

## Contributions to the Bulgarian lichenicolous mycota – an annotated checklist and new records

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**Abstract:** SHIVAROV, V. V., VARGA, N., LŐKÖS, L., BRACKEL, W. v., GANEVA, A., NATCHEVA, R. & FARKAS, E. 2021. Contributions to the Bulgarian lichenicolous mycota – an annotated checklist and new records. – *Herzogia* 34: 142–153.

An annotated checklist of 45 taxa of lichenicolous fungi from Bulgaria is presented. *Arthonia parietinaria*, *Athelia arachnoidea*, *Cercidospora caudata*, *C. epipolytropa*, *Didymocyrtis cladoniicola*, *Endococcus verrucosus*, *Illosporiopsis christiansenii*, *Lichenocodium erodens*, *L. lecanorae*, *Pronectria subimperspicua*, *Pyrenochaeta xanthoriae* and *Stigmidium tabacinae* are reported for the first time from Bulgaria. To assess the expected diversity of lichenicolous fungi in Bulgaria, we applied a Lichenicolous Index (LI) to compare with other regions with better knowledge about lichenicolous mycota. At the current stage of the known number of lichens in Bulgaria we expect between 225 and 315 lichenicolous fungi for the country.

**Zusammenfassung:** SHIVAROV, V. V., VARGA, N., LŐKÖS, L., BRACKEL, W. v., GANEVA, A., NATCHEVA, R. & FARKAS, E. 2021. Beiträge zu den bulgarischen lichenicolous Mycota – eine kommentierte Checkliste und neue Funde. – *Herzogia* 34: 142–153.

Eine kommentierte Checkliste mit 45 Taxa lichenicoler Pilze aus Bulgarien wird vorgelegt. *Arthonia parietinaria*, *Athelia arachnoidea*, *Cercidospora caudata*, *C. epipolytropa*, *Didymocyrtis cladoniicola*, *Endococcus verrucosus*, *Illosporiopsis christiansenii*, *Lichenocodium erodens*, *L. lecanorae*, *Pronectria subimperspicua*, *Pyrenochaeta xanthoriae* und *Stigmidium tabacinae* werden erstmals aus Bulgarien gemeldet. Um die zu erwartende Diversität lichenicoler Pilze in Bulgarien abzuschätzen, wandten wir den Lichenicolous Index (LI) an. Dieser erlaubt einen Vergleich mit bezüglich flechtenbewohnender Pilze besser bekannten Regionen. Beim derzeitigen Wissen über die Zahl der Flechten in Bulgarien erwarten wir zwischen 225 und 315 flechtenbewohnende Pilze für das Land.

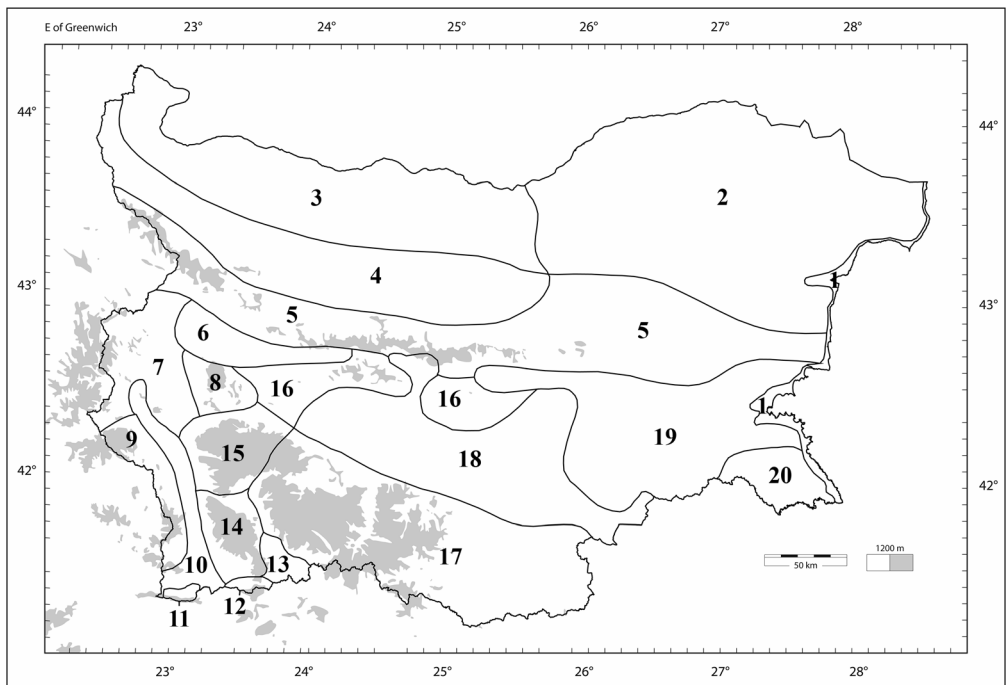
**Key words:** Biodiversity, Bulgaria, distribution, lichenicolous fungi.

### Introduction

The lichenicolous fungi of Bulgaria are still inadequately known and studied even after almost a century from the first published country record of this group (SZATALA 1929). Up to now several papers were published with records of lichenicolous fungi from Bulgaria (e.g. HAFELLNER 1987, 1995, 2018, POPNIKOLOV 1931, 1937, POPNIKOLOV & ZHELEZOVA 1964, VĚZDA 1973, 1983). In their catalogue MAYRHOFER et al. (2005) reported nine lichenicolous species. An annotated checklist of forty-five taxa is provided based on all available literature sources and specimens. Twelve species are reported for the first time from Bulgaria.

