



Lactarius subgenus *Russularia* (Russulaceae) in South-East Asia: 3. new diversity in Thailand and Vietnam

KOMSIT WISITRASSAMEEWONG^{1,2,3}, JORINDE NUYTINCK⁴, HUYEN THANH LE⁵, ESKE DE CROP³, FELIX HAMPE³, KEVIN D HYDE^{1,2} & ANNEMIEKE VERBEKEN³

¹Institute of Excellence in Fungal Research, Mae Fah Luang University, 333 Moo 1, Thasud sub-district, Muang district, Chiang Rai 57100, Thailand, E-mail: Komsit.Wisitraseewong@UGent.be (corresponding author)

²School of Science, Mae Fah Luang University, 333 Moo 1, Thasud sub-district, Muang district, Chiang Rai 57100, Thailand

³Research Group Mycology, Department of Biology, Gent University, K.L. Ledeganckstraat 35, 9000 Gent, Belgium

⁴Naturalis Biodiversity Center, Section National Herbarium of the Netherlands, P.O. Box 9517, 2300RA Leiden, The Netherlands

⁵Faculty of Environment, Hanoi University of Natural Resources and Environment, 41A Street K1, Cau Dien, Tu Liem, Hanoi, Vietnam

Abstract

Lactarius subgenus *Russularia* is a dominant group of milkcaps in Southeast Asia. This paper reveals the large diversity of the subgenus, with eight new species and one known species being described from montane evergreen and coniferous forests. All new species are supported by both morphological and molecular data, the latter using Maximum likelihood and Bayesian analysis based on the ITS region. Complete macro- and micro-morphological descriptions and illustrations are given. A key to the new taxa is provided. *Lactarius chichuensis* is reported for the first time from Thailand.

Keywords: Russulales, identification, ectomycorrhizal fungi, biodiversity

Introduction

Tropical Southeast Asia is recognized as one of the world's biodiversity hotspots and contains a high concentration of endemic species (Myers *et al.* 2000). The high number of endemic plants includes several families of ectomycorrhizal trees (e.g. Dipterocarpaceae, Fagaceae, Betulaceae, and Pinaceae). However, biodiversity is strongly declining in Southeast Asia due to deforestation for urbanization, logging, and agricultural expansion by local people and agricultural companies, who clear vast areas for crop cultivation (Sodhi *et al.* 2010). Since ectomycorrhizal (ECM) fungi are obligate symbionts of ECM trees and shrubs, an inevitable consequence of forest logging is the loss of ECM species, including those belonging to the genus *Lactarius* Pers. Issues regarding forest logging have therefore become of great concern in many countries (Mortimer *et al.* 2012).

Mycorrhizal trees have been used for reforestation programs in many regions such as tropical Africa, South America and Southeast Asia. Thus many attempts used mycorrhizal symbionts to improve the reforestation performance of transplanted mycorrhizal trees (Bâ *et al.* 2009, Ergiles *et al.* 2009, Sanon *et al.* 2010, Aggangan *et al.* 2012). Since ECM fungi facilitate water and nutrient uptake for their host plants, they are considered as microorganisms that can promote plant growth in forests. There is little information regarding the use of *Lactarius* species in tree seedling production. *Lactarius deliciosus* (L.: Fr.) Gray appears to be the most used *Lactarius* species applied to improve seedling establishment of *Pinus* trees (Guerin-Laguette *et al.* 2003, Parladé *et al.* 2004, Diaz *et al.* 2009). Our research aims at exploring the biodiversity of *Lactarius* subgenus *Russularia* (Fr.) Kauffman in Southeast Asia, as in local ecosystems it is one of the dominant groups in terms of numbers of basidiocarps covering the forest floor.

Lactarius subgenus *Russularia* is one of the three major subgenera of *Lactarius*. Species traditionally placed in this subgenus are recognized by basidiomata which are typically dry and vary in color from orange to warm brown (Heilmann-Clausen *et al.* 1998). As mentioned in Wisitraseewong *et al.* (2014b), it is remarkable that most taxa in this group have unchanging latex and that the group as a whole is characterized by few color changes in the latex as compared to the other subgenera of *Lactarius* and *Lactifluus* (which together form the large group of milkcaps). Some species are described as having white to pale yellow latex e.g. *L. quietus* (Fr.: Fr.) Fr., and *L. decipiens* Qué.