ГОДИШНИК НА СОФИЙСКИЯ УНИВЕРСИТЕТ „СВ. КЛИМЕНТ ОХРИДСКИ“
БИОЛОГИЧЕСКИ ФАКУЛТЕТ
Книга 2 – Ботаника
Том 101, 2017

ANNUAL OF SOFIA UNIVERSITY “ST. KLIMENT OHRIDSKI”
FACULTY OF BIOLOGY
Book 2 – Botany
Volume 101, 2017

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

TEODOR T. NEDELIN[1], MELANIA M. GYOSHEVA[2*] & MARIA N. LACHEVA[3]

[1] Department of Silviculture, Faculty of Forestry, University of Forestry, 10 Kliment Ohridski bld, 1797 Sofia, Bulgaria
[2] Department of Plant and Fungal Diversity and Resources, Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences, 23 Acad. G. Bonchev Str., 1113 Sofia, Bulgara
[3] Department of Botany and Agrometeorology, Faculty of Agronomy, Agricultural University Plovdiv, 12 Mendeleev Str.,4000 Plovdiv, Bulgaria

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),

**corresponding author*: M. M. Gyosheva – Department of Plant and Fungal Diversity and Resources, Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences, 23 Acad. G. Bonchev Str., 1113 Sofia, Bulgara; melanygyosheva@abv.bg

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 *Ostrova* 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 granulatus Fr. (**Plate I, Fig. 5**)
Specimen examined: In the Plovdiv city park *Bunardzhika*, in soil, among

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 *Loven park*, 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 m^2.

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 *Q. 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 *Q. 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 *Q. robur,* 15.12.2016, leg. T. Nedelin, det. M. Gyosheva & T. Nedelin (SOMF 29715); in the Sofia city park *Yuzhen park*, in soil, under *Q. robur,* 20.12.2016, leg. & det. T. Nedelin (SOMF 29718).

