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STUDIES OF CERTAIN SPECIES OF MELANCONIS ON CARPINUS, OSTRYA AND CORYLUS¹

LEWIS E. WEHMEYER

(WITH 3 FIGURES)

There occur, upon *Carpinus*, *Ostrya* and *Corylus*, a difficult group of related species of *Melanconis* which have been described under many names in a number of genera. Although this group of species, or varieties, shows a rather wide range of variation in certain characters, it is difficult to distinguish morphologic species because of the overlapping ranges of variation. The literature and exsiccati of these species are also extremely confusing. It is the purpose of this paper to present and review certain data which may help to clear up this situation.

PERTHECIAL STAGE

A study of a large number of collections and exsiccati of this group of species from various hosts, from both Europe and America, and both in the fresh and dried condition, shows that there is a great deal of variation in a number of characters. Superficially, they vary from minute pustules to rather widely erumpent discs. The ectostroma varies in size from 250–2000 μ or more in diameter and from a dull gray, through gray-green to yellow- or olive-green in color, and may be sharply outlined or merged with a slight entostromatic development in the bark. The spores, when young, are small fusoid with tapered ends which may bear faint pointed or globose evanescent appendages. With maturity, they become rounded at the ends and constricted at the septum. In dried material, the protoplast may shrink giving the appearance of a thickened wall. In size, the spores are from 11–27 by 3–9.5 μ . The asci vary from 50–127 \times 6.5–14 μ . In spite of these variations,

¹ Papers from the Department of Botany and the Herbarium of the University of Michigan, No. 621.

very little correlation could be found between the different characters or between these and the host.

In a previous study (14), this group was broken up into three species (*M. xanthostroma*, *M. hyperopta* and *M. sulphurea*). A tabulation by hosts, of spore measurements from some forty-one European and twenty-four American collections indicated that there were two rather than three species represented. One of these, *M. sulphurea*, on *Corylus*, has larger spores (18) $20-27 \times 6-9.5 \mu$, whereas the second, *M. xanthostroma*, on *Carpinus* and *Ostrya*, has somewhat smaller spores (10) $11.5-20$ (23) \times (3) $3.5-5$ (7) μ . The spores found on *Carpinus* and *Ostrya* show two general groups, one measuring $11-15 \times 3-5 \mu$ and the other $15-23 \times 5-6 \mu$, but there are many collections showing overlapping ranges as regards spore size. That this difference in spore size is due, in part at least, to the maturity of the spore and the vigor of development, is supported by the fact that one collection on *Carpinus* (Wehm. Herb. No. 3625) which had spores measuring $11.5-15 \times 3-4 \mu$ when collected, yielded spores of this size and also larger ones measuring $17-20 \times 5-6.5 \mu$, after four to five days in a damp chamber. It is also true that the European collections on *Carpinus* show a slightly narrower range of spore size ($15-20$ (23) \times $3.5-7 \mu$). Cultural data, which will be presented later, also show that there is in America a distinct species on *Ostrya*.

On the information available, and until further cultural data can be obtained, it seems best to arrange the various synonyms under three species occurring upon the three genera as follows:

MELANCONIS XANTHOSTROMA (Mont.) Schroet. Krypt.-Fl. Schles. 2: 441. 1897.

Sphaeria xanthostroma Mont. Ann. Sci. Nat. II. 1: 301. 1834.

Valsa chrysostroma Fries, Sum. Veg. Scand. 412. 1846.

Valsa xanthostroma (Mont.) Tul. Ann. Sci. Nat. IV. 5: 117. 1856.

Valsa bitorulosa Berk. & Br. Ann. & Mag. Nat. Hist. III. 3: 367. 1859.

Valsaria bitorulosa (Berk. & Br.) de Not. in Rab. Fung. Eur. 932.

- Melanconis chrysostroma* (Fries) Tul. Fung. Carp. 2: 125. 1863.
- Diaporthe hyperopta* Nit. in Otth, Nachtr. 6, Mittheil. nat. Ges. Bern, 1868: 47.
- Diaporthe carpinicola* Fuckel, Symb. Myc. Nachtr. 2: 37. 1873.
- Diaporthe decipiens* Sacc. Fung. Ven. 4: 6. 1875.
- Diaporthe nigro-annulata* Kunze, in Kunze. Fung. Sel. 122. 1875.
- Sphaeria carpinigera* Berk. & Curt. in Curt. Herb.
- Diatrype carpinigera* Berk. & Curt. Grevillea 4: 96. 1876.
- Diaporthe Kunzeana* Sacc. Fung. Ven. 5: 180. 1876.
- Cryptospora bitorulosa* (Berk. & Br.) Niessl, Hedwigia 16: 119. 1877.
- Cryptospora nigro-annulata* (Kunze) Rehm in Thüm. Myc. Univ. 2063. 1881.
- Diaporthe bitorulosa* (Berk. & Br.) Sacc. Syll. Fung. 1: 608. 1882.
- Diaporthe Carpini* Sacc. nec Fuckel, Syll. Fung. 1: 607. 1882 (Myc. Ven. Spec. 137).
- Diaporthe mucosa* Wint. in Sacc. Syll. Fung. 1: 609. 1882.
- Diaporthe carpinigera* (Berk. & C.) Sacc. Syll. Fung. 2, Add. XLVIII. 1883.
- Diaporthe Ellisii* Rehm, Bull. Torrey Club 10: 89. 1883.
- Valsa Ellisii* Rehm in Ellis & Ev. N. Am. Fungi 1567. 1886.
- Diaporthe farinosa* Peck, N. Y. State Mus. Rep. 40: 69. 1887.
- Melanconis bitorulosa* (Berk. & Br.) Ellis & Ev. North Am. Pyrenom. 522. 1892.
- Diaporthe leucostoma* Feltg. in Höhnel, Sitz. Acad. Wiss. Wien 115: 1251. 1900.
- Chorostate decipiens* (Sacc.) Trav. Fl. Ital. Crypt. 2: 208. 1906.
- Chorostate Kunzeana* (Sacc.) Trav. Fl. Ital. Crypt. 2: 200. 1906.
- Chorostate mucosa* (Wint.) Trav. Fl. Ital. Crypt. 2: 192. 1906.
- Chorostate suspecta* Sacc. Ann. Myc. 11: 115. 1913.
- Discodiaporthe xanthostroma* (Mont.) Petr. Hedwigia 62: 293. 1920.

