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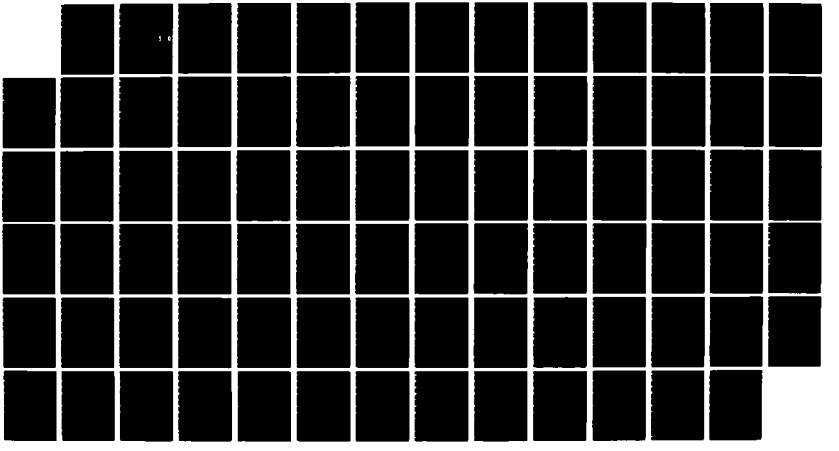

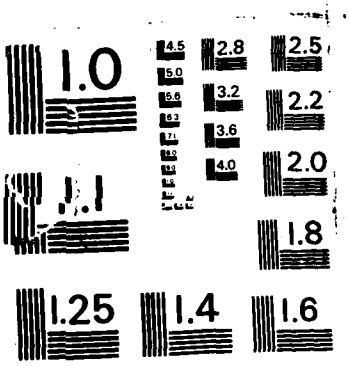

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PHLEBOTOMINE VECTORS OF HUMAN DISEASE

ANNUAL REPORT

DAMD 17-82-C-2223

By D.G. YOUNG

30 DECEMBER 1983

Supported by

U. S. ARMY MEDICAL RESEARCH & DEVELOPMENT COMMAND
Fort Detrick, MD 21701

DEPARTMENT OF ENTOMOLOGY & NEMATOLOGY
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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

A taxonomic review of the 14 Lutzomyia spp. known to occur in North America was completed. New distribution records obtained in 1983 were included. Data on Ecuadorian sand flies were compiled based on published and unpublished records and a new anthropophilic species in the vexator group was described from eastern Ecuador.

Fifteen phlebotomine species, including 5 anthropophilic Lutzomyia were

collected for the first time in Peru at a site in Madre de Dios Department -- a region endemic for mucocutaneous leishmaniasis. Males and females of an undescribed, ungrouped Lutzomyia sp. were also captured in the Rimac Valley at Cocachacra where human cases of bartonellosis and uta (cutaneous leishmaniasis) continue to be diagnosed. There is a resurgence of the former disease in Peru with 3,795 human cases reported in 1982. Collections of phlebotomines in Costa Rica yielded an undescribed Lutzomyia (Vespertilionis group). Progress was made towards the completion of a handbook on the neotropical Phlebotominae.

Attempts to colonize Lutzomyia longipalpis, possibly a species complex, from Costa Rican material were unsuccessful but viable eggs of this vector species were obtained from wild-caught females in Colombia in November, 1983. Lutzomyia christophei, the suspected vector of diffuse cutaneous leishmaniasis in Dominican Republic, was reared in the laboratory at Walter Reed Army Institute of Research for the first time. Colonies of 4 nearctic Lutzomyia spp. are being maintained at the University of Florida and females of 3 of them, Lu. shannoni, Lu. anthophora and Lu. diabolica, are able to transmit Leishmania mexicana (WR 411, Texas strain) by bite to hamsters. The site of development of a Leishmania sp. (Isabel strain) from the Dominican Republic in experimentally-infected Lu. anthophora indicates that the parasite belongs in the section Suprapylaria.

Several hundred Sergentomyia sand flies from Tanzania were slide mounted. The undescribed male of S. decipiens and two undescribed species were included in this collection. At least 2 species from Tanzania were reared for taxonomic purposes and to have noninfected females available to feed on Leishmania-like parasites found in red blood cells of sympatric lizards (geckoes). The parasite, subsequently lost, did not develop in 15 flies that took bloodmeals from a highly-infected lizard.

ABSTRACT

1. Preparing Institution: University of Florida

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3. Principal Investigator: David G. Young

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7. Key Words: Sand fly

Phlebotominae

Leishmaniasis

Bartonellosis

Lutzomyia

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PROGRESS REPORT
DAMD 17-82-C-2223

Introduction

This report covers the period from 1 Feb. 1983 to 30 Dec. 1983. Research was focused mainly on New World sand flies with the aim of completing a handbook on the neotropical fauna.

Objectives

1. To study the taxonomy of sand flies from the neotropical region, with special emphasis on the fauna of Mexico and Central America, and to provide a handbook on the entire fauna.
2. To study the taxonomy of sand flies from Africa and the Near East, providing identification keys, reference collections (based mainly on newly collected material); and to evaluate future needs for study in these areas.
3. To colonize, in the laboratory, different species of Phlebotominae from Africa, the Near East and the Neotropical Region, with special emphasis on vector species.
4. To assess the susceptibility of colonized species to aetiologic agents of disease.

Results

The following results are discussed in order of the objectives given above.

1. Taxonomic studies of New World Phlebotominae

A review (ca. 100 pages) of the North American Lutzomyia spp. by the PI and P.V. Perkins was completed during this time. The manuscript was submitted to Mosquito News as a supplemental publication. Two new species from Arizona (vexator group and shannoni group) are described and information on the biology, geographic distribution, disease relationships and taxonomy of all the species is included. This year the PI identified specimens of Lu. aquilonia collected near Ft. Collins, Colorado, a locality quite distant from Washington State and southern Canada where it had been previously recorded.

A review of the sand flies of Ecuador was also completed and sent to the Journal of Med. Entomol. for publication. The paper is based on literature records and on collections made by the PI in 1976 and by colleagues in 1982. Results of this study, including a description of a new anthropophilic vexator group species are given in Appendix I.

From 16 April to 1 June, 1983, the PI collected sand flies in Peru, Bolivia and Costa Rica, identified material in local collections and demonstrated rearing techniques to medical entomologists working in these countries.

In Peru (Appendix II), collections were made at two different sites. One, near the Rio Tambopata (Madre de Dios), is endemic for mucocutaneous leishmaniasis; the other lies in the bartonellosis and "uta" endemic region of the Andes near Lima, Peru (Cocachacra). Sand flies at the latter site have been intensively studied for many years by Drs. Townsend, Shannon, Hertig and Herrer and our discovery there of an undescribed species, to be named Lu. oligodonta, was therefore quite unexpected. The first female, collected in a small cave (apparently man-made), fed to repletion on the arm of a human volunteer. Further studies on its vector potential and

habits are now being carried out by Peruvian colleagues. This species is most unusual among American species; the female cibarium is almost devoid of teeth (similar to that of Phlebotomus (Phlebotomus) spp. in the Old World. It is noteworthy to mention that the incidence of bartonellosis in Peru is greatly increasing (from 197 cases in 1979; 389 in 1980; 495 in 1981 to 3,795 in 1982; data from San Marcos University, Trop. Med. Institute "Daniel Carrion").

At the Tambopata site, the PI and others captured 15 phlebotomine spp. that had not been previously recorded in the country. Of these, 5 are anthropophilic and are of potential medical importance.

The sand fly fauna of Bolivia is poorly known. Both visceral and cutaneous leishmaniasis (including espundia) are present in the country. In early May, 1983, the PI collected phlebotomines at a site about 210 km NW of Santa Cruz in eastern Bolivia near the Rio Yapacani, an area where mucocutaneous leishmaniasis and an unidentified L. mexicana sp. are prevalent in humans. Of 13 phlebotomine spp. collected (1 Brumptomyia sp. and 12 Lutzomyia spp.), 7 are known to be anthropophilic [Lu. amazonensis (new record in Bolivia), Lu. davisi, Lu. carrerai (new record in Bolivia with 2 color forms), Lu. gomezi (new record in Bolivia), Lu. nevesi, Lu. serrana and Lu. shannoni]. Lutzomyia shawi (new record in Bolivia) was identified from previously collected material stored at CENETROP in Santa Cruz. Of 43 females dissected for leishmanial promastigotes (32 shannoni, 2 serrana, 13 carrerai and 1 davisi) none was positive. The majority of sand flies were captured in Shannon traps (77♂, 142♀) and on tree trunks (85♂, 35♀). The very wet conditions probably contributed to the relatively low numbers taken. Two weeks earlier in Peru nearly 3,000 sand flies were captured in 4 days.

A description of a new Lutzomyia sp. in the Vespertilionis group from central America was submitted to the Journal of Med. Entomol. in August, 1983 (Appendix III). One male was captured by the PI in May, 1983. Another conspecific male from Honduras, collected in the 1950's, was on hand and it, therefore, seemed appropriate to formally name this species. The PI also confirmed identifications of a number of other Lutzomyia specimens in Costa Rica, most of which were collected by investigators during the past decade. More than 20 species represent new country records.

These data will help fill in distributional gaps of Lutzomyia spp. in Central America and western South America and will be included in the handbook of neotropical sand flies that should be completed by December, 1984 (estimate based on progress made during 1983).

In addition to the results mentioned above, a manuscript on the species group Microps (a newly-created group of 6 Lutzomyia spp. with descriptions of 2 new species) was submitted to the Rev. Brasil. Biol. for publication.

2. Taxonomic studies of Old World Phlebotominae

Several hundred specimens of Sergentomyia collected near Morogoro, Tanzania in November, 1982 by the PI were slide mounted and arranged according to species. The previously unknown male of S. decipiens and at least 2 undescribed species are included in the material. No other work on Old World sand flies was carried out during the year.

3. Colonization of sand flies

Due to Florida regulations, it is not possible to maintain lab colonies of exotic sand fly species in the state. However, in

November, 1983, the PI, Dr. R. Tesh and Colombian colleagues captured blood-engorged Lu. longipalpis at Melgar, Colombia. These were taken to Yale University where they deposited ca. 150 eggs and it is expected that a viable laboratory colony will become established. Attempts in May, 1983 to rear Costa Rican Lu. longipalpis were unsuccessful, probably due to unfavorable conditions in San Jose where field-collected adults from Guanacaste Prov., were taken. There is evidence that Lu. longipalpis, the principal vector of visceral leishmaniasis in the Americas, represents a species complex. It is therefore important to establish laboratory colonies from different areas to help verify if this is true and to evaluate the vector potential of the different forms. Current attempts in Costa Rica to colonize this species (or ally) by colleagues of the PI are being made.

For the first time, Lu. christophei in the species group verrucarum and a suspected vector of cutaneous (DCL) leishmaniasis in Hispaniola, was reared in the laboratory by Richard Johnson, a student working with the PI. Field-collected females readily fed on hamsters in the laboratory and their eggs were sent to Walter Reed Army Institute of Research where F_1 adults were obtained. Females of this generation fed on white mice and probed the skin on humans. There is also circumstantial evidence that this species is anthropophilic under natural conditions. A DCL patient living in the Dominican Republic was asked to collect "erisos" (= Lutzomyia) that happen to land on his skin or clothing near his home in El Siebo Province. Two weeks later he brought 2 dead females to the Dermatology Institute in Santo Domingo. They were subsequently identified by the PI as Lu. christophei.

Viable laboratory colonies of Lu. anthophora, Lu. shannoni, Lu. vexator and Lu. diabolica are presently being maintained by the PI at the University of Florida.

4. Susceptibility of colonized sand flies to pathogens

A paper on the transovarian transmission of Rio Grande virus was published in the Amer. J. of Trop. Med. Hyg. This represents the first time that this mode of transmission for a Phlebovirus has been virologically confirmed.

Twenty-six females of Lu. anthophora fed upon a hamster experimentally-infected with Leishmania (Isabel strain) that was originally isolated from a human patient in the Dominican Repbulic. The objective was to determine the initial site of development of this parasite in the invertebrate. All flies dissected 3 and 5 days after the infecting bloodmeal had promastigotes in the midgut, indicating that this strain belongs in the section Suprapylaria, not Peripylaria (i.e. those in the braziliensis complex that initially multiply in the hindgut). The numbers of promastigotes were relatively low, ranging from 300-500/fly, in contrast to L. mexicana promastigotes in Lu. anthophora that are more abundant (1000+/fly) when kept under the same conditions.

It was demonstrated that lab-bred females of 3 Lutzomyia spp. (Lu. shannoni, Lu. diabolica and Lu. anthophora) are able to transmit L. mexicana (WR 411 from Texas) by bite to hamsters in the laboratory. Specific results will be published in 1984.

An unusual Leishmania-like parasite that infects red blood cells of Tanzanian geckoes failed to develop in 2 sympatric Sergentomyia spp. that were reared in the laboratory (n = 1599). Unfortunately, the donor

lizard died and it was not possible to transmit these parasites to other lizards or hamsters.

APPENDIX I

Additions to the Phlebotomine Sand Fly Fauna of Ecuador (Diptera: Psychodidae)[1]

D.G. Young[2] and T.E. Rogers[2]

Abstract. A checklist of phlebotomine sand flies of Ecuador (49 species and subspecies), with additional comments on some species, is given. The female of Lutzomyia abunaensis (species group aragaoi), both sexes of L. (Trichophoromyia) napoensis, n.sp., L. (Trichophoromyia) wilkersoni, n.sp. and L. tortura, n. sp. (species group vexator) are described. Three closely related and anthropophilic sand flies in the subgenus Psychodopygus ("L. davisi complex") are keyed and illustrated.

Previous records of 39 species and subspecies of Phlebotominae from Ecuador include those of Rodriguez (1950, 1956), Arzube (1960) and Young (1979). This number, increased to 49 in the present report (Table 1), is conservative in view of the varied habitats within the Republic and clearly reflects limited collections rather than actual species diversity.

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[1]Research supported by U.S. Army Medical Research and Development Command contracts DADA 17-72-2139 and DAMD 17-82-C-2223. Florida Agr. Exp. Station Journal Series No.

[2]Department of Entomology and Nematology, University of Florida, 3103 McCarty Hall, Gainesville, Florida 32611, U.S.A.. Present address of T.E. Rogers is A.C.G. Dhahran North, P.O. Box A2, Dhahran, Kingdom of Saudi Arabia.

Information on phlebotomine-borne diseases in Ecuador is also inadequate. Leon (1957) reported a human case of visceral leishmaniasis in Esmeraldas Province but we have no additional details. The principal New World vector of this disease is Lutzomyia longipalpis (Lutz and Neiva), a species inhabiting dry areas that has not yet been found in Ecuador.

Human cases of cutaneous leishmaniasis were documented by several authors including Rodriguez and Alvíles Nuge (1953), Rodriguez (1969) and Leon and Leon (1976). The few and old reports of bartonellosis in Ecuador were given by Hertig (1940), Montalvan (1940) and Gamarra Caller (1964). The vectors of these diseases in Ecuador remain unknown.

In the present paper we describe 3 new species of Lutzomyia and the previously unknown female of L. abunaensis Martins, Falcão and da Silva. A checklist of the known sand fly fauna of Ecuador is presented (Table 1) and further information on the distribution and taxonomy of some species is given.

We examined specimens of all species recorded in the literature except for Brumptomyia pentacantha (Barretto), Lutzomyia cayennensis (Floch and Abonnenc), L. monticola (Costa Lima), L. sallesi (Galvão and Coutinho) and L. ylephiletor (Fairchild and Hertig), species reported by Rodriguez (1956) and/or Arzube (1960). Most of the new information given here is based on recent collections from five localities listed below and shown in Fig. 1.

1. Limoncocha (0°24'S; 76°30'W), Napo Prov., near the junction of Rio Jivino and Rio Napo, 280 m elev. We collected sand flies

there from 18-24.V.1976 in secondary and primary forests using CDC light and flight traps, by directly aspirating flies on tree trunks and on human bait.

2. Tinalandia (0°21'S; ; 79°04'W), Pichincha Prov., about 12 km E of Santo Domingo de Los Colorados, 700-1000m elev. We collected flies in patches of original forest surrounding a hilly golf course overlooking the Pacific coastal plain. The name, "Tinalandia," does not appear on most maps. Collections were made 4-9.V. and 26-28.V.1976.
3. 17 km SE of Puyo (approx. 1°55'S; 77°58'W), Pastaza Prov., about 800 m. elev., flight trap, 4.XI.1981 (R.C. Wilkerson).
4. 12 km S of Zamora (approx. 4°12'S; 78°56'W), Zamorachinchipe Prov., about 1200 m elev., flight trap, 6-7.II.1982 (R.C. Wilkerson).
5. 6 km SE of Piñas (approx. 3°43'S; 70°40'W), El Oro Prov., about 1000 m elev., flight trap, 1.III.1982 (R.C. Wilkerson).

