# Overview of *Xylariales* (*Ascomycota*) in Bulgaria

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**Abstract.** This article represents information about the known diversity of xylarialean fungi of Bulgaria. Fifty-seven species, including three varieties and one subspecies, are listed in five families of *Xylariales* in alphabetical order. Information on the species distribution by floristic regions and their host plants or substrata is included. *Anthostoma decipiens* is reported for the first time for Bulgaria, and *Hypoxylon howeanum* has been recorded on *Diatrype stigma*. The first molecular results are reported for *Diatrypella quercina*, *Hypoxylon fuscum*, *H. fragiforme*, and *Jackrogersella cohaerens* from Bulgaria, based on the examination of some recent Bulgarian collections.

**Key words:** Bulgarian mycota, molecular data, plant hosts, preliminary list

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## Introduction

Order *Xylariales*, described by Nannfeldt in 1932, is known as one of the largest group of ascomycetes, with more than 2487 species worldwide (Kirk & al. 2008). Usually, its members were characterized by well-developed coloured stromata, composed almost entirely of fungal pseudotissues with different morphology (Plate I, Figs. 1-9). Ascomata are perithecia, often immersed in the stroma, mostly black and thick-walled. They have usually 8-spored unitunicate asci, with mostly an amyloid apical ring, and with radially asymmetric, pigmented ascospores with germ pores, or slits. Most species are known as common endophytes, hemibiotrophs and plant parasites, or saprobes on trunks and bark of twigs from various trees or shrubs (Kirk & al. 2008; Fournier & Magni 2003).

In the existing checklists of Bulgarian ascomycetes, detailed information on the species diversity, plant hosts and substrata has been published for some fungal groups. Ascomycetous fungi have been studied by Dimitrova & Baral (2005), who reported 67 species of the family *Helotiaceae,* including three varieties; Stoykov & Denchev (2006) have reported 89 species of the order *Diaporthales*; Dimitova & Gyosheva (2009) have added 191 species and two varieties of the order *Pezizales*, and Dimitrova & Gyosheva (2010) have identified 120 species of the order *Helotiales*. Dimi-


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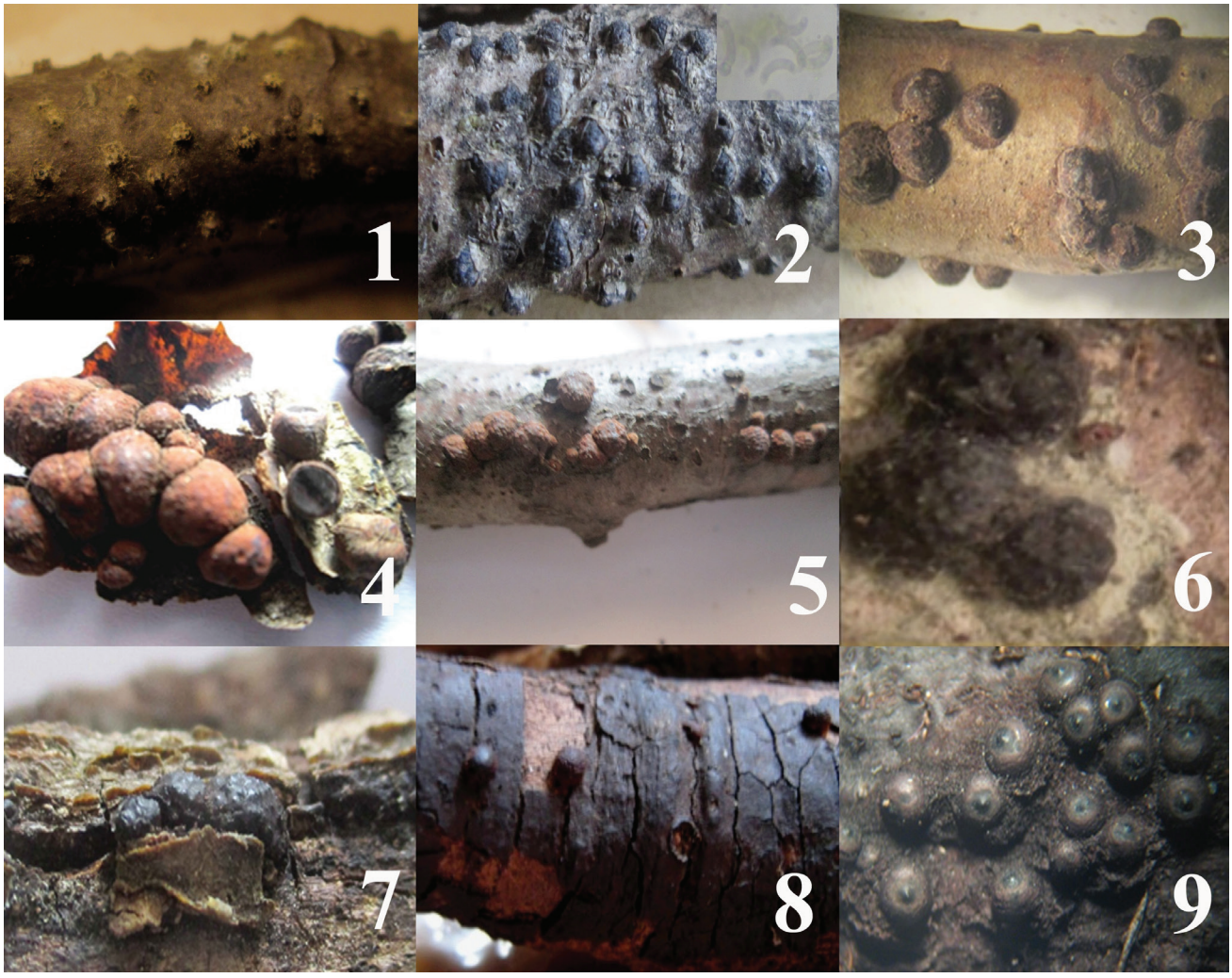


