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STUDIES OF PHLEBOTOMINE SAND FLIES.(U)
MAY 76 D G YOUNG DADA17-72-C-2139

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STUDIES OF PHLEBOTOMINE SAND FLIES

ANNUAL REPORT

By

D. G. YOUNG

31 May 1976

Supported by

U. S. ARMY MEDICAL RESEARCH & DEVELOPMENT COMMAND
WASHINGTON, D. C. 20314

CONTRACT DADA-17-72-C-2139

DEPARTMENT OF ENTOMOLOGY & NEMATOLOGY
UNIVERSITY OF FLORIDA
Gainesville, Florida 32611

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ABSTRACT

1. Preparing Institution: University of Florida

2. Title of Report: Studies of phlebotomine sand flies

3. Principal Investigator: D. G. Young, Associate in Entomology

4. No. of pages and date: 155, 3 May 1976

5. Contract no. DADA 17-72-C-2139

6. Supported by: Dept. of the Army, Washington, D.C. 20314

The reference collection of Phlebotominae continued to grow. Seventy-five percent of the New World species are represented; thus making it the most complete collection in existence. A review of the subgenus Evandromyia of Lutzomyia was completed. Another paper dealing with phlebotominae and parasites in one area of Mato Grosso, Brazil is now in press. A manuscript on sand fly classification on a world wide basis is near completion. Identification keys to the sand flies of Trinidad, Panama, the subgenus Psychodopygus, the subgenus Dampfomyia and the gasparviannai group were finished and are included in this report. Thirty-six phlebotomine species were collected in Ecuador. Twenty-five of these represent new records for the Republic. Several undescribed taxa were discovered. A sand fly colony (Lutzomyia vexator) is being maintained in Gainesville. Studies related to disease transmission, physiology and behavior can be undertaken with specimens from this colony. Work continued on the Colombian sand fly project. A final draft will be available before July 1, 1977.

7. Key words:

Phlebotomine sand fly	Trinidad
Identification keys	Panama
Lutzomyia	Evandromyia
Psychodopygus	Dampfomyia

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Progress Report
DADA 17-72-C-2139

Introduction

Following the format of the previous annual reports,[1,2] we are continuing to provide identification keys and brief references to the American sand flies. The treatment of the species in the subgenus Psychodopygus should be especially worthwhile since the identity of some species has been confusing in the past. Several members in this subgenus have been incriminated as vectors of dermal leishmaniasis.[3]

Objectives

Our objectives under this contract are as follows:

1. To prepare keys, illustrations and other aids to identification both by geographic areas and by taxonomic groups.
2. To arrive at a more satisfactory classification of the subfamily Phlebotominae.
3. To build an American reference collection.
4. To maintain a laboratory colony of at least one species of Lutzomyia sand fly.

Results

1. General

The sand fly, Lutzomyia vexator, is being maintained at low levels in our laboratory. Several investigators including Dr. P.C.C. Garnham and Dr. Susan McIver are interested in subcolonizing this species in order to have material for transmission or receptor studies.

The reference collection continued to grow due to gifts from Drs. Vianna Martins, J. Arias and others in Brazil. A few species, not previously represented in the collection, were captured in Ecuador during May, 1976. At present we have slide mounted specimens of 75% of the described New World species.

The draft of the paper on Panamanian phlebotomines is now in the

hands of Dr. Howard Christensen, formerly of the Gorgas Memorial Laboratory. The work, as mentioned earlier, was unexpectantly delayed due to the cancellation of a grant (NIH) from which Dr. Christensen received support. Hopefully, we will be able to complete the paper in 1977. A rough draft of the keys and some tables are enclosed to illustrate the type and degree of coverage (p.69).

Two other papers are now in press (see appendices I and II)and another, dealing with the classification of Phlebotominae on a world wide basis, should be completed by 30 March 1977. The authors are D.J. Lewis, D.G. Young, G.B. Fairchild and D.M. Minter.

The field trip to Ecuador was quite productive. Thirty-six phlebotomine species were collected from two localities--one near the Rio Napo, east of the Andes; the other in a forest near the Pacific coast. Twenty-five of the species represent new records for the Republic. Several undescribed species were taken (see p.30) for a summary of the Ecuadorian Phlebotominae).

Work continued on the sand fly fauna of Colombia. The paper which deals with over 100 species is the doctoral dissertation of the principal investigator. Illustrated keys to the Phlebotomines of Trinidad were completed. The first draft of this begins on p.3 . Other keys to some subgenera or species groups of Lutzomyia are included in this report. As in previous reports, figures taken from other works are so indicated by a small reference number above the specific name in the figure legend. Original figures are unmarked.

The Phlebotomine Sand Flies of Trinidad

Introduction

The presence of sand flies on Trinidad was first noted by Knab in 1913.[4] He described Lutzomyia (= Phlebotomus) atroclavata from specimens collected on Gasparee Island. A second species, L. trinidadensis, was described by Newstead in 1922.[5] Theodor illustrated and briefly described a female of another species from Trinidad in 1932.[6] The identity of this species remains uncertain although it was probably L. lichyi, certainly not trinidadensis.

Callan in 1947 provided information on the man-biting habits of L. gomezi (as trinidadensis) from the Island.[7] L. marajoensis was added to the fauna in 1961 by Fairchild & Hertig.[8]

Ten species of Lutzomyia and one of Brumptomyia, collected at Bush Bush Forest, Nariva Swamp, were listed by Aitken et al., 1968.[9] L. tintinnabula, not L. amazonensis, was one of these species.

Leishmaniasis, caused by Leishmania mexicana, was first reported in rodents in Trinidad by Tikasingh in 1969.[10] Further studies by him revealed that L. flaviscutellata is the natural vector.[11] To date, no human cases have been documented but flaviscutellata is known to bite man on Trinidad.

During the past twenty years, Drs. T.H.G. Aitken, E. Tikasingh and their associates collected over 2000 sand flies using a variety of traps and baits. For the most part, these flies were identified by G.B. Fairchild and D.J. Lewis. A publication based on this work is now being prepared. The following key with original illustrations of Trinidadian specimens will be part of this paper.

Key To The Phlebotomine Sand Flies of Trinidad

1. Males.....2

   Females.....22

2. Style with 5 major spines*.....3

   Style with 3-4 major spines.....4

3. Interocular suture complete. Genitalia large (Fig. 1); coxite with a distinct tuft of setae implanted on a subcircular base and with a distal row of 4-5 strong setae; style with 2 proximal spines set on a common tubercle, a single median spine and 2 terminal spines..... .....*Brumptomyia leopoldoi* (Figs. 1,2)

   Interocular suture incomplete. Genitalia much smaller (Fig.3); coxite with scattered setae on inner median surface, distal strong setae absent; style with 2 proximal spines separated, a subterminal spine and 2 terminal spines.....*Lutzomyia trinidadensis* (Fig.3)

4. Style with 3 major spines.....5

   Style with 4 major spines.....6

5. Fifth palpal segment very short, less than length of third segment. Antennal ascoids on segments 3-10. Paramere complex with a slender ventral arm attached to a main lobe; coxite lacking persistant setae... .....*L. tintinnabula* (Fig.4)

   Fifth palpal segment longer than segments 2+3. Antennal ascoids on segments 3-14. Paramere simple; coxite with a distal patch of setae.. .....*L. pilosa* (Fig.5)

---

* A major spine is defined here as one that is longer than the width of the style.

6. Style with a small subterminal bristle.....7

Style without a subterminal bristle.....13

7. Paramere very broad, deeply concave dorsally, convex ventrally; coxite lacking a tuft of setae.....L. rangeliana (Figs.6,7)

Paramere otherwise; coxite with at least 1 tuft or patch of setae....8

8. Paramere with a dorsobasal arm bearing 2 modified setae; coxite with 2 fan-like setae at base.....L. lichyi (Fig. 8)

Paramere without a dorsobasal arm or modified setae; basal coxite tuft of simple setae.....9

9. Tips of genital filaments spherically enlarged, each with a distinct inner "tooth"; coxite with a basal tuft of 10+ setae and a median ventral group of 6+ setae.....10

Tips of genital filaments simple, not enlarged nor with an inner "tooth"; coxite with a basal tuft of 3-6 setae but without a median group....11

10. Dorsum of aedeagus with a sclerotized projection; genital filaments shorter than 0.30mm.....L. walkeri (Figs. 9,10)

Aedeagus simple, without a dorsal projection; genital filaments 0.30mm or longer.....L. marajoensis (Fig.11)

11. Hind femur with a row of 2-5 short spines. Genital filaments less than 3x length of the pump.....L. spinosa (Fig.12)

Hind femur without spines. Genital filaments greater than 3x length of the pump.....12

12. Cibarial arch well defined, complete. Setae of coxite tuft longer than width of coxite; dorsal setae of paramere restricted to distal third of the structure.....L. ovallesi (Fig.13)

Cibarial arch absent. Setae of coxite tuft shorter than width of coxite; dorsal setae of paramere covering most of the structure.....
.....L. migonei (Fig.14)

13. Coxite with a definite tuft or patch of 4+ long setae on inner surface.....14

Coxite without a setal tuft although short & scattered setae may be present (as in Figs. 24 & 25).....6

14. Fifth palpal segment shorter than the third. Coxite with a patch of 30+ setae.....L. antunesi (Fig. 15)

Fifth palpal segment longer than segments 3+4. Coxite with less than 30 setae.....15

15. Coxite tuft of 4 strong setae. Pleura moderately pigmented.....L. atroclavata (Fig. 16)

Coxite tuft of 10+ thin setae. Pleura pale.....L. gomezi (Fig. 17)

16. Antennal ascoids with very long posterior spurs.....L. shannoni (Fig. 18, 19)

Antennal ascoids simple or with very short spurs as in Fig. 26.....17

17. Fifth palpal segment equal to or longer than combined length of segments 1+2+3.....18

Fifth palpal segment shorter than combined length of segments 1+2+3...19

18. Cibarium with vestiges of horizontal teeth in comb-like row (similar to Fig. 36); head longer than wide from vertex to tip of clypeus. Wing broader (Fig. 21).....L. cayennensis (Figs. 20, 21)

Cibarium with horizontal teeth appearing as small dots, not in a comb-like row. Head as long as wide. Wing slender (Fig. 23) ... .L. micropyga (Figs. 22, 23)

19. Paramere with a dorsobasal hump; inner surface of coxite with 10+ short scattered setae. Genitalia relatively large (Figs. 24, 25). Newstead's scales (=sensory rods) on palpal segments 2 & 3.....20

Paramere without a dorsobasal hump; inner surface of coxite without such setae. Genitalia smaller (Figs. 27, 28). Newstead's scales restricted to palpal segment 3.....21

20. Tip of genital filament twisted like a corkscrew; paramere & aedeagus broad as shown.....L. aragaoi (Fig. 24)

Tip of genital filament straight & pointed; paramere & aedeagus more slender.....L. barrettoi (Figs. 25, 26)

21. Basal spine of style somewhat isolated. Antennal segment 3 long, equal to or greater than head height from vertex to tip of clypeus. Mesonotum faintly to moderately pigmented.....L. nordestina (Fig. 27)

Basal spines of style paired, i.e. inserted at the same level. Antennal segment 3 shorter than head height. Mesonotum strongly pigmented.....L. flaviscutellata (Fig. 28)

22. Cibarium with 4 longitudinal rows of horizontal teeth. Interocular suture complete. Individual sperm ducts very long & thin.....Brumptomyia leopoldoi (Figs. 29, 30)

Cibarium with a transverse row of horizontal teeth. Interocular suture incomplete. Sperm ducts shorter & thicker.....23

23. Posterior part of pharynx with spines.....24

Pharynx without spines.....26

24. Spermathecae sausage-shaped. Cibarium with 4 inwardly directed horizontal teeth.....Lutzomyia trinidadensis (Figs. 31, 31)

Spermathecae globular or pear-shaped. Cibarium with 4 or more upright horizontal teeth.....25

25. Cibarium with 4 short, well separated horizontal teeth. Antennal ascoids nearly reaching ends of their respective segments. Spermathecae slightly constricted in middle.....
.....L. atroclavata (Figs. 33, 34)

Cibarium with 14+ longer horizontal teeth in a comb-like row. Ascoids short, their tips ending just beyond the middle of their respective segments. Spermathecae spherical or nearly so.....
.....L. cayennensis (Figs. 35, 36)

26. Cibarium with 6 or more horizontal teeth.....27

Cibarium with 4 horizontal teeth.....30

27. Spermathecae large, spherical or oval in shape, without segments (Figs. 37, 39). Antennal ascoids with short posterior spurs (Fig. 26). Newstead's scales (=sensory rods) on palpal segments 2 & 3. Pleurae moderately pigmented.....28

Spermathecae smaller, shape otherwise, with distinct segments (Figs. 41, 43). Ascoids without posterior spurs. Newstead's scales restricted to palpal segment 3. Pleurae pale.....29

28. Spermathecae oval, very large; stem of genital fork angular, slightly notched at tip.....L. barrettoi (Figs. 37, 28)

Spermathecae nearly spherical, smaller; stem of genital fork more or less acute at tip.....L. aragaoi (Figs. 39, 40)

29. Cibarium with 6-7 horizontal teeth. Individual sperm duct shorter than spermatheca. Antennal segment 3 equal to or longer than proboscis. Head height from vertex to tip of clypeus longer than wide.....
.....L. flaviscutellata (Figs. 41, 42)

Cibarium with 8-10 horizontal teeth. Individual sperm duct about twice the length of the spermatheca. Antennal segment 3 shorter than proboscis. Head height subequal to width.....L. antunesi (Figs. 43, 44)

30. Palpal segment 5 very short, less than half the length of the third segment. Spermathecae with semi-telescoped segments (imbricated), individual ducts and part of common duct rugose, heavily sclerotized.. .....L. tintinnabula (Figs. 45, 46)

Palapl segment 5 longer than half the length of the third. Spermathecae not imbricated, individual and common duct smooth-walled or with faint striations.....31

31. Hind femur with a row of 3-5 short spines. Most of the individual sperm duct thick walled, well sclerotized; common duct tenuous; spermathecae as shown.....L. spinosa (Figs. 47-49)

Hind femur without spines. Spermathecae and sperm ducts otherwise....32

32. Antennal ascoids with long posterior spurs (Fig. 19). Spermathecae sausage shaped as shown.....L. shannoni (Figs. 50, 51)

Antennal ascoids simple or with very short, hardly noticeable posterior spurs. Spermathecae otherwise.....33

33. Palpal segment 5 shorter than combined length of segments 3+4. Inner pair of horizontal teeth inclined towards the middle of the cibarium.... .....L. nordestina (Figs. 52, 53)

Palpal segment 5 longer than combined length of segments 3+4. Inner pair of horizontal teeth upright or nearly so.....34

34. Common sperm duct long, over one third the length of the individual duct.. 35

Common sperm duct absent or short, never exceeding one third the length of the individual duct.....38

35. Spermathecae longer than wide, wrinkled with incomplete striations....36

Spermathecae about as long as wide, smooth walled without striations..37

36. Eyes large, separated at narrowest part by about 6 facet diameters. Spermathecae constricted near middle with longer individual ducts. .....L. ovallesi (Figs. 54, 55)

Eyes small, separated by about 9 facet diameters. Spermathecae more or less uniform in width throughout, seemingly joined directly to the common duct.....L. rangeliana (Figs. 56, 57)

37. Individual sperm ducts thinner, each about half the width of the spermathecae.....L. walkeri (Figs. 58, 59)

Individual sperm ducts thicker, each over half the width of the spermathecae.....L. marajoensis (Figs. 60, 61)

38. Common sperm duct absent. Spermathecae and cibarium as figured..... .....L. pilosa (Figs. 62, 63)

Common sperm duct present. Spermathecae and cibarium otherwise.....39

39. Spermathecae long & tubular, only slightly wider than the individual duct, smooth walled.....L. migonei (Figs. 64, 65)

Spermathecae more or less spherical at end, distinctly wider than the individual duct, with incipient or complete annuli at base.....40

40. Cibarium with a small but obvious protuberance between the inner pair of horizontal teeth; cibarial arch ill defined in middle. Individual sperm duct about 5x the length of the common duct. Wing length less than 1.5mm; beta of wing venation equal to or longer than alpha..... .....L. micropyga (Figs. 66, 67)

Cibarium lacking a median protuberance; cibarial arch strongly developed throughout. Individual sperm duct longer than 6x the length of the common duct. Wing length greater than 1.5mm; beta shorter than alpha.....41

41. Pleura pale contrasting with dark mesonotum. Antennal segment 3 shorter thatn proboscis. Spermathecae with about 10 well developed annuli; individual sperm ducts thinner & longer.....
.....L. gomezi (Figs. 68, 69)

Pleura & mesonotum well pigmented. Antennal segment 3 longer than proboscis. Spermathecae with fewer annuli; individual ducts wider and shorter.....L. lichyi (Figs. 70, 71)

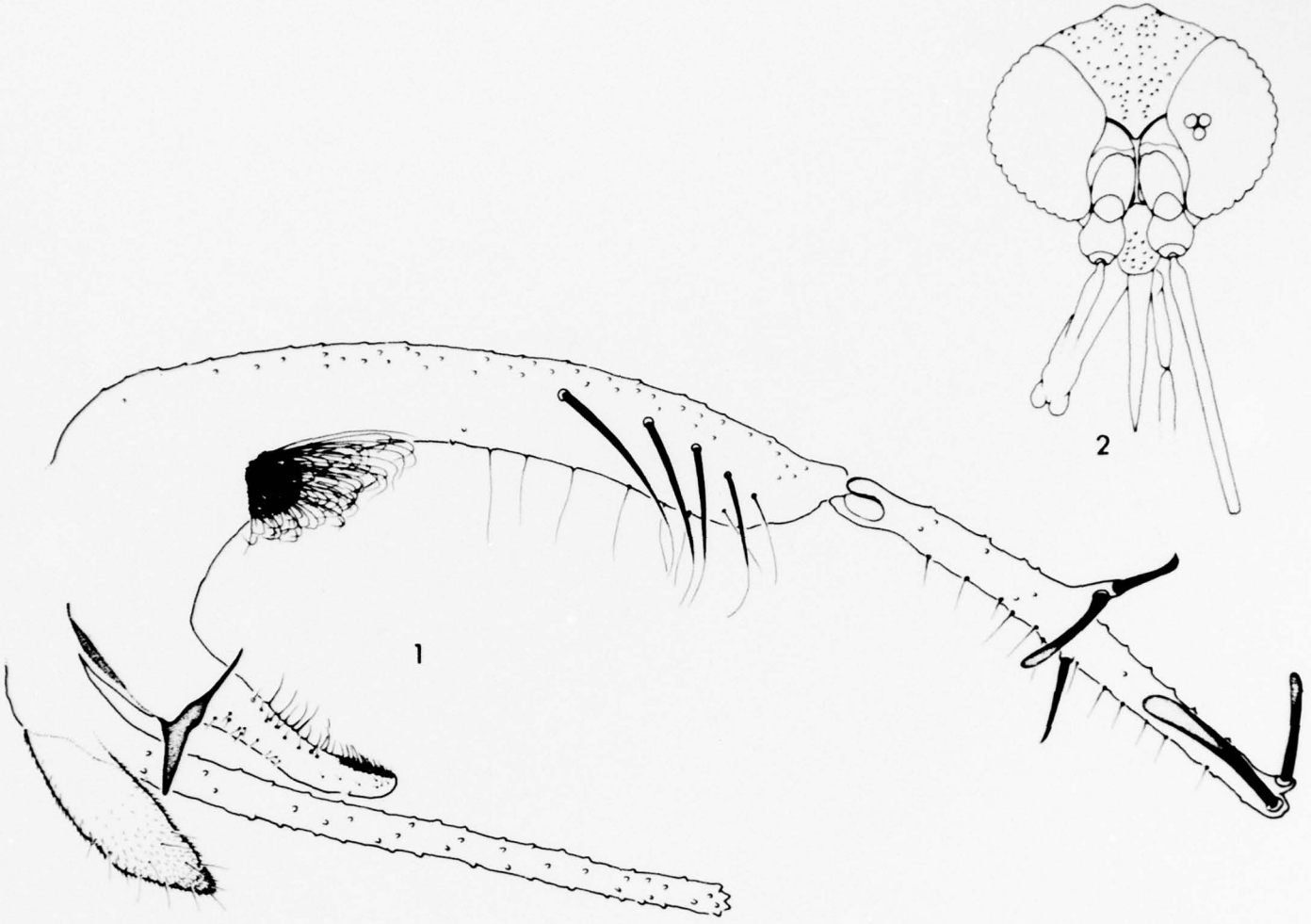


Fig. 1-2. Brumptomyia leopoldi. ♂

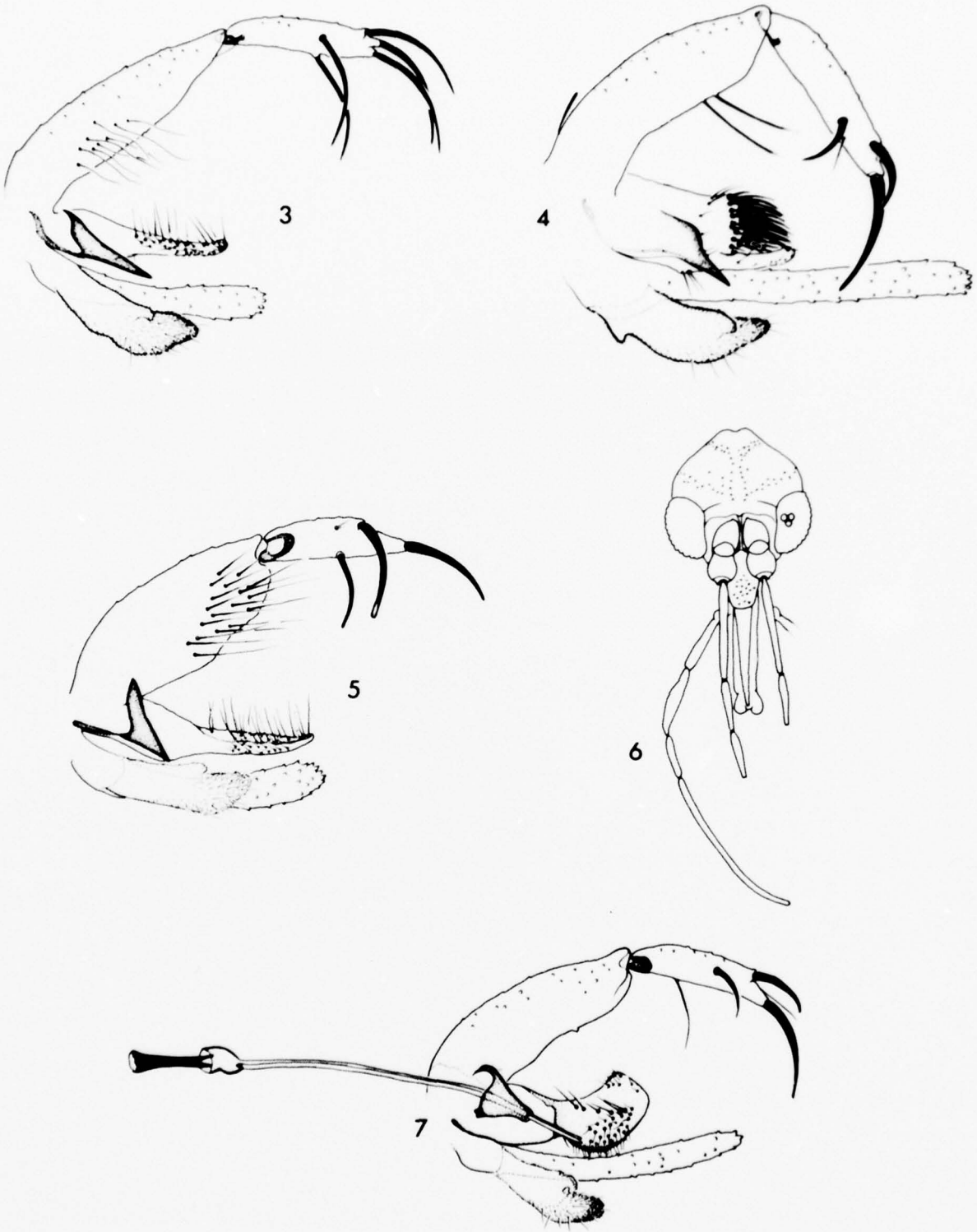
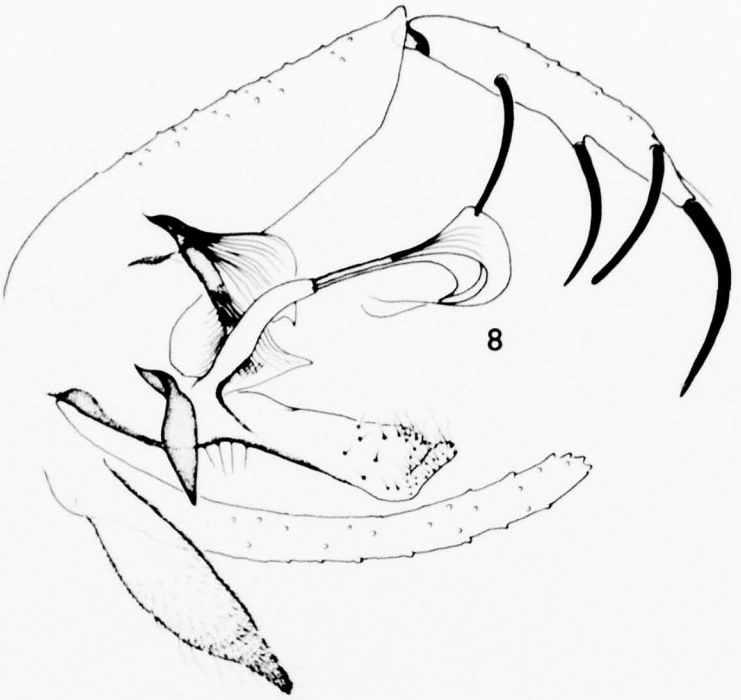


Fig. 3-7. Lutzomyia spp.♂♂. (3), L. trinidadensis. (4), L. tintinnabula. (5), L. pilosa. (6-7), L. rangeliana.



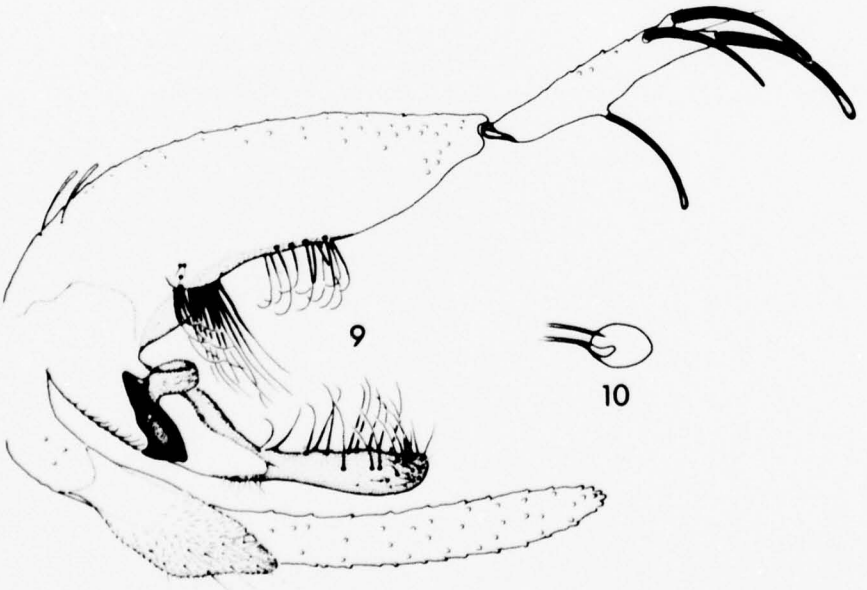


Fig. 8-10. Lutzomyia spp.♂♂. (8), L. lichyi. (9-10), L. walkeri

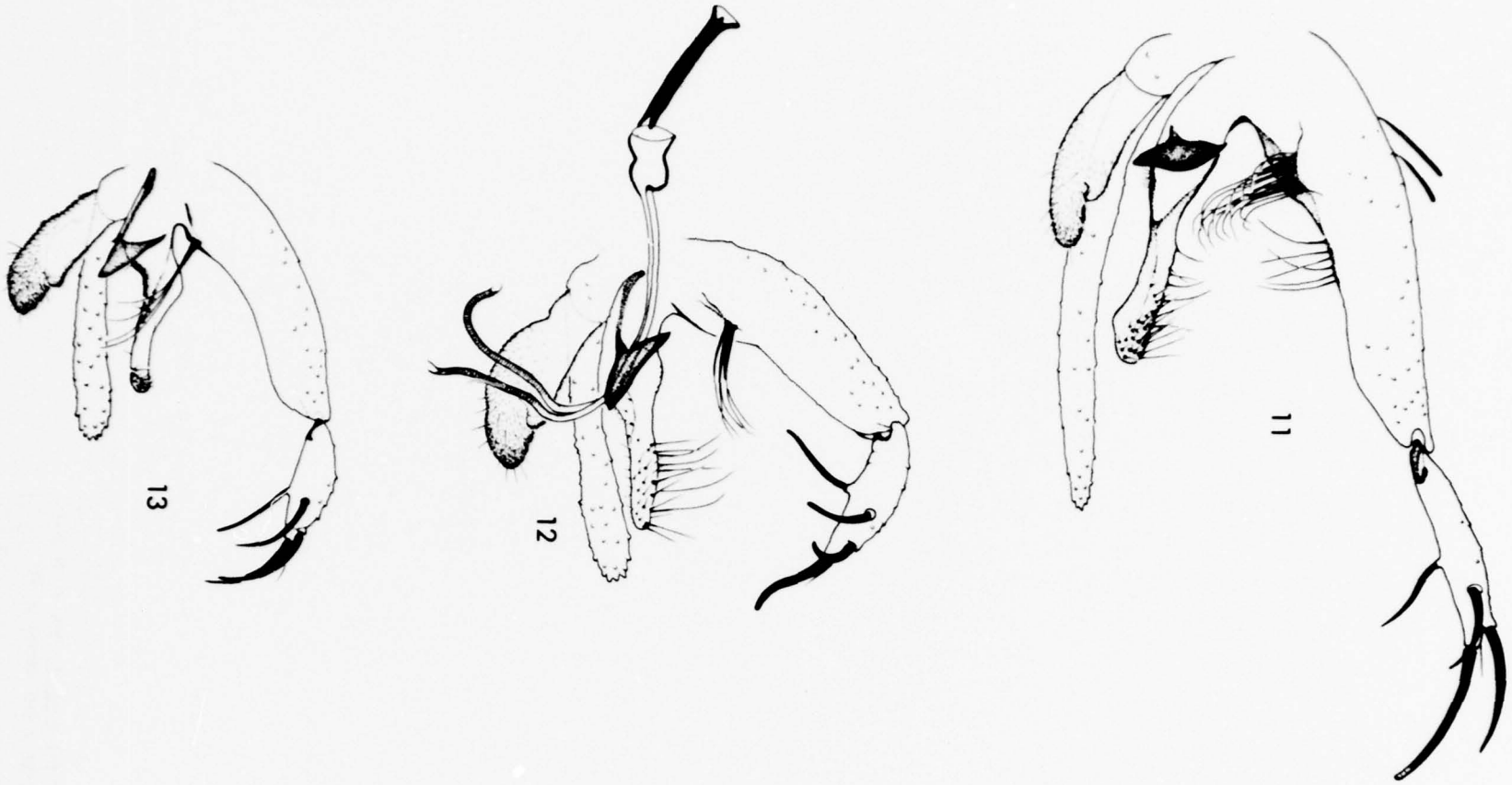


Fig. 11-13. Lutzomyia spp.♂♂. (11), L. marajoensis. (12), L. spinosa. (13), L. ovallesi.

