps. Both sexes of a number of species are readily collected at lights or in light traps. Females of some species are known to feed on amphibians. Nothing is known about the adult bionomics of the species in Jamaica.

KEYS TO SPECIES

ADULTS

1. Wing predominantly white scaled dorsally; head predominantly light scaled (Cuba; see genus) *oteizai*
 Wing predominantly dark scaled dorsally, with restricted lines of iridescent azure scales on base of veins R and Cu; head predominantly dark scaled, with azure scales anteriorly 2
- 2(1). Mesonotum with a median longitudinal line of iridescent azure scales; scutellum with similar scales on midlobe; abdominal tergites without iridescent azure apicolateral spots 3
 Mesonotum without median longitudinal line of iridescent azure scales; all lobes of scutellum dark scaled; abdominal tergites with large iridescent azure apicolateral spots 4
- 3(2). Mesonotal line of azure scales ending in anterior part of prescutellar space; iridescent azure streak of vein Cu not reaching half distance to its furcation **6. socialis**
 Mesonotal line of azure scales extending to scutellum; iridescent azure streak of vein Cu extending more than half distance to its furcation (U.S.A.; possibly northern Antilles other than Jamaica; see genus) . . . *sapphirina*
- 4(2). Hindtarsus entirely dark dorsally, indistinctly paler on distal segments ventrally; apicolateral azure spots present on abdominal tergites III-VII; male foretarsal segment 1 much shorter than 2 **7. cooki**
 Hindtarsus white or grayish white from about middle of segment 3 to apex; apicolateral azure spots present on abdominal tergites II, III, V and VI; male foretarsal segment 1 longer than 2 **8. lowii**

MALE GENITALIA

1. Clasper with about 15 heavy spiniforms in distal half **8. lowii**
 Clasper with 1 (rarely 2) slender subapical spiniform 2
- 2(1). Apex of aedeagus with denticulate lobe (Cuba; see genus) *oteizai*
 Apex of aedeagus without denticulate lobe 3
- 3(2). Tergite IX short, its proximal border shallowly emarginate; clasper with distinct dorsomesal postmedian lobe **7. cooki**
 Tergite IX long, its proximal border very deeply emarginate; clasper without distinct dorsomesal postmedian lobe 4
- 4(3). Distance between basal tergal lobes of proctiger greater than length of lobe **6. socialis**
 Distance between basal tergal lobes of proctiger less than length of lobe (U.S.A., possibly northern Antilles other than Jamaica; see genus) *sapphirina*

PUPAE

(oteizai unknown)

1. Metanotal hair 11-C usually single; trumpet pinna long and strongly oblique, meatus without open slit **8. lowii**
 Metanotal hair 11-C usually with at least 3 branches; trumpet pinna short and truncate, meatus with long narrow open slit 2
- 2(1). Trumpet distinctly flared apically; hair 1-IX not developed **7. cooki**
 Trumpet not distinctly flared apically; hair 1-IX distinct 3
- 3(2). Trumpet index about 8.0, tracheoid ending distinctly before middle
 **6. socialis**
 Trumpet index about 11.0-12.0, tracheoid extending distinctly distad of middle (U.S.A., probably northern Antilles other than Jamaica; see genus)
 *sapphirina*

LARVAE

1. Prothoracic hair 3-P less than 0.4 of 1-P; hair 14-P branched 2
 Prothoracic hair 3-P more than 0.5 of 1-P; hair 14-P single (unknown in *oteizai*) 3
- 2(1). Pecten teeth usually less than 12; comb scales usually 8 or less; head hair 4-C usually triple **6. socialis**
 Pecten teeth usually more than 12; comb scales usually more than 8; head hair 4-C usually double or single (U.S.A., possibly northern Antilles other than Jamaica; see genus) *sapphirina*
- 3(1). Comb scales usually more than 10; siphon usually with distinct dark ring before hair 1-S **7. cooki**
 Comb scales usually less than 9; siphon usually without distinct premedian dark ring 4
- 4(3). Abdominal hair 1 a multiple stellate tuft on all segments. **8. lowii**
 Abdominal hair 1 apparently (doubtfully) single on segments III-VII (Cuba; see genus). *oteizai*

6. *Uranotaenia socialis* Theobald

Figs. 15,19

1901. *Uranotaenia socialis* Theobald, 1901b:340-342. TYPE: Lectotype male (111), Kingston district, Jamaica, M. Grabham [BM; designation of Belkin, 1968b:38].

Uranotaenia socialis of Theobald (1905a:35; 1905b:36; 1907:557; 1910:502); Grabham (1905:402-404); Coquillett (1906b:26); Howard, Dyar and Knab (1917:905-908, in part); Johnson (1919:424); Dyar (1922a:98-99); Gowdey (1926:74); in part of Galindo, Blanton and Peyton (1954:164-168); in part of Stone, Knight and Starcke (1959:119); Porter (1967:40).

Uranotaenia sapphirina socialis of Dyar and Shannon (1924a:190).

Uranotaenia sapphirina of Dyar (1928:420-421, in part); Edwards (1932:99, in part); Matheson (1944:256-257, in part); Hill and Hill (1945a:3; 1948:40); Carpenter, Middlekauff and Chamberlain (1946:104-107, in part); Thompson (1947:79); Lane (1953:570-571, in part); Horsfall (1955:345-346, in part); Perez Viguera (1956:433-439, in part).

FEMALE (fig. 15). Wing about 2.0-2.5 mm. Head with only a few light brown short erect scales on occiput; vertex dark scaled except for azure blue scales in a large triangular anterior patch narrowly connected on each side to an elongate triangular lateral azure patch; frontal tuft not developed. Mesonotal integument uniformly brown; general vestiture of relatively short, narrow, curved dark bronzy scales; a narrow median longitudinal line of short, nearly circular deep azure scales from just behind anterior promontory to about middle of prescutellar space; a line of similar azure scales above paratergite from wing root cephalad to almost level of scutal angle. Median scutellar lobe with broad line of broad azure scales in the midline, surrounded on each side by narrow line of deep bronzy broad scales; lateral lobe with deep bronzy broad scales. Pleural integument brown and with large blackish blotch in upper *stp*; *apn* with large patch of deep azure broad scales; a broad line of similar scales in dark part of upper *stp*. Legs predominantly dark except for light bases and lower surfaces of mid and hindfemur and pure white apical dorsal spots on femora and tibiae, poorly developed on foreleg, moderately on midleg and strongly on hindleg. Wing dark scaled dorsally except for azure streaks on (1) posterior part of base of R to just beyond arculus and (2) on base of Cu extending from arculus to a little over 0.3 of distance to furcation of Cu; vein R_{2+3} about 3.3 of vein R_2 . Haltere stem light, knob dark scaled. Abdominal tergites apparently entirely dark scaled, without lateral apical light markings; sternites with pale tan scales.

MALE. Essentially similar to female in ornamentation except for a median apical triangular pale patch on tergite V. Sexual dimorphism marked; flagellar whorls very long and dense, flagellar segments 12 and 13 each about 3.0 as long as segment 11; anterior midclaw greatly enlarged, posterior not visible.

MALE GENITALIA (fig. 15). Ninth tergite long, deeply emarginate at base, unsclerotized distally. Basal tergal lobe of proctiger short, truncate, separated from its mate by a distance greater than its length. Sidepiece with 1 scale on one side. Clasper slender, without distinct lobe; 1 subapical spiniform and numerous short setae in distal half; spicules not developed. Aedeagus with smooth apex; subapical spine very prominent.

PUPA (fig. 15). Chaetotaxy as figured; integument and hairs usually lightly pigmented, most large branched hairs with branches of unequal length. Trumpet not distinctly flared apically; pinna small, truncate; meatus with long narrow slit; tracheoid extending to about 0.4; index about 8.0. Cephalothoracic hair 6-C much longer than 7-C; metanotal hair 11-C weak, usually 4-branched. Abdominal hair 9-VIII dorsal and distinctly removed mesad of caudolateral angle; 1-IX strongly developed, more than 0.5 of tergite length. Paddle uniformly lightly pigmented; inner part about 2.0 of outer; outer margin with closely set sharp strong denticles, inner with a few weaker widely spaced denticles; hair 1-P weak, usually double.

LARVA (fig. 19). Chaetotaxy as figured. Head capsule brown; antenna slightly darker; hairs 5,6-C blackish brown; 4-C usually triple (2-4); hair 7-C usually 5-branched (4-6). Prothoracic hair 3-P usually 9-branched (7-10), less than 0.4 of 1,2-P; hair 14-P at least 4-branched. Mesothoracic hair 6-M usually single. Abdominal hair 6-I,II triple, 6-III-VI usually about 10-branched (8-15); hair 1-III-VI usual-

ly at least 10-branched (10-14). Comb scales usually 7 or 8 (5-8), widely spaced, the middle ones enlarged. Siphon rather uniformly pigmented except for slightly lighter base ventrally; index slightly less than 5.0; pecten usually with fewer than 11 fully developed teeth, ending before hair 1-S; hair 1-S before the middle of ventral surface. Caudal margin of saddle with short sharp spicules of varied sizes; hair 1-X usually 8-10-branched; most proximal hairs of ventral brush (4-X) short, usually with 3 or 4 branches.

SYSTEMATICS. *Uranotaenia socialis* appears to be a distinct species in the *sapphirina* complex. The very scanty material of the typical Jamaican population is readily separated from *sapphirina* from the southern U.S.A. in all stages by the characters in the keys and additional features mentioned in the diagnosis. However, the genitalic difference in the basal tergal lobes of the proctiger may not hold as it is based on a single specimen of *socialis* and there is considerable variation in the lobes of *sapphirina*. The Jamaican population differs in detail from the "*socialis*" from Honduras and Panama described by Galindo, Blanton and Peyton (1954: 164-168) and from other populations we have examined from British Honduras and especially from Guyana. All of these populations are distinct from *sapphirina* in the characters pointed out by Galindo, Blanton and Peyton (loc. cit.). It is probable that a complex of species or subspecies is involved but this cannot be resolved without detailed study of large samples of all stages of the different populations. For the present we retain all the Neotropical populations under the name *socialis*.

BIONOMICS. Of 4 collections of immature stages of *socialis* obtained during our survey, 2 were at a margin of a swamp, 1 in a ditch and 1 at the edge of a stream. In all cases the water was permanent, clear and fresh. All the breeding sites were in full sunlight and contained algae. The associated species were *Anopheles* (*Nys.*) *albimanus*, *An.* (*An.*) *grabhamii* and *Culex* (*Mel.*) *atratus*. All the collections were obtained in the lowlands, below 22 m. Adults were caught in light traps but not on human or donkey bait.

DISTRIBUTION. *Uranotaenia socialis* is definitely known only from Jamaica but 1 or more similar forms are known from Central America, Panama, northern South America and the Guianas and are tentatively retained under *socialis*.

JAMAICA. *Kingston and St. Andrew:* Kingston, M. Grabham, 1 M, 1 F [USNM]. Rockport, Apr 1906, M. Grabham, 4 M, 7 F [USNM]. *St. Catherine:* Caymanas Bay (744). Naggo Head (23). Tamarind Farm (25). *St. Elizabeth:* Luana (358). *St. Thomas:* Grants Pen (77).

Material Examined: 46 specimens; 8 males, 11 females, 21 larvae, 6 pupae; 5 individual rearings (2 larval, 2 pupal, 1 incomplete).

7. *Uranotaenia cooki* Root

Figs. 17,20

1937. *Uranotaenia cooki* Root, 1937:98-100. TYPE: Lectotype genitalia, foreleg and part of another tarsus of a male all mounted on 1 slide, Port-au-Prince, Haiti, 11 Feb 1932, S.S. Cook [USNM, 50375; designation of Stone and Knight, 1957c:200].

Uranotaenia cooki of Pratt (1947:578-581); Lane (1953:581); Galindo, Blanton and Peyton (1954:114-117, in keys); Stone, Knight and Starcke (1959:112); Porter (1967:37).

FEMALE (fig. 17). Wing about 2.0 mm. Head with a few short dark erect scales on posterior part of vertex and occiput; vertex dark scaled except for a contin-

uous broad azure border to the eyes bent laterally across vertex to *apn*. Mesonotal integument blackish brown; general vestiture of relatively long, narrow, straight dark bronzy scales; a line of light azure scales above paratergite from wing root cephalad to scutal suture (from scutal angle). All scutellar lobes with broad flat dark bronzy scales. Pleural integument dark to blackish brown except for light membranes and somewhat lighter lower *stp*; a broad line of azure scales on *apn*, a line of similar scales on upper *stp* slightly broadened posteriorly. Legs predominantly dark scaled except for (1) lighter ventral surfaces on femora, (2) azure patches on base of all coxae, (3) small white knee spots on mid and hindlegs, and (4) a large dorsal apical white spot on hindtibia and a very small one on midtibia. Wing dark scaled dorsally except for azure streaks on (1) posterior part of base of R to just beyond arculus and (2) on base of Cu extending from arculus to a little over 0.4 of distance to furcation of Cu; vein R_{2+3} about 3.3 of vein R_2 . Haltere stem light, knob dark scaled. Abdominal tergites dark scaled except for conspicuous light azure apicolateral patches on III-VII, progressively smaller distally; sternites with dark tan scales.

MALE (fig. 17). Essentially similar to female in ornamentation except for smaller knee spots and absence of midfemoral apical light spot. Sexual dimorphism marked; flagellar whorls longer than in female but not very dense, flagellar segments 12 and 13 moderately elongate, each slightly less than 2.0 of segment 11; foretarsal segment 1 greatly shortened, a little less than 0.25 of segment 2, and twisted; anterior midclaw greatly enlarged, posterior not visible.

MALE GENITALIA (fig. 17). Ninth tergite relatively short, very shallowly emarginate at base. Basal tergal lobes of proctiger more or less triangular and widely separated. Clasper widened distally and with a prominent but inconspicuous wrinkled dorsomesal lobe near apical 0.25, bearing minute setae; ventral surface with minute setae in distal half; 1 subapical spiniform; spicules not developed. Aedeagus with smooth apex; apical spine very long and curved.

PUPA (fig. 17). Chaetotaxy as figured; integument moderately to strongly unevenly pigmented; hairs moderately pigmented, some of the larger hairs with branches of uneven lengths. Trumpet distinctly flared apically; pinna small, truncate; meat-us with a very narrow short slit; tracheoid extending to about 0.5; index about 12.0. Cephalothoracic hair 6-C only slightly longer than 7-C; metanotal hair 11-C weak, usually 4-branched. Abdominal hair 9-VIII at caudolateral angle of tergite; 1-IX apparently not developed at all. Paddle moderately to lightly pigmented; inner part only slightly wider than outer; outer margin with closely set sharp strong denticles, inner with a few scattered weak denticles; hair 1-P inconspicuous, single.

LARVA (fig. 20). Head capsule darker and more mottled than in *socialis* and hairs 5,6-C not quite as strongly thickened; 4-C usually triple (2,3); hair 7-C usually 5-branched (4-6). Prothoracic hair 3-P usually 6-branched, about 0.7 of 1,2-P; hair 14-P single. Mesothoracic hair 6-M apparently usually double. Abdominal hair 6-I,II usually double, 6-III-VI usually 5,6-branched; 1-III-VI usually about 5-branched. Comb scales usually about 12 (10-14), with long slender pointed shaft and expanded minutely fringed sides. Siphon with dark ring in about basal half; index about 4.5; pecten usually with about 18 teeth extending to hair 1-S at about middle of ventral surface. Caudal margin of saddle with rather long sharp spicules; hair 1-X usually 5,6-branched; most proximal hairs of ventral brush (4-X) short, usually single or double.

SYSTEMATICS. The Jamaican specimens described here are only provisionally assigned to *cooki* since no topotypic material of the immature stages of *cooki* is

available for comparison. However, it seems very likely that this assignment is correct and that the 2 populations are conspecific despite some discrepancies with the descriptions and figures of Root (1937) and Pratt (1946), particularly in the shape of the clasper of the male genitalia. The head capsule of Jamaican *cooki* tends to be mottled dark brown and not golden brown as described by Pratt (loc. cit.) for the Puerto Rican population.

BIONOMICS. The only 2 collections of the immature stages of this species in Jamaica were in a deeply shaded ditch in an area of scrub forest. The water was permanent, clear and fresh; there was abundant flotage and some vegetation. One male was collected in a light trap together with specimens of *socialis* and *lowii*.

DISTRIBUTION. *Uranotaenia cooki* has been reported only from Haiti, Puerto Rico, Virgin Islands (St. Croix) and now Jamaica; it undoubtedly occurs also in the Dominican Republic.

JAMAICA. *Kingston and St. Andrew:* Ferry (797,798). *St. Elizabeth:* Luana (358).

Material Examined: 13 specimens; 3 males, 1 female, 6 larvae, 3 pupae; 3 individual rearings (1larval, 2 pupal).

8. *Uranotaenia lowii* Theobald, 1901

Figs. 18,20

1901. *Uranotaenia lowii* Theobald, 1901b:339-340. TYPE: Lectotype female, Castries, St. Lucia, Feb, G.C. Low [BM; designation of Belkin, 1968b:37-38].
1906. *Uranotaenia continentalis* Dyar and Knab, 1906c:186,187. TYPE: Larva, Baton Rouge, Louisiana, U.S.A., 6-9 Sept and 23 Oct 1904, J.W. Dupree [LU; see Stone, Knight and Starcke, 1959:114]. Synonymy with *lowii* by Dyar (1922a:97).
- For other possible synonymy see Stone, Knight and Starcke (1959:114-115).

Uranotaenia lowii of Theobald (1905a:40); Grabham (1905:401-402); Coquillett (1906b:26); Howard, Dyar and Knab (1917:911-914, in part); Johnson (1919:424); Gowdey (1926:74); Dyar (1922a:97-98; 1928:425, in part); Matheson (1929:202; 1944:258, in part); Edwards (1932:99, in part); Carpenter, Middlekauff and Chamberlain (1946:101-104, in part); Hill and Hill (1945a:3; 1948:40); Pratt (1947:581-583); Thompson (1947:79); Lane (1953:568-570, in part); Galindo, Blanton and Peyton (1954:155-157, in part); Carpenter and LaCasse (1955:76-77); Horsfall (1955:344, in part); Perez Viguera (1956:440-442); Stone, Knight and Starcke (1959:114-115); Montchadsky and Garcia (1966:35); Porter (1967:37).

FEMALE (fig. 18). Wing about 2.0-2.3 mm. Head apparently without erect scales; vertex dark scaled except for azure scales in a small anterior triangular spot connected to an azure line laterally which widens in a line towards *apn*. Mesonotal integument light yellowish tan except for dark brown prescutellar area, paratergite and laterally above paratergite; general vestiture of relatively short, very narrow dark bronzy scales; a line of light azure scales above paratergite (in dark spot) extending from wing root anteriorly to about 0.75 of distance to scutal angle. All scutellar lobes with broad flat dark bronzy scales. Pleural integument very light yellowish tan except for dark brown *apn*, lower part of *ppn*, upper *stp* and sometimes middle *mep*; a broad line of azure scales on *apn*, a broad even line of similar scales through middle of dark upper *stp*. Legs predominantly dark scaled except for (1) lighter ventral surfaces of femora, (2) small azure patches on base of all coxae, (3) small white knee spots on all legs, (4) dorsal apical white spots on fore and hindtibiae and (5) white or whitish apex of hindtarsus from at least middle of

segment 3. Wing dark scaled dorsally except for light azure streaks on (1) posterior part of base of R to just beyond arculus and (2) base of Cu extending from arculus to a little less than 0.3 of distance to furcation of Cu; vein R_{2+3} about 3.3 of vein R_2 . Haltere stem light, knob dark scaled. Abdominal tergites dark scaled except for apicolateral patches of pale azure scales on segments II,III,V,VI, that of III distinctly larger; sternites pale scaled.

MALE. Essentially similar to female in ornamentation. Sexual dimorphism very slight; flagellar whorls only slightly longer and denser than in female; flagellar segment 12 subequal to 11, segment 13 about 1.5 of 11; anterior midclaw enlarged, posterior short and slender.

MALE GENITALIA (fig. 18). Ninth tergite long, deeply emarginate at base. Basal tergal lobes of proctiger small, narrowed distally and relatively widely separated. Sidepiece without scales. Clasper broad from base; distal part with about 15 or more heavy broad acute spiniforms in about 4 curved rows on dorsal and dorso-mesal surface; body of clasper with numerous conspicuous spicules. Aedeagus very broad, with smooth apex, without apical spine.

PUPA (fig. 18). Chaetotaxy as figured; integument uniformly moderately pigmented; hairs moderately pigmented, some of the larger hairs with branches of uneven lengths. Trumpet slightly flared apically; pinna long, strongly oblique; meatus without open slit; tracheoid extending to about 0.6 or slightly beyond; index about 6.5 or less. Cephalothoracic hair 6-C much longer than 7-C, sometimes double; metanotal hair 11-C weak, usually single. Abdominal hair 9-VIII on dorsal surface near caudolateral angle of tergite; 1-IX developed but weak, less than 0.5 of tergite length. Paddle elongate, moderately pigmented; inner part about 2.0 of outer in width; outer margin with closely set sharp denticles, stronger distally; inner margin with larger but weaker denticles, some smaller denticles in a second irregular row; hair 1-P single.

LARVA (fig. 20). Head capsule uniformly dark brown except for light ocular areas; hair 4-C usually triple; 7-C usually 4,5-branched. Prothoracic hair 3-P usually 5,6-branched, about 0.7 of 1,2-P; hair 14-P single. Mesothoracic hair 6-M usually double. Abdominal hair 6-I,II usually double, 6-III-VI usually 6-10-branched; 1-III-VI usually about 8-branched. Comb scales usually about 7 (6-8), subequal in length, fringed in basal 0.6. Siphon usually darkened dorsally in basal half; index about 4.5; pecten usually with 12-16 fully developed teeth, not extending beyond hair 1-S; hair 1-S somewhat variable in position, usually before middle of ventral surface. Caudal margin of saddle with sharp spicules of varied size; hair 1-X usually 5,4-branched; most proximal hair of ventral brush (4-X) short, usually single or double.

SYSTEMATICS. The Jamaican population undoubtedly belongs to the *lowii* complex but it shows a number of departures from the typical population from St. Lucia, especially in a considerably longer azure streak on vein Cu which is less than 0.23 of the vein in the latter population. The Cayman population differs from the Jamaican in having the hindtarsal light scaling beginning beyond the basal half of segment 3; in many Jamaican specimens the light scaling starts in the basal 0.25 or less (particularly in the males) and is dingy white instead of pure white. In neither population is there any indication of pale tarsal markings on the fore and midtarsi mentioned for the Panama population by Galindo, Blanton and Peyton (1954:155). There is considerable variation in both populations in the femoral and tibial light markings. The taxonomic status of the various reported populations of *lowii* cannot be determined without a careful comparative study of all the stages

of individually reared specimens. Pending such a revision we are retaining the Jamaican population in *lowii*, but suspect that it is a distinct species.

BIONOMICS. The immature stages of *lowii* were collected only twice during our survey, in a ditch and a ground pool, where the water was of a temporary nature, clear, fresh and with some vegetation. Both sites were in partial shade. Hill and Hill (1948:40) record larvae from grassy stock ponds and ground pools. Adults have been collected only in light traps. All the records of the species to date are from lowlands.

DISTRIBUTION. *Uranotaenia lowii* has the widest reported distribution of any species of *Uranotaenia* in the New World, extending from the southern U.S.A. to Argentina. However it is very probable that a species complex is actually involved.

JAMAICA. *Clarendon*: Yorks Pen (604). *Kingston and St. Andrew*: Kingston, shallow pools, M. Grabham, 3 M, 4 F; 13 Sept 1905, J.M. Aldrich Collection, 2 M, 2 F [USNM]. *St. Catherine*: Central Village (759,761). *St. Elizabeth*: Luana (358).

Material Examined: 101 specimens; 18 males, 19 females, 38 larvae, 26 pupae; 19 individual rearings (8 larval, 9 pupal, 2 incomplete).

TRIBE CULICINI

In the West Indies the tribe Culicini is most easily recognized in the larval stage, by the following combination of features: comb scales present; normal siphon with at least 3 pairs of hairs and a pecten of at least a few teeth; ventral brush with several pairs of hairs. The adults can usually be recognized by the following combination of features: mesonotum with scales all narrow and without conspicuous pattern of ornamentation; pleuron without postspiracular bristles; wing without conspicuous speckling; and abdomen truncate apically in the females. The pupae have the tracheoid developed and a normal pinna on the trumpet, and cephalothoracic hair 8-C removed caudad from the level of the trumpet.

Of the 3 New World genera, 2 are represented in Jamaica: *Deinocerites* by 1 indigenous species and *Culex* by 15 indigenous species and the introduced *quinquefasciatus*. The third genus of the tribe, the recently described monotypic *Galindomyia* Stone & Barretto, 1969, is known only from Colombia. The marked dominance in the number of species of the tribe in the New World tropics as a whole is not evident in Jamaica or elsewhere in the West Indies.

GENUS DEINOCERITES

This endemic New World genus is strikingly differentiated in all stages from the related genus *Culex* as indicated in the description of *cancer*. In the adults, the antenna is longer than the proboscis and the first flagellar segment is remarkably elongated in most species. The male genitalia are unique in the development of the so-called dorsal paramere (see description of *cancer*). The pupae have many apparently primitive features in the abdominal chaetotaxy but are most readily separated from *Culex* by the great development of paddle hair 1-P which is at least two-thirds as long as the paddle. In the larva, the shape of the head capsule (broadest near the antenna), the presence of a "hairy" lobe at the base of the mandible, and features of the siphon (3 pairs of siphonal hairs characteristic in development and position; and the bifid or trifid pecten teeth) will immediately separate *Deinocerites* from *Culex* and all other genera of the subfamily.

We are providing keys to separate the closely related *magnus* (Theobald, 1901), the only other species of the genus known from the West Indies, with a distribution starting at Mona Island (east of Hispaniola) and extending through Puerto Rico, the Virgin Islands and all the Lesser Antilles to Trinidad, the Guianas and apparently the state of Maranhao in Brazil.

Members of this genus are all apparently normally confined to the holes of land-crabs for breeding and resting sites. Some species may be involved as vectors of arboviruses as suggested by the isolation of St. Louis encephalitis virus from *D. pseudus* Dyar & Knab, 1909 in Panama (Grayson, Srihongse and Galindo, 1967).

KEYS TO SPECIES

ADULTS

1. *Female*: specialized setae of cercus arising side by side on apex. *Male*: only larger claw of foreleg with large subbasal tooth **9. cancer**
Female: specialized setae of cercus not arising side by side, 1 apical, the other subapical. *Male*: both claws of foreleg with subbasal tooth (see genus) *magnus*

MALE GENITALIA

1. Dorsal paramere with slender apical spine, ventral teeth numerous, slender and arising from distinct lobe; ninth tergite lobe extending beyond subapical lobe of sidepiece **9. cancer**
Dorsal paramere with short broad apical process, ventral teeth few in number, short, heavy and arising in single row along truncate border; ninth tergite lobe not reaching subapical lobe of sidepiece (see genus). *magnus*

PUPAE

1. Cephalothoracic hair 7-C usually double; abdominal hair 3-II usually single **9. cancer**
Cephalothoracic hair 7-C with 3 to 5 branches; abdominal hair 3-II double or triple (see genus) *magnus*

LARVAE

1. Ventral brush of anal segment usually with 6 pairs of hairs; hair 2-C usually shorter than 1-C; hair 8-P usually single **9. cancer**
Ventral brush of anal segment usually with 7 pairs of hairs; hair 2-C usually longer than 1-C; hair 8-P usually double (see genus). *magnus*

9. *Deinocerites cancer* Theobald

Figs. 21,22

1901. *Deinocerites cancer* Theobald, 1901b:215-217. TYPE: Lectotype female, Spanish Town

Road, Kingston, Jamaica, 8 Feb 1900, M. Grabham [BM; designation of Belkin and Hogue, 1959:432].

Deinocerites cancer of Johnson (1919:422); Dyar (1922a:8); Gowdey (1926:73); King, Bradley and McNeel (1944:61); Hill and Hill (1945a:2; 1948:51-52); Thompson (1947:78); Belkin and Hogue (1959:432-434); Montchadsky and Garcia (1966:47); Porter (1967:39).

Deinocerites cancer in part of Theobald (1903a:276-281; 1905a:35-36; 1905b:37); Coquillett (1906b:26); Howard, Dyar and Knab (1915:201-205); Dyar (1928:262-263); Edwards (1932:222); Matheson (1944:250-251); Carpenter, Middlekauff and Chamberlain (1946:275-277); Lane (1953:554-556); Carpenter and LaCasse (1955:325-327); Horsfall (1955:599-600); Perez Viguera (1956:476-483); Stone, Knight and Starcke (1959:284).

FEMALE. Wing about 3.0-3.4 mm. Medium-sized brown species with antenna longer than proboscis and greatly elongate flagellar segment 1. *Head:* Decumbent scales tan, all narrow except for small patch of broad, paler ones laterally. Erect scales all tan, very numerous and extending to near orbital bristles. Labium dark scaled. Palpus 3-segmented, dark scaled, about 0.2 of proboscis. Antenna exceeding proboscis from about middle of flagellar segment 7; flagellar segment 1 a little longer than combined length of segments 2 through 4. *Thorax:* Mesonotal integument brown, paler on scutal angle; scales brown, predominantly narrow but somewhat broadened in supraalar area; bristles all present and strongly developed except acrostichals which are absent on disc; paratergite broad, bare. Scutellar lobes with narrow brown scales, more numerous and narrower on midlobe. Pleural integument generally light, with darkened areas especially on *ppn* and *stp*; scales restricted to upper part of *ppn* where they are narrower in front and somewhat broadened posteriorly, a few sometimes on *ppl*, and a patch of broad bronzy somewhat translucent scales covering almost all of *stp*; all normal pleural bristles present except *sp* and *psp*; *ppn* with several short bristles in lower part; 1 or 2 short hairs below base of haltere; *pra* and upper *mep* bristles short; 1 lower *mep* bristle. *Legs:* Forecoxa with large patch of dark scales, midcoxa and hindcoxa with pale scales. Remainder of legs dark scaled except for usual pale surfaces of femora. Claws all simple; pulvilli very small and with setiform spicules. *Wing:* Vein scales all dark; plume scales of veins R_2 and R_3 rather broad, especially distad. *Haltere:* Stem pale; knob dark scaled. *Abdomen:* Tergites entirely dark scaled; tergite I very extensively scaled, some scales extending on to laterotergite. Sternites with paler scales, especially on proximal segments. Sternite VIII with specialized setae along margin of deep median apical emargination; cercus conical, usually at least partially visible, its apex with 1 pair of long flattened specialized setae arising side by side.

MALE. Essentially as in the female including palpus and antenna but latter distinctly longer, exceeding proboscis from about middle of flagellar segment 4. Labium with distinct false joint at about 0.6 from base, beyond joint labium is more or less flattened dorsoventrally. Claws of foreleg and midleg somewhat enlarged, unequal; both larger claws with conspicuous subbasal tooth, smaller claws simple; hindclaws as in the female.

MALE GENITALIA (fig. 21). *Segment IX:* Very strongly developed. Tergite represented primarily by extremely large lobe articulated with and movable on lateral dorsal process of sternite, with numerous setae at base mesally and with distal flattened part extending beyond subapical lobe of sidepiece. Sternite long and broad, widely separating sidepieces, with small median longitudinal apodeme, with narrow lateral process directed dorsad to articulate with tergite. *Sidepiece:* Conical; mesal membrane not developed distad of subapical lobe; tergal surface with num-

erous bristles of varied size; scales absent. Subapical lobe (median mesal lobe of Belkin and Hogue, 1959) submedian in position, projecting dorsad; with 3 specialized setae, 2 of which are flattened spiniforms, and 3 short slender specialized setae on sternal (inner) surface. A conspicuous apicosternal bristly lobe extending beyond base of clasper. *Clasper*: Short, irregular in shape; with a dorsal inner postmedian angular shelflike process, a ventral inner apical tooth and a dorsal outer apical rounded process; inserted between the 2 processes is a heavy bifid spiniform; dorsal surface with very dense vestiture of very long hairlike spicules. *Phallosome*: Complex, composed of a ventral aedeagus and 1 pair each of ventral and dorsal parameres (of Belkin and Hogue, 1959). Aedeagus more or less cylindrical in dorsal aspect, apparently homologous to tergally broadly connected simple lateral plates of some subgenera of *Culex* such as *Melanoconion*. Dorsal paramere apparently homologous to the opisthophallus of some Dixinae (Belkin, 1968a:9); the 2 dorsal parameres closely approximated tergally and with broad incomplete sclerotized dorsal bridge; apical spine slender, moderately curved; ventral teeth slender, long and arising usually from a distinct process from the convex caudolateral border, 2 or more teeth often with common base, several additional smaller denticles removed from border. *Proctiger*: Broad; basolateral sclerotization small, broadly connected to paraproct sclerotization and with only a slight dorsolateral process; paraproct sclerotization moderate, without basal sternal process. Crown of paraproct broad, with a single row of blunt teeth arising from expanded apical part of the paraproct sclerotization. Cercal setae numerous and long, primarily subapical but 2 or more detached from group proximad.

PUPA (fig. 21). Chaetotaxy as figured, not studied in detail. In general similar to *Culex* but with following apparently diagnostic features for the genus and species. *Cephalothorax*: Uniformly lightly pigmented. Hair 5-C double, very strongly developed, largest hair on cephalothorax. *Trumpet*: Relatively short and with small pinna; inner wall well separated from outer throughout; tracheoid in basal 0.35 or more; meatus without slit. *Metanotum and Abdomen*: Rather uniformly moderately pigmented, anterior segments lighter. Abdominal hair 1-II similar in appearance to float hair (1-I) but closer to its mate; 1-III-VI relatively poorly developed; 2-III-VII mesad of hair 1; hair 5 similarly developed on segments II-VI (very unusual and probably primitive condition), long and single, mesad of hair 4 on segment II; hair 6 similarly developed on I-VI (very unusual and probably primitive condition), very long and single; 7-II ventral in position; 9-VII short, branched and caudad of hair 6; hair 9-VIII very long and single, arising ventrally at caudolateral angle; 1-IX not developed. *Paddle*: Midrib very strongly developed to near apex; external buttress slightly developed near base; margins without distinct spicules; only hair 1-P developed, single, subequal in length to paddle.

LARVA (fig. 22). Chaetotaxy as figured, not studied in detail. In general similar to *Culex* but with the following apparently diagnostic features for the genus and species. *Head*: Head capsule about as wide as long, widest at level of base of antenna because of projecting subantennal lobe and the absence of a distinct ocular bulge. Labrum poorly differentiated dorsally, rounded on anterior margin; labial plate very long and narrow; maxillary suture complete and extended dorsolaterally caudad of posterior tentorial pit; collar not developed; subantennal lobe very prominent containing a deep pouch with eversible inner wall into which projects a conspicuous fingerlike lobe of mandible with long hairlike spicules; mental plate rudimentary, poorly sclerotized and with sharp widely spaced marginal spicules. Hair 0-C setiform; 1-C short, widely spaced; 2-C developed; 3-C represented by a spicule

or sometimes a distinct hair; 4-6-C in anterior part of head capsule; 4-C short and branched; 5-C moderate, with 4 or 3 branches; 6-C long, single and conspicuously pectinately barbed in basal part; 7-C multiple, shorter than 5-C; hairs 8-10-C short and branched; 11-C short, branched, on dorsal surface of subantennal lobe far removed from 12,13-C which are ventral, small, branched and at about same level. Neck with a small sclerotized plate on each side on ventral surface (possibly rudiment of collar). *Antenna*: Slender, about 0.5 of head capsule length, gradually slightly tapered; shaft with a few minute spicules in basal half; shaft hair (1-A) submedian, with a few branches, barely reaching apex of shaft; apical hairs (2-6-A) moderately developed. *Thorax*: Hairs 1-3-P on poorly sclerotized connected basal tubercles, all single, 3-P about 0.7 of hair 1; tubercles of 6,7-M not connected. *Abdomen*: Chaetotaxy essentially as in *Culex*; hairs 6-I-V all double, 6-VI single, 6-I,II shorter than others. *Segment VIII*: Essentially as in *Culex*. Comb scales in about 8 rows; small, elongate and with expanded fringed apex. Tubercle developed only at base of hair 3-VIII. *Siphon*: Elongate and without marked distal tapering; index usually about 4.5-4.7; acus attached, with ventral process. Pecten of about 5-7 widely spaced teeth of unusual form, bifid or rarely trifid to base. Siphonal hairs (1,1a-S) always 3 pairs; proximal large and conspicuous, usually double and submedian in position; distal 2 short and inconspicuous, one subventral, other subdorsal, both usually double; 2-S short, nearly apical; median caudal filament of spiracular apparatus apparently not developed. *Anal Segment*: Saddle represented by poorly defined separate small dorsal and ventral sclerotizations; a small patch of spicules caudoventrad of dorsal saddle. Hair 1-X near middle of segment laterally, usually single; 2-X multiple, with subequal branches. Ventral brush with 6 pairs of hairs, all on grid without distinct lateral bar. Gills represented by short protuberance indented in middle.

SYSTEMATICS. The type locality of *cancer*, the type species of the genus *Deinocerites*, was restricted to Jamaica by the designation of the lectotype (Belkin and Hogue, 1959:432). There is therefore no doubt about the identity of the Jamaican population and our descriptions have been made from the exact type locality on Spanish Town Road west of Kingston.

Deinocerites cancer in the sense of Belkin and Hogue (1959:432-434) appears to be a single species although there is some variation in all stages in different populations which are now known from Florida, the Bahamas, Hispaniola, Cuba, Cayman Islands, British Honduras and the Atlantic coast of Guatemala, Honduras, Nicaragua and northern Panama (Almirante).

BIONOMICS. The immature stages of *cancer*, as well as all other species of *Deinocerites*, are normally found only in the burrows of land crabs. In Jamaica *cancer* has been collected solely in crabholes of medium to large size, never in smaller holes such as those made by fiddler crabs. Besides breeding in mangrove swamps and salt marshes, *cancer* has been found utilizing crabholes along river banks a considerable distance from the sea. In the former cases the salinity of the water in the breeding sites may reach 56 parts per 1000 NaCl; in the latter it is quite fresh. On 2 occasions a few larvae of *cancer* were taken in rockholes at the seashore. The only normal associate of *cancer* is *Culex (C.) janitor* but this association is confined to crabholes with fresh water. In brackish crabholes, *Aedes (O.) taeniorhynchus* is sometimes found with *cancer* and occasionally one finds *Culex (C.) nigripalpus*, *Psorophora (G.) jamaicensis* and even *Anopheles (Nys.) albimanus* and *Anopheles (A.) grabhamii* together with *cancer* in very large shallow holes in drying swamps.

In Jamaica, *cancer* feeds on donkeys and other domestic animals and will also bite man. Adult populations show marked fluctuation during the year and may reach very high levels at times in areas with extensive mangrove swamps where *cancer* can be the most common mosquito in donkey-baited traps and light traps. Records over a 3-year period at Holland Bay (St. Thomas) indicate peak catches in April, May and June.

DISTRIBUTION. *Deinocerites cancer* is now known from Florida and the Bahamas, Hispaniola (Haiti, Dominican Republic), Jamaica, Cuba, Cayman Islands and the Atlantic coast of Central America from British Honduras to northern Panama.

JAMAICA. *Deinocerites cancer* is a common species near the coast all around the island. We are listing here only the records of our survey. *Clarendon*: Milk River Bath (865-867). *Hanover*: Bulls Bay (89). *Kingston and St. Andrew*: Duhaney Park, Spanish Town Rd (610,705). Ferry (215, 217-221,347-350,366-371,385,386,398,701,736,770,857-861,883-886,903). Port Royal (269-271, 274-279,314-317,880-882). Riverton City (344-346,839). Rockfort (948-950,953,961). *Portland*: Port Antonio (812). *St. Catherine*: Fort Augusta (264). Port Henderson (260-263,313,878,879). *St. Elizabeth*: Black River, 2 mi E (794). *St. Mary*: Annotto Bay (254,255). *St. Thomas*: Chiswick (92). Duckenfield Hall (90,205A). Folly Bay (103). Golden Grove (140). Grants Pen (871). Holland Bay (112). New Pera (180). White Bay (78,79,127,170,175,178). *Westmoreland*: Broughton Wharf (88). Cave (615,616). Crab Pond Bay (783).

Material Examined: 4069 specimens; 446 males, 896 females, 1994 larvae, 733 pupae; 480 individual rearings (177 larval, 268 pupal, 35 incomplete).

GENUS CULEX

Culex is the dominant genus of the tribe Culicini and is characterized in the adults by a normal antenna, subequal to or shorter than the proboscis in both sexes, and with a strongly plumose flagellum in the males. In the male genitalia there is no separate "dorsal paramere" as in the genus *Deinocerites*. The larvae are distinguished from the latter by lacking a long spiculate lobe at the base of the mandible and the pupae by the short paddle hair and abdominal hair 6-VII caudad or at level of hair 9 and different in appearance from 6-VI.

The genus is much more poorly represented in Jamaica and the Greater Antilles in general than elsewhere in the New World tropics where it is the dominant genus of the subfamily Culicinae. Only 3 subgenera are currently known from Jamaica: (1) *Culex*, represented by 7 species, including the introduced *quinquefasciatus*, (2) *Melanoconion*, represented by 8 species, one of which is not named, and (3) *Micraedes* by 1 species. The only species definitely endemic to the island is *arawak* of the subgenus *Micraedes* and it is also the only species of the genus known from bromeliads. It is surprising that there is no representative of the subgenus *Microculex* which is the dominant breeder of the genus in bromeliads elsewhere in the New World tropics.

It is very probable that more species of *Culex* will eventually be found in Jamaica including some of the species known from elsewhere in the Greater Antilles. None of the latter species has been included in the keys but all are listed under the subgenera *Culex* and *Melanoconion* with reference to recent reviews.

The key to the adults is applicable primarily to females and may not be entirely reliable, particularly in the subgenus *Melanoconion*. The males are generally similar to the females in ornamentation but can be identified with certainty only on the basis of the genitalia.

KEYS TO SUBGENERA AND SPECIES

ADULTS

(22. Jamaican form unknown)

Micraedes

1. Palpus about 0.35 of proboscis in both sexes, very slender (*Micraedes*) 25. **arawak**

 Palpus less than 0.25 of proboscis in females, subequal to or longer than
 proboscis in males 2
- 2(1). Medium-sized species; veins R₂ and R₃ with linear plume scales; acrosti-
 chal bristles present on disc of mesonotum (*Culex*) 3
 Small species; veins R₂ and R₃ with broad plume scales at least distally;
 acrostichal bristles absent on disc of mesonotum (*Melanoconion*) 14

Culex

- 3(2). Tarsi without indication of pale or whitish scales forming rings over the
 joints, even on hindleg 4
 Tarsi with more or less distinct pale or whitish scales forming rings over
 joints, especially on hindleg 5
- 4(3). Mesepimeron with large patch of scales in the middle and with numerous
 scales at base of upper *mep* bristles; abdominal tergites of female with
 distinct widened transverse basal pale bands 16. **quinquefasciatus**
 Mesepimeron without scales in the middle and with only a few narrow
 scales among upper *mep* bristles; abdominal tergites of female usually
 without transverse basal pale bands, rarely with very narrow bands
 15. **nigripalpus**
- 5(3). Males; palpus longer than proboscis 6
 Females; palpus less than 0.25 of proboscis 10
- 6(5). Palpus with only a few short bristles from apex of segment 3 distad
 13. **janitor**
 Palpus with numerous long bristles from middle of segment 3 distad 7
- 7(6). Palpus exceeding proboscis from at least 0.5 of segment 4 8
 Palpus exceeding proboscis by about length of segment 5 or less 9
- 8(7). Line of whitish scales on lower surface of palpal segment 4 interrupted
 in the middle and on apex 11. **corniger**
 Line of whitish scales on lower surface of palpal segment 4 interrupted
 in middle only 12. **chidesteri**
- 9(7). Lower surface of palpal segment 4 without line of whitish scales
 10. **bahamensis**
 Lower surface of palpal segment 4 with conspicuous line of whitish scales .
 14. **secutor**

- 10(5). Labium uniformly dark, without even an indication of pale scaling ventrally 11
 Labium distinctly pale scaled ventrally or with more or less distinct pale ring extended dorsad 12
- 11(10). Mesepimeron with only a few pale scales in middle and a few elongate pale scales in upper *mep* bristles **13. janitor**
 Mesepimeron with conspicuous patches of whitish scales in middle and at base of upper *mep* bristles **14. secutor**
- 12(10). Ventral surface of labium with long pale area not sharply marked **12. chidesteri**

 Ventral surface with discrete postmedian whitish band, sometimes extended dorsad to form a more or less distinct ring 13
- 13(12). Abdominal tergites with conspicuous complete transverse basal whitish bands **10. bahamensis**
 Abdominal tergites with indistinct tan patches in middle not forming complete transverse bands **11. corniger**

Melanoconion

- 14(2). Hindtarsal segment 5 white to gray, other hindtarsal segments with at least indication of pale to white rings over the joints, sometimes with conspicuous white rings **18. opisthopus**
 All tarsi without any indication of white rings 15
- 15(14). Decumbent scales of vertex of head all linear, broad scales restricted to sides and at most extending a short distance dorsad along orbital line 16

 Narrow decumbent scales restricted to central part of vertex and occiput, broad scales forming a nearly complete orbital line 17
- 16(15). Pleural integument blackish brown, *mep* with upper and lower blackish spots **17. atratus**
 Pleural integument light; *mep* uniformly light **24. panocossa**
- 17(15). Mesepimeron with large median patch of scales **19. erraticus**
 Mesepimeron without scales in middle (separation of species in this group tenuous and not reliable) 18
- 18(17). Mesonotal integument with strong violet red iridescence **23. pilosus**
 Mesonotal integument without strong metallic iridescence 19
- 19(18). Thoracic integument blackish brown; broad scales of orbital line dark **20. iolambdis**

 Thoracic integument brown; broad scales of orbital line light, grayish to white **21. inhibitor**

MALE GENITALIA

(22. Jamaican form unknown)

- 1. Paraproct with a dense clump of sharp spicules in addition to blunt teeth (*Culex*). 2
- Paraproct with only a single row of blunt teeth 8

Culex

- 2(1). Basal sternal process of proctiger weak and short, not curved sternad distally; inner division of lateral plate strongly developed, in form of very large broad outwardly directed sharp sternal spine 16. **quinquefasciatus**
- Basal sternal process of proctiger strong and long, its distal part bent sternad; inner division of lateral plate not developed 3

- 3(2). Sidepiece with conspicuous dense clumps of moderately long setae on tergal surface near base of subapical lobe and distad; subapical lobe without leaf 10. **bahamensis**
- Tergal surface of sidepiece with only scattered short setae; subapical lobe with leaf developed 4

- 4(3). Ninth tergite deeply emarginate on distal margin, with prominent lobes; tergal lobe of basolateral sclerotization of proctiger broad and with conspicuous spicules 15. **nigripalpus**
- Ninth tergite shallowly if at all emarginate, lobes poorly differentiated; tergal lobe of basolateral sclerotization of proctiger narrow and without spicules visible at 100X 5

- 5(4). Mesal spine of lateral plate inconspicuous, much shorter than median process 11. **corniger**
- Mesal spine of lateral plate conspicuous, subequal in length to median process 6

- 6(5). Mesal spine of lateral plate conspicuously bent outward distally; median process with very small teeth 12. **chidesteri**
- Mesal spine of lateral plate straight; median process with moderately large teeth 7

- 7(6). Ventral cornu of lateral plate very conspicuous, more than twice as long as teeth of median process; mesal spine tapered from base in mesal aspect 13. **janitor**
- Ventral cornu of lateral plate inconspicuous, subequal in length to teeth of median process; mesal spine broadened beyond base and then sharply narrowed 14. **secutor**

Micraedes

- 8(1). Distal division of subapical lobe not distinctly separated from proximal, appearing as sternal appendage of proximal division (*Micraedes*) 25. **arawak**

Subapical lobe clearly separated into proximal and distal divisions (*Melanoconion*) 9

Melanoconion

- 9(8). Distal division of subapical lobe with 1 long hooked seta and a long-petiolate leaf; a very narrow nonstriated foliform on sidepiece near base of clasper **24. panocossa**
 Distal division of subapical lobe with more numerous specialized setae; sidepiece without such a foliform near base of clasper 10
- 10(9). Distal half of clasper uniformly tapered and simple, its outer margin smoothly curved and without apical "snout"; 4-6 broad flattened apically curved setae on sidepiece between the divisions of the subapical lobe **17. atratus**
 Distal part of clasper not uniform, with head, outer crest and/or apical "snout"; specialized setae not developed between divisions of subapical lobe 11
- 11(10). Clasper with strong outer subapical rounded head following a narrow stem **23. pilosus**
 Clasper without such rounded head and narrow basal stem 12
- 12(11). Proximal division of subapical lobe not divided *and* with the 2 setae arising at about same level; lobe of ninth tergite fingerlike
 **18. opisthopus**
 Proximal division of subapical lobe subdivided *or* with setae arising far apart; lobe of ninth tergite round to oval 13
- 13(12). Proximal division of subapical lobe undivided, the 2 setae inserted far apart on common stem; distal division without broad leaf
 **20. iolambdis**
 Proximal division of subapical lobe distinctly divided into 2 arms, each bearing 1 apical seta; distal division with broad leaf 14
- 14(13). Distal division of subapical lobe with long slender stem; distal part of lateral plate with apical and subapical tooth **19. erraticus**
 Distal division of subapical lobe with short broad stem; distal part of lateral plate with subapical lateral tergal process and more or less strongly developed denticles along rounded sternal lobe **21. inhibitor**

PUPAE

(22. Jamaican form unknown)

Micraedes

1. Abdominal tergite VIII with caudal lobe overlying lateral part of tergite IX; hair 1-IX absent (*Micraedes*, group characters, pupa unknown for species). **25. arawak**
 Abdominal tergite VIII with caudal lobe not overlying lateral part of tergite IX; hair 1-IX present 2

- 2(1). Meatus of trumpet with narrow slit from proximal part of pinna; hair 2-VI usually laterad of hair 1 (*Melanoconion*) 3
 Meatus of trumpet without slit from proximal part of pinna; hair 2-VI usually mesad of hair 1 (*Culex*) 9
- Melanoconion*
- 3(2). Hair 9-VIII at or very near caudolateral angle 4
 Hair 9-VIII distinctly removed cephalad of caudolateral angle on ventral surface 5
- 4(3). Paddle uniformly pigmented; caudolateral angle of abdominal segment VIII rounded **18. opisthopus**
 Paddle conspicuously infuscated on apex of external surface and nearly all of internal; caudolateral angle of abdominal segment VIII strongly produced **24. panocossa**
- 5(3). Hair 5-V double or triple *and* at least nearly as long as tergite following . 6
 Hair 5-V usually with at least 4 branches; if double or triple, then distinctly shorter than tergite following 7
- 6(5). Pinna of trumpet short, including slit less than 0.3 of total length **23. pilosus**
 Pinna of trumpet long, including slit about 0.4-0.5 of total length **19. erraticus**
- 7(5). Hair 6-IV,V at least 4-branched; 5-V usually at least 5-branched; trumpet index usually more than 8.5. **17. atratus**
 Hair 6-IV,V usually triple; 5-V usually 4-branched; trumpet index usually 8.0 or less 8
- 8(7). Trumpet uniformly darkly pigmented, only slightly flared **21. inhibitor**
 Trumpet lighter in color between apex of tracheoid and base of pinna, more strongly flared. **20. iolambdis**
- Culex*
- 9(2). Median plate of abdominal tergite I with distinct short spicules, particularly caudally **10. bahamensis**
 Median plate of abdominal tergite I without distinct spicules 10
- 10(9). Hairs 5-IV-VI all single and distinctly longer than tergite following; 8-C single **11. corniger**
 Hairs 5-IV-VI usually at least double; 8-C branched 11
- 11(10). Median caudal part of sternite II with distinct discrete short sharp spicules 12
 Median caudal part of sternite II without distinct spicules or with minute spicules in imbricate lines 13
- 12(11). Trumpet very long, index usually more than 9.0 **12. chidesteri**
 Trumpet moderate, index usually about 5.0 **15. nigripalpus**

- 13(11). Hair 5-IV extending at least to middle of tergite VI; trumpet darkened on apex, slender, not flared, pinna short 14. **secutor**
 Hair 5-IV usually barely reaching apex of tergite V; trumpet not darkened on apex, more or less distinctly flared, pinna usually long 14
- 14(13). Hair 6-III-V usually single; 1-VI,VII weak, usually double . . . 13. **janitor**
 Hair 6-III-V usually at least double; 1-VI,VII moderate, usually 4-branched. 16. **quinquefasciatus**

LARVAE

Micraedes

1. Caudolateral border of anal saddle with very long spinelike marginal spicules, some with lateral fringes or branches; thorax and abdomen with stellate hairs (*Micraedes*) 25. **arawak**
 Caudolateral border of anal saddle at most with simple sharp spicules; thorax and abdomen without stellate hairs 2
- 2(1). Prothoracic hair 3-P at least 0.67 of 1-P; labrum short dorsally, without projecting lobe at base of 1-C (*Culex*) 3
 Prothoracic hair 3-P less than 0.5 of 1-P; labrum long dorsally, usually with projecting lobe at base of 1-C (*Melanoconion*) 9

Culex

- 3(2). Anal saddle restricted to small sclerotized dorsal plaque; gills 1 pair only, more or less globular 10. **bahamensis**
 Anal saddle complete; 2 pairs of gills, at least dorsal elongate 4
- 4(3). Antennal shaft hair (1-A) small, simple, with less than 10 branches, not reaching apex of shaft; prothoracic hair 3-P branched 5
 Antennal shaft hair (1-A) large, with more than 20 barbed branches, extending well beyond apex of shaft; prothoracic hair 3-P single. 6
- 5(4). Siphonal hairs with spikelike branches; siphon very short, index about 2.5; prothoracic hairs 1,2-P single 11. **corniger**
 Siphonal hairs with normal branches; siphon moderate, index about 4.0; prothoracic hairs 1-3-P usually all double. 13. **janitor**
- 6(4). Siphon index usually less than 5.0; head hair 6-C usually with at least 5 branches 16. **quinquefasciatus**
 Siphon index usually at least 6.0; head hair 6-C usually with 2 to 4 branches 7
- 7(6). Siphonal hairs usually 4 pairs, 2 middle ones displaced dorsad
 15. **nigripalpus**
 Siphonal hairs usually at least 6 pairs, all more or less in line or ventrad of pecten 8
- 8(7). Siphon index usually more than 16.0; siphonal hairs usually 8 pairs, all dorsad of pecten and all short 12. **chidesteri**

Siphon index usually not more than 10.0; siphonal hairs usually 6 pairs, all ventrad and distad of pecten, long except apical pair . . . **14. secutor**

Melanoconion

- 9(2). All or some of the comb scales long and more or less spinelike 10
All comb scales small and with evenly fringed apex 12
- 10(9). Comb scales of 2 types, some short and apically fringed, others long and spinelike although very minutely fringed **24. panocossa**
Comb scales all long and spinelike with sharp unfringed apical part 11
- 11(10). Siphon short, index usually less than 5.0, distinctly upturned distally, convex on ventral margin; siphonal hairs extending to near apex; anal saddle without differentiated marginal spicules. **23. pilosus**
Siphon index usually 6.0 or more, only slightly upturned, nearly straight on ventral margin; anal saddle with distinct sharp marginal spicules.
. **19. erraticus**
- 12(9). Siphon uniformly dark, index usually more than 17.0; distal subdorsal siphonal hair inserted near apex, at a distance less than 0.5 of its length; antenna uniformly dark **18. opisthopus**
Siphon moderately pigmented, with or without dark submedian ring, index usually not exceeding 14.0; distal subdorsal siphonal hair inserted at a distance from apex greater than its length; antenna light except on distal part and sometimes at base 13
- 13(12). Siphon usually with 3 pairs of subdorsal hairs; anal saddle with distinct differentiated marginal spicules **17. atratus**
Siphon usually with 2 pairs of subdorsal hairs; anal saddle without differentiated marginal spicules 14
- 14(13). Head hair 6-C double or triple, 5-C multiple **22. Jamaican form**
Head hair 6-C single, 5-C single to triple 15
- 15(14). Head hair 5-C usually triple; prothoracic hair 7-P usually double; siphon without submedian dark ring **21. inhibitor**
Head hair 5-C usually single or forked apically; prothoracic hair 7-P usually triple; siphon usually with dark submedian ring **20. iolambdis**

Subgenus CULEX

Adults of the nominate subgenus can be separated from the other subgenera of *Culex* by their generally larger size, presence of narrow plume scales on veins R₂ and R₃, and the presence of the acrostichal bristles on the mesonotal disc. In the male genitalia the paraproct has numerous large sharp spicules in addition to the blunt teeth and the subapical lobe of the sidepiece is not distinctly divided. The larvae have prothoracic hair 3-P at least two-thirds as long as hair 1. The pupae lack the "slit" in the meatus of the trumpet and have abdominal hair 2-VI always mesad of hair 1.

The subgenus is represented in Jamaica by 7 species, each of which apparently belongs to a distinct but not necessarily equivalent group. All the species except *quinquefasciatus* are indigenous; *secutor* may be endemic but its relationship to similar forms in Hispaniola, Puerto Rico and the island of Dominica cannot be determined at this time. Of the other species, the extralimital distributions of 2 are confined to the West Indies: *janitor* apparently to Hispaniola and Puerto Rico; *bahamensis* to the Bahamas, Florida, Cuba, Hispaniola, Puerto Rico, Virgin Islands and the northern Lesser Antilles as far south as Guadeloupe. The 3 remaining species belong to complexes with very wide reported distributions. The Jamaican *nigripalpus* is not obviously differentiated from other populations we have seen from the United States southward to the Guianas and Ecuador. The Jamaican populations of *corniger* and *chidesteri*, on the other hand, do not agree very well with some of the other populations reported as these species and may belong to distinct Antillean segregates. Because of the paucity of Jamaican or extralimital material we have not been able to determine their taxonomic status and have retained them under the names of the complexes. The record of *bickleyi* Forattini, 1965 from Jamaica is based on a misidentification of *secutor*.

Several other species of the subgenus *Culex* have been reported from the Greater Antilles, Bahamas and the Virgin Islands: (1) *duplicator* Dyar & Knab, 1909 from Hispaniola; (2) *finlayi* Perez Viguera, 1956 from Cuba, which we consider provisionally to be conspecific with *chidesteri* from Jamaica; (3) *habilitator* Dyar & Knab, 1906 from the Dominican Republic and also reported from Puerto Rico, Virgin Islands (Virgin Gorda, St. Thomas), the Lesser Antilles southward to Montserrat; and probably erroneously from Trinidad and Peru; (4) *inflictus* Theobald, 1901, undoubtedly erroneously from Cuba as all the material of the complex we have seen from the West Indies is from the Lesser Antilles; (5) *interrogator* Dyar & Knab, 1906, undoubtedly erroneously from Puerto Rico (Porter, 1967:40; ascribed to Bram (1967) who does not list the species from Puerto Rico); (6) *scimitar* Branch & Seabrook, 1959 from the Bahamas and apparently Cuba (Bram, 1967:100); and (7) *sphinx* Howard, Dyar & Knab, 1913 from the Bahamas. We have not included any of these in the keys although at least *duplicator* and *habilitator* might possibly occur in Jamaica. Bram's (1967) revision of the subgenus should be consulted in case specimens are encountered in Jamaica that do not appear to fit any of the species we are treating here.

As in the case of the subgenus *Melanoconion*, the recognition of most species of the subgenus *Culex* is still based primarily on male genitalic differences. Caution should be exercised in using these characters exclusively because of considerable individual variation as well as the occurrence of at least superficially similar male genitalia in species differing strongly in larval features.

For the description of the lateral plate of the male genitalia we have adopted a modification of the terminology of Bram (1967) as follows: (1) **mesal spine** for external process, (2) **dorsal process** for basal process but in a broader sense to include the most tergal angle of the median process, (3) **ventral cornu** (as in Bram) as the most sternal angle of the median process, and (4) **median process** as in Bram but with the differentiation of an **external lobe** which is developed in some species. This terminology is illustrated in fig. 29.

10. *Culex* (C.) *bahamensis* Dyar & Knab

Figs. 23,25

1906. *Culex bahamensis* Dyar and Knab, 1906c:210. TYPE: Lectotype larva, Bahama Islands, 1903, T.H. Coffin [USNM; designation of Stone and Knight, 1957a:43].
1918. *Culex (Transculicia) eleuthera* Dyar, 1918a:184-186. TYPE: Lectotype male (19), Governor's Harbor, Eleuthera, Bahama Islands, 1903, T.H. Coffin [USNM, 21570, designation of Stone and Knight, 1957a:48]. Synonymy with *bahamensis* by Dyar (1920a:29).
1920. *Culex (Transculicia) petersoni* Dyar, 1920a:27-29. TYPE: Holotype male (St.J.-12), Leinster Bay, St. John, Virgin Is., 22 Oct 1919, E. Peterson [USNM, 22689]. Synonymy with *bahamensis* by Dyar (1928:360).

Culex (C.) *bahamensis* of Dyar (1928:360-361); Edwards (1932:205); King, Bradley and McNeel (1944:42); Matheson (1944:202-203); Carpenter, Middlekauff and Chamberlain (1946:240-242); Pritchard, Seabrook and Mulrennan (1947:12); Lane (1953:324-325); Carpenter and LaCasse (1955:274-275); Perez Viguera (1956:390-393); Stone, Knight and Starcke (1959:243); Forattini (1965a:146); Montchadsky and Garcia (1966:43); Porter (1967:38); Bram (1967:32-33).

Culex (Transculicia) bahamensis of Dyar (1920a:29).

Culex bahamensis of Howard, Dyar and Knab (1915:300-301); Fisk (1939:469); Hill and Hill (1945a:2; 1948:53); Thompson (1947:78).

Culex corniger in part (Florida record) of Howard, Dyar and Knab (1915:246); Dyar (1922a:23-24; 1928:367-368); Matheson (1944:203-204).

FEMALE. Wing usually less than 3.0 mm. A rather small species with general characters as described here for *quinquefasciatus* and with the following conspicuous diagnostic features. *Head*: Narrow decumbent scales darker. Erect scales all dark. Labium with discrete postmedian ventral white band frequently extended dorsad to form a more or less complete ring. Palpus always with some whitish scales distally. *Thorax*: Acrostichal bristles stronger. *Ppn* scales broader. *Legs*: All femora pale at base; anterior surface of forefemur with a few pale scales near lower part, that of midfemur with more extensive pale scaling; anterior surface of hindfemur with a conspicuous lower whitish line usually reaching apex. Base and apex of all tibiae pale; posterior surface of foretibia and midtibia entirely whitish, anterior surface more or less distinctly speckled with pale scales, more on midtibia; anterior surface of hindtibia with whitish line to near apex. Lower surface of all tarsal segments 1 and usually 2 pale scaled; base of tarsal segments 1 pale; very narrow pale rings over the joints between all tarsal segments involving apex and base of adjoining segments, less distinct or sometimes absent on distal joints of foreleg and midleg. *Wing*: Costa lightly speckled with whitish scales. *Abdomen*: Basal transverse pale bands of tergites even on most segments and joined to basolateral pale patches.

MALE. Differing from *quinquefasciatus* in same features as female and from the male of that species in the following. False joint of labium at about 0.6 from base, area around it with pale scaling extending to form a ring dorsally. Palpus exceeding proboscis from about 0.5 of segment 5; with more or less complete pale ring beyond middle of segment 3 and at base of segments 4 and 5, very narrow on latter; lower surface without whitish line.

MALE GENITALIA (fig. 23). In general as in *quinquefasciatus*, differing chiefly in following conspicuous features. Sidepiece with clumps of moderately long setae on tergal surface at base of subapical lobe and distad of it. Subapical lobe more

proximal; setae *a-c* all short and broad; *d-h* represented by about 4 flattened and several simple setae; leaf not differentiated. Clasper slender, sharply bent near base. Lateral plate without inner division; outer division complex; mesal spine long, acuminate and straight; median process with about 15-20 flattened appressed teeth; dorsal process poorly differentiated, broad and rounded; ventral cornu strongly differentiated, in form of spine bent outward at nearly a right angle. Basal sternal process of proctiger long and curved sternad in distal part.

PUPA (fig. 23). Chaetotaxy as figured, not studied in detail; apparently variable. In general as in *quinquefasciatus*, differing chiefly in following conspicuous features. Cephalothoracic hairs 1,5-C longer. Trumpet darkened apically. Median plate of abdominal tergite I with conspicuous short sharp spicules anteriorly and posteriorly. Hair 5-V,VI longer and usually single; dorsal hairs of segment VII weaker, 1,4,5-VII frequently single.

LARVA (fig. 25). In general as described and figured by Carpenter and LaCasse (1955:275) and as described by Bram (1967:32-33), except as noted. Differing from *quinquefasciatus* as described here in following conspicuous features. Head hairs 5,6-C weaker and shorter. Antenna lightly pigmented except for darkened distal part, contrasting with head capsule; longer, about 0.67 of head length. Thorax and abdomen weakly and sparsely spiculate, integument very pale, whitish. Prothoracic hair 7-P usually triple, 8-P usually single or with weak branch. Abdominal hair 6-I-VI weaker, usually triple or double; 7-I usually single; 1-III-V weaker, shorter, inconspicuous, apparently usually triple; 13-III-V much weaker, inconspicuous. Comb scale patch smaller; scales strongly pigmented and more slender. Siphon more slender and evenly slightly tapered; integument spiculate, very conspicuously on apex, particularly ventrad where spicules are long and heavy; pecten teeth with a longer apical spine and usually only 2 denticles in basal part; siphonal hairs usually 5 pairs (sometimes 6 on 1 side), all ventrad of pecten and 2 within pecten, all more strongly branched; median caudal filament of spiracular apparatus apparently not developed. Anal saddle incomplete, represented by heavily pigmented dorsal plaque (not complete as stated by Carpenter and LaCasse, and Bram), rest of integument densely spiculate; hair 1-X with 3 or 4 basal branches in addition to main shaft; ventral brush with 7 pairs of hairs, the most proximal hair sometimes precratal, hairs more heavily branched; gills a single pair, very short and bulbous.

SYSTEMATICS. The Jamaican population agrees in general with other populations of *bahamensis* from the Bahamas, Grand Cayman, Puerto Rico, Virgin Islands (St. Thomas, St. John, St. Croix), Anguilla, St. Barthelemy, St. Kitts, Antigua and Guadeloupe. We have seen no material from Florida, Cuba or Haiti but there is no reason to doubt these records. It seems very doubtful that the records of this species from French Guiana as well as Trinidad are correct.

Females from Jamaica tend to have conspicuous white speckling on the costa of the wing which is seldom developed in the other populations we have seen. There are some differences in the immature stages also, but these are subject to considerable variation. Contrary to the statements of Howard, Dyar and Knab (1915:301), Carpenter and LaCasse (1955:275) and Bram (1967:33) the anal segment of the larva is not completely ringed by the saddle but has a strongly pigmented, dorsal sclerotized plaque with poorly defined margins.

BIONOMICS. In Jamaica the immature stages of *bahamensis* have been found several times in coral rockholes near the sea with fresh to salty water and in shallow open pools in mangrove areas. Large artificial containers are sometimes used for breeding. This species is usually found alone but occasionally is associated with

Psorophora (G.) insularia and *Culex (Mel.) atratus*. Nothing is known of the habits of the adults.

DISTRIBUTION. *Culex bahamensis* has been reliably reported from the Bahamas (type locality), Cuba, Grand Cayman, Jamaica, Hispaniola, Florida, Puerto Rico, Virgin Islands, the Leeward Islands and Guadeloupe.

JAMAICA. Restricted to the coast at or near sea level. Collected from all parishes except Manchester, Portland, St. Elizabeth and St. Mary. The following records are of specimens seen by us. *Clarendon*: Milk River Bath (207). *Hanover*: Bulls Bay (89,717). Mosquito Cove (936). *Kingston and St. Andrew*: Ferry (898). *St. Ann*: Runaway Bay, Feb 1969, W.W. Wirth, 3 F [USNM]. *St. Catherine*: Port Henderson, Salina, 10 Dec 1946, G.A. Thompson, 3 M, 4 F [JAM]. *St. James*: Montego Bay, 16 Mar 1940, 1 M [UCLA]; 6-7 Dec 1954, Fitz and Bignum, 2 L [USNM]. *St. Thomas*: White Bay (121). *Westmoreland*: Negril (233).

Material Examined: 294 specimens; 22 males, 56 females, 144 larvae, 72 pupae; 24 individual rearings (8 larval, 9 pupal, 7 incomplete).

11. *Culex (C.) corniger* Theobald

Figs. 24,25

1903. *Culex corniger* Theobald, 1903a:173-174. TYPE: Lectotype male with attached genitalia mount, Para, Brazil, E.A. Goeldi [BM; designation of Belkin, 1968b:15].
1906. *Culex hassardii* Grabham, 1906a:167-170. TYPE: Lectotype by PRESENT DESIGNATION, male with intact genitalia, Newcastle, Jamaica, 15 Oct 1905, Major Hassard; 1 of a series of 8 males and 5 females all bearing printed labels, //Kingston/Jam//M Grabham/Collector//, and 3 handwritten labels, on 3 separate specimens, //Newcastle/Jamaica/15-10-05//C. hassardii//Gbm//hassardii//, evidently all part of Grabham's original material [USNM]. Synonymy with *lactator* by Theobald (1910:613), with *corniger* by Howard, Dyar and Knab (1915:240).
1907. *Culex subfuscus* Theobald, 1907:403-405. TYPE: Holotype male with genitalia on slide, Moneague (St. Ann), Jamaica, 12 Feb 1905, Lord Walsingham [BM]. Synonymy with *corniger* by Dyar (1921a:28), suggested by Bonne-Wepster and Bonne (1921:18).

For complete current synonymy, see Stone, Knight and Starcke (1959:244-245).

Culex (C.) corniger of Dyar and Knab (1918:174); Dyar (1928:367-368, except record from Florida); Edwards (1932:205); Lane (1953:374-375); Perez Viguera (1956:394-399); Stone, Knight and Starcke (1959:244-245); Forattini (1965a:154); Montchadsky and Garcia (1966:43); Porter (1967:38); Bram (1967:43-45); Page (1967).

Culex corniger of Theobald (1905b:25); Howard, Dyar and Knab (1915:240-246, except record from Florida); Johnson (1919:422); Gowdey (1926:73); Hill and Hill (1945a:2; 1948:54); Thompson (1947:78).

Culex subfuscus of Howard, Dyar and Knab (1915:429-430); Johnson (1919:423); Gowdey (1926:73).

FEMALE. Wing about 3.2 mm. Medium-sized to rather small species with general characters as described here for *quinquefasciatus* and with the following conspicuous diagnostic features. *Head*: Labium with a distinct whitish ventral patch at about 0.5-0.7, darkened distad. *Thorax*: Mesonotal scales scantier, predominantly bronzy; inconspicuous patches of whitish or creamy scales, some broadened, on humeral and scutal angles, lower and upper parts of fossal line, above paratergite, in anterior part of supraalar area around end of acrostichal line, and sides of prescutellar space; sometimes entire lateral margin from humeral angle to wing root pale scaled. Scutellar scales narrow and numerous on midlobe, broadened and sparse

on lateral lobe; all pale. Pleural integument darkened, especially on *psp*, *stp*, *pra* and on upper and lower patch on *mep*. *Apn* scales largely restricted to lower part; *ppn* scales sparser, dark in front, light caudad. *Legs*: Anterior surface of hindfemur darker, pale scaling of lower part indistinct and not extending much beyond basal 0.5. Knee spots small but conspicuous. All tibiae with small apical light spot, larger on hindtibia. Tarsi with narrow pale rings over all the joints, represented by only a few scales on distal segments. *Abdomen*: Tergal pale markings in form of elongate narrow median tan patches not connected to basolateral whitish patches. Sternites with apicolateral dark patches on distal segments, usually forming narrow apical transverse bands on VI and VII.

MALE. Differing from *quinquefasciatus* in same features as female and from the male of that species in the following. False joint of labium at about 0.6 from base, with distinct complete pale ring distad of it, followed by darkened apical area. Palpus longer, exceeding proboscis from about middle of segment 4; with conspicuous broad pale dorsal band beyond middle of segment 3; segment 4 with very narrow dorsal basal pale band and with conspicuous white scaled patches on ventral surface at base and subapically; segment 5 with very narrow basal dorsal pale band and sometimes extensively pale scaled apex dorsally; segment 3 with bristles beginning at about middle of segment, those of segments 4 and 5 less numerous and shorter than in *quinquefasciatus*. Claws of foreleg subequal in length. Abdominal tergites with complete even pale basal transverse bands except on II where pale scaling is restricted to median area.

MALE GENITALIA (fig. 24). In general as in *quinquefasciatus*, differing chiefly in following conspicuous features. Setae of IX tergite lobe much more numerous. Subapical lobe less prominent; setae *a-c* variable, *b* usually strongly developed and distinctly longer than *a* and *c*; setae *d-f* represented by 1 simple seta; leaf (*g*) developed, accessory seta (*h*) slender. Clasper with 1 very long basal external seta in 1 specimen. Lateral plate without inner division; outer division complex; mesal spine very short, flattened and straight; median process with closely packed numerous teeth of varied size and a conspicuous ventral external lobe; dorsal process poorly differentiated, rounded; ventral cornu flattened, straight, rounded apically except for dorsal point. Basal sternal process of proctiger long and curved sternad distally.

PUPA (fig. 24). Chaetotaxy as figured, not studied in detail; apparently variable. In general as in *quinquefasciatus*, differing in following conspicuous features. Pigmentation usually uniformly light. Cephalothoracic hairs 1,3,8,9-C usually single. Trumpet shorter, with much smaller pinna. Hair 1-III-VII usually single or double; 2-VII usually mesad of hair 1; hair 5-IV-VI usually single and distinctly longer than tergite following; 6-III-VI usually single; 4,5-VII frequently single. Paddle very lightly pigmented; at least external margin usually with inconspicuous spicules.

LARVA (fig. 25). Markedly different from other local species of subgenus; in life superficially resembling species of *Aedes*. With general features of *quinquefasciatus* as described here but with the following conspicuous differences; chaetotaxy variable. Head only slightly wider than long; most hairs with fewer branches; hairs 4-7-C in an arcuate line at about level of antennal base, all short and without distinct barbs, 4-C double or triple, 5,6-C triple or double, 7-C usually with 4 or 5 branches; 8-C usually single, longer than usual. Antenna short, about 0.35 of head length; shaft uniform, without differentiation into proximal and distal parts; spicules absent; hair 1-A short, not reaching apex of shaft, usually double or triple; terminal antennal hairs short. Thoracic integument with short sharp spicules; hair

3-P usually triple or double, 4-P usually with 4 branches, 7,8-P usually double. Abdominal hairs 6-I-VI double; 7-I usually triple; 1-III,IV usually single; 13-III-V usually double. Comb scales in a very small patch, more slender and somewhat spatulate; hairs without conspicuous basal plates or tubercles. Siphon very short and broad, index about 2.5. Pecten of about 5-9 teeth, with numerous small basal and 1 large distal denticle near main spine. Siphonal hairs (1,1a-S) usually 5 pairs; 2 pairs ventrad of pecten, the proximal within pecten; 1 pair about in line with pecten; 1 pair subdorsal; 1 pair dorsal; all with 2 or 3 spikelike branches; median caudal process of spiracular apparatus shorter, not reaching apex of ventrolateral valve. Anal saddle very short, usually with differentiated short spinelike marginal spicules; hairs 2,3-X both single; ventral brush with 7 pairs of hairs; gills sausage shaped but somewhat pointed apically, very long, nearly 3.0 of dorsal saddle length.

SYSTEMATICS. The assignment of the Jamaican population, described as *has-sardii* by Grabham and *subfuscus* by Theobald, to *corniger* is only provisional. We find considerable differences in the immature stages of this population from those of other populations of *corniger* from Mexico, Central America, Panama and northern South America and it seems probable that a complex of species with somewhat similar male genitalia may be involved over the wide reported range (Mexico to Uruguay). Unfortunately we have no material from the type locality (Para, Brazil) or from the other localities in the West Indies where "*corniger*" has been found (Cuba, Haiti and Guadeloupe).

The male genitalia of the Jamaican population do not agree in several details of the lateral plate and the subapical lobe with the figures in Lane (1953:375) and Bram (1967:44).

BIONOMICS. In Jamaica *corniger* is found breeding most commonly in broken or cut bamboo where it is usually associated with *Aedes (H.) inaequalis* and *Wyeomyia (W.) nigritubus*. It has also been found in treeholes, leaves on the ground, coconut shells, and occasionally in artificial containers. It also uses leaf axils of aroids, flower bracts of *Heliconia* and, according to Hill and Hill (1948:54), leaf axils of ground bromeliads; in such habitats its associates may be *Wyeomyia (W.) mitchellii*, *W. (W.) hirsuta* and *Aedes (H.) walkeri*. This species breeds also in ground waters with large amounts of decaying vegetable matter, such as stream bed pools and rockholes, where its associates may be *Anopheles (A.) grabhamii*, *Culex (C.) secutor* and *Culex (Mel.) inhibitor*.

Females of *corniger* occasionally bite man in Jamaica and have been taken in donkey and chicken baited traps (Page, 1967). Both sexes have also been taken in a light trap.

DISTRIBUTION. As indicated under systematics above, *corniger* may consist of a complex of species over its wide reported distribution extending from Mexico to Uruguay.

JAMAICA. *Culex corniger* has been most often collected in the mountainous central and eastern portions of the island at elevations of up to 480 m; Hill and Hill (1948:54) report records up to 2700 ft; less often collected at low elevations near the coast. The following records are of specimens seen by us. *Kingston and St. Andrew*: Hermitage Dam Road (288,289,296,300-303, 307,308,611,739,827,891). Hope Gardens (944). Kingston and vicinity, M. Grabham, 8 M, 5 F; June 1958, H.D. Pratt, 2 L [USNM]. Mount Salus (780). Newcastle, 15 Oct 1905, M. Grabham [USNM]. Parks Road (50). U.W.I. (382). *Manchester*: Williamsfield (636). *Portland*: Ecclesdown (748,749). Manchioneal (915). *St. Ann*: Moneague, Jan 1940, ? W.H. Komp, 2 M, 33 L [UCLA]. Runaway Bay, Feb 1969, W.W. Wirth, 2 M [USNM]. *Parish not Specified*: 9 Sept 1905, M. Grabham, 2 L [UCLA]; Jan 1940, ? W.H. Komp, 4 L [UCLA].

Material Examined: 516 specimens; 74 males, 105 females, 223 larvae, 114 pupae; 64 individual rearings (22 larval, 38 pupal, 4 incomplete).

12. *Culex* (*C.*) *chidesteri* Dyar

Figs. 26,27

1921. *Culex* (*Culex*) *chidesteri* Dyar, 1921c:117-118. TYPE: Lectotype male (1520) with genitalia slide, Colon, Panama, 24 June 1921, W.S. Chidester [USNM, 24716; designation of Stone and Knight, 1957a:45].
1956. *Culex* (*Culex*) *finlayi* Perez Viguera, 1956:382-389. TYPE: Not designated, described from male, female and larva, Finca "El Pino," Casiguas, Barrio de Jaruco (Habana), Cuba, late Nov, I. Perez Viguera [location unknown]. Synonymy with *chidesteri* by Montchadsky and Garcia (1966:43).

Culex (*C.*) *chidesteri* of Bonne and Bonne-Wepster (1925:240); Dyar (1925c:162-163; 1928:365); Edwards (1932:207); Floch and Abonnenc (1945:21-22); Pratt (1947:581); Lane (1953:375-377); Carpenter and LaCasse (1955:275-277); Stone, Knight and Starcke (1959:244); Montchadsky and Garcia (1966:43); Bram (1967:42-43); Porter (1967:38).

Culex chidesteri of Hill and Hill (1945a:2; 1948:53-54); Thompson (1947:78).

Culex (*C.*) *finlayi* of Stone (1963:134); Bram (1967:63-64); Porter (1967:38).

FEMALE. Wing about 3.6 mm. A medium-sized species with general characters as described here for *quinquefasciatus* and with following conspicuous diagnostic features. *Head*: Erect scales all dark. Labium usually with more or less distinct long pale area on lower surface. Palpal segment 3 more slender. *Thorax*: Mesonotal scales usually darker except on anterior promontory and humeral angle. *Psp* frequently with a few broad pale scales just caudad of spiracle. *Legs*: Knee spots usually somewhat more conspicuous. All tibiae with more or less distinct pale apical spot; posterior surfaces of tibiae more distinctly pale. Extremely narrow pale rings over the tarsal joints, involving apex and base of adjoining segments, sometimes represented by only a few scales or absent on distal joints, especially on foreleg and midleg. *Abdomen*: Basolateral pale patches of tergites II-VII larger and whiter, basal transverse pale bands narrower and straighter, usually connected to basolateral patches on IV-VI.

MALE. Differing from *quinquefasciatus* in same features as female and from the male of that species in the following. False joint of labium at about 0.6 from base, with distinct pale ring distad of it extending to dorsal surface. Palpus longer, exceeding proboscis by nearly full length of segments 4 and 5; with a few pale scales laterally near middle of segment 3; lower surface of segment 4 with line of whitish scales interrupted in the middle; bristles of segment 3 longer, more numerous, extending from near middle to apex of segment. Basal transverse pale bands of abdominal tergites narrower.

MALE GENITALIA (fig. 27). In general as in *quinquefasciatus*, differing chiefly in the following conspicuous features. Subapical lobe with seta *a* distinctly shorter than *b* and *c*; setae *d-f* represented by 3 alveoli; leaf (*g*) broad, somewhat pointed; accessory seta (*h*) slender. Lateral plate without inner division; outer division complex; mesal spine long, broad and flat and angled laterad distally; median process with about 18 small teeth in central area, produced as a flattened lateral lobe sternad of the ventral cornu; dorsal process poorly differentiated, rounded; ventral cornu a conspicuous, broad, slightly rugose lateral lobe. Basal sternal process of proctiger long and curved sternad distally.

PUPA (fig. 27). Chaetotaxy as figured, not studied in detail; variable. In general as in *quinquefasciatus*, differing chiefly in following conspicuous features. Pigmenta-

tion usually stronger and more uniform but darker on metanotum and anterior abdominal segments. Cephalothoracic and metanotal hairs usually with more branches. Trumpet much more slender, longer and not flared apically; index usually more than 9.0; uniformly darkly pigmented; tracheoid extending beyond 0.5; pinna very small. Median caudal part of sternite II with conspicuous short sharp spicules. Hair 1-III-V usually with more branches; 2-III-VI usually removed cephalad of caudal margin, 2-VII mesad of hair 1; hair 5-IV usually with 4 branches; 5-V,VI variable, single or double, shorter or subequal to tergite following; 6-III-VI usually stronger, sometimes with 4 branches.

LARVA (fig. 26). In general as described and figured by Carpenter and LaCasse (1955:276-277) except as noted. Differing from *quinquefasciatus* as described here in following conspicuous features. Head hair 6-C usually triple. Antenna nearly as long as head, proximal part lightly pigmented, distal darkened. Thorax and abdomen conspicuously spiculate. Prothoracic hairs 4,7,8-P missing in all specimens. Abdominal hair 6-I,II double or triple. Comb scales more slender, somewhat spatulate. Siphon much longer and slender, index usually more than 16.0; pecten teeth usually with more numerous denticles, distal widely separated; siphonal hairs usually 8 pairs, all short and above level of pecten, the proximal within last pecten tooth; median caudal filament of spiracular apparatus longer. Anal saddle and integument with long spicules; hair 1-X usually double; gills subequal, rounded apically, distinctly longer than dorsal saddle length.

SYSTEMATICS. There is considerable doubt about the assignment of the Jamaican population to *chidesteri*. It appears that several distinct species are currently confused under *chidesteri* which has been reported over a wide range extending from Texas to Brazil and Argentina. Our limited material from Jamaica agrees fairly well with topotypic *chidesteri* from Panama. There are apparently some differences in the male genitalia of these 2 populations but these cannot be evaluated properly because we have only 2 males from Jamaica. The Jamaican population may be conspecific with the Cuban, described as *finlayi* by Perez Viguera, in spite of the bizarre appearance of the lateral plate of the male genitalia of the latter which we believe is due to the unusual aspect from which the drawing was made. Unfortunately we have not seen material of the complex from Cuba, Puerto Rico (Pratt, 1947:581), Guadeloupe (Floch and Abonnenc, 1945:21-22), or from other localities in the Antilles.

There is also considerable doubt about the identity of several other populations reported as *chidesteri*. The population from Texas described and figured by Carpenter and LaCasse (1955:276-277) agrees well in the larva with the Jamaican and Panamanian populations but the lateral plate of the male genitalia figured for *chidesteri* by these authors is completely different and apparently indistinguishable from that of *interrogator* Dyar & Knab, 1906 as figured by them (Carpenter and LaCasse, 1955:281). The male genitalia of Mexican specimens figured as *chidesteri* by Martinez Palacios (1950: figs. 3,4) resemble *laticlasper* Galindo & Blanton, 1954 and are those of an undescribed species with a larva of the *chidesteri* type which we have from Mexico, Guatemala and Costa Rica. The male genitalia figured by Lane (1953:376) and Bram (1967:44, fig. 10c, subapical lobe only) are quite distinct from topotypic Panamanian *chidesteri* and suggest the presence of another species of the *chidesteri* complex in South America. The phallosome of a specimen from Puerto Rico figured by Bram (1967:44, fig. 10d) resembles in some respects that of the Jamaican specimens and the differences from the latter may be due to the flattening of the preparation from which his figure was made.

BIONOMICS. We found the immature stages of *chidesteri* twice in the same small swamp in association with *Mansonia (M.) titillans* and Hill and Hill (1948:54) report larvae from a stock pond. Hill and Hill (loc. cit.) collected adults in association with *arawak* (as *americanus*) in caves. This species is apparently very uncommon in Jamaica.

DISTRIBUTION. Reported over a wide range extending from Texas to Argentina; probably a complex of species involved; type locality, Panama.

JAMAICA. *Clarendon*: Locality not specified (Hill and Hill, 1948:54). *St. Ann*: Moneague (Hill and Hill, loc. cit.). *Westmoreland*: Petersville (277,361).

Material Examined: 18 specimens; 2 males, 4 females, 6 larvae, 6 pupae; 6 individual rearings (2 larval, 4 pupal).

13. *Culex (C.) janitor* Theobald

Figs. 29,30

1903. *Culex janitor* Theobald, 1903a:183-185. TYPE: Lectotype male with genitalia mount, Kingston, Jamaica, M. Grabham [BM; designation of Belkin, 1968b:16-17].

Culex (C.) janitor of Dyar (1918c:96; 1928:372-373); Bonne-Wepster and Bonne (1921:21); Bonne and Bonne-Wepster (1925:215); Edwards (1932:206); Tulloch (1937:150); Lane (1953:360-362); Stone, Knight and Starcke (1959:250); Forattini (1965a:161-162); Bram (1967:71, in part); Porter (1967:38).

Culex janitor of Theobald (1905a:24; 1905b:26); Grabham (1905:406-407); Coquillett (1906b:23); Howard, Dyar and Knab (1915:258-261); Johnson (1919:422); Gowdey (1926:73); Hill and Hill (1945a:3; 1948:55); Thompson (1947:78).

FEMALE. Wing about 3.6 mm. A medium-sized species with general characters as described for *quinquefasciatus* and with the following conspicuous diagnostic features. *Head*: Erect scales all dark. Labium uniformly dark, without indication of pale scaling ventrally. *Thorax*: Pleural integument usually darkened at least on *psp*, *pra* and upper and lower *mep*. *Psp* nearly always with a few small broad whitish scales in anterior part just caudad of spiracle; middle *mep* scale patch small, usually with less than 10 scales. *Legs*: Tibiae with pale apex and usually a few scattered pale scales. Usually all tarsal segments 1 with at least a few pale scales at base dorsally; tarsal joints with narrow pale rings involving apex and base of adjoining segments, varied in color, frequently reduced to a few pale dorsal scales or absent on distal 2 joints of foreleg and midleg and sometimes inconspicuous even on hindleg. *Abdomen*: Pale markings of tergites restricted to small basolateral whitish patches, sometimes slightly produced dorsad at base but not forming transverse bands. Sternites II-VII pale scaled at base, with more or less extensive dark scaled patches distally in the middle and laterally and forming complete transverse dark bands usually more extensive on basal segments.

MALE. Differing from *quinquefasciatus* in the same features as female and from male of that species in the following. False joint of labium at about 0.6 from base, with distinct pale ring around it extending to dorsal surface. Palpus more slender and shorter, exceeding proboscis by about 0.5 of segment 5; ventral surface of segment 4 with long line of pale scales not quite reaching apex, base usually with some dorsal pale scales; segment 5 with patch of pale scales at base dorsally as well as ventrally; segments 4 and 5 very slender; bristles of segments 3-5 very short and

less numerous. Abdominal tergites III-V usually with complete narrow transverse basal pale bands, VI, VII with basolateral light patches only, II usually without pale scales.

MALE GENITALIA (fig. 29). In general as in *quinquefasciatus*, differing chiefly in the following conspicuous features. Subapical lobe with seta *a* slightly shorter than *b* and *c* and rounded apically; *d-f* represented by 2 microsetae and 1 simple seta; leaf (*g*) broad, distinctly pointed; accessory seta (*h*) very slender. Lateral plate without inner division; outer division complex; mesal spine long, slender, tapered and ridged; median process with about 8 moderately large teeth; dorsal process strongly differentiated as laterally projecting simple spine; ventral cornu strongly differentiated, more than twice as long as teeth of median process, with apex angled dorsad. Basal sternal process of proctiger long, with broadened distal part curved sternad.

PUPA (fig. 29). Chaetotaxy as figured, not studied in detail; apparently variable. In general very similar to *quinquefasciatus*, differing chiefly in the following. Hair 1-II stronger, usually with conspicuous stem; 1-IV-VII weaker, usually double, sometimes single; 6-III-VI usually single. Paddle usually slightly produced on apex.

LARVA (fig. 30). Chaetotaxy as figured, not studied in detail; apparently variable. Differing conspicuously from *quinquefasciatus* as described here in the following. Head not as wide; labrum less conspicuous; maxillary suture continued caudolaterad to collar base; hair 1-C stronger distally, not filamentous; 4-6-C more anterior, 5,6-C shorter. Antenna about 0.4 of head length; shaft uniform, with very inconspicuous, practically invisible scattered spicules; hair 1-A submedian, usually with 5 or 6 simple branches not reaching apex of shaft; terminal hairs all short. Basal tubercles of thoracic hairs strongly developed; prothoracic hairs 1-3-P usually all double, sometimes triple, 4-P usually triple, 6-P usually double, 7-P usually with at least 6 branches, 8-P weak. Abdominal hair 6-III-V usually triple; 1-III-V usually weaker. Comb scale patch larger, denser, with about 5 rows of scales; basal plate of hair 1-VIII not developed, tubercle of 3-VIII weak. Siphon more uniform in width, index usually about 4.0; pecten usually with 6-8 widely spaced teeth with several long denticles; siphonal hairs usually 5 pairs, proximal 3 subequal, usually multiple and below level of pecten with the first 2 within pecten, the distal 2 slightly above level of pecten, subapical usually double and long, distal short and at least triple; median caudal filament of spiracular apparatus very short. Anal saddle short, with imbricate spicules caudolaterally; gills sausage shaped but with apex somewhat pointed, nearly 3.0 of saddle length.

SYSTEMATICS. There is no doubt about the identity of the Jamaican population as it is the topotypic one. We have 1 male with associated immature stages from Haiti which agrees with the Jamaican material and it appears likely that the material from Puerto Rico (Tulloch, 1937:150) recently identified on the basis of male genitalia by Bram (1967:71) is also conspecific with *janitor*. On the other hand, Bram's record (loc. cit.) of a specimen of *janitor* from Bogota, Colombia, is undoubtedly in error and may pertain to a specimen of *bickleyi* Forattini, 1965 which may be conspecific with *alani* Forattini, 1965.

There is considerable variation in the extent and color of the light tarsal markings in the Jamaican population but they are apparently always developed. There may be some difficulty in seeing them in worn females and these could be mistaken for *nigripalpus* which is sometimes found resting in crabholes. Such females of *janitor* can be recognized by the dark areas on the mesopleuron which is uniformly light in *nigripalpus* and also usually by the presence of a few scales in the middle

of the mesepimeron (absent in *nigripalpus*). The males of the 2 species are readily separated by the development of the palpus.

BIONOMICS. *Culex janitor*, the False Crabhole Mosquito, appears to be even more restricted to crabholes than *Deinocerites cancer* and to have more specific breeding requirements. We found the immature stages of *janitor* only in 2 crabholes containing fresh water. They were associated with *cancer* in 1 instance and with both *cancer* and *Culex (C.) nigripalpus* in the other. Our collections of adults of *janitor* in crabholes were also much less numerous than those of *cancer* and in less than half of these was *cancer* found associated.

We have 1 doubtful record of *janitor* in a biting-landing collection (359).

DISTRIBUTION. Jamaica (type locality), Hispaniola (Haiti) and Puerto Rico. Record from Colombia erroneous, see systematics above.

JAMAICA. Distinctly more restricted in distribution than *D. cancer*. *Kingston and St. Andrew*: Ferry (701,702,719,720,736,885,888,889). Kingston and vicinity, IV-06, M. Grabham, 14 M, 8 F; Dec 12, M. Grabham, 1 M, 1 F [USNM]. Rockfort (949). *St. James*: Montego Bay, 1 July 1957, King and Beidler, 3 M, 4 F [USNM]. *Westmoreland*: Cave (616). Crab Pond Bay (359,360). *Parish not Specified*: 17 Feb 1902, M. Grabham, 1 F; M. Grabham, 4 L; R.B. Hill, 2 M, 2 F [USNM].

Material Examined: 412 specimens; 240 males, 73 females, 77 larvae, 22 pupae; 20 individual rearings (9 larval, 7 pupal, 4 incomplete).

14. *Culex (C.) secutor* Theobald

Figs. 31,32

1901. *Culex secutor* Theobald, 1901b:321-322. TYPE: Lectotype male with genitalia on slide, Cinchona (St. Andrew), Jamaica, elev. 4900 ft, M. Grabham [BM; designation of Belkin, 1968b:20].
1906. *Culex lamentator* Dyar and Knab, 1906c:219. TYPE: Larval skin (124.1) with associated pupal skin and female, San Francisco Mountains, Santo Domingo [Dominican Republic], 28 Aug 1905, A. Busck [USNM; designation of Stone and Knight, 1957a:52]. Synonymy with *secutor* by Dyar (1918c:97).
1907. *Culex quasiselector* Theobald, 1907:398-400. TYPE: Lectotype male with genitalia slide, Newcastle, Jamaica, M. Grabham [BM; designation of Belkin, 1968a:19]. Synonymy with *secutor* by Howard, Dyar and Knab (1915:282,286).
1907. *Culex toweri* Dyar and Knab, 1907:13. TYPE: Holotype female, Mayaguez, Puerto Rico, W.V. Tower [USNM, 10222; see Stone and Knight, 1957a:57]. Synonymy with *secutor* by Dyar (1918c:97).

Culex (C.) secutor of Dyar (1918c:97; 1928:373-374); Bonne and Bonne-Wepster (1925:215-216); Edwards (1932:206); Lane (1953:355-357, in part); Stone, Knight and Starcke (1959:259, in part); Forattini (1965a:172-174); Bram (1967:100-101, in part); Porter (1967:39).

Culex secutor of Theobald (1903a:182; 1905a:22-23; 1905b:26; 1910:355); Grabham (1906a:167); Dyar (1905a:26); Coquillett (1906b:23); Dyar and Knab (1906c:219); Howard, Dyar and Knab (1915:282-286); Johnson (1919:422); Gowdey (1926:73); Hill and Hill (1945a:3; 1948:57); Thompson (1947:78).

Culex lamentator of Dyar (1906:17); Howard, Dyar and Knab (1915:276-279).

Culex toweri of Theobald (1910:613); Howard, Dyar and Knab (1915:281-282).

Culex (C.) bickleyi of Bram (1967:33-35, in part); Porter (1967:38).

FEMALE. Wing about 4.0-4.5 mm. A rather large, very dark species with general characters as described here for *quinquefasciatus* and with the following conspic-

uous diagnostic features. *Head*: Erect scales of vertex all dark. Labium without any indication of pale scaling ventrally. *Thorax*: Mesonotal integument blackish brown to nearly black; scaling predominantly dark bronzy, patches of creamy to tan scales on anterior promontory, humeral and scutal angles, upper end of fossal line, and a few above paratergite; acrostichal bristles more strongly developed. Pleural integument blackish brown with lighter pruinose areas on *mep* between and around upper and lower dark spots; lower *apn* scales narrower; *ppn* with creamy to tan curved scales; scales of *ppl*, *stp* and *mep* narrower and whiter. *Legs*: Anterior surface of hindfemur extensively whitish to about 0.65 from base. Knee spot on hindleg more conspicuous. Tibiae dark except for a few pale scales at base dorsally and conspicuously pale apex. Tarsal segment 1 of all legs narrowly pale at base; hindtarsal segment 5 pale scaled on apex; narrow pale rings on joints of tarsal segments involving apex and base of adjoining segments, present on all joints and rather conspicuous on hindleg, usually restricted to the 2 basal joints and less conspicuous on foreleg and midleg. *Abdomen*: Basolateral pale patches of tergites small and white; dorsal pale markings restricted, creamy to tan, variable, II usually with median patch, III-V sometimes with narrow transverse bands or median patch. Distal sternites with variable median dark patches, frequently expanded as apical transverse dark band on V-VII.

MALE. Differing from *quinquefasciatus* in the same features as female and from male of that species in the following. False joint of labium surrounded by narrow ring of pale scales. Palpal segment 3 with pale scales near middle; ventral line of whitish scales sometimes interrupted in middle of segment 4 or not reaching its apex; segment 3 with bristles longer, more numerous and extending to about middle of segment. Dorsal light markings of abdominal tergites essentially as in female but broader.

MALE GENITALIA (fig. 31). In general as in *quinquefasciatus*, differing chiefly in the following conspicuous features. Subapical lobe with setae *d-f* represented by 1 or 2 simple setae and 1 longer, heavier seta with distinctly broadly recurved apex; leaf (*g*) narrower and with sharply acuminate apex; accessory seta (*h*) very slender. Lateral plate without inner division; outer division complex; mesal spine long, broadened beyond base and then sharply narrowed; median process with 5-7 moderately large teeth and a small lateral lobe; dorsal process strongly differentiated as laterally projecting lobe with more or less strongly developed spine or point recurved mesad; ventral cornu poorly developed, short, only slightly longer than one of the larger teeth of the median process. Basal sternal process of proctiger long, narrow and curved sternad distally.

PUPA (fig. 31). Chaetotaxy as figured, not studied in detail; apparently variable. In general as in *quinquefasciatus*, differing chiefly in following conspicuous features. Trumpet slender, not markedly flared apically; darkened on apex; pinna short. Hair 5-IV-VI longer, usually reaching middle of second tergite following.

LARVA (fig. 32). Chaetotaxy as figured, not studied in detail; apparently variable. Differing from *quinquefasciatus* as described here in following conspicuous features. Head hairs 5,6-C longer, 5-C usually with 4 branches, 6-C usually triple. Antenna longer, about 0.67 of head length; proximal part with very conspicuous large spicules, distal without spicules and strongly darkened. Thoracic and abdominal integument with small patches of sparse short tubercular spicules, chiefly laterally, sometimes conspicuously developed. Abdominal hair 6-I,II usually double, 1-III-V short, usually triple or double. Segment VIII with minute spicules laterally; comb scales more numerous, in about 5 rows, scale more slender; hair 1-VIII with

poorly developed basal tubercle. Siphon longer, index usually at least 6.0, frequently greater; tapered distally; pecten usually with at least 12 teeth with large lateral denticles and poorly developed apical spine; siphonal hairs usually 6 pairs, all distad and ventrad of pecten, apical smaller and usually double or triple, others multiple; median caudal filament of spiracular apparatus apparently not developed. Anal saddle conspicuously emarginate on proximal margin subdorsally; distinctly spiculate dorsally; hair 1-X frequently double; 2-X usually with only 1 branch at base of main shaft; gills varied in shape but always at least 3.0 of dorsal saddle length.

SYSTEMATICS. The topotypic Jamaican population of *secutor*, with its synonym *quasisecutor*, is quite uniform and there is no indication that more than 1 species is present on the island. The status of the 2 extralimital synonyms of *secutor* cannot be resolved at this time as we have no material of *lamentator* from Hispaniola and only a small series of *toweri* from Puerto Rico. The latter has male genitalia similar to topotypic *secutor* but the larvae show some constant slight differences as do the females. Another form with similar male genitalia occurs in the interior of the island of Dominica in the Lesser Antilles. Females of this form lack tarsal light markings and the larvae are more similar to *toweri* from Puerto Rico than to *secutor* from Jamaica. Although the 3 populations from Hispaniola, Puerto Rico and Dominica may be nothing more than geographical races of *secutor*, it is possible that a complex of closely related species is involved. Similar male genitalia have been described for 2 forms from Colombia, *alani* Forattini, 1965 and *bickleyi* Forattini, 1965; 2 specimens from Jamaica identified as the latter by Bram (1967:35) are actually *secutor*. It seems probable that *alani* and *bickleyi* are conspecific but whether or not this species is related to *secutor* cannot be determined until the immature stages and females from Colombia are described.

BIONOMICS. *Culex secutor* definitely prefers cool and shaded waters for breeding. We did not find it below elevations of about 480 m. Its natural breeding sites appear to be pools in mountain stream beds where its common associates are *Anopheles (A.) grabhamii*, *Culex (Mel.) inhibitor* and *Culex (C.) nigripalpus*. We have found it on several occasions in large artificial containers. This species has not been recorded biting man or domestic animals.

DISTRIBUTION. *Culex secutor* may be restricted to Jamaica but similar forms occur in Hispaniola, Puerto Rico and Dominica. The status of these forms is uncertain as well as that of the somewhat similar *alani* and *bickleyi* from Colombia; see systematics.

JAMAICA. At elevations above 480 m. *Kingston and St. Andrew*: Cinchona Botanical Gardens (340-343,365,612-614,751-753); 10 Dec 1903, M. Grabham, 1 M, 1 F [USNM]. Hardwar Gap, Jan 1946, G.A. Thompson, 6 L [USNM]. Hermitage Dam Road (738,739,827,828,851,852,891,893). Kingston and vicinity, M. Grabham, 1 M, 1 F, 6 L [USNM]. Newcastle, 10 Apr 1906, M. Grabham, 7 M, 4 F [USNM]. Newcastle, 1 mi S (755,832-835). *Parish not Specified*: 17 June 1902, M. Grabham, 1 M, 1 F; 21 Jan 1946, W.H. Komp, 1 M, 1 F; Jan 1946, G.A. Thompson, 1 M, 2 L; G.A. Thompson, 2 M [USNM]. *St. Thomas*: Locality not specified (Hill and Hill, 1948:57).

Material Examined: 1426 specimens; 201 males, 231 females, 659 larvae, 335 pupae; 131 individual rearings (25 larval, 77 pupal, 29 incomplete).

15. *Culex (C.) nigripalpus* Theobald

Figs. 26,28

1901. *Culex nigripalpus* Theobald, 1901b:322-324. TYPE: Holotype male, St. Lucia, G.C. Low

[Lost, see Belkin, 1968b:18].

1903. *Culex similis* Theobald, 1903a:207-208. TYPE: Holotype female, Red Hills, Kingston, Jamaica, M. Grabham [Lost, see Belkin, 1968b:20]. Synonymy with *nigripalpus* by Dyar (1921a:28, as race; 1925c:166).
1905. *Culex microsquamosus* Theobald in Grabham, 1905:407-410. TYPE: Lectotype male with genitalia on slide, Rio Cobre Canal dam, near Spanish Town (St. Catherine), Jamaica, 17 Jan 1905, M. Grabham [BM; designation of Belkin, 1968b:17]. Synonymy with *nigripalpus* by Dyar (1921a:28, as synonym of race *similis*; 1925c:166).

For complete current synonymy see Stone, Knight and Starcke (1959:252).

Culex (C.) nigripalpus of Dyar (1921a:28, as race *similis*; 1925c:166; 1928:363-364); Bonne and Bonne-Wepster (1925:209-211); Edwards (1932:207); Lane (1953:348-351, in part); Carpenter and LaCasse (1955:282-284); Perez Vigueras (1956:376-381); Stone, Knight and Starcke (1959:252); Forattini (1965a:129-134); Montchadsky and Garcia (1966:44); Bram (1967:84-86); Porter (1967:38); Page (1967).

Culex nigripalpus of Hill and Hill (1945a:3; 1948:55-56); Thompson (1947:78).

Culex similis of Theobald (1905a:26-27); Coquillett (1906b:23); Howard, Dyar and Knab (1915:339-342); Johnson (1919:423); Gowdey (1926:73).

Culex microsquamosus of Grabham (1905:407); Dyar and Knab (1906c:219); Howard, Dyar and Knab (1915:403-406); Johnson (1919:423); Gowdey (1926:73, as *macrosquamosa*).

FEMALE. Wing about 3.2-3.6 mm. A medium-sized species with general characters as described here for *quinquefasciatus* and with following diagnostic features. **Head:** Narrow decumbent scales darker, coppery. Erect scales all dark. Labium with pale ventral scaling more restricted, forming a broad median band. **Thorax:** Mesonotal scaling all light bronzy or dark coppery, without patches of lighter scales on the sides. Mesepimeral integument lighter than remainder of pleuron, without darkened area. *Apn* usually without scales in lower part; *ppn* with narrow dark bronzy scales in upper part; whitish scaling of pleuron usually restricted to a few small broad scales in upper and lower *stp* and a few narrow scales in upper *mep*. **Legs:** Essentially as in *quinquefasciatus*. **Abdomen:** Basolateral tergal whitish patches produced dorsally on V-VII; basal transverse pale markings usually completely absent, rarely developed as narrow bands on some segments.

MALE. Differing from *quinquefasciatus* in the same general features as female and from the male of that species in the following. False joint before the middle, surrounded by numerous long setae. Palpus exceeding proboscis from about the basal third of segment 4; ventral surface with small patches of whitish scales at base and apex of segment 4 and a few on base of segment 5; bristles more numerous and longer, on segment 3 extending from about middle of segment. Abdominal tergites with very indistinct dingy pale transverse bands sometimes developed, segments V,VI with more distinct basolateral dingy white patches.

MALE GENITALIA (fig. 28). In general as in *quinquefasciatus*, differing chiefly in the following conspicuous features. Tergite IX deeply emarginate on caudal margin between lobes which appear prominent. Subapical lobe with setae *d-f* not developed, occasionally represented by 1 alveolus; leaf (*g*) with sharply acuminate apex; accessory seta (*h*) very slender. Lateral plate without inner division; outer division complex; mesal spine very long, pointed in mesal aspect; median process with 3 or 4 strong teeth along mesal margin; dorsal process very broad, flat and rounded, projecting caudolaterad; ventral cornu a curved inner spine with ridged apical portion. Tergal lobe of basolateral sclerotization of proctiger broad and with conspicuous spicules; basal sternal process long, with widened distal part curved sternad.

PUPA (fig. 28). Chaetotaxy as figured, not studied in detail; apparently variable.

In general as in *quinquefasciatus*, differing chiefly in following conspicuous features. Trumpet not flared, pinna small. Median caudal part of abdominal sternite II with short sharp spicules. Abdominal hair 5-IV usually with 4 branches.

LARVA (fig. 26). In general as described and figured by Carpenter and LaCasse (1955:283). Differing from *quinquefasciatus* as described here in following conspicuous features. Head hairs 5,6-C usually both triple. Antenna longer, about 0.67 of head length. Thoracic integument with variable spiculation, usually with conspicuous short sharp spicules; prothoracic hair 7-P usually triple (2-4). Abdominal hair 6-I,II usually triple; 1-III-V shorter, double or triple. Segment VIII with inconspicuous spicules; comb scales in smaller, sparser patch. Siphon long and slender, index usually more than 8.0; pecten teeth usually about 12 (9-15), with several large denticles to near apex; siphonal hairs usually 4 pairs, all distad and at or above level of pecten, proximal usually long and single or double, following one shorter usually double or triple, the last 2 shorter and double or triple; median caudal process of spiracular apparatus longer. Anal saddle usually with short strong spicules which are not differentiated along caudal margin; hair 2-X sometimes with only 1 branch at base of main shaft; gills variable, from shorter than to nearly 3.0 of dorsal saddle length.

SYSTEMATICS. The unique type male of this important species is lost (Stone, 1957a:341; Belkin, 1968b:18) but we have a large series from St. Lucia, the type locality, that agrees with the current interpretation of *nigripalpus*. The Jamaican *similis* and *microsquamosus* agree in every detail with this topotypic material in all stages and we are confident that these nominal species are conspecific with *nigripalpus*. We have made no attempt to check the identity of all the other current synonyms of *nigripalpus* listed in Stone, Knight and Starcke (1959:252). This species is so clearly marked in the male genitalia (particularly IX tergite lobe and tergal lobe of basolateral sclerotization of the proctiger) that there should be no difficulty in checking the synonymies when males with associated immature stages are available for the extralimital nominal species.

BIONOMICS. Contrary to the experience of Hill and Hill (1948:56) we found *nigripalpus* to be a widespread and common species in Jamaica. It was found to utilize all types of ground water (permanent, semipermanent and temporary) including occasionally large crabholes and seaside rockholes. It may also breed occasionally in large artificial containers and was once doubtfully recorded from an epiphytic bromeliad. *Culex nigripalpus* tolerates a wide range of conditions in its breeding habitats (salinity, sunlight, organic matter, etc.) and has been found with almost every species known to utilize ground water habitats in Jamaica. It is most common in the coastal plains but is known to breed at elevations of about 480 m.

Page (1967) reports *nigripalpus* to be a common man-biting species and very readily attracted to donkey-baited and chicken-baited traps. We also found it to be attracted to light traps. St. Louis Encephalitis virus was twice isolated from *nigripalpus* in Caymanas, St. Catherine, in June 1962 and Aug 1963, and an unidentified virus in Milk River, Clarendon, in Sept 1962 (Belle, Grant and Page, 1964, L.S. Grant, personal communication).

DISTRIBUTION. Reported from many localities from the southern U.S.A. to northern Brazil and Ecuador; apparently only 1 species involved in the West Indies.

JAMAICA. Widely distributed from sea level to elevations of about 500 m. *Clarendon*: Yorks Pen (604). *Hanover*: Mosquito Cove (936). *Kingston and St. Andrew*: Duhaney Park (610). Ferry (216,736,797-799,857,896). Hermitage Dam Road (611,891,893). Kingston and vicinity, M. Grabham, 1 F [USNM]. Mona, R.B. Hill, 1 F [UCLA]. Temple Hall (49,253). U.W.I. (209,641). *St. Ann*: Delight (757). Runaway Bay, Feb 1969, W.W. Wirth, 6 M, 1 F [USNM]. *St. Catherine*:

Bog Walk (914). Browns Hall (601). Caymanas (210,211,745). Central Village (759,761). Colbeck Farm (600). Rio Cobre Dam (818); 16 Apr 1906, M. Grabham, 11 M, 10 F [USNM]. Spanish Town (34). *St. Elizabeth*: Luana (358). *St. Mary*: Annotto Bay (254,255). *St. Thomas*: Albion (804,805). Amity Hall (58). Dalvey (93,148,151). Duckenfield Hall (53,54,146). Folly Bay (104). Golden Grove (140). Grants Pen (800,814,871,872). Hampton Court (147). Holland Bay (71,72,142,143,168). Hordley Estate (62). New Pera (199). *Westmoreland*: Broughton Wharf (87). Crab Pond Bay (784). Grange Hill (132). Negril (232). Petersville (228,229,786). *Parish not Specified*: 7 Dec 1900, M. Grabham, 1 M; M. Grabham, 3 L; June 1945, G.A. Thompson, 10 M [USNM]; R.B. Hill, 1 L [USNM].

Material Examined: 1162 specimens; 246 males, 258 females, 288 larvae, 370 pupae; 215 individual rearings (58 larval, 134 pupal, 23 incomplete).

16. *Culex (C.) quinquefasciatus* Say

Figs. 4,5,33

1823. *Culex 5-fasciatus* Say, 1823:10-11. TYPE: Adults, type locality restricted to vicinity of New Orleans, Louisiana by Belkin, Schick and Heinemann (1966:4-5) [Lost]. Synonymy with *fatigans* not universally accepted, see Stone (1957:342-343).
1828. *Culex fatigans* Wiedemann, 1828:10. TYPE: Lectotype female, East Indies, collection Winthem [NMW; designation of Belkin, 1968a:68]. Synonymy with *quinquefasciatus* by Dyar and Knab (1909a:34) not universally accepted.
1909. *Culex revocator* Dyar and Knab, 1909b:256. TYPE: Lectotype male, Hope Gardens, Kingston, Jamaica, M. Grabham [USNM, 12100; designation of Stone and Knight, 1957a:55]. Synonymy with *quinquefasciatus* by Dyar (1918c:99).

For very extensive synonymy see Stone, Knight and Starcke (1959:254-256).

Culex (C.) quinquefasciatus of Dyar (1918c:99; 1922a:16-17; 1928:380-382); Carpenter and La Casse (1955:286-288); Porter (1967:38).

Culex (C.) pipiens quinquefasciatus of Stone, Knight and Starcke (1959:254-256).

Culex quinquefasciatus of Howard, Dyar and Knab (1915:345-360); Johnson (1919:423); Gowdey (1926:73); Hill and Hill (1945a:3; 1948:56); Thompson (1947:78).

Culex (C.) pipiens fatigans of Lane (1953:344-346) and authors.

Culex (C.) fatigans of Edwards (1932:208-209); Page (1967).

Culex fatigans of Theobald (1905a:27-28); Grabham (1906a:167).

Culex (C.) pipiens of Forattini (1965a:42-87); Bram (1967:90-91).

Culex pipiens of Coquillett (1906b:23).

Culex revocator of Howard, Dyar and Knab (1915:344-345); Gowdey (1926:73).

FEMALE. Wing about 3.6 mm. A medium-sized brown species with dark legs and banded abdomen; diagnostic characters as in the key. *Head*: Decumbent scales of vertex and occiput all narrow and pale tan; broad whitish scales restricted to sides and lower surface, none along orbital line above. Erect scales numerous, extending to orbital bristles, pale tan in center, dark laterally. Labium dark scaled above, pale ventrally from base to about 0.7. Palpus 3-segmented, about 0.2 of proboscis; largely dark scaled, some pale or even whitish scales sometimes on segments 2 and 3. Antenna about as long as proboscis; torus with rather long hairs and sometimes a few narrow scales; flagellar segment 1 usually with a few whitish scales near middle on inner surface. *Thorax*: Mesonotal integument uniformly brown, pleuron lighter and without darkened areas. Mesonotal scales narrow and pale brown to coppery, usually longer and paler in front, sides and prescutellar area; paratergite bare; mesonotal bristles all developed, including acrostichals on disc. Scutellum

with narrow elongate scales similar to paler scales of mesonotum. *Apn* with numerous light brown scales, elongate in upper part, broadened in lower; *ppn* with light brown to tan narrow scales in upper half, sometimes with broader scales towards lower posterior part of patch; *ppl* with small patch of broad flat whitish scales; *stp* with an upper and a lower patch of broad whitish scales; *mep* with a rather large patch of elongate broad whitish scales near middle and numerous more elongate semierect whitish scales at base of upper *mep* bristles; bristles present on *apn*, *ppn*, *ppl*, *stp*, *pra*, upper *mep* and lower *mep* (1 strong and sometimes 1 or 2 additional weaker). *Legs*: Coxae with whitish scales at base and dark ones distally. Trochanters with pale scales. Anterior and dorsal surfaces of forefemur and midfemur predominantly dark, ventral and posterior surfaces and usually apex pale; hindfemur pale at base and on lower part of anterior surface to near apex, remainder as on other legs. Knee spots inconspicuous, involving primarily base of tibiae. Tibiae predominantly dark except at base; hindtibia with a more or less conspicuous anterior apical pale-scaled spot. Tarsi dark. Posterior surfaces of tibiae and sometimes lower surface of basal tarsal segments more or less distinctly paler than upper surfaces. Claws all simple and very small, particularly on hindlegs; pulvilli distinctly developed as long spiculose lobes under each claw. *Wing*: Dorsal vein scales all dark; plume scales of veins R_2 and R_3 elongate and narrow. *Haltere*: Upper part of stem and knob with pale brown or tan scales, some darker scales on lower part of knob. *Abdomen*: Tergites predominantly dark scaled. Tergite I with small median apical patch of dark scales; laterotergite without scales. Tergites II-VII with dingy white basolateral patches and distinct dingy white, creamy or tan transverse basal bands widened in the middle and frequently not connected to basolateral patches; extent of pale scaling variable but transverse pale bands usually broad. Sternites II-VII predominantly pale scaled, sometimes with a few dark scales apically in middle of posterior segments but not forming transverse apical bands. Apex of abdomen truncate; cercus short and broad, usually not visible at rest.

MALE. Essentially as in female except for sexual characters. Labium with false joint at about 0.67 from base. Palpus 5-segmented, exceeding proboscis by about length of segment 5 or a little more; segments 4 and 5 upturned; a line of whitish scales ventrally from base of segment 4 to base of segment 5, sometimes some pale scales laterally toward apex of segment 3; apical third of segment 3 with about 12 moderately long external ventrolateral hairs; segments 4 and 5 with numerous moderately long ventrolateral and ventral bristles. Antennal flagellum densely long plumose. Claws of foreleg and midleg enlarged and unequal; longer claws with large submedian tooth, smaller claws with subbasal tooth; hindclaws as in the female, very small. Abdominal tergites with broad even basal transverse pale bands, basolateral pale patches not developed.

MALE GENITALIA (fig. 33). *Segment IX*: Tergal lobe poorly indicated, with variable number of setae, sometimes in 2 rows. *Sidepiece*: Conical; tergal surface with short setae in mesal portion; scales absent. *Subapical Lobe*: Undivided. Setae as figured; *a* and *b* heavy, *c* more slender; sternal group (*d-f*) usually 3, sometimes 4, most sternal distinctly flattened; leaf (*g*) moderately developed, apex rounded; accessory seta (*h*) slender, close to leaf. *Clasper*: Simple; moderately broad; gradually tapering in distal part. *Phallosome*: Lateral plates complex, connected by proximal and narrower distal sclerotized tergal bridges in basal part. Inner division represented by very large, broad, outwardly directed, sharply pointed sternal spine (absent in all other Jamaican species). Outer division relatively simple; with long straight acuminate mesal spine (external process of Bram, 1967); median process

relatively simple, without teeth; dorsal process (basal of Bram) short and rounded; ventral cornu in form of short broad spinelike process. In undissected phallosome, the 2 mesal spines subparallel, not diverging, so that distance between apex of mesal spine and apex of inner division (DV) on one side is usually more than 0.7 of the distance between the apices of the 2 mesal spines (D), i.e., $DV/D > 0.7$. *Proctiger*: Strongly developed. Basolateral sclerotization produced into relatively narrow glabrous tergal lobe; broadly joined to paraproct sclerotization laterally. Paraproct sclerotization broad; with variable but relatively short and straight basal sternal process arising laterally; apex with numerous large acuminate spicules extending on membrane in addition to blunt teeth. Cercal sclerite elongate, usually with 3-5 setae in distal part, all elongate.

PUPA (figs. 4,33). Chaetotaxy as figured, variable except for diagnostic features as in the key. *Cephalothorax*: Lightly to moderately pigmented, darkened on mesonotum. All hairs usually double or triple. *Trumpet*: Relatively short and flared apically; index about 5.0 or less; tracheoid darkened, extending to about 0.4 from base; pinna very long, oblique, its maximum length usually at least 0.4 of total trumpet length; meatus without "slit". *Metanotum and Abdomen*: Pigmentation uneven, moderate to strong on anterior segments, particularly in middle, light on posterior segments. Median plate of abdominal tergite I without distinct spicules. Median caudal part of sternite II without distinct short sharp spicules. Hair 10-C usually double or single; 12-C usually triple. Hair 1-III-VI usually multiple, sometimes double or triple on V-VII; hairs 2-III-VI all mesad of hair 1 and near caudal margin, 2-VII laterad of hair 1; hair 5-IV-VI usually double, rarely triple, 5-IV usually barely as long as tergite V; hair 6-III-VI usually double or triple. *Paddle*: Lightly pigmented; midrib darker and strong to near apex; external buttress indicated at base; marginal spicules not developed; both hairs (1,2-P) distinct.

LARVA (fig. 5). Chaetotaxy as figured, not studied in detail; extremely variable. Diagnostic characters as in the key. *Head*: Distinctly wider than long. Labrum distinct dorsally but rather short, truncate or at most slightly emarginate on anterior border, without projecting lobe at base of hair 1-C; ocular bulge slight; labial plate elongate; maxillary suture complete, extended caudolaterad from posterior tentorial pit to near collar; collar moderately developed; mouthbrushes filamentous; mental plate normal. Pigmentation uniformly moderate except for usual light and darkened areas. Hair 0-C a minute peg; 1-C very slender, filamentous distally; 3-C distinct; 2-C usually represented by a short sharp spicule mesad of 3-C; hairs 4-6-C at about middle of head capsule, 4-C usually single and rather long, 5,6-C usually with at least 4 branches; 8-10-C usually all branched; 11,13-C moderately long, usually double or triple; 12-C short, caudad of hair 13; hair 14-C usually more anterior than shown in figure. *Antenna*: About 0.5-0.6 of head length. Shaft moderately to strongly pigmented, sometimes lighter in middle of proximal part; width of proximal part varied, sometimes nearly 2.0 of distal; spicules strongly developed on proximal part, slender except toward hair 1-A, distal part usually without spicules. Hair 1-A large, multiple; longer than distal part of shaft. *Thorax*: Integument glabrous. Larger hairs all with conspicuous basal tubercles; common tubercles only for hairs 1-3-P, 6,7-M and pleural groups (9-12-P,M,T). Prothoracic hairs 1-3-P all single, 3-P at least 0.67 of hair 1; hairs 4,7,8-P all long and usually double; 5,6-P long and single; 13-P absent. *Abdomen*: Integument glabrous. Hair 6-I,II long, usually with 4 branches, 6-III-VI equally long or longer, usually double; 7-I long, usually double, 7-II much shorter, branched; 1-III-V usually double or single; 13-III-V usually triple. *Segment VIII*: Comb scales in a patch of 3 or 4 ir-

regular rows, all short, simple and evenly fringed on sides and apex. Hairs 1,3-VIII with basal tubercles, 2-VIII with very small basal plate. *Siphon*: Index variable, usually less than 5.0; usually more or less distinctly swollen near or before middle, apex narrowed; moderately to strongly pigmented, often with darkened base and apex; acus attached, large, with longer ventral than dorsal process. Pecten variable, usually with 8-12 teeth, distal tooth sometimes more widely spaced; larger teeth usually with 3 or 4 long basal denticles and rather short principal spine. Siphonal hairs (1,1a-S) usually 4 pairs, the proximal sometimes within pecten, all except subapical ventrad of level of pecten, subapical distinctly out of line dorsad; 2-S a short straight slender nearly apical spiniform; median caudal filament of the spiracular apparatus slender, rather long, extending slightly beyond ventrolateral valve. *Anal Segment*: Saddle complete, without acus; moderately uniformly pigmented; without distinct differentiated marginal spicules. Hair 1-X moderately long, usually single; 2-X usually double or triple. Ventral brush with 6 pairs of hairs all on strongly developed grid with lateral bar attached to saddle. Gills unequal, dorsal usually markedly longer than ventral, usually distinctly longer than dorsal saddle length.

SYSTEMATICS. Both the nomenclature and the taxonomy of the ubiquitous Southern House Mosquito are highly controversial matters to this day. We follow Stone, Knight and Starcke (1959:254) in using the name *quinquefasciatus* but treat it as a full species instead of a subspecies of *pipiens*.

This species is not indigenous to Jamaica or to the New World as a whole but was probably introduced from Africa. The Jamaican population does not appear to present any striking peculiarities.

Culex quinquefasciatus is an extremely variable species but on Jamaica it can be readily separated in all stages except the pupa from all the indigenous forms by the key characters. The male genitalia are particularly diagnostic, especially in the presence of the characteristically developed inner division of the lateral plate of the phallosome, which in our opinion is not homologous with the ventral cornu of the outer division as interpreted by Bram (1967:91).

BIONOMICS. The breeding sites of *quinquefasciatus* in Jamaica are as elsewhere in the tropical, subtropical and warm temperate regions of the world. They are almost invariably domestic and peridomestic and range from small artificial containers to extensive polluted ground waters.

The females bite man primarily after dusk, indoors or near buildings where they rest during the day. They are seldom collected on human bait away from habitations but have been caught in some numbers in chicken-baited traps in such situations (Page, 1967). *Culex quinquefasciatus* is the dominant vector of nocturnal periodic Bancroftian filariasis in urban and suburban situations.

DISTRIBUTION. Widespread through the tropical, subtropical and warm temperate regions of the world, at low or moderate elevation.

JAMAICA. Found throughout the island at low and moderate elevations, primarily in association with man; does not seem to be present at elevations above 800 m.

Material Examined: 753 specimens; 114 males, 109 females, 269 larvae, 261 pupae; 173 individual rearings (66 larval, 87 pupal, 20 incomplete).

Subgenus MELANOCONION

Adults of this subgenus can be separated from other subgenera of *Culex* in Jamaica by the small size, the presence of broadened plume scales on at least the

distal part of veins R_2 and R_3 , and the absence of acrostichal bristles on the disc of the mesonotum. In the male genitalia the paraproct has only a single row of elongate teeth and the subapical lobe of the sidepiece is divided into proximal and distal parts. The larvae have prothoracic hair 3-P much shorter than 1-P and the caudolateral border of the anal saddle lacks long spinelike spicules. The pupae are readily recognized by the narrow slit in the meatus of the trumpet and the position of abdominal hair 2-VI usually laterad of hair 1.

As indicated under *pilosus*, we do not consider *Mochlostyrax* as a subgenus distinct from *Melanoconion*. In this broader sense, *Melanoconion* is represented in Jamaica by at least 7 described species and 1 undescribed form (sp. 22) which may prove to be a distinct species. The current knowledge of the subgenus as a whole does not permit a satisfactory internal classification but the Jamaican species appear to fall into 5 more or less natural groups: (1) *atratus*, the type species of the subgenus and the dominant species on the island; (2) *opisthopus*; (3) *erraticus*, *iolambdis*, *inhibitor* and sp. 22; (4) *pilosus*; and (5) *panocossa*, formerly reported as *aikenii*. It is possible that 2 species are represented in our limited material of *iolambdis*. Three other names have been applied recently to Jamaican *Melanoconion*: *taeniopus* of authors and *annulipes* of Belkin (1969a) both refer to *opisthopus* in our present treatment, and *flabellifer* of authors is *inhibitor*.

The Jamaican fauna of *Melanoconion* has not been adequately sampled and it is very probable that several other species will eventually be found on the island. The following species recorded from elsewhere in the Greater Antilles should be looked for especially: (1) *carcinophilus* Dyar & Knab, 1906 from Hispaniola (Dominican Republic and Haiti); (2) *mulrennani* Basham, 1948 from Florida and Cuba, found also on Grand Cayman; and (3) *peccator* Dyar & Knab, 1909 from eastern U.S.A., Mexico and Puerto Rico. These have not been included in the keys but can be identified readily by comparison of the male genitalia with the figures in Rozeboom and Komp (1950).

The only suggestion of endemism at the specific level in *Melanoconion* in Jamaica is in the case of species 22, which is very doubtful however, since the 2 larvae of this form may be nothing more than aberrant individuals of *inhibitor*. Three of the species (*atratus*, *erraticus* and *pilosus*) have been reported to have very wide distributions extending to Brazil, and 4 (*opisthopus*, *iolambdis*, *inhibitor* and *panocossa* [as *aikenii*]) have reported ranges extending southward to Panama or Colombia. However, the Jamaican populations for which immature stages are known (all but *panocossa*) show at least a suggestion of local differentiation. We have made no attempt to evaluate this because of lack of extralimital material or the great complexity of the problem owing to the considerable individual variation in the Jamaican and other populations.

Most species of *Melanoconion* are difficult or nearly impossible to differentiate as preserved females except as to groups, characterized chiefly by the type of scaling of the vertex of the head and the plume scales of the wing veins. However, it appears that in some species at least, fresh females show characteristic integumentary thoracic coloration or pleural spotting which may be useful in differentiation.

The descriptions and recognition of most species of *Melanoconion* have been based primarily on the male genitalia, often without association either with the female or the immature stages. Although in general, male genitalic differences are excellent diagnostic features, little attention has been paid to the considerable individual variation which is evident in many of these characters and difficulties may

be encountered in relying exclusively on slight genitalic differences in recognizing new forms. As pointed out by Rozeboom and Komp (1950), careful dissection and uniform orientation of the mounts of the lateral plate of the phallosome are essential to determine its features. In our brief descriptions of the **lateral plate** we are using the following terminology: (1) **basal part**, consisting of the so-called "hook" which is nothing more than the heavily sclerotized outer tergal rim of the remaining membranous proximal part of the plate; the width of the "hook" shows considerable individual variation; the apex of the hook projects sternad; (2) **distal part**, which is sclerotized throughout and shows the most useful taxonomic and diagnostic features; this is the part which projects caudad in the undissected genitalia; it frequently shows a curved spine at base near the sternal margin of the basal part and its outer part is variously developed into spines or denticulate processes; all of these features are subject to considerable individual variation. The ninth tergite lobe is frequently characteristically developed in a given species but again it is subject to much individual variation. In the **subapical lobe** of the sidepiece the **proximal division** may have either stout rods or sinuous setae; in the **distal division** there are typically in order from the base, 1 large *hooked seta*, 1 *short saber* (varied in width); 1 *long saber* (also varied), 3 closely appressed *foliforms* (variously flattened setae), and frequently a conspicuous straited "*leaf*" whose position is varied. Our terminology for the **clasper**, which shows very useful group as well as diagnostic characters, is indicated in fig. 48.

Many species of *Melanoconion* appear to have highly specialized breeding sites and their immature stages are still poorly known and apparently not always correctly associated in spite of the excellent pioneer studies of Foote (1952; 1954). Although we find a great deal of individual variation in the larval and pupal chaetotaxy in the Jamaican species, there is no difficulty in separating the different species except possibly *inhibitor* and *iolambdis*. However, since additional species of *Melanoconion* are probably present on Jamaica, identification must be based in all stages on careful comparison with the descriptions and illustrations and not on key characters alone.

17. *Culex* (Mel.) *atratus* Theobald

Figs. 35,36

1901. *Culex atratus* Theobald, 1901b:55-57. TYPE: Lectotype male with attached genitalia mount, Ferry Swamp (St. Catherine), Jamaica, 8 Feb 1900, M. Grabham [BM; designation of Belkin, 1968b:13].
1909. *Culex falsificator* Dyar and Knab, 1909b:257-258. TYPE: Lectotype male (408) with genitalia slide, La Habana, Cuba, 15 Feb 1904, J.R. Taylor [USNM, 12108; designation of Stone and Knight, 1957a:49-50]. Synonymy with *atratus* by Bonne and Bonne-Wepster (1925:268).
1938. *Culex advieri* Senevet, 1938:185-187. TYPE: Holotype male (234) on slide with dissected genitalia, associated pupal skin on another slide, Prise d'Eau de Pointe-a-Pitre, Guadeloupe, 27 Aug 1936, G. Senevet [FMP; see Belkin, 1968b:12]. Synonymy with *atratus* by Rozeboom and Komp (1950:87).

Culex (*Melanoconion*) *atratus* of Dyar and Ludlow (1921:47); Dyar (1923d:187; 1928:338-339); Bonne and Bonne-Wepster (1925:268); Edwards (1932:214); Matheson (1944:216-217); Carpenter, Middlekauff and Chamberlain (1946:260-262); Rozeboom and Komp (1950:87); Lane (1953:473-474); Foote (1952; 1954:21-23); Carpenter and LaCasse (1955:303-305); Perez

Vigueras (1956:400-403); Stone, Knight and Starcke (1959:266); Montchadsky and Garcia (1966:45); Porter (1967:39); Page (1967).

Culex atratus of Howard, Dyar and Knab (1915:388-390); Johnson (1919:423); Gowdey (1926:73); Hill and Hill (1945a:2; 1948:52-53); Thompson (1947:78).

Melanoconion atratus of Theobald (1903a:239; 1905a:28-29; 1905b:32; 1910:456); Dyar (1905b:49, designation as type species); Grabham (1905:403,404); Coquillett (1906b:24).

Culex falsificator of Howard, Dyar and Knab (1915:425-426).

FEMALE. Wing about 2.3 mm. Small dark species with dark tarsi and head without a complete border of broad scales behind eyes. *Head*: Decumbent scales narrow and pale in broad central area from occiput to orbital margins; broad scales grayish, largely restricted to lateral patch which is extended dorsally a short distance along orbital margin to about level of second upper orbital bristle. Erect scales dark, numerous, extending on vertex. Labium dark scaled. Palpus 3-segmented, dark scaled; about 0.2 of proboscis. Antennal torus with a few short setae on mesal surface. *Thorax*: Mesonotal integument blackish brown; scales narrow, dark bronzy; paratergite bare. Mesonotal bristles all strongly developed except acrostichals which are absent caudad of anterior promontory; 2 posterior fossals present; parascutellar bristle very weak. Scutellar lobes with narrow dark scales. Pleural integument largely blackish brown with gray pruinose areas, *mep* with upper and lower blackish spots; scales absent except narrow bronzy on upper *ppn* and broad translucent whitish in upper *stp* and a line of similar scales on lower posterior *stp*; 1 lower *mep* bristle present. *Legs*: Dark scaled except for usual pale scaling of femora, narrowly at base on anterior surface, along ventral line and most of posterior surface. *Wing*: Dorsal scales all dark; plume scales distinctly broadened on at least distal parts of veins R_2 and R_3 . *Haltere*: Stem largely pale, knob dark scaled. *Abdomen*: Tergite I with dorsal patch of dark scales, laterotergite without scales. Tergites II-VII dark scaled except for basolateral white patches which are usually narrowly extended dorsad basally on V-VII but do not form transverse bands. Sternites II-VII white at base, dark apically.

MALE. Essentially as in female except for sexual characters. Palpus exceeding proboscis from at least basal 0.5 of segment 4; dark scaled except for a few pale scales at base ventrally on segment 4 and sometimes also segment 5; apex of segment 3 and all of 4 with numerous long bristles, segment 5 with shorter bristles. Antennal flagellum densely long plumose. Claws of foreleg and midleg enlarged, unequal; larger claws with submedian tooth, smaller claws with small subbasal tooth.

MALE GENITALIA (fig. 35). *Segment IX*: Tergite lobe prominent; basal part with distally barbed setae; distal part pointed laterad, bare. *Sidepiece*: Outer margin convex, inner concave; mesal membrane not developed except at base. Outer part of tergal surface with numerous setae of varied sizes; scales at base of outer part of tergal surface and laterally. Subapical lobe conspicuously divided, with several (usually 4-6) specialized flattened setae with expanded curved sharply pointed apex between divisions; proximal division prominent, with apical heavy rod, submedian smaller thinner rod and numerous simple short setae at base; distal division less prominent, with 1 broad truncate leaf, 1 long hooked seta and 3 short foliiform setae. *Clasper*: Simple; broad at base, distal part slender, uniform in width and smoothly curved on outer margin; spiniform small. *Phallosome*: Lateral plate with basal hooklike marginal sclerotization directed sternad; distal part in form of a very long heavy sternal spine. *Proctiger*: Basolateral sclerotization broad, with tergal projection not forming a prominent lobe, and with a free sternal process. Paraproct sclerotization narrow, not continuous with basolateral sclerotization; apex

with only a single row of elongate teeth, without spicules; cercal setae usually 2.

PUPA (fig. 35). Chaetotaxy as figured, not studied in detail; apparently quite variable. *Cephalothorax*: Pigmentation uneven, moderate to strong. All hairs usually branched. *Trumpet*: Long and narrow, not distinctly flared apically; index about 8.5 or greater; tracheoid darkened, extending to nearly 0.5 from base; pinna long, continued into meatus as a narrow slit with sclerotized parallel walls about 0.5 of pinna length. *Metanotum and Abdomen*: Pigmentation uneven, moderate to strong, usually darkened on anterior segments and sometimes posterior. Hair 10-C usually with 6-10 branches, rarely dendritic; 11-C usually single, longer than 10-C; hair 12-C usually triple. Hair 1-III-VI multiple; 2-III-V mesad of hair 1; hair 2-VI,VII usually laterad of hair 1; hair 5-IV-VI shorter than tergite following, usually multiple, 5-VI usually with at least 4 branches; 6-III-VI usually with at least 4 branches; 9-VII cephalad of hair 6, usually double or triple; 9-VIII inserted on ventral surface distinctly cephalad of caudolateral angle, usually with 3 or 4 branches; 1-IX distinct, single. Caudolateral angle of tergite VIII rounded or slightly produced but not forming a spine; caudal margin of tergite VIII with slight lobe which does not overlie lateral margin of tergite IX. *Paddle*: Lightly pigmented; midrib strong to near apex; external buttress developed at base only; margins without distinct spicules. Hair 1-P moderate, single; 2-P usually very weak.

LARVA (fig. 36). Chaetotaxy as figured, not studied in detail; apparently variable. In general as described by Foote (1952; 1954:21-23), except as noted. *Head*: Wider than long. Labrum distinct dorsally, concave on anterior border between bases of hair 1-C; ocular bulge distinct; labial plate elongate; maxillary suture complete, extended caudad from posterior tentorial pit to near collar; collar very poorly developed, represented by slight marginal thickening; mouthbrushes filamentous. Pigmentation moderate to strong, uniform except for usual lighter areas. Hair 0-C a minute peg; 1-C thick and dark but without subbasal broadening shown by Foote (1952, fig. 14; 1954, fig. 6j); hairs 2,3-C absent; 4-6-C in posterior part of head capsule, 4-C single or apically forked, 5-C short, multiple, 6-C very long, single; 8-10-C all branched; 13-C double or forked, near level of 11-C; hair 14-C double, anterior. *Antenna*: Slightly shorter than head capsule. Shaft lightly pigmented and with thin spicules in curved thicker part basad of hair 1-A; distal part thinner, straighter and darkly pigmented, with a few heavier shorter spicules. Hair 1-A very large, multiple. *Thorax*: Integument with stiff thin spicules. Larger hairs all with conspicuous basal tubercles; common tubercles only for hairs 1-3-P and pleural groups (9-12-P,M,T). Prothoracic hairs 1,2-P long and single, 3-P short and multiple; 4-P usually double; 5,6-P single; 7-P usually triple or with 4 branches; 8-P usually double; 13-P absent. *Abdomen*: Integument glabrous; tergite IV pale in life; others dark. Hair 6-I,II long, usually double, 6-III shorter, usually with 4 branches, 6-IV-VI usually triple; 7-I long and single, 7-II-VI short and branched; 1-IV-VI usually with 4 or 5 branches, rarely with more or fewer. *Segment VIII*: Comb scales in a patch of 3 or 4 irregular rows, those of posterior row longer, with spatulate fringed apex; hair 2-VIII on large sclerotized basal plate, 3-VIII at end of long sclerotized plate. *Siphon*: Long and slender, index about 12.0-14.0; moderately pigmented, somewhat darker near middle; acus attached, with long dorsal extension. Pecten usually composed of about 16-20 teeth in basal 0.3 or less; distal 2 or 3 teeth more widely spaced; longer teeth fringed as in figure. Siphonal hairs (1,1a-S) conspicuously differentiated into subventral and subdorsal; subventral hairs usually 5 pairs, all distal to pecten, usually with 5-3 branches, most distal smaller and usually double or triple; subdorsal hairs always 3 pairs, usually double or single;

2-S inserted in membrane near base of dorsolateral valve, only slightly recurved and with very thin straight subbasal branch. *Anal Segment*: Saddle complete, without acus; darker than siphon; caudolateral area with conspicuous sharp marginal spicules, grading into smaller spicules basad. Hair 1-X short and branched; 2-X usually with 3 short to moderate branches from base of main shaft; 3-X single; ventral brush with 5 pairs of hairs on grid which is attached to saddle margin by lateral bar. Gills pointed, less than 0.5 of dorsal saddle length.

SYSTEMATICS. The Jamaican population of *atratus* is the topotypic one as Belkin (1968b:13) restricted the type locality to Jamaica by designating the lectotype. This species was designated as the type species of *Melanoconion* by Dyar (1905b:49).

We have made no attempt to determine whether the widespread populations (Florida to Brazil) currently regarded as *atratus*, primarily on the basis of the characteristic male genitalia, are actually conspecific with the Jamaican population. There appears to be at least regional differentiation in the immature stages, particularly in the larva, judging by the descriptions and figures in Foote (1954:21-23) which do not agree with the Jamaican population. The Florida population as described and figured by Carpenter and LaCasse appears to be very similar to the Jamaican.

Although there is considerable variation in all stages of Jamaican *atratus*, there is no difficulty in differentiating this dominant species from all the other local species of *Melanoconion*.

BIONOMICS. The immature stages of *atratus* are most commonly found in Jamaica in more or less permanent bodies of water such as ponds, stream margins, ditches and swamps with plentiful vegetation such as grass, reeds and algae. This species tolerates some brackishness but prefers fresh water partially shaded from the sun. The most common associates of *atratus* are *Anopheles (N.) albimanus* and *Anopheles (A.) grabhamii*; less common associates are *Culex (C.) nigripalpus*, *Uranotaenia socialis* and *U. cooki*.

Previous authors (Grabham; Theobald; Hill and Hill) have reported *atratus* to be a major pest or nuisance to man. Page (1967), however, found only a few females attracted to human bait. *Culex atratus* has been collected in donkey-baited traps and light traps and has been found resting in crabholes along with *Deinocerites cancer*, *Culex (C.) janitor* and *Culex (Mel.) opisthopus*.

DISTRIBUTION. Reported to be widespread from the Florida Keys in the U.S.A. southward through the Antilles, Panama, Trinidad, the Guianas to Brazil; probably a complex of species. Apparently one form in the Greater Antilles, Cayman Islands, Virgin Islands and northern Lesser Antilles.

JAMAICA. Very common and widely distributed in the lowland swampy areas; highest collection made at 300 m. *Hanover*: Bulls Bay (717). *Kingston and St. Andrew*: Ferry (701,719,720,769,781,797,798,898,899). Kingston and vicinity, 1901, M. Grabham, 1 M, 1 F [USNM]. Temple Hall (47). *St. Ann*: Drax Hall (609). *St. Catherine*: Caymanas (29,30,33,213,744,862). Central Village (759). Gregory Park (18). Naggo Head (10). Passage Fort (13). Port Henderson (6). Tamarind Farm (25). *St. Mary*: Castleton Botanical Gardens (807). *St. Thomas*: Grants Pen (75-77,414,813,814,816,871). Roselle (727). Winchester House (67). *Westmoreland*: Crab Pond Bay (785). Negril (86). *Parish not Specified*: G.A. Thompson, 1 L, 1 P; June 1945, G.A. Thompson, 1 M [USNM]; R.B. Hill, 2 M, 6 L [JAM]; 1943, R.B. Hill, 1 M [UCLA].

Material Examined: 504 specimens; 73 males, 71 females, 210 larvae, 150 pupae; 119 individual rearings (33 larval, 66 pupal, 20 incomplete).

18. *Culex* (Mel.) *opisthopus* Komp

Figs. 37,38

1907. *Melanoconion annulipes* Theobald, 1907:512-513. TYPE: Holotype female, Red Hills, Jamaica, M. Grabham [BM]. Rejected as junior secondary homonym of *Culex annulipes* Meigen, 1830 [now *Aedes* (*O.*) *annulipes*] by Edwards (1932:213).
1926. *Culex* (*Choeroporpa*) *opisthopus* Komp, 1926:44-45. TYPE: Lectotype male (2177) with genitalia slide, Puerto Castilla, Honduras, Mar 1925, W.H.W. Komp [USNM; designation of Stone and Knight, 1957a:54]. Synonymy with *annulipes* by Belkin (1969b:68).
1928. *Culex* (*Mochlostyrax*) *mychonde* Komp in Dyar, 1928:295. TYPE: Holotype male genitalia slide, Almirante, Panama, 1 Feb 1928, W.H.W. Komp [USNM]. Synonymy with *opisthopus* by Komp (1935:3-4) who disclaimed authorship of description in Dyar.
1968. *Culex* (*Melanoconion*) *cedecei* Stone and Hair, 1968:49-41. TYPE: Holotype male with associated larval and pupal skins, progeny of female collected at Mahogany Hammock (Dade Co.), Florida, U.S.A., 21 June 1967 [USNM, 69792]. Synonymy with *annulipes* by Belkin (1969a:27).

Culex (*Melanoconion*) *opisthopus* of Edwards (1932:213); Komp (1935:3-4); Pratt, Wirth and Denning (1945:245-251); Rozeboom and Komp (1950:94); Lane (1953:403-405); Foote (1954:77-79, in part); Carpenter and LaCasse (1955:310-311); Porter (1967:39); Belkin (1969b:68).

Culex (*Mochlostyrax*) *opisthopus* of Dyar (1928:294-295).

Culex (Mel.) *annulipes* of Belkin (1969a:26-28); Galindo (1969:87, with subspecies *annulipes*, *cedecei* and *opisthopus*).

Culex annulipes of Howard, Dyar and Knab (1915:258); Johnson (1919:422); Gowdey (1926:73).

Culex (Mel.) *mychonde* of Edwards (1932:213).

Culex (*Mochlostyrax*) *mychonde* of Dyar (1928:295).

Culex (Mel.) *taeniopus* in part of Edwards (1932:213); Rozeboom and Komp (1950:97); Lane (1953:402-403); Stone, Knight and Starcke (1959:275); Forattini (1965a:184-185); Porter 1967:39, in toto).

Culex (*Mochlostyrax*) *taeniopus* in part of Dyar (1928:293-294).

Culex taeniopus of Hill and Hill (1945a:3; 1948:57); Thompson (1947:78).

Culex (Mel.) *cedecei* of Hair (1968:425-427).

FEMALE. Wing about 2.5 mm. A small dark species with hindtarsus narrowly banded with white on segments 1-4, and segment 5 largely light gray to white. In general as in *atratus*, with following conspicuous differences. Decumbent scales of vertex and occiput of head all narrow, dark in middle, grayish to white laterally; broad decumbent scales grayish to white, restricted to sides. Sometimes 1-3 additional lower *mep* bristles present. Hindtarsal segment 1 with or without a few pale scales at base; variable, usually narrow, complete or incomplete white rings on base of segments 2-4 involving apex of preceding segment; apex of segment 4 with narrow apical white ring or dorsal band; segment 5 varying from largely white to gray, frequently darkened ventrally. Wing with broader plume scales on veins R₂ and R₃.

MALE. Differing from *atratus* in same features as female. Palpus slightly longer than in *atratus*; with more distinct patches of pale scales at base of segments 4 and 5; apex of segment 3 with only a few shorter bristles; segment 4 with less numerous bristles. Abdominal tergites II-VII with conspicuous rather broad basal white bands, nearly joining basolateral white patches on distal segments.

MALE GENITALIA (fig. 37). In general as in *atratus*; with following diagnostic features. Lobes of tergite IX closely approximated, fingerlike, long, distal part wrinkled, setae very fine and short. Tergal setae and scales of sidepiece less numerous. Divisions of subapical lobe approximated; proximal division entire, with 2 deeply inserted sinuous apical setae; distal division with elongate stem, 1 long sinuous hooked seta, 1 long thick narrow asymmetrically truncate leaf, 1 long thin saber, 1 short saber and 3 narrow foliforms. Clasper with postmedian wrinkled crest and apical snout on outer margin; spiniform broad. Distal part of lateral plate of phallosome with tergal apicolateral angle produced into a short spine. Basolateral sclerotization of proctiger with large free rounded tergal lobe, connected by narrow sclerotized process to base of paraproct sclerotization.

PUPA (fig. 37). Chaetotaxy as figured, not studied in detail; apparently variable. In general as described for *atratus* and with following diagnostic features. Pigmentation uniform, moderate to strong. Cephalothoracic hair 6-C usually single; 11-C usually double. Trumpet more slender, index about 10.0 or slightly more, tracheoid to slightly beyond 0.5; pinna shorter, including slit about 0.2 of total length. Abdominal hair 3-I usually double; 1-III-V with fewer branches; 5-IV-VI shorter and usually with fewer branches, 5-VII weak, usually forked; 6-III-VI usually double, 6-VII usually closer to hair 9; hair 9-VII weaker, usually double or single; 9-VIII inserted at or very near caudolateral angle, weaker, usually double or single. Paddle more strongly pigmented, especially midrib.

LARVA (fig. 38). Chaetotaxy as figured, not studied in detail; apparently variable. In general as in *atratus* but with following conspicuous differences; agreeing with the description and figures of *opisthopus* in Carpenter and LaCasse (1955: 311) but not in Foote (1954:77-79). *Head*: More rounded, narrower and with inconspicuous ocular bulge; uniformly moderately to strongly pigmented; hair 3-C present, minute, in line with hair 5; hairs 4-6-C more anterior; 5-C longer; 6-C much longer, extending beyond apex of antennal shaft; 12-C more anterior; 13-C multiple. *Antenna*: Shaft uniformly moderately to strongly pigmented from base to apex. *Thorax*: Integument glabrous; hair 8-P usually triple. *Abdomen*: Tergite IV not distinctly paler than others; hair 6-I,II usually double, 6-III-VI usually with 4 or more branches; 7-I usually double. *Segment VIII*: Sclerotized plates of hairs 2,3-VIII smaller. *Siphon*: Longer and thinner, index usually more than 17.0; pecten teeth usually less than 12, in basal 0.2 or less, fringes finer and absent from base; subventral hairs usually 4 pairs, rarely 3, much shorter, usually triple or double; subdorsal hairs only 2 pairs, the proximal usually double and distad of last subventral hair, the distal single and removed from apex of siphon by less than its length; hair 2-S more curved and with submedian branch; spiracular apparatus with long median caudal filament. *Anal Segment*: Caudal margin of saddle without sharp spinelike spicules; hair 2-X sometimes with 5 basal branches in addition to main shaft; gills more than 0.5 of dorsal saddle length.

SYSTEMATICS. Until recently the Jamaican *annulipes* had been considered conspecific with *taeniopus* following the tentative synonymy by Dyar (1928:294). This synonymy was accepted by Edwards (1932:213) and later by Stone, Knight and Starcke (1959:275) although Rozeboom and Komp (1950:97) suggested that *annulipes* was probably conspecific with *opisthopus*. Belkin (1969a:26-28) found the male genitalia of topotypic *opisthopus* from Honduras to be similar to those of *annulipes* from Jamaica and Grand Cayman and to *cedecei* from Florida. Because of the similarity in the immature stages of *cedecei* and Jamaican *annulipes* he synonymized these 2 nominal species and tentatively assigned the Grand Cayman pop-

ulation to the same species for which he incorrectly used the name *annulipes*. Later Belkin (1969b:68) found that the name *annulipes* was invalid because it had been rejected as a junior secondary homonym prior to 1961 (by Edwards, 1932:213) and provisionally applied the next available name, *opisthopus*, to the populations from Jamaica, Grand Cayman and Florida.

The taxonomic status of the *opisthopus* complex is by no means settled. Galindo (1969:84-85,87) considers the Jamaican form to be subspecifically distinct from *cedecei* from Florida and from *opisthopus* from Central America and Panama, apparently primarily on differences in the amount of light scaling on the hindtarsi and unspecified slight differences in the subapical lobe of the male genitalia of *cedecei* from Florida and *mychonde* from Panama. Since topotypic *opisthopus* from Honduras is still known only in the adult stage the problem cannot be definitely resolved and we prefer not to recognize subspecies at this time and are retaining the populations from Jamaica, Grand Cayman and Florida under *opisthopus*.

As indicated by Belkin (1969a:28) and in the description and illustrations of the larva here, Foote's (1954:78) illustration of the terminal segments of the larva of *opisthopus* does not agree with the material from Jamaica and Florida. This may be due to incorrect association of the stages or possibly the presence of a different species in Puerto Rico.

The association of the stages of the Jamaican population was obtained through progeny rearings of several females but the immature stages were not found in nature.

BIONOMICS. The breeding sites of *opisthopus* are unknown in Jamaica but are probably in underground solution pools in coral limestone as in Florida. A few males have been collected resting in crabholes. Females are readily attracted to human bait near sunset and will also come to light traps. A few females were found resting in dense vegetation along the edge of a large swamp at the foot of coralline hills.

Immature stages of *opisthopus* from Jamaica were obtained by rearing eggs produced by females blooded on humans in the field. Development, as in the case of the population from Florida (Hair, 1968), was very slow and survival was favored by relatively low temperatures.

DISTRIBUTION. As tentatively interpreted here (see systematics), *opisthopus* in a broad sense is known from Florida, Puerto Rico, Jamaica, Grand Cayman, British Honduras, Honduras and Panama.

JAMAICA. From near sea level to about 150 m. *Kingston and St. Andrew*: Ferry (719). *St. Elizabeth*: Luana (357,358). Maggoty (793). *St. Thomas*: Grants Pen (718,874-876).

Material Examined: 286 specimens; 7 males, 214 females, 50 larvae, 15 pupae; 4 individual rearings (3 larval, 1 pupal).

19. *Culex* (Mel.) *erraticus* (Dyar & Knab)

Figs. 42,43

1906. *Mochlostyrax erraticus* Dyar and Knab, 1906c:224. TYPE: Lectotype larval skin, mounted with 2 others on 1 slide, Baton Rouge, Louisiana, U.S.A., J.W. Dupree [USNM; designation of Stone and Knight, 1957a:49].

For extensive current synonymy see Stone, Knight and Starcke (1959:270-271).

Culex (*Melanoconion*) *erraticus* of Dyar and Knab (1918:179, in part); Edwards (1932:214, in

part); King and Bradley (1937:345-349); King, Bradley and McNeel (1944:44); Matheson (1944:215-216); Carpenter, Middlekauff and Chamberlain (1946:262-265); Rozeboom and Komp (1950:91); Lane (1953:492-495); Foote (1954:51-54); Carpenter and LaCasse (1955:305-307); Perez Viguera (1956:404-409); Montchadsky and Garcia (1966:45); Porter (1967:39).

Culex (Mochlostyrax) erraticus of Dyar (1928:399-300, in part).

Culex (Choeroporpa) erraticus in part of Dyar (1922a:12).

Culex erraticus of Matheson (1929:172-173, in part); Hill and Hill (1945a:3; 1948:54); Thompson (1947:78).

FEMALE. Jamaican material in alcohol. Probably differing from *atratus* as in North American populations in a larger size and following features. Narrow decumbent scales of head restricted to occiput and posterior part of vertex; broad decumbent scales largely grayish or whitish forming a complete anterior band on vertex. Mesonotal integument lighter; scaling predominantly coppery to dark golden in anterior part and scutellar lobes; pleural integument brown, broad scales whiter and more numerous on *stp* patches and present also in a large patch in middle *mep*; parascutellar bristle strong.

MALE. Wing about 2.5 mm. Differing from *atratus* by the characters as given above for female. Palpus apparently a little shorter than in *atratus* and without pale scales on base of segment 4.

MALE GENITALIA (fig. 43). In general as in *atratus*; with the following diagnostic features. Lobe of tergite IX oval in outline. Divisions of subapical lobe approximated; proximal division with 2 arms, basal shorter, each with 1 long apical sinuous seta; distal division essentially as in *opisthopus* but leaf very broad and very conspicuous and foliform broad. Clasper with snout and spiculelike transverse ridges proximad of it on external margin. Distal part of lateral plate of phallosome as figured. Basolateral sclerotization of proctiger with conspicuous broad free dorsal lobe.

PUPA (fig. 43). Chaetotaxy as figured, not studied in detail; apparently variable. In general as described for *atratus* and with following diagnostic features. Trumpet shorter, index about 6.0 or slightly greater; moderately pigmented except for darkened tracheoid; pinna longer, including slit about 0.4-0.5 of total length. Abdominal hair 5-V,VI usually double and distinctly longer than tergite following; 6-VI usually triple or with 4 branches; 9-VII stronger, usually triple or with 4 branches, 9-VIII stronger and usually with at least 4 branches. Caudolateral angle of tergite VIII produced into a sharp caudal spine.

LARVA (fig. 42). In general as described and figured by Foote (1954:51-54) and Carpenter and LaCasse (1955:305-307). Differing from *atratus* as described here in the following conspicuous features. Head pigmentation very light; hair 1-C shorter; 14-C multiple, submedian. Prothoracic hair 4-P single. Abdominal integument with thin hairlike spicules; hair 6-I,II usually double or triple, 6-III-VI triple or with 4 branches. Comb scales in 2 irregular rows, with long spinelike shaft fringed in basal part only; hair 2-VIII without sclerotized basal plate. Siphon shorter, slightly upturned distally, lightly pigmented; index about 6.0-7.0; pecten teeth about 12-16, more evenly spaced and with more distinctly differentiated apical spine on distal teeth; subventral hairs longer and with more branches especially in distal 2; subdorsal hairs only 2 pairs, usually triple; hair 2-S much stronger and longer, very strongly recurved and usually without basal branch. Saddle lightly pigmented, with conspicuous hairlike spicules in distal part in addition to larger marginal spinelike spicules; hair 2-X usually with only 1 branch at base of main shaft;

ventral brush with 6 pairs of hairs.

SYSTEMATICS. The limited material from Jamaica agrees in general with topotypic *erraticus* from the southern United States and is probably conspecific with it. We have made no attempt to compare this material with the widespread populations (Mexico through Brazil) currently regarded as *erraticus*.

BIONOMICS. We found immature stages of *erraticus* only twice, in a ditch in a swamp (77) and a large stream bed pool (728). In the first instance *erraticus* was associated with *Anopheles (N.) albimanus*, *Uranotaenia socialis* and *Culex (Mel.) atratus*; in the second it was found alone.

This species is apparently rare in Jamaica and nothing is known of the habits of the adults on this island.

DISTRIBUTION. Reported to be widespread from the eastern and central United States southward through Central America and the West Indies to Colombia and Brazil.

JAMAICA. *St. Thomas*: Grants Pen (77). Roselle (728). *Parish not Specified* (probably Clarendon): R.B. Hill, 2 M [JAM]; Feb 1945, G.A. Thompson, 1 L [USNM]; Dec 1945, G.A. Thompson, 2 M, 1 F [UCLA].

Material Examined: 20 specimens; 7 males, 1 female, 7 larvae, 5 pupae; 5 individual rearings (3 larval, 2 incomplete).

20. *Culex (Mel.) iolambdis* Dyar

Figs. 39,41

1918. *Culex (Choeroporpa) iolambdis* Dyar, 1918:106-107. TYPE: Holotype male, Panama, A. Busck [USNM, 21603].

Culex (Melanoconion) iolambdis of Edwards (1932:216); Rozeboom and Komp (1950:92); Pratt and Seabrook (1952:27-32); Lane (1953:471-472); Foote (1954:61-63); Carpenter and La Casse (1955:307-308); Stone, Knight and Starcke (1959:272); Montchadsky and Garcia (1966:45); Porter (1967:39).

Culex (Mochlostyrax) iolambdis of Dyar (1925c:175; 1928:329).

FEMALE. Jamaican material consisting of a single slide-mounted female. Probably differing from *inhibitor* as in the male in the following features. Narrow decumbent scales of head restricted to occiput; broad decumbent scales all dark, even on orbital line, except in lateral grayish patch. Mesonotal integument blackish brown; scales darker. Pleural integument uniformly blackish brown; *ppn* scales less numerous; broad scales of *stp* not as distinctly pale. Femora almost completely dark, with only slightly paler ventral line, posterior surface dark.

MALE. Wing about 2.0 mm. Differing from *inhibitor* by the darker coloration as indicated above under female. Palpus as in *inhibitor* except that bristles on segment 4 more numerous and longer.

MALE GENITALIA (fig. 39). Differing from *atratus* by same general features as *erraticus* and distinguished from the latter chiefly by the following. Lobe of tergite IX rounded in outline. Proximal division of subapical lobe not split, the 2 setae arising far apart; leaf of distal division resembling a foliform. Distal part of lateral plate of phallosome with 2 or 3 small apical denticles and a strong subapical lateral spine.

PUPA (fig. 39). Chaetotaxy as figured, not studied in detail; apparently variable.

In general as described for *atratus* and with following diagnostic features. Pigmentation usually deeper. Trumpet rather distinctly flared; shorter, index about 6.0; area between apex of tracheoid and slit distinctly lighter than remainder; pinna including slit about 0.35-0.4 of total length. Abdominal hair 5-V usually triple or with 4 branches, 5-VI double or triple, both not exceeding apex of tergite following; 6-III-VI usually triple; 9-VII usually triple, 9-VIII usually with at least 5 branches. Caudolateral angle of tergite VIII acute to obtuse, not rounded, sometimes produced into small sharp caudal spine. Paddle hairs 1,2-P better developed.

LARVA (fig. 41). In general as described and figured by Foote (1954:61-63) and Carpenter and LaCasse (1955:307-308). Differing from *atratus* as described here in the following conspicuous features; very similar to *inhibitor*. Head hair 1-C shorter, heavier, especially near base; 5-C usually single or with postmedian fork or barb, sometimes double or triple; 14-C multiple, farther removed from anterior border. Thorax with sparse inconspicuous short spicules; prothoracic hair 4-P single. Abdominal hair 1-IV,V usually double or triple. Comb scales more numerous. Siphon shorter, usually slightly upturned; index about 7.0-8.0; usually with a broad submedian dark ring; pecten teeth more evenly spaced, broader and with stronger denticles; subventral hairs longer and with more branches; subdorsal hairs only 2 pairs, usually triple; hair 2-S much stronger and longer, strongly recurved and with slender premedian recurved branch. Saddle with short heavy spicules dorsolaterad but without marginal spicules; hair 2-X usually with only 1 short branch at base of main shaft; ventral brush with 6 pairs of hairs; gills somewhat longer.

SYSTEMATICS. The male genitalia of the small sample of the Jamaican population agree in general with topotypic *iolambdis* from Panama and with those of a population from Guatemala. In both of the latter there is a great deal of variation in the shape and denticulation of the lateral plate of the phallosome which is much more uniform in the Jamaican material and agrees well with the illustration in Rozeboom and Komp (1950: fig. 44).

The larva of Jamaican *iolambdis* is very similar to that described and figured by Carpenter and LaCasse (1955:307-308), presumably from Florida, but shows significant differences from the descriptions and figures in Foote (1954:61-63) and from specimens we have seen from Panama and less significant differences from specimens from Guatemala and Mexico. In our collections from mangroves near Crab Pond Bay (782,784), the dark postmedian ring of the larval siphon is strongly marked as it is in populations from Florida and Puerto Rico, but it is not indicated in the 2 larvae obtained in a swamp at Port Henderson (6) as is typical of *iolambdis* reported elsewhere, including Panama. The specimens from Port Henderson show other features reminiscent of the Central American populations but unfortunately no males from this collection are available to determine whether or not there are also genitalic differences. There is a possibility that 2 species are represented in our Jamaican material but this cannot be determined without additional associated material of all stages. The identity of these forms must await a thorough study of material of *iolambdis* in the current sense from its entire reported range.

As indicated under *inhibitor*, the key characters to separate *iolambdis* from that species even on Jamaica may not be reliable. Panamanian larvae of the *iolambdis* complex will key out to *inhibitor* in our key.

BIONOMICS. All 3 collections of immatures of *iolambdis* were made in mangrove areas, in a ditch (6), stream margin in a clearing (782) and a pond (784), all with fresh water. Associated species were *Anopheles* (Nys.) *albimanus*, *Anopheles*

(*A.*) *crucians*, *Culex (C.) nigripalpus* and *Culex (Mel.) atratus*. We have no information at all on the adults.

DISTRIBUTION. Panama (type locality), Florida, Puerto Rico, Jamaica, Mexico, Guatemala and Colombia.

JAMAICA. Apparently rare and restricted to the coast. *St. Catherine*: Port Henderson (6). *Westmoreland*: Crab Pond Bay (782,784). *Parish not Specified*: R.B. Hill, 1 M, 2 F, 5 L [USNM], 6 M [JAM], 1 M, 2 F [UCLA].

Material Examined: 35 specimens; 11 males, 5 females, 13 larvae, 6 pupae; 4 individual rearings (2 larval, 2 pupal).

21. *Culex (Mel.) inhibitor* Dyar & Knab

Figs. 40,41

1906. *Culex inhibitor* Dyar and Knab, 1906c:216. TYPE: Described from larva, lectotype not designated because of poor condition of material (135), San Francisco Mountains, Santo Domingo (Dominican Republic), 3 Sept 1905, A. Busck [USNM; see Stone and Knight, 1957a:51].

1906. *Culex investigator* Dyar and Knab, 1906c:216. TYPE: Described from larva (256a), only head capsule remaining, lectotype not designated, along railroad track 3 mi from Santa Lucrecia [Jesus Carranza] (Vera Cruz), Mexico, 20 June 1905, F. Knab [USNM; see Stone and Knight, 1957a:51]. Doubtful synonymy with *inhibitor* by Dyar (1928:317,318); accepted by Matheson (1929:173) and subsequent workers.

Culex (Melanoconion) inhibitor of Edwards (1932:216, in part); Rozeboom and Komp (1950:91-92); Lane (1953:466-467, in part); Foote (1954:59-60); Porter (1967:39).

Culex (Mochlostyrax) inhibitor in part of Dyar (1928:317-318).

Culex inhibitor of Howard, Dyar and Knab (1915:391-393); Matheson (1929:173-175, in part); Komp (1935:6); King and Bradley (1937:349-350); Hill and Hill (1945a:3; 1948:55); Thompson (1947:78).

?*Culex flabellifer* of Hill and Hill (1945a:3; 1948:55); Thompson (1947:78).

FEMALE. Wing about 2.7 mm. In general similar to *atratus* and extremely similar to *iolambdis* from which it differs apparently primarily by a generally lighter coloration. Narrow decumbent scales of head restricted to occiput and posterior part of vertex; remainder of vertex with broad decumbent scales, largely dark except on orbital border and sides where they are whitish to grayish. Mesonotal integument brown. Pleural integument brown (greenish in fresh specimens), usually without distinct sharply marked darkened areas; broad whitish scales usually restricted to lower posterior *stp* line or small patch. Femora apparently more extensively pale at base than in *atratus*.

MALE. Differing from *atratus* by same characters as female. Palpus sometimes longer than in *atratus*; segments 4 and 5 more slender and without pale scales at base; apex of segment 3 with only a few moderately long bristles, segment 4 with shorter and much less numerous bristles.

MALE GENITALIA (fig. 40). Differing from *atratus* by same general features as *erraticus* and distinguished from the latter chiefly by the following. Proximal division of subapical lobe short and shallowly cleft; distal division with short broad stem, leaf not as strongly developed. Subapical part of external margin of clasper with shallow wrinkles not appearing as spicules. Distal part of lateral plate of phallosome with large subapical lateral tergal process, more or less strongly developed

denticles along sternal margin, and a prominent slender external hooked basal sternal spine.

PUPA (fig. 40). Chaetotaxy as figured, not studied in detail; variation extensive. Very similar to *iolambdis* and differing from *atratus* in same features; distinguished from the former primarily by the following. Pigmentation usually much lighter. Trumpet widened distad but indistinctly flared; index a little less than 8.0; uniformly pigmented throughout; pinna including slit usually less than 0.35 of total length. Abdominal hair 5-V,VI weaker and shorter; 9-VIII usually with 4 branches or triple. Caudolateral angle of tergite VIII usually acute. Paddle hairs 1,2-P weaker.

LARVA (fig. 41). In general as described and figured by Foote (1954:59-60). Differing from *atratus* as described here in the same features as *iolambdis* except for the following characters which may not always be reliable because of considerable variation. Head hair 5-C usually triple. Prothoracic hair 7-P usually double. Abdominal hair 6-III,IV weaker, frequently double. Siphon without dark ring. Saddle with weaker dorsolateral spicules; hair 2-X frequently with 2 basal branches; gills usually longer.

SYSTEMATICS. The Jamaican population of *inhibitor* is extremely variable in all stages. Apparently some of the Jamaican material was identified by W.H.W. Komp as *Culex flabellifer* Komp, 1936 and by Alan Stone as *inhibitor* with the result that both nominal species were reported by Hill and Hill (1945a; 1948) and Thompson (1947).

The Jamaican material agrees in general with topotypic *inhibitor* from the Dominican Republic and we believe that, in spite of the great variability, the 2 populations are conspecific. We have seen no material from Mexico or Panama reported as *inhibitor*, presumably on the basis of male genitalia. The male genitalia of the Jamaican population exhibit a great deal of variation in the shape and particularly in the denticulation of the lateral plate of the phallosome. These variations do not appear to be correlated with the type of breeding site or the elevation (see bionomics).

The immature stages of the Jamaican population are very variable and it is probable that some difficulty may be experienced in separating them from *iolambdis* by the characters given in the keys. The larva is in general very similar to that of *species 22* and the latter may prove to consist merely of aberrant specimens of *inhibitor*. Outside of Jamaica, the pupal stage of *inhibitor* is unknown, and the larva is known either from fragments of associated skins or unassociated whole larvae (Mexico, Panama and "West Indies"). Foote's description of the larva (1954:59-60) does not agree in several details with the Jamaican material and his key (1954:10) contradicts the description in couplet 52 in the statement that abdominal segments I-IV are spiculate.

BIONOMICS. The majority of our collections of immature stages of *inhibitor* were made at an elevation of about 480 m on the Hermitage Dam Rd (739,827, 828,851,852,891,893,895) in shaded stream bed pools or rockholes in association primarily with *Anopheles (A.) grabhamii*, *Culex (C.) corniger*, *Culex (C.) secutor* and *Culex (C.) nigripalpus*. Here both sexes were found resting in large numbers on moist rock ledges. Three other collections were at an elevation of about 150 m near Temple Hall, in a pool in a ditch exposed to the sun (45) without associated species, in large ground pool in partial shade (47) with *Anopheles (Nys.) albimanus*, *Anopheles (A.) grabhamii* and *Culex (Mel.) atratus*, and in a rockhole in the shade (352) in association with *Aedes (O.) calumnior*, *Aedes (F.) mediovittatus* and *Aedes (H.) inaequalis*. Although we found a considerable number of adults resting in

crabholes at low elevations (360,616,701,888), immature stages could not be located in their vicinity and the only collection of immature stages at a low elevation came from the north slope from a ground pool in a dried stream bed of a tributary of the Rio Grande (921), presumably in a shaded situation as the associated species were *Anopheles (A.) grabhamii* and *Psorophora (J.) ferox*.

DISTRIBUTION. Dominican Republic (type locality), Jamaica.

JAMAICA. Common species of *Melanoconion* at elevations above 150 m; also at lower elevations to near sea level. *Clarendon*: Goshen (352). *Kingston and St. Andrew*: Ferry (701, 888). Hermitage Dam Road (738,739,827,828,851-853,891,893-895); 20 Jan 1940, ? W.H. Komp 2 M, 1 F [UCLA]. Irish Town, 23 Nov 1943, R.B. Hill, 1 M, 1 F [USNM]. Kingston and vicinity, Apr 1906, M. Grabham, 1 M, 1 F [USNM]. Temple Hall (45,47). *Portland*: Rio Grande (921). *St. Ann*: Runaway Bay, Feb 1969, W.W. Wirth, 1 M, 1 F [USNM]. *Westmoreland*: Cave (616). Crab Pond Bay (360). *Parish not Specified* (probably Kingston and St. Andrew): 23 Jan 1945, R.B. Hill, 2 M; R.B. Hill, 2 M [USNM]; R.B. Hill, 1 lpM, 6 M [JAM]; R.B. Hill, 1 M [UCLA].

Material Examined: 452 specimens; 105 males, 139 females, 115 larvae, 93 pupae; 56 individual rearings (15 larval, 34 pupal, 7 incomplete).

22. *Culex (Mel.) sp.*, Jamaican form

Fig. 45

FEMALE, MALE, PUPA. Unknown.

LARVA (fig. 45). Known by 2 specimens only. Chaetotaxy as figured. Differing from all other local species of *Melanoconion* in head hair 6-C double or triple, and 5-C with 4 or 5 branches and at least 0.75 of 6-C. In other respects essentially as in *inhibitor* but both specimens with pecten and subventral hairs of siphon asymmetrical, 5 pairs and longer pecten on one side and 6 pairs and pecten shorter on the other; hair 2-S weaker than in *inhibitor*.

DISCUSSION. The 2 larvae at hand may be nothing more than aberrant individuals of *inhibitor* as indicated by their general similarity with this species in nearly all features. However, the unique development of head hairs 5 and 6 and some features of the siphon suggest that a distinct species, related to *inhibitor*, may be involved. One larva was collected at the east end of Holland Bay, St. Thomas (168) in association with *Culex (C.) nigripalpus* and the other by itself in a large crabhole in a cane field at Fort Stewart, St. Mary (809).

23. *Culex (Mel.) pilosus* (Dyar & Knab)

Figs. 42,44

1906. *Mochlostyrax pilosus* Dyar and Knab, 1906c:224. TYPE: Lectotype larval skin (267b) with associated pupal skin and male, S. Lucrecia [Jesus Carranza] (Vera Cruz), Mexico, 21 June 1905, F. Knab [USNM; designation of Stone and Knight, 1957a:54-55].
1906. *Mochlostyrax jamaicensis* Grabham, 1906b:318-320. TYPE: Lectotype by PRESENT DESIGNATION, male with intact genitalia, with printed labels, //Kingston/Jam//M Grabham/Collector// and handwritten label, //Mochlostyrax/jamaicensis/Gbhm.//, evidently part of Grabham's original material together with 2 females, both bearing the same printed labels and 1 with handwritten //reductor// [USNM]. Synonymy with *pilosus* apparently by Dyar (1924c:186).

1909. *Culex reductor* Dyar and Knab, 1909b:257. TYPE: Same as for *jamaicensis* Grabham, 1906 [USNM]. Replacement name for *jamaicensis* Grabham, 1906 preoccupied by *Culex jamaicensis* Theobald, 1901 [now in *Psorophora*].

For complete current synonymy see Stone, Knight and Starcke (1959:277-278).

Culex (Melanoconion) pilosus of King, Bradley and McNeel (1944:45); Matheson (1944:218-219); Carpenter, Middlekauff and Chamberlain (1946:268-271); Rozeboom and Komp (1950:94-95); Lane (1953:452-454); Carpenter and LaCasse (1955:313-315); Perez Viguera (1956:410-415); Montchadsky and Garcia (1966:46).

Culex (Mochlostyrax) pilosus of Dyar (1924c:186; 1928:290-291); Edwards (1932:218); Foote (1954:114-116); Stone, Knight and Starcke (1959:277-278); Porter (1967:39).

Culex pilosus of Matheson (1929:171-172); Hill and Hill (1945a:3; 1948:56); Thompson (1947:78).

Culex reductor of Howard, Dyar and Knab (1915:399-402); Johnson (1919:423); Gowdey (1926:73).

FEMALE. Wing about 2.3 mm. Small dark species; differing from *atratus* principally in the following features. Narrow decumbent scales of head restricted to occiput, broad scales largely grayish to whitish forming a complete broad band behind eyes. Mesonotum with strong violet red iridescence. Pleural integument brown, usually with only small darkened spot at base of *mep* bristle; scaling sparse, only a few narrow scales at extreme upper *ppn*, broad scaling usually restricted to lower *stp*.

MALE. Differing from *atratus* by same features as female and the following. Palpus more slender and slightly longer, exceeding proboscis by nearly full length of segment 4; pale scales absent; apex of segment 3 with only a few heavy bristles, segment 4 with long bristles less numerous.

MALE GENITALIA (fig. 44). In general as in *atratus*; with following diagnostic features. Lobes of tergite IX widely separated, small, fingerlike, each arising from setiferous basal area. Tergal setae of sidepiece more numerous and longer; scales restricted to small basal lateral area. Divisions of subapical lobe approximated; proximal division with 2 arms, each with 1 long sinuous apical seta; distal division with setae essentially as in *opisthopus* but leaf thinner, sabers and foliforms broader and insertions different. Clasper distinctly narrowed beyond middle and with conspicuous swollen head with spicules on outer margin. Distal part of lateral plate of phallosome with apical tergal spine, lateral subapical spine and longer thinner slender apical mesal sternal spine. Basolateral sclerotization of proctiger with very short, inconspicuous free dorsal lobe.

PUPA (fig. 44). Chaetotaxy as figured, not studied in detail; apparently variable. In general as described for *atratus* and quite similar to *erraticus*; differing from former chiefly in the following. Trumpet shorter, index usually a little less than 6.0; pinna including slit usually less than 0.3 of total length. Abdominal hair 5-V, VI nearly as long as tergite following, usually double or triple; 6-VI usually with 4 or more branches; 9-VII, VIII with branches as in *erraticus* but weaker. Caudolateral angle of tergite VIII acute.

LARVA (fig. 42). In general as described and figured by Foote (1954:114-116) and Carpenter and LaCasse (1955:313-315). Differing from *atratus* as described here in the following conspicuous features. *Head*: Labial plate much shorter; maxillary sutures divergent; collar more distinct. An inconspicuous ovoid gill on ventral surface near antennal base. Hairs 4-6-C (particularly 4) nearer middle of head capsule; 5-C single or double; 6-C single, usually conspicuously barbed, relatively short; 7-C with fewer branches; 13-C large, multiple, near 12-C; hair 14-C nearer anterior

border, usually triple. *Antenna*: More slender and less curved; distal part longer; spicules more conspicuous. *Thorax*: Integument with very sparse minute spicules. Prothoracic hair 4-P single, 7-P usually double, 8-P usually single. *Abdomen*: Integument practically glabrous at 200 X. Hair 6-I,II usually triple, 6-III-VI usually double. *Segment VIII*: Comb scales usually about 8-12, in an irregular single or partial double row, very heavily sclerotized and darkly pigmented, spinelike and without fringes; hair 2-VIII with moderate basal plate, 3-VIII with very large basal plate. *Siphon*: Conspicuously upturned and slightly narrowed distally; short, index about 3.5-4.5; lightly to moderately uniformly pigmented except for darkened basal ring; acus large but without dorsal process. Pecten of about 10 (7-12) strongly pigmented teeth, conspicuously longer distally, with uniform, short fringes to near apex. Subventral hairs usually 8 pairs, extending from within pecten to near apex, all very long, the basal usually triple, the distal with 4 or more branches; subdorsal hairs 2 pairs, lateral in position, usually double or triple; hair 2-S set on a conspicuous sclerotized basal plate, very strong, distinctly recurved and with slender curved subbasal branch. Median dorsal valve of spiracular apparatus very small. *Anal Segment*: Saddle lightly to moderately pigmented, without differentiated marginal spicules. Hair 2-X usually with only 1 rather long branch from base of main shaft. Gills longer than saddle.

SYSTEMATICS. For the present we are retaining *jamaicensis* (Grabham, 1906) as a synonym of *pilosus* (Dyar & Knab, 1906). The male genitalia of the Jamaican population are entirely similar to topotypic *pilosus* from Mexico but we do not have sufficient material of the immature stages of the latter to evaluate the slight differences apparent in these stages. We have made no attempt to compare it with other populations of *pilosus* which have been reported from a range extending from southeastern United States to northern Argentina.

Culex pilosus cannot be confused with any other Jamaican *Melanoconion* in any stage. These differences, in our opinion, are no more significant than those characterizing *atratus* or *opisthopus*, and therefore we are relegating the subgenus *Mochlostyrax*, to which *pilosus* is currently assigned, to the status of a section in the subgenus *Melanoconion*.

BIONOMICS. We have only 3 collections of *pilosus* from Jamaica, all of immature stages. One of these (232) was on the coast in a ground pool in association with *Anopheles (A.) grabhamii* and *Anopheles (A.) vestitipennis*. The other 2 were in the interior at elevations of 300-350 m; the Petersville collection (618) was in a shaded ground pool in association with *Psorophora (G.) infinis*; the Moneague area collection (757) was in an open stock pond in association with *Anopheles (N.) albimanus*, *Culex (C.) nigripalpus* and 2 species of *Psorophora (G.)* and 2 species of *Aedes (O.)*.

The larvae of this species have the curious habit of resting on their backs on the bottom and sides of their breeding sites where they are very difficult to see.

DISTRIBUTION. *Culex pilosus*, with its numerous current synonyms, has a reported range extending from the southeastern United States southward through the Bahamas, Greater Antilles, Mexico (type locality), Central America to Ecuador and northern Argentina and Paraguay.

JAMAICA. *Clarendon*: Locality not specified, larvae, H.D. Pratt (Hill and Hill, 1948:56). *Kingston and St. Andrew*: Kingston and vicinity, M. Grabham, 1 M, 3 F [USNM]. *St. Ann*: Delight (757). *Westmoreland*: Negril Swamp (232). Petersville (618). *Parish not Specified* (probably Clarendon): June 1945, G.A. Thompson, 2 M [USNM].

Material Examined: 66 specimens; 11 males, 6 females, 35 larvae, 14 pupae; 15 individual rearings (8 larval, 3 pupal, 4 incomplete).

24. *Culex* (Mel.) *panocossa* Dyar

Fig. 48

1923. *Culex* (*Melanoconion*) *panocossa* Dyar, 1923a:120-121. TYPE: Lectotype male (1809) with genitalia slide, Bas Obispo, Canal Zone, Feb 1923, J.B. Shropshire [USNM; designation of Stone and Knight, 1957a:54].

Culex (*Gnophodeomyia*) *panocossa* of Dyar (1923d:188).

Culex (Mel.) *aikenii* in part of Dyar (1925a:21-22; 1925c:168; 1928:337-338); Edwards (1932:214); Rozeboom and Komp (1950:86); Lane (1953:423-425); Foote (1954:14-16); Stone, Knight and Starcke (1959:266).

Culex aikenii of Thompson (1947:78,79); Hill and Hill (1948:10, footnote).

FEMALE. Unknown in Jamaica. Apparently indistinguishable from *ocossa* Dyar & Knab, 1919 in Panama. Probably in general similar to *atratus* but generally lighter in color and without darkened spots on upper and lower *mep*. Plume scales of veins R_2 and R_3 probably much broader.

MALE. Known from Jamaica only by the genitalia described below. Panamanian specimen (PA 12-116) differs from *atratus* by the features indicated above for female and also by a shorter palpus which exceeds the proboscis by distinctly less than full length of segment 5.

MALE GENITALIA (fig. 48). In general as in *atratus*; very similar to *ocossa*. Lobe of tergite IX poorly differentiated, very short and broad, prominent laterally only, with 5 or 6 marginal setae. Apex of sidepiece with numerous moderately long bristles closely set in a single or partial double row from mesal sternal angle around side to tergal surface, appearing as a dense apical tuft. Proximal division of subapical lobe long columnar, with 2 apical rods, the longer distinctly shorter than stem of lobe, latter with 3 microsetae on tergal (outer) surface; distal division shorter, columnar, with long apical hooked seta and expanded, petiolate leaf near base; a very narrow, nonstriated foliform on tergal surface near base of clasper. Clasper with distinct subapical crest with distinct ridges, and a slight apical snout; spiniform very broad and large. Lateral plate of phallosome essentially as in *atratus* but basal "hook" with more extensive sclerotization; distal part with sternal spine shorter and more acute, and with an external slender sharp slightly curved spine near base sternally. Basolateral sclerotization of proctiger with conspicuous tergal lobe and without free sternal process.

PUPA. Unknown in Jamaica and not definitely known in Panama. Probably similar, at least in general features, to *ocossa* as figured here (fig. 47) from Guyana and with the diagnostic characters as indicated in the key. Pupa of *ocossa* differing from *atratus* primarily in the following. Cephalothoracic hairs 5,8-C with fewer branches, usually triple. Trumpet distinctly flared; tracheoid extending to beyond middle; pinna longer, including slit about 0.5 of total length. Abdominal hair 1-II, III weaker, usually with 5 or 6 branches, 1-V,VI usually triple; 5-IV-VI dark, with heavy densely barbed branches; 6-III-VI usually double, rarely single; 9-VII weak, usually single; 9-VIII single or apically forked, located at tip of distinct caudolateral process; 1-IX strongly developed. Paddle conspicuously infuscated on apex of external surface and nearly all of internal; only hair 1-P developed.

LARVA. Unknown in Jamaica and not definitely known in Panama. Probably similar, at least in general features, to *ocossa* as figured here (fig. 46) from Guyana and with the diagnostic characters as indicated in the key. Larva of *ocossa* differ-

ing from *atratus* primarily in the following. *Head*: Not as wide; maxillary suture not extended caudad from posterior tentorial pit. Hairs 4-6-C nearer middle of head capsule; 3-C strongly developed; 5-C much longer, strongly barbed near middle. *Antenna*: Spicules more conspicuous and stronger, especially on distal part. *Thorax*: Integument glabrous. Basal tubercles not as strongly developed; larger hairs usually with very conspicuous long barbs especially near middle. Hair 4-P triple or double; 7-P usually with 5 branches; 8-P triple. *Abdomen*: Hair 6-III-VI usually with 5 branches; 1-III strongly developed, usually with at least 8 branches, 1-IV-VI usually with at least 6 branches. *Segment VIII*: Comb scales of 2 types, slender spatulate fringed scales in 3 irregular rows, the caudal row interspersed with about 6 long spinelike minutely fringed long scales. Hair 2-VIII with much smaller basal plate. *Siphon*: Shorter, index about 6.0; slightly upturned. Pecten usually of about 7-12 rather widely spaced teeth, all but the proximal very long and slender and with dense fringe of very short fine spicules. Subdorsal siphonal hairs only 1 pair, placed far dorsad, usually with 4 branches. Hair 2-S strong, recurved and with distinct subbasal recurved branch. *Anal Segment*: Saddle without marginal spicules. Hair 2-X usually with 4 or 5 very short branches at base of main shaft. Ventral brush with 6 pairs of hairs. Gills markedly unequal, upper only about 0.5 of lower, latter subequal to saddle length.

SYSTEMATICS. The record of *panocossa* from Jamaica is based on a single male collected by G.A. Thompson in a light trap in Clarendon in February 1945 (Thompson, 1947:78,79) and identified by W.H.W. Komp as *aikenii*. In the USNM is a single genitalia slide mount by Thompson marked 450212, originally labelled *atratus* by him and corrected in pencil to *aikenii* by A. Stone. We consider that this slide is the one examined by Komp and that the pinned specimen is probably lost. There are 2 other Thompson slides in the USNM collection marked 450212 containing a male pupal skin and fragments of a larval skin which were also originally marked *atratus* by Thompson and corrected to *aikenii* by Stone, probably in the belief that these were associated with the above mentioned male genitalia. However, the immature stages are undoubtedly those of *atratus*. The Thompson number probably merely refers to the date that the material was either collected or mounted and does not imply association; associations are indicated in the Thompson material from Jamaica by the addition of an identifying number or letter following the date number.

The male genitalia of the Jamaican specimen are extremely close to those of *panocossa* Dyar, 1923 (originally described from Panama) and we are assigning the Jamaican population to this species. *Culex panocossa* and *ocossa* (Dyar & Knab, 1919) have recently been resurrected from synonymy with *aikenii* (Aiken & Rowland, 1906) by Belkin (1970b) who also relegated the latter to the status of a *nomen dubium*. The 2 species are clearly distinct in the male genitalia as originally indicated in the description of *panocossa* by Dyar and as shown by our illustrations (figs. 47,48). At present there is no way of distinguishing the females of the 2 species. The immature stages of *panocossa* are not definitely known even in the type locality of Panama. Since they are probably in general similar to those of *ocossa* we are providing here brief descriptions and illustrations of the pupa (fig. 47) and the larva (fig. 46) of the latter from the type locality of Georgetown, Guyana. Hopefully, these figures as well as the characters in the keys based on *ocossa* will provide a basis for the identification of *panocossa* in Jamaica.

BIONOMICS. In Panama the immature stages of *panocossa* apparently occur in water collections containing *Pistia*, in association with *ocossa*. Nothing is known of

the breeding sites of this species in Jamaica as the only specimen known, a male, was collected in a light trap.

DISTRIBUTION. To date *panocossa* is definitely known only from Panama (type locality) and Jamaica, but it is very likely that the records of "*aikenii*" from Mexico and Costa Rica also pertain to this species which has a more northern distribution than *ocossa* (Panama to Surinam).

JAMAICA. Clarendon: Locality not specified, 1 male genitalia (450212), Feb 1945, G.A. Thompson [USNM].

Subgenus MICRAEDES

25. *Culex* (Micr.) arawak Berlin

Figs. 34,48

1970. *Culex (Micraedes) arawak* Berlin, 1970:37-38. TYPE: Holotype male (KO 29-19) with genitalia slide (680626-4), Moneague (St. Ann), Jamaica, 1943, R.B. Hill [USNM].

Culex (Aedinus) bisulcatus in part of Porter (1967:39); Stone (1967:218).

Culex (Aedinus) americanus in part of Stone, Knight and Starcke (1959:281).

Culex americanus of Hill and Hill (1945a:2; 1948:52).

FEMALE. Unknown; probably similar to male and with palpus about 0.35 of proboscis length.

MALE. Wing about 3.0 mm. A pale, tan to yellowish species with brown appendages and abdominal tergites. *Head:* Decumbent scales all narrow and whitish except on the sides and lower surface where they are broad. Erect scales pale brown, long and numerous. Proboscis shorter than forefemur. Palpus slender, about 0.35 of proboscis; 5-segmented, segment 5 minute; without long bristles. Antennal flagellum with sparse long whorl bristles. *Thorax:* Mesonotal integument tan; scales narrow, pale brown to tan. Mesonotal bristles all developed, including acrostichals which extend to prescutellar space. Paratergite bare. Scutellar lobes with narrow tan scales. Pleural integument pale tan to yellowish; scales apparently absent but possibly a few tan scales may be developed on upper *ppn* and paler scales on *stp* and upper *mep*; pleural bristles normal for genus but lower *mep* bristle absent. *Legs:* Predominantly with brown scales except for pale scales on coxae and usual pale surfaces of femora. Claws of foreleg and midleg enlarged, unequal; larger claws with submedian tooth, smaller simple; hindclaws simple. *Wing:* Dorsal vein scales all brown; veins R_2 and R_3 with broadened plume scales near apex. *Haltere:* Stem pale, knob with very dark scales. *Abdomen:* Tergite I apparently with small median patch of brown scales; laterotergite without scales. Tergites II-VII predominantly with brown scales and with large lateral patches of silvery white scales extending from base to near apex. Sternites II-VII predominantly pale scaled, distal segments with some scales dark.

MALE GENITALIA (fig. 48). Essentially as in subgenus *Melanoconion* as described for *atratus*; with the following diagnostic features. *Segment IX:* Tergite lobe broad, with 5 or 6 setae and without distal clear portion. *Sidepiece:* Not as strongly inflated as in *Melanoconion*; tergal surface with moderately long bristles extending to near base of proximal division of subapical lobe and with 1 to several

scattered scales; lateral and sternal surfaces without scales; sternal surface with short bristles. Subapical lobe not clearly differentiated into divisions, the distal division appearing as distal sternal appendage of proximal; proximal division prominent, split apically into 2 equal parts, tergal part with a long narrow saber, sternal with a flattened rod, a smaller narrow saber arising from base on tergal surface; distal division with 4 relatively simple setae with slightly hooked apex and 1 longer seta with recurved apical barb. *Clasper*: Relatively simple, slender; a long seta on external margin at base; apex with slight snout. *Phallosome*: Basal "hook" of lateral plate broadly sclerotized; distal part with long apical process and a long sternolateral spine at base. *Proctiger*: Relatively smaller. Basolateral sclerotization with tergal process nearly meeting its mate on midline. Apex of paraproct with 6 or 7 teeth. Cercal setae 2, their alveoli confluent.

PUPA. Unknown, but probably as in other members of Bisulcatus Group of subgenus as indicated in the key.

LARVA (fig. 34). Conspicuously different from species of *Melanoconion*; readily separated from other local species of *Culex* by the stellate hairs of thorax and abdomen, and by the long spinelike marginal spicules of anal saddle. Chaetotaxy as figured; not studied in detail. *Head*: Only slightly wider than long (1.2); ocular bulge inconspicuous. Lightly pigmented except for darkened postocular spot. Labrum well differentiated dorsally; labial plate long; maxillary suture straight, complete but extending only short distance caudad of posterior tentorial pit; collar moderately well developed. Hair 3-C apparently not developed; 4-6-C in anterior part of head capsule, 5,6-C both branched and longer than antenna; 8,10-C single; 9-C double; 11-C strongly developed; 13-C closer to 12-C than to 11-C; hairs 14, 15-C anterior. *Antenna*: Short, a little more than 0.5 of head length; shaft slender, nearly straight, basal part not markedly differentiated except for more conspicuous spicules; pigmentation uniformly light. Hair 1-A near middle. *Thorax*: Integument glabrous; tubercle of hairs 1-3-P poorly developed; 3-P relatively long, about 0.6 of 1-P, both branched; 4-P triple; 7-P single; 8-P short and with 4 branches; 14-P single; 0,8-P, 1,13,14-M and 3,13-T stellate. *Abdomen*: Integument glabrous, very pale; hairs 1,2,5,7,9,13 stellate on most segments; hair 2 in anterior part of segment; 6-I quadruple, 6-II single, both long; 6-III-VI shorter, double; 7-I,II both long, 7-I double, 7-II triple. *Segment VIII*: Comb scales slender, simple, fringed but not spatulate; in 3 irregular rows. *Siphon*: Very lightly pigmented except for darkened basal ring and apex; acus attached and with ventral projection; index about 10.5-12.0. Pecten extending to about 0.35; with about 25 long teeth with short denticles extending to near apex. Subventral siphonal hairs 4 pairs, usually with at least 5 branches, progressively shorter caudad; subdorsal hairs 2 pairs, usually double; hair 2-S slightly recurved and with small subbasal branch. *Anal Segment*: Saddle complete, very lightly pigmented; caudal margin with long spines, some branched apically; hair 1-X single; 2-X usually triple. Ventral brush with 5 pairs of hairs, all on grid with distinct lateral bar not attached to saddle. Gills narrow, long, about 3.0 of dorsal saddle length.

SYSTEMATICS. This is an endemic species of the Bisulcatus Group that in the past has been reported as *americanus* (Neveu-Lemaire, 1902). The association of the male and the larva is presumptive only and the pupa is unknown as no individual rearings have been made. However, it is very probable that only 1 species of the group is present on the island and that the male and the larva are correctly associated. These are readily separated from the other 2 species of the group as indicated by Berlin (1970): *antillumagnorum* Dyar, 1928 from Cuba, Hispaniola

(Dominican Republic), Puerto Rico and the Virgin Islands and *bisulcatus* (Coquillett, 1906) from the Virgin Islands and Lesser Antilles from St. Croix to St. Lucia. *Culex arawak* is the only representative of the subgenus *Micraedes* on Jamaica. This subgenus, formerly lumped into *Aedinus* of Stone, Knight and Starcke (1959: 281-282), shows some affinities with *Melanoconion* but can be distinguished from it by the characters indicated in the keys. For more details, the recent revision of Berlin (1970) should be consulted.

BIONOMICS. We did not succeed in rearing either of the 2 larvae we obtained in separate collections (763,772) in the vicinity of Moneague in epiphytic bromeliads where they were associated with *Aedes (H.) walkeri*, *Aedes (H.) grabhami*, *Aedes (H.) stenei*, *Wyeomyia (W.) mitchellii*, *Wyeomyia (W.) stellata* and *Wyeomyia (W.) hirsuta*.

Hill and Hill (1948:52, as *americanus*) collected adults of both sexes on moist earth in limestone caves near Moneague.

DISTRIBUTION. Endemic to Jamaica, where at present it is known only from the Moneague area.

JAMAICA. *St. Ann*: Moneague, Jan 1940, W.H. Komp, 13 L [UCLA]; 28 Jan 1943, R.B. Hill, 1 M [UCLA], 1 M [USNM]. Moneague-Spanish Town Road, bend near mi post 29 (763). Moneague-Spanish Town Road, near Unity Valley (772).

Material Examined: 17 specimens; 2 males, 15 larvae.

TRIBE MANSONIINI

The tribe Mansonini is strikingly differentiated from all the Culicinae by unique adaptive morphological features associated with securing "air" from plant tissues in the larva (piercing valves of the siphon) and in the pupa (apical process of trumpet). Females of this tribe in Jamaica, as elsewhere in the New World tropics, appear annectant between the Culicini (truncate abdomen) and the Aedini (presence of postspiracular bristles). Adults of both sexes in this area can be separated from those of both other tribes by the presence of only broad plume scales on the dorsal veins of the wing. These scales are markedly asymmetrical in the genus *Mansonia* but less so in *Coquillettidia*, the 2 genera known from the New World tropics, both represented in Jamaica.

We have seen material of only 3 species of the tribe from Jamaica but have also included a fourth, *flaveola*, which has been recently reported from Jamaica (Porter, 1967:40) and could occur on the island.

The genus *Coquillettidia* is represented in Jamaica by 1 species of the subgenus *Rhynchotaenia*. This appears to be *nigricans* although positive identification cannot be made on the basis of females, the only known stage for this population. Since *nigricans* can be easily confused with "*venezuelensis*", another species of the subgenus reported from Central America, we discuss briefly its diagnostic features under *nigricans* and have included it in the key to the adults.

In the nominate subgenus of *Mansonia* we treat 3 species. One of these is undoubtedly a member of the *titillans* complex and we tentatively assign it to this species. The second species, formerly reported as *indubitans*, we describe as a new species, *dyari*, since it differs markedly from populations of what appears to be true *indubitans* from Trinidad, Surinam and the Amazon basin. *Mansonia flaveola*, originally described from St. Thomas, Virgin Islands and known primarily from Puerto Rico, can be easily confused with *titillans* and may occur in the Greater Antilles including Jamaica.

Identifications of Neotropical Mansonini have been based in the past to a large extent on the male and female genitalia and many species are currently reported to have extremely wide distributions. It appears to us that there are many more species than currently recognized and that many of these have rather restricted distributions. Many of the populations currently regarded conspecific differ markedly in details of the male genitalia but do not appear to show significant differences in the female. In several instances, when the immature stages are known, there are good correlated differences in the larvae and pupae. Unfortunately, at the present time associated material of all stages from the type localities of most described species is lacking and it is very difficult, if not impossible, to apply the available names correctly.

The Jamaican material of the tribe is very limited, fragmentary and in very poor condition. However, owing to the efforts of G.A. Thompson, all the stages of *titillans* and *dyari* are known and the pupa and adults of both sexes have been associated through rearings for the latter.

The immature stages of the Mansonini are rarely collected or seen since they are attached to plants below the water surface and only the pupa comes to the surface for the emergence of the adult. They also require special treatment for rearing. Belkin, Hogue et al (1965:34,35,58) have described methods for the collection and rearing of the immature stages of the Mansonini. Adults of some species are notorious pests at least in the vicinity of their breeding sites which are primarily stagnant bodies of water such as lakes, ponds and swamps.

KEYS TO GENERA AND SPECIES

ADULTS

1. Femora with a conspicuous preapical white band on anterior surface (*Coquillettia*, subg. *Rhynchotaenia*); wing without speckling of pale scales . . . 2
 - Femora conspicuously speckled with dark and light scales but without distinct preapical white band on anterior surface; wing distinctly speckled with pale scales (*Mansonia*, subg. *Mansonia*) 3
- Coquillettia*
- 2(1). Tibiae dark on anterior surface except for preapical light band 26. *nigricans*
 -
 - Tibiae speckled with light spots on anterior surface (see *nigricans*) "venezuelensis"
 -
- Mansonia*
- 3(1). Males See Key to Male Genitalia
 - Females 4
- 4(3). Palpus about 0.5 of proboscis; labium without distinct postmedian white dorsal band; predominant scaling of abdominal tergites light to dark coppery 28. *flaveola*
 - Palpus about 0.35 or less of proboscis; labium with a small but distinct postmedian white dorsal band; predominant scaling of abdominal tergites dark bronzy 5

- 5(4). Apex of tergite VII with row of short dark spiniforms; ventral surface of labium predominantly dark scaled, without distinct broad pale band; elongate scales of supraalar area of mesonotum with simple apex 27. *titillans*
 Apex of tergite VII without row of short dark spiniforms; ventral surface of labium with pale band from about 0.25 to 0.65; elongate scales of supraalar area of mesonotum with forked apex 29. *dyari*

MALE GENITALIA

Coquillettidia

1. Tergite IX sclerotized, lobe with setae; claspette with apical setae longer than body; cercal setae absent (*Coquillettidia*, subg. *Rhynchothaenia*) 26. *nigricans*
 Tergite IX membranous, without setae; claspette with apical spiniform shorter than body; cercal setae present (*Mansonia*, subg. *Mansonia*) 2

Mansonia

- 2(1). Sidepiece capitate distally, its outer apical tergal area with numerous long, narrow striated scales 29. *dyari*
 Sidepiece gradually slightly tapering distally, its outer apical tergal area with simple setae only 3
 3(2). Free portion of claspette projecting dorsomesad; external margin of clasper smooth and even in outline; integument dark 27. *titillans*
 Free portion of claspette projecting directly caudad; external margin of clasper with a distinct angle; integument light 28. *flaveola*

PUPAE

Coquillettidia

1. Hair 6 absent on abdominal segments I-VI; distal portion of apical process of trumpet with conspicuous "villi" (*Coquillettidia*, subg. *Rhynchothaenia*); trumpet index over 12.0 26. *nigricans*
 Hair 6 present on abdominal segments I-VI; distal portion of apical process of trumpet without conspicuous "villi" (*Mansonia*, subg. *Mansonia*); trumpet index less than 11.0 2

Mansonia

- 2(1). All dorsal abdominal hairs short and relatively weak; paddle very broad, index less than 2.0 28. *flaveola*
 Some dorsal abdominal hairs, especially 1, 3 and 5, strongly developed and long; paddle narrower, index distinctly more than 2.0 3
 3(2). Trumpet broad, index about 6.0; paddle moderately broad, index about 2.5 27. *titillans*
 Trumpet slender, index about 10.0; paddle narrow, index over 3.0 29. *dyari*

LARVAE

Coquillettidia

1. Distal part of antenna (beyond hairs 2,3-A) at least 2.0 of basal, practically colorless; 2,3-A very short; head capsule width subequal to length (*Coquillettidia*, subg. *Rhynchotaenia*) 26. *nigricans*
 Distal part of antenna (beyond hairs 2,3-A) subequal to or shorter than proximal, distinctly pigmented; 2,3-A of same order of magnitude as distal part of antenna; head capsule width distinctly greater than length (*Mansonia*, subg. *Mansonia*) 2

Mansonia

- 2(1). Ventral brush with 4 pairs of hairs on grid (hair 3-VIII usually double; 1-S usually with 4 branches) 27. *titillans*
 Ventral brush with 3 pairs of hairs on grid 3
 3(2). Dorsal comb scales long; spinelike; hairs 3-VIII and 1-S both single 28. *flaveola*
 All comb scales short and broad; hairs 3-VIII and 1-S both multiple . 29. *dyari*

GENUS COQUILLETIDIA

26. *Coquillettidia* (Rhyn.) *nigricans* (Coquillett)

Figs. 49,50

1904. *Taeniorhynchus nigricans* Coquillett, 1904:166-167. TYPE: Lectotype female, Panama, 18 Apr 1904, J.W. Ross [USNM, 7943; designation of Stone and Knight, 1957c:198].
 1909. *Bancroftia persephassa* Dyar and Knab, 1909b:254. TYPE: Holotype female, San Antonio de Los Banos (La Habana), Cuba, J.H. Pazos [USNM, 12118]. Synonymy with *nigricans* by Dyar (1921a:31).

Coquillettidia (*Rhynchotaenia*) *nigricans* of Ronderos and Bachmann (1963a:51, in part); Stone (1967:204); Porter (1967:37).

Mansonia (*Rhynchotaenia*) *nigricans* in part of Dyar (1918d:113-114; 1921a:30-31; 1925b:41; 1925c:151-152; 1928:258); Edwards (1932:117); Lane (1953:615-616); Perez Viguera (1956:451-452); Stone, Knight and Starcke (1959:107); Montchadsky and Garcia (1966:37).

Mansonia nigricans of Howard, Dyar and Knab (1915:511-512); Hill and Hill (1945a:2; 1948:50); Thompson (1947:79); Horsfall (1955:376).

Taeniorhynchus (*Rhynchotaenia*) *nigricans* in part of Castro and Bressanello (1952:233-234).

Taeniorhynchus (*Coquillettidia*) *nigricans* of Bonne and Bonne-Wepster (1925:330).

Taeniorhynchus nigricans of Coquillett (1906b:24).

Orthopodomyia persephassa of Howard, Dyar and Knab (1917:886-887).

FEMALE. Wing about 3.0 mm. Small blackish species with proboscis, femora, tibiae and tarsi banded with white; mesonotum golden scaled in middle; wing dark scaled. *Head*: Decumbent scales all light, pale yellowish in middle, whitish laterally; erect scales light in middle in front, dark posteriorly and laterally. Labium with broad submedian white band; labella light brown. Palpus tipped with a few white scales. Torus with large mesal patch of short broad pale golden scales. *Thorax*:

Mesonotal scaling sparse, predominantly pale golden in the middle, dark bronzy scales primarily in fossa, outer posterior dorsocentral and prescutellar lines, posterior part of acrostichal line, and in front and above wing root. Midlobe of scutellum with pale golden scales; lateral lobes without scales. Pleural scaling restricted to *apn*, *stp* and *mep*, pale golden to whitish, narrow on *apn*, broad elsewhere; *stp* with large upper scale patch and a small lower; *mep* with single large patch caudad of anterior median bristles. *Legs*: Coxae with dark scales except for a few light ones at base of patch. Anterior surface of all femora entirely dark scaled except for light apex and a white preapical band and a more or less distinct subbasal band on midleg and hindleg; posterior surface with light streak from near base to near preapical light band. Foretibia and midtibia dark except for postmedian or preapical light band or spot, a few pale scales apically and a light posterior streak from near base to light ring; hindtibia with only a preapical and a narrow apical light ring. All tarsi with narrow light rings on base of all segments and a few light scales on apex of segments 1-3, occasionally also apex of segment 4. *Wing*: Dorsal plume scales all broad, slightly asymmetrical; all dorsal scales dark except for a very small patch of light ones at base of vein R beyond remigium. *Haltere*: Entirely light, including scales of knob. *Abdomen*: Laterotergite without scales. Tergites with dark scales except for basolateral white patches on segments II-VIII, larger and more conspicuous on V-VII. Sternites with creamy scales at base and dark distally.

MALE. Not known for Jamaican population; described from Panamanian specimens. Essentially similar to female in coloration. Palpus exceeding proboscis by about length of segment 5 which is drooping; dark scaled except for broad pale bands at base of segments 2 and 3 and narrow pale bands at base of 4 and 5; with long ventrolateral bristles from apex of segment 3 through 5.

MALE GENITALIA (fig. 49). Not known for Jamaican population; described and figured from Panamanian specimens. *Segment VIII*: Tergite about 0.75 length of sternite, setae of middorsal surface restricted to distal 0.35. *Segment IX*: Tergite very long and conspicuous, projecting cephalad much more than sternite; its caudal border with a conspicuous small median lobe; lateral tergal lobes separated by distance subequal to width of median lobe, each lobe usually with 7-11 setae, the median ones shorter and somewhat flattened, outer thin and longer. *Sidepiece*: Mesal surface unsclerotized for less than 0.5 distance between apex of claspette and base of clasper; area distad of unsclerotized area with numerous moderate setae; mesal portion of dorsal surface with numerous shorter, thinner setae; scales and long setae restricted to apex and lateral and ventrolateral areas. *Claspette*: Not connected across midline with its mate, with a long narrow tergal process; with a short apical tubercle bearing 2 very long, slender, closely appressed, flattened, apically rounded setae. *Clasper*: Slender except for basal swelling; outer and inner margins smooth in outline and gradually tapering beyond swelling; dorsal surface with a thin ledgelike expansion starting beyond basal swelling and extending to apex; without setae. Spiniform broad, flat, broadly rounded apically; moderately long and projecting more than 0.5 of its length beyond apex of clasper. *Phallosome*: Aedeagus small, rounded in outline; aedeagal sclerite with 4-6 short denticles on apex of its dorsomesal projection only. *Proctiger*: Paraproct strongly sclerotized and pigmented; its apex with variable number of strong teeth, usually 3. Cercal setae absent.

PUPA (fig. 49). Not known for Jamaican population; described and figured from Panamanian specimens. Chaetotaxy as figured but extremely variable and unstable;

hairs usually all single but occasionally some of the smaller hairs with irregular terminal branches; some of the hairs frequently represented by alveoli only or completely absent. *Cephalothorax*: Lightly pigmented. Only hairs 6-9-C moderately developed; 1-3-C apparently all absent; 4,5-C very difficult to see, apparently sometimes absent. *Trumpet*: Very long, slender, index over 12.0; heavily pigmented except for light bulb and apical process. Distal part without tracheoid, forming an inconspicuous bulb. Meatus nearly straight. Apical process slender, weakly sclerotized; its basal 0.5 within a conspicuous funnel (representing walls of pinna) projecting from bulb; its distal 0.5 free, projecting beyond funnel, bearing numerous conspicuous "villi". Basal tubercle strongly developed. *Metanotum and Abdomen*: Moderately unevenly pigmented. Dorsal and lateral surfaces of abdomen with minute sharp spicules which are stronger and more conspicuous distally. Caudolateral angle of tergite VIII produced into acute spinelike process. Sternites II-VII with conspicuous anterior transverse arcuate ridges extended caudad and delimiting central areas. Hair 2 absent on segments II, VII, represented at most by an alveolus on VI; hair 3 absent on II, VI, VII; hair 6 absent on all segments; hair 8 sometimes absent on VII; hair 9 absent on I; hair 10 absent on II and VI; hair 11 apparently represented by an alveolus on III-VII; other alveoli occasionally present on II-VII, probably representing transitory hairs 12 and 13. Hair 9-VII very weak and short, removed ventrolaterally cephalad of caudolateral angle; 9-VIII weak, dorsal, removed mesad of caudolateral spine. *Paddle*: Deeply emarginate apically on inner margin, with outer lobe much longer than inner. Margins with short denticles, in 1 row on inner margin and several rows on external buttress. *Terminal Segments*: Female genital lobe short, with very broad cercus. Male genital lobe very long; sidepiece case with conspicuous slender apical process.

LARVA (fig. 50). Not known for Jamaican population; partially described and figured from Panamanian specimens. Complete chaetotaxy not studied; apparently unstable and extremely variable; most hairs small, very fine, practically unpigmented and very difficult to locate; usually many hairs broken off in mature larvae. *Head*: Head capsule uniformly light yellowish except for darkened collar and a black spot near base of mouthbrushes. Head capsule about as long as wide; antenna inserted a considerable distance caudad of anterior border; labrum not produced at insertion of hair 1-C. Ventrolateral angle of antennal tubercle without spine. Maxillary suture interrupted in middle anterior portion, hair 14-C in this position; 15-C distinctly caudad of 14-C near middle of labial plate. *Antenna*: Distal "annulate" part (beyond hairs 2,3-A) more than 2.0 of basal, practically colorless. Basal part darker than head capsule, without spicules; hair 1-A beyond middle. *Thorax*: Only lateral and ventrolateral hairs conspicuous, chiefly those of pleural groups. *Abdomen*: All hairs inconspicuous, even hair 6 which is apparently single on intermediate segments; usually practically all hairs are broken off in mature larvae. *Segment VIII*: Comb scales usually about 10, very slender on attached and free portions, latter consisting of a single simple spine; frequently a short thin spine projecting from base below the principal spine. Hairs 3-5-VIII in a compact group. *Siphon*: Body of siphon moderately pigmented except for darkened basal ring. Hair 1-S inserted on preapical ridge. *Anal Segment*: Saddle moderately pigmented except for narrow darkened basal ring. One accessory saddle hair (x-X) present in addition to 1-X on saddle. Ventral brush with 5 pairs of hairs on strongly developed grid; hairs strongly flattened, apparently double. Gills slender, pointed; slightly shorter than saddle.

SYSTEMATICS. The identification of the Jamaican population of the subgenus

Rhynchotaenia as *nigricans* is based entirely on females. Although these females are extremely similar in ornamentation to topotypic females from Panama, positive identification can be made only after discovery of the male and immature stages. For the present we are describing these stages for topotypic *nigricans* from Panama from material kindly provided by M.M. Boreham.

We have seen females of *nigricans* similar to the Panamanian and Jamaican populations from Mexico, Guatemala and Honduras. *Coquillettidia nigricans* has been reported also from Cuba, El Salvador, Colombia, Venezuela, Peru, Brazil, Bolivia and Argentina (Stone, Knight and Starcke, 1959:107). In view of the marked difference in the aedeagus of the topotypic population of *nigricans* from that described and figured by Lane and Coutinho (1940:593,595) for *neivai*, it seems highly improbable that these 2 forms are conspecific as believed by Lane (1951:335) and it would appear that *neivai* is a distinct species with a South American distribution extending possibly as far north as Venezuela.

Another species of the subgenus *Rhynchotaenia* that could easily be confused with *nigricans* is *venezuelensis* (Theobald, 1912) which has a wide reported distribution in Central and South America. Females of this complex we have examined from Guatemala, Honduras and Costa Rica frequently lack light scales at the base of vein C and could be mistaken for *nigricans*. However, they are readily separated from it by the speckled tibiae and the presence of some light speckling on the anterior surface of the femora. This form, which appears to be distinct from topotypic *venezuelensis*, may possibly occur in the Greater Antilles.

BIONOMICS. The immature stages of *nigricans* have not been collected in Jamaica. Larvae are said to attach to roots of sedges that form floating islands in Gatun Lake in the Canal Zone (Dyar, 1925c:151).

A few females have been collected on animals or in light traps in Jamaica.

DISTRIBUTION. Panama (type locality); probably Mexico, Guatemala, El Salvador, Honduras, Cuba and Jamaica; other records in literature doubtful except possibly from Colombia and Venezuela.

JAMAICA. Probably more widespread than reported. *Clarendon*: Locality not specified, Feb 1945, G.A. Thompson (Thompson, 1947:79). *St. Elizabeth*: Black River, 2 mi E (794). Luana (357,358). Maggoty (792A). *St. Thomas*: Bath, R.B. Hill, 1944 (50-35) [USNM].

Material Examined: 12 females.

GENUS MANSONIA

27. *Mansonia* (M.) *titillans* (Walker)

Figs. 50,51

1848. *Culex titillans* Walker, 1848:5. TYPE: Holotype female, with genitalia on slide, Brazil, presented by Mrs. J.P.G. Smith [BM].

Mansonia (M.) *titillans* in part (?) of Dyar (1918d:112; 1928:254-255); Shannon (1931:151); Edwards (1932:116); Matheson (1944:246-247); Pratt (1945:121-129; 1953:15); Carpenter, Middlekauff and Chamberlain (1946:124-127); Lane (1953:594-597); Carpenter and LaCasse (1955:107-109); Perez Vigueras (1956:453-461); Stone, Knight and Starcke (1959:106); Ronderos and Bachmann (1963a:48; 1963b:61; 1964:1-8); Forattini (1965b:70-76); Montchadsky and Garcia (1966:37); Porter (1967:37).

Mansonia titillans in part (?) of Theobald (1903a:273; 1905a:33-34; 1905b:31); Coquillett (1906b:25); Howard, Dyar and Knab (1915:516-521); Johnson (1919:423); Gowdey (1926:73); King,

Bradley and McNeel (1944:58); Hill and Hill (1945a:2; 1948:50-51); Thompson (1947:79); Perez Viguera (1948:298-300); Horsfall (1955:380-381).

Taeniorhynchus (T.) titillans in part (?) of Bonne and Bonne-Wepster (1925:316-320); Lima (1935:464-466); Barretto and Coutinho (1944:57-59).

FEMALE (fig. 51). Wing about 4.0 mm. Medium-sized brown to dark brown species lightly to moderately speckled with white and whitish scales on labium, palpus, wing, femora, tibiae and tarsal segments 1, and abdomen; tarsi with small but conspicuous dorsal basal white bands on all segments except on 5 of foreleg and midleg; labium with a narrow dorsal white band at apical third. *Head*: Decumbent scales narrow, whitish or pale golden on disc; broader and white on sides and along lower part of ocular border. Erect scales dark, very numerous, present on nearly all of disc and sides. Proboscis slightly longer than forefemur. Labium predominantly dark scaled throughout, lightly to moderately speckled with whitish scales; with conspicuous narrow dorsal white band on apical third. Palpus about 0.35 of proboscis; segment 4 minute, white, without scales; segment 3 (long "terminal" segment) a little more than 2.0 of club-shaped segment 2; without scales on ventral and inner surfaces, predominantly dark scaled on dorsal and outer surfaces, with scattered whitish and white scales, scaling shaggy on segment 2. Antenna subequal in length to proboscis; base of flagellar segments whitish, strongly contrasting with dark color of remainder; torus with a few small scales, both dark and light, on mesal surface; flagellar segment 1 with a few small dark scales on mesal surface. *Thorax*: Mesonotal scales all narrow, curved, short, except for large patch among supraalar bristles and smaller patch at end of dorsocentral row of bristles where they are very long and outstanding; predominantly dark bronzy but with some lighter, whitish to golden brown scales present, primarily on anterior promontory, supraalar area, and around prescutellar area. Mesonotal bristles very numerous, all rows strongly represented; fossa with several bristles. Scutellum with whitish to golden narrow scales on all lobes. Paratergite very poorly developed, bare. Pleural scaling sparse, usually restricted to *apn*, *ppn*, *ppl* and *stp*; scales narrow and pale golden on *apn* and *ppn*; pale golden and broader on *ppl*; whitish or white and broad in small patch on upper *stp* and along lower posterior *stp*; sometimes a few scales on *pst* similar to those on *ppl*, a few elongate whitish scales in upper *mep*. Mesepimeron with 3 or more middle anterior bristles in addition to large upper *mep* patch; *psp* bristles numerous. *Legs*: Coxae and trochanters with light and dark scales. Femora speckled with light scales against a background of dark scales except for a narrow pale dorsal streak on foreleg and predominantly pale posterior surfaces of midleg and hindleg; very small pale knee spots more or less distinct on all femora. Tibiae predominantly dark with some pale scaling on all surfaces, except ventral surface which is paler especially on foreleg. Tarsi as described above; white markings sometimes forming complete rings on segments 2-4 at least on hindlegs. *Wing*: Dorsal plume scales all broad and distinctly asymmetrical; predominantly dark but with scattering of whitish scales throughout. *Haltere*: Stem pale, knob dark scaled. *Abdomen*: Laterotergite bare. Tergite I with small median patch of pale scales; tergites II-VII predominantly dark scaled, with more or less numerous pale (dingy white or yellowish) scales laterally and more or less conspicuous short apicolateral transverse border of white scales; on tergite II usually a varied apical transverse band of pale scales. Sternites II-VII with irregular and variable mixture of dark and pale scales. Tergite VII with a long apical arcuate row of short dark spiniforms. Tergite VIII with about 8 (6-9) of the heavy spiniforms of the apical row clumped together at the midline.

MALE. In general similar in ornamentation to female except for more extensive pale scaling of the abdomen and tarsi. Palpus in general similar to that described for *dyari* except pale scaling other than basal white bands more yellowish.

MALE GENITALIA (fig. 51). Described and figured from 1 Jamaican specimen, compared with Central American material. Essentially as described and figured by Carpenter and LaCasse (1955:107-108). *Segment VIII*: Tergite with single apical row of 8-10 specialized thickened setae with flared apex with 2-5 forks. *Segment IX*: Tergite poorly developed, median part unsclerotized except for complete or incomplete narrow caudal bridge. *Sidepiece*: Elongate; mesal margin nearly straight, without any indication of distal swelling; distinctly differentiated narrow mesal membrane from apex of sessile part of claspette to base of clasper; tergoapical area with a few simple setae of varied size; apical sternomesal area with a few moderate and short simple setae; tergommesal margin with 5-9 thin setae in basal 0.5. A row of 3 or more very heavy, long, nearly straight bristles at base of tergal surface laterally; other strong bristles laterally near base and sternolaterally near apex. Scales numerous, restricted to lateral and ventral surfaces. *Claspette*: Greater part sessile on sidepiece, including a sternal sclerotization meeting its mate on midline, a tergal sclerotization extending towards mesal basal angle of sidepiece, and a broader caudal sclerotization extending in basal mesal membrane of sidepiece. Free distal portion of claspette short, projecting dorsomesad, appearing swollen on mesal margin; usually with 1 heavy apical spiniform, sometimes with 1 additional short adjacent somewhat thickened seta. *Clasper*: Inserted at apex of sternal margin of sidepiece. Base not markedly swollen; distal part gradually and only moderately bent dorsad; tapering very gradual except on apical 0.2. External margin even in outline. Dorsal surface with short, broad, flat, apically rounded ledge arising in basal 0.4 and not reaching apex of body of clasper. Spiniform short, projecting for less than 0.5 of its length beyond apex of clasper. *Phallosome*: Aedeagus widened and broadly rounded distally, without any lateral process and with lateral plates joined apically across midline in distal 0.13-0.2. *Proctiger*: Very long; broad at base and distinctly constricted laterally near middle when viewed in resting position; with conspicuous dorsal spiculose membranous lobe on each side developed from basolateral sclerotization just ventrad of tergite IX. Ventrolateral part of paraproct sclerotization twisted near middle to form the lateral constriction; apex of paraproct with 1 heavy apical spine. Cercal setae about 6-8, usually all short.

PUPA (fig. 51). Chaetotaxy as figured; hairs usually all single except 9-VII, VIII; occasionally some normally single hairs with 1 or 2 irregular short branches or barbs. *Cephalothorax*: Evenly moderately to lightly pigmented. All normal hairs present but only 8,9-C easily seen. *Trumpet*: Short, index about 6.0 or less; darkly pigmented and contrasting. Tracheoid extending on posterior (convex) surface to level of base of apical process so that no bulb is differentiated. Meatus moderately curved with convex outline posterior. Apical process strongly curved laterad in distal part; its base very broad, with a solid envelope around the more heavily sclerotized central core; funnel (representing walls of pinna) inconspicuous, very shallow throughout and extending to beyond middle; distal free part heavily sclerotized, covered with densely packed minute, apparently branched spicules. Basal tubercle very prominent. *Metanotum and Abdomen*: Pigmentation moderate, even or uneven, somewhat darker caudad. Spiculation inconspicuous. Caudolateral angle of segment VIII not produced. Sternites without conspicuous transverse ridges. Hair 2 present on segments I-VII; hair 3 absent only on VII; hair 6 absent only on VII; hair 8 absent on II; hair 9 absent on I; hair 10 apparently absent on II; hair

11 present only on VII, apparently not represented even by an alveolus on other segments. Hair 9-VII,VIII strongly developed, branched; at caudolateral angle of segments, ventral not dorsal as shown on figure. Dorsal hairs strongly developed, 1 and 5 longer than tergites following on II-VI; ventral hairs weak and difficult to see. *Paddle*: Moderately broad, index about 2.5 or less. Shallowly emarginate apically on inner margin, only outer lobe developed. Margins with sharp denticles. *Terminal Segments*: Female genital lobe short, details invisible in material at hand. Male genital lobe less than 0.5 of paddle length; apex of sidepiece case with slight process.

LARVA (fig. 50). Complete chaetotaxy not studied. Most hairs strongly developed and easy to see. *Head*: Head capsule uniformly moderately pigmented except for darkened collar and a blackish spot near base of mouthbrushes. Head capsule distinctly wider than long; antenna inserted far forward; labrum distinctly produced at base of hair 1-C. Ventrolateral angle of antennal tubercle with long sharp spine. Maxillary suture complete; hair 15-C only slightly caudad of level of 14-C. *Antenna*: Distal part (beyond hairs 2,3-A) very inconspicuously "annulate", subequal in length to basal part, moderately pigmented and easy to see. Basal part more heavily pigmented, especially at base; spicules distinct. Hair 1-A multiple, branches barbed; inserted before middle, at end of widened proximal part. Hairs 2,3-A single, slightly longer than distal part of antenna. *Thorax*: Not studied. *Abdomen*: Hair 6 long and single on segments I-VI. *Segment VIII*: Comb scales usually about 8; dorsal in form of long slender spines with fine fringes at base only; ventral with shorter main spine with secondary basal spine; occasionally 1 very short broad apically fringed scale. Hairs 3-5-VIII widely separated; 3-VIII usually double, distinctly barbed and not flattened. *Siphon*: Body of siphon slightly pigmented. Hair 1-S usually with 4 or 5 branches, simple, not flattened and without distinct barbs; inserted a short distance basad of preapical ridge. *Anal Segment*: Saddle strongly pigmented. Accessory saddle hairs (x-X) absent. Hair 1-X short, simple, usually with 6 branches; branches of dorsal brush hairs (2,3-X) simple, not flattened or barbed. Ventral brush (4-X) with 4 pairs of hairs on strong grid, all with simple branches except 4d-X whose branches are flattened distally; 4 precratial hairs, all usually double, the proximal with slight flattening of branches distally.

SYSTEMATICS. Our assignment of the Jamaican population to *titillans* is only tentative as we have not seen topotypic material of this species from Brazil. *Mansonina titillans* in the current sense may be a complex of at least 2 forms judging by the flattened hair 3-VIII and uniformly long comb scales of the larva and different trumpet and paddle of the pupa from Argentina figured by Ronderos and Bachman (1963b:59) and slight but constant differences in the male genitalia of specimens from that area examined by us. However, these differences may be clinal or strictly local.

The Jamaican population of *titillans* is apparently similar to those we have seen from the United States (Florida), Cuba, Antigua, St. Lucia, Mexico, El Salvador, Costa Rica, Panama, Trinidad and Guyana, but not all critical stages were available for comparison for all these populations.

Characteristic of the *titillans* complex is the shape of the male clasper as described and figured here. An interesting feature of the larva is the presence of 4 pairs of hairs on the grid of the ventral brush. This feature is also found in a new species found recently in Panama by M.M. Boreham as well as in true *indubitans* from South America and Trinidad (see *dyari*).

BIONOMICS. According to Hill and Hill (1948:49) the favorite host plant for

the attachment of the larvae and pupae of *titillans* is the water hyacinth (*Eichhornia crassipes*). Our only collections of immature stages (227,361,789) were all made in the same small shallow grassy semipermanent swamp with rice plants, sedges and herbaceous vegetation. Pratt (1953:17) records collecting pupae of *titillans* from the roots of a *Pontederia*-like plant with purplish flowers in Clarendon on 11 Jan 1946 in company with G.A. Thompson.

Females of *titillans* bite man readily in Jamaica and have been collected also in animal-baited traps and light traps. An unidentified virus was recovered from *titillans* in Milk River, Clarendon, in Sept 1962 (L.S. Grant, personal communication).

DISTRIBUTION. Brazil (type locality); reported from the southern U.S.A. (Florida and Texas) all the way to Argentina; as indicated under systematics above it is doubtful that all these populations are conspecific. A form apparently similar to the one found in Jamaica occurs in Florida, Mexico, Central America, Panama, Greater and Lesser Antilles, Trinidad and the Guianas.

JAMAICA. *Clarendon*: Rhymesbury and probably other localities, Jan 1945-Jan 1946, G.A. Thompson, 1 M, 14 F, 7 L, 4 P [USNM; UCLA]. South Clarendon, May 1944, A.E. Pritchard, 1 L [USNM]. *Kingston and St. Andrew*: Ferry (703). Kingston and vicinity, various dates, M. Grabham, 7 F [USNM]. *St. Catherine*: Rio Cobre Valley (914). *St. James*: Unspecified locality (Hill and Hill, 1948:51). *St. Thomas*: Grants Pen (874). *Westmoreland*: Crab Pond Bay (359). Petersville (227,361,789).

Material Examined: 75 specimens; 1 male, 25 females, 45 larvae, 4 pupae; no individual rearings.

28. *Mansonia* (M.) *flaveola* (Coquillett)

Figs. 50,52

1906. *Taeniorhynchus flaveolus* Coquillett, 1906a:182. TYPE: Holotype male, St. Thomas, Virgin Islands, Aug 1905, A. Busck [USNM, 8288].

Mansonia (M.) *flaveola* in part (?) of Shannon (1934:107); Pratt (1945:121-129; 1953:14); Lane (1953:598-600); Stone, Knight and Starcke (1959:106); Ronderos and Bachmann (1963a:48; 1963b:57, possible synonym of *pseudotitillans*; 1964:6-7); Porter (1967:37).

Mansonia flaveola of Howard, Dyar and Knab (1915:521-523).

Taeniorhynchus (T.) *flaveolus* in part (?) of Lima (1935:461-463); Barretto and Coutinho (1944:62-64).

Taeniorhynchus flaveolus of Coquillett (1906b:24); Theobald (1910:432; questions generic placement).

Taeniorhynchus (T.) *titillans* var. *flaveolus* of Bonne and Bonne-Wepster (1925:320).

Mansonia (M.) *titillans* in part of Dyar (1918d:112; 1925c:151; 1928:254-255); Edwards (1932:116).

FEMALE (fig. 52). Wing about 4.5 mm. Described from Puerto Rican population. General size and appearance of *titillans* as described except for less contrast between dark and light scaling and with the following conspicuous differences. **Head**: Orbital line of narrow decumbent scales better differentiated, with whitish or white scales instead of yellowish. Proboscis a little shorter than forefemur. Labium without dorsal white band in apical third; scaling varied from predominantly dark to predominantly light; light scaling light dingy yellow to light coppery. Palpus distinctly longer, about 0.5 of proboscis; usually more extensively pale; minute apical segment distinctly longer. **Thorax**: Mesonotum with narrow pale scales more

numerous and white or whitish. Scales of *apn* and *ppn* broader and whitish. *Legs*: More extensively pale, sometimes femora, tibiae and tarsal segments 1 predominantly pale, speckled with dark scales. At least basal 0.5 of hindtarsal segment 1 whitish; basal light scaling of tarsal segments 2-4 (2 and 3 on foreleg) more extensive, forming complete whitish rings, variable in size but usually at least 0.3 of segment length on segments 3 and 4 on midleg and foreleg. *Wing*: Dorsal pale scaling somewhat more extensive. *Abdomen*: Tergites II-VII predominantly with dingy light to dark coppery scales with variable patches of bronzy scales basolaterally, particularly on segments II and III and sometimes basally across entire tergite on III; apicolateral light scales very few and dingy white. Sternites II-VII predominantly with dingy white scales. Tergites VII and VIII with spiniforms essentially as in *titillans*.

MALE. Described from Puerto Rican populations. Essentially similar to female except for somewhat lighter scaling throughout. Palpus essentially as in *titillans* but scaling and bristles much paler.

MALE GENITALIA (fig. 52). Described and figured from Puerto Rican specimens. In general similar to *titillans* as described above but with the following diagnostic features; integument very pale. *Segment VIII*: Specialized setae not as strongly differentiated, more slender, with longer apical forks; in an uneven apical median patch and scattered in apical 0.3 of tergite. *Sidepiece*: Without distinct differentiation of a mesal membrane. *Claspette*: Free portion somewhat longer and projecting dorsocaudad not dorsomesad, not appearing swollen in resting position. *Clasper*: Broader in proximal part which is nearly straight after initial strong basal curvature; external margin with distinct postmedian angle, beyond which apical portion is gradually tapered; dorsal ledge submedian in origin, with broad basal part and narrow thumblike distal part. *Phallosome*: Aedeagus nearly circular in outline. *Proctiger*: Narrower and with less conspicuous median lateral constriction; dorsal lobe of basolateral sclerotization with few to no spicules; ventrolateral sclerotization broader at base and less twisted distally.

PUPA (fig. 52). Described and figured from 1 Puerto Rican specimen. Chaetotaxy as figured. In general similar to *titillans* as described above except for following conspicuous diagnostic features. Trumpet somewhat shorter. Abdominal pigmentation lighter; dorsal hairs much weaker and shorter, none exceeding 0.6 of length of tergite following. Paddle distinctly broader, index less than 2.0; apical emargination shallower; marginal denticles weaker.

LARVA (fig. 50). Described from 1 Puerto Rican specimen for details of head and terminal segments only. In general as described for *titillans* above except for following striking differences. *Head*: Lighter in color. Spine of antennal tubercle longer and more slender. *Segment VIII*: Comb with 2 dorsal scales long and spine-like and 4 much shorter scales with short apical and weaker basal denticles. Hair 3-VIII single; 4,5-VIII shorter and with more numerous branches. *Siphon*: Lighter in color. Hair 1-S inserted a greater distance from preapical ridge, single and distinctly flattened. *Anal Segment*: Saddle lighter in color; a pitlike sense organ dorsad of subbasal precratal hair. Ventral brush with only 3 pairs of hairs on grid; hair 1-X weaker; dorsal brush hairs (2,3-X) and ventral brush hairs (4-X) with fewer branches, these as well as the unbranched precratal hairs all distinctly flattened.

SYSTEMATICS. The material of *flaveola* we have studied is all from the main island of Puerto Rico and the islet of Isla Verde, north of San Juan, Puerto Rico. There is no reason to doubt the conspecificity of these populations with topotypic *flaveola* from St. Thomas in the Virgin Islands which is located on the same

submarine rise as Puerto Rico and is only about 40 miles from its eastern end. Apparently no additional topotypic material has been collected and a recent search by M.M. Boreham on St. Thomas proved negative.

The name *flaveola* is hardly descriptive of the general coloration of the females of this species from Puerto Rico. The general appearance of these females is not markedly different from *titillans* although as pointed out in the description, the light speckling of the legs is more extensive and the predominant color of the abdominal tergites is coppery (light to dark). The males tend to be lighter in color, with more yellowish abdominal tergal scaling.

We have not been able to locate the source for the record of *flaveola* from Jamaica by Porter (1967:40) but it is quite possible that this species occurs on the island as well as elsewhere in the West Indies and has been confused with *titillans*. The only material we have seen from elsewhere than Puerto Rico and St. Thomas that can be assigned with some doubt to *flaveola* is from Panama (courtesy of M.M. Boreham).

The most characteristic feature of the female of *flaveola* is the relatively long palpus. Populations with this feature and a distinct yellow color have been reported as *flaveola* from South America (Surinam, French Guiana, Brazil, Peru, Bolivia and Argentina). Although these populations undoubtedly belong to the *flaveola* complex, their conspecificity with it is questionable. The palpus of the few females we have seen from the Lower (Brazil) and Upper (Peru) Amazon [USNM] is considerably longer than in the Caribbean *flaveola*. The male genitalia from the Lower Amazon are quite similar to typical *flaveola* in general features but the material is not adequate for detailed comparison. The status of the South American "*flaveola*" population cannot be determined without study of the immature stages, which have not been described, but it seems very unlikely that they will prove to be conspecific with typical *flaveola*.

BIONOMICS. Larvae and pupae of *flaveola* were collected in Puerto Rico on the roots of water spoon (*Hydromystria stolonifera*) on 19 Sept 1943 (Pratt, 1945: 121). Adults of *flaveola* have been taken in light traps in Puerto Rico.

DISTRIBUTION. St. Thomas, Virgin Islands (type locality), Puerto Rico and possibly Panama; the record from Jamaica (Porter, 1967:40) has not been confirmed but this species may occur on the island. Other records of *flaveola*, from South America, probably pertain to a different species.

JAMAICA. No material seen.

29. *Mansonia (M.) dyari*, n.sp.

Figs. 50,53

TYPES: Holotype male and allotype female, with associated pupal skins and genitalia mounted together on 2 slides (450103), [Ft. Simonds], Clarendon, Jamaica, 3 Jan 1945, G.A. Thompson [USNM]. Paratypes: 1 male with genitalia slide and associated pupal skin (450301/2/A), 1 male (4/4), 13 females (LT-1, LT 3/1, LT 3/3, LT 3/4V, LT 3/4VIII, LT 3/5, LT 4/2, LT 4/3, DT 20/2, 450105S, 450208-1, 450208-2, 450208-3) all with genitalia slides except LT 3/4VIII and LT 3/5, 1 female genitalia slide (Journ. Kans. Ent. Soc. 18:125, 1945 fig.) without associated female, 15 larvae, same locality as holotype and allotype, Jan-Aug 1945, G.A. Thompson [BM; UCLA; USNM]; 2 females [UCLA], 12 females [USNM], [Molynes Pen], Kingston, Jamaica, 16 Nov 1906, M. Grabham.

Mansonia (M.) indubitans of Pratt (1945:121-129; 1953:12-14); Carpenter, Middlekauff and Chamberlain (1946:121-123); Carpenter and LaCasse (1955:105-107); in part of Stone, Knight and Starcke (1959:106); Montchadsky and Garcia (1966:37); Porter (1967:37).
Mansonia indubitans of Hill and Hill (1945a:2; 1948:49-50); Thompson (1947:79).

FEMALE (fig. 53). Wing about 3.5 mm. In general similar to *titillans* as described above except chiefly for the smaller size, whiter color of the pale scaling throughout and the following. *Head*: Decumbent scales white throughout. Labium more extensively pale scaled; lower surface with broad pale band extending from basal 0.25 to 0.65. Palpus slightly shorter; segment 3 about 1.8 of segment 2. Antennal torus with white scales more numerous; flagellar segment 1 without scales. *Thorax*: Erect scales in supraalar area more numerous, longer and darker (nearly black), majority of these with broad truncate apex with several points; clump of erect scales at posterior end of dorsocentral row of bristles larger and darker. Scutellar scales white. *Legs*: White scaling of tarsi more extensive, usually forming complete rings on segments 2-4 of all legs. Knee spots less distinct. *Abdomen*: Scaling of tergite I white; tergite II apparently without pale apical transverse band. Tergite VII without apical row of spiniforms, corresponding hairs short, slender, simple; setae removed from apex of segment. Tergite VIII without a median clumping of the spiniforms of the posterior row.

MALE. In general similar to female in ornamentation except for a more or less distinct apical transverse pale band on tergite II. Palpus exceeding proboscis by about length of segment 5; dorsal surface extensively speckled with pale scales, very narrow, more or less distinct white bands at base of segments 2-5; apex of segment 3 with a dense clump of thin straight setae ventrally, projecting forward externally to beyond middle of segment 5; entire ventral surface of segment 4 with similar but curved setae projecting forward internally to about same level; entire ventral surface of segment 5 with much shorter, nearly straight setae outward and inward.

MALE GENITALIA (fig. 53). In general as described and figured for *indubitans* by Carpenter and LaCasse (1955:105-106), agreeing with description of *titillans* as given above except for following diagnostic features. *Segment VIII*: Tergite usually with only 5 or 6 forked apical spiniforms. *Sidepiece*: Mesal margin distinctly swollen in distal part, particularly sternally, to form a short, broad lobe so that sidepiece appears broadly capitate in distal half; mesal membrane much more extensive; tergoapical area with numerous long, narrow, sharply pointed striated scales; apical sternomesal area with large clump of moderately long, somewhat flattened setae and shorter simple hairs; setae on tergommesal margin less numerous in basal 0.5, usually 2 or 3 but additional 1 or 2 setae usually present near level of origin of free part of claspette. *Claspette*: Apical spiniform only about half as thick. *Clasper*: Broader; base very broad; distal part bent dorsad at nearly right angle, distinctly sharply tapered only on apical portion; external margin appearing sinuous in resting position but without sharp angle; dorsal ledge much broader, arising from base and reaching nearly to apex of body of clasper. *Phallosome*: Aedeagus somewhat less swollen distally. *Proctiger*: Paraproct spine not as strong.

PUPA (fig. 53). Chaetotaxy as figured. In general very similar to *titillans* as described above but with the following diagnostic features. Trumpet distinctly longer and more slender, index about 10.0; apical process much longer, funnel more conspicuous at base and extending to near tip of apical process. Dorsal abdominal hairs somewhat shorter, rarely exceeding length of tergite following; hair 6 distinctly shorter. Paddle distinctly more slender, index about 3.5; marginal denticles

less distinct.

LARVA (fig. 50). In general as described for *titillans* above except for following striking differences in details of antenna and terminal segments. *Antenna*: Hair 1-A inserted near middle of basal part; 2,3-A apparently shorter. *Segment VIII*: Comb scales about 7, all short, broad and with subequal apical and lateral denticles. Hair 3-VIII usually with 5 distinctly flattened branches; 5-VIII with 2 flattened branches. *Siphon*: Lighter in color. Hair 1-S inserted a greater distance from preapical ridge, usually with 5-7 distinctly flattened branches. *Anal Segment*: Saddle lighter in color. Ventral brush with only 3 pairs of hairs on grid. Hair 1-X with more numerous and longer branches. Hairs 2-4-X (including precratal tufts) all with strongly flattened branches; dorsal brush (2,3-X) and grid hairs of ventral brush (4-X) with fewer branches.

SYSTEMATICS. This species is distinct in all stages from *indubitans* Dyar & Shannon, 1925, whose type locality is Belem, Brazil. We have seen no topotypic material of *indubitans* but we have studied associated material of all stages from Trinidad [UCLA] whose male genitalia are identical with those of 2 specimens from the Amazon basin [USNM] identified by Shannon as *indubitans* and 1 specimen from Surinam [USNM]. Because of this genitalic similarity we consider that the Trinidad population is probably conspecific with *indubitans*.

The male genitalia of all the material of the *indubitans* complex we have seen from South America and Trinidad conform to a type different from *dyari* and are in general similar to the figure in Barretto and Coutinho (1944:85) in the broadened clasper. The immature stages are in general similar to the figures of the larva (1,2) and pupa (10,11) in Ronderos and Bachmann (1963b:59-60). However, there are considerable differences in the shape of the clasper, particularly in Colombian populations, and it is possible that in South America the complex is represented by another species in addition to true *indubitans*.

Material of the *indubitans* complex we have seen from Florida, Puerto Rico, Costa Rica and Panama agrees quite well with *dyari* from Jamaica. It appears, therefore, that from Panama northward in Central America and Mexico, and in the Greater Antilles and southeastern United States the *indubitans* complex may be represented by this one species. Some local differentiation may be present, however, as suggested by the differences in the chaetotaxy of the terminal segments of the larva figured in Carpenter and LaCasse (1955:106).

Mansonia dyari differs from *indubitans* in the following features: (1) in the male genitalia, presence of many striated long setae or scales on the apex of the side-piece, instead of a few; and much more convoluted clasper which is sharply bent in the distal 0.5 and much narrower beyond its base; (2) in the pupa, the trumpet longer and more slender and the long abdominal hairs shorter; and (3) in the larva, short broad comb scales instead of a few slender spinelike; ventral brush with 3 pairs of hairs on grid instead of 4; hair 3-VIII multiple instead of double.

A striking feature of all the members of the *indubitans* complex is the development of numerous long erect scales with broad truncate apex with several points (in general similar to erect scales of head capsule) in the supraalar area, and a clump of broadened, semierect dark scales at the posterior end of the dorsocentral row of bristles. Females of the complex lack the row of short dark spiniforms on the apex of tergite VII and have no median clumping of the spiniforms of the posterior row on tergite VIII. In our opinion, the taxonomic value of the arrangement of spiniforms on tergite VIII in the subgenus *Mansonia* is limited and can be used only to delimit groups because of marked individual variation.

BIONOMICS. The immature stages of *dyari* (as *indubitans*) were collected attached to the roots of water lettuce (*Pistia stratiotes*) in south Clarendon parish by G.A. Thompson and H.D. Pratt on 17 Jan 1945 (Pratt, 1945:121). Females were taken in the same area in light traps in 1943, 1944 and 1945.

DISTRIBUTION. Jamaica (type locality); Florida, Puerto Rico, Costa Rica and Panama; and probably other records of *indubitans* from the Greater Antilles, Mexico and Central America.

JAMAICA. *Clarendon*: Ft. Simonds, Sandy Gully and Rhymesbury area, Jan-Aug 1945, G.A. Thompson et al., 2 M, 15 F, 15 L, 2 P [USNM; BM; UCLA]. *Kingston and St. Andrew*: Kingston vicinity, Molyne Pen, 16 Nov 1906, M. Grabham, 14 F [USNM; UCLA].

Material Examined: 48 specimens; 2 males, 29 females, 15 larvae, 2 pupae; 2 individual pupal rearings.

TRIBE ORTHOPODOMYIINI

GENUS ORTHOPODOMYIA

The species of *Orthopodomyia* reported from the West Indies are easily recognized in the adult stage by the pattern of narrow white scaled lines on the mesonotum and the absence of postspiracular bristles. The siphon of the larvae has no pecten teeth, the head capsule and the antenna are normal, the comb is uniquely developed and segments VII and VIII have large sclerotized dorsal plates. The pupae resemble those of the Aedini in the absence of a tracheoid on the trumpet and in general chaetotaxy and are difficult to differentiate as a group but the West Indian species may be differentiated by the combination of characters given in the key.

We are following the worldwide revision of the genus by Zavortink (1968) for the taxonomy of the species known from the West Indies. Zavortink recognizes *waverleyi* from Jamaica as a species distinct from *signifera* (Coquillett, 1896) which has rather distinct populations in Cuba and Puerto Rico and possibly Hispaniola (Haiti).

We are including both species in the key to the adults, the only stage showing reliable differences. For detailed descriptions of all stages, Zavortink's revision should be consulted.

KEY TO ADULTS

1. Lateral prescutellar light scaled line connected to the inner dorsocentral line; posterior fossal line indicated and connected to the sparsely scaled outer dorsocentral line 30. *waverleyi*
- Lateral prescutellar light scaled line not connected to inner dorsocentral line; posterior fossal line absent and outer dorsocentral line densely scaled (Cuba, Puerto Rico) *signifera*

30. *Orthopodomyia waverleyi* (Grabham)

Figs. 54,55

1903. *Mansonia waverleyi* Grabham, 1907:25. TYPE: Lectotype male (650626-14) with genitalia slide, Waverley Estate, Constant Spring (St. Andrew), Jamaica, 1 Sept 1906, M. Grabham [USNM; designation of Zavortink, 1968:31-32].

Orthopodomyia waverleyi of Howard, Dyar and Knab (1917:891-893); Johnson (1919:424); Gowdey (1926:74); Edwards (1939:121-123); Zavortink (1968:31-35).

Pneumaculex waverleyi of Theobald (1910:469,619-620).

Orthopodomyia signifera of Dyar (1928:397, in part); Edwards (1932:108, in part); Lane (1939:97, in part; 1953:628-629, in part); Hill and Hill (1945a:3; 1948:51); Thompson (1947:79); Stone, Knight and Starcke (1959:124, in part); Porter (1967:37, in part).

FEMALE. Wing about 3.8 mm. A medium-sized black species highly ornamented with white scales on head, thorax, legs, wing and abdomen. *Head*: Decumbent scales all white, in a conspicuous orbital line and a sparse patch on disc. Erect scales numerous, extending to orbital bristles; long, slender, all black. Labium with narrow line of white scales laterad of labial groove from base to apex. Palpus 4-segmented, segment 4 minute; about 0.33 of proboscis; with narrow dorsal line of white scales to apex of segment 3. Antennal torus with narrow curved mesal line of white scales continued on flagellar segments, sometimes up to segment 7. *Thorax*: Vestiture sparse, largely in longitudinal lines with extensive bare spaces between lines; very dark bronzy scales in (1) rather broad acrostichal line to anterior part of prescutellar space in middle of which they are replaced by short dark hairs, (2) broad dorsocentral line, and (3) scattered over most of fossa; pure white scales all in lines mostly 1 or 2 scales wide along (a) inner dorsocentral, connected to (b) denser lateral prescutellar, (c) sparse posterior fossal, connected to (d) outer (posterior) dorsocentral, and (e) and (f) anterior prescutal and supraalar forming a continuous lateral border from humeral angle to parascutellum. Median scutellar lobe with line of white scales continuous with lateral prescutellar line, posterior scales very long. Mesonotal bristles very strongly developed, especially acrostichals, dorsocentrals and fossals, all very long. Paratergite bare. Pleural scaling pure white, sparse, arranged as follows: narrow line across *apn* and *ppn*; small patch in posterior *psp*; line across *ppl* and upper anterior *stp* continuous with large patch in upper and posterior *stp*; small patch in *pra*; small middle and upper *mep* patches. Pleural bristles moderately developed, on *apn*, *ppn*, *ppl*, *stp*, *pra* and upper *mep*. *Legs*: Coxae and trochanters with white scales. Femora predominantly dark except for usual pale surfaces and speckling of white scales. Small white knee spots usually distinct. Tibiae predominantly dark, with speckles and lines of white scales. Tarsi predominantly dark, marked with white patches, bands or rings as follows: foretarsal segment 1 usually with small basal and apical dorsal patches, segment 2 sometimes with basal dorsal patch; midtarsal segment 1 with complete narrow basal ring and incomplete apical ring, segment 2 with small basal and apical dorsal patches; all hindtarsal segments with basal and apical bands, usually forming complete rings at base of segment 1 and on joint between segments 1 and 2, segment 5 sometimes without apical patch; foretarsal and midtarsal segment 4 shorter than 5. Claws all simple, subequal. *Wing*: Dorsal scales predominantly dark, white scales in speckles and small spots; remigium with white scales; vein 1A with long basal white streak. *Haltere*: Pale scaled. *Abdomen*: Tergite I with median patch of white

scales, laterotergite without scales; tergite II largely white scaled; tergites III-VIII predominantly dark, with small basolateral patches of white scales and sometimes basal white scales dorsally, not forming complete transverse bands. Sternite II entirely white scaled; sternites III-VII white scaled at base and middle, apicolateral dark scaling becoming more prevalent on distal segments.

MALE. Essentially as in female. Palpus very slender; slightly shorter than proboscis; porrect; 5-segmented, segment 5 minute; segments 1-3 with white scales on dorsal surface in a continuous or speckled line, segment 4 with dorsal basal band of white scales, segment 5 with white scales only; segment 4 with a few moderately long bristles primarily toward apex. Antennal flagellum densely long plumose.

MALE GENITALIA (fig. 54). As figured; diagnostic characters as in the key to tribes and genera. *Segment VIII*: Tergite with small median caudal lobe. *Segment IX*: Tergite short, without lobe but with a few submedian setae on each side removed from posterior margin. *Sidepiece*: More or less conical; mesal surface membranous for short distance distad of claspette; tergomesal area with 2-4 specialized bristles near level of claspette. *Claspette* (basal mesal lobe): Poorly differentiated, with 3-5 stout bristles and 1 or 2 finer bristles. *Clasper*: Simple, narrow; spiniform broadened distally into a fine-toothed comb. *Phallosome*: Aedeagus large, bulbous at base, narrowed distally; a dorsolateral subapical crown of several denticles. *Proctiger*: Only slightly narrowed distad of very broad base. Basolateral sclerotization strong but not meeting on dorsal midline; broadly continuous at base with ventrolateral sclerotization. Distinct narrow dorsal sclerotization present. Paraproct apex usually with 2 or 3 teeth. Cercal setae usually 3 or 4.

PUPA (fig. 54). In general resembling species of tribe Aedini; diagnostic characters as in the key to tribes. *Cephalothorax*: Moderately pigmented, darkened on mesonotum. Hairs 8-C and 9-C in a line perpendicular to middorsal ridge. *Trumpet*: Very darkly pigmented, contrasting; tracheoid not developed; pinna large. *Metanotum and Abdomen*: Uniformly moderately to strongly pigmented but anterior part generally darker. Hairs 10-12-C usually single to triple. Abdominal hairs other than 1-I, 9-VII, VIII weak, mostly single or with a few branches; 1-VI mesad of hairs 2 and 3; hair 2-III-V mesad of hair 1. *Paddle*: Small; outer part slightly wider than inner; midrib weak distally; marginal spicules not developed. Only hair 1-P developed, branched.

LARVA (fig. 55). Diagnostic characters as in the key to tribes and genera; body purple in life. *Head*: Darkly pigmented, lighter on sides in ocular area. Length subequal to width; ocular bulge not developed; antennal insertion far forward; labrum very short; labial plate very long; maxillary suture incomplete anteriorly, nearly straight; mouthbrushes normal; collar very poorly developed. *Antenna*: Short, widened in basal half; shaft without spicules; hair 1-A in basal half. *Thorax*: Hair 13-P not developed. Common basal tubercles developed only for pleural groups (9-12). *Abdomen*: Chaetotaxy normal; segment VII usually with large sclerotized dorsal plate, segment VI often with smaller plate. Hair 1-III-VII long, single; 6-I, II multiple; 6-III-VI very long and single; 7-I long, usually double; 7-II short, usually triple. *Segment VIII*: Very large sclerotized plate covering most of dorsal and lateral surfaces. Comb scales in 2 rows, the posterior row shorter; basal part of free portion of scales with fine fringes, distal a long slender spine. *Siphon*: Strongly uniformly pigmented; pecten completely absent; base irregularly sclerotized in older specimens. Hair 1-S large, multiple, near middle. *Anal Segment*: Saddle complete, uniformly strongly pigmented. Acus absent but conspicuous lateral basal sclerotized band developed. Hair 1-X weak, usually single. Ventral brush usually with 7 pairs

of hairs on weakly developed grid. Gills short to moderate, rounded apically.

SYSTEMATICS. *Orthopodomyia waverleyi* is the most derived species of the Signifera Group of *Orthopodomyia* in adult ornamentation but it is extremely similar in the immature stages to some populations of *signifera* (Coquillett, 1896). It is apparently endemic to Jamaica since it is very likely that its record from Haiti by Root (1927:465) actually pertains to *signifera* which is known to occur in Cuba and Puerto Rico (Zavortink, 1968:42).

We have not been able to find a record of the existence of a Waverley Estate in Constant Spring and it is possible that the name *waverleyi* was a lapsus for a name derived from the Maverley Estate near Constant Spring.

BIONOMICS. Immature stages of this species have been reported only from tree-holes where they were associated most frequently with *Corethrella (C.) appendiculata* (7). They were also found with *Toxorhynchites (L.) portoricensis* (3), *Haemagogus equinus* (2), *Aedes (Steg.) aegypti* (2), *Aedes (H.) inaequalis* (1) and *Aedes (F.) mediovittatus* (1). Nothing is known of the habits of the adults.

DISTRIBUTION. Apparently endemic to Jamaica; record from Haiti (Root, 1927:463,465) doubtful.

JAMAICA. *Kingston and St. Andrew*: Constant Spring (327,697,698). Waverley Estate, 1 Sept 1906, M. Grabham, 2 males, 2 larvae [USNM, type series]. Hermitage Dam Rd (110,394,625). *St. Mary*: Broadgate (256,401,407,622,642). *St. Thomas*: Leith Hall (690). *Parish and Locality not Specified*: 1 F, R.B. Hill [USNM].

Material Examined: 459 specimens; 47 males, 44 females, 265 larvae, 103 pupae; 72 individual rearings (30 larval, 38 pupal, 4 incomplete).

TRIBE AEDINI

The tribe Aedini in the West Indies is most clearly characterized in the larval stage, by the following combination of features: comb scales present; normal siphon with pecten of at least 1 pair of teeth and with 1 subventral tuft located well beyond base; ventral brush with several pairs of hairs. Adults of the genera *Aedes* and *Psorophora* possess postspiracular bristles and their females have the tip of the abdomen more or less tapered; those of *Haemagogus* resemble sabethines from which they can be differentiated by the base of the hindcoxa being distinctly ventrad of the meron and the postnotum without setae. The pupae lack a tracheoid on the trumpet and are most similar to the Culisetini and Orthopodomyiini from which they are differentiated by the combination of characters indicated in the key to the tribes and genera.

The Aedini are represented in Jamaica by all the 3 genera known from the New World and by more species than any other tribe: (1) *Psorophora* by 8 indigenous species; (2) *Aedes* by 13 indigenous species, the introduced African *aegypti* and possibly 1 additional endemic species, and (3) *Haemagogus* by 1 indigenous species, *equinus*.

GENUS PSOROPHORA

Adults of the genus *Psorophora* are distinguished from the other genera of the tribe in the New World by the presence of spiracular bristles. In the larvae, the ventral brush consists of a few pairs of hairs on a poorly developed grid and several precratal hairs which pierce the saddle, except in *insularia* which has an incom-

plete saddle. The pupae can be distinguished with some difficulty from *Aedes* by the characters given in the key to the tribes and genera.

All 3 recognized subgenera are represented in Jamaica: (1) *Psorophora* by *ciliata*, (2) *Janthinosoma* by *johnstonii*, "ferox" (probably a distinct species, *echinata*) and the unnamed *sp. 34*, and (3) *Grabhamia* by *infinis*, *jamaicensis*, *pygmaea* and *insularia*.

We have included in the keys *howardii* which is known from Cuba and may possibly occur in western Jamaica, and *columbiae* which is known from Grand Cayman Island and probably is the species reported as *confinnis* from Cuba.

We have encountered more problems in studying *Psorophora* than with any other genus primarily because of the very confused taxonomy of the group and the paucity of material, particularly in the subgenus *Janthinosoma*. It appears that undue reliance has been placed on similarity in male genitalia which has resulted in unwarranted extensive synonymy of species frequently well characterized in the larvae or pupae or even in adult ornamentation. Distinctive features in the immature stages are not always easily found because of very pronounced individual variation in chaetotaxy. The male genitalia appear to be extremely similar in many forms in the subgenera *Janthinosoma* and *Grabhamia*. Much work remains to be done on this genus in Jamaica, particularly in the subgenus *Janthinosoma*.

Members of this genus breed only in temporary ground waters such as ground pools and flooded margins of streams and swamps, and even seaside pools. Avid blood suckers are known in all 3 subgenera but are particularly numerous and important in the subgenus *Grabhamia*.

KEYS TO SUBGENERA AND SPECIES

ADULTS

- 1. Very large species; mesonotum with unscaled areas between acrostichal and dorsocentral bristles and between prescutellars and supraalars (*Psorophora*) 2
- Medium-sized to small species; mesonotum scaled between acrostichals and dorsocentrals and between prescutellars and supraalars 3

Psorophora

- 2(1). Mesonotum with median longitudinal line of golden scales from anterior promontory to near scutellum 31. *ciliata*
- Mesonotum with median longitudinal line of dark bronzy scales from anterior promontory to prescutellar space (Cuba; see subgenus) *howardii*

- 3(1). Tibiae uniformly dark, with violet to purple reflections; proboscis without pale ring or pale scales ventrally in either sex; light basal markings absent from tarsal segments 1-3 on all legs (*Janthinosoma*) 4
- Tibiae speckled or spotted with light scales; proboscis with distinct pale ring or with pale scales ventrally in females; light basal markings present on at least segments 1 and 2 of all legs (*Grabhamia*) 6

Janthinosoma

- 4(3). Mesonotal scales all dingy white, without strong yellowish or golden cast; hindtarsal segment 4 white, segment 5 dark 32. *johnstonii*

Some of mesonotal scales dark bronzy, golden or with strong yellowish cast; hindtarsal segments 4 and 5 both white 5

- 5(4). Mesonotum with mixed vestiture of golden and dark bronzy scales without definite pattern **33. ferox**
 Mesonotum with discrete broad median longitudinal stripe of dark bronzy scales, lateral scales light golden **34. Jamaican form**

Grabhamia

- 6(3). Wing with dark scales only; abdominal tergites with apicolateral silvery white patches not forming complete transverse bands; mesonotum with very conspicuous spots or patches of silvery scales **35. infinis**
 Wing speckled with dark and light scales; abdominal tergites with conspicuous broad transverse apical white or whitish bands on at least basal segments; mesonotum without conspicuous silvery spots or patches. 7
- 7(6). First segment of all tarsi with more or less distinct median ring or band of pale scales; tibiae with discrete evenly spaced spots of light scales in females. 8
 First segment of all tarsi without median ring or band of pale scales; tibiae irregularly speckled with light scales in females 9
- 8(7). Pale scales of mesonotum silvery gray to yellowish gray without lavender cast **36. jamaicensis**
 Pale scales of mesonotum with strong lavender cast (U.S.A., Grand Cayman; see *jamaicensis*) *columbiae*
- 9(7). Female proboscis with sharply marked narrow white band ventrally, often forming distinct ring; apex of segment 3 of male palpus nearly reaching base of labella of proboscis **38. pygmaea**
 Female proboscis extensively pale ventrally but without sharp demarcation; apex of segment 3 of male palpus extending only to about 0.7 of proboscis **37. insularia**

MALE GENITALIA

(34. Jamaican form unknown)

1. Aedeagus with sharp broad lateral subapical spine (*Psorophora*) 2
 Aedeagus conical or cylindrical, without lateral spine 3

Psorophora

- 2(1). Clasper relatively simple, without dorsomesal lobe; apical lobe of claspette small, with about 30 filamentous setae. **31. ciliata**
 Clasper complex, with long broad dorsomesal lobe; apical lobe of claspette very large, with more than 100 setae (Cuba; see subgenus) *howardii*

Janthinosoma

- 3(1). Apex of claspette with 1 short simple and 2 large twisted foliforms (*Janthinosoma*) **32. johnstonii**; **33. ferox**
 Apex of claspette without such foliforms (*Grabhamia*) 4

Grabhamia

- 4(3). Sternite IX truncate on nearly entire distal margin, not extending between sidepieces; claspettes diverging at an acute angle from base, with distinct sternal and tergal sclerotizations from base of main bar **35. infinis**
 Sternite IX broadly rounded on distal margin, extending between sidepieces; claspettes diverging at an obtuse angle from base, without sternal or tergal sclerotizations from base of main bar 5
- 5(4). Apical lobe of claspette not differentiated from sidepiece, apical setae simple, not flattened, and usually arising from separate tubercles set in membrane of sidepiece. **37. insularia**
 Apical lobe of claspette more or less strongly differentiated from sidepiece providing a free common sclerotized plate from which all or most setae arise, latter distinctly flattened 6
- 6(5). Inner margin of sidepiece straight, without indication of apicosternal lobe; mesal area distad of claspette with more than 30 setae; clasper with moderate internal swelling distad of middle; apical lobe of claspette narrow **38. pygmaea**
 Inner margin of sidepiece produced into a short broad apicosternal lobe; mesal area distad of claspette with less than 30 setae; clasper with strong internal swelling, most prominent at about middle of clasper; apical lobe of claspette broad **36. jamaicensis; columbiae**

PUPAE

(34. Jamaican form unknown)

1. Very large species; paddle heavily pigmented near external buttress and apex; abdominal hair 5-II caudad of 3-II, usually with less than 5 branches; metanotal hair 10-C usually with less than 5 branches (*Psorophora*) . . . 2
 Medium-sized to small species; paddle without contrasting pigmentation near external buttress and apex; abdominal hair 5-II cephalad of 3-II, usually with more than 5 branches; metanotal hair 10-C usually with more than 5 branches 3

Psorophora

- 2(1). Abdominal segments II-VII with diffuse sublateral diagonal dark stripes; tergite VIII without submedian dark spots **31. ciliata**
 Abdominal segments II-VII with sharply marked, saturated diagonal dark stripes; tergite VIII with small submedian dark spots (Cuba; see subgenus).
 *howardii*
- 3(1). Posterolateral angle of abdominal segment IV with conspicuous spines (*Janthinosoma*) 4
 Posterolateral angle of abdominal segment IV without spines (*Grabhamia*) . 5

Janthinosoma

- 4(3). Distal abdominal segments with only central area darkly pigmented, sides light **32. johnstonii**

Distal abdominal segments uniformly pigmented from side to side
 33. *ferox*

Grabhamia

- 5(3). Abdominal hair 2-I,II usually laterad or in line with hair 3 6
 Abdominal hair 2-I,II distinctly mesad of hair 3 7
- 6(5). Abdominal hair 1-II with dendritic branching; 4-I usually with at least 7
 branches 38. *pygmaea*
 Abdominal hair 1-II with 5-7 simple branches; 4-I usually with 4 or 5 branch-
 es 37. *insularia*
- 7(5). Cephalothoracic hairs 4,5,7-C usually double or triple, 8-C usually multiple;
 abdominal hair 3-II,III forked, branched or with strong barbs . 35. *infinis*
 Cephalothoracic hairs 4,5,7-C usually with at least 4 branches, 8-C usually
 double; abdominal hair 3-II,III usually single 8
- 8(7). Metanotal hair 12-C usually with at least 5 branches; abdominal hair 6-II,III
 usually with at least 4 branches, 1-IV usually with at least 4 branches,
 5-VII usually at least triple 36. *jamaicensis*
 Metanotal hair 12-C usually single or double; abdominal hair 6-II,III single
 to triple, 1-IV usually single, 5-VII usually double (U.S.A., Grand Cay-
 man; see *jamaicensis*) *columbiae*

LARVAE

(34. Jamaican form unknown)

1. Very large species; head capsule truncate in front; antenna not reaching an-
 terior border of head capsule; pecten teeth numerous (*Psorophora*). . . 2
 Medium-sized species; head capsule normal, rounded in front; antenna ex-
 tending well beyond anterior border of head capsule; pecten teeth re-
 duced, usually less than 10 3

Psorophora

- 2(1). Hair 1-X of anal segment usually with 3 or 4 branches from base
 31. *ciliata*
 Hair 1-X of anal segment single or forked some distance from base (Cuba;
 see subgenus) *howardii*
- 3(1). Antenna at least subequal in length to head capsule (*Janthinosoma*) . . . 4
 Antenna at most about 0.8 of head capsule length (*Grabhamia*) 5

Janthinosoma

- 4(3). Siphon short and broad, without distinct narrowed distal part; ventral brush
 with total of about 14 hairs, grid strongly sclerotized between bars . . .
 32. *johnstonii*
 Siphon elongate, moderately swollen in proximal half and with distinct nar-
 rowed distal part; ventral brush with total of about 18 hairs, grid unsclero-
 tized. 33. *ferox*

Grabhamia

- 5(3). Anal saddle widely incomplete and indented around insertion of hair 1-X; gills short and rounded 37. *insularia*
 Anal saddle complete, hair 1-X on saddle; gills long and pointed 6
- 6(5). Head hairs 5,6-C usually both single 38. *pygmaea*
 At least hair 5-C multiple 7
- 7(6). Head hair 6-C single but with strong barbs; ventral brush usually with a total of 12 hairs, 4 of which on strong grid bars; median spine of comb scales about 2.0 of lateral; pecten teeth very broad, without strongly differentiated main spine 35. *infinis*
 Head hair 6-C at least triple, usually multiple; ventral brush usually with a total of 16-18 hairs, 4 of which sometimes on weak grid bars; median spine of comb scales about 3.0 or more of lateral; pecten teeth with strongly differentiated main spine 8
- 8(7). Head capsule with a distinct marginal tubercle or spine caudad of hair 10-C; head hair 6-C long, usually reaching anterior margin of head capsule 36. *jamaicensis*
 Head capsule without distinct tubercle or spine caudad of hair 10-C; head hair 6-C shorter, not reaching anterior border of head capsule (U.S.A., Grand Cayman; see *jamaicensis*) *columbiae*

Subgenus PSOROPHORA

Females of the subgenus *Psorophora*, called gallinippers in the United States, are giants among biting mosquitoes. They have all the claws with 1 tooth as in the subgenus *Janthinosoma*. Adults of both sexes are distinguished from the other 2 subgenera by the extensive longitudinal unscaled areas between the acrostichal and dorsocentral rows of bristles and between the prescutellars and supraalars. The larvae are predaceous on other mosquitoes and can easily be recognized by the subquadrate head with the mouthbrush bases produced to the anterolateral angles of the head capsule and the very short antenna. The pupae of the 2 species treated here are easily recognized from members of the other subgenera by their large size and the deep pigmentation of the paddle laterally near the buttress and on the apex.

Both North American species of the subgenus, *ciliata* (Fabricius, 1794) and *howardii* Coquillett, 1901, have been reported in the past from the West Indies but only from Cuba. During the present survey we found *ciliata* in the western part of Jamaica and we have seen material of this species from Grand Cayman Island.

We have included in the keys the distinguishing features of the very similar *howardii*. Although this species has not been found in Jamaica to date, it may be present in the western part of the island that has not been thoroughly surveyed. This species is very easily confused with *ciliata* in all stages except in the male genitalia.

31. *Psorophora (P.) ciliata* (Fabricius)

Figs. 56,57

1794. *Culex ciliata* Fabricius, 1794:401-402. TYPE: Adult(s), locality restricted to vicinity of Ten Mile Station near Charleston, South Carolina, U.S.A., by Belkin, Schick and Heinemann (1966:3-4) [NE].

For extensive complete synonymy, see Stone, Knight and Starcke (1959:125).

Psorophora (P.) ciliata of numerous authors, including Coquillett (1906b:14); Howard, Dyar and Knab (1917:530-536); Dyar (1922a:33-34; 1928:113-114); Matheson (1929:189-191; 1944:233-234); Edwards (1932:124); King, Bradley and McNeel (1944:54); Carpenter, Middlekauff and Chamberlain (1946:133-136); Perez Viguera (1948:301-302; 1956:310-315); Lane (1953:733-735); Carpenter and LaCasse (1955:114-116); Horsfall (1955:386-390); Stone, Knight and Starcke (1959:125); Montchadsky and Garcia (1966:38).

FEMALE. Wing about 7.5 mm. A very large dark brown species with femora predominantly yellowish and with conspicuous erect black scales on apices of all femora, all of the tibiae and hindtarsal segments 1 and 2. *Head*: Decumbent scales all broad, whitish, sparse, absent from median longitudinal line; erect scales very narrow, some indistinguishable from setae, widely distributed, unusually short and largely dark except anteriorly where they grade into golden upper orbital bristles. Labium predominantly with erect dark scales in basal 0.5, with decumbent scales distally, yellowish except in short apical dark ring. Palpus about 0.35-0.4 of proboscis; with erect dark scales and very numerous hairs. *Thorax*: Mesonotum with very dark integument; scaling sparse; narrow acrostichal stripe of narrow curved golden to coppery scales from anterior promontory extending through prescutellar space where it is bounded by broad white scales laterad to prescutellar bristles, a very small bare space between end of golden stripe and scutellum; indefinite line of slightly broader, darker golden to dark coppery scales just mesad of dorsocentral bristles to about level of scutal angle; distad of this point a broad patch of narrow very dark metallic scales (difficult to see against integument) around both sides of posterior dorsocentral bristles, continued as a narrowed line among prescutellar bristles but not reaching scutellum; narrow shiny bare space between acrostichal and dorsocentral bristles to level of prescutellar space; broader but shorter shiny bare space between prescutellar and supraalar bristles reaching scutellum; side of mesonotum with sparse vestiture of predominantly very broad flat white scales from near humeral angle to near scutellum, merging with anterior dorsocentral light scales where some scales have a yellowish tinge and with posterior dorsocentral dark patch where some of the white scales are elongate; scutal angle and paratergite bare. Mesonotal bristles very numerous but short, all rows present. Scutellum with sparse vestiture of narrow to moderately broad scales varying from white to distinctly golden. Pleuron with very sparse vestiture of largely broad white scales, some narrower or slightly yellowish present, restricted to *ppl*, *pcx*, hypostigial area, lower *ssp*, *psp*, upper *stp*, *pra* and *mep*. *Legs*: Forecoxa and midcoxa with small patch of white and dark scales, hindcoxa with small basal patch of white scales. Trochanters with mixture of yellowish and dark scales. Femora predominantly with smooth vestiture of yellowish scales except for conspicuous apical tufts of erect dark scales. Tibiae shaggy except for the smooth yellowish dorsal scaling at base, with erect dark scales, denser apically. Foretarsus and midtarsus smooth scaled throughout; segment 1 largely pale, yellowish to dingy white, apex darkened; segment 2 pale in about basal 0.5;

segment 3 with narrower basal pale ring; segments 4 and 5 usually all dark. Hind-tarsal segments 1 and 2 with dark scaling shaggy as on tibiae, remainder of scaling smooth; segments 1-4 with conspicuous, contrasting, moderate, basal whitish rings from 0.25-0.35 of segment length; segment 5 with or without whitish scales at base. All claws with 1 tooth. *Wing*: Dorsal scaling largely dark except for varying number of inconspicuous pale scales on base of costa and radius. *Haltere*: Stem pale; knob predominantly dark scaled. *Abdomen*: Laterotergite bare; tergite I with median patch of whitish scales; tergites II-VI predominantly tan to light brown in central dorsal area, darker laterad but with scattered paler scales and a more or less conspicuous narrow lateral border of widely spaced very broad white scales. Sternites II-VI with sparse vestiture of very broad white scales. Segment VII elongate and markedly narrowed distad, with only apex of cerci projecting.

MALE. Essentially similar to female in ornamentation but with less contrast between dark and light scales of legs; abdominal scaling greatly reduced, tergites bordered with very numerous long hairs. Palpus exceeding proboscis by length of segments 4 and 5 which are upturned and densely hairy; nearly entire length of segment 3 also with long hairs. Antennal flagellum densely plumose. Femora with fringe of very long thin hairs.

MALE GENITALIA (fig. 57). *Segment VIII*: Shortened; tergite and sternite subequal in length. Tergite with numerous thickened moderately long specialized setae without normal attenuate apex, arranged in several long irregular rows near caudal margin. *Segment IX*: Tergite poorly sclerotized; long but with a deep proximal emargination in middle; lobe poorly differentiated, broad and only slightly projecting, usually with about 20 thin straight setae. *Sidepiece*: More or less cylindrical and without indication of lobes; usually without scales; without distinct membrane from claspette to clasper base; apical sternomesal area strongly sclerotized, with distinct patch of setae of varying sizes. *Claspette*: Stem distinctly separated from sidepiece; long and slender at base; widened distally into a more or less triangular apical lobe produced mesodorsad; outer sternal angle of lobe with specialized flattened seta (foliform) with sharply recurved acute apex which is minutely widely forked; dorsal surface of lobe with about 30 slender curved setae with filamentous apex which usually appears twisted in mounts. *Clasper*: Relatively narrow. Outer margin concave to a subapical angle, convex from angle to apex. Inner margin convex except in subapical area, slightly bulging beyond middle where it bears 4-7 thickened setae. Ventral surface with 4-6 thinner setae near inner margin. Dorsal surface with a slight thin ledge extending proximad from subapical angle and a shorter ledge extending to apex. Spiniform apical, short. *Phallosome*: Aedeagus small, narrowed distally; sternally subapical area produced into conspicuous acute lateral spine, tergally into a narrow dorsal denticulate median process. *Proctiger*: Very broad at base, narrowed distad. Apex of paraproct usually with 3 strong teeth. Cercal setae short, numerous, extending from near apex to near base of narrowed part of proctiger.

PUPA (fig. 57). Very large. Chaetotaxy as figured; studied in detail for North American populations by Barr and Barr (1969); extremely similar to that of *howardii* from which it is distinguished primarily by diffuse instead of saturate, sharply marked sublateral diagonal pigmented stripes on abdominal tergites and sternites II-VII. *Cephalothorax*: Unevenly pigmented. Hair 6-C with at least 3 branches; 8-C usually single. *Trumpet*: Uniformly darkly pigmented. *Metanotum and Abdomen*: Evenly pigmented, grossly appearing to have 3 longitudinal diffuse dark stripes. Caudolateral angle of tergite IV without spines. Sternite VIII with conspicuous

sublateral lobe on caudal margin. Hair 10-C usually with less than 5 branches. Hair 3-III closer to 5-III than to 1-III; hair 5-II,III usually with less than 4 branches; 9-VIII usually with less than 6 principal branches. *Paddle*: Midrib, external buttress, base of outer and apex of inner parts deeply pigmented. Marginal spicules distinct only on external buttress. Hairs 1,2-P both present, 2-P very poorly developed.

LARVA (fig. 56). Very large. Chaetotaxy as figured; not studied in detail. Very similar to *howardii* from which it is distinguished by saddle hair 1-X with 3 or 4 branches from near base instead of single or forked beyond middle. *Head*: Subquadrate in outline, ocular bulge very small; concave dorsally near anterior margin (labrum and palatum); mouthbrush process projecting dorsolaterally beyond anterior edge of frontoclypeus; maxillary suture complete but weak anteriorly, extended caudad beyond posterior tentorial pit which is located about 0.3 from collar. Dorsal chaetotaxy unusual, homologies uncertain; hairs 0,1-C near outer angle of frontoclypeus above mouthbrush bases, both very short; 4-C long, single; 5-C short, with apical forks; 6-C far forward, near level of 3-C; hair 2-C absent; 8-C far caudad of 9-C. *Antenna*: Slender and short; apex not reaching anterior border of head capsule; shaft with short sharp denticles. Hair 1-A single, short; near distal 0.2. *Thorax*: Without conspicuous tubercles except for those of pleural groups (9-12); hair 13-P absent. *Abdomen*: Hair 12-I present. Hair 7 multiple on all segments, long on I,II; hair 6 usually double on I,II, single or double on III-VI. *Segment VIII*: Comb usually with about 12-16 scales in a single curved row; comb scales with sharp median spine and strong basal denticles; area proximad of comb with patch of differentiated broad apically denticulate spicules. *Siphon*: Elongate, not swollen in middle. Acus strongly developed. Pecten usually with more than 20 teeth in an evenly spaced row; teeth with a long slender attenuate filament and usually 1 short basal denticle. Hair 1-S long, single, inserted beyond middle, distad of pecten. *Anal Segment*: Saddle complete. Hair 1-X usually with 4 or 3 branches arising from base. Ventral brush usually with 5 or 6 pairs of hairs on a very poorly developed grid without lateral bar, and about 10-12 hairs in an irregular double row piercing the saddle to near the base. Gills very long, slender and attenuate apically.

SYSTEMATICS. The 2 females, the only material available from Jamaica, agree in all respects with topotypic *ciliata* from the southeastern United States and we have no doubt that they are conspecific with the latter. We have, therefore, provided descriptions of the other stages from this topotypic material.

Elsewhere in the Antilles, *ciliata* has been reported only from Cuba (Perez Viguera, 1948:301-302; 1956:310-315; Montchadsky and Garcia, 1966:38) but we have seen material also from Grand Cayman Island.

Although *ciliata* has been reported to have a range extending from southern Canada to Argentina (Stone, Knight and Starcke, 1959:125), it seems probable that actually a complex of at least 2 forms is involved. Material we have seen from Mexico agrees well with topotypic *ciliata* but specimens from Venezuela show considerable departure in details of mesonotal ornamentation and leg markings, and it seems unlikely that true *ciliata* occurs in South America south of the Guianas. However, we have no material to enable us to determine the status of 3 nominal species currently listed as synonyms of *ciliata*, namely *cyanopennis* (Humboldt, 1819) from Colombia, *tibialis* (Robineau-Desvoidy, 1827) from Brazil, and *lynchi* Brethes, 1916 from Argentina.

BIONOMICS. The immature stages of this species have not been collected in

Jamaica but will undoubtedly be found in open sunlit temporary pools or flooded margins of swamps. The larvae are predaceous and develop very rapidly. The females are persistent biters and attack humans at any time of the day in the vicinity of their breeding sites.

DISTRIBUTION. Canada and eastern United States southward through Mexico, Central America, West Indies to Colombia and Argentina. South American records probably pertain, at least in part, to a different species.

JAMAICA. *St. Elizabeth*: Black River. *Westmoreland*: Petersville (206).

Material Examined: 2 females.

Subgenus JANTHINOSOMA

Adults of the subgenus *Janthinosoma* are usually readily recognized from the other 2 subgenera by the dark violet metallic scaling of the legs, labium and abdominal tergites. All but a few species have conspicuous white markings on hind-tarsal segments 4 and/or 5 and sometimes 3. Females have all the claws with 1 tooth. The larvae resemble the subgenus *Grabhamia* in a strongly inflated siphon and a normal head but can usually be distinguished by the antennae being longer than the head capsule. The pupae are usually readily separated from the subgenus *Grabhamia* by the presence of distinct spines on the caudolateral angle of abdominal tergite IV and the longer trumpet.

The taxonomy of the subgenus is in a very confused state, to a large extent because of the lack of males and associated immature stages for many populations, and the apparent variability of the tarsal markings in the adults. Although the larvae of nearly half the recognized species have been described, they cannot be adequately separated at the present time.

Three distinct species are now known to occur in Jamaica but the material available for study has been so limited and fragmentary that we have not been able to determine the exact taxonomic status and extralimital relationships of any of these species.

Members of this subgenus breed primarily in the shade in flooded wooded areas that are often inaccessible, and their immature stages are seldom collected. Females of some species are avid blood suckers but apparently not in Jamaica.

32. *Psorophora* (J.) *johnstonii* (Grabham)

Figs. 58,61

1905. *Janthinosoma johnstonii* Grabham, 1905:410-411. TYPE: Syntypes 4 females, 5.5 mi along Molyne's Road at foot of Red Hills, Kingston, Jamaica, July 1905, M. Grabham [NE].
1906. *Janthinosoma coffini* Dyar and Knab, 1906a:134. TYPE: Holotype female, Nassau, Bahamas, B.W.I., 22 June 1903, T.H. Coffin [USNM, 9969]. Synonymy with *johnstonii* by Thurman, Haeger and Mulrennan (1951).
1906. *Janthinosoma schwarzi* Dyar and Knab, 1906a:135. TYPE: Holotype female, Cayamas, Cuba, 7 May, E.A. Schwarz [USNM, 9970]. Synonymy with *johnstonii* by Howard, Dyar and Knab (1917:572).

Psorophora (*Janthinosoma*) *johnstonii* of Howard, Dyar and Knab (1917:572-574); Dyar (1928:

121); Edwards (1932:125); Pratt (1946:210); Perez Viguera (1948:293-298; 1956:346-355); Thurman, Haeger and Mulrennan (1951); Lane (1953:751-753); Carpenter and LaCasse (1955:124-125); Stone, Knight and Starcke (1959:128); Montchadsky and Garcia (1966:39).

Psorophora johnstonii of Johnson (1919:423); Gowdey (1926:73); Hill and Hill (1945a:2; 1948:48); Thompson (1947:79).

Psorophora coffini of Horsfall (1955:390).

FEMALE. Jamaican material not available; significant characters from Grabham's original description. Body length 4.5 mm. *Head*: Decumbent scales all broad, pale yellow and violet; an orbital line of white scales. A group of dark erect scales on occiput. Interorbital bristles black. *Thorax*: Mesonotum with creamy white broad scales on black background, denser on sides; mesonotal bristles black. Scutellum with white scales. *Apn* with white scales and long black bristles; other pleural areas with silvery scales and golden hairs. *Legs*: With metallic violet reflections. Base and most of lower surface of femora yellow scaled; knee spot white, small. Hind-tarsal segment 4 completely white except for a few apical black bristles. *Haltere*: Stem and knob pale yellow. *Abdomen*: Tergite I with pearly white scales and golden hairs; tergites II-VI violet scaled, with lateral apical white scaled areas and black bristles. Sternites white scaled with basal bands of violet scales.

MALE. Unknown for Jamaican population. Presumably similar to female in ornamentation.

MALE GENITALIA, PUPA and LARVA. Unknown for Jamaican population. Figures (figs. 58,61) based on specimens from Florida; diagnostic characters as in the keys.

