A new species and first record of *Pulmoniscus* Leistikow, 2001 (Isopoda, Oniscidea, Philosciidae) from Colombia

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**ABSTRACT**

A new species of *Pulmoniscus* Leistikow, 2001 from Department of Bolívar, Colombia, is described. It constitutes the first record of the genus for the country and for the continental portion of the Neotropics. *Pulmoniscus turbanaensis* n. sp. is distinguished by the male pereopod 7 ischium with concave sternal margin and the shape of the male pleopod 1. In addition, ecological remarks and a distribution map are provided.

**KEY WORDS**

Crustacea, Terrestrial isopods, Bolívar, Tropical Dry Forest, Neotropical.

**INTRODUCTION**

The family Philosciidae Kinahan, 1857 is one of the most diverse within the suborder Oniscidea, surpassed only by the Armadillidae Brandt, 1833 (Sfenthourakis and Taiti, 2015). Philosciidae includes approximately 600 species placed in 115 genera and it is widely distributed in Australia, southern Asia, Africa, Europe, and the Americas (Leistikow, 2001; Schmalfuss, 2003; Taiti and Schotte, 2016). This family constitutes one of the most important groups of terrestrial isopods in tropical and wetlands habitats (Leistikow, 2001). To date, the family is considered paraphyletic due to characteristics shared with the families Halophilosciidae Verhoeff, 1908 and Scleropactidae Verhoeff, 1938 (Leistikow, 2001; Schmidt, 2008).
The monotypic genus *Pulmoniscus* Leistikow, 2001 (Philosciidae) comprises *Pulmoniscus insularuminfraventum* (Vandel, 1952) from Gran Roque (Winward Islands), Cerros Orientales, Venezuela. The genus is mainly defined by the cephalon without lateral lobes, outer endite of maxillula with crown-shaped and 3-tiped apex teeth on outer set, pleopod exopods with monospiracular covered lungs (Leistikow, 2001).

The present work describes a new species of *Pulmoniscus*, constituting the first record of the genus in Colombia. In addition, ecological remarks and a distribution map are provided.

**Material and Methods**

Specimens were stored in 75% ethanol and identifications were based on morphological characters. The appendages (antennulae, antennae, buccal pieces, pereopods and pleopods) were prepared in glycerin. The images were obtained with Axio Lab. A1 microscope and SteREO Discovery.V12 ZEISS stereomicroscope with adapted camera Axiocam ERc 5s. The final illustrations were prepared using the software GIMP with the methods proposed by Coleman (2006) and Montesanto (2015; 2016). The coordinates of the *noduli laterales* were obtained and figured as in Vandel (1962).

**Abbreviations**

- CUDC-CRU: Colección de Crustáceos del Programa de Biología de la Universidad de Cartagena, Cartagena de Indias, Colombia.
- ICN-CI: Colección de Crustáceos Isópodos del Instituto de Ciencias Naturales, Universidad Nacional de Colombia, Bogotá, Colombia.

**Study Area**

The three studied localities are placed at the northern Department of Bolívar, western portion of the Colombian Caribbean (Fig. 1). These localities belong to the Tropical Dry Forest (TDF) ecosystems, characterized by high levels of endemism and beta-diversity. TDF is currently one of the most endangered ecosystems in the world (García et al., 2014). There are several factors that have caused the fragmentation of this ecosystem. The high level of human establishment, the intense transformation resulted by livestock farming, thinning wood, and burning for the establishment of crops sowing are among the responsible factors for this fragmentation (Escober, 1997; Rangel-Ch. et al., 1997).

The Macondo estate, Turbaco is part of one remaining TDF area. It is located at 100 m from the Botanical Garden Guillermo Piñeres, at an altitude of 130 m. The average annual temperature and precipitation are 28°C and 900–1,200 mm, respectively. This region is characterized by having marked dry, rainy, and transition seasons, with annual humidity level of approximately 70% (Alcaldía de Turbaco-Bolívar, 2012). The vegetative cover is composed by fruit and ornamental species such as meddler (*Manilkara sapota*), mango (*Mangifera indica*), bamboo (*Bambusa vulgaris*), and sapodilla tree (*Pouteria sapota*); and by native species such as ceiba tree (*Ceiba pentandra*), purple oak (*Tabebuia rosea*), and mata ratón (*Gliricidia sepium*).

