

to show that the Crawfordsville crinoid beds, which have been regarded as belonging to the Keokuk, are the stratigraphical equivalents of the Knobstone strata farther south.

The accompanying map shows the area covered by the Knobstone group, north of Morgan County, as that area is given on Gorby's geological map of 1893. It shows also (approximately) the area in and north of Putnam County as the field work of 1897 indicates it to be.

It will be noticed that (as worked out by the University Survey of 1897) no Knobstone is represented as occurring north of Montgomery County, while by far the larger part of that county is underlain by it.

Small isolated areas of the Knobstone may exist north of Montgomery County, but these will in all probability be found to be only outliers.

The limits of the area, as changed from Gorby's map of 1893, are only approximate. The whole region being covered over by glacial drift, except in the deepest creek valleys, makes it necessary to trace the contacts largely by well sections. It is consequently impossible to trace them more than approximately.

SOME INDIANA MILDEWS.* BY M. A. BRANNON.

Four years ago a paper on "Mildews of Indiana" was presented to you by Mr. J. N. Rose, of Wabash College. His was the first step toward determining the various species of Indiana mildews. The few species, and their hosts, named in this paper are the second attempt, I believe, in this State in the direction of determining these interesting parasites, which are everywhere abundant.

To Rose's list, containing the names of eleven species and twenty-nine hosts, are added several hosts for some of the species mentioned by him, also nine species and ten hosts not found in his list.

Bessey's "Erysiphe of the United States;" Cook's "Hand-Book of British Fungi;" Bull. of the Ill. State Laboratory of Nat. History, Vol. II., and Rose's "Mildews of Indiana" were the guides used in determining and describing the following species.

Sphaerotheca Castagnei Lév.

*Paper read before the Indiana Academy of Science, 1889, and heretofore unpublished.

Found on leaves of *Prænanthes altissima*. Rose's additional notes to Cooke's description of this form do not state that some perithecia contain two asci. Such a case was observed in two or three perithecia of this species found on an *Erigeron*. In these unusual forms one ascus was much larger than its companion, but not as large as the ascus existing alone in a perithecium. A few of these unusual forms might lead to the questioning of what has, heretofore, been considered a strong generic difference between a *Sphærotheca* and an *Erysiphe*.

Podosphæra oxacantha DC. was found on cherry leaves. This species was named *Podosphæra Kunzei* by Dr. Bessey, but the reasons for changing to *P. oxacantha* are detailed in Bot. Gazette, Vol. XI, page 60, 1886.

Phyllactina suffulta Reb. (*P. guttata* Lév.).

Found sparingly on leaves of a *Desmodium*.

Uncinula flexuosa.

Occurred abundantly on leaves of the buckeye. This is a beautiful species and is characterized by wavy outlines of appendages at their extremities. It is amphigenous, appendages are hyaline, varying from thirty-six to fifty-six in number; asci, seven to twelve; spores, six to ten, and strongly pedicellate.

Uncinula Ampelopsidis Pk. was found in abundance on leaves of *Ampelopsis quinquefolia*. In the Trans. Albany Inst., Vol. VII, page 216, Peck includes *U. Americana*, *U. spiralis* and *U. subfusca* under the one name of *Uncinula Ampelopsidis*.

Uncinula adunca Lév.

Found very abundantly on willow leaves. It is amphigenous; has six to eight asci, and usually from four to six spores, rarely eight, in our species, though Bessey describes it with only four spores.

Uncinula circinnata C. and P.

On silver maple leaves.

Microsphæra Ravenelii B.

On leaves of honey locust. The repeated forking at the apices of the appendages makes the determination of this species very easy. It has from eight to sixteen appendages; asci, four to nine; spores, six to eight.

Microsphæra extensa C. and P.

