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TAXONOMIC STUDIES OF THE SUBGENUS *HELCOCYRTOMYIA* – II. SERIES *VEXATOR* (DIPTERA, PSYCHODIDAE, PHLEBOTOMINAE)

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Continuing to review the subgenus Helcocyrtomyia *(Diptera, Psychodidae, Phlebotominae) some specimens of sandflies from the* vexator *series were examined. Taxonomic remarks, geographic distribution and drawings of those species are presented.*

Key words: taxonomy – Phlebotominae – series *vexator* – *Helcocyrtomyia* – geographic distribution

The systematics of sandflies received more attention after the demonstration of their involvement in the transmission of diseases to man. But with the increase in the number of new species being described, the selection of the most relevant structures for distinction among them showed up to be more difficult.

The genus *Phlebotomus* Rondani was initially divided into subgenera based on the structure of the male hypopygium (França, 1919, 1921; França & Parrot, 1920, 1921). The American phlebotominae were distributed into three subgenera: *Brumptomyia* França & Parrot, *Lutzomyia* França e *Neophlebotomus* França & Parrot. The presence of spines or tuft of bristles in the base of the basistyle of the males was taken as an essential morphological character for the subgenus *Brumptomyia,* comprising then two species, *brumpti* Larousse and *vexator* Coquillet. Dyar (1929) considered *brumpti* as the type species for *Brumptomyia* and also included other six species in the subgenus: *peruensis,* Shannon, *noguchii* Shannon, *quinquefer* Dyar, *cortelezzii* Brèthes, *verrucarum* Townsend, and *walkeri* Newstead.

New diagnostic characters were suggested by Mangabeira (1942) but still maintaining *Phlebotomus brumpti* as the type species. Some species earlier classified as *Brumptomyia* (e.g. *Phlebotomus vexator*) by the presence of a tuft of bristles in the basistyle were included by Mangabeira & Galindo (1944) in the *vexator* group: *vexator, trinidadensis* Newstead, *sordellii* Shannon & Del Ponte, *noguchii, peruensis, quinquefer, yucatanensis* Galliard, *rickardi* Costa Lima, *peresi* Mangabeira, *oswaldoi* Mangabeira, *villelai* Mangabeira, and *stewarti* Mangabeira & Galindo. The following characters were considered in the description of the group *vexator:* "Basistyle with or without a tuft of bristles in the internal face but without a row of bristles in the upper half. Dististyle with five spines of which two are terminal; usually there is a pair of median spines but inserted in different position. Paramere without appendix or spines. Lateral lobe unarmed".

Later on, Theodor (1948) recognized two genera for the Old World sand flies, *Phlebotomus* and *Sergentomyia,* and two genera for the New World species: *Brumptomyia* and *Lutzomyia.* The last two had been considered as subgenera until then. The species previously classified as *Lutzomyia* by Theodor (1948) were grouped in the genus *Sergentomyia* by Barretto (1955), due to morphological similarities.

Based on the descriptions by Theodor (1948) for the genus *Brumptomyia,* a new classification was proposed by Fairchild (1955) including species from both the Old and the New World. The taxonomic status of *Brumptomyia* returned to subgenus which was divided into groups. The species previously described under the same subgenus by Mangabeira & Galindo (1944) plus the species from the group *vexator* (Mangabeira & Galindo, 1944) were joined as group *brumpti.*

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According to Fairchild (1955), the characters present in all the species of the group *brumpti* were "the presence of five spines on the dististyle, a basal tuft on basistyle and usually annulate spermathecae". The group *brumpti* was divided in two series, *brumpti* and *vexator*. The *brumpti* series was very homogeneous, showing elongate dististyles, several rows of horizontal teeth in the cibarium and larva with two caudal setae in all stages. The series *vexator,* less homogeneous, comprised species with the following characters: "male dististyles five-spined and with a terminal pair, though with the total lenght shorter than in the *brumpti* series. A basal tuft is commonly present on the basistyle, reduced to a few lax setae in some species or rarely absent. The cibarium has a single row of horizontal teeth, sometimes displaced laterally. The spermathecae are usually slender with a relatively long and slender duct, mostly with few to many annuli on the basal portion of the spermathecal body, rarely the spermathecae quite smooth, but all with a terminal knob".

Barretto (1961, 1962) created a subgenus *Helcocyrtomyia,* whose type species was *Lutzomyia peruensis.* The new subgenus comprised the species from the *vexator* series of Fairchild (1955) plus some others classified before under the group *cruciatus* from subgenus *Brumptomyia* by Fairchild (1955).

The subgenus *Helcocyrtomyia,* as defined by Barretto in 1962 (Martins et al., 1978) comprises species with a long fifth palpal segment, greater in length than the third segment and sometimes longer than the sum of the lengths of segments 3 and 4. The ascoids are usually short or very short.

