

First record of *Temnomastax beni* (Orthoptera: Eumastacidae) from Brazil

Primer registro de *Temnomastax beni* (Orthoptera: Eumastacidae) en Brasil

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ABSTRACT

Here a new record for *Temnomastax beni* is presented, a species previously known only for the type locality in Bolivia. The new record for Brazil, in Acre state, increases the geographic distribution of the species by 520 Km. Furthermore, it allows us to perform a better comparison with other species of the genus. An additional description of external morphology is presented, as well as the first description of the phallic complex.

Keywords: Amazon, distribution, monkey grasshopper, phallic complex, Temnomastacinae.

RESUMEN

Se presenta aquí un nuevo registro de *Temnomastax beni*, especie previamente conocida solo en la localidad tipo en Bolivia. El nuevo registro para Brasil, en el estado de Acre, amplía la distribución geográfica de la especie en 520 km. Además, nos permite realizar una mejor comparación con otras especies del género. Se presenta una descripción adicional de la morfología externa, así como la primera descripción del complejo fálico.

Palabras clave: Amazonia, distribución, saltamontes payaso, complejo fálico, Temnomastacinae.

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INTRODUCTION

Eumastacidae comprises small arboreal grasshoppers, mainly identified by the following combination of characters: perpendicular position of the hind legs when resting, slender body, cervical membrane apparent, antennae smaller than the fore femur, presence of four well-developed apical spurs on the hind tibia, and tympanic organ absent (Song 2018, Costa *et al.* 2024). Currently it is composed of eight subfamilies and 255 species, distributed mainly in the Neotropical Region; in Brazil four subfamilies and 43 species are reported (Cigliano *et al.* 2024, Costa *et al.* 2024). The subfamily with broadest geographic distribution is Temnomastacinae; additionally, this group has the highest richness in the Brazilian territory, 72 % (31 species) of all species that occurs in Brazil.

One of the most widely distributed genera belonging to this subfamily is *Temnomastax* Rehn and Rehn 1942, which was revised recently (Olivier *et al.* 2019, Olivier 2020). This genus comprises nine species grouped into three morphological groups: *Beni* group (*T. beni* Rehn and Rehn 1942); *Latens* group (*T. borelli* (Giglio-Tos 1897), *T. hamus* Rehn and Rehn 1942, *T. latens* Rehn and Rehn 1942, and *T. monnei* Olivier 2019); and *Tigris* group (*T. descampsii* Olivier 2019, *T. otavioi* Olivier 2019, *T. ricardoi* Descamps 1973, and *T. tigris* (Burr 1899)). Groups *Latens* and *Tigris* typically inhabit dry regions in the central region of South America, as Cerrado, Pantanal, and Chaco; while the *Beni* group is recorded in the Amazon region only (Olivier *et al.* 2019, Cigliano *et al.* 2024).

Among all species of *Temnomastax*, only *T. beni* had not been recorded in Brazil, being known only from the type locality, in Rurrenabaque, Beni Department, Bolivia (Rehn and Rehn 1942, Cigliano *et al.* 2024). This species was described based on two male specimens, which were collected between the end of 1921 and the beginning of 1922 by Willian Montana Mann during the Mulford Biological Exploration; the formal description was published two decades later. Currently, the holotype is housed at the National Museum of Natural History, Smithsonian Institution, United States of America (USNM), and the paratype (Fig. 1) is housed at the Entomology Collection at the Academy of Natural Sciences of Drexel University, United States of America (ANSP), both specimens in good condition.

Temnomastax beni is characterized by the macropterous condition, absence of a complete black ring on the distal region of metafemur, absence of a dorsal spine on the outer margin of the 1st metatarsomere, male cerci tapered and subgenital plate with a large fistuliform process projected backward (Figs. 1 and 2a, b) (Rehn and Rehn 1942, Olivier *et al.* 2019).

During an expedition to the Reserva Florestal de Humaitá (Humaitá Forest Reserve) located in the state of Acre, between 17-28 feb 2022, five adult males of *T. beni* were collected (Fig. 2). In this work we provide the first record of this species from Brazil and provide an additional description of the external morphology and phallic complex, as well as photographs of the paratype and collected specimens.

