Pyrenomycetes of the Great Smoky Mountains National Park. II. *Cryptovalsa* Ces. et De Not. and *Diatrypella* (Ces. et De Not.) Nitschke (*Diatrypaceae*)

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Vasilyeva, L.N. and Stephenson, S.L. (2005). Pyrenomycetes of the Great Smoky Mountains National Park. II. *Cryptovalsa* Ces. et De Not. and *Diatrypella* (Ces. et De Not.) Nitschke (*Diatrypaceae*). Fungal Diversity 19: 189-200.

Descriptions and keys are provided for the five species of *Cryptovalsa* and eight species of *Diatrypella* now known from the Great Smoky Mountains National Park in the eastern United States. Ten of these are new records for the Park. *Cryptovalsa mori* (Nitschke) Lar. N. Vassiljeva comb. nov., *Cryptovalsa opaca* (Cooke) Lar. N. Vassiljeva comb. nov., and *Diatrypella major* (Berl.) Lar. N. Vassiljeva comb. nov. are proposed as new combinations for the respective taxa.

Key words: Ascomycotina, generic concepts, Southern Appalachians, taxonomy, temperate forests.

Introduction

The delineation of the allantosporous genera (*Cryptosphaeria*, *Cryptovalsa*, *Diatrype*, *Diatrypella*, *Eutypa*, and *Eutypella*) traditionally recognised for the *Diatrypaceae* is often rather problematic, since it is based upon characters of the stromata that are extremely variable (Vasilyeva and Stephenson, 2004). In particular, the stromata of *Cryptovalsa* and *Diatrypella*, with both having polysporous asci, are very similar in appearance, and some species have been transferred between the two genera. In brief, *Diatrypella* is a polysporous counterpart of *Diatrype* that includes many species with pustulate 'diatrypelloid' stromata [for example, *D. disciformis* (Hoffm.: Fr.) Fr. (Fig. 1A), *D. albopruinosa* (Schwein.) Cooke, *D. virescens* (Schwein.) M.A. Curtis, etc.], while *Cryptovalsa* is a polysporous counterpart of *Eutypa*.

Eutypoid stromata are of two types. Examples of the first type are widely effuse as diatrypoid stromata [cf. *Diatrype stigma* (Hoffm.: Fr.) Fr.] but mostly

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within wood tissues [cf. *Eutypa maura* (Fr.: Fr.) Fuckel, *E. falvovirens* (Pers. : Fr.) Tul. et C. Tul. (Fig. 1B)], whereas examples of the second type (Fig. 1B) are erumpent from bark in a diatrypelloid manner [cf. *E. leprosa* (Pers.: Fr.) Sacc.]. The latter were treated recently as members of *Eutypella* (Rappaz, 1987), although eutypoid stromata have a definite ectostromatic disc, whereas the traditional circumscription of *Eutypella* includes taxa with mere clusters of perithecial beaks (similar to those in *Diaporthe*).

Eutypoid stromata of members of the genus *Cryptovalsa* are mostly well developed and similar to those of *Eutypa leprosa*. Whether this genus corresponds to *Eutypa* or *Eutypella*, the above comparison shows it to be surely different from *Diatrypella*. Nevertheless, it is still difficult to formulate clear differences between *Diatrypella* and *Cryptovalsa*, and some authors (e.g. Tiffany and Gilman, 1965) place the latter name in synonymy with the former.

Both genera need a thorough investigation. Very few publications have been devoted to *Diatrypella*. For a long time, the concept of *Diatrypella favacea* (Fr.) Ces. et De Not., but also including *D. verruciformis* (Ehrh.: Fr.) Nitschke, *D. nigro-annulata* (Grev.) Nitschke, *D. tocciaeana* De Not., and *D. aspera* (Fr.) Nitschke, was the one accepted by most mycologists (Croxall, 1950). Several decades later, there was a renewed interest in this 'species', and a new subspecies of *D. favacea* was described by Chlebicki (1986). However, examination of the illustration provided with the description indicates that it has nothing to do with *D. favacea*.

