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A new species and a new record of *Sarcofahrtiopsis* (Diptera: Sarcophagidae) from the Brazilian Amazon

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ABSTRACT

A new species of sarcophagid fly, *Sarcofahrtiopsis papei* **sp. nov.**, is described based on a male specimen from the state of Amazonas in the Brazilian Amazon. It differs from congeners mainly in having the dorsal surface of the basiphallus with a clubbed projection bearing many tiny sclerotized spines. We also report the first record of *Sarcofahrtiopsis matthewsi* for the Brazilian Amazon.

KEYWORDS: Amazonas, Insecta, Oestroidea, taxonomy, true flies

Uma nova espécie e um novo registro de *Sarcofahrtiopsis* (Diptera: Sarcophagidae) da Amazônia Brasileira

RESUMO

Uma nova espécie de mosca sarcofagídea, *Sarcofahrtiopsis papei* **sp. nov.**, é descrita com base em um espécime macho do estado do Amazonas, na Amazônia brasileira. Difere dos congêneres principalmente por ter a superfície dorsal do basifalo com uma projeção em forma de clava contendo vários diminutos espinhos esclerotizados. Também reportamos o primeiro registro de *Sarcofahrtiopsis matthewsi* para a Amazônia brasileira.

PALAVRAS-CHAVE: Amazonas, Insecta, Oestroidea, taxonomia, mosca

INTRODUCTION

Sarcophagidae, known as flesh flies, comprise more than 3000 described species across all zoogeographic regions (Pape 1996; Pape *et al.* 2011; Yan *et al.* 2020). At present, 385 species and 42 genera of flesh flies have been recorded for Brazil (Mello-Patiu *et al.* 2024), but the number of expected species is higher. It is the seventh most abundant dipteran family in the main Brazilian zoological collections, but most specimens remain unidentified at generic and specific level (Carvalho *et al.* 2002), some of them unknown to science.

During the study of flesh flies of one of the most important entomological collections from the Brazilian Amazon at the Instituto Nacional de Pesquisas da Amazônia (INPA), we found a new species of *Sarcofahrtiopsis* Hall, a small genus with 16 valid species occurring mainly in the Antillean Islands, Central America, and the northern portion of South America, with two species (*Sarcofahrtiopsis paterna* Dodge and *Sarcofahrtiopsis farri* Dodge) reaching USA (Florida and Texas, respectively) and one species (*Sarcofahrtiopsis cuneata* (Townsend)) reaching southern South America (Pape 1996; Pape and Méndez 2004; Carvalho-Filho *et al.* 2014, 2017; Buenaventura and Pape 2018; Mulieri and Dufek 2019). Until now, only three species have been recorded from Amazonia: *S. cuneata*, *Sarcofahrtiopsis cupendipe* Carvalho-Filho & Esposito, and *Sarcofahrtiopsis terezinh*ae Carvalho-Filho, Souza & Soares (Carvalho-Filho *et al.* 2014, 2017).

Specimens of this genus are small to medium-sized (3 to 6 mm) and have sarcosaprophagous larvae (Pape and Dahlem 2010; Yan *et al.* 2020). Three species, namely *Sarcofahrtiopsis carcini* Pape & Mendez, *Sarcofahrtiopsis kuna* Pape & Méndez, and *Sarcofahrtiopsis chiriqui* Pape & Mendez, have been reared from rotting semi-terrestrial crabs in mangrove habitats (Pape and Mendez 2002, 2004; Mendez *et al.* 2008). Two species have been reared from the feces of disk-winged bats (*Thyroptera tricolor* Spix) accumulated inside their temporary roosts, the young coiled leaves of banana-like plants (*e.g. Heliconia* L. spp., *Phenakospermum guyannense* (Rich.) Endl. ex Miq.) (Pape *et al.* 2002; Carvalho-Filho *et al.* 2014).