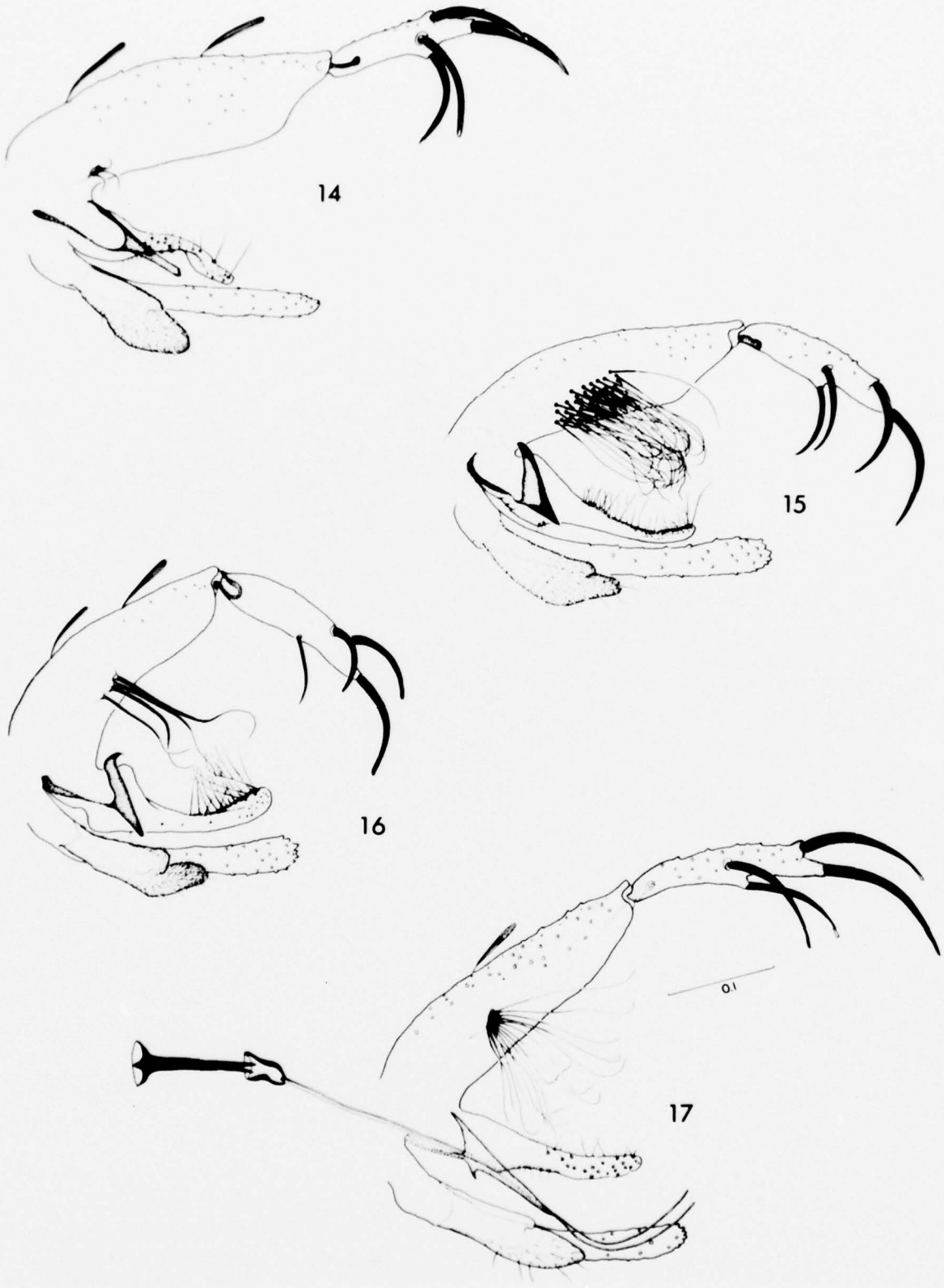
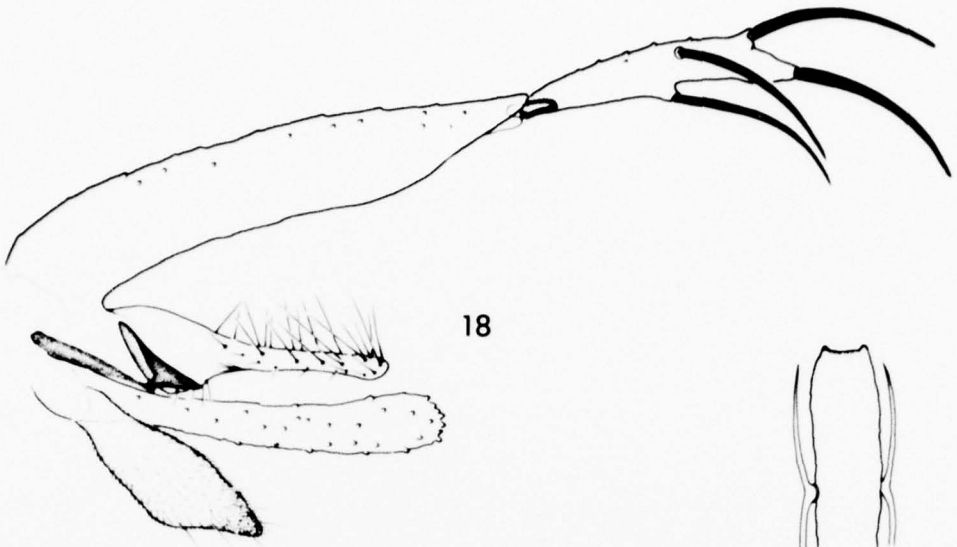


Fig. 14-17. Lutzomyia spp.♂♂. (14), L. migonei. (15), L. antunesi. (16), L. atroclavata. (17), L. gomezi.



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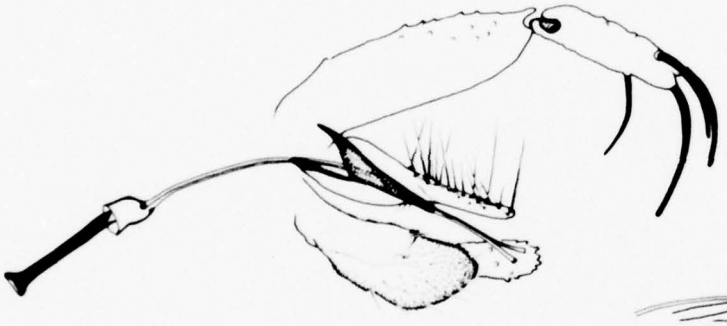

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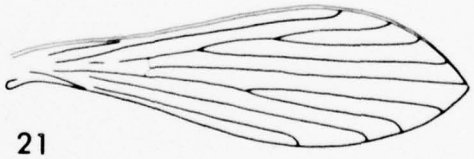

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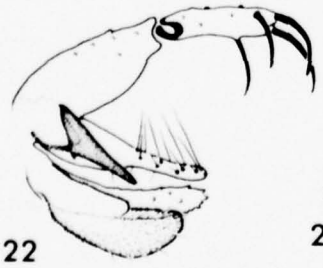

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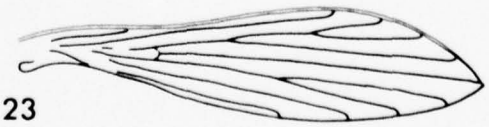

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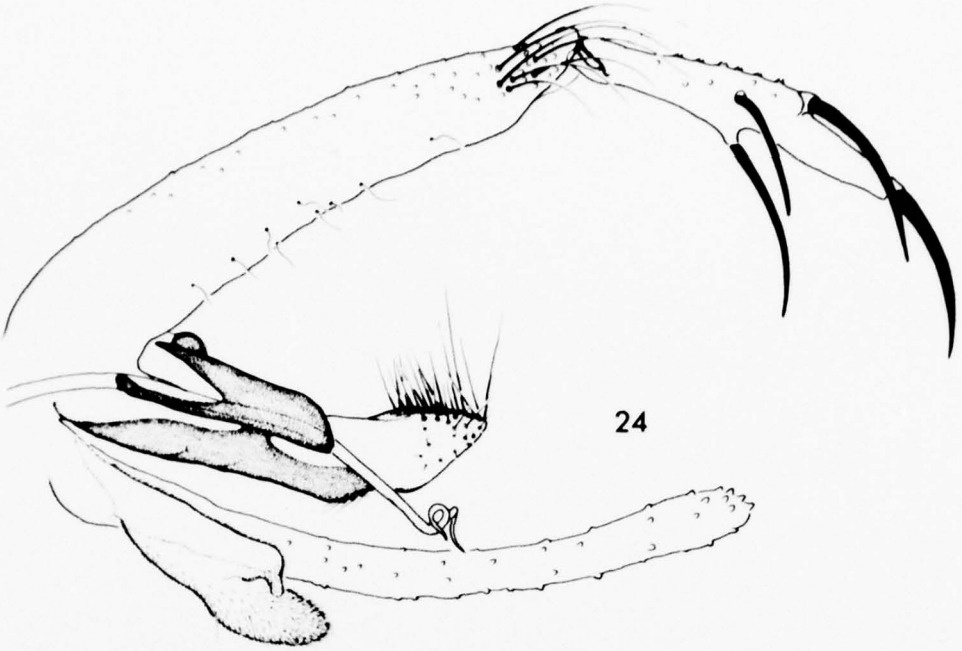
Fig. 18-23. Lutzomyia spp.♂♂ . (18-19), L. shannoni. (20-21), L. cayennensis. (22-23), L. micropyga.



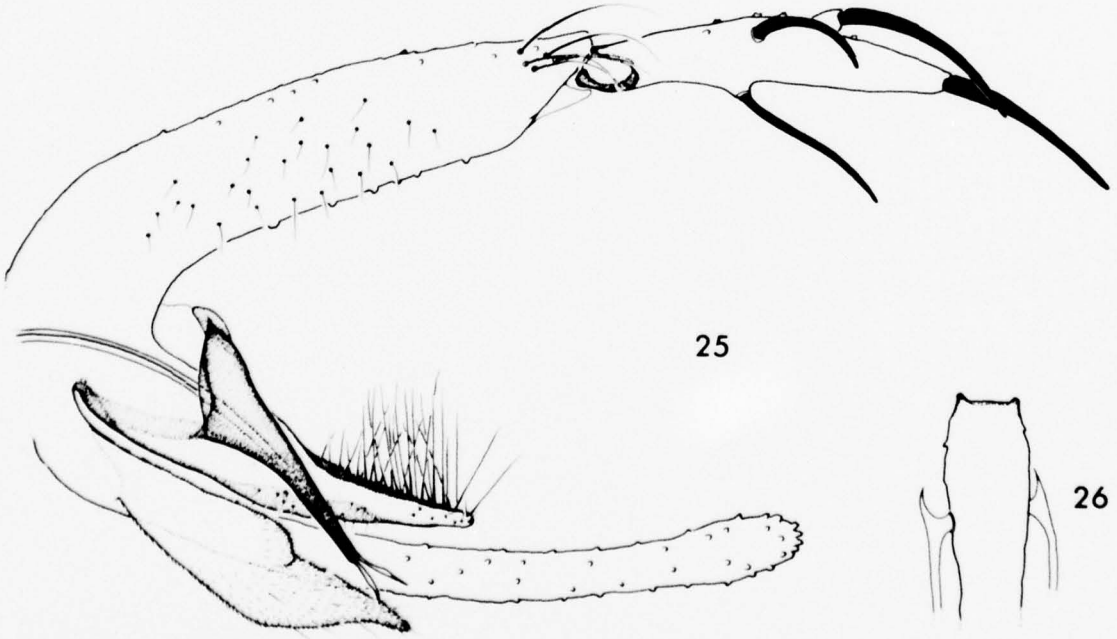


Fig. 24-26. Lutzomyia spp.♂♂. (24), L. aragaoi. (25-26), L. barrettoi.

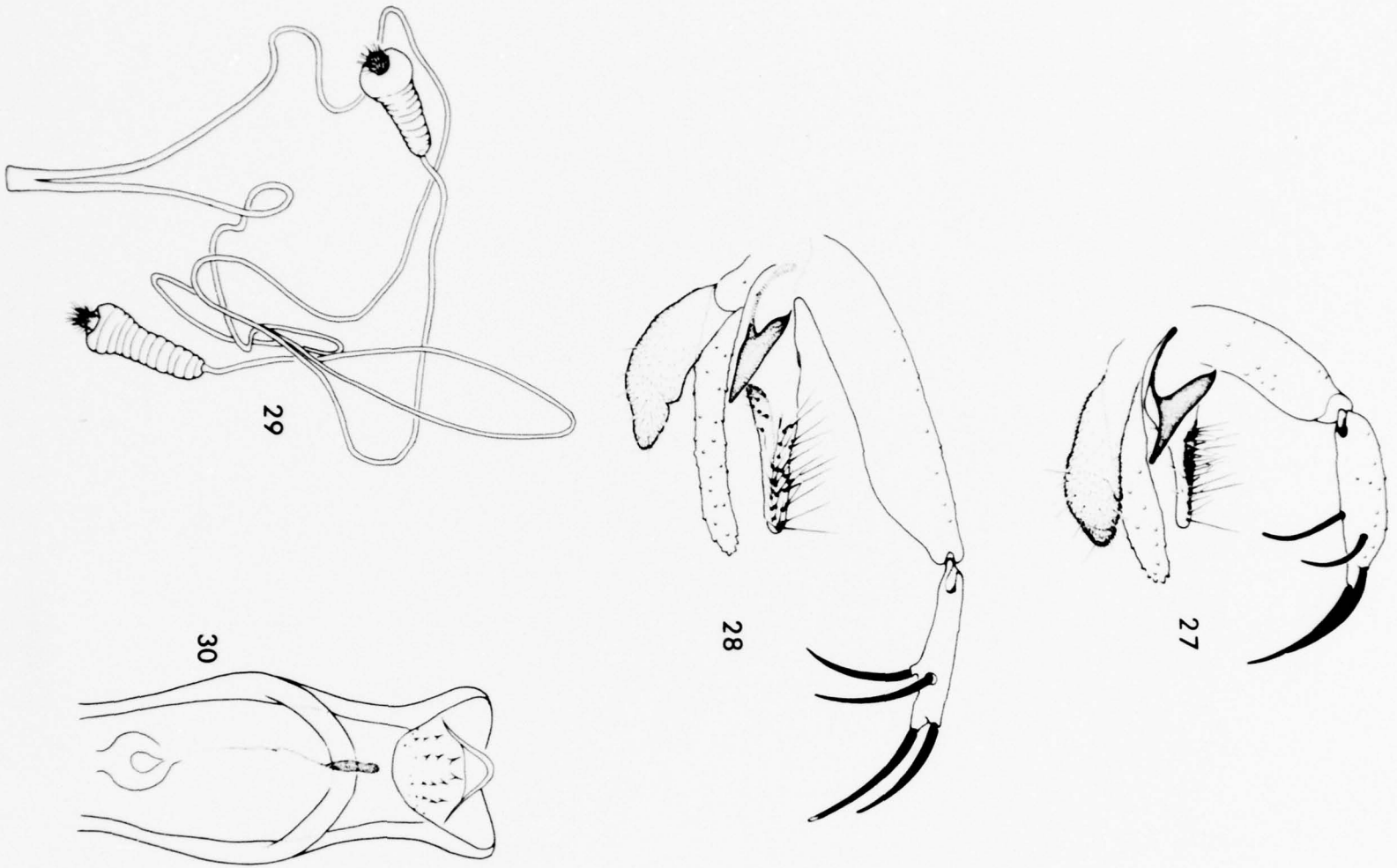


Fig. 27-30. Lutzomyia spp.♂♂ and Brumptomyia sp.♀. (27), L. nordestina. (28), L. flaviscutellata. (29-30), B. leopoldoi.

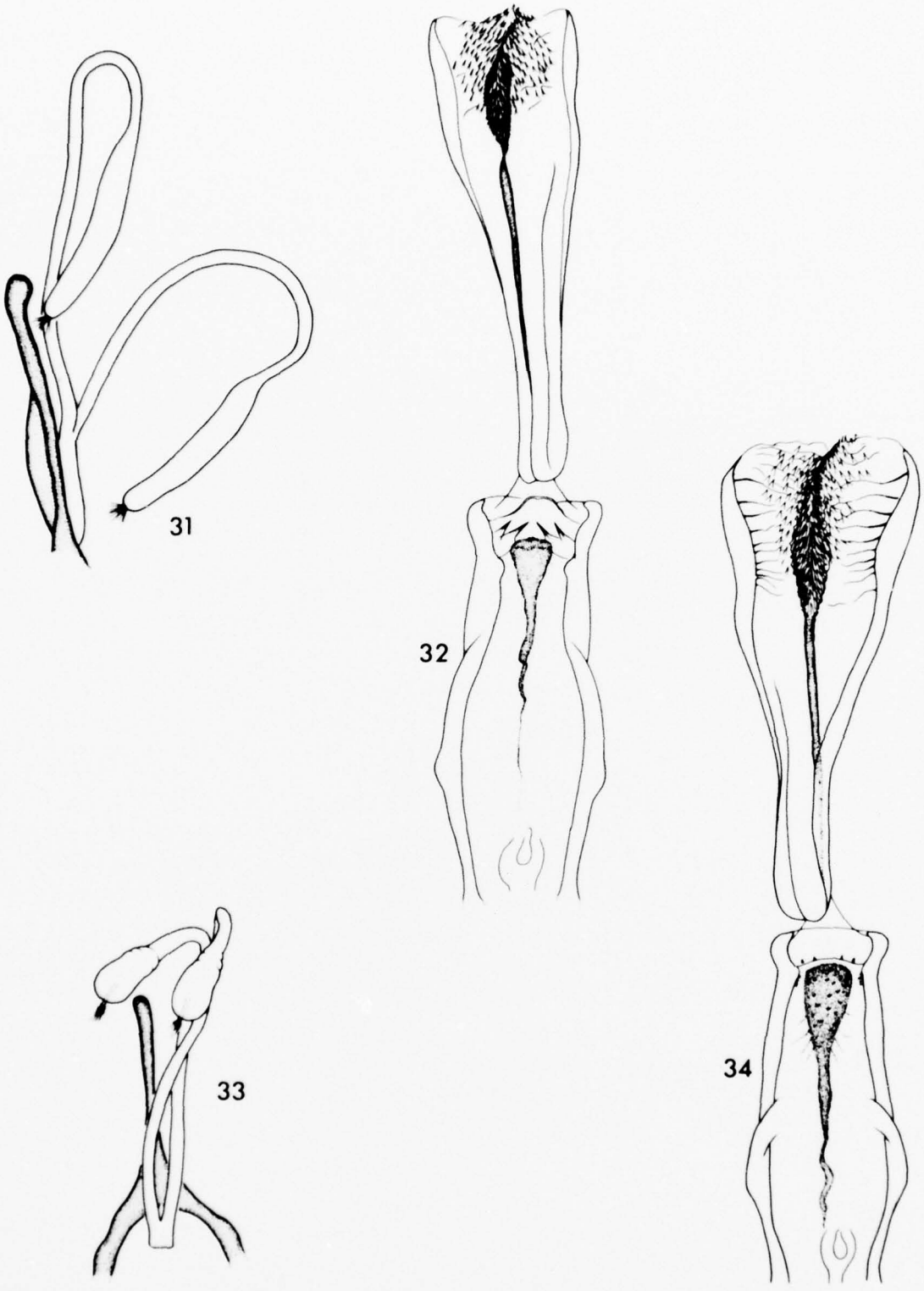


Fig. 31-34. Lutzomyia spp.♀♀ . (31-32), L. trinidadensis. (33-34), L. atroclavata.

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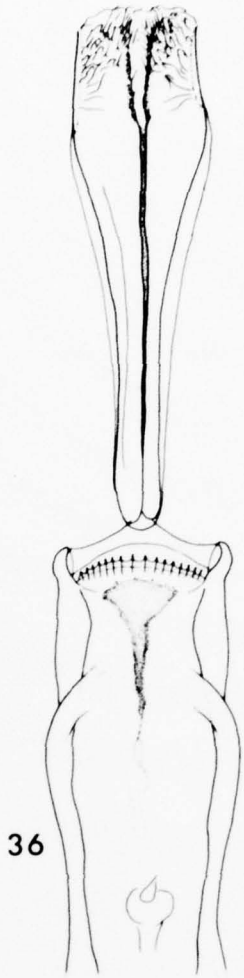

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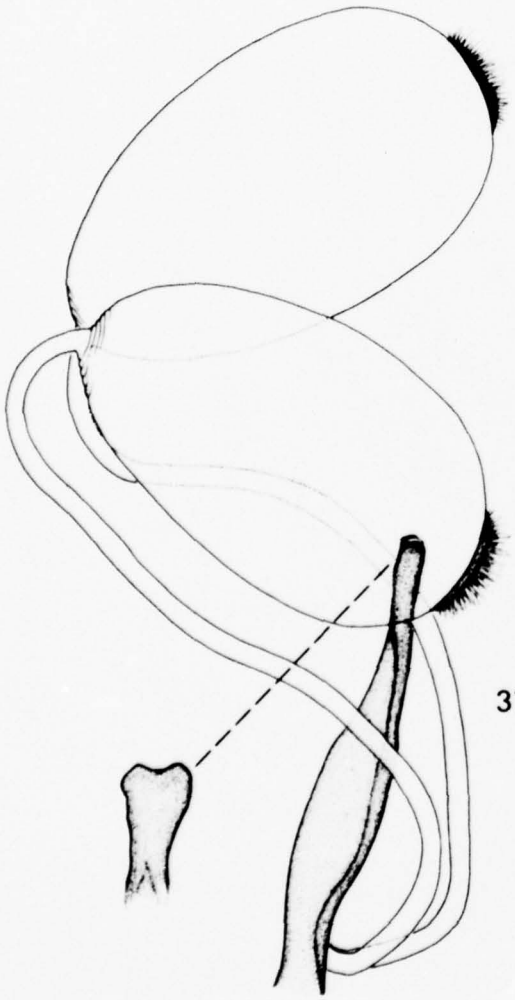

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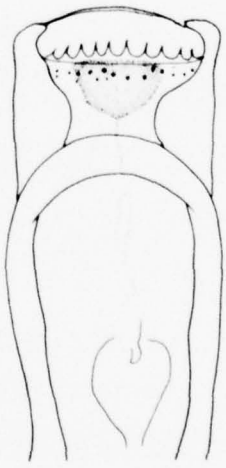

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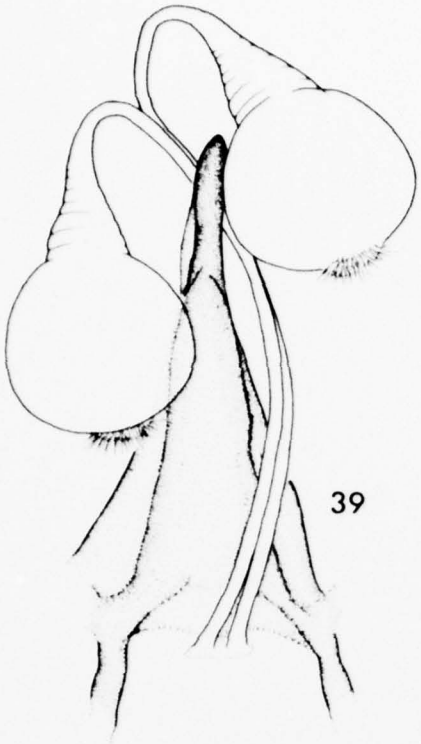
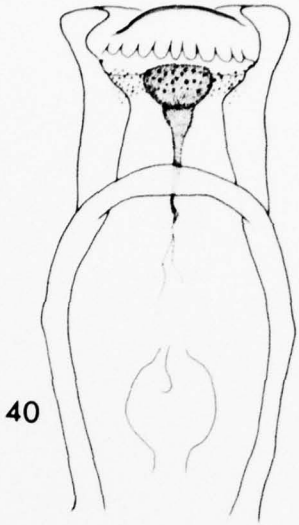
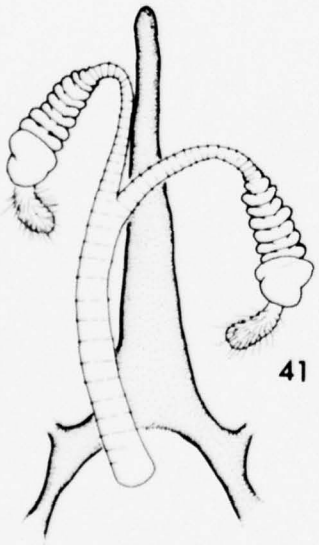
Fig. 35-38. Lutzomyia spp.♂♀. (35-36), L. cayennensis. (37-38), L. barrettoi.







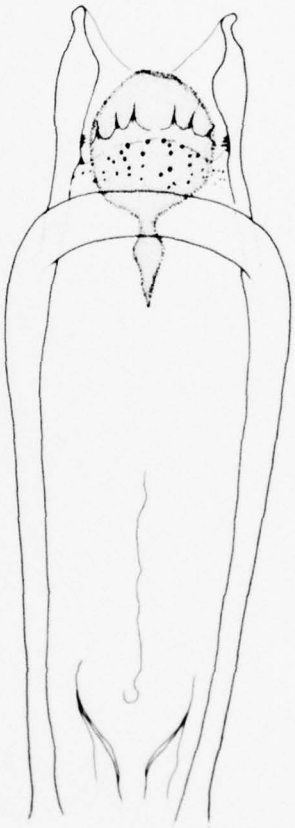
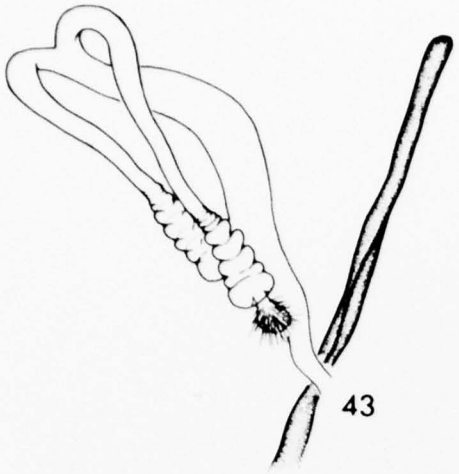


Fig. 39-42. Lutzomyia spp.♀♀. (39-40), L. aragaoi. (41-42), L. flaviscutellata.



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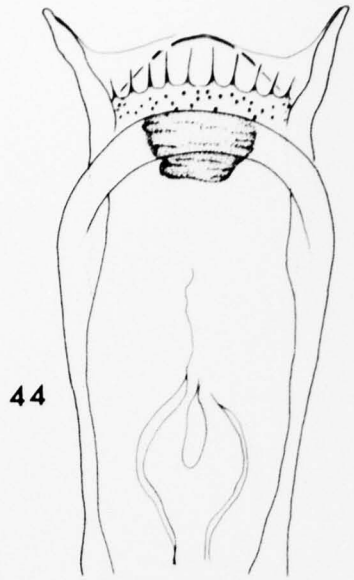

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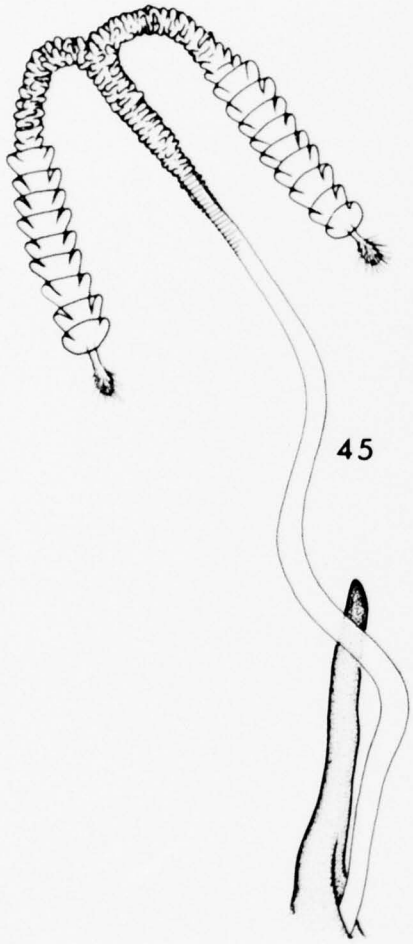

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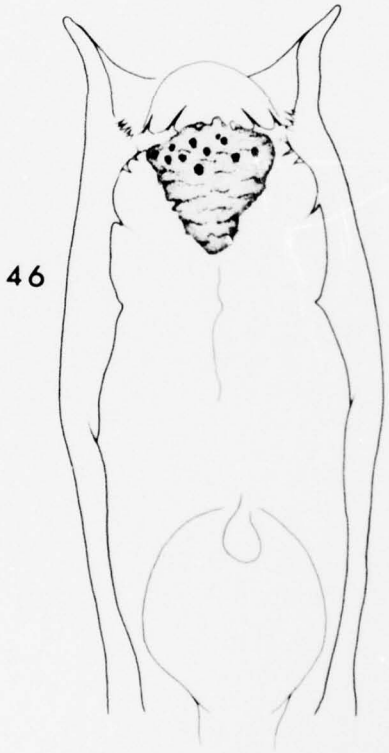
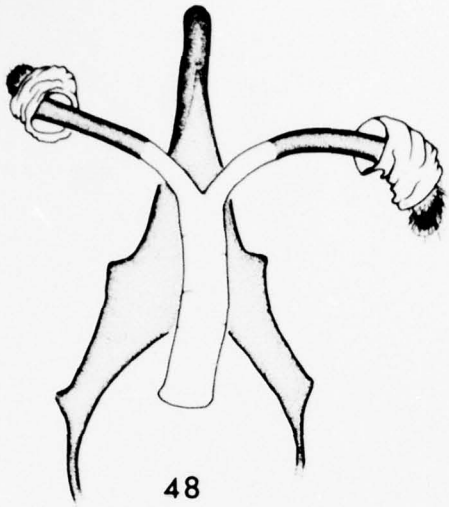


46

Fig. 43-46. Lutzomyia spp.♀♀. (43-44), L. antunesi. (45-46), L. tintinnabula.

47



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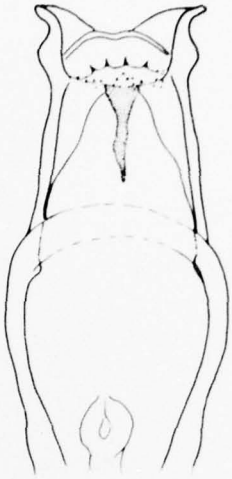

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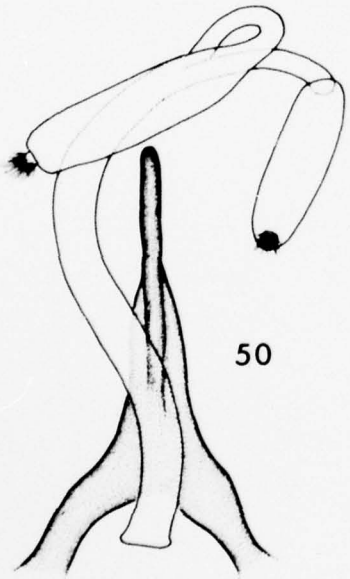

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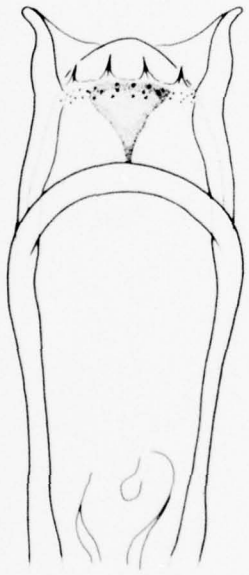
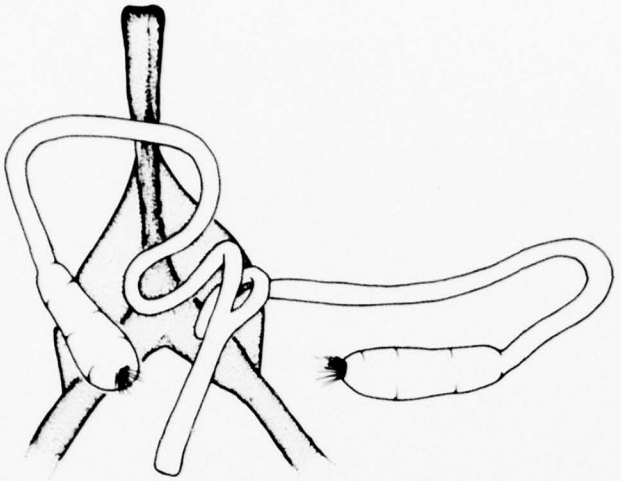


51

Fig. 47-51. Lutzomyia spp.♀♀. (47-49), L. spinosa. (50-51), L. shannoni.



