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New distributional records for Neotropical spongillafies (Neuroptera: Sisyridae)

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Abstract. Distributional data are presented for Neotropical spongillafies (Sisyridae). New country records from Uruguay are presented for *Climacia carpenteri* Parfin and Gurney, *C. insolita* Flint, *C. versicolor* Flint. *Climacia desordenata* Monserrat is synonymized with *Climacia basalis* Banks, **NEW SYNONYMY**. For the first time, *Sisyra apicalis* Banks is reported from Guatemala, Suriname, and Uruguay, and *S. panama* Parfin and Gurney is reported from Peru. Additional distributional data are presented for other species.

Key words. Neuroptera, Sisyridae, *Climacia*, *Sisyra*, Neotropics

Introduction

The distribution of Neotropical spongillafies (Neuroptera: Sisyridae) is becoming increasingly better known. The monograph on sisyrids published by Parfin and Gurney (1956) provided the most substantial description of the Neotropical fauna to date. Subsequently, the works of Penny (1981, 2002), Penny and Rafael (1982), Flint (1998, 2006), and Monserrat (2005) described additional species and added distributional records. Monserrat (2005) found female syntypes of *Climacia basalis* Navás in Barcelona (Museu de Zoologia) as well as another 10 specimens in Berlin (Zoologisches Museum, Museum für Naturkunde) with identical data, including males. Since *C. basalis* Navás from Brazil and *C. basalis* Banks from Brazil and Guyana are homonyms, Monserrat (2005) renamed the Navás species *C. desordenata* considering it a valid species. Flint (2006), however, synonymized *C. basalis* Navás with *C. basalis* Banks because the male of the latter species is unknown and the wing patterns of the two species cannot be distinguished. Based on this synonymy, records of *C. desordenata* Monserrat, **NEW SYNONYMY**, are attributable to *C. basalis* Banks. Monserrat (2005) also established *Sisyra nocturna* Navás as a synonym of *S. apicalis* Banks, and he provided a distributional record for this species from Brazil. Monserrat (2005) also reported distributional records for *C. californica* Chandler (Mexico), *C. townesi* Parfin and Gurney (Brazil), and *S. elongata* Penny and Rafael (Brazil).

Despite those studies, the sisyrid fauna of the Neotropics remains relatively poorly described. Prior to this study, there are no reported occurrences of spongillafies from Belize, El Salvador, and Guatemala in Central America, or from Colombia, Ecuador, French Guiana or Uruguay in South America. There are no occurrence records from the Galápagos Islands or Falkland Islands as well. Distributional data for spongillafies in the Caribbean also are scant. Although *S. apicalis* Banks is known from the Cayman Islands, and *S. apicalis* Banks and *C. antillana* Alayo are known from Cuba (Banks 1908; Parfin and Gurney 1956; Alayo 1968), there are no known occurrences of spongillafies from Jamaica, Haiti, Dominican Republic, Puerto Rico, or the Lesser Antilles.

Recently, I examined spongillafies from several museum collections that yielded several new country records for these insects in the Neotropics as well as new distributional information for countries where species were previously reported. Those records and an assessment of diversity among spongillafies and freshwater sponge hosts in the Neotropics are presented in this paper.

Methods and Materials

I examined adult spongillafies from the American Museum of Natural History (AMNH), National Museum of Natural History, Smithsonian Institution (NMNH), and the Florida State Collection of Arthropods (FSCA). Several of the spongillafies were sorted from bulk blacklight trap samples belonging to the FSCA. Genitalia were removed and cleared in room temperature, saturated NaOH until internal structures could be seen with magnification. Genitalia were rinsed in 70 percent ethanol, stored in a genitalia vial with glycerin, and mounted on the pin below the specimen or stored in the vial. Data contained within brackets [] was added by the author.

Results

I report distributional records for eight species of spongillafies from Brazil, Chile, Guatemala, Nicaragua, Paraguay, Peru, Suriname, and Uruguay. The specimens from Guatemala and Uruguay represent the first report of spongillafies from those countries. The record of *Sisyr apicalis* from Suriname represents the first report of the genus and species from that country. I also present a list of the species of Sisyridae known from southern Mexico, Central and South America (Table 1).

Climacia carpenteri Parfin and Gurney, 1956

This species previously was reported from Brazil, and Paraguay (Parfin and Gurney 1956; Flint 1998, 2006; Monserrat 2005). González Olazo (1983) published a new distributional record for *C. carpenteri* Parfin and Gurney from Argentina, but Monserrat (2005) showed this record was a misidentification of *Climacia versicolor* Flint. The discovery of this species in Uruguay represents a new country record. Flint (1998) reported on *C. carpenteri* collected from Departamento Concepción, Paraguay. I examined 20 additional specimens from Paraguay collected by the same collector (J. A. Kochalka) from which Flint reported records. Flint's records were from specimens taken August through December. Some of the specimens I examined were collected during July. *C. carpenteri* appears to be the most widely distributed of the Neotropical species of *Climacia*.

