

tributed to the Smithsonian Institution a manuscript on "The Plants of Louisiana." In this contribution he was aided by Prof. W. M. Carpenter and by Dr. Josiah Hale, who contributed the *Cypreaceæ* and *Gramineæ*. The Smithsonian did not publish the contribution, and Riddell made an abridgement of it under the title of "Catalogus Floræ Ludovicianæ" for the *New Orleans Medical and Surgical Journal*, which published it in 1852. The manuscript catalogue contained descriptions of new species by Prof. Carpenter, and twenty-one species and several varieties by Riddell. The manuscript or the subsequently printed catalogue seem not to have been consulted by Dr. Chapman in his Southern Flora, although *Dicliptera Halei*, one of Riddell's new species, is inserted.

While residing in New Orleans, Dr. Riddell was for some years connected with the government mint. He published in 1845 a "Monograph of the Dollar," a work containing fac simile impressions of between five and six hundred kinds of United States and Mexican dollars, both genuine and counterfeit. During the latter part of his life he did much work with the compound microscope, investigating extensively the lower forms of life, and inventing the binocular microscope. As early as 1836 he published in Cincinnati a paper on "Miasm and Contagion," in which he advocated that contagious diseases are caused by "organized and living corpuscles of various kinds." This contribution became popular, and was republished in Boston. He also contributed considerably to the scientific journals on matters relating to chemistry and other topics.

Dr. Riddell is said to have been a universal favorite with all who knew him. His students regarded him with adoration. He was a clear, concise lecturer, and a logical thinker. His business abilities were extraordinarily good, and he amassed a handsome property. His name is indelibly associated with botany through the genus *Riddellia*, a name which Nuttall gave to a western Composite. The original species, *R. tagetina*, has been supplemented more recently by *R. Cooperi* and *R. arachnoidea*, both added by Dr. Gray.—L. H. BAILEY, JR.

Notes on Some Ustilagineæ of the United States.

The study of the *Ustilagineæ* is beset with difficulties, for not only do the species themselves present comparatively few salient points of distinction, but the generic characters as estimated by recent writers depend largely upon the mode of germination of

the spores. A perusal of the admirable paper of Woronin, *Beitrag zur Kenntniss der Ustilagineen*, shows how large a part the germination plays in the limitation of the genera, and when one bears in mind how little is known of the germination of our native species, he will understand how imperfect the classification of our *Ustilagineæ* must be. In the present article I would like to call attention to some of our little known forms, without pretending to regard my determination of the species as anything more than provisional, expecting that increased knowledge of the development, which it is to be hoped we shall soon have, will necessitate a reform in the nomenclature.

The genus *Entyloma*, founded by DeBary on *Protomyces microsporus*, Unger, includes a comparatively small number of species, in which the small mycelium inhabits the leaves of different herbaceous plants, and where the spores are formed in the continuity of the hyphæ, usually in large numbers, but do not become pulverulent as in most *Ustilagineæ*. The germination of the spores resembles that known in species of *Tilletia*; a short germinal tube is given off, at whose apex is borne a whorl of short cells which unite with one another in pairs. In some of the species of *Entyloma*, besides the spores in the interior of the leaves, there are conidia borne on stalks which penetrate the stomata in dense tufts and form white pulverulent spots on the leaves. Schrøter makes two divisions of the genus according as the species bear conidia or not. The spores of the greater number of species of this genus are very nearly alike in size and shape, being oval or somewhat angular, and in most cases it is not easy to define the species by the spores alone. The presence or absence of conidia, it seems to me, can hardly be regarded as constant in all cases, for, as in the form on *Ambrosia*, the conidia are sometimes present, but more frequently they are wanting. The conidia are usually like the forms referred to the genera *Fusidium*, *Cylindrospora* or *Ramularia* and, in the case of our species, it may be that the conidial forms have already been described as species of the genera above named, without reference to the spores in the interior of the leaves; but if such is the case I have been unable to trace them.