MATERIAL AND METHODS

An expedition to the Humaitá Forest Reserve was conducted with focus on collecting botanical material by the second author. However, during the expedition, several eumastacids specimens were observed, and five specimens were collected to enable species identification. The collections were performed during the afternoon (3:00 PM) in an open area near the research base of Universidade Federal do Acre (UFAC) (9°45'03.3" South, 67°40'20.9" West), at 174 m above sea level.

The Humaitá Forest Reserve is a forest fragment owned by the UFAC, covering approximately 20 km². It is in the municipality of Porto Acre, in the state of Acre, Brazil. Its climate is characterized as tropical humid with average temperature of 26°C and average rainfall of 1900 mm (Duarte 2005, Botelho *et al.* 2012, Alvares *et al.* 2013).

After being manually collected, all specimens were preserved in 90 % ethanol and sent to the Zoology Sector at the Universidade Federal de Mato Grosso do Sul (UFMS) to proceed with the identification by the first author. The phallic complex of two individuals was extracted. Subsequently, all specimens were mounted, labeled, and housed at the Zoological Collection of the Universidade Federal de Mato Grosso do Sul (ZUFMS). One of the five specimens (ZUFMS-ORT-2843) was sent to the Entomological Collection at the Museu Nacional / Universidade Federal do Rio de Janeiro (MNRJ) so that photographs could be taken; this same specimen



Fig. 1. Paratype male of *Temnomastax beni* Rehn & Rehn, 1942 in lateral view and its labels. Scale bar 10 mm (by Andressa F. Oliveira).

was deposited in MNRJ (MNRJ-ENT6-32944). Habitus photographs were taken with a Canon 6D Mark II equipped with a 100mm macro lens. The phallic complex was photographed in a Leica M205 stereomicroscope, using the LAS X software for image capture and stacking.

The specimens were identified based on literature (Rehn and Rehn 1942, Olivier et al. 2019) and comparison with images of holotype and paratype (Fig. 1). The measurements of specimens and position of tarsomeres here provided follow Olivier et al. (2019): lengths of body (bd), pronotum (pr), tegmina (tg), hind femur (hf), hind tibia (ht), 1st protarsomere (PrTm1), 2nd protarsomere (PrTm2), 1st mesotarsomere (MsTm1), 2nd mesotarsomere (MsTm2), 1st metatarsomere (MtTm1), and 2nd metatarsomere (MtTm2); all measurements were performed under a Leica M205 C stereomicroscope coupled to a Leica DFC420 camera, being obtained by Leica Application Suite V3.8 software.

RESULTS

Temnomastacini Rehn & Grant, 1958

Temnomastax beni Rehn and Rehn 1942

Temnomastax beni Rehn and Rehn 1942: 14, Descamps 1979: 144, Olivier 2014: 458, 2017: 235, Olivier and Aranda 2017: 1203, 2018: 269, Olivier et al. 2019: 29. (<https://orthoptera.speciesfile.org/otus/826980/overview>) (Fig. 1-3)

Table 1. Measurements of all *Temnomastax beni* Rehn and Rehn (1942) specimens studied herein. 1 - Measurements of types were obtained from Rehn and Rehn (1942); 2 - Paratype with abdomen very curved upward. Measurements are given in millimeters.

	Lengths				
	bd	pr	tg	hf	ht
ZUFMSORT2840	19,63	2,32	15,13	13,08	13,7
ZUFMSORT2841	19,23	2,05	15,02	12,67	13,51
ZUFMSORT2842	17,96	2,09	14,21	12,31	12,72
ZUFMSORT2843	18,25	2,00	14,02	11,92	12,36
ZUFMSORT2844	19,09	2,06	15,08	13,92	13,35
Holotype ¹	19.7	2.6	15.9	13.3	-
Paratype ¹	15.9 ²	2.4	15.4	13.0	-

Additional description. Measurements (Table 1). Interocular space, mouthparts, and ventral face of the body bluish. A continuous stripe from the postocular region, passing through the lower regions of the cervical membrane, lateral lobe of the pronotum, mesoepisternum, and mesoepimerom; lower region of metaepisternum and metaepimerom little marked (Fig. 1 and 2a–c). Pronotal disk blackish with minute scattered yellow dots; upper region of lateral lobes blackish (Fig. 2c, d). Tegmina and hindwings translucent, with the proximal portion of veins

