



## A new species of *Sisyra* Burmeister, 1839 (Neuroptera: Sisyridae) from Peru, with identification key to the Neotropical species of the genus

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### ABSTRACT

A new species of *Sisyra* Burmeister is described from the tropical rainforest of Tambopata National Reserve, Madre de Dios region, Peru. *Sisyra tambopatensis* **sp. nov.** is described based on a male specimen, which greatly differs from its congeners in the overall shape of the male gonocoxite 9. In addition, an identification key to the Neotropical species of *Sisyra* is provided.

### Introduction

The spongillaflies (Sisyridae) compose a small family of Neuroptera. Recently, phylogenetic studies based on genomics recovered Sisyridae together with Nevrothidae and Osmylidae in the superfamily Osmyloidea (Winterton et al., 2018). Furthermore, this clade is supported by one morphological synapomorphy, the female gonocoxite 9 semi-articulated with tergite 9; and by the aquatic/semi-aquatic larval habitus of these families (Winterton et al., 2018).

Currently, Sisyridae comprises 85 species, including 12 extinct, distributed in 12 genera. *Sisyra* Burmeister, 1839 is the most species-rich genus of the family, with 49 valid species (Forteath et al., 2015; Assmar and Calor, 2020; Oswald, 2022). It is distributed worldwide, except in the North and South poles, and it can be differentiated from the other genera due to the lack of the series of outer gradate crossveins in the forewing (Parfin and Gurney, 1956; Monserrat, 1981). Five species of *Sisyra* have been recorded in the Neotropical region, of which three are currently known from Peru, i.e., *S. apicalis* Banks, 1908, *S. elongata* Penny & Rafael, 1982 and *S. panama* Parfin & Gurney, 1956 (Bowles, 2015; Assmar and Calor, 2020).

Although the most recent description of a *Sisyra* species from the Neotropics was published in 1982 (Penny and Rafael, 1982), the general knowledge about the genus in the region is increasing lately due to efforts of several researchers (e.g., Hamada et al., 2014; Bowles, 2015; Ardila-Camacho and Martins, 2017; Assmar and Salles, 2017; Assmar and Calor, 2020). Here, I describe a new species of the genus *Sisyra* from Madre de Dios, Peru, I also provide an identification key to the Neotropical species and their current distribution.