The type of the genus belonging to the division in which there are no conidia is *Ent. microsporum* (Unger), DeBary, which has been found by Prof. Arthur on *Ranunculus repens* near Chicago, but, although I have often searched for it, I have never found it near Cambridge. Another species found on *Ranunculus* in Europe, which has no conidia, *Ent. Ranunculi* (Bon.), I have never

found in this country, but a form found on *Thalictrum dioicum* in Wisconsin, by Prof. Wm. Trelease, is very nearly related to *Ent. Ranunculi*, although it would be going too far, at present, to call the two identical. The fungus on *Thalictrum* produces on the leaves rather small circular spots, which are at first yellow and later black. On the specimens which I have examined the conidia were not in very good condition, and it would be necessary to examine more mature specimens before expressing a decided opinion on the species. The conidia were in small patches on the under surface of the leaves, and the conidial spores were linear, acute, 11-20 μ long by about 3 μ broad. The spores were abundant in the interior of the leaves, but hardly mature, and measured 9-12 μ in diameter.

The most common *Entyloma*, at least in the east, is one which occurs on *Compositæ*. Several years ago, when looking for the oospores of *Peronospora Halstedii* on *Ambrosia artemisiæfolia*, I repeatedly found bodies which were evidently not the desired oospores, although the *Peronospora* was growing on the leaves, but rather the spores of an *Entyloma*. Since then I have found specimens on *Ambrosia* with conidia as well as deep-seated spores, and what is evidently the same fungus was found in a luxuriant condition on *Aster puniceus* at Wood's Holl by Trelease. I have since repeatedly found the fungus on *Ambrosia* and *Aster* in small quantities, and it was abundant on *Aster puniceus*, growing at the top of Tuckerman's ravine on Mt. Washington, in September, 1882. On *Ambrosia* the fungus causes yellowish or grayish discolorations of indefinite shape, which become eventually black. On *Aster* the spots are more circumscribed and, although generally yellow, they sometimes have a purple border and the leaves become slightly thickened, which is not the case when it grows on *Ambrosia*. The conidia form farinaceous spots on the under surface of the leaves, which they sometimes almost cover. The determination of our species is doubtful. Several *Entylomata* are known on *Compositæ*. *Ent. Calendulæ* (Oudemans) and *Ent. Picridis*, Rostrup, of Europe, are said to be destitute of conidia and, if we accept the statement as absolute, our form must be different. The spores of our *Entyloma* average about 7.5-11.5 μ , while those of *Ent. Calendulæ* are often from 11-15 μ in diameter. Of *Ent. Picridis* I have examined only the specimen in Myc. Univ. No. 1815, in which the measurements more nearly resemble those of our own species. Of previously described American forms there is a *Protomyces polyspora*, Peck, in Myc. Univ. No. 1813, on *Ambrosia trifida* from New York. In my specimen there are no conidia nor are

any mentioned in the description. The species is an *Entyloma* rather than a *Protomyces*, as that genus is now limited. The spores are much like those of the form on *Ambrosia artemisiifolia* and *Aster*, differing only in being somewhat darker and more angular, but the specimen of Peck was collected later in the season than any of my specimens. The conidial spores of my specimens are fusiform or slightly clavate, often somewhat curved, and measure $15-20\ \mu$ by $2-3\ \mu$. They sometimes appear to be divided, but on this point I am not certain. I would propose the provisional name of *Entyloma Compositarum*, while awaiting further information with regard to the occurrence of conidia in the European *Ent. Picridis* and its relation to *Ent. Calendulæ*. I am inclined to believe that *Ent. Compositarum* may prove to be a more fully developed form of *Ent. polysporum* (Peck), the relationship of which to *Ent. Picridis* needs further study, for, although as distributed in Myc. Univ., the two have a different aspect, I am not so sure that one is not an earlier and the other a more mature form of the same species.