Melanconis Ostryae (Dearn.) comb. nov.

- Diaporthe ostryigena* Ellis & Ev. in Herb. (N. Am. Fungi 3420) 1896.
- Diaporthe Ostryae* Dearn. Mycologia 18: 246. 1926.

Melanconis flavo-virens (Othl.) comb. nov.

Valsa flavo-virens Othl. Nachtr. 6, Mittheil. Nat. Ges. Bern. 1868: 47.

Diaporthe sulphurea Fuckel, Symb. Myc. 205. 1869.

Diaporthe affinis Sacc. Michelia 1: 28. 1878.

Valsa olivaestroma Cooke, Grevillea 14: 48. 1886.

Diaporthe elaeostroma (Cooke) Berl. & Vogl. Syll. Add. 107. 1886.

Chorostate sulphurea (Fuckel) Trav. Fl. Ital. Crypt. 2: 209. 1906.

Chorostate affinis (Sacc.) Trav. Fl. Ital. Crypt. 2: 209. 1906.

Discodiaporthe sulphurea (Fuckel) Petr. Hedwigia 62: 291. 1921.

Melanconis sulphurea (Fuckel) Petr. Ann. Myc. 21: 321. 1923.

CONIDIAL STAGE

A number of collections examined have shown associated conidial stages. Table 1 will serve as a reference for these associations.

From this table it can be seen that three types of conidia have been found associated with this species. First, a small cylindrical to allantoid, one-celled, hyaline form measuring $(5.5) 8-14 \times 1.5-2.5 \mu$. This type was found on both European and American material, but always on *Carpinus*.² Second, a larger, fusoid to clavate, one-celled, hyaline type measuring $17-27.5 \times 4-5 \mu$ and found only on American material on *Carpinus*. Third, a *Melanconium* type of pustule with ovoid, brown, one-celled conidia, $11-16 \times 5-10 \mu$ occurring on *Ostrya* in America and on *Carpinus* in Europe. *Melanconium triangulare* Ellis & Ev., although given as the conidial stage of *D. Ellisii*, is probably in error.

The associations of conidial stages with the various species of this group to be found in the literature are numerous and confusing. A brief survey of these will be considered here.

On *Carpinus*:

Melanconium bicolor beta ramulorum Corda.

Melanconium microsporium Nees.

² The *D. Bloxami* specimens are given as on *Fagus*, but seem to be *Melanconis xanthostroma* on *Carpinus*. These somewhat larger conidia may, however, belong to some other species.

TABLE I

Collection	Cylindric, hyaline conidia	Fusoid, hyaline conidia	Ovoid, brown conidia
Syd. Myc. March. 263, sub <i>Cryptospora bitorulosa</i> (C)	8-10×2.5		
Syd. Myc. March. 2947, sub <i>Diaporthe Bloxami</i> (F?)	11-14×2-2.5		
Rehm Asc. 980, sub <i>Diaporthe Bloxami</i> (F?)	11-14×2-2.5		
Thüm. Myc. Univ. 469, sub <i>Diaporthe decipiens</i> (C)	8-11×2-2.5		
Ellis N. A. F. 1567, sub <i>Diaporthe Ellisii</i> (C)	8-11×2		
Wehm. Herb. 3647, sub <i>Melanconis hyperopta</i> (C)	5.5-8.3×2-2.5		
Wehm. Herb. 3645, sub <i>Melanconis hyperopta</i> (C)	10-12×1.5-2		
Wehm. Herb. 3625, sub <i>Melanconis hyperopta</i> (C)	8-10×2.5-3	17-23.5×4-5	
Rab. Fung. Eur. 2243, sub <i>Cryptospora bitorulosa</i> (C)	9-12×2-2.5		
Wehm. Herb. 3624, sub <i>Melanconis hyperopta</i> (C)		18-27×4-5	
Rab. Fung. Eur. 2243b, sub <i>Cryptospora bitorulosa</i> (C)			11-14×7-10
Syd. Myc. March. 984, sub <i>Diaporthe decipiens</i> (C)			10.5-16×8-9
Dearness Herb., July 6, 1904, sub <i>Diaporthe Ostryae</i> (O)			11-15×5-7
Wehm. Herb. 3828, sub <i>Melanconis Ostryae</i> (O)			10-12×5-6.5
Wehm. Herb. 3829, sub <i>Melanconis Ostryae</i> (O)			11-13×5-6.5
Ellis N. A. F. 1568, sub <i>Melanconium triangulare</i> (C)			5-6 μ diam.