## Materials and methods

The presented species were studied on the basis of specimens and/or information from literature for their occurrence in Bulgaria. The studied specimens are deposited in the Mycological Collection of the Institute of Biodiversity and Ecosystem Research, Sofia (SOMF), Herbarium of Faculty of Biological Sciences at the University of South Bohemia in České Budějovice (CBFS), the Botanical Department of the Hungarian Natural History Museum, Budapest (BP), and in the private herbarium of W. v. Brackel (hb Brackel). MAYRHOFER et al. (2005) reported specimens of lichenicolous fungi from Bulgaria kept in the Herbarium of St. Kliment Ohridski Sofia University (SO). The specimens were not found during a visit of the first author in the Herbarium (SO) in 2014 with main focus on *Muellerella*. There was no additional access for in-depth search in the collection for this study. The acronyms of collections are given only for revised specimens for the purpose of the study. If there was more than one host, the localities and lichens are given with corresponding numbers. The terminology for distribution patterns follows the Bulgarian floristic regions (Fig. 1). The taxonomic concept follows NIMIS et al. (2018) for lichens, and DIEDERICH et al. (2018) for lichenicolous fungi. Only obligately lichenicolous fungi are included, except for *Athelia arachnoidea*, a corticioid basidiomycete, which parasites epiphytic lichens and invades also mosses, algae, and leaf litter (JÜLICH 1972, YURCHENKO 2006). Lichenicolous species with known lichenized stage are not listed here. If the occurrence of a lichenized stage was doubtful, we followed LAWREY & DIEDERICH (2018). Routine mycological methods were used for the identification of species (SMITH et al. 2009).



**Fig. 1.** Map of Bulgaria with floristic regions and mountain areas over 1200m. Floristic regions: 1 – Black Sea coast, 2 – Northeast Bulgaria, 3 – Danubian Plain, 4 – Forebalkan, 5 – Balkan Range, 6 – Sofia region, 7 – Znepole region, 8 – Vitosha region, 9 – West Frontier Mts, 10 – Valley of River Struma, 11 – Mt Belasitsa, 12 – Mt Slavyanka, 13 – Valley of River Mesta, 14 – Pirin Mts, 15 – Rila Mts, 16 – Mt Sredna Gora, 17 – the Rhodopes, 18 – Thracian Lowland, 19 – Toundzha Hilly Country, 20 – Mt Strandzha.

All measurements were made in water. 10% potassium hydroxide was used for better observation of taxonomically important structures, and applied before iodine reagents to identify different types of amyloidity. The measurements of conidia in *Didymocyrtis cladoniicola* are given as:  $(\min - \{\bar{x} - SD\} - \bar{x} - \{\bar{x} + SD\} - \max)$ , where min and max are the extreme values,  $\bar{x}$  the arithmetic mean, and SD the corresponding standard deviation; n represents the number of measurements. New records for the country and new records for the floristic regions are indicated by asterisks (\*).

To assess the expected diversity of lichenicolous fungi in Bulgaria, we applied the Lichenicolous Index (LI) introduced by ZHURBENKO (2007). It is defined as the taxa of lichenicolous fungi per taxa of lichens within a region (lichenicolous fungi/lichens).

## Results and discussion

A total of 45 taxa is listed here, which is five times more compared to the Catalogue of the lichenized and lichenicolous fungi in Bulgaria (MAYRHOFER et al. 2005). Even with this increase of studies on this group in Bulgaria during the last sixteen years, we are aware that it is far from complete. For Bulgaria the LI at present is 0.040, whereas in well investigated areas it may be up to 0.25 (see Table 1) and presumably this is far from being the end. It is obvious that a much higher number of lichenicolous fungi than currently known can be expected for Bulgaria, maybe 5–7 times as high. Given the fact that also the number of lichens known from Bulgaria will increase distinctly with further studies, the factor 7 is more probable. We can expect between 225 and 315 lichenicolous fungi at the current stage of known lichenized mycota in Bulgaria.

## List of taxa

*Abrothallus parmeliarum* (Sommerf.) Arnold

**Host:** *Parmelia saxatilis* (L.) Ach.

Mt Belasitsa, below Kongur Peak, 1200m, sub *Abrothallus smithii* Tul. (POPNIKOLOV 1937); Pirin Mts, above Sugarevo village, 1000m, on granite rock, 5 August 1983, leg. I. Pišút (VĚZDA 1983).

*Arthonia diploiciae* Calatayud & Diederich

**Host:** *Diploicia canescens* (Dicks.) A.Massal.

**Tab. 1.** Lichenicolous Index (LI), worldwide, in two well studied regions in Central Europe, in nearby countries, and in Bulgaria.

Country / Region	Lichenicolous fungi	Lichens	LI (Lichenicolous index)	Source (Lichenicolous fungi / Lichens)
World	2.000	19.387	0.103	DIEDERICH et al. 2018 / LÜCKING et al. 2016
Bavaria (Germany)	399	1.624	0.246	BRACKEL 2019
Belgium, Luxembourg & N France	201	930	0.216	DIEDERICH & SÉRUSIAUX 2000
Italy	492	2.565	0.192	BRACKEL 2016 / NIMIS 2016
Greece	64	1.353	0.047	ARCADIA 2016
Romania	40	1194	0.033	own compilation, CIURCHEA 2007
Bulgaria	45	c. 1.120*	0.040	this paper

\*Approximate number of lichens in Bulgaria based on published and unpublished data.

