*Mem. Inst. Oswaldo Cruz*, Rio de Janeiro, Vol. *84* (3): 333-341, jul./set. 1989

# TAXONOMY AND DISTRIBUTION OF PHLEBOTOMINE SANDFLIES IN VENEZUELA. I. THE *OSWALDOI* SPECIES GROUP OF THE GENUS *LUTZOMYIA* (DIPTERA: PSYCHODIDAE)

M. DORA FELICIANGELI

Centro de Investigaciones Biomédicas, Facultad de Ciencias de la Salud, Universidad de Carabobo, Núcleo Aragua, Apdo 4944, Maracay, Venezuela

*Species of sandflies in the* oswaldoi-*group of the genus* Lutzomyia *occurring in Venezuela are reviewed. A new species,* Lutzomyia saccai *n. sp. is described. A distribution map and pictorial keys for males and females are provided with notes on biological and ecological data collected in Venezuela.*

Key words: *Lutzomyia* – *oswaldoi*-group – *Lutzomyia saccai* n. sp. – *Lutzomyia trinidadensis* – *Lutzomyia rorotaensis* – keys – taxonomy – biology – distribution

The *oswaldoi* species group of the genus *Lutzomyia*, as defined by Theodor (1965), includes sandflies whose males have simple parameres (except *L. appendiculata* Martins, Falcão & da Silva, 1961) and 5 large spines on the style. The spermathecae are segmented, with an enlarged apical segment, or else smooth capsules. Barretto (1962) places these species and others with 5 spines on their styles in the subgenus *Helcocyrtomyia* (i. e. the *oswaldoi* and the *vexator* species groups of Theodor).

Martins et al. (1978) followed Barretto's classification but excluded *L. sanguinaria* (Fairchild & Hertig, 1957), a member of the *vexator* group, and *L. pia* (Fairchild & Hertig, 1961).

Young (1979) also suggested that *L. pia* may not be closely allied to the other members of the group. More recently he treats it as an "isolated species" considering that this taxon is "probably an aberrant *verrucarum*-group species" (pers. commun.). I am in agreement with Prof. Martins and Dr Young and will not include *L. pia* in this review of the Venezuelan sandflies of the *oswaldoi*-group.

Support for this research was obtained through the Consejo Nacional de Investigaciones Científicas y Tecnológicas (CONICIT, Project S1-1444) and the Consejo de Desarrollo Científico y Humanístico de la Universidad de Carabobo (CODECIH, Project FCS-005-84).

Received January 4, 1989.
Accepted March 21, 1989.

Of the 20 species described in the *oswaldoi* group, 5 of them, *L. appendiculata, L. breviducta* (Barretto, 1950), *L. ferreirana* Barretto, Martins & Pellegrino, 1956, *L. pratti* (Vargas & Najera, 1951) and *L. machupicchu* Martins, Llanos & da Silva, 1975, only are known by the males. The status of these taxa will be better understood when the females become available.

*Medical importance* – All species in this group are mainly saurophilic (Young, 1979) and none of them has been incriminated as disease vectors to man.

Three species in the *oswaldoi*-group have been found in Venezuela: *L. trinidadensis* (Newstead, 1922), *L. rorotaensis* (Floch & Abonnenc, 1944) and *L. saccai* n. sp. which is described below.

In an attempt to bring together the scattered biological and ecological information on the sandflies in Venezuela, available references are included for each species and ordered by political divisions. Though this might appear cumbersome and artificial, it provides a first sketch of the geographical distribution of the phlebotomine sandflies in Venezuela. A map for this group is presented. In the section "Material examined" altitudinal data are given whenever available. A pictorial key to the species of the *oswaldoi*-group in Venezuela is also provided (Figs 2, 3).

