



Two new species of *Pseudonannolene* Silvestri, 1895 from Brazilian iron ore caves (Spirostreptida: Pseudonannolenidae)

LUIZ FELIPE MORETTI INIESTA¹ & RODRIGO LOPES FERREIRA¹²

¹Laboratório de Ecologia Subterrânea, Setor de Zoologia, Departamento de Biologia, Universidade Federal de Lavras, Minas Gerais, Brazil

²Corresponding author. E-mail: drops@dbi.ufla.br

Abstract

Pseudonannolene gogo sp. n. and *Pseudonannolene rolamossa* sp. n. are described from individuals collected from Brazilian iron ore caves, Minas Gerais state. The family Pseudonannolenidae is exclusively Neotropical and frequently found in caves of Brazil, from which 23 species are known. The new species are compared with its congeners and with other Brazilian cave-dwelling species.

Key words: Neotropics, Brazil, *Pseudonannolene*, conservation, iron ore

Introduction

Individuals of the family Pseudonannolenidae occur in different regions of Brazil (Iniesta & Ferreira 2013a). The genus with the widest distribution in the country is *Pseudonannolene* Silvestri, 1895, with over 23 known species (Brölemann 1909; Trajano et al. 2000; Iniesta & Ferreira 2013a). The genus is mainly characterized by the longitudinal separation of the promentum (Mauriès 1987, Iniesta & Ferreira 2013a) Among the known species in the country, eleven have cave populations, caves associated with different lithologies (Trajano et al. 2000; Souza Silva et al. 2011). Only two species are restricted to the subterranean environment (Iniesta & Ferreira 2013a, Iniesta & Ferreira 2013b). In caves, individuals of this genus are found in different microhabitats, feeding preferentially on bat guano and plant materials imported from the external environment. This work describes two new species of the genus found in ferruginous caves of Minas Gerais, Brazil.

Material and methods

Type specimens were collected during 2012 and are deposited in the Zoology Collection, Seção de Invertebrados Subterrâneos (ISLA) at the Universidade Federal de Lavras (UFLA), Campus Universitário de Lavras, Minas Gerais, Brazil. *Pseudonannolene gogo* sp. n. (Fig. 1A) was collected in five iron ore caves located in the municipality of Mariana, Minas Gerais state, while *Pseudonannolene rolamossa* sp. n. (Fig. 2A) was collected in a single iron ore cave located in the municipality of Nova Lima, Minas Gerais state, Brazil.

Measurements and drawings were made under a stereomicroscope (Stemi 2000 (ZEISS)). Dissections were made with fine entomological pins. The stereoscopic images were acquired using the Leica M205 A, with the program Leica Application Suite auto montage to combine the images.

Pseudonannolene gogo Iniesta & Ferreira, new species.

(Figs. 1A, B, C)

Material examined: *Holotype*: Male ♂ (ISLA 4000) from Mariana/MG, Brazil; SPA62 cave; 13/V/2011; Pellegrini, T. G. collec.

Paratype: 1 Male ♂ (ISLA 4001) from Mariana/MG, Brazil; SPA66 cave; 13/V/2011; Pellegrini, T. G. collec. 1 Female ♀ (ISLA 4002) from Mariana/MG, Brazil; SPA74 cave; 13/V/2011; Pellegrini, T. G. collec. 1 Female ♀ (ISLA 4003) from Mariana/MG, Brazil; SPA17 cave; 13/V/2011; Pellegrini, T. G. collec.

Other material studied: 3 Female ♀ and 1 Male ♂ from Mariana/MG, Brazil; SPA30 cave, SPA 17 cave and SPA 66 cave; 13/V/2011; Pellegrini, T. G. collec.

Etymology. The epithet is a noun in apposition, a toponymic for the name of the region (Gogo) where the species was collected.

Measurements: Length from 42 up to 52 mm; maximum midbody diameter between 3.02 to 4.16 mm; body rings ranging between 55 to 61; length of antennae ranging from 3.0 to 3.70 mm (relation to diameter ranging 0.89 to 0.99); length of legs 1.20 to 1.25 mm (relation to diameter ranging 0.40 to 0.30); length of tarsal claw 0.10 to 0.16 mm (relation to diameter ranging 0.03 to 0.038).