SYSTEMATICS. We have seen no material of *johnstonii* from Jamaica. The 4 female syntypes are all lost and we have not been able to locate the female from St. Andrew collected by Hill and Hill (1948:48) or the specimens (presumably all females) collected by G.A. Thompson at Portland Ridge and mentioned in Hill and Hill (loc. cit.) and Pratt (1946:210). We did not find this species during our surveys and apparently no males or immature stages have been collected as yet in Jamaica.

Our description of topotypic *johnstonii* is therefore confined to an extract of apparently significant features of the female mentioned in the original description of Grabham. These do not agree in several respects with the current interpretation of *johnstonii* which is based to a large extent on material from the Florida Keys studied by Thurman, Haeger and Mulrennan (1951). These authors accepted the synonymy of *schwarzi* from Cuba with *johnstonii* by Howard, Dyar and Knab (1917:572) although the latter had before them only the unique holotype female of *schwarzi* and no material at all of *johnstonii*. Thurman, Haeger and Mulrennan themselves synonymized *coffini* which had been regarded as a distinct species by Howard, Dyar and Knab (1917:574-575), Dyar (1928:121-122) and provisionally by Pratt (1946), and had been reported from the Bahamas (type locality) and the Virgin Islands. The synonymy was based on the great variation in the supposed distinctive characters of the females (body size and extent of knee spots) which they found in the topotypic population of *coffini*, in populations from the Florida Keys (first reported as *varipes* by King, Bradley and McNeel, 1939:50-51); Virgin Islands (reported as *coffini* by Dyar, 1928 and Pratt, 1946), and Puerto Rico (reported as *johnstonii* by Pratt, 1946). Thurman, Haeger and Mulrennan found no significant differences in the larvae from the Virgin Islands and Florida and considered the male genitalia from these 2 populations to be identical. However, only 1 female (presumably the holotype of *schwarzi*) from Cuba was seen by these au-

thors and no specimens at all of topotypic *johnstonii* from Jamaica.

For the present we are retaining the synonymy of Thurman, Haeger and Mulrennan but suspect that true *johnstonii* from Jamaica may prove to be a species distinct from other members of this complex. We have seen 3 females from Grand Cayman Island which have a facies quite distinct from that of specimens from Florida but agree in general with Grabham's description except for light interorbital bristles, dingy white decumbent and pale erect head scales, and dingy white mesonotal scales. These specimens actually fit better the redescription of *schwarzi* (as *johnstonii*) by Howard, Dyar and Knab (1917:573-574) except for very indistinct knee spots and practically no narrow dark scales in the middle of the mesonotum.

Since it is very likely that the male genitalia and the immature stages of topotypic *johnstonii* will conform to the same general type, we have included key characters and figures of these from specimens from Florida.

BIONOMICS. Immature stages of *johnstonii* have never been found in Jamaica. It seems probable that the breeding sites will be found to be shaded temporary pools in wooded areas similar to those used by *ferox*. This species is apparently rare in Jamaica and the females may bite only in the shade.

DISTRIBUTION. Jamaica (type locality), Cuba, Cayman Islands, Florida, Bahamas, Puerto Rico and Virgin Islands; possibly 2 or more forms involved.

JAMAICA. *Clarendon*: Portland Ridge, G.A. Thompson, females biting (Hill and Hill, 1948:48). *Kingston and St. Andrew*: Red Hills, Molyne Rd at base of, M. Grabham, type series. Locality not specified, 1 specimen in animal-baited trap (Hill and Hill, 1948:48).

Material Examined: None.

33. *Psorophora (J.) ferox* (Humboldt)

Figs. 59,60

1819. *Culex ferox* Humboldt, 1819:340. TYPE: Adults, Guayaquil River valley near San Borondon [Samborondon], Ecuador [NE].
1821. *Culex posticus* Wiedemann, 1821:43. TYPE: Holotype female, Mexico, coll. Winthem [NMW]. Synonymy with *ferox* by Dyar (1923b:122).
1906. *Janthinosoma echinata* Grabham, 1906b:311-313. TYPE: Lectotype by PRESENT DESIGNATION, female, with handwritten locality and date label, Molyne Road, Kingston, Jamaica, 10 Apr 1906, M. Grabham; 1 of 2 specimens apparently of type series, the other a male without genitalia, bearing label //echinata// [USNM]. Synonymy with *posticus* by Howard, Dyar and Knab (1917:548).
1907. *Janthinosoma sayi* var. *jamaicensis* Theobald, 1907:157. TYPE: Lectotype female, Runaway Bay (St. Ann), Jamaica, 15 Apr, Lord Walsingham [BM; designation of Belkin, 1968b:27]. Synonymy with *posticus* by Howard, Dyar and Knab (1917:548).

For extensive complete current synonymy see Stone, Knight and Starcke (1959:127-128).

Psorophora (Janthinosoma) ferox of Dyar (1923c:180-181; 1928:116-117); Edwards (1932:125); King, Bradley and McNeel (1944:55); Matheson (1944:236-237); Carpenter, Middlekauff and Chamberlain (1956:142-145); Lane (1953:745-747); Carpenter and LaCasse (1955:120-122); Horsfall (1955:399-401); Perez Viguera (1956:342-345); Stone, Knight and Starcke (1959:127-128); Forattini (1965a:410-417); Montchadsky and Garcia (1966:38-39); Porter (1967:37).

Psorophora ferox of Hill and Hill (1945a:2; 1948:47); Thompson (1947:79).

Psorophora (J.) sayi of Dyar (1922a:35-36).

Psorophora posticata of Matheson (1929:192-193).

Psorophora (J.) posticatus of Howard, Dyar and Knab (1917:548-552); Johnson (1919:423); Gowdey (1926:73).

Janthinosoma posticata of Coquillett (1906b:17).

FEMALE. Wing about 3.5 mm. Medium-sized dark species with dark scales predominantly metallic with violet reflections; mesonotal scaling mixed dark and golden, without definite pattern; hindtarsus with segments 4 and 5 white. *Head*: Integument light to dark brown, shining. Decumbent scales usually absent from anterior part of vertex except for an arcuate sparse row of broad silvery white scales anterior to orbital bristles; more numerous but still sparse broad golden scales on posterior part of vertex, occiput and laterally. Erect scales numerous, golden. Proboscis subequal to or slightly longer than forefemur; labium predominantly with dark violet scales except at base and variable extent of lower surface where scales tend toward coppery. Palpus 3-segmented; largely without scales on segment 1; segments 2 and 3 with deep violet scales, sometimes some coppery scales on 2. Antenna slightly shorter than proboscis; mesal surface of torus with a few short dark hairs but no scales; flagellar segment 1 with a few small dark scales on mesal surface. *Thorax*: Integument shining, moderate to dark brown. Mesonotal vestiture a mixture of small broad pale scales, golden except for white ones above wing root, and smaller narrower dark bronzy scales; no distinct pattern discernible. Paratergite bare. Scutellum predominantly with small broad golden scales on all lobes but smaller dark bronzy scales usually present on midlobe. Scaling of *apn* sparse, golden in upper part, white in middle; *ppn* with broad silvery white scales except for narrower pale golden scales in upper part; *ppl*, *pcx*, hypostigial area, *ssp*, *psp*, *stp*, *pra* and *mep* with broad silver white scales. *Legs*: Forecoxa and midcoxa with scales silvery white at base and coppery or bronzy distally, hindcoxa with small patch of silvery white scales. Trochanters with golden to coppery scales. Anterior and dorsal surfaces of forefemur and midfemur largely deep violet, posterior and lower deep golden to coppery to beyond middle; hindfemur predominantly golden except for dark violet distal 0.25-0.3 on all surfaces and an indefinite dorsal dark line extending from dark area to near base. Knee spots usually poorly developed on midfemur and hindfemur and absent on forefemur. Remainder of legs dark violet except for white hindtarsal segments 4 and 5; apex of hindtarsal 3 completely dark. Distal part of hindtibia and hindtarsal segments 1 and 2 (rarely also 3) slightly shaggy, with short semierect scales. All claws with subbasal tooth; those of hindlegs smaller. *Wing*: All dorsal scales dark violet. *Haltere*: Stem pale; knob dark scaled. *Abdomen*: Laterotergite and sides of tergite I with pale scales, whitish to light golden; middle of tergite I with patch of dark violet scales. Tergites II-VI predominantly dark violet except for lateral patches of light golden scales expanded triangularly mesad on apex. Sternites II-VI predominantly golden, with scattered violet scales not forming bands. Segment VII predominantly dark violet, usually with some golden scales laterally and toward apex of sternite.

MALE. Described from 1 Jamaican specimen. In general similar to female in ornamentation except for presence of a very small apical dorsal patch of white scales on hindtarsal segment 3. Palpus exceeding proboscis by nearly entire length of segments 4 and 5 which are porrect or only slightly upturned; apex of segment 3 and all of 4 with moderately long bristles. Antennal flagellum densely plumose. Claws of foreleg and midleg enlarged, unequal; larger claws with heavy short basal tooth and more slender longer premedian tooth; smaller claws with slender basal

tooth only. All femora and midtibia and hindtibia with long outstanding bristles or hairs.

MALE GENITALIA (fig. 59). Unknown for Jamaican population, probably in general similar to those figured here from specimens from Wilson Dam, Alabama. *Segment VIII*: Shortened and narrowed; tergite and sternite subequal in length. Tergite with lateral distal patch of several thickened specialized setae without normal attenuate apex. *Segment IX*: Tergite short, completely but lightly sclerotized; lobe broad, poorly differentiated but projecting, usually with more than 12 thin setae. *Sidepiece*: More or less cylindrical and without distinct lobes; mesal membrane developed only in basal part. *Claspette*: Attached base sternal. Stem long and slender; free from near base and projecting dorsad. Distal part (apical lobe) bent caudolaterad; with dense preapical mesal patch of about 16 specialized setae with flattened fringed apices; apex with 2 flattened, broadened and strongly contorted filaments and 1 shorter narrow foliform. *Clasper*: Inner margin strongly inflated, with 1 short seta on ventral surface of expansion. Ventral surface with strong ridge near outer margin, several setae on ridge and 1 or 2 nearby. Spiniform apical, prominent. *Phallosome*: Aedeagus small; broad basally, narrowed distad; apex appearing pointed because of median dorsal ridge. *Proctiger*: Very broad at base, sharply narrowed distad. Paraproct with 4 apical spines. Cercal setae usually 4, in distal part only.

PUPA (fig. 59). Figured from 1 Jamaican specimen. Apparently distinguished from other populations of the *ferox* complex by weaker and shorter hairs 1 and 5 on abdominal segments IV and V, and a shorter, somewhat flared trumpet. *Cephalothorax*: Moderately evenly pigmented. Hair 6-C double; 8-C with 4 branches. *Trumpet*: Uniformly darkly pigmented, contrasting; apparently flared distally. *Metanotum and Abdomen*: Evenly moderately pigmented, lighter distad. Caudolateral angle of tergite IV with several short sharp spines. Sternite VIII with conspicuous sublateral lobe on caudal margin. Hair 10-C subequal to 11-C in length, with 9 branches from near base; 12-C double. Hair 3-III closer to 1-III than to 5-III; hair 1-VII single. *Paddle*: Uniformly lightly pigmented. Margins without distinct spicules. Only hair 1-P present.

LARVA (fig. 60). Chaetotaxy not studied in detail. In general similar to other populations of *ferox* complex and without obvious diagnostic features. *Head*: Distinctly broader than long, ocular bulge very conspicuous; labrum and mouthbrush base normal; maxillary suture complete and strong throughout, not extended caudad beyond posterior tentorial pit which is near collar. Dorsal chaetotaxy normal; hairs 5,6-C both long, usually double but 1 branch usually weaker and slightly shorter, both with fine barbs. *Antenna*: Distinctly longer than head capsule, slender, prominent; slightly darker on distal part; shaft with conspicuous sharp denticles. Hair 1-A submedian, multiple, long, usually reaching apex of antennal shaft. *Thorax*: Hair 13-P apparently absent. *Abdomen*: Hair 12-I present. Hair 6-I,II multiple, 6-III double or triple, 6-IV-VI single or double; 7-I,II long, with 3 or 4 branches; 7-III-V short, multiple. *Segment VIII*: Comb usually with about 7 scales with broad base, long differentiated median spine, 2 strong denticles and some fringes basally; bases of some scales usually connected by light sclerotizations. *Siphon*: Moderately swollen in proximal part but varied in shape. Acus distinct, attached. Pecten variable, usually with 3-5 widely spaced teeth in proximal 0.3. Hair 1-S very inconspicuous, short, multiple; varied in position and difficult to see. *Anal Segment*: Saddle complete; deeply indented for ventral brush. Hair 1-X short and inconspicuous. Ventral brush usually with 4 pairs of hairs on a very poorly

developed grid without lateral bar, and about 10-12 precratal hairs in an irregular double row piercing the saddle to near base. Gills very long, slender and attenuate distally.

SYSTEMATICS. *Psorophora ferox* appears to be a single somewhat variable species throughout much of its reported wide range as currently interpreted. However, there is considerable differentiation in local populations, perhaps enough to justify the recognition of subspecies or even species in some cases. The Jamaican population, for which the name *echinata* is available, appears to be among these. It differs from *ferox* from the Guayas River basin in Ecuador in the white of the hindtarsus being usually restricted to segment 4 and 5 (rarely a few white scales occur on the ventral surface of the apex of segment 3) and apparently in a shorter flared trumpet and shorter dorsal abdominal hairs 1 and 5 in the pupa. The larva of the Jamaican population has a more strongly inflated siphon and a very inconspicuous siphonal hair 1-S, but in these features it resembles the North American populations. A similar reduction in the white tarsal markings we have seen only in a small sample of a population from Dominica. There is an even greater reduction in specimens from St. Lucia in which the white scaling is restricted to hindtarsal segment 5. No males or immature stages are known for the latter 2 populations. In all other populations we have seen from the United States, Mexico, British Honduras, Guatemala, Costa Rica, Nicaragua, Panama, Colombia, Trinidad, French Guiana and Peru at least the extreme apex of hindtarsal segment 3 is white scaled in the adults. The male genitalia we have available for some of these populations appear to be all indistinguishable from topotypic *ferox* from Ecuador.

Since our sample of Jamaican adults consists of a limited number of females, 1 male without genitalia, 1 complete individual larval rearing and a few whole larvae, we prefer not to recognize the Jamaican population as a distinct form at this time.

We have listed here only the synonymy pertinent to the Jamaican population. The rest of the extensive current synonymy is given by Stone, Knight and Starcke (1959:127-128) with the inclusion of *fiebrigi* (Edwards, 1922) which has been shown since to be a distinct species by Souza and Guedes (1962) and earlier by Vargas (1951:57). We have not studied in detail the North American populations (including Cuba and the Bahamas) which were treated as *sayi* (Dyar & Knab, 1906) by Howard, Dyar and Knab (1917:554-557) and were considered by them to be distinct from the other populations of the complex. Only a small portion of the taxonomic literature on the *ferox* complex is listed here as the bulk of it is not pertinent to the Jamaican population.

BIONOMICS. The only definitely associated immature stages of *ferox* from Jamaica (921) were collected in a ground pool in a dried stream bed in association with *Anopheles (A.) grabhamii* and *Culex (Mel.) inhibitor*, presumably in a shaded situation. Three other collections of larvae, probably of this species, came from a coral rockhole in deep shade in a mangrove area (159) in association with 3 species of *Aedes (O.)*, a large temporary ground pool at an elevation of about 15 m (156) in association with *Psorophora (G.) jamaicensis*, and a large semipermanent ground pool in partial shade at an elevation of about 225 m (788) without associated species. The immature stages have been seldom collected probably partially because they are easily alarmed and stay for long periods at the bottom of the pools where they are difficult to see among the numerous dead leaves and other organic debris.

Females of *ferox* bite man fiercely during the day in the shade of thickets or wooded areas. This species may be more common than our records indicate for

collectors may be driven out of the areas where it occurs because of attacks by the females of this and other species biting in the shade.

DISTRIBUTION. Ecuador (type locality) and a very wide reported range extending from southeastern Canada southward through Central America, West Indies and South America to Peru and Argentina; possibly more than 1 species involved.

JAMAICA. *Clarendon*: Locality not specified, G.A. Thompson (Hill and Hill, 1948:47). *Kingston and St. Andrew*: Molynes Rd, Kingston, 10 Apr 1906, M. Grabham, 1 F [USNM]. Kingston and vicinity, M. Grabham, 1 M [USNM]. *Portland*: Blue Hole (918). Port Antonio, Rio Grande River (921). *St. Ann*: Runaway Bay, Lord Walsingham, type series of *jamaicensis*. *St. Elizabeth*: Maggoty (792A). *St. Thomas*: Golden Grove (156). Grants Pen (649). Holland Bay (159). *Westmoreland*: Crab Pond Bay (359,360); 21 July 1961, T.H. Farr, 11 F [JAM]. Petersville (788).

Material Examined: 30 specimens; 1 male, 21 females, 7 larvae, 1 pupa; 1 individual larval rearing.

34. *Psorophora* (J.) sp., Jamaican form

FEMALE. In general very similar to *ferox* as described above, including white hindtarsal segments 4 and 5. Readily distinguished from *ferox* by the following features. *Head*: Decumbent scales more numerous on anterior part of vertex, with about 3 rows of white ones between orbital margin and orbital bristles; also numerous in interocular space. Labium and palpus entirely dark violet. Antennal torus with several translucent light scales on mesal surface. *Thorax*: Mesonotal vestiture in a conspicuous definite pattern with a broad median longitudinal stripe of narrow dark bronzy scales bordered on the sides by larger broader pale golden scales. All scutellar lobes with dark bronzy scales, midlobe with a few lighter, coppery scales near base. *Apn* with numerous silvery white broad scales except for a few light golden in upper part; pleural bristles, especially on *ppn*, more numerous.

MALE, PUPA and LARVA. Unknown; the pupa and larva are probably of the type described above for *ferox* and some of the whole larvae provisionally identified as the latter may actually be of this form.

SYSTEMATICS. This is unquestionably a distinct species but we refrain from naming and describing it in detail at this time because of the limited material at hand and its poor condition. Our series consists of 3 females each from 2 collections, only 1 of which is in reasonably good condition but unfortunately lacks the hindtarsus. This species has a facies somewhat similar to *albipes* (Theobald, 1907) but differs markedly from this and all other *Janthinosoma* species we have seen in the scaling of the vertex of the head which is, however, of the type found in the *ferox* complex except for being more extensive. The light golden scales of the sides of the mesonotum are much broader than in other species with similar mesonotal markings and are of the type found in the populations of the *johnstonii* complex from Grand Cayman Island.

DISTRIBUTION. Known only from Jamaica.

JAMAICA. *Kingston and St. Andrew*: Ferry and vicinity (795). *St. Thomas*: Holland Bay (117).

Material Examined: 6 females only.

Subgenus GRABHAMIA

Adults of the subgenus *Grabhamia* are readily recognized from the other 2 sub-

genera of *Psorophora* by the presence of basal light markings on at least the basal segments of all tarsi and the absence of extensive unscaled areas between the acrostichal and dorsocentral and between the prescutellar and supraalar rows of bristles. Females of Jamaican species lack teeth on all the claws. The larvae resemble the subgenus *Janthinosoma* from which they can be separated by the antennae being distinctly shorter than the head capsule. The pupae lack spines on the caudolateral angle of abdominal tergite IV.

In Jamaica, 2 distinct groups occur: (1) the *cingulata* group, represented by *infinis*, in which the wing is entirely dark scaled, and (2) the *confinnis* group, represented by *jamaicensis*, *pygmaea* and *insularia*, in which the wings are speckled with light and dark scales. All the species are restricted to the West Indies except *pygmaea* which is known also from southern Florida.

We have included in the keys *Psorophora (G.) columbiae* (Dyar & Knab, 1906), another member of the *confinnis* complex, which has been confused under the latter name with *jamaicensis* and is present on Grand Cayman Island and probably also in Cuba.

Members of this subgenus breed primarily in open, sunlit ground waters and the immature stages of several species develop very rapidly. Several species are important pest mosquitoes and may be vectors of arboviruses. In Jamaica, *jamaicensis* and *pygmaea* are important man-biting mosquitoes.

35. *Psorophora (G.) infinis* (Dyar & Knab)

Figs. 61,63

1906. *Janthinosoma infine* Dyar and Knab, 1906c:181,182. TYPE: Lectotype larval skin (103.1) with pupal skin on same slide, with associated male (103.1) and its genitalia (103.1) incorrectly labeled slide 192 instead of 193, Santo Domingo (Dominican Republic), Aug 1905, A. Busck [USNM; designation of Stone and Knight, 1955:285].

Psorophora (Grabhamia) infine of Dyar (1928:131-132); Edwards (1932:126).

Psorophora (Janthinosoma) infine of Howard, Dyar and Knab (1917:594-596).

Psorophora infine of Hill and Hill (1945a:2; 1948:47-48); Thompson (1947:79).

Grabhamia infine of Dyar (1906:16).

Psorophora (Grabhamia) cingulata in part of Lane (1953:762-763); Stone, Knight and Starcke (1959:129); Forattini (1965a:429-430); Porter (1967:37); Page (1967, *in toto*).

FEMALE. Wing about 3.5 mm. Medium-sized species, differing conspicuously from other Jamaican species of the subgenus in completely dark wings and the mesonotum with contrasting patches of silvery scales on a background of bronzy scales. *Head*: Dorsal decumbent scales narrow, predominantly silvery, very conspicuous on ocular border. Erect scales long and slender, all dark. Proboscis with a narrow white ring starting at about 0.6 from base. Palpus with dark scales, apex with numerous pale hairs. Antennal torus with whitish scales and pale hairs on mesal surface. *Thorax*: Mesonotal integument dark reddish brown. Mesonotal vestiture predominantly of small narrow curved bronzy scales; with conspicuous patches or lines of narrow silvery scales at anterior promontory, humeral angle, along suture from scutal angle and at the point of its contact with dorsocentral line, in front of wing root, in supraalar area before bare space, in prescutellar space at end of acrostichal row and mesad of posterior prescutellar bristles. Paratergite bare.

Scutellar lobes all with narrow silvery scales. *Apn* and *ppn* with narrow silvery scales; *ppl*, *stp*, lower *pra* and middle *mep* with discrete patches of broad silvery scales; *psp* sometimes with a few narrow light golden scales. *Legs*: Forecoxa and midcoxa with small patch of silvery scales, some dark scales also on forecoxa; hindcoxa without scales. Trochanters predominantly with pale scales. Remainder of legs predominantly dark except for usual light ventral and/or posterior surfaces of the femora and as noted. All femora with narrow preapical white band; forefemur and midfemur with anterior ventral row of discrete pale yellowish to white spots. Distinct pale knee spots involving both apex of femur and base of tibia on all legs. Anterior surface of all tibiae with a dorsal row of discrete white spots; apex of foretibia with large white spot anteriorly. Foretarsus with narrow dorsal basal white bands on segments 1 and 2, midtarsus with similar bands on 1-3, rarely with a few white scales at base of 1 additional segment on both legs; hindtarsus with more or less complete narrow to moderate basal white rings on all segments, sometimes reduced ventrally on segment 5. Claws all simple, subequal. *Wing*: Dorsal scales all dark; plume scales long and narrow. *Haltere*: Entirely pale; scales of knob very pale golden. *Abdomen*: Laterotergite without scales, middle of tergite I with a few dark scales. Tergites II-VI predominantly dark scaled, sides with narrow lines of silvery scales connected to narrow apical transverse lines of silvery scales on II-V, usually broadly interrupted dorsally except on segment II. Sternites II-VII predominantly with pale golden scales, VII with dark scales laterally and subapically.

MALE. Ornamentation essentially as in the female. Palpal segment 3 reaching only to about 0.8-0.85 of proboscis; segments 4 and 5 slender, only slightly upturned; only extreme apex of segment 3 and all of segment 4 with a few long bristles; joint between segments 2 and 3 pale, base of segments 4 and 5 with a few pale scales. Claws of foreleg and midleg enlarged, unequal; larger claw with 1 tooth, smaller simple.

MALE GENITALIA (fig. 63). Very different from other Jamaican species of the subgenus in the base of the claspette and sternite IX. *Segment VIII*: Shortened and narrowed at base; heavy specialized setae of tergite entirely lateral distally. *Segment IX*: Tergite short, with long narrow bridge between longer lateral areas which are not at all produced distally into lobes but bear each about 12 slender setae. Sternite very strongly developed, with prominent anterior lobe; distal margin nearly straight and not produced between sidepieces. *Sidepiece*: More or less cylindrical but distinctly curved; without lobes; mesal membrane not developed distad of claspette, this area with 60 or more short setae; apicosternal area with numerous thin curved setae. *Claspette*: Base with distinct anterior sternal sclerotized plate joined to that of its mate and with tergal sclerotization extending into mesal membrane of sidepieces. The 2 claspettes diverging at base at an acute angle. Distinct short apical lobe projecting free from sidepiece, with 5-7 flattened specialized setae with very inconspicuous lateral spicules in distal part; seta closest to sidepiece (sternal) usually distinctly broader. *Clasper*: Base rather broad; external margin nearly straight except apically; internal margin moderately swollen; dorsal and ventral surfaces both with a ridge in area of swelling, ventral ridge with 2 or 3 setae; dorsal surface without distinct reticulations; apical part gradually narrowed and curved dorsad, with short apical spiniform. *Phallosome*: Aedeagus small, nearly parallel-sided except for narrowed apex, without denticles. *Proctiger*: Moderately broad at base and gradually narrowed to near apex; ventrolateral sclerotization not produced on sternal surface. Apex of paraproct with 4 or 5 small teeth. Cercal setae about 8, restricted to distal half.

PUPA (fig. 63). Chaetotaxy as figured, not studied in detail; apparently highly variable. In general similar to *jamaicensis* from which it differs in following conspicuous features. *Cephalothorax*: Hairs 4,5,7-C usually double or triple; 8-C usually multiple. *Trumpet*: Usually narrower and longer. *Metanotum and Abdomen*: Larger hairs on anterior abdominal segments with pigmented rings around alveoli. Hair 12-C usually with 3 or 4 branches. Hair 3-I distally forked or strongly barbed; 1-II with flattened base and numerous irregularly dendritic branches; 3-II,III forked, branched or with strong barbs; 5-VII usually single or double; 6-II,III single to triple. *Paddle*: Hair 2-P apparently always absent.

LARVA (fig. 61). Chaetotaxy not studied in detail, apparently in general similar to *jamaicensis*. Readily differentiated from other Jamaican members of subgenus by following conspicuous features. *Head*: Rather uniformly lightly pigmented. Hair 5-C multiple; 6-C single, barbed in basal half. *Antenna*: Longer and more slender, about 0.7 of head capsule length; uniformly lightly pigmented; shaft with inconspicuous slender denticles. *Segment VIII*: Comb usually of 6 scales whose bases are attached to a poorly pigmented, lightly sclerotized plate; median spine of scale not much more than 2.0 of largest lateral spine, which is separated from median by short denticle. *Siphon*: Moderately inflated. Uniformly lightly pigmented except on incomplete dark basal ring. Pecten varied, usually with 5-8 teeth which may extend to about 0.4 of siphon length; teeth very broad, without strongly differentiated principal spine, with numerous denticles, 2 or 3 often of same order of magnitude. Hair 1-S conspicuous, long, usually with 2-4 branches. *Anal Segment*: Saddle very lightly pigmented, difficult to see. Ventral brush usually with a total of 12 hairs, 4 of which on strong grid bars with lateral sclerotization.

SYSTEMATICS. *Psorophora infinis* is the most distinct of the 6 or more species included in the current concept of *cingulata* (Fabricius, 1805) whose type locality was restricted to Cayenne, French Guiana, by Belkin, Schick and Heinemann (1965: 41-42). It differs from all the other species in the very conspicuous discrete silvery markings of the mesonotum of the adults, a shorter male palpus, characteristic male genitalia, and unique comb scales and other features of the larva as described above. Almost all these distinctive features were recognized in the redescription of *infinis* by Howard, Dyar and Knab (1917:594-596) and it is difficult to understand how Lane's synonymy (1953:762) of this species with *cingulata* has been accepted.

The Jamaican population of *infinis* agrees in all respects with the topotypic material from the Dominican Republic but there is considerable variation in our relatively large series from Jamaica, particularly in the immature stages. We have seen no material of *infinis* from anywhere else. Dyar's (1928:132) record from Cuba, the basis for all subsequent reports from this island, is questionable as neither Perez Viguera (1956) nor Montchadsky and Garcia (1966) found *infinis* in Cuba. The records of *cingulata* from the Lesser Antilles actually pertain to at least 2 undescribed species of the complex, 1 in the Leeward Islands and 1, or possibly 2, in the Windward Islands.

BIONOMICS. The immature stages of *infinis* have been found in Jamaica in ground pools, rockholes and occasionally in tanks, cisterns and concrete drainage sumps. One collection, made in a leaf axil of a terrestrial bromeliad (608) is either a natural or laboratory contamination. The breeding sites may be deeply shaded or fully exposed to the sun. This species appears to be more common at higher elevations, our collections having come primarily from elevations of 80 m to 1600 m. The species found most commonly associated with *infinis* was *Culex (C.) secu-*

tor; occasional breeding associates were *Culex (C.) corniger*, *Culex (Mel.) inhibitor*, *Aedes (O.) calumnior* and *Aedes (F.) mediovittatus*.

This species does not seem to be attracted to man as only a few females have been taken on human bait (Page, 1967). One female was taken in a light trap (611). However, these records were obtained in the lowlands where *infinis* is uncommon. Nothing is known of the habits of the adults at higher elevations.

DISTRIBUTION. Definitely known only from the Dominican Republic (type locality) and Jamaica; probably occurs also in Haiti. Record from Cuba doubtful, see systematics above.

JAMAICA. *Clarendon:* Mocho (603). *Kingston and St. Andrew:* Cinchona Botanical Gardens (340,341,343). Cinchona Botanical Gardens, rd to (612). Hermitage Dam Rd (611,739). Newcastle Rd, elev. 2500-3000 ft (Hill and Hill, 1948:48). *St. Ann:* Drax Hall (608). *Westmoreland:* Petersville (618,620). *Parish not Specified:* Sept 1944, R.B. Hill, 3 M, 3 F [USNM].

Material Examined: 249 specimens; 41 males, 82 females, 98 larvae, 28 pupae; 28 individual rearings (10 larval, 15 pupal, 3 incomplete).

36. *Psorophora (G.) jamaicensis* (Theobald, 1901)

Figs. 66,67

1901. *Culex jamaicensis* Theobald, 1901a:345-346. TYPE: Lectotype female, Spanish Town Road, Kingston, Jamaica, 8 Feb 1900, M. Grabham [BM; designation of Belkin, 1968b:27].
1907. *Taeniorhynchus walsinghamii* Theobald, 1907:484-486. TYPE: Holotype female, Runaway Bay (St. Ann), Jamaica, Apr, Lord Walsingham [BM]. Synonymy with *jamaicensis* by Howard, Dyar and Knab (1917:581).

Psorophora (Grabhamia) jamaicensis of Dyar (1928:128-129); Edwards (1932:126).

Psorophora (Janthinosoma) jamaicensis in part (?) of Howard, Dyar and Knab (1917:582-585).

Psorophora jamaicensis of Johnson (1919:423); Gowdey (1926:73).

Grabhamia jamaicensis in part of Theobald (1903a:244-245, *in toto*; 1905a:29-30; 1905b:23; 1910:281); Coquillett (1906b:21).

Taeniorhynchus walsinghamii of Theobald (1910:419,427).

Psorophora (Grabhamia) confinnis in part of Aitken (1940:677); Lane (1953:768-770); Carpenter and LaCasse (1955:129-131); Horsfall (1955:390-394); Stone, Knight and Starcke (1959:129-130); Forattini (1965a:422-428); Porter (1967:37); Page (1967, *in toto*).

Psorophora confinnis of Hill and Hill (1945a:2; 1948:46-47); Thompson (1947:79).

FEMALE. Wing about 4.0 mm. Medium-sized dark brown species with speckled wings; labium broadly pale in the middle at least ventrally; a dense patch of dark scales at base of vein R_{4+5} ; hindtarsal segment 1 with a median white ring. *Head:* Decumbent scales of vertex and occiput narrow and gray, sparse except in lateral patch above broader, flatter, predominantly yellowish scales of sides. Erect scales numerous, dark except in middle and back where they are pale. Labium with median pale yellowish gray band occupying more than 0.5 of its length, frequently some dark scales scattered on band dorsally. Palpus tipped with yellowish gray scales; apparently 3-segmented but possibly a minute segment 4 may be invaginated. *Thorax:* Mesonotal integument dark rusty brown. Mesonotal scales narrow, curved; predominantly light bronzy to dark coppery with pale, silvery gray to yellowish gray scales scattered throughout and usually concentrated in small patches in front of fossa, at humeral angle, inner posterior part of fossa, above wing root,

and in and around prescutellar space. Paratergite bare. All lobes of scutellum with narrow light scales, silvery gray to yellowish gray. *Apn* scales narrow, predominantly pale as on mesonotal patches except for some darker coppery above; *ppn* scales narrow and dark as on mesonotum except for some paler ones in lower posterior part; other pleural scales broader, whitish, usually restricted to *ppl*, *psp*, *stp*, base of *pra* and middle *mep*. *Legs*: Coxae and trochanters with pale scales predominant. Femora with usual pale surfaces; anterior surface predominantly dark scaled, lightly speckled with pale scales and with conspicuous white preapical band and apex. Tibiae predominantly dark scaled, anterior surfaces with rather evenly spaced spots of white scales. Tarsi predominantly dark scaled; segment 1 on all legs with a short basal and a little longer median white bands which may form complete rings; foretarsal segments 2 and 3, midtarsal segments 2-4 and hindtarsal segments 2-5 with short basal white rings, smaller on distal segments. Claws all simple, subequal. *Wing*: Dorsal veins speckled with dark and light scales without distinct pattern; base of vein R_{4+5} with dense patch of dark scales producing a more or less distinct spot. *Haltere*: Entirely pale. *Abdomen*: Laterotergite and median dorsocaudal part of tergite I with pale scales. Tergites II-VI dark scaled at base, II and III with apical transverse white scaled bands triangularly produced basad, IV similar but usually basal projection of white band not as regular, V-VI usually with sublateral light scaled stripes, narrowly connected on apex; sides of tergites II-VI with narrow lines of light scales connected distally with transverse dorsal light bands or markings. Sternites II-VI predominantly with yellowish gray scales, with some subapical dark scales.

MALE. Essentially similar to female in ornamentation except as noted. Labium with only a few pale scales at false joint, without broad pale ring. Palpus exceeding labium by entire length of segments 4 and 5 which are sharply upturned; distal 0.5 of segment 3 and all of segments 4 and 5 with numerous long bristles; joint between segments 2 and 3 pale, base of 4 and 5 with a few pale scales. Antennal flagellum densely plumose. Tarsal white rings less distinct, usually reduced or not developed on distal segments. Foreclaws and midclaws enlarged, unequal; larger claws with flattened apically rounded basal external tooth and a longer submedian tooth; smaller claws with basal external tooth only. Abdominal tergites with scaling greatly reduced, with dark scaling predominating on distal segments, lateral light scales replaced by very long hairs.

MALE GENITALIA (fig. 66). In general similar to other species of subgenus except *infinis*. *Segment VIII*: Shortened; specialized setae of tergite lateral. *Segment IX*: Tergite well sclerotized; with a narrow median bridge between broad lateral lobes; each lobe with 12-18 thin setae. Sternite projecting between sidepieces, its anterior margin not markedly lobed, its distal margin broadly rounded. *Sidepiece*: More or less cylindrical except for produced sternal apex which bears short straight setae; mesal membrane not developed distad of claspette, this area with about 20-25 short setae. *Claspette*: Without sternal or tergal sclerotizations from base of main bar. The 2 claspettes diverging at base at an obtuse angle. Distinct broad apical lobe projecting free from sidepiece, with 1 or 2 specialized flattened setae with minutely spiculate distal part at external angle near sidepiece and usually 5 similar specialized setae on the mesal projection, occasionally 1 or more additional simpler setae present. *Clasper*: Narrow at base; external margin sinuous; internal margin produced into a broad lobe which bends ventrad, 1 dorsal and 1 ventral subapical setae on this lobe; apical part strongly narrowed and bent dorsomesad, with short apical spiniform. Dorsal surface strongly reticulate. *Phallosome*: Aedeagus

small, nearly parallel-sided except for base and rounded apex, without denticles. *Proctiger*: Moderately broad at base and gradually narrowed to near apex; ventrolateral sclerotization broad and strongly produced on sternal surface. Apex of paraproct with 4 or 5 small teeth. Cercal setae about 6, restricted to distal half.

PUPA (fig. 66). Chaetotaxy as figured, not studied in detail; differing markedly from that described for "*confinnis*" by Barr and Barr (1969:8-9) in more branches in hairs 10,12-C, 6-I-III,VI, 1-IV and 5-VII. *Cephalothorax*: Unevenly pigmented, distinctly darker in male; hairs 6,8-C double. *Trumpet*: Uniformly lightly pigmented, relatively short and broad. *Metanotum and Abdomen*: Unevenly pigmented, particularly on lower surface of abdomen; lighter caudad; distinctly darker in male. Caudolateral angle of tergite IV without spines. Sternite VIII with slight lobe on caudal margin laterad of genital segments. Hair 10-C usually with 9 barbed branches; 12-C usually with at least 5 branches. Hair 3-III closer to 1-III than to 5-III; hair 1-IV usually with at least 4 branches; 5-IV-VI usually double and shorter than tergite following, 5-VII usually at least triple; 6-I-III,VI with at least 4 branches, often more; 9-VIII with at least 6 branches. *Paddle*: Very lightly pigmented. Marginal spicules indistinct. Hair 1-P normal in length; 2-P frequently absent, when present very weak.

LARVA (fig. 67). Chaetotaxy as figured but not studied in detail. Very similar to North American "*confinnis*" as described and figured by Carpenter and LaCasse (1955:130-131) but readily separated by the lateral postocular spine and nearly straight dorsal caudal border of head capsule. *Head*: Distinctly broader than long; ocular bulge conspicuous anteriorly; a distinct spinelike tubercular lateral caudal postocular process; labrum and mouthbrush base normal; maxillary suture complete and strong throughout, nearly straight, not extended caudad beyond posterior tentorial pit which is about 0.17 from collar. Dorsal chaetotaxy normal; hairs 5-7-C all multiple; hair 6 usually reaching anterior margin of head capsule, hair 7 reaching insertion of antennal hair 1-A. *Antenna*: Distinctly shorter than head capsule; shaft with small sharp denticles. Hair 1-A submedian, multiple, nearly reaching apex of shaft. *Thorax*: Hair 13-P absent. *Abdomen*: Hair 12-I present; 6-I usually with 4 branches, 6-II usually triple; 6-III-V double; 7-I,II long, triple to with 5 branches, 7-III-V short, multiple. *Segment VIII*: Comb usually with 6 scales whose bases are all connected into a lightly sclerotized plate; individual scales with long differentiated median sharp spine, usually 2 strong denticles and some weaker denticles and fringes at base. *Siphon*: Elongate, only slightly swollen in basal part. Acus distinct, attached. Pecten rarely with more than 4 widely spaced teeth in proximal 0.3; teeth usually with only 1 basal or subbasal denticle. Hair 1-S readily seen, long but weak, multiple. *Anal Segment*: Saddle complete; moderately indented for ventral brush. Hair 1-X short, inconspicuous, double to multiple with weak forks. Ventral brush usually with 16 hairs, 4-6 of which on very poorly developed grid without lateral bar and 10-12 in an irregular double row piercing the saddle. Gills very long and slender.

SYSTEMATICS. *Psorophora jamaicensis* is currently considered to be conspecific with *confinnis* (Lynch Arribalzaga, 1891) primarily on the basis of similarity in the male genitalia. Martini (1935:45) was the first to suggest this synonymy and Aitken (1940:674-677) formalized it. However, we find that in all stages except the male genitalia, *jamaicensis* is easily distinguished from all the other populations of the complex we have seen and therefore restore it to full specific status.

That *jamaicensis* is not just a local Jamaican population of *confinnis* is confirmed by the presence of similarly marked adults and similar larvae and pupae (not

always all stages from a given locality) in Hispaniola (Haiti and Dominican Republic), Puerto Rico and the Virgin Islands (St. Croix; mentioned by Barr and Barr, 1969:8, as not being conspecific with their "*confinnis*"). We consider all these populations to be conspecific with topotypic *jamaicensis*.

Psorophora jamaicensis can be separated from the North American populations of the *confinnis* complex by the diagnostic features mentioned in the keys. In the absence of topotypic material of *confinnis* from Argentina we have not been able to determine the taxonomic status of populations other than *jamaicensis* but believe that it is very likely that the populations north of the Amazon basin belong to 1 or more species distinct from true *confinnis*. For the present we are provisionally applying the name *columbiae* (Dyar & Knab, 1906) to the populations from the eastern and southern United States and to a population from Grand Cayman Island. We have made no attempt to study carefully the extensive material of the *confinnis* complex from Mexico and Central America but it appears that at least some of the populations in this area may be conspecific with those from eastern North America.

Psorophora jamaicensis appears to be a relict species throughout most of its range and in the process of being replaced by the dominant *pygmaea* throughout their area of sympatry. There is some suggestion of hybridization between the 2 species in Jamaica; 2 males in our collection with external facies of *pygmaea* have the male genitalia and pupal features indistinguishable from *jamaicensis*.

Our records suggest that *jamaicensis* is perhaps less common in some areas of Jamaica than reported in the past. As indicated under *pygmaea*, the characters used to separate these species in Hill and Hill's key to adults (1948:25, couplet 14) are invalid and it seems probable that some of the specimens identified as *confinnis* (= *jamaicensis*) in the past were actually *pygmaea*, including some tabulated for Page's (1967) observations on man-biting mosquitoes.

P.F. Mattingly has kindly reexamined the holotype of *walsinghamii* for us and confirmed that the first tarsal segment of all legs does have a submedian pale band as in *jamaicensis*. The presence of this feature, not mentioned in Theobald's original description, removes all doubt from the validity of the synonymy of *walsinghamii* with *jamaicensis*.

BIONOMICS. In Jamaica, the immature stages of *jamaicensis* are found mainly in temporary ground pools (62%) but occur also in ditches, ponds, margins of swamps and occasionally in crabholes and rockholes. The breeding sites are usually without any vegetation and exposed to the sun. Brackish water is tolerated but fresh water appears to be preferred. The most common associate of *jamaicensis* is its congener *pygmaea*; much less frequent associates are *Aedes* (*O.*) *hemisurus*, *Aedes* (*O.*) *tortilis* and various permanent ground water breeders such as the dominant species of *Anopheles* and *Culex*. The species is widespread in the lowlands and occurs at higher elevations also; our highest record is from 450 m.

Females of *jamaicensis* bite man readily and have been taken in small numbers in donkey-baited traps. The populations of the adults vary a great deal during the year, being very low during the dry months and very high during the wet season. At Caymanas, Milk River and Salt River *jamaicensis* was most common during 2 periods, April-June and September-November.

An unidentified virus was isolated from specimens of this species collected 19 Sept 1962 at Milk River, Clarendon (L.S. Grant, personal communication).

DISTRIBUTION. Jamaica (type locality). Hispaniola, Puerto Rico and Virgin Islands (St. Croix).

JAMAICA. Widespread but possibly not as common as reported in past in some areas. *Clarendon*: Fort Simonds, 20 Jan 1946, G.A. Thompson, 1 M [UCLA]. Frankfield (81). Parnassus (863,864). Pass Side (869). Summerfield (80). Toll Gate (870). Yorks Pen (604). *Kingston and St. Andrew*: Hermitage Dam Rd (291). Kingston and vicinity, various dates, M. Grabham, 8 M, 23 F [USNM]. Red Hills Quarry (841). Upper Mountain View, 25-27 Oct 1946, G.A. Thompson, 8 F [JAM]. *St. Ann*: Delight (757). Runaway Bay, Feb 1969, W.W. Wirth, 1 F [USNM]. *St. Catherine*: Bog Walk (913). Caymanas (2-4,862). Congrieve Park (21,22). Spanish Town (37). *St. James and St. Mary*: Localities not specified (Hill and Hill, 1948:47). *St. Thomas*: Amity Hall (58,59,61). Chiswick (101,102,161,162). Dalvey (93). Duckenfield Hall (94,165). Golden Grove (156). Hampton Court (171). Holland Bay (96,97,155). New Pera (202). Rocky Point (163). Springfield House (157). Winchester House (128). *Trelawny*: Locality not specified (Hill and Hill (1948:47)). *Westmoreland*: Grange Hill (137). Petersville (362,363). *Parish not Specified*: Various dates, M. Grabham, 7 L; Apr 1945, G.A. Thompson, 3 M; Mar 1946, G.A. Thompson, 25 L [USNM]; R.B. Hill, 10 L [JAM].

Material Examined: 735 specimens; 92 males, 147 females, 335 larvae, 161 pupae; 120 individual rearings (63 larval, 46 pupal, 11 incomplete).

37. *Psorophora* (G.) *insularia* (Dyar & Knab)

Figs. 62,64

1906. *Janthinosoma insularius* Dyar and Knab, 1906a:125-136. TYPE: Holotype female (108.1), Santo Domingo (Dominican Republic), Aug 1905 (stated to be 11 July in Howard, Dyar and Knab, 1917:607, but Busck's notes give Aug), A. Busck [USNM, 9975; see Stone and Knight, 1955:285].
1908. *Aedes haruspicus* Dyar and Knab, 1908:56. TYPE: Lectotype female, Port Antonio, Jamaica, 15 Nov 1906, M. Grabham [USNM, 11995; designation of Stone and Knight, 1955:284]. Synonymy with *insularia* by Dyar (1928:126).

Psorophora (*Grabhamia*) *insularia* of Dyar (1928:126); Edwards (1932:126); Pratt (1946:213); Lane (1953:770-771; in part, not figures of larva); Stone, Knight and Starcke (1959:130); Porter (1967:37); Barr and Barr (1969:9-10).

Psorophora (*Janthinosoma*) *insularius* of Howard, Dyar and Knab (1917:605-607).

Psorophora insularia of Maldonado-Capriles, Pippin and Kuns (1958:68).

Psorophora insularius of Hill and Hill (1945a:2; 1948:48).

Psorophora (*Janthinosoma*) *haruspicus* of Howard, Dyar and Knab (1917:603-605).

Psorophora haruspicus of Johnson (1919:423); Gowdey (1926:73).

FEMALE. Wing about 3.0-3.5 mm. Small species; generally similar to *jamaicensis* and *pygmaea* from both of which it can be distinguished by the much lighter mesonotal integument, lack of contrast between the darker and lighter scales and the following conspicuous features. *Head*: Decumbent scales of disc of vertex distinctly silvery-gray white. Labium broadly pale in the middle to largely light ventrally but band not sharply differentiated dorsally. Palpus with brown scales, a few paler scales sometimes at base of segment 2 but none on apex of 3. Antennal torus with broad white scales. *Thorax*: Mesonotal integument light brown to dark tan, with a rather distinct dark spot at upper posterior part of fossa. Mesonotal scaling pale throughout, golden and silvery-gray white, without distinct pattern but golden on acrostichal line and predominantly silvery on dorsocentral line, scutal angle (broadly), caudad of dark spot, above wing root, posterior part of supraalar area and in prescutellar space. Scutellar lobes with silvery-gray white scales. *Apn* with broad, semierect whitish scales. *Ppn* with whitish narrow scales above and some broad

whitish scales below and posteriorly. Rest of pleural scaling scantier but a few broad white scales present on *ssp.* *Legs*: Predominantly with brown scales, except for usual pale surfaces of femora and generally paler lower surfaces of all tibiae. Femora moderately speckled with paler scales on anterior surfaces, preapical white bands conspicuous but small; knee spots poorly developed, yellowish to white. Tibiae lightly speckled with pale scales on anterior surfaces; foretibia with a large conspicuous inner dorsal apical spot of white to whitish scales. Submedian pale band of tarsal segments 1 not developed, these segments without distinct speckling of light scales; basal pale tarsal rings as in the other species but dingy white and frequently indistinct except on segments 1-3. *Wing*: Dorsal scaling sparse, with little contrast between light and dark scales; base of vein R_{4+5} without concentration of dark scales. *Abdomen*: Light scaling of tergites dingy white; apical light bands irregular, sometimes extensive but usually not produced triangularly basad.

MALE. Differing from *jamaicensis* and *pygmaea* essentially in the same features as the female except for sexual differences. Labium indistinctly pale in distal part ventrally. Palpus distinctly shorter than in *jamaicensis* and *pygmaea*, segment 3 usually barely reaching to 0.7 of proboscis.

MALE GENITALIA (fig. 64). In general differing from *jamaicensis* in same features as *pygmaea* and distinguished from both by the following. *Segment IX*: Tergite lobe usually with less than 12 setae. *Sidepiece*: Sternal apex not produced; mesal setae intermediate in number. *Claspette*: Free apical lobe practically undeveloped, represented by 2 or 3 separate tubercles arising from membrane of sidepiece, each bearing 1 relatively simple seta without flattened distal part. *Clasper*: Swollen part of internal margin much less developed than in *pygmaea*; subapical setae more numerous and proportionately longer.

PUPA (fig. 64). Chaetotaxy as figured, not studied in detail, apparently extremely variable. In general differing from *jamaicensis* in same features as *pygmaea*; very similar to latter, apparently distinguished from it by the following. Trumpet lighter. Abdominal hair 4-I usually with 4 or 5 branches; 1-II shorter, with 5-7 simple branches.

LARVA (fig. 62). Chaetotaxy not studied in detail, apparently in general similar to *jamaicensis*. Unique in genus in having an incomplete saddle and short rounded gills. *Head*: Strongly pigmented except for light ocular bulge. Hair 1-C moderate, darkly pigmented; 5-C usually triple or double; 6-C usually double or single. *Antenna*: Short, about 0.5 or slightly more of head length; darkened distally; shaft usually of uniform width and without denticles, rarely with 1 or 2 denticles distally. Hair 1-A strong, multiple. *Segment VIII*: Comb usually of 5 or 6 scales, not connected basally; scales with 1 differentiated apical and 2 basal shorter spines and smaller denticles. *Siphon*: Moderately inflated to very near tip, where swelling sometimes most conspicuous; varied in length; lightly pigmented except on basal ring and apex. Pecten varied, usually with 1-3 teeth in basal 0.33; teeth simple or with 2 or 3 weak to strong basal denticles or spicules. Hair 1-S small but distinct, usually with 3-5 branches, rarely single. *Anal Segment*: Saddle widely incomplete, narrowed laterally. Hair 1-X short, usually with 3 or 4 branches, inserted in indentation of saddle. Ventral brush usually with 10-12 hairs in an irregular double row, at least caudal 6 with distinct grid bars at base, sometimes connected laterally. Gills short, rounded.

SYSTEMATICS. In view of the extensive variation present in our relatively small sample from Jamaica in the adults (size and ornamentation), pupae (hair branching and development), and larvae (chaetotaxy, comb scales, pecten teeth, antennal

anomalies), we believe that the Jamaican *haruspicus* is conspecific with *insularia* from the Dominican Republic in spite of the differences noted between the 2 nominal species in the redescrptions of Howard, Dyar and Knab (1917:603-607). Plasticity marked by individual variation and frequent anomalies rather than development of stabilized characters in isolated populations seems to be characteristic of salt rockhole breeders such as *insularia*.

Outside of Jamaica and Hispaniola, *insularia* has been reported from Mona Island (Maldonado-Capriles, Pippin and Kuns, 1958:68) and Puerto Rico (Stone, Knight and Starcke, 1959:130). Barr and Barr (1969:10) noted significant differences between the pupae from these 2 populations but considered them to be probably conspecific. Our Jamaican material shows similar individual variation except for the position of hair 2 on abdominal segment I, which, however, may also be an anomaly or an individual variation. Therefore, although we have not seen the material from Mona Island and Puerto Rico, we believe that it is conspecific with topotypic and Jamaican *insularia*.

We have males and females of *insularia* from Guantanamo, Cuba, that have a considerably darker mesonotal scaling than in the Jamaican population. These conform to the latter, however, in the relatively short male palpus, and in the indistinct pale scaling of the labium and legs.

The larva of *insularia* is unique in the genus in having an incomplete anal saddle and short rounded gills, both characters common features in salt water breeders in general.

BIONOMICS. The immature stages of *insularia* have been found only in seaside coral rockholes in the splash zone, fully exposed to the sun. The water in the breeding sites is brackish and clear and the bottom is sandy. *Culex (C.) bahamensis* is at times associated with *insularia*. All the records we have are from August to November and it is possible that breeding is confined to this time of the year when a proper combination of rain water and salt water spray is obtained in the rockholes. Nothing is known of the habits of the adults in Jamaica as they have not been collected in nature. Collections from Cuba suggest that adults of both sexes may be taken in light traps.

DISTRIBUTION. Hispaniola (Santo Domingo, type locality), Cuba, Mona Island, Puerto Rico and Jamaica.

JAMAICA. To date known only from the north coast. *Hanover*: Bulls Bay (89,717). Mosquito Cove (936). *Portland*: Navy Island (389,400). Port Antonio, various dates, M. Grabham, 6 M, 6 F, 3 L [USNM]. *St. Mary*: Port Maria (927).

Material Examined: 221 specimens; 34 males, 41 females, 83 larvae, 63 pupae; 47 individual rearings (12 larval, 25 pupal, 10 incomplete).

38. *Psorophora (G.) pygmaea* (Theobald)

Figs. 62,65

1903. *Grabhamia pygmaea* Theobald, 1903a:245-246. TYPE: Lectotype female with wing on slide, Antigua, Leeward Is., Aug, W.R. Forrest (119) [BM; designation of Belkin, 1968b: 28-29].
1903. *Culex nanus* Coquillett, 1903:256. TYPE: Lectotype female, Key West, Florida, U.S.A., Aug 1901, A. Busck [USNM, 6893; designation of Stone and Knight, 1955:285]. Synonymy with *pygmaea* by Theobald (1907:289,290).
1904. *Taeniorhynchus antiguae* Giles, 1904:382,384. TYPE: Lectotype female, Antigua, 11

June 1901, W.R. Forrest [BM; designation of Belkin, 1968b:25]. Synonymy with *pygmaea* by Theobald (1907:289,290).

Psorophora (Grabhamia) pygmaea of Dyar (1922a:41; 1928:126-127); Edwards (1932:127); King, Bradley and McNeel (1944:56); Matheson (1944:242-243); Carpenter, Middlekauff and Chamberlain (1946:160-162); Pratt (1946:213); Lane (1953:771-773); Carpenter and LaCasse (1955:133-134); Horsfall (1955:404); Perez Viguera (1956:336-339); Stone, Knight and Starcke (1959:130); Montchadsky and Garcia (1966:39-40); Porter (1967:37); Page (1967).

Psorophora (Janthinosoma) pygmaea of Howard, Dyar and Knab (1917:600-603).

Psorophora pygmaea of Johnson (1919:423); Gowdey (1926:73); Hill and Hill (1945a:2; 1948:48-49); Thompson (1947:79).

Grabhamia pygmaea of Theobald (1905a:31-32; 1905b:23; 1907:289-291); Coquillett (1906b:21).

FEMALE. Wing about 3.0-3.5 mm. Superficially very similar to *jamaicensis* from which it can usually be distinguished by the smaller size and the following conspicuous differences. *Head*: Decumbent scales more numerous. Erect scales shorter and broader, all light except laterally. Labial pale band narrower, usually less than 0.2 of proboscis and relatively well marked. Palpus with scattered pale scales, usually not tipped with pale scales. Antennal torus with numerous narrow pale scales instead of hairs. *Thorax*: Mesonotal integument dark to blackish brown. Mesonotal scaling predominantly light coppery to gray golden with rather distinct patches of dark bronzy scales laterally in front of scutal angle, in upper posterior part of fossa and in anterior part of supraalar area. *Apn* and *ppn* scales all pale and narrow, more numerous; lower part of *ssp* with numerous broad whitish scales in 1 or 2 patches; broad pleural scales somewhat whiter. *Legs*: Femora more extensively pale on anterior surfaces, pale scales predominating on basal part at least, subapical pale band not as distinct. Tibiae with scattered pale scales, not arranged in discrete spots. First tarsal segments without submedian pale band, with scattered pale scales. Basal white bands or rings usually restricted to segments 1-3 on foreleg and midleg, 1-4 on hindleg. *Wing*: Pale scales whiter, more conspicuous; plume scales shorter and broader. Base of vein R_{4+5} without concentration of dark scales. *Abdomen*: Light scaling of tergites whiter; tergite I with large patch of white scales; apical white bands of tergites II-V more conspicuous, all triangularly produced basad; tergites VI, VII with numerous scattered white scales in addition to narrow apical pale band; sternites with grayish white scales only.

MALE. Differing from *jamaicensis* essentially in the same features as the female except for sexual characters. Labium with more distinct ventral pale band than in *jamaicensis* and abdominal tergites with more conspicuous and extensive pale scaling. Palpus essentially as in *jamaicensis*. Pale scaling of femora and especially tibiae not as distinct as in female.

MALE GENITALIA (fig. 65). In general similar to *jamaicensis*, differing from it in the following conspicuous features. *Sidepiece*: Sternal apex not produced. Mesal surface beyond claspette with setae more numerous. *Claspette*: Free apical part very short and not markedly expanded, usually with 4 (3-5) specialized setae. *Clasper*: Swollen part of internal margin not as prominent and more distal.

PUPA (fig. 65). Chaetotaxy as figured, not studied in detail, apparently extremely variable. In general similar to *jamaicensis* from which it differs in the following conspicuous features. *Cephalothorax*: Unevenly pigmented, light ventrally, darkened dorsally on mesonotum, more strongly in male. *Trumpet*: Short, strongly flared distally, pinna long; uniformly concolorous with mesonotum. *Metanotum and Ab-*

domen: Moderately and strongly pigmented anteriorly, largely colorless distally; darker in male. Hair 10-C usually with at least 12 branches. Hair 2-I usually laterad or in line with 3-I; hair 4-I with 7-12 branches. Hair 1-II usually with dendritic branching; 2-II usually laterad or in line with 3-II. *Paddle*: Practically colorless except for midrib and external buttress.

LARVA (fig. 62). Chaetotaxy not studied in detail, apparently in general similar to *jamaicensis*. Readily differentiated from other members of subgenus by the following features. *Head*: Strongly pigmented except for light ocular bulge; latter usually with 1 or more small tubercles in caudal part. Hairs 5,6-C both long, usually single; 1-C very slender, lightly pigmented. *Antenna*: Short, less than 0.5 of head length; darkly pigmented; shaft of uniform width, with scattered short denticles. Hair 1-A variable in position. *Segment VIII*: Comb usually of 6 scales whose bases are united by irregular sclerotizations; scales with 1 differentiated apical and 2 basal shorter spines and smaller denticles. *Siphon*: Moderately inflated; varied in length. Pecten varied, usually with 4-6 teeth which may extend to 0.5; teeth usually with several basal denticles, sometimes simple. Hair 1-S small but distinct, with 2-4 branches. *Anal Segment*: Saddle complete, moderately to strongly indented for ventral brush. Hair 1-X short, usually double or triple. Ventral brush usually with total of 12 hairs, 8 of which with well developed grid bars but no lateral sclerotization, and 4 precratal hairs piercing the saddle. Gills moderately long, pointed.

SYSTEMATICS. *Psorophora pygmaea* is apparently an extremely variable and very common dominant species with a wider distribution in the West Indies than any other species of the genus. We have not studied in detail the various populations but a superficial examination of populations from Antigua (type locality), Nevis, St. Kitts, Hispaniola (Haiti), Jamaica, Grand Cayman and Cuba (Guantanamo) shows no obvious significant constant differences. *Psorophora pygmaea* has also been reported from Puerto Rico (Tulloch, 1937:142), Bahamas (Howard, Dyar and Knab, 1917:603) and Florida (Key West, type locality of *nanus*; and near Miami Beach by Buren, 1946:185). All these records undoubtedly pertain to *pygmaea* in the current sense. However, the record of *pygmaea* from Trinidad in Stone, Knight and Starcke (1959:130) is very doubtful.

The Jamaican population agrees in all significant details of general coloration of adults, male genitalia, pupa and larva with the topotypic population of *pygmaea* from Antigua. There is a great deal of variation in the chaetotaxy of the immatures and in the light markings of the legs and abdominal tergites in both populations. The relatively large adults from Antigua do not show the wide range in size which is evident in our Jamaican collections but this is probably merely due to different conditions in the breeding sites.

As indicated under *jamaicensis* there is a suggestion of hybridization or introgression between that species and *pygmaea*. The adults of the presumed hybrids tend toward the *pygmaea* type of ornamentation but the male genitalia and the pupa are indistinguishable from *jamaicensis*. Possibly the development of the small tubercles in the postorbital area of the larva in *pygmaea* may be a feature derived from *jamaicensis* through introgression or common ancestry.

It appears that *pygmaea* has been confused with *jamaicensis* in the past in Jamaica. Presumably the 2 species were separated as adults on the basis of the characters in couplet 14 of the key in Hill and Hill (1948:25) that are not valid. Our records suggest that *pygmaea* may be a more common species in some areas in Jamaica than *jamaicensis* and we suspect that at least some of the specimens re-

ported as *confinnis* (= *jamaicensis*) by Page (1967:182) were actually *pygmaea*.

BIONOMICS. Immature stages of *pygmaea* are found in temporary ground pools with a muddy bottom, usually fully exposed to the sun. Margins of ponds and swamps are also used by this species. All these breeding sites are similar to those used by *jamaicensis* but *pygmaea* is found much more frequently in brackish water, a little more than half of our collections being recorded from brackish water. These 2 species are frequently associated in a single habitat; lesser frequent associates of *pygmaea* are *Aedes* (*O.*) *taeniorhynchus* and *Aedes* (*O.*) *tortilis* and occasional ones *Aedes* (*O.*) *hemisurus*, *Aedes* (*O.*) *pertinax*, *Culex* (*C.*) *nigripalpus* and *Anopheles* (*N.*) *albimanus*. The majority of our records of *pygmaea* are from the lowlands, all but one (200 m) below 60 m.

Females of *pygmaea* bite man and donkeys but do not seem to enter stable traps readily. They are sometimes found in very large numbers exceeding the populations of *jamaicensis*. An unidentified arbovirus was isolated from *pygmaea* collected in Sept 1962 at Milk River, Clarendon (L.S. Grant, personal communication).

DISTRIBUTION. Antigua (type locality), Cuba, Cayman Islands, Jamaica, Florida, Bahamas, Hispaniola, Puerto Rico, Nevis, St. Kitts.

JAMAICA. Probably more widely distributed than present records indicate. *Clarendon*: Parnassus (863,864). Pass Side (869). Toll Gate (870). *Kingston and St. Andrew*: Ferry and vicinity (237A). Kingston and vicinity, various dates, M. Grabham, 7 M, 12 F, 3 L [USNM]. Red Hills quarry (841). *St. Ann*: Delight (757). *St. Catherine*: Caymanas (Page, 1967). *St. Thomas*: Chiswick (101,102). Holland Bay (95-97,99,143). Morant Point (100). White Bay (139). *Parish not Specified*: M. Grabham, 2 L [USNM].

Material Examined: 2132 specimens; 211 males, 306 females, 1299 larvae, 316 pupae; 114 individual rearings (18 larval, 92 pupal, 4 incomplete).

GENUS AEADES

Aedes is the dominant genus of the tribe Aedini and is characterized in the adults by normal anterior pronotal lobes and the absence of spiracular bristles. In the New World the larvae are readily distinguished from *Psorophora* by the absence of precratal tufts on the body of the anal segment except rarely at the very apex, but are difficult to separate from those of *Haemagogus* (see key to tribes and genera). The pupae are very similar to those of *Psorophora* and *Haemagogus* and can be separated only by the combination of characters given in these keys.

All 3 subgenera indigenous to the New World tropics are represented in Jamaica by indigenous species: (1) *Ochlerotatus* by 7 species in 4 groups, (2) *Finlaya* by 1 species only, (3) *Howardina* by 5 species. In addition, the ubiquitous *aegypti* of the Old World subgenus *Stegomyia* has been introduced.

We have included in the keys all the other species of *Aedes* reported from the West Indies as indicated under the subgenera *Ochlerotatus* and *Howardina*.

The habitats of the immature stages of species of *Aedes* in the West Indies range from temporary ground pools and rockholes to treeholes and leaf axils of various plants. Females of some species, particularly *taeniorhynchus*, are avid blood suckers; some of these species may be involved in the transmission of arboviruses.

At the conclusion of this study we found 1 male *Aedes* in the USNM collection with the following printed label //Jamaica BWI/Jan 1946/GA Thompson//. The specimen lacks the abdomen and there is no indication that a genitalia slide was prepared. Without the genitalia it is impossible to determine with certainty the subgeneric status of this specimen but it appears probable that it falls in a group

annectent between *Finlaya* and *Ochlerotatus*. There are a few resemblances with the *Aedes (O.) varipalpus* complex of the western United States but these are not necessarily indicative of true affinity. We have provisionally included this form in the key to the adults among the species of *Ochlerotatus*. Additional striking features of this specimen are as follows: (1) decumbent scales of vertex of head narrow, erect scales very numerous; palpus slender, about 0.8 of proboscis, banded with white at joints between segments 3 and 4 and 4 and 5, with only a few long bristles on 4 and 5; labium entirely dark; (2) mesonotal scales all narrow, in an indistinct pattern of pale golden on bronzy background, a patch of white scales in supraalar area; scutellar scales all narrow and pale golden; paratergite with moderately broad white scales; pleural scales predominantly broad and white; (3) knee spots conspicuous; foretarsi and midtarsi (hindtarsi missing) white on base of segment 1 and on joints between segments 1 and 2 and 2 and 3; (4) costa of wing with basal whitish streak on lower surface nearly reaching level of humeral crossvein.

We suspect that this unnamed form is a treehole or bamboo breeder.

KEYS TO SUBGENERA AND SPECIES

ADULTS

1. Pleural scales all metallic silvery; vertex of head usually without erect scales 2
 Pleural scales dark, grayish or pure white, but never metallic silvery (*Ochlerotatus*) 11

Stegomyia

- 2(1). Clypeus with scales; mesonotum with lateral prescutal silvery line curved inward and broadened along scutal suture (*Stegomyia*) 52. **aegypti**
 Clypeus without scales; mesonotum with varied pattern but never with such a silvery line 3

Finlaya

- 3(2). Mesonotum with a narrow median (acrostichal) longitudinal silvery line from anterior promontory to prescutellar space (*Finlaya*)
 46. **mediovittatus**
 Mesonotum without a median longitudinal silvery line (*Howardina*) 4

Howardina

- 4(3). All mesonotal light scales golden (Aurites Group) 5
 At least lateral mesonotal line silvery or white 7
- 5(4). Pleuron with large silvery patch continuous from lower *pra* across posterior *stp* to its lower margin 48. **aurites**
 Pleuron with 3 small separate silvery patches, 1 each on lower *pra*, upper *stp* and lower *stp* 6
- 6(5). Antealar area (above paratergite) included in lateral marginal line, with golden scales, rarely 1-3 bronzy scales present 49. **grabhami**
 Antealar area with numerous dark bronzy scales below narrow posterior lateral marginal golden line 50. **inaequalis**; 51. **stenei**

- 7(4). Lateral mesonotal line broadened to form a conspicuous fossal silvery patch **47. walkeri**
Lateral mesonotal line very narrow, not extending on fossa 8
- 8(7). Median prescutellar line golden, faint; palpus entirely dark (Lesser Antilles; see subgenus) *busckii*
Median prescutellar line silvery, conspicuous; palpus with some silvery scales 9
- 9(8). Hindtarsal segment 5 with some white scales (Cozumel Island, Yucatan Peninsula, British Honduras; see subgenus) *cozumelensis*
Hindtarsal segment 5 with black scales only. 10
- 10(9). Hindtarsal segment 3 white scaled in barely more than basal 0.5 (Bahamas; see subgenus) *bahamensis*
Hindtarsal segment 3 white scaled in at least basal 0.7 (Hispaniola; see subgenus). *albonotatus*
- Ochlerotatus*
- 11(1). Dorsal wing scales and legs predominantly yellow (Cuba; see subgenus) *pallens*
Dorsal wing scales predominantly dark or wings speckled with pale scales; legs predominantly dark or speckled or banded with pale or white scales 12
- 12(11). At least hindtarsus distinctly ringed with white dorsally 13
All tarsi entirely dark dorsally 15
- 13(12). Upper part of *ppn* predominantly with broad white scales (see genus). **undetermined species**
Upper part of *ppn* with all scales narrow and dark 14
- 14(13). Wing without speckling of pale scales; mesonotal scaling predominantly dark bronzy **39. taeniorhynchus**
Wing extensively speckled with pale scales; mesonotal scaling predominantly golden and reddish coppery. **40. sollicitans**
- 15(12). Anterior part of mesonotum with white to silvery white scales in a large median patch or broad stripe 16
Anterior part of mesonotum with bronzy, coppery, golden or light tan scales 17
- 16(15). White scaling of mesonotum in a hexagonal or rounded patch extended towards scutal angle **42. hemisurus**
White scaling of mesonotum in a broad parallel-sided longitudinal stripe (Bahamas; see subgenus) *condolescens*
- 17(15). Mesonotal disc completely or largely covered with pale tan scales, dark bronzy scales restricted to acrostichal line or patch at end of acrostichal line 18

- Light scaling of mesonotal disc grayish white, pale golden to light bronzy, not as extensive or completely absent, dark bronzy scales always present on posterior dorsocentral and prescutellar lines 19
- 18(17). Mesonotum at most with a small patch of dark scales at posterior end of acrostichal line **45. calumnior**
 Mesonotum with a distinct continuous acrostichal dark scaled line (Bahamas; see subgenus) *obturbator*
- 19(17). Mesonotal disc entirely dark scaled or with a narrow grayish to white acrostichal line **41. pertinax**
 Anterior part of mesonotum with large patch or broad median stripe of deep golden to light bronzy scales (*tortilis* complex)
 **43. tortilis; 44. auratus**

MALE GENITALIA

Stegomyia

1. Aedeagus with apical and lateral denticles; IX tergite lobe very large; strongly diverging laterad; paraproct without apical spine (*Stegomyia*) **52. aegypti**
 Aedeagus smooth, without denticles; IX tergite lobe small, submedian; paraproct with strong apical spine 2
- 2(1). Claspette very small, appearing as a mesal lobe appressed to base of sidepiece (*Howardina*) 3
 Claspette strongly differentiated, projecting sternally mesad of sidepiece, with strongly differentiated columnar stem and specialized apical filament 8

Howardina

- 3(2). Tergal surface of sidepiece with very dense vestiture of long setae, some as long as sidepiece (Bahamas; see subgenus) *bahamensis*
 Tergal surface of sidepiece with sparse vestiture of short or moderate setae, none more than 0.5 of sidepiece length 4
- 4(3). Clasper very long, including spiniform about as long as sidepiece (*Hispaniola*; see subgenus) *albonotatus*
 Clasper short or moderate, including spiniform not exceeding 0.75 of sidepiece length 5
- 5(4). Claspette narrowed distally into a distinct apical process bearing 1 seta; body of claspette with short subapical setae 6
 Claspette conical; gradually tapered, apical seta (sometimes 2) borne on short basal tubercle; body of claspette with several strong subapical setae on smaller tubercles 7
- 6(5). Basal tergal setae of sidepiece weak, much shorter and weaker than tergo-mesal marginal setae (Aurites Group)
 **48. aurites; 49. grabhami; 50. inaequalis; 51. stenei**

Basal tergal setae of sidepiece strong, subequal in length and development to tergomesal marginal setae (Lesser Antilles; see subgenus). . . *busckii*

- 7(5). Clasper more than 0.5 of sidepiece length, without distinct subapical setae **47. walkeri**
 Clasper less than 0.5 of sidepiece length, with distinct subapical setae (Cozumel Island, Yucatan Peninsula, British Honduras; see subgenus) *cozumelensis*

Finlaya

- 8(2). Sidepiece with numerous scales on dorsal surface; claspette stem longer than clasper exclusive of spiniform (*Finlaya*) **46. mediovittatus**
 Sidepiece at most with a few scales on dorsal surface; claspette stem usually shorter than, at most subequal to, clasper exclusive of spiniform (*Ochlerotatus*) 9

Ochlerotatus

- 9(8). Basal tergomesal lobe detached from sidepiece, attached to base of claspette (Serratus Group) **41. pertinax**
 Basal tergomesal lobe attached to sidepiece at base, separate from claspette 10
- 10(9). Basal tergomesal lobe of sidepiece without differentiated heavy seta dorsally at base 11
 Basal tergomesal lobe of sidepiece with a heavy differentiated seta dorsally at base 13
- 11(10). Middle of dorsal surface of sidepiece with setae nearly as long as entire sidepiece; basal tergomesal lobe very large **45. calumnior**
 Middle of dorsal surface of sidepiece with short or minute setae only; basal tergomesal lobe small 12
- 12(11). Claspette filament with retrorse process **39. taeniorhynchus**
 Claspette filament without retrorse process **40. sollicitans**
- 13(10). Claspette filament without sharp retrorse process on convex margin 14
 Claspette filament with distinct sharp retrorse process on convex margin 15
- 14(13). Claspette filament narrow at base, widened and angled near middle; specialized seta of basal tergomesal lobe attenuate apically. **42. hemisurus**
 Claspette filament broadened and angled near base; specialized seta of basal tergomesal lobe with slightly expanded flattened apex (Cuba; see subgenus) *pallens*
- 15(13). Claspette filament about 2.0 of stem length, with very slender long petiole (specimen from Mona Island; see subgenus) *obturbator*
 Claspette filament only slightly longer than stem, with short petiole 16
- 16(15). Distal part of basal tergomesal lobe narrow, usually with less than 10 thin setae largely in 2 irregular rows **43. tortilis**

Distal part of basal tergomesal lobe larger and broader, usually with more than 25 longer, heavier setae in several irregular rows 44. *auratus*

PUPAE

(44. *auratus* unknown)

1. Abdominal hair 2-III usually distinctly laterad of hair 1, rarely in line with it in which case 3-III is closer to hair 5 than to hair 1 or about equidistant 2
 Abdominal hair 2-III usually distinctly mesad of hair 1, rarely in line with it in which case 3-III is much closer to hair 1 than to hair 5 (*Ochlerotatus*) 12

Stegomyia

- 2(1). Cephalothoracic hair 6-C longer than hair 7 (*Stegomyia*) 52. *aegypti*
 Cephalothoracic hair 6-C much shorter than hair 7 3

Finlaya

- 3(2). Hair 4-II mesad of hair 5 (*Finlaya*) 46. *mediovittatus*
 Hair 4-II laterad of hair 5 (*Howardina*). 4

Howardina

- 4(3). Paddle deeply emarginate at hair 1-P 47. *walkeri*
 Paddle smoothly rounded at apex or at most shallowly emarginate 5

- 5(4). Metanotal hair 10-C usually with at least 10 branches (Aurites Group) . 6
 Hair 10-C usually with less than 5 branches 9

- 6(5). Pigmentation very light and uniform; metanotum uniformly lightly pigmented. 7
 Pigmentation moderate and uneven; metanotum with light area in middle of lateral surface 8

- 7(6). Hair 2-VI distinctly laterad of hair 3 48. *aurites*
 Hair 2-VI mesad or in line with hair 3 49. *grabhami*

- 8(6). Median tergal darkening of abdominal segment III indistinct
 50. *inaequalis*
 Median tergal darkening of segment III sharply marked 51. *stenei*

- 9(5). Cephalothoracic hair 5-C at least 2.0 of hair 4 (Cozumel Island, Yucatan Peninsula, British Honduras; see subgenus) *cozumelensis*
 Cephalothoracic hair 5-C subequal to hair 4 10

- 10(9). Hairs 7,10-C both single; paddle elongate, length more than 1.5 of greatest width (Hispaniola; see subgenus) *albonotatus*
 Hairs 7,10-C usually at least double; paddle length moderate, usually less than 1.3 of greatest width 11

- 11(10). Pinna long, more than 0.33 of total trumpet length; paddle slightly emarginate at hair 1; hair 6-III,IV strong, usually at least double (Bahamas; see subgenus) *bahamensis*
Pinna about 0.25 of total trumpet length; paddle evenly rounded on apex; hair 6-III,IV weak, single (Lesser Antilles; see subgenus) *busckii*
- Ochlerotatus*
- 12(1). Caudolateral angles of abdominal segments III-V with conspicuous denticles (Serratus Group) **41. pertinax**
Caudolateral angles of abdominal segments III-V without denticles 13
- 13(12). Abdominal hair 9-VII usually with at least 5 barbed branches 14
Abdominal hair 9-VII usually simple, double or triple 15
- 14(13). Hair 6-III-VI usually single; 5-III usually double or triple
. **39. taeniorhynchus**
Hair 6-III-VI usually at least double; 5-III usually with at least 5 branches .
. **40. sollicitans**
- 15(13). Abdominal hairs 5-IV-VI usually all single, rarely 1 of these double
. **45. calumnior**
Abdominal hairs 5-IV-VI usually all double, rarely 1 of these single or
triple 16
- 16(15). Hairs 6-III-VI usually all single; 1-V-VII usually double **42. hemisurus**
At least hair 6-VI usually double; 1-V-VII usually at least triple
. **43. tortilis**

LARVAE

1. Anal saddle incomplete; ventral brush with 5 or 6 pairs of hairs 2
Anal saddle complete; ventral brush with 7 to 9 pairs of hairs (*Ochlerotatus*) 12

Stegomyia

- 2(1). Tubercles of mesothoracic and metathoracic pleural groups (9-12) with long sharp spine; caudal margin of saddle without spicules (*Stegomyia*) **52. aegypti**
Tubercles of mesothoracic and metathoracic pleural groups without long sharp spine; caudal margin of anal saddle with long spicules. 3

Finlaya

- 3(2). Pecten of siphon arcuate, curved dorsad distally; comb scales strongly sclerotized, with sharp median spine and 1 or more smaller spines or strong denticles at base (*Finlaya*) **46. mediovittatus**
Pecten of siphon straight; comb scales poorly sclerotized and lightly pigmented, without strong basal spines or strong denticles (*Howardina*) 4

Howardina

- 4(3). Abdominal integument densely covered with large branched spicules
. **47. walkeri**

- Abdominal integument glabrous at 100 X 5
- 5(4). Hair 13-P present (Cozumel Island, Yucatan Peninsula, British Honduras; see subgenus) *cozumelensis*
Hair 13-P absent 6
- 6(5). Ventral brush with 5 pairs of hairs (Lesser Antilles; see subgenus)
. *busckii*
Ventral brush with 6 pairs of hairs 7
- 7(6). Head hair 6-C usually single or double; pecten teeth short and with basal denticles; siphon index 3.0 or less 8
Head hair 6-C multiple, usually with more than 5 branches; pecten teeth long, slender and without basal denticles; siphon index more than 4.0 (Aurites Group) 9
- 8(7). Gills subequal; siphon hair 1-S adjacent to last pecten tooth (Hispaniola; see subgenus) *albonotatus*
Gills markedly unequal; siphon hair 1-S well beyond last pecten tooth (Bahamas; see subgenus) *bahamensis*
- 9(7). Hair 2-VIII large, stellate, with 4-7 branches **51. stenei**
Hair 2-VIII small, single 10
- 10(9). Siphon index less than 5.5; gills markedly unequal, the smaller distinctly shorter than saddle **50. inaequalis**
Siphon index 6.0 or more; gills subequal and distinctly longer than saddle 11
- 11(10). Head hair 5-C usually at least triple; 7-C about 0.5 of antenna and usually with 6 branches **48. aurites**
Head hair 5-C usually single; 7-C very short, less than 0.25 of antenna and usually triple **49. grabhami**

Ochlerotatus

- 12(1). Comb scales large, spinelike and fringed near base only, in a single irregular row; bases of prothoracic hairs 5,6-P connected by narrow arcuate anterior plate (Serratus Group) **41. pertinax**
Comb scales small, broad and fringed to at least near apex where a spinule may be developed, in a patch of 3 or more irregular rows; bases of prothoracic hairs 5,6-P not connected 13
- 13(12). Lateral abdominal hair 6-III-V double to 5-branched 14
Lateral abdominal hair 6-III-V single 15
- 14(13). Comb scales without well-developed median spinule; saddle with distinct sharp spicules near dorsocaudal margin **39. taeniorhynchus**
Comb scales with well-developed median spinule; saddle without sharp spicules near dorsocaudal margin **40. sollicitans**

- 15(13). Lateral abdominal hair 6-I,II single 16
 Lateral abdominal hair 6-I,II double or triple 18
- 16(15). Dorsocaudal margin of saddle with short sharp spicules (Mona Island specimens; see subgenus). *obturbator*
 Dorsocaudal margin of saddle without sharp spicules 17
- 17(16). Siphon index more than 3.0, pecten teeth more than 24; gills less than dorsal saddle length **45. calumnior**
 Siphon index less than 2.5, pecten teeth less than 15; gills more than 2.0 dorsal saddle length **44. auratus**
- 18(15). Head hair 6-C usually double; distal pecten teeth strongly detached; siphon hair 1-S well within pecten (Cuba; see subgenus). *pallens*
 Head hair 6-C single; distal pecten tooth not distinctly detached; siphon hair 1-S at end of pecten 19
- 19(18). Thoracic and abdominal integument with long sharp spicules; comb scales without median spinule; ventral brush without precratal hair on saddle **42. hemisurus**
 Thoracic and abdominal integument with much shorter and less dense spicules; comb scales with distinct short median spinule; ventral brush usually with 1 precratal hair on saddle **43. tortilis**

Subgenus OCHLEROTATUS

Females of the subgenus *Ochlerotatus* can usually be recognized from other subgenera of *Aedes* by the narrow, elongate projecting cerci; both sexes have the head with narrow decumbent scales in a rather broad median patch and the erect scales usually numerous and extending on the disc of the vertex. In the male genitalia the claspette is well developed and the aedeagus is without teeth. In the Antilles the larvae can be recognized by the complete anal saddle and the pupae by abdominal hair 2 usually being distinctly mesad of hair 1 on segments III-V.

Seven species of *Ochlerotatus* are recognized here from Jamaica representing the main evolutionary lines of the subgenus in the Neotropical area: (1) the widespread *taeniorhynchus* and the Nearctic *sollicitans* of the *Taeniorhynchus* Group, (2) *pertinax*, formerly regarded as conspecific with the nominate species of the *Serratus* Group, (3) *hemisurus* of the *scapularis* complex and *tortilis* and *auratus* of the *tortilis* complex in the *Scapularis* Group, and (4) a new species, *calumnior*, apparently related to *obturbator*.

An additional undescribed species from Jamaica, possibly belonging to this subgenus, is discussed under the genus *Aedes*.

We have included in the keys 3 other species reported from the Greater Antilles: (1) the North American *pallens* Ross, 1943 currently regarded as a subspecies of *fulvus* (Wiedemann, 1828), reported from Cuba; (2) *condolescens* Dyar & Knab, 1907 from the Bahamas (female only known), actually probably a complex of forms similar to the *scapularis* complex, reported from Cuba, Puerto Rico, Lesser Antilles, Mexico, Guatemala and South America and now also Grand Cayman; and (3) *obturbator* Dyar & Knab, 1907 from the Bahamas (female only known), re-

ported also from Mona Island (male genitalia and larva).

Members of this subgenus are predominantly breeders in temporary ground pools. The Jamaican *calumnior* breeds normally in coral rockholes. Females of *taeniorhynchus*, *hemisurus* and *tortilis* attack man vigorously in Jamaica.

39. *Aedes* (O.) *taeniorhynchus* (Wiedemann)

Figs. 68,69

1821. *Culex taeniorhynchus* Wiedemann, 1821:43. TYPE: Female, Mexico [NMW; see Belkin, 1968b:7-8].
1823. *Culex damnosus* Say, 1823:11-12. TYPE: Adults, Pennsylvania [NE]. Synonymy with *taeniorhynchus* apparently by Coquillett (1906b:21).
1904. *Taeniorhynchus niger* Giles, 1904:382,384. TYPE: Lectotype female, Antigua, W. Indies, 21 July 1901, W.R. Forrest [BM: designation of Belkin, 1968b:6]. Name rejected as secondary homonym of *Aedes niger* Theobald, 1901 [now *Ficalbia nigra*] apparently by Dyar (1922a:88). Synonymy with *taeniorhynchus* by Bonne and Bonne-Wepster (1925:411).
1905. *Culex portoricensis* Ludlow, 1905:386-387. TYPE: Lectotype female, San Juan, Puerto Rico, 15 Aug 1905, L.G. de Queveda [USNM, 10007; designation of Stone and Knight, 1956a:224]. Synonymy with *niger* by Howard, Dyar and Knab (1917:672); with *taeniorhynchus* apparently by Dyar (1928:218).
1914. *Aedes epinolus* Dyar and Knab, 1914:61-62. TYPE: Lectotype female, Ventanillas (Cajamarca), Peru, 4 Feb 1914, C.H.T. Townsend [USNM, 18362; designation of Stone and Knight, 1956a:217]. Synonymy with *taeniorhynchus* apparently by Bonne and Bonne-Wepster (1925:411).

Aedes (*Ochlerotatus*) *taeniorhynchus* of Edwards (1932:138); King, Bradley and McNeel (1944:47-49); Matheson (1944:139-140); Carpenter, Middlekauff and Chamberlain (1946:209-211); Lane (1953:678-680); Carpenter and LaCasse (1955:238-240); Horsfall (1955:452-453); Perez Viguera (1956:268-277); Stone, Knight and Starcke (1959:155); Forattini (1965a:302-312); Montchadsky and Garcia (1966:41-42); Porter (1967:38); Page (1967).

Aedes (*Taeniorhynchus*) *taeniorhynchus* of Dyar (1928:218-219).

Aedes taeniorhynchus of Matheson (1929:132-133); Hill and Hill (1945a:2; 1948:45); Thompson (1947:78).

Ochlerotatus taeniorhynchus of Coquillett (1906b:19,21).

Culicelsa taeniorhynchus of Felt (1904:391b); Theobald (1907:377-379).

Culex taeniorhynchus of Theobald (1901a:350-353; 1903a:158-159; 1905a:22; 1905b:25; 1910:316).

Aedes (*Taeniorhynchus*) *portoricensis* of Dyar (1922a:88).

Aedes niger of Howard, Dyar and Knab (1917:672-675); Johnson (1919:423); Gowdey (1926:73-74).

FEMALE. Wing about 3.0-3.5 mm. A medium-sized to rather small dark species with banded proboscis, tarsi and abdomen; palpus usually tipped with white scales, wing without speckling of white scales. *Head*: Narrow decumbent scales of vertex usually predominantly dark except for narrow ocular pale border and interocular space, and variable posterior patch of pale scales, latter sometimes extensive. Broad decumbent scales predominantly whitish, a few dark scales dorsally and in a lateral patch. Erect scales very numerous, usually all dark. Proboscis with variable small premedian whitish ring, sometimes incomplete dorsally or nearly absent. Palpus tipped with a few white scales; 4-segmented, segment 4 minute. Antennal torus

with median patch of pale to dark small broad scales. *Thorax*: Mesonotal integument very dark; scaling narrow, predominantly dark, bronzy to coppery, with pale scales, some whitish, on anterior promontory, humeral angle, above *ppn*, along scutal suture and posterodorsal part of fossa, prealar and posterior supraalar areas, laterad of acrostichal line in front of prescutellar space, and around and in prescutellar space. Mesonotal bristles all developed, rather short and dark. Paratergite with small broad whitish scales. All scutellar lobes with long narrow pale scales. Pleuron with uniformly dark integument. *Apn* with moderately broad, semierect scales, dark in upper part, white to whitish in lower; *ppn* with dark scales in upper part, narrow along mesonotal border anteriorly, moderately broad towards lower posterior patch of similar white or whitish scales; rest of pleural scaling moderately broad, whitish to white, present on *ppl*, *psp*, *ssp* (large patch), *stp* (upper and lower), base of *pra*, and upper anterior part of *mep*. One lower *mep* bristle sometimes present. *Legs*: Predominantly dark. Forecoxa with large patch of scales, dark except at base; midcoxa with smaller patch of dark and white scales; hindcoxa with small apical patch of white scales. Trochanters and base of femora predominantly pale scaled. Femora with usual pale surfaces; hindfemur pale on lower part of anterior surface. Knee spots indistinct. Tibiae with some pale scales at base and apex; usually some dingy indistinct pale scaling on lower surface, particularly on midtibia, and sometimes indistinct dingy pale spots or line on dorsoanterior surface of midtibia and hindtibia. Foretarsus and midtarsus with very small dorsal basal bands of white scales on segments 1-3, usually indistinct or completely absent on segment 1 of foretarsus. Hindtarsus with small basal white rings on all segments, usually involving a few white or pale scales on apex of preceding segment; basal white ring of segment 5 usually less than 0.3 of its length. Claws of foreleg and midleg all with subbasal tooth; hindclaws simple. *Wing*: Dorsal scales usually all dark except for a few pale scales at base of costa which sometimes form a short line. *Haltere*: Stem and knob usually pale. *Abdomen*: Tergite I with numerous dark scales; laterotergite with large patch of white scales. Tergites II-VI with narrow basal transverse white bands, VI and VII with apical transverse row of white scales; large lateral submedian patches of white scales on II-VII, not connected to transverse bands, extended dorsad on VI and VII. Basal sternites predominantly pale scaled, distal with more or less extensive subapical dark band. Cercus slender, exerted.

MALE. Essentially similar to female except for sexual characters. Palpus subequal to proboscis in length; porrect; with numerous long bristles from apex of segment 3 distad; with white scales near base of segment 2 and at base of segments 3-5. Antennal flagellum densely long plumose. Claws of foreleg and midleg enlarged, unequal, larger claws with basal external and submedian teeth, smaller claws with basal tooth only; hindclaws simple, as in female. Abdominal tergites with broader basal white bands on II-VII; lateral white patches not developed on II-IV, represented by a few scales on V-VII dorsolaterally, sides of tergites with numerous long bristles. Abdominal sternites II-V predominantly dark scaled; VI, VII with white scales laterally.

MALE GENITALIA (fig. 68). *Segment IX*: Tergite deeply emarginate in middle of anterior margin; lobe poorly differentiated, with 3-6 setae, sometimes flattened. *Sidepiece*: Elongate, more or less cylindrical; mesal membrane developed to apex. Basal tergomesal lobe prominent; with circular apical area bearing about 15-20 slender attenuate setae, 1 to several heavier shorter setae nearby. *Claspette*: Stem slender, shorter than clasper. Filament with simple acute retrorse process. *Clasper*: Expanded in basal 0.65. Spiniform long. *Phallosome*: Aedeagus small, sim-

ple; parallel-sided in basal 0.6. *Proctiger*: Moderately developed. Basolateral sclerotization strongly developed, produced into spiculate tergal lobe ventrad of lobe of tergite IX. Apex of paraproct with 1 simple spine. Cercal setae about 5 or 6, mostly in distal half.

PUPA (fig. 68). Chaetotaxy as figured, not studied in detail. *Cephalothorax*: Moderately to darkly pigmented, lighter ventrally. Hair 1-C usually double; 3-C usually triple; 8-C at least triple. *Trumpet*: Uniformly darkly pigmented, contrasting; short; pinna large. *Metanotum and Abdomen*: Lightly to moderately pigmented; darker anteriorly. Hair 10-C multiple, long; 11-C single, double or with strong barbs. Hair 1-II large, with dendritic branching, 1-III usually with 6-8 barbed branches, 1-IV-VII single or double; 5-IV-VI usually double, sometimes triple; 6-III-VI usually single; 9-VII usually with at least 5 barbed branches. *Paddle*: Uniformly lightly pigmented except for darkened midrib and external buttress. *Terminal Segments*: Female genital lobe with long projecting cercus.

LARVA (fig. 69). Chaetotaxy and general morphology essentially as in *hemisurus*, not studied in detail; diagnostic characters as in the key. Head capsule unevenly darkly pigmented, darkened on collar. Antenna light in basal part, darkened distad; spicules very small and sparse. Lateral abdominal hairs 6-I,II usually double, rarely triple, 6-III-V usually triple, 6-VI usually single. Comb scales in a patch of 3 irregular rows; scales small, with fringe of long spicules, without differentiated spine. Siphon short; darkly to moderately pigmented, with darker narrow basal and apical rings; pecten with about 11-17 short evenly-spaced teeth with differentiated spine and several denticles in basal half; hair 1-S distad of and in line with pecten. Anal saddle lightly to moderately pigmented, darkened at base dorsally; with short spicules dorsolaterally toward caudal margin. Ventral brush usually with 8 pairs of hairs. Gills shorter than saddle.

SYSTEMATICS. The Jamaican and other Antillean populations, as noted by Howard, Dyar and Knab (1917:672-675) who considered them to be at least subspecifically distinct, are consistently darker in adult ornamentation than the topotypic populations from Mexico. This is particularly striking in the dark erect scales of the head and in the reduction of the white rings on the hindtarsus, the fifth segment having only a short basal white ring. We can find no significant differences in the male genitalia, or in the immature stages which all show considerable variation as in all other populations we have seen.

The Antillean populations could be separated, if desired, as the subspecies *portoricensis* (Ludlow, 1905); the earlier name, *niger* (Giles, 1904), having been rejected as a junior secondary homonym by Dyar (1922a:88). However, a thorough study of the *taeniorhynchus* complex should be undertaken first to evaluate the taxonomic status of the various populations from the entire range which covers the coasts and inland saline areas from California to northern Peru (and outlying islands) and from Massachusetts to southern Brazil. There is at least 1 distinct species breeding in bromeliads in the Galapagos Islands that is undoubtedly derived from *taeniorhynchus* and a form as distinct as the Antillean in the Revillagigedo Islands off the coast of Baja California. The mainland populations show considerable variation, with occasional specimens at least showing reduction or almost complete loss of white markings on the proboscis, palpus and tarsi.

BIONOMICS. In Jamaica as elsewhere the natural breeding sites of *taeniorhynchus* are transient pools in mangroves and salt marshes. These breeding sites are influenced by tides and rainfall. The water in these breeding sites is usually at least slightly brackish. In our collections in these areas *taeniorhynchus* was frequently

found alone but was also commonly associated with *Deinocerites cancer* in large shallow crabholes and with *Psorophora (G.) pygmaea* in isolated ground pools. *Aedes taeniorhynchus* also does well in fresh water in temporary ground pools and in irrigation and stream overflows in the coastal lowlands. We found it once in a coral limestone rockhole in the foothills (238) in association with *calumnior* and *mediovittatus*.

Aedes taeniorhynchus is the most serious pest mosquito of the island (Page, 1967). Females will bite at any time of day in the shade in the mangroves and wooded areas near the breeding sites and at times of high population densities even out in the open. In late afternoon and particularly at and following dusk they actively search for blood and will attack in droves out of doors and will also invade houses. This species enters donkey-baited stable traps but the catches are smaller than those made on exposed human bait. *Aedes taeniorhynchus* is also attracted to light traps.

Cache Valley Virus has been isolated 3 times from *taeniorhynchus* in Jamaica, from a collection in St. Thomas parish in March 1963, and from collections in September and October 1965 in Caymanas, St. Catherine. Unidentified arboviruses were also isolated from *taeniorhynchus* collected in Milk River, Clarendon in September 1962 and May-July 1963 (L.S. Grant, personal communication).

DISTRIBUTION. Primarily coasts but some interior areas from California to Peru (including Revillagigedo and Galapagos Islands) and from Massachusetts to Brazil.

JAMAICA. Widespread; probably throughout the lowland coastal areas of the island. Records given here are only for the material examined by us. *Clarendon*: Goshen (238). Fort Simonds, Dec 1945, G.A. Thompson, 4 M, 2 F [USNM]. *Kingston and St. Andrew*: Beverly Hills, Oct 1959, R.P. Bengry, 6 F [JAM]. Ferry and vicinity (222,237A,348,349,369,371,384-386,391A,398,610,796,860,861,896); 13 May 1941, Chapin, 1 F [USNM]; 7-31 Oct 1946, G.A. Thompson, 1 M, 1 F [JAM]. Gunboat Beach (912). Hermitage Dam Rd (108). Kingston and vicinity, M. Grabham, 1 F [USNM]. Liguanea, 3 June 1931, Kisiuk, 1 F [USNM]. Red Hills (842). *Manchester*: Richmond Hill, 16 Jan 1940, W.H. Komp, 5 F [USNM]. *St. Ann*: Runaway Bay, Feb 1969, W.W. Wirth, 1 F [USNM]. *St. Catherine*: Port Henderson (313). *St. Elizabeth*: Black River (794). Luana (357,358). *St. Thomas*: Chiswick (92). Grants Pen (649,802,875,876). Holland Bay (95,96,98,99,114,115,142,159). Morant Point (100,179). White Bay (79,119,120,139,144,177). *Westmoreland*: Cave (616). Crab Pond Bay (359). Grange Hill (137). *Parish not Specified*: No data, 2 F; Apr 1945, G.A. Thompson, 1 M [USNM]; R.B. Hill, 3 M [JAM].

Material Examined: 511 specimens; 62 males, 189 females, 142 larvae, 118 pupae; 83 individual rearings (26 larval, 48 pupal; 9 incomplete).

40. *Aedes (O.) sollicitans* (Walker)

Figs. 69,70

1856. *Culex sollicitans* Walker, 1856:427. TYPE: Lectotype female, vicinity of Charleston, South Carolina, U.S.A. (type locality restricted by Belkin, Schick and Heinemann, 1966: 3) [BM; designation of Belkin, 1968b:7].

Aedes (Ochlerotatus) sollicitans of Edwards (1932:137); King, Bradley and McNeel (1944:46-47); Matheson (1944:137-139); Carpenter, Middlekauff and Chamberlain (1946:199-203); Lane (1953:673-676); Carpenter and LaCasse (1955:227-229); Horsfall (1955:445-448); Perez Viguera (1956:258-267); Stone, Knight and Starcke (1959:154); Forattini (1965a:313-318); Montchadsky and Garcia (1966:41); Porter (1967:38); Page (1967).

Aedes (Taeniorhynchus) sollicitans of Dyar (1922a:90; 1928:216-217).

Aedes sollicitans of Howard, Dyar and Knab (1917:658-665); Johnson (1919:423); Gowdey (1926:74); Hill and Hill (1945a:2; 1948:44-45); Thompson (1947:78).

Ochlerotatus sollicitans of Coquillett (1906b:19).

Grabhamia sollicitans of Theobald (1903a:247-248; 1905a:32-33; 1905b:23; 1907:291-294).

Culex sollicitans of Theobald (1901a:368-370); Felt (1904:294-297).

FEMALE. Wing about 4.0 mm. A medium-sized brown species with banded proboscis, speckled wings and conspicuously ringed tarsi. Differing from *taeniorhynchus* in following conspicuous features. *Head:* Decumbent and erect scales predominantly pale. Pale ring of proboscis postmedian, larger. Palpus distinctly longer, with only a few apical pale scales. Scales of antennal torus more numerous, predominantly pale. *Thorax:* Mesonotal vestiture generally paler, largely golden in posterior part and along broad dorsocentral line, reddish coppery between dorsocentral lines, reddish coppery to bronzy laterad of dorsocentral line. Mesonotal bristles shorter, dark in anterior part, golden in posterior. Paratergite with white scales on underside. Scutellar lobes with golden scales. Pleuron with very strong contrast between upper dark part as on side of mesonotum and the extensive pure white scaling which forms a broad diagonal lower streak from *ppl* to upper middle *mep* and includes *pst*, *acx*, *ppl*, *pcx*, lower *apn*, lower *ppn*, *ssp*, hypostigial area, *psp*, upper *stp*, all of *pra* and upper *mep*; upper *mep* with reddish bronzy and coppery scales on a very dark background; lower posterior *stp* with small patch of broad pure white scales similar to those in upper streak. *Legs:* Anterior surface of all femora predominantly dark with extensive whitish speckling. Knee spots large, whitish. Tibiae extensively speckled with whitish scales. Foretarsus and midtarsus with distinct basal white rings on segments 1-3, segment 1 with speckling of pale scales sometimes forming a median band, segment 5 of midtarsus largely pale; hindtarsus with broad basal white rings on segments 1-4, segment 5 entirely white except for a few dingy apical scales ventrally, segment 1 with extensive pale scaling in middle forming a more or less distinct broad pale band or ring; basal white rings including a few white scales on apex of preceding segment on all legs. *Wing:* Dorsal veins extensively speckled or streaked with pale scales. *Abdomen:* Tergite I with pale scales in middle; tergites II-VII with median longitudinal pale streak in addition to narrow basal transverse pale bands; lateral white patches smaller. Sternites all predominantly pale scaled, some dark scales on distal segments.

MALE. Essentially similar to female in ornamentation. Proboscis with very broadly pale ventral surface forming a more or less distinct pale ring dorsally. Palpus exceeding proboscis by about 0.5 of segment 5, latter drooping; white scaling usually restricted to very small dorsal basal patches on segments 3-5; very dense vestiture of long largely golden hairs from middle of segment 3 distad.

MALE GENITALIA (fig. 70). In general similar to *taeniorhynchus*, differing primarily in following conspicuous features. Sidepiece broader; basal tergomesal lobe less prominent but extending farther sternad, with larger area of more numerous long thin bristles followed sternad by shorter setae. Claspette with shorter stem; filament sickle shaped, without retrorse process. Clasper without distinct mesal expansion; spiniform shorter.

PUPA (fig. 70). Chaetotaxy as figured, not studied in detail. In general similar to *taeniorhynchus*, differing in following conspicuous features. Cephalothoracic hairs 4-7-C with more branches. Trumpet narrower, with smaller pinna. Metanotum and anterior abdominal segments unevenly pigmented; most hairs with pigment rings

around aveoli. Hair 1-II smaller and with fewer branches, 1-III with more branches; 5-III shorter and with more branches; 6-II-VI usually at least double.

LARVA (fig. 69). Chaetotaxy and general morphology essentially as in *hemisurus* and especially *taeniorhynchus*, not studied in detail; differing from *taeniorhynchus* in the following conspicuous features. Head capsule with more conspicuous ocular bulge. Antenna darkened from near base; spicules stronger and more numerous. Lateral abdominal hairs 6-III-V usually double. Comb scales with distinct differentiated median apical spinule. Siphon distinctly more slender and lighter in color; pecten usually more extensive, usually with more than 17 teeth, occasionally 1 or 2 apical teeth slightly detached. Anal saddle without distinct spicules dorsolaterally near caudal margin. Gills somewhat longer but not exceeding dorsal saddle length.

SYSTEMATICS. The Jamaican population of *sollicitans* shows no striking differences from the topotypic mainland population in North America or the other populations in the West Indies. This species is easily recognized in all stages by the features mentioned in the brief diagnosis above.

BIONOMICS. We have only 3 collections of immature stages of *sollicitans* from Jamaica, 2 from brackish water by the sea, in footprints in a salt marsh (7), and a coral rockhole (153), both without associated species, and 1 from fresh water in a flooded margin of a stream a considerable distance from the sea (896) in association with *Aedes* (*O.*) *taeniorhynchus*, *Aedes* (*O.*) *hemisurus*, *Aedes* (*O.*) *tortilis*, *Culex* (*C.*) *nigripalpus* and *Anopheles* (*N.*) *albimanus*.

Females of *sollicitans* bite man freely during the day as well as at night and at times are a great nuisance. They can fly 8 to 10 miles from the breeding sites but this does not seem to have led to widespread breeding over the island. Although the species probably occurs in all coastal areas, particularly in mangrove areas, it is not very common and the breeding appears to be sporadic and localized.

DISTRIBUTION. Eastern North America, primarily coasts but also inland areas with brackish water, from New Brunswick to Texas (type locality, Charleston, South Carolina); Mexico, Cuba, Cayman Islands, Jamaica, Bahamas, Puerto Rico.

JAMAICA. Probably occurs in all coastal areas; in addition to our records below, *sollicitans* has been reported by the MOH staff in *Clarendon*, *St. Elizabeth* and *Westmoreland* parishes. *Kingston and St. Andrew*: Ferry and vicinity (237A,896); 12 May 1941, Chapin, 1 M, 3 F [USNM]; 7 Oct 1946, G.A. Thompson, 1 F [JAM]. *Kingston and vicinity*, 8 Sept 1917, H. Morrison, 1 F [USNM]. *Riverton City* (840). *St. Catherine*: Port Henderson (7). *St. Thomas*: Morant Point (153). *White Bay* (405).

Material Examined: 121 specimens; 20 males, 26 females, 47 larvae, 28 pupae; 27 individual rearings (15 larval, 11 pupal, 1 incomplete).

41. *Aedes* (*O.*) *pertinax* Grabham

Figs. 71,72

1906. *Aedes pertinax* Grabham, 1906b:316-318. TYPE: Lectotype male with genitalia slide (206), Kingston, Jamaica, 10 Apr 1906, M. Grabham [USNM; designation of Stone and Knight, 1956a:223].
1907. *Protoculex quasiserratus* Theobald, 1907:465-466. TYPE: Lectotype female, Kingston, Jamaica, M. Grabham [BM; designation of Belkin, 1968b:7]. Synonymy with *pertinax* by Howard, Dyar and Knab (1917:791).

Aedes pertinax of Howard, Dyar and Knab (1917:791-794); Johnson (1919:423).

- Aedes (Ochlerotatus) nubilus* in part of Dyar (1922c:161-162; 1928:157); Edwards (1932:142).
Aedes nubilus of Howard, Dyar and Knab (1917:721-723, in part); Hill and Hill (1945a:2; 1948:44); Thompson (1947:78).
Aedes (Ochlerotatus) serratus of Komp (1949:105-114, in part); Lane (1953:658-600, in part); Perez Viguera (1956:302-304); Stone, Knight and Starcke (1959:153, in part); Montchadsky and Garcia (1966:41); Porter (1967:38); Page (1967).

FEMALE. Wing about 4.0 mm. A medium-sized brown species with dark tarsi and unbanded abdomen; mesonotal scaling usually all dark, rarely with a narrow pale scaled acrostichal line. *Head*: Narrow decumbent scales in a broad median patch extended on interocular space and narrow orbital line, whitish or with slight yellowish cast; broad decumbent scales dark in large patch dorsally, pale laterally. Proboscis entirely dark. Palpus 3-segmented; entirely dark. Antennal torus with short dark hairs on mesal surface. *Thorax*: Mesonotal scales narrow, predominantly or entirely dark bronzy; sometimes a narrow acrostichal line of whitish scales, line broadened posteriorly and extending on anterior part of prescutellar space; anterior promontory and lateral prescutellar area sometimes with pale to whitish scales. Paratergite bare. Mesonotal bristles poorly developed; acrostichals and anterior dorsocentrals not developed except on anterior promontory and humeral angle; fossals absent. Lateral scutellar lobe with dark bronzy scales, median with dark bronzy or pale to whitish scales. Pleural scaling restricted; *apn* apparently without scales; *ppn* with dark bronzy narrow scales in uppermost part followed ventrad by large patch of small moderately broad dark bronzy scales and similar white scales at lower posterior corner of patch; remaining scales broad and white, restricted to *ppl*, upper posterior and lower posterior *stp*, base of *pra* bristles and upper anterior *mep*. *Legs*: All coxae with whitish scales, forecoxa with dark scales in distal part of patch. Trochanters and base of femora pale scaled. Femora dark except for usual pale surfaces and whitish lower part of anterior surface of hindfemur to near apex; dorsal dark line of hindfemur extending to near base. Tibiae and tarsi dark. All claws with heavy subbasal tooth. *Wing*: Dorsal scales all dark except occasionally with a few pale scales at extreme base of costa not forming a line. *Haltere*: Largely pale. *Abdomen*: Tergite I with large patch of dark scales in middle; laterotergite without scales. Tergites II-VII dark scaled except for large basolateral whitish patches. Sternites II-VII predominantly pale scaled, with apical bands and apicolateral patches of dark scales.

MALE. Essentially similar to female in ornamentation; head scaling predominantly pale except for erect scales. Palpus exceeding proboscis by about full length of segment 5; segments 4 and 5 slightly drooping; numerous moderately long dark bristles on apex of segment 3 and all of segment 4, segment 5 with shorter bristles. Antennal flagellum densely long plumose. Mesonotum usually with pale scales around prescutellar space; acrostichal light-scaled line apparently more frequently developed than in female.

MALE GENITALIA (fig. 71). In general as in other species of *Ochlerotatus* but with the characteristic detached basal tergomesal lobe as in other members of the Serratus Group. *Segment IX*: Tergite lobe small, prominent, with 5-10 setae, some distinctly flattened. *Sidepiece*: Elongate; scales numerous laterally and ventrally, occasionally a few scales dorsally. A conspicuous thumblike apical tergomesal lobe with short thin setae. Sternomesal margin basad of apical lobe with 2 irregular rows of bristles subequal in length to apicosternal bristles distad of apical lobe. Basal tergomesal lobe detached (separated by membrane) from tergomesal margin of sidepiece and joined to base of claspette, thus appearing as a dorsal lobe of

claspette; complex in structure, tergally with small lobe bearing a long specialized seta and 1 or 2 short simple setae, sternally with a long slender lobe bearing about 12 setae of varied lengths. *Claspette*: Stem slender and long but shorter than clasper; filament broad at base, more or less sickle shaped, without retrorse process. *Clasper*: Long and slender, with only slight mesal expansion; spiniform slender. *Phallosome*: Aedeagus moderately tapered distad. *Proctiger*: Essentially as in *taylorhynchus*.

PUPA (fig. 71). Chaetotaxy as figured, not studied in detail, apparently variable; distinguished from other local species of *Ochlerotatus* by denticles on caudolateral angle of abdominal segments III-V, characteristic of Serratus Group. *Cephalothorax*: Lightly to moderately pigmented with darker mesonotum and wing and leg cases. All hairs branched, 4,5,7,8-C usually with at least 4 branches. *Trumpet*: Moderately unevenly to uniformly darkly pigmented, contrasting. Pinna very small. *Metanotum and Abdomen*: Lightly to moderately pigmented, anterior segments darkened. Lateral areas of abdominal segments III-V and to lesser extent II with tubercular spicules grading into conspicuous denticles on lateral and caudal margins near caudolateral angles on III-V. Hair 9-VII very weak, usually with 2-4 simple branches; 6-VII dendritic; possibly homology of 6,9-VII reversed. Hair 6-III-VI usually double. *Paddle*: Lightly pigmented, with slightly darker midrib and external buttress.

LARVA (fig. 72). Chaetotaxy as figured, not studied in detail. Readily separated from other local species of *Ochlerotatus* by the single row of spinelike comb scales characteristic of Serratus Group. General morphology and chaetotaxy as in *tortilis* except as noted. *Head*: Unevenly darkly to moderately pigmented; anterior ocular area with small denticles. Hair 4-C unusually long. *Antenna*: Uniformly lightly pigmented; spicules small but distinct. *Thorax*: Bases of hairs 5,6-P connected by narrow curved anterior sclerotized plate. *Abdomen*: Hair 6-I,II usually double, 6-III-VI single; 1-IV,V single or double. *Segment VIII*: Comb scales in single row of 8-12, scale in form of large spine fringed at base. *Siphon*: Short, darkly pigmented, with black basal ring and lighter distal part. Pecten usually with at least 12 evenly spaced teeth, majority with long spine and several basal denticles. Hair 1-S ventrad of pecten and usually proximad of base of last tooth. *Anal Segment*: Saddle moderately pigmented except for blackish basal ring. Ventral brush usually with 8 pairs of hairs on strongly developed grid and 2 precratal hairs on saddle margin or piercing saddle. Gills markedly uneven and very long.

SYSTEMATICS. We are restoring *pertinax* to full specific status for the West Indian populations currently placed under *serratus* (Theobald, 1901) following the synonymy of *nubilus* (Theobald, 1903) with *serratus* by Komp (1949:105-114) and of *pertinax* with *nubilus* by Dyar (1922c:151; 1925c:145). Neither synonymy is justified in our opinion. It appears that there are at least 3 distinct species in the *serratus* complex: *serratus* (with the probable synonym *mathisi* Neveu-Lemaire, 1902 and possibly also *meridionalis* Dyar & Knab, 1906); *nubilus* (with the probable synonym *polyagrus* Dyar, 1918); and *pertinax* (with the synonym *quasiserratus*).

The past confusion of *serratus*, *nubilus* and *pertinax* is primarily due to the belief that the differences in mesonotal ornamentation are individual variations. This does not appear to be the case. In all true *serratus* we have seen there is a broad whitish longitudinal line in both sexes. In *nubilus*, which occurs sympatrically with *serratus*, all the males have a broad whitish line but the female mesonotum may be completely dark or with whitish scales in a varied line which is broadened an-

teriorly. The male genitalia of *nubilus* are markedly different from those of *serratus* and *pertinax* in a much larger sternal division of the basal tergomesal lobe and in lacking long bristles on the sternomesal margin.

Aedes pertinax combines the features of *nubilus* in ornamentation and *serratus* in the male genitalia. As indicated in the diagnosis above, females tend to have the mesonotum completely dark or occasionally with a narrow acrostichal light line which broadens caudad; males apparently always have some white mesonotal scaling but not as extensive as in *nubilus*. The male genitalia of *pertinax* are very similar to *serratus* but the latter has the sternomesal setae much longer, conspicuously longer than those in the sternoapical patch.

Aedes pertinax appears to be an uncommon relict species with considerable individual variation and anomalies in all stages. From a single larval collection we have reared females with or without the light mesonotal line. On the basis of general similarity of the immature stages and the presence of considerable chaetotaxic variation in the same individual there is no indication that the 2 color forms are distinct species.

Although we have not seen any material of *pertinax* outside of Jamaica, we believe that specimens from Cuba, the Dominican Republic and the Bahamas assigned to this species by Howard, Dyar and Knab (1917:794) are probably conspecific with *pertinax* as are the dark specimens from the Dominican Republic listed by these authors (1917:723) under *nubilus*.

We have not been able to determine the status of the populations of the *serratus* complex from Central America and Mexico as we have seen nothing but females from this area except for 1 male from Mexico which differs in the basal tergomesal lobe from *pertinax*. It is possible that *meridionalis* is a form distinct from *serratus* as we find considerable variation in the mesonotal markings of the females in this area, some approaching the condition in *pertinax*.

Related to *serratus*, *nubilus* and *pertinax* are 4 Neotropical species (*aenigmaticus* Cerqueira & Costa, 1946; *eucephalaeus* Dyar, 1918; *hastatus* Dyar, 1922; and *oligopistus* Dyar, 1918) and 3 Nearctic species (*atlanticus* Dyar & Knab, 1906; *dupreei* (Coquillett, 1904); and *tormentor* Dyar & Knab, 1906). These species also belong to the *Serratus* Group which appears to be sharply differentiated from the other New World *Ochlerotatus* in male genitalia and larva and usually in adult ornamentation. The generic group name *Protoculex* Felt, 1904 (type species, *serratus*) is available for this group.

BIONOMICS. The only collection of immature stages of *pertinax* was made in a coral rockhole with brackish water, in association with *Aedes (O.) taeniorhynchus*, *Aedes (O.) tortilis* and *Psorophora (G.) pygmaea*. Females were taken biting man a considerable distance from the sea. This species appears to be very uncommon.

DISTRIBUTION. Jamaica (type locality); probably also Cuba, Hispaniola, Puerto Rico and the Bahamas.

JAMAICA. *Clarendon*: Locality not specified, G.A. Thompson (Hill and Hill, 1948:44, as *nubilus*). *Kingston and St. Andrew*: Kingston and vicinity, Apr 1906, M. Grabham, 2 M, 2 F, 13 L [USNM], 4 L [UCLA]. *St. Elizabeth*: Maggotty (792,792A). *St. Thomas*: Holland Bay (159).

Material Examined: 67 specimens; 6 males, 26 females, 28 larvae, 7 pupae; 8 individual rearings (7 larval, 1 incomplete).

42. *Aedes* (O.) *hemisurus* Dyar & Knab

Figs. 73,74

1906. *Aedes hemisurus* Dyar and Knab, 1906c:199. TYPE: Larva, Kingston, Jamaica; based on figure in Grabham (1905:405) [NE; see Stone and Knight, 1956a:218].
1907. *Aedes indolecens* Dyar and Knab, 1907:11-12. TYPE: Holotype female, Cayamas, Cuba, May, E.A. Schwarz [USNM, 10249; see Stone and Knight, 1956a:219]. Synonymy with *hemisurus* and *scapularis* apparently by Howard, Dyar and Knab (1917:787).

Aedes (*Ochlerotatus*) *scapularis* of Dyar (1922b:57-59; 1928:167-168, in part); Edwards (1932:142, in part); Lane (1953:665-667, in part); Perez Vigueras (1956:286-295); Stone, Knight and Starcke (1959:153, in part); Montchadsky and Garcia (1966:41); Porter (1967:37); Page (1967).

Aedes scapularis of Howard, Dyar and Knab (1917:783-787, in part); Johnson (1919:423); Gowdey (1926:74); Hill and Hill (1945a:2; 1948:44); Thompson (1947:78).

Aedes tortilis of Belle, Grant and Page (1964:453).

Ochlerotatus confirmatus of Coquillett (1906b:19, in part).

Culex confirmatus of Theobald (1905a:25; 1905b:26); Grabham (1905:404-405).

FEMALE. Wing about 3.0-3.5 mm. Medium-sized to small dark brown species with the anterior 0.6 of mesonotum largely silvery scaled; all tibiae largely pale on one surface. *Head*: Narrow decumbent scales all pale, white or whitish, in a broad median patch extended on interocular space and narrow orbital line; broad decumbent scales laterally and ventrally, all usually pale, creamy to light tan. Erect scales numerous, extending over most of vertex as well as occiput, all light except posterolaterally. Labium dark, indistinctly paler ventrally. Palpus with minute globular segment 4. Antennal torus with short hairs and sometimes a few small narrow scales on mesal surface. *Thorax*: Mesonotum with large rounded hexagonal patch of silvery scales from anterior promontory and humeral angle to about level of posterior end of paratergite; lateral margin of patch nearly straight from humeral angle to near scutal angle, lateral triangular area in front of scutal angle with dark bronzy to golden scales, varied in extent but not encroaching mesad on silvered area; posterolateral margin nearly straight, more or less following scutal suture to about level of first or second posterior dorsocentral bristle; posterior transverse margin jaggedly truncate. Posterior part of mesonotum predominantly with dark to light bronzy scales; usually lighter coppery to golden scales around prescutellar space. Paratergite bare. Mesonotal bristles poorly developed; acrostichals and anterior dorsocentrals not developed except on anterior promontory and humeral angle; fossals absent. Scutellar lobes with light bronzy to golden scales. *Apn* usually with only a few moderately broad, dark to pale scales in addition to hairs. *Ppn* with narrow bronzy to coppery scales along mesonotal border, followed ventrad by broader flatter dark bronzy scales and broad white scales in lower posterior part of patch. Remainder of pleural scaling broad and white, on *ppl*, narrow streak on *ssp*, 3 narrowly connected patches on *pra*, upper *stp* and lower *stp*, and on upper *mep*, occasionally 1 or more scales on *psp*. *Legs*: Forefemur predominantly pale except for distal part of anterior (upper) surface and lower anterior dark streak; anterior surface of midfemur predominantly dark except for pale base and white lower streak to near apex; anterior surface of hindfemur white to near apex. Knee spots not developed. Tibiae predominantly dark; foretibia with continuous pale streak on ventral surface; midtibia with continuous pale streak on dorsoposterior surface; hindtibia pale in middle 0.6 or more, chiefly on ventroanterior sur-

face, dark throughout on dorsal surface. Two basal segments of all tarsi pale ventrally, most conspicuously on hindleg; remainder of tarsi dark, with ventral surface somewhat lighter on hindleg. All claws with prominent subbasal tooth. *Wing*: Dorsal scales all dark except for small patch of pale scales at extreme base of costa and remigium, producing a conspicuously pale base to wing. *Haltere*: Largely pale. *Abdomen*: Tergite I with large patch of dark scales in middle; laterotergite without scales. Tergites II-VII with large basolateral white patches and basomedian patches of indistinctly pale scales more obvious posteriorly and sometimes forming a longitudinal line. Sternites II-VII pale scaled except for small apicolateral patches of dark scales on distal segments. Cercus narrow, long, projecting.

MALE. Essentially similar to female in ornamentation. Palpus exceeding proboscis by about 0.5 of segment 5; apex of segment 3 and all of segment 4 with long dark bristles, segment 5 with shorter bristles. Antennal flagellum densely long plumose. Claws of foreleg and midleg enlarged, uneven; larger claws with long sharp basal external tooth and blunt submedian tooth; smaller claws with subbasal tooth only; hindclaws as in female.

MALE GENITALIA (fig. 73). In general as in other local species of *Ochlerotatus* and particularly the *tortilis* complex, *condolescens* and *obturbator*. Integument densely spiculate on segment IX, sidepiece and base and stem of claspette. *Segment IX*: Tergite deeply emarginate in middle of anterior margin, with only a narrow sclerotized caudal bridge connecting the small prominent submedian tergal lobes; each lobe usually with 3-6 setae, some distinctly flattened. *Sidepiece*: Elongate, more or less cylindrical but curved inward. Mesal membrane developed to apex. Scales usually restricted to lateral surface, some occasionally developed on dorsal surface. Tergal surface with sparse vestiture of short to moderately long setae, 2 or 3 thickened and longer near level of base of apical lobe. Sternomesal margin with 2 or 3 irregular rows of long bristles. Apical lobe (tergomesal) inconspicuous and short, frequently collapsed mesad in mounts; with a few short thin setae. Basal tergomesal lobe attached to sidepiece, its distal part projecting ventrad and appearing folded under in most preparations; with strongly differentiated basal tergal specialized seta and about 12 simple setae of varied sizes in distal part. *Claspette*: Stem slender and elongate but shorter than clasper; filament narrow at base, expanded near middle, with an obtuse outer angle without any indication of retrorse process or spicules. *Clasper*: Long and slender, with slight mesal expansion in basal half; shaft with conspicuous spicules, primarily on inner surface, to near the subapical seta; spiniform long and slender. *Phallosome*: Aedeagus small, simple; short pyriform, at most slightly narrowed subapically; completely sclerotized dorsally, with slight apical emargination. *Proctiger*: Moderately developed. Basolateral sclerotization strongly developed, produced into lateral tergal lobe ventrad of lobe of tergite IX. Paraproct sclerotization strong, broadly joined to basolateral sclerotization; apex of paraproct with 1 simple free spine and a short strong mesal sclerotized process. Cercal setae usually 3-5, in distal half.

PUPA (fig. 73). Chaetotaxy as figured, not studied in detail, apparently variable. Essentially as in other local species of *Ochlerotatus*. *Cephalothorax*: Moderately pigmented with darkened mesonotum and leg and wing cases. Hairs 1-3-C double; 4-C with several distal forks; 5-C usually distally forked; 6-C usually at least triple; 7-C with 2 or more distal forks; 8-C at least triple; 7-C with at least 2 forks. *Trumpet*: Elongate; strongly reticulate; pinna small. Uniformly darkly pigmented, contrasting. *Metanotum and Abdomen*: Moderately, rather uniformly pigmented, anterior part darker. Hair 10-C usually with 5 branches; 11-C double; 12-C usually

with 2-4 distal forks. Hair 2-I mesad of hair 3; hair 3-II usually with 2 forks. Hair 1-II dendritic; 1-III varied in position, sometimes laterad of hair 3, weak, usually double to 4-branched; 1-IV-VII strong, usually double, varied in length. Hair 2-IV,V distinctly mesad of hair 1. Hair 3-II,III usually branched. Hair 5-II branched; 5-III usually with 4 or more branches. Hairs 6-III-VI usually all single. Hair 9-VII double or triple, often with strong barbs or distal forks. *Paddle*: Lightly pigmented, with darker midrib; external buttress indistinct. Marginal spicules poorly developed. Only paddle hair 1-P developed, single, strong. *Terminal Segments*: Female cercus strongly sclerotized externally, projecting well beyond genital lobe.

LARVA (fig. 74). Chaetotaxy as figured, not studied in detail; in general as in other local species of *Ochlerotatus*, diagnostic characters as in the key. Thoracic and abdominal integument with distinct spicules. *Head*: Distinctly wider than long; darkly pigmented except for usual light areas. Labrum narrow from dorsal aspect, distinctly produced laterally in front at base of hair 1-C; ocular bulge conspicuous, with distinct short sharp spicules near anterior part; maxillary suture complete, diverging; labial plate short; collar strongly developed. Hairs 5,6-C far forward, both strong and usually single; 4-C near level of hair 6, short and usually triple; 8-C usually long and single; 13-C long and single, near level of 12-C; hair 14-C short, spiniform, removed caudad of anterior border; 15-C near middle of labial plate; 11,12,15-C all short and multiple. *Antenna*: Short, uniform in width; shaft with sparse short sharp spicules; uniformly moderately pigmented; hair 1-A near middle, usually with 3 or more branches. *Thorax*: Integument with dense vestiture of long sharp spinelike (not hairlike) spicules. Only pleural groups (9-12-P, M,T) and hairs 6,7-M with common basal plates. Hairs 1-6,8-10,12,14-P usually all single; 7-P usually triple; 13-P not developed. *Abdomen*: Integument as on thorax, spicules more hairlike on distal segments. Hair 12-I present. Lateral abdominal hair 6-I,II usually double, 6-III-VI usually single; 7-I long and single, 7-II-VI branched, moderate to short; 1,13-IV,V long and single. *Segment VIII*: Comb scales usually about 20-25 in triangular patch of 3 irregular rows; scales short, with even fringe of strong spicules. *Siphon*: Index about 2.5 or slightly more; slightly tapered in distal half; uniformly moderately pigmented except for blackish basal ring and slight apical darkening; integument with distinct imbricate sculpturing; strong attached acus present. Pecten teeth usually 12-15, evenly spaced in slightly more than basal half, distal 1 or 2 sometimes slightly more widely spaced; teeth with strongly differentiated slender main spine and 1 to several subbasal denticles. Hair 1-S distad of and more or less in line with pecten; 2-S subapical, distinctly shorter than distal pecten teeth. *Anal Segment*: Saddle complete, with distinct attached slender acus; uniformly lightly pigmented except for basal darkening, chiefly dorsad of acus; integument distinctly imbricate; without distinct caudal marginal spicules. Hair 1-X single, long. Dorsal brush with hair 2-X multiple, less than half as long as single 3-X. Ventral brush with 8 pairs of hairs on a strongly developed grid with lateral bar attached to saddle; no precratal hairs. Gills subequal, pointed, distinctly longer than dorsal saddle length.

SYSTEMATICS. We are restoring *hemisurus* to full specific rank for the West Indian populations currently placed under *scapularis* (Rondani, 1848). In our opinion, the synonymy of *hemisurus* and *indolescens* with *scapularis* by Howard, Dyar and Knab (1917:787) is unjustified as there appear to be at least 4 and possibly more distinct nonclinal forms involved. As in the case of *pertinax* of the *serratus* complex, the past confusion is primarily due to the belief that the differences noted in the mesonotal ornamentation are individual variations rather than char-

acteristic of populations.

The mesonotal pattern of *hemisurus* is very similar to that of *scapularis* from Brazil, but in the male genitalia the filament of the claspette differs markedly in lacking any indication of a retrorse process or spicules and the distal part of the basal tergomesal lobe bears fewer setae. True *scapularis* apparently extends northward through the Guianas to Trinidad where it seems to be sympatric with a number of forms, 1 of which appears to be the only representative of the *scapularis* complex in northcentral Venezuela. These forms resemble *camposanus* Dyar, 1918 (undoubtedly a member of the *scapularis* complex) from coastal Ecuador and northern Peru, in the reduction of the anterior part of the silvery patch of the mesonotum by the extension of dark scales over the outer part of the fossa near the scutal suture. The Venezuelan representative of this complex is distinct in the reduction of the white scaling of the hindtibia and the populations from the Guianas and Trinidad differ in details of ornamentation so that it appears that in northern South America there may be 3 distinct forms of the *camposanus* type. The male genitalia of these forms show considerable regional differentiation; in *camposanus* the retrorse process of the claspette filament is usually completely undeveloped.

In the majority of specimens from Central American populations of the *scapularis* complex we have seen (Honduras, Guatemala, British Honduras and Mexico), the mesonotal silvery patch is extensive as in *hemisurus*. We have no males or immature stages from this area and therefore cannot determine with certainty whether some of these populations belong to *hemisurus*.

Easily confused with the *scapularis* complex are a number of species with a somewhat similar mesonotal silvery ornamentation. The sides of the silvery patch in these forms are straight instead of directed toward the scutal angle from the front and back and the hindtibia does not show the conspicuous pale scaling. Among these other members of the Scapularis Group are: the West Indian *condolenscens* Dyar & Knab, 1907 (records other than from the West Indies and possibly Central America are probably erroneous); the North American *infirmitus* Dyar & Knab, 1906; and a large number of Neotropical forms, mostly undescribed but including *euplocamus* Dyar & Knab, 1906 and *crinifer* (Theobald, 1903). Also part of the Scapularis Group is the West Indian *tortilis* complex.

BIONOMICS. Immature stages of *hemisurus* have been collected in a variety of temporary ground pools, small or large, sunlit or in partial shade but always with fresh water. The largest number were found in an overflow of a stream. The most common associated species was *Aedes (O.) tortilis* but other temporary pool breeders were frequently found with *hemisurus*.

Females of *hemisurus* bite man readily during the day, usually in the shade, rarely in the open but near wooded areas. Being a conspicuously marked species, *hemisurus* has been noticed and collected more than some of the other species of the subgenus *Ochlerotatus*. It was found by Page (1967:181) to bite man more frequently than any other mosquito except *taeniorhynchus*. An unidentified arbovirus was recovered from *hemisurus* (as *tortilis*) collected in September 1962 at Milk River, Clarendon (Belle, Grant and Page, 1964:453).

DISTRIBUTION. Jamaica (type locality), Cuba and Hispaniola; possibly also Puerto Rico.

JAMAICA. More widespread than our records indicate; reported in addition from *Manchester* (including Mandeville), *Portland*, *St. Elizabeth* and *St. James* parishes by Hill and Hill (1948:44, as *scapularis*). *Clarendon*: Goshen (353). Parnassus (863). Yorks Pen (604). *Kingston and St. Andrew*: Beverly Hills, Liguanea, 6 Dec 1953, R.P. Bengry, 1 F [JAM]. Ferry and vicinity (768, 796, 799, 890, 896). Kingston and vicinity, M. Grabham, 1 M, 2 F [USNM]. *St. Ann*: Delight

(757). *St. Catherine*: Bog Walk (913,914). Caymanas (404). Central Village (759). Rio Cobre Dam, M. Grabham, 2 M, 1 F [USNM]. Spanish Town (37). *St. Thomas*: Grants Pen (649). *Parish not Specified*: No data, 1 F [USNM]; R.B. Hill, 5 L [JAM].

Material Examined: 251 specimens; 56 males, 91 females, 61 larvae, 43 pupae; 37 individual rearings (19 larval, 16 pupal, 2 incomplete).

43. *Aedes* (O.) *tortilis* (Theobald)

Figs. 75,76

1903. *Culex tortilis* Theobald, 1903b:281-282. TYPE: Lectotype female, Kingston, Jamaica, 20 Aug 1903, M. Grabham [BM; designation of Belkin, 1968b:8].
1906. *Culex bracteatus* Coquillett, 1906a:184. TYPE: Holotype female, Havana, Cuba, 1 Nov 1902, J.R. Taylor [USNM, 7753; see Stone and Knight, 1956a:215]. Synonymy with *tortilis* by Dyar (1922b:55), as subspecies.
1906. *Aedes habanicus* Dyar and Knab, 1906c:198. TYPE: Lectotype fragments of a larval skin, Havana, Cuba, 28 Oct 1903, J.R. Taylor [USNM; designation of Stone and Knight, 1956a:218]. Synonymy with *bracteatus* apparently by Howard, Dyar and Knab (1917:802).
1907. *Aedes balteatus* Dyar and Knab, 1907:9-10. TYPE: Holotype female, Santo Domingo (Dominican Republic), Aug 1905, A. Busck [USNM, 10142; see Stone and Knight, 1956a:215]. Synonymy with *tortilis* by Dyar (1922b:55-56), as subspecies.
1907. *Aedes plutocraticus* Dyar and Knab, 1907:11. TYPE: Holotype female (10), Nassau, Bahama Islands, 21 June 1903, T.H. Coffin [USNM, 19251; see Stone and Knight, 1956a:224]. Synonymy with *tortilis* by Dyar (1922b:55), as subspecies.
1922. *Aedes tortilis virginensis* Dyar, 1922b:56. TYPE: Holotype female, St. Thomas, Virgin Islands, Aug 1905, A. Busck [USNM, 24898].

Aedes (*Ochlerotatus*) *tortilis* in part of Dyar (1928:169-170); Edwards (1932:143); Pritchard, Seabrook and Mulrennan (1947:11); Lane (1953:653-654); Carpenter and LaCasse (1955:245-247); Perez Viguera (1956:296-301); Stone, Knight and Starcke (1959:156); Forattini (1965a:369-371); Montchadsky and Garcia (1966:42); Porter (1967:38); Page (1967).

Aedes (*Ochlerotatus*) *tortilis tortilis* in part, *tortilis plutocraticus*, *tortilis bracteatus*, *tortilis balteatus* and *tortilis virginensis* all of Dyar (1922b:54-56).

Aedes tortilis in part of Howard, Dyar and Knab (1917:806-809); Johnson (1919:424); Gowdey (1926:74); Hill and Hill (1945a:2; 1948:45-46); Thompson (1947:78).

Aedes bracteatus, *plutocraticus* and *balteatus* of Howard, Dyar and Knab (1917:802-804; 804-805; 809-810).

Culex tortilis of Theobald (1905a:26; 1905b:26; 1907:428-429; 1910:387).

FEMALE. Wing about 2.5-3.0 mm. A rather small dark brown species with disc of mesonotum with coppery to dark golden scales, fossa with extensive area of dark bronzy scales. General morphology and chaetotaxy as in *hemisurus*; extremely similar to *auratus*, from which it cannot be separated with certainty. *Head*: Narrow decumbent scales in a narrow to moderately broad median line, extending on interocular space and orbital line, whitish to pale golden. Broad decumbent scales more numerous, narrower dorsally; predominantly pale except for indefinite dark patch laterally. Erect scales all yellowish except for a few dark ones posterolaterally, largely confined to occiput and posterior part of vertex. Labium entirely dark. Palpus dark, 3-segmented. *Thorax*: Mesonotum with dark golden to coppery scales covering anterior 0.6 or more except most of fossa and antealar area, usually projecting caudad along acrostichal line; similar pale scales in supraalar area, above

wing root in front of a patch of outstanding golden linear scales, and around prescutellar space; remaining areas with dark bronzy scales, denser in fossa and at end of posterior dorsocentral row of bristles. Mesonotal bristles better developed than in *hemisurus*; lateral prescutal bristles strong, occasionally outer fossal bristle developed. Scutellar lobes with golden to coppery scales. *Apn* usually with some moderately broad pale scales. *Ppn* scaling varied; usually narrow only, golden to bronzy along mesonotal border followed ventrad by bronzy scales with some pale scales; sometimes broadened in lower posterior part of patch. Remaining pleural scales broad, dingy white; on *ppl*, usually streak on lower *ssp*, below *pra* bristles, more or less continuous patch on upper and lower posterior *stp*, and upper *mep*. *Legs*: Coxae predominantly with pale scales, forecoxa with some dark scales. Trochanters and base of femora with pale scales. Femora with usual pale surfaces; forefemur and midfemur predominantly dark on anterior surfaces; hindfemur predominantly pale on anterior surface except for apex and on upper surface in about distal half. Knee spots not developed. Tibiae predominantly pale at base dorsally, remainder dark but sometimes appearing paler on ventral surfaces in some aspects. Tarsi entirely dark. *Wing*: Dorsal scales all dark. *Haltere*: Stem and knob predominantly pale. *Abdomen*: Tergite I with large dorsal patch of dark scales; laterotergite occasionally with a few creamy scales. Tergites II-VII with large lateral patches of creamy scales, triangularly extending dorsad at base except on VII; median dorsal basal pale patches, dark tan to whitish, present on at least II-IV, sometimes narrowly connected to lateral white patches. Sternites II-VII with creamy scales.

MALE. Essentially similar to female in ornamentation except for more conspicuous, whitish basal transverse bands on abdominal tergites II-VII and absence of lateral pale patches. Palpus only slightly longer than proboscis. Pleural scaling reduced. Other sexual characters as in *hemisurus*.

MALE GENITALIA (fig. 75). Essentially as in *auratus* and *hemisurus*, differing from latter primarily in the following. Tergal setae of sidepiece somewhat stronger and longer; apical lobe more prominent. Basal tergomesal lobe usually with less than 10 unspecialized setae on distal part. Filament of claspette with conspicuous retrorse process and 1 to several spicules proximad of process.

PUPA (fig. 75). Chaetotaxy as figured, not studied in detail. In general similar to *hemisurus*, differing primarily in the following features. Abdominal hair 1-V-VII usually at least triple; 4-VII usually branched or forked; 6-VI usually double or triple. Paddle margins with less conspicuous spicules.

LARVA (fig. 76). Chaetotaxy as figured, not studied in detail. General morphology and chaetotaxy essentially as in *hemisurus*. Head hair 4-C usually shorter. Thoracic and abdominal spicules much shorter and not as dense. Abdominal hair 6-II rarely single. Comb scales of posterior row with a distinct but poorly differentiated slender median spinule. Siphon usually darker proximad, lighter distad; hair 1-S shorter. Saddle more strongly pigmented; acus usually more broadly attached; integument distad of saddle without spicules dorsad of hair 1-S. Ventral brush frequently with 1 hair on margin of or piercing saddle. Gills usually about equal to dorsal saddle length.

SYSTEMATICS. In the current taxonomic interpretation, which follows Dyar (1928:169), *tortilis* is regarded as a single highly variable species confined to the West Indies except for intrusions into Florida and southern Mexico and Guatemala. However, we find that on Jamaica there are 2 apparently distinct species, *tortilis* and *auratus*, indistinguishable in general adult morphology and ornamentation but readily separated by male genitalic and larval features as indicated in the diagnoses.

The taxonomic status of the other populations, which were regarded as distinct geographically isolated species by Howard, Dyar and Knab (1917:802-805,809-810) and as subspecies by Dyar (1922b:54-56), cannot be determined without a thorough revision which is beyond the scope of this study and cannot be undertaken until associated immature stages and males are obtained from all areas.

Topotypic *tortilis* from Jamaica appears to be different from all the other populations of the complex in the larval stage in the development of a distinct median spinule on the comb scales and a denser spiculation of the thoracic and abdominal integument. In the male genitalia there are fewer setae on the distal part of the basal tergomesal lobe than in other populations except those from the Lesser Antilles. As noted in the diagnosis, there is a great deal of variation in the color of the pale scaling of the mesonotum in the females of topotypic *tortilis*. In some specimens it may even be light bronzy and not sharply contrasted with the dark bronzy scaling. This type of variation occurs also in all other populations. However, the mesonotum of Jamaican females tends to have some pale scales above the paratergite and above the wing root that are usually not found in other populations.

Perhaps some of the variability evident in all stages of *tortilis* in Jamaica may be due to hybridization or introgression with the sympatric *auratus*. This is suggested by the male genitalia of some specimens in which the distal part of the basal tergomesal lobe bears numerous setae as in *auratus* while the rest of the side-piece is typical of *tortilis*. We have seen a few larvae (notably collection JA 730) with a mixture of *tortilis* and *auratus* features: comb scales and abdominal hair 6-I as in *tortilis*, and gills and hair 6-II as in *auratus*. While these differences could be individual variations in *tortilis*, the presence of 2 species of the same complex in Jamaica and the geographical differentiation in the complex elsewhere suggests that *auratus* may have been an early stock of the complex on Jamaica and that *tortilis* is a more recent invader which may be replacing the relict *auratus*. A similar situation may exist elsewhere in the Greater Antilles, Bahamas, Puerto Rico, Virgin Islands, and the Leeward Islands, with a dominant *tortilis*-like form replacing an earlier geographical isolate in each group. This may not be the case in St. Lucia where a rather distinct uniform population is present.

On the basis of general adult morphology, male genitalia, and larval and pupal features, the *tortilis* complex is very similar to the *scapularis* complex and should be included in the Scapularis Group. The similarity is most marked in the pupa where the separation from *hemisurus* is very tenuous.

BIONOMICS. Topotypic *tortilis* breeds in brackish water ground pools in mangrove swamps as well as in freshwater temporary pools and overflows of streams. There appears to be some preference for shaded situations but *tortilis* has been taken in pools exposed to full sunlight. In mangrove areas it has been found associated most frequently with *Psorophora (G.) pygmaea*. In freshwater situations it has been taken more frequently with *Aedes (O.) hemisurus* than any other species.

Females of *tortilis* bite man readily but Page (1967) found this species to be less numerous in man-biting collections than *taeniorhynchus*, *hemisurus*, *nigripalpus* or *jamaicensis*.

DISTRIBUTION. Jamaica (type locality); complex reported also from Florida, Bahamas, Virgin Islands, Puerto Rico, Hispaniola, Cayman Islands, Cuba, Mexico, Guatemala, Leeward and northern Windward Islands.

JAMAICA. More widespread than our records indicate; found in interior also; reported by Hill and Hill (1948:46) also from the parishes of *Hanover* and *St. James* (including Montego

Bay). *Clarendon*: Milk River Bath (730). Parnassus (863). *Kingston and St. Andrew*: Ferry and vicinity (197A,610,796,799,869). Liguanea, 3 June 1931, Kisliuk, 1 F [USNM]. Hill Gardens, July 1924, G.C. Stratham, 1 F [USNM]. Mona, R.B. Hill, 1 F [UCLA]. *St. Ann*: Delight (757). *St. Catherine*: Bog Walk (913,914). *St. Elizabeth*: Luana (357). *St. Thomas*: Chiswick (161). Holland Bay (97,143,159). *Westmoreland*: Crab Pond Bay (790). *Parish not Specified*: 1945, R.B. Hill, 1 M [JAM].

Material Examined: 213 specimens; 40 males, 54 females, 72 larvae, 47 pupae; 44 individual rearings (15 larval, 22 pupal, 7 incomplete).

44. *Aedes* (O.) *auratus* Grabham

Figs. 77,93

1906. *Aedes auratus* Grabham, 1906b:313-315. TYPE: Lectotype by PRESENT DESIGNATION, male with genitalia slide (680827-15), Kingston, Jamaica, 10 Apr 1906, M. Grabham [USNM; 1 of 4 specimens (3 males, 1 female) bearing identical labels, undoubtedly part of Grabham's type series; date given in Howard, Dyar and Knab (1917:809), 10 July 1906, is that of receipt from Grabham as indicated by labels].

Aedes auratus of Dyar and Knab (1906b:163).

Aedes (*Ochlerotatus*) *tortilis* in part of authors indicated under that species.

Aedes tortilis in part of Howard, Dyar and Knab (1917:806-809); Johnson (1919:424); Gowdey (1926:74); Hill and Hill (1945a:2; 1948:45-46); Thompson (1947:78).

FEMALE. Only thorax and part of head of 1 specimen known. Apparently extremely similar to *tortilis*, possibly distinct in *ppn* dark scales all moderately broad, pale scaling of pleuron distinctly white (absent on *ssp* and *psp*) and narrow scaled area of head wider.

MALE. Ornamentation apparently as in the female. Sexual characters apparently as in *tortilis* but palpus exceeding proboscis by nearly full length of segment 5. Tibiae and tarsal segments 1 indistinctly pale on lower surface.

MALE GENITALIA (fig. 93). Essentially as in *hemisurus* and *tortilis*, differing from both primarily in the following. Tergal setae of sidepiece of 2 sizes, short mesally and distinctly longer laterally; a row of 5 or 6 conspicuously thickened and elongated subapical tergal bristles and 2 or 3 similar bristles near base laterally. Basal tergomesal lobe larger, with more than 25 setae on distal part, some of the most distal setae distinctly flattened.

PUPA. Unknown.

LARVA (fig. 77). Chaetotaxy as figured, not studied in detail. General morphology and chaetotaxy essentially as in *hemisurus*. Very similar to *tortilis* from which it is distinguished primarily by the following features. Thoracic and abdominal spiculation similar but sparser. Abdominal hair 6-I,II always single. Comb scales of posterior row without differentiated median spinule. Siphon lighter in pigmentation; hair 2-S much shorter. Saddle lighter; acus less distinct. Gills more than 2.0 of dorsal saddle length.

SYSTEMATICS. *Aedes auratus* has been considered to be conspecific with *tortilis* since Howard, Dyar and Knab (1917:806). However, it is obviously distinct from *tortilis* in the male genitalia and in the larva and we are therefore restoring it to full specific rank. The only material of *auratus* we have seen is from Grabham's original collections. The only remaining female is in such poor condition that it is impossible to differentiate it from *tortilis*. As suggested under the lat-

ter, *auratus* may be an earlier derivative of the complex that is being replaced by *tortilis* and may hybridize with it.

BIONOMICS. The immature stages were collected by Grabham in temporary rain pools in the vicinity of Kingston, apparently in association with those of *per-tinax* as larval skins of both species were mounted by him on 1 slide.

This species has not been found since Grabham's original collections of immatures on 2 and 7 April 1906.

DISTRIBUTION. Endemic to Jamaica.

JAMAICA. *Kingston and St. Andrew:* Kingston vicinity, 2,7 Apr 1906 (immatures), 10 Apr 1906 (adults), M. Grabham, 3 M, 1 F, 11 L [USNM; UCLA].

Material Examined: 15 specimens as above.

45. *Aedes* (O.) *calumnior*, n.sp.

Figs. 78,79

TYPES: Holotype male (JA 603-101) with slides of male genitalia and associated pupal skin, Mocho, in cut forest near May Pen (Clarendon), Jamaica, 90 m, 6 Sept 1966, D.C. Watson [USNM]. Paratypes: 65 males, 75 females, 12 pupae, 26 larvae, same data as holotype (JA 603), including 3 lpM (603-10,11,13), 2 pM (603-102,104), 3 lpF (603-12,14,15), 2 lp (603-16,17), 2 p (603-100,103) [BM; UCLA].

Aedes orbturbator in part of Stone, Knight and Starcke (1959:150); Porter (1967:37).

Aedes tortilis in part of Jamaican reports.

FEMALE. Wing about 3.2 mm. A medium-sized dark legged species with disc of mesonotum usually entirely covered with elongate pale tan scales from anterior promontory to scutellum. *Head:* Decumbent scales all pale tan except a varied lateral patch of broad dark scales; median stripe of narrow scales very wide extending to dark scaled patch, scales elongate and semierect except on ocular border. Erect scales covering almost entire dorsal surface, all pale except a few dark posterolaterally. Labium dark scaled. Palpus 3-segmented; dark scaled. Antennal torus with a few short dark hairs on mesal surface. *Thorax:* Mesonotum elongate; integument light brown, darkened laterally; vestiture of very long, mostly straight light tan scales throughout except laterally on outer part of fossa near scutal angle, above paratergite, prealar area and sometimes part of supraalar area and posterior part of acrostichal line, where scales dark bronzy, curved and shorter. Acrostichal bristles developed throughout, long but sparse; only 2 or 3 anterior dorsocentrals developed cephalad of scutal suture, usually strong. Paratergite bare. Median scutellar lobe with numerous narrow pale tan scales; lateral lobe usually without scales. *Apn* usually without scales; *ppn* with large upper patch of dark bronzy broadened scales, occasionally a few pale scales at lower posterior part of patch; remaining pleural scaling of moderately broad whitish scales, very sparse, usually restricted to *ppl*, lower *ssp*, upper and lower posterior *stp*, base of *pra* and middle anterior *mep*, sometimes a few scales on *psp*. *Legs:* Coxae with small patches of whitish scales. Trochanters and base of femora with pale scales. Femora with usual pale surfaces but not extensive; anterior surfaces largely dark. Knee spots not developed. Tibiae and tarsi dark. All claws with 1 tooth. *Wing:* All dorsal scales dark. *Haltere:* Stem pale; knob largely pale scaled. *Abdomen:* Tergite I with median patch of dark scales and a few scattered whitish scales laterally; laterotergite with

a few whitish scales. Tergites II-VI predominantly dark, with narrow basal transverse bands of tan scales connected on III-VI to inconspicuous narrow lateral line of whitish scales, tergite II usually with separate larger basolateral patch of whitish scales; tergite VII usually entirely dark. Sternites II-VI usually predominantly pale scaled, whitish on proximal segments and basal parts of distal which tend to be light tan, distal segments with increasing apical bands of dark scales; sternite VII predominantly dark except at base. Cercus normal for subgenus, projecting.

MALE. Essentially similar to female in ornamentation but mesonotal light scaling more extensive laterally, dark scaling more restricted and sparser; tergal abdominal transverse pale bands more conspicuous, whiter, widened laterally on IV-VII, lateral light patches replaced by much shorter hairs than usual in *Ochlerotatus*. Palpus subequal to distinctly shorter than proboscis; very slender, porrect and without long bristles. Antennal flagellum densely long plumose. Claws of foreleg and midleg enlarged, unequal; larger claws with strong blunt submedian tooth; smaller claws with small sharp basal external tooth; all claws with short spicules on base and shaft.

MALE GENITALIA (fig. 78). Markedly different from other local *Ochlerotatus*, suggestive of some *Finlaya*. *Segment VIII*: Tergite with numerous very long attenuate setae. *Segment IX*: Tergite short laterally; anterior margin narrowly but deeply emarginate in middle; lobe wide, close to midline, with 12-16 setae. *Sidepiece*: Narrow at base, widened beyond; mesal membrane developed to apex. Tergal surface densely covered with very long setae. Scales on lateral and ventral surfaces. Sternomesal area with dense vestiture of setae, straight and moderately long near level of basal tergomesal lobe, followed distad by short curved setae and then by longer setae with curled apex; numerous longer setae and heavy bristles ventrad of these. Apicotergal lobe not developed. Basal tergomesal lobe attached to sidepiece, widened ventrad into a large prominent lobe densely covered with setae which are largely straight except at lateral margin where they are curved inward. *Claspette*: Bases of the 2 claspettes closer together than in other species. Stem elongate, narrow; filament with an external ledge from base to near apex, posterior margin with retrorse process and sometimes 1 or more spicules. *Clasper*: Long, slender, slightly expanded on mesal margin. Spiniform long and slender. *Phallosome*: Aedeagus small, simple, rounded apically but with an indistinct deep median emargination in the dorsal sclerotization. *Proctiger*: Rather small, essentially as in other species. Cercal setae 3-5, in distal half.

PUPA (fig. 78). Chaetotaxy as figured, not studied in detail. Essentially as in *hemisurus*, differing primarily in abdominal hairs 1-IV-VI weaker; 3-III, 5-IV-VI usually all single; 6-III-VI usually all double or triple; 4-VII, VIII frequently forked or double; 9-VII usually double.

LARVA (fig. 79). Chaetotaxy as figured, not studied in detail. General morphology and chaetotaxy essentially as in *hemisurus*, differing primarily in the following conspicuous features. Head hair 14-C double, not spiniform. Antennal shaft with a few minute inconspicuous spicules. Thoracic and abdominal integument without distinct spicules. Abdominal hairs 6-I-VI all single; 1-IV, V much weaker. Comb scales frequently more numerous. Siphon and anal saddle more strongly pigmented. Siphon distinctly longer, index usually more than 3.0, slightly swollen at about middle; pecten teeth usually more than 24. Gills unequal, shorter, broader and not as distinctly tapered distally.

SYSTEMATICS. The general morphology and ornamentation of the adults of *calumnior* is so similar to *obturbator* Dyar & Knab, 1907 from the Bahamas that

it is not surprising that partially denuded females of *calumnior* have been reported as *obturbator* in the past. Adults of *calumnior* have at most only a few scattered dark scales along the acrostichal line and small patch of dark scales at the end of it instead of a complete moderately broad line of dark scales as in *obturbator*. The male genitalia and the larva of *calumnior* are strikingly different from "*obturbator*" from Mona Island reported by Maldonado-Capriles, Pippin and Kuns (1958: 66-68). Whether the latter are conspecific with topotypic *obturbator* cannot be determined as only females are known from the Bahamas. However, since *calumnior* differs from both populations in adult ornamentation, we are confident that it is a distinct species. It may not even be related to *obturbator* and therefore we are only provisionally associating the 2 species.

We have seen a few females from Grand Cayman which may be conspecific with *calumnior*. However this cannot be determined definitely without males and immatures and we are therefore considering *calumnior* to be restricted to Jamaica for the present.

BIONOMICS. *Aedes calumnior* differs markedly from other species of *Ochlerotatus* in Jamaica in its breeding sites which in all but 1 instance (marshy depression) were coral rockholes where *mediovittatus* and/or *inaequalis* were invariably associated with it. The rockholes, except for one in a garden, were all in shaded situations in scrub forests. A few females of *calumnior* have been taken in biting-landing collections in a similar environment or in denser woods.

DISTRIBUTION. Tentatively considered endemic to Jamaica, but possibly present in Cayman Islands (see systematics).

JAMAICA. Probably more widespread than current records indicate. *Clarendon*: Ft. Simmonds, 14 July 1942, C.B. Philip, 3 F [USNM]. Goshen (235,238,352,602). Mocho (603). *Kingston and St. Andrew*: Red Hills (845). Rockfort (953). *St. Catherine*: Bog Walk (914). *St. James*: Red Hill, Montego Bay, 26 June 1957, King, 5 L [USNM]. Montego Bay, R.B. Hill, 1 M [USNM]. *St. Mary*: Annotto Bay (254).

Material Examined: 303 specimens; 86 males, 106 females, 61 larvae, 50 pupae; 43 individual rearings (16 larval, 20 pupal, 7 incomplete).

Subgenus FINLAYA

46. *Aedes* (F.) *mediovittatus* (Coquillett)

Figs. 80,81

1906. *Stegomyia mediovittata* Coquillett, 1906c:60. TYPE: Holotype male (99.4) with associated larval and pupal skins, St. Domingo [Dominican Republic], Aug 1905, A. Busck [USNM, 9138; see Stone and Knight, 1956a:221].
1907. *Aedes uncatus* Grabham, 1907:25. TYPE: Lectotype male (210) with male genitalia slide, near Kingston, Jamaica, M. Grabham [USNM; designation of Stone and Knight, 1956a:226]. Synonymy with *mediovittatus* by Howard, Dyar and Knab (1917:821).

Aedes (*Finlaya*) *mediovittatus* of Bonne and Bonne-Wepster (1925:420); Dyar (1928:227-228, in part); Edwards (1932:152, in part); Lane (1953:695-697, in part); Perez Viguera (1956: 248-257); Stone, Knight and Starcke (1959:167, in part); Forattini (1965a:394-395); Montchadsky and Garcia (1966:40); Porter (1967:38).

Aedes (*Gualteria*) *mediovittatus* of Dyar (1918b:79).

Aedes mediovittatus of Howard, Dyar and Knab (1917:821-824); Johnson (1919:424); Gowdey (1926:73); Hill and Hill (1945a:2; 1948:43); Thompson (1947:78).

Gymnometopa mediovitata of Coquillett (1906b:25); Theobald (1907:210-211; 1910:219).
*Aedes uncatu*s of Theobald (1910:596-597).

FEMALE. Wing about 3.5 mm. An elegant medium-sized brown species with silvery markings; superficially resembling species of subgenus *Howardina* but immediately distinguished from its local representatives by a median acrostichal silvery line. *Head*: Decumbent scales predominantly broad, dark in front of disc, yellow to golden in back and silvery on side near orbital margin; conspicuous narrow median longitudinal line of narrow silvery scales from interocular space to occiput. Erect scales short, yellow, largely restricted to occiput. Proboscis long and slender; predominantly dark scaled, with a few scattered white scales, primarily in middle part. Palpus 4-segmented, segment 4 small; dark scaled except for silvery scales on upper surface, scattered on segment 2, large basal patch on 3 and all of 4. Antennal torus with large mesal patch of broad silvery scales; flagellar segment 1 with a few scales on mesal surface, usually including some silvery scales. *Thorax*: Mesonotum predominantly with small narrow bronzy, coppery and golden scales in a definite pattern and with conspicuous silvery markings; a narrow acrostichal line of narrow silvery scales to prescutellar space; broad silvery scales in (1) a short lateral prescutellar line, (2) a short line or patch in posterior part of fossa near scutal suture, (3) a supraalar line and (4) a line above wing root; golden scales in (1) inner anterior dorsocentral line, broadened on humeral angle and (2) outer posterior dorsocentral and prescutellar line; dark bronzy scales primarily in broad median longitudinal line between the dorsocentral and prescutellar golden lines and between posterior dorsocentral-prescutellar and supraalar bristles; coppery scales largely in lateral areas, primarily in fossa and caudad of fossal silvery patch. Paratergite with broad silvery scales. Acrostichal bristles absent except on anterior promontory; fossal bristles absent; others present, moderately to strongly developed. All lobes of scutellum with large apical patch of broad silvery scales; median lobe with large patch of small bronzy scales cephalad of silvery patch. Pleural scaling all broad silvery except for small broadened curved bronzy scales in upper part of *ppn*; largely in lines or narrow patches; restricted to middle of *apn*, upper middle *ppn*, *ppl*, *pcx*, lower *ssp*, upper *stp*, lower *stp*, and 2 separate ones in upper *mep*. Lower *mep* bristles absent. *Legs*: Coxae with small patches of silvery scales, dark scales also present on forecoxa. Trochanters largely with golden to coppery scales. Femora predominantly dark scaled except for usual light surfaces; midfemur and hindfemur with narrow line or streak of white scales on anterior surface from base to near apex and some scattered white scales; forefemur with scattered dingy white or light yellowish scales on anterior surface more or less in longitudinal line in lower part. Distinct knee spots on all legs, involving only apex of femora. Tibiae predominantly dark, all with conspicuous ventral white spot, in basal 0.25-0.3 on foreleg and midleg, in basal 0.3-0.4 on hindleg. Tarsi with basal white bands or rings; small on segments 1 and 2 of foretarsus and midtarsus; large on all segments of hindtarsus, forming complete rings on 2-5, occupying more than 0.7 of segment on 4 and 5. Claws of foreleg and midleg subequal, all with small subbasal tooth; those of hindleg smaller, without tooth; all with slender external basal spicules. *Wing*: Dorsal scales all dark. *Haltere*: Stem light; knob with dark to pale scales at base and silvery scales on apex. *Abdomen*: Laterotergite with large patch of silvery scales; tergite I with median patch of dark scales. Tergites II-VII predominantly dark scaled, with large basolateral silvery patches; tergites III-V with very narrow transverse basal bands of pale scales. Sternites II-VII predominantly

with pale yellowish scales and with some dark scales apicolaterally; at least sternites V-VII with submedian lateral patches of silvery scales, sometimes produced to form a postmedian transverse band. Cercus not projecting beyond apex of abdomen.

MALE. Essentially similar to female in ornamentation; basal transverse pale bands of tergites more extensive, usually present on segments III-VI. Palpus very slender and without conspicuous bristles; subequal to proboscis; a very large dorsal silvery patch on base of segment 2, progressively smaller basal silvery rings on 3-5. Claws of foreleg and midleg enlarged, unequal; larger claws with long subbasal tooth, smaller with short thin external basal tooth.

MALE GENITALIA (fig. 80). *Segment VIII*: Sclerotization of tergite distinctly emarginate on caudal margin. *Segment IX*: Tergite lightly sclerotized, deeply emarginate on anterior margin; lobe small, prominent, usually with 4 curved setae but sometimes with only 1 thickened seta. *Sidepiece*: Very elongate, cylindrical; mesal membrane largely sternal, extending only about halfway to base of clasper. Scales very numerous from outer part of dorsal to outer part of ventral surface. Basal tergomesal angle with a heavy specialized seta. *Claspette*: Strongly developed; with long slender stem and expanded filament with retrorse angle. *Clasper*: Short, simple; spiniform more than 0.5 of body of clasper. *Phallosome*: Aedeagus without teeth; with conspicuous distal bulbous expansion. *Proctiger*: Moderately developed, gradually narrowed distad. Paraproct with a single apical tooth. Cercal setae usually 3.

PUPA (fig. 80). Chaetotaxy as figured, not studied in detail; apparently quite variable in degree of development of some hairs and their positions. In general similar to species of subgenus *Howardina* and superficially to *aegypti*; usually readily distinguished from these by the characters in the key to subgenera and species. *Cephalothorax*: Moderately pigmented except for darkened mesonotum. All hairs short and usually all single or double. *Trumpet*: Short, with large pinna; uniformly darkly pigmented, contrasting. *Metanotum and Abdomen*: Moderately to lightly pigmented, darker anteriorly. Abdominal segments II-IV with rather conspicuous short spicules, particularly laterally on tergites. All hairs except 10-C, 1-I-III and 9-VI-VIII usually single or double. Hair 9-VI dorsal, usually strongly developed and cephalad of 6-VI. *Paddle*: Moderately pigmented, slightly darkened on midrib. Inner and outer parts subequal in width; margins with rather distinct sharp spicules. Hair 1-P strong.

LARVA (fig. 81). Chaetotaxy as figured, not studied in detail; stellate hairs always well developed. Readily differentiated from all other local species by the short siphon with the row of pecten teeth curved dorsad distally. *Head*: Uniformly moderately pigmented. Labrum not evident from dorsal surface, hair 1-C just caudad of rounded anterior border on dorsal surface; maxillary suture complete, short; collar moderately developed. Hairs 4,6-C far forward, near anterior border; 4-C long and multiple; 6-C single, flattened in basal part, attenuate distally. *Antenna*: Short, shaft uniform in width, without spicules. Hair 1-A single, submedian. *Thorax*: Hair 13-P absent. Hairs 1-3-P on common basal plate; tubercles of 5,6-P joined; many of the dorsal hairs stellate as figured. *Abdomen*: Stellate hairs as figured. Hair 6-I usually with 4 or 5 branches, 6-II triple or double, 6-III-VI usually double; 7-I long, single, 7-II-VI stellate; 3-VII strong and single, very long, extending beyond base of siphon. *Segment VIII*: Comb scales usually 6-8, in a single row; scales varied from single long spine to short spine with strong basal denticles. *Siphon*: Short, slightly narrowed distad; strongly pigmented, darkened

at base which is irregularly sclerotized; acus not developed. Pecten usually of more than 20 simple teeth with adjoining bases, in a row curved dorsad distally. Hair 1-S usually single, long, postmedian. *Anal Segment*: Saddle incomplete, strongly pigmented; caudal margin with long simple spines of varied length. Hair 1-X strong, usually 3 or 4-branched. Ventral brush with 6 pairs of hairs on a strongly sclerotized, heavily pigmented boss. Gills, short, rounded, unequal.

SYSTEMATICS. *Aedes mediovittatus*, the only representative of the subgenus *Finlaya* in the West Indies, appears to be a single highly variable species as interpreted by Howard, Dyar and Knab (1917:821-824) who synonymized *uncatus*, proposed for the Jamaican population by Grabham.

We have not made a careful analysis of our large sample from Jamaica but it is evident that there is a great deal of variation in all stages. The comb scales of the larva vary tremendously even on an individual specimen. However, as pointed out by Grabham, the "subdorsal thoracic lines" (inner and outer dorsocentral) of the adults are uniformly golden throughout in the Jamaican population.

We have seen some material of *mediovittatus* from Grand Cayman, Cuba (Guantanamo), Hispaniola (Haiti and Dominican Republic), Puerto Rico and Virgin Islands (St. Croix). The larvae, from Haiti and Puerto Rico only, do not show any significant differences from the Jamaican population. The pupae from Puerto Rico fall within the range of variation of the Jamaican population except for an occasional slight emargination on the apex of the paddle. The male genitalia of specimens from the Dominican Republic, Puerto Rico and St. Croix are also indistinguishable from the Jamaican population. There appear to be, however, some more or less constant differences in the ornamentation of the adults in the samples of the different populations. Specimens from Grand Cayman and Cuba resemble the Dominican Republic population in having the outer dorsocentral line at least partially silvery instead of golden. The Puerto Rican population is very similar to the Jamaican in this character although all the golden scales appear lighter. In 2 specimens from St. Croix the outer dorsocentral line is largely white but in the third it is pale golden as in Puerto Rican specimens; the acrostichal line in all 3 is not as distinctly silvery as in the other populations.

The taxonomic significance of this slight, apparently regional, differentiation cannot be determined without a great deal more material than is currently available. For the present all these populations are considered to be conspecific.

On geographical grounds, we believe that the record of *mediovittatus* from Venezuela (Aragua) in Dyar (1928:228) is incorrect and probably pertains to a sibling species or is based on mislabeled material.

BIONOMICS. Immature stages of *mediovittatus* have been found most frequently in treeholes, commonly in coral rockholes and occasionally in bamboo. The breeding associates of *mediovittatus* include all the other species normally utilizing the same type of habitat, but *Aedes (H.) inaequalis* in treeholes and *Aedes (O.) calumnior* in rockholes appear to be its most common associates.

Females of *mediovittatus* readily attack man during the day in wooded areas where this species breeds.

DISTRIBUTION. Hispaniola (Dominican Republic, type locality; Haiti), Cuba, Cayman Islands, Jamaica, Puerto Rico and Virgin Islands (St. Croix); record from Venezuela probably erroneous.

JAMAICA. Probably more widespread than present records indicate; chiefly at low or moderate elevations. *Clarendon*: Balcarres (902). Goshen (235,236,238,239,352,602). Mocho (603). Sandy Gully, G.A. Thompson (Hill and Hill, 1948:43). Locality not specified, Jan 1946, G.A. Thompson, 1 F [USNM]. *Kingston and St. Andrew*: Constant Spring (82,248,327,328,387,408,699). Hermitage Dam Rd (286,288,296,390,391,397,623,624,627). Kingston and vicinity, M. Grabham, 3 M, 2 F [USNM]. Red Hills (845). Rockfort (949,952). Temple Hall (252). *Man-*

chester: Mandeville (638). *St. Catherine*: Bog Walk (913,914). Rio Cobre Dam (351,373,605). *St. Thomas*: Grants Pen (410,801). *Westmoreland*: Negril (230). *Parish not Specified*: M. Graham, 6 L [USNM]; 1945, R.B. Hill, 1 L [JAM].

Material Examined: 679 specimens; 103 males, 90 females, 301 larvae, 185 pupae; 146 individual rearings (44 larval, 85 pupal, 17 incomplete).

Subgenus HOWARDINA

The subgenus *Howardina* resembles the subgenus *Finlaya* in all stages and probably represents an early specialized offshoot of the same general stock. In the West Indies, *Howardina* is the dominant group of container breeding Aedini. The adults have a linear pattern of golden or silvery scales on the mesonotum and silvery scales on the pleuron. The females have untoothed claws and the males possess a very small claspette and a simple aedeagus. The larvae resemble *Finlaya* and the introduced *aegypti* of the Old World subgenus *Stegomyia* in the incomplete saddle of the anal segment; they are differentiated from both by the comb scales lacking a sharply differentiated strong median spine. The pupae also resemble *Finlaya* and *aegypti* but can be separated by the key characters. The subgenus has recently been revised by Berlin (1969), whose taxonomic treatment is followed here.

All the species known from Jamaica are endemic and fall into 2 distinct groups of the Walkeri Section: (1) the Walkeri Group, represented by the nominate form (with the only other known species, *argyrites*, in Venezuela) and (2) the endemic Aurites Group with a flock of at least 4 sibling species: *aurites*, *grabhami*, *inaequalis* and *stenei*; a fifth form may represent a distinct species or hybrids between *grabhami* and *stenei*.

Elsewhere in the West Indies the subgenus is represented by 3 other groups of the Walkeri Section with largely complementary distributions. All of these have been included in the keys since 1 or more of the species might possibly occur in Jamaica. For descriptions of these, Berlin's revision (1969) should be consulted. The Ioliota Group is represented by *cozumelensis* Diaz Najera, 1966 on Cozumel Island off the coast of Yucatan as well as on the mainland southward to British Honduras. The Albonotatus Group consists of at least 2 species: *albonotatus* (Coquillett, 1905) on Hispaniola (Haiti and Dominican Republic) and questionably on Guadeloupe, and *bahamensis* Berlin, 1969 in the Bahamas; a third, undescribed, species may be present in the northern part of the Dominican Republic. The Busckii Group, with only *busckii* (Coquillett, 1906) recognized at present, includes a complex of more or less differentiated populations definitely known only from the Lesser Antilles. We agree with Berlin (1969:67) that the record of *busckii* from Jamaica by Hill and Hill (1945a:2; 1948:43) was probably based on an erroneous identification of a member of the Aurites Group but it is possible that a member of the *busckii* complex does occur on this island.

47. *Aedes* (H.) *walkeri* (Theobald)

Figs. 82,83

1901. *Culex walkeri* Theobald, 1901a:424. TYPE: Holotype female (45/110), Jamaica [BM].

Aedes (*Howardina*) *walkeri* of Bonne and Bonne-Wepster (1925:368); Dyar (1928:235); Edwards

(1932:156); Lane (1953:725-727); Stone, Knight and Starcke (1959:174); Porter (1967:38); Page (1967); Berlin (1969:33-37).

Aedes walkeri of Dyar and Knab (1906c:189,192); Howard, Dyar and Knab (1913a:70; 1917:849-852); Dyar (1918b:73,80); Johnson (1919:424); Gowdey (1926:74); Hill and Hill (1945a:2; 1948:46); Thompson (1947:78).

Howardina walkeri of Theobald (1903a:287-289; 1905a:20-22; 1905b:21; 1907:215-216; 1910:220); Dyar (1905a:23); Coquillett (1906b:26); Grabham (1906a:170-171).

Culex walkeri of Blanchard (1905:416).

Haemagogus walkeri of Dyar and Knab (1906b:166).

?*Culex fasciatus* of Johnson (1894:271).

FEMALE (fig. 83). Wing about 2.6 mm. Small dark species with mesonotum broadly silvered on sides and with narrow longitudinal silvery or golden lines on disc. *Head*: Decumbent scales predominantly broad, dark in submedian and lateral patches separated by golden patch, silvery below; a broad median line of narrow silvery scales from interocular space to occiput. Erect scales very short, restricted to occiput. Palpus tipped with silvery scales. *Thorax*: Mesonotal scales all narrow; sides broadly silvery from humeral angle to wing root, including most of fossa; central area between silvery sides with very dark bronzy scales extending on prescutellar space and with narrow golden inner dorsocentral and outer (posterior) dorsocentral lines; a broader median prescutellar line, golden in front, silvery behind and continued on median lobe of scutellum. Acrostichal bristles developed on anterior promontory only; only 1 posterior fossal bristle present; other bristles present, moderately developed. Paratergite bare. All scutellar lobes with narrow very dark bronzy scales in addition to white scales on median lobe. Pleural scales silvery, in restricted patches only on *apn*, *ppl*, upper and lower *stp*, *pra* and upper anterior *mep*. Lower *mep* bristles absent. *Legs*: Anterior surface of forefemur and midfemur largely dark; hindfemur largely creamy except for dark apical 0.3 or more dorsally, extending to anterior and posterior surfaces, and lower part of surface with silvery streak joining knee spot. Knee spots present on all legs, most conspicuous on hindleg. Tibiae all dark. Tarsal white markings restricted to a few dorsal scales on foretarsal segment 1 and moderate rings on hindtarsal segments 1-3. Claws simple on all legs but with minute spicules at base of external surface. *Wing*: Dorsal scales all dark. *Haltere*: Stem pale; knob mostly dark, fringe scales creamy. *Abdomen*: Laterotergite with large patch of silvery scales; tergite I with numerous dark scales dorsally. Tergites II-VII predominantly dark scaled; with broad basolateral silvery patches, progressively more removed from base and extending more tergally on distal segments; basomedian creamy patches more or less distinct on III-VII. Sternites creamy on II-IV, on other segments with basal creamy and apical dark scales. Cercus usually not visible.

MALE. Essentially similar to female in ornamentation. Palpus porrect, slender, subequal to proboscis in length, without long bristles; with basomedian white scales on segments 4 and 5. Antennal flagellum densely long plumose. Claws of foreleg and midleg enlarged and unequal, larger with submedian and basal teeth, smaller with basal only; hindclaws as in female.

MALE GENITALIA (fig. 83). *Segment VIII*: Long and wide, unspecialized. *Segment IX*: Tergite moderately developed, narrowed in middle; lobe not developed but represented by group of about 3 or 4 setae. *Sidepiece*: More or less conical; mesal membrane developed from base to apex; scales present laterally and ventrally. *Claspette*: Very poorly developed, represented by an inconspicuous sternal basomesal lobe bearing 1 apical bristle on a short broad conical tubercle. *Clasper*: Sim-

ple; base slightly swollen and with minute spicules. Spiniform simple, about 0.2 of clasper shaft. *Phallosome*: Aedeagus moderate, subquadrate; without teeth. *Proctiger*: Strongly developed; basolateral sclerotizations not meeting on middorsal line. Paraproct with large, simple, heavily sclerotized, curved apical tooth. Cercal setae short, near paraproct apex, usually about 3.

PUPA (fig. 83). In general similar to other species of subgenus *Howardina* but readily separated by presence of minute denticles on abdomen and distinctly emarginate paddle. *Cephalothorax*: Moderately pigmented throughout. Hair 5-C usually at least triple, subequal to distance from its alveolus to trumpet base and at least 2.0 length of 4-C; hair 7-C usually triple. *Trumpet*: Slender, index about 4.5-5.0, pinna small; uniformly moderately pigmented and only slightly contrasting with cephalothorax. *Metanotum and Abdomen*: Moderately to strongly pigmented, progressively lighter caudad; integument with minute denticles. Hair 10-C with 2-7 branches. All large abdominal hairs except 1-I-III, 9-VII, VIII usually single or double; 2-II-VII laterad of hair 1, hair 2-II laterad or in line with 3-II; hair 5-IV, V usually extending to apex of tergite following; 9-II-VI usually at level or slightly cephalad of hair 6; hair 9-VII subequal to hair 6; hair 4-VIII single. *Paddle*: Short; inner part distinctly broader than outer; uniformly lightly pigmented except for slightly darker midrib. Apex distinctly emarginate at hair 1-P. Marginal spicules more or less distinct.

LARVA (fig. 82). General morphology and chaetotaxy as in other members of subgenus; readily differentiated from local species by densely stellate hairs, abdominal integument with dark dendritic spicules and pecten extending almost to apex of siphon. In life very dark and hairy, quite different in appearance from other species of subgenus. *Head*: Width subequal to length; integument smooth and strongly pigmented. Labrum very narrow, not evident from dorsal surface; maxillary suture complete, short; collar poorly developed. Hair 1-C always branched; 4-6-C all far forward; 5-C single; 14-C stellate; 15-C long. *Antenna*: Short; shaft appearing smooth but with scattered minute sharp spicules. Hair 1-A single, submedian, very weak. *Thorax*: Hair 13-P absent. Hairs 1-3-P on common basal plate, tubercles of 5-7-P joined. Many of the hairs strongly and darkly pigmented. *Abdomen*: Integument with densely packed, large, dendritically branched spicules; stellate hairs as figured. Hair 6-I, II with 3 or 4 branches, 6-III-V double or triple, 6-VI usually double; 7-I long, single or double, 7-II-VI stellate; 3-VII strong and single, very long, extending beyond base of siphon. *Segment VIII*: Comb scales in single row of about 12; scale long, minutely fringed to near apex. *Siphon*: Darkly pigmented; integument with minute spicules; index a little less than 3.0; acus absent. Pecten extending almost to apex, with about 20 teeth; distal teeth long, simple. *Anal Segment*: Saddle narrowly incomplete; darkly pigmented; body with numerous strong spicules; caudal margin with long fringed spines. Hair 1-X strong, usually with about 8 branches. Ventral brush with 6 pairs of hairs on very strongly sclerotized boss without distinct grid bars.

SYSTEMATICS. *Aedes walkeri*, the type species of the subgenus *Howardina*, is endemic to Jamaica. Its only close relative is *argyrites* Dyar & Nunez Tovar, 1927 from Venezuela.

This species is very readily recognized from all other mosquitoes of Jamaica in all stages and shows relatively little individual variation except in the color of the median prescutellar line of the adult mesonotum which ranges from entirely silvery to predominantly golden. The larvae of *walkeri* are easily recognized in the field by their very dark "furry" bodies.

BIONOMICS. The breeding sites of *walkeri* are primarily leaf axils of terrestrial and epiphytic bromeliads but other habitats may occasionally be used by this dominant species, such as heliconia axils (748), treeholes (336,390), broken or cut bamboo (711,778) and a crabhole (369). This species has been found associated with all the members of the Aurites Group of *Howardina* and has a much wider altitudinal and geographical range than any other species of the subgenus in Jamaica. Other associates of *walkeri* are some of the members of the Hirsuta Group of *Wyeomyia* (see).

Females of *walkeri* attack man readily in the shade during the day, with peaks of activity at 0900 and 1700 according to Berlin (1969:35) but Hill and Hill (1948:46) maintain that they prefer to feed at dusk in the open.

DISTRIBUTION. Endemic to Jamaica, where it is widespread at elevations of 30 m to 1400 m.

JAMAICA. *Clarendon:* Balcarres (902A). Goshen (237,239,353). *Hanover:* Lethe (665,667). Sandy Gully, Feb 1945, G.A. Thompson, 1 L [USNM]. *Kingston and St. Andrew:* Castleton (645). Ferry and vicinity (369,399). Hardwar Gap (647). Hermitage Dam (85,390). Hermitage Dam Rd (282,294,304,318,319,322-324,333,334,392,393,723-725,765,843,854,855). Irish Town (683). Kingston and vicinity, 1 Apr 1906, M. Grabham, 1 M, 2 F [USNM]. Mavis Bank, M. Grabham, 1 M [USNM]. Mount Salus (777-779,848). Newcastle (122-124,335-338,678-682). Newcastle, 14-15 mi from Kingston on road to (648). Temple Hall (646,646A). *Manchester:* Hope Farm (354,356,634A,635,664,684). Mandeville (639,640,940,941). Melrose Hill (243,244,247,631,633,657,660). Williamsfield (637). *Portland:* Ecclesdown (748). Fairy Hill (693-695). Port Antonio (925). Portland Point, 4 Aug 1942, C.B. Philip, 1 F [USNM]. Sherwood Forest (707-711,716). *St. Ann:* Dunns River (740). Faiths Pen (762). Fern Gully (930,931). Moneague and vicinity (374,379,606,607,732,733,735,758,763,764,767,771,772). Mount Diablo (381). Runaway Bay, Feb 1969, W.W. Wirth, 4 M, 4 F [USNM]. *St. Catherine:* Bog Walk (913,914). Dove Hall (820,825). Harkers Hall (821). Zion Hill (824). *St. Elizabeth:* Maggoty (792A). *St. James:* Copse (668). Montego Bay, Jan 1940, W.H. Komp, 2 L [USNM]. Reading (669-672,675). *St. Mary:* Broadgate (257,643). Castleton Botanical Gardens (644). *St. Thomas:* Barrett's Gap, 14 Nov 1946, G.A. Thompson, 1 F [JAM]. Norris (653). Pleasant Hill, 14 June 1931, Kisliuk, 7 F [USNM]. Port Morant (729). Scotland Gate (654). Windsor Forest, road to (650,651). *Westmoreland:* Crab Pond Bay (359,360). Petersville (787). *Parish not Specified:* Jan 1940, W.H. Komp, 1 F; 1940, ? W.H. Komp, 1 F; Jan 1946, G.A. Thompson, 1 M, 9 F; M. Grabham, 1 M, 3 F, 5 L, 1 P; R.B. Hill, 3 F; G.A. Thompson, 1 F [USNM].

Material Examined: 2997 specimens; 250 males, 1162 females, 884 larvae, 701 pupae; 519 individual rearings (151 larval, 239 pupal, 129 incomplete).

48. *Aedes* (H.) *aurites* (Theobald)

Figs. 84,85

1907. *Howardina aurites* Theobald, 1907:216-218. TYPE: Lectotype female, Newcastle (St. Andrew), Jamaica, elev. 4000 ft, July 1906, Col. Loscombe [BM; designation of Belkin, 1968b:4].

Aedes (*Howardina*) *aurites* of Bonne and Bonne-Wepster (1925:371); Dyar (1928:236, in part); Edwards (1932:155, in part); Lane (1953:720-722, in part); Berlin (1969:40-42).

Aedes aurites of Howard, Dyar and Knab (1917:859-860); Dyar (1918b:73); Johnson (1919:424); Gowdey (1926:73); Hill and Hill (1945a:2, in part; 1948:42-43, in part).

Howardina aurites of Theobald (1910:220).

Aedes (*Howardina*) *inaequalis* in part of Thompson (1956:199-200); Stone, Knight and Starcke (1959:174); Porter (1967:38); Page (1967:38).

Aedes inaequalis in part of Thompson (1947:78).

FEMALE (fig. 84). Wing about 2.6 mm. Small dark species with general morphology as in *walkeri*; with the following diagnostic features in ornamentation. *Head*: Broad decumbent scales predominantly yellow, submedian and lateral dark patches very small; narrow decumbent scales golden on median longitudinal line and short orbital line. Erect scales yellowish. Only a few silvery scales on apex of palpus. *Thorax*: Mesonotal light scales all golden, in longitudinal lines broader than the intervening densely dark scaled lines; inner dorsocentral light line extending to prescutellar space, followed by moderately broad median prescutellar line; outer dorsocentral light line complete, extending from humeral angle to lateral scutellar lobe, merging with lateral marginal line anteriorly so that fossa is largely golden; lateral marginal light line complete to supraalar area and including area above paratergite. Scutellar lobes with longitudinal lines of golden scales flanked by dark scales. *Apn* almost completely covered with silvery scales; *ppl* with large patch of silvery scales; a very large continuous silvery patch extending from *pra* bristles through the posterior part of *stp* to base of coxa; *mep* with upper anterior patch of silvery scales. *Legs*: Tarsal white basal markings restricted to a few scales on midtarsal segment 1, and short rings on hindtarsal segments 1 and 2. *Abdomen*: Silvery markings as in *walkeri*; basomedian tergal light scaling inconspicuous.

MALE. Ornamentation essentially as in female. Palpus as in *walkeri* but without white scales.

MALE GENITALIA (fig. 84). In general similar to *walkeri*; differing primarily in following features. Claspette with distinct apical fingerlike cylindrical process more than 2.0 as long as wide and bearing a shorter, heavier bristle. Clasper more slender and curved; spiniform longer. Aedeagus longer, subequal to proctiger.

PUPA (fig. 84). General morphology and chaetotaxy as in *walkeri*; very similar to other species of the group as given below; distinguished from these primarily by the following features: metanotum uniformly lightly pigmented, hair 9-C single, 2-VI laterad of 3-VI. *Cephalothorax*: Uniformly lightly pigmented. Hair 5-C with at least 4 branches, moderately long but not reaching base of trumpet; 7-C with at least 4 branches. *Trumpet*: Long and slender; pinna small; uniformly lightly pigmented, slightly contrasting. *Metanotum and Abdomen*: Uniformly lightly pigmented, without light areas on sides of metanotum. Hair 10-C usually with at least 10 branches. Hair 1-II-IV with many branches, 1-II with about as many branches as 1-I; hair 2-II-VII usually laterad or in line with hair 1, hair 2-II mesad of 3-II; hair 5-IV,V long, usually exceeding tergite following; 9-III-VI short, usually at level or slightly cephalad of hair 6; hair 9-VII subequal to hair 6; hair 4-VIII usually double. *Paddle*: Practically unpigmented; apex rounded; marginal spicules indistinct; hair 1-P single.

LARVA (fig. 85). General morphology and chaetotaxy as in *walkeri*; in general similar to other members of the group as given below; distinguished from these most readily by the characters in the key. *Head*: Width subequal to length; integument smooth; pigmentation very light except for darkened collar. Hair 1-C single; 5-C branched, usually triple; 6-C with at least 6 branches; 14-C single; 15-C short. *Antenna*: Simple as in *walkeri*, but longer. *Thorax*: Stellate hairs less strongly developed than in *walkeri*. *Abdomen*: Integument glabrous. Stellate hairs less strongly developed than in *walkeri*; hair 2 not markedly displaced cephalad; 6-III-VI usually single. Hair 2-VII small, single. *Segment VIII*: Comb scales fringed on apex. *Siphon*: Long, index about 6.0-6.5; integument glabrous; moderately pigmented except for darkened basal ring. Pecten not reaching middle of siphon. *Anal Segment*: Saddle moderately pigmented, darkened basally; body without spicules ex-

cept distally; caudal margin with row of long simple spines; hair 1-X always single. Ventral brush with 6 pairs of hairs on weak boss without grid bars. Gills subequal, about 2.0 of dorsal saddle length.

SYSTEMATICS. *Aedes aurites* is the most strongly differentiated member of its group which includes also *grabhami*, *inaequalis* and *stenei*. There is no striking variation in adult ornamentation in the small series of specimens examined and the immature stages are quite uniform in the diagnostic features.

This apparently uncommon species was incorrectly synonymized with *inaequalis* by Thompson (1947:78; 1956:199) who apparently did not realize that the large continuous silvery patch of the sternopleuron and prealar knob is a constant and unique feature of *aurites*.

BIONOMICS. Immature stages of *aurites* are known only from arboreal bromeliads, generally at elevations above 1000 m but sometimes down to elevations of 300 m in favorable areas. This species has not been found associated with any other member of the Aurites Group. Females have been collected biting man in the shade during the day.

DISTRIBUTION. Endemic to Jamaica, where it appears to have a rather restricted distribution, primarily at higher elevations.

JAMAICA. *Kingston and St. Andrew*: Ferry and vicinity (702). Hardwar Gap (647). Newcastle (125,337,338,677,679-682). *Manchester*: Hope Farm, 1 Jan 1946, G.A. Thompson, 2 lpM, 1 lM, 1 lpF, 1 lP; 1 Oct 1946, G.A. Thompson, 1 P [USNM].

Material Examined: 145 specimens; 24 males, 33 females, 44 larvae, 44 pupae; 36 individual rearings (7 larval, 22 pupal, 7 incomplete).

49. *Aedes* (H.) *grabhami* Berlin

Figs. 86,87

1906. *Howardina aureostriata* Grabham, 1906a:171-173. TYPE: Syntypes males, females, larvae, pupae, Newcastle (St. Andrew), Jamaica, elev. 4000 ft, Col. Loscombe and Miss Maclaverty [NE]. Name *aureostriata* preoccupied in *Aedes* by *aureostriatus* (Doleschall, 1857) and *aureostriatus* (Leicester, 1908).
1969. *Aedes* (*Howardina*) *grabhami* Berlin, 1969:42-46. TYPE: Holotype male (JA 688-20) with associated larval and pupal skins and genitalia slide, Hope Farm (Manchester), Jamaica, elev. 1000 ft, 12 Nov 1966, O.G.W. Berlin [USNM].

Aedes (*Howardina*) *aureostriatus* in part of Bonne and Bonne-Wepster (1925:370-371).

Aedes aureostriatus in part of Howard, Dyar and Knab (1917:855-859); Dyar (1918b:73,80); Johnson (1919:424); Gowdey (1926:73).

Howardina aureostriata of Theobald (1910:609-611).

Haemagogus aureostriatus of Dyar and Knab (1906b:166,167).

Aedes (*Howardina*) *inaequalis* in part of Thompson (1956:199-200); Stone, Knight and Starcke (1959:174); Porter (1967:38); Page (1967).

Aedes inaequalis in part of Thompson (1947:78).

Aedes (*Howardina*) *aurites* in part of Dyar (1928:236); Edwards (1932:155); Lane (1953:720-722).

Aedes aurites in part of Hill and Hill (1945a:2; 1948:42-43).

FEMALE (fig. 87). Wing about 2.2 mm. Essentially similar to *aurites* but smaller in size and differing conspicuously in the following features. Submedian and lateral patches of broad dark scales on vertex more extensive. Erect occipital scales

largely dark. Mesonotal dark scaling less dense but more extensive, light lines usually distinctly narrower, outer dorsocentral line usually not merging with lateral marginal line anteriorly so that fossa has numerous dark scales; lateral marginal line usually narrower but including area above paratergite which contains at most 3 dark scales. Lateral scutellar lobes with a few narrow golden scales only. Lower *ssp* with small patch of silvery scales; silvery patches separate on base of *pra*, upper *stp* and lower *stp*. Midtarsus with a few white scales on segments 1 and 2; hindtarsus with moderate rings on segments 1-3.

MALE. Essentially similar to female in ornamentation. Sexual characters as in *aurites*.

MALE GENITALIA (fig. 87). As figured; apparently indistinguishable from other members of *Aurites* Group.

PUPA (fig. 87). Chaetotaxy as figured; extremely similar to *aurites* from which it can be distinguished by hair 2-VI being distinctly mesad or at level of 3-VI.

LARVA (fig. 86). Chaetotaxy as figured. In general similar to *aurites* as described above; with the following conspicuous diagnostic features. Head hair 5-C single. Thoracic and abdominal stellate hairs usually with fewer branches than in *aurites*. Abdominal hair 2-VII small and single. Siphon index about 6.8-8.5. Gills about 1.5 of saddle length, subequal.

SYSTEMATICS. *Aedes grabhami* is another distinct species of the *Aurites* Group which was erroneously synonymized, as *aureostriatus*, with *inaequalis* by Thompson (1947:48, 1956:199-200). Berlin (1969:42-46) described *grabhami* as a new species rather than a substitute name for *aureostriatus*, because the types of the latter are lost. However, there is no doubt that the 2 nominal species represent the same taxon.

As pointed out by Berlin (loc. cit.), there is considerable variation in the adults of *grabhami* in the width of the golden longitudinal mesonotal lines. There are also a few specimens in which the mesonotum is almost completely golden except for a few dark scales in indistinct narrow longitudinal lines. In these individuals the hindtarsal markings are restricted to segments 1 and 2. As Berlin suggested, these specimens may represent a distinct species or possibly hybrids between *grabhami* and *stenei*, which frequently occur together. This material is provisionally retained under *grabhami* because of similarity in other features.

BIONOMICS. Immature stages of *grabhami* are found in both terrestrial and epiphytic bromeliads, apparently frequently in association with *stenei* and some species of the *Hirsuta* Group of *Wyeomyia*. It is not known, however, if this association extends to the use of the same individual axil. Next to *stenei*, this is the most common species of the *Aurites* Group and its females attack man readily with a peak of activity at about 1700 hours.

DISTRIBUTION. Endemic to Jamaica, where it is widespread and common, especially at elevations between 30 m and 550 m.

JAMAICA. *Clarendon*: Balcarres (902A). *Hanover*: Lethe (667). *Kingston and St. Andrew*: Ferry and vicinity (702). Hermitage Dam Rd (319,723,725,765,854,892). Kingston and vicinity, M. Grabham, 1 M [USNM]. Newcastle, 14-15 mi from Kingston on rd to (648). *Manchester*: Hope Farm (354,356,684,686-688); July 1945-Jan 1946, G.A. Thompson, 3 lpM, 4 lpF, 2 lM, 2 lp, 2 M, 2 F, 6 L [USNM]. Mandeville, 5 Mar 1928, Pickering, 5 F [USNM]. Melrose Hill (630-632,655,656,658). *Portland*: Sherwood Forest (706,708). *St. Ann*: Faiths Pen (762). Mon-eague and vicinity (375,376,378,731-735,758,763,764,771-774,776). Mount Diablo (380). *St. James*: Reading (669,670,676). *St. Mary*: Broadgate (643). *St. Thomas*: Leith Hall (689). Windsor Forest, rd to (650-652A). *Parish not Specified*: 1944, R.B. Hill, 1 M; 1 Jan 1946, G.A. Thompson, 7 L; M. Grabham, 1 lp; G.A. Thompson, 1 M, 2 F [USNM].

Material Examined: 1223 specimens; 172 males, 385 females, 293 larvae, 373 pupae; 298 individual rearings (69 larval, 198 pupal, 31 incomplete).

50. *Aedes* (H.) *inaequalis* (Grabham)

Figs. 88,89

1907. *Howardina inaequalis* Grabham, 1907:25-26. TYPE: Lectotype male with genitalia slide, Kingston, Jamaica, M. Grabham [USNM; designation of Stone and Knight, 1956a:219].

Aedes (*Howardina*) *inaequalis* in part of Thompson (1956:199-200); Stone, Knight and Starcke (1959:174); Porter (1967:38); Page (1967); Berlin (1969:46-49, *in toto*).

Aedes inaequalis in part of Thompson (1947:78).

Howardina inaequalis of Theobald (1910:611).

Aedes (*Howardina*) *aurites* in part of Dyar (1928:236); Edwards (1932:155); Lane (1953:720-722).

Aedes aurites in part of Hill and Hill (1945a:2; 1948:42-43).

Aedes (*Howardina*) *aureostriatus* in part of Bonne and Bonne-Wepster (1925:370-371).

Aedes aureostriatus in part of Howard, Dyar and Knab (1917:855-859); Dyar (1918b:73,80).

FEMALE (fig. 88). Wing about 2.4 mm. In general similar to *aurites* and *grabhami* and differing conspicuously in the following features; indistinguishable from *stenei*. Submedian and lateral patches of broad dark scales on vertex more extensive. Erect occipital scales largely dark. Mesonotal dark scaling less dense but much more extensive; mesonotal light lines faint and much narrower, outer dorsocentral line not merging with lateral marginal anteriorly so that fossa is largely dark scaled; lateral marginal line narrow throughout, not including area above paratergite which contains dark scales only. Lateral scutellar lobes with a few narrow golden scales. *Apn* silvery patch distinctly smaller than in *aurites* and *grabhami*; other pleural scale patches as in *grabhami*. Tarsal markings as in *grabhami*.

MALE. Essentially similar to female in ornamentation. Sexual characters as in *aurites*.

MALE GENITALIA (fig. 88). As figured; apparently indistinguishable from other members of *Aurites* Group.

PUPA (fig. 88). Chaetotaxy as figured; as described for *aurites*; differing from the latter and *grabhami* by the lightly pigmented lateral area on metanotum and from *stenei* by the absence of the triangular darkening on the anterior abdominal segments.

LARVA (fig. 89). Chaetotaxy as figured. In general similar to *aurites* as described above; with the following conspicuous diagnostic features. Head hair 5-C usually double, rarely single. Thoracic and abdominal stellate hairs usually with fewer branches than in *aurites*. Abdominal hair 2-VII small and single. Siphon index about 4.25-5.3. Gills markedly unequal, ventral about 0.65 of dorsal, latter at most subequal to dorsal saddle length.

SYSTEMATICS. In recent years, following Thompson's (1947:78; 1956:199-200) unwarranted synonymies, *inaequalis* has been treated in a very broad sense to include *aurites* and *grabhami* (as *aureostriatus*). Berlin (1969:46-49) demonstrated that Grabham's *inaequalis* is distinct in all stages from these species but cannot be separated in the adults from Thompson's *stenei*. We agree with Berlin's interpretation and regard *inaequalis* as a distinct species restricted in breeding to treeholes

and occasionally rockholes and crabholes. In view of these generalized breeding sites, this species may represent the primitive stock from which the 3 other species of the Aurites Group, all bromeliad breeders, were derived.

BIONOMICS. *Aedes inaequalis* is the only member of the Aurites Group that does not breed in bromeliads. Its immature stages are found primarily in treeholes and cut or broken bamboo but may also occur occasionally in rockholes and crabholes. It has been found associated with all the other species with similar breeding sites but its common associate in treeholes appears to be *Aedes (F.) mediovittatus* and in bamboo, *Wyeomyia (W.) nigrifubus*.

Females of *inaequalis* probably bite man as do other members of the Aurites Group and are probably included in the *stenei-inaequalis* group in Berlin's data on the biting activity since the 2 species cannot be differentiated (Berlin, 1969:fig. 7).

DISTRIBUTION. Endemic to Jamaica, where it occurs from near sea level to elevations of about 330 m.

JAMAICA. *Clarendon*: Goshen (352,602). Mocho (603). *Kingston and St. Andrew*: Constant Spring (327,408,696). Ferry and vicinity (369). Hermitage Dam (390). Hermitage Dam Rd (109, 280,288,290,292-294,296,298,300,302-304,306-309,321,325,326,330,331,397,826). Mount Salus (780). Temple Hall (250-252). *Manchester*: Hope Farm (634). *Portland*: Blue Hole (916,917). Port Antonio (924). Sherwood Forest (711,713,715). *St. Catherine*: Rio Cobre Dam (351,372, 373,605). Zion Hill (822). *St. Mary*: Castleton Botanical Gardens (258). Port Maria (173). *St. Thomas*: Folly Bay (103). Grants Pen (412). *Westmoreland*: New Roads (901). *Parish not Specified*: Jan 1940, ? W.H. Komp, 1 M, 2 F [USNM].

Material Examined: 599 specimens; 60 males, 86 females, 351 larvae, 102 pupae; 86 individual rearings (30 larval, 47 pupal, 9 incomplete).

51. *Aedes (H.) stenei* Thompson

Figs. 90,91

1956. *Aedes (Howardina) stenei* Thompson, 1956:196-199. TYPE: Holotype male (45090211) with associated larval skin and male genitalia slide, near Hope Farm, just above Porus, on road to Mandeville, Manchester (as Clarendon), Jamaica, elev. about 1000 ft, Sept 1945, G.A. Thompson [USNM].

Aedes (Howardina) stenei of Stone, Knight and Starcke (1959:174); Porter (1967:38); Berlin (1969:49-52).

Aedes aurites in part of Hill and Hill (1945a:2; 1948:42-43).

Aedes n.sp. of Thompson (1947:78).

FEMALE. Wing about 2.6 mm. Apparently indistinguishable from *inaequalis*; differing from *aurites* and *grabhami* in the same features as *inaequalis*.

MALE. Essentially similar to female in ornamentation. Sexual characters as in *aurites*.

MALE GENITALIA (fig. 91). As figured; apparently indistinguishable from other members of Aurites Group.

PUPA (fig. 91). Chaetotaxy as figured; as described for *aurites*; differing from all members of the group by the triangular darkening of the anterior abdominal segments.

LARVA (fig. 90). Chaetotaxy as figured. In general similar to *aurites* as described above; with the following conspicuous diagnostic features. Head hair 5-C usually with 4 branches (3-5). Thoracic and abdominal stellate hairs developed

about as in *aurites*. Abdominal hair 2-VII a stellate tuft with 4-7 spikes. Siphon index about 5.8-6.7. Gills slightly less than 2.0 of saddle length, subequal.

SYSTEMATICS. *Aedes stenei* is undoubtedly a distinct species in the Aurites Group, although it is indistinguishable from *inaequalis* in the adults. It is immediately recognized from all the other species of the group by the stellate nature of hair 2 on abdominal segment VII of the larva. Its affinity with *inaequalis* is also indicated by the similarity in the pupal stage.

There is a suggestion of possible rare hybridization or introgression between *stenei* and *grabhami*, which frequently occur together (see *grabhami*).

BIONOMICS. Immature stages of *stenei* are known only from terrestrial and epiphytic bromeliads, usually associated with *grabhami* and sometimes with species of the Hirsuta Group of *Wyeomyia*. This association may not extend to the utilization of the same individual axil, however. *Aedes stenei* appears to be the dominant member of the Aurites Group.

Berlin (1969:51) believes that the majority of the females of the *stenei-inaequalis* complex which he observed to feed on man were actually *stenei*. They showed a peak of activity at about 1700 hrs (Berlin, 1969:fig. 7).

DISTRIBUTION. Endemic to Jamaica, where it is widespread between elevations of about 330 m to 760 m.

JAMAICA. *Hanover*: Lethe (666). *Kingston and St. Andrew*: Hermitage Dam Rd (318,319, 392,723,725,854,855). Kingston and vicinity, 15 Sept 1906, M. Grabham, 1 M [USNM]. Mavis Bank, M. Grabham, 1 M [USNM]. Mount Salus (779). Newcastle, 14-15 mi from Kingston on rd to (648). Rockfort (952,957). Shooters Hill, 3 Dec 1946, G.A. Thompson, 2 F [JAM]. Stony Hill, 16 Sept 1946, G.A. Thompson, 1 F [JAM]. Temple Hall (646). *Manchester*: Hope Farm (240-242,355,661,685,688); Sept 1945-Jan 1946, G.A. Thompson, 2 lpM, 5 lpF [USNM]. Melrose Hill (630-632,655,658). *Portland*: Port Antonio (925). Sherwood Forest (706,708,710). *St. Ann*: Faiths Pen (762). Fern Gully (930). Moneague and vicinity (375,376,607,731-734,758, 763,764,771-774,776); 1943, R.B. Hill, 1 F [USNM]. Mount Diablo (380,381). *St. Catherine*: Bog Walk (914). Dove Hall (820). *St. Elizabeth*: Maggotty (791). *St. James*: Reading (699-671, 673,674,676). *St. Mary*: Broadgate (643). *St. Thomas*: Port Morant (729). Windsor Forest, rd to (650-652). *Parish not Specified*: New Park, June 1929, C.D. Williams, 1 F [BM]; Apr 1906, M. Grabham, 1 F; 1944, R.B. Hill, 4 M, 1 F; Jan 1940, W.H. Komp, 2 M; R.B. Hill, 1 M, 4 F [USNM].

Material Examined: 1501 specimens; 226 males, 395 females, 388 larvae, 492 pupae; 371 individual rearings (102 larval, 227 pupal, 42 incomplete).

Subgenus STEGOMYIA

52. *Aedes* (S.) *aegypti* (Linnaeus)

Figs. 1,92,93

1762. *Culex aegypti* Linnaeus, 1762:470. TYPE: Neotype female (0325 B/14) with associated larval and pupal skins, Kuala Lumpur, Selangor, Malaya, Sept 1957, W.W. Macdonald [BM; designation of Mattingly, Stone and Knight (1962:208-219)]. Name and neotype validated under plenary powers by International Commission on Zoological Nomenclature (1964:246).

For complete synonymy see Stone, Knight and Starcke (1959:178-180).

Aedes (*Stegomyia*) *aegypti* of Dyar (1920b:204; 1928:239-241); Carpenter and LaCasse (1955: 261-263); Christophers (1960); Porter (1967:38) and numerous other authors. *Aedes aegypti* of Hill and Hill (1945a:2; 1948:41-42); Thompson (1947:78).

Aedes argenteus of Howard, Dyar and Knab (1917:824, footnote); Johnson (1919:424); Gowdey (1926:73).

Aedes calopus of Howard, Dyar and Knab (1917:824-840).

Stegomyia fasciata of Theobald (1901a:289-295; 1905a:19-20); Grabham (1906a:167).

Stegomyia fasciata var. *mosquito* of Theobald (1905a:20).

FEMALE (fig. 1). Wing about 3.0 mm. Medium-sized dark species with contrasting silvery ornamentation on head, thorax, legs and abdomen; easily recognized by the silvery scales on the clypeus and the more or less continuous silvery line on the mesonotum from the humeral angle to the scutellum, broadened and crescentic in the area of scutal angle and suture. *Head*: Decumbent scales all broad, flat except along narrow silvery orbital line; scales silvery on median longitudinal line from interocular space to back of occiput, on sides and below, separated by patches of dark scales. Erect scales restricted to occiput, all pale. Clypeus with large patch of silvery scales on each side of median line. Proboscis dark. Palpus 4-segmented; segment 3 with silvery scales above. Antennal torus with large mesal and external patches of silvery scales. *Thorax*: Mesonotal scaling predominantly dark, with distinctive pattern of light scales as follows: (1) a more or less continuous silvery line from humeral angle to near scutellum, narrow anteriorly where scales are narrow, broadened and crescentic in area of scutal angle and scutal suture where scales are broader, narrow along outer posterior dorsocentral line, (2) a patch of narrow elongate silvery scales on anterior promontory, (3) a very narrow outer acrostichal line of very narrow yellowish scales from about level of end of patch on anterior promontory to near the anterior border of prescutellar space, (4) a small median patch of very narrow whitish scales at anterior end of prescutellar space, (5) a very narrow lateral prescutellar line of narrow whitish scales, and (6) a transverse patch of broadened whitish to silvery scales in front of wing root, sometimes extended caudad by narrower whitish scales along supraalar line. Paratergite with broad silvery scales. Acrostichals developed only on anterior promontory; anterior dorsocentrals well developed, displaced laterad toward fossa. Scutellum with broad flat silvery scales on all lobes, median lobe with similar dark scales in distal part. *Apn* with large patch of broad silvery scales. *Ppn* with large patch of broad silvery scales becoming narrower dorsad and with some narrow dark in upper part; a separate patch of a few broad silvery scales in lower part of *ppn*. Remaining pleural scaling broad and silvery, present on: *pst*, *ppl*, middle lower *ssp*, *pra*, upper *stp*, lower posterior *stp*, upper *mep* and middle *mep*. *Legs*: Coxae with large patches of silvery scales. Trochanters and base of femora pale scaled. Anterior surfaces of femora varied from predominantly dark with line of pale scales on lower surface to predominantly pale and whitish with dark scaling largely restricted to dorsal line and distal part of anterior surface, variously extended basad. Knee spots silvery, conspicuous on all legs. Tibiae dark. Foretarsal and midtarsal segments 1 and 2 with short basal white or silvery dorsal patches or rings; hindtarsal segments 1-3 with short to moderate basal silvery rings, segment 4 usually silvery for more than 0.5, segment 5 entirely silvery. Claws of foreleg and midleg with submedian tooth; hindclaws simple. *Wing*: Dorsal scales dark except for small silvery patch at base of costa. *Haltere*: Largely pale. *Abdomen*: Tergite I largely pale scaled except for basolateral dark patches; laterotergite with silvery scales. Tergites II-VII with narrow basal transverse white bands usually involving 1 row of scales on apex of preceding segment; large lateral patches of silvery scales on all segments, usually not visible from above. Sternites II-IV largely pale scaled, IV with dark scales later-

ally, V,VI predominantly dark with pale scales basally and in middle, VII dark except for small subapical lateral silvery patch.

MALE (fig. 1). Essentially as in the female except for sexual characters. Palpus subequal to proboscis in length, slightly upturned; silvery scales present dorsally on base of segment 2, a basal ring on segment 3, and small basal ventral patch on segments 4 and 5; segment 4 with a few short bristles. Antennal flagellum moderately densely long plumose. Claws of foreleg and midleg enlarged and unequal; larger claw of foreleg with broad sharp submedian tooth, all others simple. Tergites with lateral silvery patches smaller, hairs short and not very numerous, sternites more extensively dark scaled.

MALE GENITALIA (fig. 92). Markedly different from indigenous species of *Aedes*. *Segment IX*: Tergite short in middle, with very conspicuous projecting, more or less triangular lateral lobe with straight outer margin and laterally diverging inner margin. *Sidepiece*: Short and broad; without basal tergomesal lobe. *Claspette*: Appressed to and occupying most of mesal surface of sidepiece; with numerous simple straight setae and a sternal row of flattened setae, 2 or more with sinuous attenuate apex. *Clasper*: Rather short and heavy, hollowed out on inner surface in distal half; spiniform short and slender, slightly subapical. *Phallosome*: Aedeagus slender except for slightly bulbous base; distal sternal part with broad lateral denticles leading to dense tergal apical patch of slender blunt spicules. *Proctiger*: Basolateral sclerotization very broad and with poorly developed tergal lobe, articulated with paraproct sclerotization; latter very broad, covering entire lateral surface, with uniform dorsal extension and a long projecting sternal arm; apex of paraproct not developed into tooth; cercal setae absent.

PUPA (fig. 92). Chaetotaxy as figured. Readily distinguished from indigenous *Aedes* by hair 6-C longer than 7-C and paddle margins with strong sharp spicules. *Cephalothorax*: Moderately pigmented, darkened on mesonotum and appendage cases; hairs usually all single or double. *Trumpet*: Uniformly moderately to strongly pigmented, contrasting; short and with large pinna. *Metanotum and Abdomen*: Moderately pigmented on posterior segments, darkened on anterior; all hairs except 1-I and 9-VIII single or with a few branches; 2-II-VIII usually laterad or in line with hair 1, never strongly mesad; 9-III-VI thickened and elongate. Posterolateral angle of segment VIII rounded. *Paddle*: Moderately pigmented; midrib strong, distinct to base of hair 1-P. Margins with distinct sharp spicules. *Terminal Segments*: Female cercus broad, only slightly projecting distad of genital lobe.

LARVA (fig. 93). Readily differentiated from indigenous species of *Aedes* by the long sharp spine on the tubercles of the mesothoracic and metathoracic pleural groups (9-12-M,T); anal saddle incomplete and without long spicules on its caudal margin. *Head*: Labrum poorly developed dorsally, without projection at base of hair 1-C; maxillary suture complete, short, convex laterally; collar moderately developed. Hairs 4,6-C far forward toward anterior border, 4-C multiple, long, anterior to 6-C; hairs 5,6-C long, single; 14-C removed from anterior margin; 15-C in anterior half of labial plate. *Antenna*: Short, slender, uniform; shaft without spicules. Hair 1-A single, submedian. *Thorax*: Hair 13-P absent; common basal tubercles present only on pleural groups (9-12) and 6,7-M, those of 9-12-M,T with sharp spine at least as long as base of tubercle. *Abdomen*: Hair 6-I,II usually triple or with 4 branches, rarely double on II; hair 6-III-V usually double or triple; 7-I long, double or single, 7-II shorter, usually double. *Segment VIII*: Comb in a single irregular row of 7-12 scales with long median spine and strong basal denticles. *Siphon*: Uniformly moderately pigmented; index about 2.0; acus not developed.

Pecten usually in basal 0.5; usually of 10-12 teeth with distinct main spine and usually 1 or 2 basal denticles. *Anal Segment*: Saddle narrowly incomplete; lightly pigmented; without spinelike spicules on caudal margin; hair 1-X on caudal margin; acus not developed. Ventral brush with 5 pairs of hairs, grid bars indistinct or absent on proximal 1 or 2 pairs. Gills long, rounded apically.

SYSTEMATICS. The ubiquitous and universally known *aegypti* is an African species now widely distributed throughout the world within the 20° C isotherms, usually in close association with human settlements. It can easily be recognized by the characters given in the keys and diagnoses above. We have made no attempt to analyze the extensive variation present in the Jamaican population in the adult ornamentation and the chaetotaxy and other features of the immature stages.

BIONOMICS. This tropicopolitan mosquito is a major domestic pest in Jamaica as elsewhere. It breeds in a wide variety of artificial containers, both out of doors and in houses, although it possibly has a preference for small containers (tin cans, flower vases, tires). In Jamaica it is not uncommon in treeholes and has been found in bamboo stumps and once in a rockhole. We also have a number of records of immature stages from ground pools, ditches and stream beds but these are almost certainly all due to laboratory contamination and cannot be regarded as natural breeding sites.

Females bite man at any time during the day indoors and in shady places. During periods of rain following dry spells they can be a very great nuisance.

Aedes aegypti is the classical vector of the virus of Yellow Fever and Dengue.

DISTRIBUTION. Tropical, subtropical and warm temperate regions of the world.

JAMAICA. Very common throughout the island, largely in vicinity of settlements.

Material Examined: 665 specimens; 106 males, 145 females, 226 larvae, 188 pupae; 139 individual rearings (57 larval, 61 pupal, 21 incomplete).

GENUS HAEMAGOGUS

Adults of the genus *Haemagogus* are brilliantly colored day-flying mosquitoes that resemble sabethines in scaling, reduction of thoracic and abdominal chaetotaxy and development of a very large *apn* lobe. They can be separated from sabethines by the base of the hindcoxa being distinctly ventrad of the meron (instead of in line with it) and the absence of spiracular bristles. They can be immediately differentiated from other New World genera of the Aedini by the very dense flat metallic thoracic scaling and the absence of all mesonotal bristles except those of the anterior promontory and supraalar area. The immature stages resemble closely those of some treehole breeding species of *Aedes* of the subgenera *Finlaya* and *Ochlerotatus* and can be separated from these with some difficulty by the combination of characters given in the keys.

In Jamaica only 1 species, belonging to the subgenus *Longipalpifer*, is known. This species, *equinus*, has a wide reported distribution from the Rio Grande valley in Texas southward through Mexico, Central America, Panama to at least northern South America and through the Guianas. It is not known anywhere in the West Indies outside of Jamaica but it may be present on at least the island of Hispaniola which shares with Jamaica a number of relict species. However, the report of larvae of *Haemagogus* from Cuba collected in bromeliads by Montchadsky and Garcia (1966:46-47) cannot pertain to *equinus* on the basis of the characters mentioned by these authors. These characters suggest rather a species of the subgenus *Howardina* of *Aedes*.

53. *Haemagogus* (L.) *equinus* Theobald

Figs. 94,95

1903. *Haemagogus equinus* Theobald, 1903b:282-283. TYPE: Holotype female, Old Pound Rd, Kingston, Jamaica, 24 Aug, M. Grabham [BM].
1906. *Aedes affirmatus* Dyar and Knab, 1906b:164. TYPE: Lectotype female, Salina Cruz, Oaxaca, Mexico [USNM, 10023; designation of Dyar, 1921b:103, see Stone and Knight, 1955:287]. Synonymy with *equinus* by Howard, Dyar and Knab (1917:871,875).
1906. *Aedes philosophicus* Dyar and Knab, 1906c:190,195. TYPE: Lectotype larval skin (295b) with associated male and genitalia slide (330), Tehuantepec, Oaxaca, Mexico [USNM; designation of Dyar, 1921b:103, see Stone and Knight, 1955:288-289]. Synonymy with *equinus* by Howard, Dyar and Knab (1917:871,874-875).

Haemagogus (Longipalpifer) equinus of Levi-Castillo (1951:attached Erratus and p. 12-13,31-33); Stone, Knight and Starcke (1959:215-216); Forattini (1965b:48-53); Porter (1967:38).

Haemagogus (Cyanocops) equinus of Lane (1953:802-806).

Haemagogus (Stegoconops) equinus in part of Dyar (1921b:102-103); Edwards (1932:179).

Stegoconops equinus of Howard, Dyar and Knab (1913b:fig. 162).

Cacomyia equinus of Coquillett (1906b:25); Theobald (1907:554-556; 1910:494).

Haemagogus equinus of Theobald (1905a:37; 1905b:37); Howard, Dyar and Knab (1917:871-875); Johnson (1919:424); Dyar (1925c:138-139); Gowdey (1926:74); Hill and Hill (1945a:2; 1948:49); Thompson (1947:79); Horsfall (1955:535).

FEMALE. Wing about 3.0 mm. A rather small species with smooth, dense, brilliant metallic thoracic scaling and reduced chaetotaxy; abdomen very long; legs predominantly dark. *Head*: Decumbent scales dark greenish blue except for narrow orbital border and large connected lateral silvery patch. Proboscis very long and slender, about 1.3 of forefemur; labium dark scaled. Palpus short, about 0.13 of proboscis; 4-segmented, segment 4 minute; scaling dark with deep violet reflections. *Thorax*: Mesonotal scaling very dense and smooth, predominantly deep bronzy with coppery, greenish blue and olivaceous reflections except for patch of blue scales over supraalar bristles and silver scales in antealar area and over paratergite; bristles developed only on anterior promontory and supraalar area. Scutellum with similar but more bluish scales. *Apn* lobe very large, projecting dorsomesad but not meeting mate across midline, densely covered with silver scales; *ppn* densely covered with scales, dark in upper part, silver in lower; remainder of pleuron largely densely covered with silver scales; *sp*, *psp*, upper *stp* and lower *mep* bristles absent. *Legs*: Coxae and trochanters with silver scales. Remainder of all legs dark scaled with deep purple or violet reflections except for basal part of lower surface of forefemur and midfemur, nearly 0.7 of anterior, lower and posterior surfaces of hindfemur, and inconspicuous knee spots of midfemur and hindfemur which are light scaled, usually dingy or slightly yellowish silver. Foreclaws and midclaws with premedian tooth. *Wing*: Dorsal scales all dark, deep blue with violet reflections. *Haltere*: Stem light; knob dark scaled. *Abdomen*: Laterotergite and side of tergite I with silver scales, remainder of tergite I dark scaled; tergites II-VIII predominantly dark blue with violet reflections with conspicuous lateral silver patches, complete on II, basal on III-VII, becoming progressively smaller on distal segments, some silver basal scales dorsally usually forming basal transverse incomplete or complete bands on IV-VII. Sternites II-VII predominantly dark scaled, with silver scales at base. Tergite VII strongly produced caudad.

MALE. Essentially similar to female in ornamentation. Palpus very slender; about

0.6-0.65 of proboscis length; apex of terminal and subterminal segments with a few short stiff bristles. Antennal flagellum densely plumose. Claws of foreleg and midleg enlarged, unequal, all with premedian or subbasal tooth.

MALE GENITALIA (fig. 94). *Segment VIII*: Tergite about 0.5 of sternite; distal margin widely and shallowly emarginate, with a large patch of long, specialized scales in the middle. *Segment IX*: Tergite unsclerotized in the middle except slightly on distal margin, which is narrowly but deeply emarginate on midline; lobe indicated only by 2 or 3 setae on side of emargination. *Sidepiece*: Elongate; with distinct complete mesal membrane. Basal tergomesal lobe not prominent, bearing numerous flattened attenuate setae of varying sizes and short simple setae. Distal sternomesal area with large patch of long striated scales as figured. Scales numerous on ventral and lateral surfaces and extending conspicuously to basal 0.5 of outer tergal area (not shown in figure). *Claspette*: Stem narrow near base; distal part widened and with thin membranous flaps projecting dorsad and ventrad from body of stem, the 2 flaps joined apically on inner surface of stem around the basal part of the filament. Basal part of filament greatly expanded and with lateral (external) sclerotized supporting ribs; distal part with broad thin posterior flap overlying a slightly convoluted anterior margin; apex narrowed. *Clasper*: Short, relatively simple; spiniform very long and slender. *Phallosome*: Aedeagus with median dorsal process. *Proctiger*: Broad at base, narrowed distally. Apex of paraproct with broad curved striated process not a spine. Cercal setae variable, 2-8.

PUPA (fig. 94). Chaetotaxy as figured, not studied in detail. Apparently only nonhairy form present in Jamaica. *Cephalothorax*: Moderately unevenly pigmented; hairs usually all single except 4,5-C, all weak except 1-C. *Trumpet*: Strongly evenly pigmented; strongly broadened from near base. *Metanotum and Abdomen*: Moderately rather evenly pigmented, lighter distad. Metanotal hairs 10-12-C usually all single, rarely 10-C double. Float hair 1-I varied, usually comparatively sparsely branched; with strongly differentiated primary branches. Hairs of abdominal segments II-VI all weak except 3-II,III and 5-IV-VI; all dorsal hairs usually single except 4 and rarely 1. *Paddle*: Midrib conspicuous, strongly pigmented; paddle hair 1-P strong.

LARVA (fig. 95). Chaetotaxy as figured, not studied in detail. Apparently only nonhairy form present in Jamaica. *Head*: Head capsule rounded in outline; uniformly moderately to strongly pigmented, with slightly darker collar. Labrum poorly developed, not visible from dorsal aspect. Maxillary suture complete, with conspicuous extension laterocaudad of posterior tentorial pit to a lateral pitlike area near collar base. Hair 1-C blunt, frequently with a few minute broad spinules; 6-C usually distinctly flattened in middle part. *Antenna*: Slender, short and without well developed spicules. Hair 1-A single, submedian. *Thorax*: Hairs 1-3-P on common tubercle; 5-7-P on separate poorly developed tubercles; 6,7-M on common tubercle. Prothoracic pleural group (9-12-P) poorly developed; 13-P absent. *Abdomen*: Hairs 1,2,5,9 all weakly stellate on I-VI, also 4-II, 7-II-V, 10-VI, 11-I, 13-I-V. Hair 6-I,II usually triple, 6-III-VI double; 7-I single. Hair 12-I present. Hair 3-VII very strong, single, extending well beyond base of siphon. *Segment VIII*: Comb scales about 8-10, in a single row; individual scales with large basal sclerotized portion and a single sharp minutely fringed spine. *Siphon*: Evenly moderately to strongly pigmented. Short, index about 2.5; slightly tapered in distal 0.5. A small detached acus present. Pecten of about 8-15 teeth in a rather even straight row in basal half, sometimes proximal teeth not developed; distal teeth with main spine and 1-3 basal denticles. Hair 1-S usually double or triple. *Anal Segment*: Saddle

incomplete, extending only about halfway around segment; moderately to strongly pigmented; caudolateral area with patch of sharp simple teeth. Hair 1-X usually double, longer than saddle; 2-X usually with 4-6 branches; 3-X single. Ventral brush with 5 pairs of hairs on grid with poorly developed lateral sclerotization. Gills short, unequal.

SYSTEMATICS. There is no question as to the identity of the Jamaican population since *equinus* was originally described from Jamaica. This population of *equinus* appears to be fairly uniform although there is considerable variation in the amount of silver scaling on the abdominal tergites and a limited amount in the chaetotaxy of the larva and the pupa, which are of the nonhairy type.

We have seen material of what appears to be *equinus* from Mexico, Guatemala, El Salvador, Honduras, Nicaragua, Costa Rica, Panama and Guyana. This agrees well with the Jamaican population except for the presence of hairy forms of the larva and pupa, particularly in Mexico. In the hairy forms, the setae are much more strongly developed and with numerous branches, producing such a strikingly different facies to the specimens that they appear to belong to a different species. In many populations both hairy and nonhairy immature stages are frequently present together and both give rise to identical adults. It is possible that hairy immatures will be discovered in some areas of Jamaica not as yet sampled.

Haemagogus equinus has also been reliably reported from near Brownsville, Texas, by Trapido and Galindo (1956) and the records from Colombia, Venezuela, Trinidad, Tobago, Surinam and French Guiana are probably also correct. We have no information to substantiate or refute the records from Brazil and Bolivia (Stone, Knight and Starcke, 1959:215).

BIONOMICS. All our collections of immature stages of *equinus* are from tree-holes but Hill and Hill (1948:49) report collecting larvae in bamboo stumps. In our collections the most frequent associate was *Aedes (F.) mediovittatus*; less frequently associated were *Aedes (H.) inaequalis* and *Corethrella (C.) appendiculata* and once each *Aedes (S.) aegypti*, *Orthopodomyia waverleyi* and *Toxorhynchites (L.) portoricensis*.

This species has seldom been collected in Jamaica but may be more common than suspected in some areas during favorable periods of rainfall. Females were taken in several biting-landing collections near Rockfort in August 1968.

Haemagogus equinus has been shown experimentally to be able to transmit Yellow Fever virus.

DISTRIBUTION. Jamaica (type locality), Texas, Mexico, Guatemala, El Salvador, Honduras, Nicaragua, Costa Rica, Panama, Colombia, Venezuela, Trinidad, Tobago, Guyana, Surinam, French Guiana; also reported from Bolivia and Brazil.

JAMAICA. Probably more widespread than present records indicate. *Kingston and St. Andrew:* Constant Spring (327,328,696,699); May 1945, R.B. Hill, 1 M, 1 F [UCLA]. Hermitage Dam (391). Kingston and vicinity, May 1945, R.B. Hill, 1 M, 2 F, 3 L [USNM]. Rockfort (948,951, 952,957-959). *St. Mary:* Broadgate (407). *St. Thomas:* Grants Pen (410,412); 6 Sept 1964, T.H. Farr, 2 F [JAM]. Poor Mans Corner, 13 Dec 1959, T.H. Farr, 1 F [JAM]. *Parish not Specified:* June 1945, R.B. Hill, 1 F [USNM].

Material Examined: 114 specimens; 9 males, 44 females, 38 larvae, 23 pupae; 20 individual rearings (8 larval, 8 pupal, 4 incomplete).

TRIBE SABETHINI

The tribe Sabethini in the New World is most readily recognized in the larval

stage, by the presence of only 1 pair of hairs in the ventral brush of the anal segment. The pupae are characterized by the following combination of characters: (1) abdominal hairs 9-VII, VIII subequal, both large and with numerous branches, (2) paddle small and without hairs, and (3) hair 1-IX not developed. The adults have the base of the hindcoxa in line with the base of the meron or slightly above it; the meron is very small and the postnotum bears some setae and also sometimes scales.

The tribe is represented in Jamaica by 2 genera, (1) *Limatus* by *hoffmani* and (2) *Wyeomyia* by at least 9, possibly as many as 11, species. We have included in the keys the 2 other genera reported from the Greater Antilles, (1) *Sabethes* (*S.*), known by *bipartipes* Dyar & Knab, 1906 from the Dominican Republic; this relict species is probably endemic to the Greater Antilles and may occur in Jamaica but its records from Panama, Ecuador, the Guianas and Brazil are undoubtedly erroneous, and (2) *Trichoprosopon* (*Runchomyia*), with a doubtful record of *longipes* (Fabricius, 1805) from Cuba by Lane (1953:857), Stone, Knight and Starcke (1959:76) and Porter (1967:39).

Members of this tribe breed exclusively in containers, in Jamaica primarily in bromeliads. Of great interest is the development of a flock of endemic species of *Wyeomyia* in Jamaica, comparable to but more complex than the situation in the Aurites Group of the subgenus *Howardina* of *Aedes*. None of the members of the tribe is known or has been suspected of being involved in disease transmission. The only species commonly attracted to man is *Wyeomyia mitchellii*.

GENUS WYEOMYIA

Wyeomyia is the dominant genus of the Sabethini in the West Indies as well as elsewhere in the New World tropics. In Jamaica, the adults can be recognized from *Limatus* by the relatively dull color of the mesonotal scales; this character separates them also from *Sabethes* and the absence of erect scales on the head will distinguish them from the species of *Trichoprosopon* (*Runchomyia*). The larvae lack an apical spine on the maxilla and are separated from the very similar *Limatus* by a longer and narrower caudolateral slit in the head capsule as indicated in the generic key. No reliable characters for the separation of pupae of *Wyeomyia* from other sabethine genera are evident at this time but perhaps the characters in the key may be applicable in the Greater Antilles.

We have placed all the Jamaican species in the subgenus *Wyeomyia* for the present as the subgeneric classification of the genus by Lane and Cerqueira (1942) and Lane (1953) does not appear to be a natural one but cannot be modified without a thorough study of the immature stages of the numerous phyletic lines which is beyond the scope of this study.

There are at least 9, possibly as many as 11, species of *Wyeomyia* in the material we have examined from Jamaica. Four more or less distinct phyletic lines are represented: (1) the Caracula Group by *nigritubus*; originally described from Panama and also reported from Mexico, this bamboo breeder was formerly known in Jamaica as *caracula* Dyar & Nunez Tovar, 1927, a species originally described from Venezuela; the group is so distinct from the other species of *Wyeomyia* in Jamaica that it should eventually be placed in a different subgenus; (2) the Pertinans Group by the topotypic population of *mitchellii*, a species with a wide range of breeding sites including bromeliads, aroids and heliconias; (3) the Vanduzeei Group by the

bromeliad breeding *vanduzeei* which is also found throughout the Greater Antilles and in southern Florida; and (4) the endemic bromeliad breeding Hirsuta Group consisting of a flock of 6 to 8 species, the previously described *hirsuta*, 5 new species (*luna*, *stellata*, *corona*, *juxtahirsuta* and *atrata*) and 2 unnamed forms (*Jamaican forms A and B*) which may or may not be distinct species.

The Hirsuta Group is apparently endemic to Jamaica and derived by local radiation from a stock in common with the Vanduzeei Group. The data that support this are: (1) *vanduzeei*, of the 3 species of Jamaican *Wyeomyia* that have extralimital distributions, is clearly most closely related (showing the greatest number of significant homologous similarities) in the following respects: (a) general chaetotaxy of larva and pupa, (b) hairs on the larval siphon characteristically differentiated into at least 3 series, (c) clasper lobes of the male genitalia completely homologous, with lobes A and E characteristically developed; (2) no other described species of *Wyeomyia* is as closely related and although the clasper lobes can be completely homologized with those of *celaenocephala* Dyar & Knab, 1906 (and the related *smithii* (Coquillett, 1901) and *haynei* Dodge, 1947), lobe A is short and rounded rather than elongate and lobe E is closely associated with lobe M rather than lobe A, and the siphonal hairs of the larva are not differentiated in the same fashion; (3) 2 or 3 unnamed bromeliad breeding species from Puerto Rico (form A known from female and associated pupal skin; form B from female and form C from larvae only, probably the same species as form A) show similarities with the Hirsuta Group, especially in the extremely depressed head capsule and spiculose body of the larva; however, the form of the individual body spicules and the chaetotaxy of the larva are quite different, and the pupal trumpets are not flattened, suggesting convergence with the Hirsuta Group; thus the Puerto Rican group may also be derived by local radiation from a stock in common with the Vanduzeei or even the Pertinans Group. Further clarification of the origin and affinities of the Hirsuta Group may be obtained when the *Wyeomyia* fauna of the rest of the Greater Antilles is better known, particularly of Cuba and Hispaniola where no species similar to the Hirsuta Group are known at present.

The Hirsuta Group is distinguished from the Vanduzeei Group by the following derived features and tendencies, assuming *vanduzeei* characters to be primitive: (1) female with anterior pronotal lobe metallic blue or violet; midtarsi dark; (2) male genitalia with the stem of clasper becoming longer and narrower; (3) pupa with the trumpet extremely flattened and often laterally expanded; and (4) larva with at least the anal saddle and siphon spiculose, usually entire body spiculose; head capsule tending to become strongly depressed; comb scales becoming longer, more pointed and less conspicuously fringed; head hairs 4-7-C multibranched and dendritic; antennal hair 1-A multiple; prothoracic hairs 2,3-P on common tubercle; abdominal hair 6-I,II more strongly branched.

Within the Hirsuta Group, 3 phyletic lines can be recognized, which may represent radiation from 2 or even 3 separate stocks: (1) the Luna Subgroup consisting of 1 highly specialized species, an early derivative from the ancestral stock and easily characterized by a number of unique features as indicated in the systematic discussion under this species; (2) the Stellata Subgroup consisting of *stellata*, *corona* and possibly *Jamaican form A* which are quite distinct from one another in all stages but are clearly related on the basis of the following: (a) male genitalia with clasper lobe A apically enlarged and bearing a comblike structure, (b) pupa with hair 5-V,VI long and conspicuously barbed, and (c) larva with stellate hairs well developed, maxilla with the long subapical seta usually multiple, hair 2-I-VII lateral

and cephalic in position, 8-VI well cephalad of 9-VI and little or not at all ventrad, and siphonal hairs mostly long, strongly barbed and arranged in 2 nearly straight lines; (3) the Hirsuta Subgroup consisting of *juxtahirsuta*, *hirsuta*, *atrata* and possibly *Jamaican form B* which are indistinguishable as adult females (except form B) and with the male genitalia of *hirsuta* and *atrata*, and the larvae of *juxtahirsuta* and *hirsuta* very similar; distinguished from the Stellata Subgroup by the following: (a) male genitalia with clasper lobes simpler, less setose and lobe A narrowed apically, (b) pupa with hair 5-V,VI shorter and not barbed, and (c) larva with stellate hairs moderately developed, hair 2-I-VII mesal and caudal in position, 8-VI directly ventrad of 9-VI or slightly cephalad and ventrad, and siphonal hairs shorter, unbarbed and arranged in 2 very irregular lines. The adults of the species of the Hirsuta Group are insufficiently known to establish diagnostic adult subgroup characters.

The species of the Hirsuta Group are largely sympatric, there being no apparent pattern to geographic or altitudinal distribution; however, the number of collections is too small to be sure, especially for *luna* and *corona*. There is some indication of specific preference for a certain bromeliad genus as a breeding site: (1) *juxtahirsuta*, *hirsuta* and *stellata* are associated only with each other and the ubiquitous *mitchellii* (6 lots), and are recorded only from *Hohenbergia* (5 lots), with the exception of a single pupal rearing of *hirsuta* from *Heliconia*; (2) *atrata* is associated only with *mitchellii* and is recorded only from *Tillandsia* (2 lots); (3) *luna* is not found in association with other *Wyeomyia* and is recorded only from *Aechmea* (1 lot); (4) *corona* and *vanduzeei* are associated only with each other (1 lot); (5) particularly suggestive are 3 lots collected at the same time in the same general area, JA 723 (*stellata*, *juxtahirsuta* and *hirsuta* in *Hohenbergia*), JA 724 (*mitchellii* and *atrata* in *Tillandsia*) and JA 725 (*stellata* and *hirsuta* in *Hohenbergia*).

Two other species have been reported in the past from Jamaica and are still listed in the world catalog as occurring on this island (Stone, Knight and Starcke, 1959). The record of *grayii* Theobald, 1901 by early workers and the subsequent records of *pertinans* (Williston, 1896) with which *grayii* was synonymized by later authors undoubtedly all refer to *hirsuta* or some other related dark legged form; these records are listed under *hirsuta* in our treatment. The record of *pampithes* (Dyar & Nunez Tovar, 1928) in our opinion pertains to the true male of *hirsuta* and is also discussed under that species.

To recapitulate, we are proposing the following groups and subgroups for the species of *Wyeomyia* recorded here from Jamaica:

Caracula Group

54. *nigritubus*

Pertinans Group

55. *mitchellii*

Vanduzeei Group

56. *vanduzeei*

Hirsuta Group

Luna Subgroup

57. *luna*

Stellata Subgroup

58. *stellata*

59. *Jamaican form A*60. *corona*

Hirsuta Subgroup

61. *juxtahirsuta*62. *hirsuta*63. *atrata*64. *Jamaican form B*

The *Wyeomyia* fauna of the remainder of the northern Antilles (Greater Antilles and the Bahamas) is very poorly known. We have seen material of only 4 or 5 species not represented in Jamaica. Whenever material was available we have included these species in the keys and have provided brief descriptions in the text as follows: (1) *bahama* Dyar & Knab, 1906 from the Bahama Islands and eastern Cuba, and *sororcula* Dyar & Knab, 1906 from the Dominican Republic, under *vanduzeei* of our treatment, and (2) 2 or 3 unnamed species from Puerto Rico, in the discussion of the Hirsuta Group above. The records of the following species from this area we consider erroneous. We have not been able to trace the original source of the record of *autocratica* Dyar & Knab, 1906 from the Bahamas (Stone, Knight and Starcke, 1959:84; Porter, 1967:39) but no specimens even faintly resembling this South American species are known from the West Indies. The recent records of *ulocoma* (Theobald, 1903) from the Dominican Republic (Lane, 1953:975; Stone, Knight and Starcke, 1959:88; Porter, 1967:40) are all based on a report by Dyar and Knab (1906c:229) and actually pertain to *mitchellii* of our treatment (see).

Adults of *Wyeomyia* are notoriously difficult to identify on the basis of ornamentation alone. The most obvious characters are white markings on the tarsi; these are not always reliable because of considerable variation and also because of sexual dimorphism in some species. The same difficulties are encountered with the markings on the underside of the labium. Considerable use is made of the color of the scales on the anterior pronotal lobe (*apn*) which is quite reliable but varies with the angle of observation. All the scales referred to in our keys and descriptions of all parts of the body as being "dark" without other qualifying statements exhibit the following range of colors depending on the angle of observation with respect to the horizontal plane of the structure: rust, gold, green, blue, violet and matt brown or black; the more acute the angle of observation (90° – 0°) the more brilliant the color; casually observed these "dark" scales appear dull bronzy and only careful observation of individual scales reveals the colors described above.

The clasper of the male genitalia in all Jamaican species is provided, as in most other species of *Wyeomyia*, with variously developed lobes which are among the most reliable diagnostic specific characters. In the past there has been no uniformity in describing these lobes which present very different configurations depending on the angle of observation with the result that apparently homologous lobes in related species have been described as different structures. We have attempted to develop for the purpose of this study a homologous terminology which is labelled in all the illustrations and have figured two sides of the clasper head. Of the 31 valid species of *Wyeomyia* (*Wyeomyia*) listed in the world catalog (Stone, Knight and Starcke, 1959:77-82) for which the male genitalia are known, 17 species (*abebela* Dyar & Knab, 1908, *celaenocephala* Dyar & Knab, 1906, *charmion* Dyar, 1928, *gaudiens* Dyar & Nunez Tovar, 1928, *gausapata* Dyar & Nunez Tovar, 1927, *haynei* Dodge, 1947, *hirsuta* (Hill and Hill, 1946), *medioalbipes* Lutz, 1904, *melan-*

opus Dyar, 1919, *mitchellii* (Theobald, 1905), *pertinans* (Williston, 1896), *scotinomus* (Dyar & Knab, 1907), *simmsi* (Dyar & Knab, 1908), *smithii* (Coquillett, 1901), *stonei* Vargas & Martinez Palacios, 1953, *telestica* Dyar & Knab, 1906 and *vanduzeei* Dyar & Knab, 1906) have clasper lobes which can be definitely homologized at least in part, and to which the terminology used here applies. In addition, at least as many species again, largely belonging to the *Pertinans* Group and either undescribed or incorrectly synonymized, also have homologous clasper lobes. Of the 9 Jamaican species of *Wyeomyia* for which the male genitalia are described all but 1 (*nigritubus*) have clasper lobes which can definitely be homologized. Considering the clasper in an extended position, projecting caudad more or less in a straight line with the sidepiece as it develops in the pupa, the lobes are as follows: (1) **lobe A** ("outer arm" of Dyar, 1928:37,39,40,43-46, for *scotinomus*, *gausapata*, *quasiluteoventralis*, *mitchellii*, *guatemala* and *simmsi*; "inner arm" of Dyar, 1928:39, for *gaudians*), the most tergal lobe, typically slender, narrowed apically and bearing 1-3 small spiniforms apically and subapically; well developed in all Jamaican species but small or not clearly differentiated in others (*simmsi*, *melanopus*), or apically enlarged in some (*Stellata* Subgroup); (2) **lobe M** (variously "main lobe", "central arm", "disk", "mid arm", "middle part", "bulb" of Dyar, 1928:37-46), the large median lobe, variously shaped, always bearing characteristic patterns of setae and often partially subdivided; present in all species; (3) **lobe E**, arising between lobes A and M, roughly digitiform, bearing setae at apex and having a longitudinal membranous flap extending tergal; always clearly differentiated in the *Hirsuta* and *Vanduzeei* Groups but absent or undifferentiated from lobe A or M in the *Pertinans* Group and the *celaenocephala-haynei-smithii* complex; (4) **lobe C** ("core-arm" of Dyar, 1928:37,39,40,43-46, for *scotinomus*, *gaudians*, *gausapata*, *quasiluteoventralis*, *mitchellii*, *guatemala* and *simmsi*), arising from the sternal margin of lobe M near the base, usually large and strongly recurved, bent mesad and bearing characteristic patterns of hairlike or spinelike spicules; present in all but a few species (*melanopus*); (5) **lobe B** ("inner arm" of Dyar, 1928:39,40,43-45, for *gausapata*, *quasiluteoventralis*, *mitchellii* and *guatemala*; "outer arm" of Dyar, 1928:39, for *gaudians*) arising from the sternal margin of lobe M just distad and laterad of the origin of lobe C; small, stemmed, bent mesad and with enlarged apex bearing characteristic patterns of hairlike or spinelike spicules; diagnostic of the *Pertinans* Group, absent in all other species; (6) **lobe M'**, arising from sternoapical corner of lobe M and bearing characteristic patterns of setae; present only in certain species of the *Pertinans* Group (*mitchellii*, "*medioalbipes*").

KEYS TO SPECIES

ADULTS

(58. *stellata* and 60. *corona* not included;
Puerto Rican form C unknown)

1. Wing with plume scales broad on branches of radius and media, ligulate only on Rs and M (fig. 102); male palpus white scaled 54. *nigritubus*
- Wing with plume scales ligulate on all branches of radius and media (fig. 102); male palpus dark scaled 2

- 2(1). Anterior pronotal lobe (*apn*) covered only with silver-white scales, often with violet reflections 3
Apn partially covered with dark scales, often with pronounced blue and violet reflections, light-colored scales confined to upper or lower ends. . . . 7
- 3(2). Labium white scaled on ventral surface for at least basal 0.8 of its length; silver-white scales of *apn* with violet reflections (Hirsuta Subgroup) . . . 4
 Labium entirely dark scaled; silver-white scales of *apn* without violet reflections (Vanduzeei Group) 5
- 4(3). Hindtarsus with short streaks of white scales on base of posterior surface of all segments **64. Jamaican form B**
 Hindtarsus usually completely dark, at most with faint narrow line of white scales on posterior surface of segment 1 and 2 or 1-3
 **61. juxtahirsuta; 62. hirsuta; 63. atrata**
- 5(3). Abdominal tergite VIII completely dark scaled or nearly so (see **56. vanduzeei**) *sororcula*
 Abdominal tergite VIII completely white scaled or nearly so 6
- 6(5). Midtarsus conspicuously white scaled on anterior surface from apex of segment 2 or base of 3 to apex of 4 or base of 5 **56. vanduzeei**
 Midtarsus with white scalation on anterior surface absent or indistinct but probably white scaled on posterior surface for full length in male (see **56. vanduzeei**) *bahama*
- 7(2). Midtarsus conspicuously white scaled on anterior surface from apex of segment 2 or base of 3 to apex of 4 or 5 8
 Midtarsus dark scaled on anterior surface but often white scaled on posterior surface for full length in male 11
- 8(7). Hindtarsus completely dark scaled 9
 Hindtarsus with basal streak of white scales on all segments 10
- 9(8). Anterior pronotal lobe (*apn*) with dark scales without gold in addition to blue and violet reflections, lower end with silver-white scales
 **55. mitchellii** (in large part)
Apn with dark scales with gold in addition to blue and violet reflections, lower end without silver-white scales (see Hirsuta Group under genus)
 *Puerto Rican form A*
- 10(8). *Apn* with silver-white scales on lower end . . . **55. mitchellii** (in small part)
Apn without silver-white scales on lower end (see Hirsuta Group under genus) *Puerto Rican form B*
- 11(7). Labium entirely dark scaled; anterior pronotal lobe (*apn*) with lower end white scaled **57. luna**
 Labium white scaled on ventral surface from base to near tip; *apn* with lower end dark scaled **59. Jamaican form A**

MALE GENITALIA

(59. and 64. Jamaican forms A and B, *bahama* and *Puerto Rican*
forms A, B and C unknown)

1. Ninth tergite lobe usually with 6-8 (5-9) thick pointed setae, progressively longer laterad (fig. 96); aedeagus with median sternal plate well sclerotized and smoothly rounded on apical (posterior) margin (fig. 97) 54. *nigritubus*
Ninth tergite lobe usually with 2-4 (1-5) thick pointed setae, subequal or progressively shorter laterad (fig. 96); aedeagus with median sternal plate membranous and laterally fringed near apex (fig. 99) 2
- 2(1). Lobe B (small, stemmed, with globular head bearing many very fine short hairlike spicules) and lobe M' (prominent, bearing about 12 heavy short hooked setae and a very long apical seta) present on head of clasper (fig. 99) 55. *mittchellii*
Lobe B and lobe M' not developed 3
- 3(2). Apex of paraproct with dense patch of about 20-40 setae 4
Apex of paraproct with only 2-5 scattered setae, or setae absent 5
- 4(3). Lobe C of clasper with apex straight and the apical arm shorter than the recurved basal arm (fig. 113) 63. *atrata*
Lobe C with apex bent and the apical arm longer than the recurved basal arm (fig. 111) 62. *hirsuta*
- 5(3). Lobe A of clasper tapered from near base, not apically enlarged (fig. 109) . 6
Lobe A apically enlarged (fig. 105) 9
- 6(5). Lobe M of clasper without patch or fringe of long hairlike spicules near base on sternal side (fig. 109) 7
Lobe M with patch or fringe of long hairlike spicules near base on sternal side (figs. 101 and 103) 8
- 7(6). Lobe C of clasper twice recurved, in middle and at apex (fig. 109)
. 61. *juxtahirsuta*
Lobe C only once recurved, at extreme apex (see 56. *vanduzeei*). . *sororcula*
- 8(6). Patch of long hairlike spicules on lobe M of clasper forming a longitudinal fringe with spicules of varying lengths (fig. 103) 57. *luna*
Patch of long hairlike spicules on lobe M forming a very dense tuft with all spicules subequal (fig. 101) 56. *vanduzeei*
- 9(5). Recurved lobe C of clasper with a small patch of short hairlike spicules on elbow only (fig. 107) 60. *corona*
Recurved lobe C with fringe of long hairlike spicules on elbow and inner limb, and another small patch of short spicules in middle of outer limb (fig. 105) 58. *stellata*

PUPAE

(59. and 64. Jamaican forms A and B, *bahama* and
Puerto Rican forms B and C unknown)

1. Hair 5-C with 2-5 branches; 9-VIII longer than paddle; integument golden, without pattern on dorsum **54. nigrifubus**
Hair 5-C single; 9-VIII shorter than paddle; integument with at least a faint pattern in yellow or brown on dorsum. 2
- 2(1). Paddle fringed with long filamentous spicules on outer and part of inner margins. **55. mitchellii**
Paddle spicules short, seldom filamentous 3
- 3(2). Dorsal intersegmental sclerites absent; trumpet brown mottled with dark brown; dorsum with iridescent markings **57. luna**
Dorsal intersegmental sclerites present; trumpet not mottled; dorsum without iridescent markings 4
- 4(3). Abdomen with middorsal stripe on segments I to VI or VII, never broader than 0.3 width of segment **61. juxtahirsuta**
Abdomen with dorsal markings extending to lateral margins on at least one segment 5
- 5(4). Abdomen with clearly defined dorsal pattern in medium to dark brown including all, or all but lateral margins, of segments II, III and center of IV to V or VI; trumpet laterally expanded **62. hirsuta**
Abdomen with poorly defined dorsal pattern in medium to light brown, not exactly as above; trumpet not laterally expanded. 6
- 6(5). Well-developed dorsal intersegmental sclerites following tergites II and III only 7
Well-developed dorsal intersegmental sclerites following tergites II to IV or V 9
- 7(6). Abdominal tergite I with a mottled brown pattern extending to lateral margins **56. vanduzeei; sororcula**
Abdominal tergite I almost completely light, only a small light brown area in center near posterior margin. 8
- 8(7). Abdominal hair 5-IV-VI double (see Hirsuta Group under genus)
. *Puerto Rican form A*
Abdominal hair 5-IV-VI single **60. corona**
- 9(6). Tergite II with extreme anterolateral corner dark, tergites III and IV with dark pattern extending to lateral margins. **63. atrata**
Tergite II with extreme anterolateral corner light, tergites III and IV with dark pattern not extending to lateral margins **58. stellata**

LARVAE

(59. and 64. Jamaican forms A and B, *bahama* and
Puerto Rican forms A and B unknown)

1. Head hair 14-C at least 0.6 length of head capsule; comb scales usually less than 20, in an irregular line **54. nigrītubus**
 Head hair 14-C never more than 0.4 length of head capsule; comb scales usually more than 20, in a straight line 2
- 2(1). Thorax and abdomen with integument completely glabrous or with only minute spicules on the most caudal abdominal segments 3
 Thorax and abdomen with integument completely or largely covered with conspicuous spicules 7
- 3(2). Abdominal hairs 6-IV-VI double, 1-3-X all single **57. mitchellii**
 Abdominal hairs 6-IV-VI single, 1-3-X never all single 4
- 4(3). Head hairs 4-7-C all single; siphon and anal segment only very minutely spiculate 5
 Head hairs 4-7-C never all single; siphon and anal segment spiculate, long spicules on caudal margin of anal saddle 6
- 5(4). Prothoracic hair 5-P with 5 or 6 branches; siphon with dorsolateral hairs double, less often single or triple **56. vanduzeei**
 Prothoracic hair 5-P with 3 or 4 branches; siphon with dorsolateral hairs 3,4-branched, less often with 2 or 5 branches (see **56. vanduzeei**)
 *sororcula*
- 6(4). Head hair 14-C single; abdominal hair 2-I-VII short and single **57. luna**
 Head hair 14-C with 3-6 branches; abdominal hair 2-I-VII longer, multi-branched and stellate **58. stellata**
- 7(2). Head hairs 4-6-C single and unbarbed; abdominal hairs 6-I,II double or triple, 6-III-VI double, 9-I-VII single (see Hirsuta Group under genus)
 *Puerto Rican form C*
 Head hairs 4-6-C with 1-6 main branches, barbed to dendritic; abdominal hairs 6-I,II with 6-10 branches, 6-III-VI single, 9-I-VII multibranched and stellate 8
- 8(7). Head hair 14-C with 7-12 branches; siphon with 9-12 short multibranched hairs in a subapical cluster **60. corona**
 Head hair 14-C with 2-6 branches; siphon without subapical cluster of hairs, all siphonal hairs single or less often double 9
- 9(8). Head hair 11-C with 8-17 branches; abdominal hair 1-X with 3-6 branches
 **63. atrata**
 Head hair 11-C with 3-7 branches; abdominal hair 1-X double 10
- 10(9). Prothoracic hair 5-P with thornlike barbs; thorax and abdomen with mid-

- dorsal and midventral stripes where integumentary spicules are greatly reduced or absent. 61. *juxtahirsuta*
 Prothoracic hair 5-P with normal hairlike barbs; thorax and abdomen with middorsal and midventral spicules only slightly shorter than lateral spicules 62. *hirsuta*

54. *Wyeomyia* (W.) *nigritubus* Galindo, Carpenter & Trapido

Figs. 96,97,98,102

1951. *Wyeomyia* (*Wyeomyia*) *nigritubus* Galindo, Carpenter and Trapido, 1951:89-91. TYPE: Holotype male with slides of genitalia and associated larval and pupal skins, La Victoria, Cerro Azul (Panama), Panama, elev. 2100 ft, 27 Apr 1950 [USNM].

Wyeomyia (W.) *nigritubus* of Lane (1953:890-892); Vargas (1956:35); Stone, Knight and Starcke (1959:80).

Wyeomyia (W.) *caracula* in part of Lane (1953:896-898); Stone, Knight and Starcke (1959:78); Porter (1967:36, *in toto*).

Wyeomyia caracula of Hill and Hill (1945a:2; 1945b:296-299; 1948:33-34); Thompson (1947:79).

FEMALE (fig. 102). Wing about 2.8 mm. Medium-sized species, largest of the Jamaican *Wyeomyia*; *apn* with dark scales on about upper two-thirds concolorous with those on head and mesonotum, silver-white scales on about lower third and small spot of whitish scales on upper end; both mid and hindtarsi with well-developed white markings; wing with plume scales broad on branches of radius and media, ligulate only on Rs and M. *Head*: Covered with broad decumbent scales only; dark on disc of vertex, silver-white on sides extending mesad in narrow line for variable short distance along orbital margin and white in a very small spot, occasionally obsolete, in center of vertex on anterior margin. Interorbital setae yellowish. Interocular space, frons, torus and clypeus without scales, brownish and somewhat pruinose. Proboscis about 0.8-0.9 of forefemur; apex enlarged slightly more than in *hirsuta*. Labium completely dark scaled or with variable narrow ventral line of white scales from near base to about 0.8. Palpus dark scaled, slightly longer than clypeus and about 0.12 of proboscis; apparently 2 segmented, basal segment minute. Antenna about 0.8-0.9 of proboscis. *Thorax*: Mesonotum densely covered with moderately broad dark scales except for variable small number of whitish scales in center on anterior margin and along lateral margin above paratergite, largely overlapping it. Scutellum covered with scales concolorous with those on mesonotum but somewhat broader. Postnotum rounded, a broad median keel slightly developed; a patch of pale yellow hairs in center at posterior end of keel; a few inconspicuous whitish scales usually present just cephalad of setae. Pleuron densely and uniformly covered with broad silver-white scales except for the following: *apn* which is partially dark scaled as described above, and anteroventral margin of *stp*, paratergite, meron and metapleuron which are without scales. Pleural chaetotaxy reduced; only following pale yellow bristles present: *apn* (several), *sp* (1-3), *ppl* (2 or 3), *pra* (2-4), lower *stp* (3 or 4), and upper *mep* (11-15). *Legs*: Coxae and trochanters largely covered with silver-white scales. Femora and tibiae largely dark scaled on anterior surface and white scaled on posterior surface. Fore, mid and hindtarsi usually with faint narrow line of white scales on posterior surface

from base of first segment for variable distance along segment 1 and sometimes 2. Foretarsus otherwise dark. Midtarsus conspicuously white scaled on anterior surface from about middle or apical third of segment 2 to apex of 4 or base of 5. Hindtarsus with variable inconspicuous streak of white scales on anterior surface from base to near apex on both segments 4 and 5. Tarsal claws small, subequal, simple. *Wing* (fig. 102): Scallation all dark. Plume scales broad on branches of radius and media, ligulate on Rs and M. *Haltere*: Stem white; knob with ventral surface white scaled, dorsal surface dark scaled. *Abdomen*: Tergites completely dark scaled; sternites completely white scaled; line of demarcation between dark and light areas more or less straight.

MALE (fig. 102). Essentially as in female but with the following differences. *Head*: Clypeus whitish. Labium white scaled on dorsal surface for short variable distance at base; ventral surface with line of white scales from base to about 0.8. Palpus entirely white scaled, very slightly shorter and narrower than in female. *Legs*: Fore and midtarsi with line of white scales on posterior surface for full length. Midtarsus completely white scaled from about middle of segment 2 to apex of 5; midtarsal segments 4 and 5 proportionately slightly wider and shorter than in female, with specialized setae and tufts of scales; midtarsal claws unequal, one minute, the other enlarged, simple and strongly curved (fig. 102). Hindtarsus as in female except white markings on segments 4 and 5 longer and more conspicuous.

MALE GENITALIA (figs. 96,97). *Segment VIII*: Tergite with posterior margin slightly emarginate in center, bordered from near center to lateral margin with band of dense long setae; cephalad of setae a diagonal band of dense long narrow scales, from center of posterior margin to middle of lateral margin. Sternite with single row of setae on posterior margin behind a wide band of scales. *Segment IX*: Tergite lobe with single row of usually 6-8 (5-9) thick pointed setae, progressively longer laterad, apices bent slightly laterad; interlobular bar short and more or less straight. Sternite about twice as wide as long, posterior projection with sides sclerotized and apex membranous. *Sidepiece*: Length 3.0-3.5 of greatest width; apical quarter bent slightly tergal. Tergal surface with 3 very long setae (*tergal triad*) inserted on closely placed tubercles about one-third distance from base; 1 very long seta (*long lateral*) inserted on tubercle on lateral surface almost 0.5 distance from base, always lost soon after eclosion. Lateral and sternal surfaces, distad of insertion of tergal triad, with many scattered scales and short setae. *Mesal Plate*: Roughly quadrangular with scattered short setae in center; outer posterior angle produced, bearing 1 or 2 longer setae. *Clasper*: Shorter than sidepiece. Stem long, narrow, about 0.8 of total length, bent slightly laterad in middle. Head as figured; lobes not positively homologized with those of other Jamaican species of *Wyeomyia*. Head primarily divided into 2 lobes, tergal and sternal. Sternal lobe with rounded apical portion (possibly homologous to lobe M) bearing about 12 short slender setae in a U-shaped pattern on its lateral surface; arising from sternal lobe immediately sternad of its attachment to stem is a long abruptly recurved arm (possibly homologous to lobe C) projecting parallel to stem for almost 0.5 of stem's length, bearing hairlike spicules on the elbow and along outer limb for less than 0.5 of distance to apex, and with the extreme apex abruptly recurved about 90°, slightly darker and comblike in appearance. Tergal lobe (possibly homologous to lobes A and E) larger, roughly rectangular, bearing a fringe of short slender setae on its long distal margin, a line of 5 or 6 slightly longer thicker setae on its internal sternal margin, 3 short often blunt spiniforms and a short hyaline conical process on its distal tergal angle, and a transverse line of about 13 closely appressed "scales"

on its lateral surface just below the distal margin and ending near the 3 spiniforms. *Phallosome*: Aedeagus broad, width about two-thirds of length; with a pair of submedian tergal arms joined at midline to form a tergal bridge, a pair of apical tergal arms bent towards each other but not joined, and a well sclerotized median sternal plate with a smoothly rounded apical (distal) margin. *Proctiger*: In lateral view, with triangular basal sclerotization attached at right angle to paraproct at base. Paraproct rodlike with 2 or 3 small apical teeth and no setae.

PUPA. (fig. 97). Chaetotaxy as figured, not studied in detail. In general similar to *hirsuta* except for the following features. *Cephalothorax*: Pigmentation uniformly pale golden. Hairs moderately pigmented; hair 5-C with 2-5 branches; 8-C weak and usually branched. *Trumpet*: Uniformly bright golden. Only slightly flattened and not laterally expanded; width of pinna only very slightly less than greatest width of meatus; more or less straight when viewed on edge. *Metanotum and Abdomen*: Pigmentation uniformly pale golden except for inconspicuous narrow light brown bands on venter at anterior margins of segments II-VII. Intersegmental sclerites absent. Integument almost completely smooth; very minute spicules present only on the more distal segments. Hairs moderately pigmented; hair 12-C usually single; 1-II relatively long and apically branched; 2-II relatively long and well laterad of 1; 2-III-VII near posterior margin; 5-IV-VI all slightly longer than following tergite; 6-I weak and single or branched; position of 6-II-VI variable, usually at level of hair 9 but may be posterior or even anterior; 7-II ventral; 9-VIII considerably longer than paddle. *Paddle*: Short, only slightly longer than segment VIII. Pigmentation pale golden. Margin smooth except for double row of minute spicules at apex. Index 1.4-1.7; tapered more or less evenly from near base, extreme tip slightly pointed. *Male Genital Lobe*: Extending to near tip of paddle; posteromesal corner prolonged into small digitiform lobe.

LARVA (fig. 98). Chaetotaxy as figured, but highly variable in length and branching of hairs. Entire body glabrous. All hairs and sclerotized portions pigmented pale to dark golden brown; stellate hairs and basal tubercles very poorly developed. *Head*: General outline squarish, without ocular bulge; length only slightly less than width, 0.80-0.95; head capsule relatively little depressed, lateral margin rounded. Labrum not distinct dorsally and without bulge at base of hair 1-C; mouthbrushes dense, filaments apically hooked, extreme lateral filaments straight. Mandible and maxilla normal, not enlarged or adapted for predaceous feeding, maxilla with the heavy subapical seta single, apex often minutely cleft; mental plate with 1 large central tooth and 6-9 pairs of small lateral teeth; maxillary suture complete, extending diagonally forward from posterior tentorial pit which is just cephalad of ventrocaudal margin of capsule. Collar essentially absent; foramen magnum less slitlike than in other Jamaican species of *Wyeomyia* but still extending dorsally almost to lateral margin of capsule; integument darkly pigmented on lateral corner and ventrolateral margin with collarlike sclerotization. Hairs 0,3-C small and ventral; 1-C thick and blunt, shorter than in other Jamaican *Wyeomyia*, inserted on anterior margin but usually bent ventrad; 4-6-C subequal, of moderate length, unbarbed and single or occasionally double; 4,6,7-C evenly spaced in straight line along anterior margin, 5-C well caudad; 7-C with 2-6 branches; 11-C with 7-12 branches; 12-C weak and with 1-3 branches; 13-C well out of line of 11-C and 12-C; hair 14-C with 8-18 branches and long, at least 0.6 length of head capsule. *Antenna*: Slender and slightly constricted near base. Hair 1-A short and single, inserted in apical 0.2-0.4. *Thorax*: Basal tubercles developed for following hairs and groups of hairs: 4-P; 5-7-P; 5,6-M; 7-T; 9-12-P,M,T; 13-T; narrow sclerotized bands

usually present connecting tubercles of 5-7-P and 9-12-P, and between 7-T, 9-12-T and 13-T; tubercle of 9-12-T large, with conspicuous annulus. Only hairs 8,14-P tending to be multibranched and stellate. Hair 4-P with 5-7 branches, barbed only finely near base and roughly 0.5 length of 5-P; hairs 5,12-P, 5,6,10,12-M, 10,12-T very long and single or double; 6-P, 9-M very long and with few branches; 7,9,10-P, 7,9,13-T very long and multibranched; 11-P,M,T relatively well developed and single; 13-P present between hairs 8 and 14, weak and with few branches; 14-M relatively long, typically with 4 or 5 branches. *Abdomen*: Hair 1-I,II short and with 1-4 branches, 1-III longer and with 1-5 branches, 1-IV-VII long and with 3-6 branches; 2-I-VII short and single or occasionally double, 2-I,II slightly cephalad of level of hair 6 and slightly laterad or at level of hair 1, hair 2-III-VII at about level of hair 6 and mesad of hair 1; hair 3-I-VII single, occasionally double, short except for 3-V which is long and 3-VII which is very long; 4-I-VII always short and usually multiple; 5-I short and single or double, 5-II,III,VII longer and 1-4 branched, 5-IV-VI long and with 2 or 3 branches; 6-I,II very long and with 3-5 branches, 6-III-VI very long and double or triple, 6-VII short and single to triple; 7-I,II very long and with 3-7 branches, 7-III-VII short and usually multiple; 8-II-VII very short and usually multiple, 8-II-VI always cephalad and slightly dorsad of hair 9, hair 8-VII directly ventrad of hair 9; hair 9-I-VII of moderate length and with 1-6 rigid and fairly thick branches; 10-I-VII, 12-II-VII, 13-VII typically single and short or moderate in length; 11-I of relatively moderate length and with 1-5 branches, 11-II-VII very short and with few branches; 13-I of moderate length and with 2-6 branches, 13-II-VI double or triple and long, subequal to length of segment, 13-VII short and single. *Segment VIII*: Comb scales usually 10-20 (8-25), highly irregular in shape and placement, in an uneven single or partially double lateral line; longest scale less than 0.10 mm long and less than 2.0 length of shortest scale; individual comb scales with short fringe at base and a pointed spine, not arched in side view. Hair 1-VIII of moderate length and multiple; 2,4-VIII of moderate length and single or double; 3-VIII short and multiple; 5-VIII usually longer and heavier than hair 4, single or double. *Siphon*: Index 3.0-4.0; ventral margin usually straight, dorsal margin usually slightly arched with widest point at about basal 0.3; apex 0.4-0.5 of basal width; integument light to dark golden brown, with or without dark basal ring. Siphonal hairs (1,1a-S) typically arranged as follows: (1) a pair of double or triple ventral hairs in about basal 0.3-0.4, about 0.5 length of siphon, (2) a pair of short single ventral hairs inserted in apical 0.3, and (3) 2 or 3 pairs of short single dorsal hairs. Hair 2-S laterally compressed, slightly sinuate, with a pointed apex, slightly shorter than width of apex of siphon and inserted on separate tubercle, not on body of siphon; valves small and colorless; 6,8,9-S very short and single; median caudal filament not apparent. *Anal Segment*: Saddle incomplete, extending just ventrad of hair 1-X; clearly defined, light to dark golden brown and with or without basal and apical dark bands. Hair 1-X very long, heavy and typically with 3-6 branches; 2-X slightly shorter than hair 3, heavy and typically with 6-9 branches; 3-X slightly shorter than hair 1, heavy and typically with 4 or 5 branches; 4-X of moderate length and typically with 8-11 branches. Gills subequal, sausage-shaped, typically about as long as siphon.

SYSTEMATICS. The Jamaican population, formerly reported as *caracula* Dyar & Nunez Tovar, 1927, described from Venezuela, is tentatively considered here to be conspecific with *nigritubus*, described from Panama. We know the true *caracula* only from the original description and the unique holotype examined by Belkin at the USNM and a male genitalia slide labeled "No. 122-1, Ven." The male geni-

talia of true *caracula*, *nigritubus* and the Jamaican form are all very similar except that *caracula* differs from the other 2 forms as follows: (1) clasper lobe ?C with extreme apex darker, more strongly recurved (about 110° vs 90°), recurved portion relatively longer, (2) clasper lobe ?C with outer limb spiculose to near apex instead of only from elbow to about half distance to apex, (3) tergal lobe with 2 relatively long blunt spiniforms and 1 short hyaline spiniform on its tergal angle instead of 3 short usually blunt spiniforms, and (4) IX tergite lobe with 4 or 5 instead of 6-8 spines. Although the immature stages of *caracula* are undescribed, the type male was said to have been bred from a larva collected from an epiphytic bromeliad; *nigritubus*, including the Jamaican population, is not known to breed in bromeliads at all and has been found primarily in bamboo. Topotypic *nigritubus* and the Jamaican form agree well in all stages except in the larva. In all the larval skins of the type series of *nigritubus* in the USNM the sclerotized areas are much darker and the hairs are more branched and usually shorter than in most Jamaican larvae. However, Jamaican larvae vary considerably in this respect, and a large series of Panamanian larvae are necessary to determine the importance of these differences.

The problem is further confused by a few additional specimens of forms close to *caracula* and *nigritubus*, as follows: (1) a male genitalia slide from "Empire, C.Z." with clasper lobes and IX tergite lobe essentially as in *caracula*, indicating that *caracula* and *nigritubus*, if distinct species, are probably sympatric; (2) two Trinidad forms, 1 from bamboo and 1 from a treehole, both with dark midtarsus (all other forms have white markings on the midtarsus), with genitalia of the *caracula* type except 1 specimen with a clasper tergal lobe of the *nigritubus* type. We have not seen any specimens of the species reported as *nigritubus* from Pueblo, Mexico, by Vargas (1956:35) but have no reason to doubt this identification. It is possible that the Jamaican form is a distinct species, but until further collections have been made, it seems best to consider it conspecific with *nigritubus*. All the forms mentioned above we are segregating into a well marked *Caracula* Group. This group shows some affinities with *arthrostigma* (Lutz, 1905) and *apronoma* Dyar & Knab, 1906 in the immature stages, but is quite distinct in the adults and male genitalia.

BIONOMICS. In Jamaica the immature stages of *nigritubus* have been found primarily in bamboo internodes (broken, cut, or uncut with small hole); the only exception is a collection of 4 larvae in a large treehole. Our collections were at elevations of from 20 to 480 m, but Hill and Hill (1948:34) report altitudes up to 2500 ft (761 m). Panamanian *nigritubus* also breeds in bamboo internodes (Galindo, Carpenter and Trapido, 1951:90). In Jamaica, frequent associates of *nigritubus* are *Culex* (C.) *corniger*, *Aedes* (Steg.) *aegypti*, *Aedes* (H.) *walkeri* and *Aedes* (H.) *inaequalis*, and occasional ones *Aedes* (F.) *mediovittatus*, *Toxorhynchites* (L.) *portoricensis* and *Corethrella* (C.) *appendiculata*.

A few females have been taken in Jamaica in biting-landing collections.

DISTRIBUTION. Panama (type locality), Mexico and Jamaica.

JAMAICA. Known only from the eastern half of the island. *Clarendon*: Goshen (239). *Kingston and St. Andrew*: Hermitage Dam Rd (111,286,287,290,293-298,300-304,306-309,321,395,737); 19 Jan 1940, ? W.H. Komp, 1 F, 1 L [USNM]. *Mount Salus* (778). *Portland*: Devils Elbow (920). *Port Antonio* (923,924). *Sherwood Forest* (711-715). *St. Catherine*: Zion Hill (822,823). *St. Mary*: Castleton Botanical Gardens (258,259,311,312). *St. Thomas*: Dalvey (150). *Parish not Specified*: Jan 1940, W.H. Komp, 1 pM, 4 M, 3 F [USNM], 2 F [UCLA]; 10 Mar 1945, R.B. Hill, 2 M, 2 F [USNM]; R.B. Hill, 5 L [JAM].

Material Examined: 452 specimens; 72 males, 78 females, 165 larvae, 137 pupae; 133 individual rearings (54 larval, 65 pupal, 14 incomplete).

55. *Wyeomyia* (W.) *mitchellii* (Theobald)

Figs. 96,99,100,102

1905. *Dendromyia mitchellii* Theobald, 1905a:37-38. TYPE: Holotype female, Jamaica, 7 Jan 1904, M. Grabham [BM; see Belkin, 1968b:41].
1905. *Dendromyia jamaicensis* Theobald, 1905a:11. TYPE: Holotype female, same specimen as holotype of *mitchellii* [BM]. Inadvertent use of a different name in the key for the specimen described under the name *mitchellii* in the text.
1906. *Wyeomyia ochrura* Dyar and Knab, 1906c:229. TYPE: Lectotype larval skin (113.1) on slide with associated pupal skin and larval and pupal skins of another specimen (113.2), with associated fragmentary male with genitalia mounted on slide (365), near Santo Domingo City, San Domingo [Dominican Republic], 17 Aug 1905, A. Busck [USNM, 9987; designation of Stone and Knight, 1957b:124-125]. Synonymy with *mitchellii* by Howard, Dyar and Knab (1915:80).
1906. *Wyeomyia violescens* Dyar and Knab, 1906a:138. TYPE: Holotype female, Cayamas, Cuba, 8 June, E.A. Schwarz [USNM, 9991; see Stone and Knight, 1957b:126]. Synonymy with *mitchellii* by Dyar (1928:43); as insular form of *mitchellii* by Dyar (1924a:105).
1906. *Wyeomyia glaucocephala* Dyar and Knab, 1906a:140. TYPE: Holotype female (113), near Santo Domingo City, Santo Domingo [Dominican Republic], 17 Aug 1905, A. Busck [USNM, 9999; see Stone and Knight, 1957b:123]. Synonymy with *ochrura* by Dyar (1924a:105), as insular form of *mitchellii*; with *mitchellii* by Dyar (1928:43).
1908. *Wyeomyia abia* Dyar and Knab, 1908:67. TYPE: Lectotype female (4-2), Dominica, W.I. [Dominican Republic], F.E. Campbell [USNM, 11988; designation of Stone and Knight, 1957b:120]. Synonymy with *mitchellii* and correction of type locality by Belkin (1970a).
1909. *Wyeomyia antoinetta* Dyar and Knab, 1909b:263. TYPE: Holotype female (356.5) with genitalia slide (363), Estero, Florida, U.S.A., early May, 1906, J.B. Van Duzee [USNM, 12179]. Synonymy with *mitchellii* by Dyar (1919:133).

Wyeomyia (W.) *mitchellii* of Dyar (1922a:5-6; 1928:43-44); Edwards (1932:85); Lane and Cerqueira (1942:556-557; in part, not genitalia figure); Matheson (1944:255); Carpenter, Middlekauff and Chamberlain (1946:90-93); Lane (1953:902-903; in part, not genitalia figure); Carpenter and LaCasse (1955:66-68; in part); Perez Viguera (1956:420-427); Vargas (1956:35, at least in part); Stone, Knight and Starcke (1959:80; in part); Montchadsky and Garcia (1966:34); Porter (1967:36); Belkin (1970a).

Wyeomyia mitchellii of Howard, Dyar and Knab (1915:80-83); Johnson (1919:422); Gowdey (1926:74); Hill and Hill (1945a:2; 1948:34-35); Thompson (1947:79).

Wyeomyia violescens, *antoinetta*, *abia* and *glaucocephala* of Howard, Dyar and Knab (1915:79-80,83-85,113-115,136-137).

Wyeomyia abia of Dyar (1919:127-128).

Wyeomyia (W.) *quasiluteoventralis* in part of Dyar (1928:40-41); Edwards (1932:85); Lane and Cerqueira (1942:557-559).

Wyeomyia (W.) *medioalbipes* in part of Lane (1953:893-894); Stone, Knight and Starcke (1959:79); Bruijning (1959:103-109); Stone (1969:2-4).

Wyeomyia (D.) *ulocoma* in part (Dominican Republic record) of Dyar and Knab (1906c:229); Lane (1953:975); Stone, Knight and Starcke (1959:88); Porter (1967:40).

FEMALE (fig. 102). Wing about 2.5 mm. Essentially as described for *hirsuta* but with the following differences. Labium with narrow ventral line of white scales from near base to about 0.8; line may be discontinuous or obsolete. Palpus usually proportionately slightly longer than in *hirsuta*, slightly longer than clypeus and about 0.12 of proboscis. *Apn* with dark scales with blue and violet reflections, ex-

cept for silver-white scales on lower end and a few white scales on extreme upper end. Forefemur with anterior surface usually entirely dark scaled except for dorsal and ventral margins near base. Midtarsus conspicuously white scaled on anterior surface from about apical third of segment 2 to about middle of 5. Hindtarsus as in *hirsuta*, except for some specimens with a faint basal streak of white scales on posterior surface of each segment, becoming progressively shorter distad.

MALE (fig. 102). Essentially as in the female; with sexual differences as noted for male *hirsuta*, except midtarsus not white on posterior surface for entire length.

MALE GENITALIA (figs. 96 and 99). In general similar to *hirsuta* but with the following differences. *Segment VIII*: Tergite with both setae and scales longer, denser and more numerous. *Segment IX*: Sternite well developed, large and relatively well sclerotized, slightly longer than wide and smoothly rounded on posterior margin. *Sidepiece*: Only about apical fifth bent rather abruptly tergad. Tergal triad inserted about 0.3-0.4 distance from base of sidepiece; long lateral seta inserted about 0.8 distance from base. Numerous scattered scales and short setae present on lateral and sternal surfaces distad of insertion of tergal triad. *Mesal Plate*: Very roughly quadrangular, the longer differentiated seta inserted near lateral margin in center. *Clasper*: Stem narrow and slightly longer than head; without internal thumb-like process at base. Head as figured; 5 lobes developed: a large median lobe (M) and 4 smaller ones (A, B, C and M'). Lobe E apparently not developed, although it may be regarded as an undifferentiated part of lobe M. Lobes B and M' not developed in other Jamaican species, although present in many of the extralimital species in the *Pertinans* Group. Lobe M large and central in position, slightly emarginate distally, with short setae and 2 or 3 very long setae on distal margin; also a longitudinal line of 6 or 7 short setae on the sternomesal margin from middle to apex. Lobe M' a prominent, stemmed lobe arising from sternolateral corner of lobe M, bearing 2 rows (1 incomplete) of short heavy apically bent setae on its sternal margin, and a few short slender setae and a single very long slender seta at apex. Lobe B a small stemmed lobe arising from middle of sternal side near base of lobe M' and bent slightly mesad, with globular head bearing many very fine short hair-like spicules. Lobe C a rather broad recurved arm arising just proximad of lobe B and bent mesad, bearing many short fine appressed hairlike spicules on elbow and outer limb; apex pointed and appearing slightly rugose. Lobe A narrowed apically, with a small apical stout hooked seta and a short conical subapical seta. *Phallosome*: Aedeagus broader, width about 0.5 length. *Proctiger*: Paraproct with apex little enlarged, bearing about 3 small teeth along upper margin at apex and 2 or 3 short setae just below.

PUPA (fig. 99). Chaetotaxy as figured, not studied in detail. As described for *hirsuta* except for the following features. *Cephalothorax*: General pigmentation pale with yellowish tint except for poorly defined pale brown pattern on mesonotum and base of wing cases as figured. Hairs lightly pigmented. *Trumpet*: Uniformly golden. Only slightly flattened and not laterally expanded, width of pinna subequal to greatest width of meatus; more or less straight when viewed on edge. *Metanotum and Abdomen*: General pigmentation pale with yellowish tint except for poorly defined pale brown pattern, as figured, on metanotum and segments I to IV or V, extending to lateral margin only on tergite II; sternites II-VII with narrow light brown bands on anterior margin in middle. Intersegmental sclerites absent. Integument almost completely smooth. Hairs poorly pigmented; hair 12-C single; 1-II single or branched; 2-II laterad and cephalad of 1-II, hair 2-III-VII anterior and lateral in position, usually anterior to hair 6 and about in line with hair

1 or 3; hair 5-IV-VI distinctly longer than the following tergite; 6-I weak and usually single, position of 6-II-VI variable but usually posterior to hair 9. *Paddle*: Relatively short, about 1.5-1.7 length of segment VIII. Pigmentation pale with yellowish tint. Margins except for basal half of inner margin fringed with long hairlike spicules. Index 1.4-2.0; tapered strongly only in apical half; widest point near middle. *Male Genital Lobe*: Extending to about 0.9 of paddle; a slight indentation on posteromesal corner.

LARVA (fig. 100). Chaetotaxy as figured, variable. As described for *hirsuta* except for the following features. Body glabrous except for minute spicules on abdominal segment VIII and anal segment. All hairs and sclerotized portions pigmented light golden. Stellate hairs and basal tubercles poorly developed; all hairs with fewer branches. *Head*: Capsule little depressed; lateral margins rounded. Hairs 4-7-C unbarbed; 4-C single; 5,7-C with 3 or 4 branches; 6-C double; 11-C not heavy, with 4-7 branches; 12-C with 3-5 branches; 13-C mesad, not in line with hairs 11-C and 12-C; hair 14-C with 2-4 branches. *Antenna*: Hair 1-A inserted at apical 0.3. *Thorax*: Only hairs 7,13-T with separate basal tubercles; 4-P included on same tubercle with 5-7-P; hairs 2,3-P not on common tubercle; otherwise only following hair groups on common tubercles: 9-12-P,M,T and 5,6-M. Only hairs 0,1,8,14-P, 13-M, 5-T tending to be multibranched and stellate; 1,11-M, 1,4,11-T with fewer branches and somewhat stellate; 4-P with 4 or 5 branches, finely barbed throughout and roughly half the length of 5-P; hairs 5-7-P all very long and single; 9-P typically triple; 14-M relatively long and multiple. *Abdomen*: Hairs 1,5,13-I-VII, 11-I with fewer branches and only slightly stellate; 2-I-VII with 4-6 branches, longer than in *hirsuta* and only slightly caudad of spiracle; 2-I,II slightly laterad of hair 1, hair 2-III-VII slightly mesad of hair 1; hair 6-I with 3 or 4 branches, 6-II-VI double; 7-I long and triple, 7-II long and double; 8-VI cephalad of hair 9, at most slightly ventrad; 9-I-VII with fewer branches, shorter and only slightly stellate; 10-I-VII, 12-II-VII single to triple; 11-VI multibranched. *Segment VIII*: Comb scales 15-26 not extending as far ventrad, longest scale less than 0.09 mm long; individual comb scales wider and blunter, not arched in side view; lateral fringe longer and easily visible. Hair 3-VIII multibranched; 5-VIII single, occasionally double. *Siphon*: Index 3.8-5.0; very slightly expanded in middle, then tapering to an apex 0.40-0.50 wide as base. Siphonal hairs (1,1a-S) not arranged in pairs or readily separable ventral, dorsolateral or basolateral groups, instead about 20-30 long single hairs tending to be shorter and double distad, irregularly scattered over entire surface. *Anal Segment*: Saddle without spicules on posterior margin. Hairs 1-3-X single; 4-X multibranched and shorter than in *hirsuta*. Gills subequal, 1.0-3.0 of dorsal saddle length.

SYSTEMATICS. In our opinion, *mitchellii* is a distinct species, the northernmost segregate of the Pertinans Group as defined below. It is diagnosed most readily by an inconspicuous but constant feature of the clasper of the male genitalia, the presence of several (usually 4 or more) submarginal dorsal setae on lobe M' that are as strong as the marginal setae of this lobe; these setae are absent or weak in all the other species. The midtarsus of the adults is conspicuously marked with white and the larva has a relatively short siphon and sparsely branched head hairs 5 and 6 (usually double or triple). Populations with male genitalia similar to topotypic *mitchellii* are known from the Atlantic slope of Mexico (at least from near Tamazunchale, state of San Luis Potosi), Cuba, Hispaniola (Dominican Republic) and southern Florida. There appear to be some slight differences among these different populations in the extent of the white tarsal markings of the adults but we have not analyzed these because of the paucity of material. In the Jamaican popu-

lation hindtarsal segments 4 and 5 are usually completely dark scaled. For the present we are considering all of these populations conspecific with *mitchellii*. The recent records of *ulocoma* from the Dominican Republic cited in the taxonomic references above are based, in our opinion, on the confusion of some of the larvae of *ochrura* collected by August Busck in the Dominican Republic with those of *ulocoma* of Dyar and Knab (1906c:229) obtained by the same collector in Trinidad. This interpretation is supported by the statement in the original description of *glaucocephala*: "The larva of this species was included with the larva in our description, cited above [Dyar and Knab, 1906c:229]. They are doubtless similar; but perfect material will probably enable them to be separated" and by Dyar's later statement (1924a:106): "Two names were proposed for the Santo Domingoan form, *ochrura* founded on the larva and *glaucocephala* on the adult."

Brujning (1959:103-106) has recently proposed a wholesale synonymy of nominal species of *Wyeomyia* with white markings on the midtarsus with *medioalbipes* (Lutz, 1904) from Brazil. Stone (1969:2-4) correctly removed several Central American and Panamanian nominal species from this synonymy but retained *mitchellii* as a junior synonym of *medioalbipes* on the basis of similarity in male genitalia and apparently also because of the belief that populations with white marked midtarsus occur in the Lesser Antilles, namely *abia* Dyar & Knab, 1908 from Dominica and *colsoni* Senevet and Quievreux, 1941 from Martinique. The latter does not appear to be the case because (1) numerous recent collections in the Lesser Antilles have produced only dark legged adults, (2) *colsoni* was differentiated from *abia* in the original description by the absence of white on the midtarsus, and (3) as indicated in the synonymy of *mitchellii* above, the type locality of *abia* is undoubtedly the Dominican Republic and not the island of Dominica.

The dark legged forms from the Lesser Antilles are obviously related to those with the midtarsus marked with white in several basic features. We are therefore proposing the Pertinans Group for this entire assemblage of species with the following combination of diagnostic characters: (1) clasper of the male genitalia with a capitate lobe B developed in nearly all species (absent in all other species known to us) and with lobe C usually characteristically developed, (2) pupal paddle with a marginal fringe of long filamentous spicules, and (3) larva with a relatively short to moderately long siphon and without strong development of stellate hairs.

The Pertinans Group appears to be 1 of the major phyletic lines in the genus and includes the type species (*grayii*), the earliest described species (*pertinans*) and "*medioalbipes*" of Stone (1969) and in part of Brujning (1959). We interpret its distribution and components as follows. In the Greater Antilles, at least 1 locality in Mexico and in southern Florida it is represented by *mitchellii* as diagnosed above. In other parts of Mexico (possible partially sympatrically with *mitchellii*), in Central America and in Panama it is represented by many species (more than suggested by Stone, 1969:3-4; we have about 13) with very distinctive male claspers; the majority of these species have conspicuous tarsal markings on the hindtarsus as well as the midtarsus. We have made no attempt to associate the numerous available names with the different species we have seen from this area.

We have seen no material or published records of the group from the Bahamas, Puerto Rico, the Virgin Islands and the northernmost islands of the Lesser Antilles. We have collections from all the major islands of the Lesser Antilles from Montserrat southward to Grenada. As noted above all the adults in this area are dark legged. On the basis of male genitalia 2 species appear to be represented, *grayii* Theobald, 1901 and *pertinans* (Williston, 1896). The clasper of both species is sup-

erficially similar to *mitchellii* but lobe M' has only 2 or 3 weak submarginal setae; in *pertinans* this lobe is sharply differentiated at base from lobe M while in *grayii* its base blends into lobe M. The larvae of both species have a considerably longer siphon and more comb scales than *mitchellii*. *Wyeomyia grayii*, whose type locality was restricted to St. Lucia by Belkin (1968b:40), shows considerable local insular differentiation in the immature stages, particularly in the larva, but we believe that only 1 species is involved, with a distribution encompassing Montserrat, Guadeloupe (*antillarum* Floch & Abonnenc, 1945; NEW SYNONYMY), Dominica, Martinique (*colsoni*, Senevet & Quievreux, 1941; NEW SYNONYMY) and St. Lucia. *Wyeomyia pertinans* shows less insular differentiation and is apparently restricted to St. Vincent (type locality), probably the Grenadines, Grenada and Barbados.

