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Notes on Iowa Fungi. VII

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NOTES ON IOWA FUNGI. VII [1]

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THE DROUGHT AND IOWA FUNGI

The drought of 1936, culminating a series of dry years, was the most severe on record in Iowa. The year started with an accumulated moisture deficiency, and during the five months from April to July, inclusive, the average precipitation for the State as a whole was only 8½ inches, slightly less than half the long-time average for the period. The lack of rain was coupled with record-breaking heat. All the months but April were above average in temperature and July was the hottest month ever experienced. Under such conditions the humus and upper layers of the soil as well as the logs on which many fungi grow were so dry that during the summer fungi of any sort were little in evidence and during most of the summer there were none to be found.

In discussing the effect of the drought on fungi in Colorado, Shope (Science 84: 155. 1936) expressed the opinion that the mycelium of many species had been killed, and that the restoration of the previously abundant fungi of the mountains would have to depend upon a new dissemination from such few localities as may have escaped the general destruction. In view of Shope's observations, it may be of interest to review the effects of the drought as observed in the immediate vicinity of Iowa City.

Throughout the summer the temperature in Iowa City varied little from the average for the State as a whole, and the total rainfall for March, April and May showed practically the same deficiency as the State. In June, however, while the fall for the State was distinctly deficient, Iowa City received more than the average amount. Most of this was concentrated in the first ten days and, following these heavier rains, a number of fungi started to develop. This was evidenced by mycelial growth and fairly abundant primordia of fructifications, but the hot dry days following effectively checked these developments and few of the primordia reached maturity. There was a fair rain on the 17th and another on the 30th with a couple of trifling showers besides,

[1] Previous notes in this series were designated by years, and appeared as follows: Trans. Ia. Ac. 32: 219-223. 1925; 34: 139-144. 1928; 34: 145-148. 1928; 35: 131-133. 1929; 36: 127-131. 1931; Univ. Ia. Stud. Nat. Hist. 13(5): 3-10. 1931. In continuing the series it seems preferable to designate each paper by number.

but little water penetrated the surface and even a day or two after the heavy rains, the logs and the ground under them and the leaves beneath the surface layers were bone dry except in a few scattered spots. July was not only terrifically hot, but the only rain was in the form of two very light showers on the 21st and 23rd which did little more than moisten the surface for a few hours. In August the heat continued, but from the 4th to the 6th over an inch of rain fell. After this heavy rain, mycelium began to develop, but few fructifications, suggesting that the fungi had to start again almost as though it were the beginning of the season. The ground did not get thoroughly dry again, for on the 16th a good rain fell and from then on until the end of September there were frequent showers and some good rains, the precipitation for September being over six inches above the average while that of the State was over three inches above average.

Fungi began to appear in abundance about the middle of August, and from that time until early in October, they were more abundant than I have ever observed them to be. A few of the species which ordinarily appear in midsummer were lacking, however. Thus, after the early June rains, young fructifications of *Cantharellus cibarius* were extraordinarily abundant, but none of them survived and the species did not appear in the fall. Young sporophores of *Tremellodendron pallidum* were equally common, but were nearly all destroyed, the few that were able to survive being represented by small and misshapen sporophores dead in the center but with new fall growth on the outside and almost invariably sterile. Other species, such as *Leotia lubrica* and *Helvella elastica*, ordinarily abundant, succeeded in maturing a few fructifications, and then disappeared.

It is possible to mention only a few of the species that were notably abundant in September. *Amanita rubescens* occurred by hundreds, many of the mushrooms being extraordinarily large even for this handsome species, but quickly succumbed to *Syzygites*. *Amanita flavoconia* and *A. flavorubescens* were more abundant than usual. Many species of *Russula* and *Lactarius*, especially *R. crustosa* and *R. nigricans* and *L. volemus*, were everywhere in the woods and persisted into October instead of almost disappearing early in September as is usually the case. *Craterellus cornucopioides* was commoner than I have ever known it to be before and some of the basidiocarps were of unusual size. The common *Tremellales*, although abundant, were less well developed than usual. These xeric

forms, depending as they do upon brief periods of growth following wettings, with intermediate dormancy, seemed never able to make up for the complete lack of opportunity to grow during the summer. Gasteromycetes were not notably abundant, and myxomycetes were perhaps scarcer than usual, although a few species were common enough.

Undoubtedly, drought conditions in the vicinity of Iowa City were not nearly so severe as in Colorado, and there seems to be no evidence that the fungous population has been materially affected.