Until recently, the names of a number of species (e.g. *D. favacea* and *D. verruciformis* or *D. discoidea* and *D. decorata*) within the genus were synonymised (Farr *et al*., 1989). The most useful publication dealing with species delimitation in *Diatrypella* is a treatment of seven species from the Pacific Northwest of the United States (Glawe and Rogers, 1984). The same number of species, but including members of *Cryptovalsa*, was listed by Tiffany and Gilman (1965) in their paper on the *Diatrypaceae* of Iowa. In addition, Vasilyeva and Scheuer (1996) attempted the delineation of several European species of *Diatrypella*. Three species, namely *Diatrypella discoidea* Cooke et Peck, *D. discoidea* var. *alni* Cooke (treated here as a separate species), and *D. favacea* (Fr.) Ces. et De Not., had been reported from the Great Smoky Mountains National Park (GSMNP) prior to the present study (Petersen, 1979).

The present paper represents the second in a series of publications on the pyrenomycetes of the Great Smoky Mountains National Park (GSMNP) in western North Carolina and eastern Tennessee (Vasilyeva and Stephenson, 2004). During a six-week period from late March to early May 2002, specimens representing a number of additional species of *Cryptovalsa* and *Diatrypella* were collected at various localities in the Park. The purpose of this paper is to

report these new records, some of which are also new for North America. The specimens upon which these records were based are deposited in the herbarium (VLA) of the Institute of Biology and Soil Science, Vladivostok, Russia.

Taxonomy

Cryptovalsa Ces. et De Not., Comm. Soc. Critt. Ital., 1(4): 203, 1863.

Type species: *Cryptovalsa protracta* (Pers.: Fr.) De Not.

Stromata rather variable, eutypoid, but when erumpent separately diatrypelloid, often immersed in wood but sometimes invading bark tissues. *Asci* cylindrical or clavate, polysporous, with short or long sralks. *Ascospores* crowded, allantoid, yellowish.

Key to species of *Cryptovalsa* known from GSMNP

1. Stromata erumpent from bark in eutypelloid manner, small and densely aggregated 2
1. Stromata larger, eutypoid or almost cryptosphaeroid, often confluent and penetrating bark tissues as a single massive body 4

2. Ascospores 5-7 µm long ..... ***C. sassafras***
2. Ascospores larger.....3

3. Ascospores 7-9 µm long on average.....***C. prominens***
3. Ascospores up to 12 µm long or even larger ..... ***C. opaca***

4. Stromata eutypoid, penetrating bark tissues and erumpent as multiple confluent ectostromatic discs, ascospores 7-9 µm long..... ***C. protracta***
4. Stromata almost cryptosphaeroid, i.e. covered by epidermis that is merely perforated by sulcate ostioles, ascospores up to 12 µm long .....***C. mori***

Cryptovalsa mori (Nitschke) Lar. N. Vassiljeva, **comb. nov.** (Fig. 2)

Valsa mori Nitschke, Pyr. Germ., p. 157, 1867.

Stromata effuse, innate in the bark, covered by epidermis that is merely perforated by black sulcate ostioles forming irregular groups. *Asci* p. sp. 80-100 × 12-16 µm. *Ascospores* 8-12 µm long.

Habitat: On dead branches of an unidentified deciduous tree.

Locality in GSMNP: Cosby (Old Settler Trail).

Notes: This species is more commonly known as *Cryptovalsa nitschkei* Fuckel and was reported under that name from both Canada (Ellis and Everhart, 1982) and the United States (Tiffany and Gilman, 1965). The descriptions in both of these publications indicate larger spores and correspond to *Cryptovalsa rabenhorstii* (Nitschke) Sacc. (12-15 µm long). Nitschke (1867) described *Valsa mori* as having ascospores 8-10 µm long. The same range of ascospore length is given for *Cryptovalsa nitschkei* in Saccardo's (1882) treatment.