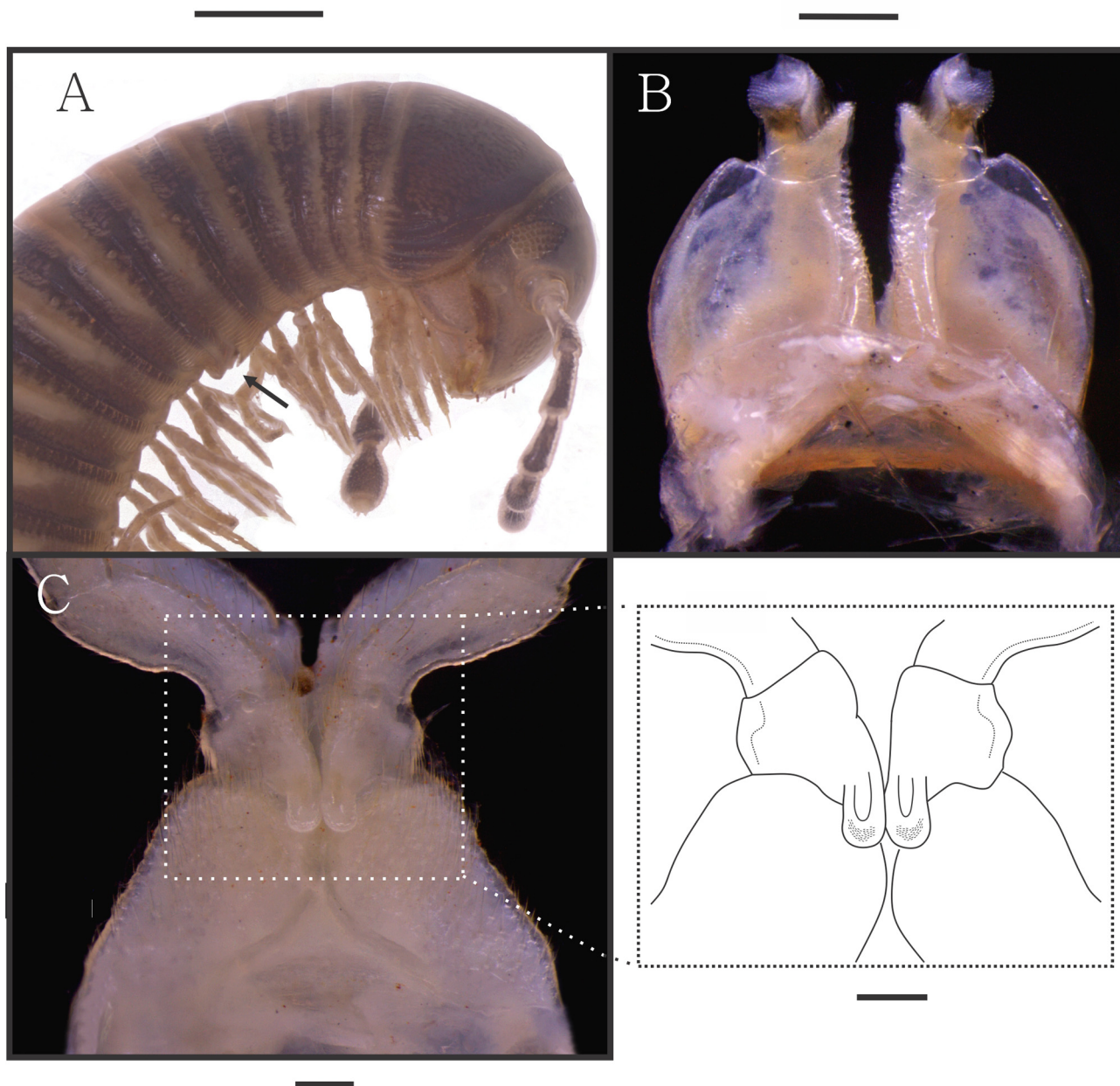


FIGURE 1. *P. gogo* n. sp., paratype male (ISLA 4001). A) Detail of anterior region. Note the arrow pointed to socket where the gonopod is allocated; B) Gonopod; C) Oral process in first pair of legs and schematic drawing (the bristles were removed). **Scales bars:** A) 1 mm; B) 200 μ m; C) 200 μ m.

