*Mem. Inst. Oswaldo Cruz*, Rio de Janeiro, Vol. 81(3) :323-331, jul./set. 1986

# NEW PHLEBOTOMINE SANDFLIES OF THE *WALKERI* GROUP (DIPTERA: PSYCHODIDAE) FROM PARÁ STATE, BRAZIL, WITH A PICTORIAL KEY 1

LEE RYAN, HABIB FRAIHA*, RALPH LAINSON & JEFFREY J. SHAW

*The male and female of* Lutzomyia carmelinoi *n.sp., and the female only of* L. baculus *and* L. williamsi, *(Diptera: Psychodidae) are described and illustrated from specimens collected in Pará state, Brazil. A pictorial key is presented to these and the other members of the* walkeri *group.*

Key words: sand flies – phlebotomines – *walkeri* group – taxonomy – new species

This paper describes a new species of *Lutzomyia*, and the female of *L. baculus* and *L. williamsi*, encountered during our studies on visceral leishmaniasis (Lainson et al., 1984, 1985) and cutaneous leishmaniasis (Lainson et al., 1973 and Ryan et al., 1986) in Santarém and Serra dos Carajás, Pará State (respectively). Numerous collections of sandflies were made during these investigations and one sandfly, *L. carmelinoi* n.sp. was colonized in the laboratory, where it presently is in the 10th closed generation.

## *Lutzomyia carmelinoi* Ryan, Fraiha, Lainson & Shaw, *new species*

Fig. 1 (1-10) and Plate 1a (measurements in mm)

**Holotype** ♂. Wing length 1.82; width 0.55. A pale sandfly, only with pale pigmentation on the head, mesonotum and dorsum of the abdomen. Head height from vertex to tip of clypeus 0.39; width 0.31. Eyes separated by 0.13. Flagellomere I, 0.24 long, II + III = 0.23; ascoids long; and those on II reaching the tip of the flagellomere. Labrum 0.24 long. Length of palpal segments: 1, 0.05; 2, 0.10; 3, 0.14; 4, 0.11; 5, 0.33. Pharynx 0.16 long. Pleura with nine upper and four lower episternal setae. Lengths of wing vein sections: *alpha*, 0.35; *beta*, 0.27; *delta*, 0.04; *gamma*, 0.46. Lengths of femora, tibiae, and basitarsi: foreleg, 0.64, 0.72, 0.39; midleg, 0.70, 0.87, 0.40; hindleg, 0.78, 1.02, 0.51. *Genitalia.* Style 0.16 long, with four major spines and subterminal bristle. Coxite 0.35 long, with 12-18 setae at the base. Paramere as shown, distal portion markedly more infuscated than the proximal, one long seta at the base and several short hairs covering the tip, the overall shape may best be described as bootlike. Aedeagus triangular, well pigmented, with acute tip. Genital pump 0.22 long, each filament heavily sclerotized, 0.27 long filament tips modified as shown. Lateral lobe 0.40 long.

**Allotype** ♀. Wing length 1.82; width 0.58. Coloration as in ♂. Head height 0.42; width 0.33. Eyes separated by 0.15. Flagellomere I, 0.22 long, II + III = 0.22; ascoids as in the male. Labrum 0.28 long. Lengths of palpal segments: 1, 0.05; 2, 0.12; 3, 0.15; 4, 0.13; 5, 0.37. Cibarium with four horizontal and numerous lateral teeth, pigment patch and cibarial arch as figured. Pharynx 0.18 long, without spines. Pleura with 15 upper and four lower episternal setae. Lengths of wing vein sections: *alpha*, 0.44; *beta*, 0.30; *delta*, 0.12; *gamma*, 0.49. Lengths of femora, tibiae, and basitarsi: foreleg, 0.74, 0.74, 0.41; midleg and hindleg missing. Spermathecae as figured, capsular with a terminal knob prominent; sperm duct smooth walled, common duct less than 1/2 the length of the individual duct.

**Type data – Holotype** ♂. Brazil: Pará State. From 7th colony generation, original 91 fed females originated from Saubal district of Santarém (Lainson et al., 1984, 1985).

**Allotype** ♀. Same data.

**Paratypes** 20♂, 20♀, same data as holotype.

Holotype and allotype in collections of Instituto Evandro Chagas, Belém. Paratypes to be deposited in the British Museum (Natural History).

---

Research supported by the Wellcome Trust, London and the Instituto Evandro Chagas of the Fundação Serviços de Saúde Pública, Rio de Janeiro.

The Wellcome Parasitology Unit, Instituto Evandro Chagas, Caixa Postal 3, 66001, Belém, PA, Brasil.