Sand fly species from these sites and from others reported in the literature are classified in Table 1 according to the scheme of Lewis et al. (1977). References to original and subsequent descriptions of the species are given by Martins et al. (1978). Terminology used in the following discussion and descriptions follows Young (1979).

Holotypes and allotypes of new taxa will be deposited in the U.S. National Museum (Nat. Hist.); Paratypes in collections at the Florida State Collection of Arthropods, Gainesville; Instituto Leopoldo Izquieta Perez,Guayaquil; and the British Museum (Nat. Hist.).

Comments On Some Species

1. Brumptomyia leopoldoi (Rodriguez 1953)

Rodriguez (1950) listed Brumptomyia hamata (Fchld. and Hertig) from Los Rios Province and later (1953) gave measurements of male and female structures that were apparently made from Panamanian specimens. Neither Rodriguez (1956) nor Arzube (1960) listed B. hamata among the Ecuadorian sand flies so it appears that the earlier record of this species was a misidentification of B. leopoldoi.

2. Lutzomyia sallesi (Galvão and Coutinho 1939)

This species was reported from Guayas Prov. by Arzube (1960) but was omitted from the list of Ecuadorian species by Martins et al. (1978). Its presence in Ecuador, at least west of the Andes, remains doubtful.

3. Lutzomyia sericea (Floch and Abonnenc 1944)

1 ♂, near Zamora, Zamorachinchipe Prov., flight trap, 6-7.II.1982 (R.C. Wilkerson). The specimen agrees closely with the original description of L. sericea and that of L. deanei (Damasceno, Causey and Arouck 1948) which is conspecific with it. The female remains unknown.

4. Lutzomyia nevesi (Damasceno and Arouck 1956)

This was the most common sand fly found resting on tree trunks at Limoncocha in May, 1976. A total of 63 ♂, 29♀ were taken. Velasco and Martins (1974) described the female and noted that some specimens were captured in man baited collections in Bolivia.

5. Lutzomyia dysponeta (Fairchild and Hertig 1953)

We examined 5 ♂ of this species from Quininde, Esmeraldas Prov., light traps, 17.I and 24.III.1972 (E. Gutierrez).

6. Lutzomyia (Evandromyia) sp. near L. infraspinosa (Mangabeira 1941)

Two females from Limoncocha closely resemble L. infraspinosa but conspecific males are needed to confirm the identification.

7. Lutzomyia abunaensis Martins, Falcão and da Silva 1965, Fig. 2-7.

Originally described from males collected at Abuna, Rondonia, Brazil, L. abunaensis was later treated as a junior synonym of L. brasiliensis (Costa Lima 1932) by Martins et al. (1978). Mangabeira and Sherlock (1962) carefully redescribed the latter species, noting that the female cibarium had 4 large horizontal teeth and that the sperm ducts were about 20 times the length of the spermathecae and were more or less subequal in width throughout.

Each of the 3 females collected with a single male at Limoncocha differs from L. brasiliensis by having 8-10 horizontal teeth in the cibarium (Fig. 5) and by having shorter sperm ducts that are thinner near the spermathecae than at the junction with the common sperm duct (Fig. 3).

The males of these two species appear to be structurally indistinguishable but, in view of the significant differences between the females, we consider L. abunaensis to be a valid species. A

description of the previously unknown female (from Limoncocha, Ecuador) is given below.

♀ (measurements in mm). Wing length 2.68; width 0.91. Whole insect well pigmented, pleura only slightly paler than mesonotum. Head height from clypeus to tip of labrum 0.43; width 0.47. Eyes large, separated by 0.09 or by distance equal to 3.5 facet diameters. Flagellomere I 0.31 long, II & III = 0.38 long; ascoids with short proximal spurs, on all flags. except last two (XIII & XIV); distal tips of all ascoids reaching beyond ends of their respective flagellomeres. Labrum 0.21 long. Lengths of palpomeres: 1, 0.04; 2, 0.10; 3, 0.14; 4, 0.08; 5, 0.18; 7 sensilla on distal 2/3rds of palp. 2 and ca. 20 scattered sensilla on palp. 3. Cibarium with 10 sharp horizontal teeth and ca. 12 large median vertical teeth and 10-15 smaller vertical teeth on each side as shown; cibarial arch complete; pigment patchy prominent, well pigmented. Pharynx 0.20 long, with ridges at posterior end. Pleura with 17-18 upper and 2-3 lower episternal setae. Lengths of wing vein sections: alpha, 0.85; beta, 0.27; delta, 0.40; gamma, 0.16. Lengths of femora, tibia and basitarsi: foreleg, 1.15, 1.83, 1.33; midleg, 1.07, 1.96, 1.35; hindleg, 1.22, 2.24, 1.40; hind femora without spines. Spermathecae as shown, with indistinct, irregular segments, convoluted; individual sperm ducts narrow at junction with spermathecae but becoming progressively wider towards short common duct.

8. Lutomyia (Trichophoromyia) napoensis Young and Rogers, new species Fig. 8-17.

♂ holotype (measurements in mm). Wing length 2.09; width 0.56. Whole insect well pigmented, pleura nearly as dark as mesonotum. Head height from vertex to tip of clypeus, 0.34; width 0.33. Eyes large, separated by 0.12 or by distance equal to 7 facet diameters. Flagellomere I 0.21 long, II & III = 0.24; ascoids with very short proximal spurs (characteristic of the subgenus), on all flags. except last 2 (XIII & XIV), those on flag. II extending to III. Labrum 0.20 long. Lengths of palpomeres: 1, 0.04; 2, 0,08; 3, 0.13; 4, 0.05; 5, 0.16; about 10 scattered sensilla at middle to end of palp. 3. Cibarium with about 15 dot-like remnants of teeth, no pigment patch or cibarial arch evident. Pharynx 0.16 long. Pleura with 14-15 upper and 3-4 lower episternal setae. Lengths of wing vein sections: alpha, 0.61; beta, 0.25; delta, 0.40; gamma, 0.22. Lengths of femora, tibiae and basitarsi: foreleg, 0.84, 1.09, 0.66; midleg, 0.79, 1.30, 0.81; hindleg, 0.89, 1.58, 0.91; femora without spines. Genitalia: Style 0.23 long, with 4 large spines inserted at different levels, subterminal spine on short process, no subterminal seta. Coxite 0.39 long, arched, with two groups of simple setae, the ventral median group of about 25 relatively thin seta and a lateral median group with about 12 setae, some of which are thicker than those in the ventral group. Paramere with a dorsal hump bearing about 15 setae, tip of paramere with 3 relatively long setae and numerous small ones. Aedeagus moderately pigmented, broad as shown. Genital pump 0.19 long, each filament about 0.86 long or 4.5X length of pump, filament tips expanded and acute. Lateral lobe 0.46 long.

♀ allotype. Wing length 2.23; width 0.69. Coloration as in ♂. Head height 0.42; width 0.33. Eyes large, separated by 0.49 or by 7 facet diameters. Flagellomere I 0.23 long, II + III = 0.23; ascoids as in ♂. Labrum 0.36 long. Lengths of palpomeres: 1, 0.05; 2, 0.16; 3, 0.18; 4, 0.07; 5, 0.14; sensilla (3) at apex of palp. 2 and ca. 20 from base to apex of palp. 3. Cibarium with 12 pointed horizontal teeth, median teeth more inwardly directed than horizontal teeth at sides; a single row of 14 vertical teeth anterior of the horizontal teeth and a median group of 5 others; pigment patch well sclerotized, conspicuous; cibarial arch, complete. Pharynx 0.17 long with posterior ridges and small punctiform teeth. Pleura with 11-13 upper and 5 lower episternal setae. Length of wing vein sections: alpha, 0.77; beta, 0.27; delta, 0.59; gamma, 0.49. Lengths of femora, tibiae and basitarsi: foreleg, 0.83, 1.05, 0.71; midleg, 0.80, 1.30, 0.79; hindleg, 0.93, 1.47, 0.86; femora without spines. Spermathecae as shown, their ducts nearly invisible but apparently with a short common duct and individual ducts at least 6X length of spermatheca.

Type data. Holotype ♂. Ecuador, Napo Prov., Limoncocha, 280 m elev., light trap, 22.V.1976 (Young and Rogers). Allotype ♀. Same data. Paratypes .23♂, 24♀, same locality, light and flight traps, 19-24.V.1976 (Young and Rogers).

Discussion. Both sexes of L. napoensis n. sp. were collected together on 7 different occasions in light and flight traps at Limoncocha in primary forest. We did not collect other species in

the subgenus Trichophoromyia at this site and therefore are confident that the males and females are conspecific.

In Sherlock and Guitton's key (1970) to the Trichophoromyia males, L. napoensis will key to couplet 7 with L. meirai (Causey and Damasceno 1945) and L. octavioi (Vargas 1949), but the parameres of these species lack a dorsal setose hump and the position of the persistent coxite setae is different. Llanos et al. (1975) redescribed and illustrated the "L. octavioi" male (based on Peruvian material) but we suspect that it represents another unnamed species, not L. octavioi that was originally described as Phlebotomus affinis (not P. affinis Theodor 1933) by Mangabeira (1942).

Since Sherlock and Guitton's review of the subgenus (1962), 5 additional species of Trichophoromyia have been discovered -- L. omagua Martins, Llanos and Silva 1976, L. cellulana Young 1979, L. howardi 1979, L. saltuosa Young 1979, and Lutzomyia sp. no. 1 of Araracuara, Morales and Minter 1981. The shape of the paramere of the latter species and L. howardi resembles that of L. napoensis but the coxite setal tufts of these species are compact with numerous setae. The other males differ from L. napoensis in paramere shape and/or arrangement and number of persistent coxite setae.

With a few exceptions, the Trichophoromyia females are difficult to identify in the absence of properly associated males.

9. Lutzomyia reburra (Fairchild and Hertig 1961)

The new record of the species from near Piñas, El Oro Pro. (3♂, 1♀) represents the southernmost limit of its known geographic distribution.

10. Lutzomyia (Trichophoromyia) wilkersoni Young and Rogers, new species Fig. 18-27.

♂ holotype (measurements in millimeters). Wing length 2.3, width 0.56. Whole insect well pigmented, pleura nearly as dark as mesonotum. Head height from vertex to tip of clypeus, 0.38; width 0.35. Eyes large, separated by 0.13 or by distance equal to 7.1 facet diameters. Flagellomere I 0.24 long, II + III = 0.28; ascoids with very short proximal spurs, on all flags, except last 2 (XIII & XIV), those on flag. II extending to III. Labrum 0.24 long. Lengths of palpomeres: 1, 0.04; 2, 0.11; 3, 0.14; 4, 0.07; 5, 0.18; about 10 scattered sensilla at distal two-thirds of palp. 3. Cibarium with about 15 dot-like remnants of teeth, mostly at sides, no pigment patch or cibarial arch evident. Pharynx 0.10 long. Pleura with 16-19 upper and 3 lower episternal setae. Lengths of wing vein sections: alpha, 0.68; beta, 0.28; delta, 0.47; gamma, 0.23. Lengths of femora, tibiae and basitarsis: foreleg, 0.91, 1.25, 0.81; midleg, 0.89, 1.55, missing; hindleg, 0.99, 1.96, missing; no spines on femora. Genitalia: Style 0.24 long, with 4 large spines inserted at different levels as shown. Coxite 0.44 long, arched with a median group of 31 simple setae. Paramere short, angular and bearing 6 relatively thick, dorsal setae as shown. Aedeagus ending in a short acute cone, base broad, moderately pigmented. Genital pump 0.18 long, each filament about 1.05 long or 5.9X length of pump; filament tips hidden within aedeagus but apparently acute and slightly enlarged. Lateral lobe 0.49 long.

♀ allotype. Wing length 2.65; width 0.87. Coloration as in ♂. Head height 0.48; width; 0.40. Eyes large, separated by 0.14 or by distance equal to 6.8 facet diameters. Flagellomere I 0.27 long, II + III = 0.29, length and distribution of ascoids as in ♂. Labrum 0.45 long. Lengths of palpomeres: 1, 0.05; 2, 0.20; 3, 0.23; 4, 0.07; 5, 0.20; 7 sensilla at end of palp. 2, 25 scattered over distal half of palp. 3. Cibarium with 8 sharp horizontal teeth, a transverse row of 12 vertical teeth and 5 median teeth, all subequal in size except for 3-4 small teeth at each side; pigment patch well sclerotized, broad; cibarial arch complete. Pharynx 0.20 long with posterior ridges and small punctiform teeth. Pleura with 14-16 upper and 4 lower episternal setae. Length of wing vein sections: alpha, 0.94; beta, 0.31; delta, 0.71; gamma, 0.27. Lengths of femora, tibiae and basitarsi: foreleg, 0.97, 1.25, 0.89; midleg, 0.94, 1.58, 1.02; hindleg, 0.99, 1.81, 1.10; femora without spines. No setae on tergite 8. Spermathecae as in Fig. 24, sperm ducts invisible.

Type data. Holotype ♂. Ecuador, Zamorachinchipe Prov., 12 km S of Zamora (4°12'S; 78°56'W)), about 1200 m elev., flight trap in forest, 6-7.II.1982 (R.C. Wilkerson). Allotype ♀ and paratypes (4♂, 17♀), same data.

Discussion. The distinctive shape of the male parameres readily serves to separate L. wilkersoni n. sp. from all other males in the subgenus Trichophoromyia. This was the only species of the subgenus captured at Zamora and we believe that the sexes are properly associated.

We are pleased to name this species for Dr. R.C. Wilkerson, University of Florida, in appreciation for his dedication and continuing interest in providing us with specimens of neotropical phlebotomines.

11. Lutzomyia (Trichophoromyia) sp.

A single male captured near Puyo, Pastaza Prov., flight trap, 4.XI.1981 (R.C. Wilkerson) resembles L. loretonensis (Llanos 1964) from Peru but the Ecuadorian specimen has 3 distinct groups of setae on the coxite and the parameters are slightly different. We refrain from naming this specimen until more material becomes available.

12. Lutzomyia olmeca bicolor Fairchild and Theodor 1971.

Specimens referable to this subspecies from Los Rios Prov. were listed incorrectly as P. apicalis Floch and Abonnenc 1943 by Rodriguez (1950, 1956), Levi-Castillo (1958) and Arzube (1960). Lutzomyia olmeca bicolor is the suspected vector of Leishmania mexicana aristedesi among rodents and marsupials in Panama.

13. Lutzomyia trapidoi (Fairchild and Hertig 1952).

This species is a suspected vector of cutaneous leishmaniasis (Leishmania braziliensis panamensis) in Panama and Colombia. The discovery of 11 ♂, 35♀ from near Piñas, El Oro Prov., flight trap (R.C. Wilkerson) is the southernmost locality where L. trapidoi has been found.

14. Lutzomyia ylephiletor (Fairchild and Hertig 1952).

Lutzomyia ylephiletor and L. trapidoi are morphologically very similar and the specimens identified as the former species from Barranco Chico, Guayas Prov. (Arzube 1960) may have been misidentified.

15. Lutzomyia amazonensis (Root 1934).

1♀, Limoncocha, light trap, 18-23.V.1976. 1♂, near Puyo, flight trap, 4.X.1981. The male of this species agrees with the recent description by Fraiha and Ward (1980) and also that of L. robini Abonnenc, Arias, Leger and Young 1980, a species that we now believe is conspecific with L. amazonensis (NEW SYNONYM).

Lutzomyia amazonensis is closely related to L. davisi (Root) and L. claustrei (Abonnenc, Leger, and Fauran), all of which are anthropophilic and which occur in many parts of the Amazon Basin. So far, L. claustrei has not been reported in Ecuador but we have specimens from Peru (Madre de Dios) and it is expected to occur in Ecuador, east of the Andes.

As an identification aid, a key to both sexes of these 3 species is given here. The illustrations (Fig. 28-66), except where otherwise noted, were drawn from Brazilian specimens collected together at Rio Urubu, Amazonas.

