COLLEMBOLA (ARTHROPODA, HEXAPODA) ASSOCIATED TO TERRESTRIAL GREEN ALGAE FROM ICE-FREE AREAS IN ADMIRALTY BAY (KING GEORGE ISLAND, SOUTH SHETLANDS ISLANDS, ANTARCTICA)

<http://dx.doi.org/10.4322/apa.2014.103>

Maria Cleide de Mendonça^{1,*}, Gabriel Costa Queiroz¹; Eduardo Assis Abrantes^{1,2},
Adriana Galindo Dalto³ & Yocie Yoneshigue Valentin³

¹Setor de Apterygotologia, Departamento de Entomologia, Museu Nacional, Universidade Federal do Rio de Janeiro - UFRJ, Quinta da Boa Vista, s/nº, São Cristóvão, CEP 20940-040, Rio de Janeiro, RJ, Brasil

²Museu de Zoologia, Serviço de Invertebrados, Laboratório de Lepidoptera, Universidade de São Paulo - USP, Avenida Nazaré, 481, CEP 04263-000, São Paulo, SP, Brasil

³Laboratório de Macroalgas Marinhas, Departamento de Botânica, Instituto de Biologia, Universidade Federal do Rio de Janeiro - UFRJ, Avenida Carlos Chagas Filho, 373, bloco A, sala A1-094, Cidade Universitária, Ilha do Fundão, CEP 21.941-902, Rio de Janeiro, RJ, Brasil

*e-mail: cleidecollembola@gmail.com

Abstract: Two species of Collembola were identified associated to the terrestrial green algae *Prasiola crispa* of ice-free areas near penguin rookeries at Polish Antarctic Station Henryk Arctowski, Admiralty Bay. *Cryptopygus antarcticus* and *Friesea grisea* are Collembola species frequently recorded for the Antarctic region, although some discrepancies were observed regarding the morphological characteristics of *F. grisea* specimens collected in this study. However, more specimens should be collected in other areas of Admiralty Bay and analyzed to confirm this diagnosis. Thus, this research can contribute to the knowledge of the biodiversity of Collembola in the region, particularly in Admiralty Bay, which is an Antarctic Specially Managed Area.

Keywords: Microinvertebrates, Penguin Rookeries, *Prasiola crispa*, Springtail

Introduction

The Class Collembola is one of the most abundant groups of arthropods in terrestrial ecosystems throughout the planet, which also includes the Antarctic continent (Rapoport, 1971; Schulte *et al.*, 2008). During the thawing period, part of the melt water accumulates between rocks, in addition to the organic detritus of seabirds creating a favorable habitat for the development of moss and algae patches, such as the green algae *Prasiola crispa* (Lightfoot) Kützing 1843 (Hayward *et al.*, 2004; Elnitsky *et al.*, 2008). These patches also support relatively diverse fauna of microinvertebrates, among these; there are some arthropods with a high degree of endemism, such as Collembola (Wise, 1971; Hayward *et al.*, 2004; Convey *et al.*, 1999). Furthermore, *P. crispa* is also part of food source items of some Collembola

species and others microinvertebrates (Bokhorst *et al.*, 2007; Roger & Lukesova, 2000).

In addition, Admiralty Bay is a protected area of the Antarctic Continent, classed as an Antarctic Specially Managed Area (ASMA no. 1) by the "Protocol to the Antarctic Treaty on Environmental Protection" and is located in the Antarctic Peninsula, one of the world's warming areas (Mulvaney *et al.*, 2012). These facts are an important incentive for the development of research studies on the biological diversity of the Antarctic Peninsula, which can contribute to the knowledge and protection of this region.

In this context, the aims of this study are to quantify and identify the Collembola species associated to the algae *Prasiola crispa* in the ice-free areas of Admiralty Bay

(King George Island, Antarctica). It was achieved through a collaborative research between the Collembola Laboratory of Museu Nacional/UFRJ and INCT- APA (Antarctic Environmental Research).