PARAGUAY: [Concepción Dept.], Concepción, 19–21.vii.1989, 1 male (FSCA); same, but 8–16.viii.1989, J. Kochalka, UV-light trap, 1 male (FSCA); same, but 17–19.vii.1989, 4 males, 2 females (FSCA); same, but 2–3.x.1989, 7 males, 4 females (FSCA); same, but 18–21.x.1989, 1 male (FSCA). **URUGUAY:** Soriano, [Rincon del] Arroyo Cololo, 15.i.1962, Carbonell, 5 males, 1 female (in alcohol) (FSCA); same, but “Segundo”, C.S.C., M.A.M., C.S.M., 43 males, 15 females (in alcohol) (FSCA).

Climacia chilena Parfin and Gurney, 1956

This species is known only from Argentina and Chile and is readily distinguished from other species of *Climacia* in having entirely hyaline wings (Parfin and Gurney 1956; Flint 1998). The record reported here is located 235 km north, northeast of the type locality at Puerto Varas, Llanquihe Province and represents a new provincial record within Chile.

CHILE: Cautín [Prov.], Pucón, 4.ii.1968, B. Heineman, 1 female (AMNH).

Climacia insolita Flint, 1998

This species previously was known from the type series collected in Argentina and Brazil (Flint 1998, 2006). Uruguay represents a new country record for *C. insolita* and further expands the range of this species in South America.

URUGUAY: Artigas [Dept.], Sepulturas, Picada del Negro Muerto, 15.xii.1957, C. Carbonell, Río Cuareim, at light, 1 male, 4 females (FSCA).

***Climacia punctulata* Flint, 2006**

Flint (2006) described this species from Minas Gerais Province, Brazil. I report it here as an additional provincial record in that country. This is only the second known report of this species.

BRAZIL: Rondônia [Prov.], 62 km SW Ariquemes, nr. Fzda. Rancho Grande, 8–20–xi–1994, J. E. E[illegible]er, blacklight trap, 1 male (FSCA).

***Climacia versicolor* Flint, 1998**

Flint (1998) described this species from Argentina and it previously was known only from the type series collected from the Río Uruguay, Provincia Entre Ríos. Uruguay represents a new country record and the second known collection of this species.

URUGUAY: Artigas [Dept.], San Gregorio, Río Uruguay, 29.xi.1959, C. S. Carbonell, at light, 1 female (FSCA); same, but Salto [Dept.], Salto Grande, 10.xi.1955, S. S. Carbonell, light near waterfall, 2 males, 3 females (FSCA).

***Climacia* sp.**

A single female specimen of this species was collected in the small Nicaraguan department of Carazo on the Pacific Coast. It was first reported by Maes and Flint (1994). It is distinct from all other known *Climacia*, primarily in the wing maculations (Fig. 1) and banding of the antennae. The antennae have the basal 8–9 segments whitish, the next 13 segments dark brown, the next 10 segments are whitish, and the last 27–28 segments are light brown. The female genitalia are similar to those of several other species of *Climacia* (Fig. 2), and are insufficient for a comparative diagnosis. This specimen likely represents an undescribed species, but formal description will be postponed until additional material becomes available for study.

NICARAGUA: Dept. Carazo, Bioreserva de Chacocente (86°10' N, 11°30' W), 11–13.ix.1992, Maes, Martínez and López, 1 female (USNM).

***Sisyrha apicalis* Banks, 1908**

This species is widespread throughout the Americas (Parfin and Gurney 1956; Penny 1981, 2002; Bowles 2006; Flint 2006), and it has the greatest latitudinal range among all the sisyrhid species in the Western Hemisphere. The occurrence of *S. apicalis* in Guatemala, Suriname, and Uruguay represents new country records for this species and further expands its known distributional range in the Americas. This species was co-collected in Peru with *S. panama* Parfin and Gurney.

