

## New locality records for two *Tuber* species in Turkey

Yasin UZUN\*, Semiha YAKAR

Karamanoğlu Mehmetbey University, Kamil Özdağ Science Faculty, Department of Biology, Karaman, Turkey  
\*yasinuzun\_61@hotmail.com

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### İki *Tuber* türü için Türkiye’de yeni lokalite kayıtları

**Abstract:** New specimens of two previously reported *Tuber* taxa, *T. excavatum* and *T. puberulum*, were collected from Eastern Black Sea region, and determined for the second time from Turkey. New distribution localities and brief descriptions of the species were provided together with the photographs related to their macro and micromorphologies.

**Key words:** Biodiversity, hypogeous fungi, *Tuber*, Turkey

**Özet:** Daha önceden rapor edilmiş olan iki *Tuber* taksonu, *T. excavatum* ve *T. puberulum*, Doğu Karadeniz Bölgesinden toplanarak Türkiye’den ikinci kez belirlenmiştir. Türlerin yeni yayılış lokaliteleri ve kısa betimlemeleri, makro ve mikromorfolojilerine ait fotoğrafları ile birlikte verilmiştir.

**Anahtar Kelimeler:** Biyoçeşitlilik, toprakaltı mantarlar, *Tuber*, Türkiye

## 1. Introduction

*Tuber* P. Micheli ex F.H. Wigg. is a truffle genus within the family *Tuberaceae* Dumort.. Members of the genus form ectomycorrhizas with many kinds of trees within the genera *Abies* Mill., *Betula* L., *Corylus* L., *Cistus* L., *Fagus* L., *Larix* Mill., *Olea* L., *Picea* A. Dietr., *Pinus* L., *Populus* L., *Pseudotsuga* Carrière, *Quercus* L., *Taxus* L., *Tilia* L. (Hawker, 1954; Lange, 1956; Honrubia et al., 1992; Medardi, 2006; Bidaud and Van Vooren, 2008; Wang et al., 2013, Türkoğlu and Castellano, 2014). Though Kirk et al (2008) mentions about the existence of 86 members of the genus, Index fungorum (www.indexfungorum.org; accessed 22 September 2018) currently lists 138 conformed *Tuber* species.

Until the end of August 2018, nine *Tuber* species, *Tuber aestivum* (Wulfen) Spreng., *T. borchii* Vittad., *T. brumale* Vittad., *T. excavatum* Vittad., *T. ferrugineum* Vittad., *T. mesentericum* Vittad., *T. nitidum* Vittad., *T. puberulum* Berk. & Broome and *T. rufum* Pollini, have been reported from Turkey (Öztürk et al., 1997; Kaya, 2009; Castellano and Türkoğlu, 2012; Türkoğlu and Castellano, 2014; Türkoğlu et al., 2015; Elliot et al., 2016; Şen et al., 2016; Alkan et al., 2018). Here we present new localities for two of them, *T. excavatum* and *T. puberulum* Berk. & Broome.

The study aims to make a contribution to the mycobiota of Turkey by presenting new distributions of some truffles.

## 2. Materials and Method

*Tuber* samples were collected from Artvin and Trabzon provinces during routine field studies between 2014 and 2018 within the Eastern Black Sea Region of Turkey. Required characteristics of the samples were recorded and they were photographed in their natural habitat. The samples were dried in and air conditioned room and prepared as fungarium materials. Measuremental evaluations were performed in the fungarium. Micromorphological investigations were carried out under a Nikon eclipse Ci-S trinocular light microscope and the photographs related to micromorphology were taken by a

DS-Fi2 digital camera aided by a Nikon DS-L3 displaying apparatus. The specimens were identified with the help of Vittadini (1831), Mattiolo (1903), Hawker (1954), Lange (1956), Honrubia et al. (1992), Pegler et al., (1993), Arroyo et al., (2005), Medardi (2006), Bidaud and Van Vooren (2008), Alvarado et al. (2012), Türkoğlu and Castellano (2014) and Elliot et al. (2016).

The specimens are deposited at Biology Department, Kamil Özdağ Science Faculty, Karamanoğlu Mehmetbey University.

## 3. Results

*Ascomycota* Caval.-Sm

*Pezizomycetes* O.E.Erikss. & Winka

*Pezizales* J.Schröt.

