Lutzomyia maruaga (Diptera: Psychodidae), a new bat-cave sand fly from Amazonas, Brazil

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A new species of parthenogenetic, autogenic and apparently extremely endemic phlebotomine is described from a sandstone cave located in primary terra firme forest to the North of the city of Manaus. Specimens were collected in the aphotic zone of the Refúgio do Maruaga cave by light trap and reared from bat guano. The adult morphology suggests a closer relationship to some Old World Phlebotominae than to species of Lutzomyia *França encountered in the surrounding rainforest, but it shares characteristics with the recently proposed Neotropical genera* Edentomyia *Galati,* Deanemyia *Galati and* Oligodontomyia *Galati.*

Key words: Phlebotominae taxonomy - new species - cave fauna

The caves and other arenitic formations of the municipal district of Presidente Figueiredo are singular relicts of the Palaeozoic (Karmann 1986), surviving between the more recent Amazonian sediments and the ancient rocks of the Guiana Shield. As part of a biological inventory of the area, insects were collected in the darkest recesses of the largest cavern. The purpose of the present communication is to describe a most peculiar phlebotomine, so as to make the name available for studies in progress on its ecology, ontogeny and classification.

MATERIALS AND METHODS

Study area - The cave, known as Gruta Refúgio do Maruaga, is catalogued (AM-0002, Sociedade Brasileira de Espeleologia). It is a cavity 302 m long in white sandstone of the Nhamundá formation (Trombetas group, Palaeozoic Era) at 02º03'02.49"S, 59º57'48.85"W in the municipally of Presidente Figueiredo, state of Amazonas, Brazil (Karmann 1986). Access to the entrance is by steep descent through primary forest from km 6 on the road leading from the BR-174 highway to the hydroelectric station of Balbina. A shallow stream runs through the whole length of the cave, from the interior to the mouth. Vertebrates observed in the cave include fish, amphibians, alligators, turtles and (close to the entrance) cocks-of-the-rock (Cotingidae), but by far the most abundant were diverse species of bats. Thick deposits of guano were present, especially in the final chambers. Although closed to visitors following the detection of pathogenic fungi, the entrance was heavily marked by human footprints.

Sampling and identification - CDC miniature light traps were hoisted on poles leaning against the walls of the cave, to give a height of approximately 4 m. Immature stages were extracted from bat guano by flotation according to Hanson (1961). Larvae and pupae were reared according to the methods of Killick-Kendrick et al. (1977) with supplementation of the medium with autoclaved guano. The adults which emerged were offered bloodmeals on anaesthetized mice and hamsters, but did not feed. Conventional clearing with potassium hydroxide and phenol resulted in the collapse of the very delicate spermathecae of this species, so drawings of specimens included in the type series are from individuals freshly dissected and mounted directly in Berlese fluid. Measurements are mean values in mm, with range in parentheses.

Lutzomyia maruaga sp. n. Alves, Freitas and Barret (Figs 1-8)

Diagnosis - Phlebotominae Kertesz. Interocular suture complete and highly developed. Cibarium with a pair of horizontal teeth, each with a basal denticle, and 1+1 clusters of vertical teeth; posterior bulge of dorsal wall lacking. Flagellomeres I to XIII each with a pair of short, simple ascoids. Upper and lower mesanepisternal setae present. Labial furca (Galati 1995) absent. Ventrocervical sensillae (Galati 1995) present. Katepisternum with a group of delicate setae on anterior margin (Galati 1995). Socket of post-alar bristle (Galati 1995) present. Attributed, conservatively, to *Lutzomyia* França (*sensu* Young & Duncan 1994) ungrouped species.

Male: unknown, believed extinct.

Female: length of insect 1.82 (1.32-2.11, n = 12). General colour pale, head, scutum and scutellum faintly pigmented, rest of insect pale. Head height from vertex to tip of clypeus 0.32 (0.30-0.34), width 0.30 (0.26-0.34, n = 12). Interocular distance 0.11 (0.08-0.13, n = 12), equivalent to 7.3 facet diameters. Interocular suture complete. Flagellomere I 0.18 (0.14-0.21, n = 12) long, II+III 0.18 (0.15-0.21, n = 12). Ascoids simples, short and paired present on flagellomeres I-XIII (Figs 5, 6). Length of palps

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0.68 (0.61-0.75), length of palpomeres: I, 0.05 (0.04-0.06, n = 12); II, 0.10 (0.07-0.12; n = 12); III, 0.11 (0.10-0.12; n=12); IV, 0.12 (0.09-0.13; n=12); V, 0.30 (0.25-0.33; n=12), palpal formula 1,2,3,4,5. Newstead's sensillae grouped medially on palpomere III (Fig. 1). Cibarium with two sharp horizontal teeth, each with a small denticle basally, and two groups of vertical teeth immediately behind; arch complete; posterior bulge lacking; pigment patch weakly marked (Figs 2, 3). Labrum-epipharynx 0.18 (0.17-0.20, n = 12) long. Pharynx 0.15 (0.14-0.16, n = 12) long, striated posteriorly with rows of obsolescent denticles (Fig. 2). Thorax 0.54 (0.50-0.60, n = 12) long. Pleura with 5 (4-7, n = 10) episternal setae, of which 2 (1-4, n = 10) upper and 3 (2-4, n = 10) lower. Wing length 1.54 (1.49-1.61, n = 12), width 0.45 (0.42-0.50, n = 12) (Fig. 4). A pair of ventrocervical sensillae present. Katepisternum with a group of delicate setae on anterior margin. Socket of post-alar bristle present. Length of wing-vein sections: *alpha* 0.25 (0.20-0.29, n = 12), *beta* 0.20 (0.17-0.29, n = 12), *gamma* 0.25 (0.22-0.29, n = 11), *delta* 0.03 (0.006-0.050, n = 12). Femora without spines. Length of femora, tibiae and basitarsi: foreleg 0.55 (0.50-0.60, n = 11), 0.59 (0.55-0.64, n = 11), 0.34 (0.30-0.37, n = 11); midleg 0.58 (0.52-0.64, n = 10), 0.74 (0.63-0.80, n = 10), 0.39 (0.35-0.41, n = 10); hindleg 0.66 (0.64-0.69, n = 9), 0.82 (0.73-0.91, n = 9), 042 (0.35-0.48, n = 9). Spermathecae 0.026 (0.021-0.030, n = 10) long, 0.011 (0.006-0.012, n = 10) wide, with four to five annulations, the apical one being the largest and most globose; terminal knob strongly pedunculate; individual ducts smooth and slender, approximately five times the length of body of spermathecae; common duct not visualized. Genital fork slightly dilated at apex (Fig. 8).