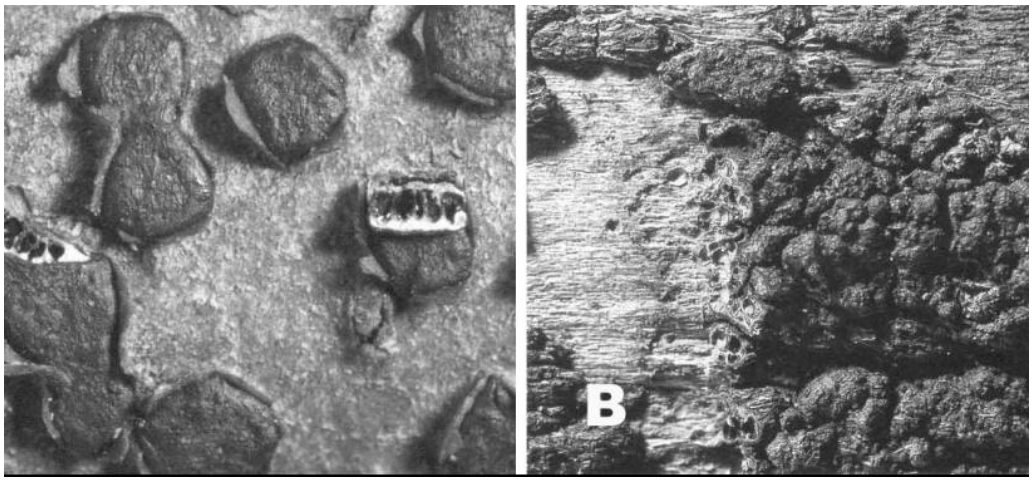


Fig. 1. Examples of the two types of stromata found in the Diatrypaceae. **A.** *Diatrype disciformis*. **B**. *Eutypa flavovirens*. [Based on illustrations provided by Breitenbach and Kränzlin (1984).]

Fuckel (1869) placed *Valsa mori* in the genus *Cryptovalsa* but did not make a correct new combination. Instead, he preferred to coin a new name (*C. nitschkei*) on the basis that the fungus occurs on different host plants. However, such a reason cannot be taken into account when nomenclatural problems are concerned. Moreover, the host ranges of *Cryptovalsa* species have not been investigated properly. Some species (e.g. *C. prominens* and *C. opaca*) are restricted to certain host plants, and it appears that *C. mori* might not be so promiscuous in regard to substrata as was supposed.

Cryptovalsa opaca (Cooke) Lar. N. Vassiljeva, **comb. nov.** (Fig. 3)

Diatrype (*Diatrypella*) *opaca* Cooke, Ann. New York Acad. Sci., 1: 185, 1879.

Diatrypella opaca (Cooke) Sacc., Syll. Fung., 1: 207, 1882.