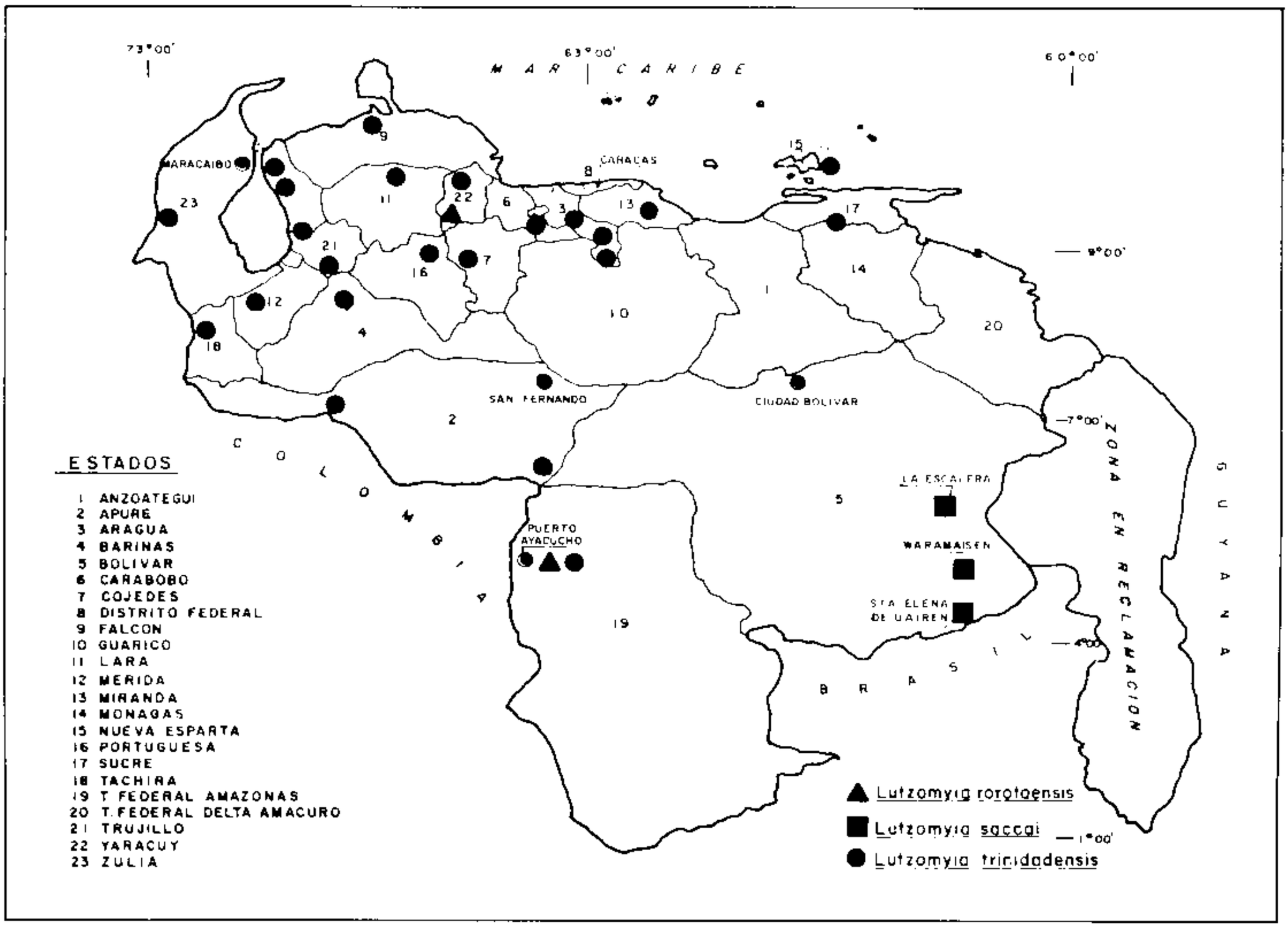


Fig. 1: Known geographical distribution of sandflies within the *oswaldoi*-species group in Venezuela.

*Lytzomyia trinidadensis* (Newstead)

*Phlebotomus trinidadensis* Newstead, 1922 (♂, ♀, Trinidad); Fairchild & Hertig, 1948: 253 (♂, ♀, redescr. full refer.); Pifano et al., 1962a: 384 (♂, ♀, keyed), 407 (redescr.); Scorza et al., 1979: 35 (feeding habits); Young, 1979: 227 (full ref.); Zeledón et al., 1982: 276 (biting man); Feliciangeli et al., 1985: 157 (anomalies); Murillo & Zeledón, 1985: 117 (Costa Rica); Ryan, 1986: 77 (♂, ♀, figs. Pará, Brazil); Ryan et al., 1987: 356 (nat. infection flagellates, Pará, Brazil); Williams, 1988: 375 (redescr. bionomics).

*Distribution:* Mexico, Belize, Honduras, Nicaragua, Costa Rica, Panamá, Colombia, Trinidad, French Guyana, Perú, Brazil, Bolivia (Martins et. al., 1978); Ecuador (Young & Rogers, 1984). *Venezuela:* Aragua (Albornoz et al., 1968; Scorza & Ortíz, 1960; Ramírez Pérez et al., 1978); Apure (present work); Barinas (Ramírez Pérez & Ramírez, 1981-82); Carabobo (Feliciangeli, 1987a); Cojedes (Aguilar et al., 1984); Falcón (Iriarte, 1952); Lara (Pifano & Ortíz, 1952; Bonfante et al., 1981); Mérida (present work); Miranda (Pifano et al., 1962a); Nueva Esparta (Pifano & Romero, 1964); Portuguesa (Pifano et al., 1962b); Sucre (Pifano & Romero, 1964; Ramírez Pérez et al., 1982a); Táchira (Ramírez Pérez et al., 1982b; Perruolo, 1984); Trujillo (Ortíz, 1965; Scorza et al., 1979); Yaracuy (Pifano & Ortíz, 1952); Zulia (Floch & Abonnenc, 1948; Marmol Léon, 1968); Territorio Federal Amazonas (Feliciangeli et al., 1988).

*Material examined:* Venezuela, *Aragua:* Turiamo: 5 ♂, 6 ♀, 28.vii.82; 8 ♂, 7 ♀, 28.vii.85; El Onoto: 1 ♂, 6.x.83; Guanasnal: 2 ♂, 9.xi.84 (Coll. A. Bravo, F. Arias); *Apure:* Guaramaco: 14 ♂, 27.iv.81, 22 ♂, 14 ♀, 29.iv.81; Cajutal: 4 ♂, 1 ♀, 28.ii.81; El Novillo: 9 ♂, 4 ♀; Puerto Paez: 1 ♂, 6 ♀, 24.iv.81; Caño Regreso: 1 ♂, 23.vii.81; San Carlos del Meta: 1 ♂, 25.iv.81 (Coll. J. Pulido); *Carabobo:* Borburata: 1 ♂, 4 ♀, 25.xii.84 (Coll. M. Ayala); San Esteban: 892 ♂, 481 ♀ (Coll. P. Aular, E. Fernandez, A. Bravo, F. Arias, M. D. Feliciangeli); *Cojedes:* Solano: 22 ♂, 3 ♀, 20.ix.84; Zambrano: 4 ♂, 2 ♀, 18.ix.84; La Morita: 2 ♂, 1 ♀, 19.ix.84, 2 ♂, 5.xi.84; La Váquira: 4 ♂, 19.ix.84 (Coll. E. Fer-

