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PRELIMINARY OBSERVATIONS ON TERRESTRIAL ISOPODS (PERACARIDA, ISOPODA) IN THE TRANSITIONAL COASTAL DESERT OF CHILE (24-29°S)

BY

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ABSTRACT

The terrestrial isopods of Chile make a group on which until now only a few studies have been done, most of which based mainly on species records in isolated zones. The aim of the present study was to make an attempt at characterization of the isopods present in three coastal protected areas in the Atacama Desert and northern-central Chile, and compare the results with literature records for northern and central Chile. The collected specimens belong to the genus *Benthanoides* (Oniscoidea, Philosciidae), probably to the species *Benthanoides pauper* that was originally described for central Chile. The obtained results would not agree with literature records that described the presence of two species of the genus *Tylos* (Oniscoidea, Tylidae) between 26-29°S, and it would be the first isopod genus recorded north of 26°S (Paposo priority site, Antofagasta Region). More systematic and ecological studies would be necessary for understanding the geographical distribution of Chilean terrestrial isopods.

RESUMEN

Los isópodos terrestres de Chile conforman un grupo sobre el que hasta ahora se han realizado pocos estudios, la mayoría de los cuales se basan principalmente en registros de especies en zonas aisladas. El objetivo del presente estudio fue intentar caracterizar los isópodos presentes en tres áreas

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costeras protegidas del desierto de Atacama y centro-norte de Chile, y comparar los resultados con registros de la literatura para el norte y centro de Chile. Los especímenes recolectados pertenecen al género *Benthanoides* (Oniscoidea, Philosciidae), probablemente a la especie *Benthanoides pauper* que fue descrita originalmente para el centro de Chile. Los resultados obtenidos no concordarían con los registros de la literatura que describían la presencia de dos especies del género Tylos (Oniscoidea, Tylidae) entre 26-29°S, y sería el primer género isópodo registrado al norte de 26°S (sitio prioritario Paposo, Región de Antofagasta). Serían necesarios estudios más sistemáticos y ecológicos para comprender la distribución geográfica de los isópodos terrestres chilenos.

INTRODUCTION

The terrestrial Isopoda in Chile have only been sparsely studied, and those studies are restricted to isolated records along the Chilean continental territory, as well as to some records for Chilean oceanic islands, specifically Easter Island and the Juan Fernandez Islands (Taiti et al., 1986; Leistikow & Wägele, 1999; Pérez-Schultheiss, 2007, 2009, 2010; De los Ríos-Escalante et al., 2018; Pérez-Schultheiss et al., 2019). These records of isopod taxa are restricted to isolated sites in central and southern Chile, specifically south of 33°S (Pérez-Schultheiss, 2009), and the Juan Fernández Islands (De los Ríos-Escalante et al., 2018), that would each comprise ecosytems with perennial forest and a rainy climate (Covarrubias & Valderas, 1981; Luebert & Plitscoff, 2006).

The reports for central Chile are restricted to the Valparaíso region, which is a semi-arid zone, as well as to northern Chile, that has an arid climate and in which there are records until 27°S (Schmalfuss & Vergara, 2000). The central-northern part (also called "little-northern Chile", 26-30°S), and the Antofagasta region (21-26°S) have at least five coastal protected areas. These areas are characterized by the presence of xerophyte vegetation associated to water condensation in the coastal mountains with an altitude of 1000 m a.s.l. in the Antofagasta region, and in the central-northern region there is a gradual increase of rainy winters, directly associated to latitude, and capable of sustaining vegetation (Luebert & Plitscoff, 2006). The climatic regions and types of vegetation here at issue can be considered to sustain terrestrial arthropod communities, among which terrestrial Isopoda. In addition, it should be specified that the qualification "transitional" as used here in "transitional coastal desert" refers to the transition of the local coastal desert to coastal prairies. The semi-arid region in-between receives most of its moisture from frequent fogs, which result in a vegetation of cactuses (Caryophyllales, Cactaceae) that are on average 2-3 m apart.

The aim of the present study thus was, to report on a first record of some isopods collected in three coastal protected areas in the Antofagasta, Atacama, and Coquimbo regions in the transitional coastal desert of the North of Chile.

