

New data about macrofungal diversity in Bulgaria

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Received: July 04, 2018 ▷ Accepted: August 06, 2018

Abstract. Five macrofungi are reported for the first time from Bulgaria. One species (*Podophacidium xanthomelum*) belongs to *Ascomycota* and four species (*Arrhenia obatra*, *A. sphagnicola*, *Marasmius curreyi*, and *Thelephora penicillata*) belong to *Basidiomycota*. *Podophacidium* (*Helotiales*) is new to the country at generic level. Descriptions and illustrations of the studied specimens are provided. New localities of about twelve macrofungi are also reported. Five of them (*Arrhenia lobata*, *A. onisca*, *A. spathulata*, *Guepinia helvelloides* and *Hericium flagellum*) are of high conservation value.

Key words: *Agaricomycetes*, *Ascomycota*, *Basidiomycota*, Bulgaria, *Helotiales*, *Pezizales*

Introduction

In the last two decades, data on the species diversity, distribution and ecology of macrofungi have been collected intensively by professional and amateur mycologists on the territory of Bulgaria. The new chorological information is important for fungal conservation, red-listing, mapping, and monitoring of fungi, both at national and European level. Comprehensive checklists of ascomycetous (*Helotiales* and *Pezizales*) and basidiomycetous macrofungi in Bulgaria have been summarized by Assyov & Denchev (2004), Dimitrova & Gyosheva (2008, 2009, 2010), Denchev & Assyov (2010) up to 2010.

The aim of this study is to contribute to the macrofungal diversity of Bulgaria by reporting new taxa for the country and adding new chorological information on rare species and species of high conservation value.

Material and methods

The macromorphological characters of the studied specimens were described on the basis of fresh material. Fresh and air-dried specimens were examined microscopically after rehydration in tap water. Micromorphological characters were inspected in water, 5% KOH and aqueous cotton blue, under Olympus BX-41, Amplival, Boeco-180/T/SP LM and Nikon Eclipse 50i. Amyloidity was tested with Melzer's reagent. All measurements are given in minimum and maximum values. Spore size was measured in water from 30 spores (ascospores or basidiospores). The specimens were collected during 2015–2018, in different regions of Bulgaria. Their identification was confirmed after Moser (1963, 1983), Dennis (1968), Breitenbach & Kränzlin (1981, 1991), Ryman & Holmåsén (1992), Courtecuisse & Duhem (1995), Hansen & Knudsen

(2000), Krieglsteiner (2000a, b; 2001), Phillips (2006), and Buczacki & al. (2012). The threat status of the species follows the *Red List of Fungi in Bulgaria* (Gyosheva & al. 2006). Microphotographs were taken with Olympus E330, Canon PS and Nikon digital cameras. Macrophotographs were taken *in situ*. The studied specimens are kept in the Mycological Collection of the Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences, Sofia (SOMF).

Results

Description of the new species

Ascomycota

Leotiomyces

***Podophacidium xanthomelum* (Pers. : Fr.) Kavina**, Crypt Czech. Exicc., No. 217 (1936) (Plate I, Figs 1-2).

Ascomata 1–3 mm in diameter, irregularly disc-shaped, sessile, hymenium smooth, sulphur-yellow, yellow, yellow-olivaceous, margin dentate, dark-brown to brown-blackish, outside scurfy, brown-blackish to almost black. **Asci** 110–135 × 8–11 µm, cylindrical to clavate, 8-spored, with amyloid pore. **Paraphyses** up to 2–3 µm at the top, filiform, slender, branched towards the apex. **Ascospores** 11.5–13.5 (–15) × (–4.5) 5–6 µm, ellipsoid to fusiform, smooth, hyaline, biguttulate, uniseriate in the ascus.

Habitat. Gregarious in coniferous forests, on soil, often grows among mosses or plant debris (bark, needles), in summer-autumn, a Rare species (Seaver 1951; Moser 1963; Dennis 1968; Breitenbach & Kränzlin 1981; Hansen & Knudsen 2000).