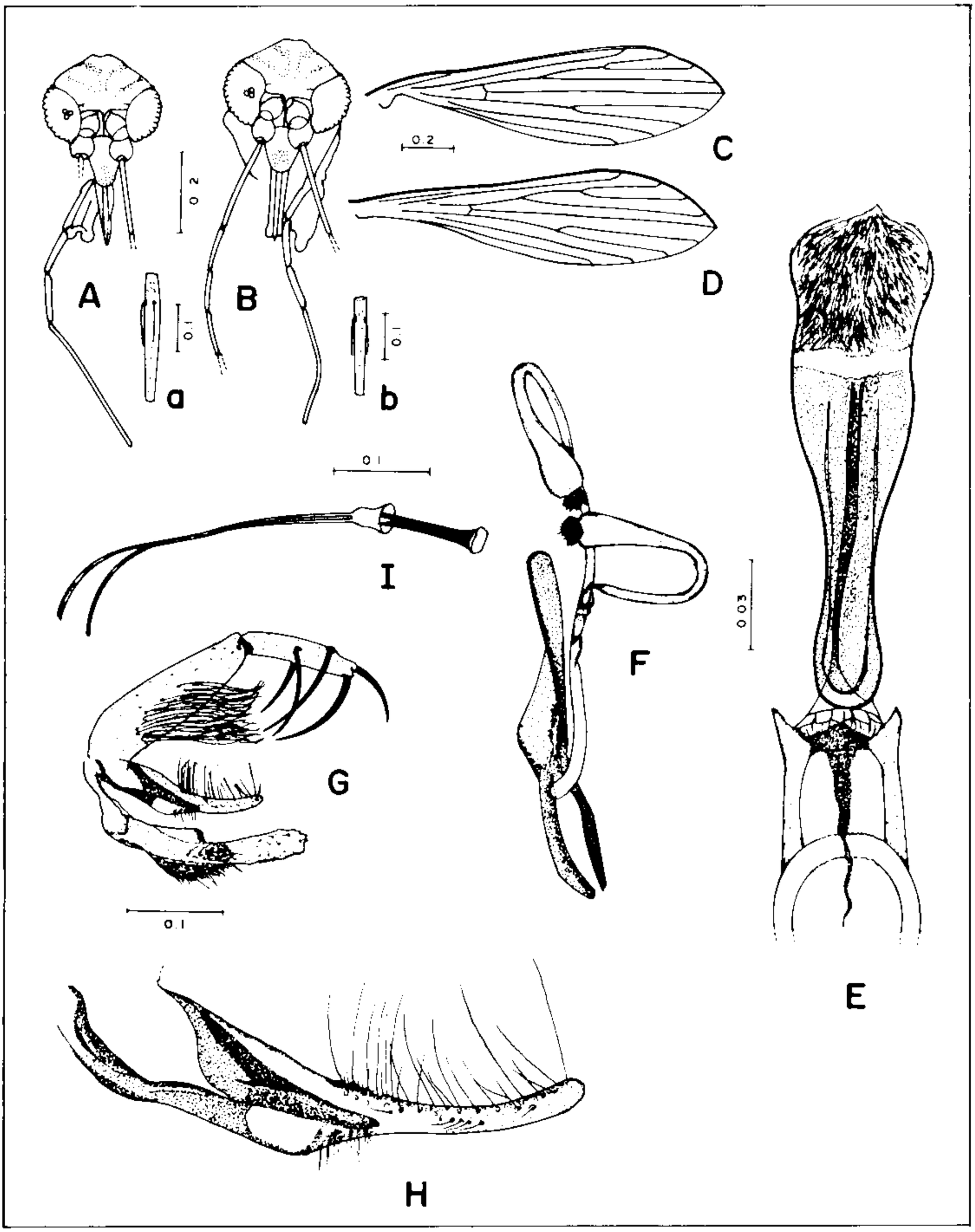


Fig. 2: *Lutzomyia saccai* n. sp. Feliciangeli, Ramirez Perez & Ramirez (Paratype ♂ No 2.19.1.M and allotype). A, ♂ head; a, ♂ flagellomere II; B, ♀ head, b, ♀ flagellomere II; C, ♂ wing; D, ♀ wing; E, ♀ cibarium and pharynx; F, spermathecae; G, ♂ genitalia; g, paramere enlarged; I, genital pump and filaments. Scale in mm.

nandez, F. Arias, A. Bravo); *Falcón:* San Luis (800 m): 4 ♂, 17.vi.86; El Puente (350 m): 35 ♂, 8 ♀, 18.vi.86; Los Platones (350 m): 92 ♂, 30 ♀, 18.vi.86; San Hilario: 31 ♂, 22 ♀, 19.vi.86; Cacagual (50 m): 94 ♂, 42 ♀, 20.vi.86; Cerro la Misión (100 m): 44 ♂, 6 ♀, 21.vi.86; Cataratas de Huequién (550 m): 34 ♂, 3 ♀, 19.vi.86 (Coll. F. Arias, A. Ramirez); *Lara:* La Parada: 7 ♂, 16 ♀, 22.ix.82; San Pedro: 1 ♂, 1 ♀, 25.ix.82; Agua Blanca: 1 ♂, 3 ♀, 24.ix.82; La Turiquia:

2 ♂, 21.ix.82; Tunere: 2 ♂, 4 ♀, 22.ix.82 (Coll. J. Amarista); La Escalera (780 m): 10 ♂, 15 ♀, 11.xii.86 (Coll. F. Arias); *Mérida:* Mesa Bolívar (840 m): 3 ♀, 17.I.85; (1000 m): 1 ♀, 17.i.85; El Vigía (100 m): 123 ♂, 51 ♀, 17.i.85; Estanques (400 m): 15 ♂, 6 ♀, 16.i.85 (Coll. A. Bravo, F. Arias); *Miranda:* Araira: 18 ♂, 4 ♀, 21.iii.85 (Coll. F. Arias); *Sucre:* Puerto Santo (60 m): 2 ♀, 23.v.87 (Coll. R. Reyes); *Territorio Federal Amazonas:* San Juan de Manapiare (140 m): 4 ♂, 9 ♀, 14.ix.84; 5 ♂, 1 ♀, 16.ix.84; Caño Mosquito (100 m): 8 ♂, 15.ix.84, 11 ♂, 1 ♀, 19.ix.84; Caño Marieta (110 m): 29 ♂, 2 ♀, 18.ix.84; El Gavilán: 36 ♂, 1 ♀, 26.ix.84 (A. Ramírez, A. Bravo); *Trujillo:* La Beticó: 9 ♂, 11 ♀, 17.v.83; Las Llanadas: 5 ♂, 4 ♀, 21.vii.83, 3 ♂, 13.vii.83, 1 ♂, 1 ♀, 20.vii.83; Rio Morosmoy: 5 ♂, 7 ♀, 12.vii.84, 20 ♂, 3 ♀, 20.iv.83 (E. Urbina, M. D. Feliciangeli); *Yaracuy:* Aroa 5 ♂, 1 ♀, 14.xii.86; San Felipe (150 m) 45 ♂, 7 ♀, 15.xii.86 (Coll. A. Ramirez, F. Arias); *Zulia:* La Yolanda (1200 m): 1 ♂, 9.v.86 (Malaise trap); Guasare (1200 m): 5 ♂, 4 ♀, 10.v.86 (Malaise trap); Los Angeles del Tocuco (310 m): 1 ♀, 14.v.86 (Malaise trap); La Nueva América: 9 ♂, 10.v.86; Las Américas: 20 ♂, 2 ♀, 9.v.86; La Yolanda: 119 ♂, 57 ♀, 10.v.86; La Habana: 20 ♂ 11 ♀, 10.v.86; La Danta: 13 ♂, 1 ♀, 10.v.86; Los Angeles del Tocuco: 2 ♂, 3 ♀, 12.v.86.

Specimens listed, except those caught in a Malaise trap, were collected in tree trunks, roots and holes but among those caught at San Esteban (Carobobo State): 1 ♂, 4.vi.79, 1 ♀, 1.iii.79; 1 ♀, 23.iv.79; 1 ♂, 21.v.79; 1 ♀, 18.vi.79; 1 ♀, 2.vii.79; 6 ♂, 1 ♀, 16.vii.79 were caught on house walls; 1 ♀, 14.v.79; 1 ♂, 1 ♀, 26.xii.79; 1 ♂, 4.xi.80 on human bait; 1 ♂, 7.v.79; 1 ♂, 14.v.79; 2 ♀, 11.vi.79; 1 ♀, 24.ix.79; 2 ♀, 8.xi.80 in a Shannon trap and 1 ♂, 7.v.79; 1 ♀, 11.vi.79; 1 ♀, 3.ix.79; 1 ♀, 29.x.79; 1 ♀, 19.xi.79 in CDC trap.

