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On three endemic species of the linyphiid spider genus *Canariphantes* Wunderlich, 1992 (Araneae, Linyphiidae) from the Azores archipelago

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Abstract

We describe *Canariphantes junipericola* **n. sp.** and *C. relictus* **n. sp.,** new single-island endemic linyphiid spiders from the islands of Flores and Santa Maria (Azorean archipelago, Macaronesia), respectively. The female of the first species was incorrectly assigned to *Canariphantes acoreensis* (Wunderlich, 1992), a species occurring in four islands in the Central Group of Azores (Faial, Pico, São Jorge and Terceira). The latter species is transferred to *Canariphantes,* its male redescribed and the female genitalia described for the first time. We discuss the systematic affinities of these new species and comment on their conservation status..

Key words: Linyphiinae, *Canariphantes, Lepthyphantes*, Macaronesia, Azores, Taxonomy, Conservation, Endemics

Introduction

The archipelago of Azores is situated in the North Atlantic Ocean and is considered the most recently formed archipelago of Macaronesian islands; the oldest island, Santa Maria, has a geological age of 8.12 M.y. and the most recent island, Pico, of 0.3 M.y. (Serralheiro & Madeira 1993; França *et al.* 2003). The dominant natural habitat dominant in the Azorean islands, prior to human colonization about 600 years ago, was mainly composed of laurel forest and other native shrub vegetation (Frutuoso 1963). This particular type of relictual forest can nowadays be found only in Macaronesia. Currently, only about 2.5% of the total area of Azores is occupied by patches of native forest (Triantis *et al.* 2010), and it is thought that man-caused extinctions played a major role in shaping the current patterns in the archipelago's spider assemblages (Cardoso *et al.* 2010a). In addition, biological invasions are severely altering the original arthropod communities (Cardoso *et al.* 2013; Florencio *et al.* 2013), with invasive species replacing natives and the functions they perform in ecosystems (Cardoso *et al.* 2014). This loss of natural habitat and its respective communities has been most intensive in the smallest islands, Graciosa and Corvo, which have lost all primary native terrestrial forest habitat, but it is also massive in most of the other islands.

The Azorean spider fauna has received little attention before the 20th century. Brief reports were made by Simon (1883), Machado (1944, 1982) and Denis (1964), and it was only by the end of the 1980's that the endemic fauna of the Azorean archipelago attracted considerable attention. Joerg Wunderlich made the first intensive effort to describe Azorean spiders (1992), listing 10 new endemic species. More recently, the complementary work of Borges & Wunderlich (2008) containing the description of eight additional endemic species and a first checklist of Cardoso *et al.* (2010b) were published. These studies were possible due to the intensive sampling effort conducted by Borges and colleagues in the scope of several projects in both native (see Borges *et al.* 2005 and a review in Borges *et al.* 2011) and exotic (Cardoso *et al.* 2009, 2013, 2014; Florencio *et al.* 2013; Meijer *et al.* 2011) habitats.

The large genus *Lepthyphantes* Menge, 1866 has recently suffered large-scale splitting, mainly due to the

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Azorean endemic arthropods occur in less than 0.25% of the current area of native forest (Borges *et al.* 2011). Due to its age (8.12 M.y.), Santa Maria is home for a number of single-island endemic arthropod species (Borges & Hortal 2009) that survive in precarious situation either in this forest fragment or in surrounding, surrogate, habitat (Meijer *et al.* 2011). Yet, *C. relictus* **n. sp.** is the only spider considered as single island endemic in Santa Maria, as probably many species in this island were driven to extinction before description (Cardoso *et al.* 2010a). Concerning the widespread species *C. acoreensis,* most areas in Terceira and Pico are well preserved, but in São Jorge and Faial are very disturbed. The only way to guarantee the survival of the island's many endemic arthropod species would be to recover the native forest in a large area.