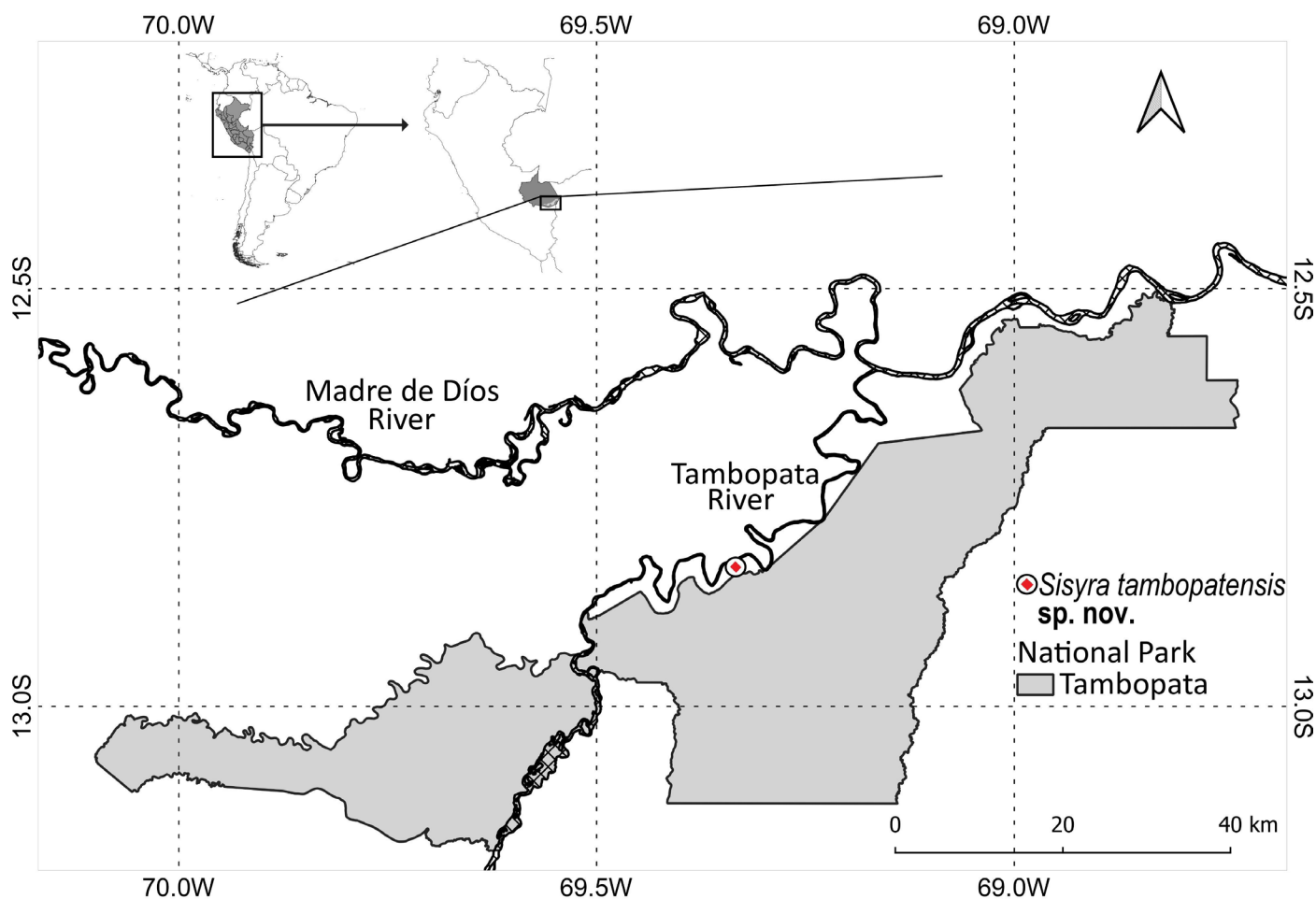
### Material and methods

The male specimen was collected in the Peruvian tropical rainforest, Tambopata National Reserve (TNR), southeast of Madre de Dios region (Fig. 1). The TNR is a protected area with 274,690.00 ha of extension, located in the Tambopata province (SERNANP, 2022). The annual mean temperature is 26°C, varying from 10°C to 38°C (SERNANP, 2022). This is an important area to both conservation and economical purposes, where the biodiversity is protected, specially endangered species (SERNANP, 2022).

Wings were dissected, dehydrated, and fixed on a slide to analyse venation and colour pattern. The genitalia were diaphonized

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**Figure 1** Tambopata National Reserve (TNR) map, with geographic coordinates, highlighted from Peru, which is located in South America. *Sisyra tambopatensis* sp. nov. was collected at Tambopata River.

using 10% KOH solution (Blahnik and Holzenthal, 2004), heated for approximately one hour and stored in micro vial with glycerine. The specimen is preserved in 80% ethanol and wings on slide. Illustrations were made using the software Adobe Illustrator CC 2017 and images treated using Adobe Photoshop CC 2018. The holotype was deposited at United State National Museum of Natural History (USNM), at Smithsonian Institution, Washington, D.C. Terminology follows Aspöck and Aspöck (2008) to genitalia and Breitzkreuz et al. (2017) to wings venation.

### *Sisyra tambopatensis* Assmar, sp. nov.

(Figs. 1–2)

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### Etymology

The species name, *tambopatensis* (Latinised locality name), is in reference to the type locality in which the holotype was collected, the Tambopata National Reserve in Peru.

