Description of *Trichophoromyia uniniensis*, a new phlebotomine species (Diptera: Psychodidae: Phlebotominae) of Amazonas State, Brazil

Simone Ladeia-Andrade¹, Nelson Ferreira Fé², Cristiani de Castilho Sanguinette³ and José Dilermando Andrade Filho³*

Abstract

**Background:** A new species of phlebotomine sand flies belonging to *Trichophoromyia* Barretto, 1962 genus is described, based on males collected in Jaú National Park, Amazonas state, Brazil.

**Methods:** The sand flies were mounted in Canada balsam. They were measured with a binocular Olympus CH-2 microscope with the aid of a micrometer objective and the drawings were done with the help of a camera lucida.

**Results:** This new species named *Trichophoromyia uniniensis* sp. nov. is closely related to *Trichophoromyia omagua* (Martins, Llanos & Silva, 1976). The former can be distinguished from the latter by the shape of its paramere that has the lower apical region turned up in the new species.

**Conclusion:** With the new species here described a total of 39 species belonging to the *Trichophoromyia* genus are now known, most of them present in the Amazon rainforest.

**Keywords:** *Trichophoromyia uniniensis* sp. nov, Sand fly, Jaú National Park, Leishmaniases

**Background**

Sand flies are natural vectors of some disease agents, especially those of the leishmaniases, affecting many thousands of people worldwide [1]. The taxonomy of phlebotomines is complex due to the diversity of their morphological structures and the small differences between the species that permit precise identification. Other problems related to the taxonomy of this group are the complexes of species, morphological variations and anomalies [2-5]. Despite these difficulties, some species of sand flies have been described recently [6-13].

The genus *Trichophoromyia* is a large group of species, found mainly in rain forest [14]. Females of several species *Trichophoromyia* are morphologically similar and many species are known only by the males [15]. The medical importance of this genus is little understood, but *Trichophoromyia ubiquitalis* (Mangabeira, 1942) has been incriminated as a vector of *Leishmania* (*Viania*) *lainsoni* Silveira, Shaw, Braga & Ishikawa, 1987 by Lainson *et al*. [16] and more recently *Trichophoromyia auracensis* (Mangabeira) has been incriminated as vector of both *L. lainsoni* and *L. braziliensis* Vianna [17].

A new species of sand flies, named *Trichophoromyia uniniensis* sp. nov., collected in Jaú National Park, Amazonas State, Brazil is described here.

**Methods**

The Jaú National Park (JNP) is the largest continuous area of protected tropical rain forest in the world (2.27 million hectares). It is situated on the right bank of the Negro river, 200 km northwest of Manaus, the capital of the state of Amazonas, Northwestern Brazil (1°40′ 3′′ S, 61°26′ 64″ W). The average annual temperature is between 26°C and 27°C, with an average rainfall of 2,000-2,250 mm; most of it occurring between December and April. The local population is grouped into 15 riverine communities, 9 along the Unini river (559 people, 116 dwellings) and 6 along the Jaú river (218 people, 41 dwellings).

Phlebotomine sand flies were collected during six surveys conducted between February 2009 and September 2010 in communities of JNP. CDC light traps were
installed 1 meter above ground level, between 6.00 pm
and 6.00 am and manual aspiration was undertaken with
a Castro aspirator at the foot of trees and on other sur-
faces in the morning and at night.

The sand flies were mounted in Canada balsam. They
were measured with a binocular Olympus CH-2 micro-
scope with the aid of a micrometer objective and the
drawings were done with the help of a camera lucida.
The measurements are given in micrometers. The classi-
fication is that proposed by Galati [14].

In accordance with section 8.5 of the ICZN’s Inter-
national Code of Zoological Nomenclature, details of
the new species have been submitted to ZooBank with
the life science identifier (LSID) zoobank.org/References/
A1273A26-8EF9-49CF-9309-35B83DD53E64.

The description of Trichophoromyia uniniensis nov. sp. is
based on eight males. After the measurements of the holo-
type male, we give, in brackets, the mean, standard devi-
tions and number of paratypes examined for each structure.