Descriptions. *Head:* Slightly pigmented in region of epicranium. Ocelli pigmented; ranging from 33 to 38. Three small labral teeth, a row of 26 labral setae and a row of 6 supralabral setae. Mandibles pigmented; 2 external teeth, 4 internal teeth and 8 rows on pectinate lamellae. Antennae pigmented; densely setose; First antennomere shorter than others; Second and third antennomeres of similar sizes. Fourth antennomere longer than the fifth; Sixth antennomere longer and wider than the fourth and fifth; Fifth and fourth antennomere with groups of basiconic sensilla on the lateral edge; Four terminal sensorial cones. Gnatochilarium typical of the genus; not modified.

Collum: Glabrous; Pigmented in central region; Edge weakly pigmented; striae on region lateral (variable among individuals); limbus not modified.

Trunk: Prozonite of darkened pigmentation and metazonite slightly brownish and whitish; Prozonite separated from metazonite due to weak suture; presence of lateral striae (variable among individuals). Openings of the repugnatorial glands (ozopore) starting from the fifth ring. Limbus smooth. Pre-anal ring pigmented; anal valve with setae on the opening.

First pair of legs (Fig. 1C): Not pigmented. Coxae with width and length larger than other podomeres; densely setose. Sternum sub-triangular; reduced; glabrous. Pre-femur has the width and the length of similar sizes; shorter than tibia and tarsus. Post-femur similar to pre-femur. Tarsal claw not modified. Oral process rounded; elongated; parallel to coxae; edge distal with wavy surface; bristles visible near pre-femur.

Gonopod (Fig. 1B): Short and stout; Coxae reduced; Sternum not visualized. Basal section short; rounded; length 0.75 times longer than wide; No bristles visible. Basiconic bristles distributed in rows on membranous internal edge from basis of basal section toward distal section. Pointed shoulder in basal section. Distal section with length about 0.5 times longer than width; Solenomere with stout trunk; rounded distal region with squamous surface and composed of two tips; internal branch shorter and stouter; covering the basis of solenomere; Setae (presumably sensory) surrounding meso-distal portion of the edge.

***Pseudonannolele rolamossa* Iniesta & Ferreira, new species.**

(Figs. 2A, B, C)

Material examined. Holotype: Male ♂ (ISLA 4004) from Nova Lima/MG, Brazil; Rola Moça 1 cave; 22/III/2012; Ferreira, R. L. collec.

Paratype: 1 Female ♀ (ISLA 4005) from Nova Lima/MG, Brazil; Rola Moça 1 cave; 22/III/2012; Ferreira, R. L. collec.

Etimology. The epithet is a noun in apposition as a toponymic for the name of the park (Parque Estadual do Rola Moça) where the species was collected. The epithet rolamossa is formed by a combination of words: "rola" means a rolling action and "mossa" (moça) means young woman in portuguese. This name is a reference to an old legend about a young girl who fell off a hill in the region.

Measurements: Length from 56 up to 58.60 mm; maximum midbody diameter between 4 to 4.16 mm; body rings ranging between 56 to 58; length of antennae ranging from 3.78 to 4 mm (relation to diameter ranging 0.95 to 0.96); length of legs 2.20 to 2.42 mm (relation to diameter ranging 0.55 to 0.58); length of tarsal claw 0.22 to 0.24 mm (relation to diameter ranging 0.06 to 0.058).

Descriptions. *Head:* Pigmented in region of epicranium. Ocelli pigmented; ranging from 30 to 34. Three small labral teeth, a row of 24 labral setae and a row of 6 supralabral setae. Mandibles pigmented; 2 external teeth, 4 internal teeth (more a small one) and 9 rows on pectinate lamellae. Antennae pigmented; densely setose; First antennomere shorter than others; Second and third antennomeres of similar sizes. Fourth antennomere longer than the fifth; Sixth antennomere longer and wider than the fourth and fifth; Groups of basiconic sensilla on the lateral edge of fifth and fourth antennomere; Four terminal sensorial cones. Gnatochilarium typical of the genus; not modified.

Collum: Glabrous; More pigmented in edge and weakly in central region; striae on region lateral; limbus not modified.