Many species of *Sarcofahrtiopsis* have been found mainly in mangroves and other coastal habitats, but they also occur in primary and secondary forests, cloud forest at altitudes of 800 to 1000 m and savanna-like vegetation (*e.g.,* chaco, cerrado) (Pape and Mendez 2002, 2004; Mendez *et al.* 2008; Sousa

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et al. 2016; Carvalho-Filho *et al.* 2017; Mulieri and Dufek 2019). Adults have been collected in traps baited with feces, rotting vertebrates and invertebrates, and fermented fruits (Lopes 1973, 1975; Sousa *et al.* 2011, 2016; Carvalho-Filho *et al.* 2017; Mulieri and Dufek 2019).

Here we describe a new species of *Sarcofahrtiopsis* based on a male specimen from a Brazilian Amazon lowland tropical forest and extend the distribution of *Sarcofahrtiopsis matthewsi* to the Brazilian Amazon.

MATERIAL AND METHODS

For the study of the male terminalia of the new species, the abdomen was cut at the base of the first segment. Then, it was macerated in heated 80% lactic acid for about one minute, washed in distilled water and transferred to temporary slides with glycerin for observation and illustration of structures. Illustrations were made with a drawing tube attached to a compound light microscope Leica DM 1000. The terminology of adult external morphology used herein follows Cumming and Wood (2017), and Buenaventura and Pape (2018) for terminalia. After examination, dissected parts were placed in microvials with glycerin and pinned with the specimen.

Photographs were taken using a Leica M205A stereomicroscope fitted with a Leica MC170 HD digital camera and connected to a computer with Leica Application Suite v. 4.9 software including an auto-montage module (Helicon Focus software) to produce the extended focus images.

The type material of the new species is deposited in the entomological collection of INPA, Manaus, state of Amazonas, Brazil. The specimen of *Sarcofahrtiopsis matthewsi* is deposited in the entomological collection of Museu Paraense Emílio Goeldi (MPEG), Belém, state of Pará, Brazil. Label data of type specimens are presented in verbatim quotation with individual lines separated by a forward slash (/) and individual labels separated by a double forward slash (//). Additional information is given in square brackets ([]).

RESULTS

Sarcofahrtiopsis papei sp. nov.

(Figures 1a-d, 2)

Zoobank registration: http://zoobank.org/urn:lsid:zoobank.org:pub:96E4C5DA-3D02-4972-A7A7-3FA6034109CB.

Type material examined. Holotype male (INPA-DIP 005211): Est. [= Estrada] Aleixo km 4 / INPA. Ln. Am. Br. [= Latina América Brasil] / Em [In] 8.V.1976 / Col-Albuquerque.

Diagnosis (male). Head with two proclinate fronto-orbital setae (Figures 1a-b); vein R_1 setulose dorsally on proximal two thirds; sternite 5 with posterior margin with a large median hump flanked on each side by a much smaller hump (Figure 2c); postgonital apodeme a thin plate with a narrow, thickened posterior margin (Figure 2d); basiphallus dorsally with a clubbed projection bearing many tiny sclerotized spines (Figures 1d, 2f).