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 *Q.*

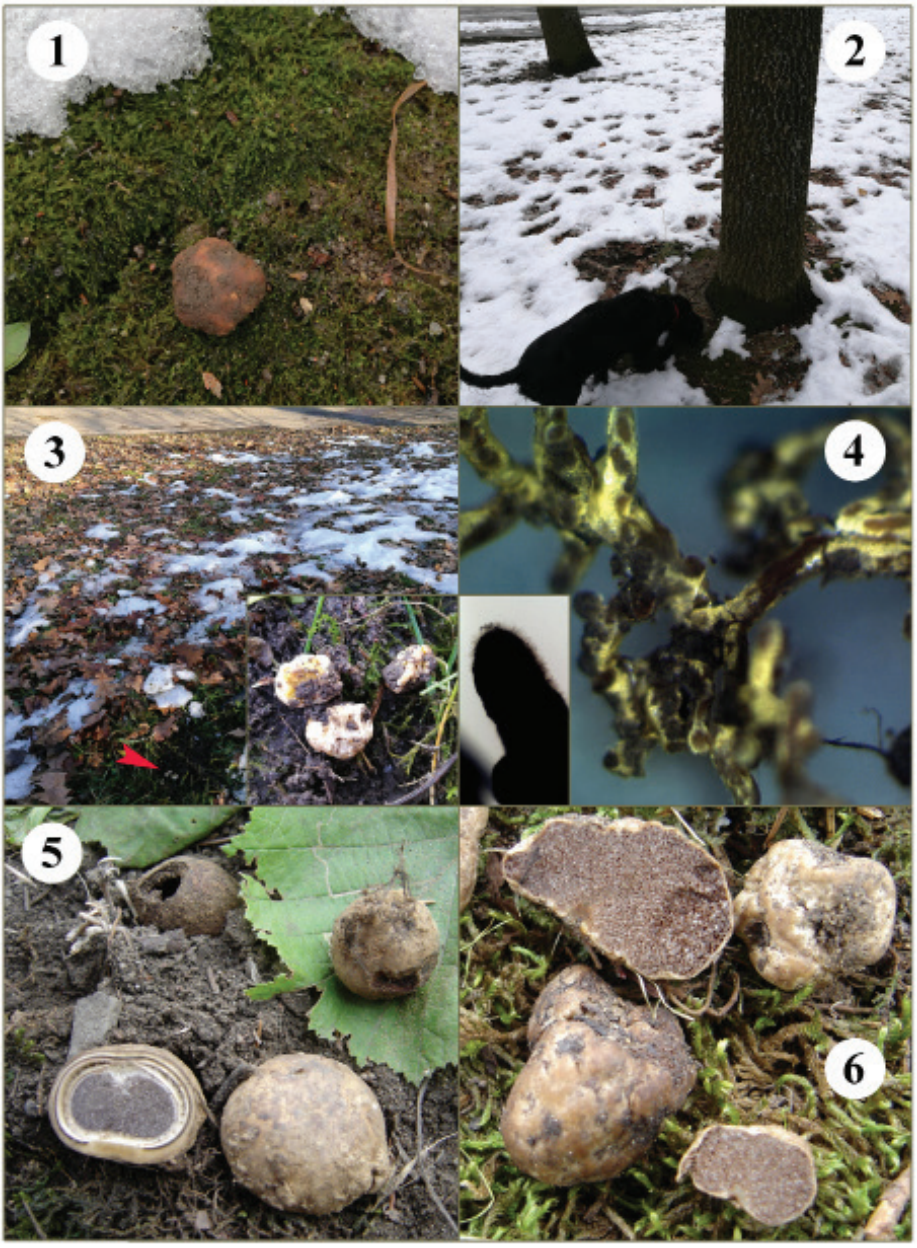

Plate I: **Fig. 1.** *Tuber excavatum* – ascoma *in situ*; **Fig. 2.** *Tuber excavatum* – locality in the Sofia city park *Borisova gradina*; **Fig. 3.** *Hymenogaster luteus* – locality in the Sofia city park *Borisova gradina*; basidiomata *in situ* (red arrow); **Fig. 4.** *Tuber brumale* – ectomycorrhizal root of *Q. 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 *Loven park*, in soil, under *Q. 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 6000384); 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 Endangerd

(CR) – one species (*Elaphomyces granulatus*), 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.

References

Assyov B., Stoykov D. & Nikolova S. 2010. New records of some rare and noteworthy larger fungi from Bulgaria. – Trakia Journal of Sciences, Series Biomedicine Sciences 8 (4): 1-6.

Atanasov D. & Martinov C. 1933. The perishing of elm *Ceratostomella ulmi* (Schwarz) Buisman – *Graphium ulmi* Schwarz. – Godishnik na Sofiyskiya Universitet, Agronomo-Lesovudski Fakultet 11: 71-86 (In Bulgarian).

Barsakoff B. 1929. Einige für Bulgarien neue Pilzarten. – Bulletin de la Société Botanique de Bulgarie 3: 87-91 (In Bulgarian, German summ.).

Barsakoff B. 1931. Neue für Bulgarien Pilzarten. – Bulletin de la Société Botanique de Bulgarie 4: 44-47 ((In Bulgarian, German title).

Barsakoff B. 1933. Characteristic der Pilzflora des Witoschagebirges – Godishnik na Sofiyskiya Universitet, Fiziko-Matematicheski Fakultet 3 (29): 4-92 (In Bulgarian, German summ.).

Barsakoff B. 1936. Einige für Bulgarien neue und seltene Pilzarten. – Bulletin de la Société Botanique de Bulgarie 7: 108-109 (In Bulgarian, German summ.).

Barzakow B. 1926a. Beitrag zur Pilzenflora in Bulgarien. – Godishnik na Sofiyskiya Universitet, Fiziko-Matematicheski Fakultet 3 (22): 59-89 (In Bulgarian).

Barzakow B. 1926b. Beitrag zur Erforchung der Pilzenflora des westlichen

Balkangebirges. – Godishnik na Sofiyskiya Universitet, Fiziko-Matematicheski Fakultet 3 (22): 113-148 (In Bulgarian).
Bencheva S. 2014. First report of *Cryptostroma corticale* (Ellis & Evern.) P. H. Greg. & S. Waller on *Acer platanoides* L. in Bulgaria. – Silva Balcanica 15 (2): 101-104.
Denchev C. M. & Assyov B. 2010. Checklist of the larger Basidiomycetes in Bulgaria. – Mycotaxon 111: 279-282.
Denchev C. M., Petrova R. D. & Stoichev G. T. 2015a. *Hymenogaster luteus* Vittad. – In: Peev D. (Ed.), Red Data Book of the Republic of Bulgaria. Vol. 1. Plants and Fungi. BAS & MoEW, Sofia, p. 818.
Denchev C. M., Petrova R. D. & Stoichev G. T. 2015b. *Hymenogaster verrucosus* Buchholz.– In: Peev D. (Ed.), Red Data Book of the Republic of Bulgaria. Vol. 1. Plants and Fungi. BAS & MoEW, Sofia, p. 819.
Dennis R.W. G. 1968. British Ascomycetes. J. Cramer, Lehre, 455 pp.
Dimitrova E. 2015a. *Elaphomyces granulatus* Fr. – In: Peev D. (Ed.), Red Data Book of the Republic of Bulgaria. Vol. 1. Plants and Fungi. BAS & MoEW, Sofia, p. 738.
Dimitrova E. 2015b. *Tuber aestivum* Vittad. – In: Peev D. (Ed.), Red Data Book of the Republic of Bulgaria. Vol. 1. Plants and Fungi. BAS & MoEW, Sofia, p. 860.
Dimitrova E. & Gyosheva M. 2008. Hypogeous ascomycetes in Bulgaria – Phytologia Balcanica 14 (3): 308 – 314.
Dimitrova E., Pencheva A., Gyosheva M., Sameva E., Bakalova G., G., Borisova Ts. & Nenova I. 2007. Parasitic and saprotrophic fungi on arboreal species in "Vrana" and "King Boris' garden" parks – preliminary note. – In: International Symposium Sustainable Forestry – Problems and challenges, Perspectives and challenges in wood technology, 46-52.
Georgiev G., Georgieva M., Mirchev P. & Zhiyanski M. 2017. Main insect pests and fungal pathogens on wood and shrub vegetation in urban ecosystems. Hlorint Ltd, Sofia, 56 pp.
Gyosheva M. M., Denchev C. M., Dimitrova E. G., Assyov B., Petrova R. D. & Stoichev G. 2006. Red List of fungi in Bulgaria. – Mycologia Balcanica 3: 81-87.
Gyosheva M. & Nedelin T. 2016. New records of larger fungi in Bulgaria. – Annual of Sofia University "St. Kliment Ochridski", Faculty of Biology, Book 2 – Botany 99: 91-99.
Hinkova Tz. 1950. Beitrag zur Bulgarischen Pilzflora. – Bulletin de L'Institut Botanique 1: 432-439 (In Bulgarian, Russian and German summ.).
Hinkova Tz. 1955. Contribution to the Bulgarian fungal flora. – Bulletin de L'Institut Botanique 4: 376-378 (In Bulgarian).
Hinkova Tz. 1961. Materials on the fungous flora of Bulgaria. – Mitteilungen des Botanischen Instituts 8: 251-259 (In Bulgarian, Russian and English summ.).
Hinkova Tz. & Stoichev G. 1983. New and rare macromycetes for Bulgaria. – Fitologiya 23: 70-72 (In Bulgarian, English summ.).
Index Fungorum. http://www.indexfungorum.org (Last assessed on 17.02.2017).
Lacheva M. 2010. Lignicolous macromycetes in parks in the city of Plovdiv. – In:

Proceedings of Eight Scientufic-Technical Conference with International Participation *Ecology and health,* Plovdiv, 471-478 (In Bulgarian).

Lacheva M. 2011. New data for *Hymenogaster* (*Agaricales*) and *Melanogaster* (*Boletales*) in Bulgaria. – In: Jubilee National Scientific Conference with international participation *The Man and the Universe*, October 6-8, 2011, Smolyan, Bulgaria, Scienific Papers: 633-638 (In Bulgarian).

Lacheva M. 2012a. New records for hypogeous ascomycetes in Bulgaria. – Science & Technologies, Plant Studies 2 (6): 30 – 34.

Lacheva M. 2012b. *Rhizopogon* and *Scleroderma* (*Boletales*) in Bulgaria. – In: Petrova A. (Ed.), Proceedings of the 7th National Conference of Botany, 29–30 September 2011, Sofia, Bulgarian Botanical Society, Sofia, 245-250 (In Bulgarian).

Montecchi A. & Sarasini M. 2000. Funghi ipogei d Europa. Associazione. Micologica Bresadola, Trento, 714 pp.

Nedelin T., Gyosheva M., Kostov K. & Savev S. 2016. New records and data on hypogeous ectomycorrhizal fungi in Bulgaria. – Forestry Ideas 22 (2): 113-126.

Peev D., Petrova A., Anchev M., Temniskova D., Denchev C. M., Ganeva A., Gussev Ch. & Vladimirov V. (Eds). 2015. Red Data Book of the Republic of Bulgaria. Vol. 1. Plants and Fungi, BAS & MoEW, Sofia, 881 pp.

Pegler D., Spooner B. & Joung T. 1993. British truffles. A revision of British hypogeous fungi. Royal Botanic Gardens, Kew, 240 pp.

Pencheva A., Dimitrova E., Gyosheva M., Sameva E., Bakalova G., Borisova Ts. & Nenova I. 2009. Parasitic and saprotrophic fungi on arboreal species in Park Vrana. – Forest Science 1: 19-28 (In Bulgarian).

Stoichev G. 1981. New taxa for the Bulgarian fungal flora. – Scientific Works of the Vasil Kolarov Higher Institute of Agriculture (Plovdiv) 26 (4): 105-107 (In Bulgarian).

Stoichev G. T. 1982. New taxa and chorological data on fungal flora of Bulgaria. – Fitologiya 21: 43-50 (In Bulgarian).

Stoichev G. T. 1995. *Phellinus* Quěl. (*Hymenochaetaceae* Donk) in Bulgaria. – Annual Scientific Session, Institute of Agriculture, Plovdiv, October 1995, 4 (1): 221-227 (In Bulgarian).

Stoichev G. T. & Anastasov H. 1988. New fungi for Bulgaria. – Scientific Works of the Vasil Kolarov Higher Institute of Agriculture (Plovdiv) 33 (4): 95-99 (In Bulgarian).

Stoichev G. T. & Dimcheva M. D. 1982. New taxa and chorological data on the fungal flora of Bulgaria. – Fitologiya 20: 68-73 (In Bulgarian).

Stoyneva M. P. & Uzunov B. A. 2016 Checklist of macromycetes, observed during the last 20 years (1994-2014) in the Sofia city park Borisova Gradina (Bulgaria) – Annual of Sofia University "St. Kliment Ohridski", Faculty of Biology, Book 2 Botany 99: 101–104.

Received 23 February 2017