Key to the species in the L. davisi complex (subgenus Psychodopygus)

1. Common sperm duct of female with rugose portion (near junction with individual ducts) subequal in width, remainder of duct smooth walled; individual ducts shorter than half the length of the spermatheca. Genital filaments of male shorter than 4.5X length of pump. Abdominal tergites, especially 1-3, pigmented and as dark as, or nearly as dark as, mesonotum 2

   Common sperm duct relatively long with rugose portion tapered and remainder with conspicuous dot-like thickenings; individual ducts over half length of spermathecae. Genital filaments longer than 5X length of pump. Abdominal tergites with faint or no pigmentation; mesonotum heavily pigmented . . . . . L. davisi (Fig. 55-66)

2. Female cibarium with median vertical teeth larger than others and usually forming 1-2 logitudinal rows. Paramere of male with a stout lateral arm, its length shorter than 3X its maximum width . . . . . L. claustrei (Fig. 42-54)

   Female cibarium with 1-3 irregular transverse, not longitudinal, rows of vertical teeth. Paramere of male with a more slender lateral arm, its length at least 5X maximum width. . . . . L. amazonensis (Fig. 28-41)

16. Lutzomyia ayrozai (Barretto and Coutinho 1940).

We examined 2♂, 6♀ of this species from near Piñas, El Oro Prov., flight trap, 1.III.1982 (R.C. Wilkerson).

17. Lutzomyia guyanensis (Floch and Abonnenc 1941).

Recorded earlier from Limoncocha by Young (1979, we examined 2♂, 1♀ from the Puyo, Pastaza Prov., collection site. The males agree with the original description of L. geniculata (Mangabeira 1941) that is provisionally treated as a junior synonym of L. guyanensis by Young (1979). The parameres of the males from Ecuador are sharply upturned unlike those of L. corrossoniensis (LePont and Pajot 1978) and L. dorlinsis (Le Pont and Desjeux 1982).

18. Lutzomyia paraensis (Costa Lima 1941).

A single female was captured near Puyo, Pastaza Prov., in a flight trap, 4.XI.1981 (R.C. Wilkerson).

19. Lutzomyia hartmanni (Fairchild and Hertig 1957).

In addition to the the specimens of L. hartmanni reported from Tinalandia, Pichincha Prov., by Young (1979), we examined 3 ♂, 29 ♀ from the Piñas collection, all captured in flight trap. This is the southernmost locality from which L. hartmanni has been found.

20. Lutzomyia tortura Young and Rogers, new species, Fig. 67-76.

♂ holotype (measurements in mm). Wing length 1.73; width 0.56. Head, mesonotum, coxas and genitalia moderately infuscated, rest of insect pale. Head height from vertex to tip of clypeus, 0.35; width

0.32. Eyes large, separated by 0.09 or by distance equal to 4.6 facet diameters. Flagellomere I, 0.35 long, II + III = 0.31; ascoids simple, those on II extending beyond middle of flag., on all flags. except last (XIV). Labrum 0.22 long. Length of palpomeres: 1, 0.03; 2, 0.11; 3, 0.14; 4, 0.06; 5, 0.15; about 20 sensilla scattered on distal 2/3 rds. of palp. 3. Cibarium lacking teeth, with a conspicuous pigment patch but more slender than in ♀; cibarial arch incomplete. Pharynx 0.17 long, without spines. Pleura with 13-17 upper and 3 lower episternal setae. Lengths of wing vein sections: alpha, 0.51; beta, 0.18; delta, 0.12; gamma, 0.19. Lengths of femora, tibiae and basitarsi: foreleg, 0.74, 1.02, 0.68; midleg, 0.72, 1.20, 0.76; hindleg, 0.80, 1.48, 0.86; femora without spines. Genitalia: Style 0.16 long with 5 major spines, proximal pair inserted more or less at same level near middle as shown. Coxite, 0.28 long, lacking a basal setal tuft or other persistent setae. Paramere, long, simple with straight dorsal setae. Aedeagus with acute tip, more slender and pigmented apically. Genital pump 0.09 long, filaments thin, each 0.34 long or about 3.7X length of pump. Lateral lobe 0.23 long.

♀ allotype. Wing length 2.00; width 0.64. Coloration as in ♂. Head height 0.40; width 0.35. Eyes separated by 0.11 or by 5.5 facet diameters. Flagellomere I, 0.36 long, II + III = 0.29; ascoids simple, on all flags except terminal one (XIV), tips of those on II ending at 0.88 of segment. Labrum 0.30 long. Lengths of palpomeres: 1, 0.04; 2, 0.14; 3, 0.18; 4, 0.08; 5, 0.16; distal 2/3rds of palp. 3 with 20 sensilla. Cibarium with 4 pointed horizontal teeth, a row of

about 16 vertical teeth, all more or less the same size; cibarial arch conspicuous at sides, diffuse in middle; pigment patch moderately pigmented, shaped as shown. Pharynx 0.18 long, unarmed. Pleura with 17-18 upper and 4 lower episternal setae. Length of wing vein sections: alpha, 0.63 beta, 0.17; delta, 0.18; gamma, 0.18. Lengths of femora, tibiae and basitarsi: foreleg, 0.83, 1.05, 0.69; midleg, 0.78, 1.22, 0.76; hindleg, 0.86, 1.47, 0.86. Spermathecae cylindrical and segmented, individual sperm ducts about 3X length of spermatheca, common duct very short.

Type data. Holotype ♂. Ecuador, Napo Prov., Limoncocha, elev. 280 m, light trap, 23.V.2976 (D. Young and T. Rogers). Allotype ♀, same data. Paratypes, 34 ♂, 32 ♀, flight and light traps and human bait, 18-25.V.1976 (D. Young and T. Rogers).

Discussion. Lutzomyia tortura n. sp. belongs in the species group vexator as defined by Theodor (1965), with further comments and species additions by Martins et al. (1978), Ortiz (1978), and Young (1979).

The male of L. tortura differs from all other males in this group by the absence of persistent setae on the coxite. Some other species such as L. scorzai (Ortiz 1965), L sanguinaria (Fairchild and Hertig 1957) and L. hartmanni (Fairchild and Hertig 1957) have only 1 to 3 persistent setae at the inner base of the coxite, so it was not surprising to discover a species without any such setae. Other males in the vexator group have 5 or more coxite setae, often forming a prominent tuft.

The female of L. tortura is indistinguishable from that of L. hartmanni and correct identifications must therefore be made when associated males are available.

During a human bait collection at Limoncocha on 19.V.1976 from 2000-2030 hrs. (0.5 man hours) in primary forest, one of us captured a total of 2 sand flies, both of which were L. tortura.

21. Lutzomyia trinidadensis (Newstead 1922).

A single female from Limoncocha, flight trap, 21.V.1976 agrees closely with the redescription of this species (Fairchild and Hertig 1948).

22. Lutzomyia monticola (Costa Lima 1932).

The presence of this species in Ecuador is doubtful. Rodriguez (1956) identified a female from Estero Claro, Guayas Prov. as this species and Arzube (1960) listed it also from Los Rios Prov. without giving additional information. According to Rodriguez (1956), Levi-Castillo used the name L. lanei (Barretto and Coutinho), instead of L. monticola. Martins et al. (1978) did not include L. monticola in their list of sand flies of Ecuador.

The species has been reported from Brazil and Argentina (Martins et al. 1978) and we have males and females from Paraguay collected at Aca-Poi, San Pedro and Sommerfield, Yhú, animal burrows and Shannon trap, III-V.1950 (M. Hertig).

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Table 1. List of phlebotomine species known to occur in Ecuador. Those marked with an asterisk are new records for the Republic. Previous records are from Rodriguez (1956), Arzube (1960), and Young (1979).

GENUS	SUBGENUS OR SPECIES GROUP	SPECIES OR SUBSPECIES	KNOWN DISTRIBUTION IN ECUADOR, BY PROVINCE
Brumptomyia França & Parrot		B. galindoi (Fchld. & Hertig)	Napo
		B. leopoldoi (Rodriguez)	Cañar, Esmeraldas, Guayas, Los Rios, Manabi, Pichincha
		B. pentacantha (Barretto)	Napo
Lutzomyia França	Subgenus Lutzomyia França	L. gomezi (Nitz.)	Azuay, Esmeraldas, Guayas, Los Rios, Manabi, Napo, Pichincha
	Species group migonei Theodor	L. sallesi (Galvão & Coutinho)	Guayas
		*L. sericea (Floch & Abonnenc)	Zamorachinchipe
		L. walkeri (Newstead)	Napo

Table 1. Continued.

GENUS	SUBGENUS OR SPECIES GROUP	SPECIES OR SUBSPECIES	KNOWN DISTRIBUTION IN ECUADOR, BY PROVINCE
Lutzomyia França (cont.)	Species group verrucarum Theodor	L. nevesi (Damasceno & Arouck)	Napo
		L. serrana (Damasceno & Arouck)	Guayas, Napo, Pichincha
	Species group vespertilionis Theodor	L. vespertilionis (Fchld. & Hertig)	Guayas
	Subspecies Pressatia Mang.	L. camposi (Rodriguez)	Los Rios, Pichincha
		L. dysponeta (Fchld. & Hertig)	Esmeraldas, Guayas, Los Rios
		L. triacantha (Mang.)	Napo
	Species group baityi Theodor	L. baityi (Damasceno, Causey & Arouck)	Napo

Table 1. Continued.

GENUS	SUBGENUS OR SPECIES GROUP	SPECIES OR SUBSPECIES	KNOWN DISTRIBUTION IN ECUADOR, BY PROVINCE
Lutzomyia França (cont.)	Subgenus Evandromyia Mang.	*L. (Evandromyia) sp.	Napo
	Species group shannoni Theodor	L. dendrophyla (Mang.)	Napo
		L. shannoni (Dyar)	Guayas, Manabi, Napo, Pichincha
		L. undulata (Fchld. & Hertig)	Pichincha
	Species group aragaoi Theodor	L. abunaensis (Martins, Falcão & Silva)	Napo
		L. barrettoi majuscula Young	Guayas, Los Rios, Manabi, Pichincha
	Species group dreisbachi Theodor	L. aclydifera (Fchld. & Hertig)	Pichincha

Table 1. Continued.

GENUS	SUBGENUS OR SPECIES GROUP	SPECIES OR SUBSPECIES	KNOWN DISTRIBUTION IN ECUADOR, BY PROVINCE
Lutzomyia	Subgenus	*L. napoensis n. sp.	Napo
França	Trichophoromyia	L. reburra (Fchld. & Hertig)	El Oro, Pichincha
(cont.)	Barretto	*L. wilkersoni n. sp.	Zamorachinchipe
		*Lutzomyia sp.	Pastaza
	Subgenus	L. flaviscutellata (Mang.)	Napo
	Nyssomyia	L. olmeca bicolor Fchld. &	Los Rios, Napo
	Barretto	Theodor	
		L. trapidoi (Fchld. & Hertig)	El Oro, Los Rios, Pichincha
		L. ylephiletor (Fchld. & Hertig)	Guayas
		L. yuilli Young & Porter	Napo
	Subgenus	*L. amazonensis (Root)	Napo, Pastaza
	Psychodopygus	*L. ayrozai (Barretto & Coutinho)	El Oro
	Mang.	L. bispinosa (Fchld. & Hertig)	Napo

Table 1. Continued.

GENUS	SUBGENUS OR SPECIES GROUP	SPECIES OR SUBSPECIES	KNOWN DISTRIBUTION IN ECUADOR, BY PROVINCE
Lutzomyia	Subgenus	L. carrerai carrerai (Barretto)	Napo
França	Psychodopygus	L. carrerai thula Young	Pichincha
(cont.)	Mang. (cont.)	L. davisi (Root)	Napo, Pastaza
		L. geniculata (Mang.)	Napo, Pastaza
		L. hirsuta hirsuta (Mang.)	Napo
		L. nocticola Young	Napo
		L. panamensis (Shannon)	Pichincha
		*L. paraensis (Costa Lima)	Pastaza
	Species group	L. hartmanni (Fchld. & Hertig)	El Oro, Pichincha
	vexator Theodor	*L. tortura n. sp.	Napo
	Species group	L. cayennensis (Floch &	Esmeraldas, Guayas
	cayennensis	Abonnenc	
	Theodor	L. micropyga (Mang.)	Napo

Table 1. Continued.

GENUS	SUBGENUS OR SPECIES GROUP	SPECIES OR SUBSPECIES	KNOWN DISTRIBUTION IN ECUADOR, BY PROVINCE
Lutzomyia França (cont.)	Species group oswaldoi Theodor	*Lutzomyia sp.	Napo
	Ungrouped	L. monticola (Costa Lima	Guayas, Los Rios
		L. nordestina (Mang.)	Cañar, Guayas, Los Rios, Napo, Pichincha

Figure Legends

Fig. 1. Map of Ecuador showing 5 sites where sand flies have recently been collected.

Fig. 2-7. Lutzomyia abunaensis Martins, Falcão and da Silva female. 2, Flagellomere II; 3, Spermatheca, ducts and genital fork, only 1 spermatheca is drawn; 4, head; 5, cibarium, same scale as Fig. 3; 6, cercus; 7, wing. Specimen from Limoncocha, Ecuador. Scale in mm.

Fig. 8-17. Lutzomyia (Trichophoromyia) napoensis Young and Rogers, new species. 8, female head; 9, male head; 10, Flagellomere II, female; 11, female wing; 12, male wing; 13, male genitalia; 14, spermathecae; 15, female cibarium; 16, male genital pump and filaments; 17, paramere, enlarged. Specimens from Limoncocha, Ecuador. Scale in mm.

Fig. 18-27. Lutzomyia (Trichophoromyia) wilkersoni Young and Rogers, new species. 18, female head; 19, female flagellomere ; 20, male head; 21, female wing; 22, male wing; 23, male genitalia; 24, spermatheca; 25, female cibarium; 26, paramere, enlarged; 27, male genital pump and filaments. All structures drawn at same scale as comparable structures in Fig. 8-17 except for Fig. 27. Specimens from near Zamora, Ecuador.

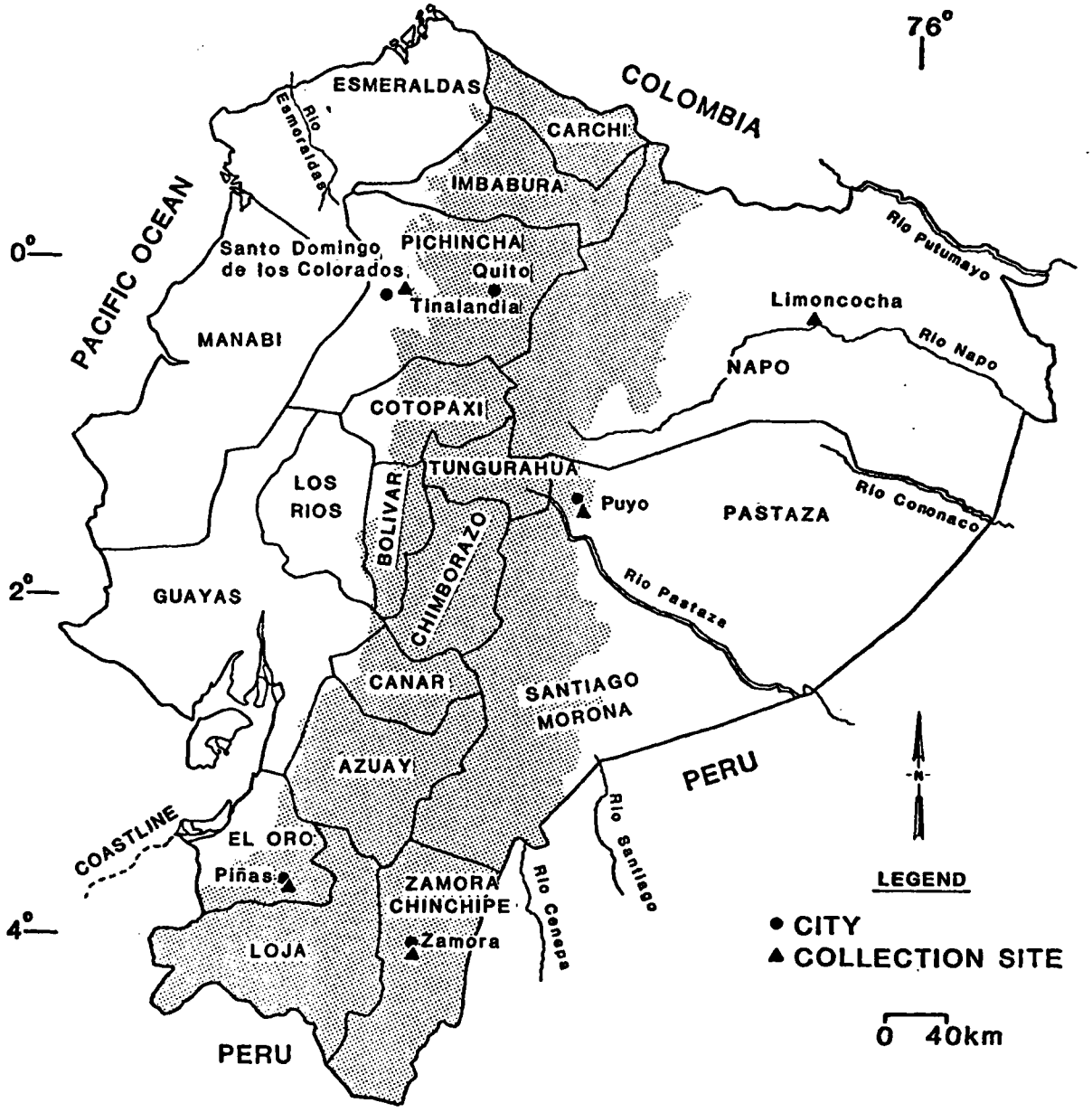
Fig. 28-41. Lutzomyia (Psychodopygus) amazonensis (Root). 28, male head; 29, female head; 30, female wing; 31, male wing; 32, male flagellomere II; 33, female flagellomere II; 34, female cibarium; 35, female cibarium, specimen from Limoncocha, Ecuador; 36, female cibarium; 37, male genitalia; 38, style of male, ventral view; 39, spermathecae, ducts and genital fork; 40, different views of lateral

arm of paramere; 41, genital pump and filaments. Specimens from Rio Urubu, Amazonas, Brazil except for Fig. 35. Scale in mm.