Description. *Male* (holotype). Body length = 4.7 mm (n = 1). **Head**. Length at antennal base 1.4 times the length at vibrissal level; parafacial and fronto-orbital plates with golden microtomentum; frontal vitta reddish brown; frons at its narrowest point 0.35 times head width; 4 frontal setae, anterior three medioclinate and posterior one reclinate; one very small and one much larger proclinate fronto-orbital setae; inner vertical seta thick and reclinate; outer vertical setae 0.5 times inner vertical and latero-clinate; ocellar triangle black with grayish microtomentum, with one pair of fine proclinate and slightly latero-clinate ocellar setae; postocellar and paravertical setae present; postocular area, gena with golden microtomentum and with thick black setae, postgena with gray microtomentum and with black setae; face with silvery microtomentum; facial ridge with silvery microtomentum, with setae close to vibrissa; 4 subvibrissal setae; antenna dark brown; postpedicel dark blackish with gray microtomentum; length of postpedicel 0.37 times head height; arista plumose. **Thorax**. Black. Prescutum and scutum with dorsal and lateral stripes of silvery-gray microtomentum, and three black stripes; postpronotal lobe, notopleuron, proepisternum, anepisternum, anepimeron and katepisternum with yellowish-gray pruinosity. Chaetotaxy: acrostichals 0 + 1; dorsocentrals 2 + 3; intra-alars 1 + 2; supra-alars 1 + 3; postpronotals 2; postalars 2; notopleurals 2; proespisternals 2; proepimeral 1; anepisternals 5; merals 5, katepisternals 2 (plus one weaker in middle); postalar wall bare. Scutellum without apical setae, with one pair of subapical and one pair of basal. Wing hyaline; vein R_1 setulose dorsally on proximal two thirds; vein R_{4+5} setulose to crossvein r-m; costal spine not differentiated; third costal sector bare ventrally; cell r_{4+5} open; lower calypter whitish. Legs with coxae and trochanters brown with silvery-gray microtomentum; femora blackish with silvery-gray microtomentum; tibiae brown; tarsi brown; fore femur with a row of setae on dorsal, ventral, and posteroventral surfaces; mid femur without ctenidium, one median anterior setae, and 2 posterodorsal setae; hind femur with rows of anterodorsal, anteroventral and posteroventral setae; fore tibia with anteroventral setae on distal half; mid tibia with 1 anterodorsal seta, 1 posterodorsal seta on proximal half and 2 posterodorsal setae on distal half; hind tibia with 1 posteroventral and two pairs of anterodorsal setae. **Abdomen**. Tergites dark brown with a band of silvery-gray microtomentum anterolaterally; sternites light brown with silvery-gray microtomentum; sternite 5 wider than long, not cleft, with short and glossiform arms strongly divergent, posterior margin with a large median hump flanked on each side by a much smaller hump, with long and thick setae mainly medially. **Terminalia**. Cercus short (shorter than length of syntergosternite 7+8) and stout, with pointed apex gently curved in profile, with most of

Figure 1. *Sarcofahrtiopsis* (*Sarcofahrtiopsis*) *papei* **sp. nov**., male holotype. **A** – Thorax, dorsal view, and head, lateral view; **B** – Head, frontal view; **C** – Habitus, lateral view; **D** – Phallus, lateral view, arrow showing the prickly clubbed projection on dorsal surface of basiphallus. *Sarcofahrtiopsis* (*Pacatuba*) *matthewsi*. **E** – Terminalia, lateral view. Scale bars: A-C = 1 mm, D-E = 0.3 mm.