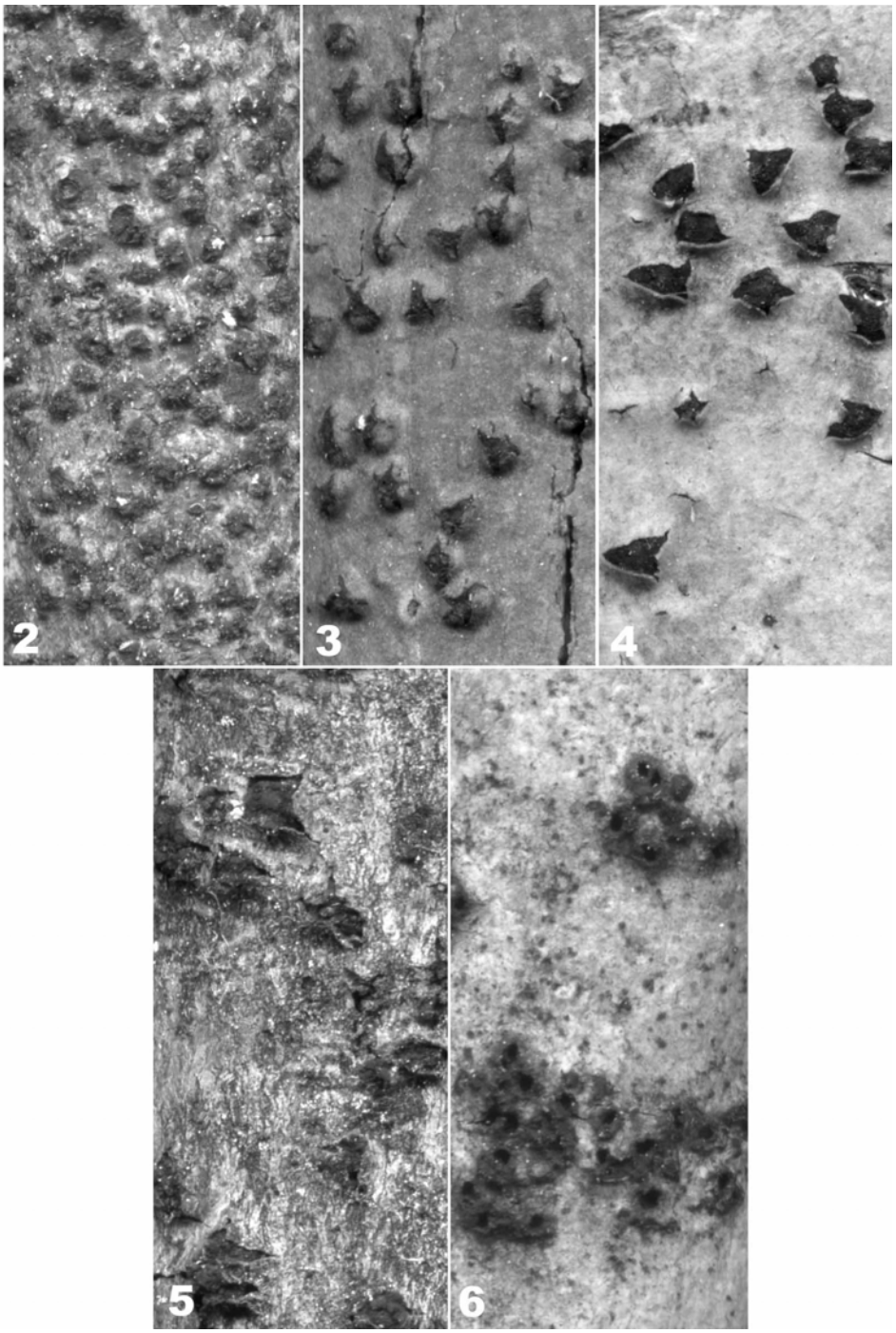
Illustration: Berlese, 1900, pl. CL, Fig. 2.

Stromata small, wart-like, orbicular or angular, 1-1.5 mm diam., dark-brown or almost black, white inside, with few perithecia; ostioles not distinctly sulcate. *Asci* 80-95 × 14-16 µm. *Ascospores* 8-12(13) × 2-2.5 µm.

Habitat: On dead branches of *Ilex opaca* Aiton.

Locality in GSMNP: Cades Cove (Parsons Branch Road).

Notes: We ventured to assign the specimen to *Diatrypella opaca* despite its ascospores are 8-12(13) µm long, while the descriptions in literature indicate 6-8 µm long (Ellis and Everhart, 1892; Berlese, 1900). Cooke (1879) did not refer to ascospore size in his original description but compared the fungus with *Diatrypella quercina* (Pers.: Fr.) Nitschke that have the same range of ascospore length as the fungus in our specimen on *Ilex opaca*. He wrote that the difference between two species consists in the smaller and 'neater' stromata and



Figs. 2-6. Stromata of species of *Cryptovalsa* known from GSMNP. **2.** *Cryptovalsa sassafras*. **3.** *Cryptovalsa prominens*. **4.** *Cryptovalsa opaca*. **5.** *Cryptovalsa protracta*. **6.** *Cryptovalsa mori*.

less prominent, smaller ostioles in *Diatrype opaca*. This might mean that ascospores are similar. Berlese's (1900, pl. CL, Fig. 2) illustration conveys just the same kind of stromata and asci that are observable in our specimen, while Ellis and Everhart (1892) indicate comparable size of asci (75-90 × 12-15 µm), which deviate from Berlese's description (asci 65-75 × 6-7 µm).

The species was first reported from Texas and Florida (Ellis and Everhart, 1892). Later, its distribution was described as encompassing the southeastern United States (Farr *et al*., 1989).