The host is represented by the capital initial, as *Carpinus* (C), *Ostrya* (O), *Fagus* (F).

This conidial stage was given by the Tulasnes (13, p. 125) as belonging to *Melanconis chrysostroma*. They state that on the surface of a covered ectostroma there are formed two types of conidia. One, *Melanconium*-like with ovate dark colored conidia, acute at one end and measuring $13-15 \times 10 \mu$, and a second "Cytisporoid" type with ovate to linear oblong conidia, sometimes curved, hyaline, and $10-13 \times 3.5-5 \mu$.

Fuckel (5, p. 37) gives the spermagonia of his *Diaporthe carpinicola* as unilocular, tuberculiform, beneath the epidermis and with conidia which are elongate fusiform, one-septate, 2-3 guttulate, straight, hyaline and $10-12 \times 5 \mu$. The septation seems doubtful.

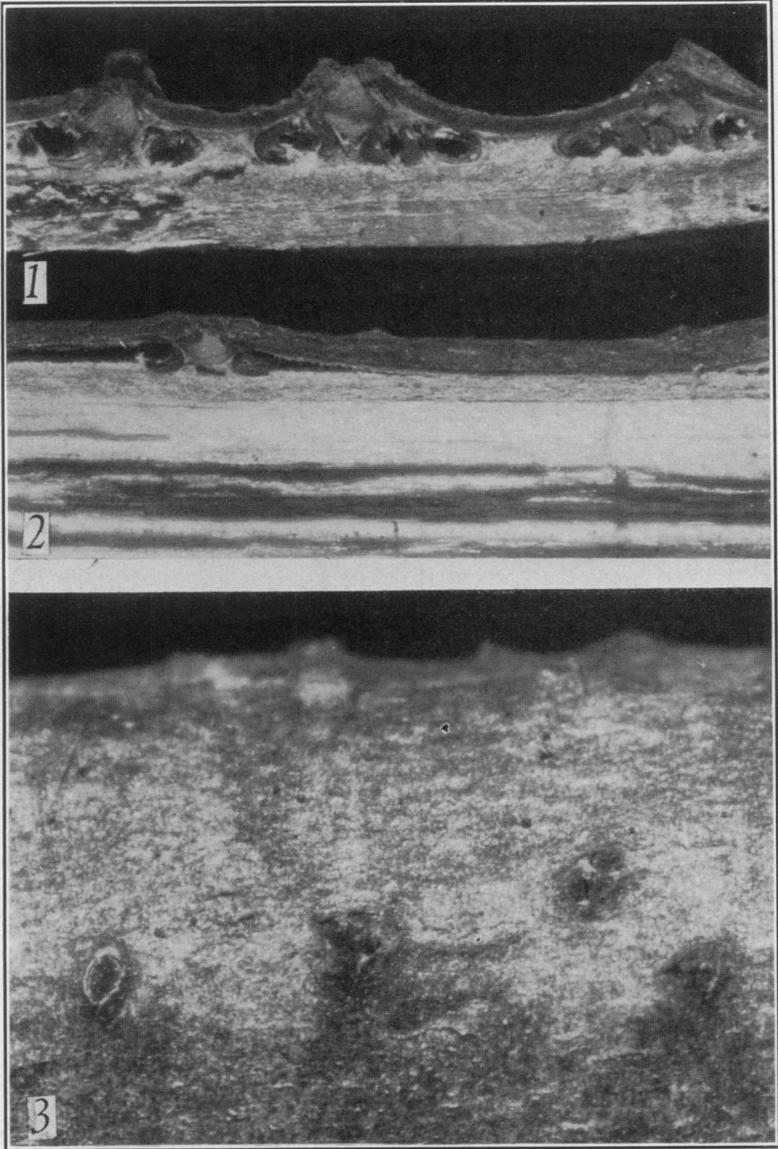


FIG. 1. *Melanconis* sp.

In Rab. Fungi Eur. 2243, Niessl gives out material containing hyaline conidia, which he gives (12, p. 119) as measuring $11-14 \times 4 \mu$ and as belonging to *Cryptospora bitorulosa* (*Diaporthe Kunzeana*). The writer finds these to be the typical cylindrical hyaline conidia and measuring $9-12 \times 2-2.5 \mu$. In No. 2243b of this same exsiccati, he issues a *Melanconium* type of conidial stage which he says is connected with *Melanconis chrysostroma*, which in turn differs from his *Cryptospora* in the greenish-yellow stroma. Both these conidial stages agree with the Tulasne's descriptions of *M. chrysostroma*.

Cytispora sp. was cited by Ellis (2, p. 89) as the conidial association for *Diaporthe Ellisii*. The oblong, hyaline, 4-nucleate conidia, measuring $8-11 \times 2-2.5 \mu$ and occurring in orange colored masses, which he describes, are typical of the smaller conidial type on *Carpinus*.

Melanconium triangulare Ellis & Ev., which was later suggested by Ellis (3, p. 38) as a conidial stage of *D. Ellisii* undoubtedly belongs elsewhere for the triangular conidia are not similar to any of the conidial stages associated with this group.

Fusicoccum Kunzeanum was given by Saccardo (Syll. Fung. 1: 607) as the conidial stage of *Diaporthe Kunzeana* (*D. Carpini* Sacc. nec. Fuckel). It is described as having a depressed conic stroma beneath the periderm with a single locule and with oblong-fusoid, straight or curved conidia, measuring $10-11 \times 3-4 \mu$. These again seem to be the small cylindrical conidial type.

