Lutzomyia Sand Flies (Diptera: Psychodidae) from Middle and Lower Putumayo Department, Colombia, with New Records to the Country

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A total of 4,840 phlebotomine sand flies from 54 localities in Putumayo department (=state), in the Colombian Amazon region, were collected in Shannon traps, CDC light traps, resting places and from human baits. At least 42 Lutzomyia *species were registered for the first time to the department.* Psychodopygus *and* Nyssomyia *were the subgenera with the greatest number of taxa, the most common species being* L. (N.) yuilli *and* L. (N.) pajoti. *They were sympatric in a wide zone of Putumayo, indicating that they should be treated as full species (new status). Among the anthropophilic sand flies,* L. gomezi *and* L. yuilli *were found in intradomiciliar, peridomestic, urban or forest habitats.* L. richardwardi, L. claustrei, L. nocticola *and* L. micropyga *are reported for the first time in the Colombian Amazon basin.* L. pajoti, L. sipani *and* L. yucumensis *are new records for Colombia.*

Key words: *Lutzomyia - Lutzomyia yuilli - Lutzomyia pajoti* - Amazon region - distribution - male anomaly - Colombia

Putumayo department (25,700 km^2) is located in the south of the Republic of Colombia, at the foothills of the Andes, in the Amazon region. Based on geography and ecology, Putumayo is divided in higher, middle and lower elevations. Only four of the 13 municipalities (counties) are located between 2,000 and 3,500 m a.s.l., in the higher Putumayo. This area represents about 5% of the total territory of the state, and contains about 10% of the total human population. Most of the 250,000 inhabitants live in the middle Putumayo (82%), which has an average altitude of 600 m. The lower Putumayo, with an average altitude of 260 m, is the largest in area (52%) but has the smallest human population. Following Holdridge's classification, based on climate and vegetation, Espinal (1977, 1989) recognized two main transitional life zones in the middle and lower Putumayo, a Tropical Wet Forest/Tropical Moist Forest, which occupies the most extensive area, and a Premontane Wet Forest/Tropical Wet Forest, around Mocoa, the capital of the state. Human cases of cutaneous leishmaniasis have been reported in the middle and lower Putumayo (Werner & Barreto 1981). Grimaldi et al. (1989) identified *Leishmania braziliensis* Viannia from there. Corredor et al. (1990) identified *Le. braziliensis* and *Le. guyannensis* Floch from the neighboring states of Caquetá and Amazonas. In 1992, 43 new cases of cutaneous leishmaniasis were reported from Putumayo; it was declared as a state of middle risk for the disease, with an incidence rate of 23.9 for 100 thousand inhabitants. The incidence rate for all of Colombia the same year was 16.5 (Ministerio de Salud 1994).

Approximately 30% of the 1,14 million km^2 of Colombia comprise the Amazon region; Putumayo and five other states are completely within this area. Only 38 *Lutzomyia* species were registered for this region in Young's review of bloodsucking psychodid flies of Colombia. With the contributions of Morales and Minter (1981), Young and Arias (1984), Young and Morales (1987), Young and Duncan (1994), and Ferro et al. (1996) this number has been increased to at least 63. The states of Caquetá and Amazonas had most of the records, with 46 and 32 species, respectively; Guaviare, two species; and none for Guainía nor Vaupés. No published records from Putumayo were found. As a part of an initial survey on insect disease vectors from Putumayo, we collected phlebotomine sand flies to determine the species composition at various sites below 700 m.

MATERIALS AND METHODS

We collected sand flies at 54 localities of the nine counties of the middle and lower Putumayo (Fig. 1); most sites were visited only once for two or three days. Accessibility and the presence of