Fig. 42-54. Lutzomyia (Psychodopygus) claustrei Abonnenc, Leger and Fauran. 42, male head; 43, female head; 44, female wing; 45, male wing; 46, male flagellomere II; 47, female flagellomere II; 48, female cibarium, specimen from Maraba, Para, Brazil; 49, Spermathecae, ducts and genital fork; 50, female cibarium; 51, style of male, ventral view; 52, male genitalia; 53, different views of lateral arm of paramere; 54, genital pump and filaments. Specimens from Rio Urubu, Amazonas, Brazil except for Fig. 48. All structures drawn at same scale as comparable structures in Fig. 28-41.

Fig. 55-66. Lutzomyia (Psychodopygus) davisi (Root). 55, male head; 56, female head; 57, female wing; 58, male wing; 59, male flagellomere II; 60, female flagellomere II; 61, style of male, ventral view; 62, spermatheca, ducts and genital fork, specimen from Para State, Brazil; 63, male genitalia; 64, female cibarium; 65, genital pump and filaments; 66, different views of lateral arm of paramere. Specimens from Rio Urubu, Amazonas, Brazil except for Fig. 62. All structures drawn at same scale as comparable structures in Fig. 28-41.

Fig. 67-76. Lutzomyia tortura Young and Rogers, new species. 67, male head; 68, male flagellomere II; 69, female head; 70, female flagellomere II; 71, female cibarium; 72, male genitalia; 73, genital pump and filaments; 74, spermathecae, ducts and genital fork; 75, female wing; 76, male wing. Specimens from Limoncocha, Ecuador. Scale in mm.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Río Esmeraldas
CARCHI
IMBABURA
PACIFIC OCEAN
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Santo Domingo de los Colorados
PICHINCHA
Quito
Tinalandia
Río Putumayo
Limoncocha
Río Napo
NAPO
MANABI
COTOPAXI
TUNGURAHUA
Puyo
PASTAZA
Río Cononaco
LOS RIOS
BOLIVAR
CHIMBORAZO
2°
GUAYAS
Río Pastaza
CANAR
SANTIAGO MORONA
AZUAY
PERU
Río Santiago
COASTLINE
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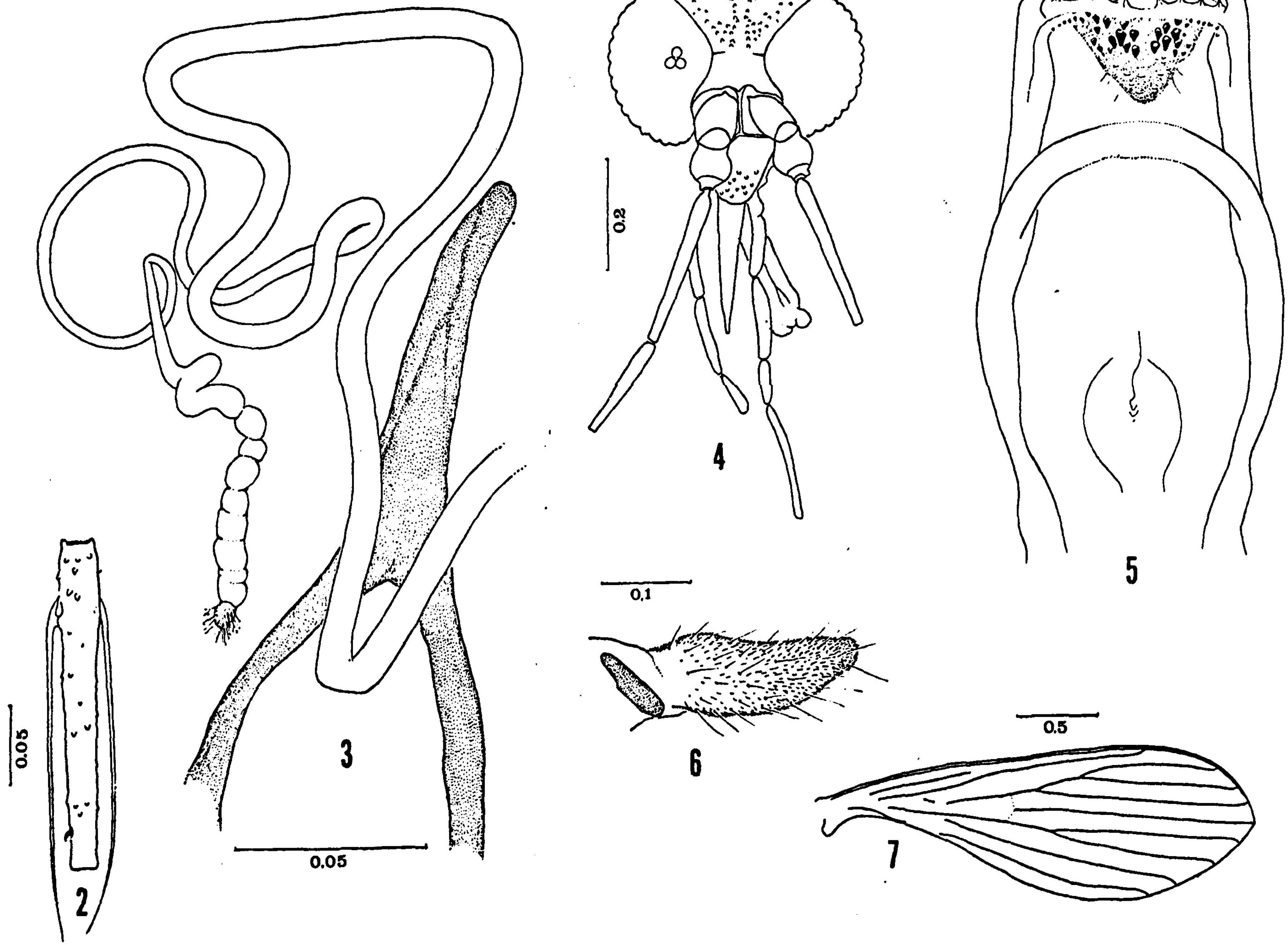
Fig. 1.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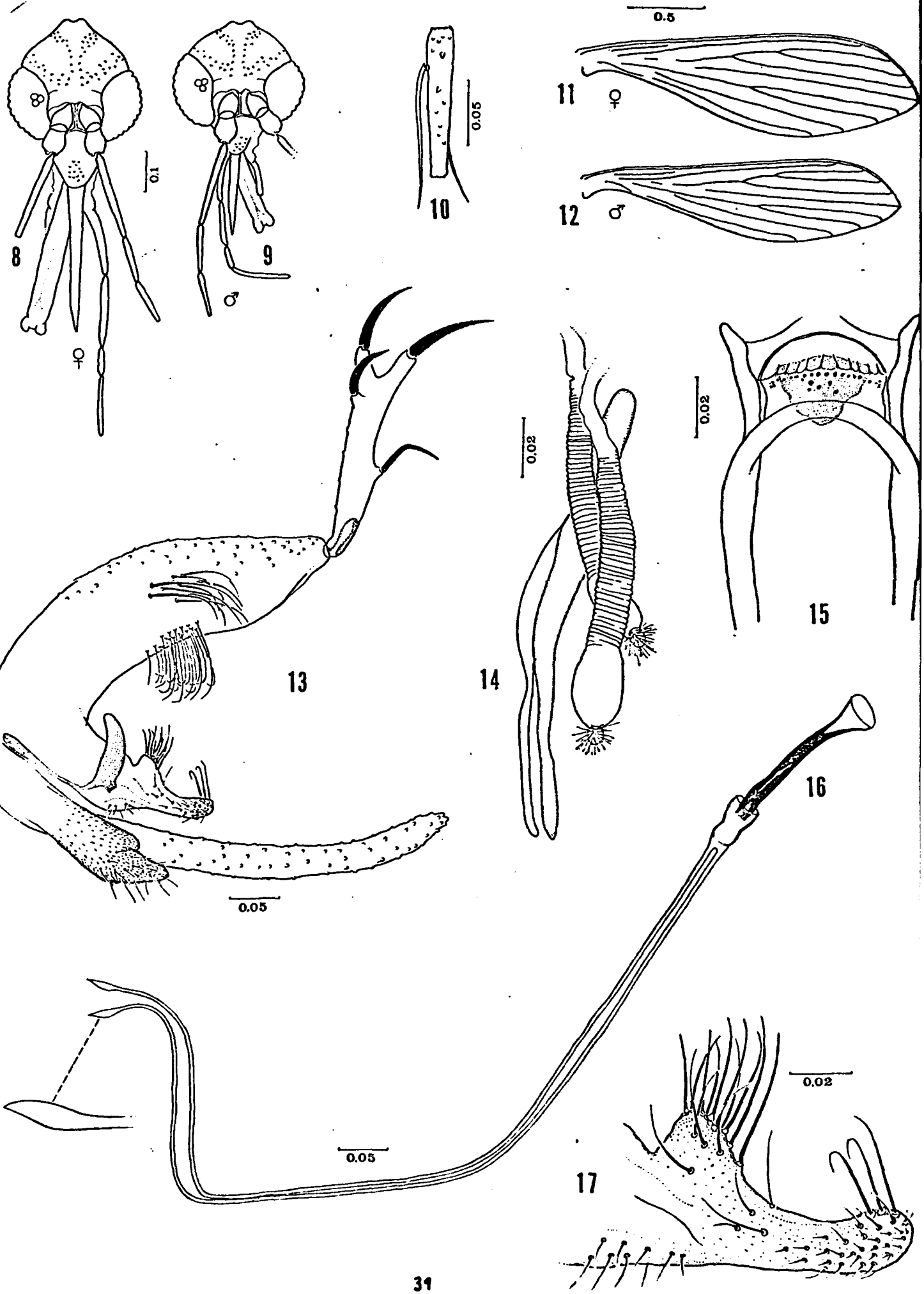
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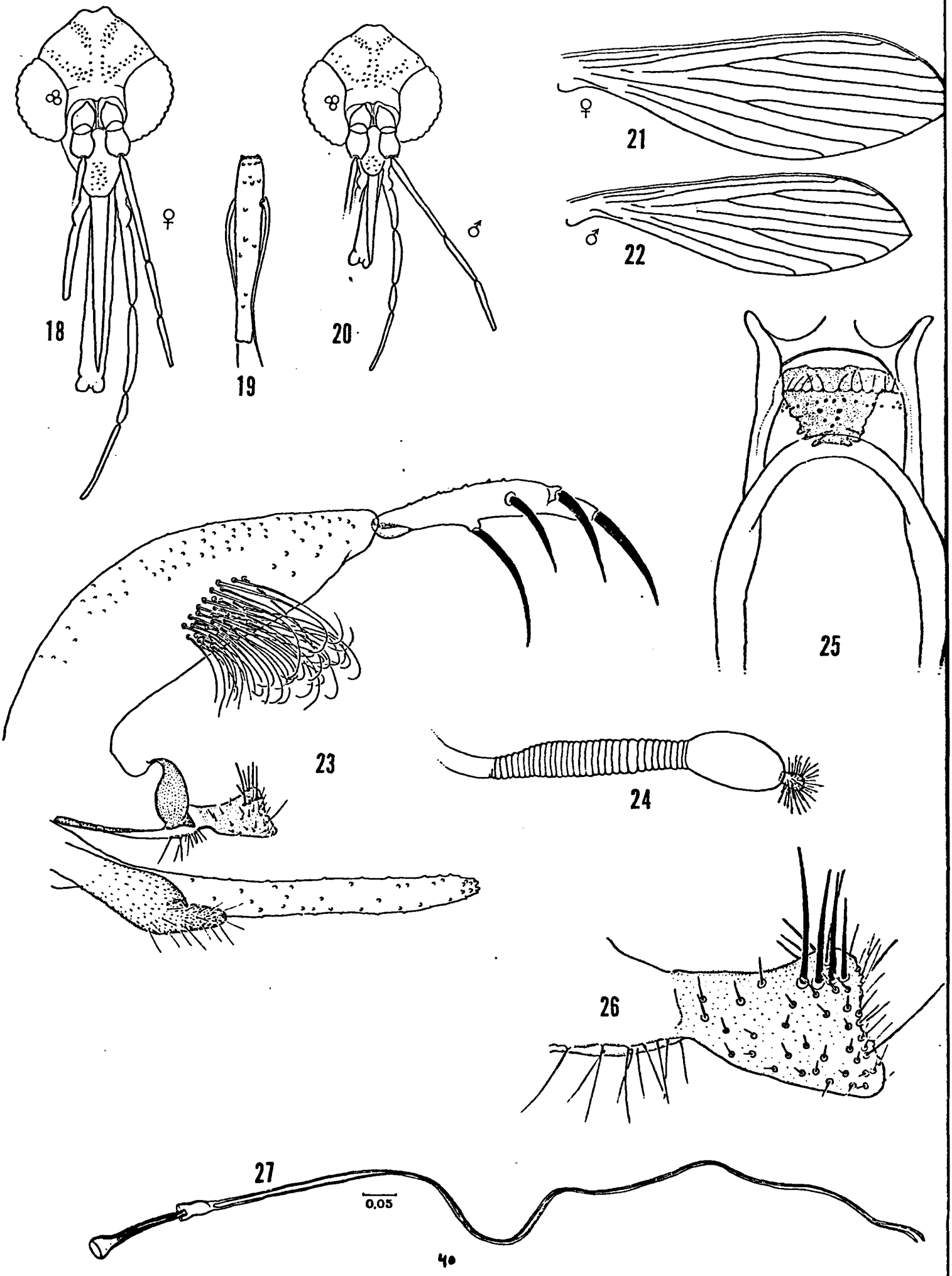
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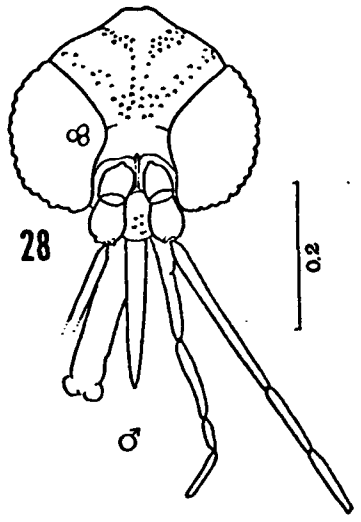
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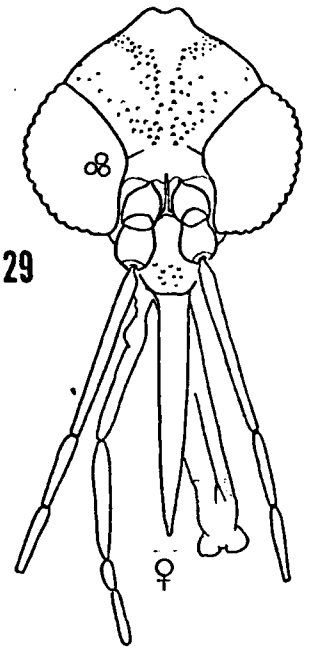
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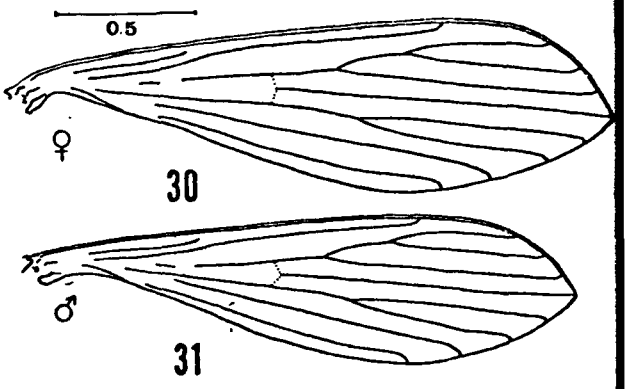
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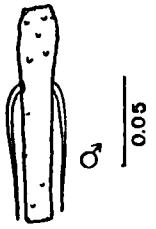
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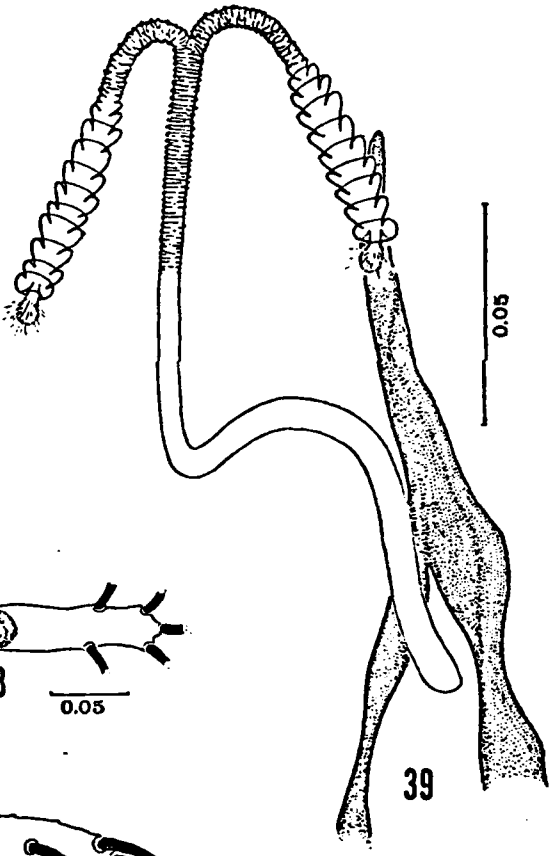
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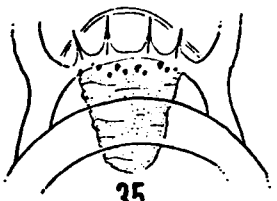
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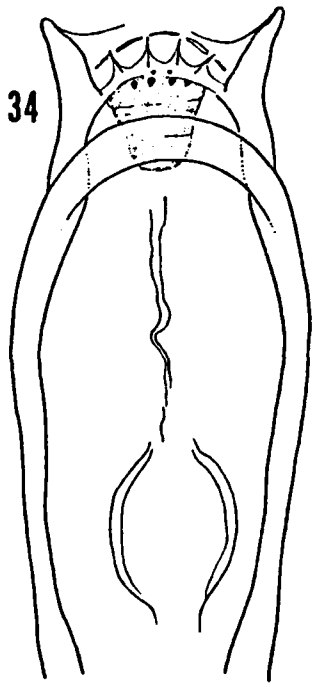
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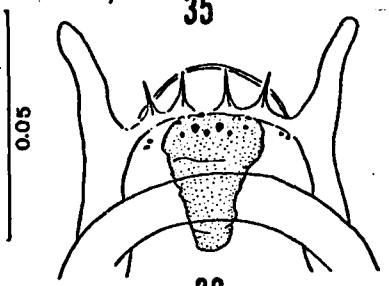
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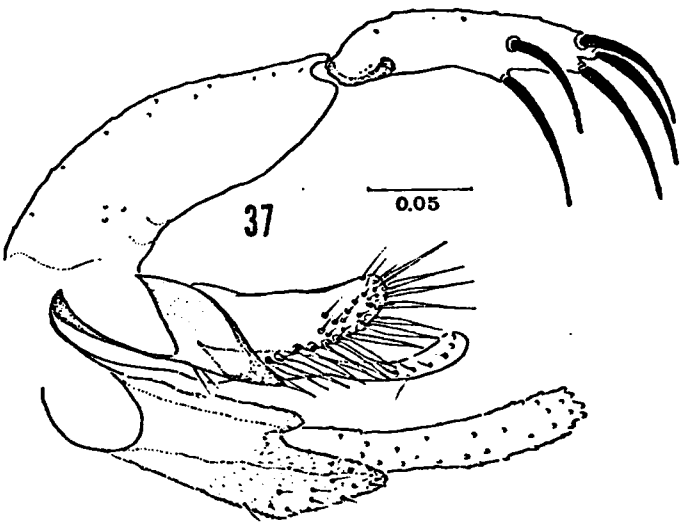
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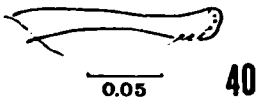
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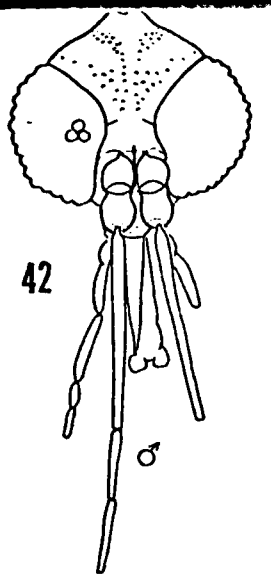