*Seção de Patologia, Instituto Evandro Chagas, Av. Almirante Barroso 492, 66050, Belém, PA, Brasil.

Received for publication January 27th and accepted March 14th, 1986.

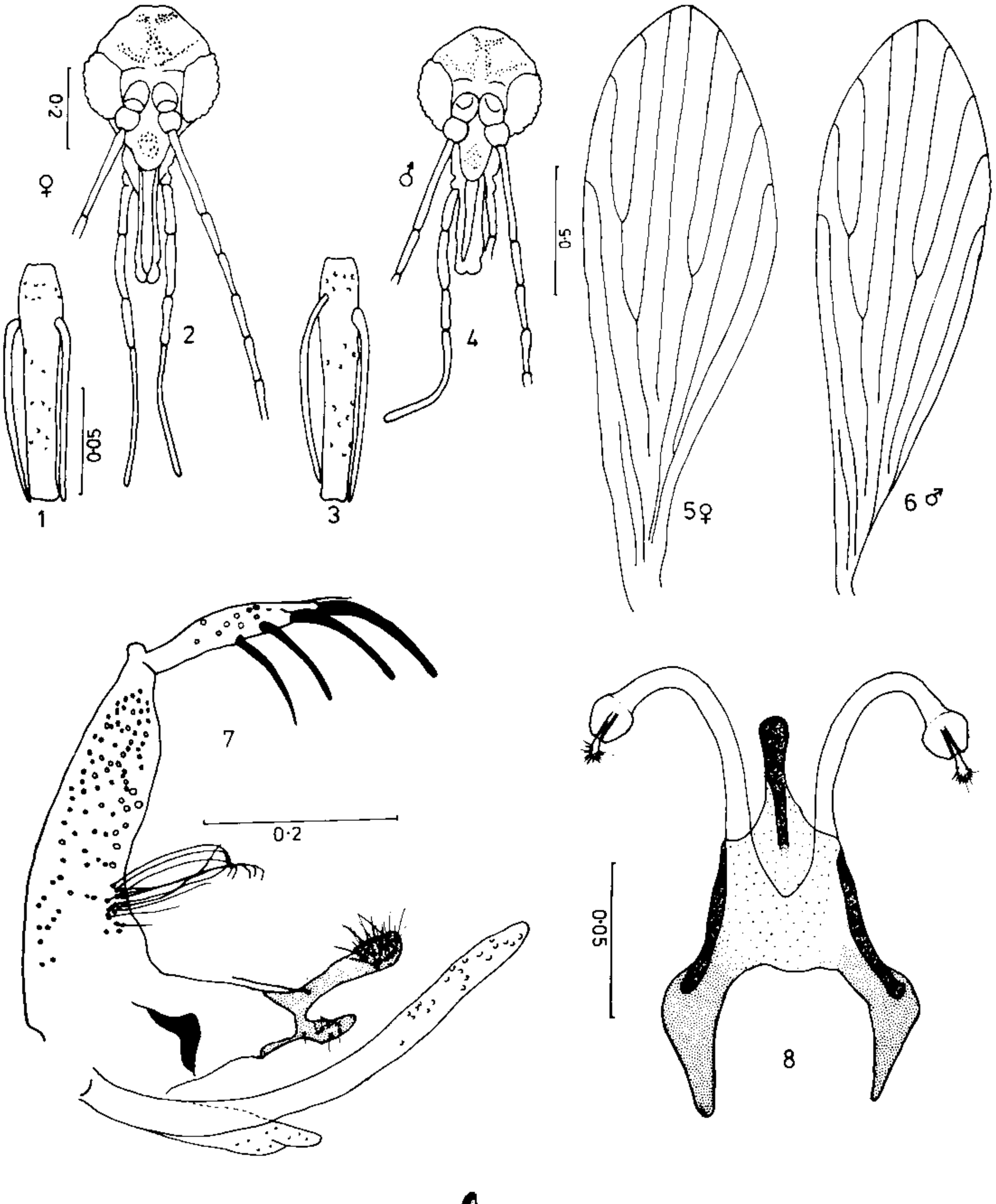


Fig. 1 (1-10) – *Lutzomyia carmelinoi* Ryan, Fraiha, Lainson & Shaw, new species. Holotype and allotype. 1. ♀ flagellomere II; 2. ♀ head; 3. ♂ flagellomere II; 4. ♂ head; 5. ♀ wing; 6. ♂ wing; 7. ♂ genitalia; 8. spermatheca and furca (Plate 1a) drawn in Berlese medium; 9. genital pump and filaments with one filament tip enlarged; 10. ♀ cibarium.