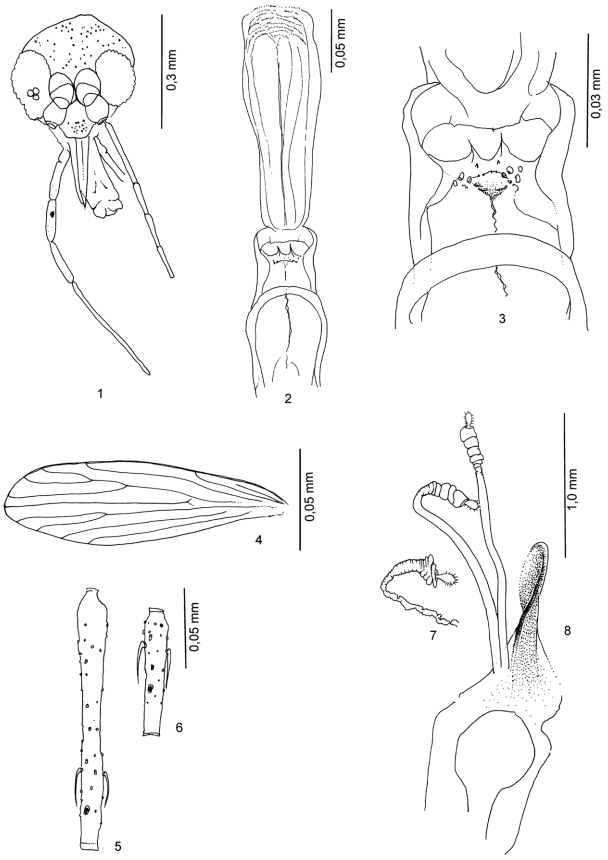
Type data - Holotype female: BRAZIL, Amazonas, Pre-sidente Figueiredo, Caverna Refúgio do Maruaga, Rodovia AM-240, km 6 (02º03'02.49"S, 59º57'48.85"W). Reared from larva; 11 female paratypes, CDC light traps and reared from guano, from the same locality, February-May 2006 (VR Alves, TV Barrett, FF Xavier Filho, RB Alencar, FL Santos, WS Santos, cols.). Type series deposited in the invertebrate collection of the Instituto Nacional de Pesquisas da Amazônia.

Etymology - The specific name is a noun in apposition and refers to the type locality.

RESULTS AND DISCUSSION

The approximately 400 specimens collected in CDC miniature light traps consisted entirely of females. Larvae and pupae isolated from bat guano in the cave were reared to adulthood in the laboratory. These laboratory reared adults reproduced to yield a further generation of adults whose progeny survived to the first larval instar. All emerging adults were female, producing fertile eggs without the presence of males or the need for a blood-meal. The species is, therefore, at least facultatively, parthenogenic and autogenic, as previously observed for *Lutzomyia mamedei* by Brazil and Oliveira (1999).

The new species share with *Lutzomyia derelicta* Freitas and Barrett (1999) and *Edentomyia piauiensis* Galati et al. (2003) the absence of the posterior cibarial bulge; and with *L. oligodonta* Young et al. (1985) and *E. piauiensis* a reduced number of cibarial teeth. In the latter two species the interocular suture is incomplete, whereas in *L. maruaga* it is very highly developed. *L. derelicta* has a complete interocular suture, but in this species the cibarium is armed with a row of four horizontal teeth, and the common spermathecal duct is developed normally, as opposed to obsolescent as in the new species.



Lutzomyia maruaga sp. n. Alves, Freitas and Barrett. Holotype female. Fig. 1: head; Figs 2-3: cibarium; Fig. 4: wing; Fig. 5: flagellomere I; Fig. 6: flagellomere II; Fig. 7: spermathecae and individual ducts retracted; Fig. 8: spermathecae, individual ducts and genital fork.

The palpal formula, the position of Newstead's sensillae, the presence of ventrocervical sensillae, post-alar bristles and anterior katepisternal bristles, suggest that the new species could be grouped with the neotropical genera *Edentomyia* Galati, *Deanemyia* Galati or *Oligodontomyia* Galati. In addition, the absence of the labial furca is shared with *Deanemyia* Galati.

In the absence of males, we are reluctant at present to propose a more precise generic placement for the new species. Molecular studies and larval morphology could in future contribute to a more detailed understanding of the systematics of this and related species.

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