**Plate I**
**Figures 1-9**
**Fig. 1.** *Anthostoma decipiens*, Forebalkan, stromata on dead fallen broadleaf twig, SOMF 31151;
**Fig. 2.** *Diatrypella quercina*, Vitosha Region, Mt Vitosha, above Boyana Quarter, ascospores and stromata on *Quercus* sp., SOMF 31402;
**Fig. 3.** *Hypoxylon fuscum*, s.str., Forebalkan, stromata on *Corylus avellana,* SOMF 31144;
**Fig. 4.** *Hypoxylon howeanum*, stromata on *Prunus cerasifera*, SOMF 31136;
**Fig. 5.** *Hypoxylon fragiforme,* Forebalkan, stromata on *Fagus sylvatica,* SOMF 31404;
**Fig. 6.** *Jackrogersella cohaerens*, Northeast Bulgaria, Shumensko Plato Nature Park, stromata on *F. sylvatica*, SOMF 26346;
**Fig. 7.** *Jackrogersella cohaerens*, Vitosha Region, Mt Vitosha, stromata on *F. sylvatica*;
**Fig. 8.** *Hypoxylon howeanum*, Forebalkan, stromata on *Diatrype stigma*, SOMF 31406;
**Fig. 9.** *Rosellinia corticium*, Forebalkan, stromata on *Tilia* sp.
Photographs (*ex situ*) by D. Stoykov.

trova (2010) has described morphologically and illustrated 126 taxa (118 species, seven varieties and one form) in the volume 6 of the monographic work *Fungi of Bulgaria*.

The aim of the present paper is to summarize the known information on the species diversity and distribution of fungi of the order *Xylariales* in Bulgaria, and to inform on their known plant hosts and substrata across the country.

## Material and methods

For each taxon in the list, binominal name with the author's name, followed by the region of distribution, designated with arabic numerals in square brackets, is given. Distribution is noted in accordance with the floristic division of the country introduced in the *Flora of the People's Republic of Bulgaria* (Jordanov 1966).

| | |
|---|---|
| 1. Black Sea Coast | 11. Mt Belasitsa |
| 2. Northeast Bulgaria | 12. Mt Slavyanka |
| 3. Danubian Plain | 13. Valley of Mesta River |
| 4. Forebalkan | 14. Pirin Mts |
| 5. Balkan Range | 15. Rila Mts |
| 6. Sofia Region | 16. Mt Sredna Gora |
| 7. Znepole Region | 17. Rhodopi Mts |
| 8. Vitosha Region | 18. Thracian Lowland |
| 9. West Frontier Mts | 19. Toundzha Hilly Country |
| 10. Valley of Struma River | 20. Mt Strandzha |

Information on the order *Xylariales* and its host plants from literature sources published prior to 1947 was also obtained from Atanasoff & Petroff (1930) and Yordanova (1947). For identification of some collections, the works of Croxall (1950), Munk (1957), Breitenbach & Kränzlin (1984), Ju & Rogers (1996), Fournier & Magni (2003), Stadler & al. (2004b), and Medardi (2012) were used. Identifications were made under LM in water.

Nomenclature generally followed Munk (1957), Rappaz (1987), Ju & Rogers (1996), Ju & al. (1998), and other more recent works cited in the main text. According to Korf (1996) and May & al. (2019), indication for the sanctioned epithets of fungal names in combinations has been omitted. Classification system of families and genera of *Xylariales* follows Wijayawardene & al. (2018). Titles of periodicals in the references section have been abbreviated also after the online BPH (https://huntbot.org/bph/).

Dry fungal stromata of some species from *Diatrypella*, *Hypoxylon* and *Jackrogersella*, collected on dead twigs of trees, were carefully removed by finely cutting them with a razor blade, and were sent for molecular analysis. The protocol presented in Stoykov & Alvarado (2019) was followed for DNA isolation, amplification and sequencing of nrITS-region from these collections.

No taxonomic decisions on unexamined specimens were made. Some unpublished records were also included.

## Preliminary checklist of *Xylariales* Nannf. in Bulgaria

Subclass ***Xylariomycetidae*** O.E. Erikss. & Winka
Order ***Xylariales*** Nannf.
Family ***Diatrypaceae*** Nitschke

***Anthostoma decipiens*** (DC.) Nitschke, Plate I, Fig. 1.

**Stromata** small, erumpent, semi-immersed, visible on the bark surface as small dark pustules, globose. **Asci** 38–40 × 5.5–6 (–7) µm, elongate ellipsoid, 8-spored. **Ascospores** (6.5–) 7.4±0.4 (–8.0) × (3–) 3.5±0.2 (–4) µm, $n_1$=16, (6.4–) 7.3±0.3 (–8.2) × (3–) 3.5±0.3 (–4.3) µm, Q ratio (1.7–) 2.1±0.2 (–2.6), $n_2$=18, one-celled, ellipsoid, or occasionally slightly asymmetric, brownish, smooth.

