

Short note

Some Interesting Species of Tricholoma (Agaricales, Basidiomycota) Recorded for the First Time for the Bulgarian Mycobiota

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Abstract. The paper presents the first records in Bulgaria of some interesting or less-known species of the genus *Tricholoma*, namely *Tricholoma arvernense*, *T. aurantium*, *T. boudieri*, *T. cingulatum*, *T. rapipes* and *T. viridilutescens*. Of these, *Tricholoma arvernense*, *T. rapipes* and *T. viridilutescens* seem to be first reports from the Balkan Peninsula. Illustrations of the Bulgarian findings are included, along with data on their localities and ecology, and comments on the known distribution in the Balkan countries. The distinguishing features of the respective species from their closest allies are also briefly accounted.

Key words: Bulgarian mycota, biogeography, boreal forests, ectomycorrhizal fungi, *Tricholomataceae*.

Introduction

The genus *Tricholoma* (Fr.) Staude is the core genus and the name-bearer in the species-rich family of *Tricholomataceae* R. Heim ex Pouzar. In Europe its species diversity has been treated by several authors, including in recent years by the tools of the molecular phylogenetics (Bon, 1991; Gulden, 1992; Riva, 1998, 2003; Noordeloos & Christensen, 1999; Galli, 2005; Christensen & Heilmann-Clausen, 2008, 2013; Kibby, 2012; Heilmann-Clausen et al., 2017). The most recent monographic work on the northern European representatives recognizes 67 species (Christensen & Heilmann-Clausen, 2013), while comprehensive phylogenetic taxonomic assessment of the diversity of the genus in southern locales is still pending. In Bulgaria so far 30 species of the genus are recorded (Denchev & Assyov, 2010; Tomović et al., 2021), and comparison of the two

figures suggests that more species should be expected to occur in this country. The author of this paper has been exploiting the opportunity to collect tricholomataceous fungi during his field trips throughout Bulgaria and this collecting effort resulted in the identification of some interesting and previously unrecorded species. Those observations are documented below.

Materials and Methods

The examined specimens were photographed with an Olympus Power Shot SX410IS digital camera and further thoroughly documented in the field. Microscopic examination was done with an AmScope T360B light microscope with an AmScope MU900 digital camera attached. All microscopic observations were carried out in KOH (5%), always on dry material. Air-dried voucher specimens are preserved in the Mycological

Collection of the Institute of Biodiversity and Ecosystem Research (SOMF).

The identification follows the current species concept as presented in Christensen & Heilmann-Clausen (2013), although the remaining monographic works, keys and

atlases, listed above, have also been regularly consulted. The collecting localities are shown on the map in Fig. 1. The background relief map was generated by the free utility Maps-for-Free (<https://maps-for-free.com/>).

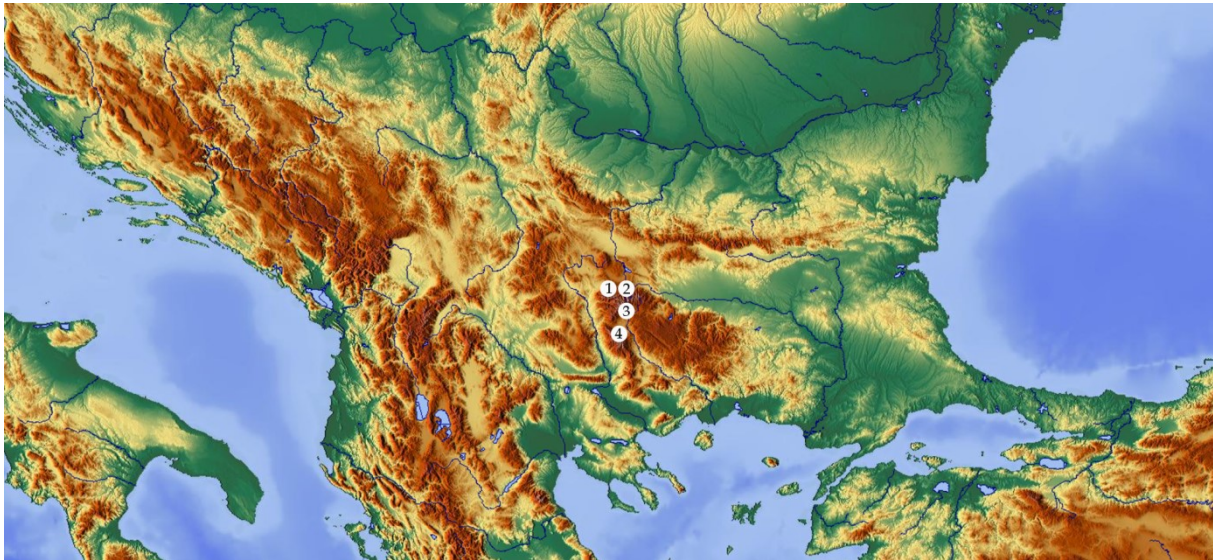


Fig. 1. The collecting localities in the context of the Balkan Peninsula: 1 – Panichishte ski resort, 2 – Borovets ski resort; 3 – Belmeken dam – Granchar lake area, 4 – Bansko area.

