

## Enumeration of the Peronosporæ of the United States.

BY W. G. FARLOW.

(Continued from p. 315.)

*C. Effusa.* Wall of oogonium thin, corrugated at maturity. Exospore thick, with a few irregular folds, which are sometimes adherent to the wall of the oogonium.

15. *P. EFFUSA* (Grev.) Rabb.

*Botrytis effusa* Grev. F. Edin. 468.

*P. effusa* Rabb. in Klotzsch Herb. Myc. no. 1880; De Bary l. c. p. 112 Pl. VIII. f. 7, XIII. f. 11; Bull. Buss. Inst. 1. 428; 29th Rept. N. Y. Bot. 52; 30th Rept. 77; Cat. Pac. Fung. 29.

*P. Chenopodii* Casp. Bot. Zeit. 1854.

Exs. Ellis N. A. F. 213.

Conidiophores short, stout, several times dichotomous. Conidia broadly ellipsoid, violet colored, very variable in size, 22–30 $\mu$  by 19–23 $\mu$ , often pedicellate. Oospores 26–35 $\mu$  in diameter, exospore dark brown, irregularly ridged.

Var. MAJOR. Tips thick, short, subulate, reflexed. Conidia ellipsoid, distinctly pedicellate.

Var. MINOR. Narrow, lower divisions suberect, tips subulate, erect, slightly curved. Conidia globose-ovoid, not distinctly pedicellate.

On *Chenopodium album*, *Atriplex hastata*, and *Spinacia oleracea*.

Mass. to Iowa, Wisconsin and California. Europe.

A coarse, common species, forming a dirty white or cinereous felt on the under side of the leaves of *Chenopodium album* and other species during the whole season. We have both forms mentioned by De Bary, but with us the slender form occurs on *Chenopodium*, and I have seen the stouter form on *Atriplex*. Oospores are abundant on *Chenopodium*, but I have not yet seen them on *Atriplex*.

NOTE.—The following three forms are very closely related to *P. effusa*, and it is scarcely possible to state any distinct points of specific difference. As they occur on hosts belonging to other orders than *Chenopodiaceæ*, they have received distinct specific names, under which they are enumerated below.

16. *P. POLYGONI* Thuemen, in Verhandl. Zool. Bot. Gesell. Vienna, 1874.

Conidiophores more slender, tips shorter and straighter than in typical *P. effusa*. Conidia violet colored, without pedicels. Oospores as in *P. effusa*.

On *Polygonum dumetorum* var. *scandens*, Kentucky (comm. Ellis), Iowa (Arthur). Europe.

Forming small and rather inconspicuous patches on the under side of the leaves. The Kentucky specimens contain oospores, and the conidiophores are precisely like those of the form on *P. aviculare*, of which I have examined specimens from Herb. Thuemen.

17. *P. ALTA* Fuckel.

*P. ALTA* Fung. Rhen. no. 39; Symb. Myc. 71; De Bary l. c. 119; 30th Rept. N. Y. Bot. 56, 77.  
*P. effusa* var. *Plantaginis* Farlow Bull. Buss. Inst. I. 428.  
 Exs. Ellis N. A. F. 214.

Conidiophores and oospores closely resembling those of slender forms of *P. effusa*.

On *Plantago major*.

From New Hampshire (Farlow) to Wisconsin (Trelease). Europe.

One of our commonest forms at least in the East. It forms dirty-white patches of considerable extent, sometimes almost covering the whole under surface of the leaves. Oospores are especially abundant in this form as found in New England, but they can not be distinguished from those of *P. effusa*. Found during the whole season.

18. *P. VIOLÆ* De Bary.

*P. VIOLÆ* De Bary l. c. 121.  
*P. effusa* var. *Violæ* Rabh. Fung. Eur. no. 1368.

Conidiophores and oospores closely resembling those of *P. effusa* var. *major*.

On *Viola tricolor* var. *arvensis*.

Cobden Ill. (Earle). Europe.

The specimens received from Mr. Earle were collected in April, 1883, and can be referred without doubt to this form, from their resemblance to *P. effusa* var. *major*. Reference has already been made, under *P. Geraniï*, to a peculiar monstrous form of conidia found by Mr. Earle on that species as well as the present. Although enormously developed the abnormal conidia retain the shape and violet color as well as the marked pedicels of the normal form. Schroeter, in Hedwigia, XVI., 132, states that the oospores of *P. Violæ* are like those of *P. effusa*. No oospores were found in the Illinois specimens.

