Taxonomic additions of the Brazilian fauna of Prosierola (Hymenoptera, Bethylidae)

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Abstract. Prosierola is characterized by having a pair of conspicuous anteromedial metapostnotal foveae on the metapetal-propodeal disc. Little is known about this genus because it is rarely sampled in collections. Therefore, the main goal of this contribution is to expand the knowledge of intraspecific morphological variations and geographical distribution of its species that occur in Brazil. We sorted material from the main collections and obtained 69 specimens of Prosierola nasalis (Westwood) recorded for the first time from Maranhão, Minas Gerais, Pará, Rio Grande do Norte and Rio Grande do Sul; one of Prosierola obliqua Evans recorded for the first time from Distrito Federal; five of Prosierola rotunda Schiffer & Azevedo recorded for the first time from Pará; and 13 of Prosierola rufescens Evans recorded for the first time from Brazil (Amazonas, Bahia, Espírito Santo, Minas Gerais). The mesoscuto-scutellar foveae placed on the dorsal surface of the mesoscutellum shown to be highly variable in size, distance, and shape at both the intra- and interspecific levels.

Keywords: Bethylinae; Intraspecific variations; Morphology; Geographic distribution; Taxonomy.

The subfamily Bethylinae comprises 12 genera and most of them have the well-established taxonomic frontiers (Barbosa & Melo 2023). Among these genera, Prosierola is easily recognized by the presence of a pair of anteromedial metapostnotal foveae on the metapetal-propodeal disc; posterior margin of the pronotum slightly produced backward medially; the metapostnotum with a triangular area marked dorsal smooth; male genitalia with divided harpe and the female genitalia with distal region of the dorsal area of the 9 tergite enlarged. These five characters are synapomorphies for the genus (Azevedo 2008; Azevedo et al. 2018; Ramos & Azevedo 2020). Another important feature of the Prosierola is a gibbous mesopleuron that, if viewed dorsally, is produced angularly or roundly. This condition is shared with its sister group, Odontepyris (Azevedo 2008; Azevedo et al. 2018; Ramos & Azevedo 2020).

The anteromedial metapostnotal foveae can vary in size (large or small), shape (elliptical, discal, circular, or oval) (Azevedo 2008) and can even be asymmetrical, with each one having a different size or shape. Despite being a key character for the identification of Prosierola, considered autapomorphic to the genus (Polaszek & Knöbber 1994), it has little taxonomic value, when used to differentiate species of Prosierola, due to its highly plastic nature.

Currently, the genus has only seven valid species, Prosierola cubana Evans, Prosierola flavicoxis (Kieffer), Prosierola nasalis (Westwood), Prosierola obliqua Evans, Prosierola rotunda Schiffer & Azevedo, Prosierola rufescens Evans and Prosierola submersa Brues, of them, three have previously been found in Brazil: P. nasalis, P. obliqua and P. rotunda (Azevedo 2008).

The genus is not commonly found in Bethylidae samples, and little is known about its lifestyle. Prosierola is known to attack larvae of Lepidoptera, characteristic found in unusual uniformity in Bethylinae, with most other bethylids preferring coleoptera larvae. P. obliqua is known to parasite the Hesperiidae family, even showing maternal care, staying in hiding with the paralyzed larvae (Muesebeck & Walker 1951; Evans 1964; Murgas 2005, 2008; Ramos & Azevedo 2020). This behavior probably protects the progenie from hyperparasitoids and the larvae from other parasitoids (multi-parasitoidism) (Doutt 1973).

All of its taxonomic information and geographic distribution are available in the synopsis proposed by Azevedo (2008), and since then, there have been no studies focused on the group. Therefore, our main goal is to expand the knowledge about the geographical distribution and taxonomy of the Brazilian Prosierola, as well as to describe new intraspecific morphological variations.

MATERIALS AND METHODS

We examined about 250,000 Bethylidae specimens from various collections around the world and were able to sort only 88 specimens of Brazilian Prosierola, which belong to the following institutions: CPDC - Centro de Pesquisa do Cacau, CEPEC-CEPLAC (J.H.C. Delabie),
RESULTS

Prosirola nasalis (Westwood, 1874)

(Figures 1A-C, 2A)

Females of this species can be distinguished from other Prosierola species by the following characteristics: the vertex without an evident callus; the head is somewhat rounded on frontal view, and is slightly longer than it is wide; the frontal line extends to about half the length of the eye; the mesoscutal-scutellar foveae are distant from each other by about 2× their diameter, with the presence or absence of a sulcus connecting them; the mesopleuron is angularly produced; the anteromedial metapostnotal foveae mainly exhibit a dusky shape.

In females of this series, we observed the following variations: one female displays a testaceous-castaneous coloration; the forewings are strongly yellowish in larger specimens, while they are weakly yellowish in smaller specimens or even subhyaline; the depth of the mesoscutal-scutellar sulcus can vary from shallow to deep; the mesoscutal-scutellar foveae exhibit significant variations in distance and shape, ranging from the mesoscutum-scutellum are semi-circular and separated from each other by about 1.0-2.0× their diameters, connected by an evident sulcus.

Prosierola obliqua Evans, 1974

(Figures 1D-F, 2B)

Prosierola obliqua can be identified by the following characteristics: the head is wider than long; the presence of a callus on the vertex of the head; the mesoscuto-‐scutellar foveae are small, elliptical and far apart; the mesopleuron is angularly produced.