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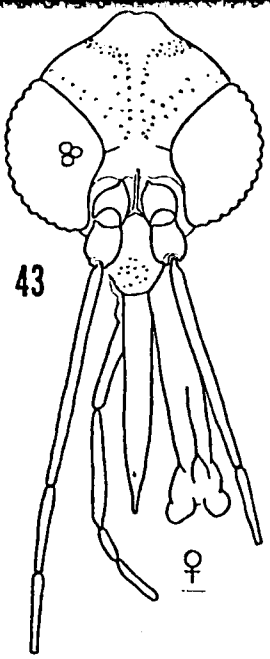

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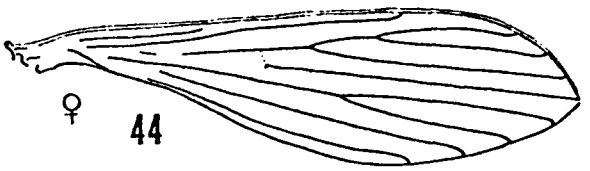

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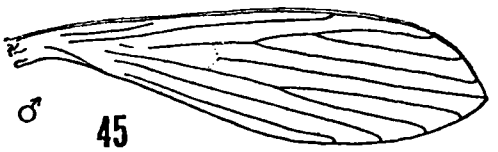

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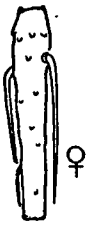

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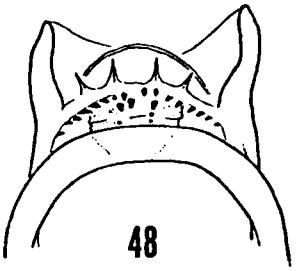

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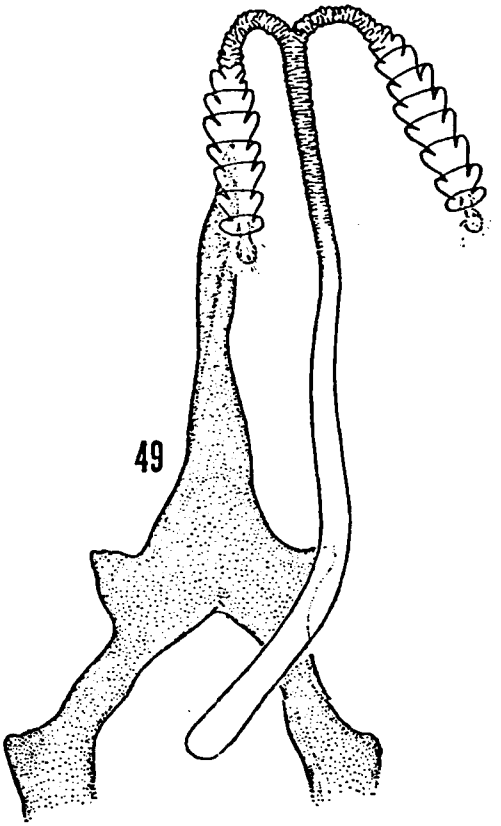

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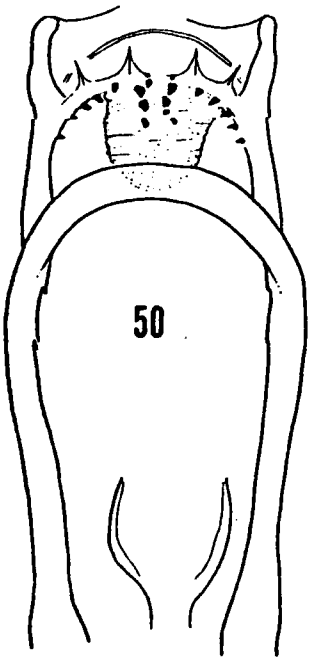

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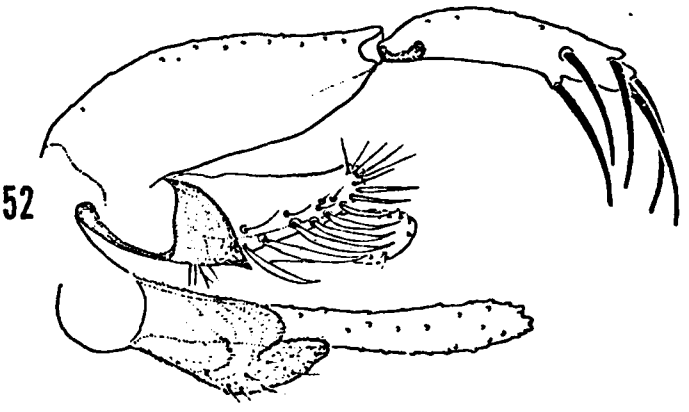

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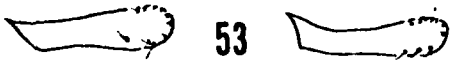

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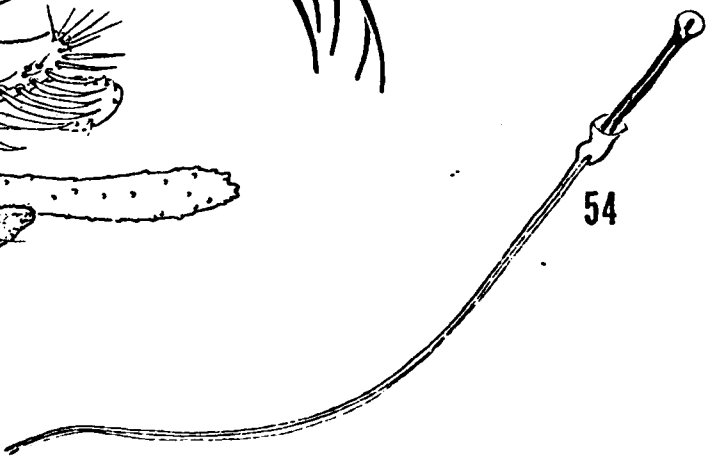

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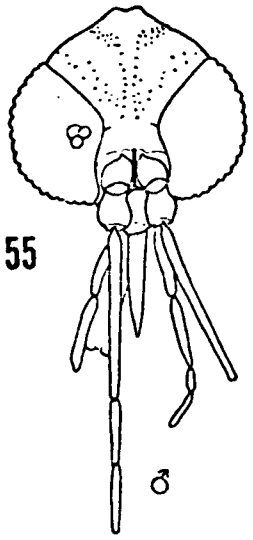

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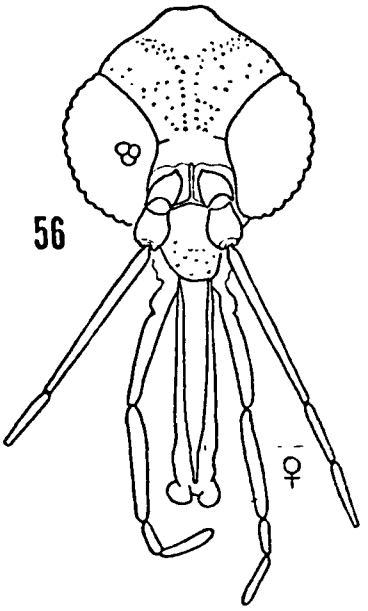

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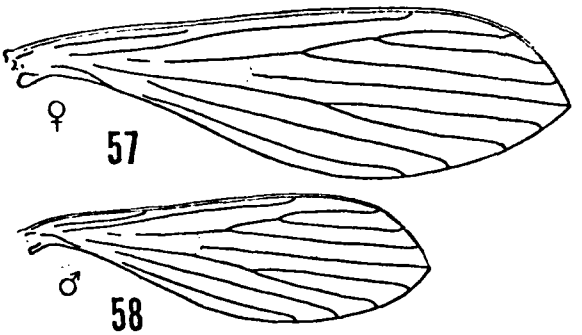

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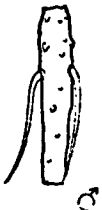

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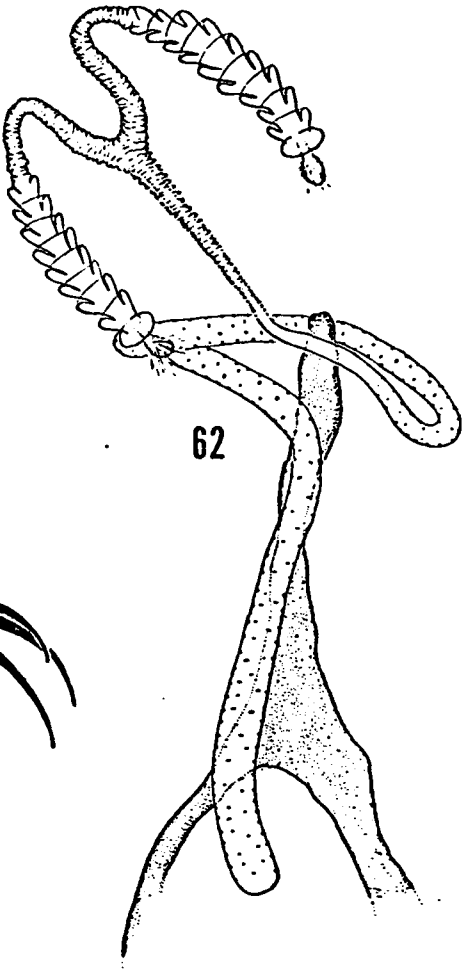

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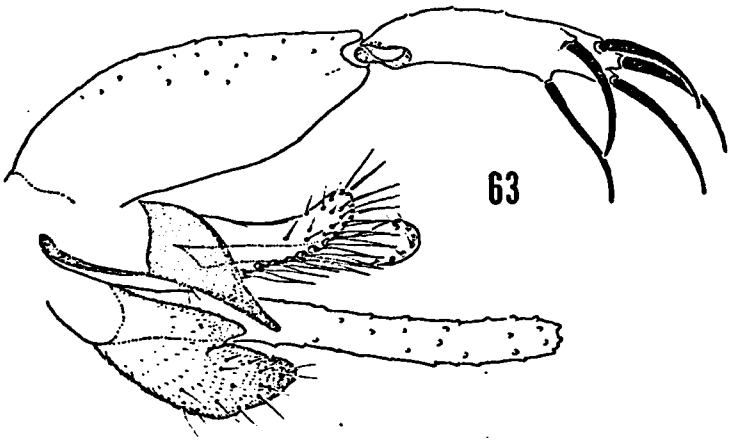

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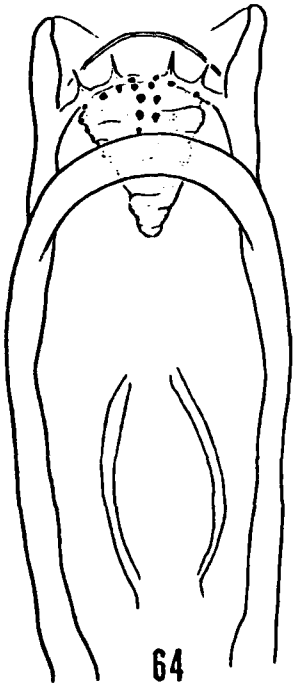

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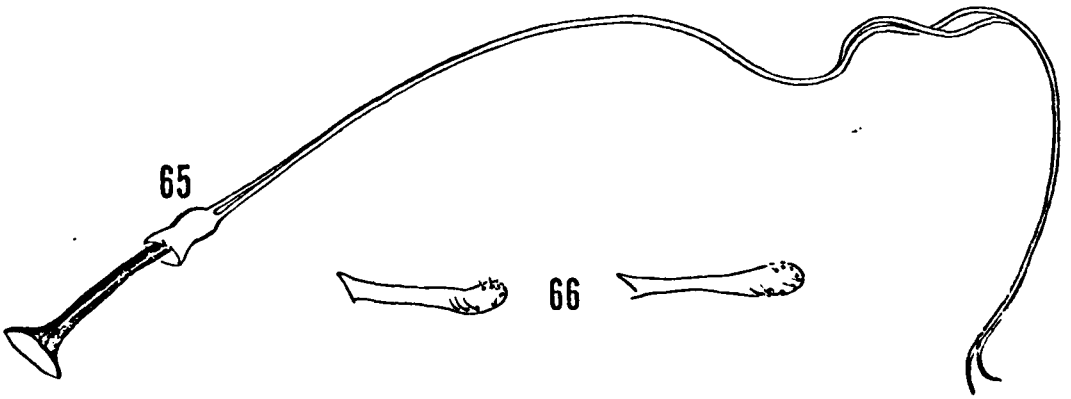

