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NOTES ON SOME SPECIES OF GERATOSTOMELLA AND GRAPHIUM

by

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NOTES ON SOME SPECIES OF CERATOSTOMELLA AND GRAPHIUM

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The writer since his former publications on wood-staining fungi (1, 2)<sup>1</sup> has made from 1907 to 1910 and again from 1924 to 1925, about one thousand pure cultures of *Ceratostomella* and *Graphium* associated with wood staining in the United States. These cultures were obtained from logs, boards and veneer products, and collected from the wood of species of *Acer*, *Aesculus*, *Castanea*, *Fagus*, *Hicoria*, *Liriodendron*, *Liquidambar*, *Pinus*, *Picea*, *Quercus*, *Tilia*, and *Tsuga*. Through the courtesy of E. Munch he has received and examined cultures of *C. cana*, *C. coerulea*, *C. picea* and *C. pini*, species described by him (5), occurring in Germany.

In the United States, species of *Ceratostomella* occur on stained wood more or less intermingled in nature with *Graphium* and other wood-staining fungi. In every instance the writer has been able to separate forms of *Ceratostomella* from those of *Graphium* and maintain them separately in pure cultures. In no case has he been able to find a species of *Ceratostomella* which has *Graphium* for a conidial stage or

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1. Numerals in parenthesis refer to literature cited at the end of the publication.

vice versa, a species of Graphium which developed Ceratostomella as an ascus or perfect stage. The usual method for the separation of mixed cultures of Ceratostomella and Graphium has been as follows: First a spore dilution in a tube of sterile water was made with spores obtained by touching a sterile needle to the viscid spore masses either from the tip of the beak of a fruiting perithecium of a Ceratostomella, or from the head of a Graphium. Four tubes of luke warm corn meal agar or corn meal + 1 per cent cane sugar agar, <sup>were made</sup> the first by transfer from the water tube, and each of the others from the preceding tube, giving the fourth tube the extreme dilution. In such cases often the fourth tube failed to receive any spores. Transfers were then made from single colonies in the plates containing the fewest colonies, usually before conidia were formed. Such cultures are usually from single spores.

The writer was first to discover the conidial stage of Ceratostomella in 1902, while doing the cultural work for Von Schrenk's publication on blue staining of pine which was published in 1903 (7). The species studied was called G. pilifera (Fr.) Winter, a name that has been cited by several writers as the name of any bluing fungus they have found staining wood in the United States. As suggested by Munch (5) this species as originally described may apply to a group of related species, and it is not possible to be certain that any one of them described in modern literature is the form described originally on pine. The writer agrees with Munch in discarding the name G. pilifera, the original description being too indefinite to apply to any species as now known.

All the species of *Ceratostomella* in the United States that have been cultured by the writer bear conidia of the *Cladosporium* form, except *C. moniliformis* Hedge. of which more will be said later. Of the species of *Graphium* studied some bear the *Cephalosporium* form of conidia, others the *Cladosporium* form. The writer cannot as yet fully accept the conclusion of Münch (5), Rumbold (6), MacCallum (4), and Lagerberg (3) that in some species of *Ceratostomella*, *Graphium* is a conidial stage. Münch (5) has described stages of *Graphium* for *Ceratostomella cana* and *C. picea* from apparently pure cultures from single spores. Lagerberg et al (3) and MacCallum (4) corroborate Münch in assigning a *Graphium* stage to *C. picea*. The former used streak cultures which are inaccurate, and the latter apparently pure cultures from single spores. Both Münch and MacCallum failed to obtain the perithecia of *Ceratostomella* from cultures from single conidia of the *Graphium* stage, thus casting a doubt upon the proof of the relation of the *Graphium* stage to *Ceratostomella*. Rumbold (6) working with a *Graphium* from Liquidamber in the United States found the perithecial stage of *Ceratostomella* which she assigned to the *Graphium*. The writer hesitates to pronounce the work of Münch, MacCallum and Rumbold inaccurate or their conclusions wrong, but in view of his failure to find *Graphium* stages of *Ceratostomella* in nearly one thousand cultures, is compelled to ask for further proof by the most exacting methods. If *Graphium* is a stage of *Ceratostomella* it should be proven by a large number of cultures from each of the spore forms, viz. - with conidia

from both Graphium and Ceratostomella, and from spores from the heads of Graphium and the perithecia of Ceratostomella.