MATERIAL AND METHODS

The studied sites reported upon herein correspond to the protected areas Sitio Prioritario Paposo (Antofagasta region), Pan de Azúcar National Park (Antofagasta region/Atacama region) and the Humboldt Penguin National Reserve (Atacama region/Coquimbo region) (fig. 1), areas included in the transitional coastal desert of Chile. The Paposo Priority Site (figs. 1 and 2A) is an area that forms part of the plant formation of the coastal desert of Tal Tal (Gajardo, 1993). This area presents a high botanical richness, representing ca. 50% of the vascular flora of the region (Marticorena et al., 1998), which is dominated by *Copiapoa cinerea* (Phil.) Britton & Rose, *Eulychnia iquiquensis* (K. Schum.) Britton & Rose, *Nolana* sp., *Lycium deserti* Phil., *Euphorbia lactiflua* Phil., *Cristaria integerrima* Phil., and *Perityle emoryi* Torr (fig. 2A) (Cavieres et al., 2002).

The Pan de Azúcar National Park (figs. 1 and 2B) is an area that is also part of the plant formation of the coastal desert of Tal Tal (Gajardo, 1993). The vegetation includes endemic species of Cactaceae, such as *Copiapoa grandiflora* F. Ritter, *Copiapoa cinerea* ssp. *columna-alba* (F. Ritter) Hunt, *Copiapoa longistaminea* F. Ritter, and *Copiapoa lauii* Diers. The climate governing these two study sites is Tropical Marine Desert along the northern margin (Sitio Prioritario Paposo) and Marine Subtropical Desert on the southern margin (Pan de Azúcar National Park) (Novoa & Villaseca, 1989).

Finally, the Humboldt Penguin National Reserve (figs. 1 and 2C-D), including Chañaral Island (332 ha) and Choros Island (56 ha) in the Atacama and Coquimbo regions, respectively (CONAF, 1997). This area is located at the boundary of the coastal desert of Huasco province, and the steppe scrub (Gajardo, 1993). The climate is Mediterranean and it has low temperatures, with low daily and yearly thermal amplitudes due to the marine influence (Armesto et al., 1993). The mean yearly precipitation is 90 mm approximately, with dry and rainy years in irregular cycles due to El Niño Southern Oscillation Events (ENSO) (Novoa & Villaseca, 1989). The flora of both islands is represented by different life forms; predominately species of scrubs, annual and perennial herbs, and Cactaceae (Arancio & Jara, 2007). The geomorphological details have been described by Aguirre (1967).

Sampling was done using pitfall traps. In each of the habitats described above, two sites were chosen of 4 × 5 m that were equipped with 20 traps each on regular intervals at each 1 m^2 (Cepeda-Pizarro et al., 2005a, b). Each trap consisted of two plastic recipients, the first located inside the second for allowing easy extraction, and that first recipient (7.4 cm diameter × 10.2 cm high) was filled for 66% with a mixture of 80% water, 10% ethanol and 10% domestic detergent. The traps were set during three days (Cepeda-Pizarro et al., 2005a, b), and after that

