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The phylogenetic affinities of *Pellaea connectens*, a rare endemic Chinese fern

WAN WANG[1], WENLI YANG[2], XINGXING MAO[1], RANRAN ZHAO[1], PING DOU[1] & GANGMIN ZHANG[1*]

[1] *Laboratory of Systematic Evolution and Biogeography of Woody Plants, College of Nature conservation, Beijing Forestry University, Beijing 100083, China*

[2] *College of Landscape Architecture and Tourism, Hebei Agricultural University, Hebei 071000, China*

** Correspondence author, E-mail: gary1967@bjfu.edu.cn*

Abstract

Using DNA sequences from five chloroplast makers (*rbcL*/ *trnL–trnF*/ *rps4*/ *rps4–trnS*/ *trnG–trnR*), we addressed the phylogenetic affinities of *Pellaea connectens*, a rare endemic Chinese cheilanthoid fern belonging to Pteridaceae. Our results confirmed that the species was a member of the newly segregated genus *Argyrochosma*, which was formerly considered as native to America, showing that the treatment of *Pellaea connectens* by Ching nor Tryon & Lugardon was supported. Moreover, its morphology, distribution, ecology, co-existing species, as well voucher specimens were also presented in this paper.

Key words: China, phylogeny, *Pellaea connectens* C. Christensen, *Argyrochosma* (J. Smith) Windham, Pteridaceae

Introduction

Pellaea connectens C. Christensen (1924: 84), a typical species of cheilanthoid fern, is rare and endemic to West Sichuan, China. Christensen (1924) was unsure as into which genus this fern should be classified. He wrote "In several respects: color, texture, the fragile castaneous stipe and partly also in the sori it agrees with *Adiantopsis*, but in the shape of the impari-pinnate pinnae, it comes near to the American species of *Pellaea* allied to *P. andromedifolia*, especially resembling *P. flavescens* from Brazil. …. The whole mode of growth of the plant recalls much more certain species of *Cheilanthes* than *Pellaea*, but I do not know any species of *Cheilanthes* with impari-pinnate pinnae. This remarkable species thus shows characters of *Adiantopsis*, *Cheilanthes*, and *Pellaea*. I could add *Notholaena*, since the margins sometimes are not at all reflexed. It connects these genera, and therefore I have named it *Pellaea connectens*". The above description indicates a species that is unique in morphology and is intermingled with several genera. Moreover, most pteridologists are not familiar with *P. connectens*, because it is known only from three specimens (*H. Smith 4800 & 4597; G. Z. Zhu & X. Li 76619*) from Jinchuan and one additional specimen collected by Sugong Wu from Muli. Thus there are only two non-type specimens collected since 1924. The rare species, characterized by 2-pinnate or occasionally 3-pinnate lamina with oblong to ovate terminal pinnules, grows on limestone crevices in dry-hot valleys. Tryon & Lugardon (1991) once treated it as a member of *Cheilanthes* Swartz (1806: 126), but most pteridologists (Ching 1940, 1978, Shing & Wu 1990, Zhang & Yatskievych 2013) still place it into *Pellaea* Link (1841: 59). Therefore, its taxonomic treatment still remains in dispute.

Cheilanthoid ferns, members of the subfamily Cheilanthoideae of Pteridaceae (Tryon 1990, Smith *et al.* 2006, Christenhusz *et al.* 2011), have been one of the most contentious fern groups with respect to their phylogeny and classification due to morphological convergence driven by adaptation to xeric environments (Tryon & Tryon 1982, Gastony & Rollo 1995, 1998, Kirkpatrick 2007). Previous studies on this fern group have demonstrated that traditional *Cheilanthes sensu* Tryon (1990), *Notholaena* R. Brown (1810: 145), and *Pellaea* are polyphyletic, and that the segregation of some small genera such as *Argyrochosma* (J. Smith 1841: 50) Windham (1987: 38), *Astrolepis* D.M. Benham & Windham (1992: 55), and *Gaga* Pryer, F.W.Li & Windham (2012: 855) is supported (Gastony & Rollo 1995, 1998, Kirkpatrick 2007, Schuettpelz *et al.* 2007, Zhang *et al.* 2007, Rothfels *et al.* 2008, Bouma *et al.* 2010, Whitney *et al.* 2010, Eiserhardt *et al.* 2011, Sigel *et al.* 2011, Li *et al.* 2012). The Asian taxa *Sinopteris* C. Christensen & Ching (1933: 359), *Leptolepidium* K.H. Shing & S.K. Wu (1979: 115), *Cheilosoria* Trevisan (1877: 579), and