*Lutzomyia rorotaensis* (Floch & Abonnenc)

*Phlebotomus rorotaensis* Floch & Abonnenc, 1944: 4 (♂, holotype, ♀, Rorota, French Guyana); Floch & Abonnenc, 1952: 167 (♂, ♀, redescr. figs).

*Lutzomyia rorotaensis:* Young, 1979: 225 (full references); Geoffroy, 1984: 257 (gynandromorph, French Guyana); Ryan, 1986: 76 (♂, ♀, figs., Pará, Brasil).

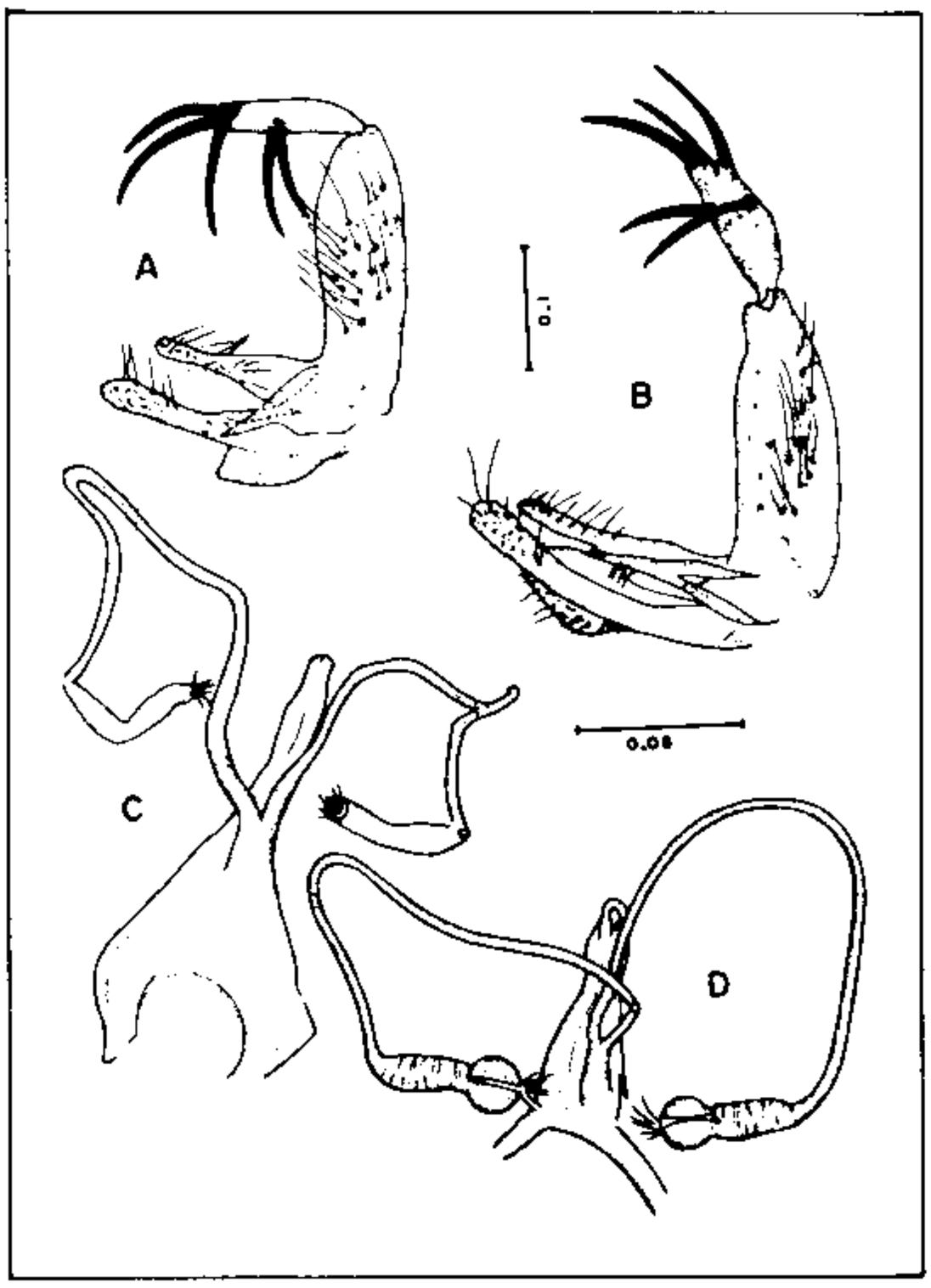


Fig. 3: *L. trinidadensis:* A, ♂ genitalia; C, spermathecae; *L. rorotaensis:* B, ♂ genitalia, D. spermathecae.

*Distribution:* [illegible] (Chaniotis et al., 1971); Colombia, French Guyana, Brazil (Martins et al., 1978); Perú (Young et al., 1985); Venezuela: Territorio Federal Amazonas (Feliciangeli et al., 1988), Yaracuy (present work).

*Material examined:* Venezuela, *Territorio Federal Amazonas:* El Limón, tree hole: 1 ♂, 21.xii.82; Pozo Azul, tree hole: 2 ♀, 24.xii.82; Caño Marieta (110 m), tree holes: 4 ♂, 4 ♀, 18.ix.84, 5 ♂, 9 ♀, 22.ix.84, human bait: 1 ♀, 19.ix.84, CDC trap: 1 ♀, 21.ix.84; Caño Mosquito (110 m), tree holes: 2 ♀, 19.ix.84; El Gavilán (100 m), tree holes: 8 ♂, 98 ♀, 26.ix.8 (Coll. A. Ramírez, A. Bravo); *Yaracuy:* Carrisillal (1020 m), tree holes: 2 ♂, 14.xii.86 (Coll. A. Ramírez, F. Arias).

*Lutzomyia saccai* Feliciangeli, Ramírez Pérez & Ramírez, *new species* (Fig. 2).