In Trinidad, Venezuela, Colombia and the Guianas, the Pertinans Group is apparently represented by at least 6 species, all white legged forms (including the hindtarsi in some). The male genitalia of at least 2 forms resemble those of *pertinans* and none have lobe M' of the clasper with the characteristic development of *mitchellii*. It is possible that 1 of these forms is conspecific with *medioalbipes* but this cannot be determined until topotypic material of this species is obtained from the state of Bahia, Brazil.

BIONOMICS. Topotypic *mitchellii* has an unusually wide range of breeding sites. It is not restricted to epiphytic (15 lots) and terrestrial (4 lots) bromeliads but occurs in the largest populations in the leaf axils of the "wild coco yam" (13 lots), an aroid apparently of the genus *Xanthosoma* but possibly confused with *Colocasia* sp., and is also found in the flower bracts of a large heliconia (2 lots). We have a record of immature stages from a treehole but this may be a contamination. Hill and Hill (1948:35) report *mitchellii* from bamboo stumps; this is probably a misidentification because in 46 bamboo collections we found only *nigritubus*. Elsewhere *mitchellii* has been found only in bromeliads in Mexico, Florida (Carpenter and LaCasse, 1955:68) and Cuba (Perez Viguera, 1956:422; Montchadsky and Garcia, 1966:34) and in both aroids ("Malanga") and bromeliads in Hispaniola. Our collections in Jamaica were from near sea level to elevations of about 760 m. We found nearly the complete array of bromeliad breeders associated with *mitchellii*, including *Culex* (*Micr.*) *arawak*, the 3 species of the subgenus *Howardina* of *Aedes* (*walkeri*, *grabhami* and *stenei*) and 4 species of *Wyeomyia* (*atrata*, *hirsuta*, *juxtahirsuta* and *stellata*). In the aroid axils *mitchellii* is usually found alone but in 1 lot it was associated with *Culex* (*C.*) *corniger*. In the flower bracts of heliconias we found it associated with *corniger*, *hirsuta* and *walkeri*.

We have several records of adult females in biting-landing collections on humans and on donkey bait and we also found *mitchellii* in a light trap collection. Hill and Hill (1948:35) state that when breeding is near houses, *mitchellii* will bite man in the open, particularly at dusk, and occasionally will enter houses.

DISTRIBUTION. Jamaica (type locality), Atlantic slope of Mexico, Cuba, Hispaniola and southern Florida. We have not seen *mitchellii* from anywhere else and consider that records from Central America, Panama, Venezuela, Trinidad and Lesser Antilles are erroneous (see systematics).

JAMAICA. Widely distributed over the island, from sea level to elevations of at least 760 m. *Clarendon*: Fort Simonds, 11 Jan 1946, H.D. Pratt, 3 L [USNM]. Trout Hall (105). *Kingston and St. Andrew*: Ferry and vicinity (703). Hermitage Dam Rd (282,322,334,724,855). Hope Botanical Gardens (942,945,946); Jan 1940, ? W.H. Komp, 15 M, 18 F [USNM], 3 M, 1 F [UCLA]. Kingston and vicinity, M. Grabham, 1 F [USNM]. Newcastle (648). Parks Rd (50). *Manchester*: Hope Farm (664). *Portland*: Devils Elbow (406,919,920). Ecclesdown (748,749). Frenchman's Cove (810). Long Bay (692). Port Antonio (922). Priestmans River (811). Reach (126). Sherwood

Forest (708). *St. Ann*: Drax Hall (608). Moneague and vicinity (377,758,763). Shaw Park (933). *St. Catherine*: Caymanas (403). *St. Elizabeth*: Luana (358). *St. James*: Reading (671,673). *St. Mary*: Quebec (621). Richmond (208). *St. Thomas*: Airy Mount (154). Port Morant (691). Roselle (726). Springfield House (158). Winchester House (130,204). *Westmoreland*: Bluefields, R.B. Hill, 3 L [JAM]. Petersville (787). *Parish not Specified*: M. Grabham, 4 F [USNM]; Jan 1940, ? W.H. Komp, 1 M [USNM], 80 L, 6 P [UCLA]; 18 Apr 1944, R.B. Hill, 1 M [USNM]; R.B. Hill, 1 M, 15 L [JAM], 1 F [UCLA]; Dec 1945, G.A. Thompson, 12 M, 9 F [UCLA]; Jan 1946, G.A. Thompson, 9 M, 12 F [USNM]; ? G.A. Thompson, 1 L, 1 P [USNM].

Material Examined: 1254 specimens; 154 males, 229 females, 606 larvae, 265 pupae; 178 individual rearings (64 larval, 100 pupal, 14 incomplete).

56. *Wyeomyia* (W.) *vanduzeei* Dyar & Knab

Figs. 101,102

1906. *Wyeomyia vanduzeei* Dyar and Knab, 1906a:138. TYPE: Lectotype male (356.5) with genitalia slide (349), Estero, Florida, U.S.A., 22 Apr-6 May 1906, J.B. Van Duzee [USNM, 9988; designation of Stone and Knight, 1957b:126].
1908. *Wyeomyia argyrura* Dyar and Knab, 1908:70. TYPE: Holotype female, San Antonio de Los Banos, Cuba, J.H. Pazos [USNM, 12009]. Synonymy with *vanduzeei* by Dyar (1922a:6).
1909. *Wyeomyia conchita* Dyar and Knab, 1909b:264. TYPE: Lectotype female (397), San Antonio de Los Banos, Cuba, J.H. Pazos [USNM, 12180; designation of Stone and Knight, 1957b:122]. Synonymy with *argyrura* by Dyar (1919:126); with *vanduzeei* by Dyar (1922a:6).

Wyeomyia (W.) *vanduzeei* in part of Edwards (1932:86); Lane and Cerqueira (1942:550); Carpenter, Middlekauff and Chamberlain (1946:96-99); Lane (1953:880-881); Carpenter and La Casse (1955:70-72); Perez Viguera (1956:428-430); Stone, Knight and Starcke (1959:82); Montchadsky and Garcia (1966:35); Porter (1967:36).

Wyeomyia (*Phyllozomyia*) *vanduzeei* in part of Dyar (1924b:112; 1928:31-32); Dyar and Shannon (1924d:480).

Wyeomyia vanduzeei of Hill and Hill (1945a:2; 1948:35-36); Thompson (1947:79).

Wyeomyia conchita, *argyrura* and *vanduzeei* of Howard, Dyar and Knab (1915:63,64,65).

FEMALE. Wing about 2.0 mm. A very small species, generally somewhat lighter in color than other Jamaican *Wyeomyia*. Essentially as described for *hirsuta* but with the following differences. *Head*: Labium completely dark scaled. *Thorax*: Mesonotum with scales relatively light colored, with bronze and gold reflections. *Aprn* covered with silver-white scales. *Legs*: Midtarsal segments 3 and 4 white scaled on anterior surface, apex of segment 2 and base of 5 may also be white scaled on anterior surface. Hindtarsal segments all with short basal streak of white scales, becoming progressively shorter distad. *Haltere*: Knob with dorsal side white scaled at base and laterally. *Abdomen*: Tergite I usually with variable white scalation at base and on sides; tergite VIII almost completely white scaled; a few white scales apically on tergite VII.

MALE. Unknown for Jamaican population, described from Grand Cayman specimens. Essentially as for female, with sexual differences as noted for male *hirsuta* and the following. Foretarsus tending to have a line of white scales for full length on posterior surface. Midtarsus white scaled on full length of posterior surface; about apical one-half to one-third of midtarsal segment 2 and all of 3, 4 and 5 completely white scaled. Hindtarsal segments with basal white streak usually longer than in fe-

male, often reaching to near apex on segment 1 and progressively shorter distad.

MALE GENITALIA (fig. 101). Described from a single specimen from Jamaica with some characters from specimens from Florida and Grand Cayman. As described for *hirsuta* but with the following differences. *Segment VIII*: Tergite with small area at center along posterior margin without setae and often without scales. *Segment IX*: Tergite lobe with 4 heavy setae (1-5 in other portions of its geographic range). *Sidepiece*: Apical third bent slightly tergal. Tergal triad inserted about one-third distance from base; long lateral seta apparently absent. Area on tergotal surface just distad of insertion of tergal triad with patch of relatively long setae, about one-half length of sidepiece. Lateral and sternal surfaces distad of insertion of tergal triad with many scattered scales and short setae. *Mesal Plate*: Roughly square in outline, with differentiated longer seta in middle of lateral margin. *Clasper*: Subequal to sidepiece in length. Stem very short, about 0.3 total length, not clearly differentiated from head and apparently without an internal thumblike process at base. Head as figured. Lobe M with longitudinal groove on its sternal surface from near base to apex, with row of rather stout short pointed setae on each side and cluster of short setae at apex; sternolateral margin of lobe M near origin of lobe C slightly produced and bearing a very dense tuft of about 12 long flattened pointed hairlike spicules. Lobe C a single large abruptly recurved arm with both an apical and a subapical membranous recurved attenuate process; many hairlike spicules on elbow and outer limb. Lobe E well developed, with the tergal membranous flap greatly enlarged and conspicuously wrinkled. Lobe A narrowed apically and slightly sinuate, bearing apically a hyaline spinelike process and subapically 2 or 3 short stout curved pointed setae. *Phallosome*: Aedeagus broader, width about two-thirds length. *Proctiger*: Paraproct with apex slightly enlarged, bearing 2 small teeth and about 4 short setae.

PUPA (fig. 101). Described from Grand Cayman material. Chaetotaxy as figured, not studied in detail; all hairs somewhat longer and heavier than in *hirsuta*. As described for *hirsuta* except for the following features. *Cephalothorax*: Generally pale with yellowish tint except for poorly defined mottled pattern as figured, in light to medium brown on mesonotum and base of wing case. Hairs lightly pigmented. *Trumpet*: Pigmented golden brown. Not flattened or laterally expanded, more or less cylindrical. *Metanotum and Abdomen*: General pigmentation pale with yellowish tint except for poorly defined mottled pattern in light to medium brown on metanotum and tergites I-IV or V, becoming progressively lighter and less extensive caudad, extending to lateral margin only on tergites I,II; pattern as figured but somewhat variable. Sternites II-VII with narrow light brown bands on anterior margin in middle. Paired brown intersegmental sclerites present following tergites II and III. Hairs lightly pigmented; hair 5-IV-VI usually barbed and extending to about middle of second following tergite; 7-I,II tending to be long and single or double. *Paddle*: Pigmentation pale with yellowish tint. Index variable, 1.4-2.5.

LARVA (fig. 102). Chaetotaxy as figured, variable. As described for *hirsuta* except for the following features. Body glabrous except for minute spicules on anal segment and siphon. All hairs and sclerotized portions lightly pigmented a golden brown. Stellate hairs and basal tubercles poorly developed. *Head*: Capsule somewhat less depressed, lateral margins slightly rounded. Hairs 4-7-C single and without barbs; 11-C with 3-5 branches, not heavy or inserted on tubercle; 14-C double or triple. *Antenna*: Hair 1-A single, about 0.4 length of antenna and inserted at apical 0.2; hair 2-A about 0.3 length of antenna. *Thorax*: Hairs 1-3,8-P, 1,4,5-T

without basal tubercles. Only hairs 0,8-P, 13-M tending to be multibranched and stellate. Hair 4-P with 10-13 branches and characteristically developed with about basal 0.4 unbarbed, middle 0.3 densely barbed and apical 0.3 sparsely barbed; 5-P with 5 or 6 branches; 6-P double or triple; 9-P double or triple; 11-P,M,T with fine flexible branches; 14-M multibranched and longer. *Abdomen*: Hairs 1,5,13-I-VII, 11-I with fewer branches and seldom stellate; 2-I,II longer, usually with 4 or 5 branches and somewhat stellate, slightly laterad of hair 1 and slightly caudad of spiracle; 2-III-VII single or double, mesad of hair 1 and slightly caudad of spiracle; 6,7-I,II with 3-6 branches; 8-VI cephalad and not distinctly ventrad of hair 9; hair 9-I-VII shorter, with fewer branches and seldom stellate. *Segment VIII*: Comb scales about 25-30, in a slightly irregular line; longest scale less than 0.09 mm long and about 2.0 length of shortest scale; individual comb scale blunter than in *hirsuta* and little arched in side view, lateral fringe longer and more readily visible. Hair 1-VIII with fewer branches and seldom stellate. *Siphon*: Index 6.5-8.0; apex 0.35-0.45 of basal width. Siphonal hairs (1,1a-S) arranged as follows: (1) a pair of long double ventrolateral hairs about 0.3 from base, (2) 4-7 short single or less often double ventral hairs in distal 0.5 in an irregular line, (3) 10-14 short double or occasionally single or triple dorsolateral hairs in an irregular double line. *Anal Segment*: Saddle without long spicules on posterior margin. Hair 1-X occasionally triple.

SYSTEMATICS. We are retaining the Jamaican population in *vanduzeei* only provisionally as we have very limited material from Jamaica and because it appears that a complex of species is involved under the current concept of *vanduzeei*.

The Vanduzeei Group appears to have a northern Antillean distribution somewhat similar to that of *mittelli* of our treatment but with an easterly extension into the Bahamas and apparent absence from Mexico. At least 3 species are apparently involved. We are tentatively assigning to *vanduzeei* populations from Cuba, Grand Cayman, Jamaica and Florida (type locality). There are considerable differences among these populations but the available material of associated stages is insufficient to determine their significance.

From the Dominican Republic we have limited material of *sororcula* Dyar & Knab, 1906 which is very distinct from *vanduzeei* in the male genitalia and is also differentiated in the female from the latter by the presence of only dark scales on abdominal tergite VIII. We believe that the unique specimen of *fratercula* Dyar & Knab, 1906 bearing label (71) is probably 1 of the specimens of the type series of *sororcula*, with which it agrees in every detail, that was incorrectly reported from Martinique as a result of an error in labeling which occurred in several other instances with August Busck's material. The following data are given for collection 71 in Busck's field notes: "the larvae in water in iron-work of an old mill, July 24, 1905" and the only species recorded are "Culex pipiens and Culex salinarius". It is very unlikely that a species of *Wyeomyia* was found associated with these species. Furthermore in extensive surveys in the Lesser Antilles no species of *Wyeomyia* of the *vanduzeei* type has ever been found. For additional details see Belkin (1970a).

A third probably distinct species of the group is *bahama* Dyar & Knab, 1906, whose male and immature stages are still unknown. This species is apparently characterized by the restriction of the white tarsal markings to the hindlegs. It is possible that this form occurs outside of the Bahamas, in eastern Cuba as suggested by Dyar (1928:32) and even in southern Florida.

We have seen no specimens with the completely silvery anterior pronotal lobe characteristic of the Vanduzeei Group from any island in the West Indies other than those mentioned above. As indicated in the discussion of the genus, there are

affinities between *vanduzeei* and the *Hirsuta* Group and it is probable that they are derived from a common stock.

BIONOMICS. Our only collection of the immature stages of *vanduzeei* (732) on Jamaica consists of a single third-instar larva found in an epiphytic bromeliad at an elevation of 380 m in association with *Wyeomyia* (*W.*) *corona* and *Aedes* (*H.*) *walkeri*, *Aedes* (*H.*) *grabhami* and *Aedes* (*H.*) *stenei*. Hill and Hill (1948:36) report larvae of *vanduzeei* from epiphytic bromeliads from Montego Bay, presumably at a lower elevation. One of us (JNB) has collected *vanduzeei* in terrestrial as well as epiphytic bromeliads on Grand Cayman but elsewhere both *vanduzeei* and *sororcula* have been reported only from epiphytic bromeliads.

A few adult females were taken in a biting-landing collection (793) on human bait at an elevation of 150 m. In Florida, females are reported to bite man readily (Seabrook and Duffey, 1946:194) and we have 2 females taken in a biting-landing collection on Grand Cayman.

DISTRIBUTION. Florida (type locality) and tentatively Cuba, Grand Cayman and Jamaica.

JAMAICA. Apparently very uncommon and localized. *St. Ann*: Moneague and vicinity (732). *St. Elizabeth*: Maggoty (793). *St. James*: Montego Bay, R.B. Hill, 1 M, 8 L [JAM].

Material Examined: 14 specimens; 1 male genitalia slide, 4 females, 9 larvae.

57. *Wyeomyia* (*W.*) *luna*, n.sp.

Figs. 103,104

TYPES: Holotype male (JA 731-11) with genitalia and associated larval and pupal skins mounted on 2 slides, track leading S into Unity Valley, 1.5 mi S of Moneague (*St. Ann*), Jamaica, elev. 380 m, epiphytic bromeliad (*Aechmea paniculigera*), 17 Aug 1967, J.N. Belkin and W.A. Page [USNM]. Allotype female (JA 731-100) with associated pupal skin mounted on slide, same data as holotype [USNM]. Paratypes: 1 lpM (JA 731-12), 1 lpF (JA 731-10), 1 larva, 1 pupa (JA 731-1), same data as holotype; 1 pM (JA 733-109), 1 mi S of Moneague on Kingston Road by roadside (*St. Ann*), Jamaica, elev. 380 m, epiphytic bromeliad in grazing area, 17 Aug 1967, J.N. Belkin and W.A. Page [UCLA].

FEMALE. Wing about 2.5 mm. Differing from *hirsuta* primarily in the following features. Labium entirely dark scaled. *Apn* with silvery scales with violet reflections on extreme upper end, dark scales with blue and violet reflections in middle and silver-white scales on extreme lower end. Hindtarsus dark scaled except for short streaks of white scales at base of segments 1, 2 and 3 on posterior surface; segments 4 and 5 white scaled on posterior surface from base to about 0.8-0.9 of each segment.

MALE. Essentially as for female, with sexual differences as noted for male *hirsuta*, including white scalation along entire length of midleg on posterior surface.

MALE GENITALIA (fig. 103). Differing from *hirsuta* in the following features. *Sidepiece*: Apical half bent tergad only very slightly. Scales as well as short setae numerous on lateral and sternal surfaces distad of insertion of tergal triad. *Mesal Plate*: Roughly triangular, with or without differentiated large seta. *Clasper*: Stem very short, about 0.2 of total length. Head as figured. Lobe M with characteristic pattern of short setae, and apically subdivided into 2 lobes, the sternolateral one shorter and narrower; sternolateral margin of lobe M near origin of lobe C produced and with a longitudinal fringe of long hairlike spicules. Lobe C a single large

abruptly recurved arm, its tip attenuate and with a subapical membranous recurved attenuate process; many hairlike relatively short spicules on elbow and outer limb. Lobe A basally enlarged, apically narrowed and slightly sinuate, with 2 short stout pointed setae at apex and 1 near middle. *Phallosome*: Aedeagus broader, width about two-thirds length. *Proctiger*: Paraproct little enlarged apically, with 2 small teeth and 2 short setae.

PUPA (fig. 103). Chaetotaxy as figured, not studied in detail. Differing from *hirsuta* in the following features. *Cephalothorax*: General pigmentation very pale except for a poorly defined mottled pattern in light yellow-brown on mesonotum behind attachment of trumpets and on base of wing cases; also an irregular middorsal spot at level of hair 8-C and a pair of small spots behind this which are pearly iridescent with glints of green, blue and violet; pattern as figured, iridescent areas indicated by diagonal lines. *Trumpet*: Relatively large, extending well beyond middorsal ridge. Pigmented brown mottled with light brown. Lateral expansion even greater than in *hirsuta*, width of pinna 0.3-0.4 greatest width of meatus. *Metanotum and Abdomen*: General pigmentation very pale except for posterolateral corner of haltere case which is light brown and a poorly defined mottled pattern in light yellow-brown on metanotum and tergites I-IV or V, becoming progressively lighter and less extensive caudad, not extending to lateral margin; also irregular areas of pearly iridescence with glints of green, blue and violet on dorsum as follows: (1) a very small separate spot at base of each hair 10-C on metanotum, (2) separate submedian and lateral spots on each side of segment I, (3) a single large roughly inverted V-shaped spot on segment II and III, and (4) a large sublateral spot on each side of segment IV; pattern in general as figured, although iridescent areas extremely variable. Sternites II-VII with narrow brown bands on anterior margin in middle. Intersegmental sclerites absent. Hairs slightly or not at all pigmented; 12-C single to triple and very long; 2-II far laterad of hair 1, hair 2-III-VII far mesad of hair 1 and near posterior margin of segment; 5-IV double or triple and extending only to just beyond middle of following tergite, 5-V,VI barbed and extending to base of second following tergite. *Paddle*: Slightly less than twice as long as segment VIII. Index 1.7-2.0. *Male Genital Lobe*: Extending to about 0.4 of paddle; apex truncate, posterolateral corner only very slightly produced.

LARVA (fig. 104). Chaetotaxy as figured, variable. As in *hirsuta* except for the following features. Body glabrous except for small spicules on siphon and anal segment. All hairs, spicules and tubercles lightly or not at all pigmented. Stellate hairs and basal tubercles very poorly developed; hairs generally longer. *Head*: Capsule somewhat less depressed, lateral margins slightly rounded. Posterior margin of capsule pigmented light brown on ventral surface. Hairs 4-6-C dendritic; 4-C with 3-5 main branches; 5-C with 2 main branches, more anterior than in *hirsuta*; 6-C double or triple; 7-C with 5-8 branches and strongly barbed; 11-C with 8-12 branches; 12-C long and double; 14-C single and shorter. *Antenna*: Longer, about 0.40 length of head capsule. Hair 1-A inserted at apical 0.3; hair 2-A about 0.4 length of antenna. *Thorax*: Hairs 1,8-P, 1,4,5-T without basal tubercles. Only hairs 0-P, 13-M with slight stellate tendency. Hairs 4,5-P brushlike with many dense branches; 6-P with 2-4 branches; 7-P multibranching; 9-P,M,T with 3 or 4 branches; 14-P,M relatively short and single or double. *Abdomen*: Hair 1-I-VII multiple, not stellate; 2-I-VII very short and single, well caudad of spiracle and well mesad of hair 1; hair 5-I-VII multiple but not stellate, long on III-VI; hair 6-I,II with 7-10 branches, 6-III double, 6-VII with 3-6 branches; 7-I,II with 3-7 branches, 7-III-VI never stellate; 8-VI,VII stellate, well cephalad and slightly ventrad of hair 9; hair 9-I-VII

with 2-5 branches and tending to be stellate; 11-I, 13-I-VII not stellate. *Segment VIII*: Comb scales about 20-30, not extending as far ventrad and shorter, longest comb scale less than 0.08 mm and 2.0-3.0 length of shortest scale; individual comb scales little arched in side view; lateral fringe more readily visible but still very faint. Hair 3-VIII double. *Siphon*: Long and narrow; index 10.0-12.0; tapering directly from base to an apex 0.30-0.40 times as wide as base. Siphonal hairs (1,1a-S) as follows, 11-13 dorsal, 12 or 13 ventral and 1 basolateral pair. *Anal Segment*: Hairs 1,2-X double; 3-X single; 4-X with 5 branches.

SYSTEMATICS. *Wyeomyia luna* is the most widely divergent species of the *Hirsuta* Group and clearly the earliest derived from the ancestral stock as is indicated by its combination of both very primitive and highly derived characters. It is possible that it arose in Jamaica from a stock separate from the stock that gave rise to the *Stellata* and *Hirsuta* Subgroups, in which case the derived characters they possess in common (given as diagnostic characters for *Hirsuta* Group in general discussion for genus *Wyeomyia*) arose through parallelism. This species is derived in the following: (1) male clasper lobes C and M uniquely developed; (2) pupa with yellow and pearly iridescent pattern on dorsum, trumpets mottled and with strong lateral expansion; (3) larva with very long siphon tapered evenly from base, sclerotized parts very poorly pigmented. In the lateral expansion of the pupal trumpets, the very distinctive pupal pattern and the poor larval pigmentation, *luna* shows convergence with *hirsuta* and *juxtahirsuta*; it is also convergent with *stellata* in the possession of a long larval siphon. *Wyeomyia luna* retains the following primitive characters: (1) male clasper lobe C with many hairlike spicules, lobe M with a group of long hairlike spicules on sternal margin, clasper stem very short, clasper head generally bulky and complex; (2) larva nearly completely glabrous, stellate hairs virtually absent (least spiculose and stellate haired of all species of the *Hirsuta* Group).

The species name is in reference to the pearly iridescence on the pupa, and as a foil to the name *stellata*, a species which also has a long siphoned larva.

BIONOMICS. The immature stages have been collected in epiphytic bromeliads (*Aechmea paniculigera* in 1 lot) at an elevation of 380 m in association with *Aedes* (*H.*) *walkeri*, *Aedes* (*H.*) *grabhami* and *Aedes* (*H.*) *stenei*.

A single adult female (identification doubtful) has been taken in a biting-landing collection (man) but it is not known if it was actually biting.

DISTRIBUTION. Endemic to Jamaica.

JAMAICA. *St. Ann*: Moneague and vicinity (377,731,733).

Material Examined: 16 specimens; 3 males, 3 females, 4 larvae, 6 pupae; 5 individual rearings (3 larval, 2 pupal).

58. *Wyeomyia* (*W.*) *stellata*, n.sp.

Figs. 96,105,106

TYPES: Holotype male (JA 725-13), adult, genitalia and associated larval and pupal skins all mounted on 3 slides, Hermitage Dam Rd (St. Andrew), Jamaica, elev. 480 m, epiphytic bromeliad (*Hohenbergia*) in forest, 15 Aug 1967, J.N. Belkin and W.A. Page [USNM]. Paratypes: 2 pM (JA 725-91,102), 1 larva (JA 723-4), same data as holotype [UCLA].

FEMALE. Unknown.

MALE. Insufficiently known.

MALE GENITALIA (figs. 96 and 105). Differing from *hirsuta* in the following features. *Segment IX*: Sternite more strongly sclerotized, about as wide as long, with rounded posterior margin. *Sidepiece*: Length 3.0-3.5 of greatest width; apical half bent tergad only very slightly. Scales as well as short setae numerous on lateral and sternal surfaces distad of insertion of tergal triad. *Mesal Plate*: Quadrangular rather than crescent shaped. *Clasper*: Head as figured. Lobe M apically subdivided into 2 subequal lobes, each with characteristic pattern of short setae. Lobe C a single large abruptly recurved arm, its tip with 2 or 3 membranous recurved serrations; many rather long hairlike spicules on elbow and inner limb; also a patch of short hairlike spicules in middle of outer limb. Lobe E somewhat reduced, shorter than lobe A and with apex bent more strongly tergad. Lobe A with apex expanded, and bearing 3 stout short setae and a row of short hairlike spicules forming a comb-like structure. *Phallosome*: Aedeagus broader, width about two-thirds length. *Proctiger*: Paraproct with apex little enlarged, bearing 3 or 4 teeth along upper margin and 3 short setae.

PUPA (fig. 105). Chaetotaxy as figured, not studied in detail; all hairs somewhat longer and heavier than in *hirsuta*. Differing from *hirsuta* primarily in the following. *Cephalothorax*: General pigmentation pale with yellowish tint except for poorly defined mottled pattern in light brown on mesonotum and base of wing cases, as figured. Hairs only slightly pigmented. *Trumpet*: Pigmented light brown; greatly flattened but little or not at all expanded laterally. *Metanotum and Abdomen*: General pigmentation pale with yellowish tint except for poorly defined mottled pattern in light to medium brown on metanotum and tergites I-VI or VII, becoming progressively lighter and less extensive caudad, extending to lateral margin only on tergite II; pattern as figured. Sternites II-VII with narrow light brown bands on anterior margin in middle. Rather large light brown paired intersegmental sclerites present caudad of tergites II-IV and sometimes a small pair caudad of tergite V. Hairs slightly pigmented; hair 12-C relatively long and with 2-4 branches; 2-II single or occasionally double, cephalad and laterad of hair 1, hair 2-III-VII slightly mesad of hair 1 and cephalad or at level of hair 6; hair 5-IV barbed and extending to basal third of second following tergite, 5-V,VI single or double, barbed and extending to near posterior margin of second following tergite; 6-III-VI usually long and single, at level or caudad of hair 9; hair 7-I,II usually long and double. *Paddle*: Pigmentation pale with yellowish tint. Index 2.5-3.3; tapered more or less evenly from near base, extreme tip not truncate. *Male Genital Lobe*: Extending to near middle of paddle; posterolateral corner with small rugose digitiform lobe.

LARVA (fig. 106). Chaetotaxy as figured, variable. Differing from *hirsuta* in the following features. Body glabrous except for minute spicules on abdominal segments IV-VII and short simple spicules on anal segment and siphon. All hairs, spicules and tubercles moderately pigmented pale to medium golden brown. Stellate hairs and basal tubercles much more strongly developed; hairs generally longer and more strongly branched. *Head*: General pigmentation pale golden. Capsule somewhat less depressed, lateral margin slightly rounded. Maxilla with the long heavy subapical seta double or triple, occasionally single. Hair 4-C with 2 main branches and many fine branches; 5-C with 1 main branch, occasionally 2, and many fine side branches; 6-C with 2 or 3 main branches and many fine branches, more caudal in position than in *hirsuta*; 7-C with 6-8 heavily barbed branches; 11-C with 3-6 main branches and several fine shorter basal branches; 12-C with 2-5 main branches and several fine shorter basal branches; 14-C heavy and with 3-6 branches. *Antenna*: Hair 1-A inserted in apical 0.2-0.3; hair 2-A about 0.4 length of antenna.

Thorax: Hair 4-P with 6-8 branches, not stellate, strongly barbed and considerably more than half the length of 5-P; hairs 5,6-P double or triple; 7-P single; 9-P with 2-4 branches; 11-P,T tending to be multibranched and stellate; 14-M long and multibranched. *Abdomen*: Hair 2-I-VII stellate and removed cephalad, nearly at level of spiracle, and only slightly mesad of hair 1; hair 6-I,II with 5-8 branches; 7-III relatively long and triple, 7-IV-VI shorter, tending to be multibranched and stellate; 8-VI stellate, well cephalad and slightly ventrad of hair 9, hair 8-VII stellate and distinctly ventrad of hair 9; hair 11-VII very short and multibranched. *Segment VIII*: Comb scales about 28-40; generally shorter, longest comb scale slightly less than 0.10 mm long and 1.5-2.0 length of shortest scale; individual comb scales pigmented light golden brown and little arched in side view; lateral fringe more readily visible but still very faint. Hair 3-VIII multibranched; 5-VIII triple. *Siphon*: Pigmented light golden brown; longer and narrower, index 7.5-9.0; tapering directly from base to an apex 0.35-0.45 times as wide as base. Siphonal hairs (1,1a-S) conspicuously barbed, 13-17 long hairs in nearly straight ventral line and 11-14 shorter hairs in irregular double dorsal line, as well as the long basolateral pair of hairs. Hair 8-S longer than 2.0 width of siphon apex. *Anal Segment*: Saddle pigmented golden brown; spicules on posterior margin longer, about 0.5 dorsal length of saddle. Hair 1-X triple; 2-X triple, occasionally with 4 branches; 3-X double, occasionally triple; 4-X with 7 or 8 branches. Gills long, 3.0-4.0 dorsal saddle length.

SYSTEMATICS. *Wyeomyia stellata* is probably most closely related to *corona* on the basis of common possession of certain derived characters in all stages as given in the general discussion of the Stellata Subgroup under the genus. Especially significant is the peculiar development of the male clasper lobe A that is very similar in both species and could hardly occur except through common ancestry. *Wyeomyia stellata* and *corona* have diverged from each other much more than have the species within the Hirsuta Subgroup as is evident in the dissimilarities of the larvae and male genitalia. In *stellata* derived characters not possessed by *corona* include: (1) male clasper lobes M and especially C with unique development, (2) larval siphon long and tapered smoothly from base (shared with *luna*). *Wyeomyia stellata* is more primitive than *corona* in the largely glabrous larva.

This species is named in reference to the stellate larval hairs (most highly developed of all Jamaican species of *Wyeomyia*) and as a foil for the name *luna*, a species which also has a long siphoned larva.

BIONOMICS. Immature stages of *stellata* have been collected from epiphytic bromeliads (*Hohenbergia* sp. in 3 lots) at elevations of 150-530 m. This species has the same associates as *hirsuta*.

DISTRIBUTION. Endemic to Jamaica.

JAMAICA. Known only from eastern half of island in inland areas. *Kingston and St. Andrew*: Hermitage Dam Rd (723,725). *Portland*: Sherwood Forest (710). *St. Ann*: Moneague and vicinity (763,771,772). *St. Catherine*: Dove Hall (820).

Material Examined: 16 specimens; 4 males, 8 larvae, 4 pupae; 4 individual rearings (1 larval, 3 pupal).

59. *Wyeomyia* (W.) sp., Jamaican form A

FEMALE. Wing 2.7 mm. Essentially as in *hirsuta* but with the following differences. *Apn* with silvery scales with violet reflections on upper half, and dark scales with blue and violet reflections on lower half. Hindtarsus with short streaks of white scales at base of segments 1, 2 and 3 on posterior surface; segment 4 white

for basal 0.7 and segment 5 for basal 0.8 on posterior surface.

MALE, PUPA and LARVA. Unknown.

SYSTEMATICS. This form, known from a single adult female, is quite distinct from all other Jamaican species of *Wyeomyia* for which the adults are well known, except *luna* which has similar *apn* scalation and tarsal markings. While it is possible that form A is *luna*, it is much more probable that it is the unknown female of *stellata*, a species similar to *luna* in some respects (larva with long siphon, retention of many primitive characters) and is thus tentatively placed in the *Stellata* Subgroup. It is also possible that form A is a distinct species or that it is the unknown female of *corona*.

BIONOMICS. The unique specimen was taken in a biting-landing collection (man) at an elevation of 380 m.

DISTRIBUTION. Endemic to Jamaica.

JAMAICA. *St. Ann*: Moneague and vicinity (735).

Material Examined: 1 female only.

60. *Wyeomyia* (W.) *corona*, n.sp.

Figs. 107,108

TYPE: Holotype male genitalia and associated larval and pupal skins all on 1 slide (adult male lost), Hermitage Dam (St. Andrew), Jamaica, elev. 1500 ft, epiphytic bromeliad, R.B. Hill and C. McD. Hill (previously designated as allotype of *hirsuta*) [USNM].

Wyeomyia (W.) *hirsuta* in part of Lane (1953:898-900); Stone, Knight and Starcke (1959:79); Porter (1967:36).

Wyeomyia hirsuta in part of Hill and Hill (1946b:236; 1948:34); Thompson (1947:79).

Phoniomyia hirsuta in part of Hill and Hill (1946a:39-41; male, pupa, larva and all figures).

FEMALE. Insufficiently known.

MALE. No material in existence. Based upon description of Hill and Hill (1946a:39), their male allotype of *hirsuta* (= *corona*) was essentially similar to the male of true *hirsuta* in external characters.

MALE GENITALIA (fig. 107). Described and figured from a single damaged specimen, the head of clasper being greatly distorted. Similar to *hirsuta* but with the following differences. *Sidepiece*: Length 3.0-3.5 times greatest width; apical portion bent tergal only very slightly. Scales as well as short setae scattered on lateral and sternal surfaces distad of insertion of tergal triad. *Mesal Plate*: Roughly quadrangular. *Clasper*: Stem short, about 0.3 total length; internal thumblike process poorly developed. Head as figured. Lobe M apically subdivided into 2 lobes: a sternal lobe slightly shorter and narrowed apically, and a tergal lobe broader and slightly emarginate apically; both lobes bearing characteristic patterns of short setae at their apices. Lobe C a single large abruptly recurved arm, its tip attenuate and with a subapical membranous recurved attenuate process; a small patch of very short hairlike spicules on elbow. Lobe A apically expanded and cleft, bearing at apex 1 rather thick pointed seta, 1 slender seta and a short fingerlike projection laterally fringed from apex down into cleft. *Phallosome*: Aedeagus broader, width probably about two-thirds length. *Proctiger*: Paraproct with apex little enlarged, bearing several small apical teeth; setae apparently absent.

PUPA (fig. 107). Described from single pupal skin in poor condition, metano-

tum missing. Chaetotaxy as figured; all hairs slightly longer than in *hirsuta*. Similar to *hirsuta* except for the following. *Cephalothorax*: General pigmentation pale with yellowish tint except for poorly defined pattern in light brown on mesonotum and base of wing cases, as figured. Hairs lightly pigmented; hair 5-C barbed. *Trumpet*: Pigmented golden brown, slightly lighter at apex. Apparently flattened but not laterally expanded, the margins roughly parallel and width of pinna subequal to greatest width of meatus. *Abdomen*: General pigmentation pale with yellowish tint except for poorly defined pattern in light brown on tergites II-IV extending to lateral margin on II but not on III and IV; pattern as figured. Sternites II-VII with narrow light brown bands on anterior margin in middle. Paired brown intersegmental sclerites present following tergites II and III. Hairs slightly pigmented; hair 2-II double and well laterad of hair 1; hair 2-III-VII relatively long and single; more lateral (nearly in line with hairs 1 or 3) and anterior (at level or well cephalad of hair 6) in position; 5-IV-VI barbed, 5-IV extending to about middle of second following tergite and 5-V, VI to near posterior margin of second following tergite; 6-VII apparently ventral in position. *Male Genital Lobe*: Extending to just before middle of paddle; posterolateral corner with small rugose digitiform lobe.

LARVA (fig. 108). Chaetotaxy as figured, variable. As described for *hirsuta* except for the following. Body spicules much shorter, always simple and golden brown. All hairs and basal tubercles moderately pigmented pale to medium golden brown. Stellate hairs and basal tubercles much more strongly developed; hairs generally longer and more strongly branched. *Head*: General pigmentation pale golden. Capsule somewhat less depressed, lateral margin slightly rounded. Maxilla with the long heavy subapical seta with 1-4 branches. Hair 4-C with 3-5 main branches and numerous fine shorter branches; 5-C single or double and with fine shorter branches; 6-C with 4-6 main branches and numerous fine shorter branches, more caudal in position than in *hirsuta*; 7-C with 7-9 branches; 11-C with 7-10 branches; 12-C heavy and with 4-7 branches; 14-C heavy and with 7-12 branches. *Antenna*: Hair 1-A double and inserted in apical 0.2-0.3. *Thorax*: Hair 4-P with 11-13 branches, strongly barbed and somewhat less than half the length of 5-P; hair 5-P with 4-6 branches; 6-P triple; 7-P with 3 or 4 branches; 9-P,T double or triple; 9-M single; 14-M longer and with 5 or 6 branches. *Abdomen*: Hair 2-I-VII stellate and anterior, at about level of spiracle and only slightly mesad of hair 1; hair 6-I,II with 7-10 branches; 6-VII 5-branched; 7-II-VI stellate; 8-VI stellate, well cephalad and slightly ventrad of hair 9; hair 8-VII stellate and directly ventrad of hair 9. *Segment VIII*: Comb scales about 25-40; generally shorter, longest comb scale about 0.10 mm long and 2.0-3.0 as long as shortest scale; individual comb scales pigmented light golden brown and less arched in side view; lateral fringe more readily visible but still very faint. Hair 3-VIII multibranched. *Siphon*: Pigmented light golden brown. Index 5.5-6.5. Siphonal hairs (1,1a-S) conspicuously barbed, typically arranged as follows: (1) a pair of long lateral hairs near base, (2) 9-12 long single hairs in a more or less straight ventral line, (3) 9-12 shorter single hairs in an irregular double dorsal line, and (4) 9-12 short multibranched hairs in subapical cluster. *Anal Segment*: Saddle pale golden brown; spicules on posterior margin longer, about 0.5 dorsal length of saddle. Hair 1-X usually 4-branched (3-5); hair 2-X usually 4-branched (3 or 4); hair 3-X double; 4-X with 6-12 branches.

SYSTEMATICS. This species was confused with *hirsuta* by Hill and Hill in their original description. Their allotype male was not conspecific with the holotype female of *hirsuta*. The male genitalia, pupal skin and larval skin of this specimen are here designated as the holotype of *corona* in spite of the fact that the pinned adult

male has been lost. We are forced to take this action owing to the fact that no additional males of *corona* are known. For further discussion of the confusion between *corona* and *hirsuta*, see the systematic discussion of the latter.

Although *corona* shows affinities with the Hirsuta Subgroup, especially *atrata* in the larva and *juxtahirsuta* in the male genitalia as mentioned in the systematics sections for those species, the similarities are largely due to retention of primitive characters, except for the strong larval spiculation which is due to parallelism. *Wyeomyia corona* is probably most closely related to *stellata* on the basis of common possession of certain derived characters in all stages as given in the general discussion of the Stellata Subgroup under the genus. However, *corona* has the following derived characters not possessed by *stellata*, indicative of its relatively strong divergence from its most closely related species. These are (1) male clasper lobes A and M with distinct development and (2) larval siphon with apical cluster of short multiple hairs.

It is possible that 2 species are confused in our interpretation of *corona*. In 2 collections made at high elevations (1220 and 1228 m), consisting of larvae only, the hairs are more strongly stellate than in the larvae from the other 2 collections which were made at lower elevations (150 and 380 m). Without males and pupae from the higher elevations it is impossible to determine whether 2 distinct species are involved.

The name *corona* refers to the crown of short multiple hairs on the larval siphon.

BIONOMICS. Immature stages of *corona* have been collected in epiphytic bromeliads (genus not recorded) at elevations of 150-1228 m. They were associated with *Wyeomyia* (*W.*) *vanduzeei*, *Aedes* (*H.*) *walkeri*, *Aedes* (*H.*) *stenei*, *Aedes* (*H.*) *aurites* and *Aedes* (*H.*) *grabhami*.

DISTRIBUTION. Endemic to Jamaica.

JAMAICA. Known only from eastern half of island, well inland. *Kingston and St. Andrew:* Hermitage Dam, R.B. Hill, 1 lpM [USNM]. *Newcastle* (677,678). *St. Ann:* Moneague and vicinity (607,732).

Material Examined: 15 specimens; 1 male genitalia mount, 1 female, 11 larvae, 2 pupae; 2 individual rearings (1 larval, 1 pupal).

61. *Wyeomyia* (*W.*) *juxtahirsuta*, n.sp.

Figs. 109,110

TYPE: Holotype male (JA 676-18), adult, genitalia and associated larval and pupal skins all mounted on 3 slides, Reading, roadside near Five mile (St. James), Jamaica, elev. 30 m, epiphytic bromeliad, 6 Nov 1966, O.G.W. Berlin and D. Watson [USNM].

FEMALE. Wing about 2.5 mm. Essentially as described for *hirsuta*.

MALE. Insufficiently known.

MALE GENITALIA (fig. 109). As described for *hirsuta* except for the following differences. *Segment IX:* Tergite lobes with 3 or 4 setae. *Sidepiece:* Apical third bent slightly tergad, less than in *hirsuta*. Scales as well as short setae numerous on lateral and sternal surfaces distad of insertion of tergal triad. *Mesal Plate:* Quadrangular rather than crescent shaped. *Clasper:* Slightly longer than sidepiece. Stem about 0.5 of total length. Head as figured. Lobe M longer, exceeding A and E, apex less rounded and distribution of setae somewhat different. Lobe C a single large abruptly recurved arm, its tip again recurved and pointed; many hairlike spic-

ules on elbow and outer limb. *Phallosome*: Aedeagus broader, width about 0.5 of length. *Proctiger*: Paraproct with apex little enlarged, bearing 3 or 4 teeth along upper margin and 2 or 3 short setae.

PUPA (fig. 109). Chaetotaxy as figured, not studied in detail; all hairs slightly shorter than in *hirsuta*. As described for *hirsuta* except for the following differences. *Cephalothorax*: Clearly defined pattern of medium brown present on mesonotum and extending forward in a sublateral stripe on each side. *Trumpet*: Lateral expansion slightly less; width of pinna about 0.6-0.8 of greatest width of meatus. *Metanotum and Abdomen*: Dorsum with clearly defined medium brown stripe from anterior margin of metanotum to segment VI or VII, never broader than 0.3 of width of segment and becoming narrower caudad. Paired medium brown intersegmental sclerites behind tergites II-IV included in the dorsal stripe on the tergites. Sternites III-VI with narrow short brown bands on anterior margin in middle. Hair 1-I single or with a few branches; 2-III-VII well mesad of all other hairs but as anterior as in *hirsuta*; 5-IV-VI relatively poorly developed, never longer than following tergite. *Male Genital Lobe*: Extending to about 0.4 of paddle length; posterolateral corner less produced.

LARVA (fig. 110). Chaetotaxy as figured, variable. Very similar to *hirsuta* except for the following. Entire body, except for head capsule, neck and narrow intersegmental bands which are nude, covered with pale simple to dendritic spicules which are shorter and more often simple; these spicules becoming simple and very small or even absent middorsally and midventrally on thorax and abdomen. Most hairs usually very slightly shorter and with fewer branches than in *hirsuta*. *Antenna*: Hair 1-A with 4 or 5 branches and longer, about 0.7 length of antenna; 2-A about 0.5 length of antenna. *Thorax*: Hairs 1-P, 1,4,5-T without basal tubercles. Hairs 4,5-P with thick thornlike barbs for most of their length; 4-P multi-branched and shorter, less than a third of the length of 5-P; hair 5-P with 7-10 branches. *Abdomen*: Hair 2-I-VII at least double. *Segment VIII*: Comb scales 14-20; somewhat shorter and less arched than in *hirsuta* but at least 0.10 mm long. *Siphon*: Index 6.5-8.5; apex 0.30-0.45 of basal width, not as figured. Siphon with 8-10 dorsal hairs and 9 or 10 ventral hairs, as well as the single basolateral pair. *Anal Segment*: Covered with simple spicules only. Hair 2-X occasionally single.

SYSTEMATICS. *Wyeomyia juxtahirsuta* is closely related to *hirsuta* and *atrata* on the basis of characters given in the discussion of the Hirsuta Subgroup. The immature stages are very similar to *hirsuta*; a condition that probably arose through parallelism as is discussed under *hirsuta*. The male genitalia are clearly of a primitive type: (1) clasper lobe C has a single recurved arm with a long inner limb (as in *corona* and *vanduzeei*), (2) scales numerous on sidepiece and (3) proctiger of moderate size with few setae (as in *vanduzeei*, *luna*, *corona* and *stellata*). *Wyeomyia juxtahirsuta* is the least common species of the subgroup (at least in our limited collections).

The name *juxtahirsuta* refers to the great similarity of the larva to that of *hirsuta*, and to the utilization of the same bromeliad as a larval habitat.

BIONOMICS. Immature stages have been collected from epiphytic bromeliads (*Hohenbergia* sp. in 1 lot) at elevations of from 30 to 600 m in association with the same species as *hirsuta*.

DISTRIBUTION. Endemic to Jamaica.

JAMAICA. *Kingston and St. Andrew*: Hermitage Dam Rd (723). *St. Ann*: Moneague and vicinity (758,774). *St. James*: Reading (676). *St. Thomas*: Norris (653). Windsor Forest, rd to (650).

Material Examined: 23 specimens; 2 males, 1 female, 15 larvae, 5 pupae; 5 individual rearings (1 larval, 2 pupal, 2 incomplete).

62. *Wyeomyia* (W.) *hirsuta* (Hill & Hill)

Figs. 96, 111, 112

1946. *Phoniomyia hirsuta* Hill and Hill, 1946a:39-41. TYPE: Holotype female with associated larval and pupal skins, Hermitage Dam (St. Andrew), Jamaica, elev. 1500 ft., epiphytic bromeliad, R.B. & C. McD. Hill [USNM].

Wyeomyia (W.) *hirsuta* in part of Lane (1953:898-900); Stone, Knight and Starcke (1959:79); Porter (1967:36).

Wyeomyia hirsuta in part of Hill and Hill (1946b:236; 1948:34); Thompson (1947:79).

Phoniomyia hirsuta of Hill and Hill (1945a:2), *nomen nudum*.

? *Wyeomyia* (*Dendromyia*) *pampithes* record from Jamaica of Lane (1953:988); Stone, Knight and Starcke (1959:86); Porter (1967:40).

? *Wyeomyia pampithes* of Hill and Hill (1945a:2; 1948:35); Thompson (1947:79).

? *Wyeomyia pertinans* of Hill and Hill (1945a:2; 1948:35); Thompson (1947:79); Porter (1967:40).

? *Wyeomyia grayii* of Theobald (1905a:39); Johnson (1919:422); Gowdey (1926:74).

FEMALE. Wing about 2.5 mm. Small species virtually indistinguishable from *atrata* and *juxtahirsuta*; tarsi dark except for occasional faint white markings on segments 1 and 2; *apn* covered with silvery scales with violet reflections; labium white ventrally. *Head*: Covered with broad decumbent scales only; dark on disc of vertex, silver-white on sides extending mesad in narrow line for variable distance along orbital margin and in a small spot in center of vertex on anterior margin. Interorbital setae blackish. Interocular space, frons, torus and clypeus without scales, yellow to dark brown and somewhat pruinose. Proboscis very slightly shorter than forefemur; apex slightly enlarged. Labium dark scaled except for a ventral line of white scales for most or all of its length. Palpus dark scaled, subequal to clypeus and about 0.10 of proboscis; apparently 2 segmented, basal segment minute. Antenna about 0.7-0.8 of proboscis. *Thorax*: Mesonotum densely covered with moderately broad dark scales except for a patch of whitish scales on anterior margin in center and a line along lateral margin above paratergite and largely overlapping it. Scutellum covered with scales concolorous with those on mesonotum but somewhat broader. Pleural chaetotaxy reduced; only following pale yellow bristles present: *apn* (several), *sp* (1-3, occasionally absent), *ppl* (3-5), *pra* (3 or 4), lower *stp* (1-3) and upper *mep* (6-11). Pleuron densely and uniformly covered with broad silver-white scales except for the following: *apn* which is covered with silvery scales with violet reflections; and anteroventral margin of *stp*, paratergite, meron and metapleuron which are without scales. Postnotum rounded, keel poorly developed; a small patch of several pale yellow hairs in center near posterior end; scales absent. *Legs*: Coxae and trochanters largely covered with silver-white scales. Forefemur dark scaled on anterior surface except for variable white scaled area at base; posterior surface covered with white scales that usually extend over to anterior surface in about the basal third from both dorsal and ventral edges. Mid and hindfemora and all tibiae largely dark scaled on anterior surface and white scaled on posterior surface. Tarsi dark scaled except for a faint variable line of white scales on posterior surface of segments 1 to 2 or 3 which may be absent, especially on hindtarsus. Tarsal claws small, subequal, simple. *Wing*: Scallation all dark. Plume scales ligulate on branches of radius and media except near the apices of veins (as in fig. 102). *Haltere*: Stem white; knob with ventral surface white scaled, dorsal surface dark scaled. *Abdomen*: Tergites completely dark scaled; sternites complete-

ly white scaled; line of demarcation between dark and light areas more or less straight.

MALE. Essentially as in female, usually somewhat smaller in size and with the following differences. Midtarsus white on posterior surface for entire length; midtarsal segments 4 and 5 proportionately slightly wider and shorter than in female, with specialized setae and tufts of scales; midtarsal claws unequal, one minute, the other enlarged, simple and strongly curved (as in fig. 102).

MALE GENITALIA (figs. 96 and 111). *Segment VIII*: Tergite with posterior margin broadly emarginate, bordered with band of long setae; anterior to setae a diagonal band of scales, shorter and broader than in *nigritubus*, from center of posterior margin to middle of lateral margin. Sternite with single row of setae on posterior margin behind a wide band of scales. *Segment IX*: Tergite lobe with single row of 2 or 3 long thick pointed setae, subequal, or lateral setae shorter, apices bent slightly laterad; interlobular bar rather short and slightly convex. Sternite poorly developed, wider than long, well sclerotized only on lateral margin of posterior projection. *Sidepiece*: Length 3.5-4.0 of greatest width; apical half bent tergad. Three very long setae (**tergal triad**) inserted in closely placed tubercles on tergal surface slightly less than 0.5 distance from base of sidepiece; 1 very long seta (**long lateral**) inserted in tubercle on lateral surface about two-thirds distance from base, always lost soon after eclosion. Lateral and sternal surfaces, distad of insertion of tergal triad, with scattered short setae; scales absent or 1 or 2 on side near insertion of long lateral seta. *Mesal Plate*: Roughly crescent-shaped, with scattered short setae, highest point bearing 1 stout longer seta. *Clasper*: About 0.9 of sidepiece length. Stem short, about 0.4 of total length, with internal thumblike process at base. Head as figured; 4 lobes developed, a large median lobe (M) and 3 smaller ones (A, E and C). Lobe M most sternal in position, with rows of very short setae along sides and on apex. Lobe C an armlike projection from base of lobe M parallel to clasper stem and extending to its base, the attenuate apex bent abruptly to side and with short hairlike spicules; base of lobe C with a recurved pointed arm, somewhat shorter than apical arm. Lobe E a long fingerlike lobe arising near base of lobe M and tergomesad of it; apex with cluster of very short setae; tergal margin with membranous flap along full length and extending tergad. Lobe A a long rodlike lobe arising at base of lobe E and tergomesad of it, with 2 short stout pointed apically curved setae at apex and 1 short simple seta below the 2 hooked setae. *Phallosome*: Aedeagus narrow, width about one-third length, widest point near middle; a pair of submedian tergal arms joined at midline forming a narrow median tergal bridge; a pair of apical tergal arms bent towards each other but not joined; and a membranous median sternal plate with a few lateral serrations at apex. *Proctiger*: In lateral view with basal rodlike sclerotization joined at right angle to base of paraproct. Paraproct rodlike, with enlarged apex bearing 2 or 3 small teeth on lateral corner and a dense tuft of about 25 short setae.

PUPA (fig. 111). Chaetotaxy as figured, not studied in detail; variable as in most species of *Wyeomyia*. Recognized by the distinctive brown pattern on the integument and the extremely flattened laterally expanded trumpet. *Cephalothorax*: General pigmentation very pale except for clearly defined pattern of uniform medium to dark brown on the mesonotum from just anterior to attachment of trumpets to posterior margin and laterally to bases of trumpets and wing cases. Hairs mostly unpigmented; 1-C more anterior in position than in other tribes of Culicinae, very long, invariably double and sigmoid; 5-C very long, always single and without barbs, all other hairs weak and with 1-4 branches, except 8-C which is single and may be

moderately long. *Trumpet*: Small, extending only about to middorsal ridge. Pigmented medium brown, progressively slightly lighter towards apex. Tracheoid not developed; entire surface with minute imbricate spicules. Greatly flattened and laterally expanded in middle so that width of pinna is about 0.5 of greatest width of meatus; appearing slightly sigmoid when viewed on edge. Pinna with small rounded opening; no suggestion of slit. *Metanotum*: Pigmentation very pale except for center and along mesal half of anterior margin which is medium to dark brown. Hairs unpigmented and relatively weak; 10,11-C usually single; 12-C double or triple. *Abdomen*: General pigmentation very pale except for well-defined medium to dark brown pattern consisting of a middorsal area on posterior half of I, all or all but lateral margins of II and III, and a middorsal stripe becoming gradually narrower and fainter on IV-V or VI. Sternites IV-VI with narrow brown bands on anterior margin in middle. Paired medium to dark brown intersegmental sclerites present in dorsal membrane following segments II,III and often IV; these tend to carry out pattern on tergites, being large after II and III, and absent or small and central after IV. Integument smooth except for very minute spicules on most surfaces. Hairs largely unpigmented. Hairs weak and single or with a few branches except for following: 1-I a large dendritic float hair; 9-VII,VIII large subequal multi-branched hairs characteristic of Sabethines; and 3,6-I,II, 3-III, 5-IV-VI which tend to be long and single. Hair 1-II multiple; 2-II single and just laterad of hair 1, hair 2-III-VII single and anterior in position (in line with or slightly posterior to hair 6 on III,IV and anterior to hair 6 on V-VII) and well mesad of hair 1; hair 5-IV-VI without barbs, 5-IV subequal to following tergite, 5-V,VI slightly longer than following tergite; 6-II posterior to hair 9 and at about level of hair 7, hair 6-III-VI at level or cephalad of hair 9 and relatively short and single or double, 6-VII dorsal and slightly mesad of hair 9; hair 9-VIII considerably shorter than paddle. Posterolateral corner of segment VIII smoothly rounded. *Paddle*: About twice as long as segment VIII. Pigmentation very pale; midrib poorly developed; external buttress not developed. Margins with single line of minute spicules from about middle to apex on both sides. Index 2.0-2.5; tapered strongly only near apex, extreme tip usually truncate. Hairs 1,2-P absent. *Male Genital Lobe*: Extending to about middle of paddle; posterolateral corner produced but not developed into digitiform lobe.

LARVA (fig. 112). Chaetotaxy as figured, variable. Entire body, except for head capsule, neck and narrow intersegmental bands, densely and more or less uniformly covered with dendritic or sometimes simple spicules. All hairs, spicules and sclerotized portions unpigmented to very pale golden. *Head*: General outline rounded; without ocular bulge; length only slightly less than width, about 0.85-0.95; head capsule strongly depressed so that anterior and lateral margins are sharp edged. Labrum not distinct dorsally, with only a slight bulge at base of hair 1-C; mouth-brushes dense, lateral filaments straight and inner filaments apically hooked. Mandible and maxilla normal, not enlarged or adapted for predaceous feeding, the long heavy subapical seta on maxilla single or double; mental plate with 1 large central tooth and about 11-13 pairs of small lateral teeth; maxillary suture complete, extending straight forward from posterior tentorial pit which is on venter of capsule distinctly removed from caudal margin. Collar absent; foramen magnum slitlike, with conspicuous dorsolateral extension on each side. General pigmentation very pale except for portions of mouthparts and edges of lateral part of foramen magnum. Hairs 0,3-C very small and ventral; 1-C relatively slender and bluntly pointed, inserted on anterior margin but characteristically bent ventrad; 4-7-C typically

with 1 or 2 main branches and numerous shorter fine branches; 4,6,7-C evenly spaced along anterior margin in a straight line, 5-C well caudad; 11-C with 3-7 branches, rather heavy and inserted on small tubercle; 12-C with 2-4 branches; 13-C usually in line with hairs 11 and 12; hair 14-C with 2-6 branches, never more than 0.4 of head capsule length. *Antenna*: Short, about 0.25 of head capsule length, without spicules. Hair 1-A double or triple, about 0.5 of antennal length and inserted in apical 0.1-0.2; hairs 2-6-A small and inconspicuous. *Thorax*: Densely and uniformly (except on neck and narrow intersegmental bands) covered with dendritic spicules about half as long as hair 1-M. Hairs 1,4,8-P, 8-M, 1,4,5,7,13-T all with at least small basal tubercles; groups 9-12-P,M,T, 2,3-P, 5-7-P and 5,6-M with common tubercles. Hairs with normal hairlike barbs or without barbs; 4-P evenly barbed from near base and somewhat shorter than half the length of 5-P. Following hairs tending to become multibranched and stellate: 0,1,4,8-P, 1,13-M, 1,4,5-T. Hairs 7,9,10,12-P, 5,6,9,10,12-M, 9,10,12-T long and single or double; 5,6-P long and with 3-7 branches; 7,13-T long and multibranched. Hair 11-P,M,T well developed, with 2-5 thick rigid branches; 13-P absent; 14-P,M short and with few branches. *Abdomen*: Densely and uniformly (except for narrow intersegmental bands) covered with dendritic spicules about as long as hair 0. Hair 1-I-VII tending to be stellate; 2-I-VII relatively short and single or double, although often multibranched and stellate on segments I,II, well caudad of spiracle and well mesad of hair 1; hair 3-I-VII usually single and relatively long, especially on segments III-V and VII; hair 4-I-VII variable but often single and never stellate; 5-I-VII tending to be stellate; 6-I,II long and with 6-9 branches, on common tubercle with 7-I,II; hair 6-III-VI very long and single, with basal tubercle; 6-VII much shorter and with 3 or 4 branches; 7-I,II moderately long and with 4-6 branches, 7-III-VI shorter and multibranched, occasionally stellate, 7-VII single; 8-II-V small and with 1-4 branches, well cephalad of hair 9 and only slightly or not at all ventrad; 8-VI,VII small and multibranched, usually directly ventrad of hair 9; hair 9-I-VII multibranched and strongly stellate; 10-I-VII, 12-II-VII of moderate length and single, sometimes double; 11-I multibranched and stellate, 11-II-VII very short and with 1-3 branches; 13-I-VII multibranched and tending to be stellate. All stellate hairs inserted on small basal tubercles. *Segment VIII*: Comb scales 22-30, in a perfectly straight line from just ventrad of hair 1 to just short of midventral line, the scales progressively shorter ventrad, longest scales at least 0.10 mm long and 2.0-4.0 length of shortest one; individual comb scales very pale golden, long, narrow and pointed, with long bases, both base and especially spine strongly arched in side view; faint lateral fringe present from base to apex, visible only under special light conditions at high magnifications. Integumentary spiculation as on rest of abdomen except that spicules tend to be shorter and simple behind the comb scales. Hair 1-VIII tending to be stellate; 2,4-VIII moderately long and single; 3-VIII short and with 3-5 branches; 5-VIII long and double. *Siphon*: Index 6.0-8.0, sides parallel in about basal half then tapering gradually in apical half to an apex 0.40-0.50 times as wide as base, not as figured. Integument evenly covered with short simple spicules except at apex. Siphonal hairs (1,1a-S) single or occasionally double and highly variable both as to number and placement, usually not in pairs but typically arranged as follows: (1) a pair of long lateral hairs near base, (2) 8-13 long hairs in an irregular ventral line, becoming shorter near apex, and (3) 9-12 shorter hairs in an irregular dorsal line; 2-S thickened in middle, laterally compressed, and with a curved and pointed tip, inserted on small distinct tubercle, not on body of siphon. Valves small and colorless; hairs 6,9-S small and single; 8-S shorter than 2.0 width of apex

of siphon, single; median caudal filament not apparent. *Anal Segment*: Saddle not clearly defined but incomplete, extending just ventrad of hair 1-X. Integument, including saddle, covered with short simple spicules becoming long and heavy on posterior margin of saddle, and long and dendritic ventrally. Hairs 1-3-X very long, heavy and double; 4-X shorter and with 3-6 branches. Gills narrow, tapering; 2.0-3.0 of dorsal saddle length, ventral pair somewhat shorter than dorsal.

SYSTEMATICS. Hill and Hill's original description of *hirsuta* included 2 species. The true *hirsuta* has to be interpreted on the basis of the holotype female. The male allotype belongs to a different species which we are describing here as *corona*. Unfortunately all the figures in Hill and Hill's original paper are based on male specimens and are of *corona* and not *hirsuta*; these figures and the description of the male and larva in Lane (1953:898-900) are reproduced from Hill and Hill and are also of *corona*.

Hill and Hill apparently suspected that they had 2 species in their material from Fern Gully and Hermitage Dam and sent slides of male genitalia of both forms and another slide of a pupal and larval skin of 1 of these to John Lane through W.H.W. Komp (Hill and Hill, 1946a:39; 1948:34 [*hirsuta*], 35 [*pampithes*]). Lane evidently recognized that 2 species were involved but obviously a misunderstanding developed for at first Hill and Hill (1946a:39) stated that Lane "reported that it [*hirsuta*] was a new species of *Phoniomyia*" and later (Hill and Hill, 1946b:236) stated "Due to a misunderstanding the mosquito [*hirsuta*] was incorrectly placed by us in the genus *Phoniomyia*. We have been informed by Dr. John Lane and by Dr. Harry D. Pratt that the correct genus is *Wyeomyia*." We believe that the misunderstanding also involved the other species which Hill and Hill (1948:35) stated was identified by John Lane from a genitalia mount as *pampithes* (Dyar & Nunez Tovar, 1928). In the Hill and Hill material at the Institute of Jamaica we found a slide of male genitalia and another of a larval skin labeled in pencil respectively //Phon./pam/♂ 151// and //Phon./pam/Larva 151//. The species on both slides is true *hirsuta*. The male genitalia slide may be the one seen by Lane in spite of the fact that Hill and Hill (1948:35) state "The larva was not saved and has not been taken again" for the identifying number (151) appears to be a general collection number as it occurs also on a slide with a whole mount of *mitchellii*. The larval skin of "pam" may have been subsequently discovered in the material mounted from collection 151. In view of the condition of the male genitalia mount it is conceivable that Lane may have tentatively identified it as species near *pampithes* or *pampithes* itself on the basis of the original description of Dyar and Nunez Tovar for obviously he was uncertain about the identity of this species and later (Lane, 1953:988) described and figured as *pampithes* a species which in no way agrees with the original description. We are therefore tentatively considering the "*pampithes*" from Jamaica to be the male of *hirsuta*.

We are also tentatively assigning to *hirsuta* the records of *pertinans* and *grayii* from Jamaica as listed in the taxonomic references above. These records are all based on dark legged specimens collected by Grabham and originally identified as *grayii* by Theobald and later assigned to *pertinans* following the currently accepted synonymy of the 2 nominal species. The species has not been identified by subsequent workers and Grabham's material is lost. It obviously belongs to the dark legged forms of the *Hirsuta* Subgroup which are indistinguishable on external adult characters. We have chosen to assign these records to *hirsuta* because it is the most common species.

Wyeomyia hirsuta is the dominant, most highly derived species in the *Hirsuta*

Group, exhibiting the largest number of advanced characters (considering *vanduzeei*-like characters to be primitive) such as (1) adult with *apn* all silvery-violet, tarsi of female all dark (all shared with *atrata* and *juxtahirsuta*), (2) male genitalia with scales on sidepiece greatly reduced or absent, proctiger large and with numerous setae, clasper lobes greatly simplified, lobe C with 2 arms (all shared with *atrata*), (3) pupa with dark distinctive pattern, trumpet laterally expanded (both shared with *juxtahirsuta*), (4) larva with sclerotized parts very poorly pigmented, body spicules long and strongly dendritic, comb scales long and arched (all shared with *juxtahirsuta*). *Wyeomyia hirsuta* is probably most closely related to *atrata* since it is difficult to see how the unique and very similar male genitalia in the 2 forms could be due to anything other than common ancestry, while the similarities of the immature stages of *hirsuta* and *juxtahirsuta*, although great, are not unique and could conceivably have arisen through parallelism. These 3 closely related species of the Hirsuta Subgroup are largely or completely sympatric and although in the case of *hirsuta* and *atrata* there is apparently an ecological barrier (they apparently breed in different bromeliads), in the case of *hirsuta* and *juxtahirsuta* it is difficult to see how they can successfully compete since they are both found in *Hohenbergia* and, in 4 collections, the same plant. A possible explanation is that they exploit different microhabitats in the same bromeliad. *Hohenbergia* are large bromeliads with a central tank containing a large amount of relatively clear water and smaller amounts of muddy water in the lower (outer) leaf axils.

BIONOMICS. Immature stages of *hirsuta* have been collected from epiphytic bromeliads (*Hohenbergia* sp. in 3 lots, *H. pendiflora* in 1 lot) except for a single collection from *Heliconia* flower bracts, at elevations from 30 to 600 m. Almost always found in association (same bromeliad, but see above under systematics) with *hirsuta* were *Aedes* (*H.*) *walkeri*, *Aedes* (*H.*) *stenei* or *Aedes* (*H.*) *grabhami*; often other species of *Wyeomyia* (*mitchellii*, *juxtahirsuta* or *stellata*); and less often *Culex* (*Micr.*) *arawak* and *Culex* (*C.*) *corniger*.

A few adult females belonging to the Hirsuta Subgroup and probably *hirsuta* itself have been taken in biting-landing collections (man), but it is not known if they were actually biting.

DISTRIBUTION. Endemic to Jamaica.

JAMAICA. Relatively widespread in inland parts of the island. *Kingston and St. Andrew*: Castleton, 2 mi S of (645). Hermitage Dam Rd (723,725). Mount Salus (779,846). Temple Hall (646). *Manchester*: Hope Farm (663A,684). Melrose Hill (655). *Portland*: Devils Elbow (920). Ecclesdown (748). Sherwood Forest (706). *St. Ann*: Fern Gully (931); R.B. Hill, 1 M, 1 L [JAM]. Moneague and vicinity (377,758,763,767,772,774). *St. James*: Reading (670,671,674,676). *St. Mary*: Castleton Botanical Gardens (664). *St. Thomas*: Windsor Forest, rd to (651).

Material Examined: 191 specimens; 15 males, 31 females, 101 larvae, 44 pupae; 41 individual rearings (12 larval, 23 pupal, 6 incomplete).

63. *Wyeomyia* (*W.*) *atrata*, n.sp.

Figs. 113,114

TYPES: Holotype male (JA 740-10), adult, genitalia and associated larval and pupal skins all mounted on 3 slides, Dunns River (St. Ann), Jamaica, 100 yd above falls, elev. 20 m, epiphytic bromeliad (*Tillandsia*), 20 Aug 1967, J.N. Belkin and W.A. Page [USNM]. Allotype female (JA 740-101) with associated pupal skin mounted on 1 slide, same data as holotype [USNM]. Paratypes: 2 pF (JA 740-100,102), 5 larvae (JA 740-1), same data as holotype [UCLA].

FEMALE. Wing about 2.4 mm. Essentially as described for *hirsuta*.

MALE. Insufficiently known.

MALE GENITALIA (fig. 113). Essentially as described for *hirsuta* except for following differences. *Sidepiece*: Slightly broader, length 3.0-3.5 of greatest width. *Clasper*: Stem slightly longer, about 0.5 total length. Lobe C with apical arm shorter, not reaching to base of stem, apex straight and pointed, not bent to side; basal recurved arm longer than apical arm. *Phallosome*: Aedeagus broader, width about 0.5 of length. *Proctiger*: Setae at apex of paraproct somewhat longer and more numerous.

PUPA (fig. 113). Chaetotaxy as figured, not studied in detail. As described for *hirsuta* except for the following. *Cephalothorax*: General pigmentation pale with yellowish tint except for poorly defined mottled pattern in pale golden brown (as figured) on mesonotum, pleural areas and base of wing cases. Hairs lightly pigmented. *Trumpet*: Pigmented golden brown. Greatly flattened but not laterally expanded, the margins roughly parallel, width of pinna subequal to greatest width. *Metanotum and Abdomen*: General pigmentation pale with yellowish tint except for poorly defined mottled pattern in light golden brown (as figured) on metanotum and all tergites, progressively lighter and less extensive caudad, extending to lateral margins on tergites I-III or IV but not on other tergites. Sternites II-VII with narrow light brown bands on anterior margin in middle. Paired light to medium brown intersegmental sclerites caudad of tergites II-IV or V; more or less round and progressively slightly smaller caudad. Hairs lightly pigmented; hair 12-C single or double; 2-II cephalad and typically mesad of hair 1; hair 2-III-VII well mesad of other hairs and cephalad of hair 6 at least on segments V-VII; hair 5-III subequal to 3-III. *Paddle*: Pigmentation pale with yellowish tint. *Male Genital Lobe*: Extending to about 0.4 of paddle.

LARVA (fig. 114). Chaetotaxy as figured, variable. Very similar to *hirsuta* except for the following. Body spicules much shorter, more often single and dark brown. All hairs and sclerotized portions moderately pigmented pale to medium golden brown. *Head*: General pigmentation pale golden. Hair 7-C with 3-5 main branches and numerous shorter branches; 11-C with 8-17 branches. *Antenna*: Hair 1-A with 3-5 branches and longer, about 0.7 length of antenna; 2-A about 0.5 length of antenna. *Thorax*: Hairs 1,4,5-T without basal tubercles. Stellate hairs poorly developed, only 1,4,8-P, 1,4-T with slight tendency to be stellate. Hair 5-P with 7-10 branches; 6-P with 2-4 branches; 7-P double or triple; 9-P,M,T double or triple. *Abdomen*: Hair 2-I-VII short, with 2-5 branches, 6-VII with 2-4 branches. Stellate hairs more poorly developed. *Segment VIII*: Comb scales 22-39; longest scale less than 0.10 mm long and only about 2.0 length of shortest scale; individual comb scales moderately pigmented golden brown and only slightly arched in side view; lateral fringe more readily visible but still very faint. *Siphon*: Pigmented light golden brown. Index 5.0-6.5; apex 0.50-0.60 width of base. Siphonal hairs (1,1a-S) more often double than in *hirsuta* and occasionally barbed, 6-9 dorsal, 5-9 ventral, and usual single basolateral pair. *Anal Segment*: Saddle well defined, pigmented dark golden brown. Hair 1-X with 3-6 branches; 2-X with 2-4 branches; 3-X double or triple; 4-X with 5-9 branches.

SYSTEMATICS. On the basis of the male genitalia *atrata* is probably most closely related to *hirsuta*, as is discussed under that species. Both the larva and the pupa show primitive characters such as (1) larva with sclerotized parts well pigmented, body spicules relatively short and seldom dendritic, comb scales relatively short and little arched, (2) pupa with diffuse pattern on much of dorsum, trumpet not

laterally expanded (all shared with *corona* and in part with *vanduzeei*).

The specific name refers to the dark spiculation of the larva.

BIONOMICS. The immature stages of *atrata* are known from epiphytic bromeliads (*Tillandsia* sp. in 2 lots) at elevations from 76 to 760 m, always in association with *Aedes* (*H.*) *walkeri*, less often with *Aedes* (*H.*) *grabhami*, *Aedes* (*H.*) *stenei*, and *Wyeomyia* (*W.*) *mitchellii*.

DISTRIBUTION. Endemic to Jamaica.

JAMAICA. *Hanover*: Lethe (665,667). *Kingston and St. Andrew*: Hermitage Dam Rd (116, 724,843,856). Irish Town (683). Newcastle, 14-15 mi from Kingston on rd to (648). *St. Ann*: Dunns River (740). *St. Catherine*: Harkers Hall (821). *St. James*: Reading (675). *Westmoreland*: Petersville (787).

Material Examined: 68 specimens; 3 males, 7 females, 48 larvae, 10 pupae; 10 individual rearings (3 larval, 7 pupal).

64. *Wyeomyia* (*W.*) sp., Jamaican form B

FEMALE. Wing 2.5 mm. Essentially as described for *hirsuta* except for the following. Labium with only a narrow ventral line of white scales from base to about 0.8. Hindtarsus with short streaks of white scales at base of all segments on posterior surface.

MALE, PUPA and LARVA. Unknown.

SYSTEMATICS. This form, known only from 3 adult females, resembles closely females of the *Hirsuta* Subgroup except in the white hindtarsal markings, and is tentatively placed in that subgroup. Form B may be an aberrant form of any of the 3 known species of the *Hirsuta* Subgroup or a new species in that subgroup. It is also possible that it is the unknown female of *corona*.

BIONOMICS. Unknown.

DISTRIBUTION. Endemic to Jamaica.

JAMAICA. *St. Ann*: Runaway Bay, Feb 1969, W.W. Wirth, 3 F [USNM].

Material Examined: 3 females only.

GENUS LIMATUS

Adults of this genus have the spiracular bristles replaced by scales and the mesonotal scales with striking brilliant golden, blue and violet sheen in some areas when viewed from certain angles. The larvae resemble *Wyeomyia* but have head hairs 1-C set close together, the distance separating them being less than 0.2 of the antennal length. The pupae are also very similar to *Wyeomyia* but perhaps may be distinguished by the features given in the key.

Until recently the genus was known from the Antilles by 1 male, 1 larva and 1 pupa of *hoffmani* described from Haiti and not known elsewhere. In August 1968, R.H. Hochman collected 2 females on the northern slope of Jamaica that we are provisionally assigning to *hoffmani*. We have also 1 female from Guadeloupe which appears to be different from *hoffmani* and may represent another species endemic to the Antilles.

65. *Limatus hoffmani* Root

1927. *Limatus hoffmani* Root, 1927:465-469. TYPE: Lectotype male with slides of genitalia and associated pupal skin, Riviere Froide, west of Port-au-Prince, Haiti, 14 Oct 1924 [USNM; Root did not designate a holotype and included a whole larva in the type series; therefore the PRESENT DESIGNATION of lectotype is made].

Limatus hoffmani of Dyar (1928:25-26); Lane and Cerqueira (1942:654-655); Lane (1953:1050); Stone, Knight and Starcke (1959:91); Porter (1967:37).

FEMALE. Wing about 2.5 mm. Small species with some mesonotal scales with brilliant metallic golden and violet to blue sheen when viewed from certain angles, spiracular bristles replaced by scales, legs without paddles. *Head*: Decumbent scales of vertex all dark and with deep blue sheen except for small median anterior golden patch; sides with very large patch of silvery scales. Labium entirely dark scaled. *Thorax*: Mesonotal scales all broad, basically bronzy or dark coppery but with brilliant metallic sheen when viewed from certain angles in the following areas: (1) dark violet to deep blue in a restricted patch in fossa and a larger darker patch in front and above wing root, (2) dark golden in front part of disc largely between dorsocentral areas, at scutal angle, scutal suture and continued on prescutellar line, and in front of scutellum including most of prescutellar area and posterior part of supraalar area; mesonotal bristles restricted to anterior promontory, humeral angle, supraalars and 1 or 2 very short posterior prescutellars; paratergite apparently with a few golden scales along external margin. Scutellar lobes with broad bronzy scales. Postnotum flattened and with broad median keel and a narrower sublateral keel in upper part; at end of this area a median patch of about 10-12 light golden hairs preceded by about an equal number of broad light golden scales, sometimes 1 or more similar scales below the hairs. Pleuron almost completely covered by broad scales except metapleuron which is bare, scales golden on upper part including *apn*, *ppn*, *sp*, *psp*, *ssp* and *pra*, distinctly silvery on *ppl*, *stp* and *mep*, pleural bristles restricted to *apn*, lower *stp*, *pra* and upper *mep*; *sp* bristles replaced by scales. *Legs*: Coxae and trochanters with silvery scales. Remainder of legs dark except for usual pale surfaces of femora and lower surfaces of all tibiae and at least base of all tarsal segments 1; pale scaling appearing white to silvery in some aspects. Claws of foreleg and midleg paired, all simple; hindleg with only 1 minute claw. *Wing*: Dorsal vein scales all dark; plume scales all very broad except on Rs and M proximad of *r-m*. *Haltere*: Stem entirely pale; knob dark scaled. *Abdomen*: Tergite I with pale yellowish to whitish scales except for a few small dark scales basally. Tergites II-VII predominantly dark scaled, sides with continuous broad line of pale yellowish to whitish scales on II-VII, with even tergal border in 1 specimen, but slightly produced tergally on apex of segments IV-VI on one side of the other specimen. Sternites pale scaled, somewhat whiter distally.

MALE. Unknown for Jamaican population. The type specimen is said to have "the abdominal colors incised...the proboscis...sharply bent at a little less than half its length and the terminal portion...only slightly arched and swollen. Both the basal portion of the proboscis and the middle of the terminal portion are of about the same dull golden tint. At the bend is a fairly extensive black-scaled area, including a patch of black scales which project ventrally. Just before the tip is a much smaller black-scaled area in the form of an obliquely-placed ring. Ventrally, just beyond the bend, is a small oval patch of blue scales, entirely within the black area at the bend." (Root, 1927:466.)

MALE GENITALIA. Unknown for Jamaican population. Stated to be intermediate between *asulleptus* and *durhamii* for the type by Root (1927:466,468). Apparently distinct from all other species of the genus in the presence of 1 tuft of long setae on the sidepiece.

PUPA and LARVA. Unknown for Jamaican population. Indistinguishable from *durhamii* according to Root (1927:469). Presumably with the generic characters as given here in the keys.

SYSTEMATICS. The assignment of the Jamaican population to *hoffmani* is provisional as our material consists of 2 females and topotypic *hoffmani* is known only by 1 male, 1 larva and 1 pupal skin. However, it seems probable that the populations from Haiti and Jamaica are conspecific. The Jamaican females appear to be intermediate in some respects between *durhamii* (Theobald, 1901) and *asulleptus* (Theobald, 1903) but they are distinct from these and all other known species of *Limatus* in several features as indicated in the description and particularly in the color of the hairs and scales of the postnotum.

BIONOMICS. The only recorded data on the bionomics of topotypic *hoffmani* is that the larvae were "taken on a hillside". The females from Jamaica were taken biting the collector.

DISTRIBUTION. Known only from Haiti and Jamaica.

JAMAICA. *St. Ann*: Fern Gully (930). *St. Mary*: Castleton, 5 mi N on A3 road (956).

Material Examined: 2 females.

TRIBE TOXORHYNCHITINI

GENUS TOXORHYNCHITES

The very large showy adults of the tribe Toxorhynchitini are readily recognized from all other Culicidae by the attenuate caudally recurved distal part of the proboscis. The monstrous larvae and pupae are also easily told from other tribes by the diagnostic characters mentioned in the key. *Toxorhynchites*, the only genus recognized, is amazingly similar in all stages throughout its nearly worldwide distribution and great difficulty is experienced in identifying species. New World species have been diagnosed largely on the basis of light markings of the tarsi, which frequently differ in the 2 sexes and are not always reliable. The metallic coloration of the thoracic scales shows considerable differences among species but is subject to some variation and is difficult to describe accurately owing to marked changes in color depending on the angle of observation. Few specific differences have been noted in the male genitalia. To date no reliable characters have been found to separate any of the species of a group in the larval and pupal stages but it is apparent that some subtle group characters are present.

In Jamaica there is apparently only 1 variable species present. It is retained here as a local population of *portoricensis* but as indicated in the discussion of the species below, the status of this species is questionable. We have provided keys in all stages to separate *portoricensis* from 2 other species reported from adjacent islands. *Toxorhynchites superbus* (Dyar & Knab, 1906) is the name applied provisionally to the species reported from Cuba. *Toxorhynchites guadeloupensis* (Dyar & Knab, 1906) is known definitely only from the northern Lesser Antilles but may also be present in Puerto Rico; records of this species from elsewhere are erroneous. Both species are bromeliad breeders whereas *portoricensis* breeds in treeholes and bam-

boo stumps.

The larvae of *Toxorhynchites* are predaceous on the immature stages of other container-breeding species of mosquitoes and the females are incapable of taking blood. Unsuccessful attempts have been made in the past to use species of *Toxorhynchites* in biological control of disease vectors or pest mosquitoes. Insular species of *Toxorhynchites* appear to have very low population densities that are adjusted to their host species density and are particularly unsuited for biological control.

KEYS TO SPECIES

ADULTS

1. Abdominal segment VII with red lateral scale tufts (Cuba; bromeliad breeder) *superbus*
Abdominal segment VII without any indication of red lateral scale tufts. 2
- 2(1). Hindtarsal segment 4 with a complete white ring occupying nearly the entire segment; pleural scaling (other than *apn* and *ppn*) dingy silver
. **66. portoricensis**
Hindtarsal segment 4 without such a white ring; pleural scaling distinctly light golden (Lesser Antilles; bromeliad breeder) *guadeloupensis*

PUPAE

1. Apex of paddle broadly truncate **66. portoricensis**
Apex of paddle broadly rounded (bromeliad breeders). 2
- 2(1). Abdominal hair 6-V very short; trumpet brown, much darker than cephalothoracic integument (Lesser Antilles) *guadeloupensis*
Abdominal hair 6-V very long, subequal to 6-VI; trumpet yellow, lighter than cephalothoracic integument (Cuba) *superbus*

LARVAE

1. Ventral brush usually with 10, rarely 9, pairs of hairs; siphon short, index usually less than 2.5 **66. portoricensis**
Ventral brush usually with only 8 pairs of hairs; siphon larger, index at least 3.0 (bromeliad breeders) 2
- 2(1). Siphonal hair 1-S usually with 6 or more thin branches (Lesser Antilles)
. *guadeloupensis*
Siphonal hair 1-S usually with 4 heavy branches (Cuba) *superbus*

66. *Toxorhynchites* (L.) *portoricensis* (von Röder)

Figs. 115,116

1885. *Megarrhina portoricensis* von Röder, 1885:337-338. TYPE: Holotype male, unspecified locality in Puerto Rico [apparently lost].
1906. *Megarhinus haitiensis* Dyar and Knab, 1906d:253-254. TYPE: Holotype female (134.1) with associated larval and pupal skins, San Francisco Mts, Santo Domingo [Dominican Republic], Sept 1905, A. Busck [USNM, 9955]. Synonymy with *portoricensis* by Howard, Dyar and Knab (1917:959).

Toxorhynchites (*Lynchiella*) *portoricensis* of Lane (1953:128-129, in part); Perez Viguera (1956:487-493); Stone, Knight and Starcke (1959:60, in part); Montchadsky and Garcia (1966:34, in part); Porter (1967:36).

Megarhinus portoricensis of Theobald (1901a:232-233; 1905b:13; 1907:129; 1910:93; all in part); Coquillett (1906b:14); Dyar and Knab (1906d:245); Howard, Dyar and Knab (1917:958-962); Root (1927:465); Dyar (1928:408-409); Edwards (1932:60); Tulloch (1937:151); Hill and Hill (1945a:3; 1948:39); Thompson (1947:49); Vargas (1953:28-31, in part).

FEMALE. Wing about 6.5-7.5 mm. A very large, brilliantly colored species with distal part of proboscis attenuate and recurved caudad; scaling all broad, flat and very dense; setae reduced. *Head*: Decumbent scales dark except for patch of light ones laterally, appearing dark bronzy to coppery from the front; an indefinite pale ocular border connected to light lateral patch. Labium dark bronzy with blue to violet reflections when viewed from different aspects. Palpus extending to about beginning of strong curvature of labium; apical segment blunt, about 0.5 of pre-apical; color dark bronzy with violet, blue or rarely green reflections except for narrowly pale apex of last 3 segments. *Thorax*: Mesonotal scales predominantly dark bronzy but some of these scales appearing dark coppery in some aspects; a conspicuous narrow acrostichal line of moderately dark greenish blue scales and some scattered similar scales in prescutellar space, a broad even lateral line of lighter greenish blue scales joining acrostichal line in front, involving *apn*, *ppn* and extending to supraalar bristles where scales are usually reddish purple when viewed from the front. Scutellum with dense vestiture of similar greenish blue scales except for lateral patch of light scales. Paratergite bare. Lower part of *ppn* with pale scales; *ppl*, *pst*, most of *stp* and *mep* with dense vestiture of dingy silvery scales. *Legs*: Coxae and trochanters with dingy silvery scales as on lower part of pleuron. Remainder of legs dark with deep blue, purple or deep violet reflections except for (1) lower surfaces of femora which are light (extensively at base), (2) small light knee spots on all femora, (3) inconspicuous dingy pale scales on anterior surface of segment 2 of midtarsus in most specimens, and (4) segment 4 of hindtarsus conspicuously white on all surfaces (exclusive of extreme apex). *Wing*: Dorsal scales all dark with deep blue to violet reflections. *Haltere*: Stem pale, knob dark scaled. *Abdomen*: Laterotergite densely covered with dingy silvery scales as on lower part of pleuron. Tergites I-VIII entirely dark with deep blue to purple or deep violet reflections except for very narrow lateral pale lines. Sternites predominantly with dingy silvery to light golden scales.

MALE. Essentially similar to female in color except that midtarsal segment 2 lacks the anterior pale scales and posterior surface of most of hindtibia and base of hindtarsal segment 1 with elongate narrow golden scales. Palpal segment 5 pointed, without apical pale scales, about 1.7 of segment 4. Antennal flagellum very strong-

ly plumose; flagellar segment 1 much longer than in female and with many more scales which are dark except along lower inner margin of segment. Claws of foreleg and midleg enlarged, larger claws toothed.

MALE GENITALIA (fig. 115). As figured; without obvious distinctive features, not studied in detail; in general very similar to *rutilus* and *septentrionalis* as described by Carpenter and LaCasse (1956:59-60). Clasper very long and slender, its spiniform long.

PUPA (fig. 115). Extremely large; rather uniformly heavily pigmented. Chaetotaxy as figured, not studied in detail; apparently very similar to *rutilus* and *septentrionalis* and other treehole breeding species of the subgenus *Lynchiella*. Trumpet moderately long, uniformly pigmented. Abdominal chaetotaxy variable; hair 6-VI very long, subequal to 5-VI; hairs 6-II-V usually all short but 6-V variable, rarely (JA 623-10) as long as 6-VI. Paddle distinctly broadly truncate apically; hairs absent. Cercal lobe with well developed hair 1-X.

LARVA (fig. 116). Extremely large; purplish or reddish in life. Chaetotaxy as figured, not studied in detail; apparently quite variable but very similar to *rutilus* and *septentrionalis*, other treehole breeding species of the subgenus *Lynchiella*, and even to Old World species of subgenus *Toxorhynchites*. *Head*: Rectangular in outline; heavily pigmented. Mouthbrushes composed of about 10 broad flattened curved simple filaments. *Antenna*: Short, slender and without spicules. *Thorax*: Most hairs on large common plates as figured. *Abdomen*: Segment I with 4 pairs of plates from which most hairs arise; segments II-VII with 3 pairs of such plates. *Segment VIII*: Comb scales absent; large sclerotized plate bearing hairs 2-5. *Siphon*: Heavily pigmented. Variable in length and index, usually shorter and broader than figured. Pecten absent. Hair 1-S near base, sometimes on a conspicuous tubercle. *Anal Segment*: Saddle complete, heavily pigmented; lateral portion of caudal margin with conspicuous spicules, those dorsad of hair 1-X markedly differentiated into short and long ones, those ventrad varied in length. Hair 1-X on caudal margin; single, strongly barbed. Ventral brush with 9 or 10 pairs of single strongly fringed hairs.

SYSTEMATICS. The Jamaican species of *Toxorhynchites* belongs to *portoricensis* as currently interpreted but this may be a complex rather than 1 species. The conspecificity of the Jamaican population with *portoricensis* itself is questionable and tentative only because of lack of specimens of the complex from critical areas and because even the supposed diagnostic feature of the *portoricensis* complex (white markings confined to hindtarsal segment 4 in both sexes) does not hold for some populations, including the Jamaican.

The female of true *portoricensis* has apparently never been collected and the only 2 males reported in the literature are apparently lost, the unique specimen (not 2 as indicated by Belkin, 1968b:34) from which von Röder described the species and the specimen mentioned by Tulloch (1937:151). In the original description of *portoricensis* the mesonotal and scutellar scales are stated to be greenish gold. This is markedly different from the condition in most other populations of the complex but may be in error because of the partially denuded condition of the specimen. The only material of the complex we have seen from Puerto Rico is 1 larva [USNM] on which the other record in Tulloch's account is apparently based. This larva agrees with the material we have from Jamaica but this is not significant since our larvae cannot be differentiated even from *septentrionalis* as well as many other treehole breeding New World *Toxorhynchites*. There is a possibility that 2 species of *Toxorhynchites* occur on Puerto Rico as Tulloch men-

tions the larval habitat of *portoricensis* as bromeliads as well as treeholes. Such is the case on Montserrat, a much smaller island than Puerto Rico, where a form of *portoricensis* breeds in treeholes and *guadeloupensis* (Dyar & Knab, 1906) in bromeliads. The Puerto Rican larva we have examined cannot be *guadeloupensis* because of the markedly shorter siphon and is therefore presumed to be true *portoricensis* from a treehole. Von Röder's *portoricensis* cannot be the same species as *guadeloupensis* because the male of the latter does not have hindtarsal segment 4 nearly completely white. Early workers reported the more northern U.S.A. form, *septentrionalis* (Dyar & Knab, 1906) of the *rutilus* (Coquillett, 1906) complex, as *portoricensis* because of the restricted tarsal markings of the male. Although there is a great deal of general similarity in mesonotal markings between the *portoricensis* and *rutilus* complexes, the adults from Jamaica, Hispaniola (Haiti, Dominican Republic) and Montserrat we have seen can be readily separated from the *rutilus* complex and it seems very likely that this would also be the case with true *portoricensis*.

The present concept of *portoricensis* is based on the Hispaniola population, described as *haitiensis* by Dyar and Knab from the Dominican Republic and synonymized with *portoricensis* by Howard, Dyar and Knab (1917:959). We have seen all the original topotypic material of *haitiensis*, including the only female, as well as another female (legs broken) from Haiti. The former female has midtarsal segment 2 marked with dingy white scales on the anterior surface as in most Jamaican specimens. This feature was overlooked in the original description and all subsequent redescriptions of this specimen.

Most adults of the Jamaican population have a much darker mesonotal scaling than any other population we have seen, showing a much narrower median light line and no blue scales in the fossal area when viewed from the side. However, the only specimen, a female, we have from northern Jamaica (JA 924-12) does have some light scales on the fossa above the light lateral border as well as in the caudal part of the disc, approaching in this respect the *haitiensis* population, in which however there are more numerous moderately dark greenish blue scales in the fossa and lighter more coppery scales in the prescutellar area and on the scutellum. Most Jamaican females, including the one from the northern slope, have a long line of dingy light scales on anterior surface of midtarsal segment 2 as in the *haitiensis* female mentioned above. The larvae of the Jamaican population show no significant differences from *haitiensis* and exhibit considerable variation in the siphon and chaetotaxy. Two of the Jamaican larvae have the siphon similar to the Puerto Rican specimen; in the majority the siphon is shorter, as in *haitiensis*. As noted above, there is considerable variation in the chaetotaxy of Jamaican pupae.

Of the Montserrat population we have only 1 male (MNT 17-10) with associated larval and pupal skins reared from a treehole. The ornamentation of the adult is similar to *haitiensis*; the larval siphon is similar to the Puerto Rican specimen and the longer-siphoned Jamaican specimens; the pupa is indistinguishable from the Jamaican population.

Final resolution of the *portoricensis* complex must await discovery of adults (particularly females) from Puerto Rico and restudy of all the available material. In view of the above facts, it appears possible that only 1 species is involved, with small relict populations showing considerable differentiation as well as a great deal of individual variation.

The *portoricensis* complex is definitely known at present only from the islands of Montserrat, Puerto Rico, Hispaniola, Jamaica and Cuba. We have seen no material from Cuba but the description under this name in Perez Viguera (1956:

487-493) conforms well with *portoricensis* as interpreted here; however, Montchadsky and Garcia (1966:34) report it from bromeliads as well as treeholes in Cuba and it is possible that 2 species may be confused under this name on the island.

Other records of *portoricensis* are probably erroneous. We have an undescribed form from Grenada (GR 31,51,111) which could be mistaken for *portoricensis* on the basis of tarsal markings but it differs in the more restricted white scaling on hindtarsal segment 4, greenish gold light markings of the mesonotum, and distinctly different larva and pupa; it has been found breeding in bromeliads and fallen fruits. This could be the species reported as *portoricensis* from Venezuela (Stone, Knight and Starcke, 1959:60) and from St. Vincent (Williston, 1896:270).

BIONOMICS. The immature stages of this predaceous species have been found in Jamaica only in large treeholes, such as occur in old mangos, yokewood and balsam cedar. The water is typically reddish brown and may be clear or turbid and with organic sediment at the bottom. The immature stages are frequently found in a solitary state, the larvae having consumed their prey or siblings. The more common associates of *portoricensis* appear to be *Orthopodomyia waverleyi* and *Corethrella appendiculata*, and the less common *Haemagogus equinus*, *Aedes (F.) mediovittatus* and *Aedes (S.) aegypti*.

Both sexes fly during the day and because of their large size and striking appearance attract the attention of even general collectors. The species appears to be uncommon.

DISTRIBUTION. Puerto Rico (type locality), Cuba, Hispaniola, Jamaica and Montserrat; other records apparently erroneous.

JAMAICA. Probably widespread over the island; our collections were all at elevations of more than 100 m. *Kingston and St. Andrew*: Constant Spring (697-699). Hermitage Dam Rd (118, 285,332,394,623). Long Mt., 4 Jan 1959, T.H. Farr; 23 Oct 1955, D. Gregory; 21 Nov 1955, T.H. Farr, 3 M [JAM]. *Manchester*: Hope Farm (634,663). *Portland*: Port Antonio (924). *Parish and Locality not Specified*: 2 F, R.B. Hill [USNM].

Material Examined: 41 specimens; 8 males, 9 females, 11 larvae, 13 pupae; 12 individual rearings (8 larval, 4 pupal).

SUBFAMILY CHAOBORINAE

The Carnivorous and Phantom Midges

The adults of the Chaoborinae are small midgelike species with short mouthparts, bristly thorax, legs and abdomen, and hairy wings. The venation is essentially as in the true mosquitoes of the subfamily Culicinae and scales are always present in the fringe of the wings and sometimes on the veins and legs. The larvae are all predaceous and have prehensile antennae and no distinct mouthbrushes of the type found in the Culicinae. The pupae are extremely varied in structure in the different tribes and some superficially resemble those of the Ceratopogonidae and Chironomidae. The chaetotaxy of the immature stages is essentially similar to that of the other subfamilies of the Culicidae. For this reason and because of the basic similarity of the morphology of the adults we are following Edwards (1932), Lane (1953) and Belkin (1962:536) in treating this miscellaneous assemblage of forms as a subfamily of the Culicidae. Some recent workers have elevated the group to family rank (Stone, 1957, 1966; Cook, 1965).

The Chaoborinae are very poorly known at the present time in the New World tropics as well as almost everywhere else in the world. Except for the pioneer morphological studies of Cook (1956) and the chaetotaxic study of the immature stages of *Corethrella laneana* by Belkin and McDonald (1955) recent work has been chiefly confined to the description of new species primarily on the basis of color pattern of adults and some features of the pupae (in the tribe Corethrellini). For the present we are following the classification of Lane (1953:64-65) who recognized 2 tribes in the New World tropics: (1) Corethrellini with the genera *Corethrella* and *Lutzomiops* and (2) Chaoborini with the genera *Sayomyia* and *Edwardsops*.

The tribe Chaoborini is represented in Jamaica by an apparently endemic species of *Sayomyia* which we are naming *lanei*. The chaetotaxy of the pupa of this species, the first homologized in full for the tribe, is amazingly similar to that of members of the subfamily Culicinae.

In Jamaica the tribe Corethrellini is now known by 3 species of *Corethrella*: (1) the widespread treehole breeding *appendiculata*, (2) the apparently endemic *longitubus* which is known from a single collection in coral rockholes and (3) the apparently endemic *librata* known definitely from a single pupal skin collected in a small swamp. In the genus *Corethrella* specific differences are most readily apparent in the pupal stage, particularly in the trumpet, the development of abdominal hairs and the integumentary ornamentation and spiculation, and in the shape of the paddle. The larvae have a very uniform chaetotaxy but we have found some apparently reliable specific differences in the terminal abdominal segments. We have figured here the complete larval and pupal chaetotaxy of all 3 species found in Jamaica. The chaetotaxy of these species is entirely similar to that described and figured for *laneana* Vargas, 1946 from southern California by Belkin and McDonald (1955). We have reinterpreted their homologies to conform to those of Belkin (1962) for the Culicinae and have made the following corrections in the chaetotaxy and morphology as described by these authors. In the pupa: (1) the structures on the mesothorax and metathorax interpreted as spiracles appear to be some type of sense organ in the form of a hollow thick-walled globe with a small circular opening to the outside; a small rudimentary metathoracic spiracle is present as in the Culicinae; (2) hairs 4-III, 3-IV, 2-V-VII of these authors are absent; (3) the

homology of the other hairs is as shown in our figures. In the larva: (1) an extra hair, y , is present on the head laterad of 4-C; (2) on abdominal segments II and III, one of the long lateral hairs (the most ventral) is hair x , true hair 5 on these segments is a minute hair laterad of hair 4, not seen by Belkin and McDonald; (3) the homology of the ventral abdominal hairs is reinterpreted as shown in our figures.

We have seen a denuded specimen with abdomen and legs partially broken in the USNM collection, tentatively identified as a species of *Lutzomiops*. The specimen bears the following labels, //Jamaica/Bath St Thos//Sta 433/Chapin and/Blackwelder//. The washed out appearance may be due to preservation in alcohol as 1 of the wings is folded. In our opinion this is probably a specimen of a species of *Corethrella*, possibly even *appendiculata*.

Our treatment of the subfamily is very brief and superficial. We have not included in the keys the other species reported from the Greater Antilles because of lack of material of the significant stages; they are briefly discussed below: (1) *Corethrella tripunctata* Lane, 1942 from Puerto Rico, under *C. longitubus*, and (2) *S. antillum* (Knab, 1913) from Cuba and *S. braziliensis* (Theobald, 1901) reported from Puerto Rico, under *S. lanei*.

All members of the subfamily are predaceous in the larval stage. The breeding sites range from ground pools to container habitats such as treeholes and leaf axils of plants. It is surprising that there are no bromeliad breeding *Corethrella* in Jamaica as bromeliads are abundant on the island and form favorite breeding sites for *Corethrella* in the continental areas of the New World tropics.

KEYS TO GENERA AND SPECIES

ADULTS

(70. *C. librata* unknown)

Sayomyia

1. Eyes small, widely separated, interocular space greater than maximum width of 1 eye; vein R_1 ending on C distad of level of apex of vein Cu_1 (Chaoborini; genus *Sayomyia*) 67. *lanei*
- Eyes large, approximated, interocular space much less than maximum width of 1 eye; vein R_1 ending on C at or basad of level of apex of vein Cu_1 (Corethrellini; genus *Corethrella*) 2

Corethrella

- 2(1). Dark species; ground color of thorax reddish brown to blackish brown; legs infuscated, with tarsi appearing ringed; haltere knob dark 68. *appendiculata*
- Pale species; ground color of thorax pale tan with restricted brown lines; legs pale, tarsi uniformly pale; haltere knob pale 69. *longitubus*

MALE GENITALIA

(70. *C. librata* unknown)

Sayomyia

1. Aedeagal sclerites separate apically (Chaoborini; genus *Sayomyia*) **67. lanei**
 Aedeagal sclerites fused apically (Corethrellini; genus *Corethrella*) 2

Corethrella

- 2(1). Lateral setae of tergite IX usually at least 25 and in 4 rows dorsally
 **68. appendiculata**
 Lateral setae of tergite IX usually about 15 and in 2 or 3 rows dorsally
 **69. longitubus**

PUPAE

Sayomyia

1. Body cylindrical; cephalothorax small, abdomen elongate; trumpet meatus coarsely reticulate; paddle free, movable (Chaoborini; genus *Sayomyia*) **67. lanei**
 Body flattened; cephalothorax large, in same plane as short abdomen; trumpet meatus granulose or imbricate; paddle continuous with tergite IX at base, immovable (Corethrellini; genus *Corethrella*) 2

Corethrella

- 2(1). Trumpet elongate, with simple small apical pinna; abdominal hairs 9-II-VII, 6-V-VII strongly developed, their length about 0.5 of tergite width. **69. longitubus**
 Trumpet relatively short and with large pinna; abdominal hairs 9-II-VII, 6-V-VII weak, their length less than 0.25 of tergite width 3
- 3(2). Trumpet more or less gradually widened distally, with broad diagonal pinna; abdominal tergites II-VII without denticles near caudal margin; abdominal hair 2-II-V extending beyond caudal margin of its tergite **68. appendiculata**
 Trumpet with distinct stem at base of elongate horizontal pinna; abdominal tergites II-VII with 2 or more rows of short denticles near caudal margin; abdominal hair 2-II-V not reaching caudal margin of its tergite **70. librata**

LARVAE

(70. *C. librata* not definitely known)

Sayomyia

1. Head compressed, without lateral row of spines; antenna directed ventrad; siphon not developed (Chaoborini; genus *Sayomyia*) **67. lanei**
 Head depressed, with lateral crown of spines; antenna directed laterad; siphon distinct (Corethrellini; genus *Corethrella*) 2

Corethrella

- 2(1). Abdominal segments I-VI without median tergal plate; anal segment without hair *y*, hair 1-X shorter than dorsal saddle length; head width about 3.5 of

antennal length; head without caudal tergite 68. *appendiculata*
 Abdominal segments I-VI with median tergite plate; anal segment with hair
y, hair 1-X longer than dorsal saddle length; head width about 2.5 of an-
 tennal length; head with caudal tergite 69. *longitubus*; ? 70. *librata*

TRIBE CHAOBORINI

GENUS SAYOMYIA

67. *Sayomyia lanei*, n.sp.

Fig. 117

TYPES: Holotype male (JA 900-10) with slides of genitalia, associated pupal skin and fragment of larval skin (head capsule), Mona Reservoir, University of the West Indies, Kingston, Jamaica, 20 Sept 1967, W.A. Page [USNM]. Allotype female (JA 756), 11 Mountain View Ave., University of the West Indies, Mona, Kingston, Jamaica, 24 Aug 1967, J.N. Belkin [USNM]. Paratypes, 1 male with genitalia slide (681268-12), 3 females (JA 750), Zoology Dept. building, University of the West Indies, Mona, Kingston, Jamaica, 24 Aug 1967, J.N. Belkin [UCLA]; 7 females (JA 756), same data as allotype [BM; JAM; UCLA; USNM]. This species is dedicated to the late John Lane, a pioneer in the study of Neotropical Chaoborinae.

FEMALE. Wing about 1.7 mm. Small pale tan species with strongly contrasting brown and blackish markings; legs conspicuously banded. With the general characteristics of *Sayomyia* as described and figured by Cook (1956:31-32) and with the following apparently diagnostic features. *Head:* Vertex pale except for lateral infuscation; clypeus pale. Labium infuscated. Palpus brown to blackish; segment 5 irregularly annulate. Antennal torus and flagellar segment 1 pale; distal flagellar segments progressively darker. *Thorax:* Ground color of integument pale tan on disc and whitish on lateral border; median longitudinal stripe brown to light brown, narrowly divided by light median acrostichal line; lateral longitudinal stripe darker brown than median; posterior part of prescutellar area darkened laterad of midline. Mesonotal bristles pale to light brown; a conspicuous patch of long blackish narrow erect scales at end of acrostichal line, preceded by a few shorter narrower scalelike black bristles. Scutellum pale except for small blackish lateral area. Postnotum dark brown except for narrow triangular anterior median area. Pleural integument pale to whitish except for variable infuscations in upper middle part of *ppn*, all of *ppl*, variable area of *psp* and especially *ssp*, anterior part of *stp* and at base of *stp* bristles, all of *pra*, upper part of *mep* and narrowly along anterior border of metapleuron; *apn* whitish. Pleural bristles pale to dark brown; *apn* with about 10 bristles; *ppn* with 1 to 3 bristles in middle of upper part; *ppl* bristles usually 4-6; *stp* usually with 3 or 4 bristles near middle of posterior border; *pra* with about 6 or 7 bristles in a vertical row; upper *mep* with 1 or 2 bristles. *Legs:* Pale and with contrasting dark brown to blackish rings on nearly all segments. Femora pale at base, usually with 7 or 6 dark rings on foreleg and midleg and 6 or 5 on hindleg; apex tan on foreleg and midleg and dark on hindleg. Tibiae narrowly pale at base and usually with dark rings as on femora but including apex on all legs. Tarsi with conspicuous broad apical dark rings on segments 1-3 on all legs, less distinct on segment 4 especially on foreleg; segment 5 light to dark. *Wing:*

Generally pale; with extensive but slight infuscation of membrane as follows: (1) at base of furcation of R_{2+3} , extending to R_1 and R_{4+5} , (2) distad of crossveins $r-m$ and $m-cu$, (3) distal part of Cu_1 , and (4) basad of furcation of Cu , extending to M and $1A$; a very faint infuscation on anterior border proximad of furcation of R . *Haltere*: Knob white. *Abdomen*: Integument pale except for conspicuous brown to blackish brown areas as follows: (1) narrow transverse band on tergite I, more dilute or interrupted near midline; (2) lateral borders of tergites II-VII, variously produced dorsad but not forming complete transverse bands; (3) large median spots on sternites VI, VII extending nearly full length of segments; and (4) small dark spots at base of lateral bristles on sternites V-VII.

MALE. Essentially as the female except for usual sexual characters and following features. Antennal flagellar whorls very long and dense. Pale color of integument lighter, whitish; dark rings of legs narrower; abdominal tergite I with only a small lateral dark spot, lateral dark areas of tergites II-VII smaller and more regular.

MALE GENITALIA (fig. 117). Essentially as in other species of *Sayomyia* as described and figured by Cook (1956). With the following diagnostic features. Side-piece infuscation starting slightly before level of apex of mesal lobe. Mesal lobe rounded on apical free portion; mesal setae on lobe and proximad thickened, especially in basal part; tergal setae adjacent to mesal setae very thin and long. Aedeagal sclerite with long fingerlike slightly curved apical dorsal part and with a short sharp slightly curved premedian ventral spine.

PUPA (fig. 117). General morphology as described by Cook (1956:14-15) for *Chaoborus americanus*. Chaetotaxy as figured, not previously described for the genus; extremely similar to that of the subfamily Culicinae; of the normal culicid hairs only the following apparently not developed, metanotal 11-C and abdominal 0-II, 3-I, 4-I, II and 9-I; hair 12 present on IV and V; all hairs unpigmented and all except 6-C, 0-III-VIII, 2-II-VII, 3-II, 9-II-VII, 14-III-VIII and 12-P with very fine branches; larger hairs with short basal stem and usually largely pectinate or plumose branching (more so than shown in figure). Cephalothoracic and abdominal integument colorless and transparent except for slight infuscations as shown in figure; minute short sharp spicules present on dorsum of thorax and abdomen. Trumpet very lightly pigmented, coarsely reticulate. Specific characters unknown as other species not described or figured in detail. Paddle apparently distinctive; very broad; apex truncate but with slight emargination near middle; midrib moderately developed, distinct to near emargination; buttresses strongly developed, external with 4 or 5 strong denticles near apex, internal with scattered small sharp denticles to near basal truncation; paddle hair 1-P with 6 branches; 2-P single, minute.

LARVA (fig. 117). Only skin of head capsule available; as figured. In living larva, thoracic air sac ovate and speckled with black pigment, abdominal air sac helical and unpigmented.

SYSTEMATICS. The adults of *lanei* are superficially similar in ornamentation to *braziliensis* (Theobald, 1901) and *festiva* (Dyar & Shannon, 1924) which in our opinion are distinct species erroneously synonymized by Edwards (1932:26). The aedeagal sclerite is characteristically developed in all 3 species, that of *lanei* differing from the others in the long slender fingerlike apical portion and a short subbasal or premedian ventral spine. The pupa of *lanei* differs from that of *braziliensis* as figured by Lane (1942: pl. 4, fig. 5) in the shape of the paddle.

The adults of 2 other species show some resemblance to *lanei*: (1) *antillum* (Knab, 1913) from Cuba, which differs in a lighter coloration and a very different aedeagal sclerite, and (2) *annulata* (Cook, 1956) from the southeastern United

States, known only in the female which is much lighter in color and has a different pattern of wing pigmentation.

In view of the apparently restricted distribution of species of *Sayomyia* in the West Indies, *lanei* in Jamaica and *antillum* in Cuba, the record of *braziliensis* from Puerto Rico (Tulloch, 1937:154; Lane, 1942:142) is probably erroneous and may pertain to an undescribed species.

BIONOMICS. Immature stages of *Sayomyia* obtain oxygen directly from the water and do not come to the surface, except the pupae for emergence of the adults. In lakes and ponds they are most readily collected with special limnological nets or samplers. One mature larva of *lanei* was collected by dragging a net in the Mona Reservoir (900), and a few adults were taken in nearby buildings where they were undoubtedly attracted to lights at night.

DISTRIBUTION. To date known only from the Mona Reservoir area but probably occurs in permanent or semipermanent bodies of water throughout Jamaica.

JAMAICA. *Kingston and St. Andrew:* University of the West Indies (750,756,900).

Material Examined: 20 specimens; 2 males, 16 females, 1 larval fragment, 1 pupa; 1 individual larval rearing (only head capsule of larva preserved).

TRIBE CORETHRELLINI

GENUS CORETHRELLA

68. *Corethrella* (C.) *appendiculata* Grabham

Figs. 118,119

1906. *Corethrella appendiculata* Grabham, 1906c:343-345. TYPE: Lectotype by PRESENT DESIGNATION, male from series of 10 "cotypes", Kingston, Jamaica, M. Grabham [USNM, 9960].

Corethrella appendiculata of Dyar and Shannon (1924c:216); Lane (1942:113-117; 1953:81-83); Cook (1956:60-62; 1965:105); Stone (1966:1).

FEMALE. Wing about 1.4 mm. Small dark reddish brown to blackish brown species with banded tarsi and banded legs. In general as described by Cook (1956:61-62). *Head:* Vertex blackish brown; clypeus dark brown; labium and palpus lighter; antennal torus blackish brown, basal flagellar segments dark brown, distal progressively lighter. *Thorax:* Mesonotal integument dark reddish brown appearing pruinose with blackish areas in some aspects; scutellum and postnotum dark reddish brown. Mesonotal bristles strongly developed except acrostichals which are short but numerous; longer bristles bronzy, shorter coppery to golden; short coppery hairs numerous between rows of bristles; metanotum with several short setae laterally. Pleural integument dark reddish brown, somewhat lighter than mesonotal. Pleural bristles restricted to 2 or 3 long and about 10-12 short on *apn*, 3 long and about 5-7 short on upper *ppn*, and about 15-18 moderate on posterior *mep* slightly above middle. *Legs:* Femora and tibiae with numerous narrow striated scales in addition to hairs and bristles of different sizes; tarsi with scales less numerous. Femora predominantly dark bronzy; forefemur and midfemur narrowly pale on apex; apical 0.3 or more of hindfemur pale; all femora swollen, midfemur more

than others. Tibiae shaggy, with several very long erect bristles and apical tufts of scales and bristles; foretibia and midtibia predominantly dark on anterior surface with somewhat darker apex, posterior surface paler; hindtibia extensively pale to whitish on posterior surface, anterior surface light brown in middle, darkened at base and apex. Tarsi very light brown except for darkened base, largely on dorsal surface, producing a ringed appearance. Claws all simple and subequal. *Wing*: Vein R_1 ending on costa slightly distad of level of furcation of R_{2+3} , distance between apices of R_1 and R_2 about 3.0 that between Sc and R_1 ; remigium and base of Sc ventrally with strong bristles. Veins with distinct narrow striated scales which are grayish white except for light brownish ones in areas of diffuse "dark" crossbands. Background of crossbands formed by concentrations of larger denser darker granular microtrichia on wing membrane; evident in dry-mounted specimens only in some aspects. Basal band extending on anterior margin from base of wing to short distance before furcation of R, involving scales on C, Sc and R; extended towards posterior border of wing as a narrow process involving scales on vein M for short distance before crossvein *m-cu*. Postmedian band much narrower but more distinct, especially on anterior border, broader but more diffuse towards posterior border of wing; involving scales of vein C, apex of Sc, apex of R_1 from level of apex of Sc, more than distal 0.5 of R_{2+3} , almost all of M distad of *r-m*, middle 0.5 of Cu_1 , a few scales on apex of Cu_2 , and a faint rather broad band of fringe scales. Erect fringe scales in 3 ranks, longest with long slender stem and broad lanceolate distal part with 5 striations. *Haltere*: Stem whitish; knob brown. *Abdomen*: Tergite I dark reddish brown; tergites II-VII yellowish brown to dark reddish brown, with vestiture of golden hairs. Sternites brown to dark reddish brown, with dark hairs.

MALE. Essentially similar to female in ornamentation and morphology except for usual sexual characters. Antennal torus much more strongly developed, flagellar whorls more strongly developed and denser. Posterior *mep* bristles usually less numerous. Claws of foreleg enlarged, distinctly unequal, both simple; other claws as in female.

MALE GENITALIA (fig. 119). *Segment VIII*: Long, strongly constricted at base. *Segment IX*: Tergite moderately developed, rounded on caudal margin; lateral setae usually 25 or more, nearly reaching midline where they are in 4 irregular rows. *Sidepiece*: Long, subcylindrical, simple; without differentiated mesal membrane. Basal mesal specialized seta flattened, relatively short, arising from distinct tubercle with apical process. Tergomesal specialized setae slender, widely spaced; distal arising at about 0.6 from base of sidepiece. *Clasper*: Slender, slightly curved; subequal to sidepiece in length; a long slender internal seta in about basal 0.18; several minute subapical setae but no differentiated spiniform. *Phallosome*: Very simple. Prosophallus with arm on each side of median line extending to base of aedeagus and distal part of small basal piece. Aedeagus porrect, triangular in outline, the 2 lateral sclerites fused distally. *Proctiger*: Largely membranous, without distinct sclerotizations; cercal setae not developed.

PUPA (fig. 119). Chaetotaxy as figured; not studied in detail but apparently uniform; hairs nearly all single. In general similar to *laneana* Vargas, 1946 as described by Belkin and McDonald (1955:84-87) from southern California and with the following diagnostic features. Uniformly lightly pigmented, a little brighter on distal abdominal segments and dorsally on cephalothorax; setae lightly to moderately pigmented. Trumpet relatively short and gradually widened from base; uniformly moderately pigmented and contrasting with general integument; pinna diagonal, moderate, cuplike; outer wall of meatus with coarse imbrications; inner tube

narrow. Abdomen conspicuously tapered distally; lateral and posterior borders of segments without amorphous membrane; caudal margin of tergites and sternites without distinct spicules; lateral margin and caudolateral angle of tergites II-VIII with inconspicuous short, widely spaced denticles. Abdominal hairs poorly developed except 2; hair 2 thickened on all segments but not spiniform, extending beyond caudal margin of tergites on II-VI; hair 8-III-V ventral or ventrolateral, 8-VI, VII dorsal or dorsolateral; 6,9-II-VII weak and short, less than 0.25 of tergite width. Segment IX and paddle relatively short and broad; combined outer length of tergite IX and paddle subequal to tergite VIII in female, only slightly longer in male.

LARVA (fig. 118). Chaetotaxy as figured, not studied in detail; apparently relatively uniform except for some variation in branching. In general similar to *laneana* Vargas, 1946 as described by Belkin and McDonald (1955:87-89) from southern California and with the following diagnostic features. Fat body pigment of thorax and abdomen dark reddish purple to dark reddish brown, very extensive in subepidermal layer, especially laterally on abdominal segments I-VII. Head uniformly moderately to lightly pigmented except for darkening along margin of foramen magnum; unusually wide; antennal process only slightly produced anteriorly; no tergal plate caudad of frontoclypeus; crown usually with about 12 to 14 spines on each side; hair 4-C branched. Antenna relatively short, less than 0.3 of maximum head width. Abdominal segments I-VI without median tergal plates. Dorsal lengths of siphon and anal saddle subequal; hair 1-S inserted a considerable distance from base of siphon. Anal segment with only 2 accessory hairs, hair *y* not developed, hair *x* inserted on edge of saddle; 1-X distinctly shorter than dorsal saddle length.

SYSTEMATICS. The topotypic population of *appendiculata* from Jamaica does not appear to differ significantly from other populations assigned to this species we have seen from Mexico, Costa Rica, Panama, St. Lucia, St. Vincent, Trinidad, and French Guiana. All of these have the diagnostic characters of the pupa and larva as given here and have the apex of the hindfemur of the adults extensively pale. We have not examined material from the United States, Brazil or Argentina. However, at least the populations from the United States are probably correctly assigned to *appendiculata* in spite of some discrepancies in coloration (hindfemur and tarsi) in the descriptions of Cook (1956:61-62).

BIONOMICS. The immature stages of *appendiculata* are found almost entirely in treeholes of varied size. We have 1 record from cut bamboo (311) and from a small artificial container (364). The water in the treehole may be clear or turbid; often it is colored and with an accumulation of plant debris. In only 6 collections out of 27 was *appendiculata* found alone. Its usual associates are *Orthopodomyia waverleyi*, *Aedes (F.) mediovittatus* and *Toxorhynchites (L.) portoricensis*. Nothing is known of the habits of the adults in Jamaica.

DISTRIBUTION. *Corethrella appendiculata* has the widest recorded distribution of any species of *Corethrella* in the New World. Its range supposedly extends from the U.S.A. southward to Argentina. It appears that at least in the Middle American area (from the southern U.S.A. to French Guiana) the various populations are very similar but no thorough comparative study has been made to date.

JAMAICA. Widely distributed in eastern, central and western parishes, from sea level to about 480 m elevation. *Hanover*: Lucea (364). *Kingston and St. Andrew*: Constant Spring (328,329, 408,679,699). Hermitage Dam Rd (281,331,332,397,623-626,826,829). Kingston and vicinity, M. Grabham, 4 M, 4 F [USNM]. *Manchester*: Hope Farm (634,663). *St. Ann*: Runaway Bay, Feb 1969, W.W. Wirth, 1 F [USNM]. *St. Catherine*: Caymanas (402,403). *St. Mary*: Broadgate (256,401,407,622,642). Castleton Botanic Gardens (311). *Westmoreland*: Grange Hill (133).

Material Examined: 267 specimens; 37 males, 43 females, 109 larvae, 78 pupae; 48 individual rearings (8 larval, 35 pupal, 5 incomplete).

69. *Corethrella (C.) longitubus*, n.sp.

Figs. 120,121

TYPES: Holotype male (JA 245-42) with associated larval and pupal skins and genitalia on slides, Goshen, about 2 mi N of Four Paths on Mocho Rd (Clarendon), Jamaica, 18 Aug 1965, W.A. Page [USNM]. Allotype female (JA 245-46) with associated larval and pupal skins on slide, same data as holotype [USNM]. Paratypes, same data as holotype, 4 lpF (245-43,47-49), 3 pM (245-101,105,107), 4 pF (245-100,102,106,111), 2 lp (245-41,42), 1 lP (245-40), 1 l (245-45), 3 L, 11 P (245) [BM; JAM; UCLA].

FEMALE. Wing about 1.6 mm. Small light brown species; with unbanded tarsi and banded wing. In general similar to *appendiculata* but lighter in color and with the following diagnostic features. *Head*: Vertex brown to dark brown; clypeus dark brown; remainder light brown. *Thorax*: Mesonotal integument uniformly light brown except for slight infuscation along acrostichal and dorsocentral lines and in front of wing root, prescutellar area darkened in middle; scutellum uniformly light brown; postnotum brown except for pale lateral margin. Mesonotal bristles largely light brown to golden; longer than in *appendiculata*, especially acrostichals; short hairs less numerous. Pleural integument light brown, with slight infuscations particularly on *apn*, *pra* and upper posterior *mep*. Pleural bristles less numerous; *ppn* usually with only 2 bristles and about 3 or 4 short hairs; posterior *mep* setae shorter, usually about 4. *Legs*: Uniformly light brown, tarsi slightly paler than other segments, scales very poorly developed and very sparse; femora less swollen; apices of tibiae not as densely hairy. *Wing*: Apex of R_1 and Sc more distant. Dorsal vein scales slightly narrower; longest fringe scales usually with only 4 striations. Dark crossbands more diffuse and broader, formed primarily by scales as microtrichia of membrane are more uniform throughout; scales of costa somewhat darkened throughout. Basal crossband broader towards posterior margin of wing, involving scales on much greater segment of vein M and some slightly darkened scales on Cu proximad of furcation. Postmedian band distinctly broader towards posterior margin, involving more scales on Cu_1 and Cu_2 ; only a few fringe scales slightly darkened. A more or less distinct apical dark spot on vein C starting proximad of apex of R_3 . *Haltere*: Stem whitish; knob creamy. *Abdomen*: Integument brown, lighter on sternites; hairs light brown to golden.

MALE. Essentially as in the female in color and morphology except for usual sexual differences as in *appendiculata*. Enlarged claws of foreleg more nearly equal than in *appendiculata*.

MALE GENITALIA (fig. 120). Very similar to *appendiculata*, differing primarily in the following features. Tergite IX shorter, with about 16 setae on each side, in 2 or 3 rows; basal mesal seta of sidepiece longer, not flattened.

PUPA (fig. 120). Chaetotaxy as figured, not studied in detail but apparently uniform. In general as in *appendiculata* and *librata* but with the following conspicuous diagnostic features. Uniformly moderately pigmented except for darkened tergum of cephalothorax; setae moderately to strongly pigmented. Trumpet very long and narrow; uniformly pigmented and contrasting with general integument; pinna terminal, small, cuplike; outer wall of meatus with small rounded spicules, giving a granular appearance; inner tube wide but well separated from outer wall. Abdomen conspicuously tapered distally; lateral and posterior borders of segments with narrow amorphous membrane which may be faintly ribbed; caudal margin of tergites II-VII and sternites III-VII with spicules shorter and less numerous than

in *librata*, usually in 1 or 2 rows; lateral margin and caudolateral angle of tergites II-VIII with denticles adjacent, longer and coarser than in *librata*. Abdominal hairs more strongly developed than in the other species; hair 2 thickened on all segments but not spiniform, extending beyond caudal margin on tergites II-VII; hair 8 dorsal on segments VI and VII; hairs 6-V-VII, 9-II-VII thickened, very conspicuous and usually longer than 0.5 of tergite width. Combined outer length of tergite IX and paddle about 1.3 of tergite VIII.

LARVA (fig. 121). Chaetotaxy as figured, not studied in detail. Apparently indistinguishable from presumptive larva of *librata*; in general similar to *appendiculata*, differing primarily in the following obvious features. Fat body pigment purplish, sparse and restricted to foregut and midgut. Head narrower and with antennal area more strongly produced anteriorly; a small tergal plate on each side of median line caudad of frontoclypeus; crown usually with 10 spines on each side; hair 4-C single. Antenna proportionally longer, about 0.4 of maximum head width. Abdominal segments I-VI each with a small median tergal plate. Siphon longer in proportion to saddle, hair 1-S nearer base of siphon. Anal segment with 3 accessory hairs, hair *y* developed, hair *x* inserted on membrane; 1-X longer than dorsal saddle length.

SYSTEMATICS. The pupa of *longitubus* is differentiated from all known pupae of *Corethrella* by the following combination of characters: (1) trumpet very long and slender and with small apical pinna, (2) abdomen strongly tapered distad, (3) abdominal hairs 6-V-VII and 9-II-VII very strongly developed.

The larva resembles *laneana* Vargas, 1946 as described by Belkin and McDonald (1955:87-89) from southern California but is distinct in having: (1) the siphon longer, hair 1-S longer, 2-S stronger and longer, and 6-S stronger; (2) saddle longer and 1-X proportionately shorter.

The adults appear to have a wing pattern similar to that described for *tripunctata* Lane, 1942 from Puerto Rico but differ in a lighter mesonotal integument, uniform color of the hindfemur and hindtibia and the absence of pale rings on the tarsi.

BIONOMICS. The only known collection of *longitubus* was made in a hole in coral limestone in a scrub forest. No other culicid was found in the breeding site.

DISTRIBUTION. Known only from the type collection in Jamaica.

JAMAICA. *Clarendon*: Goshen (245).

Material Examined: 53 specimens; 4 males, 9 females, 13 larvae, 27 pupae; 16 individual rearings (6 larval, 7 pupal, 3 incomplete).

70. *Corethrella* (C.) *librata*, n.sp.

Figs. 122,123

TYPE: Holotype male pupal skin (JA 361), Petersville (Westmoreland), Jamaica, 11 Sept 1965, rice swamp near post office, J.N. Belkin and W.A. Page [USNM].

FEMALE and MALE. Unknown.

PUPA (fig. 123). In general similar to *appendiculata* and *longitubus* in chaetotaxy and with the following diagnostic features. Uniformly very lightly pigmented. Trumpet concolorous with general integument; uniformly lightly imbricate; meatus narrow, stemlike, bent in distal part which bears a long relatively narrow horizon-

tal pinna with stigmatic plate; one margin of pinna crenulate. Abdomen conspicuously tapered distally; lateral and posterior border of abdominal segments with moderately broad amorphous membrane which may be faintly ribbed; caudal margins of tergites I-VII and sternites III-VII with 2 or 3 irregular rows of short sharp, widely spaced spicules; lateral margins and caudolateral angles of tergites II-VIII with widely spaced denticles, more strongly developed on distal segments. Abdominal hairs in general shorter and weaker than in the other species; hair 2 thickened on all segments but not distinctly spiniform, relatively short, not reaching caudal margin of tergites on II-VIII; hair 8 ventral on all segments; hairs 6 and 9 weak and short on all segments. Combined outer length of tergite IX and paddle about 1.75 of tergite VIII.

LARVA (fig. 122). Association with pupa presumptive only. Extremely similar to *longitubus* and without obvious diagnostic features except possibly a somewhat longer tubercle of hair 13-T.

SYSTEMATICS. This species is definitely known by a single pupal skin which shows some resemblance to a population of *laneana* Vargas, 1946 from southern California in the structure of the trumpet and general abdominal chaetotaxy. It differs from the latter however in the following features: (1) pinna of trumpet apparently much narrower; (2) amorphous membrane of abdominal segments narrower; (3) caudal spicules of abdominal segments more numerous; (4) lateral marginal denticles of abdominal tergites smaller but extending around caudolateral angle; (5) abdominal hair 2 simple on all segments, not spiniform; (6) hair 8-IV-VII ventral; (7) hair 6-V-VII more anterior; and (8) tergite IX and paddle longer.

The larva collected in association with the pupal skin is probably conspecific. It differs from *laneana* in the same features as *longitubus* but cannot be separated with certainty from the latter.

BIONOMICS. The only collection of *librata* (a pupal skin and a whole larva) was made in a semipermanent swampy area in a grassy field with sedges and rice. The water was clear and fresh but brown in color. The associated species were *Culex* (*C.*) *chidesteri* and *Mansonia* (*M.*) *titillans*.

DISTRIBUTION. Known only from the single collection in Jamaica.

JAMAICA. *Westmoreland*: Petersville (361), 1 pupal skin, 1 whole larva.

SUBFAMILY DIXINAE

The Dixia Midges

Dixa midges, often considered to form a separate family rather than a subfamily of the Culicidae, share with the Culicinae and Chaoborinae a basic morphological similarity in all stages and particularly an almost identical pattern of chaetotaxy in the immature stages. For this reason we are following Belkin (1962:93-96; 1968a:8-15) in treating them as the subfamily Dixinae of the Culicidae.

All stages of the Dixinae are readily separated from the Culicinae and Chaoborinae by the combination of features given in the keys to the subfamilies.

Prior to our survey of the Culicidae of Jamaica, only 2 species of Dixinae had been reported from the West Indies: *clavulus* Williston, 1896 from St. Vincent in the Lesser Antilles and *hoffmani* Lane, 1942 from Puerto Rico. The 2 species described here from Jamaica show some superficial similarity to the above mentioned species but in our opinion are distinct forms. One of them, *scitula*, we are assigning provisionally to *Dixella* Dyar & Shannon, 1924 (type species, *lirio* Dyar & Shannon, 1924 from Panama), the only genus of the subfamily recognized to date from the New World tropics. For the other, *biambulacra*, we are erecting the genus *Mesodixa* because of several fundamental morphological differences in the adults, male genitalia and larva. All 4 West Indian species belong to the tribe Paradixini.

As pointed out by Belkin (1968a:14,20,31-32), the generic classification of the entire subfamily is in chaotic condition because of the remarkable uniformity in the general morphology of all stages, the use of superficial characters in defining genera and the lack of knowledge of the immature stages of the type species.

All members of the subfamily utilize still or flowing ground waters for breeding sites. The larvae feed at the water surface by turning their heads ventral surface up over the thorax. They are usually found resting on the edges of the breeding site with the body bent in a U, with only the head and tail ends in the water. They are capable of crawling out of the water and move rapidly on the surface film by a backward looping motion of the body. Pupae can swim but are most frequently found partially or completely out of the water (surrounded by water film, however); emergence of the adult takes place with the pupa out of the water. Both sexes can be found resting on the vegetation in shaded protected areas near the breeding sites. Dixia midges are seldom encountered except in their natural environment; females do not take blood and neither sex is attracted to light traps.

KEYS TO GENERA AND SPECIES

ADULTS

1. Sternopleuron and metapleuron without setae as indicated below; mesonotum and pleuron with sharply contrasting pattern of dark and pale color; scutellum dark blackish brown (*Dixella*) 71. *scitula*
- Sternopleuron with 2 setae above transverse suture, metapleuron with 1 seta below spiracle; mesonotum and pleuron rather uniformly light brown, without sharply contrasting pattern; scutellum light brown (*Mesodixa*)
- 72. *biambulacra*

MALE GENITALIA

1. Apical lobe of sidepiece with narrowed distal part directed sternad; clasper with distinct acute apical spiniform (*Dixella*) 71. *scitula*
 Apical lobe of sidepiece with simple expanded distal part; clasper without spiniform (*Mesodixa*) 72. *biambulacra*

PUPAE

1. Paddle constricted at about half distance from genital lobe to apex, broad proximad, very narrow distad; trumpet with narrow pinna with a deep posterior notch in meatus (*Dixella*) 71. *scitula*
 Paddle constricted just distad of genital lobe, uniformly narrow and tapered beyond; trumpet with a uniformly broad pinna without posterior notch in meatus (*Mesodixa*) 72. *biambulacra*

LARVAE

1. Ventral ambulacral combs present on segments V-VII; antennal hair 1-A on external margin at about 0.67 from base (*Dixella*) 71. *scitula*
 Ventral ambulacral combs present on segments V and VI; antennal hair 1-A on apex of shaft ventrally (*Mesodixa*) 72. *biambulacra*

GENUS DIXELLA

71. *Dixella scitula*, n.sp.

Figs. 123,124,125

TYPES: Holotype female (JA 742-13) with associated larval and pupal skins, pond near Claremont (St. Ann), Jamaica, at mile post 34 on Spanish Town Road, 20 Aug 1967, J.N. Belkin and W.A. Page [USNM]. Allotype male (691003-2) with genitalia slide, Runaway Bay (St. Ann), Feb 1969, W.W. Wirth [USNM]. Paratypes, 5 lpF (JA 742-10-12,14,15), 30 larvae, 1 pupa (JA 742), same data as holotype [BM; JAM; UCLA; USNM]; 1 M (691003-1), same data as allotype [UCLA].

FEMALE (fig. 124). Wing about 3.0 mm. In general similar to *biambulacra*; differing chiefly in a slightly larger size, darker color and the following diagnostic features. Clypeus yellowish except at base; antennal scape and pedicel blackish brown. Mesonotal integument reddish to dark brown with blackish brown vittae and median fossal spot; sides from humeral angle to scutellum strongly contrasting yellowish to light tan, narrowly except for dorsal extensions on scutal suture and on parascutellum; acrostichals apparently not extending on prescutellar space. Scutellum and postnotum dark to blackish brown; scutellar bristles very short, in an even single row. Upper part of pleuron (except light brown *apn*) tan to yellowish, lower part dark to blackish brown including *ppl*; sternopleuron and lower metapleuron without bristles. Coxae and trochanters pale; tibiae uniformly dark brown, not darkened on apex; rest of legs dark brown except hindfemur which is light brown with blackish apex; claws as figured. Wing base lighter in color; crossvein *r-m* always slightly distad of furcation of Rs; vein Sc ending on costa usually slight-

ly before or at furcation of vein R. Haltere paler. Genitalia essentially as in New Zealand *Paradixa* but apparently without differentiated bursa copulatrix and the following features; narrowed lateral part of tergite IX with setae; cowl distinctly articulated with and not continuous with tergite IX, widely interrupted on mid-ventral line; cercus broad and short, its base broadly joined to base of postgenital plate and extended dorsad but not meeting on middorsal line; postgenital plate with short triangular distal process with setose sides and a narrow poorly sclerotized bare triangular area which joins the broad poorly sclerotized basal part; spermatheca in segment VII.

MALE. Essentially similar to female. All claws enlarged; median teeth usually 3 or 4, longer and more distal than in *biambulacra*.

MALE GENITALIA (fig. 123). In general similar to *biambulacra* except for following significant differences. *Segment IX*: More strongly sclerotized; sternal articular process more conspicuous; sternite without setae or with 1 or 2 setae restricted to sides; dorsal median part of tergite more strongly sclerotized and not appearing as a lobe. *Sidepiece*: Shorter and broader; apical inner tergal lobe much longer, its upper surface with long seta near middle and a short one subapically; narrowed apex of lobe directed sternad and with 2 small apical setae. *Clasper*: Longer and more slender, apex with distinct sharply pointed spiniform. *Phallosome*: Prosopphallus (?) produced as a long conical process apparently bearing genital opening at its apex. Aedeagal sclerite a poorly sclerotized plate laterad of prosopphallic cone, not attached to sidepiece, its apex broad and recurved. Opisthophallus strongly developed, articulated with long process of basal piece; complex in structure; a large ovoid inner spiculose lobe at base of lateral sclerotized bar, latter joined to its mate across midline; dorsolaterad of transverse bar on each side a conspicuous irregular short lobe, spiculose at base, apical part with smooth integument and with several tubercles each with a microseta. *Proctiger*: Simple spiculose lobe, without setae.

PUPA (fig. 125). Morphology and chaetotaxy as figured. Very similar to *biambulacra*, differing apparently chiefly in the following features. Pinna of trumpet narrower, with deep notch on posterior margin. Tergite VIII with less distinct median caudal process. Paddle sharply attenuated in distal third, not gradually tapered from near base.

LARVA (fig. 125). Morphology and chaetotaxy as figured. More similar to species of *Paradixa* than to *biambulacra*; differing from the latter in following diagnostic features. Head hair 17-C present. Antenna normal; shaft with sparse patch of shorter hairlike spicules ventrally toward inner margin distad of hair 1-A only, no dorsal inner line of hairlike spicules; 1-A on outer margin of shaft at about 0.67 from base. Ventral prothoracic hairs subequal in length to entire thorax. Hair 11-II present on outer face of proleg. Ventral ambulacral combs present on segments V-VII, with more distinct median sclerite. Longest ventral hair (4-VIII) of segment VIII projecting beyond apex of basal saddle of anal segment. Anteromedian lobe of spiracular apparatus with median sclerotization bifurcate anteriorly, arms bearing hair 3-S; anterolateral lobe smaller; median plate with small unpaired median sclerite not connected to larger lateral lobes, area with short sharp spicules and some hairlike spicules caudad of median sclerite; apex of posterolateral lobe with pointed ventral apical process, 13-S longer. Pecten with spicules of marginal row in form of small furcate spines; 1 large bifurcate postpecten spine always present; hair 1-S more proximal, with at least 3 branches. Basal anal saddle smaller, not connected to the basal plate bearing hair 4-X.

SYSTEMATICS. This elegant species is provisionally assigned to *Dixella*. There appears to be a superficial resemblance in the external features of the adults of *scitula* and to *hoffmani* Lane, 1942 from Puerto Rico, which is known from the female only and whose generic placement is also uncertain. However, the color pattern of the thorax does not agree in details and we believe that the 2 species are distinct and belong to different genera.

The association of the male is presumptive only as no rearings of this sex were obtained. However, it is very likely that it is correct because of the similarity with the female in details of morphology and coloration. The male genitalia resemble *lirio* Dyar & Shannon in general superficial features of the sidepiece and clasper but differ in details of the apical lobe of the sidepiece. We did not study the phallosome of *lirio* and do not know if it is of the same type as that of *scitula*.

BIONOMICS. The immature stages of *scitula* were collected twice along the edge of Dunns River above the falls (741,775) in association with *Mesodixa biambulacra* and once in a pond near Claremont (742) in association with *Anopheles albimanus*. Two males were found in a stream bed at Runaway Bay presumably in a sweeping collection.

DISTRIBUTION. To date known only from the north slope of Jamaica.

JAMAICA. *St. Ann*: Claremont (742). Dunns River (741,775). Runaway Bay, stream bed, Feb 1969, W.W. Wirth, 2 M [USNM; UCLA].

Material Examined: 69 specimens; 2 males, 9 females, 46 larvae, 12 pupae; 10 individual rearings (9 larval, 1 incomplete).

MESODIXA, new genus

TYPE SPECIES: *Mesodixa biambulacra*, n.sp.

With the general characteristics of the tribe Paradixini; differing from *Paradixa* Tonnoir, 1924 as redescribed by Belkin (1968a:29-31) in the following diagnostic features.

ADULTS. Sternopleuron with 2 setae above transverse suture; metapleuron with 1 seta below spiracle.

MALE GENITALIA. Opisthophallus largely membranous, without spines. Proc-tiger membranous, with 1 or 2 sternal setae. Median dorsal part of tergite IX poorly sclerotized, appearing as a median lobe.

PUPA. Without apparent differences.

LARVA. Antennal hair 1-A at apex of ventral surface of shaft; latter with long hairlike spicules on inner dorsal margin as well as on ventral surface. Ventral prothoracic hairs shorter than entire thorax. Ventral ambulacral combs present only on abdominal segments V and VI. Median plate of spiracular apparatus without unpaired median sclerite, area with stellate spicules; posterolateral lobe with rounded ventral apical process.

For discussion see *biambulacra* below.

72. *Mesodixa biambulacra*, n.sp.

Figs. 124,126

TYPES: Holotype male (JA 775-10), genitalia and associated larval and pupal skins, all mount-

ed on 3 slides, Dunns River (St. Ann), Jamaica, about 150 yd above falls, 10 Sept 1967, W.A. Page [USNM]. Allotype female (JA 775-11) and associated larval and pupal skins, mounted on 2 slides, same data as holotype [USNM]. Paratypes, 4 lpF (JA 741-10-12,14), 1 pM (JA 741-102), 2 pF (JA 741-100,101), 16 larvae, 15 pupae (JA 741), same locality as holotype, 20 Aug 1967, J.N. Belkin and W.A. Page; 1 lpM (JA 775-15), 1 lpF (JA 775-12), 1 pM (JA 775-100), 1 lp (JA 775-14), 13 larvae, 12 pupae, 2 M, 1 F (JA 775), same data as holotype [BM; JAM; UCLA; USNM].

FEMALE (fig. 124). Wing about 2.5 mm. Morphology of head and thorax as figured; essentially as described by Belkin (1968a:29-30) for *Paradixa*, except as noted. *Head*: Dorsal surface dark brown; clypeus brown, somewhat darkened at base. Antenna about 2.0 of mesonotum; scape and pedicel (torus) light brown; flagellar segment 1 a little longer than combined length of segments 2 and 3. *Thorax*: Mesonotal integument light brown, with darkened but not strongly contrasting median and lateral vittae and anterior part of fossa; acrostichals strongly developed and extending about halfway on prescutellar space, dorsocentrals very strong except at anterior end. Scutellum very light brown to tan; with strong marginal bristles in a single row except in middle where more bristles usually present. Postnotum brown. Pleural integument light brown with slightly darkened areas, most conspicuously on *mep*; *apn* and *ppn* with a few bristles; 2 bristles above transverse suture of *stp*; metapleuron with 1 bristle below spiracle and 2 microsetae near base of haltere (latter also present in *Paradixa*). *Legs*: Brown to light yellowish brown, with darkened apices of femora and tibiae, most conspicuously on hindleg. Only midtarsal segment 1 with differentiated apical spiniform. Claws with external spicules only, as figured, several basal and 1 long subbasal. *Wing*: Membrane with barely perceptible infuscation around *r-m*. Vein Sc relatively poorly developed, with setae in distal 0.5 only, usually ending on costa slightly before furcation of vein R; crossvein *r-m* strongly developed, at furcation of Rs; *m-cu* weaker, more or less in line with *r-m* but angled proximad. *Haltere*: Light at base, darkened distally. *Abdomen*: Dark brown. *Genitalia*: Markedly different from New Zealand *Paradixa*; tergite IX short, laterally joined to cowl which is indented and heavily sclerotized on the midline; cercus elongate, very narrowly joined at its base laterally to broadened base of postgenital plate; postgenital plate large, with short narrow dorsal lateral extension, distal bilobed part with narrow median triangular unsclerotized sternal area; a small attached atrial sclerite present; bursa apparently poorly differentiated and without visible sclerotizations; spermatheca apparently in segment VIII.

MALE (fig. 124). Essentially similar to female. All claws enlarged and all with 4 or 5 median teeth in addition to basal external spicules.

MALE GENITALIA (fig. 124). Markedly different from *Paradixa* and relatively small and simple. *Segment IX*: Very deep, moderately to poorly sclerotized and with numerous bristles on tergite and sternite; sternite small, its boundary indicated by slight articular process for sidepiece; tergite very large, moderately sclerotized on lateral part, dorsal part poorly sclerotized and appearing as a large median lobe. *Sidepiece*: Short; with conspicuous apical inner tergal fingerlike lobe, with long seta tergally in basal part and 2 microsetae near apex sternally, distal part somewhat expanded, not bent ventrad. *Clasper*: Simple and uniform in width, with clear apical process and numerous simple setae. *Phallosome*: Very simple and lightly sclerotized. Prosophallus short and broad, continuous across midline. Aedeagal sclerite very broadly attached to sidepiece (basal piece) at base, apex somewhat hooked. Opisthophallus apparently represented by a prominent membranous lobe with lightly sclerotized basal lateral bar and basal sternal bridge. *Proctiger*: Simple,

short broad setose lobe, with 1 or 2 sublateral setae on sternal surface.

PUPA (fig. 126). Morphology and chaetotaxy as figured. Essentially as described by Belkin (1968a:30) for *Paradixa*, but with the following distinctive features. *Cephalothorax*: Hair 1-C apparently absent. Integument strongly tubercular. *Trumpet*: Short and with large rounded or ovoid pinna. *Abdomen*: Integument strongly tubercular on transverse ridges. Tergite VIII with conspicuous median caudal process with sharp spicules. Hairs 6,7-II-VII more dorsal in position; hair 12 present on segment VII. *Paddle*: Evenly tapered from base, just distad of genital lobe. Hair 2-P at external margin.

LARVA (fig. 126). Morphology and chaetotaxy as figured. Essentially as described by Belkin (1968a:30-31) for *Paradixa* but with the following conspicuous diagnostic features. *Head*: Posterior tentorial pit at about middle of labial plate as in *Paradixa* (incorrectly figured in Belkin, 1968a). Hair 4-C cephalad and laterad of 5-C; hairs 8,17-C apparently both absent; 14,15-C both small and forked. *Antenna*: Shaft with line of long hairlike spicules on inner margin dorsally and a separate line on ventral surface. Antennal hair 1-A on apex of shaft ventrally, moderately thickened and hooked. *Thorax*: Integument with very dense vestiture of long heavy spicules, particularly dorsally and laterally, and small bare areas. Ventral prothoracic hairs shorter than entire thorax. *Abdomen*: Spiculation more spine-like and shorter than on thorax. Prolegs with hooks essentially as in *Paradixa* but lighter hooks long. Ventral ambulacral combs on segments V and VI only (as in *Nothodixa*); teeth in a single rank, separated by a very small median sclerite and with numerous heavily pigmented spicules at base. Hair 14-I more lateral in position, near outer base of proleg (also laterad of 13-I in *Paradixa* and not as shown in Belkin, 1968a); hair 11-II apparently absent. Segment VII with conspicuous median caudal ventral spiculate process; ventral hairs of segment short, none reaching middle of segment VIII. Hairs of segment VIII short, longest (4-VIII) not reaching apex of basal saddle of anal segment. *Spiracular Apparatus*: Spiracles moderate. Anteromedian lobe with more or less hexagonal median sclerotization, fenestrate in middle and bearing hair 3-S; hairs 4,5-S on common basal plate not connected to median sclerotization. Median plate not developed, lateral sclerotizations small and not connected, this area densely covered with short largely stellate spicules as in *Nothodixa*. Posterolateral lobe with short rounded clear ventral apical process; hairs 8,9-S both submarginal, near the lateral spicules; other hairs as in *Paradixa*. Pecten plate strongly sclerotized and heavily pigmented dorsally; with short broad, apically fringed spicules in 2 or 3 rows; at most 1 simple small post-pecten spicule developed; hair 1-S in distal dorsal part, usually single or double. *Anal Segment*: Basal saddle well developed, joined to the plate bearing hair 4-X.

SYSTEMATICS. This species differs from all other known *Paradixini* in several fundamental features mentioned in the generic diagnosis and undoubtedly belongs to a phyletic line distinct from *Dixella*. The larval characters are particularly striking. In our opinion, the differences between *Mesodixa* and all other *Paradixini* are of the same order of magnitude as those differentiating *Nothodixa* Edwards, 1930 from *Dixa* Meigen, 1818 in the tribe *Dixini*.

Although there is some superficial resemblance in color pattern of adults of *biambulacra* with *clavulus* Williston, 1896 from St. Vincent, known from females only, the antennal flagellum of *clavulus* appears to be considerably longer and it seems unlikely that the 2 species are even congeneric.

BIONOMICS. The immature stages of *biambulacra* have been collected only twice, both times in association with *D. scitula* (741,775) along the edge of Dunns River

above the falls. Adults have not been found in nature.

DISTRIBUTION. To date known only from the north slope of Jamaica.

JAMAICA. *St. Ann*: Dunns River (741,775).

Material Examined: 95 specimens; 6 males, 9 females, 39 larvae, 41 pupae; 14 individual rearings (8 larval, 4 pupal, 2 incomplete).

JA COLLECTION DATA

The bulk of the material on which this study is based was collected and reared following the methods outlined by Belkin, Hogue et al (1965, 1967). This material is identified only by 1 of the following 2 printed labels: //JA [handwritten collection number]/Jamaica 64/65/William A. Page// or //JA [numbers continuous with above]/Jamaica 64-68/Mosq Mid Amer//. All the data pertinent to each collection (locality, date, collector, breeding site, rearing information, etc.) are entered on standard record forms deposited in the Department of Zoology, University of California, Los Angeles. These data are summarized in the following list under each collection number. Included in this series are some miscellaneous collections, particularly a very valuable one by R.H. Hochman [USNM].

The data are given in the following order: Collection number. Parish, nearest town, specific locality (Universal Transverse Mercator Grid coordinates; Jamaica 1:50,000, U.S. Army Topographic Command, E721); approximate elevation above sea level in meters; date, abbreviation for collector(s). [Collections of immature stages] Specific breeding site and general environment; water conditions; vegetation in breeding site; bottom conditions; light condition. [Collections of adults] Type and site of collection; hours of collection. [Species obtained] Number assigned to species in text followed by scientific name. The following abbreviations are used for the names of collectors: Bk (J.N. Belkin); BkP (J.N. Belkin and W.A. Page); Br (O.G.W. Berlin); BrW (O.G.W. Berlin and D.C. Watson); F (T.H. Farr); H (R.H. Hochman; followed by his field number); M (Ministry of Health officials); P (W.A. Page); T (H. Tucker); W (D.C. Watson).

1. St. Catherine, Spanish Town, Caymanas area (TQ980930), 10 m; Jan 64, T. Collection of immatures without data. 1. *Anopheles (Nys.) albimanus*.

2. St. Catherine, Spanish Town, Caymanas area (TQ980930), 10 m; Jan 64, T. Collection of immatures without data. 1. *Anopheles (Nys.) albimanus*; 36. *Psorophora (G.) jamaicensis*.

3. St. Catherine, Spanish Town, Caymanas area (TQ980930), 10 m; Jan 64, T. Collection of immatures without data. 36. *Psorophora (G.) jamaicensis*.

4. St. Catherine, Spanish Town, Caymanas Estate (TQ980930), 10 m; Jan 64, P. Small ground pool in partial forest; water fresh, clear, temporary; vegetation abundant, mud bottom; partial shade. 1. *Anopheles (Nys.) albimanus*; 36. *Psorophora (G.) jamaicensis*.

5. No collection.

6. St. Catherine, Spanish Town, Port Henderson (UQ015855), sea level; 21 Jan 64, T. Ditch in littoral mangrove; water permanent, clear, fresh, slow current; vegetation abundant with floating and submerged weeds, scum; mud bottom; partial shade. 3. *Anopheles (A.) crucians*; 17. *Culex (Mel.) atratus*; 20. *Culex (Mel.) iolambdis*.

7. St. Catherine, Spanish Town, Port Henderson (UQ015855), sea level; 21 Jan 64, P. Footprints in salt marsh; water temporary, clear, brackish; algae; mud bottom; full sun. 40. *Aedes (O.) sollicitans*.

8. St. Catherine, Spanish Town, Naggo Head (TQ999865), 4 m; 21 Jan 64, T. Stream margin in salt marsh; water permanent, clear, fresh, moderate current; vegetation scanty, submerged weeds; mud bottom; full sun. 1. *Anopheles (Nys.) albimanus*.

9. St. Catherine, Spanish Town, Port Henderson (UQ015855), sea level; 22 Jan 64, T. Large concrete artificial container, domestic; water temporary, clear, fresh; algae scanty; mud bottom on concrete; full sun. 1. *Anopheles (Nys.) albimanus*; 16. *Culex (C.) quinquefasciatus*.

10. St. Catherine, Spanish Town, Naggo Head, Portmore (UQ006876), 5 m; 22 Jan 64, T. Pond in thorn scrub; water permanent, clear, fresh; algae and submerged weeds scanty; mud bottom; full sun. 1. *Anopheles (Nys.) albimanus*; 17. *Culex (Mel.) atratus*.

11. St. Catherine, Spanish Town, Naggo Head, Portmore (UQ006876), 5 m; 22 Jan 64, T. Concrete artificial container in thorn scrub; water temporary, clear, fresh; concrete and twigs bottom; full sun. 1. *Anopheles (Nys.) albimanus*.

12. St. Catherine, Spanish Town, Passage Fort (UQ024893), 4 m; 23 Jan 64, T. Stream margin in thorn scrub; water permanent, clear, fresh, moderate current; submerged weeds; mud bottom; full sun. 1. *Anopheles (Nys.) albimanus*.

13. St. Catherine, Spanish Town, Passage Fort (UQ024893), 4 m; 23 Jan 64, T. Ditch in thorn scrub; water temporary, clear, fresh; vegetation scanty, algae; mud bottom; partial shade. 17. *Culex (Mel.) atratus*.

14. St. Catherine, Spanish Town, Passage Fort (UQ024893), 4 m; 23 Jan 64, T. Ditch in thorn scrub; water temporary, clear, fresh, stagnant; no vegetation; mud bottom; partial shade. 4. *Anopheles (A.) vestitipennis*.

15. St. Catherine, Spanish Town, Gregory Park, Newlands (UQ008895), 10 m; 24 Jan 64, T. Footprints in canefield; water temporary, clear, fresh; mud bottom; partial shade. 16. *Culex (C.) quinquefasciatus*.

16. St. Catherine, Spanish Town, Gregory Park (UQ009905), 10 m; 24 Jan 64, T. Stream margin in thorn scrub; water permanent, clear, fresh, slow current; algae; mud bottom; full sun. 1. *Anopheles (Nys.) albimanus*.

17. St. Catherine, Spanish Town, Gregory Park, Newlands (UQ008895), 10 m; 24 Jan 64, T. Stream margin in canefield; water permanent, clear, fresh, slow current; algae; mud bottom; full sun. 1. *Anopheles (Nys.) albimanus*.

18. St. Catherine, Spanish Town, Gregory Park (UQ009905), 10 m; 27 Jan 64, T. Pond in thorn scrub; water permanent, clear, fresh; vegetation abundant, algae, floating water lily; mud bottom; full sun. 1. *Anopheles (Nys.) albimanus*; 17. *Culex (Mel.) atratus*.

19. St. Catherine, Spanish Town, Gregory Park (UQ009905), 10 m; 27 Jan 64, T. Large concrete drum, domestic; water temporary, clear, fresh; no vegetation; concrete bottom; partial shade. 52. *Aedes (S.) aegypti*.

20. St. Catherine, Spanish Town, Grange Farm, 1 mi from Bernard Lodge (TQ 960888), 15 m; 28 Jan 64, T. Ditch in field; water temporary, clear, fresh, algae; mud bottom; full sun. 1. *Anopheles (Nys.) albimanus*.

21. St. Catherine, Spanish Town, Congrieve Park, 1½ mi from Bernard Lodge (TQ971871), 15 m; 28 Jan 64, T. Drain in field; water temporary, clear, fresh, stagnant; algae; mud bottom; full sun. 36. *Psorophora (G.) jamaicensis*.

22. St. Catherine, Spanish Town, Congrieve Park, 1½ mi from Bernard Lodge (TQ971871), 15 m; 28 Jan 64, T. Footprint in canefield; water temporary, clear, fresh; algae; mud bottom; full sun. 1. *Anopheles (Nys.) albimanus*; 36. *Psorophora (G.) jamaicensis*.

23. St. Catherine, Spanish Town, Naggo Head (TQ999865), 4 m; 28 Jan 64. T. Stream margin in clearing in thorn scrub; water permanent, clear, fresh, slow current; floating weeds and algae scanty; mud and gravel bottom; full sun. 1. *Anopheles (Nys.) albimanus*; 3. *Anopheles (A.) crucians*; 6. *Uranotaenia socialis*.

24. St. Catherine, Spanish Town, Cookson Farm (probably about UQ000881), 10 m; 28 Jan 64, T. Drain in field; water temporary, clear, fresh; vegetation scanty, grass and algae; mud bottom; full sun. 1. *Anopheles (Nys.) albimanus*.

25. St. Catherine, Spanish Town, Tamarind Farm, 1 mi SW of Spanish Town (TQ923888), 22 m; 29 Jan 64, T. Swamp margin in ricefield; water temporary, clear, fresh; vegetation abundant, algae, rice; mud bottom; full sun. 1. *Anopheles (Nys.) albimanus*; 6. *Uranotaenia socialis*; 17. *Culex (Mel.) atratus*.

26. St. Catherine, Spanish Town, Great Salt Pond Farm (TQ969858), 12 m; 29 Jan 64, T. Ditch in plantation; water temporary, clear, fresh; vegetation scanty weed, algae; mud bottom; partial shade. 1. *Anopheles (Nys.) albimanus*.

27. St. Catherine, Spanish Town, Finleys Cottage; 30 Jan 64, T. Ditch in plantation; water temporary, clear, fresh; vegetation, algae, floating weed; mud and gravel bottom; full sun. 1. *Anopheles (Nys.) albimanus*.

28. St. Catherine, Spanish Town, Finleys Cottage; 30 Jan 64, T. Crabhole on shore of stream in plantation; water semipermanent, clear, fresh; no vegetation; mud bottom; full sun. 4. *Anopheles (A.) vestitipennis*; 5. *Anopheles (A.) grabhamii*.

29. St. Catherine, Spanish Town, Caymanas Bay, 1½ mi N of Caymanas (TQ 975952), 15 m; 3 Feb 64, T. Marshy depression in cleared forest; water semipermanent, clear, fresh; vegetation scanty floating weed, algae; mud bottom; full sun. 1. *Anopheles (Nys.) albimanus*; 5. *Anopheles (A.) grabhamii*; 17. *Culex (Mel.) atratus*.

30. St. Catherine, Spanish Town, Caymanas Bay (TQ975952), 15 m; 3 Feb 64. T. Stream margin in plantation; water permanent, clear, fresh, moderate current; vegetation abundant, floating weeds, algae; sand, gravel bottom; partial shade. 1. *Anopheles (Nys.) albimanus*; 5. *Anopheles (A.) grabhamii*; 17. *Culex (Mel.) atratus*.

31. St. Catherine, Spanish Town, Caymanas Bay (TQ975952), 15 m; 3 Feb 64, T. Large earthen pot, domestic; water clear, fresh; partial shade. 16. *Culex (C.) quinquefasciatus*; 52. *Aedes (S.) aegypti*.

32. St. Catherine, Spanish Town, Caymanas (TQ980930), 15 m; 4 Feb 64. T. Ditch in canefield; water temporary, clear, fresh, stagnant; vegetation abundant, floating weeds, algae; mud, rock bottom; partial shade. 1. *Anopheles (Nys.) albimanus*; 5. *Anopheles (A.) grabhamii*.

33. St. Catherine, Spanish Town, Caymanas (TQ980930), 15 m; 4 Feb 64, T. Large ground pool in field; water temporary, clear, fresh; algae; mud bottom; deep shade. 17. *Culex (Mel.) atratus*.

34. St. Catherine, Spanish Town, March Pen Road, 1 mi S of Spanish Town (TQ932885), 15 m; 6 Feb 64, T. Ditch in plantation; water clear, fresh, stagnant; algae, water grass; mud, gravel bottom; partial shade. 3. *Anopheles (A.) crucians*; 15. *Culex (C.) nigripalpus*; 16. *Culex (C.) quinquefasciatus*.

35. St. Catherine, Spanish Town, Blair Pen Farm, 15 m; 6 Feb 64, T. Drain in field; water temporary, clear, fresh, slow current; vegetation abundant, algae, grass, floating weeds; mud bottom; full sun. 1. *Anopheles (Nys.) albimanus*.

36. St. Catherine, Spanish Town, St. Johns Road (TQ910911), 30 m; 6 Feb 64, T. Large drain along road; water temporary, clear, fresh; vegetation abundant, grass, algae; mud bottom; partial shade. 1. *Anopheles (Nys.) albimanus*; 3. *Anopheles (A.) crucians*.

37. St. Catherine, Spanish Town, Featherbed Lane (TQ935905), 30 m; 6 Feb 64, T. Footprints in ricefield; water temporary, clear, fresh; vegetation abundant grass, algae; mud bottom; partial shade. 4. *Anopheles (A.) vestitipennis*; 36. *Psorophora (G.) jamaicensis*; 42. *Aedes (O.) hemisurus*.

38. St. Catherine, Spanish Town, Featherbed Lane (TQ935905), 30 m; 6 Feb 64, T. Drain in plantation; water temporary, clear, fresh, slow current; vegetation abundant, algae, grass; mud bottom; partial shade. 4. *Anopheles (A.) vestitipennis*; 5. *Anopheles (A.) grabhamii*.

39. Kingston and St. Andrew, Kingston, Cavaliers, Mount Tirza (UR963010), 380 m; 11 Feb 64, T. Large copper container; water clear, fresh; partial shade. 16. *Culex (C.) quinquefasciatus*; 52. *Aedes (S.) aegypti*.

40. Kingston and St. Andrew, Kingston, Cavaliers, Mt. Tirza (UR063010), 380 m, 11 Feb 64, T. Small drum, domestic; water colored, fresh; 2 ins tar bottom; partial shade. 16. *Culex (C.) quinquefasciatus*.

41. Kingston and St. Andrew, Kingston, Cavaliers (UR063010), 380 m; 11 Feb 64, T. Stream pool in plantation; water permanent, clear, fresh, stagnant; vegetation algae, flottage; mud, gravel bottom; partial shade. 5. *Anopheles (A.) grabhamii*.

42. Kingston and St. Andrew, Kingston, Cavaliers (UR063010), 380 m; 11 Feb 64, T. Cut bamboo, domestic; water temporary, clear, fresh; decaying plant matter in bottom; partial shade. 16. *Culex (C.) quinquefasciatus*.

43. Kingston and St. Andrew, Kingston, Cavaliers (UR063010), 380 m; 14 Feb 64, T. Stream margin in clearing in rain forest; water permanent, clear, fresh, slow current; vegetation scanty, algae, water lily; mud bottom; partial shade. 5. *Anopheles (A.) grabhamii*.

44. Kingston and St. Andrew, Kingston, Temple Hall (UR069033), 150 m; 17 Feb 64, T. Drain in plantation; water temporary, clear, fresh, slow current; sand, gravel bottom; deep shade. 5. *Anopheles (A.) grabhamii*.

45. Kingston and St. Andrew, Kingston, Temple Hall, on main road (UR069033), 150 m; 17 Feb 64, T. Pool in ditch in plantation; water temporary, clear, fresh; vegetation scanty, algae; sand, gravel bottom; full sun. 21. *Culex (Mel.) inhibitor*.

46. Kingston and St. Andrew, Kingston, Temple Hall, Murdock Spring (UR069033), 150 m; 17 Feb 64, T. Small ground pool in clearing in rain forest; water temporary, clear, fresh, algae; sand, gravel bottom; full sun. 1. *Anopheles (Nys.) albimanus*, 5. *Anopheles (A.) grabhamii*.

47. Kingston and St. Andrew, Kingston, Temple Hall (UR069033), 150 m; 17 Feb 64, T. Large ground pool in clearing in rain forest; water temporary, clear, fresh; vegetation scanty, algae, floating weeds; sand, gravel bottom; partial shade. 1. *Anopheles (Nys.) albimanus*; 5. *Anopheles (A.) grabhamii*; 17. *Culex (Mel.) at-ratus*; 21. *Culex (Mel.) inhibitor*.

48. Kingston and St. Andrew, Temple Hall, Wag Water River (UR069033), 150 m; 18 Feb 64, T. Stream margin in clearing in rain forest; water permanent, clear, fresh, slow current; vegetation scanty, algae; sand, gravel bottom; full sun. 1. *Anopheles (Nys.) albimanus*.

49. Kingston and St. Andrew, Kingston, Temple Hall (UR069033), 150 m; 18 Feb 64, T. Small ground pool in plantation; water temporary, clear, fresh; no vegetation; sand, gravel bottom; full sun. 15. *Culex (C.) nigripalpus*; 16. *Culex (C.) quinquefasciatus*.

50. Kingston and St. Andrew, Kingston, Parks Road (UR026018), 380 m; 18 Feb 64, T. Wild coco yam, domestic; partial shade. 11. *Culex (C.) corniger*; 55. *Wyeomyia (W.) mitchellii*.

51. Kingston and St. Andrew, Kingston, Mount Airy, 3 mi from Brandon Hill (UR123042), 600 m; 19 Feb 64, T. Large ground pool in plantation; water temporary, clear, fresh; mud bottom; partial shade. 5. *Anopheles (A.) grabhamii*.

52. St. Thomas, Golden Grove, Dalvey, Belgium (UQ674805), 20 m; 3 Mar 64,

T. Drain in plantation; water temporary, clear, fresh; vegetation scanty, algae; mud, rock bottom; full sun. 16. *Culex (C.) quinquefasciatus*.

53. St. Thomas, Golden Grove, Spanish Wood, near Duckenfield Hall (UQ673815), 30 m; 3 Mar 64, T. Ditch in canefield; water temporary, clear, fresh, stagnant; mud bottom; full sun. 15. *Culex (C.) nigripalpus*.

54. St. Thomas, Golden Grove, Duckenfield Hall, Spanish Wood (UR673815), 30 m; 4 Mar 64, T. Small ground pool in canefield; water temporary, turbid, fresh; algae; mud bottom; full sun. 1. *Anopheles (Nys.) albimanus*; 15. *Culex (C.) nigripalpus*.

55. St. Thomas, Golden Grove, Duckenfield Hall, Spanish Wood (UR673815), 30 m; 4 Mar 64, T. Ditch in canefield; water temporary, clear, fresh; mud bottom; full sun. 1. *Anopheles (Nys.) albimanus*.

56. St. Thomas, Golden Grove (UQ653832), 30 m; 4 Mar 64, T. Stream margin in plantation; water permanent, clear, fresh, slow current; vegetation scanty, algae, floating water grass; mud bottom; full sun. 1. *Anopheles (Nys.) albimanus*; 5. *Anopheles (A.) grabhamii*.

57. St. Thomas, Golden Grove, Holland Bay (UQ706832), 1 m; 4 Mar 64, T. Stream margin in plantation; water permanent, clear, fresh, slow current; vegetation abundant, algae, floating weeds; mud bottom; full sun. 1. *Anopheles (Nys.) albimanus*.

58. St. Thomas, Golden Grove, Amity Hall (UQ670855), 80 m; 9 Mar 64, T. Stream margin in plantation; water permanent, clear, fresh, slow current; vegetation abundant, algae; sand, gravel bottom; partial shade. 1. *Anopheles (Nys.) albimanus*; 5. *Anopheles (A.) grabhamii*; 15. *Culex (C.) nigripalpus*; 36. *Psorophora (G.) jamaicensis*.

59. St. Thomas, Golden Grove, Amity Hall, Quaw Hill (UQ676855), 61 m; 9 Mar 64, T. Large ground pool in clearing in rain forest; water temporary, colored, fresh; full sun. 36. *Psorophora (G.) jamaicensis*.

60. St. Thomas, Manchioneal, Hectors River (UQ662908), 15 m; 11 Mar 64, T. Stream margin in plantation; water permanent, clear, fresh, slow current; vegetation scanty, floating weeds; mud, gravel bottom; full sun. 5. *Anopheles (A.) grabhamii*.

61. St. Thomas, Golden Grove, Amity Hall (UQ670855), 80 m; 11 Mar 64, T. Large ground pool, domestic; water temporary, colored, fresh; mud bottom; partial shade. 36. *Psorophora (G.) jamaicensis*.

62. St. Thomas, Golden Grove, Hordley Estate (UQ658848), 15 m; 17 Mar 64, T. Drain in plantation; water temporary, colored, fresh, stagnant; scum; mud, rock bottom; partial shade. 15. *Culex (C.) nigripalpus*; 16. *Culex (C.) quinquefasciatus*.

63. St. Thomas, Golden Grove (UQ653832), 30 m; 17 Mar 64, T. Drain in cultivation; water temporary, clear, fresh, stagnant; vegetation scanty, algae; mud bottom; partial shade. 1. *Anopheles (Nys.) albimanus*; 5. *Anopheles (A.) grabhamii*.

64. St. Thomas, Port Morant, New Pera (UQ630777), sea level; 24 Mar 64, T. Marshy depression in ricefield; water temporary, clear, fresh; vegetation abundant, rice; mud bottom; full sun. *Culex (Mel.) sp.*

65. St. Thomas, Golden Grove, Chiswick, 1 mi from Dalvey (probably UQ687800), 8 m; 25 Mar 64, T. Large ground pool in junction of mangrove swamp and canefield; water temporary, colored, brackish; no vegetation; mud bottom; full sun. 1. *Anopheles (Nys.) albimanus*; 5. *Anopheles (A.) grabhamii*; *Culex (Mel.) sp.*

66. St. Thomas, Golden Grove, Wheelerfield (UQ635854), 30 m; 1 Apr 64, T. Stream margin in plantation; water permanent, clear, fresh, slow current; vegetation abundant, algae, flotage; floating weeds; mud bottom; full sun.

67. St. Thomas, Golden Grove, Winchester House (UQ633845), 30 m; 1 Apr 64, T. Seepage in plantation; water permanent, clear, fresh, slow current; vegetation scanty, algae; mud bottom; partial shade. 1. *Anopheles (Nys.) albimanus*; 5. *Anopheles (A.) grabhamii*; 17. *Culex (Mel.) atratus*.
68. St. Thomas, Golden Grove, Hampton Court (UQ659809), 70 m; 7 Apr 64, T. Small crabhole, domestic; water temporary, colored, fresh; mud bottom; partial shade. 16. *Culex (C.) quinquefasciatus*.
69. St. Thomas, Golden Grove, Hampton Court (UQ659809), 70 m; 7 Apr 64, T. Large absorption pit, domestic; water temporary, colored, fresh; mud bottom; partial shade. 16. *Culex (C.) quinquefasciatus*.
70. St. Thomas, Golden Grove, Hampton Court (UQ659809), 70 m; 7 Apr 64, T. Large crabhole, domestic; water temporary, clear, fresh; mud bottom; partial shade. 16. *Culex (C.) quinquefasciatus*.
71. St. Thomas, Golden Grove, Holland Bay (UQ700834), sea level; 9 June 64, T. Small ground pool in mangrove swamp edge; water temporary, brackish; sand bottom; partial shade. 15. *Culex (C.) nigripalpus*.
72. St. Thomas, Golden Grove, Holland Bay (UQ700834), sea level; 17 June 64, T. Drain in plantation; water temporary, clear, fresh, stagnant; mud bottom; partial shade. 15. *Culex (C.) nigripalpus*.
- 73, 74. No collections.
75. St. Thomas, Yallahs, Grants Pen, on sea side of Albion swamp (UQ279800), sea level; 16 July 64, BkP. Freshwater swamp margin; water permanent, clear, fresh; vegetation abundant, grassy; mud, sand bottom; partial shade. 1. *Anopheles (Nys.) albimanus*; 17. *Culex (Mel.) atratus*.
76. St. Thomas, Yallahs, Grants Pen, 20 ft W of drainage ditch (UQ280803), 8 m; 16 July 64, BkP. Freshwater swamp interior; water semipermanent, clear, fresh; vegetation abundant, algae, grassy; mud, decayed plant matter bottom; partial shade. 17. *Culex (Mel.) atratus*.
77. St. Thomas, Yallahs, Grants Pen waterworks, 50 yds S of road (UQ280803), 8 m; 16 July 64, BkP. Ditch in freshwater swamp; water permanent, clear, fresh, slow current; vegetation abundant, scum, algae, grassy, *Typha* sp.; mud bottom; full sun. 1. *Anopheles (Nys.) albimanus*; 6. *Uranotaenia socialis*; 17. *Culex (Mel.) atratus*; 19. *Culex (Mel.) erraticus*.
78. St. Thomas, Golden Grove, White Bay (UQ735817), 3 m; 16 July 64, BkP. Adults resting in very open shallow crabhole in mangrove swamp; time 1430. 9. *Deinocerites cancer*.
79. St. Thomas, Golden Grove, White Bay (UQ735817), 3 m; 16 July 64, BkP. Large crabhole in mangrove; water permanent, clear; mud, sand bottom; partial shade. 9. *Deinocerites cancer*; 39. *Aedes (O.) taeniorhynchus*.
80. Clarendon, Chapelton, Summerfield, 1 mi from Chapelton, on St. Thomas River (TR589023), 240 m; 17 July 64, BkP. Small ground pool in road rut in field; water temporary, turbid, fresh; vegetation scanty, grass; mud bottom; full sun. 36. *Psorophora (G.) jamaicensis*.
81. Clarendon, Frankfield (TR475089), 250 m; 17 July 64, BkP. Rockhole in coral limestone on stream margin in rain forest; water temporary, clear, fresh, stagnant; rock, decaying plant matter bottom; full sun. 36. *Psorophora (G.) jamaicensis*.
82. Kingston and St. Andrew, Kingston, Constant Spring, behind post office (UQ098959), 150 m; 18 July 64, BkP. Large treehole, 1 m above ground; water temporary, light brown; decaying vegetation bottom; partial shade. 46. *Aedes (F.) mediovittatus*.

83. Kingston and St. Andrew, Kingston, Constant Spring, behind post office (UQ098959), 150 m; 18 July 64, BkP. Small treehole 0.75 m from ground; water light brown; decaying vegetation bottom; partial shade. 52. *Aedes (S.) aegypti*.
84. Kingston and St. Andrew, Kingston, Hermitage Dam Road (UQ120998), 400 m; 18 July 64, BkP. No material.
85. Kingston and St. Andrew, Kingston, Hermitage Dam (UQ120998), 480 m; 18 July 64, BkP. Epiphytic bromeliad in rain forest; water dark brown; deep shade. 47. *Aedes (H.) walkeri*.
86. Westmoreland, Savanna-La-Mar, Negril, S. past lighthouse (QL795190), 2 m; 29 July 64, P. Rockhole, coral, seaside in thorn scrub; water semipermanent, clear, brownish, fresh; scanty algae; rock, decaying plant matter bottom; partial shade. 17. *Culex (Mel.) atratus*.
87. Westmoreland, Savanna-La-Mar, Little London, Broughton Wharf (QL952149), sea level; 30 July 64, P. Canoe in mangrove; water temporary, clear, brown, fresh; wood bottom; partial shade. 15. *Culex (C.) nigripalpus*.
88. Westmoreland, Savanna-La-Mar, Little London, Broughton Wharf (QL952149), sea level; 30 July 64, P. Large crabhole in mangrove; partial shade. 9. *Deinocerites cancer*.
89. Hanover, Lucea, Bulls Bay, 3 mi W of Lucea on Green Island Road (QL943423), sea level; 2 Aug 64, W. Rockhole, coral seaside in rocky littoral; water semipermanent, green, salty; rock bottom; full sun. 9. *Deinocerites cancer*; 10. *Culex bahamensis*; 37. *Psorophora (G.) insularia*.
90. St. Thomas, Golden Grove, Duckenfield Hall, Spanish Wood (UQ673815), 30 m; 5 Aug 64, T. Large crabhole in mangrove; water dark brown, brackish; mud bottom; deep shade. 9. *Deinocerites cancer*.
91. St. Thomas, Golden Grove, Dalvey, Belgium (UQ674805), 20 m; 7 Aug 64, P. Small ground pool in mangrove edge; water temporary, brackish; decaying vegetation bottom; full sun. 1. *Anopheles (Nys.) albimanus*; 5. *Anopheles (A.) grabhamii*.
92. St. Thomas, Golden Grove, Chiswick, 11 yds from sea (probably UQ687800), 8 m; 7 Aug 64, P. Crabhole in mangrove; water brackish; mud bottom; full sun. 9. *Deinocerites cancer*; 39. *Aedes (O.) taeniorhynchus*.
93. St. Thomas, Golden Grove, Dalvey (UQ677805), 15 m; 10 Aug 64, P. Pond in clearing in rain forest; water temporary, clear, fresh; mud, decaying grass bottom; partial shade. 15. *Culex (C.) nigripalpus*; 36. *Psorophora (G.) jamaicensis*.
94. St. Thomas, Golden Grove, Duckenfield Hall, about ¼ mi E of Duckenfield-Holland Bay road junction (UQ673835), 25 m; 10 Aug 64, P. Large ground pool in canefield; water temporary, light brown, fresh; mud bottom; full sun. 36. *Psorophora (G.) jamaicensis*.
95. St. Thomas, Golden Grove, Holland Bay, about 6 chains E of village, near first bridge (UQ700834), sea level; 10 Aug 64, T. Large ground pool in mangrove; water clear, brackish; algae; sand bottom; full sun. 38. *Psorophora (G.) pygmaea*; 39. *Aedes (O.) taeniorhynchus*.
96. St. Thomas, Golden Grove, Holland Bay, 1 chain W of village (UQ700834), sea level; 10 Aug 64, T. Marshy depression in mangrove; water temporary, colored, brackish; vegetation abundant, grassy; mud, sand bottom; full sun. 36. *Psorophora (G.) jamaicensis*; 38. *Psorophora (G.) pygmaea*; 39. *Aedes (O.) taeniorhynchus*.
97. St. Thomas, Golden Grove, E of Holland Bay village, between milestones 50 and 51 (UQ715825), sea level; 11 Aug 64, T. Swamp margin in mangrove; water temporary, brownish, brackish; vegetation scanty, grass; mud bottom; deep shade. 36. *Psorophora (G.) jamaicensis*; 38. *Psorophora (G.) pygmaea*; 43. *Aedes (O.) tortilis*.

98. St. Thomas, Golden Grove, E of Holland Bay village, between milestones 51 and 52 (UQ715825), sea level; 11 Aug 64, T. Swamp interior in mangrove, 2 chains from road; water colored, brackish; mud, sand bottom; deep shade. 39. *Aedes (O.) taeniorhynchus*.

99. St. Thomas, Golden Grove, Holland Bay, E, between milestones 51 and 52 (UQ715825), sea level; 11 Aug 64, T. Drain, about 1 chain inside mangrove swamp; water temporary, colored, brackish, stagnant; mud, sand bottom; deep shade. 38. *Psorophora (G.) pygmaea*; 39. *Aedes (O.) taeniorhynchus*.

100. St. Thomas, Golden Grove, Morant Point lighthouse (UQ745813), 5 m; 11 Aug 64, T. Large ground pool in littoral grass; water temporary, clear, brackish; vegetation scanty, grass; mud, rock bottom; full sun. 38. *Psorophora (G.) pygmaea*; 39. *Aedes (O.) taeniorhynchus*.

101. St. Thomas, Golden Grove, Chiswick (probably UQ687800), 8 m; 11 Aug 64, T. Large ground pool in mangrove; water temporary, clear, brackish; mud bottom; full sun. 36. *Psorophora (G.) jamaicensis*; 38. *Psorophora (G.) pygmaea*.

102. St. Thomas, Golden Grove, Chiswick (probably UQ687800), 8 m; 11 Aug 64, T. Small ground pool in mangrove; water temporary, clear, brackish; mud bottom; full sun. 36. *Psorophora (G.) jamaicensis*; 38. *Psorophora (G.) pygmaea*.

103. St. Thomas, Golden Grove, Folly Bay, 9 yds from sea (UQ725799), sea level; Aug 64, T. Rockhole, coral seaside, in littoral mangrove; water fresh; vegetation decaying; rock bottom; partial shade. 9. *Deinocerites cancer*; 50. *Aedes (H.) inaequalis*.

104. St. Thomas, Golden Grove, Folly Bay, 16 chains from sea (UQ725799), sea level; Aug 64, T. Pond, littoral; water semipermanent, brackish; vegetation scanty, grassy; mud bottom; full sun. 15. *Culex (C.) nigripalpus*.

105. Clarendon, Chapelton, Trout Hall (TR525072), 350 m; 15 Aug 64, M. Adults on donkey bait at dusk. 55. *Wyeomyia (W.) mitchellii*.

106. Kingston and St. Andrew, Kingston, Hermitage Dam Road (UQ120998), 450 m; 20 Aug 64, P. No data.

107. Kingston and St. Andrew, Kingston, Hermitage Dam Road (UQ120998), 450 m; 20 Aug 64, P. Adults biting man in forest about 3 yds off road; 1115 hrs. *Aedes (H.) sp.*

108. Kingston and St. Andrew, Kingston, 25 yds from Constant Spring Road along Hermitage Dam Road (UQ106997), 160 m; 20 Aug 64, P. Adult biting man; 1030 hrs. 39. *Aedes (O.) taeniorhynchus*.

109. Kingston and St. Andrew, Kingston, Hermitage Dam Road, about 100 yds before end of tarmac (UQ120998), 450 m; 20 Aug 64, P. Rockhole, coral limestone, in rain forest; water temporary, clear, fresh; vegetation decaying; rock bottom; deep shade. 50. *Aedes (H.) inaequalis*.

110. Kingston and St. Andrew, Kingston, Hermitage Dam Road, at beginning of dirt road (UQ120998), 450 m; 20 Aug 64, P. Treehole in rain forest; water slightly brown, fresh; decaying vegetation bottom; deep shade. 30. *Orthopodomyia waverleyi*.

111. Kingston and St. Andrew, Kingston, Hermitage Dam Road, at beginning of dirt road (UQ120998), 450 m; 20 Aug 64, P. Bamboo, cut and broken, at edge of clearing in rain forest; water temporary, colored light brown, fresh; decaying plant matter bottom; partial shade. 54. *Wyeomyia (W.) nigrifubus*.

112. St. Thomas, Golden Grove, Holland Bay (UQ706832), 3 m; 19 Aug 64, T. Large crabhole in mangrove; water colored, brackish; sand bottom; partial shade.

9. *Deinocerites cancer*.

113. St. Thomas, Morant Bay, Seaforth, approx ½ mi W of Serge Island and Seaforth road junction (UQ453840), 80 m; 19 Aug 64, T. Ditch in field; water temporary, clear, fresh, stagnant; mud, concrete bottom; partial shade. 16. *Culex (C.) quinquefasciatus*.

114. St. Thomas, Golden Grove, Holland Bay, between milestones 51 and 52 (UQ715825), 3 m; 19 Aug 64, T. Drain in mangrove; water temporary, dark brown, brackish, stagnant; mud bottom; full sun. 39. *Aedes (O.) taeniorhynchus*.

115. St. Thomas, Golden Grove, Holland Bay, between milestones 51 and 52 (UQ715825), 3 m; 19 Aug 64, T. Small ground pool in road in mangrove; water temporary, clear, brackish; mud, gravel bottom; full sun. 16. *Culex (C.) quinquefasciatus*; 39. *Aedes (O.) taeniorhynchus*.

116. Kingston and St. Andrew, Kingston, Hermitage Dam Road near beginning of dirt road (UQ120998), 450 m; 20 Aug 64, P. Epiphytic bromeliad, clearing in rain forest; water clear; decaying vegetation bottom; deep shade. 63. *Wyeomyia (W.) atrata*.

117. St. Thomas, Golden Grove, Holland Bay, between milestones 51 and 52 (UQ715825), 3 m; 19 Aug 64, T. Adults biting man on road near mangrove swamp; 1530 hrs. 34. *Psorophora (J.) sp., Jamaican form*.

118. Kingston and St. Andrew, Kingston, Hermitage Dam Road, 2 yds off road (UQ120998), 450 m; 20 Aug 64, P. Large treehole in rain forest; water brown; mud-like debris bottom; deep shade. 66. *Toxorhynchites (L.) portoricensis*.

119. St. Thomas, Golden Grove, White Bay (UQ735817), 2 m; 28 Aug 64, T. Large ground pool in mangrove; water temporary, clear, brackish; mud, dead leaves bottom; partial shade. 39. *Aedes (O.) taeniorhynchus*.

120. St. Thomas, Golden Grove, White Bay (UQ735817), 2 m; 28 Aug 64, T. Rockhole, coral, in mangrove; water temporary, clear; rock, dead leaves bottom; full sun. 39. *Aedes (O.) taeniorhynchus*.

121. St. Thomas, Golden Grove, White Bay, entrance to Morant Point lighthouse (UQ738814), 3 m; 18 Aug 64, T. Galvanized iron water container, domestic in mangrove-littoral grass; water temporary, clear, fresh; full sun. 1. *Anopheles (Nys.) albimanus*; 5. *Anopheles (A.) grabhamii*; 10. *Culex (C.) bahamensis*.

122. Kingston and St. Andrew, Kingston, Newcastle, Woodcutter's Gap (UQ192998), 1350 m; 3 Sept 64, P. Epiphytic bromeliad, 2.5 m, in montane rain forest; water turbid, brown; partial shade. 47. *Aedes (H.) walkeri*.

123. Kingston and St. Andrew, Kingston, Newcastle, Woodcutter's Gap (UQ192998), 1350 m; 3 Sept 64, P. Epiphytic bromeliad in montane rain forest; water clear, brown; partial shade. 47. *Aedes (H.) walkeri*.

124. Kingston and St. Andrew, Kingston, Newcastle (UQ188992), 1200 m; 5 Sept 64, P. Small epiphytic bromeliad 3 m above ground, domestic; water clear, colored; partial shade. 47. *Aedes (H.) walkeri*.

125. Kingston and St. Andrew, Kingston, Newcastle, by "Refuge", a house (UQ188992), 1200 m; 5 Sept 64, P. Large epiphytic bromeliad, 4 m above ground, domestic; water clear, brown; partial shade. 48. *Aedes (H.) aurites*.

126. Portland, Manchioneal, Reach, 3 mi E of Manchioneal (UQ618950), 225 m; 9 Sept 64, M. Wild coco yam in rain forest; partial shade. 55. *Wyeomyia (W.) mitchellii*.

127. St. Thomas, Golden Grove, White Bay (UQ735817), 3 m; 9 Sept 64, T. Adults in CDC light trap in mangrove. 9. *Deinocerites cancer*.

127A. St. Thomas, Golden Grove, Rocky Point (due S of Golden Grove) (UQ

652785), 2 m; 10 Sept 64, T. Stream margin in plantation; water permanent, clear, fresh, slow current; algae; mud bottom; partial shade.

128. St. Thomas, Golden Grove, Winchester House (UQ633845), 30 m; 15 Sept 64, T. Small ground pool in plantation; water temporary, clear, fresh; mud, gravel bottom; full sun. 36. *Psorophora (G.) jamaicensis*.

129. St. Thomas, Bath, Plantain Garden River Estate (UQ605837), 60 m; 15 Sept 64, T. Large ground pool in plantation; water temporary, clear, fresh; algae; mud, gravel bottom; full sun.

130. St. Thomas, Golden Grove, Winchester House, about 4 chains NW of school (UQ633845), 30 m; 15 Sept 64, T. Wild coco yam in plantation; deep shade. 55. *Wyeomyia (W.) mitchellii*.

131. Westmoreland, Frome, Grange Hill (QL977266), 90 m; 26 Sept 64, P. Well, disused, domestic; water turbid; mud, old tins, etc. bottom; partial shade.

132. Westmoreland, Frome, Grange Hill (QL977266), 30 m; 26 Sept 64, P. Disused pit latrine, concrete edge, domestic; water temporary, clear, fresh; mud, old mattress in bottom; partial shade. 15. *Culex (C.) nigripalpus*; 16. *Culex (C.) quinquefasciatus*.

133. Westmoreland, Frome, Grange Hill (QL977266), 30 m; 26 Sept 64, P. Discarded motor tires, domestic; water clear; deep shade. 52. *Aedes (S.) aegypti*; 68. *Corethrella (C.) appendiculata*.

134. Westmoreland, Frome, Grange Hill (QL977266), 30 m; 26 Sept 64, P. Wooden barrel, domestic; water clear; partial shade. 52. *Aedes (S.) aegypti*.

135. Westmoreland, Frome, Grange Hill (QL977266), 30 m; 26 Sept 64, P. Wooden water drum, domestic; water clear; deep shade. 52. *Aedes (S.) aegypti*.

136. Westmoreland, Frome, Grange Hill (QL977266), 30 m; 26 Sept 64, P. Artificial container, domestic; water clear; partial shade. 52. *Aedes (S.) aegypti*.

137. Westmoreland, Frome, Grange Hill (QL977266), 30 m; 26 Sept 64, P. Ditch, domestic; water temporary, clear, stagnant; vegetation scanty, grassy; mud bottom; partial shade. 36. *Psorophora (G.) jamaicensis*; 39. *Aedes (O.) taeniorhynchus*.

138. Westmoreland, Frome, Grange Hill (QL977266), 30 m; 26 Sept 64, P. Adults biting man in open area near slaughter house; 1130 hours.

139. St. Thomas, Golden Grove, White Bay (UQ735817), 2 m; 28 Sept 64, T. Small ground pool in coconut plantation, mangrove; water temporary, clear, brackish; mud, gravel bottom; full sun. 38. *Psorophora (G.) pygmaea*; 39. *Aedes (O.) taeniorhynchus*.

140. St. Thomas, Golden Grove (UQ653832), 15 m; 29 Sept 64, T. Very shallow crabhole in field; water colored, fresh; gravel bottom; full sun. 9. *Deinocerites cancer*; 15. *Culex (C.) nigripalpus*; 16. *Culex (C.) quinquefasciatus*.

141. St. Thomas, Golden Grove (UQ653832), 15 m; 29 Sept 64, T. Discarded motor tire in plantation; water colored; partial shade. 16. *Culex (C.) quinquefasciatus*.

142. St. Thomas, Golden Grove, Holland Bay, east end (UQ706832), 3 m; 5 Oct 64, T. Swamp margin in mangrove; water temporary, colored, brackish; vegetation grassy; mud bottom; partial shade. 15. *Culex (C.) nigripalpus*; 39. *Aedes (O.) taeniorhynchus*.

143. St. Thomas, Golden Grove, Holland Bay, east end (UQ706832), 3 m; 5 Oct 64, T. Large ground pool in mangrove; water temporary, clear, brackish; vegetation grassy; mud bottom; partial shade. 15. *Culex (C.) nigripalpus*; 38. *Psorophora (G.) pygmaea*; 43. *Aedes (O.) tortilis*.

144. St. Thomas, Golden Grove, White Bay (UQ735817), 2 m; 6 Oct 64, T. Ditch in plantation and mangrove; water temporary, colored, brackish, stagnant; sand bottom; partial shade. 39. *Aedes (O.) taeniorhynchus*.

145. St. Thomas, Golden Grove, Holland Bay, nr 49 milestone (UQ715825), 2 m; 6 Oct 64, T. Large ground pool in clearing in mangrove; water temporary, clear, brackish; vegetation grassy; sand bottom; full sun.

146. St. Thomas, Golden Grove, Duckenfield Hall (UQ670820), 30 m; 7 Oct 64, T. Ditch, domestic; water temporary, colored, fresh, stagnant; mud bottom; partial shade. 15. *Culex (C.) nigripalpus*; 16. *Culex (C.) quinquefasciatus*.

147. St. Thomas, Golden Grove, Hampton Court (UQ659809), 70 m; 7 Oct 64, T. Small ground pool in plantation; water colored, fresh; mud bottom; full sun. 5. *Anopheles (A.) grabhamii*; 15. *Culex (C.) nigripalpus*.

148. St. Thomas, Golden Grove, Dalvey (UQ677805), 30 m; 7 Oct 64, T. Pond in clearing in rain forest; water temporary, colored, fresh; vegetation scanty, grassy; mud bottom; full sun. 1. *Anopheles (Nys.) albimanus*; 15. *Culex (C.) nigripalpus*.

149. St. Thomas, Golden Grove, Hampton Court (UQ659809), 70 m; 7 Oct 64, T. Pond in plantation; water temporary, colored, fresh; vegetation grassy, floating weeds; mud bottom; full sun. 1. *Anopheles (Nys.) albimanus*; 5. *Anopheles (A.) grabhamii*.

150. St. Thomas, Golden Grove, Dalvey (UQ677805), 20 m; 7 Oct 64, T. Cut bamboo in plantation; water colored, fresh; partial shade. 52. *Aedes (S.) aegypti*; 54. *Wyeomyia (W.) nigrifubus*.

151. St. Thomas, Golden Grove, Dalvey (UQ677805), 20 m; 7 Oct 64, T. Pond in plantation; water temporary, colored, fresh; vegetation grassy; mud bottom; full sun. 15. *Culex (C.) nigripalpus*.

152. St. Thomas, Golden Grove, White Bay (UQ735817), 2 m; 19 Oct 64, T. Large ground pool in mangrove; water colored, brackish; mud, gravel bottom; full sun.

153. St. Thomas, Golden Grove, Morant Point (UQ745813), 2 m; 19 Oct 64, T. Rockhole, coral limestone in littoral grass; water clear; vegetation grassy; rock bottom; full sun. 40. *Aedes (O.) sollicitans*.

154. St. Thomas, Golden Grove, Airy Mount at Martha River (UQ626805), 80 m; 21 Oct 64, T. Terrestrial bromeliad; full sun. 55. *Wyeomyia (W.) mitchellii*.

155. St. Thomas, Golden Grove, Holland Bay, milestone 48 (UQ715825), 3 m; 21 Oct 64, T. Swamp margin in coconut plantation, mangrove; water semipermanent, brackish; mud bottom; full sun. 36. *Psorophora (G.) jamaicensis*.

156. St. Thomas, Golden Grove, Golden Grove Cemetery (UQ653832), 15 m; 22 Oct 64, T. Large ground pool, domestic; water clear, fresh; mud bottom; full sun. 33. *Psorophora (J.) ferox*; 36. *Psorophora (G.) jamaicensis*; 38. *Psorophora (G.) pygmaea*.

157. St. Thomas, Morant Bay, Springfield House, E of Morant Bay (UQ485775), 8 m; 22 Oct 64, T. Ground pool in plantation; water temporary; mud bottom; partial shade. 36. *Psorophora (G.) jamaicensis*.

158. St. Thomas, Morant Bay, Springfield House, E of Morant Bay (UQ485775), 8 m; 22 Oct 64, T. Terrestrial bromeliad in plantation; deep shade. 55. *Wyeomyia (W.) mitchellii*.

159. St. Thomas, Golden Grove, Holland Bay, east end (UQ706832), 3 m; 23 Oct 64, T. Rockhole, coral, in mangrove; water temporary, colored, brackish; rock, decaying vegetation bottom; deep shade. 33. *Psorophora (J.) ferox*; 38. *Psorophora (G.) pygmaea*; 39. *Aedes (O.) taeniorhynchus*; 41. *Aedes (O.) pertinax*; 43. *Aedes (O.) tortilis*.

160. St. Thomas, Golden Grove (UQ653832), 15 m; 22 Oct 64, T. Small ground pool; water temporary, stagnant; mud bottom; full sun.

161. St. Thomas, Golden Grove, Chiswick (probably UQ687800), 8 m; 22 Oct 64, T. Large ground pool at edge of mangrove; water fresh; vegetation grassy; mud bottom; full sun. 36. *Psorophora (G.) jamaicensis*; 43. *Aedes (O.) tortilis*.

162. St. Thomas, Golden Grove, Chiswick (probably UQ687800), 8 m; 22 Oct 64, T. Small ground pool at edge of mangrove; water fresh; vegetation grassy; mud bottom; full sun. 36. *Psorophora (G.) jamaicensis*.

163. St. Thomas, Golden Grove, Rocky Point (UQ652785), 2 m; 23 Oct 64, T. Small ground pool in plantation; water fresh; vegetation grassy; mud, decaying vegetation bottom; full sun. 36. *Psorophora (G.) jamaicensis*.

164. St. Thomas, Golden Grove, Duckenfield Hall (UQ670820), 15 m; 27 Oct 64, T. Large ground pool in field; water colored, fresh; mud bottom; full sun. 16. *Culex (C.) quinquefasciatus*.

165. St. Thomas, Golden Grove, Duckenfield Hall (UQ670820), 15 m; 27 Oct 64, T. Small ground pool in field; water clear, fresh; mud bottom; full sun. 36. *Psorophora (G.) jamaicensis*.

166. St. Thomas, Golden Grove (UQ653832), 30 m; 27 Oct 64, T. Small ground pool in plantation; water fresh; vegetation grassy; mud bottom; full sun. 16. *Culex (C.) quinquefasciatus*.

167. St. Ann, Ocho Rios, Cave Valley (TR746376), 15 m; 19 Oct 64, M. Large crabhole; water temporary, colored; vegetation grassy; partial shade.

168. St. Thomas, Golden Grove, Holland Bay, east end (UQ706832), 3 m; 27 Oct 64, T. No data. 15. *Culex (C.) nigripalpus*; 22. *Culex (Mel.) sp.*, Jamaican form.

169. St. Thomas, Golden Grove, White Bay (UQ735817), 2 m; 28 Oct 64, T. Large ground pool in mangrove; water colored, brackish; mud, gravel bottom; partial shade. 1. *Anopheles (Nys.) albimanus*.

170. St. Thomas, Golden Grove, White Bay (UQ735817), 2 m; 28 Oct 64, T. Small crabhole in mangrove; water clear, brackish; sand bottom; partial shade. 9. *Deinocerites cancer*.

171. St. Thomas, Golden Grove, Hampton Court (UQ659809), 70 m; 29 Oct 64, T. Ground pool; water fresh; vegetation grassy; mud bottom; full sun. 16. *Culex (C.) quinquefasciatus*; 36. *Psorophora (G.) jamaicensis*.

172. St. Thomas, Golden Grove, Chiswick (probably UQ687800), 30 m; 29 Oct 64, T. Small ground pool at edge of mangrove; water fresh; vegetation grassy; mud bottom; full sun. 16. *Culex (C.) quinquefasciatus*.

173. St. Mary, Port Maria, Prospect (UR005320), 20 m; 3 Nov 64, T. Rockhole, coral, domestic; water temporary, colored, fresh; mud, decaying vegetation bottom; partial shade. 50. *Aedes (H.) inaequalis*.

174. St. Thomas, Golden Grove, Stokes Hall (UQ640824), 15 m; 8 Nov 64, P. Tire, roadside; water clear, fresh; mud, sand bottom; full sun.

175. St. Thomas, Golden Grove, White Bay (UQ735817), 2 m; 8 Nov 64, P. Large crabhole in mangrove; water clear, brackish; mud, sand bottom; partial shade. 9. *Deinocerites cancer*.

176. St. Thomas, Golden Grove, White Bay (UQ735817), 2 m; 8 Nov 64, P. Large crabhole in mangrove; water clear, brackish; mud, sand bottom; partial shade.

177. St. Thomas, Golden Grove, White Bay (UQ735817), 2 m; 8 Nov 64, P. Ditch in mangrove; water temporary, turbid, brackish; stagnant; mud, sand bottom; partial shade. 39. *Aedes (O.) taeniorhynchus*.

178. St. Thomas, Golden Grove, White Bay (UQ735817), 2 m; 8 Nov 64, P. Large crabhole in mangrove; water clear, brackish; mud, sand bottom; partial shade. 9. *Deinocerites cancer*.

179. St. Thomas, Golden Grove, Morant Point lighthouse grounds (UQ745813), 2 m; 8 Nov 64, P. Large ground pool in littoral grassland; water temporary, clear, brackish; vegetation abundant, grass; mud, decaying plant matter bottom; full sun.

39. *Aedes (O.) taeniorhynchus*.

180. St. Thomas, Port Morant, New Pera (UQ630777), 2 m; 19 Nov 64, T. Crab-hole in mangrove, water colored, brackish; deep shade. 9. *Deinocerites cancer*.

181. No collection.

182. No data. 16. *Culex (C.) quinquefasciatus*; 52. *Aedes (S.) aegypti*.

183. No data. 16. *Culex (C.) quinquefasciatus*.

184. No data. 55. *Wyeomyia (W.) mitchellii*.

185. No data. 16. *Culex (C.) quinquefasciatus*; 52. *Aedes (S.) aegypti*.

186. No data. 47. *Aedes (H.) walkeri*.

187, 188. No collections.

189. No data. 36. *Psorophora (G.) jamaicensis*.

190. No data. 16. *Culex (C.) quinquefasciatus*.

191. No data. 16. *Culex (C.) quinquefasciatus*.

192-194. No collections.

195. St. Thomas, Golden Grove, Stokes Hall (UQ640824), 15 m; 1 Feb 65, T. Large asphalt drum in plantation; water clear, fresh, stagnant; asphalt bottom; full sun. 16. *Culex (C.) quinquefasciatus*; 52. *Aedes (S.) aegypti*.

196. St. Thomas, Golden Grove, Duckenfield Hall (UQ670820), 15 m; 2 Feb 65, T. Stream in field; water semipermanent, clear, fresh, slow current; vegetation grassy; mud bottom; partial shade. 16. *Culex (C.) quinquefasciatus*.

197. St. Thomas, Golden Grove (UQ653832), 30 m; 1 Feb 65, T. Large asphalt drum in field; water colored, fresh, stagnant; asphalt bottom; partial shade. 16. *Culex (C.) quinquefasciatus*; 52. *Aedes (S.) aegypti*.

197A. Kingston and St. Andrew, Kingston, Ferry (UQ018938), 10 m; 2 Feb 65, M. Stream margin overflow; water colored, fresh, slow current; algae, grassy; mud, decaying vegetation bottom; partial shade. 43. *Aedes (O.) tortilis*.

198. St. Thomas, Golden Grove, Duckenfield Hall (UQ670820), 15 m; 1 Feb 65, T. Stream margin in field; water semipermanent, clear, fresh, slow current; mud bottom; full sun. 16. *Culex (C.) quinquefasciatus*.

199. St. Thomas, Port Morant, New Pera (UQ630777), 2 m; 1 Feb 65, T. Pond in grazing area; water semipermanent, colored; vegetation grassy; mud bottom; partial shade. 15. *Culex (C.) nigripalpus*.

200. St. Thomas, Golden Grove, Duckenfield Hall (UQ670820), 15 m; 2 Feb 65, T. Large artificial container, domestic; water temporary, clear, fresh; rust bottom; partial shade.

201. St. Thomas, Golden Grove, Amity Hall (UQ670855), 80 m; 2 Feb 65, T. Large container, domestic; water temporary, colored; rust bottom; partial shade.

202. St. Thomas, Port Morant, New Pera (UQ630777), 2 m; 1 Feb 65, T. Small ground pool in field; water colored, fresh; mud bottom; full sun. 36. *Psorophora (G.) jamaicensis*.

203. St. Thomas, Port Morant, Old Pera (UQ603765), 3 m; 2 Feb 65, T. Stream margin; water temporary, colored, fresh, slow current; vegetation grassy; mud, decaying plant matter bottom; partial shade.

204. St. Thomas, Golden Grove, Winchester House (UQ633845), 25 m; 3 Feb 65, T. Wild coco yam in grassy area; deep shade. 55. *Wyeomyia (W.) mitchellii*.

205. St. Thomas, Golden Grove, Winchester House (UQ633845), 25 m; 3 Feb 65, T. Stream margin in field; water permanent, clear, fresh, slow current; vegeta-

tion algae, floating weeds; mud bottom; full sun. 1. *Anopheles (Nys.) albimanus*.

205A. St. Thomas, Golden Grove, Duckenfield Hall, Spanish Wood (UQ673815), 30 m; 19 Feb 65, T. Small crabhole; water temporary, stagnant; partial shade. 9. *Deinocerites cancer*.

206. Westmoreland, Whitehouse, Petersville (SR875057), 100 m; 3 Feb 65, M. Adults resting in postal agency. 31. *Psorophora (P.) ciliata*.

207. Clarendon, May Pen, Milk River Bath (TQ504752), 2 m; Feb 65, M. Collection of immatures without data. 10. *Culex (C.) bahamensis*.

208. St. Mary, Port Maria, Richmond, Mount Zion (UR001180), 250 m; 24 Feb 65, T. Wild coco yam, in plantation; full sun. 55. *Wyeomyia (W.) mitchellii*.

209. Kingston and St. Andrew, Kingston, grounds of Zoology Dept, U.W.I. (UQ 148913), 122 m; 18 May 65, P. Half barrels (iron), domestic; water permanent, turbid, rusty, fresh; rusty iron bottom; full sun. 5. *Anopheles (A.) grabhamii*; 15. *Culex (C.) nigripalpus*; 16. *Culex (C.) quinquefasciatus*; 52. *Aedes (S.) aegypti*.

210. St. Catherine, Spanish Town, Caymanas Bay (TQ975952), 15 m; 29 June 65, P. Ditch in canefield; water semipermanent, clear, fresh, slow current; mud bottom; full sun. 1. *Anopheles (Nys.) albimanus*; 5. *Anopheles (A.) grabhamii*; 15. *Culex (C.) nigripalpus*.

211. St. Catherine, Spanish Town, Caymanas (TQ980930), 25 m; 29 June 65, P. Ditch in canefield; water semipermanent, clear, fresh, slow current; mud bottom; partial shade. 15. *Culex (C.) nigripalpus*.

212. St. Catherine, Spanish Town, Caymanas Bay (TQ975952), 15 m; 29 June 65, P. Stream pool blocked by cane leaf in canefield; water permanent, clear, fresh, slow current; mud, decaying vegetation bottom; partial shade.

213. St. Catherine, Spanish Town, Caymanas Bay (TQ975952), 15 m; 29 June 65, P. Stream pool in clearing; water permanent, clear, fresh, stagnant; vegetation abundant, algae, floating and submerged weeds; mud bottom; partial shade. 17. *Culex (Mel.) atratus*.

214. Kingston and St. Andrew, Kingston, Gordon Town (UQ183949), 380 m; 25 June 65, M. No data. 52. *Aedes (S.) aegypti*.

215. Kingston and St. Andrew, Kingston, Ferry, 1 mi along Red Hills Road (UQ010946), 15 m; 6 July 65, P. Large crabholes in banks of drainage channels in thicket in thorn forest; water clear, brackish; mud, sand bottom; deep shade. 9. *Deinocerites cancer*.

216. Kingston and St. Andrew, Kingston, Ferry, 1 mi along Red Hills Road (UQ010946), 15 m; 6 July 65, P. Ditch in forest; water semipermanent, turbid, fresh, slow current; vegetation scanty; mud bottom; partial shade. 15. *Culex (C.) nigripalpus*.

217. Kingston and St. Andrew, Kingston, Ferry, 1 mi along Red Hills Road (UQ010946), 15 m; 6 July 65, P. Small crabhole in thorn forest; water colored, brackish; mud, sand bottom; deep shade. 9. *Deinocerites cancer*.

218. Kingston and St. Andrew, Kingston, Ferry, 1 mi along Red Hills Road (UQ010946), 15 m; 6 July 65, P. Large crabhole in thorn forest; water colored, brackish; mud bottom; deep shade. 9. *Deinocerites cancer*.

219. Kingston and St. Andrew, Kingston, Ferry, 1 mi along Red Hills Road (UQ010946), 15 m; 6 July 65, P. Large crabhole in thorn forest; water colored, brackish; mud, sand bottom; deep shade. 9. *Deinocerites cancer*.

220. Kingston and St. Andrew, Kingston, Ferry, 1 mi along Red Hills Road (UQ010946), 15 m; 6 July 65, P. Large crabhole in thorn forest; water colored, brackish; mud bottom; deep shade. 9. *Deinocerites cancer*.

221. Kingston and St. Andrew, Kingston, Ferry, 1 mi along Red Hills Road (UQ010946), 15 m; 6 July 65, P. Large crabhole in thorn forest; water colored, brackish; mud, sand bottom; deep shade. 9. *Deinocerites cancer*.

222. Kingston and St. Andrew, Kingston, Ferry, 1 mi along Red Hills Road (UQ010946), 15 m; 6 July 65, P. Adults biting beneath trees; 1030 hrs. 39. *Aedes (O.) taeniorhynchus*.

223. No data. 52. *Aedes (S.) aegypti*.

224. St. Catherine, Linstead, Recess Pen nr water tank (TR848135), 70 m; 13 July 65, P. Pool in stream in forest; water permanent, clear, fresh, slow current; vegetation abundant; mud, decaying vegetation bottom; deep shade. 52. *Aedes (S.) aegypti* (contamination).

225. St. Catherine, Linstead, Recess Pen nr water tank (TR848135), 70 m; 13 July 65, P. Stream pool in grazing area; water permanent, clear, fresh, slow current; vegetation abundant, grassy, wood, herbaceous; mud bottom; deep shade. 5. *Anopheles (A.) grabhamii*; 16. *Culex (C.) quinquefasciatus*.

226. St. Catherine, Linstead, Recess Pen nr water tank (TR848135), 70 m; 13 July 65, P. Stream pool in grazing area; water permanent, clear, fresh, slow current; vegetation abundant, grassy, woody, herbaceous; mud bottom; deep shade. 5. *Anopheles (A.) grabhamii*.

227. Westmoreland, Whitehouse, Petersville, behind postal agency (SR875057), 225 m; 21 July 65, P. Swamp margin in grazing area; water semipermanent, clear, colored slightly brown, fresh; vegetation abundant, water weeds, 1-1½ ft wild rice; mud bottom; full sun. 12. *Culex (C.) chidesterei*; 27. *Mansonia (M.) titillans*.

228. Westmoreland, Whitehouse, Petersville, ½ mi S of postal agency (SR875057), 225 m; 21 July 65, P. Animal (cattle) tracks in grazing area; water temporary, clear, fresh; vegetation scanty grass; mud bottom; partial shade. 15. *Culex (C.) nigripalpus*.

229. Westmoreland, Whitehouse, Petersville, ½ mi S of postal agency (SR875057), 225 m; 21 July 65, P. Animal (cattle) tracks in grazing area; water temporary, clear, fresh; vegetation abundant, grass; mud bottom; partial shade. 15. *Culex (C.) nigripalpus*.

230. Westmoreland, Savanna-La-Mar, Negril village by Negrito Beach cottages (QL799228), 4 m; 24 July 65, P. Rockhole, coral limestone, domestic; water temporary, clear, fresh; vegetation scanty algae; rock, decaying plant matter bottom; partial shade. 46. *Aedes (F.) mediovittatus*.

231. Westmoreland, Savanna-La-Mar, 2 mi from Negril village on road to lighthouse (QL787203), 3 m; 24 July 65, P. Rockhole, coral limestone, in clearing; water semipermanent, clear, fresh; vegetation scanty algae; sand, rock, decaying plant matter bottom; full sun. 1. *Anopheles (Nys.) albimanus*; 5. *Anopheles (A.) grabhamii*.

232. Westmoreland, Savanna-La-Mar, Negril Swamp, 100 yds from main road nr parish border (QL818258), 2 m; 25 July 65, P. Large ground pool in freshwater swamp; water permanent, clear, brown, fresh; vegetation abundant, reeds, flotage; mud bottom; deep shade. 4. *Anopheles (A.) vestitipennis*; 5. *Anopheles (A.) grabhamii*; 15. *Culex (C.) nigripalpus*; 23. *Culex (Mel.) pilosus*.

233. Westmoreland, Savanna-La-Mar, Negril Village, Llantrissant House, sea level (QL799229); 30 July 65, P. Rockhole, coral, seaside, rocky shore; water semipermanent, clear, brackish; sand, rock bottom; full sun. 10. *Culex (C.) bahamensis*.

234. No collection.

235. Clarendon, May Pen, Goshen, on Mocho Road about 2 mi N of Four Paths (TQ553918), 150 m; 18 Aug 65, P. Rockhole, coral limestone, in scrub forest; water clear, fresh; abundant flotage; rock, decaying vegetation bottom; partial shade.

16. *Culex (C.) quinquefasciatus*; 45. *Aedes (O.) calumnior*; 46. *Aedes (F.) mediovittatus*.

236. Clarendon, May Pen, Goshen, on Mocho Road about 2 mi N of Four Paths (TQ553918), 150 m; 18 Aug 65, P. Rockhole, coral limestone, in scrub forest; water clear, fresh; scanty flottage; rock, dead leaves bottom; partial shade. 46. *Aedes (F.) mediovittatus*.

237. Clarendon, May Pen, Goshen, on Mocho Road about 2 mi N of Four Paths (TQ553918), 150 m; 18 Aug 65, P. Rockhole, coral limestone, in scrub forest; water clear, fresh; scanty flottage; rock, dead leaves bottom; partial shade. 47. *Aedes (H.) walkeri*.

237A. Kingston and St. Andrew, Kingston, Ferry, quarry by Fresh River (UQ 022942), 10 m; 13 Sept 65, W. Adults biting man in open land by quarry; 1705 hrs. 38. *Psorophora (G.) pygmaea*; 39. *Aedes (O.) taeniorhynchus*; 40. *Aedes (O.) sollicitans*.

238. Clarendon, May Pen, Goshen, on Mocho Road 2 mi N of Four Paths (TQ 553918), 150 m; 18 Aug 65, P. Rockhole, coral limestone, in scrub forest; water clear, fresh; vegetation scanty; rock, dead leaves bottom; partial shade. 39. *Aedes (O.) taeniorhynchus*; 45. *Aedes (O.) calumnior*; 46. *Aedes (F.) mediovittatus*.

239. Clarendon, May Pen, Goshen, on Mocho Road 2 mi N of Four Paths (TQ 553918), 150 m; 18 Aug 65, P. Large treehole, "slippery tree", in scrub forest; water clear, fresh; decaying organic matter bottom; deep shade. 46. *Aedes (F.) mediovittatus*; 47. *Aedes (H.) walkeri*; *Aedes (H.) sp.*; 54. *Wyeomyia (W.) nigritubus*.

240. Manchester, Porus, Hope Farm, 4 mi from Porus on Mandeville Road (TQ 404993), 280 m; 18 Aug 65, P. Large epiphytic bromeliads in grazing area; water colored; deep shade. 51. *Aedes (H.) stenei*.

241. Manchester, Porus, Hope Farm (TQ404993), 280 m; 18 Aug 65, P. Large epiphytic bromeliads in grazing area; water colored; deep shade. 51. *Aedes (H.) stenei*.

242. Manchester, Porus, Hope Farm (TQ404993), 280 m; 18 Aug 65, P. Large epiphytic bromeliads in grazing area; water colored; deep shade. 51. *Aedes (H.) stenei*.

243. Manchester, Porus, Melrose Hill, milestone 41 on Porus-Mandeville Road (TQ411986), 280 m; 18 Aug 65, P. Small epiphytic bromeliads in partial forest; water clear; deep shade. 47. *Aedes (H.) walkeri*.

244. Manchester, Porus, Melrose Hill, milestones 40-41 on Porus-Mandeville Road (TQ411986), 280 m; 18 Aug 65, P. Small epiphytic bromeliads in partial forest; water clear; partial shade. 47. *Aedes (H.) walkeri*.

245. Clarendon, May Pen, Goshen, on Mocho Road about 2 mi N of Four Paths (TQ553918), 150 m; 18 Aug 65, P. Rockhole, coral limestone in partial forest; water clear, fresh; mud, rock, dead plant matter bottom; partial shade. 69. *Corethrella (C.) longitubus*.

246. Manchester, Porus, Melrose Hill, milestones 40-41 on Porus-Mandeville Road (TQ411986), 280 m; 18 Aug 65, W. Adults resting on canvas flap of land rover; 1340 hours. 47. *Aedes (H.) walkeri*.

247. Manchester, Porus, Melrose Hill, milestones 41-40, Porus-Mandeville Road (TQ411986), 280 m; 18 Aug 65, W. Very small epiphytic bromeliad, 3-4 m above ground in partial forest; water clear; partial shade. 47. *Aedes (H.) walkeri*.

248. Kingston and St. Andrew, Constant Spring, behind post office (UQ098958), 150 m; 24 Aug 65, W. Small, deep treehole in rain forest; water clear, fresh; partial shade. 16. *Culex (C.) quinquefasciatus*; 46. *Aedes (F.) mediovittatus*.

249. Kingston and St. Andrew, Constant Spring, behind post office (UQ098958), 150 m; 24 Aug 65, W. Rockhole, coral limestone in rain forest; water clear, fresh; partial shade. 52. *Aedes (S.) aegypti*.

250. Kingston and St. Andrew, Kingston, Temple Hall by Wag Water River (UR 069033), 150 m; 25 Aug 65, P. Cut bamboo in grazing area; water clear, fresh; partial shade. 50. *Aedes (H.) inaequalis*.

251. Kingston and St. Andrew, Kingston, Temple Hall by Wag Water River (UR 069033), 150 m; 25 Aug 65, P. Cut bamboo in grazing area; water turbid, fresh, dead leaves, bits of bamboo on bottom; partial shade. 50. *Aedes (H.) inaequalis*.

252. Kingston and St. Andrew, Kingston, Temple Hall by Wag Water River (UR 069033), 150 m; 25 Aug 65, P. Cut bamboo in grazing area; water turbid, fresh; dead leaves, cut bits of bamboo bottom; partial shade. 46. *Aedes (F.) mediovittatus*; 50. *Aedes (H.) inaequalis*; 52. *Aedes (S.) aegypti*.

253. Kingston and St. Andrew, Kingston, Temple Hall near Wag Water River (UR069033), 150 m; 25 Aug 65, P. Stream pool in grazing area; water semipermanent, turbid, fresh, stagnant; mud, sand bottom; partial shade. 15. *Culex (C.) nigripalpus*.

254. St. Mary, Annotto Bay, between milestone 31-32 on Annotto Bay-Kingston Road (UR119209), 2 m; 25 Aug 65, P. Marshy depression in freshwater swamp; water semipermanent, clear; vegetation abundant, reeds; mud, sand bottom; partial shade. 9. *Deinocerites cancer*; 15. *Culex (C.) nigripalpus*; 45. *Aedes (O.) calumnior*.

255. St. Mary, Annotto Bay, between milestones 31-32 on Annotto Bay-Kingston Road (UR119209), 2 m; 25 Aug 65, P. Large crabhole in freshwater swamp; water colored; mud, sand bottom; deep shade. 9. *Deinocerites cancer*; 15. *Culex (C.) nigripalpus*.

256. St. Mary, Annotto Bay, Broadgate by P.W.D. embankment works (UR 082165), 300 m; 25 Aug 65, P. Large treehole by roadside; water clear, very dark red-brown; deep shade. 30. *Orthopodomyia waverleyi*; 68. *Corethrella (C.) appendiculata*.

257. St. Mary, Annotto Bay, Broadgate by P.W.D. embankment works (UR 082165), 300 m; 25 Aug 65, P. Small epiphytic bromeliad in clearing by river; water clear; full sun. 47. *Aedes (H.) walkeri*.

258. St. Mary, Kingston, Castleton Botanic gardens by Wag Water (UR072098), 450 m; 25 Aug 65, P. Cut bamboo in botanic gardens; water clear; dead leaves bottom; partial shade. 50. *Aedes (H.) inaequalis*; 54. *Wyeomyia (W.) nigrifubus*.

259. St. Mary, Kingston, Castleton Botanic gardens by Wag Water (UR072098), 450 m; 25 Aug 65, P. Cut bamboo in botanic gardens; water clear; dead leaves bottom; partial shade. 54. *Wyeomyia (W.) nigrifubus*.

260. St. Catherine, Spanish Town, Port Henderson on road to Fort Augusta (UQ025865), 1 m; 27 July 65, W. Large crabhole by seaside; water turbid, salty; mud, sand bottom; deep shade. 9. *Deinocerites cancer*.

261. St. Catherine, Spanish Town, Port Henderson on road to Fort Augusta (UQ025865), 1 m; 27 July 65, W. Large crabhole by seaside; water clear, salty; mud, sand bottom; full sun. 9. *Deinocerites cancer*.

262. St. Catherine, Spanish Town, Port Henderson on road to Fort Augusta (UQ025865), 1 m; 27 July 65, W. Large crabhole by seaside; water turbid, salty; mud, sand bottom; full sun. 9. *Deinocerites cancer*.

263. St. Catherine, Spanish Town, Port Henderson on road to Fort Augusta (UQ025865), 1 m; 27 July 65, W. Large crabhole by seaside; water turbid, salty; sand bottom; full sun. 9. *Deinocerites cancer*.

264. St. Catherine, Spanish Town, Fort Augusta (UQ042872), 2 m; 27 July 65, W. Large crabhole in saltmarsh; water colored, salty; mud, sand bottom; partial shade. 9. *Deinocerites cancer*.

265. St. Catherine, Spanish Town, Port Henderson (UQ014853), 1 m; 27 July 65, W. Small ground pool, domestic; water clear, fresh; mud, sand bottom; partial shade. 52. *Aedes (S.) aegypti* (contamination).

266, 267. No collections.

268. Kingston and St. Andrew, Kingston, Port Royal (UQ045837), sea level; 30 July 65, W. Large crabhole in mangrove; water turbid, salty; sand bottom; deep shade. 9. *Deinocerites cancer*.

269. Kingston and St. Andrew, Kingston, Port Royal (UQ045837), sea level; 30 July 65, W. Large crabhole in mangrove; water turbid, salty; sand bottom; deep shade. 9. *Deinocerites cancer*.

270. Kingston and St. Andrew, Kingston, Port Royal (UQ045837), sea level; 30 July 65, W. Large crabhole in mangrove; water colored, salty; mud, sand bottom; deep shade. 9. *Deinocerites cancer*.

271. Kingston and St. Andrew, Kingston, Port Royal (UQ045837), sea level; 30 July 65, W. Large crabhole in mangrove; water colored, salty; mud, sand bottom; deep shade. 9. *Deinocerites cancer*.

272. No collection.

273. Kingston and St. Andrew, Kingston, grounds of U.W.I. (UQ148913), 120 m; 27 July 65, W. Ditch, domestic; water clear, fresh, slow current; vegetation scanty; mud bottom; partial shade. 16. *Culex (C.) quinquefasciatus*; 52. *Aedes (S.) aegypti* (contamination?).

274. Kingston and St. Andrew, Kingston, Port Royal (UQ045837), sea level; 3 Aug 65, W. Large crabhole in mangrove; water turbid, salty; deep shade. 9. *Deinocerites cancer*; 52. *Aedes aegypti* (contamination).

275. Kingston and St. Andrew, Kingston, Port Royal (UQ045837), sea level; 3 Aug 65, W. Large crabhole in mangrove; water colored, salty; deep shade. 9. *Deinocerites cancer*.

276. Kingston and St. Andrew, Kingston, Port Royal, Fort Charles (UQ045837), 1 m; 3 Aug 65, W. Large crabhole, littoral; water turbid, salty; mud, sand bottom; deep shade. 9. *Deinocerites cancer*.

277. Kingston and St. Andrew, Kingston, Port Royal, Florizel Ave. (UQ045837), 2 m; 3 Aug 65, W. Large crabhole, littoral; water colored, salty; mud, sand, gravel bottom; deep shade. 9. *Deinocerites cancer*.

278. Kingston and St. Andrew, Kingston, Port Royal, Florizel Ave. (UQ045837), 2 m; 3 Aug 65, W. Small crabhole, littoral; water turbid, salty; mud, sand bottom, deep shade. 9. *Deinocerites cancer*.

279. Kingston and St. Andrew, Kingston, Port Royal (UQ045837), sea level; 22 Aug 65, W. Small crabhole in mangrove; water colored, salty; mud, sand bottom; deep shade. 9. *Deinocerites cancer*.

280. Kingston and St. Andrew, Kingston, Hermitage Dam Road (UQ120998), 450 m; 22 Aug 65, P. Large treehole in clearing in forest; water colored brown; partial shade. 30. *Orthopodomyia waverleyi*; 50. *Aedes (H.) inaequalis*; 52. *Aedes (S.) aegypti* (contamination?).

281. Kingston and St. Andrew, Kingston, Hermitage Dam Road (UQ120998), 450 m; 22 Aug 65, P. Large treehole in clearing in forest; water brown; mango leaves and fruit on bottom; partial shade. 68. *Corethrella (C.) appendiculata*.

282. Kingston and St. Andrew, Kingston, Hermitage Dam Road (UQ120998),

450 m; 22 Aug 65, P. Epiphytic bromeliads, 3-4 m above ground in rain forest; partial shade. 47. *Aedes (H.) walkeri*; 55. *Wyeomyia (W.) mitchellii*.

283. Kingston and St. Andrew, Kingston, Hermitage Dam Road (UQ120998), 450 m; 10 Aug 65, P. Epiphytic bromeliad in rain forest.

284. Kingston and St. Andrew, Kingston, Hermitage Dam Road (UQ120998), 450 m; 10 Aug 65, P. Epiphytic bromeliad in mango grove.

285. Kingston and St. Andrew, Kingston, Hermitage Dam Road (UQ120998), 450 m; 10 Aug 65, P. Large treehole in mango tree in clearing in forest; water brown; partial shade. 66. *Toxorhynchites (L.) portoricensis*.

286. Kingston and St. Andrew, Kingston, Hermitage Dam Road (UQ120998), 480 m; 10 Aug 65, P. Cut and broken bamboo in forest; water clear, fresh; plant material bottom; partial shade. 46. *Aedes (F.) mediovittatus*; 54. *Wyeomyia (W.) nigrivirus*.

287. Kingston and St. Andrew, Kingston, Hermitage Dam Road (UQ120998), 450 m; 10 Aug 65, P. Cut and broken bamboo in forest clearing; water clear; partial shade. 52. *Aedes (S.) aegypti*; 54. *Wyeomyia (W.) nigrivirus*.

288. Kingston and St. Andrew, Kingston, Hermitage Dam Road (UQ120998), 450 m; 10 Aug 65, P. Large treehole in cleared area; water clear, brown; full sun. 11. *Culex (C.) corniger*; 46. *Aedes (F.) mediovittatus*; 50. *Aedes (H.) inaequalis*.

289. Kingston and St. Andrew, Kingston, Hermitage Dam Road (UQ120998), 450 m; 10 Aug 65, P. Small treehole, "redwood", in clearing; water clear, red; full sun. 11. *Culex (C.) corniger*.

290. Kingston and St. Andrew, Kingston, Hermitage Dam Road (UQ120998), 480 m; 13 Aug 65, P. Cut bamboo in forest; water clear; partial shade. 50. *Aedes (H.) inaequalis*; 54. *Wyeomyia (W.) nigrivirus*.

291. Kingston and St. Andrew, Kingston, Hermitage Dam Road (UQ120998), 450 m; 13 Aug 65, P. Large ground pool in road through forest; water temporary, clear, fresh; vegetation scanty, submerged grass; mud bottom; full sun. 36. *Psorophora (G.) jamaicensis*.

292. Kingston and St. Andrew, Kingston, Hermitage Dam Road (UQ120998), 450 m; 13 Aug 65, P. Cut bamboo in forest clearing; water clear; partial shade. 50. *Aedes (H.) inaequalis*.

293. Kingston and St. Andrew, Kingston, Hermitage Dam Road (UQ120998), 450 m; 13 Aug 65, P. Cut bamboo in forest clearing; water clear; partial shade. 50. *Aedes (H.) inaequalis*; 54. *Wyeomyia (W.) nigrivirus*.

294. Kingston and St. Andrew, Kingston, Hermitage Dam Road (UQ120998), 450 m; 13 Aug 65, P. Cut bamboo in forest; water clear; partial shade. 47. *Aedes (H.) walkeri*; 50. *Aedes (H.) inaequalis*; 54. *Wyeomyia (W.) nigrivirus*.

295. Kingston and St. Andrew, Kingston, Hermitage Dam Road (UQ120998), 450 m; 13 Aug 65, P. Cut bamboo in forest; water clear; partial shade. 50. *Aedes (H.) walkeri*; 54. *Wyeomyia (W.) nigrivirus*.

296. Kingston and St. Andrew, Kingston, Hermitage Dam Road (UQ120998), 450 m; 13 Aug 65, P. Cut bamboo in forest; water clear; partial shade. 11. *Culex (C.) corniger*; 46. *Aedes (F.) mediovittatus*; 50. *Aedes (H.) inaequalis*; 54. *Wyeomyia (W.) nigrivirus*.

297. Kingston and St. Andrew, Kingston, Hermitage Dam Road (UQ120998), 450 m; 13 Aug 65, P. Cut bamboo in forest; water clear; deep shade. 54. *Wyeomyia (W.) nigrivirus*.

298. Kingston and St. Andrew, Kingston, Hermitage Dam Road (UQ120998), 450 m; 13 Aug 65, P. Cut bamboo in forest; water clear; deep shade. 50. *Aedes (H.)*

inaequalis; 52. *Aedes (S.) aegypti*; 54. *Wyeomyia (W.) nigrifubus*.

299. Kingston and St. Andrew, Kingston, Hermitage Dam Road (UQ120998), 450 m; 13 Aug 65, P. Adults biting man, edge of road through forest; 1115 hrs. 50. *Aedes (H.) inaequalis*; 51. *Aedes (H.) stenei*.

300. Kingston and St. Andrew, Kingston, Hermitage Dam Road (UQ120998), 450 m; 13 Aug 65, P. Uncut internode of bamboo with small hole, in forest; water clear; partial shade. 11. *Culex (C.) corniger*; 50. *Aedes (H.) inaequalis*; 52. *Aedes (S.) aegypti*; 54. *Wyeomyia (W.) nigrifubus*.

301. Kingston and St. Andrew, Kingston, Hermitage Dam Road (UQ120998), 450 m; 13 Aug 65, P. Cut bamboo in forest; water clear; partial shade. 11. *Culex (C.) corniger*; 54. *Wyeomyia (W.) nigrifubus*.

302. Kingston and St. Andrew, Kingston, Hermitage Dam Road (UQ120998), 450 m; 13 Aug 65, P. Bamboo internode with small hole, in forest; water clear; partial shade. 11. *Culex (C.) corniger*; 50. *Aedes (H.) inaequalis*; 54. *Wyeomyia (W.) nigrifubus*.

303. Kingston and St. Andrew, Kingston, Hermitage Dam Road (UQ120998), 450 m; 13 Aug 65, P. Cut bamboo in forest; water clear; partial shade. 11. *Culex (C.) corniger*; 50. *Aedes (H.) inaequalis*; 54. *Wyeomyia (W.) nigrifubus*.

304. Kingston and St. Andrew, Kingston, Hermitage Dam Road (UQ120998), 450 m; 13 Aug 65, P. Cut bamboo in forest; water clear; partial shade. 47. *Aedes (H.) walkeri*; 50. *Aedes (H.) inaequalis*; 52. *Aedes (S.) aegypti*; 54. *Wyeomyia (W.) nigrifubus*.

305. Kingston and St. Andrew, Kingston, Hermitage Dam Road (UQ120998), 450 m; 13 Aug 65, P. Bamboo internode with hole, in forest; water clear; partial shade. 52. *Aedes (S.) aegypti*.

306. Kingston and St. Andrew, Kingston, Hermitage Dam Road (UQ120998), 450 m; 13 Aug 65, P. Cut bamboo in forest; water clear; partial shade. 50. *Aedes (H.) inaequalis*; 54. *Wyeomyia (W.) nigrifubus*.

307. Kingston and St. Andrew, Kingston, Hermitage Dam Road (UQ120998), 450 m; 13 Aug 65, P. Cut bamboo in forest; water clear; partial shade. 11. *Culex (C.) corniger*; 50. *Aedes (H.) inaequalis*; 54. *Wyeomyia (W.) nigrifubus*.

308. Kingston and St. Andrew, Kingston, Hermitage Dam Road (UQ120998), 450 m; 13 Aug 65, P. Cut bamboo in forest; water clear; partial shade. 11. *Culex (C.) corniger*; 50. *Aedes (H.) inaequalis*; 54. *Wyeomyia (W.) nigrifubus*.

309. Kingston and St. Andrew, Kingston, Hermitage Dam Road (UQ120998), 450 m; 13 Aug 65, P. Cut bamboo in forest; water clear; deep shade. 50. *Aedes (H.) inaequalis*; 54. *Wyeomyia (W.) nigrifubus*.

310. Kingston and St. Andrew, Kingston, Hermitage Dam Road (UQ120998), 450 m; 13 Aug 65, P. Epiphytic bromeliad in forest; deep shade.

311. St. Mary, Kingston, Castleton Botanic Gardens (UR072098), 450 m; 25 Aug 65, P. Cut bamboo in botanic garden; water clear; dead leaves bottom; partial shade. 54. *Wyeomyia (W.) nigrifubus*; 68. *Corethrella (C.) appendiculata*.

312. St. Mary, Kingston, Castleton Botanic Gardens (UR072098), 450 m; 25 Aug 65, P. Cut bamboo in forest; water clear; dead leaves bottom; partial shade. 54. *Wyeomyia (W.) nigrifubus*.

313. St. Catherine, Spanish Town, Port Henderson on road to Fort Augusta (UQ025865), 2 m; 28 Aug 65, P. Large crabhole in mangrove, saltmarsh; water clear, salty; sand bottom; full sun. 9. *Deinocerites cancer*; 39. *Aedes (O.) taeniorhynchus*.

314. Kingston and St. Andrew, Kingston, Port Royal, small swamp behind Flori-

zel Avenue (UQ045837), sea level; 30 Aug 65, W. Large crabhole in mangrove; water clear, salty; mud, sand bottom; partial shade. 9. *Deinocerites cancer*.

315. Kingston and St. Andrew, Kingston, Port Royal, small swamp behind Florizel Avenue (UQ045837), sea level; 30 Aug 65, W. Large crabhole in mangrove; water colored; salty; mud, sand bottom; deep shade. 9. *Deinocerites cancer*.

316. Kingston and St. Andrew, Kingston, Port Royal, swamp behind Fort Charles (UQ045837), 2 m; 30 Aug 65, W. Large crabhole in saltmarsh; water colored, salty; mud, sand bottom; deep shade. 9. *Deinocerites cancer*.

317. Kingston and St. Andrew, Kingston, Port Royal, swamp behind Fort Charles (UQ045837), 2 m; 30 Aug 65, W. Large crabhole in saltmarsh; water colored, salty; mud, sand bottom; deep shade. 9. *Deinocerites cancer*.

318. Kingston and St. Andrew, Kingston, Hermitage Dam Road (UQ120998), 480 m; 1 Sept 65, P. Epiphytic bromeliads, 4 m above ground, in forest; water brown; partial shade. 47. *Aedes (H.) walkeri*; 51. *Aedes (H.) stenei*.

319. Kingston and St. Andrew, Kingston, Hermitage Dam Road (UQ120998), 450 m; 1 Sept 65, P. Broad-leaved epiphytic bromeliads in grazing area; water clear; deep shade. 47. *Aedes (H.) walkeri*; 49. *Aedes (H.) grabhami*; 51. *Aedes (H.) stenei*; 52. *Aedes (S.) aegypti* (contamination?).

320. Kingston and St. Andrew, Kingston, Hermitage Dam Road (UQ120998), 450 m; 1 Sept 65, P. Epiphytic bromeliad in forest; water clear; deep shade.

321. Kingston and St. Andrew, Kingston, Hermitage Dam Road (UQ120998), 450 m; 1 Sept 65, P. Cut bamboo in forest; water clear; partial shade. 50. *Aedes (H.) inaequalis*; 54. *Wyeomyia (W.) nigrifubus*.

322. Kingston and St. Andrew, Kingston, Hermitage Dam Road (UQ120998), 450 m; 1 Sept 65, P. Narrow-leaved epiphytic bromeliads in forest clearing; water clear; deep shade. 47. *Aedes (H.) walkeri*; 55. *Wyeomyia (W.) mitchellii*.

323. Kingston and St. Andrew, Kingston, Hermitage Dam Road (UQ120998), 450 m; 1 Sept 65, P. Broad-leaved epiphytic bromeliad in forest clearing; water clear; deep shade. 47. *Aedes (H.) walkeri*.

324. Kingston and St. Andrew, Kingston, Hermitage Dam Road (UQ120998), 450 m; 1 Sept 65, W. Narrow-leaved epiphytic bromeliads in forest; water clear; partial shade. 47. *Aedes (H.) walkeri*.

325. Kingston and St. Andrew, Kingston, Hermitage Dam Road (UQ120998), 450 m; 1 Sept 65, P. Large treehole in mango tree in clearing in forest; water turbid; partial shade. 50. *Aedes (H.) inaequalis*.

326. Kingston and St. Andrew, Kingston, Hermitage Dam Road (UQ120998), 450 m; 1 Sept 65, P. Cut bamboo in forest clearing; water clear; dead leaves, bits of cut bamboo on bottom; partial shade. 50. *Aedes (H.) inaequalis*.

327. Kingston and St. Andrew, Kingston, Constant Spring, roadside at Waterworks gate (UQ106975), 225 m; 7 Sept 65, BkP. Large treehole, 2 m above ground in grazing area; water colored brownish; flotage; partial shade. 30. *Orthopodomyia waverleyi*; 46. *Aedes (F.) mediovittatus*; 50. *Aedes (H.) inaequalis*; 52. *Aedes (S.) aegypti*; 53. *Haemagogus equinus*.

328. Kingston and St. Andrew, Kingston, Constant Spring, roadside at Waterworks gate, Waterworks Road (UQ106975), 225 m; 7 Sept 65, BkP. Treehole, 1 m above ground in grazing area; water clear, pale brown; decaying vegetation; partial shade. 46. *Aedes (F.) mediovittatus*; 53. *Haemagogus equinus*; 68. *Corethrella (C.) appendiculata*.

329. Kingston and St. Andrew, Kingston, Constant Spring, roadside at Waterworks gate, Waterworks Road (UQ106975), 225 m; 7 Sept 65, BkP. Treehole, 0.5 m

above ground in grazing area; water clear, brown; partial shade. 68. *Corethrella (C.) appendiculata*.

330. Kingston and St. Andrew, Kingston, Hermitage Dam Road (UQ120998), 350 m; 7 Sept 65, BkP. Small treehole in stump in clearing; water clear, colored; full sun. 50. *Aedes (H.) inaequalis*.

331. Kingston and St. Andrew, Kingston, Hermitage Dam Road (UQ120998), 450 m; 7 Sept 65, BkP. Large treehole in forest clearing; water colored; partial shade. 50. *Aedes (H.) inaequalis*; 68. *Corethrella (C.) appendiculata*.

332. Kingston and St. Andrew, Kingston, Hermitage Dam Road (UQ120998), 450 m; 7 Sept 65, BkP. Large treehole in clearing in forest; water turbid; partial shade. 66. *Toxorhynchites (L.) portoricensis*; 68. *Corethrella (C.) appendiculata*.

333. Kingston and St. Andrew, Kingston, Hermitage Dam Road (UQ120998), 450 m; 7 Sept 65, BkP. Epiphytic bromeliads 3 m above ground in forest; water clear; partial shade. 47. *Aedes (H.) walkeri*.

334. Kingston and St. Andrew, Kingston, Hermitage Dam Road (UQ120998), 450 m; 7 Sept 65, BkP. Epiphytic bromeliads 2 m above ground in forest; water turbid; deep shade. 47. *Aedes (H.) walkeri*; 55. *Wyeomyia (W.) mitchellii*.

335. Kingston and St. Andrew, Newcastle, Waterworks track (UQ189994), 1100 m; 8 Sept 65, BkP. Epiphytic bromeliads 3 m above ground in forest; partial shade. 47. *Aedes (H.) walkeri*.

336. Kingston and St. Andrew, Newcastle, rose apple thicket along Ulster Road (UQ189994), 1100 m; 8 Sept 65, BkP. Large treehole in forest; deep shade. 47. *Aedes (H.) walkeri*.

337. Kingston and St. Andrew, Newcastle, Ulster Road (UQ189994), 1100 m; 8 Sept 65, BkP. Epiphytic bromeliads in forest; full sun. 47. *Aedes (H.) walkeri*; 48. *Aedes (H.) aurites*.

338. Kingston and St. Andrew, Newcastle, Ulster Road (UQ189994), 1100 m; 8 Sept 65, BkP. Epiphytic bromeliads in forest; full sun. 47. *Aedes (H.) walkeri*; 48. *Aedes (H.) aurites*.

339. Kingston and St. Andrew, Newcastle, Ulster Road (UQ189994), 1100 m; 8 Sept 65, BkP. Leaf axil, large epiphytic bromeliads in forest; partial shade.

340. Kingston and St. Andrew, Cinchona, Botanical Gardens (UQ245984), 1600 m; 8 Sept 65, BkP. Large concrete water tank by great house, domestic; water clear, stagnant; flottage; concrete bottom; deep shade. 14. *Culex (C.) secutor*; 35. *Psorophora (G.) infinis*.

341. Kingston and St. Andrew, Cinchona, Botanical Gardens (UQ245984), 1600 m; 8 Sept 65, BkP. Drain sump in botanical garden; water temporary, turbid, fresh, stagnant; mud bottom; full sun. 14. *Culex (C.) secutor*; 35. *Psorophora (G.) infinis*.

342. Kingston and St. Andrew, Cinchona, Botanical Gardens (UQ245984), 1600 m; 8 Sept 65, BkP. Large concrete water tank at small house, domestic; water clear, fresh; algae; concrete bottom; deep shade. 14. *Culex (C.) secutor*.

343. Kingston and St. Andrew, Cinchona, Botanical Gardens (UQ245984), 1600 m; 8 Sept 65, BkP. Large tank, domestic; water clear, fresh, stagnant; concrete bottom; deep shade. 14. *Culex (C.) secutor*; 35. *Psorophora infinis*.

344. Kingston and St. Andrew, Kingston, Riverton city by Salt River (UQ042923), 3 m; 9 Sept 65, BkP. Large crabhole in grazing area; water turbid, brackish; mud bottom; partial shade. 9. *Deinocerites cancer*.

345. Kingston and St. Andrew, Kingston, Riverton city by Salt River (UQ042923), 3 m; 9 Sept 65, BkP. Small crabhole in grazing area; water turbid, brackish; mud, sand bottom; partial shade. 9. *Deinocerites cancer*.

346. Kingston and St. Andrew, Kingston, Riverton city by Salt River (UQ042923), 3 m; 9 Sept 65, BkP. Large crabhole in saltmarsh; water turbid, brackish; mud, sand bottom; deep shade. 9. *Deinocerites cancer*.

347. Kingston and St. Andrew, Kingston, Ferry, by P.W.D. quarry (UQ022942), 10 m; 9 Sept 65, BkP. Large open crabhole in cleared mangrove; water clear, brackish; mud, sand bottom; full sun. 1. *Anopheles (Nys.) albimanus*; 9. *Deinocerites cancer*.

348. Kingston and St. Andrew, Kingston, Ferry, by P.W.D. quarry (UQ022942), 10 m; 9 Sept 65, BkP. Large crabhole in cleared mangrove; water clear, brackish; mud, sand bottom; full sun. 9. *Deinocerites cancer*; 39. *Aedes (O.) taeniorhynchus*.

349. Kingston and St. Andrew, Kingston, Ferry, by P.W.D. quarry (UQ022942), 10 m; 9 Sept 65, BkP. Large crabhole in mangrove; water clear, brackish; mud, sand bottom; partial shade. 9. *Deinocerites cancer*; 39. *Aedes (O.) taeniorhynchus*.

350. Kingston and St. Andrew, Ferry, Fresh River by quarry (UQ022942), 10 m; 9 Sept 65, BkP. Stream margin in scrub; water clear, fresh, slow current; vegetation scanty, algae, submerged weed; mud, sand, gravel, rock bottom; full sun. 1. *Anopheles (Nys.) albimanus*.

351. St. Catherine, Spanish Town, track at crescent, Rio Cobre Dam (TQ903960), 30 m; 10 Sept 65, BkP. Large treehole in ackee tree in partial forest; water turbid; partial shade. 46. *Aedes (F.) mediovittatus*; 50. *Aedes (H.) inaequalis*.

352. Clarendon, May Pen, Goshen, 2 mi N of Four Paths on Mocho Road (TQ 553918), 150 m; 10 Sept 65, BkP. Rockhole, coral limestone in scrub forest; water clear, fresh; vegetation scanty; rock, dead leaves bottom; partial shade. 21. *Culex (Mel.) inhibitor*; 45. *Aedes (O.) calumnior*; 46. *Aedes (F.) mediovittatus*; 50. *Aedes (H.) inaequalis*.

353. Clarendon, May Pen, Goshen, 2 mi N of Four Paths on Mocho Road (TQ 553918), 150 m; 10 Sept 65, BkP. Adults biting man in thicket; 1150 hrs. 42. *Aedes (O.) hemisurus*; 47. *Aedes (H.) walkeri*.

354. Manchester, Porus, Hope Farm, on Porus-Mandeville Road (TQ404993), 330 m; 10 Sept 65, BkP. Small epiphytic bromeliads in grazing area; water clear; partial shade. 47. *Aedes (H.) walkeri*; 49. *Aedes (H.) grabhami*.

355. Manchester, Porus, Hope Farm, on Porus-Mandeville Road (TQ404933), 330 m; 10 Sept 65, BkP. Large epiphytic bromeliads in grazing area; water clear, brown; partial shade. 51. *Aedes (H.) stenei*.

356. Manchester, Porus, Hope Farm, on Porus-Mandeville Road (TQ404933), 330 m; 10 Sept 65, BkP. Adults biting man by side of road beneath trees; 1320 hrs; weather cloudy. 47. *Aedes (H.) walkeri*; 49. *Aedes (H.) grabhami*; 50. *Aedes (H.) inaequalis*; 51. *Aedes (H.) stenei*.

357. St. Elizabeth, Black River, Luana, by side of swamp, milestones 82-83, Black River-Middle Quarters Road (SR978010), 3 m; 10 Sept 65, BkP. Adults biting man by roadside; 1830 hrs. 1. *Anopheles (Nys.) albimanus*; 3. *Anopheles (A.) crucians*; 4. *Anopheles (A.) vestitipennis*; 18. *Culex (C.) opisthopus*; 26. *Coquillettidia (R.) nigricans*; 39. *Aedes (O.) taeniorhynchus*; 43. *Aedes (O.) tortilis*.

358. St. Elizabeth, Black River, Luana, by swamp, milestones 82-83 (SR978010), 3 m; 11 Sept 65, BkP. Adults in C.D.C. light trap overnight in thicket between road and swamp edge. 3. *Anopheles (A.) crucians*; 6. *Uranotaenia socialis*; 7. *Uranotaenia cooki*; 8. *Uranotaenia lowii*; 15. *Culex (C.) nigripalpus*; 18. *Culex (Mel.) opisthopus*; *Culex (Mel.) sp.*; 26. *Coquillettidia (R.) nigricans*; 39. *Aedes (O.) taeniorhynchus*; 55. *Wyeomyia (W.) mitchellii*.

359. Westmoreland, Savanna-La-Mar, Crab Pond Bay, 100 yds W of milestone

102, Black River-Savanna-La-Mar Road (SR168060), 2 m; 11 Sept 65, BkP. Adults biting man in thicket about 100 yds S of road; 0930 hrs. 13. *Culex (C.) janitor*; 27. *Mansonia (M.) titillans*; 33. *Psorophora (J.) ferox*; 39. *Aedes (O.) taeniorhynchus*; 47. *Aedes (H.) walkeri*.

360. Westmoreland, Savanna-La-Mar, Crab Pond Bay, 100 yds W of milestone 102, Black River-Savanna-La-Mar Road (SR168060), 2 m; 11 Sept 65, BkP. Adults resting and swarming in crabholes; 1000 hrs. 13. *Culex (C.) janitor*; 21. *Culex (Mel.) inhibitor*; 33. *Psorophora (J.) ferox*; 47. *Aedes (H.) walkeri*.

361. Westmoreland, Whitehouse, Petersville, behind postal agency (SR875057), 225 m; 11 Sept 65, BkP. Small pond in grazing area; water semipermanent, clear, brown, fresh, stagnant; abundant vegetation, algae, rice plants; mud, plant matter bottom; partial shade. 12. *Culex (C.) chidesteri*; 27. *Mansonia (M.) titillans*; 70. *Corethrella (C.) librata*.

362. Westmoreland, Whitehouse, Petersville, outside postal agency and store (SR 875057), 225 m; 11 Sept 65, BkP. Small ground pool, domestic; water temporary, clear, fresh; vegetation grass; mud bottom; full sun. 36. *Psorophora (G.) jamaicensis*.

363. Westmoreland, Whitehouse, Petersville, near postal agency (SR875057), 225 m; 11 Sept 65, BkP. Small ground pool, domestic; water temporary, turbid, fresh; mud bottom; full sun. 36. *Psorophora (G.) jamaicensis*.

364. Hanover, Lucea, Lowton lane (QL987417), sea level; 16 Aug 65, M. Small artificial container, domestic. 68. *Corethrella (C.) appendiculata*.

365. Kingston and St. Andrew, Cinchona, Botanical Gardens (UQ246984), 1600 m; 8 Sept 65, W. Adult biting man, near disused cistern; 1630 hrs. 14. *Culex (C.) secutor*.

366. Kingston and St. Andrew, Kingston, Ferry, by P.W.D. quarry (UQ022942), 10 m; 13 Sept 65, P. Large crabhole in cleared mangrove; water turbid, brackish; mud, sand bottom; full sun. 9. *Deinocerites cancer*.

367. Kingston and St. Andrew, Kingston, Ferry, by P.W.D. quarry (UQ022942), 10 m; 13 Sept 65, P. Large crabhole in cleared mangrove; water turbid, brackish; mud, sand bottom; full sun. 9. *Deinocerites cancer*.

368. Kingston and St. Andrew, Kingston, Ferry, by P.W.D. quarry (UQ022942), 10 m; 13 Sept 65, P. Large crabhole in cleared mangrove; water turbid, brackish; mud, sand bottom; full sun. 9. *Deinocerites cancer*.

369. Kingston and St. Andrew, Kingston, Ferry, by P.W.D. quarry (UQ022942), 10 m; 13 Sept 65, P. Large crabhole in cleared mangrove; water turbid, brackish; mud, sand bottom; full sun. 9. *Deinocerites cancer*; 39. *Aedes (O.) taeniorhynchus*; 47. *Aedes (H.) walkeri*; 50. *Aedes (H.) inaequalis*. Mixed collection.

370. Kingston and St. Andrew, Kingston, Ferry, by P.W.D. quarry (UQ022942), 10 m; 13 Sept 65, P. Large crabhole in cleared mangrove; water brackish; mud, sand bottom; full sun. 9. *Deinocerites cancer*.

371. Kingston and St. Andrew, Kingston, Ferry, by P.W.D. quarry (UQ022942), 10 m; 13 Sept 65, P. Large crabhole in cleared mangrove; water turbid, brackish; mud, sand bottom; full sun. 9. *Deinocerites cancer*; 39. *Aedes (O.) taeniorhynchus*.

372. St. Catherine, Spanish Town, by Rio Cobre Dam pool (TQ903960), 30 m; 17 Sept 65, P. Ditch in cultivation; water temporary, turbid, fresh, slow current; vegetation scanty, algae, flottage; mud, sand bottom; partial shade. 50. *Aedes (H.) inaequalis* (contamination).

373. St. Catherine, Spanish Town, track by Rio Cobre Dam crescent (TQ903960), 30 m; 17 Sept 65, W. Large treehole in forest; water clear; partial shade. 46. *Aedes (F.) mediovittatus*; 50. *Aedes (H.) inaequalis*; 52. *Aedes (S.) aegypti*.

374. St. Ann, Moneague, Unity Valley (TR761194), 450 m; 17 Sept 65, P. Epiphytic bromeliad in grazing area; water turbid; partial shade. 47. *Aedes (H.) walkeri*.

375. St. Ann, Moneague, Unity Valley, 2 mi S (TR761194), 450 m; 17 Sept 65, P. Bromeliads growing on bank in grazing area; deep shade. 49. *Aedes (H.) grabhami*; 51. *Aedes (H.) stenei*.

376. St. Ann, Moneague, Unity Valley (TR761194), 450 m; 17 Sept 65, P. Large epiphytic bromeliads in grazing area; water colored brown; deep shade. 49. *Aedes (H.) grabhami*; 51. *Aedes (H.) stenei*.

377. St. Ann, Moneague, track in Unity Valley (TR761194), 450 m; 17 Sept 65, P. Adults biting-landing on man, by side of road under trees; 1200 hrs. 55. *Wyeomyia (W.) mitchellii*; 57. *Wyeomyia (W.) luna*; ? 62. *Wyeomyia (W.) hirsuta*.

378. St. Ann, Moneague, track from Unity Valley (TR761194), 450 m; 17 Sept 65, P. Epiphytic bromeliads on bank in grazing area; partial shade. 49. *Aedes (H.) grabhami*.

379. St. Ann, Moneague, track from Unity Valley (TR761194), 450 m; 17 Sept 65, P. Epiphytic bromeliads (*Tillandsia*), in grazing area; water clear; full sun. 47. *Aedes (H.) walkeri*.

380. St. Ann, Moneague, roadside, Ewarton-Moneague Road, Mt. Diablo (TR 781153), 450 m; 17 Sept 65, P. Epiphytic bromeliads in forest; water clear; partial shade. 49. *Aedes (H.) grabhami*; 51. *Aedes (H.) stenei*.

381. St. Ann, Moneague, roadside, Ewarton-Moneague Road, Mt. Diablo (TR 781153), 450 m; 17 Sept 65, P. Epiphytic bromeliads in forest; water clear; partial shade. 47. *Aedes (H.) walkeri*; 51. *Aedes (H.) stenei*.

382. Kingston and St. Andrew, Kingston, Zoology Dept., U.W.I. (UQ148913), 122 m; 18 Sept 65, W. Small enamel dish, domestic; water clear, fresh; containing honey and rainwater; partial shade. 11. *Culex (C.) corniger*.

383. Kingston and St. Andrew, Cinchona, Botanical Gardens (UQ246984), 1600 m; 8 Sept 65, W.

384. Kingston and St. Andrew, Kingston, Ferry, on Red Hills Road (UQ010946), 10 m; 27 Sept 65, P. Adults biting man along road by Fresh River; 1032 hrs. 39. *Aedes (O.) taeniorhynchus*.

385. Kingston and St. Andrew, Kingston, Ferry, by Fresh River along Red Hills Road (UQ010946), 10 m; 27 Sept 65, P. Large crabhole in scrub forest; water turbid, brackish; partial shade. 9. *Deinocerites cancer*; 39. *Aedes (O.) taeniorhynchus*.

386. Kingston and St. Andrew, Kingston, Ferry, by P.W.D. quarry (UQ022942), 10 m; 27 Sept 65, P. Large crabhole in mangrove; water turbid, brackish; full sun. 9. *Deinocerites cancer*; 39. *Aedes (O.) taeniorhynchus*.

387. Kingston and St. Andrew, Kingston, Constant Spring, Waterworks Road by Waterworks gate (UQ106975), 225 m; 27 Sept 65, P. Large treehole in grazing area; water clear; partial shade. 46. *Aedes (F.) mediovittatus*; 52. *Aedes (S.) aegypti*.

388. Kingston and St. Andrew, Kingston, Constant Spring, Waterworks Road by Waterworks gate (UQ106975), 225 m; 27 Sept 65, P. No data.

389. Portland, Port Antonio, Navy Island (UR460114), sea level; 5 Oct 65, M. Rockhole, coral limestone, in rocky shore; water clear, brackish; sand bottom; full sun. 37. *Psorophora (G.) insularia*.

390. Kingston and St. Andrew, Kingston, Hermitage Dam, gateway to reservoir (UR126001), 480 m; 29 Oct 65, P. Large treehole in "yokewood" in grazing area; water turbid; partial shade. 1. *Anopheles (Nys.) albimanus* (contamination); 46. *Aedes (F.) mediovittatus*; 47. *Aedes (H.) walkeri*; 50. *Aedes (H.) inaequalis*.

391. Kingston and St. Andrew, Kingston, Hermitage Dam, gateway to reservoir

(UR126001), 480 m; 29 Oct 65, P. Small treehole in "yokewood", in grazing area; water colored; deep shade. 46. *Aedes (F.) mediovittatus*; 53. *Haemagogus equinus*.

391A. Kingston and St. Andrew, Kingston, Ferry, by P.W.D. quarry (UQ022942), 10 m; 6 Nov 65, P. Adults biting in small copse by Fresh River; 1235 hrs. 39. *Aedes (O.) taeniorhynchus*.

392. Kingston and St. Andrew, Kingston, Hermitage Dam Road (UQ120998), 450 m; 29 Oct 65, P. Epiphytic bromeliads, 4 m above ground, in forest; water colored; partial shade. 47. *Aedes (H.) walkeri*; 51. *Aedes (H.) stenei*.

393. Kingston and St. Andrew, Kingston, Hermitage Dam Road (UQ120998), 450 m; 29 Oct 65, P. Epiphytic bromeliads, 4 m above ground, in forest; water clear, brown, slimy; partial shade. 47. *Aedes (H.) walkeri*; 51. *Aedes (H.) stenei*.

394. Kingston and St. Andrew, Kingston, Hermitage Dam Road (UQ120998), 450 m; 29 Oct 65, P. Large treehole, 0.5 m above ground in forest clearing; water clear, brown; partial shade. 30. *Orthopodomyia waverleyi*; 66. *Toxorhynchites (L.) portoricensis*.

395. Kingston and St. Andrew, Kingston, Hermitage Dam Road (UQ120998), 450 m; 29 Oct 65, P. Cut bamboo in forest clearing; water clear, slimy; partial shade. 54. *Wyeomyia (W.) nigrifubus*.

396. Kingston and St. Andrew, Kingston, Hermitage Dam Road (UQ120998), 450 m; 29 Oct 65, P. Epiphytic bromeliads in forest; water clear; partial shade.

397. Kingston and St. Andrew, Kingston, Hermitage Dam Road (UQ120998), 450 m; 29 Oct 65, P. Large treehole in clearing in forest; water brown; full sun. 46. *Aedes (F.) mediovittatus*; 50. *Aedes (H.) inaequalis*; 68. *Corethrella (C.) appendiculata*.

398. Kingston and St. Andrew, Kingston, Ferry, by P.W.D. quarry (UQ022942), 10 m; 6 Nov 65, P. Large crabhole in mangrove; water clear, brackish; partial shade. 9. *Deinocerites cancer*; 39. *Aedes (O.) taeniorhynchus*.

399. Kingston and St. Andrew, Kingston, Ferry, old road from Spanish Town (UQ022942), 10 m; 6 Nov 65, P. Epiphytic bromeliad in scrub forest; water clear; full sun. 47. *Aedes (H.) walkeri*.

400. Portland, Port Antonio, Navy Island, honeycomb rock on W shore (UR 460114), sea level; 12 Nov 65, P. Rockhole, coral limestone in splash zone, seaside; water clear, brackish; rock, sand bottom; full sun. 37. *Psorophora (G.) insularia*.

401. St. Mary, Annotto Bay, Broadgate, by roadside (UR082165), 300 m; 12 Nov 65, P. Large treehole in clearing; water turbid, brown. 30. *Orthopodomyia waverleyi*; 68. *Corethrella (C.) appendiculata*.

402. St. Catherine, Spanish Town, Caymanas Estate, roadside (TQ980930), 10 m; 26 Nov 65, P. Small treehole, 2-3 m above ground in canefield; water turbid; deep shade. 38. *Corethrella (C.) appendiculata*.

403. St. Catherine, Spanish Town, Caymanas Estate, by roadside (TQ980930), 10 m; 26 Nov 65, P. Large treehole in mango tree, 3 m above ground in canefield; water colored; partial shade. 55. *Wyeomyia (W.) mitchellii*; 68. *Corethrella (C.) appendiculata*.

404. St. Catherine, Spanish Town, Caymanas Estate (TQ980930), 10 m; 26 Nov 65, P. Adults biting man in open pasture; 1200 hrs. 42. *Aedes (O.) hemisurus*.

405. St. Thomas, Golden Grove, White Bay, on road to Morant Point (UQ735817), 3 m; 28 Nov 65, W. Adult caught inside land rover; 1000 hrs. 40. *Aedes (O.) sollicitans*.

406. Portland, Long Bay, Devils Elbow (Pt. Antonio-Manchioneal Road) (UQ 626989), 75 m; 28 Nov 65, P. Epiphytic bromeliads, 1 m above ground in roadside;

water clear. 55. *Wyeomyia (W.) mitchellii*.

407. St. Mary, Annotto Bay, Broadgate, by roadside (UR082165), 300 m; 28 Nov 65, P. Large treehole in clearing by roadside; water turbid, brown. 30. *Orthopodomyia waverleyi*; 53. *Haemagogus equinus*; 68. *Corethrella (C.) appendiculata*.

408. Kingston and St. Andrew, Kingston, Constant Spring, Waterworks Road, Waterworks gate (UR106975), 225 m; 3 Dec 65, P. Large treehole, 2 m above ground in grazing area; water turbid; partial shade. 46. *Aedes (F.) mediovittatus*; 50. *Aedes (H.) inaequalis*; 68. *Corethrella (C.) appendiculata*.

409. St. Thomas, Yallahs, Grants Pen, milestone 14 on Kingston to Yallahs Road, track up hillside (UQ282810), 70 m; 10 Dec 65, P. Adults biting-landing beside treehole in scrubland; 1100 hrs.

410. St. Thomas, Yallahs, Grants Pen, path up hill from bend near milestone 14 (UQ282810), 70 m; 10 Dec 65, P. Small treehole in forest; water clear; partial shade. 46. *Aedes (F.) mediovittatus*; 53. *Haemagogus equinus*.

411. St. Thomas, Yallahs, Grants Pen, track from near milestone 14 (UQ282810), 70 m; 10 Dec 65, P. Adult biting man along path into forest; 1245 hrs.

412. St. Thomas, Yallahs, Grants Pen, track near milestone 14 (UQ282810), 70 m; 10 Dec 65, P. Small treehole in forest; water brown; partial shade. 50. *Aedes (H.) inaequalis*; 53. *Haemagogus equinus*.

413. St. Thomas, Yallahs, Grants Pen, stream in swamp opposite waterworks (UQ280803), 8 m; 10 Dec 65, W. Stream margin in freshwater swamp; water permanent, clear, fresh, moderate current; mud, sand bottom; partial shade. 1. *Anopheles (Nys.) albimanus*; 17. *Culex (Mel.) atratus*.

414. St. Thomas, Yallahs, Grants Pen, opposite waterworks (UQ280803), 8 m; 10 Dec 65, W. Swamp edge, between roots of plants in swamp; water permanent, turbid, stagnant, brackish; mud, sand bottom; partial shade. 17. *Culex (Mel.) atratus*.

415–599. No collections.

600. St. Catherine, Old Harbour, Colbeck Farm (TQ738874), 80 m; 5 Sept 66, W. Seepage, overflow from tank in grazing area; water clear, fresh; partial shade. 15. *Culex (C.) nigripalpus*.

601. St. Catherine, Old Harbour, Browns Hall, road to Bellas Gate (TQ709925), 150 m; 5 Sept 66, W. Epiphytic bromeliad; water clear. 15. *Culex (C.) nigripalpus* (contamination).

602. Clarendon, May Pen, Goshen, road to Mocho from Four Paths (TQ553918), 60 m; 6 Sept 66, W. Rockhole, coral limestone in partial forest; water clear, fresh; vegetation abundant, flottage; rock bottom; partial shade. 45. *Aedes (O.) calumnior*; 46. *Aedes (F.) mediovittatus*; 50. *Aedes (H.) inaequalis*.

603. Clarendon, May Pen, Mocho (TQ527956), 90 m; 6 Sept 66, W. Rockhole, coral limestone, in cleared forest; water clear, fresh; rock bottom; full sun. 35. *Psorophora (G.) infinis*; 45. *Aedes (O.) calumnior*; 46. *Aedes (F.) mediovittatus*; 50. *Aedes (H.) inaequalis*.

604. Clarendon, Hayes, Yorks Pen (TQ623778), 20 m; 6 Sept 66, W. Drain in pasture; water temporary, colored, fresh, slow current; vegetation abundant, algae; mud bottom; partial shade. 5. *Anopheles (A.) grabhamii*; 8. *Uranotaenia lowii*; 15. *Culex (C.) nigripalpus*; 36. *Psorophora (G.) jamaicensis*; 42. *Aedes (O.) hemisurus*.

605. St. Catherine, Spanish Town, Rio Cobre Dam, track leading into forest (TQ903960), 30 m; 9 Sept 66, W. Large treehole, domestic; water turbid; partial shade. 46. *Aedes (F.) mediovittatus*; 50. *Aedes (H.) inaequalis*.

606. St. Ann, Moneague, along roadside (TR763206), 150 m; 9 Sept 66, W. Epiphytic bromeliad, 2.5 m above ground. 47. *Aedes (H.) walkeri*.

607. St. Ann, Moneague, road to Moneague from Spanish Town (TR763206), 150 m; 9 Sept 66, W. Epiphytic bromeliads. 47. *Aedes (H.) walkeri*; 51. *Aedes (H.) stenei*; 60. *Wyeomyia (W.) corona*.

608. St. Ann, St. Ann's Bay, Drax Hall (TR698386), 15 m; 9 Sept 66, W. Terrestrial bromeliad, by side of flooded stream in old pasture. 5. *Anopheles (A.) grabhamii*; 35. *Psorophora (G.) infinis*; 55. *Wyeomyia (W.) mitchellii*.

609. St. Ann, St. Ann's Bay, Drax Hall (TR698386), 15 m; 9 Sept 66, W. Stream pool in old pastureland. 17. *Culex (Mel.) atratus*.

610. Kingston and St. Andrew, Ferry, Duhaney Park, near river (UQ034938), 10 m; 6 Sept 66, W. Adults in CDC light trap in thicket; 1700-0800 hrs. 9. *Deinocerites cancer*; 15. *Culex (C.) nigripalpus*; 39. *Aedes (O.) taeniorhynchus*; 43. *Aedes (O.) tortilis*.

611. Kingston and St. Andrew, Kingston, Hermitage Dam Road (UQ120998), 450 m; 7 Sept 66, W. Adults in CDC light trap in thicket; 1600-0800 hrs. 11. *Culex (C.) corniger*; 15. *Culex (C.) nigripalpus*; 35. *Psorophora (G.) infinis*; 51. *Aedes (H.) stenei*.

612. Kingston and St. Andrew, Cinchona, road to Botanical Gardens (UQ246984), 1000 m; 10 Sept 66, W. Small ground pool along road in forest; full sun. 14. *Culex (C.) secutor*; 21. *Culex (Mel.) inhibitor*; 37. *Psorophora (G.) infinis*.

613. Kingston and St. Andrew, Cinchona Botanical Gardens (UQ246984), 1600 m; 10 Sept 66, W. Water tank in gardens, domestic; water clear, fresh; deep shade. 14. *Culex (C.) secutor*.

614. Kingston and St. Andrew, Cinchona Botanical Gardens (UQ246984), 1600 m; 10 Sept 66, W. Ditch, domestic; full sun. 14. *Culex (C.) secutor*.

615. Westmoreland, Savanna-La-Mar, Cave, logwood grove by pond (RL125145), 1 m; 13 Sept 66, W. Large crabhole in forest; water brackish; deep shade. 9. *Deinocerites cancer*.

616. Westmoreland, Savanna-La-Mar, Cave, logwood grove by pond (RL125145), 1 m; 13 Sept 66, W. Adults resting in crabhole (615). 9. *Deinocerites cancer*; 13. *Culex (C.) janitor*; 21. *Culex (Mel.) inhibitor*; 39. *Aedes (O.) taeniorhynchus*.

617. No collection.

618. Westmoreland, Whitehouse, road to Petersville (SR875057), 60 m; 14 Sept 66, W. Ground pool in forest; water temporary, clear, fresh; rock bottom; full sun. 23. *Culex (Mel.) pilosus*; 35. *Psorophora (G.) infinis*.

619. Westmoreland, Whitehouse, Petersville (SR875057), 225 m; 14 Sept 66, W. Small ground pool in grazing area; water temporary, clear, fresh; vegetation scanty; mud, sand bottom; full sun.

620. Westmoreland, Whitehouse, Petersville, along donkey path (SR875057), 80 m; 14 Sept 66, W. Small ground pool in partial forest; water temporary, clear, fresh; vegetation scanty; gravel bottom. 35. *Psorophora (G.) infinis*.

621. St. Mary, Port Maria, Quebec, along old river banks (UR011295), 15 m; 16 Sept 66, W. Coco yam, in cultivation; partial shade. 55. *Wyeomyia (W.) mitchellii*.

622. St. Mary, Annotto Bay, Broadgate, by roadside (UR082165), 300 m; 16 Sept 66, W. Large treehole in cleared forest; water brown; deep shade. 30. *Orthopodomyia waverleyi*; 68. *Corethrella (C.) appendiculata*.

623. Kingston and St. Andrew, Kingston, Hermitage Dam Road (UQ120998), 450 m; 21 Sept 66, W. Large treehole in clearing in forest; water brown; deep shade. 46. *Aedes (F.) mediovittatus*; 52. *Aedes (S.) aegypti*; 66. *Toxorhynchites (L.) portoricensis*; 68. *Corethrella (C.) appendiculata*.

624. Kingston and St. Andrew, Kingston, Hermitage Dam Road (UQ120998),

450 m; 21 Sept 66, W. Small open treehole in forest; water clear. 46. *Aedes (F.) mediovittatus*; 68. *Corethrella (C.) appendiculata*.

625. Kingston and St. Andrew, Kingston, Hermitage Dam Road (UQ120998), 450 m; 21 Sept 66, W. Large treehole at edge of forest; water clear; deep shade. 30. *Orthopodomyia waverleyi*; 68. *Corethrella (C.) appendiculata*.

626. Kingston and St. Andrew, Kingston, Hermitage Dam Road (UQ120998), 450 m; 21 Sept 66, W. Large treehole in forest; water clear; partial-shade. 68. *Corethrella (C.) appendiculata*.

627. Kingston and St. Andrew, Kingston, Hermitage Dam Road (UQ120998), 450 m; 21 Sept 66, W. Adults resting on surface of water in treehole (624). 46. *Aedes (F.) mediovittatus*.

628, 629. No collections.

630. Manchester, Melrose Hill, 4 mi from Porus on road to Mandeville (TQ 411986), 280 m; 23 Oct 66, BrW. Epiphytic bromeliads, 3 m above ground in forest; full sun. 49. *Aedes (H.) grabhami*; 51. *Aedes (H.) stenei*.

631. Manchester, Melrose Hill, 4½ mi from Porus on road to Mandeville (TQ 411986), 280 m; 23 Oct 66, BrW. Epiphytic bromeliads in forest; water turbid; partial shade. 47. *Aedes (H.) walkeri*; 49. *Aedes (H.) grabhami*; 51. *Aedes (H.) stenei*.

632. Manchester, Melrose Hill, 4½ mi from Porus on Mandeville Road (TQ411986), 280 m; 23 Oct 66, BrW. Epiphytic bromeliads, 1.5 m above ground in forest; water turbid; partial shade. 49. *Aedes (H.) grabhami*; 51. *Aedes (H.) stenei*.

633. Manchester, Melrose Hill, 5 mi from Porus on Mandeville Road (TQ411986), 280 m; 23 Oct 66, BrW. Epiphytic bromeliads, 3 m above ground in forest; partial shade. 47. *Aedes (H.) walkeri*.

634. Manchester, Porus, Hope Farm (TQ404993), 305 m; 23 Oct 66, BrW. Treehole, grazing area, forest; water turbid; deep shade. 50. *Aedes (H.) inaequalis*; 66. *Toxorhynchites (L.) portoricensis*; 68. *Corethrella (C.) appendiculata*.

634A. Manchester, Porus, Hope Farm (TQ404993), 305 m; 23 Oct 66, BrW. Adults biting man, under cassia trees; 1130 hrs. 47. *Aedes (H.) walkeri*.

635. Manchester, Porus, Hope Farm (TQ404993), 305 m; 23 Oct 66, BrW. Epiphytic bromeliads, 3 m above ground, grazing area; water turbid; full sun. 47. *Aedes (H.) walkeri*.

636. Manchester, Williamsfield, Williamsfield gardens (TQ385995), 330 m; 23 Oct 66, BrW. Cut bamboo in plantation; water turbid, colored; partial shade. 11. *Culex (C.) corniger*.

637. Manchester, Williamsfield, Williamsfield gardens (TQ385995), 330 m; 23 Oct 66, BrW. Epiphytic bromeliads, 2.5 m above ground, grazing area; water turbid; partial shade. 47. *Aedes (H.) walkeri*.

638. Manchester, Mandeville (TQ345965), 600 m; 24 Oct 66, BrW. Treehole, 2.5 m above ground, on roadside; water turbid, colored; partial shade. 46. *Aedes (F.) mediovittatus*.

639. Manchester, Mandeville (TQ345965), 600 m; 24 Oct 66, BrW. Epiphytic bromeliads, 2.5 m above ground, on roadside; water turbid; partial shade. 47. *Aedes (H.) walkeri*.

640. Manchester, Mandeville (TQ345965), 600 m; 24 Oct 66, BrW. Epiphytic bromeliads, 3 m above ground, on roadside; water turbid; deep shade. 47. *Aedes (H.) walkeri*.

641. Kingston and St. Andrew, Kingston, U.W.I., Botany Dept. garden, 122 m (UQ148913); 26 Oct 66, Br. Large drum containing *Pistia*; partial shade. 15. *Culex*

(*C.*) *nigripalpus*; 16. *Culex* (*C.*) *quinquefasciatus*; 52. *Aedes* (*S.*) *aegypti*.

642. St. Mary, Annotto Bay, Broadgate, along roadside (UR082165), 300 m; 27 Oct 66, BrW. Large treehole in clearing; partial shade. 30. *Orthopodomyia waverleyi*; 52. *Aedes* (*S.*) *aegypti*; 68. *Corethrella* (*C.*) *appendiculata*.

643. St. Mary, Annotto Bay, Broadgate, along road (UR082165), 300 m; 27 Oct 66, BrW. Epiphytic bromeliads, on roadside; partial shade. 47. *Aedes* (*H.*) *walkeri*; 49. *Aedes* (*H.*) *grabhami*; 51. *Aedes* (*H.*) *stenei*.

644. St. Mary, Kingston, Castleton Botanic Gardens (UR072098), 450 m; 27 Oct 66, BrW. Epiphytic bromeliads, 1 m above ground in botanic garden. 47. *Aedes* (*H.*) *walkeri*; 62. *Wyeomyia* (*W.*) *hirsuta*.

645. Kingston and St. Andrew, Kingston, 2 mi S from Castleton on Kingston Road (UR063085), 180 m; 27 Oct 66, BrW. Epiphytic bromeliads. 47. *Aedes* (*H.*) *walkeri*; 62. *Wyeomyia* (*W.*) *hirsuta*.

646. Kingston and St. Andrew, Kingston, Temple Hall (UR069033), 150 m; 27 Oct 66; BrW. Epiphytic bromeliads, 0.6 m above ground, along roadside; shade of trees. 47. *Aedes* (*H.*) *walkeri*; 51. *Aedes* (*H.*) *stenei*; 62. *Wyeomyia* (*W.*) *hirsuta*.

646A. Kingston and St. Andrew, Kingston, Temple Hall (UR069033), 150 m; 27 Oct 66, BrW. Adults biting along roadside in shade of trees; 1600 hrs. 47. *Aedes* (*H.*) *walkeri*.

647. Kingston and St. Andrew, Newcastle, Hardwar Gap (UR173002), 1160 m; 29 Oct 66, BrW. Epiphytic bromeliads, 0.5 m above ground in montane rain forest; water turbid; partial shade. 47. *Aedes* (*H.*) *walkeri*; 48. *Aedes* (*H.*) *aurites*.

648. Kingston and St. Andrew, Newcastle, 14-15 mi on road from Kingston (UQ 179980), 760 m; 29 Oct 66, BrW. Epiphytic bromeliads, 1 m above ground in forest; water colored; partial shade. 47. *Aedes* (*H.*) *walkeri*; 49. *Aedes* (*H.*) *grabhami*; 51. (*H.*) *stenei*; 55. *Wyeomyia* (*W.*) *mittchellii*; 63. *Wyeomyia* (*W.*) *atrata*.

649. St. Thomas, Yallahs, Grants Pen (UQ276803), 3 m; 30 Oct 66, BrW. Adults biting man in pasture; 0730 hrs. 33. *Psorophora* (*J.*) *ferox*; 39. *Aedes* (*O.*) *taenio-rhynchus*; 42. *Aedes* (*O.*) *hemisurus*.

650. St. Thomas, Yallahs, road to Windsor Forest (UQ300870), 225 m; 30 Oct 66, BrW. Epiphytic bromeliads, 2 m above ground; partial shade. 47. *Aedes* (*H.*) *walkeri*; 49. *Aedes* (*H.*) *grabhami*; 51. *Aedes* (*H.*) *stenei*; 61. *Wyeomyia* (*W.*) *juxta-hirsuta*.

651. St. Thomas, Yallahs, road to Windsor Forest (UQ300870), 180 m; 30 Oct 66, BrW. Epiphytic bromeliads, 1.2 m above ground; deep shade. 47. *Aedes* (*H.*) *walkeri*; 49. *Aedes* (*H.*) *grabhami*; 51. *Aedes* (*H.*) *stenei*; 62. *Wyeomyia* (*W.*) *hirsuta*.

652. St. Thomas, Yallahs, road to Windsor Forest (UQ300870), 200 m; 30 Oct 66, BrW. Epiphytic bromeliads, 1.3 m above ground; partial shade. 49. *Aedes* (*H.*) *grabhami*; 51. *Aedes* (*H.*) *stenei*.

652A. St. Thomas, Yallahs, road to Windsor Forest (UQ300870), 200 m; 30 Oct 66, BrW. Adults biting man; 0900 hrs. 49. *Aedes* (*H.*) *grabhami*.

653. St. Thomas, Yallahs, Norris (UQ326818), 80 m; 30 Oct 66, BrW. Epiphytic bromeliads, 3 m above ground; water turbid. 47. *Aedes* (*H.*) *walkeri*; 61. *Wyeomyia* (*W.*) *juxtahirsuta*.

654. St. Thomas, Yallahs, Scotland Gate, along Yallahs-Windsor Castle Road (UQ382810), 150 m; 30 Oct 66, BrW. Epiphytic bromeliads, 2.5 above ground in forest; water turbid; partial shade. 47. *Aedes* (*H.*) *walkeri*.

655. Manchester, Melrose Hill, 3 mi from Porus (TQ411986), 305 m; 1 Nov 66, Br. Epiphytic bromeliad. 49. *Aedes* (*H.*) *grabhami*; 51. *Aedes* (*H.*) *stenei*; 62. *Wyeomyia* (*W.*) *hirsuta*.

656. Manchester, Melrose Hill, along road, 3½ mi from Porus (TQ411986), 305 m; 1 Nov 66, Br. Epiphytic bromeliads, 1 m above ground; water turbid. 49. *Aedes (H.) grabhami*.

657. Manchester, Melrose Hill, along road, 3½ mi from Porus (TQ411986), 320 m; 1 Nov 66, Br. Epiphytic bromeliads, 2.5 m above ground. 47. *Aedes (H.) walkeri*.

658. Manchester, Melrose Hill, along roadside, 3½ mi from Porus (TQ411986), 320 m; 1 Nov 66, Br. Epiphytic bromeliads, 1.2 m above ground. 49. *Aedes (H.) grabhami*; 51. *Aedes (H.) stenei*.

659. Manchester, Melrose Hill, along roadside, 3½ mi from Porus (TQ411986), 320 m; 1 Nov 66, Br. Epiphytic bromeliads, 2.1 m above ground.

660. Manchester, Melrose Hill, along road, 4½ mi from Porus (TQ411986), 305 m; 2 Nov 66, Br. Epiphytic bromeliads. 47. *Aedes (H.) walkeri*.

661. Manchester, Porus, near Hope Farm (TQ404993), 305 m; 2 Nov 66, Br. Epiphytic bromeliads, 1 m above ground. 51. *Aedes (H.) stenei*.

662. Manchester, Porus, near Hope Farm (TQ404993), 305 m; 2 Nov 66, Br. Epiphytic bromeliads.

663. Manchester, Porus, Hope Farm, along road (TQ404993), 305 m; 2 Nov 66, Br. Large treehole. 66. *Toxorhynchites (L.) portoricensis*; 68. *Corethrella (C.) appendiculata*.

663A. Manchester, Porus, Hope Farm, along road (TQ404993), 305 m; 2 Nov 66, Br. Adults biting man, 1 m above ground, shady area along road; 1330-1400 hrs. 62. *Wyeomyia (W.) hirsuta*.

664. Manchester, Porus, 1 mi from Hope Farm (TQ404993), 335 m; 2 Nov 66, Br. Epiphytic bromeliad, 1 m above ground. 47. *Aedes (H.) walkeri*; 55. *Wyeomyia (W.) mitchellii*.

665. Hanover, Montego Bay, Lethe, roadside (SR865358), 76 m; 6 Nov 66, BrW. Epiphytic bromeliads. 47. *Aedes (H.) walkeri*; 63. *Wyeomyia (W.) atrata*.

666. Hanover, Montego Bay, Lethe, by road (SR865358), 76 m; 6 Nov 66, BrW. Epiphytic bromeliads. 51. *Aedes (H.) stenei*.

667. Hanover, Montego Bay, Lethe, by roadside (SR865358), 76 m; 6 Nov 66, BrW. Epiphytic bromeliads. 47. *Aedes (H.) walkeri*; 49. *Aedes (H.) grabhami*; 63. *Wyeomyia (W.) atrata*.

668. St. James, Montego Bay, Copse, by roadside (SR862342), 213 m; 6 Nov 66, BrW. Epiphytic bromeliads, 1.2 m above ground. 47. *Aedes (H.) walkeri*.

669. St. James, Montego Bay, 1 mi S of Reading, by railroad (SR884400), 150 m; 6 Nov 66, BrW. Epiphytic bromeliads, 1.2 m above ground. 47. *Aedes (H.) walkeri*; 49. *Aedes (H.) grabhami*; 51. *Aedes (H.) stenei*.

670. St. James, Montego Bay, 1 mi S of Reading, by railroad (SR884400), 150 m; 6 Nov 66, BrW. Epiphytic bromeliads, 1.5 m above ground. 47. *Aedes (H.) walkeri*; 49. *Aedes (H.) grabhami*; 51. *Aedes (H.) stenei*; 62. *Wyeomyia (W.) hirsuta*.

671. St. James, Montego Bay, 1 mi S of Reading, by railroad (SR884400), 150 m; 6 Nov 66, BrW. Epiphytic bromeliads, 1.2 m above ground. 47. *Aedes (H.) walkeri*; 51. *Aedes (H.) stenei*; 55. *Wyeomyia (W.) mitchellii*; 62. *Wyeomyia (W.) hirsuta*.

672. St. James, Montego Bay, 1 mi S of Reading, by railroad (SR884400), 150 m; 6 Nov 66, BrW. Adults in bushes along roadside; 1210 hrs. 47. *Aedes (H.) walkeri*.

673. St. James, Montego Bay, 1 mi S of Reading (SR884400), 150 m; 6 Nov 66, BrW. Epiphytic bromeliads, 2 m above ground; water turbid, foul; partial shade. 51. *Aedes (H.) stenei*; 55. *Wyeomyia (W.) mitchellii*.

674. St. James, Montego Bay, 1 mi S of Reading, near railroad (SR884400), 150 m; 6 Nov 66, BrW. Epiphytic bromeliads, 2.1 m above ground; water turbid, foul;

deep shade. 51. *Aedes (H.) stenei*; 62. *Wyeomyia (W.) hirsuta*.

675. St. James, Montego Bay, 1 mi S of Reading, alongside railroad (SR884400), 150 m; 6 Nov 66, BrW. Epiphytic bromeliads, 1.5 m above ground. 47. *Aedes (H.) walkeri*; 63. *Wyeomyia (W.) atrata*.