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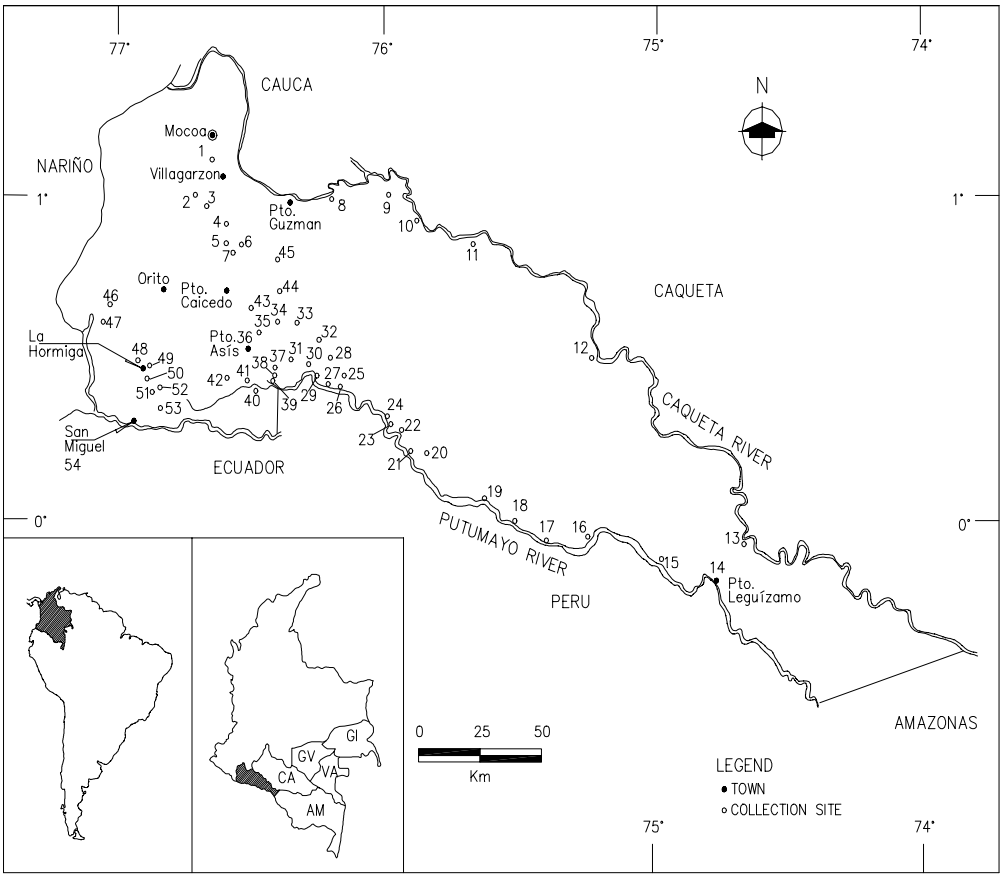

Fig. 1: localities sampled for phlebotomine sand flies in Putumayo. 1: El Pepino; 2: La Castellana; 3: San Miguel; 4: El Desierto; 5: San Vicente; 6: La Mariposa; 7: Albania; 8: El Cedro; 9: El Recreo; 10: José María; 11: El Gallinazo; 12: Cocha Afuera; 13: La Tagua; 14: Pto. Leguízamo; 15: Salato Grande; 16: La Paya; 17: Perecera; 18: El Hacha; 19: Concepción; 20: Agua Linda; 21: Montepa; 22: Peña Colorada; 23: Lorencito; 24: Piñuna Negro; 25: La Chilpa; 26: Santa Elena; 27: Lisberia; 28: Pto. Gamboa; 29: Buena Vista; 30: Comandante; 31: Belén; 32: Pto. Silencio; 33: Peneya; 34: Los Achapos; 35: El Aguila; 36: Pto. Asís; 37: Ancurá; 38: Pto. Playa; 39: La Pedregosa; 40: Bajo Cohembí; 41: La Esmeralda; 42: La Manuela; 43: San Isidro; 44: El Picudo; 45: Arizona; 46: La Libertad; 47: Churuyaco; 48: Santa Rosa; 49: El Tigre; 50: Bellavista; 51: La Palestina; 52: El Venado; 53: San Vicente Bajo; 54: San Miguel; AM: Amazonas; CA: Caquetá; GV: Guaviare; GI: Guainía; VA: Vaupés

human cases of insect borne diseases (leishmaniasis, malaria, Chagas) were the principal reasons for selecting a specific site. In Putumayo, the process of colonization has been intense and most of the primary forest has been cut near human settlements. People grow banana, cassava, corn, sugar cane and, in some farms coffee, and cocoa. Also, some land is used for livestock production, but probably the main activity in the field is coca cultivation.

