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ORIGINAL ARTICLE

Two new records of terrestrial isopods (Isopoda, Oniscidea) from the state of Paraíba, Brazil

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ABSTRACT

Two species of Oniscidea are recorded for the state of Paraíba for the first time. *Cubaris murina* Brandt, 1833 from Campina Grande and Cabaceiras and *Porcellionides pruinosus* (Brandt, 1833) from Campina Grande. Moreover, *Alloniscus buckupi* Campos-Filho & Cardoso, 2018 and *Atlantoscia floridana* (Van Name, 1940) have their distribution extended, and a short discussion about the record of *A. buckupi* in a semiarid area is provided.

KEYWORDS

Woodlice, Northeastern Brazil, Caatinga biome, Neotropics, distribution.

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INTRODUCTION

Terrestrial isopods (Oniscidea) comprise more than 3,800 species in 38 families distributed in almost all types of terrestrial habitats (Schmalfuss, 2003; Javidkar *et al.*, 2015; Richardson and Araujo, 2015; Sfenthourakis

and Taiti, 2015; Taiti, 2018). Among them, 192 species are known from Brazil, mostly from southeastern and southern regions (Campos-Filho *et al.*, 2018a; 2019). In the state of Paraíba, Northeastern Brazil, three species are recorded, *Alloniscus buckupi* Campos-Filho and Cardoso, 2018 (Alloniscidae) and *Atlantoscia floridana* (Van Name, 1940) (Philosciidae) from João Pessoa, and *Armadillidium vulgare* (Latreille, 1804) (Armadillidiidae) from Boqueirão (Lemos de Castro, 1985; Zimmermann *et al.*, 2015; Campos-Filho *et al.*, 2018b).

In this work two species of terrestrial isopods are recorded from the state of Paraíba for the first time: *Cubaris murina* Brandt, 1833 from Campina Grande and Cabaceiras, and *Porcellionidaes pruinosus* (Brandt, 1833) from Campina Grande. In addition, *A. buckupi* and *A. floridana* were also found to occur in Campina Grande, the former in the Caatinga biome, which will be briefly discussed below.

Material and Methods

The material was collected with the aid of pitfall traps as proposed by Aquino *et al.* (2006). The traps consisted of Styrofoam containers 10 cm high and 10 cm diameter with a solution of 100 ml ethanol 70% and 5 ml of detergent. The sampling was carried out during the dry season, from 9 to 13 October 2017. The soil salinity and pH levels of the sampling site were measured with aid of TDS&EC B-M1X and ATC 0-14 pen type equipment, respectively. The material was stored in 75% ethanol and identifications were based on morphological characters. The species were examined with the aid of Biofocus SQFL-BI and Olympus CH-2 microscopes and, when necessary, appendages were mounted in micro-preparations with Hoyer's medium (Anderson, 1954). The material is deposited in the Museu de Zoologia, Universidade de São Paulo, São Paulo, Brazil (MZUSP).

Study area

The state of Paraíba is located in northeastern Brazil with an area of about 56,000 km^2 (3.6% of the Northeastern Region total area). The state is mainly covered by Caatinga and Atlantic forest (MMA, 2015; SUDENE, 2017). The Caatinga formation has a large territorial coverage, more than 900,000 km^2 (approximately 54% of the territory of the Northeastern Region and 11% of the whole Brazilian territory), and it composes the vegetation mosaic of the Seasonal Tropical Dry forests (Andrade-Lima, 1981; Silva *et al.*, 2011; Pereira *et al.*, 2017; SUDENE, 2017). According to Köppen's criteria, the state has three distinct climate regions: 1) littoral, 'Agreste' and 'Brejos de Altitude' with rainfall of about 1,800 mm/year; 2) 'Sertão', with rainfall of about 820 mm/year; and 3) 'Borborema Plateau', with rainfall of about 800 mm/year (Francisco *et al.*, 2015).

The specimens were collected in 'Campus I' of the Universidade Federal de Campina Grande (UFCG), Campina Grande, and in the municipality of Cabaceiras (Figs. 1, 2), both inserted in the Borborema Plateau and the Brazilian semiarid region (SUDENE, 2017). Campina Grande is located at 560 m a.s.l., annual average temperature of about 25ºC, rainfall period from February to August, and vegetation composed of Seasonal Forest and Caatinga (Limeira, 2008). Cabaceiras is located near Paraíba river, approximately 400 m a.s.l., with extreme Semiarid climatic domain, annual rainfall of about 270 mm (Corrêa *et al.*, 2010).