676. St. James, Montego Bay, Reading, roadside near Five mile (SR894413), 30 m; 6 Nov 66, BrW. Epiphytic bromeliads, 2 m above ground. 49. *Aedes (H.) grabhami*; 51. *Aedes (H.) stenei*; 61. *Wyeomyia (W.) juxtahirsuta*; 62. *Wyeomyia (W.) hirsuta*.

677. Kingston and St. Andrew, Newcastle, track to Catherine's Peak (UQ195995), 1220 m; 8 Nov 66, BrW. Epiphytic bromeliads, 1.2 m above ground in forest. 48. *Aedes (H.) aurites*; 60. *Wyeomyia (W.) corona*.

678. Kingston and St. Andrew, Newcastle, track to Catherine's Peak (UQ195995), 1228 m; 8 Nov 66, BrW. Epiphytic bromeliads, 2 m above ground in forest. 47. *Aedes (H.) walkeri*; 50. *Wyeomyia (W.) corona*.

679. Kingston and St. Andrew, Newcastle, track to Catherine's Peak (UQ195995), 1250 m; 8 Nov 66, BrW. Adults along track in open; 1130 hrs. 47. *Aedes (H.) walkeri*; 48. *Aedes (H.) aurites*.

680. Kingston and St. Andrew, Newcastle, track to Catherine's Peak (UQ195995), 1270 m; 8 Nov 66, BrW. Epiphytic bromeliads, 1 m above ground in forest. 47. *Aedes (H.) walkeri*; 48. *Aedes (H.) aurites*.

681. Kingston and St. Andrew, Newcastle, track to Catherine's Peak (UQ195995), 1250 m; 8 Nov 66, BrW. Epiphytic bromeliads, 1.5 m above ground in forest. 47. *Aedes (H.) walkeri*; 48. *Aedes (H.) aurites*.

682. Kingston and St. Andrew, Newcastle, track to Catherine's Peak (UQ195995), 1310 m; 6 Nov 66, BrW. Epiphytic bromeliads, 2.5 m above ground in forest. 47. *Aedes (H.) walkeri*; 48. *Aedes (H.) aurites*.

683. Kingston and St. Andrew, Irish Town, 7 mi from Newcastle (?UQ170960), 600 m; 8 Nov 66, BrW. Epiphytic bromeliads, 1.2 m above ground on roadside; partial shade. 47. *Aedes (H.) walkeri*; 63. *Wyeomyia (W.) atrata*.

684. Manchester, Porus, Hope Farm, by roadside (TQ404993), 305 m; 12 Nov 66, Br. Adults biting, swarming and taken by sweeping in shade of citrus and Papilionaceae trees; 1130 hrs. 47. *Aedes (H.) walkeri*; 49. *Aedes (H.) grabhami*; 50. *Aedes (H.) inaequalis*; 51. *Aedes (H.) stenei*; 52. *Aedes (S.) aegypti*; ? 62. *Wyeomyia (W.) hirsuta*.

685. Manchester, Porus, Hope Farm (TQ404993), 305 m; 12 Nov 66, Br. Epiphytic bromeliads, 1.2 m above ground. 51. *Aedes (H.) stenei*.

686. Manchester, Porus, Hope Farm (TQ404993), 305 m; 12 Nov 66, Br. Epiphytic bromeliads, 1.2 m above ground. 49. *Aedes (H.) grabhami*.

687. Manchester, Porus, Hope Farm (TQ404993), 305 m; 12 Nov 66, Br. Epiphytic bromeliads, 1.2 m above ground. 49. *Aedes (H.) grabhami*.

688. Manchester, Porus, Hope Farm (TQ404993), 305 m; 12 Nov 66, Br. Epiphytic bromeliads, 2 m above ground. 49. *Aedes (H.) grabhami*; 51. *Aedes (H.) stenei*.

689. St. Thomas, Morant Bay, Leith Hall, edge of canefield (UQ580770), 10 m; 13 Nov 66, BrW. Epiphytic bromeliads in canefield. 49. *Aedes (H.) grabhami*.

690. St. Thomas, Morant Bay, Leith Hall (UQ580770), 10 m; 13 Nov 66, BrW. Large treehole in mango tree. 30. *Orthopodomyia waverleyi*.

691. St. Thomas, Port Morant, roadside (UQ600795), 30 m; 13 Nov 66, BrW. Wild coco yam. 55. *Wyeomyia (W.) mitchellii*.

692. Portland, Port Antonio, near Long Bay (UR603028), sea level, 13 Nov 66,

- BrW. Epiphytic bromeliads, 0.6 m above ground. 55. *Wyeomyia (W.) mitchellii*.
693. Portland, Port Antonio, Fairy Hill (UR540086), 30 m; 13 Nov 66, BrW. Epiphytic bromeliads, 1.5 m above ground. 47. *Aedes (H.) walkeri*.
694. Portland, Port Antonio, Fairy Hill (UR540086), 30 m; 13 Nov 66, BrW. Epiphytic bromeliads, 1.2 m above ground. 47. *Aedes (H.) walkeri*.
695. Portland, Port Antonio, Fairy Hill (UE540086), 30 m; 13 Nov 66, BrW. Epiphytic bromeliads, 2.5 m above ground. 47. *Aedes (H.) walkeri*.
696. Kingston and St. Andrew, Constant Spring, Waterworks gate, Waterworks Road (UQ106975), 210 m; 16 Nov 66, BrW. Large treehole in grazing area; partial shade. 50. *Aedes (H.) inaequalis*; 53. *Haemagogus equinus*.
697. Kingston and St. Andrew, Constant Spring, Waterworks gate, Waterworks Road (UQ106975), 200 m; 16 Nov 66, BrW. Large treehole. 30. *Orthopodomyia waverleyi*; 66. *Toxorhynchites (L.) portoricensis*; 68. *Corethrella (C.) appendiculata*.
698. Kingston and St. Andrew, Constant Spring, Waterworks gate, Waterworks Road (UQ106975), 210 m; 16 Nov 66, BrW. Large treehole. 30. *Orthopodomyia waverleyi*; 66. *Toxorhynchites (L.) portoricensis*.
699. Kingston and St. Andrew, Constant Spring, Waterworks gate, Waterworks Road (UQ106975), 210 m; 16 Nov 66, BrW. Large treehole. 46. *Aedes (F.) mediovitatus*; 53. *Haemagogus equinus*; 66. *Toxorhynchites (L.) portoricensis*; 68. *Corethrella (C.) appendiculata*.
700. Kingston and St. Andrew, Constant Spring, Waterworks gate, Waterworks Road (UQ106975), 210 m; 16 Nov 66, BrW. Epiphytic bromeliads.
701. Kingston and St. Andrew, Ferry, about 1 mi along Red Hills Road from Spanish Town Road where track goes N (UQ010946), 10 m; 8 Aug 67, BkP. Adults resting in crabholes; 1500 hrs. 9. *Deinocerites cancer*; 13. *Culex (C.) janitor*; 17. *Culex (Mel.) atratus*; 21. *Culex (Mel.) inhibitor*; 50. *Aedes (H.) inaequalis*; 51. *Aedes (H.) stenei*.
702. Kingston and St. Andrew, Ferry, about 1 mi along Red Hills Road from Spanish Town Road where track goes N (UQ010946), 10 m; 8 Aug 67, BkP. Adults resting in crabhole; 1500 hrs. 13. *Culex (C.) janitor*; 48. *Aedes (H.) aurites*; 49. *Aedes (H.) grabhami*.
703. Kingston and St. Andrew, Ferry, about 1 mi along Red Hills Road from Spanish Town Road where track goes N (UQ010946), 10 m; 8 Aug 67, BkP. Adults biting man in shade of trees within forest; 1500 hrs. 27. *Mansonia (M.) titillans*; 55. *Wyeomyia (W.) mitchellii*.
704. Kingston and St. Andrew, Ferry, about 1 mi along Red Hills Road from Spanish Town Road where track goes N (UQ010946), 10 m; 8 Aug 67, BkP. Egg rafts from crabholes.
705. Kingston and St. Andrew, Ferry, Duhaney Park, reclaimed swamp on Spanish Town Road, on S side, about 100 yds W of Duhaney Bridge (UQ034938), 10 m; 9 Aug 67, BkP. Large crabholes in saltmarsh; water turbid, brackish; mud, sand bottom; partial shade. 9. *Deinocerites cancer*.
706. Portland, Port Antonio, Kemnay-Sherwood Forest, on road from Fairy Hill to Nonesuch (UR542073), 250 m; 13 Aug 67, BkP. Epiphytic bromeliads (*Hohenbergia pendiflora*) in grazing area; water clear; partial shade. 49. *Aedes (H.) grabhami*; 51. *Aedes (H.) stenei*; 62. *Wyeomyia (W.) hirsuta*.
707. Portland, Port Antonio, Sherwood Forest, along road to Nonesuch (UR538062), 250 m; 13 Aug 67, BkP. Epiphytic bromeliads (*Tillandsia*) in grazing area; partial shade. 47. *Aedes (H.) walkeri*.
708. Portland, Port Antonio, Sherwood Forest, along road to Nonesuch (UR

538062), 250 m; 13 Aug 67, BkP. Epiphytic bromeliads (*Hohenbergia*) in grazing area. 47. *Aedes (H.) walkeri*; 49. *Aedes (H.) grabhami*; 51. *Aedes (H.) stenei*; 55. *Wyeomyia (W.) mitchellii*.

709. Portland, Port Antonio, Sherwood Forest, along road to Nonesuch (UR 538062), 250 m; 13 Aug 67, BkP. Epiphytic bromeliads (*Guzmania*) in grazing area. 47. *Aedes (H.) walkeri*.

710. Portland, Port Antonio, Sherwood Forest, along road to Nonesuch (UR 538062), 250 m; 13 Aug 67, BkP. Epiphytic bromeliads (*Hohenbergia*) in grazing area. 47. *Aedes (H.) walkeri*; 51. *Aedes (H.) stenei*; 58. *Wyeomyia (W.) stellata*.

711. Portland, Port Antonio, Sherwood Forest, along road to Nonesuch, group of trees and bamboo about 150 yds from road (UR538062), 250 m; 13 Aug 67, BkP. Cut bamboo in grazing area; water clear; plant matter bottom; partial shade. 47. *Aedes (H.) walkeri*; 50. *Aedes (H.) inaequalis*; 54. *Wyeomyia (W.) nigritubus*.

712. Portland, Port Antonio, Sherwood Forest, along road to Nonesuch, group of trees and bamboo about 150 yds from road (UR538062), 250 m; 13 Aug 67, BkP. Bamboo internode, with very small hole, in grazing area; water clear, fresh. 54. *Wyeomyia (W.) nigritubus*.

713. Portland, Port Antonio, Sherwood Forest, along road to Nonesuch, group of trees and bamboo about 150 yds from road (UR538062), 250 m; 13 Aug 67, BkP. Cut bamboo in grazing area. 50. *Aedes (H.) inaequalis*; 54. *Wyeomyia (W.) nigritubus*.

714. Portland, Port Antonio, Sherwood Forest, along road to Nonesuch, group of trees and bamboo about 150 yds from road (UR538062), 250 m; 13 Aug 67, BkP. Cut bamboo in grazing area. 54. *Wyeomyia (W.) nigritubus*.

715. Portland, Port Antonio, Sherwood Forest, along road to Nonesuch, group of trees and bamboo about 150 yds from road (UR538062), 250 m; 13 Aug 67, BkP. Cut bamboo in grazing area. 51. *Aedes (H.) inaequalis*; 54. *Wyeomyia (W.) nigritubus*.

716. Portland, Port Antonio, Sherwood Forest, along road to Nonesuch, group of trees and bamboo about 150 yds from road (UR538062), 250 m; 13 Aug 67, BkP. Epiphytic bromeliads, 1½ m above ground in grazing area; water clear. 47. *Aedes (H.) walkeri*.

717. Hanover, Lucea, Bulls Bay (QL941423), sea level; 13 Aug 67, W. Rockhole, coral, seaside in splash zone, seashore; water brackish; full sun. 10. *Culex (C.) bahamensis*; 17. *Culex (Mel.) atratus*; 37. *Psorophora (G.) insularia*.

718. St. Thomas, Yallahs, Grants Pen, Albion swamp (UQ280803), 3 m; 11 Aug 67, BkP. Adults biting man in swamp, area of *Typha* sp.; 1030 hrs. 18. *Culex (Mel.) opisthopus*.

719. Kingston and St. Andrew, Ferry, about 1 mi along Red Hills Road from Spanish Town Road where track goes N (UQ010946), 10 m; 15 Aug 67, BkP. Adults resting in crabholes; 1000-1100 hrs. 13. *Culex (C.) janitor*; 17. *Culex (Mel.) atratus*; 18. *Culex (Mel.) opisthopus*.

720. Kingston and St. Andrew, Ferry, about 1 mi along Red Hills Road from Spanish Town Road where track goes N (UQ010946), 10 m; 15 Aug 67, BkP. Gravid female adults resting in crabholes; 1000-1100 hrs. 13. *Culex (C.) janitor*; 17. *Culex (Mel.) atratus*.

721. Kingston and St. Andrew, Ferry, about 1 mi along Red Hills Road from Spanish Town Road where track goes N (UQ010946), 10 m; 15 Aug 67, BkP. Gravid female adults resting in crabholes. *Culex (Mel.) sp.*

722. Kingston and St. Andrew, Ferry, about 1 mi along Red Hills Road from

Spanish Town Road where track goes N (UQ010946), 10 m; 15 Aug 67, BkP. Adults biting man under trees in woodland; 1030 hrs.

723. Kingston and St. Andrew, Kingston, Hermitage Dam Road (UQ120998), 480 m; 15 Aug 67, BkP. Epiphytic bromeliads (*Hohenbergia*) in forest. 47. *Aedes (H.) walkeri*; 49. *Aedes (H.) grabhami*; 51. *Aedes (H.) stenei*; 58. *Wyeomyia (W.) stellata*; 61. *Wyeomyia (W.) juxtahirsuta*; 62. *Wyeomyia (W.) hirsuta*.

724. Kingston and St. Andrew, Kingston, Hermitage Dam Road (UQ120998), 480 m; 15 Aug 67, BkP. Epiphytic bromeliads (*Tillandsia*) in forest. 47. *Aedes (H.) walkeri*; 55. *Wyeomyia (W.) mitchellii*; 63. *Wyeomyia (W.) atrata*.

725. Kingston and St. Andrew, Kingston, Hermitage Dam Road (UQ120998), 480 m; 15 Aug 67, BkP. Epiphytic bromeliads (*Hohenbergia*) in forest. 47. *Aedes (H.) walkeri*; 49. *Aedes (H.) grabhami*; 51. *Aedes (H.) stenei*; 58. *Wyeomyia (W.) stellata*; 62. *Wyeomyia (W.) hirsuta*.

726. St. Thomas, Morant Bay, Roselle, 50 yds W of waterfall on main road (UQ446766), 1 m; 16 Aug 67, BkP. Wild coco yam in clearing; water clear; partial shade. 55. *Wyeomyia (W.) mitchellii*.

727. St. Thomas, Morant Bay, Roselle, 50 yds W of waterfall on main road (UQ446766), 1 m; 16 Aug 67, BkP. Seepage in clearing by road; water permanent, clear, fresh, slow current; vegetation scanty, grass, flottage; mud, dead leaves bottom; partial shade. 17. *Culex (Mel.) atratus*.

728. St. Thomas, Morant Bay, Roselle, bridge E of Whitehorses beach, 2 m (UQ 462769), 16 Aug 67, BkP. Stream pool in clearing; water permanent, clear, fresh, stagnant; vegetation scanty, water lilies; mud bottom; partial shade. 19. *Culex (Mel.) erraticus*.

729. St. Thomas, Port Morant, bridge E of Port Morant on main road by speed limit sign (UQ603785), sea level; 16 Aug 67, BkP. Epiphytic bromeliads (*Hohenbergia*) in mangrove swamp. 47. *Aedes (H.) walkeri*; 51. *Aedes (H.) stenei*.

730. Clarendon, May Pen, Milk River Bath (TQ504752), 1 m; 15 Aug 67, BkP. Adults biting man by roadside in mangrove swamp; 1200 hrs. 43. *Aedes (O.) tortilis*.

731. St. Ann, Moneague, track leading S into Unity Valley, 1.5 mi S of Moneague (TR761194), 380 m; 17 Aug 67, BkP. Epiphytic bromeliads (*Aechmea paniculigera*) in edge of grazing area; water turbid, brown, fresh; plant matter bottom. 49. *Aedes (H.) grabhami*; 51. *Aedes (H.) stenei*; 57. *Wyeomyia (W.) luna*.

732. St. Ann, Moneague, track leading S into Unity Valley, 1.5 mi S of Moneague (TR761194), 380 m; 17 Aug 67, BkP. Various epiphytic bromeliads in grazing area; partial shade. 47. *Aedes (H.) walkeri*; 49. *Aedes (H.) grabhami*; 51. *Aedes (H.) stenei*; 56. *Wyeomyia (W.) vanduzeei*; 60. *Wyeomyia (W.) corona*.

733. St. Ann, Moneague, 1 mi S of Moneague on Kingston Road by roadside (TR763205), 380 m; 17 Aug 67, BkP. Various epiphytic bromeliads in grazing area; partial shade. 47. *Aedes (H.) walkeri*; 49. *Aedes (H.) grabhami*; 51. *Aedes (H.) stenei*; 57. *Wyeomyia (W.) luna*.

734. St. Ann, Moneague, track leading S into Unity Valley, 1.5 mi S of Moneague (TR761194), 380 m; 17 Aug 67, BkP. Various epiphytic bromeliads in grazing area. 49. *Aedes (H.) grabhami*; 51. *Aedes (H.) stenei*.

735. St. Ann, Moneague, track leading S into Unity Valley, 1.5 mi S of Moneague (TR761194), 380 m; 17 Aug 67, BkP. Adults biting man along road in shade; 1400 hrs. 47. *Aedes (H.) walkeri*; 49. *Aedes (H.) grabhami*; 50. *Aedes (H.) inaequalis*; 51. *Aedes (H.) stenei*; 59. *Wyeomyia (W.) sp.*, Jamaican form.

736. Kingston and St. Andrew, Ferry, along Red Hills Road, 8¼ mi from Kingston, between road curve and river (UQ003951), 20 m; 18 Aug 67, BkP. Large crab-

hole by shore of river; water turbid, fresh; mud, sand bottom; partial shade. 9. *Deinocerites cancer*; 13. *Culex (C.) janitor*; 15. *Culex (C.) nigripalpus*.

737. Kingston and St. Andrew, Kingston, Hermitage Dam Road (UR126001), 480 m; 19 July 67, P. Adult biting man; 1800 hrs. 54. *Wyeomyia (W.) nigrifubus*.

738. Kingston and St. Andrew, Kingston, Hermitage Dam Road, first culvert down from dam (UR126001), 480 m; 19 July 67, BkP. Adults resting beneath rock hanging over pool (739); 1800 hrs. 14. *Culex (C.) secutor*; 21. *Culex (Mel.) inhibitor*.

739. Kingston and St. Andrew, Kingston, Hermitage Dam Road, first culvert down from dam (UR126001), 480 m; 19 July 67, BkP. Rockhole in stream bed in forest; water permanent, clear, fresh, very slow current; vegetation scanty, algae; rock, abundant dead plant material bottom; deep shade. 5. *Anopheles (A.) grabhamii*; 11. *Culex (C.) corniger*; 14. *Culex (C.) secutor*; 21. *Culex (Mel.) inhibitor*; 35. *Psorophora (G.) infinis*.

740. St. Ann, Ocho Rios, Dunns River, 100 yds above falls (TR738373), 20 m; 20 Aug 67, BkP. Epiphytic bromeliads (*Tillandsia*), 2 m above ground, in plantation of citrus and pimento. 47. *Aedes (H.) walkeri*; 63. *Wyeomyia (W.) atrata*.

741. St. Ann, Ocho Rios, Dunns River, about 150 yds above falls (TR738373), 20 m; 20 Aug 67, BkP. Stream margin in plantation of citrus and pimento; water permanent, clear, fresh, strong current; vegetation scanty; mud, rock bottom; partial shade. 71. *Dixella scitula*; 72. *Mesodixa biambulacra*.

742. St. Ann, Claremont, at milestone 34 on road to Spanish Town (TR718270), 300 m; 20 Aug 67, BkP. Pond in pasture; water permanent, turbid, green-brown color, fresh, stagnant; vegetation scanty, grass, algae; mud bottom; full sun. 1. *Anopheles (Nys.) albimanus*; 71. *Dixella scitula*.

743. St. Catherine, Spanish Town, Caymanas, along irrigation canal 50 yds N of bridge (TQ980930), 15 m; 21 Aug 67, BkP. Ditch, blocked, in grazing area; water permanent, clear, fresh, stagnant; vegetation grassy, algae, abundant flotage; mud, sand bottom; full sun. 1. *Anopheles (Nys.) albimanus*; 5. *Anopheles (A.) grabhamii*.

744. St. Catherine, Spanish Town, Caymanas Bay, washing place on Fresh River (TQ975952), 15 m; 21 Aug 67, BkP. Stream margin in clearing; water permanent, clear, fresh, slow current; vegetation abundant, watercress, algae, flotage; mud, sand bottom; full sun. 1. *Anopheles (Nys.) albimanus*; 5. *Anopheles (A.) grabhamii*; 6. *Uranotaenia socialis*; 17. *Culex (Mel.) atratus*.

745. St. Catherine, Spanish Town, Caymanas Bay, Fresh River, E of village (TQ975952), 15 m; 21 Aug 67, BkP. Pool at stream margin in field; water semipermanent, turbid, fresh, stagnant; vegetation scanty; mud bottom; partial shade. 15. *Culex (C.) nigripalpus*.

746. St. Catherine, Spanish Town, Caymanas Bay, Fresh River, downstream from village (TQ975952), 15 m; 21 Aug 67, BkP. Stream margin in grazing area; water permanent, clear, fresh, slow current; abundant vegetation, algae, herbaceous; mud bottom; full sun. 1. *Anopheles (Nys.) albimanus*; 5. *Anopheles (A.) grabhamii*.

747. St. Catherine, Spanish Town, Caymanas Bay, spring house near YMCA camp (TQ975952), 15 m; 21 Aug 67, BkP. Stream margin in grazing area; water permanent, clear, fresh, slow current; abundant vegetation, watercress; mud bottom; partial shade. 1. *Anopheles (Nys.) albimanus*; 5. *Anopheles (A.) grabhamii*.

748. Portland, Manchioneal, Ecclesdown, along road running W from store (UQ582972), 350 m; 22 Aug 67, BkP. Heliconia flower bracts in forest; water clear, fresh, slimy; dead plant material bottom; deep to partial shade. 11. *Culex (C.) corniger*; 47. *Aedes (H.) walkeri*; 55. *Wyeomyia (W.) mitchellii*; 62. *Wyeomyia (W.) hirsuta*.

749. Portland, Manchioneal, Ecclesdown, along road W from store (UR582972), 305 m; 27 Aug 67, BkP. Heliconia flower bracts in forest; water clear, fresh, slimy; dead plant material bottom. 11. *Culex (C.) corniger*; 55. *Wyeomyia (W.) mitchellii*.

750. Kingston and St. Andrew, Kingston, Dept. of Zoology, U.W.I. (UQ148913), 122 m; 21 Aug 67, BkP. Adult on staircase of new building, dead. 67. *Sayomyia lanei*.

751. Kingston and St. Andrew, Cinchona, Botanical Gardens (UQ246984), 1600 m; 24 Aug 67, BkP. Water tank at great house, domestic; water permanent, clear; concrete bottom; deep shade. 14. *Culex (C.) secutor*.

752. Kingston and St. Andrew, Cinchona, Botanical Gardens, greenhouse (UQ 246984), 1600 m; 24 Aug 67, BkP. Large water tank, domestic; water permanent, clear; concrete bottom; deep shade. 14. *Culex (C.) secutor*.

753. Kingston and St. Andrew, Cinchona, Botanical Gardens (UQ246984), 1600 m; 24 Aug 67, BkP. Large water tank behind great house; water permanent, clear; vegetation scanty algae; concrete bottom; deep shade. 14. *Culex (C.) secutor*.

754. Kingston and St. Andrew, Clydesdale, at swimming pool in stream (UQ 232999), 1060 m; 24 Aug 67, BkP. Seepage in forestry plantation; water permanent, clear, fresh, slow current; vegetation scanty, algae; mud, rock bottom; partial shade. 5. *Anopheles (A.) grabhamii*.

755. Kingston and St. Andrew, Newcastle, culvert about 3/4 mi S of Newcastle on Kingston Road (UQ186990), 1100 m; 24 Aug 67, BkP. Rockhole, stream margin in forest; water semipermanent, clear, stagnant; mud, rock, abundant dead leaves bottom; partial shade. 14. *Culex (C.) secutor*.

756. Kingston and St. Andrew, Mona, U.W.I., 11 Mountain View Ave. (UQ 146908), 180 m; 24 Aug 67, BkP. Adults at light on verandah. 67. *Sayomyia lanei*.

757. St. Ann, Moneague, Delight, on N side of road from Ersil-Walkers Wood (TR787232), 350 m; 25 Aug 67, BkP. Stock pond in pasture; water semipermanent, clear, fresh, stagnant; vegetation scanty, grass; mud bottom; full sun. 1. *Anopheles (Nys.) albimanus*; 15. *Culex (C.) nigripalpus*; 23. *Culex (Mel.) pilosus*; 36. *Psorophora (G.) jamaicensis*; 38. *Psorophora (G.) pygmaea*; 42. *Aedes (O.) hemisurus*; 43. *Aedes (O.) tortilis*.

758. St. Ann, Moneague, 2 mi S on Spanish Town Road near Unity Farm (TR 765192), 380 m; 25 Aug 67, BkP. Various epiphytic bromeliads. 47. *Aedes (H.) walkeri*; 49. *Aedes (H.) grabhami*; 51. *Aedes (H.) stenei*; 55. *Wyeomyia (W.) mitchellii*; 61. *Wyeomyia (W.) juxtahirsuta*; 62. *Wyeomyia (W.) hirsuta*.

759. St. Catherine, Spanish Town, Central Village, roadside opposite new housing estate (UQ968907), 20 m; 29 Aug 67, P. Many small ground pools in roadside grazing area; water temporary, clear, fresh; vegetation abundant, grassy, flottage; mud, dead leaves, mule dung bottom; partial shade. 1. *Anopheles (Nys.) albimanus*; 8. *Uranotaenia lowii*; 15. *Culex (C.) nigripalpus*; 17. *Culex (Mel.) atratus*; 42. *Aedes (O.) hemisurus*.

760. St. Catherine, Spanish Town, Central Village; roadside opposite new housing estate (UQ968907), 20 m; 29 Aug 67, P. As 759, egg rafts.

761. St. Catherine, Spanish Town, Central Village, Spanish Town Road opposite new housing estate (UQ968907), 20 m; 29 Aug 67, P. Many small ground pools in roadside grazing area; water temporary, clear, fresh; vegetation abundant, grassy, flottage; mud, dead leaves, mule dung bottom; partial shade. 8. *Uranotaenia lowii*; 15. *Culex (C.) nigripalpus*; 16. *Culex (C.) quinquefasciatus*.

762. St. Ann, Moneague, Faiths Pen in school yard (TR786172), 530 m; 31 Aug 67, P. Various epiphytic bromeliads, domestic. 47. *Aedes (H.) walkeri*; 59. *Aedes*

(*H.*) *grabhami*; 51. *Aedes* (*H.*) *stenei*.

763. St. Ann, Moneague, bend near milestone 29 on Spanish Town to Moneague Road (TR763191), 530 m; 30 Aug 67, P. Various epiphytic bromeliads in grazing area; partial shade. 25. *Culex* (*Micr.*) *arawak*; 47. *Aedes* (*H.*) *walkeri*; 49. *Aedes* (*H.*) *grabhami*; 51. *Aedes* (*H.*) *stenei*; 55. *Wyeomyia* (*W.*) *mittelli*; 58. *Wyeomyia* (*W.*) *stellata*; 62. *Wyeomyia* (*W.*) *hirsuta*.

764. St. Ann, Moneague, bend near milestone 29 on Spanish Town-Moneague Road (TR763191), 530 m; 30 Aug 67, P. Various epiphytic bromeliads in grazing area; partial shade. 47. *Aedes* (*H.*) *walkeri*; 49. *Aedes* (*H.*) *grabhami*; 51. *Aedes* (*H.*) *stenei*.

765. Kingston and St. Andrew, Kingston, Hermitage Dam Road (UQ120998), 480 m; 5 Aug 67, BkP. Epiphytic bromeliad (*Hohenbergia*). 47. *Aedes* (*H.*) *walkeri*; 49. *Aedes* (*H.*) *grabhami* (continuation of No. 892).

766. St. Ann, Runaway Bay, 2 mi E of town on coast road (TR518428), 1 m; 5 Sept 67, P. Stream margin in coconut plantation; water permanent, clear, fresh, slow current; vegetation abundant, herbaceous, algae; mud bottom; partial shade. 1. *Anopheles* (*Nys.*) *albimanus*.

767. St. Ann, Moneague, Clarendon-Moneague Road, 3 mi W of Moneague (TR 736251), 380 m; 5 Sept 67, P. Various epiphytic bromeliads in clearing, grazing area; partial shade. 47. *Aedes* (*H.*) *walkeri*; 62. *Wyeomyia* (*W.*) *hirsuta*.

768. Kingston and St. Andrew, Ferry, Fresh River along Red Hills Road (UQ 010946), 15 m; 6 Sept 67, P. Small ground pool on shore of stream; water temporary, clear, stagnant; vegetation scanty, grass; mud, dead leaves bottom; partial shade. 42. *Aedes* (*O.*) *hemisurus*.

769. Kingston and St. Andrew, Ferry, along river (UQ010946), 20 m; 6 Sept 67, P. Small ground pool on bank of stream; water semipermanent, clear, fresh, stagnant; vegetation scanty, flotage, algae, grass; mud, dead leaves bottom. 5. *Anopheles* (*A.*) *grabhamii*; 17. *Culex* (*Mel.*) *atratus*.

770. Kingston and St. Andrew, Ferry, along river bank (UQ010946), 15 m; 6 Sept 67, P. Large crabhole. 9. *Deinocerites cancer*.

771. St. Ann, Moneague, on Spanish Town-Moneague Road near Unity Valley (TR761194), 380 m; 7 Sept 67, P. Various epiphytic bromeliads in forest. 47. *Aedes* (*H.*) *walkeri*; 49. *Aedes* (*H.*) *grabhami*; 51. *Aedes* (*H.*) *stenei*; 58. *Wyeomyia* (*W.*) *stellata*.

772. St. Ann, Moneague, Spanish Town-Moneague Road near Unity Valley (TR 761194), 350 m; 7 Sept 67, P. Various epiphytic bromeliads in grazing area. 25. *Culex* (*Micr.*) *arawak*; 47. *Aedes* (*H.*) *walkeri*; 49. *Aedes* (*H.*) *grabhami*; 51. *Aedes* (*H.*) *stenei*; 58. *Wyeomyia* (*W.*) *stellata*; 62. *Wyeomyia* (*W.*) *hirsuta*.

773. St. Ann, Moneague, road from Unity Valley to Hollymount (TR761194), 600 m; 7 Sept 67, P. Various epiphytic bromeliads in grazing area; partial shade. 49. *Aedes* (*H.*) *grabhami*; 51. *Aedes* (*H.*) *stenei*.

774. St. Ann, Moneague, road from Unity Valley to Hollymount (TR761194), 600 m; 7 Sept 67, P. Various epiphytic bromeliads in grazing area; partial shade. 49. *Aedes* (*H.*) *grabhami*; 51. *Aedes* (*H.*) *stenei*; 61. *Wyeomyia* (*W.*) *juxtahirsuta*; 62. *Wyeomyia* (*W.*) *hirsuta*.

775. St. Ann, Ocho Rios, Dunns River, about 150 yds above falls (TR738373), 20 m; 10 Sept 67, P. Stream margin in plantation; water permanent, clear, strong current; vegetation scanty, herbaceous; mud, rock bottom; partial shade. 71. *Dixella scitula*; 72. *Mesodixa biambulacra*.

776. St. Ann, Moneague, milestones 30-31 on Spanish Town Road (TR752220),

500 m; 10 Sept 67, P. Various epiphytic bromeliads in grazing area. 49. *Aedes (H.) grabhami*; 51. *Aedes (H.) stenei*.

777. Kingston and St. Andrew, Redhills, Mt. Salus, ½ mi W of postal agency (UQ065988), 450 m; 11 Sept 67, P. Various epiphytic bromeliads in roadside clearing. 47. *Aedes (H.) walkeri*.

778. Kingston and St. Andrew, Redhills, Mt. Salus, ½ mi W of postal agency (UQ065988), 450 m; 11 Sept 67, P. Cut and broken bamboo in forest. 47. *Aedes (H.) walkeri*; 54. *Wyeomyia (W.) nigrifubus*.

779. Kingston and St. Andrew, Redhills, Mt. Salus, ½ mi W of postal agency (UQ065988), 450 m; 11 Sept 67, P. Various epiphytic bromeliads in forest. 47. *Aedes (H.) walkeri*; 51. *Aedes (H.) stenei*; 62. *Wyeomyia (W.) hirsuta*.

780. Kingston and St. Andrew, Redhills, Mt. Salus, ½ mi W of postal agency (UQ065988), 450 m; 11 Sept 67, P. Cut and broken bamboo in forest. 11. *Culex (C.) corniger*; 50. *Aedes (H.) inaequalis*.

781. Kingston and St. Andrew, Ferry, river (UQ010946), 20 m; 12 Sept 67, P. Stream margin in clearing; water permanent, clear, fresh, slow current; vegetation abundant, algae, submerged weeds; mud bottom; partial shade. 1. *Anopheles (Nys.) albimanus*; 17. *Culex (Mel.) atratus*.

782. Westmoreland, Bluefields, track to Crab Pond Bay between milestones 101-102 on Black River to Savanna-La-Mar Road (SR171055), sea level; 14 Sept 67, P. Stream margin in clearing in mangrove; water permanent, clear, brown, fresh, slow current; vegetation scanty, grassy; mud bottom; full sun. 1. *Anopheles (Nys.) albimanus*; 20. *Culex (Mel.) iolambdis*.

783. Westmoreland, Bluefields, track to Crab Pond Bay between milestones 101-102 on Black River to Savanna-La-Mar Road (SR171055), sea level; 14 Sept 67, P. Large crabhole, flooded, in clearing in mangrove swamp; partial shade. 9. *Deinocerites cancer*; 21. *Culex (Mel.) inhibitor*.

784. Westmoreland, Bluefields, track to Crab Pond Bay between milestones 101-102 on Black River to Savanna-La-Mar Road (SR171055), sea level; 14 Sept 67, P. Pond in mangrove swamp; water clear, brown, fresh, stagnant; vegetation scanty; mud, sand, dead leaves bottom; partial shade. 15. *Culex (C.) nigripalpus*; 20. *Culex (Mel.) iolambdis*.

785. Westmoreland, Bluefields, track to Crab Pond Bay between milestones 101-102 on Black River to Savanna-La-Mar Road (SR171055), sea level; 14 Sept 67, P. Stream pool blocked by sand bar by seaside; water permanent, clear, brown, very slow current; vegetation scanty, flottage; mud, sand bottom; partial shade. 1. *Anopheles (Nys.) albimanus*; 5. *Anopheles (A.) grabhamii*; 17. *Culex (C.) atratus*.

786. Westmoreland, Whitehouse, near Petersville, 2 mi from Auchindown on road to Hopetown (SR861068), 250 m; 14 Sept 67, P. Pond in field; water permanent, clear, fresh, stagnant; vegetation scanty, grass; mud bottom; partial shade. 15. *Culex (C.) nigripalpus*.

787. Westmoreland, Whitehouse, about 2 mi W of Petersville postal agency on Hopetown Road (SR864065), 300 m; 14 Sept 67, P. Various epiphytic bromeliads in clearing by roadside; full sun. 47. *Aedes (H.) walkeri*; 55. *Wyeomyia (W.) mitchellii*; 63. *Wyeomyia (W.) atrata*.

788. Westmoreland, Whitehouse, behind Petersville postal agency (SR875057), 225 m; 14 Sept 67, P. Large ground pool in grazing area; water semipermanent, clear, fresh; vegetation abundant, grass 0.75 m high, tangled; mud bottom; partial shade. 33. *Psorophora (J.) ferox*.

789. Westmoreland, Whitehouse, behind Petersville postal agency (SR875057),

225 m; 14 Sept 67, P. Pond in grazing area; water permanent, clear, fresh, stagnant; vegetation abundant, grassy, herbs; mud bottom; partial shade. 27. *Mansonia (M.) titillans*.

790. Westmoreland, Bluefields, track leading to Crab Pond Bay, milestones 101-102 on Black River to Savanna-La-Mar Road (SR171055), sea level; 14 Sept 67, P. Adults biting man amongst bushes in mangrove swamp, overcast day; 1000-1100 hrs. 4. *Anopheles (A.) vestitipennis*; 43. *Aedes (O.) tortilis*.

791. St. Elizabeth, Maggotty, small pond on right of road, ½ mi S of town (TR 079098), 150 m; 15 Sept 67, P. Epiphytic bromeliad in plantation; deep shade. 51. *Aedes (H.) stenei*.

792. St. Elizabeth, Maggotty, by small pond on W side of road, ½ mi S of town (TR079098), 150 m; 15 Sept 67, P. Progeny of 2 females from collection 792A. 41. *Aedes (O.) pertinax*.

792A. St. Elizabeth, Maggotty, by small pond on W side of road, ½ mi S of town (TR079098), 150 m; 15 Sept 67, P. Adults biting man under trees in cassava plot; 1100-1130 hrs. 26. *Coquillettidia (R.) nigricans*; 33. *Psorophora (J.) ferox*; 41. *Aedes (O.) pertinax*; 47. *Aedes (H.) walkeri*.

793. St. Elizabeth, Maggotty, by small pond on W side of road, ½ mi S of town (TR079098), 150 m; 15 Sept 67, P. Adults biting man under trees in cassava plot; 1100-1130 hrs. 4. *Anopheles (A.) vestitipennis*; 18. *Culex (Mel.) opisthopus*; 56. *Wyeomyia (W.) vanduzeei*.

794. St. Elizabeth, Black River, 2 mi E of town on Crane Road (TQ004922), sea level; 13-14 Sept 67, P. Adults in CDC light trap in bushes at edge of swamp and new (unused) road, 1.5 m above ground; 1600-0630 hrs. 3. *Anopheles (A.) crucians*; 9. *Deinocerites cancer*; *Culex (Mel.) sp.*; 26. *Coquillettidia (R.) nigricans*; 39. *Aedes (O.) taeniorhynchus*.

795. Kingston and St. Andrew, Ferry, about 1 mi along Red Hills Road from Spanish Town Road where track goes N (UQ010946), 10 m; 18 Sept 67, P. Adults biting man under trees; 1000-1200 hrs. 34. *Psorophora (J.) sp.*, Jamaican form.

796. Kingston and St. Andrew, Ferry, about 1 mi along Red Hills Road from Spanish Town Road where track goes N (UQ010946), 10 m; 18 Sept 67, P. Small ground pool in scrub forest; water temporary, turbid, fresh; vegetation abundant, grassy; mud bottom; partial shade. 39. *Aedes (O.) taeniorhynchus*; 42. *Aedes (O.) hemisurus*; 43. *Aedes (O.) tortilis*.

797. Kingston and St. Andrew, Ferry, about 1 mi along Red Hills Road from Spanish Town Road where track goes N (UQ010946), 10 m; 18 Sept 67, P. Blocked drain in scrub forest; water semipermanent, clear, fresh, stagnant; vegetation abundant, flottage; mud, dead leaves bottom; partial shade. 5. *Anopheles (A.) grabhamii*; 7. *Uranotaenia cooki*; 15. *Culex (C.) nigripalpus*; 17. *Culex (Mel.) atratus*.

798. Kingston and St. Andrew, Ferry, about 1 mi along Red Hills Road from Spanish Town Road where track goes N (UQ010946), 10 m; 19 Sept 67, P. Blocked drain in scrub forest; water semipermanent, clear, fresh, stagnant; vegetation abundant, flottage; mud, dead leaves bottom; partial shade. 5. *Anopheles (A.) grabhamii*; 7. *Uranotaenia cooki*; 15. *Culex (C.) nigripalpus*; 17. *Culex (Mel.) atratus*.

799. Kingston and St. Andrew, Ferry, about 1 mi along Red Hills Road from Spanish Town Road where track goes N (UQ010946), 10 m; 19 Sept 67, P. Ditch in scrub forest; water semipermanent, clear, fresh, stagnant; mud bottom; partial shade. 15. *Culex (C.) nigripalpus*; 42. *Aedes (O.) hemisurus*; 43. *Aedes (O.) tortilis*.

800. St. Thomas, Yallahs, Grants Pen playing field (UQ276803), 1 m; 6 July 67, P. Pond in clearing, grazing area in dry scrub; water permanent, clear, brown, fresh;

vegetation fairly abundant, grassy, herbaceous, woody; mud bottom; partial shade.

1. *Anopheles (Nys.) albimanus*; 17. *Culex (C.) nigripalpus*.

801. St. Thomas, Yallahs, Grants Pen, edge of playing field (UQ276803), 1 m; 6 July 67, P. Small treehole, 1 m above ground in mangrove swamp; water clear, brown; decaying vegetation bottom; deep shade. 46. *Aedes (F.) mediovittatus*.

802. St. Thomas, Yallahs, Grants Pen, playing field (UQ276803), 1 m; 6 July 67, P. Adult biting man in parked car; 1045 hrs. 39. *Aedes (O.) taeniorhynchus*.

803. St. Thomas, Yallahs, Albion estate, along dirt road towards sea (UQ292784), 3 m; 6 July 67, P. Ditch in freshwater swamp; water permanent, clear, fresh, moderate current; vegetation abundant, algae, grass, submerged weeds; mud, plant material bottom; partial shade. 1. *Anopheles (Nys.) albimanus*.

804. St. Thomas, Yallahs, Albion estate, along dirt road towards sea (UQ292784), 3 m; 6 July 67, P. Stream pool in freshwater swamp, water permanent, clear, fresh, slow current; vegetation abundant, grassy, herbaceous; mud, green vegetation trampled by cattle on bottom; partial shade. 4. *Anopheles (A.) vestitipennis*; 15. *Culex (C.) nigripalpus*.

805. St. Thomas, Yallahs, Albion estate, along dirt road towards sea (UQ292784), 3 m; 6 July 67, P. Cattle tracks in freshwater swamp; water turbid, fresh; vegetation abundant, grassy; mud bottom; partial shade. 15. *Culex (C.) nigripalpus*.

806. St. Thomas, Yallahs, Albion, opposite store at Easington Road junction (UQ299785), 15 m; 16 July 67, P. Large treehole in plantation; water clear, brown; deep shade. 16. *Culex (C.) quinquefasciatus*; 52. *Aedes (S.) aegypti*.

807. St. Mary, Annotto Bay, Castleton Botanic Gardens, Wag Water River (UR 072098), 450 m; 7 July 67, P. Stream margin in clearing; water permanent, clear, slow current; vegetation scanty, floating algae; sand bottom; full sun. 1. *Anopheles (Nys.) albimanus*; 17. *Culex (C.) atratus*.

808. St. Mary, Annotto Bay, Fort Stewart, 500 yds before milestone 34 on Port Antonio Road (UR167201), 5 m; 7 July 67, P. Stream margin in canefield; water permanent, clear, moderate current; vegetation scanty, grassy, submerged weeds; mud bottom; full sun. 1. *Anopheles (Nys.) albimanus*.

809. St. Mary, Annotto Bay, Fort Stewart, 500 yds before milestone 34 on Port Antonio Road (UR167201), 5 m; 7 July 67, P. Large crabhole in canefield; water fresh; mud bottom; deep shade. 22. *Culex (Mel.) sp.*, Jamaican form.

810. Portland, Port Antonio, Frenchmans Cove Hotel (UR495102), 3 m; 7 July 67, P. Wild coco yam, domestic; partial shade. 55. *Wyeomyia (W.) mitchellii*.

811. Portland, Port Antonio, Priestmans River, between road and river, 3 m (UR 585054); 7 July 67, P. Wild coco yam, in cultivation; partial shade. 55. *Wyeomyia (W.) mitchellii*.

812. Portland, Port Antonio, Health Office, sea level; 7 July 64, P. Resting on walls of lavatory; 1200 hrs. 9. *Deinocerites cancer*; 16. *Culex (C.) quinquefasciatus*.

813. St. Thomas, Yallahs, Grants Pen playing field (UQ276803), 1 m; 11 July 67, P. Marshy depression in edge of clearing; water semipermanent, clear, colored, brackish; vegetation abundant, herbaceous; mud, plant material bottom; full sun. 1. *Anopheles (Nys.) albimanus*; 17. *Culex (Mel.) atratus*.

814. St. Thomas, Yallahs, Grants Pen, edge of playing field (UQ276803), sea level; 11 July 67, P. Pit, 2 ft square in edge of grazing area by mangrove; water permanent, clear, colored, brackish; mud bottom; full sun. 1. *Anopheles (Nys.) albimanus*; 15. *Culex (C.) nigripalpus*; 17. *Culex (Mel.) atratus*.

815. St. Thomas, Yallahs, Grants Pen fish house (UQ273804), sea level; 11 July 67, P. Large concrete storage tank, domestic; water fresh; deep shade. 52. *Aedes (S.)*

aegypti.

816. St. Thomas, Yallahs, Grants Pen waterworks (UQ280803), 3 m; 11 July 67, P. Blocked drain in cattail marsh; water permanent, clear, fresh, stagnant; vegetation abundant, grassy, floating duck weed; mud bottom; partial shade. 17. *Culex (Mel.) atratus*.

817. St. Thomas, Yallahs, E bank of Yallahs River at Easington bridge (UQ 319822), 35 m; 11 July 67, P. Pond in dry forest; water semipermanent, turbid, fresh, stagnant; mud bottom; full sun. 5. *Anopheles (A.) grabhamii*.

818. St. Catherine, Spanish Town, crescent by Rio Cobre Dam (TQ903960), 30 m; 12 July 67, P. Small ground pool, overflow from dripping standpipe, domestic; water turbid, stagnant; vegetation abundant, grassy; mud bottom; partial shade. 15. *Culex (C.) nigripalpus*.

819. St. Catherine, Spanish Town, Rio Cobre River, 50 yds above dam (TQ 903960), 30 m; 12 July 67, P. Stream margin in plantation; water permanent, clear, moderate current; vegetation abundant, floating (*Pistia*), algae; mud bottom; full sun. 1. *Anopheles (Nys.) albimanus*.

820. St. Catherine, Bog Walk, Dove Hall, milestone 11 on Harkers Hall Road, bank of Rio Pedro (TR920042), 150 m; 12 July 67, P. Various epiphytic bromeliads in plantation; water colored; deep shade. 47. *Aedes (H.) walkeri*; 51. *Aedes (H.) stenei*; 58. *Wyeomyia (W.) stellata*.

821. St. Catherine, Bog Walk, Harkers Hall, in pasture by road (TR965044), 225 m; 12 July 67, P. Various epiphytic bromeliads, 2.5 m above ground in grazing area; water clear; deep shade. 47. *Aedes (H.) walkeri*; 63. *Wyeomyia (W.) atrata*.

822. St. Catherine, Kingston, between Harkers Hall and Zion Hill (TR987041), 225 m; 12 July 67, P. Cut bamboo in roadside forest; water clear; partial shade. 50. *Aedes (H.) inaequalis*; 52. *Aedes (S.) aegypti*; 54. *Wyeomyia (W.) nigratubus*.

823. St. Catherine, Kingston, between Harkers Hall and Zion Hill (TR987041), 225 m; 12 July 67, P. Cut bamboo in roadside forest; partial shade. 54. *Wyeomyia (W.) nigratubus*.

824. St. Catherine, Kingston, between Harkers Hall and Zion Hill (TR987041), 225 m; 12 July 67, P. Various epiphytic bromeliads, 1.2 m above ground in roadside forest. 47. *Aedes (H.) walkeri*.

825. St. Catherine, Bog Walk, Dove Hall, milestone 11 on Harkers Hall Road, bank of Rio Pedro (TR920042), 150 m; 12 July 67, P. Adult biting man under tree (820); 1215 hrs. 47. *Aedes (H.) walkeri*.

826. Kingston and St. Andrew, Kingston, Hermitage Dam Road (UQ120998), 450 m; 13 July 67, P. Large treehole in mango tree in forest clearing. 50. *Aedes (H.) inaequalis*; 68. *Corethrella (C.) appendiculata*.

827. Kingston and St. Andrew, Kingston, Hermitage Dam Road (UR126001), 480 m; 13 July 67, P. Stream pool in forest; water clear, brownish, fresh, slow current; mud, much decaying plant material bottom; deep shade. 11. *Culex (C.) corniger*; 14. *Culex (C.) secutor*; 21. *Culex (Mel.) inhibitor*.

828. Kingston and St. Andrew, Kingston, Hermitage Dam Road, first culvert down from dam gate (UR126001), 480 m; 13 July 67, P. Stream pool, about 3 ft above 827, in forest; water permanent, clear, fresh, slow current; rock, decaying plant material bottom; deep shade. 5. *Anopheles (A.) grabhamii*; 14. *Culex (C.) secutor*; 21. *Culex (C.) inhibitor*.

829. Kingston and St. Andrew, Kingston, Hermitage Dam Road, lower end of Water Commission land (UQ120998), 400 m; 13 July 67, P. Large treehole in mango tree in forest; water semipermanent, clear, colored; mud bottom; partial shade.

68. *Corethrella (C.) appendiculata*.

830. St. Catherine, Kingston, Caymanas (TQ980930), 10 m; 17 July 67, P. No material.

831. Kingston and St. Andrew, Irish Town, the house "Bracken" (UQ172968), 760 m; 18 July 67, P. Concrete pond, domestic; water permanent, turbid, green, fresh; full sun. 16. *Culex (C.) quinquefasciatus*; 52. *Aedes (S.) aegypti*.

832. Kingston and St. Andrew, Newcastle, culvert under road 18.8 mi from Kingston (UQ193988), 1050 m; 18 July 67, P. Small stream pool in forest; water semi-permanent, clear, fresh, very slow current; mud, rock, dead leaves bottom; partial shade. 5. *Anopheles (A.) grabhamii*; 14. *Culex (C.) secutor*.

833. Kingston and St. Andrew, Newcastle, culvert 18.8 mi from Kingston (UQ 193988), 1050 m; 18 July 67, P. Stream pool, about 20 ft above (832) in forest; water semipermanent, clear, very slow current; rock, dead leaves bottom; deep shade. 5. *Anopheles (A.) grabhamii*; 14. *Culex (C.) secutor*.

834. Kingston and St. Andrew, Newcastle, 18.3 mi from Kingston, near "The Hut" (UQ192985), 1050 m; 18 July 67, P. Large water trough in forest; water permanent, colored greenish brown; concrete, dead leaves bottom; partial shade. 5. *Anopheles (A.) grabhamii*; 14. *Culex (C.) secutor*.

835. Kingston and St. Andrew, Newcastle, 18.3 mi from Kingston, near "The Hut" (UQ192985), 1050 m; 18 July 67, P. Pool at base of trough (834) in forest; water semipermanent, clear, fresh, stagnant; vegetation abundant, grassy; mud bottom; partial shade. 5. *Anopheles (A.) grabhamii*; 14. *Culex (C.) secutor*.

836. Kingston and St. Andrew, Irish Town, Kingston Road between Irish Town and Tamarind Tree, culvert beneath road (UQ170958), 460 m; 18 July 67, P. Drain under culvert in forest; water permanent, clear, stagnant; vegetation scanty, grassy; mud bottom; deep shade. 5. *Anopheles (A.) grabhamii*.

837. Kingston and St. Andrew, Kingston, Molyne's Road, base of Red Hills near Mackeville Terrace (UQ068949), 61 m; 19 July 67, P. Large treehole, 4 m above ground, domestic; water clear, brown; partial shade. 52. *Aedes (S.) aegypti*.

838. Kingston and St. Andrew, Kingston, Molyne's Road at base of Red Hills (UQ068949), 61 m; 19 July 67, P. No material.

839. Kingston and St. Andrew, Kingston, Riverton City by Salt River, near coast (UQ042923), sea level; 20 July 67, P. Small crabhole in saltmarsh; water turbid, fresh; mud bottom; full sun. 9. *Deinocerites cancer*.

840. Kingston and St. Andrew, Kingston, Riverton City by Salt River, near coast (UQ042923), sea level; 20 July 67, P. Adults biting man in open on saltmarsh; 1000 hrs. 40. *Aedes (O.) sollicitans*.

841. Kingston and St. Andrew, Kingston, Red Hills quarry, base of Red Hills, 150 yds from bridge (UQ066950), 60 m; 21 July 67, P. Small ground pool on road; water clear, fresh; mud bottom; full sun. 36. *Psorophora (G.) jamaicensis*; 38. *Psorophora (G.) pygmaea*.

842. Kingston and St. Andrew, Kingston, Red Hills, Belvedere Road, near upper end of Belvedere Crescent (UQ050957), 225 m; 21 July 67, P. Adults biting man under trees; 1000 hrs. 39. *Aedes (O.) taeniorhynchus*.

843. Kingston and St. Andrew, Kingston, Hermitage Dam Road, lower end of Water Commission land (UQ120998), 450 m; 13 July 67, P. Various epiphytic bromeliads, 1½ m above ground in forest; water clear, brown; partial shade. 47. *Aedes (H.) walkeri*; 63. *Wyeomyia (W.) atrata*.

844. Kingston and St. Andrew, Kingston, Hermitage Dam Road (UQ120998), 480 m; 13 July 67, P. Epiphytic bromeliad growing on bank in forest; water clear,

brown; full sun. No material.

845. Kingston and St. Andrew, Kingston, Red Hills, Swain Spring Road, house "Morris Mount" (UQ060975), 450 m; 24 July 67, P. Rockhole in garden; water temporary, clear, fresh, stagnant; mud, rock bottom; partial shade. 45. *Aedes (O.) calumnior*; 46. *Aedes (O.) mediovittatus*.

846. Kingston and St. Andrew, Kingston, Mt. Salus Road, between milestones 10-11, 500 yds W of Mt. Salus postal agency (UQ065988), 450 m; 24 July 67, P. Epiphytic bromeliad (*Hohenbergia*) in forest; water clear; partial shade. 62. *Wyeomyia (W.) hirsuta*.

847. Kingston and St. Andrew, Kingston, Mt. Salus Road, milestones 10-11, 500 yds W of Mt. Salus postal agency (UQ065988), 450 m; 24 July 67, P. No material.

848. Kingston and St. Andrew, Kingston, Mt. Salus Road, between milestones 10-11, 500 yds W of Mt. Salus postal agency (UQ065988), 450 m; 24 July 67, P. Various epiphytic bromeliads, 2.5 m above ground in forest; partial shade. 47. *Aedes (H.) walkeri*.

849. Kingston and St. Andrew, Kingston, Mt. Salus Road, milestones 10-11, 500 yds W of Mt. Salus postal agency (UQ065988), 450 m; 24 July 67, P. Epiphytic bromeliad about .75 m above ground in forest; partial shade. No material.

850. Kingston and St. Andrew, Kingston, Mt. Salus Road (UQ065988), 450 m; 24 July 67, P. No material.

851. Kingston and St. Andrew, Kingston, Hermitage Dam Road, first culvert down from dam gate (UR126001), 480 m; 25 July 67, P. Stream pool in forest; water semipermanent, clear, fresh, very slow current; mud, rock, much decaying plant material bottom; partial shade. 5. *Anopheles (A.) grabhamii*; 14. *Culex (C.) secutor*; 21. *Culex (Mel.) inhibitor*.

852. Kingston and St. Andrew, Kingston, Hermitage Dam Road, first culvert down from dam gate (UR126001), 480 m; 25 July 67, P. Stream pool in forest; water semipermanent, clear, fresh, slow current; rock, dead leaves bottom; partial shade. 5. *Anopheles (A.) grabhamii*; 14. *Culex (C.) secutor*; 21. *Culex (Mel.) inhibitor*.

853. Kingston and St. Andrew, Kingston, Hermitage Dam Road, first culvert down from dam gate (UR126001), 480 m; 25 July 67, P. Adults resting on and under rock overhang, with seepage running down face of rock; 0930 hrs. 21. *Culex (C.) inhibitor*.

854. Kingston and St. Andrew, Kingston, Hermitage Dam Road (UQ120998), 450 m; 25 July 67, P. Various epiphytic bromeliads at top of 10 ft bank in forest; full sun. 47. *Aedes (H.) walkeri*; 49. *Aedes (H.) grabhami*; 51. *Aedes (H.) stenei*.

855. Kingston and St. Andrew, Kingston, Hermitage Dam Road, near Mint Spring (UQ120998), 450 m; 25 July 67, P. Various epiphytic bromeliads on bank in forest. 47. *Aedes (H.) walkeri*; 51. *Aedes (H.) stenei*; 55. *Wyeomyia (W.) mitchellii*.

856. Kingston and St. Andrew, Kingston, Hermitage Dam Road, near Mint Spring (UQ120998), 450 m; 25 July 67, P. Small epiphytic bromeliad 4 m above ground in forest. 63. *Wyeomyia (W.) atrata*.

857. Kingston and St. Andrew, Ferry, quarry swamp at N side (UQ022942), 10 m; 26 July 67, P. Large open crabhole in cleared mangrove; water fresh; mud bottom; full sun. 5. *Anopheles (A.) grabhamii*; 9. *Deinocerites cancer*; 15. *Culex (C.) nigripalpus*.

858. Kingston and St. Andrew, Ferry, quarry swamp at N side (UQ022942), 10 m; 26 July 67, P. Large crabhole in cleared mangrove; water turbid, pale brown, stagnant, slightly brackish; mud, dead leaves bottom; partial shade. 9. *Deinocerites cancer*.

859. Kingston and St. Andrew, Ferry, quarry swamp at N side (UQ022942), 10 m; 26 July 67, P. Adults resting inside crabhole (858); 1000 hrs. 9. *Deinocerites cancer*.

860. Kingston and St. Andrew, Ferry, quarry swamp at N side (UQ022942), 10 m; 26 July 67, P. Large crabhole in mangrove; mud bottom; deep shade. 5. *Anopheles (A.) grabhamii*; 9. *Deinocerites cancer*; 39. *Aedes (O.) taeniorhynchus*.

861. Kingston and St. Andrew, Ferry, quarry swamp at N side (UQ022942), 10 m; 26 July 67, P. Small crabhole in mangrove; deep shade. 9. *Deinocerites cancer*; 39. *Aedes (O.) taeniorhynchus*.

862. St. Catherine, Spanish Town, Caymanas, about ½ mi from Spanish Town Road (TQ995930), 10 m; 26 July 67, P. Ditch in canefield; water temporary, clear, fresh, stagnant; algae; mud, dead leaves bottom; partial shade. 17. *Culex (Mel.) atratus*; 36. *Psorophora (G.) jamaicensis*.

863. Clarendon, May Pen, Parnassus on May Pen-Milk River Road (TQ603840), 30 m; 28 July 67, P. Large ground pool in canefield; water temporary, clear, fresh, stagnant; abundant grass; mud bottom; full sun. 36. *Psorophora (G.) jamaicensis*; 38. *Psorophora (G.) pygmaea*; 42. *Aedes (O.) hemisurus*; 43. *Aedes (O.) tortilis*.

864. Clarendon, May Pen, Parnassus on May Pen-Milk River Road (TQ603840), 30 m; 28 July 67, P. Small ground pool in ruts in canefield edge; water temporary, turbid, fresh, stagnant; vegetation abundant, grass; mud bottom; full sun. 36. *Psorophora (G.) jamaicensis*; 38. *Psorophora (G.) pygmaea*.

865. Clarendon, Milk River Bath, culvert at milestone 42 (TQ504752), 10 m; 28 July 67, P. Large crabhole on edge of mangrove; water clear, fresh; mud bottom; partial shade. 9. *Deinocerites cancer*.

866. Clarendon, Milk River Bath, culvert at milestone 42 (TQ504752), 10 m; 28 July 67, P. Large crabhole on edge of mangrove; partial shade. 9. *Deinocerites cancer*.

867. Clarendon, Milk River Bath, culvert at milestone 42 (TQ504752), 10 m; 28 July 67, P. Large crabhole on edge of mangrove; partial shade. 9. *Deinocerites cancer*.

868. Clarendon, Milk River Bath, culvert by milestone 42 (TQ504752), 10 m; 28 July 67, P. Swamp edge in mangrove; water semipermanent, clear, fresh, stagnant; mud bottom; partial shade. 1. *Anopheles (Nys.) albimanus*; 5. *Anopheles (A.) grabhamii*.

869. Clarendon, Milk River Bath, Pass Side on Milk River-Toll Gate Road (TQ504796), 25 m; 28 July 67, P. Large ground pool in scrub forest; water temporary, clear, fresh; vegetation abundant, grass, flottage; mud bottom; full sun. 36. *Psorophora (G.) jamaicensis*; 38. *Psorophora (G.) pygmaea*.

870. Clarendon, Toll Gate, about 2 mi S on Milk River Road (UQ480853), 30 m; 28 July 67, P. Ditch in grazing area; water temporary, clear, fresh, stagnant; vegetation scanty, grassy; mud bottom; full sun. 36. *Psorophora (G.) jamaicensis*; 38. *Psorophora (G.) pygmaea*.

871. St. Thomas, Yallahs, Grants Pen, Albion swamp, between waterworks and milestone 16 (UQ280803), 5 m; 1 Aug 67, BkP. Small ground pool in edge of cat-tail swamp; water semipermanent, clear, fresh; stagnant; mud, dead leaves bottom; partial shade. 1. *Anopheles (Nys.) albimanus*; 9. *Deinocerites cancer*; 15. *Culex (C.) nigripalpus*; 17. *Culex (Mel.) atratus*.

872. St. Thomas, Yallahs, Grants Pen, seaside of Albion swamp (UQ279800), sea level; 1 Aug 67, BkP. Small ground pool in edge of freshwater swamp; water clear, brown, fresh; mud, dead leaves bottom; partial shade. 1. *Anopheles (Nys.)*

albimanus; 15. *Culex (C.) nigripalpus*.

873. St. Thomas, Yallahs, Albion estate, along dirt road by side of store, towards sea (UQ292784), 3 m; 1 Aug 67, BkP. Ditch in plantation; water permanent, clear, fresh, slow current; vegetation scanty, algae; mud bottom; partial shade. 1. *Anoph-(Nys.) albimanus*; 5. *Anopheles (A.) grabhamii*.

874. St. Thomas, Yallahs, Grants Pen, NE corner of playing field (UQ276803), 1 m; 1 Aug 67, BkP. Adults biting man under trees; 1845-1915 hrs. 18. *Culex (Mel.) opisthopus*; 27. *Mansonia (M.) titillans*.

875. St. Thomas, Yallahs, Grants Pen, NE corner of playing field (UQ276803), 1 m; 1 Aug 67, BkP. Adults biting man under trees; 1845-1915 hrs. Individual isolations for egg-laying. 18. *Culex (Mel.) opisthopus*; 39. *Aedes (O.) taeniorhynchus*.

876. St. Thomas, Yallahs, Grants Pen, NE corner of playing field (UQ276803), 1 m; 1 Aug 67, BkP. Adults biting man under trees; 1845-1915 hrs. Progeny from mass egg-laying. 18. *Culex (Mel.) opisthopus*; 39. *Aedes (O.) taeniorhynchus*.

877. St. Catherine, Spanish Town, Port Henderson, road to Fort Augusta (UQ 025865), 1 m; 2 Aug 67, BkP. No material.

878. St. Catherine, Spanish Town, Port Henderson, within swamp alongside road to Fort Augusta (UQ025865), 1 m; 2 Aug 67, BkP. Large crabhole in mangrove; water brackish; mud, sand bottom; partial shade. 9. *Deinocerites cancer*.

879. St. Catherine, Spanish Town, Port Henderson, along road to Fort Augusta (UQ025865), 1 m; 2 Aug 67, BkP. Large crabhole along road through mangrove. 9. *Deinocerites cancer*.

880. Kingston and St. Andrew, Port Royal, U.W.I. marine laboratory (UQ045837), sea level; 3 Aug 67, BkP. Large crabhole, domestic; water brackish; mud, sand bottom; partial shade. 9. *Deinocerites cancer*.

881. Kingston and St. Andrew, Port Royal, swamp on Palisadoes (UQ045837), 1 m; 3 Aug 67, BkP. Large crabhole in mangrove; partial shade. 9. *Deinocerites cancer*.

882. Kingston and St. Andrew, Port Royal, swamp along Palisadoes (UQ045837), 1 m; 3 Aug 67, BkP. Large crabhole in mangrove; partial shade. 9. *Deinocerites cancer*.

883. Kingston and St. Andrew, Ferry, about 1 mi along Red Hills Road from Spanish Town Road where track goes N (UQ010946), 10 m; 4 Aug 67, BkP. Large crabhole in scrub forest; partial shade. 9. *Deinocerites cancer*.

884. Kingston and St. Andrew, Ferry, about 1 mi along Red Hills Road from Spanish Town Road where track goes N (UQ010946), 10 m; 4 Aug 67, BkP. Large crabhole in scrub forest; partial shade. 9. *Deinocerites cancer*.

885. Kingston and St. Andrew, Ferry, about 1 mi along Red Hills Road from Spanish Town Road where track goes N (UQ010946), 10 m; BkP. Large crabhole in scrub forest; water fresh; partial shade. 9. *Deinocerites cancer*; 13. *Culex (C.) janitor*.

886. Kingston and St. Andrew, Ferry, about 1 mi along Red Hills Road from Spanish Town Road where track goes N (UQ010946), 10 m; 4 Aug 67, BkP. Deep large crabhole in scrub forest; partial shade. 9. *Deinocerites cancer*.

887. Kingston and St. Andrew, Ferry, about 1 mi along Red Hills Road from Spanish Town Road where track goes N (UQ010946), 10 m; 4 Aug 67, BkP. Large crabhole.

888. Kingston and St. Andrew, Ferry, about 1 mi along Red Hills Road from Spanish Town Road where track goes N (UQ010946), 10 m; 4 Aug 67, BkP. Adults resting in crabholes. 13. *Culex (C.) janitor*; 21. *Culex (Mel.) inhibitor*.

889. Kingston and St. Andrew, Ferry, about 1 mi along Red Hills Road from

Spanish Town Road where track goes N (UQ010946), 10 m; 4 Aug 67, BkP. Adults resting in crabhole. 13. *Culex (C.) janitor*.

890. Kingston and St. Andrew, Ferry, about 1 mi along Red Hills Road from Spanish Town Road where track goes N (UQ010946), 10 m; 4 Aug 67, BkP. Adults biting man beneath trees; 1100-1230 hrs. 42. *Aedes (O.) hemisurus*.

891. Kingston and St. Andrew, Kingston, Hermitage Dam Road, first culvert down from bridge (UR126001), 480 m; 5 Aug 67, BkP. Stream pool in forest; water permanent, clear, fresh, slow current; flottage; mud, rock, plant material bottom; partial shade. 5. *Anopheles (A.) grabhamii*; 11. *Culex (C.) corniger*; 14. *Culex (C.) secutor*; 15. *Culex (C.) nigripalpus*; 21. *Culex (Mel.) inhibitor*.

892. Kingston and St. Andrew, Kingston, Hermitage Dam Road (UR126001), 480 m; 5 Aug 67, BkP. Epiphytic bromeliad (*Hohenbergia*), growing on bank in forest. 49. *Aedes (H.) grabhami*.

893. Kingston and St. Andrew, Kingston, Hermitage Dam Road, first culvert down from dam gate (UR126001), 480 m; 8 Aug 67, BkP. Rockhole in stream in forest; water semipermanent, clear, fresh, slow current; mud, rock, dead leaves bottom; partial shade. 5. *Anopheles (A.) grabhamii*; 14. *Culex (C.) secutor*; 15. *Culex (C.) nigripalpus*; 21. *Culex (Mel.) inhibitor*.

894. Kingston and St. Andrew, Kingston, Hermitage Dam Road, first culvert down from dam gate (UR126001), 480 m; 8 Aug 67, BkP. Adults resting on rocks overhanging pool (893); 1030 hrs. 21. *Culex (Mel.) inhibitor*.

895. Kingston and St. Andrew, Kingston, Hermitage Dam Road, first culvert down from dam gate (UR126001), 480 m; 8 Aug 67, BkP. Rockhole in stream, 3 ft above 893, in forest; water semipermanent, clear, fresh, slow current; mud, rock, dead leaves bottom; partial shade. 21. *Culex (Mel.) inhibitor*.

896. Kingston and St. Andrew, Ferry, about 1 mi along Red Hills Road from Spanish Town Road, on river side of road (UQ010946), 10 m; 8 Aug 67, BkP. Large ground pool in cleared river bank; water clear, fresh; vegetation abundant, grassy, flottage; mud, dead leaves bottom; full sun. 1. *Anopheles (Nys.) albimanus*; 15. *Culex (C.) nigripalpus*; 39. *Aedes (O.) taeniorhynchus*; 40. *Aedes (O.) sollicitans*; 42. *Aedes (O.) hemisurus*; 43. *Aedes (O.) tortilis*.

897. No collection.

898. Kingston and St. Andrew, Ferry, about 1 mi along Red Hills Road from Spanish Town Road, by river side (UQ010946), 10 m; 8 Aug 67, BkP. Large ground pool (896) in cleared river bank, egg rafts; water temporary, clear, fresh; vegetation abundant, grassy; mud, dead leaves bottom; full sun. 10. *Culex (C.) bahamensis*; 17. *Culex (Mel.) atratus*.

899. Kingston and St. Andrew, Ferry, about 1 mi along Red Hills Road from Spanish Town Road, N bank of river (UQ010946), 10 m; 8 Aug 67, BkP. Stream margin in river bank; water permanent, clear, fresh, slow current; vegetation abundant, grassy, herbaceous; mud bottom; full sun. 17. *Culex (Mel.) atratus*.

900. Kingston and St. Andrew, U.W.I., Mona Reservoir (UQ143913), 200 m; 20 Sept 67, P. Reservoir, domestic; water permanent, clear, fresh; rock bottom; full sun. 67. *Sayomyia lanei*.

901. Westmoreland, Leamington, New Roads (SR894134), 28 Oct 67, F. Epiphytic bromeliad. 50. *Aedes (H.) inaequalis*.

902. Clarendon, Spaldings, Balcarres (TR427056), 915 m; 7 Nov 67, F. Tree-hole. 46. *Aedes (F.) mediiovittatus*.

902A. Clarendon, Spaldings, Balcarres (TR427056), 915 m; 7 Nov 67, F. Leaf axil, epiphytic bromeliad. 47. *Aedes (H.) walkeri*; 49. *Aedes (H.) grabhami*.

903. Kingston and St. Andrew, Ferry, about 1 mi along Red Hills Road from Spanish Town Road where track goes N (UQ010946), 10 m; 19 Sept 67, F. Large crabhole. 9. *Deinocerites cancer*.

904–910. No collections.

911. Kingston and St. Andrew, Gordon Town (UQ183949), 360 m; 2 Aug 68, H(802). Seepage in rain forest. 5. *Anopheles (A.) grabhamii*.

912. Kingston and St. Andrew, Palisadoes, Gunboat Beach (UQ133847), sea level; 3 Aug 68, H(803). Adults biting man, adjacent to mangrove; 2000–2100 hrs. 39. *Aedes (O.) taeniorhynchus*.

913. St. Catherine, Bog Walk, 3 mi S of town along Rio Cobre (TQ847990), 90 m; 4 Aug 68, H(804). Adults biting man in forest. 36. *Psorophora (G.) jamaicensis*; 42. *Aedes (O.) hemisurus*; 43. *Aedes (O.) tortilis*; 46. *Aedes (F.) mediovittatus*; 47. *Aedes (H.) walkeri*.

914. St. Catherine, Bog Walk, Rio Cobre Valley (TQ897990), 100 m; 5 Aug 68, H(805). Adults biting man in forest. 15. *Culex (C.) nigripalpus*; 27. *Mansonia (M.) titillans*; 42. *Aedes (O.) hemisurus*; 43. *Aedes (O.) tortilis*; 45. *Aedes (O.) calumnior*; 46. *Aedes (O.) mediovittatus*; 47. *Aedes (H.) walkeri*; 50. *Aedes (H.) inaequalis*; 51. *Aedes (H.) stenei*.

915. Portland, Manchioneal, 2 mi S of town (UQ650920), 3 m; 6 Aug 68, H(806). Dried fallen banana leaf in banana plantation. 11. *Culex (C.) corniger*.

916. Portland, Port Antonio, Blue Hole (UR534094), sea level; 7 Aug 68, H(1-807). Hole in fallen tree. 50. *Aedes (H.) inaequalis*; 52. *Aedes (S.) aegypti*.

917. Portland, Port Antonio, Blue Hole (UR534094), sea level; 7 Aug 68, H(2-807). Treehole. 50. *Aedes (H.) inaequalis*.

918. Portland, Port Antonio, Blue Hole (UR534094), sea level; 7 Aug 68, H(3-807). Adult biting near shore in woods. 33. *Psorophora (J.) ferox*.

919. Portland, Long Bay, Devils Elbow, 2½ mi S of Long Bay (UQ628989), 40 m; 7 Aug 68, H(4-807). *Colocasia axils*. 55. *Wyeomyia (W.) mitchellii*.

920. Portland, Long Bay, Devils Elbow, 2½ mi S of Long Bay (UQ628989), 40 m; 7 Aug 68, H(5-807). Adults biting man, vicinity of 919; 1500–1730 hrs. 52. *Aedes (S.) aegypti*; 54. *Wyeomyia (W.) nigritubus*; 55. *Wyeomyia (W.) mitchellii*; ? 62. *Wyeomyia (W.) hirsuta*.

921. Portland, Port Antonio, Rio Grande River (UR425089), 15 m; 8 Aug 68, H(808). Ground pool in dried stream bed, about 1½ hrs down river from raft departure point. 5. *Anopheles (A.) grabhamii*; 21. *Culex (Mel.) inhibitor*; 33. *Psorophora (J.) ferox*.

922. Portland, Port Antonio, bamboo grove near Bonnie View Hotel (UR461096), 125 m; 9 Aug 68, H(1-809). Adult biting man. 55. *Wyeomyia (W.) mitchellii*.

923. Portland, Port Antonio, bamboo grove near Bonnie View Hotel (UR461096), 125 m; 9 Aug 68, H(2-809). Bamboo, uncut internode. 54. *Wyeomyia (W.) nigritubus*.

924. Portland, Port Antonio, bamboo grove near Bonnie View Hotel (UR461096), 125 m; 9 Aug 68, H(3-809). Bamboo stumps, cut or broken. 50. *Aedes (H.) inaequalis*; 52. *Aedes (S.) aegypti*; 54. *Wyeomyia (W.) nigritubus*; 66. *Toxorhynchites (L.) portoricensis*.

925. Portland, Port Antonio, near Bonnie View Hotel (UR461096), 80 m; 9 Aug 68, H(4-809). Adults biting man in shade of bromeliad-laden tree. 47. *Aedes (H.) walkeri*; 50. *Aedes (H.) inaequalis*; 51. *Aedes (H.) stenei*.

926. Portland, Port Antonio, Bonnie View Hotel (UR461096), 80 m; 10 Aug 68, H(1-810). Adult biting in hotel room. 52. *Aedes (S.) aegypti*.

927. St. Mary, Port Maria, 2 mi W of town near Tropic Winds Motel (UR000350), 10 Aug 68, H(2-810). Adults biting man at edge of forest near coast; 0930-1000 hrs. 37. *Psorophora (G.) insularia*.
928. St. Mary, Port Maria, Tropic Winds Motel (UR000350), 11 Aug 68, H(1-811). Adults resting in motel room. 52. *Aedes (S.) aegypti*.
929. St. Mary, Port Maria, Tropic Winds Motel (UR000350), 11 Aug 68, H(2-811). Adults biting, 0100 hrs.
930. St. Ann, Ocho Rios, Fern Gully (TR788335), 210 m; 12 Aug 68, H(1-812). Adults biting in the open on footpath up the side of fern gully. 47. *Aedes (H.) walkeri*; 50. *Aedes (H.) inaequalis*; 51. *Aedes (H.) stenei*; 65. *Limatus hoffmani*.
931. St. Ann, Ocho Rios, Fern Gully (TR788335), 210 m; 12 Aug 68, H(2-812). Terrestrial bromeliad, off footpath, up side of fern gully. 47. *Aedes (H.) walkeri*; 62. *Wyeomyia (W.) hirsuta*.
932. St. Ann, Ocho Rios, Fern Gully (TR788335), 210 m; 13 Aug 68, H(1-813). Epiphytic bromeliad.
933. St. Ann, Ocho Rios, Shaw Park gardens (TR765355), 3 m; 13 Aug 68, H(2-813). *Colocasia axils*. 55. *Wyeomyia (W.) mitchellii*.
934. Hanover, Lucea, about 5 mi S of Lucea; 15 Aug 68, H(1-815). Bamboo stump, cut or broken.
935. Westmoreland (Hanover border), 2 mi N of Negril (QL814270), sea level; 15 Aug 68, H(2-815). Adults biting on beach; 1900-dusk. 1. *Anopheles (Nys.) albimanus*.
936. Hanover, Lucea, Mosquito Cove, 4 mi E of Lucea (RL055415), sea level; 16 Aug 68, H(1-816). Rockhole, coral, seaside; water fresh; algae. 10. *Culex (C.) bahamensis*; 15. *Culex (C.) nigripalpus*; 37. *Psorophora (G.) insularia*.
937. Hanover, Lucea, Mosquito Cove (RL055415), sea level; 16 Aug 68, H(2-816). Adult biting at side of larval collection 936. 52. *Aedes (S.) aegypti*.
938. Manchester, Mandeville (TQ345965), 600 m; 17 Aug 68, H(1-817). Adult biting at dusk in open.
939. Manchester, Mandeville, Mandeville Hotel (TQ345965), 600 m; 17 Aug 68, H(2-817). Adult biting in hotel room.
940. Manchester, Mandeville (TQ345965), 600 m; 18 Aug 68, H(1-818). Epiphytic bromeliad. 47. *Aedes (H.) walkeri*.
941. Manchester, Mandeville (TQ345965), 600 m; 18 Aug 68, H(2-818). Adults biting in woods, dusk. 47. *Aedes (H.) walkeri*.
942. Kingston and St. Andrew, Kingston, Hope Botanical Gardens (UQ152932), 180 m; 19 Aug 68, H(1-819). Terrestrial bromeliad. 55. *Wyeomyia (W.) mitchellii*.
943. Kingston and St. Andrew, Kingston, Hope Botanical Gardens (UQ152932), 180 m; 19 Aug 68, H(2-819). Epiphytic bromeliad.
944. Kingston and St. Andrew, Kingston, Hope Botanical Gardens (UQ152932), 180 m; 19 Aug 68, H(3-819). Flower bract, *Heliconia* sp. 11. *Culex (C.) corniger*.
945. Kingston and St. Andrew, Kingston, Hope Botanical Gardens (UQ152932), 180 m; 19 Aug 68, H(4-819). *Colocasia axil*. 55. *Wyeomyia (W.) mitchellii*.
946. Kingston and St. Andrew, Kingston, Hope Botanical Gardens (UQ152932), 180 m; 19 Aug 68, H(5-819). Adults biting in palm garden. 55. *Wyeomyia (W.) mitchellii*.
947. Kingston and St. Andrew, Gordon Town (UQ183949), 360 m; 20 Aug 68, H(820). Stream pool in forest. 5. *Anopheles (A.) grabhamii*.
948. Kingston and St. Andrew, Rockfort, off Windward Road (UQ156874), 2 m; 21 Aug 68, H(1-821). Adults biting in wooded area in scrub forest; 1500-1800 hrs.

9. *Deinocerites cancer*; 53. *Haemagogus equinus*.

949. Kingston and St. Andrew, Kingston, near Rockfort, off Windward Road (UQ156874), 2 m; 21 Aug 68, H(2-821). Adults resting in crabholes in scrub forest.

9. *Deinocerites cancer*; 13. *Culex (C.) janitor*; 46. *Aedes (F.) mediovittatus*.

950. Kingston and St. Andrew, Kingston, near Rockfort, off Windward Road (UQ156874), 2 m; 21 Aug 68, H(3-821). Flooded crabhole in scrub forest. 9. *Deinocerites cancer*.

951. Kingston and St. Andrew, Kingston, near Rockfort, off Windward Road (UQ156874), 2 m; 21 Aug 68, H(4-821). Treehole in scrub forest. 53. *Haemagogus equinus*.

952. Kingston and St. Andrew, Kingston, above Rockfort (UQ156874), 30 m; 22 Aug 68, H(1-822). Adults biting in woods; 1500-1800 hrs. 46. *Aedes (F.) mediovittatus*; 50. *Aedes (H.) inaequalis*; 51. *Aedes (H.) stenei*; 52. *Aedes (S.) aegypti*; 53. *Haemagogus equinus*.

953. Kingston and St. Andrew, Kingston, Rockfort (UQ160872), 2 m; 22 Aug 68, H(2-822). Adults biting by crabhole; 1900-dusk. 9. *Deinocerites cancer*; 45. *Aedes (O.) calumnior*.

954. St. Mary, Annotto Bay, Wag Water River, 5 mi N of Castleton, off A3 Road (UR073133), 150 m; 23 Aug 68, H(1-823). Stream margin in forest. 5. *Anopheles (A.) grabhamii*.

955. St. Mary, Annotto Bay, Wag Water River, 5 mi N of Castleton (UR073133), 150 m; 23 Aug 68, H(2-823). Rockhole in boulder about 10 ft above stream bed. 52. *Aedes (S.) aegypti*.

956. St. Mary, Annotto Bay, Wag Water River, 5 mi N of Castleton on A3 Road (UR073133), 150 m; 23 Aug 68, H(3-823). Adult biting in woods along bank, in afternoon. 65. *Limatus hoffmani*.

957. Kingston and St. Andrew, Kingston, Rockfort (UQ160872), 2 m; 24 Aug 68, H(1-824). Adults biting in woods in scrub forest. 50. *Aedes (H.) inaequalis*; 51. *Aedes (H.) stenei*; 53. *Haemagogus equinus*.

958. Kingston and St. Andrew, Kingston, above Rockfort (UQ160872), 30 m; 24 Aug 68, H(2-824). Treehole in woods. 53. *Haemagogus equinus*.

959. Kingston and St. Andrew, Kingston, Rockfort (UQ160872), 2 m; 25 Aug 68, H(1-825). Adults biting in woods. 52. *Aedes (S.) aegypti*; 53. *Haemagogus equinus*.

960. Kingston and St. Andrew, Kingston, Rockfort (UQ160872), 2 m; 25 Aug 68, H(2-825). Adults resting in crabhole.

961. Kingston and St. Andrew, Kingston, Rockfort (UQ160872), 2 m; 25 Aug 68, H(3-825). Crabhole in scrub forest. 9. *Deinocerites cancer*.

962. Kingston and St. Andrew, Newstead, below Windward Falls (UQ206870), 100 m; 25 Aug 68, H(4-825). Stream margin. 1. *Anopheles (Nys.) albimanus*; 5. *Anopheles (A.) grabhamii*.

REFERENCES CITED

- Aitken, Thomas H.G.
1940. The genus *Psorophora* in California (Diptera, Culicidae). *Rev. Entomol.* 11: 672-682.
- Barr, A. Ralph and S. Barr
1969. Mosquito Studies (Diptera, Culicidae). XIII. Pupae of the genus *Psorophora* in North America and Puerto Rico. *Amer. Entomol. Inst., Contrib.* 4(4): 1-20.
- Barretto, M. Pereira and J.O. Coutinho
1944. Sobre o genero *Taeniorhynchus* Arribalzaga, 1891, com a descricao de tres novas especies do subgenero *Taeniorhynchus* (Diptera, Culicidae). *Arq. Hig. Saude Publica, Sao Paulo* 9:53-85.
- Belkin, John N.
1962. The mosquitoes of the South Pacific (Diptera, Culicidae). Berkeley, Univ. Calif. Press. 2 vol.
1968a. Mosquito Studies (Diptera, Culicidae). VII. The Culicidae of New Zealand. *Amer. Entomol. Inst., Contrib.* 3(1). 182 p.
1968b. Mosquito Studies (Diptera, Culicidae). IX. The type specimens of New World mosquitoes in European museums. *Amer. Entomol. Inst., Contrib.* 3(4). 69 p.
1969a. The problem of the identity of the species of *Culex* (*Melanoconion*) related to *opisthopus*. *Mosquito Syst. Newslett.* 1(2):26-28.
1969b. *Culex* (*Melanoconion*) *annulipes* invalid. *Mosquito Syst. Newslett.* 1:68.
1970a. Corrected type localities for *Wyeomyia abia* D. & K., 1908 and *W. fratercula* D. & K., 1906. *Mosquito Syst. Newslett.* 2:57-58.
1970b. *Culex* (*Melanoconion*) *aikenii* (A. & R., 1906) a *nomen dubium*; *ocossa* D. & K., 1919 and *panocossa* Dyar, 1923 both valid. *Mosquito Syst. Newslett.* 2:59-60.
- Belkin, John N. and C.L. Hogue
1959. A review of the crabhole mosquitoes of the genus *Deinocerites* (Diptera, Culicidae). *Univ. Calif., Publications Entomol.* 14:411-458.
- Belkin, John N., C.L. Hogue, P. Galindo, T.H.G. Aitken, R.X. Schick and W.A. Powder
1965. Mosquito Studies (Diptera, Culicidae). II. Methods for the collection, rearing and preservation of mosquitoes. *Amer. Entomol. Inst., Contrib.* 1(2):19-78.
1967. Estudios para mosquitos (Diptera, Culicidae). IIa. Metodos para coleccionar, criar y preservar mosquitos. *Amer. Entomol. Inst., Contrib.* 1(2a): 21-89.
- Belkin, John N. and W.A. McDonald
1955. A population of *Corethrella laneana* from Death Valley, with descriptions of all stages and discussion of the Corethrellini (Diptera, Culicidae). *Southern Calif. Acad. Sci., Bull.* 54:82-96.
- Belkin, John N., R.X. Schick, P. Galindo and T.H.G. Aitken
1965. Mosquito Studies (Diptera, Culicidae). I. A project for a systematic study of the mosquitoes of Middle America. *Amer. Entomol. Inst., Contrib.* 1(2): 1-17.
1967. Estudios sobre mosquitos (Diptera, Culicidae). Ia. Un proyecto para un estudio sistematico de los mosquitos de Meso-America. *Amer. Entomol. Inst., Contrib.* 1(2a):1-19.

Belkin, John N., R.X. Schick and S.J. Heinemann

1965. Mosquito Studies (Diptera, Culicidae). V. Mosquitoes originally described from Middle America. Amer. Entomol. Inst., Contrib. 1(5). 95 p.

1966. Mosquito Studies (Diptera, Culicidae). VI. Mosquitoes originally described from North America. Amer. Entomol. Inst., Contrib. 1(6). 39 p.

Belle, Edward A., L.S. Grant and W.A. Page

1964. The isolation of St. Louis Encephalitis Virus from *Culex nigripalpus* mosquitoes in Jamaica. Amer. J. Trop. Med. Hyg. 13:452-454.

Berlin, O. George W.

1969. Mosquito Studies (Diptera, Culicidae). XII. A revision of the Neotropical subgenus *Howardina* of *Aedes*. Amer. Entomol. Inst., Contrib. 4(2). 190 p.

1970. Mosquito Studies (Diptera, Culicidae). XVIII. The subgenus *Micraedes* of *Culex*. Amer. Entomol. Inst., Contrib. 5(1):21-63.

Blanchard, Raphael

1905. Les moustiques. Histoire naturelle et medicale. Paris, de Rudeval. 673 p.

Bonne, Cornelis and J. Bonne-Wepster

1925. Mosquitoes of Surinam. Koninkl. Inst. Trop., Mededeel. 21. 558 p.

Bonne-Wepster, Jean and C. Bonne

1921. Notes on South American mosquitoes in the British Museum (Diptera, Culicidae). Insecutor Inscitiae Mens. 9:1-26. 27 Jan.

Boyd, Mark F. and F.W. Aris

1929. A malaria survey of the island of Jamaica, B.W.I. Amer. J. Trop. Med. 9: 309-399.

Bram, Ralph A.

1967. Classification of *Culex* subgenus *Culex* in the New World (Diptera: Culicidae). U.S. Nat. Mus., Proc. 120:1-122.

Brujning, C.F.A.

1959. Notes on *Wyeomyia* mosquitoes of Suriname, with a description of *Wyeomyia surinamensis* sp. n. Stud. Fauna Suriname Other Guyanas 8:99-146.

Buren, William F.

1946. *Psorophora pygmaea* (Theobald), an exotic mosquito now established in Florida. Mosquito News 6:185.

Carley, Paul S.

1931. Results of the dissection of 1,017 wild-caught anophelines in Jamaica. Amer. J. Trop. Med. 11:293-296.

Carpenter, Stanley J. and W.J. LaCasse

1955. Mosquitoes of North America (north of Mexico). Berkeley, Univ. Calif. Press. 360 p.

Carpenter, Stanley J., W.W. Middlekauff and R.W. Chamberlain

1946. The mosquitoes of the Southern United States east of Oklahoma and Texas. Amer. Midland Natur. Monogr. 3. 292 p.

Carr, H.P. and R.B. Hill

1942. A malaria survey of Cuba. Amer. J. Trop. Med. 22:587-607.

Castro, Manuel and M. Bressanello

1952. Revision de las especies de "Taeniorhynchus (Rhynchotaenia)" (Dipt. Cul.). Rev. Brasil. Biol. 12:229-246.

Christophers, S. Rickard

1960. *Aedes aegypti* (L.), the yellow fever mosquito. Its life history, bionomics, and structure. Cambridge Univ. Press. 739 p.

Cook, Edwin F.

1956. The Nearctic Chaoborinae (Diptera, Culicidae). Minn. Univ. Agr. Exp.

Sta., Tech. Bull. 218. 102 p. Mar.

1965. Family Chaoboridae in A catalogue of the Diptera of America north of Mexico. U.S. Dep. Agr., Agr. Handbook 276:102-105. Aug.

Coquillett, Daniel W.

1903. Four new species of *Culex*. Can. Entomol. 35:255-257.

1904. New North American Diptera. Entomol. Soc. Wash., Proc. 6:166-192.

1906a. New Culicidae from the West Indies and Central America. Entomol. Soc. Wash., Proc. 7:182-186.

1906b. A classification of the mosquitoes of North and Middle America. U.S. Bur. Entomol., Tech. Ser. 11. 31 p.

1906c. Five new Culicidae from the West Indies. Can. Entomol. 38:60-62.

Dyar, Harrison G.

1905a. A synoptic table of North American mosquito larvae. N.Y. Entomol. Soc., J. 13:22-26.

1905b. Remarks on genitalic genera in the Culicidae. Entomol. Soc. Wash., Proc. 7:42-49.

1906. Illustration of mosquito larvae. Entomol. Soc. Wash., Proc. 8:15-21.

1918a. A second note on the species of *Culex* of the Bahamas (Diptera, Culicidae). Insecutor Inscitiae Mens. 5:183-187. 29 Jan.

1918b. The male genitalia of *Aedes* as indicative of natural affinities (Diptera, Culicidae). Insecutor Inscitiae Mens. 6:71-86. 10 Apr.

1918c. A revision of the American species of *Culex* on the male genitalia (Diptera, Culicidae). Insecutor Inscitiae Mens. 6:86-111. 10 Apr.

1918d. A note on the American species of *Mansonia* (Diptera, Culicidae). Insecutor Inscitiae Mens. 6:112-115. 10 Apr.

1919. A revision of the American Sabethini of the *Sabethes* group by the male genitalia (Diptera, Culicidae). Insecutor Inscitiae Mens. 7:114-112. 17 Nov.

1920a. A second *Culex* of the subgenus *Transculicia* Dyar (Diptera, Culicidae). Insecutor Inscitiae Mens. 8:27-29. 27 Feb.

1920b. The earliest name of the yellow fever mosquito (Diptera, Culicidae). Insecutor Inscitiae Mens. 8:204. 15 Dec.

1921a. Comment on the preceding paper (Diptera, Culicidae). Insecutor Inscitiae Mens. 9:26-31. 27 Jan.

1921b. The genus *Haemagogus* Williston (Diptera, Culicidae). Insecutor Inscitiae Mens. 9:101-114. 3 Oct.

1921c. Illustrations of certain mosquitoes (Diptera, Culicidae). Insecutor Inscitiae Mens. 9:114-118. 3 Oct.

1922a. The mosquitoes of the United States. U.S. Nat. Mus., Proc. 62:1-119.

1922b. The American *Aedes* of the *scapularis* group (Diptera, Culicidae). Insecutor Inscitiae Mens. 10:51-60. 3 Apr.

1922c. The American *Aedes* of the *serratus* group (Diptera, Culicidae). Insecutor Inscitiae Mens. 10:157-166. 28 Oct.

1923a. Notes on American *Culex* (Diptera, Culicidae). Insecutor Inscitiae Mens. 11:118-121. 5 Oct.

1923b. Mosquitoes described by von Humboldt (Diptera, Culicidae). Insecutor Inscitiae Mens. 11:121-122. 5 Oct.

1923c. The mosquitoes of Panama (Diptera, Culicidae). Insecutor Inscitiae Mens. 11:167-186. 10 Dec.

1923d. On some of the American subgenera of *Culex* (Diptera, Culicidae). Insecutor Inscitiae Mens. 11:187-190. 10 Dec.

- 1924a. Notes on the Sabethids of the West Indies (Diptera, Culicidae). *Insecutor Inscitiae Mens.* 12:104-107. 21 Aug.
- 1924b. *Phoniomyia* and *Dendromyia* Theobald (Diptera, Culicidae). *Insecutor Inscitiae Mens.* 12:107-113. 21 Aug.
- 1924c. Some new mosquitoes from Colombia – II (Diptera, Culicidae). *Insecutor Inscitiae Mens.* 12:183-186. 22 Oct.
- 1925a. Some new mosquitoes from Colombia – III (Diptera, Culicidae). *Insecutor Inscitiae Mens.* 13:21-24. 15 Apr.
- 1925b. The subgenera of *Mansonia* Blanchard (Diptera, Culicidae). *Insecutor Inscitiae Mens.* 13:40-43. 15 Apr.
- 1925c. The mosquitoes of Panama (Diptera, Culicidae). *Insecutor Inscitiae Mens.* 13:101-195. 16 Sept.
1928. The mosquitoes of the Americas. Wash., Carnegie Inst. (Publication 387). 616 p. May.
- Dyar, Harrison G. and F. Knab
- 1906a. Diagnoses of new species of mosquitoes. *Biol. Soc. Wash., Proc.* 19:133-142.
- 1906b. Notes on some American mosquitoes with descriptions of new species. *Biol. Soc. Wash., Proc.* 19:159-172.
- 1906c. The larvae of Culicidae classified as independent organisms. *N.Y. Entomol. Soc., J.* 14:169-230.
- 1906d. The species of mosquitoes in the genus *Megarhinus*. *Smithsonian Misc. Collect.* 48:241-258. 27 Sept.
1907. Descriptions of some American mosquitoes. *N.Y. Entomol. Soc., J.* 15:9-13.
1908. Descriptions of some new mosquitoes from tropical America. *U.S. Nat. Mus., Proc.* 35:53-70.
- 1909a. On the identity of *Culex pipiens* Linnaeus [Diptera, Culicidae]. *Entomol. Soc., Wash., Proc.* 11:30-39.
- 1909b. Descriptions of some new species and a new genus of American mosquitoes. *Smithsonian Misc. Collect.* 52:253-266.
1914. New mosquitoes from Peru. *Insecutor Inscitiae Mens.* 2:58-62. 24 Apr.
1918. The genus *Culex* in the United States (Diptera, Culicidae). *Insecutor Inscitiae Mens.* 5:170-183. 29 Jan.
- Dyar, Harrison G. and C.S. Ludlow
1921. Two new American mosquitoes (Diptera, Culicidae). *Insecutor Inscitiae Mens.* 9:46-50. 27 Jan.
- Dyar, Harrison G. and R.C. Shannon
- 1924a. The American species of *Uranotaenia*. *Insecutor Inscitiae Mens.* 12:187-192. 22 Oct.
- 1924b. Some new species of American *Dixa* Meigen (Diptera, Culicidae). *Insecutor Inscitiae Mens.* 12:193-201. 22 Oct.
- 1924c. The American Chaoborinae (Diptera, Culicidae). *Insecutor Inscitiae Mens.* 12:201-216. 22 Oct.
- 1924d. The subfamilies, tribes, and genera of American Culicidae. *Wash. Acad. Sci., J.* 14:472-486. 4 Dec.
1925. New mosquitoes from Brazil (Diptera, Culicidae). *Wash. Acad. Sci., J.* 15:39-41.
- Edwards, Frederick W.
1932. Diptera. Fam. Culicidae. *Genera Insectorum* 194. 258 p.

1939. A new species of *Orthopodomyia* (Diptera, Culicidae). Roy. Entomol. Soc. London, Proc. (B) 8:121-123.
- Fabricius, Johann C.
1794. Entomologia systematica emendata et aucta. Vol. 4. Hafniae. 472 p.
- Felt, Ephraim P.
1904. Mosquitoes or Culicidae of New York State. N.Y. State Mus., Bull. 79: 241-400.
- Fisk, Frank W.
1939. New mosquito records from Key West, Florida. J. Econ. Entomol. 32:469.
- Floch, Herve and E. Abonnenc
1945. Les moustiques de la Guadeloupe (II). Les genres *Megarhinus*, *Aedes*, *Culex*, *Deinocerites*, *Mansonia* et *Wyeomyia*. Inst. Pasteur Guyane Ter. Inini, Publication 110. 48 p.
- Foote, Richard H.
1952. The larval morphology and chaetotaxy of the *Culex* subgenus *Melanoconion* (Diptera, Culicidae). Entomol. Soc. Amer., Ann. 45:445-472.
1954. The larvae and pupae of the mosquitoes belonging to the *Culex* subgenera *Melanoconion* and *Mochlostyrax*. U.S. Dep. Agr., Tech. Bull. 1091. 126 p. Sept.
- Foote, Richard H. and D.R. Cook
1959. Mosquitoes of medical importance. U.S. Dep. Agr., Agr. Handbook 152. 158 p.
- Forattini, Oswaldo P.
1962. Entomologia Medica. Vol. 1. Sao Paulo, Fac. Hig. Saude Publica. 662 p.
1965a. Entomologia Medica. Vol. 2. Sao Paulo, Univ. Sao Paulo. 506 p.
1965b. Entomologia Medica. Vol. 3. Sao Paulo, Univ. Sao Paulo. 416 p.
- Galindo, Pedro
1969. Notes on the systematics of *Culex (Melanoconion) taeniopus* Dyar and Knab and related species, gathered during arbovirus investigations in Panama. Mosquito Syst. Newslett. 1:82-89.
- Galindo, Pedro, F.S. Blanton and E.L. Peyton
1954. A revision of the *Uranotaenia* of Panama with notes on other American species of the genus (Diptera, Culicidae). Entomol. Soc. Amer., Ann. 47:107-177.
- Galindo, Pedro, S.J. Carpenter and H. Trapido
1951. Descriptions of two new species of *Wyeomyia* and the male of *Sabethes tarsopus* Dyar and Knab (Diptera, Culicidae). Entomol. Soc. Wash., Proc. 53: 85-96. 12 Apr.
- Giles, George M.
1904. Notes on some collections of mosquitoes received from abroad. J. Trop. Med. 7:381-384.
- Goeldi, Emileo A.
1905. Os mosquitos no Para. Mus. Goeldi Hist. Natur. Ethnogr., Para, Mem. 4. 154 p.
- Gowdey, Carlton C.
1926. Catalogus Insectorum Jamaicae. Jamaica Dep. Agr., Entomol. Bull. 4. 114 p.
- Grabham, Michael
1905. Notes on some Jamaican Culicidae. Can. Entomol. 37:401-411.
1906a. Notes on some mosquitoes from Newcastle, Jamaica. Can. Entomol. 38: 167-173.

1906b. Four new Culicidae from Jamaica, West Indies. *Can. Entomol.* 38:311-320.

1906c. A new *Corethrella* from Jamaica. *Entomol. News* 17:343-345.

1907. Notes on some new mosquitoes from Jamaica, West Indies. *Can. Entomol.* 39:25-26.

Grayson, Margaret A., S. Srihongse and P. Galindo

1967. Isolation of St. Louis Encephalitis Virus from *Deinocerites pseudus* in Panama. *Mosquito News* 27:204.

Hair, Jakie A.

1968. Observations on two species of *Culex* of the subgenus *Melanoconion*. *Mosquito News* 28:425-429.

Hill, Rolla B. and C. McD. Hill

1945a. *Catalogus Insectorum Jamaicensis*. Supplement. A list of mosquitoes found in Jamaica. Jamaica, Dep. Agr. 3 p.

1945b. *Wyeomyia caracula* Dyar & Nunez-Tovar, a description of the larva and pupa and a redescription of the adult (Diptera, Culicidae). *Entomol. Soc. Wash., Proc.* 47:296-299. 28 Dec.

1946a. *Phoniomyia hirsuta*, a new sabethine from Jamaica (Diptera, Culicidae). *Entomol. Soc. Wash., Proc.* 48:39-41. 18 Mar.

1946b. A correction. *Entomol. Soc. Wash., Proc.* 48:236. 23 Dec.

1948. The mosquitoes of Jamaica. *Inst. Jamaica, Bull. Sci. Ser.* 4. 60 p.

Horsfall, William R.

1955. Mosquitoes. Their bionomics and relation to disease. New York, Ronald Press. 723 p.

Howard, Leland O., H.G. Dyar and F. Knab

1913a. The mosquitoes of North and Central America and the West Indies. Vol. 1. A general consideration of mosquitoes, their habits, and their relations to the human species. Wash., Carnegie Inst. Wash. (Publication 159). 520 p. 21 Jan.

1913b. The mosquitoes of North and Central America and the West Indies. Vol. 2. Plates. Wash., Carnegie Inst. Wash. (Publication 159). 150 plates. 24 Feb.

1915. The mosquitoes of North and Central America and the West Indies. Vol. 3. Systematic description (in two parts). Part I. Wash., Carnegie Inst. Wash. (Publication 159). p. 1-523. 1 Oct.

1917. The mosquitoes of North and Central America and the West Indies. Vol. 4. Systematic description (in two parts). Part II. Wash., Carnegie Inst. Wash. (Publication 159). p. 525-1064. 31 Mar.

Humboldt, F.H. Alexandre de

1819. Voyage aux regions equinoxiales du Nouveau Continent... Pt. 1. Relation historique. Vol. 2. Paris, Maze. 722 p.

International Commission on Zoological Nomenclature

1964. Opinion 711. *Culex aegypti* Linnaeus, 1762 (Insecta, Diptera): validated and interpreted under the plenary powers. *Bull. Zool. Nomencl.* 21:246-248.

Johnson, Charles W.

1894. List of the Diptera of Jamaica with descriptions of new species. *Acad. Natur. Sci. Phila., Proc.* 46:271-281.

1919. A revised list of the Diptera of Jamaica. *Amer. Mus. Natur. Hist., Bull.* 41: 421-449.

King, Willard V. and G.H. Bradley

1937. Notes on *Culex erraticus* and related species in the United States (Diptera, Culicidae). *Entomol. Soc. Amer., Ann.* 30:345-357.

- 1941a. General morphology of *Anopheles* and classification of the Nearctic species. Amer. Ass. Advance. Sci. Symp. Hum. Malaria, p. 63-70 (Publication 15).
- 1941b. Distribution of the Nearctic species of *Anopheles*. Amer. Ass. Advance. Sci. Symp. Hum. Malaria, p. 71-78 (Publication 15).
- King, Willard V., G.H. Bradley and T.E. McNeel
1939. The mosquitoes of the Southeastern States. U.S. Dep. Agr., Misc. Publication 336. 91 p. June.
1944. The mosquitoes of the Southeastern States. Rev. ed. U.S. Dep. Agr., Misc. Publication 336. 96 p. Feb.
- Komp, William H.W.
1926. A new *Culex* from Honduras. Insecutor Inscitiae Mens. 14:44-45. 11 Mar.
1935. Notes on the validity of the types of the species in the subgenera *Mochlostyrax* and *Melanoconion* in the U.S. National Museum (Diptera, Culicidae). Entomol. Soc. Wash., Proc. 37:1-11.
1941. The classification and identification of the *Anopheles* mosquitoes of Mexico, Central America and the West Indies. Amer. Ass. Advance. Sci. Symp. Hum. Malaria, p. 88-97 (Publication 15).
1942. The anopheline mosquitoes of the Caribbean Region. Nat. Inst. Health, Bull. 179. 195 p.
1949. *Aedes (Ochlerotatus) nubilus* Theobald, 1903 a synonym of *Aedes (Ochlerotatus) serratus* Theobald, 1901 (Diptera, Culicidae). Entomol. Soc. Wash., Proc. 51:105-114.
- Kumm, Henry W.
1929. The geographical distribution of the malaria carrying mosquitoes. Amer. J. Hyg. Monogr. Ser. 10. 178 p.
- Lane, John
1939. Catalogo dos mosquitos neotropicos. Bol. Biol. Ser. Monogr. 1. 218 p.
1942. Dixinae e Chaoborinae. Revisao das especies neotropicas (Diptera, Culicidae). Rev. Entomol. 13:81-149.
1951. Synonymy of Neotropical Culicidae (Diptera). Entomol. Soc. Wash., Proc. 53:333-336.
1953. Neotropical Culicidae. Sao Paulo, Univ. Sao Paulo. 2 vol.
- Lane, John and N.L. Cerqueira
1942. Os sabetineos da America (Diptera, Culicidae). Sao Paulo (State), Arq. Zool. 3:473-849. 19 Oct.
- Lane, John and J.O. Coutinho
1940. *Mansonia* subg. *Rhynchotaenia*: Descricao de duas especies novas dados sobre o subgenero (Dipt. Culicidae). Rev. Entomol. 11:589-597.
- Levi-Castillo, Roberto
1951. Los mosquitos del genero *Haemagogus*, Williston 1896 en America del Sur. Cuenca, Ecuador, Don Bosco. 77 p.
- Lima, A. da Costa
1935. Especies de *Taeniorhynchus (Taeniorhynchus)*, (Diptera: Culicidae). Inst. Oswaldo Cruz, Mem. 30:453-469.
- Linnaeus, Carolus
1762. Zweyter Theil, enthalt Beschreibungen verschiedener wichtiger Naturalien. In Hasselquist, F. Reise nach Palästina in den Jahren von 1749 bis 1752. Rostock. p. 267-606.
- Ludlow, Clara S.
1905. Mosquito notes – No. 4. Can. Entomol. 37:385-388.

Maldonado-Capriles, J., W.F. Pippin and M.L. Kuns

1958. An annotated check list of the mosquitoes of Mona Island, Puerto Rico, and the larva and male of *Aedes obturbator* D. & K. (Diptera, Culicidae). Entomol. Soc. Wash., Proc. 60:65-68.

Martinez Palacios, Amado

1950. Identificacion de los mosquitos mexicanos del subgenero *Culex* (Diptera, Culicidae) por la genitalia masculina. Soc. Mex. Hist. Natur., Rev. 11:183-187.

Martini, Erich

1935. Los mosquitos de Mexico. Mexico, Dep. Salubr. Publica, Bol. Tec. (A) 1. 65 p.

Matheson, Robert

1929. A handbook of the mosquitoes of North America. Springfield, Ill., Thomas. 268 p.

1944. Handbook of the mosquitoes of North America. Ed. 2. Ithaca, Comstock Publishing Co. 314 p.

Mattingly, Peter F., A. Stone and K.L. Knight

1962. *Culex aegypti* Linnaeus, 1762 (Insecta, Diptera): proposed validation and interpretation under the plenary powers of the species so named. Z. N. (S.) 1216. Bull. Zool. Nomencl. 19(4):208-219.

Montchadsky, Alexander S. and I. Garcia Avila

1966. Las larvas de los mosquitos (Diptera: Culicidae) de Cuba. Su biologia y determinacion. Poeyana (A) 28. 92 p.

Osten Sacken, Carl R.

1868. Description of a new species of Culicidae. Amer. Entomol. Soc., Trans. 2: 47-48.

Page, William A.

1967. Observations on man-biting mosquitoes in Jamaica. Roy. Entomol. Soc. London, Proc. (A) 42:180-186.

Penn, George H.

1949. Pupae of the Nearctic anopheline mosquitoes north of Mexico. Nat. Malaria Soc., J. 8:50-69.

Perez Viguera, I.

1948. Notas sobre la *Psorophora johnstonii*, *Mansonia titillans*, *Anopheles atropos* y sobre la presencia en Cuba de la *Psorophora ciliata*. Univ. Habana 73-75:293-319.

1956. Los ixodidos y culicidos de Cuba. Su historia natural y medica. La Habana. 579 p.

Porter, John E.

1967. A check list of the mosquitoes of the Greater Antilles and the Bahama and Virgin Islands. Mosquito News 27:35-41.

Pratt, Harry D.

1945. *Mansonia indubitans* Dyar and Shannon — A new mosquito addition to the United States fauna. Kans. Entomol. Soc., J. 18:121-129.

1946. The larva of *Psorophora (Janthinosoma) coffini* Dyar and Knab and a key to the *Psorophora* larvae of the United States and the Greater Antilles (Diptera, Culicidae). Entomol. Soc. Wash., Proc. 48:209-214.

1947. The genus *Uranotaenia* Lynch Arribalzaga in Puerto Rico. Entomol. Soc. Amer., Ann. 39:576-584. 23 Jan.

1953. Notes on American *Mansonia* mosquitoes. Entomol. Soc. Wash., Proc. 55: 9-19. 16 Feb.

- Pratt, Harry D. and E.L. Seabrook
1952. The occurrence of *Culex iolambdis* Dyar in Florida and Puerto Rico, with a description of the larva (Diptera, Culicidae). Entomol. Soc. Wash., Proc. 54: 27-32. 15 Feb.
- Pratt, Harry D., W.W. Wirth and D.G. Denning
1945. The occurrence of *Culex opisthopus* Komp in Puerto Rico and Florida with a description of the larva (Diptera, Culicidae). Entomol. Soc. Wash., Proc. 47:245-251. 22 Nov.
- Pritchard, A. Earl, E.L. Seabrook and J.A. Mulrennan
1947. The mosquitoes of the Florida Keys. Florida Entomol. 30:8-15.
- Prout, W.T.
1909. Report of the twenty-first expedition of the Liverpool School of Tropical Medicine. Jamaica, 1908-1909. Section II. Malaria. Ann. Trop. Med. Parasitol. 3:471-552.
- von Röder, Victor
1885. Dipteren von der insel Portorico. Stettiner Entomol. Zeitung 46:337-349.
- Ronderos, Ricardo A. and A.O. Bachmann
1963a. A proposito del complejo *Mansonia* (Diptera – Culicidae). Soc. Entomol. Argent., Rev. 25:43-51.
1963b. Mansoniini Neotropicales. I (Diptera, Culicidae). Soc. Entomol. Argent., Rev. 26:57-65.
1964. Mansoniini Neotropicales II (Diptera, Culicidae). Buenos Aires (Prov.), Com. Invest. Cient., Notas 2(6). 8 p.
- Root, Francis M.
1927. Note on the mosquito fauna of the Republic of Haiti. Amer. J. Hyg. 7: 463-469.
1937. A new species of *Uranotaenia* (Diptera, Culicidae) from Haiti. J. Parasitol. 23:98-100.
- Ross, Edward S. and H.R. Roberts
1943. Mosquito atlas. Part I. Phila., Amer. Entomol. Soc. 44 p.
- Rozeboom, Lloyd E.
1941. Distribution and ecology of the anopheline mosquitoes of the Caribbean region. Amer. Ass. Advance. Sci. Symp. Hum. Malaria, p. 98-107 (Publication 15).
- Rozeboom, Lloyd E. and W.H.W. Komp
1950. A review of the species of *Culex* of the subgenus *Melanoconion* (Diptera, Culicidae). Entomol. Soc. Amer., Ann. 43:75-114.
- Russell, Paul F., L.E. Rozeboom and A. Stone
1943. Keys to the anopheline mosquitoes of the world. Phila., Amer. Entomol. Soc. 152 p.
- Say, Thomas
1823. Descriptions of the dipterous insects of the United States. Acad. Natur. Sci. Phila., J. 3:9-54.
- Seabrook, E.L. and T.E. Duffey
1946. The occurrence of *Megarhinus rutilus* Coq. in S.E. Florida. Mosquito News 6:193-194.
- Senevet, Georges
1938. Les moustiques de la Guadeloupe (Mission 1936). Inst. Pasteur Algerie, Arch. 16:176-190.
- Shannon, Raymond C.
1931. On the classification of Brazilian Culicidae with special reference to those

- capable of harboring the yellow fever virus. Entomol. Soc. Wash., Proc. 33: 125-164.
1934. The genus *Mansonia* (Culicidae) in the Amazon Valley. Entomol. Soc. Wash., Proc. 36:99-110.
- Simmons, James S.
1941. The transmission of malaria by the *Anopheles* mosquitoes of North America. Amer. Ass. Advance. Sci. Symp. Hum. Malaria, p. 113-130 (Publication 15).
- Simmons, James S. and T.H.G. Aitken
1942. The anopheline mosquitoes of the northern half of the Western Hemisphere and the Philippine Islands. Army Med. Bull. 59. 213 p.
- Souza, M.A. and A.S. Guedes
1962. Sobre *Psorophora (Janthinosoma) fiebrigi* Edwards, 1922 (Diptera – Culicidae). Rev. Brasil. Malariol. Doencas Trop. 14:249-253.
- Stone, Alan
1953. The halteres of *Anopheles walkeri* Theobald. Mosquito News 13:209-210.
1957. Corrections in the taxonomy and nomenclature of mosquitoes (Diptera, Culicidae). Entomol. Soc. Wash., Proc. 58:333-344.
1961. A synoptic catalog of the mosquitoes of the world, supplement I. (Diptera: Culicidae). Entomol. Soc. Wash., Proc. 63:29-52.
1963. A synoptic catalog of the mosquitoes of the world, supplement II. (Diptera: Culicidae). Entomol. Soc. Wash., Proc. 65:117-140.
1965. Family Culicidae in A catalogue of the Diptera of America north of Mexico. U.S. Dep. Agr., Agr. Handbook 276:105-120. Aug.
1966. A catalogue of the Diptera of the Americas south of the United States. 11. Family Chaoboridae. Sao Paulo, Secretar. Agr., Dep. Zool. 8 p.
1967. A synoptic catalog of the mosquitoes of the world, supplement III. (Diptera: Culicidae). Entomol. Soc. Wash., Proc. 69:197-224.
1969. Bredin-Archbold-Smithsonian biological survey of Dominica: The mosquitoes of Dominica (Diptera: Culicidae). Smithsonian Contrib. Zool. 16. 8 p.
- Stone, Alan and J.A. Hair
1968. A new *Culex (Melanoconion)* from Florida (Diptera, Culicidae). Mosquito News 28:39-41.
- Stone, Alan and K.L. Knight
1955. Type specimens of mosquitoes in the United States National Museum: I, The genera *Armigeres*, *Psorophora* and *Haemagogus* (Diptera, Culicidae). Wash. Acad. Sci., J. 45:282-289.
- 1956a. Type specimens of mosquitoes in the United States National Museum: II, The genus *Aedes* (Diptera, Culicidae). Wash., Acad. Sci., J. 46:213-228.
- 1956b. Type specimens of mosquitoes in the United States National Museum: III, The genera *Anopheles* and *Chagasia* (Diptera, Culicidae). Wash. Acad. Sci., J. 46:276-280.
- 1957a. Type specimens of mosquitoes in the United States National Museum: IV, The genus *Culex* (Diptera, Culicidae). Wash. Acad. Sci., J. 47:42-59.
- 1957b. Type specimens of mosquitoes in the United States National Museum, V: The Sabethini (Diptera, Culicidae). Wash. Acad. Sci., J. 47:117-126.
- 1957c. Type specimens of mosquitoes in the United States National Museum: VI, Miscellaneous genera, addenda, and summary. Wash. Acad. Sci., J. 47:196-202.
- Stone, Alan, K.L. Knight and H. Starcke
1959. A synoptic catalog of the mosquitoes of the world (Diptera, Culicidae).

- Wash., Entomol. Soc. Amer. (Thomas Say Found., vol. 6). 358 p.
- Taylor, Richard M.
1967. Catalogue of arthropod-borne viruses of the world. Bethesda, Public Health Serv. (Publication 1760). 898 p.
- Theobald, Frederick V.
1901a. A monograph of the Culicidae or mosquitoes. Vol. 1. London, Brit. Mus. Natur. Hist. 424 p.
1901b. A monograph of the Culicidae or mosquitoes. Vol. 2. London, Brit. Mus. Natur. Hist. 391 p.
1903a. A monograph of the Culicidae or mosquitoes. Vol. 3. London, Brit. Mus. Natur. Hist. 359 p.
1903b. Two new Jamaican Culicidae. Entomologist 36:281-283.
1903c. Notes on Culicidae and their larvae from Pecos, New Mexico, and description of a new *Grabhamia*. Can. Entomol. 35:311-316.
1905a. The mosquitoes or Culicidae of Jamaica. Kingston, Inst. Jamaica. 40 p.
1905b. Diptera. Fam. Culicidae. Genera Insectorum 26. 50 p.
1905c. [*Culex microsquamosus*, n.sp.] in Grabham, M. Notes on some Jamaican Culicidae. Can. Entomol. 37:407-410.
1907. A monograph of the Culicidae or mosquitoes. Vol. 4. London, Brit. Mus. Natur. Hist. 639 p.
1910. A monograph of the Culicidae or mosquitoes. Vol. 5. London, Brit. Mus. Natur. Hist. 646 p.
- Thompson, George A.
1947. A list of the mosquitoes of Jamaica, British West Indies. Mosquito News 7: 78-80.
1956. *Aedes stenei*, a new species of mosquito from Jamaica, B.W.I., with re-description of a closely related species (Diptera, Culicidae). Mosquito News 16:196-200.
- Thurman, Ernestine B., J.S. Haeger and J.A. Mulrennan
1951. The taxonomy and biology of *Psorophora (Janthinosoma) johnstonii* (Grabham, 1905), (Diptera, Culicidae). Entomol. Soc. Amer., Ann. 44:144-157.
- Trapido, Harold and P. Galindo
1956. Genus *Haemagogus* in the United States. Science 123:634.
- Tulloch, George S.
1937. The mosquitoes of Puerto Rico. Puerto Rico Univ., J. Agr. 21:137-167.
- Vargas, Luis
1951. Las especies de *Psorophora* (Diptera: Culicidae). *Psorophora (Janthinosoma) fiebrigi* Edwards, 1922. Inst. Salubr. Enferm. Trop., Rev. 12:53-58.
1953. *Megarhinus* de Norteamerica (Diptera: Culicidae). Inst. Salubr. Enferm. Trop., Rev. 13:27-32.
1956. Especies y distribucion de mosquitos mexicanos no anofelinos (Insecta Diptera). Inst. Salubr. Enferm. Trop., Rev. 15:19-36.
- Vargas, Luis and A. Martinez Palacios
1950. Estudio taxonomico de los mosquitos anofelinos de Mexico. Mexico, D.F., Secretar. Salubr. Asistencia. 143 p.
1956. Anofelinos mexicanos. Taxonomia y distribucion. Mexico, D.F., Secretar. Salubr. Asistencia. 181 p.
- Walker, Francis
1848. List of the specimens of dipterous insects in the collection of the British Museum. Part I. London, Brit. Mus. 229 p.

1856. *Insecta Saundersiana*. Vol. 1. Diptera. London, van Voorst. p. 415-474.
- Wiedemann, Christian R.W.
1820. *Diptera exotica*. Pt. 1. Kiel. 42 p.
1821. *Diptera exotica*. II. Kiel. p. 43-50.
1828. *Aussereuropäische zweiflügelige insekten*. Vol. 1. Hamm. 608 p.
- Williston, Samuel W.
1896. On the Diptera of St. Vincent (West Indies). Roy. Entomol. Soc. London, Trans. 44:253-446.
- Zavortink, Thomas J.
1968. Mosquito Studies (Diptera, Culicidae). VIII. A prodrome of the genus *Orthopodomyia*. Amer. Entomol. Inst., Contrib. 3(2). 221 p.

FIGURES

1. Morphology of adults; general
2. Morphology of adults; chaetotaxy and scaling of head and thorax
3. Morphology of adults; female and male genitalia
4. Morphology of pupa
5. Morphology of larva; general
6. Morphology of larva; head, siphon, anal segment and hair types
7. *Anopheles (Nys.) albimanus*, *An. (An.) crucians*, *An. (An.) grabhamii* and *An. (An.) vestitipennis*; head, legs and wing of female
8. *Anopheles (Nys.) albimanus*, *An. (An.) atropos*, *An. (An.) crucians*, *An. (An.) vestitipennis* and *An. (An.) walkeri*; head, prothoracic submedian hairs, hair 1 on abdominal segments I-III, and abdominal segment IV of larva
9. *Anopheles (Nys.) albimanus*; male genitalia and pupa
10. *Anopheles (An.) atropos*; male genitalia and pupa
11. *Anopheles (An.) crucians*; male genitalia and pupa
12. *Anopheles (An.) vestitipennis*; male genitalia and pupa
13. *Anopheles (An.) grabhamii*; male genitalia and pupa
14. *Anopheles (An.) grabhamii*; larva
15. *Uranotaenia socialis*; head, thorax and base of wing of female; male genitalia; and pupa
16. *Uranotaenia sapphirina*; head, thorax and base of wing of female; male genitalia; and pupa
17. *Uranotaenia cooki*; head, thorax and base of wing of female; male foretarsus and genitalia; and pupa
18. *Uranotaenia lowii*; head, thorax and base of wing of female; male genitalia; and pupa
19. *Uranotaenia socialis*; larva
20. *Uranotaenia sapphirina*, *U. cooki* and *U. lowii*; head, prothoracic submedian hairs and terminal segments of larva
21. *Deinocerites cancer*; male genitalia and pupa
22. *Deinocerites cancer*; larva
23. *Culex (C.) bahamensis*; male genitalia and pupa
24. *Culex (C.) corniger*; male genitalia and pupa
25. *Culex (C.) bahamensis* and *Culex (C.) corniger*; head and terminal segments of larva
26. *Culex (C.) chidesteri* and *Culex (C.) nigripalpus*; head and terminal segments of larva
27. *Culex (C.) chidesteri*; male genitalia and pupa
28. *Culex (C.) nigripalpus*; male genitalia and pupa
29. *Culex (C.) janitor*; male genitalia and pupa
30. *Culex (C.) janitor*; larva
31. *Culex (C.) secutor*; male genitalia and pupa
32. *Culex (C.) secutor*; larva
33. *Culex (C.) quinquefasciatus*; male genitalia and pupa
34. *Culex (Micr.) arawak*; larva
35. *Culex (Mel.) atratus*; male genitalia and pupa
36. *Culex (Mel.) atratus*; larva
37. *Culex (Mel.) opisthopus*; male genitalia and pupa
38. *Culex (Mel.) opisthopus*; larva
39. *Culex (Mel.) iolambdis*; male genitalia and pupa

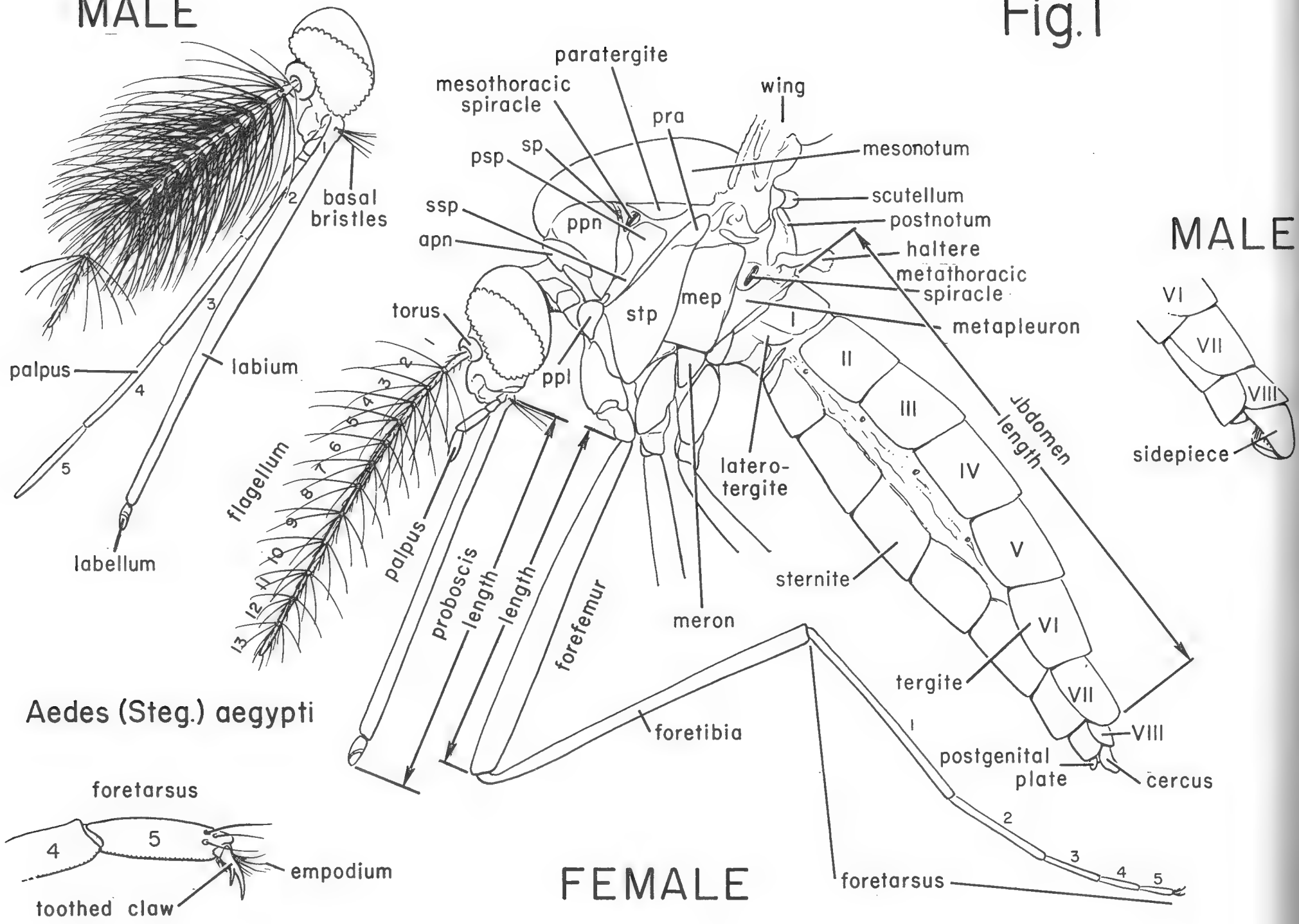
40. *Culex (Mel.) inhibitor*; male genitalia and pupa
41. *Culex (Mel.) iolambdis* and *C. (Mel.) inhibitor*; head and terminal segments of larva
42. *Culex (Mel.) erraticus* and *C. (Mel.) pilosus*; head and terminal segments of larva
43. *Culex (Mel.) erraticus*; male genitalia and pupa
44. *Culex (Mel.) pilosus*; male genitalia and pupa
45. *Culex (Mel.) sp.*, Jamaican form; larva
46. *Culex (Mel.) ocosa*; larva
47. *Culex (Mel.) ocosa*; male genitalia and pupa
48. *Culex (Mel.) panocossa* and *Culex (Micr.) arawak*; male genitalia
49. *Coquillettidia (Rhyn.) nigricans*; male genitalia and pupa
50. *Coquillettidia (Rhyn.) nigricans* and *Mansonia (M.) titillans*; head and terminal segments of larva. *Mansonia (M.) dyari* and *Mansonia (M.) flaveola*; terminal segments of larva
51. *Mansonia (M.) titillans*; male and female genitalia, and pupa
52. *Mansonia (M.) flaveola*; male and female genitalia, and pupa
53. *Mansonia (M.) dyari*; male and female genitalia, and pupa
54. *Orthopodomyia waverleyi*; male genitalia and pupa
55. *Orthopodomyia waverleyi*; larva
56. *Psorophora (P.) ciliata*; larva
57. *Psorophora (P.) ciliata*; male genitalia and pupa
58. *Psorophora (Janth.) johnstonii*; male genitalia and pupa
59. *Psorophora (Janth.) ferox*; male genitalia and pupa
60. *Psorophora (Janth.) ferox*; larva
61. *Psorophora (Janth.) johnstonii* and *Psorophora (Grabh.) infinis*; head and terminal segments of larva
62. *Psorophora (Grabh.) insularia* and *Psorophora (Grabh.) pygmaea*; head and terminal segments of larva
63. *Psorophora (Grabh.) infinis*; male genitalia and pupa
64. *Psorophora (Grabh.) insularia*; male genitalia and pupa
65. *Psorophora (Grabh.) pygmaea*; male genitalia and pupa
66. *Psorophora (Grabh.) jamaicensis*; male genitalia and pupa
67. *Psorophora (Grabh.) jamaicensis*; larva
68. *Aedes (Ochl.) taeniorhynchus*; male genitalia and pupa
69. *Aedes (Ochl.) sollicitans* and *Ae. (Ochl.) taeniorhynchus*; head and terminal segments of larva
70. *Aedes (Ochl.) sollicitans*; male genitalia and pupa
71. *Aedes (Ochl.) pertinax*; male genitalia and pupa
72. *Aedes (Ochl.) pertinax*; larva
73. *Aedes (Ochl.) hemisurus*; male genitalia and pupa
74. *Aedes (Ochl.) hemisurus*; larva
75. *Aedes (Ochl.) tortilis*; male genitalia and pupa
76. *Aedes (Ochl.) tortilis*; larva
77. *Aedes (Ochl.) auratus*; larva
78. *Aedes (Ochl.) calumnior*; male genitalia and pupa
79. *Aedes (Ochl.) calumnior*; larva
80. *Aedes (Finlaya) mediovittatus*; male genitalia and pupa
81. *Aedes (Finlaya) mediovittatus*; larva
82. *Aedes (How.) walkeri*; larva

83. *Aedes* (How.) *walkeri*; thoracic ornamentation of female, male genitalia and pupa
84. *Aedes* (How.) *aurites*; mesonotal pattern of female, male genitalia and pupa
85. *Aedes* (How.) *aurites*; larva
86. *Aedes* (How.) *grabhami*; larva
87. *Aedes* (How.) *grabhami*; mesonotal pattern of female, male genitalia and pupa
88. *Aedes* (How.) *inaequalis*; mesonotal pattern of female, male genitalia and pupa
89. *Aedes* (How.) *inaequalis*; larva
90. *Aedes* (How.) *stenei*; larva
91. *Aedes* (How.) *stenei*; male genitalia and pupa
92. *Aedes* (Steg.) *aegypti*; male genitalia and pupa
93. *Aedes* (Steg.) *aegypti*; larva. *Aedes* (Ochl.) *auratus*; male genitalia
94. *Haemagogus* (Longip.) *equinus*; male genitalia and pupa
95. *Haemagogus* (Longip.) *equinus*; larva
96. *Wyeomyia* (W.) *hirsuta*, *W. (W.) mitchellii*, *W. (W.) nigratubus* and *W. (W.) stellata*; male genitalia
97. *Wyeomyia* (W.) *nigratubus*; male genitalia and pupa
98. *Wyeomyia* (W.) *nigratubus*; larva
99. *Wyeomyia* (W.) *mitchellii*; male genitalia and pupa
100. *Wyeomyia* (W.) *mitchellii*; larva
101. *Wyeomyia* (W.) *vanduzeei*; male genitalia and pupa
102. *Wyeomyia* (W.) *vanduzeei*; larva. *W. (W.) mitchellii* and *W. (W.) nigratubus*; apex of female wing and apex of male midtarsus
103. *Wyeomyia* (W.) *luna*; male genitalia and pupa
104. *Wyeomyia* (W.) *luna*; larva
105. *Wyeomyia* (W.) *stellata*; male genitalia and pupa
106. *Wyeomyia* (W.) *stellata*; larva
107. *Wyeomyia* (W.) *corona*; male genitalia and pupa
108. *Wyeomyia* (W.) *corona*; larva
109. *Wyeomyia* (W.) *juxtahirsuta*; male genitalia and pupa
110. *Wyeomyia* (W.) *juxtahirsuta*; larva
111. *Wyeomyia* (W.) *hirsuta*; male genitalia and pupa
112. *Wyeomyia* (W.) *hirsuta*; larva
113. *Wyeomyia* (W.) *atrata*; male genitalia and pupa
114. *Wyeomyia* (W.) *atrata*; larva
115. *Toxorhynchites* (Lynch.) *portoricensis*; male genitalia and pupa
116. *Toxorhynchites* (Lynch.) *portoricensis*; larva
117. *Sayomyia lanei*; male genitalia, pupa and head of larva
118. *Corethrella* (C.) *appendiculata*; larva
119. *Corethrella* (C.) *appendiculata*; male genitalia and pupa
120. *Corethrella* (C.) *longitubus*; male genitalia and pupa
121. *Corethrella* (C.) *longitubus*; larva
122. *Corethrella* (C.) *librata*; larva
123. *Corethrella* (C.) *librata*; pupa. *Dixella scitula*; male genitalia
124. *Dixella scitula*; head, wing and claws of female. *Mesodixa biambulacra*; female head, thorax, genitalia and claws; male genitalia, claws and apex of hindtibia
125. *Dixella scitula*; larva and pupa
126. *Mesodixa biambulacra*; larva and pupa

MALE

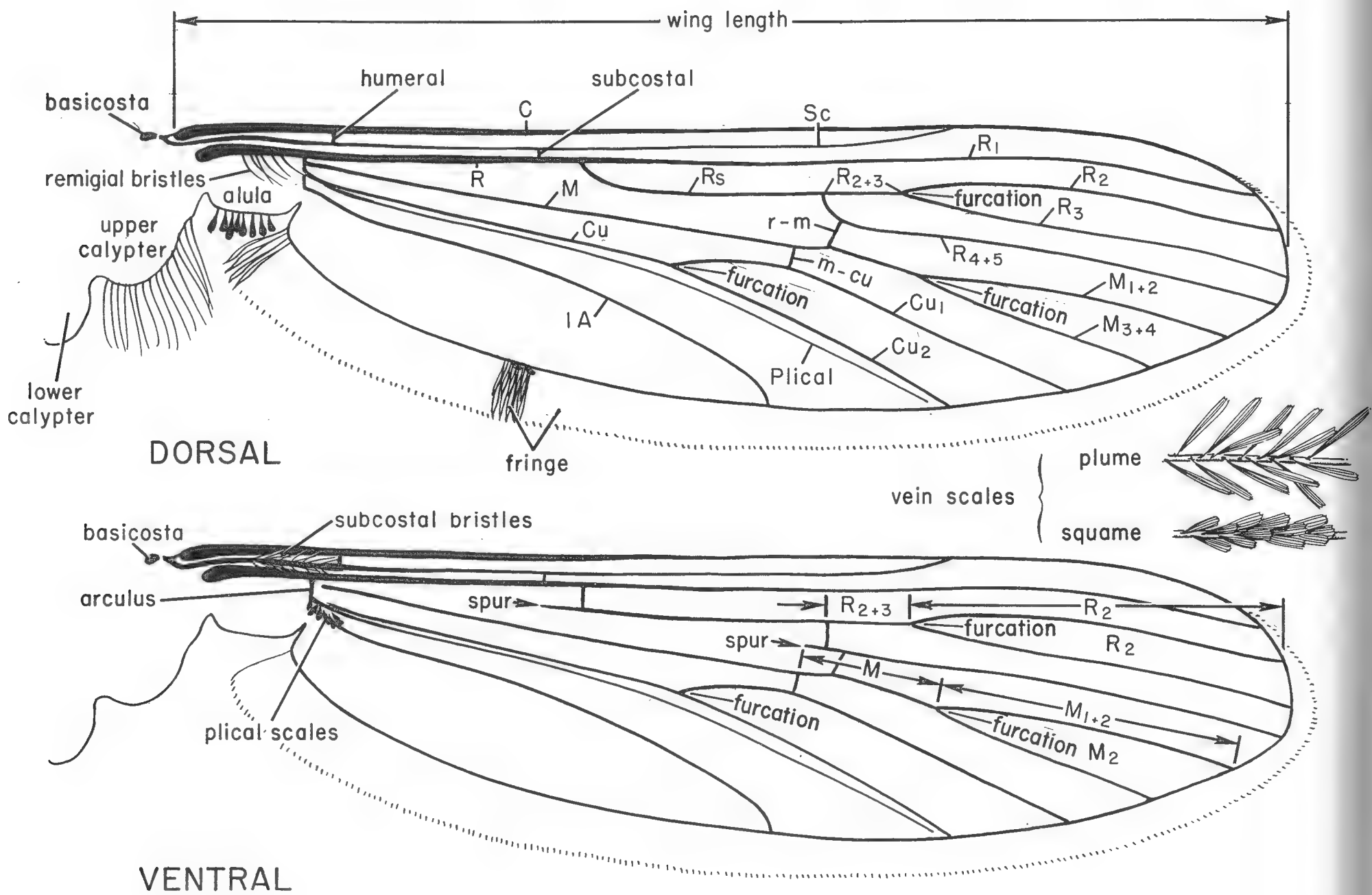
Fig. I

MALE



Aedes (Steg.) aegypti

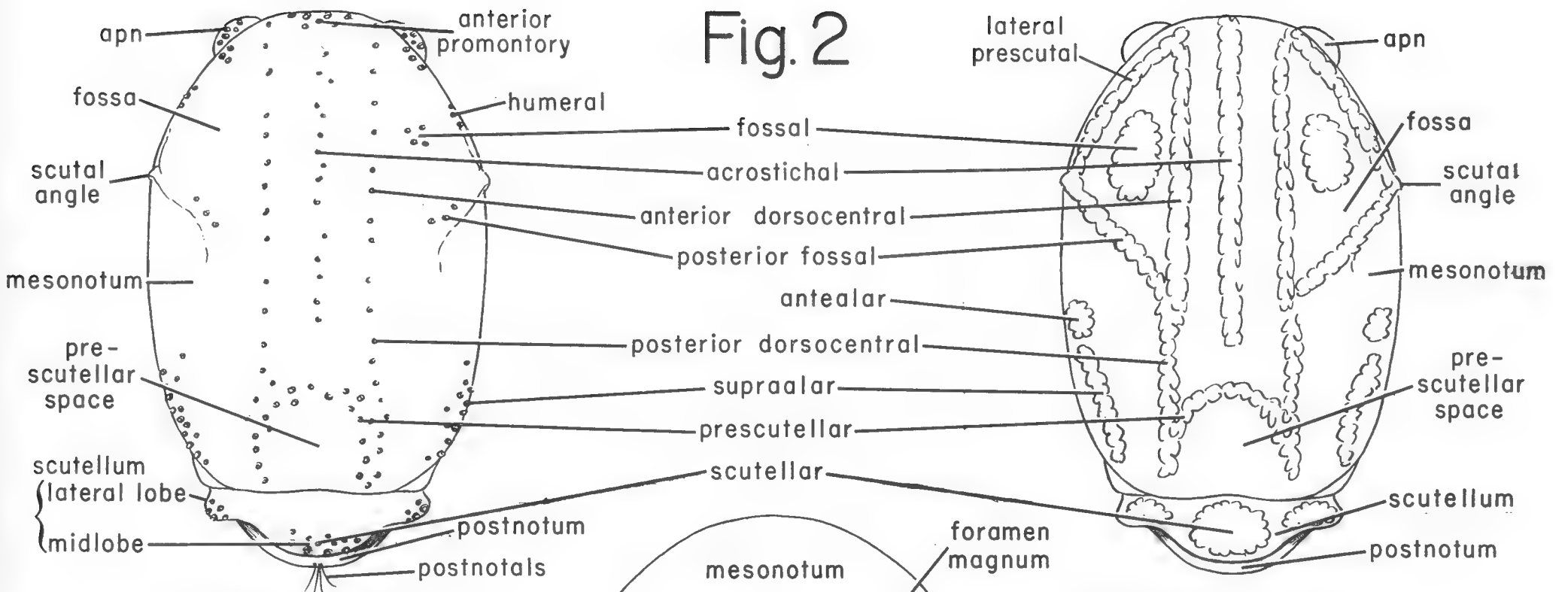
FEMALE



DORSAL

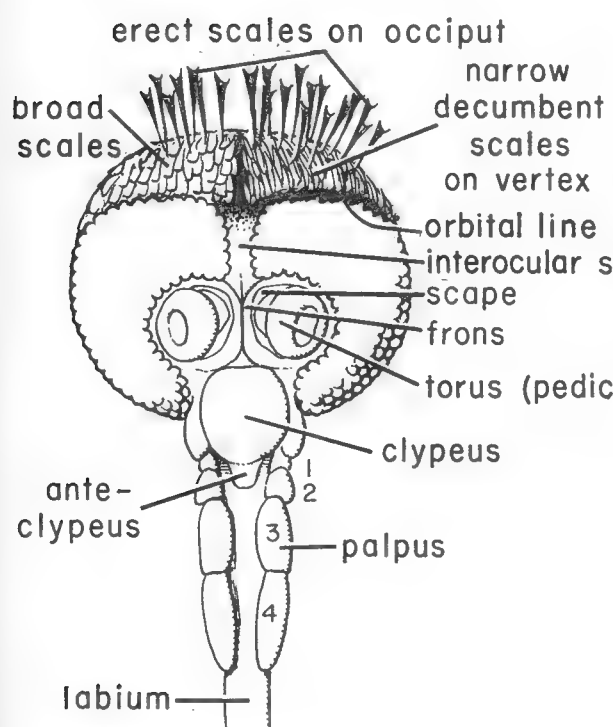
VENTRAL

Fig. 2

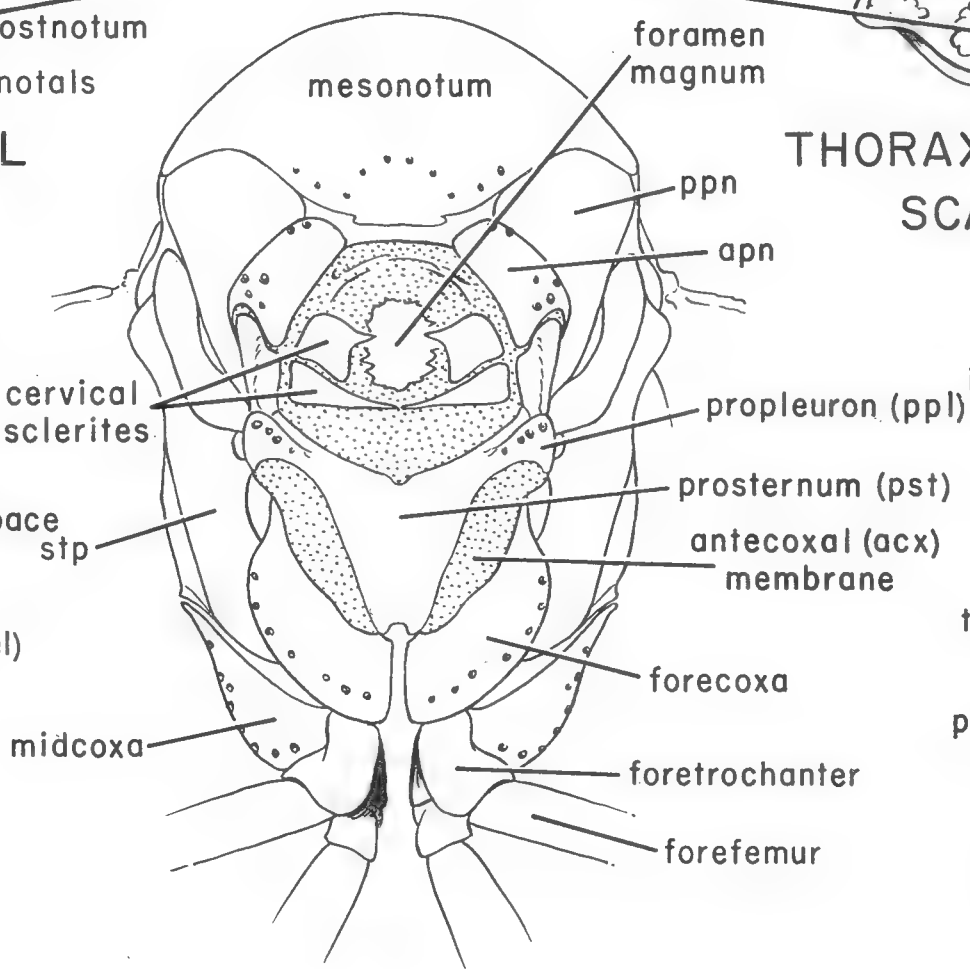


THORAX - DORSAL BRISTLES

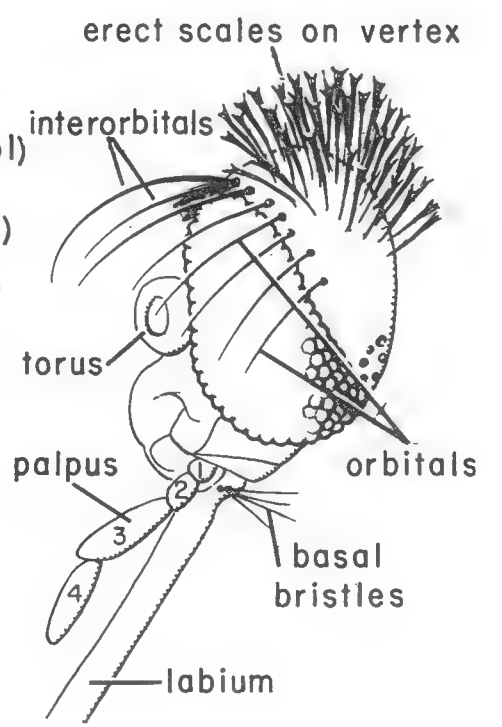
THORAX - DORSAL SCALING



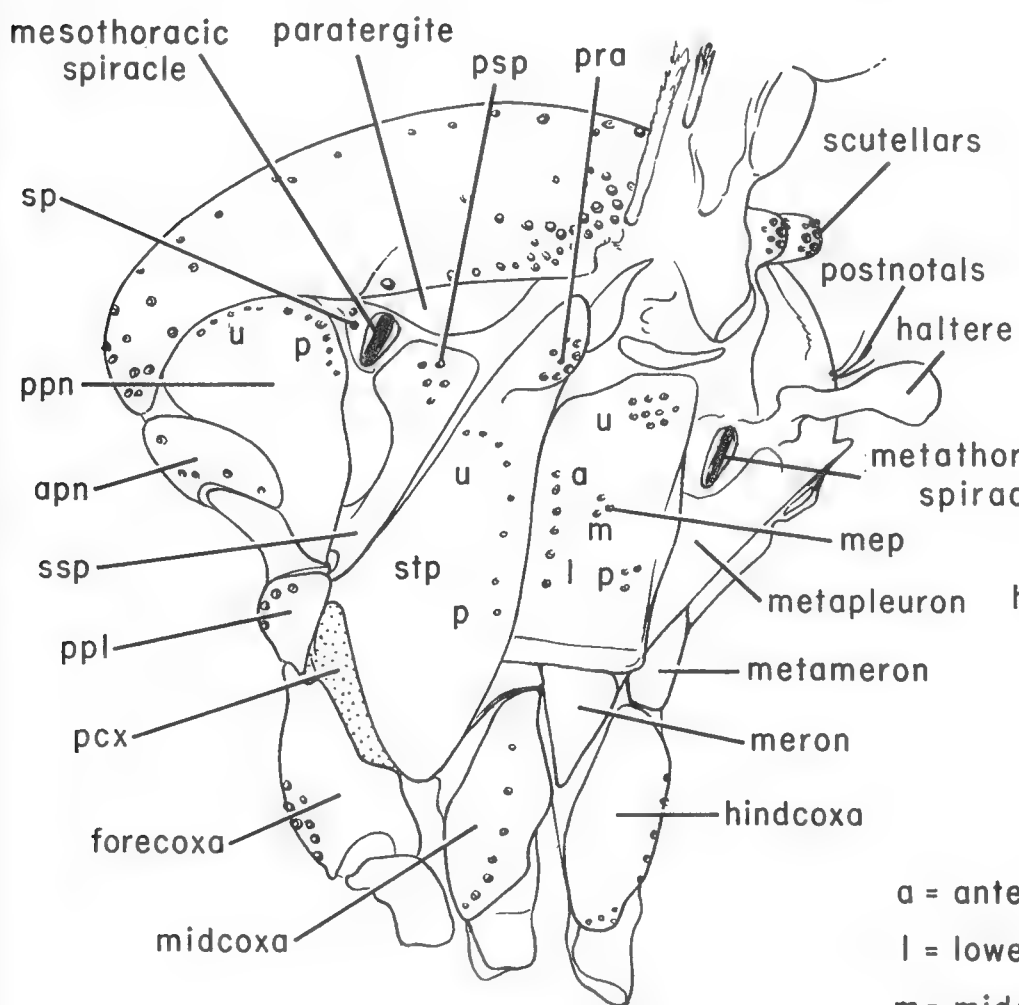
HEAD - ANTERIOR



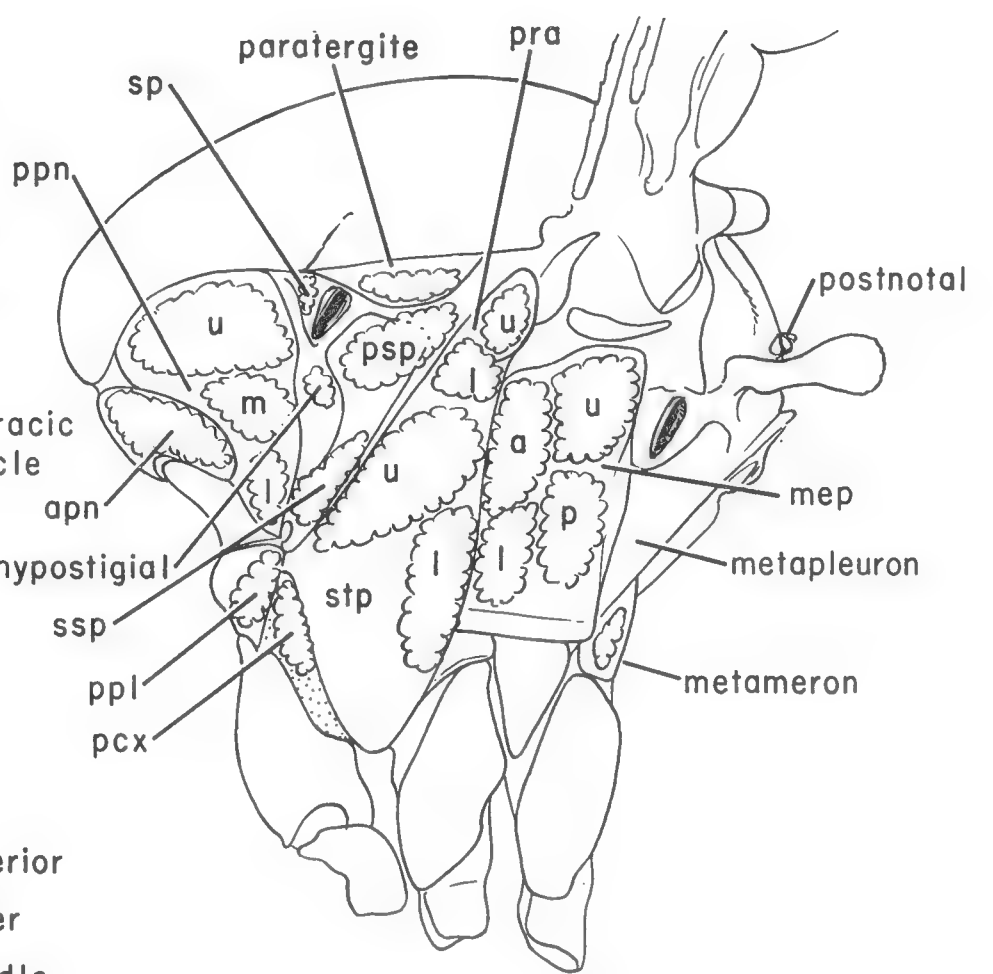
THORAX - ANTERIOR



HEAD - LATERAL



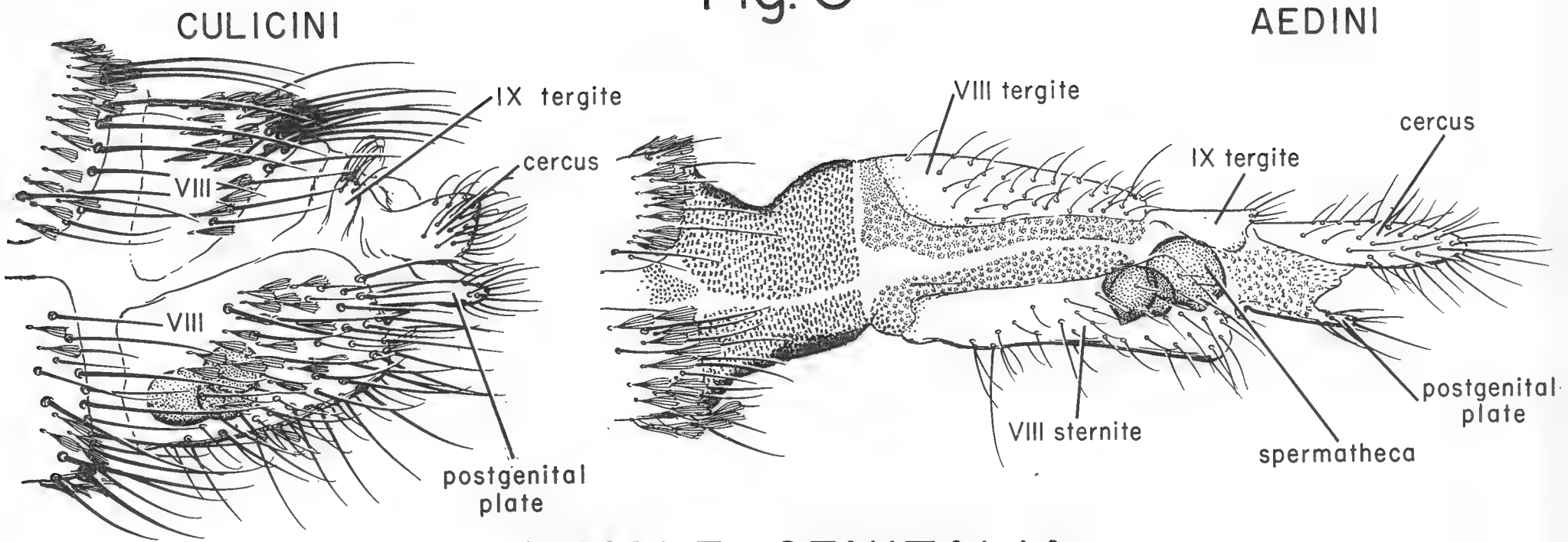
THORAX - LATERAL BRISTLES



THORAX - LATERAL SCALING

a = anterior
l = lower
m = middle
p = posterior
u = upper

Fig. 3



FEMALE GENITALIA

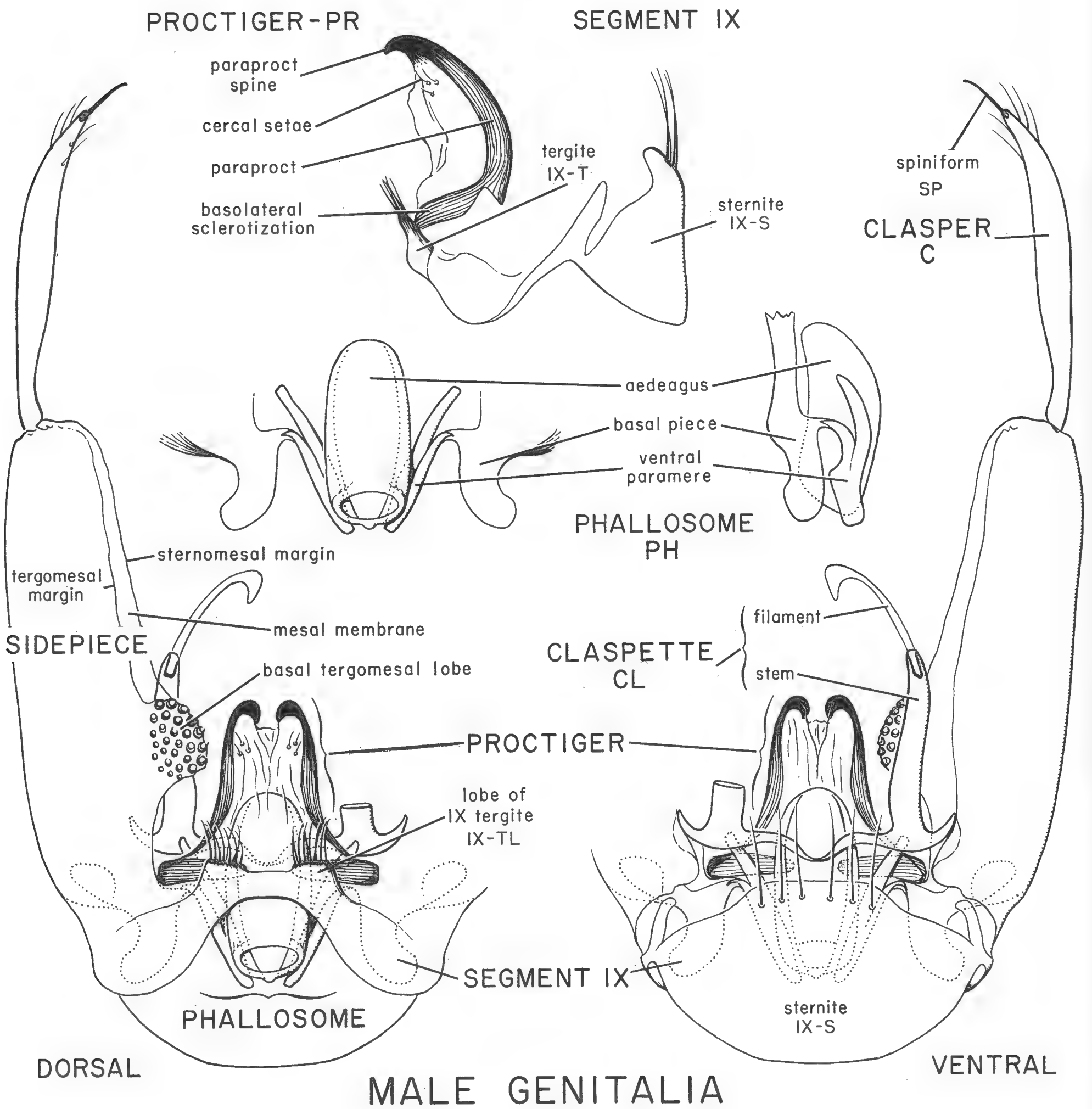
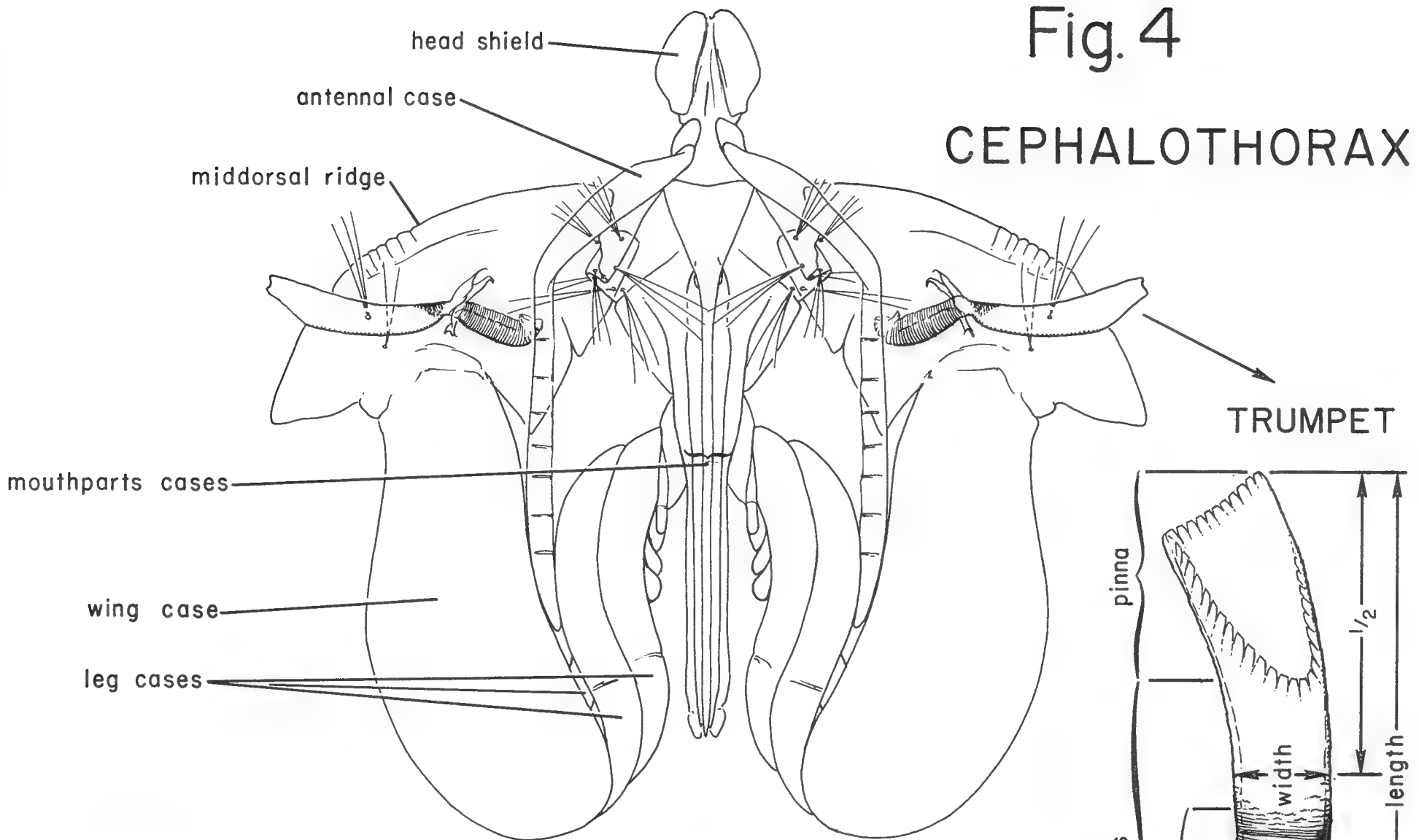
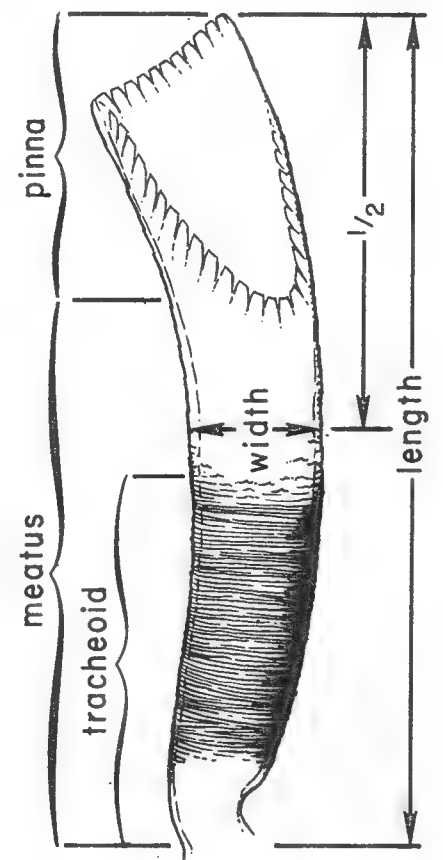


Fig. 4

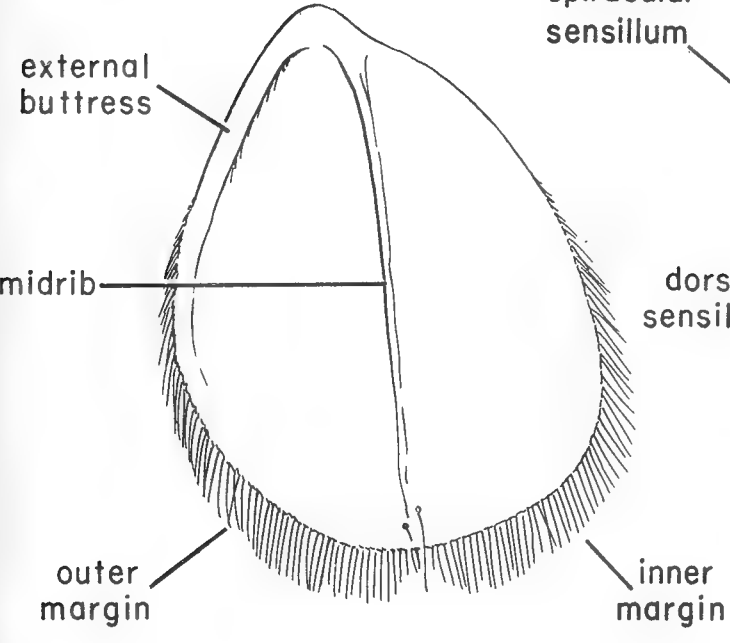
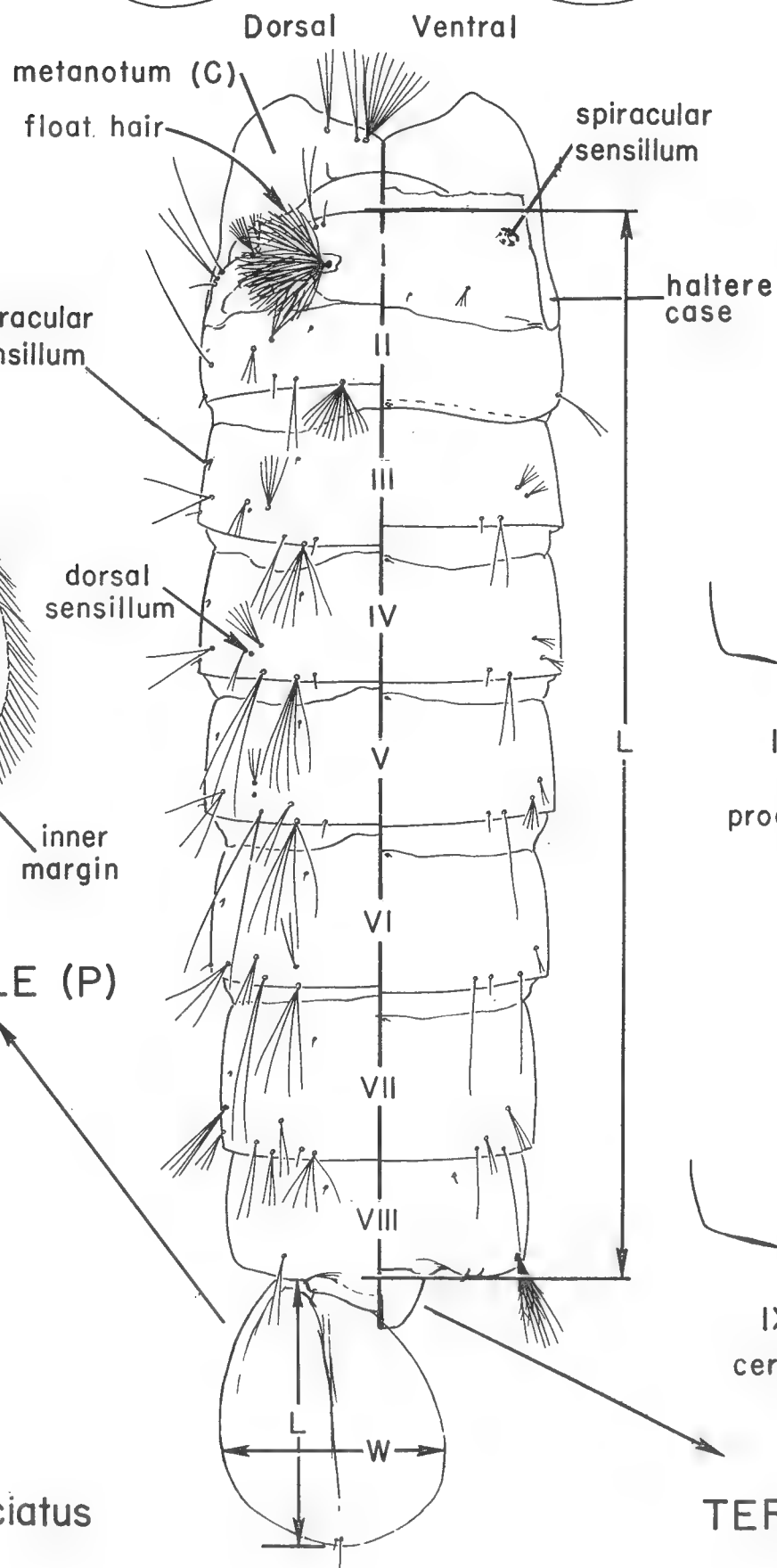
CEPHALOTHORAX



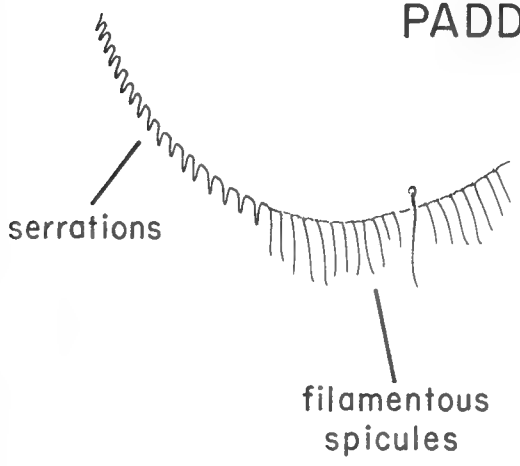
TRUMPET



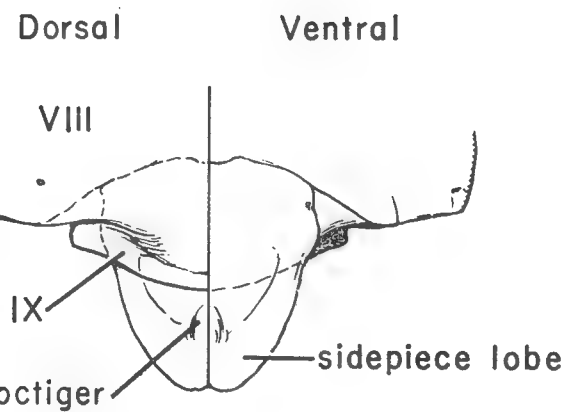
ABDOMEN & METANOTUM



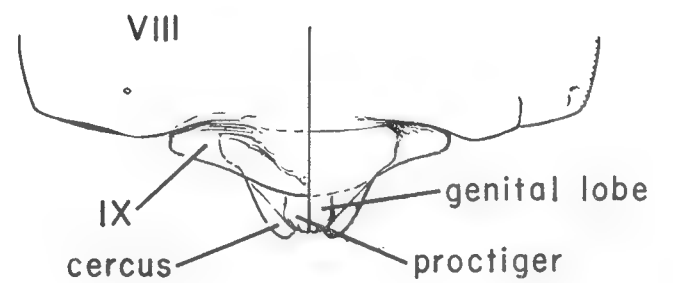
PADDLE (P)



Culex (C.) quinquefasciatus



MALE



FEMALE
TERMINAL SEGMENTS

Fig. 5

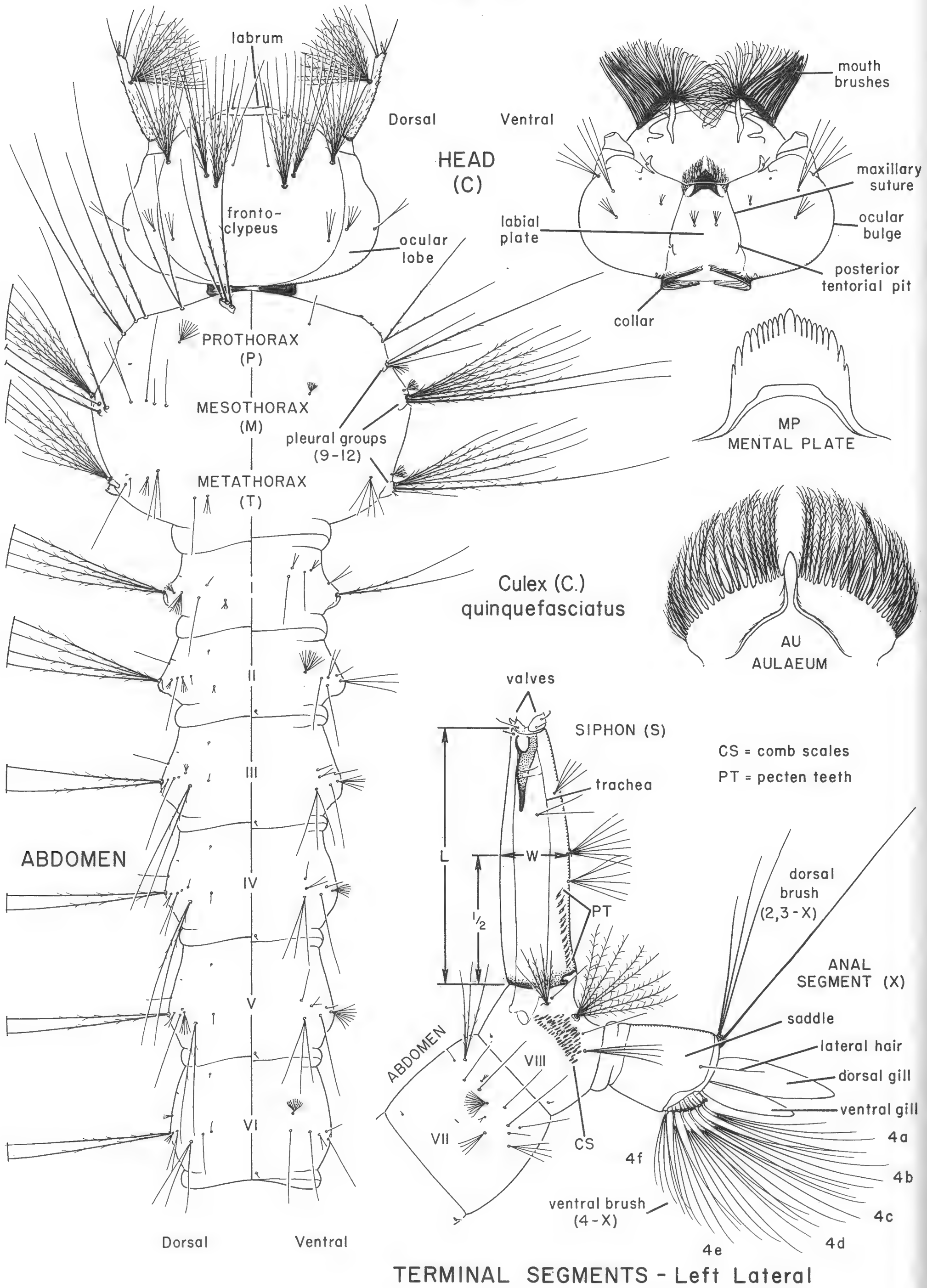
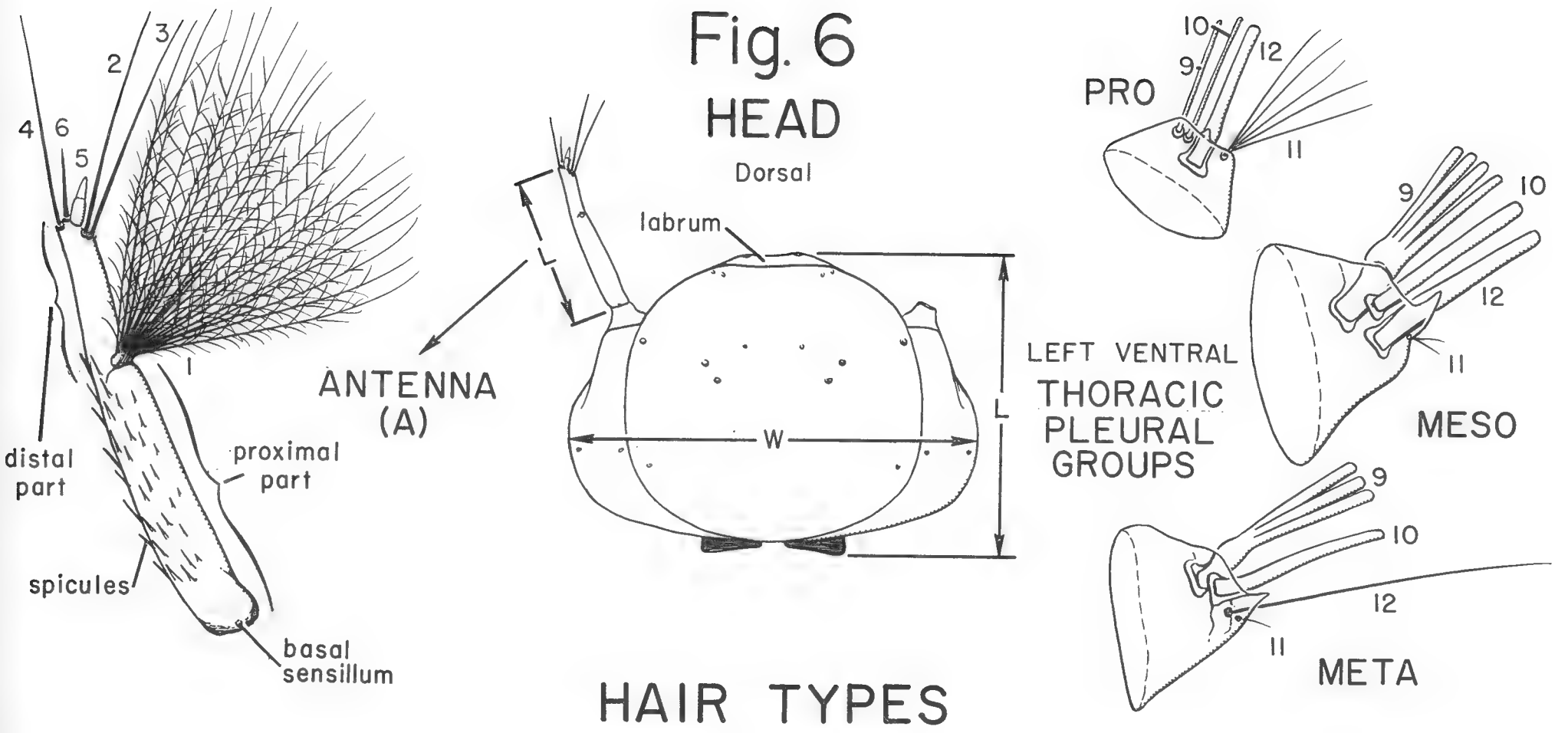
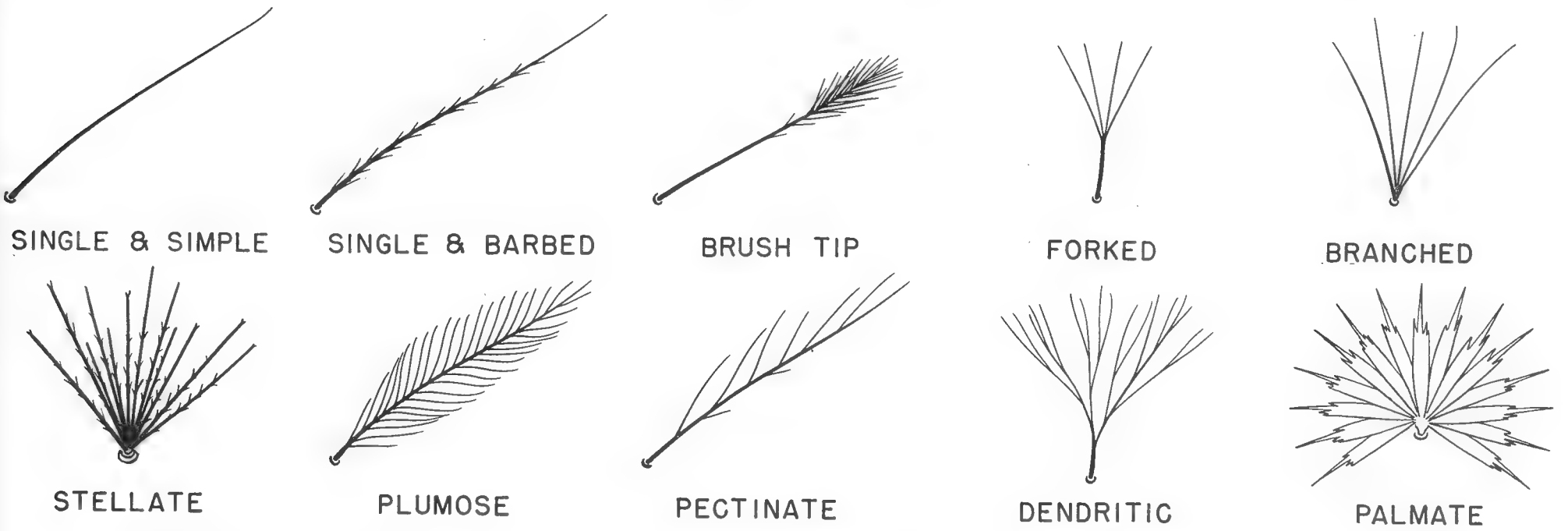


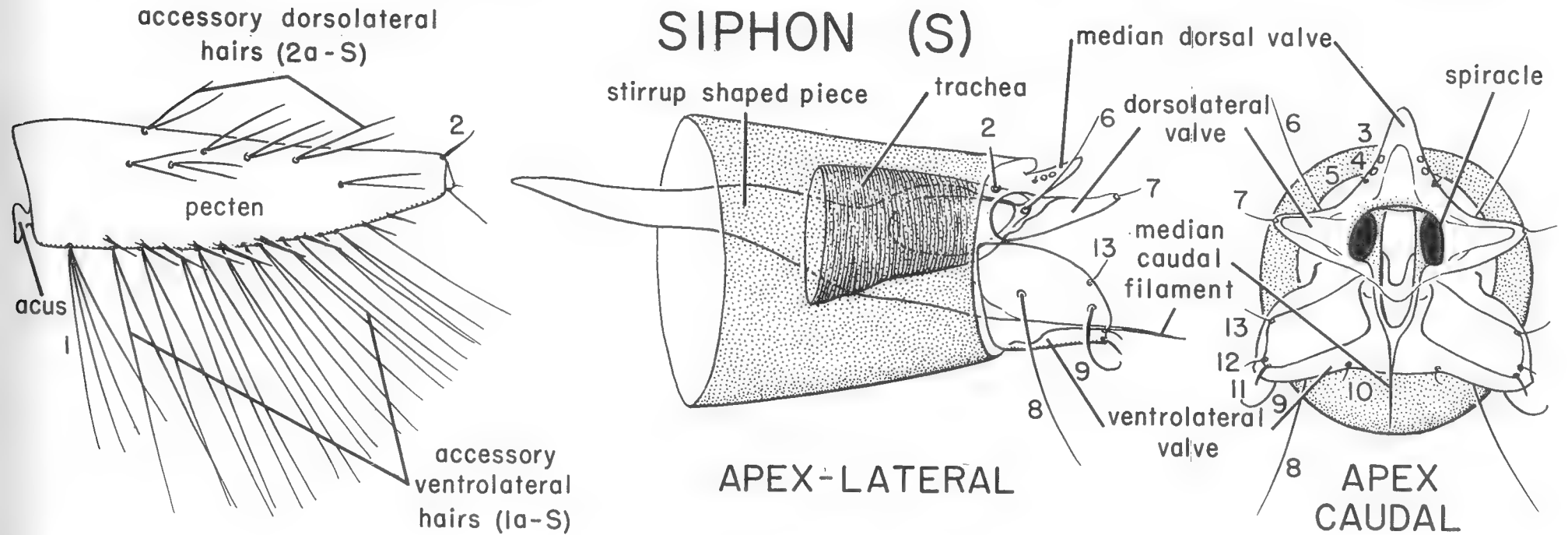
Fig. 6
HEAD



HAIR TYPES



SIPHON (S)



ANAL SEGMENT (X)

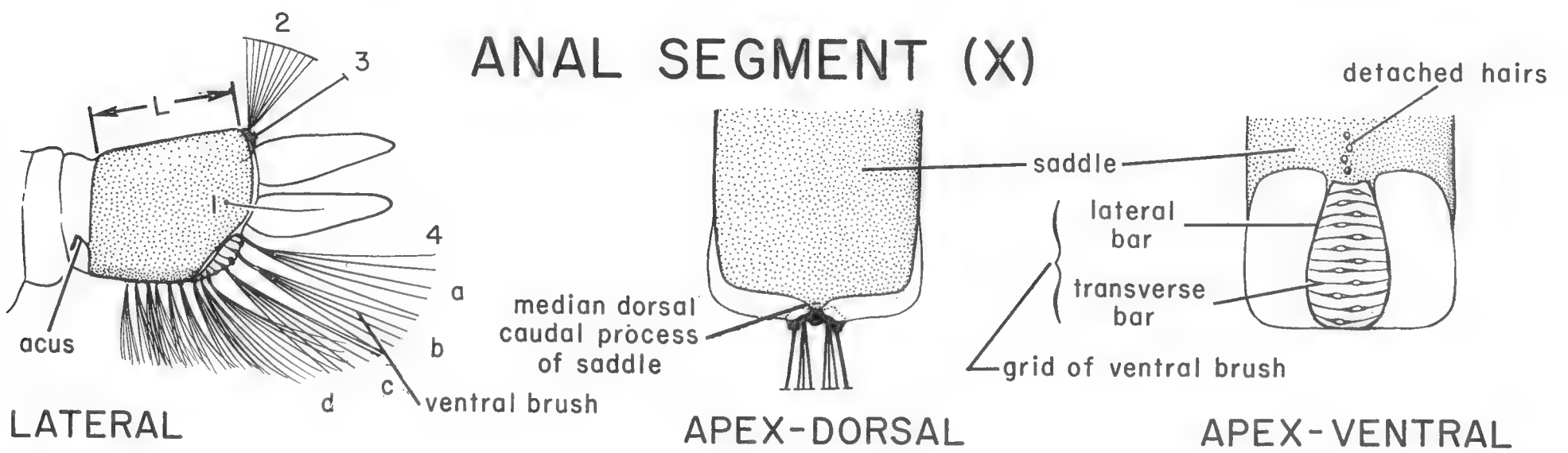
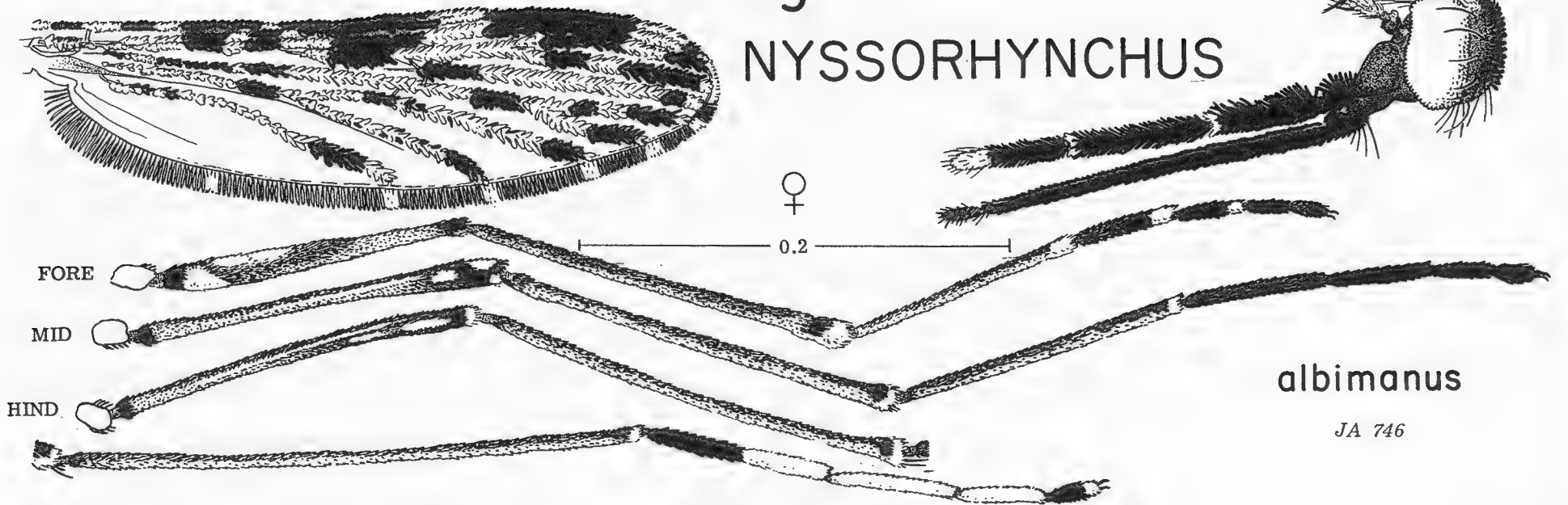


Fig. 7

NYSSORHYNCHUS



ANOPHELES

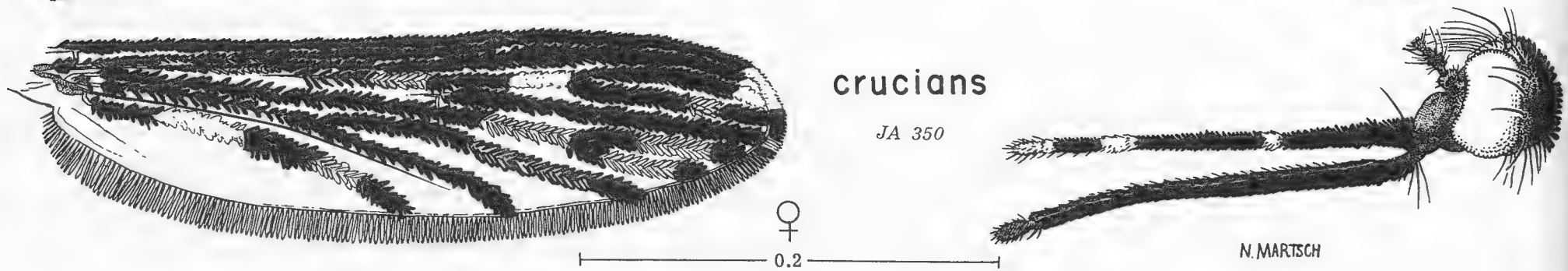
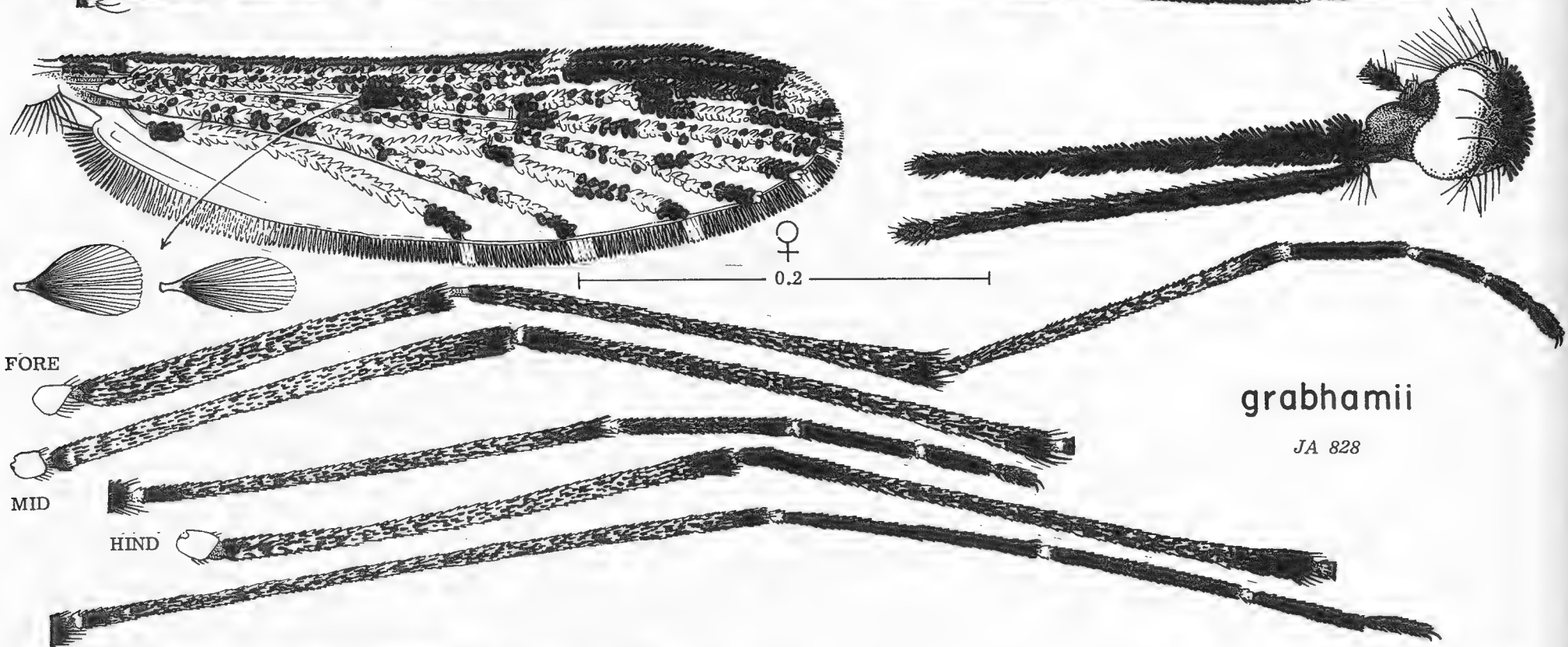
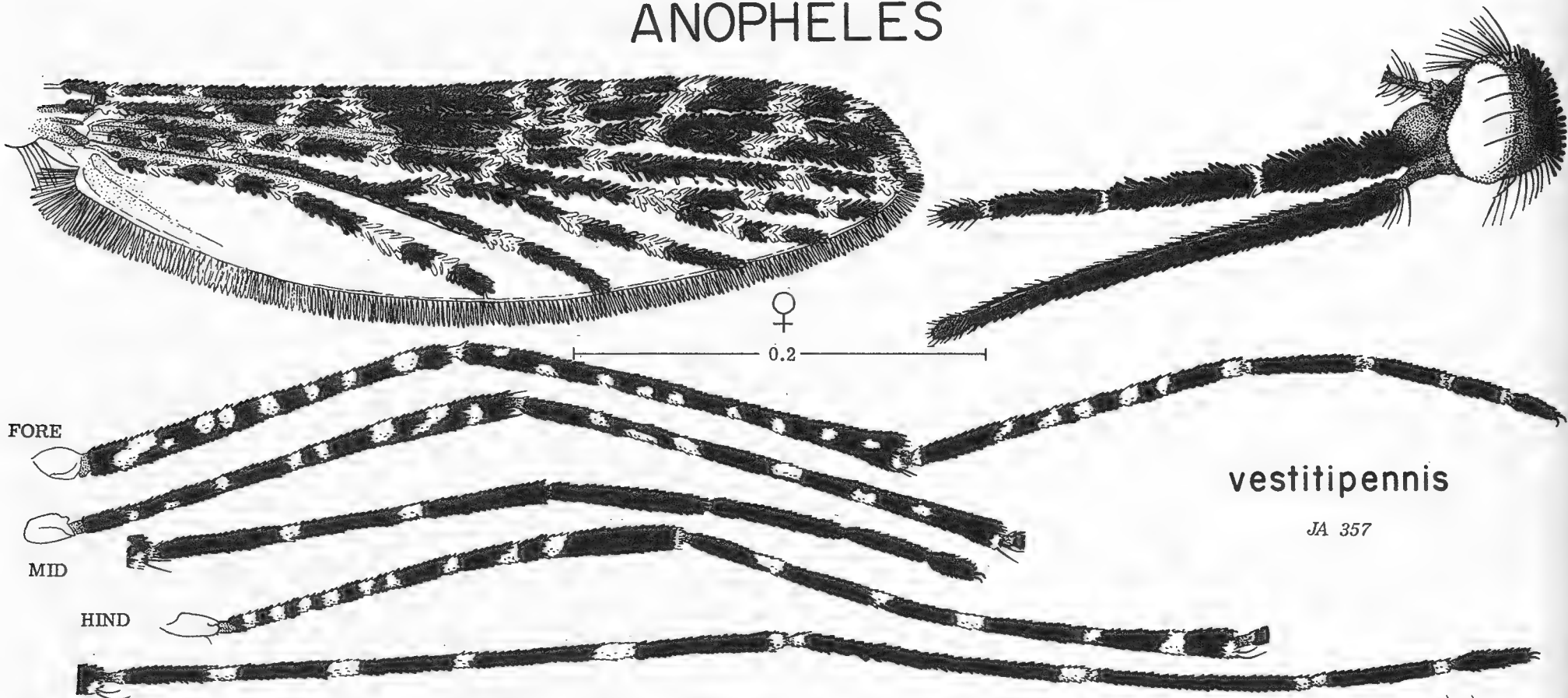
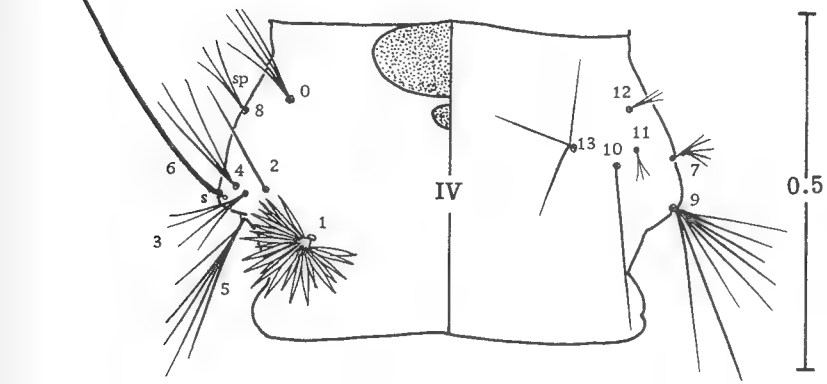


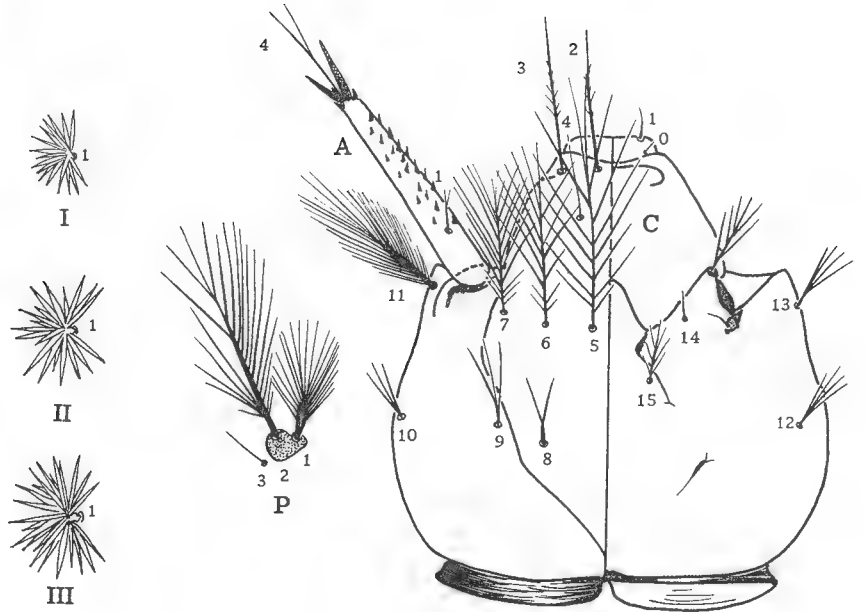
Fig. 8

NYSSORHYNCHUS



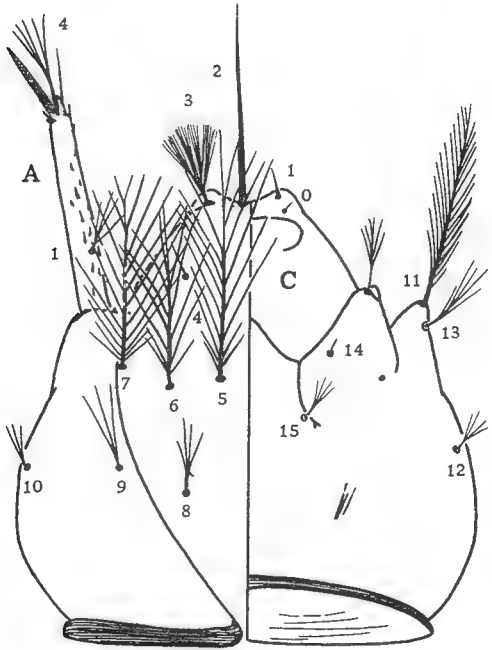
albimanus

JA 746



crucians

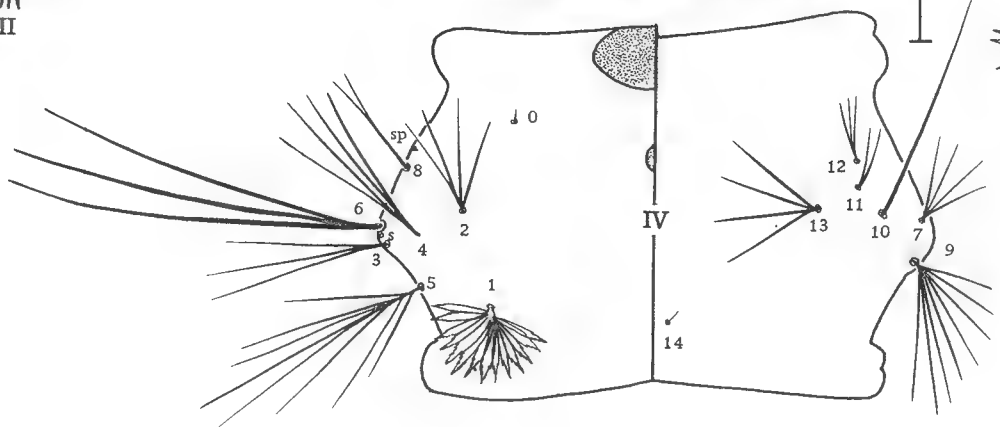
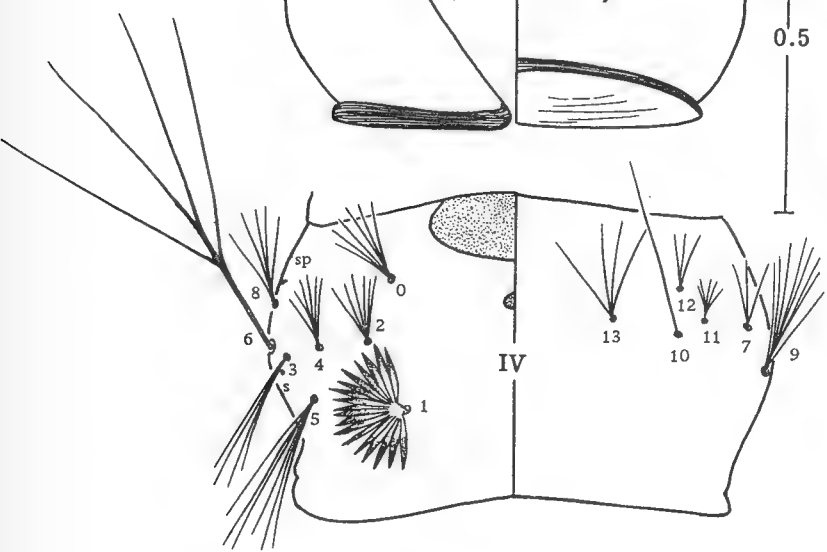
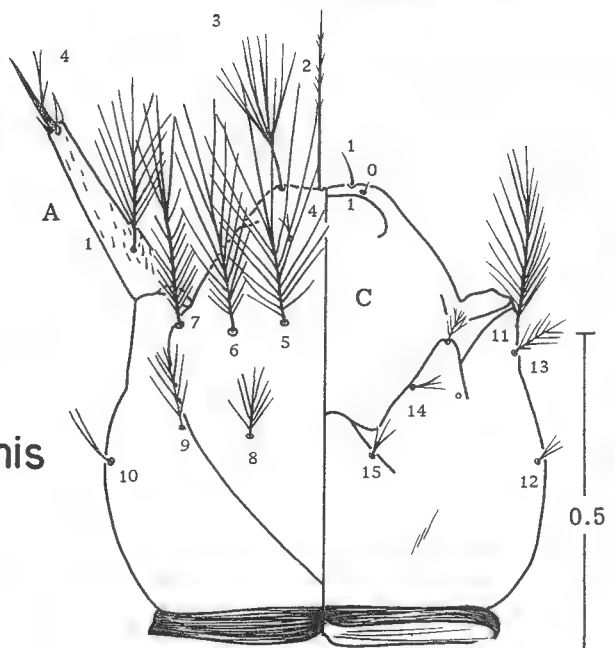
JA 34



ANOPHELES

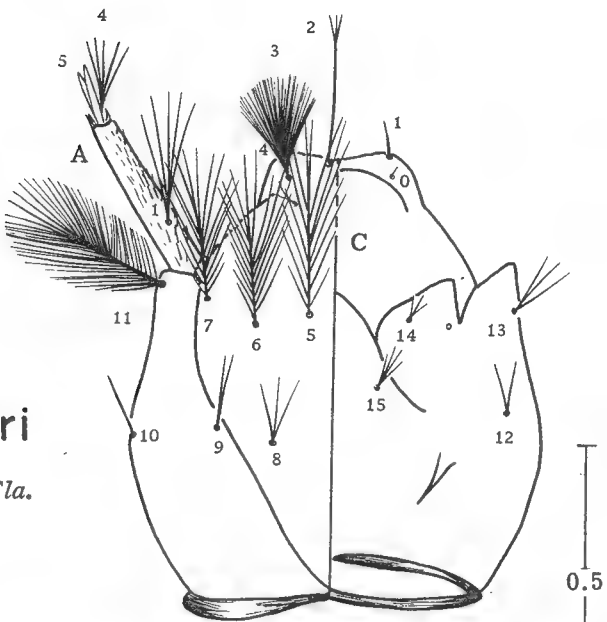
vestitipennis

JA 804



walkeri

Orlando, Fla.
U. S. A.



atropos

Key Largo, Fla.
U. S. A.

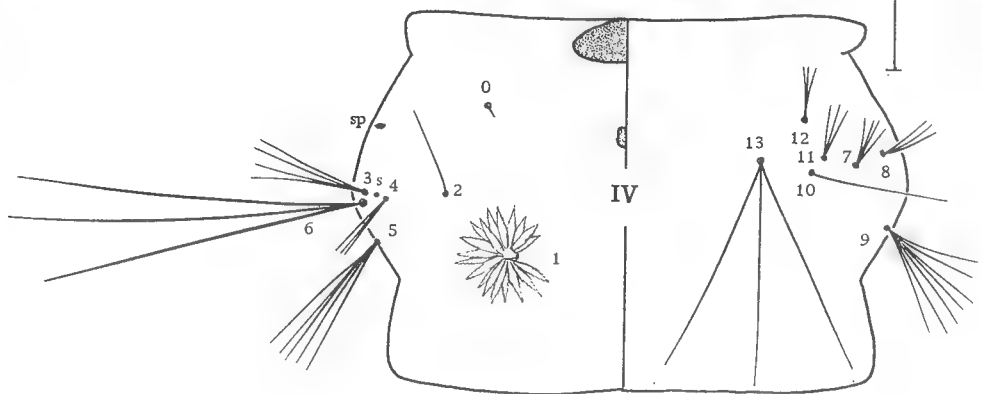
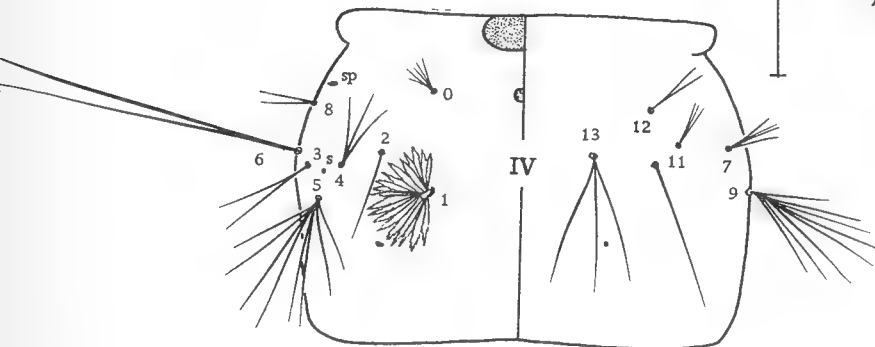
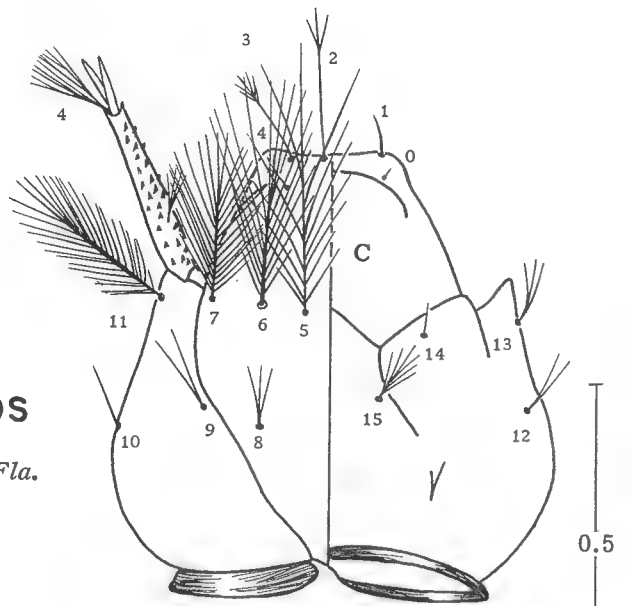
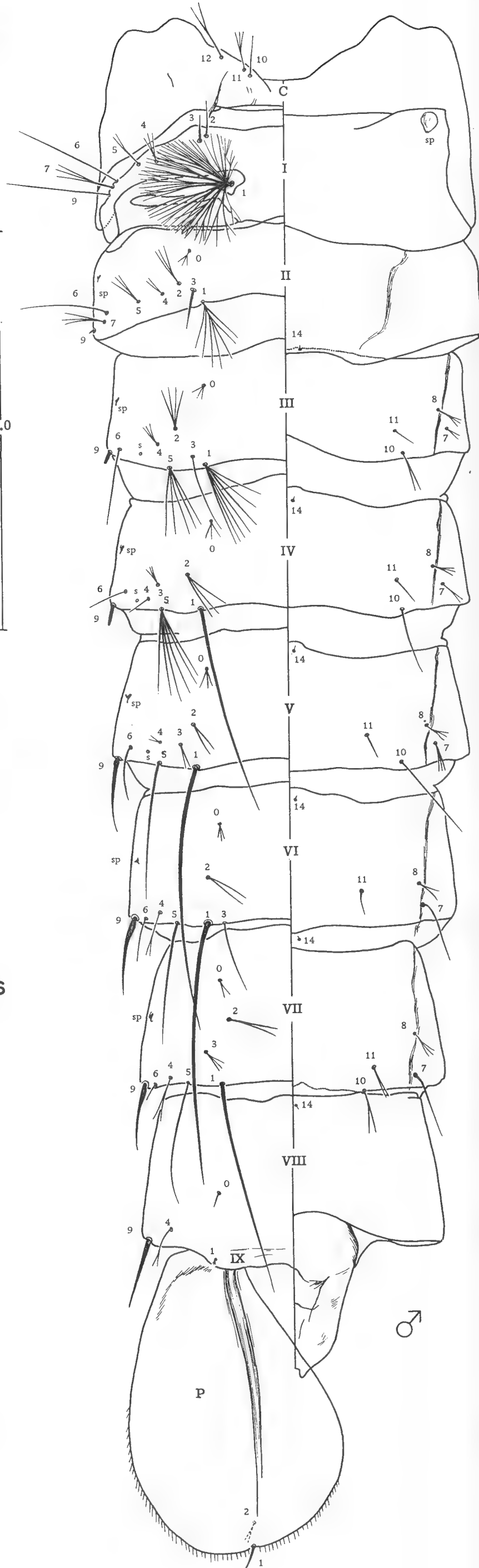
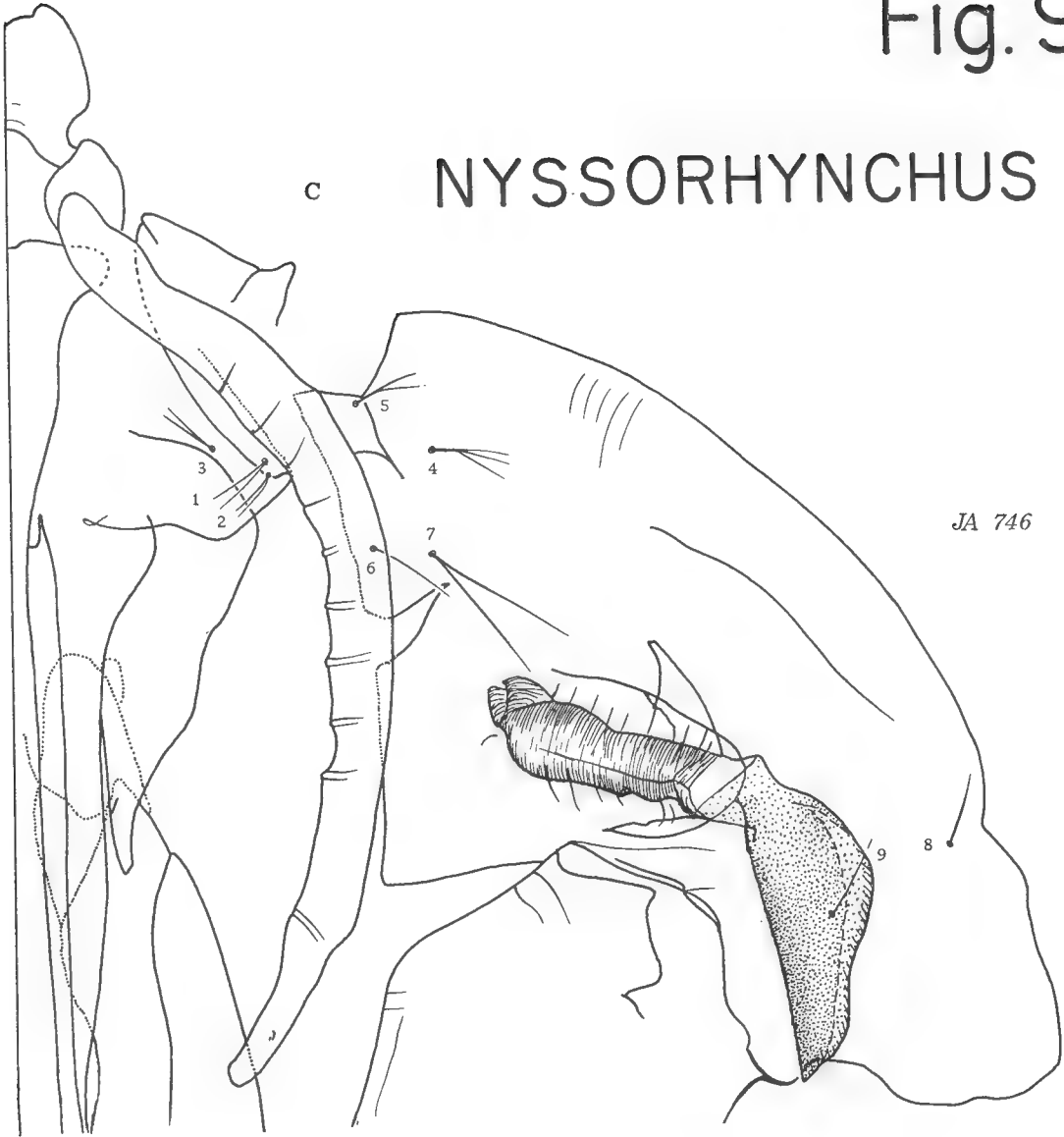
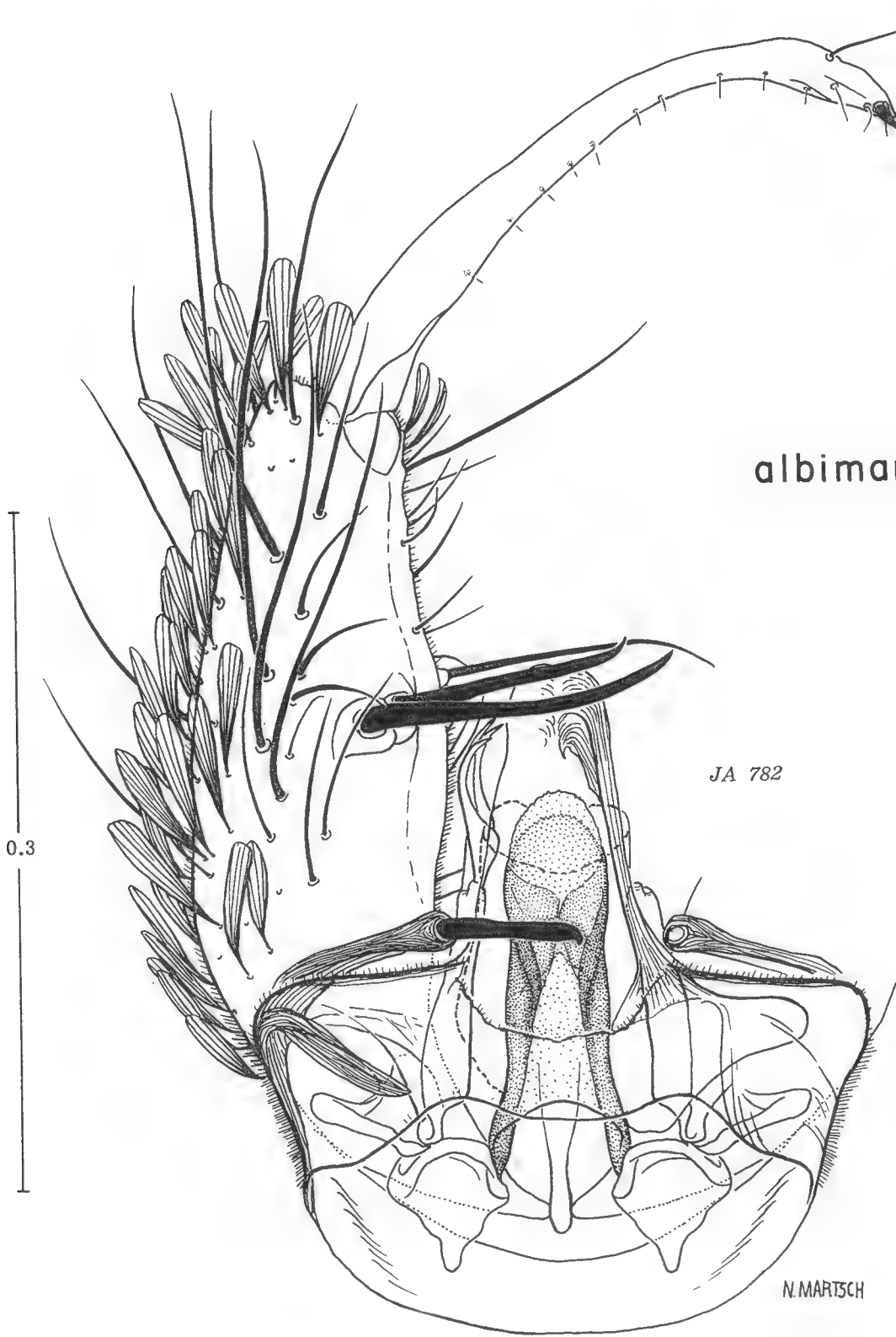


Fig. 9

NYSSORHYNCHUS



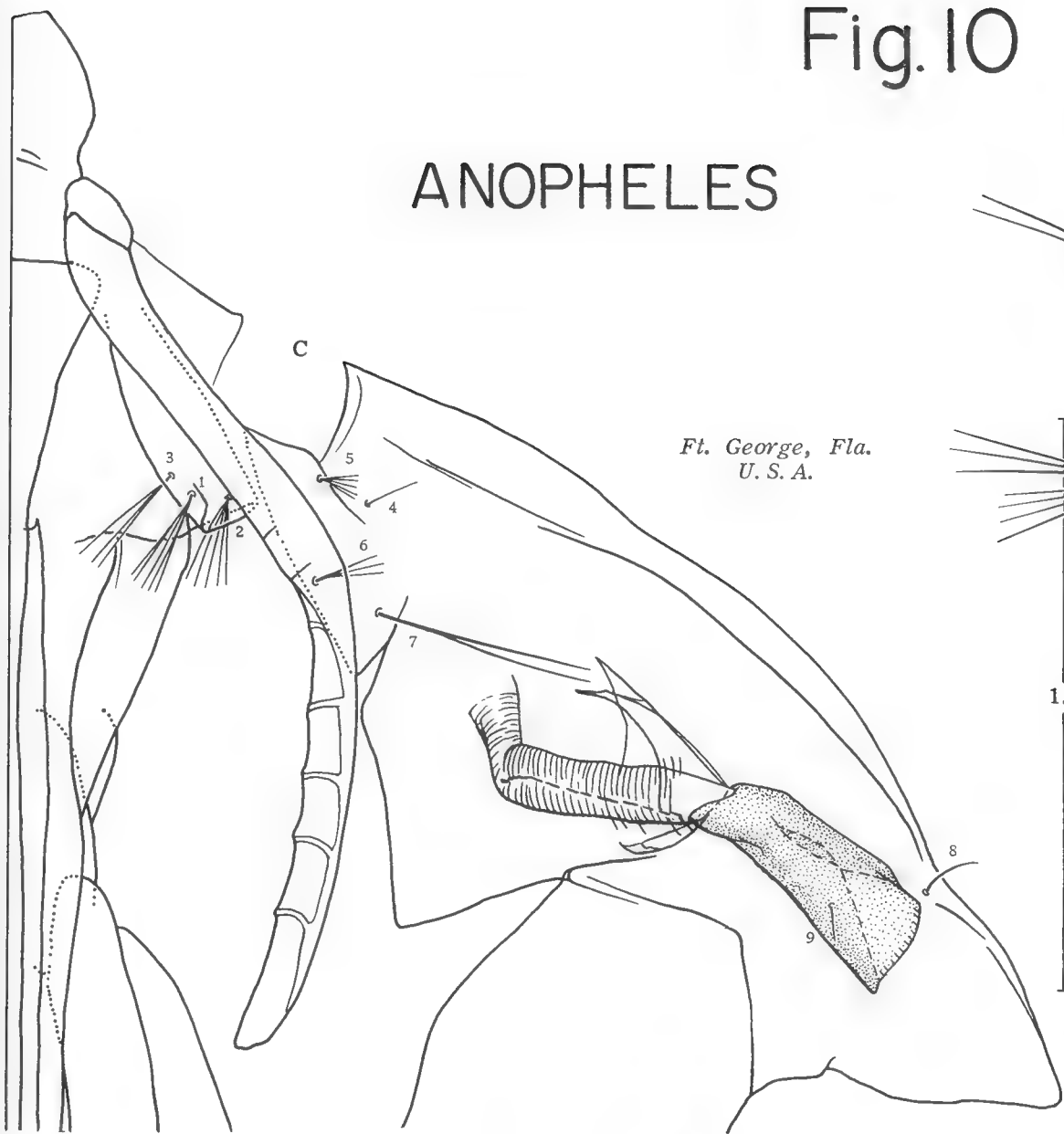
albimanus



N. MARTSCH

Fig. 10

ANOPHELES



atropos

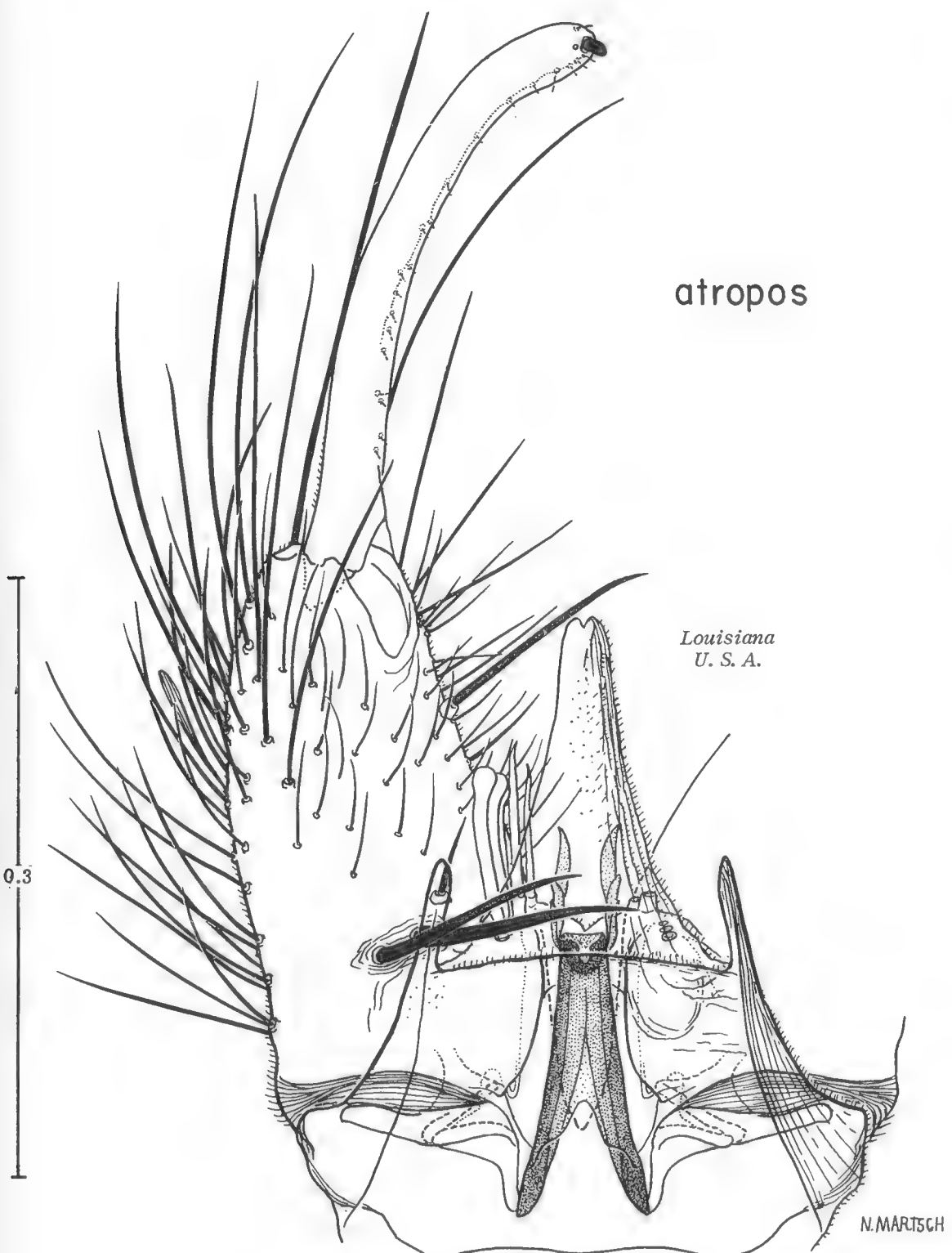
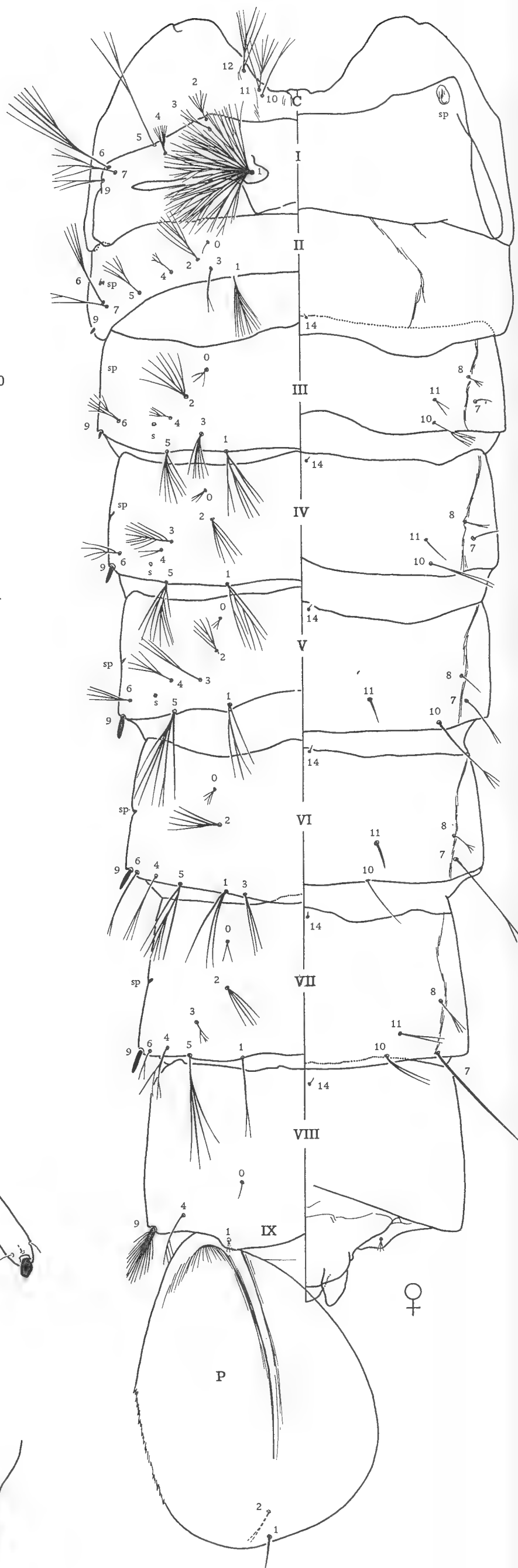
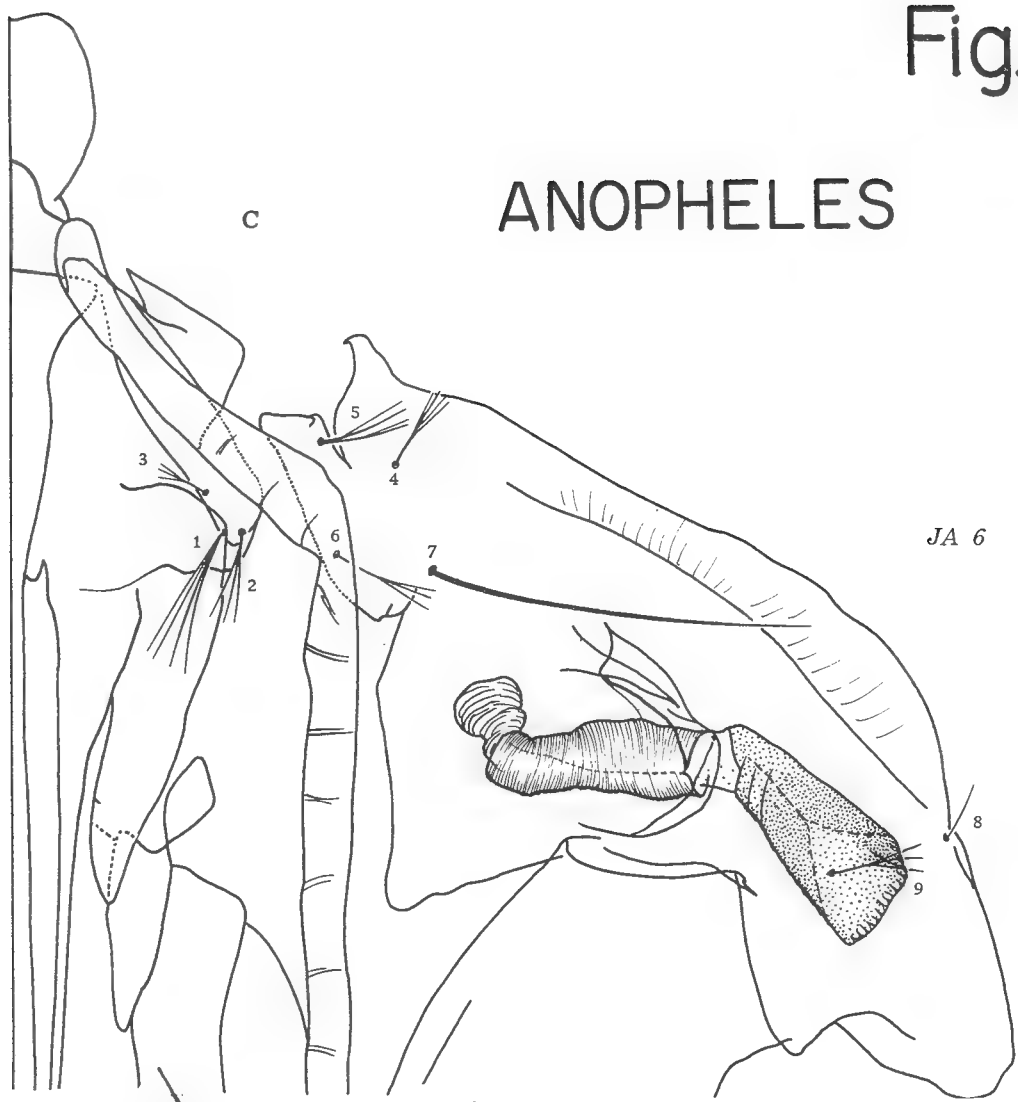


Fig. II

ANOPHELES



crucians

Wilson Dam, Ala.
U. S. A.

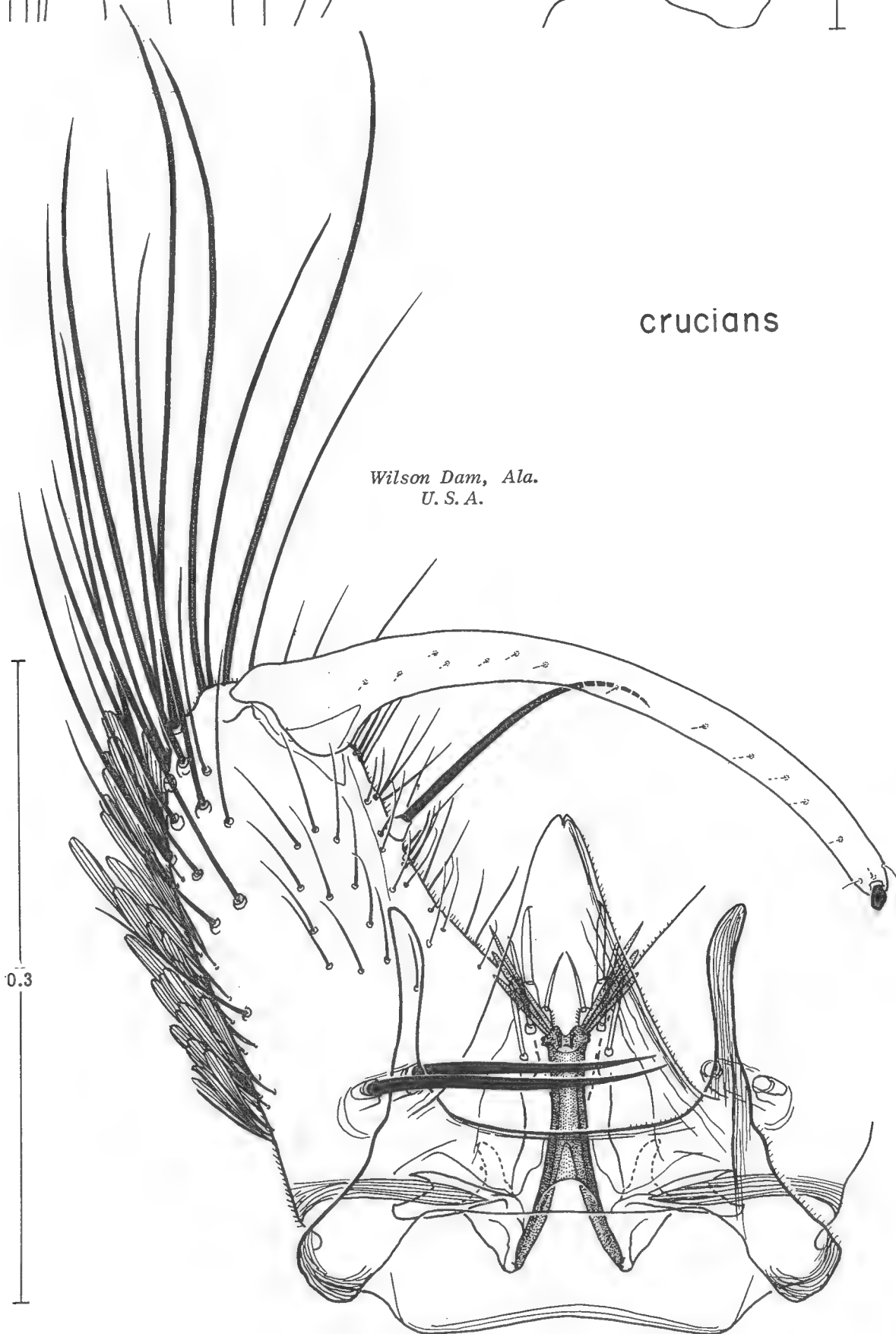
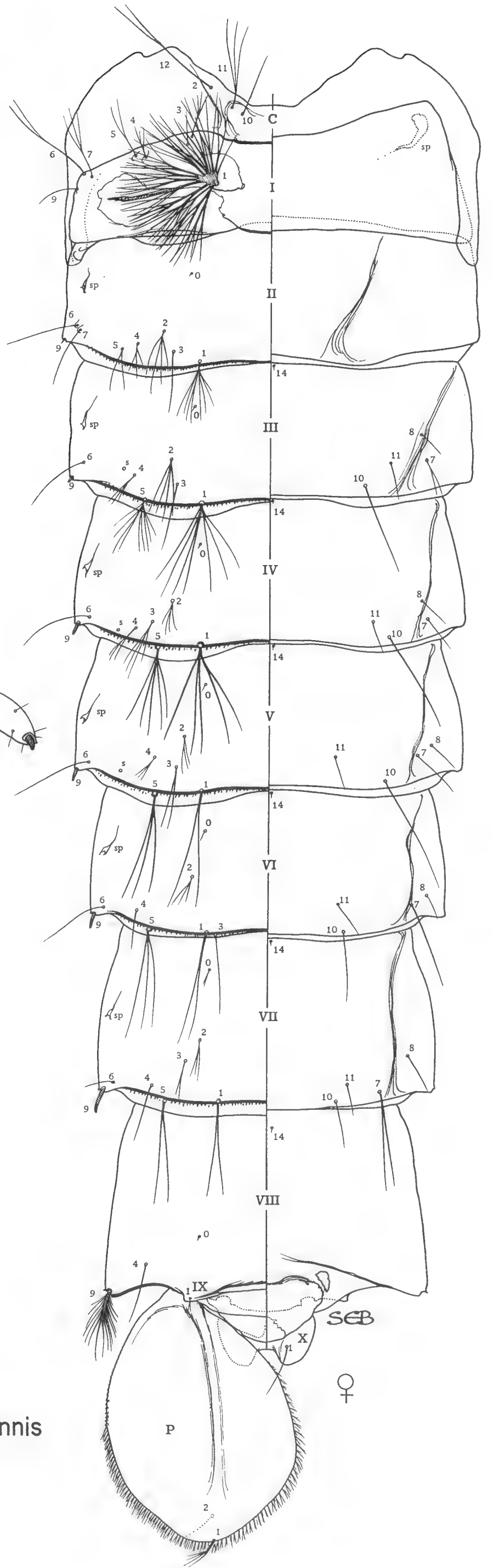
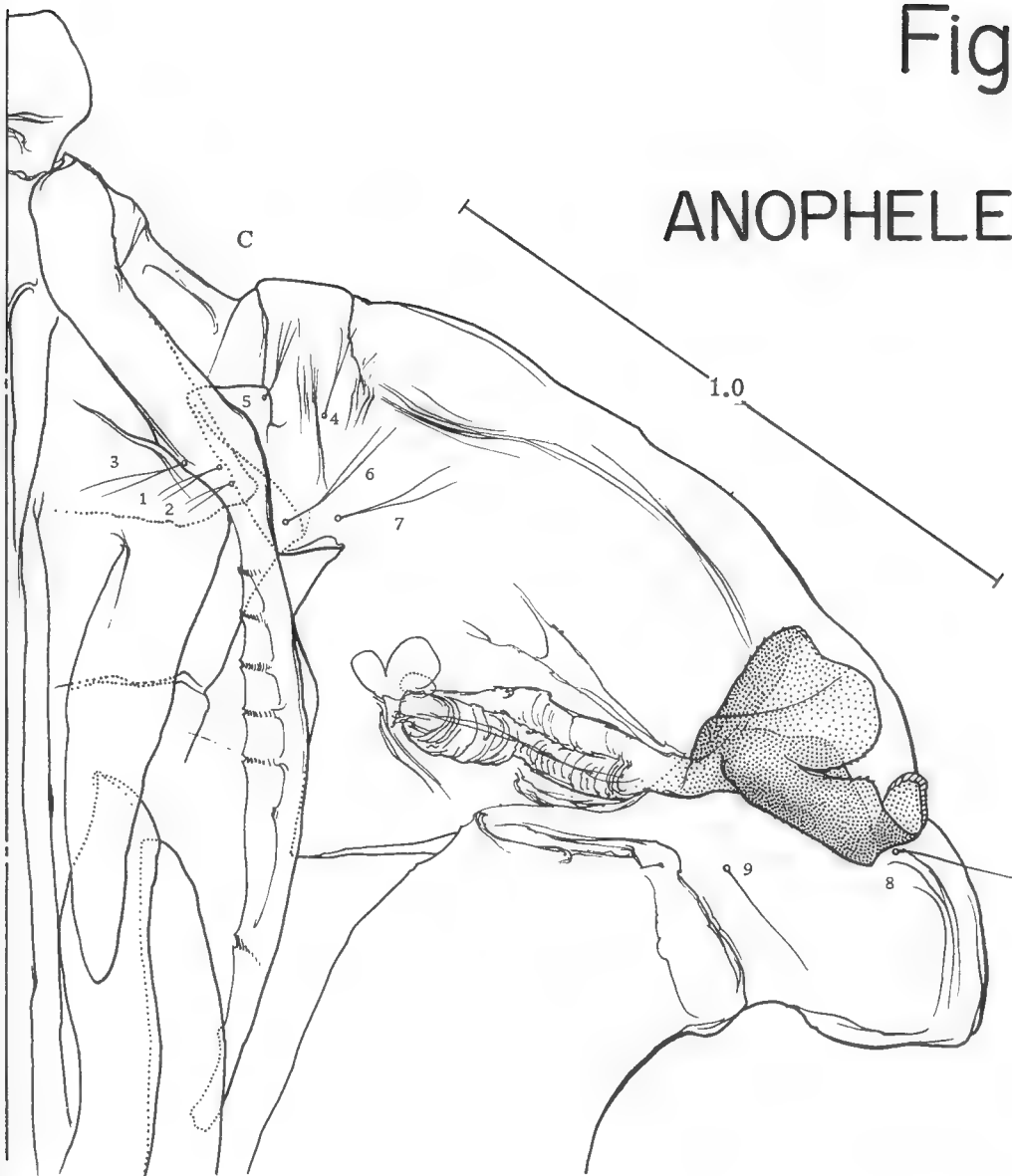


Fig. 12

ANOPHELES

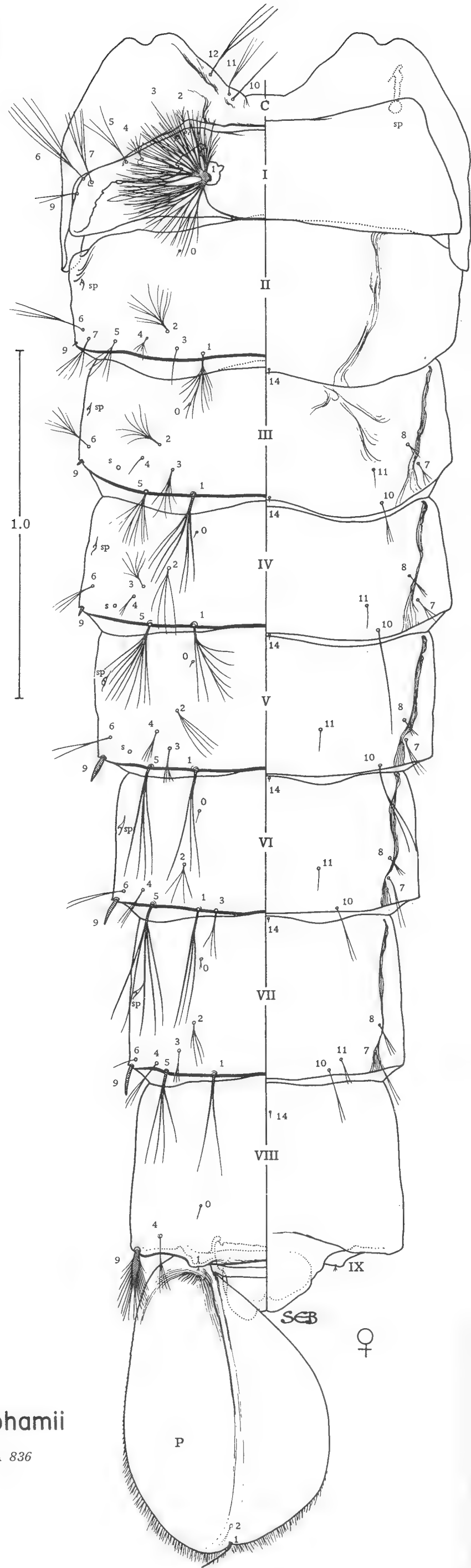
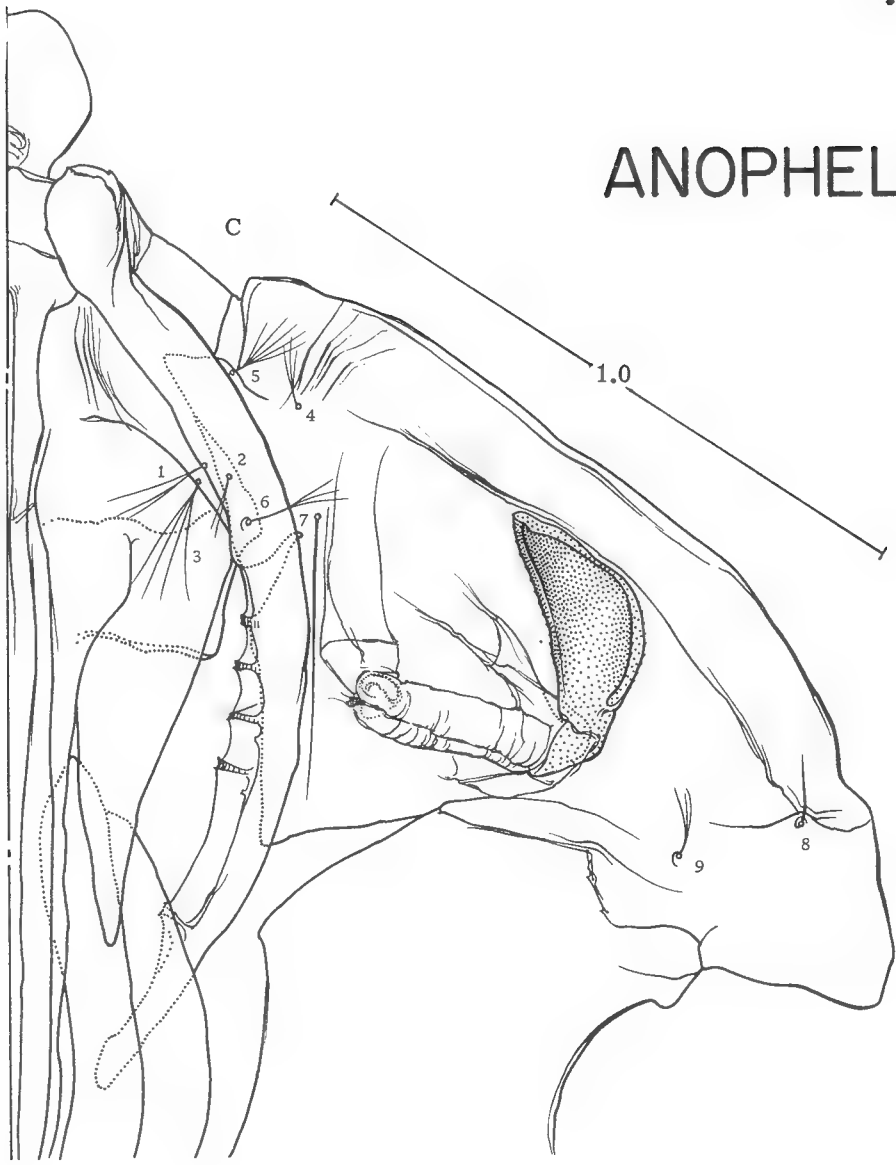


vestitipennis

JA 804

Fig. 13

ANOPHELES



grabhamii

JA 836

Fig. 14

ANOPHELES

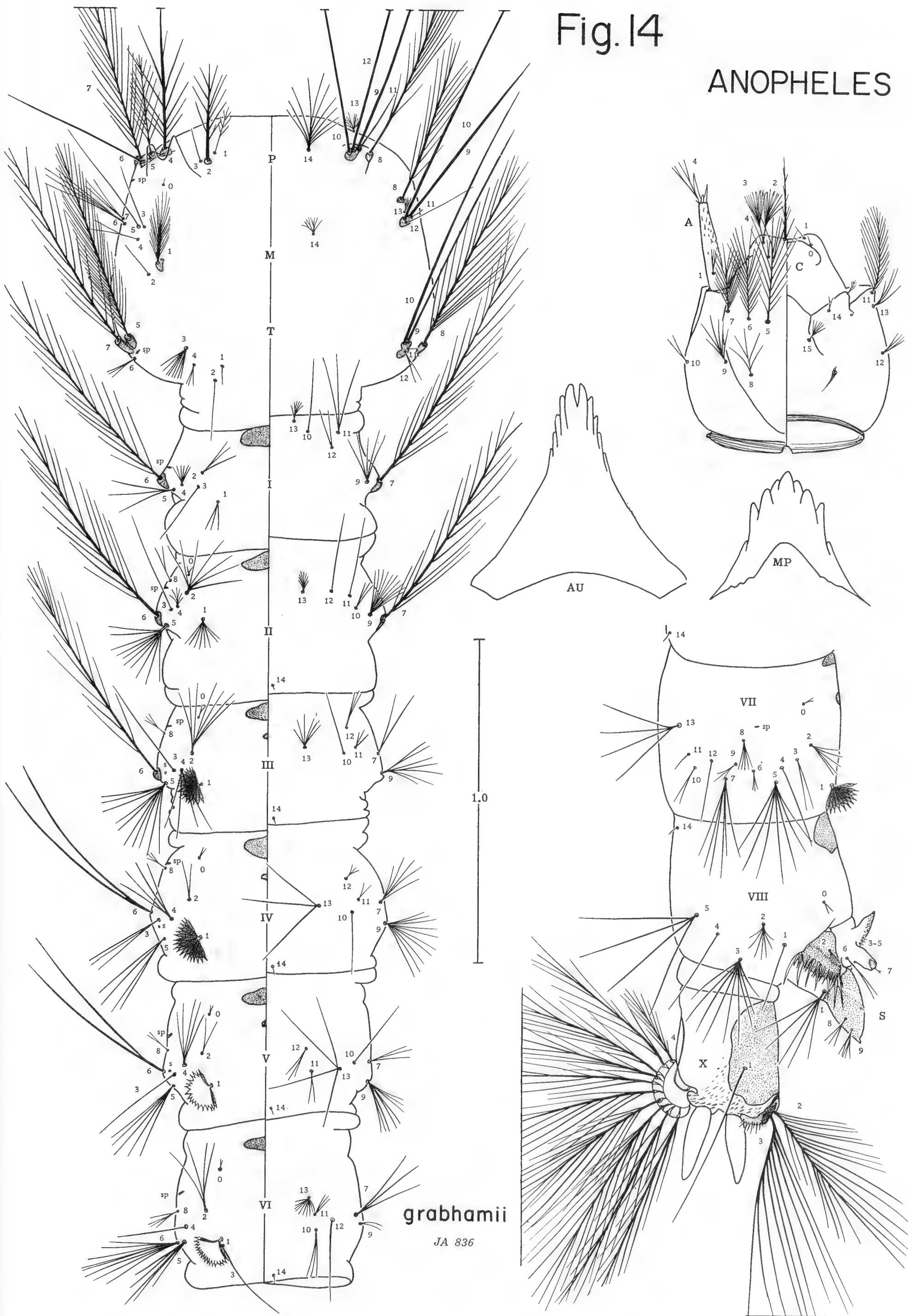


Fig. 15

URANOTAENIA

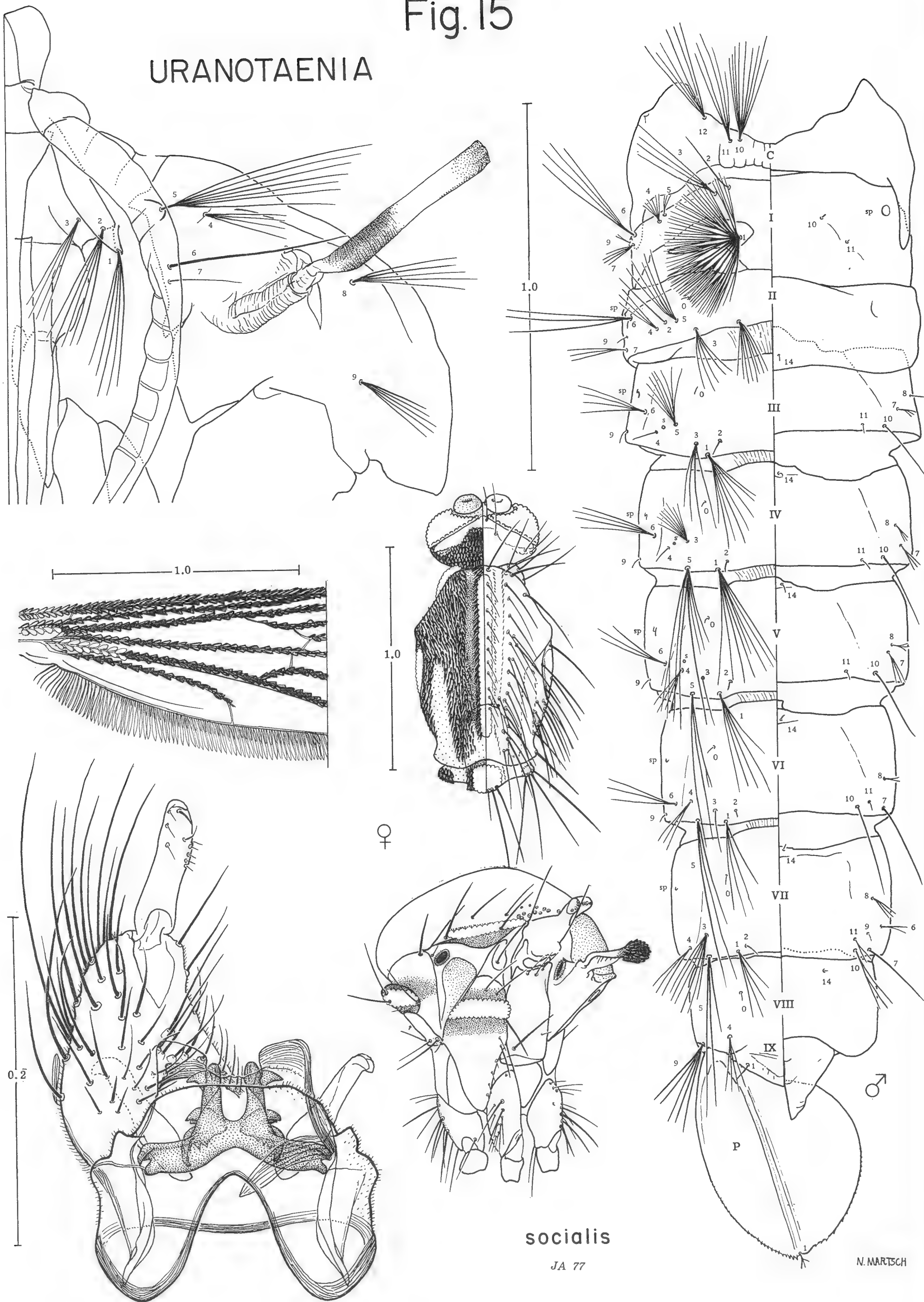


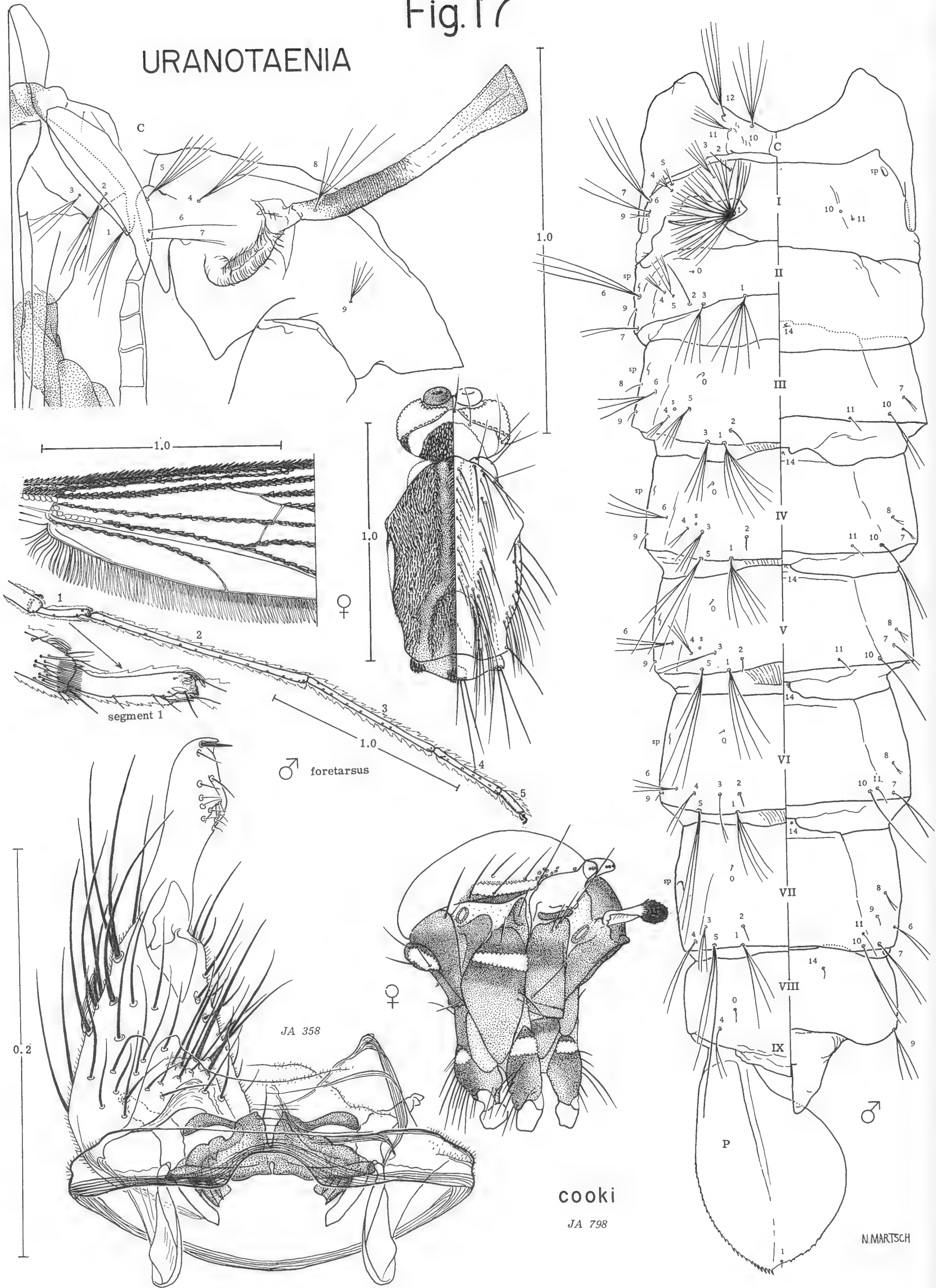
Fig. 16

URANOTAENIA



Fig. 17

URANOTAENIA

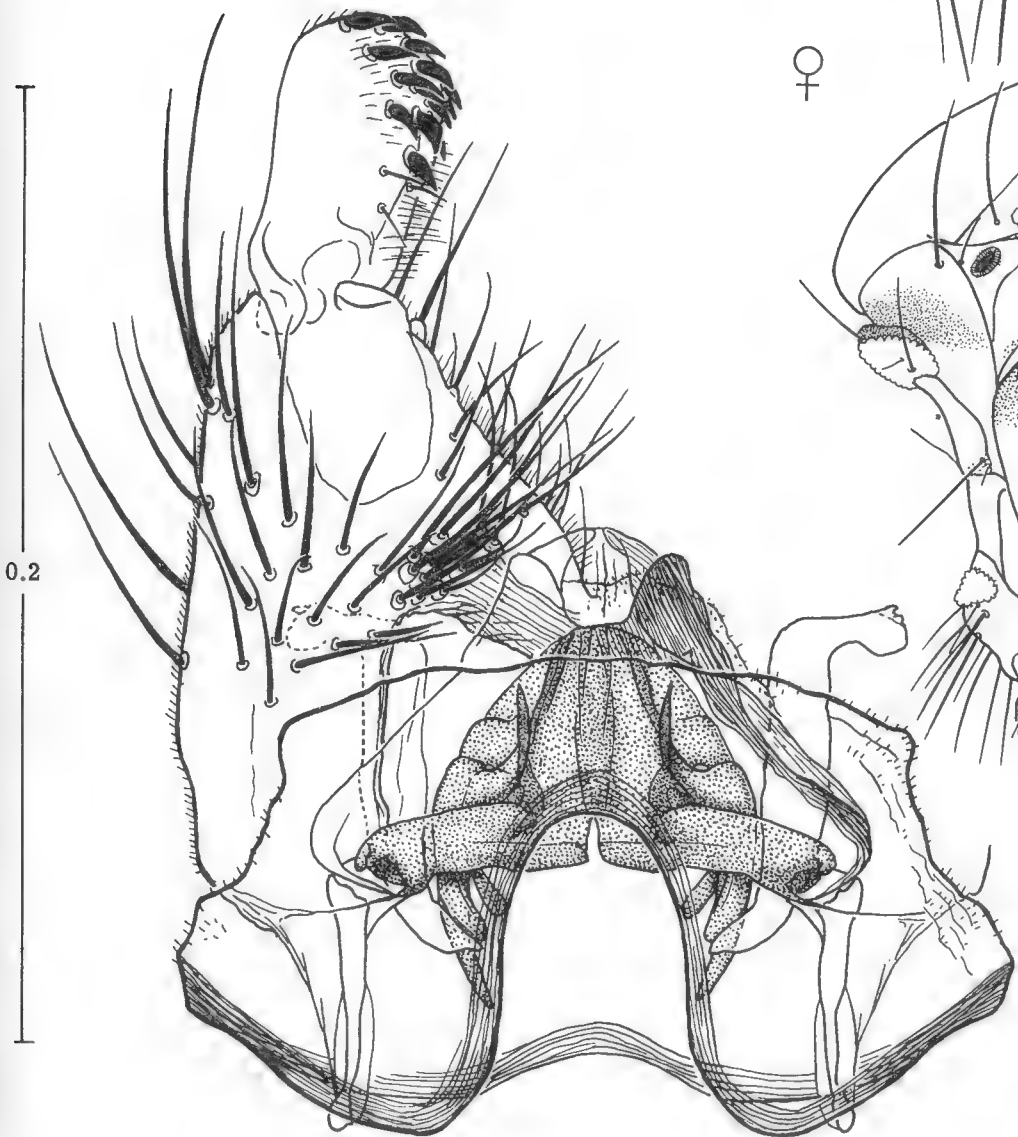
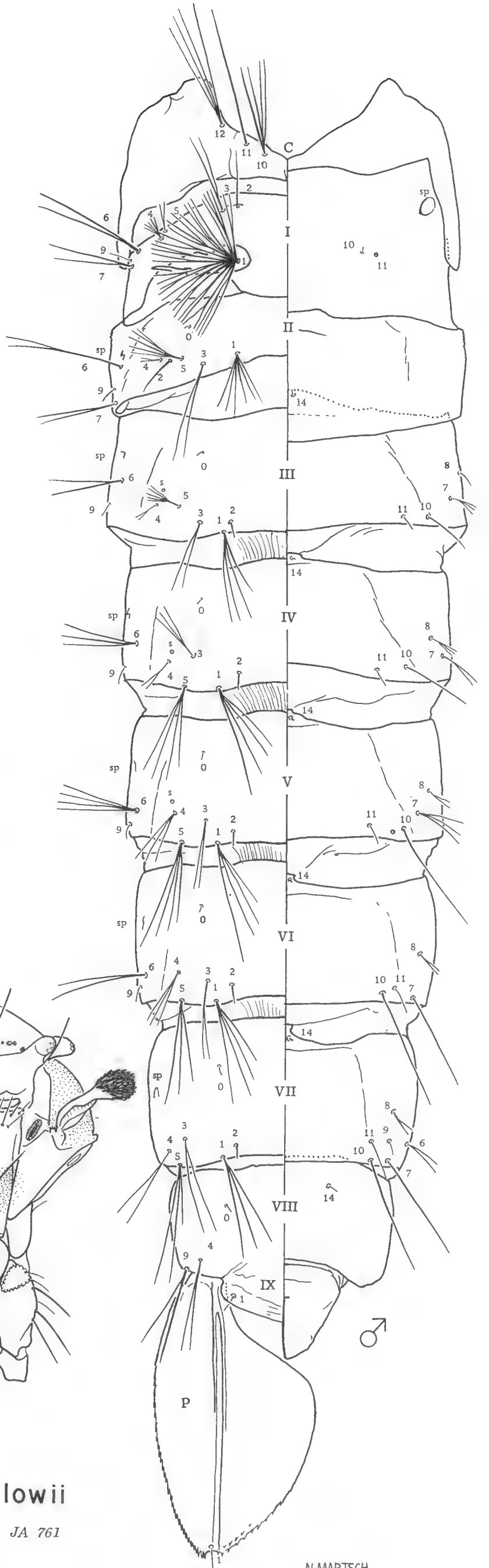
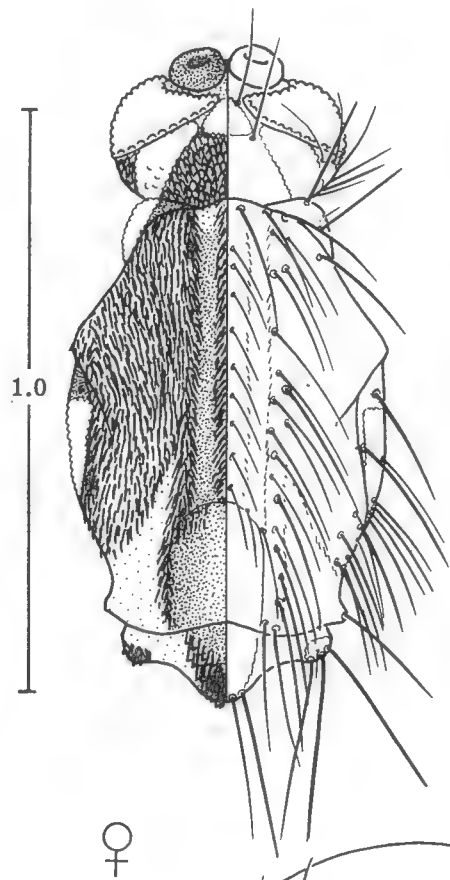
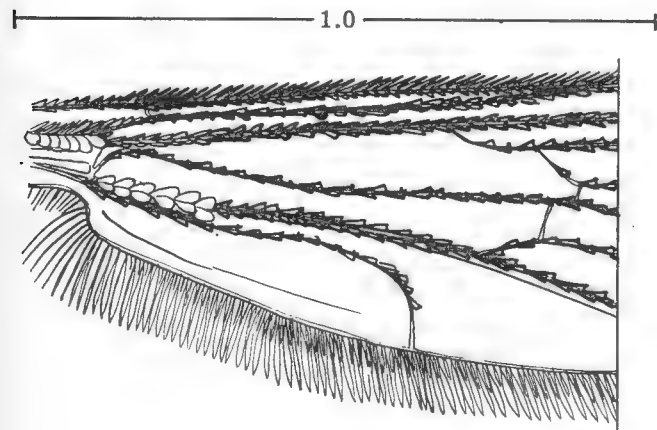
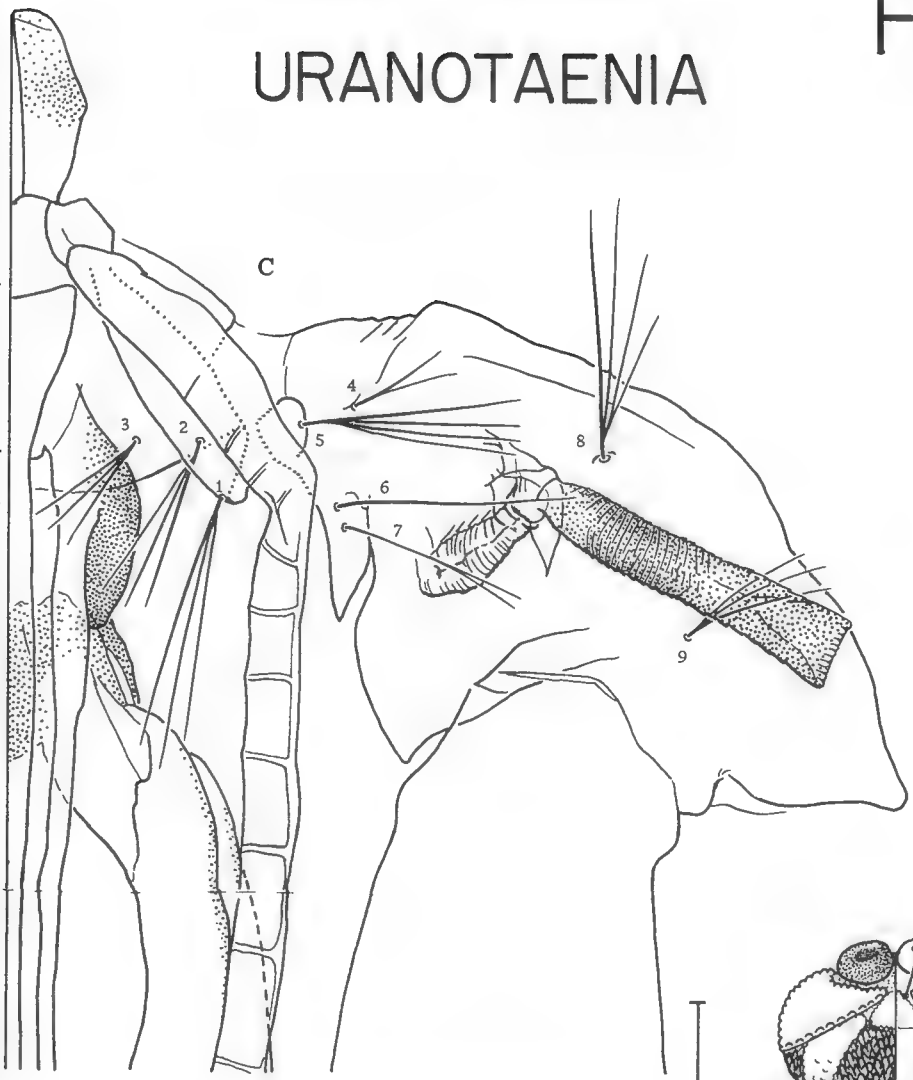


cooki
JA 798

N. MARTSCH

URANOTAENIA

Fig. 18

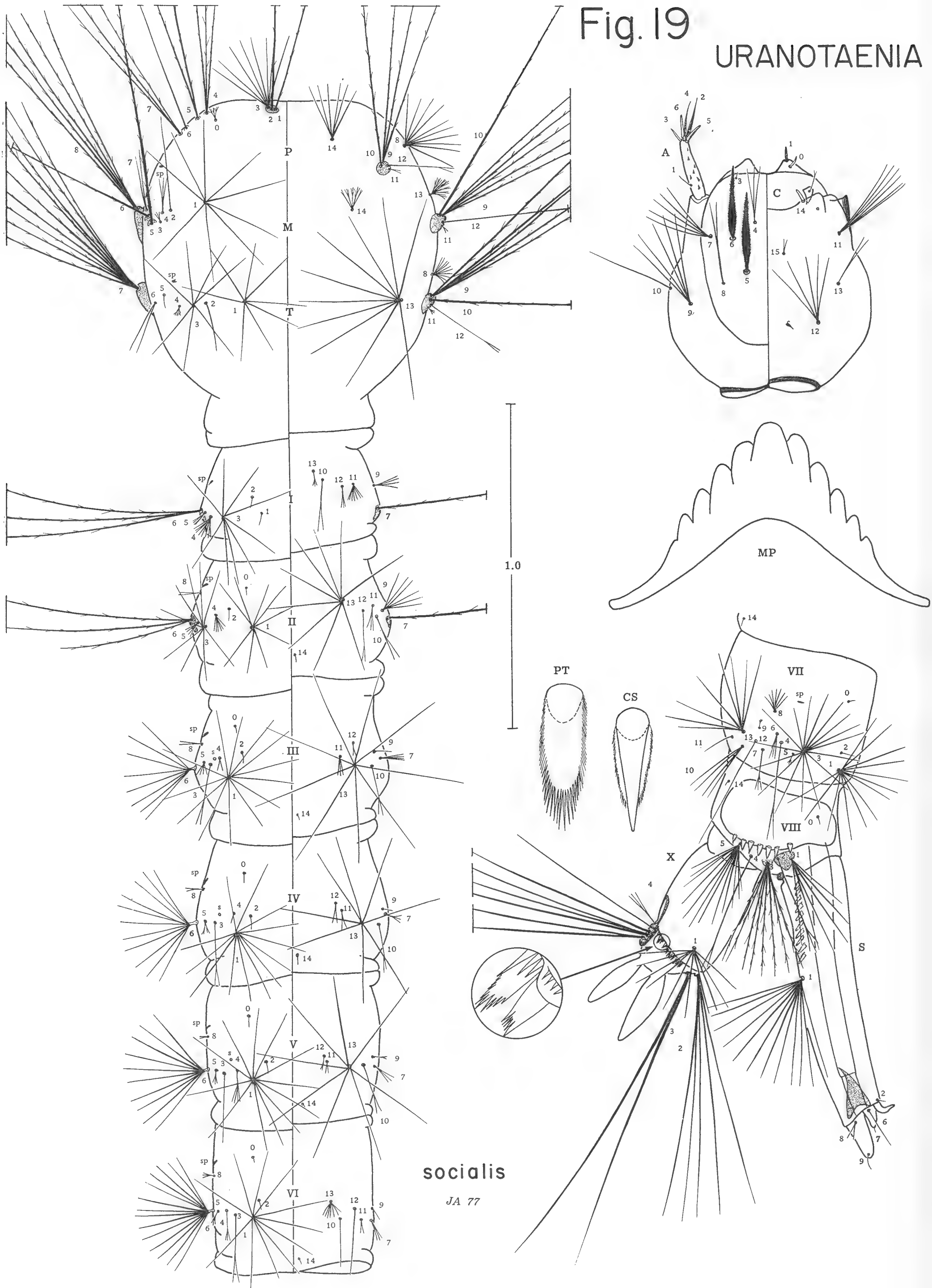


lowii

JA 761

N. MARTSCH

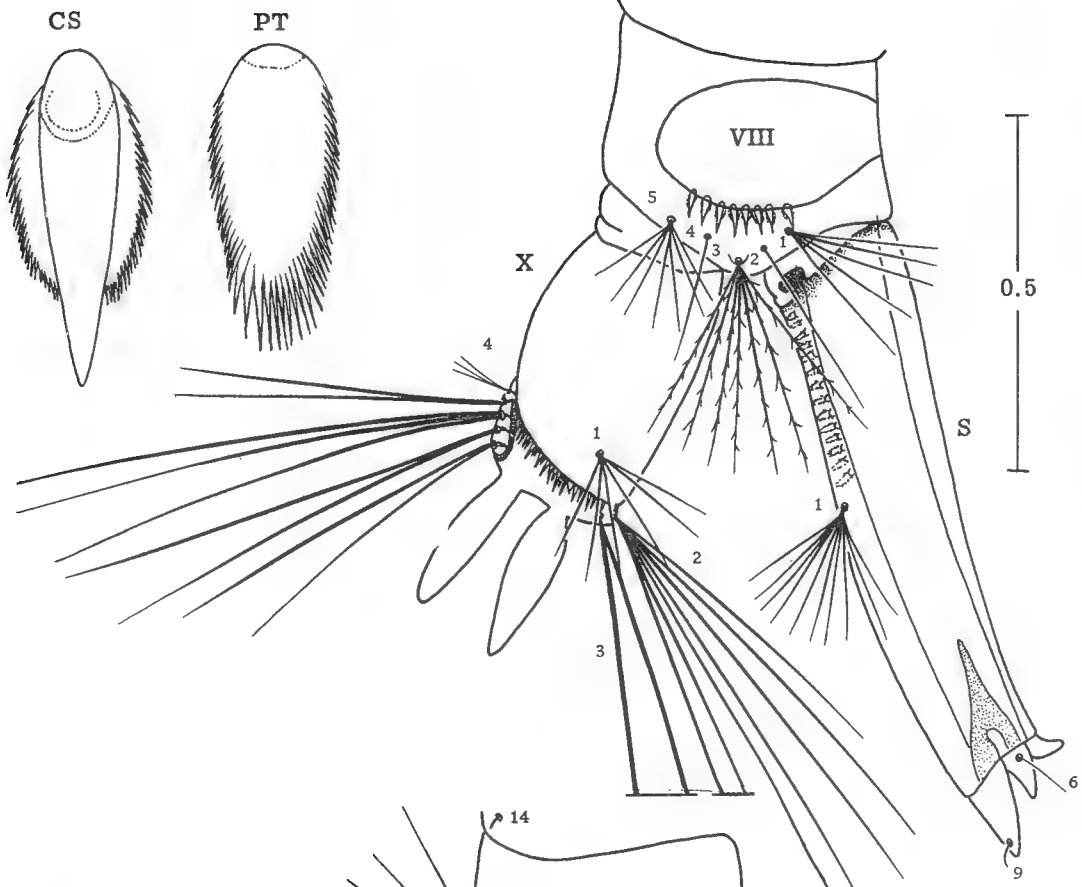
Fig. 19
URANOTAENIA



socialis
JA 77

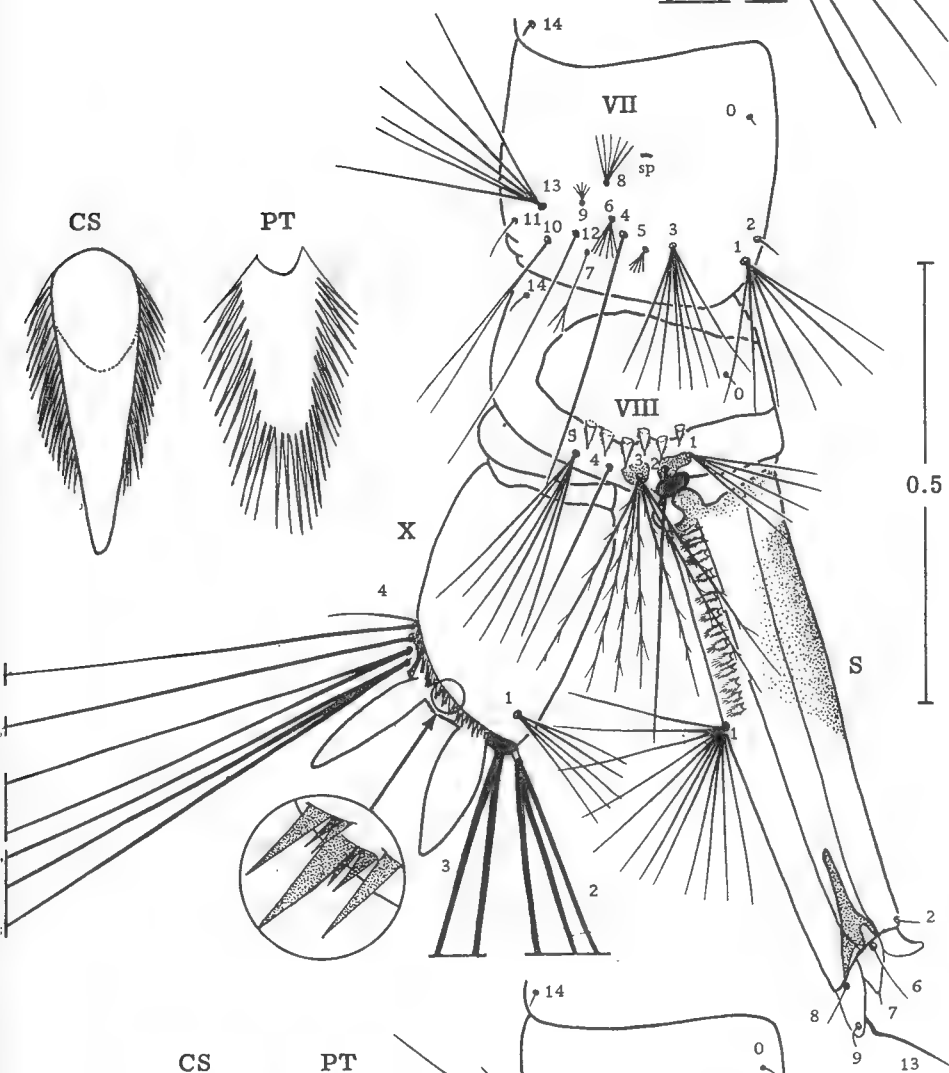
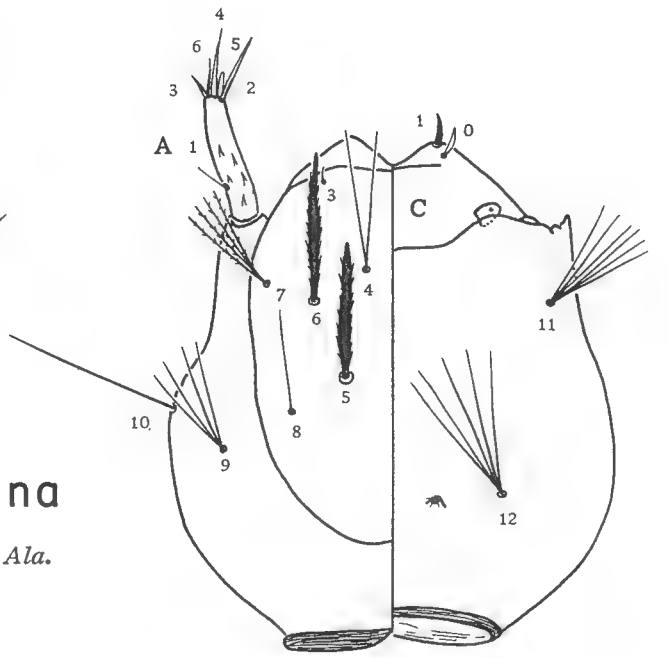
Fig. 20