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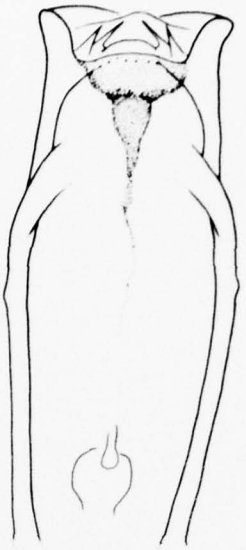

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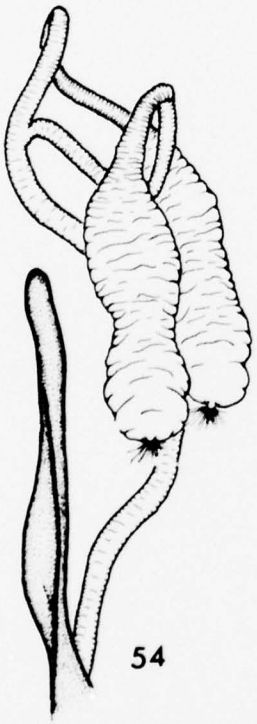

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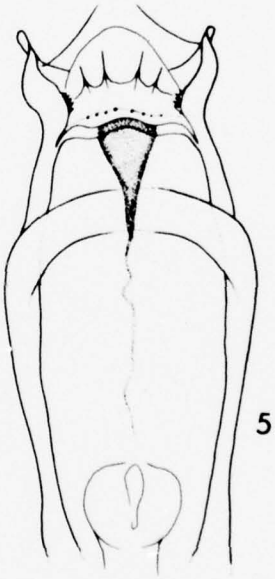
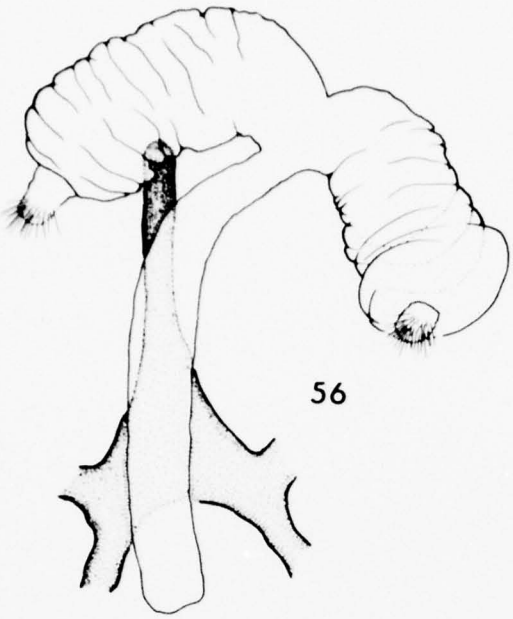
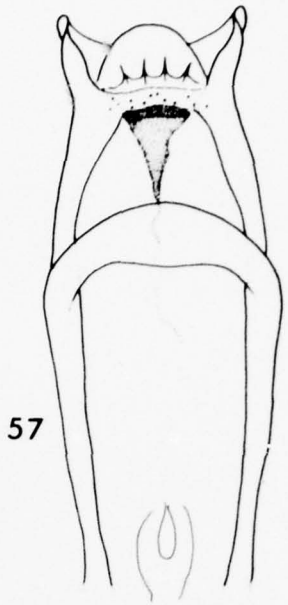
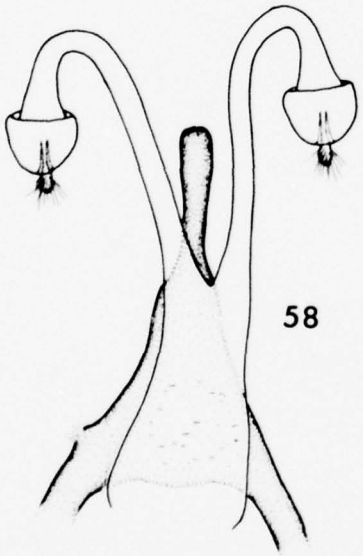


55

Fig. 52-55. Lutzomyia spp.♀♀. (52-53), L. nordestina. (54-55), L. ovallesi.







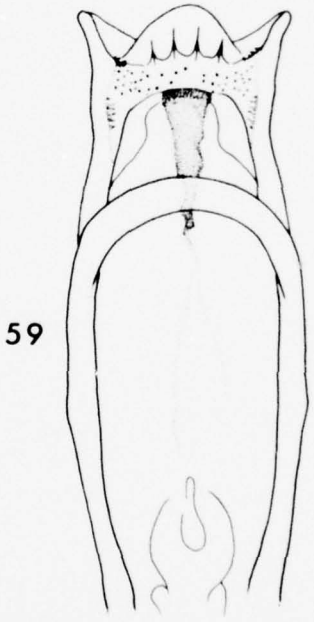
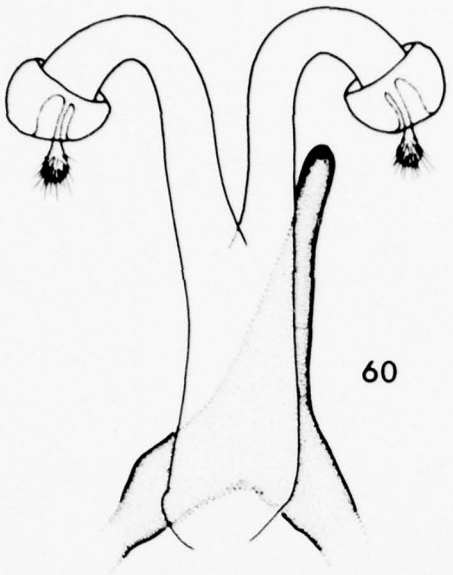
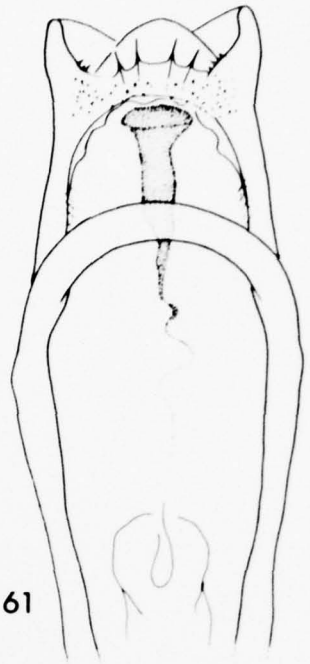
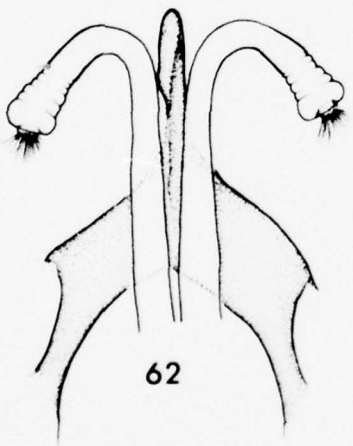


Fig. 56-59. Lutzomyia spp.♀♀ . (56-57), L. rangeliana. (58-59), L. walkeri.







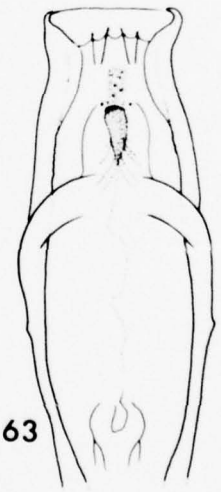
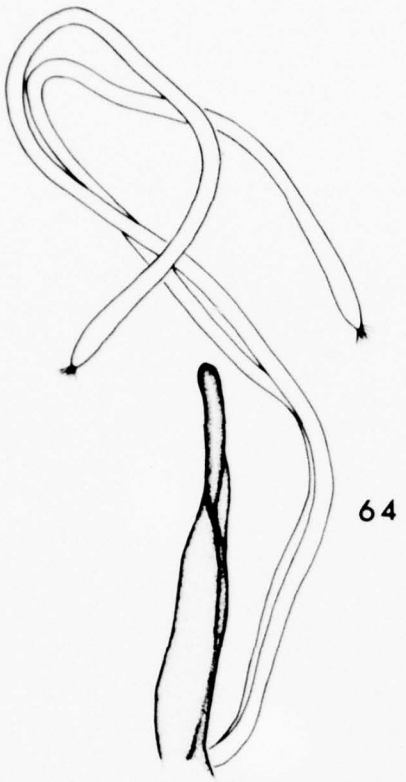
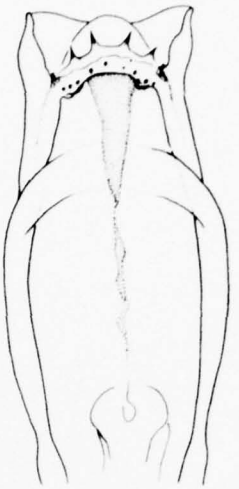


Fig. 60-63. Lutzomyia spp.♀♀ . (60-61), L. marajoensis. (62-63), L. pilosa.



64



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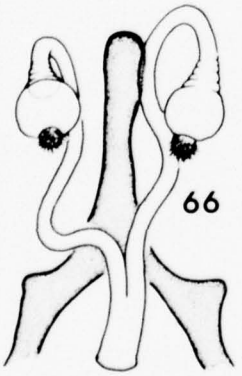

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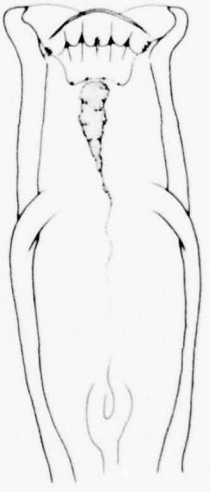
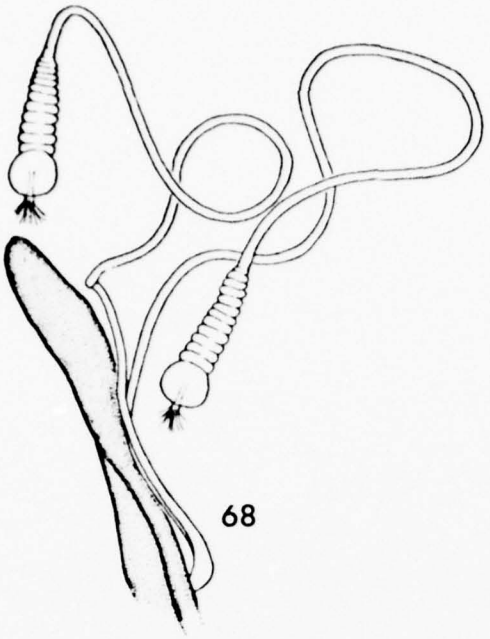
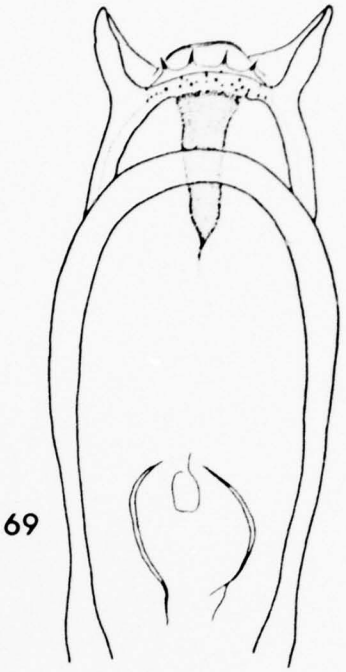
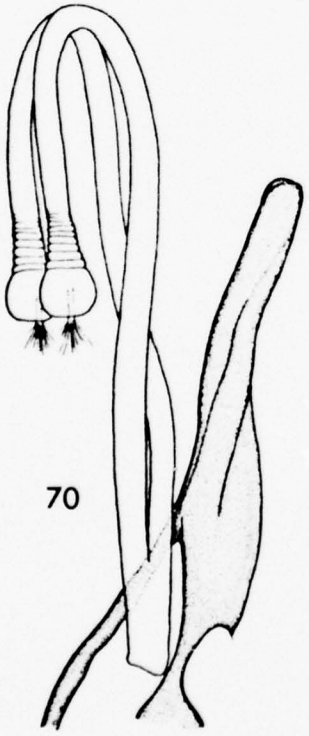


67

Fig. 64-67. Lutzomyia spp.♀♀. (64-65), L. migonei. (66-67), L. micropyga.







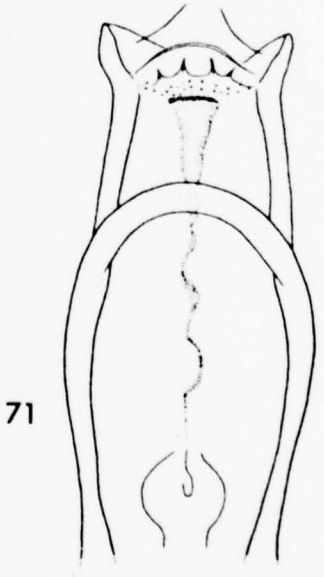


Fig. 68-71. Lutzomyia spp.♀♀ . (68-69), L. gomezi. (70-71), L. lichyi.

Phlebotomine Sand Flies of Ecuador

In May, 1976, three of us collected about 100 sand flies at two locations in Ecuador---16 km east of Santo Domingo, de Los Colorados, Pichincha Prov. (Elev. 700 m above sea level) and at Limoncocha, Napo Prov. near the Rio Napo (Elev. 250 m). We collected the specimens in well developed, though partially disturbed forests, in animal burrows and on tree trunks using simple tube aspirators. CDC light traps and malaise traps were also used successfully at both localities. A few specimens were taken in human bait collections. The high interandean valley between Quito and Banos was sampled for sand flies but no specimens were found. Their absence was probably due to several factors including: The widespread use of insecticides, the time of year, or the intensive cultivation of the region.

Sand fly borne disease has been reported in Ecuador. Bartonellosis was discovered in the southern provinces of Loja and Oro in the early 1940's.[12,13] It is apparent, however, that cutaneous leishmaniasis is certainly more widespread and important in terms of human involvement. Rodriguez and Nugue described clinical cases, apparently caused by Leishmania braziliensis, from western Ecuador.[14] Based on information gained elsewhere in the Neotropics, it seems certain that sand fly borne arbovirusus and Leishmania mexicana also occur in parts of the Republic. Obviously, in order to study the natural transmission of these pathogens, it is necessary to know which phlebotomine species are present.

Rodriguez listed 13 species of sand flies from Ecuador[15] and later, Arzube added three more.[16] Only one species, Brumptomyia pentacantha

Barretto, was reported by them from the Amazonian region of eastern Ecuador (Oriente).

Results

An up to date checklist of the sand fles of Ecuador is given below. Species collected by us at Limoncocha are indicated by the letter "L"; those from near Santo Domingo de Los Colorados by "S". Twenty-six species represent new records for the Republic.

Genus Brumptomyia França & Parrot

*1. B. leopoldoi (Rodriguez) (S)

2. B. mesai Sherlock (L)

*3. B. pentacantha (Barretto)

Genus Lutzomyia França

4. L. abunaensis Martins, Falcão & daSilva (L). The previously unknown female, to be described elsewhere, was taken at Limoncocha.

5. L. aclydifera (Fchld. & Hertig) (S)

6. L. baityi (Damasceno, Causey & Arouck) (L)

*7. L. barrettoi (Mang.) (S)

8. L. bispinosa (Fchld. & Hertig) (L)

*9. L. camposi (Rodriguez) (S)

10. L. carrerai (Barretto) (L)

*Species previously reported from Ecuador by Rodriguez and/or Arzube.

*11. L. cayennensis (Floch & Abonnenc)

12. L. davisi (Root) (L)

13. L. dendrophylla (Mang.) (L)

*14. L. dysponeta (Fchld. & Hertig)

15. L. (Evandromyia) sp. (L)

16. L. flaviscutellata (Mang.) (L)

17. L. guyanensis (Floch & Abonnenc) (L)

*18. L. gomezi (Nitz.)

19. L. hirsuta (Mang.) (L)

20. L. micropyga (Mang.) (L)

*21. L. monticola (Costa Lima). Reported from Guayas Prov. by Arzube but probably not this species.

22. L. nevesi (Damasceno & Arouck) (L)

23. L. nocticola Young (L)

*24. L. nordestina (Mang.) (S,L)

*25. L. olmeca bicolor Fchld. & Theodor (L). Listed as L. apicalis by Arzube.

26. L. (oswaldoi group) sp. (L)

27. L. panamensis (Shannon) (S)

28. L. (Pressatia) sp. (L)

29. L. reburra (Fchld. & Hertig). A single female from Puerto Quito, Pichincha Prov. examined. J. Cohen, coll.

*30. L. serrana (Damasceno & Arouck) (S,L)

*31. L. shannoni (Dyar) (S,L)

*Species previously reported from Ecuador by Rodriguez and/or Arzube.

*32. L. sallesi (Galvão & Coutinho)

*33. L. trapidoi (Fchld. & Hertig) (S)

34. L. (Trichophoromyia) n. sp. (L)

35. L. undulata (Fchld. & Hertig) (S)

36. L. (vexator group) sp. (S)

37. L. (vexator group) sp. (L)

*38. L. vespertilionis (Fchld. & Hertig) (S)

39. L. walkeri (Newst.) (L)

*40. L. ylephiletor (Fchld. & Hertig)

41. L. yuilli Young & Porter (L)

42. L. (Psychodopygus) n. sp. (S)

= paraensis, Fchld. & Hertig, 1951 (not paraensis Costa, Lima, 1941).

*Species previously reported from Ecuador by Rodriguez and/or Arzube.

Keys to the Species of *Lutzomyia* Sand Flies

Subgenus *Psychodopygus* Mangabeira, 1941

The subgenus *Psychodopygus*, represented by about 25 species, has been recently reviewed by Forattini[17] and Ortiz.[18] The former author and others treat the group as a distinct genus of Phlebotominae but this is not acceptable for several reasons.

The species are here grouped into 3 series following Theodor.[19] This is admittedly artificial but is convenient for identification purposes. The group, series *unisetosa* (=series *chagasi*), has been changed to the series *squamiventris* since it is based on the oldest name and is frequently used for the group. The 3 series are defined by Theodor on the basis of male characteristics as follows:

series *arthuri*---Style with 2 or 4 major spines. Parameres simple.

series *panamensis*---Style with 3 or 5 (sometimes 6) major spines, no small subterminal setae. Parameres with thick tufts of setae.

series *squamiventris*---Style with 1 large, terminal spine. Parameres simple or very complex.

I have examined specimens of all described species except *L. parimaensis*, *L. guyanensis*, *L. rachoui* and sp. no. 780. These are probably synonyms of other species and are so treated here.

As mentioned in earlier reports,[1,2] some *Psychodopygus* spp. have been incriminated as vectors of human cutaneous leishmaniasis in several countries. From the standpoint of medical importance the group as a whole is quite important. Man-biting specimens may be extremely abundant in well-forested areas from southern Mexico to southern Brazil.

The imbricated spermathecae and short fifth palpal segment (apomorhpic features) are characteristic of all females of the subgenus. Some males in the

series squamiventris, eg. L. lainsoni, have very complex genitalia whereas others in the series arthuri have retained simple genitalia with 4 major spines on the style and simple parameres.

Species:

1. L. amazonensis (Root), 1934, Amer. J. Hyg., 20:244. (Female, Iquitos, Peru). Forattini, 1960, Studia Ent., 3:467 (Female, redescribed). The male, undescribed but discovered (A.V. Martins, personal comm.), resembles that of L. recurva in the series panamensis.

   Known distribution: Amazon Basin in Peru & Brazil.

2. L. arthuri (Fonseca), 1936, Rev. Ent. 6:324 (Female, São Paulo, Brazil). Fonseca, 1939, Mem. Inst. Butantan, 12:181 (Male).

   = L. rachoui (Damasceno & Arouck), 1956, XIII Congr. Brasil. Hig., Fortaleza, mimeograph, 6 p. (Male, Minas Gerais, Brazil). Unquestionably considered to be synonomyous with arthuri by Martins et al., 1968, Bol. Museu Hist. Nat. Univ. Fed. Minas Gerais, No. 1, p. 2.

   Known distribution: Brazil; Rio de Janeiro, São Paulo and Minas Gerais.

3. L. ayrozai (Barretto & Coutinho), 1940, An. Fac. Med. Univ. S. Paulo, 16:131 (Male, São Paulo, Brazil). Barretto & Coutinho, 1943, Rev. Brasil. Biol., 3:183 (Female). Although a male and female were taken in copula, there still remains the possibility that the sexes were not properly associated. The female of ayrozai

described by Barretto is close to guyanensis, the male of which is quite different from that of ayrozai. A male cotype of ayrozai, examined by me, has definite areas of pigmentation on the lower pleura. A female identified by Barretto from São Paulo lacks these pigmented areas. If the ayrozai female proves to be guyanensis or another species then L. tintinnabula becomes a junior synonym of L. aryozai. Males and females of tintinnabula have pigmented areas on the lower pleura and have been collected in Minas Gerais, not far from São Paulo---the type locality of ayrozai. I am unable to separate males of ayrozai and tintinnabula without associated females.

Known distribution: São Paulo, Brazil. Other geographic records are doubtful.

4. L. bernalei Osorno, Morales & Osorno, 1967, Caldasia, 10:30 (Male, Araracuara, Caqueta, Colombia).

Known distribution: Type locality.

5. L. bispinosa (Fairchild & Hertig), 1951, Ann. Ent. Soc. Amer. 44:410 (Male, female, La Victoria, Cerro Jefe, Panama).

Known distribution: Belize, Honduras, Nicaragua, Panama, Colombia, N Brazil.

6. L. carrerai (Barretto), 1946, An. Fac. Med. Univ. S. Paulo, 22:286 (Male, Female, Restrepo, Colombia).

= P. davisi Root, 1934 (in part). Amer. J. Hyg. 20:233 (The females described are L. carrerai, Caravellas, Bahia, Brazil).

= S. pessoanus Barretto, 1955, Rev. Hosp. Clin. 10:247 (Male, Itatiaia, Rio de Janeiro, Brazil). Barretto, 1966, Papeis

Avulsos, 18:134 (Female, type locality, Itatiaia).

Known distribution: Brazil, (Bahia, Rio de Janeiro, Pará). East of the Andes in Colombia, Peru and Ecuador.

7. L. chagasi (Costa Lima), 1941, Acta Med. Rio, 7:8, 14, 16 (Female Rio Negro, Amazonas, Brazil). Martins, et al., 1968, Bol. Museu Hist. Nat. Univ. Fed. Minas Gerais, No. 1, 14 p. (Female).

= P. unisetosus Mangabeira, 1941, Mem. Inst. Oswaldo Cruz, 36:238 (Male, Pará, Brazil). Synonomy discussed by Martins et al. in above citation.

Known distribution: Amazon Basin; Colombia, Brazil and Peru.

8. L. davisi (Root), 1934, Amer. J. Hyg., 20:242 (Male, Fordlandia, Para, Brazil). Females described by him as L. davisi represent L. carrerai. Forattini, 1960, 1973 misidentified females as follows: His descriptions of L. davisi (Root) actually represent L. hirsuta (Mang.) and those of L. paraensis (Costa Lima) are of L. davisi (Root). Martins et al., 1973, Rev. Brasil. Biol., 33:419 (Female description).

= L. rooti (Mangabeira), 1942, Mem. Inst. Oswaldo Cruz, 37:112 (Male, Pará, Brazil).

= P. parimaensis Ortiz & Alvarez, 1972, Rev. Inst. Nac. Hig., Caracas, 5:139 (Female, Sierra Parima, Amazonas, Venezuela). I tentatively treat parimaensis as a junior synonym of davisi based solely on the original description.

Known distribution: Colombia, Peru, Bolivia, Brazil, Venezuela, Ecuador.

9. L. fairchildi Barretto, 1966, Papeis Avulsos, 18:137 (Male, female, Itatiaia, Rio de Janeiro, Brazil).

Known distribution: Southern Brazil.

10. L. fairtigi Martins, 1970, Proc. Ent. Soc. Wash. 72:279 (Male, female, Villavicencio, Colombia); earlier described as P. squamiventris by Fairchild & Hertig, 1951 (not P. squamiventris Lutz & Neiva, 1912).

Known distribution: Southern Colombia.

11. L. guyanensis (Floch & Abonnenc), 1941, Inst. Past. Guyane, Pub. 15, p. 17 (Female, Montaña Lucifer, Fr. Guiana).

= L. geniculata (Mangabeira), 1941, Mem. Inst. Oswaldo Cruz, 36:245 (Male, Belem, Para, Brazil). Fairchild & Hertig, 1951, Ann. Ent. Soc. Amer. 44:412 (Description of both sexes).

Known distribution: Panama, Colombia, Fr. Guiana, Brazil, Ecuador.

12. L. hirsuta (Mangabeira), 1942, Mem. Inst. Oswaldo Cruz 37:116 (Male, Abaetá, Para, Brazil). Forattini, 1960, Studia Ent. 3:468 (Female, as P. davisi Root).

= P. colasbelcouri Floch & Chassignet, 1947, Inst. Past. Guyane, Pub. 152, p. 1 (Male, Baduel, Fr. Guiana).

= P. Sp. No. 780 Floch & Chassignet, 1948, Inst. Past. Guyane, Pub. 170, p. 1, (Female, Baduel, Fr. Guiana).

Known distribution: Colombia, Brazil, Ecuador, Fr. Guiana, Bolivia.

13. L. lainsoni (Fraiha & Ward), 1974, Bull. Ent. Res. 64:209 (Male, female, Transamazonica highway, Pará, Brazil).

Known distribution: Northern Brazil, Pará State.

14. L. lloydi (Antunes), 1937, Rev. Biol. Hig., 8:24 (Female, São Paulo, Brazil). Coutinho, 1940, Arqu. Zool. Est. S. Paulo 1:331 (Male). Forattini, 1973, Entomologia Medica, vol. 4, p. 412 (Male, female).

Known distribution: Southern Brazil.

15. L. maripaensis (Floch & Abonnenc), 1946, Inst. Past Guyane Pub. 140, p. 1, (Male, Rio Oyapock). Forattini, 1960, Studia Ent. 3:472 (Female, as squamiventris Lutz & Neiva). Fraiha et al., 1971, Mem. Inst. Oswaldo Cruz, 69:497.

Known distribution: Fr. Guiana, Northern Brazil.

16. L. matosi (Barretto & Zago), 1956, Rev. Brasil. Ent. 5:177 (Male, Rio de Janeiro, Brazil). Barretto, 1966, Papeis Avulsos, 18:135 (Female).

Known distribution: Southern Brazil, near Rio de Janeiro.

17. L. nicaraguensis (Fairchild & Hertig), 1961, Proc. Ent. Soc. Wash. 63:26 (Male, Villa Somoza, Nicaragua). Female undescribed but keyed and illustrated in this report.

Known distribution: Nicaragua, Western Panama.

18. L. nocticola Young, 1973. Fla. Ent. (Male, female, Rio Anori, Antioquia Dept., Colombia).

Known distribution: Western Panama (Bocas del Toro, Prov.), Colombia, Ecuador (near Rio Napo).

19. L. panamensis (Shannon), 1926, J. Wash. Acad. Sci. 16:192 (Male, female, Cano Saddle, Canal Zone). Fairchild & Hertig, 1951, Ann. Ent. Soc. Amer. 44:405 (Redescribed, discussed).

Known distribution: Mexico, Belize, Nicaragua, Costa Rica, Panama, Colombia, Venezuela, Peru, Northern Brazil.

20. L. paraensis (Costa Lima), 1941, Acta Medica, Rio, 7:7 (Male, Belem, Para, Brazil). Martins et al., 1973, Rev. Brasil. Biol. 33:411 (Taxonomic discussion).

Known distribution: Northern Brazil (Records from other countries by various authors require confirmation).

21. L. recurva Young, 1973, Fla. Ent. 56:106 (Male, female, near Rio Curiche, Choco', Colombia).

Known distribution: Panama, Darien Prov.; Northern Colombia, Choco'.

22. L. squamiventris (Lutz & Neiva), 1912, Mem. Inst. Oswaldo Cruz, 4:89 (Female, Rio Trombetas & Para', Barzil). Martins et al., 1968, Bol. Museu Hist. Nat. Univ. Fed. Minas Gerais, No. 1, 14 p. (Female redescribed).

= P. complexus Mangabeira, 1941, Mem. Inst. Oswaldo Cruz, 36:242 (Male, Piratuba, Para', Brazil).

Known distribution: Amazon Basin (Brazil).

23. L. tintinnabula Christensen & Fairchild, 1971, J. Med. Ent., 8:301 (Male, female, Quiá, Dto. Pinogana, Darien Prov., Panama).

Known distribution: Panama, Colombia, Trinidad, Brazil (Minas Gerais, Pará), Fr. Guiana (As L. ayrozai, various authors).

24. L. wellcomei (Fraiha, Shaw & Lainson), 1971, Mem. Inst. Oswaldo Cruz, 69:489 (Male, Female, Serra dos Carajas, Pará, Brazil).

Known distribution: Brazil (Pará).

25. Lutzomyia (Psychodopygus) n. sp. #1.

= L. paraensis, Fairchild & Hertig, 1951, (not paraensis Costa Lima, 1941), Ann. Ent. Soc. Amer. 44:406. This unnamed species has been called L. pessoana (Barretto) by most authors but pessoana is a junior synonym of L. carrerai---a species distinct from Lutzomyia n. sp. #1.

Known distribution: Honduras, Costa Rica, Panama, Western side of Andes in Colombia and Ecuador.

Subgenus Psychodopygus (series arthuri)

Key to Adult Males

1. Style with 2 major spines.----------L. bispinosa (Fig. 72)
   Style with 4 major spines.----------2

2. Coxite and style arched, slender; the spines on style restricted to terminal on fourth of structure.----------L. arthuri (Fig. 72)
   Coxite and style stouter; at least one spine on stlye implanted near middle of structure.----------3

3. Paramere with a tuft of long dorsal setae; proximal spines on style inserted on the same level (paired).----------L. matosi (Fig. 72)
   Paramere without a tuft of long setae; proximal spine on style isolated.----------L. lloydi (Fig. 73)

Subgenus Psychodopygus (series panamensis)

Key to Adult Males

1. Style with 5 (sometimes 6) major spines; paramere as shown.----------L. davisi (Fig. 73)
   Style with 3 strong spines and 1 smaller bristle; paramere otherwise.----------2

2. Paramere with a curved dorsal branch in addition to a main lobe and lateral arm which bear strongly recurved setae; aedeagus long and relatively slender.----------L. recurva (Fig. 74)
   Paramere without a dorsal branch, main lobe and lateral or ventral arm bear non-recurved setae; aedeagus relatively short and stout.-----3

3. Main lobe of paramere with two tufts of blade-like setae; ventral arm with 2 strong setae, one terminal and one subterminal.-------
----------L. panamensis (Fig.74)
Main lobe of paramere with one group of setae, blade-like or not; ventral arm with small, usually more numerous setae.----------4

4. Ventral arm of paramere long and slender, inserted near base of main lobe.----------5
Ventral arm shorter and stouter; inserted at end of main lobe.-----6

5. Dorsum of paramere with a long seta implanted on a tubercle; ventral setal tuft of about 7 setae.----------L. nicaraguensis (Fig.75)
Dorsum of paramere without a long seta; ventral setal tuft (2-3) setae.----------L. hirsuta (Fig.75)

6. Mesonotum & pleurae pale.----------7
Mesonotum partly or entirely infuscated.----------9

7. Lateral lobe & coxite subequal in length; tips of genital filaments modified as shown.----------L. fairchildi (Fig.76)
Lateral lobe linger than coxite; tips of genital filaments simple.----------8

8. Epipharynx longer than 0.20 mm.----------Lutzomyia n. sp. #1 (Fig.76-77)
Epipharynx shorter than 0.20 mm.----------L. carrerai (Fig.77)

9. Main lobe of paramere with short distal setae and a short ventral arm.----------L. tintinnabula (Fig.78)
L. ayrozai (Fig.78)

Main lobe of paramere with longer distal setae and a longer ventral arm.----------10

10. Paramere with 10-14 terminal setae, its width less than or equal to width of style. Coxae pale.----------L. nocticola (Fig.78)
Paramere with 16+ terminal setae, its width greater than width of style. Coxae infuscated.----------L. paraensis (Fig.79)

Subgenus Psychodopygus (series squamiventris)

Key to Adult Males*

1. Parameres simple.----------2
Paremeres complex with 1-2 lobes or arms.----------4

2. End of paramere with a dorsal tuft of long, erect setae---------
----------L. chagasi (Fig.79)
Paramere slender without a distal setal tuft.----------3

3. Coxite stout, constricted in middle; style enlarged at base, the subterminal spines very small, hair-like; aedeagus broad, paramere somewhat pointed at tip.----------L. maripaensis (Fig.79)
Coxite and style relatively slender, subequal in width throughout, the subterminal spines of style stronger; aedeagus longer; paramere rounded at tip.----------L. guyanensis (Fig.80)

4. Mesonotum pale. Coxite without a median constriction; paramere as shown.----------L. lainsoni (Fig.80)
Mesonotum dark. Coxite with a median constriction at base; paramere otherwise, with a small, leaf-like seta at tip of dorsal arm.-----5

*The genitalia are difficult to describe and it is necessary to compare specimens with the figures.