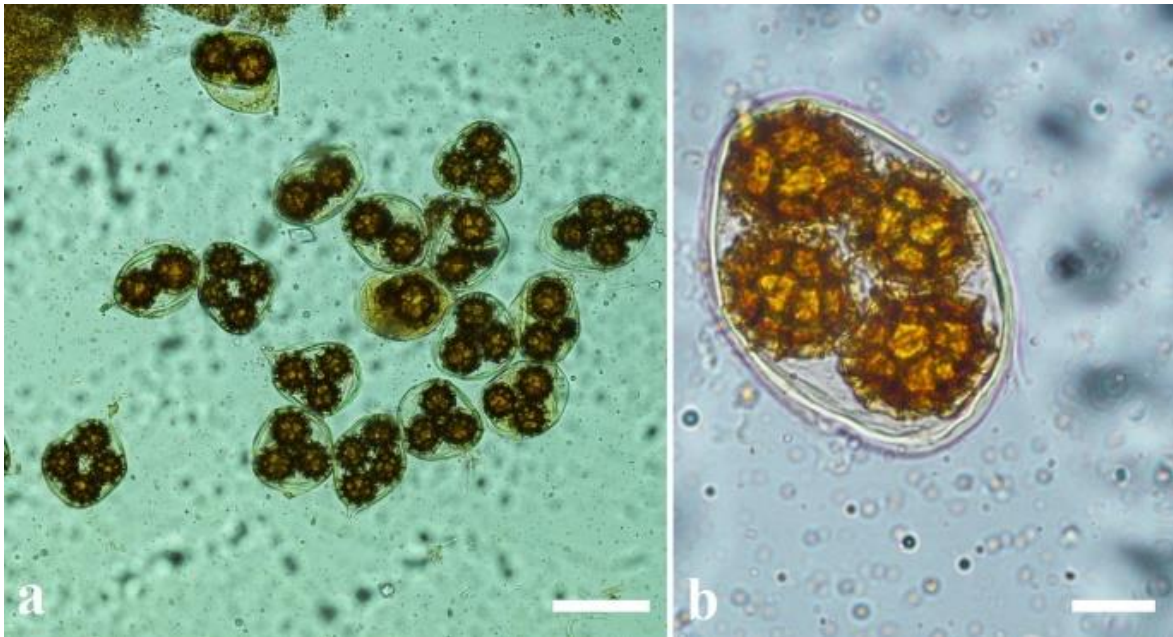
*Tuberaceae* Dumort.

*Tuber excavatum* Vittad., Monogr. Tuberac. (Milano): 49 (1831) [Syn: *Rhizopogon excavatus* (Vittad.) Rabenh., *Tuber excavatum* Vittad. f. *excavatum*, *Tuber excavatum* f. *globispora* Vaček, *Tuber excavatum* Vittad. subsp. *excavatum*, *Tuber excavatum* subsp. *lapideum* (Mattir.) E.Fisch., *Tuber excavatum* subsp. *typicum* E.Fisch., *Tuber excavatum* var. *brevisporum* E. Fisch., *Tuber excavatum* Vittad. var. *excavatum*, *Tuber excavatum* var. *fulgens* G. Gross, *Tuber excavatum* var. *intermedium* G.Gross, *Tuber excavatum* var. *longisporum* E.Fisch., *Tuber excavatum* var. *sulphureum* G.Riouisset & Riouisset, *Tuber lapideum* Mattir.]

Ascomata 10-30(35) mm in diameter, hypogeous, subglobose to globose or slightly lobed to irregular, with a distinct cavity, smooth in appearance but minutely papillate to somewhat coarsely warted, pale yellowish brown to yellowish brown when young, reddish brown at maturity (Figure 1). Peridium 200-350 µm thick, yellowish in section. Gleba whitish to straw colored at first, greyish-brown, reddish-brown to purplish-black when mature, marbled with cream or pale yellowish, branching and radially arranged veins. Asci 90-100 × 65-80(90) µm, ellipsoid to subglobose, sessile or short-



**Figure 1.** Ascocarps of *Tuber excavatum*



**Figure 2.** Asci (a,b) and ascospores (a,b) of *Tuber excavatum* (Bars a: 100 µm, b: 20 µm)

stalked, 1-4-spored (Figure 2a,b). Ascospores  $30\text{--}40(45) \times 25\text{--}35(40) \mu\text{m}$ , spore size varies depending on the number of spores in the ascus, ellipsoid, broadly ellipsoid or subglobose, yellowish-brown, ornamented with a coarse reticulum (Figure 2b).

