Studies in the Stromatic Sphaeriales of Indiana—II[1]

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This paper is the second in a series of taxonomic reports covering the stromatic members of the order *Sphaeriales*. An attempt is made here to organize and to complete, where possible, the scattered and often unrelated or incomplete data concerning the Indiana species of the family *Diatrypaceae*, and to present it in such a manner that it will form a workable basis for future taxonomic investigation or for classroom determination of collections.

During the preparation of this study specimens were available from the following institutions: DePauw University (DPU)[2]; Indiana University (IU); Miami University (MU); New York Botanical Garden (NY); and Wabash College (WAB).

DIATRYPACEAE

Diatrypeae Winter, in Rabenhorst, *Kryptogamen-Flora.* 1 (Div. II): 810. 1887.

Diatrypaceae Lindau, in Engler and Prantl, *Die Natürlichen Pflanzenfamilien.* 1 (Div. I): 472. 1897.

Stromata composed entirely of fungus elements (stroma and host not mixed), effused, pulvinate, shield-shaped, or tuberculiform. Conidial and ascigerous stages characteristically on different stromata. Perithecia monostichous or polystichous with their ostiola separately erumpent. Ascospores small, cylindrical, usually curved, allantoid, hyaline or light brown unicellular.

Key to the Genera

Asci 8-spored.....*Diatrype*
Asci with more than 8 spores.....*Diatrypella*

DIATRYPE Fries

Diatrype Fries, Summa Veg. Scand. 385. 1849.

Valseutypella Hoehnel, Ann. Mycol. 16:224. 1918.

Ectosphaeria Spegazzini, Bol. Acad. Cordoba, 25:48, ill. 1921.

Stromata effused or isolated, ectostroma deciduous, exposing a widely erumpent entrostromatic disk. Perithecia parallel, separately

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[2] These abbreviations are used in locating specimens referred to in the citations following each species description throughout this paper.

erumpent. Ascospores eight, allantoid, yellowish. Imperfect stage ectostromatic.

Key to the Species

1. Stromata greenish-yellow.....7. *D. virescens*
   Stromata (mature) light brown to black.....2
2. Stromata 2 cm. in length to widely effused.....3
   Stromata variously pulvinate but not exceeding 4 mm. in longest diameter.....4
3. Perithecia closely packed; asci (sp. p.)[3] 25-30 microns long.....5. *D. platystoma*
   Perithecia evenly distributed; asci (sp. p.) 30-50 microns long.....6. *D. stigma*
4. Ascospores 12-16 microns long.....1. *D. albopruinosa*
   Ascospores not exceeding 12 microns in length.....5
5. Asci (sp. p.) 40-45 microns long.....4. *D. hochelagae*
   Asci (sp. p.) less than 40 microns in length.....6
6. Ostiola prominent, erumpent; stromata 1.5-2.5 mm. in diameter.....2. *D. asterostoma*
   Ostiola small, obtusely conical, slightly projecting; stromata 2-3 mm. in diameter.....3. *D. disciformis*

1. *Diatrype albopruinosa* (Schweinitz) Cooke

Sphaeria albopruinosa Schweinitz, Syn. fung. N. Am. 195. 1831.

Diatrype albopruinosa (Schweinitz) Cooke, Grevillea, 13:37. 1885.

Diatrype roseola Winter, Journ. Mycol. 1:121. 1885.

Diatrype Durieui Montagne, in Herb. Curtis (fide Ellis & Everhart, N. Am. Pyr. 570. 1892.)

Diatrype Webberi Ellis & Everhart, in Herb. E. & E. (fide Ellis & Everhart, N. Am. Pyr. 570. 1892.)

Eutypella sheariana Berlese, Icon. Fung. 3:68. 1905.

