ARTICLE VI.—*Parasitic Fungi of Illinois.* PART II. By T. J. BURRILL and F. S. EARLE.

ERYSIPHEÆ, LÉV.

(Ann. Sci. Nat., Ser. III., Tome XV.)

On living plants. Mycelium superficial, consisting of numerous branching, septate, usually white, much interwoven threads, which extend widely over the epidermis of the host, adhering to it by means of haustoria; conidia simple, colorless, cylindrical, oval or ovate, borne one above the other, on erect, simple, septate colorless hyphæ; perithecia seated singly on the mycelium, membranaceous, indehiscent, globose or sometimes depressed, at first colorless, then yellow, becoming dark brown or black when mature, bearing various thread-like appendages; asci arising from the base of the perithecium, delicate, thin-walled, colorless, oblong, oval, ovate or suborbicular, usually pedicellate, containing 2–8 spores; spores (except in *Saccardia*) simple, colorless, granular, oblong or oval.

The *Erysipheæ*, commonly known as "white mildews" or "blights," may be easily recognized by the white, dusty or web-like coating they form on the leaves, or other succulent parts, of many common plants. They frequently grow throughout the summer, but, usually, only reach their full development in the fall, when the perithecia, or little fruit-balls, may be seen like minute black or dark brown dots scattered over the whitened surface of the leaves.

The very abundant mycelium consists of numerous slender, white or colorless, septate threads, that branch widely, and extend over the leaf in every direction, frequently crossing and interlacing. These threads are usually pressed close to the host, but they do not themselves enter it.* They send out at intervals, however, short special branches called haustoria, that

* It is held by some writers that in *Sphærotheca pannosa*, Lév., the mycelium does sometimes enter the tissues of the host, but this is not satisfactorily proven.

1

penetrate the epidermal cells, serving for the secure attachment of the fungus, and probably also for its nourishment. These haustoria present several forms, and they are of some importance in the classification of the species. In some cases the haustorium simply consists of a slender tube which penetrates the epidermal cell of the host, within which it swells to an oval or club-shaped sac, filled with granular protoplasm. More often there is an external appendage or sucker, that is pressed close to the surface of the epidermal cell; and from this, or from near it on the mycelial thread, the haustorium proper takes its rise and penetrates the epidermis. This external appendage may be smooth and entire, merely constituting a hemispherical swelling on the mycelial thread; or, it may take the form of a flattened disk with an indented margin. In the latter case they are said to be "lobed," in the former, "not lobed."

The conidia, or asexual reproductive bodies, are cylindrical, oval or nearly orbicular, simple, colorless cells filled with protoplasm. They are formed by constriction at the ends of short, simple, erect, rather stout, septate, colorless branches of the mycelium, called fertile hyphæ or conidiophores. A septum forms near the end of the young hypha, and the walls at this point become constricted. The cell thus cut off usually swells a little, and at length falls away as a mature conidium. Before this happens, however, other constrictions have taken place below, thus forming a chain of nearly mature conidia adhering end to end. Under favorable conditions they germinate quickly, sending out a slender tube, which, on the proper host, soon develops into a new mycelium. They are produced in immense numbers throughout the growing season, and, as they are very light and easily carried by the wind, they serve for the rapid increase and wide distribution of the parasite.

Other reproductive bodies arise, like the fruits of higher plants, from a process of fertilization. The process has been carefully studied by De Bary and others. It differs slightly in the different genera. In those with a single ascus *(Sphærotheca* and *Podosphæra)* it is as follows:—

Where two threads of the mycelium approach or cross each other, a short special branch arises from each. One of these swells to two or three times the diameter of the thread, and is separated from it by a transverse partition. It now constitutes the carpogonium, homologous with the pistil of the flowering plants. The other branch, the antheridium, remains cylindrical, and is closely applied to the carpogonium, bending over its summit. A septum is formed near the tip, dividing off a small cell, whose contents, passing into the carpogonium, effect its fertilization. Slender branches now arise on all sides from near the base of the carpogonium. They become branched and septate, and soon join together, forming a membranous, cellular, enveloping wall. An inner membrane or coating is developed by short projections branching from the inner wall. The carpogonium is divided by a cross partition, and the upper portion develops into the suborbicular ascus containing the spores, which with its enveloping membranes constitutes the sporocarp, or true fruit of the fungus. In the genera having several asci the carpogonium is more elongated, and is bent around the antheridium. After fertilization, the enveloping wall develops as above. The carpogonium becomes divided by cross partitions into a number of cells, each of which either develops directly into an ascus, or sends up an ascus-bearing branch. In all cases the spores develop within the asci by free cell-formation.


I. II. III.

FIG. 1.

FIGURE 1. *Sphærotheca Castagnei*, Lév. I., Process of fertilization: *a*, a thread of the mycelium bearing the oögonium *c*; *b*, *b*, another filament of the mycelium bearing the antheridium *d*. II., same as I., at a later stage of growth, the oögonium *c* and antheridium *d* still seen, the former becoming inclosed by the mycelial branches *e*. III., a still later stage of same, the oögonium *c* being now completely inclosed within the tissue forming the mycelial branches, the wall of the young carpogonium. Magnified 300 times. (After De Bary.)

This act of fertilization does not usually take place till late in the summer. The sporocarp resulting from it is called in this group, the perithecium. When quite young it is colorless, but it soon becomes yellowish, and when mature is a dark brown or black, usually globular, body, visible to the naked eye. Its wall consists of a rather tough membrane, whose cellular structure can be seen in the more or less distinct reticulations of its surface. It is provided with slender hair-like outgrowths called appendages, very characteristic of this family. These present many forms, and it is from them that the generic characters are mostly taken. The perithecium remains on the fallen leaves over winter. It is not provided with a mouth or ostiolum of any kind. The contained asci and spores only escape on its decay in the spring.

The asci are delicate, thin-walled, colorless sacs filled with granular protoplasm, from which the spores are formed. The latter (except in *Saccardia*) are simple, colorless, oblong or oval cells, filled with densely granular protoplasm. In the genus *Saccardia*, occurring on oak leaves in the Southern States, the spores are septate or "muriform," and colored.

Delicate membranaceous conceptacles, other than the perithecia, are sometimes found in connection with the mycelium of the *Erysipheæ*. They are thin-walled, and on slight pressure rupture irregularly, emitting immense numbers of minute oblong nucleated spores, immersed in a gelatinous fluid. They were noticed by Cesati, in connection with the grape milde w Supposing them to be independent organisms, he named them *Ampelomyces quisqualis*, and specimens were published under that name as No. 1669 in Rabenhorst's Herbarium Mycologicum. Later they were called *Cicinobolus florentinus* by Ehrenberg, and *Byssocystis textilis* by Riess. Tulasne, von Mohl, and others, finding that these conceptacles were borne on the same mycelium as the conidia and perithecia, naturally concluded that they were organs of the same plant, and, from their analogy to certain asexual reproductive bodies in allied groups of the *Ascomycetes,* called them pycnidia, and the minute bodies they contain stylospores or pycnidiospores. This is still the accepted belief of many botanists. De Bary (Morph. und Phys. der Pilze, III., pp. 53–75, Tafeln VI., VII.) shows that the pycnidia instead of being reproductive organs of the *Erysiphe,* are, in reality, the fructification of a fungus that is parasitic on the *Erysiphe.* He calls it *Cicinobolus Cesatii*, and gives numerous figures showing its delicate septate mycelium developing within the mycelial threads of the *Erysiphe*, and sending up branches which, by repeated division, form the cellular wall of the pycnidium.

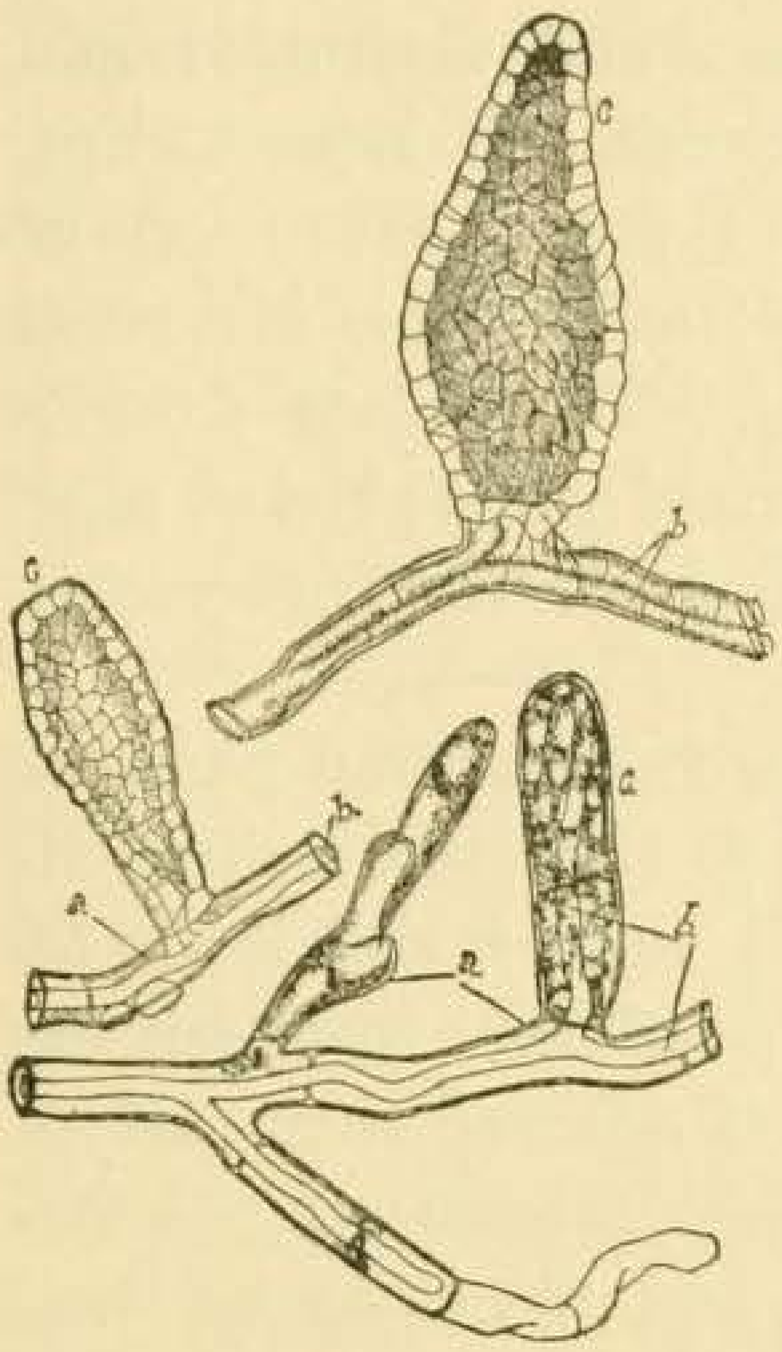

FIGURE 2. *Cicinobolus Cessatii*, DBy.: *a* the mycelium of *Erysiphe galeopsidis*, DC., within which is to be seen the parasitic mycelium *b* of *Cicinoblus*; *c*, *c*, *c* different stages of the so-called pycnidium in which the spores of the parasite are developed. Magnified 300 times. (After De Bary.)

FIG. 2.

This frequently develops in one of the cells of a conidiophore, in which case the shriveled upper portion remains as a kind of appendage. In other cases it is developed directly from the mycelium. Occasionally, on rupturing a perithecium, it will be found to contain minute bodies like *Cicinobolus* spores, instead of asci. This is considered a fourth kind of reproductive body by Berkeley (Introduction to Crypt. Bot. p. 78). It is more likely a case of the *Cicinobolus* developing its fruit within the growing perithecium.

This parasite has been mostly investigated in connection with the grape mildew *(Erysiphe Tuckeri)*. Some writers suppose it to be of considerable use in holding this disease in check (Thümen, Pilze des Weinstocks, p. 178). It occurs on several of our specimens of *Erysiphe cichoracearum*, DC., where its delicate mycelium can be seen by the aid of a good objective and careful manipulation.

Various *Macrosporium-* and *Helminthosporium-* like bodies are frequently associated with *Erysiphe* mycelium, but their organic connection with it is doubtful. Minute yellow spherical echinulate bodies are also often seen clinging to it, but they are foreign substances,—probably pollen grains.

The abundant mycelium of these plants is so conspicuous that it early attracted the attention of investigators. The literature of the family is unusually large and extended; and arising from so many independent sources, and representing such widely different views, there is so much confusion of names and descriptions that the difficulty of study is increased rather than lessened by its abundance. The plants form a natural, closely related, and easily recognized group; but its rank and position in the natural system has been very differently estimated by different writers.

They were known to Linnæus under the common name of *Mucor erysiphe*. Persoon (Syn. Fung., p. 124) called them all *Sclerotium erysiphe*, but separated as a variety the form on *Corylus*, now classed in the genus *Phyllactinia*. Soon writers began to distinguish different species, but referred them all to a single genus called *Erysibe* by Link and Rabenhorst, *Alphitomorpha* by Wallroth and Schlectendal, and *Erysiphe* by Hedwig, the latter followed by De Candolle, Schweinitz, Fries, and others. This genus was often classed among the puff-balls, *(Gasteromycetes)*. In 1851 Léveillé published a monograph of the group (Ann. Sci. Nat., Ser. III., Tome XV.) in which he divided the old genus *Erysiphe* into six genera as follows:—

Sphæroetheca.— Perithecium containing a single ascus, appendages floccose, undivided.

Podosphæra.— Perithecium containing a single ascus, appendages dichotomously divided at the tip.

Uncinula.—Asci several, appendages coiled at the tip.

Phyllactinia.— Asci several, appendages straight, rigid, swollen at base.

Microsphæra.— Asci several, appendages dichotomously divided.

Erysiphe.—Asci several, appendages floccose, undivided.

Tulasne (Select. Fung. Carp. Vol. I., [1861]) does not adopt this division, but returns all the species to the genus *Erysiphe*. De Bary (Morph. und Phys. der Pilze III. [1870]) divides the group into two genera according to the characters of the carpogonuim, calling those *Podosphæra* in which this organ is straight (orthotropus) and which develop only one ascus, and retaining the name *Erysiphe* for those with a curved (campylotropus) carpogonium and several asci. For a true, natural classification, the life history of plants must be taken into account, no matter how obscure and impractical, for ordinary work, the characteristics it affords may be. It is probable that De Bary's arrangement is more logical; but for convenience most modern botanists use Léveillé's classification, which is the one adopted in this paper.