Black Sea coast, 5 km south of the town of Sozopol, 3–10 m, on andesitic rocks in the littoral zone, 20 September 1978, leg. A. Vězda (HAFELLNER 1995).

*Arthonia molendoi* (Frauenf.) R.Sant.

**Host:** *Xanthoria elegans* (Link) Th.Fr.

Rila Mts, above Rilski ezera chalet, in SW direction, 42.22028°N/23.32000°E, c. 2140 m, on rock outcrops, amphibolite, 25 May 2010, leg. A. Atanasova & H. Mayrhofer (HAFELLNER 2018).

*Arthonia oligospora* Vězda

**Hosts:** *Lecania nylanderiana* A.Massal., *Myriolecis crenulata* (Hook.) Śliwa et al.

Black Sea coast, N of the town of Balchik, in the vicinity of natural phenomenon Balchishka Tuzla, on rocky shore, 10 m, 19 July 1971, leg. A. Vězda (VÉZDA 1973).

**Note:** An obligately lichenicolous fungus described from Bulgaria. The species was referred as lichenized fungus by MAYRHOFFER et al. (2005), but it is clear from the protologue that it is an obligately lichenicolous fungus. Known in Bulgaria only from its type locality (i.e. the above-mentioned locality at Balchik).

\**Arthonia parietinaria* Hafellner & Fleischhacker

**Host:** *Xanthoria parietina* (L.) Th.Fr.

Znepole region, Choklyovo blato marsh, on twigs of *Salix fragilis* L., 42.39907°N/22.81657°E, 865 m, 3 June 2019, leg. V. Shivarov (SOMF).

**Note:** In Bulgaria the species is locally abundant in the Choklyovo blato marsh. It is possible that the species is facilitated by the higher humidity and organic load in this type of habitats. It is easily observed in the field due to numerous black apothecia. For more information and photographs of the species see FLEISCHHACKER et al. (2016).

*Arthonia varians* (Davies) Nyl.

**Hosts:** *Lecanora rupicola* (L.) Zahlbr. (1), *Protoparmeliopsis muralis* (Schreb.) M.Choisy (2)

Vitosha region, surroundings of Studena village, on sandstones, 800 m (1, 2) (POPNIKOLOV 1931); Valley of river Struma, railway station Levunovo, near the Struma river, 100 m (1) (POPNIKOLOV 1937); Mt Belasitsa, near Kongur Peak, 1500 m (1) (POPNIKOLOV 1937).

**Note:** POPNIKOLOV (1931) mentioned that the fungus is common on the southern slopes of Mt Vitosha, and locally abundant on sandstones between Studena and Krapets villages, the latter is currently located in the under-water area of the Studena Dam water reservoir. We believe that the report of *Arthonia varians* on *Protoparmeliopsis muralis* most probably is based on a misidentified specimen of *Arthonia protoparmeliopseos* Etayo & Diederich, which is more common on this host.

\**Athelia arachnoidea* (Berk.) Jülich

**Hosts:** *Melanelixia subaurifera* (Nyl.) O.Blanco et al. (1), *Physcia adscendens* (Th.Fr.) H.Olivier (2)

Balkan Range, 5 km N of the town of Sliven, near the road to Rakovo village, on *Quercus cerris* L., 42.70400° N/26.30206° E, 450 m, 18 September 2007, leg. W. v. Brackel (hb Brackel) (1); *ibid.*, Terziyski bair, W Grozden village, on *Quercus cerris* L., 42.71250° N/26.72611° E, 300 m, 19 September 2007, leg. W. v. Brackel (hb Brackel) (2); the Rhodopes, Haskovo Province, Mineralni bani village, in the central park, on the bark of *Biota orientalis* (L.) Endl., 41.93739° N/25.34850° E, c. 285 m, 12 June 2019, leg. L. Lőkös & N. Varga (BP) (2).

**Note:** This is a common species on various lichens, also invading mosses and algae, mostly in anthropogenic environments (BRACKEL 2014), many further records from Bulgaria are expected for the future.

*Carbonea vitellinaria* (Nyl.) Hertel

**Host:** *Candelariella vitellina* (Hoffm.) Müll.Arg.

Mt Belasitsa, Blagoevgrad Province, Kongur Peak, on N-facing siliceous rock outcrops below Malak Kongur Peak, 41.33416°N/23.17750°E, 1698 m, 27 May 2010, leg. A. Atanasova & H. Mayrhofer (MAYRHOFFER et al. 2020); Pirin Mts, without further data (IVANOV 2010); \*Rila Mts, Damga Peak (Vazov vrah), on siliceous rock, 42.18654°N/23.31824°E, 2674 m, 13 August 2019, leg. V. Shivarov (SOMF).

\**Cercidospora caudata* Kernst.

**Hosts:** *Caloplaca aurantia* (Pers.) Hellb. (1), *C. chlorina* (Flot.) H.Olivier (2), *C. crenulatella* (Nyl.) H.Olivier (3)

Black Sea coast, town of Kavarna, Cape Kaliakra, limestone rock in supralittoral zone, 43.36794°N/28.46450°E, 25–50 m, 24 November 2005, leg. J. Vondrák (CBFS) (1); the Rhodopes, near Studen Kladenets Dam, on volcanic rock, 41.67°N/25.67°E, 27 October 2002, leg. J. Vondrák (CBFS), sub *Muellerella* sp. (2). Thracian Lowland, town of Asenovgrad, hill in SE direction, on calcareous rock, 42.00168°N/24.87757°E, 300 m, 6 June 2016, leg. V. Shivarov (SOMF) (3).