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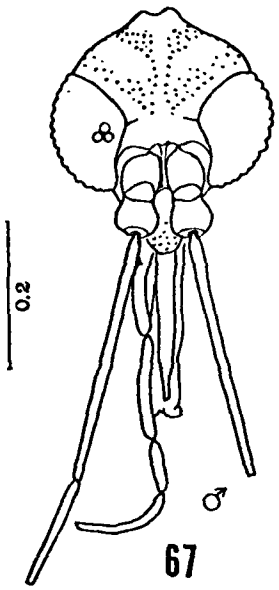

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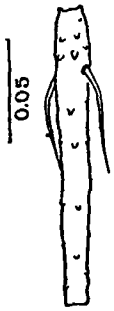

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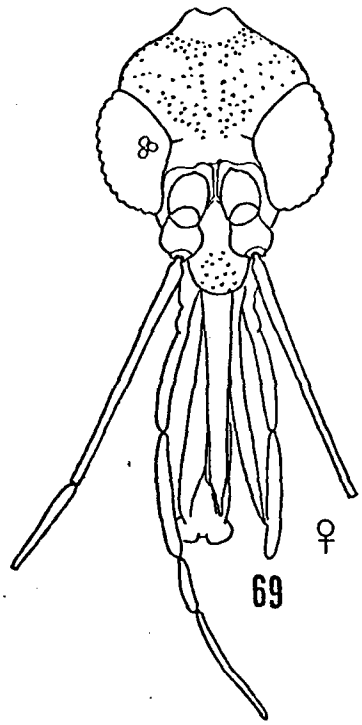

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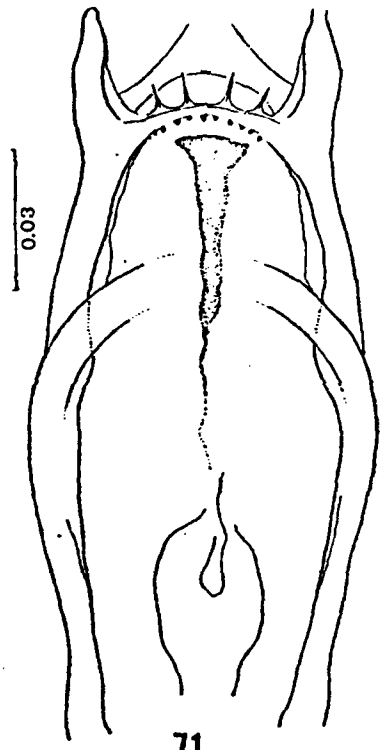

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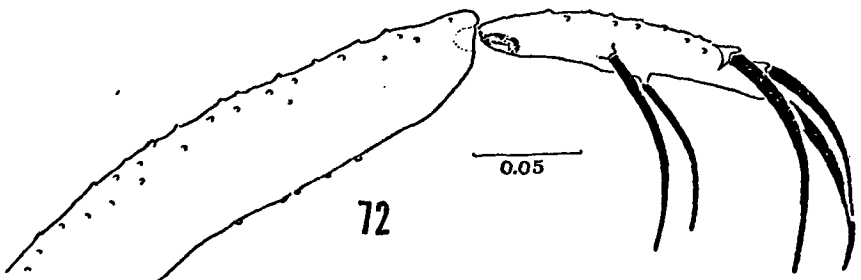

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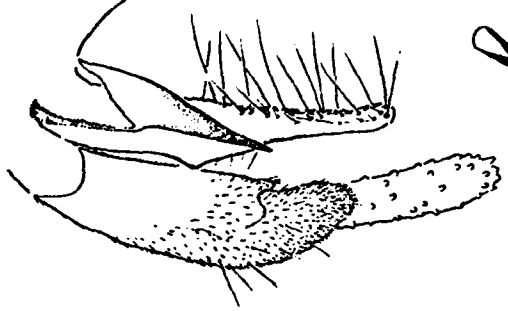

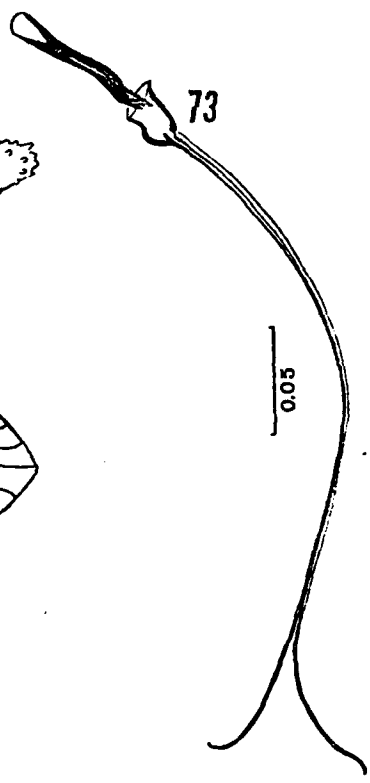

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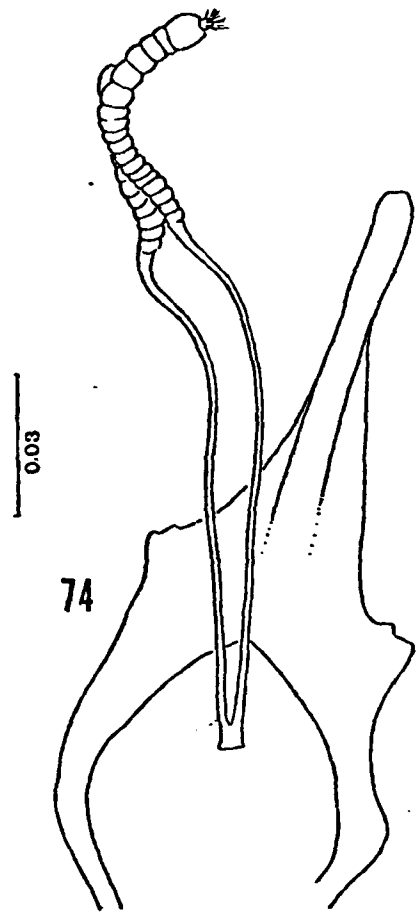

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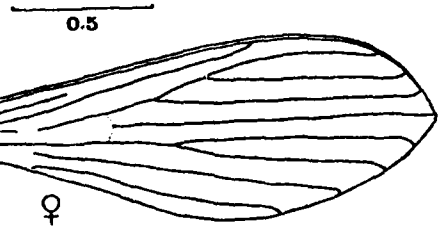

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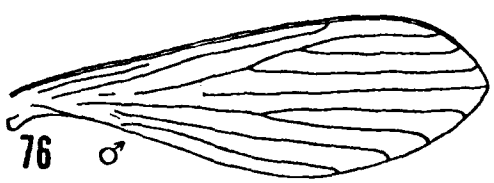

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APPENDIX II

New Records Of Phlebotomine Sand Flies From Peru With A Description Of Lutzomyia oligodonta n. sp. From The Rimac Valley (Diptera: Psychodidae)[1]

David G. Young,[2] José Enrique Pérez R.,[3] and Guillermo Romero[3]

Abstract. One species of Brumptomyia and 14 species of Lutzomyia sand flies from Tambopata Reserve, Madre de Dios, Peru, are reported in Peru for the first time. Twenty-three other Lutzomyia species were taken at the same site. An additional species, Lutzomyia oligodonta n. sp., described here, is based on males and females found in a small cave located in a leishmaniasis and bartonellosis endemic site in the Rimac Valley. The species has an unusual combination of morphological characters and can not be placed in any existing subgenus or species group of Lutzomyia.

Phlebotomine sand flies have been implicated as vectors of bartonellosis and leishmaniasis in the Peruvian highlands for more than 200 years (Palma 1908, 1909; Herrer and Christensen 1975) but it was not

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[1]Research supported by U.S. Army Medical Research and Development Command Contract DAMD 17-82-C-2223 and UNDP/World Bank/WHO Special Programme for Research and Training in Tropical Diseases.

[2]Department of Entomology and Nematology, University of Florida, Gainesville, Florida 32611, USA.

[3]Universidad Peruana Cayetano Heredia, Instituto de Medicina Tropical "Alexander von Humboldt," Apartado 5045, Lima-100, Peru.

until 1913, when Townsend described Lutzomyia verrucarum (as Phlebotomus verrucarum), that serious studies of these insects began. Shannon (1929) and Hertig (1942, 1943, and 1948) studied the Andean fauna, especially the 3 Lutzomyia species then known from the Rimac Valley near Lima where bartonellosis and leishmaniasis (uta) remain endemic. Alexander (1944), Blancas and Herrer (1959-1960) and Llanos (1973) described or reported additional sand flies from other areas of Peru. All of the known species in Peru (72), except for L. hirsuta (Mang.) (see Young 1979), were listed by Llanos (1981) who also gave references to earlier works on Peruvian sand flies.

In the present report, we add 16 previously unreported species to the fauna based on recent collections at the Tambopata Reserve, Madre de Dios Department and at Cocachacra, Lima Department, in the Rimac Valley where L. oligodonta n. sp., described below, was discovered. Terminology follows that of Young (1979). All measurements are in millimeters.

Lutzomyia oligodonta Young, Pérez and Romero n. sp.

(Figs. 1-12)

Holotype ♂. Wing length 2.43; width 0.72. A well-pigmented, dark sand fly, pleura nearly as dark as mesonotum. Head height from vertex to tip of clypeus, 0.44; width 0.39. Eyes large, separated by 0.14 or by distance equal to 6.9 facet diameters. Interocular suture nearly complete but middle third noticeably less developed than at either base (unlike that of the Brumptomyia or Warileya spp.. Flagellomere I, 0.29 long, II + III = 0.25; ascoids on II extending to 0.60 of segment, simple, on all flagellomeres except terminal one (XIV). Labrum 0.25

long. Lengths of palpomeres: 1, 0.04; 2, 0.12; 3, 0.18; 4, 0.13; 5, 0.27; palpal sensilla (7) grouped at middle third of palp. 3. Cibarium without teeth or pigment patch; cibarial arch complete as in ♀. Pharynx 0.21 long, no visible spicules or punctiform teeth present. Pleura with 6 upper and lower episternal setae. Lengths of wing vein sections: alpha, 0.45; beta, 0.25; delta. 0.13; gamma, 0.52. Lengths of femora, tibiae and basitarsi: foreleg, 0.81, 0.89, 0.49; midleg, 0.84, 1.09. 0.74; hindleg, 0.97, 1.42, 0.79; femora without spines. Genitalia. Style 0.22 long, with 5 spines; basal isolated spine at 0.27 of segment, thinner than others, a pair of large, spatulate median spines borne on a short process, but individually inserted, and 2 terminal spatulate spines; no subterminal seta. Coxite 0.39 long, with a median group of about 25 long simple setae. Paramere simple, 0.24 long. Aedeagus slender with acute tip, well sclerotized and 0.15 long. Genital pump 0.18 long, each filament thin, 0.87 long or about 4.8 x length of pump with simple, pointed tip. Lateral lobe 0.29 long.

Allotype ♀. Wing length 2.55; width 0.81. Coloration as in ♂. Head height 0.48; width 0.42. Eyes separated by 0.17 or by distance equal to 8.3 facet diameters. Interocular suture as in ♂. Flagellomere I 0.26 long, II + III = 0.23; ascoids on II longer than in ♂, reaching to 0.87 of segment; simple, without proximal spurs, on all flagellomeres except terminal one (XIV). Labrum 0.35 long and with 8 distal sensilla. Lengths of palpomeres: 1, 0.04; 2, 0.16; 3, 0.19; 4, 0.15; 5, 0.35; palal sensilla (10) grouped at middle third of palp. 3. Cibarium unusual for the genus, with poorly-defined, nearly invisible teeth, a group of about 8 small inconspicuous dot-like vertical teeth anterior to each pair of the small curved "horizontal teeth" (actually may be

remnants of horizontal teeth); pigment patch absent; cibarial arch complete; 9 basal sensilla prominent within cibarium as shown. Pharynx 0.22 long, with numerous spicules, punctiform teeth and ridges at posterior end. Pleura with 9 upper and 6 lower episternal setae. Lengths of wing vein sections: alpha, 0.40; beta, 0.33; delta, 0.05; gamma, 0.47. Lengths of femora, tibiae and basitarsi: foreleg, 0.86, 0.81, 0.48; midleg, 0.89, 1.07, 0.58; hindleg, 1.04, 1.60, 0.76; femora without spines. Spermathecae as shown, each with 12 annulations, the terminal one slightly larger than others; sperm ducts thin and long, each greater than 8 x length of spermatheca, common duct short as shown. Stem of genital fork enlarged at apex, most noticeable when viewed laterally.

Type data. Holotype ♂. Peru: Department of Lima, Cocachacra, (Elev. 1460 m), in small cave near southern edge of town, 24,IV.1983, G. Romero and D. Young. Allotype ♀, same data, but 5, VI.1983, E. Pérez. Paratypes (all from type locality). 2♂, 1♀ same data as holotype. 9o, 5♀, same data but 1.V.1983, E. Pérez and G. Romero. 10♂, 3♀, 7.V.1983, E. Pérez. 2♀, 15.V.1983, E. Pérez. 2♂, 6♀, 22.V.1983, E. Perez. 1♀, 30.V.1983, E. Pérez. 1♀, 5.VI.1983, E. Pérez. Holotype, allotype and some paratypes in collection at the Museo de Historia Natural, Lima; other paratypes to be deposited in collections at the Florida State Collection of Arthropods, Gainesville, The British Museum (Nat. Hist.), and the U.S. National Museum (Nat. Hist.).

Discussion. The specific name, oligodonta, refers to the few cibarial teeth of the female, a distinctive feature among Lutzomyia spp. females, but somewhat similar to the condition in some Phlebotomus and Warileya females. The teeth are very lightly pigmented, often difficult or

impossible to see with phase contrast microscopy, and resemble the remnants of teeth seen in many Lutzomyia spp. males. One paratype has broader teeth than those of the allotype (Fig. 14) but in all individuals they are inconspicuous, a character state that readily distinguishes the female of L. oligodonta from other known Lutzomyia or Brumptomyia females.

The spermathecae and thin ducts of the female and the arrangement of the spines on the male style resemble those of the Brumptomyia species but the antennal ascoids are simple, the interocular suture is incomplete, the female cibarial armature is different, the lateral lobe of the male genitalia is relatively short and there are no long, persistent setae beyond the coxite tuft. The distribution, size and number of labrocibarial adoral sensilla of L. oligodonta are characteristic of the Lutzomyia, not the Brumptomyia species (Lewis 1975).

The median spines of the style of L. oligodonta are inserted close together on a short arm -- an arrangement similar to that of the males of L. correalimai Martins, Coutinho and Luz 1970, L. rupicola Martins, Godoy and and Silva 1962 (both Brazilian species), and males in the subgenus Viannamyia Mangabeira 1941. These males, however, have only 4 spines on the style and have differently-shaped parameres as well as other diagnostic features.

The range of variation of some structures of L. oligodonta is as follows. Length of labrum varies from 0.31 to 0.39 for females (n=13) and from 0.22 to 0.27 for males (n=10). Length of palpomere 5 varies from 0.23 to 0.39 for females (n=9) and from 0.26 to 0.35 for males (n=9). The lower values are the result of shrinkage during slide

mounting. Length of flagellomere I is 0.20-0.28 for females (n=13) and 0.22-0.27 for males (n=10). The genital filaments of 10 males range from 3.94 to 5.18 times the length of the pump. Wing length for females (n=10) ranges from 2.49 to 2.72; that for males (n=7), 2.11-2.40.

The relationship of L. oligodonta with other Lutzomyia species is obscure and it is not possible at present to place it in any existing subgenus or species group.

So far, specimens have been found only in a small cave (approx. 2 m high, 1.5 m wide, 4 m deep) at the southern edge of Cocachacra village, about 50 m from a house were two of the occupants contracted cutaneous leishmaniasis in 1982. Lutzomyia noguchii (Shannon 1929),a small-eyed species (Fig. 18) with different spermathecae, cibarial armature and relatively slender wings (Fig. 15. — 19), was also collected in the same cave. Lutzomyia verrucarum, an anthropophilic species, easily recognized by the sac-like spermathecae, also occurs at Cocachacra. Lutzomyia peruensis (Shannon 1929) (Fig. 20-24) is considered to be "very rare below about 1750 m" (Hertig 1942, p. 35) and has not yet been collected at Cocachacra. The males of these species are easily distinguished from that of L. oligodonta by their different coxite setal tufts, parameres and arrangement of the spines on the styles.