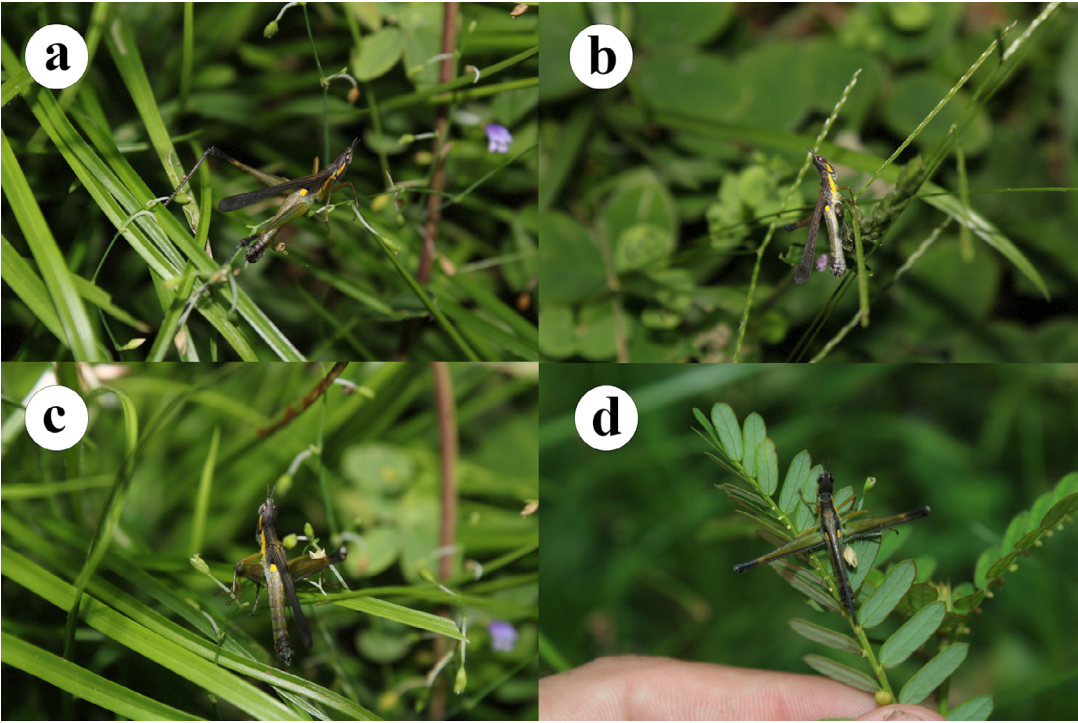


Fig. 2. Male specimens of *Temnomastax beni* Rehn & Rehn, 1942 in nature. a-c. latero-dorsal views, d. dorsal view (by Diego F. da Silva).

Table 2. Number of tibial spines in all legs of the *Temnomastax beni* Rehn and Rehn (1942) specimens.

		ZUFM-SORT2840	ZUFM-SORT2841	ZUFM-SORT2842	ZUFM-SORT2843	ZUFM-SORT2844
		Outer/Inner	Outer/Inner	Outer/Inner	Outer/Inner	Outer/Inner
Left legs	Foretibiae	9/9	10/9	9/7	10/10	11/11
	Mesotibiae	10/10	9/9	6/8	8/9	12/11
	Metatibiae	25/25	24/24	25/24	24/25	28/25
Right legs	Foretibiae	9/11	9/7	8/8	9/10	11/11
	Mesotibiae	8/9	10/9	8/10	9/11	11/11
	Metatibiae	23/24	24/24	24/25	24/25	27/28

yellowish (Fig. 1). Tibial spines (Table 2). PrTm1 with 2.6x the length of PrMt2; MsTm1 with 2.5x the length of MsTm2; MtTm1 with 3.7x the length of MtTm2. Tarsal claws unequal, with internal serration. 1st abdominal segment with a well visible yellow spot laterally (Fig. 2a–d); dorsal face from the 2nd to the $\frac{2}{3}$ anterior of the 7th abdominal tergite blackish with many minute scattered yellow dots (Fig. 2a–c); dorsal face from $\frac{1}{3}$ posterior of the 7th to 9th abdominal tergites black (Fig. 2c). Membranous central region of epiproct greenish blue. Medio-apical region of cerci laterally compressed, tapered, and gradually curved downward and inward, $\frac{1}{3}$ apical resembling a tarsal claw in lateral view. *Phallic complex*: Epiphallus. V-shaped well marked in dorsal view, posterior apex very tapered and curved upward; central region completely membranous (Fig. 3c, e); anterior $\frac{1}{3}$ convex and posterior $\frac{2}{3}$ markedly concave in lateral view (Fig. 3e); lateral projections located just before the end of the anterior $\frac{1}{3}$, directed laterally at acute angle in relation to the posterior region, not curved downwards in lateral view - positioned at the same level as the most sclerotic region (Fig. 3c, e). Endophallus. Endophallic sclerite. $\cap$ -shaped, outer margin of the anterior region bilobed, and inner arc trigonal in dorsal view, lateral branches convergent at the anterior $\frac{1}{3}$ and almost parallels posteriorly, tips curved inward (Fig. 3d); little sinuous with the anterior $\frac{1}{3}$ concave