Materials and Methods

Samples of *P. crista* tuft were taken at penguin rookeries areas next to the Polish Station Henryk Arctowski (Admiralty Bay, King George Island). The samples of approximately 3 cm² were fixed in 4% formaldehyde for transportation. In Brazil, the material was processed at the Marine Macroalgae Laboratory (UFRJ, INCT-APA) through stereomicroscope and the associated fauna was sorted in taxonomic groups and preserved in ethanol 70%. Springtails were separated and sent to Collembola Laboratory of Museu Nacional/UFRJ. There, the specimens of Collembola with strong body pigmentation were diaphanized using a solution with 1/3 potassium bichromate and 2/3 of hydrochloric acid. Subsequently, the specimens were mounted on slides

to be observed in optical microscope with magnification of 1.000 x. The identification was carried out using specialized literature.

Results

A total of 16 Collembola specimens, belonging to the families Isotomidae (Entomobryomorpha) and Neanuridae (Poduromorpha) were collected. The Isotomidae species *Cryptopygus antarcticus* Willem, 1902 was represented by 13 specimens, while of the Neanuridae species *Friesea grisea* (Shaeffer, 1891), only 3 specimens were obtained. Both species have strong dark pigmentation on their bodies, as described in the literature.

Discussion

The species *C. antarcticus* is found widespread in the Antarctic continent and its adjacent islands (Wise, 1971; McGaughan *et al.*, 2010). Deharveng (1981) found that many specimens, from different regions of the continent,

Figure 1. Sampling station in Admiralty Bay (blue triangle), highlighting its location in relation to King George Island and South Shetland Islands (Antarctic Peninsula). Illustration: Rafael Bendayan de Moura.

had enough differences in morphological characters to separate them into four subspecies: *C. antarcticus antarcticus*, *C. a. maximus*, *C. a. reagens* and *C. a. travei*.

More recently, McGaughran *et al.* (2010) tested the validity of the subspecies previously described in a biogeographic study of circum-Antarctic *Cryptopygus* by means of molecular data. Nevertheless, no great support was obtained by the results for a conclusive separation of some of the species that forms the *Cryptopygus* “complex” of Antarctic. It was evident, however, that the species present in the region of the Antarctic peninsula is *C. a. antarcticus*, as that originally described by Willem (1901), despite the fact that there were recent and subsequent colonization events in the islands of this region. The specimens of *C. antarcticus* obtained in this study have the same characters described in original description, corroborating the works cited above.

The specimens of *F. grisea* obtained and studied in the present work are largely consistent with the morphological characters previously described (e.g. Salmon, 1962). However,

there are some discrepancies, such as the presence of serrated dorsal chaetae. The dorsal chaetotaxy of this species was described as being composed only of smooth chaetae throughout the body. Furthermore, the material examined by Salmon (1962) presented differences between males and females regarding the apical bulb, on fourth antennal segment, and chaetae of the sixth abdominal segment, near the anal spines. Such differences were not observed in the specimens in this study. Thus, further analysis of more specimens of the region, with special attention to the characteristics mentioned, besides others such as the mouthparts, can generate new information about this species.

Conclusion

The study of endemic springtail from Antarctic enriches the collections and expertise of taxonomists of the country and also provides greater integration between the research teams. Both species identified, although common, are important in the Antarctic continent, which reinforces the

Figures 2. *Friesia grisea*: A. Anal spines and setae of abd.seg.VI, female, specimen collected by INCT equip in 2011; B. Anal spines and setae of abd.seg.VI, male (modified from Salmon, 1962); C. Anal spines and setae of abd.seg.VI, male (modified from Salmon, 1962); D. Anal spines and setae of abd.seg.VI, female (modified from Salmon, 1962).

valuable information obtained from this wildlife research by a Brazilian team.