Cryptovalsa prominens (E. Howe) Berl., Icon. Fung., 3: 112, 1900. (Fig. 4)

Diatrype prominens E. Howe, Bull. Torr. Bot. Club, 5: 42, 1874.
Diatrypella prominens (E. Howe) Ellis et Everh., North Amer. Pyren., p. 592, 1892.
Illustration: Berlese, 1900, Tab. CXXXIX, Fig. 2.

Stromata wart-like, erumpent from bark, orbicular or angular, densely aggregated; perithecia few, subglobose, necks short, ostioles conical sulcate. *Asci* 80-90 × 10-14 µm. *Ascospores* (6)7-9(10) µm long.

Habitat: On dead branches of *Platanus occidentalis* L.
Locality in GSMNP: Cosby (common).

Notes: The species was reported previously from New York and California by Ellis and Everhart (1892) and from Iowa by Tiffany and Gilman (1965), on dead branches of *Platanus*. Strangely enough, Berlese (1900) referred to the specimen from New York (Shear, New York Fungi exs., N 338) as having been collected on *Lonicera japonica*.

Cryptovalsa protracta (Pers.: Fr.) De Not., Sfer. Ital., p. 40, 1863. (Fig. 5)

Sphaeria protracta Pers., Syn. Meth. Fung., p. 34, 1801.
Sphaeria protracta Pers.: Fr., Syst. Mycol., 2: 425, 1823.
Valsa protracta (Pers.: Fr.) Nitschke, Pyr. Germ., p. 155, 1867.
Engizostoma protractum (Pers.: Fr.) Kuntze, Rev. Gen. Pl., 3(2): 475, 1898.
Illustration: Berlese, 1900, Tab. CXL, Fig. 2.

Stromata sometimes diatrypelloid in shape, but mostly confluent into a single eutypoid body penetrating the bark tissues and erumpent as multiple confluent ectostromatic discs with rather large sulcate ostioles. *Asci* p. sp. 80-90 × 8-10 µm. *Ascospores* 7-9 µm long.

Habitat: On dead branches of an unidentified deciduous tree (?*Acer*).
Locality in GSMNP: Cosby (Appalachian Trail).

Notes: This species was indicated for North America (Florida) as *Cryptovalsa ampelina* (Nitschke) Fuckel (Farr *et al*., 1989). Berlese (1900) listed *C. ampelina* as a synonym of *C. protracta* that has a priority.

Cryptovalsa sassafras (Ellis et Everh.) Berl., Icon. Fung. 3: 111, 1900. (Fig. 6)

Diatrypella sassafras Ellis et Everh., North Amer. Pyren., p. 588, 1892.
Illustration: Berlese, 1900, Tab. CXXXIX, Fig. 1.

Stromata small, 1-1.5 mm diam., with several coarse, black, stellate-cleft ostioles at the brown disc. *Asci* not observed (Ellis and Everhart: p. sp. 75-80 × 10 µm; Berlese: p. sp. 50-60 × 8-9 µm). *Ascospores* 5-7 µm long.

Habitat: On dead branches of *Lindera benzoin* (L.) Blume.

Locality in GSMNP: Cosby (Low Gap Trail).

Notes: Prior to the present study, this species was known only from the type locality in New Jersey (Ellis and Everhart, 1892; Farr *et al*., 1989).

Diatrypella (Ces. et De Not.) Nitschke, Pyr. Germ., p.69, 1867.

Diatrype sect. *Diatrypella* Ces. et De Not., Comm. Soc. Critt. Ital., 1: 202, 1863.

Microstoma Auersw. in Rabenh., Fungi Eur., N 253, 1860.

Type species: *Diatrypella favacea* (Fr.) Nitschke

Stromata conical-truncate, cushion-like or discoid, usually delimited by a black zone in host tissues, with umbilicate or sulcate ostioles. *Asci* cylindrical. polysporous, with long stalks. *Ascospores* allantoid, hyaline or yellowish.