Mouth aspirators and small hand nets were used to capture phlebotomines from Shannon traps (Shannon 1939) and protected human baits at night. Also, we used CDC miniature light traps (Sudia & Chamberlain 1962) at heights of 1.5-3 m. Diurnal resting places on tree trunks were searched in few occasions. We initiated monthly collections in April 1995 and continued until June 1996. Also, specimens were obtained in September and October 1997. Mostly in Shannon trap located about 1 km from the nearest house in secondary forest. Collectors, acting as human baits, were located inside and at a distance of 3-5 m from the houses (peridomestic), as well as, inside the forest. We usually collected from 18:00 to 22:00 h. Sand flies were killed with carbon tetrachloride, placed in labeled cardboard boxes, then transferred to the Departamento de Microbiología at the Universidad del Valle where they were macerated in potassium hydroxide (KOH 10%) for 24 h at room temperature (Forattini 1973), and viewed in drops of liquid phenol on microscopic slides. We identified sand flies with the aid of the keys and descriptions of Young (1979) and Young and Duncan (1994). Specimens were deposited in the Psychodidae reference collection of the Departamento de Microbiología under capture codes PPC 1-178.

RESULTS

The number of collecting localities, by county, and the geographic positions and altitude of their capitals are given in Table I. The names of the capitals are the same as the counties, except for La Hormiga, which is the capital of Valle del Guamuez.

A total of 4,840 sand flies (4077 female; 763 male) were collected. Table II shows the species found by county. The last four individuals were damaged and impossible to recognize, even at the subgeneric level. At least 42 *Lutzomyia* species were identified, including a new one that will be described elsewhere. No phlebotomine sand flies in other genera were captured. All of the specimens had a normal morphological aspect, except for one *L. yuilli-pajoti* male, which has a style with five spines. The most common species was *L. yuilli* Young & Porter followed by *L. pajoti* Abonnec, Léger & Fauran. The males of these two species are morphologically indistinguishable and, when females of both species were in the same place, or no females were obtained, the males found were put under the name *L. yuilli-pajoti* (Table II). In 24 places both species were present and the number of localities by county was Orito, 2; Pto. Asís, 5; Pto. Caicedo, 3; Pto. Leguízamo, 3; San Miguel, 1; Valle del Guamuez, 5; and Villa Garzón, 5. No females of *L yuilli* were found in eight sites of Pto. Asís and one of Pto. Leguízamo counties, and the 226 male captured were associated with the *L. pajoti* females obtained (Table II). A similar procedure was used with *L. chagasi* (Costa Lima) and *L. fairtigi* Martins. Although the last species was not found in Putumayo, there are records from Caquetá (Young 1979), and the females from Pto. Caicedo, Pto. Leguízamo and Valle del Guamuez (Table II) were assigned to *L. chagasi-fairtigi*.

Most of the specimens (4,478) were captured using Shannon traps, but the only individuals of *L. micropyga* (Mangabeira) and *L. olmeca bicolor* Fairchild & Theodor were obtained on tree trunks and CDC light traps, respectively. The male of *L. sipani* Fernández, Carbajal, Alexander & Need was obtained with a CDC light trap in Buenavista, Pto. Asís, while the female was found on a tree trunk in La Paya, Pto. Leguízamo.

A total of 217 (205 female, 12 male) sand flies were collected with human baits. We captured *L. gomezi* (Nitzulescu), 2 female; *L. pajoti*, 1 female; *L.* (*Trichophoromyia*) sp., 1 female; and *L. yuilli*, 3 female, in the counties of Pto. Asís, Pto. Caicedo and Valle del Guamuez, all inside houses. The peridomestic areas yielded *L. gomezi*, 13 female; *L. evangelistai* Martins & Fraiha, 3 female; *L. yuilli*, 16 female; and *L. witoto* Young & Morales, 1 male; in the same counties, plus Pto. Leguízamo and Villa Garzón. The rest of the specimens obtained with human bait were mainly from Pto. Leguízamo county, where the only male of *L. sordellii* (Shannon & Del Ponte) was captured inside the forest, as well as, *L. paraensis* (Costa Lima) 5 female, and *L. yucumensis* (Le Pont, Caillard, Tibayrenc & Desjeux) 12 female and 1 male. The last two species were captured with Shannon traps in Pto. Caicedo, too.