Besides *Ent. Compositarum*, I have examined three other species of the genus which are new to the United States. Prof. Bessey, to whom we owe so many interesting discoveries of *Ustilagineæ*, sent me an *Entyloma* collected in September, 1878, on leaves of *Solanum* or *Physalis* in Iowa, and later I received from Prof. Arthur the same fungus on *Physalis*, also from Iowa. In both cases there were abundant conidia and spores. The conidia are at first short but become long and filiform, measuring from $20-45\ \mu$ by $1.5-3\ \mu$. Contrary to what is found in most species, the conidia on *Physalis* occur on both surfaces of the leaves in circumscribed round spots, which are at first pale but soon become black. The spores are yellowish or slightly brown when mature, generally globose, on an average $12-15\ \mu$ in diameter, and the surface, although sometimes smooth, is often slightly undulate. There is already a *Protomyces physalidis* Kalch. & Cooke, on *P. Hornemanni* from South Africa, described in *Grevillea*, vol. ix, p. 22, Sept., 1880. It may be that this is the same as the fungus from Iowa, but as no conidia are described in the African species, our species may be called provisionally *Entyloma Besseyi*.

Two other species have abundant conidia as well as spores. One was discovered on the leaves of *Menispermum Canadense*, in Wisconsin, by Prof. Trelease, in August, 1881, and the other on *Lobelia inflata* was collected by me at Gilead, Maine, in September, 1882. As far as I can ascertain, both species are undescribed, although in the case of the one on *Menispermum*, it seems

hardly probable that the striking conidia could have escaped the notice of earlier collectors. *Entyloma Menispermii* produces dark, ill-defined discolorations on the upper surface of the leaves, which are not thickened by the presence of the fungus. The conidia form conspicuous, farinaceous, polygonal patches on the under surface of the leaves, which they sometimes nearly cover. The conidial stalks are more loosely branched than in the previously mentioned species and the conidial spores are stouter and pointed at one end, measuring $11-24\ \mu$ by $3.5-4\ \mu$. The spores are globose and smooth with thin walls, about $5.5-11\ \mu$ in diameter.

Entyloma Lobeliæ produces no marked distortions of the leaves, but the plants infested have a whitish color, looking as if they were attacked by some member of the *Perisporiaceæ*. Ill defined yellowish spots are formed on the upper side of the leaves, and gradually the whole leaf blackens and shrivels. The conidia, although very abundant on the under side of the leaves, are not so distinctly characterized under the microscope as those of the last species. They are narrowly fusiform and measure $10-25\ \mu$ by $2-3\ \mu$. The spores are larger than in *Ent. Menispermii*, but smaller and decidedly more delicate than in *Ent. Besseyi*.

The species above mentioned may be summarized as follows:

A. *Species destitute of conidia.*

1. ENT. MICROSPORUM (Ung.) DeBary.
On *Ranunculus repens*. Near Chicago. Prof. J. C. Arthur.
2. ENT. POLYSPORUM (Peck).
On *Ambrosia trifida*. New York.
3. ENT. LINARIÆ (Schrt.).
On *Veronica peregrina*. Wisconsin. Trelease.

B. *Species with conidia.*

4. ENT. COMPOSITARUM Farlow ad int.
Conidia fusiform or slightly clavate, often curved, $15-20\ u$ long by $2-3\ u$ broad. Spores globose or somewhat angular, about $7.5-11.5\ u$ in diameter, wall thin and nearly colorless.
On *Aster puniceus* and *Ambrosia artemisiæfolia*. New England.
5. ENT. BESSEYI Farlow ad int.
Conidia rod-shaped, becoming filiform, $20-45\ u$ long by $1.5-3\ u$ broad. Spores globose, $7.5-15.5\ u$ in diameter, average $12-15\ u$, yellowish brown, thick walled, surface smooth or undulate.
On *Physalis*. Iowa. Profs. Bessey and Arthur.
6. ENT. MENISPERMI Farlow and Trelease.
Conidia acutely ovate, $11-24\ u$ by $3.5-4\ u$. Spores light colored, globose or somewhat angular, smooth, with thin walls, about $5.5-11\ u$ in diameter.
On *Menispermum Canadense*. Wisconsin. Prof. Trelease.
7. ENT. LOBELIÆ Farlow.
Conidia narrowly fusiform, $10-25\ u$ by $2-3\ u$. Spores light-colored, globose or slightly angular, thin-walled, $8-15\ u$ in diameter, average $7.5-11.5\ u$.
On *Lobelia inflata*. Gilead, Maine.
- ?8. ENT. RANUNCULI (Bon.)
forma *Thalictri*.
On *Thalictrum dioicum*. Wisconsin. Trelease.