and posterior $\frac{2}{3}$ almost linear until the apex in lateral view (Fig. 3e). Ectophallus. Globose and almost completely membranous (Fig. 3d, e); ectophallic sclerite slightly surpassing the epiphallus apex, latero-ventral portions more sclerotic than the other portions visible in latero-axial and axial views. Genital aperture dorso-apical (Fig. 3e).

Remarks: The examined specimens were found foraging on plants of *Emblica urinaria* (L.) R.W.Bouman (Phyllanthaceae), *Rhynchospora* Vahl (Cyperaceae), and an unidentified Poaceae (Fig. 2).

Material examined: BOLIVIA. **Dep. Beni:** Holotype male, Rurrenabaque, 21 dec 1921-22, W.[illian] M.[ontana] Mann, Mulford Bio[logical] Expl[oration], Type 61104, [photograph examined] (USNM); paratype male, same data as holotype [photograph examined] (ANSP). **BRAZIL. Acre:** five males, Porto Acre, Reserva Florestal de Humaitá, próximo ao alojamento da Universidade Federal do Acre, 9°45'03.3"South, 67°40'20.9"West, 174 m, 27.II.2022, Silva, D.F., Oliveira M.H., Silva, M.A.T., Silva, C.G. & Menezes, D. leg. (ZUFMS-ORT-2840-2842, 2844 and MNRJ-ENT6-32944).