GUATEMALA: Guatemala [Dept.], Amatitlán, Lago de Amatitlán, km 29.5, 2–9.vi.2002, S. Hagen 1 female (FSCA) (in alcohol) (FSCA). **PERU:** Loreto [Region], Yacumama Lodge, 73.5° W, 4.8°S, nr. Jct. Río Marañon and Río Ucayali, 6–20.viii.1994, D. Nickle, P. Skelley et al., small light in woods, 3 males (FSCA). **SURINAME:** Saramacca [District], Damboentong, 27.vi to 9.vii.2006, Malaise, Alies van Sauers-Muller, 1 female, abdomen missing (FSCA); same but 31.viii to 10.ix.2006, sex undetermined, abdomen missing (FSCA). **URUGUAY:** Cerro Lago [Dept.], Sierra del Vaz, Río Tucari, 20 km SE Melo, 23–26.iii.1963, J. K. Bouseman, 1 male (AMNH).

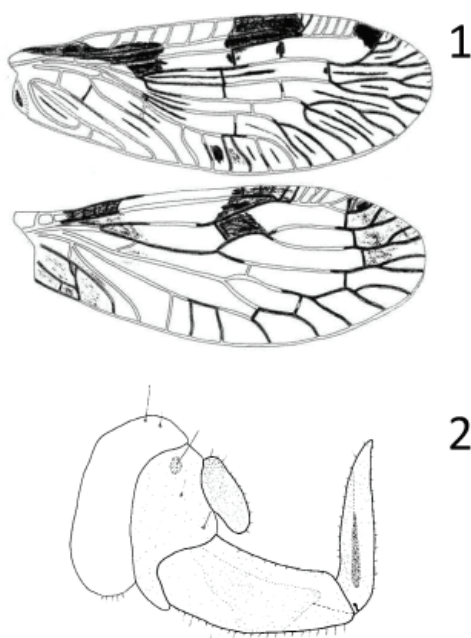
***Sisyrta panama* Parfin and Gurney, 1956**

This species has been previously reported from Bolivia, Brazil, and Panama (Parfin and Gurney 1956; Penny 1981; Flint 2006). Here, I report four specimens from Peru where it was co-collected with *S. apicalis* Banks. Although this is a new country record for this species it is not unexpected given that it also occurs in Brazil and Bolivia.

BRAZIL: Rondônia [Prov.], 62 km SW Ariquemes, nr. Fzda. Rancho Grande, U. Schmitz, BL trap, 27.iv.1992, 3 females (FSCA); same, but 6.v.1992, 2 females (FSCA); same, but 20.viii.1992, 1 female (FSCA); same, but 12.ix.1992, 2 females (FSCA). **PERU:** Loreto [Región], Yacumama Lodge, 73.5° W, 4.8°S, nr. Jct. Río Marañon and Río Ucayali, 6–20.viii.1994, D. Nickle, P. Skelley et al., small light in woods, 2 males, 2 females (in alcohol), 1 male, 2 females (pinned) (FSCA).

Discussion

The distribution and diversity of spongillafies in the Americas is becoming increasingly better known. *Sisyrta apicalis* is the most widespread sisyrind in the Americas being distributed from the southern portion of North America southward throughout much of South America, particularly along coastal areas. Similarly, *Climacia carpenteri* (Parfin and Gurney 1956; Flint 1998, 2006; Monserrat 2005; this study) is the most widespread species in South America. Most species of *Climacia* and other *Sisyrta* species have more restricted distributions. There are now four species of spongillafies known from Uruguay for the first time (*C. carpenteri*, *C. insolita*, *C. versicolor*, and *S. apicalis*). In addition, the finding of *S. apicalis* in Guatemala marks the first time spongillafies have been reported from that Central American country. Similarly, the finding of *S. apicalis* in Suriname marks the first time representatives of this genus have been collected in that country. The occurrence of *S. panama* in Peru also expands the known range of that species. Although the data here expands the known distributions of spongillafies in the Neotropics, there are no known occurrences of this family in Belize, El Salvador, Colombia, Ecuador, or French Guiana. Spongillafies also have not been documented for most of the Caribbean.



Figures 1–2. Female *Climacia* sp. from Nicaragua. 1) Wings. 2) Genitalia (lateral).

