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THE ULVACEAE OF NORTH AMERICA.

F. S. Collins.

The family *Ulvaceae* is here taken in the same limitations as by Wille in Engler & Prantl[1] excluding, the genera *Pringsheimia* and *Protoderma*, considered doubtful by him. The red algae, *Bangia*, *Porphyra* etc., included by earlier authors, are now generally recognized as belonging to the *Rhodospermeae*, the last important work including them among the *Ulvaceae* being J. G. Agardh's monograph.[2] This work has been here used as the basis for generic and specific divisions for the remainder, though somewhat modified by later publications, especially by Rosenvinge.[3]

There has been no general paper on the North American algae, with descriptions, since Harvey's.[4] In this, *Porphyra*, etc., were included in the *Ulvaceae*, as was usual at that time. Excluding these there are described two genera and nine species. In Farlow's list of 1876[5] there are two genera and six species. Since this no general list has been published, but in 1881 Farlow's Manual[6] contained two genera, eight species and six varieties, for the New England Coast, and the progress since then may be shown by the fact that the list

[1] A. Engler & K. Prantl, Die Natürlichen Pflanzenfamilien, I. Abt. 2, 1897.

[2] J. G. Agardh, Till Alg. Syst. part 3, Lunds Univ. Årsskrift, Vol. XIX, 1882.

[3] L. Kolderup Rosenvinge, Grønlands Havalger. Meddelelser om Grønland. Kjobehavn, 1893.

[4] W. H. Harvey, Nereis Boreali-Americana, part III. Chlorospermeae. Smithsonian Contributions to Knowledge. Washington, 1858.

[5] W. G. Farlow, List of the Marine Algae of the United States. Report of the U. S. Fish Commission for 1875. Washington, 1876.

[6] W. G. Farlow, Marine Algae of New England and the adjacent coast. Report of U. S. Fish Commission for 1879. Washington, 1881.

published by the writer in 1900[1] gives from New England four genera, with twenty-six species, and six varieties. The present paper gives four genera, with thirty-three species, and twenty-six varieties, fifty-nine species and varieties as compared with Harvey's nine in 1856 and Farlow's six in 1876. Of many of these species no description is to be found in English, and no complete or nearly complete list with descriptions is to be found in any language; so that a paper of the present scope would seem to be of use. The region covered is the North American continent, with Greenland and the Alaskan islands. Some indication is also given of extra-limital distribution.

In distinction from some other green algae, also of wide distribution and common occurrence, — the Cladophoras, for instance, in which specific distinctions are based on characters discernible with the naked eye or at most with a pocket lens,— few of the *Ulvaceae* can be distinguished except by microscopic examination. The external form of the frond certainly counts for something, but only in connection with characters of the individual cell. The type of structure is a flat membrane composed of a single layer of cells, side by side, all similar except at the base of the frond, where they are usually modified for the purpose of giving a firmer attachment to the substratum. In manner of reproduction there is no distinction to be made, and, with the exception of the basal cells referred to, any cell may develop the zoospores which are the only form of reproduction known. Generic and specific distinctions are therefore based on vegetative characters.

In some forms the membrane is developed very soon after the germination of the spore, but in all species there is probably a filamentous stage, though it may be only of a few cells. In the genus *Monostroma* the filament develops into a sac of a more or less clavate form. In some species this soon splits, and thereafter the plant grows as a flat membrane; at the other extreme in this genus we have a persistent nearly cylindrical sac, never splitting, and opening at the top only in fructification. Between these two all intermediate forms can be found in the various species. When the sac continues permanently closed except from external causes, we have the genus *Enteromorpha*, in which the species range from broadly clavate to filiform, and from simple to much branched; in *E. percursa* the cells of the

[1] RHODORA, Vol. II, 41, 1900.

original monosiphonous filament divide longitudinally, forming two parallel series, and there is no further development. This is so different from most *Enteromorpha* species that this has been often kept as a separate genus, *Tetranema*, *Diplonema* or *Percursaria*; but there are undoubted species of *Enteromorpha* in which the most of the frond is of the normal form, while the tips of the branches are of the *Tetranema* type; so that it seems better to consider this very simple form as merely a case where the development stops at an early stage. In most species of *Enteromorpha* the tubular or saccate form continues through life, with or without branching; but in *E. Linza* the membrane on opposite sides adheres more or less, the frond becoming flat in the middle with open spaces at the edges. This type leads to *Ulva*, in which the membranes adhere throughout, forming a flat expansion, two layers of cells in thickness.

The specific distinctions are based somewhat on the general form of the frond, but more on the size and shape of the cells and their arrangement. The latter, as seen in a superficial view of the frond, ranges from *Ulva Lactuca* with irregular polygonal cells closely set in no definite order, to *Ilea fulvescens* with cells of circular outline, in groups of twos, fours, or their multiples, arranged in longitudinal series. The shape of the cells as shown in a cross section of the frond is also important, as well as the character of the individual cell wall and of the membrane generally. All our species are marine, but some extend into brackish, and rarely into quite fresh water.

As the species now acknowledged have been largely formed by segregation from older species, and as in the earlier American literature little or no attention was given to microscopic characters, all the forms being divided among a few common species, it is evident that where these common species are quoted in the older works there must be doubt as to which of our present species are meant. The result is quite a list of doubtful references, and also some uncertainty in cases where the writer has ventured to decide on what seems good authority, but without seeing actual specimens. But this is unavoidable in such cases. In the following list the writer has endeavored to make as complete as possible the references to American literature, but no such attempt has been made with foreign references, and apart from the citation of the original description, Agardh's monograph and De Toni's Sylloge[1] are the principal works cited. Refer-

[1] J. B. De Toni, Sylloge Algarum Omnium hucusque cognitarum. Vol. I. Patavii, 1889.

ences have been made by number to the principal American exsiccatae: Farlow, Anderson & Eaton, Algae Americae-Borealis; Collins, Holden & Setchell, Phycotheca Boreali-Americana; Tilden, American Algae. A specific key is suggested under each genus, but it is impossible to make a key that will give satisfactory results in every case.

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ULVACEAE.

Frond consisting of a membrane of one or two layers of cells; in the simplest forms of merely two rows of cells, side by side; or in some parts of the frond of only a single series of cells. Membrane forming a tube or sac, or a flat expansion; simple or branching. Near the base of the frond the cells send down rhizoidal prolongations to the substratum, often uniting to form a thickened stipe; otherwise than this there is no specialization of cells. Asexual propagation by oval zoospores with four cilia, which may be formed in any ordinary cell of the frond, by successive division. Fructification by zoospores similar to the asexual, but noticeably smaller, and with two cilia; after the union of two such zoospores, with no apparent distinction of sexes, a new plant immediately begins to develop.

Of world-wide distribution; the plants usually gregarious, often growing in great quantities. They are specially plants of the litoral zone, occasionally extending down for a short distance in the sublitoral.

Key to the Genera.

Frond membranaceous, of two layers of cells — ULVA.

Frond originally tubular, sooner or later opening at the top, and usually dividing into a membrane of a single layer of cells — MONOSTROMA.

Frond tubular, or ruptured only by external causes; membrane parenchymatous — ENTEROMORPHA.

Frond tubular, very gelatinous, the cells in distinct longitudinal series, which are only loosely connected with each other — ILEA.

ULVA L.

Frond membranaceous, flat, consisting of two layers of cells, in any of which, excepting those in the thickened base, zoospores may be formed, issuing through an opening in the surface of the frond.

The genus is taken here in the restricted sense, including only the species having fronds always flat; those with tubular fronds, sometimes included in it, now forming the genus *Enteromorpha*. About six species can be considered as well established, though a number of others have been described, some of which must be considered as forms or varieties, and others are insufficiently known. *U. Lactuca* is cosmopolitan; *U. fasciata* is found in nearly all warm seas; *U. Californica* is known from only one station.

KEY TO THE SPECIES.

Fronds minute, triangular or reniform, with distinct stipe	2. U. CALIFORNICA.
Fronds ample, undivided or irregularly lobed	1. U. LACTUCA.
Fronds divided into linear segments	3. U. FASCIATA.

1. U. LACTUCA L. Sp. Pl., 1163, 1753. Frond very variable in shape, at first attached and generally of a lanceolate or ovate lanceolate form; later of irregular shape, and often detached and floating. The cells usually vertically elongate in cross section (see Plate 41, fig. 1); seen from the surface, irregularly angular, closely set; thickness of frond very variable.

A very common plant over the whole world, and extremely variable in form, thickness and color. Two fairly marked types can be distinguished in the species as found with us on both Atlantic and Pacific coasts, connected by innumerable forms. Farlow (2) 379; (3) 713; (4) 42, Pl. III, fig. 1. Hay (1) 33. Hay & MacKay (1) 63. Collins (3) 310; (6) 77; (7) 246; (8) 45. Dame & Collins (1) 157; Bennett (1) 95. Martindale (1) 92. Britton (1) 400. Anderson (1) 218. Rosenvinge (1) 939; (2) 145; (3) 116. McClatchie (1) 351. *U. Lactuca* var. *Lactuca* Farlow (4) 43. Hay & MacKay (1) 63. Martindale (1) 92. Britton (1) 400. Collins (7) 246. *U. latissima* Curtis (1) 156. Harvey (1) 59; (2) 176. Kemp (1) 41. Harvey & Bailey (1) 163. Ashmead (2) 96. Olney (1) 42. Eaton (1) 348; (2) 5. Farlow (1) 292; (2) 379; (3) 712. Robinson (1) 166. Anderson (1) 218. Fowler (1) 48.

Var. RIGIDA. (Ag.) Le Jolis, Alg. Mar. de Cherbourg, 38, 1863. Frond at first lanceolate or ovate lanceolate, firm and stiff, with a distinct stipe; later somewhat irregularly divided, and often with numerous perforations of various sizes; cells vertically elongate in cross section. Plate 41, fig. 1. cross section.

This is a common form of exposed shores, but occurs also sometimes in quieter waters. In its earlier stage it is distinctly lanceolate in outline, but this form is afterwards lost by irregular growth. It is firm in texture, the color growing deeper as the plant grows older, finally becoming brownish or blackish; the cells have their greatest length at right angles to the surface of the frond, being sometimes three times as long as wide. Farlow (4) 42. Hay & MacKay (1)

63. Bennett (1) 95. Martindale (1) 92. Collins (7) 246; (8) 45. *U. rigida* Harvey (2) 176. Murray (1) 260. Britton (1) 400. Saunders (1) 410. Exsicc. Amer. Algae, 124, 260; Phyc. Bor.-Am., 407.

Var. LATISSIMA (L.) DC., Fl. Fr., Vol. I, 9, 1805. Frond irregular in outline, soon becoming detached and passing most of its life in a floating condition; thinner than var. *rigida*, lighter colored, and with cells nearer square in cross section.

This is a common form of creeks and lagoons, where it forms floating sheets, often of several square meters in extent. It is doubtful if this variety corresponds with the *U. latissima* of Agardh; more probably both the varieties here given are included in the various forms given by him under *U. rigida*; his *U. latissima* is given as occurring only in the German Ocean and the Baltic, and, with some doubt, on the French coast and in the Mediterranean. It is not easy to find from his description just what the difference is between his *U. latissima* and his *U. rigida* "formae b, substantia tenuiores exsiccatione membranaceae." Collins (6) 77. Bennett (1) 95. Britton (1) 400. Martindale (1) 92.

Var. MESENTERIFORMIS (Roth) Collins (8) 45; *U. mesenteriformis* J. G. Agardh, Till Alg. Syst. part 3, 163, 1882; De Toni, Syll. Alg., Vol. I, 103, 1889. Frond much contorted and bullate, forming crumpled masses, lying loose on the bottom.

This form is strikingly distinct in appearance, forming much crisped and wrinkled masses, usually of a dark green color, lying on the bottom in creeks and quiet bays. It is so twisted and grown together that only by tearing can even a small piece of it be spread out flat. In cross section the cells are nearer square than those of the type. It is common in marshy ponds near Bridgeport, Conn., and will probably be found in similar places. Known elsewhere only in the Baltic.

2. U. CALIFORNICA Wille. Frond 1.5 to 2 cm. long, up to 1.5 cm. wide, triangular or reniform with wavy edge, sometimes with proliferations of a few cells each; passing quickly into a flattened tapering stipe. The cells of the stipe, which on the inner side of each layer form rhizoidal prolongations, are in cross section about quadrate, or a little longer tangentially. The cells in the upper part of the frond are, seen superficially, nearly isodiametric, somewhat irregular in form, with rounded corners; longer and shorter cells alternate, but the longitudinal series are quite inconspicuous. The upper part of the frond is about .03 mm. in thickness.

A species with minute fronds, with more definite outline than is usual in species of this genus. It is known only from Pacific Beach, San Diego County, California, where it is reported by Mrs. E. Snyder as forming a rather dense coating on rocks near high water mark. Exsicc. Phyc. Bor.-Am., 611.

3. U. FASCIATA Delile, Egypt, 153, Pl. LVIII, fig. 5, 1813; J. G. Agardh, Till Alg. Syst., part 3, 173, 1882; De Toni, Syll. Alg. Vol. I, 114, 1889. Frond divided into linear segments, margin smooth or undulate; in cross section the two layers of cells separate somewhat at the margin, which is rounded, with a small open space between the rows.

The structure of the frond in this species is similar to that of *U. Lactuca*, except the margin, which resembles *Enteromorpha Linza*; but the shape of the frond with definite linear divisions is quite distinct. These divisions may be dichotomous or apparently lateral; their width may vary from 5 mm. to 5 cm.; and the frond may reach a length of a meter; the margin may be quite smooth and even, or much crisped and undulate; in this it corresponds to forms of *Enteromorpha Linza*. Found on the east coast at Florida, and on the west coast along the whole of California: in warm waters all over the world. Harvey (1) 58; (2) 176. Farlow (2) 379; (3) 713. Hervey (1) 54. Anderson (1) 218. EXSICC. Phyc. Bor.-Am., 221.

Three forms of this species have been distinguished on the Pacific coast, passing into each other more or less.

Forma TAENIATA Setchell, Phyc. Bor.-Am., 862. Lobes slender and elongated, crisped and ruffled; prominent teeth on the margins near the base of the frond.

Forma LOBATA Setchell, Phyc. Bor.-Am., 863. Lobes shorter and broader, seldom crisped or ruffled.

Forma CAESPITOSA Setchell, Phyc. Bor.-Am., 809. Divisions numerous, irregular; fronds intricately entangled, forming a dense coating on the rocks.

MONOSTROMA Thuret.

Frond at first a closed tube or sac, which later opens or splits, forming a membranous expansion, of a single layer of cells, except at the base, where it is thickened, and may consist of several layers of elongated cells. Zoospores formed in any of the cells of the monostromatic part, issuing through an opening at the surface of the frond.

In some of the species of this genus the saccate form has not been observed, but it probably occurs in all. Its persistence varies much, from *M. latissimum*, in which the frond forms a flat expansion when only two or three mm. high, to *M. Groenlandicum*, in which the greater part of the frond continues tubular through its whole life, only the upper part opening at the time of the formation of the zoospores. Some of the smaller species do not exceed 1 dm. in length; others, like *M. Blyttii*, may reach 5 dm. It has representatives in all oceans, and several species inhabit by preference brackish water;

one species lives in fresh water exclusively, and some of the marine and brackish species occasionally occur also in fresh water.

About 30 species have been described, but the differences between some of them seem to be largely due to the age of the specimen or to local conditions; the following arrangement is based chiefly on Rosenvinge's work on the algae of Greenland, where this genus is given a careful study, based on an ample supply of living plants.

Key to the Species.

1. Frond always tubular 2
1. " tubular only in early stage of growth 3
2. Tube filiform 10. M. Groenlandicum
2. " intestine-like, collapsing 3a. M. articum var. intestiniforme
3. Frond in the full-grown plant with a long, slender stipe; membrane not over 10 μ thick 6. M. leptoderum
3. Frond never distinctly stipitate 4
4. Frond saccate for a considerable part of the growth of the plant; then splitting part of or all the way to the base 2. M. Grevillei
4. Frond saccate only in the very early stages or not at all 5
5. Frond dark or dull green, not gelatinous nor adhering to paper. 1. M. fuscum
5. Frond light or bright green, more or less gelatinous, adhering to paper 6
6. Mature frond divided into distinct segments 7
6. Frond from broadly lanceolate to orbicular; not divided into segments 8
7. Segments linear or lanceolate; frond about 6 μ thick above 4. M. pulchrum
7. " few, broad, of no fixed form; frond 25–45 μ thick; cells closely set 3. M. arcticum
7. Segments obovate, frond 18–36 μ thick; cells not closely set 7. M. crepidinum
8. Frond not over 30 μ thick 9
8. " 40–50 μ thick 5. M. undulatum
9. Frond usually not much plicate 10
9. " " much plicate 5a. M. undulatum var. Farlowii
10. Cells arranged in distinct groups of 4 9. M. quaternarium
10. " without order, or indistinctly in groups of 2, 3, or 4 8. M. latissimum

1. M. fuscum (Post. & Rupr.) Wittr., Monogr., 53, Pl. IV, fig. 13, 1866; J. G. Agardh, Till Alg. Syst., part 3, 113, 1882; De Toni, Syll. Alg., Vol. I, 109, 1889.

Frond membranaceous, at first tubular, soon splitting, dull or dark green, more or less lobed but not divided to the base; membrane 20–70 μ thick; cells 4–6 angled, very closely set; in cross section from square to vertically elongate, with only slightly rounded corners; occupying nearly the entire thickness of the membrane.

Under this species are included three which were formerly, and by some are still kept distinct; *M. fuscum* with frond of dull color, 20–35 μ thick and cells quadrate in cross section; *M. Blyttii* with deep green frond, blackish in drying, 60–70 μ thick and cells "pal-

isade form" in cross section; and *M. splendens* with deep green glossy frond, 50–55 μ thick, more deeply parted than the others, with cells similar to *M. Blyttii* or more rounded. These three forms pass into each other with no dividing line, while they are sharply marked off from all other species of the genus in nearly every respect. The very young plant is in the form of a closed tube, which soon splits down one side, and spreads out to form a flat membrane; not splitting into several segments, as in the *M. Grevillei* group.

Forma BLYTTII (*M. Blyttii*, Wittr., Monogr., 49, Pl. III, fig. 11, 1866) is common from Nahant northward and has been found at Newport, R. I., by Mrs. Simmons; it grows in tide pools, and also on pebbles in the sublitoral zone; at Revere Beach, Mass., great quantities are sometimes washed ashore by November storms, the stones on which they grew remaining attached to them. In Greenland it is reported as found from Jan. to March, and from May to Sept.; very young plants being found in June. On the Massachusetts coast it makes its appearance in Sept., and reaches its full development in Nov. and Dec. The thinner form which apparently should be considered the typical *M. fuscum* appears to be less common, but is found at Greenland and in Alaska. Plate 41, fig. 2, cross section; fig. 3, surface.

Forma SPLENDENS (*M. splendens* Wittr., Monogr., 50, Pl. III, fig. 12, 1866) occurs in the northern Pacific, in Bering Sea and vicinity, passing into forma *Blyttii*, which occurs nearly typical at Victoria, B. C., and in Washington.

In one form or another the species probably occurs throughout the Arctic Ocean. Kjellman (1) 299; (2) 54. Rosenvinge (1) 940, figs. 47–48; (2) 145, figs. 47–48; (3) 116. Collins (8) 44. Saunders (1) 409. *M. Blyttii* Farlow (4) 41; (5) 477. Collins (1) 70. Britton (1) 400. *M. splendens* Kjellman (2) 54. Setchell (1) 591. EXSICC. Phyc. bor.-Am., 715, 911; Alg. Am.-Bor., 98.

2. M. GREVILLEI (Thuret) Wittr., Monogr., 57, Pl. IV, fig. 14, 1866; J. G. Agardh, Till Alg. Syst., part 3, 101, 1882; De Toni, Syll. Alg., Vol. I, 103, 1889. Frond attached, at first saccate, then opening at the top, and ultimately splitting to the base; soft and delicate, pale green; membrane 15–20 μ thick, cells quadrate with rounded angles, closely set; in cross section horizontally oval, 12–14 μ high. Plate 41, fig. 4, cross section; fig. 5, surface.

The saccate form is plain in young plants, and may persist for some time when growing in still water; but at exposed points the frond is soon torn open, and in mature plants all trace of the original shape is lost, wherever growing. According to Rosenvinge, Grønlands Havalger, p. 948, the specimens from Greenland referred to *M. lubricum* Kjellman, in Algae Arctic Sea, p. 295, are *M. Grevillei*. *M. crassiusculum* Kjellman, Om Beringhafvets Algflora, p. 53, Pl. VII, figs. 13–15, seems from the description and figures to be hardly

distinct from *M. Grevillei*, or at most a variety characterized by the slightly thicker frond, with cells occupying considerably less than half the thickness of the frond in cross section. The species is common all along the Atlantic coast from Greenland (March to August) at least as far south as New Jersey (spring months), and has been found on the Pacific coast from Monterey to Alaska. It occurs throughout northern Europe. Farlow (4) 41. Pike (1) 106. Dame & Collins (1) 157. Martindale (1) 92. Rosenvinge (1) 946, fig. 50; (2) 149, fig. 50; (3) 117. Collins (8) 44. *Ulva Lactuca* Harvey (1) 60. Robinson (1) 166. Hervey (1) 54. Exsicc. Phyc Bor.-Am., 15.

Var. Vahlii (J. Ag.) Rosenvinge (1) 949; *M. Vahlii* J. G. Agardh, Till Alg. Syst., part 3, 109, Pl. III, figs. 84–89, 1882; De Toni, Syll. Alg., Vol. I, 106, 1889. Slenderer in form, often cylindrical, retaining its saccate shape longer, and with cells arranged in more or less distinct longitudinal series. Otherwise like the type. It occurs in Greenland and in Alaska, and has been found in the Mystic River marshes at Medford, Mass. At the Medford locality it was already formed when the ice broke up in the spring, and quite disappeared in April. It occurred in a ditch where the water remained with little change of level from tides; the conditions were changed by "improvements" several years ago, since which time the plant has not been seen. Rosenvinge (1) 949; (2) 151. *M. Vahlii* Dame & Collins (1) 157. Collins (4) 346; (8) 44. Saunders (1) 410.

3. M. arcticum Wittr. Monogr., 44, Pl. II, fig. 8, 1866; J. G, Agardh, Till Alg. Syst., part 3. 106, 1882; De Toni, Syll. Alg., Vol. I, 105, 1889.

Frond attached, at first saccate, soon splitting into a few broad laciniae; subradiately plicate, with crisped margin; pale green, becoming yellowish in drying; membrane 25–45 μ thick; cells 4–6 angled, closely set, irregularly placed; in cross section either horizontally or vertically oval, 10–30 μ high. Plate 41, fig. 6, cross section: fig. 7, surface.

A northern species, chiefly distinguished from *M. Grevillei* by the thicker frond, which is saccate only in the earliest stages, and afterwards appears as a rather broad membrane, not split up into narrow strips as is usual in *M. Grevillei*. Rosenvinge, who was familiar with it in Greenland, unites with this species three others, *M. saccodeum* Kjellm.; *M. cylindraceum* Kjellm.; and *M. angicavum* Kjellm.; and then reduces the whole to var. *arctica* of *M. Grevillei*. He says that it is impossible to draw the line between the forms with a thickness of 25 μ and those reaching 60 μ; or between those with cells in cross section horizontally oval and those vertically oval. In forms so closely related and passing into each other so much as do the forms of *Monostroma*, it is more a matter of personal pref-

erence or of convenience than anything else, whether the forms are distinguished as marked varieties or nearly allied species; the seven forms united by Rosenvinge are here divided into two groups, one included as varieties under *M. Grevillei*, the other as *M. arcticum*; it seems more convenient to keep apart forms such as *M. angicavum* with very thick membrane and large, vertically elongate cells, and the thin membraned typical *M. Grevillei*, with small, horizontally elongate cells. All the forms mentioned are found in Greenland, but are not recorded farther south on this coast; they occur also in northern Norway; the type is found in Alaska. Kjellman (1) 299. *M. Grevillei* var. *arctica* Rosenvinge (1) 949, fig. 51; (2) 152, fig. 51. *M. saccodeum* Kjellman (1) 296, Pl. XXVIII, figs. 1–10. *M. cylindraceum* Kjellman (1) 295, Pl. XXX. *M. angicavum* Kjellman (1) 297, Pl. XXIX. EXSICC. Phyc. Bor.-Am., 910.

Var. INTESTINIFORME Rosenv. (1) 153, 1893. Frond tubular, up to 50 cm. long; membrane 25–50 μ thick; cells rounded, closely set, vertically oval in cross section, 15–20 μ high; usually arranged in more or less distinct series longitudinally.

This variety resembles in habit *M. Grevillei* var. *Vahlii*, but is more persistently tubular, and except by careful examination of its structure, is liable to be mistaken for *Enteromorpha intestinalis*. It is found in Greenland. Rosenvinge (1) 953, fig. 52: (2) 153, fig. 52.

4. M. PULCHRUM Farlow (4) 41, 1881; J. G. Agardh, Till Alg. Syst., part 3, 104, 1882; De Toni, Syll. Alg., Vol. I, 110, 1889. Frond dividing into linear or lanceolate segments with slender base, much crisped at the margin, light green, membrane about 6 μ thick in upper part, up to 15 μ near base, cells roundish, rather irregular in form. Plate 41, fig. 8, cross section; fig. 9, surface.

A beautiful species, extremely delicate, adhering so closely to paper when mounted that it is almost impossible to detach it for examination. It occurs on rocky shores, usually epiphytic on other algae, and is found from April to June on the New England coast, where it occurs as far south as Newport, Rhode Island, and north to Newfoundland.

Foslie and Rosenvinge include *M. pulchrum* under *M. undulatum*, as var. *Farlowii*, Foslie; but this is probably incorrect. It may be that specimens of the latter variety have been distributed under the name of *M. pulchrum*, as there is some external resemblance between them. The latter is, however, more delicate and is usually divided so as to resemble a tuft of fronds of *Enteromorpha Linza*, with narrow tips, the edges much crisped and wavy; while the former has a generally rounded and fan-like outline, the plications long and radiating from the base to the margin. Both, however, vary considerably, and forms can be found which it would be hard to distinguish by external characters. Even if we accept the statement of J. G.

Agardh that the *Ulva Lactuca* of Linnaeus and his immediate successors was a *Monostroma*, with delicate and much divided frond; and that it is the plant distributed as No. 121 of Areschoug, Alg. Scand. Exsicc.; it still remains unlikely that Farlow's *M. pulchrum* is the same plant, as suggested by Agardh. Both Areschoug's plant and a specimen of *M. Grevillei* forma *Lactuca* from Flensburg, determined by Hauck, are relatively coarse plants beside *M. pulchrum*. To appreciate the extreme delicacy of typical forms of the latter, one must have collected it; it requires as careful handling as the tenderest *Callithamnion*. Reinbold, Chlorophyceen der Kieler Fohrde, p. 124, says of *M. Lactuca*, comparing it with *M. Grevillei*, "Thallus rigider, nicht so schlüpfrig," which is by no means the case with *M. pulchrum*. In structure the European specimens referred to come quite near to *M. Grevillei*, but not to *M. pulchrum*. While it is probable that this species is saccate in its early stages, I know of no observation of such a state. Farlow (4) 41. Bennett (1) 95. Collins (8) 44. Exsicc. Phyc. Bor.-Am., 658. Alg. Am.-Bor., 217.

5. M. UNDULATUM, Wittr.. Monogr., 47, Pl. III, fig. 9, 1866; De Toni, Syll. Alg., Vol. I., 105, 1889. Frond membranaceous, soft and flaccid, with strongly undulate margin; 40–50 μ thick; cells angular, closely set, showing somewhat of an arrangement in twos, threes, and fours; in cross section about 20 μ high, semicircular or oval; the chromatophor not occupying the full height of the cell; not over 10 μ in the middle. Plate 41, fig. 12, cross section; fig. 13, surface.

The typical form, described from Norway, has been found once in Greenland by Rosenvinge; the frond is thicker than in any other species but *M. fuscum*, which is not liable to be mistaken for it, being amply distinct by its color and consistency. Kjellman (1) 295. Rosenvinge (1) 945; (2) 149; (3) 117.

Var. FARLOWII Foslie, Contrib. I, 114, 1891, excl. syn. Frond similar to the type, but less than 30 μ thick.

Foslie and Rosenvinge consider this as identical with *M. pulchrum* Farlow; but this appears to be a misapprehension, the latter being much thinner, with more slender and pointed segments or fronds. Greenland, Rosenvinge; Newfoundland, Holden; Marblehead, Collins. Found also in northern Norway. Rosenvinge (1) 945; (2) 149; both excl. syn. Collins (8) 44. Exsicc. Phyc. Bor.-Am., 406.

6. M. LEPTODERMUM Kjellm., Algenv. Murmanschen Meeres, 52, Pl. I, figs. 23–24, 1874; De Toni, Syll. Alg., Vol. I, 109, 1889. Frond cuneate-obovate, passing by a narrow base into a tubular, filiform stipe; the flat part of the frond usually entire, with a more or less undulate margin; often twisted below. Cells in the tubular part arranged in longitudinal series, closely set, angular; in flat part similar but smaller: membrane 7–10 μ thick, cells in cross section quadrate or rectangular, 5–8 μ high. Plate 41, fig. 10, cross section; fig. 11, surface.

This species has the most delicate frond of all in the genus, except *M. pulchrum*. It is found in Greenland in many places, growing below low water mark or in pools. It occurs also in Nova Zembla. In young plants the filiform stipe is short and inconspicuous; it appears to continue growing during the life of the plant, reaching a length of two or three cm. Plants collected by the writer at Nahant in June, 1882, and at Cohasset, Mass., in April, 1883, have the membranous part of the frond the same as in Greenland specimens; the stipe, however, is quite inconspicuous. They would seem to belong to this species, possibly imperfectly developed from being so far south of its ordinary range. Apart from the stipe, the chief characters are the thinness of the frond, approached only by *M. pulchrum*; and the squarish cells, regularly arranged, almost like a *Prasiola*. *M. zostericolum* Tilden, American Algae, No. 388, seems to be identical with the plant from Cohasset. As Rosenvinge notes that young plants with very short stipe grew in company with older, long-stiped individuals, it would seem better to include all the forms in question under *M. leptodermum*, without distinction, even as form. Rosenvinge (1) 944, fig. 49; (2) 149, fig. 49; (3) 117. Collins (8) 44.

7. M. CREPIDINUM Farlow (1) 14, 1881; J. G. Agardh, Till Alg. Syst., part 3, 101, 1882; De Toni, Syll. Alg., Vol. I., 103, 1889. Frond delicate, light green, 5–15 cm. long, flabellately orbiculate, when fully developed split nearly or quite to the base, segments obovate; membrane 18–36, rarely 45 μ thick; cells roundish-angular, when actively dividing forming compact groups of 2, 3, or 4, separated by rather wide spaces. Plate 41, fig. 14, cross section; fig. 15, surface.

One of the smaller species of the genus, confined to the Atlantic Coast of the United States, on which it is rather common from Cape Cod to New Jersey, and found also at Salem harbor, Mass. A favorite habitat seems to be on woodwork between tide marks, but it also grows on rocks; it is usually in rather dense tufts, which have a rich dark green color, though the individual frond is light green. It is found in spring and summer. The form varies from a flat, roundish, undivided frond, slightly lobed at the margin, to a frond cut nearly to the base into several segments, and radially much plicate. Under the microscope, there usually appear several quite distinct starch granules in each cell. Farlow (4) 42. Collins (1) 70; (3) 310; (6) 77; (8) 44. Martindale (1) 92. Britton (1) 400. EXSICC. Phyc. Bor.-Am., 229. Alg. Am.-Bor., 174.

8. M. LATISSIMUM (Kütz.) Wittr., Monogr., 33. Pl. I, fig. 4, 1866. J. G. Agardh., Till Alg. Syst., part 3, 99, 1882; De Toni, Syll. Alg., Vol. I, 102, 1889. Frond at first attached, afterwards floating, thin and soft, glossy, of irregular shape, more or less plicate near the even or undulate margin; membrane 20–25 μ thick, cells 4–6 cornered or roundish, closely set, without order or more or less distinctly in twos, threes or fours; in cross section vertically oval or

nearly circular, 14–18 μ high. Plate 41, fig. 18, cross section; fig. 19, surface.

Apparently not uncommon in quiet waters, especially in ditches in marshes, where the water is sometimes brackish rather than salt. At first it is attached to various objects, but soon becomes loosened and floats freely, sometimes in such abundance as to quite fill a ditch from bottom to surface. It appears in spring, and continues, chiefly in the floating state, through the summer. The color is a quite rich green in the young plant, usually paler in the older, floating individuals. The arrangement of cells varies in plants from the same locality, and even in different parts of the same frond; in some cases the arrangement of cells in twos and fours is very like *M. quaternarium* but the New England plant probably is all *M. latissimum*. The cells are usually said to be vertically elongate in cross section; but this is true only in a general way, as individual cells, and sometimes a considerable proportion of the whole, have their longer axes parallel to the surface of the frond; indeed, the shape of the cells, whether seen from above or in cross section, is liable to vary in any species of *Monostroma*, or in different stages of growth of the individual. From Maine to Florida; Washington and Alaska; shores of Europe, Africa, New Zealand. Dame & Collins (1) 158. Collins (4) 341; (8) 44. Exsicc. Phyc. Bor.-Am., 14.

9. M. QUATERNARIUM (Kütz.) Desmaz., Plantes Crypt. de France, Nouvelle Série, 603; Wittr., Monogr., 37, 1866; J. G. Agardh, Till Alg. Syst., part 3, 98, 1882; De Toni, Syll. Alg., Vol. I, 100, 1889. Frond at first attached, soon becoming free, soft and delicate, irregularly lobed and folded, 20–23 μ thick; cells rounded, when actively dividing set closely in threes and fours within the mother cell wall; in cross section semicircular or oval, 15–17 μ high. Plate 41, fig. 16, cross section; fig. 17, surface.

As was noted under *M. latissimum*, that species is very near *M. quaternarium*, and as far as New England specimens are concerned, it is impossible to draw the line. Specimens from California, however, all as far as seen distinctly show the arrangement in threes and fours, and more plainly than do any eastern specimens.

Besides occurring in salt water at Santa Cruz, California, it is found in quite fresh water in the interior of the state, at Santee, by Miss Minnie Reed, and was collected by Dr. Sereno Watson at 2000 meters elevation in the Diamond mountains, Nevada. It occurs in various parts of Europe. I am indebted to Dr. George T. Moore of the U. S. Department of Agriculture for the opportunity to examine an authentic specimen of *Ulva merismopedioides* Wood, collected by Dr. Watson in connection with the U. S. Geological Exploration of the Fortieth Parallel. It is undoubtedly *M. quaternarium*, and as the cells are actively dividing, the quaternate character is very marked. Anderson (1) 218. *Ulva merismopedioides*, Wood (1) 182. Exsicc. Phyc. Bor.-Am., 567.

10. M. GROENLANDICUM J. G. Agardh, Till Alg. Syst., Part 3, 107, Pl. III, Figs. 80–83, 1882; De Toni, Syll. Alg., Vol. I, 106, 1889.

Frond filiform, tubular, cylindrical, up to 15 cm. long, from a very slender base expanding to 1 mm. diameter; apex broken only after exit of zoospores. Cells in the lower part of the frond loosely arranged in twos and fours, roundish angular; in the upper part more evenly distributed, more or less closely set. In cross section the membrane is 25–35 μ thick; the cells radiately elongate, 2–4 times as long as broad; in the younger parts the central cavity is filled with a gelatinous substance, which disappears as the plant becomes older. Zoospores formed first at the summit of the frond, and developing successively in lower cells. Plate 41, fig. 20, cross section; fig 21, surface.

This plant has no external resemblance to a *Monostroma*, and was placed in this genus with a mark of doubt by both Farlow and Rosenvinge. It appears like a slender unbranched *Enteromorpha*, but seems, however, to be in structure more nearly related to *Monostroma*. It has been found at Nahant and Swampscott on the Massachusetts coast; at Newfoundland; at several places in Greenland and in Alaska. It occurs from April to June in New England; in July at Newfoundland; and from May to August in Greenland. At Nahant, it grows in rather dense tufts, at the lower limit of the litoral zone, in company with *Cladophora arcta*, *Bangia fusco-purpurea*, *Urospora penicilliformis*, etc. Rosenvinge (1) 954, fig. 53; (2) 155, fig. 53; (3) 117. Saunders (1) 410. Collins (8) 44. Exsicc. Phyc. Bor.-Am., 13. *M. Collinsii* Alg. Am.-Bor., 216, without description.

ENTEROMORPHA Link.

Frond originating in a single series of cells, which by repeated division form a tubular frond, the membrane of which consists of a single layer of cells; in some of the simpler species the tubular stage is not reached, and the frond in the adult state consists of two or a few series of cells, united without any interior open space. All the cells of the frond, except the lowest, capable of producing zoospores, which are discharged through an opening in the cell wall.

A large genus, at least 50 species having been described, of which a part will probably be united with other species. It is connected with *Ulva* by *E. Linza*, in which the tube is compressed, and the membranes united in the median part; on the other hand, *Monostroma Groenlandicum* is hardly to be distinguished from some of the simple filiform species of *Enteromorpha*. *E. intestinalis* is found the world over, and other species are very widely distributed. They are found not only in the sea, but also about salt springs and salt mines; they abound in brackish, and are occasionally found in quite fresh water.

The specific distinctions are not always clearly marked, but that is to be expected in a genus of this extent, where the characters available for specific distinctions are so few. In the following arrangement J. G. Agardh's classification is pretty nearly followed, and a few more species are recognized than are allowed in Rosenvinge's work. Though perplexing intermediate forms will undoubtedly be found, it is thought that the type of each species will be found fairly distinct.

Key to the Species.

1. Frond flat, the membranes free at the margins but united between — 7. E. Linza
1. Frond of one to a few series of cells, not tubular — 2
1. Frond tubular — 3
2. Frond simple — 12. E. percursa
2. Frond branched — 14. E. cruciata
3. Cells not arranged in longitudinal series except in the very youngest parts — 4
3. Cells more or less in longitudinal series, usually in the greater part of the frond — 9
4. Cells of new generation in twos, threes and fours in the wall of the mother cell — 2. E. fascia
4. Mother cell wall not persisting after division — 5
5. Frond with short, spine-like ramuli, in addition to branches — 19. E. acanthophora
5. Frond with more or less plentiful branches — 6
5. Frond simple or with a few proliferations — 7
6. Frond with flattened rachis branching from the margin — 1a. E. micrococca var. subsalsa
6. Frond filiform; branches with contracted base, expanding upwards — 9. E. compressa
7. Cells 10–16 μ in diam.; frond usually inflated and constricted; often of large size — 6. E. intestinalis
7. Cells 4–8 μ diam.; fronds usually only 1–5 cm. long — 8
8. Frond 8–10 μ thick; cells 5–7 μ diam. — 8. E. minima
8. Frond 15–20 μ thick; cells 4–5 μ diam. — 1. E. micrococca
9. Frond simple, inflated and flexuous — 3. E. flexuosa
9. Frond simple or with occasional proliferations; not inflated — 10
9. Frond regularly branched — 11
10. Frond narrowly linear, strongly compressed — 10. E. marginata
10. Frond filiform, 2–8 cells wide, tubular only in the widest parts; branches 2 cells wide — 13. E. torta
10. Frond filiform, tubular, of uniform diameter; of numerous series of squarish cells — 4a. E. prolifera var. tubulosa
11. Frond beset with numerous short thorn-like branches — 5a. E. salina var. polyclados
11. Branches proliferous, similar to main filament — 4. E. prolifera
11. Branches proliferous, of two or sometimes one series of cells — 5. E. salina
11. Branches of successive orders, tapering from base to apex — 12
12. Chromatophor filling cell — 13
12. Chromatophor not filling cell, giving a net-like appearance — 14
13. Ultimate ramuli short, spine-like, not monosiphonous 18. E. ramulosa
13. Ultimate ramuli of a single series of cells — 11. E. crinita

13. Ultimate ramuli polysiphonous, of a few, symmetrically placed series of cells — 16. E. ERECTA
    14. Ultimate ramuli of a single series of cells — 15. E. HOPKIRKII
    14. Ultimate ramuli not of a single series of cells — 17. E. CLATHRATA

1. E. MICROCOCCA Kütz., Tab. Phyc., Vol. VI., 11, Pl. XXX, fig. 2, 1856; J. G. Agardh, Till Alg. Syst., part 3, 123, 1882; De Toni, Syll. Alg., Vol. I., 118, 1889. Fronds 1–5 cm. long, 1–5 mm. wide, tubular or compressed, simple or slighly proliferous, much curled and twisted; cells angular, 4–5 μ diam., in no definite order; thickness of membrane, 15–20 μ. Plate 42, fig. 1, surface; fig. 2, cross section.

The smallness of its cells distinguishes it from all our species but *E. minima*, in which the dimensions are only slightly larger; but the latter has a very thin and delicate membrane, while in *E. micrococca* it is relatively quite thick, the thickening being specially pronounced on the inner side. This gives it a coarser feeling to the touch than has *E. minima*. It is common from Marblehead, Mass., north; its favorite habitat on the New England coast appears to be the surface of shaded steep or vertical cliffs, especially where the flow or drip of fresh water keeps it continually moist; it has been found in Alaska; also on the Atlantic and Mediterranean shores of Europe. Collins (4) 336; (7) 245; (8) 44. Saunders (1) 411. *E. intestinalis* var. *micrococca*, Rosenvinge (1) 957, fig. 54; (7) 157, fig. 54. EXSICC. Phyc. Bor.-Am., 66.

Var. SUBSALSA Kjellm. (1) 292, Pl. XXXI, figs. 1–3; De Toni, Syll. Alg., Vol. I, 120, 1889. Rachis flattened, with numerous patent branches from the edges; much twisted and contorted; color, dark green.

Reported by Kjellman from the west coast of Greenland, and from various localities in the European Arctic Sea; Rosenvinge raises some doubt as to the identity of the Greenland plant. Its habitat in the Arctic regions is in lagoons; at Cambridge, Mass., Setchell found what is apparently the same plant, growing in muddy places in Charles River marshes. It also occurs on the west coast at Washington. Collins (8) 44. EXSICC. Phyc. Bor.-Am., 467.

2. E. FASCIA Post & Rupr. (1) 21; J. G. Agardh, Till Alg. Syst., part 3, 125, 1882; De Toni, Syll. Alg., Vol. 1, 120, 1889. Frond elongate, tubular-compressed, from a slender stipe, sparingly branched; cells 4–6 x 6–8 μ, roundish-angular, in no apparent order, often containing 2–4 daughter cells.

In the form of the frond not unlike *E. intestinalis*, but with a different arrangement of cells, somewhat recalling *Ilea fulvescens*. The latter, however, is much softer and more gelatinous, and the cells are arranged in longitudinal series, and more symmetrical in all respects. The characteristic arrangement of cells is not always distinct, and in its absence this species is not easily distinguished

from *E. intestinalis*. It occurs on both shores of the Bering Sea. Kjellman (2) 52.

3. E. FLEXUOSA (Wulf.) J. G. Agardh, Till Alg. Syst., part 3, 126, 1882; De Toni, Syll. Alg., Vol. I, 121, 1889. Frond cylindrical, tubular, simple, tapering to a filiform stipe below, above inflated, flexuous and intestine-like; cells 6–8 x 8–12 μ, roundish polygonal, in longitudinal series; membrane somewhat thickened on the inside; chromatophor filling the thick walled cell. Plate 42, fig. 3, surface.

This is a southern species, and on our Florida shores appears to take the place of *E. intestinalis* in the north. From the latter it differs in having somewhat smaller cells, arranged in regular series; also somewhat more delicate membrane. From *E. compressa* it is also distinguished by the arrangement of the cells, and its habit is dissimilar; from both these species it differs in having a thicker wall between the cells. It seems to be common in Florida, and occurs on the west coast at Santa Barbara and San Diego. Warmer temperate regions of the world. Exsicc., Phyc. Bor.-Am., 462.

4. E. PROLIFERA (Fl. Dan.) J. G. Agardh, Till Alg. Syst., part 3, 129; Pl. IV, figs. 103 and 104, 1882; De Toni, Syll. Alg., Vol. I, 122, 1889. Frond up to several meters long, and 2 cm. diameter, tubular or compressed, with more or less abundant proliferous branches, which are usually simple, but sometimes also proliferous; branches varying much in length and diameter; cells 10–12 μ, in the younger parts always arranged in longitudinal series, which become less distinct in the older parts; membrane 15–18 μ thick, not much exceeding the dimensions of the cells in cross section. Plate 42, fig. 5, surface.

A common species, formerly included in *E. compressa* or *E. intestinalis*, to the former of which it is most allied, but from which it differs in the longitudinally seriate cells, very manifest in the younger portions, and disappearing only in the quite old parts. In habit it is very variable, from slender, slightly branched forms, only a few cm. long, to richly and repeatedly branched fronds; branches sometimes long and slender, sometimes short and very densely set, sometimes long and short intermingled quite without order. In one form there is a stout main stem, from which smaller proliferous branches issue at nearly right angles, reminding one of some coniferous trees. It appears to prefer somewhat sheltered localities, where it is not left bare for any considerable time at low tide. It is reported from Greenland, and as far south as New Jersey; as Agardh reports it from the West Indies, it probably occurs along the whole Atlantic coast. It has been found only at Alaska on the west coast, but probably occurs at other localities. It occurs in brackish water in South Dakota, (Saunders) and in fresh or very slightly brackish at Los Angeles, California, (Miss Monks). It is found along all the shores of Europe, and in fresh water in several European countries.[1] Rosen-

[1] E. LINGULATA J. G. Agardh, Till Alg. Syst., part 3, 143, 1882. "Tufted, grass-green, delicately membranacous, tubular, membrane somewhat collapsing in

vinge, (1) 960; (2) 158; (3) 118. Collins (8) 44. Saunders (1) 411. EXSICC. Phyc. Bor.-Am., 610, 913; Amer. Algae, 127, 264, 265 (as *E. compressa*), 128 (as *E. clathrata*), 385.

Var. ARCTICA (J. Ag.) Rosenv. (1) 960; (2) 158. *E. arctica*, J. G. Agardh, Till Alg. Syst., part 3, 124, Pl. IV, figs. 100–102, 1882; De Toni, Syll. Alg., Vol. I, 120, 1889. Cells smaller and rounded, membrane 20–30 μ thick, cells 10–14 μ in cross section, usually longer than broad, sometimes double their breadth. Occurs Greenland to Spitzbergen.

Var. TRABECULATA Rosenv. (1) 961, fig. 55; (2) 159, fig. 55. Slenderer than the type, with long capillary branches; the central cavity traversed by transverse and oblique "trabeculae." Greenland.

Var. TUBULOSA (Kütz.) Reinbold, Chlorophyceen der Kieler Fohrde, 117, 1889; *E. tubulosa*, J. G. Agardh, l. c., 128, 1882; De Toni, l. c., 122, 1889. Slender, slightly branched, of nearly uniform size throughout. In ditches in salt marshes, Revere, Mass.; Great Salt Lake, Utah; Baltic and German Seas. EXSICC. Phyc. Bor.-Am., 471; Amer. Algae, 262.

5. E. SALINA Kütz., Phyc. Germ., 247, 1845; De Toni, Syll. Alg., Vol. I, 136, 1889. Frond filiform, tubular, with a few branches, which are sometimes opposite, of two or more rows of cells, or in the youngest of a single series; cells quadrangular, 14–16 μ square, or slightly longer than broad, in longitudinal series throughout; membrane thickened on both sides.

The slender fronds with relatively large cells in longitudinal series distinguish this species with tolerable distinctness from any others within our limits. It was found by De A. Saunders at Lake Pontchartrain in Louisiana, and by Mrs. Curtiss in Florida. Found in the Baltic and near salt mines in the interior of Europe. EXSICC. Phyc. Bor.-Am., 859.

Var. POLYCLADOS Kütz., Phyc. Germ., 246, 1845. Filaments beset with more or less numerous short, horizontal, spine-like ramuli. Occurring in a brackish ditch at Key West, Florida; collected by Farlow.

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drying, below densely branched, branches ascending, somewhat dilated from a narrow base, simple, long, apparently lingulate; cells subquadratically rounded, forming longitudinal series through nearly the whole length of the frond; endochrome rounded, occupying nearly the whole space of the cell. Atlantic shores of Europe and America; in the Gulf of Mexico."

The above is translated from the original description; the species does not appear to have been recognized by American algologists. At Marblehead, Mass., a form occurs which agrees very well with the *E. lingulata* of Hauck, in Phycotheca Universalis, No. 14; but Bornet, comparing this with an authentic specimen from Agardh, considers Hauck's plant to belong to a different species. See Bornet, les Algues de P.-K.-A. Schousboe, p. 199. It is possible that Agardh's plant may have been included here in *E. prolifera*; there is no very sharp line drawn in the descriptions.

6. E. INTESTINALIS (L.) Link, Epist. in Hor. Phys. Berlin, 5, 1820; J. G. Agardh, Till Alg. Syst., Part 3, 131, Pl. IV, Fig. 109, 1882; De Toni, Syll. Alg., Vol. I. 123, 1889. Frond simple or having at the base a few branches similar to the main frond, or occasionally a few proliferations above; length varying from a few centimeters to several meters; diameter from 1–5 cm.; at first attached by a short cylindrical stipe, but soon detached and floating; cylindrical or expanding above, more or less inflated, often much crisped and contorted, and irregularly and strongly constricted; cells 10–16 μ diam., in no regular order; thickness of membrane varying from 50 μ below to 20 μ above; cells in cross section from 12 to 30 μ. Plate 42, Fig. 6, surface; fig. 7, cross section.

A common and exceedingly variable species, occurring throughout our limits except on the southern Atlantic coast, where *E. flexuosa* appears to take its place. There are many intermediate forms that connect it with *E. compressa*, but in its typical form it is distinguished by the internally thickened membrane, and by the intestinal appearance, which is indicated by both its generic and its specific name. It is especially a plant of quiet waters, where it sometimes attains enormous dimensions. Europe, West Brazil, Indies, Japan. Harvey (1) 57, in part. Eaton (1) 348. Farlow (1) 292; (2) 378; (3) 712. Wood (1) 183. Robinson (1) 166. Hervey (1) 50. Hall (1) 112, in part. Rosenvinge (1) 957; (2) 157; (3) 117. Collins (7) 245; (8) 44. Saunders (1) 411. *Ulva Enteromorpha* var. *intestinalis* Farlow (4) 43. Hay & MacKay (1) 63. Collins (4) 310; (6) 77. Dame & Collins (1) 157. Bennett (1) 95. Martindale (1) 92. Howe (1) 67. EXSICC. Phyc. Bor.-Am., 464. Amer. Algae, 263.

Among the many forms of this species which have been described, the following have been recognized in America.

Forma CYLINDRACEA J. G. Agardh, Till Alg. Syst., part 3, 131, 1882. Frond long and slender, of uniform diameter. Newport, R. I., Bridgeport, Conn., floating unattached. Saunders (1) 411. Collins (8) 44. EXSICC. Phyc. Bor.-Am., 465: Amer. Algæ, 126.

Forma CLAVATA J. G. Agardh, l. c. 131. Frond attached, clavate, from a filiform stipe, usually more or less contorted. Cutler, Maine; Alaska. EXSICC. Phyc. Bor.-Am., 966.

Forma MAXIMA J. G. Agardh, l. c. 132. Frond floating, unattached, inflated and bullate. In quiet waters, Mass., Conn., N. J., Alaska. Saunders (1) 411. Collins (8) 44.

Forma **tenuis** n. f. Membrane thin and delicate, not thickened within. Artesian running water, Redfield, So. Dakota. Amer. Algae, 125. In size and shape of cells and in habit of frond, this form agrees with forma *clavata* of the coast. The difference in the character of the membrane may be due to the peculiar station.

7. E. LINZA (L.) J. G. Agardh, Till Alg. Syst., part 3, 134, Pl. IV,

figs. 110–112, 1882; De Toni, Syll. Alg., Vol. I, 124, 1889. Frond lanceolate or linear-lanceolate, simple, 1–5 dm. long, 1–20 cm. broad; stipe short, hollow; upper part of the frond flat, the membranes grown together, as in *Ulva*, except at the edges, where they remain free. Plate 42, fig. 8, cross section of margin.

Forma CRISPATA, edges much crisped and folded.

Forma LANCEOLATA, edges even or plicate, not crisped.

These two forms are taken as defined by Agardh, l. c., and in one form or another this species seems common along the whole Atlantic coast from Maine to Florida, and is reported on the Pacific coast from Bering Straits to Santa Barbara, Cal. It grows on stones, woodwork and other algae, usually in places seldom or never left bare by the tide. The smaller forms look like forms of *E. intestinalis*, but in the latter the frond, though often collapsed, is tubular throughout; in *E. Linza* the two membranes adhere, except at the edges, where there is a narrow open space, around which the cells are arranged, in cross section nearly in a circle. Europe, West Indies, Brazil, Peru, Tasmania. Kjellman (2) 53. Collins (7) 245; (8) 44. Saunders (1) 410. *Ulva Linza* Post. & Rupr. (1) 21. Hooper (1) 30. Harvey (1) 59; (2) 176. Kemp (1) 41. Farlow (1) 292; (2) 379. Hall (1) 112. Anderson (1) 218. Fowler (1) 48. *U. Enteromorpha* var. *lanceolata* Farlow (4) 43. Pike (1) 106. Hay & MacKay (1) 63. Collins (3) 310. Dame & Collins (1) 157. Bennett (1) 95. Britton (1) 400. Martindale (1) 92. *U. latissima* var. *Linza* Hervey (1) 53. EXSICC. Phyc. Bor.-Am., 16, 967; Amer. Algae, 384.

8. E. MINIMA Näg. in Kütz., Sp. Alg., 482, 1849; J. G. Agardh, Till Alg. Syst., part 3, 135, 1882. Frond 1–10 cm. long, 1–5 mm. broad, simple or slightly proliferous, soft and delicate, membrane 8–10 μ thick, cells angular, 5–7 μ diam. arranged in no definite order. Plate 42, fig. 9, surface; fig. 10, cross section.

A small species, resembling *E. compressa*, but smaller in dimensions of fronds and size of cells. It is probably common, but is easily overlooked among the larger and better known species of the genus. The extreme thinness of the frond gives it a very soft and delicate feeling to the touch, which is the best character by which to recognize it when growing. It seems to grow mostly in the lower half of the litoral zone. At Southwest Harbor, Mount Desert Island, Maine, it grew in abundance on woodwork of weirs, etc.; at Spectacle Island, Penobscot Bay, on rock; at Bridgeport, Conn., on rocks, *Fucus*, *Spartina*, etc., on a muddy shore; at San Francisco, California, on rocks at high water mark. Found also at Vancouver and Alaska; North Atlantic, Mediterranean, South Pacific. Collins (5) 458; (8) 44. *E. intestinalis* var. *minima* Rosenvinge (1) 959; (2) 159. EXSICC., Phyc. Bor.-Am., 468, 912.

Forma RIVULARIS Collins, has a pale color, fronds half a meter in length, and substance more gelatinous than the type. These differ-

ences are probably all due to its place of growth, — running fresh water, Alaska. Exsicc., Phyc. Bor.-Am., XXVI; Amer. Algae, 261, as *E. micrococca*.

Forma GLACIALIS Kjellman, Algenv. Murm. Meeres, 50, 1877. Frond 9–13 μ thick, cells 5–8 μ diam.: forming a dense coating on rocks covered only at high tide, and at other times wet with water from melting ice. Greenland. Rosenvinge (1) 959; (2) 159.

9. E. COMPRESSA (L.) Grev., Algae Brit., 180, Pl. XVIII, 1830, excl. var.; J. G. Agardh, Till Alg. Syst., part 3, 137, 1882; De Toni, Syll. Alg., Vol. I, 126, 1889. Frond tubular, more or less compressed, sometimes constricted, varying much in dimensions, simple or slightly branched; branches usually simple, cylindrical or expanding above, in either case narrowed at the base, similar in appearance to the main frond; cells in no definite order; membrane rather thin. Plate 42, fig. 11, surface; fig. 12, cross section.

A very variable species, but now understood in a narrower sense than formerly, and including only forms with branches contracted at the base and expanded upwards, with cells about 10–15 μ diam., arranged in no definite order and with membrane not thickened. It occurs all along the Atlantic coast, and from Alaska to San Francisco. In New England it appears to be one of the less common species. Europe, Brazil, West Indies, Sandwich Islands, Tasmania. Farlow (1) 292; (2) 378; (3) 712. Robinson (1) 166. Kjellman (2) 52. Collins (1) 245; (8) 44. *Ulva compressa* var. *racemosa* Kjellman (2) 52. *U. Enteromorpha* var. *compressa* Farlow (4) 43. Dame & Collins (1) 157. Collins (6) 77. *Enteromorpha intestinalis* var. *compressa* Rosenvinge (1) 958; (2) 158. Exsicc., Phyc. Bor.-Am., 964.

Forma SUBSIMPLEX J. G. Agardh, Till Alg. Syst., 137, 1882. Frond hardly branched, of uniform diameter. So. Harpswell, Maine. Exsicc., Phyc. Bor.-Am., 964.

10. E. MARGINATA J. G. Agardh, Alg. Med., 16, 1842; Till Alg. Syst., part 3, 142, 1882; De Toni, Syll. Alg., Vol. I, 127, 1889.

Frond filiform, compressed, simple or with a few short proliferous branches; cells 4–8 μ diam., squarish, arranged in longitudinal series, very distinctly in the two or three rows at each side, less so in the middle portion. Plate 42, fig. 13, surface.

A small species and apparently not common. It occurs on stems and roots of *Spartina*, etc., at Quincy and Weymouth, Mass., Newport, R. I., Bridgeport, Conn., and Atlantic City, New Jersey. Inland at Great Salt Lake, Utah. The color is usually quite a deep green; the fronds are comparatively narrow, seldom over 15–20 cells wide, and the width continues quite uniform throughout a filament, the margin being straight and even. Usually the fronds are simple, but occasionally one finds a few proliferous branches. Mediterranean. *Ulva marginata* Packard (1) 702. Collins (2) 131; (3)

310; (8) 44. Martindale (1) 93. Britton (1) 400. EXSICC., Amer. Algae, 266; Phyc. Bor.-Am., 466.

11. E. CRINITA (Roth) J. G. Agardh, Till Alg. Syst., part 3, 145, 1882; De Toni, Syll. Alg., Vol. I, 129, 1889.

Frond filiform, cylindrical or compressed, much and repeatedly branched, the branches tapering, the smallest usually of a single series of quite short cells; cells almost always in longitudinal series, often rounded, nearly or quite filled by the chromatophor. Plate 42, fig. 14, surface view with monosiphonous branch.

In habit this species is much like *E. clathrata*, especially the var. *prostrata*; but the latter lacks the short-celled monosiphonous ramuli; monosiphonous ramuli are found in *E. Hopkirkii*, but the net-like cells of the latter are quite distinct from the cells of *E. crinita*, which resemble those of *E. prolifera*, though somewhat smaller. Their typical forms are of different habit; intermediate forms are, however, provokingly common. It occurs along the New England coast and from San Francisco, Cal., to Alaska; according to Agardh, in the Gulf of Mexico; it probably extends over the coasts of both sides of the continent; Atlantic shores of Europe; Red Sea. Collins (5) 2; (8) 44. Saunders (1) 412. *E. clathrata* var. *crinita* Martindale (1) 93. Britton (1) 401. EXSICC, Phyc. Bor.-Am., 460, 965.

12. E. PERCURSA (Ag.) J. G. Agardh, Alg. Med., 15, 1842; *E. percursa* var. *simpliciuscula*, Till Alg. Syst., part 3, 146, 1882[1]; De Toni, Syll. Alg., Vol. I, 146, 1889, in part.

Frond filiform, in the earliest state of one row, afterwards of two rows of cells, placed symmetrically side by side; cells 10–15 μ wide, from once to twice as long. Plate 42, fig. 15, young filament; fig. 16, mature filament.

A common species, forming masses in upper tide pools, and in ditches in marshes, etc. It often grows in company with other species, but is easily distinguished on microscopic examination by the double row of cells, usually in exact symmetry, side by side. The small chromatophors occupy only part of the cell room, giving the same net-like appearance found in *E. clathrata*. It is found from Greenland to New Jersey, and from Alaska to California; it is apparently a summer plant. Europe. Collins (8) 44. *Tetranema percursum* Collins (7) 244. *Percursaria percursa* Rosenvinge (1) 963; (2) 160; (3) 118. *Ulva percursa* Collins (2) 131; (3) 310. Martindale (1) 93. Britton (1) 401. EXSICC. Alg. Am.-Bor., 219; Phyc. Bor.-Am., 469, 968.

13. E. TORTA (Mert.) Reinbold, Nuova Notarisia, series 4, 201, 1893. *E. percursa* var. *ramosa* J. G. Agardh, Till Alg. Syst., part 3, 146, 1882.

[1] The *E. percursa* of J. G. Agardh, l. c. 146, appears to include at last two species; for a full discussion of the question see Reinbold, Nuova Notarisia, Series IV, 201, 1893.

Frond filiform, compressed, simple or with occasional long proliferous branches, which usually consist of only two rows of cells; cells rectangular, always in longitudinal and mostly in cross series. Plate 42, fig. 4, surface view.

A very slender species, the main filaments only 2–8 cells wide, and only in the wider forms showing any open space within. The branches are few, at wide angles, and are seldom over two cells wide. They resemble somewhat the fronds of *E. percursa*, but the cells in the latter are more symmetrically arranged; and *E. percursa* is always simple and never has over two rows of cells, as do most of the older parts of this plant. It has been found only once in this country, at Eagle Island, Penobscot Bay, Maine, in a lagoon, where the water is usually more salt than the sea, with which it connects only at very high tides. Here the plant was scattered among *Cladophora expansa*, *Lyngbya aestuarii*, and species of *Enteromorpha*, the whole forming a dense mass covering the water for a considerable area. Europe. Collins (5) 2; (8) 44. Exsicc. Phyc. Bor.-Am., 223.

14. E. CRUCIATA Collins (5) 3. Frond filiform, branching, mostly of a single series of cells, but at the points of branching often of two or more series; branches issuing at right angles or nearly so, usually opposite but sometimes alternate or secund, simple, usually short, tapering; monosiphonous portions 20–30 μ diameter; cells about as long as broad, cell wall thick; in the irregular masses, where several branches issue near together, the cells are rounded and sometimes reach a diameter of 50 μ. Plate 43, fig. 1.

This plant is very different from other species of *Enteromorpa*, the nearest being *E. percursa*; but *E. cruciata* has nothing of the symmetry and uniformity that especially characterize *E. percursa*. The monosiphonous parts with few and short branches remind one somewhat of *Rhizoclonium*, but the branches are often of many cells, and wherever several branches issue near the same point, an irregular mass of cells is formed. The chromatophor is roundish, in young plants bright green, in older plants or parts of the plant paler, as in other *Enteromorpha* species; the chromatophor does not fill the cell. It was found in a lagoon at Eagle Island, Penobscot Bay, Maine, in floating masses in company with *Cladophora expansa*, *Lyngbya*, etc., in July, 1894, and is not known elsewhere. Collins (5) 3; (8) 44. Exsicc. Phyc. Bor.-Am., 222.

15. E. HOPKIRKII Harvey, Phyc. Brit., Pl. CCLXIII, 1849; J. G. Agardh, Till Alg. Syst., part 3, 151, 1882; *E. plumosa* De Toni, Syll. Alg., Vol. I, 132, 1889. Frond filiform, cylindrical or somewhat compressed, very slender and delicate, much and repeatedly branched, the branches tapering and ending in a single series of cells; cells about 8 μ wide in monosiphonous part, below about 12 × 20 μ, with quite small chromatophor, always in longitudinal and often in cross series. Plate 43, fig. 3.