The males show five spines in the distystile, of which two are terminal and the others are unpaired. The basystile has an inner basal tuft, which may be compact or difuse or, at times, composed of so few hairs that the tuft seems to be absent. The paramere is simple and unadorned, and the lateral lobe is unarmed. The cibarium of the female has four horizontal teeth with or without vertical teeth; the pigment patch is well-defined or pale; the cibarial arch is incomplete, and often laterally flared. The pharynx of several species is armed with spines. The body of the spermatheca is capsulate, with or without annulations and with a well-developed "head"; individual spermathecal ducts are long and narrow and the common duct is very short or absent.

Forattini (1971) proposed a new classification for the phlebotominae with an increased number of genera and a decreased number of subgenera. The American phlebotominae were distributed into seven genera including *Lutzomyia.* The great majority of species of *Helcocyrtomyia* Barretto (1962) pertains to the subgenera *Lutzomyia* e *Trichopygomyia* Barretto.

Attempting to make the taxonomic studies of *Helcocyrtomyia* easier, Martins et al. (1978) proposed the division of the *Helcocyrtomyia* species into three series (*oswaldoi, peruensis* and *vexator*), based not only on morphological characters but also on some data concerning geographic distribution. Even though lacking taxonomic status, these series have been used throughout this study (Dias, 1989; Dias et al., 1991).

The present paper reviews the species pertaining to the *vexator* series, as proposed by Martins et al. (1978), "the cibarium of the female with few or many very fine vertical teeth which, frequently, are so small that they can be overlooked. Body of the spermatheca with the shape of a simple capsule; individual spermathecal ducts are long; common duct is lacking".

MATERIALS AND METHODS

This work was based on sandflies coming from donations and deposited in the American Phlebotominae collection at the Centro de Pesquisas René Rachou (CPqRR), Fundação Oswaldo Cruz (FIOCRUZ), Belo Horizonte, Brazil.

The sandflies were identified using specific descriptions, taxonomic keys, comparison with species of the standard collection and micrometry data. Additional information was provided by drawings of the available specimens in a light chamber.

The classification adopted in this work was that proposed by Martins et al. (1978).

RESULTS

In our review of the subgenus *Helcocyrtomyia,* 8887 specimens of sandflies were examined. Among these, 7650 belonged to the *oswaldoi* series (Dias et al., 1991); the remaining were from the *vexator* and *peruensis* series. Only the *vexator* series will be dealt with in the present paper.

Lutzomyia (Helcocyrtomyia) apache
Young & Perkins (Fig. 1: a, b, c, d, e, f)