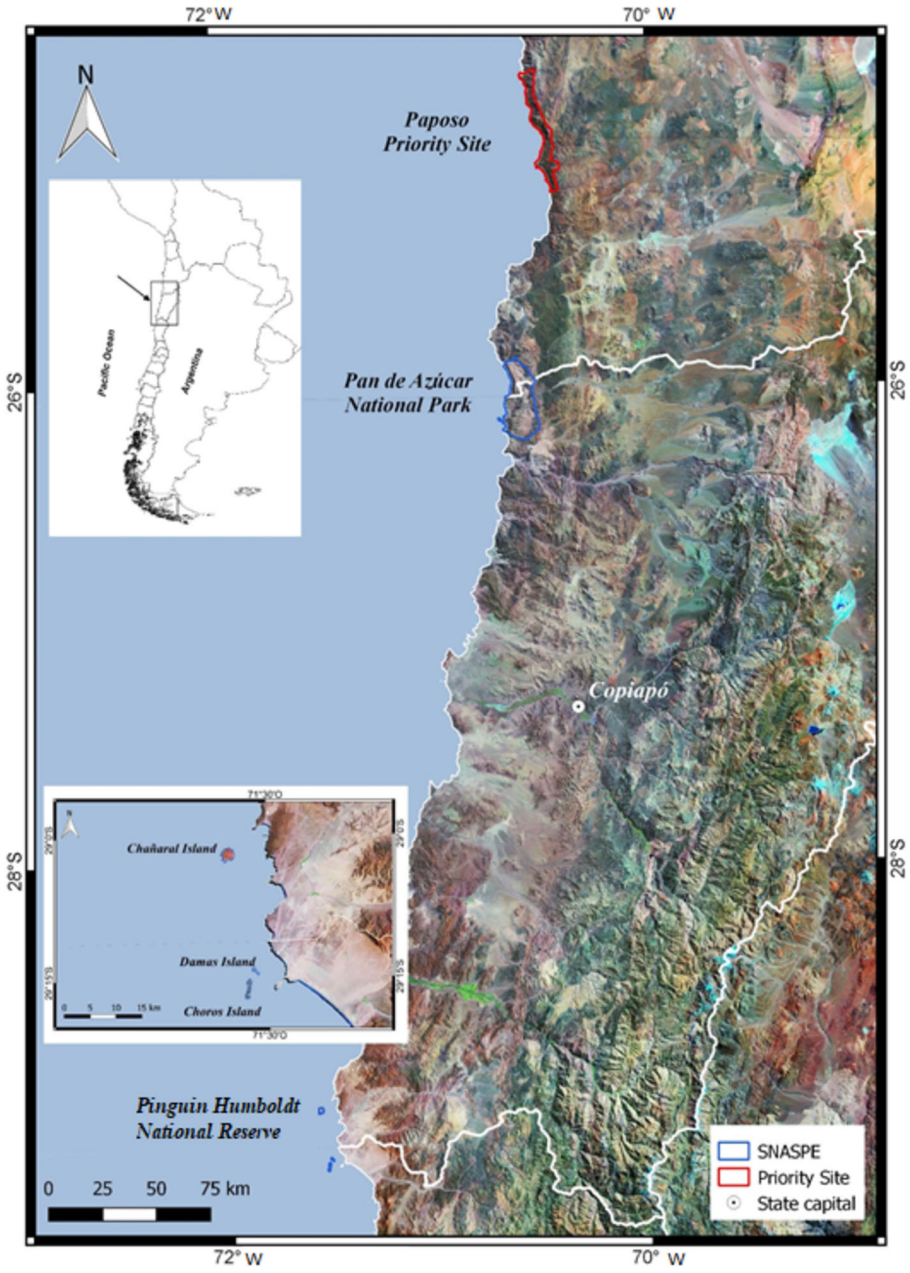

Fig. 1. Collection areas of terrestrial isopods (Crustacea, Isopoda) in the transitional coastal desert of Chile.

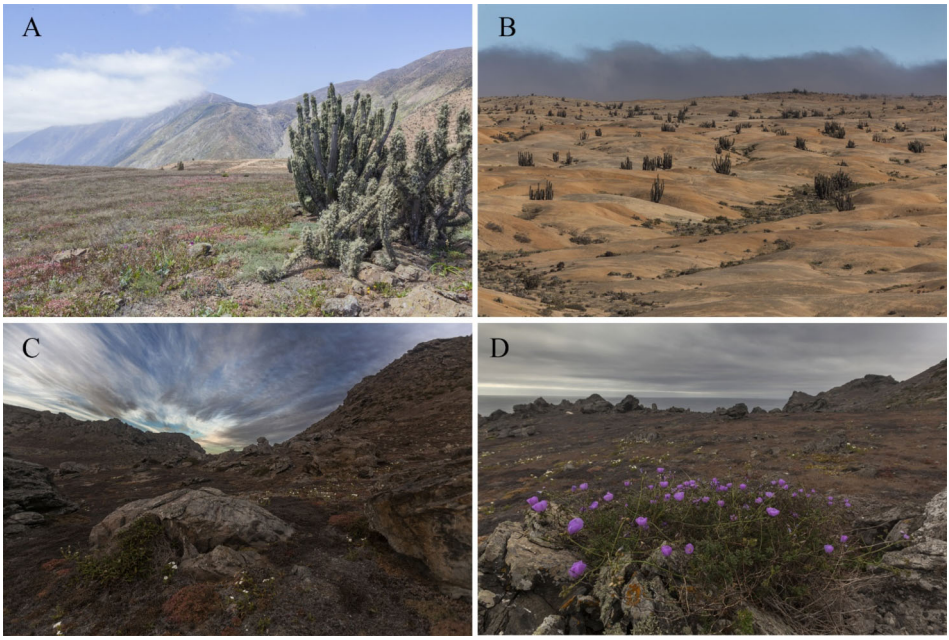

Fig. 2. Collection areas of terrestrial isopods (Crustacea, Isopoda) in the transitional coastal desert of Chile: A, Paposo Priority Site (Antofagasta region, Chile); B, Pan de Azúcar National Park (Antofagasta region/Atacama region, Chile); C, Chañaral Island, Humboldt Penguin National Reserve (Atacama region, Chile); D, Choros Island, Humboldt Penguin National Reserve (Coquimbo region, Chile).

period the specimens collected were fixed with absolute ethanol and identified according to literature descriptions in Van Name (1936) and Pérez-Schultheiss (2007, 2009, 2010). Collected specimens were deposited in the Entomological Ecology Laboratory of the La Serena University (LEULS), the Biological and Chemical and Sciences Department of the Catholic University of Temuco (UCT), and the Zoology Area of the National Natural History Museum, Santiago de Chile (MNHN).