Key to the species of *Diatrypella* known from GSMNP

1. Ascospores 4-5 µm long on average 2
1. Ascospores 6-8 µm long on average 6

2. Stromata small, up to 2 mm diam. 3
2. Stromata larger 4

3. Ostioles large and often surrounded by a ring-like furrow, on *Betula* ..... ***D. decorata***
3. Ostioles smaller, without a ring-like furrow, on *Fagus* ..... ***D. major***

4. Ostioles do not project above stromatal surface, sometimes with radiating stellate fissures around, on *Alnus* ..... ***D. placenta***
4. Ostioles more prominent, projecting above the stromatal surface 5

5. Stromata without yellow-green pigment, on *Betula* ..... ***D. discoidea***
5. Stromata with yellow-green pigment above perithecia inside, ostioles larger, on *Betula* .... ***D. betulina***

6. Stromata with whitish ectostromatic disc and black sulcate ostioles 7
6. Stromata black, ostioles non-sulcate ..... ***D. verruciformis***

7. Ostioles prominent and large, 6-sulcate, on *Betula* ..... ***D. favacea***
7. Ostioles less prominent and smaller, on *Fagus* ..... ***D. melaleuca***

Diatrypella betulina (Peck) Sacc., Syll. Fung., 1: 208, 1882. (Fig. 7)

Diatrype betulina Peck, New York State Mus. Rep., 25: 101, 1873.

Illustrations: Peck, 1873, plate 1, Figs. 27-31.

Stromata erumpent from bark, discoid or elliptical, up to 4 mm diam., flat or slightly convex, brown or dark at the surface, with prominent sulcate ostioles and yellow-green pigment above perithecia inside. *Asci* p. sp. 50-60 × 6-8 µm. *Ascospores* 4-6 µm long.

Habitat: On dead branches of *Betula* spp.

Localities in GSMNP: Cosby (Low Gap Trail, Snake Den Ridge Trail).

Diatrypella decorata Nitschke, Pyr. Germ., p. 79, 1867 (Fig. 8)

Illustration: Berlese, 1900, Pl. CLVII.

Stromata small, wart-like, elliptical, up to 2 mm diam., brown at the surface with large sulcate ostioles, often surrounded by a ring-like furrow. *Asci* p. sp. 40-45 × 5-6 µm. *Ascospores* 4-5(6) µm long.

Habitat: On dead branches of *Betula* sp.

Locality in GSMNP: Purchase Knob (Hemphill Bald Road).

Diatrypella discoidea (Cooke et Peck) Sacc., Syll. Fung., 1: 207, 1882. (Fig. 9)

Diatrype discoidea Cooke et Peck in Peck, New York State Mus. Rep., 28: 71, 1876.

Stromata orbicular to elliptical, flat or slightly convex, up to 3 mm diam., with brown surface and sulcate ostioles; perithecia polystichous. *Asci* p. sp. 40-45 × 5-7 µm. *Ascospores* 4-5(6) µm long.

Habitat: On dead branches of *Betula* spp.

Localities in GSMNP: Newfound Gap; Balsam Mountain (Flat Creek Trail); Cosby (Low Gap Trail).

Notes: Glawe (1986) considered this species to be identical with *D. decorata*.

Diatrypella favacea (Fr.) Nitschke, Pyr. Germ., p. 77, 1867 (Fig. 10)

Sphaeria favacea Fr., Syst. Mycol., 2: 354, 1823

Diatrype (*Diatrypella*) *favacea* (Fr.) Ces. et De Not., Comm. Soc. Critt. Ital., 1(4): 202, 1863.

Microstoma favaceum (Fr.) Auersw., Verh. Nat. Ver. Brünn, 3: 165, 1864 (1865).