In 1906, Höhnel (6, p. 681) listed *Fusicoccum Carpini* as the conidial stage of *Diaporthe Carpini* Sacc. This is an error for *F. Carpini* was described as the conidial stage of *D. Carpini* Fuckel nec Saccardo, which is an entirely different species.

Melanconium deplanatum Speg.

Myxosporium deplanatum (Lib.) Sacc.

Discosporium deplanatum (Lib.) Höhn.

Höhnel (7, p. 197) in his discussion of his new genus *Discosporium*, gives the above synonymy and points out that this species is the same as the conidial stage described by Fuckel for his *Diaporthe carpinicola*. He claims that there are perithecial stromata of *Melanconis chrysostroma* on Fuckel's exsiccati and that this conidial stage belongs to that species and not to *D.*

carpinicola, not recognizing the identity of the two perithecial stages. He also points out the identity of the conidia of this species with the "cytisoroid" conidia of the Tulasne's description and says that he has seen hyaline ovoid conidiae, $14 \times 10 \mu$ in these locules, which he considers to be immature *Malanconium* conidia.

Malacostroma irregulare (Died.) Höhn.

Cytospora carnea Ellis & Ev.

Dothiorella irregularis Died.

Höhnel (8, p. 355) gives the above synonymy for the conidial stage of *Diaporthe farinosa* Peck. This *Diaporthe* was originally given as occurring on *Tilia*, but obviously is on *Carpinus*. These conidial stages occur on *Tilia*, have large tuberculate, multilocular stromata and conidia which are elongate fusoid, two-guttulate and $8-12 \times 2.5-3 \mu$. This is undoubtedly an incorrect guess.

On *Corylus*:

Myxosporium sulphureum Sacc.

This is given as the conidial stage of *Diaporthe sulphurea* Fuckel by Saccardo (Syll. Fung. 1: 625). The conidia are given as fusiform, inaequilateral, one-celled and $12-16 \times 5-6 \mu$. These conidia seem to be of the fusiform hyaline type found on *Carpinus* but are shorter than those obtained from American material on that host.

Discosporium sulphureum (Sacc.) Petr.

Petrak (10, p. 291) has pointed out the similarity between *Myxosporium sulphureum* Sacc. and *Discosporium deplanatum* (Lib.) Höhn, and places *M. sulphureum* in the genus *Discosporium*. Petrak is of the opinion that *Melanconium bicolor beta ramulorum*, occasionally found on *Carpinus*, has no connection with *M. xanthostroma*. He considers the conidial stages of both *M. xanthostroma* and *M. sulphurea* as a *Phomopsis* with an open cavity (*Discosporium*) and erects a new genus, *Discodiaporthe*, to accommodate these two species. In a later paper (11, p. 321) he concludes that this conidial stage is in reality a hyaline spored *Melanconium* and that the difference in the conidial stage between *Melanconis* and his *Discodiaporthe* is not of generic importance and therefore unites these two genera.

These reports in the literature seem to indicate that there is a

species on *Carpinus* with a *Melanconium* type of conidial stage with a dark brown, ovoid, one-celled, and a cylindrical, hyaline, one-celled type of conidium. The reports of conidial stages on *Corylus* are more sparse but indicate one type of conidium which is fusoid, inaequilateral, hyaline and one-celled. A further consideration of these conidial stages and their relation to the American species will be postponed until after a presentation of the cultural data.

CULTURAL RESULTS

Melanconis xanthostroma (Mont.) Schroet., which name may be used tentatively for the American species on *Carpinus*, was the first to be cultured, from material collected near Ann Arbor, Michigan, in November, 1935. Sprays of ascospores were made onto nutrient agar on November 12 and again on December 7, 1935. No germination was evident in either case until after forty-eight hours, when a few spores showed short germ tubes. The spores became irregularly swollen (FIG. 2: 4) and measured $18-20 \times 5.5-6.5 \mu$. They put out from one to three germ tubes $3-3.5 \mu$ in diameter, from one or both cells. Growth from isolated ascospores was exceedingly slow on nutrient agar, but much more rapid on oat agar where colonies 1.5-2 cm. in diameter were produced in about two weeks. A rather abundant compacted cottony white mycelium was formed on the surface. The growth became yellow-green or gray-green with age. In old cultures, irregular pulvinate masses of compacted hyphae were formed on the surface, from which were exuded pinkish spore masses. The spores in these droplets were fusoid, one-celled, hyaline, often abnormally curved or bent and measured $16-25 \times 3.5-5 \mu$.

On May 2, 1936, autoclaved twigs of *Carpinus caroliniana* were inoculated from single ascospore cultures. Growth was very slow on twigs also appearing superficially, only after a month's incubation, as a whitish to yellowish cottony mycelium at the point of inoculation. After about six weeks, yellow-orange spore horns appeared at these points. Afterwards, more normal conidial pustules (FIG. 2: 1) were formed more rapidly over the entire surface. The ectostromata originate on the bark surface beneath the periderm and consist of a yellowish green prosenchyma. The