Specimen examined. Western Rhodopi Mts, Dabrash ridge, E-SE from peak Mandrenski, in a spruce forest, single cluster of more than 40 ascomata, on soil, among *Plagiothecium denticulum* var. *undulatum* R. Ruthe ex Geh., ca 1636 m a.s.l., 24.08.2017, leg. R. Natcheva, det. M. Gyosheva (SOMF 29831).

General distribution. *Podophacidium xanthomelum* was reported so far from northern, central and western parts of Europe, and from North America (Seaver 1951; Raitviir & Järv 1997; Prongué & al. 2004; Kirk & al. 2008; Mihál & al. 2011).

Note. *Podophacidium* Niessl is a genus of the family *Dermataceae* Fr. (*Helotiales*, *Leotiomyces*, *Ascomycota*). Only two species are known from the

genus worldwide: *Podophacidium pulvinatum* Raitv. & Järv and *P. xanthomelum* (Kirk & al. 2008). So far, both representatives of the genus were not known from Bulgaria. Recently *P. xanthomelum* has been recorded in Slovenia as a saprotroph on spruce needles (Mihál & al. 2011). *P. xanthomelum* is well distinguished from *P. pulvinatum* macroscopically – by the colour and denticulate margin of ascomata, and microscopically – by the size of asci, branched paraphyses, and shorter and wider ascospores (Raitviir & Järv 1997).

Basidiomycota

Agaricomycetes

***Arrhenia obatra* (J. Favre) Redhead, Lutzoni, Moncalvo & Vilgalys**, Mycotaxon 83: 47 (2002) (Plate II, Fig. 8).

Pileus 0.5–0.8 (–1) cm in diameter, convex, slightly depressed in the center, hygrophanous, fibrillose-floccose, dark-brown, black-brown to gray-brown in old specimens, margin radially striate, inrolled. **Gills** broad, distant, decurrent, brownish to blackish. **Stipe** 1–1.5 × 0.1–0.2 cm, central, cylindrical, smooth, concolorous with the pileus. **Context** thin, whitish. Smell indistinctive. **Basidia** clavate, 4-spored. **Basidiospores** 6.8–7.5 (–8) × 4.5–6.5 µm, broadly ellipsoid, smooth, hyaline. **Pileipellis** consisting of brown incrustated parallel hyphae, up to 8–10 µm across, septa with clamp connections.

Habitat. Solitary and in groups, on sandy soil, often in peaty habitats and marshy areas, among mosses and dwarf willows, in the alpine zone of the mountains, in summer (Breitenbach & Kränzlin 1991; Courtecuisse & Duhem 1995).

Specimen examined: Rila Mts, below peak Yanchov Vrah, on a temporary drying part of a *Sphagnum* dominated poor fen, on sandy soil, among *Polytrichum* sp. and *Bryum* sp., ca 2398 m a.s.l., 15.07.2015, leg. R. Natcheva & M. Gyosheva, det. M. Gyosheva (SOMF 29679).

General distribution. The species has been reported so far from the high mountain areas of North, Central and West Europe. Rare species (Breitenbach & Kränzlin 1991; Courtecuisse & Duhem 1995).