5. Both lobes of paramere broad, about subequal in width.--------
----------L. wellcomei (Fig.81)
Paramere otherwise; with a more slender dorsal arm.----------6

6. Tip of paramere upturned, pointed, the median group of dorsal setae relatively long.----------L. bernalei (Fig.81)
Tip of paramere rounded, the median group of dorsal seta short----
----------7

7. Paramere as shown, with 2 small leaf-like setae on the dorsal arm, one at the tip; the other in the middle.------L. squamiventris (Fig.81)
Paramere otherwise, with only 1 small leaf-like seta at tip of dorsal arm.----------L. fairtigi (Fig.81)

Subgenus Psychodopygus

Key to Adult Females

1. Cibarium with 6-8 horizontal teeth.----------2
Cibarium with 4 horizontal teeth.----------3

2. Cibarium with 6 horizontal teeth. Last annulation of spermatheca asymmetrical.----------L. lloydi (Fig.73)
Cibarium with 8 horizontal teeth. Last annulation of spermatheca symmetrical.----------L. arthuri (Fig.72)

3. Cibarium with subequal & relatively small vertical teeth in 1-3 transverse rows, no longitudinal rows.----------4
Cibarium with vertical teeth of varying size, those in the middle enlarged and forming 2 or more longitudinal rows.----------7

4. Mesonotum & pleurae pale.----------L. lainsoni (Fig.80)

   Mesonotum dark, contrasting with pale pleurae.----------5

5. Individual sperm ducts about one-third the length of the spermathecae.----------L. amazonensis (Fig.74)

   Individual sperm ducts as long as or longer than the spermathecae.----------6

6. Terminal annulation of spermatheca asymmetrical. Common sperm duct with faint transverse striations below rugose portion.----------L. matosi (Fig.72)

   Terminal annulation of spermatheca symmetrical. Common duct smooth walled below the rugose portion.----------L. recurva (Fig.74)

7. Common sperm duct completely smooth walled, without rugosity.----------L. squamiventris* (Fig.81)
   L. maripaensis
   L. wellcomei
   L. chagasi
   L. fairtigi

   At least part of the common duct rugose and/or with transverse striations.----------8

*At present, specific identification of these females is certain only when associated males are on hand. The undiscovered female of L. bernalei probably belongs in this group.

8. Spermathecae shorter than individual ducts.-----L. ayrozai (Fig.78)
L. guyanensis (Fig.80)

Spermathecae longer than individual ducts.----------9

9. Mesonotum & pleura pale.----------10

Mesonotum partly or entirely pigmented, contrasting with pale pleura.----------

10. Epipharynx length greater than 0.30 mm.-------Lutzomyia n. sp. #1 (Fig.76)

Epipharynx length less than 0.30 mm.----------L. fairchildi (Fig.76)
L. carrerai (Fig.77)

11. Terminal annulation of spermatheca asymmetrical.----------
----------L. panamensis (Fig.74)

Terminal annulation of spermatheca symmetrical.----------12

12. Horizontal teeth of cibarium short, slanted inwardly.----------13

Horizontal teeth larger, more or less erect.----------13

13. Procoxae dark, mesocoxae & metacoxae pale.-----L. tintinnabula (Fig.78)

All coxae moderately to heavily pigmented.-----L. paraensis (Fig.79)

14. Common sperm completely smooth walled below rugose portion.-------
----------L. nocticola (Fig.78)

Common duct with distinct transverse striations, complete or not.----
----------15

15. Common sperm duct with complete transverse striations. Stem of genital fork broad & blade-like.----------L. bispinosa (Fig.72)

Common sperm duct with incomplete transverse striations, appearing

as dots or short nonconnected lines. Stem of genital fork slender & more or less acute at tip.----------16

16. Individual sperm ducts less than half the length of the spermathecae; rugose portion of common duct distinctly swollen near junction with individual ducts.-------L. hirsuta (Fig. 75)*

L. nicaraguensis (Fig. 75)

Individual ducts over half the length of the spermathecae; rugose portion of common duct not swollen, about subequal in width throughout.----------L. davisi (Fig. 73)

*The procoxae of nicaraguensis are well pigmented. Those of hirsuta lack pigmentation.

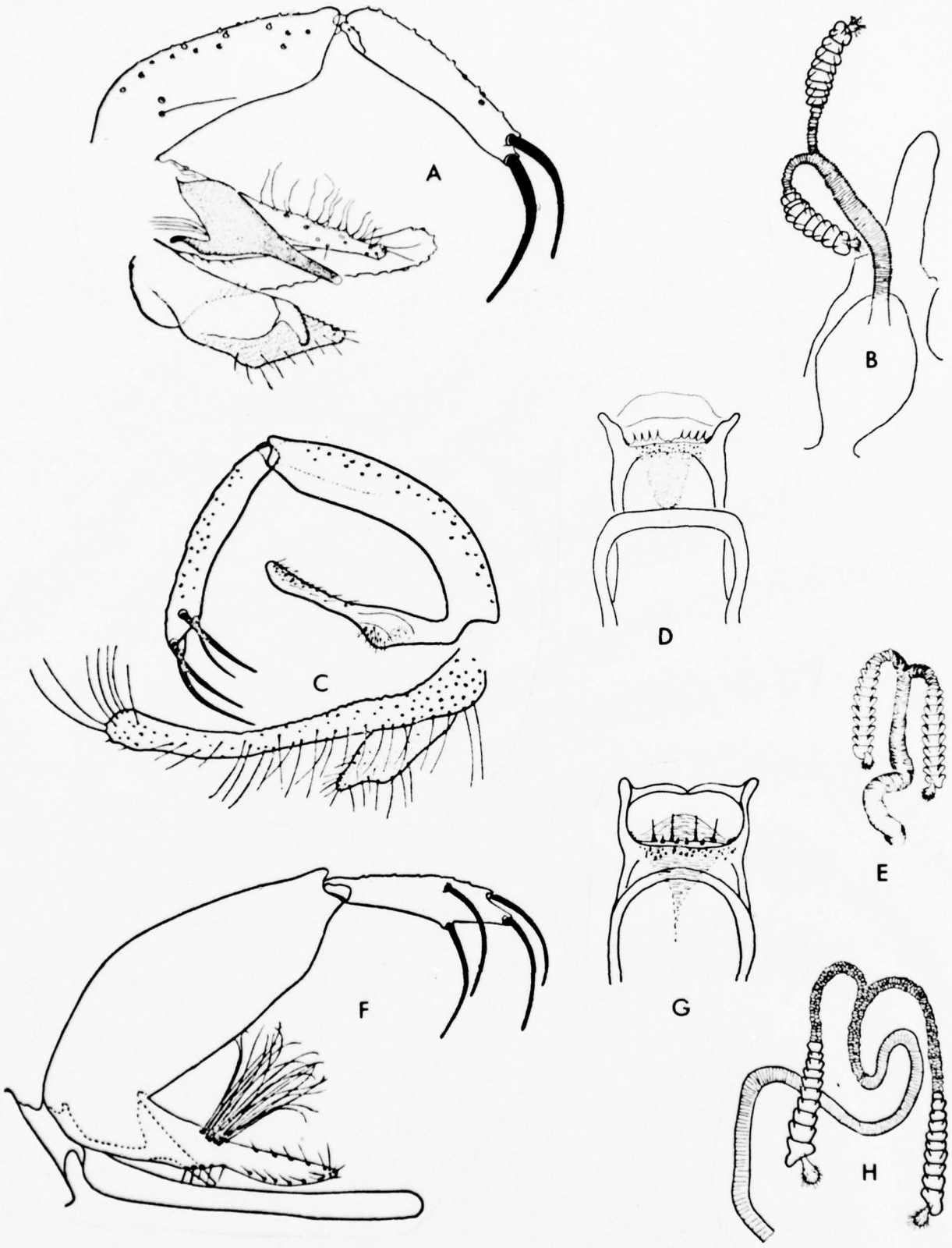


Fig. 72. Lutzomyia bispinosa[20], A, B; L. arthuri[20,17], C-E; L. matosi[22,23], F-H.

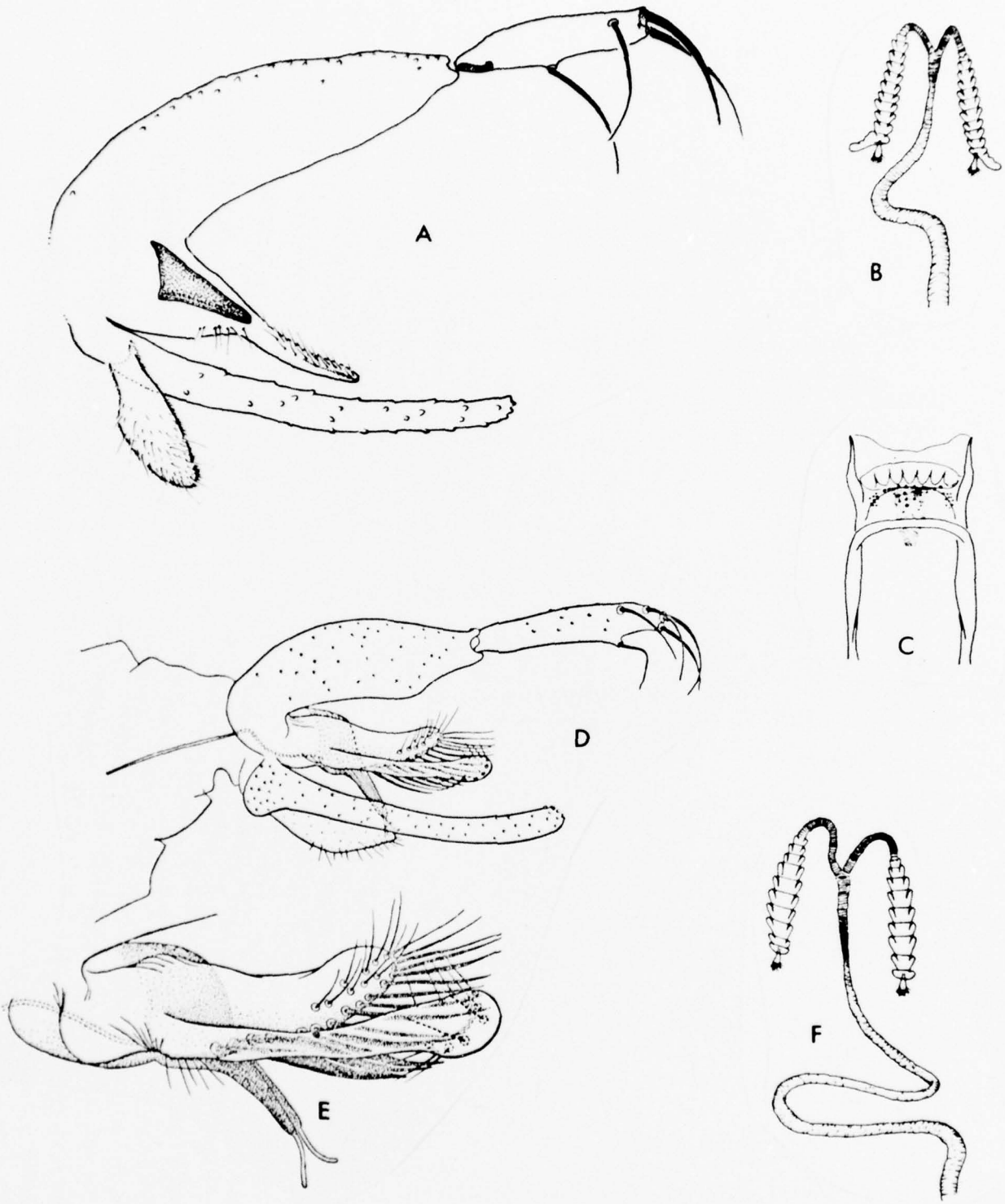


Fig. 73. L. lloydi[17], A-C; L. davisi[24,17], D-F.

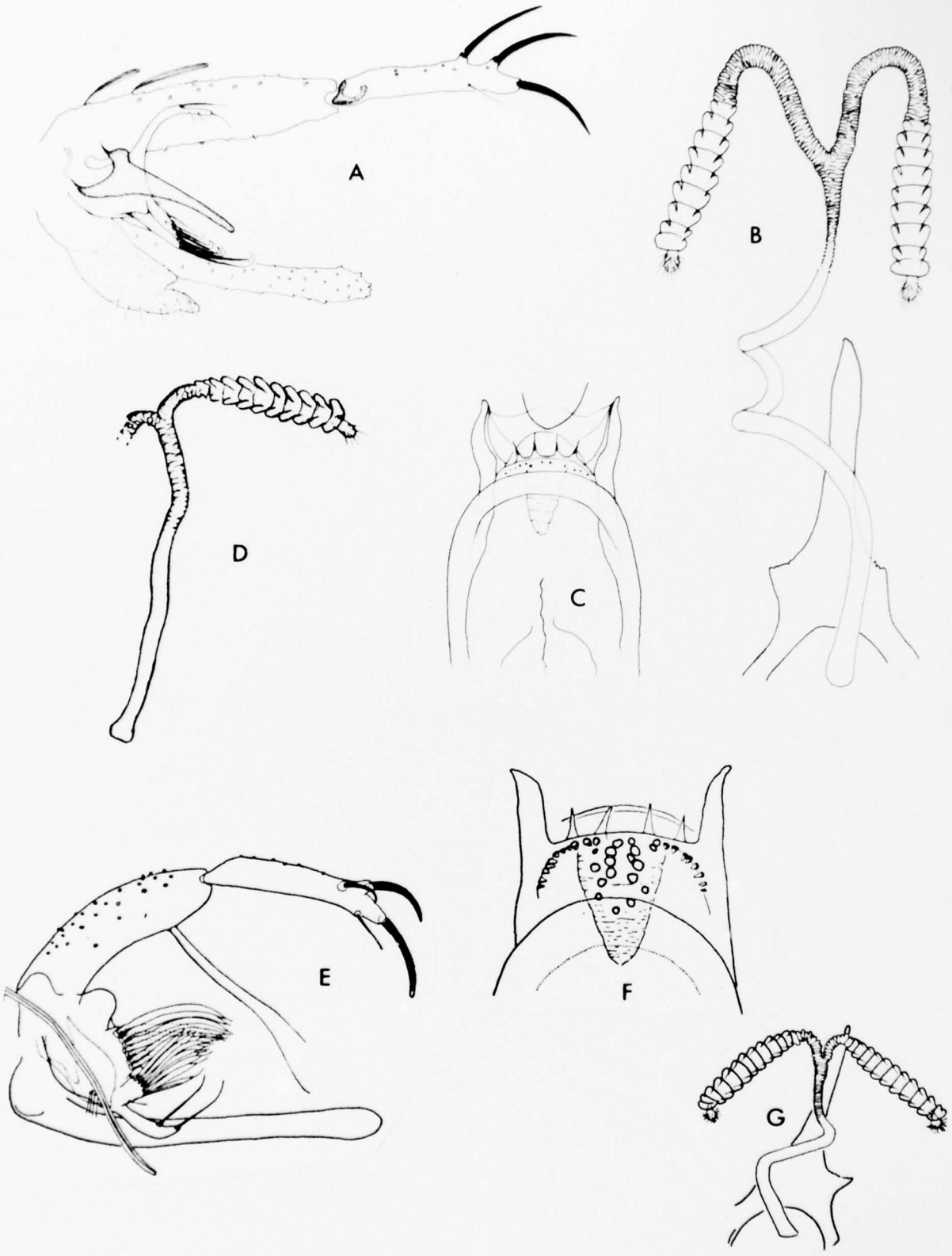


Fig. 74. L. recurva[25], A-C; L. amazonensis, D; L. panamensis[20], E-G.

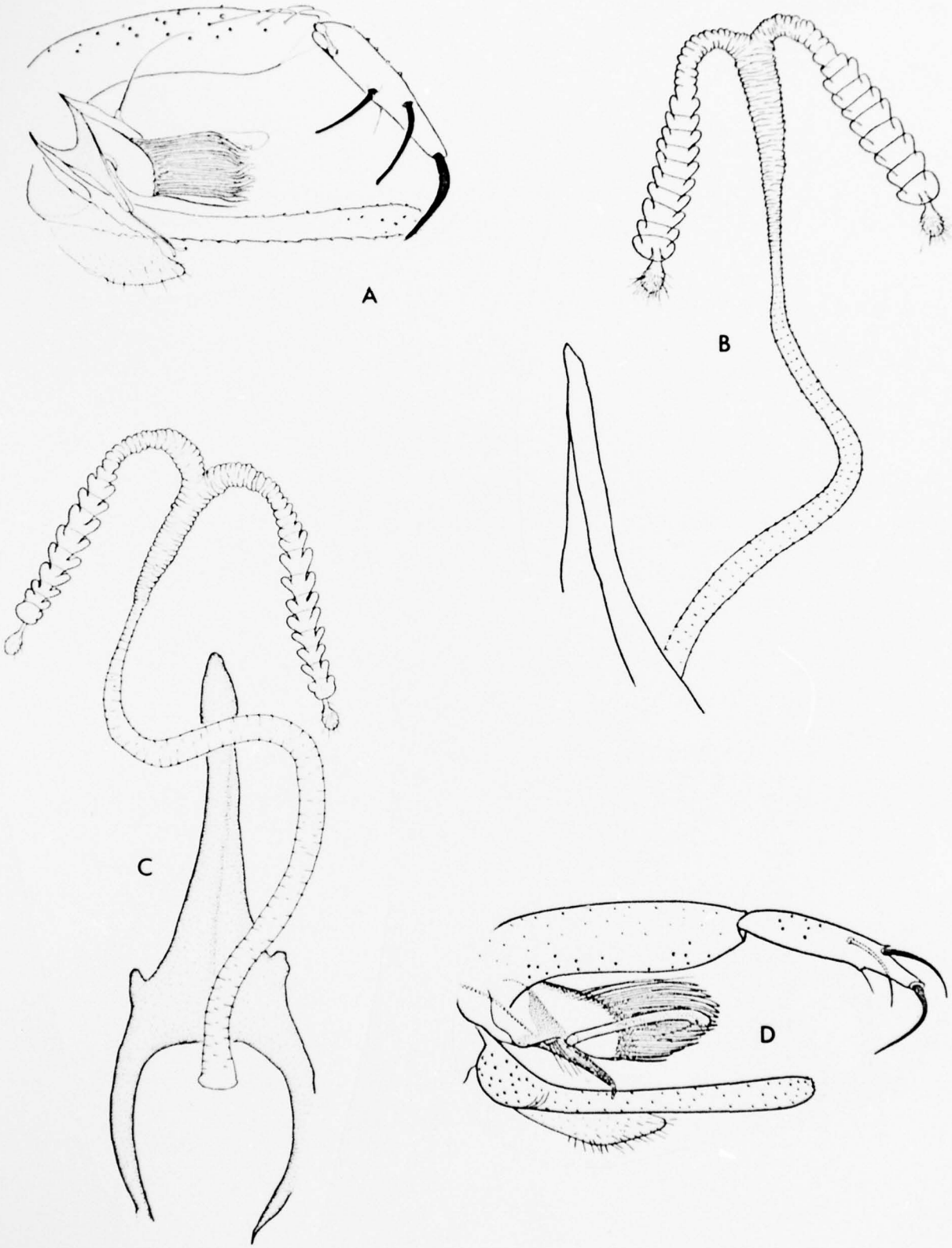


Fig. 75. L. nicaraguensis[26], A, B; L. hirsuta[24], C, D.

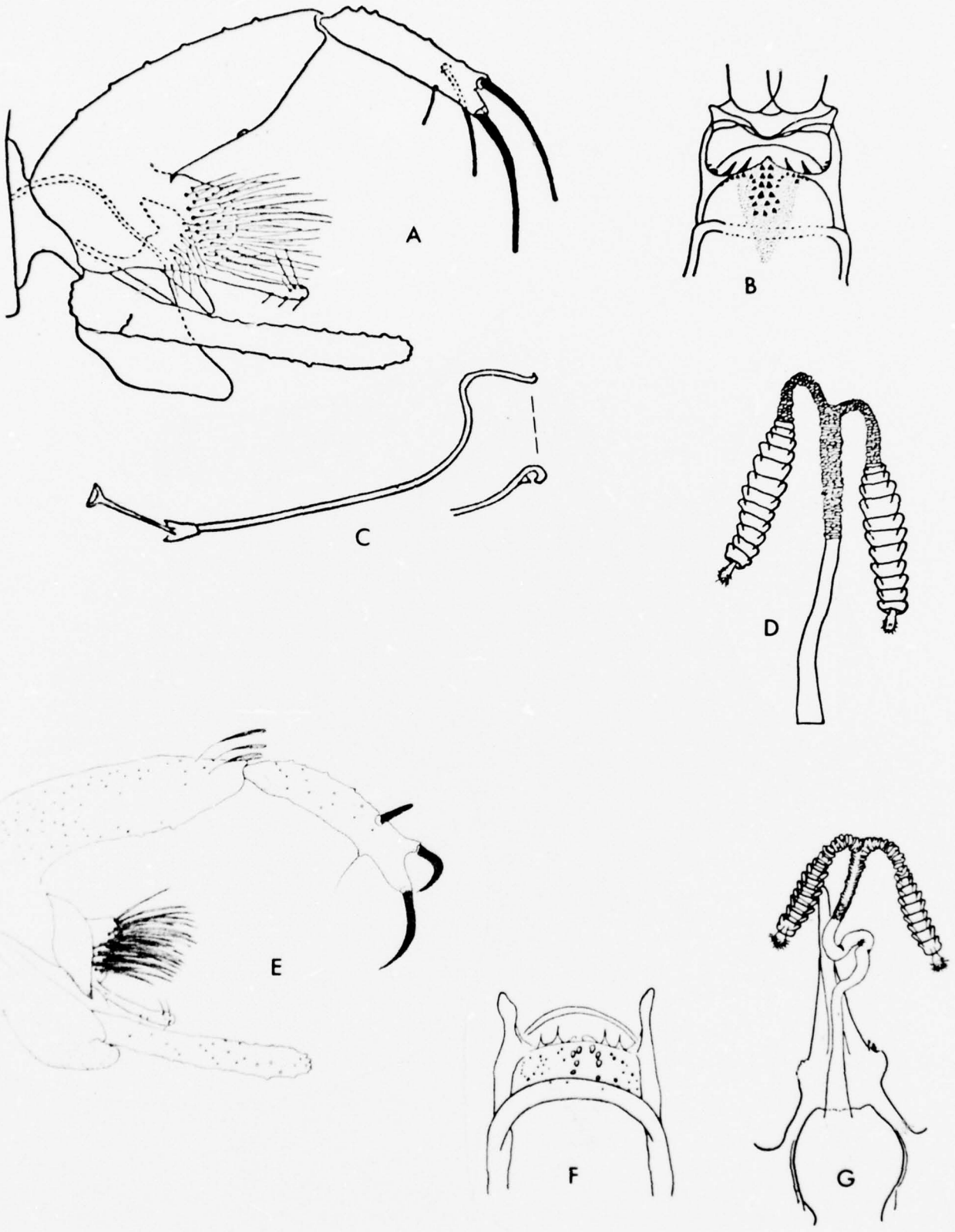


Fig. 76. L. fairchildi[23], A-D; Lutzomyia n.sp.[20] #1, E-G.

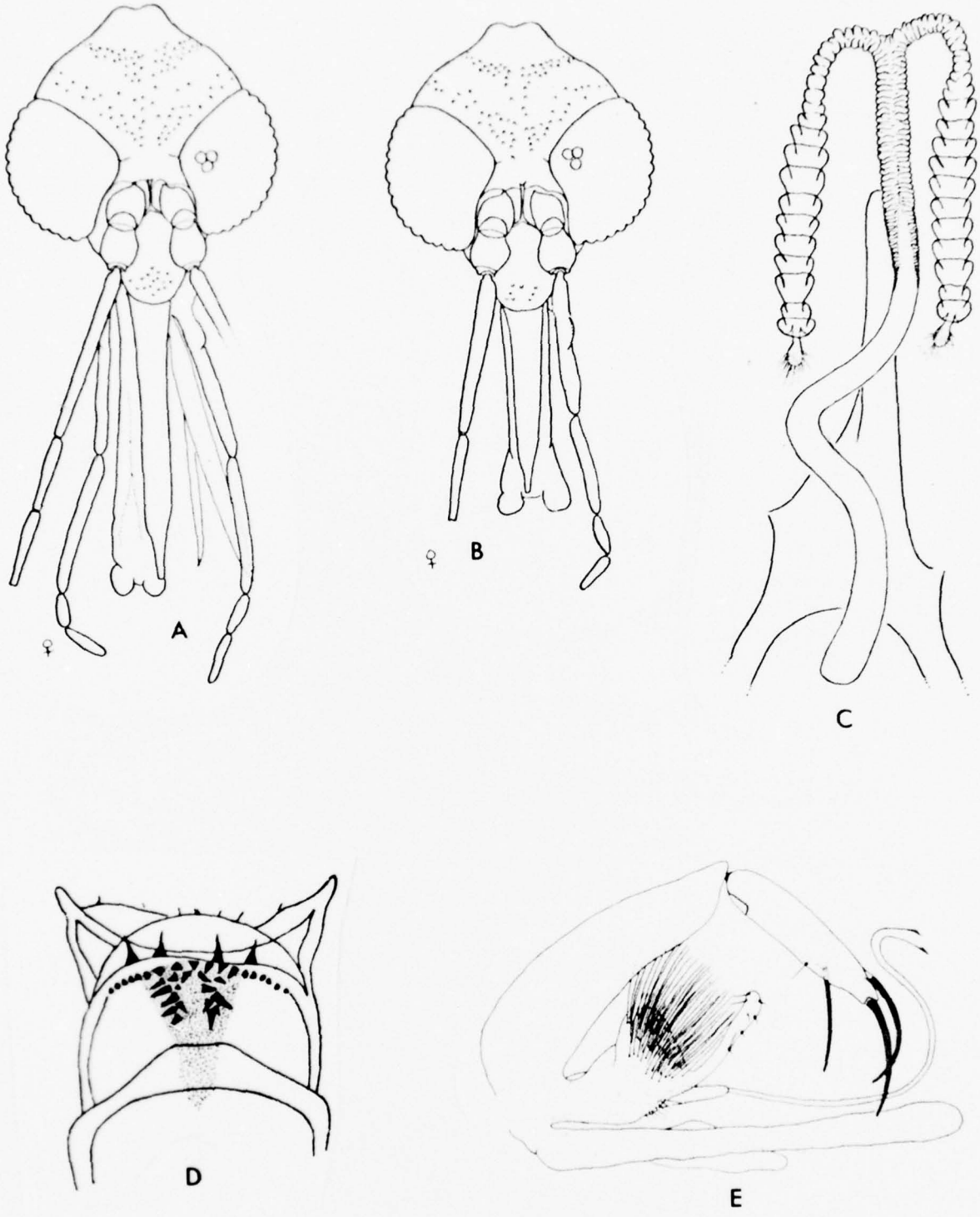


Fig. 77. Lutzomyia n.sp. #1, A; L. carrerai[27], B-E.

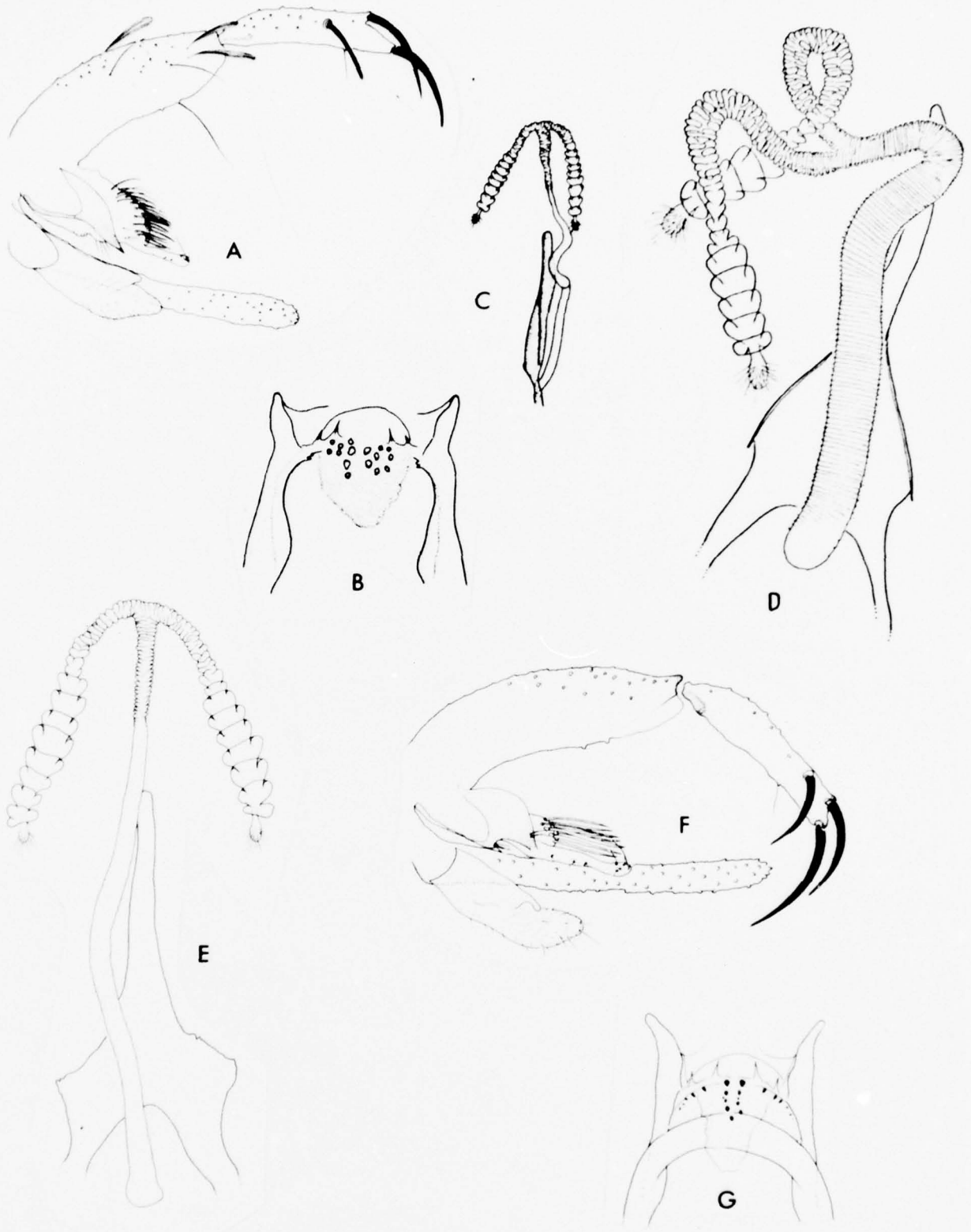


Fig. 78. L. tintinnabula, A-C; L. ayrozai, D; L. nocticola[25], E-G.

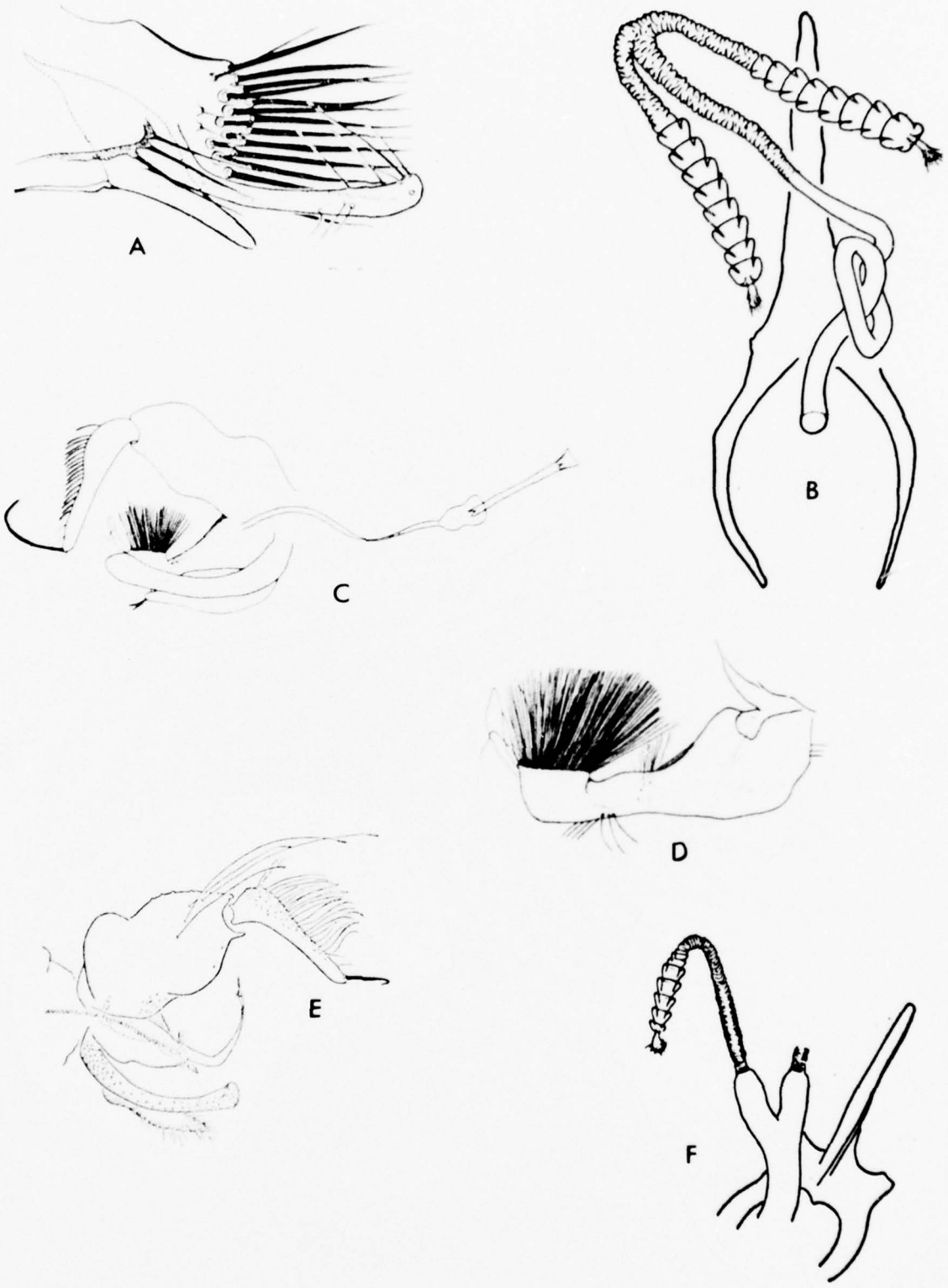


Fig. 79. L. paraensis[28], A, B; L. chagasi[29], C, D; L. maripaensis[30,31], E-F.