**Note:** The specimen from the Black Sea coast is coexisting with *Muellerella erratica* in the same part of the host thallus.

\**Cercidospora epipolytropa* (Mudd) Arnold

**Host:** *Lecanora polytropa* (Ehrh.) Rabenh.

Rila Mts, small summit E of Haramia Peak, on siliceous rock, 42.19943°N/23.32736°E, 2378 m, 23 July 2019, leg. V. Shivarov (SOMF).

*Clypeococcum hemiamyloideum* Shivarov

**Host:** *Verrucaria anziana* Garov.

Rila Mts, Malyovitsa River, on siliceous rocks in the water, 42.20759°N/23.38705°E, 1744 m, 29 July 2016, leg. V. Shivarov; *ibid.*, 42.18524°N/23.37226°E, 2082 m, 29 July 2016, leg. V. Shivarov; *ibid.*, 42.17564°N/23.37441°E, 2244 m, 9 October 2016, leg. V. Shivarov (SOMF) (SHIVAROV 2019).

**Note:** This species was described from Bulgaria on a host, which was identified as *Verrucaria latebrosa* Körb., but at the time of publication *V. anziana* was still treated as an uncertain synonym of the host (SHIVAROV 2019). ORANGE (2020) showed that *V. anziana* and *V. latebrosa* are distinct species. The host of *Clypeococcum hemiamyloideum* is here confirmed to be *V. anziana*. For details on the distribution, ecology, and photographs of the host and its parasite see SHIVAROV (2019).

\**Didymocyrtis cladoniicola* (Diederich, Kocourk. & Etayo) Ertz & Diederich

**Host:** *Cladonia rangiformis* Hoffm.

Sofia region, Negushevo village, 42.71716°N/23.72911°E, 635 m, 16 July 2018, leg. K. Vassilev (SOMF).

**Note:** The lichenicolous *Phoma*-like species on *Cladonia* were recently transferred in the genus *Didymocyrtis* based on phylogenetic analysis (ERTZ et al. 2015). Low host specificity in this species makes the morphology, and in particular the size of conidia the most important taxonomic character to distinguish this species from closely related lichenicolous fungi (DIEDERICH et al. 2007). The Bulgarian specimen completely agrees with the description of *D. cladoniicola*, with bleached host thallus, pycnidia 80–130 µm, conidiogenous cells short-ampulliform, and conidia guttulate, (4.4–)4.7–5.3–5.9(–7.0) × (2.1–)2.3–2.5–2.8(–3.3) µm, l/w (1.7–)1.8–2.1–2.3(–2.6), n=50. This is the first record of a lichenicolous fungus on *Cladonia* recorded from Bulgaria. More than 1200 specimens of *Cladonia* from different localities and habitats were checked for lichenicolous fungi, but only *D. cladoniicola* was found, and it could be regarded as a rare species in Bulgaria.

*Endococcus perpusillus* Nyl.

**Hosts:** *Schaereria fuscocinerea* (Nyl.) Clauzade & Cl.Roux (1), *Sporastatia polyspora* (Nyl.) Grummann (2)

Vitosha region, in the subalpine zone of Mt Vitosha, near Cherni vrah Peak, 2280 m (2) (POPNIKOLOV 1931); \*Rila Mts, Deno Peak, 5 m below the summit in W direction, on siliceous rock, 42.19672°N/23.60299°E, 2782 m, 17 September 2019, leg. V. Shivarov (SOMF) (1).

**Note:** The record from Vitosha region on the host *Sporastatia polyspora* most probably belongs to *Polycoccum sporastatae* (Anzi) Arnold as suggested by HAFELLNER (2018). Moreover, in the locality of *E. perpusillus* in the Rila Mts, the infected thallus of *Schaereria fuscocinerea* was found together with thalli of *Sporastatia polyspora* and *S. testudinea*, but none of them were infected with *E. perpusillus*.

***Endococcus propinquus*** (Körb.) D.Hawksw. s. lat.**Host:** *Acarospora fuscata* (Schrad.) Arnold

Vitosha region, Mt Lyulin, above Vladaysko defile, 800–1000 m (POPNIKOLOV 1931).

**Note:** POPNIKOLOV (1931) reported from the same locality that the fungus occurs also on *Aspicilia cinerea* (L.) Körb. We have found a specimen from this locality collected by A. Popnikolov and identified by Ö. SZATALA as *Tichothecium gemmiferum* = *E. propinquus* on *A. cinerea*, but our re-examination revealed that it belongs to *E. verrucosus*. As *E. propinquus* in strict sense is confined to hosts of the genus *Porpidia*, this species still needs to be confirmed for Bulgaria.**\**Endococcus verrucosus*** Hafellner**Host:** *Aspicilia cinerea* (L.) Körb.

Vitosha region, Lyulin Mt, c. 700 m, May 1930, leg. A. Popnikolov (BP).

**Note:** The ascospores of the revised specimens are identical with the description and photographs in ZHURBENKO & NOTOV (2015). *Endococcus verrucosus* has a mostly arctic-alpine distribution (HAFELLNER 1994), and the occurrence at a low altitude in Bulgaria seems an exception. However, the locality is most probably in the gorge of the Vladayska reka River, whose microclimate facilitates lichens with a main distribution in Northern Europe (SHIVAROV 2015). See comments under *E. propinquus*.**\**Illosporopsis christiansenii*** (B.L.Brady & D.Hawksw.) D.Hawksw.**Host:** *Xanthoria parietina* (L.) Th.Fr.