The true position and rank of the group in the vegetable kingdom still seems to be a matter of doubt, no two authors exactly agreeing in regard to it. The arrangement adopted by Winter (Die Pilze, II.) perhaps on the whole best expresses their true relations. It is essentially the same as that proposed by Saccardo (Sylloge Fung., I.) and may be expressed as follows:—

Class.......................*Ascomycetes.*
Order.........................*Pyrenomycetes.*
Suborder........................*Perisporiaceæ.*
Family...............................*Erysipheæ.*

It is usually easy to determine, even without the aid of a magnifier, whether or not a given fungus belongs to this family; and a moment's examination of the mature perithecium under the microscope will suffice to place it in its proper genus. Specific determination is often a matter of much greater difficulty. In other groups of parasitic fungi, as, for instance, the *Uredineæ*, the species are, for the most part, confined quite closely to a single host, or at least to a few very closely related host species. Very slight differences in the form or markings of the spores, taken in connection with a difference of host plant, are considered of specific importance. Some of the *Erysipheæ* have long been recognized as having a much wider range of habitat; but it was natural for the botanist, if he found a plant of this family developing on a new host, to consider it a new species, especially if he observed a few more or a few less asci or spores, or found the appendages differing in number or length from the descriptions of other accepted species. Then, too, owing to the poor instruments at their command, the descriptions of the earlier investigators are lacking in those microscopical characteristics that are now so carefully noted. While the above view of narrow specific limitations prevailed, the older names were apt to be disregarded By further study, and the comparison of numerous specimens of each of the so-called species, it becomes apparent that in very many cases the differences between them in the number and length of the appendages, the number and size of the asci and spores, and the appearance of the mycelium,— all so easily recognized in single instances,— are not constant; that these parts are exceedingly variable, and that it is frequently impossible to maintain distinctions based on them. This necessitates the putting together of forms often considered specifically distinct, and a corresponding change in specific descriptions.

This wider view of the limits of species sometimes throws new light on the work of the earlier mycologists, enabling us to decide with reasonable certainty whether or not their names should be adopted for the species as now understood. The process leads to the abandonment of some familiar names, which is always to be regretted; but the true interests of a stable nomenclature demand the adoption of the earliest specific name given to any form of the species. (See Bull. Ill. State Lab. Nat. Hist., Vol. II., p. 149.)

In his admirable revision of the fungi for "Rabenhorst's Kryptogamic Flora," Winter has very carefully and thoroughly performed this labor for the European species of *Erysipheæ,* and his nomenclature is adopted, for the most part, in this paper, for those species common to both continents, such changes only being made as are suggested by the study of numerous American specimens. The distinctively American species are usually much less encumbered with synonyms than those that also occur in Europe. In a number of cases, however, names have been given to forms that cannot now be considered distinct, and, in some cases, owing to the difficulty of interpreting his descriptions, the names given by Schweinitz have been disregarded. The attempt is here made to clear up these difficulties, so far at least as our Illinois species are concerned.

Some of the species of *Erysipheæ* are of practical interest from the injuries they do to cultivated plants. The mildew of roses, hops, gooseberries, raspberries, grapes,* and of many ornamental plants and trees, is caused by different species of this family. As their development is superficial, they are easily reached by remedial agents. Sulphur has long been successfully used to check the ravages of the grape mildew, and as a remedy for rose mildew in greenhouses. Its use is often indiscriminately recommended for any and all of these diseases, but the caution should be added, that, in some cases, the host plant suffers more from the sulphur, as usually applied, than from the parasite. The fact is, that each case needs careful practical study before a remedy can be safely recommended. More recently sulphate of copper has come into extended use for the destruction of various fungous parasites. The crystals may be dissolved in water — one pound to two gallons — and used as a spray. Or the mixture may be improved by the addition of lime slacked in water, — the whole so diluted that it can be easily applied with a broom or whisk. As the copper sulphate is poisonous, care must be exercised in handling and applying. The remedy appears to be serviceable against the *Peronospora* of the vine as well as for the special fungi to which attention is herein directed.

Illustrations of the Genera.

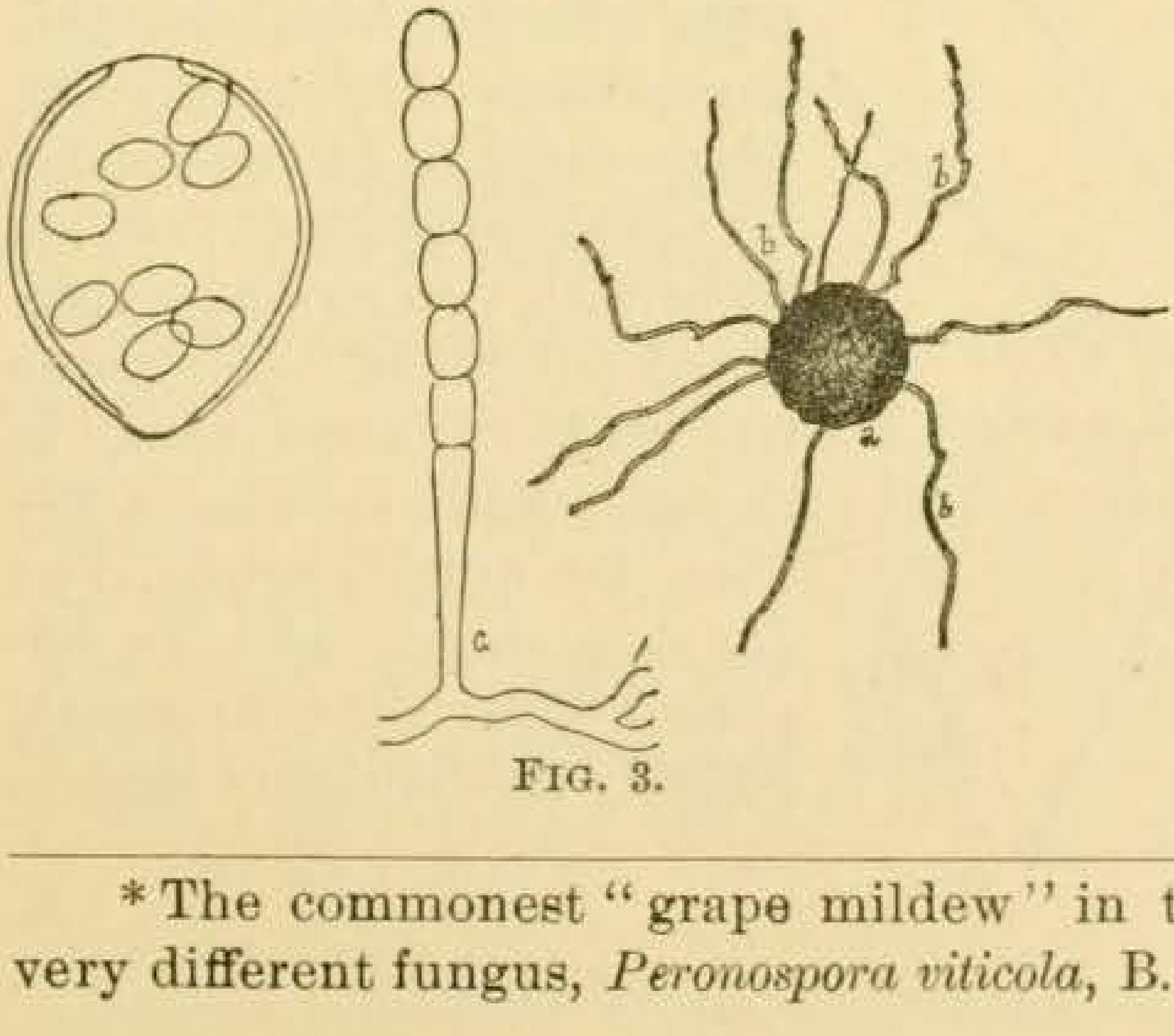

Fig. 3.

Figure 3. *Sphærotheca Castagnei*, Lév.: *a*, perithecium with *b* appendages,— magnified 90 times; *c*, fertile hypha or conidiophore, bearing six conidia which readily separate at the constrictions,— magnified 190 times; *d*, the single ascus with eight spores,— magnified 250 times.

* The commonest "grape mildew" in this country is caused by a very different fungus, *Peronospora viticola*, B.&C.

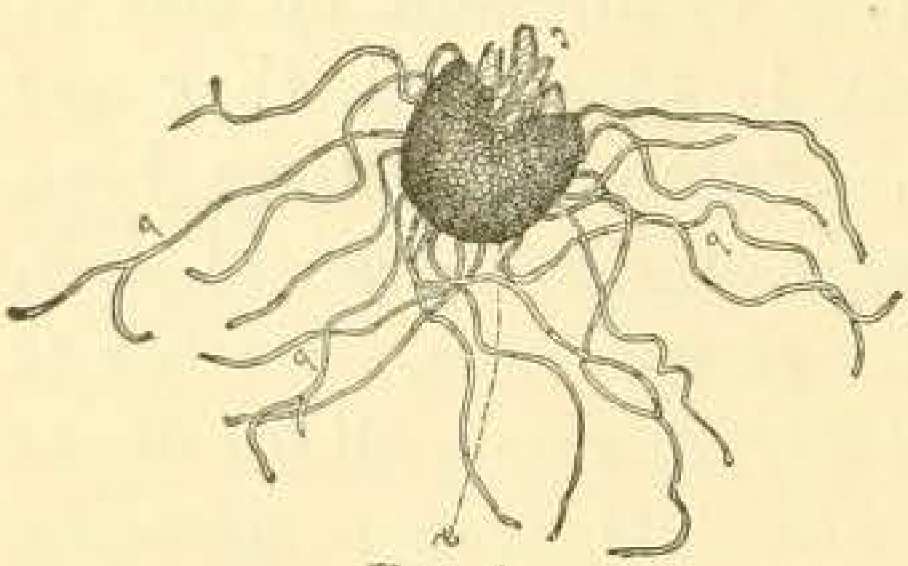

FIG. 4.

FIGURE 4. *Erysiphe chicoracearum*, DC. A ruptured perithecium with thread-like appendages and protruding asci, each containing two spores, — magnified 90 times.

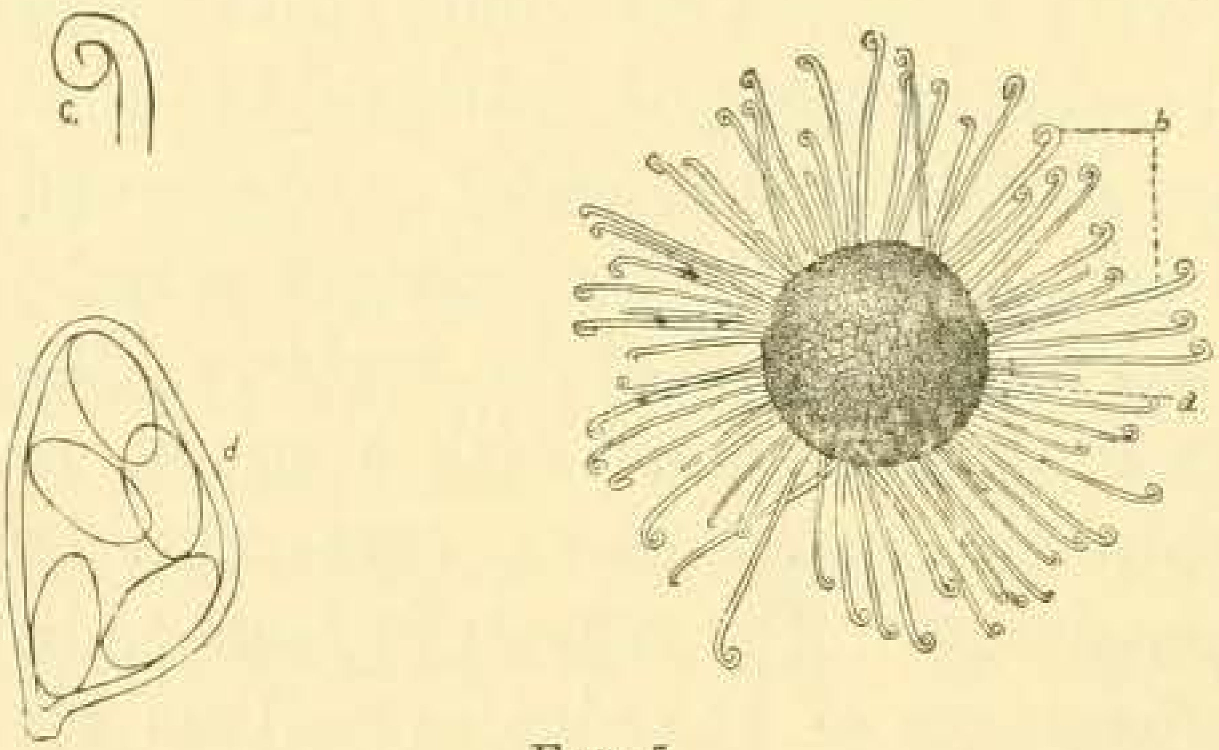

FIG. 5.

FIGURE 5. *Uncinula ampelopsidis*, Peck: *a*, perithecium with the numerous appendages (*b*) coiled at the tip,— magnified 100 times; *c*, one of the appendages (tip) further magnified; *d*, an ascus with five spores,—magnified 200 times. The lower, pointed end of the ascus is attached to the bottom of the cavity of the perithecium.

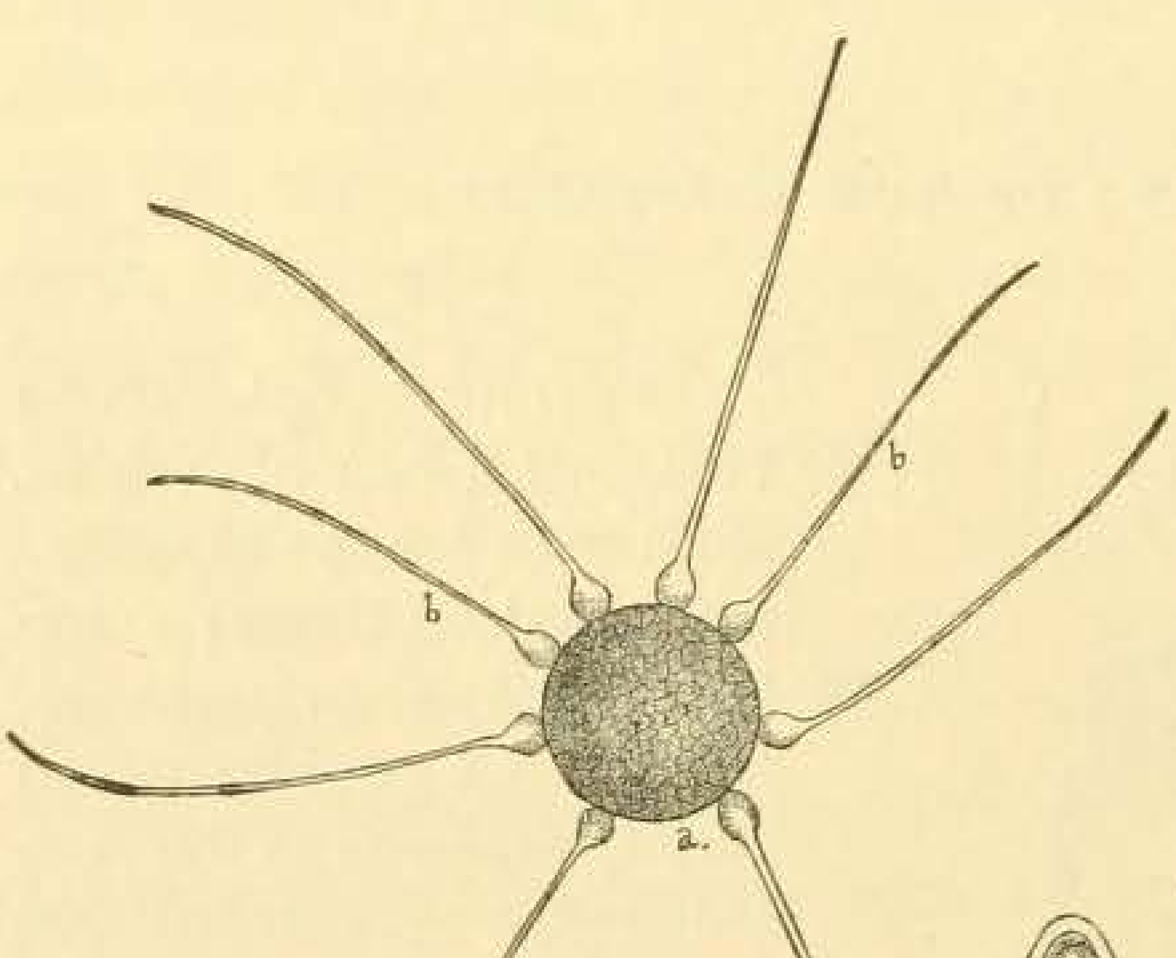

FIG. 6.