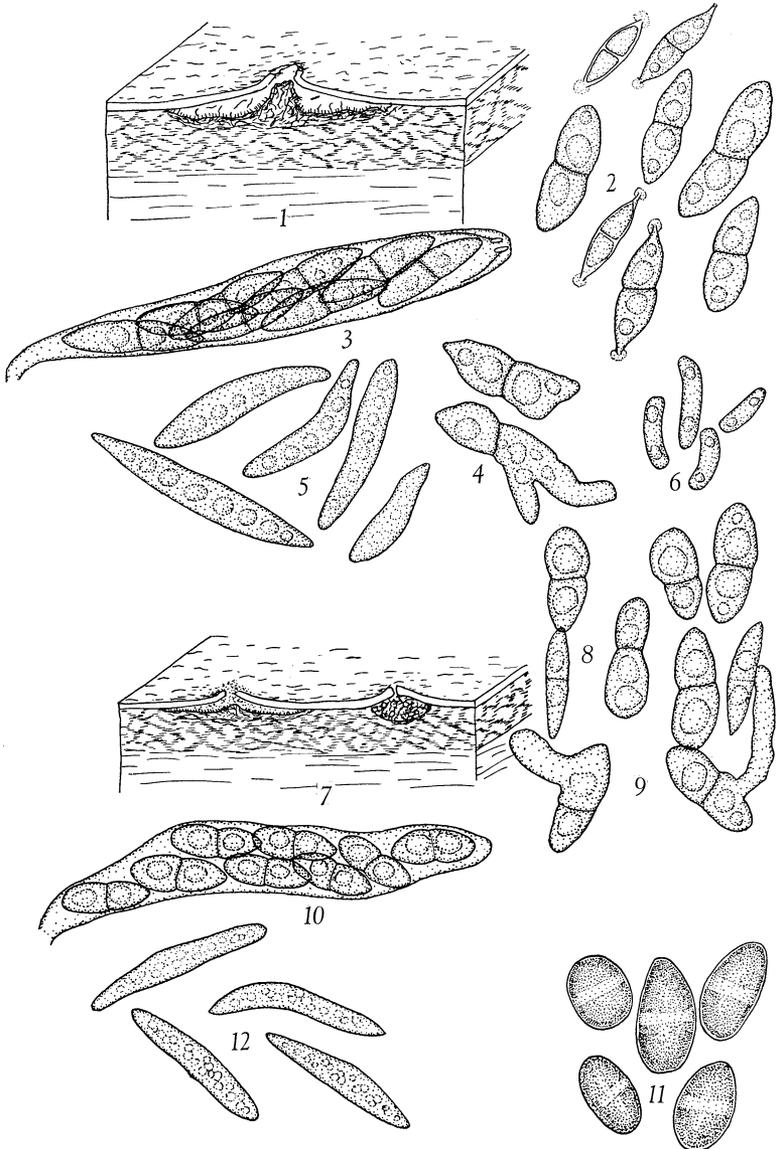


FIG. 2. *Melanconis* sp.

central portion grows upward and ruptures the periderm and becomes the erumpent disc which is olive-green in color. The basal portions spread out centrifugally, and on these flanks or the sur-

face of this portion, around the central sterile disc, the hymenium is formed. As a result the spore masses are pushed out at the sides of the central disc, not through it. The conidia (FIG. 2: 5) are variable in size and shape, especially so in old pustules or under unfavorable growth conditions. They are cylindric-fusoid to ellipsoid-fusoid, straight to curved or bent, one-celled, hyaline, show a single row of conspicuous droplets when fresh and measure from 16.5–30 (37) \times 3.5–5 μ . The spore masses are either pinkish or yellow at first, becoming dark olive brown when dry. These alpha conidia, as they appear to be, correspond to the fusoid hyaline type found twice in nature. Scores of pustules of all ages were examined in a search for the beta or cylindric type of conidium (FIG. 2: 6), commonly found associated with this species in nature, but none were found. In old pustules the alpha conidia may become narrower or shorter and approach the beta type in size, but these should not be considered as such. It is probable that the rather vigorous growth under the moisture conditions of the culture tubes is not favorable for the formation of the cylindric conidia, for in spite of their absence from culture, the writer is still of the opinion that they represent a second conidial type for this species.

Similar inoculations onto twigs of *Ostrya virginiana* made on July 3, 1936, gave very similar results. The conidial stromata tended to be somewhat smaller and the amount of spore production was greatly reduced but the stromata and conidia were of the same type, the latter measuring 15–23.5 \times 3.5–5.5 μ .

Melanconis Ostryae (Dearn.) comb. nov.

The lack of any dark walled conidia in the life history of the species on *Carpinus caroliniana* and the occurrence of a *Melanconium* stage on type material of *Diaporthe Ostryae* from Dr. Dearness, suggested a closer consideration of this species on *Ostrya*. Several occurrences of a *Melanconium* in association with *Melanconis* (*Diaporthe*) *Ostryae* were soon found in the field. Three sets of spray cultures on nutrient agar were made, and single spores isolated from this material as follows:

3828. S. Ascospores from perithecia on *Ostrya virginiana* collected July 29, 1936, near Ann Arbor, Mich.

3828. *C. Melanconium* conidia from pustules on the same twigs as 3828 S.
3829. Ascospores from perithecia on *Ostrya virginiana* collected August 6, 1936, near South Lyons, Mich.