Systematics

Family Alloniscidae Schimdt, 2003

Genus *Alloniscus* Dana, 1854

Alloniscus buckupi Campos-Filho & Cardoso, 2018

Material examined. 2 ♂♂ (MZUSP 40090), Campina Grande, Universidade Federal de Campina Grande (UFCG), 7º12'53"S 35º54'54"W, 09–13 October 2017, colls. I.M.D. Correia and D.C. Moura.

Distribution. This species is recorded from Cabo Branco beach, João Pessoa (Campos-Filho *et al.*, 2018b). The present record considerably extends its distribution.

Family Philosciidae Kinahan, 1857

Genus *Atlantoscia* Ferrara and Taiti, 1981

Atlantoscia floridana (Van Name, 1940)

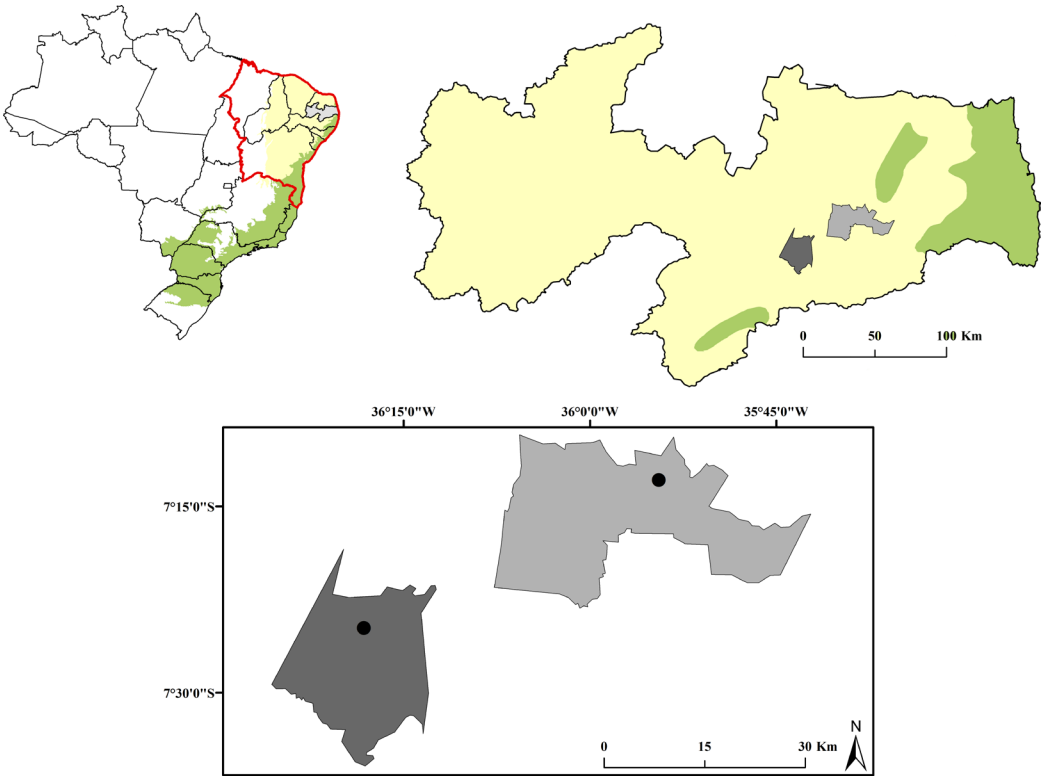

Figure 1. Sampling areas (●). Legend: red line = Northeastern Brazil limit; yellow area = Caatinga formation; green area = Atlantic forest.