FIGURE 6. *Phyllactinia suffulta*, (Reb.) Sacc.: *a*, perithecium with the needle-shaped appendages (*b*) swollen at base,—magnified 50 times; *c*, a branched appendage; *d*, an ascus with two spores,— magnified 100 times. The point (pedicel) of attachment is shown. The appendages are normally quite straight, but are here shown as they appeared under the microscope, possibly mechanically bent.

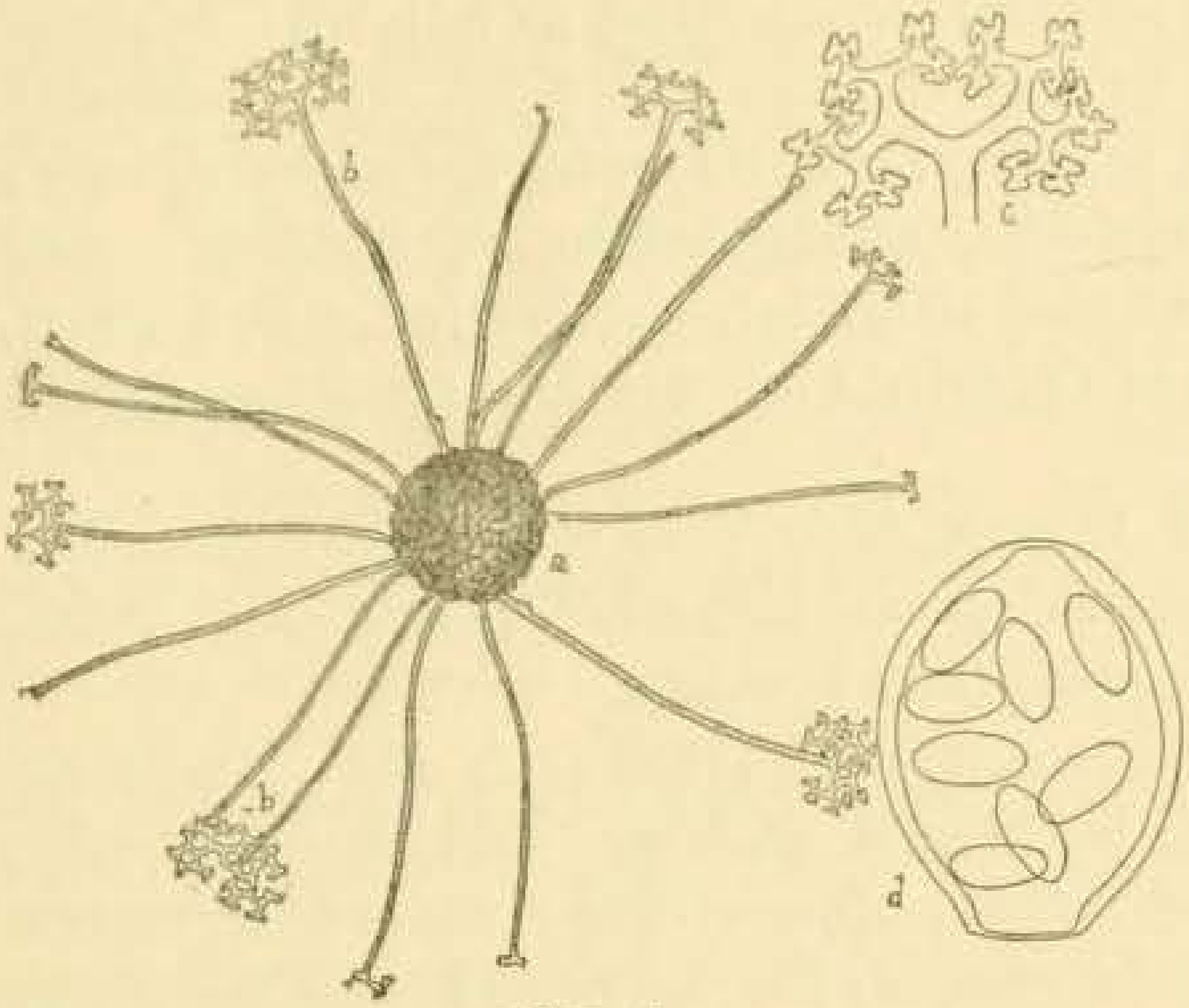

FIG. 7.

FIGURE 7. *Podosphæra oxycanthæ*, (DC.) DBy.: *a*, pericthecium with dichotomously forked appendages *b*,—magnified 90 times; *c*, a tip of an appendage more magnified; *b*, the single ascus with eight spores,—magnified 325 times.

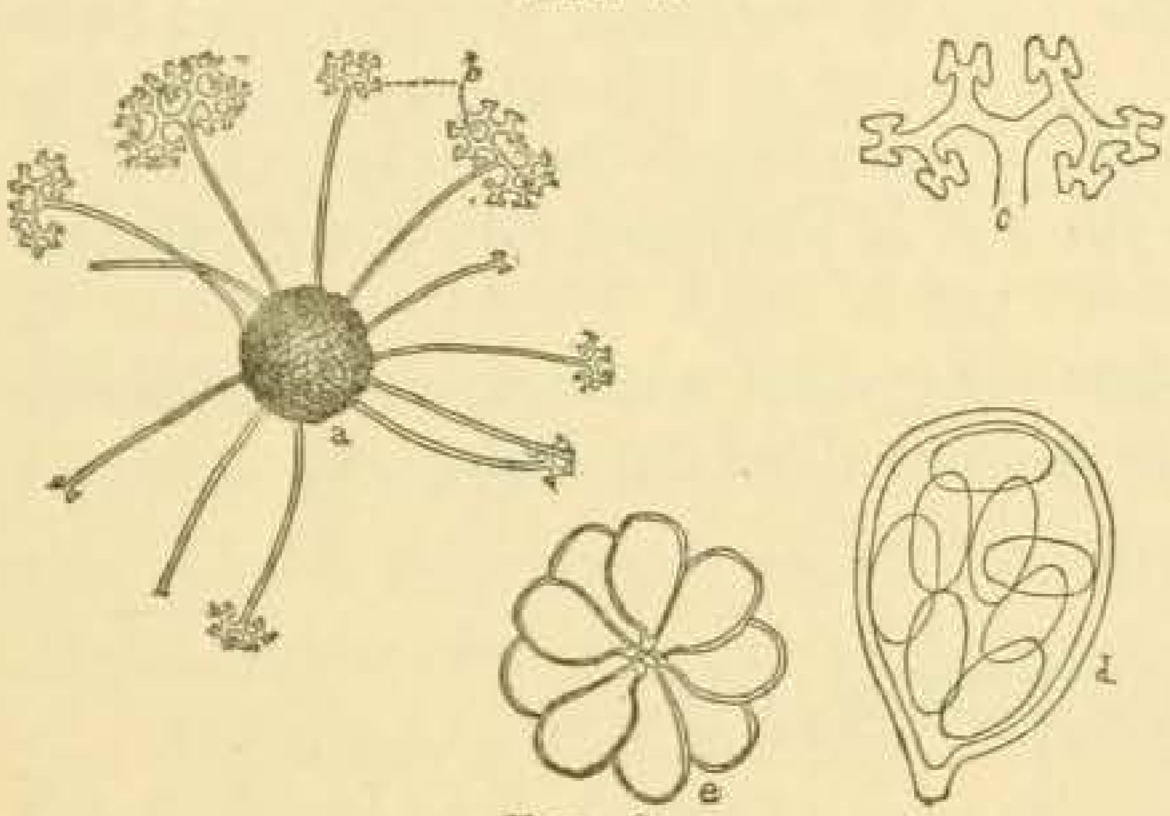

FIG. 8.

FIGURE 8. *Microsphæra Ravenelii*, Berk.: *a*, perithecium with its dichotomously forked appendages *b*,—magnified 75 times; *c*, a tip of an appendage more magnified; *d*, one of the several asci containing eight spores,—magnified 375 times; *e*, a group of asci from one perithecium,—magnified 150 times.

KEY TO THE GENERA OF ERYSIPHEÆ.

I. Appendages consisting of simple threads similar to the mycelium, and often interwoven with it............A.

II. Appendages dissimilar to, and free from the mycelium.B.

A. Perithecia containing only one ascus..SPHÆROTHECA.
   Perithecia containing several asci.........ERYSIPHE.

B. Appendages simple, not usually forked at the tip...1.
   Appendages dichotomously forked at the tip.......2.

1. Appendages coiled at the tip, asci several. UNCINULA.
   Appendages needle-shaped, abruptly swollen at base, asci several.............PHYLLACTINIA.

2. Perithecia containing only one ascus. PODOSPHÆRA.
   Perithecia containing several asci. MICROSPHÆRA.

Note. Three other genera have been described as follows:—

(1). *Pleochæta* (Saccardo, Sylloge Fungorum, I., p. 9). Perithecia globose-lenticular, indehiscent, texture subcoriaceous, parenchymatous; appendages very numerous, rod-like, straight, simple, hyaline; asci clavate, two-spored; spores simple, elliptical, subhyaline. *P. Curtisii,* Sacc. & Speg. occurs on leaves of *Celtis* in Alabama and Carolina, and in South America.

(2). *Erysiphella* (Peck, 28th Report, New York State Museum p. 63). "Perithecia destitute of appendages, spores definite." *E. aggregata,* Peck, is described on the fertile aments of *Alnus serrulata.*

(3). *Saccardia* (Cooke, Grevillea VII. [1878], p. 49). Mycelium arachnoid, often evanescent; perithecia globose, asci globose-ovate, 8-spored; spores elliptical, many-celled; appendages none or interwoven with the mycelium. *S. quercina,* Cooke on the leaves of *Quercus virens,* Georgia, and *S. Martii,* Ell. & Sacc. on *Q. laurifolia,* Florida, have been described. None of these plants are known in Illinois. Doubts may be expressed as to the validity of these groups as genera of *Erysipheæ.*

Calocladia, Lév. is a synonym for *Microsphæra,* but was previously used for a genus of *Algæ.*

Erysibe was used for *Erysiphe* by several authors, and Wallroth's genus *Alphitomorpha* was made to include all of the *Erysipheæ.*

SPHÆROTHECA, Lév.

(Ann. Sci. Nat., Series III., Tome XV., p. 138.)

Perithecium containing only one ascus. Appendages simple threads not unlike the mycelium with which they are frequently interwoven. Ascus suborbicular, usually containing eight spores. Very rarely two asci have been observed.

S. pannosa, (Wallr.) Lév.

(l. c. p. 138.)

Alphitomorpha pannosa, Wallr. (Verhand. d. Naturf. Freunde, I., p. 43).
Erysibe pannosa, Lk. (Species Plant. VI., I., p. 104).
Eurotium rosarum, Grev. (Scott. Crypt. Fl. III., p. 164, Fig. 2).

Mycelium abundant on the leaves, stems, etc., often sterile; perithecia more often occurring on the branches, scattered, delicate, 90–100 μ, reticulations evident, small, 10–15 μ; appendages short and delicate, much interwoven with the mycelium, sometimes colored; ascus large, delicate, ovate, expanding, when free from the perithecium, to a length greater than its diameter; spores 8, large, 29 μ long.

On *Rosa* sps.: Cook, Sept. 7, 1458; McHenry, Aug. 20, 1212; Pulaski, May 5, 4537. *Rose* stems: Champaign, autumn (Burrill). *Rosa lucida:* Union, Aug. 20 (Earle).

Winter (Die Pilze, II., p. 26) and Saccardo (Syl. Fung. I., p. 2) describe this species with hyaline appendages; but Tulasne (Fung. Carp. Select. I., p. 208) describes them as colored. They frequently are colored in our specimens. De Bary (Morph. und Phys. der Pilze, II., p. 48) says "colorless or brown at base."

S. mors-uvæ, (Schw.) B. & C.

(Grev. IV., p. 158.)

Erysiphe mors-uvæ, Schw. (N. A. Fungi, p. 270).

Mycelium abundant, at first white, becoming dark brown, densely covering the leaves, stems, and fruit; perithecia most abundant on the stems and fruit, densely aggregated, embedded in the thick felted mycelium, variable in size, 90-120 μ, dark brown, reticulations obscure; appendages short, delicate, hyaline or slightly colored, interwoven with and overrun by the dense mycelium; ascus broadly elliptic, eight-spored, both ascus and spores smaller than in *S. pannosa.*

On *Ribes rotundifolium:* McLean, July 16, 2373; La Salle, June 16, 5216. *Ribes* (cultivated): Pulaski, May 8, 4572; Union, June 22 (Earle).

This is the common "gooseberry mildew." It has been referred to *S. pannosa* (Bessey, Erysiphei, p. 3, etc.), but it is sufficiently distinguished by its dense, dark-colored mycelium, which is strikingly unlike that of most of the *Erysipheæ.*

S. pruinosa, C. & P.

(Erysiphei of the U. S.)

Hypogenous; mycelium thin, effuse, persistent; conceptacles minute, black; appendages few, long, colorless, sporangium, ovate, eight-spored.

Leaves of *Rhus glabra.* Greenbush, August.