***Arrhenia sphagnicola* (Berk.) Redhead, Lutzoni, Moncalvo & Vilgalys**, Mycotaxon 83: 48 (2002) (Plate II, Fig. 10).

Plate I

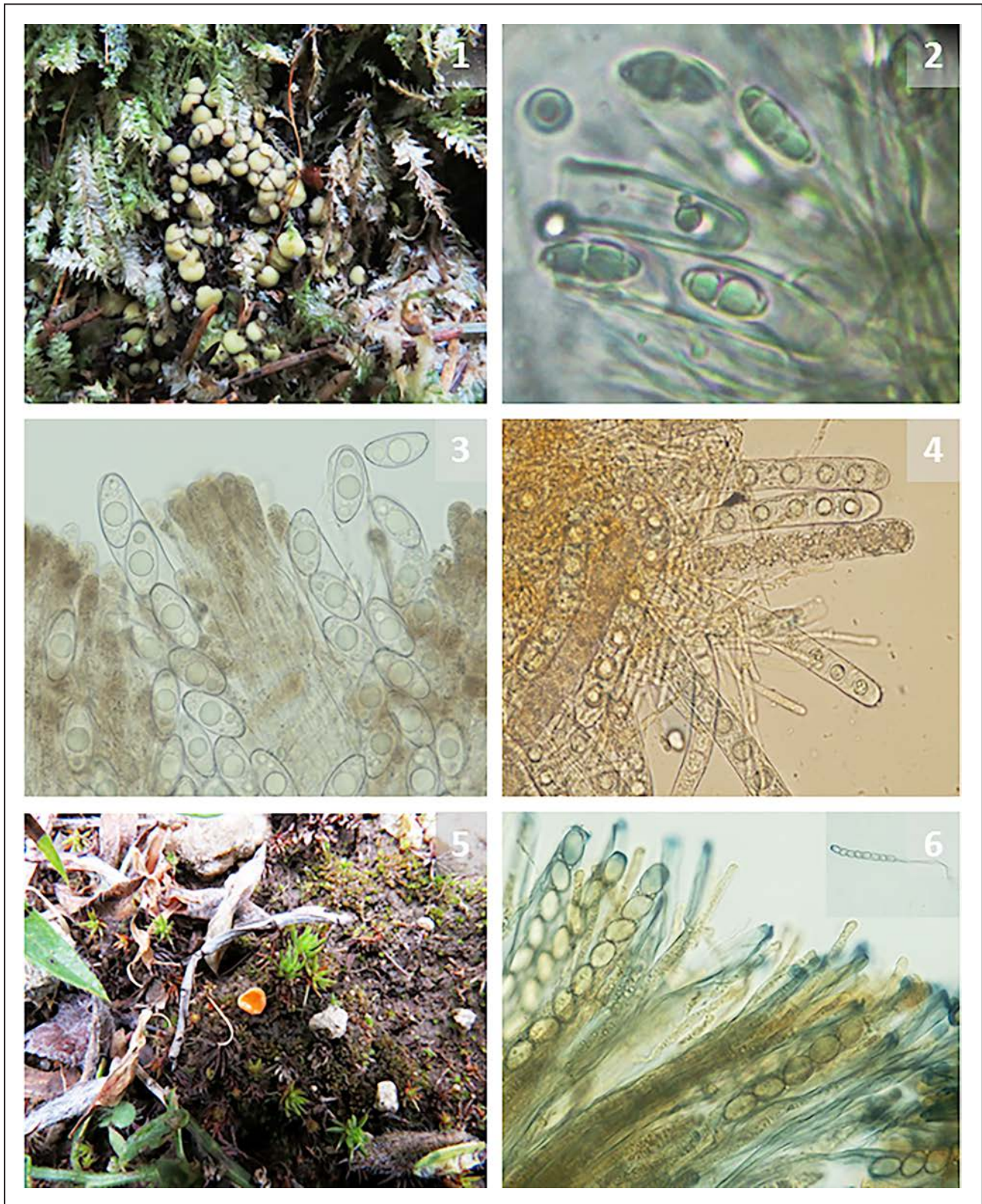


Fig. 1. *Podophaecidium xanthomelum* – ascomata; **Fig. 2.** *Podophaecidium xanthomelum* – ascospores; **Fig. 3.** *Gyromitra martinii* – asci, ascospores and paraphyses; **Fig. 4.** *Lamprospora crechqueraultii* – asci, ascospores and paraphyses; **Fig. 5.** *Neottiella rutilansii* – ascomata; **Fig. 6.** *Peziza domiciliana* – asci, ascospores and paraphyses in Melzer's reagent.

Plate II



Fig. 7. *Arrhenia lobata* – basidiomata; Fig. 8. *Arrhenia obatra* – basidioma; Fig. 9. *Arrhenia onisca* – basidioma; Fig. 10. *Arrhenia sphagnicola* – basidioma.