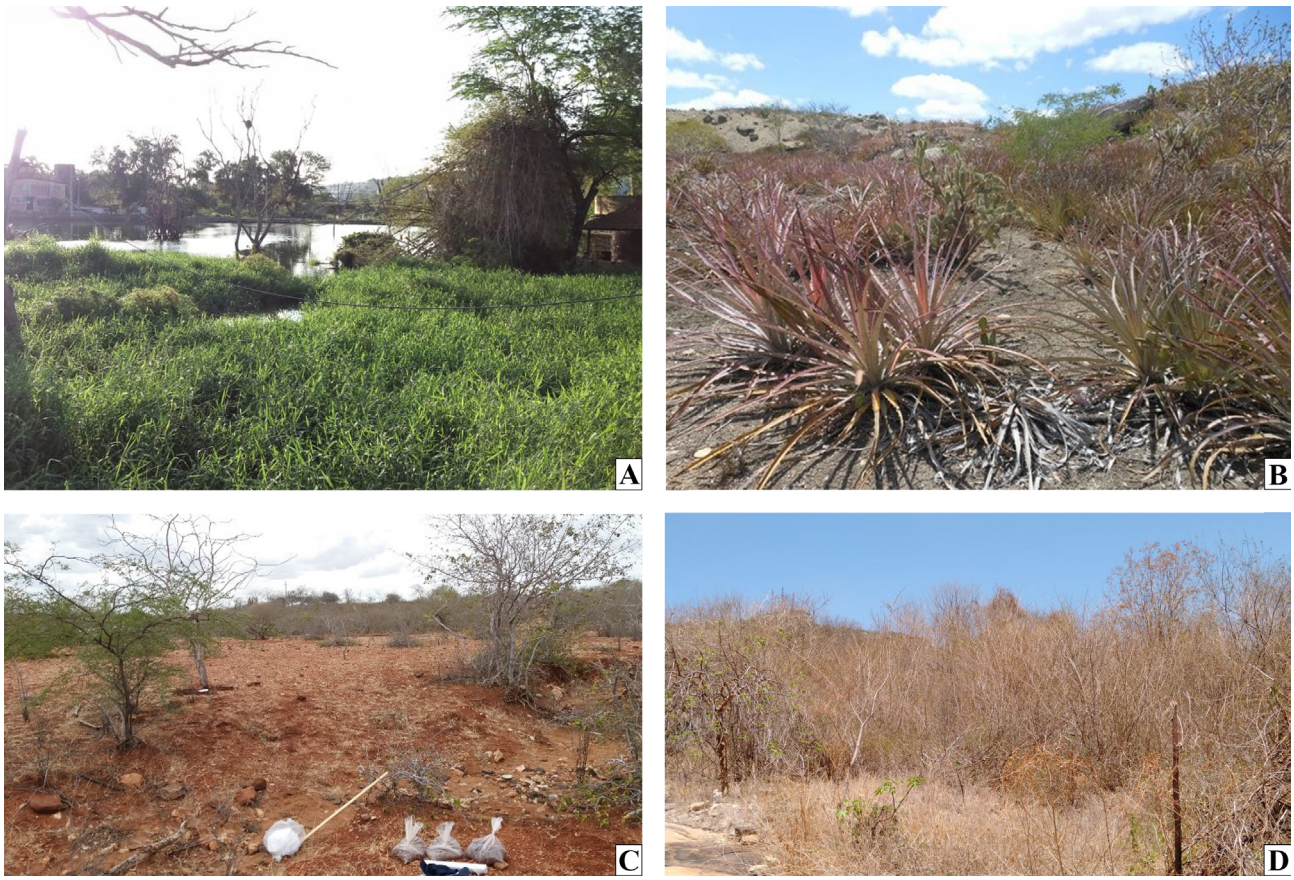

Figure 2. Study area. A, Artificial lake, Campina Grande; B, Caatinga, Campina Grande; C, D, Caatinga, Cabaceiras.

Material examined. Many ♂♂ and ♀♀ (MZUSP 40091), Campina Grande, Universidade Federal de Campina Grande (UFCG), 7°12'53"S 35°54'54"W, 09–13 October 2017, colls. I.M.D. Correia and D.C. Moura.

Distribution. Originally described from Florida, USA (Van Name, 1940) and recorded from Argentina, Brazil (from Amapá to Rio Grande do Sul states), coastal regions of Florida, and Ascension and St. Helena Islands (Schmalfuss, 2003; Campos-Filho *et al.*, 2013; 2018a). In the state of Paraíba, this species was recorded from Parque da Bica (Zoobotanical Garden Arruda Câmara), João Pessoa (Lemos de Castro, 1985). The present record extends the species distribution in the state.