*Tuber excavatum* grows under both coniferous and deciduous trees such as *Pinus*, *Fagus*, *Olea*, *Quercus* and *Taxus* species (Hawker, 1954; Pegler et al., 1993; Medardi, 2006; Türkoğlu and Castellano, 2014; Arroyo et al., 2005).

*Tuber excavatum* was reported previously from Turkey only once from one locality in Denizli province (Türkoğlu and Castellano, 2014).

**Specimen examined:** Trabzon, Maçka, Hamsiköy village, under death leavaes of *Carpinus* and *Corylus* sp. under

mixed stants of *Carpinus betulus* L., *Corylus* sp. and *Picea orientalis* L., 40°42'N -39°30'E, 970 m, 01.09.2018, Yuzun 6746.

***Tuber puberulum*** Berk. & Broome, Ann. Mag. nat. Hist., Ser. 1 18: 81 (1846) (1973) [**Syn:** *Tuber puberulum* var. *albidum* Bucholtz, *Tuber puberulum* var. *borchioides* G.Gross, *Tuber puberulum* var. *longisporum* Bucholtz, *Tuber puberulum* var. *michailowskjanum* Bucholtz, *Tuber puberulum* Berk. & Broome var. *puberulum*]

Ascomata 5-25 mm in diameter, hypogeous, subglobose, sometimes irregular or lobed with some slight grooves, surface smooth, initially whitish, becoming beige to greyish or yellowish-brown when mature (Figure 3). Peridium 100-200 µm thick, pseudoparenchymatous, composed of small, subglobose to subangular cells,

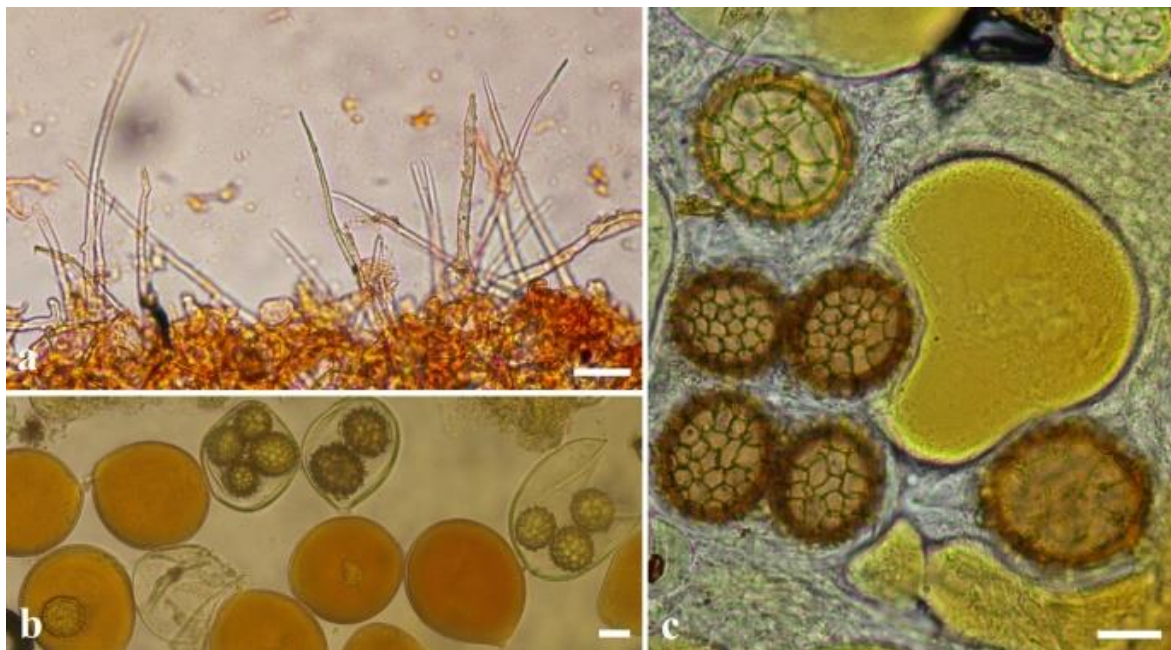
covered with hairs in young specimens. Hairs 50-110  $\mu\text{m}$  long, 4-6  $\mu\text{m}$  across at the base, hyaline, some septate, tapered towards the apex (Figure 4a). Gleba firm, solid, whitish at first, then light brown, brown pink, marbled with numerous, white, branching veins. Taste and odour not distinctive. Asci 70–93  $\times$  60–80  $\mu\text{m}$ , ellipsoid, subglobose to globose to subspherical, sessile or short-stalked, 1-4-spored (Figure 4b). Ascospores 32-45- (50)  $\times$  27-35(40)  $\mu\text{m}$ , subglobose to spherical or broadly ellipsoid, light yellow, reddish brown at maturity, ornamented with a reticulo-alveolate, polygonal meshes (Figure 4c).