Pileus 1–2.5 (3) cm in diameter, initially convex and slightly depressed in the center, subsequently infundibuliform, hygrophanous, ochre-brownish, light-brown, beige-brown, with dark-brown scales, margin involute for a long time. **Gills** broad, decurrent, ochraceous to pale-brownish. **Stipe** 2–5 × 0.3–0.5 cm, cylindric, smooth, ochre-brown, tomentose towards the base. **Context** thin, pale-brownish. Smell indistinctive. **Basidia** clavate, 4-spored, with basal clamp. **Basidiospores** 8–12.5 × 4–5 μm, ellipsoid to cylindric, variable, smooth, hyaline. **Pileipellis** consisting of brown, incrustated, parallel to irregular hyphae, septa with clamp connection.

Habitat. Solitary or in small groups, among *Sphagnum* spp., in peaty habitats and in damp coniferous forests

(spruce, pine) in the mountains, in summer to autumn (Breitenbach & Kränzlin 1991; Ryman & Holmåsén 1992; Courtecuisse & Duhem 1995; Krieglsteiner 2001; Stasińska 2011; Buczacki & al. 2012).

Specimen examined. Central Rhodopi Mts, Chairski Ezera Lakes: Kadirev Gyol locality, solitary among peat mosses and *Lycopodiella inundata* (L.) Holub, ca 1370 m a.s.l., 19.09.2017, leg. & det. M. Gyosheva (SOMF 29794).

General distribution. *Arrhenia sphagnicola* has been reported from North, Central, West, and East Europe, North America and Asia. A widespread, but seldom recorded species (Breitenbach & Kränzlin 1991; Ryman & Holmåsén 1992; Courtecuisse & Duhem 1995; Krieglsteiner 2001; Stasińska 2011; Buczacki & al. 2012).

Marasmius curreyi Berk. & Broome, Ann. Mag. Nat. Hist. 3: 209 (1879) (Plate III, Figs 12-13).

Pileus up to 0.4–0.5 cm in diameter, initially convex to plano-convex, depressed in the center to umbilicate, sulcate-striate, reddish-brown, rust-brown, pink-brownish, orange-brown, with dark-brown center, finely tomentose, margin crenulate. **Gills** distant, broad, broadly adnate to a collarium, whitish, cream-whitish. **Stipe** to 3 cm long and 0.2 cm thick, filiform, smooth, brown-blackish, paler at the apex. **Context** very thin, membranous, creamish. Smell indistinctive. **Basidia** clavate, 4-spored, with basal clamp. **Basidiospores** 7.5–10 × 4–5–5 µm, ellipsoid to elongate-ellipsoid, smooth, hyaline. **Cheilocystidia** clavate, pyriform. **Pileipellis** consisting of clavate, pyriform, verrucose, broom-like cells, thick-walled, brownish pigmented.

Habitat. Solitary or in small groups, on dead stems and culms, mainly from *Poaceae* and *Cyperaceae*, in meadows, June–October (Courtecuisse & Duhem 1995; Krieglsteiner 2001; Antonín & Buyck 2006; Buczacki & al. 2012).

Specimen examined. Mt Sredna Gora, along the road to Eledzhik Hunting Lodge, in a meadow, at the edge of a temporary pool, one basidioma on a dead grass stem, ca 933 m a.s.l., 18.05.2018, leg. R. Natcheva, det. M. Gyosheva (SOMF 30003).

General distribution. *Marasmius curreyi* has been reported from Europe, North and South America, Africa, and Asia. The species is widespread, but seldom recorded (Courtecuisse & Duhem 1995; Krieglsteiner 2001; Antonín & Buyck 2006; Buczacki & al. 2012).

Thelephora penicillata (Pers. : Fr.) Fr., Syst. Mycol. 1: 434 (1821) (Plate III, Fig. 15).

Basidiomata up to 2–3 cm high and 2–3 cm wide, coral-like, cushion-like, with numerous erect branches, pointed topward, finger-like, whitish for a long time, subsequently purple-brownish with whitish ends, smooth or finely granular. **Stipe** very short, purple-brown. **Flesh** very thin, fibrous, cottony, whitish. Smell indistinctive. **Basidia** cylindrical-clavate, with basal clamp. **Basidiospores** 7–9 (–10) × 5–7 µm, subglobose to irregularly ellipsoid, spinose, pale-brown, with drops. **Cystidia** absent.