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Literature cited

Amorim, I.R., Emerson, B., Borges, P.A.V. & Wayne, R. (2012) Phylogeography and molecular phylogeny of Macaronesian island *Tarphius* (Coleoptera: Zopheridae): why so few species in the Azores? *Journal of Biogeography,* 39, 1583–1595. http://dx.doi.org/10.1111/j.1365-2699.2012.02721.x

Borges, P. & Hortal, J. (2009) Time, area and isolation: Factors driving the diversification of Azorean arthropods. *Journal of Biogeography,* 36, 178–191. http://dx.doi.org/10.1111/j.1365-2699.2008.01980.x

Borges, P. & Wunderlich, J. (2008) Spider biodiversity patterns and their conservation in the Azorean archipelago, with descriptions of new species. *Systematics and Biodiversity,* 6, 249–282. http://dx.doi.org/10.1017/s1477200008002648

Borges, P.A.V., Aguiar, C., Amaral, J., Amorim, I.R., André, G., Arraiol, A.,. Baz A., Dinis, F., Enghoff, H., Gaspar, C., Ilharco, F., Mahnert, V., Melo, C., Pereira, F., Quartau, J.A., Ribeiro, S., Ribes, J., Serrano, A.R.M., Sousa, A.B., Strassen, R.Z., Vieira, L., Vieira, V., Vitorino, A. & Wunderlich, J. (2005) Ranking protected areas in the Azores using standardized sampling of soil epigean arthropods. *Biodiversity and Conservation*, 14, 2029–2060. http://dx.doi.org/10.1007/s10531-004-4283-y

Borges, P.A.V., Gaspar, C.S., Santos, A.M.C., Ribeiro, S.P., Cardoso, P., Triantis, K. & Amorim, I.R. (2011) Patterns of colonization and species distribution for Azorean arthropods: evolution, diversity, rarity and extinction. *In*: Martins, A.M.F. & Carvalho, M.C. (Eds.), *Celebrating Darwin: Proceedings of the Symposium "Darwin's Mistake and what we are doing to correct it"*, Ponta Delgada, 19–22 September, 2009. *Açoreana,* Suplemento 7, 93–123.

Bosmans, R. (1991) Two new *Lepthyphantes* species from the Saharian Atlas (Araneae: Linyphiidae). *Biol. Jaarb. Dodonaea,* 58, 63–70.

Bosmans, R. (2006) Contribution to the knowledge of the Linyphiidae of the Maghreb. Part X. New data on *Lepthyphantes* Menge (sensu lato) species (Araneae: Linyphiidae). *Belgian Journal of Zoology*, 136, 173–191.

Bosmans, R. & Bouragba, N. (1992) Trois nouvelles Linyphiidae de l'Atlas Algérien, avec la description du mâle de *Lepthyphantes djazairi* Bosmans, et la redescription de *Lepthyphantes homonymus* Denis (Araneae). *Bulletin et Annales de la Société Royal d'Entomologie de Belgique,* 128, 245–262.

Cardoso, P., Borges, P.A.V. & Gaspar, C. (2007) Biotic integrity of the arthropod communities in the natural forests of Azores. *Biodiversity and Conservation*, 16, 2883–2901.
http://dx.doi.org/10.1007/s10531-006-9078-x

Cardoso, P., Lobo, J.M., Aranda, S.C., Dinis, F., Gaspar, C. & Borges, P.A.V. (2009) A spatial scale assessment of habitat effects on arthropod communities of an oceanic island. *Acta Oecologica,* 35, 590–597.
http://dx.doi.org/10.1016/j.actao.2009.05.005

Cardoso, P., Arnedo, M.A., Triantis, K.A. & Borges, P.A.V. (2010a) Drivers of diversity in Macaronesian spiders and the role of species extinctions. *Journal of Biogeography*, 37, 1034–1046.
http://dx.doi.org/10.1111/j.1365-2699.2009.02264.x

Cardoso, P., Wunderlich, J. & Borges, P.A.V. (2010b) Araneae. *In:* Borges, P.A.V., Costa, A., Cunha, R., Gabriel, R., Gonçalves, V., Martins, A.F., Melo, I., Parente, M., Raposeiro, P., Rodrigues, P., Santos, R.S., Silva, L., Vieira, P. & Vieira, V. (Eds.), *A list of the terrestrial and marine biota from the Azores.* Princípia, Cascais, pp. 202–205.