Holotype ♂ (Measurements in mm). (Slide No 2.19.5.M). Whole insect well pigmented. Wing length 1.70, width 0.50. Head height from vertex to tip of clypeus 0.36; width 0.27. Eyes large separated by 0.12 or distance equal to 7.75 facet diameters. Flagellomere I. 0.30 long,

II + III = 0.27; ascoids simple. Labrum 0.17 long. Length of palpomeres: 1, 0.03; 2, 0.11; 3, 0.15; 4, 0.12; 5, 0.33. Index FI/L = 1.7. Cibarium without teeth, cibarial arch incomplete. Pharynx 0.15 long, with ridges at posterior and. Pleura with 13-10 upper and 6-6 lower episternal setae on each side. Lengths of vein sections: $\alpha$, 0.43; $\beta$, 0.28; $\gamma$, 0.28; $\delta$, 0.15. Lengths of femora, tibiae and basitarsi: foreleg, 0.80, 0.79, 0.42; midleg, 0.76, 0.97, 0.50; hindleg 0.83, 1.21, 0.57. Genitalia: style 0.17 long with 5 major spines, proximal pair inserted more or less at same level near middle. Coxite 0.21 long with a tuft of about 30 persistent setae as shown. Paramere simple and sligthly upturned at the tip. Aedaegus well sclerotized 0.09 long. Genital pump 0.15 long; each filament 0.39 long or about 2.6 x length of pump, with simple tips. Lateral lobe 0.23 long.

The Table gives the ranges of variation of some structures of males of *L. saccai.*

Allotype ♀ (Slide No 2.19.1.H). Coloration as in male. Wing length 1.74, width 0.51. Head height 0.36, width 0.36. Eyes separated by 0.12 or distance equal to 8.3 x facet diameters. Flagellomere I 0.24 long, II + III = 0.22; ascoids, simple and present in all but last (XIV) antennal segment. Labrum 0.19 long. Lengths of palpomeres: 1, 0.04; 2, 0.09; 3, 0.13; 4, 0.13; 5, 0.29. Cibarium with 4 horizontal teeth the inner pair lightly bent inward and 1 row of dotlike vertical teeth; pigment patch well sclerotized slender and cibarial arch not complete. Pharynx 0.16 long armed with conspicuous and numerous posterior spines and spicules. Pleura with 8-8 upper and 4-4 lower episternal setae. Lengths or vein sections: $\alpha$, 0.37; $\beta$, 0.31; $\gamma$, 0.27; $\delta$, 0.15. Lengths of femora, tibia and basitarsi: foreleg, 0.72, 0.72, 0.39; midleg, 0.74, 0.90, 0.43, hindleg, 0.77, 1.05, 0.51. Spermathecae as shown; sperms ducts 0.135 long, about 4.5 x length of common duct, stem of genital fork is long and slender.

*Etimology:* I take the pleasure in naming this species in honour to Professor Giuseppe Saccá who has greatly contributed to the knowledge of Italian sand flies and to my early training in medical entomology.

*Type data:* Holotype ♂. VENEZUELA: Bolívar State, La Gran Sabana, Waramaisen 1000 m, tree holes, 12.vii.1985 (A. Ramírez, A. Bravo). Allotype ♀, Bolívar state, La Gran Sabana, La Escalera 840 m, tree holes, 17.vii.85. Paratypes: 3 ♂ same data as holotypes; 2 ♂, 2 ♀ same data as allotype; 1 ♀ same data as holotype but 13.vii.85, 5 ♂, 1 ♀ Bolívar State, La Gran Sabana, Santa Elena de Juairén tree holes, 15.viii.84 (M. D. Feliciangeli, A. Ramírez).

*Type data.* Holotype and allotype will be deposited at the Centro Nacional de Referencia sobre Taxonomía de Flebótomos, Universidad de Carabobo, Maracay, Venezuela. Paratypes in Florida State Collection of Arthropods, Gaineswlle, Florida, U.S.A. and at the British Museum (Natural History), London U.K.

TABLE

Range of variation of some structures in males of *Lutzomyia saccai* n. sp.

| | n | $\bar{x}$ | SD | CV (%) |
|---|---|---|---|---|
| Wing | | | | |
| length | 9 | 1.727 | 0.085 | 4.93 |
| width | 9 | 0.451 | 0.031 | 6.80 |
| Head | | | | |
| height | 9 | 0.338 | 0.014 | 4.29 |
| width | 9 | 0.272 | 0.064 | 23.53 |
| FI | 9 | 0.270 | 0.026 | 9.17 |
| FII | 9 | 0.127 | 0.008 | 6.24 |
| Palp 1 | 9 | 0.036 | 0.003 | 7.59 |
| Palp 2 | 9 | 0.099 | 0.010 | 10.2 |
| Palp 3 | 9 | 0.137 | 0.006 | 4.45 |
| Palp 4 | 9 | 0.114 | 0.010 | 8.78 |
| Palp 5 | 9 | 0.284 | 0.041 | 14.41 |
| Pharynx | 9 | 0.143 | 0.009 | 6.12 |
| Labrum | 9 | 0.171 | 0.008 | 4.71 |
| Fore leg | | | | |
| femur | 8 | 0.732 | 0.054 | 7.35 |
| tibia | 7 | 0.737 | 0.052 | 7.09 |
| tarsi | 7 | 0.396 | 0.031 | 7.89 |
| Mid leg | | | | |
| femur | 9 | 0.722 | 0.036 | 4.96 |
| tibia | 9 | 0.875 | 0.067 | 7.71 |
| tarsi | 9 | 0.462 | 0.028 | 6.11 |
| Hind leg | | | | |
| femur | 6 | 0.772 | 0.064 | 8.26 |
| tibia | 6 | 1.077 | 0.089 | 8.22 |
| tarsi | 6 | 0.518 | 0.032 | 6.19 |
| Coxite | 9 | 0.223 | 0.014 | 6.14 |
| Style | 9 | 0.121 | 0.024 | 20.02 |
| Lat. lobe | 9 | 0.227 | 0.011 | 4.83 |
| Gen. pump | 9 | 0.142 | 0.006 | 4.38 |
| Gen. fil. | 9 | 0.354 | 0.022 | 6.32 |

*Discussion:* Of the more than 20 described females in the *oswaldoi* species group, besides *L. saccai* n. sp., only *L. trinidadensis, L. borgmeieri* Martins, Falcão & Silva, 1972, the recently described *L. pusilla* Dias, Martins, Falcão & Silva, 1986 and *L. capibaxa* Dias, Falcão, Silva & Martins, 1987 have conspicuous spines in the pharynx and the cibarium with 4 horizontal teeth, the inner pair bent inward. Spermathecae of *L. trinidadensis* are smooth and sausage-shaped while those of the other 3 species are annulated at the base. *Lutzomyia saccai* has smooth leek-shaped spermathecae. The male of *L. borgmeieri* has a distinct tuft of 4-5 hairs on the coxite whereas *L. pusilla* and *L. capibaxa* have no tuft or sparse undeciduous hairs. The male of the new species most closely resembles the male of *L. quechua* Martins, Llanos & Silva, 1975 because of the consistent tuft of undeciduous setae on the coxite and the slender paramere. The setation on the paramere, however, is formed by long hairs in *L. saccai* n. sp. but short hairs in *L. quechua* and the female of this species has unarmed pharynx and spermathecae annulated at the base.