The Mameyal is located at the rural area of Turbana municipality. It is a vegetation fragment that has been preserved for several years. This region shows climate characteristics similar to Macondo estate. The Mameyal is characterized by the presence of mamey fruit (*Mammea americana*), *Mangifera indica*, and *Manilkara sapota*. The dense canopy hinders the passage of sunlight to the ground, preventing the establishment of a structured understory. Those fruit trees are part of the diet of the red howler monkey *Alouatta seniculus* (Linnaeus, 1766) (Ratiarson and Forget, 2011).

The Tierra Bomba Island is located at the occidental portion of the Cartagena Bay, at 3 km from Bocagrande, Cartagena de Indias. The island was formed during the marine transgression dynamics of Pleistocene, and has an area of approximately 2,000 ha (Núñez et al., 1999). The coastal line is marked by the presence of mangroves and dense dry shrubs on its inner portion. To date, both ecosystems are endangered due the urban expansion.
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Systematics

Philosciidae Kinahan, 1857

Pulmoniscus Leistikow, 2001

Type species. Balloniscus insularuminfraventum Vandel, 1952 by monotypy.


Pulmoniscus turbanaensis López-Orozco, Carpio-Díaz & Campos-Filho n. sp.
(Figs. 1–5)

Type material. Holotype: 1 ♂ (CUDC-CRU 12), El Mameyal, Turbana, Bolívar, Colombia, 10°16′31.32″N 75°26′0.25″W, 23.X.2015, leg. Keiner Meza-T.

Paratypes: 1 ♂ (CUDC-CRU 13), 1 ♀ (CUDC-CRU 14), same locality and date as holotype, leg. Y. Carpio-Díaz. 7 ♂, 21 ♀ (CUDC-CRU 15), same locality and date as holotype, leg. C.M. López-Orozco. 3 ♂, 2 ♀ (ICN-CI-85), S.VI.2016, same locality as holotype, leg. Y. Carpio-Díaz. 1 ♂, 2 ♀ (CUDC-CRU 16), Tierra Bomba, Cartagena de Indias, Bolívar, Colombia, 10°21′41.59″N 75°32′24.00″W, 7.VIII.2016, leg. Y. Carpio-Díaz. 12 ♂, 5 ♀ (CUDC-CRU 17), Macondo estate, Turbaco, Bolívar, Colombia, 10°21′26.88″N 75°25′45.92″W, 15.VII.2016, leg. Y. Herrera-Medina.

Figure 1. Distribution map of Pulmoniscus turbanaensis n. sp. Dark grey areas = Tropical Dry Forest.
Figure 2. Pulmoniscus turbanaensis n. sp. ♀ Paratype (CUDC-CRU 14): A. Dorsal habitus; B. Dorsal scale-seta, C. b/c noduli laterales coordinates; D. d/c noduli laterales coordinates; E. Cephalon, frontal view; F. Cephalon, dorsal view; G. Telson; H. Antenna; I. Antennula.

Description. Maximum body measurements: ♂ (holotype), 8.5 mm length, 3 mm width; ♀ 6.9 mm length, 2.8 mm width. Body outline as in Fig. 2A. Color light to dark brown; antennal peduncle with first, second and distal portion of fifth article and flagellum unpigmented; cephalon with irregular unpigmented spots; pereon with dark lines on median and paramedian portions; epimera with one distinct unpigmented row, outer margins unpigmented; pleon strongly pigmented, pleonites 1–3 with two unpigmented spots; telson strongly pigmented, two unpigmented spots on paramedian region, one thin unpigmented spot on median portion; uropods weakly pigmented (Fig. 2A).