Cardoso, P., Borges, P.A.V., Triantis, K.A., Ferrández, M.A. & Martín, J.L. (2011a) Adapting the IUCN Red List criteria for invertebrates. *Biological Conservation*, 144, 2432–2440.
http://dx.doi.org/10.1016/j.biocon.2011.06.020

Cardoso, P., Erwin, T.L., Borges, P.A.V. & New, T.R. (2011b) The seven impediments in invertebrate conservation and how to overcome them. *Biological Conservation*, 144, 2647–2655.
http://dx.doi.org/10.1016/j.biocon.2011.07.024

Cardoso, P., Rigal, F., Fattorini, S., Terzopolou, S. & Borges, P.A.V. (2013) Integrating landscape disturbance and indicator species in conservation studies. *PLoS One,* 8, e63294.
http://dx.doi.org/10.1371/journal.pone.0063294

Cardoso, P., Rigal, F., Carvalho, J.C., Fortelius, M., Borges, P.A.V., Podani, J. & Schmera, D. (2014) Partitioning taxon, phylogenetic and functional beta diversity into replacement and richness difference components. *Journal of Biogeography,* 41 (4), 749–761.
http://dx.doi.org/10.1111/jbi.12239

Denis, J. (1934) Sur quelques araignées des Pyrenees-Orientales. *Bulletin de la Société entomologique de France,* 39, 72–77.

Denis, J. (1964) Spiders from the Azores and Madeira. *Boletim Museu municipal do Funchal,* 18, 68–102.

Florencio, M., Cardoso, P., Lobo, J.M., Azevedo, E.B. & Borges, P.A.V. (2013) Arthropod assemblage homogenisation in oceanic islands: the role of exotic and indigenous species under landscape disturbance. *Diversity and Distributions,* 19, 1450–1460.
http://dx.doi.org/10.1111/ddi.12121

França, Z., Cruz, J.V., Nunes, J.C. & Forjaz, V.H. (2003) Geologia dos Açores: uma perspectiva actual. *Açoreana,* 10, 11–140.

Frutuoso, G. (1963) *The sixth book on longing for the land.* Instituto da Cultura de Ponta Delgada, Ponta Delgada, Portugal.

Gaspar, C., Gaston, K.J., Borges, P.A.V. & Cardoso, P. (2011) Selection of priority areas for arthropod conservation in the Azores archipelago. *Journal of Insect Conservation,* 15, 671–684.
http://dx.doi.org/10.1007/s10841-010-9365-4

IUCN (2001) IUCN Red List Categories and Criteria version 3.1. Available from: http://www.redlist.org/technical-documents/categories-and-criteria/2001-categories-criteria (accessed 7 July 1014)

Kulczynski, W. (1898) Symbola ad faunam aranearum Austriae inferioris cognoscendam. *Rozprawa i sprawodzanie wydziat matematyczno-pzyrodniczy Academia umiejetnosi Cracov,* 36, 1–114.

Machado, A.B. (1944) As afinidades e a origem da fauna araneidológica dos Açores. *Publicações do Instituto de Zoologia "Augusto Nobre"*, 18, 1–16.

Machado, A.B. (1982) Acerca do estado actual do conhecimento das aranhas dos Açores. *Boletim da Sociedade portuguesa de Entomologia (suplemento. A),* 7, 137–143.

Meijer, S.S., Whittaker, R.J. & Borges, P.A.V. (2011) The effects of land-use change on arthropod richness and abundance on Santa Maria island (Azores): unmanaged plantations favour endemic beetles. *Journal of Insect Conservation,* 15, 505–522.
http://dx.doi.org/10.1007/s10841-010-9330-2

Menge, A. (1866) Preussische Spinnen. *Erste Abtheilung. Schrift. naturf. Ges. Danzig (N.F.)*, 1, 1–152.

Platnick, N. (2014) The World Spider Catalogue, version 14.5, American Museum of Natural History. Available from: http://research.amnh.org/iz/spiders/catalog (accessed 7 July 2014)

Saaristo, M.I. & Tanasevitch, A.V. (1993) Notes on the systematics of the spider genus *Lepthyphantes* Menge (Aranei Linyphiidae Micronetinae). *Arthropoda Selecta,* 2, 55–61.