The role, if any, of L. oligodonta as a vector of cutaneous leishmaniasis and/or bartonellosis remains to be determined. The first female collected (24.IV.1983) fed to repletion on the arm of a human volunteer when the screen of a 120 ml sand fly holding cage (Endris et al. 1982) was pressed against the skin. Other females fed readily on white mice in the laboratory and attempts are now being made to establish a laboratory colony of this sand fly and to study its habits and distribution in the field.

Phlebotomine sand flies

from Tambopata Reserve, Madre de Dios, Peru

Sand flies from this forested site, located about 30 km SW of Puerto Maldonado (12°50'S; 069°,20°W), 290 m elev., were collected by Dr. R.C. Wilkerson, University of Florida, in flight traps (February, October and November, 1982) and by Dr. Terry Erwin, National Museum of Natural History, in canopy fogging collections (1982). In addition, two of us (D.G.Y. and E.P.R.) collected nearly 3,000 specimens at Tambopata from 18-22 April, 1983 using light and flight traps and by directly aspirating flies from tree trunks, an animal burrow and from a lantern-illuminated bedsheet. The species collected are listed below by subgenus or species group following the classification of Lewis et al. (1977). Species previously unknown in Peru are marked with an asterisk.

Genus Brumptomyia França and Parrot 1921

*1. B. galindoi (Fairchild and Hertig 1947) (= B. mesai Sherlock 1962). 1♂, flight trap, 18-21.IV.1983. This male agrees with the description of B. mesai from Colombia considered a junior synonym of B. galindoi by Fraiha et al. (1970) and Young (1979).

Genus Lutzomyia França 1924

Subgenus Migonei Theodor 1965

2. L. migonei (França 1920). 1♀, canopy fogging collection, 25.X.1982.

Subgenus Pressatia Mangabeira 1942

3. L. (Pressatia) sp. 1♀, flight trap, 1-9.XI.1982. Specific identification must await the discovery of the conspecific male.

Subgenus Evandromyia Mangabeira 1941

*4. L. (Evandromyia) sp. 1♀, flight trap, 1-9.XI.1982. The spermathecae resemble those of L. infraspinosa (Mangabeira 1941) but final identification must be based on male characters.

Subgenus Viannamyia Mangabeira 1941

5. L. furcata (Mangabeira 1941) or L. caprina Osorno, Morales and Osorno 1972. 1♀, canopy fogging collection, 20.X.1982.

species group shannoni Theodor 1965

6. L. abonnenci (Floch and Chassignet 1947). 9♂, tree trunks, 19-22.IV.1983.

7. L. campbelli (Damasceno, Causey and Arouck 1945). 1♀, light trap, 19-22.IV.1983. The female agrees closely with the description given by Llanos et al. (1975).

8. L. dendrophyla (Mangabeira 1942). 16♂, tree trunks, 19-22.IV.1983.

Females of this species, L. shannoni and L. abonnenci were not separated by us. A total of 10 females of one or more of these species was taken in April, 1983.

*9. L. lutziana (Costa Lima 1932). 2♂, flight trap, 18-21.IV.1983.

10. L. scaffi (Damasceno and Arouck 1956). 3♂, 1♀, tree trunks, 19-21.IV.1983.

11. L. shannoni (Dyar 1929). 22♂, tree trunks, 19-21.IV.1983.

Species group aragaoi Theodor 1965

12. L. aragaoi (Costa Lima 1932). 1♂, flight trap, 15-21.IV.1982; 1♂ animal burrow, 22.IV.1983.

13. L. brasiliensis (Costa Lima 1932). 1♂, flight trap, 15-21.II.1982.

*14. L. runoides (Fairchild and Hertig 1953). 2♂, flight trap, 1-9.XI.1982.

Species group dreisbachi Young and Fairchild 1974

*15. L. dreisbachi (Causey and Damasceno 1945). 1♂, 7♀, flight trap, 15-21.II.1982. 1♂, flight trap, 1-9.XI.1982. 24♂, flight trap, 18-21.IV.1983.

Subgenus Trichophoromyia Barretto 1962

16. L. auraensis (Mangbeira 1942). 9 ♂, flight trap, 1-9.XI.1982.

17. L. omagua Martins, Llanos and Silva 1976. 4♂, flight trap, 15-21.II.1982.

*18. L. ubiquitalis (Mangbeira 1942). 2♂, flight trap, 15-21.II.1982. 1♂, flight trap, 18-21.IV.1983.

*19. L. (Trichophoromyia) sp. #1. 1♂, flight trap, 15-21.II.1982. 6♂, flight trap, 18-21.IV.1983. This species is similar to L. (Trichophoromyia) sp. #2 but the parameres lack a dorsal hump. Full description of both species will be given elsewhere after the females can be correctly associated with the males. We collected 32 females in this subgenus at Tambopata.

*20. L (Trichophoromyia) sp. #2. 2♂, flight trap, 15-21.II.1982. 1♂, flight trap, 1-9.XI.1982. 5♂, flight 18-21.IV.1983. The male resembles L. howardi Young 1979 described from a Colombian specimen, but the Peruvian males have only 8-12, rather thick, coxite setae and the parameres are slightly different.

Subgenus Nyssomyia Barretto 1962

21. L. antunesi (Coutinhoi 1939). 1♀, illuminated sheet, 20-21.IV.1983.

22. L. flaviscutellata (Mangabeira 1942). 1♀, flight trap, 15-21.II.1982. 1♀, flight trap, 18-21.IV.1983.

*23 L. richardwardi Ready and Fraiha 1981. 1♂, light trap; 2♂, flight trap, 18-21.IV.1983. This is a provisional identification. Confirmation of the presence of this species, described from Brazilian material, at Tambopata must await the discovery of the female.

*24. L. shawi Fraiha, Ward and Ready 1981. 1♂, 1♀, flight trap, 15-21.II.1982. 2♀, tree trunks; 79♂, 204♀, light trap; 19♂, flight trap; 38♂, 181♀, illuminated sheet, 18-21.IV.1983.

This species, previously known only from Pará, Brazil and anthropophilic (Fraiha et al. 1981), was the most common sand fly encountered in April, 1983. Seven females captured in light traps and from an illuminated sheet took bloodmeals from a human volunteer.

*25. L. whitmani (Antunes and Coutinho 1939). 1♀, canopy fogging collection, 20.X.1982.

26. L. yuilli Young and Porter 1972. 1♀, canopy fogging collection, 8.XI.1982.

Subgenus Psychodopygus Mangabeira 1941

27. L. (Psychodopygus) sp., near L. chagasi (Costa Lima 1941). 1♀, flight trap, 1-9.XI.1982. 4♀, light traps; 23♀, illuminated sheet, 19-22.IV.1983. These females may or may not be conspecific with L. chagasi; males are needed to confirm its presence or that of another species at Tambopata Reserve.

28. L. carrerai carrerai (Barretto 1946). 1♂, 4♀ (2 dark ♀) 15-21.II.1982. 2♂, 1♀, canopy fogging collection, 20 & 25.X.1982. 1♀, flight trap, 1-9.XI.1982. 104♂, 36♀, light traps; 9♂, 5♀, flight trap; 36♂, 56♀ (1♂, 9♀ dark forms, illuminated sheet,

18-22.IV.1983. The majority of specimens of this species are very pale, others have very dark mesonota but lack structural distinguishing features.

*29. L. claustrei Abonnenc, Leger and Fauran 1979. 1♂, flight trap; 1♂, illuminated sheet, 18-21.IV.1983. This is an Amazonian species reported earlier from French Guiana and Brazil (Abonnenc et al. 1980).

30. L. davisi (Root 1934). 2♂, 3♀, flight trap, 15-21.II.1982. 1♂, flight trap, 1-9.XI.1982. 42♂, 86♀, light traps; 1♂, 7♀, flight trap, 24♂, 78♀, illuminated sheet, 19-22.IV.1983.

31. L. guyanensis (Floch and Abonnenc 1941). 1♀, light trap; 4♀ illuminated sheet, 19-22.IV.1983. We are unable to separate the females of this species, L. geniculata (Mangabeira 1941), L. corossoniensis LePont and Pajot 1978 and L. dorlinsis LePont and Desjeux 1982, the latter two species being described from males only and apparently closely related. The specimens from Tambopata may represent L. geniculata which has been reported from Peru (Martins et al. 1978).

32. L. hirsuta hirsuta (Mangabeira 1942). 7♀, flight trap, 15-21.II.1982. 7♂, 13♀, light traps; 6♂, 12♀, illuminated sheet, 18-21,IV.1983.

*33. L. lainsoni (Fraiha and Ward 1974). 11♂, 31♀, light traps; 10♂, 19♀, illuminated sheet, 18-21.IV.1983. An anthropophilic species, L. lainsoni was known previously only in Brazil. Five females took full bloodmeals from a human volunteer at Tambopata Reserve.

34. L. paraensis (Costa Lima 1941). 1♀, flight trap, 15-21.II.1982. 1♂, 1♀, light traps; 1♀, illuminated sheet, 18-21.IV.1983.

Species group cayennensis Theodor 1965

35. L. micropyga (Mangabeira 1942). 1♂, 1♀, tree trunk, 22.IV.1983. 1♂, canopy fogging collection, 25.X.1982.

Species group oswaldoi Theodor 1965

*36. L. rorotaensis (Floch and Abonnenc 1944). 3♂, 3♀, canopy fogging collection, 25 & 31.X.1982.

Ungrouped species

*37. Lutzomyia n. sp., near L. microps (Mangabeira 1942). 1♂, flight trap, 1-9.XI.1982. This specimen is conspecific with an unnamed species from Brazil that is being described by Young and Arias (in preparation)

38. Lutzomyia nordestina (Mangabeira 1942). 2♂, canopy fogging collection. 25.X.1982.

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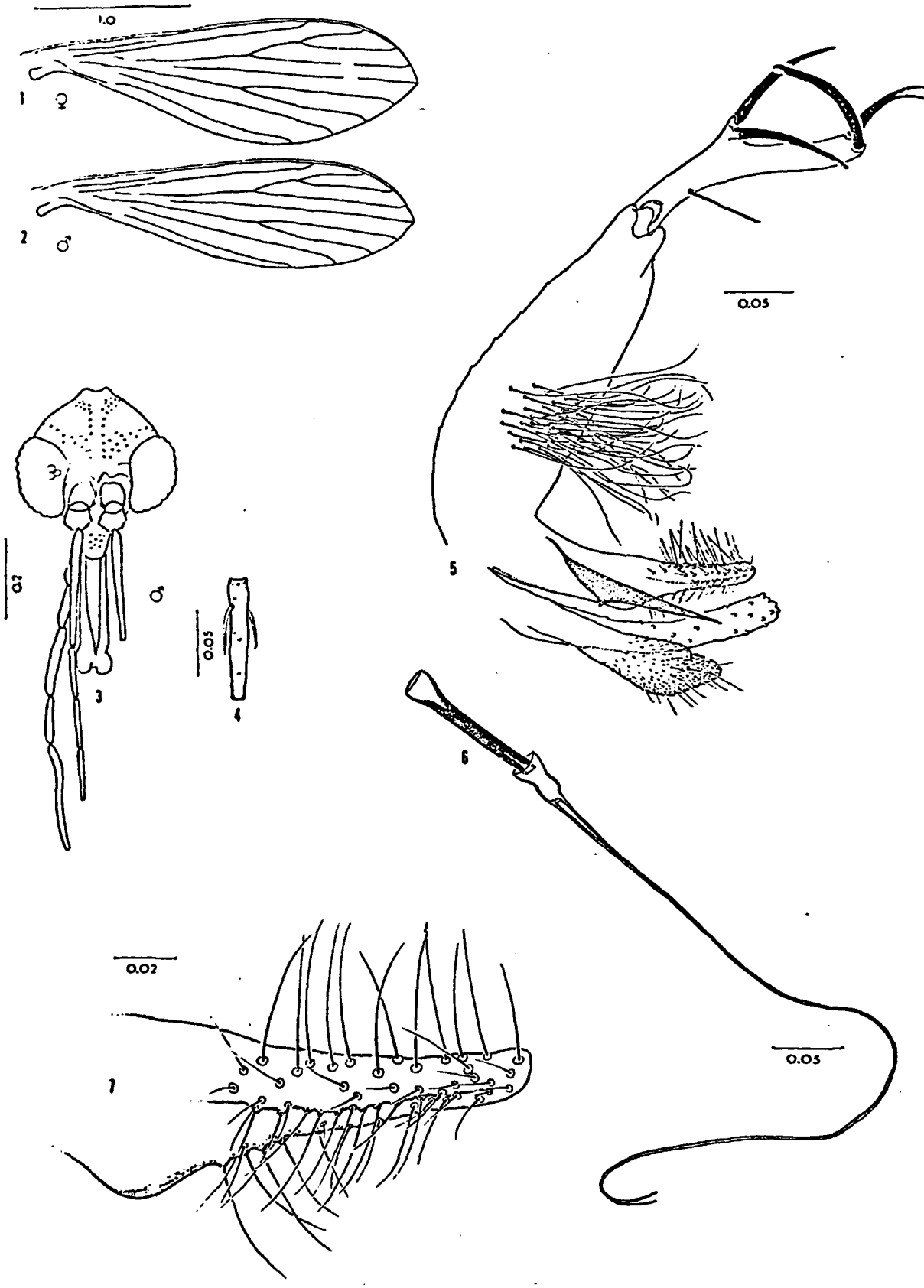
FIGURE LEGENDS

Figs. 1-7. Lutzomyia oligodonta Young, Pérez and Romero, new species. 1, ♀ wing; 2, ♂ wing; 3, ♂ head; 4, ♂ flagellomere II; 5, ♂ genitalia, lateral view; 6, genital pump and filaments; 7, paramere. Scale in millimeters.

Figs. 8-14. Lutzomyia oligodonta Young, Pérez and Romero, new species (female structures). 8, head, same scale as Fig. 3; 9, flagellomere II; 10, posterior end of pharynx; 11, tip of genital fork stem, lateral view; 12, spermathecae (drawn from specimen in liquid phenol); 13, cibarium; 14, cibarial armature (paratype). Scale in millimeters.