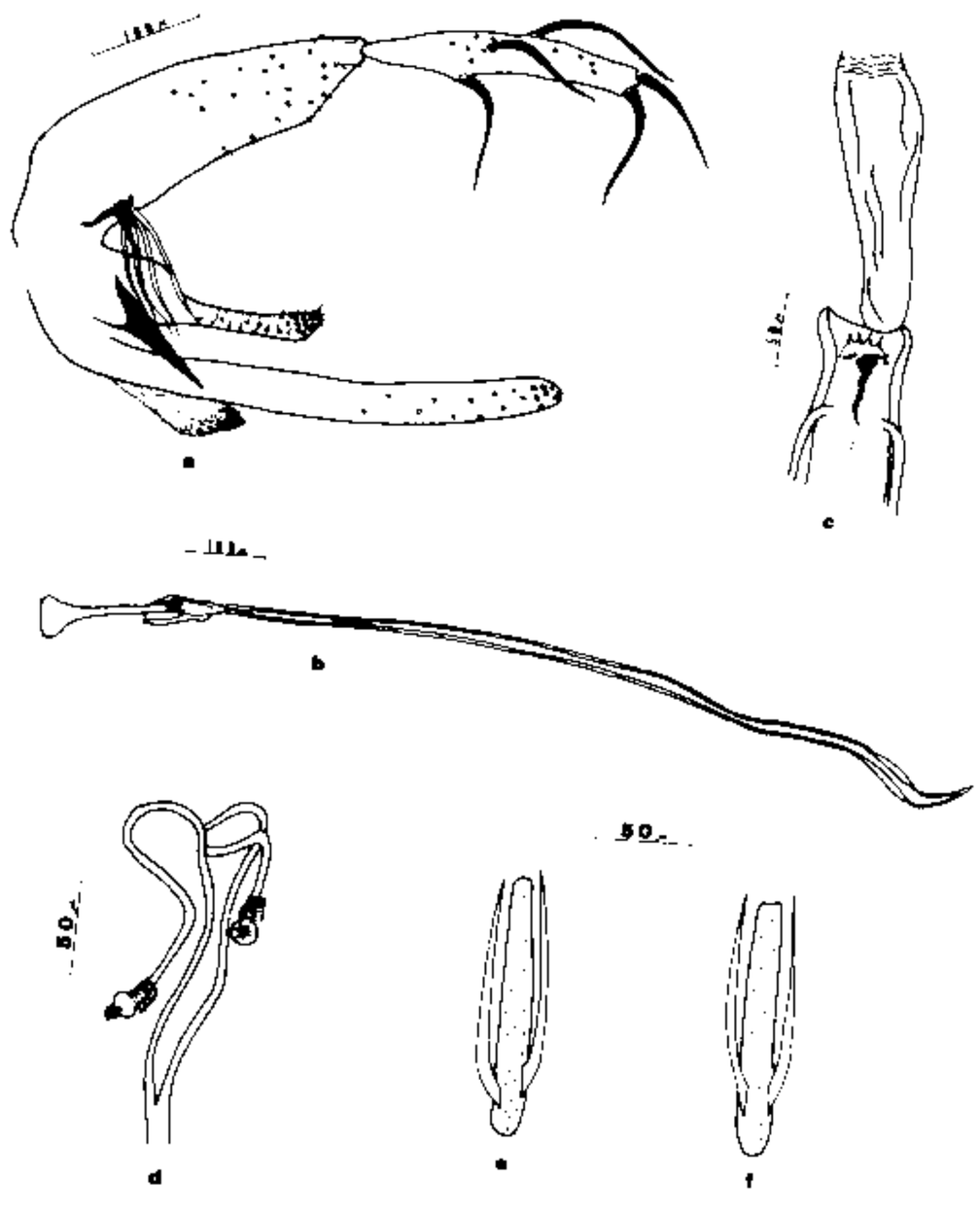

Fig. 1: *Lutzomyia apache* (Paratypes male and female – reference collection) – a: terminalia; b: genital pump and filaments; c: pharynx and cibarium; d: spermathecae; e: male flagellomere II; f: female flagellomere II.

Lutzomyia apache Young & Perkins, 1984. *Mosq. News, 44:* 294 (male & female).

Types: holotype male and allotype female deposited in The United States National Museum of Natural History, Washington, D.C., USA. *Type locality:* Apache Co., Arizona, USA. *Material examined:* USA. Arizona – Paratypes, 1 ♂ & 1 ♀ (Apache Co.), Springerville, 3-VII-53, light trap, W. Wirth col. (Specimens donated by D. G. Young).

Geographic distribution: USA – Arizona – Apache Co. (31° 46'N; 109° 06'W); Cochise Co. (32° 06'N; 109° 58'W); Gila Co. (33° 00'N; 112° 46'W).

Among the species of the *vexator* series, *L. apache* is very similar to *L. oppidana* and *L. vexator,* but they can be distinguished by some characters. *L. apache* differs from *L. oppidana* mainly by the shape of the paramere. In *L. oppidana* it is bigger, rounded-apex and with bristles implanted only at the distal part. In *L. apache* the paramere is smaller with bristles along every superior extention. *L. apache* can be distinguished from *L. vexator* not only by the size of the paramere, bigger in *L. apache,* but also by the arrangement of spines in the distystile. In *L. apache* the two basal spines are inserted at different levels, while in *L. vexator* one of them is implanted well below all the other four.

In addition, Young & Perkins (1984) noted that the ascoids in *L. apache* transcend the apice of the segment, but not in *L. oppidana* or *L. vexator.* Other difference considered by the authors is the lenght of the extremity of the genital filaments after the inflated portion, that in *L. apache* is much longer than in *L. oppidana* or *L. vexator.*

The females can be distinguished mainly by the thickness and the lenght of the individual spermathecal ducts. In *L. apache* these ducts are more slender and longer than in *L. oppidana* and *L. vexator.*

Lutzomyia (Helcocyrtomyia) oppidana
(Dampf) (Fig. 2: a, b, c, d, e, f)