## *Lutzomyia williamsi* Damasceno, Causey & Arouck, 1945
Fig. 2 (1-2.7) and Plate 1b

♀. Wing length (in mms.) 1.70; width 0.50. A pale sandfly, with only the head mesonotum and dorsum of the abdomen lightly infuscated. Head height 0.38; width 0.31. Eyes separated by 0.13. Flagellomere I, 0.19 long, II + III = 0.21; ascoids long reaching the tip of flagellomere II. Labrum 0.26 long. Lengths of palpal segments: 1, 0.05; 2, 0.12; 3, 0.14; 4, 0.12; 5, 0.28. Cibarium with four horizontal teeth and about 26 lateral teeth, the pigment patch and cibarial arch as figured. Pharynx 0.18 long, without spines. Pleura with 17 upper and 23 lower episternal setae. Lengths of wing vein sections: *alpha*, 0.36; *beta*, 0.22; *delta*, 0.05; *gamma*, 0.24. Lengths of femora, tibiae, and basitarsi: foreleg, 0.67, 0.68, 0.39; midleg, 0.72, 0.80, 0.49; hindleg, 0.70, 0.98, 0.56. Spermathecae as figured, ovoid in shape, terminal knob prominent originating centrally, common duct small, less than 1/6th the length of the individual ducts.