The sexes of *L. saccai* n. sp. have been associated on the basis of affinities of non-sexual characters, especially the degree and distribution of body pigmentation. Moreover *L. saccai* n. sp. has been, so far, the only species in the *oswaldoi* group collected in Bolivar State, in two different years, while *L. trinidadensis* and *L. rorotaensis* share the same habitat in northern Territorio Federal Amazonas. I compared the ranges of variation of some structures in males of *L. saccai* n. sp. (Table) with morphometric measurements given in the original description of *L. rorotaensis* and the re-description of *L. trinidadensis* (Williams, 1988). *Lutzomyia saccai* n. sp. shows to be larger than *L. rorotaensis* and this species exceedes in size *L. trinidadensis*. However, the ratios length of genital filaments/length of sperm pump, often useful in sandfly taxonomy, is inverted in the three forms: *L. saccai,* 2.5; *L. rorotaensis,* 2.7 and *L. trinidadensis*, 3.4.

## GENERAL DISCUSSION

### *Taxonomy and Biology*

Twenty species of phlebotomine sandflies are included in the *oswaldoi*-group: *L. alphabetica* (Fonseca, 1936); *L. appendiculata* Martins, Falcão & da Silva, 1981; *L. borgmeieri* Martins, Falcão & da Silva, 1971; *L. breviducta* (Barretto, 1950); *L. capibaxa* Dias, Falcão, da Silva & Martins, 1987; *L. ferreirana* Barretto, Martins & Pellegrino, 1956; *L. goiana* Martins, Falcão & da Silva, 1962; *L. longipennis* (Barretto & Coutinho, 1946); *L. machupicchu* Martins, Llanos & da Silva, 1975; *L. oswaldoi* (Mangabeira, 1942); *L. peresi* (Mangabeira, 1942); *L. pratti* (Vargas & Najera, 1951); *L. pusilla* Dias, Martins, Falcão & da Silva, 1986; *L. quechua* Martins, Llanos & da Silva, 1975; *L. rorotaensis* (Floch & Abonnenc, 1944); *L. sordellii* (Shannon & Del Ponte, 1927); *L. trinidadensis* (Newstead, 1922); *L. zikani* (Barretto, 1950); *L.* sp. No 2 of Aracuarara Morales & Minter, 1981 and *L. saccai* n. sp.

After re-examination of the type material, Prof. Williams (1988) recently re-described *L. trinidadensis*, discussing the status of forms previously placed in synonymy with this species. He remarks that the taxonomic status of *L. villelai* (Mangabeira, 1942) should be re-examined. Also he suggests that "*L. trinidadensis*" is not a single species, as generally recognized over the past 40 years, but a "combination of several sibling". This might explain the "surprising" (as referred by Prof. Williams) observations of Prof. Scorza et al. (1979) on the feeding habits of this species which was collected in Trujillo State biting mule (62%), horse (11%), pig (11%), cow (4%) and man (11%). On the other hand, Zeledón et al. (1982) also refer having captured seven *L. trinidadensis* biting humans in Honduras, and the same behaviour has been observed by Bonfante in Lara State, Venezuela (pers. commun.).

I have not caught sandflies at the same localities surveyed by Scorza and Bonfante, but, by the extensive collections made through the country using man as bait, I have been unable to confirm their observations. During a year study at San Esteban, Carabobo State, I sporadically collected males and females landing on man, but not biting. *L. trinidadensis* was presumed to enter rural houses because of the abundance of geckoes which inhabit the walls, rather than attraction to man or light (Feliciangeli, 1987a).

As previously reported in other countries by McConnel & Correa (1964), Christensen et al. (1972), Williams (1970) and Ryan et al. (1987), non leishmanial flagellates were found in *L. trinidadensis* (13.7%) in Venezuela (Aguilar et al.,

1984; Feliciangeli, 1987b). An unusual infection by a nematod, doubled up along the body of the fly was also observed in a male caught at San Esteban.

In relation to *L. rorotaensis,* we have sporadically cught it using light traps or landing on man, but not feeding.

Except for the resting sites, tree trunks, no further biological information is available on *L. saccai* n. sp.

*Distribution*

Though the *oswaldoi*-group is not a medically important group of phlebotomine sandflies, I have started the revision of these flies in Venezuela with this group because the distribution of *L. trinidadensis* gives a clear indication of the area that has been surveyed in this country for the phlebotomine fauna. In fact, this species is the most common sandfly collected from tree-holes and butresses throught the area studied except the Gran Sabana (part of the Guyanensis Shield in Bolivar State) where this fly was absent in the collections carried out by our team during August, 1984 and July, 1985. However there is no reason to believe that *L. trinidadensis* would not occur there. More extensive collections need to be made to fill this gap as well as in the other eastern States (Anzoategui, Monagas and Territorio Federal Delta Amacuro) not suveryed for sandflies.

Although abundant in lowland forest, *L. trinidadensis* has been caught as high as 1840 m. a.s.l. (Scorza et al., 1979), showing a great ability to flourish in the majority of the 22 life zones described in Venezuela (Ewel & Madriz, 1968). However it is known that the life zone concept of Holdridge (1964) can only give a general idea of a classification of the world's vegetation. The question whether life zones are real in nature or whether they are simply a convenient but arbitrary classification still remains open (MacArthur, 1972). Therefore, the presence of the same species in two very different life zones like tropical moist forest and tropical thorny woodland (as *L. trinidadensis* does), might be interpretated as the result of the presence of similar microenvironments in the two zones.

*Lutzomyia rorotaensis* has been collected only in lowland tropical moist forest at 100 m. a.s.l. in the Territorio Federal Amazonas and in a moist pre-mountain forest at 1020 m. a.s.l. in Yaracuy State. This disrupt distribution deserves special attention in terms of the possibility of misidentification of this species with *L. trinidadensis.* On the other hand, its recent discovery in Venezuela allows us to fill in a gap in its distribution which extends from Panamá to Colombia and Perú in the western and Venezuela, French Guyana and Brazil in the eastern part of South America.

The distribution of *L. saccai* n. sp. is at this moment restricted to the Gran Sabana (Guyanensis Shield) in the life zones defined as very moist pre-mountain forest and moist pre-mountain forest (Ewel & Madriz, 1964).