In connection with the species of *Entyloma* previously mentioned, I would add that *Protomyces Sagittariæ*, Fuckel, a species whose systematic position is not well known, was found by me growing on *Sagittaria variabilis*, Engelm., at Newton, Mass., in the month of October. I am indebted to Prof. DeBary for an authentic specimen of Fuckel. I received from Mr. J. Fletcher, of Ottawa, some fruit of *Potamogeton Vaseyi*, Robbins, attacked by a very curious fungus. The specimens had been preserved in alcohol and consequently there was no possibility of making the spores germinate. The fruit of the *Potamogeton* was swollen and a section showed globular masses scattered through the substance of the fruit. The masses consisted of densely packed cells, the outer layer of which was darker colored than the rest and regularly arranged, so that the cells, which had the shape of short cylinders with rounded ends, had their longer axis always in the direction of the radius. Beneath this regularly arranged layer the cells were roundish-angular and presented the appearance of parenchymatous cells. Having but little material at my disposal I was unable to study the fungus at all satisfactorily, but it appeared to me to be probably one of the *Ustilagineæ*, related perhaps to *Sorosporium* or *Thecaphora*. My friend, Dr. Maxime Cornu, of Paris, has expressed the opinion that the fungus in question belongs to a genus recently described by him under the name of *Doassansia*. As the description of the genus has not yet reached this country, I can give no further information, but would call the attention of collectors of *Potamogeton* to the existence of this curious fungus of which more material is much needed. The fungus occurs also on *P. pusillus*, *P. perfoliatus*, var. *lanceolatus*, and *P. natans*, according to Mr. Fletcher, whose description of the diseased fruit, when freshly gathered, I quote for the benefit of collectors of aquatic plants:

“The fruit was swelled out to more than four times its proper size and was almost globular, of a greenish white color, spotted with reddish-brown—later these fruits cracked and then the whole soon decayed and a white mouldy growth was developed.”

While collecting in King's ravine in the White mountains, in August, 1882, I found a curious fungus on *Epilobium alpinum* growing on the borders of the torrent which falls from Mt. Adams to the floor of the ravine. The *Epilobium* was infested with *Æcidium Epilobii*, D. C., and on some of the leaves were dark-colored spots which I, at the time, supposed to belong to *Puccinia Epilobii*, D. C. A microscopic examination showed that the fungus was one of the *Ustilagineæ* and very closely re-

lated to *Doassansia Alismatis*, Cornu, for an authentic specimen of which I am indebted to the author of the species. The fungus appears to the naked eye in the form of blackish convex nodules about the size of a pin's head, which are collected in groups, especially at the apex of the leaves, and visible on both sides of the leaves. The nodules consist of densely packed roundish-angular spores, those on the outside being dark colored and those within lighter colored. The masses are surrounded by a fine mycelium, but the development of the spores and their germination could not be studied from the material which I collected and, owing to the remoteness of the locality, it will be difficult for future collectors to find the spot where my specimens were collected. It is not impossible that the fungus has been described by some older writer, but I have not been able to find any trace of it. To mark the species it may be named temporarily *Doassansia Epilobii*.