Saaristo, M.I. & Tanasevitch, A.V. (1996) Redelimitation of the subfamily Micronetinae Hull, 1920 and the Genus *Lepthyphantes* Menge, 1866 with descriptions of some new genera (Aranei, Linyphiidae). *Berichte des Naturwissenschaftlich-Medizinischen Vereins in Innsbruck,* 83, 163–186.

Saaristo, M.I. & Tanasevitch, A.V. (1999) Reclassification of the *mughi*-group of the genus *Lepthyphantes* Menge, 1866 (sensu lato) (Aranei: Linyphiidae: Micronetinae). *Berichte des Naturwissenschaftlich-Medizinischen Vereins in Innsbruck,* 86, 139–147.

Saaristo, M.I. & Tanasevitch, A.V. (2000) Systematics of the *Bolyphantes-Poeciloneta* genus-group of the subfamily Micronetinae Hull, 1920 (Arachnida: Araneae: Linyphiidae). *Reichenbachia,* 33, 255–265.

Saaristo, M.I. & Tanasevitch, A.V. (2001) Reclassification of the *pallidus*-, *insignis*- and *spelaeorum*-groups of *Lepthyphantes*

Menge, 1866 (sensu lato) (Arachnida: Araneae: Linyphiidae: Micronetinae). *Reichenbachia,* 34, 5–17.
Saaristo, M.I. & Tanasevitch, A.V. (2003) New taxa for some species of the genus *Lepthyphantes* Menge sensu lato (Aranei, Linyphiidae, Micronetinae). *Revue Arachnologique,* 14, 109–128.
Schaefer, H., Moura, M., Maciel, M.G.B., Silva, L., Rumsey, F. & Carine, M.A. (2011) The Linnean shortfall in oceanic island biogeography; a case study in the Azores. *Journal of Biogeography,* 38, 1345–1355. http://dx.doi.org/10.1111/j.1365-2699.2011.02494.x
Serralheiro, A. & Madeira, J. (1993) Stratigraphy and geochronology of Santa Maria island (Azores). *Açoreana,* 7, 575–592.
Simon, E. (1883) Études arachnologiques. 14e Mémoire. XXI. Matériaux pour servir à la faune arachnologique des îles de l'Océan Atlantique (Açores, Madère, Salvages, Canaries, Cap Vert, Sainte-Helène et Bermudes). *Annales de la Société entomologique de France,* 3, 259–314.
Simon, E. (1884) *Les arachnides de France*. Paris, 5, 180–885.
Syncroscopy (1997) *Auto-Montage Pro, version 5.03.0061*. Syncroscopy, a Division of Synoptics Ltd. Information. Available from: http://www.syncroscopy.com/auto-montage/ (accessed 7 July 2014)
Tanasevitch, A. (2013) On linyphiid spiders (Araneae) from Israel. *Revue suisse de Zoologie,* 120, 101–124.
Triantis, K.A., Borges, P.A., Ladle, R.J., Hortal, J., Cardoso, P., Gaspar, C., Dinis, F., Mendonça, E., Silveira, L.M.A., Gabriel, R., Melo, C., Santos, A.M.C., Amorim, I.R., Ribeiro, S.P., Serrano, A.R.M., Quartau, J.A. & Whittaker, R.J. (2010) Extinction debt on oceanic islands. *Ecography,* 33, 285–294. http://dx.doi.org/10.1111/j.1600-0587.2010.06203.x
Turquin, M.-J. (1973) Une biocenose cavernicole originale pour le Bugey: le puits de Rappe. Comptes Rendus 96e Congresse Naturel Sociétès Savantes, Toulouse 1971. *Sciences,* 3, 235–256.
Wunderlich, J. (1992) Die Spinnen-Fauna der Makaronesischen Inseln. *Beiträge zur Araneologie,* 1, 1–619.
Wunderlich, J. (2011) Extant and fossil spiders (Araneae). *Beiträge zur Araneologie,* 6, 1–40. http://dx.doi.org/10.5431/aramit4414