### Material Examined

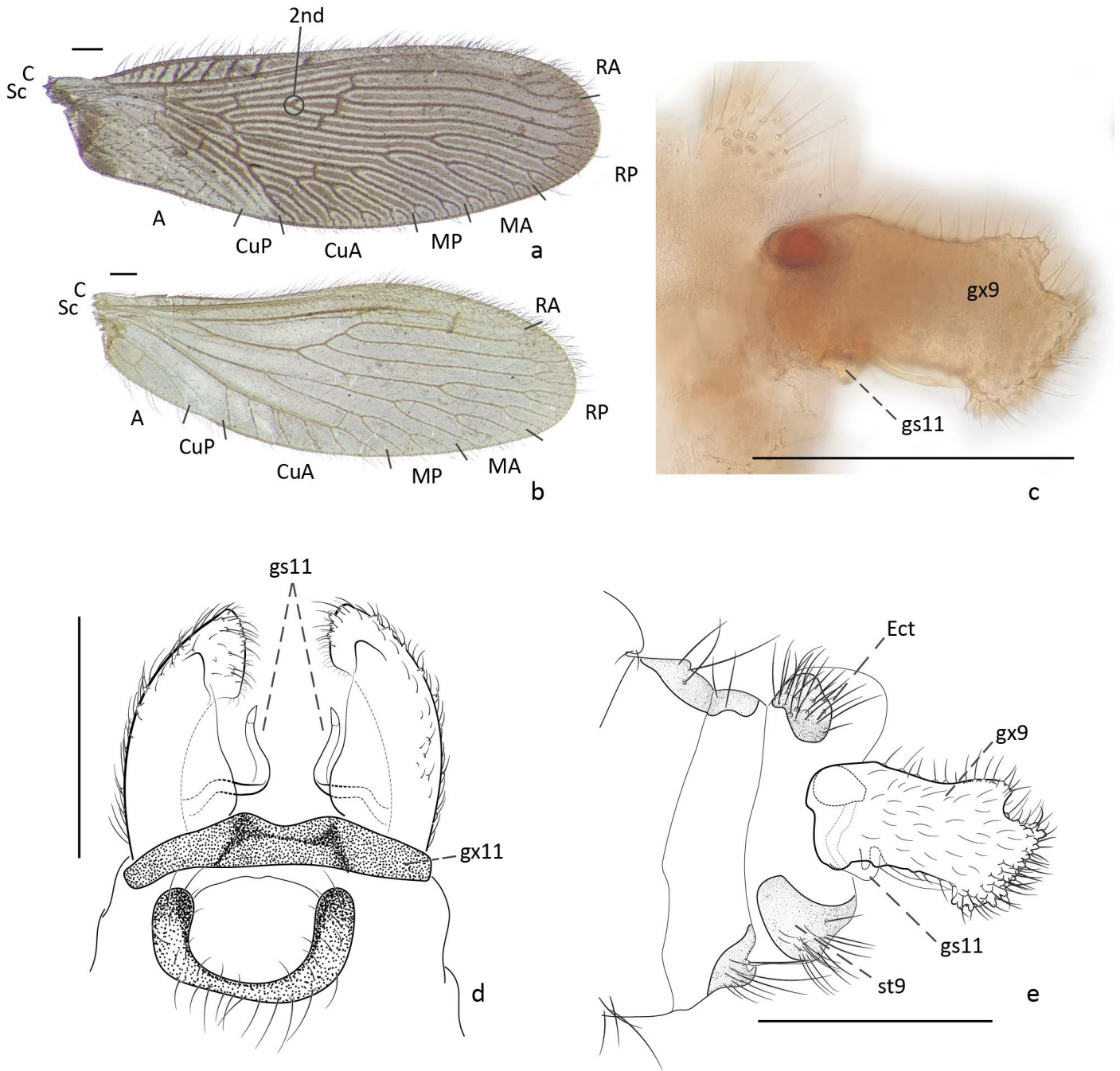
Holotype ♂ PERU, Madre de Dios, Rio Tambopata Res. 30 km (air) SW P[uer]to. Maldonado, 12°50' S 69°20' W, 209 m, 02.v.1984, T.L. Erwin et al, male adult in alcohol (USNM 1477009), genitalia in glycerin (USNM 1477009) and wings on slide (USNM 1477054).

