



A new genus, *Rubroboletus*, to accommodate *Boletus sinicus* and its allies

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Abstract

Rubroboletus is erected as a new genus to accommodate *Boletus sinicus* and its allies based on morphological and molecular evidence. Morphologically, *Rubroboletus* differs from the remaining genera in Boletaceae by the combination of a reddish pileal surface, an orange-red to blood red surface of the hymenophore, yellow tubes, pink to red reticula or spots on the yellow background of the stipe, a bluish color-change when injured, a non-amyloid context, smooth spores which are olive-brown in deposit, and an interwoven trichodermal pileipellis. Our phylogenetic analyses based on five gene markers (ITS, nrLSU, *tef1-a*, *rpb1* and *rpb2*) recognized eight species in the genus, including one new species and seven new combinations. A key to the eight species is provided.

Keywords: Boletes, New taxa, *Rubroboletus*, Phylogeny, Taxonomy

Introduction

The genus *Boletus* L. (1753: 1176) has been widely studied by mycologists from all over the world (Fries 1838; Murrill 1909; Singer 1947, 1986; Dick 1960; Hongo 1960; Smith & Thiers 1971; Corner 1972; Nilson & Persson 1977; Pegler & Young 1981; Zang 1983, 2006; Høiland 1987; Both 1993, 1998; Watling & Li 1999; Li & Song 2000; Binder & Bresinsky 2002; Horak 2005, 2011; Binder & Hibbett 2006; Ortiz-Santana *et al.* 2007; Drehmel *et al.* 2008; Dentinger *et al.* 2010) since it was erected. Singer (1986) divided it into seven sections mainly based on morphological characters such as the color of the hymenophore, the color-change of the context when exposed to air and the taste of the basidioma. *Boletus* sect. *Luridi* Fr. (1838: 417) sensu Singer (1986: 778), typified by *B. luridus* Schaeff. (1774: 107), is the largest section in *Boletus* s. l. and harbors more than 40 species. It is characterized by small and discolorous pores, a pileus either viscid or with coverings, a context often containing poisonous substances and sometimes a finely reticulated stipe (Singer 1986).

Molecular techniques have accelerated the developments of the fungal taxonomy (Taylor *et al.* 2000; Weiss 2010; Hibbett *et al.* 2011; Yang 2011). Combined with morphological characters and molecular evidence, a batch of new genera of boletes were erected recently (Halling *et al.* 2007, 2012a, b; Desjardin *et al.* 2008, 2009; Li *et al.* 2011, 2014; Zeng *et al.* 2012, 2014; Hosen *et al.* 2013; Arora & Frank 2014; Gelardi *et al.* 2014). With these techniques, it was found that sect. *Luridi* was not monophyletic (Marques *et al.* 2010; Vizzini 2014a; Wu *et al.* 2014) and species of this section were split into at least six lineages (Clades 37, 39, 40, 41, 44 and 46) in Wu *et al.* 2014. The genus *Suillellus* Murrill (1909: 16) (Clade 44) was reconfirmed to accommodate *B. luridus* and its allies. Additionally, *B. magnificus* W.F. Chiu (1948: 221) in Clade 37, *B. firmus* Frost (1874: 103) in Clade 39, *B. rufo-aureus* Masee (1909: 204) in Clade 41, and *B. floridanus* (Singer 1945: 799) Murrill (1948: 23) and *B. frostii* J.L. Russell (1874: 102) in Clade 46 were transferred to *Neoboletus* Vizzini (2014d: 1), *Caloboletus* Vizzini (2014b: 1), and *Crocinoletus* N.K. Zeng *et al.* (2014: 134), and *Exsudoporus* Vizzini (2014c: 1), respectively. However, taxonomically, it was not well clarified yet for the species in the Clade 40, a statistically well supported clade (BS=100%, PP=1.0) consisting *Boletus sinicus* W.F. Chiu (1948: 220) and its allies.

This study is to compare the morphological features between this lineage and related taxa, and to erect a new genus to accommodate *B. sinicus* and its allies.

Some species, such as *B. fagicola* A.H. Sm. & Thiers (1971: 338), *B. fragrans* Vittad. (1835: 153), *B. implitus* Fr. (1838: 421), *B. lupinus* Fr. (1838: 418), *B. rhodopurpureus* Smotl (1952: 31), *B. rubricitrinus* Murrill (1940: 66) and *B. sullivantii* Berk. & Mont. (1856: 152) were placed in sect. *Luridi* (Singer 1986). However, their morphological characters, like the color of the pileus and the surface of the hymenophore, and the color change of the context, are not in accordance with *Rubroboletus*. Their systematic positions can only be settled in the near future.

Several species of *Boletus* sect. *Luridi*, such as *R. satanas* and *R. rhodoxanthus*, were reported as poisonous (Ammirati *et al.* 1985; Ellis & Ellis 1990; Kretz *et al.* 1991; Rumack & Spoerke 1994; Benjamin & Denis 1995; Ennamany *et al.* 1998; Flammer 2008). Although *R. sinicus* was sporadically sold in wild mushroom markets in Yunnan, China (Chiu 1948, 1957; Wang *et al.* 2004), it has long been suspected that this taxon is probably poisonous and its edibility needs further chemical studies.

Acknowledgments

The authors are indebted to B. Eugene Wofford at University of Tennessee (TENN), Degreef Jérôme at the National Botanical Garden of Belgium (BR) and Genevieve Lewis-Gentry at Harvard University (FH) for providing specimens on loan and granting permission to extract DNA from the specimens. They are grateful to Yan-Chun Li, Bang Feng and Li-Hong Han of Kunming Institute of Botany (KIB), Chinese Academy of Sciences for providing collections. Thanks are also due to Dr. Z.W. Ge (KIB) for polishing the English of the manuscript. The anonymous reviewers are acknowledged for their valuable comments and suggestions. This study was supported by the Funds for International Cooperation and Exchange of the National Natural Science Foundation of China (No. 31210103919), the Ministry of Science and Technology, China (2013FY110400) and the CAS/SAFEA International Partnership Program for Creative Research Teams.

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