Trunk: Prozonite of darkened pigmentation, metazonite dark brownish and some whitish and blackish spots; Prozonite separated from metazonite due to weak suture; presence of lateral striae (variable among individuals). Opening of the repugnatorial glands (ozopore) starting from the fifth ring. Limbus smooth. Pre-anal ring pigmented; anal valve with setae on the opening.

First pair of legs (Fig. 2C): Pigmented. Coxae shorter but still larger than others podomeres; densely setose; rounded. Sternum wider; sub-triangular and rounded; Pre-femur with width and length proportional; shorter than tibia and tarsus. Post-femur similar to pre-femur. Tarsal claw not modified. Oral process rounded; elongated; parallel to coxae; edge distal with wavy surface; bristles visible near base.

Gonopod (Fig. 2B): Coxae reduced; Sternum not visualized. Basal section elongated; length about 2 times longer than width; No bristles visible. Basiconic bristles distributed in rows on membranous internal edge, toward distal section. Pointed shoulder in basal section evident and rounded. Distal section with length slightly longer than width; Ornated solenomere with squamous surface and compound of two tips (trappings), external tip more elongated than the rounded internal tip. Base of solenomere covered by internal branch; Internal branch wider, stout and oblique; with longer setae (presumably sensory) surrounding meso-distal portion of the edge.