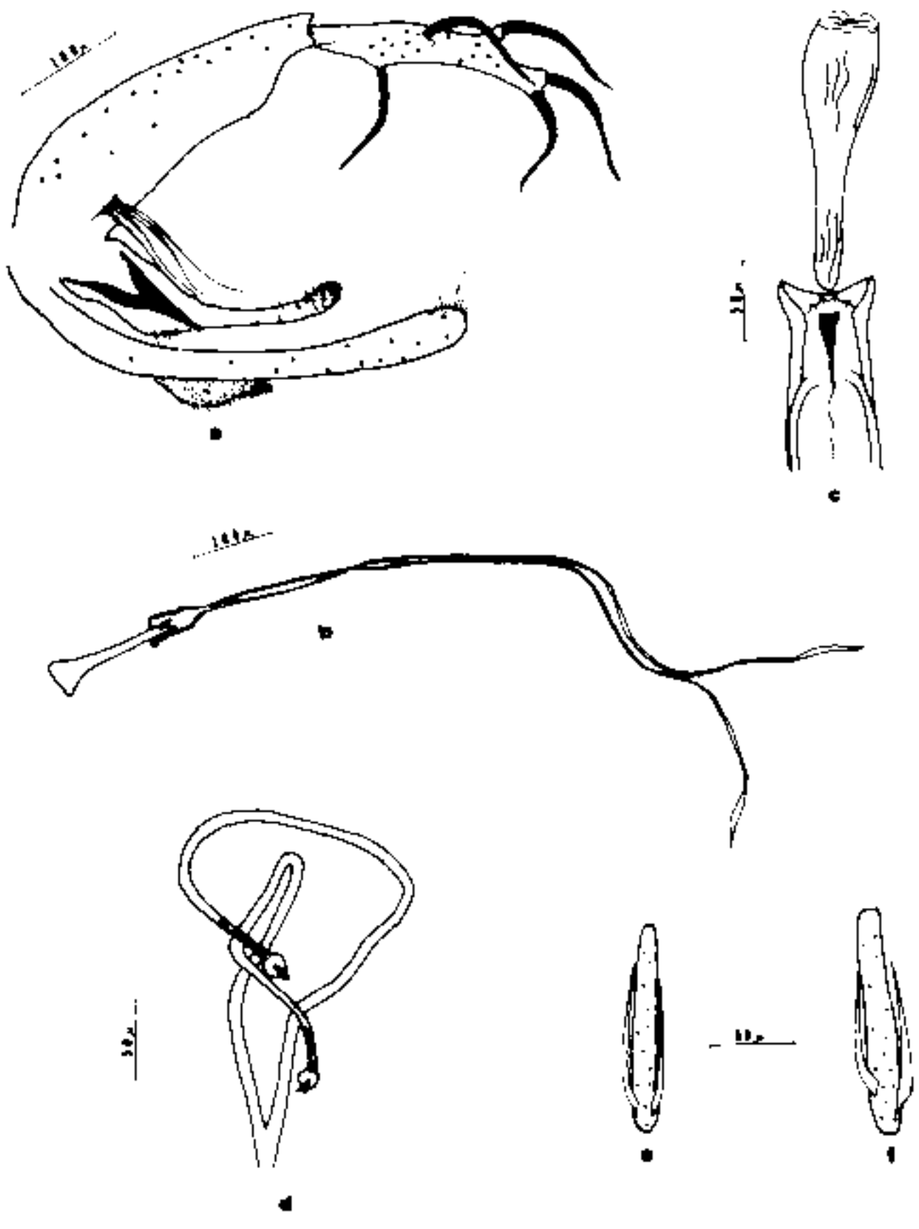

Fig. 2: Lutzomyia oppidana (male no. 6801/female no. 6729) – a: terminalia; b: genital pump and filaments; c: pharynx and cibarium; d: spermathecae; e: male flagellomere II; f: female flagellomere II.