**Description**

*Trichophoromyia uniniensis* sp. nov. Ladeia-Andrade, Fé,
Sanguinette & Andrade Filho (Figures 1, 2, 3, 4 and 5)

**Holotype (male)** Sand fly of small size, ca. 2,774 (2,994 ±
272.6; n = 7) in length. Scutum and paratergite light brown,
contrasting with pale scutellum and pleura.

**Head (Figure 1)**

552 (548 ± 6.8; n = 7) long and 345 (353 ± 11.0; n = 7)
wide. Head length/head width ratio 1.60: 1 (1.53 ± 0.04;
 n = 7). Clypeus 82 (82 ± 3.5; n = 7) long; clypeus length/
head length ratio 0.15: 1 (0.15 ± 0.01; n = 7). Eye 238
(230 ± 5.0; n = 7) long and 126 (123 ± 13.3; n = 7) wide;
eye length/head length 0.43: 1 (0.42: 1 ± 0.00; n = 7).
Interocular distance 112 (122 ± 7.0; n = 7). Labrum-
epipharynx (LE) 201 (198 ± 3.3; n = 7). LE/head length
0.36: 1 (0.36 ± 0.01; n = 7). Antenna with simple and
long ascoid, reaching the basis of the next flagellomere.
Ascoids on AIII implanted at the same level. Antennal for-
mula 2/III-XIII. Antennomere lengths: AIII 255 (260 ±
7.5; n = 6); AIV 129 (130 ± 6.4; n = 6); AV 126 (126 ± 3.1;
 n = 6); AXV > AXVI (AXV > AXVI; n = 4). Papilla present
on AIII (pre-apical), AIV, AXIV-AXVI. Ratios: AIII/head
length 0.46: 1 (0.48 ± 0.01; n = 6); AIII/LE 1.27: 1 (1.32 ±
0.04; n = 6). Palpomere lengths: P1 34 (31 ± 1.1; n = 7); P2
85 (90 ± 4.9; n = 7); P3 112 (119 ± 2.3; n = 6); P4 51 (50 ±
1.1; n = 5); and 119 (119 ± 2.4; n = 4). Palpal formula
1.4.2.3.5.; [1.4.2.3.5.; n = 1; 1.4.2.5.3.; n = 1; 1.4.2.(3.5.); n =
2]. Newstead’s spines inserted medially on palpomere 3
and not visible on palpomere 2.

**Cervix**

Ventralcervical sensillae absent.

Thorax

Proepimeral setae 3–3 (3–3; n = 2; 4–4; n = 2) and anep-
pisternal superior setae present, 18–18, in the paratypes
ranging from 14 to 18, setae in the anterior region of the
katepisternum absent. Wing (Figure 2) 1,863 (1,977 ± 44.6;

---

**Figure 1** *Trichophoromyia uniniensis* sp. nov. (Holotype male N° 90,072). Head, frontal view. Bar = 100 μm.

**Figure 2** *Trichophoromyia uniniensis* sp. nov. (Holotype male N° 90,072). Wing. Bar = 250 μm.
Length/width ratio 3.56:1 (3.60:1 ± 0.3; n = 5). Length of the vein sections: R\textsubscript{5} 1,325 (1,306 ± 21.1; n = 6); alpha 607 (568 ± 26.9; n = 6); beta 235 (270 ± 15.5; n = 7); gamma 248 (251 ± 13.3; n = 6); delta 400 (352 ± 22.7; n = 6). The anterior and posterior legs of the hollotype were lost. Anterior femur, tibia, tarsomere I and tarsomeres II + III + IV + V 773 ± 11.4 (n = 4), 1,007 ± 19.3 (n = 4), 645 ± 20.5 (n = 4) and 683 ± 23.8 (n = 4), respectively. Femur, tibia, tarsomere I and tarsomeres II + III + IV + V of the median leg measurement: 718 (725 ± 7.5; n = 4), 1,270 (1,256 ± 19.3; n = 4), 745 (735 ± 30.6; n = 4) and 731 (718 ± 11.0; n = 4), respectively. The mean and standard deviation of the paratypes for femur, tibia, tarsomere I and tarsomeres II + III + IV + V of the posterior leg were 798 ± 10.1 (n = 6), 1,424 ± 10.2 (n = 6), 840 ± 16.4 (n = 6) and 791 ± 14.0 (n = 6), respectively.