19. *P. URTICÆ* (Lib.) De Bary.

*Botrytis Urticæ* Libert MSS.; Berkeley Journ. Hort. Soc. London I. 31.  
*P. Urticæ* De Bary l. c. 112; Cat. Pac. Fung. 36.

“Conidiophores short, loosely 4–6 dichotomous; divisions flexuous, tips subulate, arcuate, often deflexed. Conidia large, broadly ovoid or subglobose, distinctly pedicellate; apex very obtuse; membrane pale violet. Oospores medium sized, exospore dark colored.”—*De Bary l. c.*

On nettles.

California (Harkness). Europe.

I have not examined American specimens of this species, which is inserted on the authority of Harkness and Moore. The description is taken from De Bary.

20. *P. FICARLE* Tul.

Comptes Rendus 1854; De Bary l. c. 113; Bull. Buss. Inst. II. 233; Cat. Pac. Fung. 29.  
 Exs. Ellis N. A. F. 215.

Conidiophores rather short and slender, several times dichotomous, tips usually straight, spinose, spreading. Conidia violet,

ovate-obtuse or ellipsoid  $20-26\mu$  by  $16-20\mu$ . Oospores rather small,  $22-32\mu$  in diam., yellowish brown, exospore smooth.

On *Ranunculus acris* and *R. bulbosus*.

Massachusetts (Farlow), California (Harkness). Europe.

One of the commonest species in the East, especially early in the season, but certainly less common in the West, from which region I have not seen any specimens, although the species is said to occur there. It covers the whole under surface of the leaves with a dense down, and oospores are frequently found in the hosts mentioned above. Our form is decidedly more luxuriant than that found on *R. Ficaria* in Europe.

### 21. *P. TRIFOLIORUM* De Bary.

De Bary l. c. p. 113; Cat. Pac. Fung. p. 29.

Conidiophores rather slender, several times dichotomous, divisions spreading and flexuous, tips acutely subulate, divergent, conidia broadly elliptic, obtuse,  $19-26\mu$  by  $15-19\mu$ , violet colored. Oospores  $26-34\mu$  in diam., thick walled, exospore dark brown, nearly smooth.

On *Astragalus Canadensis*.

Iowa (Arthur), Minnesota (Farlow), California on clover (Harkness). Europe.

To this species should be referred a form common in Iowa and Minnesota on *Astragalus Canadensis*. It forms dirty-white patches on the under surface of the leaves, the upper surface of which becomes more or less yellow. Our form on *Astragalus* is more luxuriant than any of the European forms of the species which I have examined, and oospores are frequently found. I have not examined California specimens. In spite of their more luxuriant growth I can see no specific difference either in the conidia or oospores by which one could separate our plant from that of Europe.

### 22. *P. CORYDALIS* De Bary.

De Bary l. c. 107.

Conidiophores slender, simple below, above several times dichotomous, divisions flexuous. Tips slender, elongated, curved. Conidia broadly ovate,  $20-24\mu$  by  $16-20\mu$ , pale violet colored. Oospores  $26.5-43\mu$  in diameter, exospore brown, slightly rugose.

On *Dicentra*.

Buffalo, N. Y. (Clinton). Europe.

This species covers the whole under surface of the leaf with a dirty-white down, and in all specimens which I have examined the oospores have been very abundant. Mr. Clinton informs me that the host is *D. Canadensis* or *D. Cucullaria*, and that the fungus perhaps occurs on both species. Our fungus agrees well with European specimens as far as the conidiophores and conidia are concerned, but the walls of the oogonia are not thick and rigid, but easily collapse, and on this account the species is here inserted with the *Effuse*. American specimens do not so well agree with the European *P. affinis* Rossm. as far as their conidia are concerned, although the oogonia resemble those of the last named species. In examining a considerable number of specimens of *P. Corydalis* and *P. affinis*

determined by European authorities the oospores of the two species hardly seemed to present differences sufficiently striking to warrant, on that ground alone, placing them in different sections of the genus.

23. *P. Euphorbiæ* Fuckel.

*P. Euphorbiæ* Fung. Rhénan. no. 40. De Bary l. c. 114.

*P. Cyparissicæ* Farlow in Bull. Buss. Inst. II. 236.