Black Sea coast, near the road between Novo Oryahovo and Shkorpilovtsi villages, on deciduous tree, 1 January 2019, leg. B. Gospodinova (SOMF).

***Intralichen christiansenii*** (D.Hawksw.) D.Hawksw. & M.S.Cole**Hosts:** *Acarospora macrospora* (Hepp) Bagl. (1), *Caloplaca biatorina* (A.Massal.) J.Steiner (2), *Caloplaca lactea* (A.Massal.) Zahlbr. (3), *Bacidia rubella* (Hoffm.) A.Massal. (4)The Rhodopes, Distr. Kurdzhali, Kirkovo, Starovo, in the village, 41.46667°N/25.41667°E, 350 m, 11 August 2004 (1); *ibid.*, near the town of Asenovgrad, on calcareous rocks around Martsiganitsa hut, c. 6 km W of Dobrostan village, 41.930°N/24.883°E, c. 1200 m, 25 August 2004 (2); *ibid.*, Distr. Haskovo, Byal Kladenets village, limestone rocks in valley below the village, 41.61667°N/25.66667°E, 350 m, 17 August 2004 (3) (VONDRÁK 2006). \*Balkan Range, 5 km N of the town of Sliven, near the road to Rakovo village, on *Quercus cerris* L., 42.70400° N/26.30206° E, 450 m, 18 September 2007, leg. W. v. Brackel (hb Brackel) (4).**\**Lichenonium erodens*** M.S.Christ. & D.Hawksw.**Host:** *Parmelia sulcata* TaylorBalkan Range, 5 km N of the town of Sliven, near the road to Rakovo village, on *Quercus cerris* L., 42.70400°N/26.30206°E, 450 m, 18 September 2007, leg. W. v. Brackel (hb Brackel).**\**Lichenonium lecanorae*** (Jaap) D.Hawksw.**Hosts:** *Melanelixia glabra* (Schaer.) O.Blanco et al. (1), *Physcia aipolia* (Humb.) Fűrnr. (2), *Polycauliona polycarpa* (Hoffm.) Frödén et al. (3)The Rhodopes, Haskovo Province, Ivaylovgrad Municipality, along the road near Kazak village, acidophilous grassland area with scattered oak trees, on bark of *Quercus* sp., 41.41274°N/25.88609°E, c. 385 m, 15 June 2019, leg. L. Lököš & N. Varga (BP) (1); Znepole region, Choklyovo blato marsh, on twigs of *Salix fragilis* L., 42.39907°N/22.81657°E, 865 m, 3 July 2019, V. Shivarov (SOMF) (3); *ibid.*, on twigs of *Prunus cerasifera* Ehrh., leg. V. Vladimirov (SOMF) (2, 3).***Lichenostigma chloroterae*** (F.Berger & Brackel) Ertz & Diederich**Host:** *Lecanora pulicaris* (Pers.) Ach.Rila Mts, Borovets Resort, on twigs of a dead *Abies alba* Mill., c. 1400 m, 9 September 1985, leg. S. Huneck (HAFELLNER 2018).***Lichenostigma elongatum*** Nav.-Ros. & Hafellner**Hosts:** *Aspicilia calcarea* (L.) Bagl. (1), *Lobothallia radiosa* (Hoffm.) Hafellner (2), *Protoparmeliopsis muralis* (Schreb.) M.Choisy (3)

The Rhodopes, c. 1 km W of Dolishte village, on limestone rocks in valley, 41.630°N/25.583°E, 300 m, 16 August 2004 (1, 2); *ibid.*, rocks nearby Sveta Marina hill, c. 5 km SW of Malko Gradishte village, 41.73°N, 26.00°E, 600 m, 19 August 2004 (2); *ibid.*, on limestone rocks in valley below Byal Kladenets village, 41.61667°N/25.66667°E, 350 m, 17 August 2004 (2); *ibid.*, c. 2 km W of Dobrostan village, on calcareous rocks, 41.93°N/24.883°E, 1300 m, 25 August 2004 (2); *ibid.*, on calcareous rocks around Martsiganitsa hut, c. 6 km W of Dobrostan village, 41.93°N/24.883°E, c. 1200 m, 25 August 2004 (3) (VONDRÁK 2006).

**Note:** The same coordinates of the last two records from 25 August 2004, referring two different localities, look like incorrect in the original publication (VONDRÁK 2006), they represent a place c. 4.5 km NW from Dobrostan village.

**Marchandiomyces corallinus** (Roberge) Diederich & D.Hawksw.

**Hosts:** *Cetraria aculeata* (Schreb.) Fr. (1), *Flavoparmelia* sp. (2), cf. *Protoparmelia* sp. (3), *Xanthoparmelia pulla* (Ach.) O.Blanco et al. (4), *Parmelia sulcata* Taylor (5), *Parmelina tiliacea* (Hoffm.) Hale (6)

Black Sea coast, coastal rocks c. 2 km SE of Sinemorets village, 42.0083°N/28.0000°E, c. 20 m, 22 August 2004 (3); the Rhodopes, Ptichar village, on acid volcanic rocks in valley of Varbitsa River, 41.4670°N/25.4167°E, 300 m, 12 August 2004 (2); *ibid.*, near Studen Kladenets Dam, 41.67°N/25.67°E, 27 October 2002 (1, 4, and other species occurring on sunny volcanic rock) (VONDRÁK 2006); \*Balkan Range, Terziyski bair, W of Grozden village, on *Quercus cerris* L., 42.71250° N/26.72611° E, 300 m, 19 September 2007, leg. W. v. Brackel (hb Brackel) (5, 6).