One of the most attractive of our *Enteromorphas* both in habit and microscopically. There are other species which occasionally have short monosiphonous branches, but in *E. Hopkrikii* nearly every young branch terminates in a monosiphonous series of considerable extent. A form is common in northern New England, growing largely on *Cladophora glaucescens*, and also on rocks and shells, in rock pools. This form is very slender throughout and the cells in the larger filaments have in a marked degree the net-like character found in *E. clathrata*; it seldom exceeds 2 dm. in length. In quiet bays another form occurs, sometimes reaching a length of over a meter; in this form the cells are squarer than in the other, the fronds not so slender; it is common in southern New England. Europe. Harvey (1) 58. Farlow (1) 292. Collins (7) 246; (8) 44. *Ulva Hopkirkii* Farlow (4) 44. Collins (3) 310; (6) 78. Dame & Collins (1) 157. Martindale (1) 93. Britton (1) 401. Hay & MacKay (1) 64. Exsicc. Phyc. Bor.-Am., 463.

16. E. ERECTA (Lyng.) J. G. Agardh, Till Alg. Syst., part 3, 152, 1882; De Toni, Syll. Alg., Vol. I, 133. 1889. Frond filiform, with numerous long, usually erect branches, more slender than the main filament; the ultimate ramuli of varying length, polysiphonous, the cells being symmetrically arranged in successive segments, similar to those of *Polysiphonia*; cells in main stem and branches in longitudinal and usually in lateral series. Plate 43, fig. 2.

The most distinctive character of this species is found in the polysiphonous ramuli; in habit it is not unlike *E. crinita*, but the cells in *E. erecta* are usually more symmetrically arranged in the older parts of the frond, and more rectangular. It is not uncommon from New Jersey north, and appears to be a plant of exposed shores. Europe. Collins (7) 246; (8) 44. *E. clathrata* var. *erecta* Martindale (1) 93. Britton (1) 404. *Ulva clathrata* var. *erecta* Collins (3) 310. Exsicc. Phyc. Bor.-Am., 461.

17. E. CLATHRATA (Roth) Grev. Alg. Brit., 181, 1830: J. G. Agardh, Till Alg. Syst., part 3, 153, 1882; De Toni, Syll. Alg., Vol. I, 133, 1889. Frond filiform, cylindrical or compressed, much branched in all directions, the branches tapering from base to summit, but not ending in a single series of cells; cells rectangular, usually longer than broad, always in longitudinal series, the chromatophor noticeably smaller than the cell. Plate 43, fig. 4, portion of surface of main filament.

A common and variable species, differing from all the preceding except *E. Hopkirkii* and *E. erecta* in having a real system of branching of various orders; also in the chromatophor smaller than the cell, which, with the fact that the cells in adjacent series are usually alternate, gives a distinctly net-like appearance to the frond. It seems to be fairly common all along the Atlantic coast, and occurs also at Bering Island in the Pacific. Europe, West Indies, Tas-

mania, New Zealand. Harvey (1) 57, in part. Farlow (1) 292; (2) 712: (3) 379. Robinson (1) 166. Hervey (1) 51. Kjellman (2) 52. Britton (1) 401. Collins (7) 246: (8) 44. *Ulva clathrata* Farlow (4) 44. Collins (3) 310; (6) 78. Dame & Collins (1) 157. Martindale (1) 93.

Forma *prostrata* LeJolis, Algues Marines de Cherbourg, 50, 1863. Fronds densely branched, prostrate, often matted. In salt marshes near Boston, Mass. *Ulva clathrata* var. *prostrata* Martindale (1) 93. Britton (1) 401. *U. clathrata* var. *Rothiana* f. *prostrata* Farlow (4) 44. Dame & Collins (1) 157. Exsicc. Phyc. Bor.-Am., 459; Alg. Am.-Bor., 215.

18. E. RAMULOSA (Eng. Bot.) Hook., British Flora, Vol. II, 319, 1833; J. G. Agardh, Till Alg. Syst., part 3, 154, Pl. IV, figs. 117, 118, 1882; De Toni, Syll. Alg., Vol. I., 134, 1889. Frond tubular, rather stiff, much branched; branches with short spine-like ramuli; cells rather rounded, showing longitudinal series only in the ultimate divisions. Plate 43, fig. 6, tip of branch.

A coarse species, readily recognized by its habit. It appears to be not uncommon along the southern part of the Atlantic coast, but rare in New England. The color is usually a rather deep or dark green; the main branches are often quite long, and are everywhere beset with short tapering ramuli; the cells are rounded, almost entirely occupied by the chromatophor; without any definite arrangement except in the ramuli. Europe, Australia, New Zealand. Collins (8) 44. *E. clathrata* var. *ramulosa* Kemp (1) 41. *Ulva clathrata* var. *ramulosa* Farlow (4) 44. Collins (3) 310. *U. clathrata* var. *uncinata* Martindale (1) 93. Britton (1) 401.

19. E. ACANTHOPHORA Kütz., Sp. Alg., 479, 1849. J. G. Agardh, Till Alg. Syst., part 3, 157; De Toni, Syll. Alg., Vol. I, 135, 1889. Frond more or less proliferously branched, the branches usually somewhat enlarged upward, beset with numerous short, spine-like ramuli, with broad base and acute tip, cells 6–8 μ diameter, roundish angular, showing no longitudinal arrangement except indistinctly at the tips of the ramuli. Plate 43, fig. 5, tip of branch.

Somewhat resembles *E. ramulosa*, but the cells are much smaller, with hardly any indication of longitudinal arrangement; the substance is less firm, and the color is lighter. The fronds seem to collapse irregularly in drying. The spine-like ramuli vary in abundance, sometimes almost covering the frond; the regular branches are not very numerous, and seem quite distinct from the ramuli. It occurs on the California coast (Brandegee), and is one of the few species that occur also in fresh water, having been collected by Miss S. P. Monks in the Santa Paula mountains, California, at an altitude of over 300 meters, and by Miss G. R. Crocker in Alameda Creek, California; West Coast of South America, New Zealand and Tasmania. Exsicc. Phyc. Bor.-Am., 515.

ILEA Ag.

Frond filamentous, hollow, the cells single, or in twos and fours, enclosed in the wall of the mother cell, and arranged in distinct longitudinal series in all parts of the frond.

I. FULVESCENS (Ag.) J. G. Agardh, Till Alg. Syst., part 3, 115, 1882; *Enteromorpha aureola* De Toni, Syll. Alg., Vol. I, 131, 1889. The only species; characters of the genus. Plate 41, fig. 22, cross section; fig. 23, proliferous branching; fig. 24, surface.

This plant grows in dense tufts, the filaments usually 5 to 20 cm. long, the diameter being seldom over 2 mm. The fronds are soft and gelatinous, the color varying from dark green to brownish or yellow. The cells have a distinctive *Gloeocapsa*-like arrangement, and are in longitudinal series so distinct that by pressure on the cover glass they readily separate, appearing like distinct filaments of one or two cells wide.

It grows best in places where streams of fresh water empty into the sea, occupying the space between high and low water marks; so that twice in each day its medium is changed from sea water to quite fresh water, and back again. It appears to be common from Maine to New Jersey, and is found in salt springs at Sussex, New Brunswick, 20 miles from the sea (Ganong). Europe, So. Pacific.

The dimensions given above will cover all accessible specimens or records, except that at Cutler, Me., in July, 1902, the writer collected this species with fronds over a meter long and two cm. in diameter, and similar specimens were collected by Dr. Farlow in the same month at Campobello, New Brunswick. The localities are only fifteen miles apart, and near the mouth of the Bay of Fundy. It may be that the great range of the tide here furnishes the conditions of this unusual development. Ganong (1) 16. Collins (8) 44. *Capsosiphon aureolus* Collins (7) 245. *Ulva aureola* Collins (2) 131; (3) 310; (6) 78. Martindale (1) 93. Britton (1) 401. EXSICC. Phyc. Bor.-Am., 264.

DOUBTFUL REFERENCES.

ULVA CLATHRATA Pike (1) 106. Bennett (1) 95. Anderson (1) 218.

U. COMPRESSA Anderson (1) 218.

U. ENTEROMORPHA var. COMPRESSA Pike (1) 106. Bennett (1) 95. Britton (1) 400. Martindale (1) 93. Hay (1) 33. Hay & MacKay (1) 63.

U. ENTEROMORPHA var. INTESTINALIS Pike (1) 106. Britton (1) 400.

U. Hopkirkii Pike (1) 106.

U. intestinalis Anderson (1) 218.

U. Lactuca Bailey (1) 402. Curtis (1) 156. Hall (1) 112. Pike (1) 106.

U. Lactuca var. Lactuca Pike (1) 106. Bennett (1) 95.

U. Lactuca var. latissima Howe (1) 167.

U. Lactuca var. rigida Pike (1) 106.

U. latissima Postels & Ruprecht (1) 21. Bailey (1) 402. Hooper (1) 30. Hall (1) 112.

Enteromorpha clathrata Hooper (1) 30. Kemp (1) 41. Olney(1) 9.

E. compressa Postels & Ruprecht (1) 21. Bailey (1) 402. Hooper (1) 30. Bailey & Harvey (1) 163. Hervey (2) 176. Ashmead (2) 96. Curtis (1) 156. Kemp (1) 41. Harvey (1) 50. Eaton (1) 348; (2) 5. Melvill (1) 265. Hall (1) 112. Murray (1) 260. Olney (1) 9. Wolle (1) 107. Fowler (1) 48.

E. erecta Hooper (1) 30. Olney (1) 42. Bailey (1) 402.

E. intestinalis Bailey (1) 402. Hooper (1) 30. Harvey (2) 176. Curtis (1) 156. Kemp (1) 41. Olney (1) 42. Wolle (1) 107.

Monostroma pulchrum Pike (1) 106. Martindale (1) 92.

M. Blytii Martindale (1) 92.

Explanation of Plates. — Plate 41. Fig. 1, *Ulva Lactuca* var. *rigida*. Figs. 2, 3, *Monostroma fuscum* forma *Blyttii*. Figs. 4, 5, *M. Grevillei*. Figs. 6, 7, *M. arcticum*. Figs. 8, 9, *M. pulchrum*. Figs. 10, 11, *M. leptodermum*. Figs. 12, 13, *M. undulatum*. Figs. 14, 15, *M. crepidinum*. Figs. 16, 17, *M. quaternarium*. Figs. 18, 19, *M. latissimum*. Figs. 20, 21, *M. Groenlandicum*. Figs. 22, 23, 24, *Ilea fulvescens*.

Plate 42. Figs. 1, 2, *Enteromorpha micrococca*. Fig. 3, *E. flexuosa*. Fig. 4, *E. torta*. Fig. 5, *E. prolifera*. Figs. 6, 7, *E. intestinalis*. Fig. 8, *E. Linza*. Figs. 9, 10, *E. minima*. Figs. 11, 12, *E. compressa*. Fig. 13, *E. marginata*. Fig. 14, *E. crinita*. Figs. 15, 16, *E. percursa*.

Plate 43. Fig. 1, *Enteromorpha cruciata*. Fig. 2, *E. erecta*. Fig. 3, *E. Hopkirkii*. Fig. 4, *E. clathrata*. Fig. 5, *E. acanthophora*. Fig. 6, *E. ramulosa*.

Malden, Massachusetts.

A BOTANICAL TRIP TO SALISBURY, CONNECTICUT.

C. H. BISSELL.

IN the summer of 1901, the writer did a little botanical collecting in the north-western corner of Connecticut, in the towns of Salisbury and North Canaan. A number of most interesting things were found and enough learned to prove that the region was worthy of a much more extended exploration.

The plants collected and the report of others to be expected led Mr. M. L. Fernald of the Gray Herbarium staff and the Hon. J. R. Churchill of Boston to plan a trip to the town of Salisbury with the writer. The evening of May 29, 1902, found them at Southington, Ct., and the next morning a start was made for Salisbury. One day and parts of two others were given to botanizing. Mr. L. Andrews was a member of the party for a portion of the first day and Judge Churchill remained for an additional day after the others were obliged to return. Mr. Fernald was the leader, and to his activity and acute observation nearly all the new and interesting discoveries should be credited. On the first day a short stroll while waiting for dinner revealed growing in moist shaded ground near the railroad two interesting forms of Fragaria. The more abundant of the two proved to be the true *F. vesca*, L., of Europe. The other awaits further study.

The first plant to attract attention in the afternoon was the form of our common dandelion, *Taraxacum officinale*, Weber, with short, broad, ascending, involucral bracts called var. *palustre*, Blytt. Mr. Fernald published an article in regard to this form in RHODORA, Aug., 1902. In this connection it may be of interest to note in passing, that the writer collected two weeks earlier in this same town but at a different station good specimens of the red-seeded dandelion *T. erythrospermum*, Andrz. This was growing in rich heavy soil which is not considered to be its usual habitat.

A small swamp was soon reached and new things came thick and fast. Shrubs of *Salix candida*, Willd., were in good fruit and common. The form found here had lanceolate leaves, the width about one third the length; on the next day, however, specimens were found on the border of Twin Lakes with much longer linear leaves. Some plants of the later collection showed leaves green and nearly

smooth on the lower surface instead of with the usual covering of dense tomentum.

In a shaded part of the swamp were found a few plants of *Galium tinctorium*, L., var. *labradoricum*, Wiegand. This was found two days later in greater quantity in a similar swamp in Sheffield, Massachusetts. A deep tangle of the swamp under larch trees gave specimens of the rare little *Carex tetanica*, Schk., var. *Woodii*, Bailey, the first collection of it in New England. Shrubs of *Betula pumila*, L., with young fruit were frequent while a few small ones of *Rhamnus alnifolia*, L'Her., were in flower. A ditch nearby yielded *Carex aquatilis*, Wahl., also new to the state. In a bit of wet springy pasture was growing a peculiar form of *Carex granularis*, Muhl., with short, nearly prostrate culms and the whole plant a very light green in color.

In open woods on limestone ledges some time was spent in collecting, for distribution by the Gray Herbarium, sets of *Carex eburnea*, Boott, and *Senecio obovatus*, Muhl. Fine fruiting plants of *Hepatica acutiloba*, DC., were found here, some with a part or all of the three leaf lobes again divided or incised making the leaf appear to be five- to nine- instead of three-lobed.

In a swampy part of some pine woods two or three plants of *Ranunculus abortivus*, L., var. *eucyclus*, Fernald, were found; and in the same place was seen a leaf of *Conioselium canadense*, Torr. & Gray, a species not before noted in Connecticut. The writer, later in the season secured specimens of this from the same town but at a different station. A limestone ledge with northern exposure showed abundance of *Avena striata*, Michx., while growing beside a spring was a beautiful clump of *Carex teretiuscula*, Good., var. *ramosa*, Boott, another new form for the state. The discovery in a meadow-pasture of an interesting form of yellow-flowered Oxalis, which proved to be *O. filipes*, Small, closed the day's collecting.

One half day was spent exploring a swamp and fields on the border-line where Connecticut joins New York. In the swamp was growing in abundance *Carex Schweinitzii*, Dewey; and a wet meadow near by yielded *Carex rostrata*, Stokes, two more species added to the state list. In the swamp, growing in dense tufts, was a form of *Carex interior*, Bailey, with dark brown scales and fruit, giving the plant a peculiar blackish appearance. Here also were found shrubs of what appeared to be *Salix lucida*, Muhl., but with

leaves whitened instead of green beneath as they should be in this species. The most marked distinction as given in descriptions between *S. lucida*, Muhl., and the western *S. lasiandra*, Benth., is this very difference in the under surface of the leaf. It would seem from these specimens that either the distinction between the two species does not hold good or that *S. lasiandra*, Benth., may be found in this region. This is a problem needing further observation and study.

While we were crossing a sandy field near the swamp many plants of yellow-flowered Oxalis were noted and a careful investigation showed there were three very distinct forms. Plentiful material was taken and afterward determined by Mr. Fernald. The species proved to be *O. cymosa*, Small, *O. stricta*, L., and *O. filipes*, Small. In the field there were such differences of appearance and habit that after a little the three species could be distinguished at a glance. Our common species, *O. cymosa*, Small, was in its early stage and was less branched and more pubescent than it appears later in the season. It had simple erect stems covered with a spreading pubescence, a thick root-stock, and small flowers. *O. stricta*, L., had larger flowers, slender rootstock, ascending slender stems branching at the base, and appressed pubescence. *O. filipes*, Small, had spreading pubescence like that of *O. cymosa*, Small, but was entirely different in habit, having small spreading stems almost wiry at the base, and slender much branched running rootstocks, the plants spreading to form tufts or mats. This last species was collected the following day in the town of Sheffield, Massachusetts.

In rich ground along a fence-row a plentiful supply of *Ranunculus allegheniensis*, Britton, was secured. Crossing a moist meadow on our way to take the train for return, Judge Churchill discovered a few plants of *Carex formosa*, Dewey, and thus added another sedge to the Connecticut list. Later in the day this species was found at another station near Lakeville. In the afternoon a piece of rich woodland on a rocky hillside gave good specimens of *Carex oligocarpa*, Schk., *Avena striata*, Michx., and *Poa debilis*, Torr.; while an excursion to the foot of Sage's Ravine yielded *Streptopus amplexifolius*, DC.

The last day was mostly spent in an unavailing search for the long lost globeflower, *Trollius laxus*, Salisb. This was collected many years ago in Cornwall, Connecticut, but has never since been

seen in New England. Judge Churchill signalized his extra day's botanizing by the discovery of another grass not previously known from Connecticut, *Trisetum subspicatum*, Beauv., var. *molle*, Gray. In spite of the failure to rediscover Trollius the trip was voted a great success by all members of the party and the collections made have added many rare and northern species to the flora of Connecticut.

SOUTHINGTON, CONNECTICUT.

FLORA OF MT. SADDLEBACK, FRANKLIN COUNTY, MAINE.

C. H. KNOWLTON.

SADDLEBACK is situated in Madrid and Sandy River Plantation. The horn and the saddle lie wholly in Madrid, while the main ridge, with three "nubbles" reaches into the next township. The highest elevation, 4450 feet, is reached at the "pinnacle," the nubble nearest the saddle. Between the second and third nubbles is a small pond of rain water.

The ridge is composed of coarse granite, evidently intruded as a core beneath overlying strata. A considerable area of this overlying rock, strongly metamorphosed and contorted, still remains at one place near the horn of the saddle; not, however, at its highest part. The granite is faulted in several places, noticeably in the saddle.

My first visit to the mountain was in company with Mr. M. L. Fernald, August 16–17, 1894, and my second the past summer, August 20–21, 1902. Mr. H. E. Dunham, now of Amesbury, Massachusetts, was a member of the party both times.

The less noteworthy, but yet typical plants of the mountain woods and bare slopes are as follows:

Oxalis Acetosella, L.
Nemopanthus fascicularis, DC.
Acer Pennsylvanicum, L.
Acer spicatum, Lam.
Pyrus Americana, DC.
Amelanchier oligocarpa, Roem.
Conioselinum Canadense, T. & G.
Kalmia glauca, Ait.
Rhododendron Rhodora, Don.
Ledum Groenlandicum, Oeder.
Alnus viridis, DC.
Empetrum nigrum, L.
[1] *Empetrum nigrum*, L., var. *Andinum*, DC.

[1] RHODORA, iv. 147, 196.

Viburnum cassinoides, L.
Lonicera ciliata, Muhl.
Diervilla trifida, Moench.
Aster acuminatus, Mx.
Aster acuminatus, form with flowers converted to chaff.
Aster macrophyllus, L.
Cnicus muticus, Pursh.
Vaccinium Oxycoccus L.
Chiogenes serpyllifolia, Salisb.
Picea nigra, Link.
Picea rubra, Link.
Abies balsamea, Miller.
Streptopus amplexifolius, DC.
Clintonia borealis, Raf.
Eriophorum vaginatum, L.
Carex crinita, Lam.
Agropyron caninum, R. & S.
Cinna pendula, Trin.

Other plants, whose occurrence and distribution deserve more than passing notice, are as follows:

Arenaria Groenlandica, Spreng. Acres and acres of the upper slopes of the mountain are covered with this delicate plant. It grows also on Mt. Bigelow, in far less profusion.

Trifolium hybridum, L., grows above timber-line with *Phleum pratense*, L. It is rather remarkable that they should have been introduced at such an elevation, higher than any horse could climb.

Rubus Chamaemorus, L., grows in the sphagnum on the higher part of the saddle toward the horn. This has been reported from the higher White Mountains, from Baldpate Mountain, Grafton, Maine, and it reappears as an arctic coast plant in eastern Maine. It has not been found on Katahdin.

Potentilla tridentata, Ait., hardly deserves mention as a mountain plant, for it is frequent on rocky slopes and dry sand-plains at all altitudes throughout the region, down as low as 350 feet in Jay, the southern town of the county, and throughout the Androscoggin valley to the coast.

Solidago macrophylla, Pursh, is abundant in the wooded parts of the mountain, and is frequent in mountain woods above 1800 feet throughout the county.

Vaccinium Pennsylvanicum, Lam., var. *angustifolium*, Gray. This grows abundantly on exposed slopes, often with the type. I have also collected it on the Abraham range, about ten miles away (RHODORA, i. 191).

Vaccinium uliginosum, L., is abundant above timber-line here and throughout the region. It also occurs along the Carrabassett in Jerusalem, and as low as 700 feet at Farmington (RHODORA i. 162).

Vaccinium caespitosum, Michx., was collected by M. L. Fernald and the author in 1894, growing in moss near the pinnacle. This I did not

detect the past season, as no fruit formed. It has been collected at Phillips by Mr. Fernald, and it should be found at other stations in the county.

Vaccinium Vitis-Idaea, L., is common above timber-line on all the mountains of the region. I have found it on a wind-swept ridge at Farmington not higher than 800 feet.

Kalmia augustifolia, L. This common species was blossoming freely at the time of my second visit, apparently a second crop of flowers.

Diapensia Lapponica, L. Abundant on the wind-swept portions, especially on the saddle. There is a small area of it on Bald Mountain in Mt. Abraham township.

Comandra livida, Richardson. Frequent in moss on the higher parts of the main ridge. This station, Bald Mountain, Katahdin, Mt. Washington, and Mt. Mansfield, Vermont, are the only stations in New England for this interesting plant.

Betula alba, L., var. *cordifolia*, Fernald, is abundant in the upper ravines, with stunted forms on the wind-swept heights.

Salix balsamifera, Barratt. I found a single shrub of this in fruit near the timber-line, at the time of my second visit.

Goodyera repens, R. Br., var. *ophioides*, Fernald. In moss, under some bushes near the summit. I have also collected it on Mt. Abraham and Mt. Blue (Avon), and it grows at much lower elevation in Chesterville (*Miss L. O. Eaton*). It is to be expected in cold mossy woods throughout the county.

Smilacina trifolia, Desf. A few depauperate fruiting specimens of this grew in wet gravel far above timber-line, nearly up to 4000 feet. In the southern towns of the county it is frequent in bogs and swampy woods.

Juncus trifidus L., is very abundant, and grows also on Bald Mountain and Mt. Bigelow.

Luzula spadicea, DC., var. *melanocarpa*, Meyer, is fairly common in the upper fault ravines.

Carex rigida, Gooden., var. *Bigelovii*, Tuckerm., is abundant on the wind-swept portions of the saddle. It also grows at the highest point of Bald Mountain.

Carex brunnescens, Poir., is occasional in moist soil between the bare ledges. It also occurs on Mt. Abraham.

Carex Magellanica, Lam. Moist gravel, one station. I have also found it in Strong and Chesterville.

Calamagrostis Langsdorfii, Trin., is abundant just above timberline. It also grows on Mt. Bigelow.

Aspidium spinulosum, Swartz, var. *dilatatum*, Hook. Common in rich mountain woods throughout the county. There seems to be a rather definite line about 1200 feet, above which it is found.

Lycopodium annotinum, L., var. *pungens*, Spring, is very common, and seems to shade into the type. It also occurs on the other mountains of the county.

CHELMSFORD, MASSACHUSETTS.

FOLIAR OUTGROWTHS FROM THE SURFACE OF THE LEAF OF ARISTOLOCHIA SIPHO.

R. G. LEAVITT.

MISS Katharine P. Loring has sent to the Gray Herbarium from Pride's Crossing, Massachusetts, a leaf of *Aristolochia Sipho* upon the under surface of which curious lamellar expansions have been formed. (Fig. 1). These unusual structures are stated by Miss Loring to have originated in the healing of wounds. She says: "I have watched it [the leaf] all summer. In the spring, when it was still folded, a fly netting dropped on it on the window sill, crushing it and splitting the leaf in several places. I thought it would wither; instead it mended itself as you see."

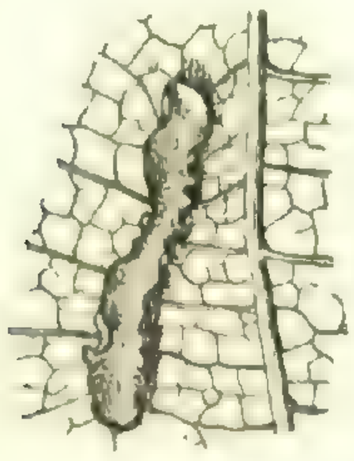


Fig. 1

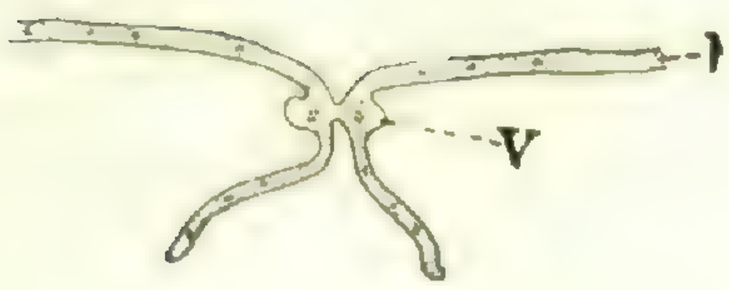


Fig. 2

The places where the young blade was split are entirely closed up. The green tissue is broken, its place being taken by collenchymatous elements. Around the margin of the break, in each case, a vein has been organized (v, Fig. 2), from which, on the under surface of the leaf, the outgrowths in question arise. There are fifteen of these structures on the half leaf sent to me for examination. They vary

in length from a quarter inch to an inch and a half, and stand out from the surface of the lamina (l, Fig. 2) about one tenth of an inch. The longer ones are parallel to the principal veins, but others are disposed irregularly. As seen from above the position of the original wounds is shown by deep furrows.

The minute structure of the accessory lamellae is like that of the blade proper, except that palisade tissue is absent. There are stomates on the outer surfaces, and veinlets springing from the veins at the bases of the outgrowths.

Perrot has recently communicated to the Société botanique de France on account of seemingly the same phenomenon observed by him in leaves of *Aristolochia Sipho* from Melun, near Paris. In Perrot's case several leaves, all from the same shoot, however, were anomalous. In interpreting the "biological significance" of the matter Perrot says :

"It would appear that the plant, by these supernumerary productions, has sought to augment the surface of its blade in order to increase its transpiration — but under what physiological influence?"

Miss Loring's observations would seem to make the nature of the process clear. The lamellae have originated in the healing of wounds, simply, and are curious examples of regeneration of the blade.

Ames Botanical Laboratory, North Easton, Massachusetts.

Erodium malacoides at Lawrence, Massachusetts.— On July 9, 1902, while collecting plants about the mills on the north side of the Merrimac River at Lawrence, Massachusetts, I found a strange Erodium in a waste place, behind a foundry. Mr. M. L. Fernald has kindly identified the plant for me as *E. malacoides*, Willd. This species is a native of the Mediterranean countries, but has been collected in or about New York City by Judge Addison Brown. Its occurrence at Lawrence seems worthy of note.— Arthur Stanley Pease, Andover, Massachusetts.

Lycopodium clavatum and its Variety.— Notes in regard to this species have been published in Rhodora by Dr. Robinson, September, 1901, Mr. Leavitt, March, 1902 and Mr. Harper, May,

[1] Bull. Soc. bot. de Fr. xlix. 163–166 (1902).

1902. Mr. Harper in his notes speaks of the typical form being always sterile, in the district where he had collected (the southern part of Worcester County, Massachusetts) and asks for the experience of other collectors in regard to this. I have known the plant here in Connecticut ever since, as a boy, I was old enough to gather it for Christmas decorations, and in later years have collected it at various stations extending pretty well over the state.

In all this time I have only twice found fruiting plants. Curiously enough one of these stations was in pine woods in the town of Union in the northeastern part of Connecticut, adjoining the towns of Worcester County Massachusetts, where Mr. Harper had botanized. Here I found two fertile plants of the typical form. The only other collection of the fruiting plant I have ever made, was several years ago, on a botanizing trip with Mr. L. Andrews, when we found it in the town of Wolcott, New Haven County, Connecticut. The specimens of this last mentioned collection prove on comparison to be undoubtedly the var. *monostachyon*. Mr. Harper stated that the southernmost station known for the variety was Little Wachusett Mountain in the central part of Worcester County, Massachusetts. We can now extend its reported range to the southern half of Connecticut.

The Wolcott station was on a moist open bank with northern exposure at an altitude of about 800 feet.— C. H. BISSELL, Southington, Connecticut.

SCHWALBEA AMERICANA IN CONNECTICUT.— On June 30, 1902, while I was driving with a friend in the town of East Lyme, we found *Schwalbea Americana*, L., growing in abundance on a gravelly bank by the roadside. I think it has never been reported hitherto from Connecticut. Mr. John Spalding, of New London, tells me that he found it, as far back as 1867, growing by the roadside, about half way from Essex to Saybrook and quite abundant.— FRANCES M. GRAVES, New London, Connecticut.

Vol. 4, no. 48, containing pages 231 to 268, plate 40, and title-page of the volume, was issued 31 December, 1902.



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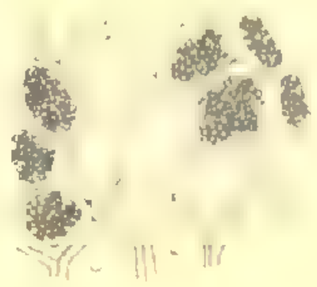
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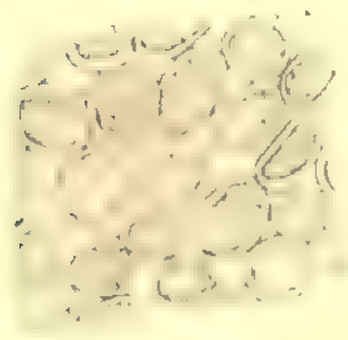
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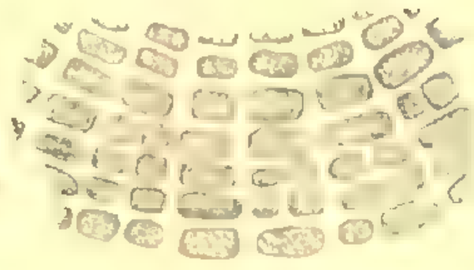
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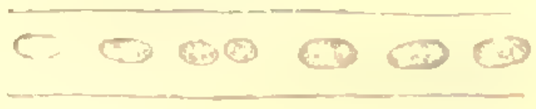
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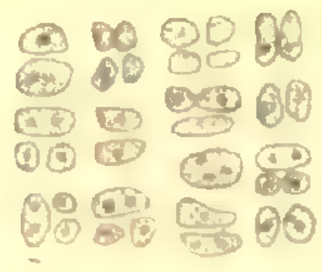
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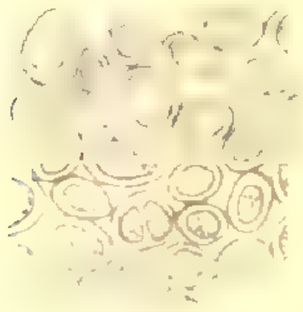


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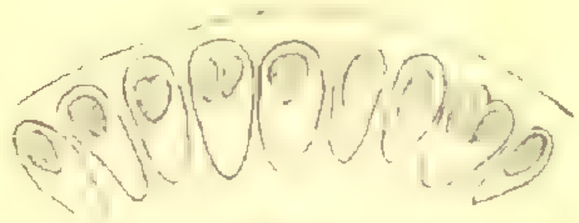
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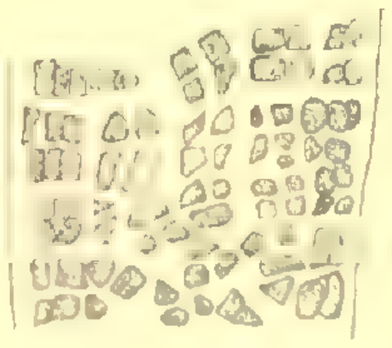
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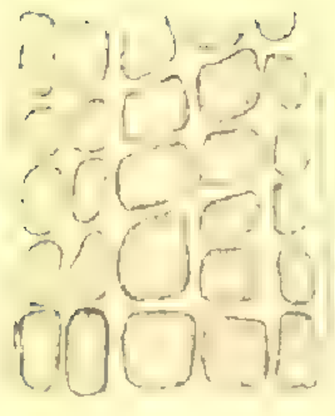
Ulvaceae of North America.



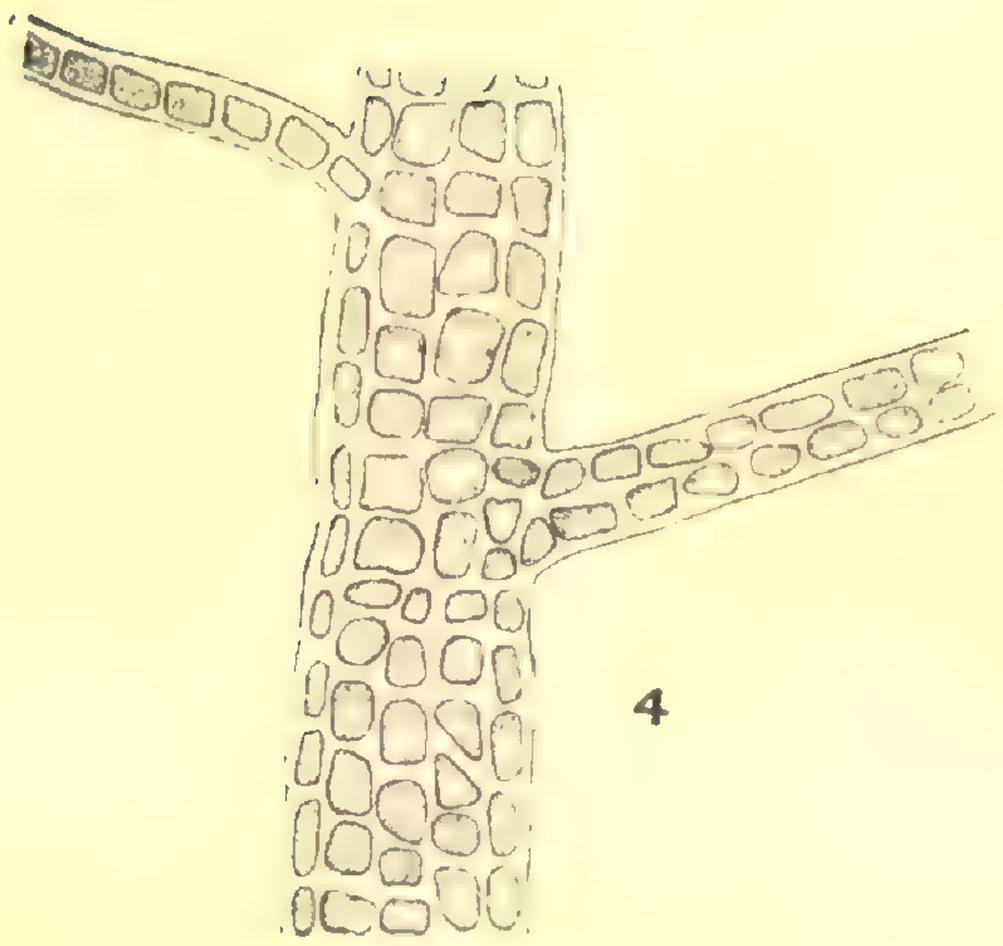
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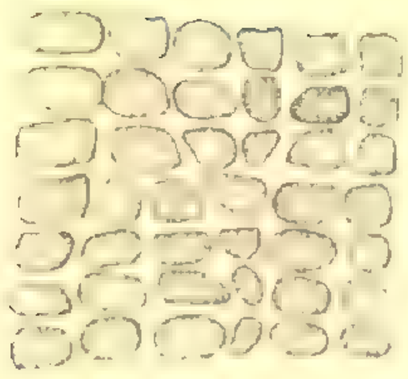
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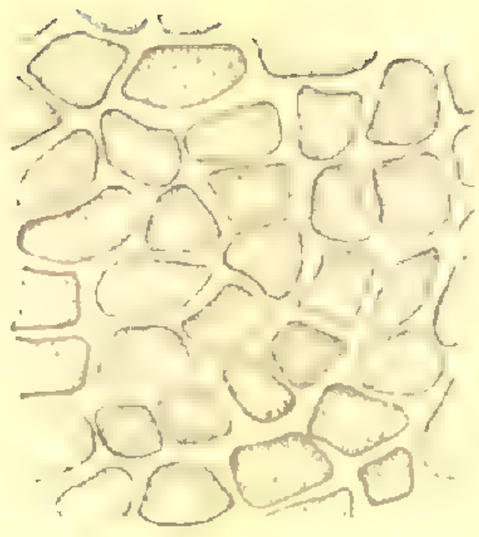
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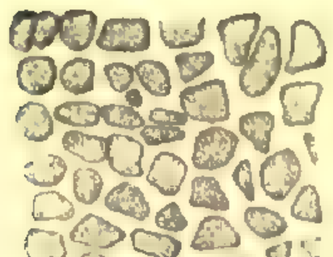
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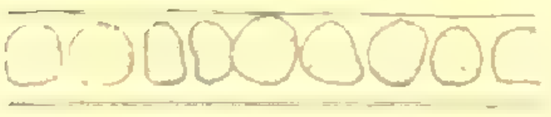
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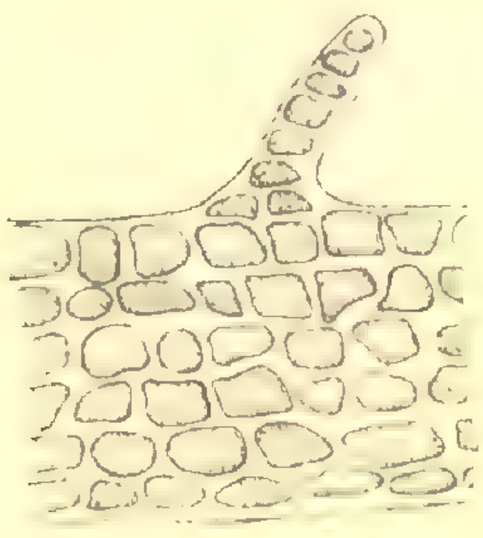
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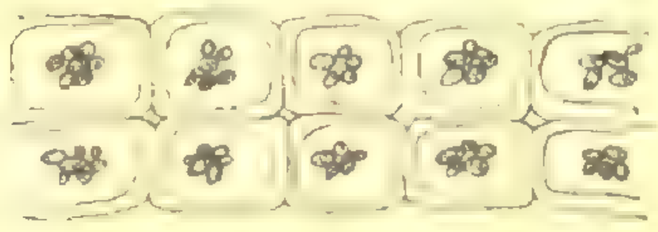
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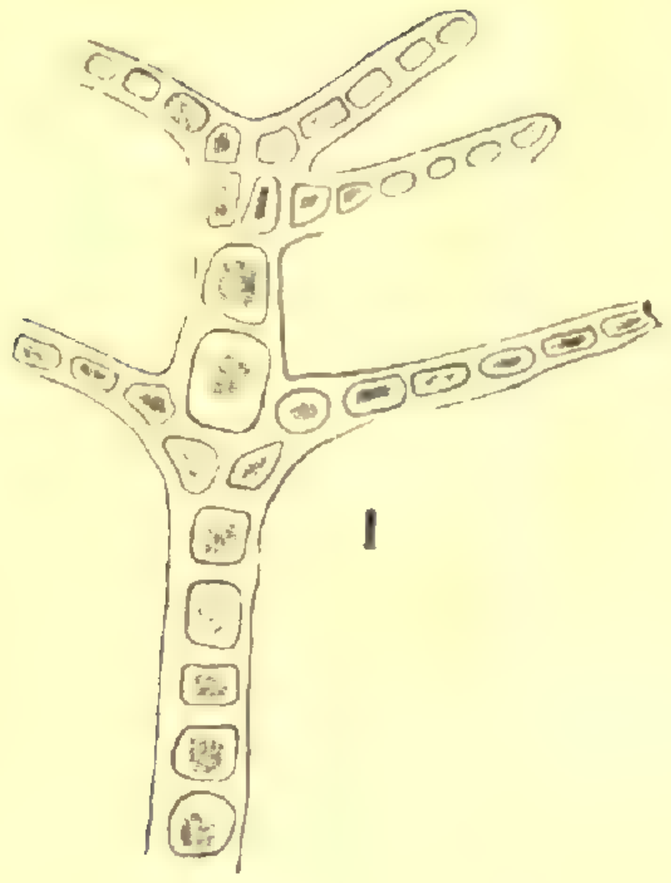
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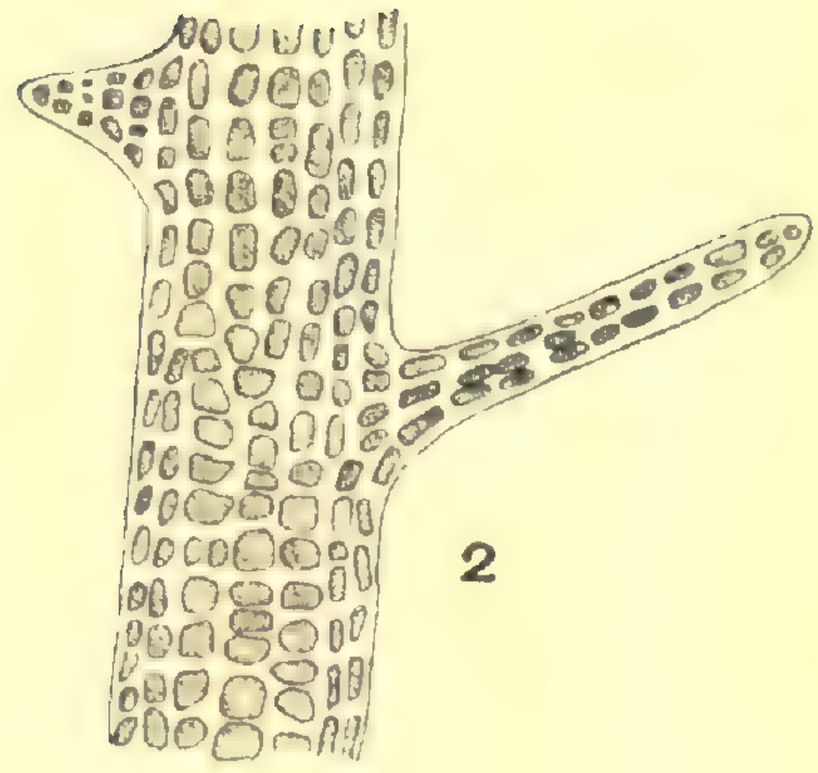


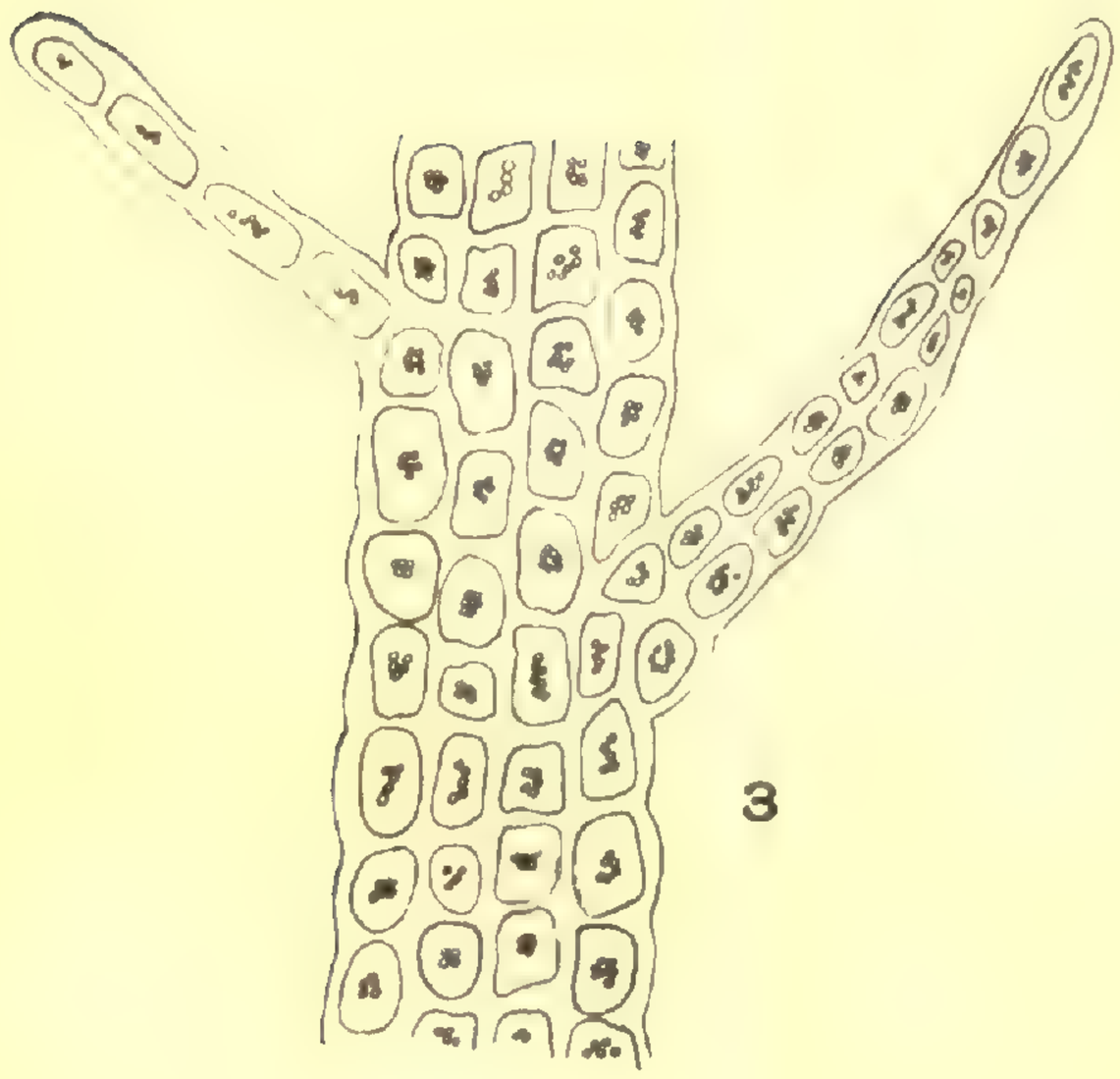
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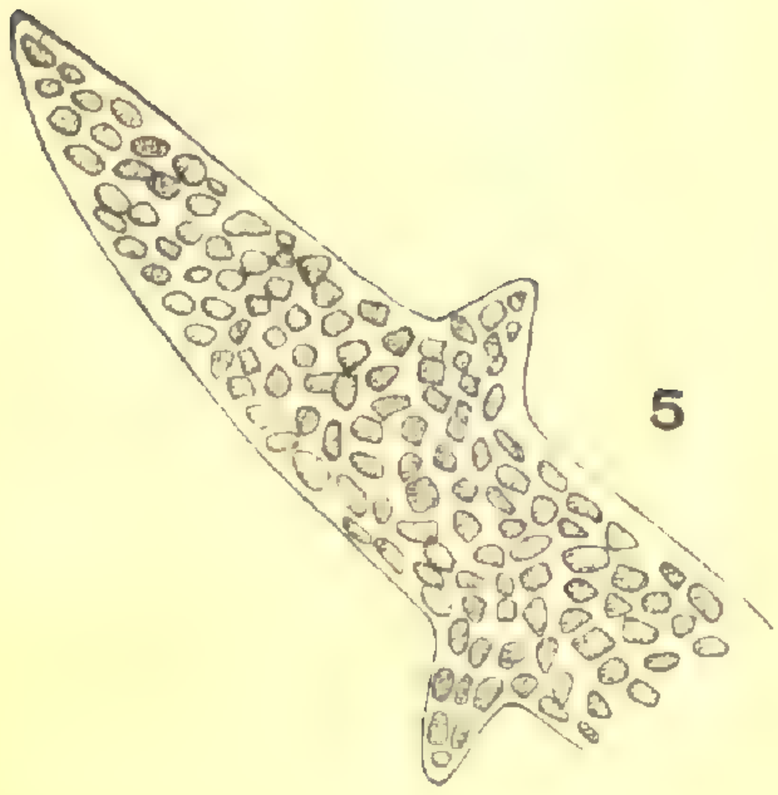
ULVACEAE OF NORTH AMERICA.

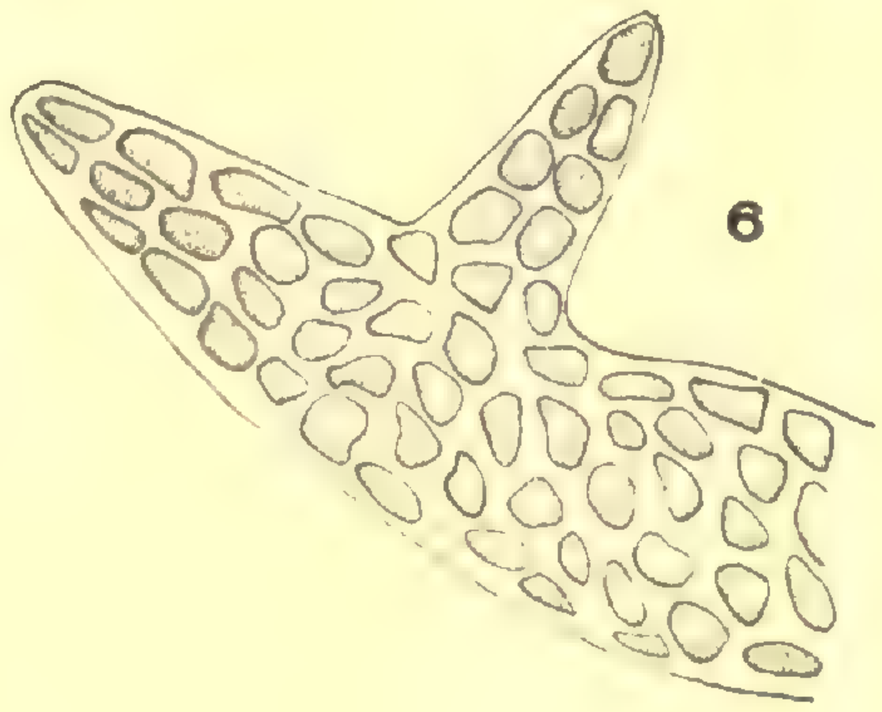

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ULVACEAE OF NORTH AMERICA.

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AN ECOLOGICAL EXCURSION TO MOUNT KTAADN.

Le Roy Harris Harvey.

(Plate 44.)

In company with a party,[1] representing the Ecological department of the Hull Botanical Laboratory of the University of Chicago, it was again my great pleasure to visit in August of the past year one of the most inaccessible and grandest mountains in New England, Ktaadn.

We took our departure from Stacyville on the fifteenth and spent the following day at Lunksoos in preparation for the mountain. The seventeenth saw us fairly started on our way and it was to be over two weeks before we should again share the hospitality of Lunksoos. Our course lay over the old Ktaadn trail as far as Sandy Stream Pond tote-road. Here we diverged to the northwest traveling along the tote-road for about a mile, then skirting the southern shore of Sandy Stream Pond we came to Ross Camps a few hundred yards beyond. From here we followed the new Rogers trail, recently cut for pack horses, which leads more directly (seven miles) to the South Basin, the site of our camp. Our return was over the same route.

In purpose our visit to the mountain was mainly ecological, espe-

[1] Drs. Henry C. Cowles and Bradley M. Davis, Department of Botany, University of Chicago; Samuel M. Coulter, Shaw School of Botany, St. Louis; A. F. Blakeslee, Department of Botany, Harvard University; John Thompson, Richmond, Indiana; Horace W. Britcher, Department of Biology, University of Maine, Orono; H. G. Barber, New York City; Mrs. Henry C. Cowles, Chicago; Miss Laura H. Bevans, Cook County Normal School, Chicago; Miss F. Grace Smith, Department of Botany, Smith College, Northampton, Massachusetts; Miss Jane Stearns, Chicago; Miss Maud L. Bates, Topeka.

cially in relation to true alpine conditions and climatic and edaphic timber lines. Much interesting data was obtained upon these points and will form the basis of an ecological discussion of the mountain to appear later.

Although the energies of the party were almost wholly devoted to a comprehensive ecological study rather than to purely floristic work, yet many noteworthy plants were recorded and the range of several species widely extended. These will be discussed below.

Composed as our party was of so many botanists, nearly all the great groups of plants had their devotees. So a division of labor was easily adjusted. To Dr. Davis and Miss Smith fell the Algae and Liverworts; Dr. Cowles became responsible for the crustaceous lichens, and Mr. Blakeslee and Miss Stearns for the foliaceous and fruticose forms. Mr. Coulter and Miss Bates devoted their energies to the mosses, while the writer gave his attention to the vascular plants. Reports on all these collections are to be expected.

Entomology was not without its enthusiasts for Mr. Britcher in the Arachnids and Mr. Barber in the Hemiptera are both specialists in their respective groups. Some very important and pioneer contributions along these lines may be expected.

The North West Basin.

The unique feature of our visit to Ktaadn was perhaps the exploration of the North West Basin, as we have called it, by four of the party[1] in a three days' side trip. We are, it is believed, the first scientific party to make a descent into this basin and though it is not the purpose of this article to describe the topography of the mountain, for this has been well done by Hamlin[2], Tarr[3], and others, yet a detailed description of this basin may be of interest, as it seems to be the least known of any part of the mountain. Williams[4] in a footnote speaks of its inaccessibility and the lack of knowledge

[1] Drs. Cowles and Davis, Mr. Blakeslee, and the writer.

[2] Hamlin, C. E. Observations upon the Physical Geography and Geology of Mount Ktaadn. Bull. Mus. Comp. Zool. Harvard 7: 206–223. 1881.

[3] Tarr, R. S. Glaciation of Mt. Ktaadn, Maine. Bull. Geol. Soc. Am. 11: 433–448. 1900.

[4] Williams, E. F. Comparison of the Floras of Mt. Washington and Mt. Katahdin. Rhodora 3: 163. 1901.

concerning it. Hamlin and Tarr seem not to have been aware of its existence.

This North West Basin, as seen from the west slope of the Northern Ridge, appears as an abysmal amphitheatre enclosed on three sides by precipitous walls with a small lake in its floor and with a very broad gateway opening to the northwest. In general form the basin suggests the capital letter V with its base slightly rounded. Its eastern arm is formed by the precipitous West wall of the Northern Ridge extending here very nearly north. The wooded North slope of the North West Spur, omitted from Williams[1] sketch map, makes the other arm of our capital letter. By the confluence of the Northern Ridge and the North West Spur as they join the North Mountain, the rounded base of our letter is formed. The floor of the basin is virtually a shelf cut from the North West Spur, apparently by glacial action. Its altitude, some 2945 feet, is about 50 feet lower than that of South Basin. In width, it varies from 200 to 250 yards. From this shelf a precipitous descent of 250 ft. leads to the valley proper below. The mouth of the basin opens broadly to the northwest into the valley of the Middle Branch of the Wissataquoik, whose southeast boundary is formed by the Northern Ridge extension, while the Sourdnahunk range to the northwest makes its opposite drainage slope.

Nestled at the base of the North West Spur and on the shelf described above are four small ponds, evidently morainic in origin. The largest (Fig. 1), nearly five acres in extent, and the most western is the only one visible from the mountain and then only from the West slope of the Northern Ridge. Rarely seen it has scarcely been reported, for parties with limited time seldom visit this part of the mountain. The shores are boulder strewn, sloping off rapidly to some depth; the spruce, fir, birch, and alders come to its very edge. The outlet stream at the northeast end of the pond plunges almost immediately over the brow of the shelf. It functions, however, only at high water after heavy rains and the Spring freshets and must at such a time go plunging and roaring over the precipitous granite walls in its mad race to the valley 250 feet below. As the bed of the stream was perfectly dry at the time of our visit we used this outlet as a means of descent, but this was possible only through the

[1] Loc. Cit. pg. 162.

abundant aid received from the birch and alder which grow to its very limits, for the outlet has no depth, but the water plunges over the smooth reddish granite as do so many of the slope streams of Ktaadn.

In altitude Lake Cowles (2938 ft.), as it may be called, is hardly above that of Chimney Pond (2928 ft.) though from the mountain it appears several hundred feet higher. While much disappointed in this respect we were, however, recompensed with some rare finds. *Nuphar Kalmianum*, *Nymphaea odorata minor*, *Potamogeton confervoides* and *Isoëtes heterospora* rewarded our endeavors.

The second pond, less than one half as large, which soon comes into sight as one descends the west slope of the Northern Ridge, is the most eastern and lies 250 yards to the east, near the confluence of the two spurs with North Mountain at the base of our capital letter V. Its shore features are similar to those of Lake Cowles except that on the east a heath society comes to the waters edge. Davis Pond, as we may call it (and not Lake Cowles, the largest of the ponds) is fed from above by a high waterfall. This source of water supply seems permanent, for we found a brawling mountain torrent as we slowly and tremblingly made our way down by the aid of the trees over its precipitous and treacherous bed, only to be driven back lower down by a vertical wall of nearly 200 ft. and forced to cross over and descend by an old avalanche-slide farther to the right.

The outlet of Davis Pond, thus differing from that of Lake Cowles, is a permanent stream but must similarly be increased into a powerful plunging waterfall in spring by the great increment of the melting mountain snows and heavy rains. Flowing over the steep walls of the shelf, the outlet stream plunges down the valley to join that of Lake Cowles about a mile below; and together they contribute to the Middle Branch of the Wissataquoik some three miles farther down the valley.

The northwest shore of Davis Pond is rather low and has long been used as winter yards by deer and moose. In places the trees and bushes have been entirely trampled down and killed. In these open places have come up a luxuriant growth of grasses, brakes and various herbs surrounded by an alder zone. Here we found *Splachnum roseum* growing in the greatest profusion on the dung of both deer and moose. *Lycopodium Sitchense*, *Petasites palmata*, *Aster puni-*

ceus, and *Osmunda Claytoniana* in great profusion, were also recorded from here.

Two more small ponds yet remain to be described. Between Lake Cowles and Davis Pond lies the third. It is about 150 ft. by 50 ft., with its longer axis running nearly east and west, and is very shallow, being nearly filled with vegetable debris accumulated from the wooded drainage slopes about it. Its shores are meadow-like and are fast encroaching on the pond proper which is itself so filled with vegetation-islands that one may walk safely across it anywhere. The future of this pond is very evident. It empties into Davis Pond along its northwestern shore.

This meadow-like society gave us an abundance of *Lycopodium inundatum* in its characteristic habitat and such other forms as *Scirpus caespitosus*, *Carex rigida Bigelowii*, *Viola blanda*, *Ledum latifolium*, *Pyrus arbutifolia*, and *Kalmia glauca*.

The last pond, a little larger than the third, is some 150 yards to the northeast of Davis Pond, and lies very near the edge of the shelf and almost in an east and west line with Lake Cowles. The outlet joins that of Davis Pond soon after it enters the valley proper below. In character this pond resembles closely Davis Pond but is less than one third its size. We recorded here no additional rarities.

Rising from and occupying the greater part of the shelf are two large *roches moutonnées* carved out by glaciation (fig. 1). The smaller forms the northeast shore of Davis Pond and the east shore of its outlet, while the larger one lies east and west extending from the outlet of Davis Pond to Lake Cowles. The summits, some 10 to 15 feet above the general level of the shelf, are flat-topped and present an unique plant society.

Wooded at the base and up the slopes by spruce, fir, and birch, the flat glaciated tops present a striking contrast in a well developed alpestrine heath society (fig. 2). *Kalmia augustifolia* is the dominant species, with *Cassandra calyculata* and *Ledum latifolium* as secondary forms. Together they give the society its characteristic xerophytic tone. Less important forms are *Chiogenes serpyllifolia*, *Empetrum nigrum*, and *Vaccinium canadense* all growing in the dense mats of *Cladonia rangiferina* and its less common variety *alpestris*. Around the bases of bare knobs of rock *Vaccinium uliginosum* is found densely matted.

Spruce islands (fig. 2) of low straggling trees have pushed out into

this heath, which is also being encroached upon from below by the forest. That this heath is one day doomed to be a feature of the past can hardly be doubted.

At the base of the South wall of our basin, over which the cataract inlet of Davis Pond falls, is a meadow-like society similar to that found at the base of the dripping West wall of the North Basin. Indeed, its very presence is due to the spray and seepage from the cliffs above. *Calamagrostis Canadensis*, *C. Langsdorfii*, *Scirpus caespitosus*, *Prenanthes trifoliolata*, *Aster radula*, *Habenaria dilatata*, *Solidago macrophylla*, *Arnica Chamissonis*, and *Diervilla trifida* are among the more characteristic forms which constitute this meadow society.

Additions to the Vascular Flora of Mount Ktaadn.

In presenting these additions and extensions in range of the flora of Mount Ktaadn it must be stated that our report embraces much territory previously unexplored, the North West Basin, the west slopes of the South Mountain, the North Spur, and the outer limits of the Great Basin including a small sphagnum bog along the trail near the foot of Lower Basin Pond. Many of our rarest finds, however, were made in those places most thoroughly explored by former parties, which illustrates the very restricted distribution of the rarer forms and strongly emphasizes "that many seasons will be required before we know approximately the bulk of its flora."

We were disappointed in not finding the rare little *Saxifraga stellaris comosa*, which has here its only stations in the eastern United States, and the evasive *Carex rariflora* not reported since Prof. Goodale found it in 1861. Several species of carices and grasses also escaped our notice. Though we found not all the old we were richly rewarded by the new. Fernald's summary[1] of the Ktaadn flora enumerates one hundred and eighty-three species and varieties. To this we have added thirty-eight forms, making the total known vascular flora of Mount Ktaadn two hundred and twenty-one species and varieties.

In the appended list the species new to Ktaadn are indicated by an

[1] Fernald, M. L. The Vascular Plants of Mount Katahdin. Rhodora 3: 166–177. 1901.

asterisk (*) before the name. Further notes on distribution will be found under each species. No asterisk being used an extension in range only is indicated.

Osmunda Claytoniana L. Sphagnous depressions, mesophytic woods, Camp Kennedy; "Moose yards," North West Basin.

* *Osmunda cinnamomea* L. Growing abundantly on the northern shore of the sphagnum bog, Great Basin.

Aspidium aculeatum Braunii Doell. Inlet of Chimney Pond, half way up to the crest, where it occurred only sparingly.

* *Asplenium Filix-foemina* Bernh. Common in mesophytic woods of the Great Basin, extending into the North Basin and as far as Camp Kennedy in the South Basin; common in the North West Basin and along the west slopes of the North Spur.

Pteris aquilina L. Open places, South Basin; common in sphagnum bog, Great Basin.

Lycopodium Selago L. From summit to shores of Lower Basin Pond, imperceptibly grading into *L. lucidulum* Michx. *L. Selago* is apparently a xerophytic form of *L. lucidulum*, which replaces it in more mesophytic habitats. All transitions were found varying with the environment.

* *Lycopodium inundatum* L. Abundant on the meadow-like shores of a small pond in the North West Basin.

