



Short Communication

Arceuthobium Species (Viscaceae) Parasitizing an Angiosperm: The Unique Case of *A. azoricum* in the Azores IslandsRui Bento Elias,^{1,†}  Mónica Moura,² Guilherme Roxo,² Lurdes Borges Silva,² Diogo Cláudio Pavão,²  Roberto Resendes,² Fernando Pereira,¹ and Daniel Nickrent³¹ Azorean Biodiversity Group and CE3C - Center for Ecology, Evolution and Environmental Changes and CHANGE - Global Change and Sustainability Institute, Universidade dos Açores - Faculdade de Ciências Agrárias e do Ambiente, 9700-042 Angra do Heroísmo, Açores, Portugal² Research Centre in Biodiversity and Genetic Resources (CIBIO), InBIO Associate Laboratory, BIOPOLIS Program in Genomics, Biodiversity and Land Planning; UNESCO Chair – Land Within Sea: Biodiversity and Sustainability in Atlantic Islands and Universidade dos Açores, Faculdade de Ciências e Tecnologia, 9500-321 Ponta Delgada, Portugal³ Plant Biology Section, School of Integrative Plant Science, College of Agriculture and Life Science, Cornell University, Ithaca, NY 14853, U.S.A.**Abstract**

Arceuthobium azoricum Wiens & Hawksw. is a rare Azorean endemic epiphytic hemiparasite (mistletoe), which typically parasitizes branches of the gymnosperm *Juniperus brevifolia* (Hochst. ex Seub.) Antoine (Cupressaceae), which is also an Azorean endemic. Here, we describe a population of *A. azoricum*, on Pico Island, parasitizing *Erica azorica* Hochst. ex Seub. (Ericaceae), which is also an Azorean endemic. Our molecular analysis (using nuclear ribosomal internal transcribed spacer) showed no differences between individuals parasitizing *Erica* and *Juniperus* species. Moreover, a preliminary analysis showed no differences in morphological characteristics between accessions sampled

from different hosts. Given that this is the first bona fide record of *Arceuthobium* sp. parasitizing an angiosperm, this population represents a unique host-shifting event, and its conservation is important because it may allow new insights into host recognition mechanisms in mistletoes. Immediate attention should be given to characterizing this Pico Island population using appropriate molecular methods and additional morphological analyses.

Keywords: dwarf mistletoe, *Erica azorica*, hemiparasite, host range, island flora, *Juniperus brevifolia*, oceanic islands

The genus *Arceuthobium* M.Bieb. (Viscaceae), commonly known as dwarf mistletoes, is an aerial parasite of Pinaceae (Old and New World) and Cupressaceae (Old World). The genus is best characterized by its flabellate habit (scale leaves) and explosively dehiscent fruits. These mistletoes are considered pathogens of commercially important conifers, especially in North America. Despite the negative effects on the host trees, the presence of these parasites can be beneficial for birds and small mammals by providing nesting and seclusion habitats or as a food source for some species. Mistletoe brooms are also important habitats for many species of insects and spiders (Geils and Hawksworth 2002).

The most recent monograph of the genus (Hawksworth and Wiens 1996) lists 42 species; however, results of molecular phylogenetic work (Nickrent et al. 2004) indicate that there are 22 New World and 8 Old World species of *Arceuthobium* in two subgenera (*Vaginata*

and *Arceuthobium*). Species of *Arceuthobium* from the Old World are placed in the subgenus *Arceuthobium*, which is classified into the following three sections: Sect. *Arceuthobium* (*A. juniperi-procerae* Chiov., *A. oxycedri* [DC.] M.Bieb., and *A. tibetense* H.S. Kiu & W. Ren), Sect. *Chinense* (*A. chinense* Lecomte, *A. minutissimum* Hook. f., *A. pini* Hawksw. & Wiens, and *A. sichuanense* [H.S. Kiu] Hawksw. & Wiens), and Sect. *Azorica* (*A. azoricum* Hawksw. & Wiens). The latter section contains *A. azoricum*, which is one of only two dwarf mistletoes known to be island endemics (Hawksworth and Wiens 1996).

To date, all *Arceuthobium* species have been found to be parasitizing members of the Pinaceae or Cupressaceae families. Here, we report the first documentation of *A. azoricum* parasitizing an angiosperm, specifically the Azorean endemic *Erica azorica* Hochst. ex Seub. (Ericaceae) (Fig. 1B). Although M. J. Bettencourt and E. Dias (*unpublished data*) gave note of this case in a Portuguese national symposium in 1999, no comprehensive study has ever been published, and *A. azoricum* has been widely considered to be exclusively parasitic on *Juniperus brevifolia* (Seub.) Antoine subsp. *brevifolia* (Fig. 1A).

Although originally considered conspecific with *A. oxycedri*, *A. azoricum* is morphologically distinct (Hawksworth and Wiens 1996). This densely caespitose, dioecious parasite grows up to 20 cm tall and has articulated, yellowish-green stems that approach 1 cm in diameter at the base and taper gradually toward the apex (Elias et al. 2022). The first specimen of *A. azoricum* was collected in 1913 on Pico Island (Guppy 1914). In addition to Pico Island, it has also been recorded on Faial, São Jorge, Terceira, and São Miguel islands (Fig. 2). The Azorean dwarf mistletoe occurs mostly in *Juniperus-Ilex* and *Juniperus* montane forests and also in successional scrublands, mostly between 600 and 900 m above sea level (a.s.l.).

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