The long colorless appendages readily distinguish the species from the preceding [*S. Castagnei*, Lév.]. The whole surface of the leaf appears pruinose.—Peck, 25th Rep. N. Y. State Mus., p. 94.

On *Rhus copallina:* Union, Sept. 17 (Earle).

Our specimen is not sufficient for full identification, but it is doubtless the same as that described above by Peck.

S. humuli, (DC) Burrill.

Erysiphe humuli, DC. (Flore Franc., VI., p. 106.
Sphærotheca Castagnei, Lév., in part.

Mostly hypophyllous. Myceliumin conspicuous or evanescent; perithecia scattered, abundant, mostly rather small, 75–95μ, wall-texture firm and compact though thin, surface smooth, reticulations small, often obscure, usually less than 15 μ; appendages slender, three or more times as long as the diameter of the perithecium, colored throughout when mature, mostly free from the mycelium; ascus broadly elliptical or suborbicular; spores usually 8, large, averaging 20 μ long.

On *Agrimonia Eupatoria:* McHenry, Aug. 20, 1183, 1213, Aug. 23, 1249, 1267; McLean, July 2, 2369; Ogle, Sept. 22, 6106 (with coleosporium); Adams, July 10 (Seymour).

This form on *Agrimonia* has usually been referred to *Sphærotheca Castagnei*, Lév. (Rabh, Fungi Europ. No. 558; Winter, Die Pilze, II., p. 27; Saccardo, Syl. Fung., I., p. 4; Trelease, Parasitic Fung. of Wis., p. 9; Peck, 29th Rep. N. Y. State Mus., p. 79). A careful examination of American and European specimens on this host and on *Potentilla*, show marked differences between them and the typical form of *S. Catagnei* on various *Compositæ*, etc. They agree, however, with the European form on *Humulus* (Rabh. Fung. Europ. No. 1049 b). Tulasne (Fung. Carp. Select. I., Tab. IV., 9), under the name of *Erysiphe humuli*, DC. gives an accurate figure of this form, showing the long, slender, colored appendages and the compact small-celled wall of the perithecium. It seems best, therefore, to revive De Candolle's old species and refer to it the forms on *Humulus*, *Agrimonia*, and *Potentilla*. The perithecia closely resemble those of *S. pannosa*, but it differs in the larger appendages and the much less abundant mycelium.

S. Castagnei, Lév.

(Ann. Sci. Nat., Ser. III., Tome XV., p. 139.)

Mycelium abundant and persistent or sometimes inconspicuous, occurring on either or both sides of leaves; perithecia abundant, scattered or somewhat aggregated, small, usually about 75 μ, but varying from 60–100 μ; texture soft, surface uneven, reticulations very large and irregular, 20–30 μ; appendages long, stout, usually colored throughout, flexuous, somewhat uneven in width, more or less interwoven with the mycelium; ascus rather small, elliptical or suborbicular; spores usually 8, small, about 15 μ long.

On *Bidens frondosa:* Jo Daviess, Sept 15, 5904; Stephenson, Sept. 13, 5842; Lee, Sept. 9, 5743; McLean, July 2, 2370; La Salle, Sept. 12, 1489, Sept. 16, 1554; Henry, Sept. 28, 1708; McHenry, Aug. 20, 1168; Union, Sept. 13 (Earle). *Bidens connatus:* Rock Island, Sept. 24, 1624; Fulton, Oct. 1, 1777. *Erechthites hieracifolia:* McHenry, Aug. 23, 1234; Champaign, Sept. 19, 6615; Adams, Aug. 20 (Seymour). *Nabalus* sps.: McLean, Sept. 20, 5662; Jo Daviess, Sept. 16, 5945. *Taraxicum dens leonis:* Champaign, Oct. 16, 6580, Oct. 23, 6590. *Veronica Virginica:* McHenry, Aug. 27, 1333; Stephenson, Sept. 13, 5809, Sept. 14, 5878; Jo Daviess, Sept. 15, 5906, Sept. 18, 5975, Sept. 19, 6002, Sept. 20, 6017; Ogle, Sept. 23, 6134. *Gerardia grandiflora:* Ogle, Sept. 23, 6129. *Brunella vulgaris:* McLean, July 3 (Seymour); Champaign, Oct. (Waite).

This abundant and widespread species can be easily distinguished from the form on *Rosaceæ*, etc., that has usually been associated with it, by the peculiarly low and large-celled, wall of the perithecium, and by the larger, more flexuous appendages. The spores, too, average smaller. It varies considerably on the different hosts, in the appearance of the mycelium and the size of the perithecia, these being larger than the average on *Erechthites* and usually smaller on *Veronica;* but the more important characteristics appear to be constant.

ERYSIPHE, (Hedw.) LÉV.

(Ann. Sci. Nat., Ser. III., Tome. XV.)

Perithecium containing several asci; appendages simple threads similar to and frequently interwoven with the mycelium.

E. liriodendri, Schw.

(N. A. Fungi, p. 269.)

On leaves and succulent stems. Mycelium abundant, dense, white, persistent; perithecia developing late, mostly after the leaves have fallen, rather large, 100 μ or more, delicate, thin-walled, embedded in and partially covered by the dense mycelium, reticulations small and indistinct; appendages several, hyaline, rather long, much interwoven with the mycelium; asci several, eight or more; spores 6—8, small.

On *Liriodendron tulipifera:* Union, Oct. 29, 2106, 2110; Champaign, (Burrill). Schweinitz describes the peculiarly dense and felted white mycelium of this species. Peck (30th Rep. N. Y. State, Mus., p. 58) mentions it as occurring at Oneida, N. Y., but gives no description. Saccardo (Syl. Fung., I., p. 21) mentions it among "*species inquirendæ.*" A full description is published here for the first time. It is not uncommon in Illinois but can seldom be collected in good condition.

E. communis, (Wallr.) Fr.
(Summa. Veg. Scand., p. 406.)

Alphitomorpha communis, horridula, Wallr., in part, (Verhdl. Naturf. Freunde, I).
Erysibe communis, nitida, horridula, Rabh. (Deutschl. Crypt. Flora).
Erysibe communis, Lk., in part.
Erysiphe aquilegiæ, DC. (Flore Franc., VI., p. 105).
Erysiphe pisi, DC. (l. c., VI., p. 274).
Erysiphe convolvuli, DC. (l. c., II., p. 274).
Erysiphe polygoni, DC. (l. c., II., p. 273).
Erysiphe communis, Fr. (Summa. Veg. Scand., p. 406).
Erysiphe communis, Martii, Lév., in part, (Ann. Sci. Nat., Ser. III., Tome XV).

Amphigenous. Mycelium abundant, persistent or sometimes evanescent; perithecia variable in size and reticulations; appendages variable in length, often quite long, lying on the mycelium or more or less interwoven with it, usually colored in part or throughout, but occasionally all hyaline; asci 4–8, or more; spores mostly 4–8, variable in size.

On *Clematis* sps.: Union, Aug. 30 (Earle). *Thalictrum purpurascens:* Jo Daviess, Sept. 18, 5977. *Ranunculus abortivus:* McLean, July 16, 2365, Aug. 1, 2367; Jo Daviess, Sept. 15, 5905; Sept. 30, 6040; Champaign, Oct. 23, 6596; Nov. 3, 6609; La Salle, Sept. 30, 6257. *Geranium maculatum:* La Salle, Sept. 30,

6248. *Pisum sativum:* Champaign, Oct. 19 (Burrill). *Astragalus Canadensis:* Jo Daviess, Sept. 15, 5907; Stephenson, Sept. 21, 6074. *Amphicarpæa monoica:* La Salle, Sept. 12, 1473, 1482; Henry, Sept. 28, 1719; Jo Daviess, Sept. 20, 6036; Ogle, Sept. 22, 6099. *Œnothera biennis:* Champaign, Sept. 19, 6616; Union, Sept. 3 (Earle).

The form on *Clematis* is referred by authors (Bessey, The Erysiphei, p. 13; Trelease, Parasitic Fungi of Wis., p. 9) to *E. tortilis*, (Wallr) Fr., or, as often written, *E. tortilis*, Link. It seems a mistake to separate it from the other forms occurring on *Ranunculaceæ*, some of which have equally long appendages; especially as on *Clematis* these are radiant, and more or less interwoven with the mycelium as is usual in *E. communis*, while in European specimens of *E. tortilis* on *Cornus* (Rabh. Fungi Europ. No. 2033; J. Kunze, Fungi Selecti Exsic., No. 577, etc.), the appendages are fasciculate and assurgent. (See also Tulasne, Selec. Fung. Carp., I., pp. 213–216).

The forms on *Leguminosæ*, etc., are often referred to *E. Martii*, Lév. De Bary (Morph. und Phys. der Pilze, III., p. 50) and Tulasne (l. c. p. 215) agree in considering this a synonym of *E. communis.* Winter, however, (Die Pilze, II., p. 31) retains *E. Martii* and refers to it all forms having hyaline appendages; but he says that he cannot decide whether this character is always constant and sufficient for their separation. Careful examination and comparison of the herbarium specimens specially mentioned by Winter, show that this character is not constant, for some of those given by him under *E. Martii* have distinctly colored appendages, while in some of those given under *E. communis* they are very slightly, if at all, colored. In fact the coloring of the appendages seems to depend, to a considerable extent, on the age and vigor of the specimen, being light colored or hyaline in the young, and often quite dark in fully matured, vigorous specimens. A portion, at least, of the appendages often remains hyaline on *Leguminosæ*, while on *Ranunculaceæ* they are usually all quite dark. All our specimens show more or less distinctly colored appendages.

2

E. galeopsidis, DC.

(Flore Franc., VI., p. 108.)

E. *lamprocarpa*, Lév., in part.
E. *labiatarum*, Chev. (Flora Paris, III., p. 380).

Amphigenous. Mycelium abundant, persistent, haustoria of the mycelial threads lobed; perithecia somewhat aggregated; appendages numerous, short, flexuous, colored, interwoven with the mycelium; asci numerous, often 12 or more; spores 2, mostly formed late.

On *Stachys palustris:* Henry, Sept. 28, 1705. *Stachys* sps.: Stephenson, Sept. 13, 5812. *Teucrium Canadense:* LaSalle, Sept. 29, 6239. *Scutellaria parvula:* Lee, Sept. 27, 6208. *Scutellaria lateriflora:* McLean, Sept. 6 (Seymour).

This can scarcely be separated from *E. cichoracearum* by the characters of the perithecia, but the difference in the haustoria, first pointed out by De Bary (Morph. und Phys. der Pilze, III., p. 49), can be observed by first soaking a portion of the leaf in caustic potash and then removing a little of the mycelium to the slide. In our specimens the perithecia and appendages are rather lighter colored than is usual in *E. cichoracearum.*

E. cichoracearum, DC.

(Flore Franc., II., p. 274.)

Alphitomorpha communis, γ depressa, horridula, Wallr. (Verhandl. Naturf. Freunde, IV).
Alphitomorpha lamprocarpa, Schl. (Verhandl. Naturf. Freunde, I., p. 49).
Erysibe communis, lamprocarpa, depressa, horridula, Lk. and Rabh.
Erysiphe horridula, Montagnei, lamprocarpa, Lév., in part.
Erysiphe ambrosiæ, verbenæ, phlogis, asterum, Schweinitz, (N. A. Fungi, p. 270).

Amphigenous. Mycelium abundant, persistent, haustoria rounded, not lobed; perithecia variable; appendages numerous, mostly short, 1–2 times the diameter of the perithecium, colored, much flexed and interwoven with the mycelium; asci variable, 4 or 5 to as many as 20, mostly numerous; spores large, quite uniformly 2, but occasionally varying to 3 or even 4.

On *Napæa dioica:* Stephenson, Sept. 13, 5806. *Vernonia fasciculata:* Lake, Aug. 27, 1364; Rock Island, Sept. 23, 1630, Sept. 24, 1656; Tazewell, July 22, 2371; McLean, Oct. 12, 1850; Jersey, Oct. 13, 6289, Oct. 14, 6312; Union, Oct. 21, 1933; Pulaski, Nov. 4, 2234. *Eupatorium purpureum:* McLean, Aug. 1, 2366. *Aster sagittifolius:* McLean, Sept. 6, 5661. *Aster lævis:* McLean, July 14, 5547. *Aster* sps: Kane, Aug. 30, 1376; Rock Island, Sept. 24, 1658, Sept. 27, 1691; Henry, Sept. 28, 1710; McLean, Oct. 11, 1833, 1835, Aug. 4, 2375; Stephenson, Sept. 13, 5804; Jo Daviess, Sept. 18, 5976; Champaign, Oct. 16, 6574; Union, Oct. 21, 1914, Oct. 24, 1964, Oct. 25, 2000, Oct. 27, 2065. *Solidago Canadensis:* Stephenson, Sept. 13, 5804. *Solidago* sps: Union, Oct. 24, 1972. *Ambrosia trifida:* La Salle, Sept. 12, 1484, 1494; Rock Island, Sept. 21, 1626; Henry, Sept. 28, 1704; McLean, Oct. 6, 1805, Oct. 13, 1865, Oct. 19, 1898; Jo Daviess, Sept. 15, 5903. *Ambrosia artemisiæfolia:* Rock Island, Sept. 23, 1632, Sept. 27, 1690; Fulton, Oct. 1, 1778; McLean, Oct. 6, 1806, Oct. 12, 1851; Champaign, Sept. 19, 6618; Union, Oct. 24, 1974, Oct. 25, 1998. *Xanthium strumarium:* Henry, Sept. 28, 1709; La Salle, Sept. 28, 6214, Sept. 30, 6246; Jersey, Oct. 12, 6278, Oct. 13, 6288. *Helianthus rigidus:* Boone, Sept. 2, 1421; La Salle, Sept. 12, 1491; Rock Island, Sept. 24, 1655; Henry, Sept. 28, 1720; Fulton, Oct. 1, 1782. *Helianthus decapetalus:* LaSalle, Sept. 14, 1532; McLean, Oct. 6, 1807. *Helianthus tuberosus:* McHenry, Aug. 20, 1154. *Helianthus* sps: La Salle, Sept. 13, 1499; McLean, Oct. 11, 1837; Lee, Sept. 9, 5742; Jo Daviess, Sept. 16, 5944; Stephenson, Sept. 13, 5803; Ogle, Sept. 22, 6087, Sept. 25, 6164; *Actinomeris squarrosa:* La Salle, Sept. 14, 1531, 1543; Rock Island, Sept. 26, 1668; McLean, Oct. 6, 1808, Oct. 19, 1897; Union, Oct. 31, 2127; Stephenson, Sept, 2, 6072; Ogle, Sept. 25, 6165. *Cirsium discolor:* McLean, July 14, 5548, (immature); Stephenson, Sept. 13, 5805. *Hieracium Canadense:* McHenry, Aug. 20, 1215. *Verbena angustifolia:* Marion, Oct. 20, 1901; La Salle, Sept. 29, 6233; Jersey, Oct. 12, 6279; Ogle, Sept. 23, 6133. *Verbena hastata:* McHenry, Aug. 20, 1155;

Rock Island, Sept. 23, 1633; Fulton, Oct. 1, 1783; Jo Daviess, Sept. 20, 6025. *Verbena urticifolia:* Piatt, Aug. 15, 1072; McHenry, Aug. 20, 1228; La Salle, Sept. 13, 1513; Rock Island, Sept. 24, 1657; Fulton, Oct. 1, 1779; McLean, July 20, 2364, Oct. 12, 1849; Ogle, Sept. 23, 6132. *Verbena stricta:* Cook, Sept. 6, 1453; Jackson, Nov. 5, 2255; Jersey, Oct. 12, 6280. *Verbena bracteosa:* Adams, Aug. 25 (Seymour). *Hydrophyllum Virginicum:* Ogle, Sept. 25, 6153. *Phlox paniculata:* Adams (Seymour). *Phlox* sps: Fulton (Wolf). *Asclepias variegata:* Union, Sept. 22 (Earle). *Parietaria Pennsylvanica:* Stephenson, Sept. 21, 6069; Lee, Sept. 27, 6209. *Stevia* sps. (from greenhouse): Union (Earle).