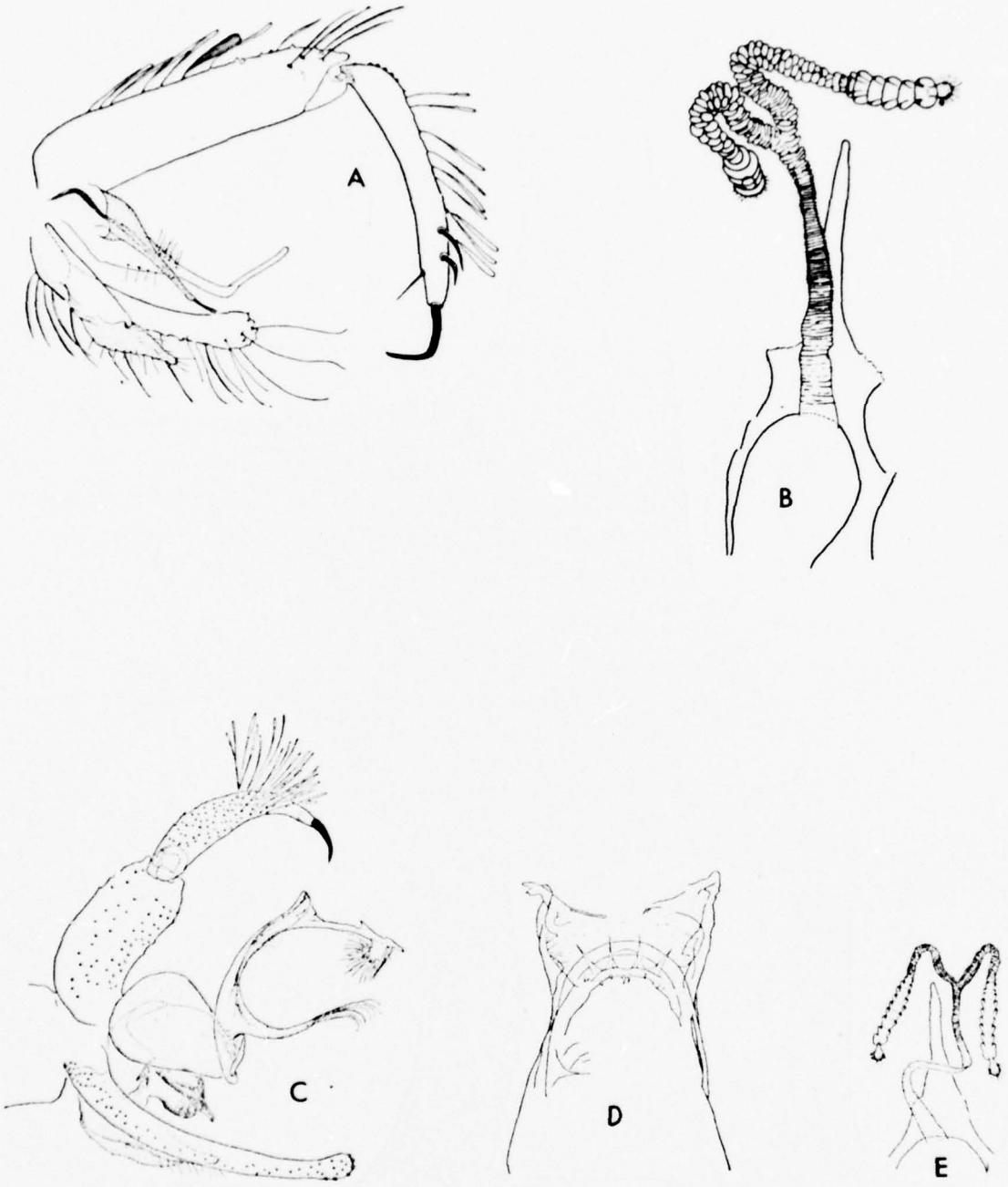


Fig. 80. L. guyanensis[20], A-B; L. lainsoni[32], C-D.

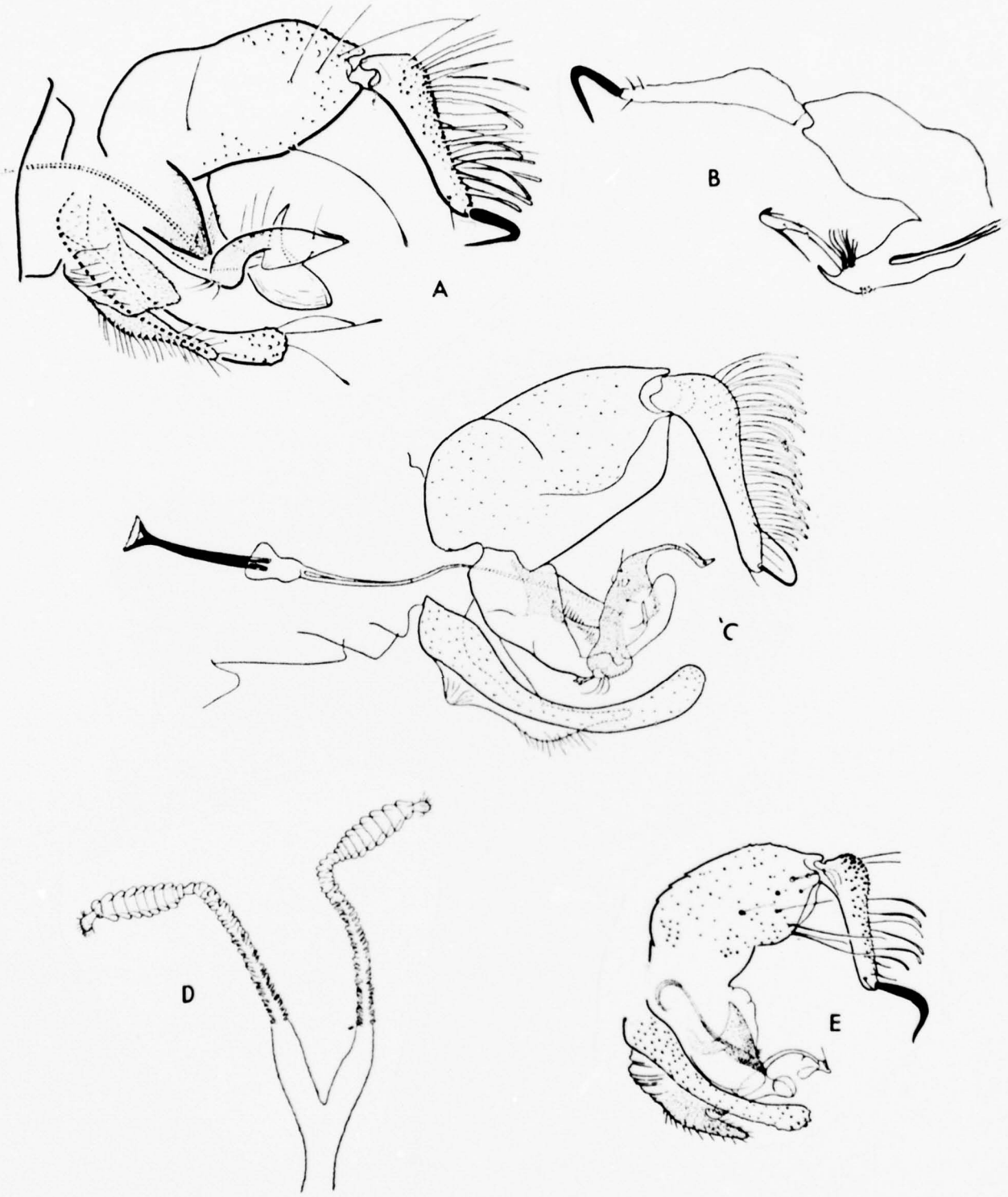


Fig. 81. L. wellcomei[30], A; L. bernalei[33], B; L. squamiventris[29,34], C, D; L. fairtigi[20], E.

Gasparviannai Group

Introduction

The included species, one of which, L. gaspariviannai Martins, Godoy & daSilva, was tentatively placed in the cruciata group by Theodor,[19] do appear to be closely related to the series cruciata species but it seems better to separate them for the moment. The coxite tuft is borne on a relatively long tubercle and the tips of the genital filaments are inflated in the two species. The only described females, L. gasparviannai and L. ciponensis Martins, Falcão & daSilva, resemble those of cruciata and its allies in the shape of the spermathecae but differ from them in having a long common duct.

All of the species occur in Brazil but one, L. carvalhoi (Damasceno, Causey & Arouck), has also been reported from French Guiana.[35] None of the species is known to bite man.

Species

1. L. carvalhoi (Damasceno, Causey & Arouck), 1945, Mem. Inst. Oswaldo Cruz, 43:8 (Male, Belém, Pará, Brazil). Fauran, 1960, Inst. Past. Guyane, No. 460, 10 p. (Fr. Guiana, Male redescribed).

2. L. cipoensis Martins, Falcão & daSilva, 1964, Rev. Brasil. Biol., 24:312 (Male, Serra do Cipo, Minas Gerais, Brazil). Martins et al., 1975, Rev. Brasil. Biol., 35:297 (Female).

3. L. flabellata Martins & daSilva, 1964, Rev. Brasil. Biol., 24:133 (Male, Colonia Calafate, Acre, Brazil).

4. L. gasparviannai Martins, Godoy & daSilva, 1962, Rev. Inst. Med. Trop. São Paulo, 4:86 (Male, female, Tingua, Rio de Janeiro, Brazil).

Key to Adult Males

1. Genital filaments over 3X the length of the pump, with simple tips. Ascoids with short but distinct posterior spurs.----------2
   Genital filaments less than 2X the length of the pump, with swollen and/or curved tips. Ascoids without posterior spurs.----------3

2. Coxite tuft of about 20 unmodified setae borne on a broad tubercle.----------L. flabellata (Fig. 82)
   Coxite tuft of 6-8 setae, some of which are foliaceous, borne on a smaller tubercle.----------L. carvalhoi (Fig. 82)

3. Genital filaments shorter, about 1.3X length of pump, with markedly enlarged tips; lateral lobe & coxite subequal in length.----------L. cipoensis (Fig. 82)
   Genital filaments 1.5-1.6X length of pump, their tips not as enlarged; lateral lobe longer than coxite.-----L. gasparviannai (Fig. 83)

Key to Adult Females*

1. Cibarium with 2 broad horizontal teeth.-------L. gasparviannai (Fig.83)

   Cibarium with 4 slender horizontal teeth.-----L. cipoensis (Fig.82)

*The females of L. flabellata and L. carvalhoi are unknown.

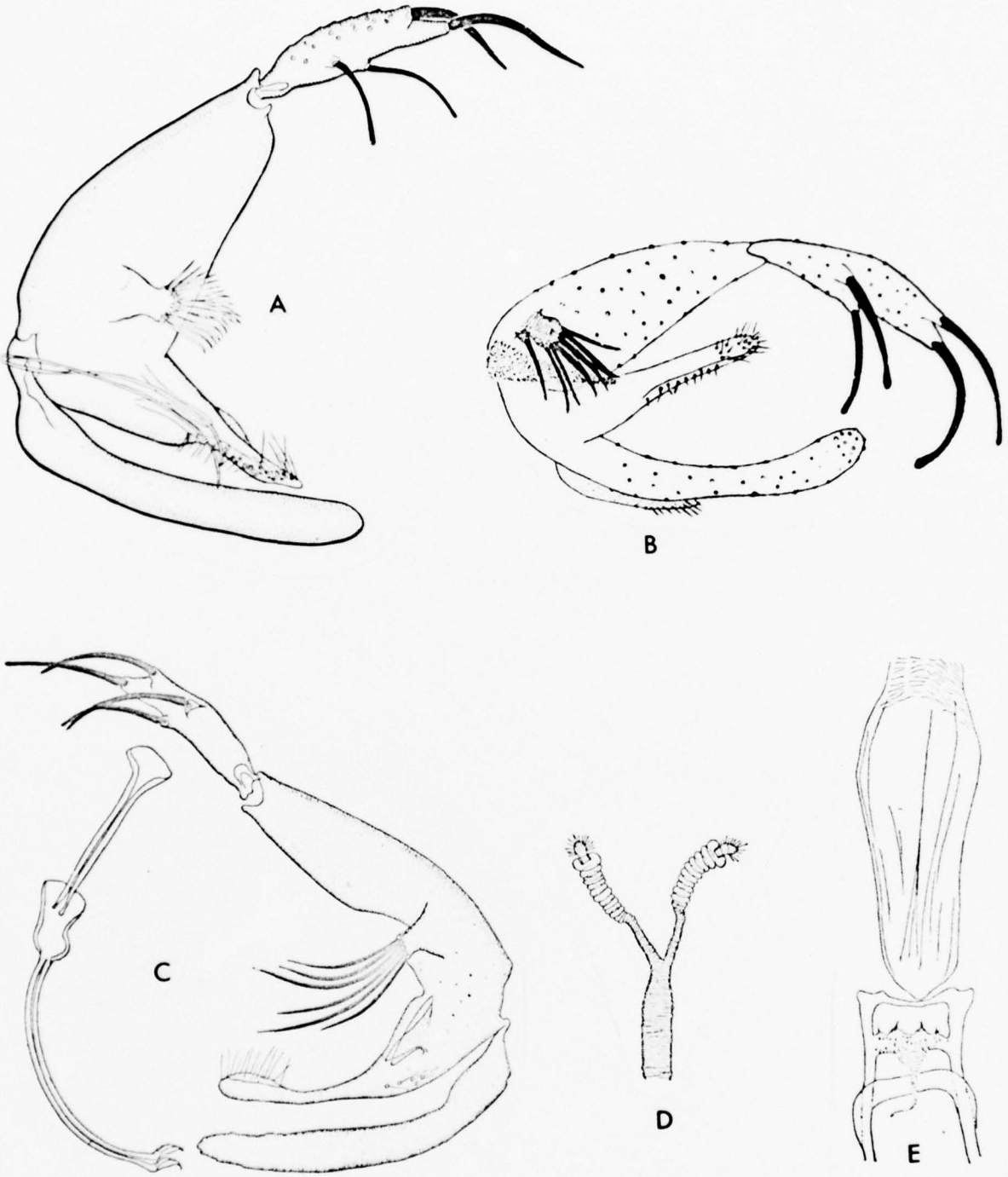


Fig. 82. Lutzomyia flabellata[36], A; L. carvalhoi[35], B; L. cipoensis[37,38], C-E.

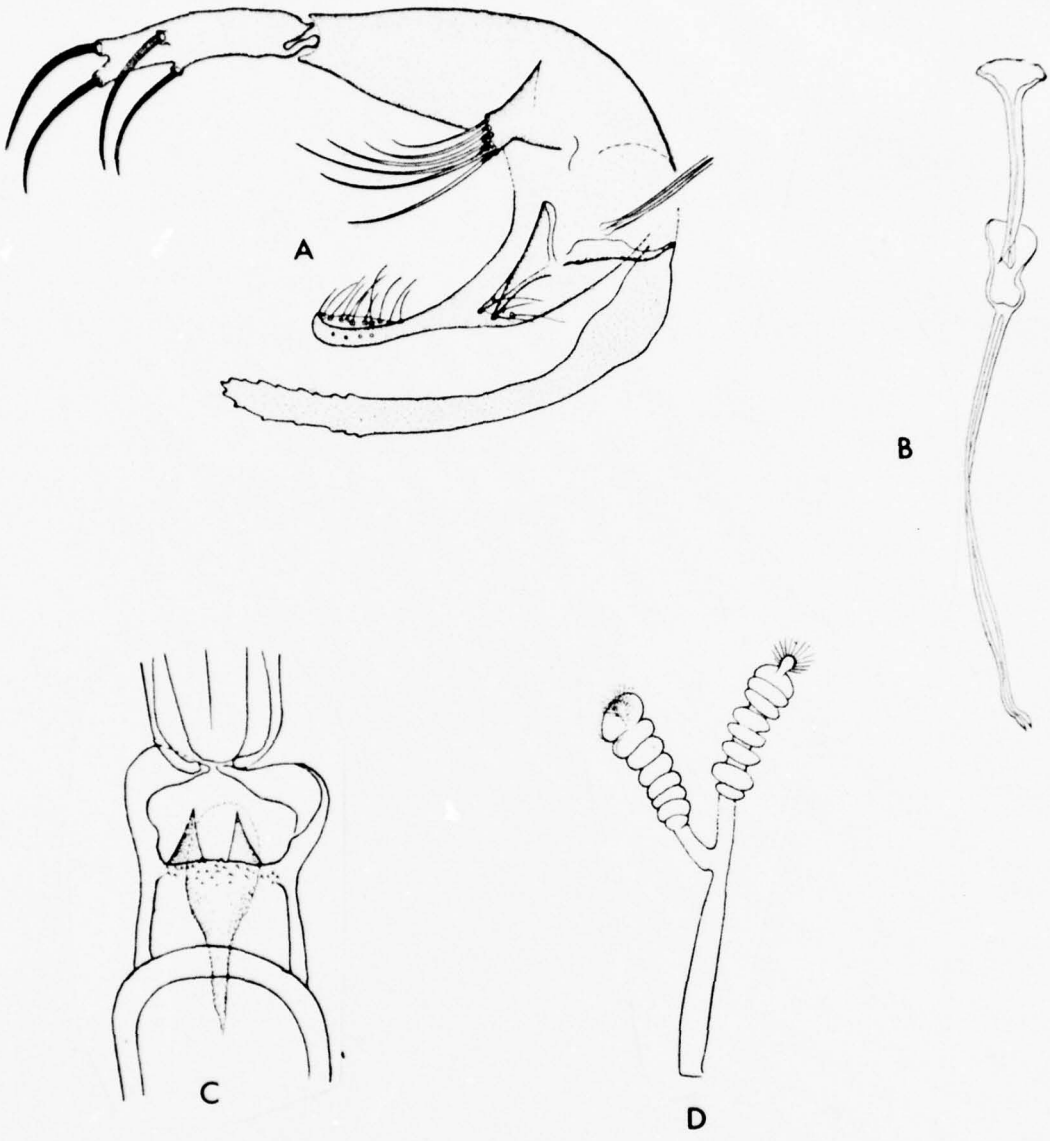


Fig. 83. L. gasparviannai[39], A-D.

Subgenus Dampfomyia

Introduction

This subgenus, created by Addis for L. anthophora, now contains five species ranging from Southern Texas to Colombia. The center of distribution is Central America.

The type species was discovered feeding on domestic rabbits but the natural host appears to be the woodrat, Neotoma sp.[40] A Phlebotomus Fever Group virus, Rio Grande virus, was recently isolated from woodrats near Brownsville, Texas[42] and it seems very likely that L. anthophora is involved with the transmission of this agent. None of the Dampfomyia species is anthropophilic. L. permira has been captured in rodent-baited traps in Belize.[41]

Forattini[17] enlarges the subgenus by adding L. saulensis (Floch & Abonnenc), L. samueli (Deane), L. deleoni (Fairchild & Hertig) and L. vesicifera (Fairchild & Hertig).

Species:

1. Lutzomyia anthophora (Addis), 1945, J. Parasit., 31:119 (Male, female, Uvalde, Texas, U.S.A.). Addis, 1945, J. Parasit., 31:319 (immatures). Fairchild & Hertig, 1956, Ann. Ent. Soc. Amer., 49:307 (Figured).

   Distribution: Texas, Mexico

2. L. dodgei (Vargas & Najera), 1953, Rev. Inst. Salub. Enf. Trop., 13:44 (Male, female, Cocula, Guerrero, Mexico).

   Distribution: Mexico, El Salvador

3. L. insolita (Fairchild & Hertig), 1956, Ann. Ent. Soc. Amer., 49:310 (Male, Almirante, Bocas del Toro Prov., Panama).

   L. rubidulus (Fairchild & Hertig), 1956, Ann. Ent. Soc. Amer., (Female, Mojinga Swamp, Panama Canal Zone). Christensen & Rutledge, 1973,

J. Med. Ent., 10:314 (As a junior synonym of insolita).

Distribution: Panama

4. L. permira (Fairchild & Hertig), 1956, Ann. Ent. Soc. Amer., 49:312 (Female, Palenque, Chiapas, Mexico). Lewis & Garnham, 1959, Proc. R. Ent. Soc. Lond., 28:83 (Male, Belize).

Distribution: Belize, Panama

5. L. rosabali (Fairchild & Hertig), 1956, Ann. Ent. Soc. Amer., 49:310 (Male, female, Puerto Armuelles, Chiriqui Prov., Panama).

Forattini[17] treats rosabali as a junior synonym of dodgei, believing that the differences between the two forms represent geographic variation. For the present, however, I prefer to treat them as distinct species based upon different male genitalia.

Distribution: Costa Rica, Panama, Colombia

Key: *

Adult males

1. Style with 5 major spines and a small subterminal bristle..... L. insolita (Fig. 84)

   Style with 2-3 major spines and 2 small bristles; one subterminal, subterminal, the other basal..... 2

2. Dorsal arm of paramere short, strongly clubbed..... ..... L. anthophora (Fig. 84)

   Dorsal arm longer and more slender..... 3

3. Dorsal arm of paramere nearly straight, not markedly enlarged distally, and with 15 or fewer setae in a single row..... ..... L. rosabali (Fig. 84)

   Dorsal arm curved, enlarged at end and with 20 + setae in 2 or more rows..... 4

* modified from that of Fairchild & Hertig[43]

4. Tips of genital filaments enlarged; paramere subequal in width throughout, lacking an acute ventral process..... L. permira (Fig.84)

Tips of genital filaments simple; proximal half of paramere about twice as wide as distal portion, a distinct acute process present on ventral surface..... L. dodgei (Fig. 84)

Adult Females

1. Individual sperm ducts thin & at least as long as the spermathecae 2

Individual sperm ducts wide & shorter than the spermathecae..... 3

2. Cibarium with prominent lateral teeth and 2 broad horizontal teeth..... L. anthophora (Fig. 85)

Cibarium without lateral teeth but with 4 + horizontal teeth..... ..... L. insolita (Fig. 85)

3. Spermathecae seemingly joined directly to common duct. Cibarium without lateral teeth..... L. permira (Fig. 85)

Spermathecae with distinct individual ducts. Cibarium with lateral teeth..... L. rosabali (Fig. 85)
L. dodgei

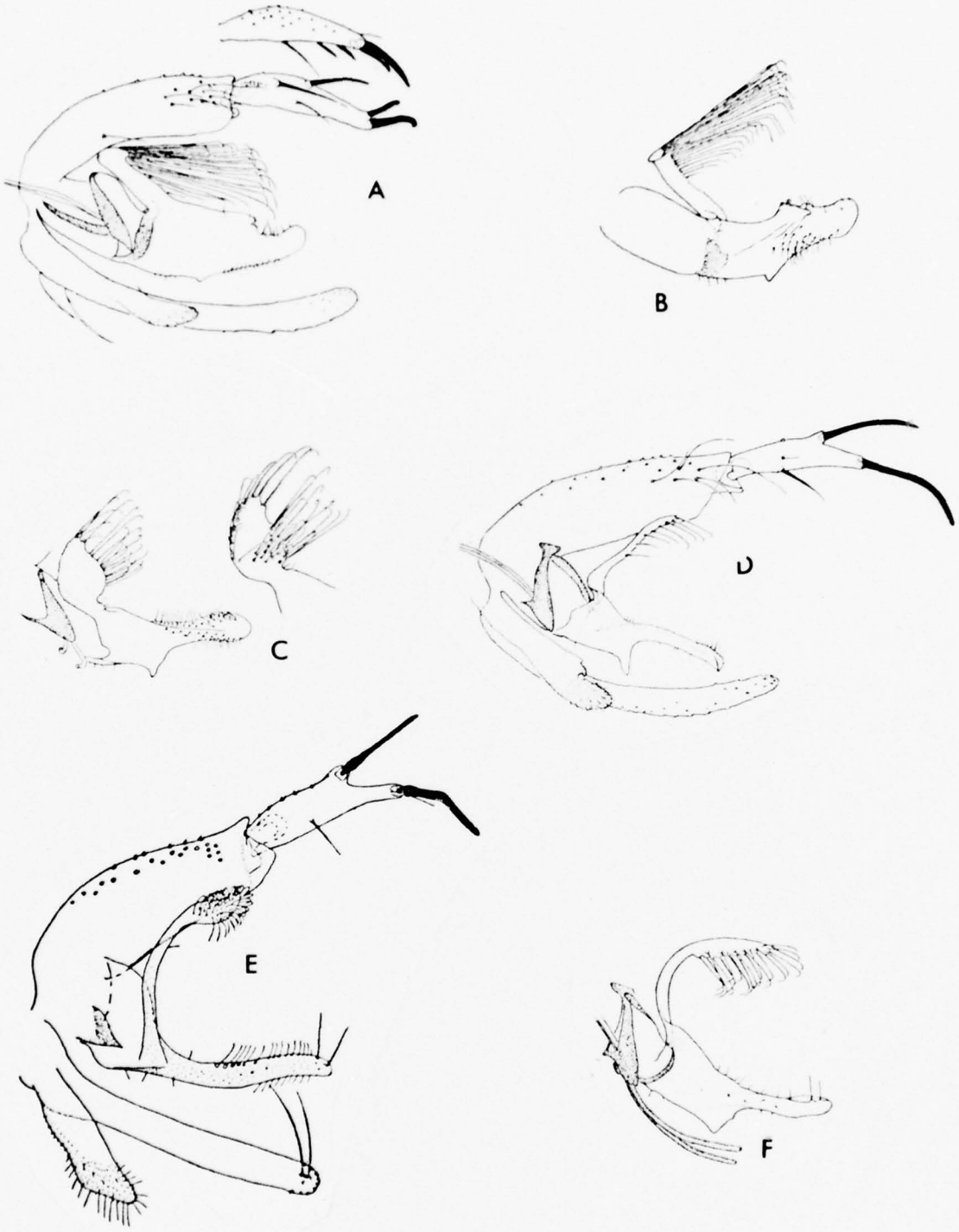


Fig. 84. Lutzomyia insolita[43], A-B; L. anthophora[43], C; L. rosabali[43], D; L. permira[44], E; L. dodgei[43], F.

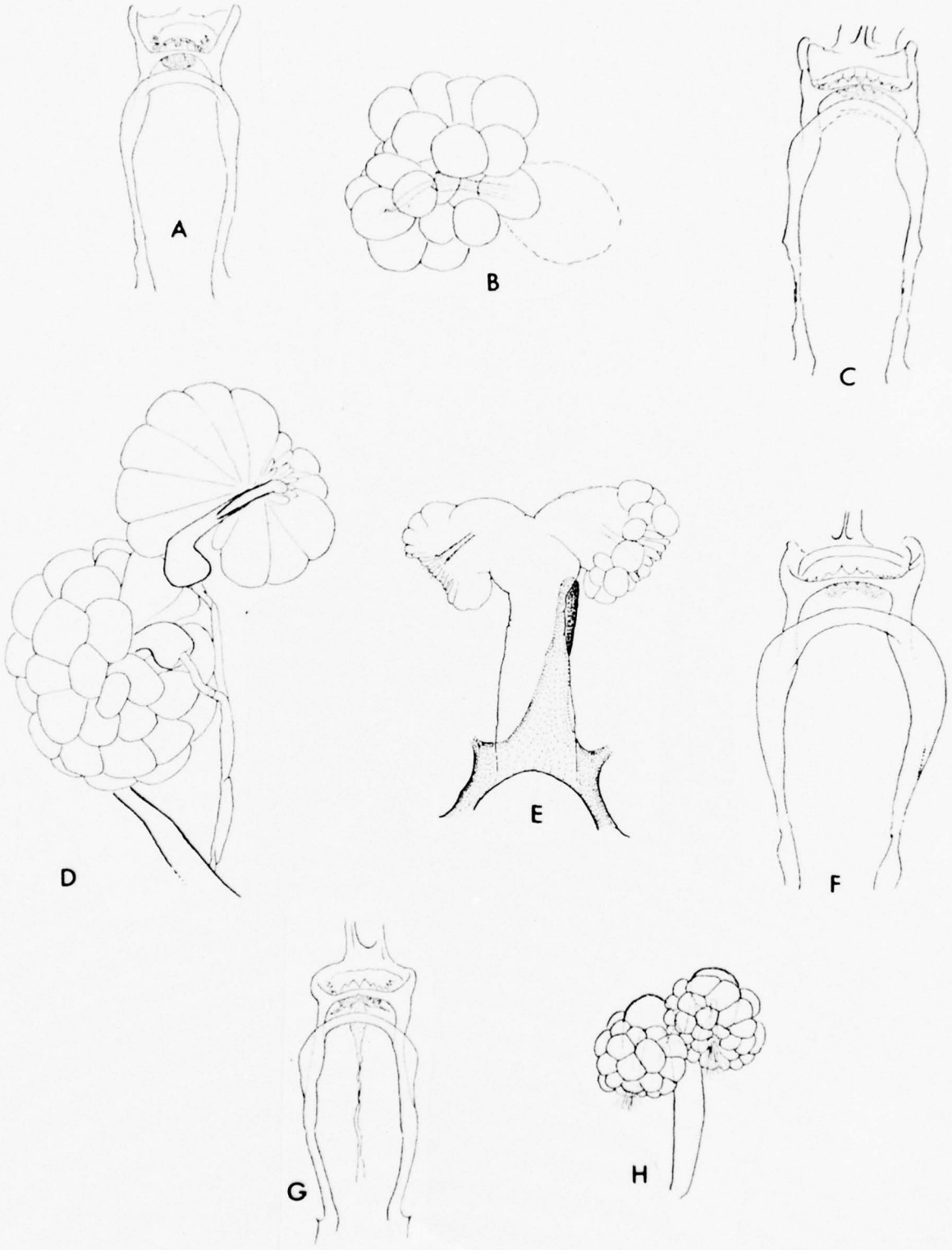


Fig. 85. L. anthophora[43], A, B; L. insolita[43], C, D; L. permira[43], E, F; L. rosabali[45], G, H.

Key to Lutzomyia males

1. Fifth palpal segment very short, never over half length of third segment nor twice as long as fourth. Palpal formula (segments in order of increasing length) 1-4-5-2-3. Abdomen clothed with recumbent scale-like setae. No basal setae on coxite. (Psychodopygus) 2

   Fifth palpal segment longer, seldom shorter than third, and if so, over half length of third and generally over twice length of fourth. Abdomen generally with erect setae, at least on hind margins of segments. Basal setae on coxite often present. 7

2. Parameres simple, without specialized setae or digitate processes. 3

   Parameres complex, with specialized setae and (or digitate processes. 4

3. Paramere straight, tapered, slightly shorter than lateral lobes. Coxite with but 2 strong spines, terminal and subterminal. bispinosa

   Paramere with very slender bare distal third bent upward at an angle, longer than lateral lobe. Coxite with 4 spines, 1 large

terminal, 2 smaller dorsal, and 1 ventral seta-like, all on distal third of style. Lateral lobes markedly shorter than coxite. geniculata

4. Parameres with two separate groups of strong blade-like setae and a short ventral digitate process bearing two long slender setae. Style with 4 spines, 1 terminal, 2 dorsal and 1 ventral, all on terminal third of style. panamensis

Paramere with setae in a single group, not blade-like, the digitate process longer and with only minute setae at apex. 5

5. Paramere with a single long seta arising from a prominent tubercle near base. Digitate process arising basal of the dense group of terminal setae. Style with 3 strong spines and a small seta, 1 terminal, the remaining spines and seta on middle third of style. nicaraguensis

Paramere without basal setiferous tubercle. Digitate process arising near distal end of paramere, below terminal group of setae. Style with 3 spines and a strong seta, all in terminal half of style. 6

6. Mesonotum distinctly infuscated. Terminal setae of paramere extending beyond end of digitate process. Small seta of style inserted basad of most basal spine. paraensis

Mesonotum hardly infuscated, not contrasting with pleura. Digitate process of paramere extending beyond ends of setae. Seta of style at level of most basal spine. n. sp.