Stromata scattered or subgregarious, sometimes confluent, suborbicular, 1.5-2.5 (exceptionally 3-4 mm. broad, slightly convex, surrounded by the ruptured epidermis, whitish when young and fresh, becoming finally dark brown, light-colored inside, surface becoming more or less fissured. Perithecia 10-30 in a stroma, crowded ovate or elliptic-oblong. Ostiola more or less prominent, 3-5 sulcate-cleft, black. Asci oblong-clavate, long-stipitate, sp. p. 55-65 x 7 microns. Ascospores heaped together, allantoid, obtuse, slightly curved, 12-16 x 2.5-4 microns, yellow-brown.

Specimens examined:

Clay Co.: May 19, 1928, Shaw (IU).

Monroe Co.: on oak, Bloomington, April 1909, Wood (IU).

Tippecanoe Co.: on oak wood, Lafayette, April 18, 1899, C. Riddle (MU).

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[3] Sp. p. is used here to indicate measurements of the spore-containing portion of the ascus.

Most of the non-effused species of Diatrype are separated with difficulty because of their macroscopic resemblances to each other. Spore and ascus measurements remain the best differential characters and are effective in separating *D. albopruinosa* (Schw.) Cke. from similar species. The asci and ascospores of *D. albopruinosa* are constantly larger than are those of *D. hochelagae* E. & E., *D. disciformis* (Hoffm.) Fr., and *D. asterostoma* Berk. & Curt.

2. *Diatrype asterostoma* Berkeley & Curtis

Diatrype asterostoma Berkeley & Curtis, Grevillea, 4:96. 1875.

Stromata wart-like, erumpent, scattered or subconfluent, 1.5-2.5 mm. in diameter, embraced at the base by the ruptured epidermis, externally black (white inside). Perithecia 10-20 in a stroma, globose, black, abruptly contracted into slender necks rising through the white substance of the stroma, with prominent, stellate-cleft, erumpent ostiola. Asci clavate, long-stipitate, sp. p. 25 x 4-5 microns, 8-spored. Ascospores allantoid, nearly hyaline, moderately curved, 6-10 x 1.5-2 microns.

Specimens examined:

Montgomery Co.: Rattlesnake Ravine, S. W. Crawfordsville, April 13, 1946, Simmons 1251 (DPU).

Morgan Co.: on fallen beech limb, ravine N. E. Martinsville, Sept. 20, 1941, Simmons 1252 (DPU).

Union Co.: on beech twigs, in open pasture, July 21, 1917, Fink 26 (MU).

This species is readily separated from *D. albopruinosa* (Schw.) Cke. and *D. hochelagae* E. & E. by reason of its smaller asci. However, distinctions made between *D. asterostoma* Berk. & Curt. and *D. disciformis* (Hoffm.) Fr. are so slight that *D. asterostoma* appears to be little more than a variety of D. disciformis. Differentiation between the two is made by means of the smaller stromata and more prominent ostiola of *D. asterostoma.*

3. *Diatrype disciformis* (Hoffmann) Fries

Sphaeria disciformis Hoffman, Veg. Crypt. 1:15. 1787.

Sphaeria depressa Sowerby, Eng. Fung. Vol. 2, pl. 216. 1799.

Sphaeria grisea DeCandolle, Flore Fr. 2:122. 1805.

Diatrype disciformis (Hoffman) Fries, Summa Veg. Scand. 385. 1849.

Stromata scattered or gregarious, flattened-pulvinate, round, 2-3 mm. in diameter, discoid, erumpent and loosely embraced by the ruptured epidermis, dark brown, whitish inside, base sunken to the wood

and circumscribed by a black line. Perithecia 20-30 (or more) in a stroma, ovate, about 0.75 x 0.5 mm., closely packed and subangular, with short necks and small, obtusely conical, smooth or 3-5-cleft, slightly projecting ostiola. Asci clavate, long stipitate, sp. p. 22-30 x 4-5 microns. Ascospores subbiseriate, allantoid, yellowish, slightly curved, 6-8 x 1.5-2 microns.

Specimens examined:

Montgomery Co.: on bark of dead limb, below dam, Sugar Creek, Crawfordsville, Spring, 1929, A. R. Bechtel 832 (WAB).