Habitat. In groups, on damp soil, among leaf litter, mosses, grasses, or on dead wood, in deciduous (alder, beech, hornbeam, lime), mixed or seldom in coniferous forests (spruce, pine), in August–November (Ryman

& Holmåsén 1992; Krieglsteiner 2000a; Phillips 2006; Buczacki & al. 2012).

Specimen examined. Western Balkan Range, Petrohan Pass, in a beech forest, near a brook, a single group among *Pellia neesiana* (Gottsche) Limpr. and *Eurhynchium angustirete* (Broth.) T.J.Kop., ca 1377 m a.s.l., 31.08.2017, leg. R. Natcheva, det. M. Gyosheva (SOMF 30004).

General distribution. The species is known from North, West, Central and East Europe. A Rare species (Ryman & Holmåsén 1992; Krieglsteiner 2000a; Phillips 2006; Buczacki & al. 2012).

New localities of macrofungi in Bulgaria

Asconycota

Pezizomycetes

Gyromitra martinii Donaldini & Astier (Plate I, Fig. 3).

Specimen examined. Vitosha region, Mt Plana, near Iskar Dam, 2 km S from Shtarkelovo Gnezdo locality, a single ascoma on soil, among mosses, in a moist floodplain with *Populus nigra* L. and *Salix* spp., ca 822 m a.s.l., 29.04.2018, leg. A. Lambevsk-Hristova, det. M. Gyosheva (SOMF 30005).

The species has been reported earlier only once from Bulgaria by Slavova & Assyov (2017), without detailed chorological data.

Note. Ascospores of our collection are 30–37.5 (–39.5) × 12.5–15 µm, ellipsoid to fusiform, hyaline, with three guttules (one large and two smaller), finely warty-reticulate and with appendages on both ends when mature.

Lamprospora crechqueraultii (P. Crouan & H. Crouan) Boud. (Plate I, Fig. 4).

Specimen examined. Mt Western Sredna Gora, near the Eledzhik Hunting Lodge, Shindera locality, on a dirt road in a beech forest, in groups on loamy-sandy soil, among bryophyte protonemata, ca 1026 m a.s.l., 18.05.2018, leg. R. Natcheva, det. M. Gyosheva (SOMF 30006).

Note. This species has been reported only once from Bulgaria as *L. crechqueraultii* var. *macrantha* Boud. more than 40 years ago for Mt Vitosha, from a peat bog, above Bor Chalet (Alexandrov 1971; Dimitrova & Gyosheva 2009).

Neottiella rutilans (Fr.) Dennis (Plate I, Fig. 5).

Specimen examined. Znepole region, Mt Milevska, above Treklyano village, in a meadow, a small group