* *Lycopodium annotinum* L. Common in mesophytic woods, South Basin, and in the *Krummholz* (scrub growth) on the table-land. Passes into *L. annotinum pungens* Spring, which replaces the type in xerophytic habitats. Extends up to West Peak.

Lycopodium Sitchense Rupr. Frequent on floor of North West Basin. We are able to record an interesting variation in the length of the peduncle of this species. Lloyd and Underwood[1] in their review of the North American species of this genus write in respect to the above species: "peduncles short (less than 1 cm.)." One specimen bearing nine strobili gave respectively the following measurements of the peduncle: 1.5, 1., .8, 1., .8, .2, .3, sessile, and .1 cm. Another specimen from a shaded habitat bearing three strobili possessed peduncles of

[1] Bull. Torr. Bot. Club, **27**: 162. 1900.

the following length, 2.5, 2., and 1.8 cm. respectively. As the shorter peduncled forms are invariably those from exposed positions obviously this difference in peduncular length is one of ecological variation in response to edaphic conditions.

* *Isoëtes heterospora* Eaton. Growing in 1–5 ft. of water, rocky shores of Lake Cowles where it was very abundant. This locality is its second in Maine (Jordan Pond, Mt. Desert, being the other) and extends its northern limit about 125 miles as well as its altitudinal limit some 1000 feet.

Isoëtes echinospora Braunii Eng. Common in 1–2 ft. of water, rocky shores, Lower Basin Pond (2500 ft.). It is interesting in this respect to note the occurrence of this species in the Lake of the Clouds (3500 ft.), Mt. Mansfield, Vt.

* *Potamogeton confervoides* Reichb. Sparsely growing in 1 foot of water, Lake Cowles.

* *Scheuchzeria palustris* L. Abundant as a pioneer in the sphagnum bog, Great Basin.

* *Zizania sp.* Common in Middle and Lower Basin Ponds; North West Basin Ponds.

* *Brachyelytrum erectum* Beauv. Along path leading from Camp Kennedy to Chimney Pond. Not common.

* *Poa alpina* L. Rare on the West walls of the North Basin at 4500 ft.

* *Bromus ciliatus* L. Common in the alpestrine meadow society at the foot of the dripping West walls of the North Basin; in a similar habitat South West wall of North West Basin.

* *Eriophorum gracile* Koch. Common in the sphagnum bog, Great Basin.

* *Carex pauciflora* Lightf. Common in the sphagnum bog, Great Basin.

* *Carex intumescens* Rudge. Frequent in meadow society at base of the dripping West wall of the North Basin; in similar habitat, base of North East wall of North West Basin; meadow, Dry Pond.

* *Juncus articulatus* L. Characteristic of the boggy shores of Lower Basin Pond.

* *Smilacina trifolia* Desf. Very characteristic of the border of the sphagnum bog, Great Basin.

* *Habenaria obtusata* Rich. Abundant in the mesophytic woods

of the Great Basin extending up in the South Basin to the foot of Saddle Slide.

* *Populus balsamifera* L. Two clumps were recorded as on the west shore of the Rocky Ponds in the North Basin.

* *Arceuthobium pusillum* Peck. On *Picea nigra*; extends well up in the Great Basin; on the east shore at the mouth of Lower Basin Pond outlet it forms a beautiful example of Arceuthobium *Krummholz.*

* *Nuphar Kalmianum* Ait. Common, rocky shores of Lake Cowles.

* *Nymphaea odorata minor* Sims. Less abundant and with the above.

* *Actaea alba* Bigel. Rare in mesophytic woods, Great Basin; extending up as far as Dry Pond.

* *Sarracenia purpurea* L. Common in the sphagnum bog, Great Basin.

* *Drosera intermedia* Hayne. A pioneer in the sphagnum bog, Great Basin; growing in the shallow water with *Scheuchzeria.*

* *Pyrus arbutifolia* L. f. Abundant, the sphagnum bog, Great Basin; North West Basin.

* *Amelanchier spicata*, Dec. Rare, West wall of North Basin on gravelly shelf.

* *Trifolium repens* L. Few plants introduced at old camp site, North shore of Chimney Pond.

Empetrum nigrum L. It is of interest to note the occurrence of this species in the sphagnum bog, Great Basin.

* *Acer Pennsylvanicum* L. Common in "cuttings" at base of West slopes of North Spur.

* *Aralia nudicaulis* L. Mesophytic woods, Great Basin.

Osmorrhiza sp. A species of Osmorrhiza occurs frequently in the mesophytic woods, North West Basin.

* *Monotropa uniflora* L. Abundant in mesophytic woods, Great Basin, extending to foot of Saddle Slide; North West Basin, mesophytic woods.

Monotropa Hypopitys L. Abundant in mesophytic woods; having a similar distribution to the species above with which it always occurs.

Vaccinium uliginosum L.

Vaccinium Vitis-Idaea L.

Chiogenes serpyllifolia Salisb.

It is of interest to note in addition to *Empetrum nigrum* the occurrence of these ericads in the sphagnum bog, Great Basin.

* *Prunella vulgaris* L. Introduced at old camp site, Chimney Pond.

* *Galeopsis Tetrahit* L. Introduced around "Camp Kennedy"; Chimney Pond; Rogers trail.

* *Rhinanthus Crista-Galli* L. Rare, gravelly shelves, dripping West wall, North Basin (4600 ft.). This addition makes another species in common with Mt. Washington, reducing by one the species peculiar to the latter.

* *Plantago major* L. Introduced at old camp site, Chimney Pond.

Galium triflorum Michx. West walls, North Basin; South West walls, North West Basin.

Linnaea borealis L. Mesophytic woods, Great Basin, extending into the *Krummholz* where it reaches perhaps its greatest development.

* *Lobelia Dortmanna* L. Rare, rocky shores of Lake Cowles, North West Basin.

* *Aster puniceus* L. Uncommon, shores of Lower Basin Pond; "Moose Yards," North West Basin, where a single plant only was noticed. Its determination was based wholly upon vegetative characters as the specimen was not in flower. It was found again later in flower near Saddle Slide.

* *Anaphalis margaritacea* Benth. & Hook. Sparingly on Saddle Slide.

* *Petasites palmata* A. Gray. Common in "Moose Yards" in the North West Basin. No flowering specimens were found.

FURTHER NOTES ON THE HEPATICAE OF MT. KTAADN.

The notes and determinations of the Liverworts, collected by Dr. Davis and Miss Smith, have been placed in my hands for report. The determinations were made by Dr. Alexander W. Evans. It is to be much regretted that Kennedy and Collins in their list[1] have

[1] Kennedy, G. G. and Collins, J. F., Bryophytes of Mount Katahdin. RHODORA 3: 181. 1901.

given no distributional notes. Consequently I have listed the entire collection with notes on their distribution. To the seventeen reported forms we add ten making a total of twenty-eight species of Hepaticae now known to Mt. Ktaadn.

The asterisk has the same meaning as in the list of vascular plants above.

* *Pellia*? Specimens all sterile. Rocky shores of ponds in the North West Basin; similar habitat, Chimney Pond.

Marsupella emarginata (Ehrh.) Dumort. In water along shores of Lower Basin Pond; North Peaks, among rocks.

* *Jamesoniella autumnalis* (DC.) Steph. In woods North West Basin, growing with *Ptilidium ciliare* and *Lepidozia reptans*.

Lophozia ventricosa (Dicks.) Dumort. Rocky shores of Chimney Pond; Saddle, among rocks; Dry Brooks, among rocks.

Lophozia inflata (Huds.) M. A. Howe. Tableland, among rocks; sphagnum bog; shores of Lower Basin Pond.

* *Lophozia Michauxii* (Web.) Macoun. In alpine mat, Saddle and Tableland.

Lophozia? Among rocks, Tableland.

* *Mylia Taylori* (Hook.) S. F. Gray. In alpine mat among wet rocks, East slope near Saddle.

* *Cephalozia bicuspidata* (L.) Dumort. Among rocks, Saddle and Tableland.

* *Cephalozia lunulaefolia* Dumort. On old logs, North Basin trail.

* *Kantia trichomanis* (L.) S. F. Gray. On old logs, North Basin trail.

Bazzania trilobata (L.) S. F. Gray. Borders of Dry Pond; South Basin, moist woods generally.

* *Lepidozia reptans* (L.) Dumort. On old logs and rotten wood, North West Basin.

Blepharostoma trichophyllum (L.) Dumort. On old logs in woods, North Basin trail.

* *Temnomia setiforme* (Ehrb.) M. A. Howe. Among rocks along shores of Chimney Pond.

Ptilidium ciliare (L.) Nees. Very common everywhere extending to the summit.

Diplophylleia taxifolia (Wahl.) Trevis. In a spring near Lower Basin Pond.

Scapania undulata (L.) Dumort. Borders of Lower Basin Pond; on logs in Great Basin; dry brook near brow of Table-land.

* *Frullania Oakesiana* Aust. On balsam fir, South Basin. Rather common.

HULL BOTANICAL LABORATORY, University of Chicago.

EXPLANATION OF PLATE 44.— Fig. 1 (upper): Shelf at base of the North West Spur of Ktaadn, showing Lake Cowles and the larger of the *roches moutonnées* to the right; Sourdnahunk Range to the west.

Fig. 2 (lower): Heath society on the larger of the *roches moutonnées*, showing the encroachment of spruce; Sourdnahunk Range to the west.

RECENTLY RECOGNIZED SPECIES OF CRATAEGUS IN EASTERN CANADA AND NEW ENGLAND,— I.

C. S. SARGENT.

SINCE the publication in RHODORA in February and April, 1901, of several species of Crataegus found in the Champlain valley by Mr. Ezra Brainerd and other Vermont botanists, and in the neighborhood of Montreal by Mr. J. G. Jack, numerous collections of these plants have been made in Canada and New England. These disclose new forms which have previously remained unrecognized. Some of these are described in the following papers, while others cannot be properly characterized until they have been more fully studied in the field.

§ CRUS-GALLI.

Crataegus exigua, n. sp. Glabrous with the exception of a few hairs along the upper side of the midribs of young leaves. Leaves mostly erect, oblong-obovate and rounded or acute at the apex, cuneate and entire below the middle, above and often only toward the apex finely serrate, with straight or incurved teeth; bright red when they unfold and nearly fully grown when the flowers open, at maturity subcoriaceous, dark green and lustrous on the upper surface, paler and dull green on the lower surface, 3.5–5 cm. long, 1.5–2.5 cm. wide, with broad midribs raised and rounded on the upper side and

four or five pairs of thin primary veins almost entirely within the parenchyma; leaves of vigorous shoots oval, acute or acuminate, coarsely glandular-serrate, with prominent primary veins, stout petioles often red in the autumn, their stipules falcate, acuminate, coarsely glandular-serrate, 1–1.2 cm. long; petioles wing-margined nearly to the base, 8–12 mm. long. Flowers 1.5–1.7 cm. in diameter on slender pedicels, in broad 17–22-flowered thin-branched compound corymbs; bracts and bractlets minute, linear, red, caducous; calyx-tube narrowly obconic. the lobes elongated, narrow, acuminate, often red at the tips, entire or sparingly glandular, with minute red glands, reflexed after anthesis; stamens 8–10, usually 10; anthers deep rose-purple; styles 1 or very rarely 2. Fruit erect on thin rigid pedicels, in broad many-fruited clusters, oblong, full and rounded at the ends, bright crimson marked by numerous dark red dots, 10–11 mm. long, 9–10 mm. wide; calyx broad with a shallow cavity and spreading closely appressed lobes; flesh thin, yellow, dry and mealy; nutlet 1, narrowed from the middle to the obtuse ends, prominently ridged on the dorsal face, with a high rounded ridge, 8–10 mm. long, or rarely 2 and then smaller and compressed on the inner face.

A broad round-topped shrub 2–3 m. in height with numerous stout stems covered with smooth pale gray bark, and slender slightly zigzag branchlets marked by small oblong pale lenticels, dark olive green tinged with red when they first appear, dull reddish brown or orange-brown during their first season, becoming pale gray-brown the following year and armed with many stout straight or slightly curved spines generally spreading at right angles, chestnut-brown and lustrous while young, finally becoming ashy gray, usually 4–5 cm. long. Flowers during the first week of June. Fruit ripens and falls during the first week of October.

Connecticut: Waterford, on the ridge east of Fog Plain Brook, and pastures near Gilead, June and October 1902; East Haven, June 17, 1902; Shelden's Cove, Lyme, September 1902; Stonington, September 1902, *C. B. Graves.*

This shrubby species is well distinguished from *Crataegus Crus-galli*, Linnaeus, the only other species of this group which has been found in New England, by its usually solitary style and nutlet, its smaller more oblong brighter-colored fruit which falls as soon as ripe early in October, while the fruit of *Crataegus Crus-galli* remains on the branches usually until spring, and by its shrubby habit.

§ Pruinosae.

* Stamens 20.

+ Anthers rose color or lilac.

Crataegus pruinosa, K. Koch. Sargent, *Silva N. Am.* xiii. 61, t. 48.

Colonies of this widely distributed species differing from the type only in rather longer calyx-lobes and in smaller duller colored fruit were found last year in North Lancaster and Shirley, Massachusetts, by *Mrs. John E. Thayer.*

Crataegus festiva, n. sp. Glabrous. Leaves broadly ovate, acute, full and rounded, concave-cuneate or rarely subcordate at the entire base, coarsely and mostly doubly serrate above, with straight teeth tipped with large red glands, often irregularly divided into short lateral lobes; tinged with red as they unfold, and about half-grown and light green when the flowers open, at maturity membranaceous, dark bluish green on the upper surface, pale yellow-green on the lower surface, 5–8 cm. long, 4–6 cm. wide, with stout light yellow midribs deeply impressed on the upper side and often tinged with red below near the base, and 4 or 5 pairs of thin obscure primary veins extending obliquely to the points of the lobes; petioles slender, sparingly glandular, 2–2.4 cm. long; stipules linear, glandular-serrate, caducous; on leading shoots leaves oblong-ovate, acute or acuminate, broadly concave-cuneate and narrowed below into stout wide-margined petioles, 3-lobed with broad acute lobes, the lateral lobes much smaller than the terminal lobe, sometimes 7–8 cm. long and broad, their stipules foliaceous, lunate, irregularly and coarsely glandular-serrate, 1.5–1.8 cm. long, persistent. Flowers 2.6–2.7 cm. in diameter when fully expanded, on slender pedicels, in broad many-flowered thin-branched compound corymbs; bracts and bractlets oblong-obovate to linear, acute, glandular-serrate, caducous; calyx-tube broadly obconic, the lobes abruptly narrowed from broad bases, acute, prominently nerved, slightly serrate above the middle, with small glandular teeth, or nearly entire, reflexed after anthesis; stamens 16–20; anthers large, deep rose color; styles 3–5. Fruit erect in few-fruited clusters, subglobose, dull red, pruinose, 10–11 mm. in diameter; calyx prominent, sessile, with a broad deep cavity, and enlarged acuminate often coarsely serrate spreading or erect lobes; flesh thin, dry and hard, insipid to the taste, greenish white; nutlets usually 3, acute at the ends, rounded and occasionally slightly ridged on the back, 6–7 mm. long.

A shrub 1–2 m. high, with numerous intricately branched stems covered with dark gray bark and rarely more than 5 cm. in diameter,

and slender zigzag branchlets green tinged with red when they first appear, dull purple and marked by oblong pale lenticels during their first season, becoming reddish brown the following year, and armed with numerous slender nearly straight lustrous chestnut-brown spines 4–5 cm. long. Flowers during last week of May. Fruit ripens from the first to the middle of October and falls slowly. Late in the autumn the leaves turn a dull purple color.

CONNECTICUT: Open rocky pastures near the shores of Niantic River, East Lyme and from one to two miles north of the village of Niantic, *C. B. Graves*, May and October 1902.

Crataegus Pequotorum, n. sp. Glabrous. Leaves ovate, acute or acuminate, rounded or broadly cuneate at the entire base, sharply and doubly glandular-serrate above, rarely divided into short acute lateral lobes; thin, often concave, dull light green above, paler below and nearly fully grown when the flowers open, at maturity membranaceous, dark blue-green on the upper surface, paler on the lower surface, 5–6 cm. long, 4–5 cm. wide, or on vigorous shoots 6.5–7 cm. long and broad, with slender midribs impressed on the upper side and 4 or 5 pairs of thin primary veins; petioles slender, slightly or on leading shoots broadly wing margined at the apex, 2–3 cm. long. Flowers 1.5 cm. in diameter, on slender elongated pedicels in simple or rarely compound 3-6, very rarely 9-flowered thin-branched corymbs; bracts and bractlets minute, oblong-obovate, glandular-serrate, caducous; calyx-tube broadly obconic, the lobes gradually narrowed from broad bases, short, acuminate, tipped with dark glands, entire or rarely obscurely serrate, reflexed after anthesis; petals occasionally deep rose color; stamens 18–20; anthers large, lilac color; styles 4 or 5, rarely 3. Fruit more or less pendant, short-obovate, full and rounded at the apex, abruptly narrowed below into the enlarged apex of the pedicel, obtusely 4 or 5-angled, 9–11 mm. long, 11–13 mm. wide, dark crimson, pruinose, marked by numerous large dark lenticels; calyx prominent, with a distinct tube, a broad shallow cavity and spreading and reflexed lobes; flesh thick, hard but somewhat juicy, insipid, crimson; nutlets 3–5, acute at the ends, thin, rounded and slightly grooved on the back, 7 mm. long.

An arborescent shrub 2–3 m. in height with a stem covered with rough gray bark, and usually 7–8 cm. in diameter, ascending and wide-spreading branches, and slender branchlets marked by small oblong pale lenticels, yellow-green tinged with red when they first appear, dull red-brown or purplish during their first season, becoming slightly darker the following year, and usually ashy gray during the following season, and armed with stout straight dark purple lustrous spines usually about 2.5 cm. long, and conspicuous globose winter-

buds 3–4 mm. in diameter, with lustrous bright chestnut-brown scales scarious on the margins. Flowers during the first week of June. Fruit ripens and begins to fall about October 20th.

CONNECTICUT: Mumford's Point, Groton, in the region once inhabited by the Pequot Indians, *C. B. Graves*, June and October 1902.

Well distinguished from the other described species of this group by the form of its thin leaves with their long petioles and by the crimson flesh of the pear-shaped fruit.

Crataegus pilosa, n. sp. Leaves ovate to rhombic, acute or acuminate, full and rounded, or cuneate or on leading shoots truncate or subcordate at the entire often glandular base, finely and usually doubly serrate above, with gland-tipped teeth and often, particularly on vigorous shoots, divided into short acute lobes; when they unfold tinged with red and coated above with long pale hairs; nearly fully grown when the flowers open and then thin, membranaceous, pale yellow-green and still slightly pilose; at maturity subcoriaceous, glabrous, dark blue-green on the upper surface, paler on the lower surface, 4–6 cm. long and broad, with slender midribs slightly impressed above and 3 or rarely 4 pairs of thin remote primary veins extending obliquely to the points of the lobes; petioles slender, wing-margined above, deeply grooved, glandular, with few large dark red glands, 1.2–1.4 cm. long; stipules linear to falcate, coarsely glandular-serrate, caducous. Flowers on slender elongated pedicels, in 3–5-flowered glabrous thin-branched compound corymbs; calyx-tube broadly obconic, the lobes short, acute, entire or occasionally furnished with a few small glandular teeth, reflexed after anthesis; stamens 20; anthers small, bright rose color; styles 5 or rarely 4, surrounded at the base by a narrow ring of pale hairs. Fruit erect, subglobose to broadly ovate, often somewhat angled below the middle, dull dark crimson, about 3 cm. long; calyx sessile, with a broad shallow cavity and much enlarged lobes gradually narrowed from broad bases, spreading or reflexed; flesh thin, dry and mealy, pale green; nutlets 4 or 5, thin, acute at the ends, conspicuously and irregularly ridged on the back" with a high rounded ridge, about 1.2 cm. long.

An intricately branched shrub 3–4 m. high, with numerous stout stems covered with rough ashy gray bark, and slender slightly zigzag branchlets marked by oblong scattered pale lenticels, yellow-green when they first appear, dull purple during their first season, chestnut-brown and lustrous when the flowers open the following spring, and finally pale gray tinged with red, and armed with numerous stout nearly straight shining chestnut-brown ultimately ashy gray spines

2–3 cm. long. Flowers about the 20th of May. Fruit ripens and falls the middle of October.

MASSACHUSETTS: Thickets, Lancaster, *Mrs. John E. Thayer*, May and October 1902.

Distinguished from all described species of the Pruinosa Group by the abundant hairs on the upper surface of the young leaves which in May make it difficult to distinguish it from some species of the Tenuifolia Group.

← ← Anthers yellow.

Crataegus conjuncta, n. sp. Glabrous. Leaves ovate to oval, acute or acuminate, rounded or cuneate, or on leading shoots truncate at the mostly entire base, sharply usually doubly glandular-serrate above, more or less deeply divided into 3 or 4 pairs of acute or acuminate lateral lobes; bronze color when they unfold, and when the flowers open thick and firm, light yellow and more than half grown; at maturity coriaceous, dark blue-green and lustrous on the upper surface, pale on the lower surface, about 5 cm. long, 3.5–6 cm. wide, with thin yellow midribs impressed above and remote slender straight or arching veins extending to the points of the lobes; petioles slender, usually slightly wing-margined above, sparingly and irregularly glandular on the margins, 2–2.5 cm. long; stipules lanceolate to oblong-obovate, glandular-serrate, caducous. Flowers 1.6–1.8 cm. in diameter on slender pedicels, in 5–10, usually 5 or 6-flowered compound thin-branched corymbs; bracts and bractlets linear and acuminate to lanceolate, glandular, pink, caducous; calyx-tube broadly obconic, the lobes gradually narrowed from broad bases, nearly triangular, tipped with bright red glands, entire or coarsely and irregularly glandular-serrate; stamens 20; anthers small, light yellow; styles 3–5, usually 5. Fruit drooping or erect in few-fruited clusters, subglobose, usually broader than long, angled sharply while young, full and rounded at the ends, about 1 cm. in diameter, when fully grown dull green covered with a thick glaucous bloom, at maturity dull orange-red more or less blotched with green and marked by many small dark dots; calyx enlarged, prominent with a well developed tube, a broad deep cavity, and spreading or incurved often slightly serrate lobes dark red on the upper side below the middle; flesh green, thin, hard and dry; nutlets 4 or 5, thick, acute at the ends, ridged on the back, with a high rounded often grooved ridge, 7–8 mm. long.

A broad round-topped intricately branched shrub 3 or 4 m. in height, occasionally arborescent in habit, with one or more stems 5–6 cm. in diameter, light gray scaly bark and slender straight or slightly zigzag

branchlets, light yellow-green when they first appear, becoming bright chestnut or orange-brown and marked by numerous small oblong pale lenticels during their first season, and ashy gray or pale gray-brown the following year, and armed with many stout nearly straight lustrous chestnut-brown ultimately gray spines 2.5–5 cm. long and often pointed toward the base of the branch. Flowers late in May or during the first week of June. Fruit ripens early in October and falls gradually.

MASSACHUSETTS: Somerset, *Miss L. H. Handy*, 1900; Topsfield, *T. E. Proctor*, October 1900, June 1901; upland pastures, Boylston and Lancaster, *J. G. Jack*, *Mrs. J. E. Thayer*, and *C. S. Sargent*, 1899 to 1902. CONNECTICUT: Oxford, *E. B. Harger*, May and September 1900 and 1901.

Crataegus cognata, n. sp. Glabrous. Leaves ovate, acute or acuminate, rounded or broadly concave-cuneate at the entire base, sharply and often doubly glandular-serrate above and divided into 3 or 4 pairs of short acute lateral lobes; nearly fully grown when the flowers open and then thin, dark blue-green on the upper surface, pale on the lower surface; at maturity coriaceous, dull blue-green above, pale yellow-green below, 6–6.7 cm. long, 3.5–5.5 cm. wide, with thin yellow midribs deeply impressed above and slender primary veins extending to the points of the lobes; petioles slender, slightly winged at the apex, grooved, glandular, with small dark glands, 2–3 cm. long; stipules linear, acuminate, glandular-serrate, caducous; on vigorous shoots leaves often oblong-ovate, acuminate, subcordate at the base, coarsely serrate, deeply 3-lobed, the lateral lobes acute and much smaller than the terminal lobe, 8–9 cm. long, 7–7.5 cm. wide, their petioles stout, 2–3 cm. long, broadly wing-margined nearly to the base, conspicuously glandular. Flowers about 2 cm. in diameter on long slender pedicels, in broad lax thin-branched 5–7-flowered compound corymbs; bracts and bractlets small linear-obovate, acuminate, glandular-serrate, turning red before falling, caducous; calyx-tube broadly obconic, the lobes gradually narrowed from broad bases, elongated entire or sparingly glandular-serrate, tipped with minute red glands, reflexed after anthesis; stamens 20; anthers pale yellow; styles 3 or 4, rarely 5. Fruit in few-fruited erect or drooping clusters, pyriform or when fully ripe sometimes oblong, pruinose, green or green tinged with red until late in the autumn, becoming dull crimson at maturity, about 1 cm. long, 1.8–1.9 cm. wide; calyx enlarged, with a short tube, a broad deep cavity, and reflexed appressed lobes, often deciduous from the ripe fruit; flesh thin, dry and mealy, greenish yellow; nuttles usually 3 or 4, thick, full and rounded at the ends, prominently ridged on the broad rounded back, with a high rounded ridge, 6–7 mm. long.

A slender arborescent shrub 2–3 m. in height with stems covered with pale gray scaly bark and 7–8 cm. in diameter, small erect and spreading branches, and stout nearly straight branchlets marked by small oblong orange-colored lenticels, olive green tinged with red when they first appear, becoming bright chestnut-brown and lustrous during their first season and dark reddish brown the following year, and armed with stout nearly straight dark purple ultimately gray spines 4–5 cm. long. Flowers at the end of May and early in June. Fruit ripens from the 1st to the 10th of October and usually falls during that month.

MASSACHUSETTS: Hill west of the main street of Great Barrington, and roadside between Great Barrington and Alford, *Brainerd* and *Sargent*, May 31, 1902; Great Barrington, *C. S. Sargent*, September 9 and October 4, 1902; CONNECTICUT: Gravelly soil, Poquonnock Plain, Groton, *C. B. Graves*, June, July and October 1901.

Crataegus littoralis, n. sp. Glabrous. Leaves ovate, acute, broadly cuneate or rounded or occasionally narrowed at the entire base, finely often doubly serrate above, with straight teeth terminating in bright red glands, and divided into 3 or 4 pairs of broad rounded or short pointed acute lobes; tinged with red when they unfold, and when the flowers open half-grown and light yellow-green; at maturity thin but firm in texture, dark green and lustrous on the upper surface, pale on the lower surface, 4–6 cm. long, 3–5 cm. wide, with prominent midribs impressed above and 4 or 5 pairs of thin primary veins arching to the points of the lobes; petioles slender, slightly wing-margined toward the apex, conspicuously glandular, often red in the autumn like the under side of the midribs, 2–2.5 cm. long; stipules linear to falcate, acuminate, glandular-serrate, reddish, caducous. Flowers 2 to 2.2 cm. in diameter on slender pedicels in compact 5 to 6-flowered simple corymbs; bracts and bractlets linear, acuminate, glandular-serrate, caducous; calyx narrowly obconic, the lobes gradually narrowed from broad bases, slender, acuminate, entire or sparingly glandular; petals often streaked with purple; stamens 20; anthers large, pale yellow; styles 2–4, usually 3. Fruit short-obovate, erect on the much thickened rigid pedicels, gradually narrowed toward the base, dark crimson, somewhat pruinose, 1–1.2 cm. long, 1–1.1 cm. wide; calyx prominent with a short distinct tube, a broad shallow cavity and spreading lobes usually deciduous from the ripe fruit; flesh thin, hard, greenish or yellowish white, slightly acid; nutlets 2–4, full and rounded at the ends, prominently ridged on the back, with a high round more or less grooved ridge, 6–7 mm. long.

A shrub with a broad open head 1–3 m. in height, with stems

rarely 1 dm. in diameter covered with pale gray smooth or near the ground slightly scaly bark, and slender nearly straight branchlets, green tinged with red when they first appear, becoming light red-brown and marked by oblong pale lenticels during their first season and ashy gray the following year, and sparingly armed with straight stout dark purple ultimately ashy gray spines from 2.5–3 cm. long.

Flowers about June 1st. Fruit ripens early in October and remains for at least another month on the branches.

CONNECTICUT: Rocky banks and elevations bordering salt marshes near Alwive Cove, New London, and Waterford, *C. B. Graves*, June, September and October 1902; *C. S. Sargent*, August 1892.

*** * Stamens 10; anthers purple.**

Crataegus dissona, n. sp. Glabrous. Leaves ovate to rhombic, acute or acuminate, cuneate and entire below, sharply and doubly serrate above, with straight spreading glandular teeth, and slightly and irregularly divided into acute lateral lobes; tinged with red as they unfold, and nearly fully grown when the flowers open, and then membranaceous and pale yellow-green, at maturity thin but firm in texture, dull dark blue-green on the upper surface, pale on the lower surface, 5–6 cm. long, 4–5 cm. wide, with thin light yellow midribs impressed on the upper side, and few slender primary veins arching obliquely to the points of the lobes; petioles slender, grooved, slightly wing margined toward the apex, sparingly glandular, with minute dark mostly deciduous glands, 2–2.5 cm. long; stipules linear, acuminate, glandular-serrate, caducous; leaves on vigorous shoots ovate, generally rounded or truncate at the broad base, more deeply lobed than the leaves of lateral branchlets, 5–6 cm. long and broad. Flowers 1.2–1.4 cm. in diameter on slender pedicels, in compact 5–7-flowered compound corymbs; bracts and bractlets linear, glandular-serrate, pink, caducous; calyx-tube broadly obconic, the lobes short, acuminate, entire or slightly glandular-serrate above the middle; stamens 10, or rarely 7–9; anthers pale purple; styles 3 or 4, rarely 5, surrounded at the base by a narrow ring of pale tomentum. Fruit pendant in drooping few-fruited clusters, pruinose, crimson, blotched with green and marked by few large dark dots, 1.2–1.6 cm. in diameter, sometimes 4 mm. broader than high; calyx small, sessile with a narrow shallow tube and erect boat-shaped lobes, their thin acuminate tips mostly deciduous before maturity; flesh thick, dry and mealy, bright yellow-green sometimes tinged with red; nutlets usually 3 or 4, thick, acute at the ends, prominently ridged on the back, with a high rounded ridge, about 7 mm. long.

A slender shrub 2–3 m. in height with stems 5 or 6 cm. in diame-

ter covered with pale gray scaly bark, erect and spreading branches and slender straight or slightly zigzag branchlets, yellow green somewhat tinged with red when they first appear, reddish brown or purple and marked by small pale dots during their first season, becoming grayish brown the following year and ashy gray during their third season, and armed with numerous stout nearly straight chestnut brown or purple ultimately gray spines 4–5 cm. long. Flowers during the last week of May. Fruit ripens and begins to fall the middle of October.

MASSACHUSETTS: Rocky upland pastures, Great Barrington, *Brainerd* and *Sargent*, May 1902, *C. S. Sargent*, September and October 1902. CONNECTICUT: Oxford *E. B. Harger*, May and September 1901; East Lyme, *C. B. Graves*, May and September 1902.

Crataegus Jesupi, n. sp. Glabrous. Leaves oblong-ovate, acuminate, broadly cuneate, rounded or rarely truncate at the mostly entire base, doubly serrate above with incurved glandular teeth and usually divided into 4 or 5 pairs of acute lateral lobes, membranaceous, pale yellow-green on the upper surface, paler on the lower surface, 6–7 cm. long, 4–5 cm. wide with slender yellow midribs impressed on the upper side and thin primary veins extending obliquely to the points of the lobes; petioles slender, slightly or on vigorous shoots broadly wing-margined toward the apex, glandular, with small scattered glands, 2–3.5 cm. long; stipules linear to falcate, acuminate, glandular-serrate, caducous. Flowers about 1.7 cm. in diameter on slender elongated pedicels, in broad, usually 7–9-flowered compound corymbs; bracts and bractlets oblong-obovate and rounded or acute at apex, to lanceolate, glandular-serrate, caducous; calyx-tube broadly obconic, the lobes gradually narrowed from broad bases, acute, entire, tipped with bright red glands; stamens 10; anthers dark red; styles 3 or 4, surrounded at the base by a narrow ring of pale tomentum. Fruit obovate to short-oblong, obtusely angled particularly below the middle, bright scarlet, pruinose when fully grown, destitute of bloom at maturity, marked by large dark dots, about 1 cm. long and wide; calyx small with a short tube, a narrow shallow cavity and spreading lobes mostly deciduous before the fruit ripens; flesh thin, dry, pale yellow; nutlets 3 or 4, thick, full and rounded at the ends, prominently and irregularly ridged on the back, with a high rounded ridge; 6–7 cm. long.

A treelike shrub 3–6 m. in height with stems 6–8 cm. in diameter and slender slightly zigzag branchlets marked by small lenticels, olive-green tinged with red when they first appear, reddish brown and lustrous during their first season, becoming gray slightly tinged

with red the following year, and armed with stout straight chestnut-brown ultimately gray spines from 2–4 cm. long. Flowers during the last week of May. Fruit ripens about the middle of October.

Vermont: Moist ground; lower slopes of Twin Mountain, West Rutland, *W. W. Eggleston*, June and October 1900, May and October 1901.

At the suggestion of its discoverer this species is named for Henry G. Jesup, professor at Dartmouth and a critical student of the flora of northern New England.

§ Intricatae.

* Anthers yellow.

Crataegus modesta, Sargent, Rhodora, iii. 28, (1901).

Described from plants growing in a small isolated colony on the rocky ledges of Twin Mountain, West Rutland, Vermont, *Crataegus modesta* is now known to be widely distributed in western New England and to grow near Albany, New York. Southward it grows more vigorously than in the original station, with larger leaves and usually larger fruit.

New York: Rocky hillsides, North Albany, *Charles H. Peck*, May, June, September and October 1901; May and September 1902, *C. S. Sargent*, September 1902. Massachusetts: Hillside, Great Barrington, *Brainerd* and *Sargent*, May 1902; *C. S. Sargent*, September and October 1902. Connecticut: Southington, *C. H. Bissell*, June and September 1901; *L. Andrews*, June and September 1902; Stonington, *C. B. Graves*, September, 1901, May 1902. Specimens in fruit only collected at East Windsor by *C. H. Bissell* (No. 22), at Oxford by *E. B. Harger* (No. 55), at Norwalk, by *C. H. Bissell* (No. 27), at Trumbull by *E. H. Eames* (Nos. 199 & 229), are provisionally referred to this species.

* * Anthers rose color or purple.

Crataegus Stonei, n. sp. Leaves oblong, narrowed to the ends, acuminate, cuneate, entire and often glandular at the base, sharply and doubly serrate above, with straight teeth tipped with dark red glands, irregularly divided into numerous short acute lateral lobes; when they unfold pale yellow green more or less tinged with red, covered above with short pale hairs and villose below along the midribs and veins; more than half-grown when the flowers open and

then membranaceous, at maturity thin but firm in texture, dark yellow-green and scabrate on the upper surface, pale on the lower surface, 7–8 cm. long, 4–5 cm. wide, with orange-colored villose midribs and veins, the thin veins extending obliquely to the points of the lobes; petioles slender, wing-margined toward the apex, slightly grooved, glandular, with stipitate dark glands, villose, 2–3 cm. long; stipules linear, acuminate, glandular-serrate, caducous. Flowers 2 cm. in diameter on stout pedicels, in villose 4–6-flowered simple compact corymbs; bracts and bractlets oblong-obovate, conspicuously glandular-serrate, turning red before falling, large and conspicuous; calyx-tube broadly obconic, coated with long matted pale hairs, the lobes gradually narrowed from broad bases, acuminate, coarsely glandular-serrate above the middle, villose, reflexed after anthesis; stamens 10; anthers large, rose color; styles 3 or 4, surrounded at the base by a broad ring of pale hairs. Fruit erect on elongated rigid slightly villose pedicels thickened toward the apex, obovate, light yellow or greenish yellow, covered toward the gradually narrowed or rounded base with long scattered pale hairs, 1.4 to 1.6 cm. long, 1.2–1.4 cm. wide; calyx large and prominent, with a broad shallow cavity and spreading much enlarged coarsely serrate lobes, dark red on the upper side at the base; flesh thin, dry and mealy; nutlets 3 or 4, thick, obtuse at the rounded ends, prominently ridge, with a high rounded irdge, 9–10 mm. long.

A shrub 1–2 m. in height with numerous intricately branched stems and stout slightly zigzag branchlets marked by occasional small oblong pale lenticels, green tinged with red and glabrous or villose when they first appear, and dark reddish purple and sometimes puberulous during their first season, becoming dull reddish brown the following year and armed with many stout nearly straight red-brown ultimately gray spines 4–6 cm. long and usually pointed toward the base of the branch. Flowers during the first week of June. Fruit ripen about the middle of September.

MASSACHUSETTS: Top of Smith Hill; Pelham, *G. E. Stone*, June and September and 1902.

I am glad to associate with this handsome and distinct species the name of its discoverer, Professor George E. Stone of the Massachusetts Agricultural College.

Crataegus Peckii, n. sp. — Leaves oblong-ovate, acute or acuminate, rounded to broadly concave-cuneate at the mostly entire glandular base, doubly serrate above, with straight or incurved gland-tipped teeth, slightly divided into 3 or 4 pairs of broad rounded or acute lobes; coated as they unfold with long matted pale hairs, and nearly fully grown and villose along the midribs and veins below when the flowers open, at maturity thin but firm in texture, dark green and

scabrate on the upper surface, paler on the lower surface, 7–8 cm. long, 5–6 cm. wide, with yellow glabrous or slightly villose midribs and remote primary veins arching to the points of the lobes; petioles stout, slightly wing-margined above by the decurrent base of the leaf-blades, glandular with large dark glands, at first villose, glabrous and more or less deeply tinged with red in the autumn, 1.8–2.5 cm. long; stipules linear, coarsely glandular-serrate, mostly deciduous before the flowers open; on vigorous shoots leaves usually broader than long, rounded or cordate at the base, more deeply lobed than the leaves of fertile branchlets, 6.5–6 cm. wide, usually about 6 cm. long, the lower side of the stout midribs often bright red. Flowers 1.5–1.7 cm. in diameter, in 3–6-flowered simple or compound slightly villose corymbs; bracts and bractlets oblong-obovate and acute to linear and acuminate, coarsely glandular-serrate, caducous; calyx-tube broad, abruptly narrowed below into the short villose pedicel, the wide lobes entire below the middle, foliaceous, laciniately divided and glandular above the middle, acuminate at the apex; stamens 10; anthers large, pink or pale purple; styles 3 or 4. Fruit in few-fruited erect clusters on short slight villose pedicels, subglobose to short-oblong or ovate, full and round and slightly hairy at the ends, light yellow-green more or less tinged with red, lustrous, marked by few large dark dots, 1.8–3 cm. long; calyx enlarged, with a short tube, a broad deep cavity, and spreading or rarely erect lobes coarsely serrate toward the apex; flesh thick, green, dry and mealy; nutlets 3 or 4, obtuse at the ends, prominently ridged on the broad rounded back, 1.6–1.8 cm. long.

A broad shrub 1–2 m. tall, with numerous intricately branched stems covered with dark gray bark and stout nearly straight branchlet marked by many large oblong pale lenticels, orange-brown and more or less villose when they first appear, light red-brown and usually villose during their first season, becoming dark gray-brown the following year, and sparingly armed with slender slightly curved chestnut brown ultimately gray spines 3.5–6 cm. long. Flowers during the first week of June. Fruit ripens from the first to the middle of October.

NEW YORK: On a slate stone knoll a few miles north of Troy, on the Hudson River, in Lansingburg, *C. H. Peck*, June, September and October 1901 and 1902. To this species I have referred provisionally fruiting specimens of a shrub collected by me on a hill west of the main street of Great Barrington, October 4, 1902.

Professor Charles H. Peck, the distinguished state botanist of New York, who has recently discovered in the neighborhood of Albany several other undescribed forms in this genus, permits me to associate his name with this handsome species.

Crataegus Bissellii, n. sp. Glabrous. Leaves oval and gradually narrowed to the ends, or rarely ovate and broadly cuneate or rounded at the base, acute or acuminate at the apex, coarsely and often doubly glandular-serrate except toward the glandular base, thin but firm in texture, dark dull blue-green on the upper surface, pale yellow-green on the lower surface, 4–6 cm. long, 2.5–4 cm. wide, with thin orange-colored midribs and usually four pairs of slender primary veins; petioles slender, slightly wing-margined toward the apex, glandular, with small dark glands, 2–3 cm. long; stipules linear, acuminate, coarsely glandular-serrate, caducous; on leading shoots sometimes broadly ovate, acute, full and rounded or very rarely subcordate at the base, often slightly 3–lobed, with small acute lateral lobes, 5–6 cm. long and broad. with stout petioles broadly wing-margined above the middle and foliaceous lunate coarsely glandular-serrate stipules often 1 cm. in length. Flowers about 1.5 cm. in diameter on slender elongated pedicels in 4–7-flowered compound corymbs; bracts and bractlets linear to oblong, acuminate, coarsely glandular-serrate, reddish, large and conspicuous, caducous; calyx-tube broadly obconic, the lobes gradually narrowed from broad bases, coarsely but irregularly glandular-serrate; stamens 10; anthers small, pink to rose-purple; styles 3 or 4. Fruit in drooping clusters, pyriform, gradually narrowed below into the slender pedicel, dull orange-red more or less tinged with green, 1.2–1.4 cm. long, 9–10 mm. wide; calyx large and prominent, with a short tube, a broad deep cavity, and reflexed lobes usually serrate only toward the apex, and bright red on the upper side below the middle; flesh thin, yellow-green, dry and mealy; nutlets 3 or 4, thick, rounded at the obtuse ends, prominently ridged on the back, with a broad rounded ridge, 7–8 mm. long.

A shrub usually about 1, very rarely 2, m. in height with numerous stems covered with pale gray bark, spreading branches, and thin nearly straight branchlets marked by occasional small pale lenticels, bright chestnut-brown and lustrous during their first season, becoming pale reddish brown the following year, and unarmed or armed with slender nearly straight purple lustrous ultimately ashy gray spines mostly pointed toward the base of the branch, 2.5–4 cm. long. Flowers at the end of May or during the first week of June. Fruit ripens from the 20th of September to the 10th of October and falls as soon as it is ripe.

Connecticut: Open pastures in rich moist soil, or borders of thickets in dry and hard or sandy soil, and on low hills of trap rock in and near Southington, *C. H. Bissell*, September 1900, June and October 1901; *L. Andrews*, May, June and September 1902; *C. S. Sargent*, September 1902.

Crataegus Hargeri, n. sp. Glabrous. Leaves ovate to ovate-oblong, acute or acuminate, full and rounded or broadly cuneate, or gradually narrowed at the mostly entire base, sharply and often doubly serrate, with spreading glandular teeth, thin but rigid in texture, light yellow-green on the upper, pale on the lower surface, about 3 cm. long, 2–2.3 cm. wide, with slender yellow midribs and primary veins deeply impressed on the upper side; petioles slender, slightly wing-margined at the apex, glandular with numerous dark persistent glands, 1.3–1.5 mm. long; on leading shoots leaves ovate, rounded or short-pointed at the apex, truncate to subcordate at the base, deeply 3-lobed, with small rounded or short-pointed lateral lobes, often 4.5–5 cm. long and wide, with stout petioles wing-margined almost to the base and foliaceous lunate coarsely glandular-serrate stipules. Flowers about 1.2 cm. in diameter on slender elongated pedicels in 3–5-flowered compound corymbs; bracts and bractlets linear to oblong-obovate, acute or acuminate, coarsely glandular-serrate, reddish before falling, caducous; stamens 10; anthers large, rose color; styles 3; calyx-tube narrowly obconic, the lobes gradually narrowed from broad bases, acuminate, entire or irregularly glandular-serrate, reflexed after anthesis. Fruit on slender erect pedicels 1.5–2 cm. in length and gradually enlarged at the apex, obovate, full and rounded above, abruptly narrowed below, dull orange-green, 1–1.2 mm. in length, calyx large and prominent with a long tube, a deep broad cavity and reflexed lobes; flesh thin, green dry and mealy; nutlets 3, thick, full and rounded at the ends, prominently ridged on the back, with a broad rounded often grooved ridge, about 6 mm. long.

A straggling semiprostrate shrub usually not exceeding 1 m. or very rarely 2 m. in height, with stems 2–3 cm. in diameter and covered with ashy gray bark, and slender slightly zigzag branchlets dark olive green tinged with red when they first appear, dull red-brown and marked by few large pale lenticels during their first season, becoming light reddish brown the following year, and armed with many straight very slender light red-brown lustrous spines 3–5 cm. long spreading in all directions and long persistent on the old stems, and nearly globose winter-buds 3–4 mm. in diameter and covered with orange-red lustrous scales rounded and scarious on the margins. Flowers at the end of May. Fruit ripens toward the end of September without becoming soft and remains on the branches after the leaves have fallen.

CONNECTICUT: Rocky pastures, Oxford, *E. B. Harger*, May, June and September 1901, May and September 1902; *C. S. Sargent*, September 1902; Southington, *C. H. Bissell*, September 1901; *L. Andrews*, May and September 1902.

ARNOLD ARBORETUM.

ANDROMEDA POLIFOLIA AND A. GLAUCOPHYLLA.

M. L. Fernald.

The attractive Bog Rosemary of our American swamps and wet shores is familiar to all northern botanists as *Andromeda Polifolia*. Under this name alone it has passed for more than half a century, its supposed range including all boreal America, Europe and Asia; and one observer of more than ordinary keenness has even ventured the statement that "this species, although so widely distributed, retains its form without variation in all latitudes"[1] from southern Canada to the Arctic Sea. Yet if we examine the material which is passing in America as *Andromeda Polifolia* we shall find that in general the plant of temperate bogs — from central Labrador to Pennsylvania, Minnesota and Lake Winnipeg — differs in nearly every feature from the plant of arctic Europe, Asia, and America (northern Labrador to Alaska).

True *Andromeda Polifolia*, described by Linnaeus as growing "*in* Europae *frigidioris paludibus turfosis*" and now known to extend across northern Asia and Arctic America, in general resembles the common shrub of New England and Canadian bogs, and it is not surprising that the two should have been confused. *A. Polifolia* has the leaves covered beneath, at least when young, with a glaucous bloom, which, however, may be quite deciduous in the older leaves; its young shoots are green and not glaucous; its scaly terminal buds are brownish but rarely glaucous, and from them arise the few flowers nodding singly at the tips of slender nearly straight pedicels often three or four times their length; the calyx-lobes are either pale or red-tinged; and the brown or reddish capsule is subglobose or obovoid, usually higher than broad. This plant, found ordinarily in the arctic regions, extends south in Europe to the Venetian Alps, in eastern Asia to Japan, and in America to Sitka, Lake Huron, and possibly to the mountains of New York.

The commoner plant of eastern America — from latitude 55° in Labrador to Lake Winnipeg, Minnesota and Pennsylvania — resembles *A. Polifolia* in foliage, but the under surface of the leaf, instead of bearing a deciduous paint-like glaucous coat, is tomentulose or

[1] Macoun, Cat. Can. Pl. i. 297.

pulverulent with fine white hairs; the young branches and the scaly buds are conspicuously glaucous; the flowers are borne on thicker curving pedicels as long or barely twice as long as the corolla; the calyx-lobes are whitish; and the very glaucous almost baccate capsule is depressed and turban-shaped, much broader than high.

Although these important differences between the Eurasian *Andromeda Polifolia* and its commoner American representative have so long been quite overlooked by American botanists, they were not unnoticed by early students of our flora. To Linnaeus, apparently, the American plant was quite unknown, and his *A. Polifolia*, based entirely upon European descriptions and specimens, is fortunately freed from any possible confusion with our plant.

The first botanist to distinguish our common species was apparently L'Heritier de Brutelle who seems to have characterized and illustrated as "*Andromeda Polifolia latifolia*" the American plant. The special volume in which L'Heritier discussed this plant was never published though the manuscript and plate were undoubtedly seen by Aiton, who in 1789 took up and described the plant under L'Heritier's name. Aiton treated *Andromeda Polifolia* as embracing three varieties as follows:[1]

Polifolia. 3. A pedunculis aggregatis, corollis ovatis, foliis alternis lanceolatis revolutis. *Sp. pl.* 564.

latifolia. α foliis oblongis, corollis ovatis incarnatis, laciniis calycinis patentibus ovatis albis: interdum apice rubicundis.

Andromeda polifolia latifolia. *L'Herit. stirp. nov. tom.* 2. *tab.* 11.

Broad-leav'd Marsh Andromeda.

media. β foliis lanceolatis, corollis oblongo-ovatis, rubicundis, laciniis calycinis magis erectis.

Common Marsh Andromeda, or Wild Rosemary.

angustifolia. γ foliis lanceolato-linearibus, laciniis calycinis oblongis rubris.

Narrow-leav'd Marsh Andromeda.

Nat. α. of North America; β. of Britain; and γ. of Newfoundland and Labrador.

Fl. May —— September. H. ♄.

[1] Aiton, Hort. Kew. ii. 68.

Aiton's variety *α*, *latifolia*, from North America, with spreading white calyx-lobes is undoubtedly the common plant of our northern bogs; his var. *β*, *media*, is the common *A. Polifolia* of northern Europe; but his var. *γ*, *angustifolia*, from Newfoundland and Labrador, is slightly problematic. The character "laciniis calycinis oblongis rubris" agrees well with a dwarf form of the true *A. Polifolia* known from Hebron, Labrador, from Lake Huron, and from the Mackenzie District and Alaska; but so far as known to the writer all the material from Newfoundland is the common American plant with white or whitish calyx-lobes.

The next treatment of the species of special interest was that of Pursh in 1814. Pursh closely followed Aiton in distinguishing two American varieties of *Andromeda Polifolia*, *α*, *angustifolia*, Ait., and *β*, *latifolia*, Ait., adding: "I strongly suspect the variety *α*. to be a distinct species, which might be called *A. rosmarinifolia*."[1] This narrow-leaved form with red calyx-lobes, as already stated, is known not only from Labrador, but from Lake Huron, Mackenzie and Alaska, and in the Old World it seems to be not infrequent. In fact, from the ordinary form of *A. Polifolia*, it differs only in its narrower more revolute leaves. In the common American plant which has ordinarily passed with us as *A. Polifolia*, both narrowly linear strongly revolute and oblong essentially flat leaves are often found on the same plant, as already noted by Macoun, who says "Young and late shoots have wider leaves than the normal form."[2] Similarly in 1778 Pallas, whose beautiful plate shows clearly the different phases of the Old World plant, after describing the common narrow-leaved form shown in his figures A and B, added to the characterization "imo interdum latifolius (fig. D)"[3] — a figure of a sterile shoot which closely simulates the broad-leaved young branches of the American plant. Thus it is evident that the breadth of leaf in true *A. Polifolia* as well as in its common American representative is largely due to the stage of development and is of no value as a diagnostic character.

In 1821 the common American plant was described by Link as a species distinct from the European *Andromeda Polifolia*, a course which, as shown by Link's description and notes, was based upon a

[1] Pursh, Fl. 291.
[2] Macoun, Cat. Can. Pl. i. 297.
[3] Pallas, Fl. Ross. i. pt. 2, 53, t. 71.

more discriminating study than the plant has since been accorded. Link's description was as follows: "*A. glaucophylla*. Foliis linearibus margine revolutis subtus albidis, floribus aggregatis terminalibus, pedunculis corolla ovata parum majoribus, antheris versus apicem aristatis. A. polifolia *β*. Pursh *am*. i. 291. Differt a praecedente cui similis pedunculorum magnitudine, qui in illa duplo longiores corolla et ultra. Folia subtus alba nec tomentosa. Glandulae inter stamina."[1]

Thus Link knew and pointed out most of the prominent features which separate the characteristic Andromedas of the two continents. Yet little attention seems to have been given to his work, although in 1834 George Don, who divided the aggregate *A. Polifolia* into many formal varieties, gave it partial recognition by attempting to keep Link's species as a variety apart from *A. Polifolia*, var. *latifolia*, Ait. Don was followed in this treatment by DeCandolle, but later authors have very generally treated the common American and European plants as one. That the two are clearly distinct species is sufficiently apparent from the foregoing discussion of the plants whose main characters are again briefly stated, and whose fruiting tips are shown in the figures kindly prepared by Mr. F. Schuyler Mathews.



Fig. 1

ANDROMEDA POLIFOLIA, L. (Fig. 1). Low shrub with elongate creeping base; stem simple or with ascending branches, 0.5 to 3 dm. high: leaves coriaceous, linear to narrowly oblong, entire, either flat or strongly revolute, glabrous, at first generally whitened beneath with a paint-like coat, later often quite green: young branches and bud-scales usually not glaucous: pedicels filiform, straightish, 2 to 4 times exceeding the nodding flower and erect fruit: corolla globose-urceolate: calyx with pale or usually reddish slightly ascending lobes: capsule brown or reddish, obovoid or subglobose, as high as broad.—Sp. 393 (1753), & Fl. Lap. 131, t. 1, fig. 2; Oeder, Fl. Dan. i. 11, t. 54; Pallas, Fl. Ross. i. pt. 2, 53, t. 71; Hook. Fl Bor.-Am. ii. 38, in part; Reich. Ic. Fl. Germ. xvii. 80, t. 110, fig. 1; Thomé, Fl. Deutschl. iv. 4, t. 463. Var. *media*, Ait. Hort. Kew. ii. 68 (1789); G. Don, Gen. Syst.

[1] Link, Enum. i. 394.

iii. 829; DC. Prodr. vii. 607. Var. *angustifolia*, Ait. Hort. Kew. ii. 68 (1789); Pursh, Fl. 291. Vars. *subulata*, *minima*, and *oleifolia*, G. Don, l. c. (1834). *A. rosmarinifolia*, Pursh, Fl. 291 (1814); G. Don, l. c. *A. Polifolia*, var. *rosmarinifolia*, DC. l. c. *Rhododendron Polifolium*, Scop. Fl. Carn. ed. 2, i. 287 (1772). — Arctic regions, extending south in Europe to Great Britain, and in the mountains to northern Italy; in Asia to Japan, &c.; and in America to Sitka (various collectors); Lake Huron (*Todd*), and "mountains, New York" (*Durand* in Herb. Thurber). Very local in temperate America, but to be expected on the mountains of northern New England.

A. GLAUCOPHYLLA, Link. (Fig. 2). Similar in habit: leaves white beneath with close fine pubescence: branchlets and bud-scales glaucous: flowers on thickish curved pedicels rarely twice as long as the urceolate corolla: calyx-lobes whitish, usually spreading: capsule depressed, turban-shaped, glaucous. — Enum. Hort. Berol. i. 394 (1821). *A. Polifolia* of Am. authors in general. *A. Polifolia*, var. *latifolia*, Ait. Hort. Kew. ii. 68 (1789); Pursh, Fl. 291; Lodd. Bot. Cab. vi. no. 546; G. Don, l. c.; DC. l. c. *A. Polifolia*, var. *angusti,folia*, Lodd. l. c. xvi. no. 1591 (1829), not Ait., and var. *revoluta* Lodd. l. c. xviii. no. 1725 (1831). [Loddiges ascribes the plants from which his plates were drawn to northern Europe, but probably they originated in America and later in cultivation were supposed to be European.] *A. Polifolia*, var. *glaucophylla*, G. Don, Gen. Syst. iii. 829 (1834); DC. l. c. *A. americana*, Hort., and *A. canadensis*, Hort. acc. to DC. l. c. (1839). — In sphagnum swamps and wet mossy shores and banks, from Aillik Bay (lat. 55°), Labrador to Lake Winnipeg, south to Minnesota, Pennsylvania and northern New Jersey.



Fig. 2

GRAY HERBARIUM.

RECORDS OF SOME PLANTS NEW TO MAINE.— On July 13th, 1902, while I was collecting along the water front below Bangor in company with Mr. F. M. Billings, we found a number of specimens of vetch-like leguminous plants growing in the gravelly ballast, which had been left there by some Italian vessels. Not being able to identify

them I referred them to Mr. M. L. Fernald of the Gray Herbarium and he has determined them as *Lens ervilea* L. and *Lens esculenta* Moench. The plants were growing together and I had supposed they were all of the same species until I submitted them to Mr. Fernald, though after knowing the truth I was able to see that they were quite different from each other.

On Aug. 10th, 1902, I collected specimens of a plant which was growing in various localities such as the rear of outbuildings, dumps and similar waste places, and which though sparingly occurring was seen in at least four localities in Bangor. Mr. Fernald pronounces this to be *Nonnea rosea* Link of Europe.—O. W. KNIGHT, Bangor, Maine.

THE ULOTHRICACEAE AND CHAETOPHORACEAE OF THE UNITED STATES.[1] — The plants included in the two families considered in this memoir are distributed all over the world, occurring abundantly in fresh water, and to a less extent in salt. Although the genera are pretty well marked, the species have been much confused, and practically no critical work has heretofore been done on the American forms. The present memoir is a careful attempt to clear up the American field, and will be very welcome to all algologists. Dr. Hazen has studied the living plants, both in the field and in the laboratory, for several years; he has had at his command all the literature and exsiccatae of the subject; and the result will probably be the standard for a long time to come. The principles adopted in the nomenclature may be best understood by two quotations: — p. 139, "In nomenclature, the Rochester code has been followed generally, though perhaps not with absolute rigidity in the case of one or two generic names": — p. 136, "One great source of confusion has been the incorrect determination of specimens, particularly manifested in the practice of forcing a given form into a certain species, or in other words, stretching a specific diagnosis. . . . . In case of doubt it is much less confusing to make a new species." As a result of the principle given in the first quotation, together with the principle of anchoring the generic name to the first species described under it by its author, two changes are made in generic names: *Tribonema* Derbés and Solier, in place of *Conferva*; *Myxonema* Fries, in place

[1] Mem. Torr. Bot. Club, Vol. XI, pp. 135–250, Pl. 20–42.

of *Stigeoclonium*. In a footnote *Hormiscia* Fries is proposed in place of *Urospora* Areschoug, but the genus is removed from the scope of the present paper. If we accept the author's principles, we cannot escape from the last two changes; as regards the first, the vital question is, what is the *Conferva* of Linnaeus? This can only be settled by the original specimens; if any are in existence, the examination should be made at once; if none are to be found, or if, as is rather likely, their condition is such as to render certainty in the matter impossible, it would hardly seem expedient to discard *Conferva*, as it is now used with a quite definite extension by practically all algologists.

This question of the actual type specimens is the one which may, if any, seriously affect Dr. Hazen's conclusions, in other particulars than the *Conferva* question. Until the test is actually made, no one can say whether we can reach any certain conclusions from specimens often over a century old, when even comparatively modern dried specimens are often of doubtful value; but until we either know, or are sure that we cannot know what the type was, is it not better to take the more conservative course, and make as few changes as possible? The burden of proof certainly rests on the one proposing the change.

Apart from the question just considered, there is little but praise to give the work. Descriptions and plates are clear, localities are given with dates and with collectors' or exsiccatae numbers. The work is of special interest to New England botanists, as of the 56 species recognized, 10 of them being new, 44 are represented at New England stations. Two forms and two varieties are recognized, the distinction being clearly made between form and variety; there are notes on 28 rejected or doubtful species and varieties.

The reviewer feels a real satisfaction, in which he is sure others will join, that when these hitherto perplexing and exasperating plants appear in the early spring of 1903, we shall be in a very different position in regard to them from the one we have heretofore occupied.— F. S. Collins.

ORGANIZATION OF THE CONNECTICUT BOTANICAL SOCIETY.

E. H. EAMES, M. D.

CONNECTICUT affords much interesting material relating to the flora of New England, partly because of its situation and the influence favoring the northward and southward distribution of numerous species. Study of these and other features being of permanent interest, it has been considered advisable to organize the botanists of the state into a *Connecticut Botanical Society*, for the collection and diffusion of correct information relating to the flora of the state, and to promote social intercourse among its members.

In fulfillment of this object, a meeting was held in New Haven, January 24th, 1903, when a simple constitution was adopted, and the following officers elected:— President, Professor A. W. Evans; Vice-President, Dr. C. B. Graves; Recording Secretary and Treasurer, Dr. E. H. Eames; Corresponding Secretary, Mr. E. B. Harger, Oxford, Connecticut.

An interesting program followed, the first paper of the day being on "November Wild Flowers," by Mr. E. B. Harger, in which the speaker described the various features pertaining to the flowering of plants at this late season. Lists and summaries for a number of years revealed about 175 species as having been found in flower in his neighborhood, with an average number for each year of about 75 species.

Field meetings being of much interest to the Society, it was decided to hold such a meeting in some little known part of the state to cover two or three days; also one-day meetings in places more readily accessible.

At the afternoon session, Mr. M. L. Fernald spoke most interestingly and at length, "On the Geographic Distribution of certain New England Plants." The known distribution of numerous species and varieties was cited, with special reference to their extra-limital occurrence and isolated stations in Europe, Asia and antipodal Japan. The Ice Age in its relation to the distribution of plants, was reviewed in explaining the otherwise seemingly erratic occurrence of many northern species, as well as some peculiar varietal or specific distinc-

tions resulting from long continued isolation on our own and other continents.

The various species dwelt upon in this fascinating discourse, were abundantly illustrated with selected herbarium specimens, a feature greatly appreciated.

As an instance of the northward extension of range in the present day, Mr. Fernald noted the Fringed Gentian in Central Maine, which he has seen to advance northward some fifty miles, under special conditions.

In conclusion, it was stated that Gaspé Peninsula, Quebec, has in its flora about 75% of circumboreal species, the percentage gradually decreasing to about 50% on Mt. Desert, 21% in Vermont, and 17% in Connecticut and on Long Island.

Mr. W. E. Britton, in a paper immediately following, entitled "Notes on the Flora of the North Haven Plains," elucidated the features of this region and its varying plant inhabitants. This was accompanied by photographs and a catalogue of the plants which had been observed.

Discussion on botanical matters in general was full of interest, and amply illustrated the advantages of such meetings. Moreover, an initial attendance of thirty-one botanists, quickly followed by a number of applications for membership, gives promise of a permanent and active organization.

Accurate and conscientious work upon a catalogue of the flora of the state being one of the most important objects of organization at this time, a committee was appointed by the President, pursuant to an article in the Constitution to collect and publish material for such work.