Family Armadillidae Brandt, 1833

Genus *Cubaris* Brandt, 1833

***Cubaris murina* Brandt, 1833**

Material examined. 1 ♂, 5 ♀♀ (MZUSP 40092), Campina Grande, Universidade Federal de Campina Grande (UFCG), 7°12'53"S 35°54'54"W, 09–13 October 2017, colls. I.M.D. Correia and D.C. Moura; 1 ♂ (MZUSP 40093), Cabaceiras, 7°24'46"S 36°18'12"W, coll. E.M. Cavalcante.

Distribution. Circumtropical species (Schmalfuss, 2003). In Brazil, it is recorded from the states of Pará, Bahia, Mato Grosso, Mato Grosso do Sul, Espírito Santo, Paraná, and Santa Catarina (Campos-Filho *et al.*, 2017; 2018a).

Family Porcellionidae Brandt, 1831

Genus *Porcellionides* Miers, 1877

***Porcellionides pruinosus* (Brandt, 1833)**

Material examined. 4 ♂♂, 11 ♀♀ (MZUSP 40094), state of Paraíba, Campina Grande, Universidade Federal de Campina Grande (UFCG), 09–13 October 2017, leg. I.M.G. Correia and D.C. Moura.

Distribution. Cosmopolitan species of Mediterranean origin (Schmalfuss, 2003). In Brazil, it is recorded from the states of Bahia, Ceará, Espírito Santo, Pará, Piauí, Rio Grande do Sul, and Santa Catarina (Campos-Filho *et al.*, 2018a).

Discussion

To date, the Caatinga comprises a high biodiversity with a high number of endemics (Leal *et al.*, 2005; Loebmann & Haddad, 2010), and, as other Brazilian biomes, suffers with high levels of degradation due to overexploitation of its natural resources (Alves *et al.*, 2009).

Among the species mentioned here, the most intriguing is the presence of *A. buckupi* in a semiarid area. To date, all species of *Alloniscus* are distributed in coastal areas, except the doubtful *A. simplex* Schmölzer, 1974 from Aberdare mountains, Kenya (Schmalfuss, 2003; Campos-Filho *et al.*, 2018b). The specimens of *A. buckupi* were collected near an artificial lake within UFCG (Fig. 1A), where the dissolved salt and pH levels strongly exceed sea levels (1,282 ppm and 10.8 *vs.* 35 ppm and 7.4–8.5). Salt dependency related with physiology have been published in different groups of littoral species (*e.g.*, Moens and Vincx, 2000; Braby and Somero, 2009; Pétillon *et al.*, 2011; Sandman *et al.*, 2013). Within Oniscidea, many papers regarding the systematics of coastal species have been published (*e.g.*, Taiti and Howarth, 1996; Taiti *et al.*, 2003; 2018; Taiti and Lopez, 2008; Messina *et al.*, 2011; 2012; Lisboa *el al.*, 2017; Pérez-Schultheiss *et al.*, 2018), but only a few studies approached the relationships between species and salt environments (*e.g.*, Barnes, 1932; 1934; 1935; 1940; Zimmer *et al.*, 2002; Lopes-Leitzke *et al.*, 2009; 2011). *Alloniscus buckupi* is considered to be introduced to Campina Grande and, probably, the salt levels of the artificial lake allow the species to survive in this area. All species of the genus are diggers on sandy beaches, probably to avoid water loss and predation (see Schmalfuss, 1884). Campos-Filho *et al.* (2018b) mentioned that specimens of *A. buckupi* were collected during a drizzle in Cabo Branco beach, João Pessoa. The specimens from Campina Grande were collected from soil samples, confirming the digger habit of this species.

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References

Alves, J.J.A.; Araújo, M.A. and Nascimento, S.S. 2009. Degradação da Caatinga: uma investigação ecogeográfica. *Revista Caatinga*, 22: 126–135.

Anderson, L.E. 1954. Hoyer's solution as a rapid permanent mounting medium for bryophytes. *The Bryologist*, 57: 242.

Andrade-Lima, D.A. 1981. The caatinga dominium. *Revista Brasileira de Botânica*, 4: 149–153.

Aquino, A.M.; Aguiar-Menezes, E.L. and Queiroz, J.M. 2006. Recomendações para coleta de artrópodes terrestres por armadilhas de queda ("Pitfall-Traps"). *Circular Técnica* (EMBRAPA), 18: 1–8.