Plate III

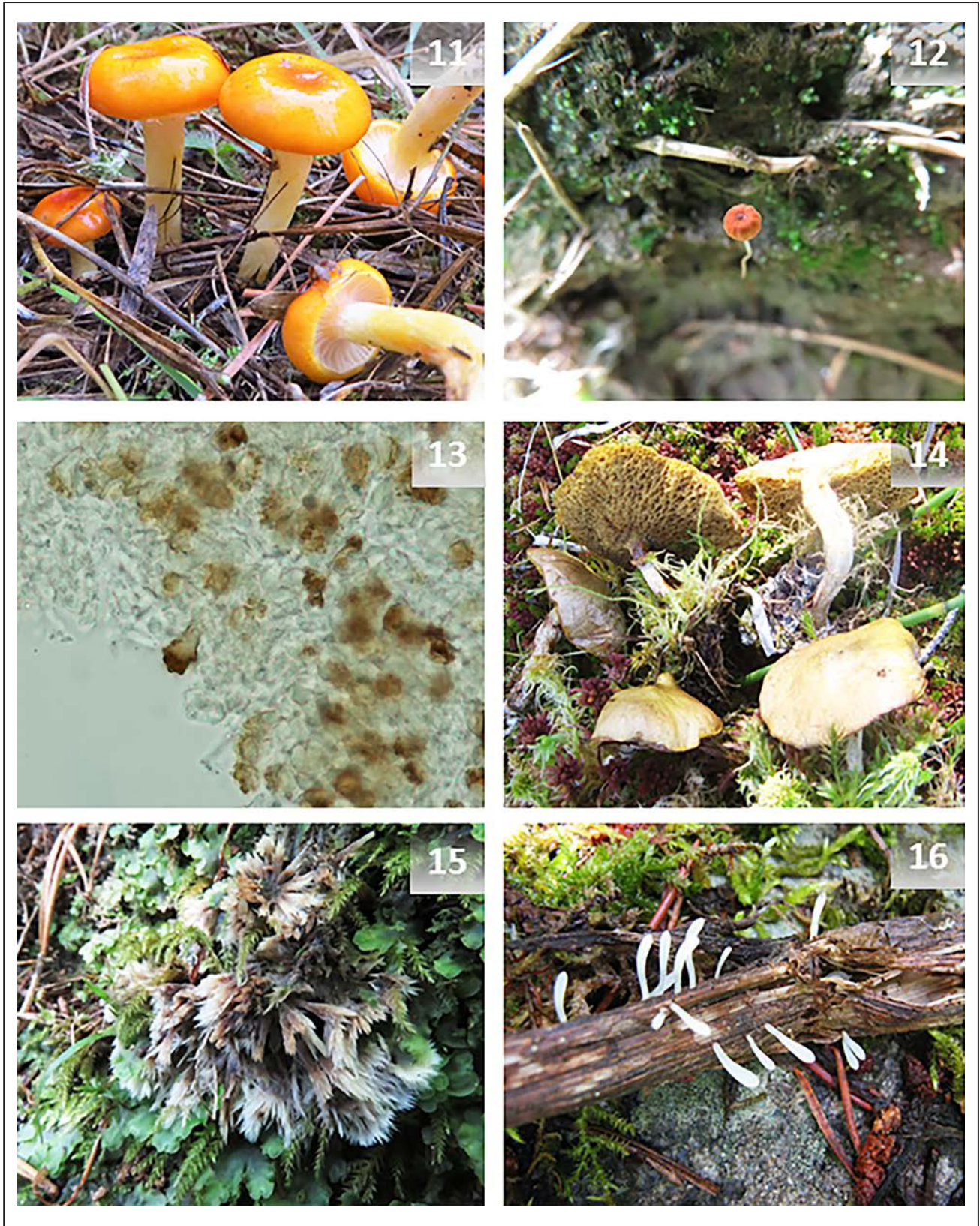


Fig. 11. *Hygrophorus hypothejus* var. *aureus* – basidiomata; Fig. 12. *Marasmius curreyi* – basidioma; Fig. 13. *Marasmius curreyi* – cells of pileipellis; Fig. 14. *Suillus flavidus* – basidiomata; Fig. 15. *Thelephora penicillata* – basidiomata; Fig. 16. *Typhula uncialis* – basidiomata.

on bare sandy soil, among *Polytrichum piliferum* Hedw., ca 1630 m a.s.l., 10.07.2018, leg. R. Natcheva, det. M. Gyosheva (SOMF 30014).

This species has been reported only once from Bulgaria, for the Central Balkan Range, near Tazha Chalet (Fakirova & Dimitrova 1999).

***Peziza domiciliana* Cooke** (Plate I, Fig. 6).

Specimen examined. Sofia region, Sofia city, near Gornobanski Pat Boulevard, a small group on soil and sawdust among paving stones, on a pathway, in a garden, ca 610 m a.s.l., a.s.l., 02.05.2018, leg. I. Apostolova, det. M. Gyosheva & A. Lambevska-Hristova (SOMF 30007).

Note. The fungus has been encountered on sandy soil, sandstone walls, sawdust, masonry, often in urban areas (Breitenbach & Kränzlin 1981; Hansen & Knudsen 2000). It has been reported earlier for Bulgaria only from Mt Western Sredna Gora and from the Central Rhodopi Mts (Dimitrova & Gyosheva 2009).