Abdomen (Figures 3, 4 and 5)

Papillae absent on abdominal tergites. Gonostyle 197 (188 ± 2.3; n = 7) long, with four spines: one apical, one upper external, one lower external and one internal implanted in the basal third. Sub terminal seta absent. Gonocoxite 330 (326 ± 4.9; n = 7) long and 116 (123 ± 8.9; n = 7) wide, about 33–35 (32–37 in paratypes) setae implanted in the middle of the structure. Paramere broad at its base, narrowing in its middle region and dilating at its apex. Distal third with ventral elbow and dorsal margin with a slight curve upwards (Figure 5). Lateral lobe 306 (300 ± 6.0; n = 7) long and 34 (29 ± 2.9; n = 7) wide, without persistent setae at its apex. Lateral lobe/gonocoxite ratio 0.93:1 (0.90 ± 0.02; n = 7). Conical and pigmented aedeagus. Genital filament 428 (420 ± 15.2; n = 7) long and genital pump 160 (169 ± 8.0; n = 7). Genital filament/genital pump ratio 2.68:1 (2.59 ± 0.25; n = 7). Apex of genital filaments with slight dilatation.

**Female**

Unknown

**Type-material**

Male holotype and all male paratypes were collected in the Jaú National Park, near the Unine river, Municipality of Barcelos, Amazonas state, Brazil with CDC light traps (Ladeia-Andrade S, Fé NF, et al. Col.). Holotype (N. 90,072) collected on 07/02/2009 in the Vila Nunes community; two males paratypes (N. 90,073 and 90,074) collected on 30/05/2009 in the Vista Alegre community; two paratypes male (N. 90,075 and 90,076) collected on 07/02/2009, in the Vila Nunes community; three paratypes male (N. 90,077, 90,078 and 90,079) collected on 06/02/2009 in the Vista Alegre community.

Holotype (90,072) and three paratypes (N. 90,073, 90,075 and 90,077) deposited in the “Coleção de Flebotomíneos” of the “Instituto René Rachou/FIOCRUZ” (FIOCRUZ-COLFLEB), Belo Horizonte, Brazil. Two paratypes (N. 90,074 and 90,078) deposited in the collection of “Instituto Nacional de Pesquisas da Amazônia (INPA), Manaus, Brazil. Two paratypes (90,076 and 90,079) deposited in...
the collection of “Instituto Oswaldo Cruz/FIOCRUZ, Rio de Janeiro, Brazil.

Etymology
The name Trichophoromyia uniniensis sp. nov. alludes to the Unini river, located in the Jau National Park, the type locality of this species.

Results and discussion
To date, 38 species have been formally described for the genus Trichophoromyia [13,14,18] which can be divided into two groups, based on the ratio between the genital filaments/genital pump. Some species have this ratio lower than 3 and others greater than 4. The new species, with a ratio of 2.68: 1 (2.59 ± 0.25; n = 7) is included in the first group. In Trichophoromyia genus, only four species have this characteristic: Trichophoromyia meirai (Causey & Damasceno, 1945), Trichophoromyia omagua (Martins, Llanos & Silva, [19]), Trichophoromyia reburra (Fairchild & Hertig, 1961) and T. ubiquitalis. Trichophoromyia meirai present the lateral lobe longer than the gonocoxite, while in the new species the opposite occurs. The paramere can be used to distinguish T. ubiquitalis and T. reburra from T. uniniensis. This structure is slightly curved towards the gonocoxite in the new species and straight in the others species. Trichophoromyia omagua also presents the curved paramere [19]. However, this species can be distinguished from the T. uniniensis n. sp. by the shape of the paramere (see Figure 5). The dorsal margin of the paramere in T. omagua is concave while in the new species in its median it is slightly convex, followed by a small pre-apical concavity. Further, the elbow in the ventral region of T. omagua is closer to the middle of the paramere while in the new species it is situated near its fourth apical region.

