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A molecular reappraisal of *Abrothallus* species growing on lichens of the order Peltigerales

AVE SUIJA[1], ASUNCIÓN DE LOS RÍOS[2] & SERGIO PÉREZ-ORTEGA[2]
[1] *Institute of the Ecology and Earth Sciences, University of Tartu, 40 Lai street, EE-51005, Tartu, Estonia. E-mail: ave.suija@ut.ee*
[2] *Departamento de Biogeoquímica y Ecología Microbiana, Museo Nacional de Ciencias Naturales, CSIC, c/ Serrano 115 dpdo, E-28006, Madrid, Spain. E-mail: sperezortega@mncn.csic.es*

Abstract

Species of the genus *Abrothallus* (Abrothallales, Dothideomycetes) are obligately lichenicolous (lichen-inhabiting) and grow on a wide variety of foliose and fruticose lichens. Bayesian Interference (BI) and Maximum Likelihood (ML) analyses of two gene loci—rDNA ITS and TEF-α—were used in order to infer the phylogenetic relationships among lineages of *Abrothallus* associated with hosts from the order Peltigerales (Lecanoromycetes). We found that the clade is subdivided into 13 lineages each of which can be delimited also by phenotypic criteria. Seven new species (*Abrothallus boomii, A. canariensis, A. doliiformis, A. eriodermae, A. ertzii, A. etayoi* and *A. nephromatis*) are described, two of which are known only by their asexual stage. *Abrothallus welwitschii* is lectotypified, and the original description is complemented. *Vouauxiomyces brattii* and *Epinephroma kamchatica* are combined within *Abrothallus*.

Key words: Abrothallales, *Epinephroma*, host-specificity, lichenicolous fungi, taxonomy

Introduction

Lichenicolous fungi represent a non-taxonomical group of fungi that are obligately associated with lichens (Lawrey & Diederich 2003). Species from the genus *Abrothallus* represent the earliest records (Acharius 1814 as *Endocarpon parasiticum* Ach., Sommerfelt 1826 as *Lecidea parmeliorum* Sommerf.), illustrations (Smith 1808 as *Lichen parasiticus*) and descriptions (de Notarius 1845, *Abrothallus bertianus* De Not.) of lichen-inhabiting fungi. The genus is easily recognizable in the field by its black roughly globose apothecioid ascomata usually covered with greenish pruina. Anatomically the genus is characterized by bitunicate asci with four to eight, 2- to 4-celled, brown, asymmetric ascospores with clear ornamentation, usually oriented with the wider cell placed upwards within the ascus. In some species the ascospores split into part-spores within the ascus (Etayo 2002, Hawksworth 1990, Suija *et al*. 2011, Wedin 1994). The sexual morph of *Abrothallus* is often accompanied with the asexual morph of *Vouauxiomyces*-type (Hawksworth 1981, Pérez-Ortega *et al*. 2011).

Despite being known for a long time, the phylogenetic adscription of the genus has remained unresolved until recently (Pérez-Ortega *et al*. 2014) as no clear synapomorphies with any other known genera have been found. Pérez-Ortega *et al*. (2014) showed that the genus belongs to Dothideomycetes and described the new order Abrothallales in the Pleosporomycetidae. *Abrothallus* represents one of the few genera in this class with apothecioid ascomata. The genus has been considered to be cosmopolitan with a broad host range including members of foliose and fruticose lichens from families Cladoniaceae, Lobariaceae, Nephromataceae, Pannariaceae, Parmeliaceae, Ramalinaceae and Stereocaulaceae. Twenty six (26) species have tentatively been accepted in the genus (*Index Fungorum* (http://www.indexfungorum.org/, Etayo & van den Boom 2006, Etayo 2010) from more than 30 macrolichen genera (Suija, pers. obs.).

Historically the species concept of the genus has been a topic of controversy, and host-specificity as species delimiting criterion has been used assuming either narrow (Kotte 1909, Santesson *et al*. 2004) or wide host selection (Hawksworth 1983, Keissler 1929, Santesson 1993). Preliminary multi-gene analysis (Pérez-Ortega *et al*. 2014) has shown that the host-specificity in *Abrothallus* is more pronounced at the host family/order level, allowing us to

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discovered in the future, which will lead to the proposal of additional taxa. We also expect that extended sampling will enable us to shed light on the evolutionary processes (host switching, co-evolutionary processes, geographical barriers, etc.) that promote speciation in this group of lichenicolous fungi.

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