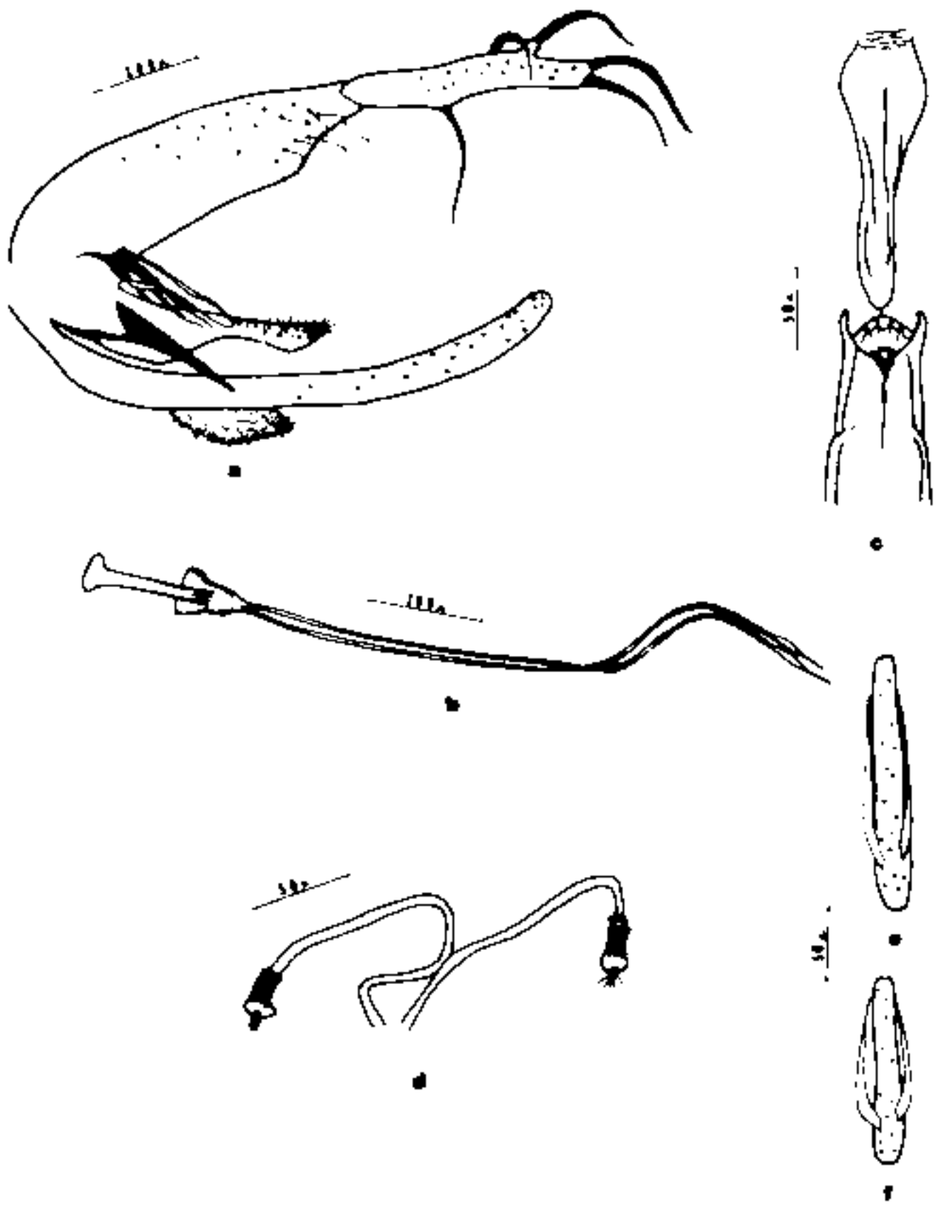

Fig. 3: *Lutzomyia vexator* (male no. 6760/female no. 6757) – a: terminalia; b: genital pump and filaments; c: pharynx and cibarium; d: spermathecae; e: female flagellomere II; f: male flagellomere II.

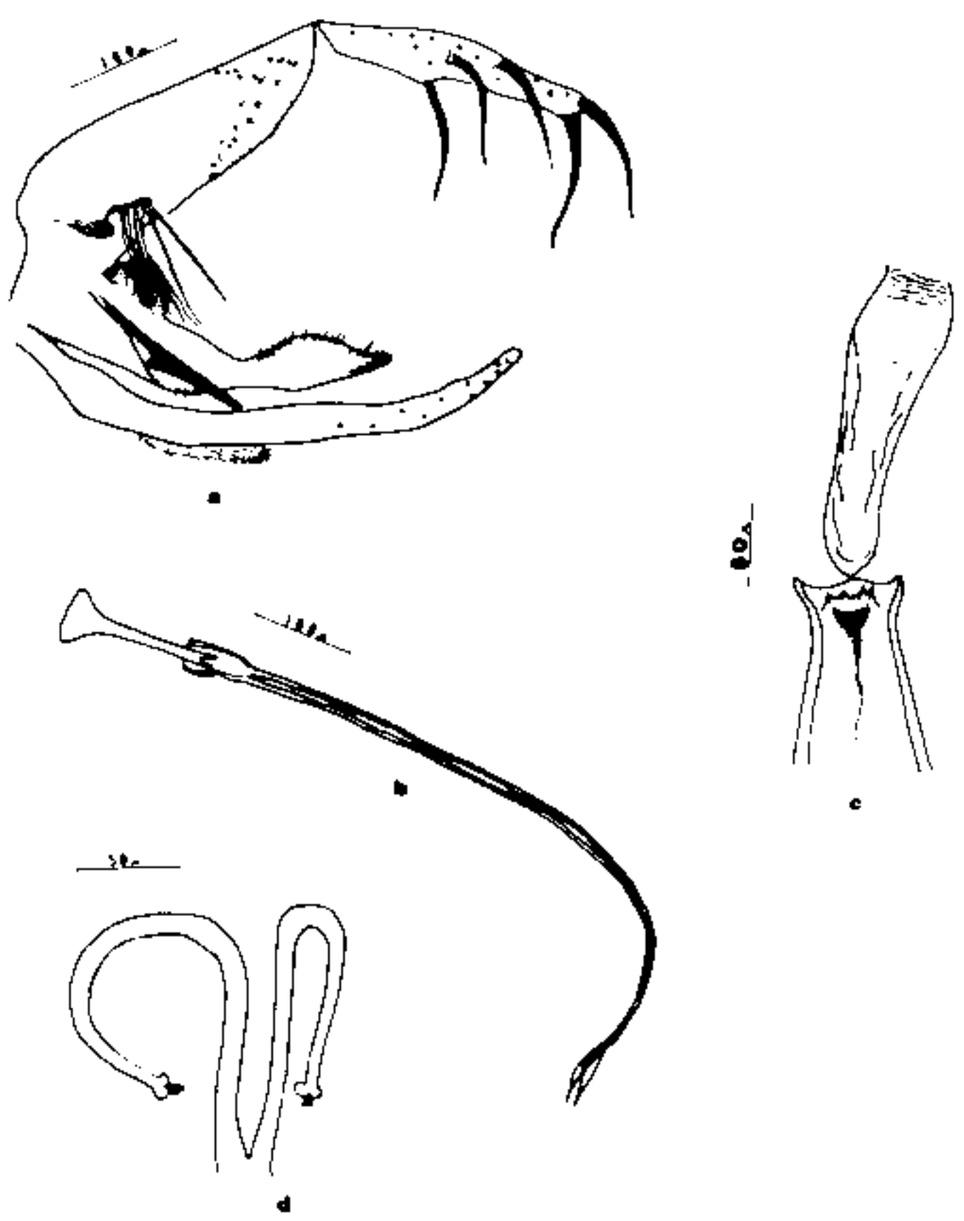

Fig. 4: *Lutzomyia vindicator* (male and female – reference collection) – a: terminalia; b: genital pump and filaments; c: pharynx and cibarium; d: spermathecae.

