

SUSCEPTIBILITY AND IMMUNITY OF DIFFERENT SPECIES OF APPLES.

Some observations were made in different parts of the city to determine the susceptibility and immunity of different species of apples. In the experiment already described the apple tree infested was of the Milum variety. In the same yard in which this tree stood was another apple tree that was never infected by the rust. It was a fall apple, variety unknown. In another yard in another part of the city stood two apple trees with interlocking branches; one was of the Bellflower variety, a winter apple, the other was a large fall apple, variety unknown. Across the street to the west stood two cedars that usually bore a few galls. The Bellflower always suffered severely from attacks of the pest, while the other tree remained free from it. The difference in the appearance of these two trees by the middle of August was most striking. The Bellflower, with its sickly, yellowish foliage, mottled with the dark clusters of Roestelia, presented a striking contrast to the dark, healthy green of its neighbor's. The effect was also very noticeable in the apples of the two trees. Those of the Bellflower were small, knotty and not numerous, although the branches had been loaded with blossoms during the spring. The apples of the other tree were large, perfect and plentiful. More extended observations regarding this point will be made next spring.

The selection of immune varieties seems to be the only solution of the problem of the extinction of the fungus, at least in this vicinity. Not only do cedars occur in the natural forests of the region, but they have been very generally planted by farmers for protection and decoration so that the only other method, the destruction of the cedars, is quite out of the question, as so many not concerned in apple growing would not destroy their cedars, and the absolute destruction of every red cedar would be necessary to exterminate the fungus.

NOTES ON THE GENUS STEMONITIS.

H. H. WHETZEL.

During the past summer and fall we have made a careful study of the genus Stemonitis, as represented by the species occurring in the vicinity of Crawfordsville, Ind. This study has brought out several striking and interesting conditions regarding the development of some structures of this genus. The study was made in the laboratories of Wabash College,

and the specimens examined represent the collections of three years from this vicinity. Many species were from the campus and the shade trees along the streets of the city.

Great care was taken in collecting. The exact place of its occurrence, the date and other important data were preserved with the material. The best specimens of each species were mounted for future reference, while the remaining material was preserved for study. On each collecting trip every specimen of slime mould was taken and subsequently identified to insure thoroughness in the local work. This was necessary, as many species could be determined only by extended study and comparison with other material. Several species that appear exactly alike to the naked eye vary greatly in minute structure.

Besides this, very careful mounts were made, both in balsam and glycerine jelly, from fresh specimens. The spores were removed from those mounted in balsam, in order to show capillitium structures; others to show spore markings were mounted in jelly, containing a small amount of potassium hydrate to swell the spores. Careful measurements of spores were kept and records preserved of their color *en masse* and under the microscope. Fresh material was always used for color records, as the spores change with age, and the entire sporangium with its spores changes color several times during the process of fruiting. The following record kept of *S. maxima* will illustrate this:

- June 25, 7 p. m., plasmodium, pearly white.
- June 26, 6 a. m., fruited (still wet), purple black.
- June 26, 10 a. m., brownish, dark.
- June 27, 3:30 p. m., lighter brown.
- July 20, spores shed, purple brown, pale.

This specimen grew on an old charred stump convenient to the laboratory, and we examined it several times each day to note any changes of color. Records of color variation of species of other genera also show this striking change of color during and after fruiting.

For determination of species, Macbride's North American Slime Moulds were used, while Lister's Mycetozoa was used for reference and comparison.

Before the presentation of the conclusions based upon a study of sporangium and spore structure, the following miscellaneous notes and observations may be of some interest:

The number of species occurring in this vicinity, so far as collections up to the present show, are six of the twelve listed by Macbride. Besides these, a seventh form was found differing quite materially from any other species collected, and not corresponding with any description of species listed by Macbride or any other author consulted. This form is very common, and its distinctive characteristics are so much unlike those of closely related individuals that it is doubtless a new species.

Very hot days following heavy showers seemed to present conditions best suited for the development of the fruiting stage of *Stemonitis*, and from early in the spring until late in the fall such conditions were sure to bring forth beautiful sporangium clusters in abundance. A hot morning following a thunder shower is particularly favorable. Examination of old trees and stumps early in the morning often revealed the pearly white plasmodia pushing forth upon the surface. As far as we have observed, all plasmodia of this genus are of a pearly white. Repeated attempts to bring these plasmodia to the laboratory to fruit always resulted in their distortion, partial development or decay. In no case were there normal fruits produced, although conditions seemed to be favorable.

A careful review of the particular habitat of each species revealed no special place for each. We have found them almost everywhere, although perhaps most frequently on the decaying trunks and stumps of the Red Maples that line the streets of the city. One stump of Red Maple has produced for three successive years the most beautiful specimens of *S. Webberi*; several fruitings being produced each season. Three were noted this year. Usually an area six inches in diameter on the side of the stump was completely covered with rich brown tufts. Board piles, posts and sides of old buildings yielded many fine specimens. Some species fruited on grass blades and leaves, which were in close proximity to the old logs in which the plasmodia grew. Some of the best specimens we obtained came from an old charred stump on the campus. The sporangia almost always occur in very exposed places. This, together with their large size and abundance, makes the discovery of them comparatively easy.

Many and careful attempts were made at germinating the spores of the different species. None was successful, although several kinds of media were used. Besides water, concoctions of rotten wood, on which the specimens grew, were tried, but all without success.

