First record of *Migonemyia vaniae* Galati, Fonseca & Marassá, 2007 (Diptera, Psychodidae, Phlebotominae) in the state of Rio de Janeiro, Brazil

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Abstract

In an investigation carried out at the headquarters of Jequitibá in Três Picos State Park, the presence of the sandfly *Migonemyia vaniae* Galati, Fonseca & Marassá, 2007 was observed. Morphometric analyzes of the sperm pump and aedeagal ducts and photographs of the structures were performed to compare the differences between *Migonemyia vaniae* and *Migonemyia migonei* (França, 1920). Since its description, *Mg. vaniae* has been recorded only in the state of São Paulo. Therefore, we report the first encounter of this species in the state of Rio de Janeiro.

Keywords

Atlantic Forest, distribution records, sandfly

Introduction

Sandflies are blood-feeding dipterous insects of the subfamily Phlebotominae in the family Psychodidae and present preferentially nocturnal twilight habits. These mosquitoes are the vectors of the leishmaniasis disease, which is caused by many trypanosomatid species of the genus *Leishmania* (Ross, 1903) (Rangel and Lainson 2003).

Currently, 1047 taxa of subfamily are described worldwide, including 1016 extant and 31 fossil species. In the American continent, there are 546 species known—529 extant species and 17 fossil species (Galati 2019)—and about 10% of the extant species may be involved in the transmission of human pathogens (Seccombe et al. 1993; Young and Duncan 1994; Maroli et al. 2013). The lack of ecoepidemiological studies in uninvestigated regions suggest that only a small portion of the estimated total arthropods in the world are described (Hamilton et

The Três Picos State Park (Três Picos State Park) is located in serra do Mar, in the mountainous region of the state of Rio de Janeiro, covering an area of 65,113 ha of the state, where the highest biodiversity index in the state is located. It is the largest nature conservation unit in the state and is within the limits of five municipalities: Cachoeiras de Macacu (about two-thirds of the park’s area are in this municipality), Nova Friburgo, Teresópolis, Guapimirim, and Silva Jardim. The park protects a fragment of Atlantic Forest composed of dense ombrophalous forest and tropical climate (INEA 2009). The headquarters of Jequitibá is in the municipality of Cachoeiras de Macacu, about 400–500 m above sea level. Surveys of the sandfly fauna have previously been conducted in the park.

Here, we report the first record of *Migonemyia vaniae* Galati, Fonseca & Marassá, 2007 in the state of Rio de Janeiro. This species was described from material collected in the Ribeira Valley, near the Alto da Serra de Paranapiacaba biological reserve in the state of São Paulo (Galati et al. 2007). Our new record expands the known geographic distribution of this species, which until now was thought to be restricted to the state of São Paulo.

**Methods**

Field campaigns were carried out under collection authorization (no. 058/2015) of the Instituto Estadual do Ambiente (INEA). Monthly captures were made in PETP, at the Jequitibá headquarters located in Cachoeiras de Macacu (22°24′57″S, 042°36′30″W), with the use of CDC light traps model HP (Pugedo et al. 2005) for approximately 24 h from November 2016 to October 2017.

The traps were arranged in five monitoring stations (MS) established according to the tracks present inside the headquarters, these being: MS1: entrance of headquarters, near bamboo plantation (22°24′50″S, 042°36′49″W); MS2: Crystal Trail, near the waterfall (22°24′58″S, 042°36′33″W); MS3: Giant Jequitibá Trail, near Jequitibá (22°25′04″S, 042°36′37″W); MS4: Observatory Trail, climbing near the lake located at the park’s head (22°24′53″S, 042°36′32″W); MS5: trail behind the visitation room near the waterfall (22°25′01″S, 042°36′23″W).

The collected material was euthanized by freezing and then preserved in alcohol 70%. In the laboratory, the sandflies were submitted to a process of clarification and diaphanization in Elisa plates. The species were identified under an optical microscope with the aid of the dichotomous key proposed by Galati (2003, 2019). Abbreviations of species names are as suggested by Marcondes (2007).

Our slide preparations of *Mg. vaniae* and *Migone myia migonei* (França, 1920) were photographed under an optical microscope (PrimoStar, Carl Zeiss) with an AxiosCam camera (Carl Zeiss). The Carl Zeiss Imaging Systems v. 4.7.2 was used to perform measurements of the ejaculatory sperm pump and aedeagal.

**Results**

After 12 months of capturing sandflies, two male specimens identified as *Migonemyia vaniae* were collected. One specimen was collected in March 2017 and another in October 2017, both at MS4: Observatory Trail, climbing near the lake located at the park’s head.

**New records.** BRAZIL – Rio de Janeiro • Cachoeiras de Macacu, Três Picos State Park, headquarters at Jequitibá; 22°24′53″S, 042°36′32″W; 464 m ailt.; 15.III.2017; T.D. Balthazar leg.; light trap CDC; 1 ♂, Colfleb NE 3289/21 slide no. 91897 • same locality; 19.X.2017; T.D. Balthazar leg.; light trap CDC; 1 ♂, Colfleb NE 3990/21 slide no. 91897.

**Identification.** We identified specimens of *Migonemyia migonei* and *Migonemyia vaniae*. These two species present a short first flagellomer (F1), smaller than ½ of the head length (Fig. 1A, B), and genitalia with the internal spine implanted very close to the apex (Fig. 1C, D), as described by Galati (2003, 2019) and characteristic of species belonging to the genus *Migonemyia*.