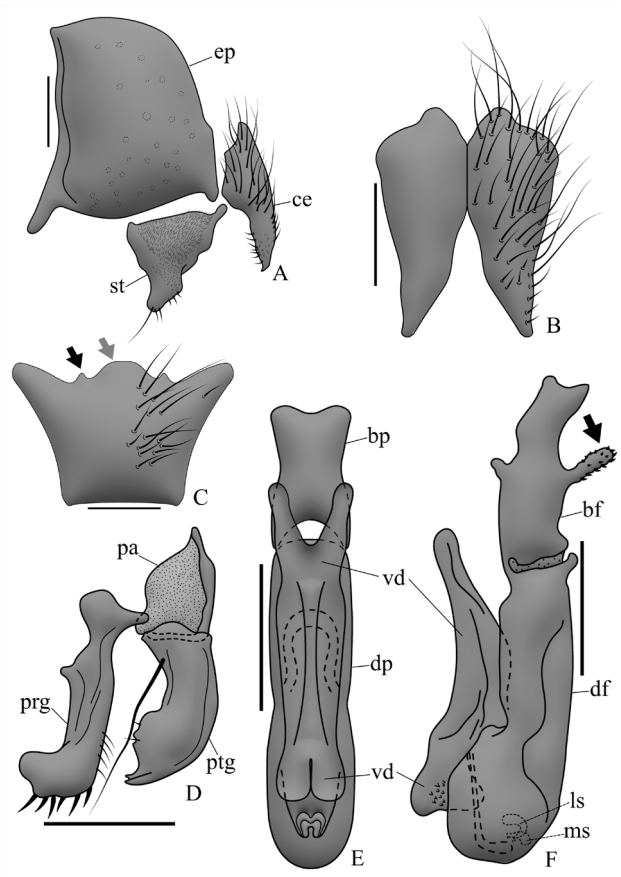

Figure 2. *Sarcofahrtiopsis* (*Sarcofahrtiopsis*) *papei* **sp. nov**., male terminalia of holotype. **A** – Epandrium, cercus and surstylus, left lateral view; **B** – Cerci, ventral view; **C** – Sternite 5, ventral view, gray arrow showing the median hump and black arrow showing the lateral small hump; **D** – Gonites, left lateral view; **E** – Phallus, ventral view; **F** –Phallus, left lateral view, arrow showing the prickly clubbed projection on dorsal surface of basiphallus. Abbreviations: bp = basiphallus; ce = cercus; dp = distiphallus; ep = epandrium; ls = lateral stylus; ms = median stylus; pa = postgonital apodeme; pg = pregonite; pt = postgonite; st = surstylus; vd = distal section of vesica; vl = vesical arm-shaped lever. Scale bars = 250 µm.

the curvature taking place along anterior margin (Figure 2a), covered with many long and thick setae. Cerci with divergent apexes in posterior view (Figure 2b). Surstylus well-developed (about the same length as cercus), triangular, with rounded apex strongly curved anteriorly, covered with setulae, except on lateral margins and distal portion, with a long seta apically (Figure 2a). Postgonital apodeme a thin plate more than half as long as postgonite and with a narrow, thickened dorsal margin (Figure 2d). Pregonite clubbed with tip strongly curved anteriorly, bearing many short and thick spine-like setae apically (Figure 2d). Postgonite shorter than pregonite, claw-shaped, curved anteriorly, with one strong seta on basal portion of anterior margin (Figure 2d). Connection between basi- and distiphallus as a desclerotized strip. Basiphallus elongate, bearing on dorsal surface a clubbed projection with many tiny sclerotized spines (Figures 1d, 2f). Distiphallus elongate and clubbed in lateral view, narrowed with a slight constriction medially in ventral view, with rounded tip; vesica well-developed and elongate, proximal arm-shaped lever of vesica parallel to phallic tube with rounded tip and bifid in ventral view (Figures 1d, 2e-f); distal section of vesica sclerotized, broadened laterally and medially divided in ventral view; juxta sclerotized and rounded (Figures 2e-f); lateral and median styli tiny, not exposed in lateral view (Figures 2e-f).

*Female***.** Unknown.

Etymology. The species epithet, which is a proper noun given a masculine Latin genitive ending, is given in honor of Dr. Thomas Pape (Natural History Museum of Denmark) for his immeasurable contributions to our knowledge of the Sarcophagidae. In addition, he has described many species of *Sarcofahrtiopsis*.

Distribution. NEOTROPICAL - Brazil (Amazonas).

Natural history. Unknown.

New record

***Sarcofahrtiopsis matthewsi* Lopes**

(Figure 1e)

Material examined. BRAZIL. Pará: Paragominas, Área de mineração da Norsk Hydro, 14–20.VI.2019, Malaise trap, leg. R. Peterson & R.R. Silva (1 male, MPEG).

Distribution. NEOTROPICAL – Brazil (Pará [new record], Ceará), Costa Rica, Nicaragua.