Barnes, T. 1932. Salt requirements and space orientation of the littoral isopod *Ligia* in Bermuda. *Biological Bulletin. Marine biological Laboratory, Woods Hole*, 63: 496–504.

Barnes, T. 1934. Further observations on the salt requirements of *Ligia* in Bermuda. *Biological Bulletin. Marine biological Laboratory, Woods Hole*, 66: 124–132.

Barnes, T. 1935. Salt requirements and orientation of *Ligia* in Bermuda. III. *Biological Bulletin. Marine biological Laboratory, Woods Hole*, 69: 259–268.

Barnes, T. 1940. Experiments on *Ligia* in Bermuda. VII. Further effects of sodium, ammonium and magnesium. *Biological Bulletin. Marine biological Laboratory, Woods Hole*, 78: 35–41.

Braby, C.E. and Somero, G.N. 2006. Following the heart: temperature and salinity effects on heart rate in native and invasive species of blue mussels (genus *Mytilus*). *The Journal of Experimental Biology*, 209: 2554–2566.

Brandt, J.F. 1833. Conspectus Monographiae Crustaceorum Oniscodorum Latreillii. *Byulleten Moskovskogo Obshchestva Ispŷtateleĭ Prirodŷ*, 6: 171–193, pl. 4.

Campos-Filho, I.S.; Cardoso, G.M. and Aguiar, J.O. 2018a. Catalogue of terrestrial isopods (Crustacea, Isopoda, Oniscidea) from Brazil: an update with some considerations. *Nauplius*, 26: e2018038.

Campos-Filho, I.S.; Cardoso, G.M. and Aguiar, J.O. 2018b. New species and first record of *Alloniscus* Dana, 1854 (Isopoda, Oniscidae, Alloniscidae) from Brazil. *Nauplius*, 26: e2018014.

Campos-Filho, I.S.; Fernandes, C.S.; Cardoso, G.M.; Bichuette, M.E.; Aguiar, J.O. and Taiti, S. 2019. Two new species and new records of terrestrial isopods (Crustacea, Isopoda, Oniscidea) from Brazilian caves. *Zootaxa*, 4564: 422–448.

Campos-Filho, I.S.; Lisboa, J.T. and Araujo, P.B. 2013. Review of *Atlantoscia* Ferrara & Taiti, 1981 (Crustacea: Isopoda: Oniscidea: Philosciidae) with new records and new species. *Organisms, Diversity & Evolution*, 13: 463–483.

Campos-Filho, I.S.; Montesanto, G.; Araujo, P.B. and Taiti, S. 2017. New species and new records of terrestrial isopods (Crustacea, Isopoda, Oniscidea) from Brazil. *Iheringia, Série Zoologia*, 107: e2017034.

Corrêa, A.C.B.; Tavares, B.A.C.; Monteiro, K.A.; Cavalcanti, L.C.S. and Lira, D.R. 2010. Megageomorfologia e morfoestrutura do Planalto da Borborema. *Revista do Instituto Geológico*, 31: 35–52.

Dana, J.D. 1854. Catalogue and description of Crustacea collected in California by Dr. John L. Le Conte. *Proceedings of the Academy of Natural Sciences of Philadelphia*, 7: 175–177.

Ferrara, F. and Taiti, S. 1981. Terrestrials isopods from Ascension Island. *Monitore Zoologico Italiano*, 13 (Suppl. 14): 189–198.

Francisco, P.R.M.; Medeiros, R.M.; Santos, D. and Matos, R.M. 2015. Classificação Climática de Köppen e Thornthwaite para o Estado da Paraíba. *Revista Brasileira de Geografia Física*, 8: 1006–1016.

Javidkar, M.; Cooper, S.J.B.; King, R.A.; Humphreys, W.F. and Austin, A. 2015. Molecular phylogenetic analyses reveal a new southern hemisphere oniscidean family (Crustacea: Isopoda) with a unique water transport system. *Invertebrate Systematics*, 29: 554–577.

Kinahan, J. 1857. Analysis of certain allied genera of terrestrial isopods; with description of a new genus, and a detailed list of the British species of *Ligia*, *Philougria*, *Philoscia*, *Porcellio*, *Oniscus* and *Armadillium* [sic]. *Natural History Review*, 4: 258–282, pls. 19–22.