*Specimen examined*: Forebalkan, Lovech District, Troyan Municipality, Patreshko village, N42°54′39.17″, E24°46′11.23″, alt. ca. 570 m, 2.05.2008, D. Stoykov, on a fallen dead twig from a broadleaf tree, SOMF 31151.

**Note.** This species was recorded on decorticated trunks of *Carpinus*, *Betula*, *Fagus*, and *Quercus* in Europe. One collection from the Eastern Forebalkan, SOMF 31132, has quite thick, clearly lucid, dark, smooth stromata arising from the bark surface. However, they are visible mainly in the ruptures of the bark periderm. When cross-sectioned in water, the squash mounts showed only longer, light brown, smooth, guttulate, ellipsoid, symmetric spore cells in mass, ca. (6.5–) 8.3±0.6 (–10.5) × (2.5–) 3.5±0.4 (–4) µm, n=35, but no asci were observed.

***Cryptosphaeria populina*** (Pers.) Sacc., as *C. populina* Sacc. [1, 3] (Stefanov & al. 1961), on *Populus* sp.

***Diatrype bullata*** (Hoffm.) Fr. [6, 8, 15] (Stoykov 2020), on *Salix* spp., *Quercus* sp.

***Diatrype disciformis*** (Hoffm.) Fr., s.l. (Syn. *Sphaeria disciformis* Hoffm.) [2, 4, 5, 7, 8, 11, 14, 15, 16] (Klika 1926; Atanasoff & Petroff 1930; Hruby 1931; Barzakov 1933; Fakirova 1978, 1985, 1993a, 1997; Fakirova & Sameva 1983; Dörfelt & Musch 1987; Fakirova & al. 2002; Gyosheva & Gussev 1998; Gussev & al. 2005; Bencheva 2008; Gyosheva & Georgieva 2009; Bencheva & al. 2012; Gyosheva & al. 2016), on *Betula pendula* Roth., *Carpinus betulus* L., *Castanea sativa* Mill., *Fagus sylvatica* L., *Picea abies* (L.) P. Karst., *Pinus peuce* Griseb., *P. sylvestris* L, *Quercus* sp.

*Materials examined*: Forebalkan, Lovech District, Golyama Zhelyzna village, in the vicinity of Peshtera Toplya Natural Landmark, alt. ca. 450 m, 5.09.2016, D. Stoykov, on dead, tiny branch of *F. sylvatica*; Balkan Range, Balgarka Nature Park, near peak Bedek, below the wind turbine park, N42°44′37.1″, E25°26′04.2″, alt. ca. 1400 m, 20.07.2012, D. Stoykov, on a small branch of *F. sylvatica*; Vitosha Region, Sofia District, Mt Vitosha, Vitosha Nature Park, above Boyana Quarter, N42°38′05.7″, E23°15′34″, alt. ca. 1055 m, 12.06.2016, D. Stoykov, on the bark of a fallen twig from *F. sylvatica*.

***Diatrype stigma*** (Hoffm.) Fr., s.l., as *Diatrype stigma* (Hoffm.) De Not. [1, 2, 4, 5, 6, 8, 15, 16, 17] (Klika 1926; Atanasoff & Petroff 1930; Nannizzi 1938; Yordanova 1947; Fakirova 1978, 1982, 1985, 1993a; Sameva 1981; Kuthan & Kotlaba 1989; Denchev & al. 2006; Bencheva 2008; Bencheva & al. 2012; Gyosheva & al. 2016; Stoykov 2020), on *Carpinus betulus*, *C. orientalis* Mill., *Corylus avellana* L., *Crataegus* sp., *Fagus sylvatica*, *Populus tremula*, *Quercus cerris* L., *Q. rubra* L., *Quercus* sp., deciduous trees

***Diatrype undulata*** (Pers.) Fr. [8] (Fakirova 1997), on *Betula pendula*

***Diatrypella favacea*** (Fr.) Ces. & De Not. (Syn.: *Diatrypella aspera* (Fr.) Nitschke; *D. betulina* (Peck.) Sacc.) [1, 4, 5, 6, 8, 14, 15, 16] (Atanasoff & Petroff 1930; Fakirova 1978, 1985, 1993b, 1997; Stoykov 2017), on *Betula pendula*, *Carpinus betulus*, *C. orientalis*, *Corylus avellana*, *Fagus sylvatica*, *Juglans regia* L.

***Diatrypella verruciformis*** (Ehrh. ex Pers.) Nitschke, as '*verrucaeformis*' [4, 8, 14, 15] (Klika 1926; Atanasoff & Petroff 1930; Fakirova 1978, 1998; Stoykov 2020), on *Carpinus orientalis*, *Corylus avellana*

***Diatrypella pulvinata*** Nitschke [4, 5, 8, 16] (Stoykov 2020), on *Quercus cerris*, *Q. pubescens* (L.) Willd., *Quercus* sp.

***Diatrypella quercina*** (Pers.) Cooke, s.l., Plate I, Fig. 2 (Syn.: *Diatrypella quercina* (Pers.) Nitschke; *Diatrype quercina* (Pers.) Tul. & C. Tul., *D. quercina* (Pers.) Fr.) [5, 6, 8, 15] (Fakirova 1985; Stoykov 2017), on *Quercus cerris*, *Q. dalechampii*, *Q. rubra*, *Q. thracica* Stef. & Nedjalkov, *Quercus* sp.