Dorsal surface baring short piliform scale-setae (Fig. 2B). Noduli laterales b/c and d/c coordinates as in Fig. 2C, D, respectively. Cephalon (Fig. 2E, F) without lateral lobes and frontal line, supraantennal line bent downwards in middle; eyes with 23 ommatidia in four rows. Pleon (Fig. 2A) slightly narrower than pereon, neopleurae 3–5 well-developed. Telson (Fig. 2G) with lateral margins concave, distal margin right-angled. Antennula (Fig. 2H) with distal article bearing six aesthetascs in three sets plus apical pair. Antenna (Fig. 2I) when extended posteriorly reaching posterior margin of pereonite 3; flagellum of three articles subequal in length, apical organ very short. Mandibles (Fig. 3A, B).
Figure 3. *Pulmoniscus turbanaensis* n. sp. ♂ Paratype (CUDC-CRU 14): A. Left mandible; B. Right mandible; C. Maxillula; D. Maxilla; E. Maxilliped; F. Uropod.

with molar penicil dichotomized bearing ten branches, left with 2+1 penicils, right mandible with 1+1 penicils. Maxillula (Fig. 3C) inner endite with distal margin rounded bearing two hairy penicils; outer endite of 4 teeth stout plus 5 teeth cleft at apex, three of them with apex crown-shaped. Maxilla (Fig. 3D) outer lobe more than twice as wide as inner lobe, distal margin rounded, covered with setae; inner lobe bearing thick setae. Maxilliped (Fig. 3E) base rectangular bearing sparse setae; palp with two setae distinct in length on proximal article; endite sub-quadrangular, medial seta surpassing distal margin, distal margin straight with one small seta. Uropod (Fig. 3F) protopod and exopod grooved on lateral margin, exopod twice as long as endopod, endopod inserted proximally. Pereopods 1–7 slightly strong; pereopod 1 carpus with longitudinal grooming brush; dactylus of two claws, inner claw not surpassing outer claw; ungual seta and dactyloar organ simple not surpassing outer claw. Pleopod exopods with monospiracular pleopodal lungs, spiraculum inserted on one third of length of outer margin, perispiracular area covered with concentric cuticular wrinkles.

Male. Pereopods 1–4 merus and carpus with brush of setae on sternal margin (Fig. 4A); pereopod 7 ischium sternal margin concave and distal sternal portion slightly prominent, tergal margin with two setae (Fig. 4B). Pleopod 1 (Fig. 4C) exopod subtriangular, outer and inner margins almost straight, outer margin bearing 4 small setae, distal margin obtuse; endopod twice as long as exopod, distal portion directed outwards, apex
Figure 4. *Pulmoniscus turbanaensis* n. sp. ♂ Paratype (CUDC-CRU 13): A. Pereopod 1; B. Pereopod 7; C. Pleopod 1; D. Pleopod 2; E. Pleopod 3 exopod; F. Pleopod 4 exopod; G. Pleopod 5 exopod.

with two lobes delimiting spermatid channels, one lobe directed outwards and other directed inwards, inner distal margin bearing small setae at apex. Pleopod 2 (Fig. 4D) exopod triangular, outer margin almost straight bearing several setae; endopod slightly longer than exopod. Pleopods 3–5 exopods as in Fig. 4E–G, respectively.

**Etymology.** The new species is named after one of the localities where the specimens were collected: Turbana.

**Remarks.** Vandel (1952) described the new species *Balloniscus insularuminfraventum* from Windward Islands, Archipelago Los Roques, Venezuela. Based on pleopod exopods with covered pleopodal lungs, the author included the genus in the subfamily *Porcellionidae quinquetracheatae* [= *Trachelipodidae* Strouhal, 1953]. Leistikow (2001) re-examined the type material of *B. insularuminfraventum* and mentioned that all pleopod exopods have monospiracular respiratory structures. Based on this argument, the author erected *Pulmoniscus* to allocate Vandel’s species. Currently, the genus is inserted in family Philosciidae, closely related to the genera *Balloniscus* Budde-Lund, 1908, *Plataoniscus* Leistikow, 2001 (Balloniscidae), *Oniscophiloscia* Wahrberg, 1922, and *Philoscia*.
Latreille, 1804 (Philosciidae). These taxa share a few characteristics, dorsal tricorn-setae with broad basis, and male pereopod 7 ischium with more than 5 setae on the lateral margin (Leistikow, 2001).