HELICOCEPHALUM SARCOPHILUM Thaxter. Fig. 1

This remarkable species was originally reported from Connecticut (Bot. Gazette 16:201. 1891) growing on carrion in a laboratory culture. It has appeared in our laboratory cultures on several occasions, always growing on dead wood. According to Thaxter's original description the height of the fertile hyphae is "1 mm. or more," with two or three full coils in the terminal portion dividing into as many as twenty-one spores, the spores 55 x 30μ. In the Iowa material there seem never to be two full coils, and the spores are fewer in number and smaller, 30-36 x 15-23μ. While these differences are rather pronounced, they perhaps may be due to poor nutrition in the Iowa forms, and the possibility of variation is sufficiently great to make it undesirable to erect a new species without fuller warrant. Thaxter suggests possible relationship with the Mucorales, and this is certainly the impression one gets from the general appearance of the fungus. As in his case, attempts to germinate the spores met with no success.

HYPOCHNELLA VIOLACEA (Auersw.) Schroet.

Originally reported from Silesia as a *Hypochnus* (see Sacc. Syll. 6:659) it was made the type of a distinct genus by Schroeter on the basis of its smooth, violet spores. Rea (Brit. Basid. 659. 1922) records it as uncommon in Britain. It seems not to have been previously collected in North America. Dr. D. P. Rogers and I found it extremely abundant near Iowa City on August 31, 1936, and a week or so later I found it nearly as abundant in a second locality. Both localities were in bottom land bordering the Iowa River, and both had been intensively collected many times before, hence it seems reasonable to suppose that if present at all, it must have been uncommon heretofore. Perhaps the unusual season had something to do with its sudden abundance. The smooth,

violet spores are striking in a water mount, but lose their color in KOH. It would seem as though this species could well be accommodated in *Coniophora* where it may find place in company with *C. cyanospora* Rogers (Univ. Ia. Stud. Nat. Hist. 17:25. 1935).

VARARIA INVESTIENS [Schw.] Karst. Fig. 2

This common species was reported from Iowa and briefly described by Emmons (Univ. Ia. Stud. Nat. Hist. 12(4):57. 1927) under the name *Corticium investiens* Bres., following Burt (Ann. Mo. Bot. Gard. 13:283. 1926). Burt did not regard the peculiar, dichotomous, yellow, spine-like structures constituting the bulk of the fructification in this and related species as justifying their segregation from *Corticium*. The latter genus, however, is still large and unwieldy, and, as Rogers has pointed out (Univ. Ia. Stud. Nat. Hist. 17:3. 1935) it is still far from a natural assemblage. Under such circumstances, the separation of various well-marked groups as distinct genera is justified, not only on the ground of taxonomic utility, but also as an approach toward a more natural arrangement. Bourdot and Galzin (Hym. Eur. 394. 1927) segregate this species and five others, applying von Höhnel's later name *Asterostromella* to the group. Burt himself recognizes *Asterostroma* (Ann. Mo. Bot. Gard. 11:28. 1924), justifiably enough, but on a character that should not be regarded as more distinctive than the "antler-shaped" hyphae of *Vararia*. Indeed, if *Vararia* is not to be recognized, it would seem to be preferable to combine it with *Asterostroma*, with which it has much in common, rather than to include it in *Corticium*.

The hymenium in *V. investiens* is quite different from that of typical Corticiums. The basidia are sparsely scattered, and when preparing to form spores protrude notably beyond the general surface established by the tips of the branching spines (Fig. 2a), and there are, in addition, occasional cystidia, extending even more beyond the general level. The spores are also peculiar. They are spindle-shaped, and markedly attenuate at the base, with only the faintest suggestion of an apiculus, and mostly 10-12.5 x 3.5-4μ. When first detached they are uniformly filled with protoplasm (Fig. 2b); later, the protoplasm is withdrawn from the basal end and a secondary wall is formed, cutting off the empty attenuate base (Fig. 2c). Occasionally a second wall is formed but no spore has been observed in which the protoplasm has been withdrawn from the distal end. With this exception, the process is strongly

suggestive of the formation of chlamydospores within the basidiospores of *Jaapia* as described and illustrated by Rogers (1. c. 28). These observations strengthen the case for regarding *Vararia* as a valid genus, with the present species as the type.

Polyporus cristatus Fries

This large and handsome polypore, characterized by its striking yellowish green or greenish yellow pileus and nearly globose spores seems not to have been previously reported from Iowa. A single specimen was found in September, 1936, growing from a nearly buried stump in bottom land near Iowa City. Overholts (Wash. Univ. Stud. 3[1]: 22. 1915) lists it from five states, including three bordering on Iowa, and both he and Murrill (N. A. Flora 9: 68. 1907, as *Grifola poripes* (Fries) Murr.) describe it as growing on the ground. In its growth on wood and in the somewhat brighter yellow of the pileus our collection differs from the published descriptions.