The ascospores (FIG. 2: 8) of *M. Ostryae* germinated within twenty-four hours by means of a single germ tube (FIG. 2: 9) some 3–4 μ in diameter. The germinating spores measured 15–18 \times 5.5–6.5 μ . Growth, in this species, was also slow but much more rapid than in *M. xanthostroma*. On nutrient agar the growth was slow (about 4 cm. in five weeks) and a distinct circular colony was formed with a wrinkled marginal zone of appressed pubescent, white mycelium. The center of the colony turned gray-brown to tan with age, but did not show the yellowish or yellow-green tints of *M. xanthostroma*. On oat agar the growth was more rapid and irregular and stromata were formed sooner and in greater abundance. Blackish spore masses were exuded from these stromata. These conidia (FIG. 2: 11) were ovoid to ovoid-oblong, one-celled, olive-brown and measured 10.5–14 \times 6–7 μ . These growth characters and the conidial formation were practically identical in each isolation (3828 S and 3829). In a few spore horns from young stromata of 3828 on oat agar, a second, or beta type of conidium was found. These conidia (FIG. 2: 12) were elongate-fusoid, one-celled, hyaline, irregularly granular and 19.5–25 \times 2.5–3.5 μ . These conidia, which are similar to the alpha conidia of *M. xanthostroma* were rare, or entirely absent from the older spore horns and were never seen again in culture. This scarcity in culture may explain the failure to find beta conidia of *M. xanthostroma*.

The *Melanconium* conidia from *Ostrya* (3828 C) germinated within twenty-four hours by means of a single germ tube, 3–3.5 μ in diameter and gave rise to a colony similar in all respects to the ascospore isolations. The same type of stromata and the same *Melanconium* type of conidium were also obtained from these cultures.

Inoculations were made onto twigs of *Ostrya virginiana* on October 7, 1936, and onto *Carpinus caroliniana* on November 10 from all three of the isolations mentioned. The results were es-

entially the same in all cases. Growth and fruiting occurred equally as well on *Carpinus* as on *Ostrya*. Superficial, spherical, white to grayish stromata which exuded watery black spore masses were first formed in the moist tubes. The more normal ectostromata (FIG. 2: 7) were formed later on the surface of the bark cortex just beneath the periderm. A conidial hymenium is formed first on the flanks and eventually over the entire surface of this gray-green ectostroma which is usually filled with crystalline granules. At maturity there remains a very thin layer of light colored stroma with the hymenial layer. The mass of spores formed are pushed out through a pore like opening in the periderm as a coiled thread or ribbon of spores. The conidia (FIG. 2: 11) are oblong-ellipsoid to ovoid, one-celled, hyaline at first, but soon olive-brown, coarsely granular and usually with a light colored equatorial band about the cell. They measure $8.5-14 \times 6-7.5 \mu$.

In some cultures after the formation of conidial ectostromata, and usually on other portions of the twigs, there arose small spheric to conic ectostromata $150-250 \mu$ in diameter. These occasionally had slight shallow cavities with a few spores on their flanks, but were normally sterile and undoubtedly represent the initiation of perithecial pustules.

This production of a *Melanconium* conidial stage by the form on *Ostrya* indicates that there is a distinct species on this host. A careful study of what material was available on *Carpinus* and *Ostrya* indicates certain other correlated characters which may be outlined as follows:

M. xanthostroma on *Carpinus* has larger ($500-1200 \mu$ diam.) more strongly erumpent ectostromata (FIG. 1: 1) which often take on a more yellow-green color. The discs are generally larger ($300-800 \mu$) and more elongate. The spores are more variable in size; immature spores being $11-15 \times 3-5 \mu$, whereas fully mature spores reach $15-23 \times 4-7 \mu$. Growth in culture is very slow and shows yellow-green to olive shades. No brown conidia formed.

M. Ostryae on *Ostrya* has minute pustules with smaller ($200-600 \mu$) less strongly erumpent ectostromata (FIG. 1: 2) which are more gray-green in color. The discs are smaller ($200-400 \mu$)