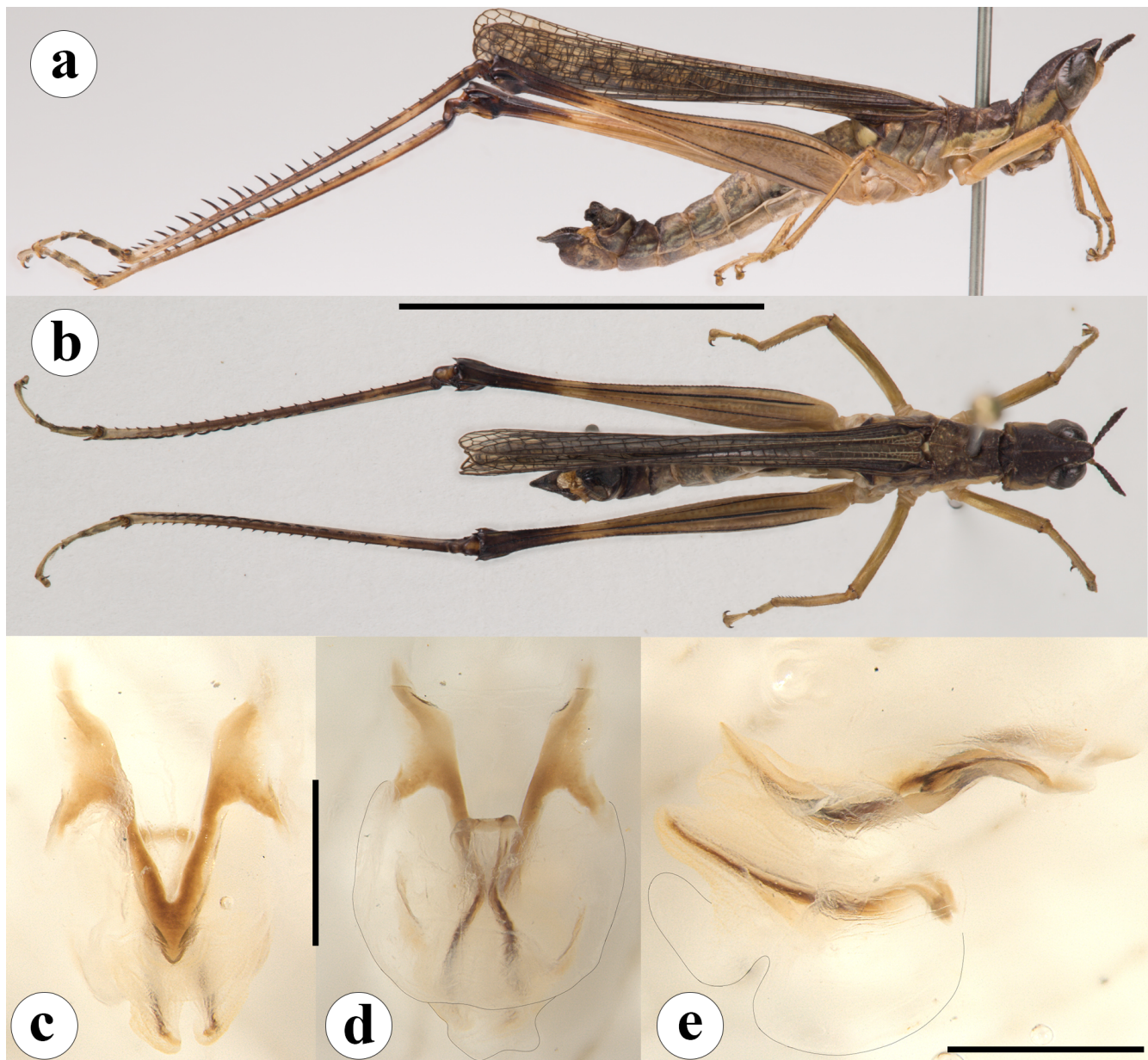


Fig. 3. Male specimen of *Temnomastax beni* Rehn & Rehn, 1942 (MNRJ-ENT6-32944). a-b. habitus: a. lateral, b. dorsal. c-e. phallic complex: c. dorsal view, d. ventral view, e. lateral view. Scale bars: a-b. 10mm, c-e. 1mm.

DISCUSSION

The new record of *T. beni* increases the number of Eumastacidae species in Brazil to 44. This also is the first record of a eumastacid grasshopper in the state of Acre, being the new occurrence of *T. beni* in Porto Acre, 520 km away from the type locality at Rurrenabaque, Bolivia. Furthermore, now all species of *Temnomastax* are recorded in Brazil, which previously occurred for five genera only: *Chapadamastax* Descamps 1982 (one sp.), *Eutemnomastax* Descamps 1979 (four spp.), *Bahiamastax* Descamps 1979 (one sp.), and *Eumastacops* Rehn and Rehn 1942 (four spp.), *Pareumastacops* Descamps 1979 (three spp.) (Cigliano et al. c2024).

Temnomastax beni is the unique species of the genus that occurs exclusively in the Amazon. This distribution is uncommon for the *Temnomastacini* genera, which occur mainly throughout the dry diagonal, being more similar to Eumastacopini genera, as *Arawakella* Rehn and Rehn 1942, *Eumastacops*, *Pareumastacops* and *Pseudemumastacops* Descamps 1974 (Descamps 1973, Cigliano et al. c2024). Besides this distinct geographic distribution, there are some morphological characters that separate this species of the remaining *Temnomastax*, as macrop- terous condition, tegmina translucent, $\frac{1}{3}$ distal of meta- femur without a complete black ring, absence of a dorsal spine on 1st metatarsomere, male cerci slightly specialized (Descamps 1979, Olivier et al. 2019), lateral projection of epiphallus not curved downward, and some level of escle- rotization on ectophallus. However, a phylogenetic study is being carried out by the first author to better understand the relationships of *Temnomastax* species.

This is the second record of this eumastacid species since the collection of the type series one century ago, and the formal description 82 years ago (Rehn and Rehn 1942). Even after all these years, female specimens remain unknown. This highlights the lack of studies focused on Eumasta- cidae fauna, and the difficulty of obtaining some species, especially those with cryptic coloration and/or a canopy- dwelling lifestyle (Descamps 1970, Olivier 2018).

AUTHOR'S CONTRIBUTION

RSO and DFS design and writing; PGBSD provided the photos of the specimen housed in MNRJ; PJCP prepared

all the plates. All authors reviewed the draft of the paper, made suggestions and corrections and approved the final version.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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