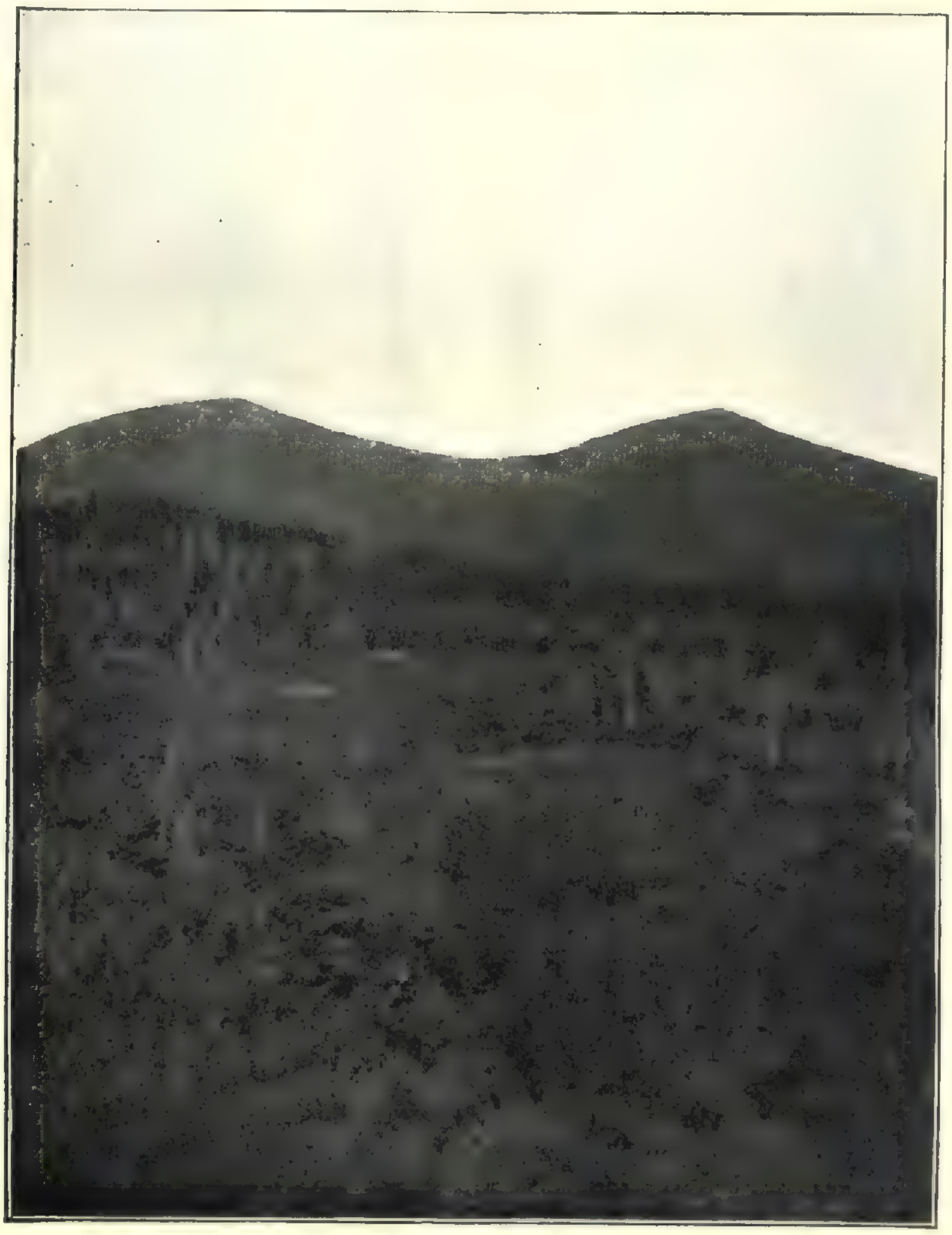
The committee on the Phaenogamous and Vascular Cryptogamous plants is as follows: — Dr. C. B. Graves, New London; Dr. E. H. Eames, Bridgeport; Mr. C. H. Bissell, Southington; Mr. L. Andrews, Southington; Mr. E. B. Harger, Oxford, and Mr. J. N. Bishop, Plainville. A committee to take charge of work upon the lower Cryptogams will be announced later. It is hoped that anyone who can contribute specimens and information relating to the flora of Connecticut, will communicate with a member of these committees. Aid of this kind will be gratefully received, and it is safe to say that the botanical world at large will, so far as its interest in this work is concerned, equally appreciate all such assistance.

Bridgeport, Connecticut.

ON January 27th, 1903, DR. LORIN LOW DAME died after brief illness at his home in Medford, Massachusetts, in his sixty-fifth year. An experienced and talented educator, Dr. Dame has for many years possessed the respect and esteem of a wide acquaintance. Among botanists he was well known for the admirable Flora of Middlesex County, Massachusetts, of which he was the senior editor, and for two valuable works upon the trees of New England. Dr. Dame was one of the founders of the New England Botanical Club, and through the seven years of its existence has been one of its most devoted members.

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AN EXPERIMENT WITH THE FRUIT OF RED BANEBERRY.

Alice E. Bacon.

Some years ago several plants of the red baneberry (*Actaea spicata*, var. *rubra*, Ait.) were transplanted to a sheltered spot in Bradford, Vermont, along the base of a veranda facing the east, and shaded by maples. The situation proving favorable, the plants each year have been very ornamental, being of unusual size and producing very large clusters of fruit. The graceful, lace-like leaves and the vivid crimson of the berries attract a great deal of attention, and the questions are often asked: "Where did you get such beautiful plants?" "What can they be?" and "Are n't those berries good to eat?"

An examination of several works on Materia Medica failed to show anything as to the properties of the red-berried species, although those of the white-berried were carefully noted. In the fear that children, attracted by the beauty of the fruit, might eat to their own undoing, an experiment in the qualities of the berries was entered upon with the following result.

A small dose was taken after the mid-day meal, as caution seemed advisable; but the only effect noted was a slight burning in the stomach. The question, however, of children eating the forbidden fruit was definitely settled at once, as no child, youth, sane adult, not even a hungry school-boy would ever devour it from deliberate choice; the taste is most nauseous, bitter, puckery; indeed, several even more drastic adjectives might be applied with perfect truth.

Having survived the first attempt, the experimenter hopefully tried again two days later, allowing time for the first dose to be completely

eliminated from the system. On this occasion double the first quantity was taken, and in less than half an hour there was a decided quickening of the pulse and a return of the burning in the stomach, this time more severe than before. These symptoms were transient, lasting perhaps fifteen minutes.

Two days later twice the former amount was taken. Half an hour afterward all curiosity on the subject of red baneberry was abundantly satisfied, for this one experimenter at least. At first there was a most extraordinary pyrotechnic display of blue objects of all sizes and tints, circular with irregular edges: as one became interested in the spots a heavy weight was lowered on the top of the head and remained there, while sharp pains shot through the temples.

Then suddenly the mind became confused and there was a total disability to recollect anything distinctly or arrange ideas with any coherency. On an attempt to talk, wrong names were given to objects, and although at the same time the mind knew mistakes were made in speech, the words seemed to utter themselves independently.

For a few minutes there was great dizziness, the body seeming to swing off into space, while the blue spots changed to dancing sparks of fire. The lips and throat became parched and the latter somewhat constricted; swallowing was rather difficult; there was intense burning in the stomach with gaseous eructations, followed by sharp colicky pains in the abdomen and also pain across the back over the kidneys. The pulse rose to 125, was irregular, wiry, tense; the heart fluttered most unpleasantly.

These symptoms lasted about an hour and were followed by a feeling of great weariness, but in three hours from the time of taking the dose all seemed to be again normal. The experiment was carried no further, as the effects in heart and brain were danger signals not to be ignored.

The conclusion reached is, that while the very unpleasant taste will prevent it from being dangerous in general, the fruit of the red baneberry evidently contains a poison having a powerful effect on circulation and brain; a dozen berries would probably be enough for a fatal dose, half that amount sufficing for the above experience.

BRADFORD, VERMONT.

[The above account of Miss Bacon's rather heroic experiments is of special interest, since it proves conclusively a fact which has hitherto been gravely questioned; for serious doubts have been expressed regarding the poisonous properties of Actaea. Thus, in a very detailed discussion of the genus by Messrs. J. U. & C. G. Lloyd (Drugs and Medicines of North America, 232–243), we find the following note: "The English plant, Actaea spicata, has acquired a reputation as a poisonous plant that it seems to us must be in most part unmerited. By old writers the plant was said to grow in dark recesses and to emit a fetid smell, which attracted toads, hence it is called toad plant. The berries were supposed to be poisonous, and the entire plant to poison cattle. Our native plants, which could hardly be distinguished from the foreign, seem to be entirely innocent of poisonous properties, and certainly do not emit any disagreeable odor." — Ed.]

LIST OF DESMIDS FOUND IN CARVER'S POND, BRIDGEWATER, MASSACHUSETTS.

JOSEPH A. CUSHMAN.

THE making of this list has taken some of the spare time of three summers, but the time thus spent has been well repaid. Interest was awakened by the discovery of one or two species which were given as southern in Wolle's Desmids of the United States. By persistent search many species were found, which, according to the latest edition of that work, have not hitherto been reported from this section of the country.

The pond in which these were collected is admirably situated for such plants and abounds in other forms of Algae as well as in Desmids. It is a shallow pond, but few portions being over six feet deep and the larger part of its area averaging less than half this depth during the summer months. In spite of its shallowness it is not stagnant as it is fed by two brooks and has an outlet at the opposite end. It covers about forty-two acres and is large enough and the conditions of its borders sufficiently varied to give a considerable difference in species in different parts. A record was kept in order to determine the frequency of occurrence of various species. The list is here given with the author of the species as given in the last edition of Wolle's Desmids of the United States.

Hyalotheca dissiliens (Smith) Breb. Seems to occur most frequently in the middle of Spring, being much less frequent later in the season. Common. Found nearly choking a small pool by the side of one of the brooks which feed the pond.

Bambusina Brebissonii Kg. Found frequently and in various stages of development.

Desmidium cylindricum Grev. Occasional.

D. Swartzii Ag. Very common.

D. aptogonium Breb. Not commonly found.

D. Baileyi Ralfs. Very common. Intermingled often with *D. Swartzii.*

Sphaerozosma pulchrum Bailey. Typical form frequent. Var. *planum* Wolle. Found frequently.

S. filiforme Rab. Fairly frequent. (No sheath observed.)

Spirotaenia condensata Breb. Rare. But few specimens found.

Penium closterioides Ralfs. Common.

Closterium macilentum Breb. Fairly rare; found but a few times.

C. acerosum (Schrank) Ehrb. Very common.

C. striolatum Ehrb. Common.

C. Dianae Ehrb. Common.

C. acuminatum Kg. Frequently found.

C. robustum Hast. Found at surface in September 1900 in great numbers with Anabaena, etc. Have not found this form before or since.

C. rostratum Ehrb. Fairly common.

C. setaceum Ehrb. Frequent.

C. Brebissonii Delp. Common in a collection made July 4, 1902. Not observed before.

C. ovale Ralfs. Common.

Docidium crenulatum (Ehrb.) Rab. Fairly frequent.

D. trabecula (Ehrb.) Naeg. Common.

D. truncatum Breb. Fairly common.

D. baculum (Breb.) D'By. Fairly frequent.

D. nodosum Bail. Fairly frequent.

D. coronatum. Rab. Frequent.

D. repandum Wolle. Rare.

Cosmarium moniliforme Ralfs. Fairly common.

C. tumidum Lund. Common.

C. taxichondrum Lund. Common.

C. pyramidatum Breb. Common.

C. margaritiferum Menegh. Common.

C. Botrytis Menegh. Common.

C. reniforme (Ralfs.) Arch. Granules fully as large as figured by Wolle. Not rare.

C. suborbiculare Wood. Frequent.
C. amoenum var. *tumidum* Wolle. Frequent.
C. Schliephackeanum Grun. Rare.
C. ornatum Ralfs. Common.
Tetmemorus Brebissonii (Menegh.) Ralfs. Fairly frequent.
Arthrodesmus octocornis Ehrb. Frequent.
Euastrum magnificum Wolle. Rare.
E. ansatum Ralfs. Common.
E. affine Ralfs. Common.
E. verrucosum (Ehrb.) Ralfs. Fairly common.
E. gemmatum Breb. Not common.
E. elegans Kg. Fairly common.
E. integrum Wolle. Frequent.
Xanthidium antilopaeum (Breb.) Kg. var. *polymazum* Nord. Few specimens found.
Micrasterias radiosa (Ag.) Ralfs. Common.
M. furcata (Ag.) Ralfs. Not common but have found frequent specimens, some deformed ones with the second pair of basal arms wanting.
M. Americana (Ehrb.) Kg. Not rare, but not occurring as frequently as other forms.
M. Americana var. *recta* Wolle. Rare; seen only a few times.
M. Mahabuleshwarensis Hobson. Fairly frequent.
M. laticeps Nord. Fairly frequent.
M. muricata Bailey. Frequent.
Staurastrum polymorphum Breb. Common, in various forms, varying in semi-cells of the same individual.
S. macrocerum Wolle. Rare.
S. leptocladum Nord. Not common.
S. anatinum Cooke & Wills. Fairly frequent.
S. muticum Breb. Common.
S. orbiculare (Ehrb.) Ralfs. Common.
S. crenulatum Naeg. Fairly common.
S. punctulatum Breb. Fairly common.

Also the following species of Pediastrum may be mentioned here as common occurring with the Desmids.

Pediastrum Boryanum (Turpin) Menegh.
P. pertusum Kg.
P. Ehrenbergii (Corda) A. Br.

Bridgewater, Massachusetts.

ORCHIDS OF CHESTERVILLE, MAINE.

LILLIAN O. EATON.

FOR the past five summers it has been especially interesting to the writer to search for orchids in Chesterville, Maine. As the town contains several bogs, many swamps, forests of varied character, a large sand-plain, and a long esker called "the Ridge," the possibility of finding many species has seemed great. Nor has the result been wholly disappointing. To the present date, I have found twenty-six representatives, a specimen of each being in my herbarium, while it seems not unreasonable to hope a few more may be discovered.

The list, with localities of the plants, is as follows.

Microstylis ophioglossoides, Nutt. In wet pasture, growing with *Vaccinium macrocarpon*; also in evergreen swamps.

Liparis Loeselii, Richard. Not unusual in old fields.

Corallorhiza innata, R. Br. In wet soil of deciduous woods, found but once, in June, 1897.

C. multiflora, Nutt. Several stations in evergreen swamps.

Listera cordata, R. Br. Plenty in cold wooded swamp, near Chesterville Plains.

Spiranthes cernua, Richard. The various forms abound in swales and meadows also by roadsides.

S. gracilis, Bigelow. Occasional by roadsides and in dry pastures.

Goodyera pubescens, R. Br. Fairly common in rich woods.

G. repens, R. Br., var. *ophioides*, Fernald. A single plant was found in deciduous woodland in 1898. In 1901 and 1902, several were found in a cedar swamp.

G. tesselata, Lodd. Occurs both in evergreen and hardwood growths, not rare.

Arethusa bulbosa, L. On a sphagnum bog, found two successive seasons; but not more than twenty-five plants in all. The only station yet known in the county.

Calopogon pulchellus, R. Br. Grows freely on at least three bogs.

Pogonia ophioglossoides, Nutt. Abundant in meadows, bogs and damp swales.

Habenaria tridentata, Hook. Roadsides and fields, occasional.

H. virescens, Spreng. In an old field, the only station so far known in the county. In 1899 and 1900, I found two or three plants each

season. In July, 1902, the plants were fairly abundant in the same field.

H. hyperborea, R. Br. In a swamp near the Plains, also in one swamp two miles farther south.

H. dilatata, Gray. Plenty on a bog in an open grassy space near the Plains.

H. obtusata, Richard. Abundant in a cold wooded swamp near the Plains.

H. Hookeri, Torr. In dry woods near North Chesterville, also on the side of the Ridge.

H. orbiculata, Torr. Not uncommon in rich woodlands.

H. blephariglottis, Torr. Plenty in two bogs, a few plants having been found on a third.

H. lacera, R. Br. Frequent in old fields.

H. psycodes, Gray. Fairly common in meadows and roadside ditches.

H. fimbriata, R. Br. Very abundant in wet soil in open woods. I have also found the pale and white forms.

Cypripedium pubescens, Willd. Occasional in wet woods.

C. acaule, Ait. Common in evergreen forest.

South Chesterville, Franklin Co., Maine.

OBSERVATIONS ON ECHINODORUS PARVULUS.

Edward L. Rand.

(Plate 45, figures 4 and 5.)

Winter Pond in Winchester, near Boston, Massachusetts, has long been known as a station for the rare little plant, *Echinodorus parvulus*, Engelm. Of late years, however, for one reason or another, the plant has not often been found here by botanists, so that some question had arisen whether it had not become very scarce or perhaps disappeared. Such, fortunately, has proved not to be the case, for on October 13th, 1901, and subsequently, Mr. E. F. Williams and I found it in abundance. Our first trip to the pond, although late in the season was well timed. Very little rain had fallen for several weeks, and in consequence, the water in the pond was, I

judge, somewhat below, or certainly as low as its summer level. If indeed, the water had been a very little higher, nearly all the plants of *Echinodorus* would have been partly or wholly submerged.

We first found very small plants growing on the shore in soft mud. These showed occasional flowers and much fruit, as might have been expected at this season of the year. Afterwards we found larger terrestrial plants, and submersed plants also, the latter growing often nearly a foot under water. Thus a good opportunity was given for observing the plant in its various forms. Certain of its characters omitted from botanical descriptions seem worthy of record here.

Many of the terrestrial plants, especially those not far from the water's edge, showed traces of decaying leaves at the base of the fresh green lanceolate or spatulate leaves mentioned in all the descriptions. By tracing plants to the water it was found that these decaying leaves were the remains of their pellucid, membranous phyllodia, which are the submersed primary leaves of the plant. These phyllodia form almost its entire foliage until through lowering of the water level the plant emerges, when they soon decay. The secondary or terrestrial leaves, which have already begun to show themselves while the plant is in shallow water, then rapidly develop. When fresh, the phyllodia are lance-linear, tapering to a point, 2 to 3 cm. long and 2 to 3 mm. broad, with no distinction of blade and petiole. So far as I am aware these submersed leaves have not been definitely mentioned in descriptions of this plant, except in the first edition of Gray's Manual, where, however, under the name *E. subulatus*, Engelm., the species was confused with *Sagittaria pusilla*, Nutt.

In one part of the pond *Echinodorus* was growing in a depth of from half a foot to a foot of water on a cleaner, more sandy bottom. Here it was easy to study the plants in their submersed form. Not only were the phyllodia, I have mentioned, conspicuous, but also the creeping and proliferous character of the shoots. A number of colonies of three or four connected plants were observed. Here I was surprised to find also a number of plants with fresh, newly opened flowers some distance under water. Although *Echinodorus* does not appear to be so true an aquatic as *Subularia* it seems that it does sometimes bloom in its submersed state. How constant this character is, may be a good subject for investigation. It is certain the plant normally develops its flower buds sometimes in a depth of water that practically permits little chance for aërial anthesis.

The lateness of the season of course gave me an excellent opportunity to examine the plant in full fruit. After a careful examination of many plants I failed to find any trace of that regularity of arrangement of the achenes on the receptacle attributed to this species of *Echinodorus* in some botanical works. There seems, therefore, no cause to refer the species to Alisma, as several authors have done.

Boston, Massachusetts.

THE GENERIC POSITION OF ECHINODORUS PARVULUS.

B. L. Robinson.

(Plate 45, figures 1–10.)

While examining some excellent material of the rare *Echinodorus parvulus*, Engelm., kindly placed at my disposal by E. L. Rand, Esq., I have had occasion to review the opinions, which have been expressed regarding the correct classification of this species, and some notes on the subject may be of interest.

The North American plant bearing this name was originally described by Dr. George Engelmann [1] as *Echinodorus subulatus*. It was so named under the impression that it was the *Alisma subulatum* of Linnaeus,[2] a species which later proved to be *Sagittaria pusilla*, Nutt. Our little Echinodorus was accordingly rechristened by Engelmann [3] and called *E. parvulus*. The propriety of this change can scarcely be questioned when we consider that the earlier name, *E. subulatus*, rested upon a confusion of two quite distinct elements, namely, the synonym *Alisma subulatum* and a true Echinodorus. In such cases it may be assumed that the status of the combination should be determined rather by the name-bearing synonym than by the material which was erroneously identified with it.

Echinodorus parvulus matures about fourteen carpels, which being arranged spirally upon a strongly convex receptacle form a

[1] Engelm. in Gray, Man. ed. 1, p. 460 (1848).
[2] Spec. Pl. i. 343 (1753).
[3] Engelm. in Gray, Man. ed. 2, p. 438 (1856).

globose head quite after the manner of the achenes in a Ranunculus. This is well shown in the excellent drawing by Mr. F. Schuyler Mathews, Plate 45, figure 2. The individual carpels (figure 3) are reddish brown, strongly 5-ribbed on the back and 3-ribbed ventrally. The stigma is essentially sessile and the beak at maturity very small or wanting. Echinodorus, although named by Richard [1] and treated by several subsequent authors as a section of Alisma, was first described as a genus by Engelmann, and was separated from Sagittaria chiefly by its perfect flowers and from Alisma by the fact that the achenes are thus arranged in a head and not in a ring. The genus has been sustained by the two high authorities, Buchenau and Micheli, who have subsequently given monographic attention to the *Alismaceae*. The distinction becomes especially clear when as in Professor Buchenau's admirably lucid treatment [2] the genus Alisma is confined to its more typical species. The marked difference in the fruit will be readily apparent if the reader will examine figures 2 and 10, representing the fruit of *E. parvulus* and *E. radicans* respectively, and will compare them with figure 9, showing the fruit of our common *Alisma Plantago*.

In 1830, some eighteen years before our little North American Echinodorus was characterized, a South American plant of identical habit from the palm swamps of Brazil was very fully described as *Alisma tenellum*, Mart. [3] The carpels of this Brazilian plant were described as "4–12, plures ut videtur abortivae, in orbem fere dispositae, attamen minus regulariter et multo minus approximatae quam in A. *Plantagine*" and in a later figure, published in the Flora Brasiliensis by Seubert, the carpels are clearly represented in a single ring. This figure accurately redrawn is shown in figure 6 of plate 45. In 1868 Professor Buchenau [4] in a general recension of the *Alismaceae* transferred *Alisma tenellum* to Echinodorus, forming the new combination *Echinodorus tenellus*. At the same time he states [5] that he had found no specific distinctions between this South American plant and the North American *E. parvulus*. Micheli [6] in the most exhaus-

[1] Mém. Mus. Par. i. 365 (1815).
[2] Buchenau in Engl. & Prantl, Nat. Pflanzenf. ii. Abt. 1, 227–232.
[3] Martius acc. to J. A. & J. H. Schultes, Syst. vii. pt. 2, 1600 (1830).
[4] Abh. naturw. Ver. Bremen, ii. 21 (1868).
[5] Buchenau, l. c., 38.
[6] Micheli in A. & C. DC. Monog. Phan. iii. 48 (1881).

tive revision of the group, which has yet appeared, also treats *E. parvulus* as a synonym of *E. tenellus*. Curiously neither Buchenau nor Micheli speaks of the uniseriate carpels, originally described in Schultes' Systema [1] and so clearly figured by Seubert in the Flora Brasiliensis,[2] although both of the later authors refer to the plate in question. Struck by the difference between the North American and the figure of the Brazilian plant I have examined all the South American specimens of *Alisma tenellum* (*Echinodorus tenellus*) in the Gray Herbarium and find that they agree perfectly in having capitate, spirally arranged achenes, quite in the manner of the North American *E. parvulus*, with which, in other respects also, the South American plant appears specifically identical.

The question at once presents itself whether we have here to do with two South American plants, one with achenes in a single ring and the other with achenes in a head. There are many reasons, however, for believing that this is not the case, but that not only the original description of *Alisma tenellum* but Seubert's description and figure are entirely in error in representing the carpels in a single ring. This question can only be decided by the examination of the original material of the species. Happily, to those of us who apply priority under the genus, the doubt about the true South American *Alisma tenellum* will in no way affect the standing of our own *Echinodorus parvulus*.

Until 1895 the North American plant was uniformly referred to Echinodorus, but of late in the Memoirs of the Torrey Botanical Club,[3] in the Illustrated Flora,[4] and in Professor Britton's recently issued Manual,[5] it is classified as an Alisma. It is natural to suppose that this transfer, made in direct opposition to the expressed views of three such authoritative writers and specialists upon the *Alismaceae* as Engelmann, Buchenau, and Micheli, would have demanded more than ordinary care and attention to the actual characters; and it is accordingly disappointing to find, on the contrary, that the fruit, in which, as we have seen, the chief generic distinctions are to be found, instead of being critically studied could not have received even the most cursory inspection by the writers making the transfer.

As shown above, the early representation of *Alisma tenellum*, pub-

[1] vii. pt. 2, 1600 (1830).
[2] Seubert in Mart. Fl. Bras. iii. pt. 1, 105 (1847), t. 13, f. II.
[3] v. 24 (1895).
[4] i. 85 (1896).
[5] p. 54 (1901).

lished in the Flora Brasiliensis [1] and reproduced in our figure 6, is of a very doubtful nature. If it is correct it must represent an otherwise unknown South American plant, which with its single row of carpels certainly can have nothing to do with our North American capitate-fruited *Echinodorus parvulus*. If, however, we choose the other horn of the dilemma and assume that *Alisma tenellum* was in reality nothing but *Echinodorus parvulus*, we are forced to the conclusion that the figure in the Flora Brasiliensis is a mistake as to carpels.

It is truly remarkable that another artist in preparing the figure for the Illustrated Flora has fallen into the same curious error and has produced a picture which in its contours, in the curve of each filament, and in the annular arrangement of the carpels, is so like a looking-glass replica of the one in the Flora Brasiliensis, that it would be hard to believe that it had not been mechanically reproduced, were we not informed in the preface of the Illustrated Flora that the cuts for the work were "all from original drawings." Unfortunately, the accompanying text is also neither accurate nor consistent. On page 84 Alisma is said in the key to have the carpels in a ring, but it is described a few lines below as having the ovaries in one or several whorls. On page 85, although figured with achenes in a single ring, *Alisma tenellum* is described as having its achenes in several whorls. As we have seen, whatever may have been the case in the original *A. tenellum*, the achenes of the North American plant under discussion are neither in a ring nor in several whorls, but are spirally arranged in a head, and in this regard, as in every other, the plant is a good Echinodorus, the genus to which it has been uniformly referred in all editions of Gray's Manual and by the foreign specialists who have worked upon the group.

There are in North America three species of Echinodorus, each of which is beautifully characterized by its carpels. In the little *E. parvulus*, the rarest of the three, they are (as shown in figure 3) rounded at maturity, glandless and essentially beakless. In *E. rostratus*, Engelm. (*E. cordifolius* Griseb.) they are (as shown in figure 8) provided with a conspicuous erect beak and with two small amber colored glands on each lateral face near the summit, while in *E. radicans*, Engelm. (figure 7) the beak is incurved and there is a single

[1] iii. pt. 1, t. 13, f. II.

larger gland near the centre of each lateral face. *E. parvulus* is the only one of these species as yet found in the northeastern states and in this region seems to have been found only at the Winter Pond station in Winchester, Massachusetts, and many years ago in fresh water pools near Mt. Auburn, Massachusetts. The species has been found several times in the neighborhood of St. Louis, Missouri, and on the Illinois side of the Mississippi by Dr. Engelmann and by Mr. Henry Eggert, at Canterbury, Delaware by Mr. W. M. Canby, on the Santee Canal, South Carolina, by Mr. H. W. Ravenel, in Decatur County, Georgia, by Mr. R. M. Harper, and at Tampa and Dunnellon, Florida, by Mr. A. H. Curtiss. There are also indefinite reports of its occurrence in Michigan and on the north shores of Lake Superior. These last records need substantiation and, in general, the rarity of the species is such that the discovery and record of new stations will have more than ordinary interest. It is not improbable that the species from its small size, inconspicuous flowers, and habit, to which Mr. Rand has called attention, of growing in some cases entirely under water, has been overlooked in many localities where it really occurs.

Plate 45, figure 1, representing the flower of *Echinodorus parvulus* shows the petals very short and distinctly obcordate, but it should be said that this was drawn from a young flower scarcely in anthesis, and that a more mature flower would probably exhibit relatively larger petals, which perhaps lose something of their obcordate form. The petals are so thin and "deliquescent" that, it is by no means easy to trace their mature form in dissections made from dried material.

EXPLANATION OF PLATE 45, FIGURES 1 TO 10. Fig. 1, *Echinodorus parvulus*, Engelm., young flower; fig. 2, the same, fruiting head; fig. 3, the same, carpel; fig. 4, the same, submersed state, showing phyllodial leaves; fig. 5, the same, emersed state, showing usual leaf-form. Fig. 6, reproduction of Seubert's probably incorrect figure of the flower of *Alisma tenellum*, Mart. Fig. 7, *Echinodorus radicans*, Engelm., carpel. Fig. 8, *E. rostratus*, Engelm., carpel. Fig. 9, *Alisma Plantago*, L., fruiting head, showing annular arrangement of carpels. Fig. 10, *Echinodorus radicans*, Engelm., fruiting head, showing capitate carpels.

GRAY HERBARIUM.

A NEW BIDENS FROM THE MERRIMAC VALLEY.

M. L. FERNALD.

(Plate 45, figures 11–20.)

IN September, 1902, Mr. Alvah A. Eaton sent to the Gray Herbarium a Bidens which for some years he had vainly attempted to reconcile with descriptions. Mr. Eaton's plant occurred on brackish shores of the Merrimac River above Newburyport, and, though in habit and in the shape of its heads it strongly suggested *Bidens bidentoides* of the lower Delaware River, its shorter heads and achenes and shorter stouter awns prevented its identification with that local species.

The plant was so unlike any Bidens known to the writer, that arrangements were made with its discoverer for a visit to the station on October second. But since the tide at mid-day was so high that the back-flow of the river covered the brackish shores above Newburyport, the original locality of the plant was inaccessible before late afternoon. In the meantime, however, the marshes on the Salisbury side of the river were explored. There on the brackish margins of streams whose banks are overflowed during high-tide were *Bidens cernua*, *B. connata* and *B. frondosa* and occasional colonies of the strange Bidens previously known from above Newburyport. In foliage the plant somewhat resembled *B. connata*, but while that species as well as *B. cernua* and the pinnate-leaved *B. frondosa* invariably had broad hemispherical heads, the plant which had led us to the muddy shores was readily distinguished by its cylindric or narrowly oblong heads. Later in the day, on the muddy shore above Newburyport where Mr. Eaton had first detected the plant with cylindric heads, it was found maintaining its habital character as it had done by the pools in Salisbury.

A detailed study of the material then collected has shown that the plant of the Merrimac shows affinities with *Bidens connata*, *B. comosa* and *B. bidentoides*.

From *Bidens bidentoides* the Merrimac plant is distinguished by its shorter heads, its much broader achenes and its shorter awns. From *B. connata* and *B. comosa* as already stated it is readily distinguished by its narrow elongate heads, but to both these species it approaches in certain other characters. As in *B. connata* the inner bracts of the

involucre are as long as the disk, but in this they differ strikingly from *B. comosa* whose broad flowering disk much exceeds the inner involucre. In its achenes the Merrimac plant is somewhat intermediate between *B. connata* and *B. comosa*. The achenes of the former are rather tetragonous in section, the ribs on the two faces being very conspicuously thickened and keel-like; and the inner achenes are 4.5 to 6 mm. long. In *B. comosa* the achenes are flat and essentially nerveless, the innermost 8 or 10 mm. long. The achenes of the cylindric-headed plant of the Merrimac shores are essentially flat, but they usually have a well defined though narrow mid-rib on each face, and the innermost achenes from 7 to 9 mm. in length. Thus in its achene the Newburyport and Salisbury plant stands between *B. connata* and *B. comosa*, though it differs from both in the shape of its head in which character it strongly simulates the local and otherwise unique *B. bidentoides*.

The awns of *Bidens bidentoides* are upwardly barbed, instead of with the retrorse barbs which are ordinarily associated with *Bidens*. On this account the plant of the Delaware flats was long supposed to be a Coreopsis. Similarly when in 1866 A. H. Smith found near Philadelphia a plant resembling in all other characters *Bidens frondosa*, but with the awns upwardly barbed, the plant was supposed to be a hybrid between *Coreopsis bidentoides* and *Bidens frondosa*, and was later referred to by Dr. Gray as "doubtless a hybrid."[1] Subsequently however, a plant quite identical with the Delaware River material has been found as far east as Cape Breton Island (Macoun, no. 19,168), fully 800 miles from the nearest *Bidens* (*Coreopsis*) *bidentoides*, so that the hybrid origin of the plant seems quite out of the question. This extreme of *B. frondosa* with upwardly barbed awns may be called var. *anomala*, Porter, a name under which the plant was distributed by the late Thos. C. Porter.

Dr. N. L. Britton has recorded[2] the occurrence of downwardly barbed awns in *Bidens discoidea* which commonly has the barbs ascending, and Dr. K. M. Wiegand has recorded[3] upwardly barbed awns in *B. connata*, concluding that such variations are rarely or never due to hybridization. In view of these exceptional tendencies already observed in the related species of *Bidens* it was interesting to

[1] Syn. Fl. i. pt. 2, 296.
[2] Bull. Torr. Bot. Club, xx (1893) 280.
[3] Bull. Torr. Bot. Club, xxvi (1899) 400.

find that many of the plants from the Merrimac shores have the awns upwardly barbed. In the examination of hundreds of heads it has been found that with the exception of one single specimen all the achenes of an individual plant have similarly barbed awns. The material at hand shows that the Delaware River *B. frondosa*, var. *anomala* is likewise essentially constant in its single morphological character, although as in the Merrimac Valley plant it shows no other feature by which it can be distinguished from the more usual form.

It is a striking coincidence that the habitat of *Bidens frondosa*, var. *anomala* and *B. bidentoides*, on brackish mudflats at the mouth of the Delaware River, should be so closely simulated by the brackish shores of the lower Merrimac where alone the plant discovered by Mr. Eaton has been found. *B. frondosa*, var. *anomala*, as already stated, however, has recently been found in Cape Breton and it is probable that the others will eventually prove to be of less restricted distribution than is at present known.

The plant of the Merrimac shores first detected by a botanist whose keen observation is adding materially to our knowledge of a remarkable botanical area, may appropriately bear his name:—

BIDENS **Eatoni**. Annual, simple or freely branched, 2.5 to 6 dm. high: leaves simple, lanceolate, with long-acuminate tips and slender petiolar bases, coarsely and often deeply serrate, 5 to 15 cm. long: heads erect, cylindric or oblong, in fruit becoming obovoid, longer than broad: outer involucre usually of 3 to 5 foliaceous bracts slightly exceeding the disk: inner involucre mostly of 5 oblong blunt or barely mucronate conspicuously striate bracts about 1 cm. long, equalling the disk: rays none: disk flowers 15 to 25: achenes flattish; the inner 7 to 9 mm. long, 1 to 1.7 mm. broad, with well developed but narrow midribs, linear-oblanceolate, usually with retrorse hairs on the margins; awns 2 to 4, downwardly barbed, the marginal longest, 3 to 4.3 mm. long, about equalling the pale yellow corollas. — Brackish shores of the Merrimac River, Newburyport, Massachusetts, Sept. 1902 (*A. A. Eaton*), Newburyport and Salisbury, Oct. 2, 1902 (*A. A. Eaton & M. L. Fernald*).

Var. **fallax**. Achenes and awns upwardly barbed.—With the species, but essentially constant in its single morphological character.

EXPLANATION OF PLATE 45, Figs. 11–20. — *Bidens Eatoni*: Fig. 11, portion of flowering plant; fig. 12, outer achene; fig. 13, inner achene. *B. Eatoni*, var. *fallax*: Fig. 14, inner achene. *B. bidentoides*: Fig. 15, flowering head; fig. 16, inner achene. *B. connata*: Fig. 17, flowering head; fig. 18, inner achene. *B. comosa*: Fig. 19, flowering head; fig. 20, inner achene.

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Schuyler Mathews del.

ECHINODORUS, ALISMA, BIDENS.

Rhodora

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ROSES VS. RAILROADS.

George T. Moore.

While it is not often that botanists and horticulturists have occasion to testify in court, at least in a technical way, it is satisfactory to know that recently when such testimony was given it resulted in a most decided victory for the growers of flowers and helped establish a principle which cannot but have considerable influence upon any future case involving the question of damage to plants by smoke and poisonous vapors. The facts which resulted in the bringing of such a suit were as follows:

The New York, New Haven and Hartford Railroad Company, while making some general improvements in the vicinity of their station at Woods Hole, Massachusetts, decided upon the removal of an old engine house, which had outlived its usefulness. After this building had been torn down and most of the material disposed of, there still remained an old tar and gravel roof, which could be neither used nor given away and since it would probably have cost a few hundred dollars to transport this material to the ocean and sink it, it was decided to set fire to the mass and thus consume it without expense. Unfortunately for this bit of economy, there was in the immediate neighborhood one of the finest rose gardens in this country, formerly the property of Mr. J. S. Fay and now owned jointly by Miss Fay and Mr. M. H. Walsh.

To those who are familiar with the various exhibitions of roses which have taken place in Massachusetts and elsewhere within the last few years, the mere mention of such names as the Jubilee, the Lillian Nordica, the J. S. Fay, the Débutante, the Sweetheart and similar famous plants, all the result of Mr. Walsh's skill, will be quite

sufficient to establish his reputation as a grower and breeder of roses. The fact that he received the first gold medal ever awarded for a rose, together with his long list of first prizes and constant success as a gardener, is well known and that he was the part owner of a collection of roses and other plants that could not be duplicated, except under exceptional circumstances, will be readily admitted.

At the time of the destruction of the engine house, about the middle of May, 1901, Mr. Walsh had a large number of stock plants on hand, besides a climbing rambler, a hybrid tea and several other new garden roses, which gave great promise, and were conceded by all who had seen them to be of unusual beauty and superior worth.

When the burning of the rubbish from the engine house began, it was the source of considerable annoyance to those living in the vicinity, but it was not until the third and last day of the fire, when the tar roof was being consumed, that anything seemed decidedly wrong in the rose garden. At this time, the leaves began to fall from a number of plants, while those which remained, together with parts of the stems, became discolored and marked in various ways. So severe was this external evidence of damage, that for months afterwards the bushes which were able to survive showed large black and gray scars, much as though they had been actually scorched by fire.

One can readily imagine the alarm with which the owners of this wonderful garden viewed the destruction of their plants and the immediate efforts made to discover the cause of such havoc. For this it did not seem necessary to seek far. The amount of dense smoke and vapor that arose from the burning of the tar roofing was, of course, tremendous and when this cloud was carried by the prevailing wind directly upon the rose garden, settling there like some heavy black fog, it could hardly be supposed to be beneficial.

As has been said, the immediate effect of this unusual environment was to cause most of the leaves to drop off and to scar and mark the young and tender stems so as practically to ruin them for exhibition or other such purposes. But this proved to be the smallest part of the loss. As in any other case of poisoning from gases, the outward evidences were but slight as compared with the internal and actual damage done to the plants. Some were killed outright, while many of those which survived were so weakened that they were of no further use for propagation. Large areas of growing tissue died in most of the shoots exposed to the action of the smoke and this together with

the loss of foliage made it impossible for a number of plants to recover even under the most careful nursing. The bushes which survived were much more susceptible to the attack of fungus diseases and it is a question whether even those plants which seemed to be but slightly affected will ever be able to attain the perfection which they promised before being subjected to the fumes of the burning tar.

When complaint was made to the Railroad Company, they failed to appreciate that the roses had been damaged and declined to recognize their liability in the matter. Consequently, a suit for $9,000 was brought, which was subsequently increased to $25,000, Robert M. Morse and Henry M. Hutchings appearing for the plaintiffs and Thomas C. Day for the defendant.

It was soon recognized by the attorneys for the plaintiffs that however great the actual damage might be and whatever estimate competent horticulturists might place upon the value of the destroyed plants, the first and most necessary point was to establish the injurious effect of the smoke and vapor from burning tar upon rose plants and to demonstrate further that this effect was distinct from any produced by changes in the weather, the use of germicides, attacks of fungi, insects, or any other cause which might be put forward by the defendant. The damage which may be produced in plants by the action of sulphurous and carbolic acids, pyradins and other substances apt to be found in tar, is well known. Gardeners know to their cost the result of burning sulphur instead of merely vaporizing it, when attempting to fumigate greenhouses and the effect of a crystal of carbolic acid on a rose leaf is a simple yet convincing demonstration of the rapidity with which the plant is affected. It has been shown by careful experiments that one part of sulphurous acid in one million parts of air is sufficient to cause the death of an average rose-bush in a few hours and the action of the various hydrocarbons is but little less severe. An analysis of pieces of the tar roofing was made by Dr. A. H. Gill of the Institute of Technology and showed the presence of sulphur, phenols and other substances which, if burned, would generate poisonous vapors in sufficient quantity to damage or destroy any plant with which they remained in contact. A microscopical examination of the discolored leaves and stems from Mr. Walsh's roses showed very clearly that the killing action had been due to a poisonous gas rather than to the presence of a fungus or other foreign organism. The contents of the cells were shrunken

and distorted, the green coloring matter being completely disorganized and filled with small brown granules of "acid chlorophyl" which gave rise to the characteristic yellow and brown splotches upon the leaves and stems.

After it had been established by expert testimony that the effect of such vapors as would be generated by the burning of tar was identical with that produced in the plants of Miss Fay and Mr. Walsh, an attempt was made to fix as nearly as possible the actual money loss involved. Such well known authorities as Mr. B. M. Watson, Mr. John K. Farquhar, Mr. Robert Cameron, Mr. Wm. H. Elliott and others equally as competent testified as to the preëminent reputation of Mr. Walsh as a rose grower and the specific worth of the individual plants he had lost. Although there was the natural variation in the estimates that would be expected, where so many opinions were given independently, the average of all the estimates on the value of the roses damaged by poisonous gases amounted to $5,543.47 on the plants of Miss Fay and $15,596 on those belonging to Mr. Walsh. In addition to this sum it was maintained that Mr. Walsh was entitled to special damages for the loss of prizes which he would undoubtedly have received and for the loss of advertising due to his inability to exhibit and keep his flowers before the public as usual. These claims were allowed by the Auditor, who awarded $21,989.32 as the total amount of damages sustained. The Railroad Company subsequently paid $20,000 in settlement, without taking an appeal.

While somewhat similar cases involving the question of damage to vegetation due to certain noxious vapors have been tried in this country, no one has ever received anything like such a sum as was paid in this instance. As Mr. Morse, in his closing argument, said, "I need not say to the Auditor that this case is one of great importance. It is important in a certain sense to the profession, not only to the profession of law, but to the profession of florists, because no action involving so serious a damage to plants or flowers has ever arisen in this country, and, while there may not be much law to be settled by it, it still will always be of interest." Considering the dignified and unprejudiced manner in which the entire hearing was conducted and the fair and careful way in which the amount of damage was estimated, it certainly established a very strong precedent in favor of those who have large interests in the growing of flowers for either pleasure or profit.

Washington, D. C.

CONTRIBUTIONS FROM THE CRYPTOGAMIC LABORATORY OF HARVARD UNIVERSITY, — LV.

R. Thaxter.

Mycological Notes, 1–2.

(Plate 46.)

1. **A New England Choanephora.** The genus Choanephora includes at present a small group of exceptionally interesting moulds which have hitherto been regarded as strictly tropical in their range; two of the three described species, *C. Simonsii* and *C. infundibulifera*, having been discovered in India by Dr. Cunningham, while the third, *C. Americana*, was found by Dr. Alfred Moeller in Brazil. The natural habitat of these fungi is on the fading flowers or even young tissues of flowering plants; but their chief interest lies in the fact that, although they are closely related to the Mucors or "bread moulds" and possess similar sporangia and zygospores, their most common and characteristic form of fructification is quite unlike that of any of their relatives and closely resembles the so-called conidial fructification of some of the higher fungi. This conidial type is often closely simulated by certain species of Oedocephalum, a "form genus" known to include imperfect conditions of both Basidiomycetes and Ascomycetes, and further bears a marked resemblance to species of Rhopalomyces, a genus the members of which are as yet unconnected with any perfect form. The fertile hypha of Choanephora, which is large and highly specialized, rises erect from the substratum on which it grows, and becomes distally enlarged to form a more or less clearly distinguished terminal head. But while in Rhopalomyces, and normally also in Oedocephalum, this primary head, by a process of budding, becomes completely covered by a layer of conidial spores, in Choanephora it normally gives rise to short radiating branchlets of variable number; which, after becoming distally swollen, produce the spores on the surfaces of the secondary heads thus formed. Fig. 1 of the accompanying plate will illustrate the general form of this fructification, although it gives but an inadequate idea of its striking and graceful appearance. The spores are dark, like those of Rhopalomyces, and it is of interest to note that Rhopalomy-

ces-like conditions not infrequently occur, in which the primary head gives rise directly to the spores. On the other hand it should be mentioned that in at least one described species of Oedocephalum,[1] Choanephora-like conditions may occur in which the primary heads, instead of producing spores, give rise to branchlets bearing sporiferous capitula.

Having been greatly interested in this genus, which at the time was only known to me through the description and figures of Cunningham, I was not a little surprised, about a dozen years since, to find growing on decaying squashes on the farm of Mr. Kendall, near the Cascades at Waverley, Mass., a fungus having exactly the characters of the conidial form of Choanephora. Since no such plant had ever been described from America, I was at first inclined to believe that it was a new species, but further search for it in the literature led to the conclusion that, notwithstanding the fact that its characters were quite unlike those of Rhopalomyces, it had been included in this genus by Berkeley as long ago as 1875, having been described in Grevillea under the name *R. cucurbitarum* from material on squashes sent by Ravenel from Lower Carolina. This conclusion was confirmed some years after by an examination of the type in the herbarium at Kew, for which privilege I was indebted to the kindness of Mr. Massee, who had already been so good as to favor me with a sketch of its spores in connection with the preparation of an earlier paper on Oedocephalum and Rhopalomyces published in 1891, (Bot. Gazette, Vol. XVI, p. 201). Material of *R. cucurbitarum* was also received from Prof. Peck, who collected it in New York; as well as from Ohio, where it was collected by Prof. Morgan; and in both instances the fungus proved identical with my New England Choanephora. An examination of the Curtis Herbarium at Harvard, moreover, brought to light specimens of the same plant under the name "*Aspergillus cucurbitaceus*" the material being labeled "Hillsborough, N. C., on squashes."

Having in mind the supposed tropical proclivities of Choanephora, I took advantage of the opportunity offered during a recent collecting trip in Florida to make cultures of various faded flowers, and at

[1] The species here referred to is redescribed by Matruchot in the January number of the new Annales Mycologici as the type of a new genus, under the name *Cunninghamella africana*. If this generic name is to stand, the species should be known as *C. echinulata*, since it was originally described by me as *Oedocephalum echinulatum* in 1891.

Eustis was rewarded by obtaining a luxuriant growth of Choanephora on flowers of a cultivated Hibiscus, as well as of a wild Malvaceous plant found in the vicinity. The species, however, proved identical with the New England form and greatly to my disappointment produced only conidial fructifications.

Choanephora cucurbitarum appears to be a very common form in the vicinity of Cambridge, and is no doubt widely distributed, at least in the eastern and southern states. Not only is it frequently found in the field growing usually on smaller squashes, but it may be readily obtained by making moist-chamber cultures of squash blossoms that have begun to fade, on which it may appear nearly pure, or mixed with other fungi. It seems somewhat remarkable that the considerable injury to squashes, for which it is responsible, is not referred to, as far as I am aware, by any of the Experiment Station workers who have the best opportunities for observing such diseases; although Mr. Peck has twice called attention to it, in his 43d and 45th Reports, and it is undoubtedly often responsible for the destruction of no inconsiderable percentage of the crop. In a majority of cases this injury appears to be due to the fact that the mycelium, which has attacked a fading flower, spreads readily thence to the young squash, the rapidly growing tissues of which it attacks like a true parasite, causing a soft rot. This rot may be very easily induced by cutting out a small plug from a young or full grown squash or pumpkin, and inserting a few spores, or a little mycelium, and replacing the plug. The mycelium spreads under these conditions with extraordinary rapidity, and in a few days involves the whole fruit in a watery decay. A coarse cottony mycelium appears at different points on the surface, and if the culture is kept only partly covered, so that the atmosphere is not too moist, an abundant coating of the conidial fructification will develop; which, to the naked eye, has the appearance of a luxuriant growth of some large Mucor, or of *Rhopalomyces strangulatus*. If the atmosphere is saturated, but few fructifications appear in such cultures, and the most luxuriant development of conidiophores seems to be adjusted within rather narrow limits, to the conditions of moisture present. On flowers, however, which furnish drier conditions, little difficulty is encountered in inducing the fungus to fruit abundantly in a moist chamber. On potato agar and similar nutrients in tubes, although the mycelium always develops rapidly and luxuriantly, fructifications very rarely appear. The

mycelium, however, in such cultures, retains its vitality for months through the concentration of the protoplasm in definite portions of the hyphae; without, as far as I have observed, producing the well differentiated chlamydospores which have been described in the other species.

The fertile hyphae (fig. 1) which are very variable in size, often reach a height of from five to six mm., and generally originate from the rapid enlargement of a slender branch from a vegetative hypha. They are whitish, with a more or less distinct purplish iridescence, and the inflated extremity may rarely bear the conidia directly, as in Rhopalomyces, but usually gives rise to from three or four to a dozen or more ramuli. The latter are commonly simple, but very frequently branched as in fig. 3, the tips swelling abruptly and forming secondary heads; the surfaces of which, by a process of budding (fig. 2), become covered by a layer of densely crowded spores (fig. 5). The conidia are rich purplish brown, appearing almost black in the mass, varying from oblong to short or long oval or elliptical in outline, and are marked by longitudinal striations which anastomose sparingly. The base of the spore is furnished with a more or less conspicuous, short, tongue-like, hyaline appendage; which is merely an adherent portion of the pedicel of attachment. The spores measure in well developed heads about 20 × 10 μ, though larger, and frequently much smaller ones are found. They are caducous at maturity, leaving the sporiferous head beset with short spinulose projections, with corresponding faint areolations as in Rhopalomyces. Germination takes place very rapidly in water, or in nutrients; the copious mycelium developing at once.

The fate of the sporigerous ramuli and heads appears to be an important point in distinguishing the species of the genus, which owes its name to the fact that in the type, *C. infundibulifera*, the branchlet and the lower half of the sporiferous head become somewhat indurated, through the thickening of the membrane. The distal portion of the head being thin-walled, shrivels, and the persistent branchlet thus has the form of a little funnel. In *C. Simonsii*, the second Indian species, there is no such modification; but although the branchlet shrivels, it is more or less persistent. In our species, however, the ramuli not only shrivel, but are caducous at about the same time that the spores fall from their attachments, and leave the primary head (fig. 4) clathrate through the presence of rounded orifices corresponding to their insertions.

It is no doubt owing to this caducous character of the ramuli, that *C. cucurbitarum* has been so long confused with Rhopalomyces. It has been noted by both Cunningham and Moeller that the fructifications of these fungi usually mature very early in the morning, and the same is generally true of *C. cucurbitarum*. Any one collecting it in the field is thus likely to be misled as to its true characters; preparations of such material showing only masses of spores, associated with the persistent primary heads, the clathrate character of which is readily overlooked.

I have never been able to obtain the sporangia of this species, although it has been cultivated in abundance, and subjected to such unfavorable conditions of nutrition as are said, in the other forms, to induce this type of fructification. In the absence of any knowledge of the sporangia the synonymy of the species must remain uncertain; but, in so far as concerns the conidial fructification, it seems to be identical with the species described by Moeller as *C. americana*, unless the caducous character of the ramuli, which is not referred to[1] in his description, may prove to constitute a sufficient distinction. The habitat is the same, while the form and variations of the fructification are exactly similar; the spore measurements and shapes are identical, the exospore is of the same color and similarly striate, and the tongue-like remains of the attachment form a similar appendage in both. Yet the two cannot be certainly united until the identity of the sporangial spores can be determined. The latter are peculiar in this genus and, although they are contained in nodding sporangia which are very Mucor-like, are unique, in two of the species, from the fact that they are furnished with tufts of hair-like appendages which project from either end.

The zygospores are known only in the two Indian species, which appear to produce them abundantly, and present no noteworthy peculiarities as compared with those of other mucors: and although the Peronospora-like parasitism of *C. Simonsii* on living leaves and shoots of Ipomoea, together with the lateral production of conidia which sometimes occurs, is certainly remarkable, it does not seem, in the absence of any indication even of heterogamy in the sexual reproduction, a sufficient reason for believing with Cunningham that the genus forms a stepping stone to the Peronosporeae. Nor does

[1] Since the above was in press Dr. Moeller has informed me that he finds the conidial fructification of our species identical with that of *C. americana*.

it appear to me that this genus, however interesting in itself, throws any important light on the at best dubious relationships which may be supposed to exist between the Oomycetous and Zygomycetous fungi.

Few references to our species appear in the literature under its original name; the description of Berkeley, and three notices of its occurrence in Peck's Reports, being, as far as I am aware, the only ones which deal with it at first hand. In a note concerning it in my revision of Oedocephalum and Rhopalomyces above referred to, I suggested that it might prove a variety of *R. elegans*, basing this opinion on the notes and sketches kindly sent me by Mr. Massee who examined the type at Kew: and in a later paper Marchal (Revue Mycol. Vol. XVI, p. 11, Jan. 1893) has assumed that this is actually the case, since he includes it in his enumeration of the species of this genus under the name *Rhopalomyces elegans*, var. *cucurbitarum*.

In this connection it may be suggested that the conditions found in Choanephora render it not at all improbable that the species of Rhopalomyces, all of which have dark spores and highly differentiated sporophores rising from a mycelium of unseptate hyphae, may eventually find a place among the Zygomycetes, when their perfect condition is discovered. It is worthy of note, however, that the conidial spores differ markedly in the two genera, from the fact that while those of Choanephora germinate very readily and with great rapidity, those of Rhopalomyces can usually be induced to do so with very great difficulty if at all.

The synonymy of our species may be appended as follows:

Choanephora cucurbitarum (B. & Rav.)

Rhopalomyces cucurbitarum, Berkeley and Ravenel, Grevillea, III, p. 11, 1875.

Rhopalomyces elegans var. *cucurbitarum* Marchal, Revue Mycologique XVI, p. 11, 1893.

Aspergillus cucurbitaceus Curtis in Herb.

to which may be added with a query,—

Choanephora americana A. Moeller, Schimper's Botan. Mittheil. a. d. Tropen. Heft 9, Phycomyceten u. Ascomyceten, p. 18, Plate I, figs. 1–4.

2. **Notes on Monoblepharis.** In a paper published in 1895 (Botanical Gazette, Vol. XX, p. 433 with plate) I gave a short account of certain species of this alga-like genus which were found growing on submerged branches in pools near Cambridge and elsewhere; two new and striking forms being described as *M. insignis* and *M. fasciculata* respectively. The discovery of these plants was a matter of considerable interest at the time, for the reason that no members of the genus had been seen since the two original species on which it was founded (*M. polymorpha* and *M. sphaerica*) were observed by Prof. Cornu of Paris, twenty-five years earlier (1870): some persons even going so far as to doubt the very existence of a genus of fungi having the unique characters which he described. Anyone, however, who knows when, how and where to look for them will find no difficulty in obtaining them; and since the publication of my previous note at least two persons, Professor Lagerheim in Sweden and Dr. Minden in Germany, have again encountered them in Europe.

Lagerheim (Bihang till k. Vet.-Akad. Handlingar, Band 25, Afd. III, No. 8, 1899) in the second part of his "Mycologische Studien," has published his interesting observations; and describes in detail two species, one of them new (*M. brachyandra*) and another which he considers a variety of Cornu's *M. polymorpha*. In connection with this account he takes occasion to subdivide the genus, recognizing two subgenera under Monoblepharis, and placing the two forms described by myself in a new genus *Diblepharis*; basing this separation largely on the fact that, in these species, zoosporangia occur which are morphologically the equivalents of oogonia, and in which biciliate zoospores are produced; apparently overlooking the statement in my former paper (l. c., p. 438) that they were *not* peculiar in this respect. The fact that this new name has been accepted in other quarters has led me to publish the present note, although I have been reluctant to do so in anticipation of a thorough examination of our New England forms which I have had in view.

The oogonia of these fungi, which are terminal or intercalary enlargements of the main hyphae, or of short branches from them, or of both combined (figs. 7, 8, 10), have a more or less characteristic form in the different species; and with few exceptions are typically associated with a finger-like antheridial cell, which appears to be inserted on them, and is in all cases the terminal cell of a hypha, or

branchlet, which has been cut off by a septum from the oogonium which later forms below it. In some instances the antheridia may normally arise in an intercalary fashion like the oogonia, in others, again, both conditions may occur (fig. 10). In a majority of cases typical antheridia may be formed apart from oogonia, while in two this diclinous habit seems to be invariable. In several species, also, these solitary antheridia are associated with larger clavate organs resembling the sporangia of some Saprolegneae, and between the two forms there usually appear a variety of intermediate conditions. These larger clavate organs have been assumed to be zoosporangia containing uniciliate zoospores, but although Lagerheim describes and figures the germination of one of the latter which we must assume he followed continuously from its exit from the sporangium to its germination, the possibilities of error in such observations are so numerous that it cannot be regarded as finally settled that these structures are not all more or less modified antheridia.

Whether these structures are in reality sporangia or are merely more luxuriantly developed antheridia is, however, a matter of little importance in connection with the main point which I desire to emphasize; namely that the species of Monoblepharis are characterized by the production of zoosporangia which are the morphological equivalents of the oogonia, and in which biciliate zoospores are produced. This is not only true of the two forms which Lagerheim has set apart under Diblepharis; but of all the other species including his own *M. brachyandra*, a variable species which appears to occur not infrequently in the vicinity of Cambridge. These sporangia (figs. 8, 9 and 11) show the variations of form characteristic of the oogonia of the species in which they occur, and may be distinguished, after the zoospores (fig. 12) have escaped, by the residual globule or globules of oil which are conspicuous in them before and for some time after the spore discharge.

Although theses porangia are less commonly produced in some species than in others, and their abundance varies in different specimens, I have seldom examined material in which they did not occur; and in *M. polymorpha* especially, they may almost wholly replace the oogonia. It seems very improbable, in view of these facts, that such organs are not equally characteristic in European material, and it is necessary to assume that they have been overlooked. That they are not accidental or unusual productions, is beyond question; and it is

safe to assume that they are to be looked upon as *the* characteristic sporangia of the group. Although it would certainly add greatly to the already sufficiently remarkable peculiarities of this genus did its members possess, not only two kinds of sporangia, resembling antheridia on the one hand and oogonia on the other, but also two varieties of zoospores; the sporangial nature of the antheridium-like type may well be doubted until indubitable evidence has been obtained in corroboration of Lagerheim's observations.

The species of Monoblepharis appear to the writer to form so well defined and coherent a group that it seems undesirable to follow Lagerheim in subdividing it into genera, or even subgenera: for, although the forms may be conveniently sorted according as they mature their oospores within (endogynous) or without (exogynous) the oogonia, such an arrangement would include *M. insignis* and *M. fasciculata* in the same section with *M. sphærica*, which is evidently more closely related to the exogynous *M. polymorpha*. Recognizing then but a single well marked genus, the species may be summarized as follows:

MONOBLEPHARIS *Cornu.*

* Oospores normally endogynous.

← Oospores smooth.

M. insignis Thaxter. Oogonia large normally superposed in single series. Vicinity of Cambridge, Mass., and of Kittery Point, Me.

M. fasciculata Thaxter. Oogonia small, fasciculate at the tips of the hyphae. Vicinity of Cambridge.

← ← Oospores bullate.

M. sphærica Cornu. Antheridium hypogynous. Vicinity of Paris, France.

* * Oospores normally exogynous.

← Oospores adherent to mouth of oogonium.

M. polymorpha Cornu. Normally androgynous the antheridia inserted above the middle third of the oogonium. Vicinity of Cambridge and of Kittery Point. Vicinity of Paris, France and of Breslau, Germany (Figs. 7–8).

M. brachyandra Lagerheim. Normally androgynous, the antheridium arising from an abruptly distinguished insertion below the upper third of the oogonium. Vicinity of Cambridge.

++ ++ Oospores not adherent to mouth of oogonium.

M. macrandra, Lagerheim (as var. of *M. polymorpha*). Normally diclinous. Holma, Sweden.

In addition to these forms Prof. Lagerheim describes two doubtful species, *M. ovigera* and *M. regnigens*. Of these the first seems a very doubtful Monoblepharis while the second should, I think, certainly be excluded from the genus. A form closely resembling it was found at Kittery Point in the spring of 1896 in a permanent pond; but although the material was just beginning to produce zoospores, I had no opportunity to determine whether the latter were uniciliate, or to ascertain whether the sporangia were proliferous as in *M. regnigens*. The hyphæ, however, have the characteristic vacuolate contents which so clearly distinguishes members of this family, and we are probably dealing here with a new genus.

What I assume to be *M. polymorpha* is the most abundant species and can be found in almost any pond or swamp, being no doubt very widely distributed. The filaments are very slender with divergent branches often much attenuated. The oogonium-like sporangia are very common, and the oogonia are more frequently solitary, or not more than two or three together, in marked contrast to the succeeding species.

M. brachyandra, which is distinguished by a shorter stouter antheridium, differently placed and arising characteristically from an abruptly distinguished notch-like insertion which breaks the even outline of the oogonium, is further peculiar from the common occurrence of intercalary antheridia of the type shown in fig. 10. The spores tend to nearly smooth forms in the material examined, and I have been unable to distinguish the two varieties described by Lagerheim, the characters of which seem to be combined in the American material. I think, however, that there can be little question as to the identity of the Swedish and American forms. The zoosporangium represented in fig. 11 is unusually elongate and is drawn from fresh material killed and stained just as the zoospores were escaping. The antheridium which it bears is also abnormally elongated. The usual form of these sporangia is exactly like that of the oogonia.

M. macrandra, which is regarded by Lagerheim as a variety of *M. polymorpha*, I have never met with. It seems to be so well distin-

guished from Cornu's species by its normally diclinous habit, hyaline spores, copious oogonia and especially by its peculiar antheridia and unique habit of discharging its oospores into the water, that I have not hesitated to separate it as a distinct species in the above synopsis.

In addition to the forms above enumerated there appear to be at least two, if not more, additional species which occur in New England; but I prefer to withhold further notes concerning these, in the hope of having an opportunity to examine them more thoroughly in the near future.

In this connection I am tempted to express my dissent from the views of Lagerheim regarding the possible points of approach that may be indicated between these fungi and existing algæ which, at the present time, might be assumed to represent their algal progenitors. In his opinion one should look to forms related to Oedogonium or Coleochaete, rather than to Vaucheria, in seeking such a point of departure; basing this opinion mainly on the fact that the oogonium in these genera is permanently uninucleate, while that of Vaucheria, before the exit of the supernumerary nuclei, is multinucleate. Apart from the fact that we do not as yet know whether the uninucleate condition in Monoblepharis or the preliminary multinucleate condition in Vaucheria are constant phenomena in all the species, it does not appear to be by any means certain that such a difference, even were it constant, should be looked upon as phylogenetically important, in view of the cytological eccentricities presented by other coenocytic plants and so well illustrated in the genus Albugo. The fact that both Oedogonium and Coleochæte possess a thallus of a totally different nature would in itself be a strong argument against such an origin. On the other hand one finds in Vaucheria not only a close resemblance in the Siphonaceous thallus, but so remarkable a correspondence in the phenomena of sexual reproduction that it is merely necessary to select a species like *Vaucheria intermedia*, in which, through a similar sequence in formation, the antheridia appear as in Monoblepharis to be inserted on the oogonia, deprive its thallus of chlorophyl and its antherozoids of one cilium, and supply it with biciliate zoospores, to obtain a very presentable species of Monoblepharis. The transformation of the zoospores would perhaps be the most violent step in this process; yet even in the Phycomycetes themselves our ideas of what a zoospore should be in this group are rudely overturned by such a form as Myrioblepharis.

EXPLANATION OF PLATE 46.

Choanephora cucurbitarum (Berk).

Fig. 1. Mature fertile hypha bearing about twelve secondary sporiferous heads, × 100.

Fig. 2. Terminal portion of a similar hypha; the spores just beginning to bud from the surface of the head, × 100.

Fig. 3. Primary head from which the fertile ramuli are developing, one at the right furcate, × 390.

Fig. 4. Primary head from which the ramuli have fallen leaving it clathrate × 390.

Fig. 5. Sporiferous secondary head, × 175.

Fig. 6. Spores, 860.

Monoblepharis polymorpha Cornu.