This exceedingly abundant and widely occurring species is doubtless to be found on other hosts in this State besides those enumerated above. Although widely variable it is usually easily recognized by its short dark appendages and numerous two-spored asci. It is usually known as *E. lamprocarpa*, Lév. Winter, however (Die Pilze, II., p. 33), adopts De Candolle's name of *E. cichoracearum,* and according to the law of priority this seems to be correct.

The forms on various *Labiatæ* are often included here, but they differ in having lobed haustoria on the mycelium threads. On the various species of *Verbena* the haustoria are smooth and rounded as in the forms on *Compositæ.*

UNCINULA, LÉV.

(Ann. Sci. Nat., Ser. III., Tome XV.)

Perithecium containing several asci; appendages free from the mycelium, recurved or coiled at the tip.

U. ampelopsidis, Peck.

(Trans. Albany Inst., VII., p. 216.)

U. Americana, Howe (Erysiphei of U. S. in Jour. Bot. 1872).

U. spiralis, B. & C. (Grev. IV., p. 159).

U. subfusca, B. & C. (Grev. IV., p. 160).

Amphigenous or frequently epiphyllous. Perithecia 85–100 μ, dark brown, opaque, reticulations small, rather obscure; appendages from 10 or 12 to 20 or more, varying in length from once and a half to four or more times the diameter of the perithecium, colored for more than half their length, frequently septate, occasionally forked, tips loosely and somewhat spirally coiled; asci mostly 4–6 (4–8 Farlow) ovate, pedicellate; spores 4–6.

Amphigenous: mycelium web-like, thin and evanescent; conceptacles minute, globose, black; appendages ten to twenty, in length once or twice the diameter of the conceptacle, simple, obscurely septate toward the base, colored, a little paler at the tips, sporangia four to six, subglobose or ovate containing four to six spores.—Peck, 25th Rep. N. Y. State Mus., p. 96.

On *Vitis* (cultivated): Union, Oct. 24, 1965, Oct. 28, 2071; Wabash (Schneck); Champaign (Burrill). *Ampelopsis quinquefolia:* McHenry, Aug. 20, 1203; La Salle, Sept. 12, 1483; Rock Island, Sept. 21, 1622; Lee, Sept. 8, 5700½; Ogle, Sept. 25, 6161; Champaign (Burrill).

The form on *Vitis*, which is one of the common "grape mildews," is usually known as *U. spiralis*, B. & C. Aside from its usually somewhat longer appendages, there seems to be no way of distinguishing it from the previously described form on *Ampelopsis*. The appendages in each are colored, frequently septate, and similarly coiled at the tip, while the cellular structure of the walls of the perithecium, and the characters of the spores and asci, are indistinguishable. In specimens on *Vitis* from Massachusetts (Seymour), the appendages are mostly very long; but in the Illinois specimens they are frequently not more than twice, or sometimes only once and a half, the diameter of the perithecium; while on *Ampelopsis* they are frequently as much as two, two and a half, or even three times the diameter.

U. macrospora, Peck.

(Trans. Albany Inst., VII., p. 215.)

Amphigenous. Mycelium conspicuous, abundant; perithecia large, 110–140 μ, wall tissue soft, reticulations very small, 5–10 μ, and rather obscure; appendages very numerous, 50 or more, hyaline, slender, smooth, usually shorter than the diameter of the perithecium, tip closely coiled, not enlarged; asci several, 8–10; spores 2, large, 20 by 30–35 μ.

Mycelium effused, persistent; conceptacles subglobose; appendages numerous, thirty or more, about equal in length to the diameter of the conceptacle; sporangia eight to twelve; spores two, very large, elliptical, .0012–.0015 inch long.– Peck, 25th Rep. N. Y. State Mus., p. 96.

On *Ulmus Americana:* Fulton, Oct. 1, 1776, 1781; McLean, Oct. 12, 1852. *Ulmus alata:* Union, Oct. 2, 6547. Oct. 21, 1916, 1934, Oct. 22, 1962, 2377, Oct. 25, 2023, Oct. 28, 2073, 2091.

This abundantly occurring species differs sufficiently from European specimens of *U. Bivonæ*, Lév. on *Ulmus campestris* (Thüm. Mycoth. Univer. No. 755). In these the perithecia are smaller (80–90 μ), and the reticulations are much larger (10–15 μ) and more distinct. The fewer (less than 20) appendages are stouter, somewhat roughened and conspicuously swollen at the tip. The usually four asci each contain two spores about 30 μ long but narrower than in *U. macrocarpa.*

U. flexuosa, Peck.

(Trans. Albany Inst., VII., p. 215.)

Hypophyllous. Perithecia large 110–125 μ, dark, opaque, reticulations obscure; appendages numerous, 40 or more, about equaling the diameter of the perithecium, hyaline, minutely roughened, thickened and irregularly flexuous toward the tip; asci about 10, ovate or pyriform, strongly pedicellate; spores 8, small, 15–20 μ long.

The wavy-flexuous appendages are peculiar to this species, and with its more numerous spores separate it from *U. adunca* Lév. to which it is sometimes referred.—Peck, 26th Rep. N. Y. State Mus. p. 80.

On *Æsculus* sps.: Union, Sept. 15 (Earle).

This handsome and peculiar species is well characterized by the several abrupt changes of direction in the upper half of the appendage, which give it a peculiar wavy outline.

U. circinata, C. & P.

(Erysiphei of the U. S. in Jour. of Bot. 1872.)

Hypophyllous. Mycelium inconspicuous; perithecia very large, depressed, 150–175 μ in greatest diameter, texture soft, reticulations very small and irregular; appendages very numerous, slender, simple, about equal to the diameter of the perithecium, hyaline, smooth, tips not swollen, ascending from the upper half of the perithecium; asci numerous, 14 or more, long and slender, oblong or narrowly ovate, pedicellate, about 30 by 75 μ; spores 8, small, about 10 by 15 μ.

Mycelium dense, effuse, persistent; conceptacles large, depressed or flattened, black; appendages very numerous, slender, about equal in length to the diameter of the conceptacle, simple, colorless; sporangia oblong or narrowly ovate, eight to sixteen, containing eight spores.—Peck, 25th Rep. N. Y. State Mus. p. 26.

On *Acer saccharinum:* Champaign, Oct. 17 (Waite).

This is distinguished from *U. aceris*, (DC.) Lév. by its simple appendages, and more numerous, very narrow asci. In our specimens the mycelium is quite inconspicuous, but in specimens from Massachusetts (Seymour) it is more abundant. The leaves affected by it can be distinguished at some distance, as the areas covered by it remain green after the rest of the leaf has assumed its autumn tint. (Waite.)

U. parvula, C. & P.
(Erysiphei of the U. S. in Jour. of Bot. 1872.)

Amphigenous. Perithecia small, 90–100 μ, delicate, reticulations distinct, small and regular, averaging about 10 μ; appendages very numerous, delicate, slender, hyaline, shorter than the diameter of the perithecium; asci 5–7, broadly elliptic; spores 6–8, mostly 6, large, 20–25 μ long.

Hypophyllous; mycelium effused, delicate, evanescent; perithecia scattered, globose, minute; appendages simple, numerous, scarcely so long as the diameter of the perithecia; asci elliptical, rostrate; spores 6.—Cooke and Peck, Erysiphei of the U. S., Supp. in Jour. of Bot., June, 1872.

On *Celtis occidentalis:* Union, Oct. 26, 2036; Oct. 31, 2144; Jackson, Nov. 5, 2264.

This is perhaps too near *U. Salicis*, (DC.) Winter, but it seems to be distinguished by its uniformly smaller size and its shorter, more delicate appendages.

U. salicis, (DC.) Winter.

(Die Pilze, II., p. 40.)

Erysiphe salicis, DC. (Flore Franc., II., p. 273).
Erysiphe populi, DC. (Flore Franc., VI., p. 104).
Alphitomorpha adunca, guttata, Wallr. (Verh. Naturf. Freunde, I., pp. 37, 42).
Erysibe adunca, obtusata, Lk. (Spec. Plant., VI., 1, p. 117).
Erysiphe adunca, Grev. (Scott. Crypt. Flora, V., tab. 296).
Uncinula adunca, Lév. (Ann. Sci. Nat., Ser. III., Tome XV).
Uncinula leuculenta, Howe (Trans. Albany Inst., VII., quoted in Amer. Nat., VII., p. 58).
Uncinula heliciformis, Howe (Torr. Bull., V., p. 4).

Amphigenous. Mycelium abundant, persistent; perithecia usually large, 100–160 μ, wall-tissue soft, elastic, reticulations rather small and indistinct; appendages variable in number, usually very numerous, hyaline, not much swollen at the tip, once to twice as long as the diameter of the perithecium; asci from 4 or 5 to 12 or more, ovate; spores usually 4 or 5, sometimes 6–8.

On *Salix* sps.: La Salle, Sept. 20, 1602; Henry, Sept. 28, 1721; Jo Daviess, Sept. 20, 6029, 6030, 6031; Stephenson, Sept. 21, 6083. *Salix petiolaris:* Piatt, Aug. 17, 1143. *Salix cordata:* McHenry, Aug. 20, 1152, Aug. 24, 1255, 1256; Cook, Sept. 5, 1435; Jo Daviess, Sept. 18, 5974. *Populus tremuloides:* McHenry, Aug. 23, 1250, Aug. 31, 1397; Jo Daviess, Sept. 18, 6018. *Populus grandidentata:* La Salle, Sept. 17, 1579. *Populus heterophylla:* Union, Oct. 25, 2020, 2031; Oct. 31, 2142.

This species is quite variable, as are most of the abundant and widely distributed ones belonging to the family. It is usually known as *U. adunca*, Lév.; but De Candolle's name has priority, and is adopted by Winter (Die Pilze, II., p. 40) and Tulasne (Fung. Carp. I., p. 198). The asci are usually described with only four or five spores, but our specimens frequently show as many as six, and sometimes seven or eight.

U. leuculenta, Howe, is described as occurring on *Populus*, with fewer and longer appendages and five or six spores. Illinois specimens on *Populus* sometimes show rather longer appendages than on *Salix*, but as the more numerous spores are frequent on both hosts, there is no sufficient ground for separating them. Trelease (Parasitic Fungi of Wis., p. 8) gives *U. heliciformis* Howe, as a synonym for *U. adunca.* Howe's description says, "appendages colored at base;" but this alone would not be a sufficient specific character. There is nothing else in the description by which to distinguish it from the other forms on *Populus.*

PHYLLACTINIA, Lév.

(Ann. Sci. Nat., Ser. III., Tome XV., p. 144.)

Perithecium containing several asci; appendages free from the mycelium, acicular, acute at the tip, abruptly swollen at base.

P. suffulta, (Reb.) Sacc.

(Syl. Fung., I., p. 5.)

Sclerotium suffultum, Rebent. (Flor. Neom., p. 360).
Erysiphe coryli, fraxini, DC. (Flore Franc., II., p. 273).
Erysiphe vagans, Bivon. (Stirp. rar. Sicil., III., p. 19).
Alphitomorpha guttata, Wallr. (Verh. Naturf. Freunde, I., p. 42).
Erysibe guttata, Lk. (Spec. Plant., VI., 1, p. 116).
Erysibe guttata, Fr. (Syst. Mycol., III., p. 245).
Phyllactinia guttata, Lév. (Ann. Sci. Nat., Ser. III., Tome XV).

Hypophyllous. Mycelium abundant, persistent, or scant and evanescent; perithecia very large, 150–250 μ, wall tissue soft, cellular structure and reticulations obscure; appendages few, usually 8–12, easily detached, hyaline, varying in length from less than to three or four times the diameter of the perithecium; asci 4 or 5 to 20 or more, ovate, pedicellate; spores normally 2, occasionally 3 or 4, variable in size, mostly quite large.

On *Liriodendron tulipifera:* Union, Oct. (Earle). *Celastrus scandens:* Jersey, Oct. 14, 6307. *Cratægus tomentosa* var. *pyrifolia:* Champaign, Oct. 18 (Seymour). *Cornus Florida:* Union, Oct. 2, 6544. *Ilex decidua:* Union, Oct. 7 (Earle). *Catalpa bignonioides:* Champaign, Oct. 10, 6577½. *Fraxinus* sps.: Union, Sept. (Earle); Champaign, Oct. (Waite). *Ulmus Americana:* Jersey, Oct. 12, 6277. *Ulmus alata:* Union, Oct. 2, 6543, Oct. 22, 2377. *Quercus macrocarpa:* Union, Oct. 21, 1917, Oct. 28, 2090, 2105. *Quercus coccinea:* Union, Oct. 31, 2139; Champaign, Oct. 30, 6377. *Quercus tinctoria:*

Union, Sept. and Oct. (Earle). *Quercus rubra:* Union, Nov. 1, 2196. *Quercus (palustris?):* La Salle, Sept. 17, 1582. *Fagus ferruginea:* Union, Sept. 20 (Earle). *Corylus Americana:* Lee, Sept. 12, 5794; Jo Daviess, Sept. 16, 5940; Ogle, Sept., 6192; Union, Sept. and Oct. (Earle). *Betula nigra:* Jersey, Oct. 14, 6306; Union, Oct. 4, 6561.

This frequently occurring species presents many variations in the size of the perithecia, the length of the appendages, the number and size of the asci, and the size of the spores; but none of these forms seem constant enough to justify their separation. On *Liriodendron* the mycelium is usually inconspicuous, the appendages but little longer than the diameter of the perithecium, and the few (8–10) asci are large and broadly ovate. On *Ulmus* the mycelium is abundant and persistent, the perithecia and appendages medium, and the very numerous (20–30) asci are small and narrow. On *Quercus* the perithecia are very large, and the 10–15 asci and the spores are much larger than on *Ulmus.* On *Corylus* the perithecia are small, but the appendages are very long. Asci and spores not observed on this host. They seem to mature later than on the others.