DOASSANSIA EPILOBII Farlow ad int. Spores densely packed in globular or lobulated masses which are 80-200 μ in diameter. Spores irregularly polyedral, approaching globular, 7.5-17 μ in diameter, average 10-12; external spores blackish-brown, thick-walled, outer surface cuticularized; internal spores lighter colored with thinner walls.

Thecaphora aterrima, Tul., was found several years ago by Prof. Bessey, on *Carex*, in Iowa. Collectors should search for this interesting species in the Eastern States. *Ustilago Sorghi* (Lk.) has been received from Dr. Taylor, of the Agricultural Department in Washington, where it was found growing on cane grown from seed imported from China, and it has also been found by Prof. Trelease, on amber-cane in Wisconsin. *Ustilago Gyn-erii*, Vize, of which I have examined specimens presented to me by Dr. Harkness, is the same as *Gymnosporium Arundinis*, Corda, and is to be excluded from *Ustilagineae*. *Tilletia striciformis*, West. (*Till. DeBaryana*) was found by Mr. B. D. Halsted on an unknown grass at Passaic, N. J., and by Mr. A. B. Seymour at Granville, Mass. A curious form has been found by Prof. Bessey on leaves of *Polygonum* (*P. Pennsylvanicum*?), at Ames, Iowa. The fungus forms purple spots on the leaves, and the spores are borne in projecting pustules nearly black in color and hard instead of pulverulent. The flowers are also affected by what seems to be the same fungus, and I have received from Mr. Halsted flowers similarly affected, from New Jersey, but he did not find the fungus on the leaves. The formation of the spores shows that the fungus is an *Ustilago*, and regarding the

fungus on the leaves alone, it would appear to be the *Tilletia bullata* of Fuckel, referred by Schroeter in Cohn's *Beit. zur Biol.*, vol. II, p. 355, to *Ust. Bistortarum* (D. C.). Prof. Bessey's specimens on leaves agree well with Schroeter's description. A question may arise as to the species when we consider its appearance on the flowers. In *Ust. Candollei*, Tul., closely related to *Ust. Bistortarum*, the ovaries are distorted so that they project like columns from the perianth, but in the specimens collected both by Prof. Bessey and Mr. Halsted, the distortion is still greater. The ovaries are all transformed into more or less globular hard masses and, as nearly all the flowers of a spike are affected, the masses coalesce, forming a compact cylinder with a nodulated surface in which the individual flowers can hardly be recognized. The color of the spores, both in the form on the flowers as well as that on the leaves, is hardly purple but more nearly brownish than in *Ust. Candollei*. While referring the species to *Ust. Bistortarum* (D. C.), it will be seen that there are several points in which the American plant does not exactly agree with the European form. The form on the leaves, I would add, is much like Libert Plant. Crypt. Ard., No. 88.

W. G. FARLOW.

"Thistledown." ¹

A STUDY.

As a child, have you not held gently poised twixt thumb and finger the airy, fleecy thistledown, then lightly blowing watched the tiny parachute as it sailed away? It is a delicate, cunning device, lighter and more buoyant than a bird's feather, smaller and finer than the moth's antennæ.

When separated from the achene, it consists of plumelike filaments attached to a ring. Its mode of attachment to the seed is peculiar. The upper end of the achene is grooved, thus leaving a small projecting edge of the calyx. Into this groove fits a minute ring—large enough to slip upon a common pin. The pappus is attached to the lower edge of this ring, while over the upper edge fits the corolla and its adhering stamens. The end of the achene—inside the groove—is elongated and to this is attached the pistil.

¹ From the "*Aurora*" for May, a journal conducted by the students of the Iowa Agricultural College. Miss Knapp is a special student in botany, and in this article gives us a glimpse of the kind of work done by Professor Bessey's pupils.—EDS.



Farlow, W. G. 1883. "Notes on Some Ustilagineæ of the United States."
Botanical gazette 8(8), 271–278. <https://doi.org/10.1086/325719>.

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