Benthanoides aff. **pauper** (Jackson, 1926)
(figs. 3-4)

Material examined. — One specimen, "sex not determined", body 8 mm long, 3 mm greatest width; from 25°00′S 70°26′W (543 m a.s.l.) in Paposo Priority Site, Antofagasta region Chile, between 20 and 30 October 2015 (fig. 3). This is the specimen upon which the provisional description is based and that has been described in some detail, below. It was taken from the total of 192 specimens collected during this survey (table I), and these have been distributed among the three institutes listed above under Material and Methods.

Provisional, crude description. — In accordance with existing descriptions, the characteristic morphology of the specimen (cf. Jackson, 1926) can be confirmed as:

Fig. 3. The specimen of *Benthanoides* aff. *pauper* (Jackson, 1926), collected from Paposo Priority Site, and examined in the present study: left, dorsal view; right, ventral aspect.

Length of body 8 mm, width 3 mm. Shape elongate-oval. Head with eyes moderately large, not prominent; lateral lobe, ridge in front of eye rather large; transverse line of prosepistome moderately curved in middle, confluent at sides with posterior marginal line; mesepistome with prominent semicircular transverse tubercle in middle; lateral parts of metepistome (which is sparsely setose) projecting slightly

TABLE I

The terrestrial isopods (Peracarida, Isopoda) observed in samples from the transitional coastal desert of Chile (Antofagasta-Coquimbo): all specimens examined seem to be most probably referable to *Benthanoides pauper* (Jackson, 1926)

Site	Region	Geographical location	Species reported
Paposo Priority Site ($n = 147$)	Antofagasta	25°00′S 70°26′W	*Benthanoides* sp. (*B. pauper*?)
Chañaral Island, Humboldt Penguin National Reserve ($n = 18$)	Atacama	29°02′S 71°35′W	*Benthanoides* sp. (*B. pauper*?)*
Pan de Azúcar National Park ($n = 18$)	Atacama	29°14′S 71°31′W	*Benthanoides* sp. (*B. pauper*?)*
Damas Island, Pinguin Humboldt National Reserve ($n = 2$)	Coquimbo	29°14′S 71°31′W	*Benthanoides* sp. (*B. pauper*?)*
Choros Island, Pinguin Humboldt National Reserve ($n = 7$)	Coquimbo	29°16′S 71°32′W	*Benthanoides* sp. (*B. pauper*?)*

n, number of specimens collected.

*Note: According to Schmalfuss & Vergara (2000), at these sites *Tylos chilensis* Schultz, 1983 and *T. spinolosus* Dana, 1853 could possibly be found, but neither of these two species was encountered there in the present study.