Phlebotomus oppidanus Dampf, 1944. *Rev. Soc. Mex. Hist. Natural, 5:* 247-248, fig. V, VI (female); Fairchild & Hertig, 1957. *Ann. Entomol. Soc. America, 50:* 326 (male & female in keys), 330 (male).

Lutzomyia (Lutzomyia) oppidana Forattini, 1971. *Pap. Av. Zool., 24:* 99. Forattini, 1973. *Entomol. Méd.,* 4th vol.: 263 (male & female).

Lutzomyia (Helcocyrtomyia) oppidana Young & Perkins, 1984. *Mosq. News, 44:* 266 (key), 295 (male & female).

Type material: Holotype female (N. F. 2110) and 14 ♂♂ deposited in the private collection of Dr A. Dumpf. *Type locality:* San Jacinto, Mexico, D. F., Mexico. *Material examined:* USA – Washington (Otello) 2 ♂♂ & 1 ♀, 9-VIII-60, light trap, R. Harwood col. (specimens donated by G. B. Fairchild).

Geographic distribution: CANADA – Alberta (54° 40'N; 115° 00'W); British Columbia (55° 00'N; 125° 15'W); MEXICO – Mexico (San Jacinto); Nuevo Leon (Monterrey – 25° 40'N; 100° 30'W); USA – Colorado (Fort Collins Co. – 40° 30'N; 105° 04'W) Larimer Co.; Montana (Ravalli Co.); Texas (Presidio Co. – 29° 39'N; 104° 20'W); Washington (Adams Co. – Otello 46° 50'N; 119° 10'W); Whitman Co. – 42° 04'N; 70° 55'W).

L. oppidana is easily identified by the shape of the paramere, arrangement of the spines in the dististyle and by the presence of a basal tuft composed of few hairs in the basistyle. *L. vexator* is the closest species to *L. oppidana,* but the former presents a longer rounded-apex paramere with some bristles implanted on its distal part. The paramere in *L. vexator* is shorter, with a squared base and dilated extremity, and with many bristles in all dorsal extension of the paramere. Other difference is the length of the genital filaments, that in *L. oppidana* is about six times the lenght of the genital pump, while in *L. vexator* it is reduced to four times. In addition to the lenght, another difference is seen in the distal part of the genital filaments. In *L. oppidana* these extremities are shorter than the inflated region, while in *L. vexator* they are longer.

Both females present the cibarium with four horizontal teeth connected in the base, vertical teeth, pigment patch and incomplete cibarial