### Diagnosis

*Sisyra tambopatensis* sp. nov. differs from its congeners by the shape of the male genitalia in the following characters: the gonocoxite 9 is long, rectangular, with a dorsal projection at the distal third and slightly broad apex. In addition, the gonostylus 11 is long and curved at the midpoint before directing distally, resembling a semi-loop.

### Description

*Adult.* Light brown, 3.5 mm. Vertex darker, with long, light brown setae. Antennae light brown to yellow throughout. Maxillary palpi light brown, five-segmented, apical segment with expanded base. Mandibular palpi light brown, three-segmented. Frons light brown, with long light brown setae. Thorax brownish, darker dorsally. Prothorax



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**Figure 2** *Sisyra tambopatensis* sp. nov. holotype (a) forewing, (b) hind wing, and male genitalia (c) photo of lateral view, and illustrations of (d) dorsal view, (e) lateral view. Scale bars= 0.4 mm. Abbreviations: C= costal; Sc= subcostal; RA= radial anterior; RP= radial posterior; MA= medial anterior; MP= medial posterior; CuA= cubital anterior; CuP= cubital posterior; A= anal; 2nd= second bifurcation of RP; Ect= ectoproct; gx9= gonocoxite 9; gx11= gonocoxite 11; gs11= gonostylus 11; st9= sternite 9.

with a medial longitudinal dark brown streak. Mesothorax dark brown dorsally, light brown laterally, but darkening near legs. Metathorax light brown, darkening near legs. Legs light brown to yellow. Abdomen weakly sclerotized.

**Wings.** Yellowish brown, with pilose margins. Forewing (Fig. 2a) 4.3 mm, membrane pale basally, presence of maculae between longitudinal veins. Pterostigma with slight pale mark. All veins brown, pale at base and anal area. Twelve subcostal veinlets before pterostigma. One sc-r, two ra-rp, two r-m, two m-cu, one cua-cup, one cu-a, two anal crossveins. Branches of CuA forked. Hind wing (Fig. 2b) 3.8 mm, homogeneous in coloration. All veins brown, except dark brown RA and lighter at pterostigma and anal area. Seven subcostal veinlets before pterostigma. One sc-r, two ra-rp, two r-m, two m-cu, one anal crossvein.

**Genitalia.** Sternite 9 as a small plate, with numerous long, light brown, dentigerous-based setae (Fig. 2e). Ectoproct with rounded margin and long, light brown setae throughout (Figs. 2c, d, e). Gonocoxite 9 stout, long, rectangular, with a dorsal projection at distal third, apex slightly

expanded, numerous light brown dentigerous-based setae (Figs. 2c, e). Gonostylus 11 long, curving to central-dorsal point before directing distally (Figs. 2c, d, e).

*Female.* Unknown.

*Larvae.* Unknown.

## Discussion

Among the Neotropical species, *Sisyra tambopatensis* **sp. nov.** is more similar to *S. panama* in the wings' venation, also sharing the pale mark of the pterostigma of the forewing (Fig. 2a). However, the morphology of the male genitalia differs since the gonocoxite 9 of *S. panama* is quadrangular, with a ventral projection at the base (Assmar and Calor, 2020), while in *S. tambopatensis* **sp. nov.** the gonocoxite 9 is rectangular, with a dorsal projection in the distal third instead. In addition, the gonostylus 11 of *S. panama* is projected ventrally, in contrast to the new species, in which the gonostylus 11 is projected central-dorsally, and curves ventrally before extending distally (Figs. 2c, e).

