



**Mutualism between frogs
(*Chiasmocleis albopunctata*, Microhylidae)
and spiders
(*Eupalaestrus campestratus*, Theraphosidae):
a new example from Paraguay**

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Commensal relationships between microhylid frogs and theraphosid spiders have been previously reported for a few species. Here we report the first example of this kind of relationship for two Paraguayan species, *Chiasmocleis albopunctata* (Microhylidae) and *Eupalaestrus campestratus* (Theraphosidae). Furthermore, we extend the known Paraguayan range of the former species by providing the first departmental records for Paraguari and Guairá.

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The possibility of commensal relationships between certain New World microhylid frogs and predatory ground spiders of the families *THERAPHOSIDAE* Thorell, 1869 and *CTENIDAE* Keyserling, 1877 was first alluded to by Blair (1936) who made brief remarks on the burrow-sharing relationship between *Gastrophryne olivacea* and *Aphonopelma hentzi* (*THERAPHOSIDAE*) in the southern prairies of North America, and this was further expanded upon by Hunt (1980), Dundee (1999) and Dundee *et al.* (2012). These authors noted that the frogs clearly benefitted from the presence of the spider with reduced predation, but were unable to determine any benefit for the spider.

The phenomenon was later documented in the Neotropics, with a similar relationship between microhylid frogs (*Chiasmocleis ventrimaculata* and *Hamptophryne boliviana*) and the spider *Xenesthis immanis* reported from Peru (Cocroft & Hambler 1989; Csakany 2002; Miller 2003) and the former with *Pamphobeteus* sp. (Tomasinelli & Biggi 2013) in the Amazon. These authors noted that chemical defences by the frogs probably play a role in their unpalatability to the spiders,

as observed in certain dendrobatid and leiuperine frogs (Powell *et al.* 1984; Szelitowski 1985; Grant *et al.* 2006).

The presence of similar relationships between certain Asian microhylids and mygalomorph spiders (Rao & Ramana 1925; Siliwal & Ravichandran 2008; Karunarathna & Amarasinght 2009; Vyas 2010; Karunarathna *et al.* 2012) led to the realisation that such relationships may be more widespread than is currently realised. However, ant predation of tarantula cocoons is well known (Baerg 1958; Foelix 1996) and Karunarathna & Amarasinght (2009) (working in Sri Lanka with the ant-eating microhylid *Uperodon nagaoui* and theraphosid spiders *Poecilotheria ornata* and *P. cf. subfusca*) suggested that such relationships were in fact more likely mutualistic. The frogs receive protection from predation with the close proximity to the spiders, and spiders receive protection from the predation of their egg cocoons with the close proximity to the ant-eating frogs.

However, despite this fascinating relationship now being well-known, the number of published reports in the literature remains relatively small (Table 1). In this note we report on a new association between a microhylid frog and a theraphosid spider from Paraguay, involving two species not previously documented as behaving commensally.

During February 2019, a mutualistic association was observed between *Chiasmocleis albopunctata* (MICROHYLIDAE) (SVL 24–35 mm, $n = 23$) and *Eupalaestrus campestratus* (THERAPHOSIDAE) (TL 110–120 mm) at Balneario Pinamar (25°30'47.8"S, 56°57'24.9"W), Paraguairí department, Paraguay. On two consecutive evenings, two holes, separated from each other by a distance of approximately 2 m, were found containing both frogs and a spider. One hole was occupied by an adult spider and three frogs, whilst the other was occupied by one frog and a subadult spider. On approach, the burrow occupants retreated deeper into the hole, but retreating slightly it was possible to capture some images as one spider emerged from the hole (Fig. 1–2). Whilst within the burrow it could be observed that the spider's legs were in contact with the frogs without an attack taking place.

Chiasmocleis albopunctata is an uncommon frog in Paraguay, mainly associated with Pantanal, Humid Chaco and Cerrado ecoregions in the northern half of the Oriental region (Concepción, Amambay, San Pedro, Canindeyú and Central departments) and northern Alto Paraguay department of the Chaco region (Weiler *et al.* 2013). This is the first report of the species from Paraguairí department, and we take the opportunity to also report the species for the first time from Guairá department (fig. 3–4) at Granja Francisca (25°47'57.4"S, 56°13'54.7"W) during October 2017, which extends the distribution of the species further south in the Oriental region.

Table 1. Documented cases of mutualism between microhylid frogs and thersaphosid spiders in the scientific literature.