This species has long been known as *P. guttata*, Lév., but priority demands the use of the name given by Rebentisch, (Sacc. Syl. Fung., I., p. 5).

The peculiar yellow oil often occurring in the perithecia of this family is here particularly abundant and noticeable. In some cases, especially on *Ulmus*, the leaves affected by the fungus turn yellow and fall prematurely.

PODOSPHÆRA, Kunze.

(Mycol., Hefte II., p. 111.)

Perithecium containing a single ascus; appendages free from the mycelium, dichotomously branched at the end.

P. oxyacanthæ, (DC.) DBy.

(Morph. und. Phys. der Pilze, III., p. 480.)

Erysiphe oxyacanthæ, DC. (Flore Franc., VI., p. 106).
Alphitomorpha tridactyla, clandestina, Wallr. (Flore Crypt. Germ., III., p. 753).

Erysibe tridactyla, Rabh. (Deutschl. Krypt. Fl., I., p. 273).
Erysibe clandestina, Lk. (Spec. Plant., VI., I., p. 103).
Podosphæra Kunzei, clandestina, Lév. (Ann. Sci. Nat., Ser. III., Tome XV).
Podosphæra trydactyla, myrtillina, DBy. (l. c., III., p. 48).
Podosphæra myrtillina, Kunze (Mycol., Hefte II., p. 111).
Podosphæra minor, Howe (Torr. Bull., V., p. 3).

Amphigenous. Mycelium variable, often abundant, persistent, perithecia 65–110 μ. dark, opaque, reticulations regular, about 10–15 μ, evident when young, scarcely observable when old, except by the uneven surface; appendages 8–20, dark brown for more than half their length, frequently septate, 1–4 times as long as the diameter of the perithecium, 3–5 times dichotomously forked, branches short, often swollen, tips recurved; ascus broadly elliptic or orbicular, about 50 by 60 μ, thick walled; spores usually 8.

On *Cratægus tomentosa* var. *pyrifolia:* Union, Nov. 3, 2194; Adams, July 3, 5394. *Cratægus* sps*:* Union, Sept. (Earle). *Prunus Anericana:* Lee, Sept. 9, 5744. *Prunus cerasus* (cultivated): McHenry, Aug. 24, 1289; Rock Island, Sept. 21, 1625; Piatt, Aug. 16, 1151; Adams, June 29, 5342; Union, Aug. 22 (Earle).

European botanists agree in dividing what is here included under *P. oxyacanthæ,* into three species, as follows:—

P. oxyacanthæ, (DC.) DBy. Appendages 8 or more, about equal to the diameter of the perithecium, standing erect on its upper surface. On *Cratægus*, *Sorbus*, and *Mespilus*.

P. tridactyla, (Wallr.) DBy. Appendages 3–7, standing erect in a parallel bundle on the summit of the perithecium. On *Prunus* sps.

P. myrtillina, (Schubert) Kunze. Appendages 6–10, arising from the upper surface of the perithecium, but radiating divergently or reflexed. On *Vaccinium*.

European specimens on the above hosts show these distinguishing characters sufficiently well. American specimens on *Prunus* often have as many as twenty appendages, and though they all stand on the upper half of the perithecium it is only in rare cases that they are collected in an erect cluster at the summit, as in *P. tridactyla*. They usually radiate even more divergently than in *P. myrtillina*. In American specimens on *Cratægus* the appendages average a little shorter than on *Prunus*, but they show no other appreciable differences. In both cases they are too variable for this to constitute a distinguishing characteristic.

As our specimens thus present intermediate forms connecting those that are separated in Europe, it becomes necessary to consider them all as belonging to one variable species. Widely varying species are common among the *Erysipheæ*, and the forms included here differ much less widely than those that are referred to *Erysiphe communis* or *Phyllactinia suffulta*. As De Candolle's name has priority, it must be retained.

MICROSPHÆRA, LÉV.

(Ann. Sci. Nat., Ser. III., Tome XV.)

Perithecium containing several asci; appendages free from the mycelium, more or less dichotomously branched at the end.

KEY TO THE ILLINOIS SPECIES OF MICROSPHÆRA.

I. Tips of the appendages not recurved . . . . A.
II. Tips of the appendages recurved when mature . . . . B.
  A. Appendages colored . . . . 1.
  Appendages hyaline or nearly so . . . . 2.
    1. Appendages short (equal to diameter of perithecium) . . . . M. SEMITOSTA.
    Appendages very long (4–6 times diameter of perithecium) . . . . M. RUSSELLII.
    2. Appendages medium (2–3 times diameter of perithecium) . . . . { M. DIFFUSA. / M. SYMPHORICARPI. }
    Appendages long (3–6 times diameter of perithecium) . . . . { M. VACCINII. / M. EUPHORBIÆ. }

B. Appendages colored . . . . M. ERINEOPHILA.
Appendages mostly hyaline . . . . 2.
2. Appendages short (2 times diameter of perithecium, or less) . . . . . { M. RAVENELII. M. ALNI.
Appendages usually long (2–4 times diameter of perithecium) . . . . { M. QUERCINA M. ELEVATA.

A. *Tips of the appendages not recurved.*
1. *Appendages colored.*

M. semitosta, B. & C.
(Grev. IV., p. 160.)

Epiphyllous. Mycelium persistent; perithecia few, somewhat aggregated, 90–100 μ, delicate, reticulations regular and distinct, about 10 μ; appendages 12 or more, about equal to the diameter of the perithecium, colored throughout, paler toward the tip, or the color stopping at a distinct line like a septum, 3 or 4 times dichotomously branched, primary branches long, others short, tips obtuse, not recurved; asci—; spores small, 10 by 15 μ.

Mycelium sparing; appendages forked three times, more than twice as long as the diameter of the perithecia; abruptly brown at the base; sporidia 4.—Berkeley, l. c.

On *Cephalanthus occidentalis:* Champaign, Oct. (Waite).

In the specimens at hand the number of asci and spores cannot be determined. Compared with the description by Berkeley, the appendages are not so long, and only part of them show the abrupt termination of the coloring.

M. Russellii, Clinton.
(26th Rep. N. Y. State Mus., p. 80.)

Amphigenous. Mycelium inconspicuous; perithecia small, 75–100 μ, delicate, reticulations regular, distinct, about 10 μ; appendages 8–18, many times longer than the diameter of the perithecium, colored for half or two thirds of their length, occasionally septate, simple, bifid, or two or three times irregularly branched, branches long, often distorted, tips not swollen or recurved; asci 4–8; spores usually 4, small.

Amphigenous; mycelium arachnoid, evanescent, appendages 8–18, very long, flexuous, colored, paler toward the tips, which are simple or one to three times divided; sporangia ovate, 4–8; spores 4, elliptical, .0007–.0008 in. long.—Peck 26th Rep. N. Y. State Mus., p. 80.

On *Oxalis stricta:* McLean, Oct. 7, 1827.

The appendages, from their length and manner of branching, much resemble those of *M. euphorbiæ*, but they are strongly colored, and the perithecia are smaller and more delicate.

2. Appendages hyaline or nearly so.

M. diffusa, C. & P.

(Erysiphei of the U. S., in Jour. of Bot. 1872.)

Usually epiphyllous. Perithecia scattered, 100–120 μ, dark, opaque, reticulations rather obscure, 10–15 μ; appendages 15–25, hyaline, or slightly tinted at base, 2–4 times as long as the diameter of the perithecium, once to four or five times irregularly or dichotomously branched, branches long and diffusely spreading, not at all swollen or recurved; asci 4–7, ovate pedicellate, rather small, 30–35 by 60–65 μ; spores 4–8, mostly 4–5.

Mycelium thin, evanescent; conceptacles minute, globose, black; appendages numerous, eighteen to twenty-five, in length once or thrice the diameter of the conceptacle, somewhat irregularly divided and slightly nodulose at the tips; sporangia ovate, four to six, containing four to six spores.—Peck, 25th Rep. N. Y. State Mus., p. 95.

On *Desmodium cuspidatum:* Jo Daviess, Sept. 20, 6041; Champaign, Sept. 18, 6617, Oct. 25, 6599. *Desmodium Canadense:* Lee, Sept. 12, 5793; Stephenson, Sept. 13, 5807, Sept. 21, 6073; Jo Daviess, Sept. 18, 5970, 5972, 6001; Ogle, Sept. 22, 6089. *Desmodium paniculatum:* Jo Daviess, Sept. 18, 5973. *Desmodium* sps.: Union (Earle). *Lespedeza capitata:* Ogle, Sept. 23, 6136. *Lespedeza hirta:* Union, Sept. 20 (Earle). *Phaseolus perennis:* Union (Earle).

This species seems to be well characterized by the long, lax branching of the appendages. In Illinois specimens on *Desmodium* the appendages are usually 2–2½ times the diameter of the perithecium; but on *Phaseolus*, some of them are 3½ times the diameter, and in specimens on *Lespedeza capitata* from Wisconsin (Pammel), which otherwise agree with this species, the appendages are five or six times the diameter.

M. symphoricarpi, Howe.
(Torr. Bull., V., p. 3.)

Amphigenous. Mycelium abundant, persistent; perithecia small, 80–100 μ, delicate, reticulations large, regular, 15–20 μ; appendages 8–16, hyaline or slightly colored at base, 2–4 times as long as the diameter of the perithecium, 4–5 times dichotomous, branches short, compact, tips truncate, somewhat swollen, not recurved; asci 4–10, small, 50 μ long; spores 4–6, small and narrow, 10–18 μ.

Mycelium effused, sub-persistent; perithecia scattered or crowded; appendages 8–14, 2–4 times the length of the diameter of the perithecia, 3–5 times dichotomous, ramuli divaricate, tips variable, often truncate, never curved; asci 4–6; spores 3–5.— Howe, Torr. Bull., V., p. 3.

On *Symphoricarpus vulgaris:* Piatt, Aug. 15, 1074, Aug. 16, 1099; McLean, July 29, 2372. *Symphoricarpus* sps.: Union, Nov. 1, 2184.

This is much like some forms of *M. vaccinii*, but the mycelium is more abundant and the reticulations are larger and more evident.

M. vaccinii, C. & P.
(Erysiphei of the U. S., in Jour. of Bot. 1872.)

Erysiphe vaccinii, Schw. [?] (N. A. Fungi, p. 270).

Amphigenous. Mycelium thin and delicate, often evanescent, or sometimes abundant, peristent; perithecia variable, often small, 80–90 μ, or large, 110–120 μ, fragile; appendages 10–20, hyaline, smooth, slightly colored at base, 2 or 3 to as many as 6 times the diameter of the perithecium, branching various, usually 3 or 4 times forked, with the tips truncate or bifid, not recurved, occasionally more ornate, with tip distinctly recurved; asci 4–8, small and broad, about 40 by 55 μ; spores 4–6 small.

Amphigenous; mycelium arachnoid, evanescent; perithecia globose, scattered; asci 6 to 8; spores 6 to 8; appendages rather numerous (12 to

20) 4 to 6 times as long as the diameter of the perithecia; 3 to 4 times dichotomously branched above, tips swollen.—Cooke and Peck, Erysiphei of U. S., in Jour. Bot. 1882.

On *Gaylussacia resinosa:* Ogle, Sept. 25, 6173; La Salle, Sept. 30, 6247. *Vaccinium (vacillans?):* Jersey, Oct. 14, 6318.

This is a variable species not only in the character of the mycelium, but in the length and branching of the appendages. In most cases the tips are swollen, and not at all recurved. There is some confusion in regard to the authority for this species. Schweinitz (N. A. Fungi, p. 270) describes an *Erysiphe vaccinii* on *Vaccinium Pennsylvanicum* from Berks Co., Penn., while Peck (23d Rep. N. Y. State Mus., p. 65) refers specimens on *Epigæa repens* to *Erysiphe vaccinii*, Schw., and on the same page describes *Microsphæra vaccinii* on *Vaccinium vacillans* as a new species. This report was submitted for publication in 1870, but was not printed until three years later. During this interval the species was published jointly by Cooke and Peck in the Journal of Botany (Jan. 1872). As Schweinitz's specimens were on *Vaccinium*, it is very probable that they belonged to this species rather than to the one on *Epigæa*. This point can probably never be satisfactorily settled, so it is best to write simply *M. Vaccinii*, C. & P.

M. euphorbiæ, B. & C.
(Grev. IV., p. 160.)

Amphigenous. Mycelium abundant, persistent; perithecia scattered, abundant, usually small, 80–100 μ, but often larger (120 μ), texture soft, elastic, reticulations 10–15 μ, frequently obscure; appendages 15–20, very long, 5–6, or more times, the diameter of the perithecium, hyaline, often slightly tinted at base, irregularly flexuous and often nodularly swollen, at first simple, then part of them bifid or three or four times dichotomous, branches long, lax, tips sometimes bifid, but not swollen or recurved ; asci 4–8, frequently 6, pedicellate, 35–40 by 65 μ; spores 4–6.

Mycelium ample; appendages many times longer than the diameter of the perithecia, once or twice forked, then lobed at the tips.—Berkeley, Grev. IV., p. 160.

On *Euphorbia hypericifolia:* Union, Oct. 24, 1931. *Euphorbia corollata:* McHenry, Aug. 20, 1198, Aug. 26, 1294, Sept. 1, 1411; Boone, Sept. 2, 1418; McLean, Oct. 7, 1821, Oct. 12, 1842; Union, Oct. 21, 1938, Oct. 25, 2005, Oct. 29, 2117; Lee, Sept. 11, 5778; Jo Daviess, Sept. 16, 5943, Sept. 18, 5971.

This is very common throughout the State, and is easily recognized by its very long, often unbranched, colorless appendages. Such appendages are also characteristic of the European species *M. Astragali*, (DC.) Trev. Our specimens closely resemble specimens of the latter on *Astragalus glycyphyllus.*

B. *Tips of appendages distinctly recurved when mature.*

M. erineophila, Peck.

(Torr. Bull., X., p. 75.)

Mycelium thin; perithecia 90–100 μ, fragile, dark, opaque, reticulations obscure; appendages few, 8–12, dark colored except the branches, scarcely equal to the diameter of the perithecium, 4–6 times regularly dichotomous, branches short and rather thick, tips recurved; asci 5–8, oval or ovate, pedicellate, rather small, 35 by 55 μ; spores uniformly 8, small.

Mycelium arachnoid, sub-persistent; perithecia .003 to .004 of an inch broad, sometimes collapsed or pezizæform; appendages 6 to 12, shorter than, or about equal to, the diameter of the perithecia, colored, the tips paler and two or three times dichotomous; asci 4, sometimes 3 or 5, eight-spored; spores .0008 to .0009 of an inch long, .00045 to .0005 broad, usually containing one or two large nuclei.—Peck, Torr. Bull., X., p. 75.