*Specimens and materials examined*: Vitosha Region, Sofia District, Mt Vitosha, above Boyana Quarter, N42°38′03.1″, E23°16′34.6″, alt. ca. 1115 m, 22.07.2017, D. Stoykov, on a dead branch of *Quercus* sp., SOMF 31402 (GenBank OR905897); idem., near the trail towards Boyansko Ezero lake, N42°38′21.4″, E23°16′11.8″, alt. ca. 970 m, on a dead branch of *Quercus* sp.; Vitosha Region, Sofia District, Mt Vitosha, N42°39′26.5″, E24°14′25.12″, 31.03.2018, D. Stoykov, on dead fallen branches of *Q. rubra*, SOMF 30456; Rila Mts, Blagoevgrad District, Rilomanastirska Gora Reserve, on the slopes above the Ilijna River, 2.06.2015, D. Stoykov, on a dead fallen branch of *Quercus* sp.

**Comments.** There are only two more ITS rDNA sequences in the public databases, AJ302444, ON705330, all slightly different from the sequence obtained in the present work, but still closer to it than other species, i.e. *Diatrypella macrospora*, *D. iranensis*, *Diatrype bullata*, *D. quercicola*, and others, all of them < 99.0% similar to the sequence obtained from the Bulgarian sample.

The examined collection from Vitosha Region, Mt Vitosha, above Boyana Quarter, alt. ca. 970 m, has black, subglobose perithecia ca. (350–) 370–580 (–630) µm, immersed in the stroma, with asci up to 85 µm, p.sp. × 11 µm, ellipsoidal, straight, polyspored; ascospores are ca. (8.2–) 9.37±0.67 (–10.2) × (1.9–) 2.34±0.27 (–2.9) µm, Q ratio (3–) 4.05±0.61 (–5), n=15, under LM in water hyaline, rounded at the ends, curved, more or less sausage-shaped, yellowish in mass when observed inside the asci.

**Notes.** *Diatrypella quercina* s.l. is considered common on oaks in Europe and North America, with single localities from Australia, Japan, and South America (according to the map generated by GBIF.org software, https://www.gbif.org/species/9027329). The name *Diatrypella quercina* is based on *Sphaeria quercina* Pers., described by Persoon (1794, 1801) with "stromata barely immersed, circular or irregullarly circular, erumpent, breaking out through the periderm; perithecia spherical, immersed, above and at the sides covered with stromatic gelatinous pseudotissues, ostioles prominent, quadrigonal, and extended up to half of the length, on oak twigs". According to the species concept of Cooke (1866), *D. quercina* has "8-15 black perithercia in a group, with ovate, quadrisulcate ostioles, linear-clavate asci, and numerous, sausage-shaped ascospores, yellowish in mass, colourless when free, common on oak branches".

***Eutypa flavovirens*** (Pers.) Tul. & C. Tul., as *E. flavovirens* (Fr.) Tul. & C. Tul. [8] (Fakirova 1985; Fakirova & Sameva 1983), *Fagus sylvatica*

***Eutypa lata*** (Pers.) Tul. & C. Tul. (Syn. *Eutypa armeniacae* Hansf. & M.V. Carter; as *Valsa prunastri* (Pers.) Fr.) [3] (Kozarov 1908; Atanasoff & Petroff 1930; Malenin & al. 1985), on *Armeniaca vulgaris* Lam., *Prunus avium* (L.) L., *Vitis vinifera* L.

***Eutypa ludibunda*** (Sacc.) Sacc., as *E. ludibunda* Sacc. [14] (Fakirova 1978), on *Robinia pseudoacacia*, *Armeniaca vulgaris*, *Prunus avium*

***Eutypa maura*** (Fr.) Fuckel (Syn. *Eutypa acharii* Tul. & C. Tul.) [6, 11, 15] (Fakirova 1978; Fakirova & Sameva 1983; Sameva 1985), on *Acer pseudoplatanus* L., *Fagus sylvatica*

***Eutypa spinosa*** (Pers.) Tul. & C. Tul. [6, 16] (Fakirova 1982; Sameva 1985), on *Fagus sylvatica*, *Quercus* sp.

***Eutypella angulosa*** (Nitschke) Sacc. var. ***angulosa*** [8], on *Betula pendula*

***Eutypella cerviculata*** (Fr.) Sacc. (Syn. *Sphaeria cerviculata* Fr.) [8] (Fakirova 1993b), on *Euonymus latifolia*

***Peroneutypa scoparia*** (Schwein.) Carmarán & A.I. Romero, in Carmarán & al. (Syn. *Peroneutypa heteracantha* (Sacc.) Berl.) [14] (Fakirova 1978, 1993b), on *Carpinus betulus*

***Quaternaria quaternata*** (Pers.) J. Schröt., in Cohn (Syn. *Eutypella quaternata* (Pers.) Rappaz) [4, 5, 8, 11, 15, 17, 20] (Hüseyin & Selçuk 2007; Bencheva 2008; Stoykov 2020), on *Fagus orientalis*, *F. sylvatica*

***Quaternaria persoonii*** Tul. & C. Tul., Sel. Fung. Carpol. 2: 105, 1863, as *Quaternaria persoonii* Tul. [15] (Klika 1926), on *Fagus sylvatica*

Family ***Graphostromataceae*** M.E. Barr & al.