The new species can be easily distinguished from *S. amazonica* Penny, 1981, *S. apicalis*, *S. elongata* and *S. minuta* Esben-Petersen (1935), by the presence of one crossvein between RP2 and RP3 and the pale mark at the pterostigma of the forewing, which are absent in these four species mentioned (Parfin and Gurney, 1956; Penny, 1981). Additionally, regarding the male genitalia, the gonocoxite 9 of *S. amazonica* and *S. apicalis* are elongated and cylindrical (Penny, 1981), compared to the rectangular shape of the gonocoxite 9 of the new species. *Sisyra elongata* has the distal third portion of the gonocoxite 9 greater expanded (Ardila-Camacho and Martins, 2017) than *S. tambopatensis* **sp. nov.**, and *S. minuta* has a small, "beak-like" gonocoxite 9 (Penny, 1981; Assmar and Calor, 2020).

The temporal distribution of the known record of *S. tambopatensis* **sp. nov.** is May, which is during the Fall season of the Neotropical region. The dietary habit of this species is unknown, but it is probably similar to the other spongillafly species, which is based on honeydew, pollen, and small arthropods, for example (Parfin and Gurney, 1956).

The number of *Sisyra* species recorded from Peru is now increased to four. The fauna of spongillafly is severely understudied in many South American countries, including Peru. No studies were ever fulfilled exclusively with the spongillafly fauna in the country and the information acquired is from new records published in general studies from the Neotropical region (e.g., Flint Junior, 2006; Bowles, 2015). Although the general knowledge about the group is increasing, there are still countries in the Neotropical region with no known records of the spongillafly, such as Ecuador or French Guiana (Bowles, 2015; Ardila-Camacho and Martins, 2017).

## Key to Neotropical *Sisyra* Burmeister species

(Key modified from Assmar and Salles (2017) and the distributional records updated from Bowles (2015)).

- 1 Streaks absent on membrane between longitudinal veins of the forewing (Penny, 1981, Fig. 7); male gonocoxite 9 "beak-like" (Penny, 1981, Fig. 15) ... *S. minuta* Esben-Petersen, 1935 (Brazil)
  - Distinct streaks present on membrane between longitudinal veins of the forewings (Assmar and Salles, 2017, Figs. 15, 16); male gonocoxite 9 not "beak-like" ... 2
- 2 Antennae not striped, same color throughout ... 3
  - Antennae striped, usually intercalating yellowish and dark parts... 5

- 3 Crossvein absent after second bifurcation of the forewing RP; male gonocoxite 9 cylindrical in lateral view, with rounded apex (Penny, 1981, Figs. 5, 13) ... *S. amazonica* Penny, 1981 (Brazil, Guyana, Paraguay)
  - Crossvein present after second bifurcation of the forewing RP (Fig. 2a); male gonocoxite 9 not cylindrical, broad in lateral view, with truncate apex ... 4

- 4 Male gonocoxite 9 quadrangular, absence of dorsal projection at distal third (Assmar and Calor, 2020, Fig. 20) ... *S. panama* Parfin & Gurney, 1956 (Bolivia, Brazil, Panama, Peru)
  - Male gonocoxite 9 rectangular, presence of dorsal projection at distal third (Figs. 2c, e) ... *S. tambopatensis* **sp. nov.** (Peru)

- 5 Male gonocoxite 9 without expanded apex in lateral view (Assmar and Salles, 2017, Fig. 13) ... *S. apicalis* Banks, 1908 (Belize, Brazil, Cuba, Guatemala, Mexico, Nicaragua, Panama, Peru, Suriname, Uruguay, United States of America)
  - Male gonocoxite 9 with expanded apex in lateral view (Ardila-Camacho and Martins, 2017, Fig. 2c) ... *S. elongata* Penny & Rafael, 1982 (Brazil, Colombia, Peru)

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## Conflict of interest

The author declares that there is no conflict of interest.

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