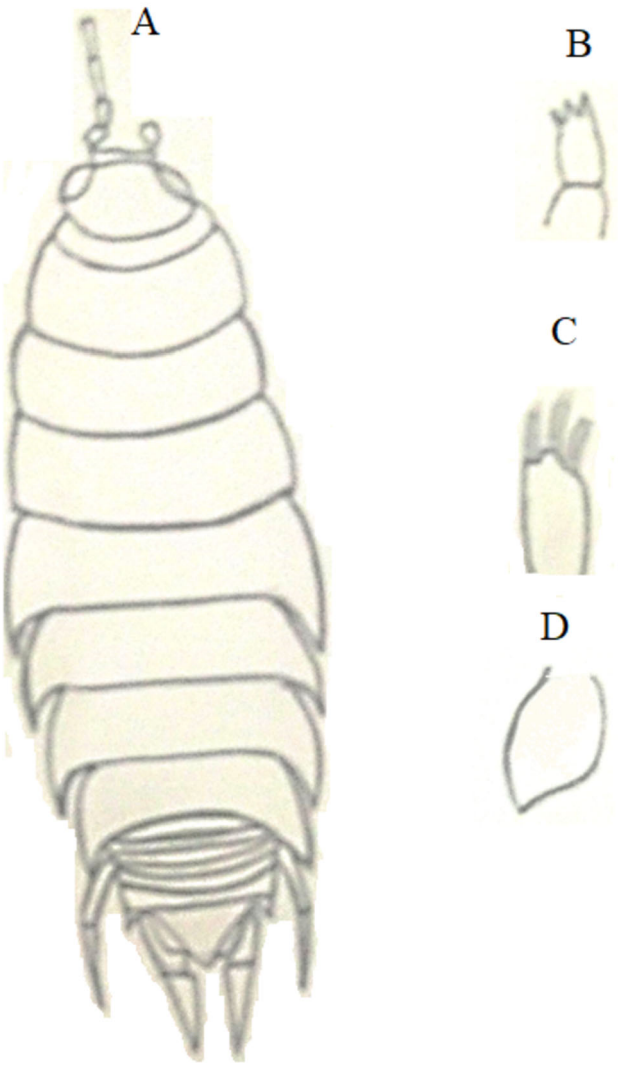

Fig. 4. Crude field sketches of some morphological aspects of the specimen of *Benthanoides* aff. *pauper* (Jackson, 1926), examined in this study: A, dorsal view; B, first maxilla; C, second maxilla; D, first pleopod.

in front of antennary sockets (fig. 4A). Abdomen with postero-lateral angles of the somites sharp and abrupt, but not long; telson not sulcate, apex obtuse (fig. 4A).

Appendages: Antennula slender, not exceeding line of epistome. Antenna absent. Maxillula (= first maxilla) with outer lacinia with 4 + 6 spines (of these, the nos. 1, 3, 4, 6 ctenate, no. 2 trifurcate, the other 5 acute and small); inner lacinia, penicilli short, thick, and nearly equal (fig. 4B, C). Maxilliped absent (fig. 3). Pleopods: no. I without posterior hook, inner edge moderately drawn out; with

few bristles and not setose at all (fig. 4D). Uropods: Protopodite not much longer than tip of telson; exopodite moderately long and 3.5 times as long as endopodite, which is very small and flattened (fig. 4A).

As the specimen described was preserved, its colour had become white after two years in ethanol 96%. On the other hand, the freshly taken photographs (fig. 3) show on the whole a brownish body, but lighter up to colourless along the edges.

Remarks. — During sorting the samples it became clear that the obtained specimens belong to the genus *Benthanoides* (Oniscoidea, Philosciidae), and may probably be referred to the species *B. pauper* (Jackson, 1926) (figs. 3, 4; table I). All collected specimens belong to this same taxon, according to the current literature. Though this genus is reported for Chile, the species identification is uncertain, because the type specimens that have been used for the first descriptions of the various *Benthanoides* species (3 in total: next to *B. pauper* also *B. peruensis* (Gruner, 1955) and *B. villosus* (Jackson, 1926) have been described) need to be studied to either confirm, or reject this taxonomic determination (cf. Pérez-Schultheiss, 2007, 2009, 2010). The literature about this taxon only described it for Valparaíso (without more details: Van Name, 1936), and the presence in central-northern and northern Chile would be a new record of this taxon for continental Chile, if unambiguously confirmed, of course. Also, long term studies about terrestrial isopod ecology would be necessary, as argued in more detail further below, because the present results were based on short term observations only (three days).

The literature about terrestrial isopods in northern and central-northern Chile has described the presence of the species *Tylos chilensis* Schultz, 1983 and *T. spinolosus* Dana, 1853 (Oniscoidea, Tylidae). The first species was described between 27-40°S (Schmalfuss & Vergara, 2000; Schmalfuss, 2003; Pérez-Schultheiss, 2007; Perez-Schultheiss & Urra, 2020), whereas the second species is restricted to 27°S, specifically in northern-central Chile (Van Name, 1936; Schultz, 1970, 1983; Schmalfuss & Vergara, 2000; Schmalfuss, 2003; Perez-Schultheiss & Urra, 2020). The literature also reported the presence of *Ligia novaezealandiae* Dana, 1853 (Ligiamorpha, Ligiidae) for the Coquimbo region (29°S; Pérez-Schultheiss, 2009). These results could not be confirmed by the findings of the present study, that reports only the presence of *Benthanoides* "aff. *pauper*". The presence of *Benthanoides* sp. (*B. pauper*?) in Paposo (24°S), in the coastal area of the Antofagasta region, constitutes the first report on a terrestrial isopod for the northern extreme of Chile, considering that terrestrial isopods in Chile have until now been reported only to the south of 27°S (Schmalfuss & Vergara, 2000; Schmalfuss, 2003; Pérez-Schultheiss, 2007).

These results would indicate that it is necessary to start exhaustive studies, first of all in taxonomy in order to determine the correct taxonomic identity of

the terrestrial isopods found on Chilean territory, and, on this basis, to do more extensive and detailed ecological studies for understanding abundance, population compositions, and distribution of those species. Also, if we consider that in the present study only one species was found, and the literature reports the presence of another two, different species (Schmalfuss & Vergara, 2000), we might be able to study with more emphasis the probable population and community dynamics of those species, that could explain the species' presence or absence.

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