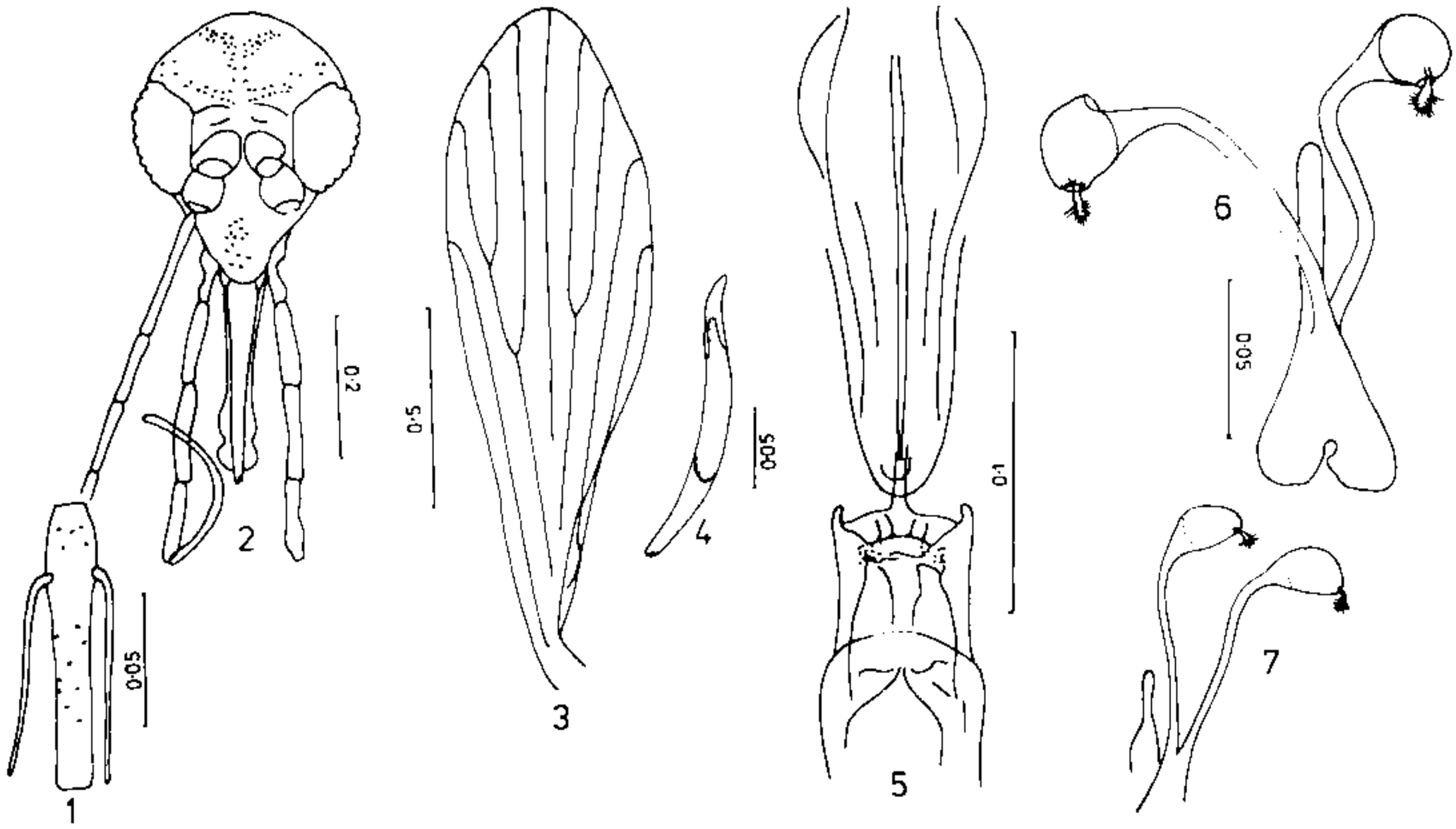


Fig. 2 (1-7) – *Lutzomyia williamsi* Damasceno, Causey & Arouck. Drawings are of the Carajás female except Fig. 7. 1. flagellomere II; 2. head; 3. wing; 4. one of 100 worms found in the abdomen; 5. cibarium; 6. spermathecae; 7. spermathecae (scale not known) drawn from a photographed (Plate 1b). dissected fly in saline.

**Material examined.** ♀. Brazil: Pará State, Serra dos Carajás, 3838 N, 2323 W, elev. 300 m, 20.X.1984, CDC light trap.

2♀ collected in Utinga forest, Belém in 1968 and 1970 in a light trap and Disney trap.

All the females are in collections of Instituto Evandro Chagas.

## *Lutzomyia baculus* Martins, Falcão & Silva, 1965
Fig. 3 (1-5)

♀. Wing length 1.96; width 0.55. A pale sandfly, only the head mesonotum and dorsum of the abdomen with faint, almost nonexistent pigmentation. Head height from vertex to tip of clypeus 0.38; width 0.33. Eyes separated by 0.12. Flagellomere I, 0.29 long, II + III = 0.29; ascoids long, those on II reaching to the tip of the flagellomere. Labrum 0.24 long. Length of palpal segments: 1, 0.07; 2, 0.11; 3, 0.14; 4, 0.13; 5, 0.35. Cibarium with four horizontal and 24 lateral teeth, pigment patch moderately infuscated, conspicuous; cibarial arch complete. Pharynx 0.168 long. Pleura with 15 upper and two lower episternal setae. Lengths of wing vein sections: *alpha*, 0.43; *beta*, 0.27; *delta*, 0.09; *gamma*, 0.27. Lengths of femora, tibiae, and basitarsi: foreleg, 0.81, 0.91, 0.55; midleg, 0.78, 1.08, 0.0; hindleg, 0.87, 1.25, 0.69.

Spermathecae as figured, pear-shaped, smooth walled with prominant terminal knob originating off centre. Common duct short, less than 1/6th the length of the individual ducts.