Ascus measurements of *D. disciformis* (Hoffm.) Fr. serve to distinguish it from both *D. albopruinosa* (Schw.) Cke. and *D. hochelagae* E. & E. Characteristics of *D. disciformis* and of *D. asterostoma* Berk. & Curt., as have been stated in previous remarks, are so similar, however, that varietal placement of *D. asterostoma*, if not actual synonymy, should be the proper treatment of the two.

4. *Diatrype hochelagae* Ellis & Everhart

Diatrype hochelagae Ellis & Everhart, Proc. Acad. Nat. Sci. Phil. 42:224. 1890.

Stromata orbicular or elongated, 2-3 mm. long and 1-2 mm. wide, often more or less confluent, pulvinate-verrucose, with the margin abrupt or slanting off at the ends, with a faint circumscribing black line which does not penetrate deeply into the wood, dull black outside, dirty white within. Perithecia crowded in the stroma, subglobose, about 0.5 mm. in diameter, with black, thick, leathery walls. Ostiola conic-hemispherical, deeply 4-5 sulcate-cleft. Asci (sp. p.) 40-45 x 7-8 microns, with stout paraphyses. Ascospores allantoid, yellowish, moderately curved, 8-12 x 2.5 microns.

Specimens examined:

Monroe Co.: on pear, Bloomington, Feb. 12, 1931, Amidei (IU).

Mature stromata of *D. hochelagae* E. & E. are scarcely separable from those of *D. albopruinosa* (Schw.) Cke. by macroscopic means. However, the differences between the two with respect to spore and ascus measurements (pointed out in the key to the species) are so constant that there is little probability of confusing these species.

5. *Diatrype platystoma* (Schweinitz) Ellis & Everhart

Sphaeria platystoma Schweinitz, Syn. fung. Car. 43. 1822.

Diatrype discostoma Cooke, Grevillea, 6:144. 1878.

Diatrype platystoma (Schweinitz) Ellis & Everhart, N. Am. Pyr. 566. 1892.

Stromata effused or, oftener, in suborbicular patches 1-2 cm. across or elongated 2-4x0.5-1 cm., soon erumpent, about 1 mm. thick, margin abrupt, slaty-black or black. Perithecia monostichous, ovate-oblong, 0.5-0.75 mm. high, closely packed. Ostiola prominent, hemispherical, entire or 4-sulcate. Asci (sp. p.) 25-30 x 4 microns, stipitate. Ascospores subbiseriate, allantoid, hyaline, 6-8 x 1.5 microns.

Specimens examined:

Monroe Co.: on maple, Bloomington, 1911, Owens (IU).

Morgan Co.: on decaying, decorticated wood, ravine N. E. Martinsville, Sept. 20, 1941, Simmons 1141 (DPU); on loosened bark of dead beech limb, ravine N. E. Martinsville, Sept. 20, 1941, Simmons 1147 (DPU).

Putnam Co.: on dead herbaceous stem, DePauw Arboretum, Oct. 25, 1945, Simmons 1136 (DPU); on dead limbs of ironwood, DePauw Arboretum, Oct. 25, 1945, Simmons 1138 (DPU); on fallen, rotting elm limb, DePauw Arboretum, Nov. 13, 1941, Simmons 1140 (DPU); on fallen oak branch, valley E. Bainbridge, Oct. 17, 1941, Simmons 1142 (DPU); on dead branch of beech, DePauw Arboretum, Nov. 13, 1941, Simmons 1144 (DPU); on upright weathered post, Hoosier Highlands, Sept. 16, 1941. Simmons 1160 (DPU).

Specimens of *D. platystoma* (Schw.) E. & E. and *D. stigma* (Hoffm.) Fr. frequently are found to be separated with difficulty. Both are effused forms of Diatrype and both become black or nearly black at maturity. *D. platystoma* usually is noticeably the more coarse of the two by reason of its slightly larger perithecia and ostiola. Ascus measurements show these of *D. platystoma* to be less than those of *D. stigma.*

6. *Diatrype stigma* (Hoffman) Fries

Sphaeria stigma Hoffman, Veg. Crypt. 1:7. 1787.