Nyctalis asterophora Fries

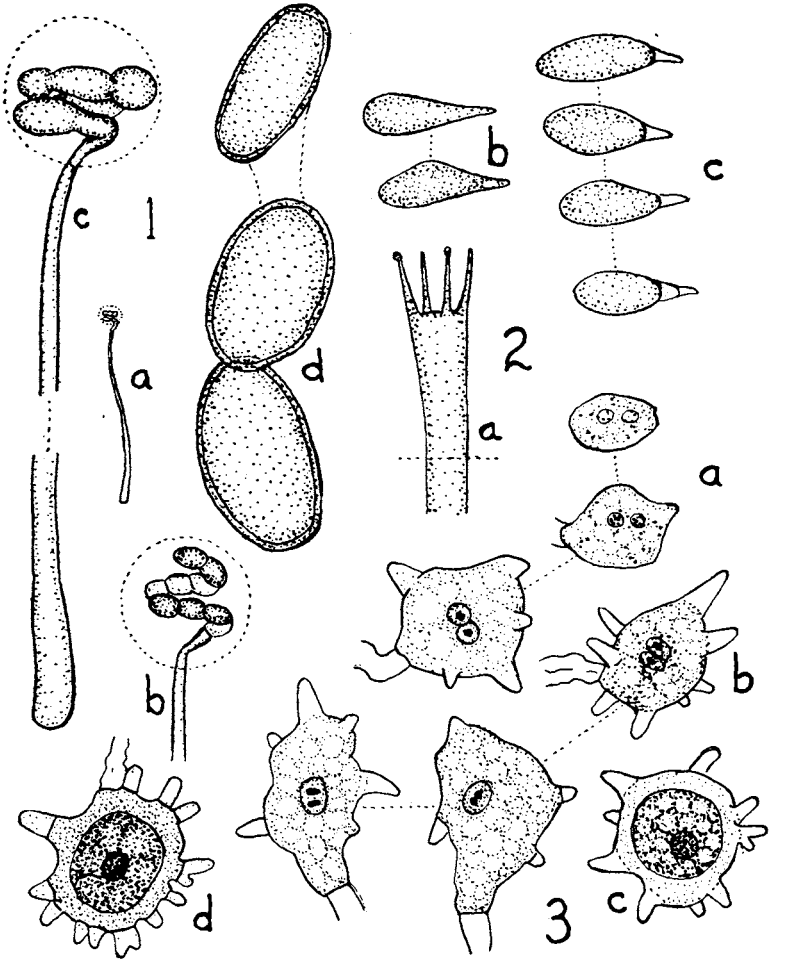
The species of *Nyctalis*, because of their curious parasitic habit on other mushrooms, have always attracted attention, and were described and illustrated by various pre-Friesian students. Micheli's fig. 1 of plate 82 has been supposed to represent a *Nyctalis*, although it is far from convincing, but there can be no doubt of the generic reference to be accorded such illustrations as those of Schaeffer (pl. 279), Bulliard (pls. 166, 516 I, 574 II) and Sowerby (pl. 383). Murrill (N. A. Flora 166. 1910) adopts Schaeffer's specific name for the species here discussed, calling it *Asterophora Clavus* (Schaeff.) Murr., but since the two well-marked species in Europe and North America are distinguished mainly by microscopic characters, it seems unwise to attempt to unravel the synonymy before 1838 when Fries (Epic. Myc. 370) clearly defined the genus and described six species, although the genus was actually proposed by him in 1825 (Syst. Orbis. Veg. 78) with a brief reference to *Agaricus parasiticus* Bull. (as discussed in Syst. Myc. 1: 135. 1821). In any event, there is no justification under the International Rules for discarding Fries's generic name. Brefeld (Untersuch. 8: 70-98, pls. 5-6, 1889) gives admirable illustrations of the two well-marked species, showing both gross and microscopic characters, and settled the long-standing controversy as to whether the chlamydospores were developed by the agaric or represented spores of a parasite. In recent years excellent photographs of *N. asterophora* have been published by Murrill (Mycol-

EXPLANATION OF FIGURES

All figures except 1a and 1b drawn with aid of camera lucida and reproduced at magnifications indicated.