Analyzing the two specimens of *Mg. vaniae*, we observed that the parameter is digitiform and its dorsal margin is slightly convex (Fig. 1C), while the specimens of *Mg. migonei*, the dorsal margin of the parameter is strongly convex (Fig. 1D), as shown by Galati et al. (2007).

The species were confirmed by studying the morphology of their aedeagal ducts, which is a taxonomic character pointed out by Galati et al. (2007). We observed that the two specimens of *Mg. vaniae* had an average spermatic pump length of 145.803 μm and an average aedeagal duct length of 646.37 μm; in four specimens of *Mg. migonei* these were 122.40 μm and 545.06 μm, respectively (Table 1).

**Discussion**

Galati et al. (2007) described *Migonemyia vaniae* from the Ribeira Valley, a rural region of the state of São Paulo, near an Atlantic Forest reserve (24°33′01″S, 048°40′15″W). Although this previously known occurrence (the type locality) in the municipality of Santo André and our new record MS4 are 665 km apart, the two areas have important similarities in their biotopes (Fig. 2).

Both collection sites are fragments of Atlantic Forest and have a dense ombrophilous forest vegetation with high-altitude tropical climate (INEA 2009; Secretaria de
Infraestrutura e Meio Ambiente 2020) and these account for the presence of *Mg. vaniae* in both sites. However, the altitude of the encounter of the type species and our report showed variation, where our new record was 464 meters above sea level, while the Ribeira Valley is 260 m above sea level, suggesting the encounter of this species within this range of altitude.

The genus *Migonemyia* has three species, of which *Migonemyia rabelloi* (Galati & Gomes, 1992) and *Mg. vaniae* were described from and only known from the state of São Paulo (Galati et al. 2007). *Migonemyia migonei* has the greatest distribution and consequently its biology and medical importance is the best known.

*Migonemyia migonei* is naturally infected with *Leishmania (Leishmania) infantum* [syn. *Leishmania (Leishmania) chagasi*; Dantas-Torres 2006] in areas of Visceral Leishmaniasis transmission, through studies using molecular techniques (De Carvalho et al. 2010; Moya et al. 2015). However, although found infected, *Mg. migonei* has not yet been characterized as a vector for Visceral Leishmaniasis (Galvis-Ovallos 2019). However, *Mg. migonei* is a secondary vector of Tegumentary Leishmaniasis according to the literature (Rangel et al. 1986; Pita-Pereira et al. 2005).

Our morphological comparisons of *Mg. migonei* and *Mg. vaniae* corroborate the descriptions by Galati et al. (2007), who found that *Mg. migonei* presents a parameter with a strongly convex dorsal margin between two concavities, and ejaculatory ducts and a sperm pump measuring ≤590 μm and 130 μm, respectively. *Migonemyia vaniae* has a digitiform parameter with a slightly convex dorsal margin, and ejaculatory ducts and the pericardiac pump measure ≥640 μm and 146 μm, respectively (Galati et al. 2007; Galati 2019). Thus, our data presented

### Table 1. Measurements of the spermatic pump (S.P.) and aedeagal ducts (E.D.) of the species *Migonemyia vaniae* and *Migonemyia migonei.*

<table>
<thead>
<tr>
<th>Specimen</th>
<th>Mg. vaniae</th>
<th>Mg. migonei</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>S.P.</td>
<td>140.969 μm</td>
</tr>
<tr>
<td></td>
<td>E.D.</td>
<td>629.562 μm</td>
</tr>
<tr>
<td>2</td>
<td>S.P.</td>
<td>150.638 μm</td>
</tr>
<tr>
<td></td>
<td>E.D.</td>
<td>663.185 μm</td>
</tr>
<tr>
<td>3</td>
<td>S.P.</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>E.D.</td>
<td>—</td>
</tr>
<tr>
<td>4</td>
<td>S.P.</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>E.D.</td>
<td>—</td>
</tr>
<tr>
<td>Average</td>
<td>S.P.</td>
<td>145.803 μm</td>
</tr>
<tr>
<td></td>
<td>E.D.</td>
<td>646.3735 μm</td>
</tr>
</tbody>
</table>

*Figure 1. Migonemyia vaniae* Galati, Fonseca & Marassá, 2007 and *Migonemyia migonei* (França, 1920). A. *Mg. vaniae* head. B. *Mg. migonei* head. C. *Mg. vaniae* genitalia presenting the parameter (arrow), which is slightly convex in the dorsal margin. D. *Mg. migonei* genitalia presenting the parameter (arrow), which is strongly convex in the dorsal margin.
confirm the first record of the species *Mg. vaniae* from the state of Rio de Janeiro.

*Migonemyia vaniae* differs from *Mg. rabelloi* and *Mg. migonei* by their longer ejaculatory pump and e dealag ducts in relation to the other species.

Until now, 64 species had been reported to occur in the state of Rio de Janeiro (Galati 2019). With our new record of *Mg. vaniae*, 65 species (of the 1016 species currently described) are now known from the state (Galati 2019).

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Authors’ Contributions

Conceptualization: JSM, MLV. Data curation: ALFS, LHC. Formal analysis: TDB, ALFS. Investigation: TDB, LHC. Methodology: TDB, ALFS, MLV. Resources: TDB. Supervision: JSM, MLV. Validation: MLV. Visualization: TDB Writing – original draft: TDB. Writing – review and editing: JSM, MLV.

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