Only 22 species of Trichophoromyia are described, based on both sexes. This because females of several species present similar morphology. [15]. In fact, of the 22 species whose females have been described, only those of T. reburra, Trichophoromyia cellulana (Young & Duncan, 1979), T. omagua and T. ubiquitalis can be differentiated morphologically [14]. Some females of Trichophoromyia were collected in the Jau National Park, however, we prefer not to describe them as females of Trichophoromyia uniniensis since other species of Trichophoromyia were also collected in sympathy with the new species.

Conclusion
With the new species here described a total of 39 species belonging to the Trichophoromyia genus are now known, most of them present in the Amazon rainforest.

Competing interests
The authors declare that they have no competing interests.

Authors’ contributions
SLA, NFF, CCS and JD Af drafted the manuscript. All the authors read and agreed with this manuscript.

Acknowledgments
The authors wish to thank the inhabitants of the Jau National Park for granting them access to their communities; Chico Mendes Institute for Biodiversity Conservation (ICMBio/SISBiO) for granting access of the research team to Jau National Park; the Health Department of Barcelos and the malaria control team of Barcelos for help with fieldwork; Rui Alves de Freitas and Antônio Coelho da Silva of Instituto Nacional de Pesquisas da Amazônia, for their valuable assistance; Dr Eunice Aparecida Bianchi Galati and Dr Andrey José de Andrade of the Faculty of Public Health (University of São Paulo) for their valuable orientation and advice. JD Andrade Filho is a research fellow of CNPq.

Author details
1Laboratório de Doenças Parasitárias, Instituto Oswaldo Cruz / FIOCRUZ, Rio de Janeiro, Brazil. 2Fundação de Medicina Tropical Dr. Heitor Vieira Dourado (FMT-HVD), Manaus, Brazil. 3Grupo de Estudos em Leishmanioses, Coleção de Flebotomíneos, Centro de Referência Nacional e Internacional para Flebotomíneos, Instituto René Rachou, Fiocruz, Av. Augusto de Lima 1715, 30190-002 Belo Horizonte, MG, Brazil.

Received: 28 July 2014 Accepted: 19 August 2014

Published: 29 August 2014

References
1. Alvar J, Vélez ID, Bern C, Herrero M, Desjeux P, Cano J, Jannin J, den Boer M: Leishmaniasis worldwide and global estimates of its incidence. PLoS One 2012, 5:e35671.
2. Lanzaro GC, Ostrovska K, Herrero MV, Lawyer PG, Warburg A: Lutzomyia longipalpis is a species complex: genetic divergence and interspecific hybrid sterility among three populations. Am J Trop Med Hyg 1993, 48:859-867.
3. Costa PL, Silva FJ, Andrade Filho JD, Shaw JJ, Brandão Filho SP: Bilateral anomaly in Evandromyia evandra (Diptera: Psychodidae: Phlebotominae) captured in Victória Municipality, Northern Rainforest Region of Pernambuco State, Brazil. J Am Mosq Cont Assoc 2012, 28:128–130.
4. Scarpassa VM, Alencar RB: Lutzomyia umbratilis, the main vector of Leishmanio y guyanensis, represents a novel species complex? PLoS One 2012, 7:e37341.
5. Sanguinette CC, Faustino JX, Serra e Meira PCL, Botelho HA, Carvalho GML, Gontijo CF, Andrade Filho JD: Anomalies in the sand fly Lutzomyia longipalpis (Lutz and Neiva), the main vector of Leishmania infantum chagasi in Brazil. J Am Mosq Cont Assoc 2013, 29:54–58.
6. Andrade AJ, Galati EAB: A new species of Evandromyia (Diptera: Psychodidae: Phlebotominae) from Minas Gerais State, Brazil. J Med Entomol 2012, 49:445–450.
7. Barata RA, Meira PCL s e, Carvalho GML: Lutzomyia diamantinensis sp. nov., a new phlebotomine species (Diptera: Psychodidae) from a quartzite cave in Diamantina, state of Minas Gerais, Brazil, Mem Inst Oswaldo Cruz 2012, 107:1006–1010.
8. Carnevalle MC, Munstermann L, Marin D, Ocampo C, Feno C: Description of Lutzomyia (Helocercomyia) tolimensis, a new species of phlebotomine sandfly (Diptera: Psychodidae) from Colombia. Mem Inst Oswaldo Cruz 2012, 107:993–997.
9. Galati EAB, Galvis-Ovallos F: Description of two new sand fly species related to Nyssomyia antunesi (Diptera, Psychodidae, Phlebotominae). J Med Entomol 2012, 49:238–252.
10. Figueira EAG, Silva G, Chagas ECS, Shimabukuro PHF: Phlebotomine sandflies (Diptera: Psychodidae) from Lábrea, state of Amazonas, Brazil, with a description of Evandromyia (Aldamyia) apurinam Shimabukuro, Figueira & Silva, sp. nov. Mem Inst Oswaldo Cruz 2013, 108:280–287.
11. Teles CBG, Freitas RA, Oliveira AFJ, Ogawa GM, Araújo EAC, Medeiros JF, Pessoa FAC, Camargo LMA: Description of a new phlebotomine species
(Diptera: Psychodidae, Phlebotominae) and new records of sand flies from the State of Acre, northern Brazil. Zootaxa 2013, 3609:85–90.