On the "*Erineum*" caused by some species of *Phytoptus* on the lower sides of the leaves of *Fagus ferruginea:* Union, Aug. 20, Sept. 20 (Earle); Pulaski, Nov. 4, 2230, 2244, 2245.

This peculiar species is not uncommon in southern Illinois. So far as is known it has not been collected elsewhere. It has been distributed by Winter as No. 3245 of his "Fungi Europ. et extra Europæi."

2. *Appendages mostly hyaline.*

M. Ravenelii, Berk.
(Grev. IV., p. 160.)

Amphigenous. Mycelium usually abundant, persistent; perithicea abundant, usually large, 100–130 μ, reticulations small and irregular, about 10 μ; appendages 10–20, somewhat roughened, usually hyaline, occasionally colored for a distance, the color ending at an abrupt line like a septum, once or twice as long as the diameter of the perithecium, 5–7 times dichotomous, branches short, forming a more or less compact head, tips not swollen at length, usually acute and recurved; asci 6–10, frequently 8, ovate pedicellate, about 45 by 60 μ; spores 4–6 (Saccardo says 8).

Mycelium effused, dirty white; appendages repeatedly forked toward the apex, much more so than in the last (*M. penicillata* Lév).—Berkeley, Grev. IV., p. 160.

On *Gleditschia tricanthos:* Piatt, Aug. 16, 1100; Fulton, Oct. 1, 1780; McLean, Aug. 6, 2363, Oct. 6, 1861; La Salle, Sept. 29, 6237; Jersey, Oct. 13, 6286. *Lathyrus palustris:* Champaign, Oct. (Waite). *Vicia Americana:* McHenry, Aug. 20, 1211.

In the typical form of this species, that on *Gleditschia*, the peculiarly colored appendages mentioned in the description seldom occur, but they may occasionally be noticed. On *Vicia* a majority of the appendages are colored in this manner, and the mycelium is rather less abundant. In other respects it agrees so closely with *M. Ravenelii* that it does not seem best to separate it, especially as the appendages are not all colored on *Vicia* while they are occasionally colored on *Gleditschia*. The form on *Lathyrus* stands about half way between the other two in the coloring of the appendages and density of the mycelium. A form on *Lathyrus* has been referred by Trelease (Parasitic Fungi of Wisconsin, p. 8.) to *M. diffusa*, C. & P. It seems from his note to be the same as our form on this host. Our specimens of *M. diffusa* on *Desmodium*, *Lespedeza*, and *Phaseolus* closely agree in the long and loose branching of their appendages, a character well expressed by the specific name, and the tips, even in the most mature specimens, are not at all recurved. This is clearly different from the regular and compact branching and recurved tips of the appendages on *Lathyrus*, which, as Trelease himself observes, "closely resemble those of *M. Ravenelii*, B."

M. alni, (DC.) Winter.
(Die Pilze, II., p. 38.)

Erysiphe alni, betulæ, DC. (Flore Franc., VI., pp. 104–107).
Alphitomorpha penicillata, Wallr. (Verhandl. Naturf. Freunde, I., p. 40).
Erysibe penicillata, Lk. (Spec. Plant., VI., I., p. 113).
Erysiphe viburni, Duby (Bot. Gall., II., p. 872).
Erysiphe ceanothi, viburni, syringæ, Schw. (N. A. Fungi, pp. 269, 270).
Microsphæra Hedwigii, penicillata, Friesii, Lév. (Ann. Sci. Nat., Ser. III., Tome XV).
Microsphæra platani, Howe (Torr. Bull., V., p. 4).
Microsphæra Van Bruntiana, Ger. (Torr. Bull., VI., p. 31).
Microsphæra viburni, Howe (Torr. Bull., V., p. 43).
Microsphæra pulchra, C. & P. (Erysiphei of U. S., in Jour. of Bot., 1872).

Amphigenous. Mycelium often delicate and evanescent, sometimes abundant and persistent; perithecia usually small, 80–100 μ, sometimes large, 100–130 μ, wall tissue compact, rather fragile, reticulations not large, 10–15 μ; appendages 6 or 8 to 15 or 20, hyaline, usually tinted at base, often somewhat roughened, usually about equaling, but varying from less than to more than twice the diameter of the perithecium, 4–6 times dichotomous, branches varying in length and angle of divergence, but always regular and symmetrical, tips acute, distinctly, often strongly, recurved; asci varying with the size of the perithecium from 2 or 3 to 8 or more, usually 4 or 5, ovate when numerous, suborbicular when few; spores 4–8, variable, mostly small, averaging about 20 μ long.

On *Ceanothus Americanus:* Stephenson, Sept. 21, 6082; Ogle, Sept. 22, 6090, Sept. 23, 6135. *Euonymus atropurpureus:* La Salle, Sept. 17, 1580; Champaign, Aug. 12, 1057. *Lonicera flava* (cultivated): Champaign, Oct. 9, 2381. *Viburnum pubescens:* McHenry, Aug. 24, 1262. *Viburnum prunifolium:* Jo Daviess, Sept. 18, 5969; Champaign, Oct. (Waite). *Ilex* *decidua:* Union, Oct. 25, 2014; Jersey, Oct. 13, 6287. *Ulmus Americana*, Jo Daviess, Sept. 19, 6003. *Syringa vulgaris:* McHenry, Aug. 20, 1173, 1214, Aug. 31, 1398; Cook, Sept. 8, 1464; La Salle, Sept. 12, 1500; Rock Island, Sept. 21, 1623; McLean, Oct. 18, 1872, Aug. 18, 5632; Union, Nov. 1, 2185; Jackson, Nov. 5, 2260; Jo Daviess, Sept. 20, 6039. *Platanus occidentalis:* Champaign, Oct. 30, 6375; Union, Sept. & Oct. (Earle). *Juglans cinerea:* Union, Sept. 22 (Earle). *Juglans nigra:* Union, Oct. 22 (Earle). *Carya alba:* Union (Earle). *Corylus Americana:* McHenry, Aug. 20, 1169, Aug. 24, 1287; Lee, Sept. 12, 5790; Stephenson, Sept. 14, 5879, Sept. 24, 6066; Jo Daviess, Sept. 16, 5941, Sept. 19, 6000; Ogle, Sept. 25, 6174.

The forms here included under *M. alni* have been assigned by different authors to various species, distinguished, for the most part, by the number of the asci and spores. In all of these forms the size of the perithecia, even when standing side by side on the same leaf, is quite variable, and, as a consequence, the number and shape of the asci they contain vary equally widely. Very small perithecia contain only a few (2–4) suborbicular asci, while larger ones contain a greater number, which, owing to lateral crowding, are narrower and longer. The spores are by no means constant in number, even in asci from the same perithecium. It is manifestly impossible to maintain specific distinctions based on such variable characteristics; and it becomes necessary, as in other genera of the family, to combine these rather widely varying forms. Aside from the number of asci and spores, the forms included here do not, however, present any very wide variations. In fact the branching of the appendages, and the cellular structure of the wall of the perithecium, are strikingly alike in all of them. The specimens collected in Union county, on *Juglans cinerea* and *J. nigra*, are sometimes very different from the type, having appendages less than the diameter of the perithecium. But on these same hosts other forms imperceptibly grade into the characteristic ones, leaving no room for specific distinction.

The form on *Syringa* is usually known as *M. Friesii*, Lév.; that on *Viburnum* as *M. viburni*, Howe; that on *Sambucus* as *M. Van Bruntiana*, Ger.; and that on *Platanus* as *M. platani*, Howe. The others are usually referred to *M. penicillata*, Lév.

It is unfortunately necessary to discard this last well-known name in favor of the one previously given by De Candolle to one of the many forms of the species. This is to be regretted the more as the name, *alni*, taken from only one among so many hosts, fails to express any true characteristic of the species as now understood. Some writers whose opinions carry great weight in all matters concerning fungi, would consider this sufficient ground for disregarding the law of priority, and would select from the names that had been given to the species, the one that seemed to them to be most appropriate, even going so far as to give a plant an entirely new name, because found to occur on other hosts than the one from which its name was derived. The case of *Phytophthora omnivora*, De Bary, may be taken to illustrate this usage. Hartig described a parasite occurring on young birch seedlings as *Peronospora fagi* (Zeitschr. f. Forst- und Jagdwesen., VIII. (1875), p. 121). Schenk described a similar parasite on *Sempervivum* as *Peronospora sempervivi* (Sitzungsber. d. Naturf. Gesellschaft zu Leipzig, July, 1875). De Bary (Morph. und Phys. der Pilze, IV., pp. 22–27) finds these two species to be identical, and that the same thing also occurs on *Clarkia*. He, therefore, in transferring them to his new genus, *Phytophthora*, writes *P. omnivora*, entirely disregarding both of the previously given names, although, in this case, there could be no question of the identity of the forms first described, but only of the appropriateness of the older names in the light of the increased knowledge of the species.

While it is doubtless very desirable to have species appropriately named, it is easy to see that this practice, if usually followed, would lead to endless confusion; for each addition to our knowledge of a species would necessitate, or at least permit, a change of name. Here, as in other branches of biology, the only safe rule seems to be to adhere rigidly to the law of priority whenever the older name is at all admissible. If this species never occurred on *Alnus* the retention of the name *M. alni* would be much more questionable.

This species is not reported as occurring on *Syringa*, in Europe, although abundant there on other hosts. This seems singular when it is remembered how frequently our lilacs are attacked by it, and naturally leads to the question whether, after all, this form may not be distinct. In the present state of our knowledge, the classification of these minute plants is necessarily based almost entirely on their morphological characters; and as there are no constant differences of form by which they can be distinguished, it is necessary to consider them identical until the contrary is proved by a careful study of their development and life history.

M. quercina, (Schw.) Burrill.

(N. A. Fungi, p. 270.)

Erysiphe quercinum, Schw. (N. A. Fungi, p. 270).

Microsphæra extensa, C. & P. (Erysiphei of U. S., in Jour. of Bot., 1872).

Microsphæra abbreviata, Peck (28th Rep. N. Y. State Mus., p. 64).

Ephiphyllous, hypophyllous, or amphigenous. Mycelium abundant, rather thin and pruinose, forming orbicular patches or spreading over the whole surface of the leaf; perithecia abundant, scattered, varying from 80–140 μ, reticulations evident, small, and irregular; appendages less than 20, varying in length from less than, to 4 or 5 times, the diameter of the perithecium, hyaline, often tinted at base, smooth or sometimes roughened, usually regularly 5–6 times dichotomous, branches short and tips strongly recurved, but presenting many curious and ornate variations caused by the more extended or unequal growth of some of the branches; asci 3–8, often rupturing by slight pressure; spores 4–8, variable, usually large, 20–30 μ long.

M. extensa, C. & P. Mycelium thin, effuse, persistent; conceptacles globose, black; appendages eight to twelve, in length three or four times the diameter of conceptacle, colorless; sporangia four, subglobose or ovate, containing four to six spores. Upper surface of oak leaves. *Quercus rubra.*—Peck, 25th Rep. N. Y. State Mus., p. 95.

M. abbreviata, Peck. Mycelium thin; conceptacles small; appendages six to fifteen, hyaline, rough, shorter than the diameter of the conceptacles, many times dichotomous at the tips, the ultimate ramulæ curved; sporangia three or four, containing three to five, mostly four, spores; spores large, .001′–.0013′ long, .00066′ broad. Under surface of dead or languishing oak leaves.—Peck, 28th Rep. N. Y. State Mus., p. 64.

On *Quercus alba:* Rock Island, Sept. 24, 1667; McLean, Oct. 12, 1848½; Jo Daviess, Sept. 18, 5968; Jersey, Oct. 12, 6276; Jackson, Nov. 5, 2269; Union, Oct. 2, 6541, 6545, Oct. 4, 6565, Oct. 28, 2085, 2186, 2099½. *Q. obtusiloba:* Union, Oct. 2, 6540, Oct. 27, 2064. *Q. macrocarpa:* La Salle, Sept. 17, 1581; Union, Oct. 21, 1917, Oct. 28, 2090, 2095, 2105. *Q. Prinus:* Union (Earle). *Q. imbricaria:* Union, Nov. 1, 2190, 2191. *Q. (nigra ?):* Union, Oct. 4, 6563, 6566, 6577, Oct. 28, 2099, 2100. *Q. coccinea:* Pulaski, Nov. 3, 2224, 2225, Nov. 4, 2241. *Q. tinctoria:* Champaign, Nov. 9, 2376; Union, Oct. 4, 6569, 6568, (6104 ?). *Q. rubra:* McHenry, Aug. 20, 1202, Aug. 27, 1336, Aug. 31, 1390; La Salle, Sept. 17, 1573, Sept. 20, 6255; Rock Island, Sept. 23, 1635; McLean, Oct. 12, 1848, Oct. 18, 1883, Aug. 1, 2368; Stephenson, Sept. 13, 5810; Jersey, Oct. 12, 6275; Union, Oct. 4, 6555, Oct. 25, 2022, Oct. 28, 2081, 2094, Nov. 1, 2192.

This abundant species probably occurs on other kinds of oak in this State besides those mentioned above. Although it is exceedingly variable, specimens from the same host species, even when collected in widely different localities, show a rather surprising agreement in characteristics; and, if varying considerably, it is within much narrower limits than when all the forms occurring on oak are taken into consideration. Thus on *Quercus rubra* the mycelium is confined to the upper surface of the leaf, and the appendages are long, three or four times the diameter, slender, and flexuous. The branches of the appendages are short, and regularly dichotomous. It was this form that Cooke and Peck described as *M. extensa;* and if any of them were worthy of a separate name it would be this one. On *Q. alba* the fungus develops on the under side of the leaf almost as often as on the upper side; the perithecia average larger than on *Q. rubra;* and the appendages are distinctly shorter and more rigid, only once and a half or twice as long as the diameter, while the branching is broader and more irregular, frequently being exceedingly ornate. If these forms stood alone we should be justified in giving them different names, but specimens on *Q. macrocarpa*, *Q. tinctoria*, etc., present many intermediate forms. On *Q. imbricaria*, *nigra*, and *coccinea*, especially when occupying the lower side of the leaf, the appendages are very short, often less than the diameter of the perithecium. This form is *M. abbreviata*, Peck. Some of our specimens agree perfectly with his description, but others show so many intermediate stages between this and the forms with longer appendages, that it is impossible to maintain specific distinctions. Other short-appendaged forms have been called *M. extensa* var. *brevis* by Peck; and Berkeley (Notices of N. A. Fungi) has referred specimens on oak (probably of this character) to *M. penicillata*, Lév. (*M. alni*, (DC.) Winter). In fact, except that the spores are usually a little larger, it is almost impossible to distinguish some of our specimens on oak, from forms of this latter species; and some specimens of *M. alni* on *Corylus* show appendages so long as to resemble the form of *M. extensa*, Peck. This all goes to show that the two species are very nearly related, and that some forms of each approach the other so closely as to make it difficult to draw the line between them. In the aggregate, however, the forms on oak differ so widely from those of *M. alni*, that they must be considered distinct. Where the fungus occupies both sides of leaves that are woolly or hairy beneath, as in *Q. imbricaria*, etc., there is often considerable difference between perithecia from the upper and lower sides; but where both sides of the leaf are smooth, as in *Q. alba*, very little difference is noticeable.