Found on the upper surface of red oak leaves and on both sides of leaves from a young oak; the species was somewhat doubtful. Both specimens had very long appendages; from four to five asci; four to eight

spores. A peculiarity was observed in the appendages of the perithecia borne on the leaves of the young oak. In many of the appendages were found swollen places resembling knee-like joints. These swellings were rather promiscuously arranged, having neither a definite location nor number on any appendage, which led to the opinion that the swellings were caused by some foreign growth. Closer observation revealed a mycelium running lengthwise the appendages and enlarging at the swollen places. This mycelium was observed, in one case, leaving the appendage and growing free from the host. Another view gave a mycelial thread of this same parasite, which, having twined itself about the apices of two appendages, was evidently drawing them together as if attempting to effect some way of reproducing itself, as is the custom of certain secondary parasites. This mycelium bore the same characteristic enlargements noted in the mycelium growing within the appendages. It acted and appeared, in many respects, like that parasite described and named *Cincinobolus Cesatii* by DeBary ("Die Pilze," p. 268), with this exception: He found this smaller parasite in the mycelium of mildews and not in the appendages of their perithecia. As it has been known to enter and develop its spores in the conidial chain, we may easily believe that it could make this further advance and take up its abode in the perithecia and their appendages. Granting that this secondary parasite may possibly be *C. Cesatii*, we have yet to dispose of the swellings borne on its mycelium. These swellings in no way resembled the reproductive organs of *C. Cesatii* figured and described by DeBary. They appear as internal growths of some other plant. It has been questioned whether these swellings may not be bacteroid forms existing on a secondary parasite of a primary parasite, thus giving the gradation of primary, secondary and tertiary parasitism. If so, it is desirable to allow the last two to remain in their epiparasitic habits and thus, as suggested by a German botanist (Thümen, "Pilze des Weinstocks," p. 178), they may exercise a restraining influence upon the first; and doubtless *Cincinobolus* does prevent the mildew from attaining its usual vigorous hold on the host plant. *C. Cesatii* has been found in the mycelium of some *Erysiphe* and *Podosphæra* species, but never, so far as could be learned, has it been found in an appendage nor in any part of a *Microsphæra* species, unless this be such a case.

Microsphæra densissima C. and P.

Very abundant on the oak leaf. This is a remarkably beautiful species growing its mycelium in orbicular and stellate patches, which enable one to recognize it at a glance.

Microsphæra diffusa C. and P.

On *Desmodium* leaves.

Erysiphe lamprocarpa (Wall.) Lév.

Found on many hosts, notably on *Compositæ*.

In addition to the host mentioned by Rose are added *Aster cordifolius*, *Aster undulatus*, *Ambrosia trifida* and *Verbena stricta*. In one instance a few asci were found containing three spores, which is contrary to what has formerly been regarded a strong specific character. This variability of spores led to another classification of this species by Burrill and Earle (Bull. Ill. State Lab. Nat. History, Vol. II, p. 404).

Erysiphe Euphorbiæ Peck.

On *Euphorbia corollata*. The host bearing this species was in a withered and very sickly condition, whether from action of the mildew could not be affirmed.

Erysiphe communis (Wall.) Schl.

On *Ranunculus recurvatus* and an aster growing in the same place which had probably received the mildew from its neighbors. The appendages of the peritheciium found on *Ranunculus* were fifteen to thirty-five in number and two to four times the diameter of the perithecia in length.

Erysiphe tortilis (Wall.) Lk.

On *Clematis Virginiana*. This species has been found on this host several times, but this specimen differed from all others described in apparently not affecting the host, which was in a vigorous condition, though the mildew was very abundant on its leaves.

Erysiphe horridula Lév.

On *Verbena stricta* and *Eupatorium purpureum*. It was difficult to decide whether this was *E. horridula* or *E. lamprocarpa*, as it closely resembles the latter, with the exception of having three to four spores in every ascus.

Recent research with improved instruments reveals many facts unknown to the early mycologists who made the first classification of mildews. Many of the characteristics forming generic and specific distinctions in their classification are found to be changeable and not always

reliable, i. e., a *Sphærotheca* having two asci in a perithecium or an *Erysiphe lamprocarpa* having more than two spores in an ascus will not harmonize with a classification denying such variableness. Hence revisions are constantly being made, which have new characteristics as bases for new classifications, or extend the limits of these formerly too restricted species. But whatever advances may be made, the revisions must retain much of the old in the development of the new, for the first classification was correct in the main, and can be altered only in respect to details based on the more minute structure revealed by further investigation with greatly improved apparatus.