Frog	Spider	Country	Source
<i>Chiasmocleis albopunctata</i> (Boettger, 1855)	<i>Eupalaestrus campestratus</i> (Simon, 1891)	Paraguay	This note
<i>Chiasmocleis ventrimaculata</i> (Anderson, 1945)	<i>Xenesthis immanis</i> (Ausserer, 1875)	Peru	Cocroft & Hambler (1989); Csakany (2002)
<i>Chiasmocleis ventrimaculata</i> (Anderson, 1945)	<i>Pamphobeteus</i> sp.	“The Amazon”	Tomasinelli & Biggi (2013)
<i>Gastrophryne olivacea</i> (Hallowell, 1856)	<i>Aphonopelma hentzi</i> (Girard, 1852)	USA	Blair (1936); Hunt (1980); Dundee (1999); Dundee <i>et al.</i> (2012)
<i>Hamptophryne boliviana</i> (Parker, 1927)	<i>Xenesthis immanis</i> (Ausserer, 1875)	Bolivia, Peru	Miller (2003)
<i>Kaloula taprobanica</i> Parker, 1934	<i>Poecilotheria hanumavilasumica</i> Smith, 2004	India	Siliwal & Ravichandran (2008)
<i>Kaloula taprobanica</i> Parker, 1934	<i>Poecilotheria fasciata</i> (Latreille, 1804)	Sri Lanka	Karunarathna <i>et al.</i> (2012)
<i>Uperodon montanus</i> (Jerdon, 1853)	<i>Heterometrus</i> sp.	India	Vyas (2010)
<i>Uperodon nagaoui</i> (Manamendra-Arachchi & Pethiyagoda, 2001)	<i>Poecilotheria ornata</i> Pocock, 1899	Sri Lanka	Karunarathna & Amarasinght (2009)
<i>Uperodon nagaoui</i> (Manamendra-Arachchi & Pethiyagoda, 2001)	<i>Poecilotheria cf. subfusca</i> Pocock, 1895	Sri Lanka	Karunarathna & Amarasinght (2009)
<i>Uperodon variegatus</i> (Stoliczka, 1872)	<i>Heterometrus</i> sp.	India	Rao & Ramana (1925)



Figure 1. *Eupalaestrus campestratus* emerging from a burrow that contains *Chiasmocleis albopunctata* at Balneario Pinamar, Paraguari department, Paraguay. (Photo Sebastien Bascoulès).



Figure 2. Three *Chiasmocleis albopunctata* visible inside a burrow from which a spider has recently emerged. (Photo Sebastien Bascoulès).



Figure 3. *Chiasmocleis albopunctata* at Granja Francisca, Guairá department, Paraguay. (Photo Sebastien Bascoulès).

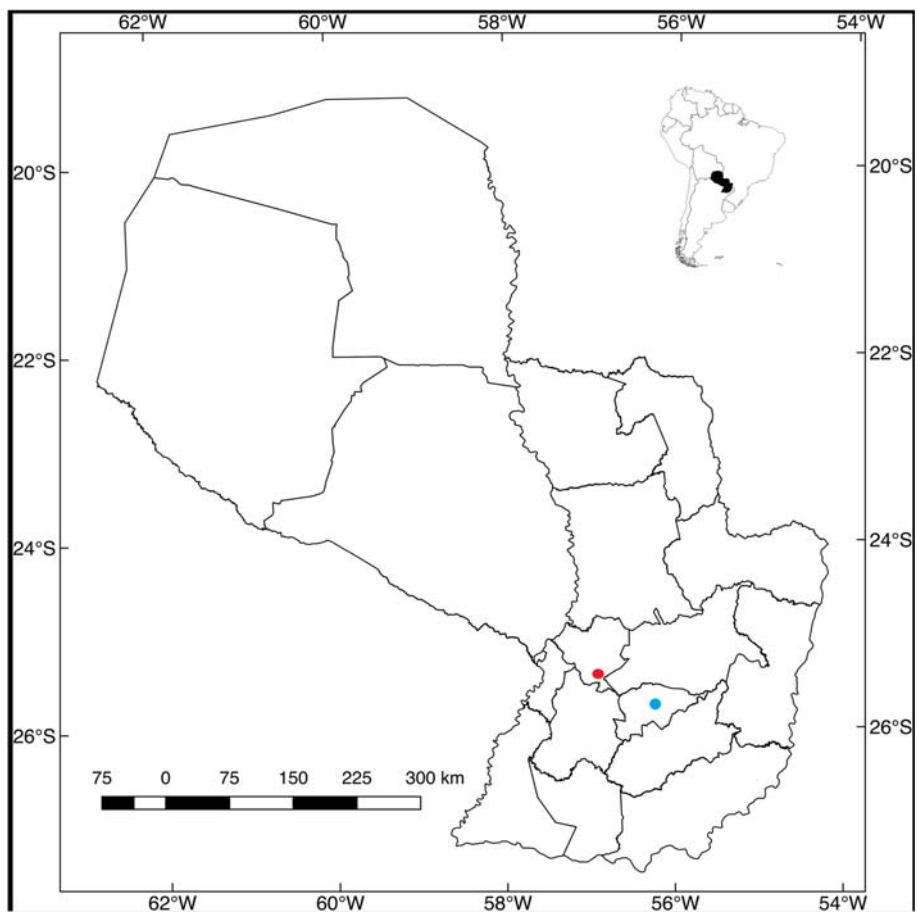


Figure 4. Map of Paraguay showing the localities mentioned in the text. Red circle: Balneario Pinamar, Paraguari department. Blue circle: Granja Francisca, Guairá department.

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