M. densissima, (Schw.) Peck, cannot be distinguished by its perithecia from the ordinary form on *Q. rubra;* but it presents some peculiarities of the mycelium, which, if constant, would entitle it to specific distinctness. It has not been found in Illinois.

All the other observed forms on *Quercus* must be considered as forming one widely variable species, and it becomes a question of some difficulty to decide under what name it should be known. If it were merely a matter of preference, the choice would easily be in favor of *M. extensa*, C. & P., both from its appropriateness, and because it is so well known. Schweinitz, however, (N. A. Fungi, p. 270) has described a species on oak as follows:—

> *Erysiphe quercinum* L. v. S., sero autumno non rara in foliis quercinis præsertim Bannisteris, Pennsylvania. Hyphasma occupans fere totum folium—expansum candicans, tenuissimum, floccis vix distinctis. Sporangiolis raris, minutissimis, sparsis nigris, Præsertim loco distinguenda species.

This description is not, perhaps, sufficient in itself to enable us to determine positively what specimens he had in hand, but it contains nothing to contradict the supposition that they belonged to some of the many forms of the species under consideration; and this is so abundant in all parts of the country, that there can be no reasonable doubt that the above supposition is correct.

Accepting this view of the case, priority demands the use of the name given by Schweinitz, rather than the more familiar one by Cooke and Peck; hence we write *M. quercina* and not *M. extensa.*

M. elevata, Burrill.

(Bull. Ill. St. Lab. Nat. Hist., Vol. I., No. 1, p. 58.)

Mostly epiphyllous. Mycelium abundant, persistent, frequently covering the leaves for some time before the appearance of perithecia; perithecia usually few, occasionally abundant, 100–120μ, reticulations large, evident when young; appendages 6–12, sometimes more, 3–4 times as long as the diameter of the perithecium, hyaline, slightly colored at base, smooth, 2–4 times dichotomous, branches short, not swollen, tips at first truncate, divergent, becoming acute and recurved; asci 4–8, ovate, about 33 by 60μ; spores 4–6, mostly 4.

M. elevata, n. sp. Upper sides of leaves of *Catalpa bignonioides.* Mycelium thin, web-like, rather evanescent. Conceptacles .004 in., conspicuously reticulated, raised from the leaf; appendages about twelve, colored at base, often simple, sometimes branched near the base, usually 2 to 4 times dichotomously forked, very long; sporangia four, oval, strongly rostrate.—Burrill, l. c.

On *Catalpa bignonioides:* Jackson, Nov. 5, 2256; Union, Oct. 2, 6537; Champaign, Oct. 17, 6571; Oct. 20, 6577. *Catalpa speciosa:* Union, Sept. 15 (Earle).

This species sometimes involves the foliage of an entire tree, giving it a gray color noticeable at some distance, and causing the leaves to fall prematurely.

The appendages resemble those of *M. vaccinii:* but the branches are not swollen and the tips are usually recurved.

Microsphæra———.

Epiphyllous. Mycelium delicate, sub-persistent; perithecia small, 80–100 μ, reticulations small, indistinct; appendages

6–10, about equaling the diameter of the perithecium, hyaline, delicate, three times dichotomous, branches widely divergent, tips recurved; asci 4–6; spores 5–6, small, narrowly oblong.

On *Scutellaria lateriflora:* Jo Daviess, Sept. 20, 6035.

This may prove to be new. The material at hand is not sufficient for definite determination, or for a full description.

Conidia-bearing mycelium has been collected on the following hosts, not mentioned under any of the above species. In the absence of perithecia it is of course impossible to determine them.

On *Rubus strigosus:* Union, May and June (Earle); Champaign (Burrill). The delicate mycelium is often quite abundant on the leaves and growing fruit, making the berries small and imperfect, or killing them outright.

On *Epilobium* pods: Jo Daviess, Sept. 15, 5902.

On *Cacalia atriplicifolia:* Rock Island, Sept. 23, 1634; Stephenson, Sept. 14, 5864; Union, Oct. 31, 2139.

On *Leptopoda brachypoda:* Union (Earle).

On *Cynoglossum Morisoni:* Jackson, Apr. 19, 4194; Union, Apr. 24, 4263; La Salle, June 16, 5215; Champaign (Burrill).

On *Solanum Carolinense:* Union (Earle).

On *grass:* McLean, July 5 (Seymour); Champaign, common.

INDEX TO HOST PLANTS.

Acer saccharinum 409
Actinomeris squarrosa 405
Æsculus 408
Agrimonia 400
Agrimonia Eupatoria 400
Alnus serrulata...................... 398
Ambrosia artemisifoliæ 405
  trifida 405
Ampelopsis quinquefolia........ 407
Amphicarpæa monoica........... 403
Asclepias variegata 406
Aster 405
  lævis................................. 405
  sagittifolius....................... 405
Astragalus Canadensis........... 403
  glycyphyllus 419
Betula nigra.......................... 412
Bidens connata...................... 401
  frondosa 401
Birch 423
Brunella vulgaris.................. 401
Cacalia atriplicifolia.............. 428
Carya alba 422
Catalpa bignonioides........ 411, 427
  speciosa 427
Ceanothus Americanus 421
Celastrus scandens 411
Celtis 398
  occidentalis 409
Cephalanthus occidentalis...... 415
Cirsium discolor.................... 405
Clarkia 423
Clematis 402, 403
Compositæ.................... 400, 406
Cornus 403
  Florida.............................. 411
Corylus......................392, 412, 426
  Americana..................412, 422
Cratægus............................. 413
  tomentosa var. pyrifolia 411, 413
Cynoglossum Morisoni........... 428
Desmodium.................... 416, 420
  Canadense 416
  cuspidatum 416
  paniculatum 416
Epigæa repens....................... 418
Epilobium 428
Erechthites hieracifolia 401
Euonymus atropurpureus...... 421
Eupatorium purpureum 405
Euphorbia corollata............... 419
  hypericifolia 419
Fagus ferruginea............ 412, 419
Fraxinus 411
Gaylussacia resinosa............. 418
Geranium maculatum 402
Gerardia grandiflora 401
Gleditschia tricanthos............ 420
Gooseberry........................... 399
Grape.................................. 407
Grass 428
Helianthus 405
  decapetalus 405
  rigidus 405
  tuberosus 405
Hieracium Canadense 405
Hops 395
Humulus 400
Hydrophyllum Virginicum ... 406
Ilex decidua 411, 422
Juglans cinerea...................... 422
  nigra................................. 422
Labiatæ 406
Lathyrus 420, 421
  palustris 420
Leguminosæ......................... 403
Leptopoda brachypoda.......... 428
Lespedeza 420
  capitata 416, 417
  hirta.. 416
Lilac 423

Liriodendron 412
tulipifera................... 402, 411
Lonicera flava........................ 421
Mespilus 413
Nabalus 401
Napæa dioica.......................... 405
Oak 390, 424, 426
Œnothera biennis 403
Oxalis stricta.......................... 416
Parietaria Pennsylvanica........ 406
Phaseolus 420
perennis 416
Phlox 406
paniculata.......................... 406
Pisum sativum 403
Platanus occidentalis............... 422
Populus 410, 411
grandidentata 410
heterophylla 410
tremuloides 410
Potentilla 400
Prunus 413, 414
Americana 413
cerasus.............................. 413
Quercus 412, 426
alba.....................424, 425, 426
coccinea.................... 411, 425
imbricaria 425, 426
laurifolia 398
macrocarpa 411, 425
nigra 425
obtusiloba......................... 424
palustris 412
Prinus 425
rubra............412, 424, 425, 426
tinctoria 411, 425
virens................................ 398
Ranunculaceæ.......................... 403
Ranunculus abortivus............. 402
Rhus copallina 399
glabra............................... 399
Ribes 399
rotundifolium 399
Rosa 399
lucida................................ 399
Rosaceæ 401
Rubus strigosus 428
Salix 410
cordata 410
petiolaris........................... 410
Sambucus 422
Scutellaria lateriflora 404, 428
parvula 404
Sempervivum 423
Solanum Carolinense 428
Solidago................................... 405
Canadensis 405
Sorbus 413
Stachys 404
palustris 404
Stevia 406
Symphoricarpus........................ 417
vulgaris............................ 417
Syringa 423
vulgaris............................ 422
Taraxacum dens-leonis............ 401
Teucrium Canadense 404
Thalictrum purpurascens 402
Ulmus 412
alata 408, 411
Americana 408, 411, 422
campestris 408
Vaccinium 413
Pennsylvanicum................. 418
vacillans 418
Verbena 406
angustifolia....................... 405
bracteosa.......................... 406
hastata 405
stricta............................... 406
urticifolia 406
Vernonia fasciculata................ 405
Veronica Virginica 401
Viburnum 422
prunifolium 421
pubescens 421
Vicia Americana 420
Vitis 407
Xanthium strumarium............. 405

SYSTEMATIC INDEX.

(*Synonyms in Italics.*)

Alphitomorpha 392, 398
adunca 410
clandestina 412
communis 402
depressa 404
guttata 410, 411
horridula 402, 404
lamprocarpa 404
pannosa 398
penicillata 421
tridactyla 412
Ampelomyces quisqualis 390
ASCOMYCETES 390, 393
Byssocystis textilis 390
Calocladia 398
CICINOBOLUS 391
Cesatii 390, 391
florentinus 390
COLEOSPORIUM 400
Erysibe 398
adunca 410
clandestina 413
communis 402, 404
depressa 404
guttata 411
horridula 402, 404
lamprocarpa 404
obtusata 410
nitida 402
pannosa 398
penicillata 421
tridactyla 413
ERYSIPHE ... 390, 392, 397, 398, 401
cichoracearum ... 391, 396, 404, 406
communis 402, 403, 414
galeopsidis 391, 404
liriodendri 401
Tuckeri 391
Erysiphe 392
adunca 410
alni 421
ambrosiæ 404
aquilegiæ 402
asterum 404
betulæ 421
ceanothi 421
communis 402
convolvuli 402
coryli 411
fraxini 411
horridula 404
humuli 400
labiatarum 404
lamprocarpa 404, 406
Martii 402, 403
Montagnei 404
mors-uvæ 399
obtusata 410
oxyacanthæ 412
phlogis 404
pisi 402
polygoni 402
populi 410
quercinum 424, 426
salicis 410
syringæ 421
tortilis 403
vaccinii 417, 418
vagans 411
verbenæ 404
viburni 421
ERYSIPHEÆ .. 387, 390, 393, 394, 397, 398, 399, 414
ERYSIPHELLA 398
aggregata 398
Eurotium rosarum 398
GASTEROMYCETES 392

Microsphæra..... 392, 397, 414, 427
alni...... 415, 421, 422, 423, 426
Astragali 419
densissima 426
diffusa............... 414, 416, 420
elevata..................... 415, 427
erineophila 415, 419
euphorbiæ 414, 418
quercina 415, 424, 427
Ravenelii..... 397, 415, 420, 421
Russellii 414, 415
semitosta 414, 415
symphoricarpi........... 414, 417
vaccinii......... 414, 417, 418, 427
abbreviata 424, 425
extensa......... 424, 425, 426, 427
var. *brevis* 426
Friesii 421, 422
Hedwigii 421
penicillata..... 420, 421, 422, 426
platani 421, 422
pulchra 421
Van Bruntiana 421, 422
viburni 421, 422
Mucor erysiphe.......................... 392
Perisporiaceæ 393
Peronospora.............................. 395
fagi 423
sempervivi 423
viticola.................................. 395
Phyllactinia 392, 397, 411
guttata 411, 412
suffulta............... 396, 411, 414
Phytophthora........................... 423
omnivora 423
Pleochæta 398
Curtisii 398
Podosphæra...... 388, 392, 397, 412
clandestina 413
Kunzei 413
minor 413
myrtillina............................ 413
oxyacanthæ........ 397, 412, 413
tridactyla 413
Pyrenomycetes 393
Saccardia............... 387, 390, 398
Martii................................ 398
quercina 398
Sclerotium erysiphe................. 392
suffultum............................. 411
Sphærotheca......388, 392, 397, 398
Castagnei......389, 395, 399, 400
Castagnei 400
humuli............................... 400
mors-uvæ 399
pannosa 387, 398, 399
pruinosa 399
Uncinula................. 392, 397, 406
aceris 409
adunca..................408, 410, 411
Americana 406
ampelopsidis............ 396, 406
Bivonæ 408
circinata 408
flexuosa............................. 408
heliciformis................. 410, 411
leuculenta 410
macrospora............... 407, 408
parvula 409
salicis...................... 409, 410
spiralis 406, 407
subfusca 406
Uredineæ 393

ERRATA.*

Page 5, line 3 of table, second column, for 39 read 38 ; line 6, second column for 121 read 120.

Page 9, line 17, for *conjunction* read *conjugation.*

Page 21, line 13, for *Ricciaciæ* read *Ricciaceæ.*

Page 67, line 17 from bottom, for *fraligifolia* read *fragilifolia.*

Page 123, line 4 from bottom, and page 126, line 1, for *Tricholeæ* read *Trichocoleæ.*

Page 126, line 2, for *Tricholea* read *Trichocolea.*

Page 177, line 16, for *Lecythia* read *Lecythea.*

Page 333, line 1, after Tachidius add Lilljeb.

Page 338, under Daphnella brachyura, line 16, insert *Hab.*—Massachusetts (*Birge*), Minnesota (*Herrick*).

Page 340, line 5, for *Scapaoleberis read Scapholeberis.*

Page 389, line 7 from bottom, for *carpogonium* read *sporocarp* ; lines 9, 12, 15, for *oögonium* read *carpogonium.*

Page 391, line 1, for *Cèssatii* read *Cesatii.*

Page 400, line 4, for *Myceliumin conspicuous* read *Mycelium inconspicuous* ; line 14, for *coleosporium* read *Coleosporium.*

Page 401, line 9, for *connatus* read *connata;* line 12, for *Taraxicum* read *Taraxacum.*

Page 408, line 15, for *macrocarpa* read *macrospora;* line 18, for *Hypohyllous* read *Hypophyllous.*

Pages 470 and 471, head of column 11, for *cyprinella* read *cyprinellus.*

Page 503, lines 8, 14, and 17, for *cyprinella* read *cyprinellus.*

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* For additional errata see page 247.