Sphaeria decorticans Sowerby, Eng. Fungi, Vol. 2, pl. 137. 1799.

Sphaeria decorticata DeCandolle, Flore Fr. 2:289. 1805.

Sphaeria undulata Fries, Syst. Mycol. 2:350. 1823.

Diatrype undulata Fries, Summa Veg. Scand. 385. 1849.

Diatrype stigma (Hoffman) Fries, Summa Veg. Scand. 385. 1849.

Stictosphaeria Hoffmanni Tulasne, Sel. fung. carp. 2:49. 1863.

Diatrype stigma Cesati & DeNotaris, Schema Sfer. Ital. 26. 1863.

Eutypa micropuncta Cooke, Grevillea, 6:144. 1878.

Diatrype Dearnessii Ellis & Everhart, in E. & E. North American Fungi, 2nd Ser. #2526. (fide Ellis & Everhart, N. Am. Pyr. 565. 1892.)

Diatrype tennissima Cooke, in Ravenel, Fungi Americani. (fide Ellis & Everhart, *loc. cit.).*

Sphaeria concolor Schweinitz, in Herb. Schweinitz. (fide Ellis & Everhart, *loc, cit.).*

Sphaeria subcutanea Wahlenberg, in Herb. Schweinitz. (fide Ellis & Everhart, *loc, cit.*)

Stromata widely effused, continuous or interrupted, often surrounding the limb, sometimes extending for several inches in length, at first covered by the epidermis, finally exposed, brownish or dusty-white, becoming darker or nearly black, whitish inside, definitely limited but irregular in outline, 0.5-1 mm. thick, sometimes undulate and of unequal thickness, the thinner parts then often sterile. Perithecia monostichous, evenly distributed, ovate, small, with short necks and punctiform, discoid, depressed-hemispherical or conical, entire or 4-cleft ostiola. Asci clavate-oblong, 8-spored, sp. p. 30-50 x 4-8 microns. Ascospores subbiseriate, allantoid, brownish, 6-9 x 1-1.5 microns.
Specimens examined:

Montgomery Co.: in Crawfords' Wood, Crawfordsville, Jan. 25, 1917, D. P. Miller (MU, WAB); Turners' Wood, S. W. Crawfordsville, May 21, 1941, Simmons 1101 (DPU).

Putnam Co.: on fallen branches, Hoosier Highlands, Sept. 16, 1941, Simmons 1137 (DPU).

Wabash Co.: on dead beech, Roann, March 20, 1908, Daisy G. Lewis (DPU).

This species is often collected in Indiana during its young stages, at which time the stroma is light brown or dusty-white in color. It commonly is found to encircle completely small dead branches. It can be separated from *D. platystoma* (Schw.) E. & E., which it greatly resembles, by reason of its constantly larger asci.

7. *Diatrype virescens* (Schweinitz) Ellis & Everhart

Sphaeria virescens Schweinitz, Syn. fung. N. Am. 195. 1831.

Diatrype disciformis (Hoffman) Fries var. *virescens* Berkeley, Grevillea, 4:95. 1875.

Diatrype virescens (Schweinitz) Ellis & Everhart, N. Am. Pyr. 569. 1892.

Stromata scattered, erumpent-superficial, orbicular, about 2 mm. in diameter, depressed-pulvinate, surrounded at the base by the ruptured epidermis; disk greenish-yellow, powdery, becoming darker with age. Perithecia monostichous, covered by the waxy, whitish substance of the stroma, about 0.33 mm. in diameter, 10-15 in a stroma, necks terminating in obstusely conical, 4-cleft, black ostiola barely erumpent

through the greenish disk. Asci (sp. p) about 35 x 5 microns, stipitate, 8-spored. Ascospores subbiseriate, allantoid, yellowish, moderately curved, 7-9 x 1.5-2 microns.

Specimens examined:

Monroe Co.: on beech, Bloomington, July, 1938, Lohman (IU).