URANOTAENIA



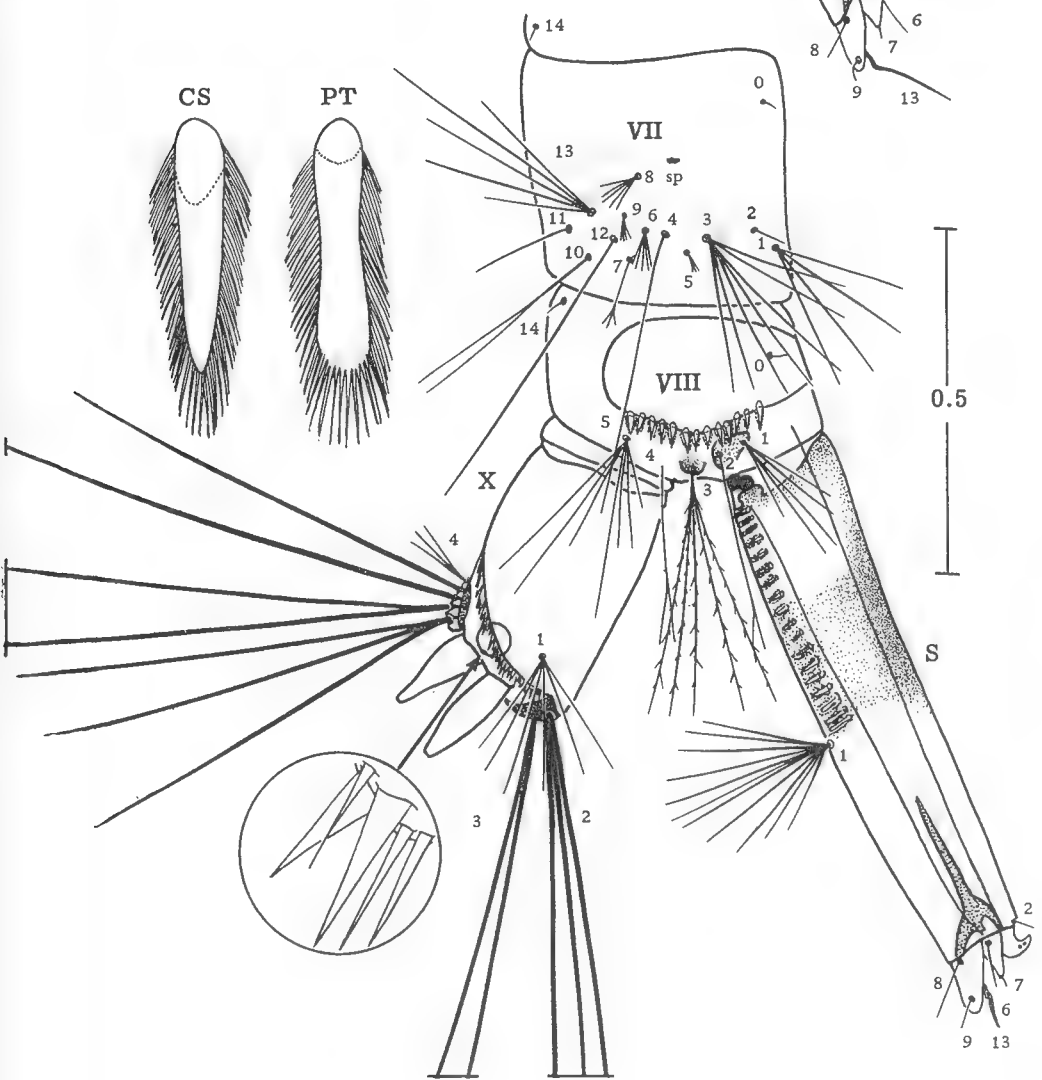
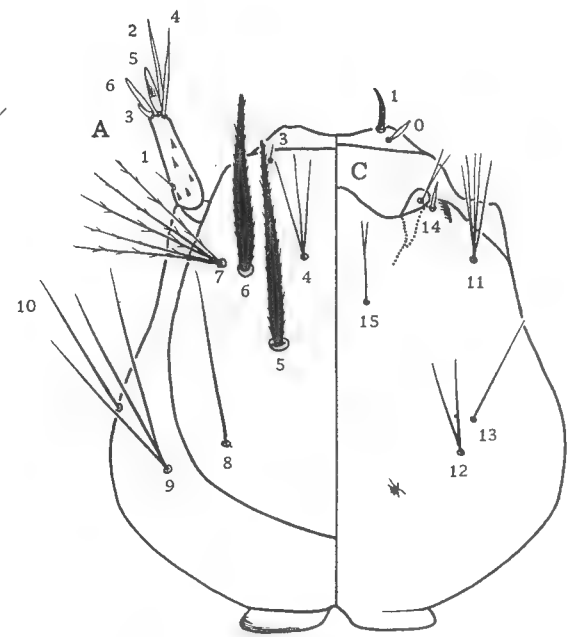
sapphirina

Wilson Dam, Ala.
U. S. A.



lowii

JA 761



cooki

JA 798

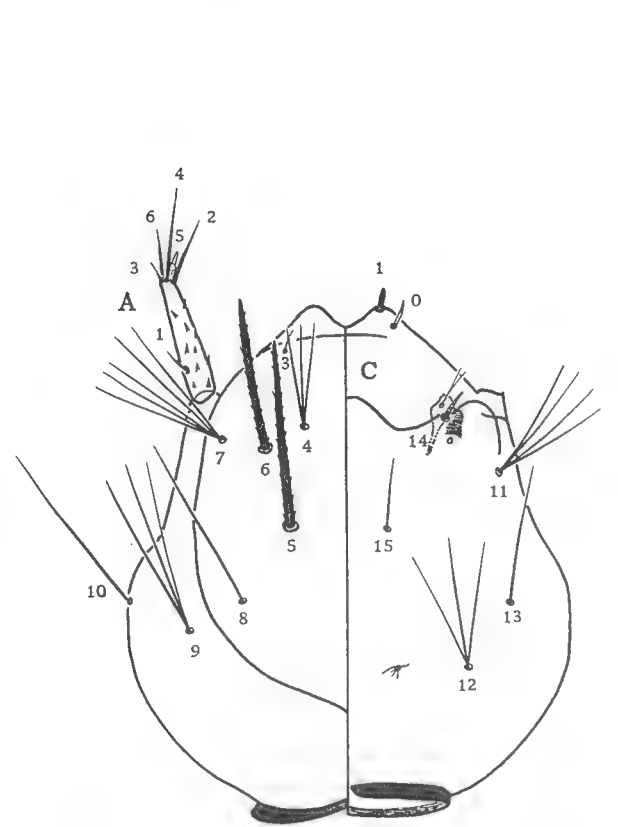
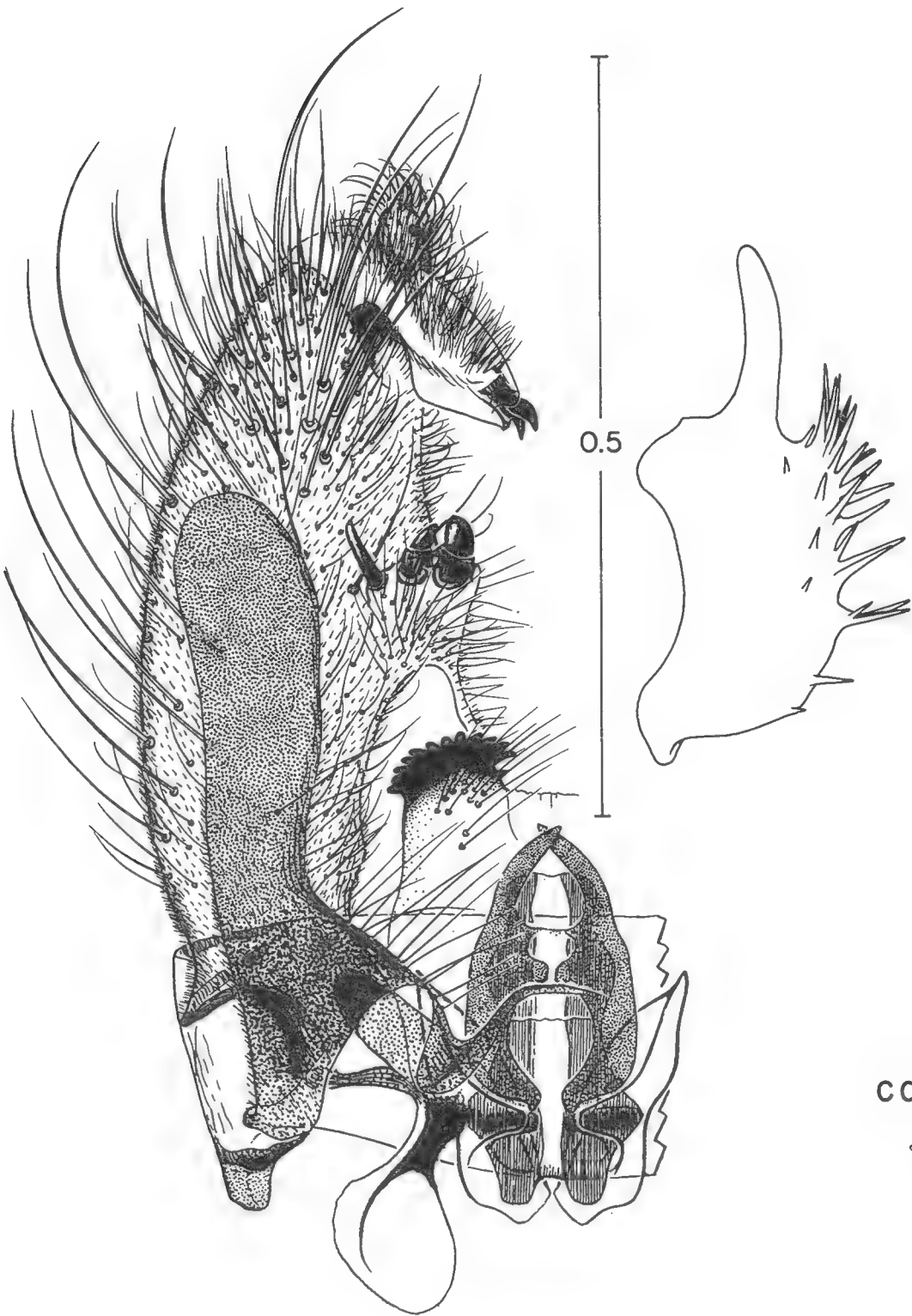
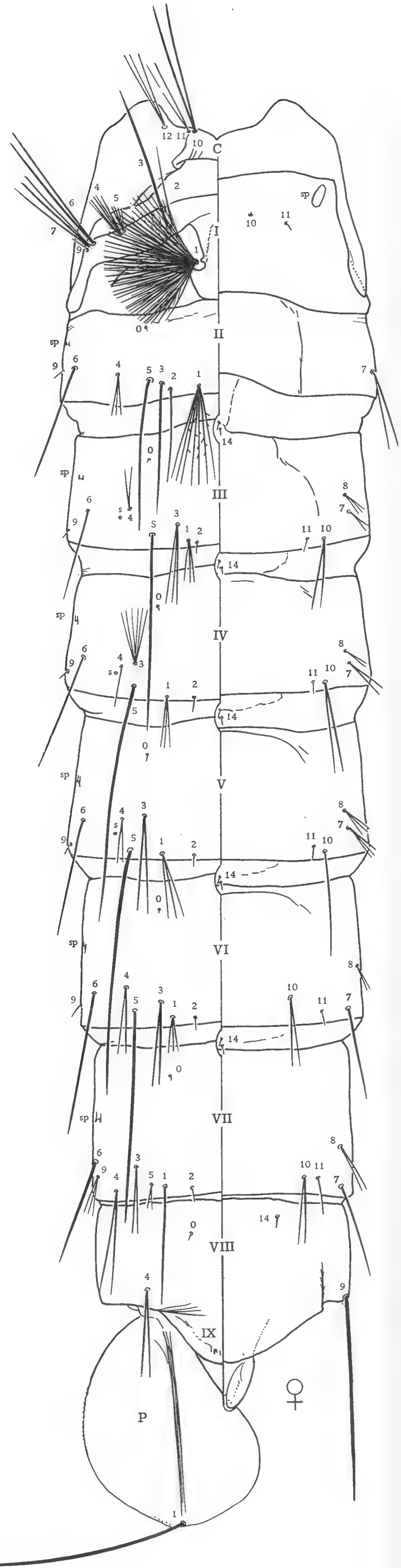
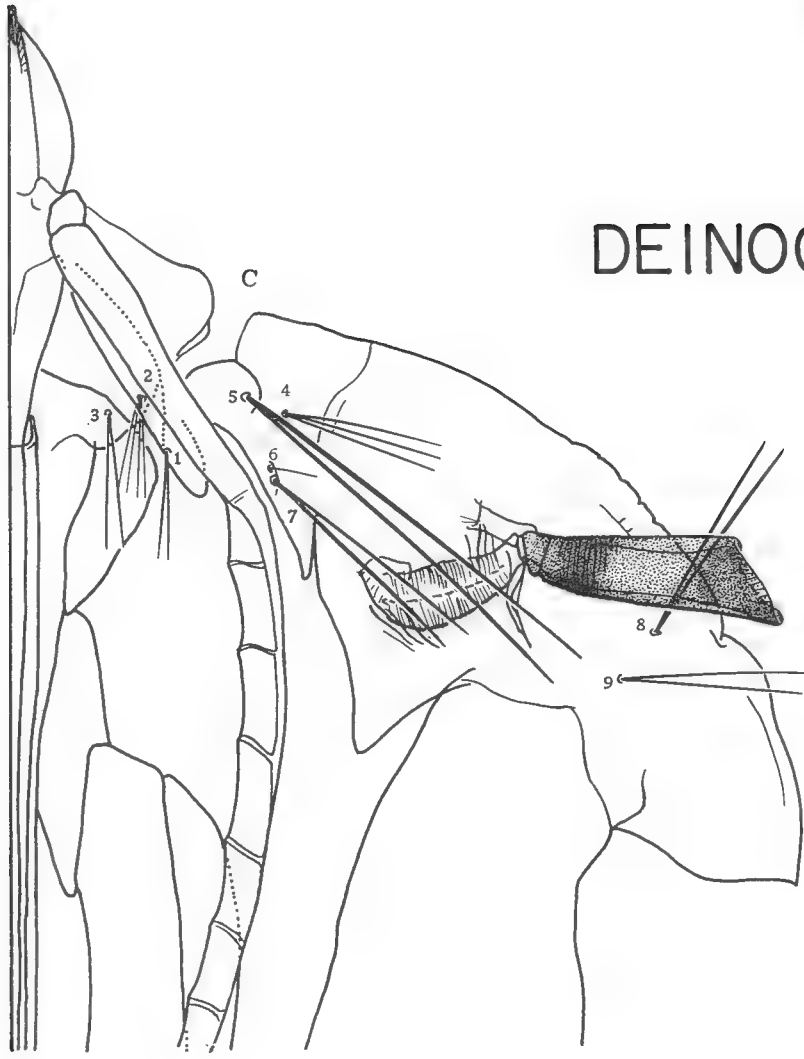


Fig. 21

DEINOCERITES



cancer

JA 705

Fig. 22

DEINOCERITES

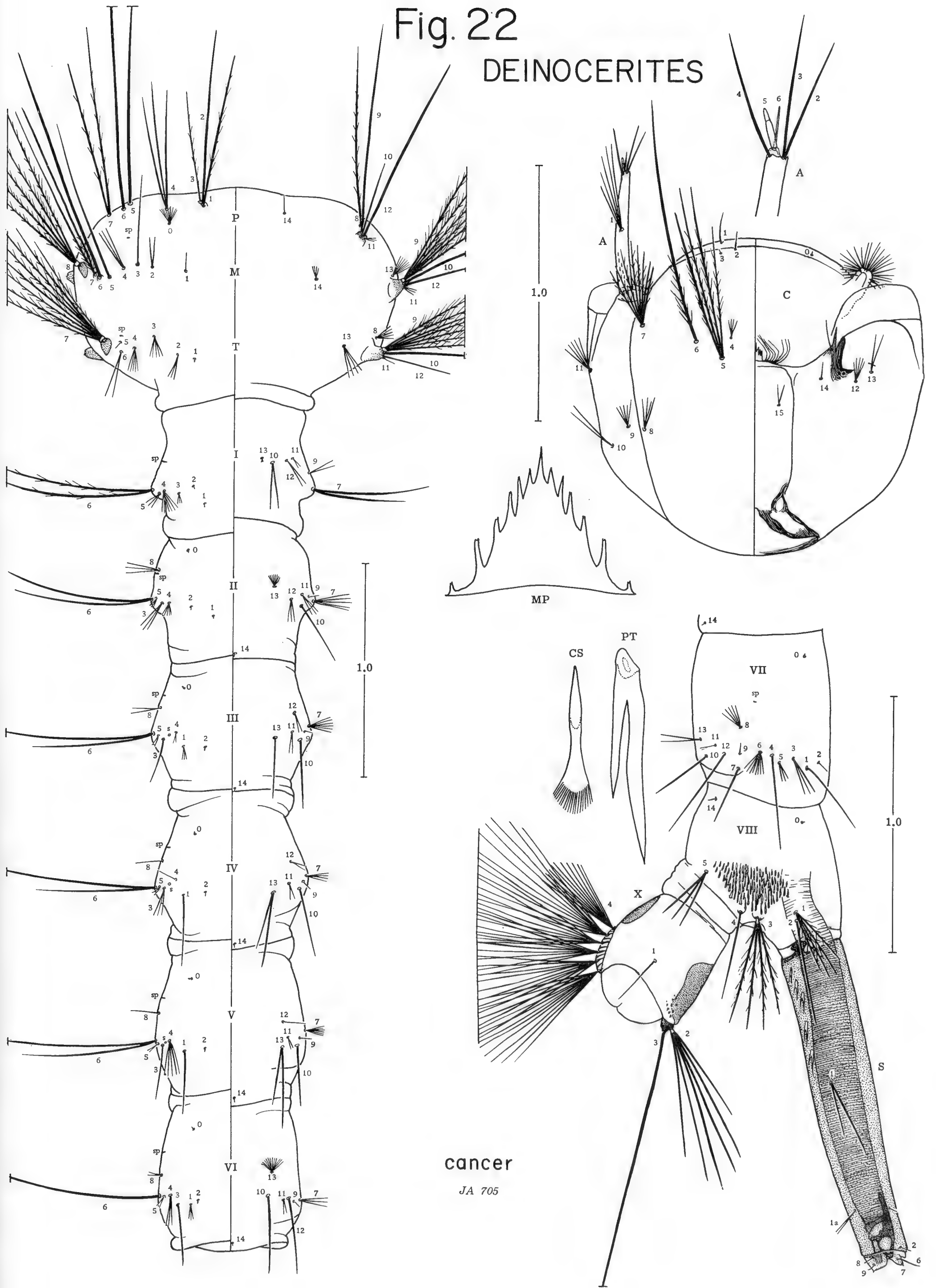
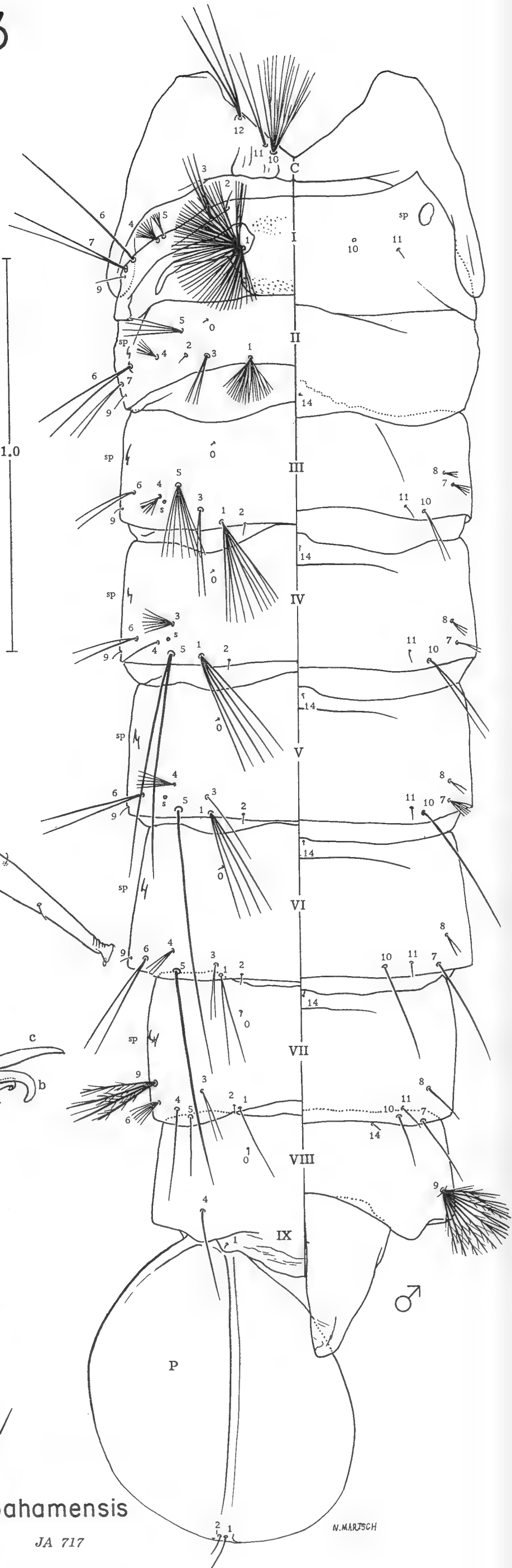
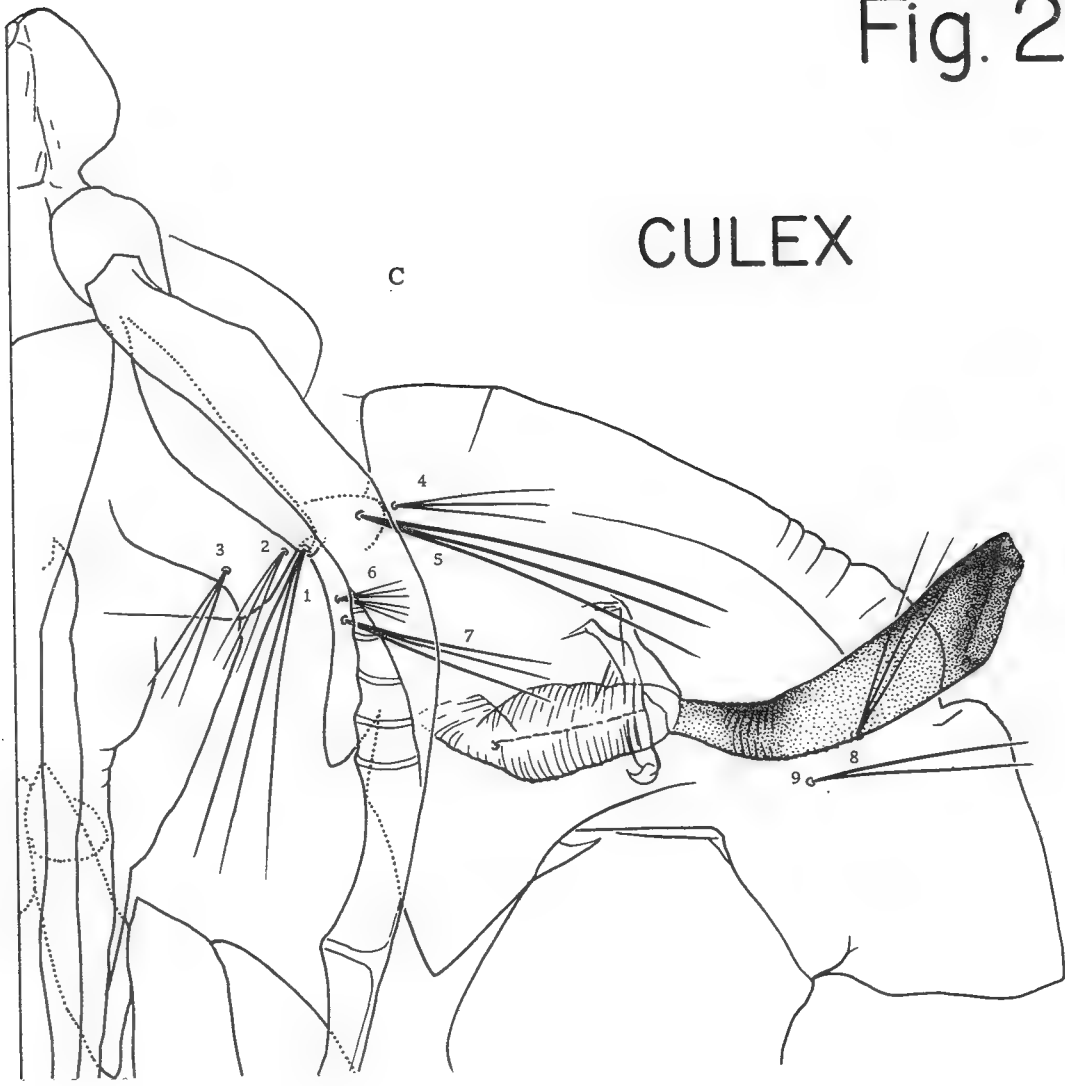


Fig. 23

CULEX



bahamensis

JA 717

N. MARZSCH

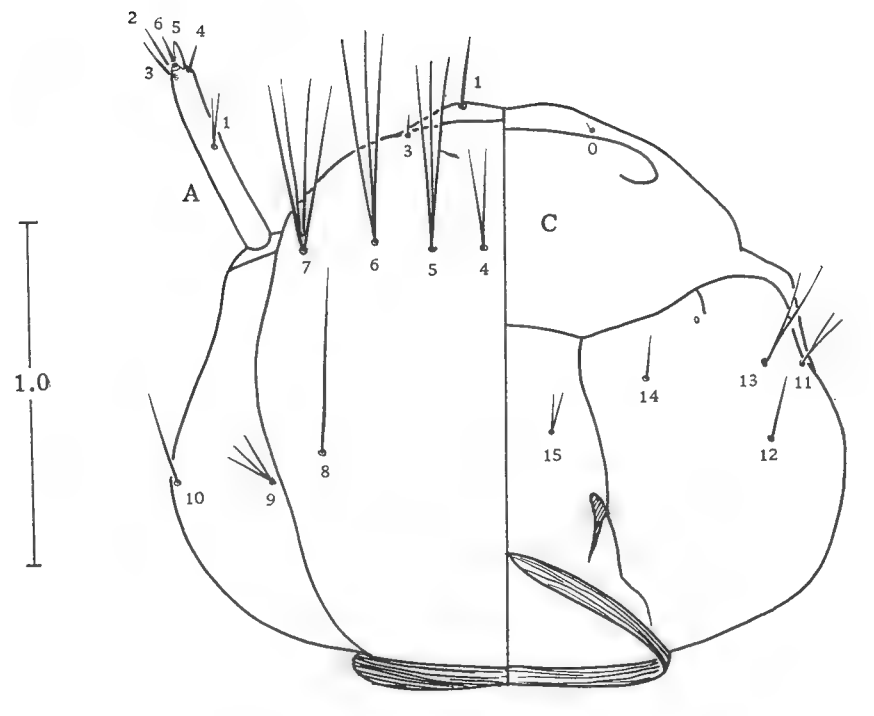
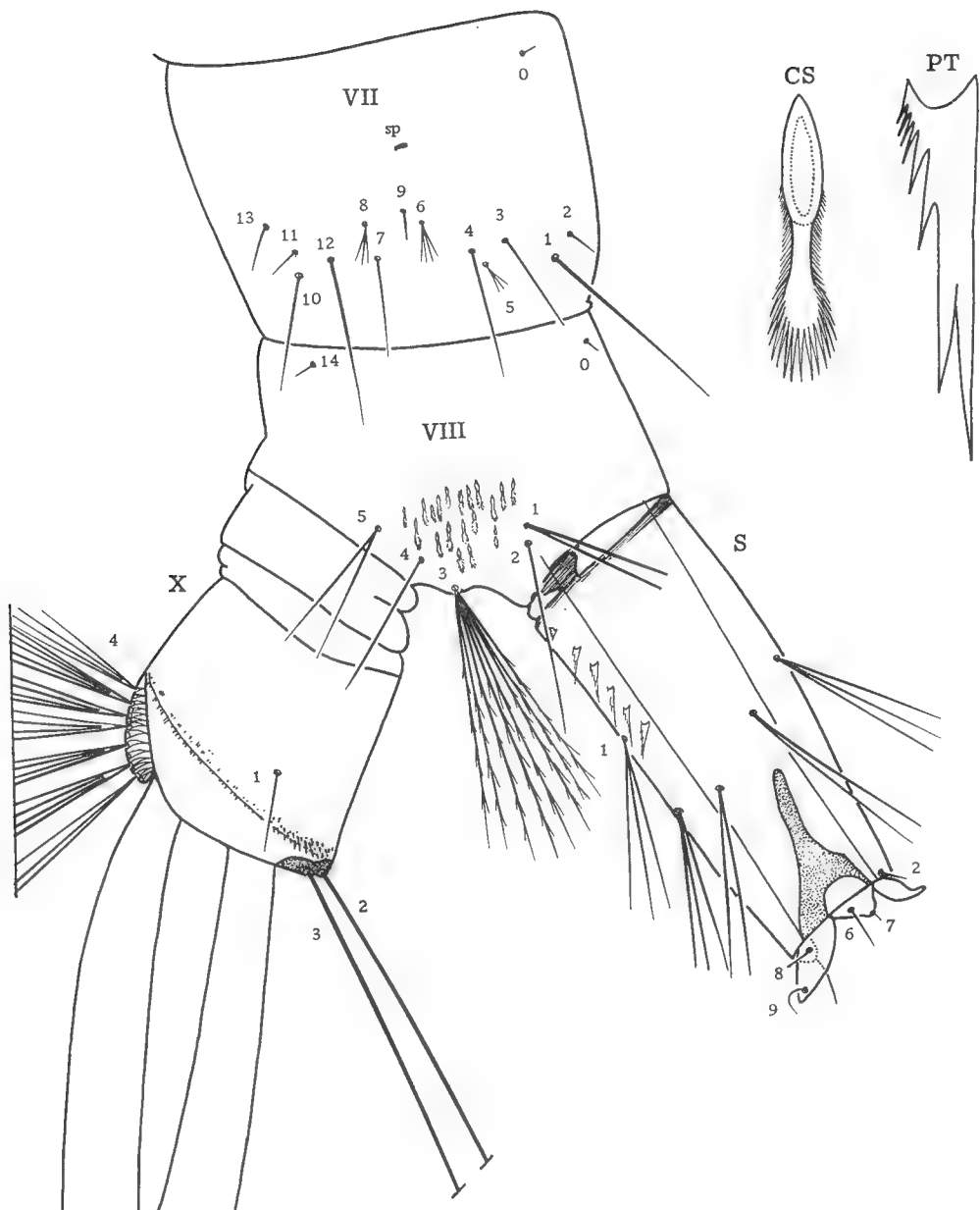
Fig. 24

CULEX



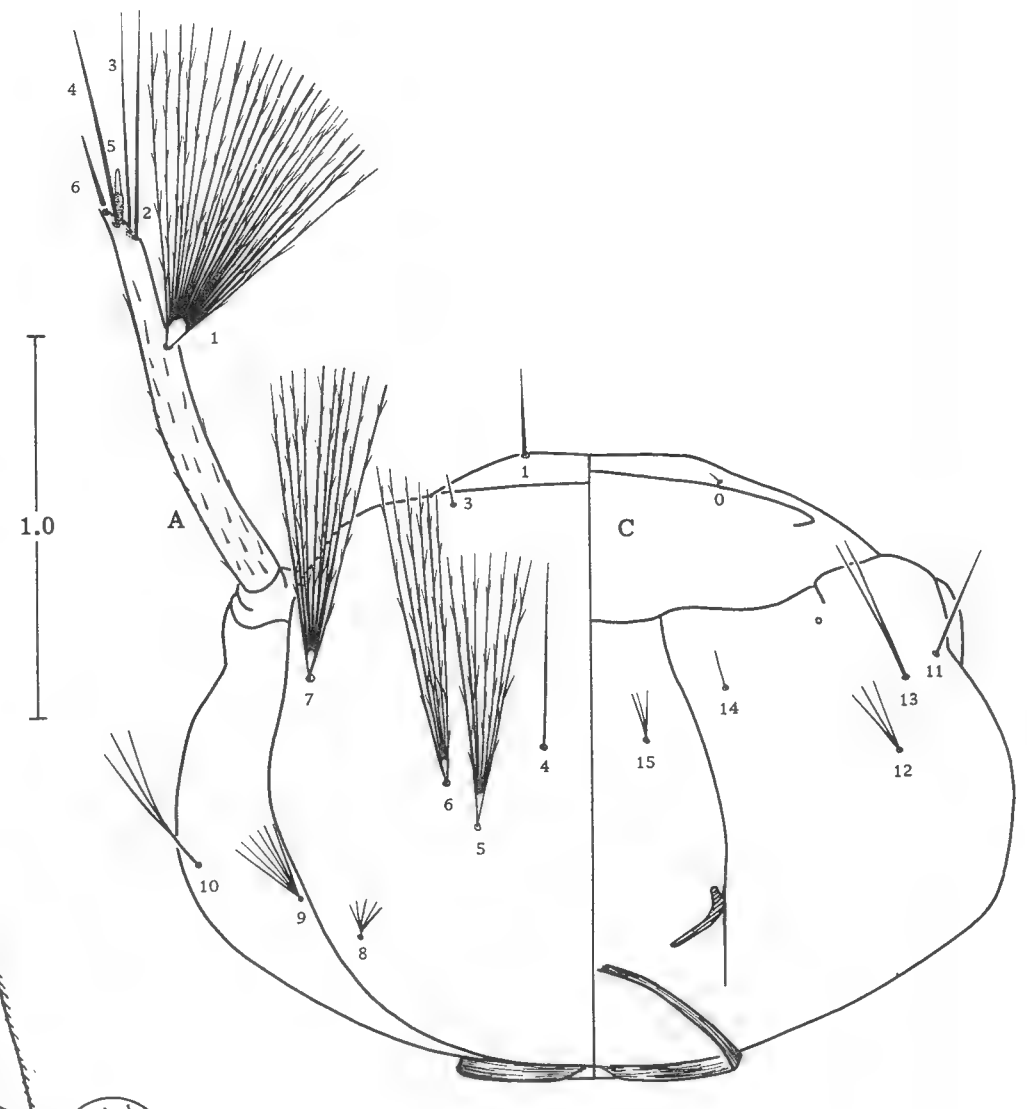
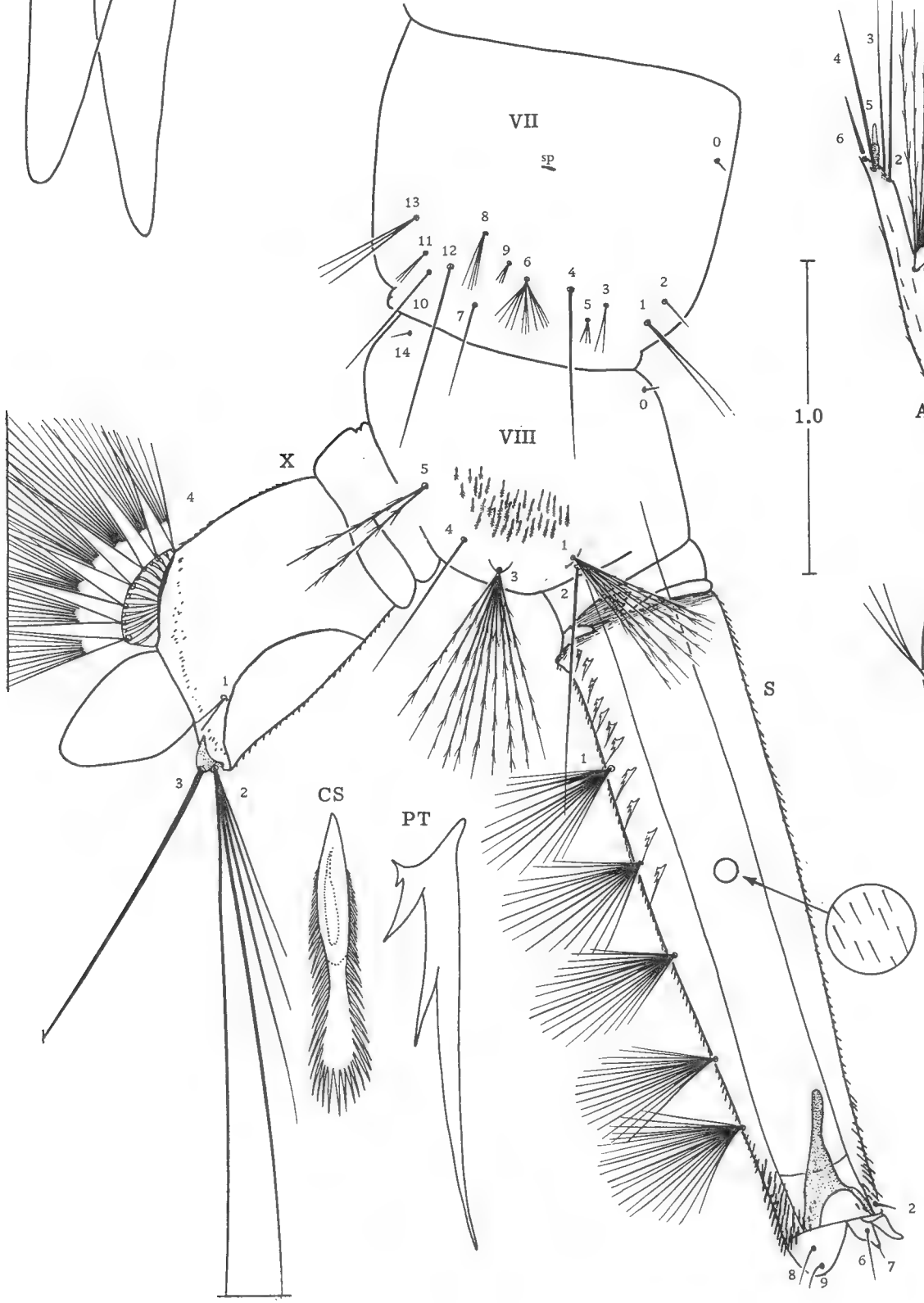
Fig. 25

CULEX



corniger

JA 228

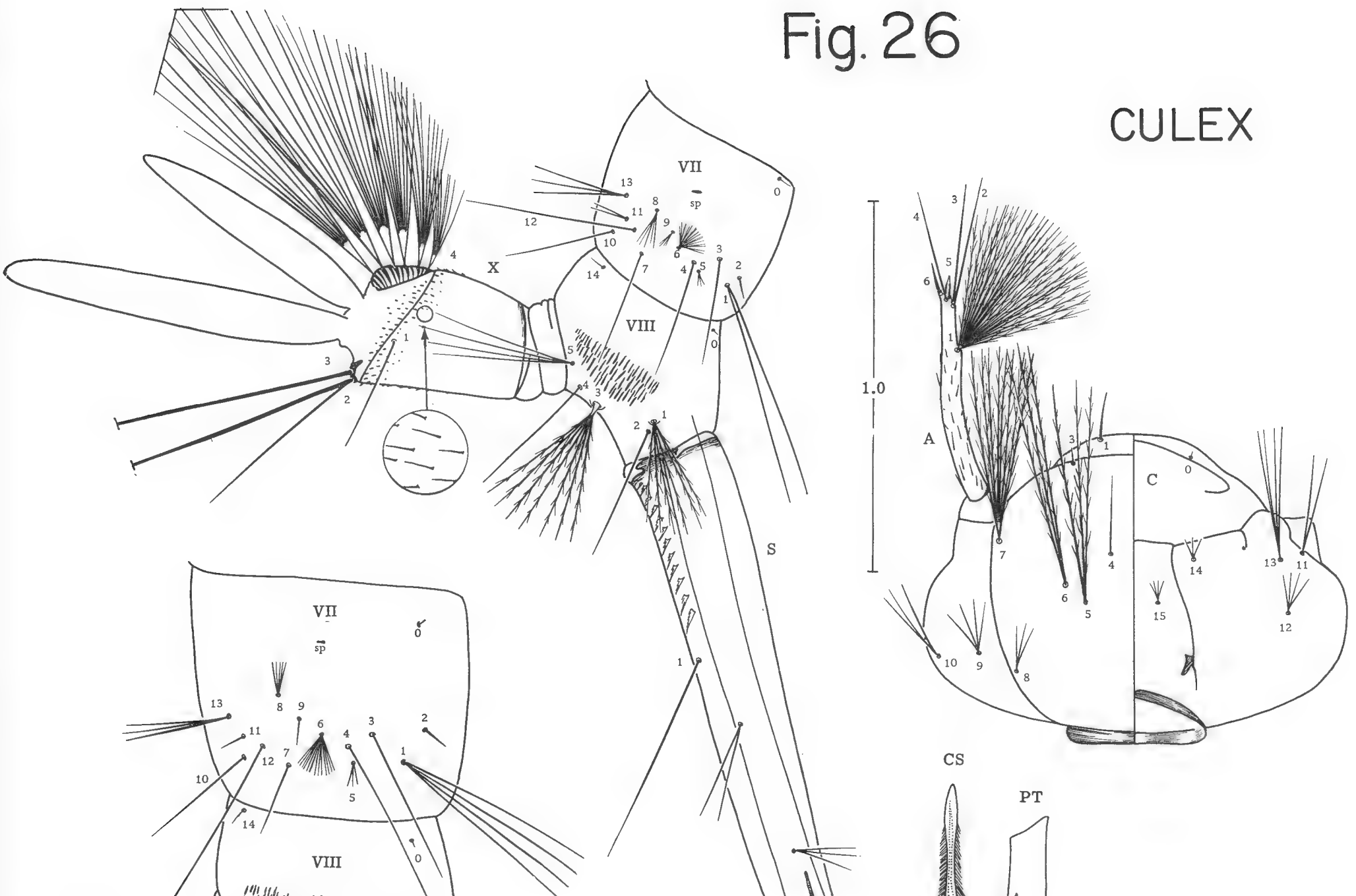


bahamensis

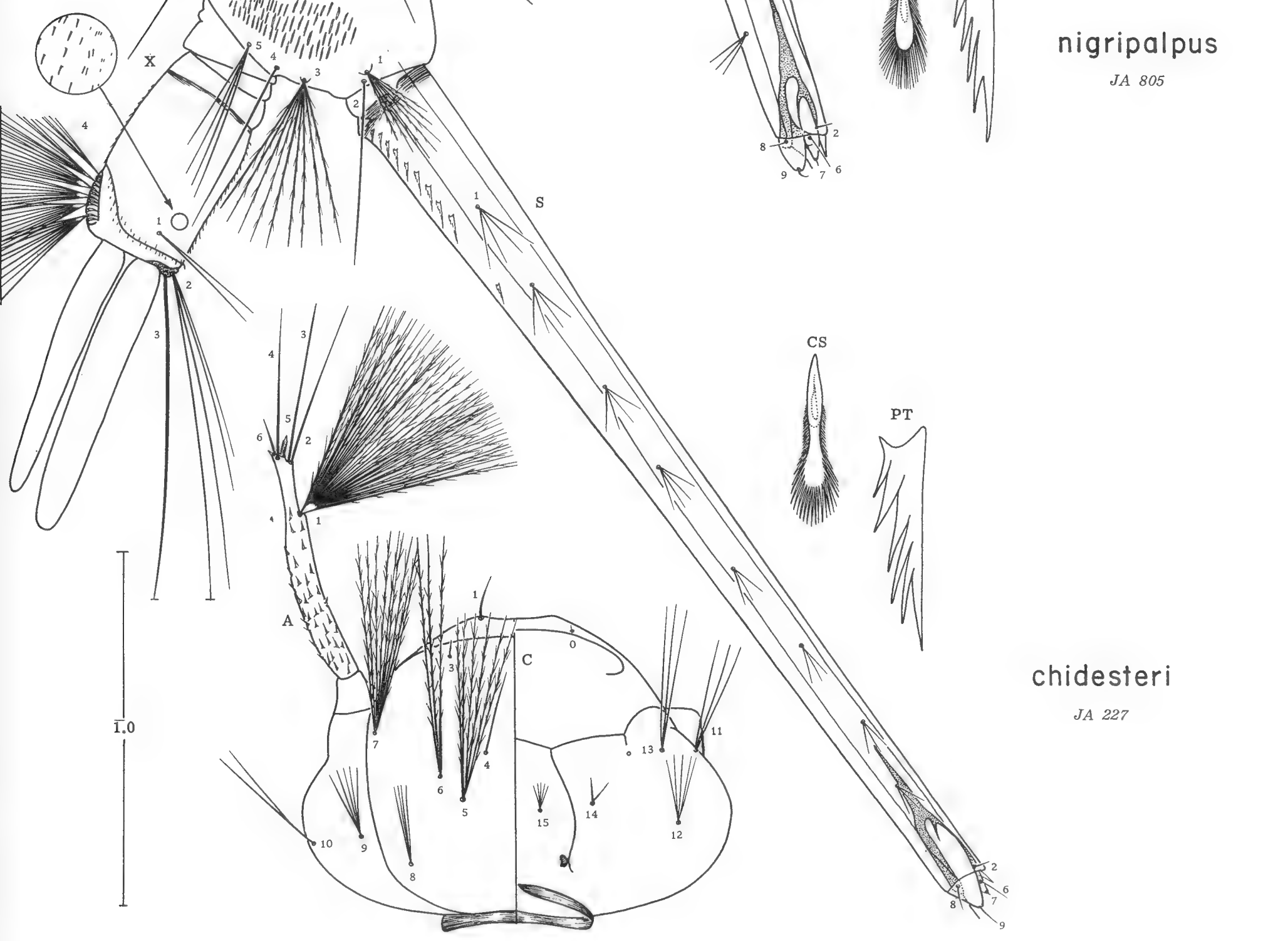
JA 717

Fig. 26

CULEX



nigripalpus
JA 805



chidesteri
JA 227

Fig. 27

CULEX

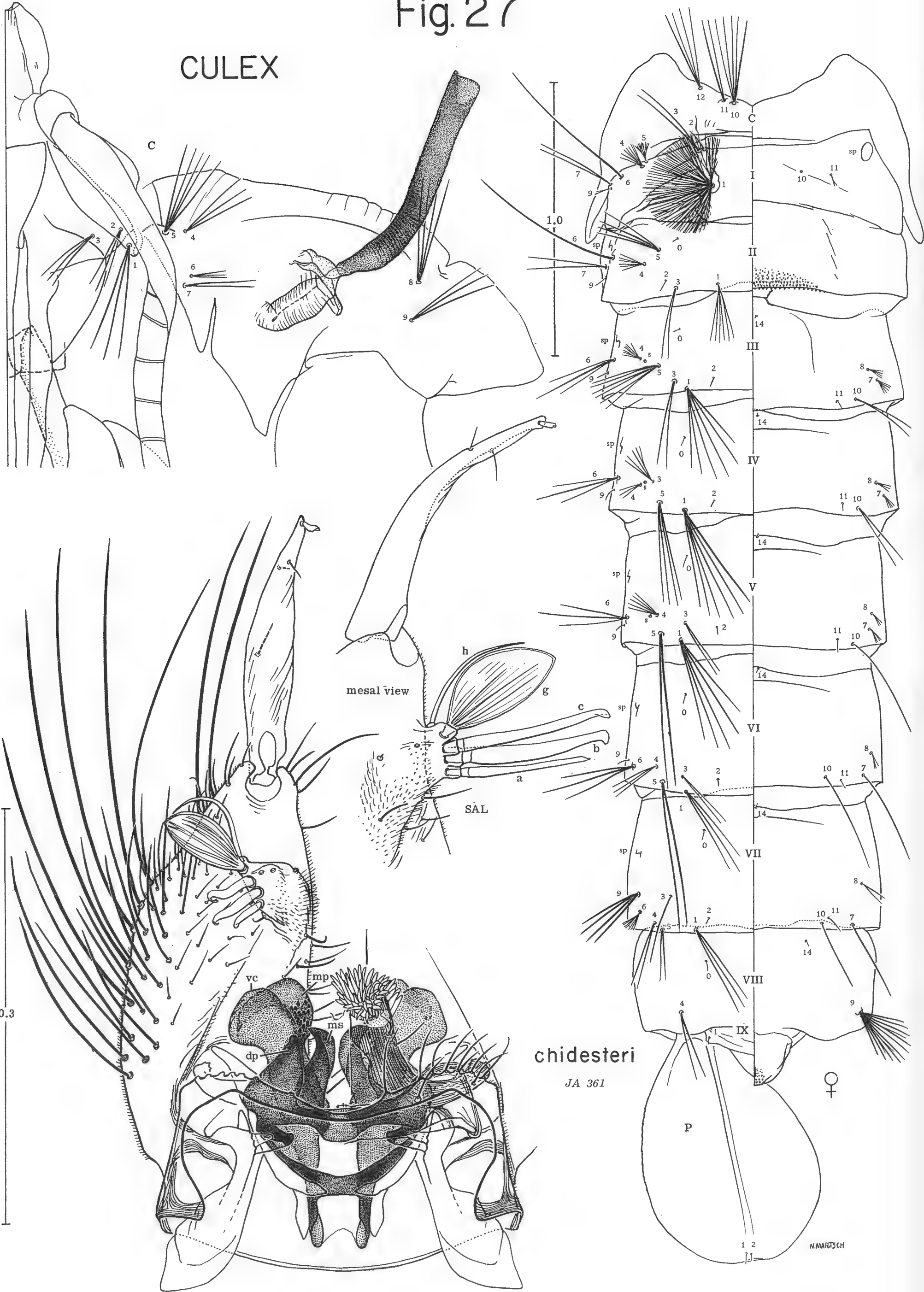
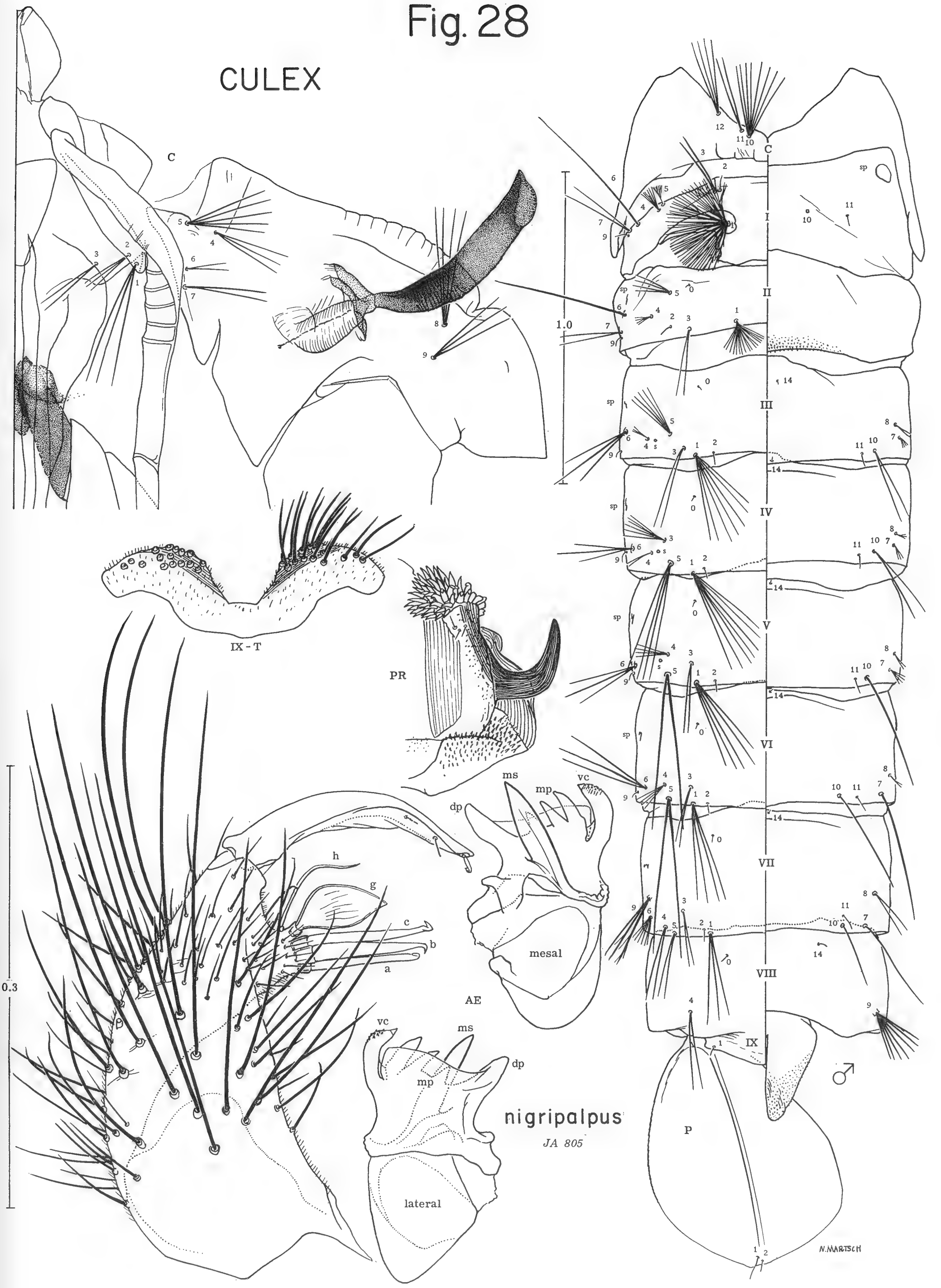


Fig. 28

CULEX



nigripalpus
JA 805

N. MARTSCH

Fig. 29

CULEX



janitor
JA 736

M. MARTSCH

Fig. 30

CULEX

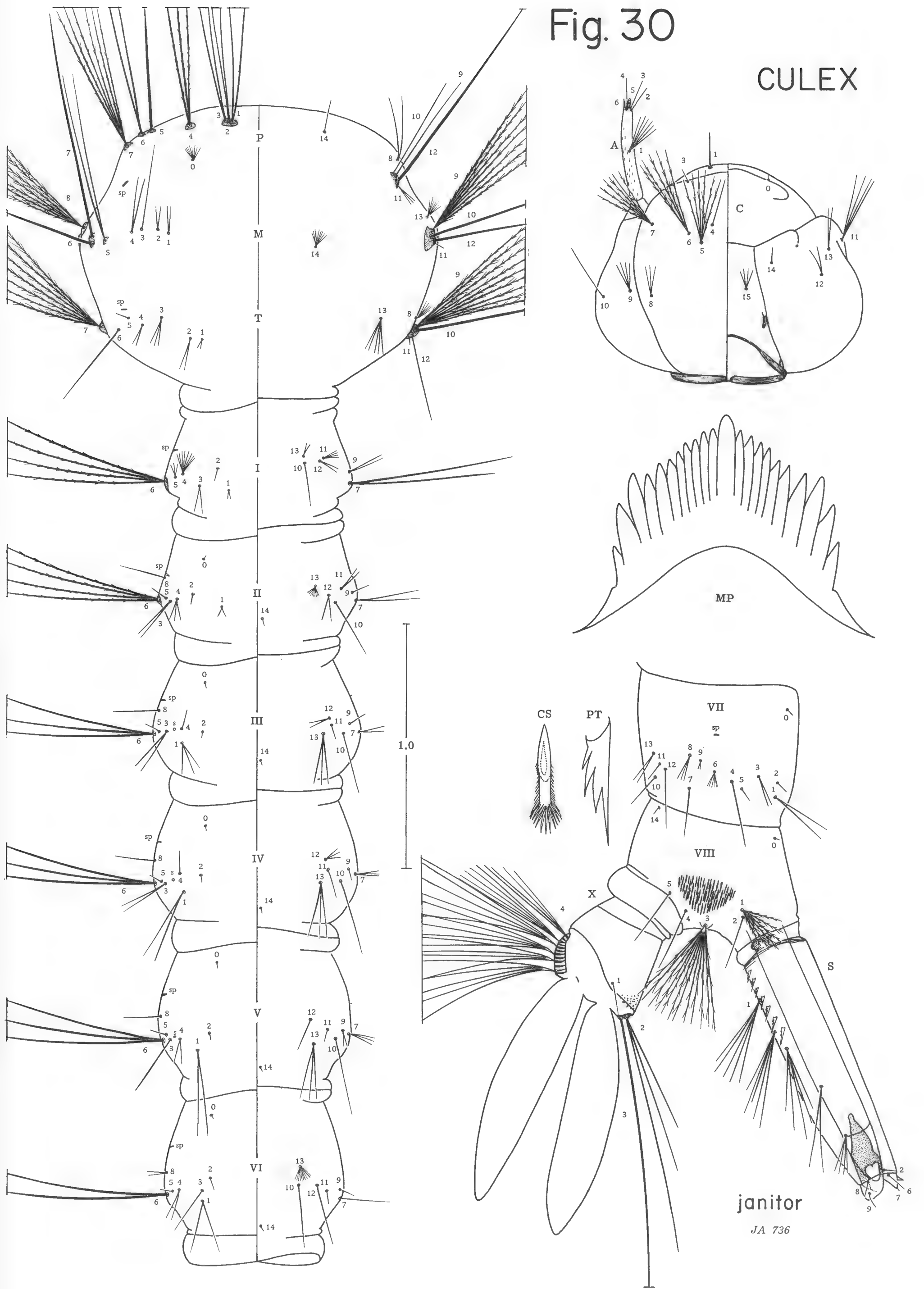


Fig. 31

CULEX



Fig. 32

CULEX

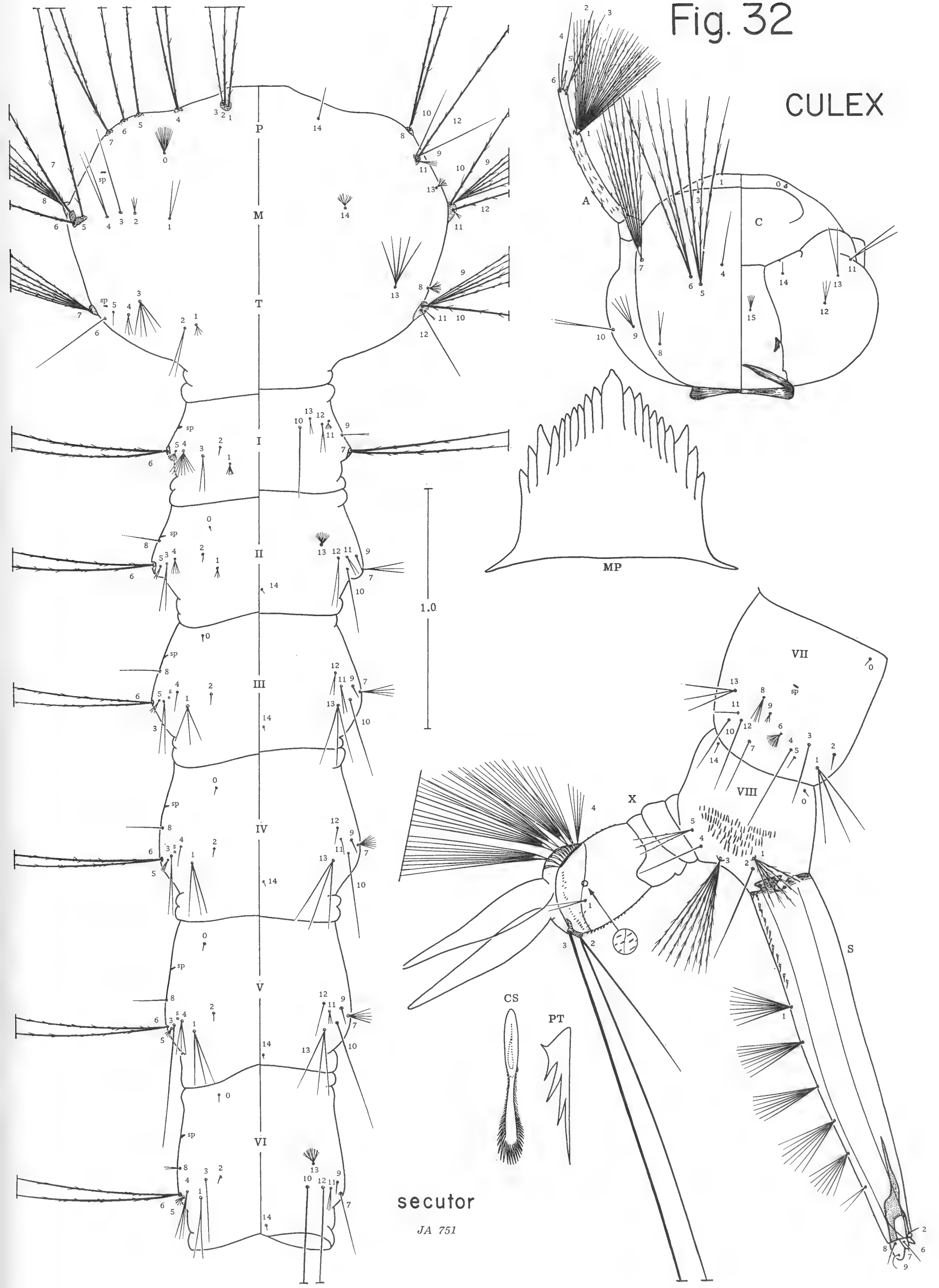


Fig. 33

CULEX



Fig. 34

MICRAEDES

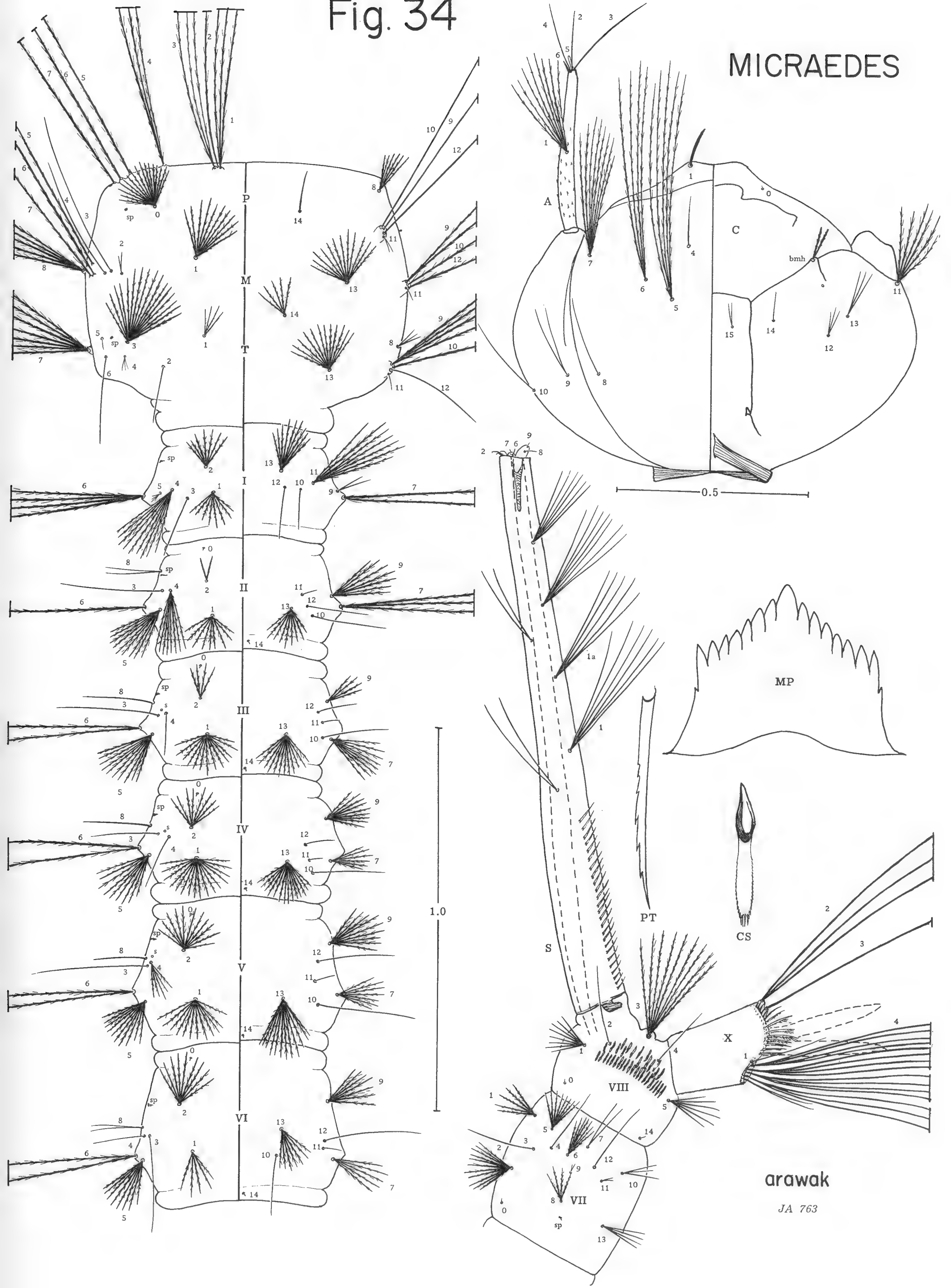


Fig. 35

MELANOCONION

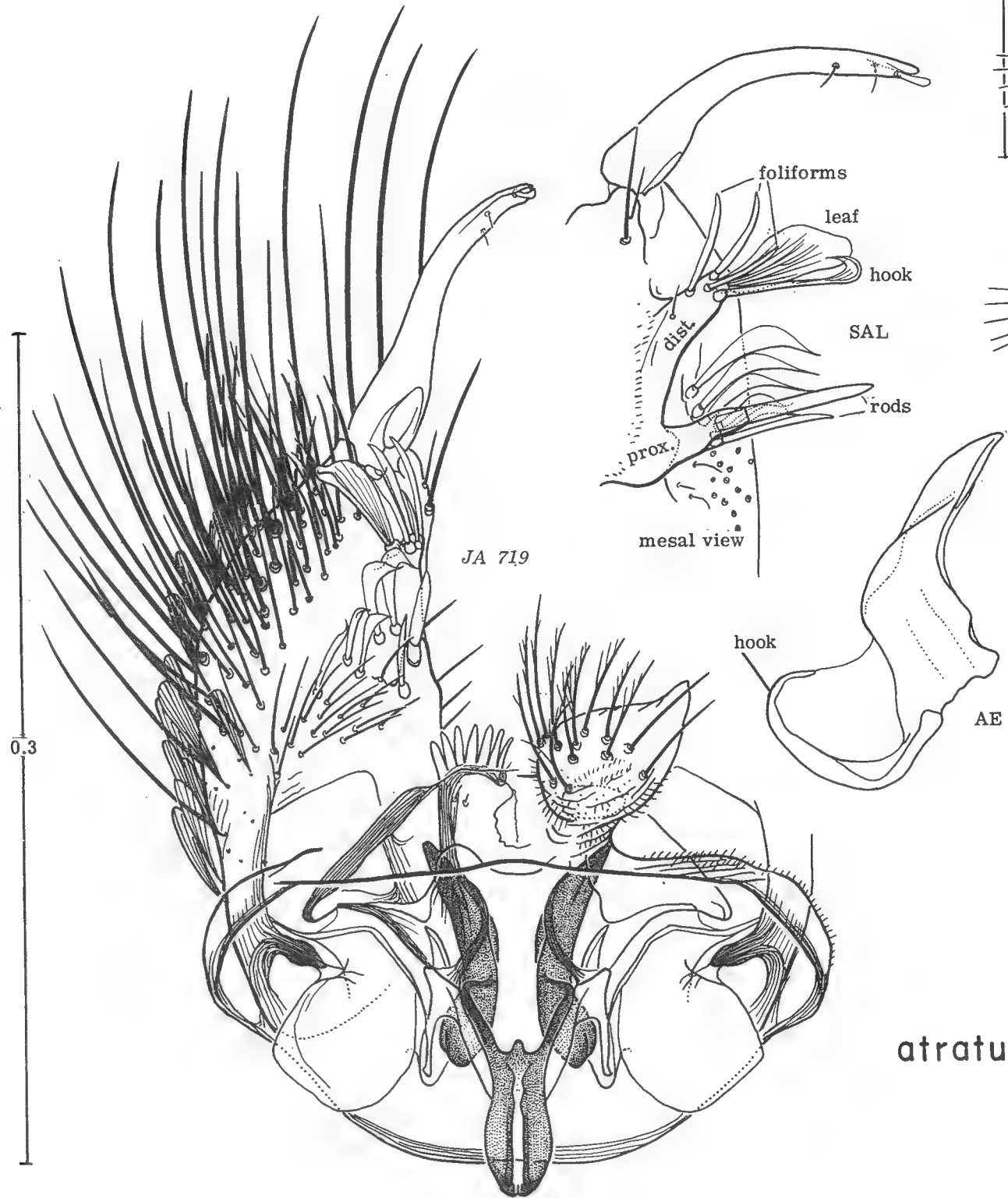
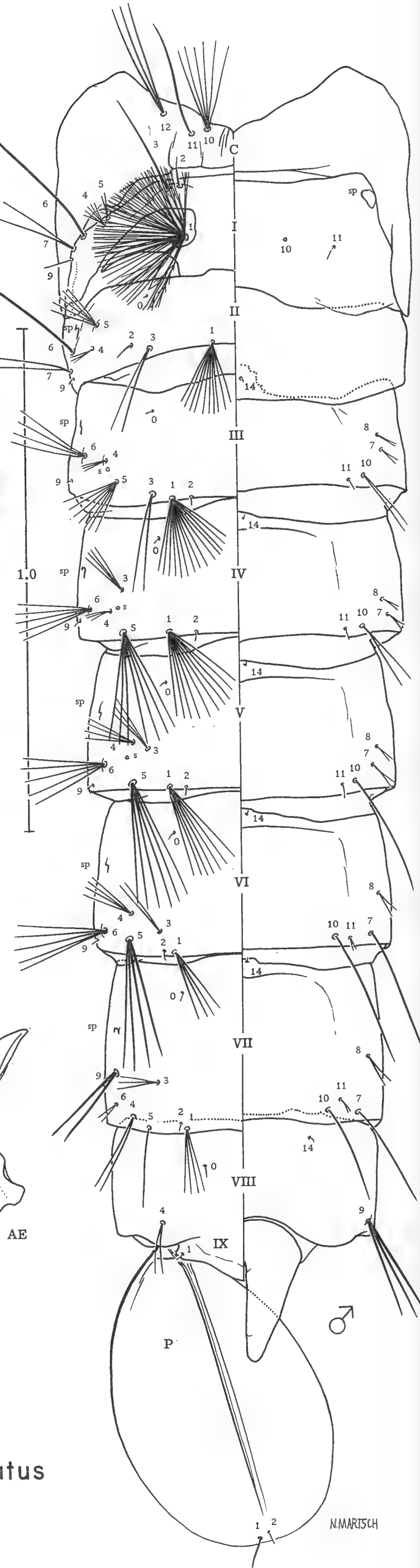
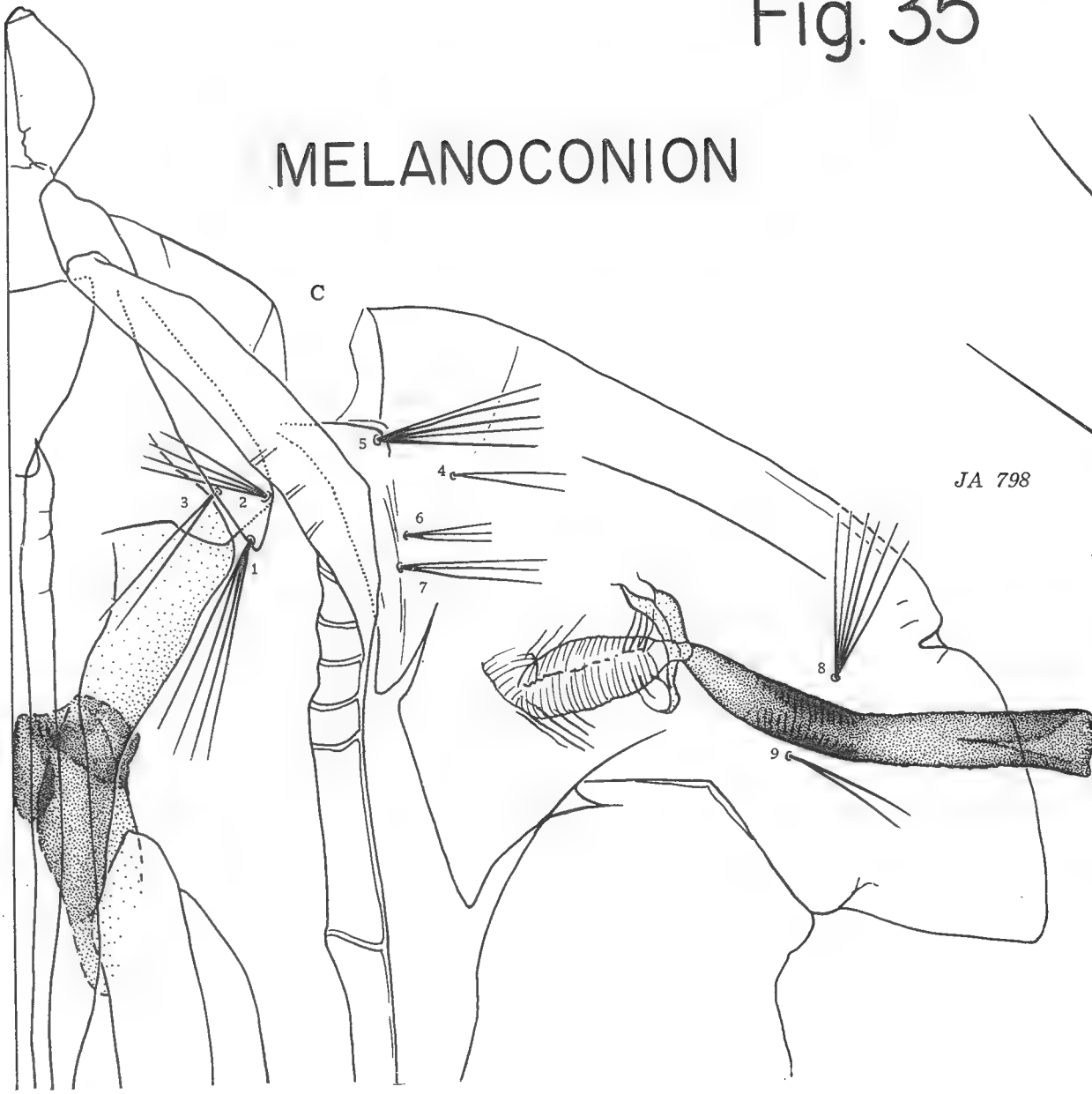


Fig. 36

MELANOCONION

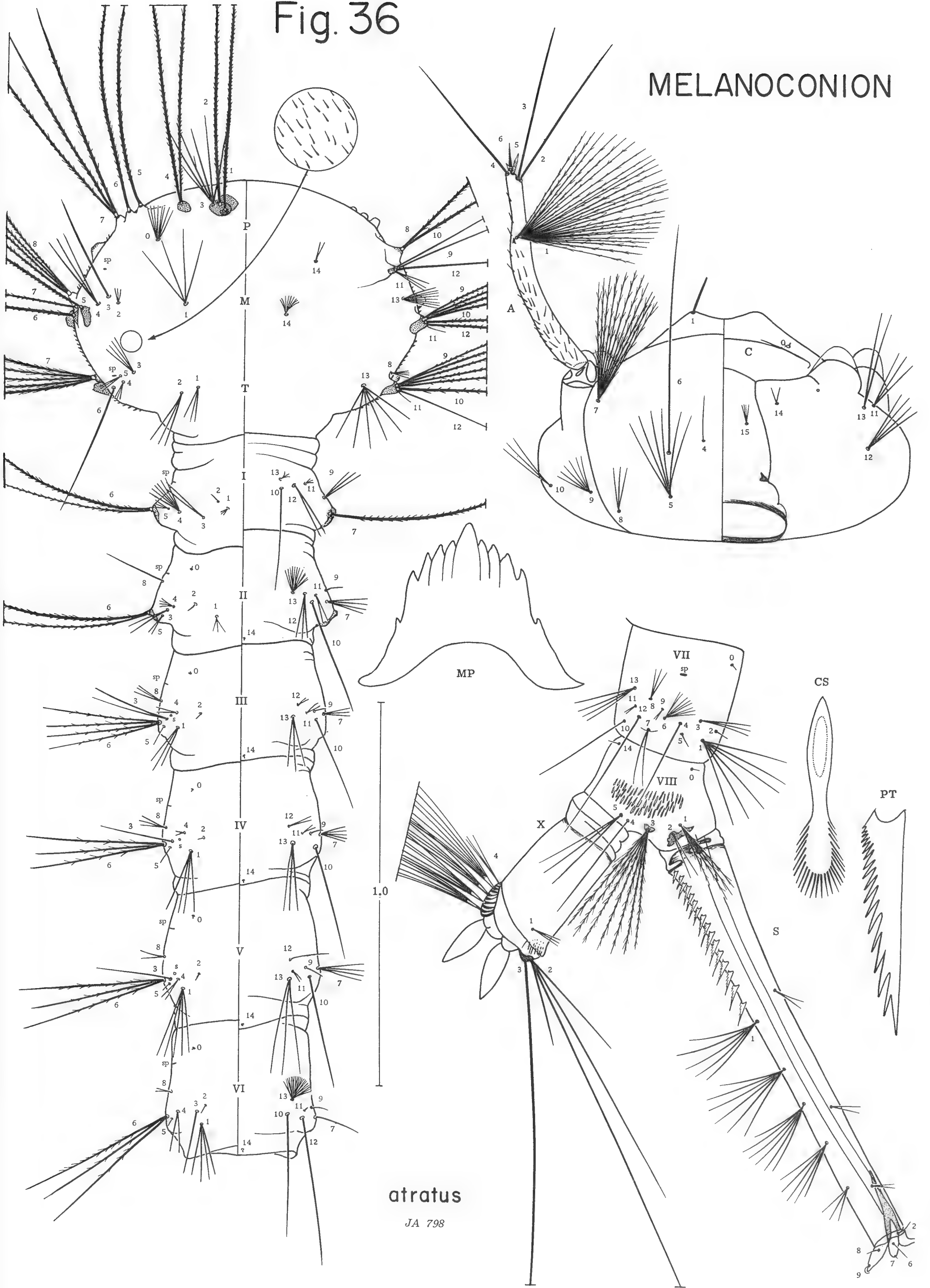
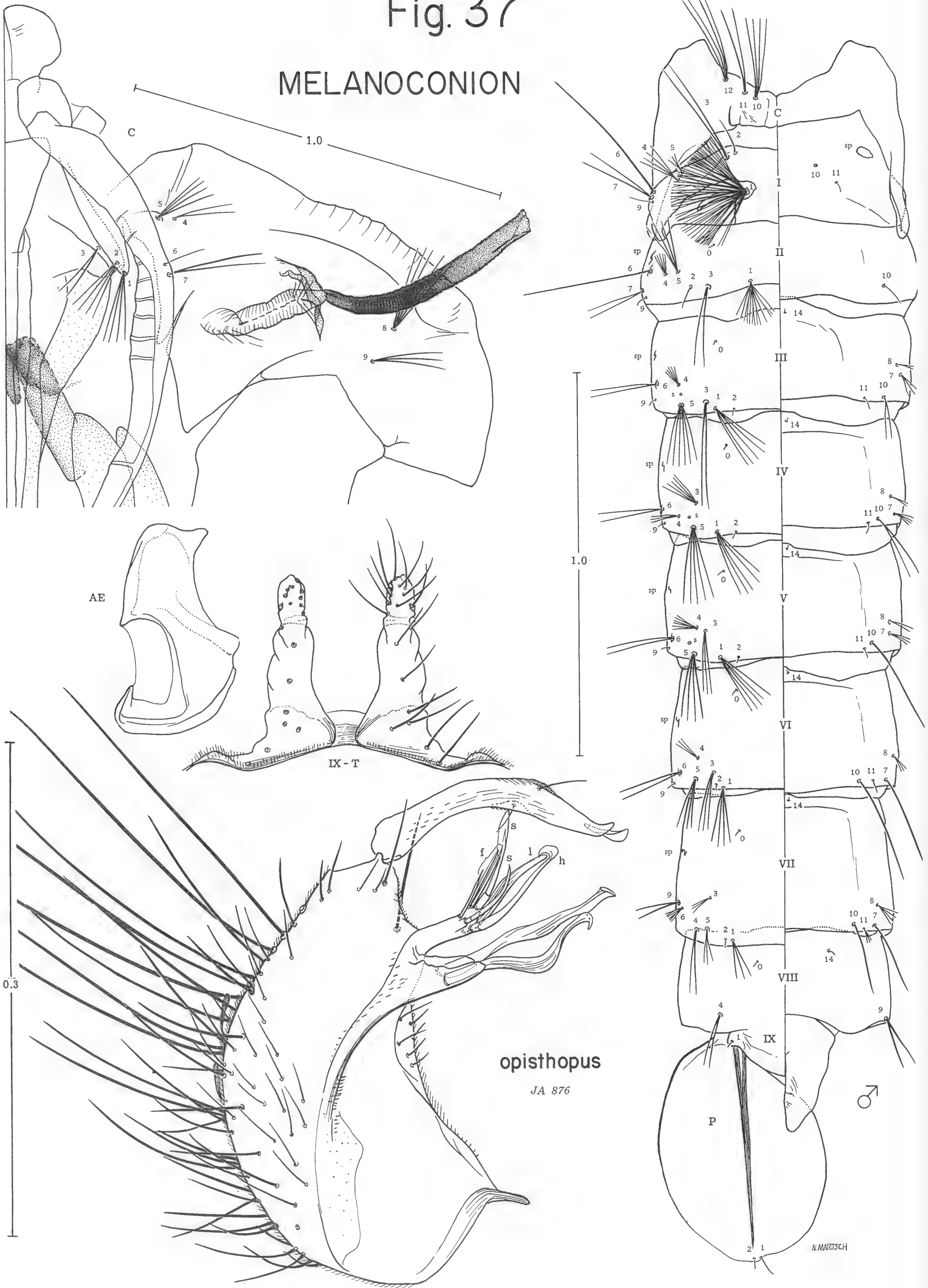


Fig. 37

MELANOCONION



opisthopus

JA 876

N. MARZTSCH

Fig. 38

MELANOCONION

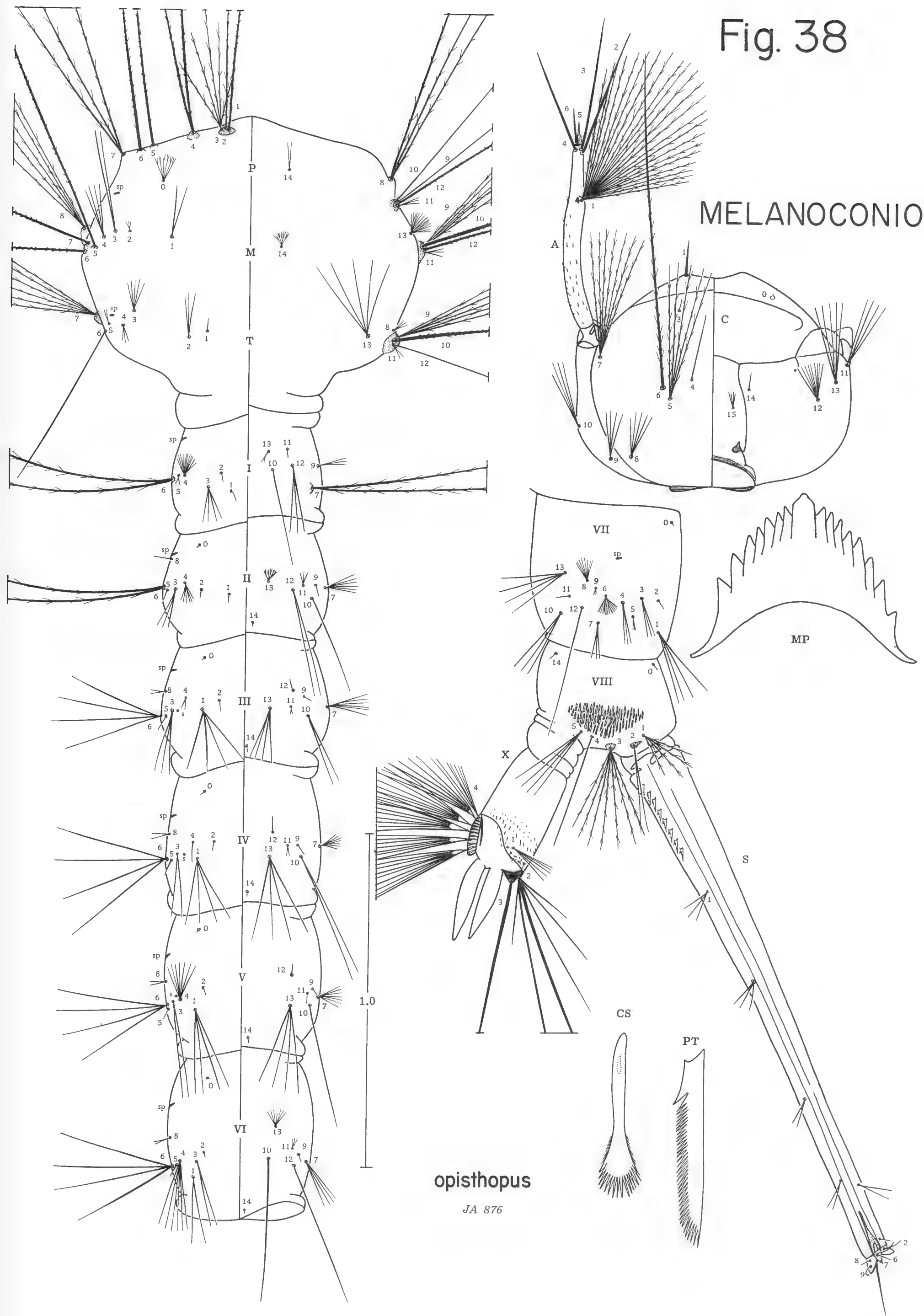
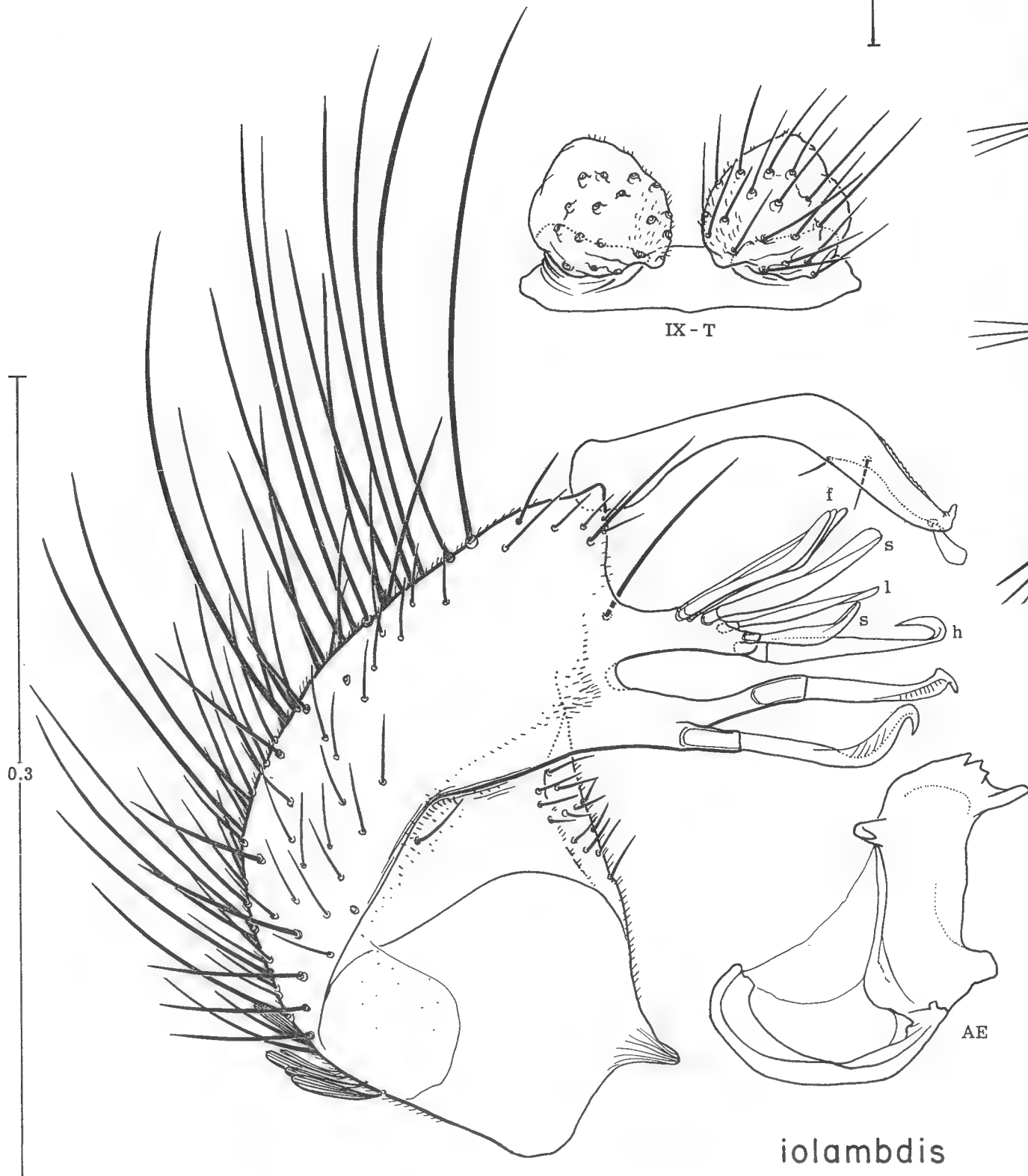
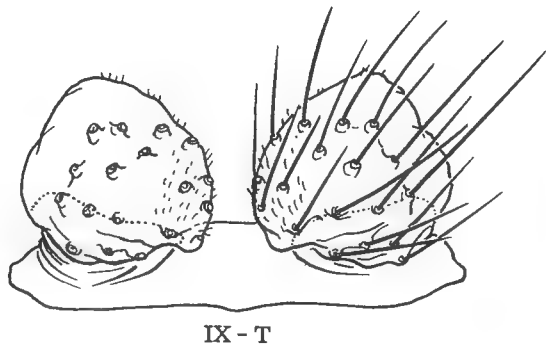
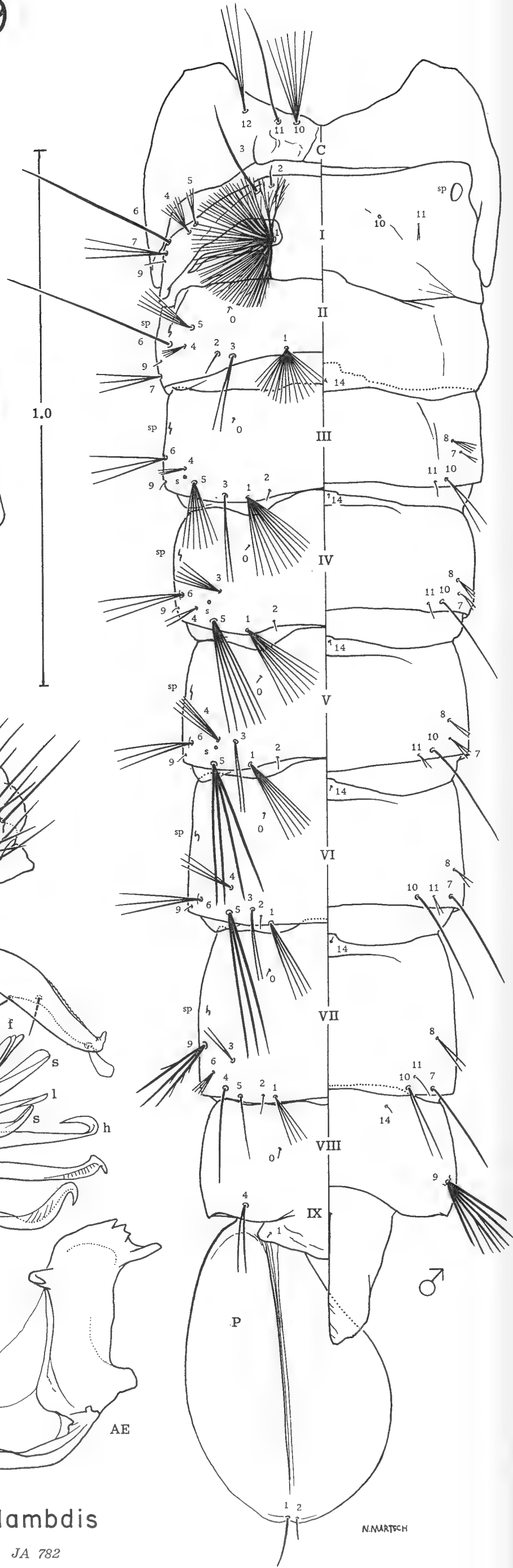
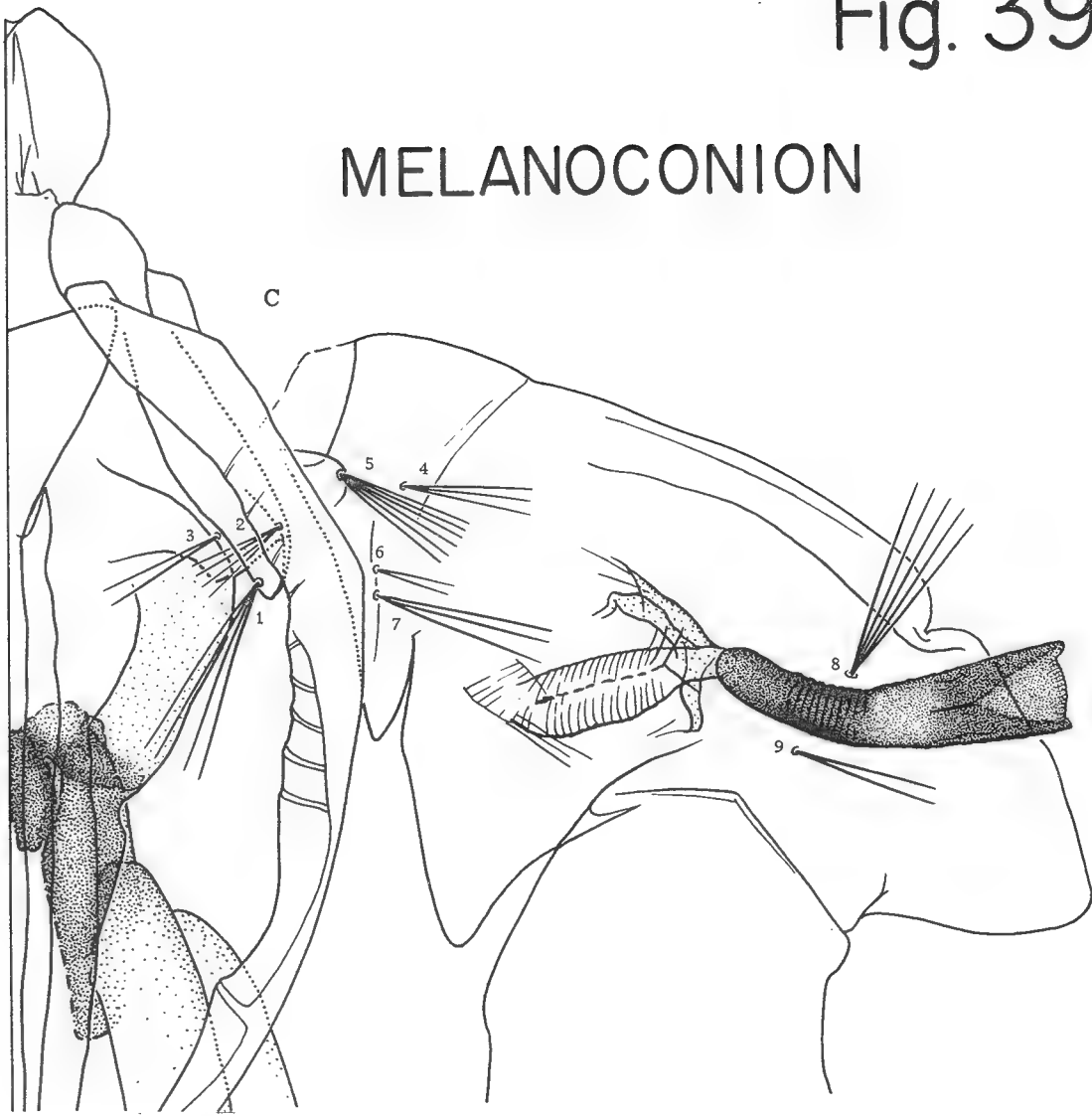


Fig. 39

MELANOCONION



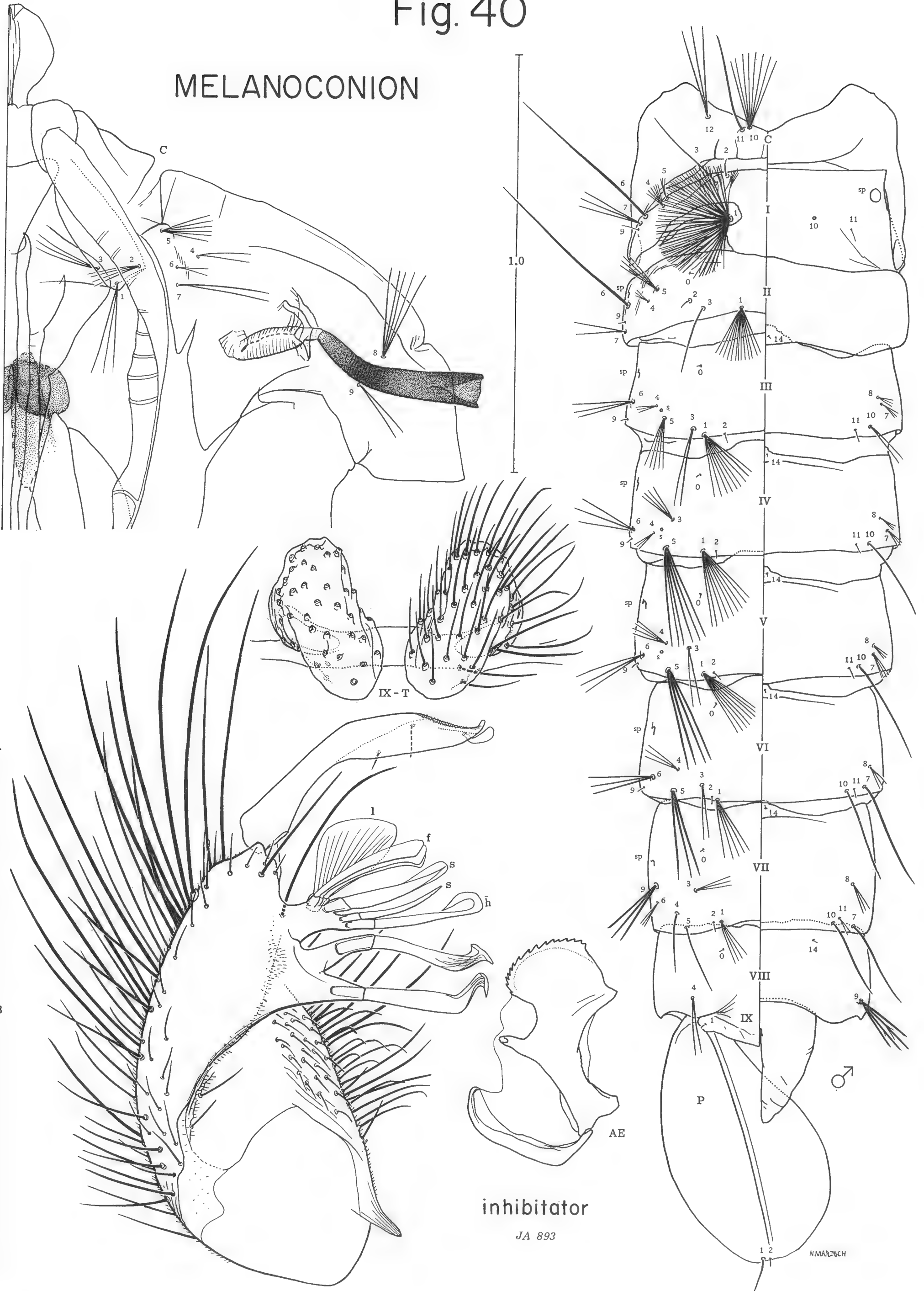
Iolambdis

JA 782

N. MARTSCH

Fig. 40

MELANOCONION



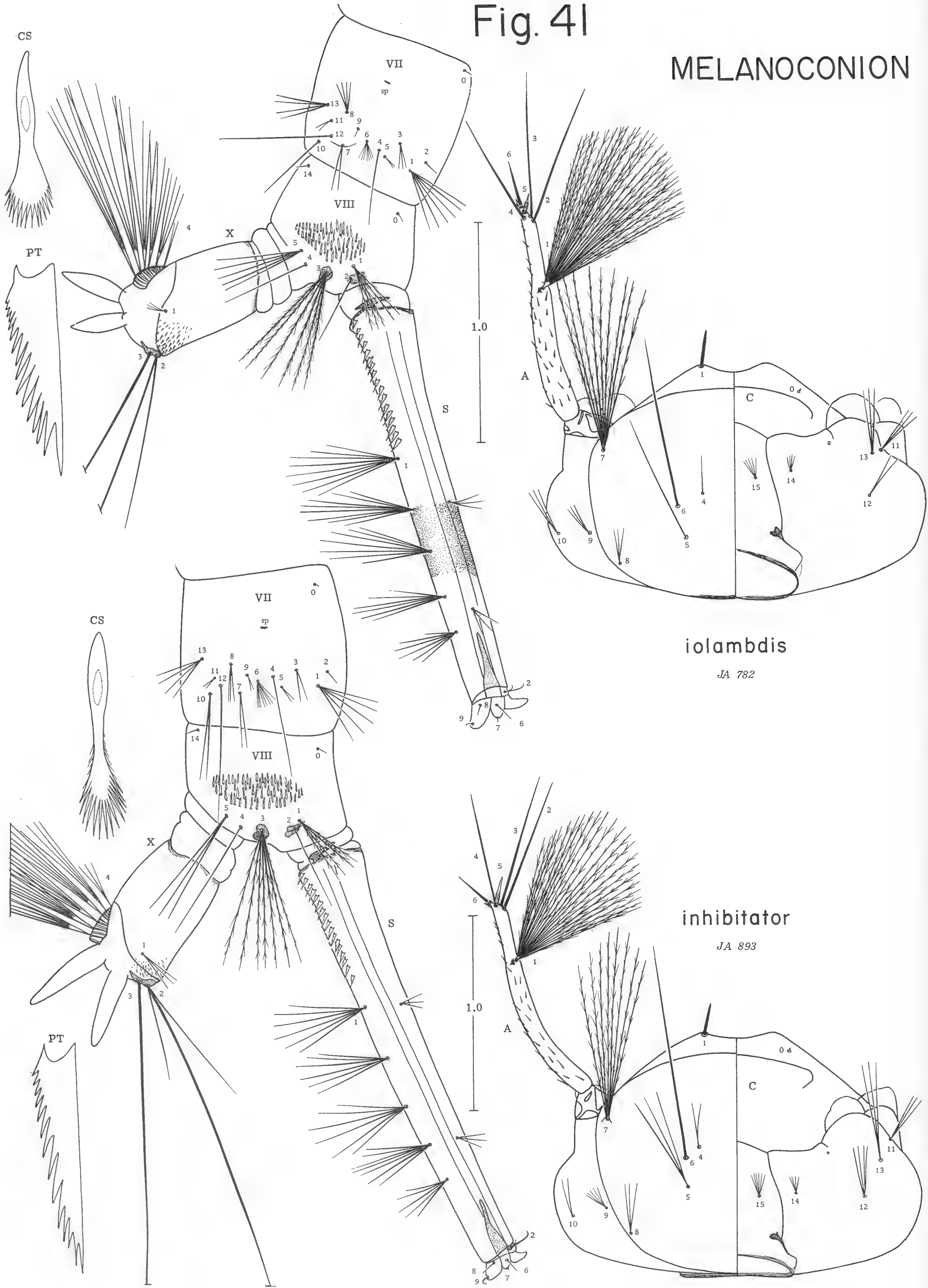
inhibitor

JA 893

N. MARTECH

Fig. 41

MELANOCONION

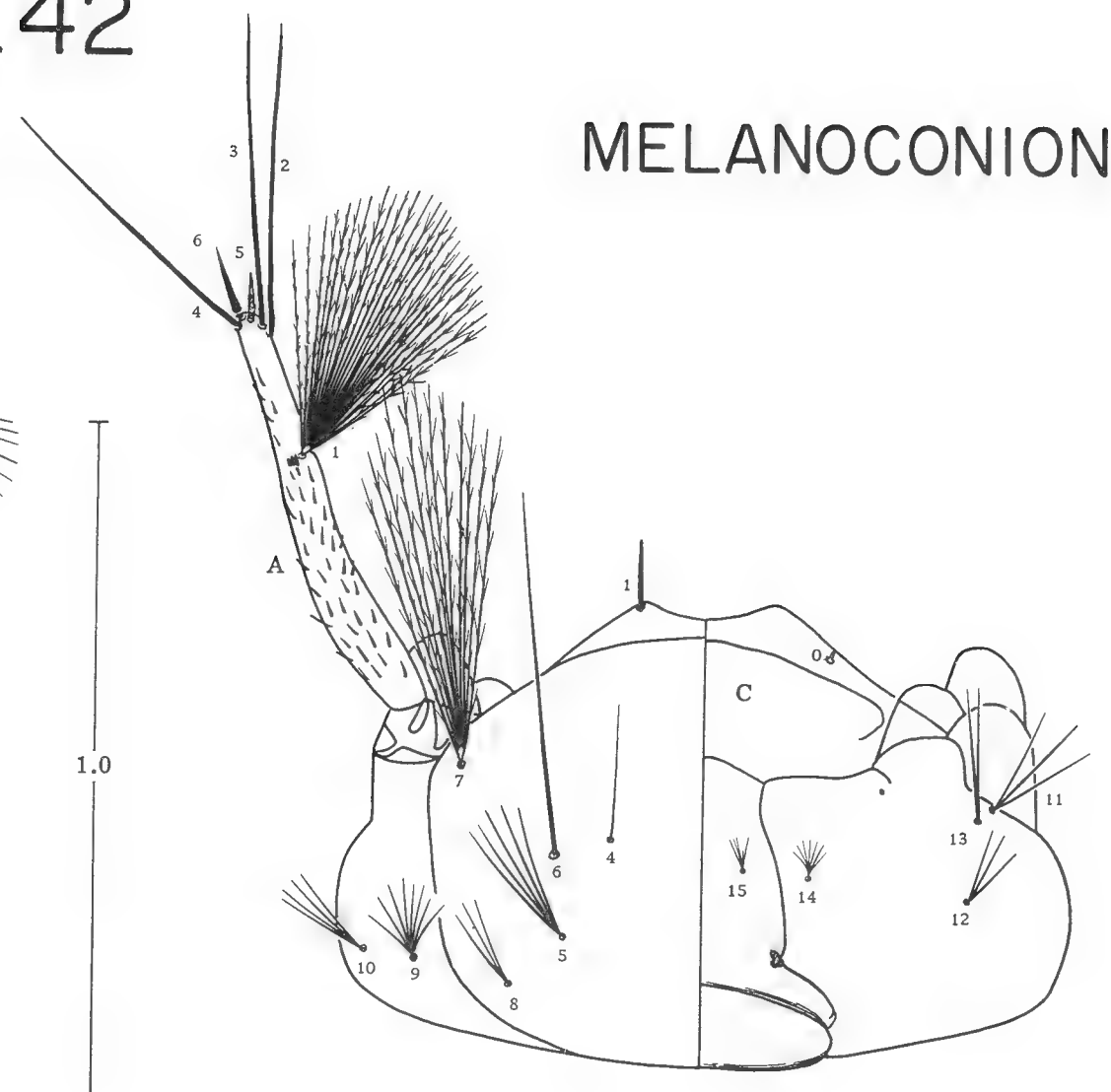
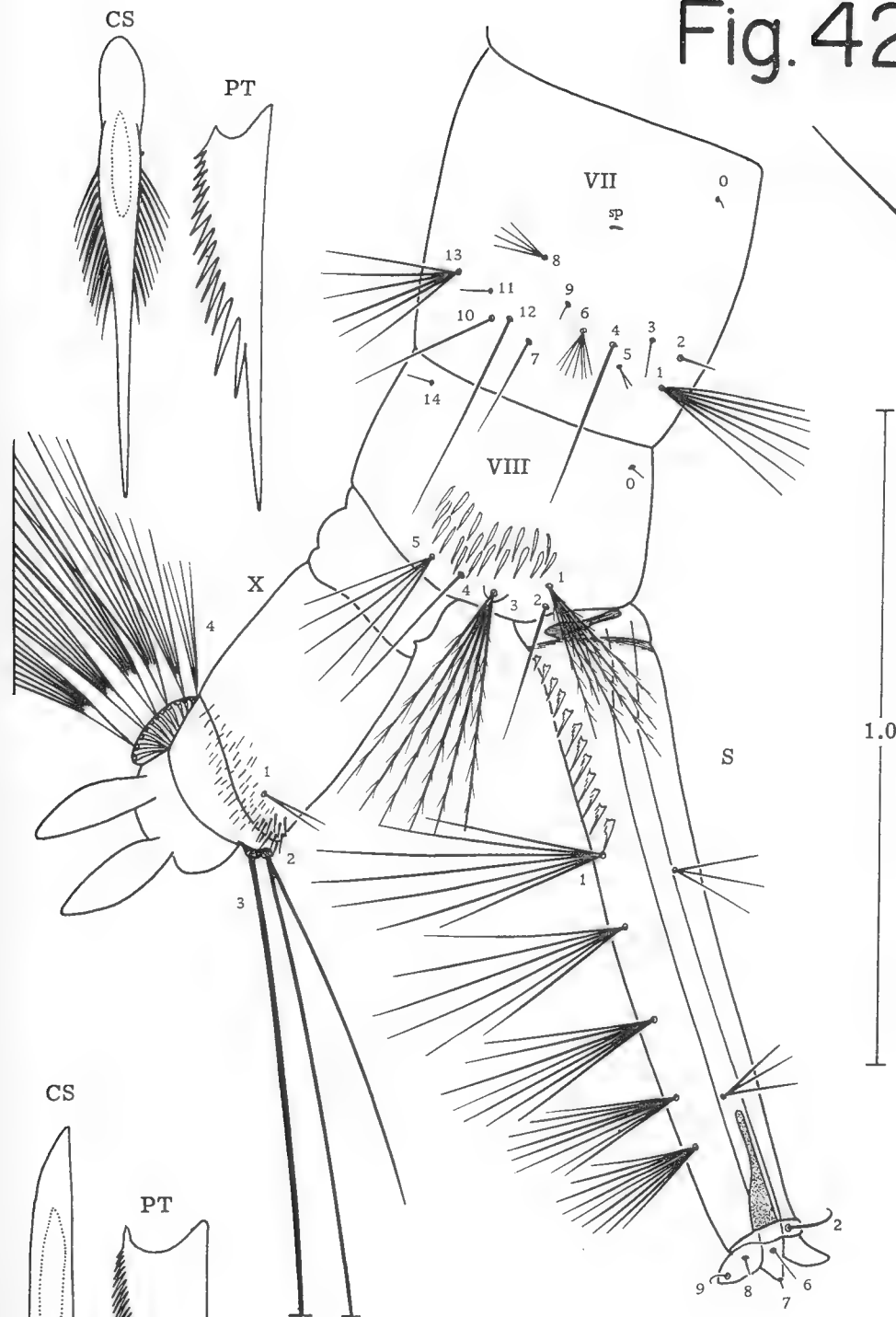


iolambdis
JA 782

inhibitorator
JA 893

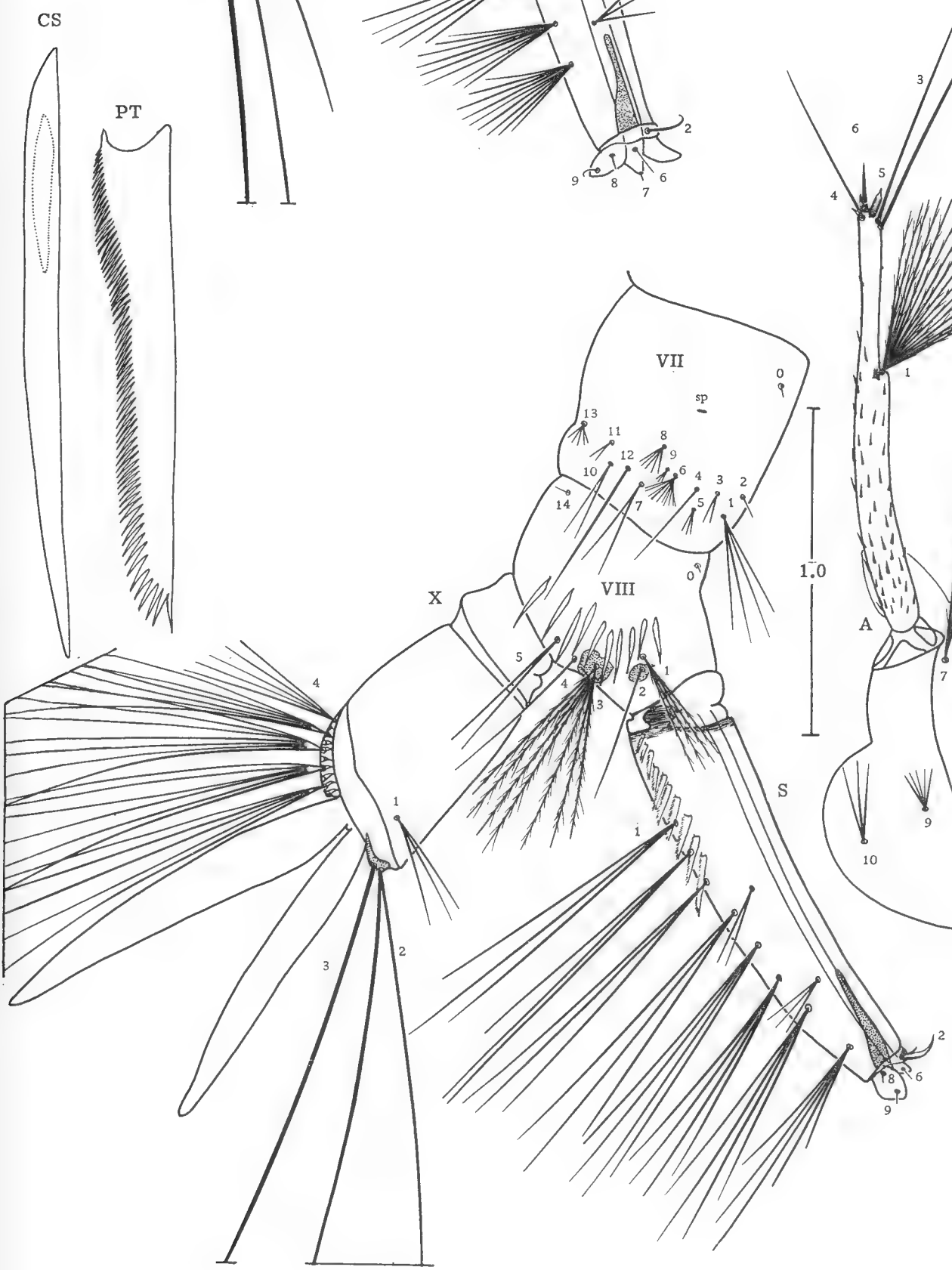
Fig. 42

MELANOCONION



erraticus

JA 728

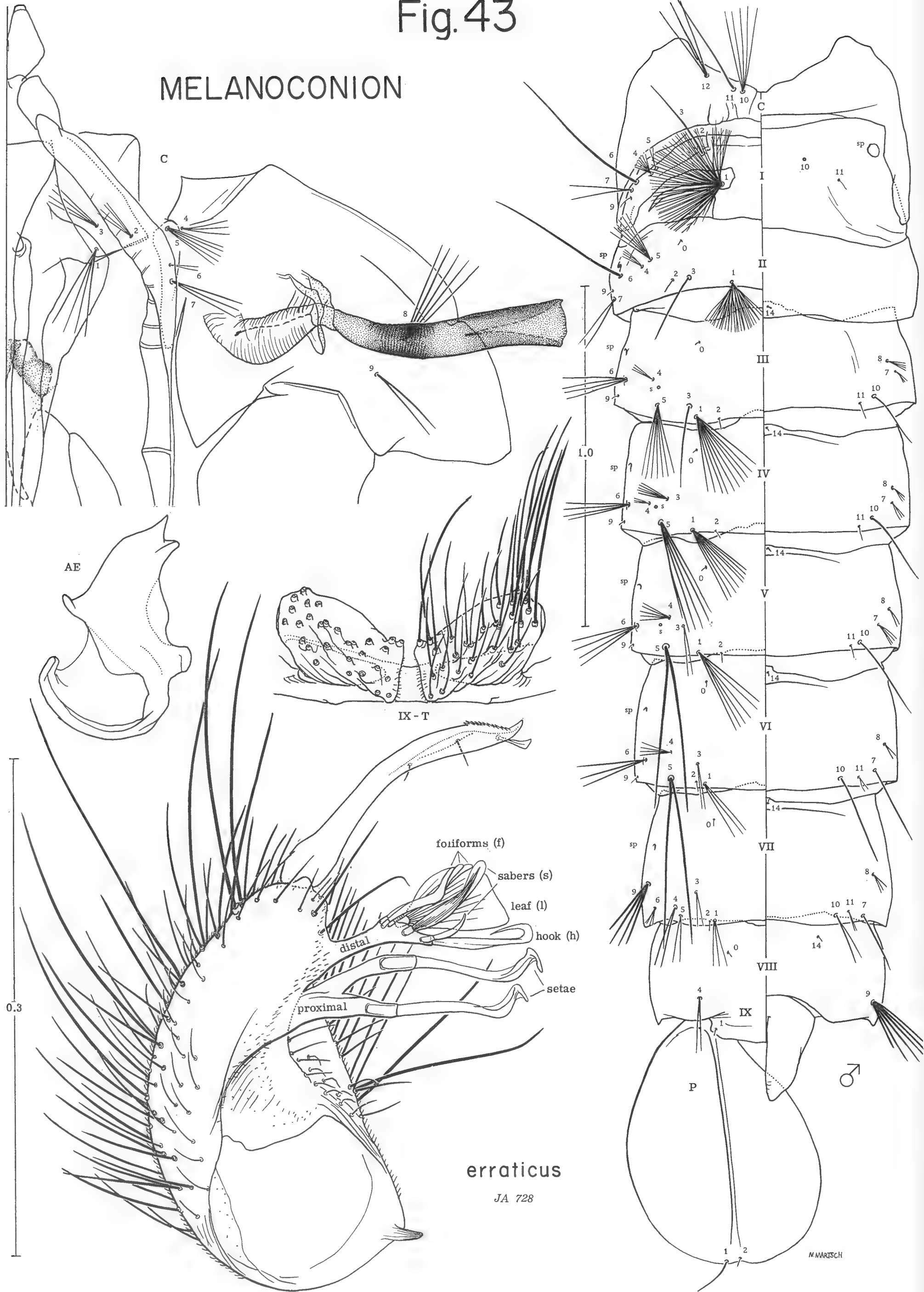


pilosus

JA 757

Fig.43

MELANOCONION



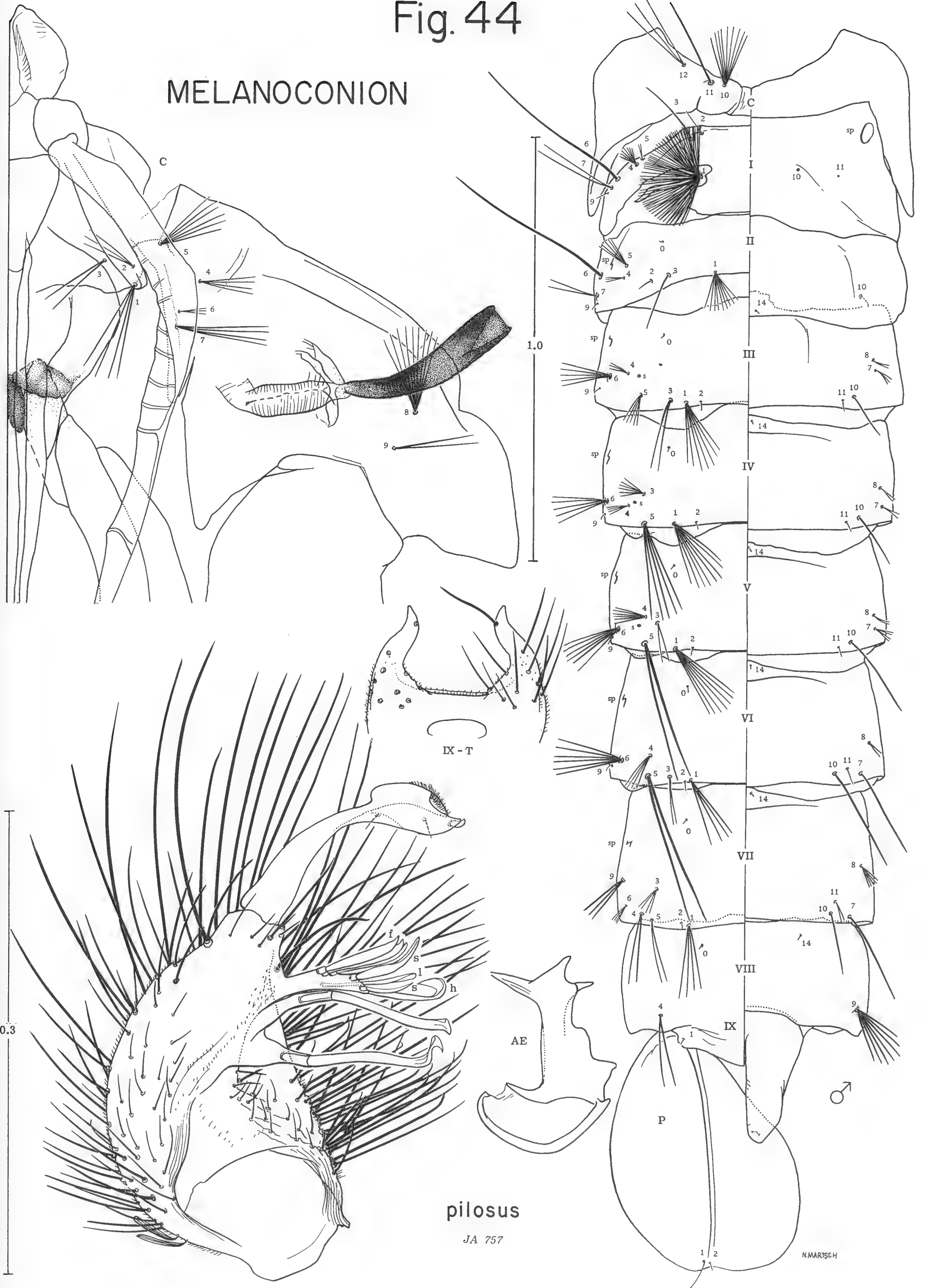
erraticus

JA 728

M. MARITSCH

Fig. 44

MELANOCONION



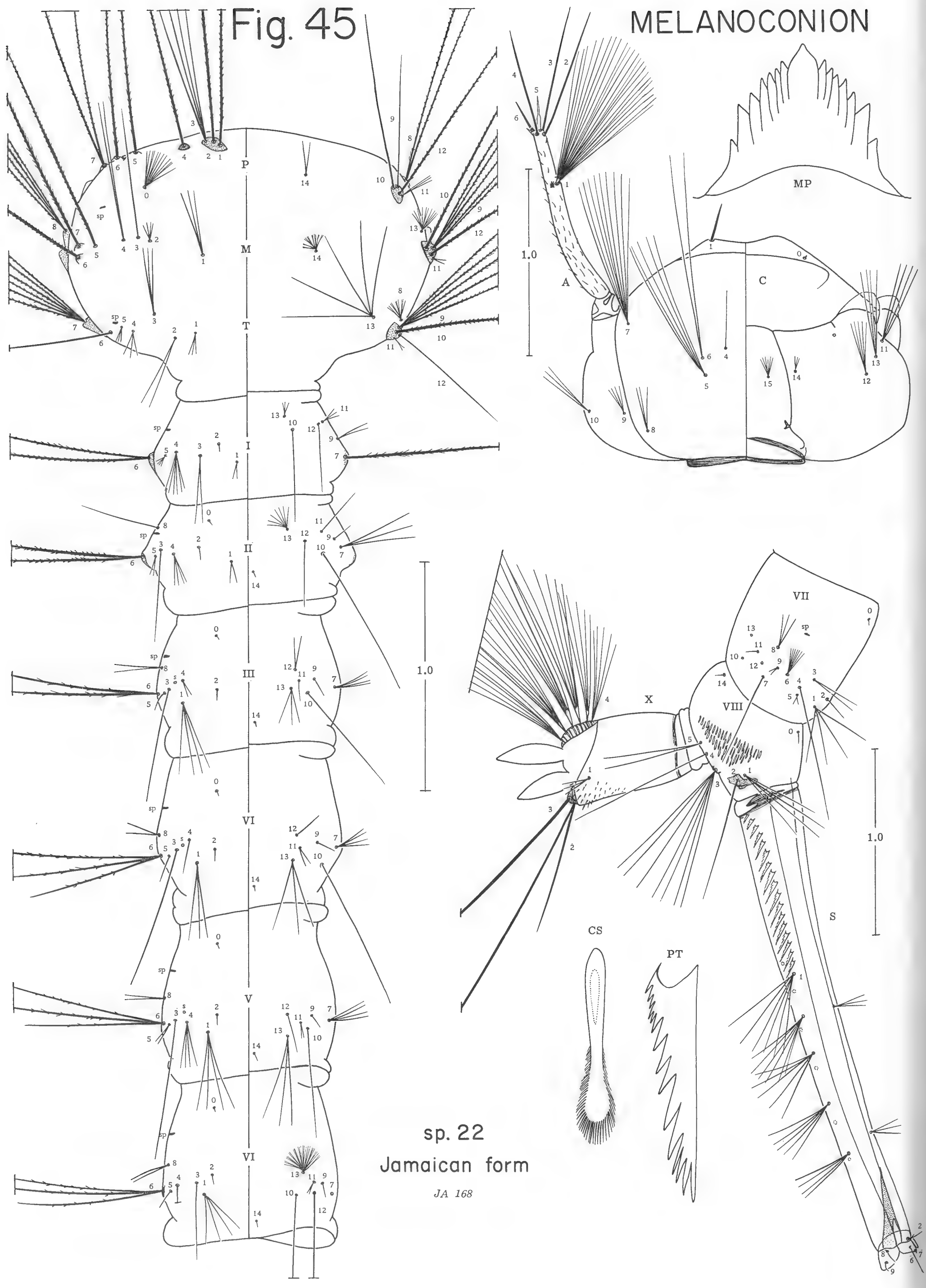
pilosus

JA 757

N. MARTSCH

Fig. 45

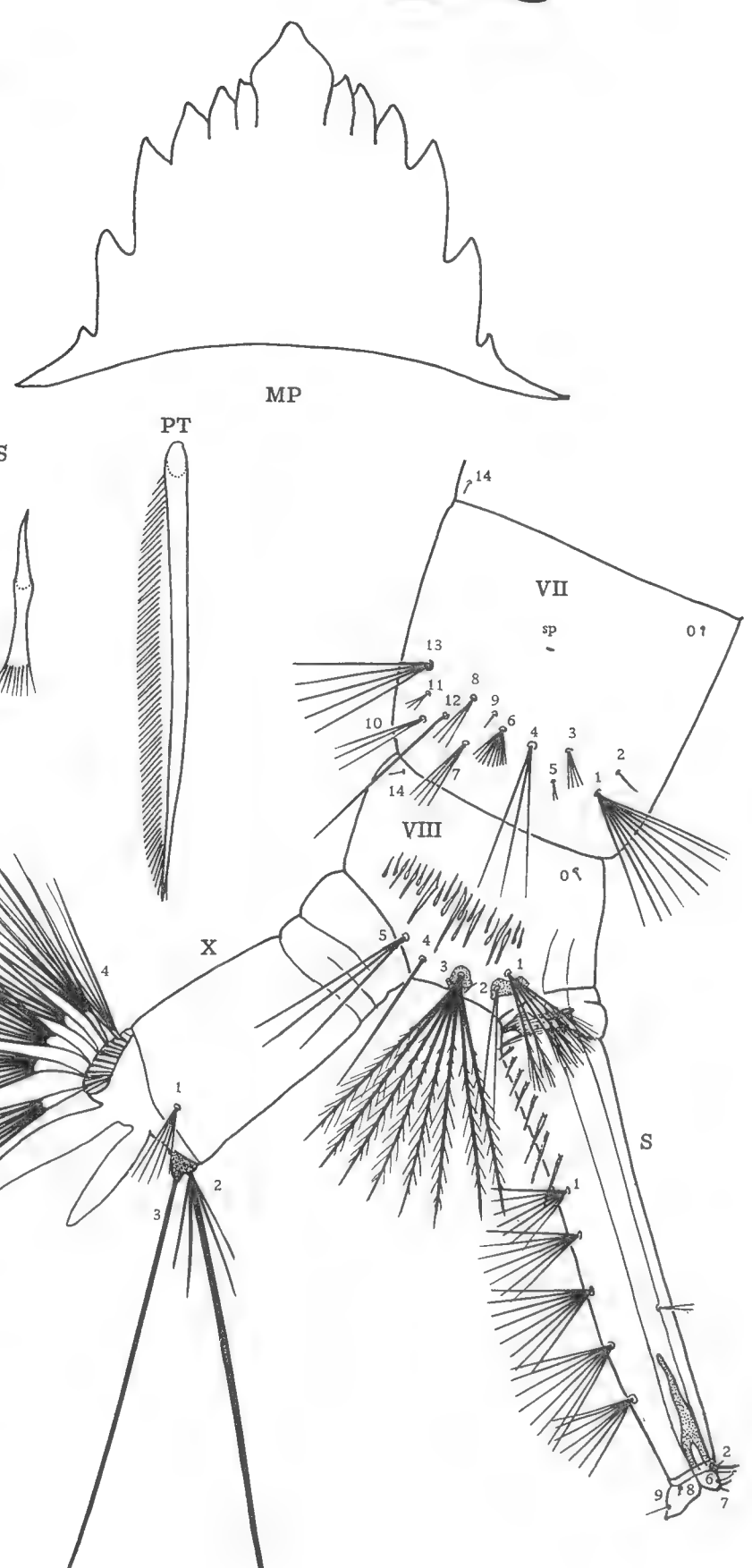
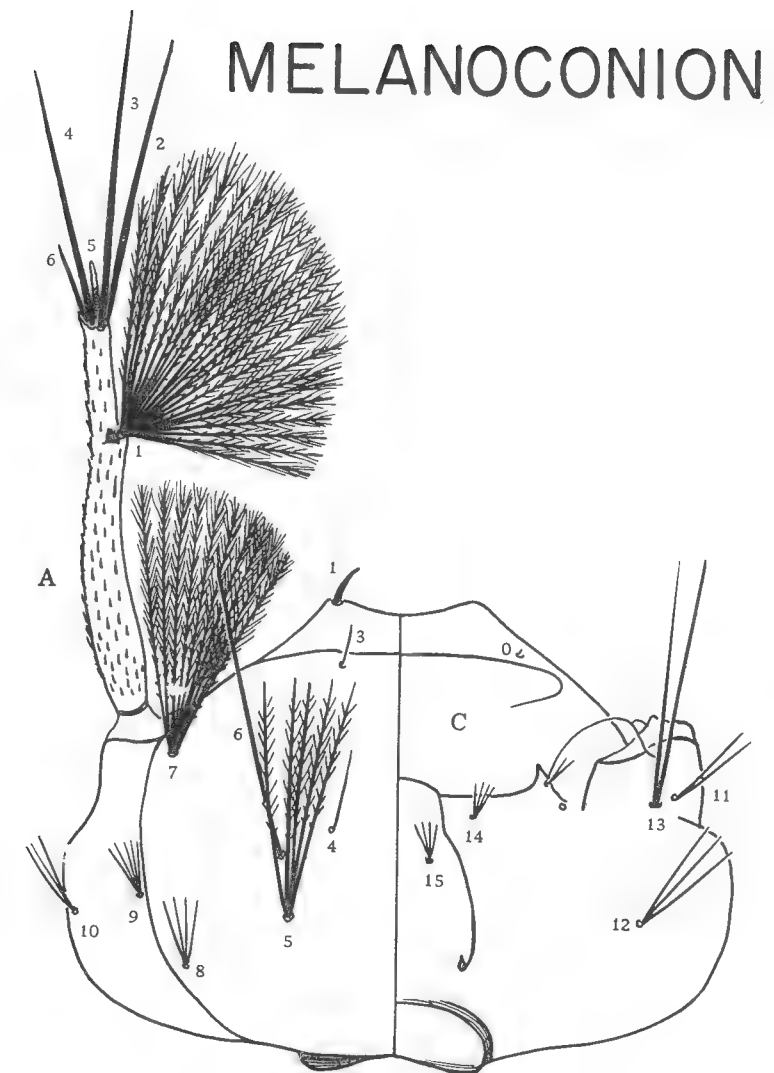
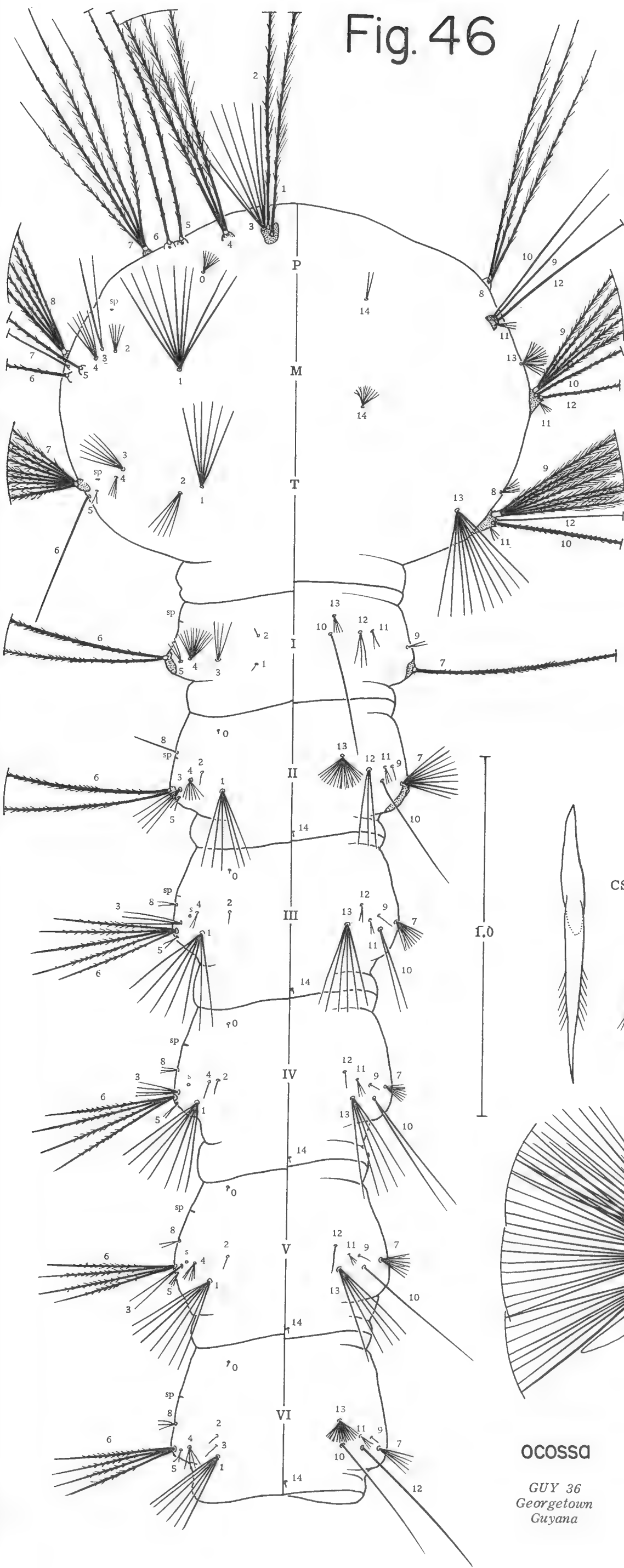
MELANOCONION



sp. 22
Jamaican form
JA 168

Fig. 46

MELANOCONION



OCOSSA
 GUY 36
 Georgetown
 Guyana

Fig. 47

MELANOCONION

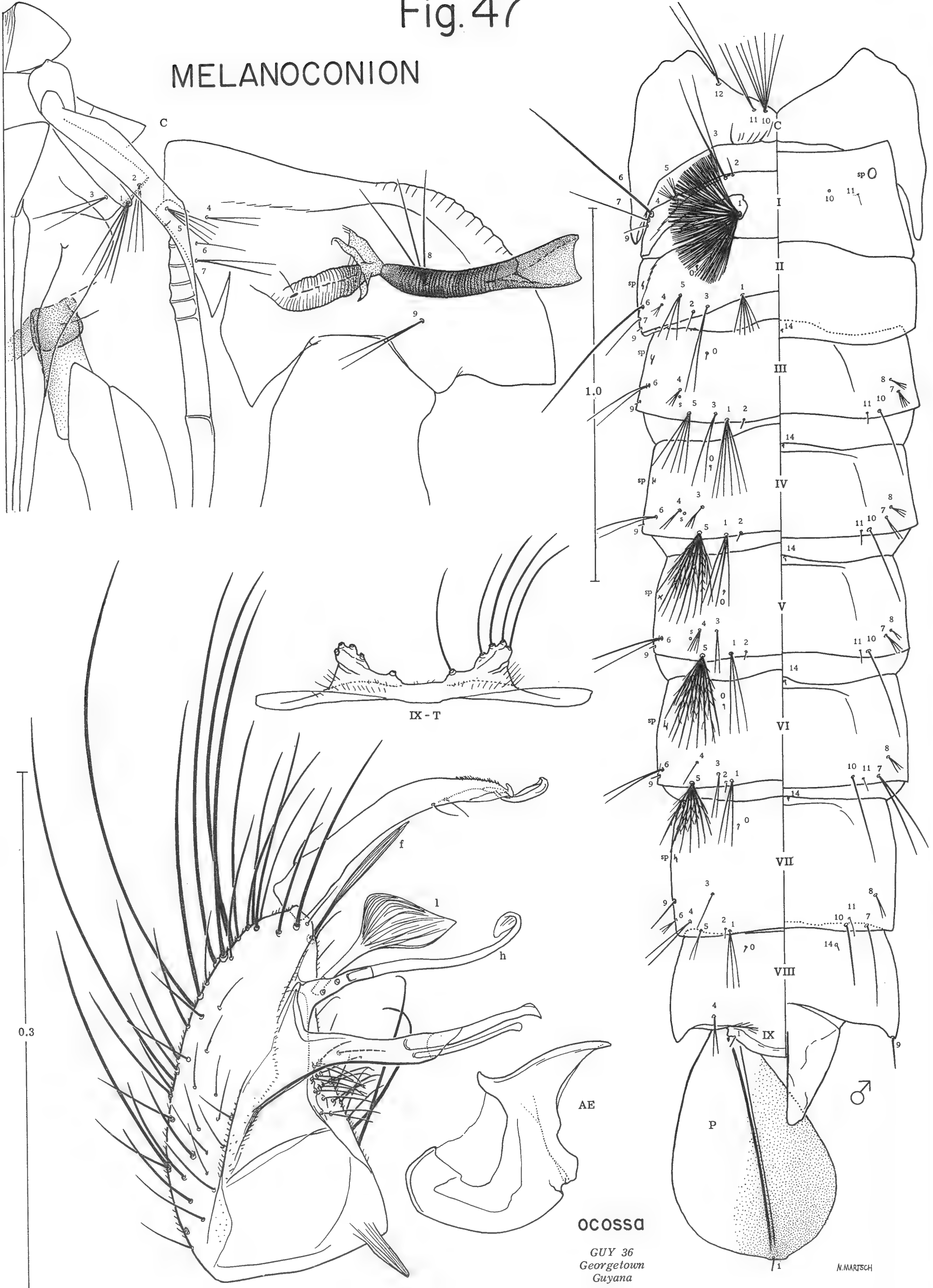
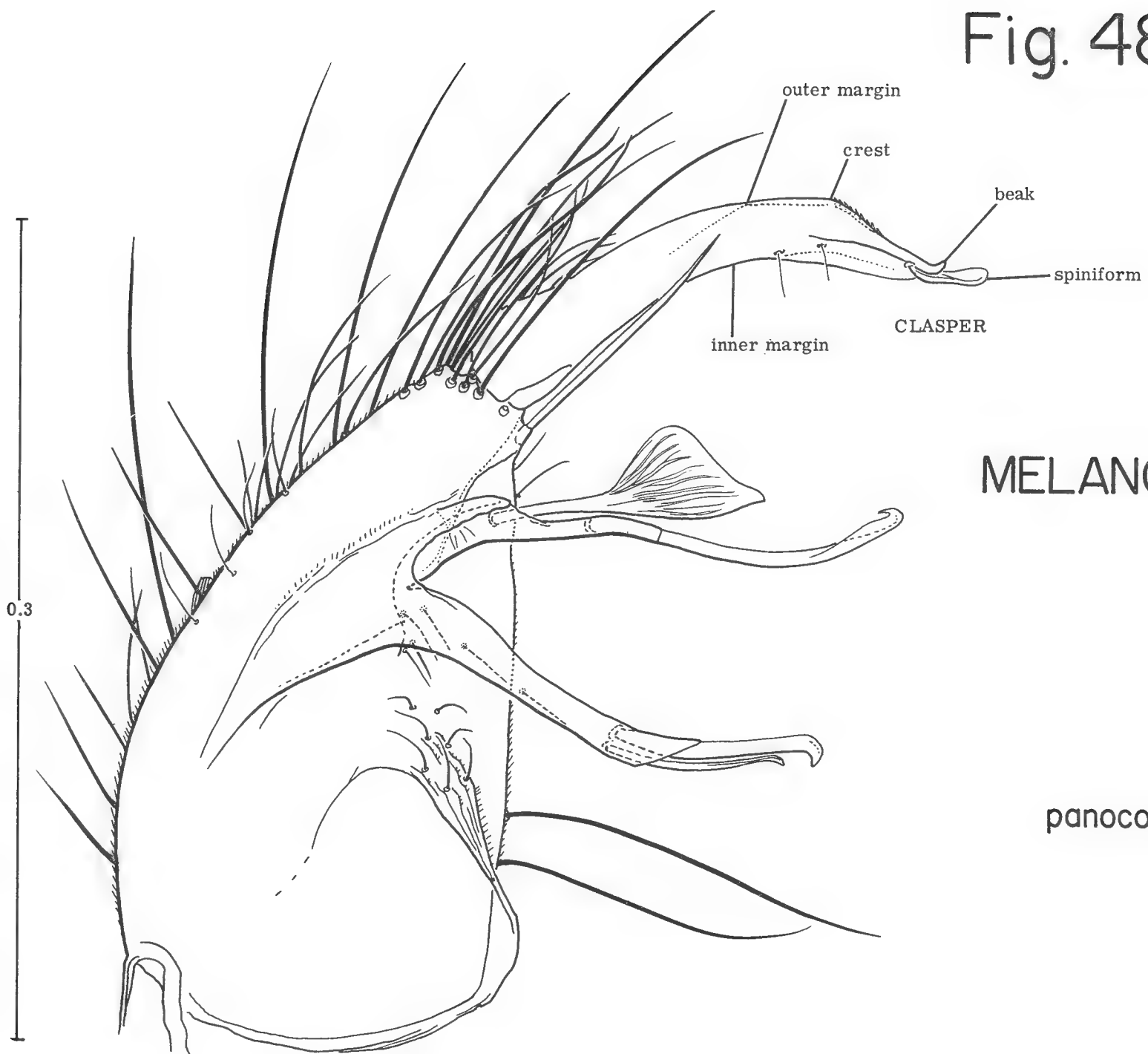


Fig. 48

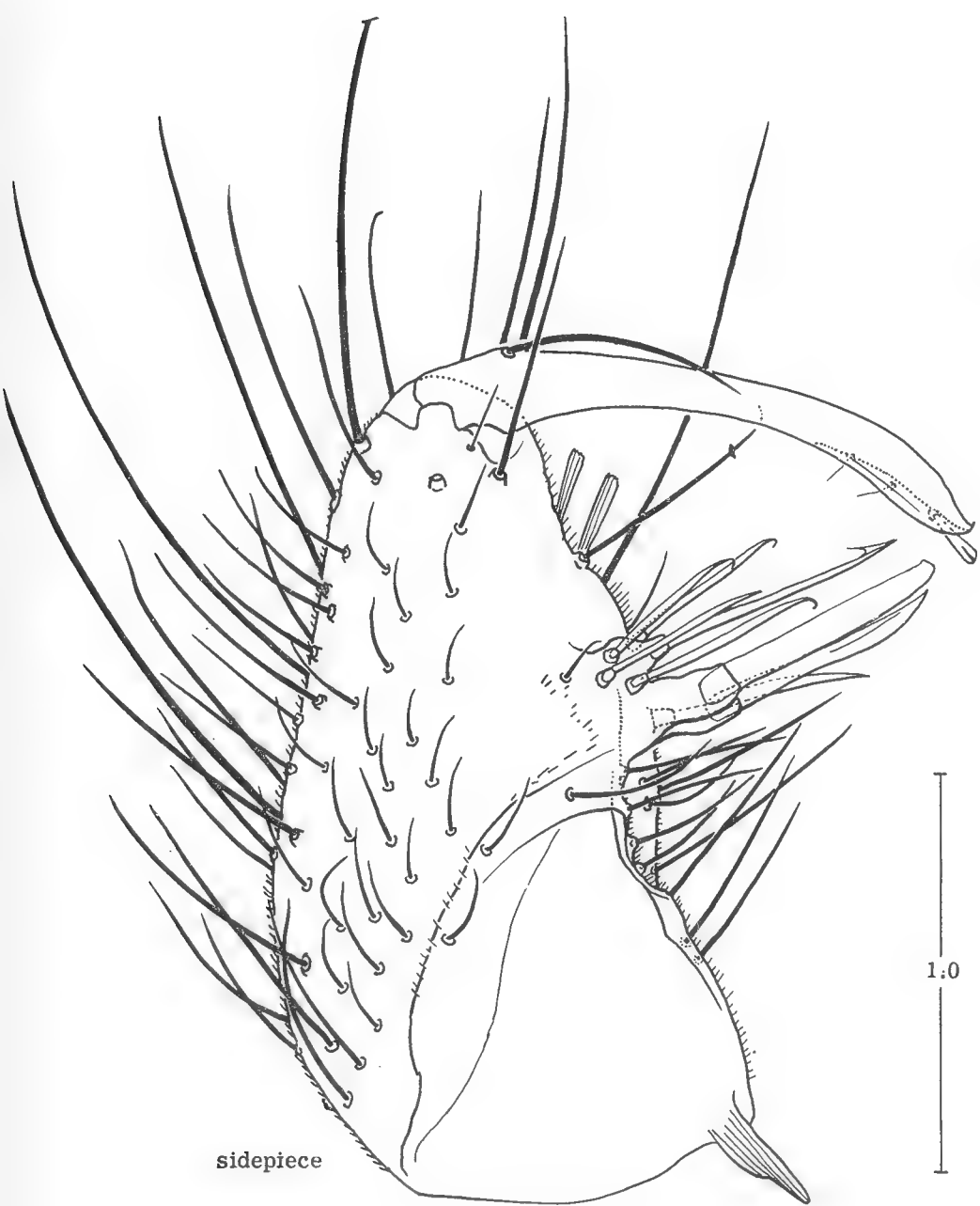


MELANOCONION

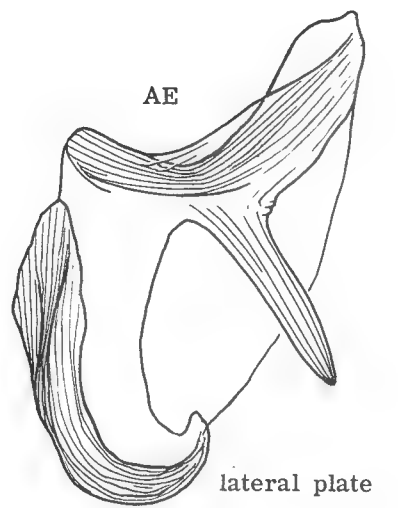
panocossa

MICRAEDES

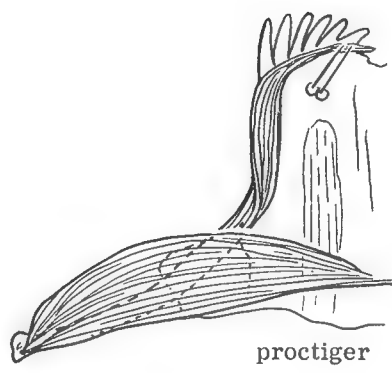
arawak



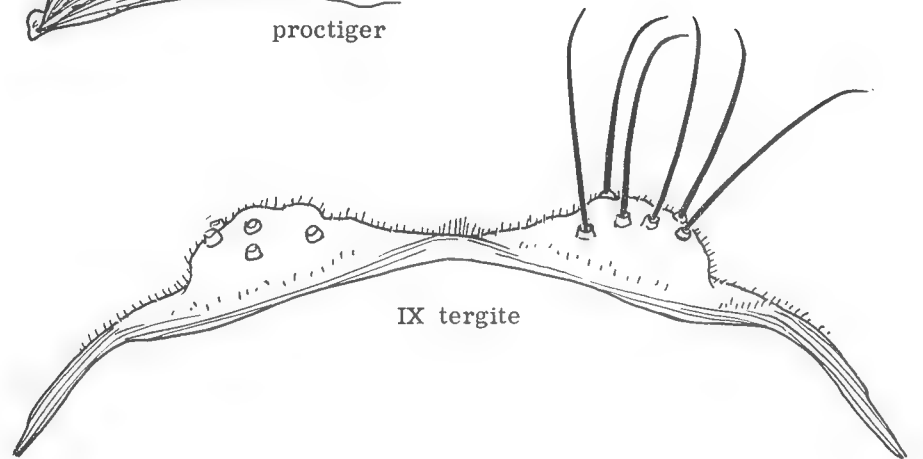
sidepiece



lateral plate



proctiger



IX tergite

Fig. 49

RHYNCHOTAENIA

nigricans

CZMB
Canal Zone

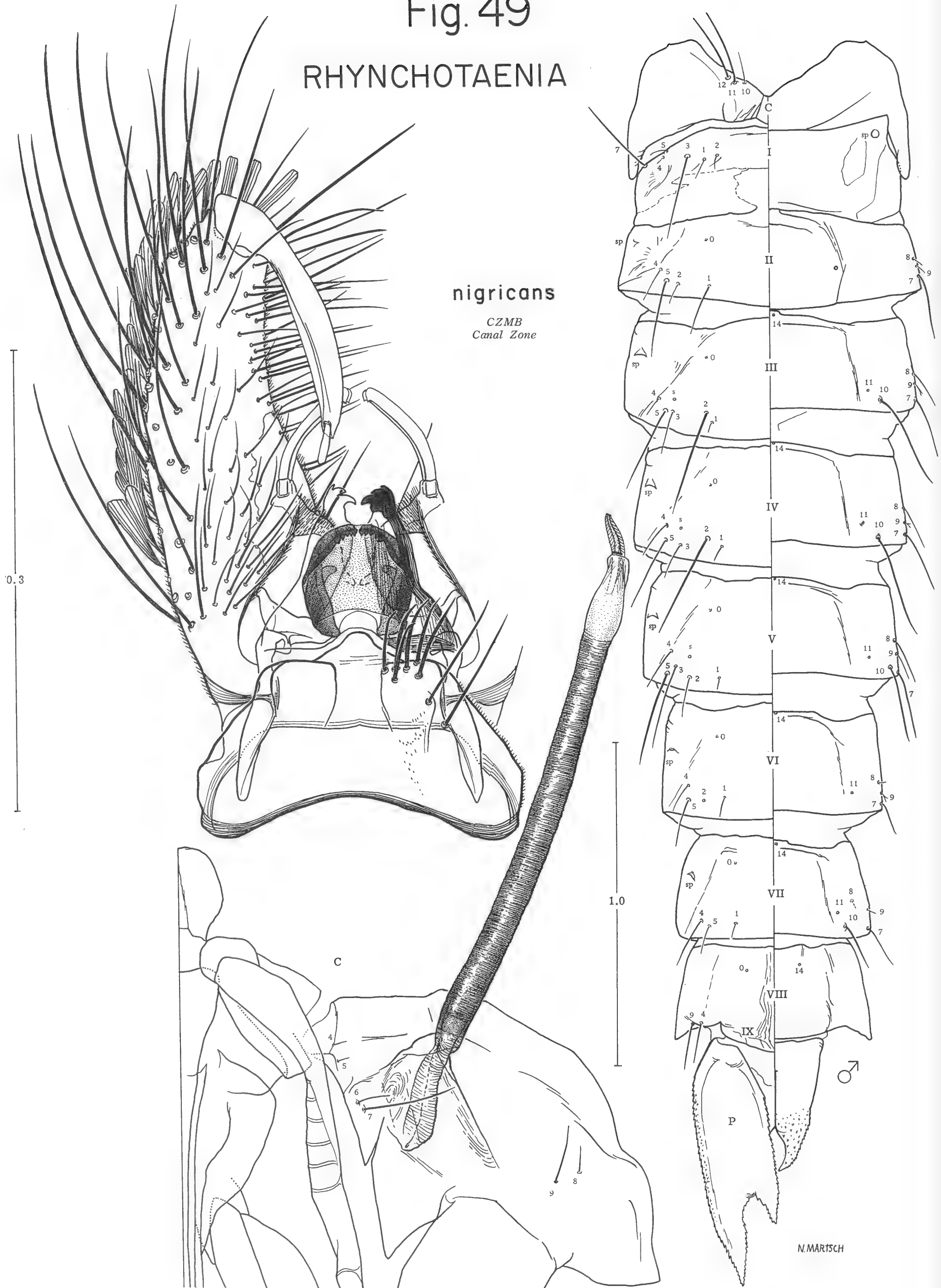
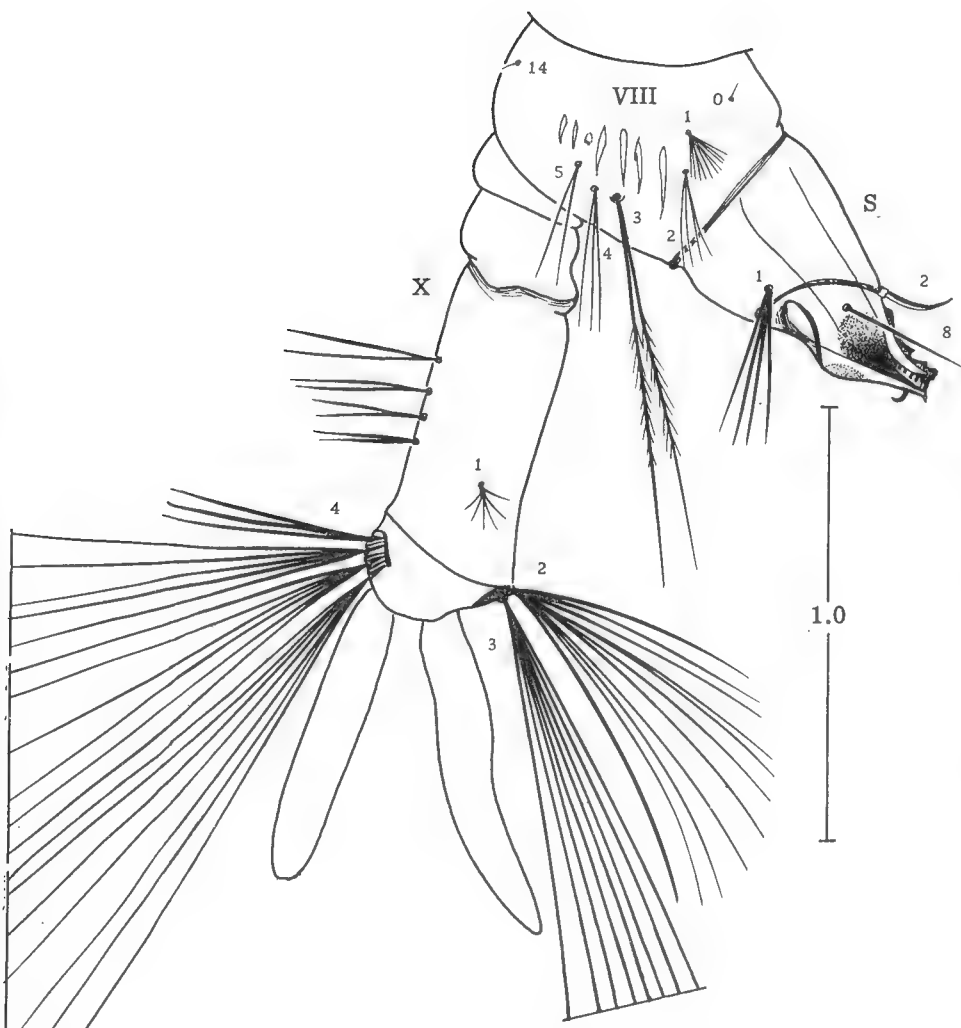
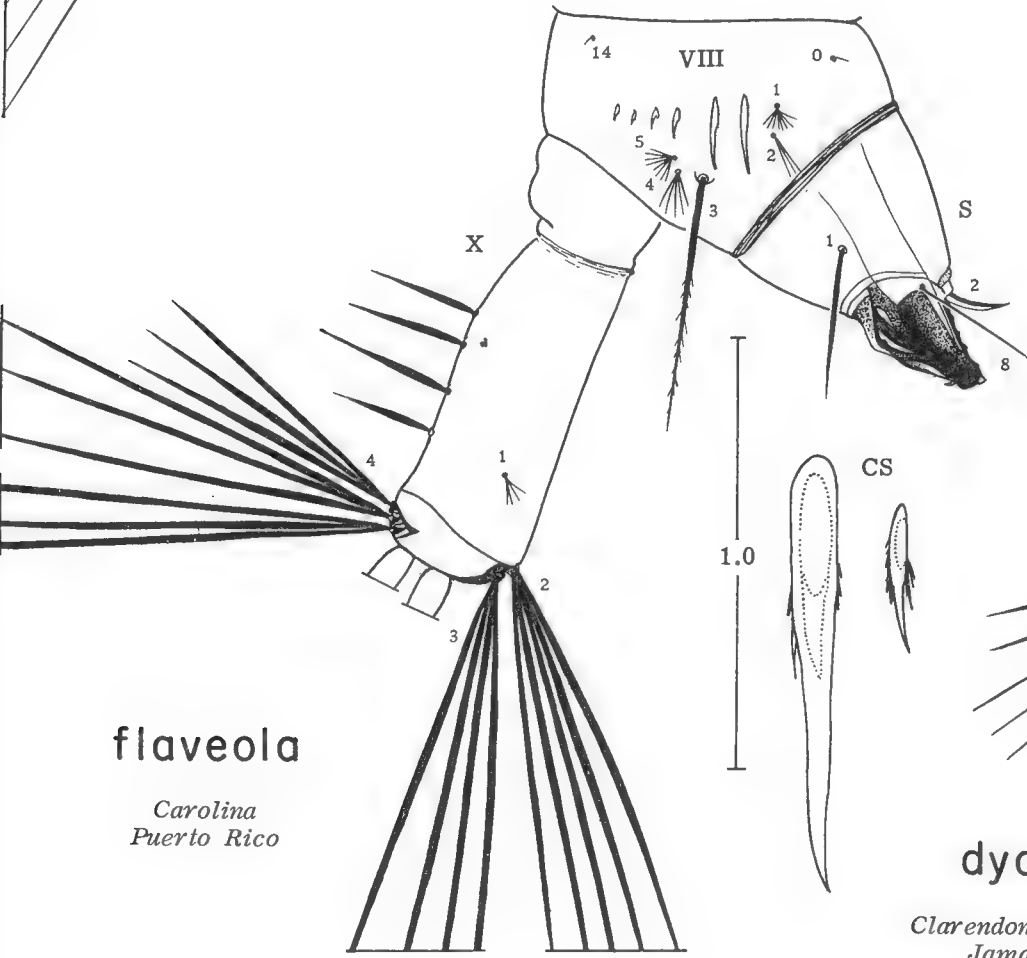
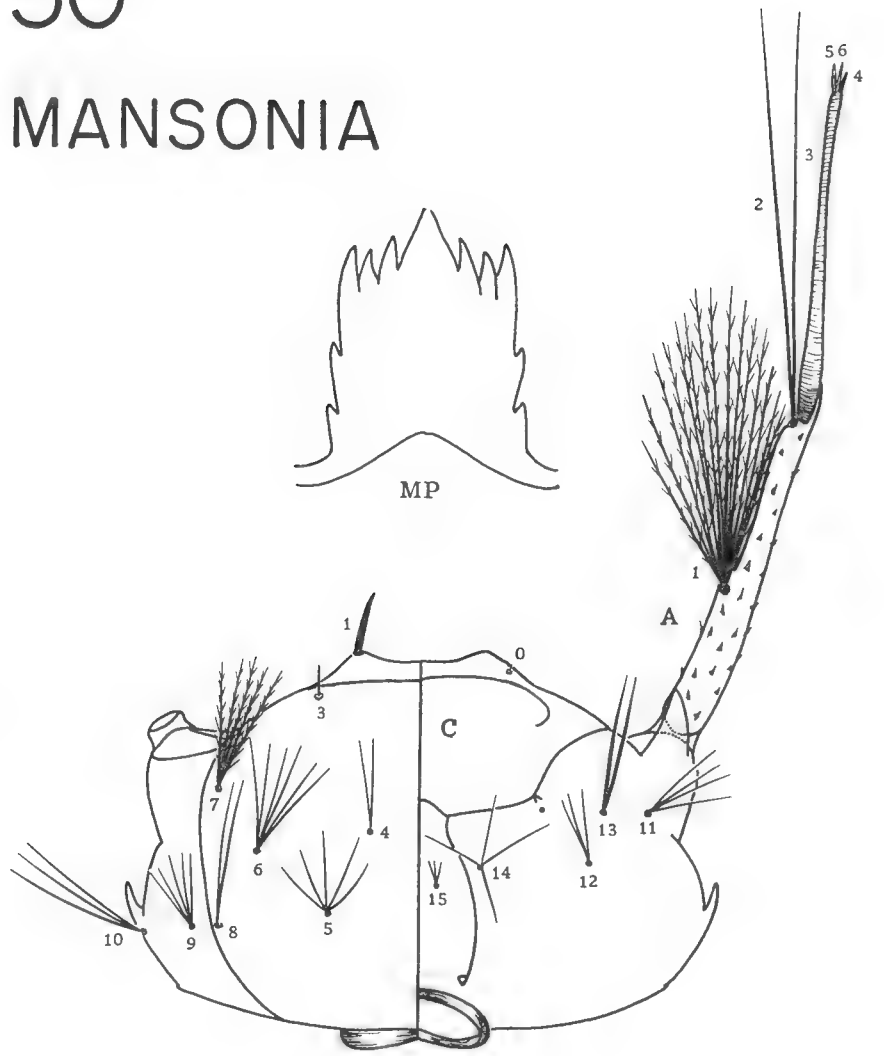


Fig. 50

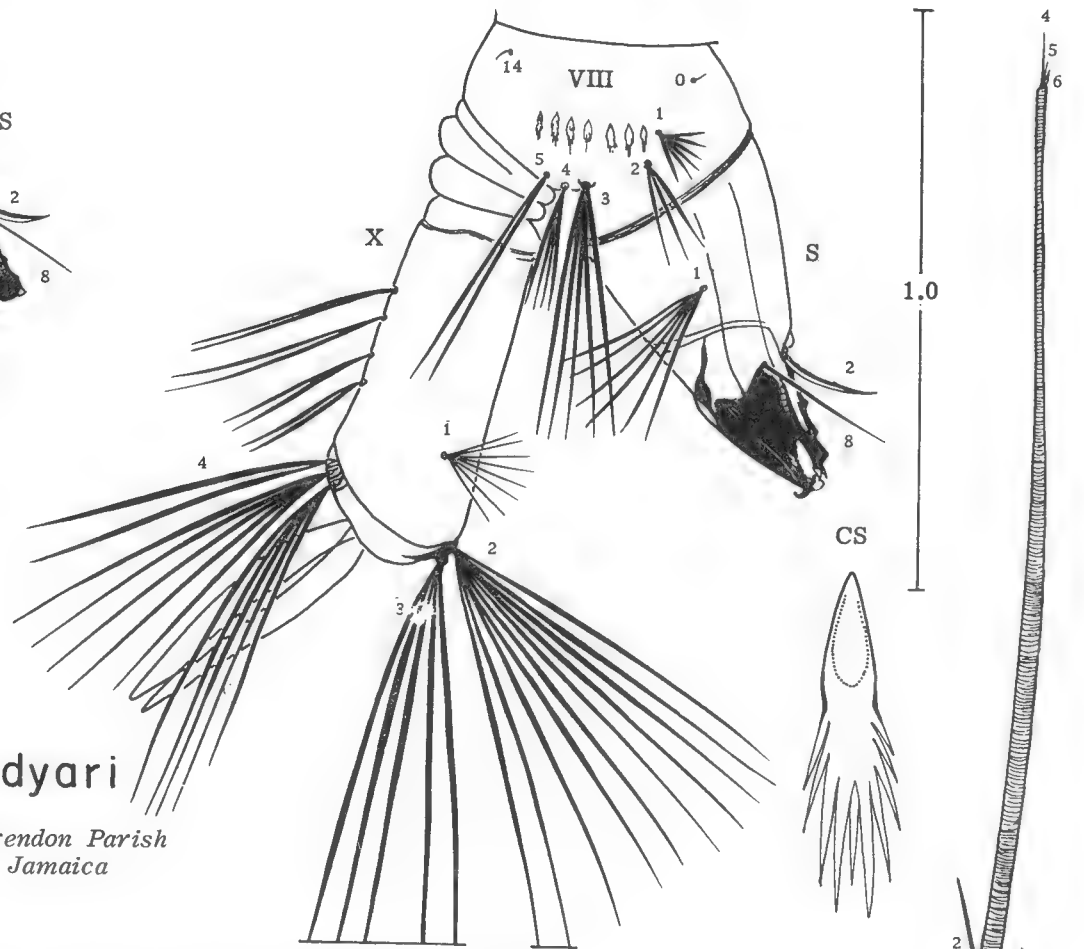
MANSONIA



titillans
JA 789

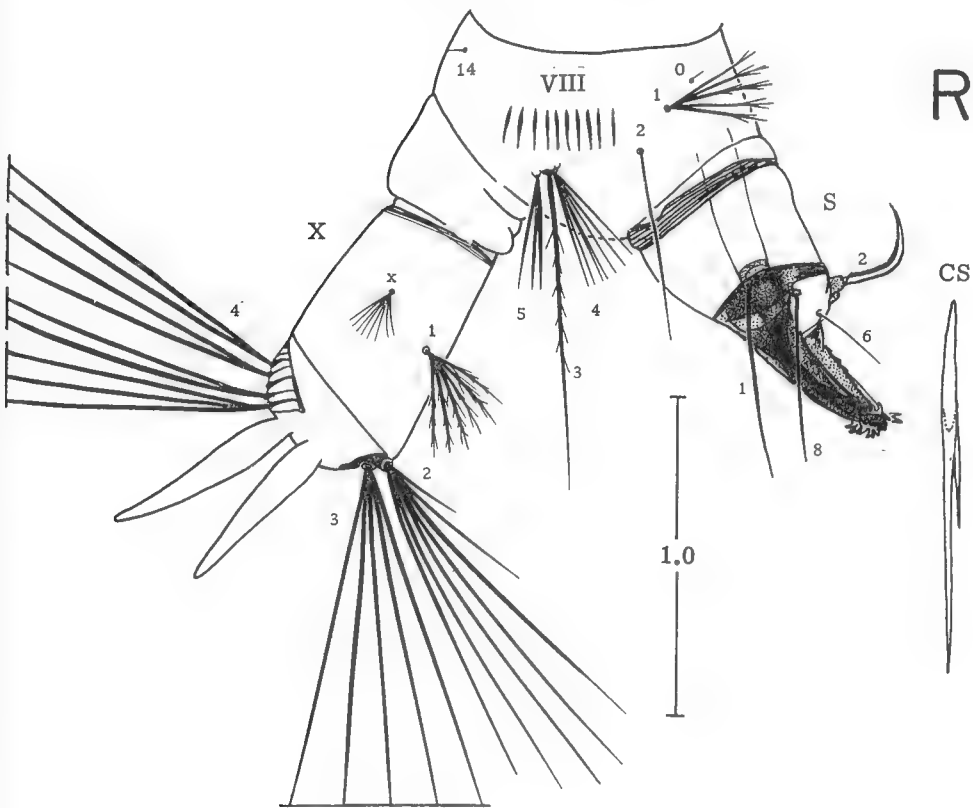


flaveola
Carolina
Puerto Rico



dyari
Clarendon Parish
Jamaica

RHYNCHOTAENIA



nigricans
CZMB
Canal Zone

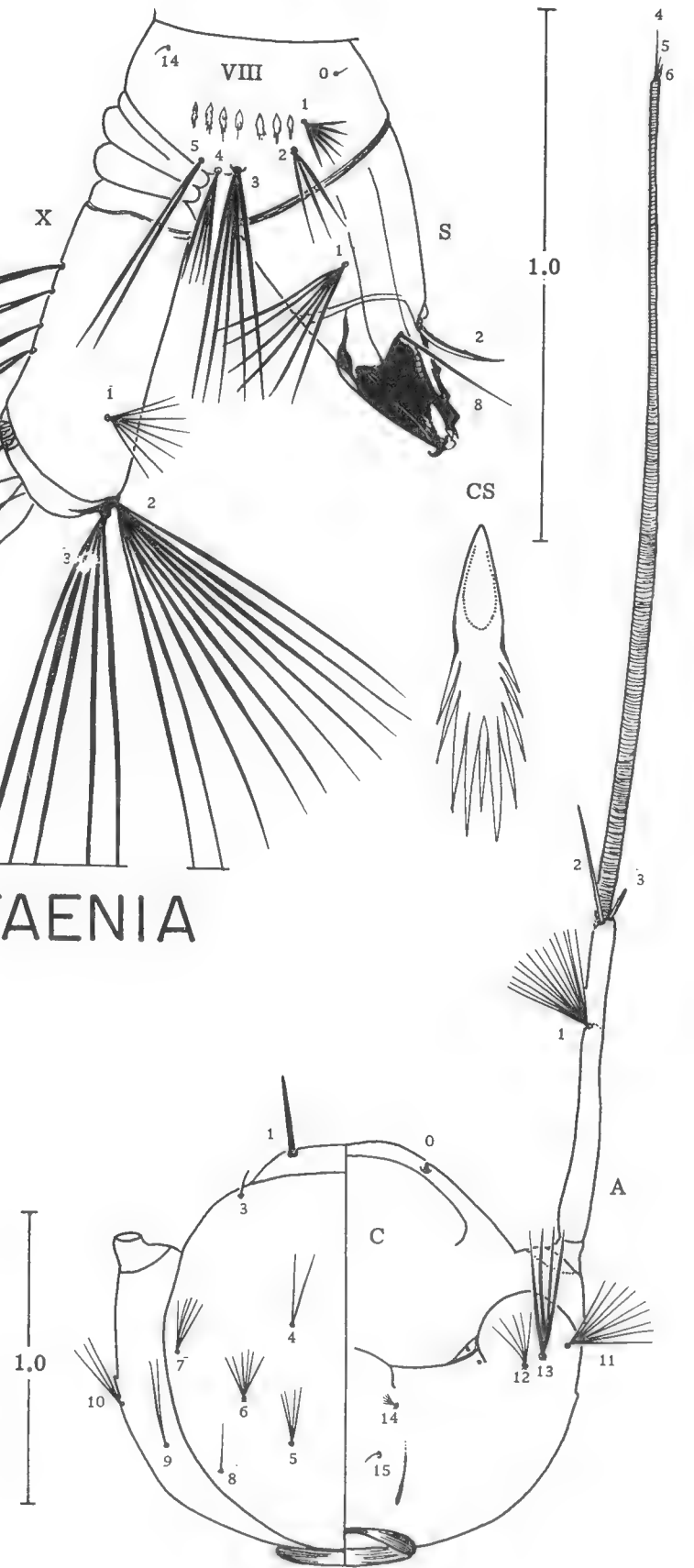


Fig. 51

MANSONIA

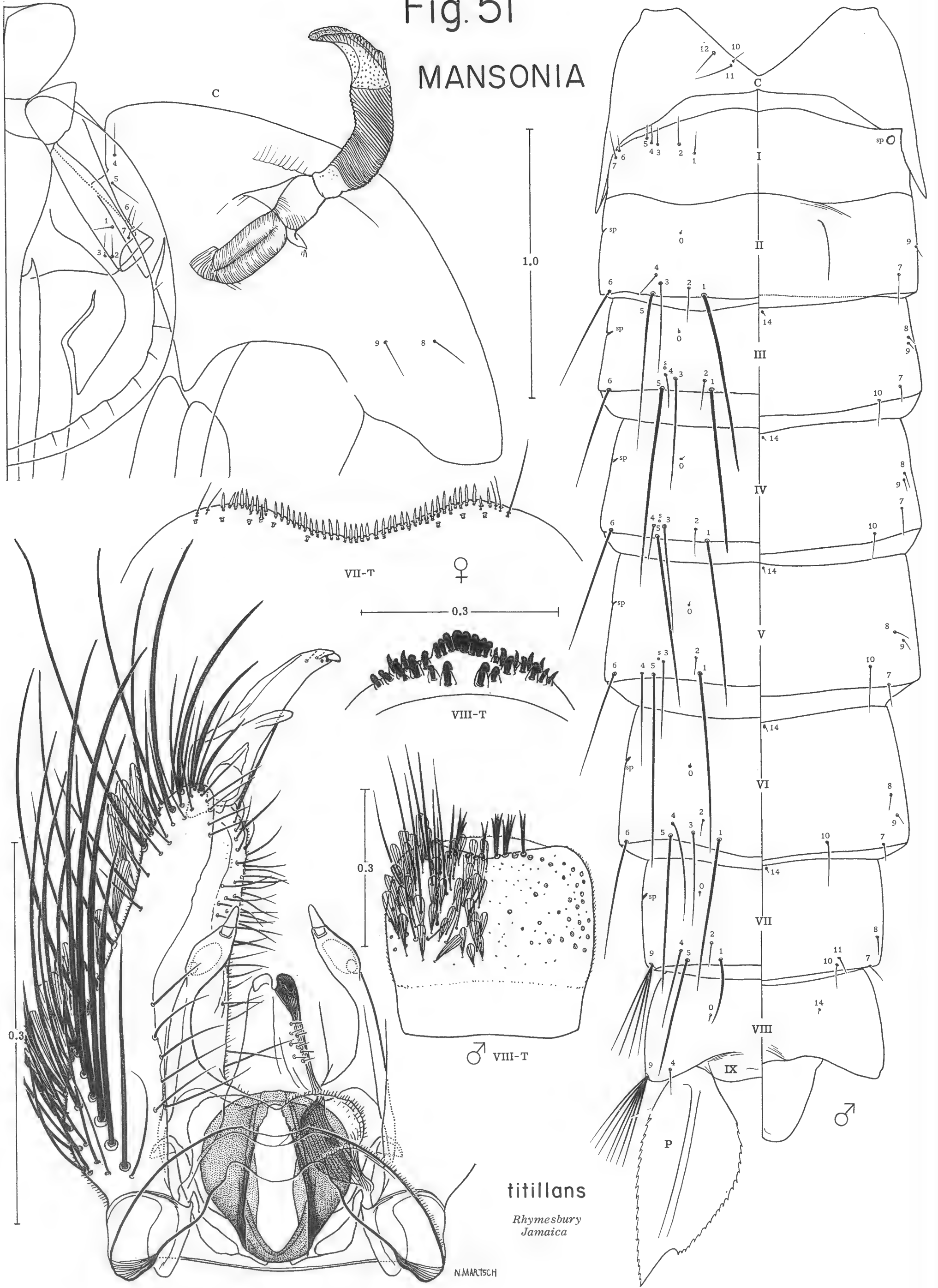


Fig. 52

MANSONIA

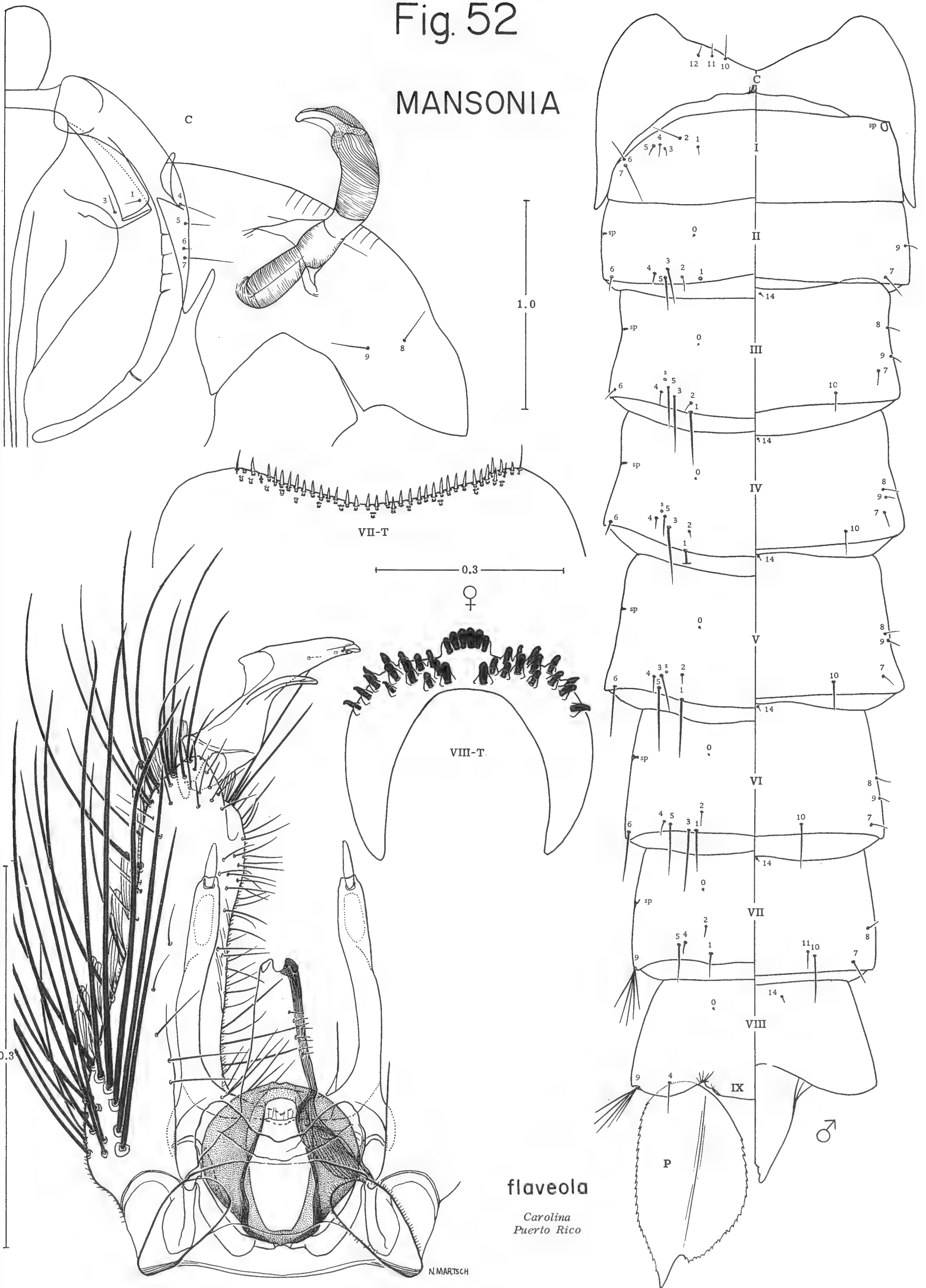
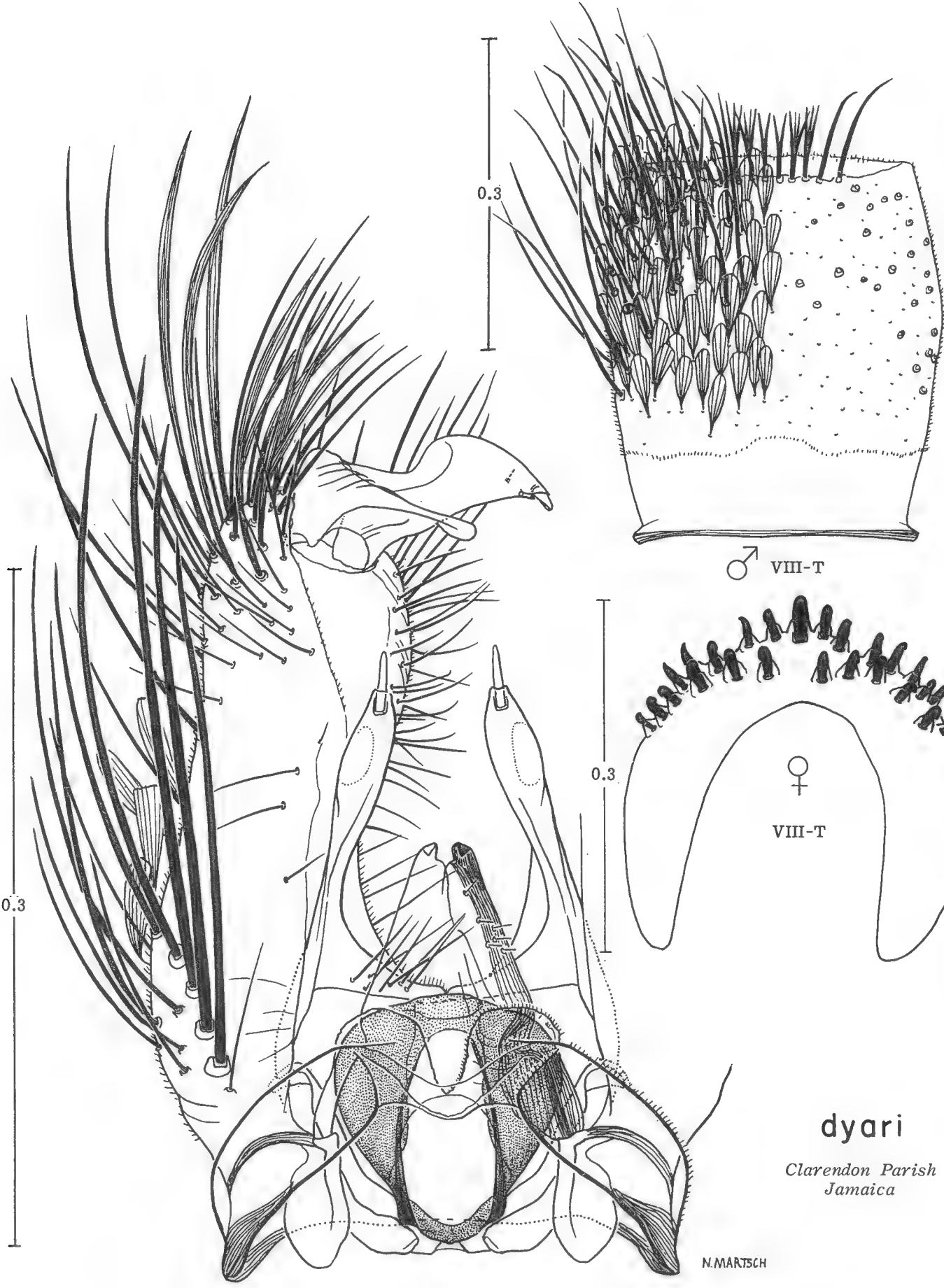
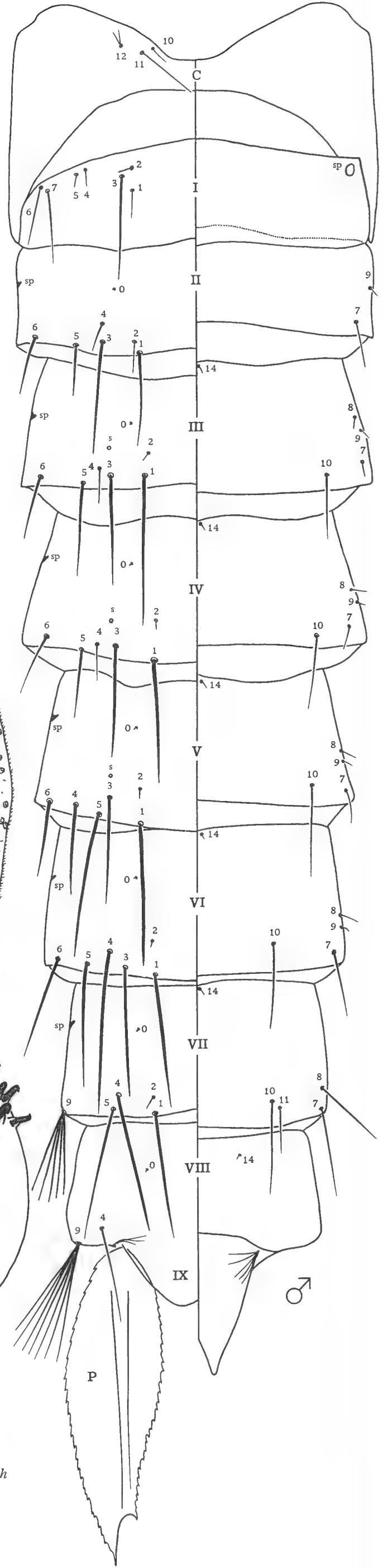
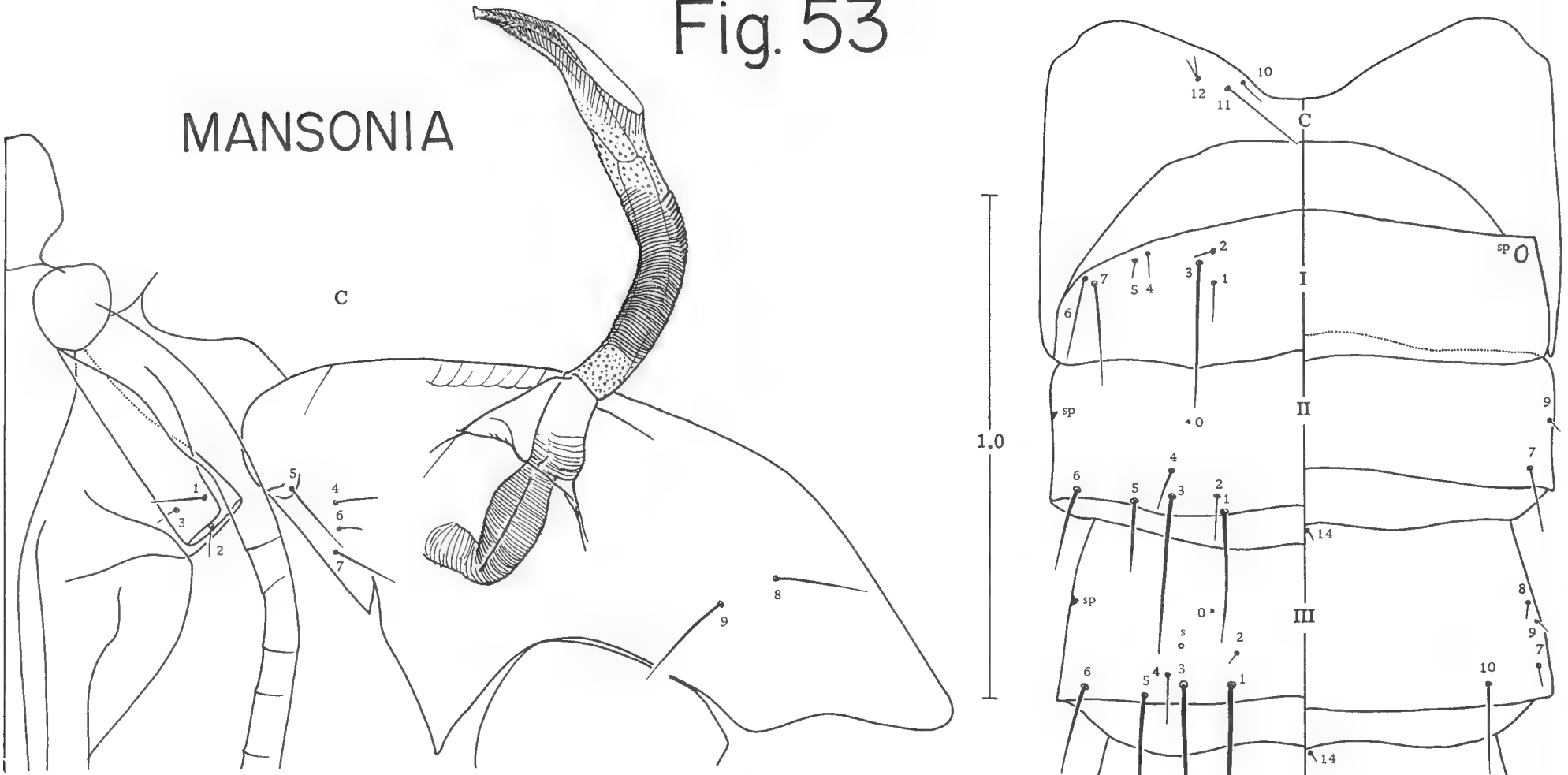


Fig. 53

MANSONIA



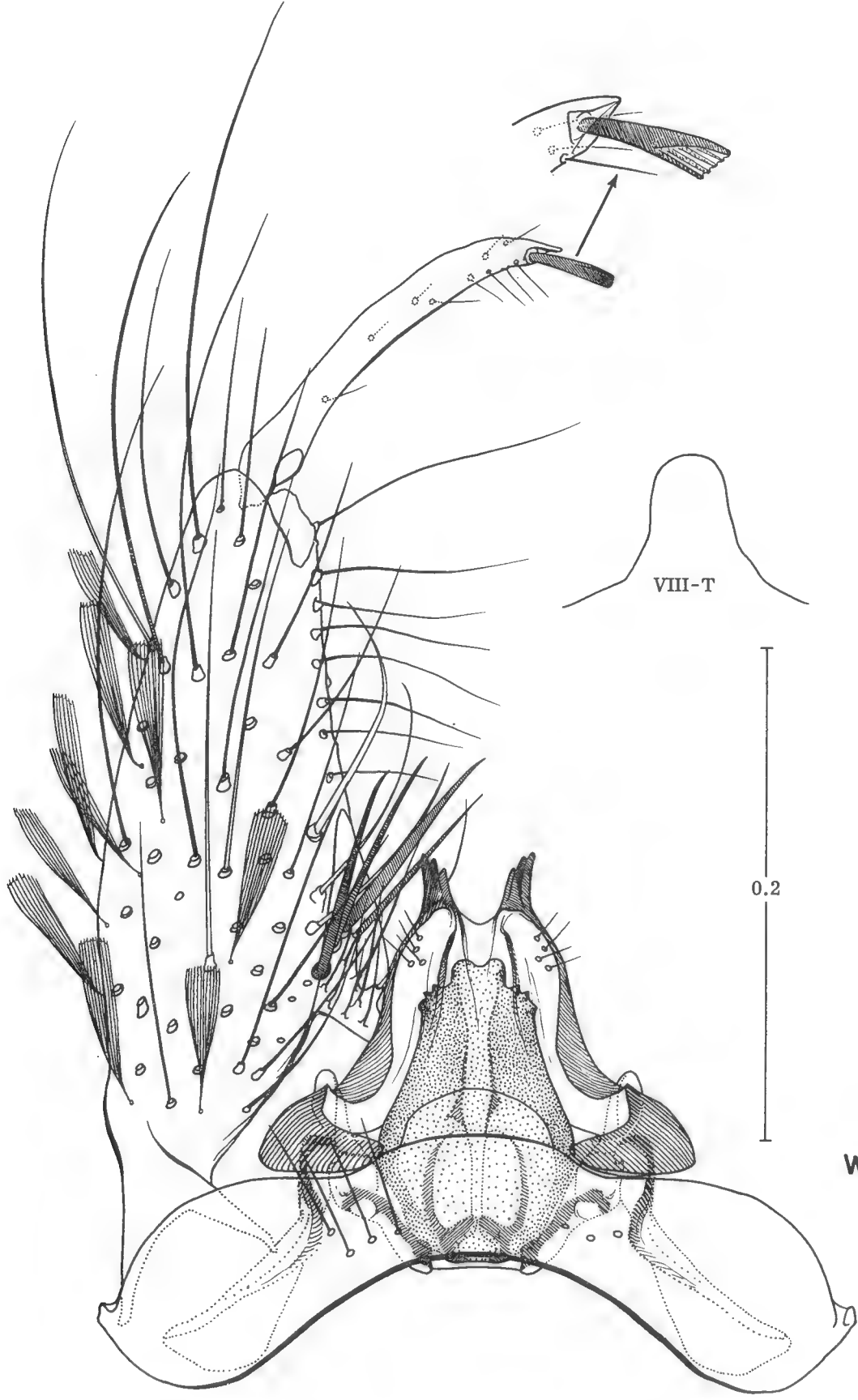
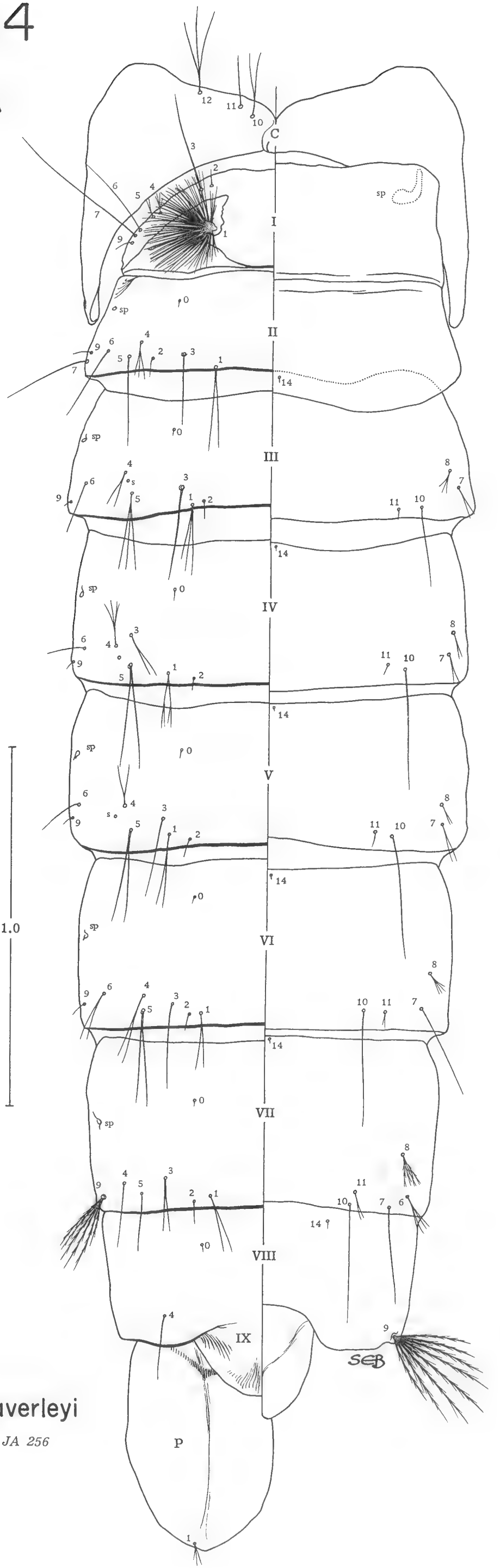
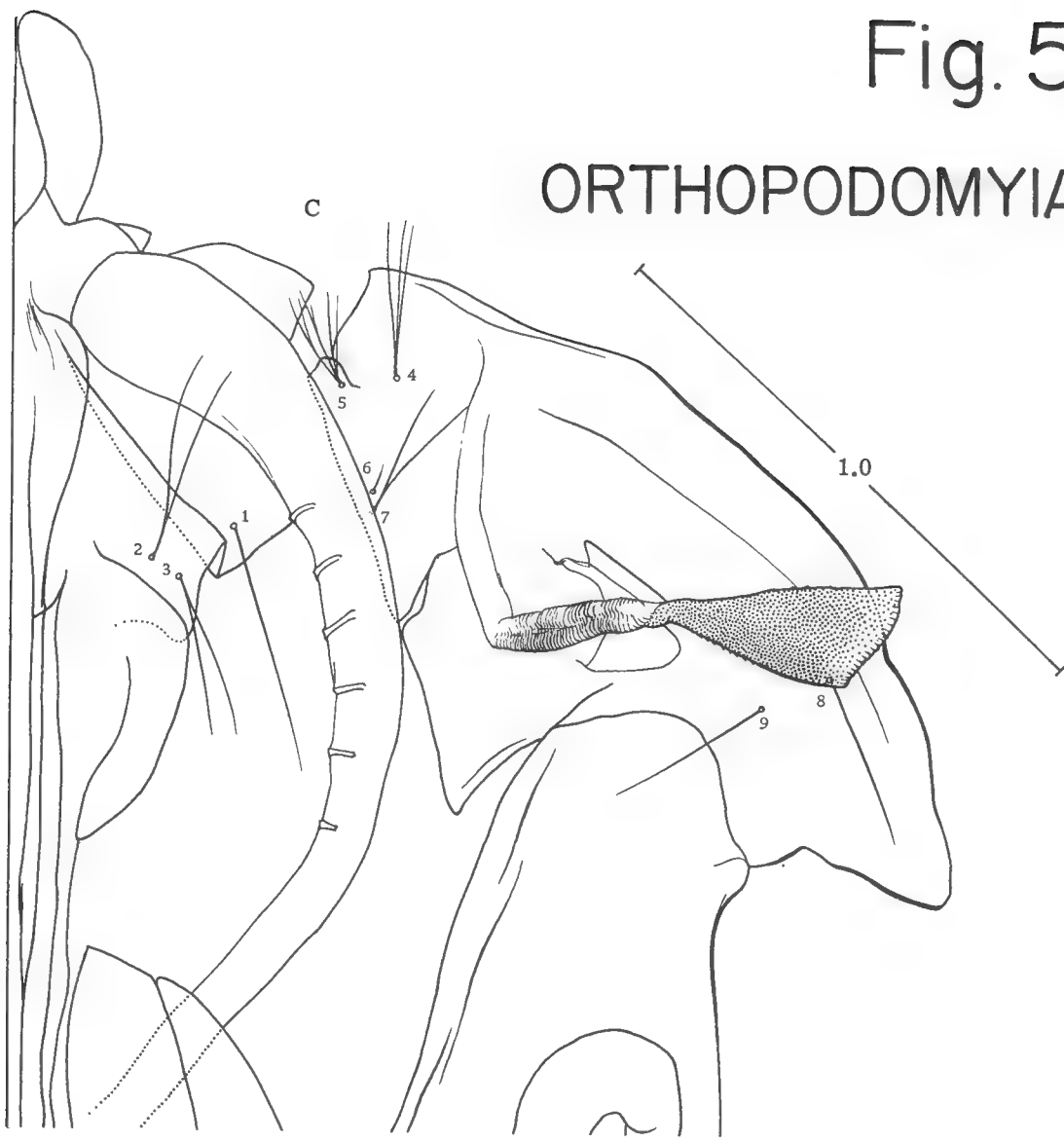
dyari

Clarendon Parish
Jamaica

N. MARTSCH

Fig. 54

ORTHOPODOMYIA



waverleyi

JA 256

ORTHOPODOMYIA

Fig. 55

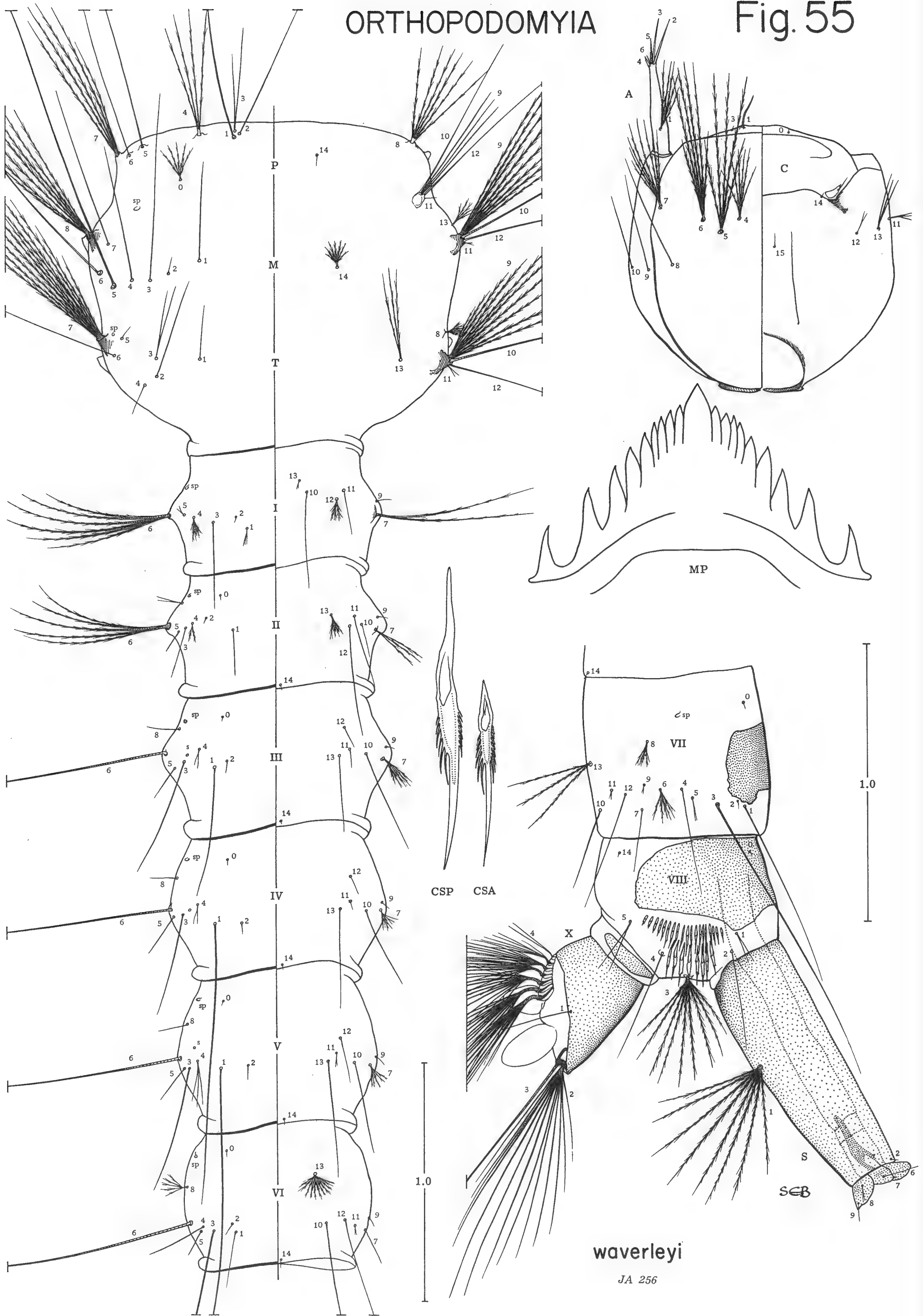


Fig. 56

PSOROPHORA

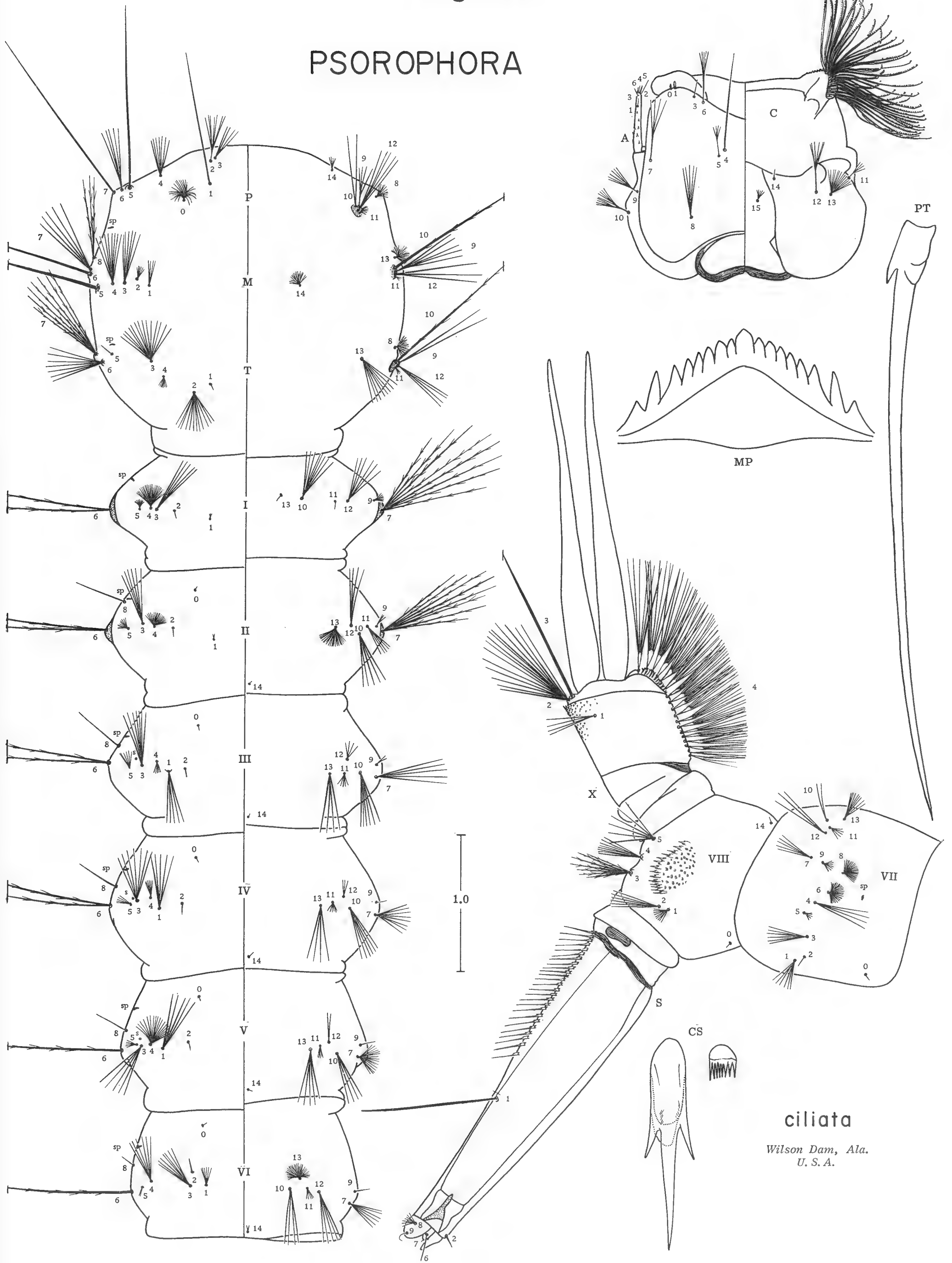


Fig. 57

PSOROPHORA

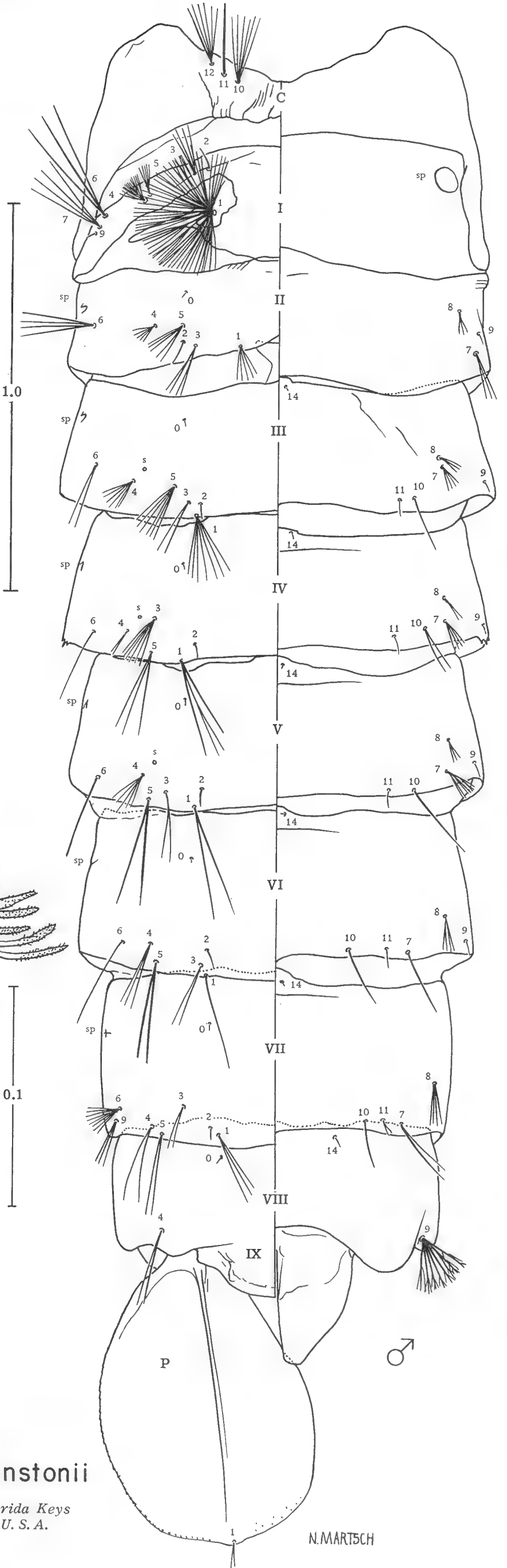


Wilson Dam, Ala.
U. S. A.

N. MARTSCH

Fig. 58

JANTHINOSOMA



johnstonii

Florida Keys
U. S. A.

N. MARTSCH

Fig. 59

JANTHINOSOMA

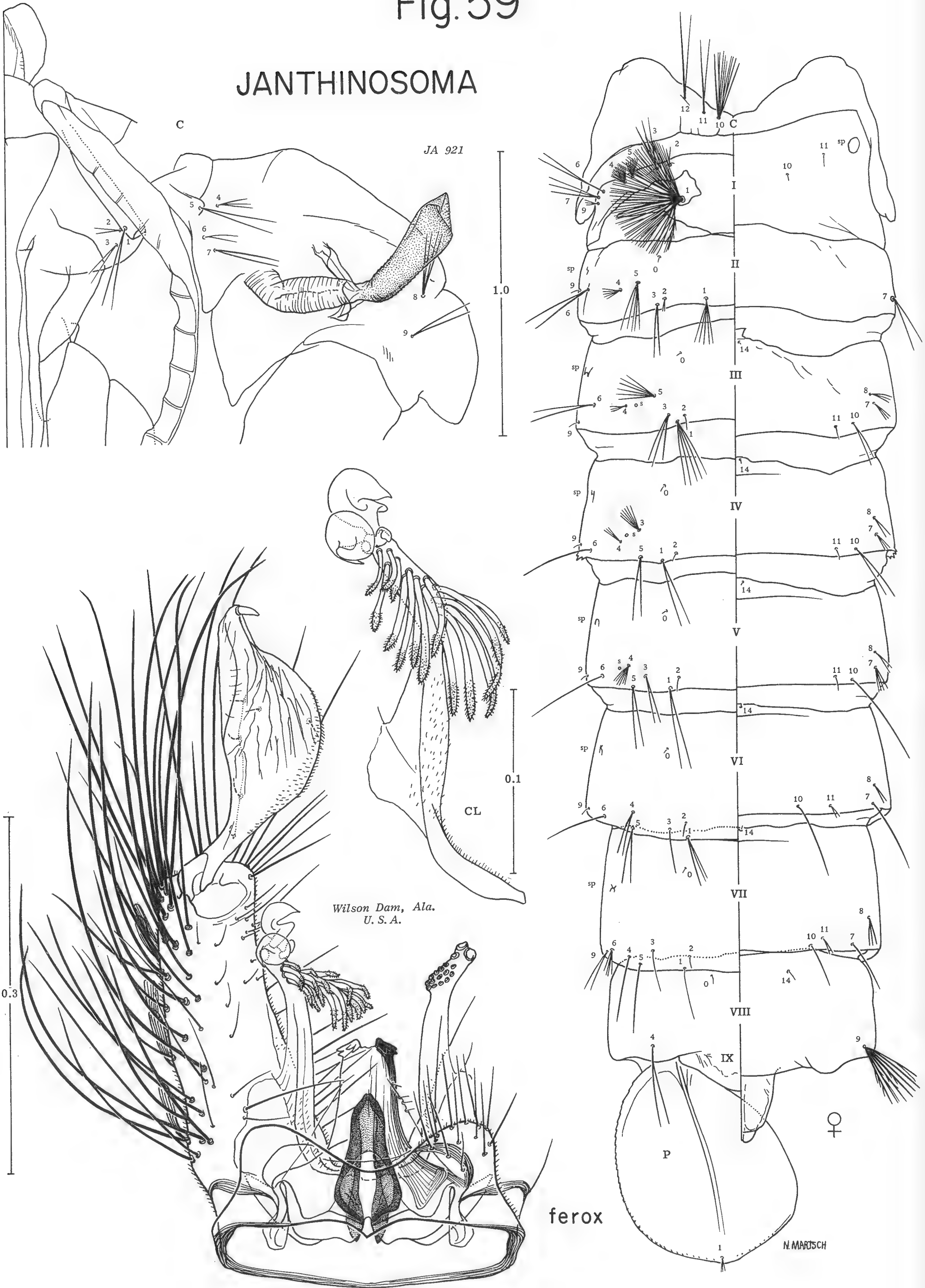


Fig. 60

JANTHINOSOMA

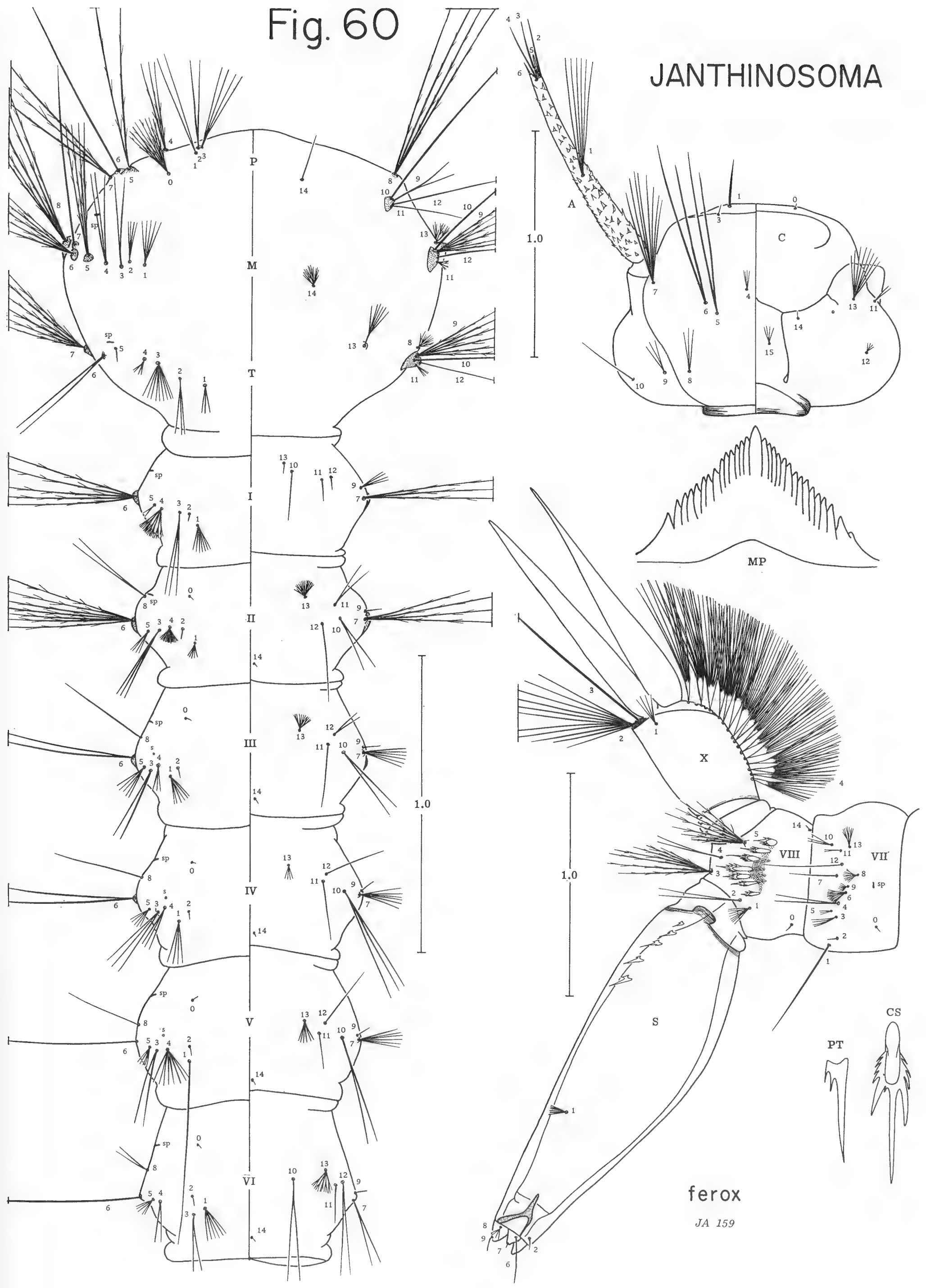
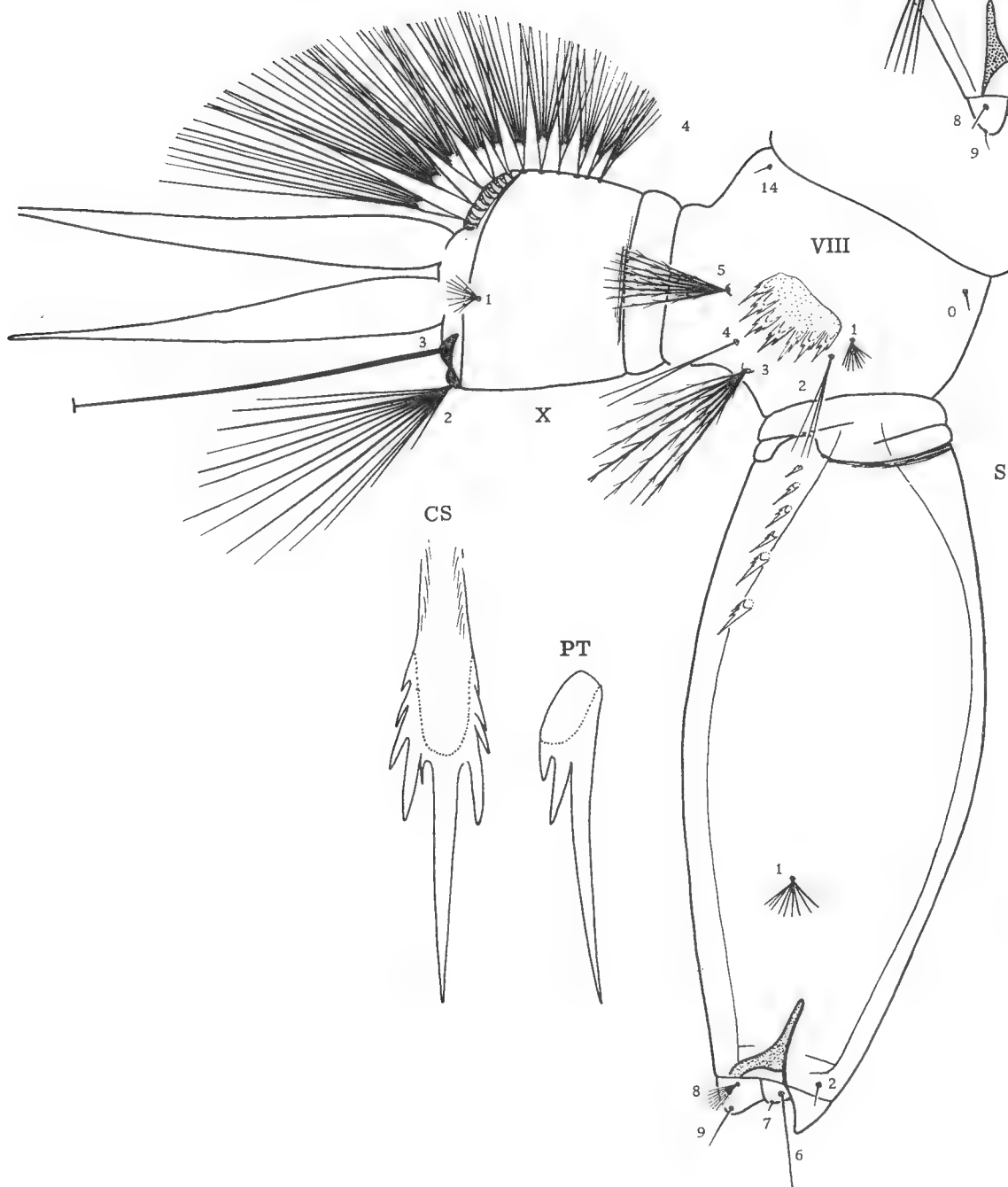
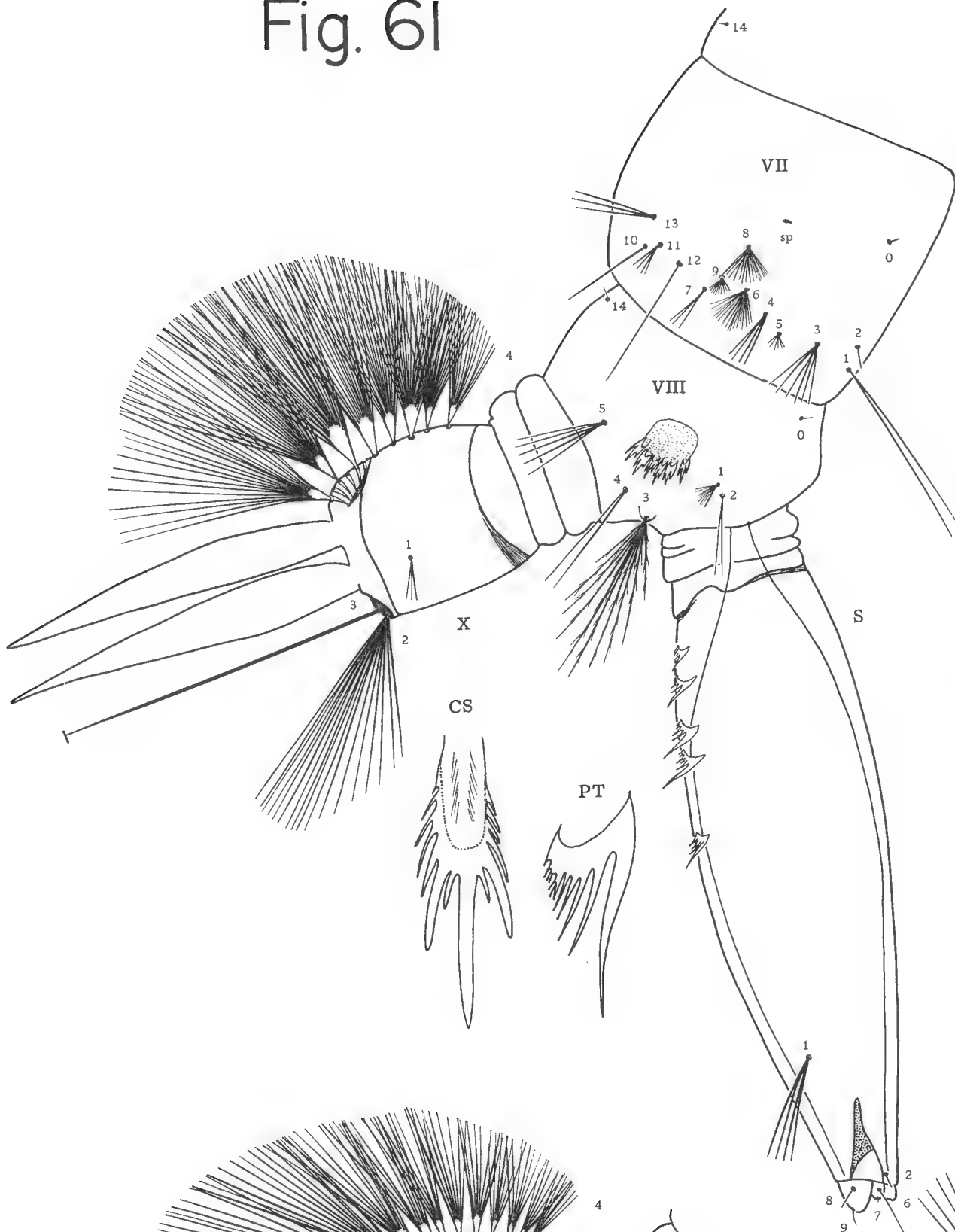
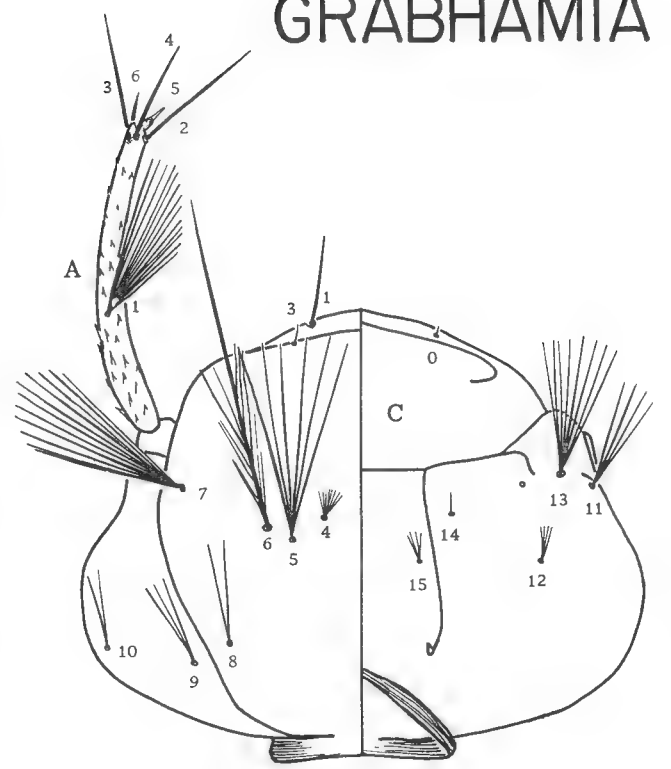


Fig. 61

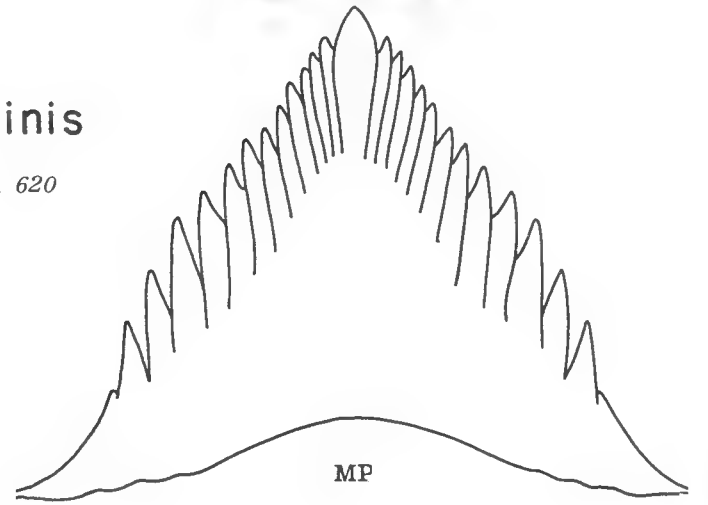


GRABHAMIA

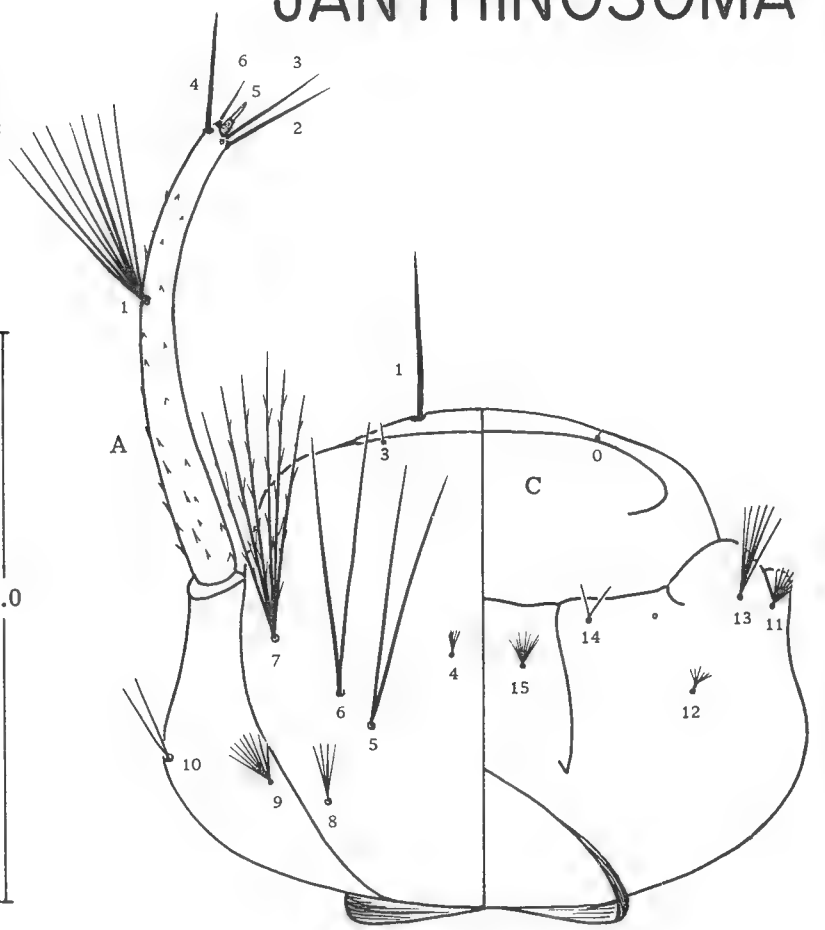


infinis

JA 620



JANTHINOSOMA



johnstonii

Florida Keys
U. S. A.

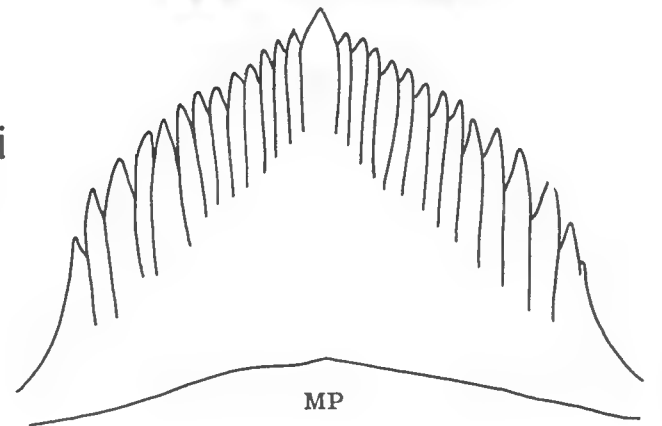
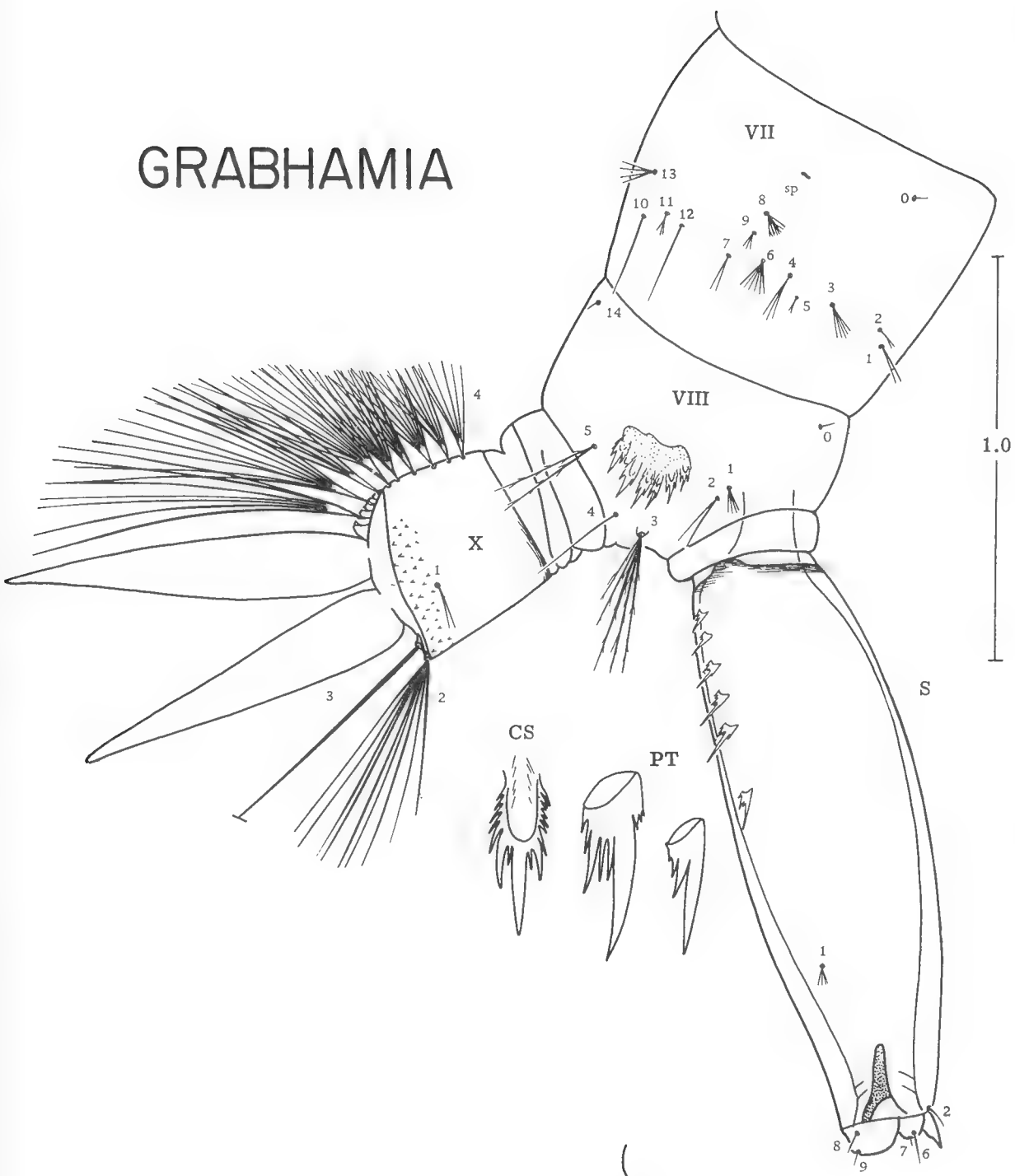


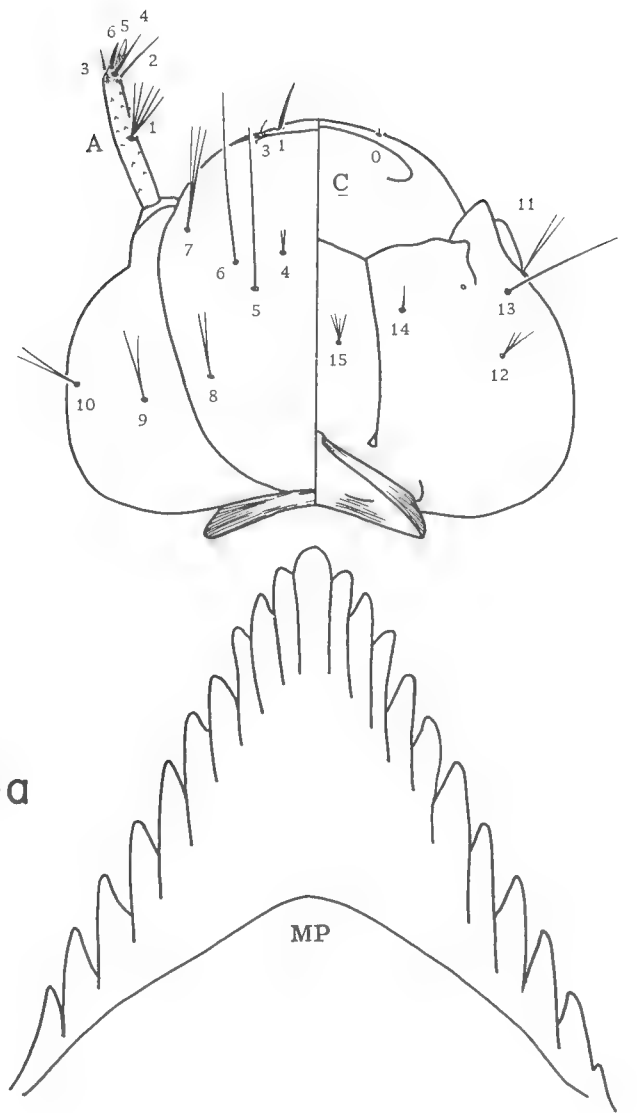
Fig. 62

GRABHAMIA



pygmaea

JA 863



insularia

JA 171

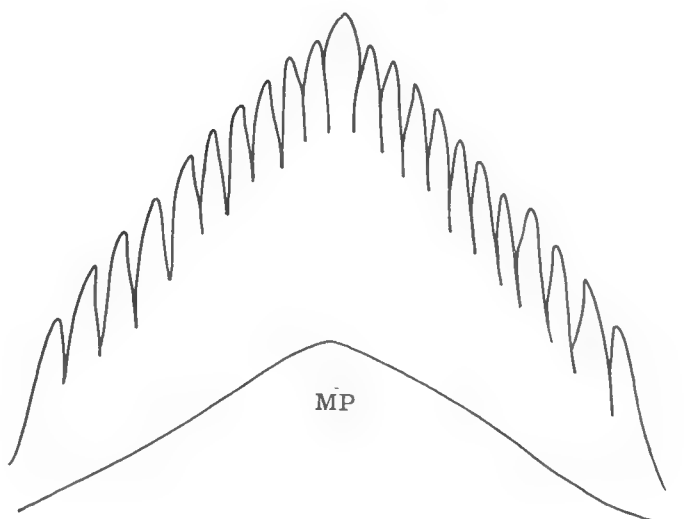
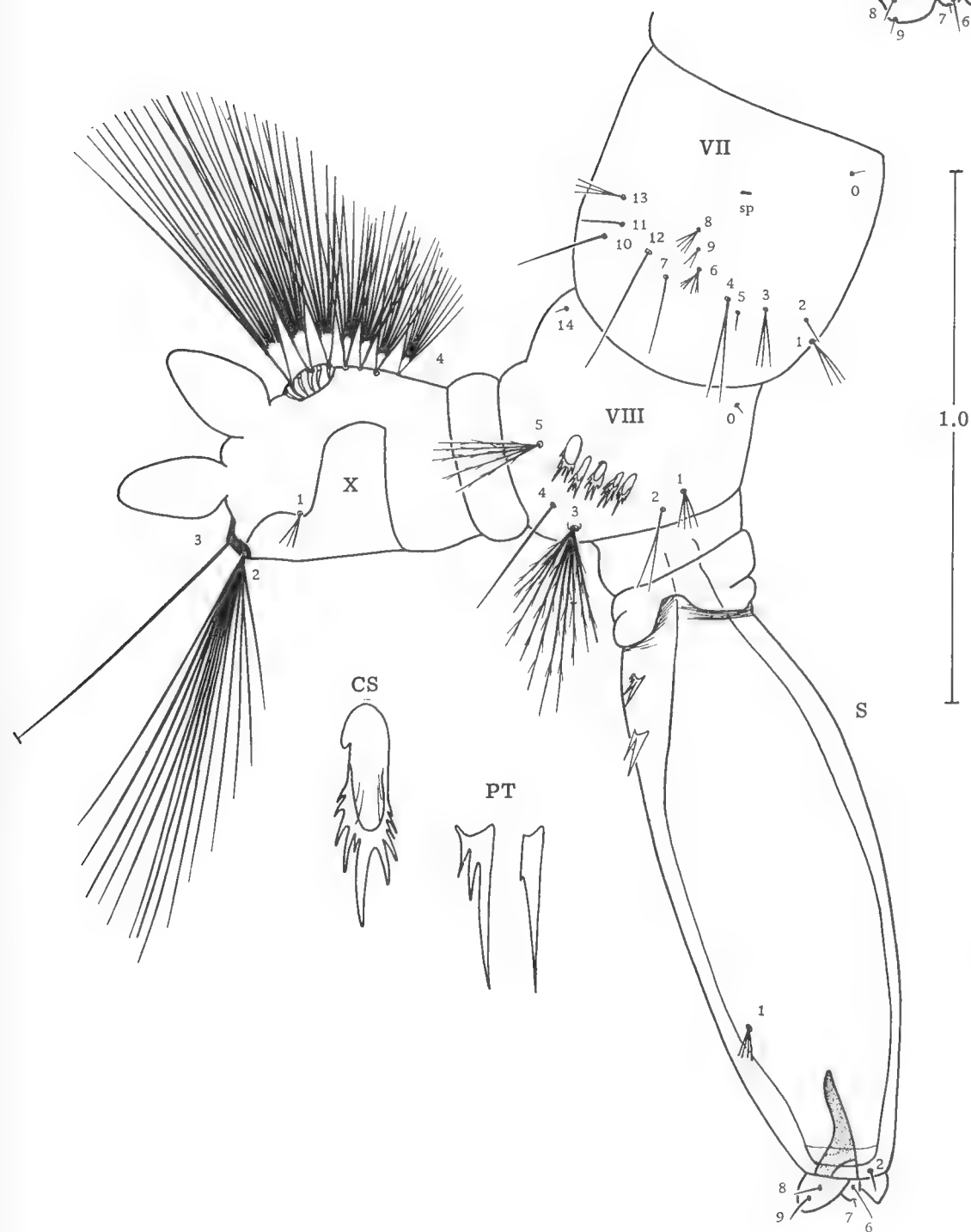
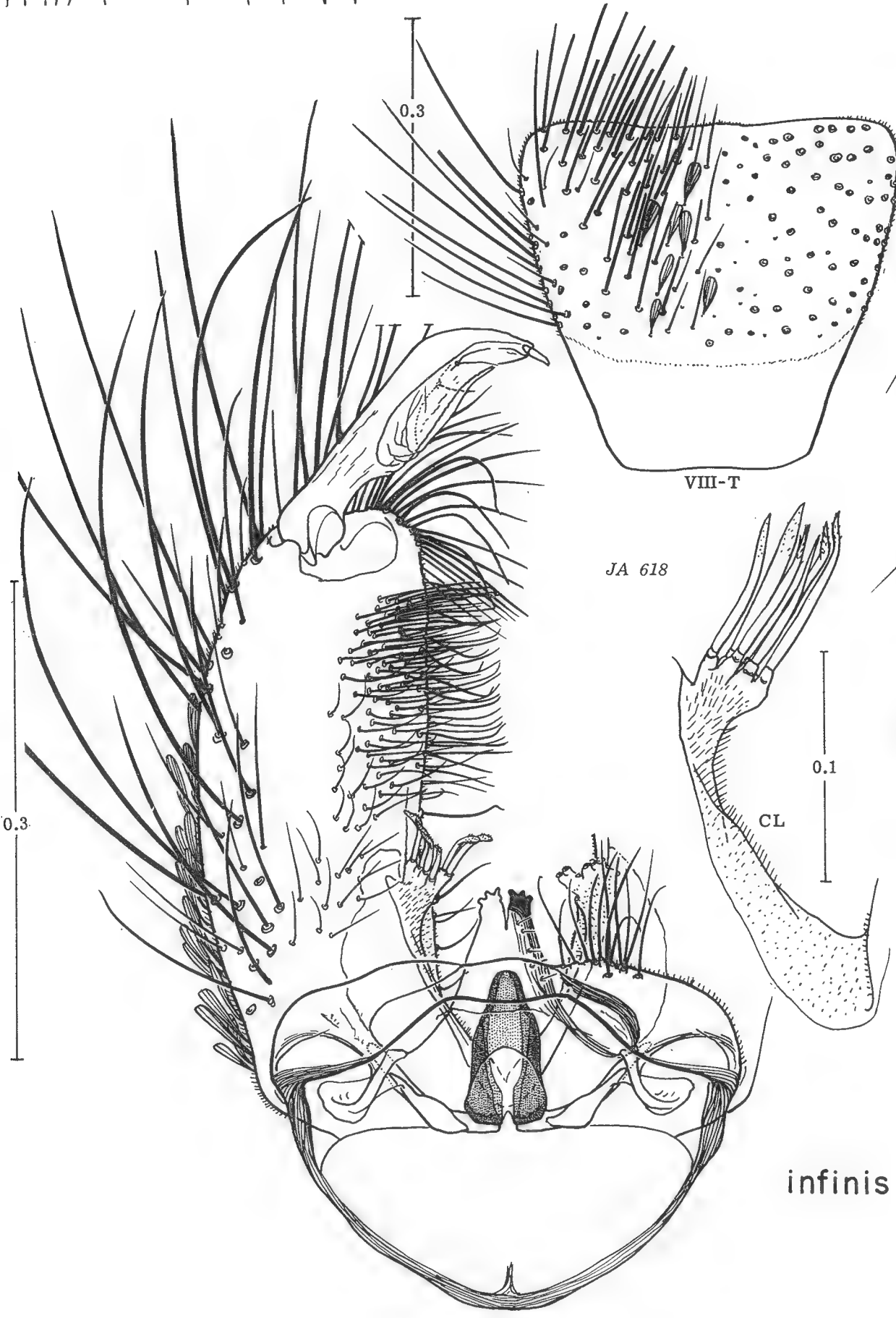
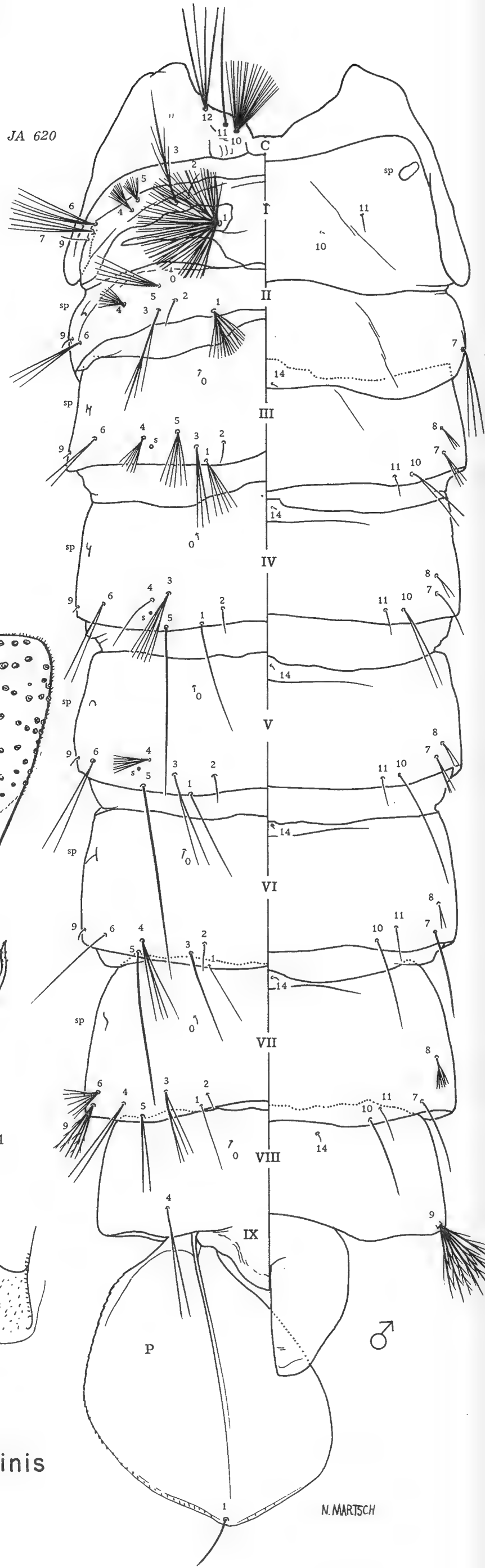
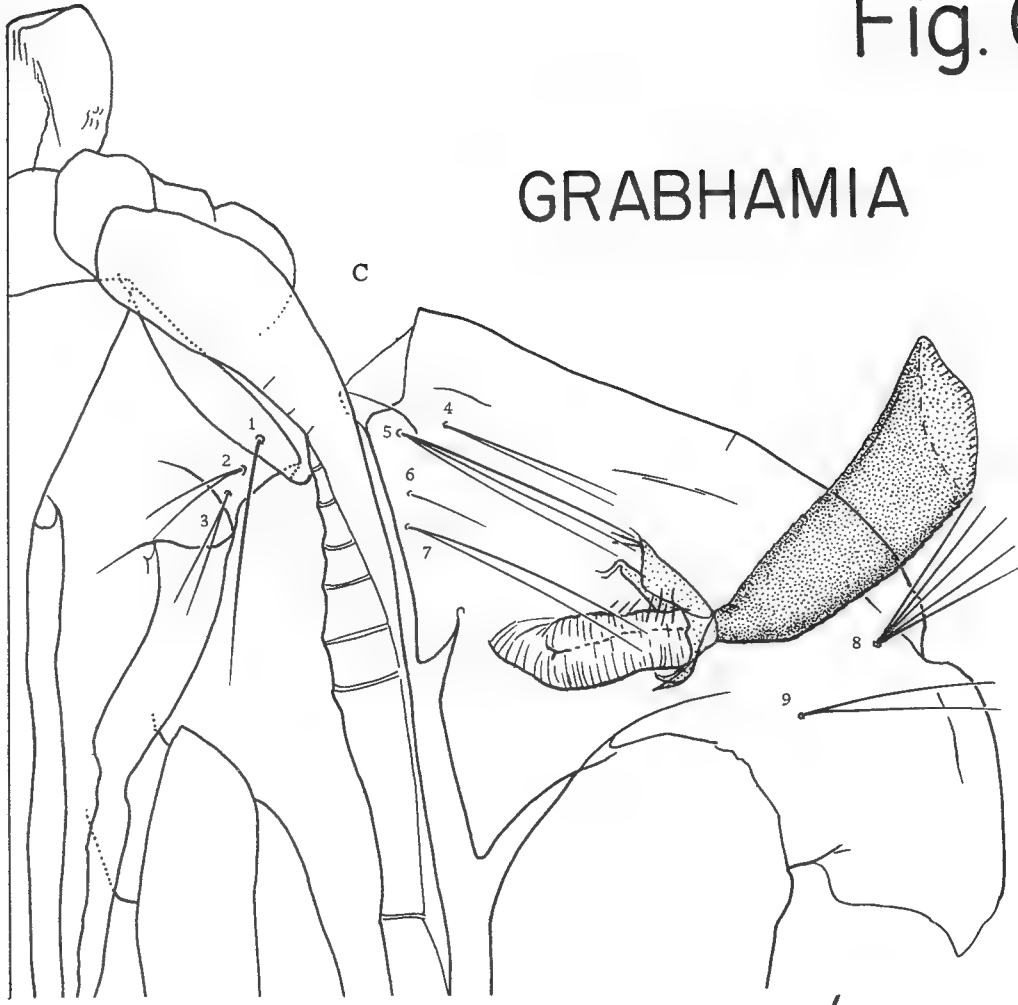


Fig. 63

GRABHAMIA



infinis

N. MARTSCH

Fig. 64

GRABHAMIA

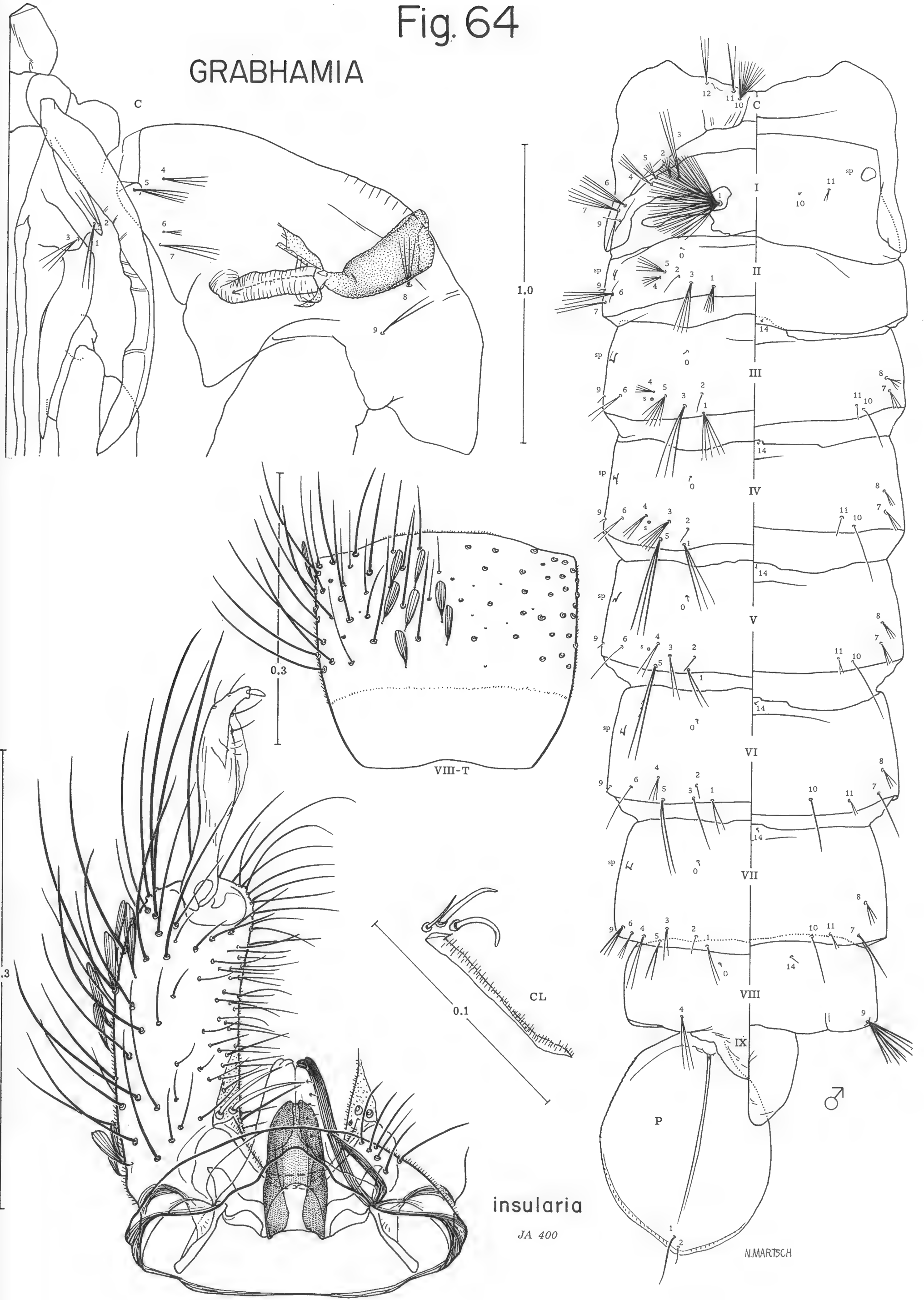


Fig. 65

GRABHAMIA

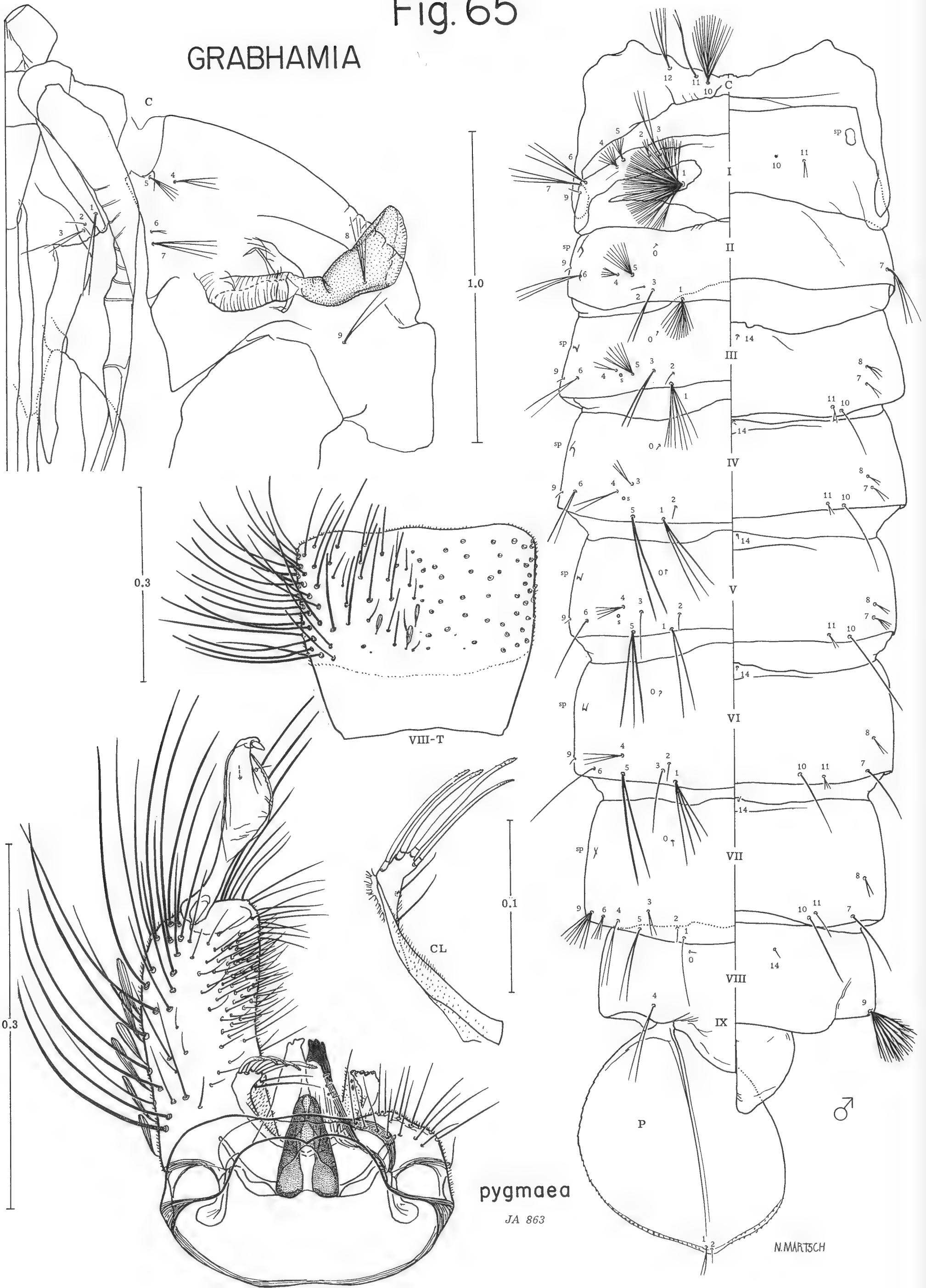


Fig. 66

GRABHAMIA

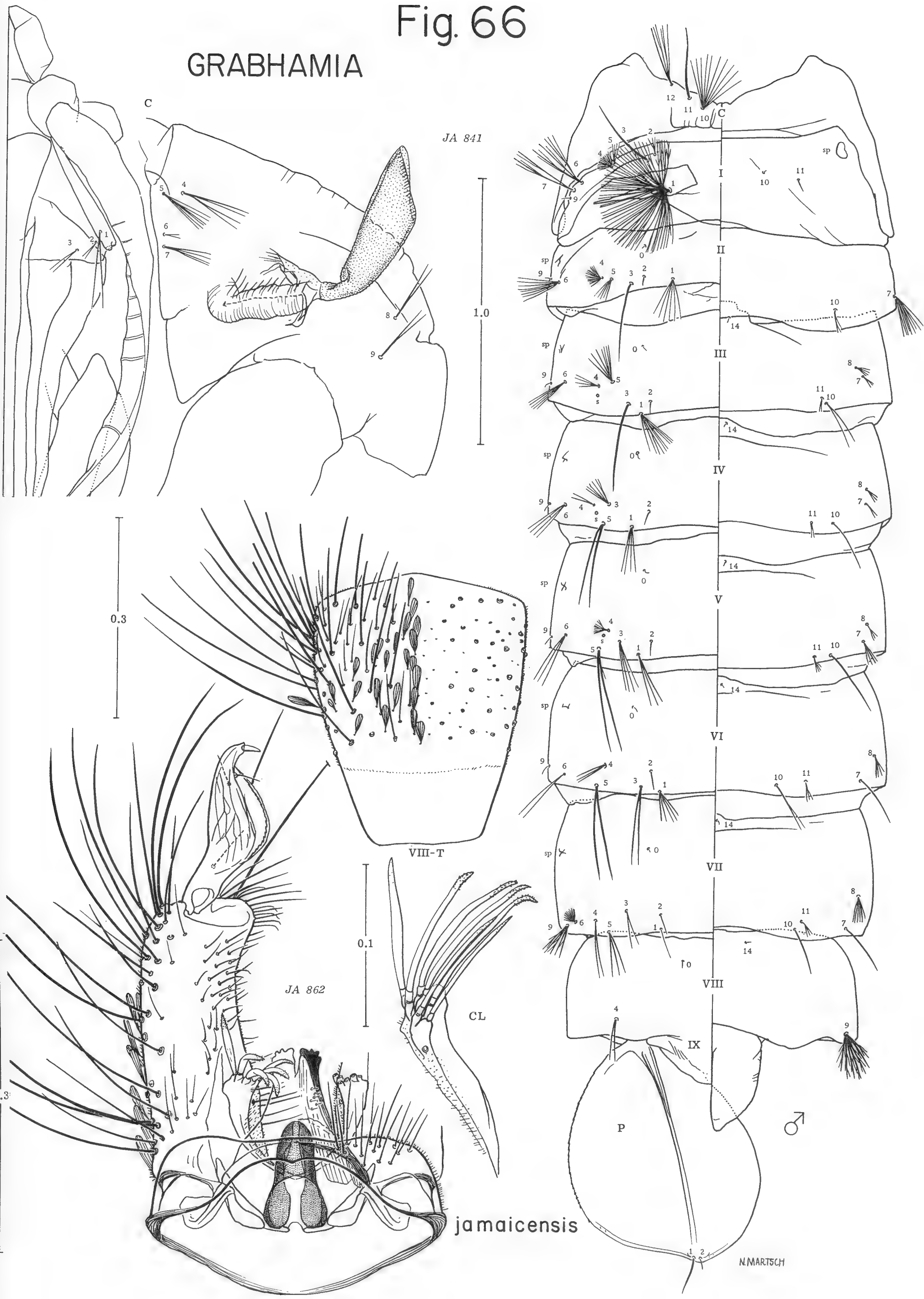
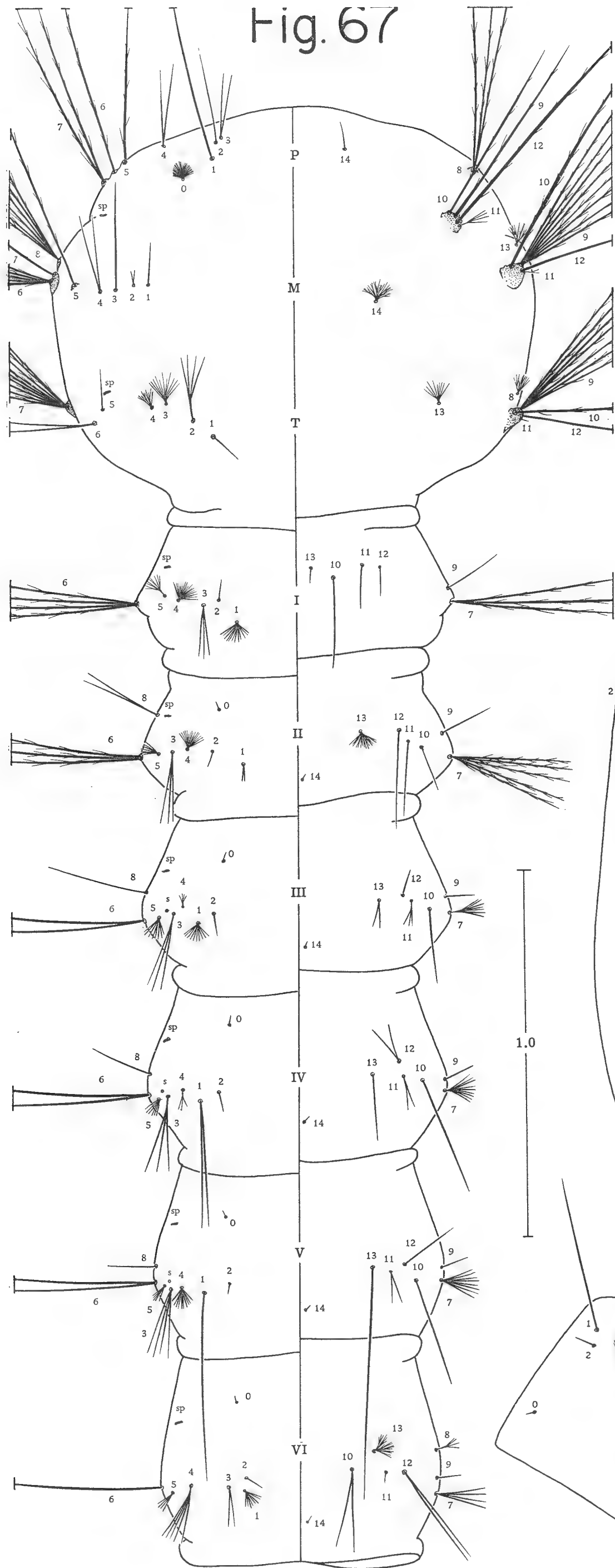
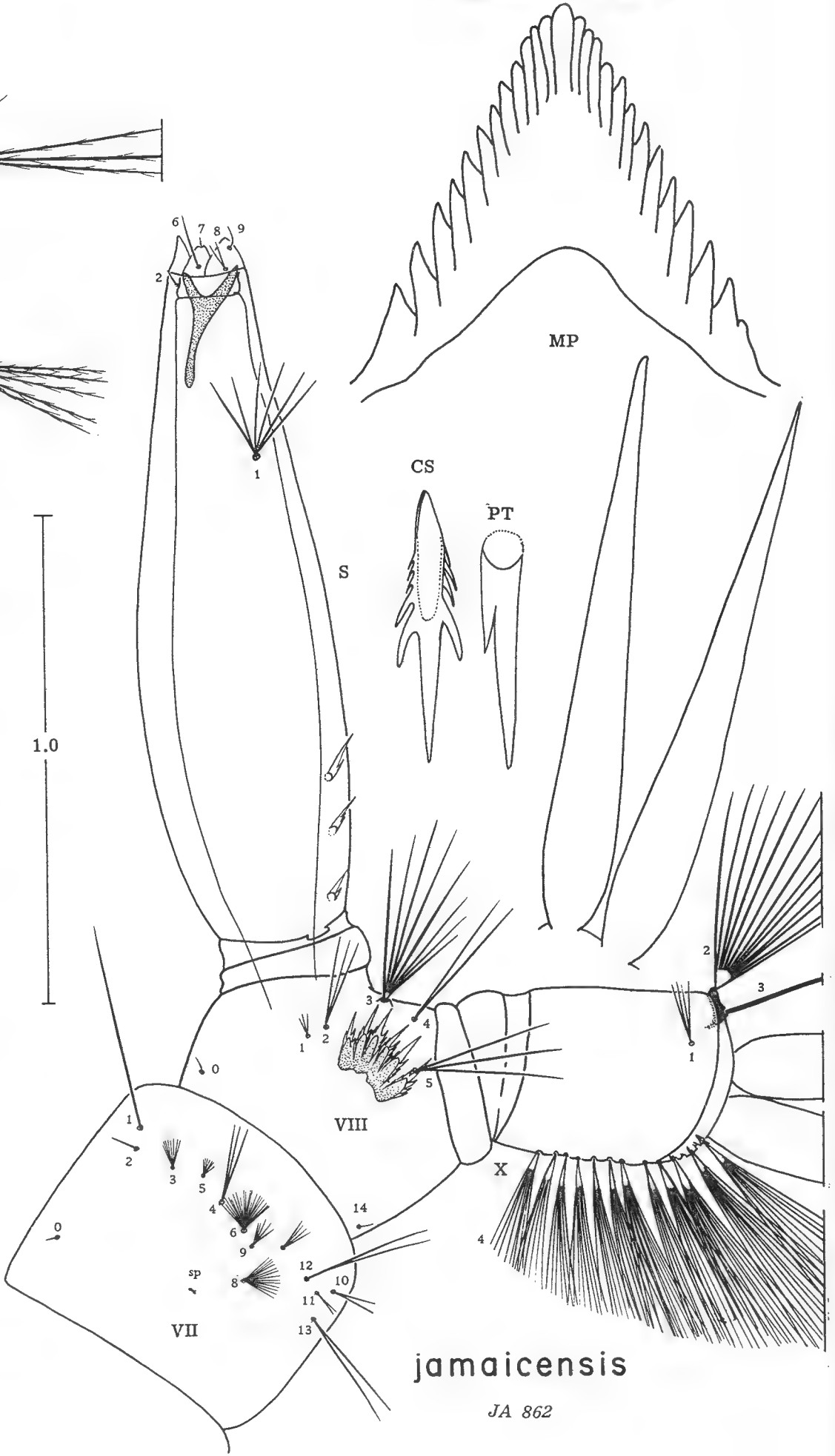
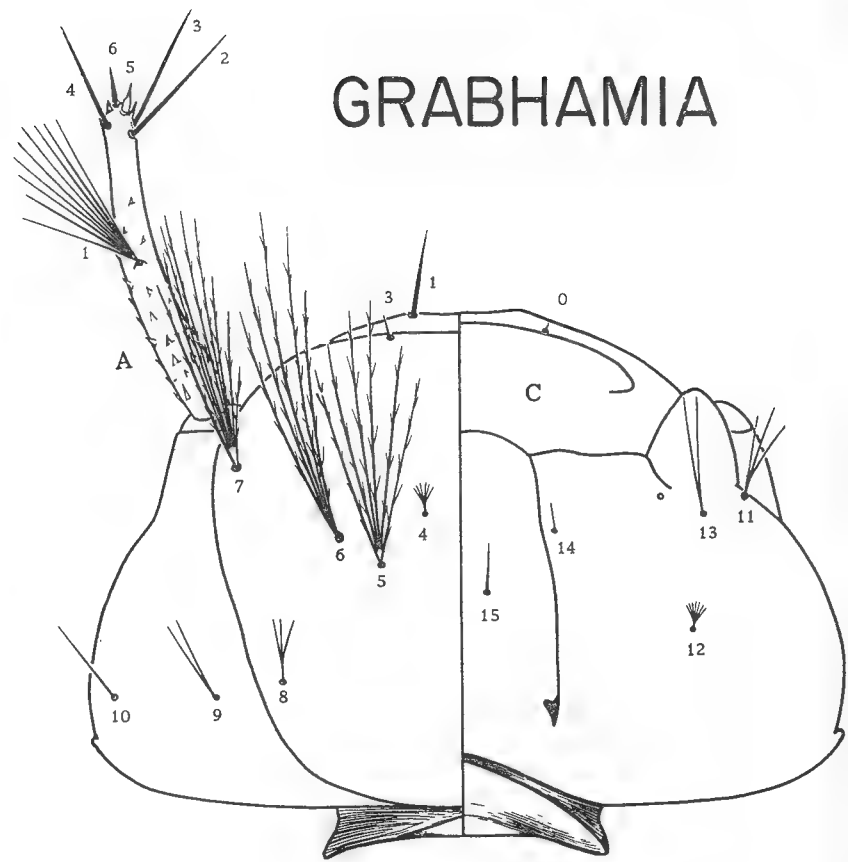


Fig. 67



GRABHAMIA

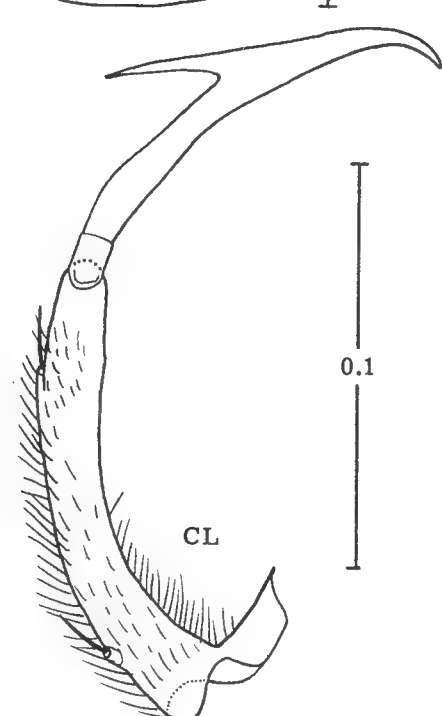
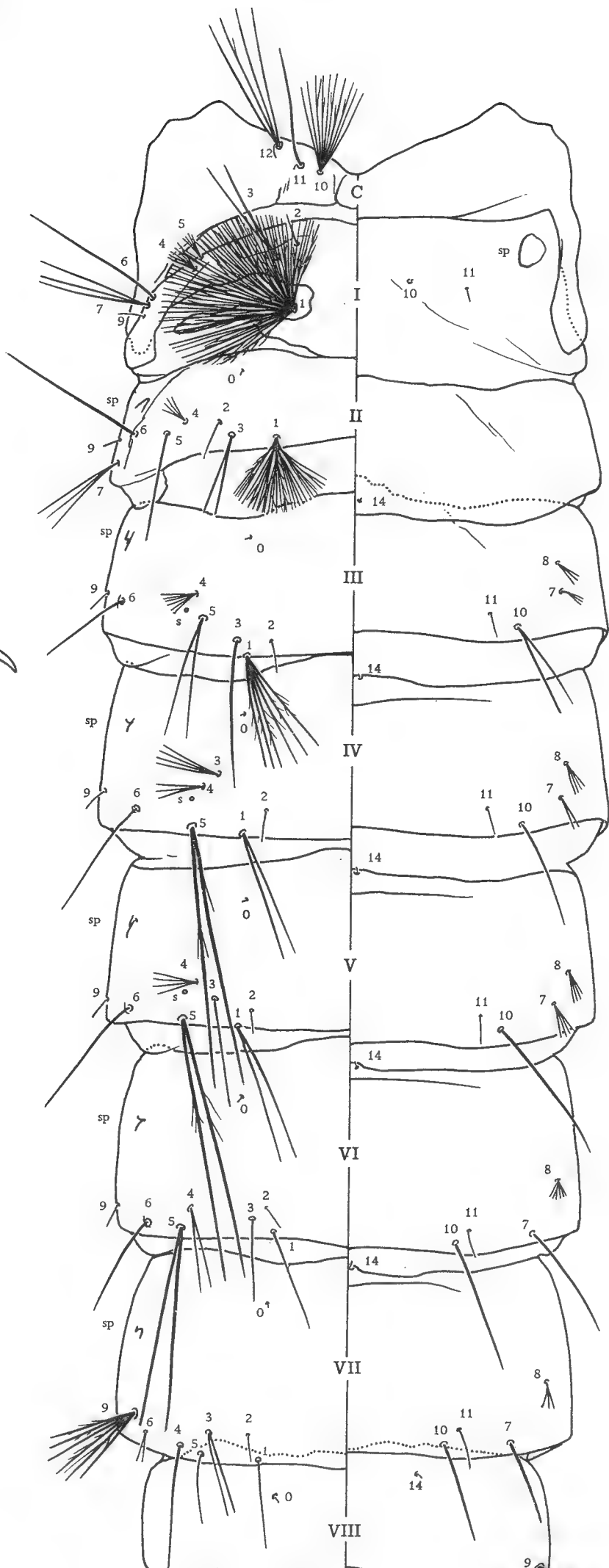
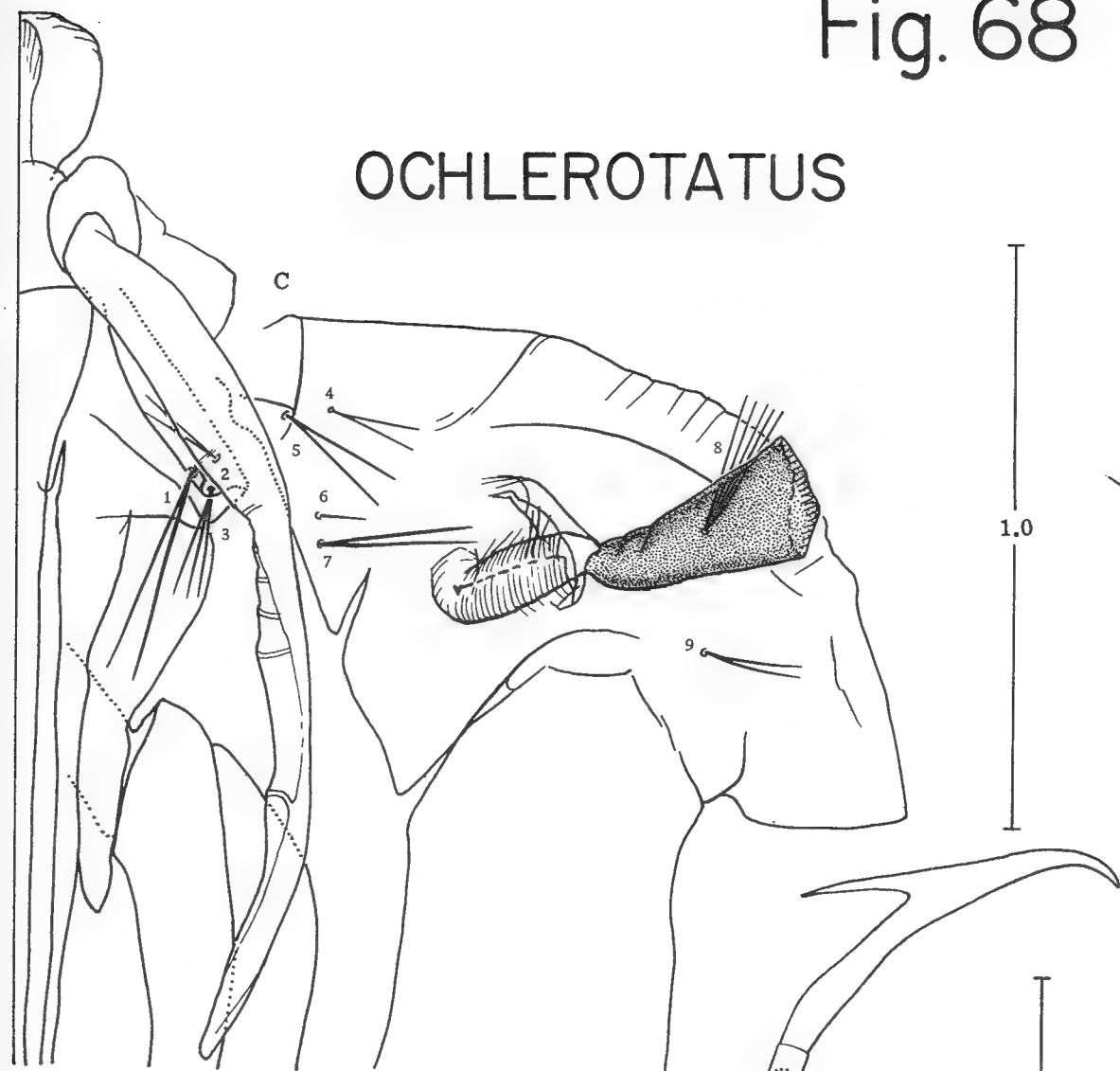


jamaicensis

JA 862

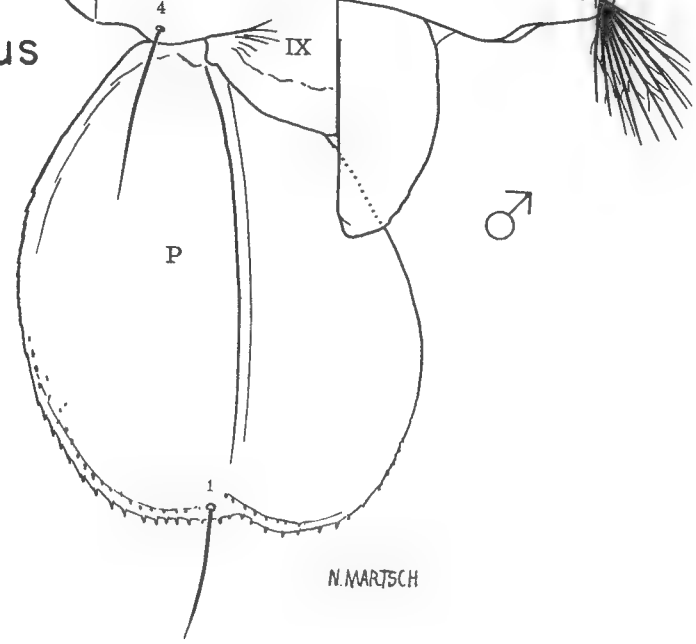
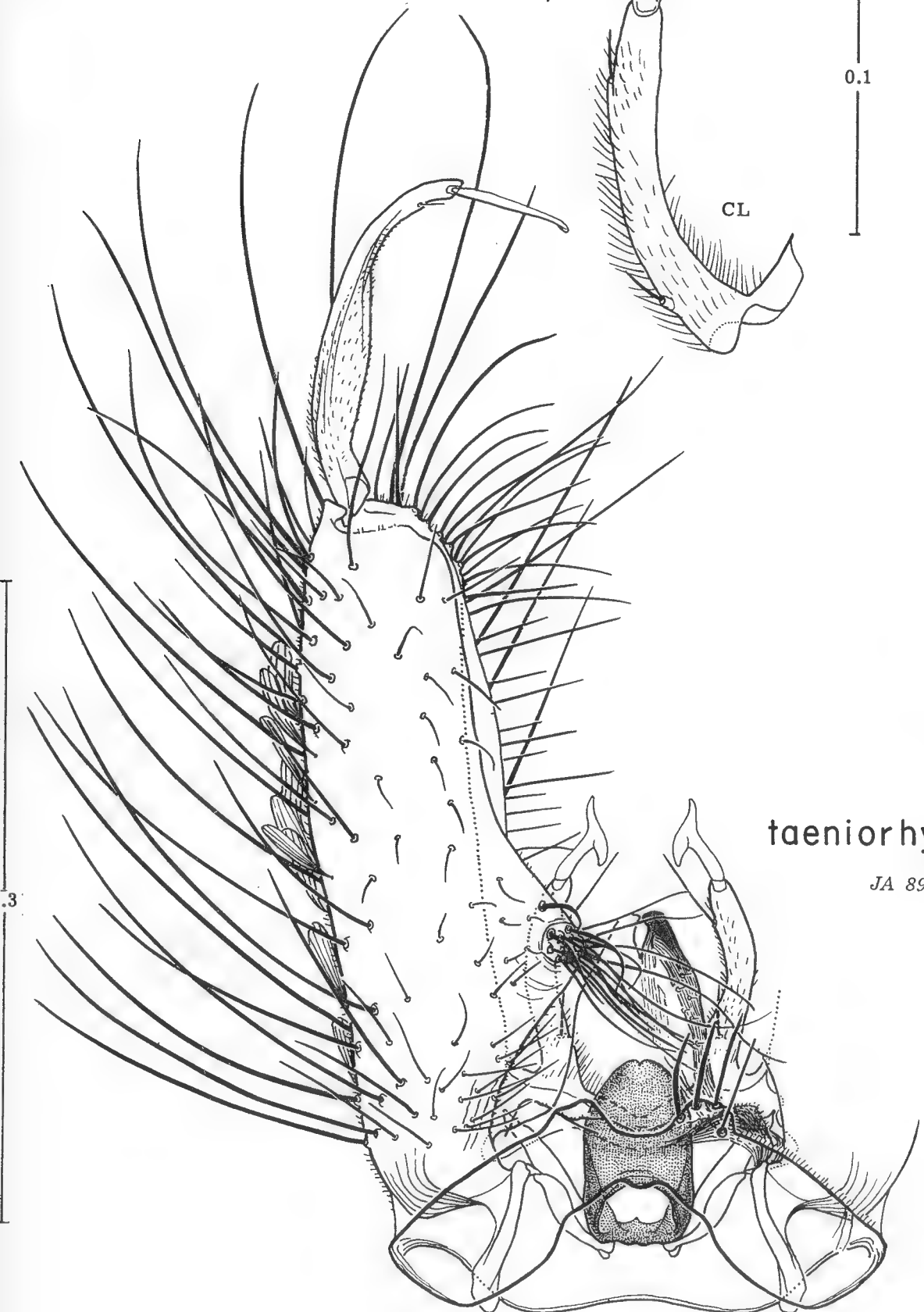
Fig. 68