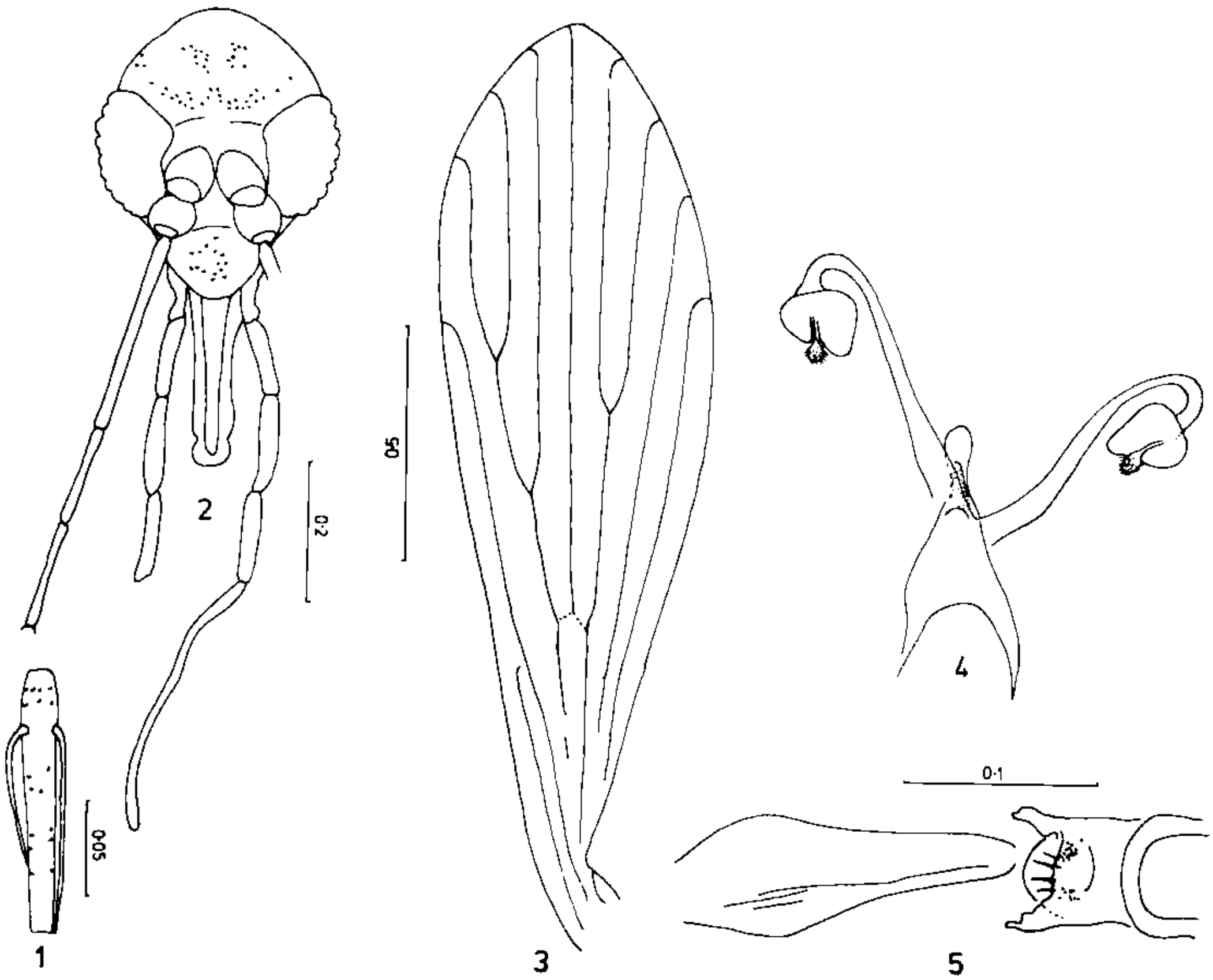


Fig. 3 (1-5) – *Lutzomyia baculus* Martins, Falcão & Silva. Drawings are of the Carajás female. 1. flagellomere II; 2. head; 3. wing; 4. spermathecae; 5. cibarium.