The material of *C. antarcticus* from the South Shetlands islands of the present study corroborates recent studies regarding the taxonomy of the Antarctic species. In this context, the importance of increasing knowledge of biological diversity, particularly in the case of Admiralty Bay, which is an Antarctic Specially Managed Area (ASMA 1), under Annex V of the Protocol to the Antarctic Treaty on Environmental Protection (Antarctic Treaty Consultative Meeting, XX ATCM, Utrecht, 1996), should be stressed. Although widely distributed and well known in the region, no specimen of *F. grisea* had yet been reported with the dorsal chaetotaxy showing serrated chaetae. The analysis of new samples can bring valuable information on this important Antarctic species.

Acknowledgements

This work integrates the National Institute of Science and Technology Antarctic Environmental Research (INCT-APA) that receives scientific and financial support from the National Council for Research and Development (CNPq process: n° 574018/2008-5) and Carlos Chagas Research Support Foundation of the State of Rio de Janeiro (FAPERJ n° E-16/170.023/2008). The authors also acknowledge the support of the Brazilian Ministries of Science, Technology and Innovation (MCTI), of Environment (MMA) and Inter-Ministry Commission for Sea Resources (CIRM). Dr Eduardo Assis Abrantes is granted by FAPESP (Process #2012/12959). MSc. Gabriel Costa Queiroz is granted by CAPES.

References

- Antarctic Treaty Consultative Meeting (XX ATCM, Utrecht, 1996). Final Report of the Twentieth Antarctic Treaty Consultative Meeting. Utrecht, Netherlands, 29 April-10 May 1996: Ministry of Foreign Affairs and Trade, 1997, 78 p.
- Bokhorst, S.; Ronfort, C.; Huiskes, A.; Convey, P. & Aerts, R. (2007). Food choice of Antarctic soil arthropods clarified by stable isotope signatures. *Polar Biology*, 30:983-990.
- Convey, P.; Greenslade, P.; Arnold, R.J. & Block, W. (1999). Collembola of sub-Antarctic South Georgia. *Polar Biology*, 22:1-6.
- Deharveng, L. (1981) Collembolles des Iles Subantarctiques de L'Océan Indien, Mission J. Travé 1972-1973. *CNFRABiologie des Sols*, 48: 33-108.
- Elnitsky, M.; Benoit, J.; Denlinger, D. & Lee Junior, R. (2008). Desiccation tolerance and drought acclimation in the Antarctic collembolan *Cryptopygus antarcticus*. *Journal of Insect Physiology*, 54: 1432-1439.
- Hayward, S.; Worland, M.; Convey, P. & Bale, J. (2004) Habitat moisture availability and the local distribution of the Antarctic Collembola *Cryptopygus antarcticus* and *Friesea grisea*. *Soil biology and Biochemistry*, 36: 927-934.
- McGaughan, A. Stevens, M. & Holland, B.R. (2010). Biogeography of circum-Antarctic springtails. *Molecular Phylogenetics & Evolution*, 57: 48-58.
- Mulvaney, R.; Abram, N. J.; Hindmarsh, R. C. A.; Arrowsmith, C.; Fleet, L.; Triest, J.; Sime L. C.; Alemany, O. & Foord, S. (2012). Recent Antarctic Peninsula warming relative to Holocene climate and ice-shelf history. *Nature*, 489: 141-145.
- Rapoport, E. (1971). The Geographical Distribution of Neotropical and Antarctica Collembola. *Pacific Insects Monograph*, 25: 99-118.
- Roger, M.W. & Lukesova, A. (2000). The effect of feeding on specific soil algae on the cold-hardiness of two Antarctic micro-Arthropods (*Alaskazetes antarcticus* and *Cryptopygus antarcticus*). *Polar Biology*, 23:766-774.
- Salmon, J.T. (1962). A New Species and Redescriptions of Collembola from Antarctica. *Pacific Insects*, 4(4): 887-894.
- Schulte, G.; Elnitsky, M.; Benoit, J.; Denlinger, D. & Lee Junior, R. (2008). Extremely large aggregations of collembolan eggs on Humble Island, Antarctica: a response to early seasonal warming? *Polar Biology*, 31: 889-892.
- Wise, K.A.J. (1971). The Collembola of Antarctica. *Pacific Insects Monograph*, 25: 57-74.