OCHLEROTATUS



taeniorhynchus

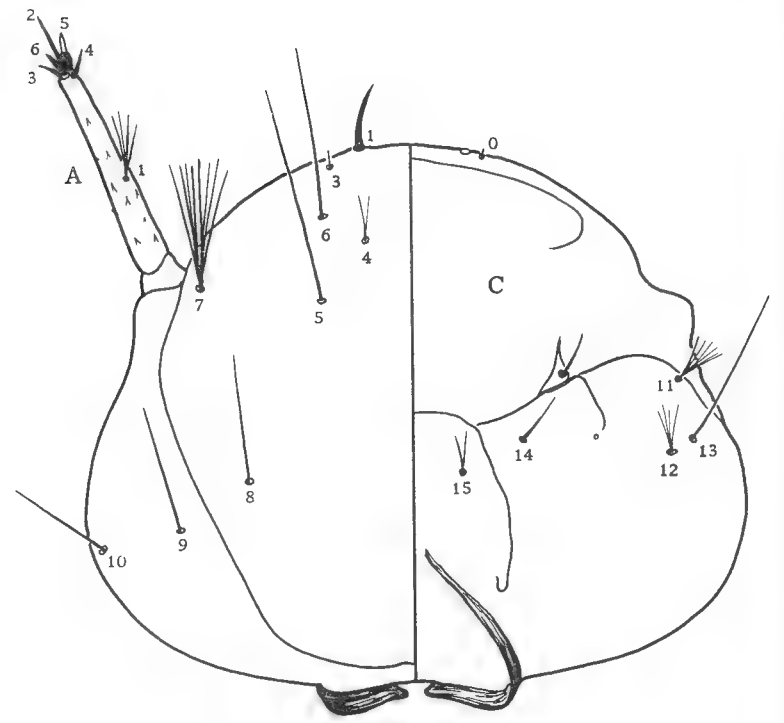
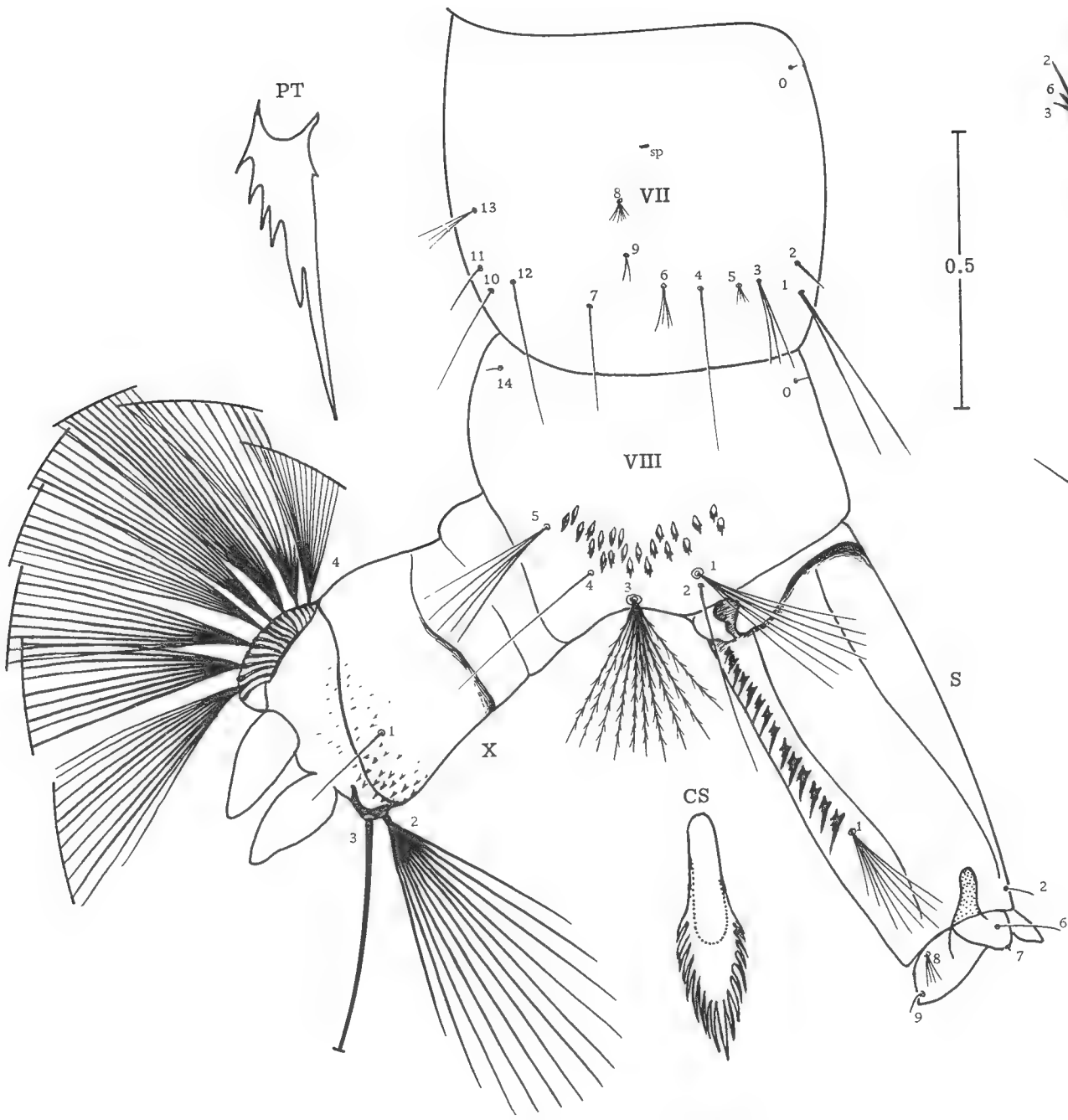
JA 896



N. MARJŠCH

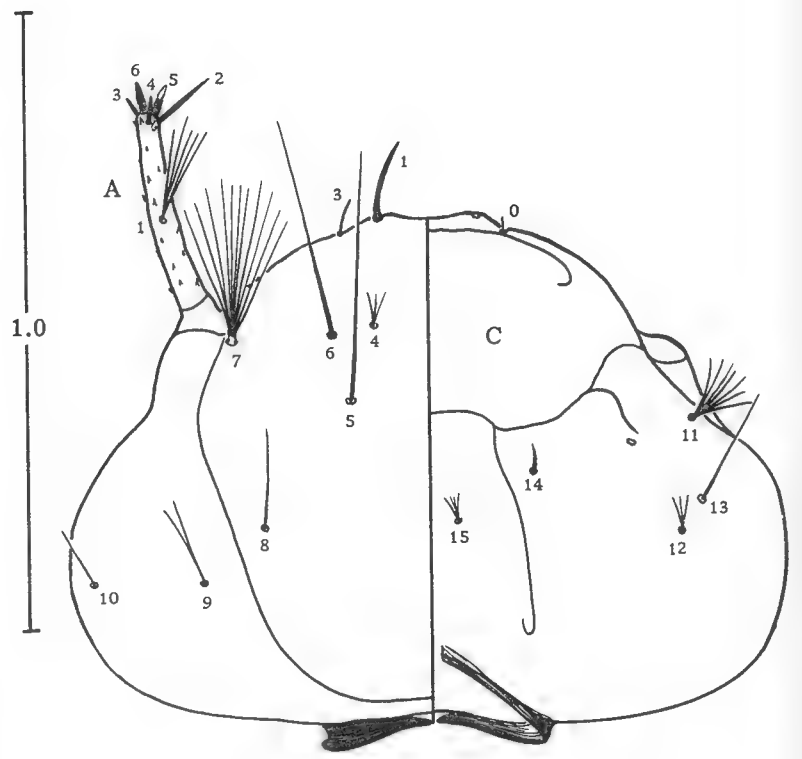
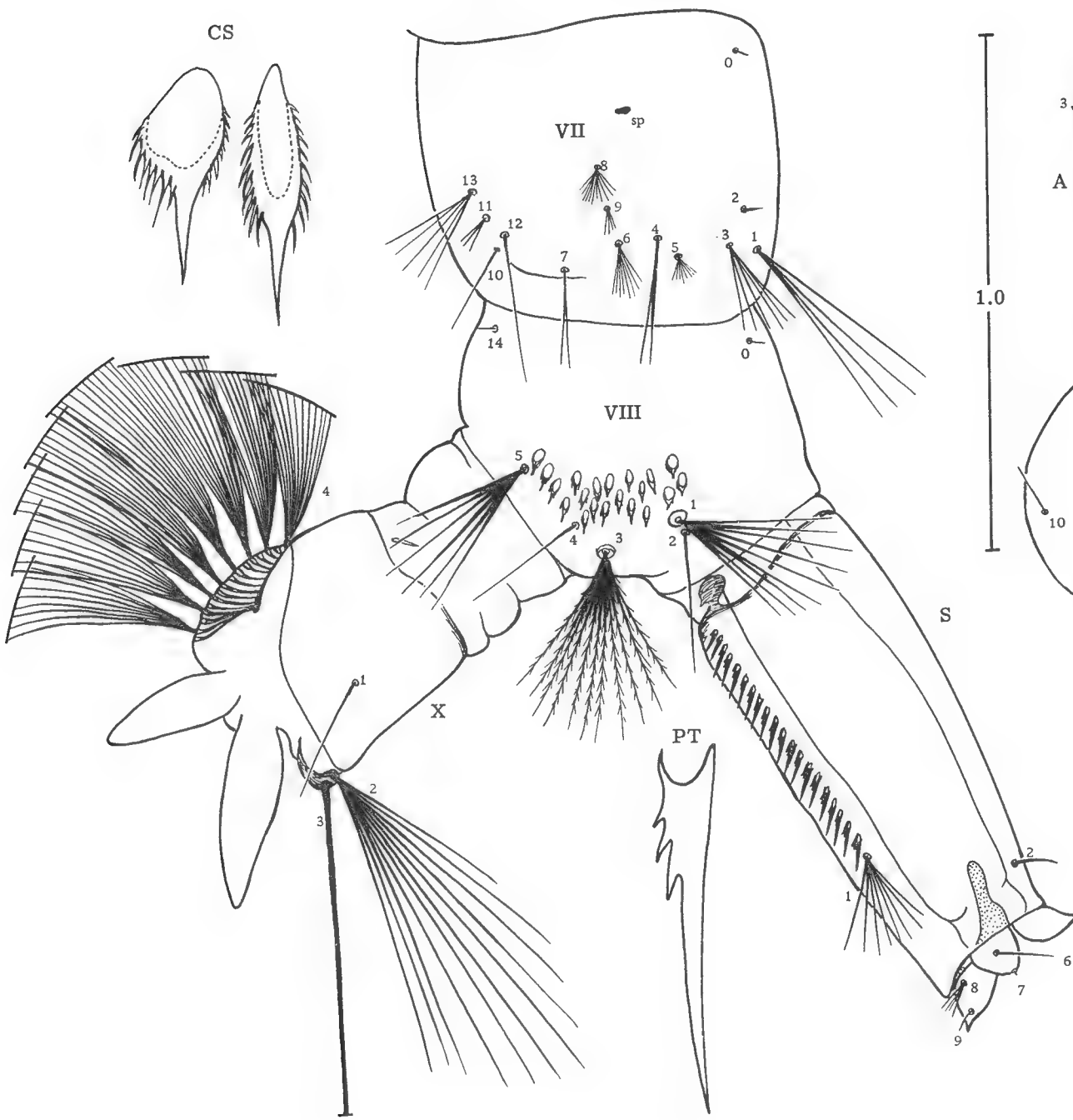
Fig. 69

OCHLEROTATUS



taeniorhynchus

JA 896

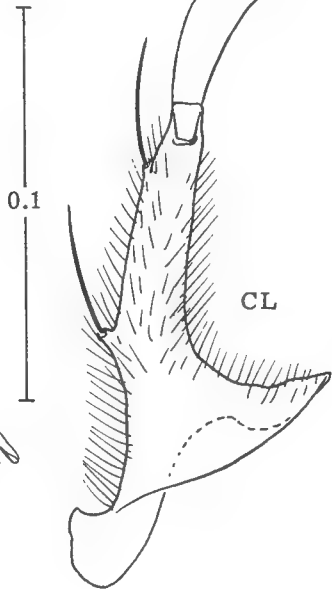
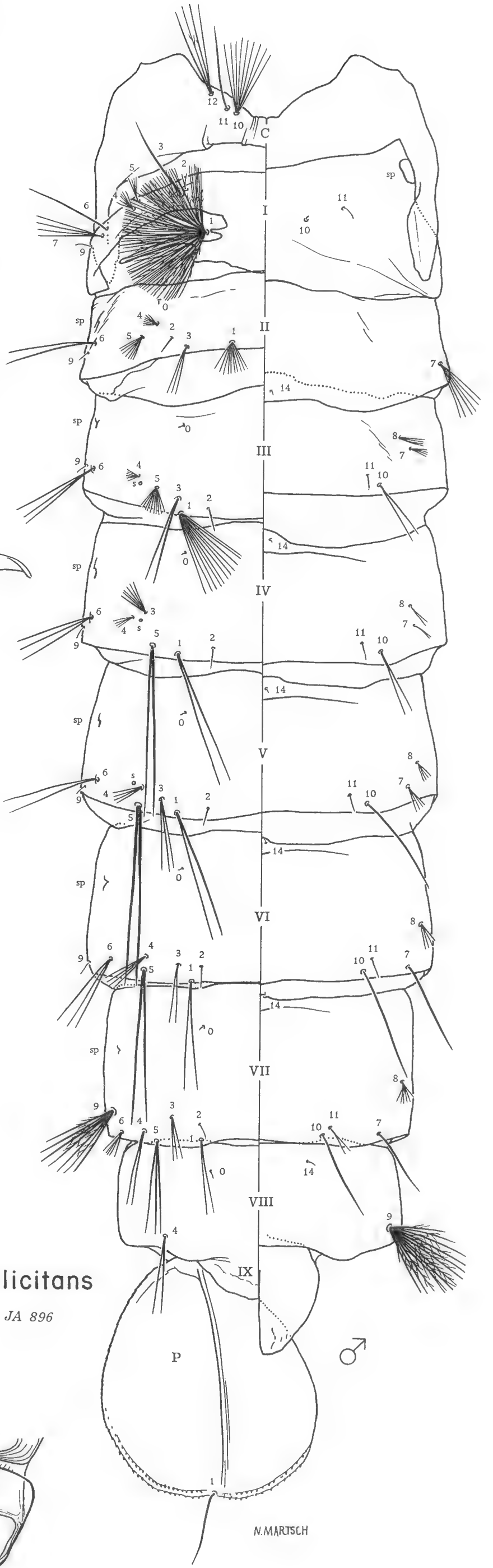
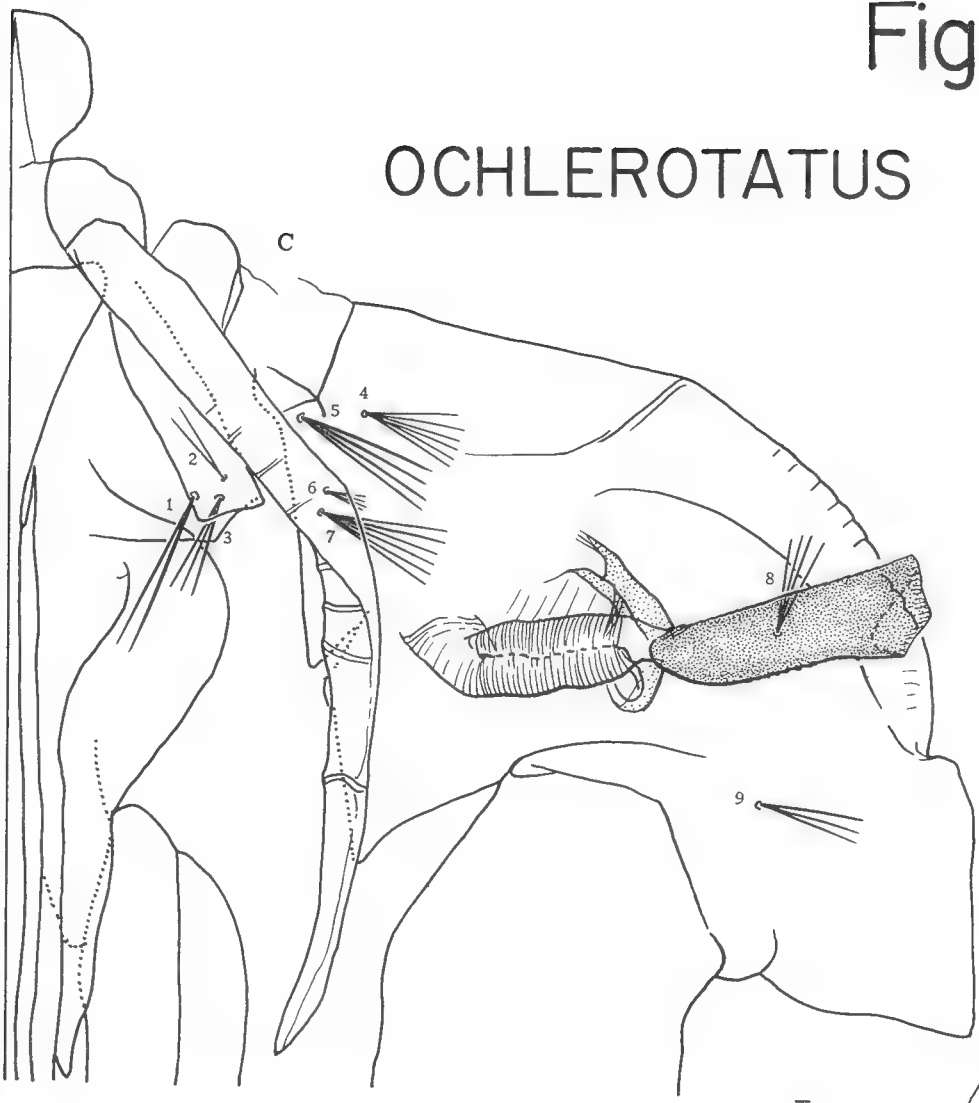


sollicitans

JA 896

Fig. 70

OCHLEROTATUS



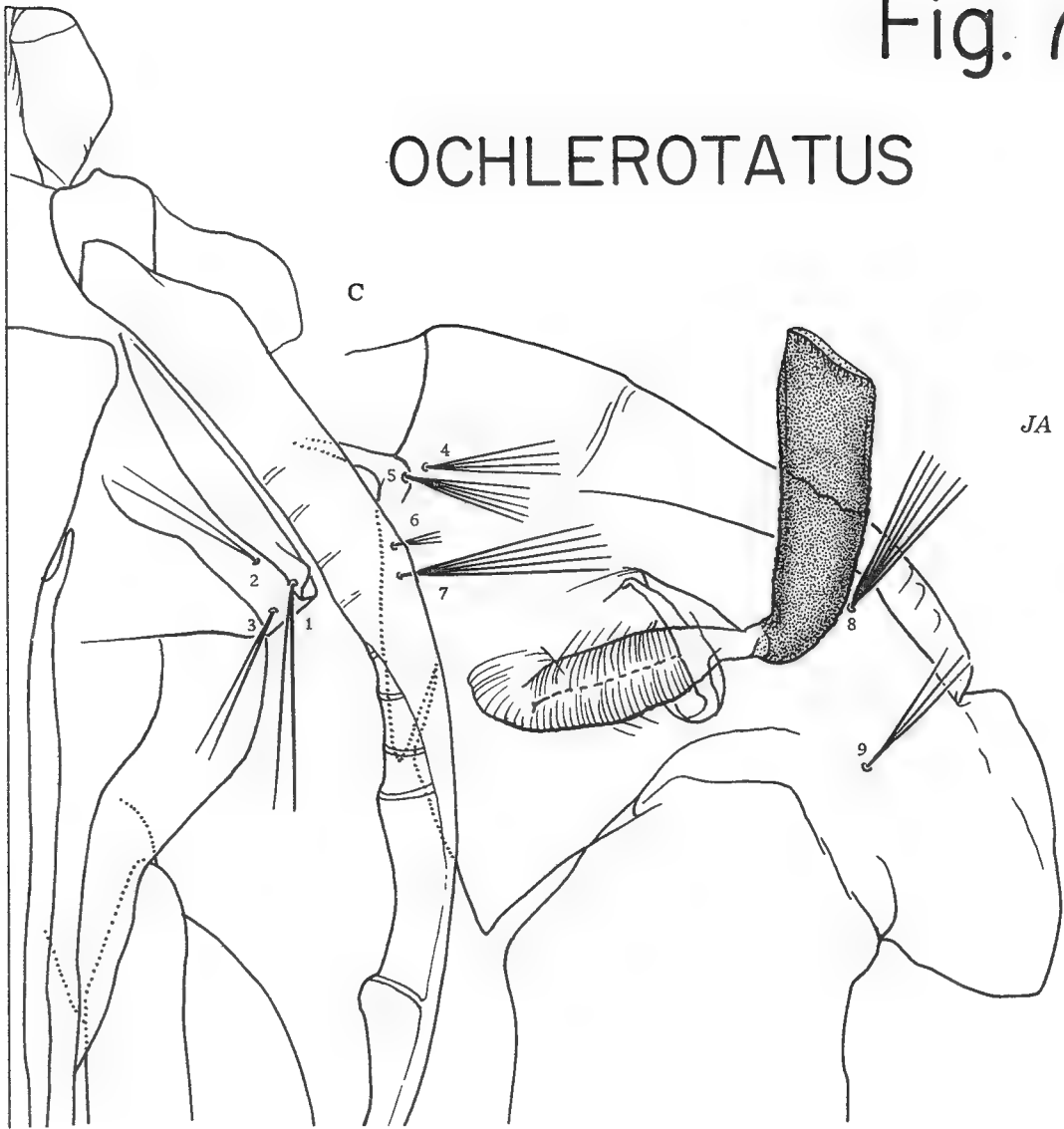
sollicitans

JA 896

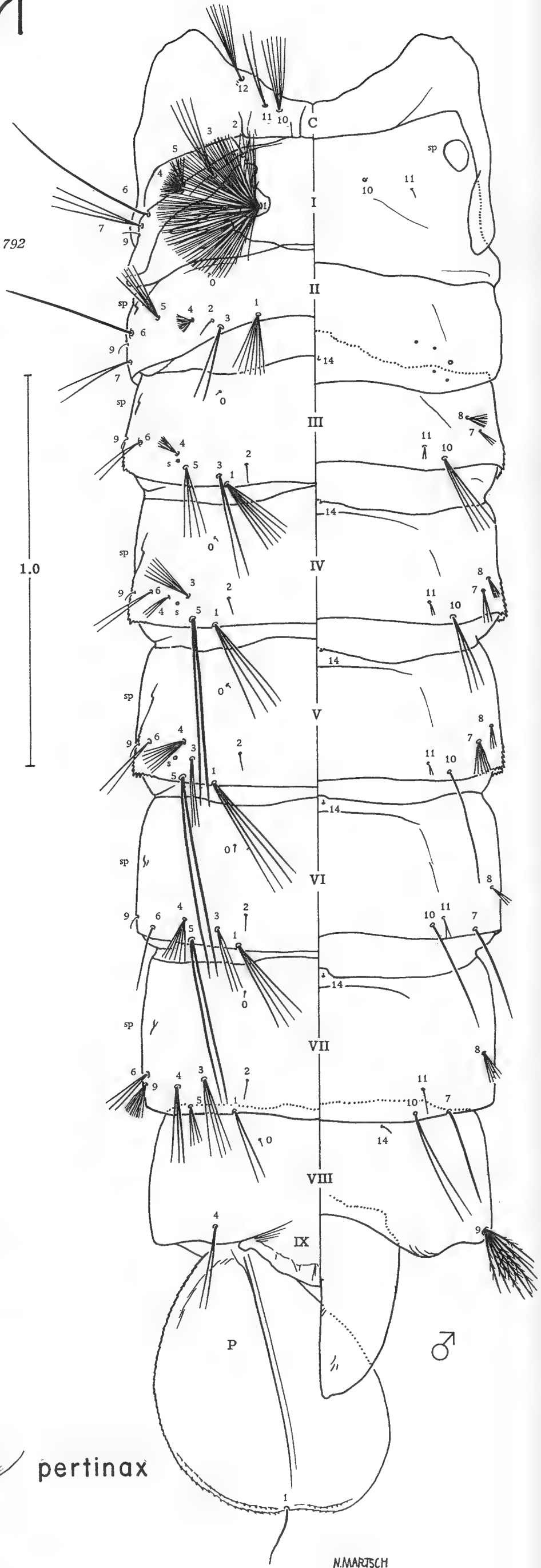
N. MARTSCH

Fig. 71

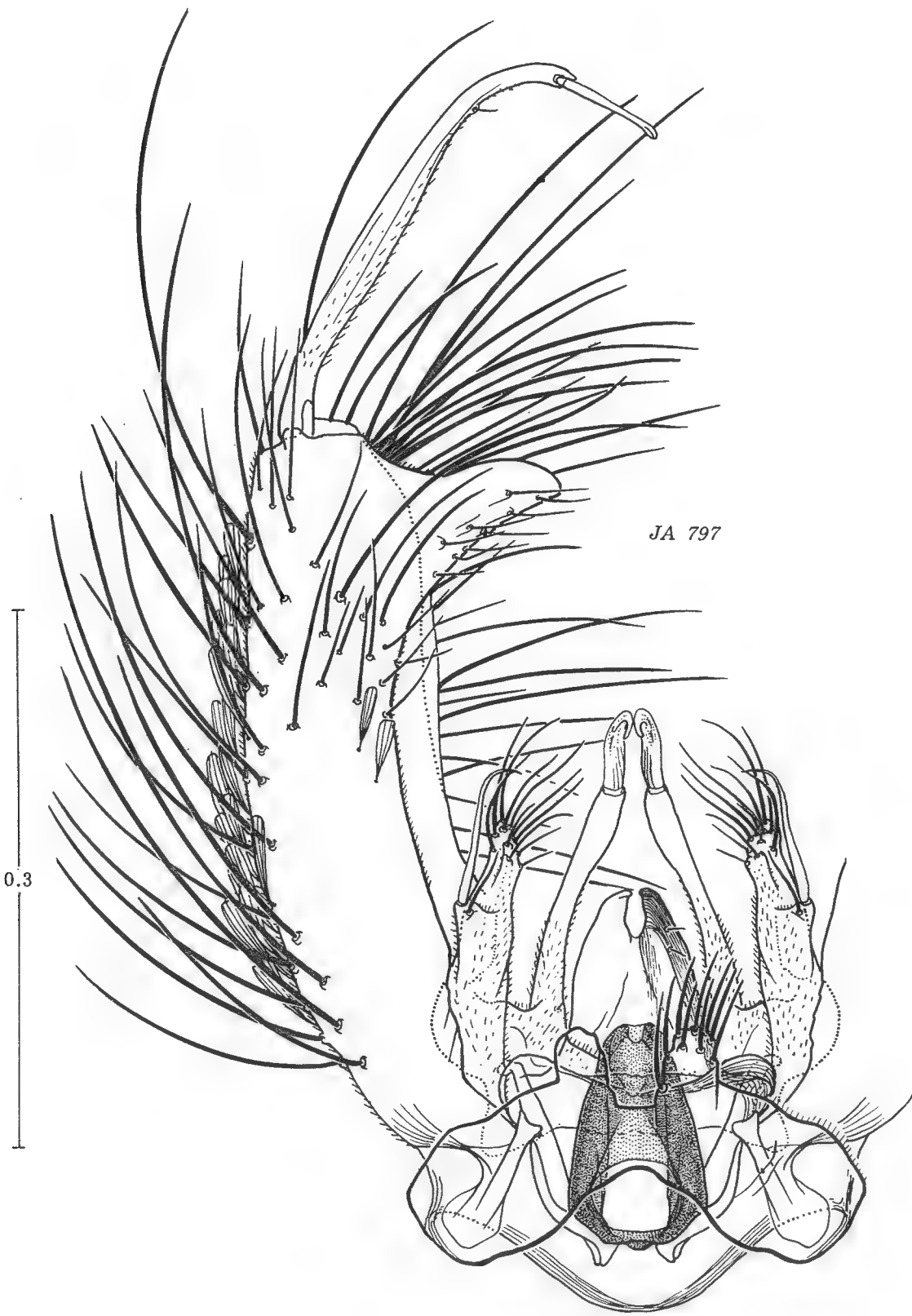
OCHLEROTATUS



JA 792



JA 797

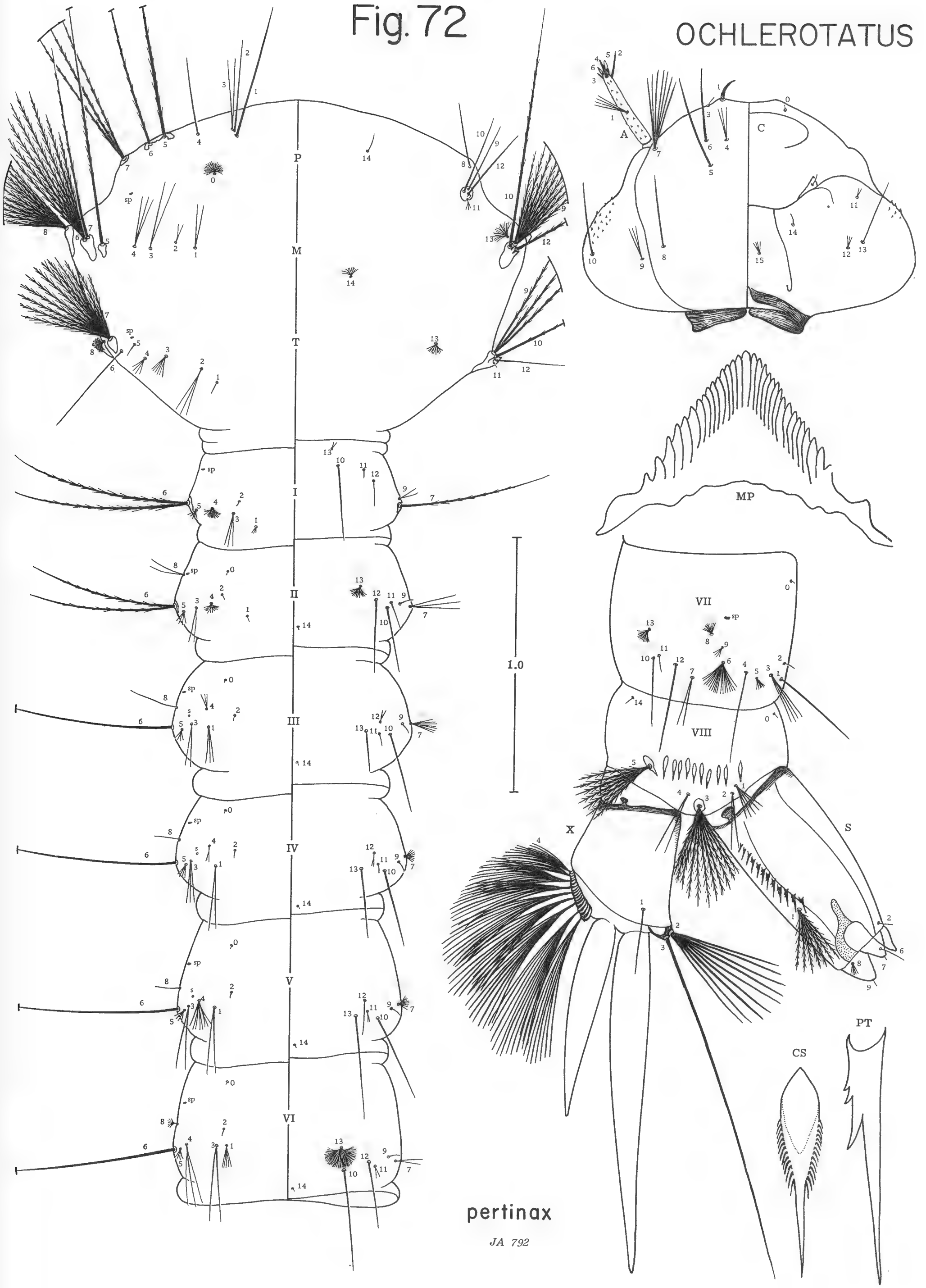


pertinax

N. MARTSCH

Fig. 72

OCHLEROTATUS

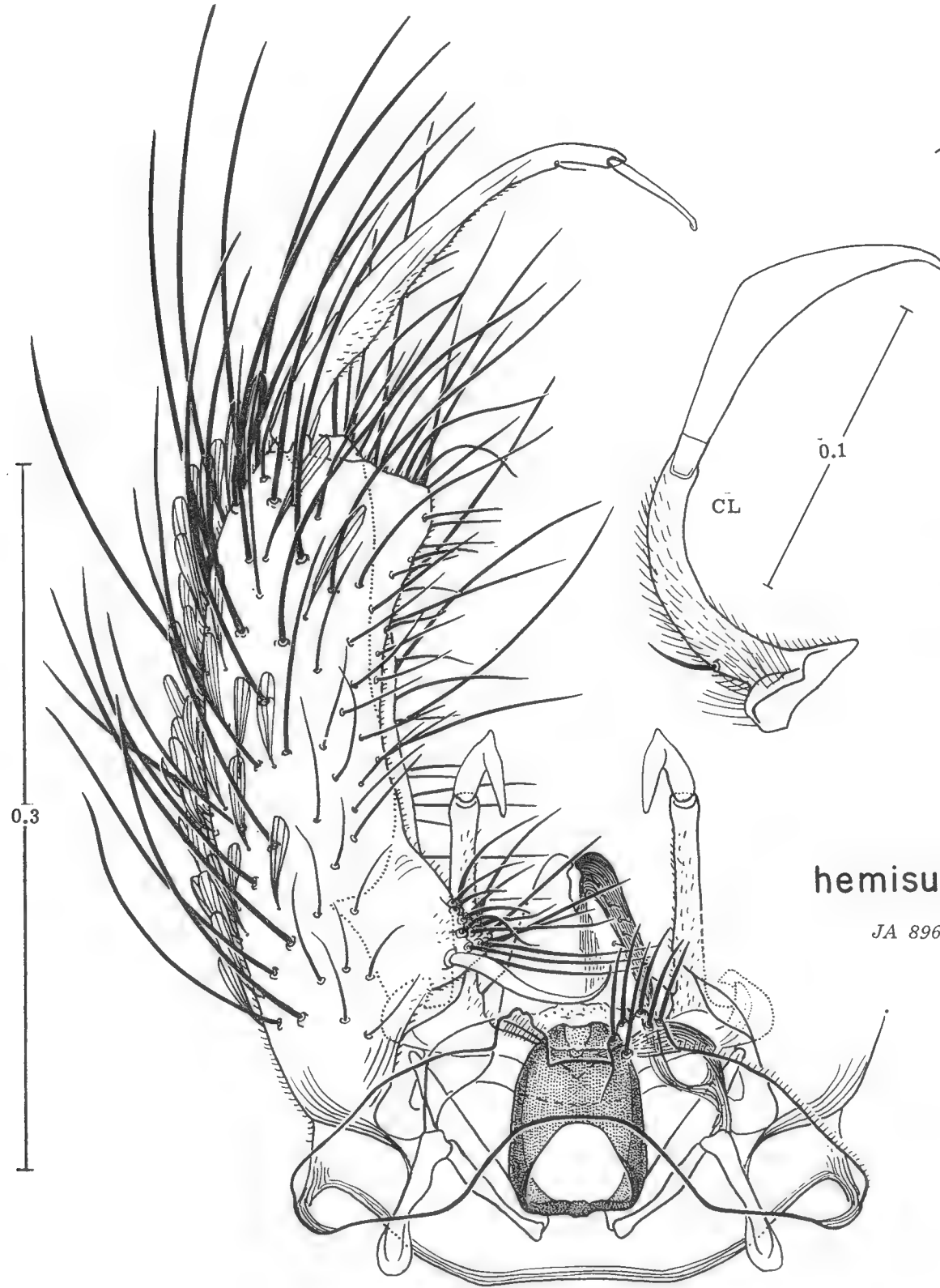
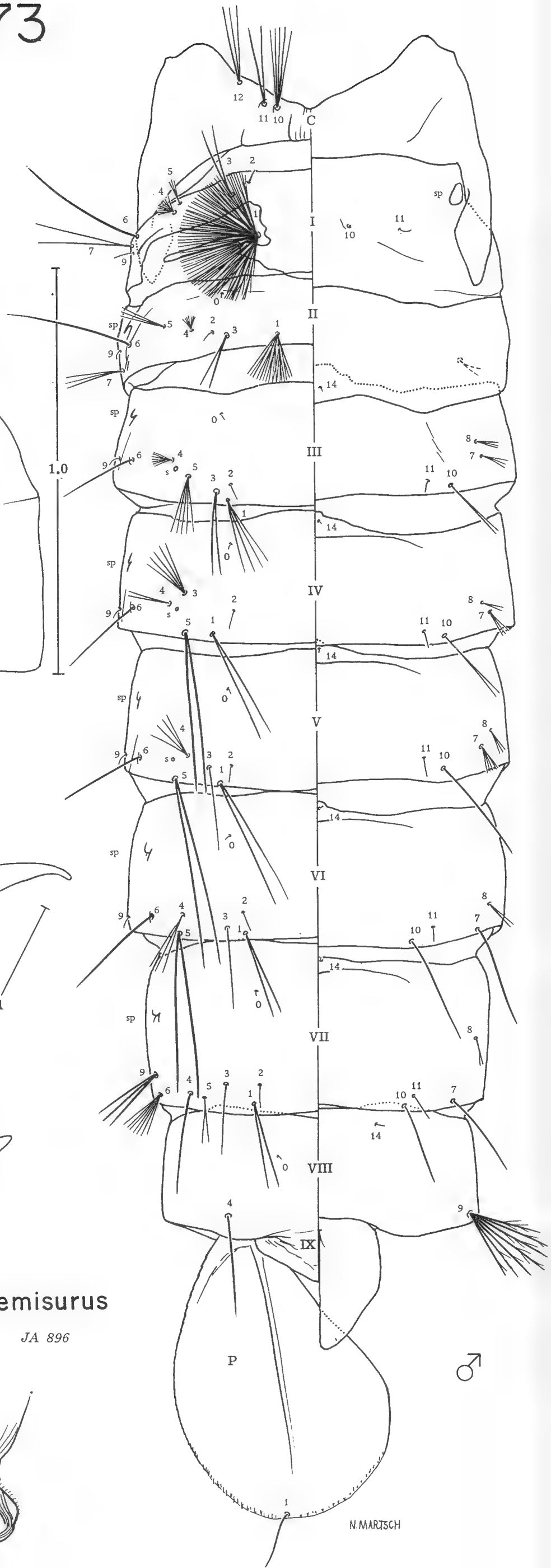
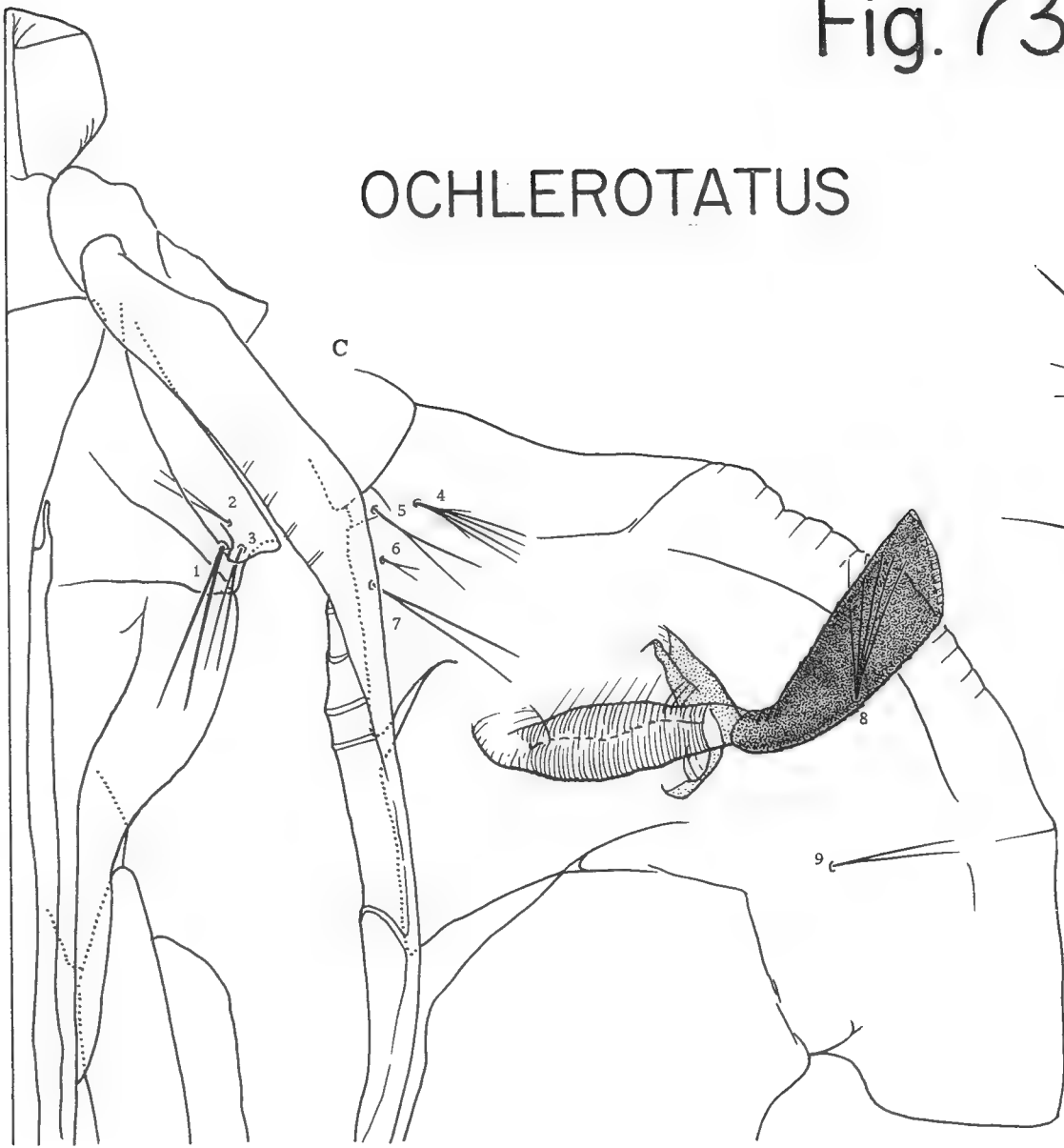


pertinax

JA 792

Fig. 73

OCHLEROTATUS



hemisurus

JA 896

N. MARTSCH

Fig. 74

OCHLEROTATUS

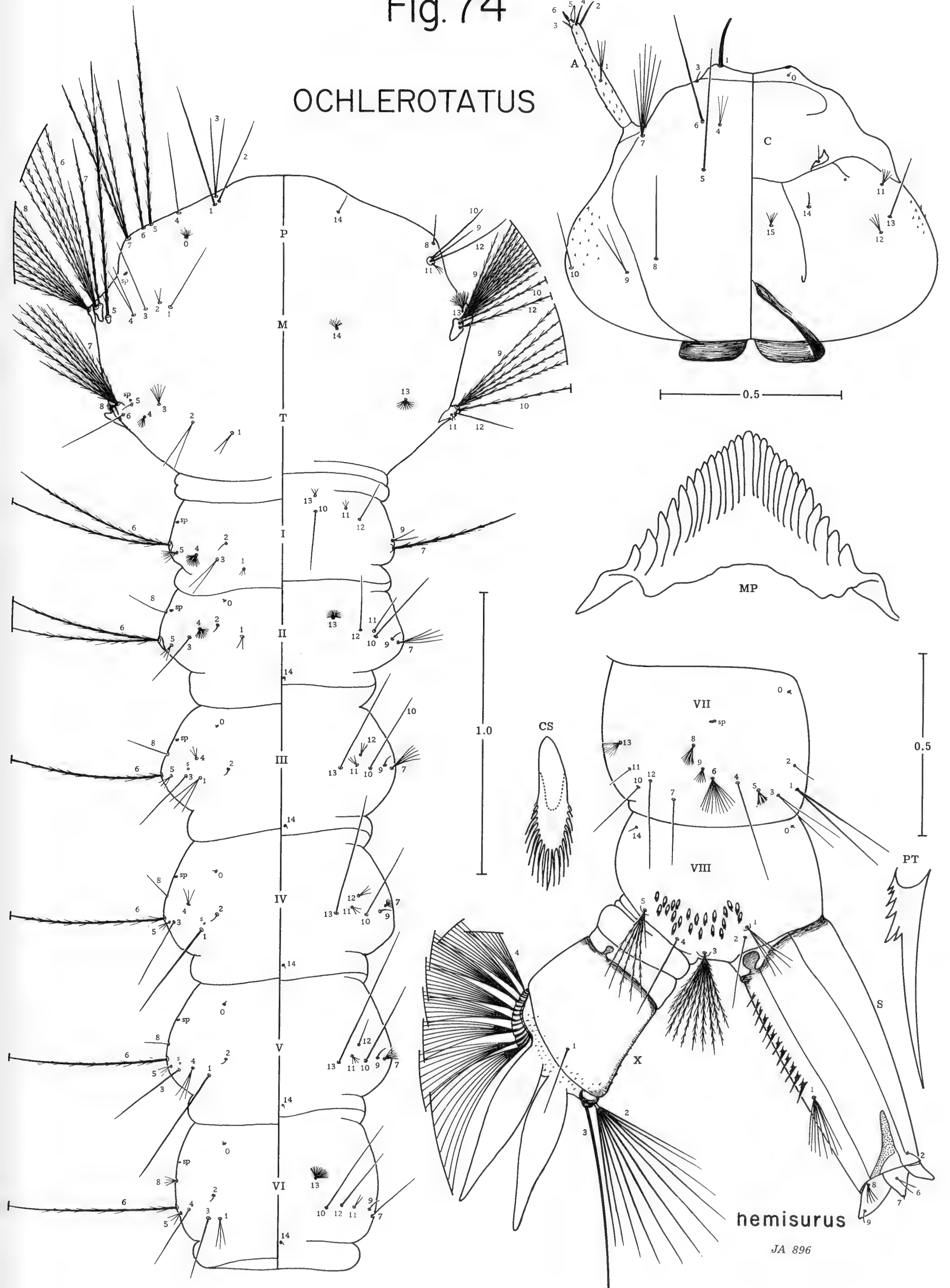
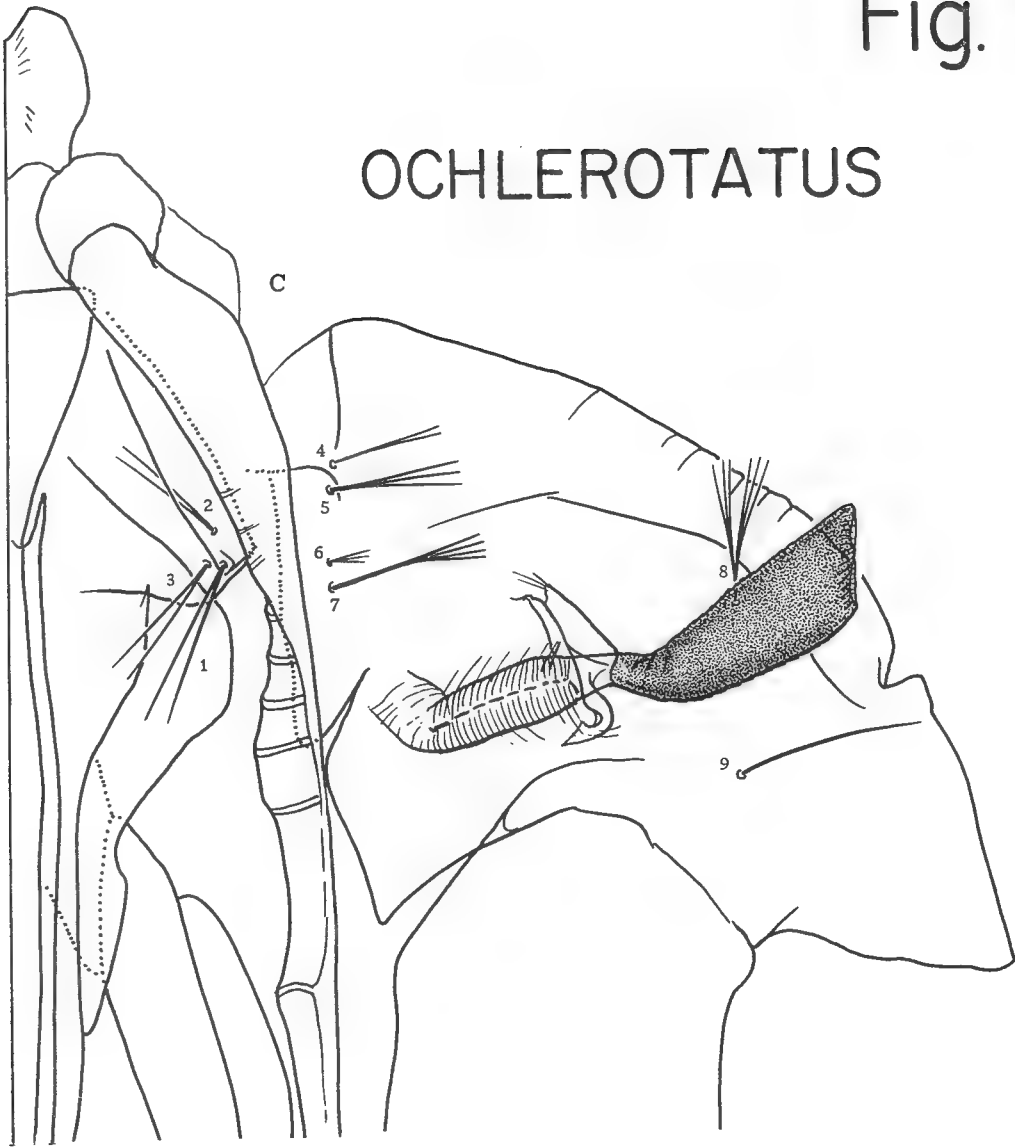
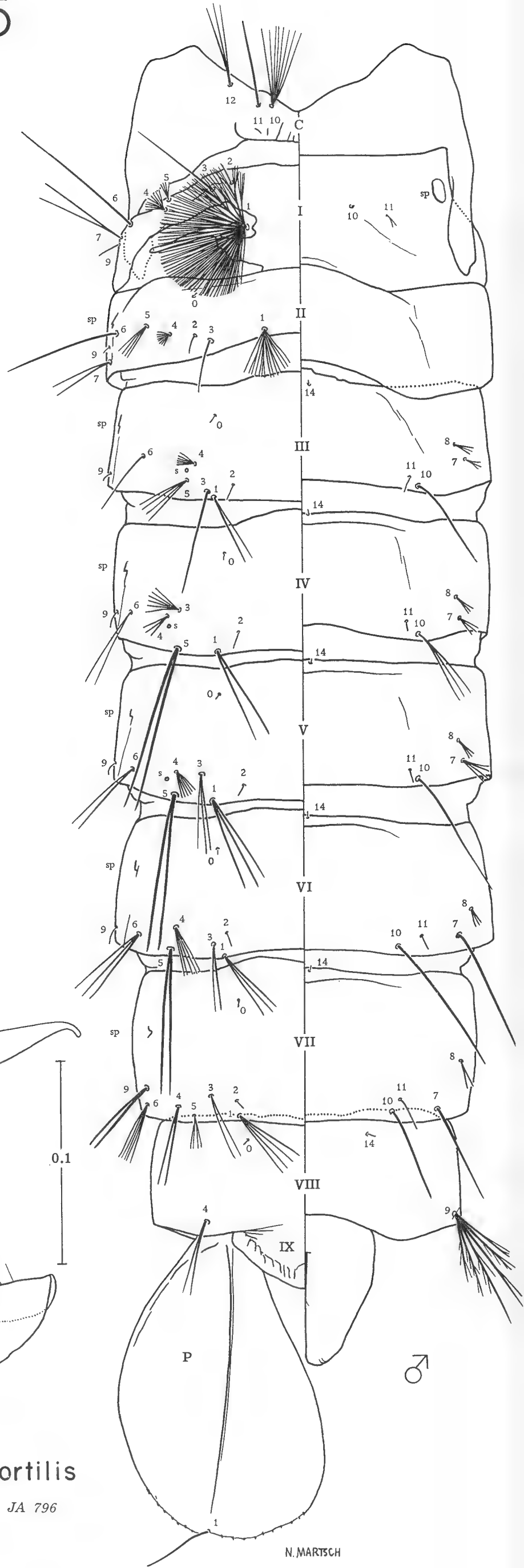


Fig. 75

OCHLEROTATUS



1.0



tortilis

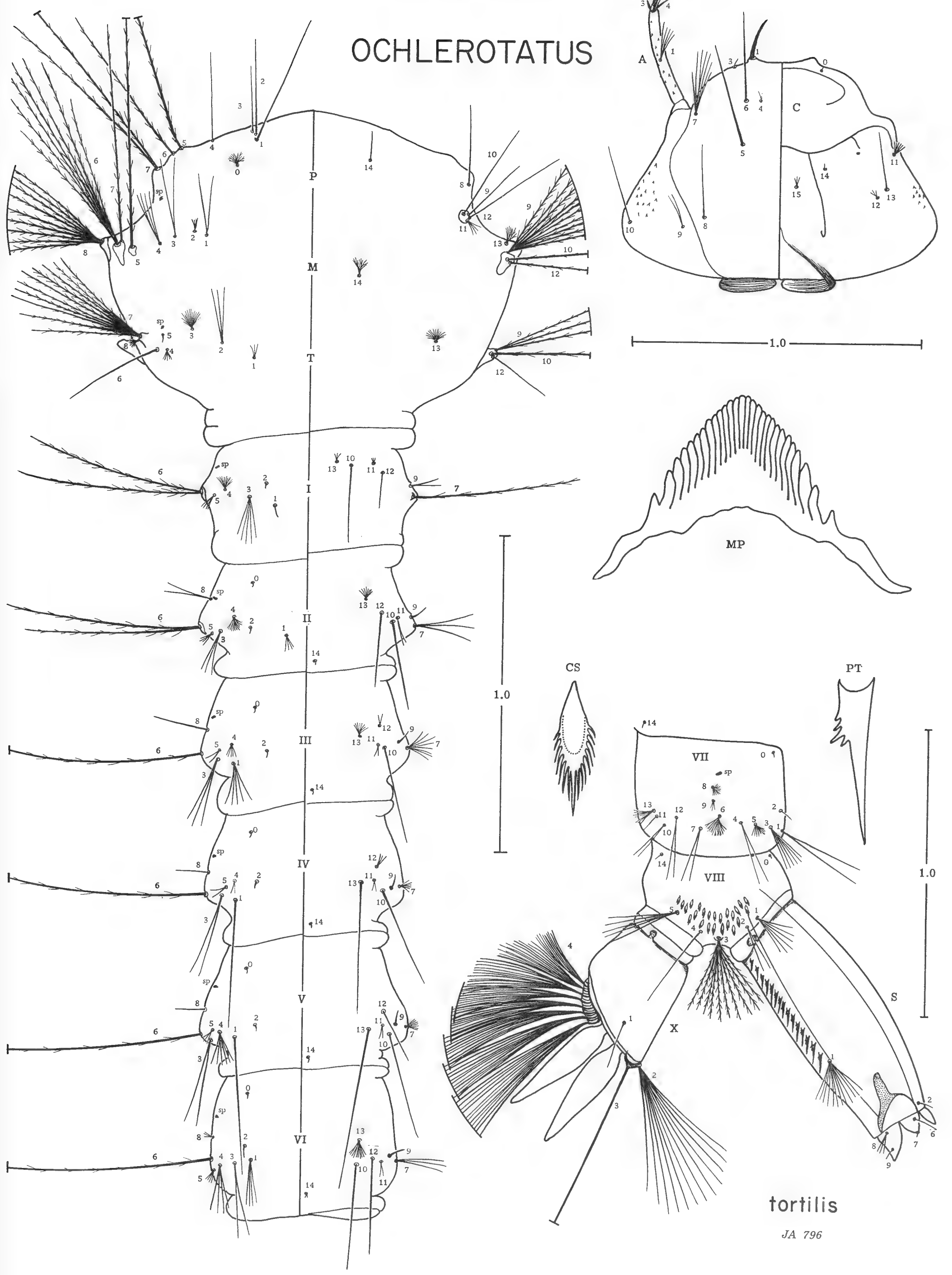
JA 796

N. MARTSCH



Fig. 76

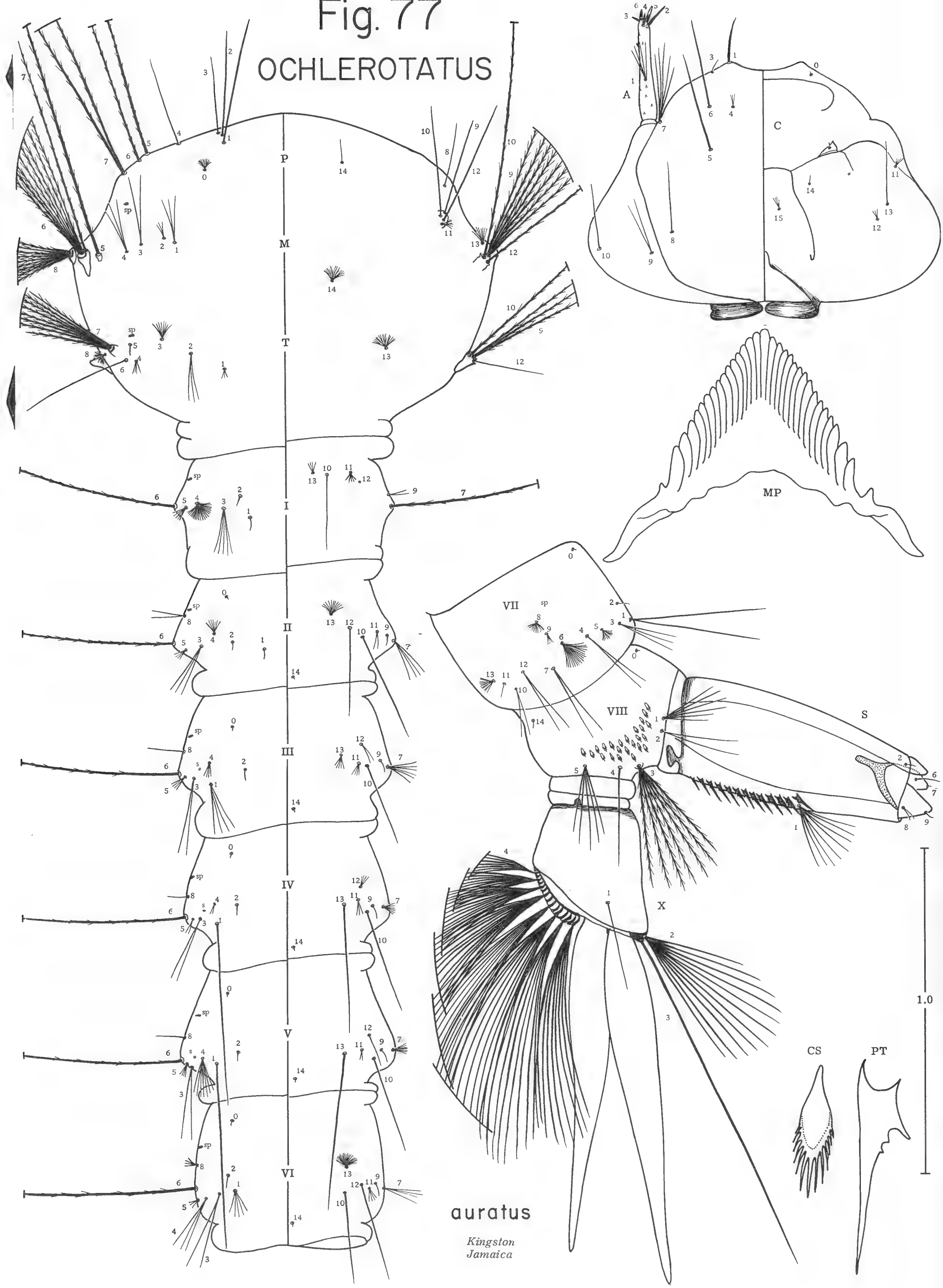
OCHLEROTATUS



tortilis

JA 796

Fig. 77
 OCHLEROTATUS



auratus
 Kingston
 Jamaica

Fig. 78

OCHLEROTATUS

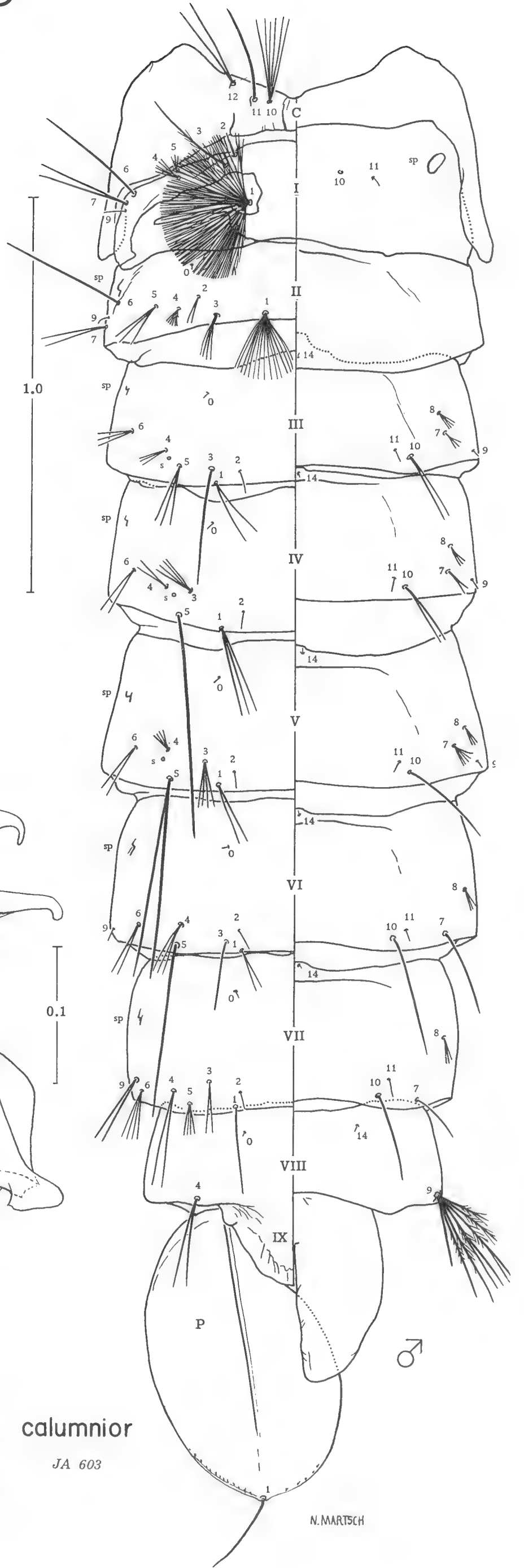
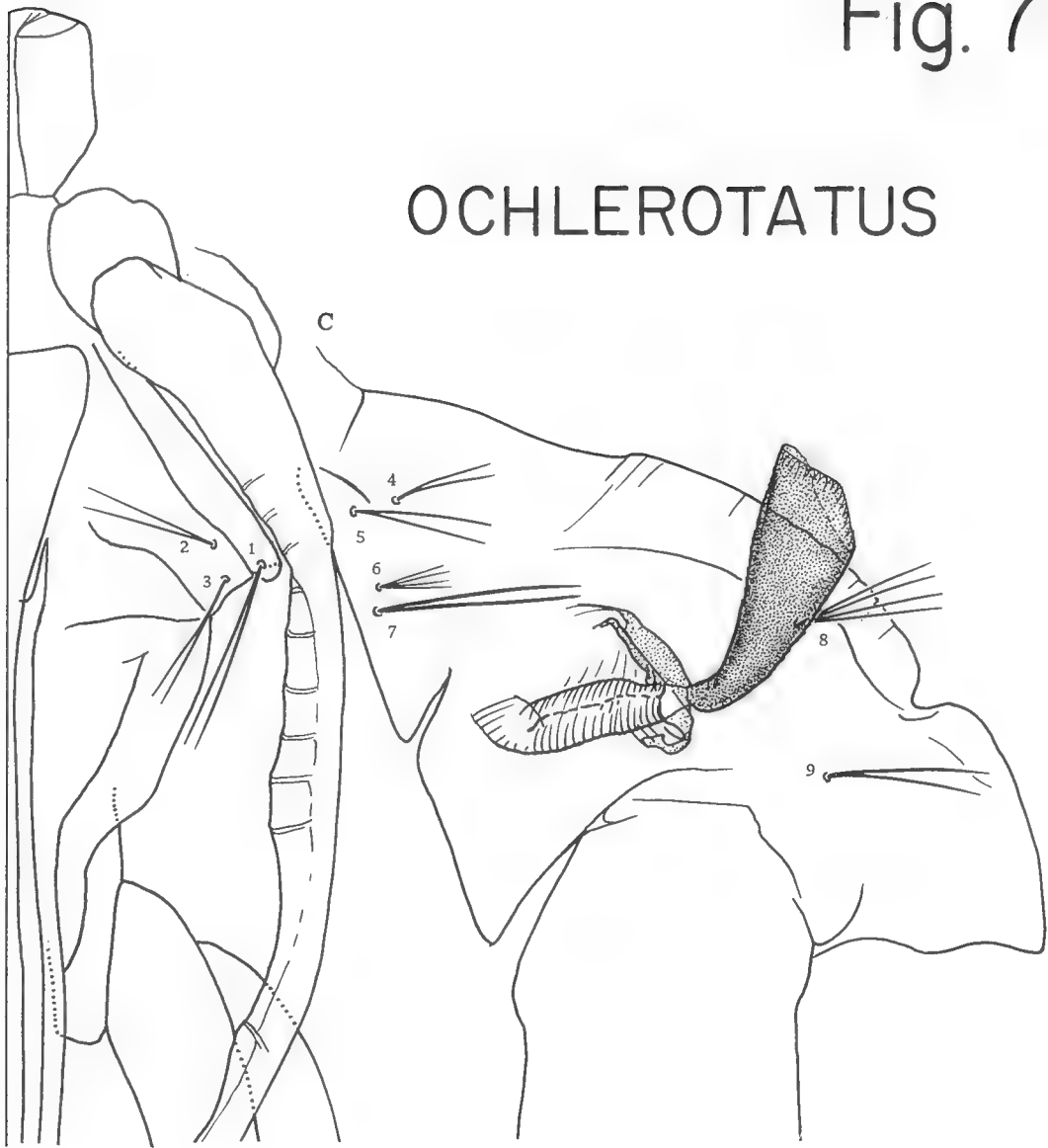


Fig. 79

OCHLEROTATUS

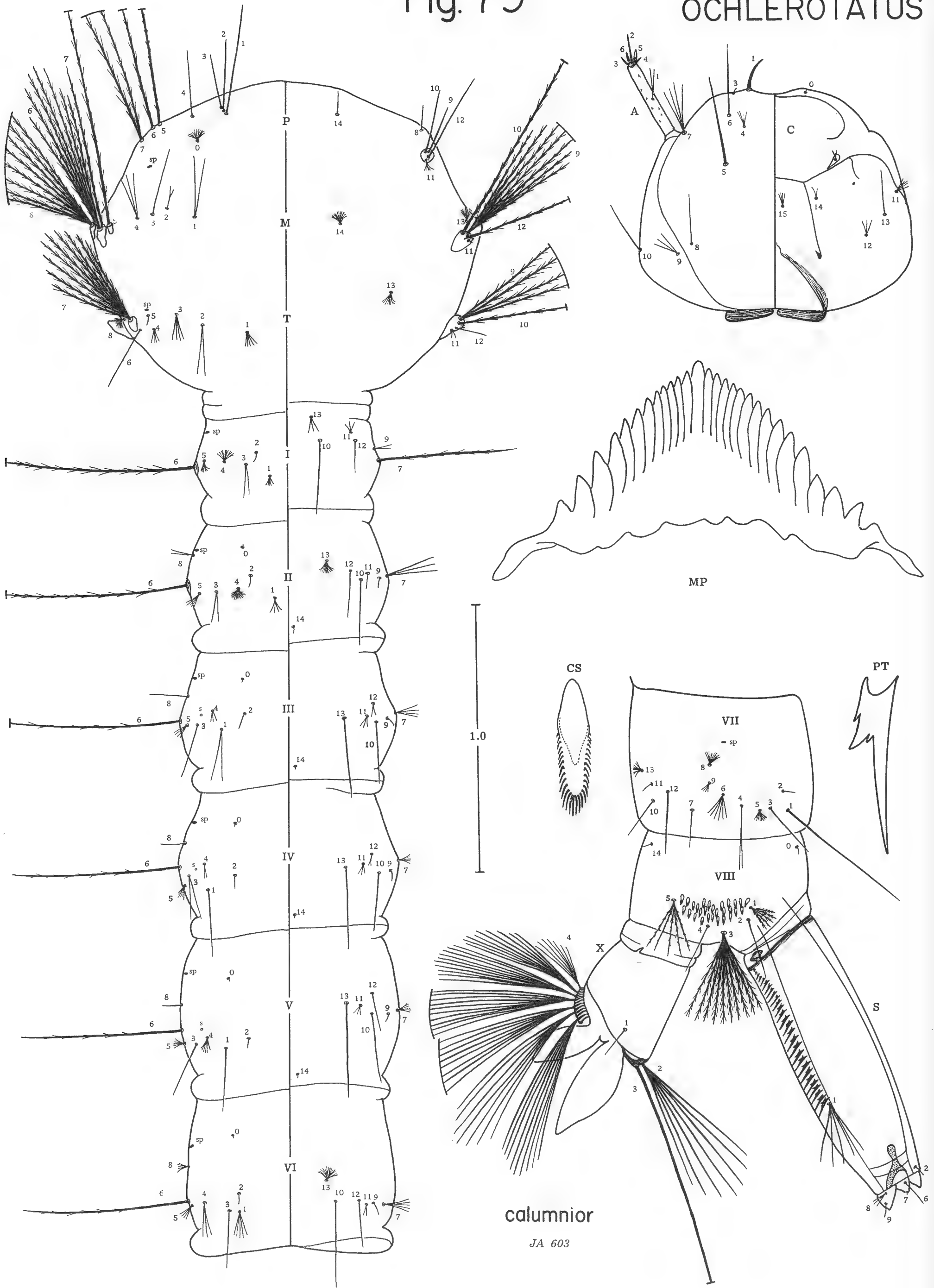
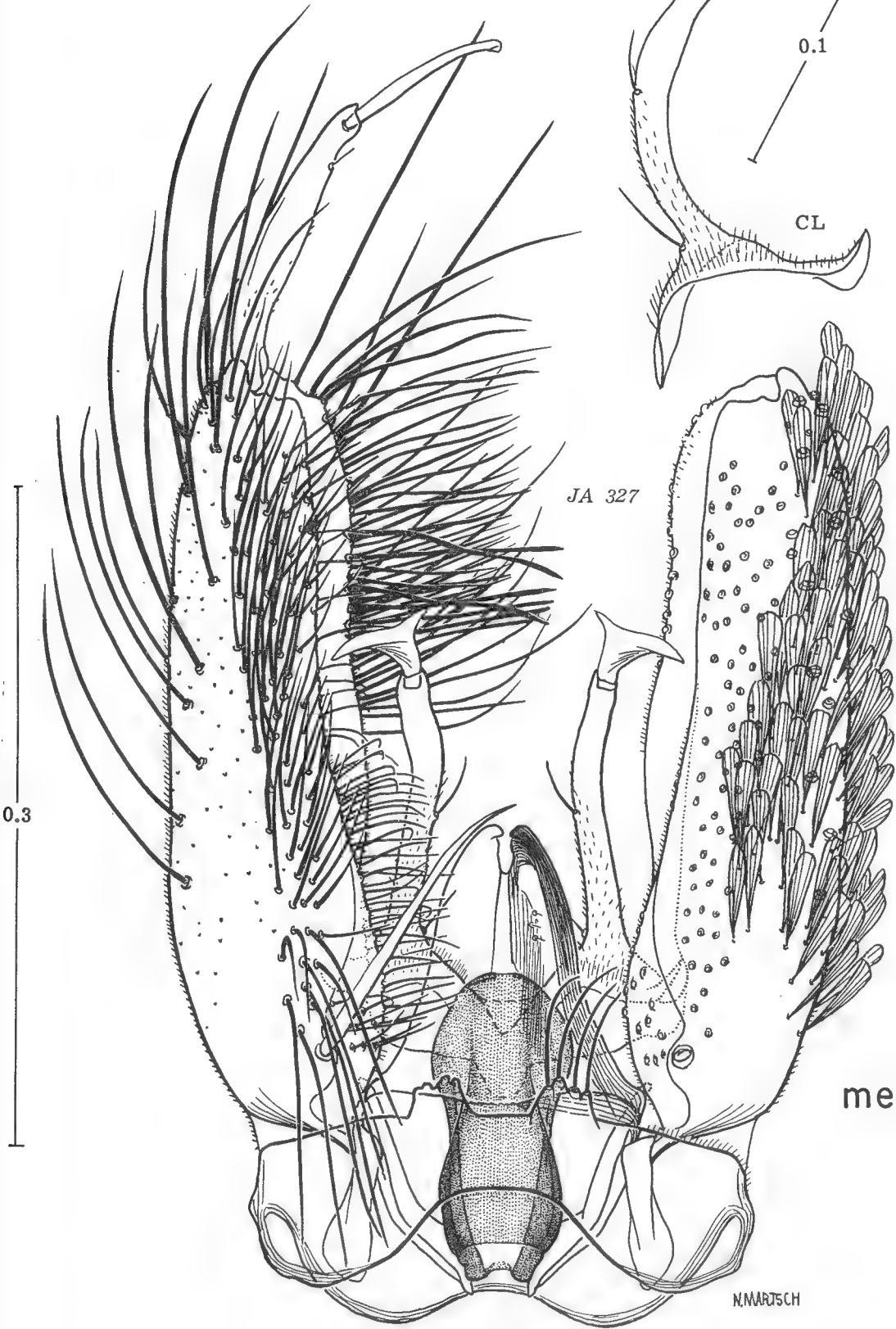
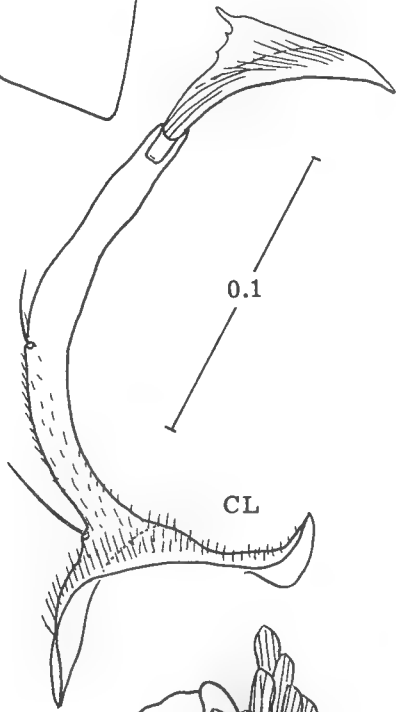
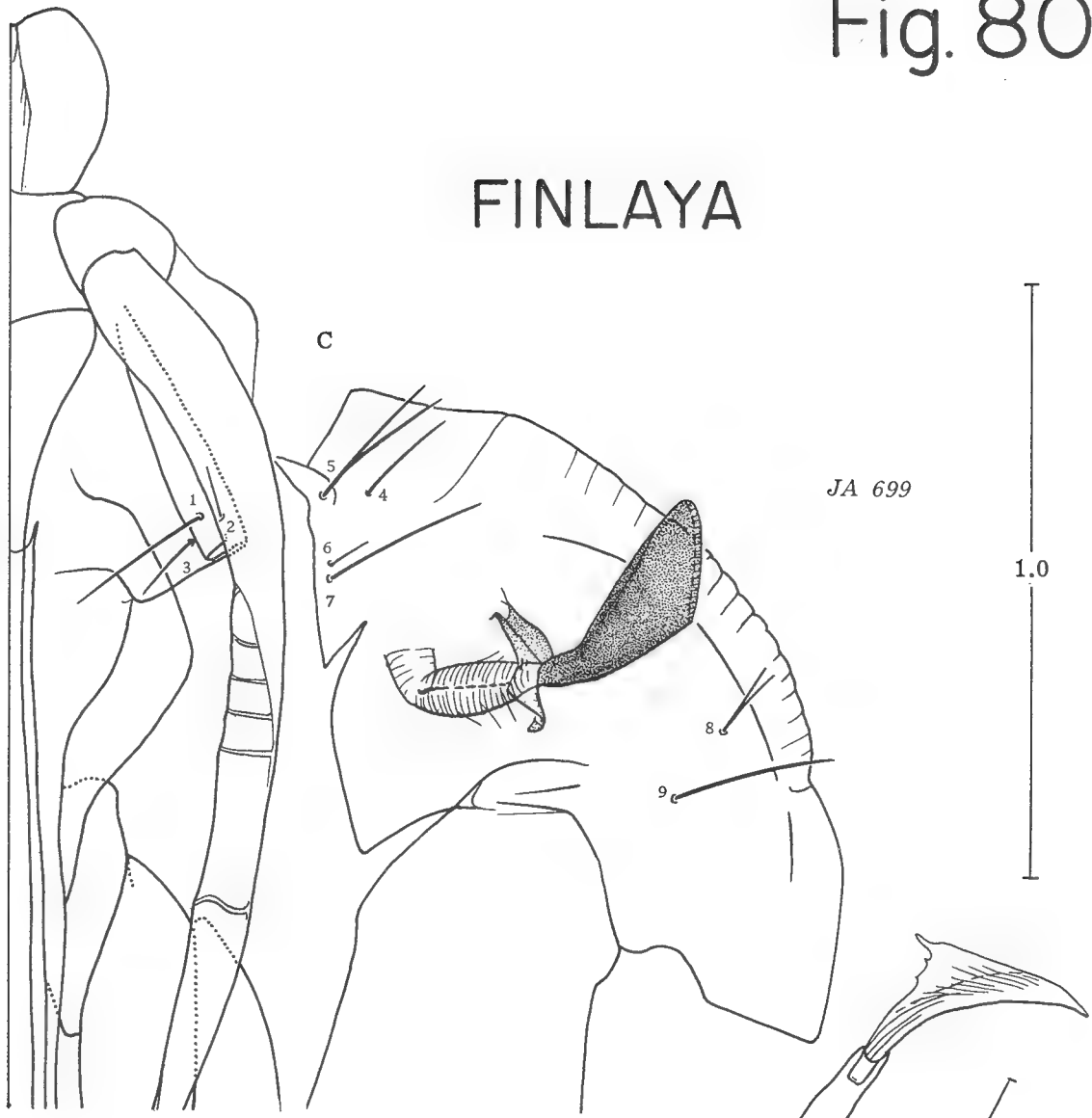


Fig. 80

FINLAYA



mediovittatus

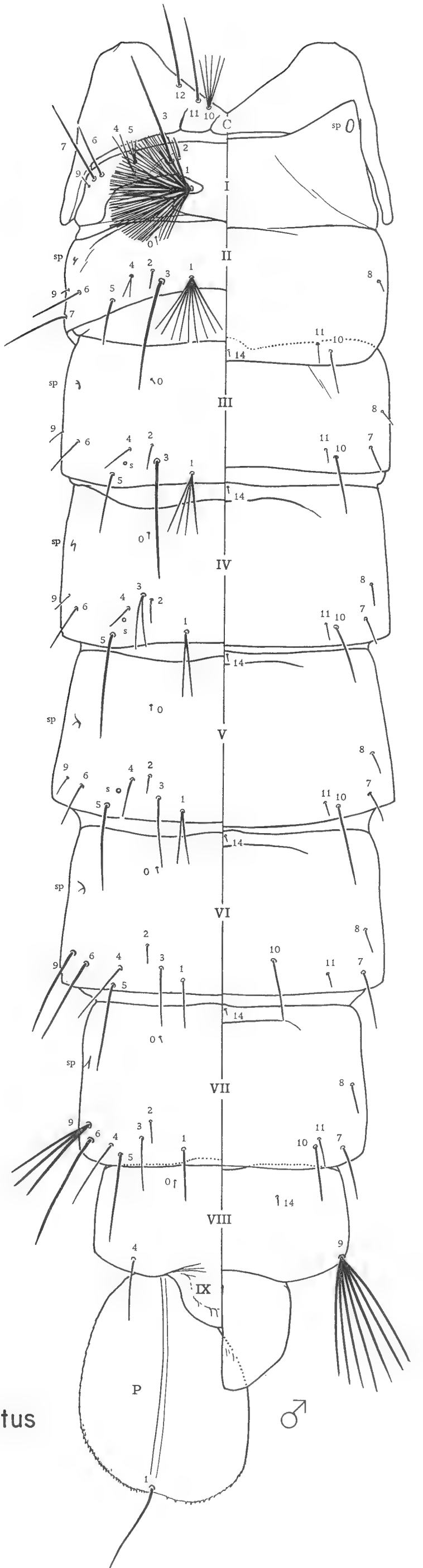
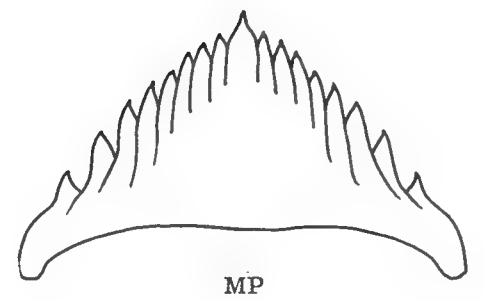
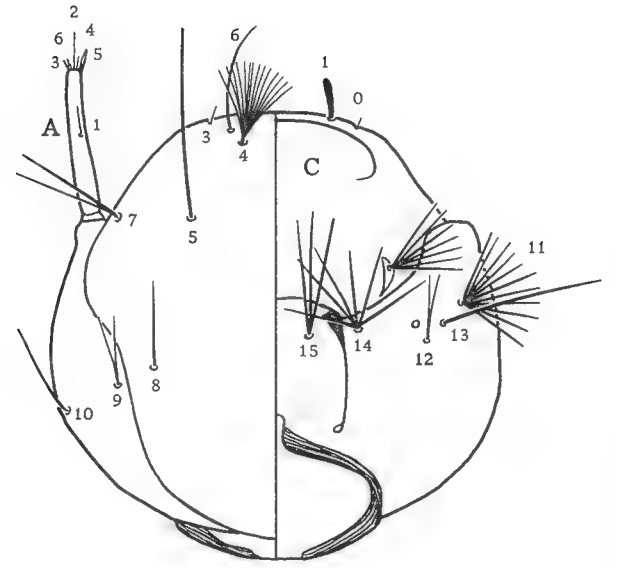
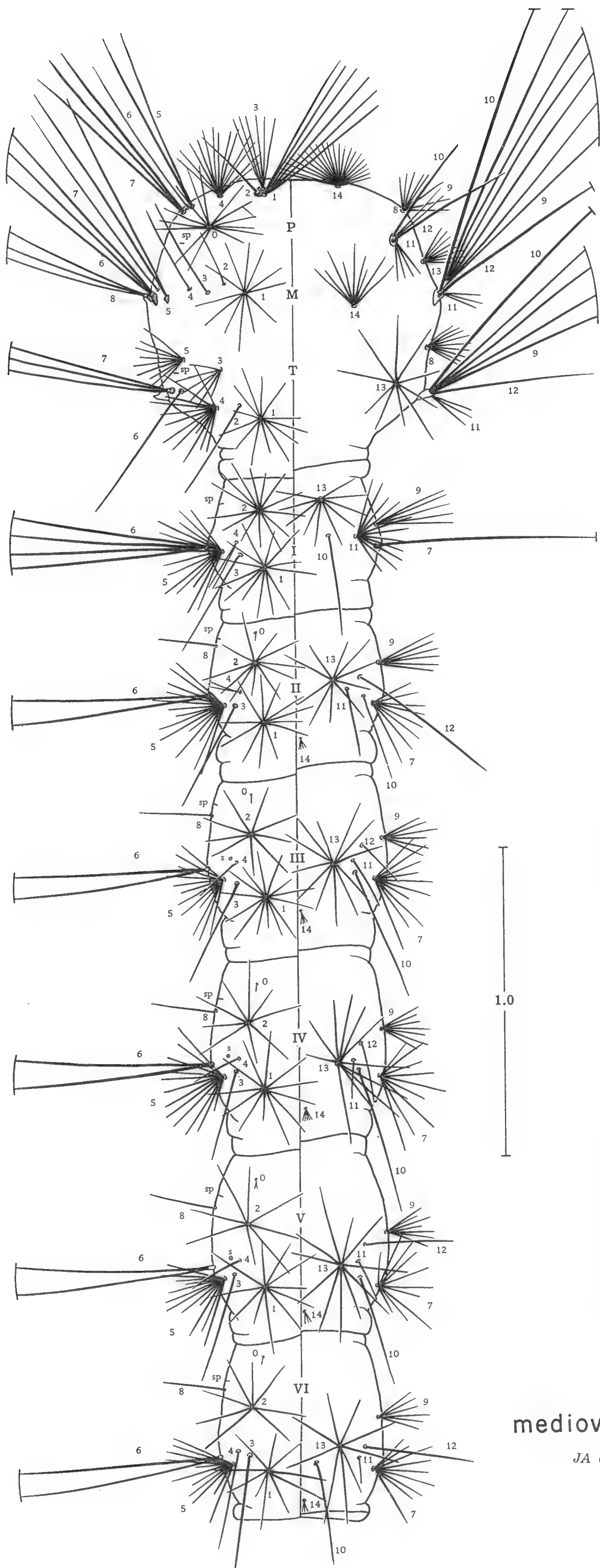
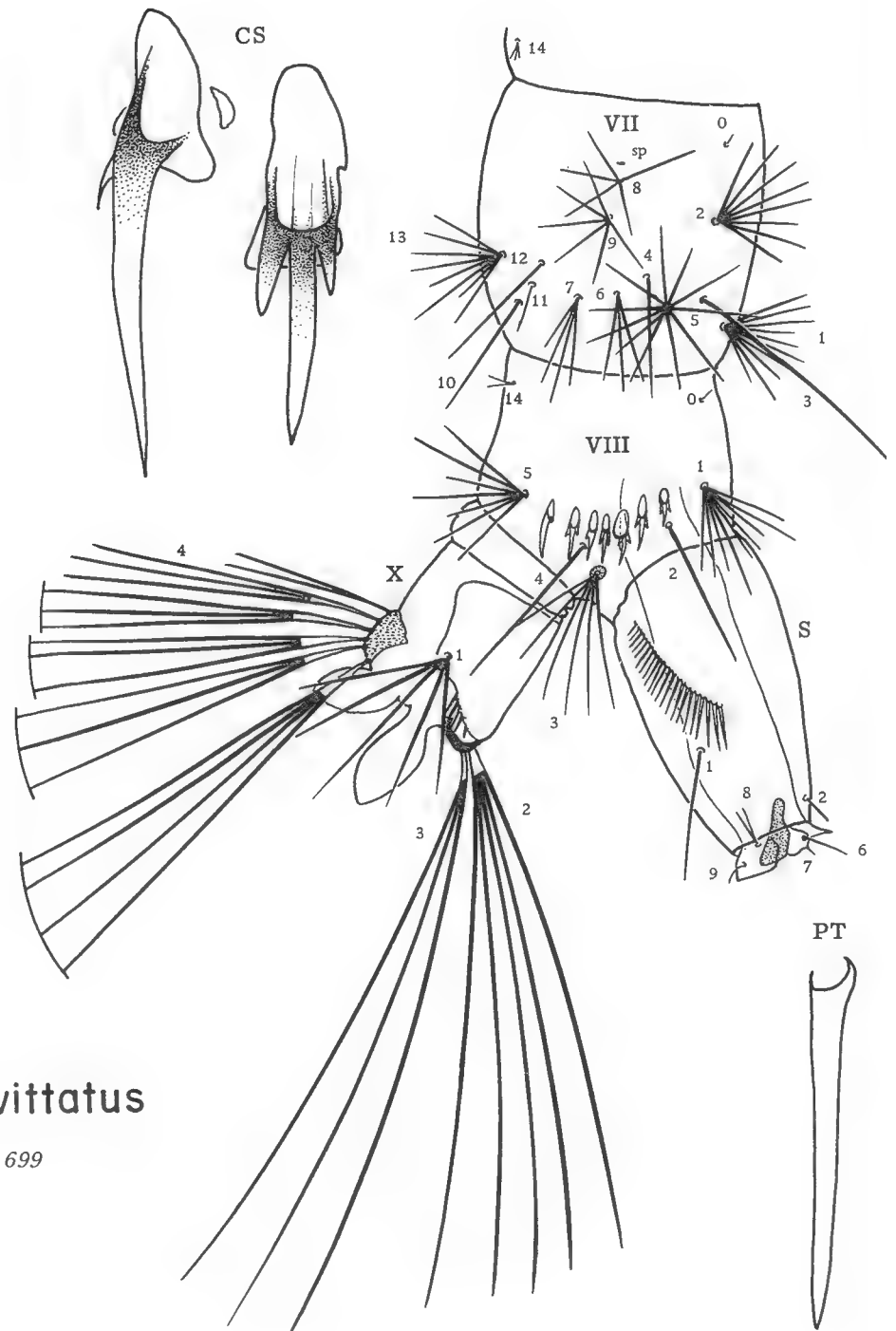


Fig. 81

FINLAYA



1.0

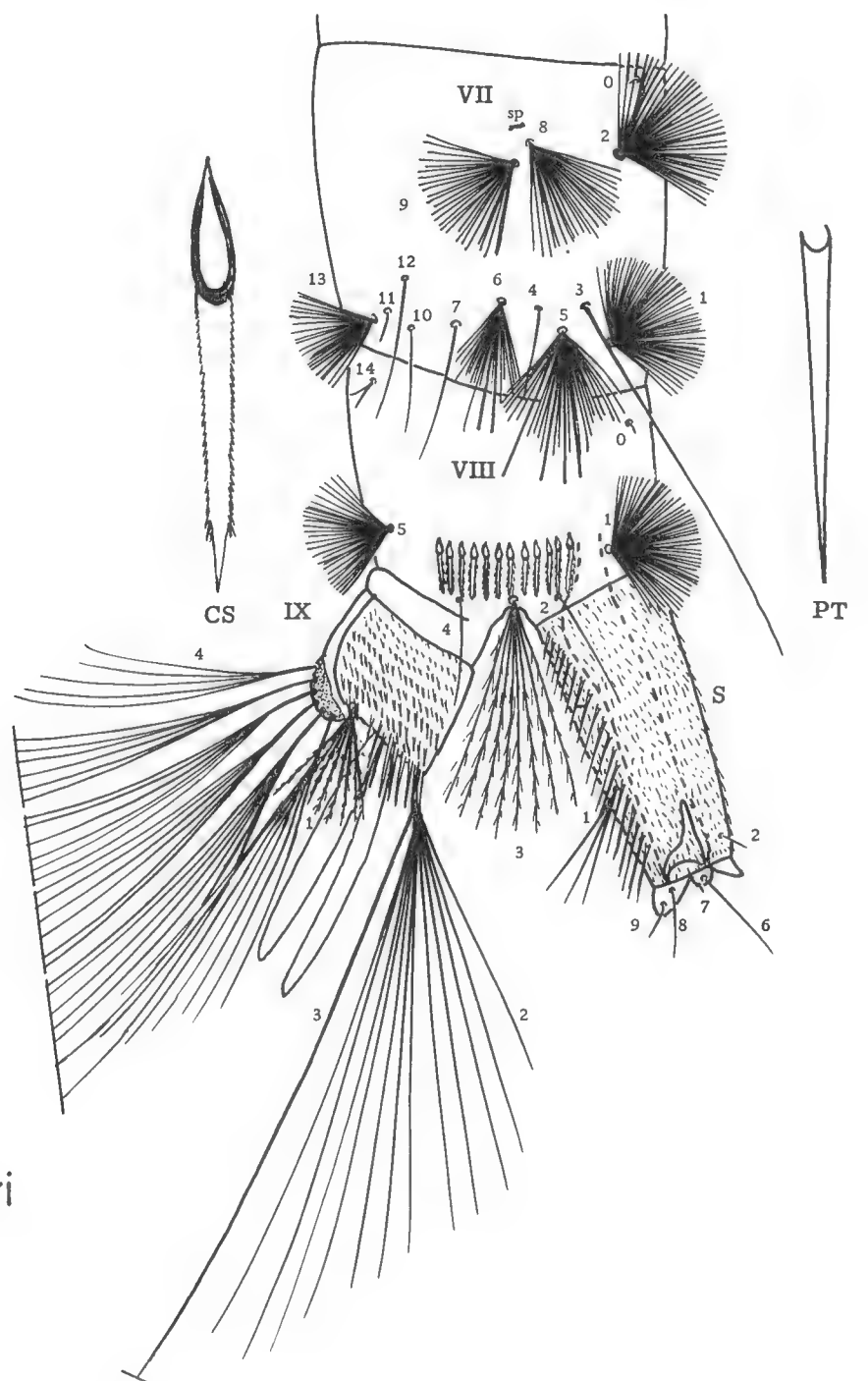
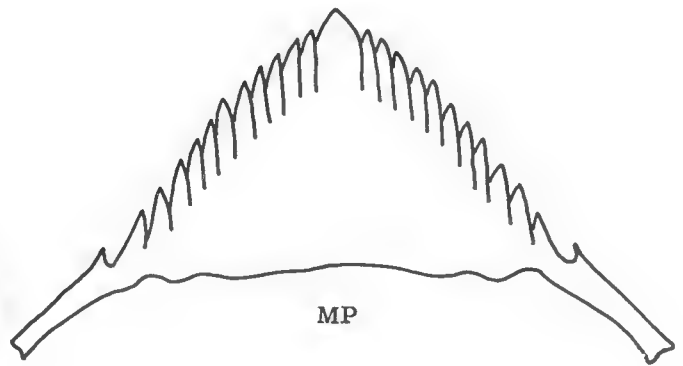
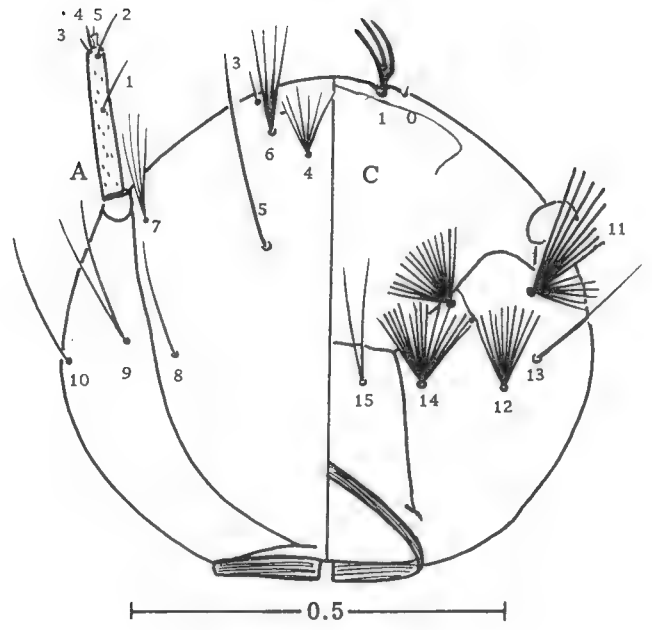
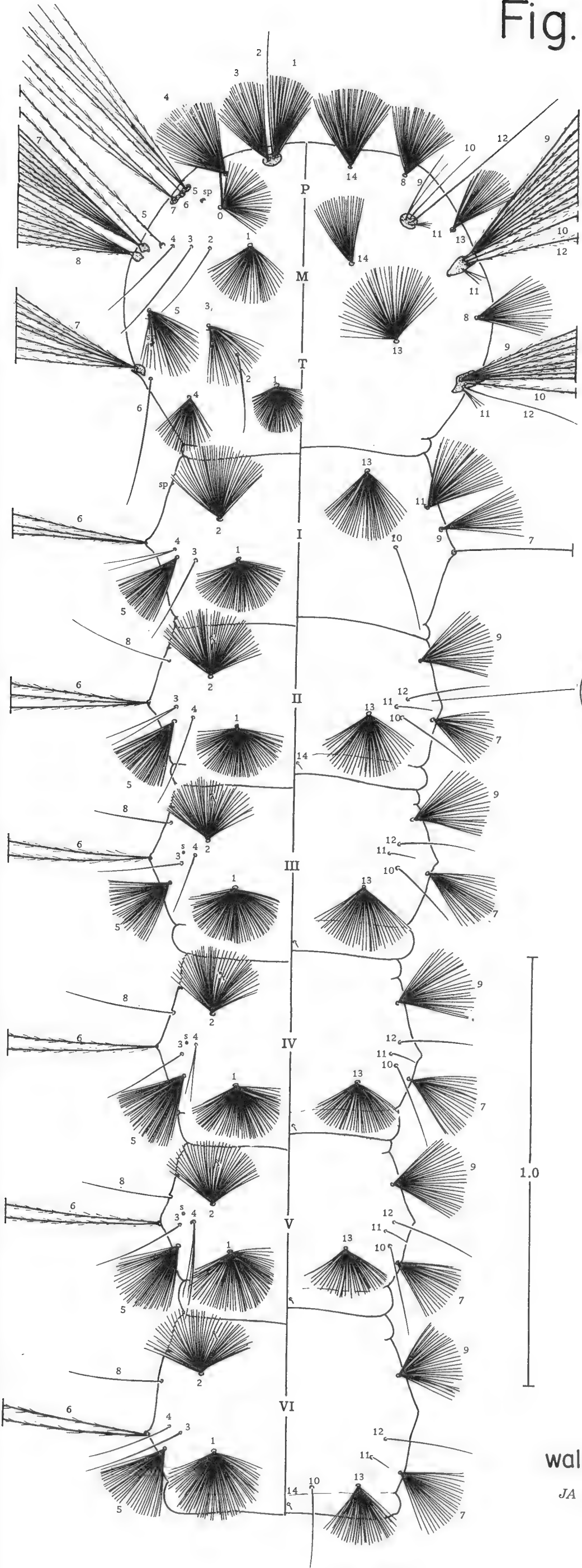


mediovittatus

JA 699

Fig. 82

HOWARDINA



walkeri
JA 243

Fig. 83

HOWARDINA

walkeri

JA 379

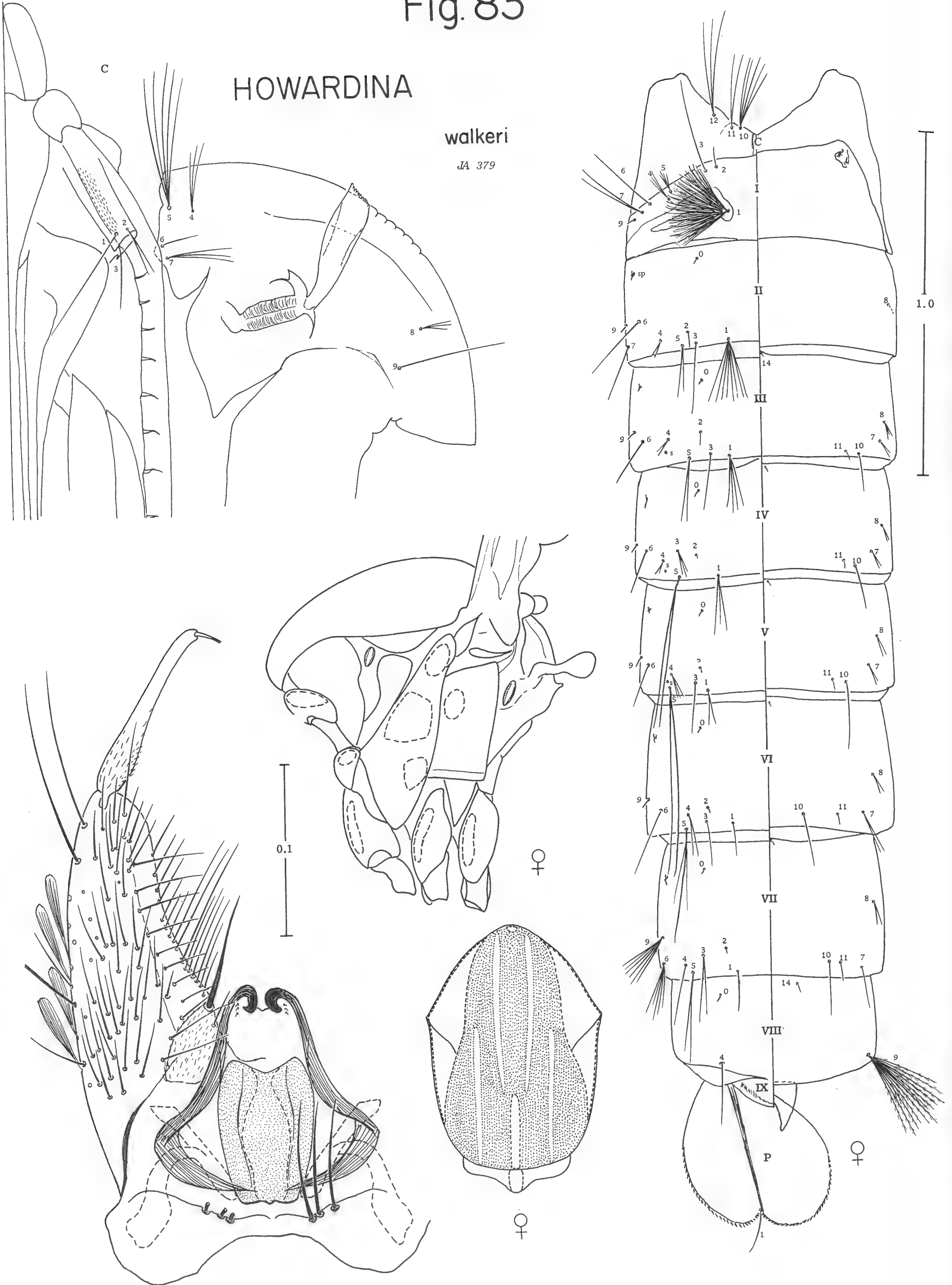
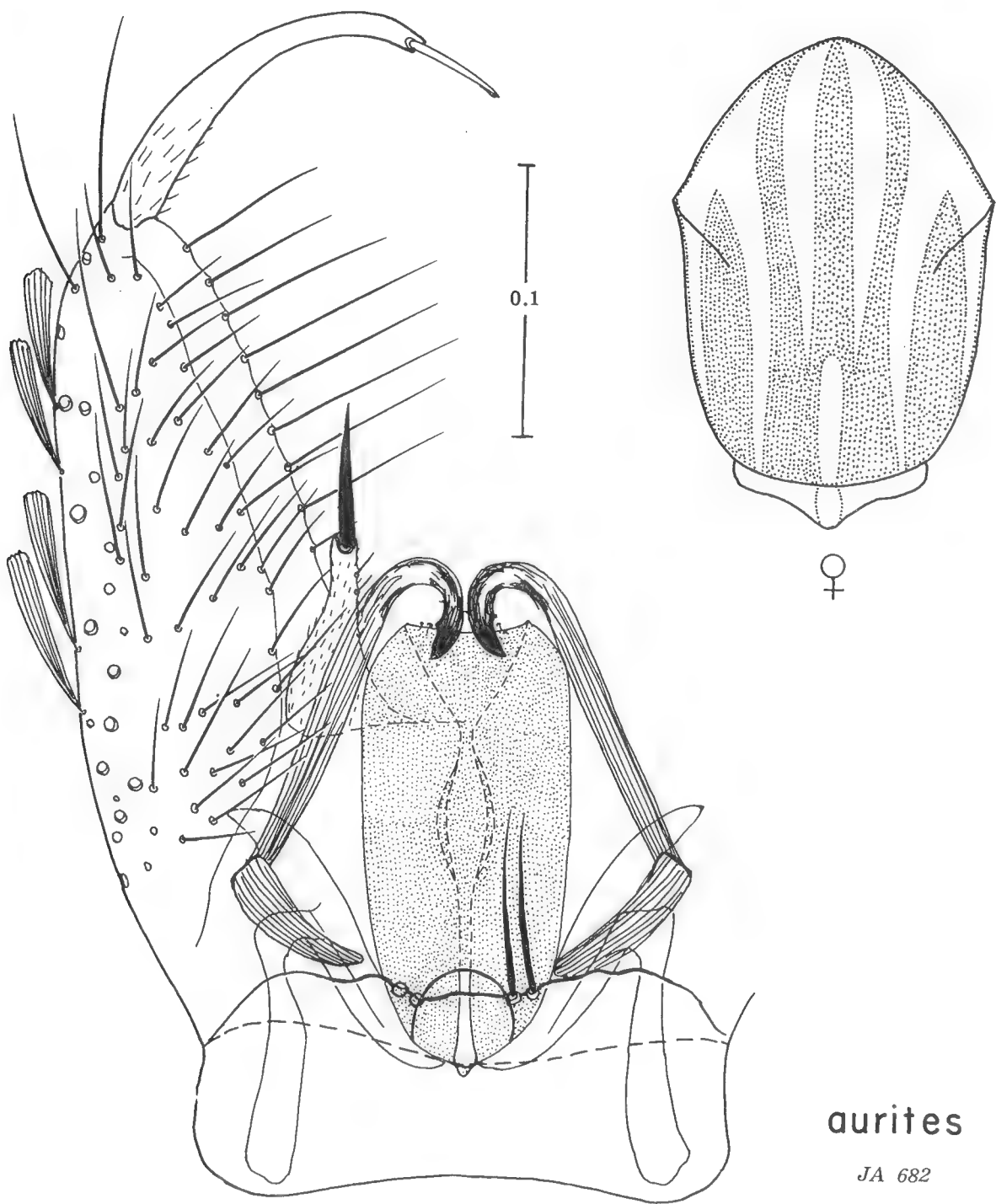
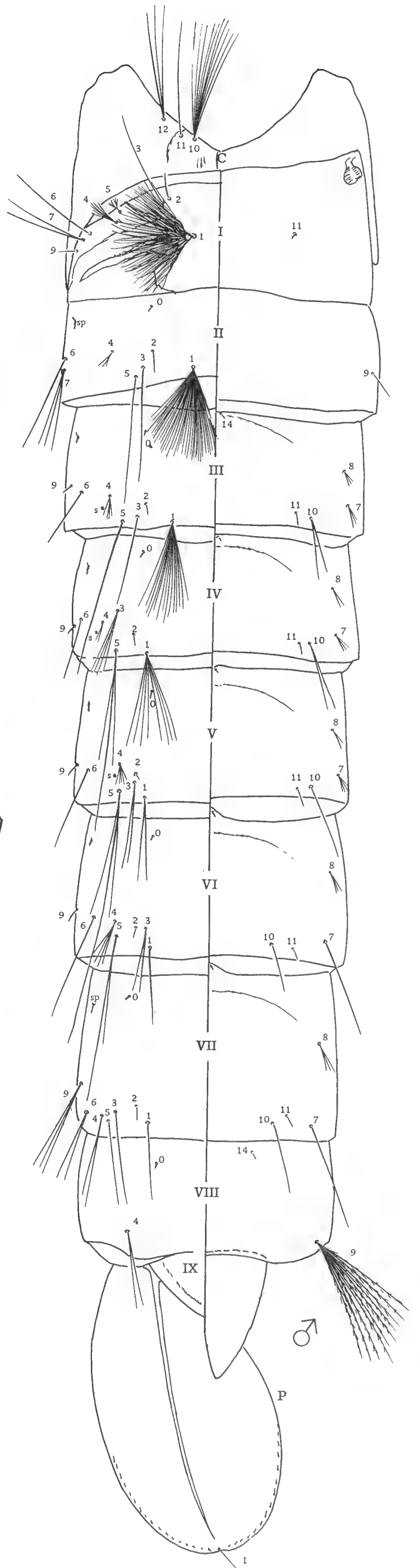
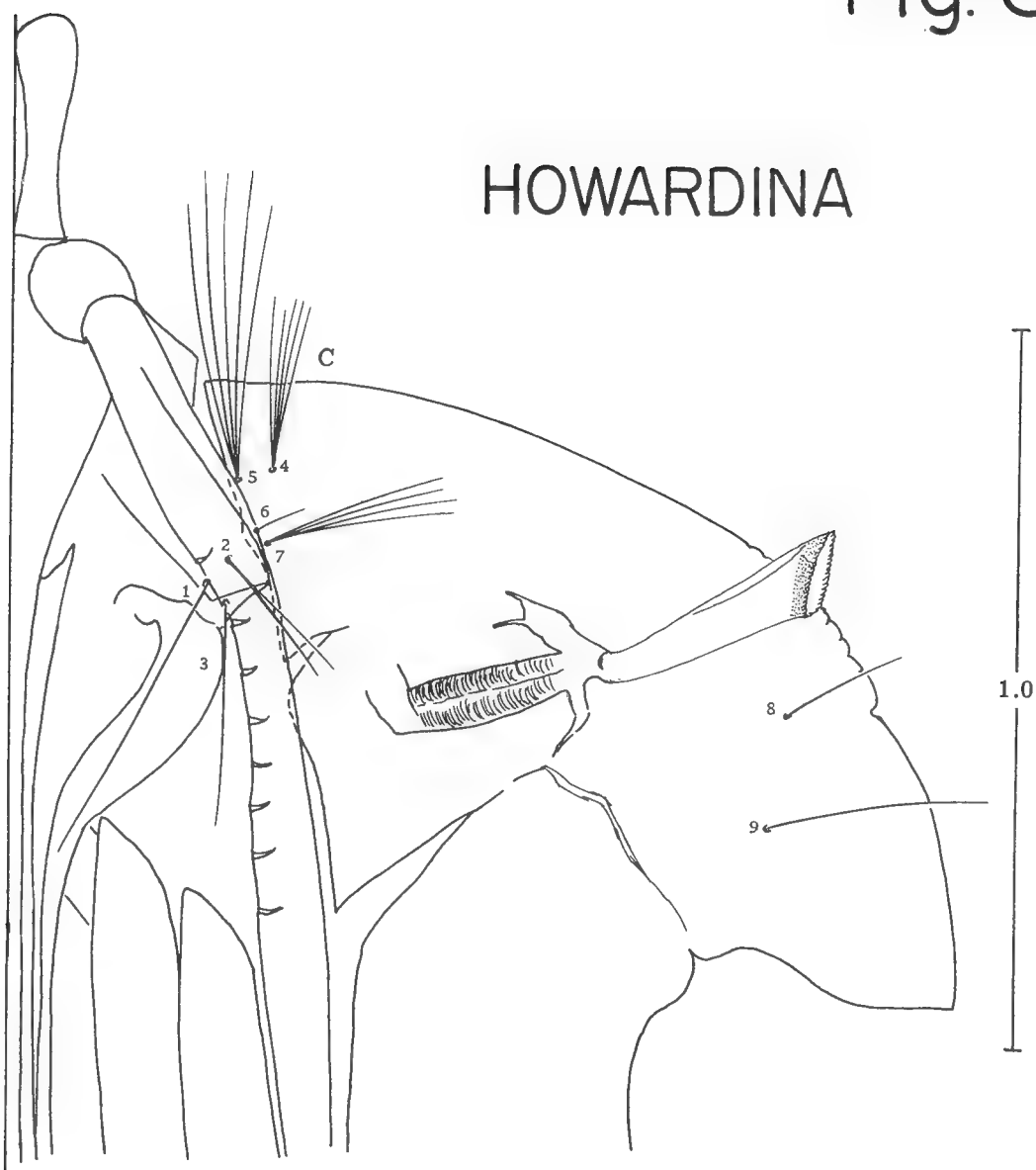


Fig. 84

HOWARDINA

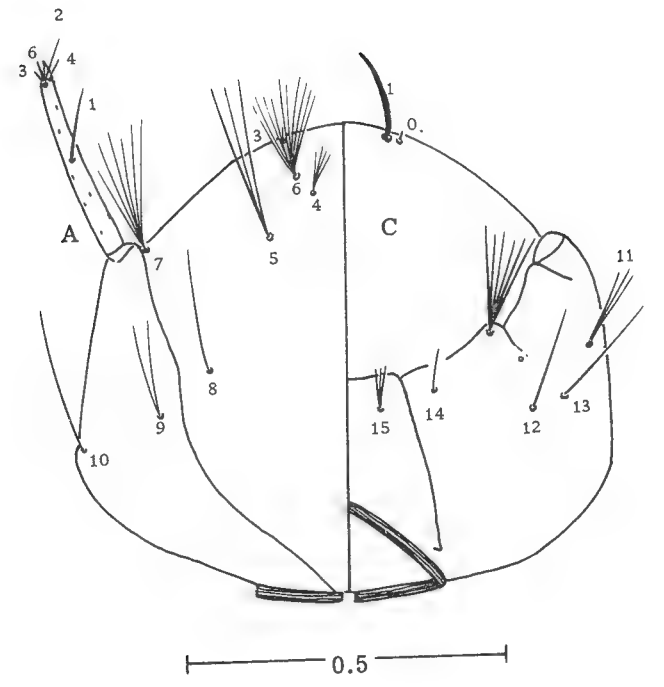
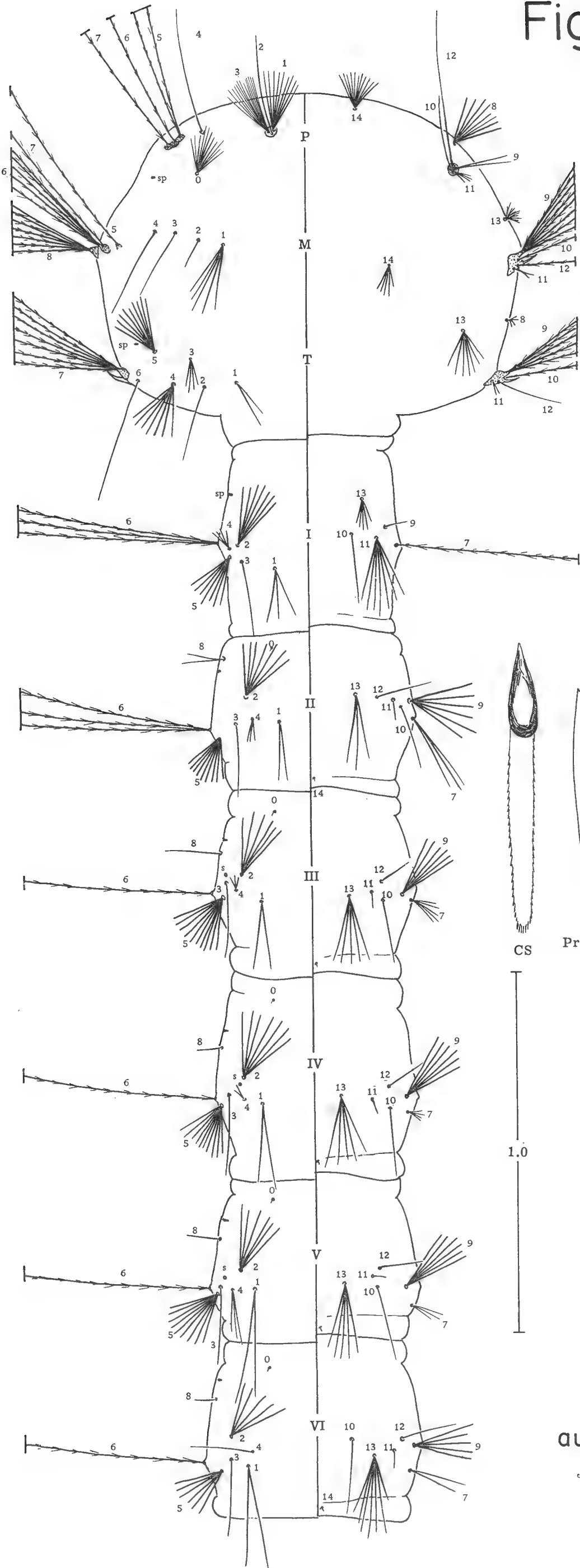


aurites

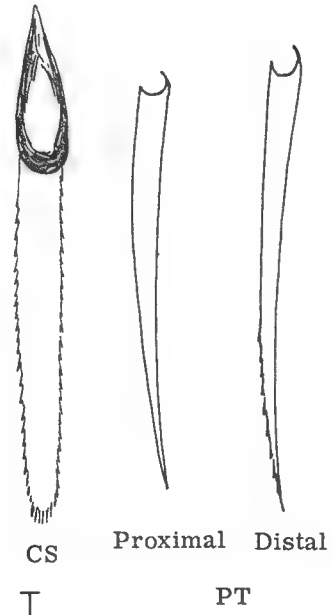
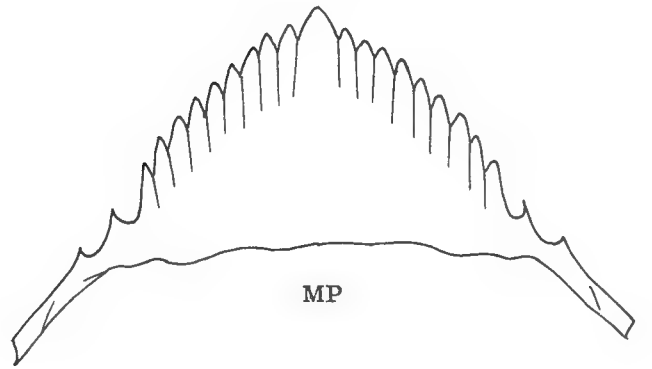
JA 682

Fig. 85

HOWARDINA



0.5



1.0

aurites

JA 682

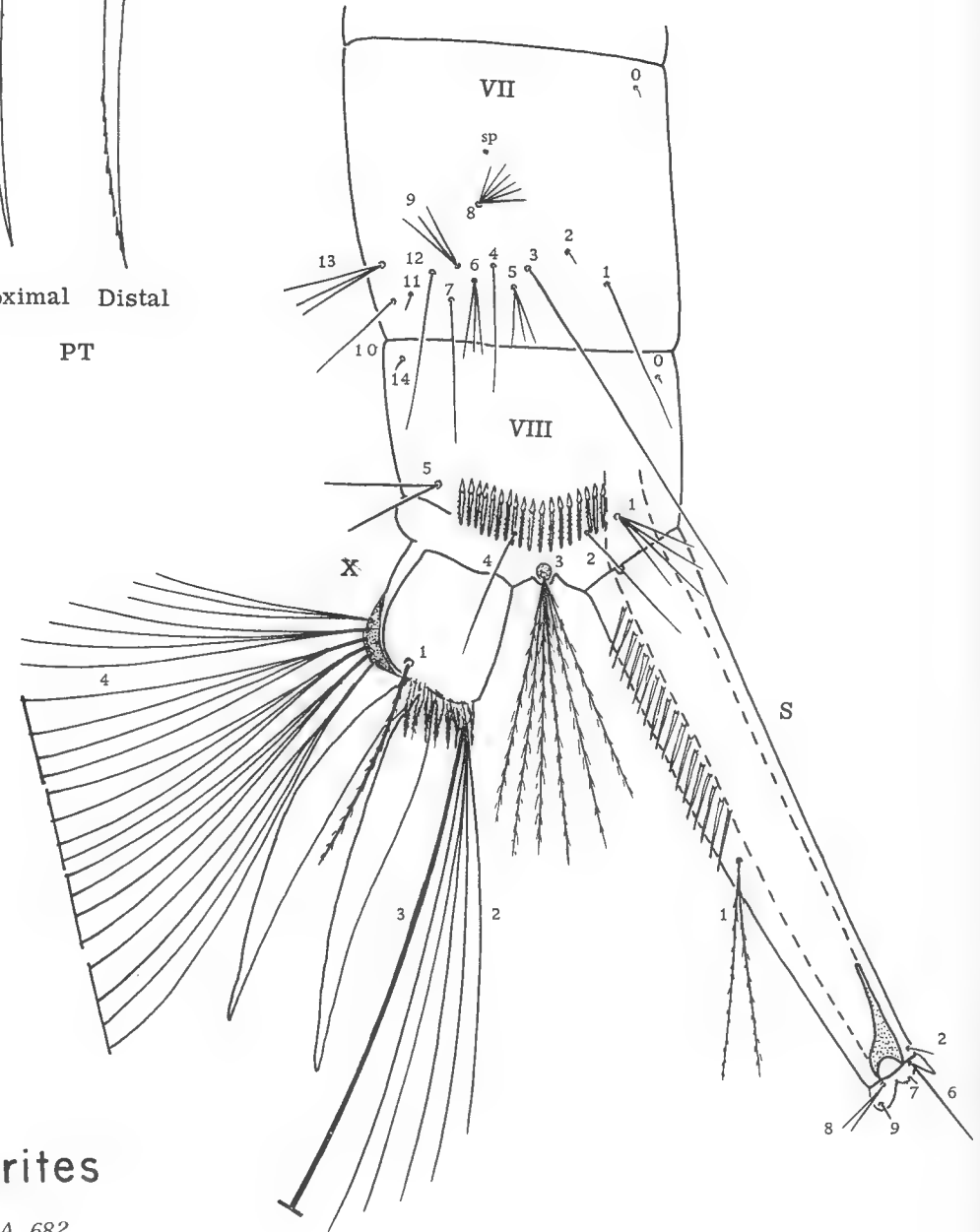


Fig. 86

HOWARDINA

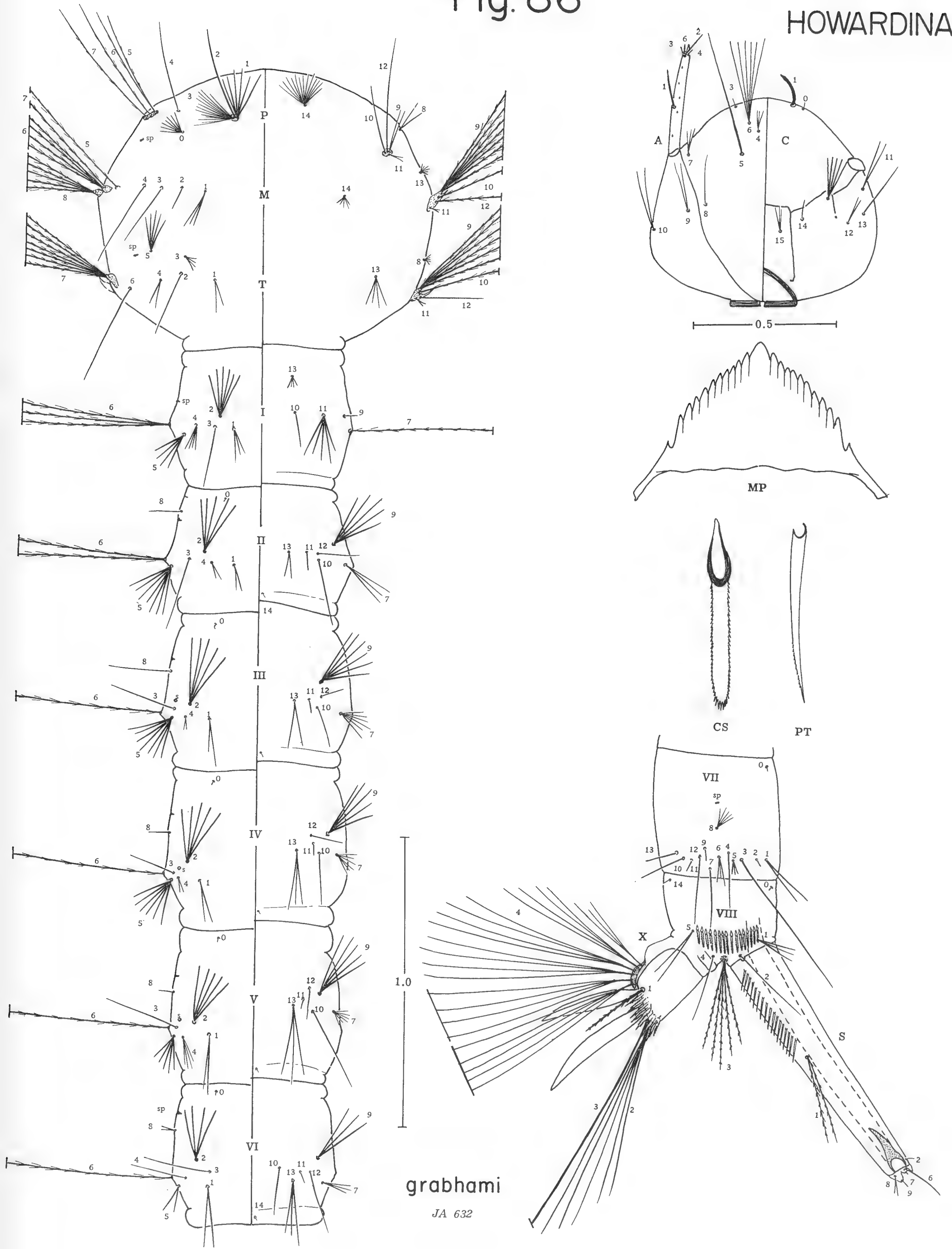
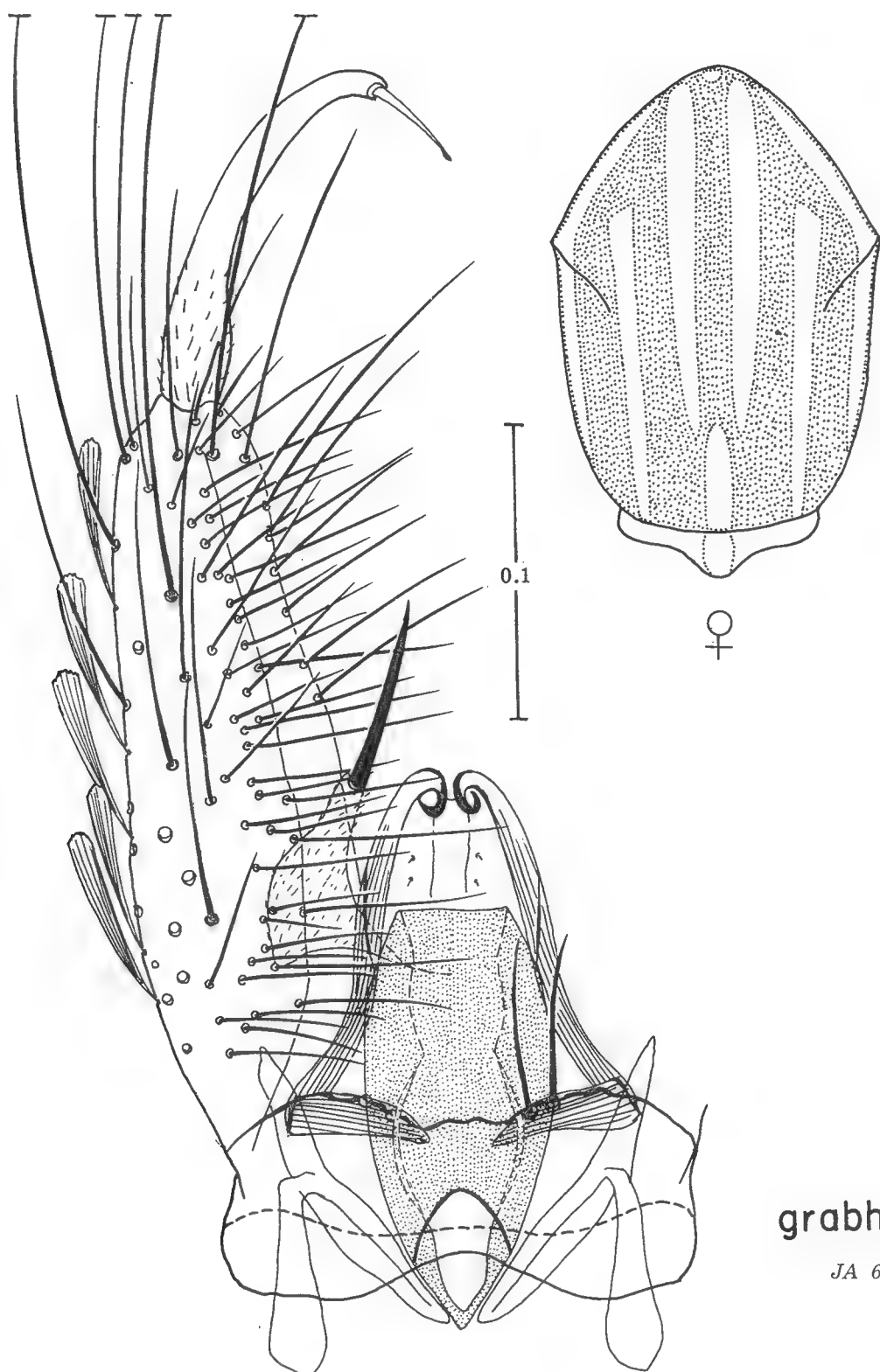
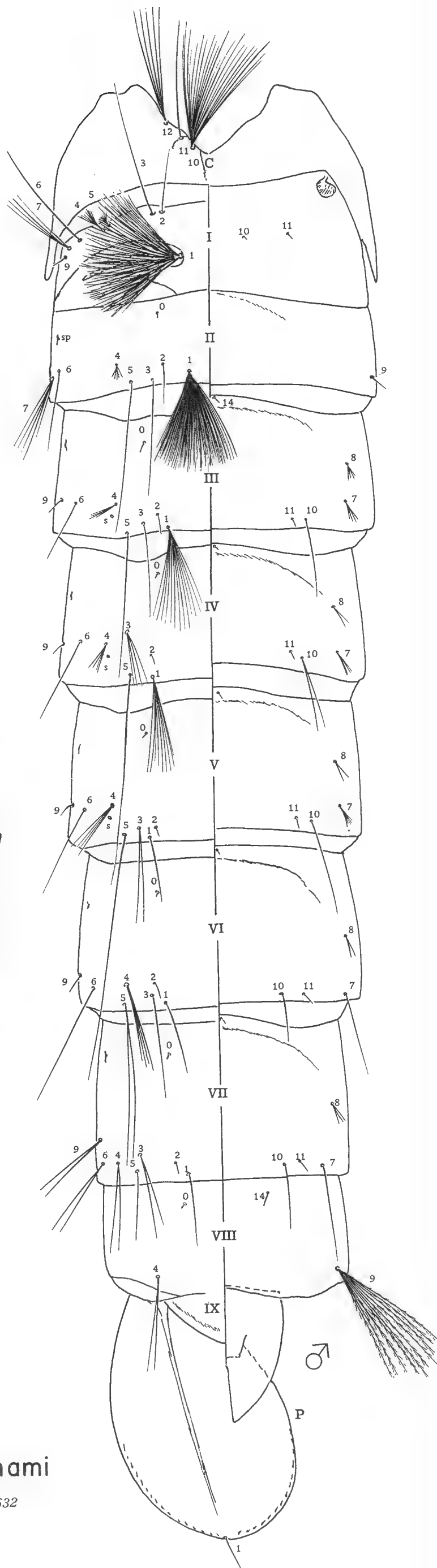
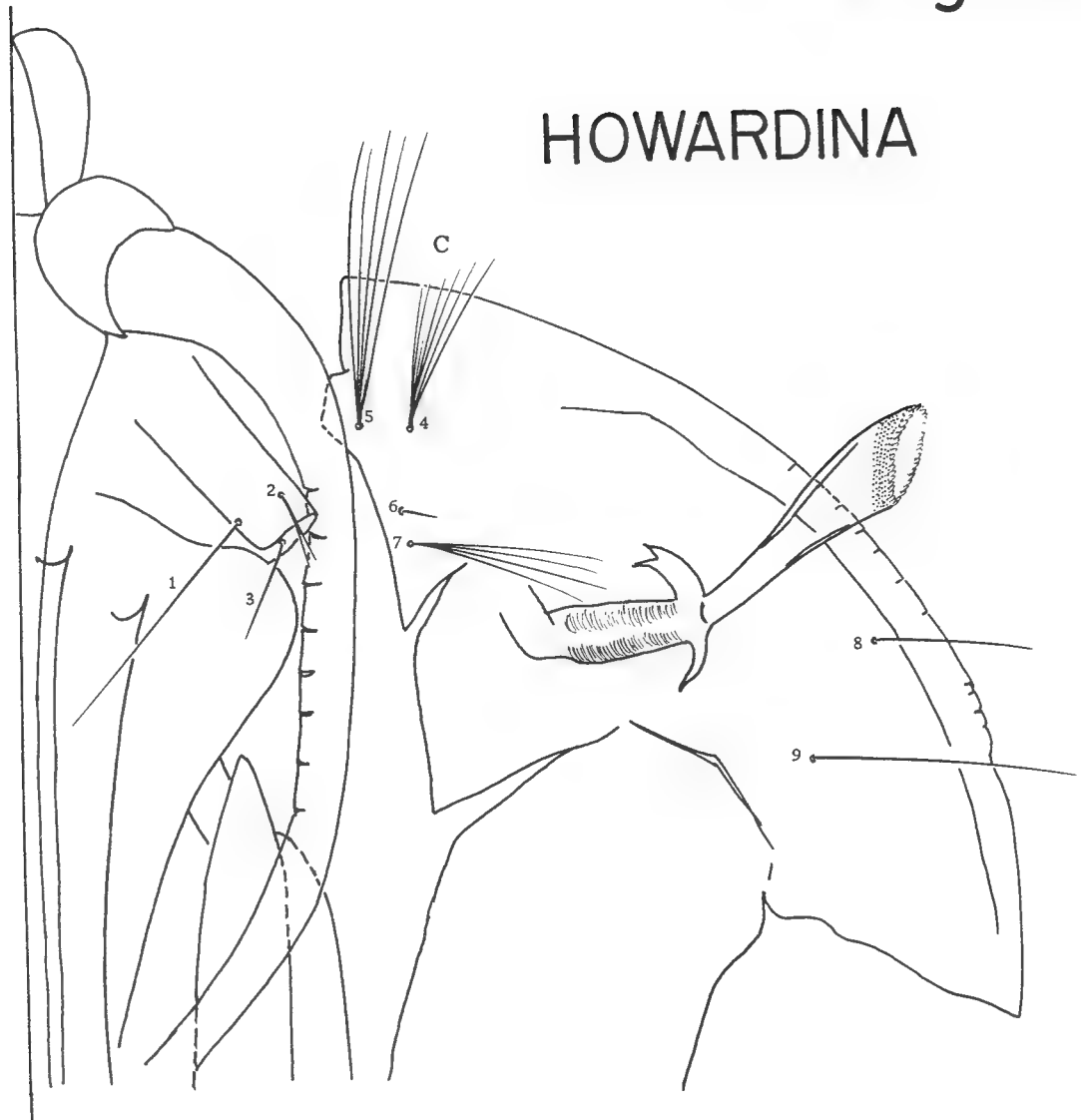


Fig. 87

HOWARDINA

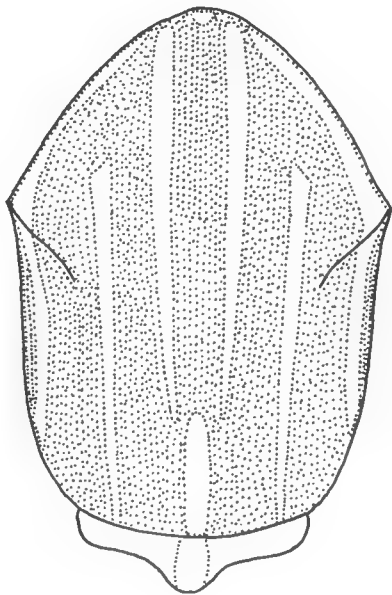
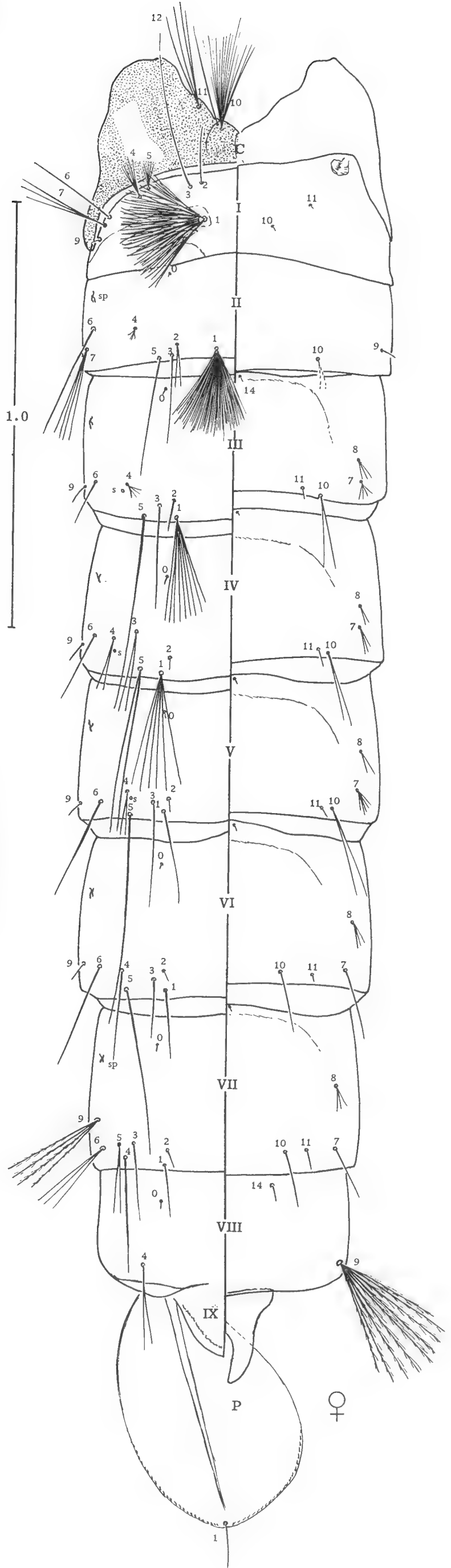
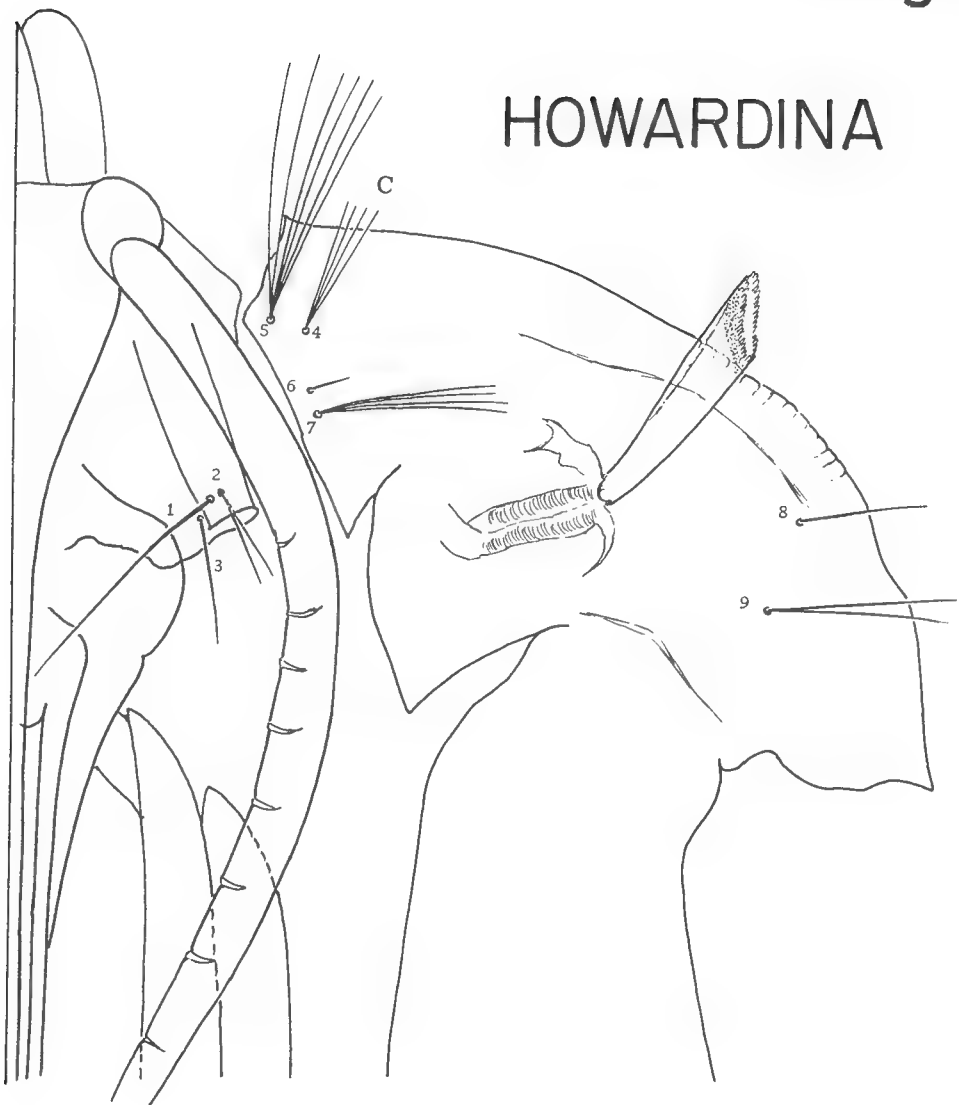


grabhami

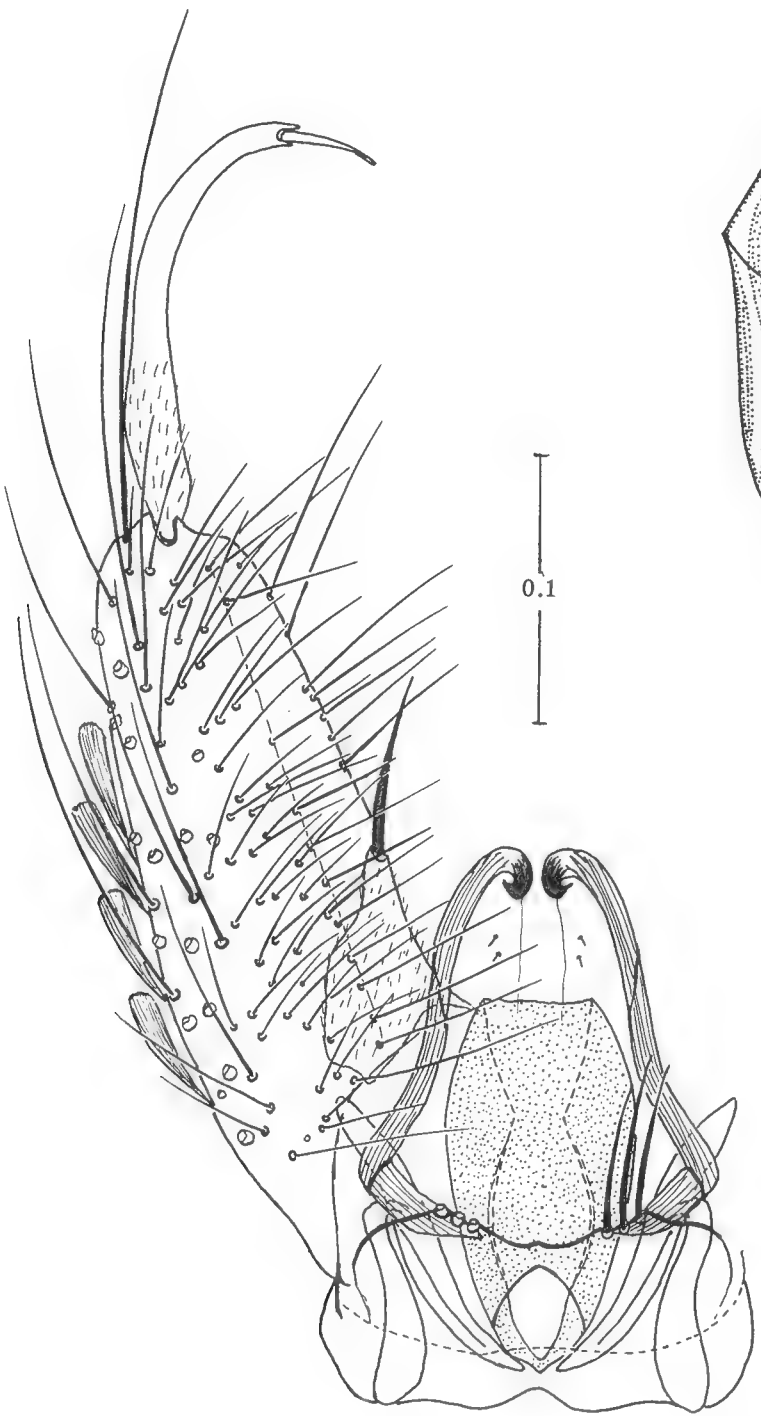
JA 632

Fig. 88

HOWARDINA



♀



inaequalis

JA 290

Fig. 89

HOWARDINA

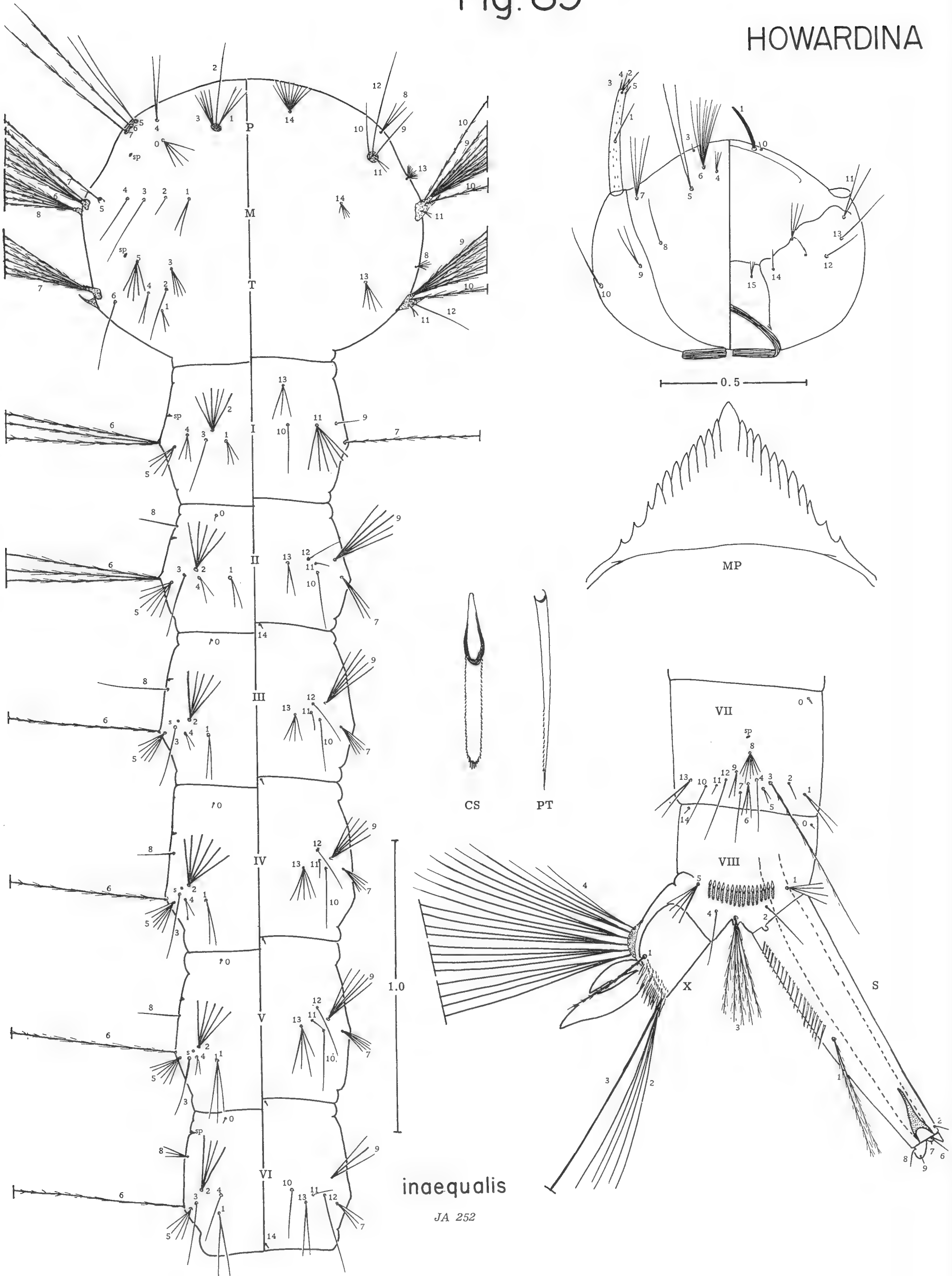


Fig. 90

HOWARDINA

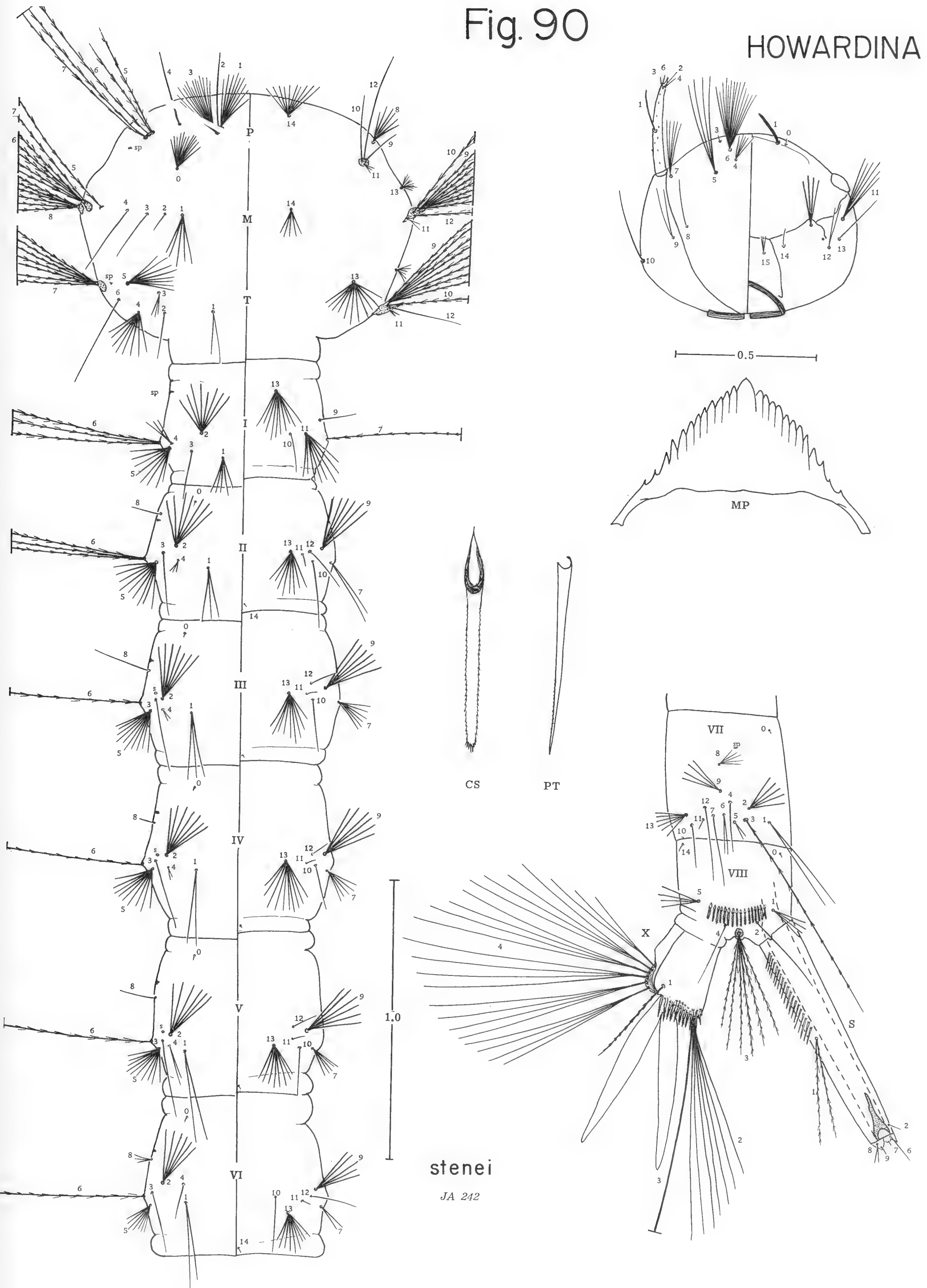
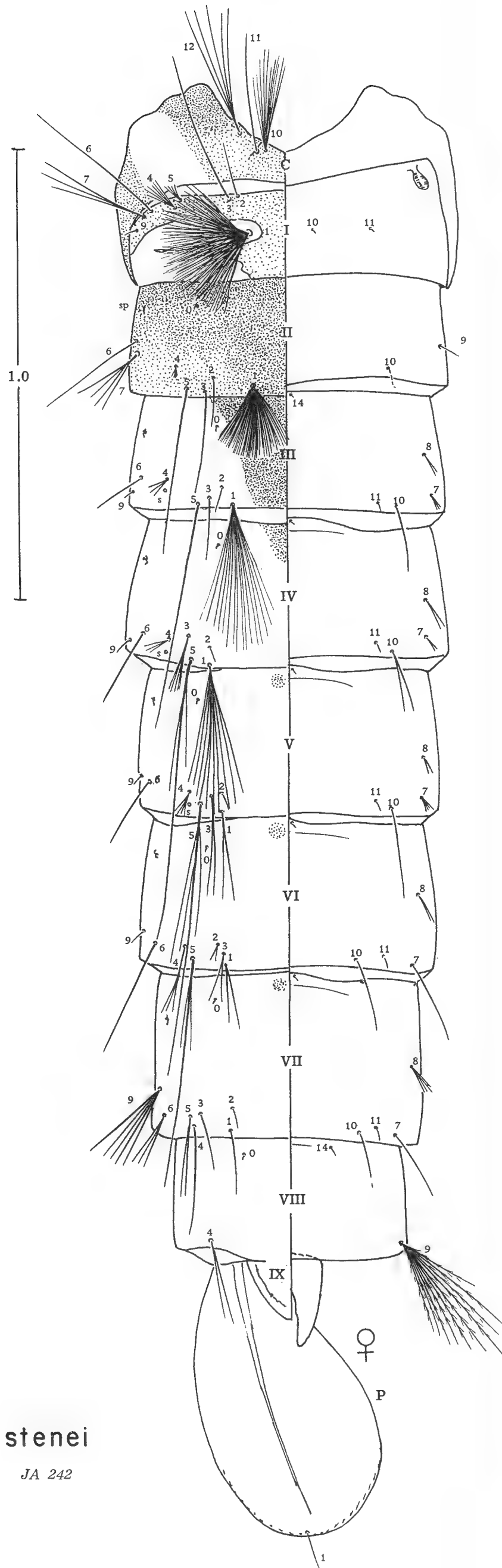
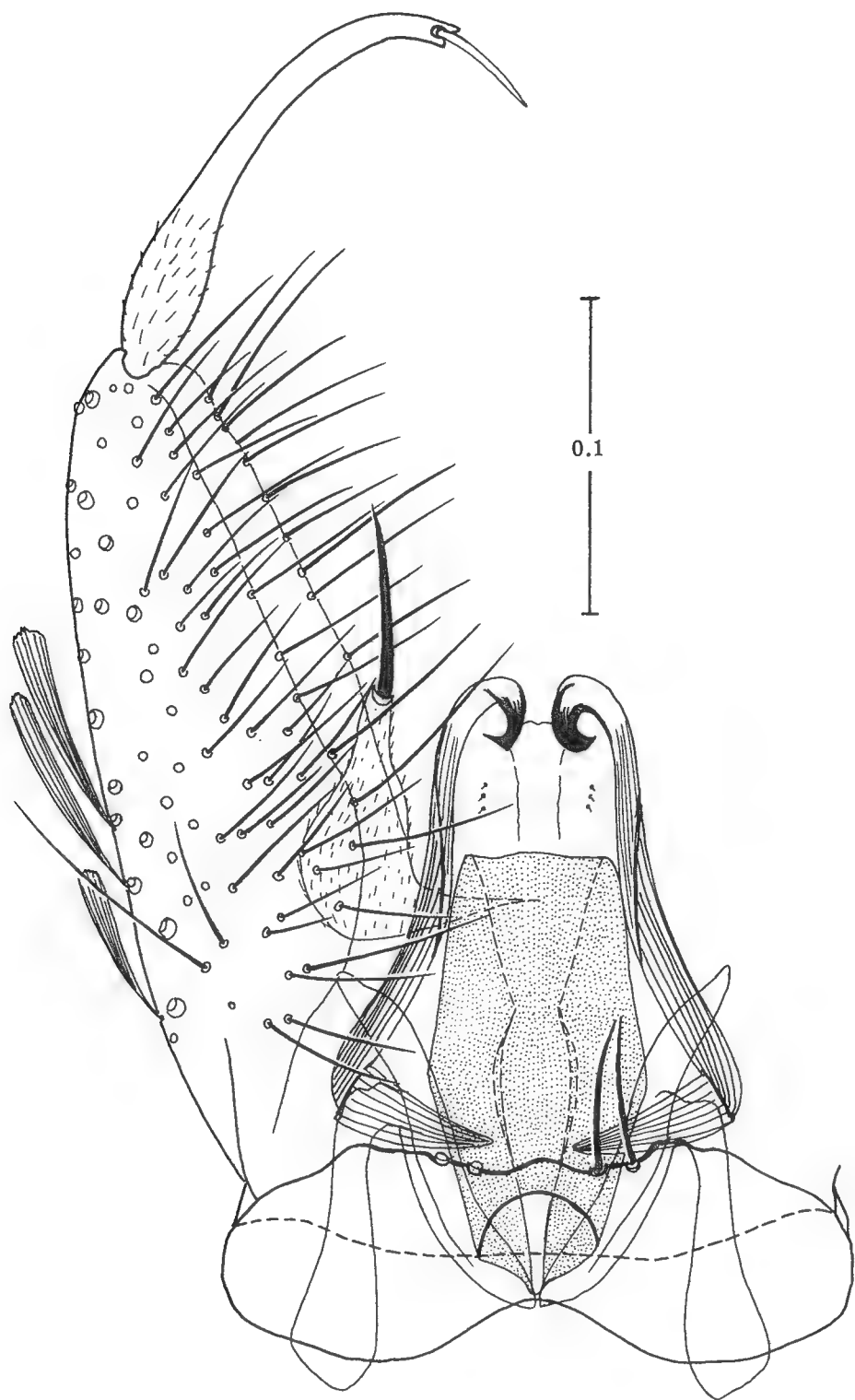
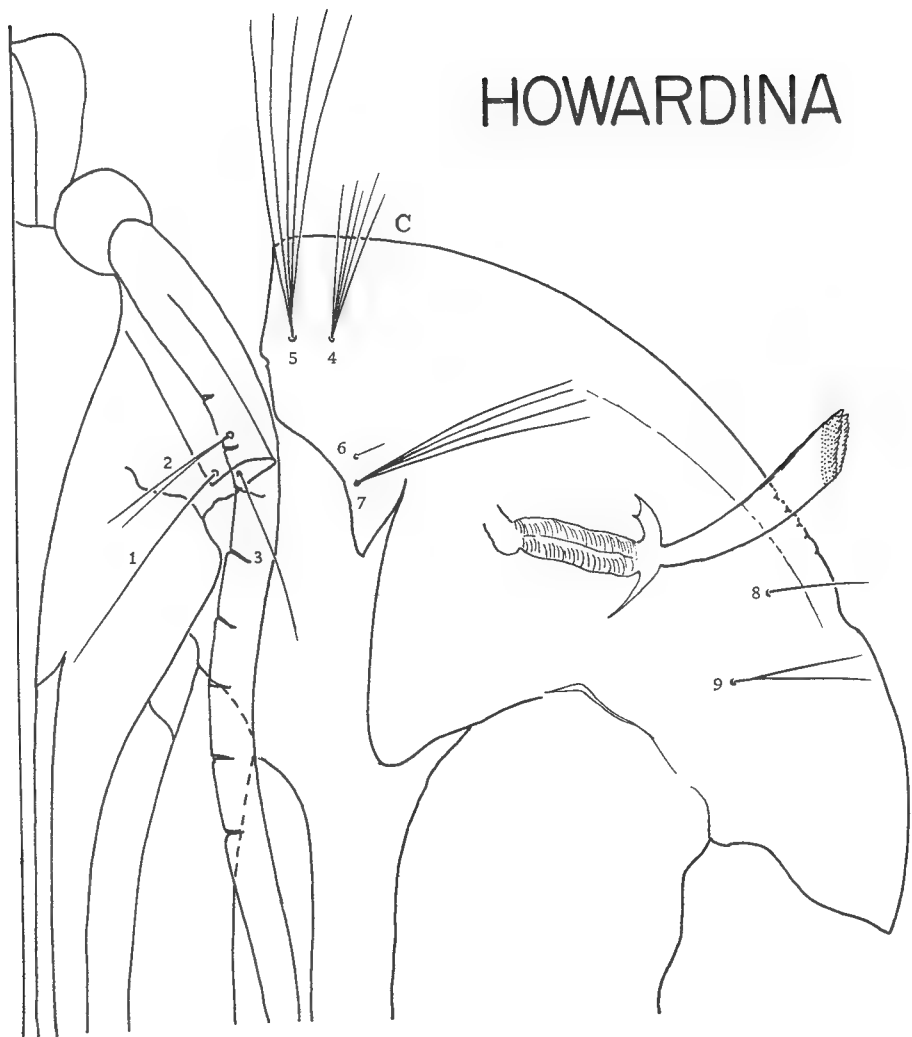


Fig. 91

HOWARDINA



stenei

JA 242

Fig. 92

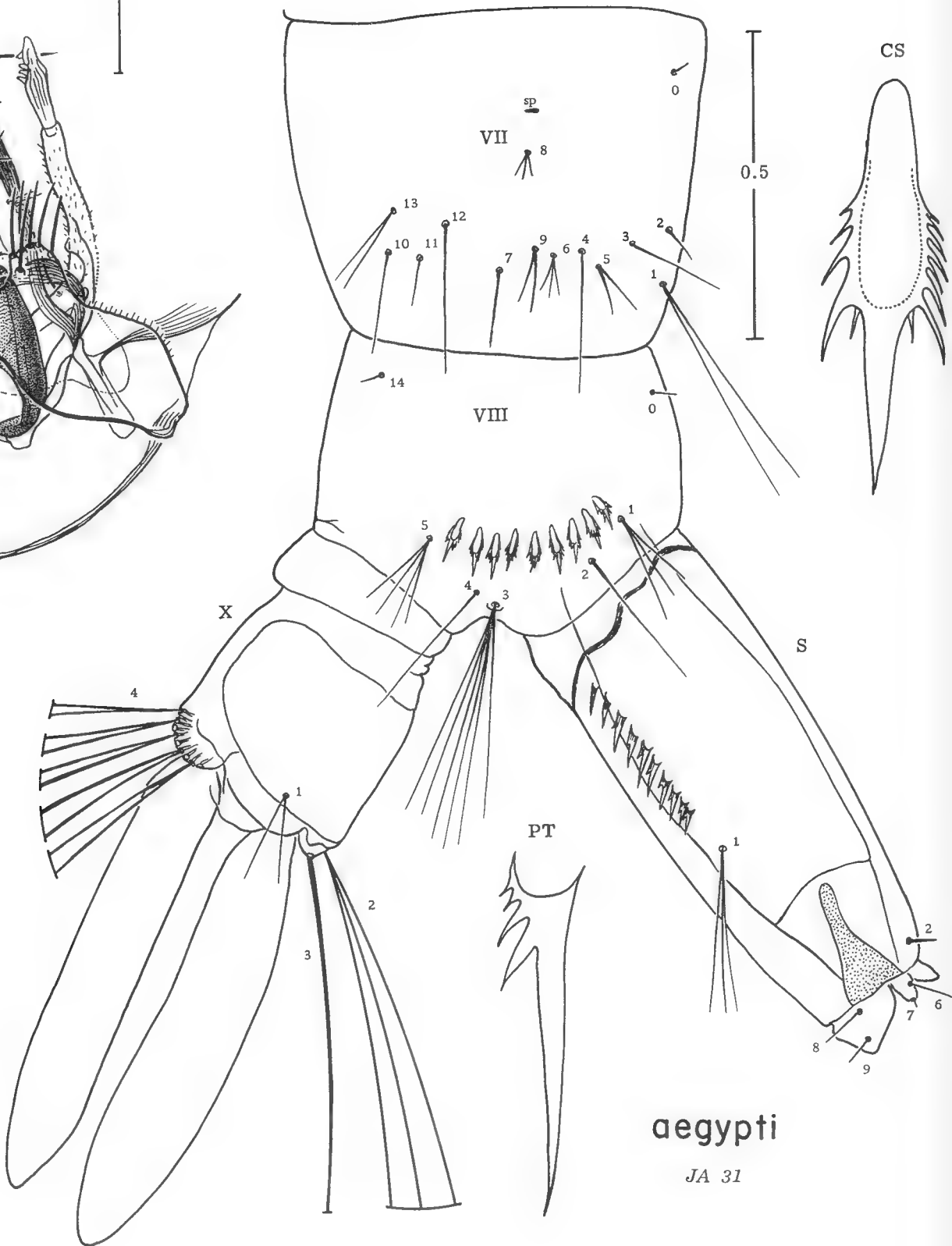
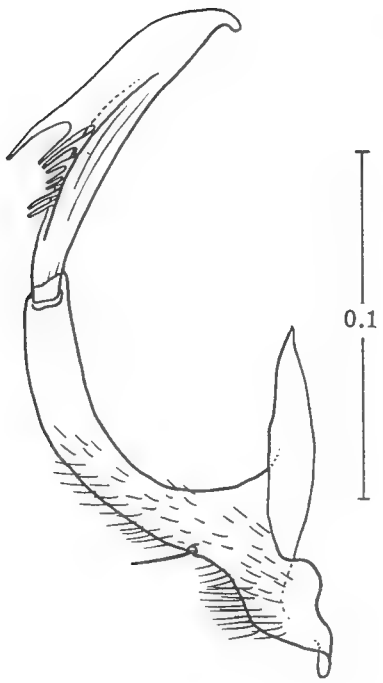
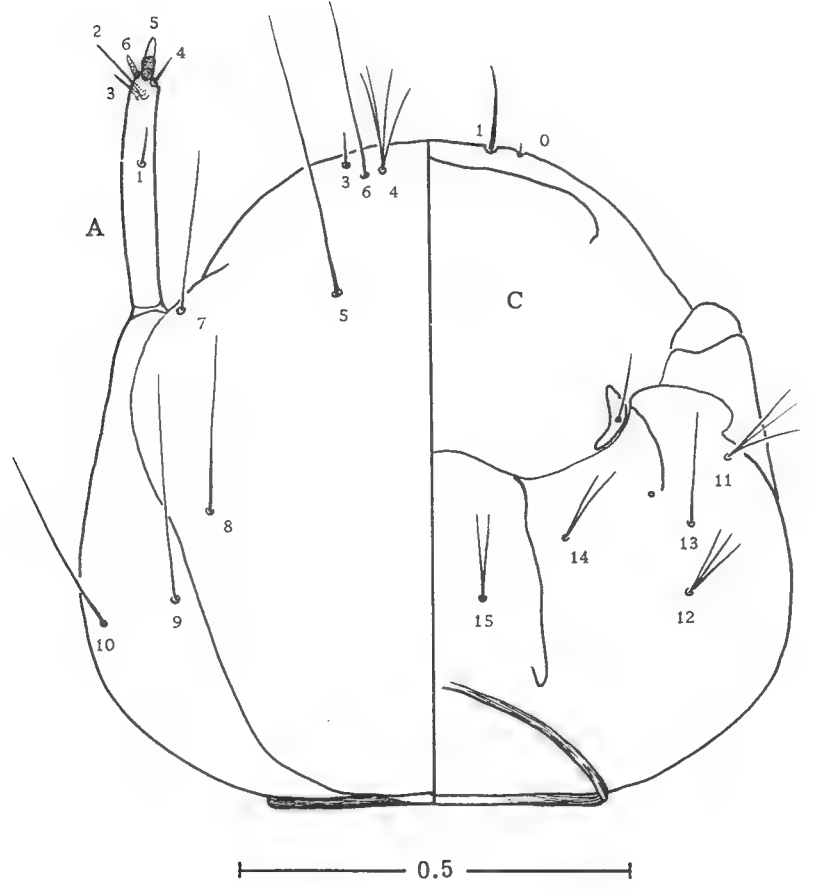
STEGOMYIA



Fig.93

OCHLEROTATUS

STEGOMYIA



auratus

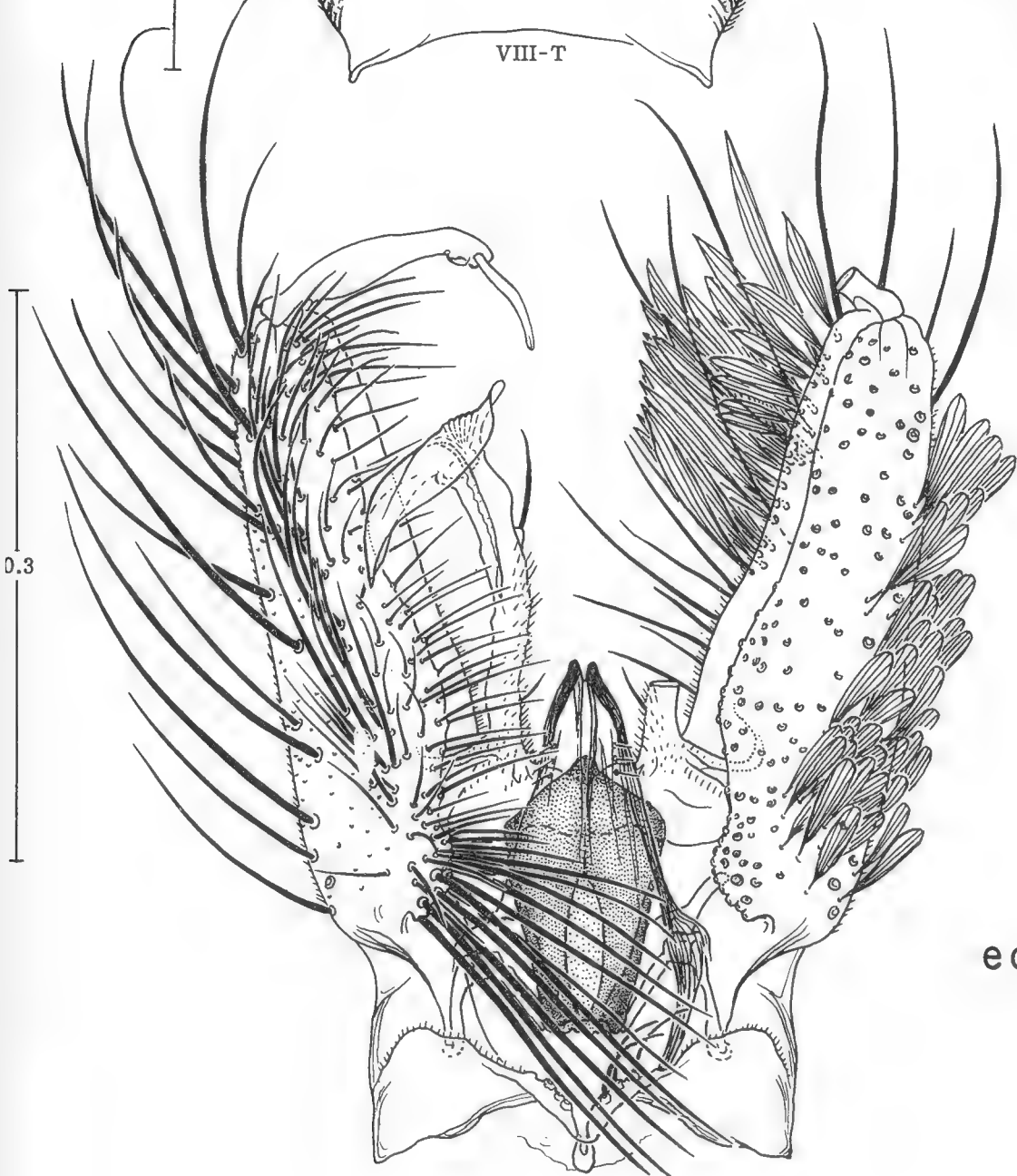
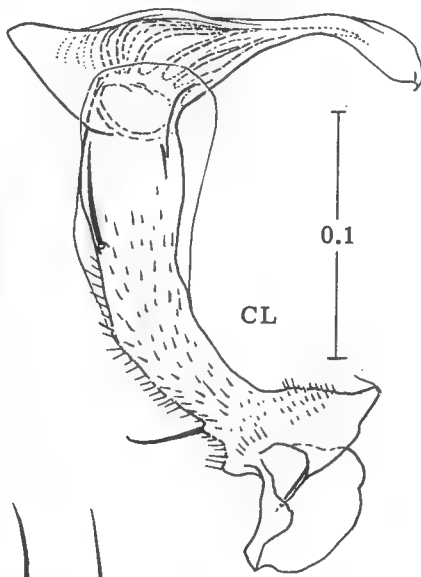
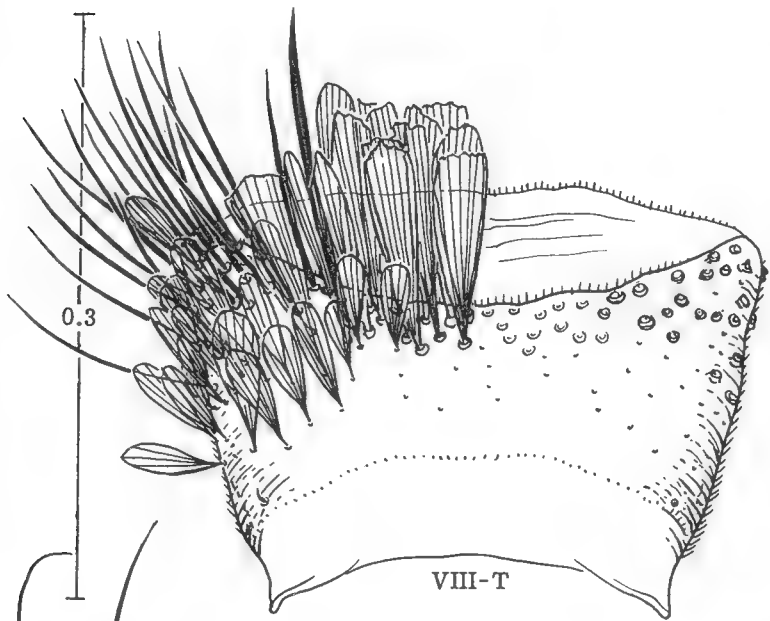
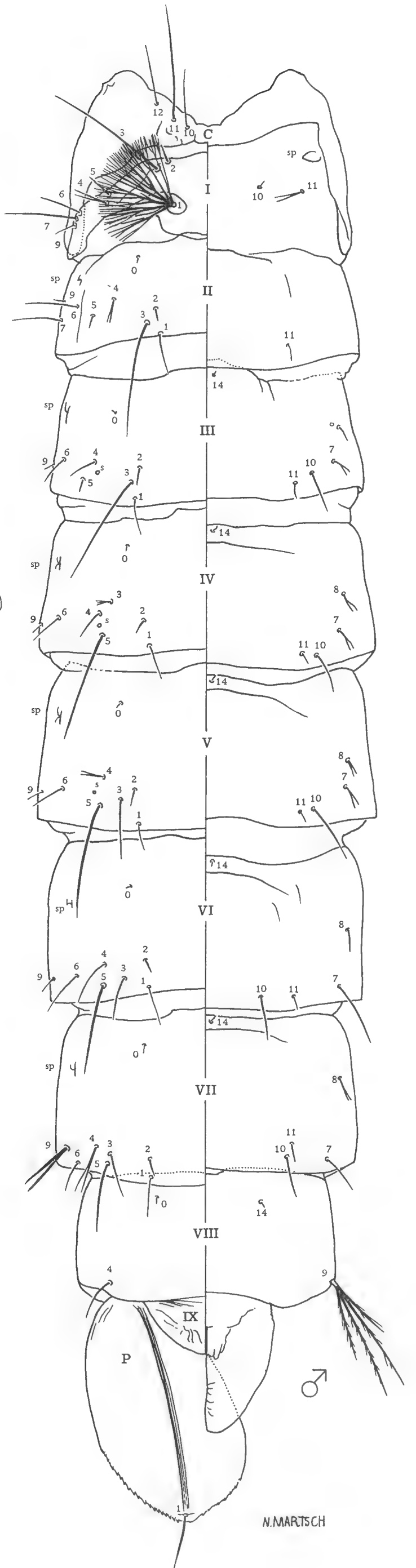
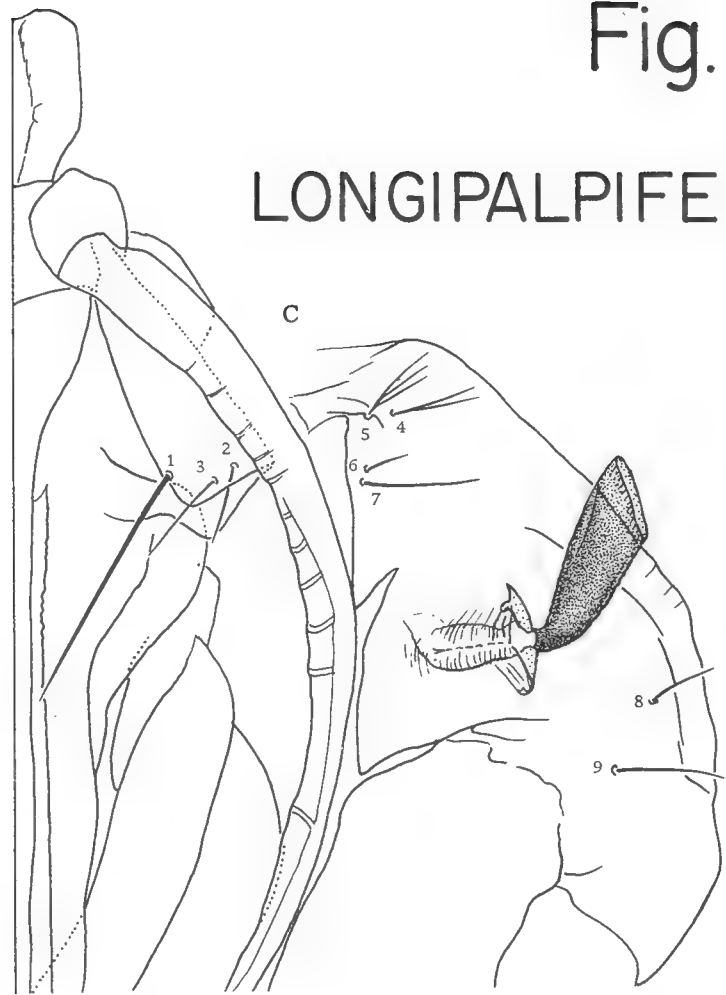
*Kingston
Jamaica*

aegypti

JA 31

Fig. 94

LONGIPALPIFER



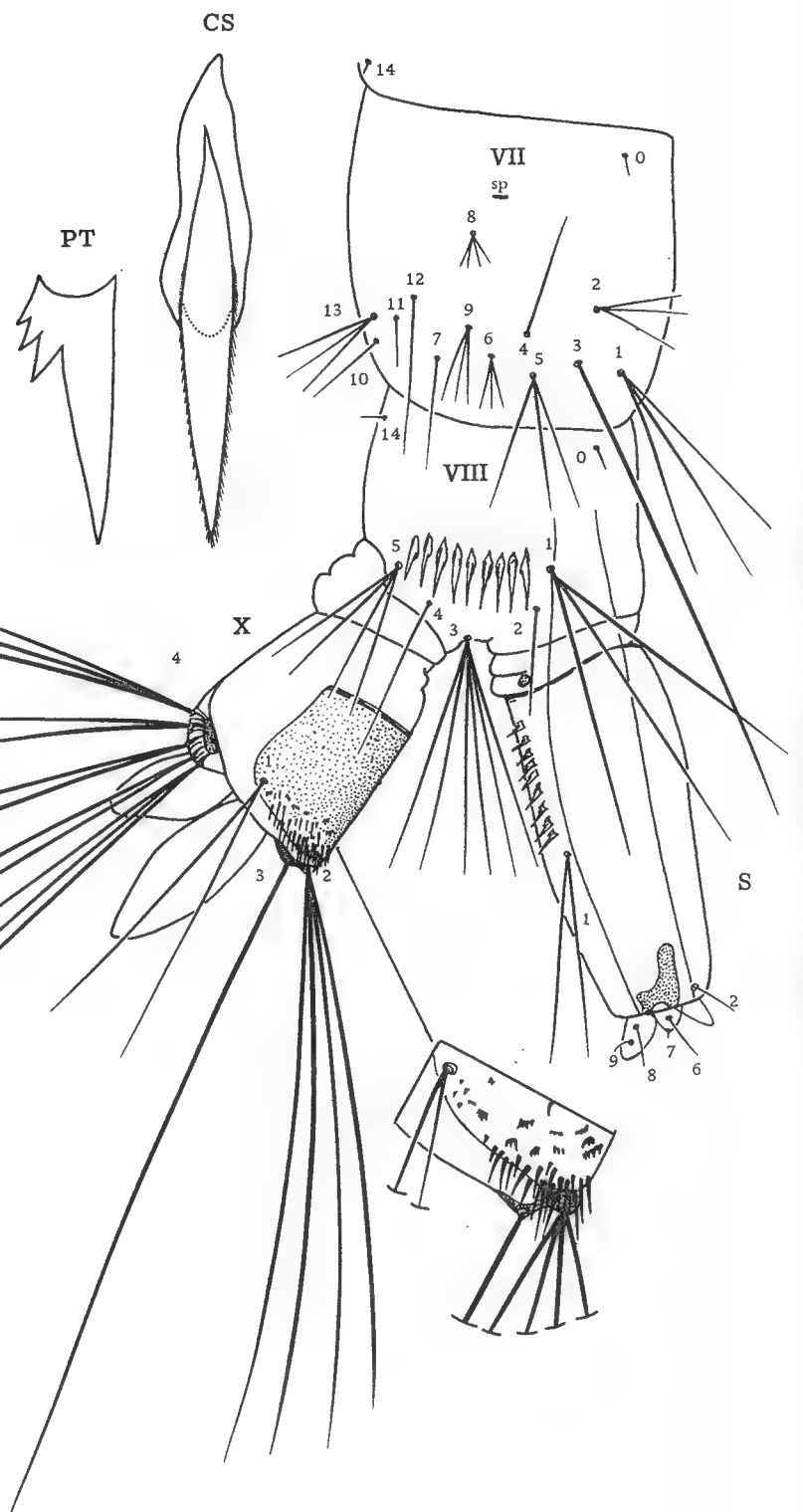
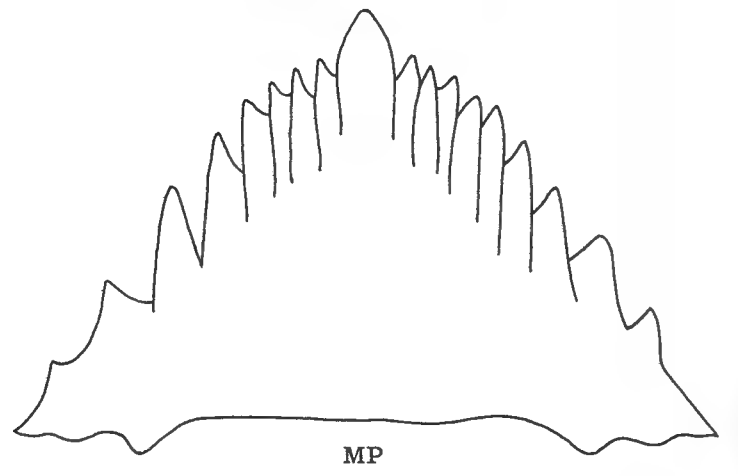
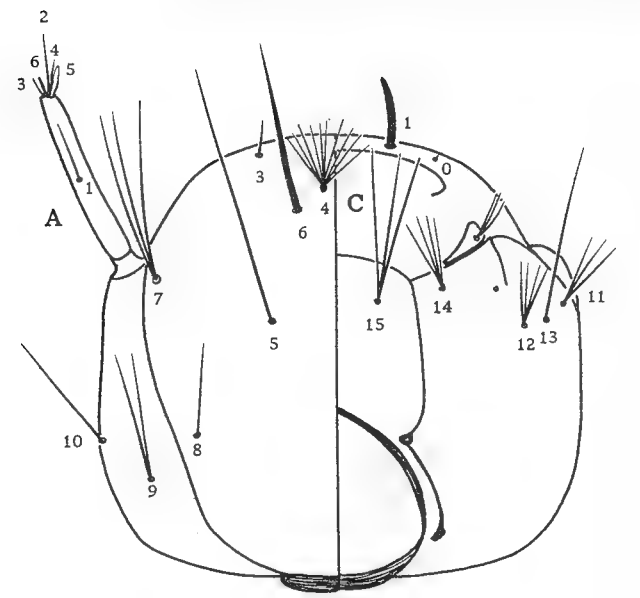
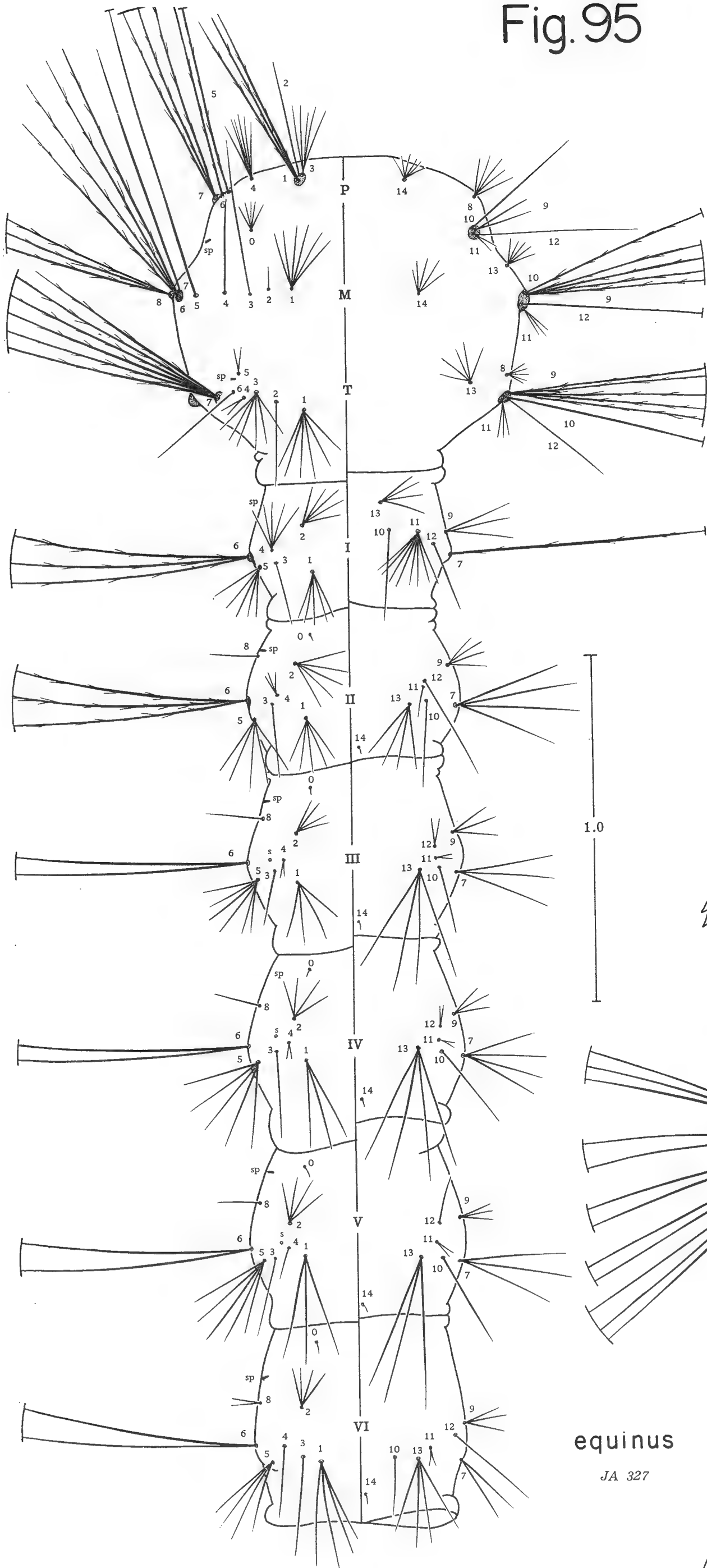
equinus

JA 328

N. MARTSCH

Fig. 95

LONGIPALPIFER



equinus
JA 327

Fig. 96

WYEOMYIA

stellata

JA 725

hirsuta

JA 763

mitchellii

JA 726

nigritubus

JA 307

N. MARITSCH

0.3

0.3

0.3

0.3

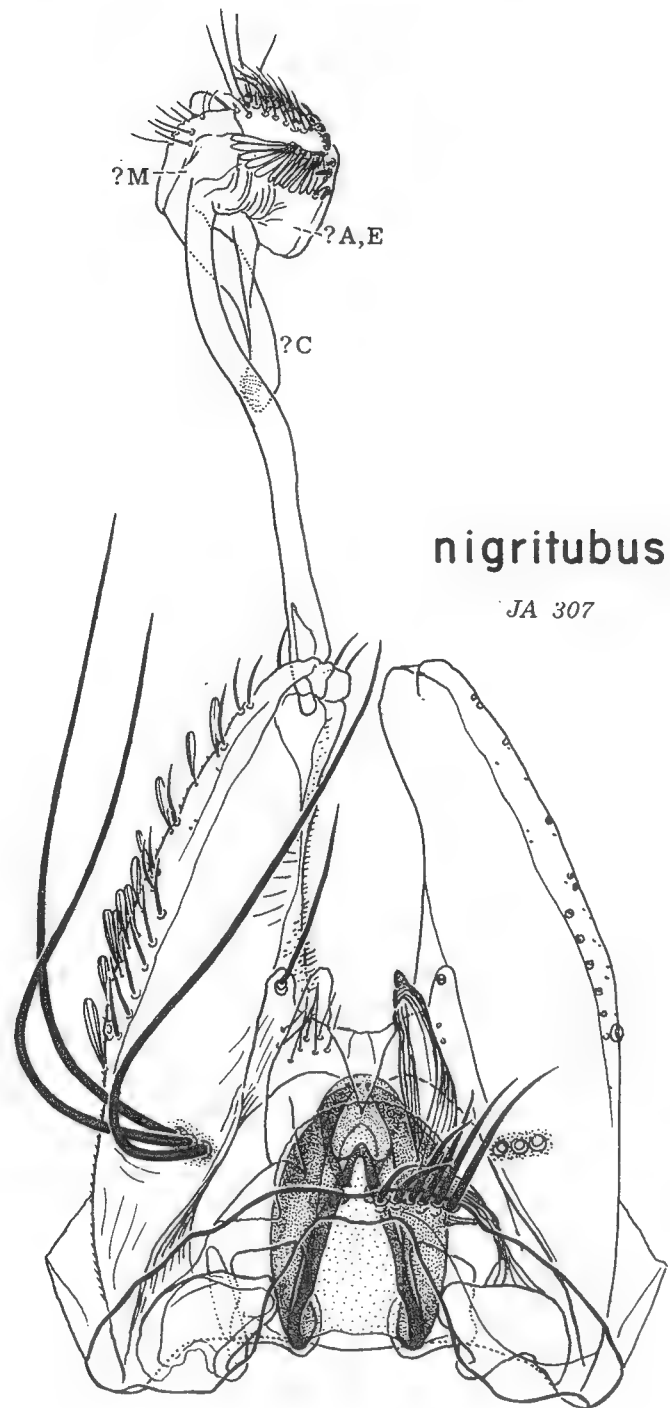
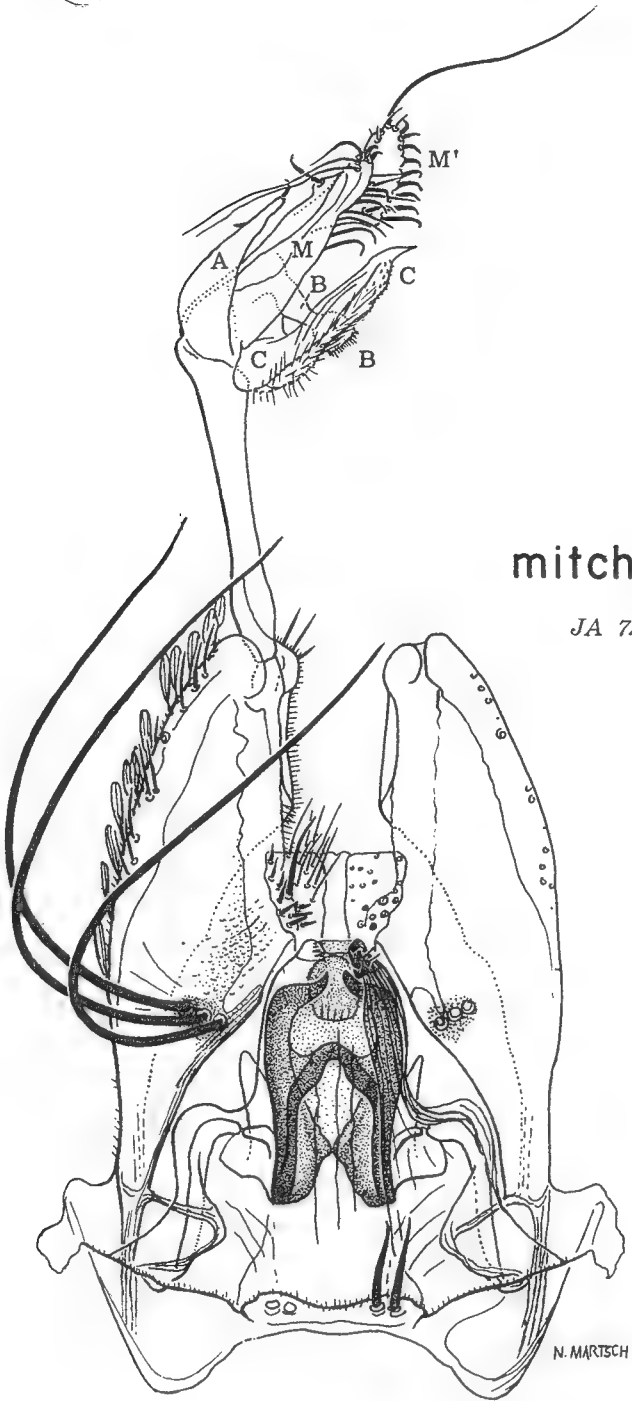
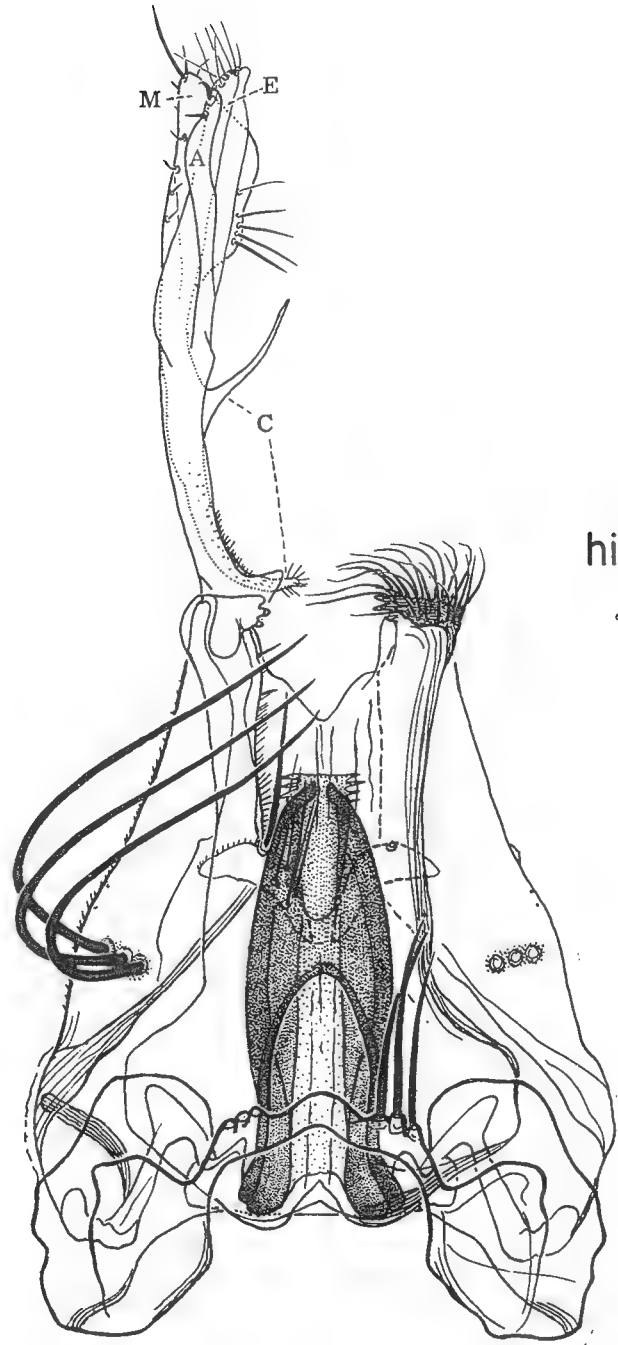
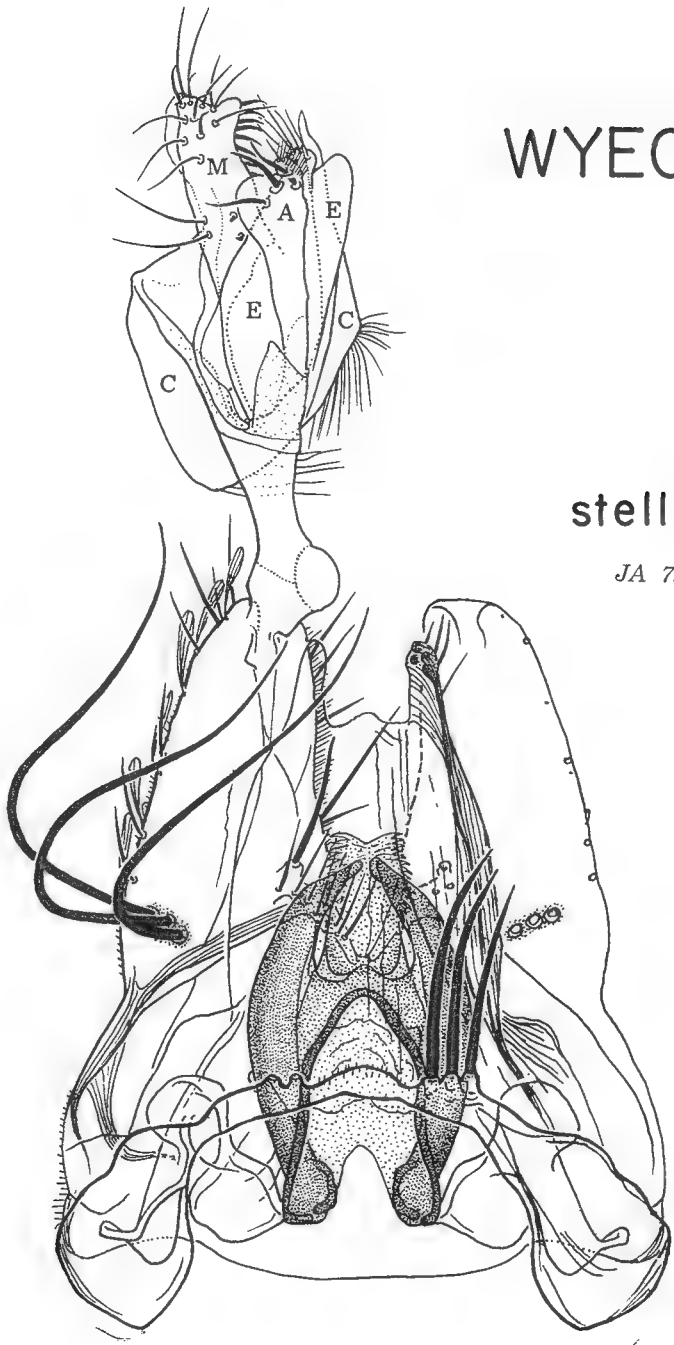
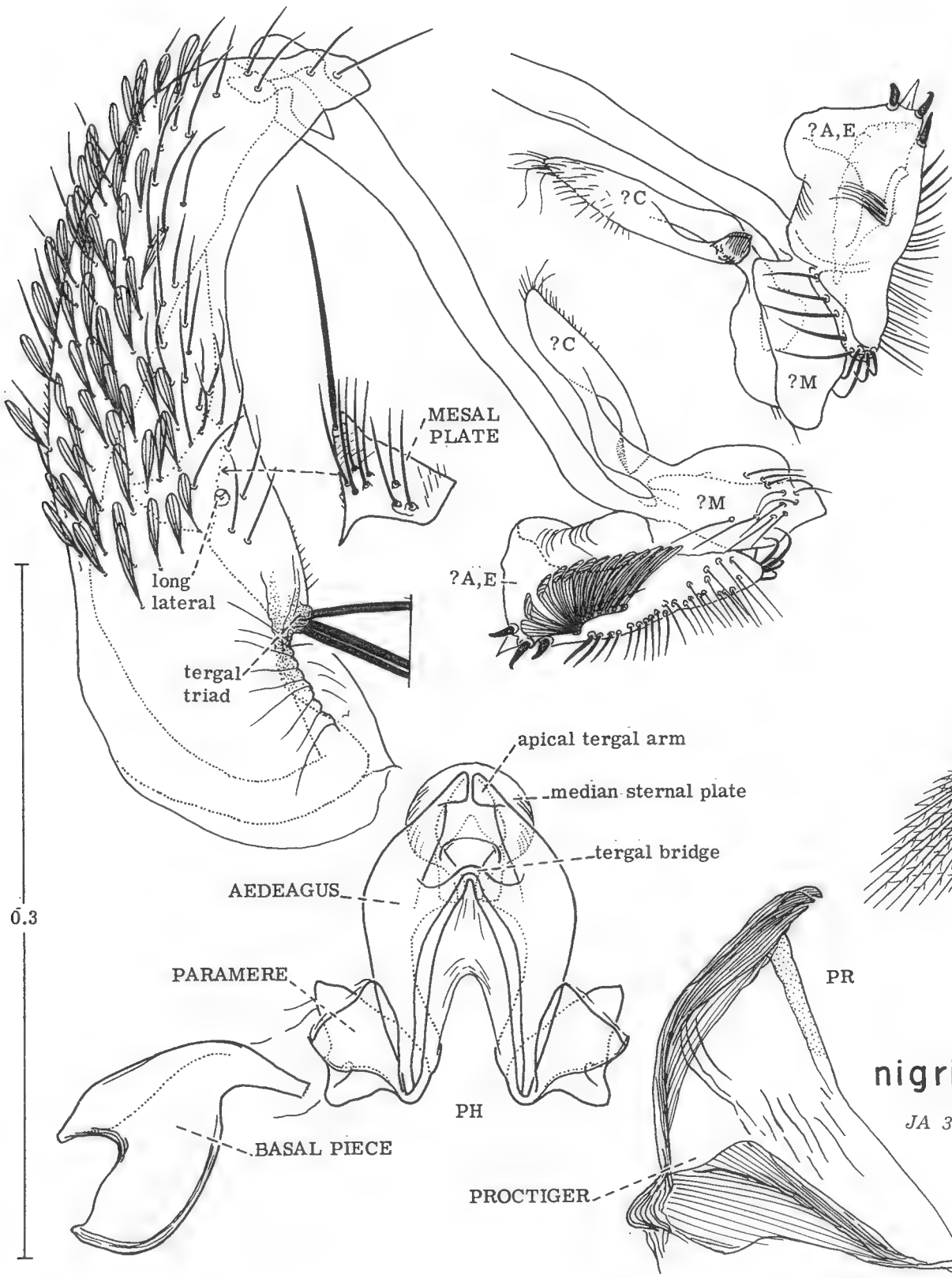
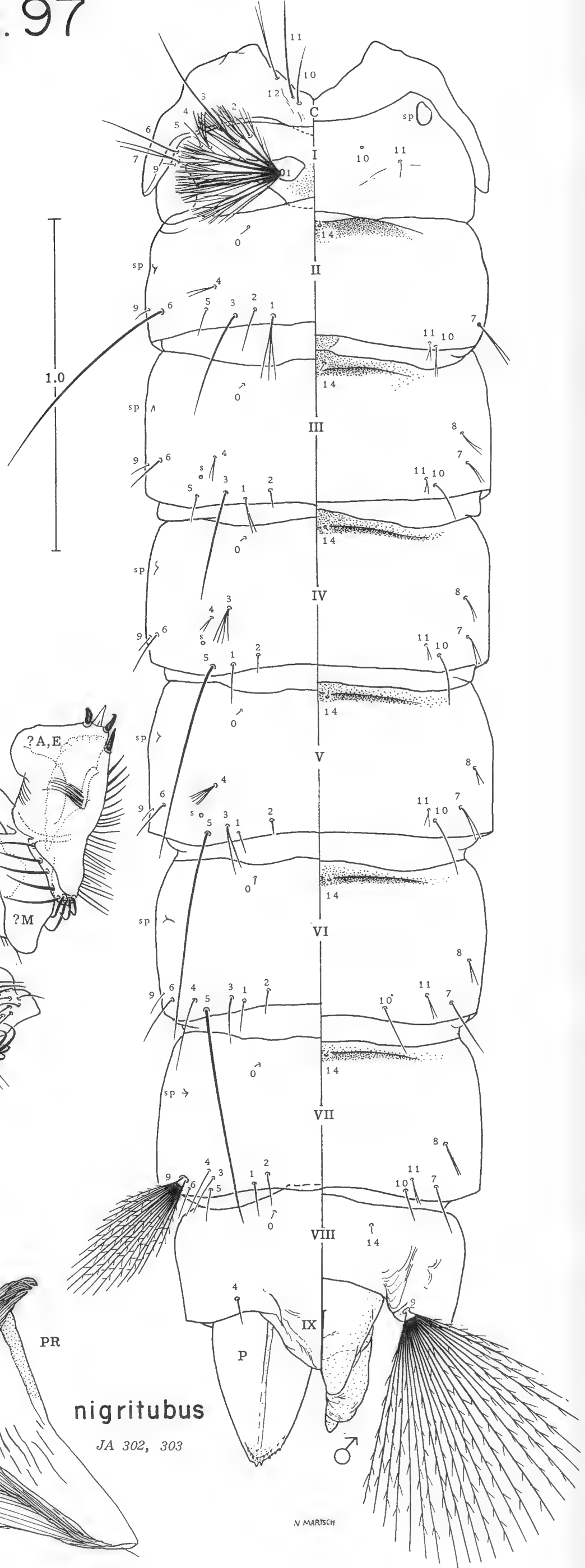
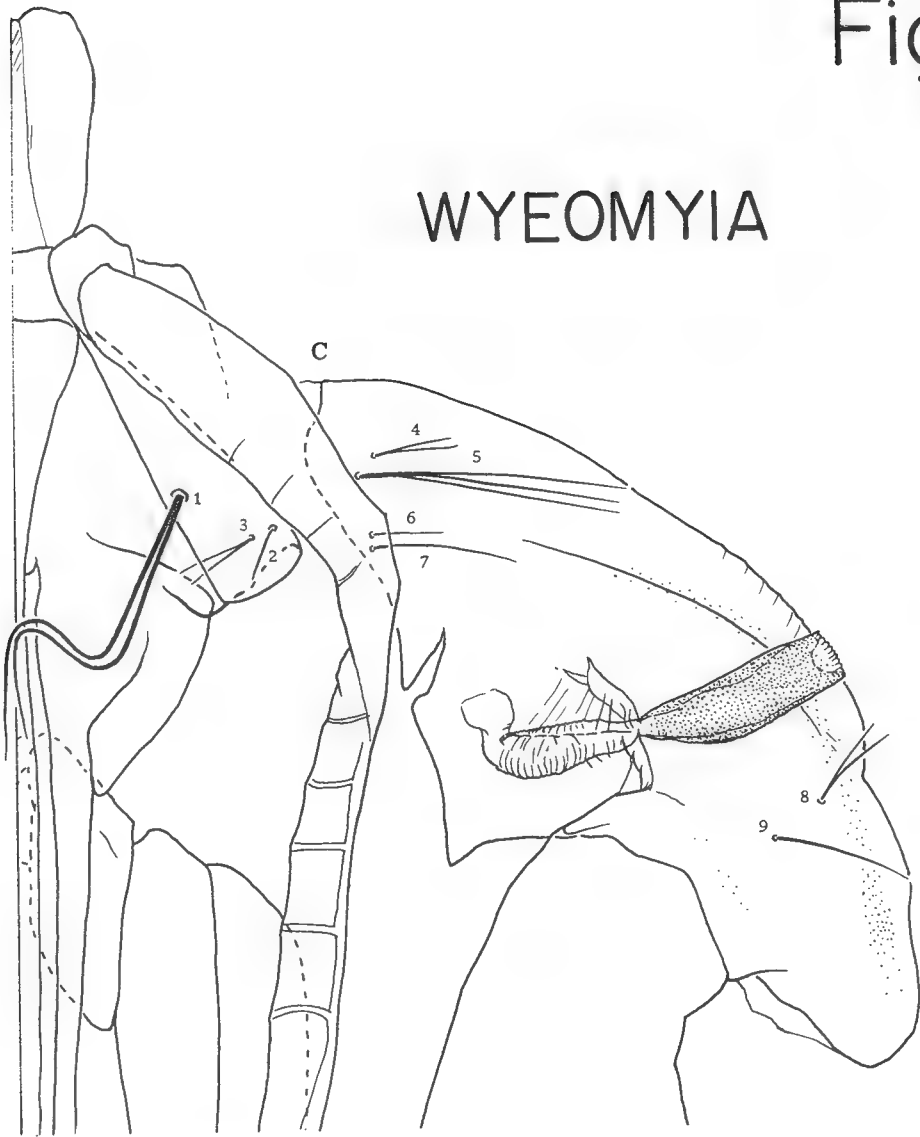


Fig. 97

WYEOMYIA



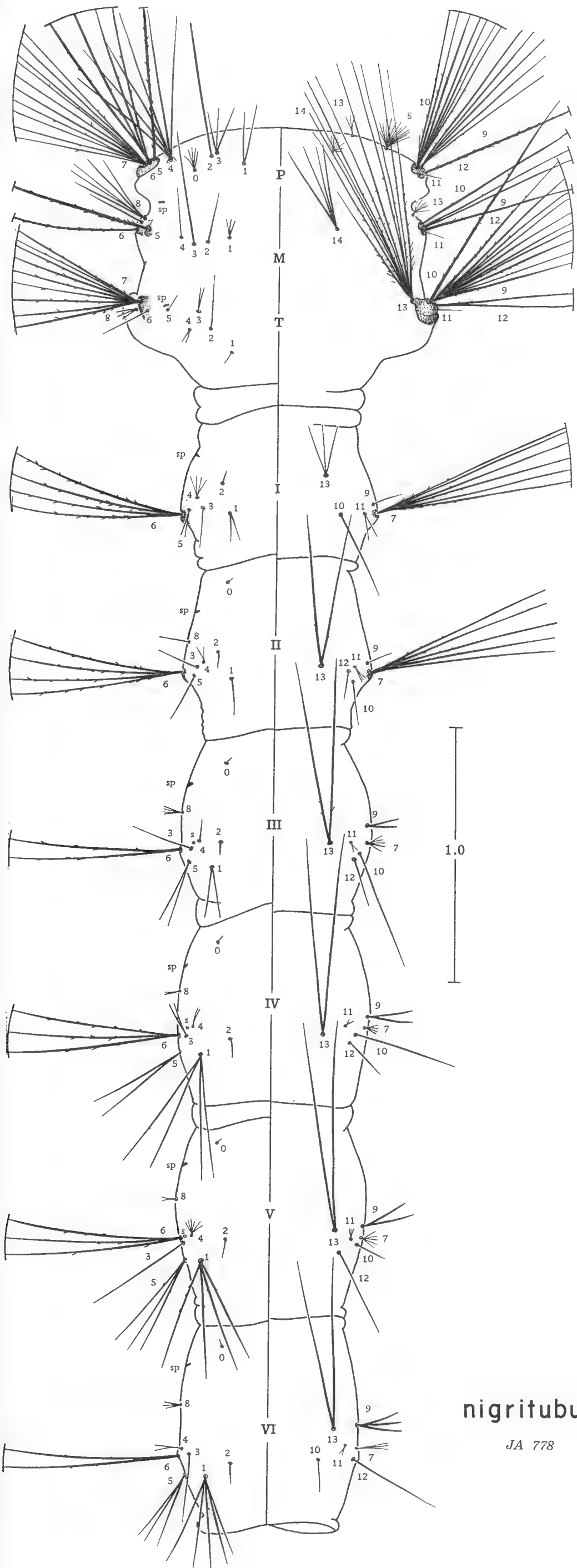
nigritubus

JA 302, 303

N. MARITSCH

Fig. 98

WYEOMYIA



nigritubus

JA 778

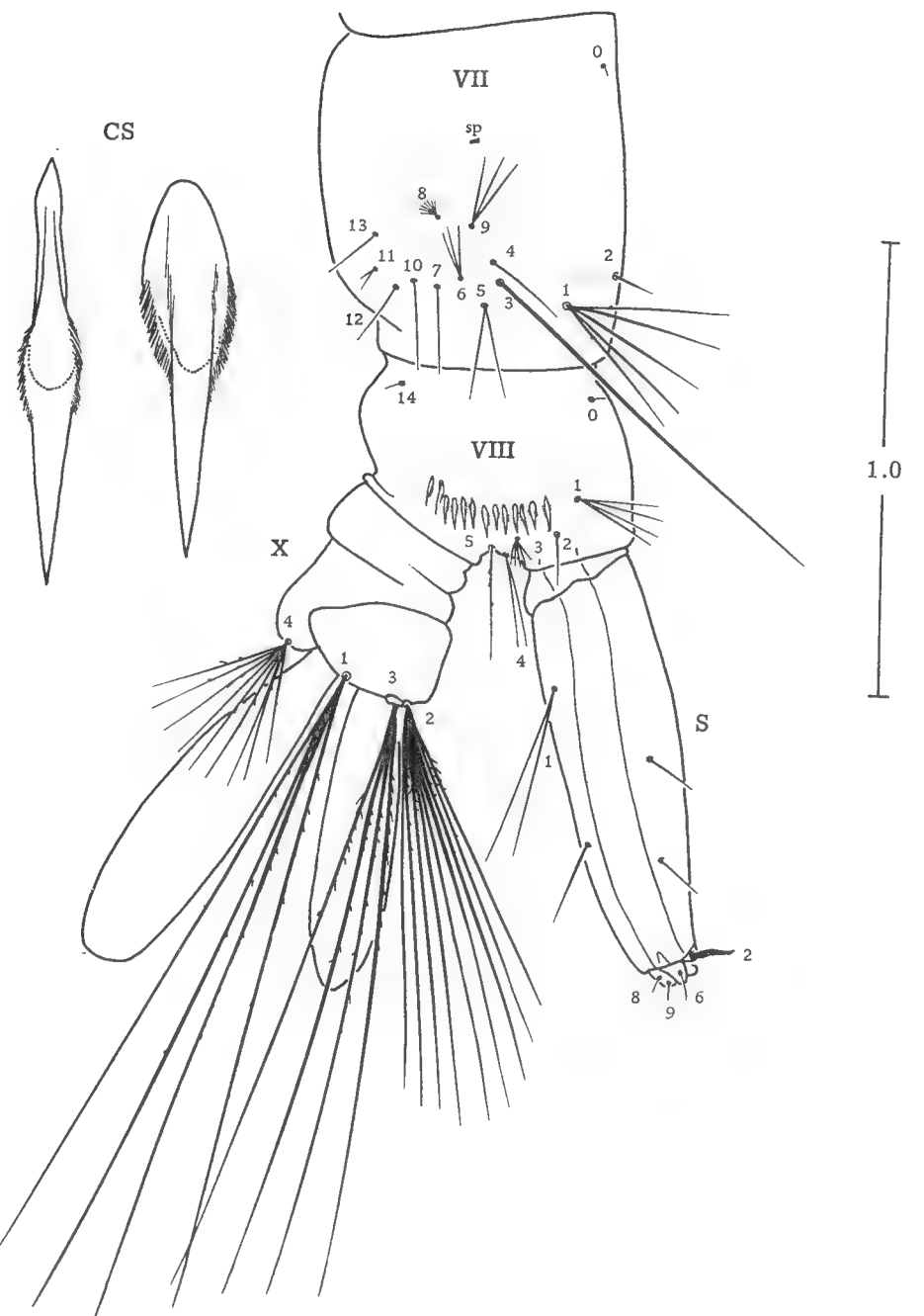
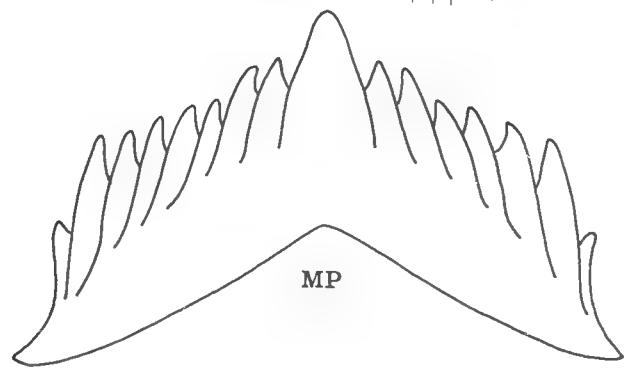
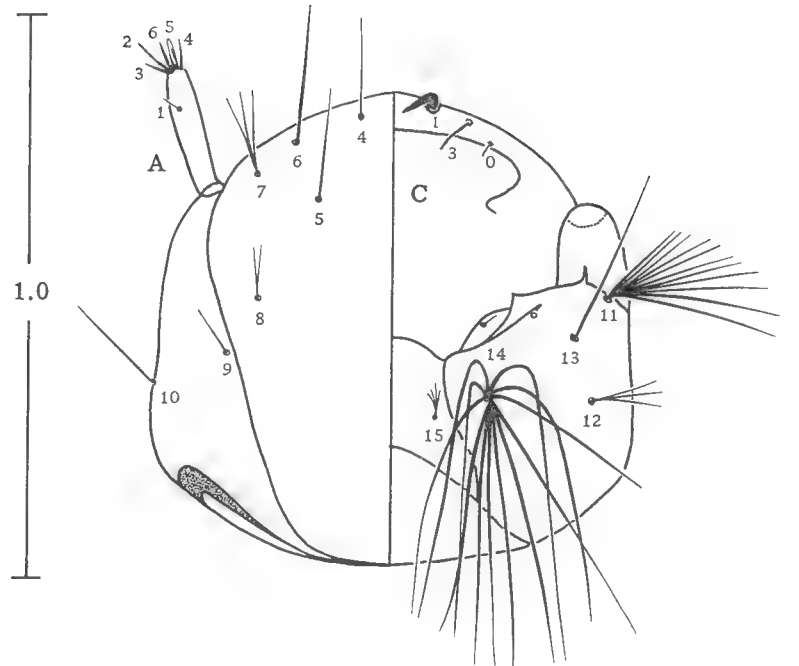
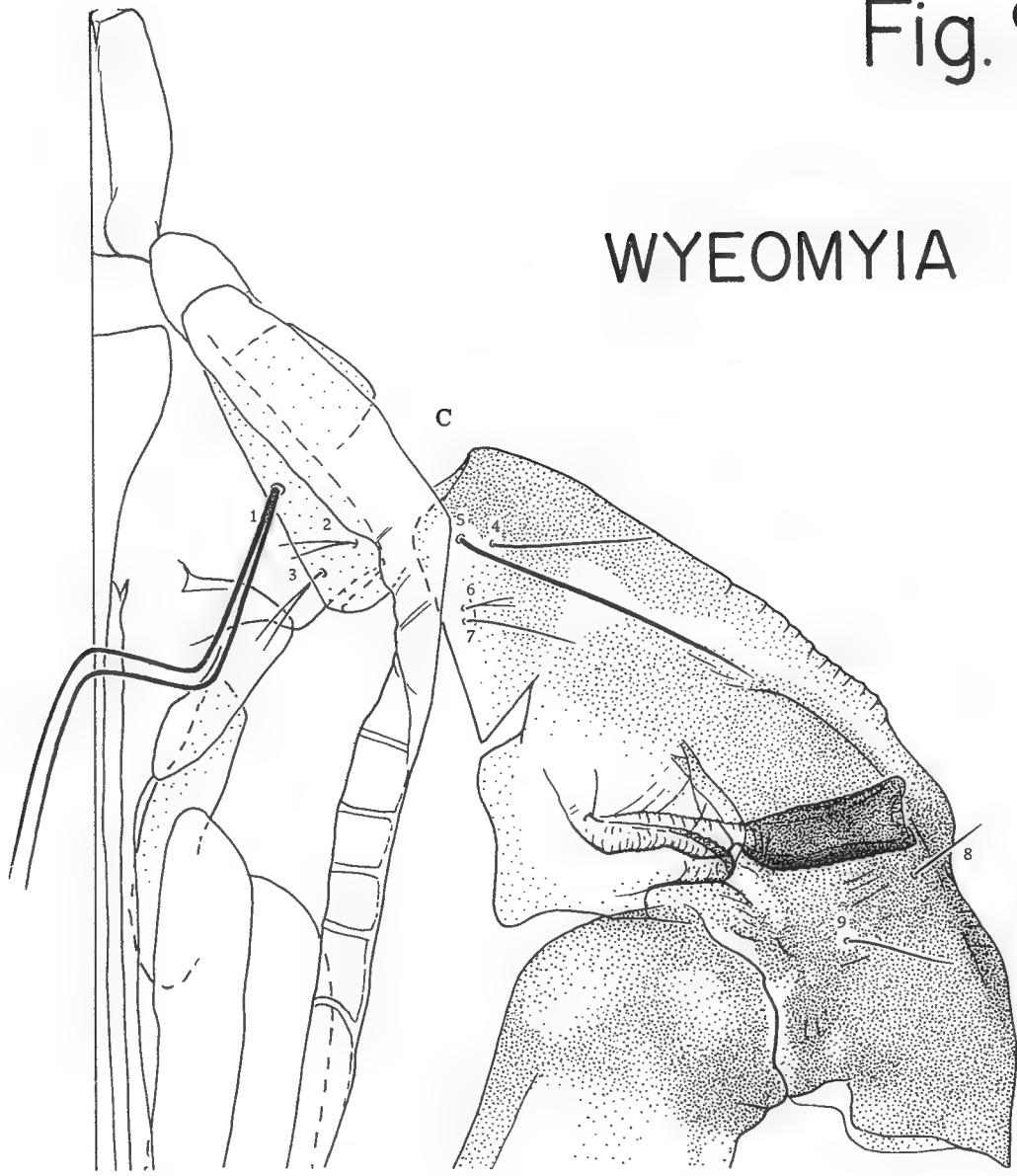
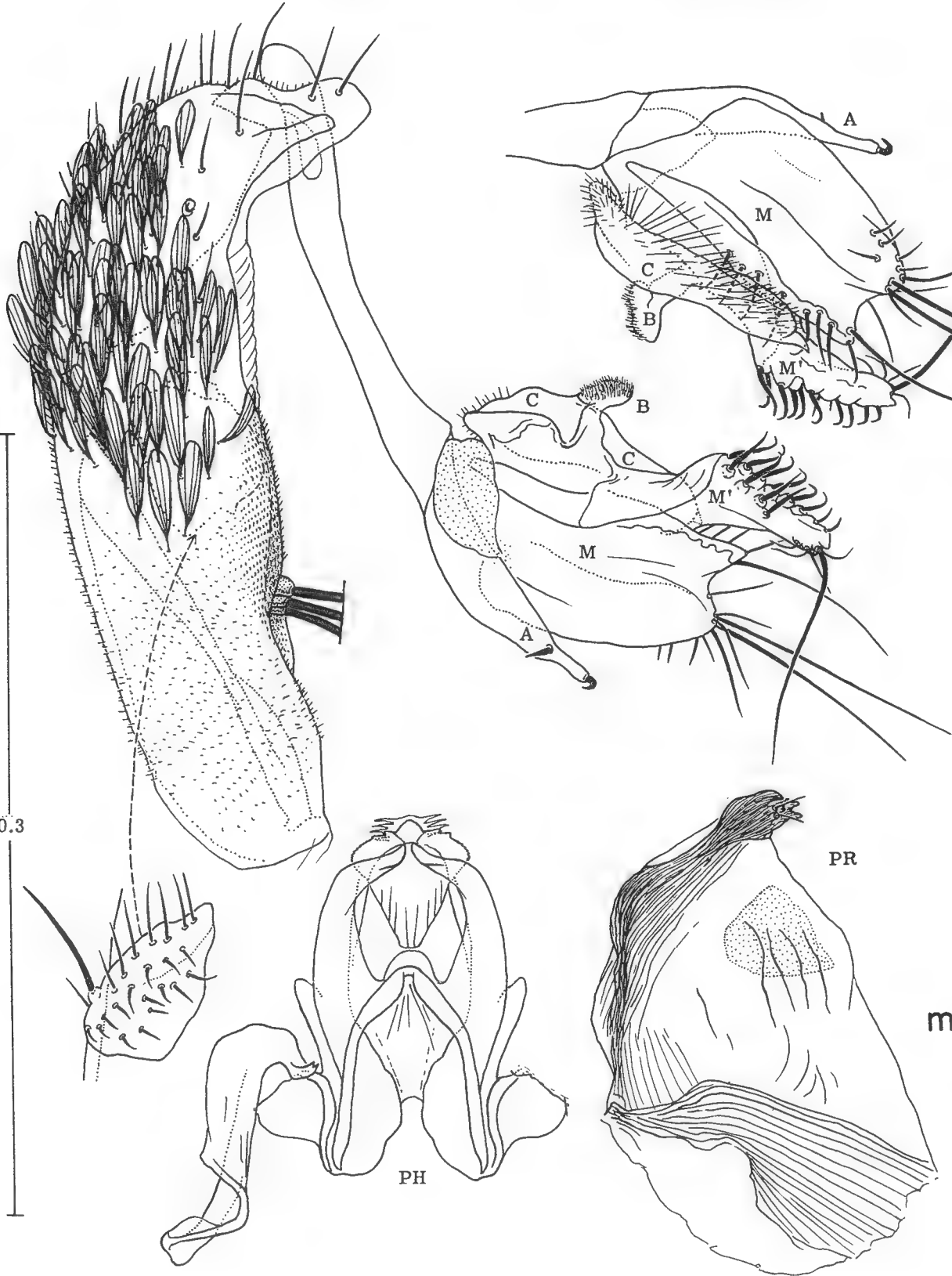
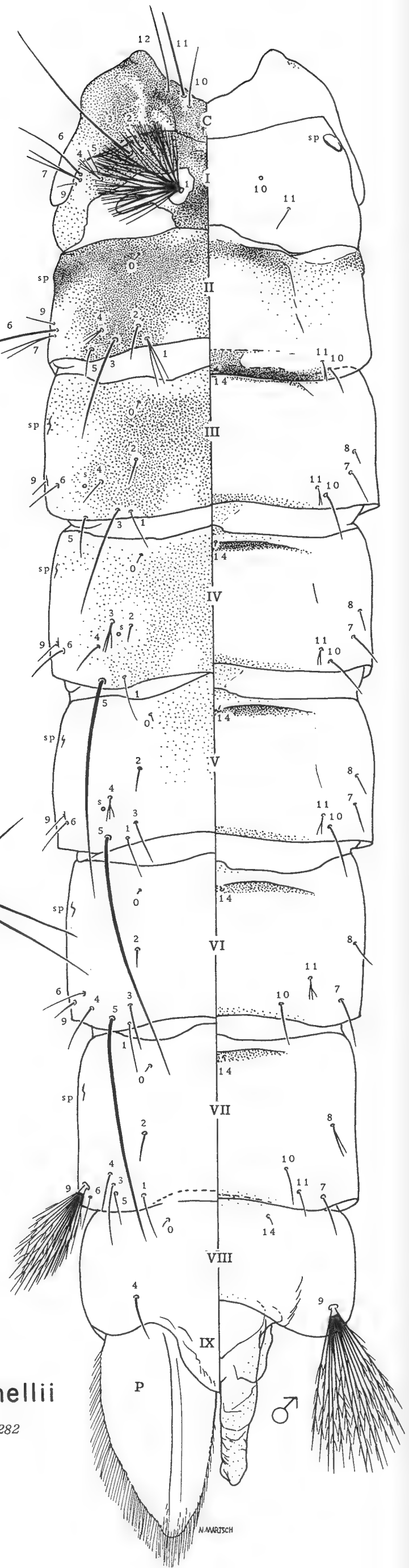


Fig. 99

WYEOMYIA



1.0



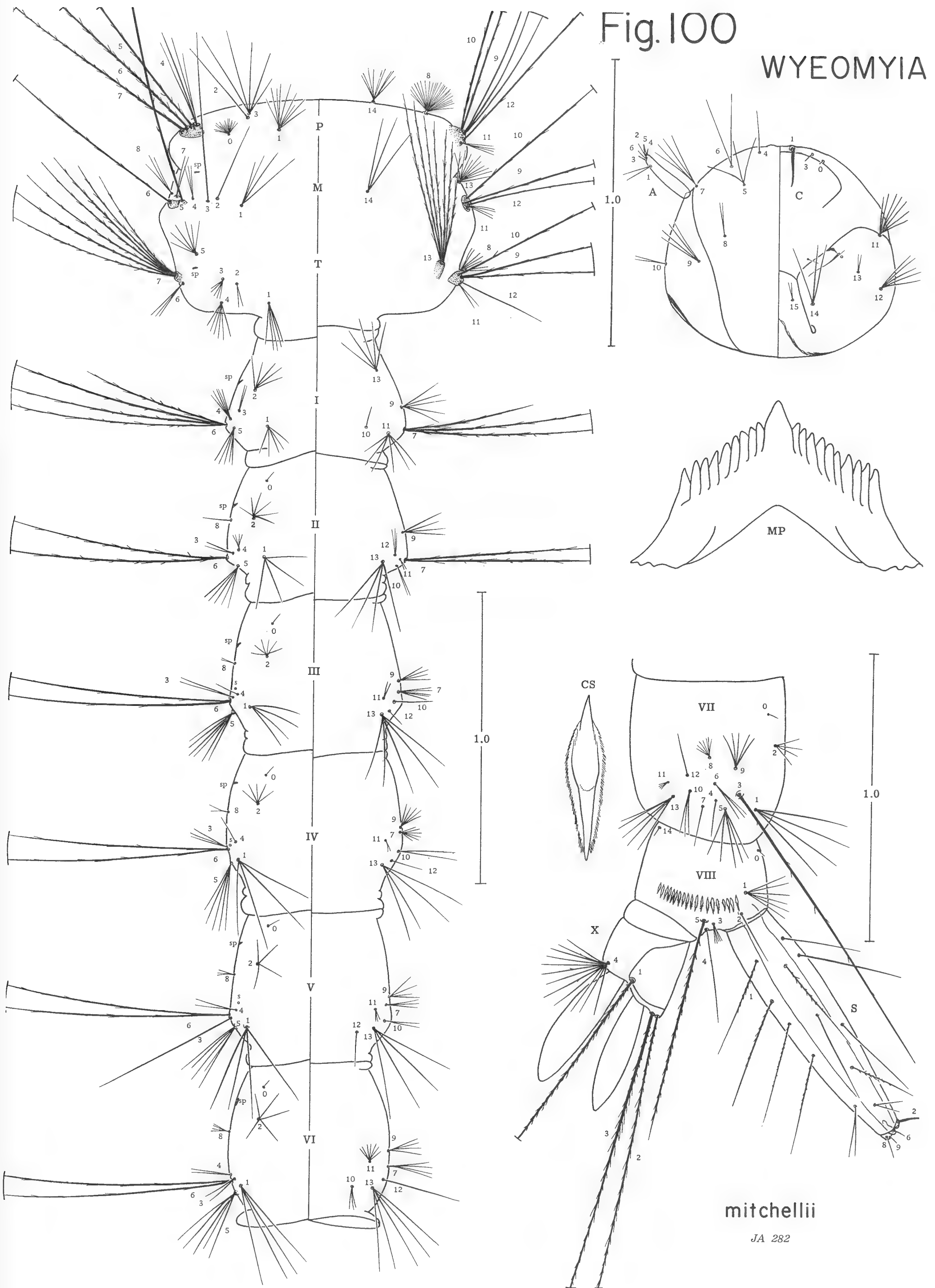
mitchellii

JA 282

N. MARJICH

Fig. 100

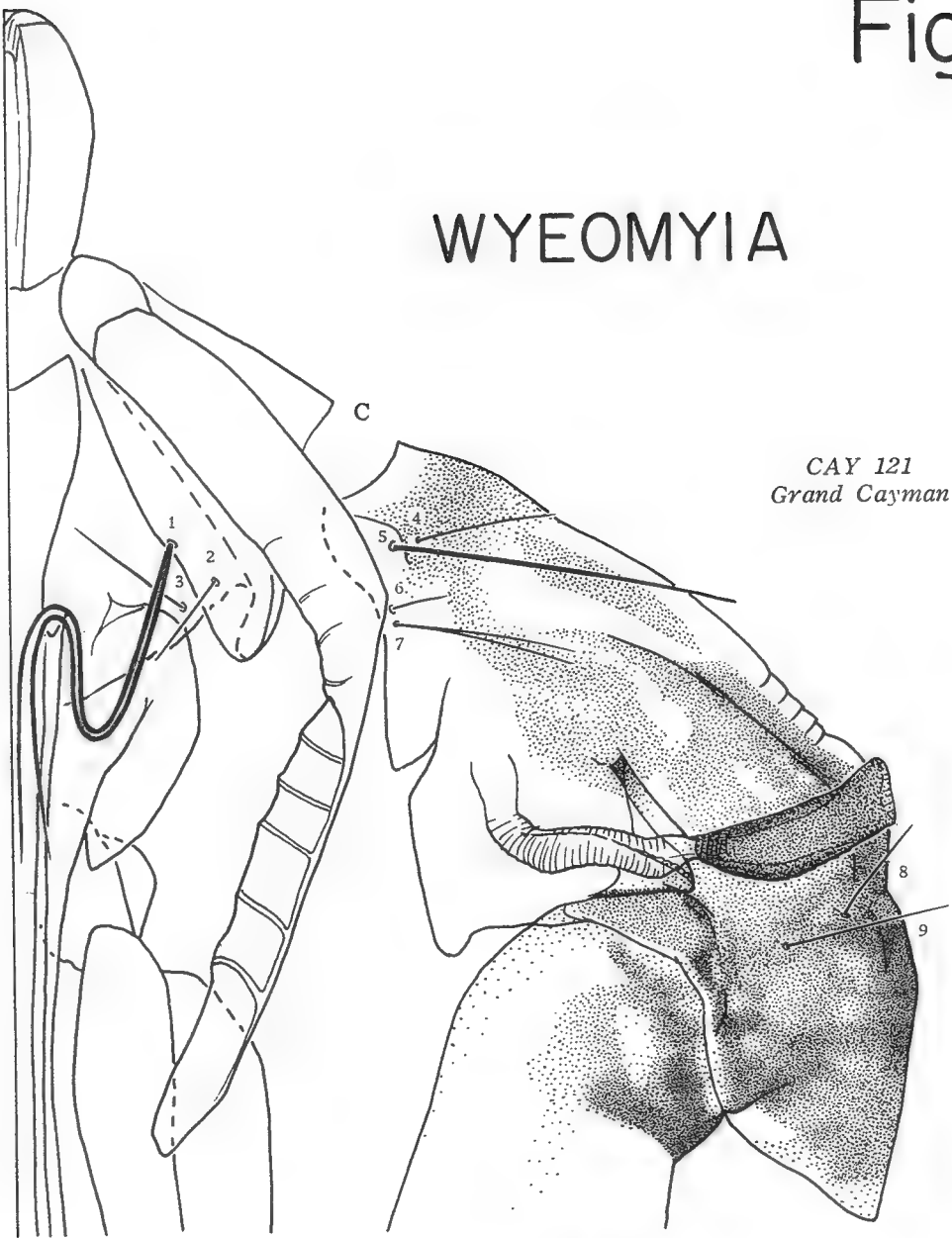
WYEOMYIA



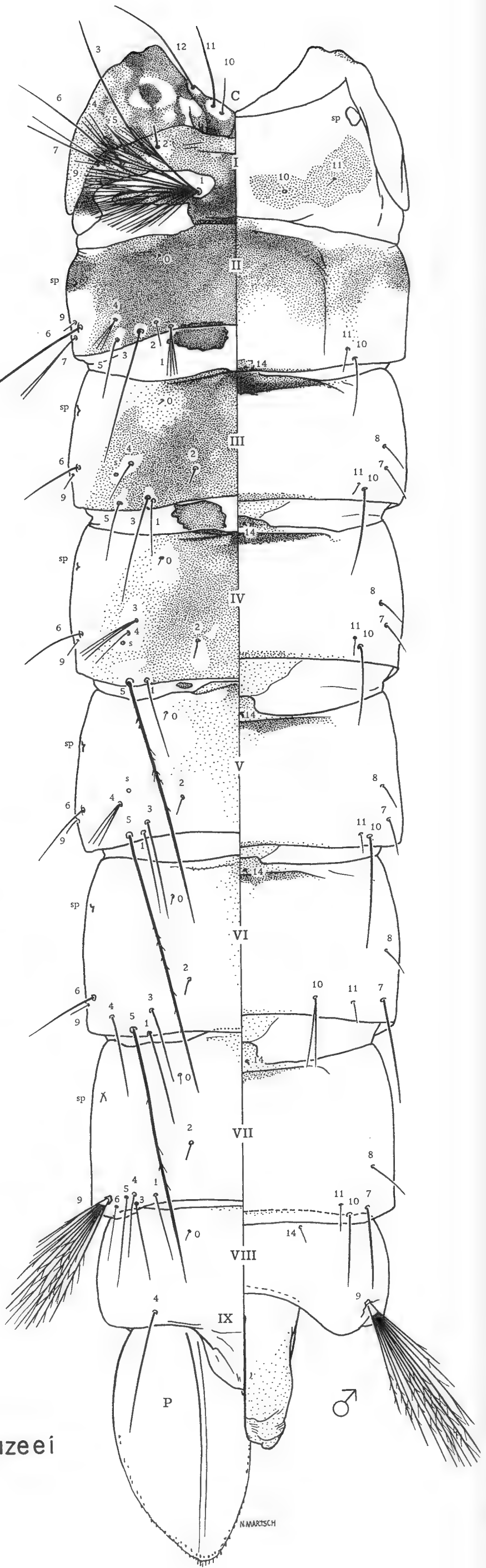
mitchellii

Fig. 101

WYEOMYIA

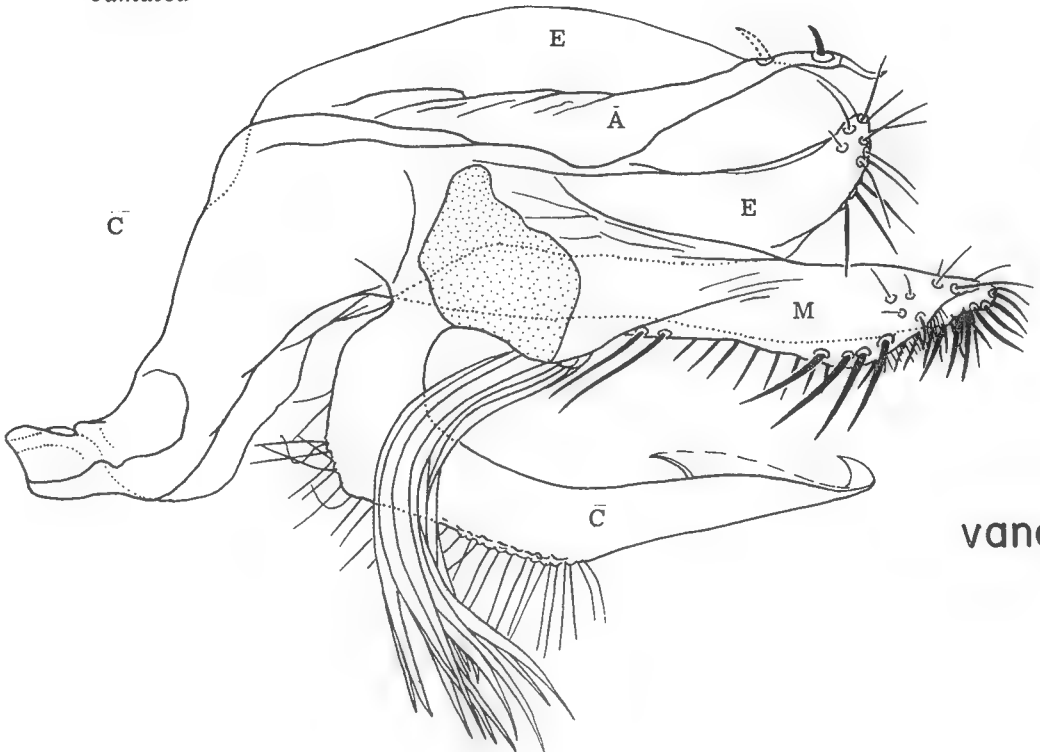


1.0



Hill & Hill 84
Jamaica

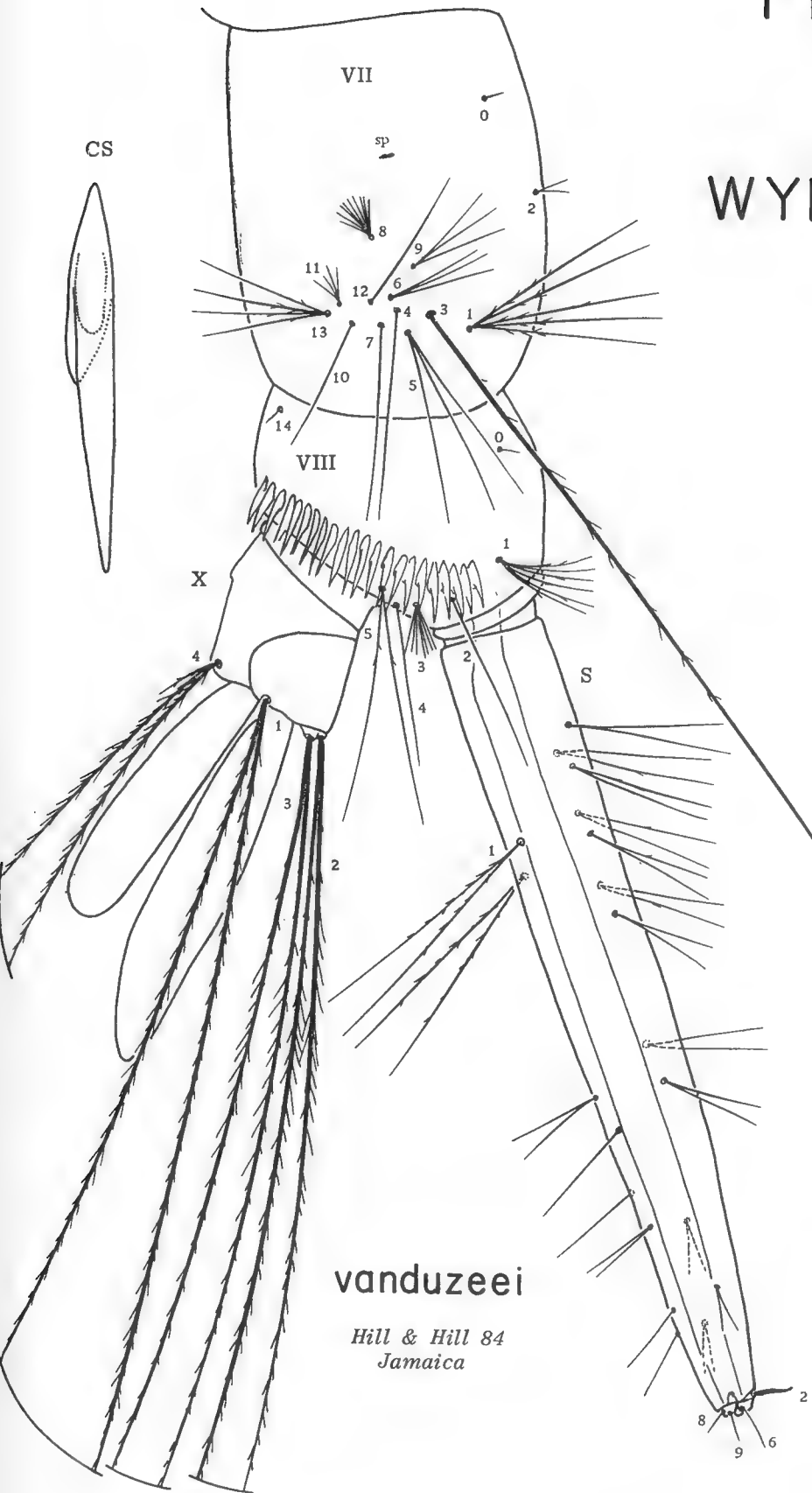
0.3



vanduzeei

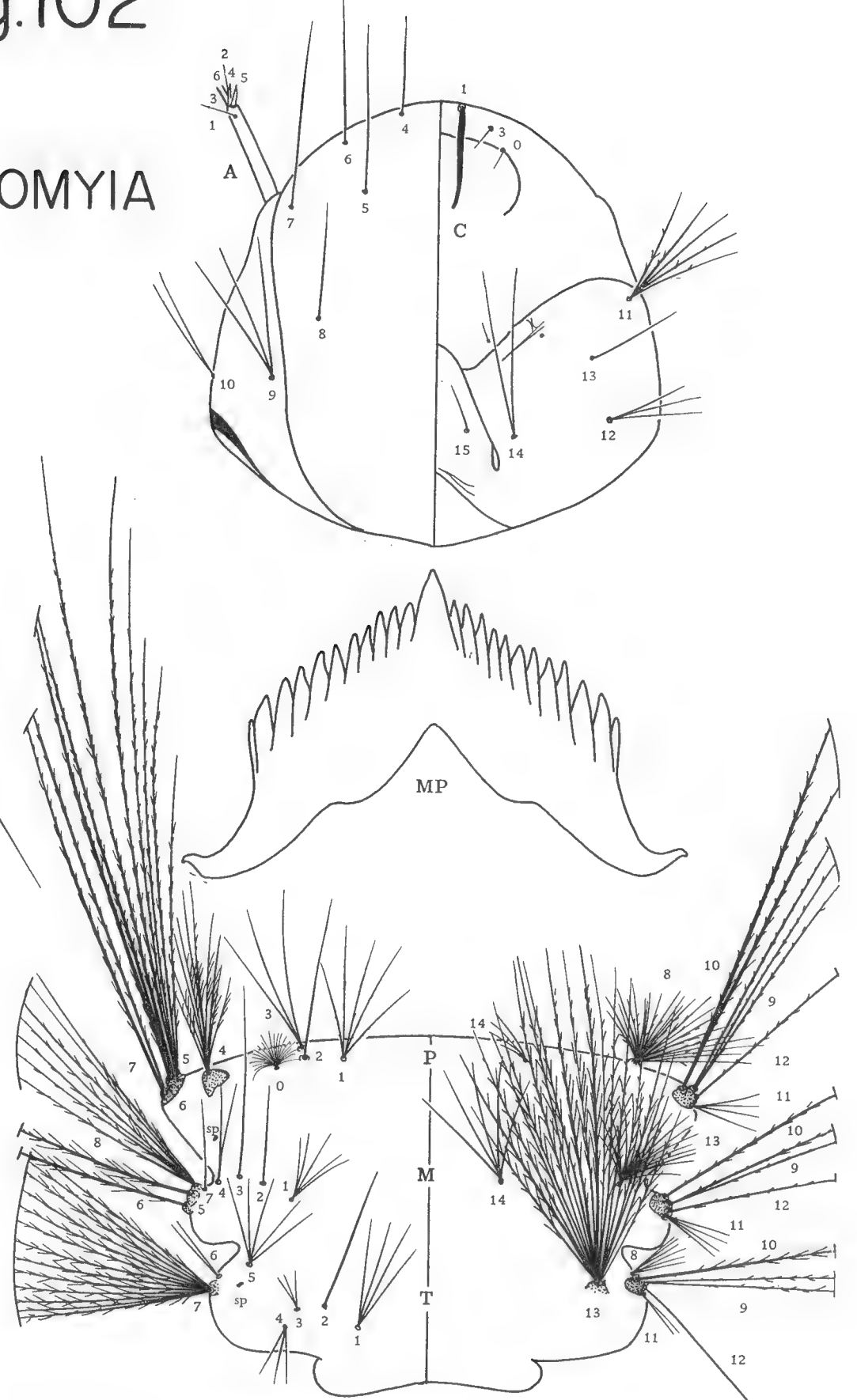
Fig.102

WYEOMYIA



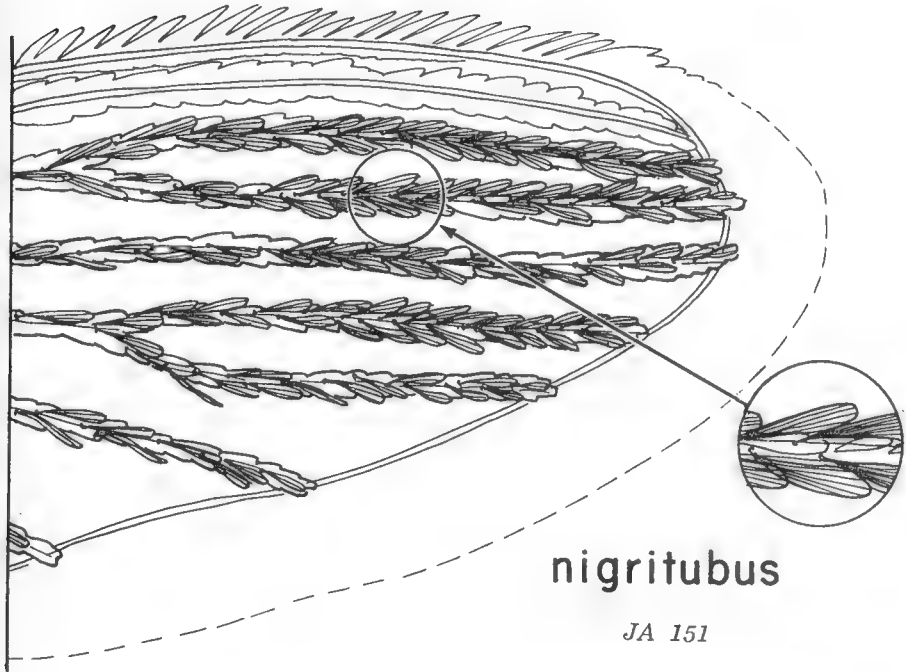
vanduzeei

Hill & Hill 84
Jamaica



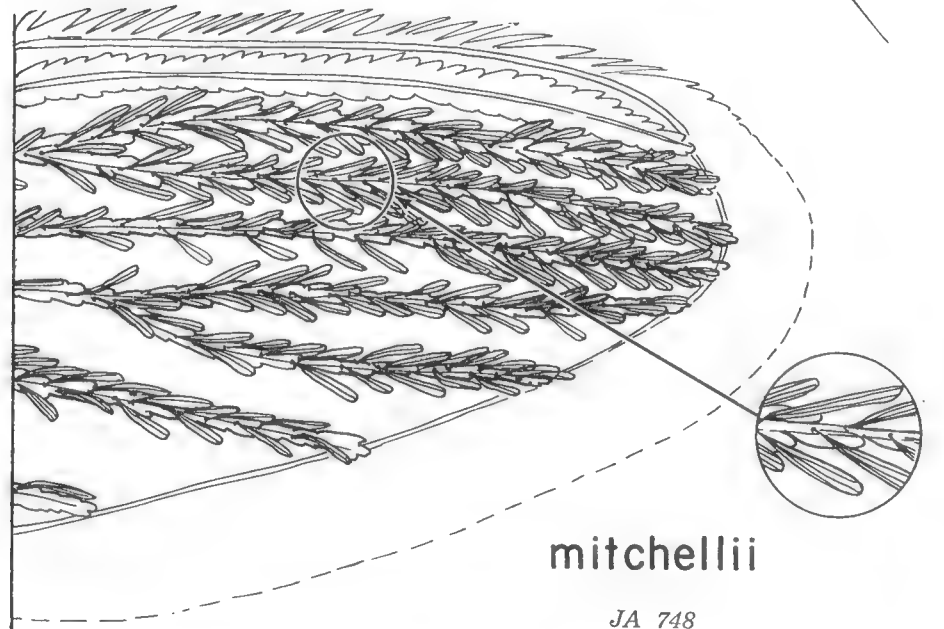
mitchellii

JA 748

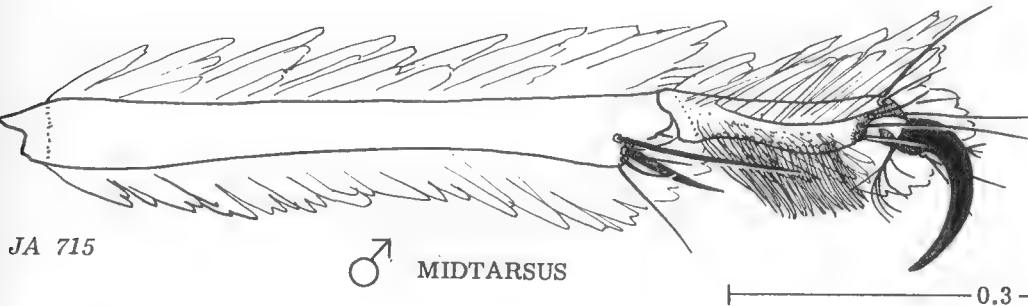


nigrifubus

JA 151

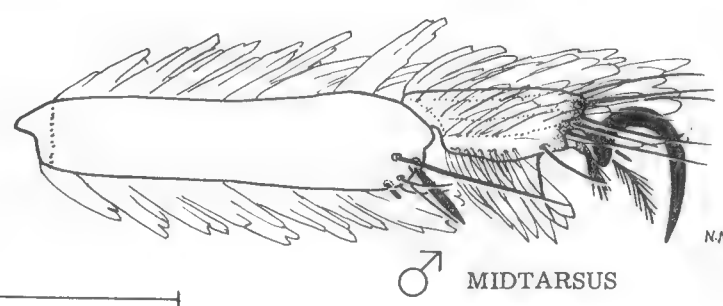


♀



JA 715

♂ MIDTARSUS



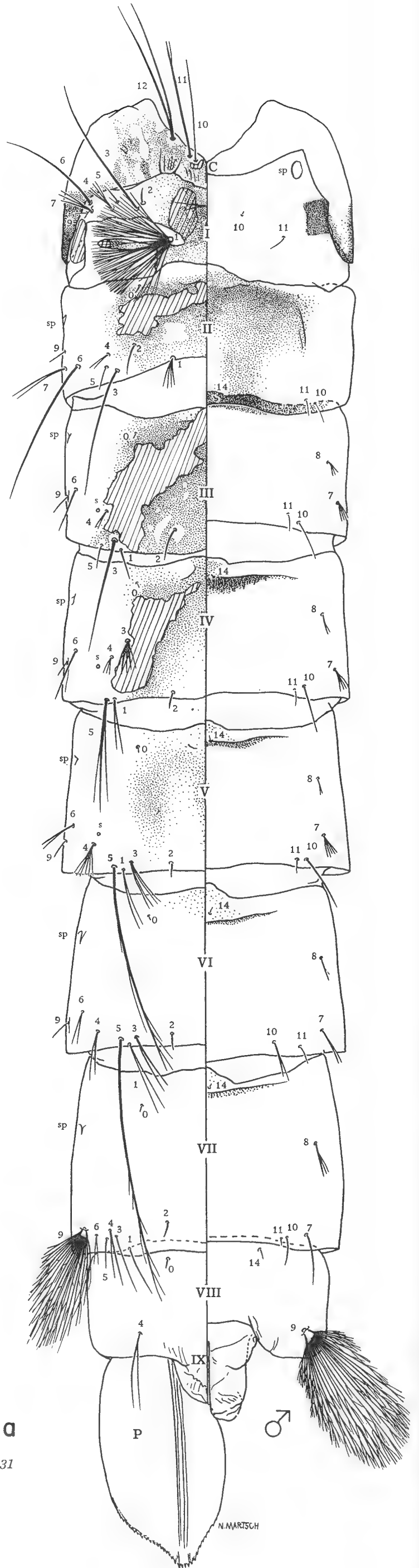
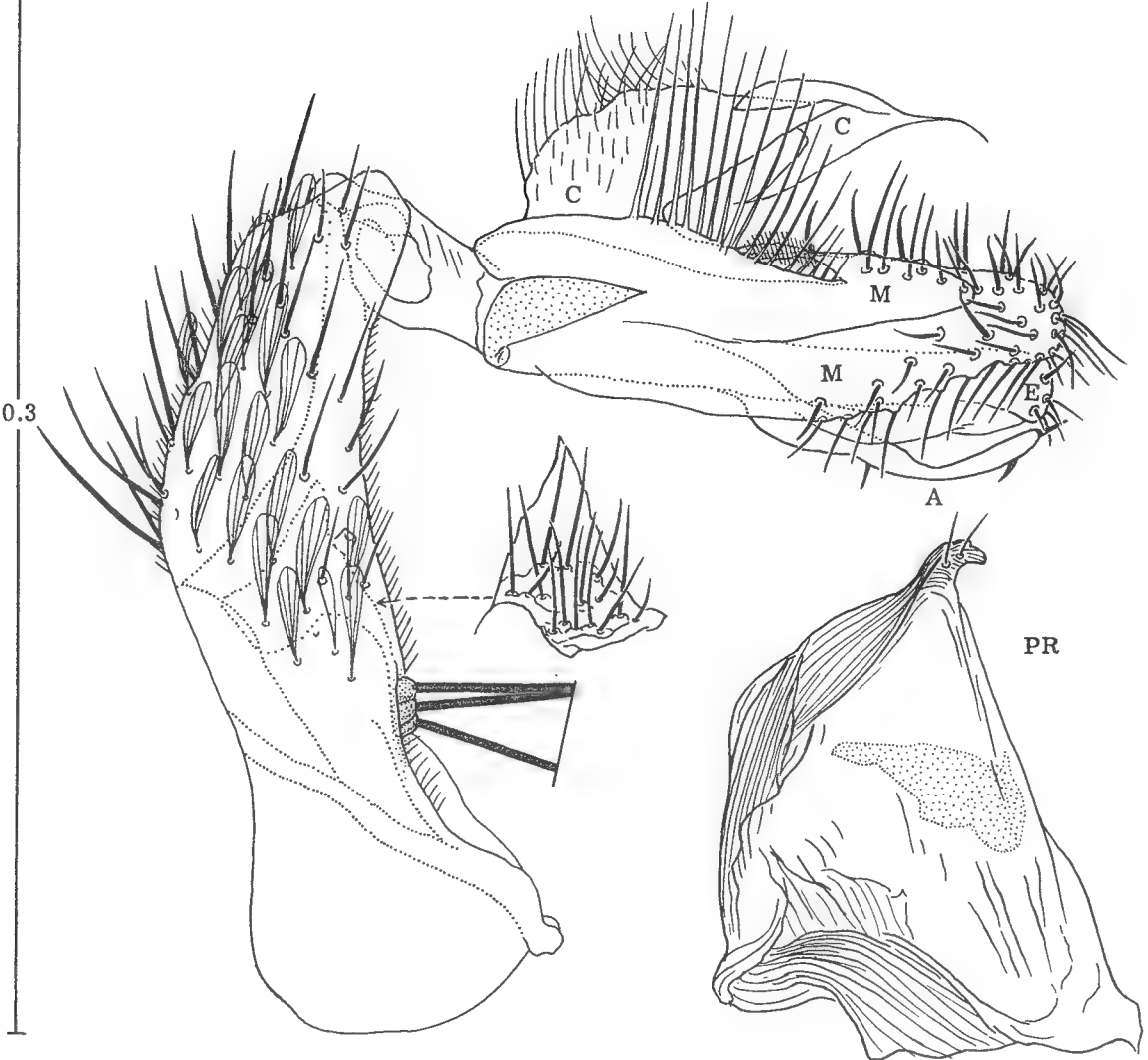
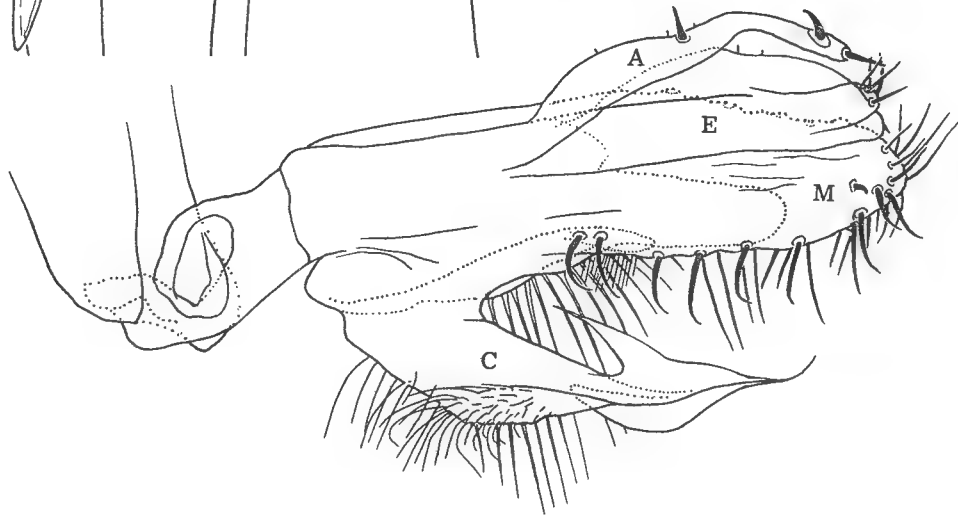
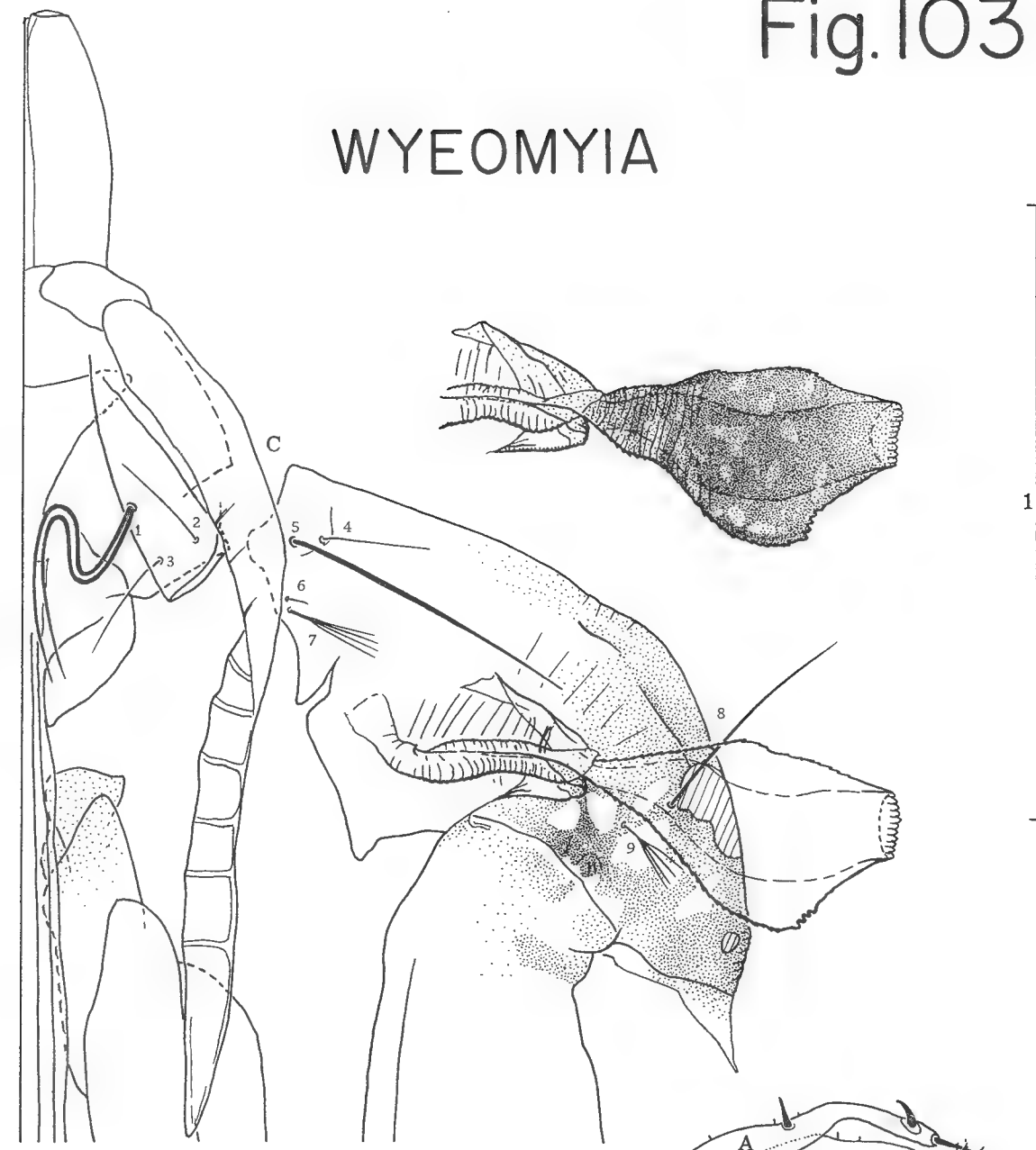
JA 184

♂ MIDTARSUS

N. MARITSCH

Fig. 103

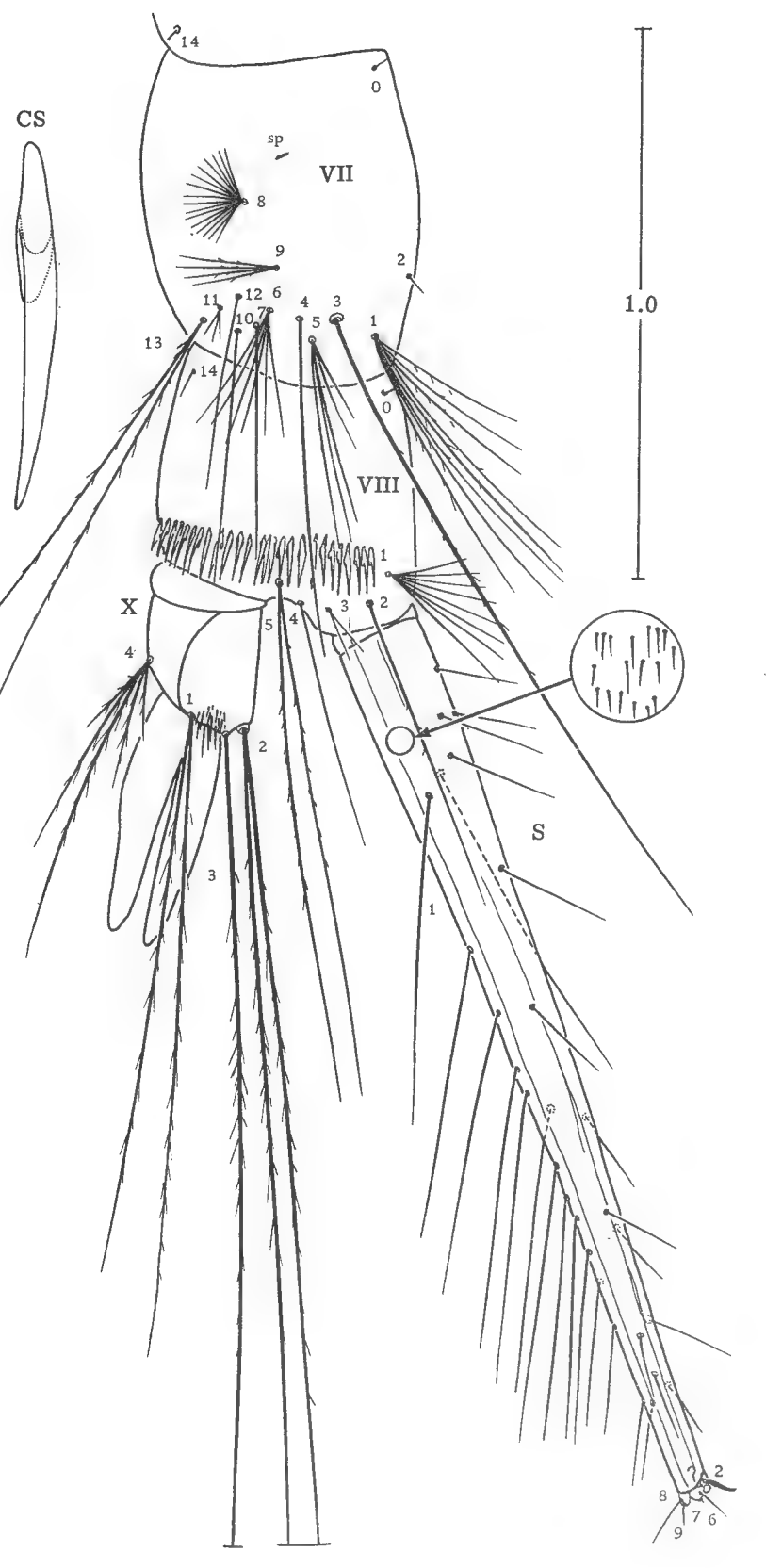
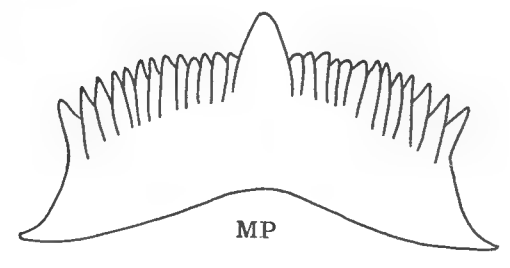
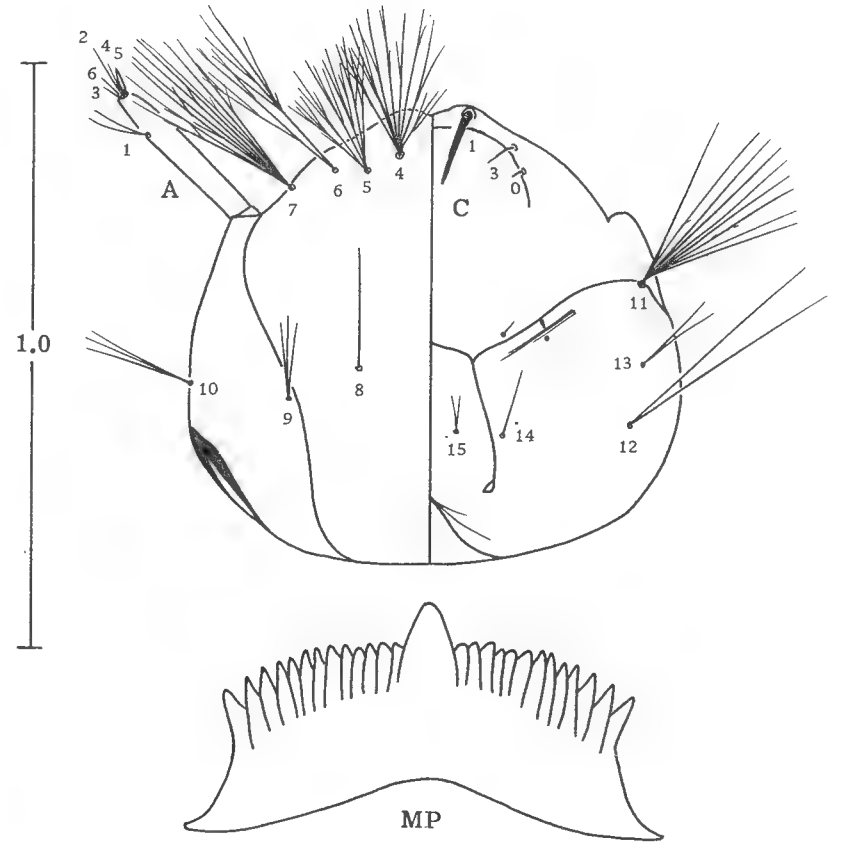
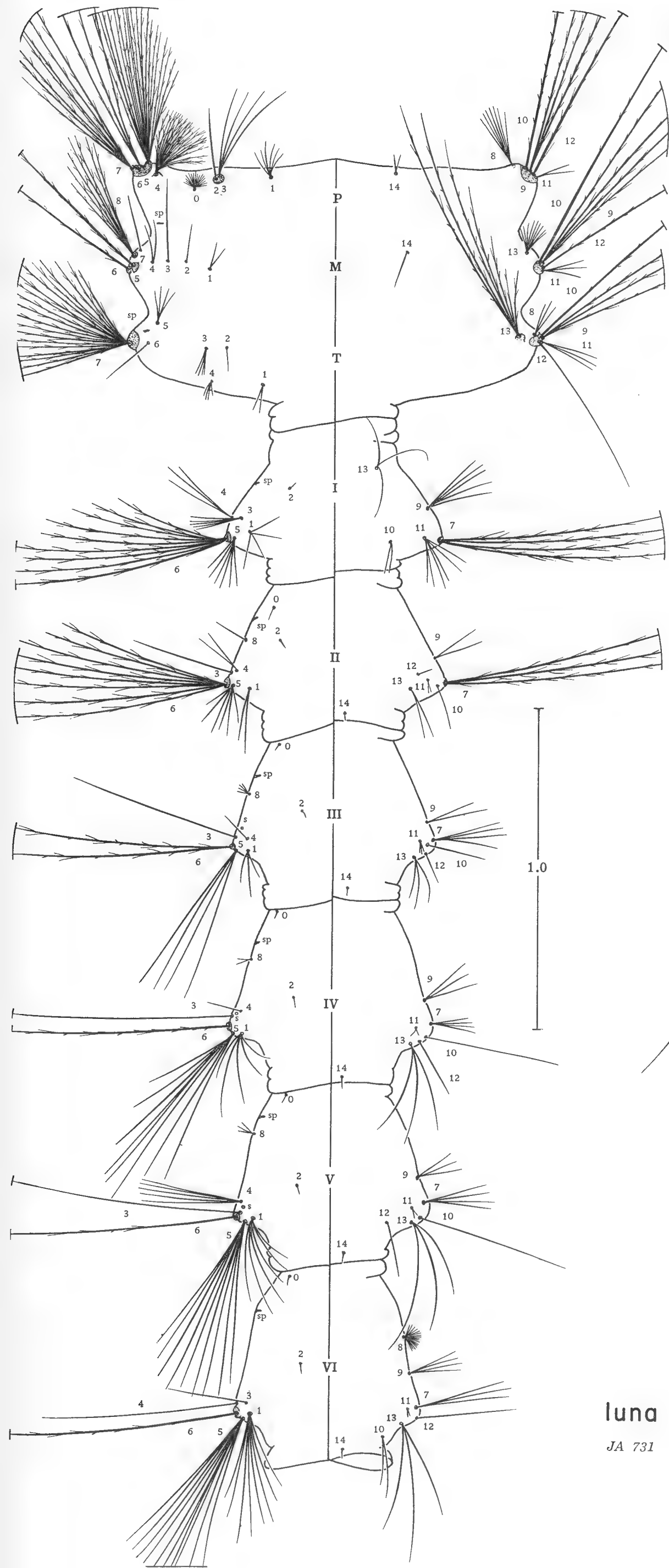
WYEOMYIA



luna
JA 731

Fig. 104

WYEOMYIA



luna
JA 731

Fig. 105

WYEOMYIA

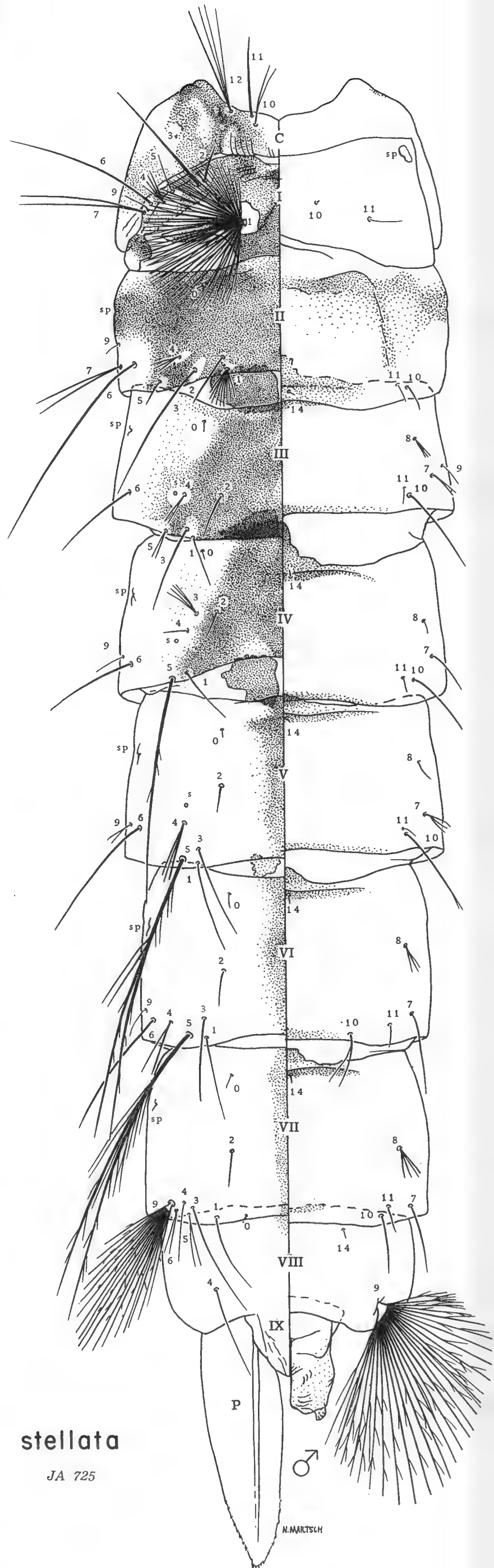
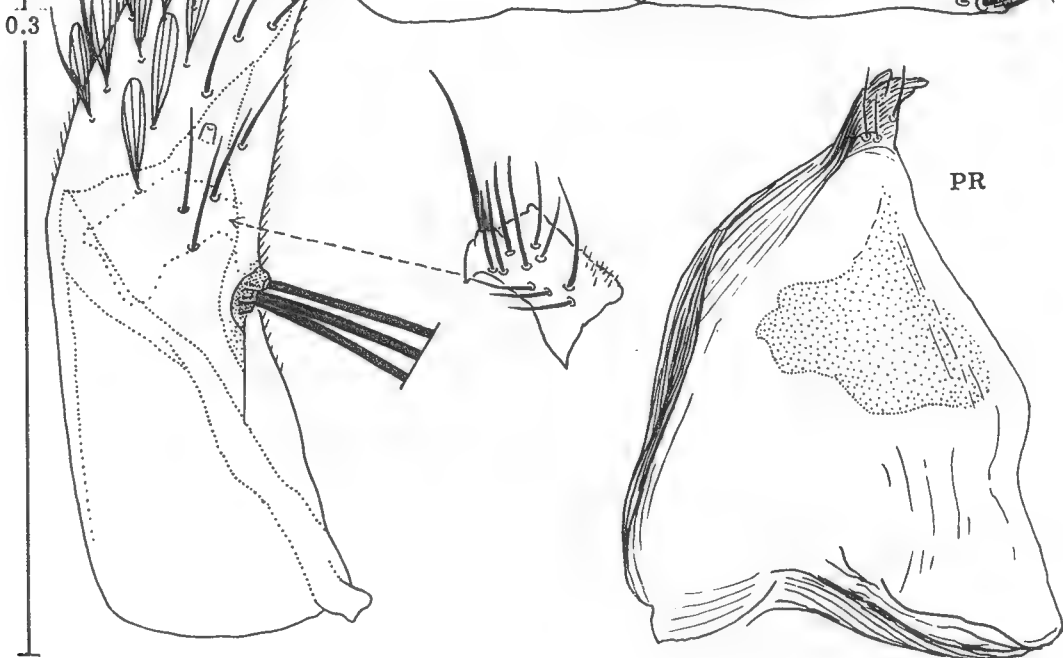
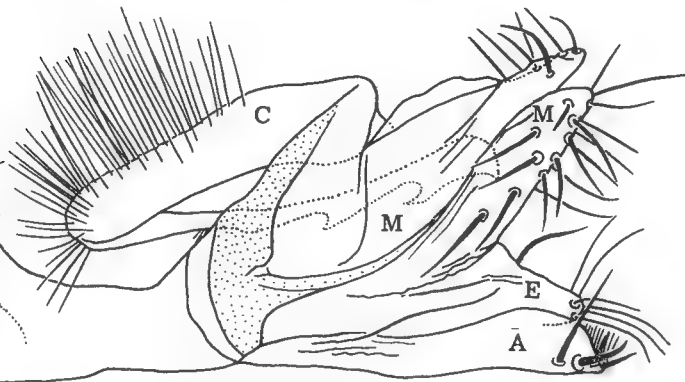
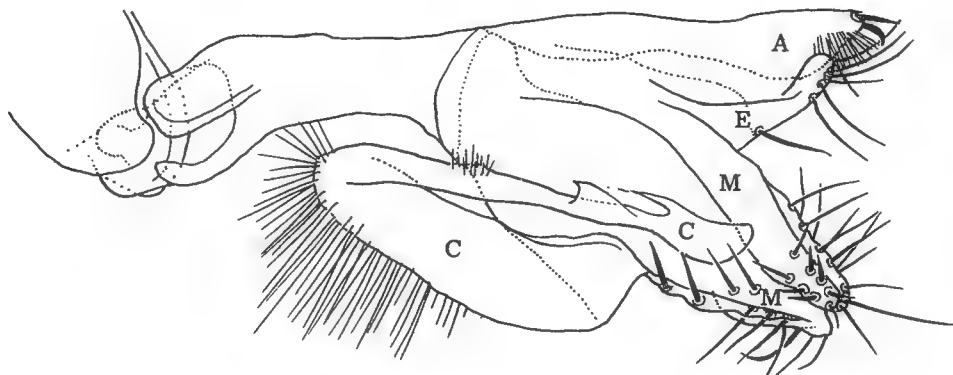
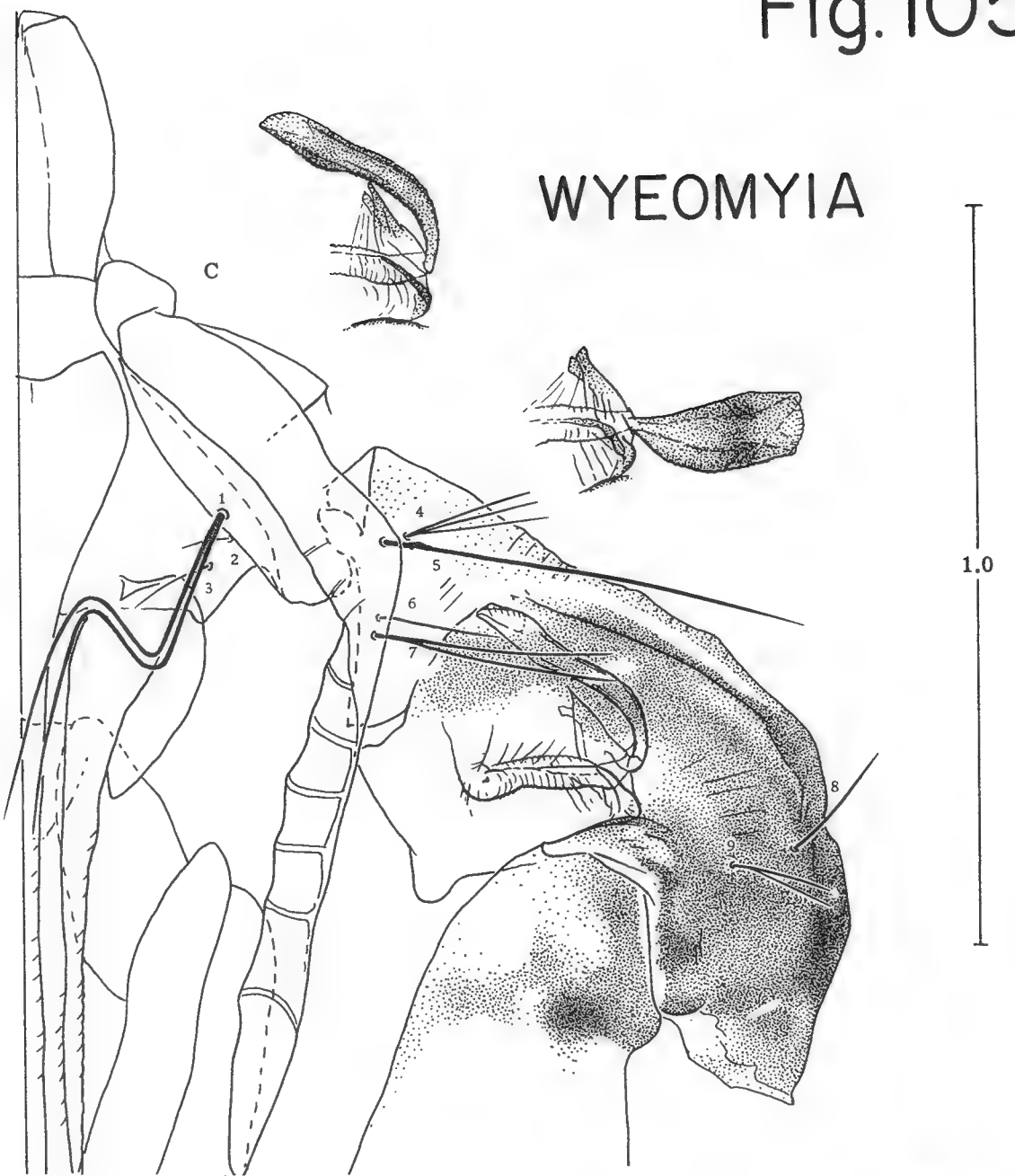
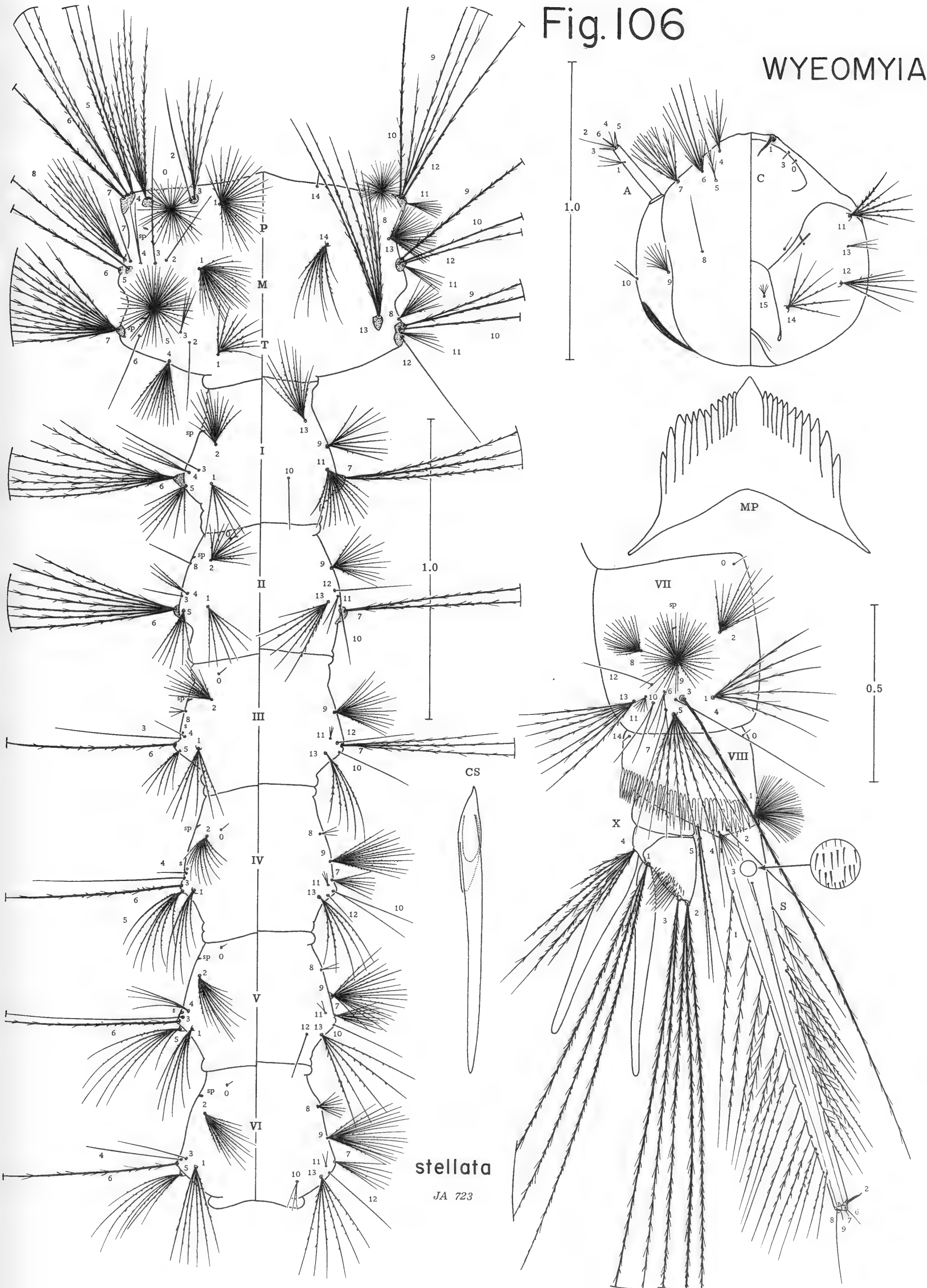