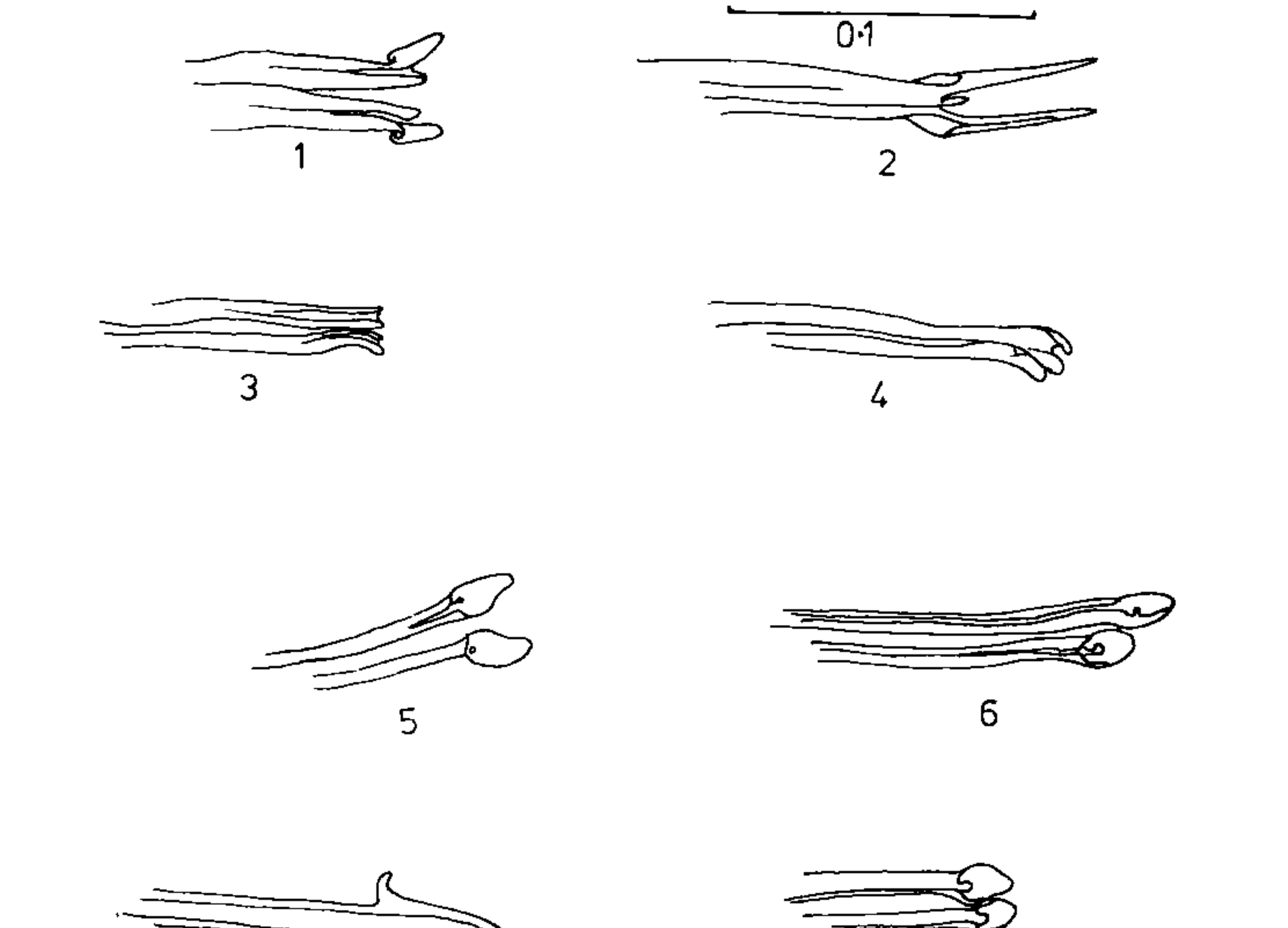


Fig. 4 (1-8) Male genital filament tips of the *walkeri* group. 1. *L. carmelinoi*; 2. *L. lenti*; 3. *L. evandroi*; 4. *L. baculus*; 5. *L. sericea*; 6. *L. dubitans*; 7. *L. williamsi*; 8. *L. walkeri*.

Fig. 5 (1-8) – Female spermathecae of the *walkeri* group. 1. *L. carmelinoi;* 2. *L. lenti;* 3. *L. evandroi;* 4. *L. baculus;* 5. *L. sericea:* 6. *L. dubitans;* 7. *L. williamsi;* 8. *L. walkeri.* Fig. 5.1 shows the measurements used to give the ratio of common (c) / individual (i) duct.



Plate 1 – Spermathecae of *Lutzomyia carmelinoi* (A) and *L. williamsi* (B).

**Material examined**. 9♀. Brazil: Pará State, Serra dos Carajás, 3838 N, 2323 W, elev. 300 m, 20.X.1984, CDC light trap.

All females are in collections of Instituto Evandro Chagas, Belém.

Key to the males of the *walkeri* group

| | | |
|---|---|---|
| 1. | Paramere simple, with or without a dorsal projection | 3 |
| | Paramere bifurcate | 2 |
| 2. | (2) Genital filament tips arrow-like and elongate 1/8th the length of the genital filaments | *lenti* |
| | Genital filaments scrolled less than 1/20th the length of the genital filaments | *carmelinoi* |
| 3. | (1) Paramere plus dorsal tooth-like projection | *evandroi* |
| | Paramere simple | 4 |
| 4. | (3) Aedeagus simple | 7 |
| | Aedeagus elongate or with dorsal projection | 5 |
| 5. | (4) Aedeagus elongate, with a beak-like appearance | *baculus* |
| | Aedeagus with dorsal projection | 6 |
| 6. | (5) Aedeagus with small rounded dorsal swelling | *sericea* |
| | Aedeagus with elongate, concave dorsal swelling | *walkeri* |
| 7. | (4) Genital filaments almost twice length of pump | *dubitans* |
| | Genital filaments only slightly longer than pump | *williamsi* |

Key to the females of the *walkeri* group

| | | |
|---|---|---|
| 1. | Common spermathecal duct short less than 1/6th the length of the individual duct | 2 |
| | Common spermathecal duct long greater than 1/3rd the length of the individual duct | 4 |
| 2. | (1) Spermathecal head width less than the width of the individual duct | *sericea* |
| | Spermathecal head wider than the individual duct | 3 |
| 3. | (2) Spermathecal head large and pear shaped terminal knob originates off-centre | *baculus* |
| | Spermathecal head ovoid, terminal knob originates centrally | *williamsi* |
| | Spermathecal head capsular and bisymetrical | *evandroi* |
| 4. | (1) Common sperm duct about 1/2 as long as the individual duct, not equal | 5 |
| | Common sperm duct equal in length to individual duct | 6 |
| 5. | (4) Ratio of widths of common / individual sperm duct 4 : 1 | *carmelinoi* |
| | Ratio of widths of common / individual sperm duct 6 : 1 | *lenti* |
| 6. | (4) Ratio of widths of common / individual sperm duct 2 : 1 | *dubitans* |
| | Ratio of widths of common / individual sperm duct greater than 3 : 1 | *walkeri* |

## DISCUSSION

Female *L. williamsi* have been collected on a number of occasions in Utinga and Serra dos Carajás forests, however at present only three examples are in our collection. One male was captured using a Disney trap in Utinga in 1968, unfortunately this specimen cannot be found, however we associate the sexes here on the bases of sizes and collection sites. One of the specimens had an abdominal infection of over 100 small worms (Fig. 2.4). Our unit was previously referred to this species as "N" and/or 222.12.