Results and Discussion

Tricholoma arvernense Bon (Fig. 2a-b)

Specimen examined: Blagoevgrad Province, Pirin Mts, below Banderitsa chalet along the road to Bansko town, 41°47'17.5"N, 23°27'32.5"E elev. ca. 1580 m, in a forest of *Picea abies* and *Pinus sylvestris* on siliceous soils, 18.09.2022, leg. B. Assyov & I. Penchev (SOMF30889).

Notes. *Tricholoma arvernense* could be most probably confused with *T. sejunctum* (Sowerby) Quéf, albeit the phylogenetic analysis in Christensen & Heilmann-Clausen (2013) has shown them not to be closely related. *Tricholoma arvernense* however has duller yellowish or ochraceous tinted pileus, on average smaller basidiospores and occurs in habitats with pines, while *T. sejunctum* has brighter yellow pileus, larger basidiospores and grows with broadleaf trees (Bon, 1976; Christensen & Heilmann-Clausen, 2013). Although described almost half a century ago (Bon, 1976), the distribution of *T. arvernense* is still incompletely known. Chris-

tensen & Heilmann-Clausen (2013) included in their map Fennoscandia, some Baltic countries, Russia, the United Kingdom, France, Germany and Austria, and Galli (2005) included Italian collections. The author is aware of no prior records of the species in the Balkan Peninsula, although it would probably appear to be not uncommon both in the Bulgarian high mountains and in other mountainous areas of the Balkans.

Tricholoma aurantium (Schaeff.) Ricken (Fig. 2c)

Specimens examined: Blagoevgrad Province, Pirin Mts, below Banderitsa chalet along the road to Bansko town, 41°47'21.6"N 23°27'32.0"E, elev. ca. 1575 m, in a forest of *Picea abies*, *Abies alba*, *Pinus sylvestris* and *Fagus sylvatica* on siliceous soils, under an old tree and next to seedlings of *A. alba*, 28.09.2022, leg. B. Assyov & I. Penchev (SOMF30890); above Bansko town, close to Katerina hotel, 41°48'17.1"E, 23°28'19.1"N,

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elev. ca 1235 m, on siliceous soils, under young trees of *Abies alba* at the road, 01.10.2022, leg. B. Assyov & I. Assyova (SOMF30891).

Notes. *Tricholoma aurantium* is readily recognized among all European tricholomas yet in the field due to the pileus tinted in shades of orange, as well as similarly coloured ornamentation on the stipe surface (Christensen & Heilmann-Clausen, 2013). It is known to be mycorrhizal with different conifers (*Picea*, *Abies*) and broadleaf trees (*Fagus*, *Quercus*) according to Christensen & Heilmann-Clausen (2013), and the two Bulgarian collections mentioned above seemed very likely associated with *Abies*. Said to be

strictly bound to lime-rich soils by Christensen & Heilmann-Clausen (2013), our specimens were both found on soils on siliceous bedrock, confirming the observations of Galli (2005) and suggesting that in southern Europe the species might have somewhat different ecology. In the Balkan countries *T. aurantium* have been reported so far from Croatia, Greece, Montenegro and North Macedonia (Zervakis et al., 1998; Tkalčec & Mešić, 2002; Lazarević et al., 2011; Karadelev et al., 2018). In the adjacent countries of the peninsula, *T. aurantium* is also known from Turkey (Doğan et al., 2021).



Fig. 2. Species of *Tricholoma*, presented in this paper: a, b – *T. arvernensis*; c – *T. aurantium*; d, e, f – *T. boudieri*; g – *T. cingulatum*; h – *T. rapipes*; i – *T. viridilutescens*.

***Tricholoma boudieri* Barla (Fig. 2d-f)**

Specimens examined: Kyustendil Province, Panichishte ski resort, 42°15'18.2"N, 23°18'14.8"E, elev. ca. 1540 m, in a forest of *Picea abies* and *Abies alba* on siliceous soils, 13.10.2021, leg. B. Assyov

& I. Penchev (SOMF30892); *idem*, 42°15'33.7"N, 23°17'37.6"E, elev. ca 1425 m, 13.09.2022, leg. B. Assyov (SOMF30893); Blagoevgrad Province, along the road between Belmeken Dam and Granchar lake, in a forest of *Picea abies* on sili-

ceous soils, 31.08.2008, leg. B. Assyov (SOMF30894); above Bansko town, close to Katerina hotel, 41°48'15.4"E, 23°28'12.9"N, elev. ca 1270 m, in a forest of *Picea abies* on siliceous soils, 01.10.2022, leg. B. Assyov & I. Assyova (SOMF30895).