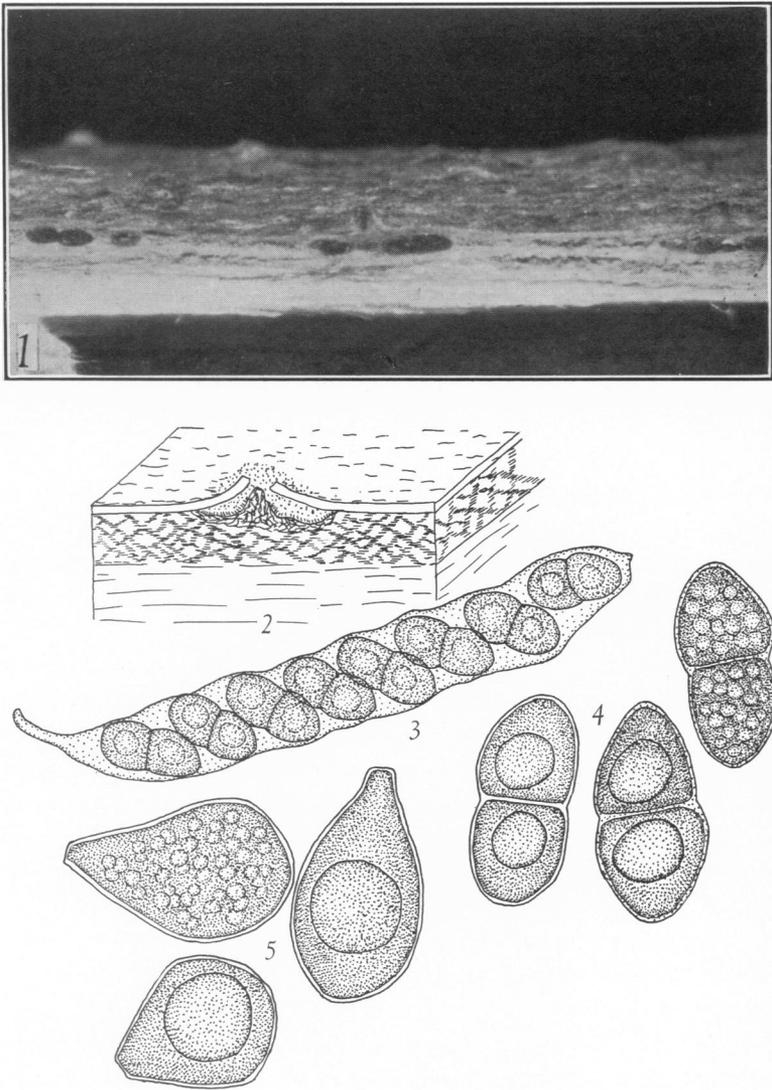


FIG. 3. *Melanconis* sp.

and more circular. The spores are not so variable, measuring $14-21 \times 4-7 \mu$, and often have one cell narrower and somewhat tapered. Growth in culture shows gray-brown to tan shades. Brown ovoid conidia are formed.

While collecting material for these studies, a *Melanconium* was also found on *Carpinus*, near Brighton, Michigan. Upon examination, this was found to be associated with a *Melanconis* with brown spores which has proved to be a new species, and is described here as follows:

***Melanconis platystroma* sp. nov.**³ (FIG. 1: 3, FIG. 3: 1-5).

Appearing on the surface (FIG. 1: 3) as flattened circular pustules with a central conical papilla through which there is finally erumpent a truncate conic, gray to yellow-gray ectostromatic disc, 0.5-0.8 mm. in diameter. The cylindric ostioles are scarcely visible or barely erumpent through the disc. The perithecia are 400-500 μ in diameter, somewhat flattened, circinate beneath the ectostroma (FIG. 3: 1) in the upper bark cortex, which is unaltered or slightly entostromatic. The asci (FIG. 3: 3) are cylindric, pinched off at the base, about $200 \times 14-17 \mu$. The spores (FIG. 3: 4) are uniseriate or overlapping, blunt ellipsoid, two-celled, constricted and occasionally slightly bent at the septum, brown to olive-brown, coarsely granular when fresh, becoming uniguttulate, and $25-31 \times 12.5-14.5 \mu$. The spore wall is brown, but the fresh spore has a greenish tint due to the color of the granular content. The paraphyses are broad band-like but soon evanescent.

³ *Melanconis platystroma* sp. nov. Stromata in superficie comparantia sicut pustulae rotundae planae papilla conica centrali per quam discus ectostromaticus conicus truncatus canus vel luteo-canus 0.5-0.8 mm. diametro demum erumpit. Ostiola cylindrica haud facile manifesta vel vix per discum erumpentes. Perithecia sub ectostromate in cortici superficiali circinata, 400-500 μ diametro. Asci cylindrici, basi praemorsi, $200 \times 14-17 \mu$. Sporae uniseriatae vel imbricatae, obtuso-ellipsoideae, bicellulae, in septo constrictae et interdum leviter curvatae, fuscae vel oliveo-fuscae, $25-31 \times 12.5-14.5 \mu$; sporae vivae crasse granulares demum uniguttulatae. Paraphyses ligamentis latis, similes mox evanescentes.

Stromata conidialia superficialia Melanconii pustulis similia cumulis sporarum nigris. Hymenium conidiale in lateribus ectostromatis conici pallide vel oliveo-fusci sub periderma. Conidia sicut cumuli sporarum nigri exsulantia, angulato-globosa vel ovoidea vel pyriformia, unicellula, viridifusca et primo crasse granulata deinde fusca uniguttulataque, apiculata, $20-31 \times 16-18 \mu$, in conidiophoribus brevibus.

In ramis *Carpini carolinianae* in sylvis "Pleasant Valley" dictis, Brighton, Michigan, 21 October, 1936. Specimina typica in Herbb. Univ. Mich. et auctoris.

Conidial stage: On surface as *Melanconium*-like pustules with black masses of spores. Conidial cavities (FIG. 3: 2) borne on the flanks of a conic, pale to olive-brown ectostroma beneath the periderm. Conidia (FIG. 3: 5) exuded as black spore masses, angular-globose to ovoid or pyriform, one-celled, greenish-brown and coarsely granular at first, becoming brown and uniguttulate, apiculate, borne on short conidophores and measuring $20-31 \times 16-18 \mu$.

On branches of *Carpinus caroliniana*, Pleasant Valley Woods, Brighton, Mich., October 21, 1936. Type specimens deposited in University of Michigan Herbarium and in author's Herbarium.

Numerous attempts have been made to germinate both the ascospores and conidia of this species, but so far all of these have failed. Twigs with both perithecial and conidial pustules were matured in damp chambers and healthy growing spores of all ages of maturity were obtained. Suspensions consisting of a mixture of conidia and ascospores in sterile distilled water were treated in various ways and then sprayed onto agar plates, as follows, in order to induce germination:

1. Suspensions and plates placed at 40° and 60° C. for 24 hrs. and then removed to room temperature.
2. Suspensions and plates placed for twenty-four hours at 2° and 10° C. alternately with similar periods at room temperature.
3. Suspensions made in dilute solutions of KOH (0.5 per cent) and lactic acid (0.5 and 2.5 per cent) before spraying onto plates.
4. Suspensions made in a dilute infusion of *Carpinus* bark and sprayed onto plates.
5. Suspensions made in several high dilutions of Indol-acetic acid.