Latreille, P.A. 1804. Histoire naturelle, générale et particulière des Crustacés et des Insectes. p. 1–413, pls 58–66. In: C.S. Sonnini (ed), Histoire naturelle, générale et particulière, des Crustacés et Insectes: ouvrage faisant suite aux oeuvres de Leclerc de Buffon, et partie du Cours complet d'Histoire naturelle. Vol. VII. Paris, L'Imprimeria de F. Dufart.

Leal, I.R.; Silva, J.M.C.; Tabarelli, M. and Lacher Jr., T.E. 2005. Changing the course of biodiversity conservation in the Caatinga of Northeastern Brazil. *Conservation Biology*, 19: 701–706.

Lemos de Castro, A. 1985. Considerações sobre *Atlantoscia alceui* Ferrara & Taiti, 1981 (Isopoda, Oniscoidea, Philosciidae). *Revista Brasileira de Biologia*, 45: 417–422.

Limeira, T.M.S. 2008. Variabilidade e Tendência das Chuvas no Estado da Paraíba. Master thesis in Meteorology, Programa de Pós-graduação em Meteorologia, Universidade Federal de Campina Grande. Campina Grande, 122p. [Unpublished].

Lisboa, J.T.; Campos-Filho, I.S.; Couto, E.C.G. and Araujo, P.B. 2017. Distribution of terrestrial isopods of the genus *Littorophiloscia* (Isopoda, Halophilosciidae) along the Brazilian coast. *North-Western Journal of Zoology*, 13: 354–356.

Loebmann, D. and Haddad, C.F.B. 2010. Amphibians and reptiles from a highly diverse area of the Caatinga domain: composition and conservation implications. *Biota Neotropica*, 10(3): http://www.biotaneotropica.org.br/v10n3/en/abstract?article+bn03910032010.

Lopes-Leitzke, E.R.; Dumont, L.F.C. and D'Incao, F. 2009. Growth of *Ligia exotica* (Isopoda: Oniscidea: Ligiidae) in two estuarine regions of Patos Lagoon, Rio Grande do Sul, Brazil. *Journal of the Marine Biological Association of the United Kingdom*, 89: 735–741

Lopes-Leitzke, E.R.; Macedo, C.W.S.S.; Longaray, D.A. and D'Incao, F. 2011. Natural diet of *Ligia exotica* (crustacea, isopoda, ligiidae) in two estuarine regions of Patos Lagoon, Rio Grande do Sul, Brazil. *Atlântica*, 33: 149–160.

Messina, G.; Montesanto, G.; Pezzino, E.; Caruso, D. and Lombardo, B.M. 2011. Diversity of terrestrial isopods in a protected area characterized by salty coastal ponds (Vendicari, Sicily). *Journal of Natural History*, 45: 2145–2158.

Messina, G.; Pezzino, E.; Montesanto, G.; Caruso, D. and Lombardo, B.M. 2012. The diversity of terrestrial isopods in the natural reserve "Saline di Trapani e Paceco" (Crustacea, Isopoda, Oniscidea) in northwestern Sicily. *ZooKeys*, 176: 215–230.

Miers, E. 1877. On a collection of Crustacea, Decapoda and Isopoda, chiefly from South America, with descriptions of new genera and species. *Proceedings of the Zoological Society of London*, 1877: 653–679, pls. 66–69.

MMA – Ministério do Meio Ambiente. 2015. Mapa de vegetação nativa na área de aplicação da Lei no. 11.428/2006 – Lei da Mata Atlântica (ano base 2009). Secretaria de Biodiversidade e Florestas, Brasília, 85p.

Moens, T. and Vincx, M. 2000. Temperature and salinity constraints on the life cycle of two brackish-water nematode species. *Journal of Experimental Marine Biology and Ecology*, 243: 115–135.

Pereira, T.M.S.; Moura, D.C.; Silva, J.A.L.; Rodrigues, E.M. and Melo, J.I.M. 2017. Resgate Florístico da Vegetação de Floresta Estacional no Município de Campina Grande – PB. *Revista Geográfica Acadêmica*, 11: 1–12.

Pérez-Schultheiss, J.; Ayala, K.; Fariña, J.M. and Coccia, C. 2018. Exotic oniscideans (Crustacea: Isopoda) in coastal salt marshes: first record of the families Halophilosciidae and Platyarthridae in Continental Chile. *New Zealand Journal of Zoology*, 46: 225–235.