Dr. Adeline Ames of this office in 1908 made poured plates on corn meal agar from cultures of C. cana, C. coerulea, C. piceae, and C. nini received by the writer from Münch. Transfer cultures of C. cana were made to tubes of pine sapwood, rice, and potato. In both the plates and tubes only the conidia and heads of Graphium were produced. The plate cultures of C. coerulea contained both the heads of Graphium and the perithecia of Ceratostomella. Transfer cultures from the plates to tubes of corn meal, gelatine + 1% dextrose, gelatine + 1% cane sugar, pine sapwood, rice, potato, and to a flask containing bread. Only the conidia and heads of Graphium were found in the tubes of pine wood and the flask of bread. The Cladosporium form of conidia appeared in the gelatine, rice, and potato tubes but no fruiting perithecia. Transfer cultures were made of C. piceae to bread in a flask, and to test tubes of pine sapwood, rice, potato, gelatine + 1% dextrose, and gelatine + 1% cane sugar. Only the conidia and heads of Graphium were produced in all of the cultures. Transfer cultures of C. nini were made to bread in a flask, and to tubes of rice, potato, pine sapwood, and gelatine + 1% cane sugar. Conidia of Ceratostomella were produced on all the cultures, and abortive perithecia on some of them.

C. piceae is described by Münch (5), MacCallum (4) and Lagerberg (3) with both the Cladosporium form and the Cephalosporium form of conidia. It certainly is peculiar to find the typical Ceratostomella type of conidia, viz. the Cladosporium form combined in a species with a typical

Graphium type of conidia, viz., the Cephalosporium form. One would expect a Graphium with the Cladosporium form to be naturally a stage of a Ceratostomella which has the same form, if Graphium is really a stage of Ceratostomella. Of the species of Graphium described by the writer (1) G. ambrosiigerum, G. eumorphum, and G. atrovirens have conidia of the Cephalosporium form, and G. album, G. aureum, G. rigidum, and G. smaragdinum have conidia of the Cladosporium form identically like those of Ceratostomella. The writer still considers these species distinct and valid.

From a study of the various species of Ceratostomella in the United States and Europe the writer will now give his conclusions as to their relation. C. plurianulata Hedge. is a distinct species from all the others, and is a heavy and the most common stainer of the sapwood of Acer, Aesculus, Fagus, Liquidambar, Liriodendron, Tilia and Quercus, and less so of Castanea and Ricoria. It has never been found by the writer on coniferous wood although a related species occurs on pine. In Europe Lagerberg (3) describes what is undoubtedly C. plurianulata from stored spruce.

Ceratostomella capillifera Hedge. is the next most common species on the wood of the same host species previously given, but does not stain wood so heavily. C. coccinea Munch is either identical with or closely related to this species. If identical C. capillifera is the older name since it was described in September, 1906 (1).

Ceratostomella schinella Hedge. is in the writer's opinion a valid species. It is found, but not so commonly, as C. plurianulata and C. capillifera, on the sapwood of the same host species staining it not so heavily. It stains the sapwood of pine heavily.

Ceratostomella nilifera of Von Schrenk (7) and Hedgcock (1, 2), in its most common form agrees closely and is probably identical with G. piceae Münch, if only the Cladosporium form of conidia of the latter is considered. G. schrenkiana Hedg. is the same species as the above form of G. nilifera and the characteristic knobby appearance of the perithecia is due to numerous rudimentary abortive perithecia. If these are all one species, on the grounds of priority G. schrenkiana (1) is the valid name.

Ceratostomella cana Münch agrees closely with a light colored form of G. nilifera in the United States, if its Graphium stage is not considered, and is no doubt a valid species.

Ceratostomella minor Hedg. is a good species and is apparently distinct from G. exigua Hedg. which has much the same habits of growth and appearance as G. pini Münch. The three forms however are closely related and may be found to be the same species. If so, G. minor (1) is the valid name for the species.

Ceratostomella moniliformis Hedg. is a species of Endoconidiophora its conidia having been found to be endoconidia. The name is hereby changed to Endoconidiophora moniliformis Hedg. new comb. E. cognatensis Münch is apparently either identical with or very closely related to it. If identical the valid name is E. moniliformis (1).

Of the forms of Graphium previously described by the writer, he found no reason to change their present status. It is desirable that the work of Münch and others with G. piceae be repeated in the manner previously suggested.

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