## KEY TO THE SPECIES OF THE *OSWALDOI*-SPECIES GROUP IN VENEZUELA

*Males*

1. Coxite with a tuft of about 30 undeciduous setae (Fig 2G). . . . . *L. saccai*
– Coxite with a tuft of sparse and deciduous setae . . . . . .2
2. Whole insect well pigmented. Style with the middle apical spine much smaller than the others (Fig 3B) . . . . . *L. rorotaensis*
– Whole insect faintly pigmented. Style with apical spines subequal in size (Fig 3A). . . . . *L. trinidadensis*

*Females*

1. Pharynx unarmed . . . . . *L. rorotaensis*
– Pharynx armed with conspicuous posterior teeth. . . . . .3
2. Spermathecae large and sausage-shaped (Fig 3C). . . . . *L. trinidadensis*
– Spermathecae small and leek-shaped (Fig 2D) . . . . . *L. saccai*

RESUMEN

**Taxonomía y distribución geográfica de los flebótomos en Venezuela. I. El grupo *oswaldoi* del género *Lutzomyia* (Diptera: Psychodidae)** – Se hace una revisión de las especies de flebótomos del grupo *oswaldoi* del género *Lutzomyia,* hasta el momento registradas en Venezuela. Se describe una nueva especie, *Lutzomyia saccai* n. sp. Se proporcionan claves para

la identificación de machos y hembras, datos biológicos y ecológicos y un mapa de distribución de estas especies en el País.

Palabras claves: *Lutzomyia* – grupo *oswaldoi* – *Lutzomyia saccai* n. sp. – *Lutzomyia trinidadensis* – *Lutzomyia rorotaensis* – keys – taxonomy – biology – distribution

## ACKNOWLEDGMENTS

To Dr David Young (University of Florida) for helpful discussions and facilities provided at his laboratory; to Dr R. Zimmerman (PAHO, Maracay, Venezuela), for reviewing the manuscript and to Mrs Margo Duncan for drawings of the new species. To Dr M. A. Otero, Chief of the Direccion de Endemias Rurales, Ministerio de Sanidad y Asistencia Social, for continuous help with materials and human resources. To the Pan American Health Organization and the Ministry of Health, which funded the travel of the Author to Gainesville.

## REFERENCES

AGUILAR, C. M.; FERNANDEZ, E.; FERNANDEZ, R. de & DEANE, L., 1984. Study of an outbreak of cutaneous leishmaniasis in Venezuela. The role of domestic animals. *Mem. Inst. Oswaldo Cruz, 79:* 181-195.

ALBORNOZ, M. R.; VASQUEZ, F. L. & ROSARIO, P. M., 1968. Estudio de un brote epidémico de leishmaniasis tegumentaria americana en el Municipio Choroní (Edo. Aragua). *Dermatol. Venez., 7:* 659-670.

BARRETTO, M. P., 1962. Novos subgeneros de *Lutzomyia* Franca, 1924 (Diptera, Psychodidae, subfamilia Phlebotominae). *Rev. Inst. Med. trop. São Paulo, 4:* 91-100.

BONFANTE, R.; TORRES, A. & MORILLO, C., 1981. Phlebotominae en una zona de Leishmaniasis tegumentaria difusa en Venezuela. *Bol. Ofic. San. Pan., 90:* 410-414.

CHANIOTIS, B. N.; NEELY, J. M.; CORREA, M. A.; TESH, R. B. & JOHNSON, K. B., 1971. Natural population dynamics of phlebotomine sandflies in Panamá. *J. Med. Entomol., 8:* 339-352.

CHRISTENSEN, H. A.; HERRER, A. & TELFORD, S. R., 1972. Enzootic cutaneous leishmaniasis in eastern Panamá. II. Entomological investigations. *Ann. Trop. Med. Parasit., 66:* 55-66.

EWEL, J. J. & MADRIZ, A., 1968. *Zonas de vida de Venezuela. Memoria explicativa sobre el mapa ecológico.* Ed. Sucre. Caracas. 265 p.

FAIRCHILD, G. B. & HERTIG, M., 1948. Notes on the *Phlebotomus* of Panamá (Diptera: Psychodidae). III. *P. cruciatus, trinidadensis* and *gomezi. Ann. Ent. Soc. Amer., 41:* 247-257.

FELICIANGELI, M. D., 1987a. Ecology of sandflies (Diptera: Psychodidae) in a restricted focus of cutaneous leishmaniasis in Northern Venezuela. II. Species composition in relation to habitat, catching method and hour of catching. *Mem. Inst. Oswaldo Cruz, 82:* 125-131.

FELICIANGELI, M. D., 1987b. Ecology of sandflies (Diptera: Psychodidae) in a restricted focus of cutaneous leishmaniasis in Northern Venezuela. IV. Sandfly monthly fluctuation and leishmaniasis incidence relationship. *Mem. Inst. Oswaldo Cruz, 82:* 177-179.

FELICIANGELI, M. D.; R. ORDOÑEZ & AGUILAR, C. M., 1985. Anomalies of sandflies in Venezuela. *Acta Amazonica, 15:* 157-166.

FELICIANGELI, M. D.; RAMIREZ PEREZ, J. & RAMIREZ, A., 1988. The Phlebotomine Sandflies of Venezuelan Amazonia. *Med. & Vet. Entomol., 2:* 47-65.

FLOCH, H. & ABONNENC, E., 1944. Phlébotomes de la Guyane Française. IX. Description de la female de *P. fluviatilis* et trois especes nouvelles. *Inst. Pasteur Guyane Publ., 83,* 11 p.

FLOCH, H. & ABONNENC, E., 1948. Phlébotomes du Venezuela. II. Description de *P. atroclavatus* Knab, 1913, de *P. evansi* Nuñez Tovar, 1924, de *P. cayennensis* Floch et Abonnenc, 1941. de *P. baduelensis* Floch & Abonnenc, 1941, de *P. punctigeniculatus* Floch & Abonnenc, 1944, de *P. venezuelensis* n. sp. *Arch. Inst. Pasteur Guyane Terr. Inini Publ., 178,* 24 p.

FLOCH, H. & ABONNENC, E., 1952. Dipteres phlébotomes de la Guyane et des Antilles Françaises. *Faune de l'Union Française, 14,* 217 p.

GEOFFROY, B., 1984. Un cas de gynandromorphisme chez *Lutzomyia (Lutzomyia) rorotaensis* Floch & Abonnenc, 1944 (Diptera, Psychodidae). *Cahiers O. R. S. T. O. M. Ent. Méd. Parasitol., 22:* 257-260.

HOLDRIDGE, L. R., 1964. *Life zone ecology.* San José, Costa Rica. Tropical Science Center. pag. var.