Fig. 7. Three oogonia the two upper with mature exogynous oospores, × 390.

Fig. 8. A zoosporangium and oogonium, 390.

Monoblepharis sp.

Fig. 9. Zoosporangium, × 500.

Monoblepharis brachyandra Lagerh.

Fig. 10. Two mature oogonia above an intercalary antheridium, × 390.

Fig. 11. Zoosporangium with abnormally developed antheridium at right, × 930.

Fig. 12. Biciliate zoospore, × 930.

The figures are drawn with camera lucida and slightly reduced from the approximate magnifications indicated.

RECENTLY RECOGNIZED SPECIES OF CRATAEGUS IN EASTERN CANADA AND NEW ENGLAND, — II.

C. S. SARGENT.

§ MOLLES.

Crataegus exclusa, n. sp. *Crataegus Pringlei*, Sargent, RHODORA, iii. 21 in part (1901). —

Leaves ovate, acute or acuminate, rounded, truncate or broadly cuneate at the glandular entire base, coarsely doubly serrate above, with straight gland-tipped teeth, and divided into three or four pairs of short acute lateral lobes; when they unfold coated above and on the midribs and veins below with long pale hairs, more than half grown, membranaceous and still slightly villose or nearly glabrous on the upper surface when the flowers open; at maturity thick and firm in

texture, dark yellow-green above, pale below, 6–7 cm. long, 5–6 cm. wide, with slender yellow villose midribs and veins; petioles slender, villose, sparingly glandular toward the apex, with large dark deciduous glands, often red in the autumn, 1.5–2.5 cm. in length; stipules linear, glandular, caducous. Flowers on stout pedicels, in broad compound many-flowered densely villose corymbs; bracts and bractlets linear to oblong-obovate, acuminate, glandular-serrate, caducous; calyx-tube narrowly obconic, covered with long thickly matted white hairs, the lobes narrow, acuminate, glandular-serrate, with bright red glands often only above the middle, villose, reflexed after anthesis; stamens 10; anthers rose color; styles 3–5, often furnished at the base with small tufts of pale hairs. Fruit drooping or erect on short stout pedicels, in many-fruited villose clusters, oblong, gradually narrowed to the full and rounded more or less hairy ends, or rarely ovate, bright cherry red, lustrous, marked by few large dark dots, 1.7 to 1.8 cm. long, about 1.3 cm. wide; calyx comparatively small, sessile, with a deep narrow cavity and linear acuminate lobes gradually narrowed from broad bases, coarsely glandular-serrate, villose-pubescent, dark red on the upper side near the base, reflexed and closely appressed or rarely erect and incurved; flesh thick, bright yellow, slightly juicy; nutlets 3–5, thin narrowed and acute at the ends, irregularly ridged on the back, with a high rounded ridge, 7–8 mm. long.

A broad shrub with numerous stout much-branched stems covered with ashy gray bark, 3–4 m. in height, and comparatively slender conspicuously zigzag branchlets marked by many small oblong pale lenticels, dark orange-green and covered when they first appear with scattered pale caducous hairs, bright red-brown and lustrous during their first season, darker reddish brown the following year, and finally ashy gray, and armed with numerous stout nearly straight bright chestnut-brown lustrous ultimately gray spines 3.5–5 cm. in length. Flowers during the last week of May. Fruit ripens late in September.

VERMONT: Open grassy slopes of Bald Mountain, Clarendon and Shrewsbury, *W. W. Eggleston*, September 30, 1899, May and August 1900, May, August and October 1901; *C. S. Sargent*, June and September 1900.

In the first account of *Crataegus Pringlei* the anthers were described as yellow. This mistake was subsequently corrected; and it now seems desirable to separate from that species the shrubby plants of Bald Mountain which I formerly considered as representing an extreme form of *Crataegus Pringlei*. *Crataegus exclusa* is a much more hairy plant, with stouter pedicels and much thicker broadly ovate not oval leaves, which show none of that tendency to droop

and become convex by the infolding of the two sides, a peculiarity which makes it always easy to recognize *Crataegus Pringlei* in the field. The habit of the Bald Mountain plant is also quite different from that of *Crataegus Pringlei* which is arborescent, with a tall well formed trunk.

Crataegus anomala, Sargent, Rhodora, iii. 74 (1901); *Silva N. Am.* xiii. 187, t. 670. During the season of 1902 *Mr. J. G. Jack* has found a number of trees of this species formerly known only in a few individuals, near Caughnawaga and on Ile Perrot in the St. Lawrence River. What appears to be *Crataegus anomala* has been collected at Crown Point, New York, by *W. W. Eggleston*, May 1902, and by *Charles H. Peck*, May and September 1902, and at Hampton, New York, by *W. W. Eggleston*, May and October 1902.

§ Lobulatae.

Crataegus lobulata, Sargent, Rhodora, iii. 22 (1901); *Silva N. Am.* xiii. 117 t. 75. A large tree of this species just out of bloom, with unusually hairy corymbs, was found on the 31st of May, 1902, by *Ezra Brainerd* and *C. S. Sargent* in a meadow by the road leading from Great Barrington to Alford, Massachusetts. *Crataegus lobulata* has also been collected at Stanford, Connecticut, by *E. H. Eames*, in May and September 1901, and September 1902.

Crataegus Robesoniana, n. sp. Leaves ovate, acute or acuminate rounded, truncate or rarely broadly cuneate at the base, sharply and often doubly serrate, with straight gland-tipped teeth, and divided into numerous short acute lateral lobes; nearly fully grown when the flowers open and covered above with short rigid pale hairs; at maturity membranaceous, light yellow-green and scabrous on the upper surface, pale and glabrous on the lower surface with the exception of a few short hairs scattered along the light yellow midribs and primary veins, 8–9 cm. long, 7–8 cm. wide, or on leading shoots often 10 cm. long and 9 cm. wide; petioles slender, nearly terete, occasionally glandular, often tinged with red in the autumn, 3–4 cm. long. Flowers about 1.5 cm. in diameter on stout pedicels covered with long white reflexed hairs, in very compact few-, usually 5-flowered compound corymbs; bracts and bractlets linear to oblong-obovate, glandular, caducous; calyx-tube narrowly obconic, villose, the lobes gradually narrowed from broad bases, linear, long-pointed, irregularly glandular-serrate, villose, reflexed after anthesis; stamens 10; anthers small, rose-purple; styles 4 or 5. Fruit in erect few-fruited clusters, oblong, full and rounded at the ends, bright scarlet, lustrous, marked by few large dots about 2 cm. long and 1 cm. wide; calyx sessile,

with a broad shallow cavity, and narrow elongated appressed lobes; flesh thick, juicy, pale yellow; nutlets 4 or 5, acute at the ends, slightly and irregularly ridged on the narrow back, 6–7 mm. long.

A tree 7 or 8 m. in height, with a tall trunk sometimes 3 dm. in diameter, stout wide-spreading or ascending branches forming an open shapely head, and slender mostly unarmed branchlets marked by many small oblong pale lenticels, olive green when they first appear, dull reddish brown during their first season, and pale red-brown and lustrous the following year. Flowers during the last week of May. Fruit ripens the first of September and soon falls.

MASSACHUSETTS: Borders of woods, usually in low moist soil. Lenox, *Brainerd* and *Sargent*, May 30, 1902; *C. S. Sargent*, September 8, 1902.

This species which is closely related to *Crataegus lobulata*, Sargent, differs from it in its compact few flowered corymbs, in the peculiar hairs which cover the pedicels of the flowers, in its remarkably thin leaves which are shorter in proportion to their length, much less deeply lobed and very rough on the upper surface, and in its early ripening fruit which falls at least a month earlier than that of *Crataegus lobulata*. The tree which should be considered the type of this species is growing on the estate at Lenox which was owned for many years by the late William R. Robeson of Boston, and was probably moved at least forty or fifty years ago from the woods in the neighborhood to its present position close to the front door of the house. The name of a family of Pennsylvania and Massachusetts which has produced at least four generations of intelligent and cultivated lovers of trees can thus properly be associated with this handsome plant.

Crataegus polita, n. sp. Leaves ovate to oval, acute or acuminate, full and rounded, or on vigorous shoots sometimes truncate or subcordate at the base, slightly and often doubly serrate, with straight glandular teeth, and divided into numerous short acuminate lateral lobes; tinged with red and covered on the upper surface with short lustrous white hairs when they unfold, nearly fully grown when the flowers open and then membranaceous, light yellow-green and scabrate above and pale and glabrous below; at maturity thick and firm in texture, smooth and dull dark yellow-green on the upper surface, light yellow-green on the lower surface, 7–9 cm. long, 6–7.5 cm. wide, with slender yellow midribs deeply impressed above and four or five pairs of thin primary veins running to the points of the lobes; petioles slender, nearly terete, sparingly glandular toward the apex, often red in autumn, 2.5–3 cm. long. Flowers about 1 cm. in diameter on elongated slender pedicels, in broad open thin-branched glabrous

compound corymbs; bracts and bractlets small, linear, acuminate, glandular-serrate, caducous; calyx-tube narrowly obconic, more or less deeply tinged with red, the lobes narrow, elongated, acuminate, coarsely glandular-serrate, red at the apex, reflexed after anthesis; stamens 5; anthers rose-purple; styles 3 or 4. Fruit in erect few-fruited clusters, subglobose to short-oblong or rarely broadly obovate, bright, cherry red, lustrous, often blotched with green or yellow, marked by few large pale dots, 1–1.3 cm. long, 9–12 mm. wide; calyx small and sessile, with a comparatively broad deep cavity and elongated lobes gradually narrowed from broad bases, coarsely glandular-serrate, red on the upper side near the base, spreading or incurved, often deciduous from the ripe fruit; flesh thick, pale yellow, dry and mealy; nutlets 3 or 4, thin, acute at the ends, prominently ridged on the back, with a high rounded ridge, about 7 mm. long.

A broad round-topped shrub 3–4 mm. high with few or many much branched stems covered with pale gray bark, often much roughened near the ground, and slender slightly zigzag glabrous branchlets marked by many small lenticels, olive green slightly tinged with red when they first appear, bright reddish brown during their first season, darker the following year, and usually only slightly armed with stout straight bright red-brown spines from 2.5–5 cm. in length. Flowers about May 20th. Fruit ripens and begins to fall during the first week of September.

Connecticut: Open rocky pastures near the Niantic River, East Lyme, *C. B. Graves*, May 26 and September 6, 1902. Massachusetts: hill west of the main street of Great Barrington, and roadside between Great Barrington and Alvord, *E. Brainerd* and *C. S. Sargent*, May 31, 1902; Great Barrington, *C. S. Sargent*, September 9, 1902.

Crataegus Holmesiana, Ashe, Sargent *Silva N. Am.* xii. 119, t, 676. A form of this species with glabrous or pubescent corymbs. slightly larger flowers and fruit which ripens from ten to twenty days later than the form figured in *The Silva of North America*, is common near Montreal where *Mr. Jack* has found it in several stations; it is also common in the neighborhood of Toronto and at Rochester, New York.

Crataegus fretalis, n. sp. Leaves ovate, acute or acuminate, full and rounded at the broad base, sharply and except towards the base mostly doubly serrate, with straight gland-tipped teeth, and divided into three or four pairs of short acute lateral lobes; tinged with red and covered when they unfold with short pale hairs, and more than half grown when the flowers open and then membranaceous,

pale yellow-green and scabrate on the upper surface and paler on the lower surface; at maturity thin but firm in texture, light yellow-green and almost smooth above, pale yellow-green below, 7–10 cm. long, 6–9 cm. wide, with slender yellow midribs and thin remote primary veins arching to the points of the lobes; petioles slender, nearly terete, often furnished above the middle with occasional minute dark glands, frequently tinged with red in the autumn, 2.5–3 cm. long. Flowers 2–2.3 cm. in diameter on slender pedicels, in small thin-branched 5–12-flowered glabrous compound corymbs; bracts and bractlets linear to ovate, glandular-serrate, small, caducous; calyx-tube narrowly obconic, the lobes narrow, elongated, acuminate. coarsely glandular-serrate mostly only near the middle, bright red at the apex, reflexed after anthesis; stamens usually 5, rarely 6 or 7, small, deep rose-color; styles 3. Fruit in few-fruited erect or drooping clusters, oblong to obovate, full and rounded at the ends, crimson, lustrous, 1.1–1.2 cm. long, about 1 cm. wide; calyx cavity deep and shallow, the lobes erect and incurved, often deciduous from the ripe fruit; nutlets 3, thin, acute at the ends, slightly and irregularly ridged on the back, 6 mm. long.

A tree 6 or 7 m. in height with a trunk rarely more than 1 dm. in diameter covered with gray bark separating into thin flakes near the ground and smooth above, long slender erect and spreading branches forming an open irregular head, and stout nearly straight branchlets marked by many small oblong pale lenticels, green more or less tinged with red when they first appear, bright reddish brown and lustrous during their first season, darker red-brown the following year, and slightly armed with stout straight red-brown shining spines 2–4 cm. in length. Flowers about May 20th. Fruit ripens at the end of September.

CONNECTICUT: Oak woods, Rumford's Point, Groton, close to the shore of Long Island Sound, *C. B. Graves*, May and September, 1902; and probably at Oxford, *E. B. Harger*, May and September, 1901.

Crataegus Thayeri, n. sp. Glabrous with the exception of the hairs on the upper surface of the young leaves. Leaves ovate to obovate, acute, gradually narrowed from near the middle and concave-cuneate at the entire base, sharply doubly serrate above, with straight gland-tipped teeth, and divided into numerous narrow acuminate lateral lobes; tinged with red when they unfold and covered above with short pale hairs, and membranaceous when the flowers open, and then dark yellow-green, lustrous and scabrate on the upper surface and pale on the lower surface; at maturity dark green, lustrous and smooth above, pale below, 5–6 cm. long, 3.5–4.5 cm. wide, with stout yellow midribs deeply impressed above like the 5–7 pairs of

very prominent thick primary veins extending obliquely to the points of the lobes; petioles slender, more or less wing-margined above by the decurrent bases of the leaf-blades, slightly grooved, 2.5–3 cm. in length; stipules linear, acuminate, glandular-serrate, caducous. Flowers 1.6 cm. in diameter on slender pedicels, in broad many-flowered thin-branched compound corymbs; bracts and bractlets linear, acuminate, entire or finely glandular-serrate, caducous; calyx-tube broadly obconic, the lobes rather abruptly narrowed from the base, slender, elongated, acuminate, tipped with small dark red glands, grandular-serrate or rarely entire; stamens 10; anthers large, deep-rose color; styles 3–5. Fruit erect on short or long rigid pedicels, subglobose to oblong or obovate, full and rounded at the ends, orange-red, marked by occasional small pale lenticels, 1–1.4 cm. long, 8–10 mm. wide; calyx sessile, with a broad shallow cavity and spreading and closely appressed mostly entire lobes; flesh thin, yellow, dry and mealy; nutlets usually 3, full and rounded at the ends, ridged on the rounded back, with a low broad ridge, about 8 mm. long and almost as broad.

A wide round-topped shrub 3 or 4 m. in height with many intricately branched stems, and very stout much contorted branchlets dark green, lustrous, and marked by numerous large pale lenticels when they first appear, dull red-brown during their first season and dark gray-brown or brown tinged with red the following year, and apparently unarmed. Flowers from the 20th to the end of May. Fruit ripens from the 1st to the middle of September.

Massachusetts: Upland rocky pastures, West Boylston, *J. G. Jack, Mrs. John E. Thayer, C. S. Sargent*, May and September 1900, 1902.

This species, of which I have seen but two individuals, resembles in the shape of the leaves *Crataegus scabrida*, Sargent, of western New England and the St. Lawrence valley, with which it should be associated. The leaves, however, are more sharply and deeply lobed and their midribs and veins are much stouter and more prominent, and the fruit is erect, much smaller and more often subglobose. The specific name of this species testifies to my appreciation of the help which I have received during several years from Mr. and Mrs. John E. Thayer of Lancaster in my studies of Crataegus in central Massachusetts.

§ Flabellatae.

* Stamens 20.

← Anthers rose color.

Crataegus flabellata Spach. Sargent, Rhodora, iii. 75 (1901).

This species, which is common in the valley of the St. Lawrence River in the neighborhood of Montreal, has been found at Walpole, New Hampshire, by *W. W. Eggleston*, October 1902, and at Crown Point, New York, by *W. W. Eggleston*, June and September, 1902, and by *C. H. Peck*, September 1902. A specimen with immature fruit collected by *Ezra Brainerd* at Ferrisburg, Vermont, July 1901, should perhaps be referred to this species.

Crataegus contigua n. sp. Leaves ovate, acuminate, full and rounded or broadly cuneate at the glandular base, coarsely and often doubly serrate, with straight gland-tipped teeth and deeply divided into five or six pairs of acuminate spreading lobes; about one third grown when the flowers open and then membranaceous, covered above with short white hairs and glabrous below; at maturity thin but firm in texture, dark green, lustrous and scabrate on the upper surface, pale yellow-green on the lower surface 6–8 cm. long, 4.5–7 cm. wide, with slender yellow midribs and thin primary veins extending to the points of the lobes; on vigorous shoots often broader than long, 7 cm. long, 7.5–8 cm. wide; petioles slender, nearly terete, frequently slightly wing-margined at the apex, glandular with scattered minute dark glands 3–5 cm. in length. Flowers 1.3–1.5 cm. in diameter on elongated slender pedicels, in many-flowered thin-branched glabrous compound corymbs; calyx-tube broadly obconic, the lobes abruptly narrowed from broad bases, linear, acuminate, entire or rarely furnished with a few small scattered glandular teeth, reflexed after anthesis; stamens 20; anthers small, pink; styles 3–5. Fruit in few-fruited drooping clusters, obovate at first when fully grown, becoming oblong and full and rounded at the ends at maturity, scarlet marked by occasional small pale dots; calyx cavity broad and shallow, the lobes spreading and appressed, often wanting from the ripe fruit; flesh thin, yellow; nutlets 3–5, usually 4, thin, acute at the ends, conspicuously ridged on the back, with a broad grooved ridge, about 8 mm. long.

A shrub 2–3 m. in height with numerous erect stems spreading into small thickets and stout nearly straight branchlets marked by few large pale lenticels, yellow-green when they first appear, light red-brown and lustrous during the first season and dull gray-brown the following year, and armed with stout nearly straight bright red-brown shining, ultimately ashy gray spines, 2.5–4.5 cm. long. Flowers during the first week of June. Fruit ripens about the 20th of September and soon falls.

VERMONT: banks of White River, Stockbridge, *W. W. Eggleston*, June, July and September 1901. Common.

+ + Anthers light yellow.

Crataegus irrasa, n. sp. Leaves ovate, acute, broadly cuneate or on leading shoots rounded at the base, laciniate, doubly, or below the middle mostly simply, serrate, with incurved glandular teeth; more than half grown when the flowers open and then covered with short lustrous white hairs and villose below along the slender midribs and thin veins arching to the points of the lobes; at maturity thin but firm in texture, dark green and lustrous on the upper surface, pale yellow-green on the lower surface, 5–6 cm. long, 4–5 cm. wide, or on leading shoots sometimes 7 cm. long and 8 cm. wide; petioles slender, slightly wing-margined at the apex, grooved, glandular, with minute dark red glands, 2–2.5 cm. long; stipules oblong-obovate and acuminate, to falcate, acuminate and auriculate on leading shoots, villose, glandular-serrate. Flowers 1.3–1.5 cm. in diameter on elongated slender densely hairy pedicels, in thin-branched 9–12-flowered villose narrow compound corymbs; bracts and bractlets linear, small, caducous; calyx-tube narrowly obconic, thickly coated with long pale hairs, the lobes gradually narrowed from broad bases, short, acute, glandular, with minute bright red glands, villose, reflexed after anthesis; stamens 20; anthers small, pale yellow; styles 4 or 5. Fruit drooping or erect on stout slightly villose pedicels, in broad many-fruited clusters, oblong, full and rounded at the ends, dark red, lustrous, marked by a few large pale dots, 1.2–1.4 cm. long, about 1 cm. wide; calyx prominent, with a short tube, a broad deep cavity and spreading closely appressed persistent lobes; flesh thin, soft and pulpy, orange color tinged with dull red; nutlets 4 or 5, full and rounded at the ends, ridged on the back, with a high wide deeply grooved ridge, 8 mm. long.

A shrub 3 or 4 m. in height with numerous stems spreading into broad thickets, and slender nearly straight or conspicuously zigzag branchlets marked by large oblong pale lenticels, olive green when they first appear, dark or light reddish brown during their first season, gray or light brown tinged with red the following year and ultimately ashy gray, and armed with numerous stout straight bright red-brown and shining ultimately ashy gray spines varying from 2.5–9 cm. in length. Flowers at the end of May and early in June. Fruit ripens at the end of September and occasionally does not fall until the following spring.

Province of Quebec: Rocky fields, the borders of woods, and banks of the St. Lawrence River, at Sault au Ricollet on the north side of Montreal Island, *J. G. Jack*, May and September 1902. Common.

Distinguished from the closely related *Crataegus flabellata* by its

broader and thicker leaves, by its much more hairy corymbs and calyx, by its pale yellow anthers and by the color of the flesh of the ripe fruit.

* * Stamens 10. Anthers pale rose color.

Crataegus fluviatalis, n. sp. *Crataegus acutiloba*, Sargent, RHODORA, iii. 76 in part, (1901).

Leaves ovate, acuminate, broadly cuneate or rounded at the base, sharply and mostly doubly serrate, with straight teeth tipped with dark glands and divided into 5 or 6 pairs of narrow acuminate spreading lateral lobes; tinged with red and villose above and along the midribs and veins below with long pale hairs when they unfold, more than half grown when the flowers open and then membranaceous, coated above with short shining white hairs and glabrous below; at maturity thin but firm in texture, smooth and dark yellow-green on the upper surface, paler on the lower surface, 5–6 cm. long, 3.5–5 cm. wide, with stout yellow midribs often becoming rose color in the autumn, and slender primary veins extending to the points of the lobes; petioles slender, grooved, slightly wing-margined at the apex, glandular, with numerous small dark red glands mostly deciduous before autumn, often rose color late in the season, 1.5–2.5 cm. in length; stipules linear to linear-obovate, glandular-serrate, caducous; on vigorous shoots leaves deeply lobed, with spreading acuminate narrow lobes, often 7–8 cm. long and 6–7 cm. wide, with short stout glandular petioles wing-margined below the middle. Flowers 1.5 cm. in diameter on elongate slender densely or slightly villose pedicels, in broad thin-branched more or less villose many-flowered compound corymbs; bracts and bractlets linear, glandular, small, caducous; calyx-tube broadly obconic, villose toward the base, glandular above, the lobes narrow, elongated, acuminate, entire or slightly and irregularly serrate, villose on the inner side above the middle, reflexed after anthesis; stamens 10; anthers pale rose color; styles 4 or 5. Fruit in broad many-fruited drooping glabrous or slightly villose clusters, oblong or rarely obovate, crimson, lustrous, marked by numerous small dots, 9–13 mm. long, 8–10 mm. wide; calyx sessile, with a broad shallow cavity, and spreading closely appressed usually entire lobes villose on the upper side; flesh thin, firm and yellow; nutlets 4 or 5, acute at the ends, conspicuously ridged on the back, with a narrow rounded ridge, about 6 cm. long.

A shrub with many slender erect stems spreading into small clusters and frequently 6 or 7 m. tall, and thin zigzag branchlets dark orange-green and slightly villose when they first appear, soon glabrous, marked by numerous oblong pale lenticels, bright red-brown and lustrous during their first season, pale orange-brown and lustrous in

their second year, and finally dark gray-brown, and armed with numerous stout often curved red-brown shining spines 3–4 cm. in length. Flowers at the end of May. Fruit ripens from the 1st to the middle of October.

Province of Quebec: Dry limestone ridges near the south bank of the St. Lawrence River in the Caughnawaga Indian Reservation, and on Montreal Island at Highlands and Rockfield, *J. G. Jack*, September and October 1899, May and September 1901 and 1902.

An Interesting Form of Leersia oryzoides. — During the latter part of September, 1902, while collecting along the tidal shores of the Merrimac river near "the laurels" in the western part of Newburyport, Mass., in company with Mr. Oakes Ames and Mr. R. G. Leavitt, I chanced to examine an apparently sterile grass that grew on the tide-swept shores, and found it to be a cleistogamous, smooth Leersia. It grew to about fifteen inches in height, and its leaves were horizontally spreading, soft and flaccid. Several specimens were taken home, and a study showed them to be very similar to *L. oryzoides* Swartz. Several trips made in the vicinity of Seabrook, New Hampshire, to observe this species growing in the field resulted in the interesting discovery that while *L. oryzoides* is often cleistogamous when growing in air, it is always rough under such circumstances; but when growing submersed it is *always* cleistogamous and *smooth*.

On another trip to the Newburyport locality in company with Mr. M. L. Fernald, a diligent search revealed a patch extending up the shore from well within the influence of the tide to nearly out of its reach. The lower part of this patch was identical in all respects with the plants of my first collection, while the upper part was the typical rough form with exserted panicles, thus beautifully demonstrating the oddity to be a physiological form, produced by submersion. It may be described as follows:

L. oryzoides forma **glabra**. Submersed or inundated regularly by tides; a few inches to 1½ ft. tall, smooth; leaves horizontal, soft and flaccid, each bearing a cleistogamous panicle in its sheath, the terminal with sheaths swollen by the enclosed flowers, but never rupturing. Spikes as in the type, but with fewer setae. — Alvah A. Eaton, The Ames Botanical Laboratory, North Easton, Massachusetts.

Western Plants at Cumberland, Maine.— In the summer of 1902 three western plants, *Solanum rostratum*, Dunal, *Rumex maritimus*, L., and *Verbena bracteosa*, Michx., made their appearance in sandy waste soil at Cumberland Center, Maine. The first has been reported several times from other parts of Maine, and has been spontaneous around buildings at Cumberland for the last two or three years. *Rumex maritimus*, L., was collected on a salt marsh at Old Orchard, Maine, a few years ago by Mr. J. C. Parlin. The present station extends the range slightly further northward and inland. The third plant, *Verbena bracteosa*, Michx., has not, to my knowledge, been reported previously from Maine. All three species were doubtless introduced from the West by impurities in grain.—Edward B. Chamberlain, Washington, D. C.

Linum catharticum on Cape Breton.— In August last, while examining the excellent sketches of Cape Breton plants made by Mrs. John S. McLennan, I was much interested in the drawing of a delicate little flax-like plant with opposite leaves and white flowers. The plant was so unlike anything with which I was familiar that Mrs. McLennan kindly guided me to the spot near her home in Sydney where she had found the plant. There it abounded in damp spots in an open field, and sufficient flowering and fruiting material was secured for later identification. Comparison of the plant with European specimens shows it to be the Old World *Linum catharticum*, L., the Fairy Flax of English pastures, which has been once before reported in Nova Scotia — on waste ground at Pictou,[1] 120 miles in direct line and more than twice that distance around the coast from Sydney.

At Sydney the Fairy Flax is not in waste ground, but grows thoroughly wild, suggesting to the casual observer the Bluet (*Houstonia caerulea*) of our New England fields. It may, however, have been first introduced in ballast, as a small colony of ballast-weeds occurs on the wharf not far away; or it was more probably first introduced into the region in imported seed. Unlike our native species of flax, *Linum catharticum* has opposite leaves and white flowers, and by these characters it may be readily distinguished should it appear in other portions of eastern America.— M. L. Fernald.

[1] Macoun, Cat. Can. Pl. i. 501.

The Eighth Annual Winter Meeting of the Vermont Botanical Club was held at the University of Vermont on January 16 and 17. The attendance was the largest in the history of the Club and the program was crowded with good papers. President Brainerd discussed the violets of the state as at present understood; W. H. Blanchard reported from the vicinity of Westminster a number of interesting plants new to Vermont, and some new to science; Mrs. E. B. Davenport gave her recollections of "the shoemaker botanist," C. C. Frost; Professor E. A. Burt discussed the *Thelephorae* of Vermont; Mrs. N. F. Flynn reported the discovery of 41 additional species in Burlington and vicinity during 1902, making the total number of seed plants and ferns recorded for the local flora of this region 1066; Dr. G. T. Moore discussed the pollution of water supplies by algae. There were 15 other shorter papers presented.

The annual address was by Mr. Clifton D. Howe of the University of Chicago, upon Some Results of Deforestation in Vermont. Mr. Howe, in his capacity as field agent for the National Bureau of Forestry, has made an extended survey of the forests of the state during the past year. It is hoped that Vermont will soon fall into line with the other New England states in formulating a forestry policy which will tend to alter the present methods of destructive lumbering.

Seventeen new members were elected and the former officers reappointed, namely: President, Ezra Brainerd; Vice-President, C. G. Pringle; Secretary, L. R. Jones. It was the sentiment that the summer meeting, which occurs about July first, be held on Stratton mountain. As this is near the Massachusetts and New Hampshire lines it is hoped that botanists from the neighboring states may join the party. Any desiring to learn more definitely the dates and plans should address the secretary, at the University of Vermont, Burlington.—L. R. Jones, *Secy*.

The following members of the Connecticut Botanical Society have been appointed as a committee to take charge of its work upon the lower cryptogams: *Bryophytes*, Professor A. W. Evans, New Haven; *Algae*, Mr. Isaac Holden, Bridgeport; *Fungi*, Dr. G. P. Clinton, New Haven.

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R. Thaxter del.

CHOANEPHORA, MONOBLEPHARIS.



Lorin L. Dame.

Rhodora

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LORIN LOW DAME.

F. S. Collins.

(With Portrait.)

Lorin Low Dame, the son of Samuel and Mary Anne (Gilman) Dame, was born in Newmarket, New Hampshire, March 12, 1838. His father was a descendant of Samuel Dame, who settled in Dover about 1630; Governors Simon Bradstreet and Thomas Dudley of Massachusetts were ancestors of his mother. In 1846 the family removed to Lowell, Massachusetts, and Lorin completed the full course of the public schools, fitting for college at the High School, entering Tufts College in 1856, and graduating at the head of his class in 1860. In the same year he became principal of the High School at Braintree, Massachusetts, where he taught two years, and then resigned the position to begin the study of law. In 1863 he was married to Miss Isabel Arnold of Braintree, and in the same year he was commissioned Second Lieutenant in the Fifteenth Massachusetts Battery. He saw active service in the Gulf States and in Tennessee, was promoted to First Lieutenant, and mustered out in August, 1865; the same year he became principal of the Lexington High School, a position which he held for three years. He was principal of the Nantucket High School for two years, of the Stoneham High School for six years, and in 1876 was chosen principal of the Medford High School, the position which he held for the rest of his life. The high standard of efficiency the school has attained during his administration and its remarkable equipment, both from the material and from the aesthetic point of view, are due very largely to his judgment and taste, and to the complete confidence felt in him by his pupils and graduates, and indeed, by all with

whom he came in contact. His death, January 27, 1903, without suffering and with no previous impairment of his abilities, was what he would have chosen for himself, could he have made the choice. Mrs. Dame and four daughters survive him.

Every boy has the collecting spirit, at one time or another, and in Mr. Dame's case it first took the form of insect collecting; but even in his school days at Lowell he did some collecting of plants, and botany then soon superseded entomology. Even in his roughest campaigning in the south, he would notice the trees and flowers, and mention them in his letters home. At Lexington he began to collect with a definite intention of becoming familiar with the plants of the region: then the Nantucket flora, with its many peculiar forms in a limited area, especially attracted him, and thereafter botany was his one especial interest, outside of his family and his professional relations.

I first met him at a meeting of the Middlesex Field Club, formed for promoting interest in the botany of the county; we were together in many field excursions, and in 1882 we undertook the preparation of a county flora, which was published in 1888 under the auspices of the Middlesex Institute, the successor of the Field Club. Practically all our spare time for these six years was devoted to this work, and I learned to appreciate thoroughly his many noble and lovable characteristics. Intellectually, thoroughness was perhaps his strongest feature; no amount of time or work was too much to give to get the facts; nothing was allowed to go into the "copy" until every possible question had been answered. Naturally, we had from various quarters lists of species that would be very interesting additions to our local flora, but unless good evidence could be brought forward for them, he was inexorable, and they remained in the file known to us as the "rogues' gallery." Occasionally some new evidence would transfer a plant to the accepted list, but the number of the incorrigible finally bore quite a large proportion to the number included in the printed work. During the preparation of this work he took especial charge of the trees, and from that time, while not losing his interest in general botany, he made the trees a specialty.

I was not associated with him in his later publications, but I know that the same care, patience and judgment were used in the folio volume, Typical Elms and other Trees of Massachusetts, and in the Handbook of the Trees of New England, both of which he prepared

in connection with Henry Brooks; the same was the case with smaller papers, chiefly on botanical or historical subjects, published in magazines; the history of the Middlesex Canal published in the Bay State Monthly, Nov., 1884, is a model of a clear, accurate, readable monograph.

He was an excellent classical scholar, and had a good knowledge of modern languages; a fine mathematician, and well read in the best literature. Though exacting in his requirements in regard to the work either of himself or of others, he had always a kindly spirit towards the worker; indeed, one cannot think of him as having an unkindly thought even to those of whose aims and methods he disapproved.

With the exception of observations during trips to Nova Scotia in 1900 and Newfoundland in 1902, his botanical work was done in New England; a visit to Europe in 1880, mostly on foot through England and Scotland, was for recreation, not for science, but his journal shows that he was always noticing the flowers and trees with whose names he was familiar, but which he had never seen growing wild. It is doubtful if any one else was as well acquainted as he with our New England trees, as they grow uncultivated; and the many summers he spent at Nantucket had made him familiar with its curiously rich flora, with very limited stations for the rarer species; probably no one else knew them as well as he did.

For nine years he was trustee of Tufts College; in 1866 he received from the College the degree of Master of Arts, and in 1902 of Doctor of Science; he was a member of the Phi Beta Kappa and Zeta Psi societies; a member of the Boston Society of Natural History, the Medford Historical Society, and an original member of the New England Botanical Club.

Though at first sight his manner seemed somewhat reserved, he had warm friends in many and widely separated quarters, and his loss will be felt in all. President Capen's address in the Tuftonian and the memorial notice by the Massachusetts Schoolmasters' Club are tributes of deep personal feeling as well as of professional appreciation; the Nantucket fishermen will miss one who was always a welcome companion on a cruise; a host of his pupils will cherish his memory; all will miss an honest, modest, able, lovable man.

THE PLANT-FORMATIONS OF EASTERN MASSACHUSETTS.

J. W. Blankinship.

This paper is the result of studies on the eastern coast of Massachusetts and includes in general the region from Cape Ann to Plymouth and from Cape Cod to some 15 miles west of Boston. In the north this region is mainly broken and hilly, but southward spreads out into extensive sandy plains. It is bounded on the east by the sea with its extensive salt marshes and there are innumerable ponds and slow-flowing streams which support a characteristic vegetation, while the Blue Hills some 600 feet high are the most prominent landmark. Almost the whole region is sparsely wooded (about half with conifers), and much of it is covered with glacial drift. The numerous hills have usually their tops and upper slopes well denuded of soil and sparse of vegetation, and these hilltop barrens often support characteristic species. The bogs of the North here approach their southern limits and bring with them their own northern species. Withal, this debatable ground between the Carolinian and Canadian regions — often misnamed the Transitional Zone, possessing a flora made up of the mingling of the species of two very different regions and rich with intergrading forms, is one well worthy of study from the ecological as well as the systematic standpoint and these brief notes are offered more as an aid to others interested in its ecology than as a study complete in itself.

The range or area over which a given species may be naturally distributed is determined by latitude, altitude, humidity and geographical barriers, which serve to group species into "floras," each occupying an essentially distinct biological area. In each of these biological regions the flora comprises a number of segregated groups of plants occupying different areas called "habitats," each composed of essentially different species adapted to this particular combination of physical, chemical and biological conditions. The efficient factors of these plant-habitats are the chemical nature of the soil with its physical condition, the amount of contained water, the relative amount of sunlight and the effect of biological agents, somewhat modified by variation in temperature, exposure and proportion of humus present in the soil. The total aggregation of species usually

found occupying a given habitat is called a "plant-formation" from its analogy to geological formations.

There is often a considerable difference in the prevailing plant-formations of adjacent districts within the same biological region, due to difference in physiography and in the underlying rock formations, upon which the nature of the soil depends. In the district here considered the limestone areas with their characteristic plant-formations appear to be wholly absent, while more inland the saline formations are wanting. Another important element in the study of the ecology of a region is the variation in altitude above sea-level. The variation here scarcely exceeds 600 feet and may be left out of consideration, but in more mountainous districts this altitudinal variation is often sufficient to affect materially the distribution of species, which tend to group themselves at the different altitudes into zones corresponding in large part to the larger latitudinal zones of the continent, each having its own system of species and plant-formations.

In every district there is usually some dominant plant-formation, throughout which the other formations occur as lines and patches, without materially affecting the general physiognomy of the region, determined by the flora of this dominant formation, which is here the upland forest composed of the Sand Plain and Hilly Upland Formations, dependent upon the nature of the soil.

The classification followed differs in several important particulars from those usually given and is based (1) upon the soil, (2) the amount of contained moisture and (3) upon the relative amount of sunlight, which by their several combinations form the plant-habitats of this region, to which must be added the three biological formations dependent upon other factors. The table below represents the possible combinations of these factors with the resulting plant-formations as they appear in our flora.

Table of Habital Factors.

(The numbers refer to the synopsis of Plant formations following.)

Soil			siliceous	argillaceous	calcareous	saline (*Halophytes*)
Humidity slight	*Xerophytes* or Arid Plants	In sunlight	(1)	(2)	....	(*m*)
		In shade	....	....	....	....
Humidity medium	*Mesophytes* or Upland Plants	In sunlight	(*n*)	(*o*)	....	....
		In shade	(3)	(4)	....	....
Humidity great	*Hygrophytes* or Lowland Plants	In sunlight	(5)	(6)	....	(7)
		In shade	(8)	(8)	....	....
Saturated or nearly so	*Helophytes* or Swamp Plants	In sunlight	(9*a* & 9*b*)	(9*a* & 9*b*)	....	(10)
		In shade	(11)	(11)	....	....
Submersed	*Hydrophytes* or Aquatic Plants	rooted	(12)	(13)	....	(14)
		floating	(15)	(15)	....	(16)

Special Adaptations: Dependent upon human habitation (17)
" " " cultivation. (18)
Saprophytic or parasitic on other organisms. (19)

It is probable that there are other plant-formations besides those here given. There may be found a limestone formation with its characteristic species to parallel the silicious, argillaceous and saline series given. A sea-cliff formation (m) may occur northward along the coast, as a number of peculiar species are found at Nahant and Cape Ann in such situations. There may be a district flora characteristic of "dry open places" (n), (o), or of the upland thickets intermediate between (1–2) and (3–4), but, if so, it certainly is not very pronounced. In this classification, I have endeavored to give only those plant-formations which stand out with clearness and are easily segregated by their flora, recognizing the fact that they all intergrade with each other and that many species are common to a series having the same soil or the same relative amount of humidity, while others, like weeds, pay little regard to any of these conditions.

The species here italicized as "characteristic" of each formation are those usually found here only in the given formation and occurring rarely elsewhere; the other species listed are common in the formation but not at all confined to it. By far the greater part of the flora

appears to fall into this latter class of *generalized species*, though the list of characteristic species may be largely extended.

It is only by thus dividing the flora of a district into its component plant-formations and recognized habitats that any system can be introduced into the present unscientific method of quoting specific habitats and any studies attempted on specific variation based upon the influence of environment.

The local plant-formations may best take their names from the habitats of which they are characteristic and hence in the district here considered we have the following:

Synopsis of the Plant-formations of Eastern Massachusetts.

I. Soil humidity slight. *Xerophytes* or Arid Plants.
(Little or no forest vegetation and hence no shade.)

A. Soil silicious . . . . . 1. Sand-Barren Formation.
B. Soil argillaceous . . . . . 2. Hilltop-Barren Formation.

II. Soil humidity medium. *Mesophytes* or Upland Plants.
(These uplands forested and consequently mainly shade vegetation.)

A. Soil silicious . . . . 3. Sand-plain Forest Formation.
B. Soil argillaceous . . . 4. Hilly upland-Forest Formation.

III. Soil humidity great. *Hygrophytes* or Lowland Plants.
a. In full sunlight.

A. Soil silicious . . . . 5. Sand-pond margin Formation.
B. Soil argillaceous . . . . 6. Low-Meadow Formation.
C. Soil saline (Halophytes) . . . . 7. Sea-shore Formation.

b. In the shade.

A & B. Soil silicious or argillaceous with abundant humus.
8. Low-Woodland Formation.

IV. Soil saturated. *Helophytes* or Swamp Plants.
a. In full sunlight.

A & B. Soil silicious or argillaceous.
with little or no Sphagnum . 9a. Swamp Formation.
with much Sphagnum . . 9b. Bog Formation.
C. Soil saline (*Halophytes*) . . . 10. Salt-marsh Formation.

b. In deep shade.

A & B. Soil silicious or argillaceous 11. Boggy-Woodland Formation.

V. Soil submersed. *Hydrophytes* or Aquatic Plants.
(All necessarily in full sunlight.)
a. Plants fixed.

A. Substratum sandy . . . . 12. Sand-Pond Formation.
B. Substratum argillaceous . . . 13. Mud-Pond Formation.
C. Substratum saline . . . . 14. Sea-shoal Formation.

b. Plants floating freely; substratum unimportant.

A & B. In fresh water . . . . 15. Fresh-water Formation.
C. In salt water . . . . . 16. Pelagic Formation.

VI. Special Adaptations. *Biophytes*.

a Dependent upon human habitation 17. Waste-Land Formation.
b. Cultivated by man for his use or admiration
18. Economic Formation.
c. Saprophytic or parasitic on other organisms
19. Fungoid Formation.

In the following lists given for the different formations the nomenclature of Gray's Manual, 6th edition, is mainly followed and also in general the same specific limits. Trees are starred (*) and shrubs marked thus (°), while the species characteristic of the different formations are *italicized*.

1. Sand-Barren Formation. *Xerophytes.*

Habitat: dry sand hills, drifting sands, and open sandy fields and plains, where the common species fail to maintain a foothold; flora well-marked but rather local, except in the Cape Cod region; species few and characteristic. Passes into (3) and (7).

Hudsonia tomentosa, Nutt.
H. ericoides, L.
° Arctostaphylos Uva-ursi, Spreng.
Lechea minor maritima, Gray.
° *Ilex glabra*, Gray.
Hypericum nudicaule, Walt.
Cyperus filiculmis, Vahl.
Chrysopsis falcata, Ell.
Cyperus Grayii, Torr.
Krigia Virginica, Willd.
Aralia hispida, Vent.
Aster linariifolius, L.
Lechea thymifolia, Michx.
° Myrica cerifera, L.
Spiranthes simplex, Gray.
° Smilax rotundifolia, L.
Corema Conradii, Torr.
Lechea tenuifolia, Michx.

2. Hilltop-Barren Formation. *Xerophytes.*

Habitat: high points of slate or granite exposed by denudation, or cliffs; very local; passing into (4).

° *Quercus prinoides*, Willd.
° *Q. ilicifolia*, Wang.
* Juniperus Virginiana, L.
° *J. communis alpina*, Gaud.
° * Prunus Pennsylvanica, L. f.
° P. cuneata, Raf.
° Arctostaphylos Uva-ursi, Spreng.
° Rhus typhina, L.
* Pinus rigida, Mill.
Silene Pennsylvanica, Michx.
Viola pedata, L.
V. ovata, Nutt.
Aralia hispida, Vent.
Lechea tenuifolia, Michx.
Cardamine parviflora, L.
Polygonum tenue, Michx.
Aster linariifolius, L.
Aristida dichotoma, Michx.
Corydalis glauca, Pursh.
Krigia Virginica, Willd.
Houstonia purpurea longifolia, Gray.
° *Vaccinium Pennsylvanicum*, Lam.
Ranunculus fascicularis, Muhl.
Lespedeza capitata, Michx.
Andropogon scoparius, Michx.
Selaginella rupestris, Spring.
* ° Prunus Virginiana, L.

More frequent on the cliffs:

Saxifraga Virginiensis, Michx.
Aquilegia Canadensis, L.
° Rhus Toxicodendron, L.
Woodsia ilvensis, R. Br.
Asplenium Trichomanes, L.
Polypodium vulgare, L.

3. Sand-Plain Forest Formation. *Mesophytes.*

Habitat: Sand or sandstone substratum, nearly level and covered with an open forest growth, which affords suitable conditions of shade and humidity and moderate accumulation of humus; passing into (1) in more exposed situations, into (5) or (8) in low ground and into (7) along the coast. Species relatively few and vegetation often scattered.

* Quercus alba, L.
* *Pinus rigida*, Mill.
* Carya alba, Nutt.
* Quercus coccinea tinctoria, Gray.
° Gaylussacia resinosa, T. & G.
° Vaccinium vacillans, Soland.
° Rhus copallina, L.
° Myrica asplenifolia, Endl.
Apocynum androsæmifolium, L.
Cypripedium acaule, Ait.
Epigæa repens, L.
Linaria Canadensis, Dumort.
Asclepias obtusifolia, Michx.
Gaultheria procumbens, L.
Crotalaria sagittalis, L.
Solidago odora, Ait.
° Ceanothus Americanus, L.
Cyperus filiculmis, Vahl.
Danthonia spicata, Beauv.
Spiranthes gracilis, Bigel.
Hieracium venosum, L.
Lupinus perennis, L.
Helianthemum Canadense, Michx.
Baptisia tinctoria, R. Br.
Viola pedata, L.
Polygala polygama, Walt.
Lespedeza capitata, Michx.
Deschampsia flexuosa, Trin.
Oenothera pumila, L.
Festuca tenella, Willd.
Sericocarpus conyzoides, Nees.
* Betula populifolia, Ait.
Tephrosia Virginiana, Pers.
Prenanthes serpentaria, Pursh.

4. Hilly Upland-Forest Formation. *Mesophytes.*

Habitat: Argillaceous soil with slate or granite base, often glacial drift; rough hilly woodlands including most of the region, with a rich and diversified flora, but apparently with few species characteristic; passing in exposed situations into (2) and in low ground into (6), (8), (9) or (11), but is often contiguous to and may pass into nearly all the other formations; often denominated "dry hillsides," "rocky slopes," "rocky open woods," etc. This is the dominant formation of the region.

* Quercus alba, L.
Q. coccinea tinctoria, Gray.
* Q. rubra, L.
* Carya alba, L.
* *C. porcina*, Nutt.
* Prunus serotina, Ehrh.
* Sassafras officinale Nees.
* Populus tremuloides, Michx.
Viola ovata, Nutt.
Hedeoma pulegioides, Pers.
Gerardia tenuifolia, Vahl.
G. quercifolia, Pursh.
G. flava, L.
Lobelia inflata, L.
Solidago nemoralis, Ait.
S. bicolor, L.

* *Ostrya Virginica*, Willd.
* *Castanea sativa Americana*, Gray.
* *Fagus ferruginea*, Ait.
* *Tsuga Canadensis*, Carr.
° Rhus typhina, L.
° R. glabra, L.
° Rubus Canadensis, L.
° R. occidentalis, L.
° Corylus Americana, Walt.
° C. rostrata, Ait.
° Vaccinium vacillans Soland.
° Myrica asplenifolia, Endl.
Lysimachia quadrifolia, L.
Melampyrum Americanum, Michx.
Solidago Canadensis, L.
S. rugosa, Mill.
Aster undulatus, L.
Geum album, Gmelin.
Lespedeza polystachya, Michx.
Geranium maculatum, L.
Anemone nemorosa, L.
A. Virginica, L.
Hieracium scabrum, Michx.
Carex Pennsylvanica, Lam.
Desmodium paniculatum, DC.
Polygala paucifolia, Willd.
Baptisia tinctoria, R. Br.
Bidens frondosa, L.

5. Sand-pond Margin Formation. *Hygrophytes.*

Habitat: wet open sandy places, about ponds and along streams; passing into (3) above and into (12) below. Very local and species few but characteristic; mainly in the Plymouth and Cape Cod regions.

Coreopsis rosea, Nutt.
Drosera filiformis, Raf.
D. intermedia Americana, DC.
Viola lanceolata, L.
Rhexia Virginica, L.
Utricularia resupinata, B. D. Greene.
U. cornuta, Michx.
Hypericum Canadense, L.
Polygala sanguinea, L.
Lobelia Dortmanna, L.
Juncus pelocarpus, E. Meyer.
J. dichotomus, Ell.
Cyperus dentatus, Torr.
Psilocarya scirpoides, Torr.
Eleocharis melanocarpa, Torr.
Hemicarpha subsquarrosa, Nees.
Eleocharis tuberculosa, R. Br.
Panicum virgatum, L.
P. verrucosum, Muhl.
Solidago tenuifolia, Pursh.
Stachys hyssopifolia, Michx.
Cyperus aristatus, Rottb.
Bartonia tenella, Muhl.
Ranunculus Cymbalaria, Pursh.
Myriophyllum tenellum, Bigel.
Cyperus flavescens, L.
Eriocaulon septangulare, With.
Eleocharis olivacea, Torr.
Juncus Greenei, Oakes & Tuckerm.
Fimbristylis autumnalis, R. & S.

6. Low-Meadow Formation. *Hygrophytes.*

Habitat: wet open places with argillaceous soil; often denominated "low open places," "swamp and stream margins," "about springs," "wet meadows," "muddy pond margins," "brooksides," "river-banks," "wet thickets," &c; passes normally into (4) above and into (9), (11) or (13) below. Flora abundant and characteristic.

° Cornus sericea, L'Her.
° *Pyrus arbutifolia*, L. f.
° Rubus hispidus, L.
° *Spiræa salicifolia*, L.
° S. tomentosa, L.
° Vaccinium corymbosum, L.
° Salix discolor, Muhl.
° S. rostrata, Rich. & other spp.
° Viburnum dentatum, L.
° Ilex verticillata, Gray.
Spiranthes cernua, Rich.
Lysimachia stricta, Ait.
Steironema ciliatum, Raf.
Saxifraga Pennsylvanica, L.
Eupatorium perfoliatum, L.
Glyceria Canadensis, Trin.
Hypericum ellipticum, Hook.
Scirpus atrovirens, Muhl.
Carex crinita, Lam. & other spp.
Eleocharis ovata, R. Br.
E. acicularis, R. Br.
Ranunculus septentrionalis, Poir.
Solidago lanceolata, L.
Phragmites communis, Trin.
Lycopus Virginicus, L.
L. sinuatus, L.
Epilobium coloratum, Muhl.
Polygonum acre, HBK.
P. Hydropiper, L.
Arenaria lateriflora, L.
Gerardia purpurea paupercula, Gray.
Houstonia cærulea, L.
Eupatorium purpureum, L.
Hypericum mutilum, L.
Viola blanda, Willd.
V. lanceolata, L
Iris versicolor, L.
Elodes campanulata, Pursh.
Mimulus ringens, L.
Cyperus strigosus, L.
Lobelia spicata, Lam.
Juncus effusus, L.
Aspidium Thelypteris, Swartz.
A. Noveboracense, Swartz.
Aster paniculatus, Lam.
Bidens connata, Muhl.
B. cernua, L.
Asclepias incarnata pulchra, Pers.
Cardamine Pennsylvanica, Muhl.

7. Sea-shore Formation. *Halohygrophytes.*

Habitat: sandy sea-beaches and high-tide flats, or sandy sea-shore immediately adjacent; soil more or less saline, passes into (3) above and (14) below. Flora sparse; species few and characteristic.

Cakile Americana, Nutt.
* *Prunus maritima*, Wang.
Euphorbia polygonifolia, L.
Chenopodium rubrum, L.
Atriplex arenarium, Nutt.
Glaux maritima, L.
Arenaria peploides, L.
Triodia purpurea, Hack.
Statice Limonium Caroliniana, Gray.
Artemisia Stelleriana, Bess.
A. caudata, Michx.
Salsola Kali, L.
Xanthium Canadense echinatum, Gray.
Ammophila arundinacea, Host.
Lathyrus maritimus, Bigel.
Polygonella articulata, Meisn.
Solidago sempervirens, L.
Buda maritima, Dumort.
Salicornia ambigua, Michx.

8. Low-Woodland Formation. *Hygrophytes.*

Habitat: low alluvial woodlands; soil moist with deep shade and much humus; substratum unimportant; passes from (3) or (4) above into any lowland or aquatic formation; often spoken of as "low

woods," "moist shady places," "deep forests," "rich woods" and like terms. These moist cool woods have a very characteristic vege tation.

* *Acer rubrum*, L.
* A. saccharinum, Wang.
* Tilia Americana, L.
* *Platanus occidentalis*, L.
* Ulmus Americana, L.
* *Pinus Strobus*, L.
* Quercus coccinea, Wang.
* Fraxinus Americana, L.
° Amelanchier Canadensis oblongifolia, Torr. & Gray.
° Alnus incana, Willd.
° A. serrulata, Willd.
° Ampelopsis quinquefolia, Michx.
° Rhus Toxicodendron, L.
Arisaema triphyllum, Torr.
Maianthemum Canadense, Desf.
Circaea Lutetiana, L.
C. alpina, L.
Boehmeria cylindrica, Willd.
Aralia nudicaulis, L.
Viola pubescens, Ait.
V. blanda, Willd.
Sanguinaria Canadensis, L.
Trillium cernuum, L.
Oakesia sessilifolia, Wats.
Erythronium Americanum, Ker.
Impatiens fulva, Nutt.
Pilea pumila, Gray.
Allium Canadense, Kalm.
Ranunculus abortivus, L.
Geranium maculatum, L.
G. Robertianum, L.
Osmunda cinnamomea, L.
Asplenium Filix-foemina, Bernh.
Medeola Virginica, L.
Cornus Canadensis, L.
Viola cucullata, Ait.
Actaea alba, Bigel.
Solidago latifolia, L.
S. ulmifolia, Muhl.
S. serotina, Ait.
Veratrum viride, Ait.
Prenanthes alba, L.

9a. SWAMP FORMATION. *Helophytes.*

Habitat: open swamps and marshes; soil more or less submersed; water shallow, often drying up in summer; plants amphibious or partly emersed; similar conditions in margins of ponds and shallow streams.

Sagittaria variabilis, Engelm.
S. heterophylla, Pursh.
° Alnus incana, Willd.
° A. serrulata, Willd.
° Rosa lucida, Ehrh.
° Myrica Gale, L.
° Rhus venenata, DC.
° Cephalanthus occidentalis, L.
Ludwigia palustris, L.
Proserpinaca palustris, L.
Cicuta maculata, L.
C. bulbifera, L.
Acorus Calamus, L.
Sium cicutaefolium, Gmelin.
Alisma Plantago, L.
Pontederia cordata, L.
Lathyrus palustris, L.
Equisetum limosum, L.
Decodon verticillatus, Ell.
Veronica scutellata, L.
Cardamine Pennsylvanica, Muhl.
Caltha palustris, L.
Sparganium eurycarpum, Engelm.
Iris versicolor, L.
Typha latifolia, L.
Carex stricta, Lam.
Sparganium simplex, Huds.
Peltandra undulata, Raf.
Zizania aquatica, L.
Glyceria fluitans, R. Br.
Rumex Brittanica, L.
Bidens chrysanthemoides, Michx.

9b. Bog Formation. *Helophytes.*

Habitat: similar to the preceding but characterized by the abundance of Sphagnum species, which form a close mat over the surface and maintain more equable conditions of temperature and moisture and thus permit the southern extension of many northern species. Flora very distinct from the preceding, with many Ericaceous shrubs.

° Vaccinium macrocarpon, Ait.
° V. Oxycoccus, L.
° Cassandra caliculata, Don.
° *Andromeda polifolia*, L.
° *Kalmia glauca*, Ait.
° *Ledum latifolium*, Ait.
° *Rhododendron Rhodora*, Don.
Sarracenia purpurea, L.
Chiogenes serpyllifolia, Salisb.
Smilacina trifolia, Desf.
Rhynchospora alba, Vahl.
Epilobium lineare, Muhl.
Menyanthes trifoliata, L.
Sphagnum spp.
Eriophorum gracile, Koch.
E. vaginatum, L.
Arethusa bulbosa, L.
Cladium mariscoides, Torr.
Drosera rotundifolia, L.
D. intermedia Americana, DC.
Utricularia cornuta, Michx.
Clintonia borealis, Raf.
Calla palustris, L.
Geum rivale, L.
Calopogon pulchellus, R. Br.
Pogonia ophioglossoides, Nutt.
Habenaria lacera, R. Br.

10. Salt-marsh Formation. *Halohelophytes.*

Habitat: mud flats covered by the sea at extreme tides and supporting a short but dense vegetation; frequent along the coast. Brackish meadows have a mixture of this flora and that of (9a). No shrubs.

Gerardia maritima, Raf.
Salicornia herbacea, L.
Suaeda linearis, Moq.
Juncus Gerardi, Loisel.
Spartina juncea, Willd.
S. stricta glabra, Gray.
Distichlis maritima, Raf.
Triglochin maritima, L.
Puccinellia maritima, Parl.
Atriplex patulum hastatum, Gray.
Iva frutescens, L.
Pluchea camphorata, DC.
Solidago sempervirens, L.
Carex maritima, O. F. Mueller.
Statice Limonium Caroliniana, Gray.
Aster subulatus, Michx.
Potentilla Anserina, L.
Scirpus maritimus, L.
Buda maritima, L.
Scirpus pungens, Vahl.
Iris prismatica, Pursh.
Typha angustifolia, L.
Aster tenuifolius, L.

11. Boggy-Woodland Formation. *Helophytes.*

Habitat: low wet woodlands, swampy or boggy with a dense Sphagnum growth; much humus and substratum unimportant.

Contains many northern species, possible here only in cool, shady, humid situations.

* *Larix Americana*, Michx.
* Pinus Strobus, L.
* Platanus occidentalis, L.
* Betula populifolia, Ait.
* *Chamaecyparis sphaeroidea*, Spach.
* Acer rubrum, L.
* Carpinus Caroliniana, Walt.
° Lindera Benzoin, Blume.
° Ilex verticillata, Gray.
° I. laevigata, Gray.
° Nemopanthes fascicularis, Raf.
° Rhus venenata, DC.
Symplocarpus foetidus, Salisb.
Veratrum viride, Ait.
Osmunda regalis, L.
Viola cucullata, Ait.
Equisetum sylvaticum, L.
Onoclea sensibilis, L.
Osmunda cinnamomea, L.
° Rhus Toxicodendron, L
Sphagnum spp.

12. Sand-Pond Formation. *Hydrophytes.*

Habitat: ponds and slow-flowing streams throughout the sand-plain region with sandy bottom and little humus; plants rooted and usually submersed or upper leaves floating.

Proserpinaca pectinacea, Lam.
Limnanthemum lacunosum, Griseb.
Hottonia inflata, Ell.
Nymphaea odorata, Ait.
Sagittaria teres, Wats.
Naias Indica gracillima, A. Br.
Orontium aquaticum, L.
Potamogeton Spirillus, Tuckerm.
Myriophyllum tenellum, Bigel.
M. ambiguum, Nutt.
Nuphar Kalmianum, Ait.
Lobelia Dortmanna, L.
Brasenia peltata, Pursh.
Eriocaulon septangulare, With.
Lycopodium inundatum Bigelovii, Tuck.

13. Mud Pond Formation. *Hydrophytes.*

Habitat: ponds and slow-flowing streams with bottom of clay or humus, often "mucky"; plants rooted and submersed or upper leaves floating, rarely emersed.

Nuphar advena, Ait.
Naias flexilis, R. & S.
Myriophyllum spicatum, L.
Nymphaea odorata, Ait.
Marsilia quadrifolia, L.
Chara fragilis, Desv.
Nitella flexilis, Ag.
Podostemon ceratophyllus, Michx.
Ranunculus aquatilis trichophyllus, Gray.
Callitriche heterophylla, Pursh.
Ranunculus multifidus, Pursh.
Potamogeton crispus, L.
P. natans, L. and other species.
Elodea Canadensis, Michx.
Vallisneria spiralis, L.

14. Sea-shoal Formation. *Halohydrophytes.*

Habitat: shallow water along the sea-shore or in salt-marsh pools. Marine plants mainly sea-weeds, fixed to rocks and soil, submersed.

Ruppia maritima, L.
Zostera marina, L.
Zannichellia palustris, L.
Potamogeton crispus, L.
Various marine algae, largely Fucaceae.

15. Fresh-water Formation. *Hydrophytes.*

Habitat: fresh-water ponds, streams and ditches; free-floating aquatics or submersed but unattached.

Utricularia vulgaris, L.
U. purpurea, Walt.
U. inflata, Walt.
Lemna minor, L.
L. trisulca, L.
Spirodela polyrhiza, Schleich.
Riccia fluitans, L.
R. natans, L.
Desmids, Diatoms and other algae.

16. Pelagic Formation. *Halohydrophytes.*

Habitat: deep sea. Plants free-floating in salt water.
Various marine algae.

17. Waste-Land Formation. *Biophytes.*

Habitat: yards, roadsides, waste places, cultivated fields, wherever the native vegetation has been weakened or destroyed by the activities of man and his domestic animals. Mainly introduced species;

Taraxicum officinale, Weber.
Capsella Bursa-pastoris, Moench.
Poa annua, L.
Plantago major, L.
P. lanceolata, L.
Chenopodium album, L.
Arctium Lappa, L.
Lepidium Virginicum, L.
L. ruderale, L.
Leontodon autumnalis, L.
Stellaria media, Cyrill.
Rumex crispus, L.
Ranunculus bulbosus, L.
R. acris, L.
Chrysanthemum Leucanthemum, L.
Cerastium vulgatum, L.
Amaranthus retroflexus, L.
Medicago Lupulina, L.
Cichorium Intybus, L.
Xanthium Canadense, Mill.
Hypericum perforatum, L.
Polygonum aviculare, L.

18. Economic Formation. *Biophytes.*

Habitat: cultivated fields, orchards and grounds. Species planted and cared for by man to supply his food, clothing, shelter or to be used for ornament or other purposes in his economic life.

The various cultivated plants.

19. Fungoid Formation. *Biophytes.*

Habitat: growing on living or dead organisms, from which they derive their sustenance. Parasites and saprophytes, mainly fungi.

Cuscuta Gronovii, Willd.
Monotropa uniflora, L.
M. Hypopitys, L.
Fungi various.
Epiphegus Virginiana, Bart
Aphyllon uniflorum, Gray.
Conopholis Americana, Wallr.

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RECENTLY RECOGNIZED SPECIES OF CRATAEGUS IN EASTERN CANADA AND NEW ENGLAND, — III.

C. S. Sargent.

§ Tenuifoliae.

Anthers rose color or purple.

* Stamens 5–10.

Crataegus tenella, Ashe, *Ann. Carnegie Mus.* i. 388, (May 1902).

I have referred provisionally to this eastern Pennsylvania and Delaware species a thin-leaved Thorn with 5–8 stamens, dark rose-colored anthers and oblong crimson fruit ripening early in September, which has been found in Connecticut by *C. B. Graves* at Waterford, and by *E. B. Harger* at Oxford where it is very abundant.