*Tuber puberulum* was reported to grow under different hardwoods and conifers such as *Fagus*, *Quercus*, *Tilia*, *Larix*, *Pinus*, *Pseudotsuga*, *Corylus*, *Picea*, (Lange, 1956; Honrubia et al., 1992; Bidaud and Van Vooren, 2008; Elliot et al., 2016).

*Tuber puberulum* was reported previously from Turkey only once by Elliot et al. (2016) from the localities within the boundaries of Aydın (Kuyucak), Denizli (Acıpayam, Buldan, Serinhisar), Muğla (Central district, Dalaman, Fethiye), Osmaniye (Central district) provinces.



**Figure 3.** Ascocarps of *Tuber puberulum*



**Figure 4.** Peridial hairs (a), asci (b) and ascospores (b,c) of *Tuber puberulum* (Bars 20  $\mu\text{m}$ )

**Specimen examined:** Artvin, Borçka, Kaynarca village, in soil under *Fagus orientalis* Lipsky., *Castanea sativa* Miller and *Rhododendron ponticum* L. mixed forest, 41°22'N-41°51'E, 1590 m, 09.11.2016, Yuzun 5425; Trabzon, Central district, Esenyurt village, in soil under *Castanea sativa*, *Fagus orientalis* and *Rhododendron ponticum* mixed forest, 40°54'N-39°45'E, 660 m, 02.09.2018, Yuzun 6755; Tonya, Erikbeli village, in soil under *Castanea sativa*, *Fagus orientalis*, *Alnus glutinosa* (L.) Gaertner and *Rhododendron ponticum* mixed forest, 40°45'N-39°14'E, 1680 m, 22.09.2015, Yuzun 4605; Yomra, Özdil village, in soil under *Castanea sativa*, *Fagus orientalis*, *Alnus glutinosa*, *Corylus* sp. and *Rhododendron ponticum* mixed forest, 40°50'N-39°48'E, 1210 m, 25.08.2018, Yuzun 6678.

#### 4. Discussions

Both *T. excavatum* and *T. puberulum* have only been reported from Turkey once. The first Turkish record of *T. excavatum* was given by Türkoğlu and Castellano (2014) from Bozturt district of Denizli province with the samples collected under mixed *Quercus* spp. and *Pinus* spp. Our

sample was collected under mixed stands of *Carpinus betulus*, *Corylus* sp. and *Picea orientalis*.

The presence of *T. puberulum* in Turkey was also noted by Elliot et al. (2016) based on the samples collected from Aydın, Denizli, Muğla and Osmaniye provinces, under different mixed stands of *Pinus brutia*, *Quercus cerris*, *Q. ilex*, *Q. coccifera*, *Q. ithaburensis*, *Q. trojana* and some other *Pinus* and *Quercus* spp. We found it under different mixed stands of *Fagus orientalis*, *Castanea sativa*, *Rhododendron ponticum* *Alnus glutinosa* and *Corylus* sp.

Morphologically *T. puberulum* could be confused with *T. borchii*. Both species are among the white truffles group. Young specimens of *Tuber borchii* could also have peridial hairs and globose spores, but the ascocarps of it always bigger (Honrubia et al., 1992).

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