The obligate dependence of larval sisyrids on freshwater sponges (Porifera: Demospongiae) as a food source and developmental site likely plays a crucial role in their distribution. Freshwater sponge host data for spongillafly larvae in the Americas is limited primarily to studies completed in North America (Canada and USA) (Brown 1952; Parfin and Gurney 1956; Isom 1968; Poirrier 1969; Poirrier and Arceneaux 1972; Clark 1985). Little data is available for the Neotropics. Sponges are biogeographically sparse in some areas (Caribbean) or understudied in others (Mexico, Central and South America). Freshwater sponges are poorly represented in Caribbean: Cuba (4 species), Puerto Rico (1 species), Virgin Islands (1 species), Barbados and Nevis Islands (1 species), Curaçao (2 species) (Smith 1994; Bass and Volkmer-Ribeiro 1998; Bass 2003; Manconi and Pronzato 2005). Recent studies have shown that the sponge diversity in the Neotropics is quite high and it may be the most diverse sponge fauna in the world (Volkmer-Ribeiro 2007). Not surprisingly, the greatest sponge diversity for the Neotropics is in Brazil where 54 species have been reported (Nicacio et al. 2011; Buso et al. 2012; Pinheiro and Nicacio 2012; Ulisses Pinheiro, personal communication), which also has the greatest diversity of spongillaflies (Parfin and Gurney 1956; Penny 1981, 2002; Penny and Rafael 1982; Flint 1998, 2006; Monserrat 2005). Conversely, the poor diversity of freshwater sponges in Caribbean inland waters may well be the reason for an equally poor diversity of spongillaflies in that region. The high diversity of both freshwater sponges and spongillaflies in the Neotropics implies a strong coevolutionary relationship between these two groups. More detailed study on host specificity and distribution of these animals may result in a better description of such relationships.

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Table 1. Spongillaflies known to occur in southern Mexico, Central and South America. Countries shown in bold font represent new country records.

Species	Distribution	References
<i>Climacia amalla</i> Flint	Peru, Venezuela	Flint (1998), Flint (2006)
<i>C. basalis</i> Banks	Brazil, Guyana	Banks (1913), Parfin and Gurney (1956), Monserrat (2005), Flint (2006)
<i>C. bifasciata</i> Penny and Rafael	Brazil	Penny and Rafael (1982)
<i>C. bimaculata</i> Banks	Brazil, Guyana, Suriname	Parfin and Gurney (1956), Penny (1981), Flint (1998)
<i>C. californica</i> Chandler	Mexico	Chandler (1953), Oswald et al. (2002), Monserrat (2005), Bowles (2006)
<i>C. carpenteri</i> Parfin and Gurney	Brazil, Paraguay, Uruguay	Parfin and Gurney (1956), Flint (1998), Monserrat (2005), Flint (2006), this study
<i>C. chapini</i> Parfin and Gurney	Mexico	Parfin and Gurney (1956); Flint (1998), Oswald et al. (2002), Bowles (2006)
<i>C. chilena</i> Parfin and Gurney	Argentina, Chile	Parfin and Gurney (1956), Flint (1998), this study
<i>C. doradensis</i> Flint	Venezuela	Flint (1998)
<i>C. insolita</i> Flint	Argentina, Brazil, Uruguay	Flint (1998), Flint (2006), this study
<i>C. lemniscata</i> Flint	Argentina	Flint (1998)
<i>C. negrense</i> Penny	Brazil, Guyana	Penny (1981), Flint (1998)
<i>C. nota</i> Parfin and Gurney	Bolivia, Brazil, Venezuela	Parfin and Gurney (1956), Flint (1998)
<i>C. punctulata</i> Flint	Brazil	Flint (2006), this study
<i>C. striata</i> Parfin and Gurney	Panama	Parfin and Gurney (1956), Pupedis (1980), Flint (1998)
<i>C. tenebra</i> Parfin and Gurney	Honduras	Parfin and Gurney (1956), Penny (1981)
<i>C. townesi</i> Parfin and Gurney	Brazil, Guyana, Peru, Venezuela	Parfin and Gurney (1956), Flint (1998), Monserrat (2005), Flint (2006)
<i>C. triplehorni</i> Flint	Argentina, Brazil	Flint (1998)
<i>C. versicolor</i> Flint	Argentina, Uruguay	Flint (1998), Monserrat (2005), this study
<i>Sisyra amazonica</i> Penny	Brazil, Guyana, Paraguay	Penny (1981), Flint (2006)
<i>S. apicalis</i> Banks	Belize, Brazil, Guatemala , Mexico, Nicaragua, Panama, Peru, Suriname , Uruguay	Banks (1908), Parfin and Gurney (1956), Penny (1981), Maes and Flint (1994), Oswald et al. (2002), Monserrat (2005), Flint (2006), Bowles (2006), this study
<i>S. ariasi</i> Penny	Brazil	Penny (1981)
<i>S. elongata</i> Penny and Rafael	Brazil, Peru	Penny and Rafael (1982), Monserrat (2005), Flint (2006)
<i>S. minuta</i> Ebsen-Petersen	Brazil	Esben-Petersen (1935), Penny (1981), Flint (2006)
<i>S. panama</i> Parfin and Gurney	Bolivia, Brazil, Panama, Peru	Parfin and Gurney (1956), Penny (1981), Flint (2006); this study