***Biscogniauxia cinereolilacina*** (J.H. Mill.) Pouzar (Syn. *Hypoxylon cinereolilacinum* J.H. Mill.) [1] (Kuthan & Kotlaba 1989), on *Tilia tomentosa* (L.) Moench

***Biscogniauxia mediterranea*** (De Not.) Kuntze var. ***mediterranea*** (Syn. *Hypoxylon mediterraneum* (De Not.) Ces. & De Not. var. *macrosporum* J.H. Mill.) [1, 5, 7, 8, 9, 10, 17] (Alexandrov & Rosnev 1993; Kuthan & Kotlaba 1989; Petrov & al. 2002; Bencheva 2006; Rosnev & al. 2010; Gyosheva & al. 2016; Bencheva & Doychev 2022), on *Carpinus betulus* L., *Quercus cerris* L., *Q. dalechampii* Ten., *Q. suber*, *Q. thracica* Stef. & Stoj.

*Specimen examined*: Black Sea Coast, Burgas District, Primorsko town, in the forest between the northern beech of Primorsko and Perla Residence, alt. ca. 6 m, 9.09.2008, D. Stoykov, on small piece of bark from oak tree, SOMF 31411.

***Biscogniauxia nummularia*** (Bull.) Kuntze (Syn.: *Hypoxylon nummularium* Bull.; *Nummularia bulliardii* Tul. & C. Tul., as '*bulliardi*') [1, 2, 4, 5, 7, 8, 15, 17] (Klika 1926; Kuthan & Kotlaba 1989; Gyosheva 2003; Gussev & al. 2005; Denchev & al. 2006; Bencheva 2008; Gyosheva & al. 2016), on *Fagus sylvatica*, very rarely reported on other broadleaf trees

*Materials examined*: Forebalkan, Lovech District, Troyan Municipality, Golyama Zhelyazna village, in the vicinity of Peshtera Toplya Landmark, alt. ca. 455 m, 5.09.2016, D. Stoykov, on fallen branches of *Fagus sylvatica*; Rila Mts, Blagoevgrad District, Rilomanastirska Gora Reserve, along the trail from Rila Monastery to Ivan Vazov chalet, 30.04.2015, D. Stoykov, on a dead fallen branch of *F. sylvatica*.

***Biscogniauxia reticulospora*** Y.M. Ju & J.D. Rogers, s.l. [4] (Stoykov & Denchev 2009), on a dead, partly decorticated deciduous twig

Family ***Hypoxylaceae*** DC.

***Daldinia concentrica*** (Bolton) Ces. & De Not., as *Daldinia concentrica* (Bull. ex Hook) Ces. & De Not.

(Syn. *Sphaeria concentrica* Bolton) [1, 2, 5, 9, 15, 17] (Klika 1926; Picbauer, 1937; Yordanova, 1947; Kreisel, 1959; Droumeva & Stoichev 1980; Fakirova & Sameva 1983; Kuthan & Kotlaba 1981, 1989; Gyosheva 2003; Denchev & al. 2006), on *Alnus glutinosa* (L.) Gaertn., *Fagus sylvatica*, *Fraxinus angustifolia* Vahl., *F. oxycarpa* Willd., *Fraxinus* sp., *Ulmus* sp.

***Daldinia vernicosa*** Ces. & De Not. [1, 4, 5] (Stadler & al. 2014; Stoykov & Alvarado 2019), on *Carpinus orientalis*, *Celtis* cf. *australis, Tilia* sp.

***Entonaema cinnabarinum*** (Cooke & Massee) Lloyd [1] (Benkert 1993; Læssøe 1997; Stadler & al. 2004a, 2008; Assyov & al. 2023), on *Fraxinus angustifolia*

***Hypoxylon fuscum*** (Pers.) Fr., s.l., Plate I, Fig. 3, as *Hypoxylon. fuscum* Pers. [1, 4, 5, 8, 14, 15, 16] (Klika 1926; Fakirova 1978, 1997; Kuthan & Kotlaba 1989; Bencheva 2006, 2008; Bencheva & al. 2012; Gyosheva & Stoykov 2019), on *Alnus glutinosa*, *Betula pendula*, *Carpinus betulus*, *C. orientalis*, *Corylus avellana*, *Fagus sylvatica*, *Quercus* sp.

*Specimens and material examined*: Forebalkan, Vratsa District, Vratchanski Balkan Nature Park, vicinity of Sveti Nikola Pusti Monastery, 17.08.2006, D. Stoykov, on dry branches of *Corylus avellana*, SOMF 31144; Forebalkan, Lovech District, Golyama Zhelyazna village, along the road to Peshtera Toplya Natural Landmark, alt. ca. 405 m, 22.09.2023, D. Stoykov, on a fallen branch of *Carpinus betulus,* SOMF 30457 - with stromata turning black, when old; Balkan Range, Gabrovo District, Balgarka Nature Park, above Balgarka chalet, 28.09.2012, D. Stoykov, on small, old branch of *Corylus avellana,* SOMF 30458; Vitosha Region, Sofia District, Mt Vitosha, above the Boyana Quarter, N42°38′27.3″, E23°16′06.9″, alt. ca. 900 m, 22.07.2017, D. Stoykov, on a dead branch of *C. avellana*, SOMF 31403 (GenBank OR905896).