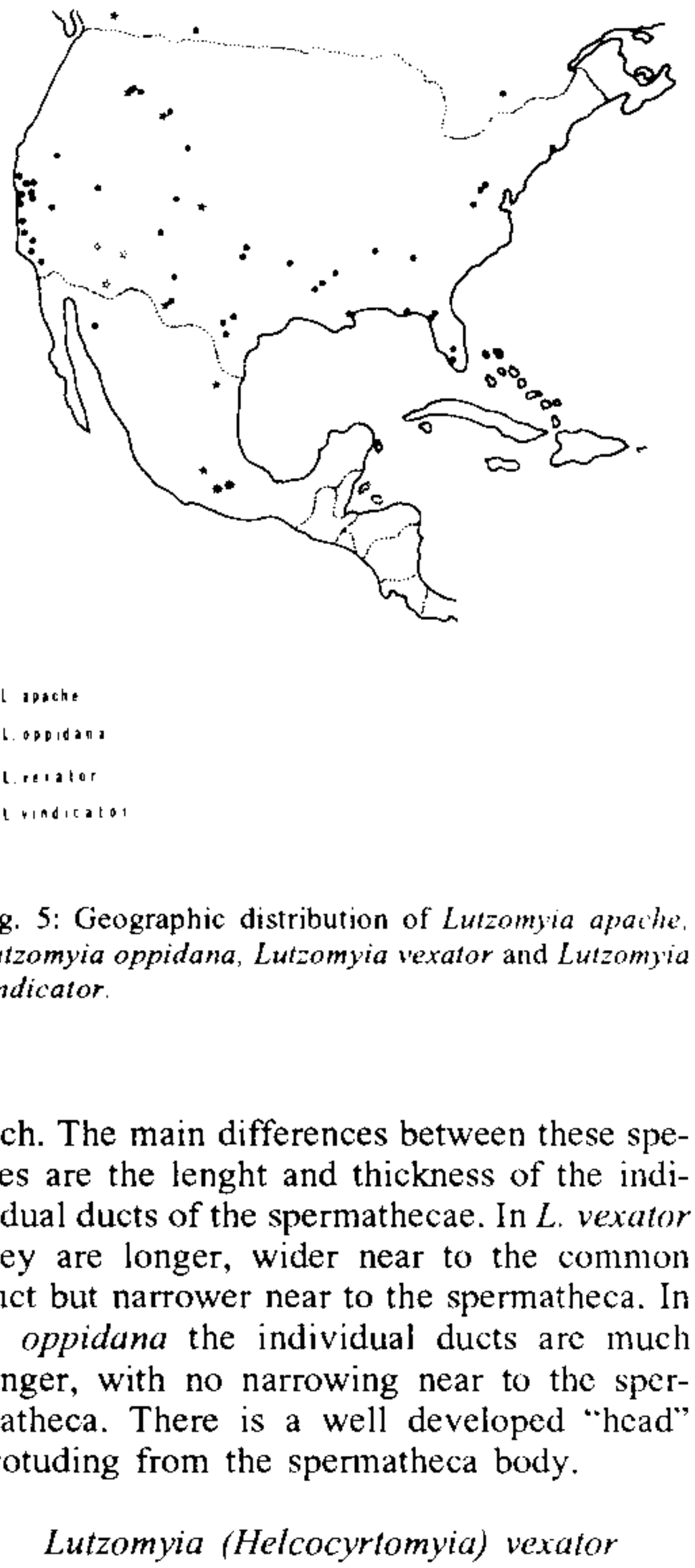

Fig. 5: Geographic distribution of *Lutzomyia apache*, *Lutzomyia oppidana*, *Lutzomyia vexator* and *Lutzomyia vindicator*.

arch. The main differences between these species are the lenght and thickness of the individual ducts of the spermathecae. In *L. vexator* they are longer, wider near to the common duct but narrower near to the spermatheca. In *L. oppidana* the individual ducts are much longer, with no narrowing near to the spermatheca. There is a well developed "head" protuding from the spermatheca body.

Lutzomyia (Helcocyrtomyia) vexator
(Coquillett) (Fig. a, b, c, d, e, f)

Phlebotomus vexator Coquillett, 1907. *Entomol. News, 18:* 102 (male & female). Mangabeira & Galindo, 1944. *Am. J. Hyg., 40:* 183-184, Figs I. III (male & female).

Phlebotomus vexator occidentis Fairchild & Hertig, 1957. *Ann. Entomol. Soc. Am., 50:* 324 (male), 326 (male & female in keys).

Lutzomyia (Lutzomyia) vexator Forattini, 1971. *Pap. Av. Zool., 24:* 100. Forattini, 1973. *Entomol. Méd.*, 4th vol.: 272 (male & female).

Lutzomyia (Helcocyrtomyia) vexator Young & Perkins, 1984. *Mosq. News, 44:* 278-280 (male & female).

Type material: 1 ♂ & 4 ♀ ♀ deposited in The United States National Museum of Natural History, Washington, D.C., USA. *Type locality:* Plummer's Island, Maryland, USA. *Material examined:* USA – Washington (Otello) 1 ♂ & 1 ♀, 26-VII-60, light trap, R. Harwood col.; Texas (Fredericksburg) 1 ♂ & 1 ♀, VII-68, H. Borchers col. (Specimens donated by D. G. Young).

Geographic distribution: CANADA – Alberta – Police Greek (49° 06'N; 116° 10'W); Ontario – Black Lake (44° 46'N; 76° 18'W). MEXICO – Sonora (28° 00'N; 111° 00'W). USA – Alabama, Lauderdale Co.; Arkansas, Garland Co.; California – Alameda Co. – Livermore (37° 40'N; 121° 46'W); Strawberry Canyon (39° 35'N; 121° 07'W); Contra Costa Co. – Byron (37° 50'N; 121° 39'W) Marsch Creek; Walnut Creek (37° 55'N; 122° 83'W); Kern Co. – Bakersfield (35° 25'N; 119° 00'W); Mann Co. – Fairfax (37° 59'N; 122° 35'W); Mendocino Co. – University of California Hopland Field Station (38° 58'N; 123° 08'W); Modoc Co. – Alturas (41° 30'N; 120° 34'W); Topaz Lake (38° 40'N; 119° 31'W); Monterey Co. – Hastings Reservation; San Luis Obispo Co. – Santa Margarita (35° 22'N; 120° 36'W); San Mateo Co. – Woodside (37° 26'N; 122° 15'W); Solano Co. – Solano (32° 59'N; 117° 16'W); Ventura Co. – Fillmore (34° 25'N; 118° 55'W); Yolo Co. – Capay (38° 43'N; 122° 03'W); Colorado – El Paso Co.; Connecticut – Middlesex Co.; Florida – Alachua Co. – Gainesville (29° 37'N; 82° 21'W); Collier Co.; Highlands Co.; Levy Co.; Wakulla Co.; Georgia – Gwinnett Co.; Louisiana – Jackson Co. – Ansley (32° 29'N; 92° 40'W); Morehouse Co.; Orleans Parishes Co. Maryland – Montgomery Co. – Plummer's Island (47° 21'N; 116° 59'W); Mississipi – Washington Co.; Montana – Ravalli Co.; New Mexico – Eddy Co.; Rio Arriba Co.; Oklahoma – Caddo Co.; Oklahoma Co.; Texas – Edwards Co.; Gillespie Co. – Fredericksburg (38° 50'N; 120° 00'W); Presidio Co. (29° 30'N; 104° 20'W); Uvalde Co. – Garner State Park (43° 04'N; 93° 37'W); Virginia – Augusta Co.; Fauquier Co. – Paris; Washington – Adams Co. – Otello (46° 50'N; 119° 10'W); Whitman Co. – Snake River (46° 25'N; 118° 40'W); Wyoming – Goshen Co.