Crataegus fucosa, n. sp. Leaves ovate, acuminate, broadly concave cuneate to rounded at the entire base, finely doubly serrate, with incurved glandular teeth, and more or less deeply divided into numerous acuminate lateral lobes; when they unfold bright red and covered on the upper surface with short pale hairs, nearly fully grown, still

slightly villose and dark green tinged with red when the flowers open; at maturity thin, smooth, and dark yellow-green on the upper surface, paler on the lower surface, 3–5 cm. long, 2.5–3 cm. wide, with very slender yellow midribs and thin veins extending obliquely to the points of the lobes; petioles slender, often slightly wing-margined at the apex, obscurely grooved, 1.5–2 cm. long; stipules linear to lanceolate, bright red, often 1 cm. in length; on vigorous shoots leaves often pendant against the branch on stout winged glandular red petioles, more deeply lobed than the leaves of fertile branchlets, long-pointed, mostly truncate at the base, coarsely serrate, with straight teeth, 7–8 cm. long, 6–7 cm. wide, with stout bright rose colored midribs. Flowers 1.5 cm. in diameter on slender pedicels, in broad many-flowered thin-branched glabrous corymbs; bracts and bractlets linear to lanceolate, glabrous, bright rose color, large and conspicuous; calyx-tube broadly obconic, bright red before anthesis like the narrow elongated acuminate mostly entire gland-tipped lobes; stamens 5–10; anthers large, bright red; styles 3, surrounded at the base by a broad ring of pale tomentum. Fruit drooping on slender pedicels, in many-fruited clusters, oblong, full and round at the ends, scarlet, lustrous, marked by minute pale dots, 1.3–1.5 cm. in length, 9–12 mm. in diameter; calyx only slightly enlarged, with a small shallow cavity and reflexed lobes, entire or slightly and irregularly dentate towards the base, bright red on the upper side below the middle, mostly deciduous from the ripe fruit; flesh thin, yellow-green; nutlets 3, large for the size of the fruit, acute at the ends, prominently ridged on the broad back, with a high often grooved ridge, about 7 mm. long.

A shrub usually about 1 m. in height with nearly erect stems forming small thickets and covered with ashy gray bark, and stout zigzag branchlets dark dull red when they first appear, red-brown and very lustrous and marked by large pale lenticels during their first season, and ashy gray the following year, and armed with numerous very stout straight or slightly curved shining red-brown ultimately gray spines 3–4 cm. in length. Flowers about May 20th. Fruit ripens early in September and soon falls.

Massachusetts: Upland rocky pastures, Berlin, *J. G. Jack*, May 1900, West Boylston, *Mrs. J. E. Thayer* and *C. S. Sargent*, May and September 1901 and 1902. Common.

Easily distinguished in early spring by the bright red color of the young leaves, bud-scales and bracts, which make it conspicuous from a long distance, and in the autumn by the large drooping leaves with their bright rose colored midribs on the ends of the branches, and by the small very lustrous early ripening fruits.

Crataegus delucida, n. sp. — *Crataegus acutiloba*, Sargent, RHODORA, iii. 23 in part (1901).

Leaves ovate to broadly oval, acute, full and rounded or rarely cuneate, or on leading shoots truncate or slightly cordate at the mostly entire base, finely and often doubly serrate, with glandular teeth, and divided into 4 or 5 pairs of short acuminate spreading lateral lobes; covered above, early in the season, with short pale hairs; at maturity membranaceous, glabrous, very smooth and light yellow on the upper surface, pale on the lower surface, 3.5–4.5 cm. long, 3–4 cm. wide, or on leading shoots sometimes 6 cm. long and wide, with slender yellow midribs and very thin primary veins arching to the points of the lobes; petioles slender, nearly terete, 2–2.5 cm. long. Flowers about 1.2 cm. in diameter on slender elongated pedicels, in compound usually 7–12-flowered glabrous thin-branched compact corymbs; calyx-tube broadly obconic, the lobes gradually narrowed from broad bases, long, slender, acuminate, entire or occasionally furnished with a few minute glandular teeth; stamens 5–10; anthers large, light red; styles 3 or 4. Fruit in drooping clusters, oblong, full and rounded at the ends, bright scarlet, very lustrous, about 1.2 cm. in length; calyx small, sessile, with a narrow deep cavity and spreading closely appressed lobes, mostly deciduous from the ripe fruit; flesh thick, succulent, light yellow; nutlets 3 or 4, full and rounded at the ends ridged on the broad back, with a wide rounded ridge, 9 mm. long.

A treelike shrub 3 or 4 m. in height with slender stems covered with ashy gray bark, small ascending branches and thin nearly straight branchlets, dark green tinged with red when they first appear, light orange-red, lustrous and marked by numerous large white lenticels during their first season, becoming light gray-brown the following year and armed with numerous stout curved dark red-brown shining spines 3.5–4.5 cm. in length. Flowers from the 20th to the 25th of May. Fruit ripens late in September or early in October.

VERMONT: Low slopes of Bald Mountain in Clarendon and Salisbury, *W. W. Eggleston*, September 1899, May and September 1901; *C. S. Sargent*, June and September 1900. Common, often forming small thickets, and in the autumn very conspicuous from the abundance of its large bright colored fruits.

Crataegus demissa, n. sp. Leaves ovate to deltoid, acute, broadly cuneate to truncate at the base, sharply doubly serrate, with straight teeth tipped with large bright red glands, and slightly divided into numerous short acute lateral lobes; when the flowers open nearly fully grown, membranaceous, dark green and coated above with short silky white hairs; at maturity thin glabrous, 3–3.5 cm. long, 2.5–3 cm. wide, with slender midribs and primary veins

extending obliquely to the points of the lobes; on vigorous shoots mostly deltoid and truncate or cordate at the base, deeply lobed, 4–6 cm. long; petioles slender, nearly terete, glandular, with minute dark glands 1–1.2 cm. long. Flowers 9 or 10 mm. in diameter on short slender pedicels, in compact 5–10-flowered glabrous corymbs; bracts and bractlets linear, entire, bright red, caducous; calyx-tube narrowly obconic, glabrous, the lobes gradually narrowed from the base, elongated, acuminate, entire, tipped with dark red glands, reflexed after anthesis; stamens 5–10; anthers small, dark rose color; styles 3 or 4, usually 3, surrounded at the base by a broad ring of pale tomentum. Fruit in few-fruited drooping clusters, short-oblong to subglobose or slightly obovate, scarlet, lustrous, 8 or 9 mm. long and nearly as broad; calyx sessile, with a broad shallow cavity and closely appressed lobes bright red on the upper side below the middle; flesh very thin, yellow, dry and mealy; nutlets 3 or rarely 4, unusually large for the size of the fruit, obtuse at the ends, prominently ridged on the broad back, with a high wide ridge, about 7 mm. long.

A slender shrub generally not more than 1 m. in height with small erect stems and slender nearly straight branchlets marked by occasional large dark lenticels, green tinged with red when they first appear, becoming bright red-brown and lustrous during their first season and gray-brown the following year, and armed with numerous stout or slender slightly curved bright red-brown shining ultimately ashy gray spines 3–5 cm. long. Flowers during the last week of May. Fruit ripens late in August or early in September and soon falls.

Massachusetts: Meadows near the Stockbridge Bowl, Lenox, *C. S. Sargent*, August 1885, *Brainerd* and *Sargent*, May 30, 1902. Vermont: Meadows, Charlotte, *C. S. Sargent*, September 7, 1900, *F. H. Horsford*, May 1902.

Well distinguished by the deltoid deeply lobed usually heart-shaped leaves on vigorous shoots, the small flowers and small nearly globose early-ripening fruit.

Crataegus glaucophylla, n. sp. Leaves broadly ovate, acute or short-pointed at the apex, rounded or broadly cuneate at the base, sharply and often doubly serrate above, with straight or incurved glandular teeth, and divided into 4 or 5 pairs of narrow acute or long-pointed lateral lobes; more or less tinged with red and roughened above by short pale caducous hairs when they unfold, more than half grown when the flowers open and then smooth light yellow-green and covered with a glaucous bloom above, pale and glaucous below, at maturity thin but firm in texture, light yellow-green on the upper surface, pale bluish green on the lower surface, about 6 cm. long and 4.5 cm. wide, or on vigorous shoots 7–8 cm. long and 6

cm. wide, with thin yellow midribs deeply impressed above and slender veins extending to the points of the lobes; petioles slender, slightly wing-margined at the apex, glandular, 2–2.5 cm. in length. Flowers small, on short slender pedicels, in long slender-branched glabrous usually 8–10-flowered compound corymbs; bracts and bractlets linear, minute, glandular, caducous; calyx narrowly obconic, green tinged with red, the lobes slender, elongated, acuminate, entire or occasionally glandular-serrate near the middle, reflexed after anthesis; stamens usually 10 or 5–10; anthers small, dark rose color; styles 3 or 4. Fruit on short thickened pedicels in drooping few-fruited clusters, short-oblong or rarely ovate, full and rounded at the ends, bright scarlet, very lustrous, marked by few large dots, 1.2–1.4 cm. long, about 1 cm. wide; calyx small, closely appressed, with a deep narrow cavity and lobes gradually narrowed from broad bases, acuminate, often slightly glandular-serrate; flesh thick, juicy, yellow, of a pleasant flavor; nutlets 3 or 4, thin, acute at the ends, prominently ridged on the back, with a broad sometimes slightly grooved ridge, about 8 mm. long.

A broad round-topped shrub 2–3 m. in height with numerous thick stems, covered with ashy gray bark, and stout zigzag branchlets marked by pale lenticels, yellow-green when they first appear, bright red-brown and lustrous during their first season, becoming dull light red-brown the following year, and armed with many slender red-brown shining straight or slightly grooved spines 2–7 cm. in length. Flowers during last week of May. Fruit ripens early in September but does not fall until the middle of October.

MASSACHUSETTS: Meadows near the Stockbridge Bowl, Lenox, *C. S. Sargent*, August 17, 1885; *Brainerd* and *Sargent*, May 30, 1902; *C. S. Sargent*, September 8, 1902; by the road from Great Barrington to Alvord, *Brainerd* and *Sargent*, May 31, 1902; Great Barrington, *C. S. Sargent*, September 8, 1902. NEW YORK: incomplete specimens collected by *C. H. Peck* at Sand Lake, Rensselaer County, and at Westport during the season of 1902 appear to belong to this species.

Crataegus ascendens, n. sp. *Crataegus acutiloba*, Sargent, RHODORA, iii. 23, in part.

Leaves oblong-ovate, acuminate, full and rounded or cuneate at the glandular base, finely and occasionally doubly serrate, with straight or incurved gland-tipped teeth, and slightly divided into 4 or 5 pairs of short broad acuminate lateral lobes; tinged with red as they unfold and covered above early in the season with short white appressed hairs; more than half grown when the flowers open, and at maturity thin but firm in texture, glabrous, dark yellow-green on

the upper surface, pale on the lower surface, 5.5–8.5 cm. long, 4.5–6 cm. wide, with slender yellow midribs and very thin primary veins extending to the points of the lobes; petioles slender, glandular with minute scattered dark mostly early deciduous glands, 2–3 cm. in length; stipules linear, acuminate, glandular-serrate, caducous. Flowers 1.4–1.5 cm. in diameter on slender pedicels, in broad compact many-flowered compound thin-branched glabrous corymbs; bracts and bractlets oblong-obovate, acute, finely glandular-serrate, caducous; calyx-tube narrowly obconic, the lobes slender, elongated, entire or sparingly and minutely glandular-serrate, reflexed after anthesis; stamens 10; anthers pink; styles 3 or 4. Fruit in broad drooping many-fruited clusters, oblong-obovate until late in the season, becoming oblong and full and rounded when fully ripe, dark crimson, lustrous, 1.3–1.4 cm. long, about 1.2 cm. wide; calyx small, sessile, with a deep shallow cavity and spreading lobes; flesh thick, yellow, soft and succulent; nutlets 3 or 4, thin, full and rounded at the ends, ridged on the narrow back, with a low round ridge, 9 mm. long.

A shrub 2–3 m. in height with numerous slender stems spreading into small thickets or rarely arborescent, ascending branches, and thin nearly straight branchlets dark olive green when they first appear, dark dull red-brown and marked by oblong pale lenticels during their first season, becoming light reddish brown the following year, and armed with few stout curved bright chestnut-brown spines 1.5–3 cm. in length. Flowers at the end of May. Fruit ripens the middle of October.

VERMONT: Low mountain slopes and hillsides at the western base of the Green Mountains up to elevations of 500 feet above the sea-level only in loamy or gravelly soil, Bristol, *C. G. Pringle*, September 1879; New Haven, May, July, September and October, 1900, Middlebury, October 13, 1900, *Ezra Brainerd*; West Rutland, *W. W. Eggleston*, May 1900.

Crataegus Randiana, n. sp. Leaves ovate to broadly oval, acute or acuminate, cuneate or rounded at the base, finely and above the middle mostly doubly serrate, with straight or incurved gland-tipped teeth, and slightly divided into short acute or acuminate spreading narrow lobes; nearly fully grown when the flowers open and then light yellow-green and covered above with short appressed white hairs and glabrous below; at maturity membranaceous, glabrous, yellow-green, 5–6 cm. long, 4.5–5 cm. wide, or on leading shoots 7.5 cm. long and broad, with very slender yellow midribs slightly impressed on the upper side and thin primary veins extending obliquely to the points of the lobes; petioles slender, nearly terete, sparingly glandular, with minute dark glands, 2–4 cm. long.

Flowers about 1.5 cm. in diameter on elongated slender pedicels, in lax thin-branched glabrous 7–12-flowered compound corymbs; calyx-tube narrowly obconic, the lobes gradually narrowed from broad bases, acuminate, entire or occasionally slightly serrate, tipped with bright red glands, reflexed after anthesis; stamens usually 5, occasionally 7; anthers large, dark rose color; styles 3 or 4. Fruit drooping on slender pedicels, oblong, full and rounded at the ends, scarlet, lustrous, marked by occasional pale dots, 1–1.2 cm. long, 8–9 mm. wide; calyx small, sessile, with a narrow shallow cavity and erect incurved lobes mostly deciduous from the ripe fruit; flesh thin, dry and mealy; nutlets 3 or 4, broad, rounded at the ends, prominently ridged on the back, with a wide rounded ridge, 6 mm. long.

A shrub 3–4 m. in height with numerous stout stems covered with ashy gray bark, erect branches forming an open irregular head, and slender nearly straight branchlets marked by small pale lenticels, dull green and tinged with red when they first appear, bright red-brown and lustrous during their first season, becoming pale gray-brown the following year, and armed with very slender straight bright red-brown shining ultimately ashy gray spines 3.5–4 cm. in length. Flowers from the 5th to the 10th of June. Fruit ripens from the middle to the end of September.

MAINE: Low moist meadows near Bar Harbor, Mt. Desert Island, *C. S. Sargent*, September 4, 1899; *Miss Beatrix Jones*, September 20, 1899, June and September 1901.

The name of Edward L. Rand, one of the authors of the *Flora of Mt. Desert Island* and the secretary of the New England Botanical Club, may be appropriately connected with this handsome and distinct plant.

Crataegus crudelis, n. sp. Leaves ovate, acute, broadly cuneate or rarely rounded at the usually entire base, finely and often doubly serrate, with glandular straight or incurved teeth, and deeply divided into numerous narrow acute spreading or reflexed lobes; when they unfold villose above and along the midribs and viens below, about half-grown when the flowers open and then membranaceous, light yellow-green and covered above with short, appressed, lustrous white hairs and nearly glabrous below; at maturity thin, dark yellow-green and scabrate on the upper surface, pale on the lower surface, 6–7 cm. long, 5–6 cm. wide, with thin midribs slightly impressed above and 5 or 6 pairs of slender primary veins arching obliquely to the points of the lobes; petioles nearly terete, slightly winged at the apex, glandular with numerous small dark persistent glands, 2–3 cm. long; stipules linear, glandular, caducous. Flowers 2 cm. in diame-

ter on long slender slightly villose pedicels, in broad compound many-flowered thin-branched hairy corymbs; bracts and bractlets linear, small, caducous; calyx-tube broadly obconic, villose at the base, glabrous above, the lobes linear, acuminate, sparingly glandular-serrate, mostly only above the middle, villose on the inner surface, reflexed after anthesis; stamens 10; anthers pink; styles 3–5, surrounded at the base by a broad ring of pale tomentum. Fruit on stout glabrous or slightly hairy pedicels, in broad drooping many-fruited clusters, oblong, full and rounded at the ends, crimson, lustrous, marked by large pale dots, 1–1.2 cm. long, 9–10 cm. wide; calyx sessile, with a broad deep cavity and much elongated lobes gradually narrowed from broad bases, villose and dark red on the upper side toward the base; flesh thin, juicy, greenish white; nutlets 3–5, full and rounded at the ends, conspicuously ridge on the broad back, with a high narrow ridge, about 7 mm. long.

A shrub with numerous ascending stems 5–7 m. in height, and stout slightly zigzag branchlets marked by many large pale lenticels, dark yellow-green when they first appear, light red-brown and lustrous during their first season, gray tinged with red the following year, and armed with many stout straight or slightly curved bright red-brown lustrous ultimately ashy gray spines, on some individuals about 4 cm. long and on others from 8–10 cm. in length, and often furnished near the middle with a short lateral branch. Flowers at the end of May or early in June. Fruit ripens at the end of September.

Province of Quebec: Valley of the St. Lawrence River near the City of Quebec; Montmorency Falls, August 1895; Montmorency Falls, Levis, and Isle of Orleans, September 1900; Montmorency Falls and Levis, May and September 1901, *J. G. Jack*.

This species resembles *Crataegus acutiloba*, Sargent (Rhodora, iii. 23), in the shape of its deeply lobed leaves, but differs from that species in its much larger flowers, in its villose corymbs and large fruits, and in the great size of the spines on some individuals, the largest of these being larger than those of any other species of this group which I have seen. *Crataegus acutiloba*, based on specimens gathered on Mt. Desert Island and at other points on the coast of Maine will, in view of the collections made during the last two years in the St. Lawrence valley, and western New England, be found probably to be confined to the coast region north of Massachusetts Bay.

Crataegus matura, Sargent, Rhodora, iii. 24 (1901). This early-ripening species was first seen by Mr. Ezra Brainerd and myself near Middlebury, Vermont, in August and September 1900, and the

early ripening of the fruit noticed. When it was described flowers of the Middlebury plant had not been collected but flowering specimens of a species with twenty stamens which had been collected by Mr. A. W. Edson at Burlington, Vermont, were thought to belong to this species and on these specimens so much of the description as relates to the flowers was based. Flowers collected the following year by Mr. Brainerd from the plant which had furnished the fruiting specimens on which *Crataegus matura* was in part established show the error of the previous determination and the importance of drawing the descriptions of Crataegus only from flowering and fruiting specimens taken from the same individual. The description of the flowering specimens from Middlebury is as follows:

Leaves more than half grown when the flowers open, membranaceous dark yellow-green and roughened above by short appressed white hairs, pale and glabrous below; stipules oblong-obovate and acuminate to lanceolate, coarsely glandular-serrate, often 1.3–5 cm. in length, caducous. Flowers about 1.6 cm. in diameter on slender pedicels, in broad many-flowered thin-branched glabrous compound corymbs; bracts and bractlets oblong-obovate to linear, acuminate, very coarsely glandular-serrate, large, conspicuous, turning red before falling, caducous; calyx-tube broadly obconic, the lobes gradually narrowed, slender, elongated, acuminate, bright red and glandular at the apex, entire or furnished with occasional minute teeth, reflexed after anthesis; stamens 5–10, usually 5–7; anthers red; styles 3–5, usually 3 surrounded at the base by a broad ring of pale tomentum.

Crataegus florea, n. sp. Leaves ovate, acute or acuminate, rounded or broadly cuneate at the base, sharply and often doubly glandular-serrate, and slightly divided into 4 or 5 pairs of short acute lobes; nearly fully grown and slightly roughened above by short white hairs when the flowers open; at maturity thin but firm in texture, dark yellow-green and scabrate on the upper surface, paler and glabrous on the lower surface, 5.5–6 cm. long, 4–5 cm. wide, with slender yellow midribs and 5 or 6 pairs of thin primary veins arching to the points of the lobes; petioles slender, narrowly wing-margined at the apex, slightly grooved, sparingly glandular, with mostly deciduous glands, 2.5–3 cm. long; on vigorous shoots sometimes as broad as long, more deeply lobed, abruptly long-pointed. Flowers about 1.5 cm. in diameter on long slender pedicels, in numerous crowded many-flowered compound corymbs; bracts and bractlets linear, glandular, small, caducous; calyx-tube narrowly obconic, the lobes gradually narrowed from broad bases, slender, acuminate, entire or occasionally undulate or obscurely serrate, reflexed after anthesis; stamens 6–10; anthers red; styles 3 or 4, surrounded at the base by a thin ring of pale tomentum. Fruit oblong, full and rounded at the

ends, scarlet, lustrous, 1.3–1.5 cm. long; calyx sessile, with a broad shallow cavity and elongated spreading lobes often deciduous from the ripe fruit; flesh thin, yellow; nutlets 3 or 4, thin acute at the ends, ridged on the back, with a high rounded ridge, 8 mm. long.

An arborescent shrub sometimes 4 m. in height or often a broad low bush, with stout nearly straight branchlets marked by small pale lenticels, dull red-brown when they first appear, rather light reddish brown and lustrous during their first season, dull and darker the following year and ultimately ashy gray, and armed with very stout slightly curved red-brown shining spines 2.5–4 cm. in length. Flowers at the end of May. Fruit ripens late in September.

MAINE: valley of the middle Penobscot River, borders of streams and woods, Orono, *M. L. Fernald*, May and September, 1901.

Crataegus monstrata, n. sp. Glabrous with the exception of the short hairs on the upper side of the young leaves. Leaves ovate to oval, acuminate, cuneate at the entire base, sharply serrate above, with straight glandular teeth, and divided into 4 or 5 pairs of narrow acuminate lateral lobes; about half grown, light yellow-green and scabrate above and glabrous below when the flowers open, at maturity membranaceous, scabrate and yellow-green on the upper surface, pale on the lower surface, 5–6 cm. long, 3.5–4 cm. wide, with very slender nearly terete petioles 2.5–3 cm. in length; on leading shoots leaves ovate, full and rounded at the broad base, often 6 cm. long and wide, with stout petioles slightly wing-margined above the middle and often conspicuously glandular. Flowers on elongated slender pedicels, in broad many-flowered thin-branched compound corymbs; bracts and bractlets linear, small, glandular, turning red in fading, caducous; calyx-tube narrowly obconic, the lobes gradually narrowed from the base, slender, acuminate, entire or rarely obscurely serrate, tipped with small red glands, reflexed after anthesis; stamens 5–7; anthers light violet color; styles usually 3. Fruit in few-fruited drooping clusters, oblong, full and rounded at the ends, bright scarlet marked by many minute pale dots, about 4 cm. long and 9 or 10 mm. wide; calyx small, sessile, with a broad shallow cavity, closely appressed entire or slightly serrate lobes; flesh thin, yellow, somewhat juicy; nutlets 3, rounded at the ends, thin, prominently ridged on the back, with a broad slightly grooved ridge, 7 mm. long.

Usually shrubby, but occasionally arborescent in habit and 3 m. in height, with ascending branches and slender slightly zigzag branchlets, light orange-green when they first appear, dull red-brown and marked by occasional small pale lenticels during their first season, and light reddish brown or ashy gray the following year, and armed with many slender slightly curved red-brown ultimately gray spines

3–5 cm. in length. Flowers during the last week in May. Fruit ripens about the middle of September.

CONNECTICUT: northern part of the valley of Eight Mile Brook, Southbury and Middlebury, *E. B. Harger*, May and September, 1901. Very abundant. "Most of the trees were so white with blossoms that they were noticeable from a distance of from one quarter to one half of a mile." (E. B. Harger *in litt.*)

Crataegus blandita, n. sp. *Crataegus pastorum*, Sargent, RHODORA, iii. 76, in part (1901).

Leaves broadly ovate, acute, truncate, rounded or rarely cuneate or on leading shoots mostly subcordate at the base, sharply sometimes doubly serrate, with glandular teeth, slightly divided into 3 or 4 pairs of broad short-pointed lateral lobes; tinged with red and covered with short pale hairs when they unfold, more than half-grown when the flowers open and then dark green and roughened on the upper surface with short lustrous white hairs and pale and glabrous on the lower surface; at maturity thin but firm in texture, smooth, dark yellow-green above, light yellow-green below, about 5 cm. long and 4 cm. wide, or on vigorous shoots often 6 cm. long and wide, with slender yellow midribs slightly impressed above and 3–5, usually 4, pairs of thin primary veins arching obliquely to the points of the lobes; petioles slender, nearly terete, glandular, with small dark red deciduous glands, frequently rose-color in the autumn, 2–3.5 cm. long; stipules linear, acuminate, often lobed at the base on vigorous shoots, glandular with bright red glands, caducous. Flowers 1.2–1.3 cm. in diameter on long slender pedicels, in thin-branched glabrous mostly 10-flowered compound corymbs with 3- or 4-flowered peduncles from the axils of the upper and occasionally also of the second leaf; bracts and bractlets linear, acuminate, glandular, small, caducous; calyx-tube narrowly obconic, the lobes slender, elongated, acuminate, finely and irregularly glandular-serrate, villose on the inner surface, reflexed after anthesis; stamens 5–10, usually 10; anthers purple; styles 3 or 4, surrounded at the base by a narrow ring of pale tomentum. Fruit in drooping many-fruited clusters, oblong, full and rounded at the ends, 1.2–1.5 cm. long, 8 or 9 mm. wide, scarlet, lustrous, marked by many small pale lenticels; calyx small, sessile, with a narrow deep cavity, and lobes villose above, spreading and reflexed, often deciduous from the ripe fruit; flesh thin, yellow; nutlets 3 or 4, acute at the ends, ridged on the back, with a broad rounded ridge, about 8 mm. long.

A shrub 2–4 m. in height with numerous erect stems spreading into small thickets, and stout zigzag branchlets marked by large pale lenticels, dark dull orange-green tinged with red when they first appear dull reddish or orange-brown during their first season, light

reddish brown the following year, later becoming lustrous and gray tinged with red, and armed with many very stout curved light red-brown spines 2.5–4.5 cm. in length. Flowers at the end of May. Fruit ripens late in September or early in October.

PROVINCE OF QUEBEC: Rocky limestone ridges, Caughnawaga Indian Reservation [Adirondack Junction]; Montreal Island, [Montreal West]; Ile Perrot, Longueil, *J. G. Jack*, August and September 1899, May 1900, May and September 1900, 1902.

Specimens of this species were referred by me two years ago to *Crataegus pastorum*, Sargent, a species which is probably confined to central and southern Massachusetts. From this species *Crataegus blandita* differs in its more deeply lobed yellow not blue-green leaves, in its larger flowers, in fewer-flowered corymbs, and its larger darker-colored fruit.

Crataegus genialis, n. sp. *Crataegus pastorum*, Sargent, RHODORA, iii. 24 (1901) in so much as relates to Berkshire County, Massachusetts, and the Champlain Valley of Vermont.

Leaves oval, acute or acuminate, rounded or cuneate or often oblique at the entire base, finely and usually doubly serrate above, with straight or incurved glandular teeth, and mostly slightly divided above the middle into 1–4 pairs of short acute lobes; slightly tinged with red or light bronze color and roughened above by short pale hair when they unfold, nearly fully grown, membranaceous, dark green and scabrate above when the flowers open; at maturity thin but firm in texture, smooth and very dark green on the upper surface, pale blue-green on the lower surface, mostly pendant, 5–7 cm. long, 5.5–6 cm. wide, with slender yellow midribs and primary veins running obliquely to the points of the lobes; petioles very slender, nearly terete, 2–3 cm. long; stipules linear, acuminate, glandular-serrate, caducous; on vigorous shoots leaves often 6–7 cm. long and broad and rounded or acuminate at the apex, coarsely serrate, their lateral lobes sometimes broad and rounded, coriaceous, very dark green, with stout rose-color midribs and thick dark red petioles generally wing-margined to below the middle, not more than 1 cm. in length and about as long as the broad foliaceous lunate stipules. Flowers 1.3–1.5 cm. in diameter on slender elongated pedicels, in broad many-flowered compound glabrous corymbs; bracts and bractlets linear, glandular, red before falling, caducous; calyx-tube narrowly obconic, the lobes slender, acuminate, entire or occasionally sparingly dentate, reflexed after anthesis; stamens 5–10; anthers small, rose color or purple; styles 3. Fruit on long slender pedicels in drooping many-fruited clusters, oblong, full and rounded at the ends, yellow-green when fully grown, becoming at maturity dark crimson, and lustrous, marked by numerous small pale dots, 1.1–1.2 cm. long, 8–9 mm. wide;

calyx somewhat enlarged, closely appressed, with a broad shallow cavity and slender lobes gradually narrowed from broad bases, acuminate, mostly entire, bright red on the upper side near the base; flesh thin, greenish yellow; nutlets 3, acute at the ends, prominently ridged on the narrow back, with a high ridge, about 6 mm. long.

A shrub 3 or 4 m. in height with slender stems covered with pale gray bark, ascending branches forming an open head, and stout very zigzag branchlets marked by large pale lenticels, yellow-green more or less tinged with red when they first appear, bright red-brown and lustrous during their first season, gray-brown the following year, and armed with many stout mostly curved bright red-brown shining ultimately gray spines 1.8–3.5 cm. in length. Flowers during the last week of May. Fruit ripens early in October, often remaining on the branches after the leaves have fallen.

MASSACHUSETTS: Meadows near the Stockbridge Bowl, *Brainerd* and *Sargent*, May 30, 1902, *C. S. Sargent*, September 9, and October 3, 1902; roadside, North Adams to Williamstown, *Brainerd* and *Sargent*, May 29, 1902, *C. S. Sargent*, September 1902. VERMONT: New Haven and North Ashburnham, October 1899, New Haven, August 1900, Salisbury Plain and Middlebury, September 1900, along the New Haven River, August and October 1900, *E. Brainerd*; Middlebury, *C. S. Sargent*, September 1900; Putney, *W. W. Eggleston*, October 1902; Bellows Falls, *J. G. Jack*, September 1901, (with earlier ripening fruit).

Crataegus dissimilis, n. sp. Leaves acuminate, full and rounded or broadly cuneate at the entire more or less oblique base, finely often doubly glandular-serrate above, and slightly divided into 3 or 4 pairs of small acute or acuminate lateral lobes; more than half grown, dark green and scabrate above and pale below when the flowers open; at maturity thin but firm in texture, glabrous, dark yellow-green and smooth on the upper surface, light yellow-green on the lower surface, 4–5 cm. long, 3–5 cm. wide, with thin yellow midribs and slender primary veins extending very obliquely to the points of the lobes; petioles slender, nearly terete, 1.5–3 cm. in length; on vigorous shoots leaves sometimes 6–7 cm. long and wide, usually slightly cordate at the base and more deeply lobed than the leaves of lateral branchlets, with stout petioles 1–1.2 cm. in length. Flowers 1.1–1.2 cm. in diameter when fully expanded, on slender pedicels, in loose thin-branched glabrous compound corymbs, the axillary peduncles elongated, sometimes 3–5 flowered, and rising above the terminal central part of the inflorescence; calyx tube narrowly obconic, tinged with red, the lobes slender, acuminate and long-pointed, entire or finely glandular-serrate below the middle, tipped with bright red

glands, reflexed after anthesis; stamens usually 10, rarely 8 or 9; anthers deep rose-purple; styles 3–5. Fruit in few-fruited erect clusters, short-oblong to obovate, in the early autumn dull red and slightly pruinose, when fully ripe, dark red, lustrous, destitute of bloom, 1.2–1.4 cm. long, about 1.2 cm. wide; calyx sessile, with a broad shallow cavity and spreading or reflexed lobes often deciduous from the ripe fruit; flesh thin, juicy, acidulous reddish orange color; nutlets usually 3 or 4, thick, acute at the ends, rounded and prominently ridged on the broad back, with a high rounded ridge, about 8 mm. long.

A shrub 3 or 4 m. in height with stems not more than 8 cm. in diameter, covered with light gray bark scaly near their base, spreading branches and slender nearly straight branchlets marked by numerous oblong pale lenticels, dull reddish brown and pruinose when they first appear, soon becoming bright red-brown and lustrous, and dark gray-brown or ashy gray in their second season, and armed with stout straight or slightly curved bright chestnut-brown and shining ultimately gray spines 4–5 cm. in length. Flowers about the 20th of May. Fruit ripens and begins to fall from the 1st to the middle of October.

Connecticut: Open rocky pastures near the Niantic River, East Lyme, *C. B. Graves*, May and September 1902.

This species appears to be well distinguished by the unusual development of the lower branches of the inflorescence, by the character of the leaves which are thicker and more rigid than is usual in species of this group, and by the short-oblong or short-obovate fruit with red-tinted flesh.

Crataegus media, n. sp. Glandular with the exception of the caducous hairs of the young leaves. Leaves ovate to rhombic, acute, broadly cuneate or rounded at the entire base, coarsely often doubly serrate above, with straight glandular teeth, and slightly divided into 3 or 4 pairs of short acuminate lateral lobes, bright red and covered above with short lustrous white caducous hairs when they unfold, about half-grown, membranaceous, light yellow green and almost glabrous when the flowers open; at maturity subcoriaceous, dark dull blue green on the upper surface, pale blue-green on the lower surface, 4–6 cm. long, about 4 cm. wide, with thin light yellow midribs and usually 4 pairs of thin primary veins extending to the points of the lobes; petioles slender, wing-margined at the apex, slightly grooved, glandular above the middle early in the season, often tinged with red in the autumn, 1.5 to 3 cm. long; stipules linear to oblong, acuminate, coarsely glandular-serrate, turning red before falling, caducous; on vigorous shoots leaves usually

full and rounded at the broad base, coarsely serrate, more deeply lobed than the leaves on lateral branchlets, often 7–8 cm. long and nearly as wide. Flowers 1.3–1.4 cm. in diameter on slender pedicels, in small usually 5 or 6-flowered thin-branched compact corymbs; bracts and bractlets linear, acute, glandular-serrate, caducous; calyx-tube broadly obconic, the lobes slender, acuminate, entire or rarely sparingly serrate above the middle, tipped with minute red glands, reflexed after anthesis; stamens 5–8; anthers light rose color; styles 3–5, surrounded at the base by a broad ring of pale tomentum. Fruit in few-fruited drooping clusters, obovate, full and rounded at the apex, gradually narrowed from above the middle to the slender base, bright scarlet, 1.4–1.8 cm. long, 1–1.4 cm. wide; calyx enlarged, sessile with a broad shallow cavity and reflexed closely appressed lobes often slightly dentate toward the apex, bright red on the upper side at the base, mostly persistent; flesh thick, sweet, nearly white, dry and mealy; nutlets 3–5, thick or thin according to their number, acute at the ends, rounded and prominently ridged on the back, with a high rounded ridge, about 8 mm. long.

An arborescent shrub 3–4 m. in height with erect branches and slender slightly zigzag branchlets, light yellow-green when they first appear, dull dark red-brown and marked by occasional large oblong pale lenticels during their first season, orange color and rather lustrous the following year, and armed with numerous slender slightly curved dark purple shining spines 4–6 cm. in length. Flowers during the last week of May. Fruit ripens early in October.

CONNECTICUT: Borders of swamps in low moist soil, Oxford, *E. B. Harger*, May and August 1901, October 1902; *C. S. Sargent*, September 1902.

This interesting species with its small flowers in few-flowered corymbs, small number of stamens, leaves at first hairy on the upper surface but dark green and subcoriaceous at maturity, and pear-shaped fruits without bloom or a calyx-tube, appears intermediate between the *Tenuifolia* and *Pruinosa* sections of the genus and might be referred with equal propriety to either.

* * Stamens usually 20.

Crataegus Forbesae, n. sp. Leaves ovate to oval, acuminate, gradually narrowed and rounded or broadly concave-cuneate at the mostly entire base, serrate, often doubly with small straight or incurved glandular teeth, and slightly divided into 3 or 4 pairs of short acute lateral lobes; tinged with red when they unfold and coated above until after the flowers open with short soft pale hairs, at maturity dull dark bluish green and glabrous on the upper surface, paler on

the lower surface, 4–5 cm. long, 3.5–4.5 cm. wide, with slender yellow midribs deeply impressed above and very thin primary veins extending obliquely to the points of the lobes; petioles slender, slightly grooved, often wing-margined at the apex by the decurrent bases of the leaf-blades, 1.5–2.5 cm. long; stipules linear, acuminate, glandular, caducous; on leading shoots leaves sometimes 5–6. cm. long and nearly as wide as long, more deeply lobed than the leaves of fertile branchlets, their petioles stout, wing-margined to below the middle, conspicuously glandular, often rose color. Flowers 1.8–2 cm. in diameter on long slender pedicels, in broad thin-branched many-flowered compound glabrous corymbs; bracts and bractlets linear to oblong-obovate, glandular, caducous; calyx-tube broadly obconic, the lobes gradually narrowed from broad bases, acuminate, entire or rarely sparingly serrate near the middle, glandular and reddish at the apex; stamens 20, rarely 15–18; anthers large, dark rose color; styles 4 or 5, surrounded at the base by a broad ring of pale tomentum. Fruit in many-fruited erect or drooping clusters, subglobose to short-oblong, full and rounded at the ends, scarlet, lustrous, marked by numerous large pale dots, 1–1.2 cm. in diameter; calyx prominent, sessile, with a broad deep cavity and nearly entire appressed lobes, dark red on the upper side near the base and generally persistent on the ripe fruit; flesh thin, juicy, pale yellow; nutlets 4 or 5, usually 5, thin, acute at the ends, slightly or prominently ridged on the back, about 7 mm. long.

A broad round-topped shrub 3–5 m. in height, sometimes beginning to flower when less than 1 m. tall, with numerous stout stems covered with smooth gray bark, and slender branchlets marked by many small pale lenticels, dull red-brown when they first appear, bright red-brown and lustrous during their first season, dull gray-brown the following year, and ultimately ashy gray and armed with stout slightly curved often blunt spines 2–4 cm. in length. Flowers about May 20. Fruit ripens from the 10th to the middle of September and soon falls.

MASSACHUSETTS: Open rocky pastures in moist soil, Clinton, Stirling, West Boylston, *Evelyn Forbes Thayer*, May and September 1901 and 1902. CONNECTICUT: In a hedge on Harris Court, New London, *C. E. Graves*, May and September 1902, *C. S. Sargent*, August 1902.

The maiden name or Mrs. John E. Thayer, an industrious collector and student of Crataegus growing in her native County of Worcester, Massachusetts, may properly be associated with this handsome plant, one of several undescribed forms which she has helped to make known.

Crataegus Alnorum, n. sp. Leaves acute or acuminate, sharply and usually doubly glandular-serrate or simply crenately serrate at the broad rounded or cuneate base, and divided into four or five pairs of small acuminate spreading lobes; coated with short lustrous white hairs when they unfold, nearly fully grown when the flowers open and then membranaceous, light yellow-green and still covered with hairs above and glabrous below; at maturity thin but firm, glabrous, dark bluish green on the upper surface, pale blue-green on the lower surface, 4.5–5.5 cm. long, 3.5–4.5 cm. wide, with slender yellow midribs slightly impressed above and thin primary veins arching to the points of the lobes; petioles slender, nearly terete, slightly wing-margined at the apex, glandular with small dark red deciduous glands, 1.5–3 cm. in length. Flowers 1.7 cm. in diameter on slender pedicels in broad thin-branched glabrous many-flowered compound corymbs; bracts and bractlets linear, glandular, small, mostly fallen before the flowers open; calyx-tube broadly obconic, the lobes abruptly narrowed from wide bases, slender, acuminate, entire or finely serrate, with occasional small gland-tipped teeth; styles 3–5, surrounded at the base by a narrow ring of pale tomentum. Fruit in gracefully drooping few or many-fruited clusters, oblong-obovate, bright scarlet, lustrous, about 1.2 cm. long and 8 mm. wide; calyx sessile, with a broad shallow cavity and reflexed appressed lobes often deciduous from the ripe fruit; flesh thin, yellow, dry and meally, nutlets 3–5, thin, acute at the narrow ends, prominently ridged on the back, with a high grooved ridge, about 7 mm. long.

A slender arborescent shrub 3–5 m. in height with ascending branches and slender nearly straight or slightly zigzag branchlets marked by occasional oblong pale lenticels, dark yellow-green more or less tinged with red when they first appear, bright red-brown during their first season, becoming light or dark gray-brown in their second year, and only slightly armed with stout straight or somewhat curved bright red-brown ultimately ashy gray spines 2.5–3 cm. long. Flowers at the very end of May or in early June. Fruit ripens toward the end of September.

Maine: Valley of the middle Penobscot River in low sandy soil mixed with or bordering Alder thickets, Orono, *M. L. Fernald*, May and September 1901. The most common species in the region often covering acres of ground with many hundreds of plants.

Arnold Arboretum.

AJUGA GENEVENSIS IN NEW ENGLAND.—In the last edition of Gray's Manual and in Britton and Brown's Illustrated Flora only one species of Ajuga is given and that is introduced, growing in New England and the Middle States, *A. reptans*, L. Dr. Britton's later Flora, however, states in the appendix that *A. genevensis*, L., has become established at a station in Pennsylvania. This is similar to *A. reptans*, L., but differs from that species in its larger flowers, stouter habit, more pubescent stem and leaves, and in its lack of runners.

A. reptans is established near Saco, Maine, about New York City, and is reported from various other stations. A recent investigation shows that some reports of stations for this species are erroneous and that the plant is *A. genevensis* instead. Many of the reports of Ajuga are not based on herbarium specimens so it is at present impossible to say just how many should be credited to *A. reptans* and how many to *A. genevensis*.

I have seen specimens of the latter species from New York City, collected many years ago by Judge Brown (the station is now probably improved out of existence), from Danville, Pennsylvania (the station noted in Dr. Britton's Flora), from New Haven, Connecticut, where it seems to be well established, and from Southington, Connecticut, where it is established at two stations. This is the plant listed in the recent Southington Flora as *A. reptans*, L. We certainly have both species of Ajuga established here in New England and the writer would be very glad to get specimens of either from any station so that we may find their exact distribution.—C. H. BISSELL, Southington, Connecticut.

RED-FLOWERED ANEMONE RIPARIA.—*Anemone riparia*, the tall graceful Anemone of calcareous northern river-banks, was originally described [1] as having large white sepals, rarely varying to greenish white. Recently, however, Mr. George H. Richards has brought to the Gray Herbarium, with *Dryas Drummondii*, *Anemone multifida*, and other unusual plants collected by him on the banks of Grand River, Gaspé County, Quebec, a specimen of *Anemone riparia* with deep red sepals. This extreme color-variation, although previously

[1] RHODORA, i, 51, t. 3 (1899).

unknown in *A. riparia* and its immediate allies, is not unprecedented in the subgenus *Euanemone*. Our common Wood Anemone, *A. quinquefolia*, varies from white to crimson-tinged, and the northern *A. multifida*, ordinarily with red flowers, is not rare with white or even greenish sepals.

It is interesting in this connection to note that Mr. Richards collected on Grand River flowers of *Anemone multifida* having as many as fourteen sepals. — M. L. Fernald.

VIOLA ARVENSIS IN NEW ENGLAND.

B. L. Robinson.

The success with which the little pale-flowered pansy of the Alleghany region has been shown to be a distinct American species instead of the *V. arvensis*, Murr. (or as many authors prefer *V. tricolor*, var. *arvensis*) of the Old World has led students of our violets to the over hasty conclusion that all our violets of this type from Maine to Georgia are of the same endemic species and are to be classed as *V. Rafinesquii*, Greene (*V. tenella*, Muhl., not Poir.). It is, however, a fact familiar to many New England observers that the little yellowish white flowered pansy, locally abundant from southern New England to Newfoundland, instead of appearing endemic, has the habits of an introduced plant. It is seldom if ever found far from dwellings and is chiefly seen in old fields, about dumping places, etc., almost always in soil which has been artificially loosened.

Some months ago Dr. E. H. Eames called my attention to the fact that this violet of New England of which he had observed specimens near Bridgeport, Connecticut, was not the plant of the South and West, now classed as *V. Rafinesquii*. A careful examination of material sent by Dr. Eames and specimens from other sources fully confirms his view.

V. Rafinesquii is a slender delicate plant with peculiar many-parted and palmately cleft stipules of roundish contour. The petals are of a pale blue or lavender tinge shading at the base into yellow, and they are nearly or quite twice as long as the very short sepals. This species is frequent from Eastern New York to Kansas and southward.

The plant of New England, however, is decidedly stouter. The stipules are also deeply cleft but the divisions are less numerous and more pinnate in their arrangement. The flowers are larger, and the petals, which are pale yellow (the upper sometimes with a faint tinge of lavender), scarcely if at all exceed the relatively large sepals. An examination of specimens and plates of the Old World material of related forms convinces me that this is just the plant figured as *V. arvensis*, Murr., in the English Botany, t. 2712, in the Flora Danica, t. 1748, and Reichenbach's Icones Florae Germanicae, t. 4517, figures which are accepted as representative of *V. arvensis*, Murr., by such critical students of Viola as Messrs. Rouy and Foucaud in their exhaustive subdivision of the violets of France.[1]

This violet, in America at least, shows no tendency to intergrade with *V. tricolor*, L., nor with *V. Rafinesquii*, Greene.

To date I have seen specimens of *V. arvensis* from the following American localities. NEWFOUNDLAND: on rocky bare slopes of hills immediately back of habitations in the poorer suburbs of St. John's, *Robinson & von Schrenk*, no. 190. MAINE: in an old field, Orono, *Fernald*; in a rich field, North Berwick, *Parlin*, no. 654. Massachusetts: abundant in an old field, Cambridge, *Fernald*; Medford Street, Somerville, *C. E. Perkins*; Northampton, *Mrs. E. H. Terry*, CONNECTICUT: sandy wastes along the beach, Black Rock, Bridgeport, *Eames*; in a garden (without cultivation), Southington, *Bissell*. NEW YORK: Oak Point, *Buchheister*.

GRAY HERBARIUM.

[1] Fl. de France, iii. 1 to 58.

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THE IDENTITY OF IRIS HOOKERI AND THE ASIAN I. SETOSA.

M. Foster.

[Editorial Note.—The discovery by Dr. G. G. Kennedy two years ago at Cutler, Maine, of the unique *Iris Hookeri*, Penny, formerly known only from the coast of eastern Canada, Labrador and Newfoundland, has drawn much attention to that handsome plant.[1] As a result of recent observations, the range of the species has been more clearly defined than heretofore, and we now know *I. Hookeri* on sea-beaches and headlands from Mallijak (Hamilton Inlet), Labrador, to the Baie des Chaleurs, New Brunswick, and up the St. Lawrence to Saguenay and Kamouraska Counties, Quebec; on Newfoundland, the Magdalen Islands, and Prince Edward Island; and from Sydney, Cape Breton, to Jonesport, Maine. With the attention of New England botanists so recently directed to this northern Iris, it was an especially happy chance which led Miss Mary A. Day, Librarian of the Gray Herbarium, to discover among some papers of the late Sereno Watson a manuscript note upon this plant from Sir Michael Foster, the distinguished secretary of the Royal Society and for twenty years Professor of Physiology at Trinity College, Cambridge. This note which its author permits us to publish was addressed to Dr. Watson shortly before his death.]

In an interesting note in Botanical Gazette, xii. p. 99, May, 1887, on "Our 'tripetalous' species of Iris," you shew that *I Hookeri* has priority as a name for the Canadian tripetalous species. I have several times received plants under the name "*I. tridentata*," clearly not specimens of Walter's plant [*I. tripetala*], but so identical in all respects with *I. setosa*, Pallas, that, though some of them were said to come from Canada, I thought there must have been some mistake, and that what I had received were simply specimens of the Asian *I. setosa*.

Two years ago, however, Mr. James Fletcher of the Agricultural Department, Ottawa, was so very kind as to send me ripe full capsules and living roots of the tripetalous Iris growing at Dalhousie,

[1] See Kennedy, Rhodora, iv. 24, and Collins, ibid, 179, t. 39.

New Brunswick. The capsule and seed were exactly like the capsule and seed of the Asian *I. setosa*. In your note you point out the features of the capsule of the Canadian Iris. I may add that the small dense seed, pyriform or oval except for the very conspicuous raphe, is most distinct. Not only is it wholly different from the wedge-shaped seed of *I. versicolor* (which in turn is almost identical with that of the European *I. pseudacorus*, the two plants being the New World and Old World forms of the same type) but so unlike the seed of other Irises known to me that I think I could always recognize it and detect it mixed with other seed. That of *I. ensata* comes nearest to it.

Mr. Fletcher's root flowered with me last summer (1889), and I must confess that I cannot see in it any specific differences from the Asian *Iris setosa*. The distinguishing feature of *I. setosa* is the diminished inner perianth-segment or standard, in which a very short narrow claw suddenly expands into a minute ala on each side, the two together not reaching the width of 1 cm., and then rapidly narrows to a bristle-like point, the whole segment being only about 1.5 or at most 2 cm. in length. In *I. versicolor*, the standards are sometimes small but never so small as this, and, moreover, they are always ovate or ovate-lanceolate.

The Canadian plant differs from what I may perhaps consider as the typical Asian plant, in the standard not narrowing rapidly to a point from the alae, but, after narrowing somewhat, maintaining the same width for a space and then suddenly becoming pointed; in the blade of the outer perianth-segment being more orbicular; in the claw of the same having a more pronounced flange at its base; in the white patch or "signal" at the junction of the claw and blade being less sharply defined, and in the ovary being more distinctly grooved on the sides. In all these features, however, except the first, seedlings of the Asian *I. setosa* vary a good deal. The inflorescence of the Canadian plant was not so full and the foliage not so luxuriant as those of a well grown Asian plant; but these, I take it, are merely matters of cultivation. The slight apparently permanent difference noted above, seems to be hardly enough to found a species upon. The Canadian plant is at most a variety and might be called *Iris setosa*, var. **canadensis**.

I may add that a plant said to come from Newfoundland, which my friend Mr. Max Leichtlin of Baden Baden gave me, appears to

be identical with Mr. Fletcher's plant. Both are much more like the Asian *Iris setosa* than a plant, which I also received from Mr. Leichtlin, which was said to come from Alaska, and which, though really an *I. setosa*, more fully perhaps deserves an independent name than does the Canadian form. Its deep rich purple flowers and tall habit make it a handsome plant.

It is interesting to observe that *Iris setosa*, like so many other of your North American plants of Asian origin, has been driven to your eastern seaboard, and nearly pushed out of the country. I can learn no evidence of its existence between Alaska on the west and East Canada. The *I. versicolor* of Canada appears to me wholly identical with the *I. versicolor* of the States but of less luxuriant growth.

Shelford, Cambridge, England, January 11, 1890.

RECENTLY RECOGNIZED SPECIES OF CRATAEGUS IN EASTERN CANADA AND NEW ENGLAND,— IV.

C. S. Sargent.

§ Coccineae.

* Anthers pale yellow.

Crataegus coccinea, Linnaeus. Sargent, *Silva N. Am.* xiii. 133, t. 683.

The range of this species can now be extended along the coast of Connecticut where it has been found by *Graves* near New London, by *Harger* at Oxford and Southbury, and by *Eames* at Stanford on the Hoosatonic River.

Crataegus Gravesii, n. sp. Leaves ovate to obovate, acute or rounded at the apex, narrowed from below the middle to the concave-cuneate or rarely rounded entire base, and slightly divided above the middle into 3 or 4 pairs of broad acute lobes; when they unfold tinged with red and coated above with silky white hairs and nearly fully grown when the flowers open and then membranaceous, light green and slightly hairy above with scattered pale hairs; at maturity thin but firm in texture, glabrous, dark green and lustrous on the upper surface, pale yellow-green on the lower surface, usually 3.5–4 cm. long and 2.5–3 cm. wide, with slender yellow midribs and 3 or 4

pairs of slender primary veins extending obliquely to the points of the lobes, or occasionally 3-nerved; petioles slender, more or less wing-margined at the apex by the decurrent base of the leaf-blades, slightly hairy and often glandular early in the season, 1–1.4 cm. in length; on leading shoots leaves often broadly ovate, rounded, slightly cordate or broadly cuneate at the base, coarsely serrate and divided into numerous short acute lateral lobes, 5–6 cm. long and nearly as wide, with thick rose-colored midribs and stout winged petioles. Flowers 1.5–1.6 cm. in diameter on slender slightly hairy or glabrous pedicels, in compact 5–16, mostly 10–12, flowered compound corymbs; bracts and bractlets linear and acuminate to lanceolate, glandular, pink; calyx-tube narrowly obconic, light green, the lobes gradually narrowed from broad bases, linear, acuminate, tipped with bright red glands, finely glandular-serrate usually only above the middle, reflexed after anthesis, deciduous from the ripe fruit; stamens 4–10, usually 7 or 8; anthers small, pale yellow; styles 2 or 3, very rarely 4, surrounded at the base by a narrow ring of pale tomentum. Fruit in erect few-fruited compact clusters, globose or depressed globose, dark orange-red, marked by numerous large dark dots, 7–11, usually about 8 mm. in diameter; calyx small with a broad, shallow cavity; flesh pale yellow-green, dry and mealy; nutlets 2 or 3, full and rounded at the ends, prominently ridged on the broad rounded back, about 6 mm. in length.

A tree occasionally 6 m. in height with a trunk 1–1.5 dm. in diameter, covered with dark gray bark separating into small thin scale-like plates, wide-spreading and ascending branches forming a flattened dome-shaped head, more often shrubby with several stout stems and a broad round-topped or flattened head, 2–3 m. tall and broad; branchlets slender, nearly straight or slightly zigzag, marked by large pale lenticels, dark orange-green and slightly or densely villose or glabrous when they first appear, light red-brown and lustrous during their first season and dull gray-brown the following year, and armed with numerous slender nearly straight bright red-brown and shining ultimately ashy spines 3–6 cm. in length. Flowers during the first week in June. Fruit ripens late in September and begins to fall about the 10th of October. In the autumn the leaves turn a dull yellow color.

Connecticut: Abundant on the glacial gravel of Poquonomoc Plain east of Poquonomoc River and on adjacent boulder-covered ridges, Groton, *C. B. Graves*, June and September 1901, *C. S. Sargent*, August 1902; Terrace north of Gales Ferry Cove, Ledyard, *C. B. Graves*, June and September 1901; Southington, *L. Andrews*, June and September 1902; North Canaan, *C. H. Bissell*, September

1901; State Line, Salisbury, *C. H. Bissell*, May and September 1902. MASSACHUSETTS; hill west of the main street, Great Barrington, *Brainerd and Sargent*, May 31, 1902, *C. S. Sargent*, September 1902; roadside, North Adams to Williamstown, *Brainerd* and *Sargent*, May 29, 1902, *C. S. Sargent*, September 1902; Amherst, *G. E. Stone*, May 1902. VERMONT: Vergennes, *Ezra Brainerd*, August and September 1900, June 1901. NEW YORK: Westport, *C. H. Peck*, May 1902.

The plants growing on the Poquonomoc Plain should be considered to represent the type of this species. The specimens collected by *Andrews* at Southington have much more hairy young branchlets and corymbs and larger fruit, and the plants from northern Connecticut, Massachusetts and New York are quite glabrous with the exception of the hairs on the upper surface of the young leaves.

I am glad to associate with this distinct species the name of Dr. C. B. Graves of New London, who has patiently and successfully studied during the last two years the numerous forms of Crataegus which he has found in New London County, Connecticut.

Crataegus Faxoni, n. sp. Leaves broadly ovate to suborbicular or rarely oval, rounded and short-pointed or acuminate at the apex, rounded, truncate or cuneate at the usually broad entire often glandular base, finely serrate above, with straight incurved teeth tipped with large dark glands, and slightly divided into 4 or 5 pairs of short acute or acuminate lobes; coated above until after the flowering time with long soft white hairs and densely hoary tomentose below; at maturity thin but firm in texture, dark dull green and glabrous on the upper surface, pale and glabrous on the lower surface, with the exception of a few hairs scattered along the stout midribs deeply impressed above and the prominent primary veins arching obliquely to the points of the lobes, 4–5 cm. long and 3.5–4 cm. wide, or on leading shoots often 6 cm. long and wide; petioles slender, grooved, often slightly winged at the apex by the decurrent base of the leaf-blades, villose at first, glandular with minute dark red scattered glands caducous except on vigorous shoots, glabrous in the autumn, 2–2.5 cm. in length; stipules linear to oblong-obovate, acute, finely glandular-serrate, villose, 7–8 mm. in length, caducous. Flowers 1 cm. in diameter on short stout villose pedicels, in compact 7–9-flowered densely villose compound corymbs; bracts and bractlets linear to oblong-obovate, acuminate, finely glandular-serrate, turning brown in fading, caducous; calyx-tube broadly obconic, villose particularly toward the base, the lobes gradually narrowed, slender, acuminate, slightly villose, glandular-serrate; stamens 5–10, usually 5; anthers pale yellow; styles 3 or 4. Fruit mostly erect on stout glabrous or slightly villose peduncles, in few-fruited clusters, oblong, full and rounded at the ends, dark crimson, lustrous, marked by few large

pale lenticels, 1–1.2 cm. long, 8–10 mm. wide; calyx small, with a narrow deep cavity and spreading and reflexed villose lobes, the tips mostly deciduous from the ripe fruit; flesh thin, yellow, dry and mealy; nutlets 3 or 4, full and rounded at the ends, prominently ridged on the broad back, with a high rounded ridge, 8–9 mm. long.

A shrub 3–3.5 m. in height with numerous stout spreading stems forming a broad round-topped handsome head, and slender nearly straight branchlets coated at first with long matted pale hairs, soon glabrous, light red-brown and marked by occasional large pale lenticels during their first season, dark gray-brown the following year and armed with slender slightly curved light chestnut-brown and shining ultimately ashy gray spines 4–4.5 cm. in length. Flowers from the 20th to the end of May. Fruit ripens at the end of September.

NEW HAMPSHIRE: river banks and open rocky pastures, Franconia, *C. E. Faxon*, September 1890, 1899, 1900, May 1901.

Crataegus Jackii, n. sp. Leaves obovate-cuneate to oblong-cuneate or rarely oval, acute, or on vigorous shoots broadly ovate and rounded or cordate at the base, to orbicular, finely and doubly serrate except toward the base, with incurved glandular teeth, and sometimes slightly divided above the middle into short acute lobes; tinged with red and villose-pubescent above, this often as they unfold and nearly fully grown and almost glabrous when the flowers open; at maturity thin but firm in texture, dark dull green on the upper surface, pale on the lower surface, 3–4 cm. long, 2–3 cm. wide, or on leading shoots often 5 cm. in diameter, with stout midribs and 3 or 4 pairs of slender primary veins extending to the points of the lobes; petioles slender, more or less wing-margined toward the apex, glandular, with numerous small bright red glands, mostly deciduous before autumn, 3–4 cm. long; stipules oblong-obovate to linear, acuminate, glandular-serrate, caducous. Flowers 2 cm. in diameter, in broad many-flowered thin-branched compound villose corymbs; bracts and bractlets conspicuous, oblong-obovate, glandular-serrate; calyx-tube broadly obconic, glabrous, the lobes gradually narrowed from broad bases, oblong, acuminate, coarsely glandular-serrate, slightly villose on the upper surface, reflexed after anthesis; stamens 5–10, usually 5; anthers pale yellow; styles 2 or 3, surrounded at the base by a narrow ring of pale tomentum. Fruit in many-fruited drooping glabrous clusters, ovate to oblong, prominently angled, full and rounded at the ends, dull dark red, marked by occasional small pale dots, 1.2–1.4 cm. long, 1–1.2 cm. thick; calyx small, with a narrow shallow cavity and acuminate closely appressed lobes coarsely serrate above the middle, villose-above, dark red toward the base on the upper side; flesh thick, somewhat juicy, bitter, white tinged with red; nutlets 2 or 3, broad, rounded at the ends, rounded and prominently ridged on the back, with a broad grooved ridge, 8 mm. in length.

A broad round-topped very intricately branched shrub rarely extending 3 metres in height with slender zigzag branchlets light green more or less tinged with red when they first appear, orange or reddish brown during their first season, becoming dull gray-brown in their second year and armed with numerous nearly straight slender spines from 3 to 6 cm. in length. Flowers at the end of May. Fruit ripens late in September.

PROVINCE OF QUEBEC: lime stone ridges near the shores of Lake St. Lawrence; Caughnawaga, May 1900, May and September 1901, May 1902, Highlands, May and September 1901; St. Ann, May and September 1902, *J. G. Jack.*

Crataegus Aboriginum, n. sp. Glabrous with the exception of a few long pale caducous hairs on the upper surface of the young leaves. Leaves ovate to rhombic, concave-cuneate at the entire glandular base, finely and often doubly serrate, with incurved teeth tipped with small red glands, and more or less deeply divided above the middle into broad acute lobes; membranaceous, pale yellow-green and almost glabrous when the flowers open; at maturity thin but firm in texture, dark yellow-green and lustrous on the upper surface, pale yellow-green on the lower surface, 5–6 cm. long, 3.5–5 cm. wide, with stout often rose-colored midribs and 3 or 4 pairs of slender veins arching obliquely to the points of the lobes; petioles stout, narrowly wing-margined and grooved nearly to the middle, glandular with minute dark glands mostly toward the apex, often rose-color late in the season, about 2 cm. in length; stipules linear and acuminate to lanceolate, coarsely glandular-serrate, sometimes 1–2 cm. in length, caducous. Flowers about 1.4 cm. in diameter on long slender pedicels, in thin-branched rather compact many flowered compound corymbs; bracts and bractlets very large and conspicuous, oblong-obovate, acute, sometimes falcate, coarsely glandular-serrate, mostly deciduous before the flowers open; calyx-tube broadly obconic, the lobes abruptly narrowed from the base, broad, acuminate, coarsely glandular-serrate, reflexed after anthesis; stamens 10; anthers pale yellow; styles 2–4. Fruit in drooping few-fruited clusters, subglobose to short-oblong, full and rounded at the ends, dark red, slightly pruinose, about 1.4 cm. long; calyx enlarged with a broad deep cavity and foliaceous coarsely serrate lobes dark red on the upper side near the base, usually erect and incurved, 7–9 mm. in length; flesh thin, hard, green and bitter; nutlets full and rounded at the ends, thick, ridged on the back, with a broad rounded often grooved ridge, about 9 mm. in length.

A broad shrub with stems about 3 m. in height and very stout branchlets marked by oblong pale lenticels, dark orange-green when they first appear, bright red-brown and lustrous during their first

year, light reddish brown or gray slightly tinged with red and lustrous during their second season, and armed with thick nearly straight bright chestnut-brown shining spines 3–4 cm. in length. Flowers at the end of May. Fruit ripens the first of October.

Province of Quebec: Roadside in the Indian village of Caughnawaga in the Caughnawaga Reservation, near the southern bank of the St. Lawrence River at the Lachine Rapids, *J. G. Jack*, August and September 1899, May and September 1900.

Although still known only in a single individual, I venture to describe this plant as it is one of the most interesting and distinct of Mr. Jack's numerous discoveries in the neighborhood of Montreal, differing as it does from all the other species of this group in the large and very conspicuous bracts and bractlets of the inflorescence, and the much enlarged foliaceous lobes of the mature calyx.

Crataegus Brunetiana, n. sp. Leaves rhombic to oblong-obovate or rarely and usually only on vigorous shoots to ovate, acute, mostly concave-cuneate and gradually or abruptly narrowed to the glandular base, sharply and generally doubly serrate, with straight or incurved teeth tipped with small dark red persistent glands, and more or less deeply divided into numerous acuminate lobes; as they unfold tinged with red, and villose above and along the midribs and veins below, and when the flowers open nearly fully grown and glabrous with the exception of a few pale hairs on the upper surface; at maturity subcoriaceous, glabrous, dark green and lustrous above, light yellow-green below, 5–8 cm. long, 3.5–5 cm. wide, with stout midribs and 4 or 5 pairs of primary veins arching to the points of the lobes; petioles stout, more or less wing-margined above, glandular, with numerous small dark red glands mostly deciduous before autumn, often bright red late in the season like the lower part of the midrids; stipules oblong-obovate, rounded or acute at the apex to lanceolate, coarsely glandular-serrate, caducous. Flowers about 1.8 cm. in diameter on elongated slender pedicels, in broad thin-branched open compound many-flowered corymbs; bracts and bractlets oblong-obovate to lanceolate, glandular-serrate, caducous; calyx-tube narrowly obconic, thickly coated with long matted white hairs, the lobes gradually narrowed from broad bases, acuminate, coarsely glandular-serrate, villose on the upper surface; stamens 10; anthers pale yellow; styles 3 or 4, surrounded at the base by a broad ring of pale tomentum. Fruit on long pedicels, in many-fruited gracefully drooping slightly villose clusters, oblong or slightly obovate, full and rounded at the ends, crimson, lustrous, marked by occasional large pale dots, 1.3 to 1.5 cm. long, about 1 cm. thick; calyx-cavity deep and narrow, the lobes elongated, acuminate, glandular-serrate, villose on the upper surface, red above toward the base, closely appressed,

persistent; flesh thick, greenish yellow, dry and mealy; nutlets 3 or 4, thick, acute at the ends, prominently ridged on the back, with a broad often grooved ridge, 5–6 mm. long.