**Milospium graphideorum** (Nyl.) D.Hawksw.

**Host:** *Opegrapha* sp.

Black Sea coast, Strandzha Natural Park, oak forest N of town of Ahtopol, on *Carpinus orientalis* Mill., 42.10°N/27.95°E (ОТТЕ 2005).

**Muellerella erratica** (A.Massal.) Hafellner & V.John

Syn. *Muellerella pygmaea* (Körb.) D.Hawksw. var. *athallina* (Müll.Arg.) Triebel

**Hosts:** *Caloplaca confusa* Vondrák et al. (1), *Caloplaca limonia* Nimis & Poelt (2), *Caloplaca* cf. *polycarpa* (A.Massal.) Zahlbr. (3), *Placocarpus schaeereri* (Fr.) Breuss (4), cf. *Protoparmelia badia* (5), *Verrucaria macrostoma* DC. (6)

\*Black Sea coast, c. 4 km S of the town of Sozopol, on siliceous cliffs at seashore, 42.38302°N/27.71217°E, 9 April 2007, leg. J. Vondrák (CBFS), sub *M. lichenicola* (1); *ibid.*, 1.5 km NE of Kamen Bryag, on limestone cliffs, 43.46632°N/28.56528°N, 6 April 2007, leg. J. Vondrák (CBFS), sub *M. lichenicola* (2); *ibid.*, town of Primorsko, near the International Youth Centre, calcareous rock on the beach, 15 September 2011, leg. V. Shivarov (SOMF), sub *M. lichenicola* (6); \*Vitosha region, on siliceous rock, c. 1600–2000 m, 8–9 July 1954, leg. Ö. Szatala (BP) (5); the Rhodopes, c. 1 km W of Dolishte village, on limestone rocks in valley, 41.630°N/25.583°E, 300 m, 16 August 2004, leg. J. Vondrák (CBFS) (3); *ibid.*, Trigrad village, on the road in E direction, on calcareous rock, c. 1300 m, 10 May 2012, leg. V. Shivarov (SOMF) (4).

**Note:** Following the concept of TRIEBEL (1989), only one specimen was accepted as belonging to *M. erratica* in the study of Verrucariaceae in Bulgaria (SHIVAROV 2015). SHIVAROV (2015) commented that there are several specimens with characters intermediate between *M. erratica* and *M. lichenicola*, mostly with variations in spore size, but none of them exceeds 64 spores per ascus and these specimens could not be referred to *M. lichenicola*. Preliminary results of a recent study confirmed that the degree of polypory correlates with phylogenetic results distinguishing the lineages of *M. erratica* and *M. lichenicola* (MUGGIA et al. 2019). Here we accept this concept and include the specimens under *M. erratica*.

**Muellerella lichenicola** (Sommerf.) D.Hawksw.

**Hosts:** *Caloplaca alociza* (A.Massal.) Mig. (1), *Tephromela atra* (Huds.) Hafellner (2)

Mt Slavyanka, Ali Botush Reserve, 1800 m (1) (POPNIKOLOV 1937); Vitosha region, above the “creative home Vitosha” of the Bulgarian Academy of Sciences, c. 1400 m (2) (POPNIKOLOV 1931).

**Note:** MAYRHOFER et al. (2005) reported that specimens exist in SO, but they were not found. POPNIKOLOV (1931) regarded it as a common species on various lichen hosts on the southern slope of Mt Vitosha between 1500–2000 m. The species needs to be confirmed for Bulgaria as none of the *Muellerella* specimens studied from Bulgaria belongs to *M. lichenicola*.

***Muellerella pygmaea*** (Körb.) D.Hawksw.**Host:** *Lecidea confluens* (Weber) Ach.

Vitosha region, Planinarska Pesen (as ‘Rezen’) chalet, on granite rock, 1700 m, 26 October 1978, leg. S. Huneck (HAFELLNER 2018).

***Nesolechia oxyspora*** var. ***fusca*** (Triebel & Rambold) Diederich**Host:** *Xanthoparmelia tinctina* (Maheu & A.Gillet) Hale

Pirin Mts, town of Sandanski, in the valley of Sandanska Bistritsa river, 400 m, 29 May 1968, leg. A. Vězda (TRIEBEL &amp; RAMBOLD 1995).

**Note:** Additional information for the locality was taken from the original label of the specimen stored in M. Two specimens stored in PC were cited by TRIEBEL & RAMBOLD (1995) from Bulgaria with limited information, from ‘Bulgar Dagh’, collected by Kotschy. However, Bulgar Dagh or Bolkar Mountains are a mountain range in southern Turkey.***Opegrapha rupestris*** Pers.Syn. *Opegrapha saxicola* Ach.**Hosts:** *Bagliettoa calciseda* (DC.) Gueidan & Cl.Roux (1), *B. limborioides* A.Massal. (2), unknown (3)

Mt Slavyanka, locality Ezeroto, below Tsarev Vrah Peak, on calcareous rocks, 2000 m, leg. A. Popnikolov (1, 2) (POPNIKOLOV 1937); the Rhodopes, Trigrad village, near cave, c. 2 km downstream of village, on hard limestone rock, 26 October 2002, leg. J. Vondrák (1) (VONDRÁK 2006); Northeast Bulgaria, town of Tutrakan, Boblata protected area, leg. P. Cretzoiu (3) (REDINGER 1937–1938).