EXS. Ellis N. A. F. 216.

Conidiophores repeatedly dichotomous, divisions flexuous, tips widely spreading, spinose, straight or sometimes curved. Conidia globose or ellipsoidal 13–16 $\mu$  by 16–19 $\mu$ , pale violet colored when mature. Oospores 23–33 $\mu$  in diam., exospore brown, thick, and irregular.

On *Euphorbia maculata*.

Mass. (Farlow), New Jersey (Ellis). Europe.

Forming rather diffuse patches of a dirty-white color on the under side of the leaves, the upper surface remaining nearly normal. The species is apparently not common. I have occasionally seen it about Cambridge, but never in quantity except in the unusually wet summer of 1878, when it was common on *E. maculata*, in the college grounds, in August. I have compared our plant with European specimens of *P. Euphorbiæ*, and it seems to me that they specifically agree, although some minor points of difference are present. The conidia of American specimens are certainly violet colored, but, although those of the European form are described as colorless, I have found them to be violet in specimens on *E. platyphylla*. About the oospores of this species writers do not all agree. They are commonly found with us and have a thick brown exospore with irregular projections. The oosporic wall is rather rigid and thick, and, if I am not mistaken, has two layers, so that it bears as much resemblance to the oospores of the *Parasiticæ* as to those of the *Effusæ*. *P. Euphorbiæ* Fuckel, and *P. Cyparissicæ* De Bary, are generally kept distinct, but I must confess that an examination of a good set of both species leads me to think that one is probably a more fully developed form of the other. The form on *P. Cyparissias* is not known to me in America.

24. *P. GRISEA* Unger.

*Botrytis grisea* Unger Exanthem. 172.

*P. grisea* Unger Bot. Zeit. 1847, 345; De Bary l. c. 115, Pl. XIII. f. 12.

Conidiophores slender, several times dichotomous. Tips flexuous, approximate or slightly spreading. Conidia ovate-obtuse, violet colored, 22–30 $\mu$  by 15–22 $\mu$ . Oospores large, 30–38 $\mu$  in diam., exospore brown.

On *Veronica alpina*.

Tuckerman's Ravine, Mt. Washington. Europe.

I have found this species but once, and then at the head of Tuckerman's Ravine, in the month of September, when oospores as well as conidia were present. Of our Eastern species this attains the highest altitude, reaching to 4,500 feet above the sea-level.

25. *P. LINARIE* Fuckel.

Fungi Rhenani 1903; Symb. Myc. 70.

Conidiophores slender, several times dichotomous. Tips short, flexuous, approximate. Conidia obovate, distinctly attenuated at the base,  $26-33\mu$  by  $12-16\mu$ , violet. Oospores  $30-34\mu$ , thick-walled, exospore dark, rough.

On *Linaria Canadensis*.

Chebacco Lake. Mass. (Seymour).

Apparently a rare species collected in June by Mr. A. B. Seymour. It forms a scanty growth of a dirty white color on the under side of the leaves, in which the oospores abound. The conidia of this species are different in shape from those of our other species and resemble those of *P. Schleideniana*. They are narrowly obovate and much attenuated at the base. The oospores are rather large and thick-walled, the exospore having more prominent ridges than in the related species.

26. *P. LEPTOSPERMA* De Bary.

De Bary l. c. p. 117, Pl. IX. f. 1, 2.

Mycelium with globose haustoria. Conidiophores rather stout and rigid, several times dichotomous, occasionally trichotomous, divisions straight, divergent above. Tips short, spinose, erect. Conidia large, rather narrowly ellipsoid, obtuse,  $31-45\mu$  long by  $16-22\mu$  broad, white. Oospores yellowish-brown, about  $38-45\mu$  in diameter, exospore smooth or with a few folds.

On *Artemisia biennis*.

Lake Minnetonka, Minn. Europe.

As far as I know the only locality in which this species has yet been found in this country, but it is to be expected on other composites, especially *Tanacetum*. The portions of the leaves attacked quickly shrivel and blacken. I found no oospores on my specimens, and the measurement given above was taken from European specimens. In all other respects the fungus seems to me to be undoubtedly the same as the European type, and is recognized by the rigid spinose tips and the large white narrowly elliptical conidia. *P. Radii* De Bary, which sometimes accompanies the present species in Europe, has not yet been found in this country.