The only locality at Mocoa, El Pepino, was sampled for less than 2 h, in May 1995. We collected *L. gomezi* 5 female, and *L. yuilli* 12 female on human bait. Also, *L. evangelistai* 3 female and *L. yuilli* 1 female were obtained with CDC and Shannon traps. This site (610 m) was the highest sample site, and local people informed us that sand flies will bite them inside and around their houses. The locality with most visits was El Picudo, Pto. Caicedo, which we sampled in June, October, November and December 1995. Of these samples, only the second one occurred during the rainy season. The Shannon trap was always located in the same spot and the number of species collected was 15, 8, 15 and 14 for each month mentioned before. We identified 25 species from there but only during the last visit, the three females of *L. yuilli* mentioned above were collected with human bait inside a house.

TABLE I

Counties and number of places studied

Counties	m	Latitude	Longitude	No. localities
Mocoa	605	1º08' N	76º38' W	1
Orito	380	0º41' N	76º52' W	2
Puerto Asís	260	0º30' N	76º29' W	18
Puerto Caicedo	270	0º41' N	76º35' W	3
Puerto Guzmán	240	0º58' N	76º35' W	4
Puerto Leguízamo	200	0º12' S	74º49' W	13
San Miguel	290	0º16' N	76º40' W	2
Valle del Guamuez	570	0º27' N	76º55' W	5
Villagarzón	426	1º02' N	76º37' W	6

TABLE II

Lutzomyia species found by county

	Mocoa	Orito		Pto. Asís		Pto. Caicedo		Pto. Guzmán		Pto. Leguízamo		San Miguel		Valle del Guamuez		Villagarzón		Total
	Female	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	
L. amazonensis	-	-	-	4	-	2	1	-	-	11	-	5	-	-	-	-	-	23
L. antunesi	-	-	-	6	2	6	4	3	1	26	19	-	-	-	-	-	-	67
L. auraensis	-	-	-	22	5	-	-	-	-	13	8	2	1	1	1	-	-	53
L. ayrozai	-	-	-	1	1	26	2	-	-	22	5	-	-	1	-	8	-	66
L. bispinosa	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	1
L. c. carrerai	-	-	-	49	3	56	8	-	-	9	2	-	-	7	2	-	-	136
L. cellulana	-	-	-	-	-	-	-	-	-	-	1	-	-	-	1	-	-	2
L. chagasi	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6	3	9
L. chagasi-fairtigi	-	-	-	-	-	23	-	-	-	20	-	-	-	1	-	-	-	44
L. claustrei	-	-	-	1	-	3	-	2	-	-	-	-	-	-	-	-	-	6
L. davisi	-	4	2	33	6	28	12	-	-	15	5	20	3	8	4	14	1	155
L. dendrophyla	-	-	-	2	-	3	-	-	-	1	2	-	-	1	1	-	-	10
L. evangelistai	3	-	-	2	1	3	-	-	-	-	-	-	-	-	-	5	1	15
L. flaviscutellata	-	-	-	1	1	4	4	-	-	-	-	-	-	-	-	-	-	10
L. geniculata	-	3	1	5	-	7	-	-	-	31	5	-	-	-	2	-	-	54
L. gomezi	5	1	-	6	2	20	-	2	-	11	-	-	-	2	3	11	-	63
L. h. hirsuta	-	-	2	21	4	6	2	-	-	9	2	3	-	6	1	1	-	57
L. howardi	-	-	-	-	-	-	-	-	-	2	1	-	-	-	-	-	-	3
L. micropyga	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	1
L. nevesi	-	-	-	7	1	-	-	-	-	-	-	-	-	-	-	-	-	8
L. nocticola	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	2
L. o. bicolor	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	1
L. pajoti	-	20	-	220	225	85	-	-	-	15	1	8	-	133	-	67	-	774
L. paraensis	-	-	-	-	-	1	-	-	-	5	-	-	-	-	-	-	-	6
L. pilosa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1
L. punctigeniculata	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-	3
L. richardwardi	-	-	-	-	-	117	4	-	-	4	-	-	-	-	-	2	-	127
L. sipani	-	-	-	1	-	-	-	-	-	-	1	-	-	-	-	-	-	2
L. sordellii	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	1
L. tortura	-	1	-	50	12	128	17	1	1	52	1	13	2	37	2	27	9	353
L. umbratilis	-	-	-	-	-	37	12	2	-	27	8	-	-	-	-	6	-	92
L. walkeri	-	-	-	4	1	-	-	-	-	10	11	-	-	-	-	1	-	27
L. witoto	-	-	-	-	-	1	3	-	-	-	2	-	-	-	-	-	1	7
L. yucumensis	-	-	-	-	-	3	1	-	-	12	1	-	-	-	-	-	-	17