**Comments.** The ITS rDNA sequence obtained from the studied sample, identified as *H. fuscum* in the present work, is 100% identical with that of the type (CBS 113049, NR172215) in the public databases. The closest sequences of other taxa were identified as *Hypoxylon fuscoides* (ON792789, 98.29% similar), *H. eurasiaticum* (NR172358, 98.07% similar, or *H. pseudofuscum* (MW367859, 98.06% similar).

***Hypoxylon fragiforme*** (Pers.) J. Kickx f., Plate I, Fig. 5 (Syn. *Gamosphaeria* (*Hypoxylon) fragiforme* (Scop.) Dumort, *Hypoxylon* '*Sphaeroxylon*' *coccineum* Bull., *Hypoxylon fragiforme* (Pers.) Petr.) [4, 5, 6, 7, 8, 15, 16, 17] (Klika 1926; Barzakov 1933; Hinkova & Fakirova 1970; Fakirova 1978, 1997; Rosnev & Stoichev 1985; Fakirova & al. 2002; Gyosheva 2003; Bencheva 2006, 2008; Gyosheva & al. 2016; Gospodinov & al. 2018), on *Betula pendula*, *Carpinus betulus*, *Corylus avellana*, *Fagus sylvatica*, deciduous trees

*Specimens and material examined:* Forebalkan, Lovech District, Golyama Zhelyazna village, in the vicinity of Peshtera Toplya Natural Landmark, 15.07.2017, D. Stoykov, on dead branches of *Fagus sylvatica*, SOMF 31404, Plate I, Fig. 5 (GenBank OR905893); idem., 26.08.2016, D. Stoykov, on a dead branch of *F. sylvatic*a; idem., N42°56′48.2″, E24°28′56.4″, alt. ca. 530 m, 5.09.2016, D. Stoykov, on a dead branch of *F. sylvatica*, SOMF 31405 (GenBank OR905894).

**Comments.** Reports of *H. fragiforme* on branches or bark from *Corylus avellana*, *Carpinus betulus*, or other deciduous trees need an additional confirmation, because in some cases the stromata of *H. fragiforme* closely resemble macroscopically those of *Hypoxylon howeanum* (Vanev & Reid 1986; Stoykov & Alvarado 2023) and could be easily misidentidied, when observed and collected in the open.

***Hypoxylon howeanum*** Peck, as '*howeianum*', Plate I, Figs. 4, 8 [1, 4, 5, 6, 15] (Vanev & Reid 1986; Kuthan & Kotlaba 1989; Stoykov & Alvarado 2023), on *Carpinus betulus*, *Corylus avellana*, *Quercus rubra*, *Q. dalechampii*, *Prunus cerasifera* Ehrh., deciduous tree

*Specimen examined*: Forebalkan, Lovech District, Troyan Municipality, Golyama Zhelyazna village, Mikrenska Usoyna Forest, 6.07.2017, D. Stoykov, on black stromata of *Diatrype stigma* on a dead branch of *Quercus dalechampii*, SOMF 31406.

**Note.** To our present knowledge, this is the first report of *H. howeanum* recorded as a fungicolous fungus, from dry stromata of *Diatrype stigma* (Plate I, Fig. 8).

***Hypoxylon macrocarpum*** Pouzar [5, 8] (Bencheva 2008), on *Fagus sylvatica*

***Hypoxylon macrosporum*** P. Karst. [5, 8] (Bencheva 2008; Bencheva & al. 2012), on *Corylus avellana*, *Fagus sylvatica*

***Hypoxylon rubiginosum*** (Pers.) Fr. [8] (Bencheva & al. 2012), on *Corylus avellana*

***Hypoxylon variolosum*** (L.) J. Kickx f. in Keissler, in Zahlbruckner (as *Hypoxylon variolosum* (L.) Keissler) [5] (Klika 1926), on *Daldinia concentrica*

***Jackrogersella cohaerens*** (Pers.) L. Wendt, Kuhnert & M. Stadler, in Wendt & al., Plate I, Figs. 6-7 (Syn.: *Annulohypoxylon cohaerens* (Pers.) Y.M. Ju, J.D. Rogers & H.M. Hsieh), as *Hypoxylon cohaerens* (Fr.) Rehm, asexual morph *Virgariella* [2, 4, 5, 8, 15, 17] (Klika 1926; Bencheva 2008; Stoykov & Gyosheva 2016), on *Fagus sylvatica*

*Specimens and material examined:* Forebalkan, Lovech District, Troyan Municipality, Golyama Zhelyazna village, vicinity of Toplya Cave Natural Landmark, 7.11.2015, D. Stoykov, on a small piece of bark from *Fagus sylvatica*, D. Stoykov, SOMF 30455; Balkan Range, Gabrovo District, Balgarka Nature Park, Gabrovo town, above Yabalka Quarter, N42°11.768, E23°35.342, alt. ca. 743 m, 24.09.2012, D. Stoykov, on the bark of old trunk of *Fagus sylvatica*, SOMF 31407 (GenBank OR905898); Rila Mts, Blagoevgrad District, Parangalitsa Reserve, near Bistritsa River, N42°02′29.3″, E23°22′04.1″, alt. ca. 1485 m, 26.05.2015, D. Stoykov, on a dead branch of *F. sylvatica*, SOMF 31408 (GenBank OR905895); Rhodopi Mts, Pazardzhik distict, Kupena Reserve, above Rozovo village, N41°59′14.1″, E24°20′16.3″, alt. ca. 1320 m, 2.07.2014, D. Stoykov, on a dry dead branch of *F. sylvatica*, SOMF 31409 (GenBank OR905899).