Basidiomycota

Agaricomycetes

***Arrhenia lobata* (Pers. : Fr.) Kühner & Lamoure ex Redhead** (Plate II, Fig. 7).

Specimen examined. Rila Mts, Rilomanastirska Gora Nature Reserve, in a poor fen in the valley of river Gyolska, near Manastirska Mandra locality, a single group among *Warnstorfia exannulata* (Schimp.) Loeske, ca 2170 m a.s.l., 07.09.2018, leg. R. Natcheva & M. Gyosheva, det. M. Gyosheva (SOMF 28533).

An Endangered species. In Bulgaria, it is known only from Mt Vitosha and Mt Strandzha (Gyosheva 2015a).

Note. *Arrhenia lobata* grows in association with mosses (*Aulacomnium* spp., *Cratoneuron* spp., *Drepanocladus* spp., *Hypnum* spp., but never with *Sphagnum* spp.) in peat bogs and other wet habitats in the high mountains (Breitenbach & Kränzlin 1991; Ryman & Holmåsén 1992; Courtecuisse & Duhem 1995; Krieglsteiner 2001; Buczacki & al. 2012). Therefore, the report of the species on soil in Mt Strandzha at a much lower elevation (Barzakov 1932) is doubtful.

***Arrhenia onisca* (Fr. : Fr.) Redhead, Lutzoni, Moncalvo & Vilgalys** (Plate II, Fig. 9).

Specimen examined. Western Rhodopi Mts, Chairski Lakes: lake Magichesko, solitary and in small groups, among peat mosses, under spruce and pine, ca

1420 m a.s.l., 19.09.2017, leg. & det. M. Gyosheva (SOMF 30008).

Note. The species has been reported so far in Bulgaria from the Western and Eastern Balkan Range, and from the Eastern Rila Mts (Denchev & Assyov 2010). Along with *A. gerardiana* (Peck) Elborne, *Arrhenia onisca* were mentioned as sphagnicolous members of the raised bogs (Vašutová & al.2013).

A Data Deficient fungus in Bulgaria (Gyosheva & al. 2006). Further studies are needed into its distribution and ecology in the country.

***Arrhenia spathulata* (Fr. : Fr.) Redhead**

Specimen examined. Thracian Lowland, Bunardzhika City Park in Plovdiv (Bunardzhika Hill), a small group among *Syntrichia ruralis* (Hedw.) F.Webber et D. Mohr., on granite rock, ca 220 m a.s.l., 12.12.2017, leg. R. Natcheva, det. M. Gyosheva, (SOMF 30009).

A Vulnerable species. In Bulgaria, it is known from the Danubian Plain, Central Balkan Range (Balgarka Nature Park), Mt Vitosha, and the Valley of River Struma (Denchev & Assyov 2010; Gyosheva & al. 2016).

***Guepinia helvelloides* (DC. : Fr.) Fr.**

Specimen examined. Western Rhodopi Mts, near the road to Chairski Lakes, in the valley of river Chairska near the inflow of river Kamarsko Dere, several basidiomata, on a decaying fir trunk in a mixed forest (spruce, silver fir, and beech), ca 1100 m a.s.l., 25.06.2018, leg. G. Gospodinov, det. M. Gyosheva (SOMF 30013).

An Endangered species in Bulgaria. The fungus has been reported so far as *Tremiscus helvelloides* (DC. : Fr.) Donk from the Pirin Mts, Rila Mts and Rhodopi Mts. The known locality in Western Rhodopi Mts is in the Beglika Nature Reserve (Gyosheva 2015c).

***Hericium flagellum* (Scop.) Pers.**

Specimen examined. Rila Mts, above Borovets Resort, near the road to Sitnyakovo Hunting Lodge, a large group on dead wood, in a coniferous forest (spruce and fir), ca 1450 m a.s.l., 23.09.2016, leg & det. M. Gyosheva (SOMF 30012).

An Endangered species in Bulgaria. It has been reported so far only from the Pirin and Rila Mts. The known localities in the Rila Mts are near Malyovitsa Chalet, in Parangalitsa Nature Reserve, and near Rila Monastery (Gyosheva 2015b).

Hygrophorus hypotheus var. *aureus* (Arrh.) Imler (Plate III, Fig. 11).