IRIARTE, D., 1952. Lista de Flebótomos señalados en Venezuela hasta ahora. *Bol. Lab. Clin. "Luis Razetti", 16:* 487-490.

MACARTHUR, R. H., 1972. *Geographical ecology. Patterns in the distribution of species.* Harper & Row Publ., 269 p.

MARMOL LEON, M. P., 1968. Acerca de tres especies de *Phlebotomus* (Diptera: Psychodidae), nuevas para Venezuela. *Rev. Fac. Med. Maracaibo, 1:* 29-35.

MARTINS, A. V.; WILLIAMS, P. & FALCÃO, A., 1978. *American Sandflies (Diptera: Psychodidae, Phlebotominae).* Academia Brasilera de Ciencias. Río de Janeiro, 195 p.

McCONNELL, E. & CORREA, M., 1964. Trypanosomes and other microrganisms from Panamanian sandflies. *J. Parasit., 50:* 523-528.

MURILLO, J. & ZELEDON, R., 1985. Flebótomos de Costa Rica (Diptera: Psychodidae). *Brenesia, 23* (Supl.), 137 p.

NEWSTEAD, R., 1922. A new species of *Phlebotomus* from Trinidad. *Ann. Trop. Med. Parasit., 16:* 47-50.

ORTIZ, I., 1965. *Phlebotomus hernandezi* n. sp. del Estado Trujillo, Venezuela (Diptera: Psychodidae). *Acta Biol. Venez., 4:* 205-211.

PERRUOLO, G., 1984. Ecología de los flebótomos (Diptera: Psychodidae) y su influencia sobre la leishmaniasis tegumentaria en zonas endémicas del estado Tachira, Venezuela. *Kasmera, 12:* 74-95.

PIFANO, C. F. & ORTIZ, I., 1952. Representants Venezolanos del género *Phlebotomus* Rondani, 1840 (Diptera: Psychodidae). *Rev. Venez. San. Asist. Soc., 17:* 135-151.

PIFANO, C. F.; ORTIZ, I. & ALVAREZ, A., 1962a. Bases taxonómicas para el conocimiento de los *Phlebotomus* de la región de Guatopo, Venezuela. *Archos Venez. Med. Trop. Paras. Med., 4:* 369-428.

PIFANO, C. F. & ROMERO, J., 1964. Investigaciones epidemiológicas sobre la leishmaniasis visceral en la Isla de Margarita, Edo. Nueva Esparta, Venezuela. *Gaceta Med. Caracas, 72:* 425-430.

PIFANO, C. F.; ROMERO, J. & HENRIQUEZ GARCIA, R., 1962b. Comprobación de un foco de leishmaniasis visceral (kala-azar) en un sector de piedemonte andino-llanero del Edo. Portuguesa. *Archos Venez. Med. trop. Parasit. Med., 4:* 1-15.

RAMIREZ PEREZ, J. & RAMIREZ, A., 1981-1982. Estudio de la fauna flebotómica del Estado Barinas (Venezuela). *Bol. Dermat. Sanit., 19:* 21-50.

RAMIREZ PEREZ, J.; RODRIGUEZ, G. & RAMIREZ, A., 1982a. Estudio de la fauna flebotómica del Estado Sucre (Venezuela). *Bol. Dir. Malariol. San. Amb., 22:* 11-22.

RAMIREZ PEREZ, J.; RODRIGUEZ, G. & RAMIREZ, A., 1982b. Estudio de la fauna flebotómica del Estado Táchira (Venezuela). *Bol. Dir. Malariol. Saneam. Amb., 22:* 53-75.

RAMIREZ PEREZ, J.; RODRIGUEZ, G.; RAMIREZ, A. & CARRILLO, F., 1978. Estudio de la fauna flebotómica del Estado Aragua (Venezuela). *Bol. Dir. Malariol. San. Amb., 18:* 43-80.

RYAN, L., 1986. *Flebótomos do Estado do Pará, Brasil (Diptera: Psychodidae: Phlebotominae)*. Doc. Tecn. nº 1, Instituto Evandro Chagas, Fundação SESP. Ministério de Saúde. 154 p.

RYAN, L.; LAINSON, R. & SHAW, J. J., 1987. Leishmaniasis in Brazil. XXIV. Natural flagellate infections of sandflies (Diptera: Psychodidae) in Pará State, with particular reference to the role of *Psychodopygus wellcomei* as the vector of *Leishmania braziliensis braziliensis* in the Serra dos Carajas. *Trans. R. Soc. trop. Med. Hyg., 81:* 353-359.

SCORZA, J. V. & ORTIZ, I., 1960. On microclimate conditions of the habitats of certain sandfly species (Diptera: Psychodidae) from Venezuela. *Z. Tropenm. Parasit., 11:* 433-440.

SCORZA, J. V.; MOGOLLON, J. & MANZANILLA, P., 1979. Notas etológicas sobre *Lutzomyia trinidadensis* (Newstead) (Diptera: Psychodidae) de Venezuela. *Bol. Dir. Malariol. San. Amb., 19:* 35-38.

THEODOR, O., 1965. On the classification of American Phlebotominae. *J. Med. Entomol., 2:* 171-197.

WILLIAMS, P., 1970. Phlebotomine sandflies and leishmaniasis in British Honduras (Belize). *Trans. R. Soc. trop. Med. Hyg., 64:* 317-368.

WILLIAMS, P., 1988. Notes on *Lutzomyia trinidadensis* (Newstead, 1922) (Diptera: Psychodidae – Phlebotominae). *Mem. Inst. Oswaldo Cruz, 83:* 375-383.

YOUNG, D. G., 1979. *A review of the bloodsucking Psychodid Flies of Colombia (Diptera: Phlebotominae and Sycoracinae)*. Univ. Florida Exp. Stn. Techn. Bull. Nº 806, 266 p.

YOUNG, D. G.; PEREZ, J. E. & ROMERO, G., 1985. New records of phlebotomine sandflies from Perú with a description of *Lutzomyia oligodonta* n. sp. from the Rimac Valley (Diptera: Psychodidae). *Int. J. Entomol., 27:* 136-146.

YOUNG, D. G. & ROGERS, T. E., 1984. The phlebotomine sandfly fauna (Diptera: Psychodidae) of Ecuador. *J. Med. Entomol., 21:* 597-611.

ZELEDON, R.; MACAYA, G.; PONCE, C.; CHAVES, F.; MURILLO, J. & BONILLA, J., 1982. Cutaneous Leishmaniasis in Honduras, Central America. *Trans. R. Soc. trop. Med. & Hyg., 76:* 276-277.