TABLE II (cont.)
Lutzomyia species found by county

	Mocoa		Orito		Pto. Asís		Pto. Caicedo		Pto. Guzmán		Pto. Leguízamo		San Miguel		Valle del Guamuez		Villagarzón		Total
	Female		Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	
L .yuilli	13		18	-	19	-	873	-	3	-	66	-	89	-	45	-	1156	-	2282
L. yuilli-pajoti	-		-	17	-	18	-	52	-	1	-	7	-	-	-	143	-	56	294
L. saulensis gp. sp.	-		-	-	-	-	1	-	-	-	1	-	-	-	-	-	-	-	2
L. verrucarum gp. sp.	-		-	-	8	-	1	-	-	-	-	-	1	-	1	-	4	-	15
L. (Pressatia) sp.	-		-	-	1	-	-	-	-	-	-	-	-	-	1	-	-	-	2
L. (Psychodopygus) sp.	-		-	-	2	-	-	-	-	-	-	-	-	-	1	-	-	-	3
L. (Psy.) Tres Esquinas	-		-	-	-	-	-	-	-	-	8	-	-	-	-	-	1	-	9
L. (Trichophoromyia) sp.	-		-	-	3	-	6	-	-	-	4	-	-	-	-	-	-	-	13
L. (Trichopho.) sp. n.	-		-	-	5	9	-	-	-	-	-	1	-	-	-	-	-	2	17
L. (Trichopygomyia) sp.	-		-	-	-	-	-	-	-	-	1	-	-	-	-	-	2	-	3
L. sp.	-		-	-	-	-	-	-	-	-	2	-	-	-	2	-	-	-	4
Total	21		47	22	473	292	1445	123	13	3	378	84	141	6	247	160	1312	73	4,840

Urban records were from the towns of Pto. Leguízamo, Pto. Asís and San Miguel. The former is from a subnormal periferic ward (barrio) named Rancho Lindo, a site sampled in April and May 1995; here *L. gomezi* 1 female, *L. antunesi* (Coutinho) 2 female, and *L. walkeri* (Newstand) 1 female, 2 male were obtained. The former species was collected with peridomestic human bait, the others with Shannon and CDC light traps. The San Martín Ward at Pto. Asís yielded *L. auraensis* (Mangabeira) 22 female, 4 male, *L. pajoti* 18 female and *L. walkeri* 1 female, 1 male with Shannon traps. Also with this technique, *L. auraensis* 2 female, 1 male, and *L. pajoti* 2 female were obtained at San Miguel. Again, at these three locations, residents complained about phlebotomine sand fly bites.

DISCUSSION

The sympatric presence of *L. pajoti* and *L. yuilli* in Putumayo reinforces the full species treatment first suggested by Young and Duncan (1994) based on material from northern Peru. These two species accounted for almost 70% (3,350) of the sand flies captured and were the most widely distributed geographically. Although both species were more attracted to Shannon traps, they were also captured biting humans in intradomiciliar, peridomestic or forest environments in different places of Putumayo. Abnormalities in male genitalia have been described in many sand flies (Abonnec et al. 1971, Marcondes 1999), but apparently this is the first record of a male *L. yuilli-pajoti* having five spines on the style.