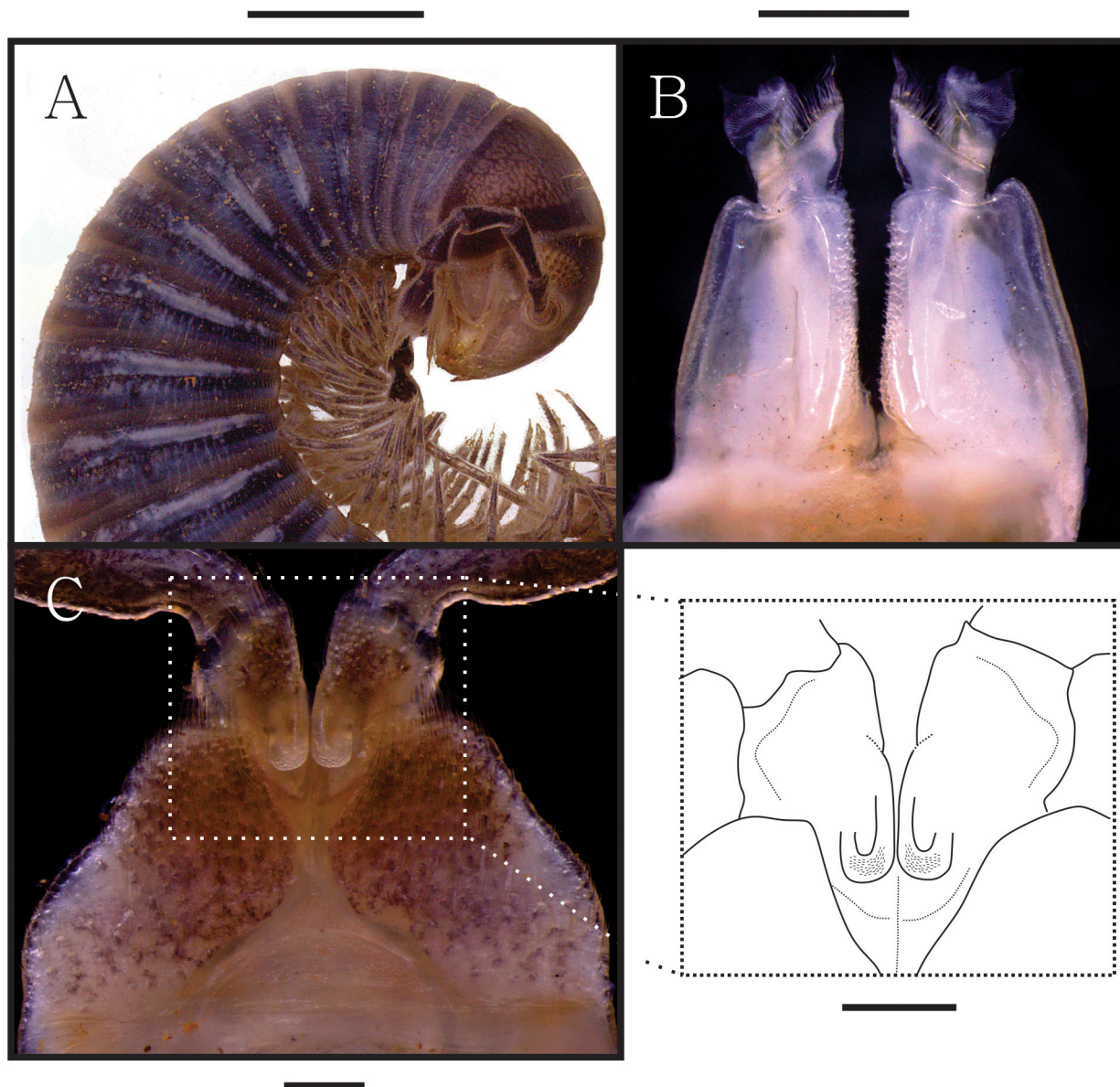


FIGURE 2. *P. rolamossa* n. sp., paratype female (ISLA 4005). A) Detail of anterior region; B) Gonopod; C) Oral process in first pair of legs and schematic drawing (the bristles were removed). Scales bars: A) 1 mm; B) 200 μ m; C) 200 μ m.

Discussion

Pseudonannolene gogo sp. n. and *Pseudonannolene rolamossa* sp. n. can be distinguished from other species of the genus by the following combination of characters. The pre-femoral process in the males resembles that of the species *P. spelaea* (Iniesta & Ferreira 2013a) *P. tocaienses* (Fontanetti 1996b), *P. mesai* (Fontanetti 2000), *P.*

chaimowiczi (Fontanetti 1996a), and *P. strinatii* (Mauries 1974) by the projection parallel to the femur and rounded aspect, while the widths and lengths of the processes are different. The darkened color of the prozonite resembles some species such as *P. tocaiensis* (Fontanetti 1996b) and *P. mesai* (Fontanetti 2000), although *P. anapophysis* (Fontanetti 1996a) and *P. chaimowiczi* (Fontanetti 1996a) show a lighter prozonite and metazonite with a darkened color. Regarding the eyes, both species have ocelli numbers usual for the genus, between 20–43 ocelli. Exceptions to this rule include the troglobite species of the genus, *P. spelaea*, which has an obvious reduction in the number of ocelli (Iniesta & Ferreira 2013a). The average length of the body is 47 mm. In *P. gogo* it is 57 mm. In *P. rolamossa* there is no difference shown when compared to other species such as *P. brevis* (45 mm.), *P. parvula* (45 mm.), *P. rugosseta* (46 mm.), *P. bovei* (50 mm.), *P. abbreviata* (50 mm.), *P. pusilla* (55 mm.) and *P. typica* (62 mm) (all described by Silvestri 1902), as well as the average number of body rings, 58 rings in *P. gogo* and 57 in *P. rolamossa*, close to the average for the genus of 60 to 66 rings (Iniesta & Ferreira 2013a). The number of supralabral setae is similar in *P. spelaea* (Iniesta & Ferreira 2013a), but the numbers of labral setae and pectinate lamellae are variable.

The structure of the gonopod, a species-specific character, proved to be different regarding the size and proportion of the basal and distal segment of the telopodite, and the characteristics of the internal branch of the solenomere. The main differences are in the ratio of the length of the basal telopodite compared to its width, as in *P. gogo*, which is different from the other Brazilian species. In relation to the distal region, the presence of two points in the solenomere and the shape of the internal branch in *P. gogo*, were similar to the species *P. imbirensis* (Fontanetti 1996a). In *P. rolamossa*, the proportion between the length and the width in the base of telopodite is similar to the species *P. chaimowiczi*, *P. anapophysis* (Fontanetti 1996a), *P. tocaiensis* (Fontanetti 1996b) and *P. mesai* (Fontanetti 2000), but the oblique shape of the internal branch distinguishes it from these species.

The description of these species, besides contributing to a better understanding of the genus in Brazilian caves, is essential for the preservation of these habitats. Both species were collected in ferruginous caves present in the Iron Quadrangle, an area intensively modified by the extraction of iron ore. In Brazil, current legislation (Decree Law No. 6.640/2008) allows for the destruction of caves, except those considered of paramount importance. In this context, the description of new species is of utmost importance to increase the relevance of these caves, which will contribute to the preservation of the quite threatened regions, like the Brazilian ferruginous fields.

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