An arborescent shrub beginning to flower when not more than 1.5 metres high, and when fully grown often 6 or 7 metres in height, with numerous stems sometimes 3 dcm. in diameter, forming an open irregular head, and stout zigzag branchlets sparingly marked by oblong pale lenticels, villose and yellow-green when they first appear, soon glabrous, bright red-brown and lustrous during their first season, ashy gray or light brown the following year, and armed with numerous stout straight bright chestnut-brown spines 5–7 cm. in length. Flowers June 1st. Fruit ripens at the end of September and often remains on the branches until the end of October or until after the leaves have fallen.

Province of Quebec: valley of the St. Lawrence River near the City of Quebec, Montmorency Falls, September 1900, May and September 1901, Levis, September 1900, May and September 1900, Isle of Orleans, September 1900, May and September 1901, *J. G. Jack*; banks of St. Charles River, City of Quebec, May and October 1902, *R. Bell.* A specimen with immature fruit collected by *Mr. Ezra Brainerd* at Roberal, Lake St. John, Province of Quebec, August 11, 1901, is probably of this species.

This handsome shrub, first found near the city where he lived for many years, recalls in its name that of the Abbé Ovide Brunet, a professor at Lavalle University and the author of important papers on the trees and other plants of Canada.

Crataegus Keepii, n. sp. Leaves obovate to rhombic, rarely to oval, acuminate, gradually narrowed to the entire glandular base, finely sometimes doubly serrate above, with straight teeth tipped with large dark red persistent glands, and slightly divided above the middle into 3 to 5 pairs of short acuminate lobes; nearly fully grown when the flowers open and then membranaceous, dark green and slightly hairy above, with white caducous hairs and pale and glabrous below; at maturity coriaceous, dark green and very lustrous on the upper surface, pale on the lower surface, 4–6 cm. long, 3–4 cm. wide, with stout yellow midribs deeply impressed above like the slender, primary veins arching to the points of the lobes; petioles slender, wing-margined at the apex by the decurrent base of the leaf blades, slightly grooved, glandular, at first sparingly hairy, soon glabrous, often rose color in the autumn, 2–2.5 cm. in length; stipules linear; acuminate turning red before falling. Flowers on elongated slender slightly villose pedicels, in lax 6–11-flowered thin-

branched villose compound corymbs; calyx-tube narrowly obconic, glabrous except at the very base, the lobes gradually narrowed from below, acuminate, coarsely glandular-serrate, villose on the inner surface, reflexed after anthesis; stamens usually 8; anthers pale yellow; styles 3 or 4. Fruit in drooping slightly villose clusters, oblong, full and rounded at the ends, bright clear red, lustrous, conspicuously marked by very large white dots, 1.1–1.2 cm. long, about 9 mm. wide; calyx small, sessile, with a deep narrow cavity and spreading closely appressed lobes villose on the upper side; flesh thin, yellow, dry and mealy; nutlets 3 or 4, thin, acute at the ends, prominently ridged on the back, with a narrow rounded ridge, 8 mm. in length.

A large arborescent shrub sometimes 4 or 5 m. in height with numerous stems forming a broad open head, and slender nearly straight branchlets marked by large pale lenticels, dark orange-green and villose when they first appear, dull light reddish brown during their first season, dull ashy gray the following year, and unarmed or sparingly armed with nearly straight dark red-brown spines about 4 cm. in length. Flowers during the first week of June. Fruit ripens early in October.

Maine: river thickets of the valley of the lower Aroostook where it is the common species and very beautiful in autumn when it is covered with its abundant brilliant fruit; Fort Fairfield, September 1900, June and September 1901, *M. L. Fernald.*

This species is named for Marcus Rodman Keep, "Parson" Keep, for forty-eight years a resident in Aroostook Co., a clergyman and missionary at large, widely identified with the educational and agricultural development of his adopted state, a friend of the poor, and the helpful adviser of all who sought information on the flora of northern Maine.

* * Anthers pink.

Crataegus Fernaldi, n. sp. Leaves ovate to rhombic, long-pointed at the apex, gradually or abruptly narrowed at the entire or glandular base, finely often doubly serrate above, with incurved teeth tipped with large dark red glands, and deeply divided above the middle into 4 or 5 pairs of narrow acuminate lobes; nearly fully grown when the flowers open and then membranaceous, light yellow-green and slightly hairy along the midribs above, pale and villose below, with scattered hairs persistent during the season on the stout yellow midribs and primary veins extending very obliquely to the points of the lobes; at maturity thin but firm in texture, dark green and lustrous on the upper surface, light yellow-green on the lower

surface, 5–6 cm. long, 4–5 cm. wide; petioles slender, wing-margined at the apex, deeply grooved, at first villose, soon glabrous occasionally glandular with minute scattered caducous glands 2–3 cm. in length; stipules linear, acuminate turning red before falling, caducous. Flowers 2 cm. in diameter on slender elongated villose pedicels, in lax many-flowered thin-branched villose corymbs; bracts and bractlets linear, acuminate, glandular-serrate, caducous; calyx-tube narrowly obconic, thickly coated with long matted white hairs, the lobes broad, acuminate, coarsely glandular-serrate, glabrous; stamens 10; anthers pink; styles 3, surrounded at the base by a broad ring of pale tomentum. Fruit on long slightly hairy pedicels, in many-fruited gracefully drooping clusters, obovate and gradually narrowed at the base, bright scarlet, lustrous; calyx small, sessile, with a small deep cavity and spreading mostly appressed lobes often deciduous from the ripe fruit; flesh thin, yellow, dry and mealy; nutlets 3, acute at the ends, prominently ridged on the broad back, with a high rounded ridge, about 8 mm. in length.

A shrub sometimes 4 or 5 m. in height with numerous stems forming an open head often broader than high, and comparatively slender nearly straight branchlets light orange-green and hairy when they first appear, with pale hairs, mostly caducous, but occasionally persistent until autumn, light red-brown, lustrous and marked by large pale lenticels during their first season, becoming darker in their second and usually ashy gray in their third year, and armed with many stout straight or slightly curved red-brown and lustrous ultimately ashy gray spines 5–7.5 cm. in length. Flowers during the first week of June. Fruit ripens at the end of September and soon falls.

MAINE: valley of the lower Aroostook River, river banks at Fort Fairfield, July 1893, June and September 1901, *M. L. Fernald*; Valley of the St. John River at Fort Kent, July 1900, *E. F. Williams*.

Crataegus Fernaldi with its lax elongated extremely villose corymbs, large flowers, pink anthers, and pear-shaped fruits gracefully drooping on their long stems in wide clusters, is one of the most distinct plants in this group, and one of the interesting discoveries made by the industrious and successful explorer and student of the flora of Maine whose name is appropriately associated with it.

CRATAEGUS PRAECOX, Sargent, RHODORA, iii. 27 (1902). This name having been used by Loudon for the early flowering Glastonbury Thorn, a variety of *Crataegus Oxyacantha* (*Arb. Brit.* ii. 833 [1830]), I propose the name of **Crataegus praecoqua** for this American species. It was through an error that the anthers of the type of

this species from Crown Point, New York, were described as pale yellow. They are pink, and the specimens collected by Mr. Jack in the Province of Quebec, with yellow anthers and previously referred to *Crataegus praecox*, can perhaps best be referred to *Crataegus coccinea*, Linnaeus, although these Canadian plants show great variation in the time their fruit ripens.

Arnold Arboretum.

A NEW STATION FOR DENTARIA MAXIMA.

C. H. Bissell.

Of the three species of pepper-root known to New England, *Dentaria maxima*, Nutt. is the most rarely found and the reported stations for it have all been in the state of Vermont, although I learn that there is in the Herbarium of the New England Botanical Club a specimen of this species collected at Lowell, Massachusetts, by Mr. W. P. Atwood, May, 1883. The two other species, *D. laciniata*, Muhl. and *D. diphylla*, Michx., are found in various parts of New England and are locally pretty well known. All the species develop foliage and flowers very early in the season before most other plants have started and they have finished their growth and often disappear by the first of July. In this part of Connecticut *D. laciniata* and *D. diphylla* are found in moist or wet places in rich soil among rocky woods and are not common. At one station of which I shall speak, they are comparatively plentiful. This place, a rocky wooded hillside with soil mostly a rich humus, moist all through, with springs along its lower edge, covers an area of perhaps an acre and is a fine station for early flowers. In late April or the first week in May, the date varying according to the season, when most of the woods are still brown and bare this spot is a mass of flowers and verdure. The first to come is the delicate little squirrel corn, *Dicentra canadensis*, DC. This is quickly followed by its near relative the Dutchman's Breeches, *Dicentra Cucullaria*, DC., and one of the pepper-roots, *Dentaria laciniata*, these two in greater numbers than any of the others. A few days later the other pepper-root, *D. diphylla* and the smooth yellow violet, *Viola scabriuscula*, Schwein. add their flowers

to the display. When visiting this spot last year in the first days of May I collected some plants that at first I thought were only a peculiar form of *D. diphylla*. A more careful examination of the specimens, however, showed a decided difference in the rootstock. Another visit was then made to the station, more material collected and observations made.

Specimens of this peculiar form were later sent to the Gray Herbarium and found by Dr. Robinson to be the rare *Dentaria maxima*, Nutt. Hartford County, Connecticut can now be added to the recorded stations for this species in New England. As the plant is little known some notes may be of interest.

There were found two colonies of about a dozen plants each surrounded by plants of both the other species. There has been some discussion as to the time of flowering of *D. maxima*. At this station *D. laciniata* bloomed a week or ten days earlier than *D. diphylla*. *D. maxima* was almost exactly intermediate in time between the other two. It is supposed to be a larger plant than the others but was about the same size in this case.

The basal leaves were like those of the stem. There were usually three leaves on a stem, sometimes two and occasionally four, when three the upper one was smaller, when four, the last one was very much smaller than the others.

The flowers were nearly white, just tinged with rose or purple much like those of *D. laciniata*. None of the plants matured fruit, in this respect following *D. diphylla* which seems hardly ever to form seed in this section.

The rootstock is larger and longer than that of *D. laciniata*, it is jointed and tubercled, grows deeper in the ground and is not at all like that of *D. diphylla*.

Southington, Connecticut.

Since above was in type has come a report of the finding of *Dentaria heterophylla*, Nutt. in Litchfield County, Connecticut, thus making four known species of Dentaria in New England instead of three as stated above.—C. H. B.

Splachnum ampullaceum, a Correction.— The moss reported from Mt. Ktaadn as *Splachnum roseum* (Rhodora 5: 44) has proved on further study to be *S. ampullaceum* and I wish to place on record this correction.— LeRoy H. Harvey, University of Chicago.

PRELIMINARY LISTS OF NEW ENGLAND PLANTS,— XI, HEPATICAE.[1]

ALEXANDER W. EVANS.

[The sign + indicates that an herbarium specimen has been seen; the sign — that a printed record has been found.]

RICCIACEAE.	Me.	N. H.	Vt.	Mass.	R. I.	Conn.
Riccia arvensis Aust.					—	+
" crystallina L.						+
" fluitans L.	+		—	+	—	+
" Sullivantii Aust.			+	+	+	+
Ricciocarpus natans (L.) Corda	+	+	+	+	+	+

MARCHANTIACEAE.	Me.	N. H.	Vt.	Mass.	R. I.	Conn.
Asterella tenella (L.) Beauv.	+		—	+	+	+
Conocephalum conicum (L.) Dumort.	+	+	+	+	+	+
Grimaldia fragrans (Balb,) Corda			+	—	—	+
Lunularia cruciata (L.) Dumort.			+	+	—	+
Marchantia polymorpha L.	+	+	+	+	+	+
Preissia quadrata (Scop.) Nees	+	+	+	+	—	+
Reboulia hemisphaerica (L.) Raddi	+		+	+	—	+

METZGERIACEAE.	Me.	N. H.	Vt.	Mass.	R. I.	Conn.
Blasia pusilla L.	+	+	+	+	+	+
Fossombronia foveolata Lindb.	+	+		+	+	+
" salina Lindb.						+
" Wondraczekii (Corda) Dumort.		+				+
Metzgeria conjugata Lindb.	—	+	+	+	—	+
Pallavicinia Lyellii (Hook.) S. F. Gray	+	+		+	+	+
Pellia epiphylla (L.) Corda	—	+	+	+	+	+
Riccardia latifrons Lindb.	+	+	+	+		+
" multifida (L.) S. F. Gray	+	+	—	+	—	+
" palmata (Hedw.) S. F. Gray	—			—	—	+
" pinguis (L.) S. F. Gray		+	+		—	+
" sinuata (Dicks.) Trevis.				+	—	+

[1] Printed in RHODORA as supplementary material.

	Me.	N. H.	Vt.	Mass.	R. I.	Conn.
JUNGERMANNIACEAE.						
Anthelia Juratzkana (Limpr.) Trevis.		+				
Archilejeunea clypeata (Schwein.) Schiffn.				+		+
" Sellowiana Steph.					+	
Bazzania triangularis (Schleich.) Lindb.		+	+	+		+
" trilobata (L.) S. F. Gray	+	+	+	+	+	+
Blepharostoma trichophyllum (L.) Dumort.	+	+	+	+		+
Cephalozia bicuspidata (L.) Dumort.	+	+	+	+		+
" catenulata (Hüben.) Lindb.	+		—		—	+
" connivens (Dicks.) Lindb.				+	—	+
" curvifolia (Dicks.) Dumort.	+	+	+	+	—	+
" divaricata (Smith) Dumort.	+	+	+	+	+	+
" fluitans (Nees) Spruce	+					+
" Francisci (Hook.) Dumort.	+					
" Jackii Limpr.				+		
" lunulaefolia Dumort.	+	+	+	+	—	+
" Macounii Aust.	+	+				
" pleniceps(Aust.) Lindb.	—	—				
Chiloscyphus ascendens Hook. & Wils.				—	—	+
" polyanthus (L.) Corda	+	+	—	+	—	+
Cololejeunea Biddlecomiae (Aust.) Evans			+	+		+
Diplophylleia albicans (L.) Trevis.	+					
" apiculata Evans				+	+	+
" taxifolia (Wahl.) Trevis.	+	+	+	+		+
Frullania Asagrayana Mont.	+	+	+	+	+	+
" Brittoniae Evans				+	+	+
" Eboracensis Gottsche	+	+	+	+	+	+
" Oakesiana Aust.	+	+	+			
" plana Sulliv.					—	+
" riparia Hampe		+		—		+
" squarrosa (R. Bl. & N.) Dumort.					—	+
" Tamarisci (L.) Dumort.	+			—	+	
" Virginica Gottsche				—	—	+
Geocalyx graveolens (Schrad.) Nees	+	+	+	+	—	+
Gymnomitrium concinnatum (Lightf.) Corda.	+	+				
" corallioides Nees		+				
Harpanthus scutatus (Web. & Mohr) Spruce		+	+	—	—	+
Jamesoniella autumnalis (DC.) Steph.	+	+	+	+	—	+
Jubula Hutchinsiae (Hook.) Dumort.	+	+	+	+	—	+
Jungermannia lanceolata L.	+	+		+	—	+
" pumila With.	—	+			—	+
" sphaerocarpa Hook.		+				
Kantia Sullivantii (Aust.) Underw.				+		+
" Trichomanis (L.) S. F. Gray	+	+	+	+	+	+
Lejeunea cavifolia (Ehrh.) Lindb.		+	+	+		+

	Me.	N. H.	Vt.	Mass.	R. I.	Conn.
Lepidozia reptans (L.) Dumort.	+	+	+	+	+	+
" setacea (Web.) Mitt.	+		—	+	—	+
" sphagnicola Evans						+
Lophocolea Austini Lindb.						+
" bidentata (L.) Dumort.	—		—	—	—	+
" heterophylla (Schrad.) Dumort.	+	+	+	+	+	+
" minor Nees			+		+	+
Lophozia alpestris (Schleich.) Evans	+	+				
" barbata (Schreb.) Dumort.	+	+	+	+	—	+
" bicrenata (Schmid.) Dumort.		+	+	+		+
" Floerkii (Web. & Mohr) Schiffn.		+				
" gracilis (Schleich.) Steph.	+	+	+	+		
" incisa (Schrad.) Dumort.	+	+	—	+	—	+
" inflata (Huds.) M. A. Howe	+	+	+			+
" lycopodioides (Wallr.) Cogn.	+	+				
" Lyoni (Tayl.) Steph.	+	+	+			+
" Marchica (Nees) Steph.	—			+		+
" ventricosa (Dicks.) Dumort.	+	+	+	+	—	
Marsupella emarginata (Ehrh.) Dumort.	+	+	+	+		+
" sphacelata (Gieseke) Dumort.	+	+	+			+
" ustulata (Hüben.) Spruce		+				
Mylia anomala (Hook.) S. F. Gray	+					+
" Taylori (Hook.) S. F. Gray	+	+	+		—	
Nardia crenulata (Smith) Lindb.	+	+	—	+	+	+
" haematosticta (Nees) Lindb.		+				
" hyalina (Lyell) Carringt.	+		+	+		+
" obovata (Nees) Lindb.	+	+				
Odontoschisma denudatum (Mart.) Dumort.		+	+	+	—	+
" prostratum (Swartz) Trevis.				+		+
Plagiochila asplenioides (L.) Dumort.	+	+	+	+	+	+
" Sullivantii Gottsche		+				+
Porella pinnata L.		+	+	+	—	+
" platyphylla (L.) Lindb.	+	+	+	+	+	+
" rivularis (Nees) Trevis.						+
Ptilidium ciliare (L.) Nees	+	+	+	+	+	+
Radula complanata (L.) Dumort.	+	+	+	+	+	+
" obconica Sulliv.						+
" tenax Lindb.		+				+
Scapania convexula C. Müll. Frib.	+					
" curta (Mart.) Dumort.	+	+				
" irrigua (Nees) Dumort.	—	+				+
" nemorosa (L.) Dumort.	+	+	+	+	+	+
" paludosa C. Müll. Frib.		+				
" subalpina (Nees) Dumort.		+				

	Me.	N. H.	Vt.	Mass.	R. I.	Conn.
Scapania umbrosa (Schrad.) Dumort.	+	+				
" undulata (L.) Dumort.	+	+	+	+	+	+
Sphenolobus exsectaeformis (Breidl.) Steph.		+				
" exsectus (Schmid.) Steph.		—	—	—		+
" Michauxii (Web.) Steph.	+	+	+	+		
" minutus (Crantz) Steph.	+	+				
Temnoma setiforme (Ehrh.) M. A. Howe	+	+	+			
Trichocolea tomentella (Ehrh.) Dumort.	+	+	+	+	—	+

Anthocerotaceae.

	Me.	N. H.	Vt.	Mass.	R. I.	Conn.
Anthoceros laevis L.	+	+	—	+	+	+
" punctatus L.			—	—	—	+
Notothylas orbicularis (Schwein.) Sulliv.				+	—	+

Galium erectum and Asperula galioides in America.—While at the Gray Herbarium recently the writer showed specimens of a plant found growing at Southington, Connecticut, which he supposed to be *Galium Mollugo*, L., but called attention to the fact that in some respects it did not agree with the descriptions of that species. Mr. Fernald then made a careful examination of the material at the Herbarium finding as a result that the plant above noted as well as specimens from some other stations should be referred not to *G. Mollugo*, but to the nearly related *G. erectum*, Huds.

It is not strange that the two species have been confused by collectors as *Galium erectum* is not reported in any of our Manuals as growing in America. *G. Mollugo* has panicled cymes, of which the branches are short and forking, the very numerous flowers being borne on strongly diverging pedicels. The inflorescence of *G. erectum* is of the same general form but has cymes with fewer and more erect branches, the much less numerous and larger flowers being borne on ascending pedicels. As far as shown by the material at the Gray Herbarium, *G. erectum* is confined to Nova Scotia and New England, its range being from Nova Scotia to Connecticut. *G. Mollugo* has a wider distribution, ranging from Newfoundland southward through the Middle States.

When Mr. Fernald was looking up the above mentioned species the writer showed him a specimen of another plant apparently also a

Galium and found growing with *G. erectum*, but not answering to any description in our Manuals. This Mr. Fernald determined to be *Asperula galioides*, M. Bieb. and stated this to be the first report of the species in New England. There is also a specimen of this plant at the Gray Herbarium, from the Michigan Agricultural College distributed as *Galium Mollugo*. These two are the only stations at present known at which the plant has been collected in this country. As the name indicates it has every appearance of being a Galium but is separated from that genus on account of the corolla, which, instead of being wheel-shaped and without a definite tube, is tubular-campanulate below the flaring limb.— C. H. BISSELL, Southington, Connecticut.

SOME VARIATIONS OF TRIGLOCHIN MARITIMA.

M. L. FERNALD.

THE common Arrow-grass, *Triglochin maritima*, is uniformly described in our floras as well as those of Europe, and in Engler and Prantl's Natürlichen Pflanzenfamilien, as having 6 carpels. Yet in July, 1902, while examining with Dr. G. G. Kennedy, and Messrs. J. F. Collins and E. F. Williams the Triglochins on the shore of Schooner Cove, at Cutler, Maine, the writer was surprised to find below high-water mark a belt of *T. maritima* with carpels varying in number from 3 to 6. Examination of these flowers shows that in some cases there are 5 normal carpels and a sixth undeveloped one, while in others the sixth is quite wanting. In several cases there are merely 4 good carpels, and in a few flowers 3 good carpels and a single undeveloped one.

Higher upon the beach, just above high-water mark, normal *Triglochin maritima* with 6 carpels was growing with the slender 3-carpelled *T. palustris*. The belt of *T. maritima* with 3, 4, 5, or 6 carpels was, as stated, considerably below high-water mark, and twice a day it was entirely covered by the chilling ocean water. The plants of this belt were very low and caespitose, forming dense clumps a decimeter or so in height, with racemes only 2 to 6 cm. long, and often distorted or umbelliform. The dwarf caespitose

development of the plant was apparently due to the discouraging conditions under which it grew, for the *T. maritima* above tide-limit grew tall and with the elongate racemes ordinarily expected in that plant.

That the remarkable reduction of carpels in the periodically refrigerated plant was in any way due to its unfavorable habitat is not so clear, for under similarly adverse conditions, at the mouth of the Tête-à-Gouche River, in Gloucester County, New Brunswick, *Triglochin maritima* with the normal 6 carpels was later found by Mr. Williams and the writer fruiting when only 3 to 6 cm. high, while in warmer parts of the marsh tall plants often had only 5 carpels; and a sheet in the Gray Herbarium shows a specimen of characteristic *T. maritima* 6 dm. high, collected by David Lyall on the Kootenai River in Idaho or British Columbia, with only 3 carpels. It seems probable, then, that under ordinary circumstances the number of carpels in *T. maritima* may vary from 3 to 6, and that this variation is unaccompanied by concomitant differences in size or habit of the plant.

The Annual Meeting and Field Day of the JOSSELYN BOTANICAL SOCIETY OF MAINE will be held at Skowhegan, June 29th to July 3rd, 1903. For detailed information, apply to MISS D. H. MOULTON, Secretary, 9 Hill Street, Portland Maine.

A HITHERTO UNDESCRIBED PIPEWORT FROM NEW JERSEY.— The following species occurs so near the southwestern boundary of New England that it may well be sought in Connecticut.

ERIOCAULON **Parkeri**, n. sp. Caespitosum pumilum 6–11 cm. altum glaberrimum, caule subnullo, radice fibris numerosis albis transverse septatis composita, foliis tenuibus planis lanceolato-linearibus a basi 3–4 mm. lata ad apicem peracutum gradatim attenuatis 3–6 cm. longis circa 7–9-nervatis reticulatis quasi fenestratis, pedunculis 10–22 erectis subrigidis obscure circa 7-angulatis 5–10 cm. altis, capitulis monoeceis depressis 3–4 mm. diametro a squamis plurimis subhyalinis non lucidis late ellipticis glabris flores aequantibus et eis arcte adpressis suffultis; floribus 2-meris, ♀ exterioribus, sepalis cymbiformibus 1.7 mm. longis fuscis glaberrimis vel prope apicem subtruncatum obscure parceque pubescentibus, petalis oblanceolato-oblongis 1.5 mm. longis extus ad apicem sparsim albo-pubescentibus intus ad apicem glandula nigra munitis, ovario compresso 1 mm. longo et lato, stylo 0.8 mm. longo, stigmatibus 2 filiformibus,

seminibus ovoideis rubro-brunneis 0.7 mm. longis basi truncatis; floribus ♂, sepalis 2 anguste spatulatis apice sparse pubescentibus, petalis perbrevibus nigroglanduliferis, staminibus 4, antheris quadratis non longioribus quam latis.— New Jersey: on the shore of the Delaware River near Cooper's Creek, *T. P. James*, September, 1858 (hb. Gr.); on the shore of the Delaware River, between high and low water mark, Camden, *C. F. Parker*, 7 October, 1877 (hb. Gr.).

Both specimens of *E. Parkeri* were distributed as *E. septangulare*, but they differ from that species in their numerous heads scarcely 4 mm. in breadth, and especially in the form of the fruiting head, which in *E. Parkeri* is campanalate at the base, the erect flowers being surrounded by an obvious and persistent involucre of their own length in the manner of a composite, while in *E. septangulare* the fruiting head through the widely spreading or even reflexed position of the outer flowers becomes ellipsoidal somewhat surrounding and obscuring the more or less deflexed involucre. The short thick pubescence, which in *E. septangulare* renders the head white is in *E. Parkeri* almost lacking.

The species is obviously related to the southern *E. Ravenelii* (unfortunately omitted by Ruhland from his treatment of the family in the Pflanzenreich), but *E. Ravenellii* is a much more slender plant with filiform peduncles and shining involucral scales.

It is a pleasure to dedicate this species to the late Charles F. Parker, an able botanist, for many years one of the curators of the Philadelphia Academy of Natural Sciences.— B. L. Robinson, Gray Herbarium.

For the privilege of using the excellent portrait engraving, which in our last issue accompanied the biographical sketch of the late Lorin Low Dame, the editors and managers of Rhodora wish to express their gratitude to Mr. R. B. Lawrence, Chairman of the School Committee of Medford, Massachusetts.

Vol. 5, no. 53, including pages 121 to 156, a reprint of plate 46, and a portrait (unnumbered), was issued 3 May, 1903.

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CHRYSANTHEMUM LEUCANTHEMUM AND THE AMERICAN WHITE WEED.

M. L. Fernald.

No plant in the eastern United States and Canada, it is safe to say, is more familiarly known than the White Weed, Marguerite, or Ox-eye Daisy, the *Chrysanthemum Leucanthemum* of our floras. So abundant is the plant in all settled regions that, like many others of our commonest plants, it is very generally ignored by the botanical collector. From late May to August the plant whitens with its showy heads millions of acres of field and meadow, and in the trail of the explorer it is among the first field-plants to make its appearance. Its closest botanical affinity is with a large group of Old World species, and it was apparently not noted in New England as a wild plant by Josselyn in the 17th century, though in 1785 Manasseh Cutler recorded it from about Boston "in fields and pastures .... very injurious to grass land."[1] These facts together with the tendency of the plant during more than a century to follow closely the path of the white man in America have led to the natural conclusion that our White Daisy was brought to us within historic time from Europe; and, as it strongly resembles the Old World *Chrysanthemum Leucanthemum*, the American plant has been universally accepted as identical with that European species.

The common American plant scarcely needs special description, yet it is important to note that, as it occurs in the fields and clearings of New England and as represented in the Gray Herbarium from many stations ranging from Nova Scotia to the Rocky Mountains, the Gulf of Mexico and southern California, the long-petioled obovate

[1] Mem. Am. Acad. i. 483.

basal leaves are coarsely and unequally toothed or even cleft, the slightly broadened bases usually fimbriate; the lower cauline leaves are oblanceolate, shorter-petioled, with irregular coarse teeth and lacerate broadened bases; the middle and upper cauline are narrowly oblong or narrowly oblanceolate, with irregular teeth, and with deeply lacerate broadened bases, and the very uppermost are linear or almost filiform and greatly reduced in length. With slight variation in the degree of toothing, practically all the American material exhibits these general tendencies of the foliage, though, as would be expected, the plants vary extremely in size and development according to the nature of the soil in which they have grown.

In July, 1902, however, while visiting the shores of the Baie des Chaleurs in the County of Bonaventure, Quebec, Mr. Emile F. Williams and the writer noticed that the Daisy of that district had leaves of quite different outline from those with which we were familiar in New England. The long-petioled spatulate-obovate basal leaves were closely and almost regularly crenate, the petioles with slightly broadened rarely fimbriate bases; the lower cauline shorter-petioled broadly spatulate leaves had regularly crenate or dentate blades, entire broad petiolar portions and somewhat coarsely toothed bases, the middle and upper cauline were oblong or broadly oblanceolate, with coarse subascending teeth much shorter than in the New England plant.

A study of this chrysanthemum from the Bonaventure region shows it to be quite identical with the European material in the Gray Herbarium passed by Nees von Esenbeck, Schultz Bipontinus, Klatt, and other eminent European students of the Compositae as typical *Chrysanthemum Leucanthemum*, L. (*Leucanthemum vulgare*, Lam., *Tanacetum Leucanthemum*, Schz. Bip.). The specimens further match such representative plates of the European *Chrysanthemum Leucanthemum* as those of Reichenbach (Icones Florae Germanicae, xvi. t. 97, fig. 1) and Thomé (Flora von Deutschland, iv. t. 584). This broad-leaved plant, the common *Chrysanthemum Leucanthemum* of Europe, is apparently little known in America. Besides the plant collected in Bonaventure, Quebec, the only American material seen by the writer is an uncharacteristic sheet from St. John's, Newfoundland, and two individuals which have recently appeared in a lawn on the estate of Oakes Ames, at North Easton, Massachusetts.

In attempting to identify the plant which abounds in fields so gen-

erally through the eastern United States and southern Canada much difficulty has been encountered. Careful search through European literature has shown that *Chrysanthemum Leucanthemum* is there regarded as a species very variable in its foliage, but in only one flora has the form so generally established in America been clearly defined. Lamarck & De Candolle in their Flore Française divided *C. Leucanthemum* into six varieties; and of these var. "γ. *foliis semi-pinnatifidis*" with the further note that "la variété γ a les feuilles toutes découpées et presque pinnatifides,"[1] seems to be the plant so generally established in America. In the Gray Herbarium two French specimens, one cultivated in 1832 in the Luxembourg Garden, the other from the fields of Arenthon, Haute-Savoie, labeled "V. à feuilles pinnatifides," are quite like the common American plant; but these, as indicated by their labels, were collected in France as noteworthy variations. An old English specimen, collected in 1838 by John Ball in Westmoreland, departs considerably from the typical form of *C. Leucanthemum* as recognized by Nees, Schultz, Klatt, Blytt, and others, as does the plate in Sowerby's English Botany (ix. t. 601) showing that in England as well as France an extreme form very like the American tendency of the plant occurs.

In order further to verify the conclusions to which the study of these plants was leading, the writer sent specimens from Vermont of the characteristic American form and from New Carlisle, Quebec, of the Baie des Chaleurs plant, to Dr. Max Gürke, Custodian of the Royal Botanical Museum at Berlin, whose continuation of Richter's Plantae Europeae is setting so high a standard of scholarship in the preparation of botanical check-lists. In response to the letter accompanying these specimens, Dr. Gürke says under date of May 25, 1903:

"Chrysanthemum Leucanthemum ist in Mitteleuropa ausserordentlich variabel in Bezug auf die Blattform, und viele Autoren erwähnen dies auch in ihren Beschreibungen. So sagt, um nur ein Beispiel anzuführen, *Döll* in seiner Flora von Baden p. 920: 'Untere Blätter gestielt, verkehrt-eiförmig, kerbig-gezähnt; die stengelständigen sitzend, halb-stengelumfassend, länglich-lineal, gesägt. Variirt mit eingeschnittenen, selbst fast fiederspaltigen Blättern, mit fast ebensträussigem Blütenstand und mit einem durch stärkere Behaarung graulich-weissem Stengel.'

"Soweit ich aus der Litteratur ersehen habe, führt aber kein Autor Varietäten in Bezug auf die Blattform mit *besonderem Namen* an, und

[1] Lam. & DC. Fl. Fr. iv. 178 (1805).

ich habe mich auch an dem im Berliner Herbarium aufbewahrten Material überzeugt, dass es schwer sein würde, aus der langen Reihe von Blattformen, deren Endglieder die von Ihnen gesandten zwei Exemplare darstellen, bestimmte Typen herauszugreifen.

"Es scheint, als ob in der Verbreitung der Formen ein Unterschied zwischen Amerika und Europa vorhanden ist. In Mitteleuropa ist entschieden die Form mit spatelförmigen oder länglich-lanzettlichen, gesägten Blättern, also die Form, welche Sie mir von Quebec gesandt haben, entschieden bei weitem *häufiger*, und kann bei uns wohl als Typus der Art betrachtet werden, während die Form mit schmäleren, eingeschnittenen oder fiederspaltigen Blättern, d. h. also die Form, welche gleich ist der Greenman'schen Pflanze von Vermont, *seltener* ist. Eine gesonderte geographische Verbreitung dieser beiden extremen Formen habe ich aus dem mir vorliegenden Material nicht ersehen können."

Thus, from these observations of Dr. Gürke it appears, as had already seemed probable from the material in the Gray Herbarium, that the extreme form of *Chrysanthemum Leucanthemum* found on the Baie des Chaleurs is the abundant form in central Europe and may be considered the type of the species; while the form ordinarily abundant in America is rare in Europe, where, however, it does not differ in geographic range from the typical plant, and though noted by various authors has received no distinctive name. In America, on the other hand, the variety with narrower more deeply and sharply toothed leaves is so widely distributed and has so uniformly held its distinctive features that it seems worthy special recognition. The two extremes of the plant, whose essential differences of foliage are well brought out in the accompanying drawings prepared by Mr. F. Schuyler Mathews, are quickly distinguished as follows.



Fig. 1.

Chrysanthemum Leucanthemum, L. (Fig. 1.) Basal leaves spatulate-obovate, on slender elongate petioles, the blades crenate-dentate, the slightly broadened petiole-bases rarely fimbriate; lower cauline leaves on shorter broader petioles, with slightly pinnatifid or laciniate bases; middle and upper leaves oblong or broadly oblanceolate, coarsely and regularly short-crenate or -dentate above, with somewhat larger teeth at base.—Common in Europe. In America, established in fields, Bonaventure Co., Quebec, and at St. John's, Newfoundland (*Robinson & Schrenk*); locally as a lawn-weed, North Easton, Massachusetts, and to be expected elsewhere.

Var. **subpinnatifidum**. (Fig. 2.) Basal leaves coarsely and irregularly toothed or lobed, often with the petioles fimbriate at base; lower cauline oblanceolate or narrowly spatulate, subpinnatifid, often even along the petioles, with sharp or bluntish simple or serrate irregular teeth, and with lacerate bases; middle and upper cauline narrowly oblong or narrowly oblanceolate, similarly subpinnatifid.—*C. Leucanthemum*, γ. *Foliis semipinnatifidis*, Lam. & DC. Fl. Fr. iv. 178 (1805).—Abundant in fields and meadows in eastern United States and Canada, and locally westward to the Pacific, apparently introduced from Europe, where it is rare. Represented by very many specimens, among them the following numbered ones from America: Nova Scotia, Yarmouth, June, 1901 (*Howe & Lang*, no. 94); New Hampshire, Jaffrey, July 4, 1897 (*Robinson*, no. 123); Vermont, Manchester, June 24, 1898 (*M. A. Day*, no. 97); Massachusetts, Nantucket, May 29, 1900 (*M. A. Day*, no. 112); Connecticut, Southington, June 10, 1898 (*L. Andrews*, no. 23); Utah, Wahsatch Mts., Aug. 14, 1879 (*Jones*, no. 1266); California, Sta. Cruz, 1860–62 (*Brewer*, no. 814): and from France, Jardin du Luxembourg, June, 1832 (Herb. *J. Gay*); Arenthon, Haute-Savoie, May, 1862 (Herb. *Joad*).



Fig. 2.

Gray Herbarium.

RECENTLY RECOGNIZED SPECIES OF CRATAEGUS IN EASTERN CANADA AND NEW ENGLAND,—V.

C. S. Sargent.

§ Tomentosae

Anthers pink or rose color.

* Stamens 10 or less.

Crataegus fertilis, n. sp. Leaves oval to obovate, acuminate, gradually narrowed from near the middle and concave-cuneate at the entire base, sharply doubly serrate above, with straight teeth tipped with minute glands, and slightly divided above the middle into numerous narrow acuminate lobes; nearly fully grown when the flowers open and then membranaceous, sparingly villose, dark yellow-green above, pale below; at maturity thin but firm in texture, glabrous, dark green and lustrous on the upper surface, pale yellow-green on the lower surface, 7–9 cm. long, 5–6 cm. wide, with slender yellow midribs and 5–7 pairs of primary veins deeply impressed above; petioles slender, grooved, more or less broadly wing-margined often nearly to the middle by the decurrent base of the leaf blades, 1.5–2.5 cm. in length; stipules linear, acuminate, minute, caducous. Flowers about 1.6 cm. in diameter on long slender pedicels, in broad thin-branched many-flowered compound villose corymbs; bracts and bractlets linear, glandular, small, mostly deciduous before the flowers open; calyx-tube broadly obconic, villose at the base, glabrous above, the lobes broad, acuminate, coarsely glandular-serrate, villose on the inner surface, reflexed after anthesis; stamens 8–13, usually 10; anthers rose color; styles 2 or 3. Fruit on stout slightly villose pedicels, in wide many-fruited slightly drooping clusters, subglobose, short-oblong or rarely ovate, dark red, very lustrous, marked by few small pale dots, about 1 cm. long; calyx prominent with a broad deep cavity and enlarged coarsely serrate lobes villose on the upper side, erect and incurved, mostly persistent; flesh yellow, thick and succulent; nutlets 2 or 3, about 7 mm. in length, thick, full and rounded at the ends, ridged on the back, with a broad deeply grooved ridge, the ventral cavities broad and deep.

A shrub with numerous stems 3 or 4 m. in height and slender slightly zigzag branchlets marked by few large pale lenticels, orange-green when they first appear, soon becoming chestnut-brown and lustrous, darker during their second year and ultimately ashy gray, and armed with stout nearly straight bright red-brown spines 3.5–8.5 cm. in length. Flowers early in June. Fruit ripens about the 20th of September.

Maine: middle Penobscot valley, river banks in rich alluvial soil, Orono, *M. L. Fernald*, May, June and September 1901.

To be distinguished from the closely related *Crataegus succulenta*, Link, by its thinner leaves, larger flowers, fewer stamens, erect calyx-lobes of the fruit, and usually stouter spines.

Crataegus dumicola, n. sp. Leaves oval to obovate, rounded and short-pointed or acute at the apex, concave-cuneate or rounded at the entire base, coarsely doubly serrate above, with glandular teeth, and slightly divided into numerous small acuminate lateral lobes; tinged with red and coated above with pale hairs as they unfold, more than half grown when the flowers open and then thin, dull yellow-green and sparingly villose on the upper surface, pale and glabrous on the lower surface; at maturity thin but firm in texture, dark yellow-green, lustrous, and scabrate above, pale below, 6–7 cm. long, 4–4.5 cm. wide, with slender yellow midribs and 4 or 5 pairs of thin primary veins arching obliquely to the points of the lobes; petioles stout, wing-margined often to the middle, villose at first, glabrous in the autumn, 9–14 mm. in length; stipules linear, acuminate, sometimes falcate, glandular, small, caducous. Flowers about 1.5 cm. in diameter on long slender slightly villose pedicels, in broad many-flowered thin-branched usually glabrous compound corymbs; bracts and bractlets linear, slightly glandular, small, mostly deciduous before the flowers open; calyx-tube broadly obconic, glabrous, the lobes abruptly narrowed from the base, slender, acuminate, finely glandular-serrate, villose on the inner surface, reflexed after anthesis; stamens 7–10, usually 8; anthers pink; styles 3. Fruit on rigid glabrous pedicels, in erect few-fruited clusters, subglobose, dark red marked by many small pale dots, about 1 cm. in diameter; calyx small, sessile, with a narrow shallow cavity and spreading lobes generally deciduous from the ripe fruit; flesh very thin and dry; nutlets 3, about 8 mm. in length, broad, rounded at the ends, ridged on the back, with a broad rounded ridge, the ventral cavities shallow, irregular, often obscure.

A shrub 2–3 m. in height with many small nearly erect branches, and stout nearly straight branchlets marked by few oblong pale lenticels, dark orange-green when they appear, orange-red and lustrous during the first season, becoming light red-brown the following year and ultimately ashy gray, and armed with stout nearly straight bright chestnut-brown shining spines 3.5–7 cm. long. Flowers during the first week of June. Fruit ripens about the middle of September and mostly falls before the end of the month.

Maine: river thickets, Fort Fairfield, at the mouth of the Aroostook, *M. L. Fernald*, June and September 1901.

Crataegus rhombifolia, n. sp. Leaves broadly rhombic to obovate or rarely ovate on leading shoots, acute or acuminate, gradu-

ally narrowed to the entire base, coarsely and doubly serrate above, with straight glandular teeth, and slightly divided above the middle into many narrow acuminate lobes; nearly fully grown when the flowers open and then membranaceous, roughened above by short rigid pale hairs and slightly villose below along the slender yellow midribs and primary veins; at maturity thin but firm in texture, dull dark green and scabrate on the upper surface, pale yellow-green and still slightly villose on the lower surface, 6–7 cm. long, about 5 cm. wide; petioles stout, more or less wing-margined above, slightly villose, about 1.5 cm. in length. Flowers 1.2 cm. in diameter on long slender villose pedicels, in compact thin-branched many-flowered hairy compound corymbs; bracts and bractlets linear, acuminate, glandular, mostly caducous before the flowers open; calyx-tube narrowly obconic, villose at the base, glabrous above, the lobes broad, acuminate, very coarsely glandular-serrate often only above the middle, villose on the inner surface, reflexed after anthesis; stamens 10; anthers purple; styles 2 or 3. Fruit on erect rigid slightly villose pedicels, in few-fruited clusters, subglobose, often hairy at the base, bright clear red, lustrous, 8 or 9 mm. in diameter; calyx enlarged, with a wide shallow cavity and broad coarsely serrate spreading and closely appressed lobes densely coated above with long white hairs; flesh thin, yellow, dry and mealy; nutlets 3, 7 mm. long, full and rounded at the ends, thick, slightly ridged on the back, with a broad low ridge, the ventral cavities short, deep and narrow.

A shrub 1–2 m. in height with slender nearly straight branchlets bright orange-colored when they first appear, becoming bright chestnut-brown and lustrous during their first season and light red-brown the following year, and armed with many stout straight chestnut-brown shining spines 2.5–3 cm. in diameter. Flowers during the first week of June. Fruit brightly colored and full grown by the middle of August, ripening a month later.

CONNECTICUT: rare; sandy terrace near Trading Cove, Norwich, *C. B. Graves*, August 23, 1900, June 4, 1901; Southington, *C. H. Bissell*, June and September 1901.

Crataegus Robinsoni, n. sp. Leaves obovate, acute or acuminate, gradually narrowed from above the middle and cuneate at the entire base, finely and often doubly serrate above, with straight or incurved teeth tipped with bright red glands, and slightly divided into 3 or 4 pairs of short acute lateral lobes; when they unfold conspicuously plicate, light yellow-green and covered above with short shining white hairs and glabrous below, about one-third grown when the flowers open, and at maturity thin and firm in texture, dark yellow-green and lustrous on the upper surface, paler on the lower surface, about 4.5 cm. long, 3–4 cm. wide, with very slender midribs and thin primary veins extending obliquely to the points of the lobes; petioles

slender, grooved, more or less wing-margined toward the apex, glandular with minute dark red glands, 1.5–1.8 cm. in length. Flowers 8–10 mm. in diameter on short slender pedicels, in compact mostly 6–7-flowered thin-branched sparingly villose compound corymbs: bracts and bractlet linear, acuminate, bright red, mostly deciduous before the opening of the flowers; calyx-tube narrowly obconic, light green, the lobes narrow, red at the acuminate apex, tipped with bright red glands, finely serrate or nearly entire, pubescent on the inner face, reflexed after anthesis; stamens 5–7, usually 5; anthers large, magenta; style 2–4, usually 3. Fruit on bright red elongated glabrous pedicels in drooping clusters, oblong to slightly obovate, full and rounded at the apex, gradually narrowed to the base, bright scarlet, lustrous, marked by occasional large dark dots, about 1 cm. long, 7–8 mm. wide; calyx prominent, with a short tube, a broad deep cavity and reflexed and closely appressed lobes pubescent on the upper surface, usually persistent; nutlets generally 3, thin, acute at the ends, prominently ridged on the back with a broad often grooved ridge, the ventral pits broad but shallow, about 6 mm. in length.

A shrub or small tree sometimes 3 m. in height with a slender stem occasionally 1 dm. in diameter, covered with ashy gray bark scaly toward the base, slender erect branches and thin nearly straight branchlets marked by a few large pale lenticels, light orange-green when they first appear, bright red or red-brown and lustrous during their first and dark gray-brown during their second year, and unarmed or sparingly armed with short stout light chestnut-brown shining spines. Flowers during the first week of June. Fruit ripens early in October.

Nova Scotia: Lock Broom, near Pictou, *Isabelle McCabe*, June and October 1902; Rustico, Pictou County, *C. B. Robinson* and *Florence Scott*, June 1902.

One of the most distinct of all the species belonging to this difficult group and well characterized by its small thin nearly glabrous leaves with very slender midribs and veins, small flowers with few stamens, oblong or obovate fruits, and by the unusually shallow cavity on the ventral faces of the nutlets. Received with numerous other forms of northern Nova Scotia from Mr C. B. Robinson, Science Master of the Pictou Academy for whom it is named.

Crataegus aquilonaris, n. sp. Leaves ovate to oval, acuminate, broadly cuneate or rounded at the entire often oblique base, sharply and often doubly glandular-serrate, and slightly divided into numerous short broad acuminate lobes; nearly fully grown when the flowers open and then light yellow-green and covered with short lustrous

white hairs on the upper surface and pale and glabrous on the lower surface; at maturity membranaceous, dark yellow-green and scabrate above, pale below, 5–6 cm. long, 3.5–4 cm. wide, with thin yellow midribs and primary veins; petioles slender, more or less wing-margined at the apex, grooved, glandular at first, with minute deciduous glands, often rose-colored in the autumn, 1.5–2 cm. in length; stipules linear, acuminate, often falcate, glandular, caducous; on vigorous shoots leaves long-pointed, coarsely serrate, subcoriaceous, often 8 cm. long and 6 cm. wide, with thick rose-colored midribs and stout petioles broadly winged to below the middle, and lunate coarsely serrate persistent stipules. Flowers on short pedicels in slightly villose many-flowered compound corymbs, with long 3-flowered peduncles from the axils of the two upper leaves; calyx-tube narrow, elongated, slightly villose below the middle, the lobes long, slender, acuminate, tipped with bright red glands, finely glandular-serrate, villose on the inner surface, reflexed after anthesis: stamens 5–10, usually 5; anthers purple; styles 2 or 3. Fruit on slender glabrous or slightly villose pedicels, in few-fruited drooping clusters, oblong, gradually narrowed to the rounded ends, dull greenish red, not fully ripe the middle of September, 1 cm. long, about 8 mm. wide; calyx small, with a narrow shallow cavity and spreading closely appressed nearly entire lobes, villose above the middle and dark red toward the base on the upper side; flesh greenish yellow; nutlets 2 or 3, about 8 mm. long, full and rounded at the ends, ridged on the back, with a very broad high slightly grooved ridge, the ventral cavities broad but shallow, oblique, widening from the base of the nutlet upward to its margins.

A shrub 2 or 3 m. in height with upright stems and stout nearly straight branchlets marked by small pale lenticels, light orange green when they first appear, orange or reddish brown and lustrous during their first season and dull gray-brown the following year, and armed with stout slightly curved or straight bright chestnut-brown shining spines 2–3.5 cm. in length. Flowers from the 10th to the middle of June. Fruit probably ripens toward the end of September.

Province of Ontario: Nipissing; not common and the only species reported, *Milton Jack*, June 15 and September 18, 1902.

Very distinct in the shape and thinness of the leaves, in the oblong fruits and in the short stout spines.

* * Stamens 20.

Crataegus membranacea, n. sp. Leaves elliptical to obovate, or rarely ovate, acute or acuminate, cuneate or occasionally rounded at the entire often oblique base, coarsely doubly serrate above, with straight glandular teeth, and divided into 4 or 5 pairs of short acumi-

nate lateral lobes; more than half grown when the flowers open and then very thin, light yellow-green and roughened above by short rigid white hairs, pale and glabrous below with the exception of a few hairs along the base of the midribs; at maturity membranaceous, yellow-green, lustrous and scabrate on the upper surface, pale on the lower surface, 6–7.5 cm. long, 4–6 cm. wide, with slender midribs and 4 or 5 pairs of thin primary veins extending obliquely to the points of the lobes; petioles slender, grooved, mostly wing-margined to below the middle, sparingly glandular, with minute red deciduous glands, often rose-colored late in the season like the under side of the midribs, 1.2–1.6 cm. in length. Flowers 1.8–2 cm. in diameter on long slender pedicels, in broad many-flowered thin-branched slightly villose compound corymbs; bracts and bractlets acuminate, bright red, small, mostly deciduous before the flowers open; calyx-tube broadly obconic, glabrous, the lobes wide, acuminate, conspicuously glandular-serrate, villose on the inner face, reflexed after anthesis; stamens 20; anthers pale rose-color; styles 3–5, usually 3. Fruit on slender glabrous pedicels, in few-fruited spreading clusters, oblong, full and rounded at the ends, 1–1.1 cm. long, 9–10 mm. wide, crimson, lustrous, marked by few large pale dots; calyx prominent with a broad deep cavity and spreading closely appressed coarsely glandular-serrate lobes, villose and bright red at the base on the upper side; flesh yellow, thick and succulent; nutlets usually 3, about 7 mm. in length, rounded at the ends, broad, ridged, the ventral cavities wide and deep.

A tall shrub, rarely arborescent in habit with a short stem 7 or 8 cm. in diameter, and slender nearly straight or slightly zigzag branchlets marked by small pale lenticels, glabrous and light orange-green when they first appear, light red-brown and lustrous during their first season, becoming dark gray-brown the following year and armed with slender nearly straight light chestnut-brown shining spines 2.5–4 cm. in length. Flowers at the very end of May. Fruit ripens the middle of September and soon falls.

VERMONT: clay soil on lime stone ridges, Middlebury, *Ezra Brainerd*, September 1900, May and September 1901.

Well distinguished from the other species of this group with 20 stamens, by its very thin mostly elliptical leaves, larger flowers and early-ripening fruits with usually three nutlets.

ARNOLD ARBORETUM.

PRELIMINARY LISTS OF NEW ENGLAND PLANTS,— XII.[1]

B. L. ROBINSON.

[The sign + indicates that an herbarium specimen has been seen; the sign — that a printed record has been found.]

	Me.	N. H.	Vt.	Mass.	R. I.	Conn.
ERIOCAULACEAE.						
Eriocaulon septangulare, With.	+	+	+	+	+	+
PHYTOLACCACEAE.						
Phytolacca decandra, L.	+	+	+	+	+	+
AIZOACEAE.						
Mollugo verticillata, L.	+	+	+	+	+	+
PORTULACACEAE.						
Claytonia caroliniana, Michx.	+	+	+	+	+	+
" virginica, L.	+	—	+	—	+	+
Montia fontana, L.	+	+	+	+	+	+
Portulaca oleracea, L.	+	+	+	+	+	+
CARYOPHYLLACEAE.						
Agrostemma Githago, L.	+	+	+	+	+	+
Arenaria groenlandica, Spreng.	+	+	+	—	+	+
" lateriflora, L.	+	+	+	+	+	+
" leptoclados, Guss.	+					
" macrophylla, Hook.			+			
" peploides, L.	+	+		+	+	+
" serpyllifolia, L.	—	+	+	+	+	+
" stricta, Michx.		+	+	+		+

[1] Printed in RHODORA as supplementary material.

	Me.	N. H.	Vt.	Mass.	R. I.	Conn.
Arenaria verna, L., var. hirta, Wats.			+			
Cerastium arvense, L.	+	+	+	+	+	+
" nutans, Raf.			+			+
" semidecandrum, L.						+
" viscosum, L.				—	+	—
" vulgatum, L.	+	+	+	+	+	+
Dianthus Armeria, L.	—		+	+	+	+
" barbatus, L.	+		+	+		+
" deltoides, L.	+	+	+	+		+
Gypsophila muralis, L.	+	+		+	+	+
Lychnis alba, Mill. (*L. vespertina*, Sibth.)	+		+	+	+	+
" chalcedonica, L.	+	+	+	+		+
" Coronaria, Desr.	—		+			+
" dioica, L. (*L. diurna*, Sibth.)	+	+	+	+	+	+
" Flos-cuculi, L.	+			+	+	+
Sagina decumbens, Torr. & Gray			+	+		+
" nodosa, Fenzl	+					
" " var. pubescens, Koch	+			+		
" procumbens, L.	+	+	+	+	+	+
Saponaria officinalis, L.	+	+	+	+	+	+
" Vaccaria, L.	+		+	+	+	+
Silene acaulis L.		+				
" antirrhina, L.	+	+	+	+	+	+
" " var. divaricata, Robinson				+	+	
" Armeria, L.	+	+	+	+	+	+
" Cucubalus, Wibel	+	+	+	+	+	+
" dichotoma, Ehrh.	+	+		+		+
" gallica, L.	+			+		
" nivea, Muhl.	+					
" noctiflora, L.	+	—	+	+	+	+
" nutans, L.	+					
" pendula, L.	+					
" pennsylvanica, Michx.	—	—		+	+	+
" stellata, Ait.					+	+
Spergula arvensis, L.	+	+	+	+	+	+
Spergularia borealis, Robinson	+	+		+	+	
" rubra, J. & C. Presl	+	+	+	+	+	+
" salina, J. & C. Presl	+	+		+	+	+
Stellaria aquatica, Scop.				+		
" borealis, Bigel.	+	+	+	+	+	+
" graminea, L.	+	+	+	+	+	+
" Holostea, L.	+					
" humifusa, Rottb.	+					
" longifolia, Muhl.	+	+	+	+	+	+

	Me.	N. H.	Vt.	Mass.	R. I.	Conn.
Stellaria longipes, Goldie	+	+		+		
" media, Cyrill.	+	+	+	+	+	+
" uliginosa, Murr.	+	+	+	+		

ILLECEBRACEAE.

	Me.	N. H.	Vt.	Mass.	R. I.	Conn.
Anychia capillacea, DC.		+	+	+	+	+
" dichotoma, Michx.		—		+	—	+
Corrigiola littoralis, L.				+		
Paronychia argyrocoma, Nutt.	+	+		+		
Scleranthus annuus, L.	+	+		+	+	+

SARRACENIACEAE.

	Me.	N. H.	Vt.	Mass.	R. I.	Conn.
SARRACENIA PURPUREA, L.	+	+	+	+	+	+

NOTES ON THE ABOVE LIST.—A few apparently erroneous reports have been purposely omitted. Of those which are included several seem open to considerable doubt. Thus, I suspect that the plant reported as *Anychia dichotoma*, Michx. in New Hampshire and Rhode Island has been *A. capillacea*, DC., although there is a considerable likelihood that *A. dichotoma* will sooner or later be found in these two states.

A broad-leaved form of *Stellaria graminea*, L., the var. *lanceolata* of Fenzl, has been found at several stations in New England, but appears to be only a form or perhaps merely a luxuriant state of the typical plant.

Portulaca grandiflora, Hook. (*P. pilosa*, Dame & Collins, not L.) has been reported both from Massachusetts and Connecticut, but is too casual in its occurrence or too obviously a relic of cultivation to be regarded as a part of our flora.

Repeated efforts to verify reports of *Sagina apetala*, L., have led to the conclusion that that species does not occur in New England and that plants hitherto referred to it from this region belong to *S. decumbens*, Torr. & Gray, or to *S. procumbens*, L.

The sole basis for the report *Stellaria aquatica*, Scop. in New

England is a single but unmistakable specimen collected near the Boston & Albany Railway at Newtonville, Mass., July 28, 1881, by C. J. Sprague. It is very doubtful if this species has persisted in our flora.

Some further notes regarding the plants of this list will be published in the August number of RHODORA.

GRAY HERBARIUM.

HENRY GRISWOLD JESUP.— It is with deep regret that botanists will learn of the death at Hanover, New Hampshire, on June 15th, of Henry Griswold Jesup, for twenty-two years professor of botany at Dartmouth College and since 1899 emeritus. Professor Jesup was one of three noted botanists who graduated from Yale College in the class of 1847, the others being the late Sereno Watson, for many years curator of the Gray Herbarium, and Mr. John Donnell Smith of Baltimore, well known for his extensive and critical work upon the flora of Central America. Professor Jesup's botanical work was chiefly systematic and devoted to the local flora of the region about Amherst, Massachusetts, and later in the vicinity of Dartmouth College. His most important publication was his Catalogue of the Flowering Plants and Higher Cryptogams, both native and introduced, found within thirty miles of Hanover, New Hampshire; issued in 1891, after some preliminary publications upon the same subject.

In his teaching his gentle and kindly nature, combined with his obvious affection for his subject, has left for him a deep and lasting regard in the minds of his many students. Among those who enjoyed his instruction and who have since become known for their professional or amateur work in botany are Professor F. O. Grover of Oberlin College, Mr. W. W. Eggleston, an energetic collaborator on the recent and admirable Vermont catalogue, and Mr. H. E. Sargent.

Two plants, *Astragalus Robbinsii*, var. *Jesupi*, Eggleston & Sheldon, and *Crataegus Jesupi*, Sargent, have been named in Professor Jesup's honor. His herbarium has been permanently deposited at Dartmouth College, and is now in charge of his successor, Professor George R. Lyman.

A SECOND STATION FOR CYPERUS HOUGHTONI IN VERMONT.— While driving in Cholchester, Vermont, in October, 1901, at a place where the road passes through a piece of dry shifting sand, I noticed

a Cyperus which seemed different from the common species of this vicinity. It was past its prime, dead ripe in fact, and I was not able to name it to my satisfaction but called it provisionally *C. Schweinitzii*, Torr. This winter President Ezra Brainerd identified it as *C. Houghtoni*, Torr., a species which appears to have been found only once before in this state, namely at Fairlee Lake by Professor Jesup. I also collected it at Keeseville, New York, in September, 1900, which must likewise be a new station, as the range of the species in Britton and Brown's Illustrated Flora is Massachusetts to Minnesota, Kansas and Oregon. The two stations here recorded are almost opposite each other, the one on the eastern and the other on the western shore of Lake Champlain, and about the same distance back from the lake shore.— NELLIE F. FLYNN, Burlington, Vermont.

CLEMATIS VERTICILLARIS IN THE MIDDLESEX FELLS. — On May 20, 1902, and again on May 13, 1903, I found in Middlesex Fells *Clematis verticillaris*, DC. growing on the ledges around Pine hill. This species is not mentioned in Dame and Collins' *Flora of Middlesex County*, nor in the catalogue of plants of the Middlesex Fells published by the Metropolitan Park Commission. It is growing over a space of fully 250 sq. ft. In 1902 when a specimen was shown to Dr. Dame he recalled having a single plant brought to him by a pupil when he was making his catalogue, but he could not find the species himself in the locality described and therefore did not put it into his list. The large number of plants now growing there seems to indicate that it has been established a long time, and the specimen he then had probably came from this place. Dr. Dame's remembrance of the locality described to him more than fifteen years ago agrees with the present place of growth. — ROBERT DILLINGHAM MORSS, West Medford, Massachusetts.

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THE AMERICAN REPRESENTATIVES OF LUZULA VERNALIS.

M. L. Fernald.

One of the earliest flowering plants of New England is the Wood Rush which is known in our current manuals as *Luzula vernalis* or *Juncoides pilosum*. The plant abounds in rich woods, mountain ravines and gullys, and in recent clearings in the interior districts of New England, New York and Eastern Canada, though it closely approaches the coast only in the northern portion of its range. And on account of its early flowering, in April and May, the species is familiar to many who later in the season devote little attention to the *Juncaceae*.

Since the days of Muhlenberg,[1] the American plant has been generally maintained as identical with the European species *Luzula vernalis*, Lamarck & DeCandolle (*L. pilosa*, Willd., *Juncus vernalis*, Reichard, *J. pilosus*, var. *a*, L.), yet that remarkable student of our northern vegetation, Sir William Hooker, noted in 1839 that the American plant differs from the European, and he designated it as *Luzula pilosa*, *β*, with "floribus pallidis."[2] Again, in 1890, Professor Franz Buchenau, though treating the American and European plants as essentially the same, commented on the tendency of the American plant to produce elongate stolons: "Bei den Exemplaren aus Nordamerika sah ich wiederholt eine ausläuferartige Streckung der grunständigen Triebe. Es bleibt zu beachten, ob dies in der neuen Welt häufiger vorkommt als in der alten."[3] These two features, paler flowers and more elongate or stoloniferous base, are usually evident in the American plant, but they are accompanied by

[1] Muhl. Gram. 200 (1817). [2] Hook. Fl. Bor. Am. ii. 188 (1839).
[3] Buchenau, Mon. Junc. 85— Engl. Bot. Jahrb. xii. 85 (1890).

other and more significant characters which separate the New World material very readily from the European.

If we examine specimens or good plates [1] of the European *Luzula vernalis* (*L. pilosa*) we shall see that the plant is caespitose but scarcely if at all stoloniferous. The inflorescence is umbelliform, but most of the unequal elongate stiff peduncles are terminated by small cymes, the lateral branchlets or pedicels being strongly divergent. The sepals and petals are firm and lucid, deep brown or castaneous, with paler margins. The lucid (as if varnished) capsule is conic-globose at base, blunt or subtruncate with a short mucro at tip.

The American plant which has oftenest passed as *Luzula vernalis* is loosely caespitose with slender elongate and freely branching rootstock. Its umbelliform inflorescence is usually quite simple, though a few of the filiform flexuous peduncles are sometimes anthelate, bearing 2 (or very rarely 3) remote flowers toward their tips. The sepals and petals are softer and duller, usually pale brown with white margins. The slightly lucid or dull capsule is broadly conic-ovoid, tapering gradually to the tip. In fact, the plant so characteristic of rich woods in the Appalachian district and the interior forested region of North America has little in common with *Luzula vernalis* of Europe. It is not, however, strictly confined to eastern America, but like many other species with which it is associated, this plant reappears in northeastern Asia.