7(2). The 4 spines on style of genitalia on long tubercles, style forked or antler like. Parameres with strong setae whose ends are frayed or tufted. No basal setae on coxites. Fifth palpal segment short, subequal to third, palpal formula 1-4-2-(5-3) or 1-4-2-3-5. (Viannamyia) 8

Style not as above. 9

8. Style with 2 long branches, each bearing a terminal and subterminal spine. Parameres slender, strongly curved downwards, bearing a short heavy terminal spur and several long dorsal tufted setae. caprina

Style with basal branch shorter, the most basal spine on a short separate tubercle at its base. Paramere stout, triangular, without terminal spur, but with several long

tufted setae dorsally. tuberculata

9. Parameres with an articulated setiferous dorsal arm. Coxites without basal setae. Fifth palpal segment very long, nearly equalling sum of 2 + 3 + 4; palpal formula 1-2-4-3-5 or 1-(2-4)-3-5. First flagellar segment of antenna short, not much longer than third palpal segment. (Dampfomyia) 10

Parameres without such an arm, or if an arm is present, it is not articulated, or there are highly modified leaf-like setae on base of coxite. 11

10. Style with 5 spines, 2 of which are terminal, and a subterminal seta. Parameres broad, the dorsal arm with a close set row of very long setae whose tips are bent downwards. insolita

Style with 4 spines and a minute subterminal seta; one of the 2 basal spines is reduced to a small seta. Paramere slender, curved, with a triangular projection below, the dorsal arm slender, nearly straight, and with a sparse row of short setae rosabali

11. Lateral lobes moderately to greatly inflated. A tuft of simple long setae on inner base of coxite. Style with 3 or 4 spines, the most basal often reduced to a slender seta. Subterminal seta present except in viriosus. Palpal formula 1-4-2-3-5, the fifth segment generally less than 2 + 3. 12

Lateral lobes slender. 15

12. Style with large paired terminal spines, median and basal spines reduced to small setae; no subterminal seta. Basal tuft on coxite of about 8 long setae. Paramere long, slender, clubbed, with a patch of short setae only on the end. Lateral lobes greatly inflated, less than 4 times as long as greatest width, markedly longer than coxite. viriosa

Style with single terminal spine and subterminal seta. Lateral lobes over 5 times as long as wide, moderately inflated, subequal or slightly longer than coxite. 13

13. Basal spine of style well developed, not seta-like, though more slender than the other two. Paramere with a triangular projection ventrally near apex. vesicifera

Basal spine of style a slender seta. Parameres without ventral

projection. 14

14. Paramere stouter and straighter, with setae dorsally on the distal 1/2 to 2/3. Aedeagus acutely pointed. vespertilionis

Paramere more slender and curved, with setae dorsally only on distal 1/3. Aedeagus bluntly rounded. isovespertiolionis

11

15(1). Style of genitalia with 4 spines, one of them terminal, but no accessory seta. Ascoids of antennae with a short or long posterior prolongation. Fifth palpal segment not over twice third. 16

Not with all the above characters. 29

16. A group of several spines on inner base of coxite, 2 of which are very heavy with leaf-like tips. Several strong spines at apex of coxite. Parameres with a dense dorsal subapical tuft of hooked setae and a single strong leaf-bladed seta at apex. Palpal formula 1-4-2-3-5, the fifth segment but slightly longer than third. Posterior prolongations of ascoids very long, exceeding base of segment. aclydifera

Without setae on base of coxite. 17

17. Parameres with an armature of heavy spines and/or seta-bearing processes. Style with paired basal, 1 median and 1 apical spine. 18

Parameres simple. 19

18. Paramere with a short basal process bearing a fan of long setae and the apex with a strong dorsal retrograde spur, tips of genital filaments expanded, blade-like. dasymera

Paramere with an oval area on mesal surface at apex surrounded by heavy curved setae below and long erect setae dorsally. Tips of genital filaments simple. cratifera

19. Most basal spines of style inserted at same level, or nearly so, paired. 20

Most basal spines of style inserted at markedly different levels. 27

20. Delta and alpha of wing venation both very long, the first over half length of second. Head markedly flattened at

vertex. Basal spines of style inserted at somewhat less than half distance from base to apex, the median spine closer to basals than to terminal spine. Paramere slender, simple. Coxite with slender non-deciduous setae at apex, and scattered short setae on inner aspect. Aedeagus long and slender, genital filaments simple, pointed. Posterior prolongation of ascoids short. barrettoi

Delta shorter, less than half alpha. Head not markedly flattened. 21

21. Tips of genital filaments curled or twisted like a pigs tail, the aedeagus large and blunt. Paramere somewhat clubbed. Style similar to barrettoi. Ascoids with short posterior spur. aragaoi

Tips of genital filaments straight, simple. 22

22. Parameres broad, their tips somewhat turned in mesad, beset with numerous long setae over most of their lengths. 23

Parameres slender, their tips simple, setae mainly dorsal and apical. Ascoids with long acute posterior spurs. 24

23. Basal spines of style at slightly different levels, the most basal closer to base than apex. Paramere tapered from base to apex, dorsally with a row of close set long straight setae from near base to apex. Ascoids with short blunt posterior spur. punctigeniculata

Basal spines paired, about midway between base and apex. Paramere nearly parallel sided, with sparser setae dorsally and long retrograde setae at apex. Ascoids with long acute posterior spurs, which do not reach end of segment. volcanensis

24. Paramere simple, slender, with long evenly waved hairs on dorsal surface of apical third. undulata

Parameres otherwise. 25

25. Paramere very slender, its apex slipper-shaped, with a rounded ventral heel ; apex beyond heel with a few waved setae dorsally. soccula

Paramere otherwise, simple. 26

26. Paramere straight or slightly curved upwards, slender and slightly clubbed, with numerous straight setae on the apical

half. shannoni

Paramere more slender, more clubbed, with fewer setae and these confined to apical third or less. abonnenci

27(19). Style with a basal spine, 2 median spines close together and a terminal spine well separated from the medians. Tips of genital filaments lanceolate. Aedeagus long and tubular. Parameres simple slightly clubbed, beset with fine short setae. Ascoids with short acute posterior spurs. runoides

Style otherwise. Tips of genital filaments not lanceolate. 28

28. Style with a basal, a median and apical and subapical spines, the latter on a long prominence. Paramere slender, evenly curved upward, sparsely short haired. Aedeagus long and tubular, the genital filaments with hooked tips. carpenteri

Style with a basal, 2 median and apical spine, the distal median spine close to the apical, the basal spine well separated from the others. Paramere straight, moderately stout, slightly clubbed, and beset with long waved setae dorsally. Aedeagus unusually short, triangular with bulbous base, the genital filaments unmodified. Delta

of wing venation unusually long, fully 2/3 alpha. A group of setae on mid-coxite internally, and setae on apical third unusually long and heavy, non-deciduous. reburra

29(15). Style with 3 or less major spines, with or without supplementary setae. 30

Style with 4 or more major spines; when 1 is terminal, there is usually an accessory subterminal seta. 35

30. Style with 3 major spines but no subterminal seta. No setae at inner base of coxite, but a patch on outer apical third. Paramere simple, pointed, dorsally hirsute, as long as short lateral lobes. Palpal formula 1-(2-4)-3-5, the fifth segment as long or longer than sum of any two preceding segments. pilosa

Style with subterminal seta and setae or spines on inner base of coxite. Palpi as above, or 1-4-2-3-5. 31.

31. Coxite and lateral lobes very long and slender, 2.5-3 times as long as parameres. Style with 3 spines, the basal one smallest. A small accessory seta below median

spine of style. Paramere with triangular tooth ventrally. 32

Coxite $\overset{S}{\wedge}$ and lateral lobes not or but slightly longer than parameres. Style with 2 strong spines, terminal and subterminal, and a long basal seta well separated from the others. No accessory seta. Parameres simple, finger like. 33

32. Setae on inner base of coxite in two groups, one of semi-fused, heavy, hooked setae, the other of numerous long slender setae. Parameres broad and blunt, with a row of somewhat blade-like setae on inner base and a small setose protuberance on mesal face near apex. camposi

Long simple setae on coxite lacking, only group of semifused heavy setae present. Parameres very slender, the apex acute, with a dense row of setae below on apical third; No blade like setae at base. dysponeta

33. Setae on inner base of coxite about 7, in a compact group, their apices hooked. Paramere subequal to coxite in length. Adeagus tapered, shorter than cerci. odax

Setae on coxite in a row, more slender, not hooked.

Paramere shorter than coxite. Aedeagus more cylindrical, subequal to cerci. 34

34. Setae on coxite about 5, long, rather heavy, and curved. Aedeagus stout, about 4 times longer than thick. serrana

Setae on coxite about 5, shorter, more slender, and straight. Aedeagus slender, about 6 times longer than thick. oresbia

35(29). Style with 4 major spines. 36

Style with 5 major spines. 54

36. Subterminal seta present on style. 37

Subterminal seta absent. 45

37. Parameres armed with strong setae or branched, not simple. 38

Parameres simple. 40

38. Parameres with 3 branches, the basal one curved and bearing dense long setae at its apex. No setae on inner

base of coxite. Palpal formula 1-(2-3-4)-5, the last subequal t preceding 3. Cerci abruptly narrowed apically. triramula

Parameres bearing a single dorsal process or strong setae. Setae present on inner base of coxite. 39

39. Paramere terminally beaked, with a long, articulated, sclerotized dorsal arm at base bearing 2 heavy setae with foliose tips. Setae on coxite 2, broadly leaf-shaped. All four spines of style at different levels. lichyi

Paramere with 2 strong hooked setae dorsally at base, the apex slender, somewhat clubbed. Setae on coxite about 4, slender, simple. 2 basal spines of style at nearly same level. longipalpis

40. No setae on inner base of coxite, but a few sparsely set long slender ones about middle of coxite. Paramere simple, slender, finger-like, dorsally sparsely long setose. (This species is keyed twice, as it usually has 5 spines on style. See couplet 54). pia

At least a few setae on inner base of coxite. 41

41. Coxite much longer than lateral lobes, with a patch of very short dorsally directed setae at base and about 6 long heavy spinose setae at apex. Style long and cylindrical, the 4 short heavy spines, of which 2 are terminal, grouped on terminal third of segment. Paramere large, arched, spatulate. Aedeagus very small; genital filaments short and heavy, about twice length of pump. Gorbitzi

Coxite subequal to lateral lobes or shorter. Style not as above. 42

42. Hind femora with a row of 4-9 long setae arising from short-spined bases. Setae on coxite about 6, in a compact group, slender and straight. Style with 3 of the 4 spines croweded near apex, the remaining one near middle of segment. Paramere simple, digitiform, finely setose, the setae longer on apical third. spinosa

Hind femora unarmed. 43

43. Paramere broad, angulate, the apex pointed and 2 sharp angles below. Setae on coxite about 6, slender, straight, inserted in a row. saulensis

Paramere not angulate, digitate or clubbed, smooth. 44

44. Setae on coxite very fine and numerous, their tips recurved. A row of about 6 long fine setae on lower margin of middle of coxite. Tips of genital filaments cup-like, with a small central knob. Paramere weakly clubbed, dorsally densely setose on apical half.

marajoensis

Setae on coxite about 10, fine and straight. Tips of genital filaments simple. Paramere slender and curved distally, a few short setae at slightly clubbed apex. No row of setae on middle of coxite. ovallesi

45(36). With setae on inner base of coxite. 46

Without such setae. 48

46. Setae on coxite 4, heavy and twice curved, their bases separate. Spines on style 1 terminal, 2 median close together, 1 basal. Paramere slender, strongly clubbed, densely long setose on apical third. atroclavata

Setae on coxite arising from a tubercle, their bases together. Spines on style 1 terminal, 1 median, 2 basal at about same level. Parameres less clubbed, more sparsely but evenly setose. 47

47. Mesonotum and scutellum strongly infuscated, pleura entirely pale. Ascoids on fourth antennal segment about 1/3 length of segment. gomezi

Mesonotum, scutellum and pleura infuscated. Ascoids of fourth antennal segment shorter, about 1/4 length of segment. cruciata

48(45). Head, mesonotum, abdomen and femora heavily infuscated, in marked contrast to pleura and scutellum, the former with silvery scales in life. Style with 1 apical, 1 subapical and 2 basal spines at same level, one of latter on a prominent tubercle and all spines on apical half of style. olmeca bicolor

Head, mesonotum and abdomen not strongly contrasting in color with pleura. 49

49. Fifth palpal segment long, longer than sum of any two preceding segments. First flagellar segment of antennae much less than half length of palpi. Genitalia simple, rather small, with 4 spines on style and simple parameres subequal to lateral lobes. Whole body stongly infuscated. 50

Fifth palpal segment short, subequal or longer than third, but shorter than sum of 3 + 4. 51

50. Genitalia exceedingly small. Wing very narrow; alpha of venation shorter than beta or gamma; delta about 1/3 alpha or less. Basal spines of style at same level. Cibarium with about 4 minute horizontal teeth. micropyga

Genitalia relatively larger. Wing broader; alpha longer than beta or gamma, delta over 1/2 alpha or longer. Basal spines of style not at same level. Cibarium with a row of numerous teeth forming a weak comb-like structure. cayennensis

51. Third antennal segment exceedingly long, markedly longer than palpi. Style of genitalia with basal spine well separated from the others, at about middle of style. Tips of genitalia filaments simple, acutely pointed.

nordestina

Third antennal segment short, hardly over 2/3 length of palpi. Basal spines of style paired, at about same level. Tips of genital filaments modified. 52

52. Aedeagus a straight-sided triangle, apex rather broad and blunt. Subapical spine of style well separated from terminal spine. Tips of genital filaments widely forked, like an open crab-claw. anduzei

Aedeagus with somewhat concave sides, the apex more slender and attenuated. Tips of genital filaments not as above. 53

53. Entirely pale species. Median spine of style well separated from apical spine. Coxite considerably longer than style, paramere or lateral lobes. Tips of genital filaments slightly expanded but not split. trapidoi

At least mesonotum somewhat infuscated, generally also head. Median spine of style almost terminal, nearly paired with apical spine. Coxite, paramere and lateral lobes subequal, not very much longer than style. Tips of genital filaments split. ylephiletrix

54(35). Style with a single terminal spine and subterminal seta, 2 median spines at different levels, and paired basal spines. No setae on base of coxite. Tips of genital filaments slightly hooked. Fifth palpal segment moderate, about equalling 3 + 4. Alpha and delta of wing venation very long, both equalling or exceeding sum of beta and gamma (see couplet 40). pia

Style with paired terminal spines and no accessory subterminal setae. Setae on base of coxite usually present. Parameres simple. 55

55. Fifth palpal segment short, less than 3 + 4. Setae on base of coxite about 3, at least one of which is stronger and arises from a strong tubercle. 56

Fifth palpal segment long, markedly longer than 3 + 4.

Setae on base of coxite few or many, none strong nor arising from strong tubercles, forming a diffuse patch or ill defined row, when numerous. 57

56. Sperm pump small and slender, the genital filaments from 3.8 to 5 times as long as pump, their tips drawn out into fine points. Aedeagus slender, acute. hartmanni

Sperm pump larger and heavier, the genital filaments from 2.1 to 3.7 times as long as pump, tips blunt and bent. Aedeagus stout, blunt. sanguinaria

57. Median spine of style closer to basal spines than to apical spines, the former markedly more slender and closer to base than to apex of style. Setae on base of coxite closely set in a transverse cluster. Pharynx constricted before apex, lamp-glass shaped, with weakly spinose transverse ridges. A strong chitinous arch in cibarium. chiapanensis

Median spine of style closer to apical spines, than to basals, the latter at about middle of segment. Setae on base of coxite fine and diffusely scattered. Pharynx

not as above and no chitinous arch in cibarium. 58

58. Terminal spines of style markedly uneven in size, the smaller, dorsal spine hardly half as long or thick as the ventral. Body including head markedly infuscated. Setae on inner aspect of coxite 12 or more, long, fine and curved at apices. rorotaensis

Terminal spines of style but slightly different in size, the dorsal somewhat shorter and more slender. Body and head pale, but slightly infuscated. Setae on coxite seldom more than 8 often reduced to 2 or 3. trinidadensis

Table 1 Panamanian sandflies collected in different microhabitats.

Phlebotomine species	Arboreal	Terrestrial	Subterrestrial		Artificial		Total
	Tree assoc.*	Forest floor**	Crevices & caves	Animal burrows	Human dwelling	Other***	
L. abonnenci****	4,307	68	31	97	-	-	4,503
L. aclydifera	290	1	10	550	-	1	852
L. anduzei	3	-	-	-	-	-	3
L. aragaoi	-	-	-	14	-	-	14
L. atroclavata	22	3	22	-	-	357	404
L. barrettoi	-	8	-	61	-	-	69
L. bispinosa	2	7	-	-	-	-	9
L. botella	-	2	-	-	-	-	2
L. camposi	204	2	5	262	-	-	473
L. carpenteri	96	2	-	1,509	1	2	1,610
L. cayennensis	94	-	2	-	4	435	535
L. chiapanensis	7	-	-	-	-	61	68
L. cruciata	142	38	-	2	-	-	182
L. dasymera	30	-	1	-	-	-	31
L. dysponeta	65	1	2	632	1	35	736
L. furcata	52	6	-	-	1	-	59
L. geniculata	2	-	-	-	-	-	2
L. gomezi	169	657	11	4	13	5	859

Continued

Phlebotomine species	Arboreal	Terrestrial	Subterrestrial		Artificial		
	Tree assoc.*	Forest floor**	Crevices & caves	Animal burrows	Human dwelling	Other***	Total
L. gorbitzi	70	-	-	1	-	-	71
L. hartmanni	7	1	-	2	-	-	10
L. insoleta	-	51	-	-	-	-	51
L. isovespertilionis*****	5,412	36	4,026	146	1	41	9,662
L. lichyi	37	2	1	1	-	-	41
L. marajoensis	2	-	-	-	2	-	4
L. micropyga	66	12	-	-	-	-	78
L. nordestina	19	-	11	57	-	-	87
L. odax	12	-	1	-	-	-	13
L. olmeca	4	356	2	-	-	-	362
L. oresbia	7	-	-	-	-	-	7
L. ovallesi	824	114	51	7	-	-	996
L. panamensis	81	310	12	-	1	-	404
L. pessoana	44	785	5	2	-	-	836
L. pilosa	13	-	-	-	-	-	13
L. pia	155	1	-	-	-	-	156
L. punctigeniculata	77	1	-	-	-	-	78
L. rorotaensis	84	8	6	-	-	-	98

Continued

Phlebotomine species	Arboreal: Tree assoc.*	Terrestrial: Forest floor**	Subterrestrial: Crevices & caves	Subterrestrial: Animal burrows	Artificial: Human dwelling	Artificial: Other***	Total
L. rosabali	4	-	-	-	-	-	4
L. runoides	5	-	12	107	-	-	124
L. sanguinaria	221	1,597	67	17	13	-	1,915
L. saulensis	6	-	-	5	-	-	11
L. serrana	95	4	-	-	-	-	99
L. soccula	4	-	-	-	-	-	4
L. spinosa	65	8	1	1	-	-	75
L. trapidoi	2,168	1,300	21	6	49	-	3,544
L. trinidadensis	15,601	248	161	192	5	1	16,208
L. triramula	172	14	23	1,401	-	-	1,610
L. tuberculata	1	-	-	-	-	-	1
L. undulata	24	1	-	1	-	-	26
L. vesicifera	58	1	142	57	-	2	260
L. viriosa	3	-	218	-	-	-	221
L. volcanensis	14	1	-	-	-	-	15
L. ylephiletor	17,733	889	1,363	55	12	6	20,058
B. galindoi	30	14	4	11	-	-	59
B. hamata	15	2	14	54	-	-	85
B. leopoldoi	2	-	-	2	-	-	4

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STUDIES OF PHLEBOTOMINE SAND FLIES.(U)
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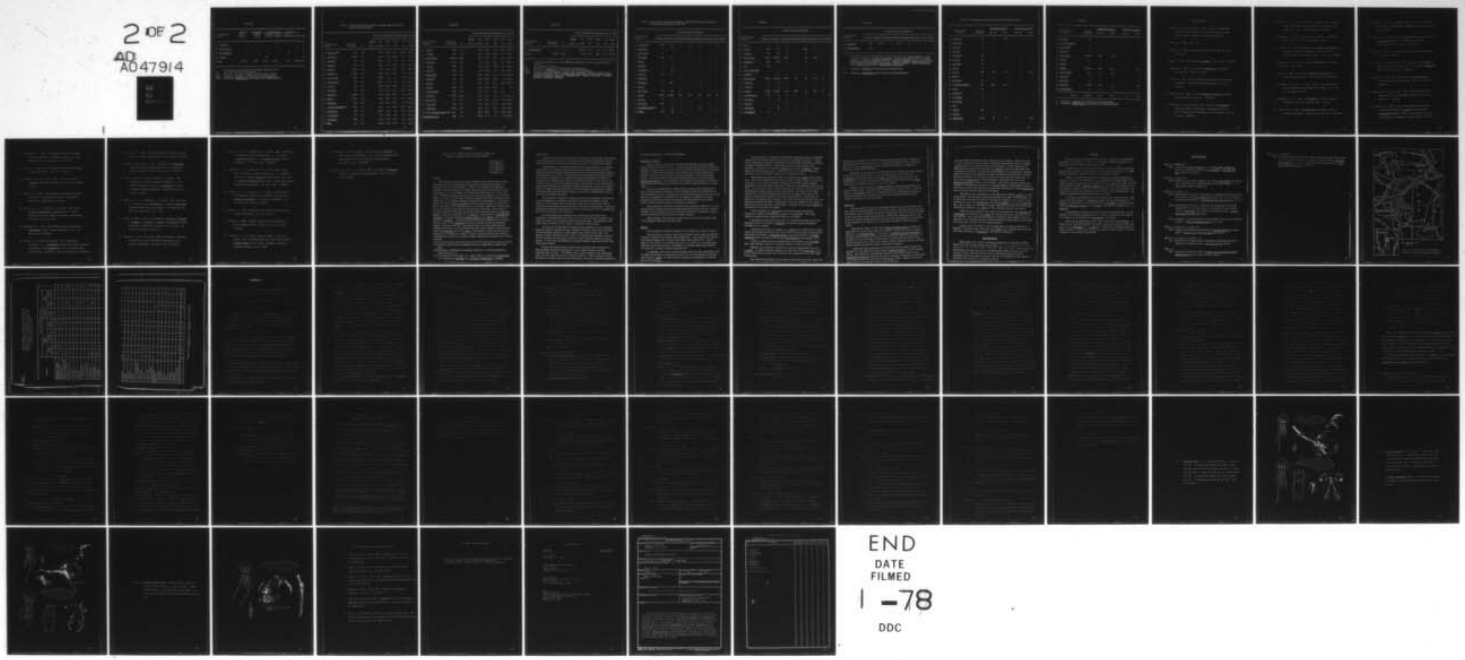

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Phlebotomine species	Arboreal: Tree assoc.*	Terrestrial: Forest floor**	Subterrestrial: Crevices & caves	Subterrestrial: Animal burrows	Artificial: Human dwelling	Artificial: Other***	Total
B. travassosi	-	-	-	1	-	-	1
W. nigrosaccula	1	-	-	-	-	-	1
W. rotundipennis	-	-	2	-	4	-	6
H. hertigi	-	-	10	-	-	-	10
Totals	48,616	6,553	6,235	5,257	105	946	67,712

* Tree trunks, tree buttresses, tree holes, hollows of trees.
** Leaf litter and low growing shrubs.
*** Old ruins, rock walls, bridges, culverts, wells, cisterns.
**** Includes L. shannoni since females are indistinguishable.
***** Includes L. vespertilionis since females are indistinguishable.

Table 2 Panamanian sandflies collected in light traps at different heights above the ground.

Phlebotomine species	No. ♂ & ♀ all strata	%	Vertical stratification frequency per t-n* (%)				
			Mag**	0-6	6-12	12-18	18	Total
			No. t-n	2,584	86	85	30	2,785
L. abonnenci***	123	0.2		18.1	34.0	19.7	28.2	100.0
L. aclydifera	2,652	3.5		45.5	15.5	25.3	13.7	100.0
L. barrettoi	59	0.1		100.0	0.0	0.0	0.0	100.0
L. bispinosa	177	0.2		45.6	0.0	32.0	22.4	100.0
L. camposi	1,166	1.6		21.5	45.7	27.5	5.3	100.0
L. carpenteri	4,648	6.2		38.7	41.1	19.5	0.7	100.0
L. cayennensis	352	0.5		100.0	0.0	0.0	0.0	100.0
L. chiapanensis	52	0.1		100.0	0.0	0.0	0.0	100.0
L. cruciata	66	0.1		51.0	24.5	24.5	0.0	100.0
L. dasymera	87	0.1		36.7	13.3	13.3	36.7	100.0
L. dysponeta	4,590	6.1		47.9	21.8	30.3	0.0	100.0
L. gomezi	5,373	7.2		42.4	38.3	15.0	4.3	100.0
L. hartmanni	210	0.3		8.8	59.1	27.3	4.8	100.0
L. isovespertilionis****	824	1.1		26.6	6.1	20.6	46.7	100.0
L. longipalpis	58	0.1		100.0	0.0	0.0	0.0	100.0
L. marajoensis	78	0.1		71.4	28.6	0.0	0.0	100.0
L. nordestina	105	0.1		62.5	18.7	18.8	0.0	100.0
L. odax	113	0.1		64.2	17.9	17.9	0.0	100.0

Continued

Phlebotomine species	No. ♂ & ♀ all strata	%	Vertical stratification frequency per t-n* (%)				
			Mag**	0-6	6-12	12-18	< 18	Total
			No. t-n	2,584	86	85	30	2,785
L. olmeca	922	1.2		43.3	35.1	13.3	8.4	100.0
L. ovallesi	495	0.7		42.9	10.9	38.5	7.7	100.0
L. panamensis	30,425	40.8		30.3	44.7	16.1	8.9	100.0
L. pessoana" n sp	1,551	2.1		6.5	47.3	45.1	1.1	100.0
L. reburra	1,001	1.3		37.6	39.4	23.0	0.0	100.0
L. runoides	201	0.3		9.4	90.6	0.0	0.0	100.0
L. sanguinaria	537	0.7		14.2	34.4	30.1	21.3	100.0
L. saulensis	138	0.2		59.8	26.4	13.8	0.0	100.0
L. spinosa	46	0.1		13.4	10.1	20.2	56.3	100.0
L. trapidoi	6,729	9.0		16.6	26.3	26.4	3[illegible]	.0
L. trinidadensis	586	0.8		14.9	17.5	33.6	34.[illegible]	.0
L. triramula	9,097	12.2		61.9	27.6	9.9	0.6	100.0
L. tuberculata	53	0.1		15.5	52.7	31.8	0.0	100.0
L. vesicifera	158	0.2		16.4	16.7	66.9	0.0	100.0
L. ylephiletor	1,409	1.9		17.0	19.6	52.7	10.7	100.0
20 other Lutzomyia spp.*****	343	0.4		38.2	34.8	7.0	20.0	100.0
Brumptomyia spp.	208	0.3		97.6	0.5	1.9	0.0	100.0

Continued

Phlebotomine species	No. ♂ & ♀ all strata	%	Vertical stratification frequency per t-n* (%)				
			Mag**	0-6	6-12	12-18	18	Total
			No. t-n	2,584	86	85	30	2,785
W. rotundipennis	2	0.1		100.0	0.0	0.0	0.0	100.0
Totals	74,634	100.0		29.8	36.8	22.2	11.2	100.0

* Trap-night (equivalent of 1 CDC light trap operated for a 12 hr. period from 1800-0600 hrs.

** Meters above the ground.

*** Includes L. shannoni since females are indistinguishable.

**** Includes L. vespertilionis since females are indistinguishable.

***** aragaoi, atroclavata, botella, furcata, gasti, geniculata, gorbitzi, insoleta, lichyi, micropypa, oresbia, pilosa, pia, punctigeniculata, recurva, rorotaensis, rosabali, serrana, tintinnabula, undulata.

Table 3 Panamanian phlebotomine sandflies collected directly from animals or from animal-baited traps, 1942-1972.

Phlebotomine species	Animal groups represented*							
	Primates	Perissod.	Carnivora	Edentata	Rodentia	Marsupia.	Aves	Reptilia
L. abonnenci**	85	62	1	6	3	1	4	-
L. aclydifera	4	4	-	-	-	-	-	-
L. atroclavata	7	-	-	-	-	-	-	-
L. bispinosa	66	39	-	-	-	-	-	-
L. botella	2	-	-	-	-	-	-	-
L. camposi	1	8	-	-	-	-	-	-
L. carpenteri	6	54	-	-	-	-	-	-
L. cruciata	17	19	1	-	-	-	-	-
L. dasymera	-	-	1	-	-	-	-	-
L. dysponeta	2	189	-	-	1	-	-	-
L. furcata	-	-	-	-	1	-	-	-
L. geniculata	18	14	2	-	-	-	-	-
L. gomezi	2,345	5,504	147	49	36	163	35	-
L. gorbitzi	3	1	-	-	7	-	-	-
L. hartmanni	326	1	-	-	-	-	-	-
L. isovespertilionis***	-	6	1	-	66	-	-	-
L. lichyi	12	20	1	-	-	1	-	-

Continued

Phlebotomine species	Animal groups represented*							
	Primates	Perissod.	Carnivora	Edentata	Rodentia	Marsupia.	Aves	Reptilia
L. odax	1	-	-	-	-	-	-	-
L. olmeca	125	111	9	-	1,563	31	-	-
L. ovallesi	28	13	1	-	3	-	-	-
L. panamensis	3,872	24,023	433	-	97	983	-	-
L. "pessoana" n sp	534	414	-	-	8	1	-	-
L. pia	46	-	-	-	-	-	-	-
L. punctigeniculata	-	1	-	-	-	-	-	-
L. runoides	-	2	-	-	-	-	-	-
L. sanguinaria	5,642	14,235	460	52	52	179	14	-
L. saulensis	2	3	-	-	-	-	-	-
L. serrana	1	4	-	-	-	-	-	-
L. trapidoi	11,552	17,621	114	184	75	497	14	-
L. trinidadensis	30	6	2	-	3	1	-	70
L. triramula	3	12	-	-	-	-	-	-
L. undulata	-	-	5	-	-	-	-	-
L. vesicifera	1	13	-	-	3	-	-	-
L. volcanensis	3	-	-	-	-	-	-	-

Continued

Phlebotomine species	Animal groups represented*							
	Primates	Perissod.	Carnivora	Edentata	Rodentia	Marsupia.	Aves	Reptilia
L. ylephiletor	815	712	-	20	4	3	-	-
W. rotundipennis	88	-	-	-	-	-	-	-

* Primates, man only; Perissodactyla, horse only; Carnivora, Canis familiaris, Potos flavus; Marsupialia, Didelphis marsupialis, Philander opossum; Edentata, Bradypus infuscatus, Choloepus hoffmanni; Rodentia, Coendou rothschildi, Mesocricetus auratus, Mus musculus, Proechimys semispinosus, Sigmodon hispidus, Tylomys panamensis; Aves, Gallus gallus; Reptilia, Thecadactylus rapicaudus.

** Includes L. shannoni since females are inditinguishable.

*** Includes L. vespertilionis since females are indistinguishable.

Table 4 Trypanosomatid infections among Panamanian sandflies.

Phlebotomine species	No. ♀♀ dissected	Flagellate positive		Leishmania positive	
		No. ♀♀	% ♀♀	No. ♀♀	% ♀♀
L. abonnenci*	83	4	4.8	-	-
L. aclydifera	6	-	-	-	-
L. barrettoi	2	-	-	-	-
L. camposi	7	-	-	-	-
L. carpenteri	36	-	-	-	-
L. cruciata	28	-	-	-	-
L. dysponeta	20	-	-	-	-
L. furcata	1	-	-	-	-
L. gomezi	940	40	4.3	1	0.11
L. gorritzi	7	-	-	-	-
L. hartmanni	29	-	-	-	-
L. isovespertilionis**	234	143	61.1	-	-
L. lichyi	22	-	-	-	-
L. longipalpis	2	1	-	-	-
L. micropyga	3	1	-	-	-
L. nordestina	1	1	-	-	-
L. odax	1	-	-	-	-
L. olmeda	459	-	-	-	-
L. ovallesi	7	-	-	-	-
L. panamensis	1,274	18	1.4	1	0.08

Continued

Phlebotomine species	No. ♀♀ dissected	Flagellate positive		Leishmania positive	
		No. ♀♀	% ♀♀	No. ♀♀	% ♀♀
L. pessoana	32	-	-	-	-
L. punctigeniculata	1	-	-	-	-
L. rorotaensis	1	-	-	-	-
L. runoides	6	-	-	-	-
L. sanguinaria	2,559	101	4.0	-	-
L. serrana	1	-	-	-	-
L. spinosa	6	-	-	-	-
L. trapidoi	2,789	375	13.5	3	0.11
L. trinidadensis	318	27	8.5	-	-
L. triramula	4	-	-	-	-
L. vesicifera	5	-	-	-	-
L. ylephiletor	1,128	101	9.0	1	0.09
W. rotundipennis	3	-	-	-	-
Totals	10,015	812	8.1	6	0.06

* Includes L. shannoni since females are indistinguishable.
** Includes L. vespertilionis since females are indistinguishable.