Fig. 106

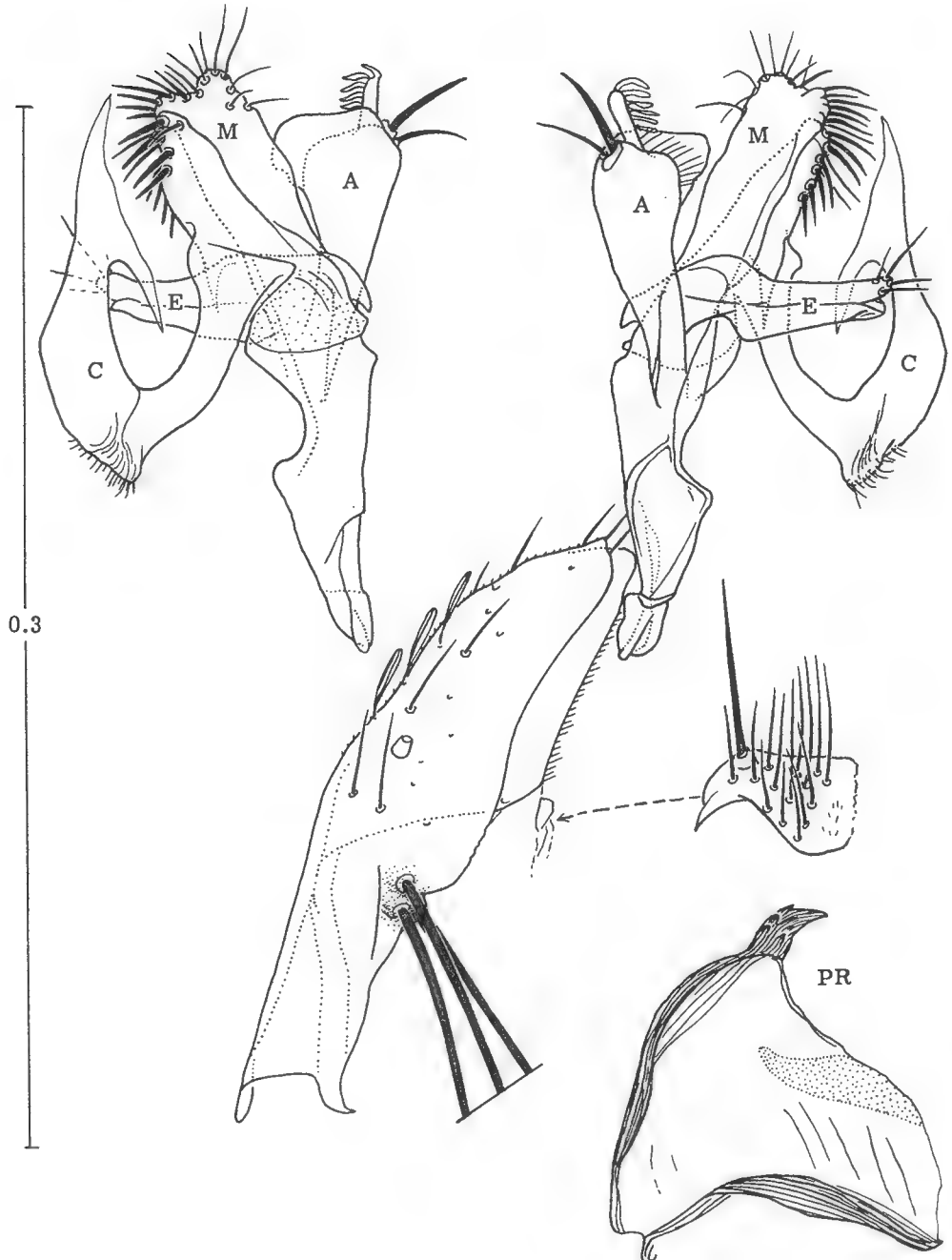
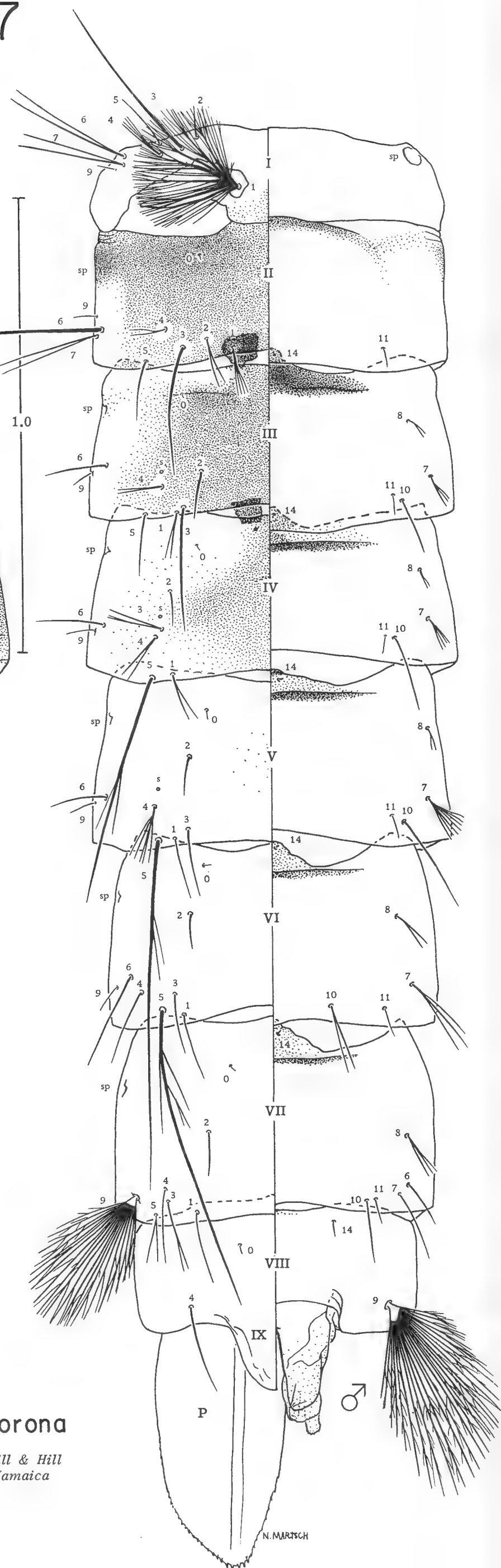
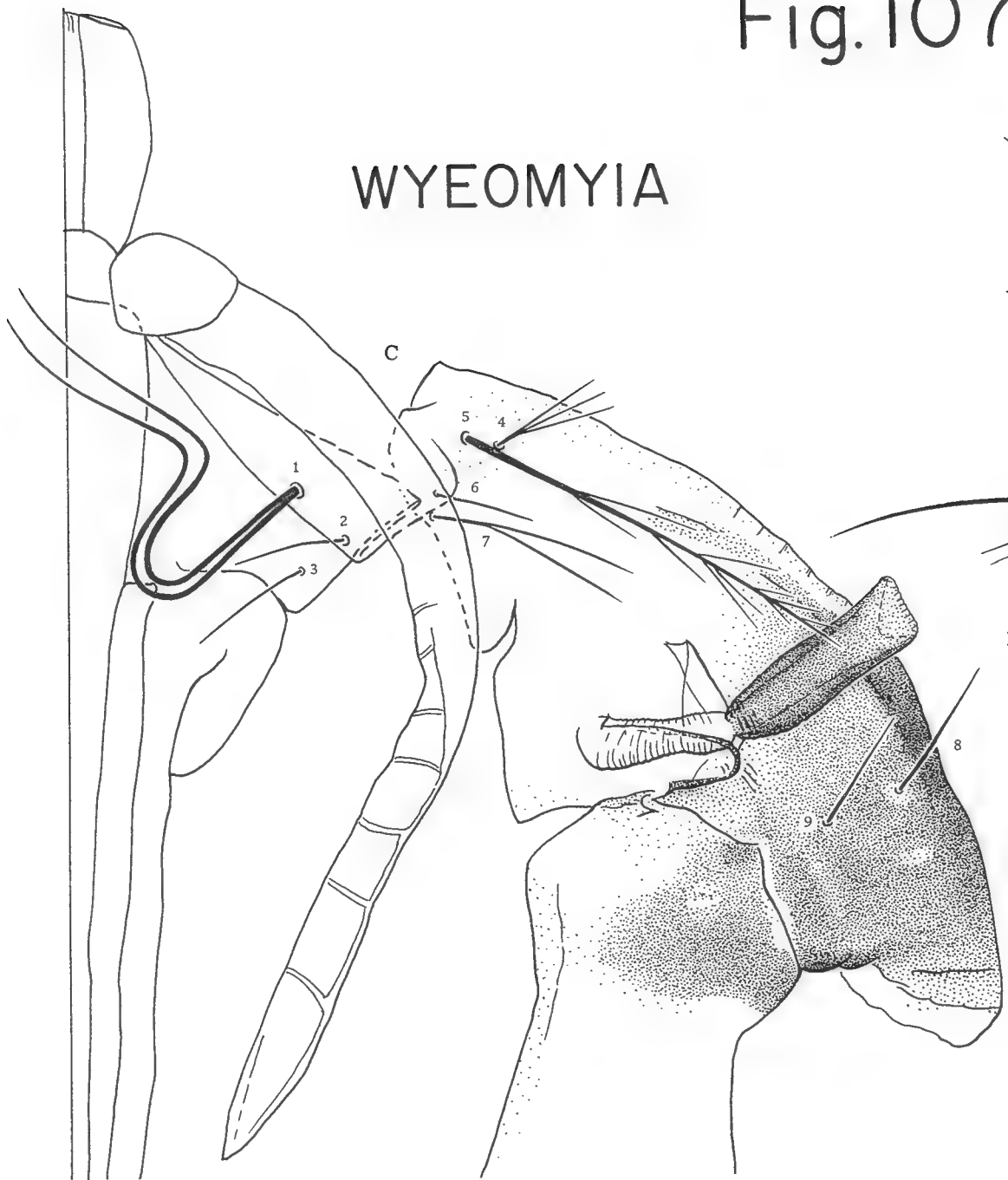
WYEOMYIA



stellata
JA 723

Fig. 107

WYEOMYIA



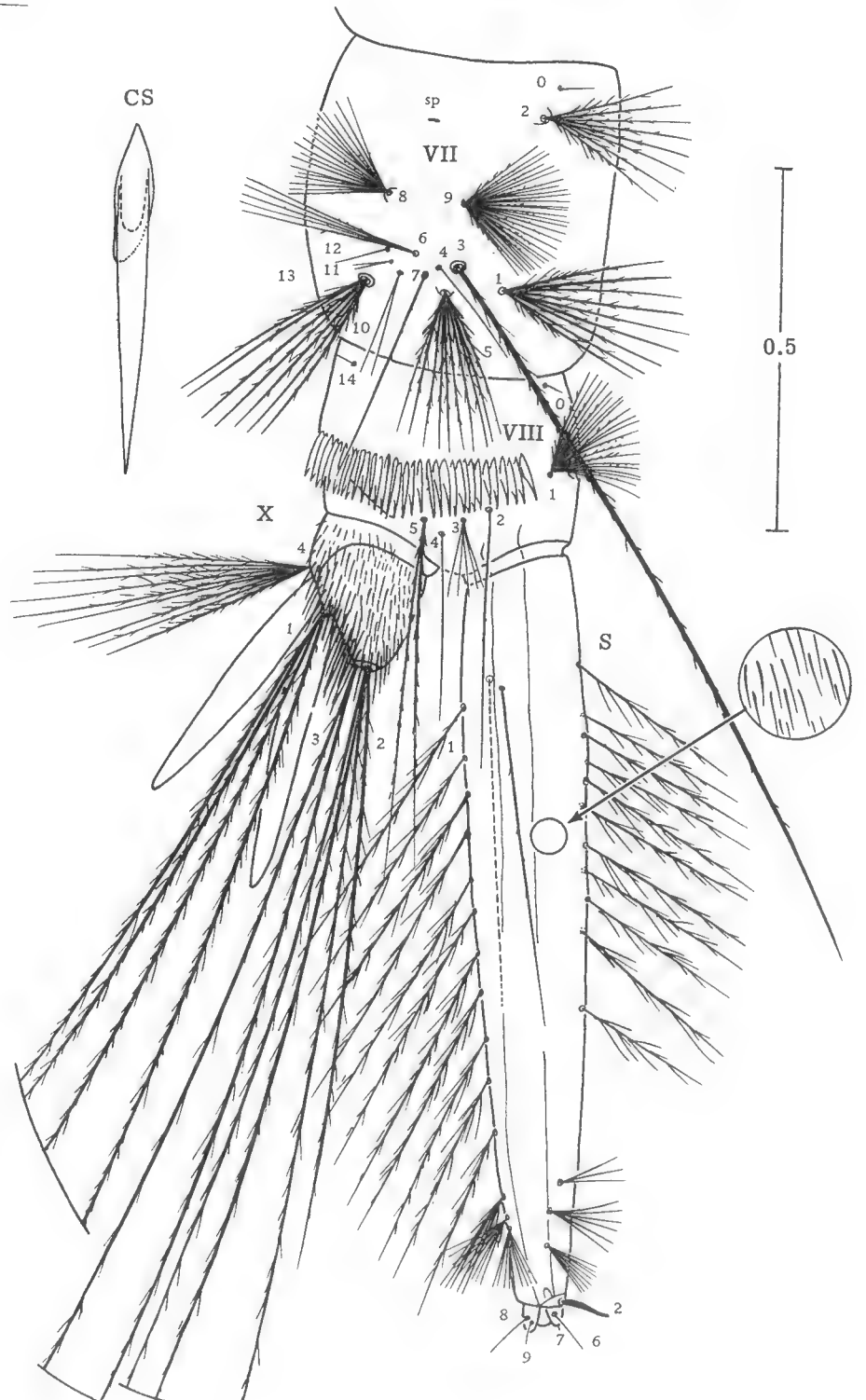
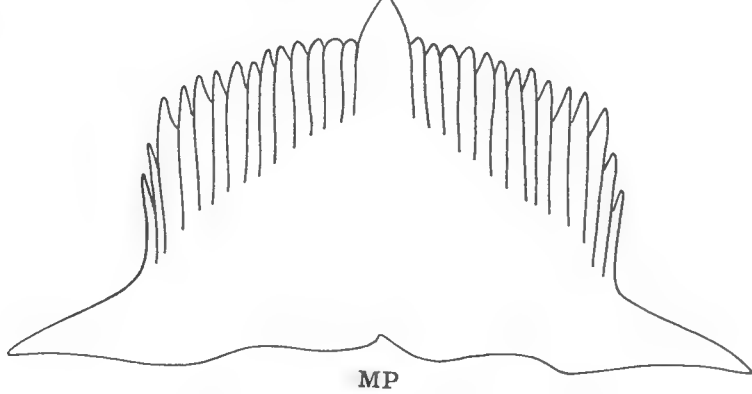
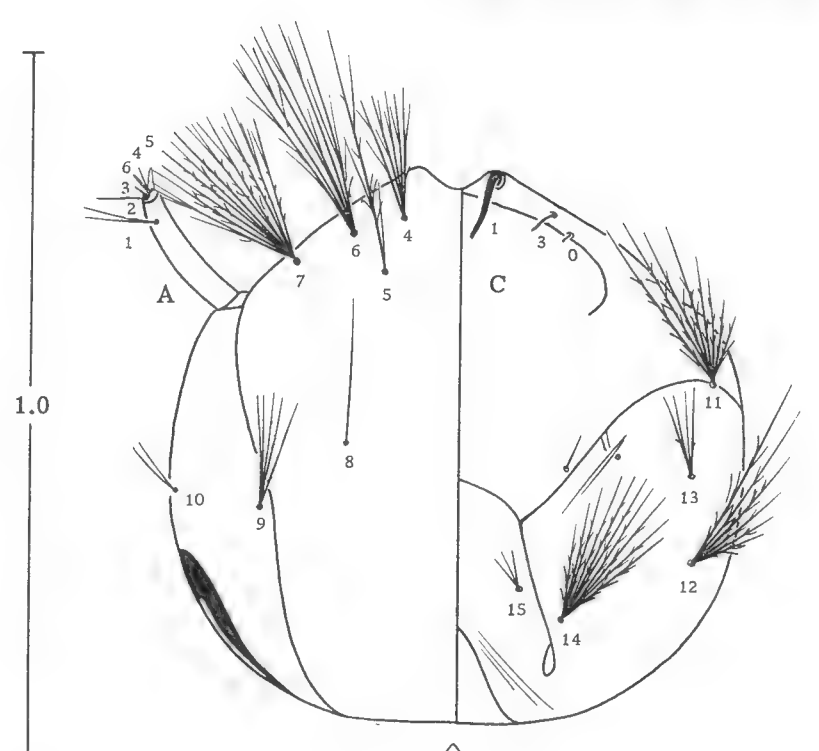
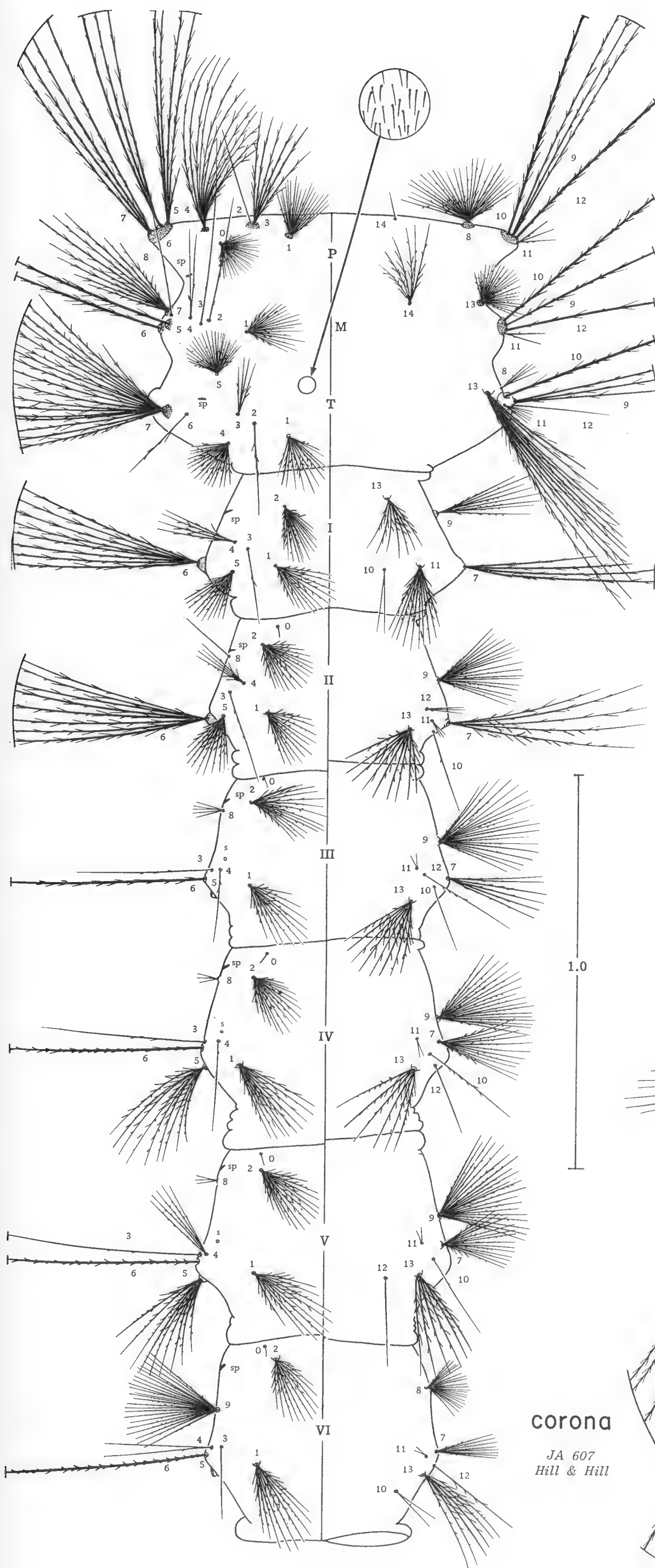
corona

Hill & Hill
Jamaica

N. MANTSCH

Fig. 108

WYEOMYIA

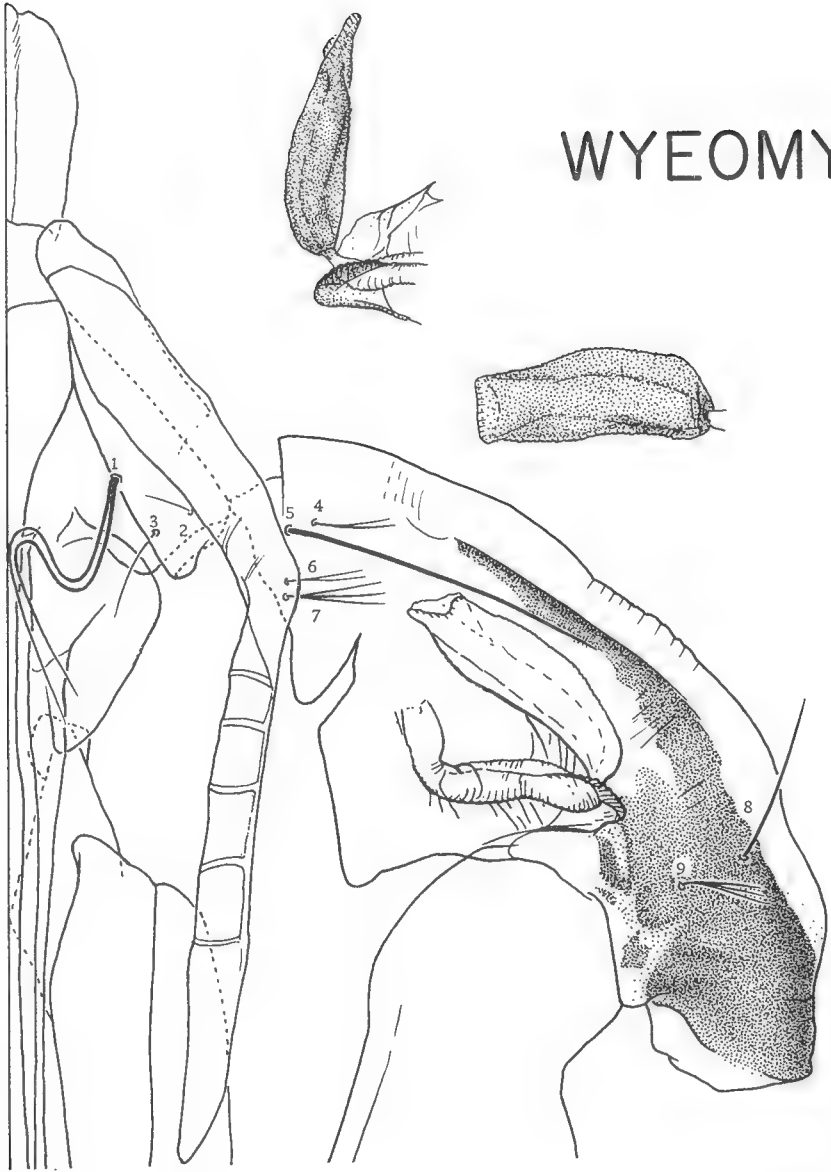


corona

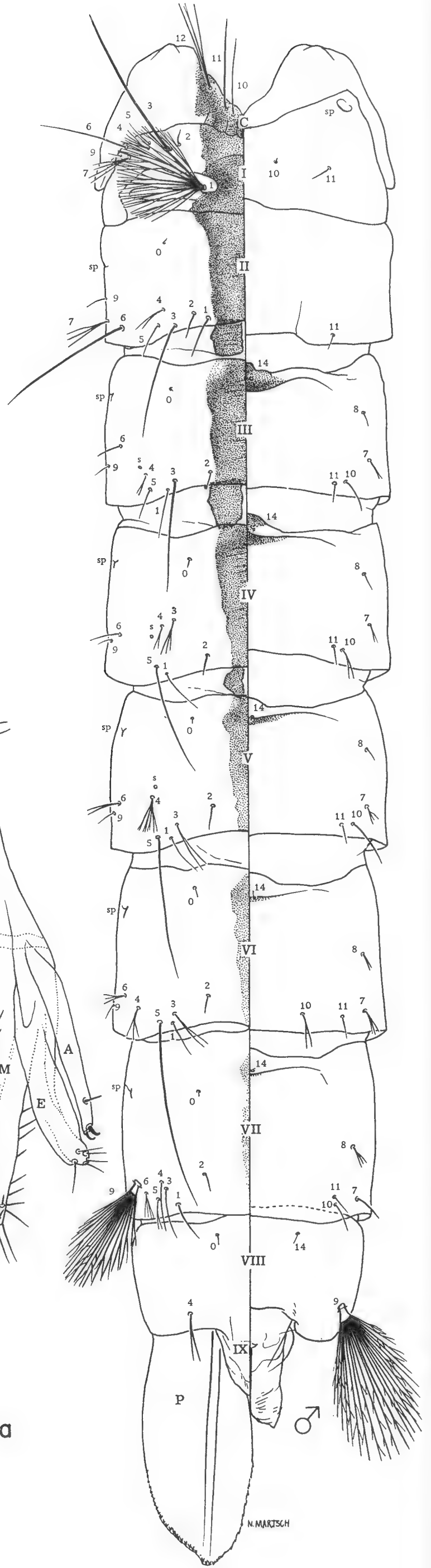
JA 607
Hill & Hill

Fig. 109

WYEOMYIA



1.0



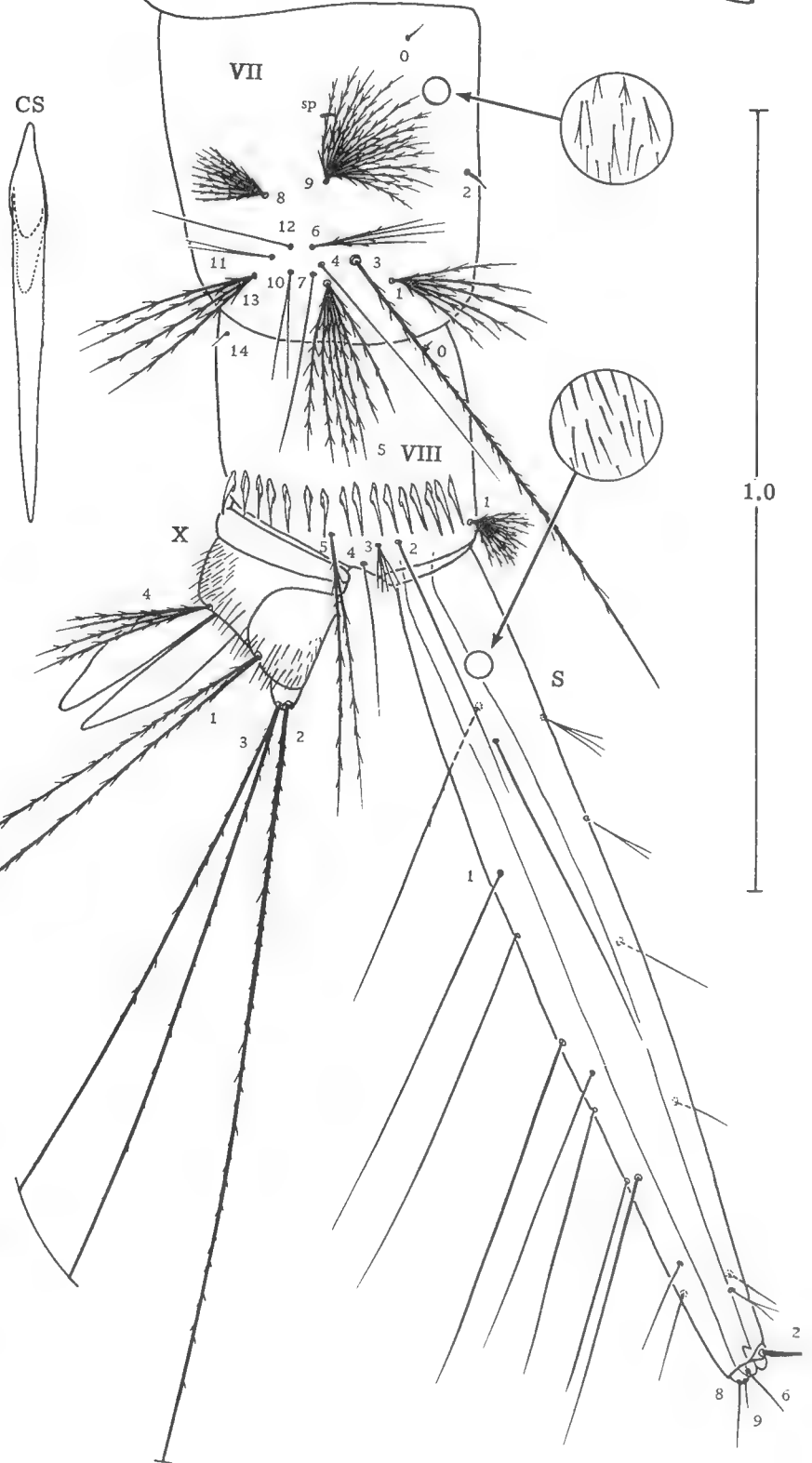
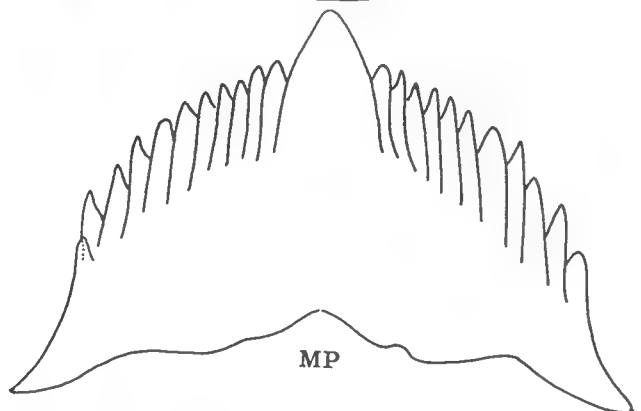
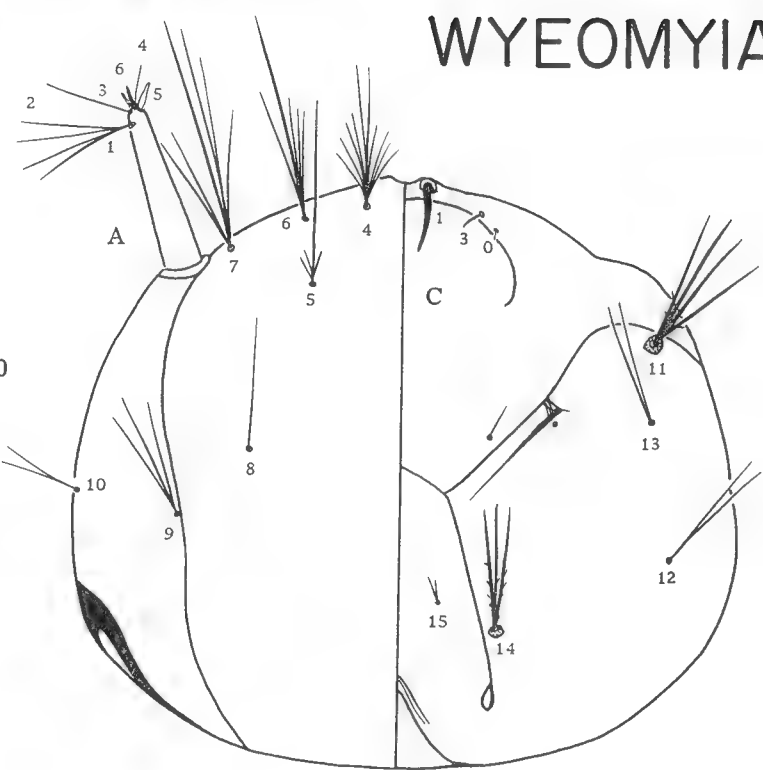
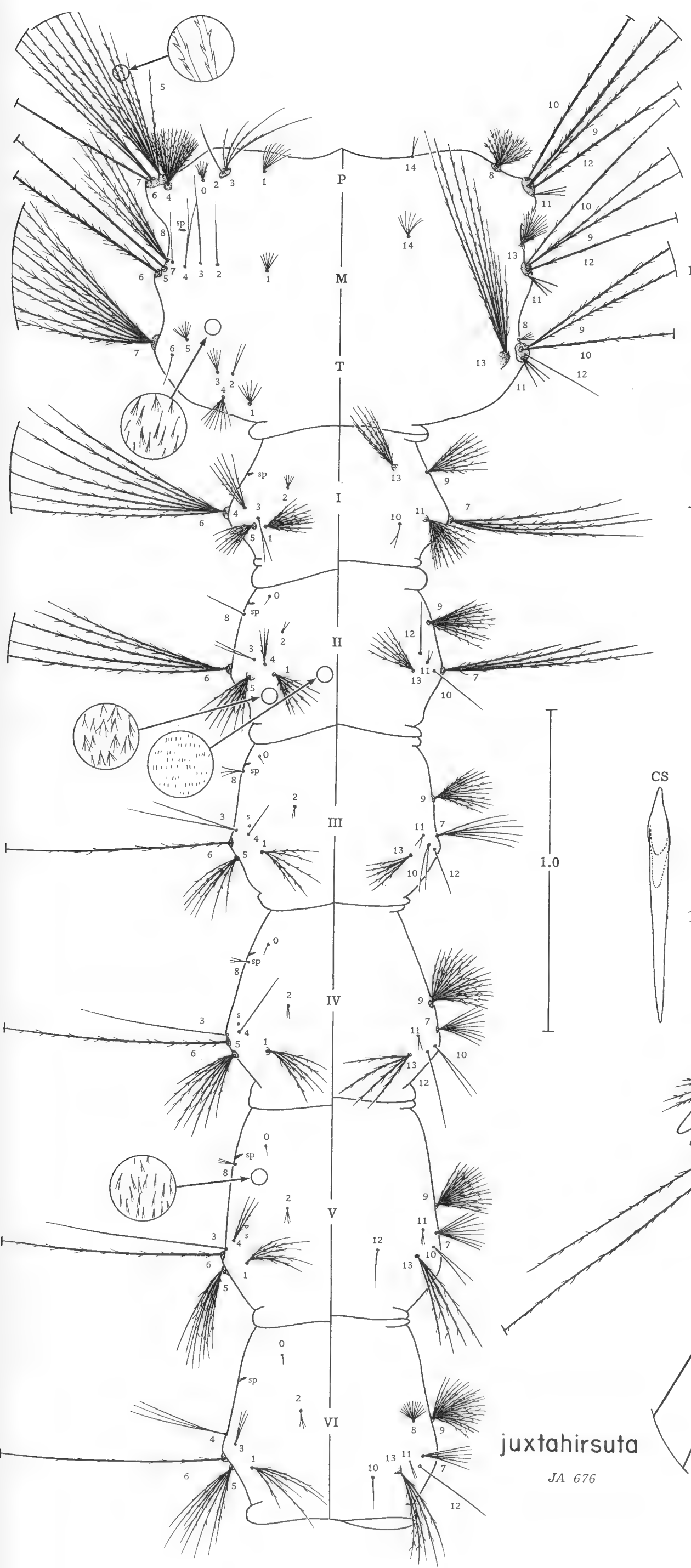
juxtahirsuta

JA 676

N. MARTSCH

Fig. 110

WYEOMYIA



juxtahirsuta
JA 676

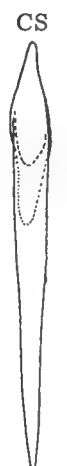


Fig. III

WYEOMYIA

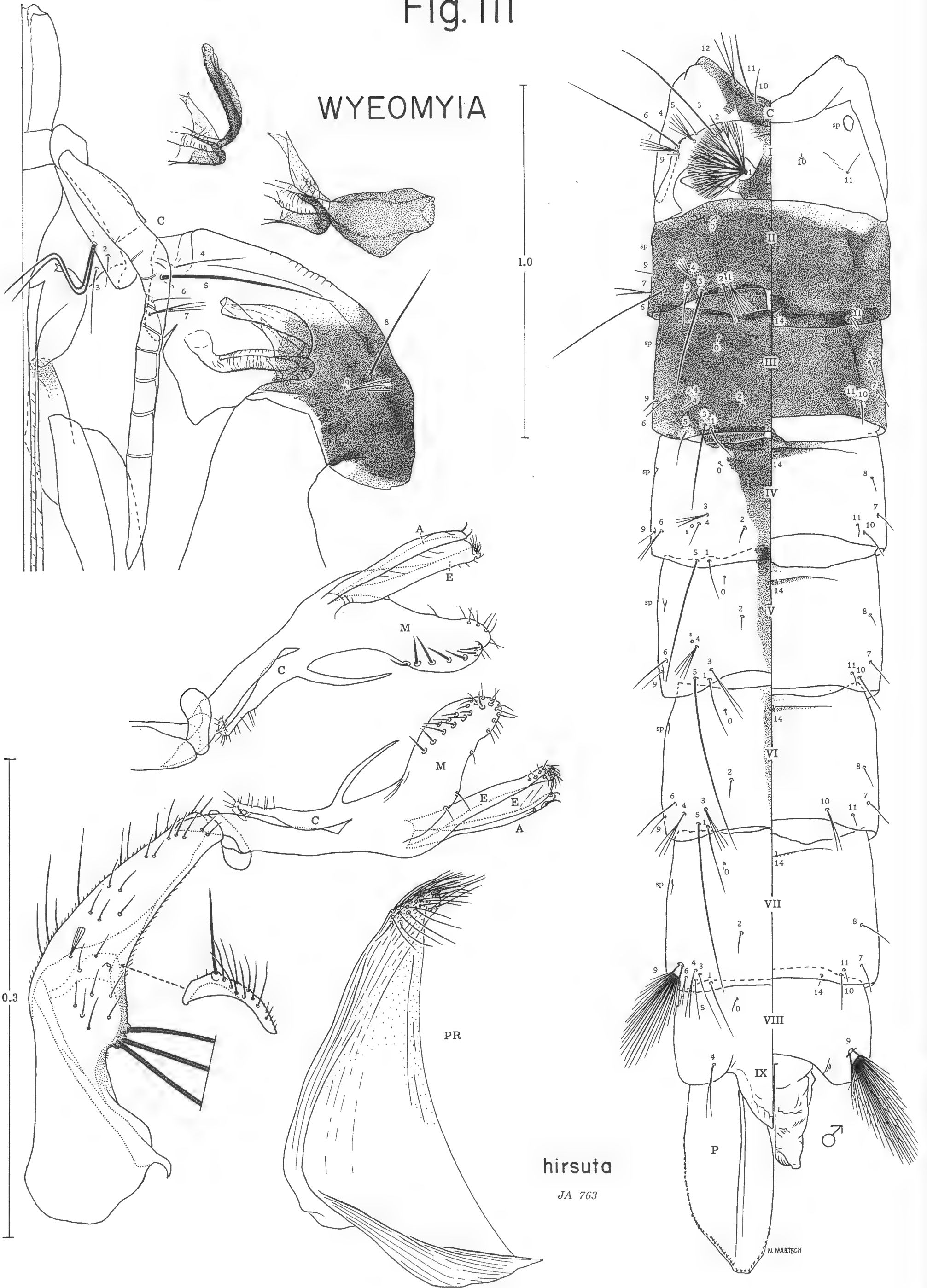
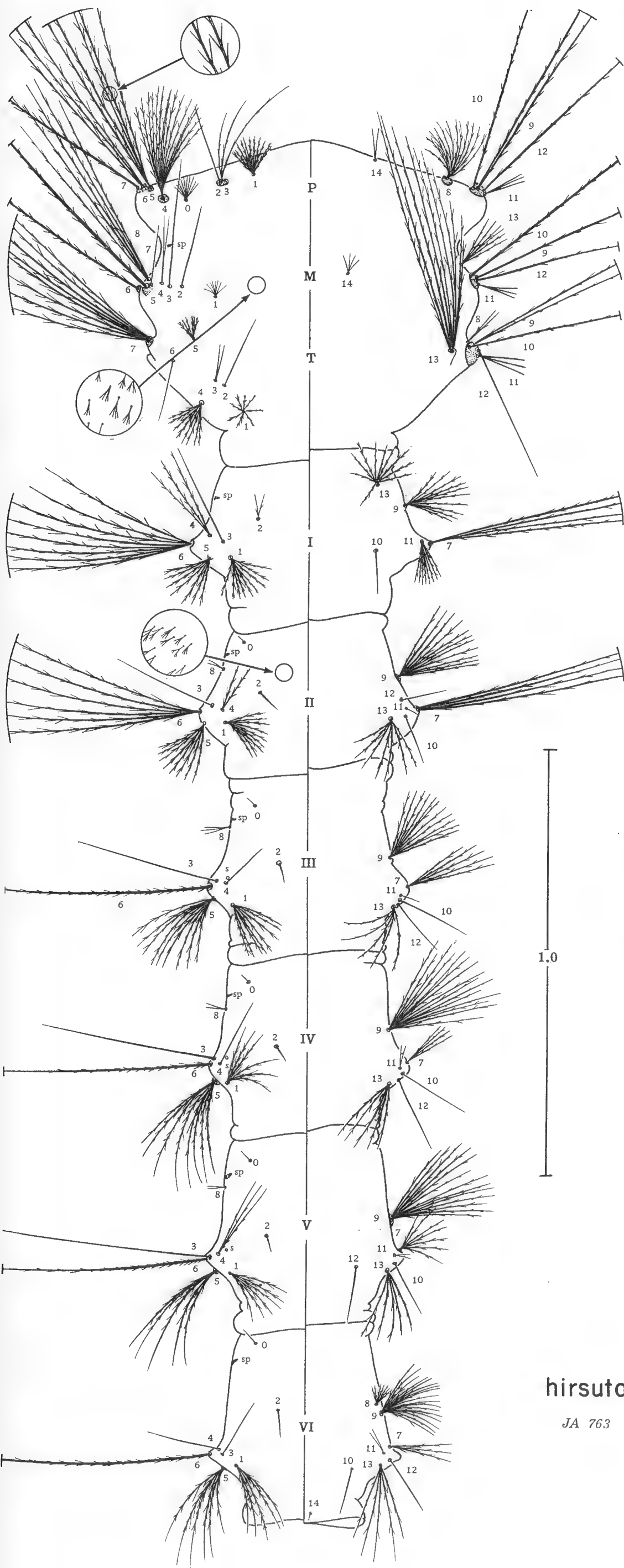


Fig. 112

WYEOMYIA



hirsuta
JA 763

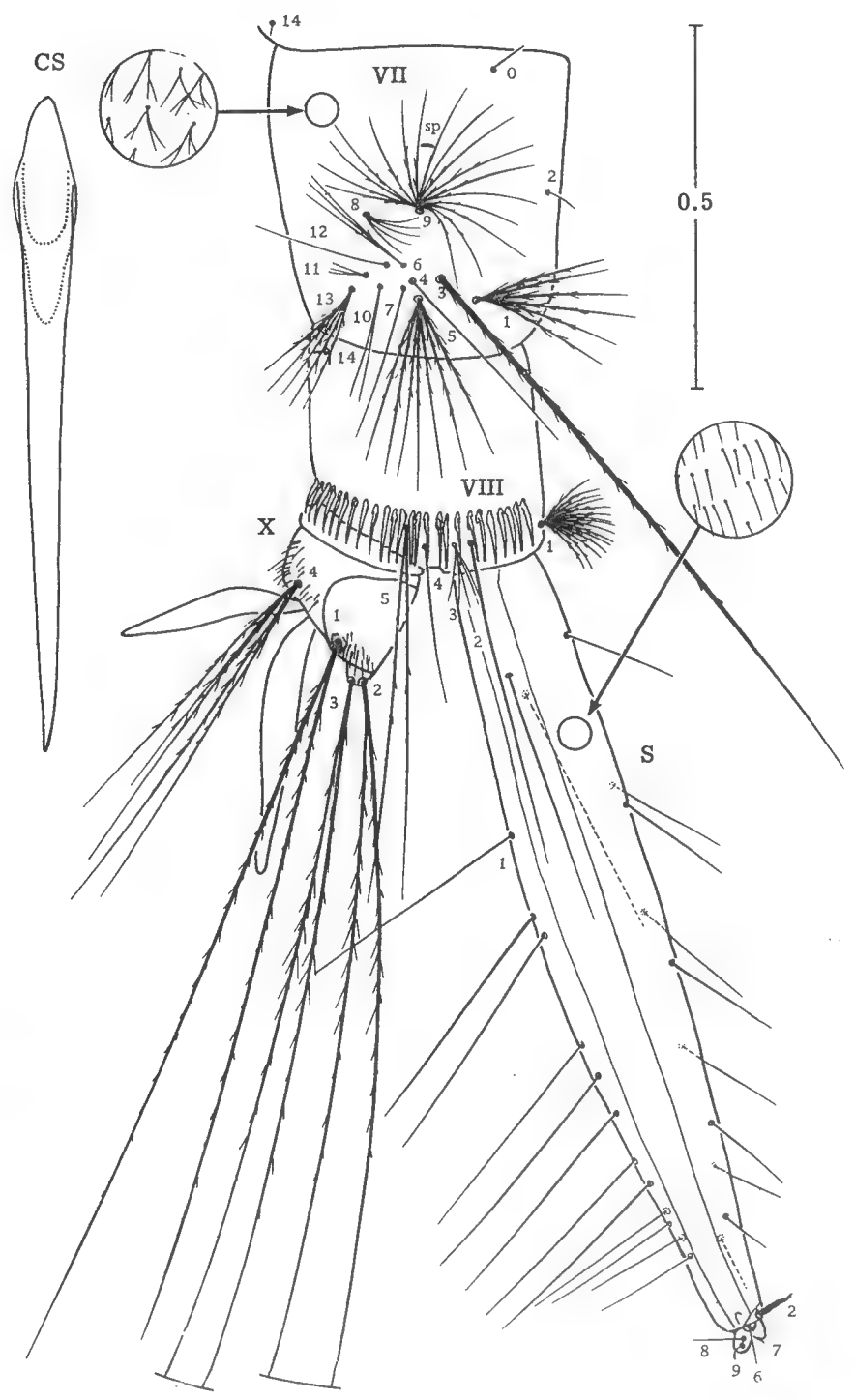
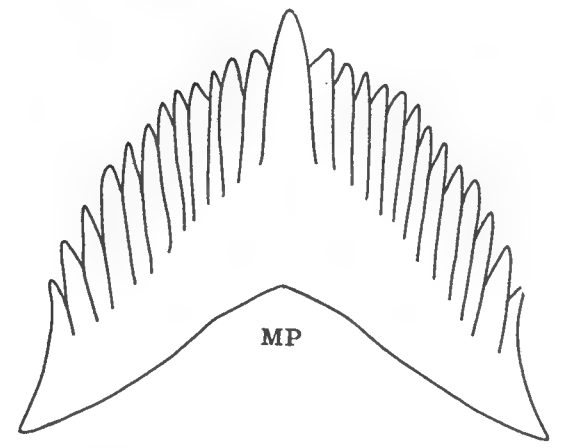
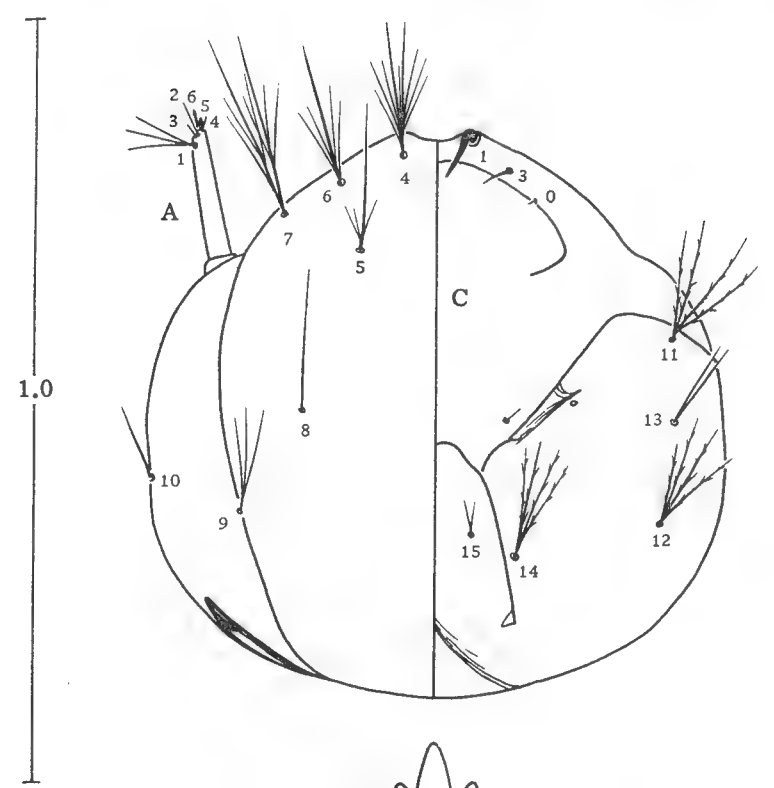
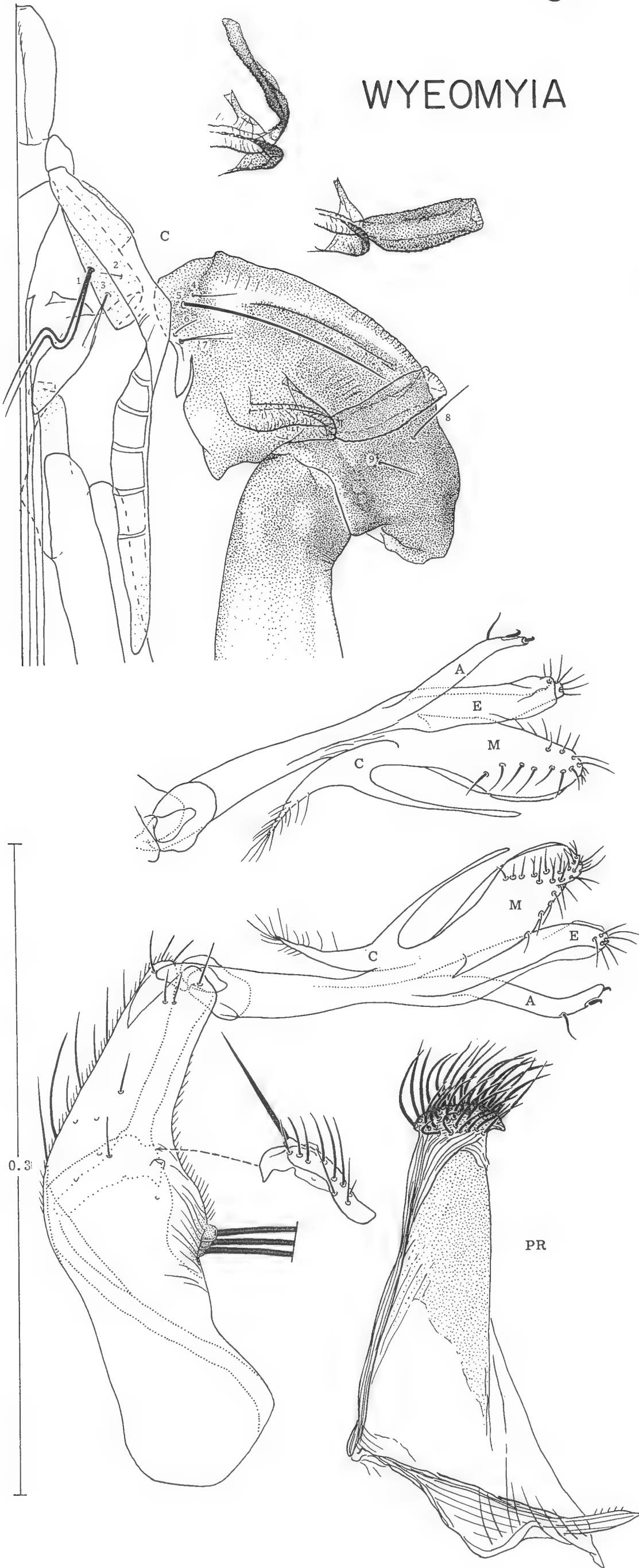
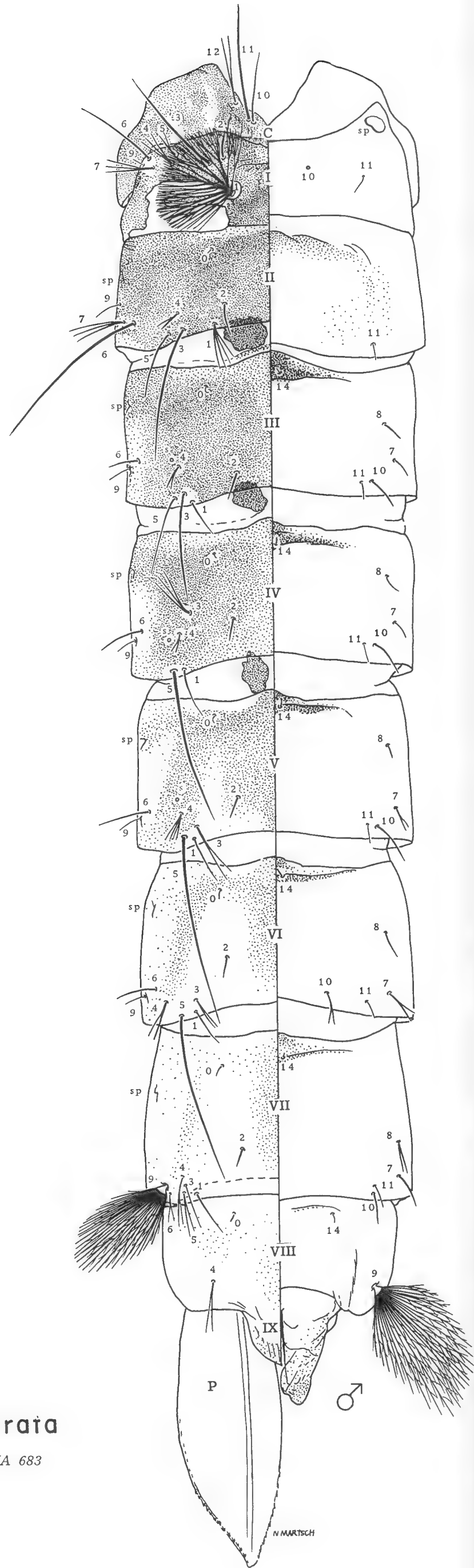


Fig. 113

WYEOMYIA



1.0

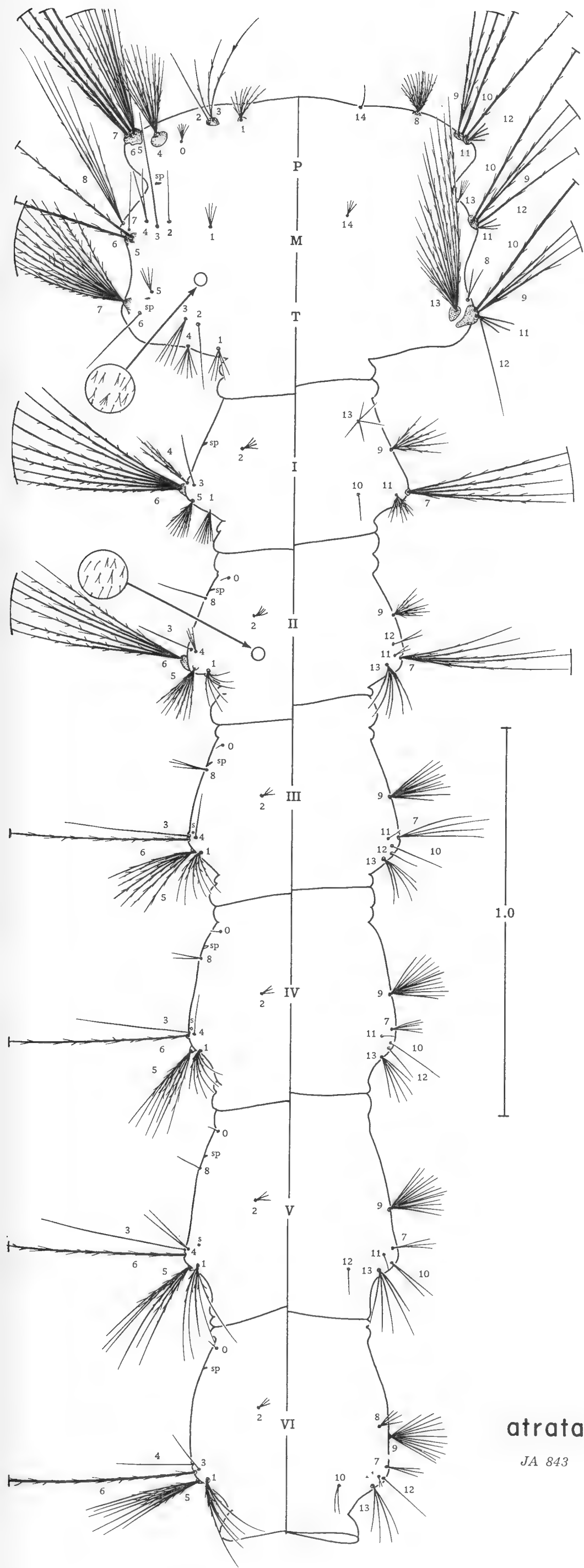


atraia
JA 683

N. MARITSCH

Fig. 114

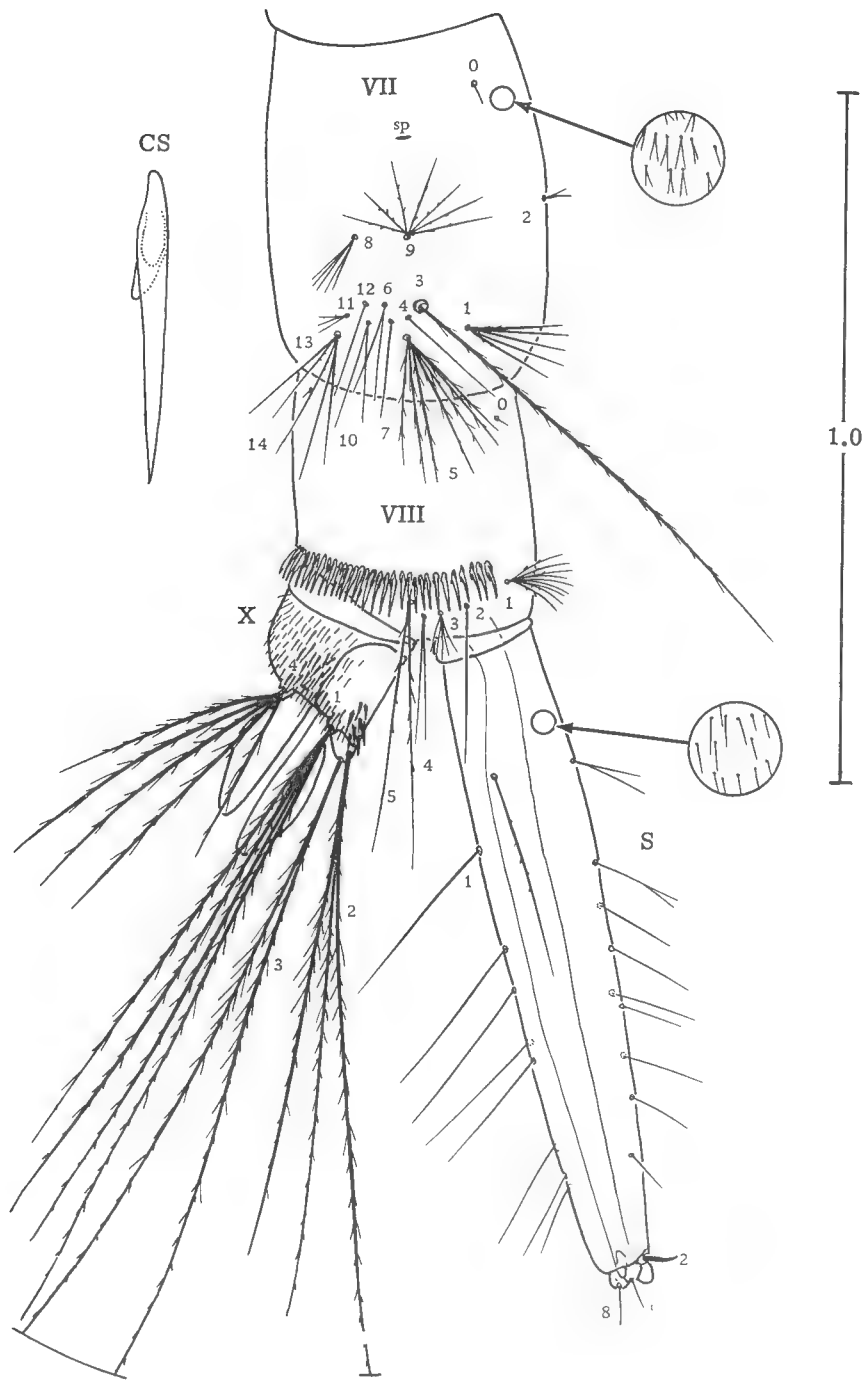
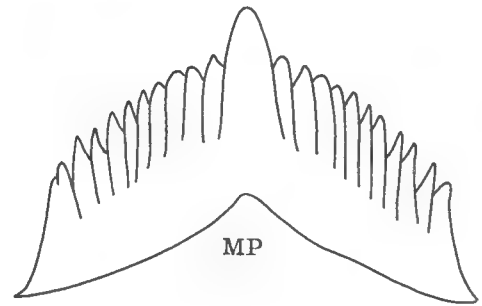
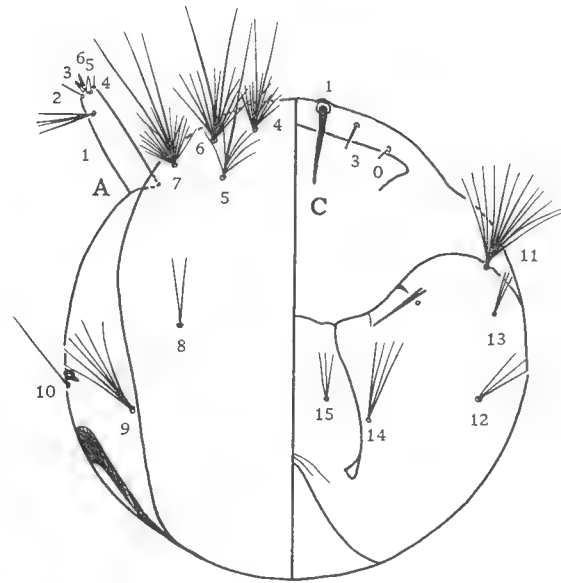
WYEOMYIA



atrata

JA 843

1.0



1.0

Fig. 115

LYNCHIELLA

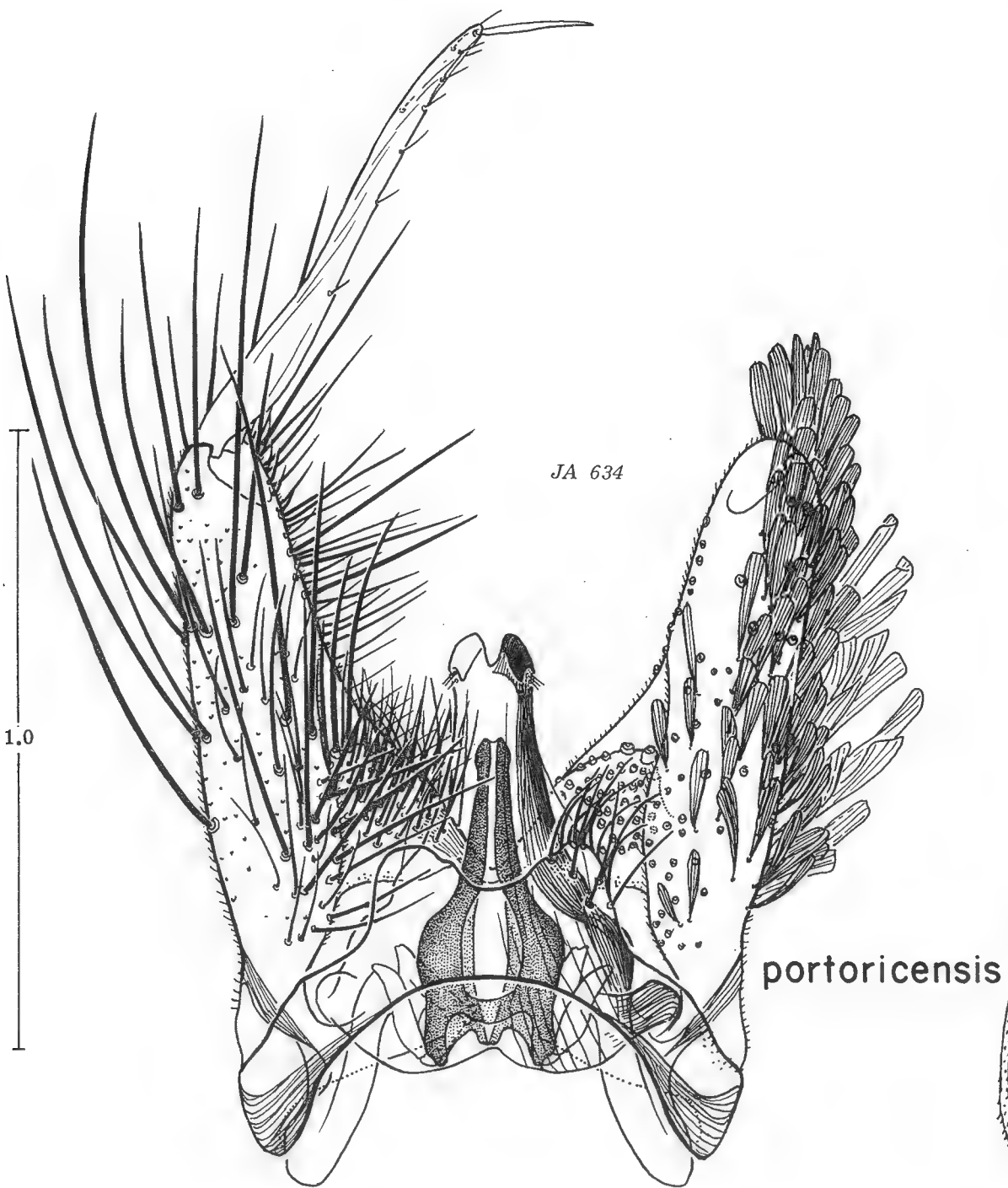
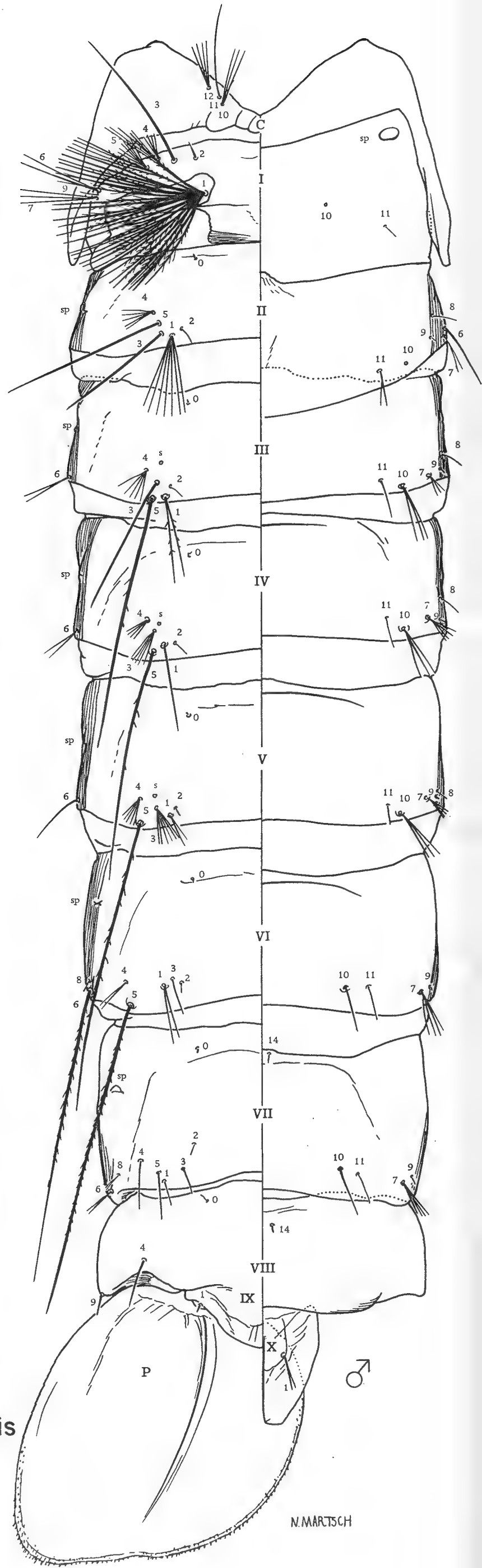
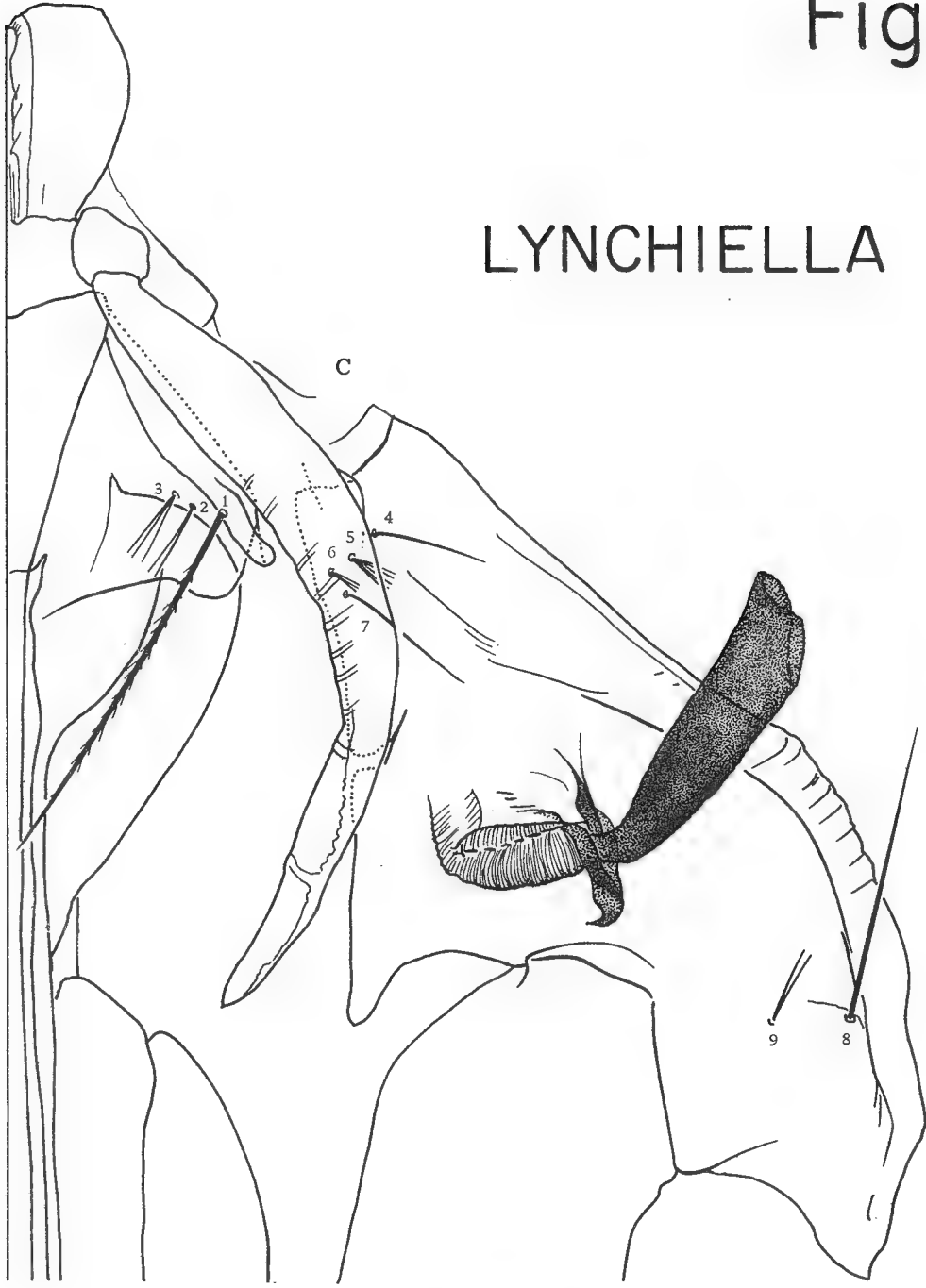


Fig. 116

LYNCHIELLA

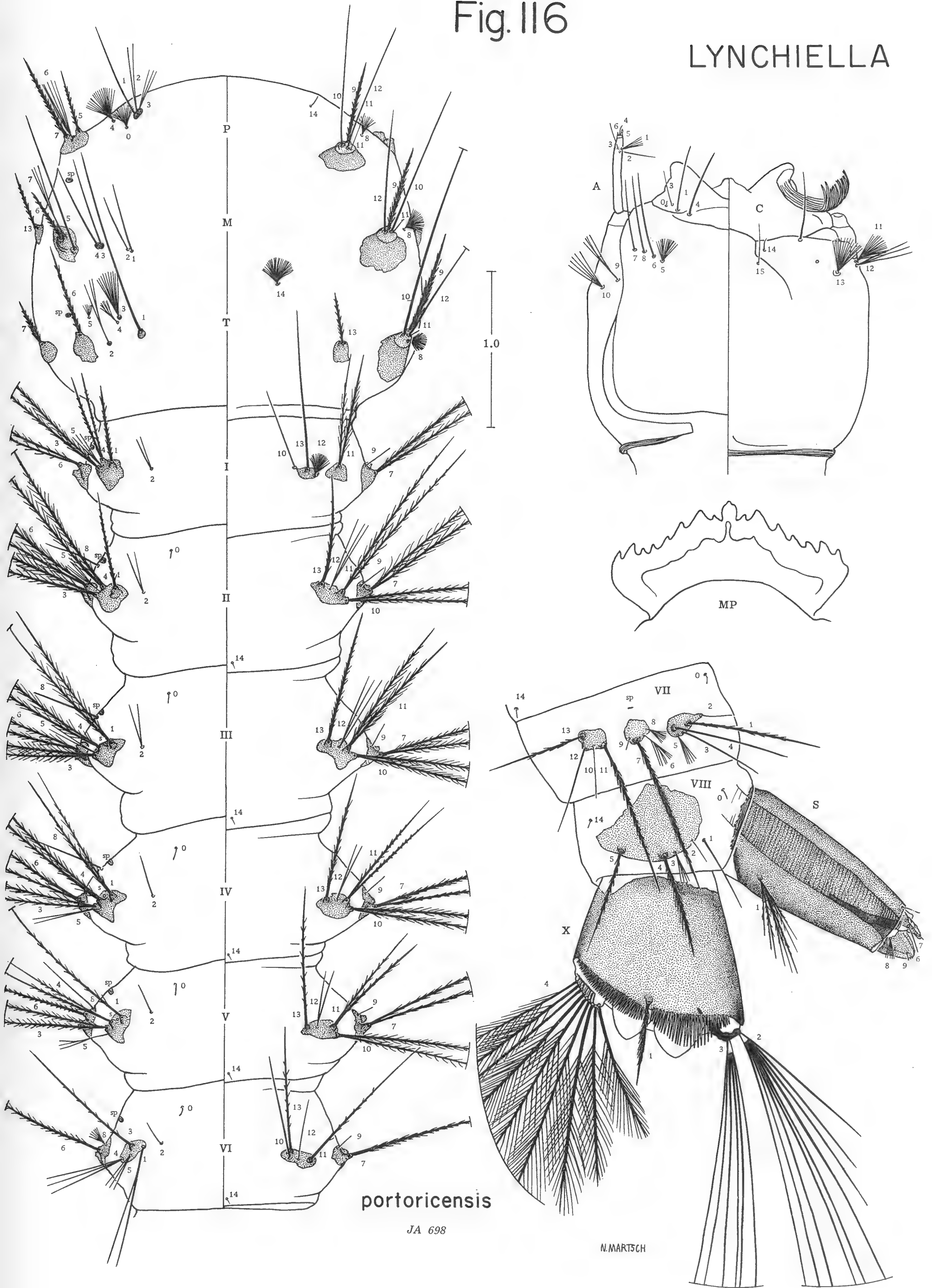


Fig. 117

SAYOMYIA

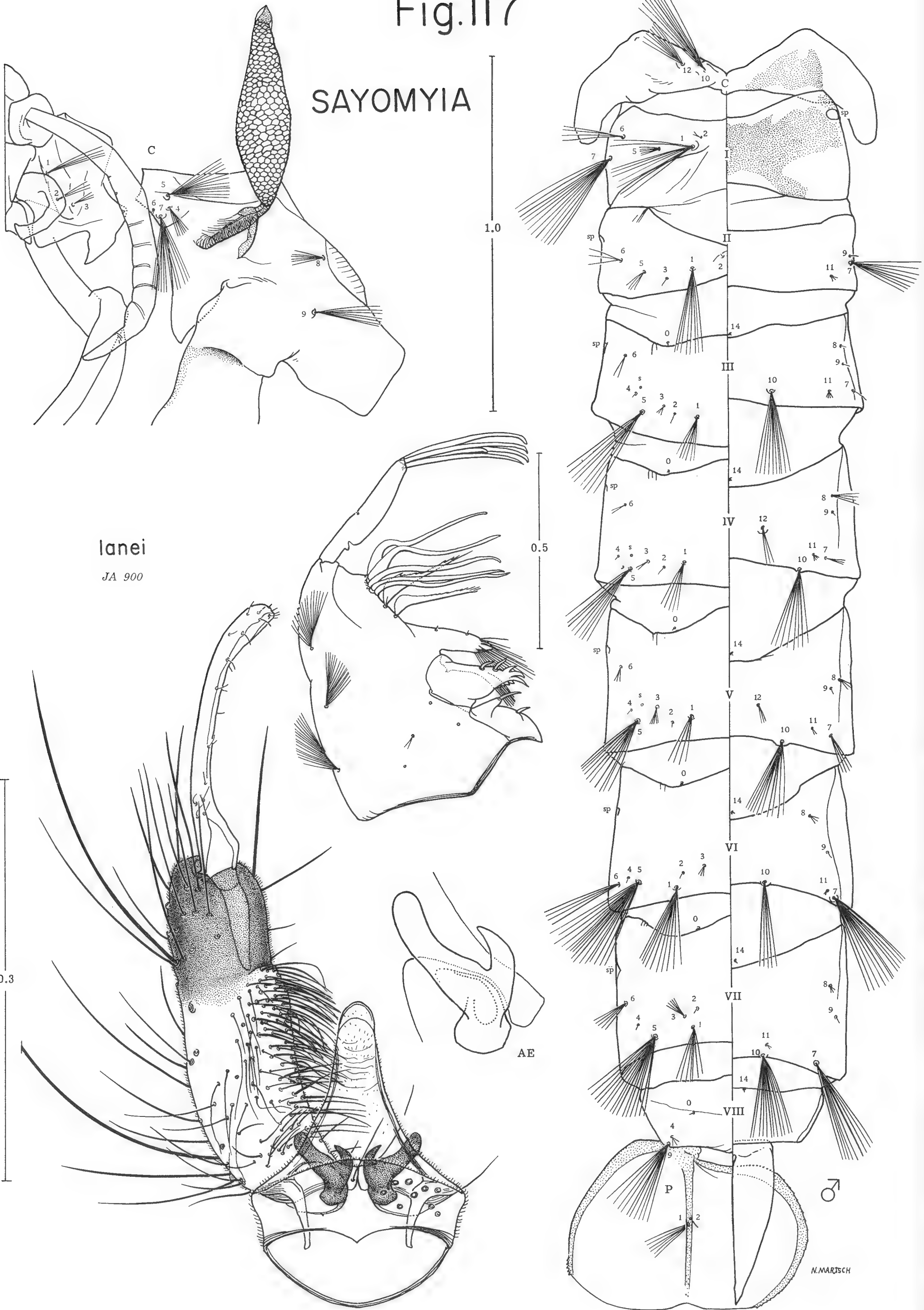


Fig. 118

CORETHRELLA

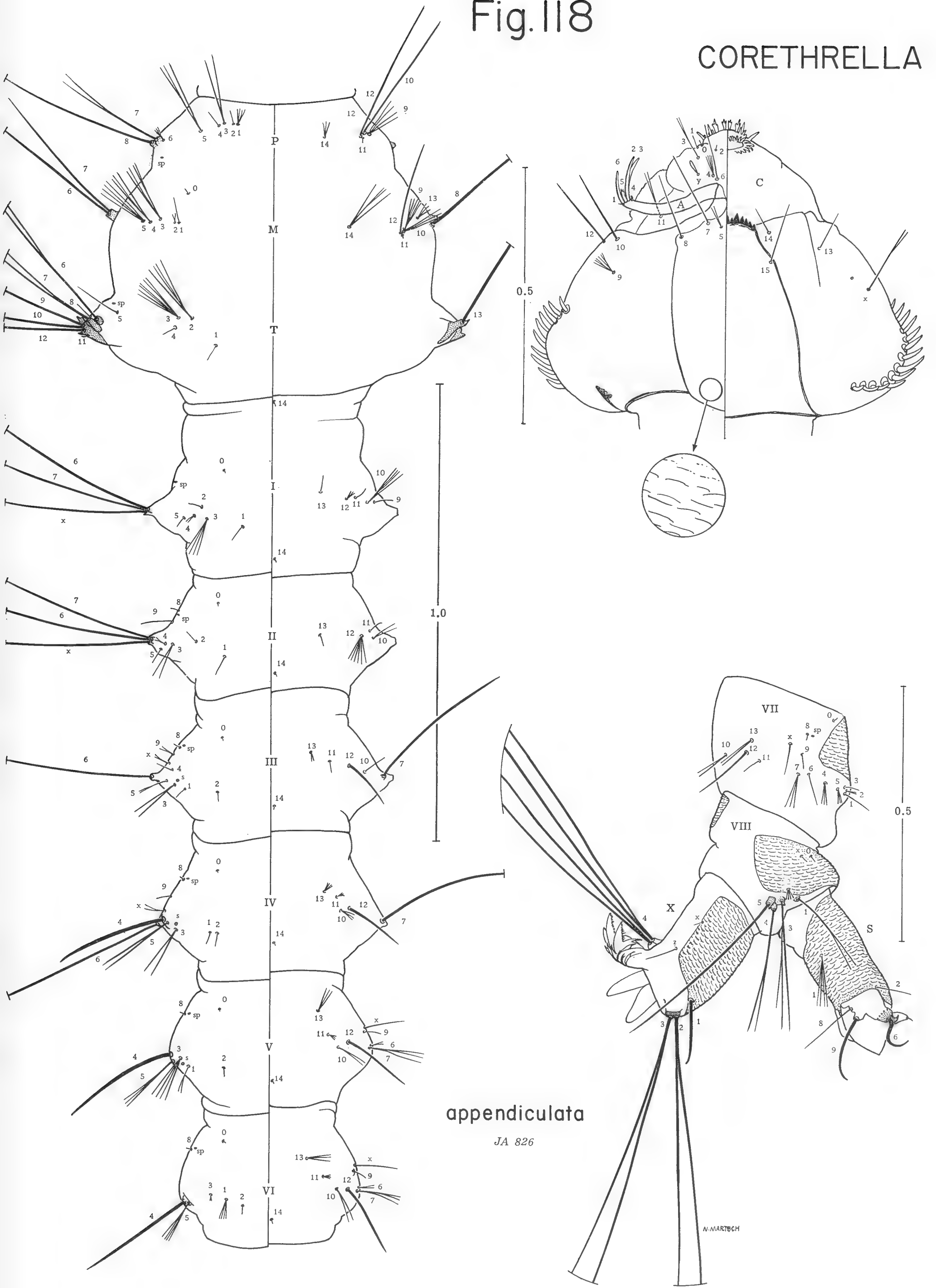
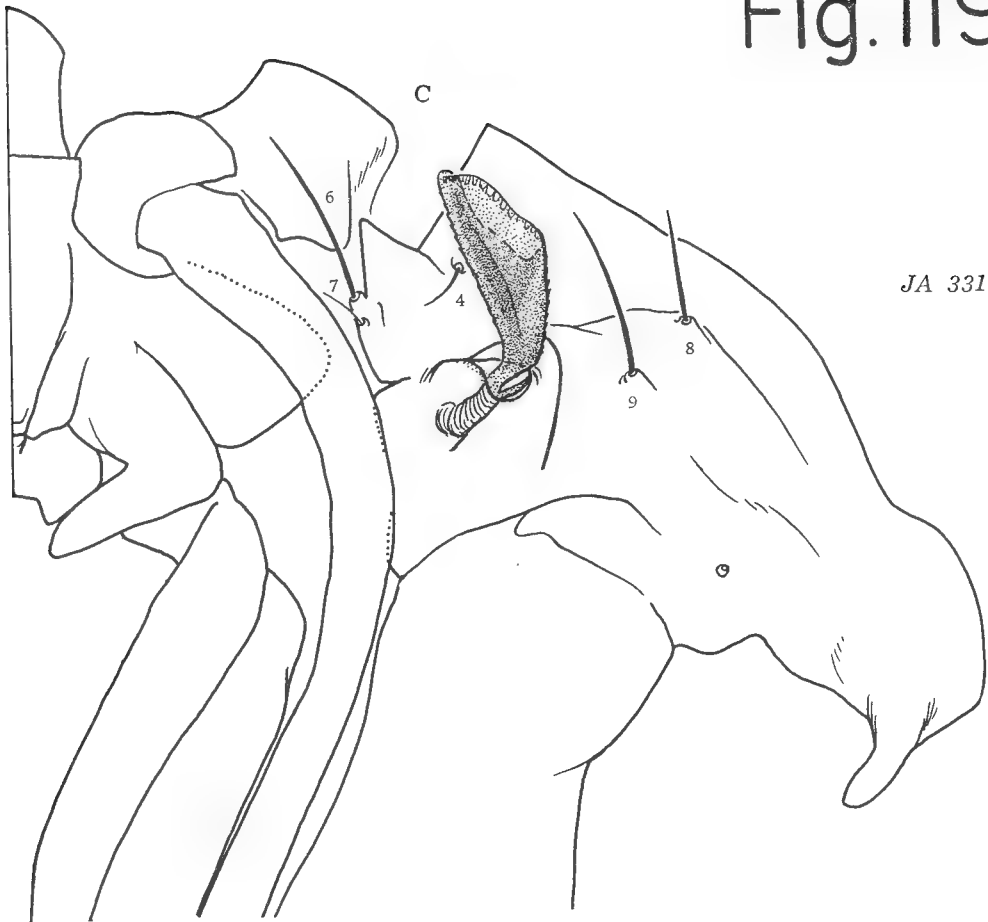
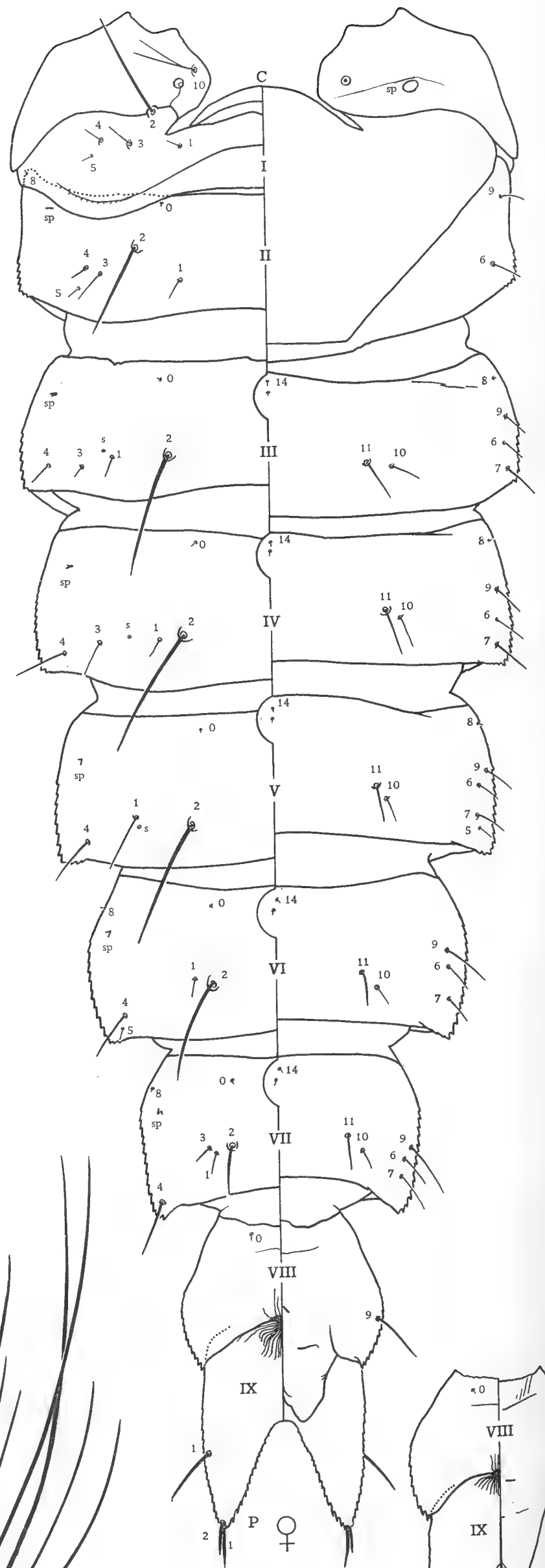


Fig. 119



CORETHRELLA



appendiculata

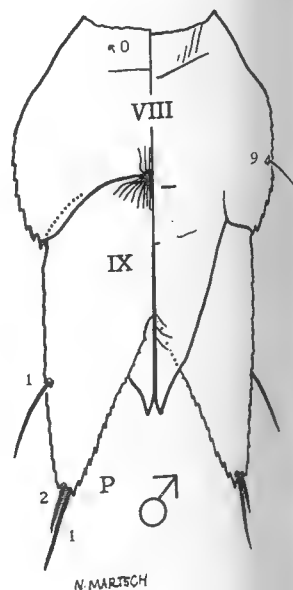
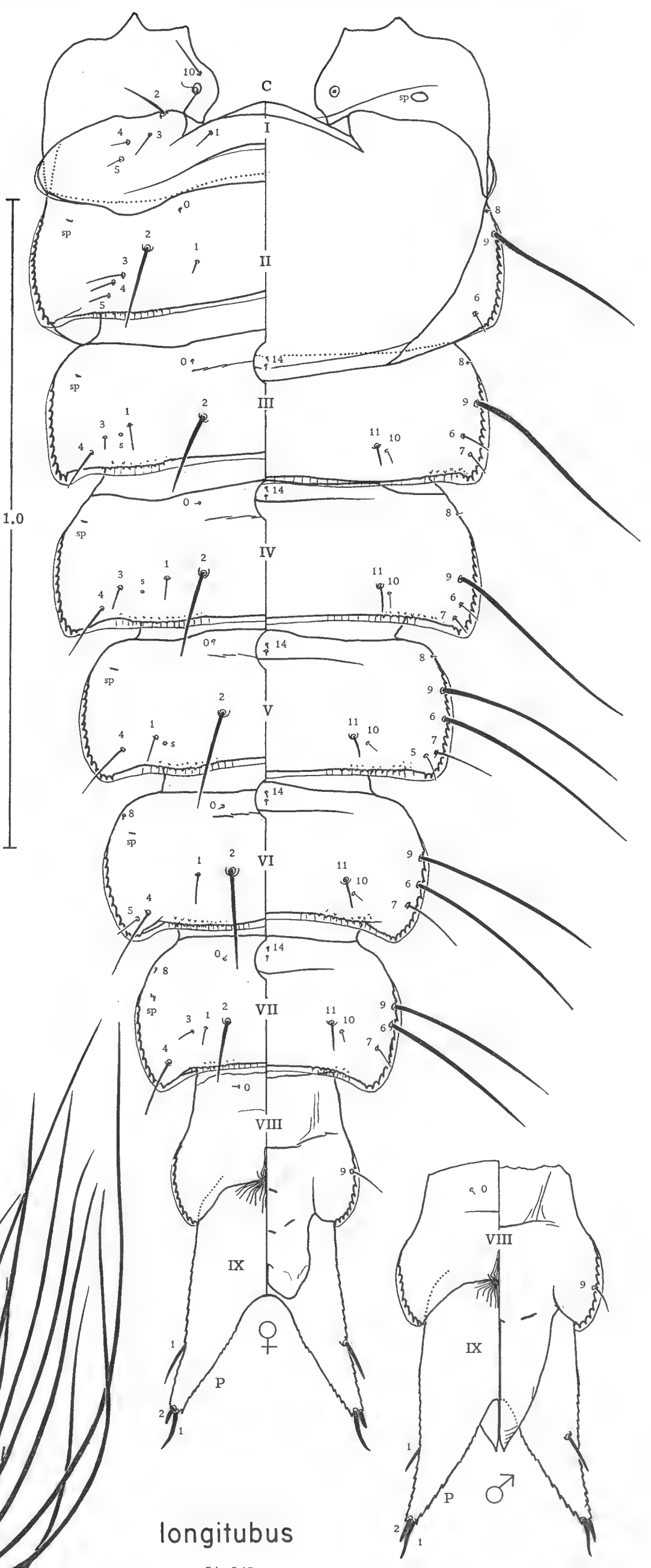
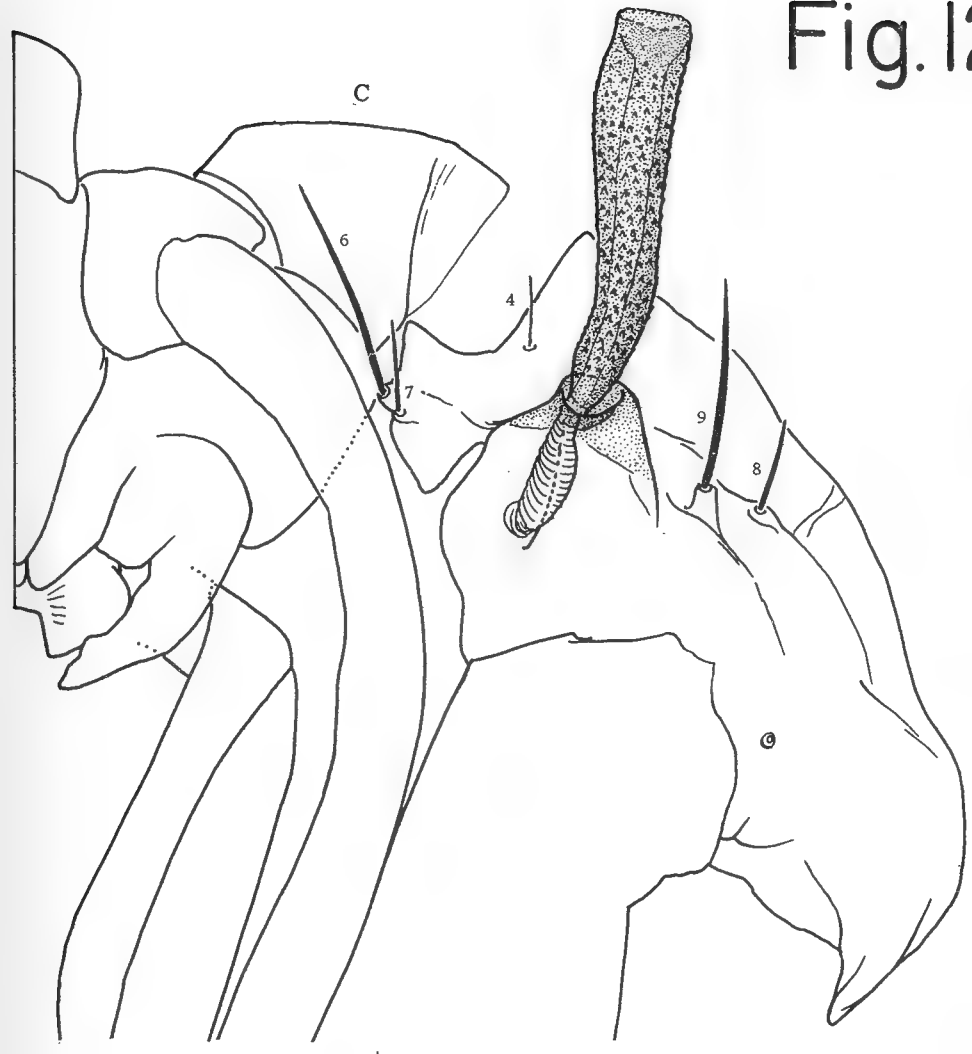


Fig. 120

CORETHRELLA



longitubus

JA 245

N. MARTSCH

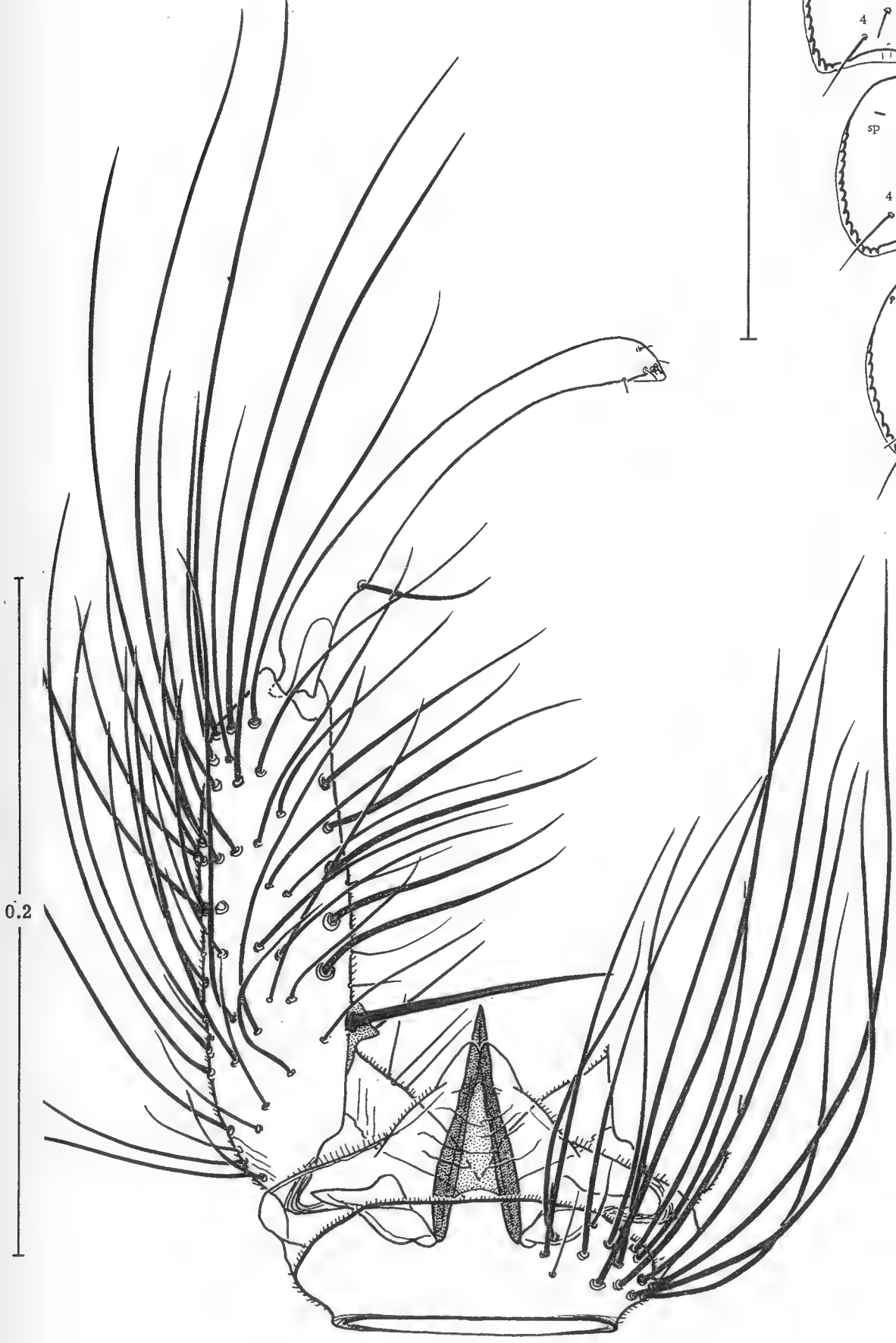


Fig. 121

CORETHRELLA

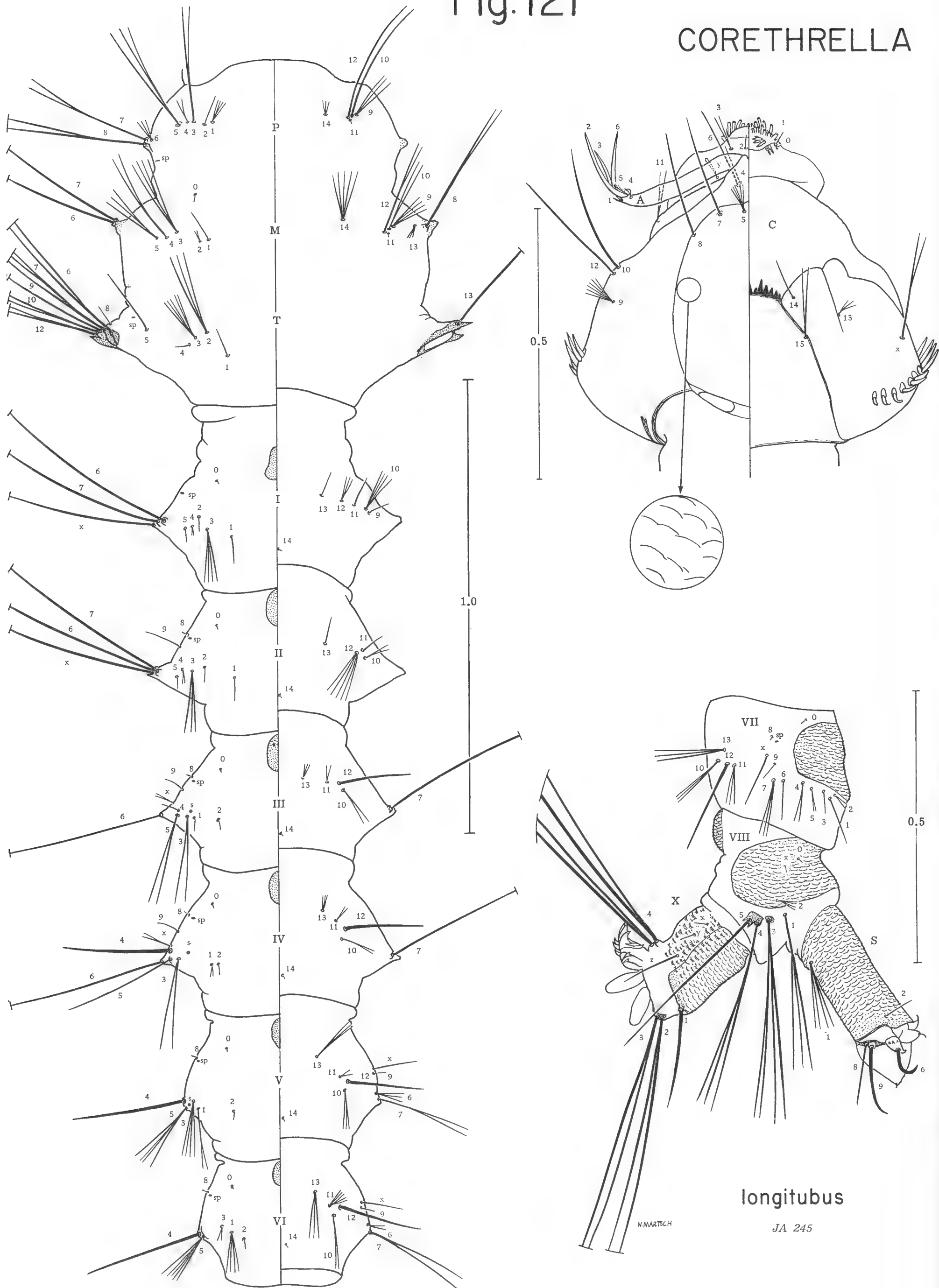
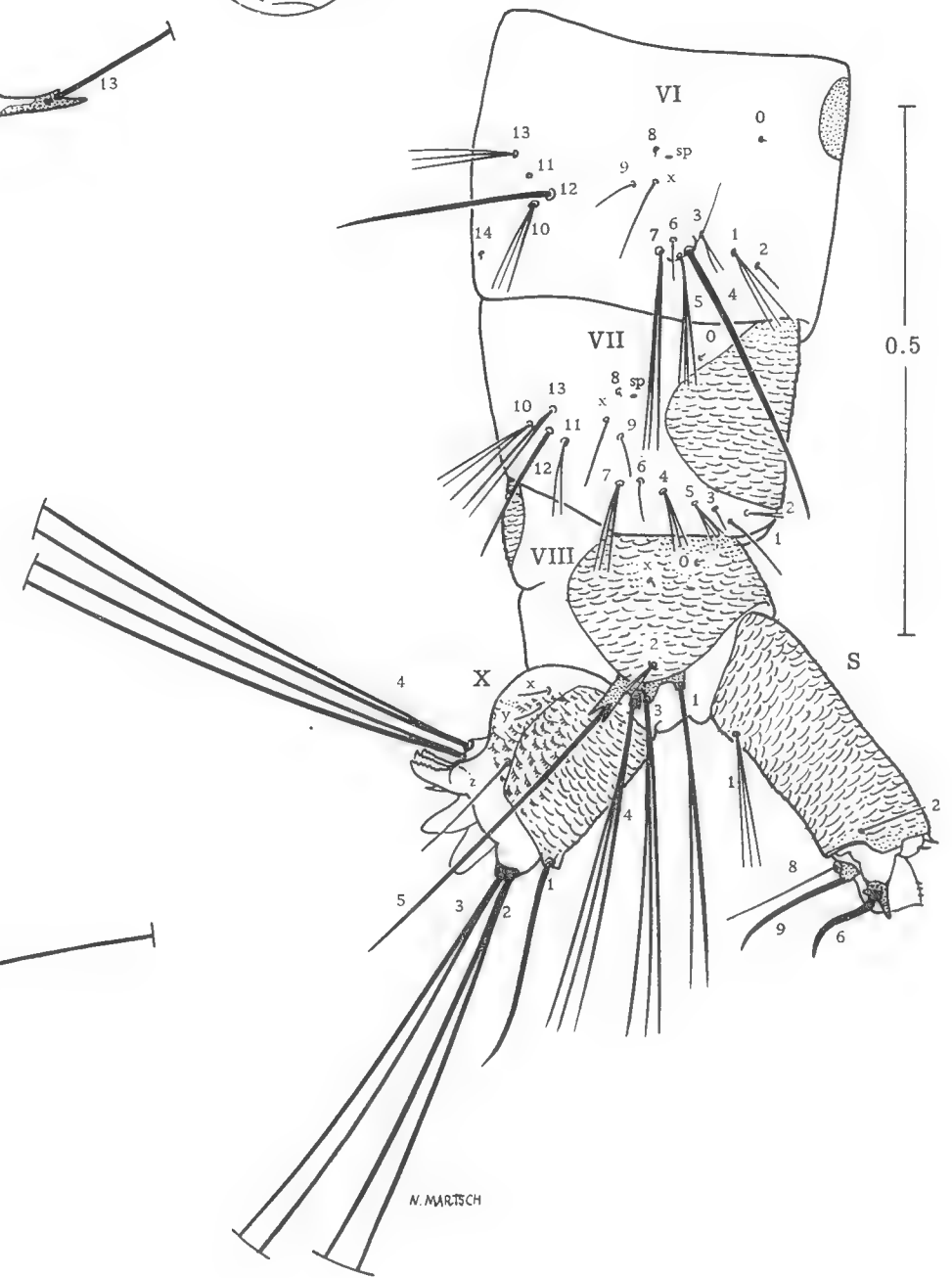
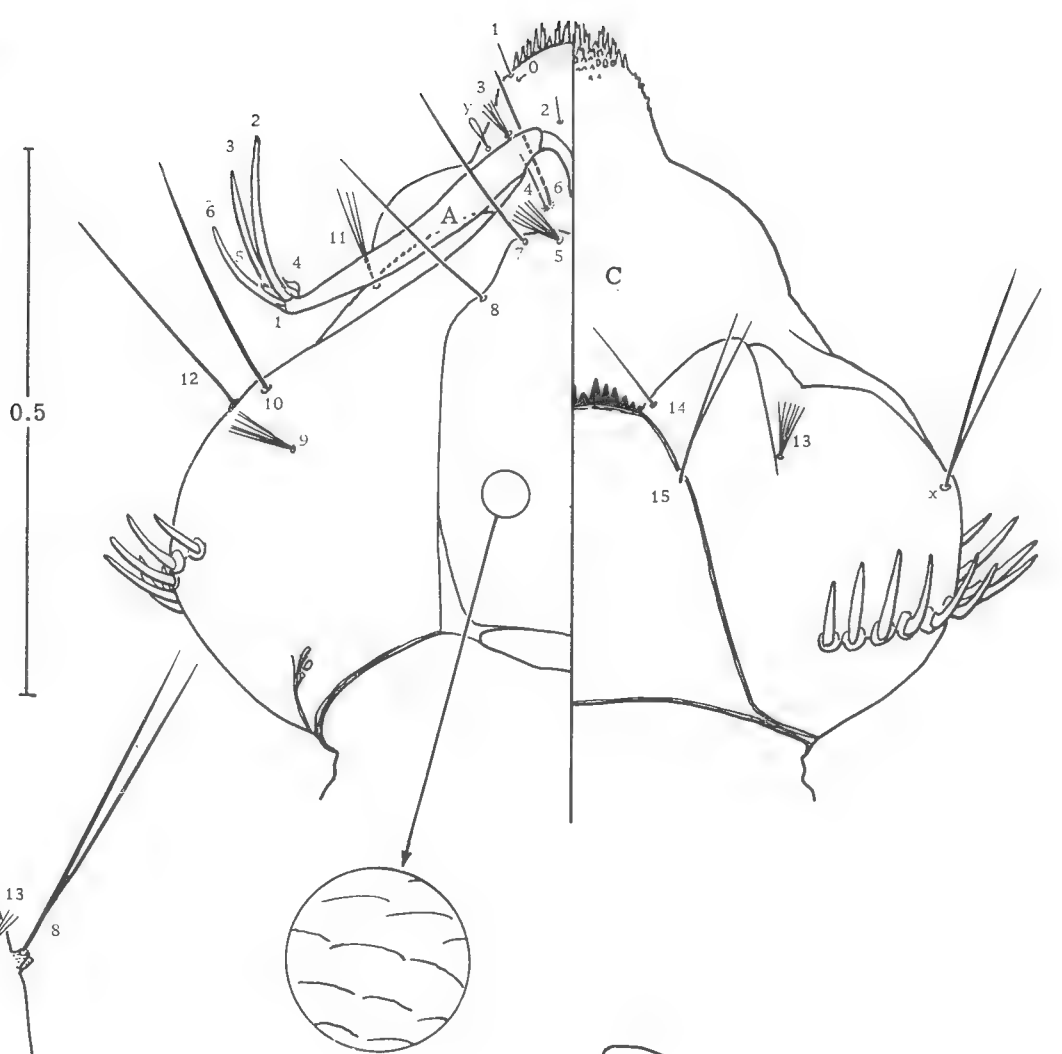
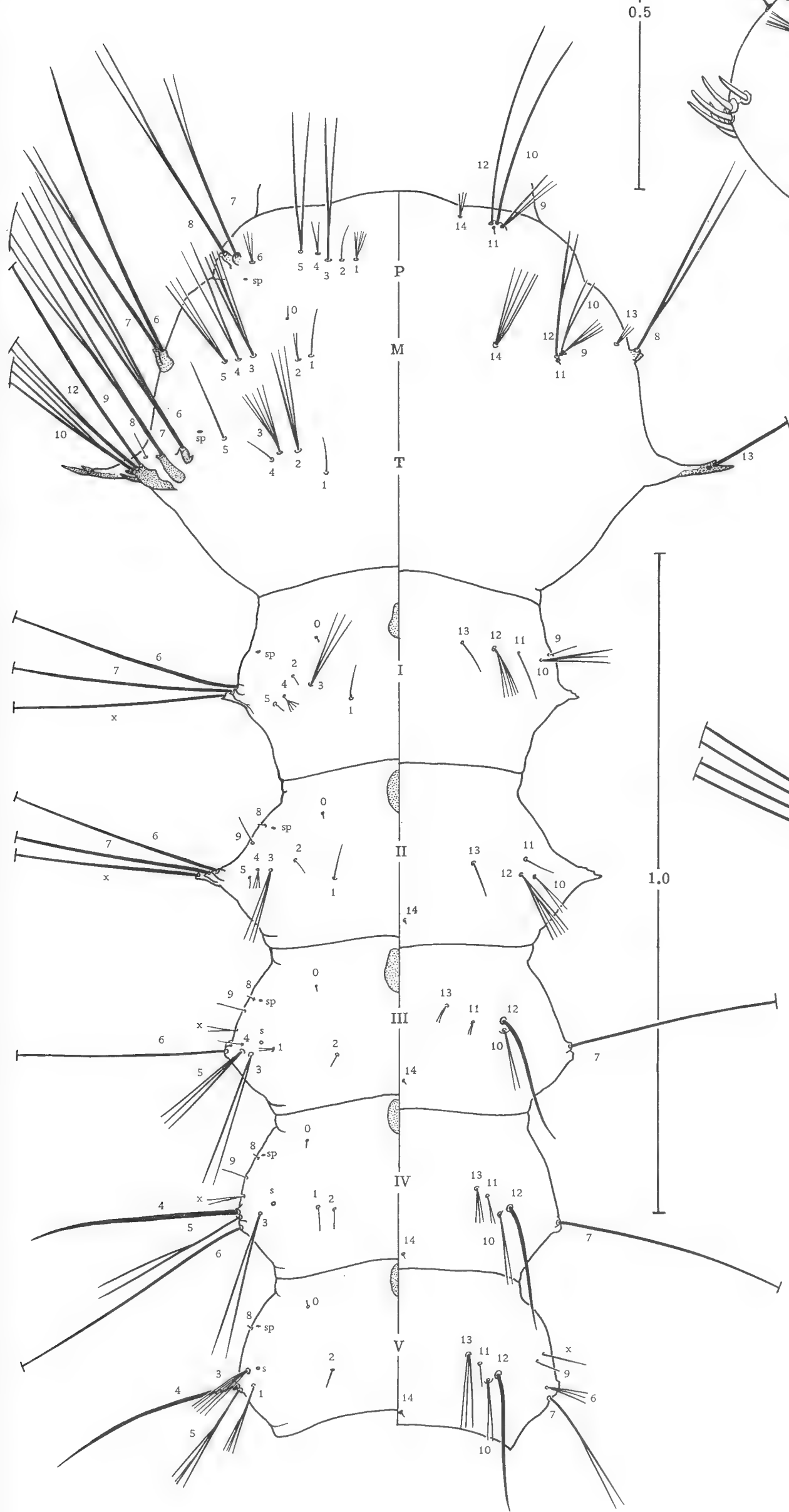


Fig. 122

CORETHRELLA



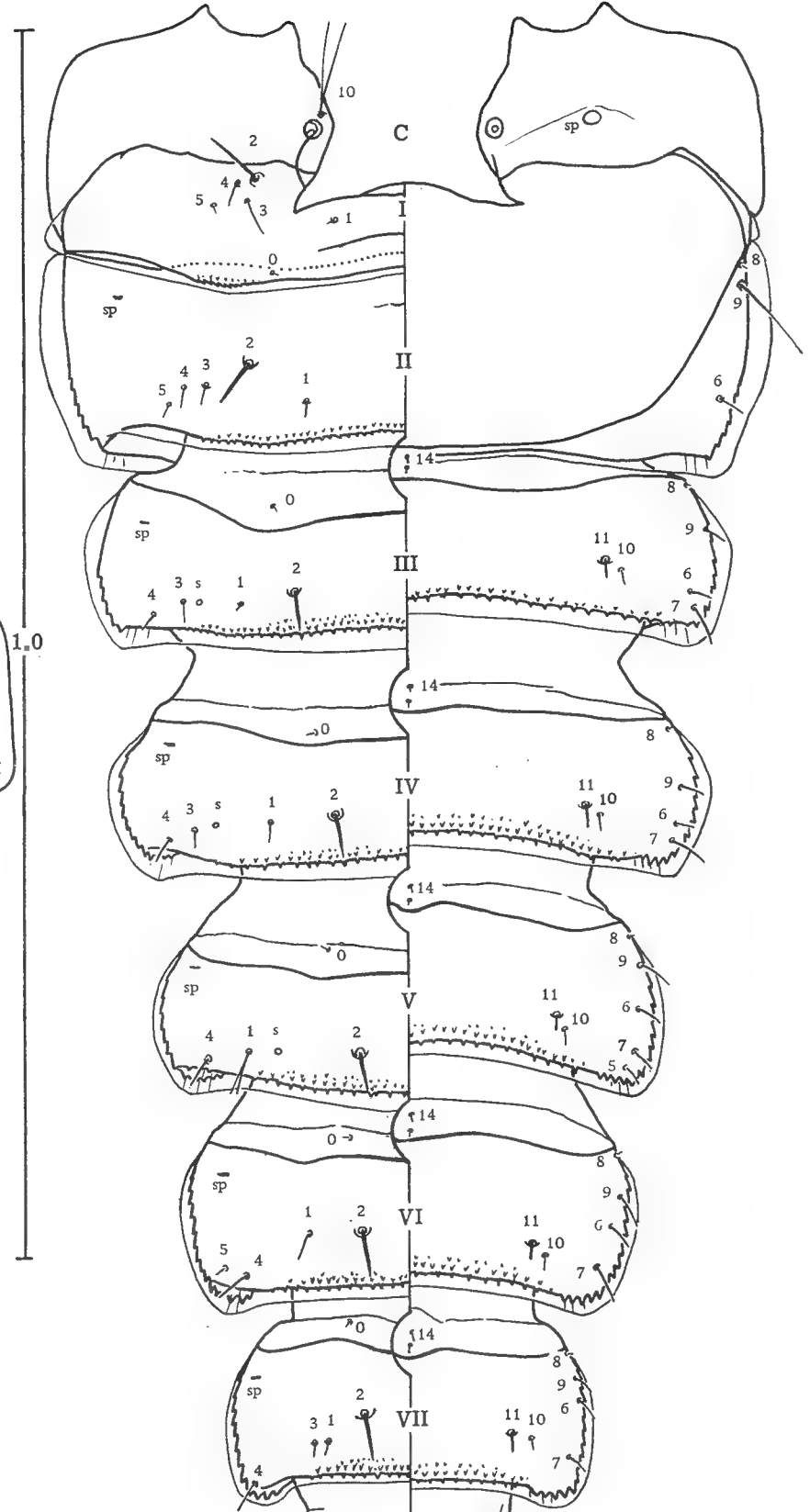
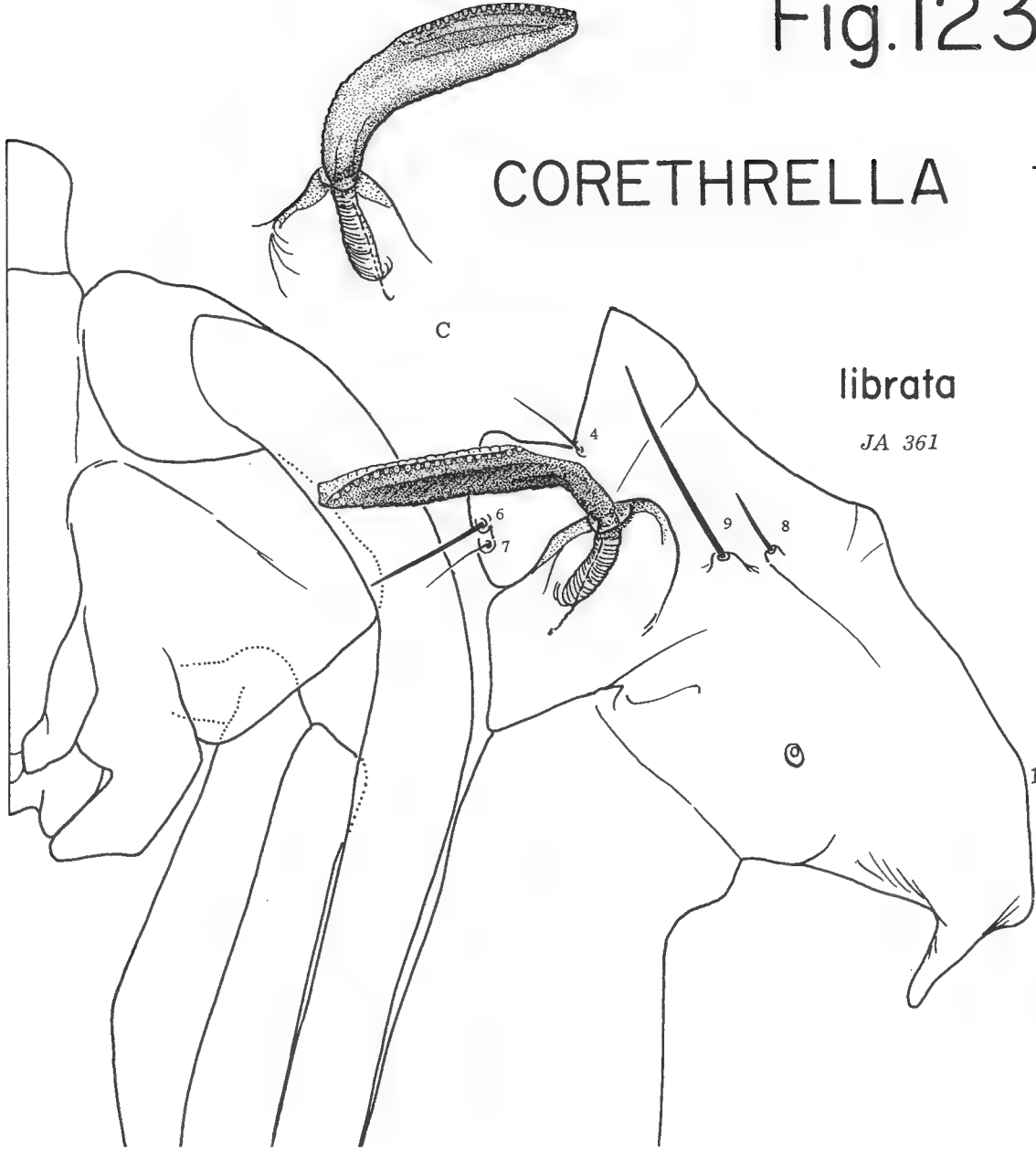
librata

JA 361

N. MARTECH

Fig. 123

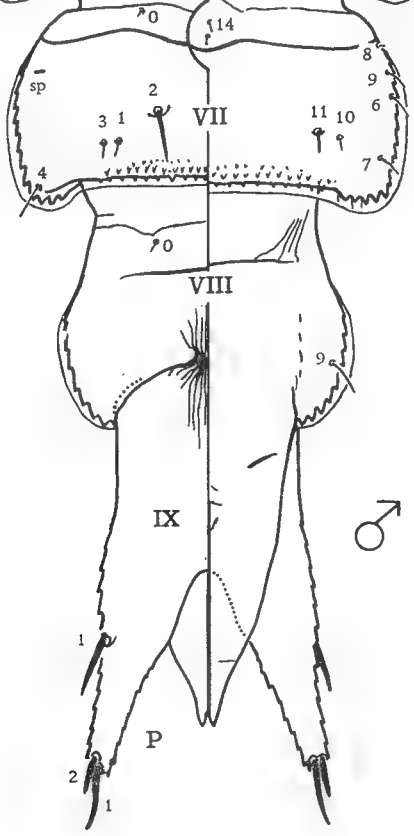
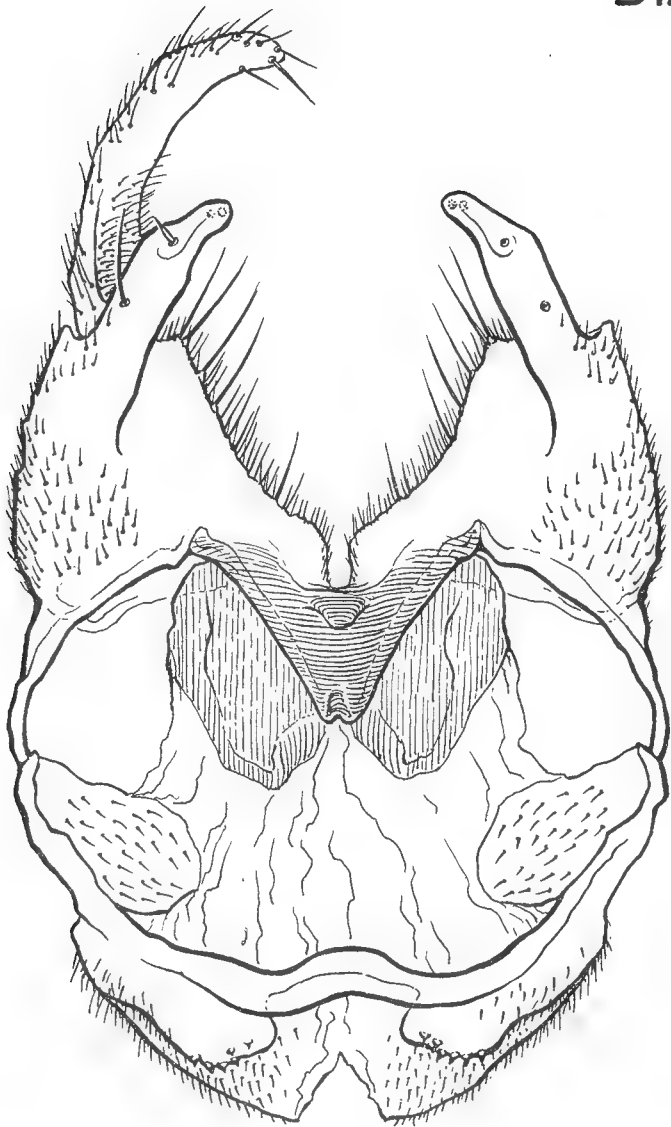
CORETHRELLA



DIXELLA

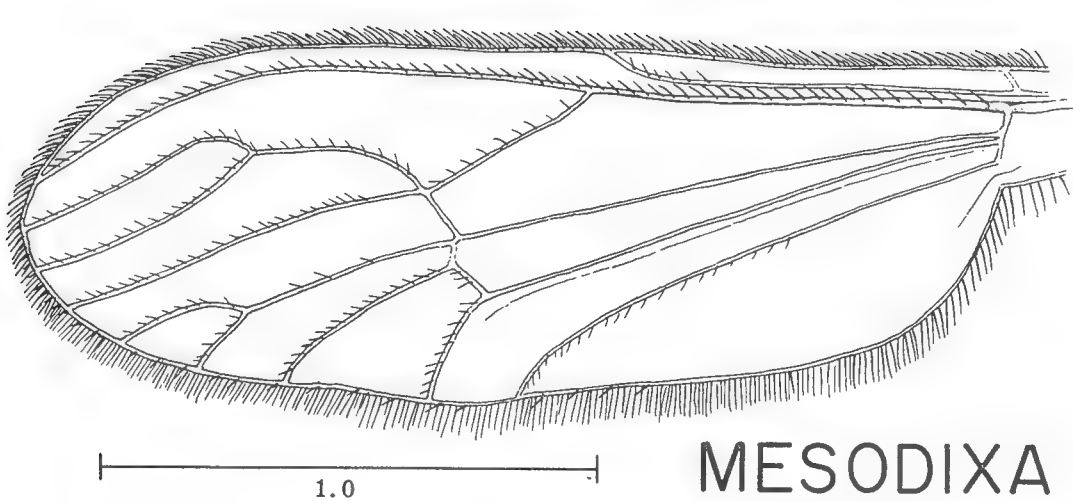
scitula

JA 742

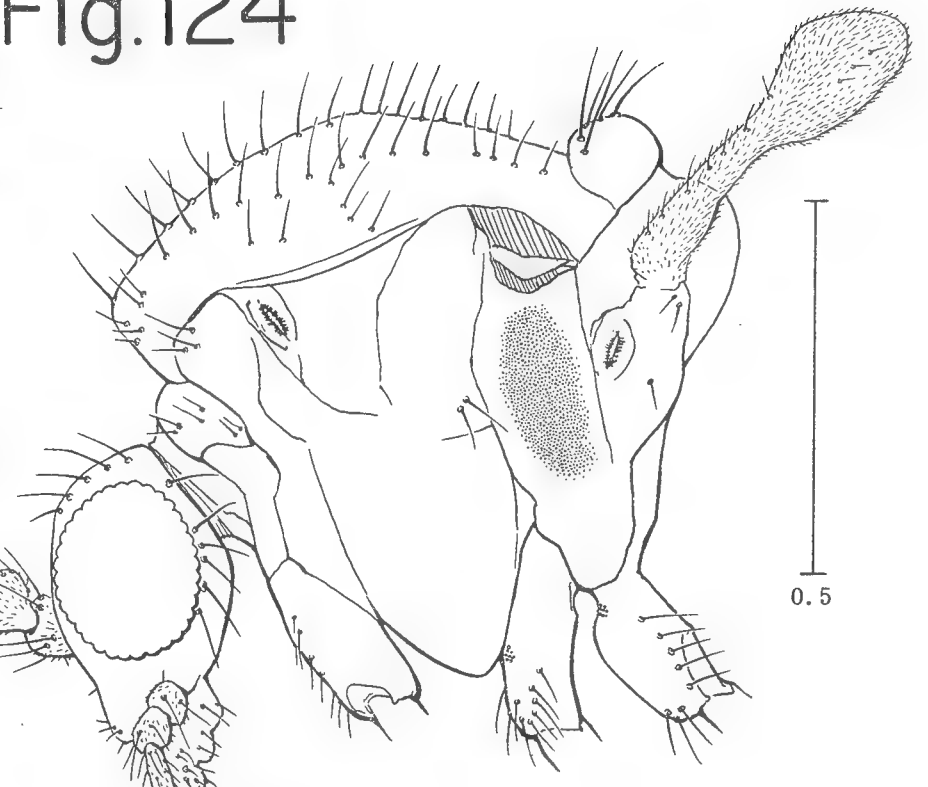


N. MARJICH

Fig. 124



MESODIXA

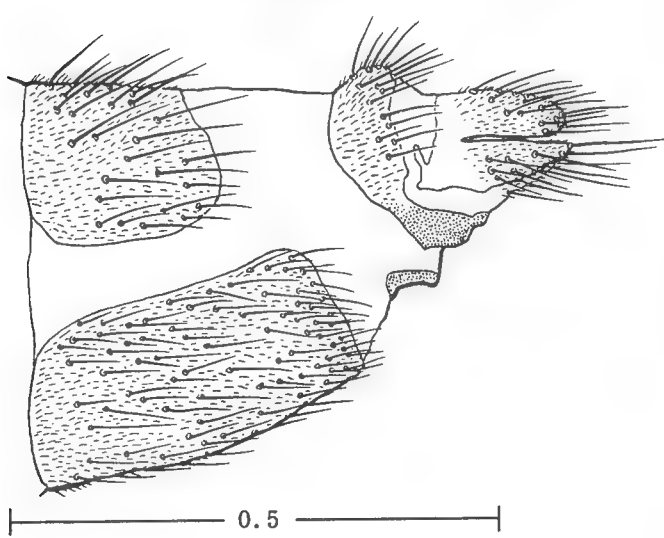


0.5

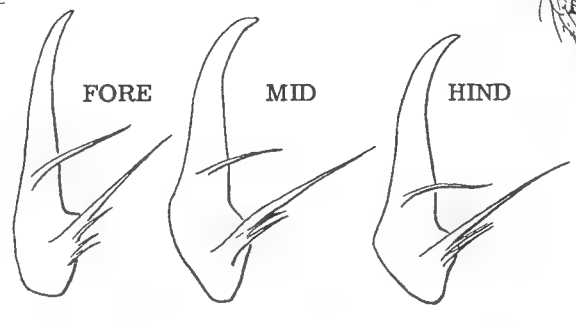
♀

biambulacra

JA 775



0.5

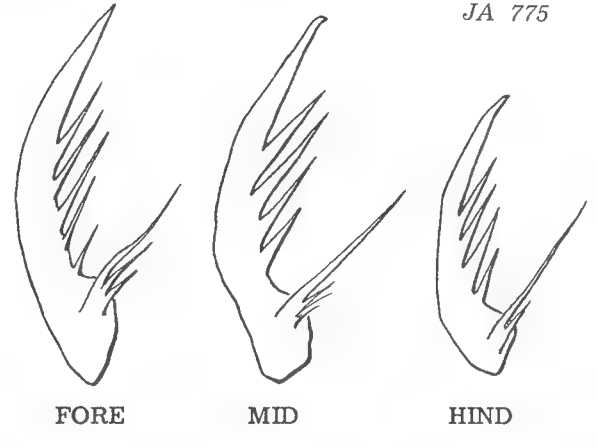


FORE

MID

HIND

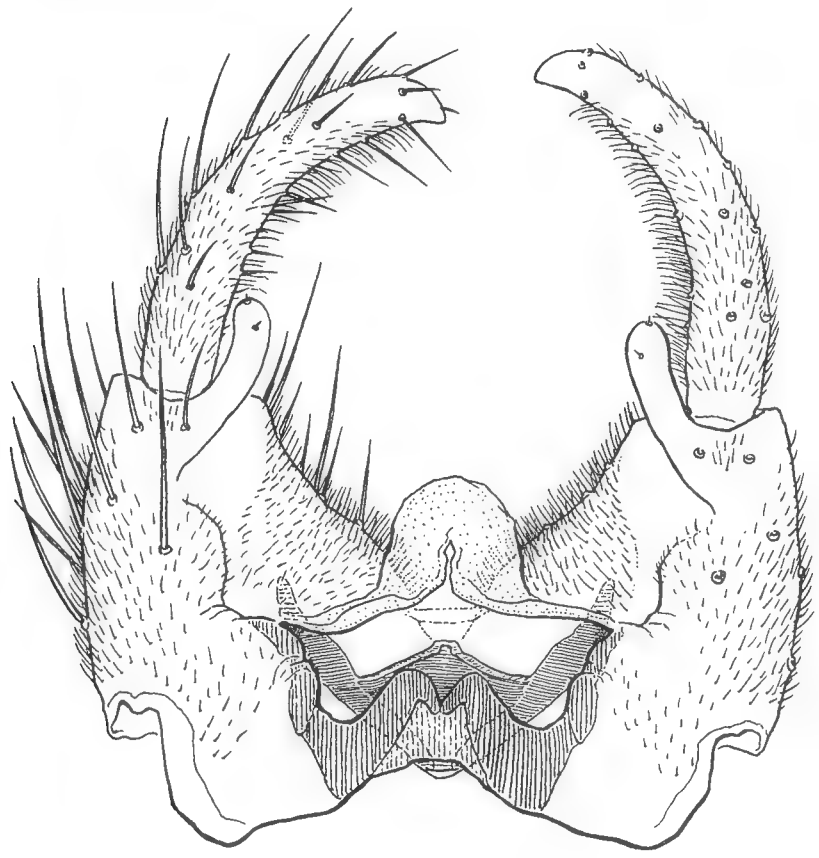
0.05



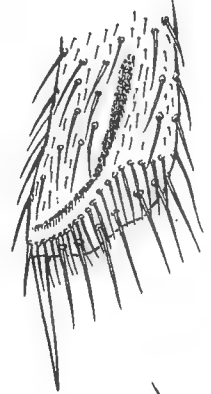
FORE

MID

HIND

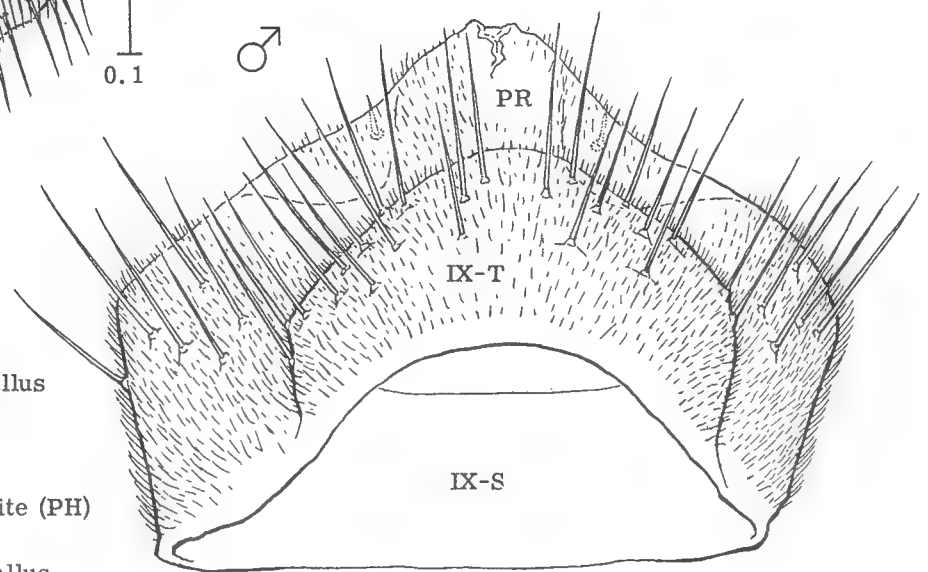


0.1



0.1




♂



IX-S

IX-T

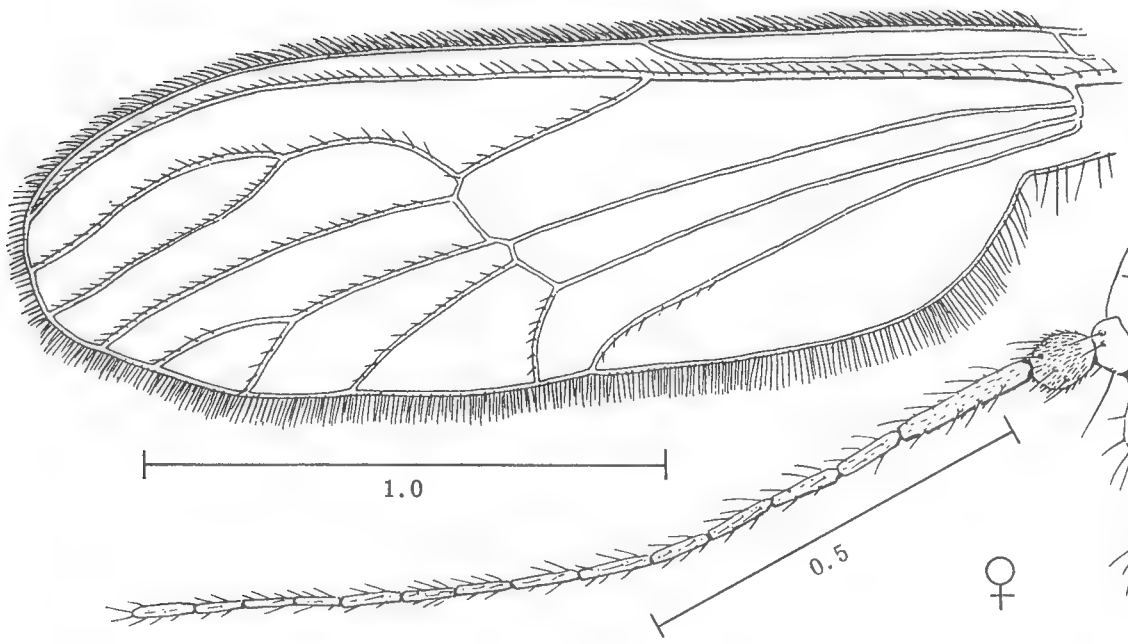
PR

-  Prosopallus (PO)
-  Aedeagal Sclerite (PH)
-  Opisthophallus (OP)

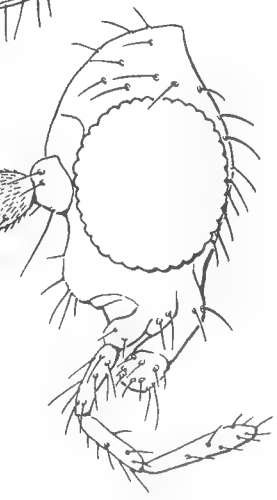
DIXELLA

scitula

JA 742



1.0



0.5

♀



FORE

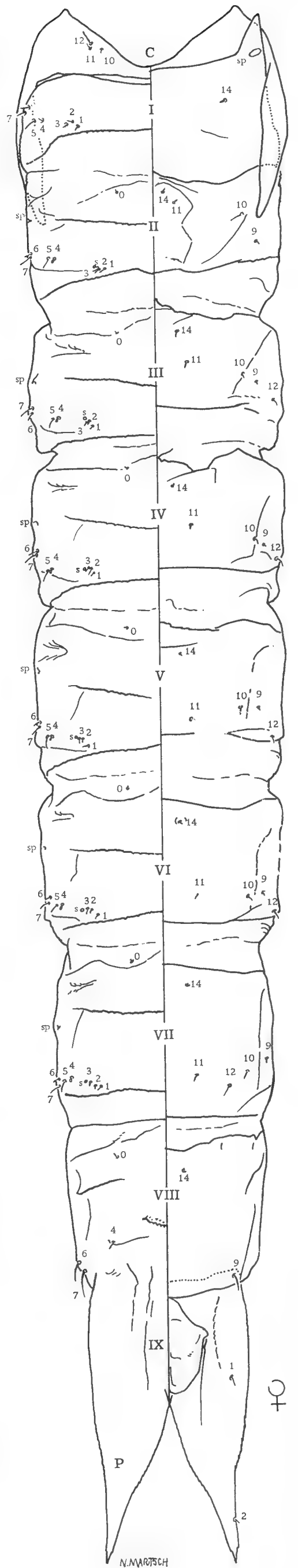
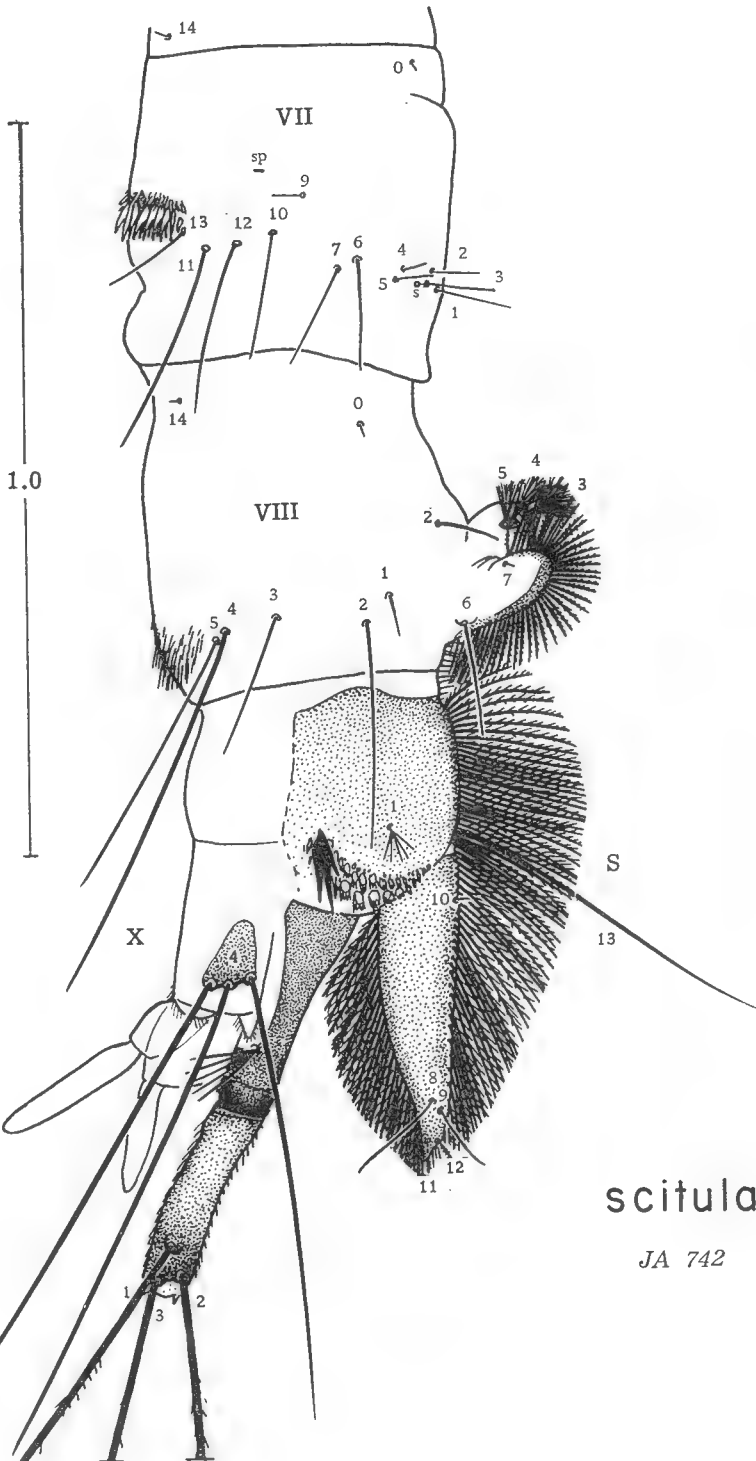
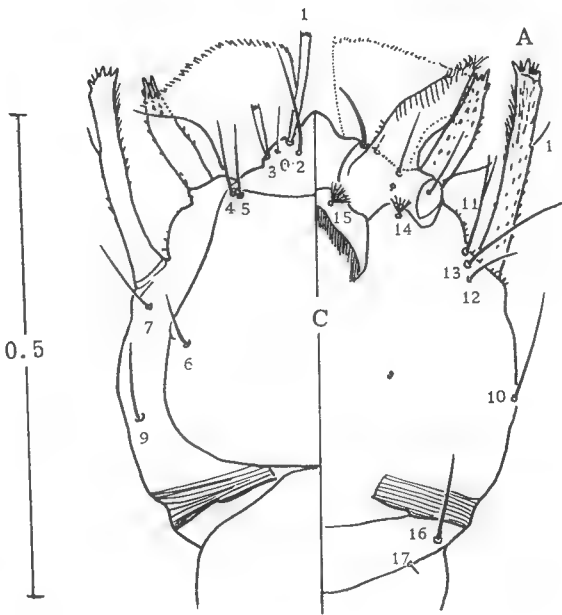
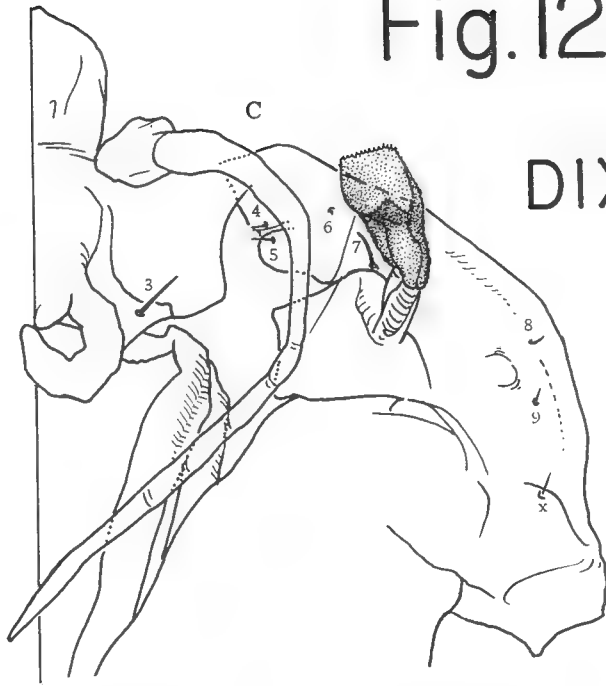
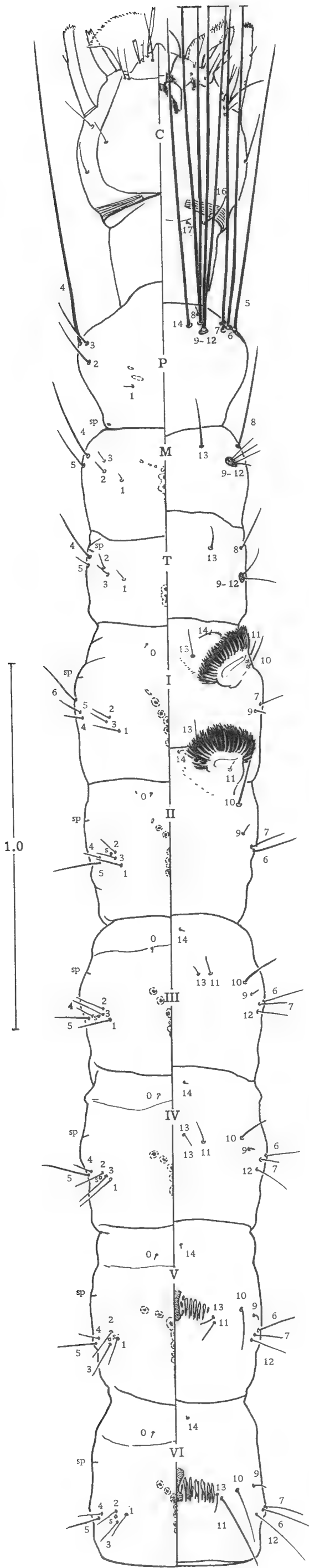
MID

HIND

0.05

Fig. 125

DIXELLA



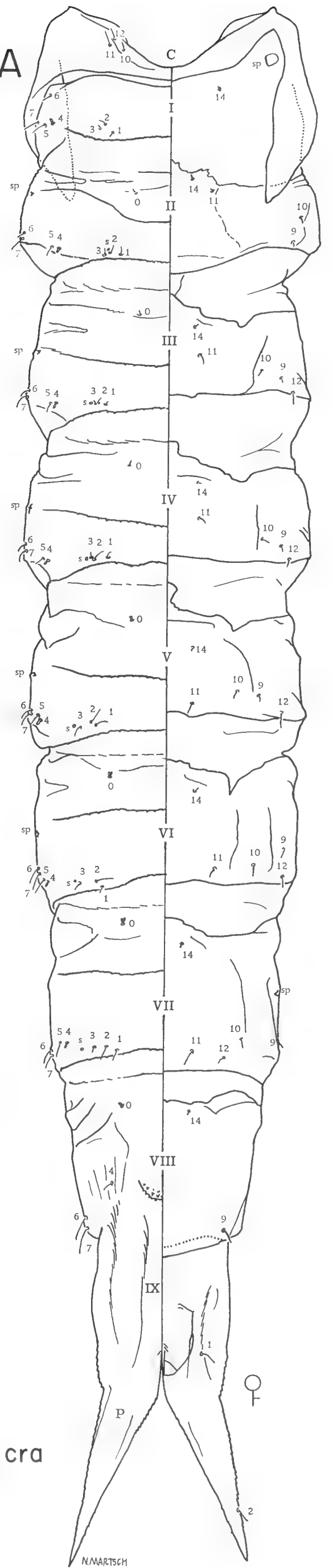
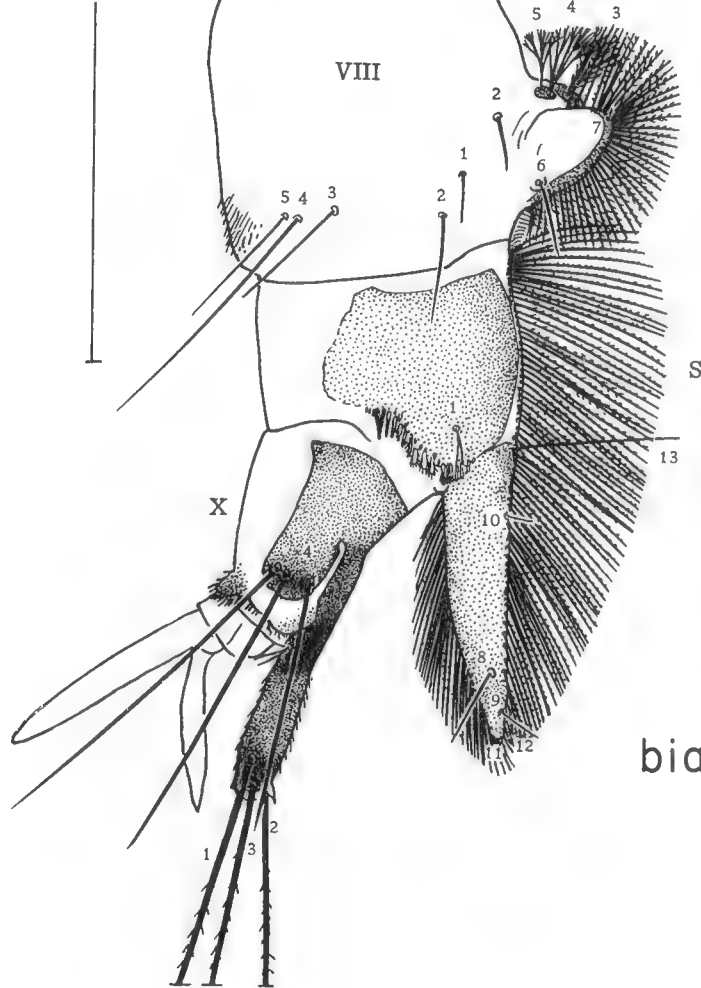
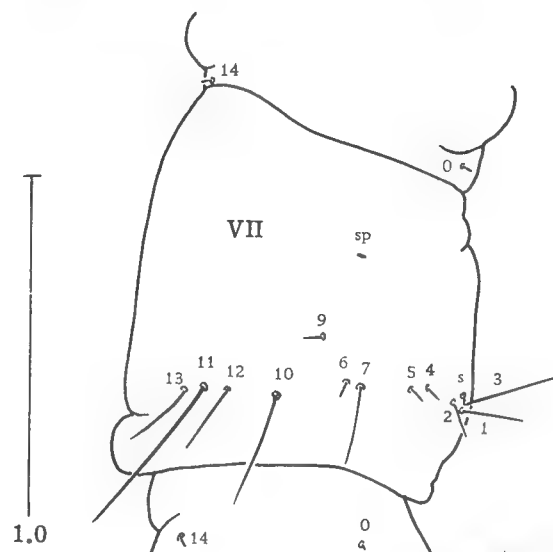
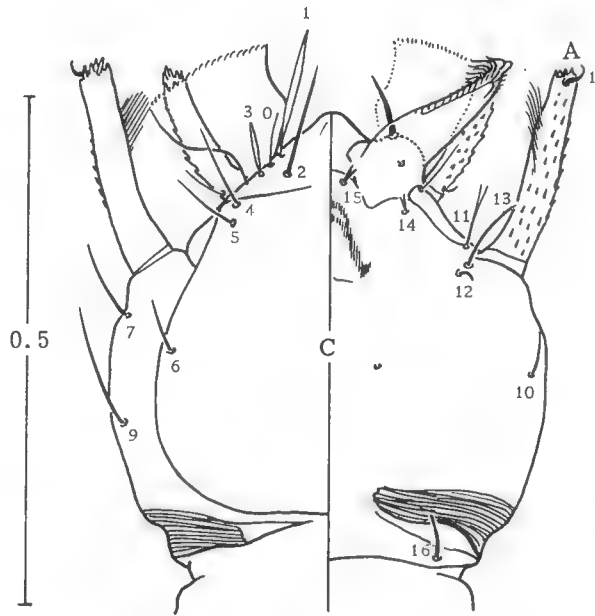
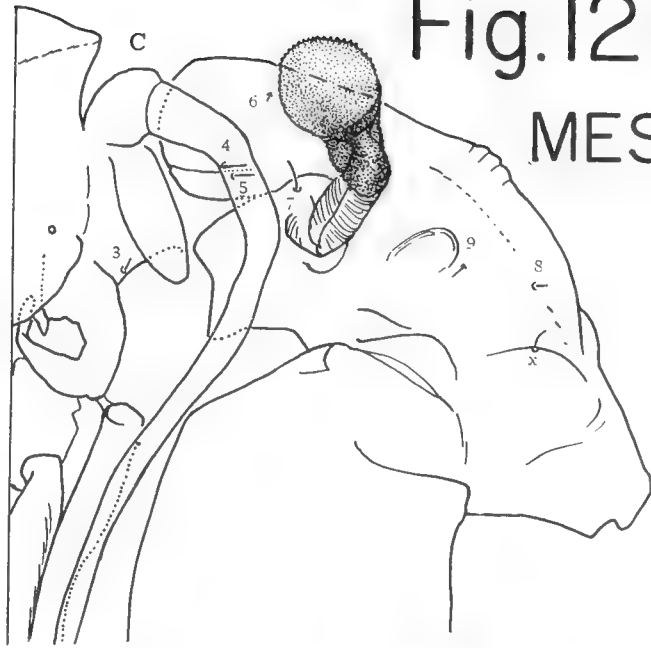
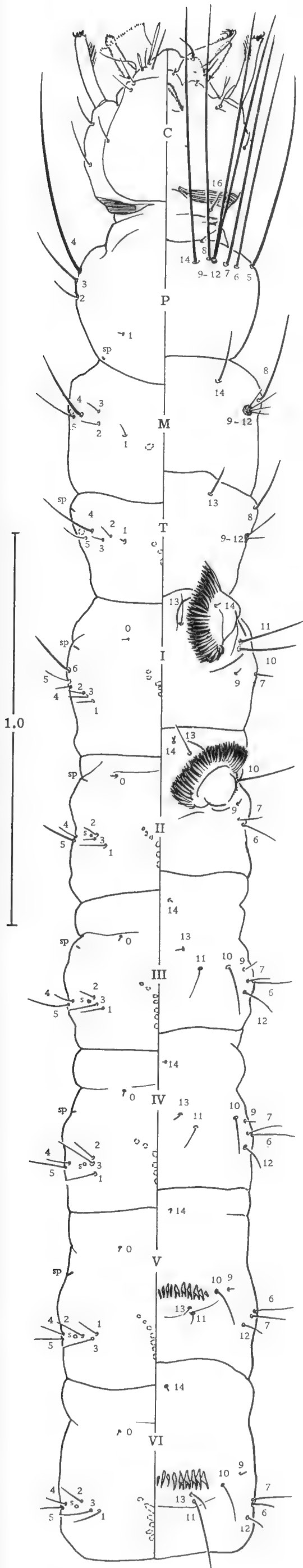
scitula

JA 742

N. MARITSCH

Fig. 126

MESODIXA



biambulacra

JA 775

N. MARTSCH

TABLE OF DISTRIBUTIONS

Legend

Habitat		Class
CA	— Plant axils, bracts	GA — Greater Antillean
CT	— Treehole, bamboo	JE — Jamaican Endemic
GP	— Ground, permanent	MA — Middle American
GT	— Ground, temporary	NA — North American
HC	— Crabhole	WG — Widespread, general
HR	— Rockhole	WN — Widespread, northern
OO	— Domestic, introduced	WS — Widespread, southern
XX	— Varied	

Distribution Symbols




-  indigenous
-  presence or identity doubtful
-  introduced

TABLE OF DISTRIBUTIONS. I

HABITAT	DISTRIBUTION		CLASS	Colom. Ecu.	Panama	C. America	Mexico	Texas	Louisiana	Florida	Bahamas	Cuba	Cayman	JAMAICA	Hispaniola	Puerto Rico	Virgin Is.	Leeward	N. Windw.	S. Windw.	Trinidad	Venezuela	Guianas	S. America	N. America
	SPECIES																								
	Anopheles																								
GP	1. albimanus	MA	★	★	★	★	★			★	★	★	★	★	★	★	★	★	★						
GP	2. atropos	NA				★	★	★		★		★	★	★											★
GP	3. crucians	NA			★	★	★	★	★	★	★	★		★	★	★									★
GP	4. vestitipennis	MA	★	★	★	★						★		★	★	★									
GP	5. grabhamii	GA										★	★	★	★	★	★								
	Uranotaenia																								
GP	6. socialis	JE		★	★									★								★	★	★	
GP	7. cooki	GA												★	★	★	★								
GP	8. lowii	WG	★	★	★	★	★	★	★	★		★	★	★	★	★				★		★	★	★	★
	Deinocerites																								
HC	9. cancer	MA		★	★	★				★	★	★	★	★	★										
	Culex																								
GP	10. bahamensis	GA								★	★	★	★	★	★	★	★	★	★						
XX	11. corniger	WS	★	★	★	★						★		★	★					★	★	★	★		★
GP	12. chidesteri	MA		★			★					★		★		★			★						
HC	13. janitor	GA												★	★	★									
GP	14. secutor	GA												★	★	★			★						
GP	15. nigripalpus	WG	★	★	★	★	★	★	★	★	★	★	★	★	★	★			★	★	★	★	★	★	★
OO	16. quinquefasciatus	OO	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
GP	17. atratus	GA								★	★	★	★	★	★	★	★	★	★						
GP	18. opisthopus	MA		★	★					★			★	★		★									
GP	19. erraticus	WN	★	★	★	★	★	★	★	★		★		★	★	★					★	★	★	★	★
GP	20. iolambdis	MA	★	★		★				★				★		★									
GP	21. inhibitor	GA												★	★										
GP	22. Jamaican form	JE												★											
GP	23. pilosus	WN	★	★	★	★		★		★	★	★		★		★					★	★	★	★	★
GP	24. panocossa	MA		★	★	★								★											
CA	25. arawak	JE												★											
	Coquillettidia																								
GP	26. nigricans	MA	★	★	★	★						★		★								★			
	Mansonia																								
GP	27. titillans	WS	★	★	★	★	★			★		★		★				★			★	★	★	★	★
GP	28. flaveola	GA		★										★		★	★								
GP	29. dyari	MA		★	★					★		★		★		★									
	Orthopodomyia																								
CT	30. waverleyi	JE												★											
	Psorophora																								
GT	31. ciliata	WN	★	★	★	★	★	★	★	★		★	★	★							★	★	★	★	★
GT	32. johnstonii	GA								★	★	★	★	★		★	★								
GT	33. ferox	WG	★	★	★	★	★	★	★	★	★	★		★	★				★	★	★	★	★	★	★
GT	34. Jamaican form	JE												★											
GT	35. infinis	GA										★		★	★										
GT	36. jamaicensis	GA												★	★	★	★								
HR	37. insularia	GA										★		★	★	★									
GT	38. pygmaea	GA								★	★	★	★	★	★	★		★							

CONSPECTUS OF TAXONOMIC CHANGES

NEW TAXA

Aedes		Mesodixa	251
<i>calumnior</i>	169	<i>biambulacra</i>	251
Corethrella		Sayomyia	
<i>librata</i>	246	<i>lanei</i>	240
<i>longitubus</i>	245	Wyeomyia	
Dixella		<i>atrata</i>	227
<i>scitula</i>	249	<i>corona</i>	218
Mansonia		<i>juxtahirsuta</i>	220
<i>dyari</i>	109	<i>luna</i>	213
		<i>stellata</i>	215

CHANGES IN TAXONOMIC STATUS

Aedes		Sayomyia	
<i>auratus</i> , to specific rank	168	<i>festiva</i> , to specific rank	241
<i>hemisurus</i> , to specific rank	163	Wyeomyia	
<i>nubilus</i> , to specific rank	159	<i>antillarum</i> , synonymy	209
<i>pertinax</i> , to specific rank	159	<i>colsoni</i> , synonymy	209
Coquillettidia		<i>grayii</i> , to specific rank	208
<i>neivai</i> , to specific rank	103	<i>mitchellii</i> , to specific rank	207
Psorophora		<i>sororcula</i> , to specific rank	212
<i>columbiae</i> , to specific rank	137		
<i>infinis</i> , to specific rank	133		
<i>jamaicensis</i> , to specific rank	136		

LECTOTYPE DESIGNATIONS

Aedes		Limatus	
<i>auratus</i>	168	<i>hoffmani</i>	230
Corethrella		Psorophora	
<i>appendiculata</i>	242	<i>echinata</i>	126
Culex			
<i>hassardii</i>	61		
<i>jamaicensis</i>	90		
<i>reductor</i>	91		

SYSTEMATIC INDEX

Names of valid taxa represented in Jamaica are in **boldface type**, names of valid extralimital taxa are in roman type. *Italic type* is used for names of all taxa considered invalid in this work (synonyms, homonyms, misidentifications, gross erroneous spellings, and so on). Misidentifications or erroneous taxonomic interpretations are indicated by the use of the term "of authors" and are listed as separate entries following the entry for the correctly applied identical name.

Boldface numerals refer to the principal text references, roman numerals to secondary text references, with the suffix k indicating mention in a key. *Italic numerals* refer to figure numbers. Numerals enclosed in parentheses at the end of an entry refer to JA collection numbers for which data are given on p. 255-304.

- abebela (*Wyeomyia*), 194
 abia (*Wyeomyia*), 205, 208
 advieri (*Culex*), 78
 Aedeomyia, 13, 15k, 16k, 17k, 19k
 Aedeomyiini, 13, 15k, 16k, 17k, 19k
 Aedes, 8, 13, 14k, 17k, 18k, 20k, 62, 115, 116, **143-144**, 151, 186, 187, 191
 Aedes, Jamaican sp., see sp. undetermined
 Aedini, 13, 14k, 17k, 18k, 20k, 97, 112, **115**, 143, 187
 Aedinus of authors, 97
 aegypti (*Aedes*), 8, 10, 11, 115, 143, 144k, 146k, 148k, 149k, 173, 175, **184-187**, 190, 204, 236; *1*, 92, 93; (JA 15, 17, 19, 31, 39, 58, 83, 133-137, 150, 164-166, 171, 172, 182, 195, 197, 209, 214, 221, 223, 224, 226, 249, 252, 265, 273, 274, 280, 287, 298, 300, 304, 305, 319, 327, 373, 387, 623, 641, 642, 684, 806, 815, 822, 831, 837, 851, 916, 920, 926, 928, 937, 952, 955, 959)
 aenigmaticus (*Aedes*), 160
 affirmatus (*Haemagogus*), 188
 aikenii (*Culex*), 94
 aikenii (*Culex*) of authors, 77, 93, 94, 95
 alani (*Culex*), 67, 70
 albimanus (*Anopheles*), 9, 10, 11, 21, 22k, 23k, **24-27**, 31, 34, 36, 49, 81, 86, 87, 89, 92, 143, 157, 251; 7, 8, 9; (JA 1, 2, 4, 8-12, 16-18, 20, 22-27, 29, 30, 32, 35, 36, 46-48, 54-58, 63, 65, 67, 75, 77, 91, 121, 148, 149, 169, 205, 210, 231, 347, 350, 357, 390, 413, 742-744, 746, 747, 757, 759, 766, 781, 782, 785, 800, 803, 807, 808, 813, 814, 819, 868, 871-873, 896, 935, 962)
 albipes (*Anopheles*), 24, 26
 albipes (*Psorophora*), 130
 albonotatus (*Aedes*), 145k, 146k, 148k, 150k, 175
 Albonotatus Group, 175
 americanus (*Chaoborus*), 241
 americanus (*Culex*) of authors, 66, 95, 96, 97
 annulata (*Sayomyia*), 241
 annulipes (*Culex*), 77, 82, 83, 84
 Anopheles, 10, 11, 13, 13k, 15k, 17k, 19k, **20-21**, 137
 Anophelini, 13, 13k, 18k, 15k, 17k, 19k, **20-21**
 antiquae (*Psorophora*), 140
 antillarum (*Wyeomyia*), 209
 antillum (*Sayomyia*), 238, 241, 242
 antillumagnorum (*Culex*), 96
 antoinetta (*Wyeomyia*), 205
 aporonoma (*Wyeomyia*), 204
 appendiculata (*Corethrella*), 9, 10, 115, 190, 204, 236, 237, 238, 238k, 239k, 240k, **242-244**, 245, 246; *118, 119*; (JA 133, 256, 281, 311, 328, 329, 331, 332, 364, 397, 401-403, 407, 408, 622-626, 634, 642, 663, 697, 699, 826, 829)
 arawak (*Culex*), 9, 10, 50, 51k, 53k, 54k, 56k, 66, **95-97**, 209, 227; *34, 48*; (JA 763, 772)
 argenteus (*Aedes*), 185
 argyrites (*Aedes*), 175, 177
 argyrotarsis (*Anopheles*) of authors, 24, 26
 argyrura (*Wyeomyia*), 210
 arthrostigma (*Wyeomyia*), 204
 asulleptus (*Limatus*), 231
 atlanticus (*Aedes*), 160
 atrata (*Wyeomyia*), 8, 9, 192, 193, 194, 196k, 197k, 198k, 199k, 209, 220, 221, 222, 227, **227-229**; *113, 114*; (JA 116, 648, 665, 667, 675, 683, 724, 740, 787, 821, 843, 856)
 atratus (*Culex*), 9, 10, 26, 31, 36, 52k, 54k,

- 55k, 57k, 61, 77, 78-81, 82, 83, 85, 86, 87, 88, 89, 91, 92, 93, 94, 95; 35, 36; (JA 6, 10, 13, 18, 25, 29, 30, 33, 47, 67, 75-77, 86, 213, 414, 609, 701, 717, 719, 720, 727, 744, 759, 769, 781, 785, 797, 798, 807, 813, 814, 816, 862, 871, 898, 899)
- atropos* (Anopheles), 9, 10, 21, 22k, 23k, 24k, 27-29; 8, 10
- auratus* (Aedes), 8, 9, 146k, 148k, 151k, 151, 165, 166, 167, 168-169; 77, 93
- aureostriatus* (Aedes), 7, 180, 181
- aureostriatus* (Aedes) of authors, 182
- aurites* (Aedes), 8, 9, 10, 144k, 146k, 148k, 150k, 175, 178-180, 181, 182, 183, 184, 220; 84, 85; (JA 125, 337, 338, 647, 677, 679-682, 702)
- aurites* (Aedes) of authors, 180, 182, 183
- Aurites Group**, 8, 144k, 146k, 148k, 150k, 175, 178, 179, 181, 183, 184
- autocratica* (Wyeomyia) of authors, 194
- bahama* (Wyeomyia), 194, 196k, 212
- bahamensis* (Aedes), 145k, 146k, 149k, 150k, 175
- bahamensis* (Culex), 9, 10, 51k, 52k, 53k, 55k, 56k, 58, 59-61, 140; 23, 25; (JA 89, 121, 207, 233, 717, 898, 936)
- balteatus* (Aedes), 165
- biambulacra* (Mesodixa), 9, 248, 248k, 249k, 249, 250, 251, 251-254; 124, 126; (JA 741, 775)
- bickleyi* (Culex), 67, 70
- bickleyi* (Culex) of authors, 58, 68, 70
- bipartipes* (Sabethes), 14k, 17k, 18k, 19k, 191
- bisulcatus* (Culex), 97
- bisulcatus* (Culex) of authors, 95
- Bisulcatus Group**, 96
- bracteatus* (Aedes), 165
- bradleyi* (Anopheles), 31
- braziliensis* (Sayomyia), 241
- braziliensis* (Sayomyia) of authors, 238, 242
- busckii* (Aedes), 145k, 147k, 149k, 150k, 175
- busckii* (Aedes) of authors, 175
- busckii* complex, 175
- Busckii Group**, 175
- calopus* (Aedes), 185
- calumnior* (Aedes), 9, 10, 89, 134, 146k, 147k, 149k, 151k, 151, 152, 155, 169-171, 174; 78, 79; (JA 235, 238, 254, 352, 602, 603, 845, 914, 953)
- camposanus* (Aedes), 164
- cancer** (Deinocerites), 9, 10, 45, 46k, 46-50, 68, 81, 155; 21, 22; (JA 78, 79, 88-90, 92, 103, 112, 127, 140, 170, 175, 178, 180, 205A, 215, 217-221, 254, 255, 260-264, 268-271, 274-279, 313-317, 344-350, 366-371, 385, 386, 398, 610, 615, 616, 701, 705, 736, 770, 783, 794, 812, 839, 857-861, 866, 867, 871, 878-886, 903, 948-950, 953, 961)
- caracula* (Wyeomyia), 191, 203, 204
- caracula* (Wyeomyia) of authors, 191, 200, 203, 204
- Caracula Group**, 191, 193, 204
- carcinophilus* (Culex), 77
- cedecei* (Culex), 82, 83, 84
- celaenocephala* (Wyeomyia), 192, 194, 195
- Chaoboridae**, 13
- Chaoborinae**, 5, 8, 12k, 237-238, 248
- Chaoborini**, 8, 237, 240
- charmion* (Wyeomyia), 194
- chidesteri* (Culex), 9, 51k, 52k, 53k, 55k, 56k, 58, 64-66, 247; 26, 27; (JA 227, 361)
- ciliata* (Psorophora), 9, 116, 116k, 117k, 118k, 119k, 120, 121-124; 56, 57; (JA 206)
- cingulata* (Psorophora), 133
- cingulata* (Psorophora) of authors, 131, 133
- Cingulata Group**, 131
- clavulus* (Dixella), 248, 253
- coffini* (Psorophora), 124, 125
- colsoni* (Wyeomyia), 208, 209
- columbiae* (Psorophora), 116, 117k, 118k, 119k, 120k, 131, 137
- conchita* (Wyeomyia), 210
- condolenscens* (Aedes), 145k, 151, 162, 164
- confinnis* (Psorophora), 136, 137
- confinnis* (Psorophora) of authors, 11, 116, 134, 136, 137, 143
- confinnis complex**, 137
- Confinnis Group**, 131
- confirmatus* (Aedes) of authors, 161
- continentalis* (Uranotaenia), 43
- cooki* (Uranotaenia), 8, 9, 37, 38k, 39k, 41-43, 81; 17, 20; (JA 358, 797, 798)
- Coquillettia**, 10, 13, 15k, 16k, 17k, 19k, 97, 98k, 99k, 100k, 100
- Corethrella**, 8, 237, 238, 238k, 239k, 242
- Corethrellini**, 8, 237, 242

- corniger* (Culex), 9, 10, 51k, 52k, 53k, 55k, 56k, 58, 61-63, 89, 134, 204, 209, 227; 24, 25; (JA 50, 288, 289, 296, 300-303, 307, 308, 382, 611, 636, 739, 748, 749, 780, 827, 891, 915, 944)
- corniger* (Culex) of authors, 59
- corona* (Wyeomyia), 8, 9, 192, 193, 194, 197k, 198k, 199k, 213, 217, 218, 218-220, 221, 226, 229; 107, 108; (JA 607, 667, 678, 732)
- coronator* (Culex), 10
- cozumelensis* (Aedes), 145k, 147k, 148k, 150k, 175
- crinifer* (Aedes), 164
- crucians* (Anopheles), 9, 21, 22k, 23k, 29-31, 88; 7, 8, 11; (JA 6, 23, 34, 36, 357, 358, 794)
- Culex*, 10, 13, 15k, 17k, 20k, 45, 48, 50, 51k, 53k, 55k, 56k, 57-58 (subgenus), 76, 137
- Culex*, Jamaican form, see sp. 22
- Culicinae*, 5, 8, 12k, 13, 237, 241, 248
- Culicini*, 13, 15k, 17k, 20k, 45, 97
- Culiseta*, 13, 14k, 16k, 18k, 20k
- Culisetini*, 13, 14k, 16k, 18k, 20k, 115
- cyanopennis* (Psorophora), 123
- damnosus* (Aedes), 152
- Deinocerites*, 5, 13, 15k, 17k, 20k, 45, 45-46, 49, 50
- Dixa*, 253
- Dixella*, 8, 10, 248, 248k, 249k, 249, 251, 253
- Dixidae*, 13
- Dixinae*, 5, 8, 12k, 248
- Dixini*, 253
- duplicator* (Culex), 58
- dupreei* (Aedes), 160
- durhamii* (Limatus), 231
- dyari* (Mansonia), 9, 97, 98, 99k, 100k, 109-112; 50, 53
- echinata* (Psorophora), 116, 126, 129
- Edwardsops, 237
- eleuthera* (Culex), 59
- epinolus* (Aedes), 152
- equinus* (Haemagogus), 9, 10, 14k, 17k, 18k, 20k, 115, 187, 188-190, 236; 94, 95; (JA 327, 328, 391, 407, 410, 412, 696, 699, 941, 951, 952, 957-959)
- erraticus* (Culex), 9, 52k, 54k, 55k, 57k, 77, 84-86, 88, 91; 42, 43; (JA 77, 728)
- eucephalaeus* (Aedes), 160
- euplocamus* (Aedes), 164
- falsificator* (Culex), 78, 79
- fasciatus* (Aedes), 185
- fasciatus* (Aedes) of authors, 176
- fatigans* (Culex), 73
- ferox* (Psorophora), 9, 90, 116, 117k, 119k, 126, 126-130, 130; 59, 60; (JA 156, 159, 359, 360, 649, 788, 792A, 918, 921)
- ferruginosus* (Anopheles), 27, 28
- festiva* (Sayomyia), 241
- fiebrigi* (Psorophora), 129
- Finlaya**, 143, 144, 144k, 147k, 148k, 149k, 170, 171, 174, 175, 187
- finlayi* (Culex), 58, 64, 65
- flabellifer* (Culex) of authors, 77, 88, 89
- flaveola* (Mansonia), 7, 8, 9, 13, 97, 98k, 99k, 100k, 107-109; 50, 52
- flaveola* (Mansonia) of authors, 109
- fratercula* (Wyeomyia), 212
- fulvus* (Aedes), 151
- Galindomyia*, 45
- gaudians* (Wyeomyia), 194, 195
- gausapata* (Wyeomyia), 194, 195
- glaucocephala* (Wyeomyia), 205, 208
- grabhami** (Aedes), 8, 9, 10, 97, 144k, 146k, 148k, 150k, 175, 180, 180-182, 182, 183, 184, 209, 213, 215, 220, 227, 229; 86, 87; (JA 319, 354, 356, 376, 378, 380, 630-632, 643, 648, 650-652A, 655, 656, 658, 667, 669, 670, 676, 684, 686-689, 702, 706, 708, 723, 725, 731-735, 758, 762-765, 771-774, 776, 854, 892, 902)
- grabhamii** (Anopheles), 9, 11, 21, 22k, 23k, 24k, 26, 33, 34-36, 49, 63, 70, 81, 89, 90, 92, 129; 7, 13, 14; (JA 28-30, 32, 38, 41, 43, 44, 46, 51, 56, 58, 60, 63, 65, 67, 91, 121, 147, 149, 209, 210, 225, 226, 231, 232, 604, 608, 739, 743, 744, 746, 747, 754, 769, 785, 797, 798, 817, 828, 832-836, 851, 852, 857, 860, 868, 873, 891, 893, 911, 921, 947, 954)
- Grabhamia**, 92, 116, 117k, 118k, 119k, 120k, 124, 130-131
- grayii* (Wyeomyia), 208, 209
- grayii* (Wyeomyia) of authors, 193, 222, 226
- guadeloupensis* (Toxorhynchites), 231, 232k, 235

- guatemala (*Wyeomyia*), 195
- habanicus* (*Aedes*), 165
- habilitator (*Culex*), 58
- Haemagogus**, 13, 14k, 17k, 18k, 20k, 115, 143, 187
- haitiensis* (*Toxorhynchites*), 233, 235
- haruspicus* (*Psorophora*), 138, 140
- hassardii* (*Culex*), 61, 63
- hastatus (*Aedes*), 160
- haynei (*Wyeomyia*), 192, 194, 195
- hemisurus** (*Aedes*), 8, 9, 11, 26, 137, 143, 145k, 147k, 149k, 151k, 151, 152, 154, 157, 161-165, 165, 166, 167, 168, 170; 73, 74; (JA 37, 353, 404, 604, 649, 757, 759, 768, 796, 799, 863, 890, 896, 913, 914)
- hirsuta** (*Wyeomyia*), 8, 9, 63, 97, 192, 193, 194, 196k, 197k, 198k, 200k, 200, 202, 205, 206, 207, 209, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 222-227, 228, 229; 96, 111, 112; (JA 644-646, 651, 655, 670, 671, 674, 676, 706, 723, 725, 748, 758, 763, 767, 772, 774, 779, 846, 931)
- hirsuta* (*Wyeomyia*) of authors, 218, 219, 226
- Hirsuta Group**, 8, 178, 181, 192, 192-193, 193, 194, 195, 213, 215, 227
- Hirsuta Subgroup** (*Wyeomyia*), 193, 194, 215, 217, 220, 221, 226, 227, 229
- hoffmani (*Dixella*), 248, 251
- hoffmani (*Limatus*), 8, 9, 10, 14k, 17k, 18k, 19k, 191, 229, 230-231; (JA 930, 956)
- howardii (*Psorophora*), 116, 116k, 117k, 118k, 119k, 120, 122, 123
- Howardina**, 5, 8, 10, 143, 144k, 146k, 148k, 149k, 172, 173, 175, 177, 178, 187, 191, 209
- inaequalis** (*Aedes*), 8, 9, 10, 63, 89, 115, 114k, 146k, 148k, 150k, 171, 174, 175, 180, 182-183, 183, 184, 190, 204; 88, 89; (JA 103, 109, 173, 250-252, 258, 280, 288, 290, 292-296, 298-300, 302-304, 306-309, 321, 325-327, 330, 331, 351, 352, 356, 369, 372, 373, 390, 397, 408, 412, 602, 603, 605, 634, 684, 696, 701, 711, 713, 715, 735, 780, 822, 826, 827, 901, 914, 916, 917, 924, 925, 930, 952, 957)
- inaequalis* (*Aedes*) of authors, 178, 180, 181
- indolenscens* (*Aedes*), 161, 163
- indubitans (*Mansonia*), 97, 106, 111
- indubitans* (*Mansonia*) of authors, 8, 97, 110, 111, 112
- infinis** (*Psorophora*), 9, 10, 92, 116, 117k, 118k, 119k, 120k, 131, 131-134, 135; 61, 63; (JA 340, 341, 343, 603, 608, 611, 612, 618, 620, 739)
- infirmatus (*Aedes*), 164
- inflictus* (*Culex*) of authors, 58
- inhibitor** (*Culex*), 8, 9, 36, 52k, 54k, 55k, 57k, 63, 70, 77, 78, 86, 87, 88-90, 90, 129, 134; 40, 41; (JA 45, 47, 352, 360, 612, 616, 701, 738, 739, 827, 828, 851-853, 888, 891, 893-895, 921)
- inornata (*Culiseta*), 13, 14k, 16k, 18k, 20k
- insularia** (*Psorophora*), 9, 10, 61, 115, 116, 117k, 118k, 119k, 120k, 131, 138-140; 62, 64; (JA 89, 389, 400, 717, 927, 936)
- interrogator (*Culex*), 65
- interrogator* (*Culex*) of authors, 58
- investigator* (*Culex*), 88
- iolambdis** (*Culex*), 9, 52k, 54k, 55k, 57k, 77, 78, 86-88, 88, 89; 39, 41; (JA 6, 782, 784)
- Ioliota Group, 175
- Jamaican form** (*Culex*), see sp. 22
- Jamaican form** (*Psorophora*), see sp. 34
- Jamaican form A** (*Wyeomyia*), see sp. 59
- Jamaican form B** (*Wyeomyia*), see sp. 64
- jamaicensis* (*Culex*), 90, 91, 92
- jamaicensis** (*Psorophora*, *Grabhamia*), 9, 10, 11, 26, 49, 91, 116, 117k, 118k, 119k, 120k, 129, 131, 133, 134-138, 138, 139, 141, 142, 143, 167; 66, 67; (JA 2-4, 21, 22, 37, 58, 59, 61, 80, 81, 93, 94, 96, 97, 101, 102, 128, 137, 155-157, 161-163, 165, 171, 189, 202, 291, 362, 363, 604, 757, 841, 862-864, 869, 870, 913)
- jamaicensis* (*Psorophora*, *Janthinosoma*), 126
- jamaicensis* (*Wyeomyia*), 205
- janitor** (*Culex*), 9, 10, 49, 51k, 52k, 53k, 56k, 58, 66-68, 81; 29, 30; (JA 359, 360, 616, 701, 702, 719, 720, 736, 885, 888, 889, 949)
- janitor* (*Culex*) of authors, 67
- Janthinosoma**, 116, 116k, 117k, 118k, 119k, 120, 124, 130, 131
- johnstonii** (*Psorophora*), 7, 9, 116, 116k, 117k, 118k, 119k, 124-126, 130; 58, 61

- juxtahirsuta* (Wyeomyia), 8, 9, 192, 193, 194, 196k, 197k, 198k, 200k, 209, 215, 220, 220-221, 222, 227; 109, 110; (JA 650, 653, 676, 723, 758, 774)
- lactator* (Culex), 61
- lamentator* (Culex), 68, 70
- laneana* (Corethrella), 237, 243, 244, 246, 247
- lanei* (Sayomyia), 9, 237, 238, 238k, 239k, 240-242; 117; (JA 750, 756, 900)
- laticlasper* (Culex), 65
- leucoptera* (Uranotaenia), 37
- librata* (Corethrella), 9, 10, 237, 239k, 240k, 245, 246, 246-247; 122, 123; (JA 361)
- Limatus*, 13, 14k, 17k, 18k, 19k, 191, 229
- lirio* (Dixella), 248, 251
- Longipalpifer**, 187
- longipes* (Trichoprosopon), 14k, 16k, 18k, 19k, 191
- longitubus* (Corethrella), 9, 10, 237, 238, 238k, 239k, 240k, 245-246, 246, 247; 120, 121; (JA 245)
- lowii* (Uranotaenia), 9, 26, 37, 38k, 39k, 43, 43-45; 18, 20; (JA 358, 604, 759, 761)
- luna* (Wyeomyia), 8, 9, 192, 193, 196k, 197k, 198k, 199k, 213-215, 217, 218, 221; 103, 104; (JA 377, 731, 733)
- Luna Subgroup**, 192, 193, 215
- Lutzomiops*, 237
- Lutzomiops* sp. of authors, 238
- lynchi* (Psorophora), 123
- Lynchiella**, 234
- macrosquamosa* (Culex) of authors, 71
- maculipes* (Anopheles) of authors, 32, 33
- magnus* (Deinocerites), 46, 46k
- Mansonia**, 10, 13, 15k, 16k, 17k, 19k, 97, 98k, 99k, 100k, 103
- Mansoniini**, 13, 15k, 16k, 17k, 19k, 97-98
- mathisi* (Aedes), 159
- medioalbipes* (Wyeomyia), 194, 208
- medioalbipes* (Wyeomyia) of authors, 195, 205, 208, 209
- mediovittatus* (Aedes), 9, 10, 89, 115, 134, 144k, 147k, 148k, 149k, 155, 171, 171-175, 183, 190, 204, 236, 244; 80, 81; (JA 82, 230, 235, 238, 239, 248, 252, 286, 288, 296, 327, 328, 351, 352, 373, 387, 390, 391, 397, 408, 410, 602, 603, 605, 623, 624, 627, 638, 699, 801, 845, 902, 913, 914, 949, 952)
- mediovittatus* (Aedes) of authors, 174
- Melanoconion**, 48, 50, 52k, 54k, 55k, 57k, 58, 76-78, 81, 92, 95, 96, 97
- melanopus* (Wyeomyia), 194, 195
- meridionalis* (Aedes), 159, 160
- Mesodixa**, 8, 10, 248, 248k, 249k, 251, 253
- Micraedes**, 50, 51k, 53k, 54k, 56k, 95-97
- Microculex*, 50
- microsquamosus* (Culex), 71, 72
- mitchellii* (Wyeomyia), 9, 63, 97, 191, 193, 194, 195, 196k, 197k, 198k, 199k, 205-210, 226, 227, 229; 96, 99, 100, 102; (JA 50, 105, 126, 130, 154, 158, 184, 204, 208, 282, 322, 334, 358, 377, 403, 406, 608, 621, 648, 664, 671, 673, 691, 692, 703, 708, 724, 726, 748, 749, 758, 763, 787, 810, 811, 855, 912, 920, 922, 933, 942, 945, 946)
- Mochlostyrax*, 77, 92
- mosquito* (Aedes), 185
- mulrennani* (Culex), 77
- mychonde* (Culex), 82, 84
- nana* (Psorophora), 140, 142
- neivai* (Coquillettia), 103
- niger* (Aedes), 152, 154
- nigra* (Ficalbia), 152
- nigricans* (Coquillettia), 9, 97, 98k, 99k, 100k, 100-103; 49, 50; (JA 357, 358, 792A, 794)
- nigripalpus* (Culex), 9, 10, 11, 26, 31, 33, 36, 49, 51k, 53k, 55k, 56k, 58, 67, 68, 70, 70-73, 81, 88, 89, 90, 92, 143, 157, 167; 26, 28; (JA 34, 49, 53, 54, 58, 62, 71, 72, 87, 93, 104, 132, 140, 142, 143, 146-148, 151, 168, 199, 209-211, 216, 228, 229, 232, 253-255, 358, 600, 601, 604, 610, 611, 641, 736, 745, 757, 759, 761, 784, 786, 797-800, 804, 805, 814, 818, 857, 871, 872, 891, 893, 896, 914, 936)
- nigritubus* (Wyeomyia), 9, 10, 63, 183, 191, 193, 195, 195k, 197k, 198k, 199k, 200-204, 209, 223; 96, 97, 98, 102; (JA 111, 150, 239, 258, 259, 286, 287, 290, 293-298, 300-304, 306-309, 311, 312, 321, 395; 711-715, 737, 778, 822, 823, 920, 923, 924)
- Nothodixa*, 253
- nubilus* (Aedes), 159, 160

- nubilus* (Aedes) of authors, 158, 160
Nyssorhynchus, 21
- obturbator (Aedes), 146k, 147k, 151k, 151-152, 162, 170, 171
obturbator (Aedes) of authors, 8, 169, 171
Ochlerotatus, 8, 10, 92, 129, 143, 144, 145k, 147k, 149, 150k, 151-152, 158, 159, 160, 162, 163, 164, 170, 171, 187
ochrura (Wyeomyia), 205, 208
ocossa (Culex), 93-94, 95; 46, 47
oligopistus (Aedes), 160
opisthopus (Culex), 9, 10, 52k, 54k, 55k, 57k, 77, 81, 82-84, 85, 91, 92; 37, 38; (JA 357, 358, 718, 719, 793, 874-876)
Orthopodomyia, 5, 13, 15k, 16k, 18k, 19k, 112
Orthopodomyiini, 13, 15k, 16k, 18k, 19k, 112, 115
oteizai (Uranotaenia), 37, 38k, 39k
- pallens* (Aedes), 145k, 147k, 151k, 151
pampithes (Wyeomyia), 226
pampithes (Wyeomyia) of authors, 193, 222, 226
panocossa (Culex), 9, 52k, 54k, 55k, 57k, 77, 93-95; 58
Paradixa, 250, 251, 252, 253
Paradixini, 8, 248, 251, 253
peccator (Culex), 77
persephassa (Coquillettia), 100
pertinans (Wyeomyia), 195, 208, 209
pertinans (Wyeomyia) of authors, 193, 222, 226
Pertinans Group, 191, 192, 193, 195, 206, 207, 208, 209
pertinax (Aedes), 9, 10, 143, 146k, 147k, 149k, 150k, 151, 157-160, 163, 169; 71, 72; (JA 159, 792, 792A)
peterstoni (Culex), 59
philosophicus (Haemagogus), 188
Phoniomyia of authors, 226
pilosus (Culex), 9, 33, 52k, 54k, 55k, 57k, 77, 90-92; 42, 44; (JA 233, 618, 757)
pipiens (Culex), 76
pipiens (Culex) of authors, 73
plutocraticus (Aedes), 165
polyagrus (Aedes), 159
portoricensis (Aedes), 152, 154
portoricensis (Toxorhynchites), 9, 10, 115, 190, 204, 231, 232k, 233-236, 244; 115, 116; (JA 118, 285, 332, 394, 623, 634, 663, 697-699, 924)
portoricensis (Toxorhynchites) of authors, 235, 236
portoricensis complex (Toxorhynchites), 234, 235
posticatus (Psorophora), 126, 127
Protoculex, 160
pseudes (Deinocerites), 46
pseudotitillans (Mansonia) of authors, 107
Psorophora, 10, 13, 14k, 17k, 18k, 20k, 115, 115-116, 116k, 117k, 118k, 119k, 120 (subgenus), 131, 143
Psorophora, Jamaican form, see sp. 34
Puerto Rican form A (Wyeomyia), 192, 196k, 198k
Puerto Rican form B (Wyeomyia), 192, 196k
Puerto Rican form C (Wyeomyia), 192, 199k
punctipennis (Anopheles) of authors, 29, 31
pygmaea (Psorophora), 9, 10, 11, 116, 117k, 118k, 119k, 120k, 131, 137, 138, 139, 140-143, 155, 160, 167; 62, 65; (JA 95-97, 99-102, 139, 143, 156, 159, 237A, 757, 841, 863, 864, 869, 870)
- quasiluteoventralis* (Wyeomyia), 195
quasiluteoventralis (Wyeomyia) of authors, 205
quasisecutor (Culex), 68, 70
quasiserratus (Aedes), 157, 159
quinquefasciatus (Culex), 8, 10, 11, 26, 50, 51k, 53k, 56k, 58, 59, 60, 61, 62, 64, 65, 66, 67, 68, 69, 71, 72, 73-76; 4, 5, 33; (JA 9, 15, 31, 34, 39, 40, 42, 49, 52, 62, 68, 69, 70, 113, 115, 132, 140, 141, 146, 164, 166, 171, 172, 183, 185, 190, 191, 195-198, 209, 225, 235, 248, 273, 641, 761, 806, 812, 831)
- reductor* (Culex), 91
revocator (Culex), 73
Rhynchotaenia, 97, 98k, 99k, 100k, 103
rutilus (Toxorhynchites), 234, 235
rutilus complex (Toxorhynchites), 235
- Sabethes, 14k, 17k, 18k, 19k, 191
Sabethini, 13, 14k, 16k, 18k, 19k, 190-191
sapphirina (Uranotaenia), 37, 38k, 39k; 16, 20

- sapphirina* (Uranotaenia) of authors, 40
sayi (Psorophora), 129
sayi (Psorophora) of authors, 126
Sayomyia, 8, 10, 237, 238k, 239k, **240**
scapularis (Aedes), 161, 163, 164
scapularis (Aedes) of authors, 11, 161, 163, 164
scapularis complex, 151, 164, 167
Scapularis Group, 8, 151, 164, 167
schwarzi (Psorophora), 124, 125, 126
scimitar (Culex), 58
scitula (Dixella), 9, 248, 248k, 249k, **249-251**, 253; 123, 124, 125; (JA 741, 742, 775)
scotinomus (Wyeomyia), 195
secutor (Culex), 9, 11, 36, 51k, 52k, 53k, 56k, 57k, 58, 63, **68-70**, 89, 133-134; 31, 32; (JA 340-343, 365, 612-614, 738, 739, 751-753, 755, 827, 828, 832-835, 851, 852, 891, 893)
septentrionalis (Toxorhynchites), 234, 235
serratus (Aedes), 159, 160
serratus (Aedes) of authors, 158
serratus complex, 159, 163
Serratus Group, 151, 158, 159, 160
signifera (Orthopodomyia), 112, 112k, 115
signifera (Orthopodomyia) of authors, 113
Signifera Group, 115
similis (Culex), 71, 72
simmsi (Wyeomyia), 195
smithii (Wyeomyia), 192, 195
socialis (Uranotaenia), 9, 26, 31, 37, 38k, 39k, **39-41**, 43, 81, 86; 15, 19; (JA 23, 25, 77, 358, 744)
socialis (Uranotaenia) of authors, 41
sollicitans (Aedes), 9, 10, 145k, 147k, 149k, 150k, 151, **155-157**; 69, 70; (JA 7, 153, 237A, 405, 840, 896)
sororcula (Wyeomyia), 194, 196k, 197k, 198k, 199k, 212, 213
sp. 22 (Culex), 8, 57k, 77, 89, **90**; 45; (JA 168, 809)
sp. 34 (Psorophora), 8, 9, 116, 117k, **130**; (JA 117, 795)
sp. 59 (Wyeomyia), 8, 9, 192, 194, 196k, **217-218**; (JA 735)
sp. 64 (Wyeomyia), 8, 9, 192, 193, 194, 196k, **229**
sp. undetermined (Aedes), 8, 13, **143-144**, 145k, 151
sphinx (Culex), 58
squamipennis (Aedeomyia), 13, 15k, 16k, 17k, 19k
Stegomyia, 143, 144k, 146k, 148k, 149k, 175, **184**
stellata (Wyeomyia), 8, 9, 97, 192, 193, 197k, 198k, 199k, 209, 215, **215-217**, 218, 220, 221, 227; 96, 105, 106; (JA 710, 723, 725, 763, 771, 772, 820)
Stellata Subgroup, **192-193**, 193, 195, 215, 217, 218, 220
stenei (Aedes), 8, 9, 10, 97, 114k, 146k, 148k, 150k, 175, 180, 181, 182, **183-184**, 209, 213, 215, 220, 227, 229; 90, 91; (JA 240-242, 299, 318, 319, 355, 356, 375, 376, 380, 381, 392, 607, 630-632, 643, 646, 648, 650-652, 655, 658, 661, 666, 669-671, 673, 674, 676, 684, 685, 688, 701, 706, 708, 710, 723, 725, 729, 731-735, 785, 762-764, 771-774, 776, 779, 791, 820, 854, 855, 914, 925, 930, 952, 957)
stonei (Wyeomyia), 195
subfuscus (Culex), 61, 63
superbus (Toxorhynchites), 231, 232k
taeniopus (Culex) of authors, 77, 82, 83
taeniorhynchus (Aedes), 9, 10, 11, 26, 49, 143, 145k, 147k, 149k, 150k, 151, 152, **152-155**, 156, 157, 159, 160, 164, 167; 68, 69; (JA 79, 92, 95, 96, 98-100, 108, 114, 115, 119, 120, 137, 139, 142, 144, 159, 177, 179, 222, 237A, 238, 313, 348, 349, 357-359, 369, 371, 384-386, 391A, 398, 610, 616, 649, 794, 796, 802, 842, 860, 861, 875, 876, 896, 912)
Taeniorhynchus Group, 151
tarsimaculatus (Anopheles), 24
telestica (Wyeomyia), 195
tibialis (Psorophora), 123
titillans (Mansonia), 9, 11, 66, 97, 98, 99k, 100k, **103-107**, 107, 108, 109, 110, 111, 247; 50, 51; (JA 227, 359, 361, 703, 789, 874, 914)
titillans (Mansonia) of authors, 107
tormentor (Aedes), 160
tortilis (Aedes), 8, 9, 10, 11, 26, 137, 143, 146k, 147k, 149k, 151k, 151, 152, 157, 159, 160, 164, **165-168**, 168, 169; 75, 76; (JA 97, 143, 159, 161, 197A, 357, 610, 730, 757, 790, 796, 799, 863, 896, 913, 914)

- tortilis* (Aedes) of authors, 11, 161, 164, 168, 169
tortilis complex, 151, 162, 164, 167
toweri (Culex), 68, 70
Toxorhynchites, 13, 13k, 16k, 18k, 19k, 231-232
Toxorhynchitini, 13, 13k, 16k, 18k, 19k, 231
 Trichoprosopon, 14k, 16k, 18k, 19k, 191
tripunctata (Corethrella), 238, 246
- ulocoma* (Wyeomyia) of authors, 194, 205, 208
uncatus (Aedes), 171, 172, 174
Uranotaenia, 10, 13, 14k, 16k, 17k, 20k, 36-37
Uranotaeniini, 13, 14k, 16k, 17k, 20k, 36-37
- vanduzeei** (Wyeomyia), 9, 192, 193, 194, 195, 196k, 197k, 198k, 199k, 210-213, 220, 221, 227, 229; 101, 102; (JA 732, 793)
Vanduzeei Group, 191, 192, 193, 195, 212
varipalpus (Aedes), 144
varipes (Psorophora) of authors, 125
venezuelensis (Coquillettia), 103
venezuelensis (Coquillettia) of authors, 97, 98k, 103
vestitipennis (Anopheles), 9, 21, 22k, 23k, 31-34, 92; 7, 8, 12; (JA 14, 28, 37, 38, 232, 357, 790, 793, 804)
violescens (Wyeomyia), 205
virginensis (Aedes), 165
- walkeri** (Aedes), 9, 10, 63, 97, 145k, 147k, 148k, 149k, 175-178, 179, 204, 209, 213, 215, 220, 227, 229; 82, 83; (JA 85, 122-124, 186, 237, 239, 243, 244, 247, 257, 282, 294, 304, 318, 319, 322-324, 333-338, 353, 354, 356, 359, 360, 369, 374, 379, 381, 390, 392, 393, 399, 606, 607, 631, 633, 634A, 635, 637, 639, 640, 643-648, 650, 651, 653, 654, 657, 660, 664, 665, 667-672, 675, 678-684, 693-695, 707-711, 716, 723-725, 729, 733, 735, 740, 748, 758, 762-765, 767, 771, 772, 777-779, 787, 792A, 820, 821, 824, 825, 843, 848, 854, 855, 902A, 913, 914, 925, 930, 931, 940, 941)
walkeri (Anopheles), 21, 22k, 23k, 8
Walker Group, 175
Walker Section, 175
walsinghamii (Psorophora), 134, 137
waverleyi (Orthopodomyia), 9, 10, 112, 112k, 113-115, 190, 236, 244; 54, 55; (JA 110, 256, 327, 394, 401, 407, 622, 625, 642, 690, 697, 698)
Wyeomyia, 6, 8, 10, 13, 14k, 16k, 18k, 19k, 178, 181, 191, 191-195, 223, 229
Wyeomyia, Jamaican form A, see sp. 59
Wyeomyia, Jamaican form B, see sp. 64
Wyeomyia, Puerto Rican sp., see Puerto Rican form A, B and C

(Continued from inside front cover)

Parts of Volume 4, with prices

- No. 1. Mosquito studies (Diptera, Culicidae), 1968.
X. Peters, T. Michael. Dixinae originally described from North America. 7 pages.
XI. Belkin, John N., Robert X. Schick, and Sandra J. Heinemann. Mosquitoes originally described from Argentina, Bolivia, Chile, Paraguay, Peru, and Uruguay. 29 pages. Price: \$1.25, postpaid.
- No. 2. Mosquito studies (Diptera, Culicidae), 1969.
XII. Berlin, O. G. W. A revision of the Neotropical subgenus Howardina of Aedes.
- No. 3. Carlson, Robert W. and Fred B. Knight, 1969.
Biology, taxonomy, and evolution of four sympatric Agrilus beetles (Coleoptera: Buprestidae). 104 pages, 47 figures. Price: \$3.25, postpaid.
- No. 4. Mosquito studies (Diptera, Culicidae), 1969.
XIII. Barr, Ralph A. and Sylvia Barr. Pupae of the genus Psorophora in America north of Mexico. 19 pages, 11 figures.
XIV. Berlin, O. G. W. Redescription of Toxorhynchites (T.) gigantulus from the Philippines. 7 pages, 2 figures.
XV. Zavortink, Thomas J. A new species of treehole breeding Anopheles from the southwestern United States. 12 pages, 4 figures. Price: \$1.25, postpaid.
- No. 5. Matthews, Robert W., 1970. A revision of the genus Spathius in America north of Mexico (Hymenoptera, Braconidae). 86 pages, 31 figures. Price: \$3.50, postpaid. postpaid.

Parts of Volume 5, with prices

- No. 1. Mosquito studies (Diptera, Culicidae), 1970.
XVI. Zavortink, Thomas J. A new species of treehole breeding Aedes (Ochlerotatus) from southern California. 6 pages, 2 figures.
XVII. Adames, Abdiel J. and Charles L. Hogue. Two new species of Deinocerites from Costa Rica. 6 pages, 6 figures.
XVIII. Berlin, O. G. W. The subgenus Micraedes of Culex. 30 pages, 12 figures, 1 map. Price: \$2.00, postpaid.
- No. 2. Mosquito studies (Diptera, Culicidae), 1970.
XIX. Zavortink, Thomas J. The treehole Anopheles of the New World. 35 pages, 12 figures. Price: \$1.25, postpaid.
- No. 3. Mosquito studies (Diptera, Culicidae), 1970.
XX. Schick, Robert X. The Terrens Group of Aedes (Finlaya). 158 pages, 60 figures. Price: \$5.00, postpaid.
- No. 4. Contributions to the mosquito fauna of southeast Asia, 1970.
V. Reinert, John F. Genus Aedes, subgenus Diceromyia Theobald in southeast Asia. 43 pages, 15 figures. Price: \$1.50, postpaid.
- No. 5. Howden, Anne T. The Tanymecini of the West Indies (Coleoptera: Curculionidae). 74 pages, 76 figures. Price: \$2.75, postpaid.
- No. 6. Kethley, John B., 1970. A revision of the family Syringophilidae (Prostigmata: Acarina). 76 pages, 38 figures. Price: \$2.75, postpaid.
- No. 7. Contributions to the mosquito fauna of southeast Asia, 1970.
VI. Mattingly, P. F. The genus Heinzmannia Ludlow in southeast Asia. 104 pages, 51 figures. Price: \$4.00, postpaid.

Parts of Volume 6, with prices

- No. 1. Mosquito studies (Diptera, Culicidae), 1970.
XXI. Belkin, John N., Sandra J. Heinemann, and William A. Page. The Culicidae of Jamaica. 458 pages, 126 figures. Price: \$15.00, postpaid.

1
5-1
nt.

Contributions
of the
American Entomological Institute

8 AUG 1970

Volume 6, Number 2, 1970



CONTRIBUTIONS TO THE MOSQUITO FAUNA OF
SOUTHEAST ASIA

VII. Genus *Aedeomyia* Theobald in Southeast Asia.

VIII. Genus *Aedes*, Subgenus *Mucidus* Theobald in
Southeast Asia.

by

W. H. Tyson

CONTRIBUTIONS
of the
AMERICAN ENTOMOLOGICAL INSTITUTE

The Contributions are for larger papers on insects. Each paper is a separate number, with separate pagination and index. Separate numbers aggregating about 500 pages constitute a volume. Issues appear irregularly, as suitable manuscripts are available.

Copies are sold separately or in subscriptions to complete volumes. Complete volumes are \$12.00. The price of separate numbers varies. Subscribers are billed for each volume with its beginning number, and receive the parts as issued. Orders for separate numbers that total less than \$8.00 must be accompanied by payment. Address orders or correspondence to the American Entomological Institute, 5950 Warren Road, Ann Arbor, Michigan 48105, U. S. A.

Parts of Volume 1, with prices

- No. 1. Dasch, Clement E., 1964. The Neotropic Diplazontinae (Hymenoptera, Ichneumonidae). 75 pages, 69 figures. Price: \$2.25, postpaid.
- No. 2. Mosquito studies (Diptera, Culicidae), 1965.
I. Belkin, John N., et al. A project for a systematic study of the mosquitoes of Middle America.
II. Belkin, John N., et al. Methods for the collection, rearing and preservation of mosquitoes. 78 pages, 4 figures. Price: \$2.25, postpaid.
- No. 2a. Same as no. 2, but in Spanish. Price: \$2.25, postpaid.
- No. 3. Matthews, Robert W., 1965. The biology of Heriades carinata Cresson. (Hymenoptera, Megachilidae). 33 pages, 23 figures. Price: \$1.00, postpaid.
- No. 4. Mosquito studies (Diptera, Culicidae), 1965.
III. Ramalingam, Shivaji, and John N. Belkin. Two new Aedes from Tonga and Samoa.
IV. Belkin, John N. The mosquitoes of the Robinson-Peabody Museum of Salem expedition to the southwest Pacific, 1956. 34 pages, 3 figures. Price: \$1.00, postpaid.
- No. 5. Mosquito studies (Diptera, Culicidae), 1965.
V. Belkin, John N., Robert X. Schick, and Sandra J. Heinemann. Mosquitoes originally described from Middle America. 95 pages. Price: \$2.75 postpaid.
- No. 6. Mosquito studies (Diptera, Culicidae), 1966.
VI. Belkin, John N., Robert X. Schick, and Sandra J. Heinemann. Mosquitoes originally described from North America. 39 pages. Price: \$1.00, postpaid.
- No. 7. DeLong, Dwight M. and Paul H. Freytag, 1967. Studies of the world Gyponinae (Homoptera, Cicadellidae). A synopsis of the genus Ponana. 86 pages, 257 figures. Price: \$2.50, postpaid.
- No. 8. Contributions to the mosquito fauna of southeast Asia, 1967.
I. Delfinado, Mercedes D. The genus Aedes, subgenus Neomacleaya Theobald in Thailand. 55 pages, 20 figures. Price: \$1.75, postpaid.

Parts of Volume 2, with prices

- No. 1. Contributions to the mosquito fauna of southeast Asia, 1967.
II. Bram, Ralph A. The genus Culex in Thailand (Diptera: Culicidae). 296 pages, 104 figures. Price: \$9.00, postpaid.
- No. 2. Schuh, Toby, 1967. The shore bugs (Hemiptera: Saldidae) of the Great Lakes region. 35 pages, 30 figures. Price: \$1.25, postpaid.
- No. 3. Snider, Richard J., 1967. The chaetotaxy of North American Lepidocyrtus s. str. (Collembola: Entomobryidae). 28 pages, 57 figures. Price: \$1.00, postpaid.
- No. 4. Contributions to the mosquito fauna of southeast Asia, 1968.
III. Delfinado, Mercedes D. The genus Aedes, subgenus Neomacleaya Theobald of southeast Asia. 76 pages, 26 figures. Price: \$2.25, postpaid.
- No. 5. Contributions to the mosquito fauna of southeast Asia, 1968.
IV. Knight, Kenneth L. Species of the subgroup Chrysolineatus of group D, genus Aedes, subgenus Finlaya Theobald. 45 pages, 12 figures. Price: \$1.50, postpaid.

Parts of Volume 3, with prices

- No. 1. Mosquito studies (Diptera, Culicidae), 1968.
VII. Belkin, John N. The Culicidae of New Zealand. 182 pages, 30 figures. Price: \$5.50, postpaid.
- No. 2. Mosquito studies (Diptera, Culicidae), 1968.
VIII. Zavortink, Thomas J. A prodrome of the genus Orthopodomyia. 221 pages, 41 figures. Price: \$6.75, postpaid.
- No. 3. Fleming, Richard C., 1968. Head musculature of sphinx moths (Lepidoptera: Sphingidae). 32 pages, 37 figures. Price: \$1.00, postpaid.
- No. 4. Mosquito studies (Diptera, Culicidae), 1968.
IX. Belkin, John N. The type specimens of New World mosquitoes in European museums. 69 pages. Price: \$2.00, postpaid.

(Continued on back cover)

Contributions
of the
American Entomological Institute

Volume 6, Number 2, 1970



CONTRIBUTIONS TO THE MOSQUITO FAUNA OF
SOUTHEAST ASIA

- VII. Genus *Aedeomyia* Theobald in Southeast Asia.
VIII. Genus *Aedes*, Subgenus *Mucidus* Theobald in
Southeast Asia.

by

W. H. Tyson

CONTENTS

INTRODUCTION	1
Genus <i>Aedeomyia</i>	2
KEY TO THE WORLD SPECIES OF ADULT <i>AEDEOMYIA</i>	6
KEY TO THE WORLD SPECIES OF <i>AEDEOMYIA</i> PUPAE	6
KEY TO THE WORLD SPECIES OF <i>AEDEOMYIA</i> LARVAE	7
SPECIES DESCRIPTIONS	
<i>Aedeomyia catasticta</i> Knab	8
<i>Aedeomyia venustipes</i> (Skuse)	12
ACKNOWLEDGEMENTS	13
LITERATURE CITED	13
DISTRIBUTION MAP	19
FIGURES	20
INDEX	27

CONTRIBUTIONS TO THE MOSQUITO FAUNA OF SOUTHEAST ASIA. VII.

GENUS *AEDEOMYIA* THEOBALD IN SOUTHEAST ASIA.¹

By

W. H. Tyson²

INTRODUCTION

The genus *Aedeomyia* was originally validated by inclusion in a key by Theobald in July (1901a :235) and again in November (1901b :98). His generic description appeared that same month (1901c :218) and was based on specimens of *Aedeomyia squammipenna* (L. Arribáizaga) = *Aedeo. squampennis*. Included in his material were specimens from the Oriental Region which were the then undescribed *catasticta* Knab. He also included *Aedes* (*Aedeomyia*) *venustipes* Skuse as probably being a member of his genus. The following year Giles (1902: 478) emended the spelling of the genus name to *Aedomyia*. Edwards (1912: 24) emended the genus by placing a diaretic mark over the initial e. Brunetti (1914: 54) placed *Aedomyia* in synonymy with *Aedes* but later considered it a valid genus. In 1923 Enderlein described a new species from Africa for which he proposed the new genus *Lepiothauma*. Edwards (1925 :262) placed *Lepiothauma* in synonymy with *Aedomyia*. Amos (1944 :24) incorrectly cited this genus as *Aediomyia*. Because of the many spelling emendations applied to this genus, the literature has been complicated by a variety of names, many of which have been used quite recently.

This paper deals primarily with *Aedeomyia catasticta* Knab but because of past problems involving synonymy and identification of *catasticta* and *venustipes*, the latter is included although not in the range of Southeast Asia.

Specimens of the following species of *Aedeomyia* have been examined: *africana* Neveu-Lemaire, *catasticta* Knab, *furfurea* (Enderlein), *pauliani* Grjebine (larvae only), *squampennis* (L. Arribáizaga), and *venustipes* (Skuse).

Abbreviations used in references to literature conform to the World List of Scientific Periodicals, 3rd. ed., Academic Press, New York, 1952. An asterisk following the abbreviations used (♀ = female, ♂ = male, P = pupa, L = larva) indicates that at least some portion of that form is figured. New distribution records are indicated by two asterisks.

The following combination of characters are those generally used to separate *Aedeomyia* from other genera: Adults with spiracular and postspiracular bristles absent, lower mesepimeral bristles less than 3; palpi 0.25 or less the length of the proboscis in both sexes; torus, flagellomere I, and clypeus with broad scales; wings densely covered with broad yellow, white, and brown scales; mid and hind femora with large apical scale tuft; male with apical two flagellomeres of antenna swollen. Pupa with hair 9-II-VI usually short and stout; paddles narrow at base, broad at apex and notched at the insertion of the apical hair. Larva with greatly enlarged antenna; trachea of siphon reduced, apex of siphon with a pair of curved hooks and a pair of multibranching hairs; pecten absent, siphon uniformly pubescent; comb scales

¹This work was supported by Research Contract No. DA-49-193-MS-2672 from the U. S. Army Medical Research and Development Command, Office of the Surgeon General, and carried out at the Southeast Asia Mosquito Project, Washington, D. C.

²Captain, MSC, U. S. Army, Department of Entomology, Walter Reed Army Institute of Research, Washington, D. C. 20012.

less than 25, usually less than 20, arranged in a single row on a sclerotized plate much as in *Uranotaenia*.

This genus is here divided into two subgenera on the basis of the morphological characteristics listed below. Subgenus *Lepiothauma* includes the Ethiopian species *furfurea* (Enderlein). Subgenus *Aedeomyia* includes the remainder of the recognized species.

Subgenus *Aedeomyia*

Subgenus *Lepiothauma*

FEMALE

- Hind tarsomeres with all scales decumbent.

- Hind tarsomeres with many erect scales dorsally.

MALE

- Penultimate flagellomere simple.

- Penultimate flagellomere with a dorsal basal tuft of 3-6 white scales (Figure 6, H).

PUPA

- Abdominal hair 9-II-VIII single or divided, hair-like or much narrowed.

- Hair 9-II-VIII single, broad and heavily sclerotized.

LARVA

- Abdominal hairs 1, 2, 5, 9, 13-I-IV simple or slightly fimbriated.

- These hairs distinctly brush-tipped.

GENUS *AEDEOMYIA* THEOBALD

Aedeomyia Theobald 1901a (July), J. trop. Med. 4: 235; 1901b (November), Mon. Cul. I: 98; 1901c (November), Mon. Cul. II: 218 (generic description). Logotype: *Aedes squamipenna* L. Arribáizaga. (Brunetti 1914: 54).

Aedomyia Giles 1902, Handbook, 2nd. ed. p. 478 (emend.).

Aedomyia Edwards 1912a, Bull. ent. Res. 3: 24 (emend.).

Aedes Brunetti 1914, Rec. Indian Mus. 10:54 (*Aedomyia* syn. of *Aedes*).

Lepiothauma Enderlein 1923, Wien. ent. Zeit. 40(1-4): 25. Orthotype: *furfurea* Enderlein.

Lepisthauma Edwards 1925, Bull. ent. Res. 15(3): 262 (lapsus for *Lepiothauma*).

Aediomyia Amos 1944, Mosq. Cont. Train. Manual p. 24 (lapsus for *Aedeomyia*).

FEMALE. *Head*. Antenna shorter than proboscis, torus and basal flagellomere with broad scales; clypeus with a median patch of white scales; palpus short, 0.20-0.25 the length of the proboscis, segments dorso-ventrally flattened, apical segment longest, usually with white scales at its apex, basal segments with several large bristles; proboscis with 4-6 basal bristles, white rings at or before middle, and before labellum, always present, a ring (usually broken or restricted to a few dorsal white scales) usually present at basal third; labellum dark; orbital bristles long and dark or pale; orbital margin with decumbent white and black scales; vertex with erect scales with truncate or slightly emarginate apices, usually mixed white, yellow and brown scales present. *Thorax*. Scutum with bristles long, those of supra-alar and prescutellum longest; most pleurites with bristles except spiracular

postspiracular, paratergite, meron, metameron, and metapleuron; upper, anterior and lower mesepimeral bristles present, upper and posterior sternopleural bristles present; scales of scutum mostly decumbent except for erect and semierect scales on the lateral margin of the scutum, the anterior promontory region and the junction of the posterior dorsocentral and the prescutellar region; scales on most pleurites except spiracular, meron and metapleuron, scales of thorax mostly yellow or white with the majority of dark scales restricted to the lateral margin of the scutum; scutellum with 3 lobes, each with long bristles, scales of scutellum usually light at base with the scales at the tip of each lobe dark; postnotum bare. *Wing*. Majority of scales dark or yellow with white scales mainly at wing base, a patch at basal third and a patch at the apical third (*africana* has the basal area mostly yellow scaled), fringe scales long, vaguely infuscated, usually of two lengths and unilaterally expanded; squama with a fringe of broad scales; alula with narrow fringe hairs. *Halter*. Stem pale, knob dark scaled with the stem and sometimes the medial region white scaled. *Legs*. All coxae and trochanters with bristles and scales; femora dark and white scaled but with broad white bands absent, apex of mid and hind femora with a large tuft of erect scales, sometimes present on fore femur but reduced in size; tibiae with most scales dark and several narrow, entire or broken, white bands, scales of fore tibia all decumbent, mid tibia with a few erect scales at base, hind tibia with a large compact tuft just before base (*furfurea*), or as above except with hind tibial tuft small or elongate (*catasticta*, *squamipennis*, *venustipes*), or with tuft absent (*africana*); tarsomere I of fore leg as long as rest of segments combined, tarsomeres II, III with distinct basal pale bands, other segments dark or mottled with white scales; mid leg with tarsomeres I-IV with basal bands, or with I-III banded (*furfurea*); tarsomeres of hind leg with scales decumbent or with erect scales dorsally (Figure 6, A, *furfurea*), basal white band on I-IV, or I-II with III all white (*venustipes*), tarsomere V all white or with a few apical, ventral black scales, or all black (*venustipes*); tarsal claws not toothed (Figure 6, G). *Abdomen*. Cylindrical, broadly truncate at apex; segment VIII with a projecting fringe or erect, elongate scales; scale pattern variable, generally dark with white and yellow scales forming a variety of patterns; segments VI, VII slightly expanded laterally, dorso-ventrally flattened. *Terminalia*. Simple, cerci short and stout, postgenital plate large, broad, and truncate (*venustipes*) or varying to small, narrow, and deeply emarginate (*squamipennis*); atrial plate and ninth and tenth tergites absent (Coher 1949: 109); spermatheca single, large, with a funnel shaped projection at base of duct (Figure 6, I).

MALE. *Head*. Antenna short as in female, or slightly longer, flagellomeres II-XI annulate, silver at base, dark at apex, flagellomeres XII, XIII swollen, XII scaleless or with a dorsal basal tuft of 3-6 white scales (*furfurea*); torus and clypeus with yellowish or white scales; palpus short as in female or slightly shorter; proboscis as in female with scales decumbent throughout or slightly rough basally, or with erect dark scales on the ventral basal half (*furfurea*); scales of head as in female. *Thorax*. Scales and bristles of scutum and pleurites as in female. *Wing*. Scaling and pattern of wing scales very similar to that of the female but generally lighter in color. *Halter*. As in female. *Legs*. As for female; fore and mid tarsal claws slightly asymmetrical, major claw with a single median, blunt tooth (Figure 6, F), hind claws small, simple. *Abdomen*. Segments I-V cylindrical, slightly tapering, VI-VII dorso-ventrally flattened and expanded laterally, segment VIII normal, not expanded; scaling of terga variable, usually dark with lateral, apical regions of each segment with white scales forming patches or oblique vittae or mostly white scaled basally and with the black scales becoming dominant apically, or varying to mostly dark scaled. *Terminalia*. Basimeres stout and short, each bearing a patch of strong bristles on the basal lobe; distimeres shorter than the basimeres and nearly parallel sided; differences in shape noted by some authors appear to be due to the angle from which they are viewed; distimeres

usually have small hairs on the apical half (apical 0.66 in *venustipes*) and the apex with a comb-like process, the teeth of which are variable in number but average about 20 (except *africana* which has 15); generally the terminalia are withdrawn into the eighth segment; ninth tergite ill defined, merely a thin sclerotized strip, without definitive characters, which lies basally to the membranous proctiger; proctiger supported laterally by simple paraprocts, each paraproct being connected distally to a sclerite with which it articulates; phallosome complicated, consists of at least 2 distinct parts; the sides of the structure are attached to the parameres and form a "horseshoe" configuration, the distal end of this structure is in the form of an enlarged cap-like structure with a tergal median lip, this lip varies slightly among the species, attached sternally to the cap are a pair of indistinct sclerites (Figure 3, E, ps) with the distal apices expanded, these attach to the sternal surface of the horseshoe but are separate structures, and seem to correspond to the prosophallus in the Dixinae (Belkin 1968: 8). These structures also vary but may not be constant intraspecifically. The homology of the parts of the phallosome is undecided and is open to challenge.

PUPA. Integument vaguely to moderately infuscated, region of paddle before insertion of apical hair with a circular area of infuscation. *Cephalothorax.* Hairs of cephalothorax single or branched, mostly branched in *catasticta*, mostly single in *furfurea* and *africana*; trumpets short and wide (*africana*, *catasticta*) or elongate and more narrow (*squamipennis*) or elongate with the pinna broad (*furfurea*, *venustipes*). *Abdomen.* Hairs 1, 6-I, 1, 5, 6-II-VI and 5-VII usually enlarged and multibranched, branches distinctly plumose to vaguely plumose, or simple (*venustipes*), hair 5-V-VII with some branches long, surpassing base of next segment, or very long with the longest branches surpassing all of the following segment and part of the next segment (*squamipennis*); hair 9-II-VIII short, stout and single or branched - single, heavily sclerotized and spinose (*furfurea*), stout and bifid on III, IV (*venustipes*), small and hair-like on I-VI (*africana*), spine-like and not sclerotized (*squamipennis*) or spine-like and sclerotized on III-VI (*catasticta*). *Paddle.* Narrow at base, wide at apex with a notch at the insertion of the apical hair (1-P), apical hair long and simple or vaguely plumose.

LARVA. *Head.* Antenna enlarged, nearly as long or longer than the head, 1-A with 6-11 plumose branches (3-5 branches in *pauliani*), placed at or beyond the middle of antenna, 2-4-A elongate and plumose, 5, 6-A much smaller and simple, situated on a pedestal, body of antenna swollen with surface spiculate and with a patch of hairs on the apical, mesal third (absent in *africana* and *pauliani*); head hairs 5-7-C large, multibranched and plumose; 1-C spinose and heavily sclerotized; mouth brushes large; maxilla elongate with a straight terminal spine, similar to 1-C but longer (much longer in *squamipennis* and *africana*) usually simple but barbed in *venustipes*; mandible of 2 separate teeth, mesal tooth bifid; mental plate small and with 5 teeth. *Thorax.* Integument minutely pubescent; main hairs of pleural groups including 4, 5, 7-P elongate and plumose. *Abdomen.* Hairs 1, 2, 5, 9, 13-I-IV multibranched, plumose (vaguely so or simple in *venustipes*) with the apex of most branches simple (*africana*, *pauliani*, *squamipennis*, *venustipes*) or slightly fimbriated (*catasticta*), or strongly brush-tipped (*furfurea*, Figure 5, H); segment VIII with comb scales in a single row on the distal margin of a sclerotized plate, teeth 6-25, each tooth usually with a membranous margin which may or may not be fringed; siphon without pecten, densely, uniformly pubescent, 1-S multibranched and plumose, placed usually slightly beyond the middle of the siphon, 2-S single (6 branched in *squamipennis*) and situated at the apical fifth (near middle in *squamipennis*), 8-S large, multibranched and slightly to distinctly plumose; lateral valves with seta 9 modified to form a pair of hook-like appendages, the function of which is still not understood; anal segment with saddle complete, surface minutely pubescent, dorsal apical region with longer erect and flattened hairs, each of which is fringed unilaterally and usually with a

smaller setiform spicule at the base, anal brush of 6 pairs of long pectinate hairs (6-8 pairs in *pauliani*, 1-IX of 3 branches (2 in *pauliani*) and placed beyond the middle of the saddle, 2, 3-IX elongate and pectinate; anal papillae short.

EGG. Baisas (1938: 191) reports *Aedeomyia* eggs having a silvery polygonal make up similar to those found in anopheline eggs.

DISTRIBUTION. The following is a list of the recognized species of *Aedeomyia* arranged in the zoogeographic regions in which they occur.

NEOTROPICAL

Aedeomyia (Aedeomyia) squamipennis (L. Arribáizaga)

ETHIOPIAN

Aedeomyia (Aedeomyia) africana Neveu-Lemaire

Aedeomyia (Aedeomyia) pauliani Grjebine

Aedeomyia (Lepiothauma) furfurea (Enderlein)

AUSTRALIAN

Aedeomyia (Aedeomyia) venustipes (Skuse)

ORIENTAL, AUSTRALASIAN, MICRONESIAN

Aedeomyia (Aedeomyia) catasticta Knab

The genus is primarily of the Southern Hemisphere. Although *catasticta*, *furfurea*, *africana*, and *squamipennis* do range north of the Equator, none approach the Tropic of Cancer. The species are well isolated except for the sympatric *furfurea* and *africana* (see Edwards 1941: 64 for additional information), and are probably relict populations of a once widespread form. The genus may have arisen in Africa and spread eastward across the Mideast, over what is now an unfavorable route, through Southeast Asia down to Australia. An ancestral form may have invaded South America via Australia and Antarctica when the climate was more propitious. This presence of a species in tropical and subtropical South America is less easily explained unless one accepts a route via Antarctica. A northern passage via Bering Straits without leaving any traces north of Central America seems less likely. The Madagascar *pauliani* is undoubtedly a derivative of *africana* but until adults are collected and described, its relationship remains unknown.

BIOLOGY AND MEDICAL IMPORTANCE. Until recently *Aedeomyia* was considered to be of no medical importance. However, Doherty, *et al.* (1968: 431) reported the isolation of MRM3929 virus, subgroup of Group B, Murray Valley encephalitis virus from *catasticta* in Australia. The virus was also isolated from the swamp pheasant *Centropus phasianinus*. Whitehead, *et al.* (1968: 440) suggested the name Alfuy for this virus. Standfast and Barrow (1968) recorded *catasticta* taken in traps baited with chickens. Aitken (1967: 72) records *squamipennis* engorging primarily on chicks and to a lesser degree on mice. He also observed feeding on wild birds in a canopy situation, as well as a higher frequency of feeding in the canopy compared to near ground level. Mattingly (1949: 399) records *africana* collected commonly on canopy platforms.

The larvae have been collected in a variety of situations: weedy ponds (Barraud 1923: 505), swamps (Mackerras 1937: 260), ponds, ditches and marshes (Penn 1948: 242), wheel ruts (Bonne-Wepster 1954: 58), stock dams and lakes (Douglas 1961: 262), and appear always to be associated with various types of thick aquatic vegetation. Mackerras (*loc. cit.*) reported *venustipes* in water with *Nitella* and Douglas (*loc. cit.*) mentioned *Myriophyllum*. *Aedeomyia catasticta* has been collected in waters heavy with *Pistia stratiotes* (Bonne-Wepster *loc. cit.*), *Spirogyra* (Iyengar & Menon 1956: 788), *Azolla* and *Utricularia* (Assem & Bonne-Wepster 1964: 78), and *Eichhornia crassipes* (Standfast & Barrow 1968: 427). Hamon (1966: 372) records *africana* with

dense *Pistia* growth. Hopkins (1952: 77) records *furfurea* with *Potamogeton* growth. The methods by which the larvae obtain oxygen when submerged are still in question. They are able to spend prolonged periods beneath the surface which lead Mackerras (*loc. cit.*) to suggest they obtain oxygen from the plant material. Douglas (*loc. cit.*) reported that isolated larvae, without plant material, were able to maintain respiration under the surface for long periods. Various authors have suggested cuticular respiration, especially through the enlarged antennae and this may be partially true. Although the trachea in the siphon is greatly reduced it is still utilized and larvae have been observed at the surface. The apex of the siphon is typical of surface breathing species. The enlarged antennae and siphonal hooks are thought to be utilized for clinging (Mackerras *loc. cit.*), but until these interesting adaptations are studied more fully, their total function will remain uncertain. It has been noted that larvae preserved in alcohol easily lose one or both antennae, the reason for which is unexplained. The pupae apparently have no special adaptations for respiration and are recorded as spending most of their time at the surface, being difficult to disturb. Lewis (1949: 60) discussed the position assumed by agitated larvae, namely, inverted while supporting themselves with the tip of the siphon and the dorsum of the thorax. Leicester (1908: 183) records *squamipenna* (= *catasticta*) adults as being similar to *Orthopodomysia* in their resting position.

KEY TO THE WORLD SPECIES OF ADULT *AEDEOMYIA*¹

1. Hind tarsomeres without erect scales dorsally (Fig. 6, B-E);
male without scale patch on penultimate flagellomere
..... Subgenus *Aedeomyia* 2
Hind tarsomeres II-IV with erect scales dorsally (Fig. 6, A);
males with a patch of 3-6 white scales at base of penulti-
mate flagellomere (Fig. 6, H); Africa, Madagascar
..... Subgenus *Lepiothauma* *furfurea*
2. Hind tarsomere III all white, V all black (Fig. 6, B);
Australia *venustipes* (p.12)
Hind tarsomere III with an apical black band, V mostly
white 3
3. Hind tibia without erect scale tuft at ventral base;
wing with a large yellow scale patch at base; Africa *africana*
Hind tibia with erect scales at ventral base; wing
base mottled, without a distinct yellow patch;
Oriental, Neotropical 4
4. Pale scales on mid band of palpus, flagellomere I,
erect scales of head, and generally those of scutum,
yellow or yellowish; Neotropical *squamipennis*
These pale scales white; Oriental, Australasian ... *catasticta* (p. 8)

KEY TO THE WORLD SPECIES OF *AEDEOMYIA* PUPAE¹

1. Seta 9 forked or multiple on at least segment VII, VIII
..... Subgenus *Aedeomyia* 2
Seta 9-II-VIII short, simple, very stout and rapier-like;
Africa Subgenus *Lepiothauma* *furfurea*

¹Adults and pupa of *pauliani* are undescribed.

2. Seta 9 short, stout and bifid on segments III-VI
(Fig. 5, B); Australia *venustipes* (p. 12)
Seta 9-III-IV hair-like, slender, or if spine-like
then not bifid at tip (Fig. 2, B) 3
3. Seta 9-I-VI minute, hair-like, infrequently bifid;
Africa *africana*
Seta 9-III-VI spine-like, even if curved and colorless 4
4. Trumpets long and slender, index 5-7; longest branch
of 5-IV-VI reaching beyond the distal margin of the
next 2 segments; Neotropical *squamipennis*
Trumpets short and broad, index 3-4; longest branch
of 5-IV-VI not reaching much beyond the distal margin
of the next segment; Oriental, Australasian *catasticta* (p. 8)

KEY TO THE WORLD SPECIES OF *AEDEOMYIA* LARVAE

1. Abdominal hairs plumose, slightly fimbriated or
simple Subgenus *Aedeomyia* 2
The majority of the abdominal hairs strongly fimbriated
with broad, brush-like terminals; Africa, Madagascar
..... Subgenus *Lepiothauma* *furfurea*
2. Head hair 6-C equal to 5, 7-C; comb patch of 19 or
more scales (Fig. 5, E); Australia *venustipes* (p. 12)
Head hair 6-C smaller and shorter than 5, 7-C;
comb patch of less than 19 scales (Fig. 5, F-G)..... 3
3. Antenna without long slender hairs on mesal, apical
half; antennal hairs 5, 6-A about as long as the ped-
estal on which they occur; Africa, Madagascar 5
Antenna with mesal, apical half with closely set hairs
which may sometimes be restricted to the distal 0.25;
Oriental, Australasian, Neotropical 4
4. Siphon with 2-S branched and placed near middle;
Neotropical *squamipennis*
Siphon with 2-S single and placed well beyond the
middle; Oriental, Australasian *catasticta* (p. 8)
5. Hair 1-IX with 2 branches; comb scales less than 8;
Madagascar *pauliani*
Hair 1-IX with 3 branches; comb scales more than
10; Africa *africana*

AEDEOMYIA (AEDEOMYIA) CATASTICTA KNAB

(Figures 1, 3, 4, 5 F, 6 D, G, I)

- Aedeomyia squammipenna* (L. Arribáizaga), Theobald 1901c, (*in part*), Mon. Cul. II: 219; Banks 1906, Philipp. J. Sci. 1(9): 990.
- Aedeomyia squamipennis*, Green 1901, (*nec* Arribalzaga), Royal Botanic Gardens Circular, Series I(25): 368; Leicester 1908, Stud. Inst. med. Res. F.M.S. 3(3): 182.
- Aedeomyia squamepennis* (Arribáizaga), Giles 1902, (*in part*), Handbook, 2nd. ed., p. 478 (emend.)
- Aedeomyia squamipenna* (Arribáizaga), Brunetti 1907, (*in part*), Rec. Indian Mus. 1(4):366; Brunetti 1912, Rec. Indian Mus. 4:488; Brunetti 1920, Rec. Indian Mus. 17: 177.
- Aedeomyia venustipes*, Taylor 1913, (*nec* Skuse), Aust. Inst. trop. Med. p. 12; Taylor, 1916, Proc. Linn. Soc. N.S.W. 41(3):573 (*catasticta* into syn.); Iyengar 1953, Bull. W.H.O. 9(6): appendix V; Thurman 1963, Proc. 9th. Pacif. Sci. Congr. 9: 52.
- Aëdeomyia venustipes*, Farner 1944, (*nec* Skuse), U.S. Navmed 133: 208.
- Aëdomyia venustipes* (Skuse), Edwards 1924, (*in part*), Bull. ent. Res. 14: 364; Edwards 1925, Bull. ent. Res. 15: 262; Edwards 1929, Bull. ent. Res. 20: 325; Barraud 1934, Faun. Brit. India, Diptera, p. 132 (♂*, ♀*, P, L*); Baisas 1938, Mon. Bull. Philipp. Hlth. Serv. 18(5): 181 (P*); Carter 1950, Ceylon J. Sci. 24(2): 88; Iyengar & Menon 1956, Bull. ent. Res. 47: 785.
- Aedomyia venustipes* (Skuse), Taylor 1916, Proc. Linn. Soc. N.S.W. 41(3): 573 (*catasticta* syn. *venustipes*); Barraud 1927, (*nec* Skuse), Indian J. med. Res. 14(3): 523 (♂*); Barraud & Covell 1928, Indian J. med. Res. 15: 676 (♀*); Borel 1930, Monogr. Coll. Soc. Pat. exot. 3:303 (♂*, ♀, L*); Bonne-Wepster & Brug 1937, Geneesk. Tijdschr. 77: 46 (♂*, ♀*).
- Aediomyia venustipes*, Amos 1944, (*nec* Skuse), Mosq. Cont. Train. Manual pp. 24, 31.
- Aediomyia catasticta*, Amos 1947, Mosq. Cont. Train. Manual pp. 17, 23.
- Aedomyia catasticta* Knab, Barraud 1923, Indian J. med. Res. 11(2): 505 (L*); Mackerras 1937, Proc. Linn. Soc. N.S.W. 62:259 (L*), (*catasticta* from syn.); Bonne-Wepster & Brug 1939, Geneesk. Tijdschr. 79: 1252 (L*); Brug & Bonne-Wepster 1947, Chron. Nat. 103: 184; Penn 1949, Pacif. Sci. 3: 38 (P*); Bonne-Wepster 1954, Roy. trop. Inst. Amst. Spec. Pub. 20: 55 (♂*, L*); Macdonald 1957, Stud. Inst. med. Res. F.M.S. 28: 17; Douglas 1961, Proc. Linn. Soc. N.S.W. 86(3): 262; Assem & Bonne-Wepster 1964, Zool. Bijdr. 6: 76 (♂*, ♀, L*).
- Aëdomyia catasticta* Knab, Edwards 1912a, (*in part*), Bull. ent. Res. 3(1): 25 (emend.); Edwards 1912b, Bull. ent. Res. 3(4): 379 (L*); Edwards 1917, Bull. ent. Res. 7: 229 (♂*); Edwards 1922, Indian J. med. Res. 10(2): 458; Edwards 1932, in Gen. Insect., Fasc. 194: 122 (syn. of *venustipes*); Lee 1944, Atlas Mosq. Larvae Aust. Reg. p. 46 (L*); Iyengar & Menon 1956, Bull. ent. Res. 47: 788 (L*).
- Aëdeomyia catasticta* Knab, Dyar 1920, Insec. Inscit. Menst. 8(10-12): 184; Coher 1948(1949), Ent. Amer. 28:107 (♀*).
- Aedeomyia catasticta* (Knab), Thurman 1963, Proc. 9th. Pacif. Sci. Cong. 9:54.
- Aedeomyia catasticta* Knab 1909, Ent. News 20:387 (♀); Brunetti 1912, Rec. Indian Mus. 4: 488; Brunetti 1920, (*in part*), Rec. Indian Mus. 17: 177; Knight, Bohart & Bohart 1944, Nat. Res. Counc. Div. med. Sci. p.40; Bohart 1945, Navmed 580: 44 (L); Knight & Chamberlain 1948, Proc. Helm. Soc. Wash. 15: 15 (P*); Penn 1948, Proc. ent. Soc. Wash. 50(9): 242; Thurman & Thurman 1955, Mosquito News 15: 222; Bohart 1957, Ins. of Micronesia 12: 20 (♂, ♀, L); Thurman 1959, Univ. Maryland Agr. expt. Sta. Bull. A-100: 61 (♂*, P, L*); Belkin 1962, Mosq. S. Pacific 1: 276,

2: 178 (♀*, P*, L*); Standfast & Barrow 1968, Trans. R. Soc. trop. Med. Hyg. 62(3): 422; Doherty, Whitehead, Wetters & Gorman 1968, Trans. R. Soc. trop. Med. Hyg. 62(3): 431; Whitehead, Doherty, Domrow, Standfast & Wetters 1968, Trans. R. Soc. trop. Med. Hyg. 62(3): 440.

FEMALE. (Figure 1) *Head.* Antenna shorter than proboscis, torus with broad white scales on most of its surface, flagellomere I inflated with white or white and black scales on apical half, flagellomeres II-XIII nearly equal in length with strong dorsal, basal bristles; clypeus inflated with a dorsal patch of white or cream-white scales; palpus very short, appearing dorso-ventrally flattened, especially so apically, dark scaled with some white scales at apex of last two segments, penultimate segment with one or more dorsal bristles; proboscis with decumbent dark and white scales, dark basally with a patch of white scales at dorsal, basal 0.25, a complete white ring before 0.5 and another just before the labellum; labellum dark, without scales; orbital bristles large and dark; scales of vertex erect basally, cream-white at middle becoming dark laterally, scales white and decumbent near front, sides dark and white scaled. *Thorax.* Bristles of scutum moderate in length, curved, yellowish or dark, scales mostly decumbent and dark but with a median longitudinal band of yellow-white scales, margined laterally with white scales, this band ends approximately at the middle where it is divided by mixed white and dark scales, the remainder of the scutum is variable dark and white scaled without a definitive pattern; scutellum yellow-white scaled with the tips of the three lobes dark scaled, scutellar bristles longer than thoracic bristles; pleurites without scales or bristles on spiracular, meron, and metapleuron, without bristles but with scales on paratergite, postspiracular and metameron. *Wing.* Scales of wing dark, white, and yellow, white prominent at base, a transverse band crossing wing just before and including base of radial-sector but becoming vague beyond M, a transverse band at 0.66 which becomes vague posteriorly, other areas of white scaling variable in size and position. *Halter.* Stem pale with the knob dark scaled. *Legs.* All coxae and trochanters with scales and bristles; femora with decumbent dark and white scales in variable patterns, fore femur with a small brush of erect scales at ventral apex, mid and hind femora with a large brush of erect scales at or before apex, apex with a small white band; tibiae dark scaled with narrow, oblique white lines which may be broken or entire, hind and sometimes mid tibiae with a variable brush of erect scales before base on ventral margin; tarsomeres variable but with tarsomere I with white bands as on tibiae and with an apical white band which joins a basal white band on tarsomere II, tarsomere II dark apically except for a thin apical white band which joins the basal white band on tarsomere III, this white band is narrow on the fore and mid tarsi but very wide on the hind tarsus, tarsomere IV all dark or with a dorsal basal white band on fore and mid tarsi but all white or white with a ventral, apical dark spot on hind tarsus; claws simple, not toothed. *Abdomen.* Scaling of terga extremely variable, terga of segments I-III either yellow scaled, dark scaled, or dark scaled with variable yellow spots, terga of segments IV-VI similar but usually with lateral white scaling, VI-VII usually with irregular oblique white bands from base, near middle, to apical lateral margins, segment VIII narrower than VII with scales on terga erect near apex and orange medially. *Terminalia.* Cerci short and broad with long bristles and shorter hairs beneath; postgenital plate very broad and slightly emarginate to truncate at apex; spermatheca large, single, with a funnel shaped projection joining the duct.

MALE. (Figure 1) *Head.* Antenna shorter than proboscis, flagellomeres I-XI with whorls of long hairs, shorter mesially, basal half of each segment with silvery reflections, flagellomeres VII-XIII elongate, inflated with hairs much reduced; palpus as in female or slightly shorter; proboscis as in female or slightly longer, basal white mark sometimes enlarged to a complete ring; scaling of head as for female but generally darker. *Wing.* Similar

to female but slightly lighter in general coloration, fringe usually light with some areas of dark scales. *Legs*. As for female but erect scales of base of hind tibia expanded to include the dorsal side as well; fore and mid claws unequal, enlarged major claw with a blunt median tooth, minor claw entire, hind claws as in female. *Abdomen*. Scaling of abdominal terga variable, usually with segments I-II white scaled, III-V white scaled with a median dark area, VI-VIII dorsoventrally flattened, much wider than V or VIII and dark scaled with variable areas of white or cream colored scales, VIII generally dark at base, light at apex with apical scales erect. *Terminalia*. (Figure 3 C-E) As described under generic characteristics (p. 3)

PUPA. (Figure 3 A-B) Integument slightly infuscated with the trumpets and a spot just anterior to the insertion of the apical paddle hair the darkest. Most body hairs minutely plumose.¹ *Cephalothorax*. Trumpets dark, striate on basal 0.33; hairs 1-6-C multiple, 7-C single or forked, 8-C multiple, 9-C single or forked, 10-C multiple, 11-C single or multiple at tip, 12-C with short stalk then multiple. *Abdomen*. Hair 1-I a multibranching tuft, 2-I single or multiple at tip, 3-I 2 or 3 branched, 4-I with stalk and multibranching tip, 5-I small, multiple, 6-I 6-8 branched, 7-I elongate, longer than 6-I, single, 9-I single; hair 1-II-VII multiple, 2-II-VII single, spine-like, 5-IV-VII multiple with a median branch elongate, 6-II-V similar to 1-II-V, 9-II-VI single, spine-like and sclerotized, bifid on VII and trifid on VIII. *Paddle*. Paddle pear-shaped, notched at insertion of apical hair, with an infuscated patch anterior of the notch, apical hair long, single, and minutely barbed.

LARVA. (Figure 4) *Head*. Antenna elongate, inflated, and twisted near base to curve mesially, 1-A beyond middle and at lateral margin, of several plumose branches, 2-4-A at distal end, elongate with plumose branches longer than those of 1-A, 5, 6-A short and spine-like, placed on a fleshy pedestal, antennal surface pubescent with a mesal, distal patch of longer hairs; head hair 1-C spine-like, heavily sclerotized and placed on a short tubercle at the side of the labrum; 3-C small, single, 4-C multiple, branches not plumose, 5, 6, 7-C multiple and plumose, 5, 7-C long, equal in length, 6-C shorter, 8-C usually single with tip multiple, 11-C 3-5 branched, 12-C 1-3 branched, 13-C single, 14-C small, multiple, 15-C single, bifid, or trifid at middle; maxillary spine elongate, heavily sclerotized, margins not barbed (Figure 3 F). *Thorax*. 4, 5, 6-P, 9, 10-M, and 9, 10-T very long, 3, 8-P, 1-M, 1, 5-T multiple with their branch tips slightly fimbriated. *Abdomen*. Hair 6-I-VI long, plumose, of 2 or more branches, 1, 2, 5-I-VI and 9, 13-II-VI multiple with fimbriated tips; segment VIII with comb teeth 9-15 on a slightly sclerotized patch, each tooth with a serrate membranous margin; siphon without pecten, uniformly pubescent, 1-S beyond middle, multiple, plumose, 2-S single, at dorsal apical 0.80, 8-S 4 branched, valves with a pair of sclerotized hooks; saddle complete, anal brush with pectinate branches, dorsal, apical region with spines, some of which are erect, flattened, and unilaterally margined, the base of each erect spine with a smaller basal branch, 1-IX 3 branched, anal papillae short.

TYPE DATA. Lectotype ♀ (selected by Stone & Knight 1957: 196) plus 2 ♀♀ and 4 ♂♂ syntypes from Samal, *Bataan*, PHILIPPINES, 31 Jan - 4 Feb -07 (Thru Miss Ludlow). U.S. National Museum #12627.

DISTRIBUTION. This is the most wide spread species in the genus. Specimens have been noted from as far north as Northern Thailand to as far

¹Note. The minute branches of many of the body hairs in both the larva and pupa have been over-accentuated in order to show properly on the illustrations. Normally, these branches are much thinner and usually not as heavily sclerotized as the main branch.

south as East-Central Australia. Besides the localities listed below, Brug & Bonne-Wepster (1947: 184) included INDONESIA, *Sumatra, Kalimantan, Billiton, Boeton*; SINGAPORE; and CEYLON. Material examined: 50 ♂♂, 64 ♀♀, 152 larvae, 29 larval skins, 14 pupae, 23 pupal skins as follows: THAILAND, *Prachin Buri*, Ban Kut Nao, 8 ♂♂, 7 ♀♀, with associated skins, 9 larvae; *Prachaub Khiri Khan*, Ko Glang Nam Rom, 1♂, 1 larval skin, 21-II-64; *Chiang Mai*, Chiangmai, 1♂, Thurman; *Tak*, Ban Tah Pui, 1 larva, 20-VII-52, Thurman; *Tak*, Sam Ngao, 1 larval skin, 20-VII-52, Thurman; *Chiang Rai*, Muang, 1♂; *Nan*, Nan, 1 larva, 14-II-53, Thurman; South Siam, 1♂, -VIII-33, Causey. CAMBODIA, *Kandal* (Phnom-Penh), Chruai Changvar, 1♂, 1♀, 10-V-67; 26-IV-67; *Sihanoukville*, Banin Pare (?), 1♂, 1♀, 26-IV-67. SOUTH VIETNAM, Pleiku, Pleiku, 1♂, 7 ♀♀, 20-IX-66, 2-X-66, 4-X-66, 14-X-66, 15-X-66, 29-XI-64; *Southern Vietnam*, Cam Ranh Bay, 1♀, 2-VI-66; *Binh Dinh*, Qui Nhon, 2♂♂, 2♀♀, 10-VI-66, 17-VI-66, 25-VI-66, 28-VI-66; *Binh Dinh*, Phu Tai, 2♂♂, 3♀♀, 4 larvae, rock pool, 20-VII-66, 29-VII-66; *Vinh Long*, Vinh Long, 1♂; *Kien Glang* (?), Van Hon, 6-XII-63; Tan Thanh, 30 larvae, rock pool, 20-I-67, Palmer. ANDAMAN ISLANDS, Haddo, 1♀, at light, 6-IV-11, C. Paiua. WEST MALAYSIA, *Selangor*, Kuala Lumpur, 5 larval skins, 1-VI-56, Gould; *Trengganu*, Dungum, 3 larvae. EAST MALAYSIA, *Sarawak*, Kuching, 1♂, 1♀. INDONESIA, *Java*, Batavia, 1♀, 1-II-16, Stanton; *Java*, Djakarta, 1♂, 16-II-56, Wijono; *Morotai*, 3 larvae, -IX-44, Darlington; *West Irian*, Hollandia, 1♀, at light, 31-I-45, King & Hoogstraal. NEW GUINEA, Los Negros, 1 larva, 20-V-44, Ruebush; Koerik, 1♂, 2♀♀. BRITISH SOLOMON ISLANDS, *Bougainville*, Augusta Bay, 1♂, 1 larva, 1944, Gurney; same data, 14 larvae, 2 larval skins, 3 pupae, 17-III-44, Gurney; Guadalcanal, 1♂, with associated skins, Belkin, *Kolombangara*, 1♂, 1♀, 2 larvae, -XI-43, -X-44, Franclemont; Solomon Islands, 1♂, -III-44, Gurney. AUSTRALIA, *Queensland*, Mitchell River Station, Magnificent Creek, 10♂♂, 13♀♀, 10 larvae, Oct-Nov-1963, Standfast & Barrow; Mareeba, 1♂, with associated skins, 21-VI-46, Flecher; Horn Island, 1 larva, 1 pupal skin, 15-VIII-52, Mackerras & Marks. FIJI ISLANDS, Fiji, 2 larvae, 11-X-43, Nadi. MARIANA ISLANDS, *Guam*, Sumay, 1♂, Oakley. CAROLINE ISLANDS, *Yap*, 1♀, 5 larvae, -VII-50, R. J. Goss; same data 34 larvae, 9 pupae, 14-II-46, Frey; Rockhampton, 1♀, 4-IV-57, Stoney; Caroline Islands, 1 larva, Frey. PHILIPPINES, *Bataan*, Samal, 1♂, 31-I-07 to 4-II-07, *syntype*; *Mindoro*, San Jose, 1♂, 4 larvae, 2 larval skins, 3 pupal skins, 10, 11-I-45, E. S. Ross; Caminawit Pt., 1♀, 2 larvae, 1 larval skin, 30-XII-49, Penn; *Mindanao*, Parang, 1♀; Cotabato, 1♂, at light, 15-VIII-58, R. E. Milliron; Lanao, Dansalan, 1♂, 15-V-31, King; Bukidnon, Cmp. del Monte, 1♂, 30-III-31, King; *Leyte*, Tacloban, 1♂, with pupal skin, 13-II-45, Roberts; Lagolago, Baybay, 2♀♀, 1 pupal skin, 13-II-45, Roberts; *Luzon*, Olongapo, 6♀♀, 1945, Rozeboom, Knight & Laffoon; La Union, Agoon River, 2♂♂, 1♀, 10 larvae, -VII-45, Franclemont; Rizal, Paranaque, 1♂, 24-XII-30, King; Albay, Camp Daraga, 1♂; Pangasinan, Manaoag, 13 larvae, 22-I-45, Bray; San Fabian, 1♂, 13-III-45, Gurney; Batangas, 2♀♀, -VIII-45; *Palawan*, Iwahig, 2 larval skins, 2 pupal skins, 28-V-45; Philippines, no data, 6♀♀.

DISCUSSION. This species is the most variable in size and coloration of the genus *Aedeomyia*. Although males tend to be smaller and lighter colored than the females, this does not always hold true. The leg banding of the adults is similar to *squamipennis* and *africana* (Figure 5 C, E) but the characters given in the key to the adults as well as the distinct ranges of the three species will easily separate them. The pupae differ on the number of branches of abdominal hair 9 as well as the moderate length of the median branch of abdominal hair 5-IV-VI. The larvae are separable on the slightly fimbriated body hairs.

AEDEOMYIA (AEDEOMYIA) VENUSTIPES (SKUSE)

(Figures 2, 5 A-E, 6 B)

- Aedes venustipes* Skuse 1889, Proc. Linn. Soc. N.S.W. 3(2): 1761 (♀*).
- Aedes (Aedeomyia?) venustipes* Skuse, Theobald 1901c, Mon. Cul. II: 223.
- Aedomyia venustipes* Skuse, Giles 1902, Handbook, 2nd. ed., p. 479;
Mackerras 1937, Proc. Linn. Soc. N.S.W. 62: 259.
- Aedomyia venustipes* (Skuse), Douglas 1961, Proc. Linn. Soc. N.S.W. 86(3):
262 (♂*, ♀, P*, L*).
- Aëdomyia venustipes* Skuse, Edwards 1932, in Gen. Insect., Fasc. 194: 122;
Lee 1944, Atlas Mosq. Larva Aust. Reg. p. 45.
- Aedeomyia venustipes* Skuse, Dobrotworsky 1965, The Mosq. of Victoria, p.
68 (♂*, ♀*, L*).
- Aedeomyia venustipes* (Skuse), Taylor 1916 (*in part*), Proc. Linn. Soc. N.S.W.
41: 573.

FEMALE. (Figure 2) *Head.* Antenna shorter than proboscis, torus with white scales over most of its surface, dense mesally, flagellomere I slightly inflated with small dark and white scales over most of its surface, remaining flagellomeres sub-equal in length with XIII longer, most flagellomeres with elongate hairs dorsally, lacking or fewer ventrally; clypeus inflated and with a dorsal patch of white scales; palpus as in *catasticta*; proboscis with white band at basal 0.25 usually incomplete ventrally; labellum dark; orbital bristles large, dark; erect scales of vertex mostly cream-colored becoming darker both laterally and basally with some scattered white scales on sides. *Thorax.* Bristles of scutum moderate in length, recurved; scales decumbent except for some dark erect scales at prealar region, pattern variable but usually with a median yellow scale line from front margin caudal to prescutellar region where it expands, region in middle of expanded area with some dark scales, yellow band margined with lighter scales, rest of scutum dark and light scaled without a definitive pattern; scutellum light scaled with lobes dark scaled; pleuron with bristles similar to *catasticta* although the upper sternopleural and prealar patches are usually connected. *Wing.* Scales and scale pattern are similar to *catasticta*. *Halter.* Stem pale scaled with the knob dark. *Legs.* Similar to *catasticta* but differ as follows: erect scales in tuft at base of hind tibia usually small and sometimes absent, hind tarsomere III all white with V all black; claws as in *catasticta*. *Abdomen.* Mostly dark scaled, terga I with many white scales, terga II-IV dark or dark with some lateral white scales, V-VII similar but white scales more numerous, VIII with erect dark, white and yellow scales.

MALE. *Head.* Antenna shorter than proboscis, whorls of hairs as in *catasticta*; palpus slightly shorter than females, white scaled at tip; proboscis somewhat longer but with general scale pattern of female, white ring at 0.25 enlarged and ill-defined. *Thorax.* As for female but general color pattern lighter. *Legs.* Mesal, basal portion of femora with many white scales, mid tibia with some erect scales at base, hind tibia with a tuft of broad, erect scales; claws as in *catasticta*. *Terminalia.* As described for the genus, no definitive characters of specific value found.

PUPA. (Figure 5 A-B) Integumental infuscations as in *catasticta*, body hairs not minutely plumose. *Cephalothorax.* Trumpets wide, slightly elongate, hairs 8, 10-C multiple. *Abdomen.* Most body hairs as described for *catasticta*, 7-I short, not longer than 6-I, 9-I single or bifid, 9-II single, 9-III-VI bifid at tip, 9-VII trifid at tip, 9-VIII with many branches. *Paddle.* Paddle with apical hair without small barbs.

LARVA. (Figure 5 C-E) *Head.* Similar to *catasticta* but differs in having hair 6-C equal in length to 5, 7-C, maxillary spine elongate, heavily sclerotized and with small barbs mainly on the basal half (Figure 5 C). *Abdomen.* Hairs 1, 2, 5, 9, 13-I-IV vaguely plumose if at all, the apices of

branches simple, not fimbriated; comb scales over 19, membranous margin not serrate.

TYPE DATA. Holotype ♀, Elizabeth Bay, near Sydney, *New South Wales*, AUSTRALIA, 1886 (Skuse), Macleay Museum of Natural History, Sydney. Allotype ♂, 3 morphotype larvae and 3 morphotype pupae (designated by Douglas 1961: 262) from Woodside, *Victoria* (Douglas), National Museum of Victoria, Melbourne.

DISTRIBUTION. This species is restricted to the extreme south-east section of Australia (see Map). Material examined: 4♂♂, 4♀♀, 6 larvae, 1 larval skin and 2 pupal skins as follows: AUSTRALIA, *Victoria*, Woodside, 3♂♂, 4♀♀, 5 larvae, 1 larval skin, 2 pupal skins, 3-2-53, 8-1-53, 23-12-52, 8-12-55, G. W. Douglas; Yarram, Gippsland, 1♂, 9-3-55, reared, T. Pearce; Gifford Bolands, 1 larva, 30-4-53, G. W. Douglas. Other localities given in the literature include National Park, *New South Wales* (Mackerras 1937: 261); Melbourne, Bairnsdale, Box Ridge, Darriman, Giffard, Won Wron, Ouyen, all of *Victoria* (Douglas 1961: 262).

DISCUSSION. This species and *catasticta* share several characteristics but can be easily separated on the scale pattern of the hind tarsomeres. The larvae differ in the number of comb teeth (9-15 in *catasticta*, 19-25 in *venustipes*); the length of head hair 6-C (equal to 5, 7-C in *venustipes*, shorter than 5, 7-C in *catasticta*); and the maxillary spine (simple in *catasticta*, barbed in *venustipes*). The pupae differ in the lack of plumose abdominal hairs, the non-barbed apical paddle hair, and the short abdominal hair 7-I.

The ranges of the two species are distinct but *catasticta* approaches the northern range of *venustipes*. The barrier involved in the separation of the two is unknown but the climate conditions of Victoria and New South Wales differ from the rest of the country. It is possible that *catasticta* is limited to the warmer regions of the North Coast.

ACKNOWLEDGEMENTS

This study is based on material in the collection of the Southeast Asia Mosquito Project and the United States National Museum. In addition, material was obtained for me by SEAMP from the following to whom I am most grateful for their assistance: Dr. F. Zumpt, South African Institute for Medical Research, Johannesburg; Dr. Peter F. Mattingly, British Museum (Natural History), London; Dr. J. Rageau, Office de la Recherche Scientifique et Technique Outre-Mer, Paris; Mrs. E. C. C. van Someren, Medical Research Laboratory, Nairobi; Dr. N. V. Dobrotworsky, University of Melbourne, Victoria; Dr. J. N. Belkin, University of California, Los Angeles; Dr. E. N. Marks, University of Queensland, Brisbane; and Dr. S. Ramalingam, University of Malaya, Kuala Lumpur. I also wish to acknowledge Dr. H. A. Standfast, Queensland Institute of Medical Research, Brisbane and Professor W. Peters, Liverpool School of Tropical Medicine, Liverpool for their valuable information on the Australasian distribution of *Aedeomyia*. My special thanks to Drs. Alan Stone and Botha de Meillon for constructive criticisms during the course of the study and the preparation of the manuscript. My thanks to the illustrators of the 406th. Medical Research Unit, Tokyo, for the habitus drawings and to Karen Prather and L. M. Druckenbrod of SEAMP for the remainder of the illustrations.

LITERATURE CITED

- AITKEN, T. H. G.
1967. The canopy-frequenting mosquitoes of Bush Bush Forest, Trinidad, West Indies. Atas do Simposio sobre a biota Amazonica 6: 65-73.

- AMOS, D. W.
 1944. Mosquito Control Training Manual. Suva, Fiji, 43 pp., illus.
 1947. Mosquito Control Training Manual. Suva, Fiji, 43 pp., illus.
- ASSEM, J. VAN DEN and J. BONNE-WEPSTER
 1964. VI. New Guinea Culicidae, a synopsis of vectors, pests and common species. Zool. Bijdr. 136 pp.
- BAISAS, F. E.
 1938. Notes on Philippine Mosquitoes VII. Mon. Bull. Philipp. Hlth. Serv. 18(5): 175-232.
- BANKS, C. S.
 1906. A list of Philippine Culicidae with descriptions of some new species. Philipp. J. Sci. 1(9): 977-1005.
- BARRAUD, P. J.
 1923. A revision of the culicine mosquitoes of India. VII. Indian J. med. Res. 11(2): 485-505.
 1927. The Indian species of *Aedomyia* and *Orthopodomyia* with descriptions of two new species. Indian J. med. Res. 14(3): 523-532.
 1934. The fauna of British India including Ceylon and Burma. Diptera V. Family Culicidae, tribes Megarhinini and Culicini. Taylor & Francis, London. 463 pp.
- BARRAUD, P. J. and C. COVELL
 1928. The morphology of the buccal cavity in Anopheline and Culicine mosquitoes. Indian J. med. Res. 15(3): 671-679, illus.
- BELKIN, J. N.
 1962. The mosquitoes of the South Pacific. Univ. Calif. Press, Berkeley. 2 vols., 608 and 412 pp., illus.
 1968. Mosquito studies VII. The Culicidae of New Zealand. Cont. Amer. ent. Inst. 3(1): 1-182, 42 figs.
- BOHART, R. M.
 1947. A synopsis of the Philippine mosquitoes. Navmed 580. 88 pp.
 1957. Insects of Micronesia. Diptera: Culicidae. B. P. Bishop Mus. 12(1): 1-85.
- BONNE-WEPSTER, J.
 1954. Synopsis of a hundred common non-anopheline mosquitoes of the Greater and Lesser Sundas, the Moluccas and New Guinea. Roy. trop. Inst. Amst. Spec. Pub. 20: 1-147.
- BONNE-WEPSTER, J. and S. L. BRUG
 1937. Nederlandsch-Indische culicinen. Geneesk. Tijdschr. Ned.-Ind. 77: 1-105.
 1939. Larvaen van Nederlandsch-Indische culicinen. Geneesk. Tijdschr. Ned.-Ind. 79(20): 1218-1279.

- BOREL, E.
1930. Les moustiques de la Cochinchine et du Sud-Annam. Mongr. Coll. Soc. Pat. exot. 3, 423 pp. Paris.
- BRUG, S. L. and J. BONNE-WEPSTER
1947. The geographical distribution of the mosquitoes of the Malay Archipelago. Chron. nat. 103: 179-197.
- BRUNETTI, E.
1907. Annotated catalogue of Oriental Culicidae. Rec. Indian Mus. 1: 297-377.
1912. Annotated catalogue of Oriental Culicidae - Supplement. Rec. Indian Mus. 4(10): 403-517.
1914. Critical review of genera in Culicidae. Rec. Indian Mus. 10(2): 15-73.
1920. Catalogue of Oriental and South Asiatic Nematocera. Rec. Indian Mus. 17: 88-184.
- CARTER, H. F.
1950. Ceylon Mosquitoes: Lists of species and names of mosquitoes recorded from Ceylon. Ceylon J. Sci. (B) 24(2): 85-115.
- COHER, E. I.
1948(1949). A study of the female genitalia of Culicidae: with particular reference to characters of generic value. Ent. Amer. 28(3): 75-112, illus.
- DOBROTWORSKY, N. V.
1965. The mosquitoes of Victoria (Diptera, Culicidae). Melbourne Univ. Press, 237 pp., 86 figs.
- DOHERTY, R. L., WHITEHEAD, R. H., WETTERS, E. J. and B. M. GORMAN
1968. Studies of the epidemiology of arthropod-borne virus infections at Mitchell River Mission, Cape York Peninsula, North Queensland. II. Arbovirus infections of mosquitoes, man and domestic fowls, 1963-1966. Trans. R. Soc. trop. Med. Hyg. 62(3): 430-438.
- DOUGLAS, G. W.
1961. Notes on Australian mosquitoes (Diptera, Culicidae). I. The life history of *Aedeomyia venustipes* (Skuse). Proc. Linn. Soc. N.S.W. 86(3): 262-267.
- DYAR, A. G.
1920. A collection of mosquitoes from the Philippine Islands. Insec. Inscit. Menst. 8(10-12): 175-186.
- EDWARDS, F. W.
1912a. A synopsis of the species of African Culicidae, other than *Anopheles*. Bull. ent. Res. 3(1): 1-53.
1912b. Revised keys to the known larvae of African Culicinae. Bull. ent. Res. 3(4): 373-385.
1917. Notes on Culicidae, with descriptions of new species. Bull. ent. Res. 17(3): 201-229.

EDWARDS, F. W.

1922. A synopsis of adult Oriental culicine (including megarhine and sabethine) mosquitoes. Part II. Indian J. med. Res. 10: 430-475.
1924. A synopsis of the adult mosquitoes of the Australasian Region. Bull. ent. Res. 14(4): 351-401.
1925. Mosquito notes - V. Bull. ent. Res. 15(3): 257-270.
1929. Mosquito notes - VIII. Bull. ent. Res. 20(3): 321-343.
1932. in Wytsman, Genera Insectorum. Diptera. Family Culicidae. Fasc. 194, Desmet-Verteneuil, Brussels. 258 pp., illus.
1941. Mosquitoes of the Ethiopian Region. III. Culicine adults and pupae. Brit. Mus. (Nat. Hist.), London. 499 pp.

ENDERLEIN, G.

1923. Zur kenntnis Afrikanischer und Orientalischer Culiciden. Wien. ent. Zeit. 40(1-4): 25-29.

FARNER, D. S.

1944. Epidemiology of diseases of military importance in the Netherlands Indies, including the identification and distribution of arthropods of medical importance. Navmed 133. 250 pp.

GILES, G. M.

1902. A handbook of the gnats or mosquitoes. 2nd. ed., London. 530 pp., 51 figs.

GREEN, E. E.

1901. List of the several species of mosquitoes recorded from Ceylon: in Mosquitoes and Malaria. Royal Botanic Gardens Circular. Series I(25): 345-368.

HAMON, J.

1966. Notes sur les moustiques de la Republique Islamique de Mauritanie. II. (Diptera, Culicidae). Ann. Soc. ent. France (n. s.), 2(2): 371-383.

HOPKINS, G. H. E.

1952. Mosquitoes of the Ethiopian Region. I. - Larval bionomics of mosquitoes and taxonomy of culicine larvae. 2nd ed., with notes and addenda by P. F. Mattingly. London. 355 pp., illus.

IYENGAR, M. O. T.

1953. A report on filariasis in Thailand. Bull. W. H. O. 9(6): 731-766.

IYENGAR, M. O. T. and M. A. U. MENON

1956. The mosquitoes of South Thailand. Bull. ent. Res. 47(4): 785-794.

KNAB, F.

1909. Two new Philippine Culicidae. Ent. News 20: 386-388.

- KNIGHT, K. L., BOHART, R. M. and G. E. BOHART
1944. Keys to the mosquitoes of the Australasian Region, including a synopsis of their distribution and breeding habits. Nat. Res. Counc., Div. med. Sci., Washington. 71 pp.
- KNIGHT, K. L. and R. W. CHAMBERLAIN
1948. A new nomenclature for the chaetotaxy of the mosquito pupa, based on a comparative study of the genera (Diptera: Culicidae). Proc. helm. Soc. Wash. 15: 1-18, illus.
- LEE, D. J.
1944. An atlas of the mosquito larvae of the Australasian Region. Tribes - Megarhinini and Culicini. Australian Military Forces, Headquarters. 119 pp., illus.
- LEICESTER, G. F.
1908. The Culicidae of Malaya. Stud. Inst. med. Res. F.M.S. 3(3): 18-261.
- LEWIS, D. J.
1949. Tracheal gills in some African culicine mosquito larvae. Proc. R. ent. Soc. Lond. (A) 24: 51-65, illus.
- MACDONALD, W. W.
1957. Malaysian parasites - XVI. An interim review of the non-anopheline mosquitoes of Malaya. Stud. Inst. med. Res. F. M. S. 28: 1-34.
- MACKERRAS, I. M.
1937. Notes on Australian mosquitoes (Diptera, Culicidae). Proc. Linn. Soc. N.S. W. 62(5-6): 260-262.
- MATTINGLY, P. F.
1949. Studies on West African forest mosquitoes. II. Bull. ent. Res. 40: 387-402.
- PENN, G. H.
1948. Biological notes on "Dry Season" mosquitoes from Caminawit Point, Mindoro, P.I. Proc. ent. Soc. Wash. 50(9): 241-248.
1949. The pupae of the mosquitoes of New Guinea. Pacif. Sci. 3: 3-85, illus.
- SKUSE, F. A. A.
1889. Diptera of Australia. Part 5. The Culicidae. Proc. Linn. Soc. N.S. W. (2), 3: 1761.
- STANDFAST, H. A. and G. J. BARROW
1968. Studies of the epidemiology of arthropod-borne virus infections at Mitchell River Mission, Cape York Peninsula, North Queensland. Trans. R. Soc. trop. Med. Hyg. 62(3):418-429.
- STONE, A. and K. L. KNIGHT
1957. Type specimens of mosquitoes in the United States National Museum: VI. J. Wash. Acad. Sci. 47: 196-202.
- TAYLOR, F. H.
1913. Report of entomologist F. H. Taylor. Austral. Inst. trop. Med. 21 pp.

TAYLOR, F. H.

1916. Contributions to a knowledge of Australian Culicidae, III. Proc. Linn. Soc. N.S.W. 41(3): 564-574.

THEOBALD, F. V.

- 1901a. The classification of mosquitoes. J. trop. Med. 4: 229-235.
- 1901b. A monograph of the Culicidae or mosquitoes. I. London. 424 pp.
- 1901c. A monograph of the Culicidae or mosquitoes. II. London. 391 pp.

THURMAN, E. B.

1959. A contribution to a revision of the Culicidae of northern Thailand. Univ. Maryland Agr. Exp. Sta. Bull. A-100. College Park, Maryland. 177 pp., 48 figs.
1963. The mosquito fauna of Thailand (Diptera: Culicidae). Proc. 9th Pacif. Sci. Congr. 9: 47-57.

THURMAN, D. C. JR. and E. B. THURMAN

1955. Report of the initial operation of a mosquito light trap in northern Thailand. Mosq. News 15(4): 218-224.

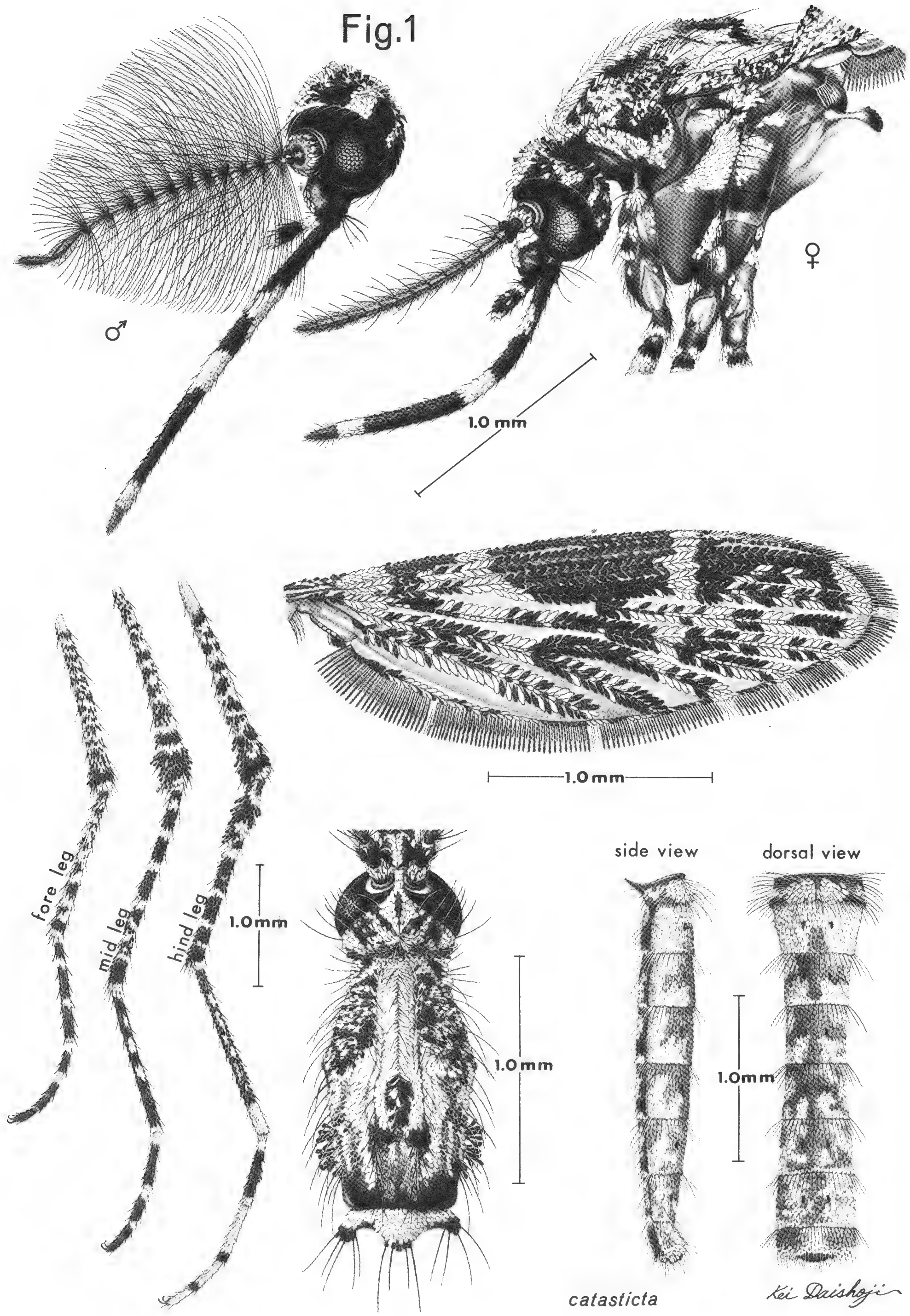
WHITEHEAD, R. H., DOHERTY, R. L., DOMROW, R., STANDFAST, H. A. and E. J. WETTERS

1968. Studies of the epidemiology of arthropod-borne virus infections at Mitchell River Mission, Cape York Peninsula, North Queensland. III. Virus studies of wild birds, 1964-1967. Trans. R. Soc. trop. Med. Hyg. 62(3): 439-445.