Pétillon, J.; Lambeets, K.; Ract-Madoux, B.; Vernon, P. and Renault, D. 2011. Saline stress tolerance partly matches with habitat preference in ground-living wolf spiders. *Physiological Entomology*, 36: 165–172.

Richardson, A. and Araujo, P.B. 2015. Lifestyles of terrestrial crustaceans. p. 299–336. In: M. Thiel and L. Watling (eds), The natural history of the Crustacea. Lifestyles and feeding biology. Oxford, Oxford University Press.

Sandman, A.N.; Wikström, S.A.; Bloqvist, M.; Kautsky, H. and Isaeus, M. 2013. Scale-dependent influence of environmental variables on species distribution: a case study on five coastal benthic species in the Baltic Sea. *Ecography*, 36: 354–363.

Schmalfuss, H. 1984. Eco-morphological strategies in terrestrial isopods. *Proceedings of the Zoological Society of London*, 53: 49–63.

Schmalfuss, H. 2003. World catalog of terrestrial isopods (Isopoda: Oniscidea). *Stuttgarter Beiträge zur Naturkunde*, 654: 1–341.

Schmidt, C. 2003. Contribution to the phylogenetic system of the Crinocheta (Crustacea, Isopoda). Part 2 (Oniscoidea to Armadillidiidae). *Mitteilungen aus dem Museum für Naturkunde in Berlin,* Zoosystematics and Evolution, 79: 3–179.

Schmölzer, K. 1974. Landisopoden aus Zentral- und Ostafrika. *Sitzungsberichte der* österreichischen *Akademie der Wissenschaften, Mathematisch-naturwissenschaftliche Klasse*, Abteilung I, 182: 147–200.

Sfenthourakis, S. and Taiti, S. 2015. Patterns of taxonomic diversity among terrestrial isopods. *ZooKeys*, 515: 13–25.

Silva, J.M.C.; Barbosa, L.C.F.; Leal, I.R. and Tabarelli, M. 2011. The Caatinga: understanding the challenges. p. 3–21. In: J.M.C. Silva; I. Leal and M. Tabarelli (eds), Caatinga: The Largest Tropical Dry Forest Region in South America. Cham (Switzerland), Springer.

SUDENE – Superintendência do Desenvolcimento do Nordeste. 2017. Nova delimitação do Semiárido. Available at: http://www.sudene.gov.br/images/arquivos/semiarido/arquivos/Rela%C3%A7%C3%A3o_de_Munic%C3%ADpios_Semi%C3%A1rido.pdf [Accessed on 10 October 2019].

Taiti, S. 2018. Biologia e biogeografia degli isopodi terrestre (Crustacea, Isopoda, Oniscidea). *Atti Accademia Nazionale Italiana di Entomologia*, Anno LXV: 83–90.

Taiti, S.; Arnedo, M.A.; Lew, S.E. and Roderick, G.K. 2003. Evolution of terrestrially in Hawaiian species of the genus *Ligia* (Isopoda, Oniscidea). *Crustaceana Monographs*, 2: 85–102.

Taiti, S.; Montesanto, G. and Vargas, J.A. 2018. Terrestrial Isopoda (Crustacea, Oniscidea) from the coasts of Costa Rica, with descriptions of three new species. *Revista de Biología Tropical*, 66 (Suppl. 1): S187–S210.

Taiti, S. and Howarth, F. 1996. Terrestrial isopods (Isopoda: Oniscidea) from the Hawaiian Islands. *Occasional Papers of the Bishop Museum*, 45: 59–71.

Taiti, S. and López, H. 2008. New records and species of Halophilosciidae (Crustacea, Isopoda, Oniscidea) from the Canary Islands (Spain). p. 37–52. In: Z. Zimmer; F. Charfi-Cheikhrouha and S. Taiti (eds), Proceedings of the International Symposium of Terrestrial Isopod Biology – ISTIB-07. Aachen, Shaker Verlag.

Van Name, W.G. 1940. A supplement to the American land and freshwater isopod Crustacea. *Bulletin of the American Museum of Natural History*, 77: 109–142.

Zimmermann, B.L.; Bouchon, D.; Almerão, M.P. and Araujo, P.B. 2015. *Wolbachia* in Neotropical terrestrial isopods. *FEMS Microbiology Ecology*, 91: fiv025.