CONCLUSIONS DRAWN FROM THE SYSTEMATIC STUDY.

Comparison of this genus with others of the order has lead us to believe that *Stemonitis* represents the most perfect differentiation and specialization of the Stemonitaceae. Next in order below it stands *Comatricha*, from which the former is not very easily separated, as its lowest forms are much like the higher forms of *Comatricha*, only its one characteristic structure, the superficial net, serving to distinguish it.

This superficial net is peculiar in several respects. In the first place, it is almost the only example of such a structure occurring among the slime moulds, although a slight indication of such a structure may be noted in the higher forms of *Comatricha*. In the second place, its gradual development and perfection in *Stemonitis* is indeed very remarkable. Besides, this gradual perfecting of net structure is found to correspond with a like perfecting of spore markings, so that in a species presenting the best development of this superficial net we find the most specialized forms of spore marking. Another and almost equally interesting gradation in structural development, parallel to the above, is to be seen in the inner or supporting network of the capillitium. Although presenting some exceptions, this shows on the whole a tendency to a steady reduction in the number of threads of the inner network and a thickening of the resulting ones. In the species we have studied there was noted, corresponding to the differentiation just described, a gradual increase in the height of sporangia. An examination of Macbride's listed species present some interesting exceptions. A wide variation in height of sporangia of the same species is common. But in general we think it may be safely said that the tendency is toward taller and larger sporangia, with the increase in complexity of the contained parts. There are other structures that upon future investigation will probably reveal a like gradation.

Upon the discovery of this gradual and parallel development of certain structures, it occurred to us that a classification of the species of this genus, upon the basis of the development of some of these structures, would not only be the most convenient, but might, at the same time, represent the natural sequence of the species in the genus. Of course that structure which showed this development, and at the same time proved most constant in the different species, was the one to be chosen as the primary basis of classification. Careful investigation of a large number of individuals of each species showed that spore markings primarily, with size and color secondarily, was the structure to be selected.

The specimens were then gone over most carefully, and the following classification prepared, including only the species that have come under our observation, although a review of the remaining six species listed by Macbride showed that they would fit into and complete most perfectly the classification which we had worked out. For convenience, the species have been placed in three groups.

CLASSIFICATION OF THE SPECIES OF STEMONITIS.

Generic character—the superficial net.

Basis of species classification—spores; their markings, size and color.

Other structural characters important in separation of species—inner and outer net structures of capillitium; height of sporangia, and general color.

a. Episporae smooth or only slightly warted, with low, scattered warts. Spores small, light colored or colorless.

1. *Stemonitis pallida* Wingate.

Spores nearly or quite smooth, $4\text{-}5\mu$, pale reddish brown; capillitium, inner network dense; outer net meshes small, $6\text{-}13\mu$; height of sporangia, 4 mm., brownish purple, becoming pallid with age.

2. *Stemonitis axifera* (Bull) Macbr.

Spores with low, scattered warts, $5\text{-}6\frac{1}{4}\mu$, pale reddish brown; capillitium as in *S. pallida*; height of sporangia 5-10 mm., ferruginous, with purple tinge after spore dispersal.

3. *Stemonitis Smithii* Macbr.

Spores minutely warted, 5μ , pale dusky brown; capillitium more open than in *S. axifera*, outer net meshes $6\text{-}15\mu$; height of sporangia, 5-12 mm., bright yellowish brown, rusty, paler after spore dispersal.

4. *Stemonitis* ——— 64 (collection number).

Spores smooth, or nearly so, 5μ , pale dusky brown, not reddish; capillitium, inner network open, outer net with small meshes $10\text{-}25\mu$, height of sporangia 10 mm., dark purple brown, like *S. maxima*.

b. Episporae distinctly warted. warts spinose; spores larger and darker than in a.

5. *Stemonitis Morgani* Peck.

Spores densely but minutely warted with spinose warts, $7\text{-}8\mu$, reddish brown, dark with purple tinge; capillitium, inner network loose, few branches, outer net large meshed $15\text{-}40\mu$; height of sporangia, 15-18 mm., rich reddish brown, dark with purple tinge.

6. *Stemonitis Webberi* Rex.

Spores densely and very distinctly warted. $8\text{-}9\mu$, reddish brown; capillitium, inner net open, outer net large, coarse, irregular meshes $50\text{-}125\mu$; height of sporangia 18 mm., rusty brown.

c. Episporae reticulate, large, dark, violaceous never brown.

7. *Stemonitis maxima* Schw.

Spores reticulate, $7\text{-}8\mu$, dark violaceous; capillitium, inner net of medium density, outer net meshes $8\text{-}40\mu$; height of sporangia 5-10 mm., dark purple brown, becoming pallid with age.

THE VEGETATION OF ABANDONED ROCK QUARRIES.

MEL T. COOK.

The study of the encroachment of plants on waste land and the order of their succession becomes especially interesting in the case of the abandoned rock quarries because of the very small amount of soil.

The following observations were made from the study of three limestone quarries in Greencastle, Indiana, and vicinity. It is impossible to give the exact ages of these quarries; a small amount of rock is still taken from them. Rough estimates will be given in the following descriptions:

Quarry A.—A small quarry, about ten or fifteen years old; about two-thirds of the floor covered with water, which drains in from a small area; no natural outlet.

Quarry B.—A much larger quarry, about fifteen or twenty years old; very long and narrow and extending east and west; the first work done in