Montgomery Co.: on dead branches, Crawfordsville, H. W. Anderson (MU); on *Tilia sp.*, Camp Rotary, near Crawfordsville, Nov. 18, 1945, A. R. Bechtel (DPU); on dead beech branches, Lybyar farm, S. W. Crawfordsville, Nov. 22, 1941, Simmons 1146 (DPU).

Putnam Co.: on beech limb, Greencastle, Jan. 22, 1908, Daisy G. Lewis (DPU); Fern, Sept. 1893, L. M. Underwood (DPU); on dead beech limb, Greencastle, May 25, 1908, Daisy G. Lewis (DPU).

D. virescens (Schw.) E. & E. is rarely confused with any other pulvinate species of Diatrype. The small yellow-green, cushion-like stromata are found to retain their color for many years under herbarium conditions, specimens examined in the course of this study often being as much as 38 years old.

Diatrypella Cesati & DeNotaris

Diatrypella Cesati & DeNotaris, Schema Sfer. Ital. 29. 1863.

Stromata effused or isolated, ectostroma absent or strongly developed but not deciduous; entostroma well developed, often pustulate but usually not widely erumpent, bounded by a dark marginal zone. Perithecia usually clustered, rarely separately erumpent. Ostiola usually sulcate. Asci long-stipitate, polysporous. Ascospores 1-celled, allantoid, yellow-hyaline. Imperfect stage primarily ectostromatic.

Key to the Species

1. Asci large, more than 80 microns long ..... 4. *D. quercina*
   Asci less than 80 microns long 2
2. Asci less than 60 microns long ..... 3. *D. prominens*
   Asci more than 60 microns long 3
3. Ostiola 3-4 stellate-cleft; entostroma whitish .... 1. *D. Cephalanthi*
   Ostiola entire; entostroma greenish ..... 2. *D. Frostii*

1. *Diatrypella Cephalanthi* (Schweinitz) Saccardo

Sphaeria Cephalanthi Schweinitz, Syn. fung. Car. 7. 1882.

Diatrypella Cephalanthi (Schweinitz) Saccardo, Syll. fung. 1:209. 1882.

Stromata scattered, 2-3 mm. in diameter, scarcely penetrating to the wood, at first small and subtubercular-erumpent, black, apex generally traversed by a single longitudinal, deep furrow (giving the appearance of an Hysterium), but this furrow soon obliterated as the apex of the stroma protrudes itself still further, assuming an orbicular or elliptical

form, 1-3 mm. in diameter, and roughened by the protruding, black, rough subconical ostiola which are 3-4 stellate-cleft. Perithecia 6-20 in a stroma, closely packed, ovate or subangular, about 0.5 mm. in diameter, lying in and covered by the scanty whitish substance of the stroma; walls thick, black leathery; necks short. Asci fusoid, 110-115 (sp. p. 75-80) x 8-10 microns, polysporous, stipitate, paraphysate. Ascospores allantoid, yellow-hyaline, not strongly curved, 6-9 x 1.5 microns.

Specimens examined:

Putnam Co.: on Cephalanthus, Fern, December 1892, L. M. Underwood (NY). determined by Ellis as "*Diatrype Cephalanthi?*"

The collection cited above is still in excellent condition and yields numerous multi-spored asci and the subhyaline, slightly curved ascospores typical of species of Diatrypella.

The stromatic pustules of Diatrypella species are so similar to each other and to pulvinate species of Diatrype that determination of members of this group depends almost entirely upon ascus observations. *D. Cephalanthi* (Schw.) Sacc., as it is described, can be separated from *D. quercina* (Pers.) Nke. and *D. prominens* (Howe) E. & E. by ascus measurements and from *D. Frostii* Peck by reason of its whitish entostroma and stellate-cleft ostiola in contrast to the greenish entostroma and entire ostiola of *D. Frostii.*

2. *Diatrypella Frostii* Peck

Diatrypella Frostii Peck, Bot. Gaz. 3:35. 1878.