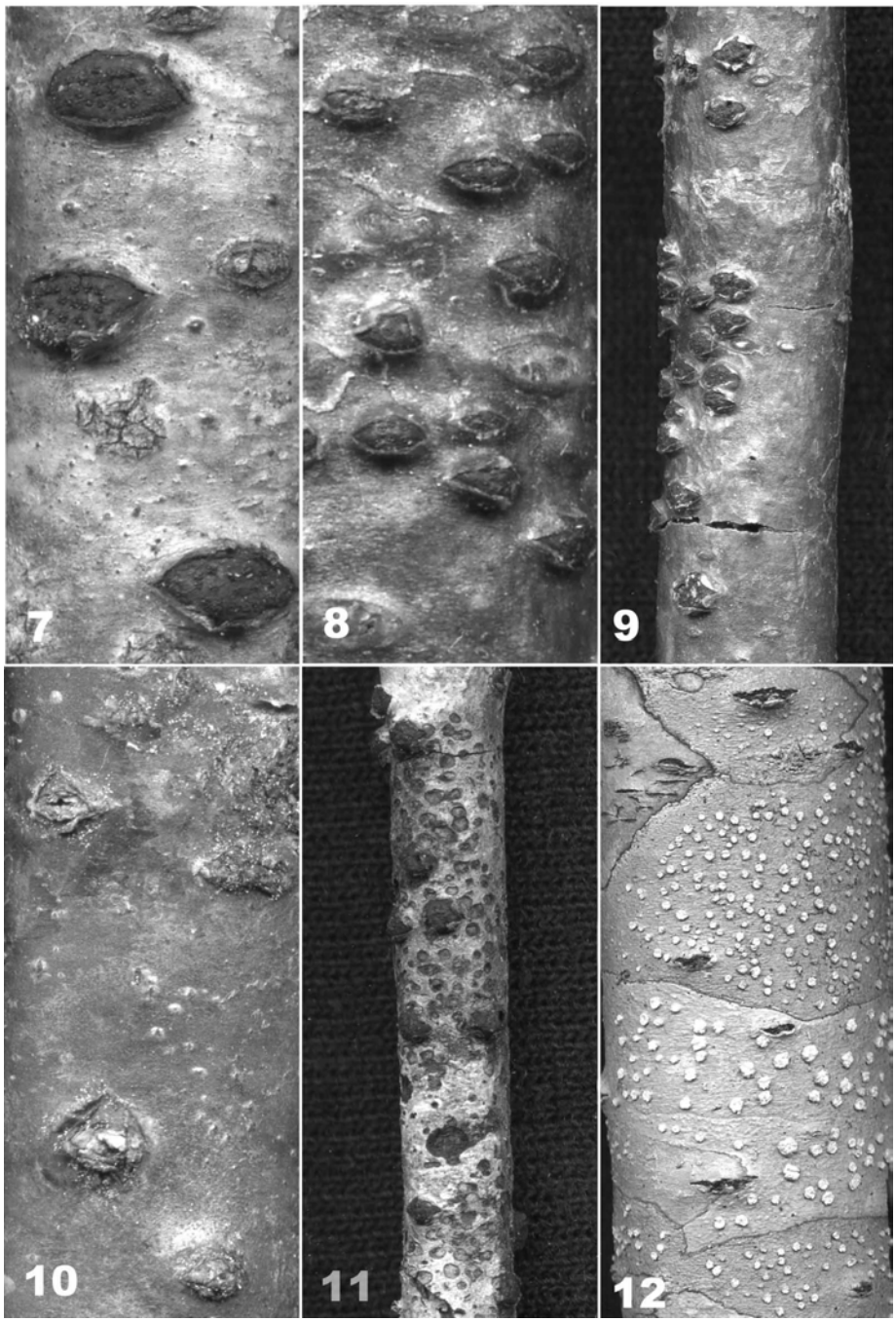
Illustration: Berlese, 1900, Pl. CLIV.

Stromata conical-truncate, with ellipsoid ectostromatic disc and large, black, 6-sulcate ostioles at whitish or pallid-brownish surface. *Asci* 70-90 × 8-12 µm. *Ascospores* 6-8 µm long.

Habitat: On dead branches of *Betula* spp.

Localities in GSMNP: Cosby (Gabes Mountain Trail, Low Gap Trail, Snake Den Ridge Trail); Cades Cove (Anthony Creek Trail, Appalachian Trail, Finley Cane Trail, Laurel Creek Road); Cataloochee (Pretty Hollow Gap Trail).

Notes: When old, the stromata are black and remind one of *Diatrypella verruciformis* (Ehrh.: Fr.) Nitschke. However, the presence of large sulcate ostioles distinguishes *D. favacea* from the latter species, which was described as having non-suclate ostioles.



Figs. 7-12. Stromata of species of *Diatrypella* known from GSMNP. **7.** *Diatrypella betulina* **8.** *Diatrypella decorata* **9.** *Diatrypella discoidea* **10.** *Diatrypella favacea*. **11.** *Diatrypella major*. **12.** *Diatrypella melaleuca*.