Updated identification key of *Sarcofahrtiopsis*

Sarcofahrtiopsis papei **sp. nov**. can be incorporated into the key to species of *Sarcofahrtiopsis* by Mulieri and Dufek (2019) by replacing couplet 15 with the following:

15. Dorsal surface of basiphallus with a clubbed projection bearing many tiny sclerotized spines. Distal section of vesica without spines …….. *Sarcofahrtiopsis papei* **sp. nov**.

15'. Dorsal surface of basiphallus without a clubbed projection. Distal section of vesica with spines 16

16. Basicosta yellowish. Distal section of vesica with 4 to 5 spines on apical margin (Figure 5F in Mulieri and Dufek (2019)) ..... *Sarcofahrtiopsis farri* Dodge

16'. Basicosta brown. Distal section of the vesica with 8 to 10 spines on apical margin (Figure 5G in Mulieri and Dufek (2019)) ..... *Sarcofahrtiopsis jamaicensis* Dodge

DISCUSSION

In the most recently published key to the species of *Sarcofahrtiopsis* from Mulieri and Dufek (2019), the new species runs to couplet 15 that includes the species *S. farri* Dodge and *S. jamaicensis* Dodge. *Sarcofahrtiopsis papei* **sp. nov**. differs from these two species and the other congeners mainly in having a basiphallus with a clubbed projection bearing many tiny sclerotized spines on the basal half (see Figures 1d, 2f). In addition, these two species have the distal section of the vesica with the apical margin bearing spines, while the vesica in *S. papei* **sp. nov**. has no spines. *Sarcofahrtiopsis spinetta* Mulieri & Dufek also have spines on the dorsal surface of the basiphallus, but they are organized in two rows on the distal half. According to the classification proposed by Buenaventura and Pape (2018), *Sarcofahrtiopsis* is composed of two subgenera: *Sarcofahrtiopsis* and *Pacatuba* Lopes, as was followed subsequently by Buenaventura (2021). Support for this division was generated by a phylogenetic hypothesis based on morphological data in which three species were utilized: *Sarcofahrtiopsis matthewsi* (type species of *Pacatuba*), *Sarcofahrtiopsis cuneata*, and *Sarcofahrtiopsis thyropteronthos* Pape, Dechmann & Vonhof. Mulieri and Dufek (2019) described a new species of *Sarcofahrtiopsis*, *S. spinetta*, that has features of both subgenera, and they highlighted the need of a more comprehensive phylogenetic analysis, based on a large number of species in this genus, to elucidate the relationship among species. For this reason, they did not utilize the subgeneric classification. Buenaventura *et al.* (2020) incorporated *S. spinetta* in the character matrix published by Buenaventura and Pape (2018) and recovered *Sarcofahrtiopsis* as monophyletic, but they suggest that the monophyly of subgenera should be tested in a phylogenetic analysis using a larger taxon sampling. Therefore, we also did not utilize the subgenera in the present paper.

Although flesh flies are among the most important Diptera families with forensic and medical-veterinary importance, and one of the most species-rich in Brazil, the distribution of most species is poorly known. *Sarcofahrtiopsis matthewsi* was described by Lopes (1975) based on specimens collected only in the state of Ceará, in northeastern Brazil. It has since been recorded in Costa Rica and Nicaragua (Pape 1996), and is now recorded for the first time in a Brazilian Amazonian state.

CONCLUSIONS

We describe a new species of *Sarcofahrtiopsis* from the central Brazilian Amazon based on a male specimen found in the entomological collection of INPA. It reinforces the importance of entomological collections as biodiversity repositories. In addition, the distribution of *Sarcofahrtiopsis matthewsi* is extended to the Brazilian Amazon, increasing the number of species recorded for this region. Therefore, now five species of *Sarcofahrtiopsis* are known to occur in Amazonia: *S. cuneata*, *S. cupendipe*, *S. matthewsi*, *S. papei* **sp. nov.**, and *S. terezinh*ae.

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