**Comments.** The three collections of *J. cohaerens* analyzed in the present work have ITS sequences quite similar (99.43-100%) to that of the epitype CBS 119126 (GenBank KY610396, Wendt & al. 2018). The collection of *Annulohypoxylon multiforme* (SOMF 26346) from Northeast Bulgaria, Shumensko Plato Nature Park, belongs also to *Jackrogersella cohaerens* (Plate I, Fig. 6).

***Jackrogersella multiformis*** (Fr.) L. Wendt, Kuhnert & M. Stadler, in Wendt & al., s.l. (Syn.: *Annulohypoxylon multiforme* (Fr.) Y.M. Ju, J.D. Rogers & H.M. Hsieh; *Hypoxylon multiforme* (Fr.) Fr.) [4, 5, 7, 8, 11, 15, 16, 17, 20] (Klika 1926; Fakirova 1978, 1982, 1993a, 1997; Gyosheva 2003; Gussev & al. 2005; Denchev & al. 2006; Bencheva 2008; Gyosheva & Georgieva 2009; Gyosheva & al. 2016), on *Alnus glutinosa*, *Betula pendula*, *Carpinus betulus*, *C. orientalis*, *Corylus avellana*, *Fagus sylvatica*, *Quercus* sp.

Family ***Lopadostomataceae*** Daranag. & K.D. Hyde

***Lopadostoma turgidum*** (Pers.) Traverso, s.l. (Syn. *Anthostoma turgidum* (Pers.) Nitschke) [14, 17, 19] (Nannizzi 1938; Fakirova 1982; Denchev & al. 2006), on *Fagus sylvatica*, *Persicaria lapathifolia*, *Quercus* sp.

**Note.** *Lopadostoma quercicola* Jaklitsch, J. Fourn. & Voglmayr was described on oaks from Europe (Jaklitsch & al. 2014).

Family ***Xylariaceae*** Tul. & C. Tul.

***Anthostomella punctulata*** (Roberge ex Desm.) Sacc. subsp. ***punctulata*** [16] (Fakirova 1994), on *Carex pendula* Huds.

***Dermatophora necatrix*** R. Hartig, sexual morph *Rosellinia necatrix* (R. Hartig) Berl. ex Prill. [2, 5, 7, 16, 17] (Savov 1923; Atanasoff & Petroff 1930; Atanasoff & al. 1932; Christoff Christova 1939; Vanev 1995), on *Fragaria moschata* Dusch., *Prunus avium* L., *Rosa damascena* Mill., *Malus dasyphyla* Book., *Morus alba* Mill., *Juglans regia* L., *Vitis vinifera*

***Euepixylon udum*** (Pers.) Laessøe & Spooner (Syn. *Euepixylon udum* (Pers.) Füisting) [8] (Bencheva & al. 2012), on *Picea excelsa*

***Hypocopra amphisphaerioides*** (Ellis & Everh.) Griffiths [10, 15, 19] (Fakirova 1969, 1974), on dung

***Hypocopra dakotensis*** Griffiths [8, 10] (Fakirova 1972), on dung

***Hypocopra dolichopoda*** J.C. Krug & Cain [6] (Fakirova 1991), on dung

***Hypocopra equorum*** (Fuckel) G. Winter [1, 8, 10, 14, 20] (Fakirova 1968, 1969, 1970), on dung

***Hypocopra merdaria*** (Fr.) J. Kickx f., as *Hypocopra merdaria* (Fr.) Fr. [8] (Fakirova 1970), on dung

***Hypocopra parvula*** Griffiths [4, 5, 6, 16, 17, 19] (Fakirova 1970, 1982), on dung, twigs of *Quercus* sp., *Salix* sp., cones of *Picea excelsa*

***Nemania diffusa*** (Sowerby) Gray [20] (Hüseyin & al. 2011), on *Alnus glutinosa* subsp. *glutinosa*

***Nemania serpens*** (Pers.) Gray var. ***serpens*** [Syn. *Hypoxylon serpens* (Pers.) J. Kickx f., as *Hypoxylon serpens* (Pers.) Fr.], asexual morph *Geniculosporium*

*serpens* Chesters & Greenhalgh - after Chesters & Greenhalgh (1964) [1, 5, 8, 17, 18, 20] (Sameva 1978; Kuthan & Kotlaba 1989; Fakirova & al. 2002; Gyosheva & Georgieva 2009), on *Fagus sylvatica*, *Quercus cerris*, *Quercus* sp.

***Rosellinia aquila*** (Fr.) Ces. & De Not., as *R. aquila* (Fr.) De Not. [4] (Fakirova & Sameva 1983; Fakirova 1985, 1993b), on *Carpinus betulus*, *Fagus sylvatica*

***Rosellinia calva*** (Tode) Sacc. [8, 16] (Fakirova 1991), on deciduous trees

***Rosellinia corticium*** (Schwein.) Sacc., Plate I, Fig. 9 [2, 4, 15] (Stoykov & Alvarado in press), on *Tilia* sp., *Quercus* sp.