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APPENDIX I

Preliminary Entomological and Parasitological Studies in Humboldt, Aripuanã, Mato Grosso State, Brazil.

R. Lainson (+)
R. D. Ward (+)
D. G. Young (++)
J. J. Shaw (+)
H. Fraiha (+)

Abstract

The preliminary results are given of studies on the sandfly fauna (Diptera: Psychodidae) in forest surrounding the Humboldt Research Centre, Município of Aripuanã, Mato Grosso State, Brazil. A total of 712 sandflies were obtained, including 26 different species: of these, 387 were caught off human bait; 317 from tree-trunks; 4 in a malaise-trap; 3 in rodent baited oil traps; and 1 in a light-trap. Man-biting species were absent or very rare during studies in the dry season (August and September, 1974), but relatively abundant at the end of the rainy season (June, 1975): this suggests a seasonal transmission of leishmaniasis. The species at present known as Lutzomyia anduzei of Floch & Abonnenc (1942) was a major man-biter: this species is an important vector of cutaneous leishmaniasis in North Pará, Brazil, and could be responsible for transmission in Aripuanã. Among a total of 349 female sandflies dissected, promastigote flagellates were found in 2 Lutzomyia yuilli; epimastigote flagellates in 1 L. yuilli; a microsporidian in Psychodopygus[ø] complexus; a gregarine, probably Monocystis chagasi, in P. davisi; and a nematode larva in P. complexus. Inoculation of the promastigote flagellates into the skin of hamsters failed to give Leishmania infections: possibly they were developmental stages of some other parasite. Two research workers of Project RADAM acquired cutaneous leishmaniasis in the Humboldt area; and 6 cases of malaria were diagnosed, 3 due to P. falciparum and 3 to P. vivax. Transmission of malaria was shown to be taking place in the camp site itself. Finally, man-biting "black-flies" (Diptera: Simuliidae) were found to be a serious problem, neceessitating constant use of insect-repellant.

(+) Instituto Evandro Chagas da Fundação Serviços de Saúde Pública, Belém, Pará, Brazil.

(++) Department of Entomology & Nematology, University of Florida, Gainesville, Florida 32611, U.S.A.

(ø) Some authorities (including D. G. Young) prefer to use the name Psychodopygus as a sub-genus of Lutzomyia, e.g. Lutzomyia (Psychodopygus) complexus.

Introduction

In January, 1973, plans were laid by the Minister of the Interior, the Minister of Education, and the Governor of the State of Mato Grosso, to establish a pioneer nucleus of workers to investigate and develop the region of Aripuanã, Mato Grosso.

Health hazards for such personel were clearly important factors to consider, and workers of the Instituto Evandro Chagas were among those asked to initiate a programme of epidemiological research, principally on the zoonotic diseases likely to be encountered in the region. The Department of Parasitology of this Institute has for long been interested in the problem of cutaneous leishmaniasis in Brazil, in particular the identification of the major phlebotomine vectors of the disease and reservoir hosts among the wild animals (Lainson & Shaw, 1973). The establishment of good working facilities in a relatively natural, forested area such as the Humboldt Centre in Aripuanã was thus welcomed as a useful oportunity to extend these studies. We present, here, some preliminary findings on the sandfly (Phlebotominae) fauna of the forest surrounding the Centre.

The Municipio of Aripuanã is situated on the river Aripuanã and is limited by the State boundaries of Amazonas, Parã, Federal Territory of Rondônia, and the Municipios of Diamantino, Porto dos Gauchos in the State of Mato Grosso, and the locality known as Chapada dos Guimarães also in the State of Mato Grosso. The precise geographical situation is latitude 7º, 19', 45" N and 12º, 22', 30" S: longitude 55º, 54', 15" E and 16º, 31', 15" W (Fig. 1).

The rainy season, ever important in its influence on the phlebotomine population, is approximately from October to April, with the heaviest rainfall from January to March: with an average of about 2,000 mm per year. The altitude is 300 metres above sea level, and the climate is equatorial and very humid.

In total area the Municipio of Aripuanã covers 140,000 k^2, and its principal geographic features include the rivers Roosevelt, Aripuanã, Juruena and Teles Pires, and the Dardanelos waterfall, of the Aripuanã river, which is 130 m high. The region is densely forested for 95 per cent of its area and the population census for 1970 listed only 2,248 inhabitants, with the largest settlement comprising only 85 persons. In the south, the Municipio of Aripuanã includes a large part of the Cinta-Larga indian reserve.

Close to the Humboldt Centre, there already existed a small collection of thatched houses occupied by employees of a local rubber collector: sanitary conditions were very poor. The Humboldt Centre itself employed a small maintenance staff, who also tended the needs of visiting scientists. Apart from malaria, which was known to be common among the local inhabitants, there was no available information

regarding leishmaniasis or other health problems.

Materials and Methods

Anthropophilic sandflies were collected off human bait, at night, usually between the hours of 19.00 and 21.00. Capture sites were selected from a variety of terrains, including high, dry forest ("terra firme") and more low-lying, swampy areas ("igapõ"). Rodent-baited, oiled traps were also set in the same localities, in attempts to indicate sandfly species attracted to rodents or other small forest mammals. They were variously baited with laboratory hamsters or the wild rodent Proechimys guyannensis. Other sandflies were captured, with aspirators, from their resting-sites on the trunks of the larger trees, with a "malaise-trap", or in light-traps.

Most of the anthropophilic sandflies were dissected, either immediately on return to the improvised laboratory or the following morning after preservation in the refrigerator, at 4°C. Dissection was in sterile 0.85 per cent saline: the gut of each fly was examined microscopically for the presence of flagellates or other parasites, using phase-contrast illumination, and identification of the female sandfly species was based largely on spermathecal characters.

Any promastigote flagellates encountered were immediately taken up in a 1.0 ml syringe, with a little saline, and inoculated intradermally into the nose or foot of a hamster. Male and female specimens of sandflies taken from tree-trunks, malaise-trap and light-trap were used only for taxonomic purposes.

Three separate visits were made to the study area: from 12-19 August, 1974; 11-15 September, 1974; and 13-21 June, 1975.

Results

The 26 species of sandflies captured, by all methods, are listed in Table I.

The first visit, in August, 1974, was well within the dry season and attempts to obtain sandflies from human bait were unsuccessful. Small numbers were found on tree-trunks, however, and a rigorous search gave a total catch of 317. Only 4 specimens were caught in the malaise-trap, and 1 in a light-trap: no animal-baited traps were set on this occasion. Altogether, 19 different species were recorded: all material was used for taxonomic purposes only.

In September, 1974, there had been sporadic showers of rain: neverthless, only 7 sandflies were taken from human bait during a total of 20 man-hours of catching, and all were P. davisi. No other method of capture was attempted and all material was used for taxonomy.

The third visit to Aripuanã was more fruitful, doubtless because it coincided with the end of the rainy season and the forest was noticably more moist. A total of 387 sandflies were caught from human bait in approximately 20 man-hours, and they included 11 different species. Rodent-baited traps gave poor results in all localities, providing only 2 female P. complexus and 1 female P. davisi: no other methods of capture were employed. We dissected 349 of the sandflies taken with human bait, and the 3 that were caught off the rodent-baited trap.

Promastigote infections were found in 2 specimens of L. yuilli Young & Porter 1972. Most of the flagellates in the first fly were attached, singly or in clusters, to the wall of the pylorus ("hindgut triangle"), with smaller numbers extending throughout the ileum and down to the rectum: others were seen swimming rapidly in the lumen. The individual parasites varied greatly in form; from the classical, elongate "leptomonad" to stumpy, oval or almost rounded bodies. The length of the single flagellum was also very variable; little more than the length of the body in the short or rounded forms attached to the gut wall, but often two or three times its length in the elongated, free parasites. Some of the latter were extremely thin, and moved with remarkable rapidity. Elongated forms were also abundant in the midgut, but none were seen in any part of the foregut. Infection in the second L. yuilli was similar, but restricted to the hindgut.

A third specimen of L. yuilli was infected with stumpy epimastigote flagellates, probably the developmental stages of a trypanosome. They showed sluggish movements and were apparently limited to the midgut.

Developmental stages and mature spores of a microsporidian were seen in the malpighian tubules of a single P. complexus, the parasite causing considerable deformation of the tubules.

A gregarine was noted in a specimen of P. davisi: both trophozoites and mature oocysts were present, the latter almost filling the accessory glands. Morphologically the parasite was similar to Monocystis chagasi, previously described in Lutzomyia longipalpis (Adler & Mayrink, 1961) and Lu. flaviscutellata (Lewis, et al., 1970).

Finally, a nematode larva was encountered in the hindgut of a P. complexus, which showed abundant remains of a previous blood-meal filling the midgut.

Hamsters were inoculated, intradermally, with the promastigotes from the 2 L. yuilli. On neither occasion, however, was it possible to find Leishmania at the site of inoculation, one year later, either by direct examination or by NNN culture of skin-snips.

The limited time available did not permit an examination of forest mammals for

diagnosed in men returning to Belém from work on the Aripuanã Project. Isolation of the parasite from their skin lesions, in hamsters and NNN culture medium, has shown it to be of the L. braziliensis complex, and further studies are in progress to obtain a more precise identification.

The problem of malaria in the neighbourhood of the Humboldt was amply confirmed by the examination of blood-films from 6 febrile persons. Three of them had P. falciparum infections, and three P. vivax: all showed mature gametocytes, and transmission was clearly in progress in the Humboldt Centre itself, for a P. vivax infection was acquired there by one of our I.E.C. staff.

Finally, several species of Simulium (Diptera: Simuliidae) were collected in pupal or adult stages. Two species were found biting man: one of these, a small fly of the S. amazonicum complex, was a severe problem in the Humboldt area, attacking from dawn to dusk in numbers which made field work extremely difficult without constant application of insect-repellent.

Discussion

The observations to date are insufficient to draw very firm conclusions, but our failure to obtain sandflies from human bait during a whole week in the dry season does suggest that transmission of cutaneous leishmaniasis in this area may be limited to the rainy season and shortly afterwards. Furthermore, subsequent captures with human bait showed a patchy distribution of some of the anthropophilic species, which in turn suggests that endemic foci of the disease may share a similarly uneven pattern.

The apparent absence of the sandfly Lutzomyia flaviscutellata surprised us, particularly as we used traps baited with rodents, to which this insect is highly attracted. Lu. flaviscutellata is the vector of Leishmania mexicana amazonensis in the Amazon region (Lainson & Shaw, 1968; Shaw & Lainson, 1968): we have found it to be common in almost all areas we have studied, including "gallery" forest in the Serra do Roncador area of Mato Grosso (Lainson & Shaw, 1970) which shares a similarly clearly demarked wet and dry season as that seen in Aripuanã.

Perhaps the most significant observation during these studies has been the abundance of that species at present known as Lutzomyia anduzei of Floch & Abonnenc (1942). This sandfly has recently been shown to be an important vector of L. braziliensis guyanensis, the causitive agent of cutaneous leishmaniasis ("pian-bois") in the extreme north of Pará State (Lainson, et al., 1976). Whether or not it is also a vector in the Aripuanã region remains to be seen.

infections in the inoculated hamsters suggests one of two things. Either they were monogenetic flagellates of this insect, or they were developmental stages of another parasite taken up in a blood-meal from some wild mammal. In the former case one might expect the incidence of infection in L. yuilli to have been much higher and, in addition, we have yet to secure any definate evidence of any monoxenous flagellate infection in the several thousand wild-caught sandflies we have dissected in Brazil. We feel, therefore, that the second hypothesis is most likely the correct one: in this respect Endotrypanum, the intra-erythrocytic trypanosomatid of the sloth Choloepus didactylus, remains a likely suspect. Shaw (1969) found this parasite to develop as a promastigote infection in the hindgut station of experimentally infected sandflies, in Panama, and subsequently (unpublished observations) isolated Endotrypanum from a naturally infected sandfly in that country.

The nature of the epimastigotes in the midgut of the third L. yuilli is equally problematical. We have found trypanosome infections in a number of wild animals, any of which might have been the source of this insect's infection. It is worth noting, however, that apart from Endotrypanum, the sloth C. dactylus also harbours Trypanosoma spp., (Shaw, 1969): it is tempting to suggest, therefore, that both promastigote and epimastigote infections of L. yuilli may have originated from this same animal.

Little more can be added to our record of a microsporidian in P. complexus and a Monocystis-like gregarine in P. davisi, for time did not permit a detailed study of this material. Both have been encountered in a variety of other sandfly species in the course of our studies elsewhere in Brazil (unpublished observations), and nematode larvae have also been seen on less frequent occasions.

Further study of sandflies in the Aripuanã region is needed to resolve the question of the promastigote infections in L. yuilli, and to pinpoint the vectors and wild mammal reservoirs of Leishmania in this poorly studied area.

Acknowledgements

These studies were carried out under the auspices of the Brazilian Research Council (C.N.Pq.) and the Wellcome Trust, London. Dr. D. G. Young's visit was sponsored by U.S. Army Medical Dept. contract No. DADA 17-72-C-2139. We are indebted to the Brazilian Air Force (F.A.B.) and the RADAM Project (Radar na Amazônia) for air transport; to Sr. Tibor Paal and his staff at the Humboldt Centre, for their hospitality during our visits; and to Dra. Zea Lins for assistance in the capture of sandflies, with human bait, on numerous occasions.

Sumário

São apresentados os resultados preliminares do estudo da fauna flebotomínea (Psychodidae: Phlebotomidae) da floresta que circunda o Centro de Pesquisa de Humboldt, Aripuanã, Estado de Mato Grosso, Brazil.

Foi obtido um total de 712 flebotomíneos, incluindo 20 espécies diferentes, 387 dos quais capturados com isca humana, 317 em troncos de árvores, 4 em armadilha tipo "malaise", 3 com isca-roedor, e 1 com armadilha luminosa.

Espécies antropófilas foram muito raras durante os estudos na época seca (agosto e setembro), mas relativamente abundantes durante as investigações no fim da época chuvosa (junho), sugerindo a existência de uma transmissão sazonal de leishmaniose cutânea na área. Lutzomyia anduzei, seg. Floch & Abonnenc (1942), foi uma das espécies antropófilas mais comumente encontradas e, sendo um dos vetores mais importantes de leishmaniose cutânea no Norte do Pará, Brazil, é possível que seja também responsável pela transmissão na área do Aripuanã.

349 fêmeas de flebotomíneos foram dissecadas, tendo sido encontrados: flagelados do tipo promastigoto em 2 Lutzomyia wilii, e do tipo epimastigoto em um exemplar da mesma espécie; um microsporidio em 1 P. complexus; uma gregarina, provavelmente Monocystis chagasi, em 1 P. davisi; e uma larva de nematódeo em 1 P. complexus.

A inoculação dos flagelados promastigotos na pela de hamster não produziu infecção leishmaniótica, possivelmente por se tratar do estágio de desenvolvimento de qualquer outro parasita, como Endotrypanum, por exemplo.

Dois casos de leishmaniose cutânea foram registrados em pesquisadores do Projeto RADAM, trabalhando na área de Humboldt, assim como 6 casos de malária produzidos por P. falciparum (3) e P. vivax (3). Finalmente, a grande densidade de "piuns" (Diptera: Simuliidae) antropófilos, constitui um sério problema na área obrigando ao uso constante de repelentes.

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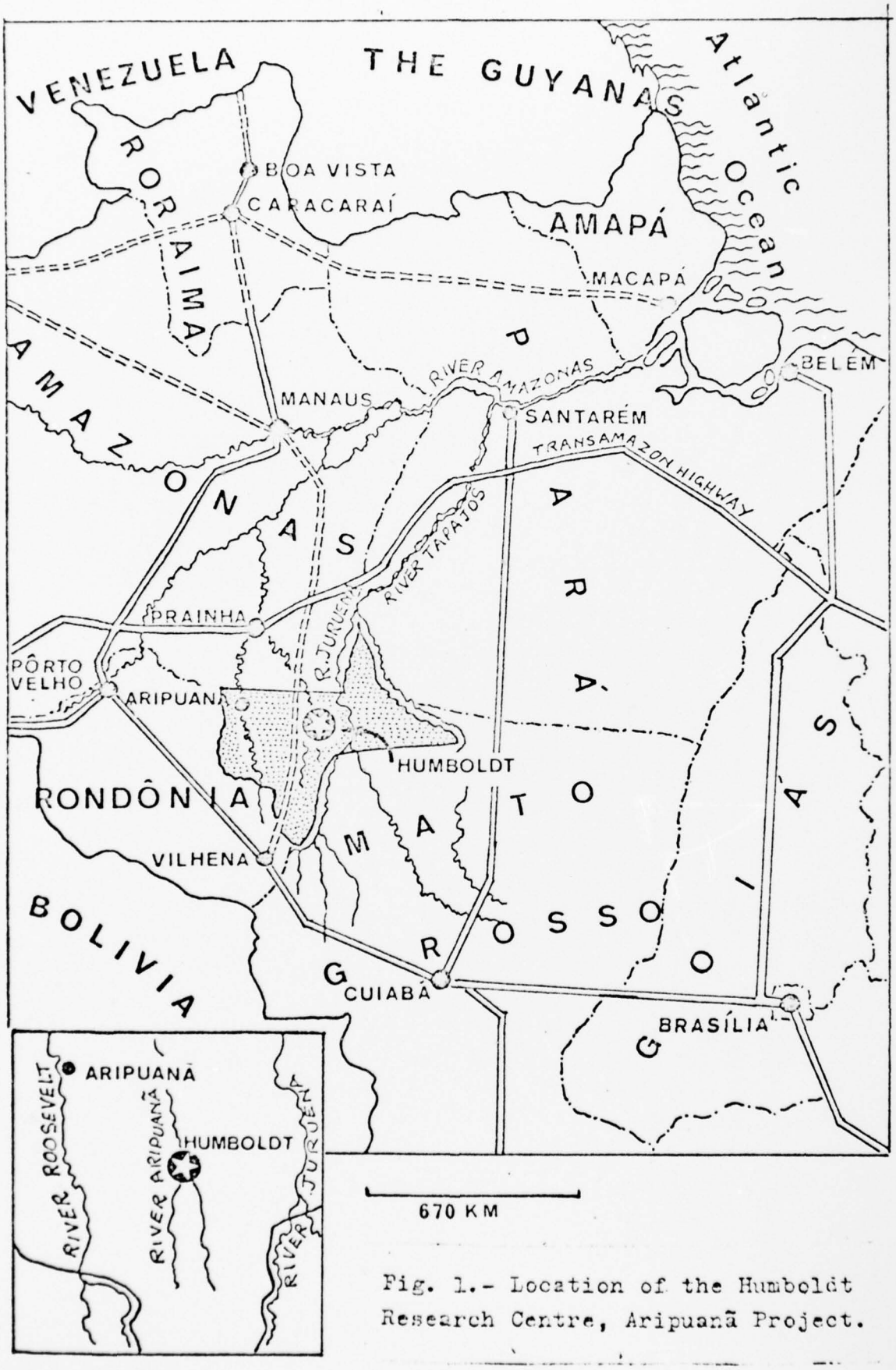

Fig. 1.- Location of the Humboldt Research Centre, Aripuanã Project.

Table I.

List of Sandflies (Psychodidae: Phlebotominae) Captured in Forest Surrounding the Humboldt Research Centre, Município de Aripuanã, the State of Mato Grosso, Brazil

Species	Date and Method of Capture									TOTALS
	August 1974						September 1974	June 1975		
	Tree-trunks		Malaise-trap		Light-trap		Human bait	Human bait	Rodent bait	
	♂	♀	♂	♀	♂	♀	♀	♀	♀	
Brumptomyia cunhai	1	3								4
Brumptomyia sp.		4								4
Lutzomyia evangelistai	1					1				2
L. anduzei, F & A	1							89		90
L. antunesi	1	1								2
L. whitmani		1								1
L. yuilli								78		78
L. (Nyssomyia) sp. 260.44								2		2
L. (Nyssomyia) sp.				1						1
L. micropyga	1									1
L. dendrophyla	72	37*						20		92
L. shannoni	148									43
L. scaffi	5	1								148

L. shannoni	148									43
L. scaffi	5	1								148
L. lutziana	3		1							4
L. lichyi				1						1
L. sp. (longispina Gp)				1						1
L. monstruosa		1								1
L. furcata	2	2								4
L. tuberculata	5	5								10
L. acanthopharynx	17	3								20
Psychodopygus complexus								129	2	131
P. bispinosus								4		4
P. carrerai								2		2
P. davisi	1						7	39	1	48
P. hirsutus								3		3
P. lainsoni								3		3
Unidentified spp.		1						11		12
T O T A L S	258	59	1	3	0	1	7	380	3	712

* Females of L. dendrophila and L. shannoni indistinguishable.

APPENDIX II

Lutzomyia Sand Flies in the Subgenus *Evandromyia* Mangabeira with a Description of a New Species from Brazil (Diptera: Psychodidae)[1]

David G. Young[2] and Jorge R. Arias[3]

ABSTRACT

The *Lutzomyia* sand flies in the subgenus *Evandromyia* Mang. are separated into two groups - the Series *infraspinosa* and the Series *monstruosa*. These are defined and the included species are catalogued. A Brazilian species, *L. inpai* n. sp., is described and illustrated. An identification key to the adult *Evandromyia* males is provided.

The classification of the *Lutzomyia* sand flies in the subgenus *Evandromyia* Mang. has been discussed by several authors. Mangabeira (1941) erected the subgenus to accomodate two species - *L. infraspinosa* (Mang.), type species, and *L. brachiphalla* (Mang.). These were originally placed in the genus *Phlebotomus* Rondani but presently most investigators including ourselves follow Theodor (1965) in restricting members of the genus to the Old World.

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1) Research partly sponsored by U.S. Army Medical Research & Development Command contract No. DADA-17-72-C-2139, and the Conselho Nacional de Pesquisas (CNPq).

2) Department of Entomology & Nematology, University of Florida, Gainesville, Florida 32611.

3) Division of Medical Sciences, Instituto Nacional de pesquisas da Amazônia (INPA), Manaus 69.000, Amazonas, Brazil.

Here we recognize 9 Lutzomyia spp. as belonging in the subgenus Evandromyia. These appear to form two groups which are informally designated the Series infraspinosa with 7 species and the Series monstruosa with 2 species.

In 1955 Fairchild placed four species in the Series infraspinosus (= Evandromyia) in the subgenus Brumptomyia França & Parrot of Phlebotomus. One of these, L. lenti (Mang.), is now believed to be more closely related to L. evandroi (Costa Lima & Antunes) and is not treated here. L. bourrouli (Barretto & Coutinho) was placed with L. cruciata and its allies in the Series cruciata.

Forattini (1971) included L. infraspinosa and L. bourrouli in the subgenus Lutzomyia França and later (1973) added L. brachiphalla. He treated L. monstruosa and L. teratodes Martins, Falcão & da Silva as members of the genus Pressatia Mang. L. cerqueirai (Damasceno & Causey) was not placed in any subgenus.

In our opinion, the Evandromyia species constitute a natural group distinct from other subgenera or species groups of Lutzomyia. In some respects (i.e. the spermathecae, palpi, cibaria and, to a lesser extent, the male genitalia) these species, especially those in the Series infraspinosa, are similar to some species in the vespertilionis Group. This latter group is primarily centered in Central America but one species, L. vespertilionis (Fchld. & Hertig), ranges south into northwestern Ecuador. The Evandromyia species are totally South American with the center of distribution being the Amazon Basin. Based on present evidence, the females feed on mammals such as bats (some vespertilionis Group species) and rodents (species in both groups). It is interesting that no close association between bats and sand flies has been noted outside the range of the vespertilionis Group species.

The following definitions of the Series infraspinosa and Series monstruosa will also serve to define the subgenus Evandromyia.

Genus Lutzomyia França

Subgenus Evandromyia Mang., 1941

Series infraspinosa

Small to medium sized, generally pale sand flies, wing length less than 2.0 mm. Palpal segment 5 longer than segments 3+4; Newstead's scales loosely grouped on middle of third segment. Antennal ascoids simple, paired on all flagellar segments except the last, their tips ending slightly before, at the same level of or slightly beyond the end of their respective antennal segments (3-15). Femur unarmed. Coxite of male genitalia with or without (only L. cerqueirai) a setal tuft; the tuft associated with a small sclerotized "plate" at base in those species having a tuft. Style with 4 major spines, the proximal spine isolated from others; subterminal seta present. Paramere simple or bifurcate, moderately to heavily sclerotized distally, with numerous fine hairs on the dorsobasal surface. Aedeagus simple, lacking ventral or lateral extensions. Genital filaments partially striated or smooth, sometimes very thick and heavily sclerotized, the tips enlarged or not. Lateral lobe usually curved upwards, pointed at tip and with 2 - 4 long spatulate setae at end. Cibarium of female with 4 sharp, equidistant horizontal teeth, a transverse row of 15 or fewer vertical teeth, a complete cibarial arch and a rather slender, moderately sclerotized pigment patch. Genital fork often with a rather short stem; spermathecae sac-like or tubular with irregular to nearly complete annuli; individual ducts shorter than the common duct.

None of the species in the series is known to be anthropophilic although L. infraspinosa has been reported infrequently feeding on man in Surinam (Wijers & Linger, 1966). Data from Disney trap collections using rodents as bait indicate that these mammals serve as hosts for some Evandromyia spp. (Shaw & Lainson, 1972; Ward et al., 1973; Aitken et al., 1975).

Species in the Series infraspinosa

1. Lutzomyia bourrouli (Barretto & Coutinho)

Phlebotomus bourrouli Barretto & Coutinho, 1941:237, ♂, ♀, Palmeiras, São Paulo State, Brazil. Barretto, 1947:189 (full reference). Floch & Abonnenc, 1947:4 (keyed). Barretto, 1950:184-105, 113-114 (♂, ♀ figured, keyed). Barretto, 1951:213 (distribution). Floch & Abonnenc, 1952:31, 45 (♂, ♀ figured, keyed). Fairchild, 1955:195.

Sergentomyia bourrouli, Barretto, 1955:181.

Lutzomyia bourrouli, Barretto, 1962:93. Martins & da Silva, 1964:128 (Brazilian records). Theodor, 1965:190. Forattini, 1971:99. Martins & da Silva, 1971:417. Martins & Morales-Farias, 1972:367, 368. Forattini, 1973:208, 212, 249, 250, 360, 367 (distribution, figured, keyed redescribed).

Known distribution: Brazil; States of Acre, Amazonas, Goias, Mato Grosso, São Paulo.

Specimens examined: 2 ♂♂, near Campo Grande, Mato Grosso, Brazil, 18 Oct. 1960, da Silva & Ferreira colls.

Remarks: See L. pinottii.

2. Lutzomyia brachiphalla (Mangabeira)

Phelebotomus brachiphallus Mangabeira, 1941:219, ♂, Piratuba, Pará, Brazil. Barretto, 1947:189-190 (full reference). Floch & Abonnenc, 1947:4 (keyed). Damasceno et al., 1949:820, 840 distribution N Brazil). Barretto, 1950:104 (keyed). Barretto, 1951:213 (distribution). Floch & Abonnenc, 1952:20, 25, 31, 77 (keyed, described). Fairchild, 1955:195. de Lucena, 1960:77.

Sergentomyia brachyphalla, Barretto, 1955:181.

Lutzomyia brachiphalla, Barretto, 1962:93. Theodor, 1965:190. Forattini, 1971:103. Martins & Morales-Farias, 1972:367 (distribution). Ward et al., 1973:178. Lainson et. al., 1973:190 (examined for Leishmania, negative, Pará, Brazil). Forattini, 1973:212, 249, 251, 256, 367 (distribution, keyed, figured, redescribed).

Known distribution: French Guiana, northern Brazil.

Specimens examined: None

Remarks: See L. inpai n. sp.

3. Lutzomyia cerqueirai (Causey & Damasceno)

Phlebotomus cerqueirai Causey & Damasceno, 1945:653, ♂, Utinga, Belém, Pará, Brazil. Barretto, 1947:193 (in catalog). Floch & Abonnenc, 1947:4 (keyed). Damasceno et al., 1949:822, 840 (distribution). Barretto, 1950:104 (keyed). Barretto, 1951:214 (distribution). Floch & Abonnenc, 1952:32 (keyed). Fairchild, 1955:194.

Sergentomyia cerqueirai, Barretto, 1955:182.

Lutzomyia cerqueirai, Barretto, 1962:93. Theodor, 1965:190. Martins et al., 1965:2 (Rondonia, Brazil). Forattini, 1971:103. Martins & Morales-Farias, 1972:367. Forattini, 1973:340, 349, 351, 352, 374 (distribution, redescribed, keyed, figured).

Known distribution: Brazil; Rondonia Territory, States of Pará, Amazonas, and Bahia (The latter State listed by Forattini, 1973).

Species examined: None

Remarks: Very little is known about this species. The female has not been discovered. The male differs from the other species in the Series infraspinosa mainly in the nature and placement of the spines on the style and in the lack of a coxite tuft. Its definite status in relation to the other species should become clear when the female is discovered.

4. Lutzomyia infraspinosa (Mang.)

Phlebotomus infraspinosus Mangabeira, 1941:216, o, Aura, Belém, Pará, Brazil. Floch & Abonnenc, 1943:19 (♀ described, French Guiana). Barretto, 1947:204 (full references). Floch & Abonnenc, 1947:4 (keyed). Damasceno et al., 1949:826, 841 (distribution N Brazil). Barretto, 1950:104, 113 (keyed). Barretto, 1951:218 (distribution). Floch & Abonnenc, 1952:20, 24, 25, 32, 45, 74 (keyed, redescribed). Fairchild, 1955:195. Forattini, 1959:160 (Amapa Terr., Brazil). Forattini 1960:478. Wijers & Linger, 1966:505-506 (Surinam).

Sergentomyia infraspinosa, Barretto, 1955:184.

Lutzomyia infraspinosa, Barretto, 1952:93 Theodor, 1965:130 (figured). Lewis et al., 1970:215 (age grading). Fraiha et al., 1971:99. Martins & Morales-Farias, 1972:367 (general distribution). Shaw & Lainson, 1972:710-714 (Belém, Brazil, positive for flagellates). Ward et al., 1973:178. Forattini, 1973:209, 213, 258, 351, 360, 367 (distribution, redescribed, keyed, figured). Ward & Killick-Kendrick, 1974:219 (larval resistance to fungi). Aitken et al., 1975:361 (virus isolation attempts, negative results, Belém, Brazil). Lewis, 1975:500, 505 (mouthpart morphology).

Known distribution: Surinam, French Guiana, Brazil.

Specimens examined: 2 ♂♂, near Marabá, Pará, Brazil, 27 Sept. 1972, light trap, D. G. Young coll. 1 ♂, Montabo, French Guiana, 23 Dec. 1945, E. Abonnenc leg.

Remarks: See L. begonae (Ortiz & Torres)

5. Lutzomyia inpai Young & Arias n. sp.

(Fig. 1)

Male: A small pale sand fly. Cibarium unarmed; cibarial arch complete; pigment patch subtriangular, as in female. Pharynx about 0.11 mm long, unarmed. Eyes separated by distance = to about 5.2 facet diameters. Antennal segment 3, 0.18 - 0.20 mm long, subequal in length to segments 4+5, ascoids simple, their tips reaching to or beyond the ends of their respective segments (3-15). Proboscis length 0.15 mm. Length of palpal segments, in mm: 1 (0.023-0.027), 2 (0.075-0.093), 3 (0.103-0.118), 4 (0.075-0.078), 5 (0.20-0.24); Newstead's scales, about 10, on middle third of segment 3. Pleuron pale, with 11-17 upper & 2-4 lower episternal setae. Mesonotum faintly pigmented, appearing pale. Wing length 1.37-1.51 mm, width about 0.42 mm; length of wing sections, in mm: alpha (0.30-0.36), beta (0.15-0.19), delta (0.04-0.10), gamma (0.17-0.20). Length of femorae, tibiae & basitarsi of slide 400 in mm: foreleg, 0.61, 0.61, 0.39; midleg, 0.59, 0.76, 0.42; hindleg, 0.66, 0.93, 0.49. Genital filaments (about 0.33 mm long) heavily sclerotized, the distal two-thirds striated & thick as shown; pump about 0.15 mm long. Style with 4 major spines & subterminal bristle. Coxite tuft of 14-24 setae associated with a proximal sclerotized plate. Aedeagus as shown, rather broad at end. Proximal, undivided portion of paramere with numerous fine hairs, mostly dorsal; the distal bifurcate portion more heavily pgimented than the proximal portion, especially well sclerotized is the lower arm. Lateral lobe (about 0.28 mm long), pointed at tip & bearing 3 distal modified setae (1 specimen has only 1 such deta). Cercus as shown.