***Phacopsis vulpina*** Tul.**Host:** *Letharia vulpina* (L.) Hue

Pirin Mts, Bezbog chalet, Bezbozhka Polyana meadow, in the near forest, 2000 m, 20 September 1967, leg. I. Pišút (HAFELLNER 1987).

***Plectocarpon encausticum*** (Nyl.) R.Sant.**Host:** *Brodoa intestiniformis* (Vill.) Goward

Vitosha region, Malak Rezen Peak, c. 2000 m, on granite boulder, 28 September 1978, leg. S. Huneck (HAFELLNER 2018).

***Polycoccum marmoratum*** (Kremp.) D.Hawksw.**Hosts:** not reported

Balkan Range, above the town of Kalofer, Mt Botev, on calcareous rock, c. 1500 m (SZATALA 1929); Mt Slavyanka, Ali Botush Reserve, on calcareous rock, 1800 m (POPNIKOLOV 1937).

**Note:** The description of the species based on the Bulgarian records in POPNIKOLOV & ZHELEZOVA (1964) agrees well with the description of *P. marmoratum*. It occurs mostly on endolithic members of Verrucariaceae. The Bulgarian host specimen of *P. marmoratum* most probably remained unidentified due to the taxonomic difficulties in this group.***Polycoccum pulvinatum*** (Eitner) R.Sant.**Host:** *Physcia caesia* (Hoffm.) Fűrnr.

The Rhodopes, Novakovo village, in the SE part of the village, on granitic outcrops at edge of deciduous forest, 41.88583°N/25.06194°E, c. 466 m, 15 September 2009, leg. A. Atanassova (HAFELLNER 2018).

***Polysporina subfuscescens*** (Nyl.) K.Knudsen & Kocourk.Syn. *Lecanora subfuscescens* Nyl., *Sarcogyne subfuscescens* (Nyl.) Boist.**Hosts:** brown crustose lichens (1), *Acarospora fuscata* (Schrad.) Th.Fr. (2)

Pirin Mts, above the town of Sandanski, valley of Sandanska Bistritsa, on granitic boulders in a pasture, 400–500 m, 29 May 1968, leg. I. Pišút &amp; A. Vězda (1) (VĚZDA 1968, KNUDSEN &amp; KOCOURKOVÁ 2008); the Rhodopes, town of Kardzhali, Kaloyantsi village, Yumruk Skala protected area, c. 5 km SW of the village, on acid vulcanite stones on north-facing slope, 41.616°N/25.516°E, 500 m, 15 August 2004, leg. J. Vondrák (2); Kirkovo, Bregovo, in valley



of river Vurbitsa c. 2 km E of village, 41.466°N/25.416° E, 300 m, 11 August 2004, leg. J. Vondrák (2) (VONDRÁK 2006, KNUDSEN & KOCOURKOVÁ 2008).

**Note:** MAYRHOFFER et al. (2005) synonymized *Acarospora lapponica* (Ach. ex Schaer.) Th.Fr. var. *lojkeana* H.Magn. and *Sarcogyne subfuscescens* (Nyl.) Boist. with the non-lichenicolous, lichenized *Polysporina lapponica* (Ach. ex Schaer.) Degel., a synonym of *Sarcogyne lapponica* (Ach. ex Schaer.) K.Knudsen & Kocourk. (see KNUDSEN & KOCOURKOVÁ 2008). *Acarospora lapponica* (Ach. ex Schaer.) Th.Fr. var. *lojkeana* H.Magn. was incorrectly accepted to occur in Bulgaria, as its distribution is in Romania (Map 3 in CRETZOIU 1936). The specimens published by VÉZDA (1968) and VONDRÁK (2006) were revised by KNUDSEN & KOCOURKOVÁ (2008), and belong to *P. subfuscescens*.

\**Pronectria subimperspicua* (Speg.) Lowen

**Host:** *Melanelixia glabratula* (Lamy) Sandler & Arup

Balkan Range, 5 km N of the town of Sliven, near the road to Rakovo village, on *Quercus cerris* L., 42.70400°N/26.30206°E, 450 m, 18 September 2007, leg. W. v. Brackel (hb Brackel).

\**Pyrenochaeta xanthoriae* Diederich

**Host:** *Xanthoria parietina* (L.) Th.Fr.

The Rhodopes, Krumovgrad Municipality, between Arven and Devesilovo villages at Krumovitsa River, on bark of *Juglans regia* L., 41.341217°N/25.682648°E, c. 390 m, 14 June 2019, leg. L. Lőkös & N. Varga (BP); Znepole region, Choklyovo blato marsh, on bark of *Salix alba* L., 42.39467°N/22.82465°E, 871 m, 11 July 2019, leg. V. Shivarov (SOMF).

**Note:** In the specimens from Choklyovo blato marsh, the apothecial margins of the infected ascomata become reduced to almost disappearing.

*Sarcopyrenia gibba* (Nyl.) Nyl. var. *geisleri* (Beckh. ex Körb.) Nav.-Ros. & Hladún

**Host:** not reported

The Rhodopes, limestone rocks in valley below Byal Kladenets village, on exposed hard limestone rock, 41.6167°N/25.6667°E, 350 m, 17 August 2004 (VONDRÁK 2006).