1. *Helicocephalum sarcophilum* Thaxter. a. fertile hypha and head, x app. 20; b. tip of same and head with chain of nine spores, x app. 100; c. base and head of younger sporophore with filament not yet septate, x 165; d. chain of three conidia, one held by gelatinous strand, x 683.
2. *Vararia investiens* [Schw.] Karst. a. Tip of basidium indicating marked projection above general level of fructification preparatory to spore production; b. Two slightly immature spores; c. Four spores showing retraction of protoplasm from attenuate base and formation of secondary wall, x 1500.
3. *Nyctalis asterophora* Fries. a. Three young chlamydospores, each with two distinct nuclei; b. stages in apparent nuclear fuson; c. nearly mature chlamydospore with dense, vacuolate contents and apparently single nucleus; d. mature chlamydospore, with dense contents and apparently a single nucleus, x 1500.

PLATE I



ogia 6, pl. 129), Overholts (Mycologia, 25, pl. 46, f. 11: pl. 47, f. 15) and Coker (Elisha Mitchell Soc. Jour. 35, pl. 1, 2). Thompson (Mycologia, 28: 222-227. 1936) grew both *N. asterophora* and *N. parasitica* in culture and publishes photographs and drawings of both species, but makes no reference to Brefeld's cultures.

So far as I can discover, neither species has ever been reported from Iowa. It was, therefore, of interest to find *N. asterophora* extremely abundant in the vicinity of Iowa City in late September and early October of 1936, growing invariably on *Russula nigricans* Fries. Both Kauffman and Murrill give the dimensions of the pileus as 1-2 cm. in diameter. Murrill gives the diameter of the chlamydospores as 15-20μ; Kauffman as 12-18μ. Coker (1. c. 30) says of the pileus "up to 3.8 cm. wide," and gives the dimensions of the chlamydospores, including the warts, as 18-26 x 14-19μ. The pileus of our largest specimen was oval, 5 cm. in one dimension and 4 cm. in the other, and pilei over 3 cm. in diameter were not uncommon. The chlamydospores, while variable in size and shape, are somewhat larger than stated by these authors, mostly 18-28 x 15.5-22μ, with some variation beyond these limits. An average of ten, taken at random, was 22.2 x 18.5μ.

Dangeard (Le Botaniste 4: 153-160. 1895) seems to have been the only one to examine the chlamydospores cytologically. This he did with *N. asterophora*, although his fig. 13 is incorrectly labelled *N. parasitica*. He found the chlamydospores binucleate from early stages to maturity without any suggestion of nuclear fusion, although he does not deny that such may take place; if it does, he concludes, it must be greatly delayed. Examination of sections of the Iowa material killed with Allen's modification of Bouin's solution ($P.F.A._3$) and stained with iron alum haematoxylin, show all stages of development. The spores are consistently binucleate in the early stages, exactly as described by Dangeard (f. 3a) but about the time the spines begin to form the two nuclei move into close proximity and apparently proceed to fuse (fig. 3b). The protoplasm of the mature spores is very dense, and the contents are difficult to interpret but the suggestion is very strong that they contain only a single nucleus (fig. 3c, 3d). Like Dangeard, I have been unable to germinate the spores, but if they could be studied in germination, it should prove enlightening.

LEPIOTA MORGANI Peck

This is the largest of our gill fungi in weight and in expanse of pileus, although *Lepiota procera* is usually taller. Peck's original

description (Bot. Gazette 4: 137. 1879) gives the diameter of the pileus as 5-9 in. (i.e., 13-23 cm.). Morgan (Jour. Cinc. Soc. Nat. Hist. 6: 61. 1883), from whose specimens and notes Peck originally described the species, repeats these measurements, but adds "larger specimens are sometimes found." Murrill (N. A. Flora 10(1): 64. 1914), using the name *Chlorophyllum Molybdites* Massee, gives the diameter as 10-20 cm., as does Kauffman (Agar. Mich. 644. 1918). The pileus of a specimen from Manchester, Iowa, brought in by Mr. Clark Paris in September, 1936, measured 28 cm. in diameter. This seems to be a record for the species.

CALVATIA RUBRO-FLAVA (Cragin) Morgan

Until the fall of 1936 this species was known from Iowa from a single collection only. In September, Dr. W. A. Anderson brought it in twice from his lawn in Iowa City, and early in October Dr. A. J. Stanley collected ten specimens in Lee County on the banks of the Mississippi. The statement in Kambly and Lee's Gasteromycetes of Iowa (Univ. Ia. Stud. Nat. Hist. 17: 136. 1936) "probably introduced" is copied from Professor Shimek's note on his collection, the only one known heretofore from the State. In the light of these recent findings it must be regarded as incorrect.

HELICOON ELLIPTICUM (Peck) Morgan

Two collections, Iowa City. On very rotten coniferous plank, Dec. 1933 (G. W. M. 1607) and on sound coniferous board, Sept. 1934 (G. W. M. 3875). Reported by Linder as known from New England, New York, and New Jersey. This marks a notable extension of the known range of the species.

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