Stromata wart-like, 1-2 mm. in diameter, seated on the inner bark which is slightly blackened and marked around each stroma with a circumscribing line penetrating to the wood, erumpent, surrounded and partly covered (except the apex) by the ruptured epidermis, black outside, greenish within, forming a white spot on the wood beneath. Perithecia ovate-globose, 10-15 in a stroma, 0.33-0.5 mm. in diameter. Ostiola vary from obtuse-conical to subelongated, conic-cylindrical, entire, often obscure. Asci polysporous, cylindric-clavate, stipitate, paraphysate, sp. p. 75-80 x 12-15 microns. Ascospores yellowish, allantoid, moderately curved, 7-8 x 2 microns.

Specimens examined:

Monroe Co.: on *Acer sp.*, Bloomington, Amidei (IU).

D. Frostii Peck, as is true with other species of Diatrypella, can best be determined by means of ascus measurements. Separation from *D. Cephalanthi* (Schw.) Sacc., which it greatly resembles, is by its characteristically greenish entostroma and entire ostiola.

3. *Diatrypella prominens* (Howe) Ellis & Everhart

Diatrype prominens Howe, Bull. Torr. Bot. Club, 5:42. 1874.

Diatrypella prominens (Howe) Ellis & Everhart, N. Am. Pyr. 592. 1892.

Stromata wart-like, orbicular or angular, 1-1.5 mm. in diameter, erumpent and closely encircled by the ruptured epidermis, subprominent, black outside, whitish inside. Perithecia 4-8 in a stroma, subglobose, about 0.33 mm. in diameter, necks short, with their ostiola obtusely conical, slightly prominent and finally broadly and irregularly perforated. Asci clavate-stipitate, 75-80 (sp. p. 40-60) x 10-12 microns, paraphysate, polysporous. Ascospores allantoid, yellow-hyaline, moderately curved, 6-8 x 1.0-1.5 microns.

Specimens examined:

Monroe Co.: on sycamore, Bloomington, April 13, 1910, J. M. Van Hook 2768 (IU).

Montgomery Co.: on dead sticks, Crawfords' Wood, near Crawfordsville, Aug. 27, 1917, Fink & Fuson 272 (MU).

Certain determination of this species, as is pointed out in the key to species of Diatrypella, depends almost entirely on ascus measurements. Asci of *D. prominens* (Howe) E. & E. are constantly less than 60 microns in length, the shortest ones to be found among the species reported for Indiana.

4. *Diatrypella quercina* (Persoon) Nitschke

Sphaeria quercina Persoon, Syn. meth. fung. 24. 1801.

Diatrype quercina Fries, Summa Veg. Scand. 385. 1849.

Diatrypella Rousselii Cesati & DeNotaris, Schema Sfer. Ital. 32. 1863.

Diatrypella quercina (Persoon) Nitschke, Pyr. Germ. 71. 1867.

Stromata erumpent, surrounded by the substellate-cleft, adherent epidermis, pulvinate, orbicular or angular, rugose, thick; disk plano-convex, becoming black, mostly solitary but sometimes 2-3 confluent, 2-4 mm. in diameter. Perithecia 2-15 in a stroma, in a single or double layer, ovoid or subangular from compression, 0.5-0.75 mm. in diameter, attenuated into rather long necks rising through the grayish-white substance of the stroma with their conic-hemispherical, quadrisulcate ostiola distinctly erumpent. Asci clavate-fusoid long-stipitate, sp. p. 80-100 x 9-10 microns. Ascospores numerous, allantoid, yellowish, strongly curved, 8-12 x 2-3 microns.

Specimens examined:

Putnam Co.: on dead oak, near Big-Four Springs, Greencastle, May 27, 1908, Daisy G. Lewis (DPU).

The relatively large asci of *D. quercina* (Pers.) Nke. (sp. p. 80-100 microns in length) readily distinguish it from other members of the genus. The multi-spored asci are easily made out, thus precluding the possibility of confusion of the species with members of the genus Diatrype.

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