***Rosellinia mammaeformis*** (Pers.) Ces. & De Not., as '*mammiformis*' [14, 16] (Sameva 1978), on *Corylus avellana*, deciduous trees

***Rosellinia quercina*** R. Hartig [18] (Dimitrov 1922), on *Quercus* sp.

***Ustulina deusta*** (Hoffm.) Maire (Syn. *Kretzschmaria deusta* (Hoffm.) P.M.D. Martin, comb. inval.), as *Ustulina deusta* (Hoffm.) Petr., *U. deusta* (Hoffm.) Lind; *U. vulgaris* Tul. & C. Tul. f. *vulgaris*) [1, 4, 5, 7, 8, 15, 16, 17] (Sameva 1981; Vanev & Reid 1986; Fakirova & al. 2002; Gyosheva 2003; Gussev & al. 2005; Denchev & al. 2006; Gyosheva & al. 2016), on *Carpinus orientalis*, *Fagus sylvatica*

***Xylaria hypoxylon*** (L.) Grev., as *Xylaria hypoxylon* (L. ex Hooke) Grev. (Syn. *Clavaria hypoxylon* L., *Xylosphaera hypoxylon* (L.) Dumort) [1, 2, 4, 5, 8, 14, 15, 16, 17, 20] (Georgiev 1906; Savov 1923; Barzakov 1926; Atanasoff & Petroff 1930; Hinkova & Fakirova 1970; Stoichev & Dimcheva 1984; Rosnev & Stoichev, 1985; Fakirova & al. 2002; Gyosheva 2003; Denchev & al. 2006; Bencheva 2008; Gyosheva & Georgieva 2009; Bencheva & al. 2012; Gyosheva & al. 2016), on *Armeniaca vulgaris* (cult.), *Abies* sp., *Carpinus betulus*, *Fagus sylvatica*, *F. sylvatica* subsp. *moesiaca* K. Malý, *Pinus peuce*, *Quercus* sp.

***Xylaria longipes*** Nitschke [1, 4, 6, 11, 15] (Stoykov 2011; Gospodinov & al. 2018; Gyosheva & Stoykov 2019), on *Picea excelsa*, *Carpinus betulus*, trunks from dediduous trees

***Xylaria polymorpha*** (Pers.) Grev., as *Xylaria polymorpha* (Pers. ex Mérat) Grev. (Syn: *Xylaria clavata* (Scop.) Schrank.; *Valsa clavata* Scop.) [2, 4, 5, 6, 7, 8, 14, 15] (Savov 1923; Barzakov 1928; Hinkova 1950, 1958; Vanev & Reid 1986; Gyosheva & Gussev 1998; Fakirova & al. 2002; Gyosheva 2003; Denchev & al. 2007; Bencheva 2008; Gyosheva & al. 2016), on *Acer* sp., *Fagus sylvatica*, *Quercus* sp., *Juglans regia*, *Lonicera* sp., deciduous trees.

## Conclusion

This overview includes 57 species belonging to 23 genera and five families of *Xylariales*. Diversity of xylarialean fungi has been unequally studied in the different floristic regions of Bulgaria. Most taxa were recorded in the Vitosha Region (27), followed by Forebalkan (23), Balkan Range (22), Rila Mts (20), Black Sea Coast (15), Rhodopi Mts (14), Mt Sredna Gora (13), Northeast Bulgaria (11), Sofia Region (10), and Pirin Mts (8). For example, only two species are known from the Danubian Plain. The most species-rich families are *Diatrypaceae* (20), *Xylariaceae* (20) and *Hypoxylaceae* (12).

Among all listed taxa, four species growing on trees and bark in Bulgaria (*Biscogniauxia nummularia, B. mediterranea* var. *mediterranea*, *Eutypa lata* and *Jackrogersella cohaerens*) have been considered dangerous invasive organisms and, therefore, included in the European database of invasive forest pathogens (Jones 2012; Santini & al. 2013). According to the literature data, *Biscogniauxia mediterranea*, *B. nummularia*, and *J. cohaerens* were analyzed for most European countries, excluding Bulgaria, for a period of 208 years. They were grouped by Santini & al. (2013) on the basis of three indexes of invasiveness (Spread Rate, Cumulative Extent, and Linear Spread Rate). The detailed analysis made by the authors has shown that *B. nummularia* and *B. mediterranea* were rated with 0 Column Z score, and *J. cohaerens* was rated with 2 Column Z score, as noted on page 246, all grouped according to the data accumulated for each fungal pathogen by different index values, per species and per factor (Santini & al. 2013). *Eutypa lata* was not among the pathogens selected for their study. *Ustulina deusta* was considered as a dangerous pathogen

on *Ulmus* trees in North Europe in the past (Innes & al. 2006).

On the other hand, dead or old effete stromata of some xylarialean fungi (i.e. *Diatrype bullata*, *D. stigma*, *Diatrypella quercina*, *D. favacea*, *Quaternaria quaternata, Hypoxylon fragiforme*, etc.) often serve as hosts for other interesting or rare microscopic pyrenomycetes with fungicolous lifestyles (e.g. Lechat & al. 2019; Stoykov 2020, 2021, 2023, the present work), and thus play an important role for the taxonomic diversity of these fungicolous fungi in natural habitats.

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