*Sclerococcum saxatile* (Schaer.) Ertz & Diederich

Syn. *Dactylospora saxatilis* (Schaer.) Hafellner

**Host:** unknown

Toundzha Hilly County, volcanic rocks above the town of Aytos, 150 m, 21 August 1977, leg. A. Vězda (HAFELLNER 1979).

*Sphaerellothecium pumilum* (Lettau) Nav.-Ros., Cl.Roux & Hafellner

Syn. *Sphaerellothecium aipoliae* (Vouaux) Nav.-Ros. & Cl.Roux

**Host:** *Physcia albinea* (Ach.) Nyl.

Pirin Mts, above Ribno Bunderishko Lake (as 'Rudno jezero'), on granitic rock, 2300 m, 12 July 1967, leg. A. Vězda (NAVARRO-ROSINÉS & ROUX 2017 as '*Sphaerellothecium aipolium* Vouaux ex Nav.-Ros. & Cl.Roux', NAVARRO-ROSINÉS et al. 2018).

*Sphinctrina turbinata* (Pers.) De Not.

**Host:** *Pertusaria amarescens* Nyl.

Valley of River Struma, railway station Levunovo, near the Struma River, 100 m (POPNIKOLOV 1937).

*Stigmatidium congestum* (Körb.) Triebel

**Host:** *Lecanora chlarotera* Nyl.

Mt Slavyanka, Ali Botush Reserve, entrance area of the reserve S of Goleshovo village, open pasture with scattered old deciduous trees, on bark of *Juglans regia* L., 41.40694°N/23.58750°E, 997 m, 28 May 2010, leg. A. Atanassova & H. Mayrhofer (HAFELLNER 2018).

*Stigmatidium gyrophorarum* (Arnold) D.Hawksw.

**Host:** *Umbilicaria cylindrica* (L.) Delise

Vitoshka region, Malak Rezen Peak, granitic boulder, 28 September 1978, leg. S. Huneck (HAFELLNER & MAYRHOFER 2020); \*Rila Mts, small summit E of Haramia Peak, on siliceous rock, 42.19943°N/23.32736°E, 2378 m, 23 July 2019, leg. V. Shivarov (SOMF).

***Stigmidium rivulorum*** (Kernst.) Cl.Roux & Nav.-Ros.

**Host:** *Staurothele fissa* (Taylor) Zwackh

Pirin Mts, Demyanitsa River, on siliceous rock in the splash water zone, 41.79079°N/23.46477°E, 1436 m, 21 July 2016, leg. V. Shivarov (SOMF).

**Note:** SHIVAROV (2017) reported *Stigmidium rivulorum* for the first time from Bulgaria with two hosts *Dermatocarpon miniatum* var. *complicatum* and *Staurothele fissa*. The first host is excluded here as its *Stigmidium* is not conspecific neither with *S. rivulorum* nor with *S. stygnospilum*.

\****Stigmidium tabacinae*** (Arnold) Triebel

**Host:** *Toninia opuntioides* (Vill.) Timdal (1), *Toninia sedifolia* (Scop.) Timdal (2)

Northeast Bulgaria, Slanchevo village, Pobiti Kamani rock phenomenon, SE group, “Stone Forest”, open rocky grassland, 43.24266°N/27.71327°E, 120m, 15 April 2007, leg. L. Lökös (BP) (1); Black Sea coast, Balgarevo village, Kaliakra Reserve, Bolata Beach, gorge along the road, 43.3860°N/28.4664°E, 45 m, 17 April 2007 leg. L. Lökös (BP) (2).

***Taeniolella phaeophysciae*** D.Hawksw.

**Host:** *Phaeophyscia orbicularis* (Neck.) Moberg

Mt Strandzha, Varovnik village (as ‘Varovik’), along the road near the village, small pastures amongst *Quercus cerris* L. woods, on bark of *Acer campestre* L., 42.21305°N/27.22528°E, 364 m, 22 September 2009, leg. A. Atanassova (HAFELLNER & MAYRHOFER 2020).

***Xanthoriicola physciae*** (Kalchbr.) D.Hawksw.

**Host:** *Xanthoria parietina* (L.) Th.Fr.

Balkan Range, near Rakovo village, on *Carpinus betulus* L., 800 m, 20 September 2007, leg. W. v. Brackel (hb Brackel) (HAFELLNER & MAYRHOFER 2020); \*the Rhodopes, Krumovgrad Municipality, between Arven and Devesilovo villages at Krumovitsa River, on bark of *Juglans regia* L., 41.341217°N/25.682648°E, c. 390 m, 14 June 2019, leg. L. Lökös & N. Varga (BP); *ibid.*, Ivaylovgrad Municipality, along the road near Kazak village, acidophilous grassland area with scattered oak trees, on bark of *Quercus* sp., 41.412746°N/25.886092°E, c. 385 m, 15 June 2019, leg. L. Lökös & N. Varga (BP); *ibid.*, Kirkovo Municipality, along the road at Dzherovo village, on twigs of *Juglans regia* L., 41.31071°N/25.30129°E, c. 395 m, 17 June 2019, leg. L. Lökös & N. Varga (BP).

**Note:** This species is common on the thalli and ascomata of *Xanthoria parietina* mostly in nutrient-rich and anthropogenic environments, so further records from Bulgaria are expected, based on own observations in Hungary (VN).

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