Holotype male: As described above. Certain measurements & characteristics of specimen as follows (in mm): Pharynx length, 0.11. Eye separation =

5.4 facet diameters. Length of antennal segment 3, 0.19 Proboscis length 0.15. Length of palpi, 1 (0.027), 2 (0.088), 3 (0.114), 4 (0.078), 5 (0.21). Pleura with 14-16 upper & 2 lower episternal setae. Wing length 1.44, width 0.416; length of vein sections: alpha (0.36), beta (0.15), delta (0.08), gamma (0.20). Coxite tuft with 16 setae. Genital filaments 0.30 long, pump 0.15 long. Lateral lobe 0.28 long with 3 specialized, apical setae.

Female: Larger than male, color the same. Cibarium with 4 sharp & equidistant horizontal teeth & with 4-8 small medial vertical teeth in one transverse row plus a group of smaller teeth on each side; cibarial arch complete; pigment patch as figured. Pharynx nearly 0.15 mm long, unarmed. Eyes separated by distance = to about 6.2 facets. Length of antenna 3, 0.21-0.22 mm, subequal in length to segments 4+5; ascoids as in male. Proboscis length 0.23-0.24 mm, considerably shorter than head height from tip of clypeus to vertex. Length of palpal segments, in mm: 1 (0.035), 2 (0.11-0.12), 3 (0.14-0.15), 4 (0.09-0.10), 5 (0.23-0.29); Newstead's scales as in male. Pleuron with 17-21 upper & 2-4 lower episternal setae. Wing length 1.69-1.80 mm, width about 0.55 mm; length of vein sections, in mm: alpha (0.42-0.49), beta (0.17-0.22), delta (0.12-0.16), gamma (0.21-0.29). Length of femorae, tibiae & basitarsi of slide 450, in mm: foreleg, 0.67, 0.71, 0.44; midleg, 0.69, 0.83, 0.48; hindleg, 0.75, 1.06, 0.56. Spermatheca sac-like, only slightly longer than wide, irregularly wrinkled, seemingly implanted directly on the large common duct; terminal knob recessed as shown.

Allotype female: As described above. Certain measurements & characteristics as follows (in mm): Pharynx length 0.146. Eye separation = to 6 facet diameters. Length of antennal segment 3, 0.21. Proboscis length 0.23. Length of palpal segments, 1 (0.035), 2 (0.114), 3 (0.14), 4 (.09), 5 (0.21). Pleura with 17 upper & 2-3 lower episternal setae. Wing length 1.69, width o.54; length of vein sections: alpha (0.42), beta (0.20), delta (0.12), gamma (0.21). Length of femorae, tibiae & basitarsi: foreleg missing; midleg, 0.66, 0.86, 0.44; hindleg, 0.75, 1.004, 0.54.

Type Data: Holotype male (NO. 400), 4 km south of Estrada Torquato Tapajos at km 54, near COSAC training Base II, Amazonas, Brazil in Disney trap baited with a Golden Hamster (Mesocricetus auratus), 21 Oct. 1975, Rui A. de Freitas & João F. Vidal colls. Allotype female (NO. 401), same data. Paratypes, 37 ♂♂, 29 ♀♀ (Nos. 402-467), same data. One male (No. 468), Maua, Estrada do Aleixo (Km 10), Manaus, Amazonas, Brazil, in Disney trap baited with rodent (Tylomys sp.), 8 Aug. 1974, J. Arias & R. Freitas colls. 1 ♂ (No. 469) same data as No. 468 except collected on 3 Sept. 1974. 2 ♂♂ (Nos. 470 - 471), same as No. 468 except collected on 18 Dec. 1974, R. Freitas coll. **Holotype** and allotype to be deposited in the Museau de Zoologia, Universidade de São Paulo, Brazil. Paratypes in the collection at INPA, Manus, Brazil; The British Museum (Natural History); U.S. National Museum (Natural History) and the Florida State Collection of Arthropods, Gainesville, Florida. L. inpai is named for the Instituto Nacional de Pesquisas da Amazonia.

Remarks: The male of L. inpai resembles L. brachiphalla in structure but the two species can be distinguished as follows. The coxite

tuft of L. inpai consists of 14 + setae; instead of only 4-6. There are normally 3 distal spatulate setae, on each lateral lobe, L. brachiphalla has 2 such setae. The lower branch of the paramere is somewhat rounded apically in L. inpai, not acute as it appears to be in L. brachiphalla (see Mangabeira, 1941). The genital filaments of L. inpai are distinctly swollen at the distal ends whereas in L. brachiphalla they appear to be subequal in width throughout.

The female of L. brachiphalla remains undescribed but it is probably very similar to that of L. inpai in details of the cibarium and spermathecae. The sexes of L. inpai were associated by color, by metrical characters and by collection data.

6. Lutzomyia begonae (Ortiz & Torres)

(Fig. 2 A-D, F-1)

Phlebotomus begonae Ortiz & Torres, 1975: 101, ♂, "El Gavilan", Terr. Federal Amazonas, Venezuela.

Male: A small sand fly, generally pale but head, mesonotum, ventral border or pleuron & coxa dusky. Cibarium unarmed; cibarial arch complete; pigment patch as in female. Pharynx about 0,13 mm long, unarmed. Eyes separated by distance = to about 6 facet diameters. Antannal segment 3, 0.17 - 0.19 mm long, less than or = to combined length of segments 4+5; ascoids simple, reaching to or beyond tip of segment 4, present on all flagellar segments except last. Proboscis length 0.16 mm. Length of palpal segments, in mm: 1 (0.035), 2 (0.86-0.126), 3 (0.108-0.126), 4 (0.075-0.096), 5 (0.25-0.29); Newstead's scales (about 10) on middle third of segment 3. Pleuron pale, with 13-21 upper & 2-3 lower episternal setae. Wing length

1.32-1.48 mm, width about 0.41 mm; length of wing sections, in mm: alpha (0.28-0.34), beta (0.14-0.17), delta (0.02-0.06), gamma (0.15-0.19). Length of femore, tibiae & basitarsi of slide 474, in mm: foreleg, 0.75, 0.57, 0.34; midleg, 0.59, 0.69, 0.39; hindleg, 0.61, 0.73, 0.44. Genital filament 0.32-0.36 mm long; the proximal half of each smooth-walled but well pigmented, the distal half with transverse striations, tip slightly enlarged; pump about 0.16 mm long. Style as shown with 4 major spines & a small subterminal seta. Coxite tuft of 22-28 simple setae associated with a proximal sclerotized plate. Aedeagus subtriangular as shown. Paramere bifurcate, the lower arm with a ventral acute process. Lateral lobe, about 0.25 mm, upturned & pointed at tip, bearing 3 distal spatulate setae. Cercus as figured.

Female: Larger than male, degree & distribution of pigmentation the same. Cibarium with 4 sharp horizontal teeth, evenly spaced & with 5-10 vertical teeth placed more or less in a single transverse row; cibarial arch complete; pigment patch subtriangular, moderately segmented. Pharynx about 0.16 mm long unarmed. Eyes separated by about 7 facet diameters. Length of antennal segments 3, 0.17 - 0.20 mm, less than or = to length of segments 4+5; ascoids as in male. Proboscis length, 0.24 - 0.25 mm, shorter than head height. Length of palpal segments, in mm: 1 (0.035), 2 (0.111 - 0.123), 3 (0.131 - 0.141), 4 (0.078 - 0.093), 5 (0.25 - 0.30); Newstead's scales as in male. Pleuron with 18 - 25 upper & 2-4 lower episternal setae. Wing length, 1.15-1.69 mm, width about 0.58 mm; length of vein sections as follows, in mm: alpha (0.33 - 0.45), beta (0.16 - 0.20), delta (0.05 - 0.12), gamma (0.15 - 0.23). Length of femorae,

tibiae & basitarsi of slide 478, in mm: foreleg, 0.59, 0.78, 0.45; midleg, 0.66, 0.95, 0.49; hindleg, 0.71, 0.96, 0.49. Spermatheca tubular, its length over 4x its width, wrinkled with incomplete annulations; individual duct short, smooth-walled; the conspicuous common duct wider, wrinkled in part; stem of genital fork rather short.

Known distribution: Venezuela (type locality), Northern Brazil.

Specimens examined: 10 ♂♂, 25 ♀♀, Maua, Estrada do Aleixo (Km 10), Manaus, Amazonas, Brazil, in *Tylomys* sp. -- baited Disney trap, Aug., Sept. and Dec., 1974, J. Arias and R. Freitas colls.

Remarks: L. begonae, recently described from a single male, closely resembles L. infraspinosa but can be separated from it by the parameres (compare Fig. 2D with Fig. 2E).

Based on the original description, the holotype of L. begonae differs mainly from the Brazilian begonae males in the length of the genital filaments and in the better developed ventral process of the paramere. It remains to be determined, however, whether or not these character states represent specific differences. For the present, we prefer to treat the Brazilian specimens as begonae, believing that these differences probably reflect geographic variation.

The male and previously undescribed female of L. begonae from Manaus, Brazil are described below. At this time we are unable to separate females of L. infraspinosa and L. begonae without associated males.

7. Lutzomyia pinottii (Damasceno & Arouck)

Phlebotomus pinottii Damasceno & Arouck, 1956:2, ♂, Rio Capim, Municipio do Capim, Pará, Brazil. De Lucena, 1960:75 (not pinottii

Damasceno & Arouck).

Lutzomyia aroucki, Barretto, 1962:93 (new name for pinottii, unnecessary change).

Lutzomyia pinottii, Theodor, 1965:190, Fraiha et al., 1970: 215 (Belem, Pará, Brazil). Forattini, 1971:103. Martins & Morales-Farias 1972:367. Shaw & Lainson, 1972:713. Forattini, 1973:249 (as a junior synonym of L. bourrouli).

Known distribution: Brazil, Pará State.

Specimens examined: 1 ♂, Belém, Pará, Brazil. H, Fraiha leg.

Remarks: After examining type material, Forattini (1973) considered L. pinottii and L. bourrouli to be conspecific even though the shape of parameres differs between the two forms.

We prefer to treat them as distinct species, however, because of the difference of the parameres, the geographic distribution, and the fact that the female of L. pinottii remains undescribed and may be distinct from that of L. bourrouli.

Series monstruosa

Similar to species in the Series infraspinosa except for the following: Eyes very small; male genitalia with a trifurcate paramere; aedeagus with a short or long ventrolateral extension and lateral lobe more or less rounded at tip, lacking long spatulate setae. Female with cylindrical, distally arched, smooth walled spermathecae.

Species in the Series Monstruosa

1. Lutzomyia monstruosa (Floch & Abonnenc)

Phlebotomus monstruosus Floch & Abonnenc, 1944a: 1, ♂, Baduel, French Guiana. Barretto, 1947: 213 (full references). Floch & Abonnenc,

1947:5 (keyed), Damasceno et al., 1949: 829, 830, 841 (distribution, N. Brazil). Barretto, 1951: 220 (distribution). Floch & Abonnenc, 1952: 20, 25, 32, 83, (keyed, redescribed). Fairchild, 1955: 195.

Phlebotomus falciformis Floch & Abonnenc, 1944b: 8, ♀, Crique, Anguille, French Guiana. Barretto, 1947: 199 (in catalog). Barretto, 1950: 183. Barretto, 1951: 216 (distribution). Floch & Abonnenc, 1952: 21, 27, 44, 182 (keyed, redescribed). Fairchild, 1955: 194. Forattini, 1959: 160 (Amapa Terr., Brazil). Forattini, 1960: 480.

Sergentomyia falciformis, Barretto, 1955: 183.

Sergentomyia monstruosa, Barretto, 1955: 184.

Lutzomyia monstruosa, Martins et al. 1962: 381, not L. monstruosa (Floch & Abonnenc, 1944). Martins et al., 1964: 324 (compared to L. teratodes). Martins et al., 1965:3. Theodor, 1965: 190. Fraiha et al., 1970: 215 (Belem, Brazil). Forattini, 1971:103. Shaw & Lainson, 1972: 710-714. Martins & Morales-Farias, 1972: 367. Ward et al., 1973:178 (in rodent baited traps, Pará, Brazil). Lainson et al., 1973: 190 (♀ examined for Leishmania, negative Pará, Brazil). Martins et. al., 1975: 515-517.

Lutzomyia falciformis, Theodor, 1965: 196. Fraiha et al., 1970: 216 (as ♀ of L. monstruosa). Forattini, 1971: 107.

Pressatia monstruosa, Forattini, 1971:103. Forattini, 1973:512, 518-521.

Known distribution: French Guiana, N. Brazil.

Specimens examined: 1 ♂, 27 km SE of Marabá, Pará, Brazil in burrow, 27 Sept. 1972, D. G. Young coll. 1 ♂, about 100 km S of Santarem, Pará, Brazil, 5 Oct. 1972, D. G. Young coll. 1 ♂, 1 ♀, 47 km W of Altamira, Pará, Brazil, in light trap & tree buttress, 10 Oct. 1972, D. G. Young coll. 1 ♀, Rio Aripuanã at Humboldt, Mato Grosso, Brazil,

in tree buttress, 19 Aug. 1974, D. G. Young coll. 4 ♀♀, near Bacuri, N of Maraba, Pará, Brazil, light trap, 31 Oct. 1 Nov. 1974. J. F. **Reinert** coll.

2. Lutzomyia teratodes Martins, Falcão & da Silva.

(Fig. 3)

Lutzomyia teratodes Martins, Falcão & da Silva, 1964:321, ♂, Itapaci, Goias, Brazil. Forattini, 1971: 103. Martins & Morales - Farias, 1972: 368. Martins et al., 1975: 515-517.

Pressatia teratodes, Forattini, 1973: 512, 513, 518, 521.

Known distribution: Brazil, Goias State, Paraguay.

Specimens examined: 1 ♂, Aca Poi, San Pedro, Paraguay, on horse, 21 April 1950, Hertig & Ottaviano colls. 1 ♂, 1 ♀, Itumbiara, Estado de Goias, Brazil, 18 Jan. 1975, J. E. da Silva coll.

Key to the Lutzomyia sand flies in the subgenus

Evandromyia (male genitalia only)*

1. Lateral lobe with distal spatulate setae; paramere undivided or bifurcate; aedeagus simple, without an extension or arm (Series infraspinosa)..... 2

   Lateral lobe without spatulate setae; paramere trifurcate; aedeagus with a short or long ventrolateral extension (Series monstruosa)..... 8

2. Paramere undivided..... 3

   Paramere bifurcate..... 4

3. Lateral lobe with 3 spatulate setae at tip; coxite with 5 - 8 small setae above base of tuft; paramere thinner - ..... L. bourrouli

   Lateral lobe with 4 spatulate setae at tip; coxite without additional setae above tuft; paramere broader - ..... L. pinottii

4. Spines on style implanted on distal third of segment, short and stout; coxite without a definite tuft of setae - ..... L. cerqueirai

   Spines on style longer, more widely spaced, the proximal one implanted on basal third or half of segment; coxite with a definite tuft of setae..... 5

5. Lateral lobe with 2 spatulate setae; coxite tuft of 4-6 setae. L. brachyphalla

   Lateral lobe with 3 spatulate setae; coxite tuft or 12 + setae..... 6

6. Genital filament very thick, expecially near end; paramere as shown (Fig. 1 D)..... L. inpai n. sp. (Fig. 1)

   Genital filament thinner (Fig. 2 D); Paramere otherwise..... 7

7. Lower arm of paramere with an acute process on vental margin.L. begonae (Fig.2)

   Lower arm of paramere without an acute process..... L. infraspinosa (Fig. 2 D)

8. Ventral extension or arm of aedeagus longer than dorsal portion of aedeagus, more or less sinuous; coxite tuft of 6-7 setae; paramere broader (se Floch & Abonnenc, 1952 or Forattini, 1973)..... L. monstruosa

   Ventral extension of aedeagus shorter than dorsal part, not sinuous; coxite tuft of about 12 setae; paramere otherwise (see Martins et al., 1964)..... ..... L. teratodes (Fig. 3)

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*Some of the character states used in this key are characterized by such relative terms as "thinner", "broader", "longer", etc. In order to understand what is meant by these adjectives, it may be useful, perhaps necessary, to refer to illustrations in original and/or subsequent descriptions.

Acknowledgments

We wish to thank Rui A. de Freitas and João P. Vidal for assistance in the field; Miss Stephanie Haney for preparing slide mounts of the bulk of the material and Dr. G. B. Fairchild for reviewing the manuscript and offering suggestions regarding content. Dr. A. V. Martins kindly sent us specimens of L. teratodes for examination.

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Fig. 1. Lutzomyia inpai, n. sp. A. Male head (No. 431). B. male wing (No. 459). C. male antennal segemnt 4 (No. 431) D. Male genitalia, lateral view drawn in phenol (No. 470). E. Female head (No. 439). F. Female wing (No. 451). G. Female cebarium (No. 449). H. Spermathecae, lateral view drawn in phenol. (No. 441). I. Spermathecae, dorsal view (No. 441). Scale in millimeters.

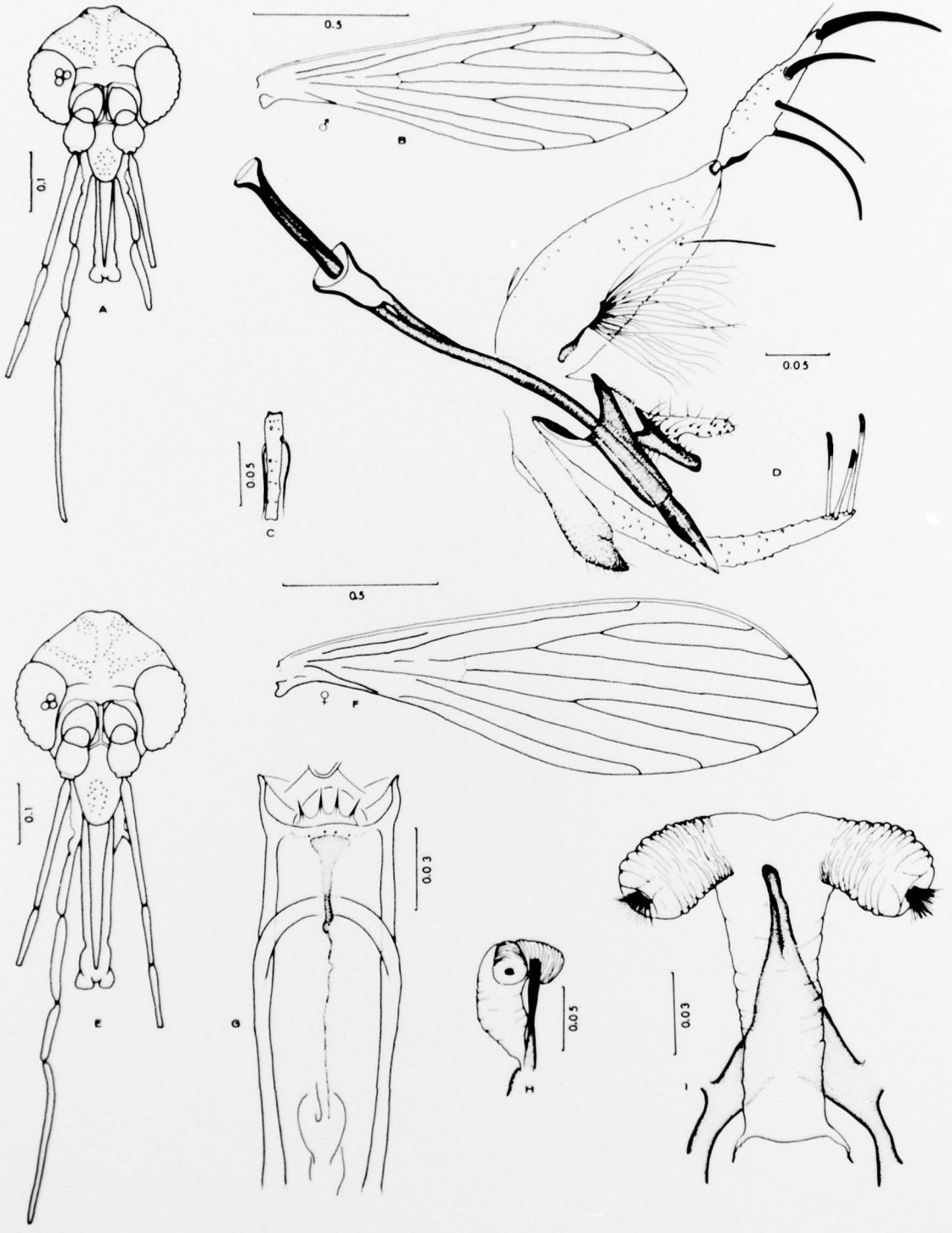
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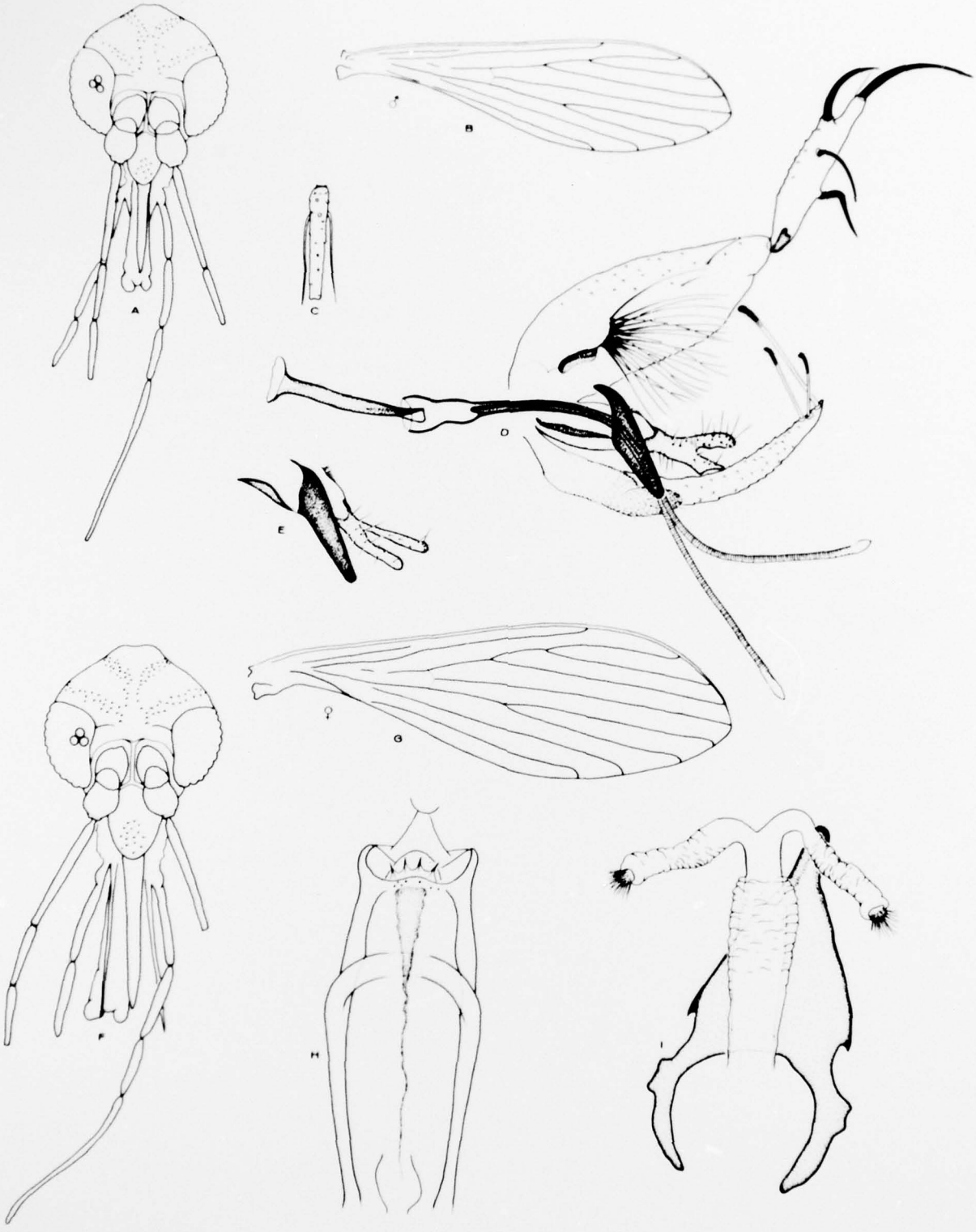
Fig. 2. Lutzomyia begonae (Ortiz & Torres). A. Male head (No. 480). B. Male wing (No. 474). C. Male antennal segment 4 (No. 480). D. Male genitalia, lateral view drawn in phenol (No. 479). F. Female head (No. 504). G. Female wing (No. 491). H. Female cibarium (No. 504). I. Spermatecae, dorsal view, in phenol (No. 504).

Lutzomyia infraspinosa (Mang.). E. lateral view of paramere and aedeagus. All structures drawn at same scale as those in Fig. 1.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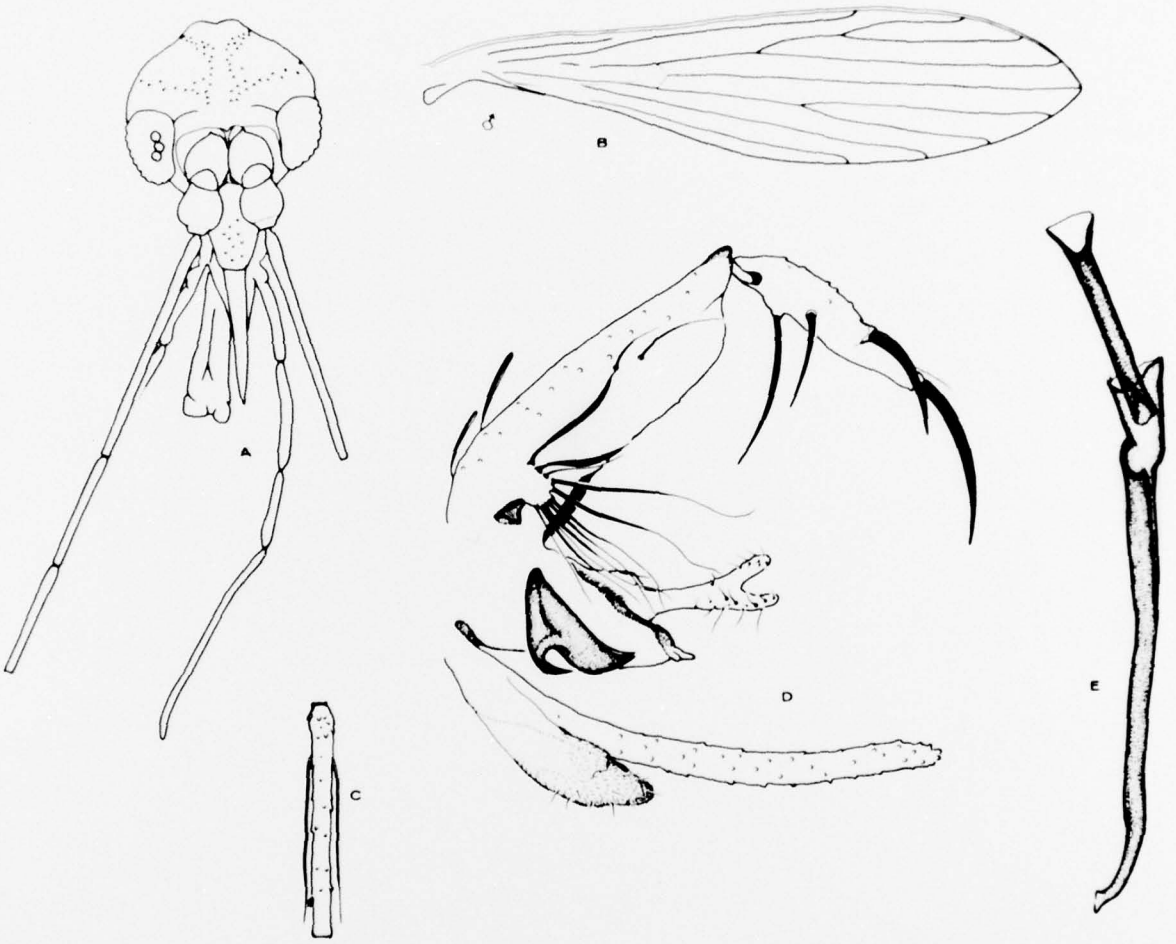
I

Fig. 3. Lutzomyia teratodes Martins, Falcão & da Silva. Male from Acá Poi, San Pedro, Paraguay. A. Head. B. Wing C. Fourth Antennal segment. D. Male genitalia, drawn in phenol. E. Genital pump and filaments (one filament is hidden behind the other).


A
B
C
D
E

LIST OF PUBLICATIONS RESULTING FROM THIS WORK

1. Young, D. G. and C. H. Porter. 1972. Lutzomyia yuilli, a new man-biting phlebotomine sand fly from Colombia (Diptera:Psychodidae). J. Med. Ent. 9(6):524-526.

2. Young, D. G. 1973. Two new phlebotomine sand flies from Colombia (Diptera:Psychodidae). Fla. Ent. 56(2):106-112.

3. Young, D. G. and C. H. Porter. 1974. Lutzomyia cirrita n. sp. from Colombia with a new synonym in the genus (Diptera:Psychodidae:Phlebotominae Fla. Ent. 57(3):321-325.

4. Young, D. G. and D. J. Lewis. 1975. Pathogens of phlebotomine sand flies. Bull. W.H.O. (In Press)

5. Young, D.G. and J.R. Arias, 1977. Lutzomyia sand flies in the subgenus Evandromyia Mangabeira with a description of a new species from Brazil. Bol. INPA(in press).

6. Lainson, R., R.D. Ward, D.G. Young, J.J. Shaw and H. Fraiha, 1977. Preliminary entomological and parasitological studies in Humboldt, Aripuana, Mato Grosso State, Brazil. Bol. INPA(in press).

PERSONNEL SUPPORTED ON PROJECT

D.G. Young, M.S., Associate in Entomology, Dept. of Entomology & Nematology
S.S. Haney, Technican, Dept. of Entomology & Nematology
G.B. Fairchild, Ph.D., Professor, Dept. of Entomology & Nematology

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UNCLASSIFIED

Security Classification

DOCUMENT CONTROL DATA - R & D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1. ORIGINATING ACTIVITY (Corporate author)	2a. REPORT SECURITY CLASSIFICATION
University of Florida Gainesville, Fla. 32601	Unclassified
	2b. GROUP

3. REPORT TITLE

Studies of Phlebotomine Sand Flies

4. DESCRIPTIVE NOTES (Type of report and inclusive dates)

Annual Report -- 1 JUNE 1975 – 1 JUNE 1976

5. AUTHOR(S) (First name, middle initial, last name)

David G. Young

6. REPORT DATE	7a. TOTAL NO. OF PAGES	7b. NO. OF REFS
31 May 1976	155	44

8a. CONTRACT OR GRANT NO.	9a. ORIGINATOR'S REPORT NUMBER(S)
DADA 17-72-C-2139	
b. PROJECT NO.	
c.	9b. OTHER REPORT NO(S) (Any other numbers that may be assigned this report)
d.	

10. DISTRIBUTION STATEMENT

Approved for public release; distribution unlimited

11. SUPPLEMENTARY NOTES	12. SPONSORING MILITARY ACTIVITY
	U.S. Army Medical Research and Development Command Washington, D. C. 20315

13. ABSTRACT

The reference collection of Phlebotominae continued to grow. Seventy-five percent of the New World species are represented; thus making it the most complete collection in existence. A review of the subgenus Evandromyia of Lutzomyia was completed. Another paper dealing with phlebotominae and parasites in one area of Mato Grosso, Brazil is now in press. A manuscript on sand fly classification on a world wide basis is near completion. Identification keys to the sand flies of Trinidad, Panama, the subgenus Psychodopygus, the subgenus Dampfomyia and the gasparviannai group were finished and are included in this report. Thirty-six phlebotomine species were collected in Ecuador. Twenty-five of these represent new records for the Republic. Several undescribed taxa were discovered. A sand fly colony (Lutzomyia vexator) is being maintained in Gainesville. Studies related to disease transmission, physiology and behavior can be undertaken with specimens from this colony. Work continued on the Colombian sand fly project. A final draft will be available before July 1, 1977.

DD FORM 1 NOV 1473 REPLACES DD FORM 1473, 1 JAN 64, WHICH IS OBSOLETE FOR ARMY USE.

Security Classification

14 KEY WORDS	LINK A ROLE	LINK A WT	LINK B ROLE	LINK B WT	LINK C ROLE	LINK C WT
Lutzomyia						
Psychodopygus						
Trinidad						
Panama						
Evandromyia						
Dampfomyia						
Identification keys						
Phlebotomine sand fly