In this series, we observed the following variations: the distance between mesoscuto-‐scutellar foveae was 3-5× their diameters in the previously studied material (AZEVEDO 2008), but in the specimen reviewed, foveae are distant from each other by about 7.0× their diameters; the anteromedial metapostnotal foveae can be asymmetrical, also not showed in previous works.


Distribution: This species was previously known from Panama, Bolivia, Paraguay, and Brazil (Maranhão, Pernambuco) (AZEVEDO 2008). It has now been recorded for the first time from the Brazilian state of Distrito Federal.

Prosierola rotunda Schifferl & Azevedo, 2002

(Figs 1G-1, 2C)

Prosierola rotunda can be identified by the following characteristics: the vertebra without a evident callus; the head has a rounded shape on frontal view; the clipeus is semi-‐circular, short and flat; the mesopleuron is produced roundly, not angularly, and presenting more close to the metaprosternal-‐propleural complex than the mesoscutellum; the antermedial metapostnotal foveae are elliptical and very close to each other, these may be asymmetrical.

In this series, we observed the following variations: the distance between mesoscuto-‐scutellar foveae vary between 1-3× their diameter, the shape can be elliptical or semi-‐circular; the antermedial metapostnotal foveae are mainly elliptical, but can be asymmetrical.


Distribution: This species was previously known from Brazil (Amazonas) (AZEVEDO 2008), and now it is recorded for the first time from the Brazilian state of Pará.

Prosierola rufescens Evans, 1964

(Figures 1J-L, 2D)

Prosierola rufescens can be identified by the following characteristics: the presence of a callus on the vertex of the head; the head is wider than longer; the mesoscuto-‐scutellar foveae are big and very close together; the mesopleuron is angularly produced.

In this series, we found the following variation: the mesoscuto-‐scutellar foveae can be circular or semi-‐circular, with their distance from each other is 1.0 to 2.0× their diameters; the antermedial metapostnotal foveae are elliptical or semi-‐circular.


Distribution: This species was previously known from Colombia, Ecuador and Paraguay (AZEVEDO 2008), and now it is recorded for the first time from the Brazilian states: Amazonas, Bahia, Espírito Santo, Minas Gerais.

**DISCUSSION**

Bethylid species can be found in various Brazilian biomes, ranging from rainforests (AZEVEDO & SANTOS 2000) to savannas (ARANDA & GRACIOLLI 2015). Despite this wide distribution, Prosierola is rarely captured, regardless of trap type or vegetation type (AZEVEDO 2008).

Studies about biological aspects and parasitoid specificity of *P. obliqua* (MURGAS 2005, 2008), show that most of the adults that emerge from the larvae are females, that could be due to a infection of the symbiotic bacteria, *Wolbachia pipientis* (Hertig), that is lethal to male parasitoids (STOUTAHMER 1997). The presence of *Wolbachia* in DNA of Bethylidae was reported by MARTINELLI et al. (2017). This, combined with the fact that *Prosierola* rarely is captured, could be the reason why so few males were found. Regardless, further studies about the biology and behavior of *Prosierola* are necessary for a more accurate answer.

Until now, the data available in the literature for *Prosierola* were based on only 82 specimens. In this study, we got an additional 88 specimens, effectively doubling the number of specimens studied.

Among the species studied, *P. nasalis* occurs in almost all Brazilian biomes, except for the Pantanal (Figure 2A), likely due to a lack of field expeditions. *Prosierola rotunda* appears to be restricted to the Amazonian Forest (Figure 2C). The type specimen was collected in Manaus, and our study identified several specimens with the same occurrence, suggesting the likely presence of more specimens in this region and others.
In contrast, *P. rufescens* exhibits a discontinuous distribution, occurring in both the Amazonian and Atlantic rainforests (Figure 2D). These differences may be attributed to various factors, including the use of different collections methods, so different groups and species within the same group may respond in a distinct way to trapping methods ([Larsen et al. 2014](#)); variations in vegetation types, which can influence food sources; the presence of natural enemies ([Aminah et al. 2020](#)); and variations in sampling efforts across different regions of the country. *Prosierola obliqua* is recorded for the first time from Distrito Federal within a Cerrado region (Figure 2B). However, it is expected to have a broader distribution in the Neotropical region, as this species has already been recorded in rainforests areas in Panama, Bolivia, Paraguay, and Brazil (Maranhão and Pernambuco).

The mesoscuto-scutellar foveae are one of the main characteristics studied for the identification of *Prosierola* ([Azevedo 2008; Azevedo et al. 2018](#)). In our study, these structures exhibited significant variation among the species, particularly concerning the distance and size between them. These differences are crucial for expanding our understanding of the genus and can contribute to future studies.

Therefore, the expansion of knowledge regarding the geographical distribution and morphological variations of *Prosierola* could help future taxonomic studies; inspire researchers to explore new collection methods and enhance sampling effort.

**Figure 1.** *P. nasalis:* A. Lateral view of mesosoma, B. Head, C. Dorsal view of mesosoma; *P. obliqua:* D. Lateral view of mesosoma, E. Head, F. Dorsal view of mesosoma; *P. rotunda:* G. Lateral view of mesosoma, H. Head, I. Dorsal view of mesosoma; *P. rufescens:* J. Lateral view of mesosoma, K. Head, L. Dorsal view of mesosoma. Photo by: Leonardo Rezeda Pereira.
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