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HYPOGEOUS MACROFUNGI ON THE TERRITORY OF THE SOFIA AND PLOVDIV CITY PARKS, BULGARIA

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Abstract. Data on the distribution of eight hypogeous macrofungi found in the city parks of Sofia and Plovdiv are presented in the paper. Seven species are new records from urban green areas in Bulgaria. Three of them are true truffles from genus *Tuber*. Four species are of high conservation value, included in the Red List of fungi in Bulgaria and also in the Red Data Book of the Republic of Bulgaria.

Key words: ascomycetes, basidiomycetes, fungal conservation, truffles, urban green areas

INTRODUCTION

Data on the fungal diversity in the Sofia city parks (*Borisova gradina, Vrana, Zapaden park*) have been reported by Barzakow (1926a,b), Barsakoff (1929, 1933, 1936), Atanasov & Martinov (1933), Hinkova (1950, 1955, 1961),

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Dimitrova et al. (2007), Pencheva et al. (2009), Assyov et al. (2010), Alexov et al (2012), Bencheva (2014), Gyosheva & Nedelin (2016), Stoyneva & Uzunov (2016), Georgiev et al. (2017), *etc.* The published information about fungal diversity in the Sofia city parks and especially in the city park *Borisova gradina* was summarized in the paper by Stoyneva & Uzunov (2016), where a checklist of 115 macrofungi recorded by the first author in the south-eastern part of the park was presented. Data on the macrofungal diversity of the Plovdiv city parks *Bunardzhika*, *Lauta* and *Ostrava* were reported by Stoichev (1981, 1982, 1995), Stoichev & Dimcheva (1982), Stoichev & Anastasov (1988), Hinkova & Stoychev (1983), Lacheva (2010), *etc.* About 140 macrofungal species were recorded so far from the city parks of Sofia and Plovdiv and only one of them (*Hymenogaster verrucosus* Bucholtz) was a hypogeous fungus. Wood-destroying fungi (saprotrophs and parasites) prevailed among all published species.

The present work provides new chorological information for eight hypogeous macrofungi (ascomycetes and basidiomycetes), collected by the authors on the territory of the Sofia and Plovdiv city parks.

MATERIAL AND METHODS

Hypogeous fungi were found by the first author in the Sofia city parks *Borisova gradina*, *Loven park* and *Yuzhen park* and by the third author in the Plovdiv city parks *Bunardzhika* and *Lauta*. The fruit bodies of hypogeous fungi in the Sofia city parks were collected by a truffle dog (**Plate I, Fig. 2**). For some species, we provide information about the period when they were recorded. The identification was confirmed by the use of the works by Dennis (1968), Pegler et al. (1993), Montecchi & Sarasini (2000). The Latin and author names follow Index Fungorum.

The studied specimens are kept at the Mycological Collection of the Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences, Sofia (SOMF) and Mycological Collection of the Agricultural University, Plovdiv (SOA).

The threat status follows the Red List of fungi in Bulgaria (Gyosheva et al. 2006). ~”

RESULTS

List of hypogeous fungi, found in the Sofia and Plovdiv city parks

Ascomycota

Eurotiales

Elaphomycetaceae

Elaphomyces gramilatus Fr. (**Plate I, Fig. 5**)

Specimen examined: In the Plovdiv city park *Bunardzhika*, in soil, among 33

mosses, in a plantation of *Pinus sylvestris* L. and *Gleditschia triacanthos* L., 17.11.2006, leg. & det. M. Lacheva (SOA 6000387).

Critically Endangered (CR) species. Previously known from five floristic regions (Dimitrova & Gyosheva 2008; Dimitrova 2015a; Lacheva 2012a). This species, probably, is not rare in Bulgaria. It has been found several times by the authors (unpubl.) in big amounts, under spruces and pines on Vitosha Mt and Rila Mts.

Pezizales

Tuberaceae

Tuber aestivum Vittad.

Specimen examined: In the *Lovenpark*, Sofia, in soil, under *Quercus robur* L., 20.12.2016-30.1.2017, leg. & det. T. Nedelin (SOMF 29676). It was found several times at one place only, with an area of about 100 m².

Endangered (EN) species. Reported from Zapadna Stara planina Mts and valley of the River Struma (Dimitrova & Gyosheva 2008; Dimitrova 2015b). This species is the most commonly encountered commercial truffle in Bulgaria but its distribution is less known in the country.

T. brumale Vittad. (**Plate I, Fig. 4**)

Specimen examined: In the Sofia city park *Borisova gradina*, buried in the soil, under *O. robur*; 1.01.2017-14.02.2017, leg. & det. T. Nedelin (SOMF 29714). It was found several times at one place only, with a very limited area. The ectomycorrhizal roots (ectomycorrhizal association of *T. brumale* with *O. robur*) are brown, ochre or yellowish-brown and the ramification is generally monopodial. Cystidia are very short (**Plate I, Fig. 4**, left corner).