Both the suspensions and the plates were kept under observation for 10-20 days, when contaminations overran the plates, but not a single germinating ascospore or conidium was seen. A few spores on the lactic acid plates showed an exudation of hyaline droplets but no further development occurred. Suspensions were also

sprayed onto autoclaved twigs of *Carpinus* but no infection has been observed.

During the period that these twigs were in the damp chamber, perithecial pustules of *M. xanthostroma* also appeared. The *Melanconium* pustules were always associated with *Melanconis platystroma* perithecial pustules, however, and apparently belong to this species.

DISCUSSION

From the foregoing discussion we see that a tabulation of spore size suggests two species in this group, one on *Carpinus* and *Ostrya* and one on *Corylus*. Cultural studies of the American species show that there are two similar but distinct species, one on *Carpinus* and one on *Ostrya*, differing in the conidial stages. Only cultural studies of the European forms and of material from *Corylus* can definitely determine the final status of species in this group, but certain suggestions do arise.

In the first place, specific (or varietal) differences seem to be correlated with the host. Stromata on *Carpinus*, both from Europe and America, are very similar and both show a cylindric hyaline type of conidium associated with these stromata. In cultures of American material, on the other hand, only the fusoid hyaline type of conidium, which has been found associated with American material in the field, was obtained. The absence of the cylindric conidia may be due to the more vigorous growth in culture.

European writers, again, report a *Melanconium* stage, *M. bicolor beta ramulorum* as associated with the species on *Carpinus* and such association has been seen by the writer. It seems probable, therefore, that there is a European species or variety on *Carpinus* differing from the American one in the conidial stage and having brown *Melanconium* and hyaline cylindric conidia. These *Melanconium* conidia are very similar to those obtained in culture for *M. Ostryae*, but appear to have a somewhat greater diameter. The cylindric hyaline conidia as cited in European descriptions seem to have a greater diameter than those found in American material, but this is not borne out by actual European material.

In America a species occurs on *Ostrya* with brown *Melanconium*

conidia similar to, but with smaller diameters than, those of the European species on *Carpinus*. Its second conidial type is similar to the hyaline fusoid conidium of the American species on *Carpinus*.

No conidia from *Corylus* have been seen by the writer, but Saccardo reports such a conidial stage with fusoid conidia similar to those obtained in culture for *M. xanthostroma* and *M. Ostryae* but distinctly shorter, which suggests that cultural studies will reveal one or several distinct species or varieties on *Corylus*.

These conidial stages also suggest a reappraisal of certain generic lines. The American form of *M. xanthostroma* would not fall within the genus *Melanconis*, although it is obviously closely related to the other species, as *M. Ostryae*, which have a definite *Melanconium* stage with brown conidia. It would rather belong with certain species of *Cryptodiaporthe* with a definite ectostroma, such as *C. galericulata*, which is reported as having similar *Fusicoccum* and *Myxosporium* stages in Europe, although cultures from American material failed to give a conidial stage. Many other species of *Cryptodiaporthe* are reported to have similar conidial stages. It seems that this group at least of the genus *Melanconis* has arisen from a section of the genus *Cryptodiaporthe* by the coloration of one or the other types of conidia formed and by the increased development of the ectostroma limiting the hymenium to the flanks of this tissue. The increase in pigmentation has subsequently been extended to the ascospores and the stromatic hyphae in various species. *Melanconis marginalis* is another species with dilutely colored conidia which is very closely related to *M. Alni* which is reported with brown conidia in Europe.

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EXPLANATION OF FIGURES

FIG. 1. 1, radial section of perithecial stromata of *Melanconis xanthostroma* (Mont.) Schroet. on *Carpinus caroliniana*; 2, radial section of perithecial stromata of *Melanconis Ostryae* (Dearn.) on *Ostrya virginiana*; 3, surface view of perithecial stromata of *Melanconis platystroma*.

FIG. 2. 1, radial section of *Discosporium* type of conidial stage of *Melanconis xanthostroma* (Mont.) Schroet. as produced in culture; 2, ascospores of *Melanconis xanthostroma* (Mont.) Schroet. showing variation in size, shape and appendages; 3, ascus and ascospores of *Melanconis xanthostroma* (Mont.) Schroet.; 4, germinating spores of *Melanconis xanthostroma* (Mont.) Schroet.; 5, hyaline fusoid type of conidia of *Melanconis xanthostroma* (Mont.) Schroet.; 6, hyaline cylindric to allantoid type of conidia of *Melanconis xanthostroma* (Mont.) Schroet.; 7, radial section showing *Melanconium* stage and young perithecial ectostroma of *Melanconis Ostryae* (Dearn.) as produced in culture on *Ostrya virginiana*; 8, ascospores of *Melanconis Ostryae* (Dearn.); 9, germinating ascospores of *Melanconis Ostryae* (Dearn.); 10, Ascus and ascospores of *Melanconis Ostryae* (Dearn.); 11, ovoid brown type of conidia of *Melanconis Ostryae* (Dearn.); 12, fusoid hyaline type of conidia of *Melanconis Ostryae* (Dearn.).

FIG. 3. 1, radial section of perithecial stromata of *Melanconis platystroma*; 2, radial section of conidial stroma of *Melanconis platystroma* as formed on *Carpinus* in culture; 3, ascus and ascospores of *Melanconis platystroma*; 4, ascospores of *Melanconis platystroma*; 5, conidia of *Melanconis platystroma*.