*L. carmelinoi* has been collected on one occasion off tree trunks. Several hundred *L. carmelinoi* were collected from a detached portion of termite nest situated in the cooking area of a rural house in the Saubal area of Santarém. These flies were feeding at night, on a dog which slept close to a piece of termite nest, and spent the day hidden in the small cavities of the nest. Although the dog in question was shown to be infected with *Leishmania chagasi* no evidence could be found for the development of this parasite in *L. carmelinoi* (Lainson et al., 1985); subsequent attempts to infect laboratory-bred specimens of this fly with various *Leishmania* species have failed.

This species is named in honour of Mr. Manuel Carmelino Mendes de Souza who has worked with this unit for 20 years and discovered the engorged females resting on the fragment of termite nest.

*L. baculus* male and females are associated on the bases of size and collecting data, since two males were taken in the CDCs at the same time as the females. Eighteen females were dissected (Ryan, Lainson & Shaw, 1986) although none was found to be infected.

These three species belong to the group *walkeri* (Martins, Williams & Falcão, 1978) however this may also be considered as a series of the *migonei* group (Young & Fairchild, 1974) and these authors may be consulted for pertinant references. The other species in this series are:

*L. dubitans* (Sherlock, 1962), resurrected by Feliciangeli (1985).

*L. evandroi* (Costa Lima & Antunes, 1936).

*L. lenti* (Mangabeira, 1938) synonimized (Martins, Williams & Falcão, 1978) with *L. lentioides (Flebotomus pinottii* of Lucena, 1960 renamed by Forattini, 1971*)* only male known.

*L. sericea* (Floch & Abonnenc, 1944) it has been suggested that this is the male of *Lu.* sp. de Baduel (Floch & Abonnenc, 1945) (Leger et al., 1977; Young, 1979 and pers. comm. 1985). Examples of both have been captured in light traps (Ready, Lainson, Shaw & Fraiha collection) in the same site in Jari, Pará state and this along with their comparative sizes suggests that they are conspecific.

*L. walkeri* (Newstead, 1914) synonimized with *L. gasti* (Sherlock, 1962) by Young (1979) and *L. marajoensis* (Feliciangeli, 1986).

*L. spp.* (Young, pers. comm. 1985) an undescribed male from Marabá, Pará.

Keys are available (Young & Fairchild, 1974 and Young, 1979) to the group level, thus we present here a pictorial and word key to the species of the *walkeri* group. Fig. 4 shows the genital filament tips, which are, in most cases, modified and Fig. 5 the spermathecae which are characteristic. Difficulty may be experienced in separating the genital filament tips (Fig. 4) of *L. walkeri, L. dubitans* and *L. sericea*, however the former only has a dorsal projection to the aedeagus. The latter two may be separated by the additional characters of the basal tuft, the former has a tuft of about 35 fine setae, the latter with about 20 blade like setae. The spermathecae of these species are generally similar but may be separated by the ratio of widths and lengths of common/individual duct (Young, 1979) see Fig. 5.1 and female keys. It should be noted that *L. baculus* does indeed have a subterminal bristle and is here included in the *walkeri* group after the suggestion of Dr. D.G. Young (personal communication 1985).

Unfortunately *L. lentioides* was poorly described from one male, which our inquiries to date have failed to find. However the published diagrams shows the detail of the genital filament tips, which appear different to other species. Apart from shape the major difference is length, *L. lenti* genital filament tips are 0.043 long whereas *L. lentioides* only 0.034 although we have seen specimens of *L. lenti* with tips 0.051 long. Indeed a specimen from the Mangabeira collection (tube 1031, collected Jacobina, Bahia, 06.01.1942) which he identified as *L. lenti* is identical to *L. lentioides.* Further samples are needed from the type localities before one may be absolutely sure of this synonimity.

RESUMO

*Lutzomyia carmelinoi* n.sp., uma nova espécie e as fêmeas de *L. baculus* e *L. williamsi* são descritas com uma chave para os outros flebótomos do grupo *walkeri.*

ACKNOWLEDGEMENTS

We wish to thank the following for their invaluable help in undertaking the field captures and laboratory colonizations: José I. de Almeida, Iorlando da R. Barata, Augusto F.N. Filho, João B.P. da Luz, Deocleciano G. Primo, Sued de N.F. Silva and Manoel C.M. de Souza. We are also grateful to Dra. Dora F. Piñero and Dr. David G. Young for their helpful criticism of an earlier draft. Professor A.V. Martins kindly supplied a male *L. baculus* (Lâmina No. 61.585) from the collection at INERu, Belo Horizonte.