Notes. *Tricholoma boudieri*, previously appearing in the mycological literature also under the synonyms *T. saponaceum* var. *lavedanum* Rolland and *T. saponaceum* var. *boudieri* (Barla) Barla, belongs to the complex around *T. saponaceum* and similarly to this species is characterized by odour of unscented soap (Christensen & Heilmann-Clausen, 2013; Heilmann-Clausen et al., 2017). It is however easily recognized even in the field from the very variable *T. saponaceum* by the well pronounced tendency to turn reddish or pinkish red with age and on handling in all parts of basidiomata (Riva, 1988, 2003; Bon, 1991; Christensen & Heilmann-Clausen, 2013; Heilmann-Clausen et al., 2017), a feature outright observed in the four studied Bulgarian collections. As far as possible to tell for the moment, this peculiarity is discernible also in dried specimens, particularly on pileal surface, where reddening occurs with age. The distribution of the species is still incompletely known, but it is said to be rare in Northern Europe, where it occurs with *Fagaceae* and mostly on calcareous soils, while it may be not that uncommon in the Mediterranean area (Christensen & Heilmann-Clausen 2013; Roux 2006) and may apparently associate also with conifers (Kalamees 2010; Roux 2006). Our own specimens were invariably linked with conifers on siliceous soils. In the Balkan countries and adjacent areas *T. boudieri* has been previously recorded from Croatia and Slovenia (Tkalčec & Mešić, 2002, as *T. saponaceum* var. *boudieri*; Christensen & Heilmann-Clausen, 2013) and judging from our own findings will probably appear to be widespread species in the Balkan high mountains.

***Tricholoma cingulatum* (Almfelt ex Fr.) Jacobashch (Fig. 2g)**

Specimens examined: Sofia Province, Rila Mts, Borovets ski resort, 42°15'26.3"N, 23°35'08.2"E, elev. ca. 1495 m, under *Salix caprea* and *Betula pendula* in a young mixed coniferous forest, 08.10.2016, leg. B. Assyov & I. Assyova (SOMF 29917); *idem*, 13.11.2020, leg. B. Assyov (SOMF30896).

Notes. *Tricholoma cingulatum* is easily identified yet in the field, due to its well-developed, cottony annulus and its apparent occurrence with plants of the genus *Salix* (Christensen & Heilmann-Clausen, 2013). Although looked for in a number of other suitable localities, it is so far known to us only from the reported here station in Rila Mts, where it appears regularly since the initial finding in 2016. In the Balkans it has been previously recorded from Croatia and North Macedonia (Tkalčec & Mešić, 2002; Karadelev et al., 2018), and in adjacent regions it has been also reported from Turkey (Doğan et al., 2021). Previously, Hinkova (1955) reported *T. ramentaceum* (Bull.) Ricken from Bulgaria [as *Armillaria ramentacea* (Bull.) Fr.]. This name has been differently interpreted in the past, with one of the interpretations referring to *T. cingulatum* (Legon & Henrici, 2005; Christensen & Heilmann-Clausen, 2013). No specimen supporting this record could be found in SOMF and it must be thus considered to be of uncertain identity.

***Tricholoma rapipes* (Krombh.) Heilm.-Claus. & Mort. Chr. (Fig. 2h)**

Specimen examined: Kyustendil Province, Panichishte ski resort, 42°15'32.7"N, 23°17'49.4"E, elev. ca. 1440 m, in a forest of *Picea abies* and *Abies alba* on siliceous soils, 13.10.2021, leg. B. Assyov (SOMF30897).

Notes. *Tricholoma rapipes* belongs to the group of species around the polymorphic *T. saponaceum* (Fr.) P. Kumm. (Christensen & Heilmann-Clausen, 2013), a species known to be widespread in Bulgaria (Denchev & Assyov, 2010). Similar to the latter due to the shared soapy scent, it could be distinguished on account of the yellowish to olivaceous pileal colours and smooth and tapering, rooting stipe, while the microscopic characters of the two seem to largely overlap (Christensen & Heilmann-Clausen, 2013). This appears to be the first record of the species in the Balkan Peninsula and Christensen & Heilmann-Clausen (2013) listed confirmed records only from Denmark, France and Sweden. The ecology of the reported here specimen seems to correspond well to the collections described by Christensen & Heilmann-Clausen (2013). Remarkably, this species occurred merely a few meters apart from the first Bulgarian collection of *T. viridilutescens*.

***Tricholoma viridilutescens* M.M. Moser (Fig. 2i)**

Specimen examined: Kyustendil Province, Panichishte ski resort, 42°15'32.7"N, 23°17'49.4"E, elev. ca. 1440 m, in a forest of *Picea abies* and *Abies alba* on siliceous soils, 13.10.2021, leg. B. Assyov (SOMF30898).

Notes. *Tricholoma viridilutescens* is a counterpart of and is known to be closely related to *T. sejunctum* (Christensen & Heilmann-Clausen, 2013). It is set apart from the latter by the pileus, which is yellowish at the margin and dark olivaceous to blackish towards the center, with blackish innate fibrils, as well as by its occurrence with *Picea* and *Abies* (Christensen & Heilmann-Clausen, 2013). Said by the latter work to be rare to occasional in Fennoscandia and Central Europe, the author is aware of no prior records of the species in the Balkan Peninsula.

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