12. Sábio PB, Andrade AJ, Galati EAB: Assessment of the taxonomic status of some species included in the Shannoni complex, with the description of a new species of Psathyromyia (Diptera: Psychodidae: Phlebotominae). J Med Entomol 2014, 51:331–341.

13. Santos TV, Silva FMM, Barata IR, Andrade AJ, Galati EAB: A new species of phlebotomid, Trichophoromyia adelssonouzai (Diptera: Psychodidae) of Brazilian Amazonia. Mem Inst Oswaldo Cruz 2014, 109:140–146.

14. Galati EAB: Morfologia e Taxonomia. Classificação de Phlebotominae. In Flebotomíneos do Brasil. Edited by Rangel RF, Lainson R. Rio de Janeiro: FioCruz; 2003:23–206.

15. Young DG, Duncan MA: Guide to the Identification and Geographic Distribution of Lutzomyia Sand Flies in Mexico, the West Indies, Central and South America (Diptera: Psychodidae). Mem Am Entomol Inst 1994, 54:1–881.

16. Lainson R, Shaw JJ, Souza AAA, Silveira FT, Falqueto A: Further observations on Lutzomyia ubiquitalis (Psychodidae: Phlebotominae), the sand fly vector of Leishmania (Viannia) lainsoni. Mem Inst Oswaldo Cruz 1992, 87:437–439.

17. Valdivia HO, De Los Santos MB, Fernandez R, Baldeviano GC, Zorrilla VO, Vera H, Lucas CM, Edgel KA, Lescano AG, Mundal KD, Graf PC: Natural Leishmania infection of Lutzomyia auresis in Madre de Dios, Peru, detected by a fluorescence resonance energy transfer-based real-time polymerase chain reaction. Am J Trop Med Hyg 2012, 87:511–517.

18. Barreto M, Burbano ME, Young DG: Description of Lutzomyia (Trichophoromyia) pabloi n. sp. and the female of L. howardi (Diptera: Psychodidae) from Colombia. J Med Entomol 2002, 39:601–604. 2002.

19. Martins AV, Llanos BZ, Silva JE: Estudos sôbre os flebotomíneos do Peru. IV. Departamento de Loreto: lista das espécies coletadas, descrição de uma espécie nova, Lutzomyia omagua n. sp. e redescrição do macho de Lutzomyia scotti (Damasceno & Arouck, 1956) (Diptera, Psychodidae, Phlebotominae). Rev Brasil Biol 1976, 36:495–501.

doi:10.1186/1756-3305-7-400

Cite this article as: Ladeia-Andrade et al.: Description of Trichophoromyia uniniensis, a new phlebotomine species (Diptera: Psychodidae: Phlebotominae) of Amazonas State, Brazil. Parasites & Vectors 2014 7:400.