Figs. 15-24. Lutzomyia noguchii (Shannon 1929) (Figs. 15-19) and Lutzomyia peruensis (Shannon 1929) (Figs. 20-24). 15, ♀ wing; 16, ♂ wing; 17, ♀ cibarium; 18, ♀ head; 19, spermathecae; 20, ♀ head; 21, spermathecae; 22, ♀ cibarium; 23, ♀ wing; 24, ♂ wing. All figures drawn at same scale as comparable structures in Figs. 1-14.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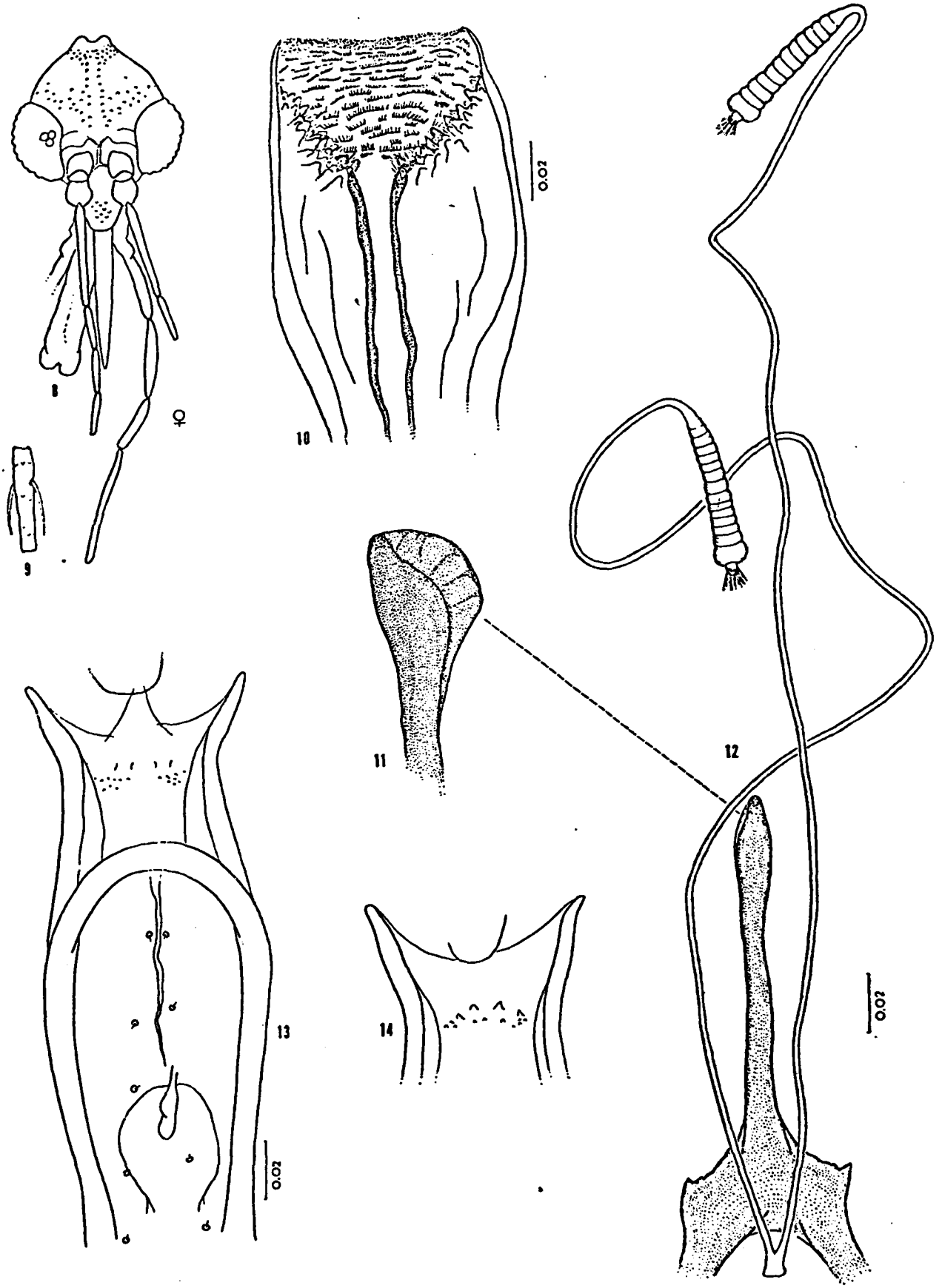
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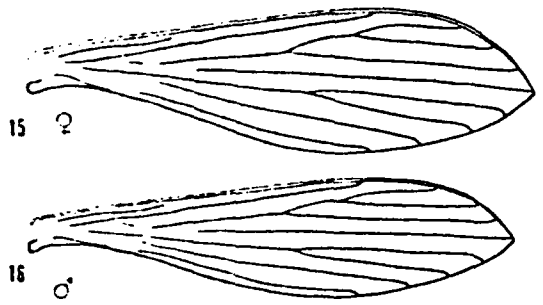
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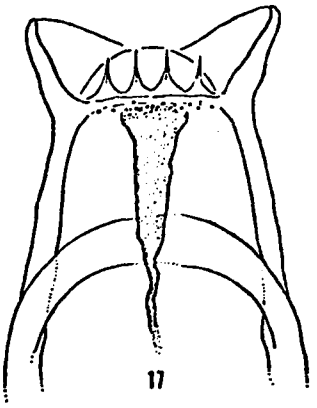
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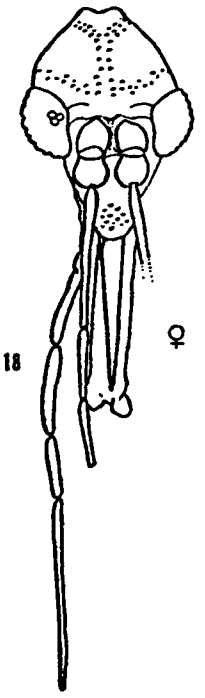
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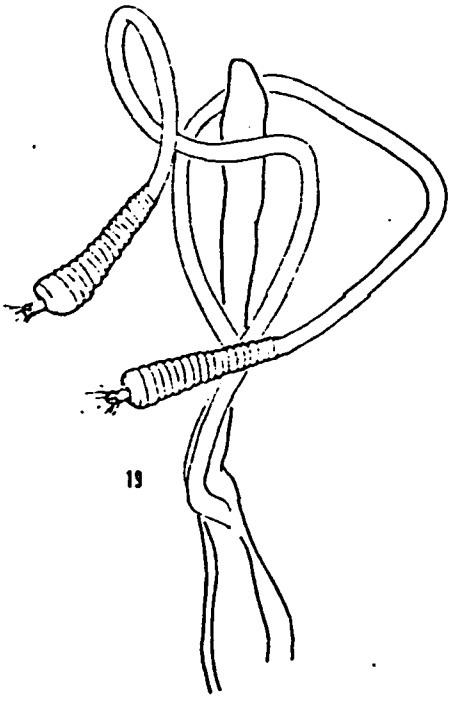
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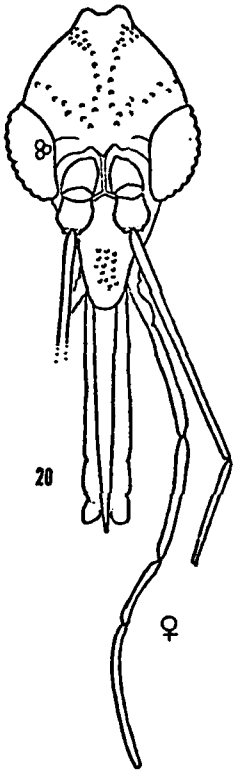
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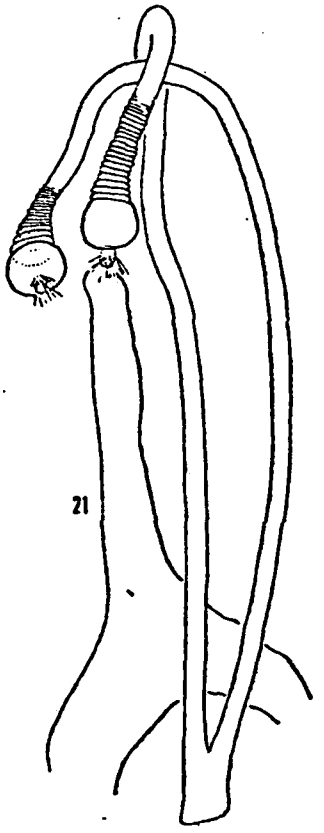
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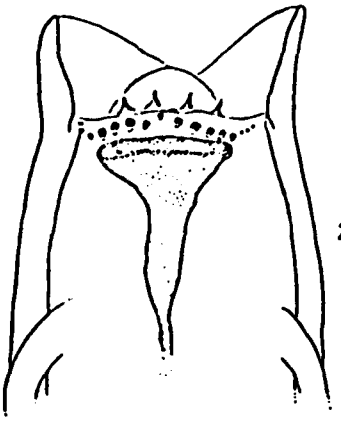
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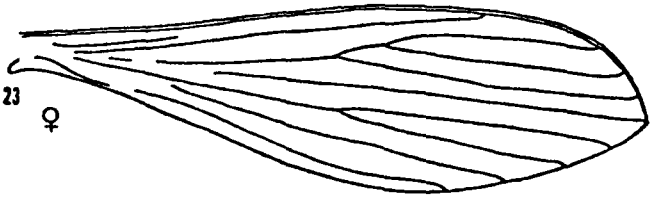
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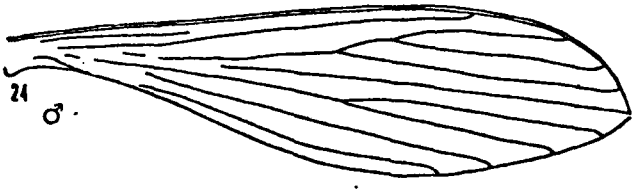
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APPENDIX III

A New Species of Phlebotomine Sand Fly, Lutzomyia zeledoni, n.sp., from Central America (Diptera:Psychodidae)[1]

D.G. Young[2] and J. Murillo[3]

Abstract. Lutzomyia zeledoni n.sp., belonging in species group vespertilionis, is described and illustrated from the male collected at Brasilito, Guanacaste Prov., Costa Rica. The species also occurs in the Lancetilla Valley, Tela, Honduras.

As a result of a 10 year extensive survey of phlebotomine sand flies in Costa Rica, 57 species have been recorded, over 20 of which represent new country records (Murillo & Zeledon, in preparation). A new species in the vespertilionis group of Lutzomyia was found near Brasilito, Guanacaste Province and its description, based on the male, is given below. All measurements are given in millimetres.

Lutzomyia zeledoni Young & Murillo, new species (Figs. 1-7)

Holotype ♂. Wing length 1.73; width 0.40. A rather pale sand fly, mesonotum faintly infuscated, slightly darker than pleura. Head height 0.33;

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width 0.25. Eyes small, separated by 0.13 or by distance equal to 7 facet diameters. Flagellomere I, 0.27 long; II + III = 0.23; ascoids simple, those on II reaching to 0.84 of segment, on all flags. except terminal one (XIV). Labrum 0.16 long. Lengths of palpomeres: 1, 0.03; 2, 0.10; 3, 0.13; 4, 0.08; 5, 0.21; palpal sensilla (7) loosely grouped near middle of palp. 3. Cibarium without teeth but with a well defined, subtriangular pigment patch & complete cibarial arch. Pharynx 0.13 long. Pleura with 11-12 upper & 2-4 lower episternal setae. Length of wing length sections: alpha, 0.27; beta, 0.19; delta, 0.07; gamma, 0.27. Lengths of femora, tibiae & basitarsi: foreleg, 0.61, 0.69, 0.41; midleg, 0.61, 0.82, 0.46; hindleg, 0.70, 0.99, 0.54; femora without spines. Genitalia. Style 0.13 long, with 4 strong spines inserted at different levels & a small subterminal bristle. Coxite 0.26 long with a basal tuft of 14-18 simple upturned setae. Aedegus 0.08 long, well pigmented throughout, shaped as shown. Paramere 0.17 long, clubbed with a ventral acute projection. Genital pump 0.14 long, filaments 0.32 long or almost 2.3 x length of pump with rounded, slightly swollen tips. Lateral lobe 0.29 long, & 0.05 wide, inflated with numerous setae.

Type data. Holotype ♂. Costa Rica: Guanacaste Prov., Brasitito (<15 m elev.), flight trap, 25.V.1983, D. Young, J. Murillo & H. Gutiérrez. Paratype ♂. Honduras, Atlantica, Tela, on tree buttress, 11.IX.1955, W. Hils. Holotype to be deposited in collection at University of Costa Rica; paratype in the US National Museum (Nat. Hist.)

Etymology. We are pleased to name this new species in honor of Dr. Rodrigo Zeledón, our friend and colleague, who has contributed greatly to our knowledge of insect vectors of human disease in Costa Rica.

Discussion.

Lutzomyia zeledoni belongs in the species group vespertilionis Theodor, 1965 (=subgenus Coromyia Barretto, 1962, in part) that now includes 9 species having a center of distribution in Central America. One species, L. aquilonia (Fairchild & Harwood 1961), occurs in North America and the range of L. vespertilionis (Fairchild & Hertig, 1947) and L. isovespertilionis (Fairchild & Hertig 1958) extends south into Colombia. The status of the form described as L. beltrani (Belize form) by Williams (1976) remains undetermined.

Of these species, only L. deleoni (Fairchild & Hertig, 1958) and L. zeledoni males have 4 strong spines on the styles. The parameres of the former species (Fig. 8) are more slender, less clubbed and the coxite setae thinner than those of L. zeledoni, the paratype of which was collected at Tela, Honduras with males of L. deleoni. Flagellomere I of this paratype is 0.37 mm long and the parameres (Fig. 7) are slightly more upturned than those of the holotype but we treat them as conspecific.

The male of L. zeledoni somewhat resembles L. vesicifera (Fairchild & Hertig, 1947) in the shape of the parameres (Fig. 9) but the latter species has only 3 strong spines on the style. The females of L. vesicifera and L. deleoni are structurally indistinguishable as observed by Fairchild & Hertig (1947, 1958) and it is likely that the unknown female of L. zeledoni closely resembles them.

The type locality, about 4 km E of Brasilito on the Pacific coast, is classified as tropical dry forest. Lutzomyia longipalpis (Lutz & Neiva 1912) is very common at this site. We collected the holotype in a flight trap operated within 3 m of a hollow tree occupied by bats and a nearly dry stream bed with nearby scattered large trees and sparse vegetation.

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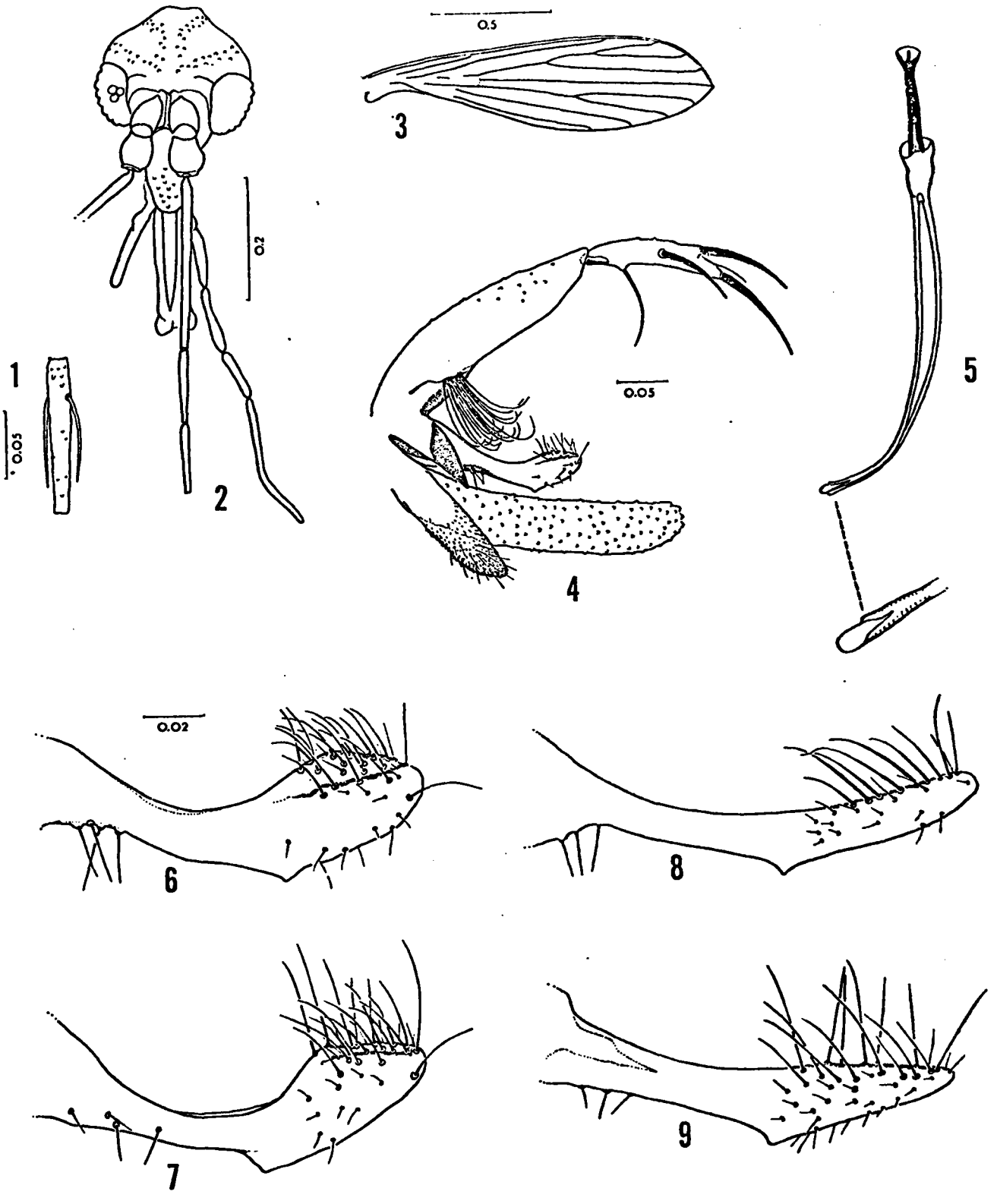
Figure Legend

Fig. 1-7. Lutzomyia zeledoni Young & Murillo, new species, male holotype. 1, flagellomere II showing ascoids; 2, head; 3, wing; 4, genitalia; 5, genital pump & filamints, same scale as Fig. 5; 6, paramere (holotype); 7, paramere (paratype).

Fig. 8. Lutzomyia deleoni (Fairchild & Hertiz, 1947), paramere of holotype.

Fig. 9. Lutzomyia vesicifera (Fairchild & Hertig, 1947), paramere of Panamanian male. Scale in millimetres; Figs. 6-9 drawn at same scale.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