The species was reported from a single locality in Northeast Bulgaria, in the vicinity of Nikolaevo village, near Ruse town (Dimitrova & Gyosheva 2008). *T. excavatum* Vittad. (**Plate I, Figs. 1-2**)

Specimens examined: In the Sofia city park *Borisova gradina*, in soil, under *O. robur*. 15.12.2016, leg. T. Nedelin, det. M. Gyosheva & T. Nedelin (SOMF 29715); in the Sofia city park *Yuzhen park*, in soil, under *O. robur*; 20.12.2016, leg. & det. T. Nedelin (SOMF 29718).¹

The species was reported previously in Bulgaria from Northeast Bulgaria (Dimitrova & Gyosheva 2008; Nedelin et al. 2016), Zapadna Stara planina Mts (Nedelin et al. 2017) and Zapadni Rodopi Mts (Lacheva 2012a). The distribution of this species in Bulgaria is less known.

Basidiomycota

Agaricales

Hymenogastraceae

Hymenogaster luteus Vittad. (**Plate I, Fig. 3**)

Specimens examined: In the Sofia city park *Borisova gradina*, in soil, under *O.*

Plate I: Fig. 1. *Tuber excavatum* - ascoma in situ; **Fig. 2.** *Tuber excavatum* - locality in the Sofia city park *Borisova gradina*; **Fig. 3.** *Hymenogaster luteus* -locality in the Sofia city park *Borisova gradina*, basidiomata in situ (red arrow); **Fig. 4.** *Tuber brumale* - ectomycorrhizal root of *O. robur* - general view (25x) and detail of the surface - cystidia (x63) -left corner; **Fig. 5.** *Elaphomyces granulatus* - ascomata in situ; **Fig. 6.** *Rhizopogon parksii* - basidiomata in situ.

robur 20.12.2016-13.02.2017, leg. T. Nedelin, det. M. Gyosheva (SOMF 29716); in the Sofia city park *Lovenpark*, in soil, under *O. robur* 09.01. 2017, leg. & det. T. Nedelin (SOMF 29717). The species was found several times at two places in the Sofia city park *Borisova gradina*.

Endangered (EN) species. It was reported previously in Bulgaria from Rila Mts (Barsakoff 1931) and Centralni Rodopi Mts (Lacheva 2011; Denchev et al. 2015a).

H. verrucosus Bucholtz

Specimens examined: In the Plovdiv city park *Bunardzhika*, near Alyosha monument, in soil, in community of *Acer campestre* L. and *A. platanoides* L., 22.09. 2010, leg. & det. M. Lacheva (SOA 60003 84); in the Plovdiv city park *Lauta*, in soil, under *Tilia cordata* Mill, and *T. tomentosa* Moench, 17. 08. 2009, leg. & det. M. Lacheva (SOA 6000383).

Endangered (EN) species. Reported previously in Bulgaria from Sredna Gora Mt (Lacheva 2011) and from the lowland Trakiyska nizina: Plovdiv city park *Lauta* (Stoichev & Anastassov 1988; Denchev et al. 2015b) and near Kadievo village (Lacheva 2011).

Boletales

Rhizopogonaceae

Rhizopogon luteolus Fr.

Specimen examined: In Plovdiv city park *Lauta*, in soil, in a community of *Pinus sylvestris* and *Acer negundo* L., 09. 09. 2007, leg. & det. M. Lacheva (SOA 6000389). '

This species is widespread. It was reported from five floristic regions (Denchev & Assyov 2010; Lacheva 2012b).

R. parksii A. H. Sm. (Plate I, Fig. 6)

Specimen examined: In the Plovdiv city park *Bunardzhika*, in the roots of *Betula* sp., in soil, 06.10.2007, leg. & det. M. Lacheva (SOA 6000386). This species is less known in Bulgaria. It was reported only once from Sredna Gora Mt (Lacheva 2012b).

DISCUSSION

The present work provides new chorological information for eight hypogeous ascomycetes and basidiomycetes collected by the authors on the territory of the Sofia and Plovdiv city parks. Seven of them are reported for first time from urban park areas of Bulgaria. All species are ectomycorrhizal fungi with roots of trees (Pegler et al. 1993). Three species are true truffles from the genus *Tuber*. Four hypogeous fungi are of high conservation value, included in the Red List of fungi in Bulgaria (Gyosheva et al. 2006) and also in the Bulgarian Red Data Book (Peev et al. 2015). They are listed in the following threat categories: Critically Endangered

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(CR) - one species (*Elaphomyces gramdatus*), Endangered (EN) - three species (*Hymenogaster luteus*, *H. verrucosus* and *Tuber aestivum*).

CONCLUSION

The data presented in the paper suggest the conclusion that the urban green areas in the cities Sofia and Plovdiv are characterized by interesting species diversity of hypogeous macrofungi (ascomycetes and basidiomycetes). This conclusion is supported by the recorded species of conservation value and especially by the truffles. The members of genus *Tuber* are the pioneer species in forest ecosystems. They provide significant benefits for the plants in urban areas - more access to vital nutrients and diminishment of toxic deposits in soils.

Most of the collected hypogeous fungi in the city parks of Sofia and Plovdiv are threatened and less studied in the country. *Tuber brumale*, *T. excavatum* and *Rhizopogon parksii* should be evaluated according to IUCN criteria at the next update of Red List of fungi in Bulgaria.

CONFLICT OF INTERESTS

The authors declare that there is no conflict of interests regarding the publication of this article.

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