## SPECIES WHOSE OOSPORES ARE UNKNOWN.

a. *Conidiophores* pinnately branched.27. *P. SICYICOLA* Trelease in litt.

Haustoria not seen. Conidiophores slender, axis long and flexuous, with very numerous 3-4 pinnate, slender, horizontal branches, alternately or frequently oppositely placed. Tips divided into several, usually three, very short spines. Conidia small  $13-17\mu$  by  $11-15\mu$  ovoid, white. Oospores?

On *Sicyos angulatus*.

Near Madison, Wis. (Trelease).

This very interesting species was discovered by Prof. Trelease in the sum-

mer of 1882. It forms rather small, scattered, frost-like spots on the under side of the leaves. The resemblance to *P. viticola* and *P. Halstedii* is striking. The present species, however, has conidiophores whose branches are more fully developed than in those species, although the general plan of the ramification is the same. Although the germination of the conidia has not yet been seen, one can not help thinking that they will prove to germinate by zoospores, so great is the resemblance of the conidia and conidiophores to those of our species of the section *Zoosporiparæ*. In the Journ. Linn. Soc. X., 363, Berkeley and Curtis describe a *Peronospora Cubensis* found by Charles Wright on some cucurbitaceous plant in Cuba, which, as far as I have been able to ascertain, is not the same as the present species, judging from the description given. The description is as follows: "Candida; floccis sursum furcatis; ramulis ultimis rectis nec uncinatis, sporis metulaformibus vel oblongis obtusis." An examination of the type in the Curtis collection, where it bears the name *Botrytis Cubensis* B. & C., shows only a minute *Ramularia*, which throws no light on the subject. Whether correct or not in assuming that *P. sieyicola* is distinct from *P. Cubensis*, the discovery of the species in Wisconsin is of economic importance. If it occurs in *Sieyos* it may be found on cucumbers, melons, and other *Cucurbitaceæ* at some future date, and it may eventually prove injurious to garden crops. Like others of our pinnate species it may, sooner or later, spread eastward, and, following the example of *P. viticola*, in time extend even to Europe. I have examined cultivated plants of *Sieyos* in Cambridge, but have been unable to find the *Peronospora*. *Echinozystis* should also be watched, for, from its close relationship to *Sieyos*, it is not unlikely that the fungus will be found upon it. A more detailed account of *P. sieyicola* will be given by the discoverer in another place, and it is to be hoped that he will be able to succeed in observing the germination of the conidia, and ascertain whether the resemblance to *P. viticola* is preserved in this point also.

#### 28. *P. ILLINOENSIS*.

Conidiophores slender, scattered, loosely 2-3 pinnate above, secondary branches usually horizontal, sometimes secund. Tips acute, short, erect, clustered. Conidia globose, or ovate-obtuse, white, 17-20 $\mu$  by 15-18 $\mu$ . Oospores?

The above unsatisfactory diagnosis is given temporarily to designate a curious form found on some leaves of *Parietaria Pennsylvanica* received from Prof. T. J. Burrill. They were collected, I believe, in Southern Ill., by Mr. A. B. Seymour. As will be seen from the description this is another of the pinnate forms which are characteristic of this country. A *Peronospora Parietaria* is mentioned by Roumeguère in the Revue Mycologique for July, 1883, and distributed in Fungi Gallici no. 2553. It was found on *Parietaria diffusa* at Chailly, France. I have not yet seen a description of the species which is said by Roumeguère to be *P. Urticeæ* pro parte. From this statement one can only assume that the Illinois form is not *P. Parietaria*: Roum. for the former is distinctly pinnate, while the latter, if *P. Urticeæ* pro parte, must be assumed to be dichotomous. Unfortunately in my copy of Fungi Gallici the specimen no 2553 only shows a *Ramularia*, and

I am not at present able to state certainly whether the American plant is *P. Parietariae*, although it probably is not. Our species is probably of limited range, and we must look to Prof. Burrill to discover the oospores and the mode of germination of the conidia. Here again the resemblance to the other pinnate species would lead us to suspect germination by means of zoospores.

b. *Conidiophores dichotomous*.

29. *P. SORDIDA* Berk.

Ann. & Mag. Nat. Hist. 1861, 449; Cat. Pac. Fung. 29.

"Forming broad, irregular, dirty, pallid spots on the under side of the leaves; threads loosely dichotomous above; tips forked, unequal; spores obovate, apiculate, .001 inch long." Berkley l. c.