REFERENCES

COSTA LIMA, A. da & ANTUNES, P.C.A., 1936. Sôbre um novo Phlebótomo encontrado no norte do Brasil. *Bras. Méd., 50* :419-422.

FELICIANGELI, M.D., 1986. Taxonomic review of *Lutzomyia walkeri* (Newstead, 1914) (= *Lutzomyia marajoensis* (Damasceno & Causey, 1944) and the resurrection of *Lutzomyia dubitans* (Sherlock, 1962) (Diptera: Psychodidae). *Mem. Inst. Oswaldo Cruz, 80* :307-312.

FLOCH, H. & ABONNENC, E., 1944. Phlébotomes de la Guyane Française (VII). Description de six espèces nouvelles. *Inst. Pasteur Guyane Franc. Terr. Ilnini, 80* :20 pp.

FLOCH, H. & ABONNENC, E., 1945. Phlebotomes de la Guyane Française (XIII). Description de deux nouvelles femelles. *Inst. Pasteur Guyane Franc. Terr. Ilnini, 98* :4 pp.

FORATTINI, O.P., 1971. Sôbre a classificação da subfamilia Phlebotominae nas Américas (Diptera, Psychodidae). *Papeis Avulsos Zoologia, 24* :93-111.

LAINSON, R.; SHAW, J.J.; RYAN, L.; RIBEIRO, R.S.M. & SILVEIRA, F.T., 1984. Presente situação da leishmaniose visceral na Amazônia, com especial referência a um novo surto da doença ocorrido em Santarém, Estado do Pará, Brasil. *Boletim Epidemiológico SESP,* Nº Especial, julho 1984.

LAINSON, R.; SHAW, J.J.; RYAN, L.; RIBEIRO, R.S.M. & SILVEIRA, F.T., 1985. Leishmanias's in Brazil: XXI. Visceral leishmaniasis in the Amazon Region and further observations on the role of *Lutzomyia longipalpis* (Lutz & Neiva, 1912) as the vector. *Trans. R. Soc. Trop. Med. & Hyg., 79* :223-226.

LAINSON, R.; SHAW, J.J.; WARD, R.D. & FRAIHA, H., 1973. Leishmaniasis in Brazil: IX. Considerations on the *Leishmania braziliensis* complex: importance of sandflies of the genus *Psychodopygus* (Mangabeira) in the transmission of *L. braziliensis braziliensis* in North Brazil. *Trans. R. Soc. Trop. Med. & Hyg., 67* :184-196.

LEGER, N.; ABONNENC, E.; PAJOT, F.X.; KRAMER, R. & CLAUSTRE, J., 1977. Liste commentée des Phlébotomes de la Guyane Française. *Cah. ORSTOM sér. Ent. Med. & Parasit., 15* :217-232.

LUCENA, D.T. de, 1960. *Flebotomus pinottii* n.sp., de Arapiraca, Alagoas, Brasil. *Rev. Bras. Malariol. Doenças Trop., 12* :75-79.

MANGABEIRA, F.O., 1938. Sobre duas novas espécies de Flebotomus (Diptera, Psychodidae). *Mem. Inst. Oswaldo Cruz, 33* :349-456.

MARTINS, A.V.; WILLIAMS, P. & FALCÃO, A.L., 1978. *American sand flies (Diptera : Psychodidae, Phlebotominae).* Acad. Bras. Ciências, Rio de Janeiro, 195 pp.

NEWSTEAD, R., 1914. Notes on *Phlebotomus,* with descriptions of new species. Part II. *Bull. Ent. Res., 5* :179-192.

RYAN, L.; LAINSON, R. & SHAW, J.J., 1986. Leishmaniasis in Brazil: XXIV. Natural flagellate infections in 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 Carajás. *Trans. R. Soc. Trop. Med. & Hyg.* (in press).

SHERLOCK, I.A., 1962. Sobre alguns *Phlebotomus* e *Brumptomyia* da Colômbia (Diptera, Psychodidae). *Mem. Inst. Oswaldo Cruz, 60* :323-336.

YOUNG, D.G., 1979. A review of the bloodsucking Psychodid flies of Colombia (Diptera : Phlebotominae and Sycoracinae). Univ. Fla. Exp. Stn. Tch. Bull., 806, 266 pp.

YOUNG, D.G. & FAIRCHILD, G.B., 1974. Studies of Phlebotomine Sandflies. *Annual Report of Dept. Ent. & Nemat.*, Uni. Florida, Gainesville, Florida 32611, 151 pp.