Diatrypella major (Berl.) Lar. N. Vassiljeva, **comb. nov.** (Fig. 11)

Diatrypella decorata Nitschke var. *major* Berl., Icon. Fung., 3: 119, 1900.

Illustration: Berlese, 1900, Tab. CLVIII.

Stromata small, wart-like, orbicular, with brown surface and sulcate ostioles. *Asci* p. sp. 45-50 × 5-7 µm. *Ascospores* 4-5 µm long.

Habitat: On dead branches of *Fagus occidentalis* L.

Locality in GSMNP: Cataloochee (Pretty Hollow Gap Trail).

Notes: This species was previously known only from Europe. Because of the new combination, the specific epithet is misleading, since the stromata are very small in comparison with those of the other species of *Diatrypella* treated here. However, we cannot introduce the new name, since there are no other species in the genus with the same epithet.

Diatrypella melaleuca Nitschke, Pyr. Germ., p. 80, 1867 (Fig. 12)

Stromata elongated, narrow-elliptical, with whitish surface and black sulcate ostioles. *Asci* p. sp. 50-60 × 7-9 µm. *Ascospores* 6-8 µm long.

Habitat: On dead branches of *Fagus occidentalis* L.

Locality in GSMNP: Cataloochee (Boogerman Trail).

Notes: This species was previously known only from Europe.

Diatrypella placenta Rehm, Hedwigia, 21: 117, 1882.

Diatrype placenta (Rehm) Cooke, Grevillea, 14: 15, 1885.

Diatrype discoidea Cooke et Peck var. *alni* Rav., Fungi Amer. exs., N 188, 1878.

Illustrations: Berlese, 1900, Pl. CLVI, Fig. 2; Glawe and Rogers, 1984, Figs. 15-17; Kahr *et al*., 1996, Fig. 7.

Stromata discoid, erumpent from bark, flat or slightly convex, up to 4 mm diam., with sulcate ostioles pressed in pallid- or dark-brown surface and surrounded with radiating fine cracks. *Asci* 45-60 × 5-7 µm. *Ascospores* 4-6 µm long.

Notes: This species, which is restricted to species of *Alnus*, was reported from the Great Smoky Mountains National Park by Petersen (1979). We did not collect it during the present study, but the species is included in our treatment of *Diatrypella* for the Park.

Diatrypella verruciformis (Ehrh.: Fr.) Nitschke, Pyr. Germ., p. 76, 1867.

Sphaeria verrucaeformis Ehrh., Pl. crypt. exs., N 280, 1785.

Sphaeria verrucaeformis Ehrh.: Fr., Syst. Mycol., 2: 355, 1823.

Microstoma verrucaeforme (Ehrh.: Fr.) Auersw. in Rabenh., Fungi Eur., N 253, 1860.

Illustration: Berlese, 1900, Pl. CLII.

Stromata verrucose or cushion-shape, 3-5 mm diam., black, with wrinkled surface and non-sulcate ostioles. *Asci* 100-120 × 10-14 µm. *Ascospores* 6-8 µm long.

Habitat: On dead branch of *Betula* sp.

Locality in GSMNP: Cataloochee (Pretty Hollow Gap Trail).

Notes: This species is tentatively listed here, since the material we collected is very old and lacks asci and ascospores. Our identification was based on the overall appearance of stromata, which is the same as what has been observed previously in authentic European material (cf. Vasilyeva and Scheuer, 1996).

Acknowledgements

The authors are grateful to Jeanie Hilten, administrative officer of Discover Life in America, as well as the many volunteers who helped with transportation within the Great Smoky Mountains National Park. Special thanks are extended to Mary McCord, Nancy Lowe, Nancy Headlee, Charlie Muise, Jim and Betsy Froyd, Robert and Nora White for their sympathy and kindness. The visit of the first author to the United States was made possible as a result of an Expert Visit award (Ref. #978557) from the North Atlantic Treaty Organization. We wish to thank Randy Darrah for his help in preparing the figures used in this paper.

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(Received 1 September 2004; accepted 3 December 2004)