On *Scrophularia Californica*.

California (Harkness). Europe.

30. *P. SPARSA* Berk.

Gardener's Chronicle 1862 p. 308; Cat. Pac. Fung. 29.

*Conidiophores* scattered, repeatedly dichotomous. *Conidia* ellipsoid, apex obtuse.

On *Rosa Californica*.

California (Harkness). Europe.

31. *P. LOPHANTHI*.

*Conidiophores* very slender, long, naked below, above repeatedly dichotomous, divisions flexuous. Tips flexuous, forcipate, one division usually considerably longer than the other. *Conidia* small, globose, or ovate-obtuse,  $19-22\mu$  by  $15-20\mu$ , violet colored. Oospores?

On *Lophanthus scrophulariæifolius*.

Charles City, Iowa. (Arthur.)

This species, which has only been collected by Prof. Arthur, forms small, dirty-white patches on the under side of the leaves. It differs from *P. Lamii* A. Br. in being much more slender and in not having pedicellate conidia. Its relation to *P. Calaminthæ* Fockel requires further study, and one needs to see the oospores before concluding that the species is a good one. The *conidiophores* are more slender and longer than in most of our species, in this respect resembling the form on *Geum*. The tips are bifurcate, one division usually being much shorter than the other.

The above includes all our species of *Peronospora*, about which I have as yet direct information. There are, however, several more species known to others, I believe. The list of our species is by no means meagre, and it will probably soon be increased, now that a number of observers are in the field. I have already, in a previous paper, called attention to the fact that our flora is characterized by the abundance of species whose conidia germinate by zoospores, and if, as is not unlikely, it should prove that the species on *Sicyos* and *Parietaria* also produce zoospores, the proportion would be still greater. Our *Peronospora* may be divided into two groups, those in which the ramification is pinnate and those in which it is dichotomous. In each group there are species which closely resemble one another, and one is tempted to ask how far the different forms described are really specifically distinct. Of the pinnate group, although we

might suppose that the greater part of the species were derived from some common ancestor, yet, as species of fungi go, they are now comparatively distinct. The same can not be said of the group *Effusæ*. I have already noticed several forms which it seems to some botanists can not be morphologically distinguished from *P. effusa*, and, in general, all of the *Effusæ* are closely related to one another. Some mycologists maintain that two forms morphologically alike must, if they grow on hosts belonging to natural orders which are not closely related, be regarded as distinct species. I am unwilling to adopt this view so long as repeated attempts have not shown that it is impossible to transfer a *Peronospora* on one host to a host of an order not nearly related. Cultures are to be recommended to persons who have a certain amount of leisure, and they do not require an elaborate equipment or special library. One might, for instance, attempt to transfer the form on *Plantago* to *Chenopodium*, or vice versa.

In my enumeration it will be noticed that no mention is made of species on *Caryophyllaceæ*, although several are found in Europe. I believe that species of *Stellaria* and *Cerastium* are attacked by *Peronosporæ* in the Western States, but a careful search in Massachusetts has failed to detect any *Peronospora* on such hosts, although *Isariopsis pusilla* Fres., which externally resembles a *Peronospora*, is common. It is hardly probable that we do not have some of the *Calothecæ* which inhabit *Caryophyllaceæ*. *P. Schleideniana* Ung., on onions, and *P. Schachtii* Fuckel, on beets, have not yet been observed in the United States as far as known, but they may be expected.<sup>1</sup>

### CYSTOPUS Lév.

Conidia white, spherical or cylindrical, in moniliform chains densely packed side by side, forming spots surrounded by the ruptured epidermis. Germination by zoospores.<sup>2</sup>

#### 32. *C. CANDIDUS* (P.) Lév.

*Uredo candida* Persoon Syn. Fung. 233; Schweinitz Fung. Am. Bor. no. 2852 in part.

*C. candidus* Lév. Ann. Sci. Nat. Ser. 3, VIII; De Bary l. c. 126 Pl. I. & II. f. 1-3; Bull. Buss. Inst. 1., 429; 29th Rept. N. Y. Bot. 76; Cat. Pac. Fung. 26; Bull. Ill. Mus. 1., 57, Pl. I. f. 1-4.

Exs. Ellis N. A. F. no. 204; Ravenel Fung. Car. IV. 96.

