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Three new combinations of *Butyriboletus* (Boletaceae)

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Abstract

Boletus peckii, *B. pulchriceps* and *B. roseopurpureus*, which were originally described from North America, are characterized by a yellow tube layer that often bruises blue, a yellow reticulated stipe especially at the apex, firm yellow-tinged flesh that often turns blue when exposed, smooth spores and an interwoven trichodermic pileipellis. The phylogenetic positions of the three species are inferred by molecular phylogenetic analysis based on DNA sequences of four gene markers (ITS, nrLSU, *tef1-α* and *rpb1*). Both morphological features and molecular phylogenetic evidence indicate that these three boletes belong to *Butyriboletus*, and thus, should be transferred to the genus.

Introduction

Butyriboletus D. Arora & J.L. Frank (2014: 466), typified by *Boletus appendiculatus* Schaeff. (1774: 130), was recently established to accommodate the "butter boletes", which were historically placed in *Boletus* sect. *Appendiculati* Konrad & Maubl. ex. Lannoy & Estadès (2001: 60) (Arora & Frank 2014). Later on, an additional four species, namely *B. cepaeodoratus* Taneyama & Har. Takah. (2013: 463), *B. fuscoroseus* Smotl. (1912: 47), *B. roseogriseus* Šutara *et al*. (2014: 7) and *B. ventricosus* Taneyama & Har. Takah. (2013: 461), were transferred to the genus (Vizzini 2014a). To date, *Butyriboletus* has harbored some 18 species, all distributed in the Holarctic regions (Zang 2006; Assyov 2012; Takahashi *et al*. 2013; Arora & Frank 2014; Li *et al*. 2014; Šutara *et al*. 2014).

In recent phylogenetic analyses, three species, *Boletus peckii* Frost (1878: 45), *B. pulchriceps* Both, Bessette & R. Chapm. (2000: 143) and *B. roseopurpureus* Both, Bessette & Roody (2000: 150) nested in the same clade ("*regius* clade" in Nuhn *et al*. 2013; Clade 46 in Wu *et al*. 2014) with *Bu. appendiculatus* and its allies, with high support values, indicating that they all may belong to *Butyriboletus*.

In this study, morphological comparisons and phylogenetic analyses based on four gene markers, i.e., internal transcribed spacer (ITS), nuclear ribosomal large subunit DNA (nrLSU), translation elongation factor 1-α (*tef1-α*) and the largest subunit of RNA polymerase II (*rpb1*), were conducted to confirm the taxonomic status and phylogenetic position of these species.

Materials and Methods

Sampling

Specimens examined are deposited in the Buffalo Museum of Science (BUF), Philipps University Marburg (MB), the New York Botanical Garden (NY), University of Tennessee (TENN), Farlow Herbarium of Harvard University (FH) and the Herbarium of Cryptogams of Kunming Institute of Botany, Chinese Academy of Sciences (HKAS). The species appear in alphabetical order by species epithet. The generic name *Boletus* is abbreviated as "*B*.", *Butyriboletus* as "*Bu*.", *Caloboletus* as "*C*.", while "*Exsudoporus*" as "*E*."

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