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Elaphomyces granulatus, A New Hypogeous Ascomycete Record for Turkey

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ABSTRACT
Toprak altı Askomiset türü olan, *Elaphomyces granulatus* Türkiye'den ilk kez rapor edilmiştir. Türkiye'den kaydedilen türün morfolojik ve mikroskobik özellikleri, toplanma lokaliteleri ile birlikte raporlanarak makro ve mikromorfolojisine ilişkin fotoğraflar verilmiştir.

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Elaphomyces granulatus, Türkiye İçin Yeni Bir Toprakaltı Askomiset Kaydı

ÖZET
The hypogeous Ascomycete species, *Elaphomyces granulatus* is reported for the first time in Turkey. The morphological and microscopic characters of the species recorded in Turkey are reported together with the localities of collection, and the photographs related to its macro and micromorphology are provided.

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INTRODUCTION

Elaphomyces Nees is a hypogeous false truffle genus within the family Elaphomycetaceae. The genus is an ecologically important one since fruit bodies form a part of the diet of some mycophagist animals and widespread ectomycorrhizal partners of many woody plants. Members of the genus are characterized by fruiting-bodies consisting of a central chamber filled with yellow to brown, olive-brown to black or blue black powdery spore mass surrounded by a thick peridium (Hawker, 1954; Trappe, 1979; Castellano et al., 2012a,b).

While *Elaphomyces* is a widespread genus and well represented in the north temperate forests and subtropical forests (Castellano et al., 2012b), only two members, *Elaphomyces leucocarpus* Vittad. and *E. muricatus* Fr., have so far been reported from Turkey (Türkoğlu et al., 2015).

Here we present another member of the genus *Elaphomyces, E. granulatus* Fr., from Turkey, based on the collections from Eastern Black Sea Region. Current checklists on Turkish macromycota (Sesli and Denchev 2014; Solak et al. 2015) and the contributions presented after the checklists (Kaya et al., 2016; Işık and Türkekul 2017, 2018; Kaşık et al., 2017; Keleş and Oruç, 2017; Türkekul, 2017; Uzun et al., 2017; Kaya and Uzun, 2018; Sadullahoğlu and Demirel, 2018; Sesli, 2018; Sesli et al., 2018; Uzun et al., 2018a, b) reveals that *E. granulatus* has not been previously reported from Turkey. The study aims to contribute to the macromycota of Turkey.

MATERIALS and METHODS

Ascomata were collected during field trips within the boundaries of Giresun, Rize and Trabzon provinces between 2016 and 2018. Ecological characteristics of the specimens were noted and they were photographed at their natural habitats. Then they were transferred to the fungarium and dried. Microscopic investigations based on dry specimens carried out under a Nikon Eclipse Ci-S trinocular compound microscope, coupled with a Nikon DS-Fi2 camera. Identification was performed by comparing the obtained data about the

macroscopic and microscopic features such as the structure of ascomata, peridium, gleba, asci, and spores, with those given in literature (Hawker, 1954; Lange, 1956; Cázares et al., 1992; Pegler et al., 1993; Arroyo et al., 2005; Trappe et al., 2007; Wang, 2011; Paz et al., 2017). Specimens are deposited in the fungarium of Biology Department, Science Faculty, Karamanoğlu Mehmetbey University.

RESULTS

Ascomycota Caval.-Sm.

Eurotiales G.W. Martin ex Benny & Kimbr.

Elaphomycetaceae Tul. ex Paol.

Elaphomyces granulatus Fr., Syst. mycol. (Lundae) 3(1): 58 (1829)

Syn: [*Ceraunium granulatum* (Fr.) Wallr., *Ceraunium scabrum* (Willd.) Wallr., *Elaphomyces cervinus* (L.) Schltdl., *Elaphomyces cervinus* (L.) Schltdl. var. cervinus, *Elaphomyces cervinus* var. *hassiacus* (R.Hesse) E.Fisch., *Elaphomyces cervinus* var. *scaber* (Willd.) Schltdl., *Elaphomyces granulatus* f. *pallidosporus* De Vito, Faust. García, A.Paz & Lavoise, *Elaphomyces granulatus* Fr. var. *granulatus*, *Elaphomyces hassiacus* R.Hesse, *Elaphomyces vulgaris* var. *granulatus* (Fr.) Corda, *Hypogaeum cervinum* (L.) Pers., *Lycoperdastrum cervinum* (L.) Kuntze, *Lycoperdon cervinum* L., *Lycoperdon scabrum* Willd., *Scleroderma cervinum* (L.) Pers., *Scleroderma cervinum* (L.) Pers. var. *cervinum*, *Scleroderma cervinum* var. *granulatum* Alb. & Schwein., *Scleroderma cervinum* var. *scabrum* Pers., *Scleroderma vulgare* var. *cervinum* (L.) W.G.Sm., *Tuber cervinum* (L.) Nees]

Macroscopic features: Ascocarps 10-40 mm in diameter, hypogeous or some subepigeous at maturity, globose to subglobose or depressed, leathery, hard when dry, yellowish brown to ochraceous-brown, covered with small, pyramidal or rounded warts. Peridium 0.5-1.8 mm thick, white, brownish at the outermost layer and inner zone, not marbled. Gleba, stuffed with ascogenous hyphae, pinkish brown when young, powdery mass of blackish-brown spores when mature, divided into compartments by white bands of sterile tissue in some samples (Figure 1).