Conidia all alike, globose, white. Oospores nearly spherical, yellowish brown. Exospore marked with few, very prominent, flexuous ridges which sometimes branch.

On *Capsella bursa-pastoris*, *Lepidium Virginicum*, *Dentaria diphylla*, *Sinapis*

<sup>1</sup>While attending the session of the American Association at Minneapolis last August I found the leaves of *Ampelopsis quinquefolia* growing on the shores of Lake Minnetonka, attacked by *P. viticola*. The spots formed were small and scattered, and the fungus not so well developed as when growing on grapes. Strange to say the plants of *Vitis riparia* growing close to the *Ampelopsis* were free from the *Peronospora*, and during all my excursions near Minneapolis I found no *Peronospora* on wild grapes. This indicates that the fungus is less common in the Northwest than in the East, where the fungus abounds on all grapes. On the other hand *P. viticola* has not been found on *Ampelopsis* in the East. That it ever occurs on *Ampelopsis* is of importance in studying the means of preventing the spread of the grape-mildew.

In September, 1883, a *Peronospora* was found on *Genn rivale* by Mr. Seymour and myself at Wellesley and Newton, Mass. The conidiophores were like those found on *Genn album* at Wood's Hall, and were sparsely scattered over the leaves. Unfortunately no oospores were found, but in other respects the species agrees sufficiently well with *P. Potentilla*. I found, in 1882, a small *Peronospora* on *Ribes Cynosbati* at Wood's Hall, Mass., but the material was too poor to warrant a description.

<sup>2</sup>The terminal conidia are said, by Tulasne, in some cases to produce tubes.

*nigra*, *Turritis* sp. *Rhaphanus sativus*, *Sisymbrium officinale*, and *Nasturtium Armoracia*.

Everywhere common. Europe.

The common white rust on cruciferous plants, distorting the leaves, stems, and even the floral organs. I have found oospores in the stems and pedicels of *Sinapis* and *Rhaphanus*. Although extremely common on *Capsella* and *Lepidium*, I have not seen oospores in those plants in this country.

### 33. *C. CUBICUS* (Strauss) Lév.

*Uredo cubica* Strauss Ann. Wetterauer Gesell. II. 86.

*C. cubicus* Lév. l. c.; De Bary l. c. 128 Pl. II. f. 17-21; Bull. Buss. Inst. I. 429; 25th Rept. N. Y. Bot. 91; 29th Rept. 76; 30th Rept. 77.

*C. spinulosus* De Bary l. c. 129; 29th Rept. N. Y. Bot. 51.

EXS. Ellis, N. A. F., no. 206.

Conidia of two kinds, the terminal ones larger than the others, depressed-globose, the others short cylindrical (squarish in optical section), with a thickened transverse ring. Oospores brown or black, globose, exospore covered with a fine, scarcely-raised net work.

On *Tragopogon porrifolius*, *Ambrosia artemisiifolia*, *Parthenium integrifolium*, *Cirsium arvense*.

Massachusetts to Iowa. Europe.

I have found oospores on all the hosts just named, and they all, as well as those in European specimens, of which I have examined a large set, have an exospore which at first sight appears to be granular, but which, on close examination, proves to be covered with a slightly raised net-work, with very small meshes. In this respect European and American specimens of *C. spinulosus* agree perfectly with *C. cubicus*, and the two forms should be united. Probably the species appears on several other composites in this country. It is, however, by no means certain that the *Cystopus* on *Convolvulaceae*, viz.: *Ipomoea edulis* in Myc. Univ. 815, *Convolvulus* in Ravenel Fung. Am. 501, and apparently not rare from New Jersey (Halsted) on *Ipomoea* to North Carolina, on *Ipom. pandurata*, *Ipom. trichocarpa* and Ohio belongs to the present species. The conidia are subcylindrical, and resemble those of *C. cubicus*, but I have never been able to find oospores in the numerous specimens which I have examined, and without them one can not determine the species with any degree of certainty. The *Cystopus* on *Convolvulaceae* is apparently the *Eridium Ipomoeae panduranae* Schweinitz's Syn. Fung. Car. No. 454, and it is to be hoped that some person will find the oospores, which should be sought in the stems and petioles rather than the leaves. In this connection I would call attention to the fact that a *Cystopus* was found on cotton leaves, in Alabama, by Prof. C. V. Riley, in 1879. The discovery is of great practical importance, although, as there were no oospores, the species could not be determined.