Species of wide distribution in North America, it was described in 1907 by Coquillett among specimens collected in Maryland (Plummer's Island). Fairchild & Hertig (1957) examined specimens from California and veri-

fied some morphological variations relative to the Plummer's Island species. Those were named as subspecies *L. vexator occidentis*. Chaniotis & Anderson (1964, 1968) redescribed this subspecies from California and confirmed the morphological variation amongst specimens. The morphological variation was also noticed by Young & Perkins (1984) when examining specimens from differents localities. The authors considered *L. vexator* a monotypic taxon without subspecies.

Lutzomyia (Helcocyrtomyia) vindicator (Dampf) (Fig. a, b, c, d)

Phlebotomus vindicator Dampf, 1944. *Rev. Soc. Mex. Hist. Nat., 5:* 248-249, Fig. VII, VIII (female). Dampf, 1947. *Rev. Soc. Mex. Hist. Nat., 8:* 206-208, Fig. XXIV, XXV (male & female).

Lutzomyia (Lutzomyia) vindicatrix Forattini, 1971. *Pap. Av. Zool., 24:* 100. Forattini, 1973. *Entomol. Méd.,* 4th vol.: 273 (male & female).

Types: Female (F – 6291) and alotype male (6186 – 13) deposited in the private collection of Dr. A. Dampf. *Type locality:* Cualtla, Estado de Morelos, Mexico. *Material examined:* MEXICO – Morelos (Miacatlan) 1 ♂ & 1 ♀, 1-V-80, light trap, M. Camino col. (Specimens donated by D. G. Young).

Geographic distribution: MEXICO – Federal District – Bosque de Chapultepec (19° 15'N; 99° 10'W); Morelos – Canon de Lobos (18° 55'N; 99° 15'W); Cuautla (19° 26'N; 104° 26'W); Miaclatam; Rio Balsas (17° 55'N; 102° 10'W); Caxaca – Ixtlan (20° 38'N; 100° 36'W); Yolox (17° 37'N; 96° 34'W).

The male of *L. vindicator* can be easily distinguished from other species of *Helcocyrtomyia* due to a characteristic morphology. The basistyle bears a basal tuft with 8 long bristles implanted in prominent tubercle; paramere wide in the base with a bristly structure on its upper part, near the basistyle. The paramere narrows in the median region.

The female shows a cibarium with 4 teeth attached in the base, very similar to the cibarium of *L. oppidana* e *L. vexator*.

The distinction can be done mainly by the spermatheca. In *L. vindicator* the individual ducts are thicker and shorter than in the other two species.

REMARKS

The species in the subgenus *Helcocyrtomyia* show a high degree of similarity in general. Among 8887 specimes examined in this work, the great majority pertained to the *oswaldoi* series that occurs in Brazil (Dias et al., 1991). The species from *vexator* and *peruensis* series are distributed in North America and Central/South (Andes) America, respectively. The number of specimens examined from the last two series is reduced as they came only from donations.

From the classical systematics point of view and according to our study, *vexator* series of *Helcocyrtomyia* comprises four species *L. apache, L. oppidana, L. vexator* and *L. vindicator*. There is a reduced number of papers concerning the biology and importance of these species. Chaniotis & Anderson (1964, 1968) and Endris et al., (1982) succeeded in rearing *L. vexator* and obtained some information on its biology under both field and laboratory conditions. *L. vexator* was also incriminated as a possible vector of malaria and trypanosomiasis of cold blooded animals (Anderson & Ayala, 1968; Ayala & Lee, 1970; Ayala, 1971a, b). Some additional observations were described by Harwood (1965) concerning the feeding habits of *L. oppidana*. This author verified that females in the laboratory could feed on snakes and lizards, but not on frogs, white mice or humans.

Recently, Williams (1991) considered the morphological differences together with evidence of geographical distribution and proposed that *Helcocyrtomyia* is not a monophylletic group. The *vexator* and *peruensis* series were combined as of Neartic origin with a southward extension through the Andes, while the *oswaldoi* series is a South American group. The recognition of *oswaldoi* series as a separate subgenus was suggested.

In our opinion, the *oswaldoi* series can be raised to subgenus, as the species involved show similar behavior and similar morphological characters, besides a peculiar geographical distribution that suggests South America as its origin. But concerning *peruensis* and *vexator* series, the morphology and behavior of some species is quite unlike, suggesting different dispersion points. Further work on the phylogeny and biology of *Helcocyrtomyia* is needed to clarify the systematic position of these species.

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