Specimen examined. Znepole region, above Gorna Dikanya village, a group among pine needles, in plantation of *Pinus nigra* Arn., 07.11.2017, leg. A. Grozdanov, det. M. Gyosheva (SOMF 30010).

Note. This fungus has been so far reported in Bulgaria as *Hygrophorus aureus* Arrh. from the Western Balkan Range, Mt Western Sredna Gora and Western Rhodopi Mts (Barzakov 1929; Hinkova & Drumeva 1978; Dimcheva & al. 1992). All specimens have been collected in pine forests and plantations of *Pinus sylvestris* L. and *P. nigra*.

Suillus flavidus (Fr. : Fr.) J. Presl (Plate III, Fig. 14).

Specimen examined. Western Rhodopi Mts, Shiroka Polyana locality, in three small groups among *Sphagnum* spp., *Vaccinium vitis-idaea* L. and *Bruckenthalia spiculifolia* (Salisb.) Rchb., in a coniferous bog woodland, under *P. sylvestris*, ca 1530 m a.s.l., 20.09.2017, leg. & det. M. Gyosheva (SOMF 30011).

Note. *Suillus flavidus* has been reported only once in the country from Rila Mts, Skakavitsa Reserve, in a wet spot near river Skakavitsa, among peat mosses, under *P. sylvestris* (Gyosheva & Denchev 2000). This species is a typical inhabitant of the mountain bog coniferous forests and scrubs, more often under *P. sylvestris* and *P. mugo* Turra (Ryman & Holmåsén 1992; Courtecuisse & Duhem 1995; Krieglsteiner 2000b; Buczacki & al. 2012). Further studies are needed into its distribution and ecology in Bulgaria. It should be evaluated at national level, according to IUCN criteria in the next update of the *Red List of Fungi in Bulgaria*.

Typhula uncialis (Grev.) Berthier (Plate III, Fig. 16).

Specimen examined. Rila Mts, Central Rilski Reserve, along the trail to Zhaltoezeren Cirques, on the ground, in groups on dead plant stems, ca 2049 m a.s.l., 02.07.2015, leg. D. Stoykov & R. Natcheva, det. M. Gyosheva (SOMF 29680).

Note. The fungus is known from a single locality in Bulgaria: Central Rhodopi Mts, Pamporovo, on dead stems of *Cirsium appendiculatum* Griseb., 26. 07. 1974, leg. & det. Ts. Hinkova (SOMF 8814). The specimen was reported by Denchev & al. (2006), without chorological data.

Conclusion

This paper reports five species of macrofungi for the first time from Bulgaria. One species belongs to *Ascomycota* and four species belong to *Basidiomycota* (*Agaricomycetes*). *Podophacidium xanthomelum* (*Leotiomyces*, *Helotiales*) is reported for the first time at generic level in the country. Furthermore, new localities of another twelve macrofungi (eleven species and one variety) were also recorded. *Arrhenia lobata* – Endangered (EN), *A. onisca* – Data Deficient (DD), *A. spathulata* – Vulnerable (VU), *Guepinia helvelloides* and *Hericium flagellum* – Endangered (EN), are of high conservation value and are included in the *Red List of Fungi in Bulgaria*. *Arrhenia lobata*, *Guepinia helvelloides* and *Hericium flagellum* are included in the *Red Data Book of the Republic of Bulgaria* (Gyosheva 2015a,b,c).

Acknowledgements. The work of M. Gyosheva was held within the framework of the project “Taxonomy, conservation and sustainable use of fungi”. Most materials were collected by M. Gyosheva and R. Natcheva within the frameworks of “Update of the Management Plan for the Rila National Park (2015)” project and “Conservation of rare and endangered plant species in Bulgaria through implementation of activities from the approved Action Plans”, financed by the Ministry of Environment and Waters. The authors extend their thanks to I. Apostolova, G. Gospodinov (IBER, Sofia) and A. Grozdanov for providing the single specimens cited above. The authors are also grateful to N. Hristova for her assistance in preparation of some of the microphotographs and to D. Stoykov for providing the microphotograph of *P. xanthomelum*.

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