### 34. *C. BLITI* (Bivon.) Lév.

*Uredo Bliti* Bivona-Bernard in Stirp. Sic. III. 11.

*Cocinea* (*Uredo*) *Amaranthi* Sch. Syn. Fung. Am. Bor. no. 2853; *Grevillea* III. 58; 28th Rept. N. Y. Bot. 61.

*Cyst. Bliti* Lév. l. c.; De Bary l. c. 127, Pl. XIII. f. 13-15; Bull. Buss. Inst. 429 in part.

EXS. Myc. Univ. 619; Ellis N. A. F. 206.

Conidia of two kinds, the terminal subglobose, generally smaller

than the others, which are rounded cylindrical, somewhat truncate at the base, with a thickened transverse band. Oospores globose, exospore brown or blackish, covered with ridges which usually unite to form a net-work, some of the ridges projecting into the center of the meshes.

On *Amarantus hybridus*, *A. retrofractus* and *Aenida cannabina*.

Everywhere common east of the Mississippi. Europe.

I have examined a very large number of specimens of this species which abounds on species of *Amarantus*, and which, with us, produces oospores abundantly in the leaves where they are plainly visible to the naked eye, and I can see absolutely no specific difference between our forms and that on *A. Blitum* of Europe. I have compared oospores on our species of *Amarantus* and *Aenida*, and they correspond precisely to those in Rabh. Fung. Eur. no. 598 on *A. Blitum*, and, in all, the exospore is covered by ridges which unite to form an irregular network whose meshes are considerably larger than in *C. cubicus*. The ends of some of the ridges project into the areolæ and terminate in blind ends. The species is apparently much more common in America than in Europe.

### 35. *C. PORTULACÆ* (DC.) Lév.

*Uredo Portulacæ* DC. Fl. Franc.

*Creoma (Uredo) canaliculata* S. Fung. Am. Bor. in part.

*Cyst. Portulacæ* Lév. l. c. : De Bary l. c. 127, Pl. III.

EXS. Ravenel Fung. Am. 500.

Conidia of two kinds, the terminal umbilicate and larger than the others which are cylindrical, and without a thickened transverse band. Oospores as in *C. Bliti*.

On *Portulaca oleracea*.

With the last. Europe.

Everywhere abundant on *Portulaca oleracea* and scarcely to be distinguished from the preceding species. The oospores are the same in both, as I am convinced from a large number of examinations, and, although the terminal conidia in one species are larger, and in the other smaller, than the rest, and the transverse band is wanting in *C. Portulacæ*, according to several writers, yet, from my own observations, I have not found these marks to be constant. Neither is the fact that the sori are sometimes concentrically arranged in *C. Portulacæ* characteristic for the same arrangement is not unfrequently seen in the form on *Amarantus*.

I would return my thanks to the following botanists who have kindly furnished specimens of *Peronospora*: J. C. Arthur, Prof. C. E. Bessey, Prof. T. J. Burrill, Hon. G. W. Clinton, F. S. Earle, J. B. Ellis, B. D. Halsted, Dr. H. W. Harkness, E. W. Holway, C. H. Peck, H. W. Ravenel, A. B. Seymour, Prof. V. M. Spalding, Prof. Wm. Trelease.

*Erratum*.—On page 312 after Section III for *Plasmatorax* read *Plasmatopara*.

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## GENERAL NOTES.

Sections of Wood Arranged for Instruction in Schools, by H. Brooks, of Boston, are offered to the students of botany and others interested in the knowledge of our timber trees. The collection contains seventeen species of woods, each in three specimens, a radial, tangential and a transverse section, each  $5\frac{1}{2}$  by nearly 2 inches wide and, according to the character of the wood,  $\frac{1}{80}$  to  $\frac{1}{150}$  inch thick. The three different sections of each species are mounted on a neat card-board and are on both sides protected by a thin and completely transparent mica plate, so that dust and use can not injure them and they can be readily examined with transmitted as well as reflected light; with a good magnifying glass they show the wood structure very nicely.

There are seventeen species of wood in each set, which is furnished in a neat box, at \$5.00; application to be made to Henry Brooks, 97 Beacon street, Boston, Mass.

The specimens are similar to those furnished by Mr. Burkart of Brunn,