Distribution of *Aedeomyia catasticta* Knab (●), and *Aedeomyia venustipes* (Skuse) (○) in the Southeast Asia - Australasian Regions.

Fig.1



♂

♀

1.0 mm

1.0 mm

fore leg

mid leg

hind leg

1.0mm

side view

dorsal view

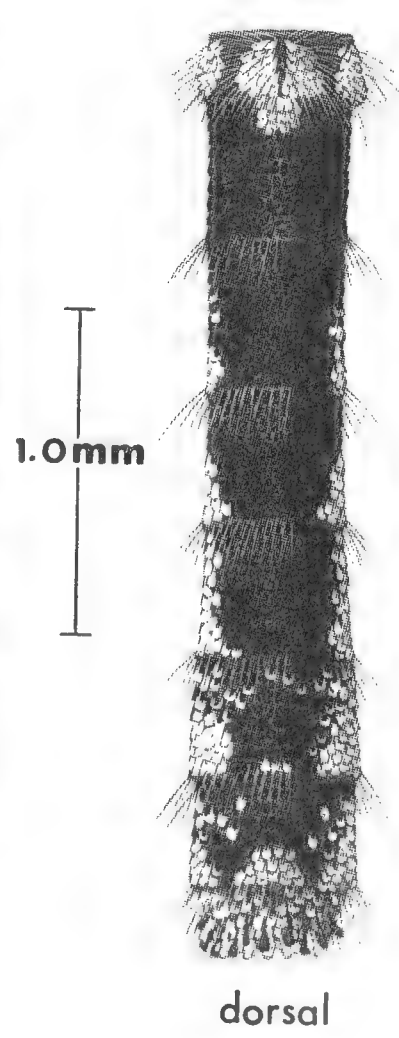
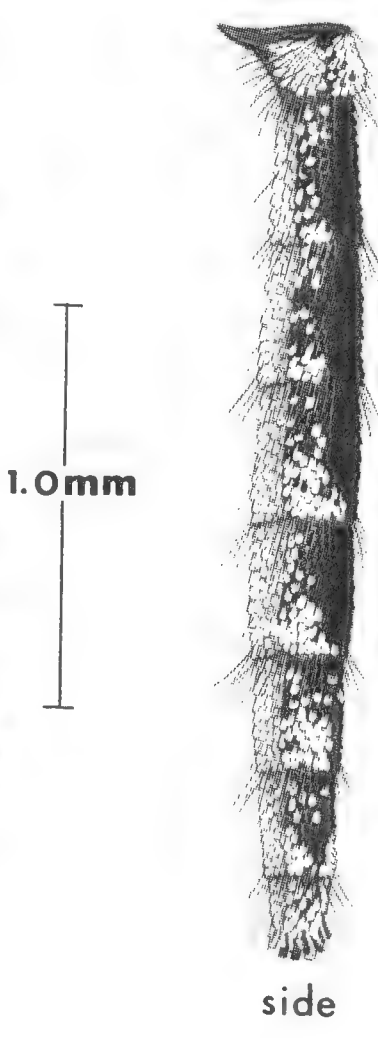
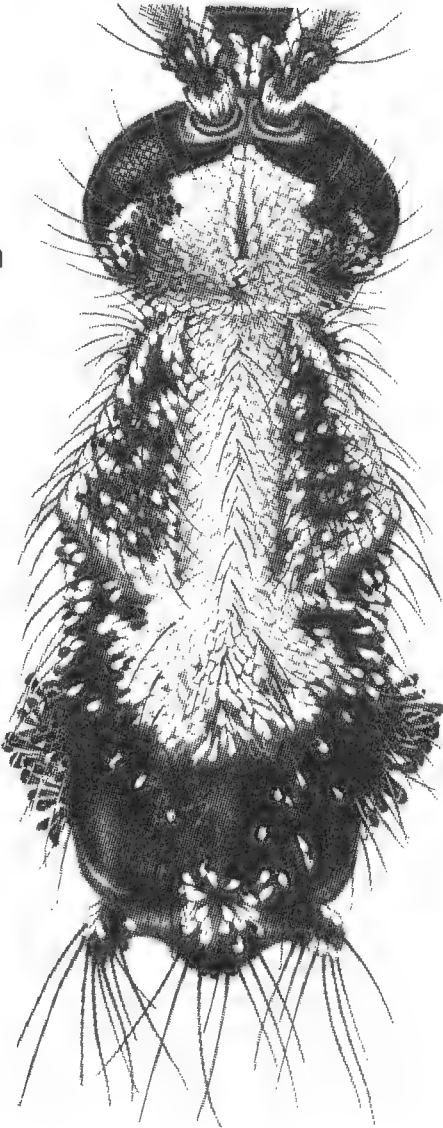
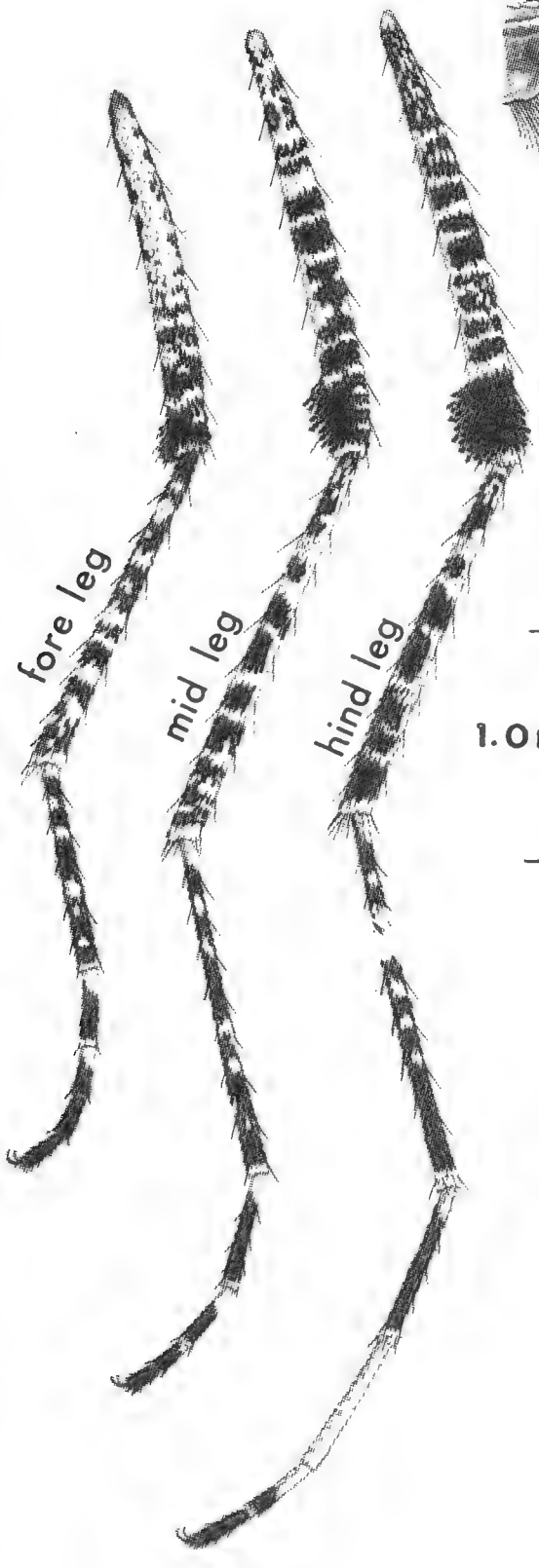
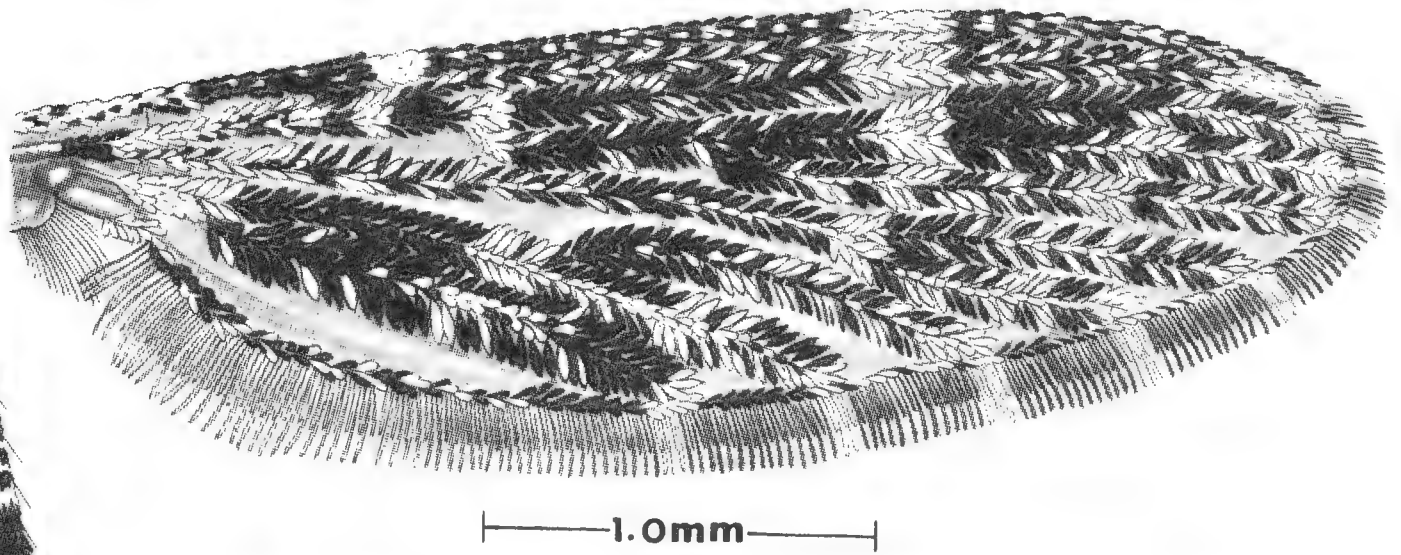
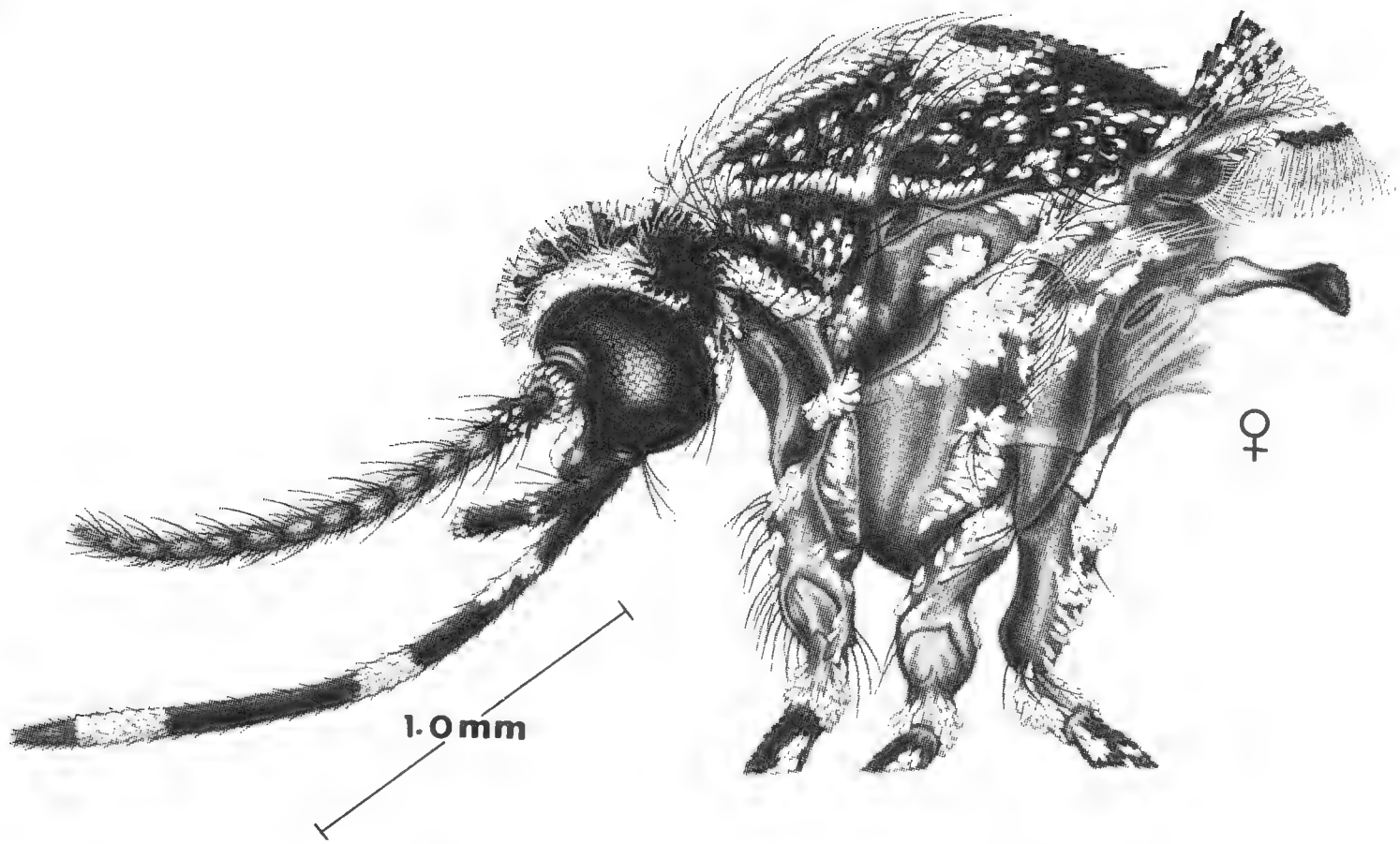
1.0mm

1.0mm

catasticta

Kei Daishoji

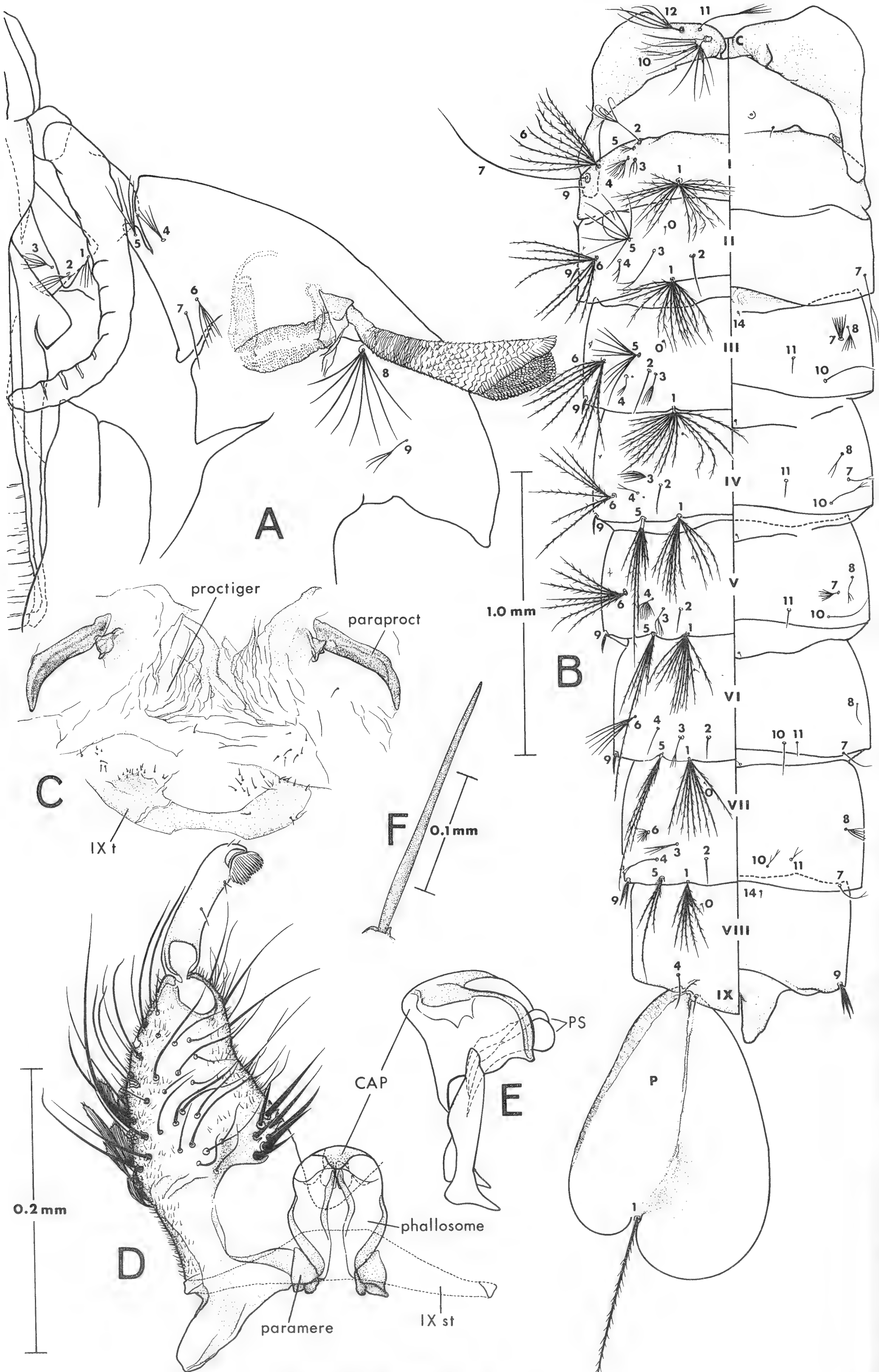
Fig. 2



venustipes

Kei Daishoji

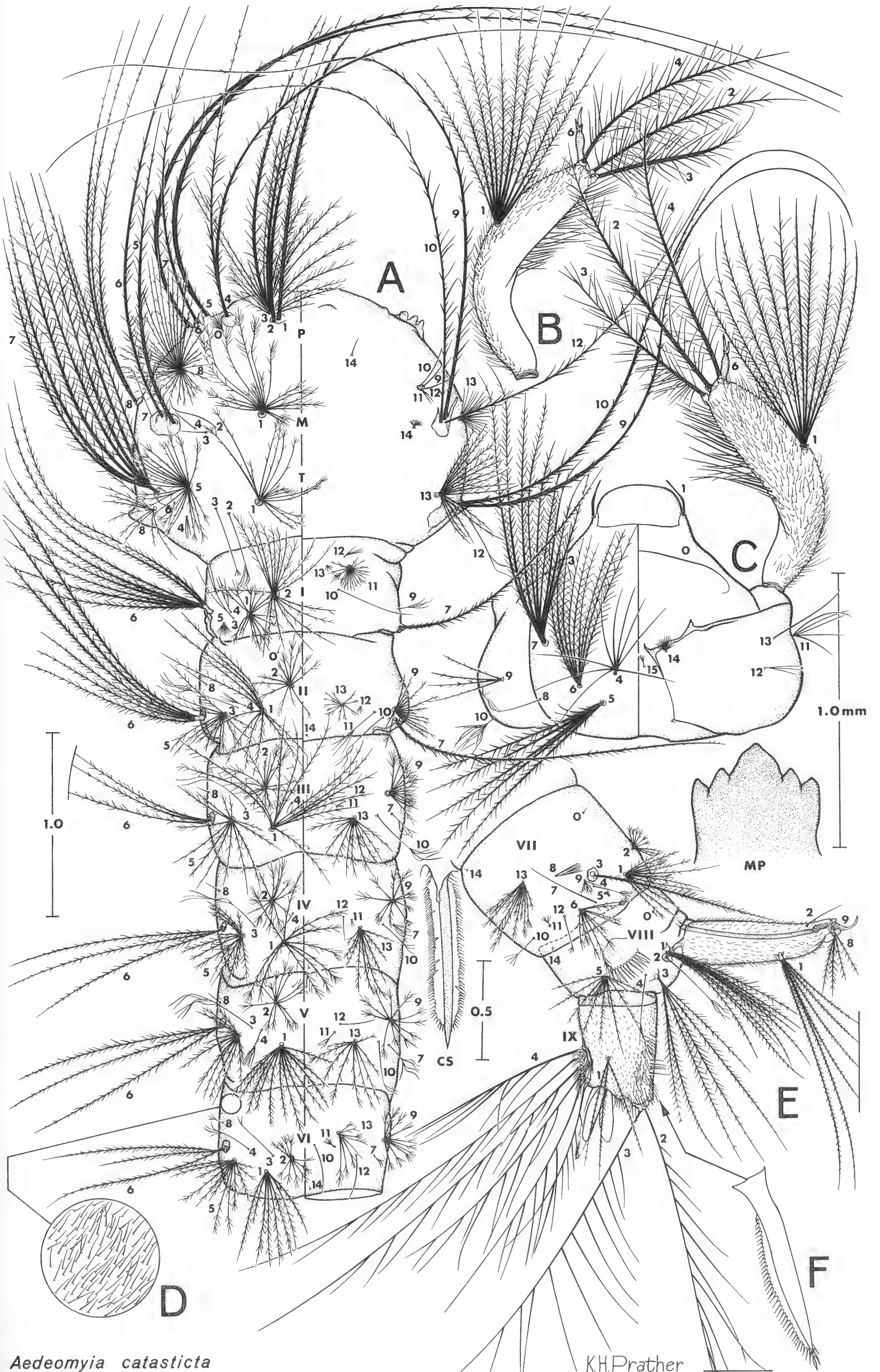
Fig.3



Aedeomyia catasticta

K.H. Prather

Fig.4



Aedeomyia catasticta

K.H. Prather

Fig.5

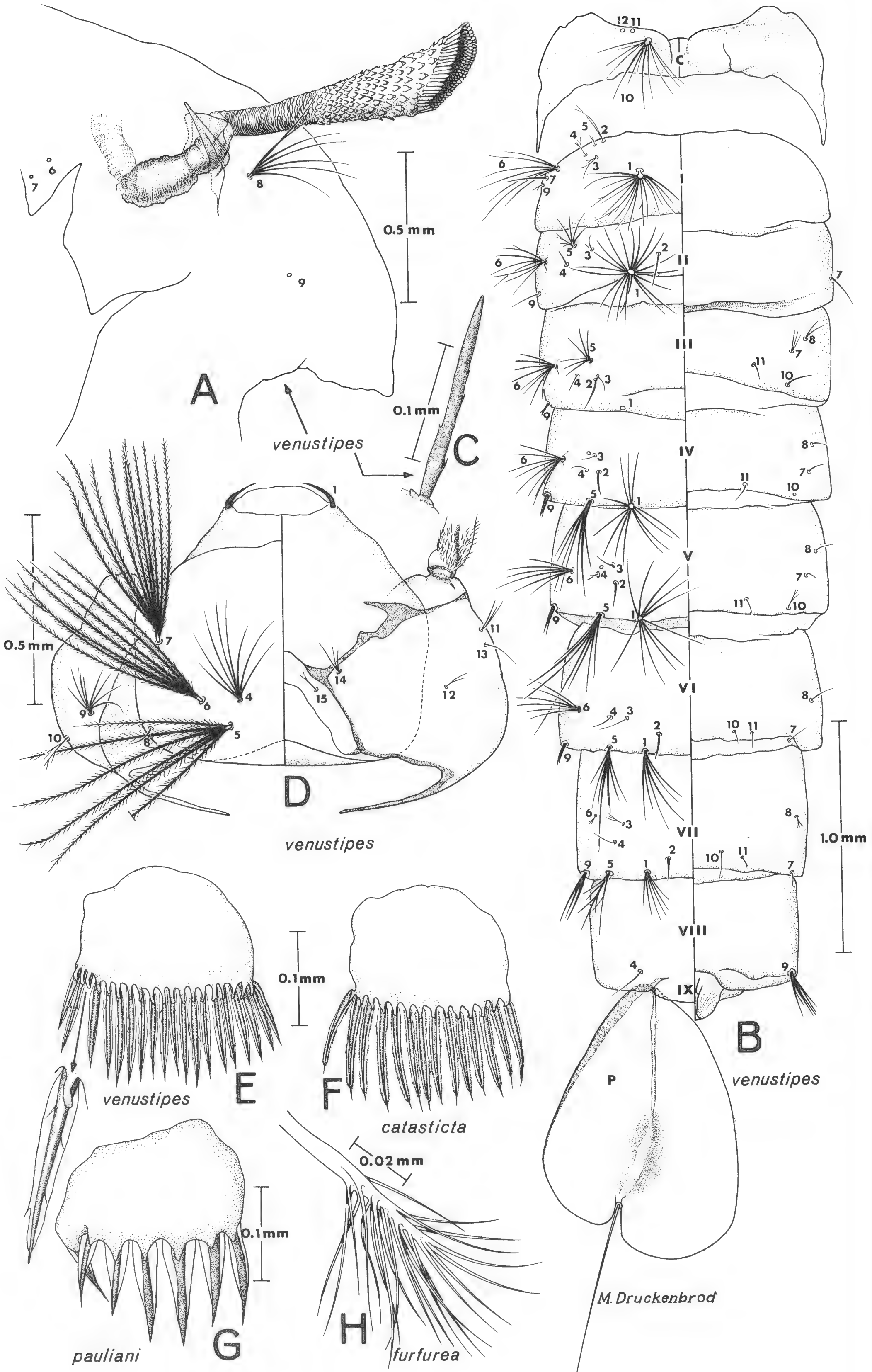


Fig. 6

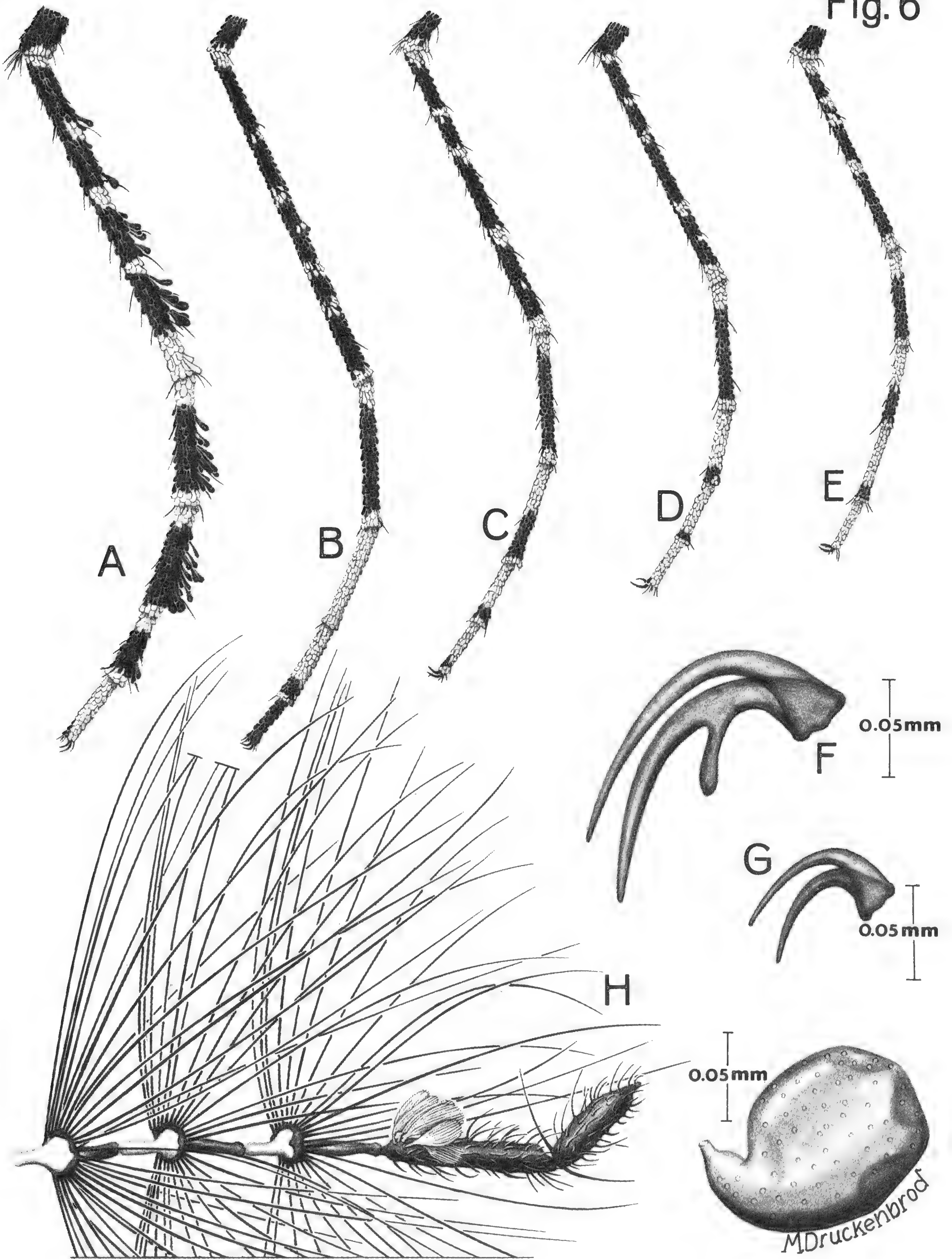


Figure.6 *Aedeomyia* (L.) *furfurea*, A, ♀ hind tarsus; F, ♂ fore tarsal claw; H, apical flagellomeres of ♂ antenna. *Aedeo.*(A.) *venustipes*, B, ♀ hind tarsus. *Aedeo.*(A.) *squamipennis*, C, ♀ hind tarsus. *Aedeo.*(A.) *catasticta*, D, ♀ hind tarsus; G, ♀ hind tarsal claw; I, spermatheca. *Aedeo.*(A.) *africana*, E, ♀ hind tarsus

INDEX

Valid names are printed in roman type, synonyms are italicized. Italicized page numbers are those which begin the primary treatment of that species. Numbers in parentheses refer to the figures illustrating some portion of that species.

<i>Aedeomyia</i>	1, 2, 5, 6, 7, 8, 11, 12, 13.
<i>Aëdeomyia</i>	8.
<i>Aediomyia</i>	1, 2, 8.
<i>Aedomyia</i>	1, 2, 8, 12, 14.
<i>Aëdomyia</i>	2, 8, 12.
<i>Aedes</i>	1, 2, 12.
<i>africana</i>	1, 3, 4, 5, 6, 7, (6E).
<i>Anopheles</i>	15.
<i>Azolla</i>	5.
<i>catasticta</i>	1, 3, 4, 5, 6, 7, 8, 12, 13, 19, (1, 3, 4, 5F, 6D, G, I).
<i>Centropus</i>	5.
<i>crassipes</i>	5.
<i>Eichhornia</i>	5.
<i>furfurea</i>	1, 2, 3, 4, 5, 6, 7, (5H, 6A, F, H).
<i>Lepiothauma</i>	1, 2, 6, 7.
<i>Lepisthauma</i>	2.
<i>Myriophyllum</i>	5.
<i>Nitella</i>	5.
<i>Orthopodomyia</i>	6, 14.
<i>pauliani</i>	1, 4, 5, 6, 7, (5G).
<i>phasianinus</i>	5.
<i>Pistia</i>	5, 6.
<i>Potamogeton</i>	6.
<i>Spirogyra</i>	5.
<i>squamepennis</i>	8.
<i>squamipenna</i>	2, 6, 8.
<i>squamipennis</i>	1, 3, 4, 5, 6, 7, 8, (6C).
<i>squamipenna</i>	1, 8.
<i>stratiotes</i>	5.
<i>Utricularia</i>	5.
<i>venustipes</i>	1, 3, 4, 5, 6, 7, 8, 12, 13, 15, 19, (2, 5A-E, 6B).

CONTENTS

INTRODUCTION	29
Genus <i>Aedes</i> Meigen, Subgenus <i>Mucidus</i> Theobald	31
KEY TO THE WORLD SPECIES OF ADULT <i>MUCIDUS</i>	34
KEY TO THE PUPAE OF SOUTHEAST ASIAN SPECIES	36
KEY TO THE LARVAE OF SOUTHEAST ASIAN SPECIES	36
DESCRIPTIONS OF THE SOUTHEAST ASIAN SPECIES	
GROUP A MUCIDUS	
<i>ferinus</i> Knight	37
<i>laniger</i> (Wiedemann)	39
<i>quasiferinus</i> Mattingly	41
<i>scatophagoides</i> (Theobald)	43
GROUP B PARDOMYIA	
<i>aurantius aurantius</i> (Theobald)	46
<i>quadripunctis</i> (Ludlow)	49
ACKNOWLEDGEMENTS	51
LITERATURE CITED	51
DISTRIBUTION MAPS	56
FIGURES	58
INDEX	79

CONTRIBUTIONS TO THE MOSQUITO FAUNA OF SOUTHEAST ASIA. VIII.

GENUS *Aedes*, SUBGENUS *Mucidus* THEOBALD

IN SOUTHEAST ASIA¹

By

W. H. Tyson²

INTRODUCTION

The subgenus *Mucidus* was originally described by Theobald (1901b: 268) as a distinct genus based on *Culex alternans* Westwood. Theobald (1907: 280) erected a new genus *Pardomyia* in which he described the species *aurantius*. The following year Leicester (1908: 71) described the same species placing it in his new genus *Ekrinomyia* and called it *aureostriata*. Edwards (1932: 133) placed the above three genera into the subgenus *Mucidus* of the genus *Aedes*. He then divided the subgenus into two groups, Group A *Mucidus* and Group B *Pardomyia*, which are differentiated on page 30. Although various authors have disagreed on the speciation within the groups, Edwards' higher classification has remained unchallenged.

This paper deals with six species from Southeast Asia in which the range of one is enlarged and the hitherto unknown immature forms of *Ae. laniger* (Wiedemann) are described. Keys to the adult, pupal and larval forms of species found in Southeast Asia are included. The key to the adult forms also includes all recognized species and subspecies of the subgenus. For taxonomic information on the Australasian forms see Knight (1947) and Belkin (1962). For the Ethiopian forms see Edwards (1941), Gebert (1948), Hopkins (1952), Muspratt (1959), and Tyson (1970). For additional information on Indomalayan and Philippine *Mucidus* see Knight & Hull (1951) and Mattingly (1961).

Abbreviations used in references to literature conform to the World List of Scientific Periodicals, 3rd. ed., Academic Press, New York, 1952. An asterisk following the abbreviations used (♀ = female, ♂ = male, P = pupa, L = larva) indicates that at least some portion of that form is figured. New distribution records are indicated by two asterisks.

Specimens of the following species of *Aedes* (*Mucidus*) have been examined during the course of this study: *alternans* (Westwood), *aurantius* (Theobald), *aurantius chrysogaster* (Taylor), *ferinus* Knight, *grahamii* (Theobald), *laniger* (Wiedemann), *lucianus* Muspratt, *mucidus* (Karsch), *nigerrimus* (Theobald), *painei* Knight, *quadripunctis* (Ludlow), *quasiferinus* Mattingly, *scatophagoides* (Theobald), *sudanensis* (Theobald), and *tonkingi* Gebert.

There is a great diversity exhibited between the two groups, *Mucidus* (Group A) and *Pardomyia* (Group B), and the following list (although incomplete) was derived to show a spectrum of the major differences that exist.

¹This work was supported by Research Contract No. DA-49-193-MD-2672 from the U. S. Army Medical Research and Development Command, Office of the Surgeon General, and carried out at the Southeast Asia Mosquito Project, Washington, D. C.

²Captain, MSC, U. S. Army, Department of Entomology, Walter Reed Army Institute of Research, Washington, D. C. 20012.

GROUP A MUCIDUS

GROUP B PARDOMYIA

ADULTS

- | | |
|--|---|
| 1. Scutum with decumbent scales and tufts of twisted, erect scales. | 1. Scutum with decumbent scales only. |
| 2. Body color white, yellow, and brown. | 2. Body color yellow-gold and brown. |
| 3. Wings with large scales of white, yellow and brown. | 3. Wings with smaller scales of yellow and brown. |
| 4. Abdomen light with apical segments white and yellow with some scales erect. | 4. Abdomen dark with apical segments yellow-gold, all scales depressed. |
| 5. Lower mesepimeral bristles 3-8. | 5. These bristles 0-5. |
| 6. Palpi of female long, 0.8 length of the proboscis. | 6. Palpi of female shorter, 0.25 length of the proboscis. |
| 7. Thoracic pleuron with many white scales, some erect. | 7. Thoracic pleuron with small patches of decumbent yellow scales. |
| 8. Legs with many erect scales. | 8. Legs with decumbent scales only. |
| 9. Males with palpi longer than proboscis by one segment. | 9. Males with palpi only slightly longer than proboscis. |
| 10. Fore and mid tarsal claws of male toothed, major claw with two teeth, minor claw with one. | 10. Male with major tarsal claw with one tooth, minor claw simple. |

PUPAE

- | | |
|---|-------------------------------------|
| 1. Trumpets moderate in length and wide. | 1. Trumpets very long and narrow. |
| 2. Cephalothorax with hairs single. | 2. These hairs multiple. |
| 3. Abdominal hair 1-I with branches simple. | 3. This hair with plumose branches. |

LARVAE

- | | |
|--|--|
| 1. Siphon with pecten not attaining siphonal tuft. | 1. Siphon with pecten attaining siphonal tuft. |
| 2. Siphonal tuft not plumose. | 2. Siphonal tuft plumose. |
| 3. Head hair 1-C long and slender. | 3. This hair small, thorn-like. |
| 4. Abdominal hair 2-VIII single. | 4. This hair double. |
| 5. Antennal tuft of 2-3 hairs. | 5. Antennal tuft of 3-5 hairs. |
| 6. Thoracic hairs 8-P, 9-M, and 9-T single. | 6. These hairs multiple or multiple and plumose. |

7. Saddle with dorsal, apical region with numerous small spines. 7. Saddle apex smooth.

The general characteristics of the subgenus were categorized by Knight (1947: 315) and more completely by Mattingly (1961: 18). The following combination of characters are those which generally separate this subgenus from other *Aedes*. Wing membrane clouded in the region of the cross veins; posterior pronotal bristles numerous (10-30); anterior and medial mesepimeral bristles present or absent (= lower mesepimerals of Knight, Mattingly, and others); female with cerci long and narrow; male with palpi as long as or longer than proboscis; larvae with mouth parts modified for predation; anal segment with ventral brush extending the length of the segment; pupae with large paddles.

GENUS *Aedes* MEIGEN
SUBGENUS *MUCIDUS* THEOBALD

Mucidus Theobald 1901a, J. trop. Med. 4:235. Logotype: *Culex alternans* Westwood, (Neveu-Lemaire) 1902, 219.

Pardomyia Theobald 1907, Mon. Cul. 4: 280. Haplotype: *aurantia* Theobald.

Erkinomyia Leicester 1908, Cul. Malaya :65, 71. Haplotype: *aureostriata* Leicester.

Aedes (Mucidus) Theobald, Edwards 1932, Gen. Insect., Fasc. 194: 132; Knight 1947, J. Wash. Acad. Sci. 37: 315; Hopkins 1952, Mosq. Ethiopian Region, 1: 121; Mattingly 1961, Cul. Mosq. Indomalayan Area, V: 17.

FEMALE. *Head.* Torus and flagellomere I with a mesal patch of scales (flagellomere scales few or absent in Group B); palpus 0.25 (Group B) to 0.8 (Group A) length of proboscis; palpus and base of proboscis with large erect scales (Group A) or moderate depressed scales (Group B); orbital and frontal bristles well developed; orbits margined with pale scales (whitish, Group A; yellow, Group B); scales of vertex mostly erect with apices forked; narrow decumbent scales on vertex present. *Thorax.* Scutum with scales narrow, decumbent (Group B) or decumbent with paired erect tufts (Group A) usually located in the following regions: scutellar, supraalar, posterior, dorsocentral, and fossal; scutum with bristles well developed, long; anterior promontary, humeral, acrostichal, dorsocentral, ante- and supraalar, and prescutellar bristles always present; scutellar bristles long; postnotum bare; anterior pronotal lobes widely separated, erect, with numerous scales and well developed bristles; pleura with several large patches of scales, some of which are erect (Group A) or decumbent and reduced to smaller patches (Group B); scales on the propleuron, sternopleuron, upper and lower mesepimeron, upper and lower prealar, and paratergite are common to both groups; bristles are present on the posterior pronotum, postspiracular, prealar, propleuron, sternopleuron, and mesepimeron; meron, metameron and metapleuron bare; middle or middle and anterior mesepimerals present, large (Group A) or moderate and few to absent (Group B). *Legs.* Fore, mid and hind coxae and trochanters with patches of scales and bristles; femora and tibiae with some erect scales (Group A) or mostly depressed scales (Group B) and distinct bands of white and brown (Group A) or yellow-gold and brown (Group B); fore and mid tarsomeres variable, dark scaled above, yellow beneath with basal yellow bands (Group B) or unicolorous yellow (Group A), or yellow with white basal bands on I and II (*tonkingi*) or with basal white bands on I-III and a median band on I (*scatophagoides*, *alternans*); hind tarsomeres dark brown with narrow yellow bands on I-III, sometimes on IV, with V all white (Group B) or with

segments yellow or yellow-brown with basal white bands on all tarsomeres or with IV and V all white (Group A) or with II all yellow-brown (*laniger*). *Wing*. Usually light and dark scaled with small to large scales, small scales yellow and brown (Group B) or with large white, yellow and brown scales (Group A); alula with narrow dark or dark-tipped scales confined to the fringe; squama with a fringe of long hairs; membrane in regions of the cross veins always clouded. *Halter*. With pale scales (Group A) or darker scales mostly on the apical half (Group B). *Abdomen*. Scaling of terga variable but generally with the basal half dark (Group B) without white scales or erect tufts or generally light with many white scales and some erect, lateral tufts (Group A). *Terminalia*. Cerci long and narrow; postgenital plate emerginate or truncate; three spermathecae, one usually larger than the others.

MALE. Similar to the female in general habitus. *Head*. Antenna plumose with hairs directed primarily dorsally and ventrally; palpus slightly longer than the proboscis (Group B) or much longer (Group A), penultimate segment shorter than last segment (Group A) or equal to or longer than the last segment (Group B), both with many ventral hairs; apex of segment III also hairy ventrally; apical segment with long, laterally projecting hairs with fewer on dorsoventral aspects (Group A) or with a moderate number of shorter hairs mesally (Group B). *Legs*. Fore and mid tarsal claws unequal, minor claw approximately 0.5 length of major claw and with one tooth, major claw with two teeth (Group A) or with minor claw entire and major claw with one tooth (Group B); hind claws equal, simple or with a minute denticle (Group B) or with one tooth (Group A). *Wing*. Similar to female but scales reduced in size and number and generally paler in color. *Terminalia*. Distimere slender with 2 to 4 setae on outer, apical 0.25, and with a well developed slender appendage; basimere with basal lobe only; basal lobe with 1-5 strong setae at base as well as numerous slender bristles (Group A) or with only bristles (Group B); claspette stem with several moderate bristles along its length (Group B) or without such bristles (Group A), filament well developed; phallosome (aedeagus) usually without teeth though in *scatophagoides* and *tonkingi* the aedeagus has a median raised ridge or carina which in *scatophagoides* projects beyond the apex in the form of a tooth.

PUPA. The pupae can be divided into their appropriate groups by the characters given on page 30. The great variation within this subgenus is exemplified in this immature form. The number and size of many of the body hairs are extremely variable and atypical members of related species are not easily separated.

LARVA. *Head*. Antenna spiculate with the antennal tuft of 2-3 hairs (Group A) or of 3-5 hairs (Group B); hair 1-C long and slender (Group A) or short and thorn-like (Group B); hair 9, 10-C single or double (Group A) or multiple (Group B); mouth brushes elongate, serrate on the inner apical margin; mental plate with 13-15 teeth; mandible trifold, basal tooth usually with 4 blunt lateral teeth. *Thorax*. Mesothoracic hairs 8, 9-M multiple and plumose (Group B) or 8 multiple not plumose and 9 single (Group A); metathoracic hairs 7, 9-T multiple and plumose (Group B) or 7 multiple, not plumose, and 9 single (Group A). *Abdomen*. Segment VIII with comb patch of 30 to 80 scales (usually over 50) in several rows, scales fringed on apical half, variable in size and shape and in number in each individual; hair 2-VIII single (Group A) or double (Group B); hairs 1, 3, 5-VIII plumose (Group B) or simple (Group A); siphon moderate with siphonal tuft (1-S) near middle and of 4-15 branches, plumose (Group B) or simple (Group A); pecten reaching or surpassing siphonal tuft (Group B) or not (Group A); pecten teeth variable, entire or having 1-4 lateral teeth; anal segment with saddle incomplete with dorsal apical edge smooth (Group B) or with many small spines (Group A); ventral brush covering the complete length of the anal segment; hairs 2, 3-X extremely long; anal papillae short, usually less than the length of the saddle.

DISTRIBUTION. The following is a list of the recognized species of *Aedes (Mucidus)* arranged by zoogeographical regions.

AUSTRALASIAN REGION

1. *Aedes (Mucidus) alternans* (Westwood)
2. *Aedes (Mucidus) aurantius chrysogaster* (Taylor)
3. *Aedes (Mucidus) painei* Knight

ORIENTAL REGION

1. *Aedes (Mucidus) aurantius aurantius* (Theobald)
2. *Aedes (Mucidus) ferinus* Knight
3. *Aedes (Mucidus) laniger* (Wiedemann)
4. *Aedes (Mucidus) quadripunctis* (Ludlow)
5. *Aedes (Mucidus) quasiferinus* Mattingly
6. *Aedes (Mucidus) scatophagoides* (Theobald)

ETHIOPIAN REGION

1. *Aedes (Mucidus) grahamii* (Theobald)
2. *Aedes (Mucidus) lucianus* Muspratt
3. *Aedes (Mucidus) mucidus* (Karsch)
4. *Aedes (Mucidus) nigerrimus* (Theobald)
5. *Aedes (Mucidus) sudanensis* (Theobald)
6. *Aedes (Mucidus) tonkingi* Gebert

The two groups have overlapping ranges. Group B is recorded from EAST and WEST MALAYSIA, NEW GUINEA, PHILIPPINES, AUSTRALIA, SOLOMON ISLANDS, BISMARCK ARCHIPELAGO, and INDONESIA (see map #2). The range of Group A can be divided into two distinct areas. The first (Oriental-Australasian) ranges from WEST PAKISTAN, INDIA, CEYLON, BURMA, THAILAND, SOUTH VIETNAM, and MALAYSIA, south and west to INDONESIA, NEW GUINEA, PHILIPPINES, TIMOR, NEW CALEDONIA, and AUSTRALIA (map #1). The second area is Ethiopian and *Mucidus* has been collected in the following countries: GHANA, KENYA, MALAWI, MALI, MAURITANIA, MOZAMBIQUE, NIGERIA, REPUBLIC OF SOUTH AFRICA, RHODESIA, SENEGAL, SOMALIA, SUDAN, TANZANIA, THE DEMOCRATIC REPUBLIC OF THE CONGO, UPPER VOLTA, and ZAMBIA. The presence of *tonkingi* on Mauritius presents an interesting problem. The absence of *Mucidus* on Madagascar and the Islands of the Seychelles-Mauritius Ridge limits the possibility of it radiating from Africa. Its close relationship to the African *sudanensis*, the Oriental *scatophagoides*, and the Australasian *alternans* further complicates the issue. Many major problems need to be answered before the origin and routes of distribution of the groups can be hypothesized.

BIOLOGY AND MEDICAL IMPORTANCE. Although not shown to be a vector of human pathogens, several species do not hesitate to feed on man. *Aedes laniger*, *scatophagoides*, *alternans*, and *aurantius* are recorded as feeding on man. The type series of *scatophagoides* was collected feeding on patients in a hospital in India (Giles in Theobald 1901b: 278).

Adults are apparently arboreal (Mattingly 1949: 399) and nocturnal (Haddow *et al.* 1951: 217). Knight (1947: 321) records *alternans* as a vicious biter and feeding at sundown. The majority of authors agree that *Aedes (Mucidus)* breed only in temporary pools of various types, and the larvae feed on other mosquito larvae. Hopkins (1952: 122) records *mucidus* larvae as showing no reluctance to feeding on smaller specimens of its own species. Gebert (1948: 96) records *tonkingi* in association with *Anopheles gambiae* and *Aedes fowleri*. Rageau & Hamon (1957: 377) record the prey of *alternans* as

being *Aedes vexans*, *vigilax*, *Culex sitiens* and *annulirostris*. Paine & Edwards (1929: 305) record *painei* feeding on *Aedes funereus*, *Culex hilli*, and *Anopheles punctulatus*. Edwards & Given (1928: 341) found *aurantius* in association with *Aedes umbrosus* and Bick (1951: 406) found *aurantius chrysogaster* in association with *Culex pullus*, *halifaxii*, *Anopheles punctulatus*, and *Uranotaenia argyrotarsis*.

Hopkins (1952: 113) believes that because of a lack of succession of generations in breeding places, the eggs are probably deposited at random while flying. Bancroft (in Theobald 1907: 162) and Giles (in Theobald 1901b: 279) note the eggs being laid singly, and Hopkins (1952: 121) believes them to be resistant to dessication.

Although fresh water is primarily utilized, *alternans* is said to breed successfully in saline marshes (Knight 1947: 321). Other species have been collected in highly polluted waters (Bick 1951: 406) or water free from pollutants.

KEY TO THE WORLD SPECIES OF ADULT *MUCIDUS*

1. Scutum with tufts of twisted erect white scales; general coloration white, yellow, and brown; palpi of female over 0.5 as long as proboscis Group A, *Mucidus* 2
- Scutum with scales depressed; general coloration gold and brown; palpi of female barely 0.25 as long as proboscis Group B, *Pardomyia* 12
- 2(1). Distal white band on all tibiae subapical; (Fig. 6); Australasian *alternans*
- Distal white band on all tibiae apical; Ethiopian and Oriental 3
- 3(2). Fore tibia with apical white band not occupying more than 0.25 of total tibial length, usually with a median white band (sometimes restricted to a few white scales) 4
- Fore tibia with apical white band longer than 0.25 of total tibial length, or median band of fore tibia absent 7
- 4(3). Tarsomere I of all legs with a distinct basal and medial white band; fore and mid tarsomeres II, III (often IV, V) with basal white bands; Ethiopian and Oriental 5
- Tarsomeres not as above 6
- 5(4). Proboscis with many white scales at middle (reduced to a vaguely defined ring in male); Oriental *scatophagoides* (p. 43)
- Proboscis yellow scaled, without white scales at middle; Ethiopian *sudanensis*
- 6(4). Fore tibia with a well developed median pale band; Philippines *ferinus* (p. 37)
- Fore tibia with a vague or interrupted (sometimes absent) median pale band; Indomalayan *quasiferinus* (p. 41)

- 7(3). Hind tarsomere II brown, sometimes with a few scattered white scales along its length; Oriental *laniger* (p. 39)
Hind tarsomere II with a distinct basal white band; Ethiopian 8
- 8(7). Hind tarsomere III 0.3-0.6 white basally; costa largely yellow 9
Hind tarsomere III white except at tip; costa yellow but generally darker 10
- 9(8). Fore tarsomeres I, II and mid tarsomeres I-III with a pale basal band; Mauritius *tonkingi*
Fore and usually mid tarsomeres unicolorous; (Fig. 5); Africa *mucidus*
- 10(9). Costa and apical 0.33 of R₁ mostly yellow scaled; proboscis yellow and white scaled, few, if any, dark scales present beyond basal 0.33; general color yellowish; Southeast Africa *lucianus*
Costa darker, usually with basal 0.5 very dark; scales of proboscis mostly dark with dark scales usually reaching apex; general color much darker; Central Africa 11
- 11(8). Hind tarsomere II less than half white, hind tarsomeres IV, V mostly white *nigerrimus*
Hind tarsomere II more than half white; hind tarsomeres IV, V either yellow-brown or mostly white (Fig. 6) *grahamii*
- 12(1). Scutum entirely yellow-copper scaled or with a few scattered dark scales randomly placed; medial and anterior mesepimeral bristles usually absent; integument reddish-brown; Philippines *quadripunctis* (p. 49)
Scutum with considerable areas of brown scaling; medial and anterior mesepimeral bristles combined 1-5, integument brown 13
- 13(12). Females only.¹ Scutum with basal and apical yellow scale bands, medial region with dark brown scales (a few yellow scales may sometimes be present) 14
Scutum as above but medial region with many yellow scales, as many as the dark scales; Australia and New Guinea *aurantius chrysogaster*
- 14(13). Terminal abdominal terga V-VIII entirely yellow scaled; Malaya to New Guinea *aurantius aurantius* (p. 46)
Abdominal terga VI-VIII with yellow scaling largely confined to mediodorsal area with many dark scales intermixed; Solomon Islands *painei*

¹Males of the *aurantius* complex, including *painei*, are indistinguishable.

KEY TO THE PUPAE OF SOUTHEAST ASIAN SPECIES¹

1. Metanotal hairs 10-12 single; trumpets shorter and more gradually expanded, 3-6 times as long as greatest width of meatus;² base tracheoid for a distance less than apical width Group A, *Mucidus* 2
- Metanotal hairs 10-12 multiple; trumpets long and narrow, index 6-10, with an abruptly expanded apex; base tracheoid for a distance as long or longer than apical width Group B, *Pardomyia* 5
- 2(1). Trumpets moderately long and slender; index 4.0-6.0, average 4.8 3
- Trumpets shorter and thicker, index 2.8-4.6, average 3.7 4
- 3(2). Abdominal hair 1-II usually bifid; hair 1-I not dendritic with an average of 6 basal branches *ferinus* (p. 38)
- This hair usually single; hair 1-I dendritic with 3 or 4 basal branches *laniger* (p. 40)
- 4(2). Abdominal hair 9-VIII with prominent secondary branching; hair 5-IV-VI single; hair 1-I not dendritic *scatophagoides* (p. 44)
- Hair 9-VIII with little or no secondary branching; hair 5-IV-VI double; hair 1-I dendritic ... *quasiferinus* (p. 42)
- 5(1). Paddle with the lateral margin densely and conspicuously spiculate *aurantius aurantius* (p. 47)
- Paddle with lateral margin vaguely to moderately spiculate *quadripunctis* (p. 50)

KEY TO THE LARVAE OF SOUTHEAST ASIAN SPECIES³

1. Pecten with apical teeth not attaining siphonal tuft; dorsal apical edge of saddle with elongate spines; thorax with hairs 2, 3-P single; abdominal hair 2-VIII single Group A, *Mucidus* 2
- Pecten with the apical 2 teeth somewhat displaced and at least 1 tooth attaining or surpassing the siphonal tuft; dorsal edge of saddle smooth; hairs 2, 3-P multiple; hair 2-VIII double Group B, *Pardomyia* 5

¹Because of the great variation that occurs within this stage, only typical individuals will key out successfully.

²Slide preparations were used to determine these indices. Pupae in spirits may prove to have different averages.

³Because of the great variation exhibited in this form, many characteristics could not be used. Distribution is in many cases the only sure means of separation.

- | | | | |
|----|--|------------------------------------|---|
| 2. | Siphon with siphonal tuft of 8-15 branches;
pecten teeth elongate | <i>scatophagoides</i> (p.42) | 3 |
| | Siphonal tuft of 4-7 branches | | |
| 3. | Pecten teeth moderate in length, 17 or less
in number | | 4 |
| | Pecten teeth elongate; usually more than 17
but sometimes less | <i>laniger</i> (p.40) | |
| 4. | Philippines | <i>ferinus</i> (p. 39) | |
| | Indonesia, Burma, Ceylon..... | <i>quasiferinus</i> (p.45) | |
| 5. | Indomalayan | <i>aurantius aurantius</i> (p.47) | |
| | Philippines | <i>quadripunctis</i> (p.50) | |

GROUP A MUCIDUS

Aedes (MUCIDUS) FERINUS KNIGHT

(Figures 1, 8 A, 10 A, 13 A, 16)

Aedes (Mucidus) ferinus Knight 1947, J. Wash. Acad. Sci. 37: 316 (σ^* , L*);
Knight & Chamberlain 1948, Proc. helm. Soc. Wash. 15:10 (P*);
Knight & Hull 1951, Pacif. Sci. 5:224; Mattingly 1961, Culic. Mosq.
Indomalayan Area V: 31 (σ^* , ♀, P*, L*).

FEMALE. (Figure 1) *Head.* Antenna longer than proboscis, light brown with apical segments darker; flagellomere I with a few white scales on mesal margin; torus with a patch of white scales on mesal half; clypeus bare, appearing frosty white in certain lights; palpus yellow brown, approximately 0.8 length of proboscis, basal segment small and slightly inflated with an oblique row of dark bristles, segment II mainly with erect pale scales but the majority with tip dark, segment III with only a few dark tipped scales, the majority white, segment IV all white scaled and the scales mostly decumbent, segments III-IV with many erect bristles on ventral side; proboscis with 4-6 basal bristles, basal half with erect white and dark scales, middle region white and progressing to yellow with a white ring at apex; labellum dark; vertex clothed with narrow erect scales that are forked at apex, medial area from mid vertex to frontal tuft white scaled, sides with mixed white and dark scales; orbital line with narrow decumbent white scales; orbital bristles pale yellow. *Thorax.* Scutum clothed with decumbent, recurved and erect narrow white scales; erect scales forming twisted tufts noticeable in regions of posterior dorsocentral, prescutellar, and supraalar; scutum with some decumbent yellow scales in fossal region; bristles of scutum gold-brown, well developed with acrostichal, anterior promontory, fossal, anterior fossal, and supraalar regions all with many bristles; scutellum with tufts of twisted, erect, white scales on each lobe; scutellar bristles very long and numerous on lateral and medial lobes; pleural integument dark brown with some pleurites with light margins; small erect tufts of white scales in regions of prealar, paratergite, upper sternopleuron, posterior sternopleuron, and anterior mesepimeron; all pleurites with some scales except metapleuron, metameron, and meron; posterior pronotum with approximately 30 bristles, postspiracular with approximately 12, prealar with approximately 27, mesepimeron with approximately 20 upper bristles and 8 anterior and middle bristles combined; anterior pronotum and propleuron with many bristles; postnotum bare. *Legs.* Coxae and trochanters with white scales and several bristles; femora with a basal and apical white band, mid and hind femora with white band at basal third and apical third, dark scales decumbent, white scales erect or decumbent; tibiae

with many erect scales, basal, medial and apical white bands present, apical white band of fore tibia less than 0.25 total length of tibia; fore and mid tarsi unicolorous yellow, tarsomere I with a small basal white band, hind tarsomeres with white bands, tarsomere I with some white scales scattered along its length and 0.8 the combined length of the following tarsomeres, tarsomere II similar to first, tarsomeres III-V white with yellow apices; tarsal claws with one lateral tooth. *Wing*. Squama with fringe of yellow hairs; alula with fringe of narrow scales with dark apices; membranous areas clouded in the regions of the cross veins; veins covered with white, yellow, and dark scales; costa white at base, medial region with yellow and dark scales and the apex usually darker; fringe of wing variably light and dark marked. *Halter*. Stem pale with knob darker and covered with pale scales. *Abdomen*. Terga with lateral, basal tufts of erect white scales and apical fringe of bristles; basal terga darker with white restricted to basal and medial regions; apical segments lighter, segment VII all white; apical segments VIII, IX retracted into segment VII. *Terminalia*. (Figure 8 A) Postgenital plate with apex rounded or slightly truncate; spermathecae 3, 1 larger than the others.

MALE. Similar to female in general habitus, but paler. *Head*. Antenna shorter than proboscis, flagellomeres I-XI shortened, densely hairy; torus and flagellomere I with white scales mesially; palpus longer than proboscis, white scaled at base, segments II, III with brown and yellow scales, segment IV with dark, yellow and white scales intermixed, segment V with a basal white band, segments IV, V with ventral tufts of golden hairs. *Legs*. Fore and mid tarsal claws enlarged, unequal, major claw with 2 lateral teeth and twice the length of the minor claw, which has 1 lateral tooth; hind tarsal claws equal in size to those of female, symmetrical, each with 1 lateral tooth. *Wing*. As in female but much paler and with a reduction in the number of scales. *Abdomen*. Scaling of terga primarily white and yellow with few or no dark scales. *Terminalia*. (Figure 10 A) Basimere moderately broad, basal lobe with 2 strong setae on inner face; filament of claspette narrow; aedeagus simple, not toothed; setose lobes of ninth tergite with 3-5 setae on either side.

PUPA. (Figure 13 A) Entire surface moderately infuscated, generally dark; trumpets moderate in length with pinna not greatly expanded; index 4-4.5. *Cephalothorax*. Hairs 1-12-C single or terminally forked. *Abdomen*. Hair 1-I somewhat stellate, not dendritic, with several basal branches; hairs 1-3-I single, 4-I forked near apex, 5, 6-I single, 7-I terminally forked, 8-11-I single; hair 1-II usually bifid at middle; hair 1-VII terminally forked, 2-4-VII single, 5, 6-VII double, 7-VII single, 8-VII trifid at half, 9-VII 3-4 branched, 10-VII terminally forked, 11-VII single; hair 9-VIII with 15-18 branches. *Paddle*. Paddles spiculate and with infuscated areas; hair 1-P with 2-4 branches.

LARVA. (Figure 16) *Head*. Antenna vaguely spiculate, antennal tuft of 2 hairs at apical fourth; hairs 1, 3-8-C single, 9-C single or double, 10-C double, 11-C single, 12, 13-C double or triple. *Thorax*. Hairs O-P 5-6 branched, 1-3-P single, 4-P 5 branched, 5-7-P single; hair 1-M double, 2, 3-M single, 4-M double, 5-M single; hair 1-T single, 2-T double, 3-T 6 branched, 4-6-T single. *Abdomen*. Hair 2, 4-VIII single; comb patch of over 50 scales, each scale fringed apically and variable in shape; siphon with well developed acus; siphonal tuft at middle, 5-7 branched, branches not plumose; pecten of 12-16 teeth, each tooth usually with 1 lateral tooth, apex moderate in length; saddle incomplete, dorsal apical region with many small spines, longest at apical margin; ventral brush of 30-32 tufts, each tuft of 5-10 branches; anal papillae nearly equal in length, short.

TYPE DATA. Holotype σ , with associated skins, San Ramon Penal Farm, Zamboanga, *Mindanao*, PHILIPPINES, 2-X-1945, J. L. Laffoon and K. L. Knight; paratypes, 1 σ , with associated skins, same data as type; 15 $\sigma\sigma$, 3 ♀♀ , Zamboanga, *Mindanao*, 12-IX-1945, J. L. Laffoon, D. R. Johnson and K. L. Knight; 1 σ , 1 ♀ , with associated skins, Olongapo, (Subic Bay), Zambales,

Luzon, 21-VII-1945, L. E. Rozeboom and E. S. Zolik; 2♀♀, Dulag, *Leyte*, 25-XI-1945, H. R. Roberts. All in the U.S. National Museum.

DISTRIBUTION. This species is restricted to the PHILIPPINES.

Specimens examined: 29♂♂, 11♀♀, 1 larva, 6 larval skins, and 3 pupal skins as follows: Paratypes, 16♂♂, 4♀♀, with 3 pairs of associated skins, as listed above: *Luzon*, Calaccad (?), 13♂♂, 5♀♀, and 2 unassociated larval skins, 1-III-1963; Labo, Bagacay, 1♀, -X-1968, human biting collection; *Leyte*, Dulag, 1 larval skin, 25-XI-1944, H. R. Roberts; *Mindanao*, San Ramon, 1 larva, 2-X-1945, Knight, Rozeboom and Laffoon; Torrey Barracks, 1♀, Ludlow. Knight & Hull (1951: 225) also record *Luzon*, Tarlac, San Miquel.

TAXONOMIC DISCUSSION. The adult habitus is similar to all members of the Group A *Mucidus*, but small characteristics enumerated in the Key to Species will separate them. The adults of *quasiferinus* and this species are very similar and are most difficult to separate. The female terminalia and the distribution offer the best means for separating the two. The larvae are also similar to *quasiferinus*, but the pupae separate easily on the size and shape of the trumpets. The preceding descriptions were based solely on paratypic material.

BIOLOGY. The type series was collected from light traps and reared from larvae collected in grassy flood pools and marshy pools (Knight 1947: 319).

Aedes (MUCIDUS) LANIGER (WIEDEMANN)

(Figures 2, 8 C, 10 B, 14 A, 17)

Culex laniger Wiedemann 1820, Dipt. exot., Sect. I: 9.

Mucidus laniger Wiedemann, Theobald 1901, Mon. Cul. I: 279.

Mucidus mucidus, Banks 1906 (*nec* Karsch) Philipp. J. Sci. I: 983.

Mucidus mucidus, Leicester 1908 (*nec* Karsch) Stud. Inst. med. Res. F. M. S. 3(3): 69.

Mucidus mucidus, Brunetti 1912 (*nec* Karsch) Rec. Indian Mus. 4(10): 440.

Mucidus laniger (Wiedemann), Edwards 1913, Bull. ent. Res. IV: 224;

Barraud 1929, Indian J. med. Res. 16: 1053.

Mucidus laniger Wiedemann, Brug & Edwards 1931, Tijdschr. Ent. 74: 257.

Aedes (Mucidus) laniger (Wiedemann), Barraud 1934, Faun. Brit. Ind. Dipt.

V: 147 (*in part*); Bohart 1945, U.S. Navmed, 580: 51 (*in part* ?);

Knight 1947, J. Wash. Acad. Sci. 37: 320 (♂, ♀)(*in part*); Knight &

Hull 1951, Pacif. Sci. 5: 225; Bonne-Wepster 1954, Roy. trop. Inst.

Amst. Spec. Pub. 106: 59; Mattingly 1961, Culic. Mosq. Indoma-

layan Area V: 31 (♂*, ♀*).

FEMALE. (Figure 2) *Head*. Antenna light brown, darker apically, flagellomere I with a few white scales mesally; torus with scattered white scales on mesal half; clypeus bare; palpus light brown, clothed with erect and semi-erect scales, scales of segment II primarily dark tipped with a few white scales randomly placed, segment III similar to II, segment IV mostly white, 0.5 length of II, mainly white scaled but with several dark scales intermixed; proboscis light brown with 4-6 basal bristles, scales of basal half erect and decumbent, dark yellow or brown tipped, apical half with decumbent dark yellow scales with a white ring before labellum; labellum dark; vertex clothed with narrow erect scales which are vaguely forked at apex, a few decumbent hair-like scales beneath, medial area white as in *ferinus*, sides with decumbent white scales; orbital line with moderate decumbent white scales; orbital bristles very pale. *Thorax*. Scales and bristles of scutum, scutellum and pleura similar to *ferinus*. *Legs*. Coxae and trochanters with white scales and rows of bristles; femora with basal and apical white bands, mid and hind femora with white bands at basal third (vague) and apical third, scales both

erect and decumbent, fore femur with a broad but interrupted medial pale band; apical band of fore tibia about 0.33 the length of the tibia, scales of tibia mainly erect; tarsi mainly yellow, fore and mid tarsi unicolorous except for a small basal white band on tarsomere I, and some dark scales on mid tarsomere I, tarsomere I of hind tarsus with a small basal white band and with many erect, dark scales, tarsomere II all yellow brown or infrequently with a narrow (.08 length of tarsomere) basal white band, tarsomeres III-V white with apices yellow and scales decumbent; each tarsal claw with 1 lateral tooth. *Wing*. Squama with fringe of yellow hairs; alula with fringe of long scales with dark tips; vein scales generally darker than *ferinus*, *quasiferinus*, and *scatophagoides*, similar to *nigerrimus*, costa with yellow and dark scales on basal 0.66 and subapical area yellow scaled, apex usually with a dark scale patch; fringe with pale and dark scales. *Halter*. As in *ferinus*. *Abdomen*. Terga mainly dark scaled, terga II-IV with many more dark scales than light, white scales confined to a basal, lateral patch and a medial patch, terga V-VII with more white scales, dark laterally. *Terminalia*. (Figure 8 C) Postgenital plate with apex slightly to moderately emarginate; spermathecae as in *ferinus*.

MALE. Similar to female in general habitus but much paler. *Head*. Antenna shorter than proboscis, flagellomeres I-XI shortened with large dorso-ventral projecting tufts of hairs, flagellomeres XII, XIII elongate, without large tufts; torus and basal flagellomere with mesal patches of white scales; palpus longer than proboscis, basal segments with dark and light scales, segments II, III yellow with scattered dark scales and a few white scales present, segments IV, V and apical third of III with ventral tufts of pale hairs, IV, V with basal white bands, scales of segments mainly decumbent except segment V where they are erect. *Legs*. Fore and mid tarsal claws unequal, hind claws equal, as described for *ferinus*. *Wing*. Very pale, white scales few, most scales small and pale; fringe hairs mainly pale; scales of alula small, short and pale. *Abdomen*. Scaling of targa mainly white with darker scales laterally, terminal segments all white. *Terminalia*. (Figure 10 B) As described for *ferinus* and typical for the Group A Mucidus.

PUPA. (Figure 14 A) Entire surface infuscated, trumpets slightly elongate, index over 4 but variable, paddles infuscated and showing areas which are clear, or sometimes entirely clear or intergrading between the two. *Cephalothorax*. Hair 1, 2-C single, 3-C 1-3 branched or forked at apical third, 4, 5-C forked or single, 6-C forked, 7-12-C single. *Abdomen*. Hair 1-I multibranched, dendritic with 2-4 basal branches, hair 2, 3-I single, 4-I variable, single, double or forked, 5, 6-I single or forked, 7-I single or bifid, 9-11-I single; hair 1-II single; hairs 1-4-VII single, 5-6-VII double or triple, 7-VII single, 8-VII bifid or trifid, 9-VII 3 or 4 branched, 10, 11-VII single; hair 4-VIII single, 9-VIII with 14-17 branches with little or no secondary branching. *Paddle*. Surface spiculate; hair 1-P double or triple.

LARVA. (Figure 17) *Head*. Antenna with acute spicules irregularly placed over entire surface, antennal tuft of 2 hairs at apical 0.25; hairs 1, 3-8-C single, 9, 10-C single or double, 11-C single, 12, 13-C double; mandibles trifid, basal tooth with 4 secondary teeth, apical tooth entire, acute. *Thorax*. Hair 0-P with 3-5 branches, 1-3-P single, 4-P with 4 branches, 5-9-P single, 14-P double or triple; hair 1-3-M single, 4-M double, 5-7-M single, 14-M 5-7 branched; hair 1-T single, 2-T double, 3-T 3 or 4 branched, 6-T single. *Abdomen*. Hair 1, 2-I single, 3-I double, 4-I with 6 branches, 5, 9-I single, 10-I double, 11-I single, 12-I double, 13-I single; hairs 2, 4-VIII single, comb scales in patch of over 60, sometimes over 80; siphon with a well developed acus; siphonal tuft just before middle and of 4-5 non-plumose branches; pecten of 20-22 teeth, apical tooth not attaining siphonal tuft, each tooth usually with only 1 basal, lateral tooth; hair 2, 6, 7-S single, 8-S double, 9-S single; saddle incomplete, apical edge with numerous spines, surface with minute scallopings; ventral tufts of anal segment 30-36, each with 8-12 branches; anal papillae short, ventral pair slightly longer than dorsal pair.

TYPE DATA. Holotype ♀ Batavia, *Java*, INDONESIA, -1815 Westermann, (Universitetets Zoologiske Museum, Copenhagen).

DISTRIBUTION. Specimens examined, 9♂♂, 16♀♀, 12 larvae, 17 larval skins, and 17 pupal skins as follows: THAILAND, *Songkhla*, Hoodyai, 2 km. south Ton Nga Falls, 3♂♂, 3♀♀ with associated skins, 12 larvae, 26-III-1965. PHILIPPINES, *Palawan*, Panakan, 3♂♂, 6♀♀, with associated skins, 4 unassociated skins, 29-XI-1967; *Luzon*, Dagupan, 1♀, -II-1945. WEST MALAYSIA, Kuala Lumpur, 1♂, 1♀, 1912, G. F. Leicester; Segambut, 1♀, 12-III-1955; *Selangor*, 1♀, 4-II-1948. SINGAPORE, Coronation Road, 1♀, 5-V-1921. INDONESIA, *Sumatra*, Djambi, 1♂, 1♀, -II-1923, DeRook; Deli, 1♀, -1914, A. J. Stanton; Poelau Radjo, 1♂, -I-1932. Parrish (1968: 4) records *laniger* at light, SOUTH VIETNAM, Pleiku.

TAXONOMIC DISCUSSION. In the past there was some doubt as to the exact determination of *laniger* (Knight 1947: 320, Knight & Hull 1951: 225). Mattingly (1961: 26) has examined Wiedemann's type and found the material originally assigned to this species by Knight as being correct.

This form is related to the Ethiopian forms in the presence of a large, apical pale band on the fore tibia. It differs from others in Group A *Mucidus* in the usually all brown second hind tarsomere. However, several specimens from the Philippines have a basal white band of one scale in thickness - approximately 0.08 the length of the tarsomere - on this segment. The previously unknown immatures are extremely variable. The larvae normally have more than 17 pecten teeth but a few individuals have less. The pecten teeth are unique in having that portion apical of the lateral tooth elongate, a character *laniger* shares with *scatophagoides*. The larvae differ from *scatophagoides* in the fewer branches of the siphonal tuft, and from *ferinus* and *quasiferinus* by the elongate apex of the pecten teeth. The pupae differ from *ferinus* in having hair 1-I dendritic whereas in *ferinus* it is stellate, and from *scatophagoides* in the lack of noticeable secondary branching in hair 9-VIII.

BIOLOGY. Material from the Philippines was collected in a stagnant ditch with some emergent vegetation. The material from Thailand was collected in a turbid flood pool that was lightly shaded and with marginal grass and rotten leaves. From this same pool were collected *Anopheles balabacensis*, *pollicaris*, *Aedes imprimens*, and *alboscuteclatus*.

Aedes (MUCIDUS) QUASIFERINUS MATTINGLY

(Figures 6, 7, 8 B, 11 A, 13 B, 18)

?*Culex laniger* Thwaites 1859, in Tennent's Ceylon, I: 268.

Mucidus laniger Wiedemann, Edwards 1922, Indian J. med. Res. 10:462 (*in part*); Brug & Edwards 1931, Tijdschr. Ent. 74: 257 (*in part?*).

Aedes (Mucidus) laniger (Wiedemann), Barraud 1934, Faun. Brit. Ind. Dipt. 5: 147 (♂*, ♀*); Carter 1950, Ceylon J. Sci., B 24:101.

Aedes (Mucidus) quasiferinus Mattingly 1961, Culic. Mosq. Indomalayan Area V: 32 (♂*, ♀*, P*, L*).

Aedes (Mucidus) ferinus, Thurman 1963 (*nec* Knight) 9th Pacif. Sci. Congr. Proc. 9: 55.

FEMALE. (Figure 6) *Head*. Antenna dark brown, flagellomere I with a narrow row of white scales on mesal margin; torus with an apical patch of white scales on mesal half; clypeus as in *ferinus*; palpus brown, clothed with erect and semi-erect scales, basal segments dark scaled with some white scales intermixed, apical segments lighter with the distal segment all white; proboscis with 6 basal bristles, scales erect and semi-erect on basal half, decumbent on apical half, base dark scaled blending to white at middle and then to yellow on the apical sixth, apex with a narrow white ring before labellum; labellum moderately dark; vertex clothed with narrow erect scales which are

vaguely forked at apex and a few narrow decumbent white scales beneath these, medial area white but sides also pale, erect scales white or yellow brown; sides with decumbent white scales; orbital bristles pale. *Thorax*. Erect scales of upper sternopleuron and anterior mesepimeron very narrow and long, nearly as long as the tufts on scutum; other scales and bristles of scutum, scutellum and pleura similar to *ferinus*. *Legs*. Coxae and trochanters with white patches and rows of bristles; scales both erect and decumbent; femora with basal and apical white bands and small white bands at basal and apical third, those of fore femur somewhat blended by white scales in between; tibia with basal and apical white bands, hind tibia with a median white band, mid tibia with a vague median band or reduced to a few white scales, fore tibia with median white band either present and large, reduced to a few white scales, or infrequently absent, usually with an interrupted band; tarsi yellowish, fore and mid tarsi with a basal white band on tarsomere I, hind tarsomeres yellow brown with white bands, hind tarsomere I equal to or slightly shorter than following tarsomeres combined, with a short basal white band, hind tarsomere II similar to first but less than half its length, hind tarsomeres III-V white with some yellow at apices and all scales decumbent; tarsal claws equal with one tooth. *Wing*. Squama with fringe of yellow hairs; alula with long, thin scales along margin, mainly pale, not dark tipped; vein scales white, yellow, and brown; costa yellowish, especially near apex, apex without a very dark spot at tip but with a moderate to pale brown spot; fringe variable, marked with pale and dark. *Halter*. Halter with pale scales over entire surface. *Abdomen*. Terga II and III yellow scaled with patches of white along basal margin, apical terga more white, yellow confined to lateral, apical margin, segment VII all white. *Terminalia*. (Figure 8 B) Postgenital plate slightly to moderately emarginate at tip; spermathecae similar to others in Group A Mucidus, but of 3 distinct sizes.

MALE. (Figure 7) Similar to general habitus of female but paler. *Head*. Antenna shorter than proboscis, basal 11 joints shortened with dense tufts of hair projecting dorso-ventrally, flagellomeres XII, XIII elongate without tufts; torus and basal flagellomere with white scales on mesal side; palpus longer than proboscis, basal segments light, segment I and base of segment II mostly white, remainder of segment II yellow with some scales dark tipped, segment III with a basal and apical white band, segment IV white, V white at base and apex with some dark scales in between; proboscis dark at base with or without a median white band, yellowish overall with a white ring at apex. *Legs*. Fore and mid tarsal claws unequal, hind claws as in female, typical of group. *Wing*. Wing pale but darker than male *laniger*; fringe hairs with some dark markings; scales of alula very small and all pale. *Abdomen*. Scaling of terga white and yellow, all terga with some yellow scales laterally except terminal segment which is all white. *Terminalia*. (Figure 11 A) Similar to *ferinus* and *laniger* but averaging a larger number of setae on the apex of the ninth tergite.

PUPA. (Figure 13 B) Entire surface deeply infuscated; trumpets moderate to very broad with index 3-3.75. *Cephalothorax*. Hairs 1-4-C single, 5-C bifid, 6-12-C single. *Abdomen*. Hair 1-I multibranching, dendritic, 2, 3-I single, 4-I trifid, 5, 6-I single, 7-I trifid, 9-I single; hair 1-II single or bifid at middle; hairs 1-4-VII single, 5-VII double, 6-VII small, bifid or trifid, 7, 8-VII single, 9-VII 3-5 branched, 10, 11-VII single; hair 4-VIII single, 9-VIII with 13-16 branches and some secondary branching. *Paddle*. 1-P bifid; entire surface spiculate, infuscation absent in some areas producing a bicolored appearance.

LARVA. (Figure 18) Specimens examined had the thorax and parts of the abdomen partially destroyed but have been reconstructed in the illustration. *Head*. Antenna sparsely spiculate, antennal tuft of 2 hairs at apical 0.25; hairs 1, 3-8-C single, 9-C single, 10-C bifid, 11-C single, 12, 13-C bifid; mentum with 6-7 lateral teeth. *Abdomen*. Hairs 2, 4-VIII single; comb

patch of over 50 scales, each scale narrow and fringed; siphon with acus well developed; siphonal tuft just before middle, of 4-6 hairs; pecten not reaching tuft, of 9-15 teeth each moderate in length with 1 basal, lateral tooth, distal tooth usually entire; saddle incomplete, apical edge similar to *ferinus* and *laniger*; ventral brush of 27-30 hair tufts, each with 6-9 branches; anal papillae short, ventral pair slightly longer than the dorsal pair.

TYPE DATA. Holotype ♀ with associated skins, Sungei Besi, Kuala Lumpur Area, *Selangor*, WEST MALAYSIA, -II-1955, W. W. Macdonald; paratypes, 1♀, Airport, Kuala Lumpur, *Selangor*, 3-II-1955, W. W. Macdonald; 1♂, Kampong Sireh, *Selangor*, 7-IV-1953; 1♀, SINGAPORE; 1♀, Dermajoe, Benkoelen, *Sumatra*, INDONESIA, 9-XII-1929, Brug and DeRook; 2♀♀, Karta Agoeng, *Sumatra*, -1925, Rodenwaldt; 1♂, ASSAM, Christophers; 1♂, Frae, THAILAND, 5-II-1928, A. Mackie; 1♀, Trincomalee, CEYLON, -1915, C. F. S. Baker. All in the British Museum.

DISTRIBUTION. Specimens examined: I have examined all but one of the paratypes plus 9♂♂, 12♀♀, 1 larval skin, and 15 pupal skins as follows: THAILAND, *Lampoon*, Lampoon, 1♀, -1952; *Chiang Mai*, Muang, 1♂, -1964; *Chiang Mai*, Heuy Chang Kien, 1♀, -1962; Ban Muang Kao, 7♂♂, 9♀♀, with 2 associated larval skins and 15 associated pupal skins; 14-VII-1966; Banshiyok, 1♂, -1965. WEST MALAYSIA, *Selangor*, Jinjang, 1♂, 12-VIII-1956, H. C. Barnett.

TAXONOMIC DISCUSSION. The adults of this species and *ferinus* are very similar. The geographic distribution and the shape of the postgenital plate of the females are the best methods for separation. The pupae are similar to *alternans* and *ferinus* but differ as follows: from *ferinus* by the much stouter and shorter trumpets, and from *alternans* in having more branches, 12-15 in hair 9-VIII (6-9 in *alternans*) and in hair 1-IV-VI (double in *alternans*, single in *quasiferinus*). Because of the variation found in the characters that have been employed in the past to separate *ferinus* and *quasiferinus* larvae, I suggest the use of distribution. I have examined the skins of 3 paratypes of *ferinus* and the stem of the hair tufts of the ventral brush and the comb scales do not show distinct differences (Mattingly 1961: 25).

BIOLOGY. The holotype was reared from larvae collected from a stagnant earth drain. Material from Thailand was collected from a partially shaded flood pool which was stagnant and contained floating dead leaves. In the same pool were collected the larvae of *Anopheles maculatus*, *Aedes albo-scutellatus*, *mediolineatus*, *caecus*, *culicinus*, and *Culex annulus*.

Aedes (MUCIDUS) SCATOPHAGOIDES (THEOBALD)

(Figures 3, 9 C, 11 B, 14 B, 19)

Culex laniger, Macquart 1839 (*nec* Wiedemann), Mem. Soc. Sci. Lille 1(2): 292.

Mucidus scatophagoides Theobald 1901b, Mon. Cul. I: 277 (♀*); Giles 1902, Handbook 2nd. ed., p. 348 (♀); Christophers 1906, Sci. Mem. Med. San. Depts. India 25 (n. s.): 13; Barraud 1929, Indian J. med. Res. 16:1053.

Mucidus scatophagoides Theobald, Edwards 1911, Bull. ent. Res. 2: 246 (emend.); Brunetti 1912, Rec. Indian Mus. 4(10): 440; Edwards 1922, Indian J. med. Res. 10: 450.

Aedes (Mucidus) scatophagoides (Theobald), Edwards 1932, Gen. Insect., Fas. 194: 133; Barraud 1934, Faun. Brit. Ind. Dipt. 5: 138 (♂*, ♀, L*); Knight 1947 (*in part*), J. Wash. Acad. Sci. 37: 319 (♂*, ♀); Mattingly 1961 (*in part*), Culic. Mosq. Indomalayan Area, V: 18.

FEMALE. (Figure 3) *Head.* Antenna light to dark brown, flagellomere I with a moderate patch of white scales on mesal margin; torus with white scales on mesal half; clypeus bare, typical for the group; palpus brown 0.66 length of proboscis, segment I small and dark, segment II with erect white and yellow scales, the yellow scales with dark tips, segment III mostly white scaled with scales at base decumbent, segment IV all white scaled; proboscis with 6 basal bristles, scales mainly decumbent but with some erect and semi-erect scales on basal half, scales dark and white at base, white at middle, and yellow with some dark tipped scales at apex, no white ring at apex; labellum light to dark brown; vertex clothed with erect and decumbent scales, erect scales white and dark, narrow, few forked, with some narrow decumbent white scales beneath; orbital bristles pale; orbital line with decumbent white scales. *Thorax.* Scales and bristles of scutum, scutellum and pleura typical for Group A Mucidus. *Legs.* Coxae and trochanters with white scale patches and rows of bristles; femora with basal and apical white bands, mid and hind femora with white bands at basal and apical third, band at basal third sometimes absent, fore femur with many white scales, basal white band sometimes enlarged covering 0.33 of femur, scales of femur small and decumbent on basal 0.5, larger and with some erect scales near apex; tibia with basal, medial, and apical white bands, scales erect, semi-erect and decumbent, darker scales very dark brown; tarsi with most segments with white bands, hind tarsomere I variable, as long as, or slightly shorter, than following segments combined, with basal and medial white bands, tarsomeres II, III with basal white bands, all scales decumbent with some semi-erect dark tipped scales on hind tarsomere I; fourth and fifth tarsomeres of fore and mid tarsi with or without white bands; tarsal claws equal with 1 tooth. *Wing.* Squama with fringe hairs pale; alula with fringe of long, thin, pale scales, not dark tipped; vein scales yellow, white and brown; costa and R₁ usually entirely yellow on apical third; fringe with distinct dark and white bands of variable size. *Halter.* Halter pale with light scales noticeable at apex. *Abdomen.* Basal terga with yellow and dark tipped yellow scales in predominance, white scales confined to lateral tufts and a median patch or stripe, segments VI and VII mostly all white with some lateral yellow scales. *Terminalia.* (Figure 9 C) Postgenital plate slightly emarginate at middle of apex; cerci with thin setae over entire surface.

MALE. Similar to female in general habitus but slightly paler. *Head.* Antenna shorter than the proboscis with basal 11 flagellomeres shortened and clothed with tufts of long, dorso-ventrally projecting hairs, hairs near base 0.5 as long as the antenna, flagellomeres XII and XIII elongate without tufts, basal flagellomere with white scales mesally; torus bare; palpi longer than proboscis by 0.2, segment I and 0.5 of segment II predominantly white scaled, apical region of segment II with yellow and dark tipped yellow scales, segment III 0.5 white, dark portion with many long, ventrally projecting hairs, segment IV white at base and apex with numerous long hairs, segment V with yellow and white scales and shorter hairs beneath; proboscis mainly yellow scaled with a few white scales on basal half and a median narrow white band. *Legs.* Fore and mid tarsal claws unequal, major claw 0.66 length of fifth tarsomere with 2 blunt teeth, minor claw 0.5 length of major claw and with 1 tooth, hind claws as in female. *Wing.* Costa and R₁ mostly yellow scaled, scales much smaller and fewer than in female. *Abdomen.* Scales reduced in number but pattern similar to female, erect scales expanded at apex and truncate. *Terminalia.* (Figure 11 B) This species is distinct in having a raised carina on the aedeagus that is prolonged apically in the form of a tooth, large setae on basal lobes of basimeres with an odd structure embracing the base of the seta, structure acute on one side, rounded over the rest of the surface, otherwise similar to the typical form.

PUPA. (Figure 14 B) Surface only slightly infuscated, trumpets short and stout with an average index of 4. *Cephalothorax.* Hair 1-3-C single,

4-6-C single, bifid or trifid, 7-12-C single. *Abdomen*. Hair 1-I multibranch-
ed, somewhat stellate, 2, 3-I single, 4-I trifid, 5-I bifid or trifid, 6-I single,
7-I bifid, 9-I single or forked; hair 1-II short, bifid near base; hair 1-4-VII
single, 5-VII with 2-5 branches, 6-VII multibranch-
ed and very small, 7-VII
single, 8-VII 4-6 branched, 9-VII with 4 branches, branches may show second-
ary branching, 10, 11-VII single; hair 4-VIII single, 9-VIII with 9-16 branches,
many with up to 4 secondary filaments. *Paddle*. Surface spiculate, without
dark infuscated areas; hair 1-P single or double or infrequently with small
secondary filaments.

LARVA. (Figure 19) *Head*. Antenna spiculate, antennal tuft of 2
or 3 hairs at distal fourth; hair 1, 3-8-C single, 9-C 2-4 branched, 10-C dou-
ble, 11-C single, 12, 13-C with 3-4 branches; mentum as in *quasiferinus*.
Thorax. Hair 0-P with 3-4 branches, 1-3-P single, 4-P with 4 branches,
5-7-P single, 7-P double, 9-P single, 14-P single or double; hair 1-3-M sin-
gle, 4-M double, 5-7-M single, 14-M with 12-13 branches; hair 1-T single,
2-T double or triple, 3-T with 4 branches, 5, 6-T single. *Abdomen*. Hair 1-I
single, 3-I double, 4-I with 5-6 branches, 5-I single, 10-I double, 11-I single,
12-I double, 13-I single; hair 1-II short, bifid; hair 1-VII bifid, 2, 3-VII sin-
gle, 4, 5-VII single or bifid, 6-VII with 4 branches, 7-VII single, 8-VII 5
branched, 9-12-VII single, 13-VII with 5 branches; hairs 2, 4-VIII single;
comb scales over 50, fringed apically; siphon with a well developed acus, si-
phonal tuft just before middle with 9-15 branches, pecten of 20-30 teeth, each
with 1, rarely 2, lateral teeth, distal tooth displaced from pecten but not
reaching siphonal tuft, hairs of siphon as in *quasiferinus*; ventral brush of 25-
28 tufts, each with 7-11 branches; anal papillae short, nearly equal in length.

TYPE DATA. Lectotype ♀ (Selected by P. F. Mattingly), Gajraula,
29 m. w. Moradabad, N. W. Provinces, INDIA, -X-1900, Giles; cotype ♀ (so
labelled), Myingyan, *Mandalay*, BURMA. Both in the British Museum.

DISTRIBUTION. Specimens examined: 2♂♂, 19♀♀, 2 larvae, 7
larval skins, and 5 pupal skins as follows: SOUTH VIETNAM**, Dong Ba
Thin, 1♀ with associated skins, 3-VIII-1966, Frolic; Hoa Da, 1♀ with associ-
ated skins, 3-VIII-1966, Haws; Nah Trang, 1 larva and 1 larval skin, 9-XI-
1966, Nourse. INDIA, Delhi, 1♀ with associated skins, 10-X-1927, R. S.
White; *Punjab*, Karmal, 1 larva, 3 larval skins, and 2 pupal skins, -VII-1930,
P. J. Barraud; *Punjab*, Pathankote, Railway Car Ridge, 1♀, 6-IX-1906, C.
Barrows; *N. Canara*, Karwar, 1♂, 3♀♀, H. Cogill; India, 1♀, Christophers;
n. w. India, 1♀; Amritsar, 1♂, 2♀♀; *Bengal*, Calcutta, 2♀♀, 4-VIII-1944, D. E.
Hardy. WEST PAKISTAN, *Lahore*, Kahna Kacha, 5♀♀, 24-VIII-1962, D. H.
Gould; same data, 1♀, 6-IX-1962; same data, 1♀, 14-IX-1962; same data, 1♀,
4-VIII-1962. Knight (1947: 320) includes CHINA, Hongkong. Mattingly (1961:
18) includes BURMA and CEYLON.

TAXONOMIC DISCUSSION. The adults of this species resemble in
general habitus the other members of the *Mucoidus* Group. They differ, how-
ever, in having a medial white band on the first tarsomere. This character
is shared with *alternans* from the Australasian Region and *sudanensis* from
Africa, but they can easily be separated. The apical white band of the femora
is subapical in *alternans* and apical in *scatophagoides* and *sudanensis*. The
latter can be separated on the presence of white scales on the proboscis
(*scatophagoides*) or the proboscis entirely yellow scaled (*sudanensis*). The
males of *scatophagoides* and *sudanensis* apparently differ from all other
Mucoidus in having the torus without scales. Both males examined has seg-
ments IV and V of the palpus contorted and laterally or dorso-ventrally flat-
tened. I doubt that this is a natural condition and probably resulted from kil-
ling freshly emerged individuals. Knight (1947: 319) noted a difference between

** New record.

the Oriental and Ethiopian specimens. Examination of additional material by Tyson (1970) has confirmed his opinion that Theobald's *sudanensis*, synonymized by Edwards (1911: 246) is distinct. Macquart mentioned *Culex laniger* Wiedemann in his 1839 work. He stated it was probably different from the true *laniger* and that it had bands on all tarsal segments. Because of the leg banding it is almost certain that he was referring to the then undescribed *scatophagoides*.

The larvae differ from other Oriental *Mucidus* by the elongate apex of the pecten teeth and the number of branches of the siphonal tuft. Hopkins (1951: 121) illustrated a larva which may not have been a fourth instar. It had 21 comb scales and in his description states the norm to be 30-40. I have not seen mature larvae with less than 48 comb scales. The pupae differ in the amount of secondary branching on hair 9-VIII, and with hairs 1, 3-III-VI long and single.

BIOLOGY. Barraud (1934: 146) lists open natural pools as breeding sites. Material from Vietnam was reared from larvae collected in a ditch, a rice paddy, and a swamp.

GROUP B PARDOMYIA

Aedes (Mucidus) aurantius aurantius (THEOBALD)

(Figures 6, 7, 9 A, 12 A, 15 B, 20)

- Pardomyia aurantia* Theobald 1907, Mon. Cul. 4: 280 (♀); Edwards & Given 1928, Bull. ent. Res. 18: 341 (P*, L*).
- Ekrinomyia aureostriata* Leicester 1908, Stud. Inst. med. Res. F.M.S. 3(3): 71 (♂, ♀); Brunetti 1912, Rec. Indian Mus. 4(10): 440.
- Mucidus (Pardomyia) aurantius* (Theobald), Brug & Edwards 1931, Tijdschr. Ent. 74: 257.
- Aedes (Mucidus) aurantius* (Theobald), Lee 1944, Atlas Mosq. Larvae Australasian Region, p. 51 (L*); Brug & Bonne-Wepster 1947, Chronica Naturae 103: 184; Macdonald 1957, Stud. Inst. med. Res. F.M.S. 28: 17; Mattingly 1961, Culic. Mosq. Indomalayan Area V: 33 (♂*, ♀*, P*, L); Assem & Bonne-Wepster 1964, Zool. Bijdr. 6:78 (♀, L).
- Aedes (Mucidus) aurantius aurantius* (Theobald), Knight, Bohart & Bohart 1944, Natl. Res. Council, Div. med. Sci., p. 33; Knight 1947, J. Wash. Acad. Sci. 37: 323 (♂, ♀, L).

FEMALE. (Figure 6) *Head.* Antenna light at base becoming dark brown apically, nearly as long as proboscis; torus with thin setiform gold scales on mesal half; clypeus light brown or yellow, bare; palpus short, approximately 0.25 the length of the proboscis, segment I short, mainly yellow scaled but with a few dark scales randomly placed, segment II with many erect hairs on dorsal surface, yellow scaled or with a few randomly placed dark scales, segment III elongate, longer than preceding segments combined, yellow scaled or yellow with apex black, segment IV short, bulbous, usually dark scaled; proboscis slender, yellow scaled with scales decumbent, semi-decumbent on ventral basal half, dark scales at ventral, lateral base, a ring at apex, and a few sometimes scattered along dorsum; labellum dark; vertex clothed with erect and decumbent scales, erect scales yellow, slightly forked at apex, decumbent scales beneath these, narrow and bright shining yellow; orbital line with bright yellow scales not separated from decumbent scales of vertex; orbital bristles pale. *Thorax.* Integument dark brown; scutum clothed with erect bristles and thin, decumbent scales, anterior region with a transverse band of bright yellow scales which also includes the anterior and posterior pronotum laterally, rest of scutal scales dark coppery brown with a few

scattered yellow scales on basal half (prescutellar, etc.); scutellum yellow scaled; postnotum bare; pleura dark with small patches of decumbent yellow scales, bristles similar to *Mucidus* Group but anterior and medial mesepimerals reduced to 1-5. *Legs.* Coxae and trochanters with rows of bristles and yellow scale patches; femora with basal and apical yellow bands, scales all decumbent, color variable but usually mottled with small yellow and dark bands; tibia with a small basal yellow band and an apical dark band, scales mainly decumbent but hind tibia with some semi-erect dark scales; tarsi variable, fore tarsi mottled, light beneath, darker dorsally, mid tarsi with tarsomere I all yellow or mottled yellow and dark, apical segments of fore and mid tarsi with vague basal yellow bands, hind tarsi dark, segments I-III with basal yellow bands, segment IV with or without a basal yellow-white band, segment V all white; fore and mid tarsal claws equal, each with 1 tooth, hind claws equal, simple. *Wing.* Scaling of wings much reduced as compared to *Mucidus* Group, scales small, yellow and dark, scales of costa and R_1 much larger than scales on other veins; fringe not banded, dark; squama with fringe of dark hairs, alula with thin, dark scales at margin. *Halter.* Halter frosted, whitish at base, dark at apex with thin dark scales. *Abdomen.* Variable; tergum I dark scaled, terga II, III dark scaled with yellow scales at base and 2 yellow spots at middle on each side of the median line, these spots may be joined on tergum III, terga IV-VII yellow scaled with scattered dark scales usually laterally. *Terminalia.* (Figure 9 A) Typical for this group; postgenital plate deeply emarginate; spermathecae 3, 1 larger than the remaining 2.

MALE. (Figure 7) Similar to female in general habitus. *Head.* Antenna shorter than proboscis, flagellomeres I-XI shortened with long tufts of hair that project mainly dorsally and ventrally, flagellomeres XII, XIII elongate, over 0.5 the length of preceding ones combined, without large tufts of hairs; palpus slightly longer than proboscis, segment I short, yellow or yellow with apex dark, segment II yellow or yellow with base dark, segment III yellow at middle, segments IV, V yellow at base, apex of segment III, segment IV and base of segment V with ventral tufts of long hairs; proboscis as in female. *Legs.* Tarsal claws of fore and mid tarsi unequal, both major and minor claws with 1 tooth, hind tarsal claws equal, entire. *Wing.* Scale fringe of alula pale, otherwise as in female. *Terminalia.* (Figure 12 A) Typical for the subgenus but with the basistyle more slender (common to *Pardomyia*); accessory lobe of the stem of the claspette small with a stout hair at its apex.

PUPA. (Figure 15 B) Trumpets long and narrow, pinna wider, base tracheoid for 0.33 the total length of the trumpet; index 6-10, averaging 8. *Cephalothorax.* Hairs 1-12-C multibranched, variable. *Abdomen.* Hair 1-I with many plumose branches, 2-I single, 3-7-I multibranched, variable; hair 1-II single, long; hairs 1, 2-VII single, 3-VII with 3 branches, 4-VII double, bifid, or trifid, 5-VII with 3-5 branches, 6-VII with 4-5 branches, 7-VII single, 8-VII trifid, 9-VII with 4 branches, 10-VII single or bifid, 11-VII multiple at apex; 4-VIII 1-3 branched, 9-VIII with 8-11 plumose branches. *Paddle.* Margin densely spiculate; 1-P single.

LARVA. (Figure 20) *Head.* Antenna sparsely spiculate, antennal tuft at apical fifth of 3-5 hairs; hairs 1, 3-8-C single, 9-C double, 10-C triple, 11-C bifid, 12-C triple, 13-C with 4 branches, 14, 15-C divided. *Thorax.* Hair 0-P multibranched, 1-P single, 2-P double, 3-P with 2-4 branches, 4-P with 2-3 branches, 5-7-P single, 8-P with 9 branches; hair 2-M double, 3-M double, 4-M with 3 branches, 5-7-M single, 8-M multibranched, 4-T small, multibranched, 5-T single, 7-T multibranched, 8-T multiple, 9-T multibranched, 10-12-T single. *Abdomen.* Hair 1, 2-I single, 3-I triple, 4-I multibranched, 5-I small, multibranched, 6-I single, 7-I with 7-8 branches, 9-I bifid, 10-I triple, 11-I small, multibranched, 12-I single; hair 1-VII with 2 branches, 2-VII single, 3-VII double or triple, 4-VII single, 5-VII single, 6-VII multibranched, 7-VII single, 8, 9-VII multiple, 10-VII 3-5 branched, 11-VII single, 12-VII with 2-4 branches, 13-VII with 3-5 branches; hair 2-VIII with 2-3 branches, 4-VIII single; comb teeth small, fringed, 60-82 in number;

siphon with acus well developed, siphonal tuft beyond middle, of 9-11 plumose branches, pecten of 20 or more teeth, each with 1 or 2 lateral teeth, apical tooth usually entire and displaced from the pecten, surpassing the siphonal tuft; saddle incomplete, hair 1-X at middle near apex of segment, ventral brush of 22-25 tufts, each of 6-11 branches; anal papillae short, ventral pair slightly longer than dorsal pair.

TYPE DATA. Holotype ♀, Kuching, *Sarawak*, EAST MALAYSIA, -XI-190-, Barker. Types of *aureostriata* as follows: lectotype ♀ and allotype ♂, Fort Road, Klang, WEST MALAYSIA, 7-I-1904, Leicester, from pupae in a mud hole. All in the British Museum.

DISTRIBUTION. Specimens examined: 10♂♂, 17♀♀, 9 larval skins, and 9 pupal skins as follows, types, 2♂♂, 1♀ paratypes, 1♀ cotype (*aureostriata*), and 8 unassociated larval and pupal skins, WEST MALAYSIA, *Selangor*, Kuala Lumpur, -1912, Leicester; *Selangor*, Rantau Panjang, 1♂, 1♀, 19-II-1954, W.W. Macdonald; same data, 2♂♂, 3-VII-1952; same data, 2♂♂, 13-II-1957; same data, 1♀, 25-II-1952; same data, 1♂, -VII-1956; same data, 2♀♀, 9-IV-1952; same data, 1♀, 4-III-1953. SINGAPORE, 1 larval skin, 1 pupal skin, D. Given. EAST MALAYSIA, *Sabah*, Darat, Berbulah, 1♀, 14-VII-1965; *Sabah*, Membakut, 1♀, -1913, Roper; *Sabah*, Kuala Abai, 2♀♀, 7-IX-1965; *Sarawak*, Kuching, 1♀, Moulton. INDONESIA, *Celebes*, Polewali, 1♀, 1-III-1926, Kaiser; *Celebes*, Kalawara, 1♀, 8-II-1937, J. Brug; *West Irian*, Hollandia, 2♂♂, 2♀♀, 12-VII-1944, E.S. Ross. KIRIWINA ISLAND, 1♀. Brug & Edwards (1931: 257) includes INDONESIA, *Doerian*. Mattingly (1961: 36) includes INDONESIA, *Sumatra*.

TAXONOMIC DISCUSSION. The adult habitus is similar to that of *painei* (Figure 7) from the Solomon Islands. The males are nearly inseparable but the females differ in the scale pattern on the terga of the abdomen. Also similar is *quadripunctis* but differs in the coloration of the integument and the scales of the scutum and abdomen. The intraspecific variation exhibited in the subgenus is somewhat less in Group B *Pardomyia*, but it does occur in the immature forms. Mattingly (1961: 34) noted variations in the color of mid tarsomere I in specimens from Sumatra and Borneo. I have seen additional material which shows this character to occur randomly throughout the range of this species. One specimen from the Celebes shows similarities to *quadripunctis*. The palpi and proboscis are entirely yellow and the legs are mostly yellow. Also, the integument is somewhat lighter than the typical *aurantius*.

Presently I am unable to separate the larvae of this species and *quadripunctis*. Knight (1947: 324) suggested that there might be a difference in the number of branches in the siphonal tuft. In all the material examined (*aurantius*, *painei*, and *quadripunctis*) the same variation in the number of branches was seen. Edwards & Given (1928: 341) showed the comb scales as being 20-26 (as cited by Knight). Mattingly states "about 50" being the average in specimens he examined. My observations show the comb scales to vary between 50 and 82 per patch, and may even go higher. Edwards & Given were probably examining a third instar larva which may account for the lower number of scales.

The pupae show close similarities in chaetotaxy to *painei* and *quadripunctis*. They differ from *painei* in the shape of the trumpets, which are gradually expanded to the pinna in *painei*, and from *quadripunctis* by the more densely spiculate paddles. Penn (1949: 41) described and figured the pupae of *aurantius chrysogaster* as differing in abdominal hair 1-I having 3-4 secondary branches. I have examined 5 slides of this subspecies from Australia and 4 of the 5 had hair 1-I single, without secondary branches, the fifth was as Penn described.

The relationship between the species in this group is interesting. It is certain that they arose from a common ancestry and have or are now reaching a point of speciation. I feel the 3 forms deserve separation until biologic or cytotaxonomic studies prove otherwise.

BIOLOGY. Like other members of the subgenus, *aurantius* immatures are found in temporary pools of various types. Those listed in the literature include pig wallows, small holes in marshy ground, grass-grown pools, pot-holes in mangrove swamps, ground pools among nipa palms, and clear marshy pools. Adults have been collected while feeding on man and domestic animals.

Aedes (MUCIDUS) QUADRIPUNCTIS (LUDLOW)

(Figures 4, 9 B, 12 B, 15 A, 21)

- Pardomyia quadripunctis* Ludlow 1910, in Theobald, Mon. Cul. 5: 608 (♀); Brunetti 1912, Rec. Indian Mus. 4(10): 460; Dyar & Shannon 1925, Insec. Inscit. Menst. 13: 73.
- Aedes (Mucidus) aurentius* var. *quadripunctis* Ludlow, Edwards 1932, Gen. Insect., Fasc. 194: 135.
- Aedes (Mucidus) aurentius quadripunctis* (Ludlow), Knight & Hull 1951, Pacif. Sci. 5: 224.
- Aedes (Mucidus) quadripunctis* (Ludlow), Bohart 1945, U.S. Navmed 580: 55; Knight 1947, J. Wash. Acad. Sci. 37: 322 (♂, ♀, L*); Mattingly 1961, Culic. Mosq. Indomalayan Area V: 26 (♂*, ♀, P*).

FEMALE. (Figure 4) *Head.* Antenna brown, nearly as long as the proboscis; torus yellow-gold with yellow scales on mesal half; clypeus light brown, bare; palpus short, approximately 0.25 the length of the proboscis, segments I and II short, yellow-gold scaled with erect hairs on segment II, segment III yellow-gold, elongate, longer than preceding segments combined, segment IV short, bulbous, apex of segment III and segment IV dark scaled; proboscis slender, yellow-gold scaled, scales mostly decumbent, semi-decumbent on ventral, basal half, base with several dark brown scales on ventral and lateral margins, apical half with scattered dark scales on dorsal surface; labellum dark; vertex clothed with narrow, decumbent, light yellow scales, above these are erect, forked at apex, and slightly darker scales; orbital bristles pale. *Thorax.* Scutum clothed with erect bristles and narrow, decumbent scales, scales yellow-copper, bristles darker yellow; integument light reddish-brown; generally similar to *aurantius*; medial and anterior mesepimeral bristles usually absent. *Legs.* Femora and tibiae as in *aurantius* but lighter due to the lighter integument; tarsi also lighter, hind tarsomeres usually with pale basal bands on I, II, sometimes on I-III, or all dark; tarsal claws as in *aurantius*. *Wing.* Scales of alula setaform, narrower than in *aurantius*. dark; squama with fringe dark; scales of wing much reduced, most noticeable on costa and R₁; clouded regions of cross veins easily seen; fringe hairs of wing longer at base than apical 0.3. *Halter.* Halter light brown with some scales on expanded apex. *Abdomen.* Variable, generally entirely yellow-gold scaled dorsally, segment VII with lateral margins dark scaled; ventral surface often dark scaled. *Terminalia.* (Figure 9 B) As in *aurantius*.

MALE. Similar to female in general habitus. *Head.* Antenna as in *aurantius*; torus bare, yellow-tan; palpus slightly longer than proboscis, segment I yellow scaled or yellow with dark scales scattered randomly, segment II yellow with apical 0.25 dark scaled, segment III all yellow scaled with apex dark, segment IV yellow with apical 0.25 dark and scattered dark scales along dorsum, segment V mottled, mainly yellow on basal half, dark on apical half, apex of segment III and all of segment IV with ventral hairs. *Legs.* As in female; tarsal claws as in *aurantius*. *Wing.* Scale fringe of alula mostly pale; wing scales generally lighter than in female. *Terminalia.* (Figure 12 B) The accessory lobe of the stem of the claspette as figured by Mattingly (1961: 35) is not as pronounced in all members, but is usually larger than in *aurantius*, and the filament is somewhat broader.

PUPA. (Figure 15 A) Trumpets long and narrow, pinna wider and dark, basal third tracheoid; index 6-10. *Cephalothorax*. Hairs 1-5-C bifid or trifold, 6-C small, triple, 7-C double, 8-C single or double, 9-C multiple, 10-C single, double, or triple, 11,12-C multiple. *Abdomen*. Hair 1-I multi-branched with branches plumose, 2-I single, 3-5-I multibranched, 6-I single or bifid; hair 1-II long, single; hair 1-VII double or bifid, 2-VII single, 3-VII double, 4-VII single, 5-VII double or triple, 6-VII small, multibranched, 7-VII small, multibranched, 9-VII with 2-4 branches, branches plumose, 10, 11-VII bifid or trifold; 4-VIII single or bifid, 9-VIII with 8-10 plumose branches. *Paddle*. Vaguely spiculate on lateral margin; hair 1-P long and single.

LARVA. (Figure 21) *Head*. Antenna vaguely spiculate, antennal tuft of 3-5 hairs at apical fifth; hairs 1, 3-8-C single, 9-C double or triple, 10-C triple, 11-C double, 12,13-C with 3-5 branches; mentum with 13 teeth. *Thorax*. Hair 0-P small, multibranched, 1-P single, 2,3-P double, 4-P with 3-4 branches, 5-7-P single, 8-P with 6-8 branches, 9-P triple, 10-P single, 11-P small, double, 12-P single or double, 14-P single; hairs 1-3-M double, 4-M with 4 branches, 5-7-M single; hair 1-T single, 2-T with 4 branches, 3-T with 8 branches, 4-T small, 4-5 branched, 5-T single, 6-T triple. *Abdomen*. Hair 1-I single or double, 3-I triple, 6-I single, 7-I with 6 plumose branches, 9-I single or double, 10-I triple, 11-I small, multibranched, 12-I double, 13-I small, multibranched; hair 1-VII double or triple, 2-VII single, 3-VII triple, 4-VII single or double, 7-VII single, 9-VII double or triple, 10-VII with 3-5 branches, 11-VII single or double, 12-VII double, 13-VII triple; hair 2-VIII double, 4-VIII single; comb scales over 50, usually over 60; siphon with well developed acus, siphonal tuft well beyond middle, of 11-15 plumose branches; pecten with apical 2 teeth displaced, apical tooth usually entire and surpassing the siphonal tuft, other pecten teeth with 1-3 lateral teeth; saddle incomplete, dorsal apical edge without spines, hair 1-X long and single; ventral brush of 22-25 tufts, each with 9-11 branches; anal papillae short.

TYPE DATA. Holotype ♀, Parang, Cotabato, *Mindanao*, PHILIPPINES, 26-X-, Page, in the U.S. National Museum.

DISTRIBUTION. This species is restricted to the PHILIPPINES. Material examined: 16♂♂, 12♀♀, 2 larvae, 26 larval skins, and 26 pupal skins as follows: *Leyte*, Tacloban, 14♂♂, 7♀♀ with associated skins, 4 unassociated larval and pupal skins, and 2 whole larvae, 25-IX-1945, H. Roberts; *Leyte*, Carigara, 1♂, 10-XI-1944, E.S. Ross; *Palawan*, Panakan, 1♂, 4♀♀ with associated skins, 29-XI-1967; *Tawi Tawi*, Tarawakan, 1♀, -IV-1967, M. Delfinado; same data, 1♀, 12-XI-1961.

TAXONOMIC DISCUSSION. This form is similar to *aurantius* and many have felt it should remain a subspecies of *aurantius* as placed by Edwards (he used the term variety). Because of the differences found in the adult and the pupal forms, and the distinct ranges of each, I prefer to leave *quadripunctis* as a distinct species.

The adults differ in having the integument reddish-brown and the abdominal tergites and scutum covered with yellow-copper colored scales (mainly copper-brown in *painei* and *aurantius*). The larvae cannot be separated on any non-varying characters. The larvae of *aurantius*, *painei* and *quadripunctis* are all very similar and at this time are best separated by distribution alone. The pupae are also similar but differ in having the lateral edges of the paddles vaguely spiculate in *quadripunctis*, densely so in *painei* and *aurantius* (See Figure 15).

BIOLOGY. Knight records the larvae from rain filled temporary puddles. Material on hand from Palawan was taken from the same locality, and perhaps the same pool, as the *laniger* material.

ACKNOWLEDGEMENTS

I wish to thank Dr. Botha de Meillon, Project Leader, Southeast Asia Mosquito Project, Dr. Alan Stone, Agriculture Research Service, U.S. Department of Agriculture, and Dr. K. L. Knight, Department of Entomology, North Carolina State College, for their help and useful criticisms during the course of the study and the preparation of the manuscript. Special thanks to Dr. P. F. Mattingly, British Museum of Natural History, who examined the cotypes of, and selected a lectotype of *Ae. scatophagoides* for me. The loan of various specimens obtained for me by SEAMP from Dr. Mattingly, Dr. J. N. Belkin, Department of Entomology, University of California at Los Angeles; the Director, Office de la Recherche Scientifique et Technique Outre Mer, Paris, France; The Director, South African Institute for Medical Research, Johannesburg; and Dr. P. Konfortion, Medical and Health Department, Regent, Mauritius, are acknowledged with thanks.¹ The illustrators of the 406th Medical Laboratory, Japan, and Mrs. Elaine Hodges of SEAMP are acknowledged for their beautiful and invaluable work, and the curator and technicians of SEAMP for their detailed work and technical assistance. My personal thanks to E. L. Peyton for always making himself available for advice.

LITERATURE CITED

- ASSEM, J. VAN DEN and J. BONNE-WEPSTER
1964. VI. New Guinea Culicidae, a synopsis of vectors, pests and common species. Zool. Bijdr. 136 pp.
- BANKS, C. S.
1906. A list of Philippine Culicidae with descriptions of some new species. Philipp. J. Sci. 1(9): 977-1005.
- BARRAUD, P. J.
1929. A revision of the Culicine mosquitoes of India. XXV. The genera *Mucidus*, *Mimomyia*, *Ficalbia*, *Rachionotomyia*, and *Hodgesia*. Indian J. med. Res. 16: 1052-1063.
1934. The fauna of British India including Ceylon and Burma. Diptera V. Family Culicidae, tribes Megarhinini and Culicini. Taylor and Francis, London. 463 pp.
- BELKIN, J. N.
1962. The mosquitoes of the South Pacific. Univ. Calif. Press, Berkeley. 2 vols., 608 and 412 pp.
- BICK, G. H.
1951. The ecology of the mosquito larvae of New Guinea. Pacif. Sci. 5: 392-431.
- BOHART, R. M.
1945. A synopsis of the Philippine mosquitoes. Navmed 580. 88 pp.
- BONNE-WEPSTER, J.
1954. Synopsis of a hundred common non-anopheline mosquitoes of the Greater and Lesser Sundas, the Moluccas, and New Guinea. Roy. trop. Inst. Amst. Spec. Pub. III, 147 pp.

¹ Figure 9-C was reproduced with the consent of the Editor, Journal of the Entomological Society of Southern Africa.

- BRUG, S. L. and J. BONNE-WEPSTER
1947. The geographical distribution of the mosquitoes of the Malay Archipelago. Chron. nat. 103: 179-197.
- BRUG, S. L. and F. W. EDWARDS
1931. Fauna Sumatrensis. (Bijdrage Nr. 68). Culicidae (Diptera). pp. 251-261.
- BRUNETTI, E.
1912. X. Annotated catalogue of Oriental Culicidae - Supplement. Rec. Indian Mus. IV:403-517.
- CARTER, H. F.
1950. Ceylon Mosquitoes: Lists of species and names of mosquitoes recorded from Ceylon. Ceylon J. Sci. (B) 24(2): 85-115.
- CHRISTOPHERS, S. R.
1906. The importance of larval characters in the classification of mosquitoes. Sci. Mem. Med. & San. Depts. India 25 (n. s.): 1-18.
- DYAR, H. G. and R. C. SHANNON
1925. The types of Philippine mosquitoes described by Ludlow and other notes on the fauna. (Diptera, Culicidae). Insec. Inscit. Menst. 13: 66-89.
- EDWARDS, F. W.
1911. The African species of *Culex* and allied genera. Bull. ent. Res. 2: 241-268.
1913. New synonymy in Oriental Culicidae. Bull. ent. Res. 4: 221-242.
1922. A synopsis of adult Oriental culicine (including megarhinine and sabethine) mosquitoes. Part II. Indian J. med. Res. 10: 430-475.
1932. in Wytsman, Genera Insectorum. Diptera. Family Culicidae. Fasc. 194, Desmet-Verteneuil, Brussels. 258 pp., illus.
1941. Mosquitoes of the Ethiopian Region. III.- Culicine adults and pupae. Brit. Mus. (Nat. Hist.), London. 499 pp.
- EDWARDS, F. W. and D. H. C. GIVEN
1928. The early stages of some Singapore mosquitoes. Bull. ent. Res. 18: 337-357.
- GEBERT, S.
1948. Notes on a new species of *Aedes*, sub-genus *Mucidus* (Diptera: Culicidae) found in Mauritius. The Entomologist 81: 96-99.
- GILES, G. M.
1902. A handbook of the gnats or mosquitoes. 2nd. ed., London. 530 pp., 51 figs.

- HADDOW, A. J., VAN SOMEREN, E. C. C., LUMSDEN, W. H. R., HARPER, J. O. and J. D. GILLETT
1951. The mosquitoes of Bwamba County, Uganda. VIII. Records of occurrence, behaviour and habitat. Bull. ent. Res. 42: 207-238.
- HOPKINS, G. H. E.
1952. Mosquitoes of the Ethiopian Region. I. - Larval bionomics of mosquitoes and taxonomy of culicine larvae. 2nd ed., with notes and addenda by P. F. Mattingly. London. 355 pp., illus.
- KNIGHT, K. L.
1947. The *Aedes (Mucidus)* mosquitoes of the Pacific. (Diptera: Culicidae). J. Wash. Acad. Sci. 37: 315-325.
- KNIGHT, K. L., BOHART, R. M. and G. E. BOHART
1944. Keys to the mosquitoes of the Australasian Region, including a synopsis of their distribution and breeding habits. Nat. Res. Counc., Div. med. Sci., Washington. 71 pp.
- KNIGHT, K. L. and R. W. CHAMBERLAIN
1948. A new nomenclature for the chaetotaxy of the mosquito pupa, based on a comparative study of the genera (Diptera: Culicidae). Proc. helm. Soc. Wash. 15: 1-18, illus.
- KNIGHT, K. L. and W. B. HULL
1951. The *Aedes* mosquitoes of the Philippine Islands. I. Keys to species. Subgenera *Mucidus*, *Ochlerotatus*, and *Finlaya*. (Diptera, Culicidae). Pacif. Sci. 5: 211-251.
- LEE, D. J.
1944. An atlas of the mosquito larvae of the Australasian Region. Tribes - Meharhinini and Culicini. Australian Military Forces, Headquarters. 119 pp., illus.
- LEICESTER, G. F.
1908. The Culicidae of Malaya. Stud. Inst. med. Res. F. M. S. 3(3): 18-261.
- MACDONALD, W. W.
1957. Malaysian parasites - XVI. An interim review of the non-anopheline mosquitoes of Malaya. Stud. Inst. med. Res. F. M. S. 28: 1-34.
- MACQUART, P. J. M.
1839. (Imprint 1838). Dipteres exotiques nouveaux ou peu connus. Mem. Soc. Sci. Lille 1(2): 121-323, 14 pls.
- MATTINGLY, P. F.
1949. Studies on West African forest mosquitoes. II. Bull. ent. Res. 40: 387-402.
1961. The culicine mosquitoes of the Indomalayan area. Part V. Genus *Aedes* Meigen, subgenera *Mucidus* Theobald, *Ochlerotatus* Lynch Arribálzaga and *Neomelaniconion* Newstead. Brit. Mus. (Nat. Hist.), London. 62 pp.

MUSPRATT, J.

1959. Research on South African Culicini (Diptera: Culicidae). V. A new species of and notes on the subgenus *Mucidus*, with other observations and records. J. ent. Soc. S. Afr. 22(1): 64-77.

NEVEU-LEMAIRE, D.

1902. Classification de la famille des Culicidae. Mem. Soc. zool. Fr. 15: 195-227.

PAINE, R. W. and F. W. EDWARDS

1929. Mosquitoes from the Solomon Islands. Bull. ent. Res. 20: 303-320.

PARRISH, D. W.

1968. The occurrence and known human-disease relationships of mosquitoes on USAF installations in the Republic of Vietnam. 5th Epidemiological Flight, U.S. Air Force. 23 pp.

PENN, G. H.

1949. The pupae of the mosquitoes of New Guinea. Pacif. Sci. 3:3-85.

RAGEAU, J. and J. HAMON

1957. *Aedes* (Diptera, Culicidae) appartenant au sous-genre *Mucidus* en Nouvelle-Calédonie. Bull. Soc. Pat. exot. 50: 372-378.

STONE, A., KNIGHT, K. L. and H. STARCKE

1959. A synoptic catalog of the mosquitoes of the world. (Diptera, Culicidae). Ent. Soc. Amer. (The Thomas Say Found.) Vol. 6: 1-358.

TENNENT, J. E.

1859. Ceylon: an account of the Island, with notices of its natural history and productions. 2nd ed., London. Illus.

THEOBALD, F. V.

- 1901a. The classification of mosquitoes. J. trop. Med. 4: 229-235.
- 1901b. A monograph of the Culicidae or mosquitoes. I. London. 424 pp.
1907. A monograph of the Culicidae or mosquitoes. IV. London. 639 pp.
1910. A monograph of the Culicidae or mosquitoes. V. London. 646 pp.

THURMAN, E. B.

1963. The mosquito fauna of Thailand (Diptera: Culicidae). Proc. 9th Pacif. Sci. Congr. 9: 47-57.

TYSON, W. H.

1970. Notes on African *Aedes*, subgenus *Mucidus*. J. ent. Soc. S. Afr. (in press).

WESTWOOD, J. O.

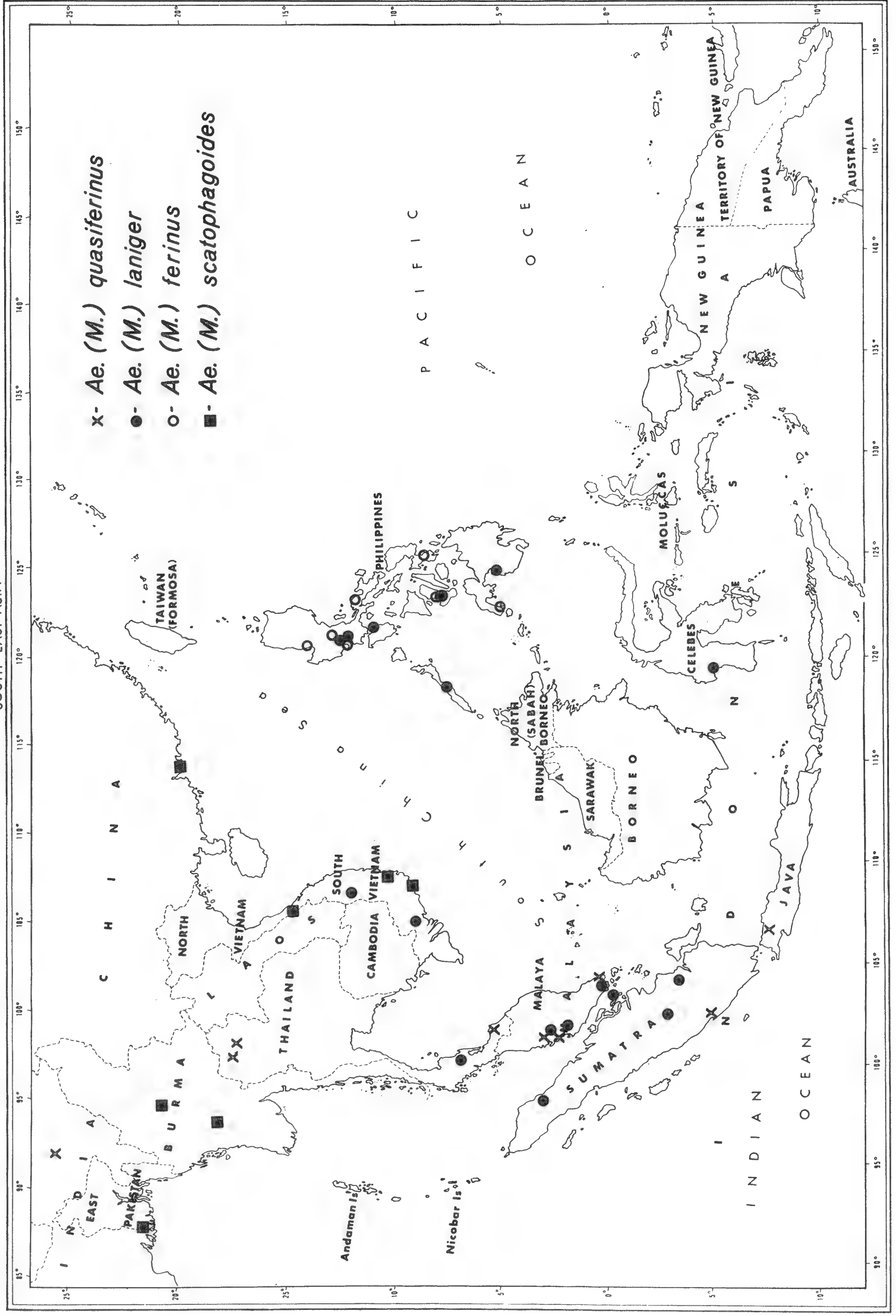
1881. Notae Dipterologicae. V. Descriptions of new species of exotic Tipulidae, with an annotated summary of species belonging to the same family, previously described. Trans. ent. Soc. Lond. 363-385.

WIEDEMANN, C. R. G.

1820. Diptera Exotica. Pars I. 244 pp. Kiel.

GROUP A MUCIDUS

SOUTH-EAST ASIA



GROUP B PARDOMYIA

SOUTH-EAST ASIA

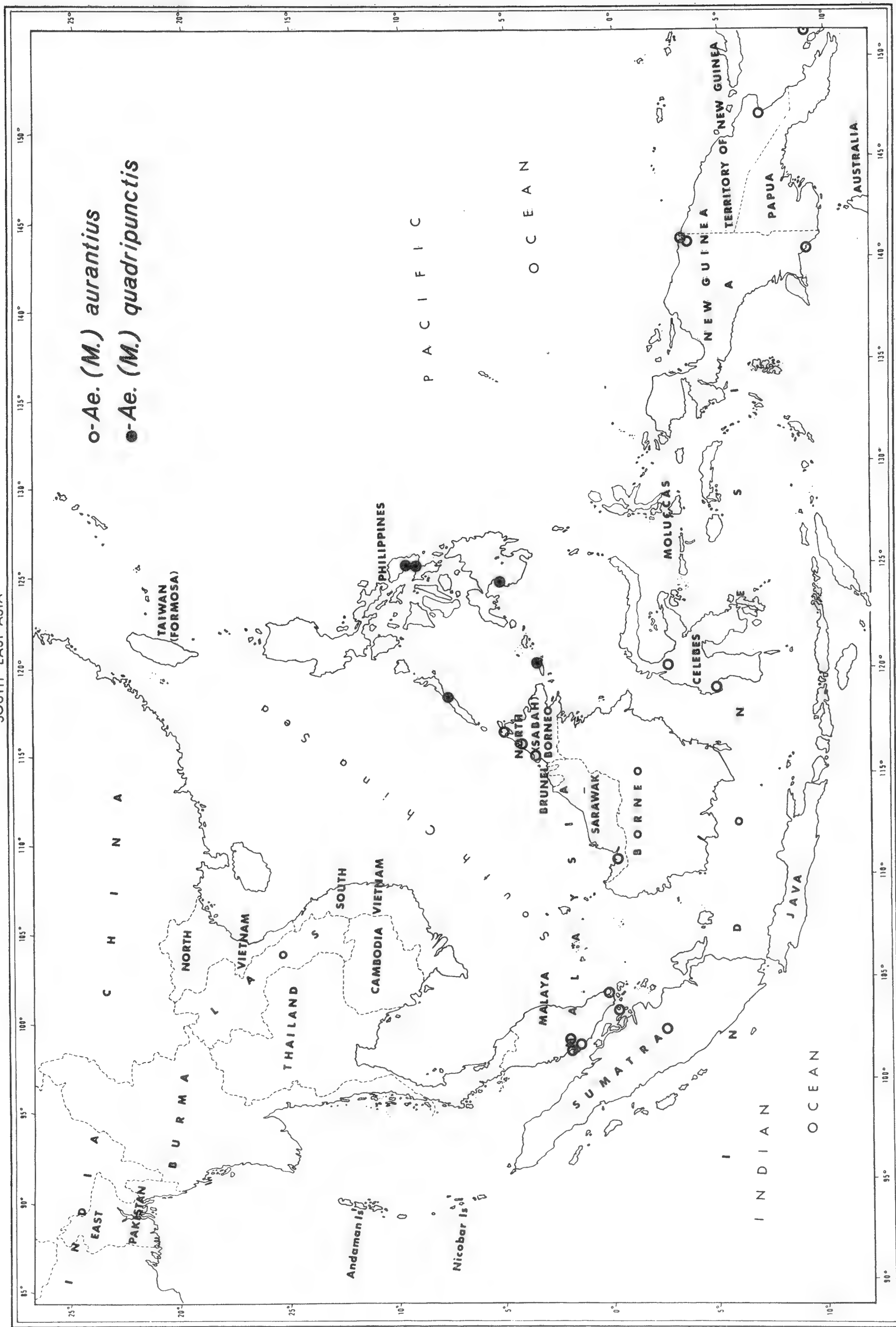


Fig.1

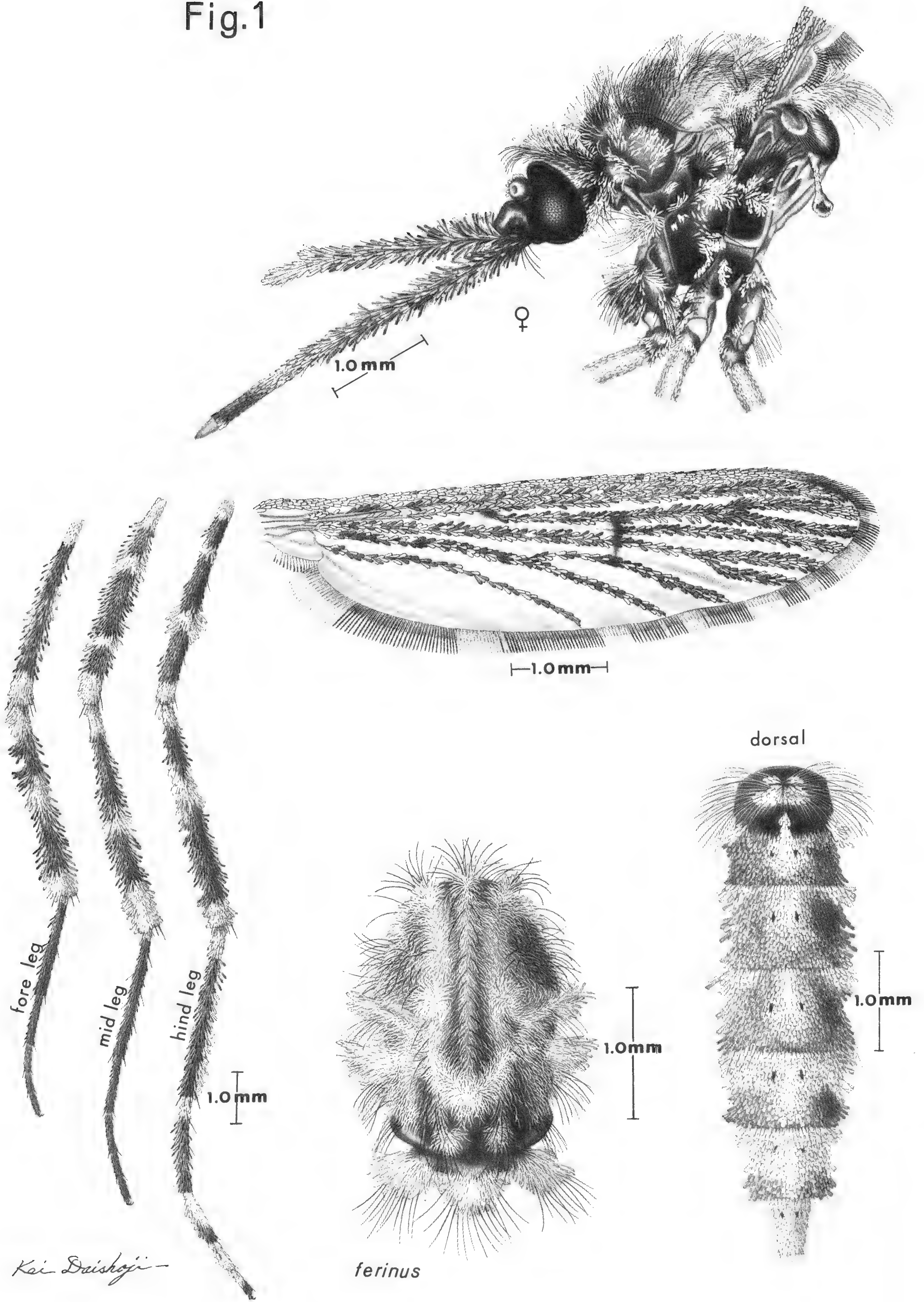
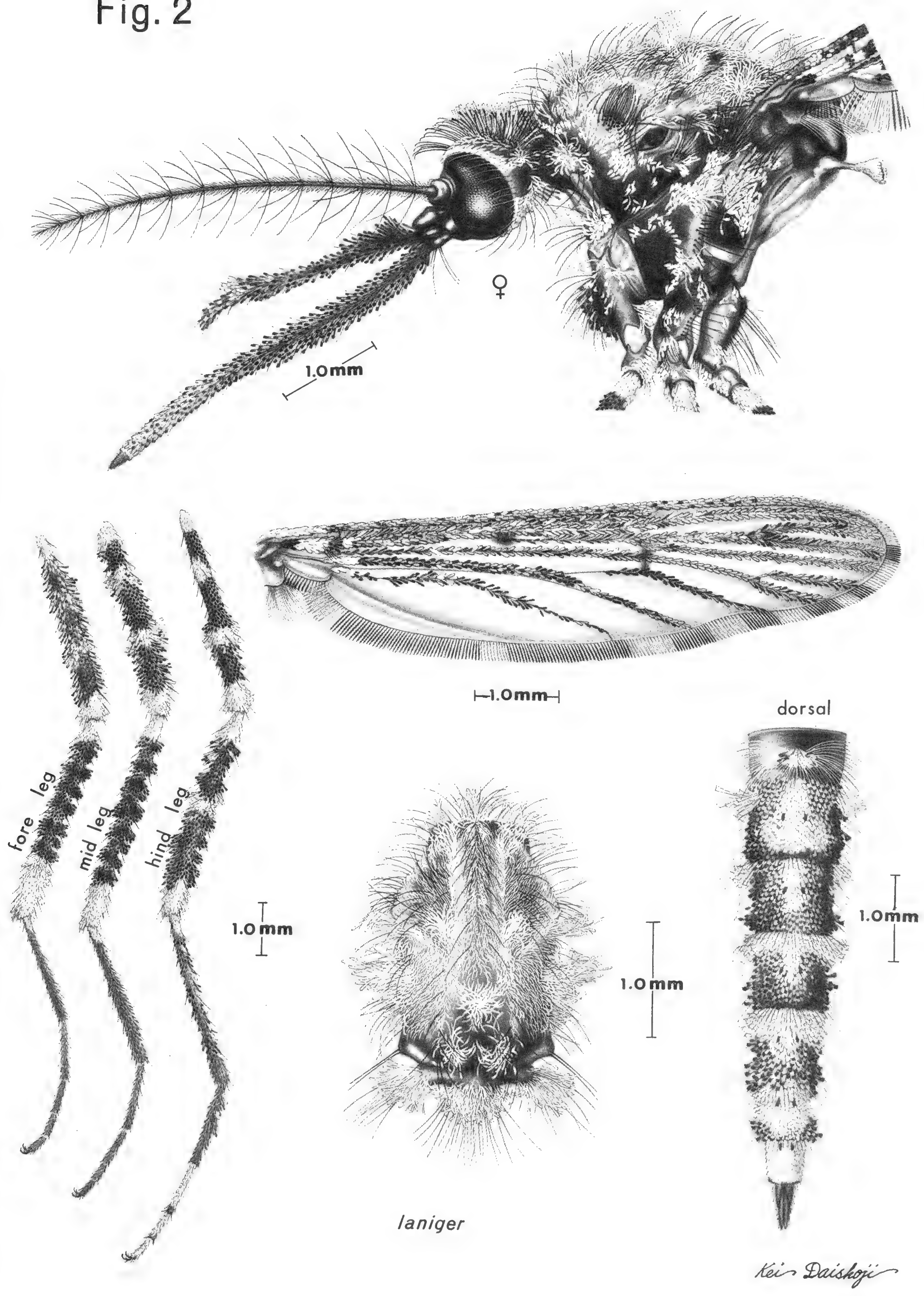


Fig. 2



♀

1.0mm

1.0mm

fore leg
mid leg
hind leg

1.0mm

1.0mm

dorsal

1.0mm

laniger

Kei Daiskoji

Fig. 3

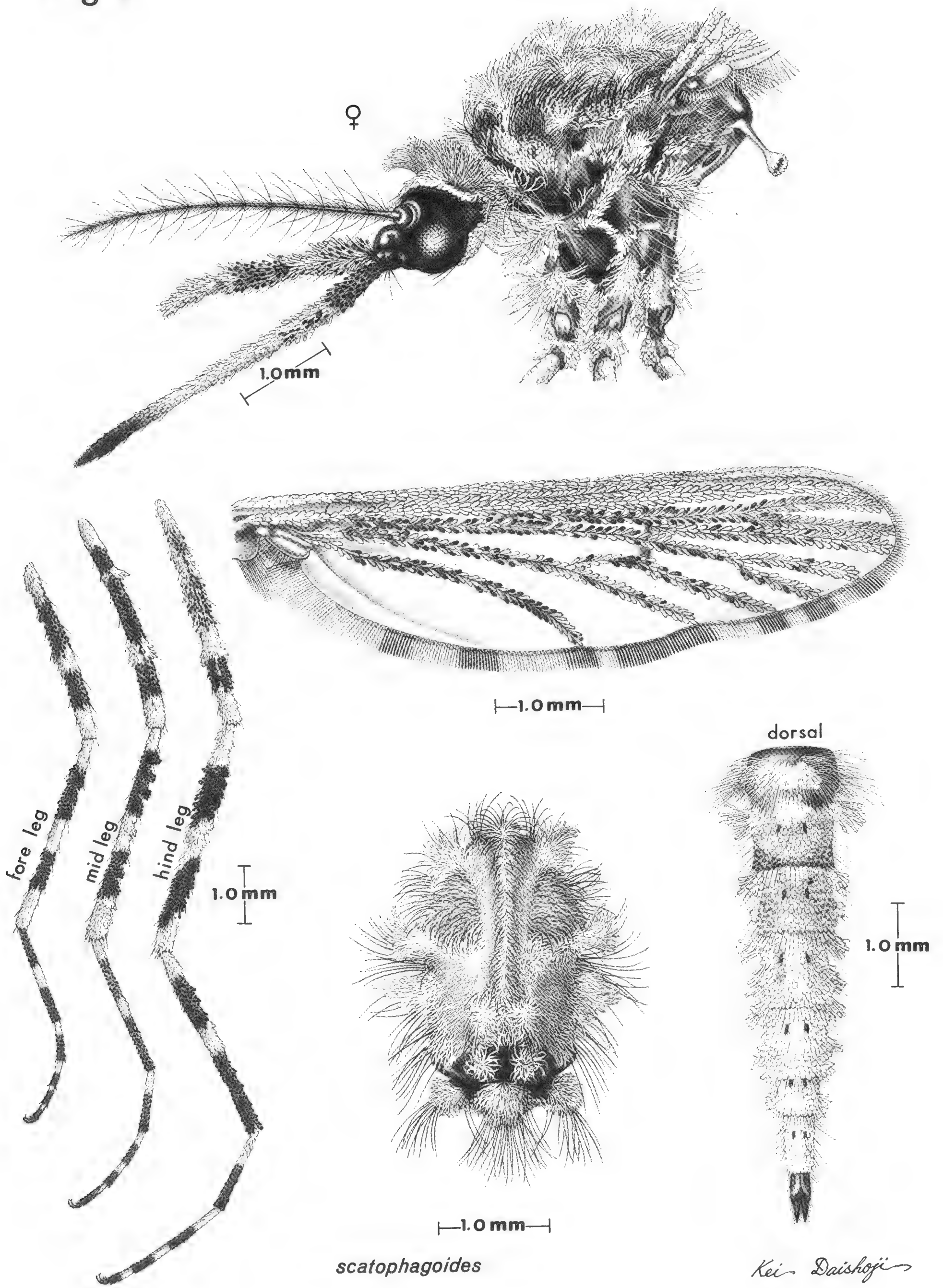
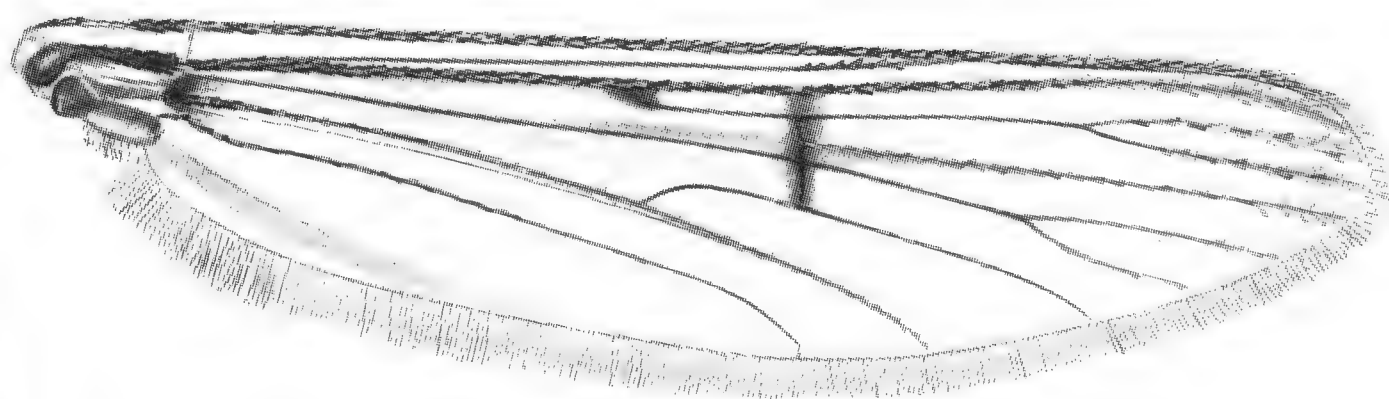
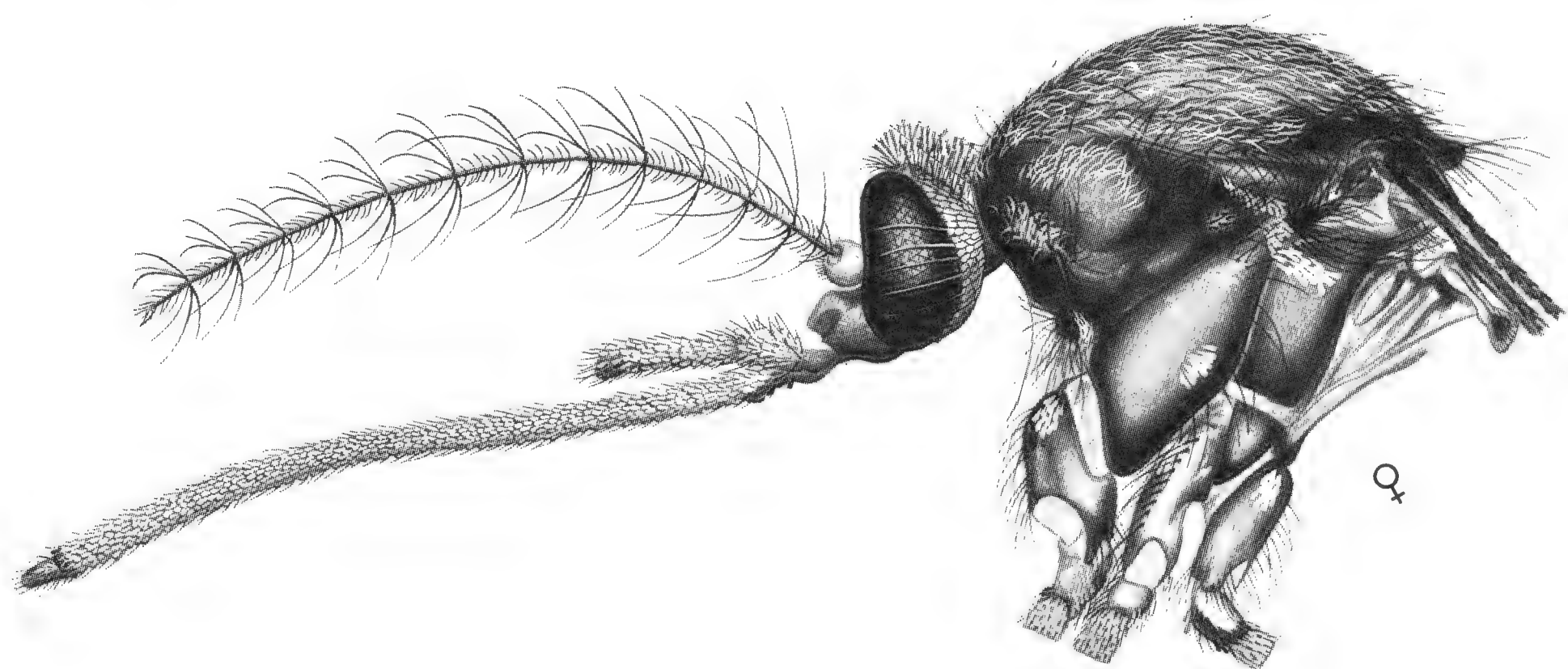
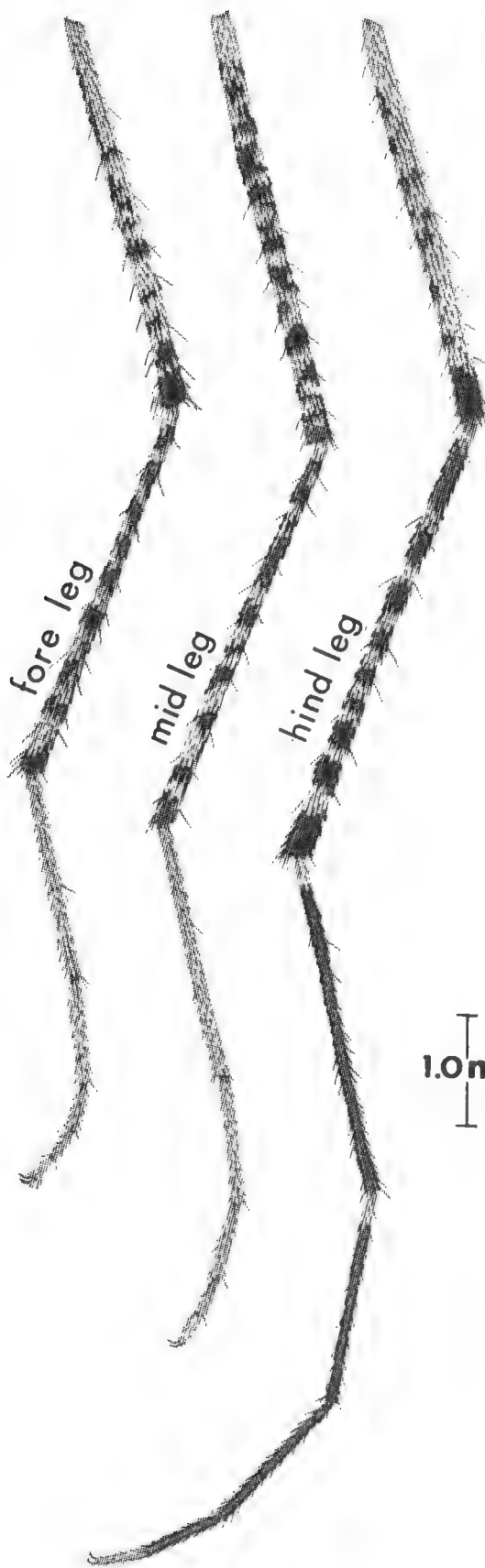


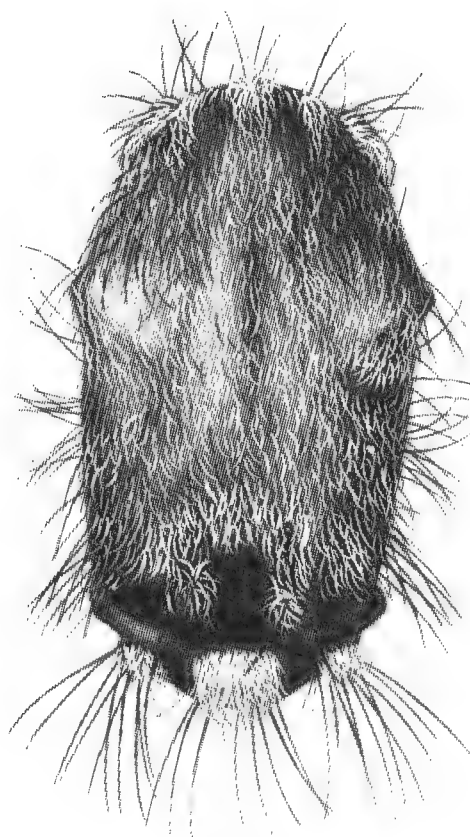
Fig.4



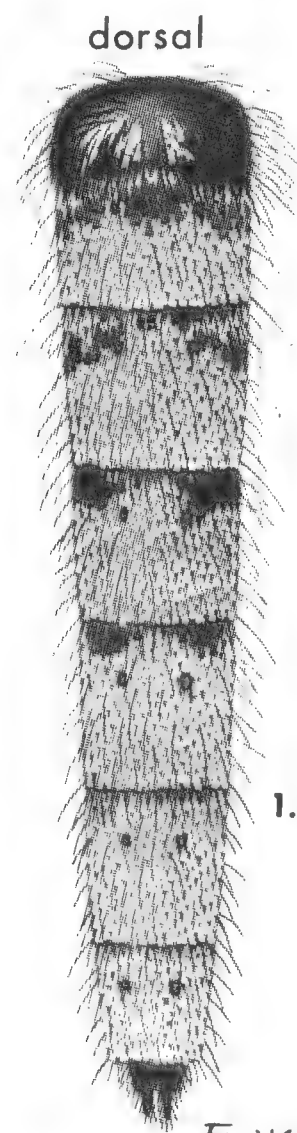
—1.0mm—



1.0mm



1.0mm



1.0mm

quadripunctis

Fujisawa
69

Fig.5

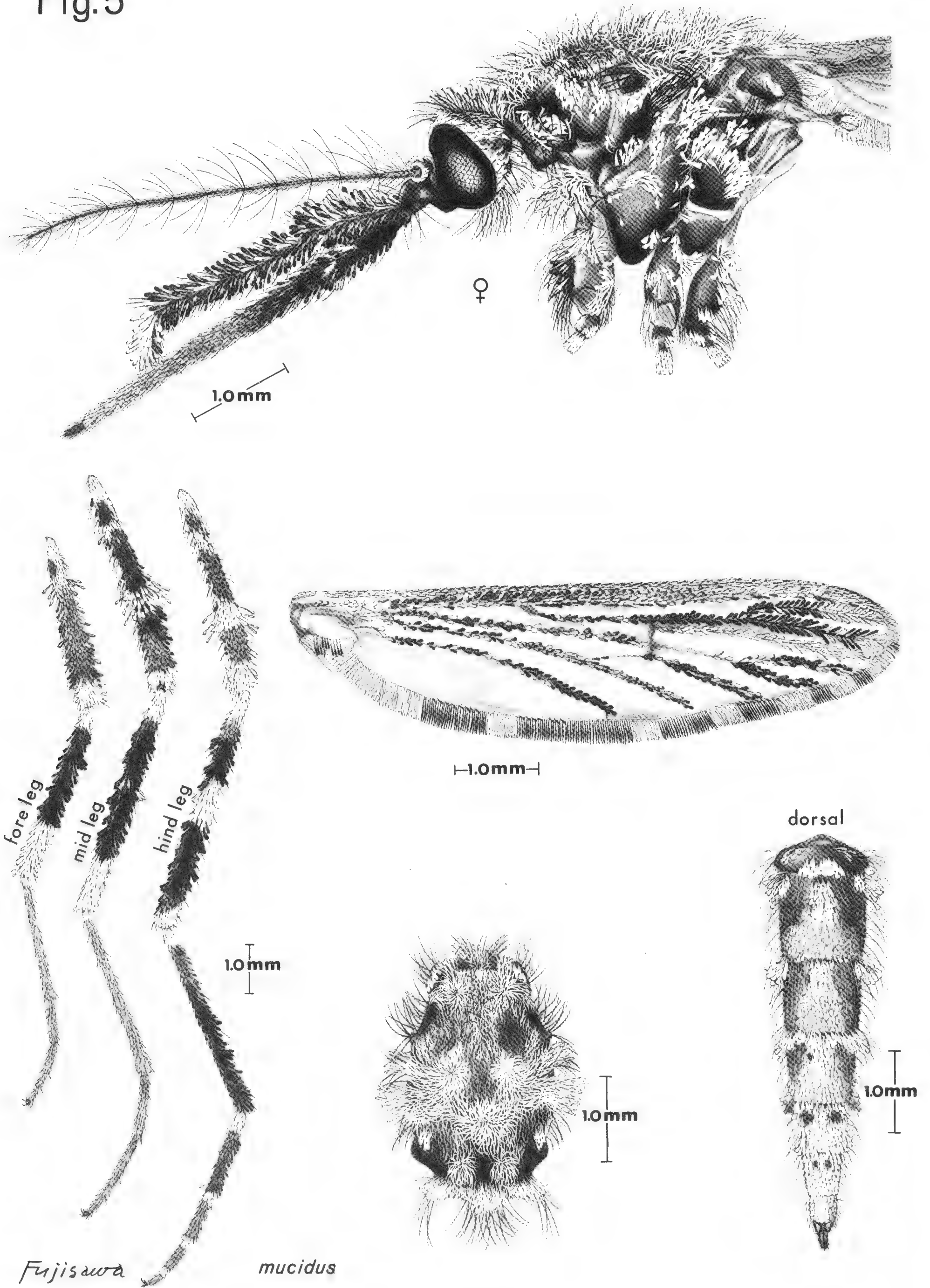


Fig. 6

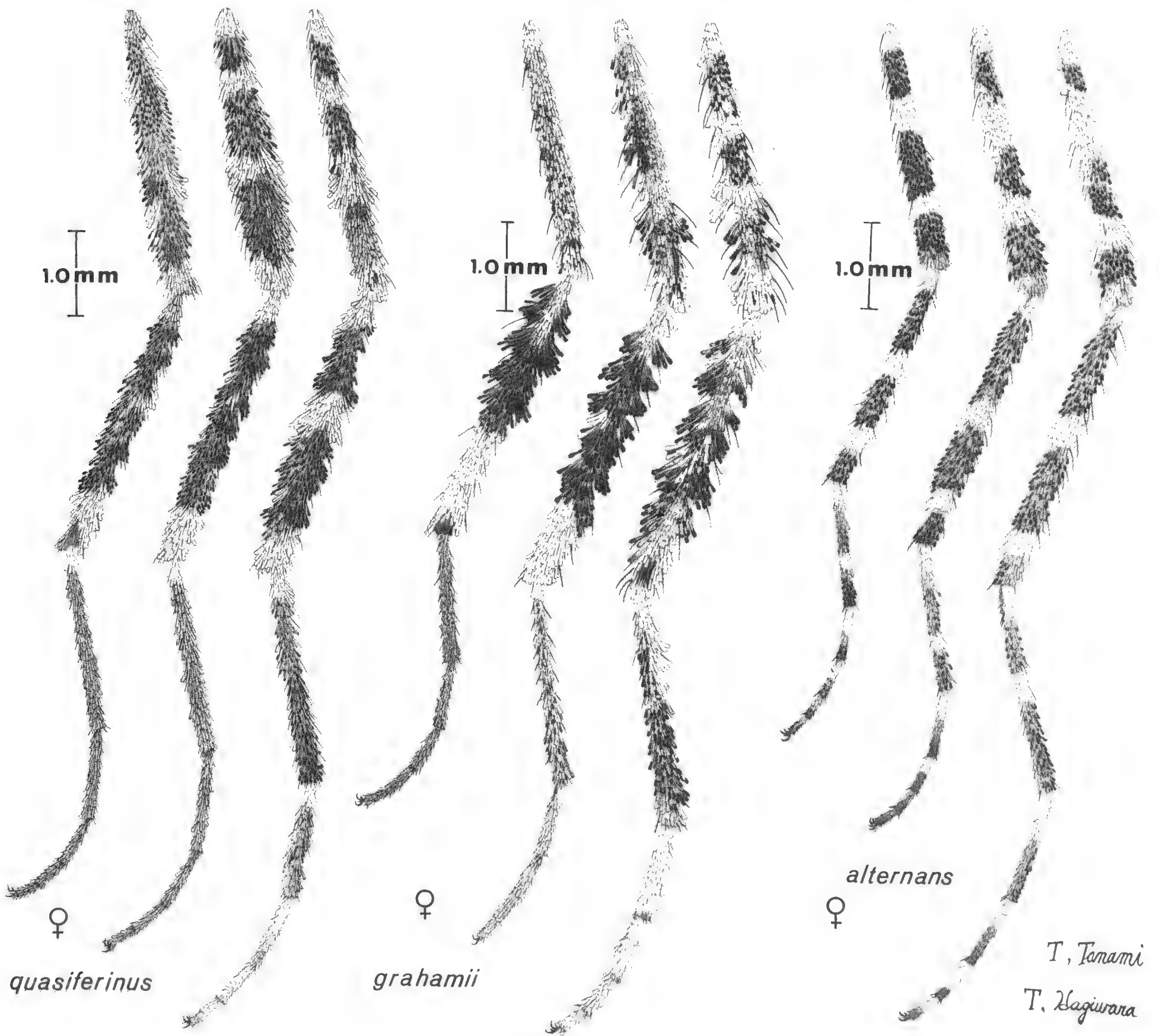
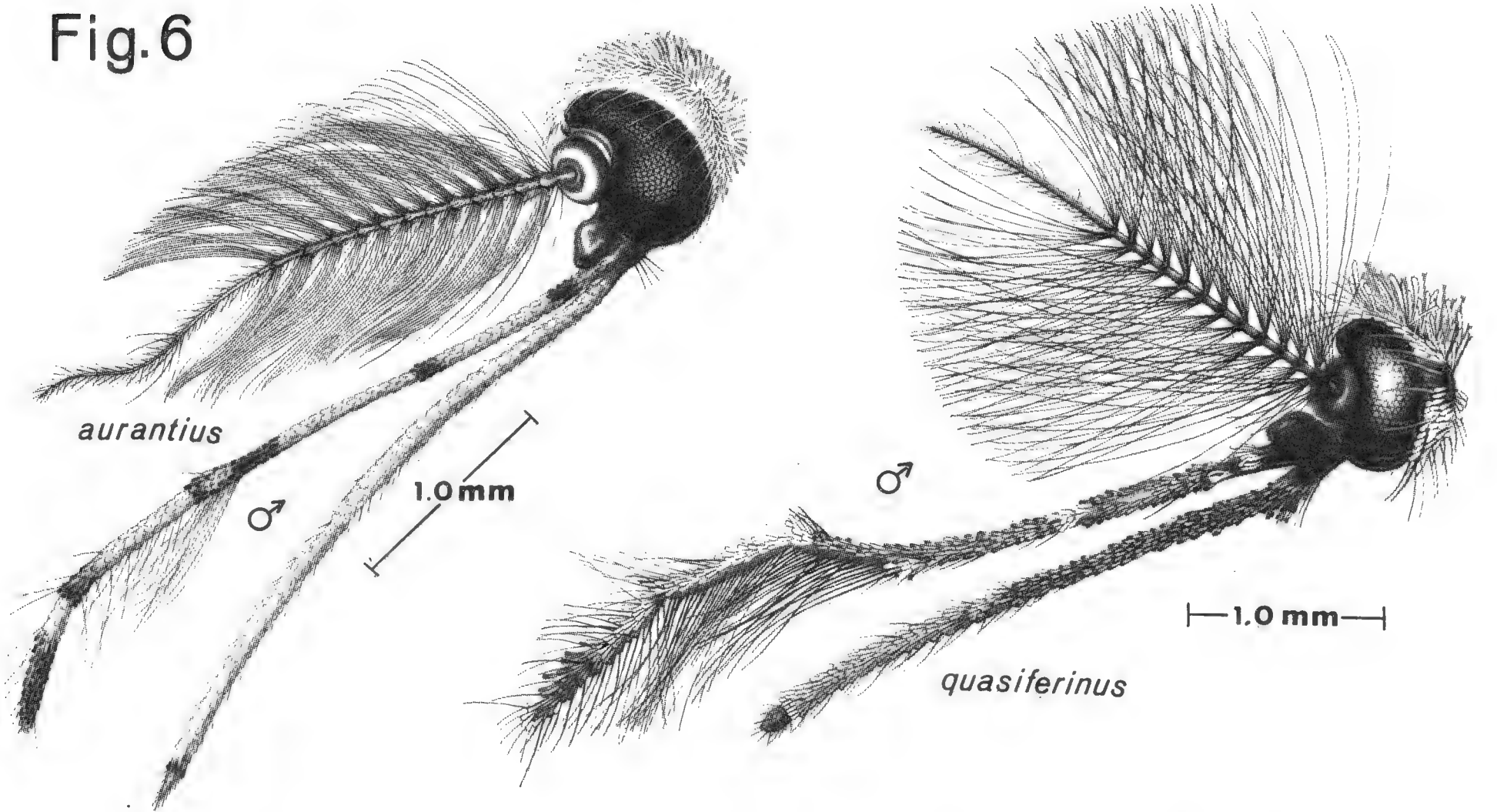
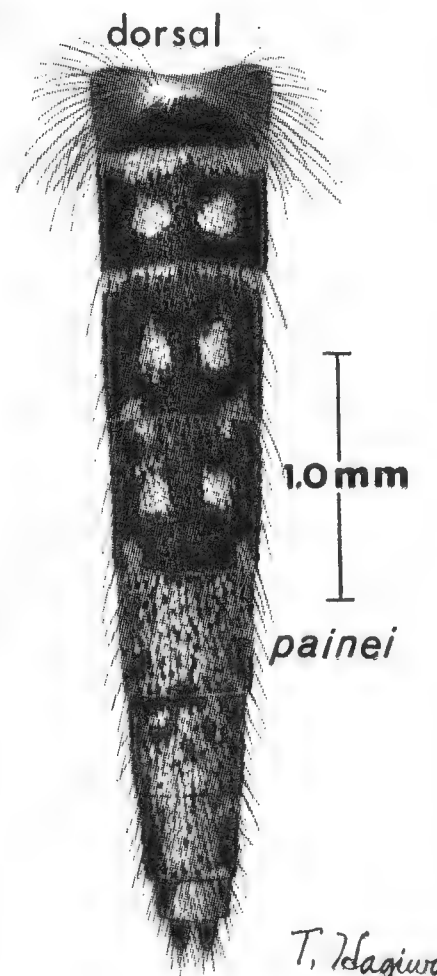
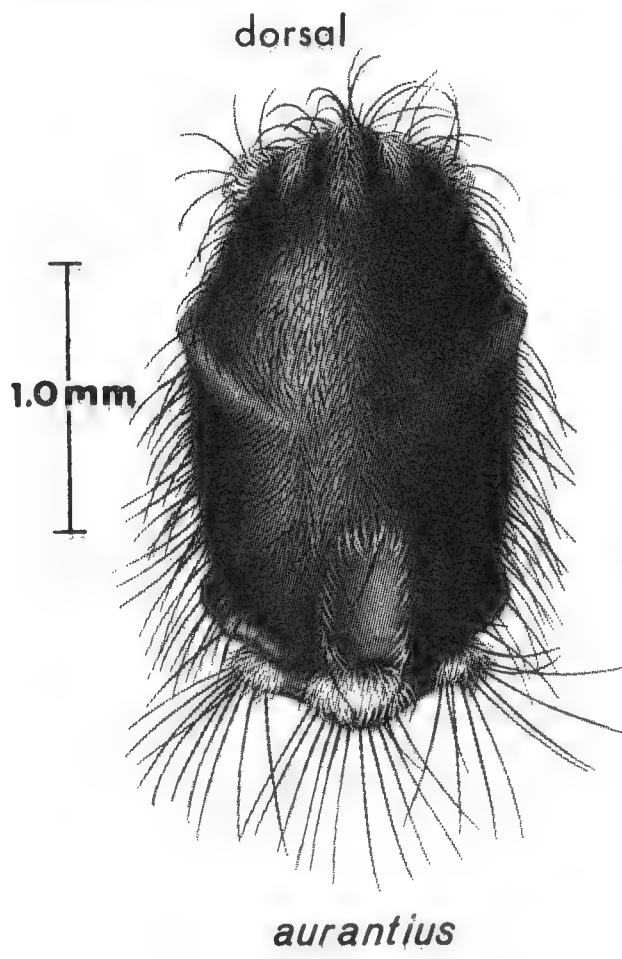
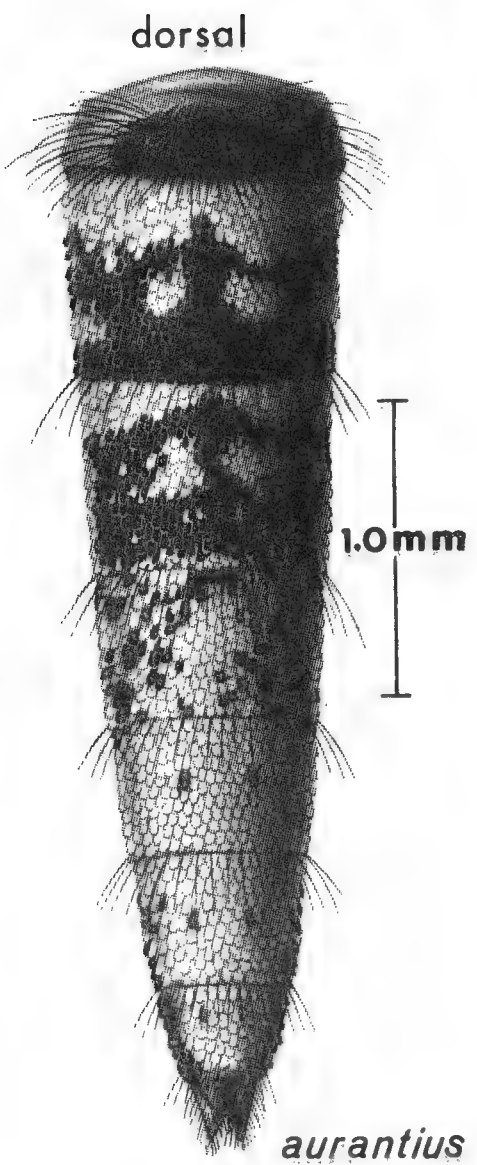
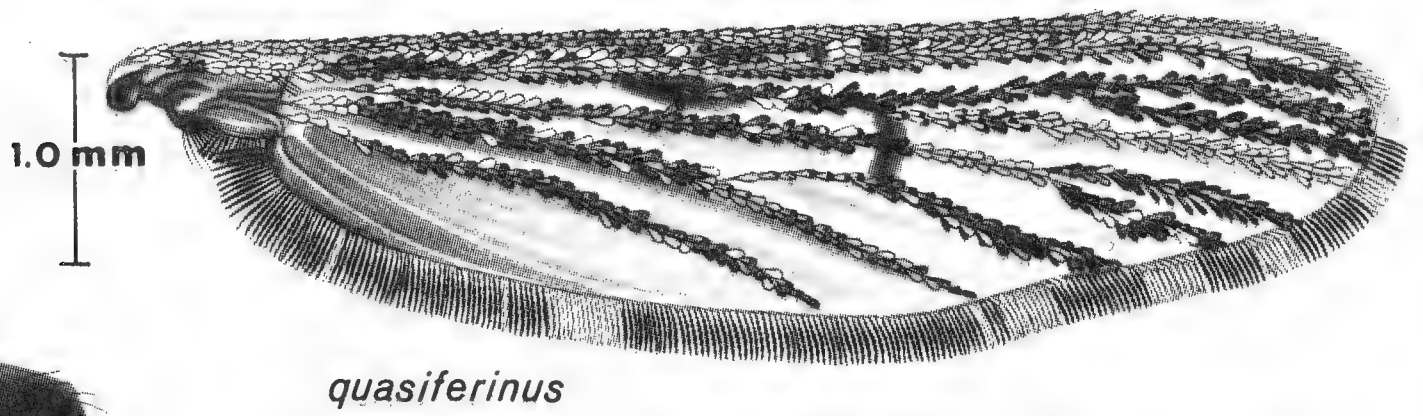
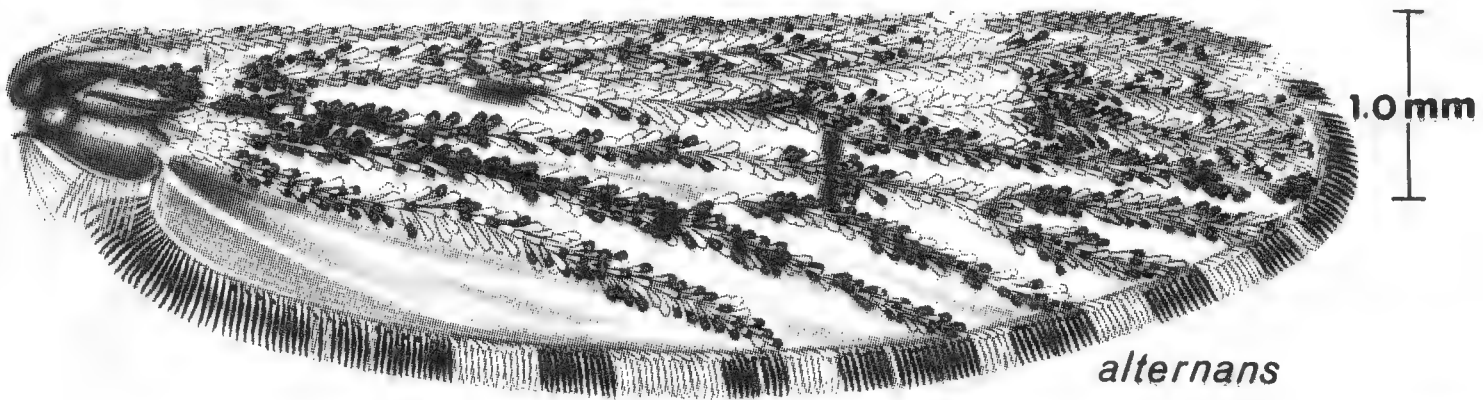
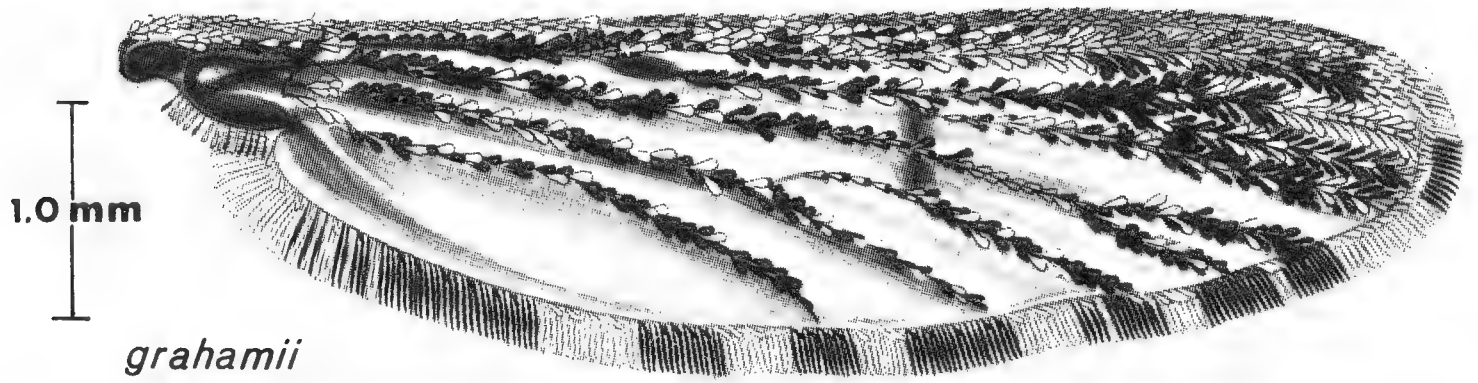
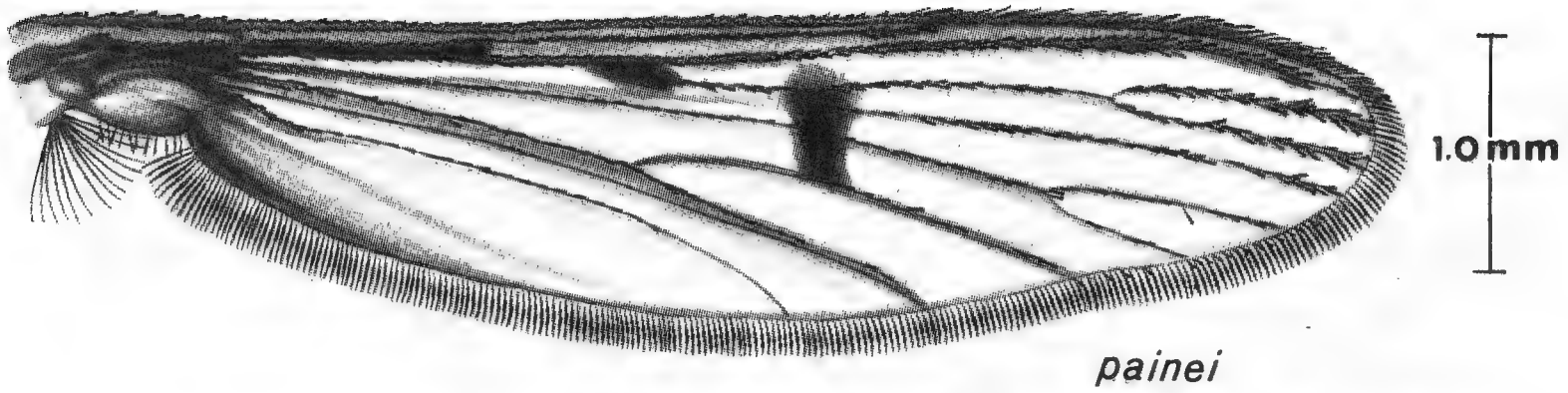
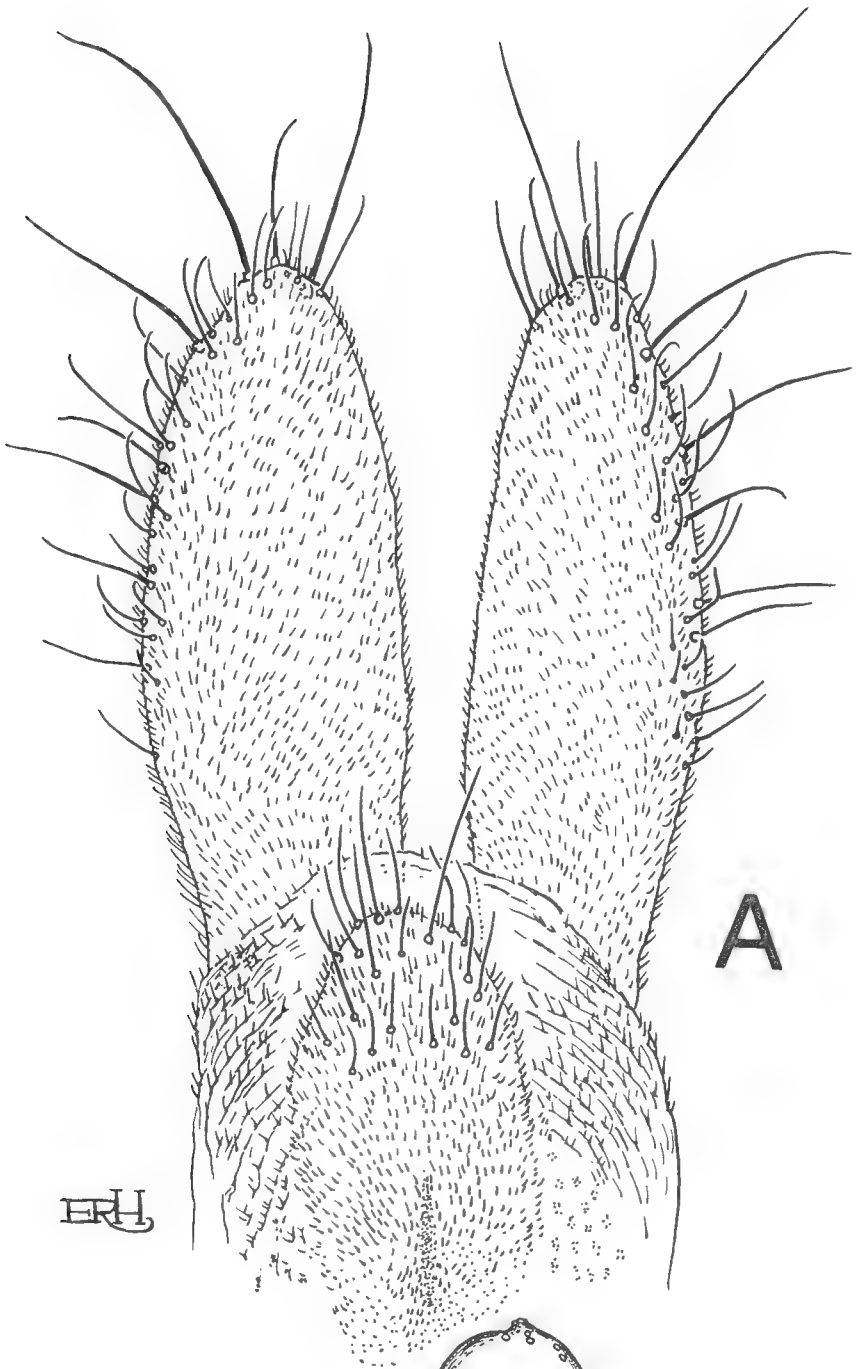


Fig. 7

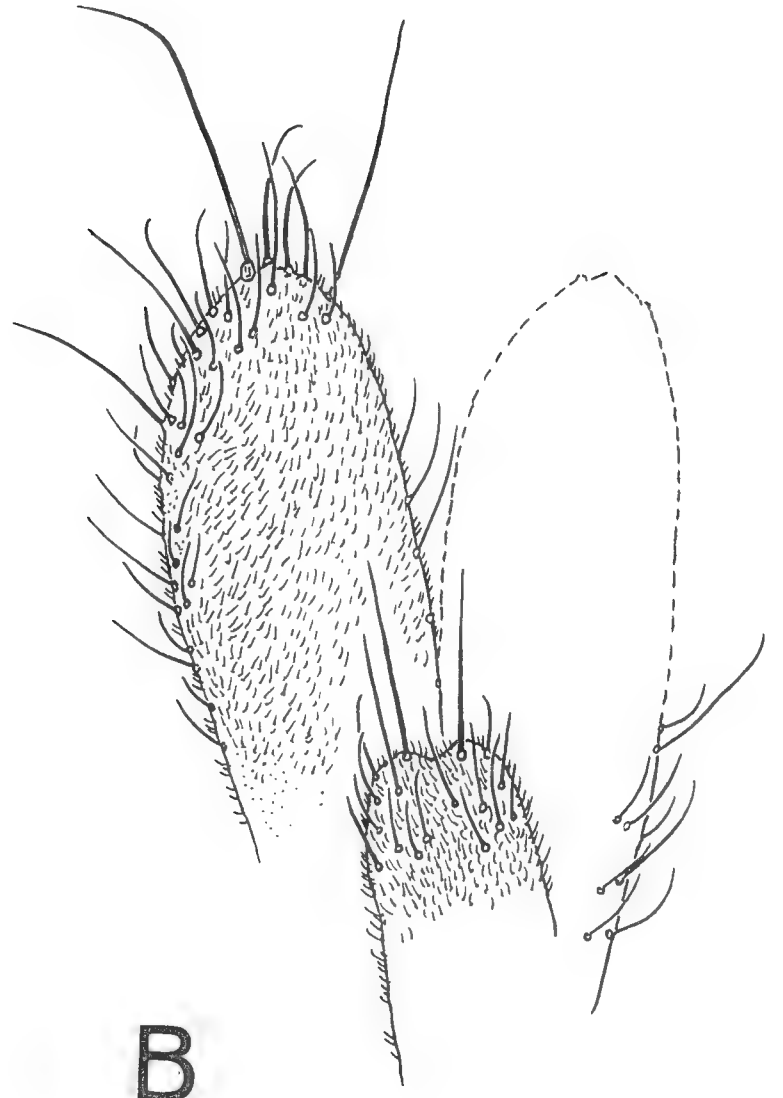


T. Nagiwaru
Kei Daishoji

Fig. 8



A

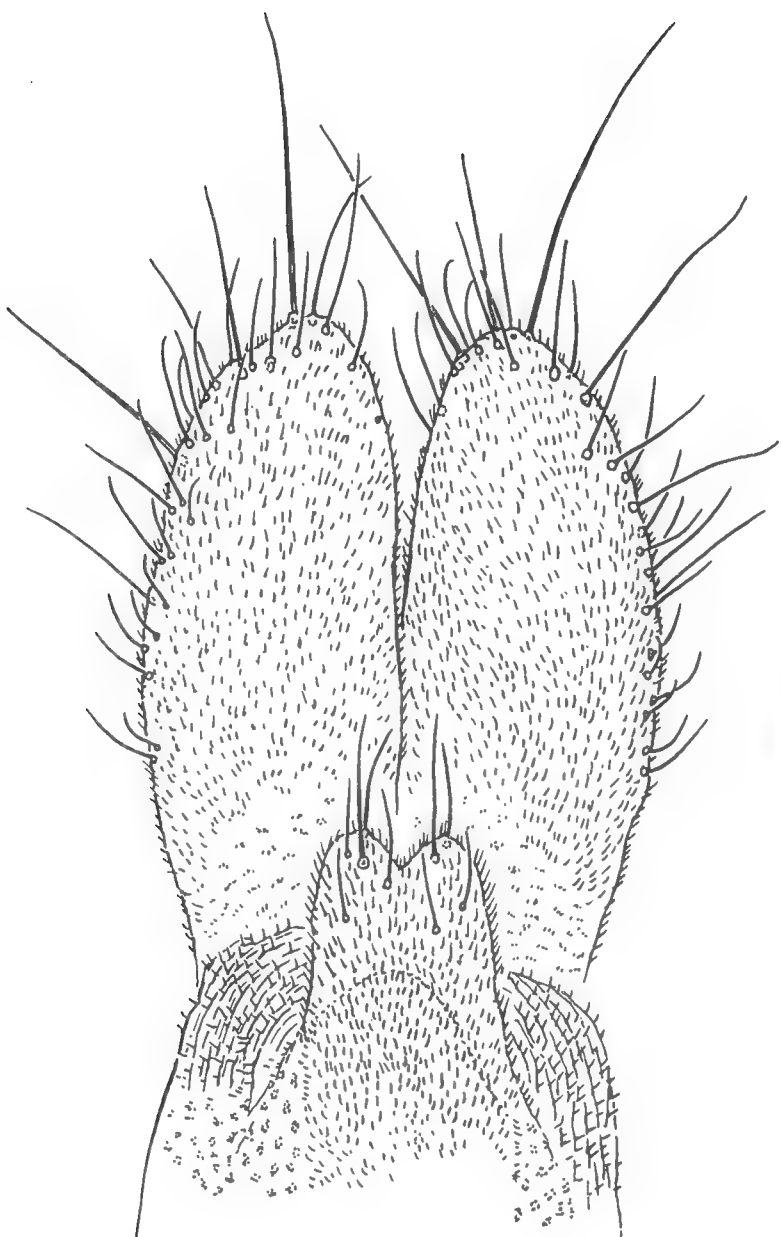
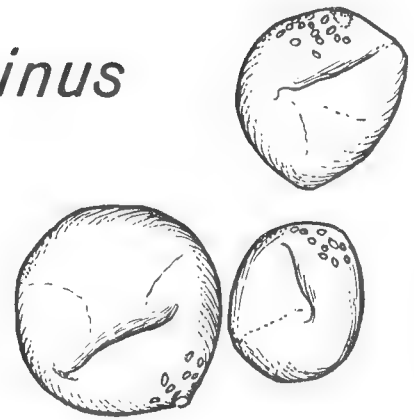


B

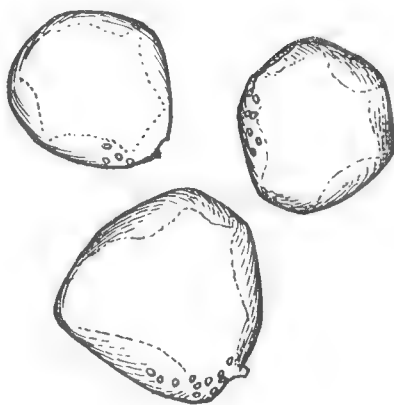
ferinus



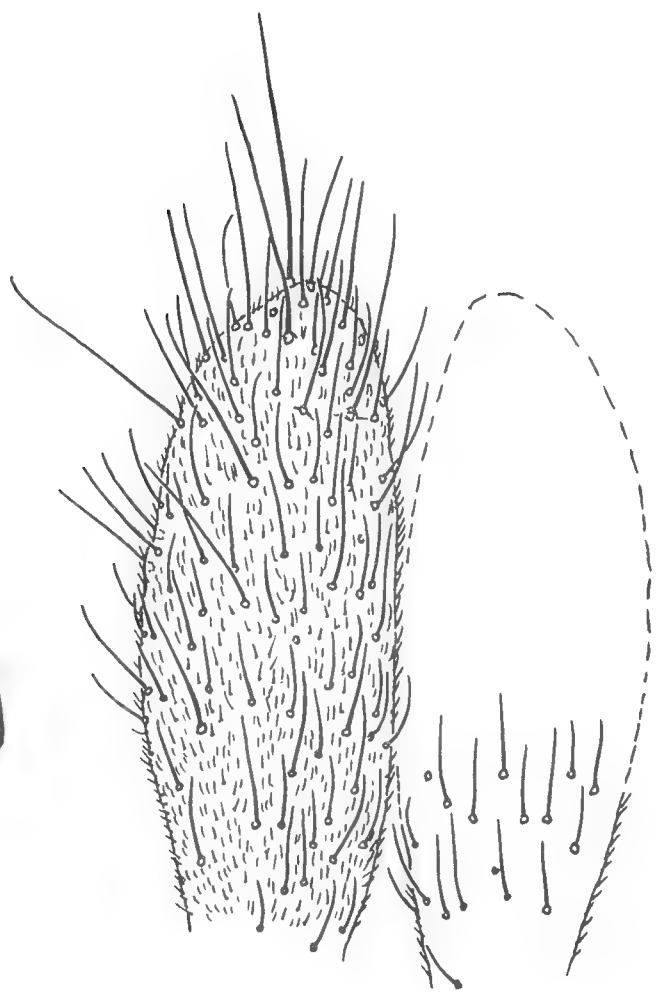
quasiferinus



C

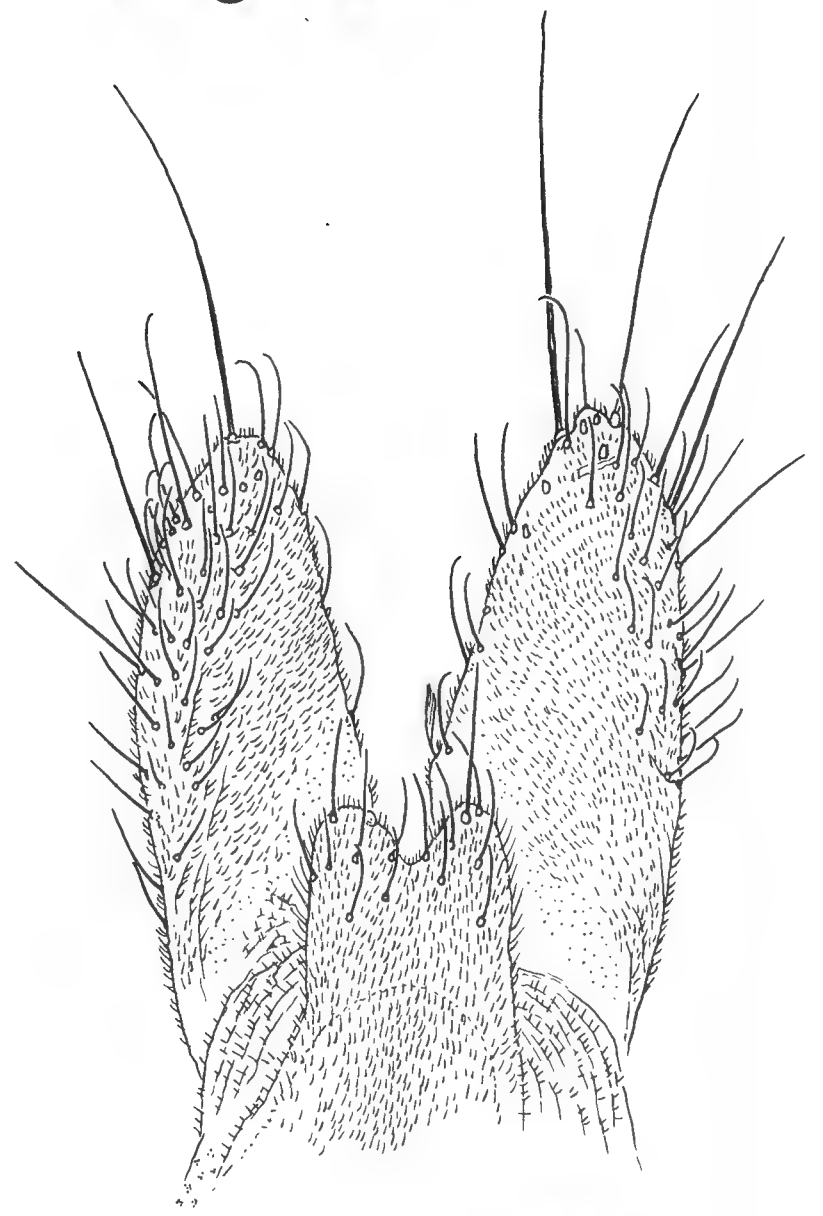


laniger



tergal view
laniger

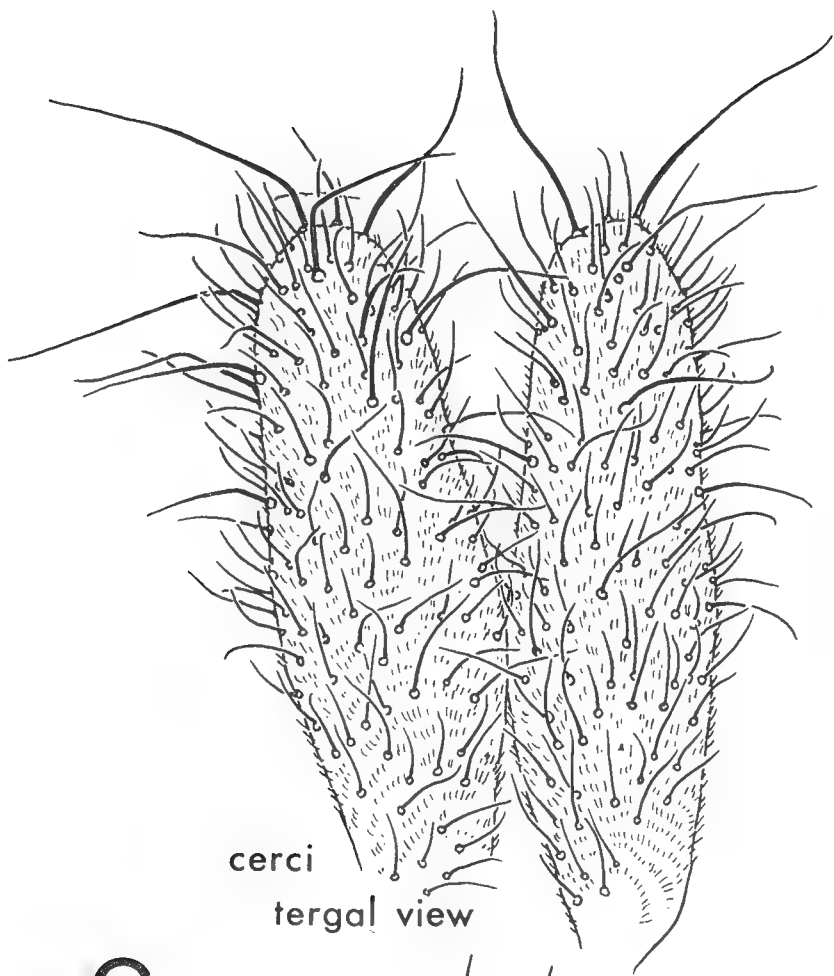
Fig. 9



B

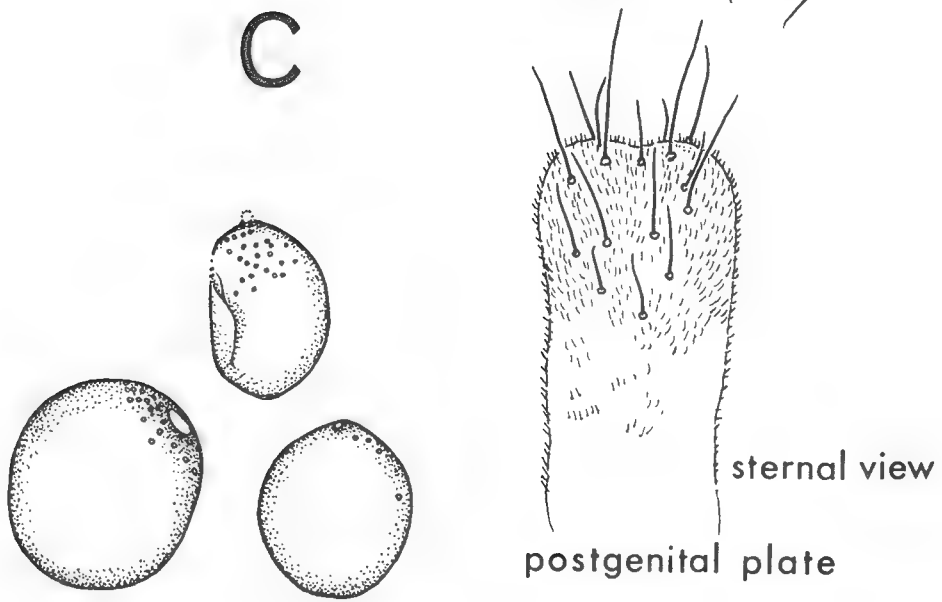


quadripunctis



cerci
tergal view

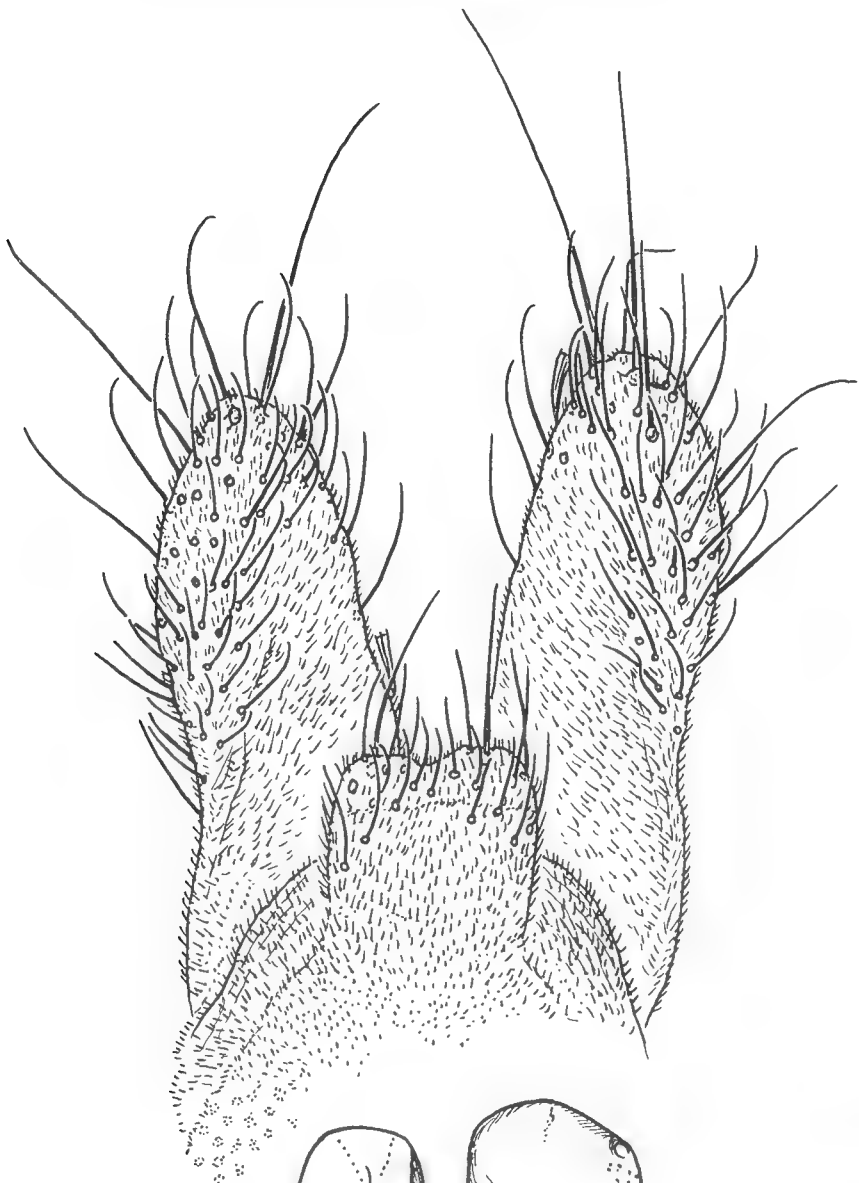
C



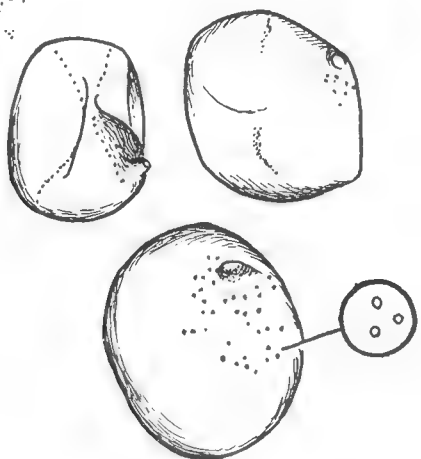
sternal view

postgenital plate

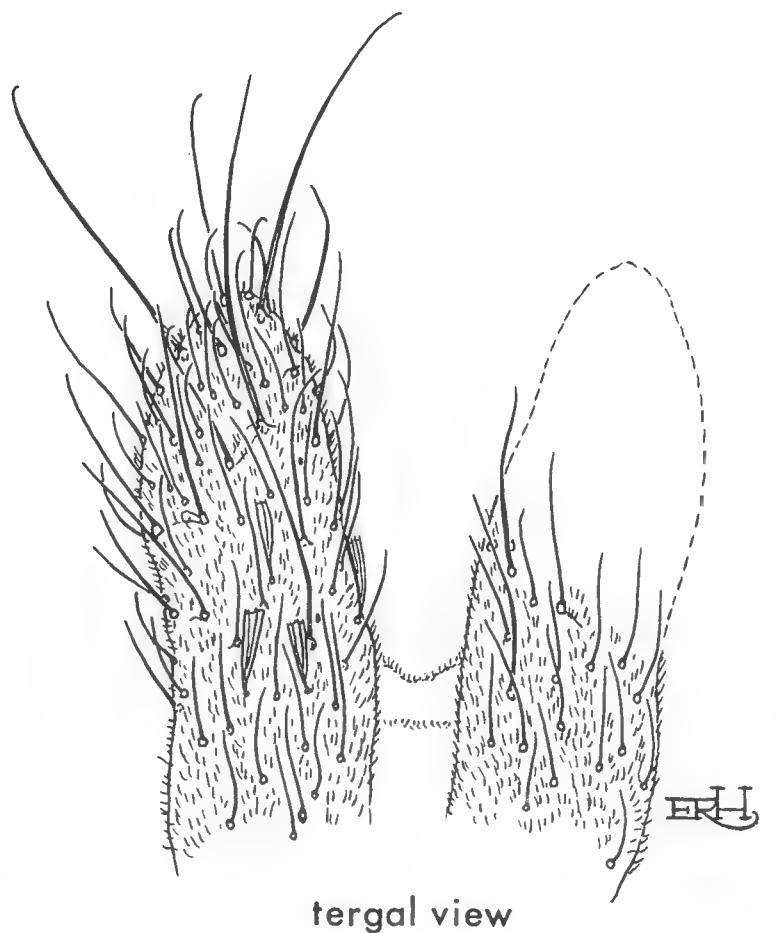
scatophagoides



A



aurantius



tergal view

Fig. 10

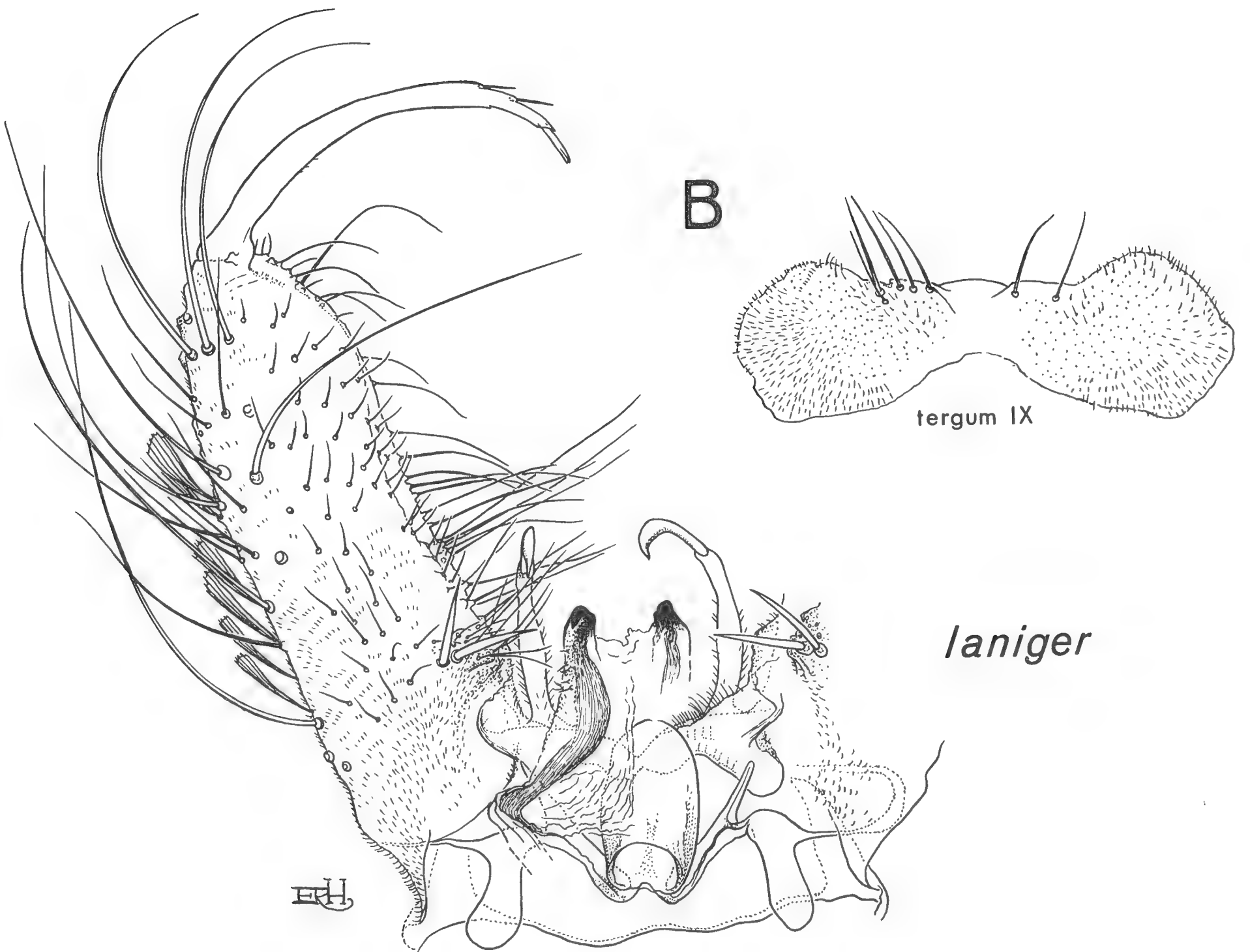
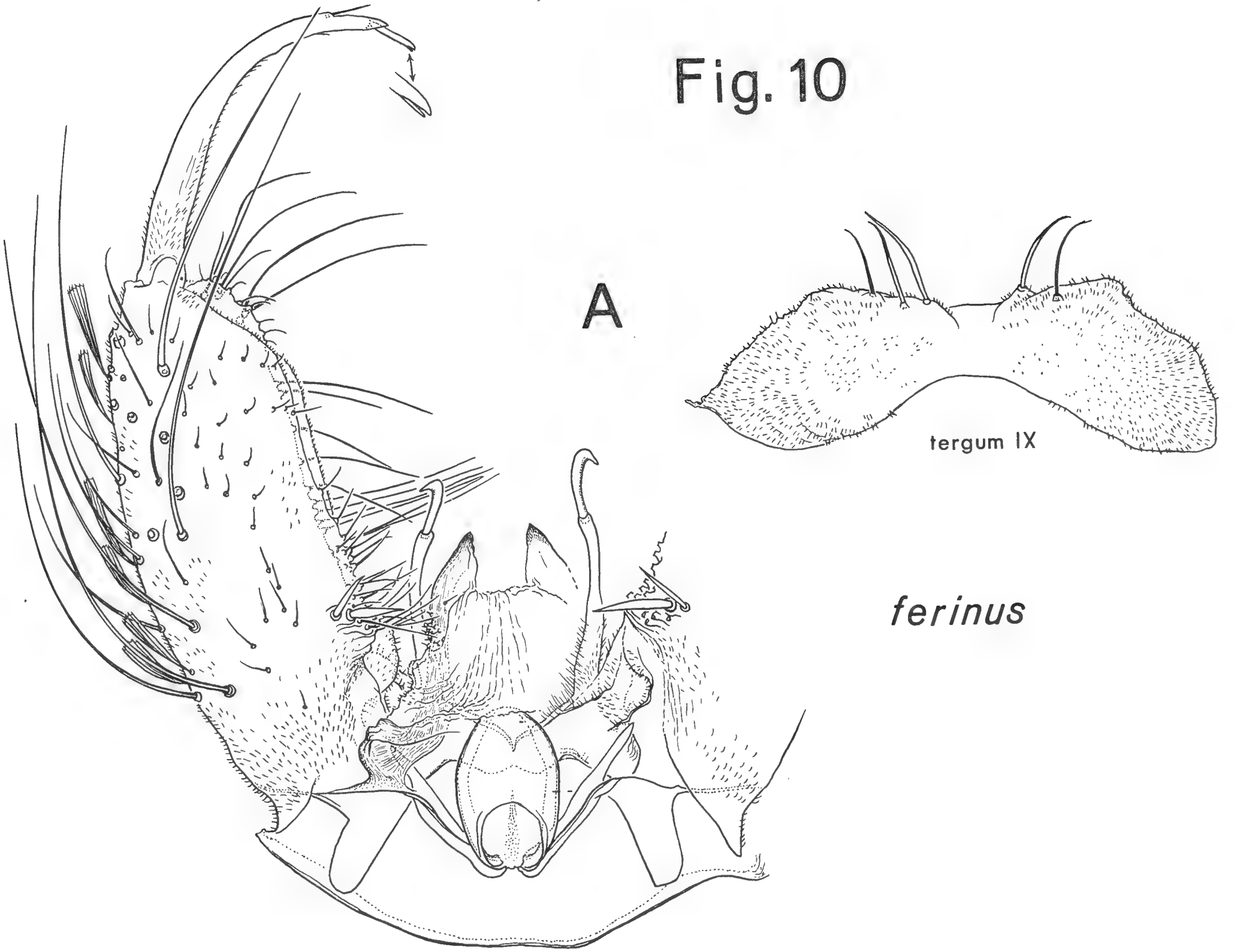


Fig. 11

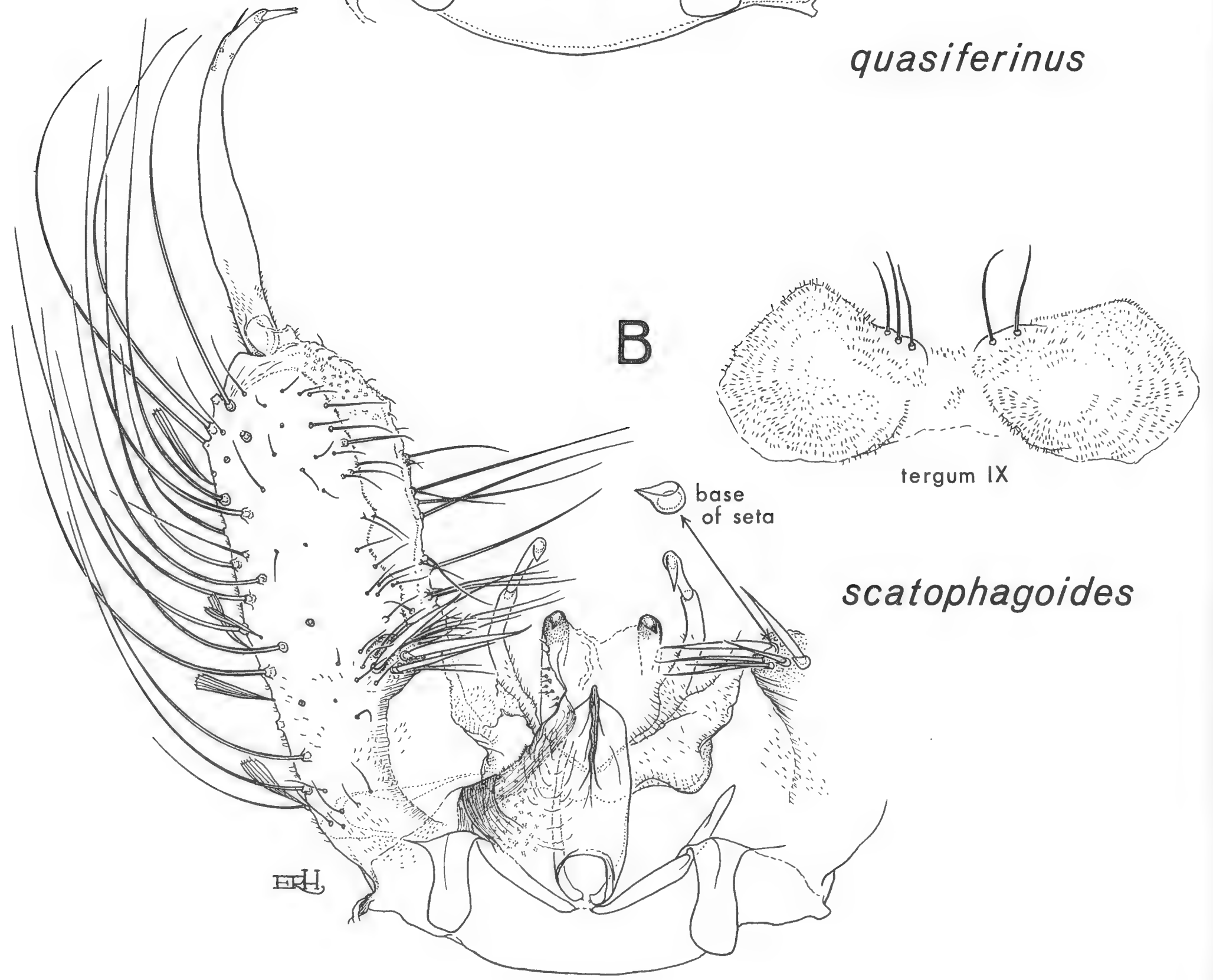
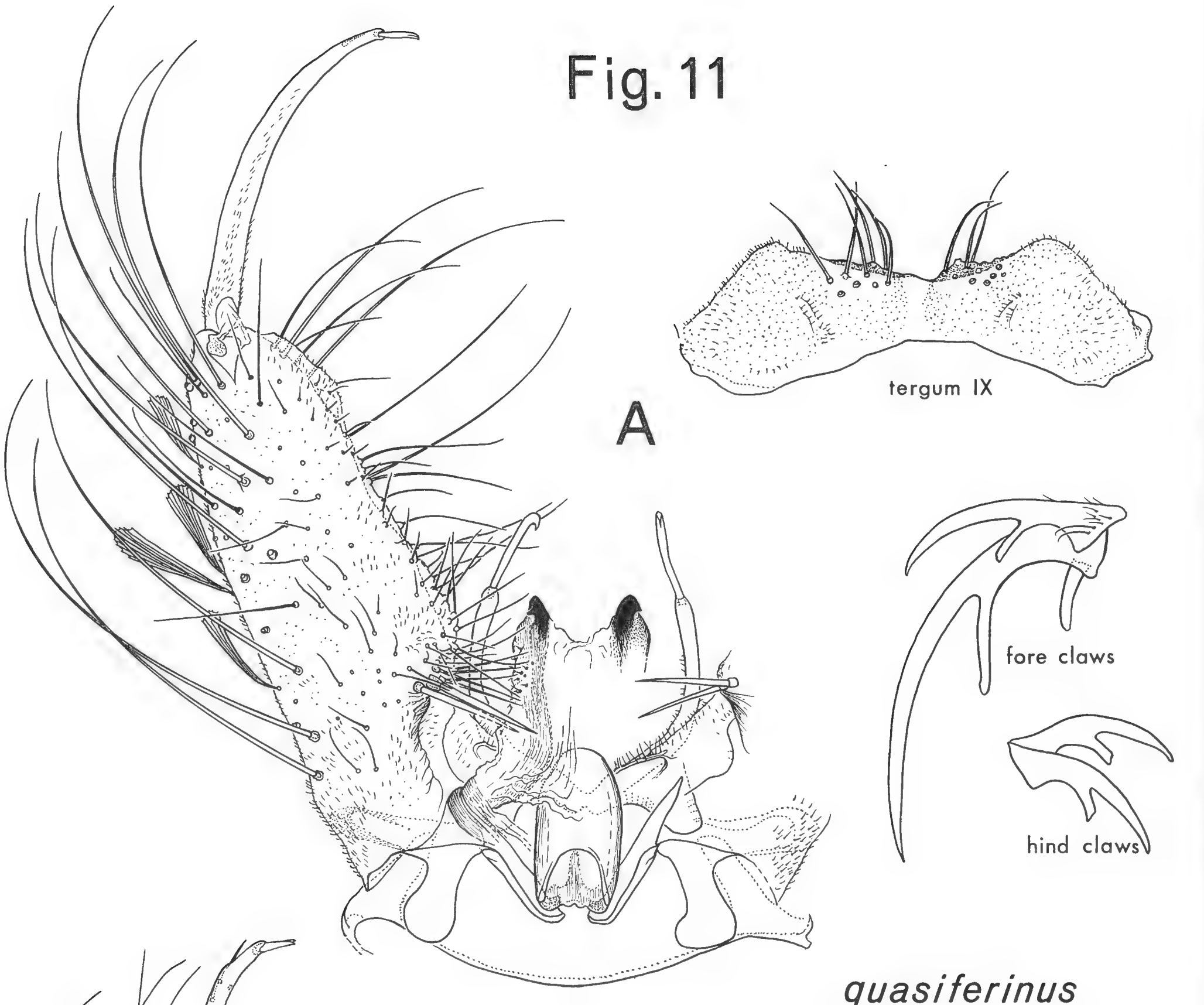
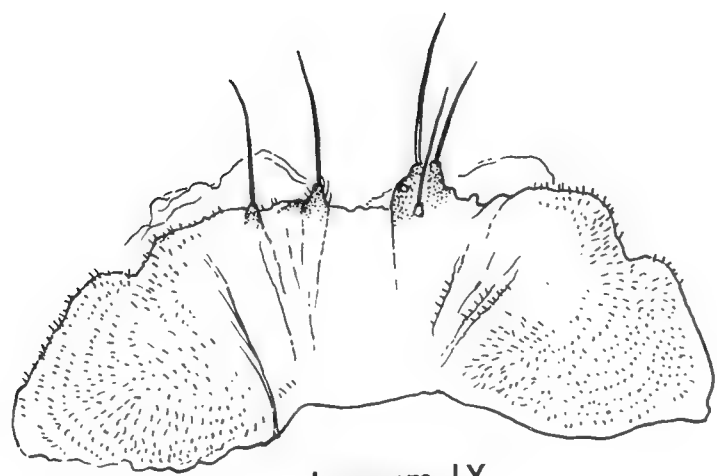
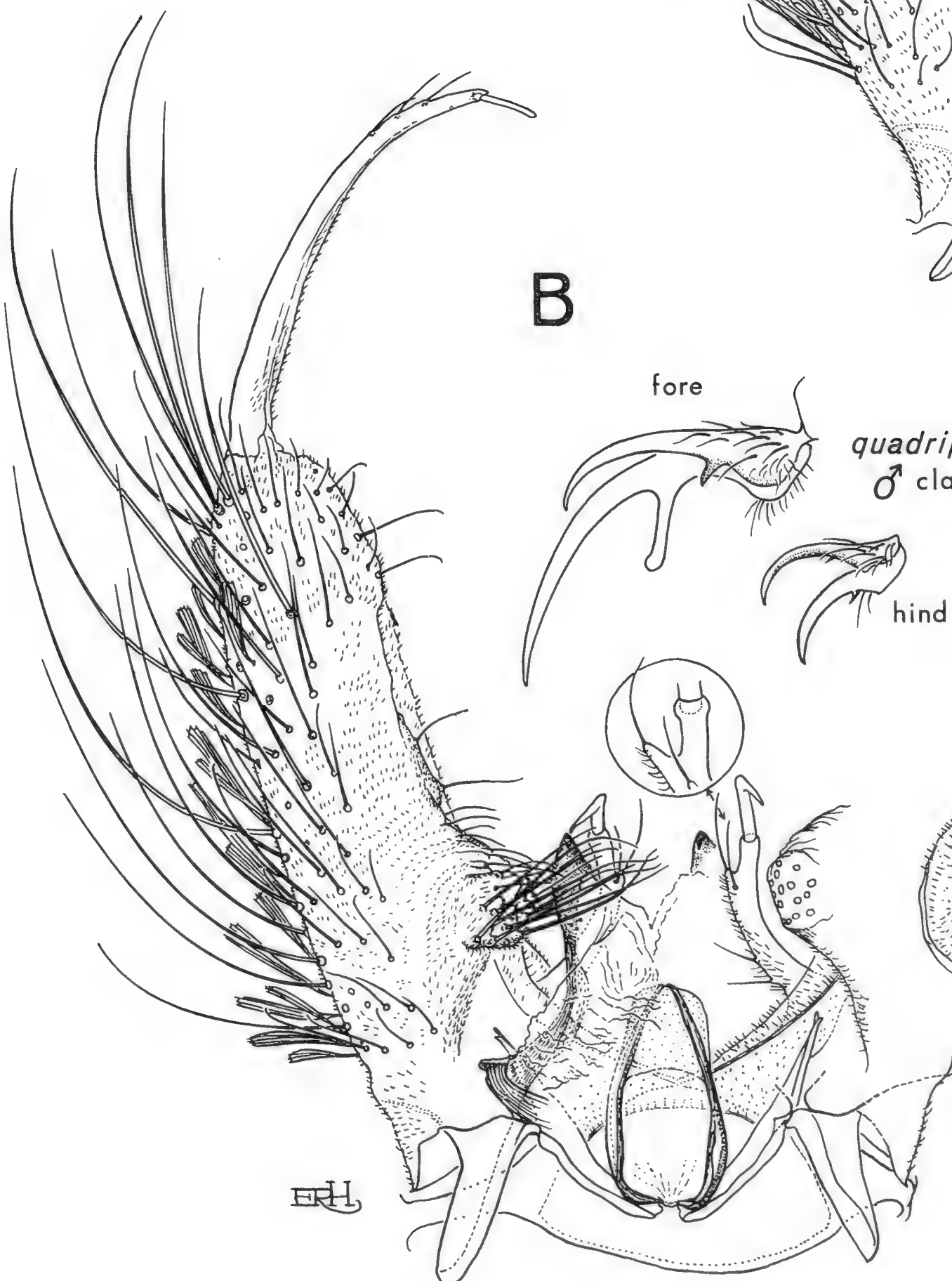
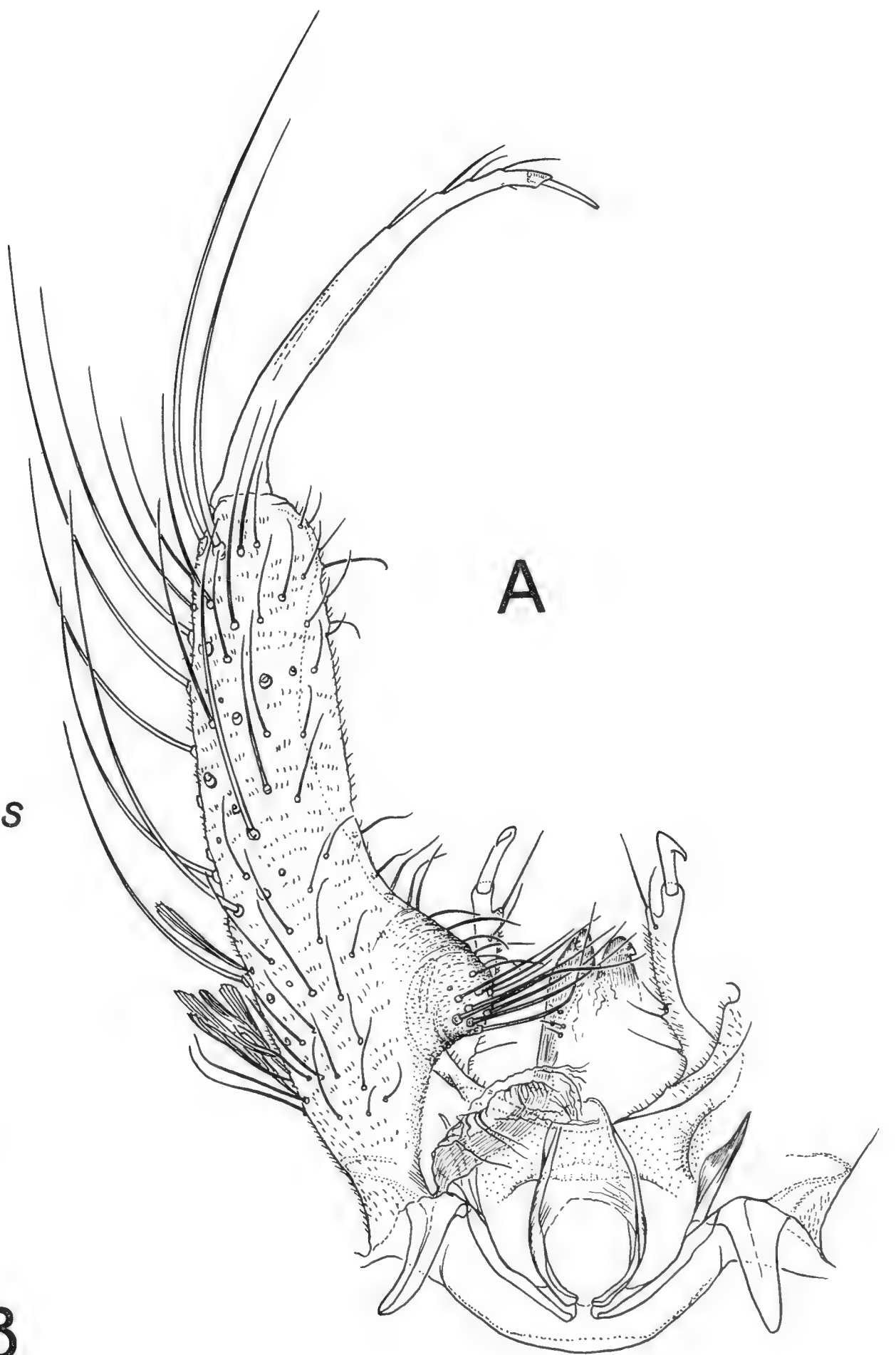


Fig. 12



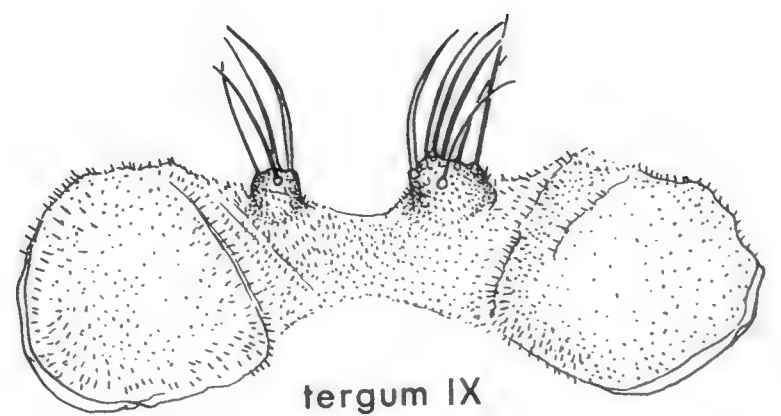
aurantius



fore

quadripunctis
♂ claws

hind



quadripunctis

EH

Fig. 13

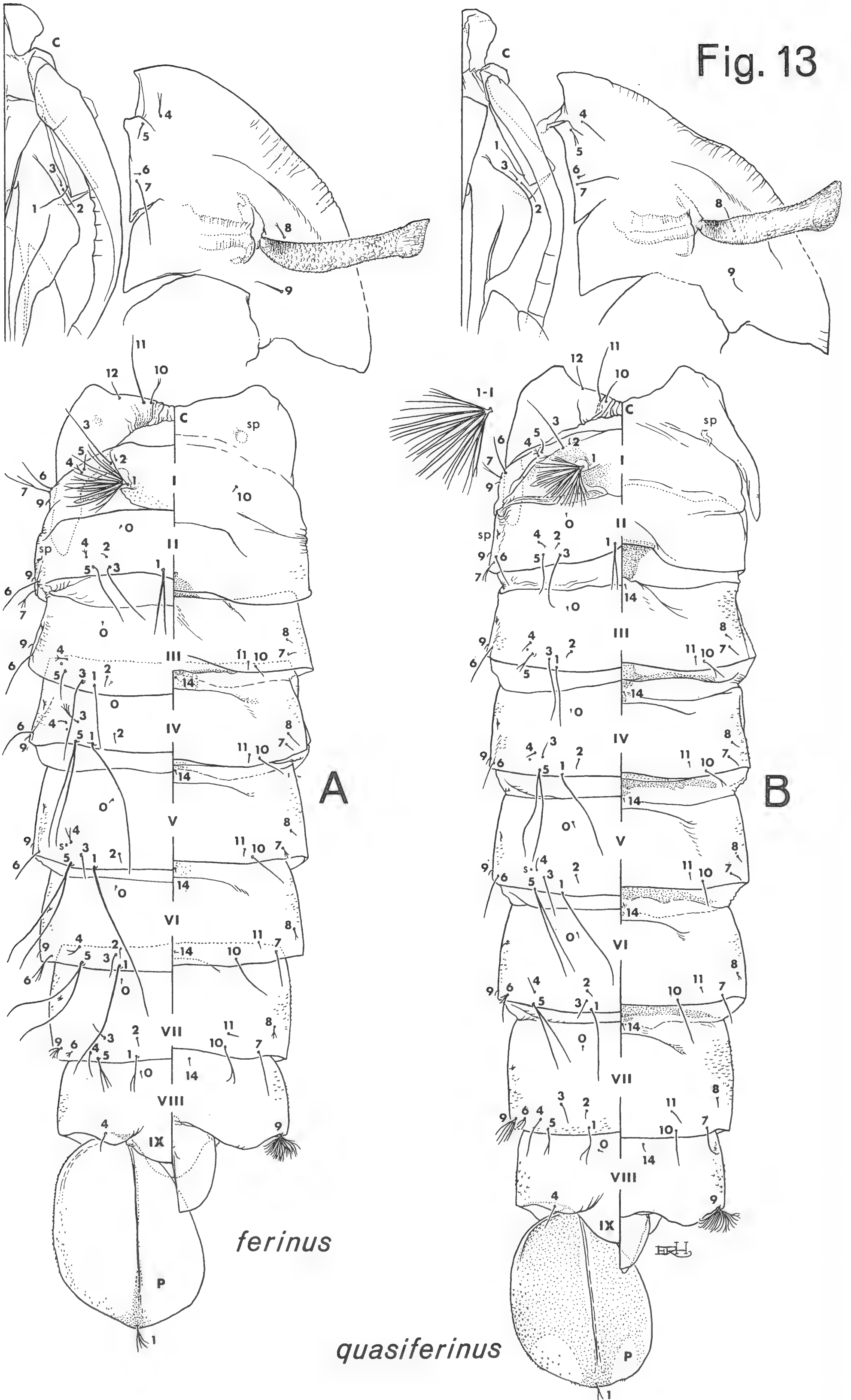


Fig. 14

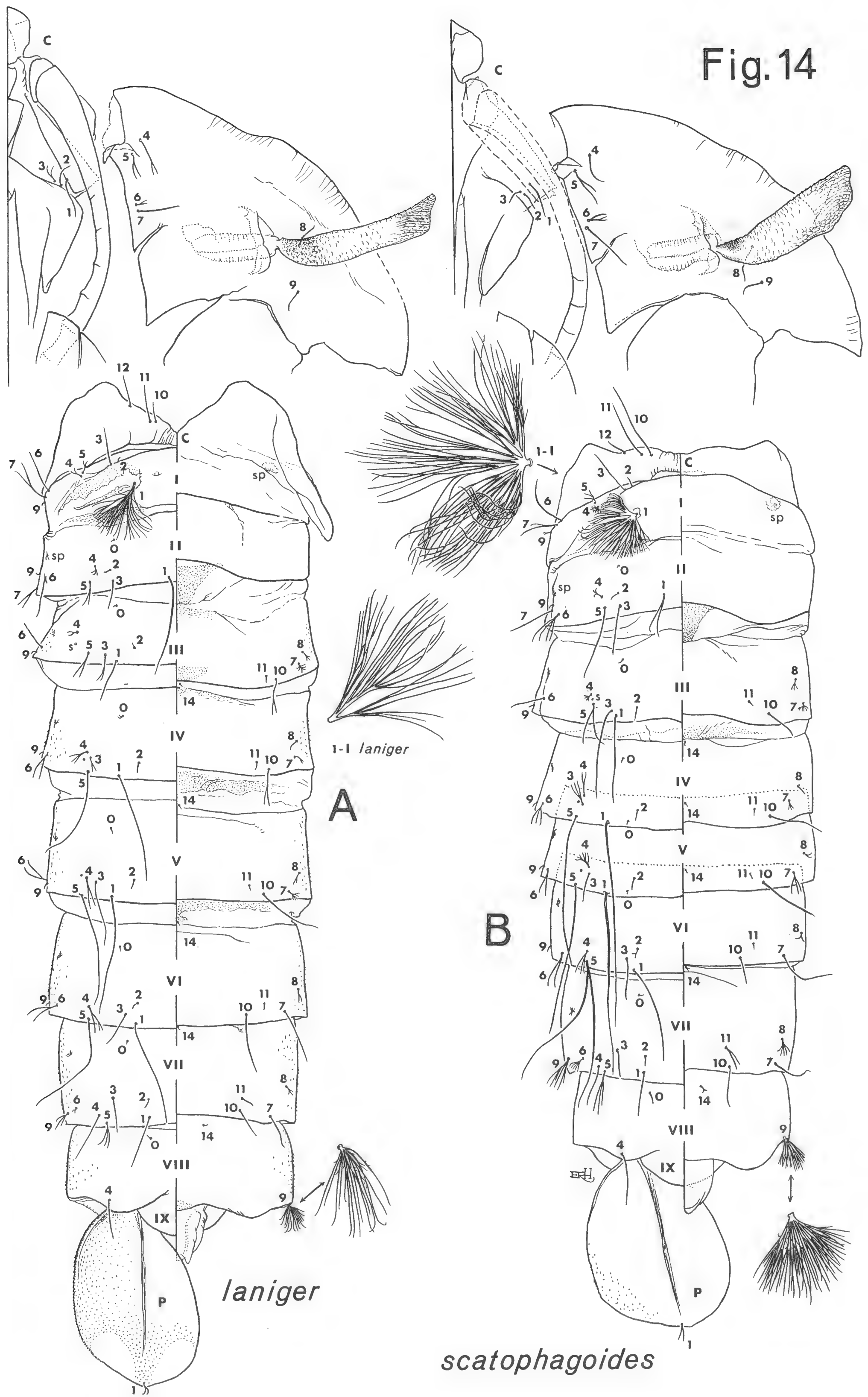


Fig. 15

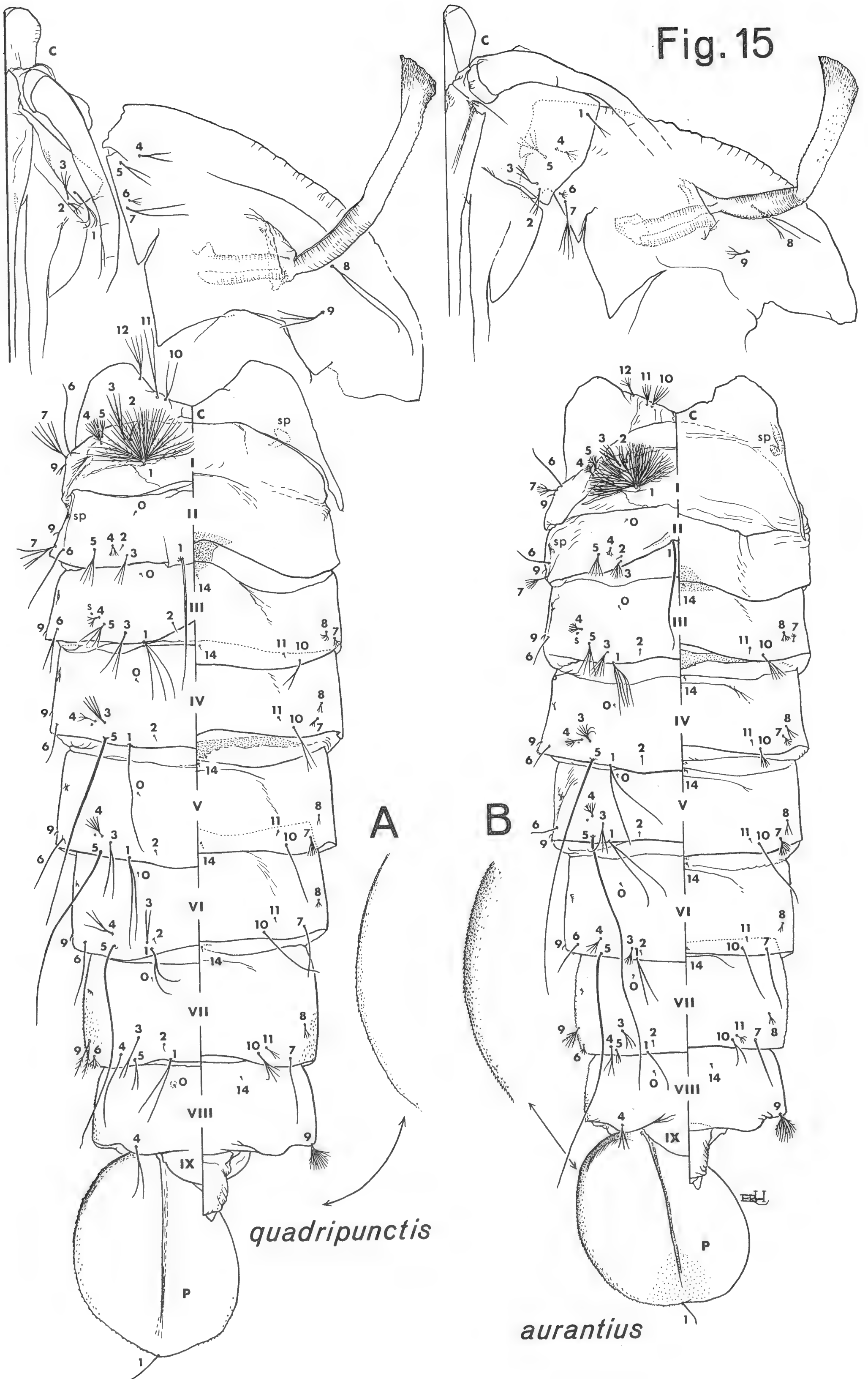


Fig. 16

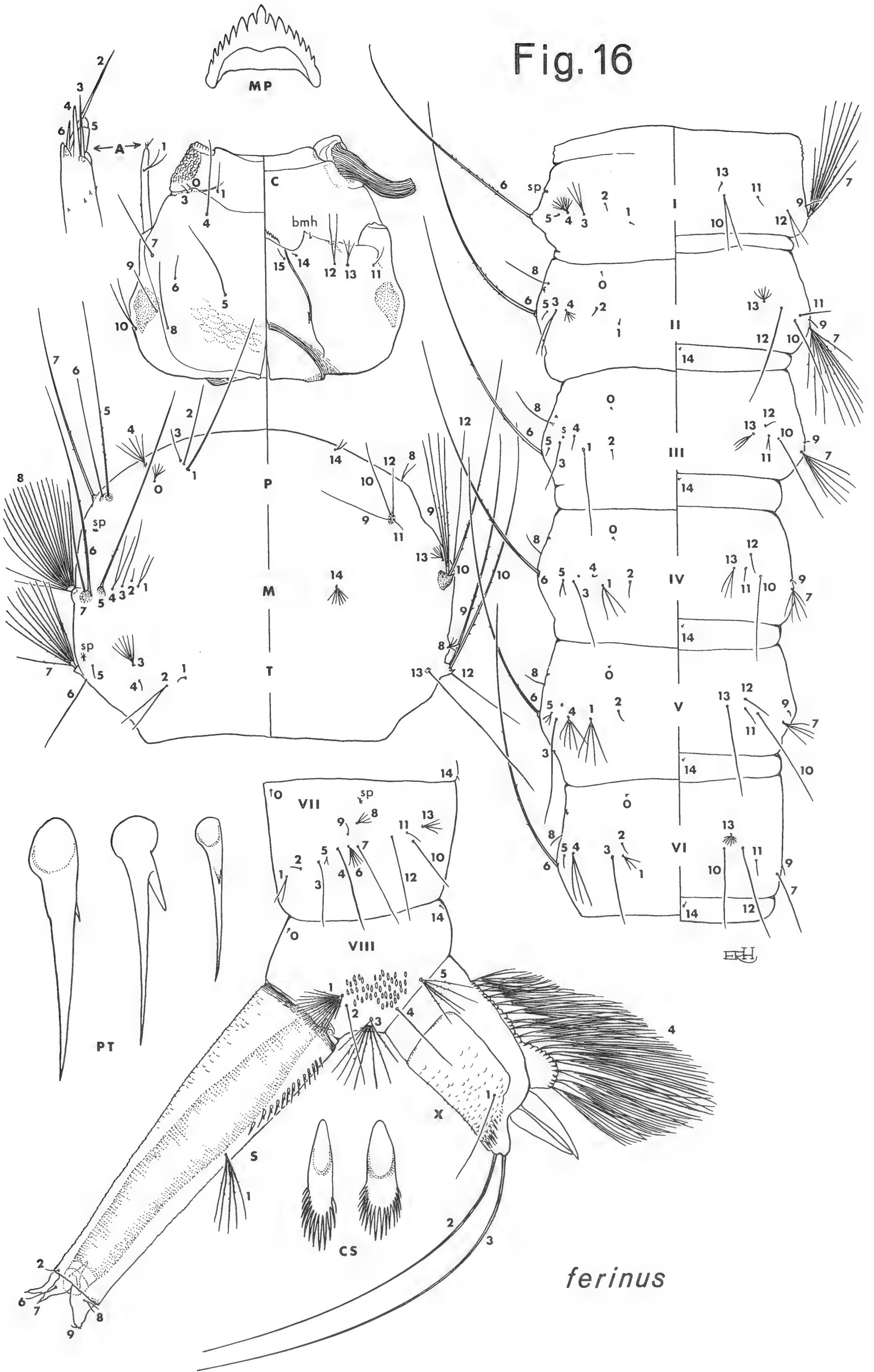


Fig. 17

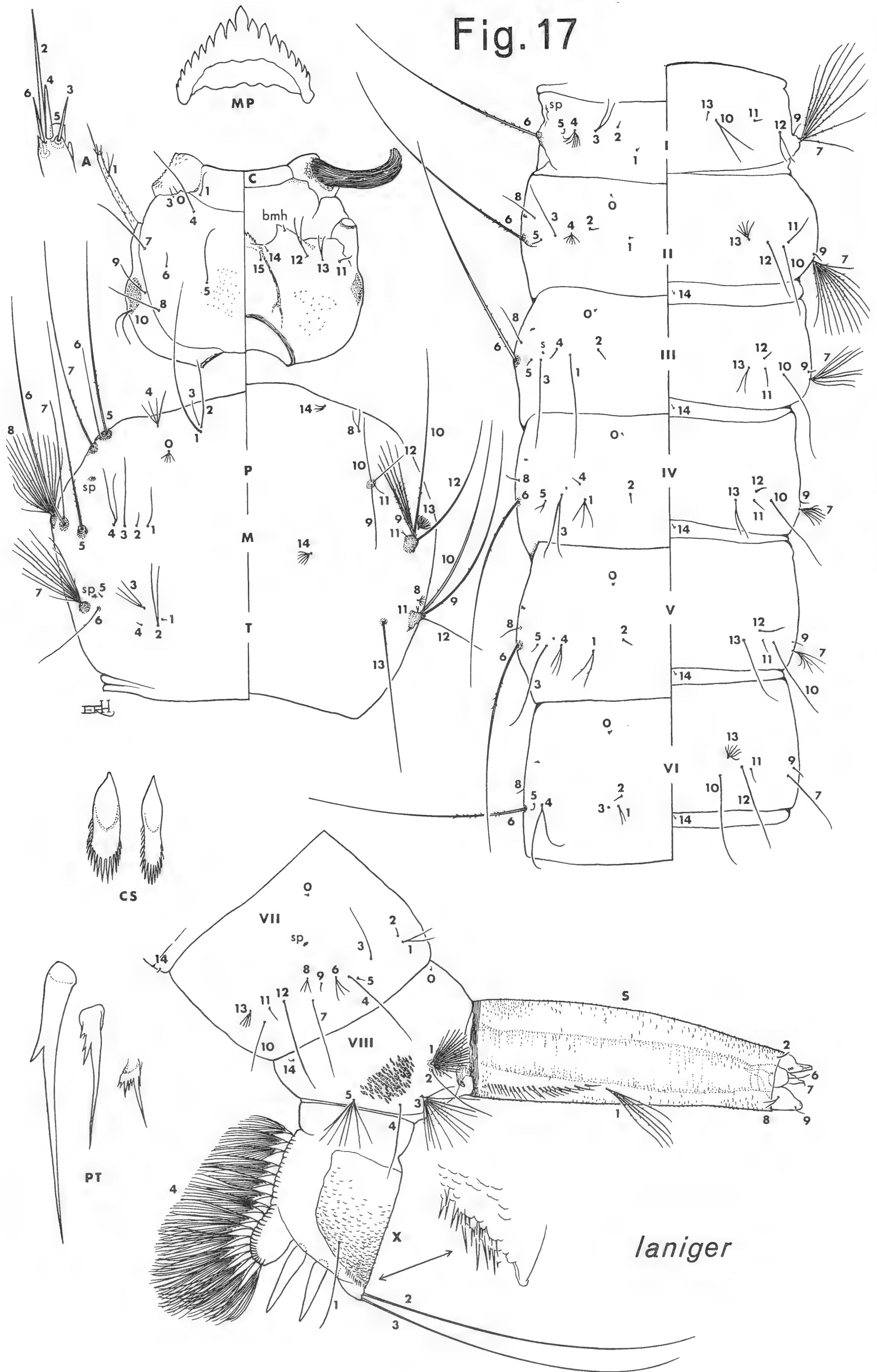
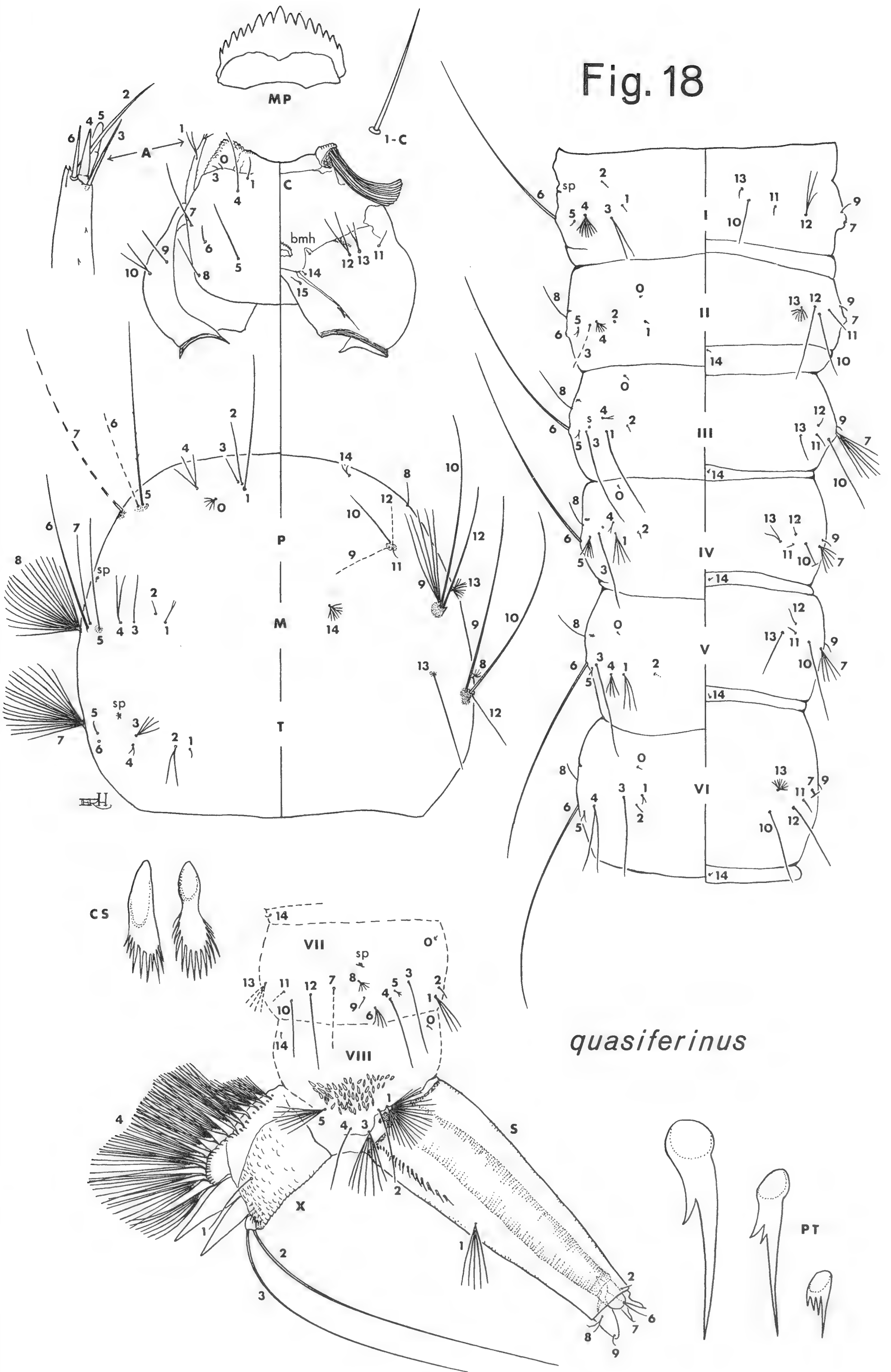
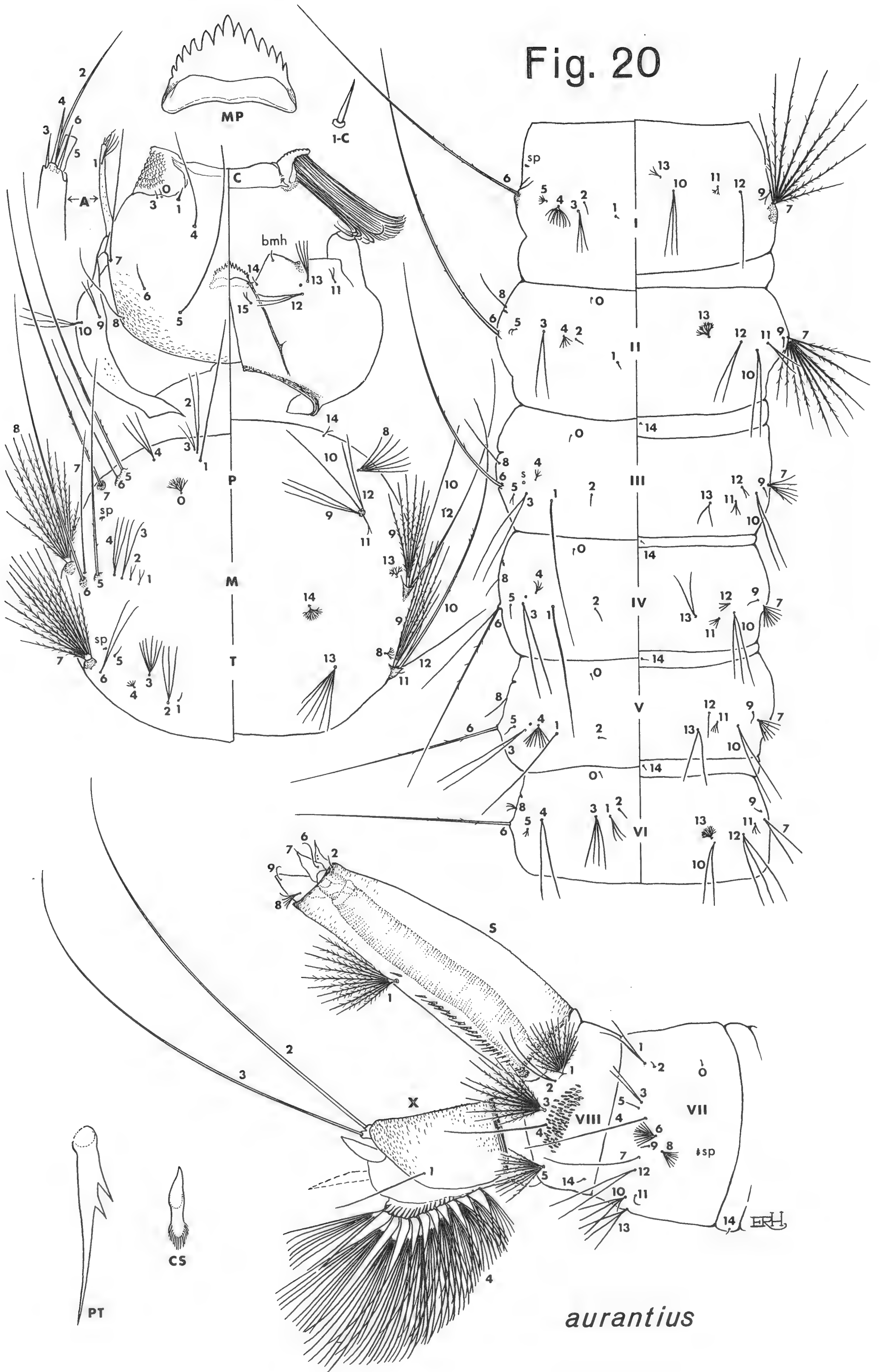


Fig. 18



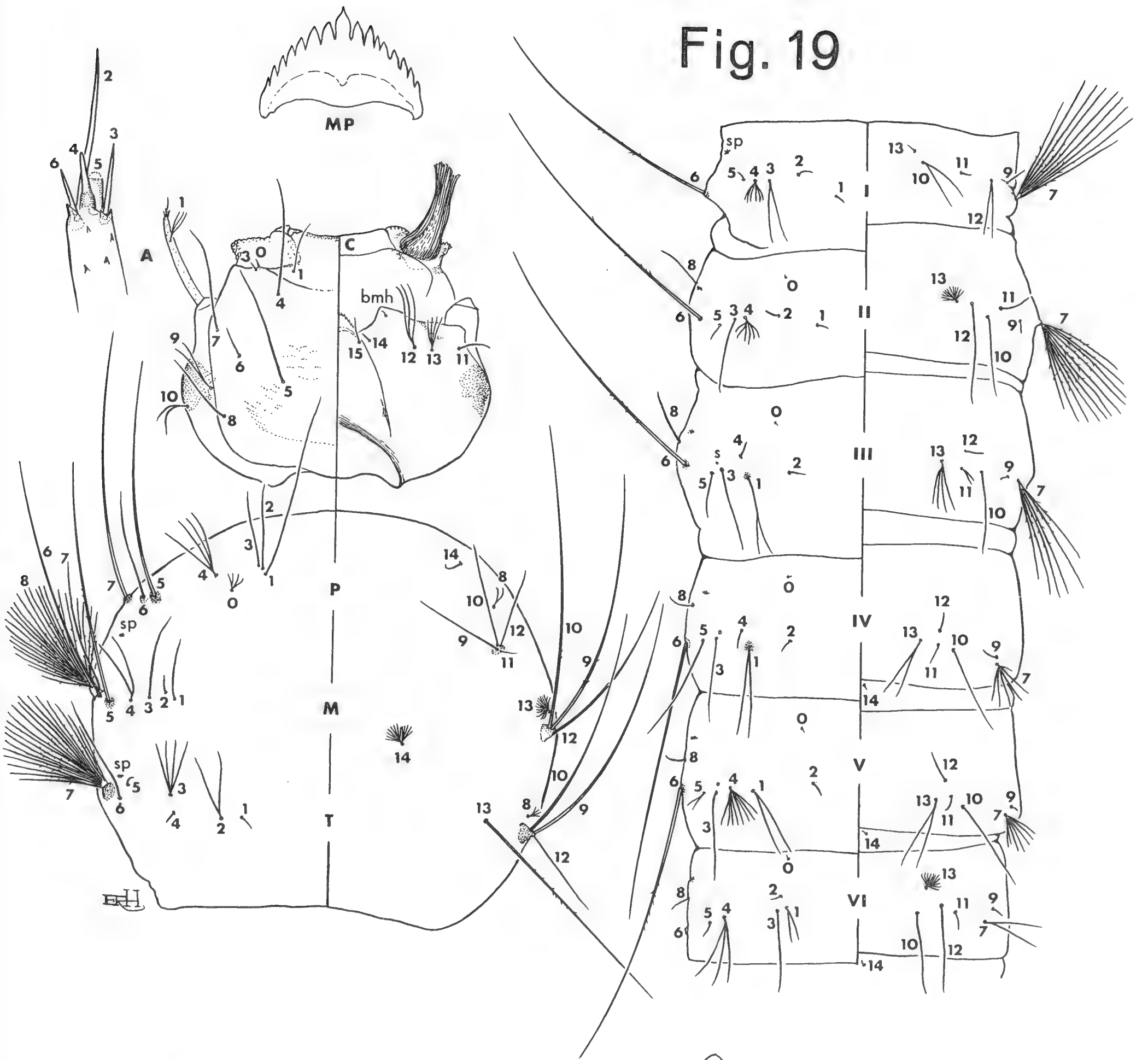
quasiferinus

Fig. 20



aurantius

Fig. 19



scatophagoides

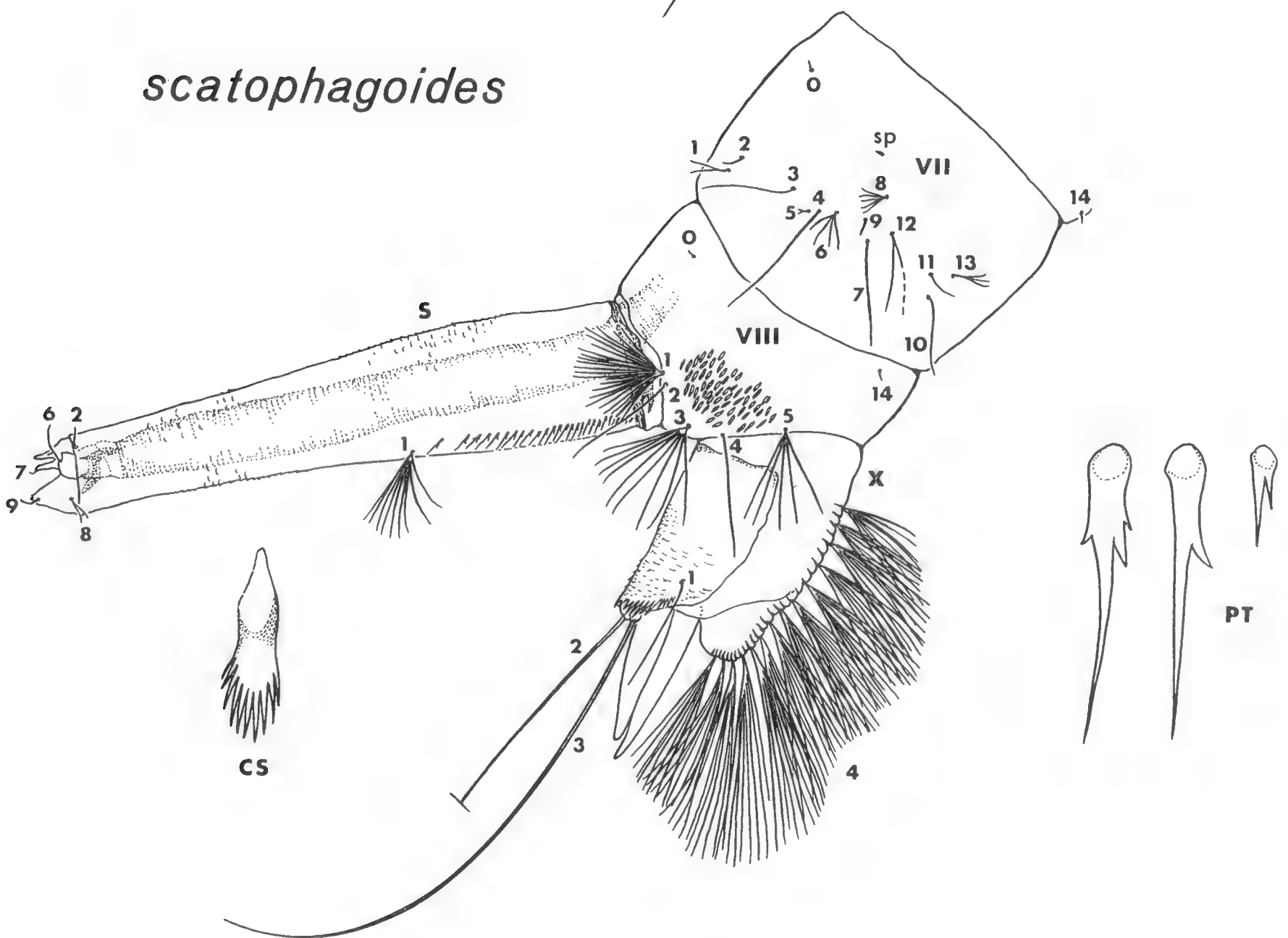
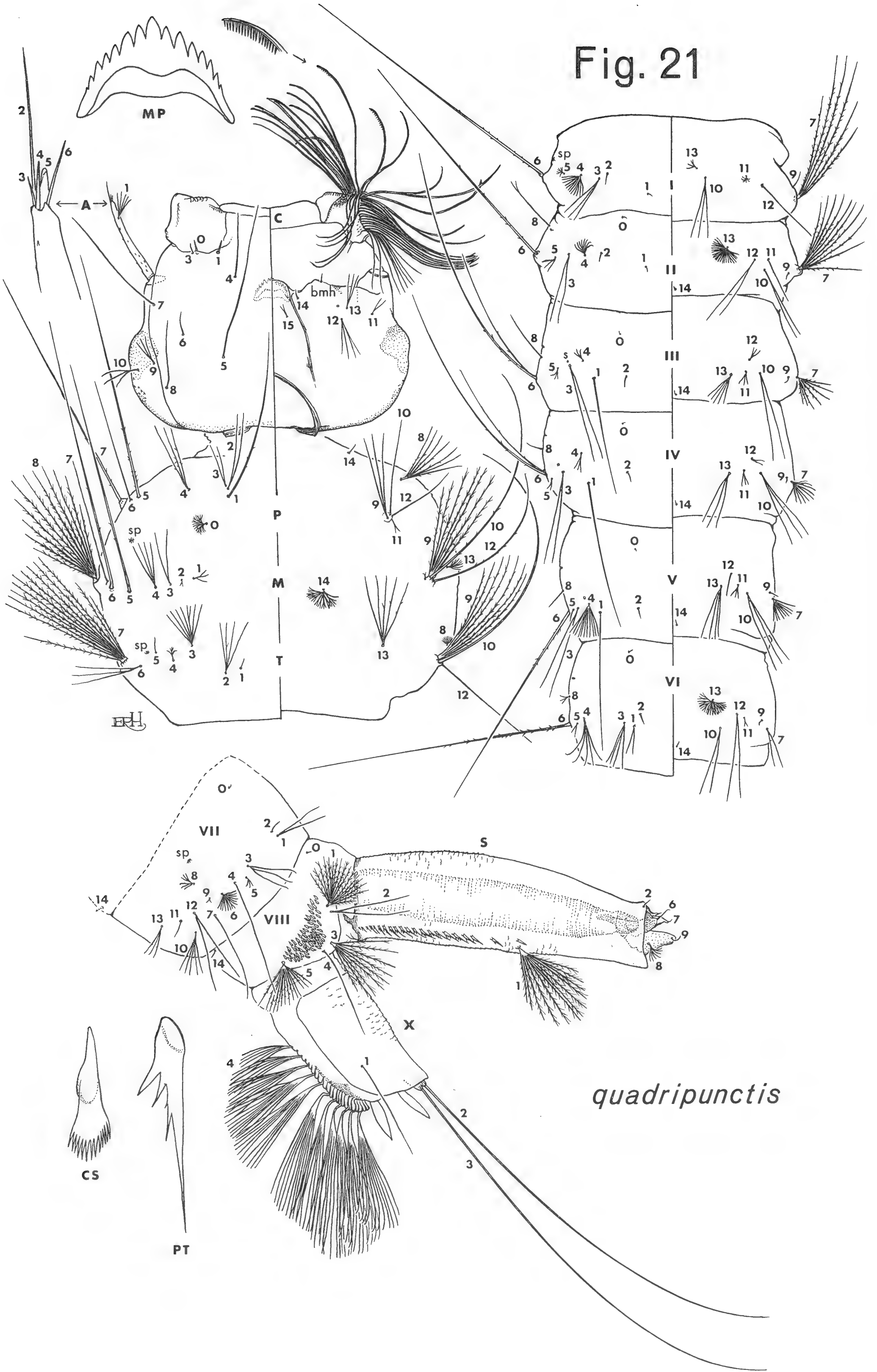


Fig. 21



INDEX

Valid names are printed in roman type, synonyms are italicized. Italicized page numbers are those which begin the primary treatment of that species. Numbers in parentheses refer to the figures illustrating some portion of that species.

<i>Aedes</i>	29, 31, 33, 34, 37, 39, 41, 43, 46, 49, 52, 53, 54.
<i>alboscuteUellatus</i>	41, 43.
<i>alternans</i>	29, 31, 33, 34, 43, 45, (6, 7).
<i>annulirostris</i>	34.
<i>annulus</i>	43.
<i>Anopheles</i>	33, 34, 41, 43.
<i>argyrotarsis</i>	34.
<i>aurantia</i>	31, 46.
<i>aurantius</i>	29, 33, 34, 35, 36, 37, 46, 48, 49, 50, 57, (6, 7, 9A, 12A, 15B, 20).
<i>aureostriata</i>	29, 31, 46, 48.
<i>balabacensis</i>	41.
<i>caecus</i>	43.
<i>chrysogaster</i>	29, 33, 34, 35, 48.
<i>Culex</i>	29, 31, 34, 39, 41, 43, 46, 52.
<i>culicinus</i>	43.
<i>Ekrinomyia</i>	29, 31, 46.
<i>ferinus</i>	29, 33, 34, 36, 37, 39, 40, 41, 42, 43, 56, (1, 8A, 10A, 13A, 16).
<i>Ficalbia</i>	51.
<i>Finlaya</i>	53.
<i>fowleri</i>	33.
<i>funereus</i>	34.
<i>gambiae</i>	33.
<i>grahamii</i>	29, 33, 35, (6, 7).
<i>halifaxii</i>	34.
<i>hilli</i>	34.
<i>Hodgesia</i>	51.
<i>imprimens</i>	41.
<i>laniger</i>	29, 32, 33, 35, 36, 37, 39, 41, 42, 43, 46, 50, 56, (2, 8C, 10B, 14A, 17).
<i>lucianus</i>	29, 33, 35, (2).
<i>maculatus</i>	43.
<i>mediolineatus</i>	43.
<i>Mimomyia</i>	51.
<i>Mucidus</i>	29, 31, 33, 34, 39, 45, 46, 49, 51, 52, 53, 54.
<i>mucidus</i>	29, 33, 35, (5).
<i>Mucidus Group</i>	29, 30, 31, 32, 33, 34, 36, 37, 39, 40, 41, 42, 44, 45, 47, 56.
<i>Neomelaniconion</i>	53.
<i>nigerrimus</i>	29, 33, 35, 40.
<i>Ochlerotatus</i>	53.
<i>painei</i>	29, 33, 34, 35, 48, 50, (7).
<i>Pardomyia</i>	29, 31, 46, 49.
<i>Pardomyia Group</i>	29, 30, 31, 32, 33, 34, 35, 36, 46, 47, 48, 57.
<i>pollicaris</i>	41.
<i>pullus</i>	34.
<i>punctulatus</i>	34.

quadripunctis	29, 33, 35, 36, 37, 48, 49, 50, 57, (4, 9B, 12B, 15A, 21).
quasiferinus	29, 33, 34, 36, 37, 39, 40, 41, 43, 45, 56, (6, 7, 8B, 11A, 13B, 18).
Rachionotomyia	51.
<i>scataphagoides</i>	43.
scatophagoides	29, 31, 32, 33, 34, 36, 40, 41, 43, 45, 46, 51, 56, (3, 9C, 11B, 14B, 19).
sitiens	34.
sudanensis	29, 33, 34, 45, 46.
tonkingi	29, 31, 32, 33, 35.
umbrosus	34.
Uranotaenia	34.
vexans	34.
vigilax	34.

(Continued from inside front cover)

Parts of Volume 4, with prices

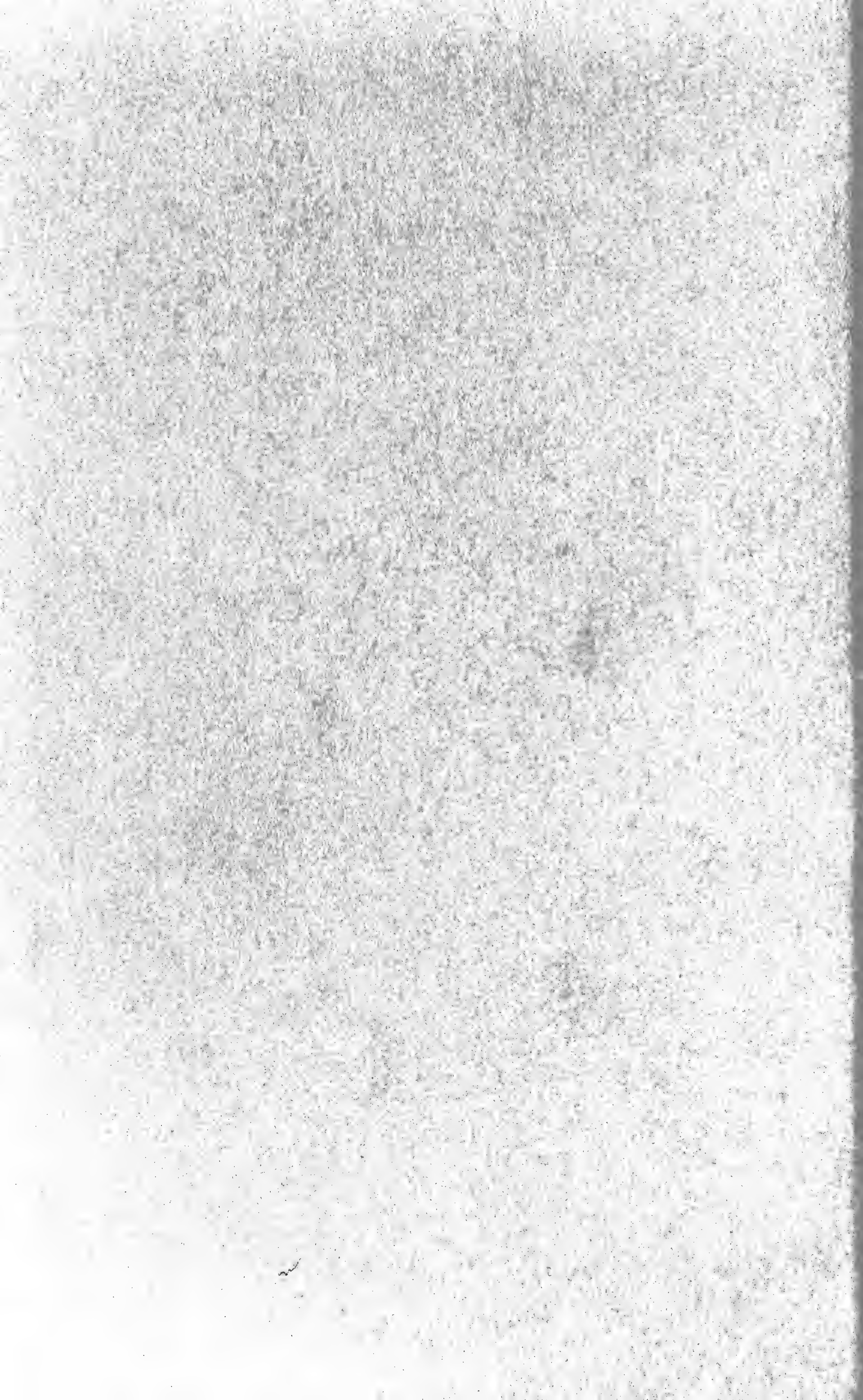
- No. 1. Mosquito studies (Diptera, Culicidae), 1968.
X. Peters, T. Michael. Dixinae originally described from North America. 7 pages.
XI. Belkin, John N., Robert X. Schick, and Sandra J. Heinemann. Mosquitoes originally described from Argentina, Bolivia, Chile, Paraguay, Peru, and Uruguay. 29 pages. Price: \$1.25, postpaid.
- No. 2. Mosquito studies (Diptera, Culicidae), 1969.
XII. Berlin, O. G. W. A revision of the Neotropical subgenus Howardina of Aedes.
- No. 3. Carlson, Robert W. and Fred B. Knight, 1969.
Biology, taxonomy, and evolution of four sympatric Agrilus beetles (Coleoptera: Buprestidae). 104 pages, 47 figures. Price: \$3.25, postpaid.
- No. 4. Mosquito studies (Diptera, Culicidae), 1969.
XIII. Barr, Ralph A. and Sylvia Barr. Pupae of the genus Psorophora in America north of Mexico. 19 pages, 11 figures.
XIV. Berlin, O. G. W. Redescription of Toxorhynchites (T.) gigantulus from the Philippines. 7 pages, 2 figures.
XV. Zavortink, Thomas J. A new species of treehole breeding Anopheles from the southwestern United States. 12 pages, 4 figures. Price: \$1.25, postpaid.
- No. 5. Matthews, Robert W., 1970. A revision of the genus Spathius in America north of Mexico (Hymenoptera, Braconidae). 86 pages, 31 figures. Price: \$3.50, postpaid. postpaid.

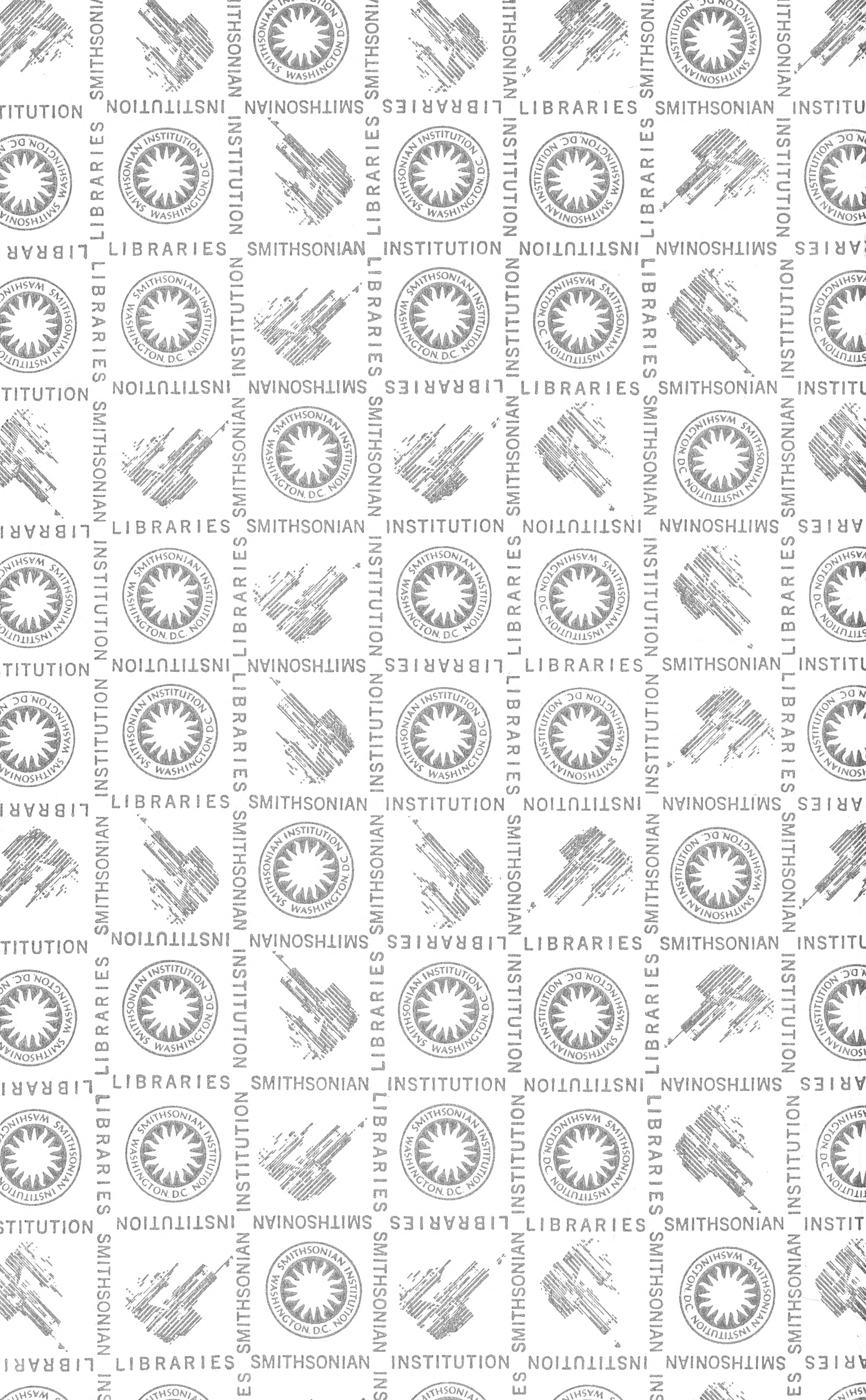
Parts of Volume 5, with prices

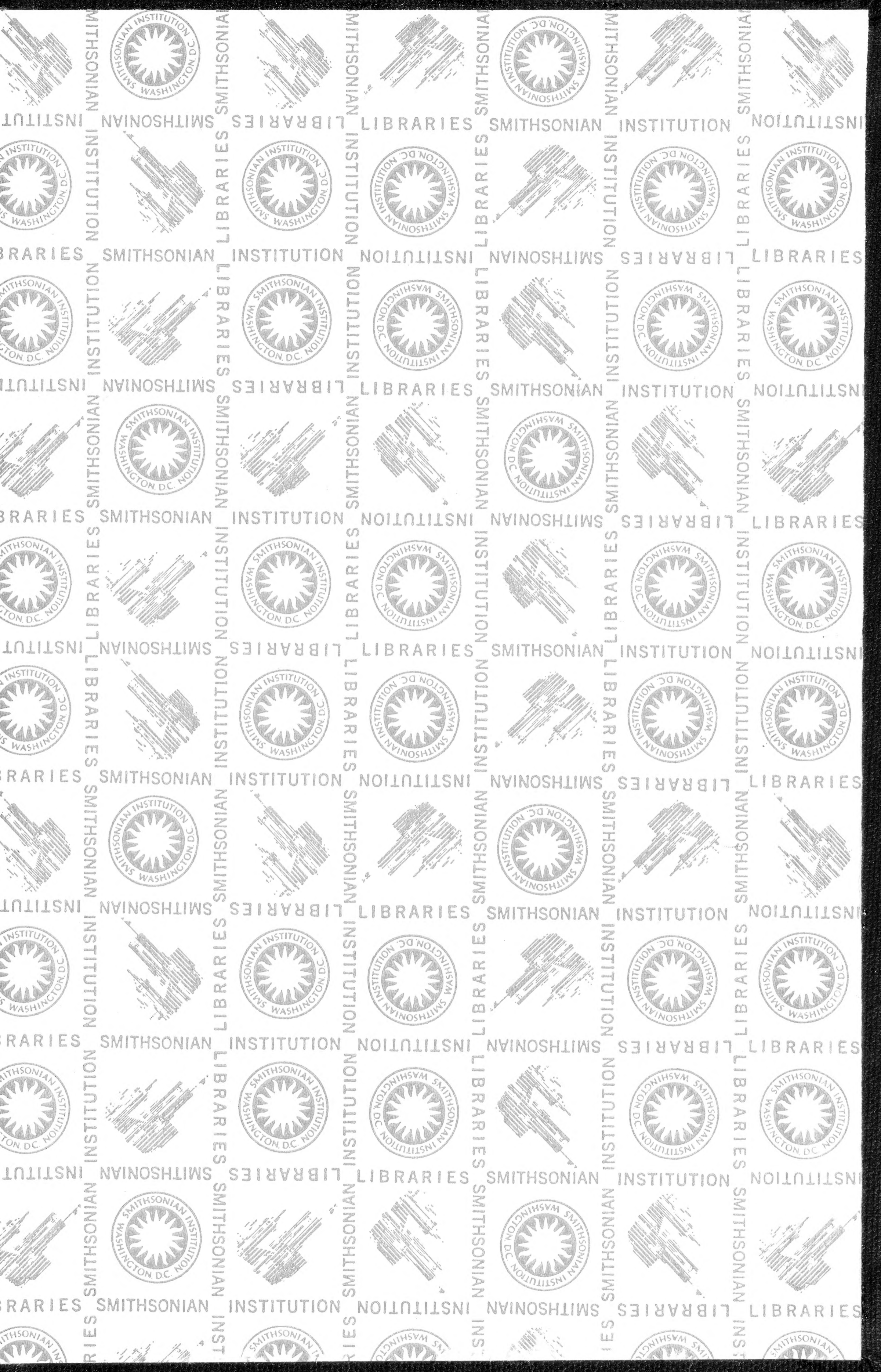
- No. 1. Mosquito studies (Diptera, Culicidae), 1970.
XVI. Zavortink, Thomas J. A new species of treehole breeding Aedes (Ochlerotatus) from southern California. 6 pages, 2 figures.
XVII. Adames, Abdiel J. and Charles L. Hogue. Two new species of Deinocerites from Costa Rica. 6 pages, 6 figures.
XVIII. Berlin, O. G. W. The subgenus Micraedes of Culex. 30 pages, 12 figures, 1 map. Price: \$2.00, postpaid.
- No. 2. Mosquito studies (Diptera, Culicidae), 1970.
XIX. Zavortink, Thomas J. The treehole Anopheles of the New World. 35 pages, 12 figures. Price: \$1.25, postpaid.
- No. 3. Mosquito studies (Diptera, Culicidae), 1970.
XX. Schick, Robert X. The Terrens Group of Aedes (Finlaya). 158 pages, 60 figures. Price: \$5.00, postpaid.
- No. 4. Contributions to the mosquito fauna of southeast Asia, 1970.
V. Reinert, John F. Genus Aedes, subgenus Diceromyia Theobald in southeast Asia. 43 pages, 15 figures. Price: \$1.50, postpaid.
- No. 5. Howden, Anne T. The Tanymericini of the West Indies (Coleoptera: Curculionidae). 74 pages, 76 figures. Price: \$2.75, postpaid.
- No. 6. Kethley, John B., 1970. A revision of the family Syringophilidae (Prostigmata: Acarina). 76 pages, 38 figures. Price: \$2.75, postpaid.
- No. 7. Contributions to the mosquito fauna of southeast Asia, 1970.
VI. Mattingly, P. F. The genus Heinzmannia Ludlow in southeast Asia. 104 pages, 51 figures. Price: \$4.00, postpaid.

Parts of Volume 6, with prices

- No. 1. Mosquito studies (Diptera, Culicidae), 1970.
XXI. Belkin, John N., Sandra J. Heinemann, and William A. Page. The Culicidae of Jamaica. 458 pages, 126 figures. Price: \$15.00, postpaid.
- No. 2. Contributions to the mosquito fauna of southeast Asia, 1970.
VII. Tyson, W. H. Genus Aedeomyia Theobald in southeast Asia. 27 pages, 6 figures.
VIII. Tyson, W. H. Genus Aedes, subgenus Mucidus Theobald in southeast Asia. 54 pages, 21 figures. Price: \$3.50, postpaid.







SMITHSONIAN INSTITUTION LIBRARIES



3 9088 00905 6599