Microscopic features: Asci 35-50 × 30-40 µm, subglobose, globose to pyriform, with hyaline, 2 µm thick walls, usually 6-8-spored (Figure 2a). Ascospores 19-31 µm in diameter, spherical, hyaline at the beginning, brownish to blackish brown at maturity, with spines or crests of 3-4 µm in height (Figure 2bc).

Ecology: *Elaphomyces granulatus* was reported to grow under the members of needle or broad-leaved trees such as *Pinus, Picea, Quercus, Cistus, Fagus and Castanea* (Arroyo et al., 2005; Kutorga and Kataržytė 2008).

Specimen examined: Giresun, Bulancak, Paşakonağı plateau, in soil under *Fagus orientalis* and *Rhododendron ponticum,* 40°43′N-38°04′E, 1500 m, 22.02.2018, Yuzun 6210; Rize, Ardeşen, Yeşiltepe village, in soil under *Fagus orientalis, Castanea sativa, Alnus glutinosa* and *Rhododendron ponticum* mixed forest, 41°09′N-41°04′E, 790 m, 28.02.2018, Yuzun 6266. Trabzon, Tonya, İskenderli village, in soil under *Fagus orientalis, Castanea sativa* and *Rhododendron ponticum* mixed forest, 40°55′N-39°14′E, 760 m, 12.11.2016, Yuzun 5464; Tonya central district, Esenyurt village, in soil under *Castanea sativa, Fagus orientalis, Picea orientalis* and *Rhododendron ponticum* mixed forest, 40°53′N-39°45′E, 745 m, 30.08.2018, Yuzun 6730.

DISCUSSION

Elaphomyces granulatus was given as a new record and the third member of the genus *Elaphomyces* in Turkey. Macro and micromorphological characteristics of the investigated *E. granulatus* specimens are generally in agreement with those given in literature.

Elaphomyces granulatus is one of the most common and the earliest scientifically named hypogeous species of the genus *Elaphomyces* (Paz et al., 2017) and often occurs in the same territories with *E. muricatus.* The fruitbodies of the two species are similar in appearance, but *E. muricatus* differs from *E. granulatus* with the marbled peridium, smaller spores and lower spore number in the asci (2-6) (Hovsepyan, 2013). *Elaphomyces granulatus* also have macromorphological similarities and may be confused with *E. asperulus* and *E. verruculosus. Elaphomyces granulatus* has a white peridium, whereas *E. asperulus* displays purplish tinges (Paz et al., 2017). On the other hand, *E. verruculosus* have smaller spore size and less coarse ornamentation compared to *E. granulatus* (Kutorga and Kataržytė, 2008).

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Figure 1. Ascocarps of *Elaphomyces granulatus*

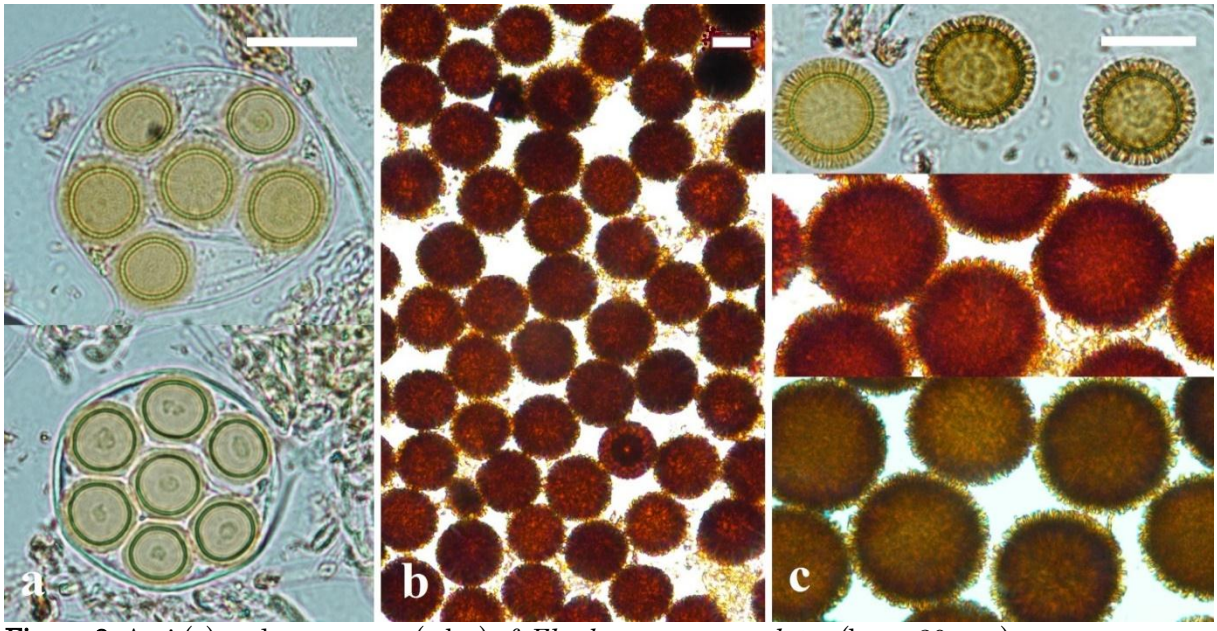

Figure 2. Asci (a) and ascospores (a,b,c) of *Elaphomyces granulatus* (bars: 20 µm)

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