Besides *L. pajoti*, two other species found in Putumayo are new records to Colombia, *L. sipani* and *L. yucumensis*. The former is a recently described species from Peru (Fernández et al. 1994) based only on males. Our female was found in a different locality from the male and it was impossible to distinguish it from *L. bourrouli* (Barretto & Coutinho) or *L. pinottii* (Damasceno & Arouck) females. These last two species have not been registered in Colombia, and the female was associated with the male found in Putumayo. *L. yucumensis* has been found in Brazil, Peru and Bolivia (Young & Duncan 1994) and in the last country it was incriminated as a vector of *Le. braziliensis* by Le Pont and Desjeux (1986).

The species left in the Verrucarrum group (Table II) resembled those in the series Serrana and may be conspecific with *L. serrana* (Damasceno & Arouck) but males from Putumayo are necessary to confirm its presence in the state and Colombian Amazon area. This species was discovered nearby Sucumbíos province, formerly Napo, of Ecuador by Young and Rogers (1984), and

Alexander et al. (1992). The females in the subgenus *Pressatia* (Table II) were different from *L. camposi* (Rodríguez) or *L. dysponeta* (Fairchild & Hertig), and probably were *L. choti* (Floch & Abonnenc) that has been found in nearby Guaviare, Colombia and Sucumbíos, Ecuador (Young & Duncan 1994). Also, the species in the Pilosa and Saulensis groups (Table II), probably were *L. pilosa* (Damasceno & Causey) and *L. saulensis* (Floch & Abonnenc), respectively. Both species were registered in nearby Caquetá (Young & Duncan 1994), but without males it is impossible to assure their presence in Putumayo.

Although, *L. richardwardi* Ready & Fraiha, *L. claustrei* Abonnec, Leger & Fauran, *L. nocticola* Young, and *L. micropyga*, have been found in different areas of Colombia (Young & Duncan 1994, Barreto et al. 1997), apparently this is their first record to the Colombian Amazon region. These species were known before in the Amazon basin of other countries (Young & Duncan 1994). *Psychodopygus* was the subgenus found with the major number of species, 13, followed by *Nyssomyia* with 7. Similar results were obtained by Feliciangeli et al. (1988) in the Territorio Federal Amazonas of Venezuela. Among the *Trichophoromyia* and *Trichopygomyia* spp. found, the females of *L. howardi* Young and *L. witoto* Young & Morales respectively, were unknown. The 2 females and a male of the former species were captured together on Salato Grande, Pto. Leguízamo (Table II) where they were the only members of this subgenus collected at that place. The same occurred with the latter species. The female of *L. witoto* was collected with 2 male on San Isidro, Pto. Caicedo (Table II).

In this initial survey, most of the sites were close to human settlements and were sampled only once. The results from El Picudo, where the total of sand flies species found was more than double compared with the species obtained during the rainy season and greater than those captured in the three other months, indicated that the true number of species present in Putumayo should be higher. Also, these data demonstrate changes in the composition of the sand flies in a given area. Regular studies over time, similar to those of Arias and Freitas (1977, 1982) and Cabanillas et al. (1995) in the Amazon region during different months, are necessary to determine the abundance and seasonal changes of the *Lutzomyia* populations in some Putumayo localities. Also, we assume that more species will be recorded once virgin forests are adequately sampled. The number of reported leishmaniasis cases in Putumayo from 1995 to 1997 were 78, 109 and 60, respectively. Pto. Asís, followed by Valle del Guamuez were the counties having the greatest number of registered cases (pers. comm., Putumayo health office). These figures are probably low due to difficulties in recording all cases. The presence of numerous mammal reservoirs and at least 10 sand flies species that are considered vectors of leishmaniasis (Young & Arias 1992), contribute to the transmission of the disease in Putumayo. Among these sand flies, *L. gomezi* and *L. yuilli* should be specially mentioned for their intradomiciliary and peridomestic anthropophilic biting habits. In the forest *L. c. carrerai* (Barretto), *L. ayrozai* (Barretto & Coutinho), *L. flaviscutellata* (Mangabeira), *L. umbratilis* Ward & Fraiha and *L. yucumensis*, among other species, might be playing some role in the transmission cycles. More studies are needed to implicate species of *Lutzomyia* as vectors of leishmaniasis in the middle and lower Putumayo, as well as to determine key epidemiological factors in this zone.

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