The pleopodal lungs are one of the most important morphological characteristics related to the terrestrialization process of Oniscidea (Ferrara et al., 1994; Leistikow, 2001). This structure evolved several times within many taxa of the suborder (see Ferrara et al., 1990; Paoli et al., 2002; Leistikow, 2001; Schmidt, 2002, 2003; Cardoso et al., 2016). Regarding the family Philosciidae, the pleopodal lungs are also present in other genera of the family such as Aphilocia Budde-Lund, 1908, Atlantoscia Ferrara & Taiti, 1981, Benthana Budde-Lund, 1908, Congophiloscia Schmalfuss & Ferrara, 1978, Philoscia Latreille, 1804, and Tiroloscia Verhoeff, 1926. As mentioned by Leistikow (2001), the pleopodal lungs of Pulmoniscus are similar to those found in Agnara Budde-Lund, 1908, characterized by monospiracular structures (see Agnoridae section in Schmidt, 2003). This was also confirmed for P. turbanaensis n. sp.

The new species is included in the genus Pulmoniscus as defined by Leistikow (2001). Pulmoniscus turbanaensis n. sp. can be easily distinguished from P. insularuminfraventum by the male pereopod 7 ischium with the sternal margin concave instead of straight. Other distinguishing characteristics are the shape of the male pleopod 1 exopod subtriangular with four setae on outer margin (vs. subquadrangular without setae), and the male pleopod 1 endopod with two lobes on apex delimiting the spermatic channels (vs. lobes absent).

Ecological remarks. In the Mameyal, P. turbanaensis n. sp. has a high population density during rainy and transition seasons. The species can be found among leaf litter of Mammea americana, Mangifera indica, and Manilkara sapota, feeding on their fruits and sheltering under pieces of trees in decomposition (Fig. 5). Some specimens were observed feeding on faeces of A. seniculus. Terrestrial isopods contribute significantly to the organic matter decomposition cycle, and are influenced by physico-chemical aspects of the leaf litter and abiotic characteristics (Zimmer and Topp, 1997; 2000; Zimmer, 2002, 2004; Zimmer et al., 2002; Quadros and Araujo, 2008). Pulmoniscus turbanaensis n. sp. has a high abundance, being the dominant species throughout the locality.

In Macondo estate, the species is equally abundant as in Mameyal and it is often preyed by domestic chickens. The species seems to be adapted to the leaf litter of Bambusa vulgaris, Mangifera indica, Pouteria sapota, and Manilkara sapota, and it was also found under rocks and tree pieces.

In Tierra Bomba, few individuals of P. turbanaensis n. sp. were found at 5 meters from the waterfront, collected together with Ligia baudiniana Milne Edwards, 1840, and between leaves of Rhizophora mangle, Avicennia germinans, and Laguncularia racemosa in mangroves. This species can be considered as introduced in the island, probably by human activities.

Figure 5. Pulmoniscus turbanaensis n. sp., Mameyal, Turbana. A. Specimens feeding on Manilkara sapota fruits; B. Specimens under piece of trees of Mammea americana, Mangifera indica and Manilkara sapota.
**Discussion**

The knowledge of arthropods diversity in TDF of Colombia is still obscure. These ecosystems are highly endangered and degraded (García et al., 2014). Many studies demonstrated high diversity of arthropods in TDF of Colombia (e.g. Guerrero and Fernández, 2008; Fontalvo-Rodríguez and Solís-Medina, 2009; González, 2014; Medina and González, 2014). The present contribution is the first record of the genus *Pulmoniscus* for Colombia and for the continental shield of the Neotropics. As mentioned by Campos-Filho et al. (2014), the taxonomic impediment has been considered the major problem for the knowledge of the biodiversity and proposal of conservation acts. Due to these reasons, taxonomic studies in TDF of Colombia have crucial importance for both the environment and the species and for the proposal of management and conservation acts to TDF. Lastly, any delay in taxonomic research could result in the permanent loss of biodiversity, even before species are discovered and described.

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**References**


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