In his discussion of *Luzula plumosa*, Meyer, a Central Asian species resembling *L. vernalis* (*L. pilosa*), Professor Buchenau says: "echte *L. pilosa* aus Ostasien sah ich noch nicht; vielleicht gehört aber doch dahin die von der Amerikanischen Pacific-Expedition (1853–56) bei Petropaulowsk in Kamschatka gesammelte Pflanze." [2] The Kamtschatkan plant referred to by Professor Buchenau was collected by Charles Wright, and the material in the Gray Herbarium matches exactly in stolons, inflorescence, flower and capsule the plant of eastern America.

This American and Kamtschatkan plant so long confused with the European *Luzula vernalis* is quite as unlike other recognized species of the subgenus *Pterodes*, although by Dr. J. K. Small it has been considered [3] the same as *Luzula Carolinae*, Watson.[4] *L. Caro-*

[1] For example: Flora Danica, iii. t. 441 (1770); Sowerby, Engl. Bot. xi. t. 736 (1800); Host, Gram. iii. t. 100 (1805); or Syme, Engl. Bot. x. t. 1548 (1873).

[2] Buchenau, l. c. 86. [3] Torreya, i. 74 (1901). [4] Proc. Am. Acad. xiv. 302 (1879).

linae is a little known plant of the Carolina Mountains. It was based on an over ripe specimen from Grandfather Mountain, and again collected at Biltmore (Bilt. Herb. no. 1185b distributed as *L. pilosa*); and though the species is reduced by Dr. Small to *L. pilosa* (*Juncoides pilosum*), the two sheets of it in the Gray Herbarium show a plant with the cauline leaves 5 to 13 cm. long, the dark flowers on loose anthelate peduncles, the filaments nearly as long as the anthers, and the valves of the old capsules much narrower than in the common American plant and quite unlike those of the European *L. vernalis* (*L. pilosa*). *L. Carolinae* is more nearly related to the Asiatic *L. plumosa*, Meyer. From that species, however, it is distinguished by its broader longer leaves and more flexuous peduncles; and from the material at hand it seems to be a local species of the Carolina Mountains. The widely distributed American plant which has been associated with it and more generally with the European *L. vernalis* (*L. pilosa*) is here proposed as

LUZULA **saltuensis**. Loosely caespitose, with elongate slender branching rootstocks: stems erect, smooth, terete, 1 to 4 dm. high: basal leaves lance-linear, flat, loosely hairy or glabrate, 1 to 2.5 dm. long, 4 to 12 mm. broad: the 2 to 4 stem-leaves 1.5 to 4.5 cm. long, lanceolate, with thick blunt callous tips: inflorescence umbelliform, subtended by a short leaf like bract; the 5 to 15 filiform somewhat unequal loosely spreading or flexuous peduncles in anthesis 0.5 to 1 cm. long, in fruit becoming 1.5 to 3 cm. long, usually 1-flowered, rarely with 2 or 3 remote flowers: flowers 3 to 4 mm. long; prophylla ovate, whitish, translucent, erose: sepals and petals firm, subequal, triangular-lanceolate, attenuate, brown with pale translucent narrow margins: stamens 6, one-half or two-thirds as long as the sepals and petals; the linear-oblong anthers many times exceeding the filaments: ovary conic, deeply three lobed; style about equalling the three erect stigmas: capsule broadly conic-ovoid, attenuate, pale, 3.5 to 4.5 mm. long, equalling or exceeding the calyx: seed subglobose, reddish brown or darker, 2 mm. in diameter, terminated by a long pale twisted caruncle.— *L. pilosa*, Muhl. Gram. 200 (1817), and Am. authors, not Willd. *L. pilosa*, β, Hook. Fl. Bor.-Am. ii. 188 (1839). *L. vernalis*, Wats. & Coult. in Gray Man. ed. 6, 546 (1890), not Lam. & DC. *Juncoides pilosum*, Coville, Mem. Torr. Club, v. 108 (1894), not *Juncodes pilosum*, O. Kuntze, Rev. Gen. Pl. ii, 725 (1891). — Rich woods, clearings and banks of streams, Newfoundland to Saskatchewan, south to New York, Michigan, and Minnesota, and in the mountains to Georgia; also Kamtschatka. The following are characteristic specimens. MAINE, Masardis, June 8, 1898, Orono, June 4, 1898 (*M. L. Fernald*, nos. 2510, 2511); Orono, May 14, 1902 (*M. L. Fernald* in *Plantae exsiccatae Grayanae*, no. 85); Somes-

ville, June 23, 1891 (*E. & C. E. Faxon*); Mechanic Falls, May 15, 1897 (*J. A. Allen*); North Berwick, June 8, 1891 (*J. C. Parlin*): NEW HAMPSHIRE, Franconia, June 9, 1887 (*E. & C. E. Faxon*); Barrett Mt., New Ipswich, June 5, 1896 (*M. L. Fernald*); Walpole, May 3, 1901 (*W. H. Blanchard*): VERMONT, Charlotte, May 30, 1892 (*C. G. Pringle & W. W. Eggleston*); Johnson, May 23, 1893, May 2, 1894 (*A. J. Grout*): MASSACHUSETTS, Mt. Wachusett, May 18, 1895 (*J. F. Collins*); Southbridge, May 5, 1899 (*R. M. Harper*); Williamstown, May 29, 1898 (*J. R. Churchill*): CONNECTICUT, Salisbury, June 5, 1901 (*C. H. Bissell*): NEW YORK, Pleasant Valley, Oneida Co., May 21, 1901 (*J. V. Haberer*, no. 962); Rochester, May 21, 1863 (*Wm. Boott*): ONTARIO, Belleville, May 20, 1878 (*J. Macoun*): MICHIGAN, Sand Hills near Detroit, May 7, 1865 (*Wm. Boott*): WISCONSIN, Milwaukee (*I. A. Lapham*): GEORGIA, Clarke Co., March, 1897 (*R. M. Harper*): KAMTSCHATKA, Petropaulovski (*C. Wright*, Herb. U. S. North Pacific Expl. Exped. 1853–56).

GRAY HERBARIUM.

AN HOUR IN A CONNECTICUT SWAMP.

ORRA PARKER PHELPS.

SALISBURY, the town occupying the northwestern corner of Connecticut, seems to be especially rich in species commonly reported further north. At least two articles relating to its flora have appeared in RHODORA within a year. The town presents a diversity of soil, and within its borders may be found lakes, mountains, meadows and cold swamps. It is, perhaps, in the swamps that one may find the greatest treasures. A twenty acre swamp bordering on two tiny lakes and extending to limestone cliffs on the east almost tempts me to accept the challenge of Mr. Rich in RHODORA, iv. 87. But that must wait until another season. Let this article hint at its possibilities. Along the western border of the swamp is a dense wood of pines and hemlocks. In a little opening where the brook comes through is a colony of ostrich ferns, together with many other species more common. A form of *Osmunda cinnamomea* with deeply incised pinnules making a beautiful "freak" is not unusual. On the cliffs to the east the walking fern flourishes. Among the many shrubs, *Rhamnus alnifolia* is abundant and *Taxus Canadensis* clothes the scattered dry hummocks and knolls with its own peculiarly brilliant dark green.

May 26. An hour's trip to the swamp resulted in a number of "finds." Leaving the road near the two ponds I went along the grassy bank between them. Almost immediately I came upon a small colony of *Spiranthes latifolia*. Only one plant was in blossom though the entire colony looked strong and vigorous. This orchid is not common in Connecticut being reported from only three stations. I have since located three other colonies of it.

At the north end of one of the ponds a stranded piece of board attracted my attention and presently I was rewarded for an almost microscopic survey, by finding three tiny plants of *Utricularia minor* in flower and fruit. Much care was needed to separate the filmy seaweed-like plants from the entangling pond drift. One specimen was especially fine, the plant being about $2\frac{1}{2}$ inches long. This Utricularia was new to me. Bishop's list locates it at Hamden and New Haven.

Leaving the ponds I plunged into the swamp. There among the tangle of ferns, skunk cabbage and Tiarella I found a large colony of *Mitella nuda*, L. This species so far as I know, has never been reported from Connecticut. May 19, I had found a small colony of this same species on the other side of the same swamp. Both colonies seemed well established.

The flower is so very tiny and lace-like that it may be easily overlooked. Doubtless a more careful survey of swamps on the northern border of our state would result in its being found in other localities.

Before reaching home I had added three unusual grasses, *Poa debilis*, *Avena striata* and *Oryzopsis asperifolia*, to my collection.

CHAPINVILLE, CONNECTICUT.

A BEAUTIFUL PLUTEOLUS.

H. WEBSTER.

THE species of the genus Pluteolus are so few and of such occasional occurrence that they are not generally known. It is of little avail to search especially for them, a remark applicable to many another toadstool, as collectors know well enough. The rarer species happen under ones eyes quite accidentally, if at all. It was only after some years of experience in the field that the writer made the

acquaintance of the genus, and then through the kindness of a friend, who showed him the delicate pinkish gray *P. coprophilus* Peck growing on a heap of street sweepings by the side of the boulevard in Allston, Massachusetts. A second species, *P. expansus* Peck, appeared near the laboratory of the Alstead School in late July, 1902, and gave material for a few notes.

The genus Pluteolus is closely similar to the more familiar Pluteus. The free gills, fibrous-cartilaginous stem, and absence of veil or ring, make the two genera easy of recognition, and the brown spores of the former quickly distinguish it from the rosy-spored Pluteus.

Pluteolus expansus, Peck, the species observed in Alstead, New Hampshire, is not a good example of the genus. In fact its author[1] placed it originally under Galera. Twenty years later,[2] in a revision of the species of the genus growing in the State of New York, he transferred it to Pluteolus, remarking:

"The species has been removed to this genus because of the viscidity of the pileus, nevertheless it must be confessed that such a feature is scarcely satisfactory for generic distinction." Moreover, the gills, as he also notes, are slightly attached.

Examination of the Alstead specimens showed a stronger reason for this transfer, in the relation of the stipe to the pileus. The substance of the two is plainly not homogeneous, a characteristic emphasized by Fries[3] in establishing for the Pluteoli a separate (sub-) genus.

The Alstead plants showed themselves after rain in grassy ground, near horse droppings. The viscid, greenish yellow caps, elevated on long slender stems, white, tinged with yellow, announced a novelty at first sight. When the plants were fresh and moist the color was charming in its delicacy. As they dried, the greenish tint faded, and gave place at last to grayish yellow or brown. There was scarcely any substance to the caps, except at the centre. They were translucently thin, long and deeply striate, the attenuated margin, from a side view, appearing gracefully arched between the attachments of

[1] Peck: 26th Report of the N. Y. State Museum, p. 58.

[2] ib.: 46th Report, p. 60.

[3] Fries: Hymenomycetes Europaei, p. 266, "Pileus carnosulus, viscidus .... Stipes subcartilagineus, *ab hymenophoro discretus*. Lamellae rotundato-liberae omnino Pluteorum. Ob has notas necesse videtur Pluteolos peculiare subgenus censere, inter Hyporhodios Pluteis analogum."

the yellowish gills. Though apparently smooth when moist, the caps were pruinose, or fibrous-pruinose when dry. The gills, though appearing free, were rounded behind up to a very slight attachment. The brittle stem, long, hollow, and rather thin-walled, was yellow-scurfy below and mealy pruinose above, with obscure striations at the tip. The base, in some specimens, was slightly swollen. In the dried plant the gills became cinnamon color.

The spores, 12 ½ to 15 μ by 7¾ to 9 μ, were broadly elliptical, smooth, very regularly rounded at one end, a little flattened or blunted at the other. In side view they showed a depression on one side, and thus appeared concavo-convex.

In the buttons the pileus was somewhat globular, with straight margins, appressed at first. Later the pileus became hemispherical rather than campanulate, and was finally expanded and upturned, exposing the mature brown gills. The expanded plants were 1 to 1¾ inch broad; the stems were 3 to 4 inches high, and slender, though proportionally thicker than in Galera or Panaeolus.

A plant so delicate as this is soon affected by hot sun. It is seen at its best on a cloudy day, or early in the morning, and is most beautiful when beaded with moisture, that clings in minute globules to the tips of the fibrils on the stem.

Alstead School of Natural History, Alstead Centre, New Hampshire.

SOME NOTES ON MOSSES, WITH EXTENSIONS OF RANGE.

J. Franklin Collins.

Hypnum cordifolium, Hedw. In specimens collected by Dr. R. H. True at North Haven, Maine, Sept. 2, 1900, the alar regions of the leaves of some stems show all gradations from the gradually enlarged cells of typical *H. cordifolium* to forms in which they are abruptly enlarged, making well defined auricles. The leaves of the specimens which exhibit the last mentioned character are often smaller than in the typical plant, otherwise the characters are apparently identical. The peculiarity of having the alar cells more or less abruptly inflated seems to be rather characteristic of certain stems in material which

I have examined from two other localities in Maine; Hebron (*Mrs. Stevens*) and Orono (*Fernald*).

HYPNUM RICHARDSONII, (Mitt.) L. & J. Man. (*Stereodon Richardsonii*, Mitten.) Collected July 16, 1902, in a mixed cedar swamp, Fort Fairfield, Maine. In leaf characters this agrees very closely with specimens from Styria, Austria (*Breidler*), Norway (*Lindberg*) and North Wakefield, Quebec (*Macoun*). It has somewhat larger leaves than Dr. Richardson's plant from Great Bear Lake. In general habit, however, it does not agree as closely with the specimens mentioned above as with some collected at Houlton, Maine, in 1899 (*J. F. C.*) and at Barnet, Vermont (*Dr. F. Blanchard*) in 1886. The three New England stations here mentioned are the only records of the plant in the United States which have come to the writer's notice. The Vermont station was published in 1898.[1] *H. Richardsonii* is closely related to *H. cordifolium*. The former differs in the somewhat pinnately arranged short branches of the fruiting plant, in the shorter costa, the abruptly enlarged alar cells and usually in the cuspidate or tapering tips of the stems and branches, due to closely imbricated leaves. The two last mentioned characters have been noticed occasionally in *H. cordifolium*.

MNIUM CINCLIDIOIDES, (Blytt) Hüben., often varies from most of the published descriptions in having slightly margined leaves, frequently with distinct, obtuse teeth. Costa sometimes percurrent.

CATOSCOPIUM NIGRITUM, (Hedw.) Bridel. Collected by E. F. Williams, M. L. Fernald and the writer in the gorge of the Aroostook River, New Brunswick, July 17, 1902. The specimens were finely fruited though not very abundant. This species has been reported from several places in British North America[2] but, so far as known to the writer, from only one locality in the United States (Montana)[3]. Anticosti Island, more than 250 miles to the northeast appears to be the previously reported station nearest to the one here mentioned. The gorge of the Aroostook River is within two miles of the eastern border of Maine, so that the finding of *Catoscopium* there is of special interest to students of the New England flora. *Catoscopium nigritum*, with its tiny, horizontal, dark capsules, is a well marked species of

[1] Grout: Mosses of Vermont.

[2] Macoun: Catalogue of Canadian Plants, Part VI: 108 (1892) & VII: 242, (1902).

[3] R. S. Williams: Bull. N. Y. Bot. Garden 2: 364 (1902).

high alpine and arctic tendencies. Conditions as favorable for its growth as those at the New Brunswick station appear to exist in several places in northern New England and it is to be expected in such localities.

ANACAMPTODON SPLACHNOIDES, (Frölich) Bridel. This moss was originally described by Frölich and published in S. E. Bridel's Species Muscorum, Pars II (1812), as *Orthotrichum splachnoides*. In his Mantissa (1819) Bridel transferred the species to a new genus, *Anacamptodon*. For more than forty years it remained the only species in the genus, as it is now understood, and to-day it is apparently the only well-known species outside the tropics. It occurs in Europe, Asia and North America and is always regarded as a rarity. Prior to 1898 it was reported in New England only from the White Mountains of New Hampshire (*Oakes*) and from western Massachusetts.[1] *Anacamptodon splachnoides* has been collected by the writer at three New England stations. One of these was discovered in 1896 in North Anson, Somerset County, Maine. The moss was finely fruited, growing around an old wound in a living Elm. It apparently fruits nearly every year at this station as specimens have been collected in fine condition several times since 1896. The other two stations are in Providence, Rhode Island. One collection was from the hollow summit of a decaying stump (July, 1893) and the other from the margin of a decaying cavity in a living maple (June, 1903). Mrs. M. L. Stevens has collected this moss in Hebron, Oxford County, Maine (Sept., 1900). *A. splachnoides* was reported from Vermont in 1898[2] and is thus known from five of the New England States. It has not been reported from Connecticut though it undoubtedly occurs there and is awaiting discovery by some of the sharp eyed collectors of that region.

BROWN UNIVERSITY.

[1] Tuckermann and Frost's "Amherst Catalogue" p. 50 (1875) and other publications.

[2] Grout: Mosses of Vermont. Collected by Dr. G. G. Kennedy.

THE DWARF MISTLETOE IN CONNECTICUT.— While studying the flora in a wooded sphagnum swamp bordering Spectacle Ponds, Kent, Connecticut, in company with Mr. E. H. Austin, the so-called "witches'-brooms" on both black spruce and tamarack trees attracted us to an investigation.

These conspicuous growths occur rather sparingly on the older trees, here 20 to 25 feet high, and examination displayed *Arceuthobium pusillum* Peck in abundance among their branches. On normal and vigorous shoots adjoining these were still other colonies, in not a few of which the parasites were as numerous as on those forming "brooms."

Several branches of the spruce bore from 18 to 22 plants of the mistletoe within one inch, a number but little exceeding that on a like area upon one branch of tamarack. In the latter species, however, while the "brooms" were similar in size they were less branched and usually bore scarcely two per cent of the number common to the other host.

Plants upon the spruce were more slender, with longer internodes, and varied in color through dull yellow to chestnut or purple-brown, which became much darker in drying. On the tamarack they were brighter in color, varying through more bronzed or golden tints to somewhat olive-brown which is appreciably retained in the more robust dried state.

No deleterious results were apparent from this parasitism, although from other influences neither host seems to attain more than moderate size or length of life.

The altitude of this station is about 1200 feet, and at this time, May 11, 1903, signs of flowers or fruit were wanting.— E. H. FAMES, Bridgeport, Connecticut.

MEETING OF THE JOSSELYN SOCIETY.

DORA H. MOULTON, SEC.

THE Josselyn Botanical Society of Maine held its Annual Meeting and Field Day from June 29th to July 3rd at Skowhegan on the banks of the Kennebec. There was an unusually large attendance of the members, whose enthusiasm and persistence. aided by the fair

weather, resulted in excellent field-work. The neighboring towns of Norridgewock and Madison were also visited.

It was at Norridgewock that Mr. A. A. Eaton gathered *Equisetum pratense* which had never been collected from New England — later he found the same species at Madison. In this locality he found every New England species of Equisetum. Fine specimens of *Botrychium lanceolatum*, *B. matricariaefolium*, and *B. tenebrosum* were also gathered by him.

Mr. Eaton delivered one of the lectures before the Society, taking for his subject "The Fern Plants of New England." Many fine and rare specimens were shown to illustrate the interesting talk.

Mr. William P. Rich gave the other lecture on "The Flora of Eastern Massachusetts in relation to the Flora of Maine." He exhibited specimens of some seventy plants which might with good reason be expected to occur in Maine. At the close of the lecture, Mr. Rich, by request, explained fully the manner of collecting, pressing, and mounting plants. His success in this line is so great, that his own sheets are perfect specimens of the art. The talk of the evening was most practical and delightful, and not without immediate results, as the next morning *Cryptotaenia Canadensis*, one of the plants mentioned was found on the banks of the river.

The following is the list of plants, prepared by Mr. M. L. Fernald, to which attention was called by Mr. Rich. Nearly all are common species in Eastern Massachusetts, and many of them can be looked for with confidence in Southern Maine. Some have been already reported in the first edition of the Portland Catalogue, but as no stations are known for them and no authenticated specimens have been seen by Mr. Fernald, they will have to be again collected to gain recognition in the flora of the state.

Thalictrum purpurascens, L.
Ranunculus Allegheniensis, Britt.
Ranunculus fascicularis, Muhl.
Magnolia glauca, L.
Arabis Canadensis, L.
Draba Caroliniana, Walt.
Draba verna, L.
Viola pedata, L.
Silene Pennsylvanica, Michx.
Anychia dichotoma, Michx.
Anychia capillacea, DC.
Hibiscus Moscheutos, L.
Geranium Carolinianum, L.
Oxalis violacea, L.
Ceanothus Americanus, L.
Lupinus perennis, L.
Desmodium rotundifolium, DC.
Desmodium cuspidatum, T. & G.
Desmodium Marilandicum, F. Boott.
Lespedeza violacea, Pers.
Strophostyles angulosa, Ell.
Cassia Marilandica, L.
Cassia nititans, L.
Ludwigia alternifolia, L.

Rotala ramosior, Koehne.
Hydrocotyle umbellata, L.
Sanicula gregaria, Bick.
Cryptotaenia Canadensis, DC.
Galium pilosum, Ait.
Eupatorium teucrifolium, Willd.
Eupatorium sessilifolium, L.
Mikania scandens, L.
Sericocarpus solidagineus, Nees.
Aster subulatus, Michx.
Aster tenuifolius, L.
Solidago speciosa, Nutt.
Solidago tenuifolia, Pursh.
Pluchea camphorata, DC.
Iva frutescens, L.
Coreopsis trichosperma, Michx.
Bidens chrysanthemoides, Michx.
Cnicus horridulus, Pursh.
Prenanthes alba, L.
Prenanthes serpentaria, Pursh.
Gaylussacia frondosa, T. & G.
Leucothöe racemosa, Gray.
Rhododendron nudiflorum, Torr.
Chimaphila maculata, Pursh.
Ilex opaca, Ait.
Ilex laevigata, Gray.
Ilex glabra, Gray.
Castilleia coccinea, Spreng.
Pycnanthemum muticum, Pers.
Collinsonia Canadensis, L.
Galeopsis Ladanum, L.
Asclepias purpurascens, L.
Asclepias quadrifolia, L.
Asclepias obtusifolia, Michx.
Asclepias tuberosa, L.
Asclepias verticillata, L.
Salicornia ambigua, Michx.
Celtis occidentalis, L.
Betula nigra, L.
Salix tristis, Ait.
Chamaecyparis sphaeroidea, Spach.
Hypoxis erecta, L.
Uvularia perfoliata, L.
Woodwardia augustifolia, Smith.
Woodsia obtusa, Torr.
Lygodium palmatum, Swartz.

Other plants of interest collected on this trip include *Ranunculus multifidus*, *Barbarea stricta*, *Polygala polygama*, *Prunus pumila*, *Potentilla arguta*, *Zizia aurea*, *Houstonia purpurea*, var. *longifolia*, *Lysimachia thyrsiflora*, *Pentstemon pubescens*, *Phryma Leptostachya*, *Corallorhiza odontorhiza*, *and Spiranthes latifolia*.

Portland, Maine.

NOTES ON ALGAE,—V.

F. S. Collins.

In Rhodora, Vol. IV, p. 176, there was noted the possibility that the *Delesseria* collected near Machias, Maine, as *D. alata* (Huds.) Lamour., might be distinct from the European species of that name; a comparison with many specimens from different parts of Europe has since changed the suspicion to a belief. *D. alata* has an entire margin, rounded tips and indistinct lateral veins, while the specimens from Starboard Island have a dentate margin, pointed tips and distinct lateral veins, agreeing with the arctic plant usually known as *D. Montagnei* Kjellman. In looking up the literature for this species,

it appears that this name cannot stand, and a recapitulation of the facts in regard to the matter will show curious instances of unnecessary names given, one can hardly say why, by botanists of high rank. The earliest name appears to be *Delesseria alata* var. *denticulata*, given by Montagne in Ann. Sci. Nat., Series 3, Bot., Vol. XI, p. 62, 1849. In Vol. XII, p. 290, 1850, Montagne raised it to the rank of a species, *D. denticulata*. A description of it appears under the same name in Montagne, Sylloge Cryptogamarum, p. 408, 1856. The specimens were all from Labrador, collected by Lamare-Picquot.

In part 2 of the Nereis Boreali-Americana, p. 94, 1853, Harvey uses the same name, referring to the Labrador specimens in herb. Montagne, and giving an additional locality, "Brandy Pot Island, River de Loup, Mr. Allom. (v. s. in herb. T. C. D.)," the last clause indicating that his description, which is fuller than Montagne's, was from specimens in the herbarium of Trinity College, Dublin, of which he was keeper. With this in mind, it is certainly surprising to find Harvey, two years later, describing a new *D. denticulata* from Australia in Trans. Royal Irish Acad., Vol. XXII, p. 548; distributing specimens of the same in Alg. Austr. Exsicc., No. 274; and illustrating the same in the Phycologia Australica, Pl. CCXLIV, in 1862; nowhere mentioning at all Montagne's species of the same name, which he had fully recognized in the Nereis Boreali-Americana. Kützing, Tab. Phyc., Vol. XVI, p. 6, Pl. XLV, 1866, retains the specific name for Montagne's plant, but with a new generic name, as *Hypoglossum denticulatum*. This appears to be the last appearance of Montagne's plant under his specific name; J. G. Agardh accepts Harvey's plant, Sp. Alg., Vol. III, p. 495, 1876, at p. 483 incidentally mentioning Montagne's species under *D. spinulosa* (J. Ag. mscr.) with synonym *D. Beeringiana* var. *spinulosa* Rupr., Alg. Ochotsk., p. 243, and note "*D. denticulata* Mont. Syll. p. 408 cum *D. Beeringiana spinulosa* Rupr., sec. spec. a Montagneo comparatum identica dicitur." Montagne certainly considered them identical, and naturally treated Ruprecht's name as a synonym of his own, published seven years earlier. In Ruprecht's description he says "Diese form (*spinulosa*) steht gewiss sehr nahe der *D. alata* var. *denticulata* Montagne in Ann. Sci. Nat., XI (1849) p. 62, aus Labrador...."

In Analecta Algologica, Cont. II, p. 66, 1894, Agardh proceeds to complicate the situation by describing a third *D. denticulata*, with the

following notes: "Hab. ad King George's Sound, Harvey." "Inter algas exsiccatas Australasicas sub no. 279 B haec a Harveyo distributa fuit, nomine *D. revolutae* inscripta . . . ."

The next reference of importance is by Kjellman, Algae of the Arctic Sea, p. 135, 1883, where the author refers to Montagne, but says "In order to distinguish the present species, *D. denticulata* Mont., from *D. denticulata* Harvey, I have changed the name of *denticulata* for that of *Montagnei*." Here arises a double confusion; Montagne's species antedates Harvey's by six years; and there is a *D. Montagneana* J. Ag., Sp. Alg., Vol. II, p. 492, 1876, seven years before Kjellman's *D. Montagnei*. Rosenvinge, Grønlands Havalger, p. 802, 1893, recognizes this last difficulty, but merely notes "Ikke at forvexle med *D. Montagneana* J. Ag., Sp. p. 492." In J. G. Agardh's final revision of the Delesseriaceae, Sp. Alg., Vol. III, part 3, 1898, the genus *Delesseria* is broken up and the species distributed among several new genera. Montagne's plant becomes *Pteridium spinulosum*, p. 225; with the note, "Ad hanc Speciem refero tum specimina Ruprechtiana, tum specimina sub nomine *D. Montagnei* mihi ex Ungava Bay missa, tum alia sub nomine *D. Montagnei* var. *angustifolia* Rosenv. quae comparare licuit." Harvey's plant becomes *Heterodoxia denticulata*, p. 131; Harvey's *D. revoluta* = Agardh's *D. denticulata* becomes *Hypoglossum denticulatum*, p. 188; and Agardh's *D. Montagneana* is *Apoglossum Montagneanum*, p. 194. If these new genera are accepted, *Heterodoxia denticulata* and *Apoglossum Montagneanum* seem to be satisfactory; it is not quite so sure about *Hypoglossum denticulatum*, as Kützing's species of that name, a synonym for *D. denticulata* Mont., dates from 1866. There seems to be some doubt, however, as to the validity of the new genera, and it is perhaps safer to retain the old genus for the present, with the name *D. denticulata* Mont. to represent the species occurring from Maine northward. New names will then be needed both for the West Australian plant and for the plant from King George's Sound. Rhodora, however, is hardly a suitable place for their re-christening.

The references for the plant in question may be summed up as follows:

Delesseria denticulata Montagne, Ann. Sci. Nat., Series 3, Vol. XII, p. 290, 1850; Sylloge Cryptogamarum, p. 408, 1856. Harvey, Nereis Bor.-Am., part 2. p. 94, 1853. Collins, Holden & Setchell, Phyc. Bor.-Am., No. 995, 1902. *D. alata* var. *denticulata* Mont. Ann. Sci. Nat., Series 3, Bot. Vol. XI, p. 62, 1849. Not *D. denticulata* Harv., Tr. R. I. Acad., Vol. XXII, p. 548, 1855;

Alg. Austr. Exsicc., No. 274; Phyc. Austr., Pl. CCXLIV, 1862; J. G. Agardh, Sp. Alg., Vol. III, p. 495. 1876, = *Heterodoxia denticulata* J. Ag., Sp. Alg., Vol. III, part 3, p. 131, 1898. Not. *D. denticulata* J. G. Agardh Analecta Algologica, Cont. II, p. 66, 1894, = *Hypoglossum denticulatum* J. Ag. Sp. Alg., Vol. III, part 3, p. 188, 1898, not of Kützing. *D. Baerii* ε *spinulosa* Ruprecht, Tange des Ochotskischen Meeres, p. 244, 1856. *Hypoglossum denticulatum* Kützing, Tab. Phyc., Vol. XVI, p. 6, Pl. XLV, not *H. denticulatum* J. Ag. Sp. Alg., Vol. III, part 3, p. 188, 1898. *D. spinulosa* (Rupr.) J. G. Agardh, Sp. Alg., Vol. III, p. 483, 1876. *D. Montagnei* Kjellman, Algae of the Arctic Sea, p. 135, 1883. Farlow, Proc. Amer. Acad., Vol. XXI, p. 471, 1886. Not *D. Montagneana* J. G. Agardh, Sp. Alg., Vol. III, part 1, p. 492, 1876, = *Apoglossum Montagneanum* J. G. Agardh, Sp. Alg., Vol. III, part 3, p. 194, 1898. *D. Montagnei* α *typica* Rosenvinge, Grønlands Havalger, p. 902, 1893. *Pteridium spinulosum* J. G. Agardh, Sp. Alg., Vol. III, part 3, p. 225, 1898, in part.

The species seems to be common from Maine to Greenland, but at the southern limit to approach the narrower forms of *D. alata*. Some specimens from Gloucester are hard to assign. It would seem, however, that the true *D. alata* does occur on the New England coast; as for instance No. 140 of Farlow, Anderson and Eaton, Alg. Am. Bor. Exsicc.

At Gloucester occurs, though apparently quite rare, *D. angustissima* Griff., which must be carefully distinguished from the narrowest forms of *D. alata*. A single specimen, from Cape Ann, seems to be *D. denticulata* var. *angustifolia* (Lyng.), agreeing well with specimens from Greenland named *D. Montagnei angustifolia* by Rosenvinge, and with others named *D. Holmiana* by Strömfelt.

The references to this variety would appear to be as follows:

Delesseria denticulata var. angustifolia (Lyng.) Collins.
D. alata β *angustifolia* Lyngbye, Tent. Hydr. Dan., p. 8, 1819.
D. Holmiana Strömfelt in Holm, Beiträge zur Flora Westgrönlands, p. 286, 1887.
D. Montagnei β *angustifolia* Rosenvinge, Grønlands Havalger, p. 803, 1893.

Pilinia rimosa Kützing, Phyc, Gen., p. 273, 1843.

The original description of this genus and species is as follows: "*Pilinia. Trichomata* hologonimica, radicata, erecta, ramosa, fasciculata, in stratum spongiosum coalita. *P. rimosa*. P. crustacea, lignicola, primo porosa, deinceps rimosa, olivaceo-virescens, *trichomatibus* tenuissimis (diam. $\frac{1}{500}'''$) ramosis, *articulis* diametro aequalibus."

It appears with practically the same description in Kütz. Sp. Alg., p. 425; in Tab. Phyc., Vol. IV, p. 20, Pl. XC, figs. 1–19, there is no description.

In Rabenhorst, Fl. Eur. Alg., Sect. 3, p. 386, 1868, the description

is "P. lignicola, crustacea, olivaceo-viridis, initio porosa, postea rimosa, mucosa: filis ramisque fasciculatis; articulis diametro ($\frac{1}{300}$ — $\frac{1}{230}$ ''' = 0.00029 — 0.00038 '') aequalibus vel duplo longioribus"; and the fig. 111 is a reproduction of Kützing's in Tab. Phyc.

In the Botanische Zeitung, Vol. XXXVII, p. 361, Pl. III, A, 1879, Reinsch describes and figures a new genus of the Chroolepideae, which he names *Acroblaste*. The plant grew on shells and pebbles in Buzzard's Bay, Massachusetts, and the description and figures are quite characteristic, but no name is given to the species. In Engler & Prantl, Die Natürlichen Pflanzenfamilien, i. abt. 2, p. 97, Wille recognizes the genus, and names the species *A. Reinschii*. In Notarisia, Vol. IV, p. 653, De Toni considers the two genera *Pilinia* and *Acroblaste* as identical, and from the descriptions and the plates concludes that Reinsch's plant is merely the fruiting state of *P. rimosa*. In Syll. Alg., Vol. I, p. 259, 1889 he adds that this is confirmed by authentic specimens of Kützing's plant. Wille, however, states, p. 101, that an investigation of authentic specimens of *P. rimosa* shows them to consist of young stages of various algae, especially Phycochromaceae, and he rejects the genus.

In July, 1902, the writer was collecting algae at Harpswell, Maine, at the old tide-mill, mentioned in Rhodora, Vol. IV, p. 178, gathering especially *Calothrix pulvinata* (Mert.) Ag., which grows in extensive sheets on beams and posts under the mill. Dr. F. D. Lambert, of Tufts College, who was of the party, called attention to the fact that some of the coating on the timbers was of a yellowish green, quite distinct from the usual very dark, blackish green of the *Calothrix*. The writer supposed it must be due to exposure to the sun; but when a specimen of the lighter colored material was examined, the next day, it proved to be quite a different plant, but agreed in every particular with the description and plate of *P. rimosa*, and under this name it has been distributed as No. 971, Phycotheca Boreali-Americana.

On a second visit to the place it was found that the *Pilinia* occupied a zone about half a meter in width, just below high water mark. Below this it passes into the *Calothrix*, the "neutral ground" occupying about half a meter, through which distance the *Calothrix* increases from a very slight admixture and the *Pilinia* diminishes correspondingly. Below this neutral ground there is no *Pilinia*. The color changes gradually, from the rather light yellowish green

of the *Pilinia* to the almost black *Calothrix*. The honeycombed, *Symploca*-like surface is common to both species, somewhat more marked, however, in the *Calothrix*. Under the microscope the two are amply distinct; the *Calothrix* with unbranched, tapering filaments, with no basal layer, the cells of the trichome disk-shaped; the *Pilinia* with branching, nearly cylindrical filaments, cells longer than broad, and arising from a basal layer of cells of irregular form.

The apparent contradiction of the reports of De Toni and Wille, both from the original specimens, is easily explained by the manner of growth of the Harpswell plant. In Casco Bay the tide has a rise and fall of four meters or somewhat more and the *Pilinia* extends, pure or mixed with *Calothrix*, for about a meter; in the North Sea the tide is much less and it is probable that the space occupied by the *Pilinia* would not exceed a few decimeters. Under such circumstances a strip could be peeled off the wood, which would be practically pure *Pilinia* at one end, *Calothrix* at the other. If then Wille's specimen came from one end, De Toni's from the other, both would be correct in their observations. It is the old story of the shield, and the two knights who fought to maintain, one that it was silver, the other that it was gold.

A plant has been distributed as No. 162, Phyc. Bor-Am., under the name of *Acroblaste Reinschii*, which is amply distinct from the Harpswell plant. It occurs abundantly at Revere Beach, Mass., on shells of *Lunatia heros*, forming a rich dark green coating about the spire of the shell. The coating is uniform with a smooth level surface, the upright filaments packed as closely as those of a *Ralfsia*, quite differently from the loosely intertwined *Pilinia* filaments; the latter are also more regularly cylindrical, and the basal layer is less of a membranous character than in *Acroblaste*. In the spring months it is unusual to find a live *Lunatia* without its coating of *Acroblaste*, and the sporangia, like those in Reinsch's figure, are abundant. It has not been noticed on empty shells, nor indeed on any substratum other than the live shells. *Pilinia*, on the other hand, both at Harpswell and in Europe, occurs only on woodwork between tide marks. Whether the Revere Beach plant is identical with the plant from Buzzard's Bay, cannot be absolutely determined; but the latter is said to occur abundantly on shells, *Turritella* in this case, and sometimes on pebbles. The figures given by Reinsch agree perfectly with the Revere Beach plant, and though one who had never seen the lat-

ter might consider the figures as applicable to *P. rimosa*, a comparison of the two plants would convince any one that the two species were distinct, and that Reinsch's plate fitted better to the Revere plant than to *P. rimosa*. That they belong to different genera, however, may be open to question until the fruit of *P. rimosa* is known. The sporangia of the latter may prove to be intercalary, which, in the present arrangement of the Chroolepideae would be sufficient to maintain it as a distinct genus. If the sporangia prove to be the same as in *Acroblaste*, then the latter name will have to be dropped, and both species placed under *Pilinia*.

Another *Pilinia* species is *P. diluta* Wood, F. W. Algae of the U. S., p. 211, 1872. This has been thoroughly studied by Miss Josephine Tilden, Minnesota Bot. Studies, Vol. I, p. 601–635, and the conclusion that she reaches, that it is merely a stage of growth of some *Stigeoclonium*, is undoubtedly correct; but her further deduction, that all species of *Acroblaste* and *Pilinia* are growth forms, is, as pointed out by Hazen,[1] unjustifiable. This appears clearly from her figures in Plate XXXII; the band-shaped chromatophores are very different from the chromatophores in Reinsch's and Kützing's figures, where they occupy the whole of the thick-walled cell.

A third species has been added to the genus, *P. maritima* (Kjellm.) Rosenv.[2] to include *Chaetophora maritima* and *C. pellicula*, both of Kjellman. Both of these species have abundant hairs, the presence of which is characteristic of the subfamily Chaetophoreae, as defined by Wille in Engler & Prantl. Rosenvinge figures terminal sporangia, whose presence is characteristic of the Chroolepideae, their absence of the Chaetophoreae. It would appear that some new character must be found, if these subfamilies are to be kept distinct; at any rate Kjellman's *C. maritima*, with abundant hairs and smooth globular thallus, can hardly be placed in the genus *Pilinia* as here understood.

The genus Porphyra is represented in Farlow's Marine Algae of New England by only one species, *P. laciniata* (Lightf.) Ag., although the author notes that *P. leucosticta* Thuret is to be expected. In the list given by the writer in Rhodora, Vol. II, p. 41, four species were

[1] The Ulothrichaceae and Chaetophoraceae of the U. S., Mem. Torr. Bot. Club, Vol. XI, p. 200, 1902.

[2] Rosenvinge, Grønlands Havalger, p. 932, 1893.

given, and it now seems that two more are to be added. There has recently been published an excellent paper on the Porphyras of the Pacific coast,[1] and while in most genera of algae, the species common to the Atlantic and Pacific Coasts are so few that a monograph for one coast would be of little use on the other, in this case five of our six species are fully treated in the paper in question. The student is referred to this paper for full accounts of structure and development, and only a key for distinguishing our species, and an indication of localities will here be given.

Key to the New England Species of Porphyra.

1. Fronds monostromatic . . . . . 2.
1. Fronds distromatic . . . . . 4.
   2. Color pink to crimson, fronds small and delicate, 15–20 μ thick. *P. coccinea* J. Ag.
   2. Color usually bluish or brownish purple, fronds reaching large size, 25–50 μ thick . . . . . 3.
3. Antheridia forming a colorless marginal zone. *P. laciniata*. (Lightf.) Ag.
3. Antheridia forming small elongated colorless patches among the darker sporocarps. . . . . *P. leucosticta* Thuret.
   4. Fronds about 25 μ thick. *P. tenuissima* (Strömf.) Setchell and Hus.
   4. Fronds 30–75 μ thick, cells in cross section square to twice as long as broad. . . . . *P. miniata* (Lyng.) Ag.
   4. Fronds 50–80 μ thick, cells in cross section square to somewhat higher than broad. *P. amplissima* (Kjellm.) Setchell and Hus.

The thickness of the frond is taken in the middle of the vegetative part; near the base the frond is often considerably thickened. *P. coccinea* has been found only once in America; it grew on a frond of *Desmarestia aculeata* washed ashore at Hampton, New Hampshire. It has the distinction of being the only species of algae recorded for the little strip of New Hampshire coast, but not found in any other New England state; it is hardly likely that it will retain this distinction permanently. *P. laciniata* is a cosmopolitan species, found throughout our range, and quite variable in form and color. The type ranges from lanceolate to much laciniate in outline; in addition to this we have forma *umbilicalis* Ag., with umbilicate fronds, often much plicate; this seems to be common on exposed rocky shores

[1] Henri T. A. Hus, An Account of the Species of Porphyra Found on the Pacific Coast of North America. Proc. Calif. Acad. Sci., 3d Series, Botany, Vol. II, p. 173 (1902).

from Nahant northward. Forma **epiphytica** n. f. is abundant from Nahant to Portland, Maine, growing on *Polysiphonia fastigiata* (Roth) Grev., or on *Ascophyllum nodosum* (L.) Le Jolis, the host plant of the Polysiphonia. The young fronds are ovate to orbicular in outline, becoming torn and irregular as they grow older; they are seldom over four or five cm. long. On the coast of eastern Maine the form seems to pass into the type, but on the Massachusetts coast the two are quite distinct. It is a plant of spring and early summer, while the type and var. *umbilicalis* are found throughout the year. The plant distributed as *P. laciniata* in Phyc. Bor.-Am., No. 235 is forma *epiphytica*. *P. leucosticta* is a plant of the spring months and of warm waters; it has not been found north of Boston. It has been distributed as Phyc. Bor.-Am., No. 376. The other three species are all northern forms, *P. tenuissima* and *P. miniata* occurring as far south as Nahant, while *P. amplissima* has been found only at Jonesport, Maine, as noted in Rhodora, Vol. IV, p. 177. *P. miniata*, from Newfoundland, has been distributed as Phyc. Bor. Am., No. 377, and *P. amplissima*, from Washington as No. XLIX of the same.[1]

It should be noted that Rosenvinge, Grønlands Havalger, p. 827 includes *P. amplissima*, *P. tenuissima* and *P. abyssicola*, the latter not occurring in New England as varieties under *P. miniata*. Rosenvinge's rule, to include under one species all forms which are connected by intermediate forms, leads to many such inclusions, where other authors see distinct species. As Hus, after careful study, and with the approval of Prof. Setchell, keeps them distinct, it has seemed best to do so here.

[1] *P. linearis* Grev. with linear fronds 15–20 cm. long, and one half to two cm. wide, with distinct stipe and cordate base, has been found by Mr. Isaac Holden at St. Johns, Newfoundland, growing in tufts on exposed rocks, and may be expected on the Maine coast. Whether it is a distinct species, or a variety of *P. laciniata* is uncertain.

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THE DENTARIAS OF CONNECTICUT.

Edwin H. Eames, M. D.

In a tract of rocky hillside woodland in Sherman, Connecticut, within half a mile of the New York state-line, there is a large colony of the daintily beautiful *Claytonia Caroliniana* Michx., which Mr. E. H. Austin had enthused me to visit April 19, 1903, at a time when it was flowering abundantly.

With this and other interesting species were a few plants of *Dentaria diphylla* Michx., with swelling flower-buds, together with others in the same condition but strikingly different in appearance. Variously situated in the damp humus of these cool woods, on rocks and in deeper accumulations of soil along the hillside, extending down a more open northerly-facing slope, nearly to the rapid waters of the Housatonic River, this peculiar plant was found in quantity at altitudes varying from 405 to 445 feet.

The stem-leaves were opposite as in *D. diphylla*, but their leaflets at once arrested my attention: distinctly narrower, more pointed and incisely-toothed, in marked contrast with the accompanying much broader and still more deeply and irregularly incised or somewhat lobate basal leaflets, they were distinctive at a glance.

When the superficial rootstocks, at times directly upon the surface and green or purple in varying degree, were uncovered, they were found to be composed of four or five to eleven or more interrupted, distinctly fusiform, toothed and tuberculate segments of annual growth and wholly unlike those of its companion species.

In flowering specimens kindly gathered for me by Mr. Austin, on May 3, and in others which we both collected one week later, the distinctions noted were strengthened by an additional one of equal interest:

the white flowers were remarkable for their large size, exceeding those of any other of our species, especially its companion of these woods, the extremes of each barely connecting.

D. diphylla is our only species to which the term "rootstock continuous" has been applied, in apposition to "jointed" as noted for all the other species. Studies in both field and herbarium seem to show that the latter term has been loosely applied. Each annual segment of most so-called "jointed" rootstocks may be a joint, but in those of the plants observed in Sherman and in all others known from our region, with one exception, there is not the faintest indication macroscopically or by fracture of a fixed or definite place of the union between these enlarged parts of the rootstock.

Just prior to the close of a field meeting of the Connecticut Botanical Society, held at Rainbow, on the Farmington River, June 6, 1903, I was particularly fortunate in finding a colony of *D. maxima*. In rich soil along the banks and alluvial bottoms of a woodland stream and nearly concealed by luxuriant later vegetation, were quantities of this rare and little understood species, chiefly noticeable for the array of bright yellow foliage like spots of sunshine filtered through the leaves overhead.

Careful search was instituted for the best the colony afforded, in company with Mr. B. B. Bristol. Although occasional plants bore pods of about mature size, few of these seemed destined to mature seeds owing to the aestival decadence prevailing among their kind. This colony seems to occupy a narrow area approximating a length of ten or twelve rods.

In this species the rootstock has been specially noted as "jointed." These plants seem to be fairly representative of the species, but there are no joints in any proper sense of the term. In fact, the rootstock is made up of constricted fusiform portions in a manner similar to the Sherman plants, but tubercled in the axils of *prominent* incurved teeth. A noteworthy and distinctive character seems to be the lifelong persistence, near the base of each segment, of the premorse remains of former stems and leafstalks and more conspicuous than any other appendages.

Since this appeared to be the second [1] Connecticut station for this species and, as it happens, in the same county of Hartford, studies were made to include specimens from the recorded station. These

[1] See RHOD. V, 168–169.

were found to have rootstocks somewhat anomalous in character and in other respects differed from any species now recognized, as will be described. This leaves the station for *D. maxima* noted in the present article the only one so far known in the state.

The plants reported by Mr. Bissell and *D. heterophylla* do not have jointed rootstocks although in the latter the fragile constricted connecting parts promotes easy rupture. *D. laciniata*, on the other hand, does have truly jointed and characteristic rootstocks in which fracture must and does occur at the precise place in which the apex of one portion is seated within a corresponding depression in the one beyond.

Inasmuch as our northeastern species are, in part, still imperfectly known and revision of these seems desirable, an attempt is made to outline the more important characters in the following summary, in which I have had the valued advice and coöperation of Dr. B. L. Robinson.

Synopsis of Species.

***Rootstock continuous, prominently toothed: stem glabrous: leaflets dentate, bluntly mucronate.**

D. DIPHYLLA Michx. Rootstock long and continuous, prominently toothed, the annual segments elongated, 3 to 9 cm. long, very slightly tapering; on or near the surface and propagating by its branches. Stems 2 to 4 dm. high, glabrous, stout, simple rarely with an additional flowering branch bearing a single ternate leaf. Leaves ternate, glabrous, those of the stem 2, opposite or nearly so, rarely 3 and alternate, on petioles 1.2 to 3.6 cm. long; basal usually present, long-petioled and similar. Leaflets 2 to 10 cm. long, 1.5 to 6 cm. wide, sessile or short-petiolate, minutely serrulate, unequally and coarsely subacute- to round-dentate, bluntly mucronate; central ones rhomboid-subovate, lateral obliquely so, often slightly lobed. Flowers white; petals 10 to 15 mm. long, twice as long as the sepals. Pedicels 1 to 3 cm. long. Pods rarely matured, 2.5 cm. long or more including style 6 to 8 mm. long. — In rich damp moist or springy soils containing much humus, in woods and shaded situations. Apparently throughout the state except near the coast in the southeastern part. Usually in colonies and local, but rather frequent in the northwestern third of the state.

****Rootstock interrupted by distinct constrictions, distinctly toothed: stem glabrous: leaflets incisely-dentate, -cleft or -lobate, sharply mucronate. (Exceptions in last species).**

D. incisa n. sp. Rootstock interrupted by the union of 4 to 11 or more distinctly fusiform annual segments 1 to 3.5 rarely 6 cm. long, slightly tubercled in the axils of distinct teeth, commonly on or near the surface and propagating by late-appearing branches; remains of earlier stems and leaf-stalks occasional, from obscure to 5 mm. long. Stems 2 to 4 dm. high, glabrous, simple stout. Leaves ternate, glabrous, those of the stem 2, opposite or nearly so, rarely 3 and alternate, on petioles 1 to 4 cm. long; basal usually present, on petioles 1.2 to 2 dm. long. Leaflets sessile or slightly united at the base, rather sparingly and minutely serrulate to ciliolate-serrulate, unequally, coarsely, and more or less deeply incised-dentate, the teeth from subacute to rounded and acutely mucronate: of the stem-leaves 4 to 9 cm. long, 1 to 3.5 cm. wide, narrowly lanceolate to lanceolate, the central one a little longer than the strongly inequalateral and commonly more deeply incised lateral ones: those of the base and detached rootstocks commonly 1.5 to 2 times wider than accompanying stem-leaflets, 5 to 10 cm. long, 1.5 to 6 cm. wide, more deeply incised or lobate, short-petiolate. Flowers averaging 9 (5–13), white, drying nearly so or more or less purple-tinted; petals 15 to 20 mm. long, 5 to 8 mm. wide, obovate, rounded at the apex, fully 2.5 times length of sepals. Pedicels 1 to 3 cm. long. Style soon 6 to 8 mm. long. Pods not seen. — Sherman, on a rich damp slightly open to thickly wooded hillside, 2–15 m. above the Housatonic River, 125–128 m. alt., 19 April, 1903, *Austin & Eames*, no. 3820; 3 May, 1903, *Austin*, no. 3820 a; 10 May, 1903, *Austin & Eames*, no. 3820 b; 16 June, 1903, *Austin*, no. 3820 c. (Type material in the author's herbarium, also in herb. Gray.)

This species differs particularly from *D. diphylla* in the rootstock, the incised and sharply mucronate teeth of the leaflets which are distinctly narrower on the stem, and in the large petals: from *D. maxima* in its usual freedom from the premorse remains of former stems and leaf-stalks fairly characteristic of that species, its opposite leaves which are markedly different in situation, size, shape and marginal characters, sessile leaflets, length of pedicels and of the petals actually and comparatively with the sepals.

D. MAXIMA Nutt. Rootstock interrupted by the union of 4 to 10 or more distinctly fusiform annual segments 1.2 to 3.5 rarely 5 cm. long, tubercled in the axils of prominent incurved teeth; commonly on or near the surface and propagating by late appearing branches; remains of earlier stems and leaf-stalks generally present, premorse, prominent, persistent and distinctive, 2 to 6 mm. long. Stems 2 to 3.5 dm. (2 ft. *Nutt.*) high, glabrous and commonly stout. Leaves ternate, glabrous, those of the stem 2 or more commonly 3 (2 to 7 *Nutt.*), alternate, often remote, rarely 2 and subopposite, much smaller than in the preceding, on petioles 1 to 8 cm. long; those from the base, when present, and detached rootstocks on petioles 1 to 2 dm. long. Leaflets prominently petiolate, moderately to freely

ciliolate, irregularly incised-dentate, the teeth subacute to rounded and acutely mucronate: of the stem-leaves ovate and obtuse, 2 to 5 rarely 7 cm. long, 1.2 to 4 cm. wide, the central one rarely somewhat lobed, the oblique lateral ones frequently 1-cleft or -lobed on the outer side: those from the base and detached rootstocks sometimes similar, usually larger, much broader, 3 to 5.4 cm. long, 2.8 to 5.8 cm. wide, central one broadly rhombic-ovate, -orbicular or broader than long, 1-cleft to -parted bilaterally, lateral ones 1-parted to -divided on the outer side, the inner division sometimes 1- to 2-cleft, obliquely rhomboidal. Flowers purple-tinted, drying pale purple; petals 12 to 15 mm. long, about twice length of sepals which are ovate-oblong, obtuse, 5 to 7 mm. long. Pedicels .6 to 1.5 cm. long in flower, 1.5 to 2 cm. long in fruit. Pods rarely matured, 2.5 to 3 cm. long including style 6 to 8 mm. long. — Windsor, in rich soil on banks and alluvial bottoms beside a woodland stream flowing into Farmington River, 6 June, 1903, *Eames*, no. 3970.

Apparent hybrids between *D. diphylla* and *D. laciniata* are in herbaria as *D. maxima*, and often require careful study to be rightly understood, as they bear more or less resemblance to this species, and possess no constant characters.

D. anomala, n. sp. Rootstock interrupted by the union of several prominently fusiform annual segments, slightly to moderately tuberculate-bracteate on a somewhat smooth surface: deep-seated: apparently intermediate between this section and the following. Stems 2 to 3.5 dm. high, somewhat pubescent, rather slender, solitary or two together, simple or occasionally with an axillary flowering branch. Leaves ternate, pubescent on both surfaces: those of the stem 2, subopposite or separated 1 to 2 cm., or 3 and irregularly alternate a fourth on the branch when present, leafless in one instance, on petioles 1 to 5.5 cm. long: basal rarely present, similar. Stem-leaflets 2 to 5.5 cm. long, 1 to 3 cm. wide, distinctly short-petiolate, somewhat ciliolate, irregularly subacute- to obtuse-dentate or incised, acutely mucronate; central one more or less deeply cleft to 1-parted on each side, the lateral ones 1-parted to -divided on the outer side. Flowers "nearly white, just tinged with rose or purple:"[1] petals 10 to 12 mm. long, obovate, rounded at the apex, 3 times length of the ovate-oblong obtuse sepals which are 3 to 4 mm. long and distinctly smaller than in any other of our species. Pedicels 7 to 20 mm. long, slender in flower. Pods not seen.— Plainville, rich moist woods, 5 May, 1902, *C. H. Bissell*; 11 May, 1902, *C. H. Bissell.* (Type material in herb. Bissell, also in herb. Gray and in the author's herbarium.)

Growing with *D. diphylla* and *D. laciniata* and flowering about midway between them in time. This species may have had a hybrid origin between the widely different accompanying species, but it is

[1] Bissell, Rhod. V, 169.

well established in two small colonies, is very constant in all its characters and apparently well worthy of specific rank, at least tentatively. It differs particularly from any of the preceding in the pubescent stem and leaves, deeply cleft to divided stem-leaflets, the actual and comparative length of sepals and petals and in the surface characters of the rootstock: from either of the following in the situation of the leaves, size, shape and lobation of the leaflets and in the sepals and petals, together with the anomalous rootstock.

* * * Rootstock interrupted by fragile constrictions, tuberous, obscurely bracteate: stems glabrous to pubescent: leaflets variable.

D. HETEROPHYLLA Nutt. Rootstocks interrupted by fragile constrictions connecting the few narrowly fusiform annual segments 1.4 to 3 cm. long, bearing few small bracteate tubercles on a smooth surface: premorse remains of former stems sometimes 2 to 3 mm. long: often deep-seated. Stems 1.5 to 3.5 dm. high, glabrous or somewhat pubescent, commonly slender and several together with 1 to several basal leaves, sometimes with one or two slender few-flowered axillary or erratic branches bearing a simple or cleft leaflet 1.5 to 2 cm. long. Leaves ternate, those of the stem generally 2 (2 to 3), variably opposite, subopposite, alternate or verticillate, commonly near top of stem at flowering time on petioles 0.4 to 3 cm. long: basal on petioles 2 to 15 cm. long, very different. Leaflets minutely serrulate: those of the stem 1.3 to 3.5 cm. long, linear to narrowly lanceolate, sparsely and obscurely to sharply mucronate-serrate. sometimes laciniate-dentate or multifid; acute or acuminate at the apex, sessile to distinctly petiolate at the tapering base: those of the base 1.2 to 4.5 cm. long, nearly the same width, prominently petiolate, and although sometimes similar to those of the stem, usually obtuse at base and apex, broadly rhombic-ovate, the central leaflet equally, the lateral oblique and unequally trilobate by varying clefts, the teeth and apices rounded and mucronate. Flowers light purple, closely cymose-paniculate at first; petals 10 to 16 mm. long, narrow, rounded at the apex, twice as long as the oblong-lanceolate obtuse sepals. Pedicels 0.3 to 2 rarely 3.5 cm. long. Pods 2.5 cm. long.—Not known from Connecticut.

D. LACINIATA Muhl. Rootstocks jointed at the constricted ends of the few narrowly fusiform to oblong, often thick tuberous annual segments 2 to 5 cm. long, 4 to 12 mm. thick at maturity, and bearing on the smooth surface few small bracteate tubercles from some of which branches arise late in the season: segments uniformly separable at certain fixed places. Stems 1 to 3.5 dm. high, pubescent, at least above, rarely glabrous, stout, solitary or several together, with or generally without accompanying root-leaves. Leaves primarily ternate, often appearing quinate, those of the stem 3, commonly near top of stem, verticillate or nearly so, on petioles 2 to 5 cm. long: basal usu-

ally common in the colonies, similar, on longer petioles, 2.5 to 12 cm. wide. Leaflets glabrous to pubescent, sparingly ciliolate, simple and linear or narrowly lanceolate to ovate, and 1- to 3-lobed, -divided, or somewhat multifid, sparingly appressed-serrate to laciniate or gash-toothed, mucronate: those of the stem scarcely petiolate, of the base distinctly so. Flowers white or purple-tinted: petals 10 to 16 rarely 18 mm. long. Pedicels in flower 0.3 to 2.5 cm. long, in fruit 1 to 2 and sometimes 3.5 cm. long. Pods common, strongly ascending on stout pedicels, 2 to 4.5 cm. long including style 6 to 9 mm. long.

In rich damp or often springy soils containing much humus, in woods or along their borders. Apparently rather rare eastward (Killingly and Old Lyme, *C. H. Bissell*), it is found at infrequent intervals throughout a large part of central and western Connecticut away from the coast, sometimes in large colonies, as in Plainville, *C. H. Bissell*, and in Gaylordsville, *Austin & Eames*. Our earliest species to flower.

Bridgeport, Connecticut.

ISAAC HOLDEN.

F. S. Collins.

Isaac Holden, son of Samuel and Sally (Brewster) Holden, was born in Preston, Connecticut, June 11, 1832. He entered Dartmouth College as sophomore in the spring of 1850, and was graduated in 1852. For twenty years after his graduation he was engaged in teaching in various places, the longest time being the last, at Clifton, Staten Island, New York, where he made a specialty of preparing young men for college and scientific schools. In 1872 he gave up teaching, and became connected with the Wheeler and Wilson Company, removing in 1878 to Bridgeport, Connecticut, where the rest of his life was spent, the last ten years as vice-president of the company, and practically in charge of its business. His death in New York City, June 25, 1903, was the result of an operation, rendered necessary by a severe attack of gall stone just on the eve of a proposed trip to Europe, June 10. He is survived by a wife, two sons and three daughters.

Mr. Holden was a man of strong character, great intellectual ability, absolute integrity, and broad sympathies. He was thoroughly at home in both ancient and modern literature, and corresponded regu-

larly with the company's agents in France, Germany, Spain, and Italy in their own languages. He was familiar with the best English literature of all periods, an excellent mathematician, a lover of good music, and a good amateur player on the violin. He believed in thoroughness in all things and had a strong dislike to shams, whether in high or low position, but was always in sympathy with honest work. He was of a genial character in social relations, and made hosts of friends in every quarter.

His interest in botany was lifelong, but it was only in the last fifteen years of his life that he made systematic collections and notes, chiefly on algae. In the study of these plants he was indefatigable, and had explored every nook and corner of the coast near Bridgeport, as well as the fresh water streams and lakes for a considerable distance inland. In preparing his specimens he had an eye for the aesthetic as well as the scientific value; it would be hard to find specimens of marine algae from any other collector at the same time so scientifically adequate and so beautiful as those that he made. He was one of the three founders of the *Phycotheca Boreali-Americana*, and many of the best contributions in this work are from him. He was intending to publish a list of the algae of Connecticut, but though his notes and records seem amply sufficient, he delayed it from his desire for almost ideal accuracy and completeness. *Hydrocoleum Holdeni* Tilden and *Gomontia Holdeni* Collins, the former a marine, the latter a fresh water alga, both discovered by him in Connecticut, commemorate his work.

He was a member of the Phi Beta Kappa, and of the New England Botanical Club; and was for eight years president of the Bridgeport Scientific Society. In 1883 he spent six weeks in Florida; though going there on account of his health, his time was spent mostly in studying the land and marine plants; in 1897 he visited Newfoundland, collecting many algae, some of which were distributed in the Phycotheca. A visit to Europe in 1900 was for business and social objects and not connected with botany.

NOTES ON NEW ENGLAND DESMIDS, — I.

Joseph A. Cushman.

In a series of short papers the writer wishes to add to the records of the forms and distribution of the Desmids of our New England flora. New England forms have not been extensively reported with the exception of the lists given at the end of the present paper, the localities given by Wolle are about all we have to depend upon for the distribution. The records of Wolle while in many points inaccurate, are nevertheless the type of work which with greater care should sometime be done for New England. It is in the spirit of adding to that work that the present series is attempted. The measurements in many cases are more full than given by Wolle.

The variety of forms noted from one pond in Bridgewater, Mass. (Rhodora, March 1903) shows what may be found in any of our numerous New England ponds. In these papers the writer hopes to record the species from as many stations in New England as possible. If the readers of Rhodora would send small amounts of material to be examined it would help the work and be thankfully received.

The following species were identified in a small collection from Steep Brook, Massachusetts, about three miles north of Fall River Railway Station. They were collected in a swamp brook on March 28, 1903, by the writer. Staurastrum was especially well represented.

Euastrum elegans Kg. This species appears to be common here as elsewhere, the specimens obtained differing considerably in this collection. One form is somewhat different from any of Wolle's figures of this species, having the end lobe more square, the angles between it and the lateral lobes almost 90 degrees and the lateral lobes divided into two well separated lobules, more distinct than in any of the figures. This was a large form measuring; diam. 35 μ, length 50–55 μ, thickness through inflation 12 μ. Of this species another smaller form, which is more common, measures: length 22 μ, diam. 18 μ, being about half the size of the first.

Cosmarium undulatum Corda, var. *crenulatum* Wolle. Wolle does not give the measurements of his variety but the specimen corresponds well with his description. Length 28–30 μ. Diam. 25 μ. Isthmus 8 μ.

Cosmarium scenedesmus Delp. The specimens collected here differ from the description and figures of Wolle in two points: surface decidedly granular, bases of semicells diverging very much more than shown in Wolle's figure (Pl. LXI, fig. 7). These characters are very constant in all specimens seen from this locality and it is very abundant. Length 30–32 μ. Diam. 32–36 μ. Isthmus 10 μ.

Penium digitus (Ehrb.) Breb. Specimen a little smaller than the measurements of Wolle. Length 228 μ. Diam. 54 μ.

Staurastrum pygmaeum Breb. A little larger than the measurements of Wolle but agreeing in all other points. Difference very slight. Length 33 μ. Diam. 28 μ. Isthmus 11 μ.

Staurastrum dejectum Breb. Diam. 25 μ.

Staurastrum subarcuatum Wolle. Wolle does not give the locality where he has recognized this species or the exact dimensions observed. The form found, measured: length 32 μ, diam. 30 μ, isthmus 12 μ.

Staurastrum saxonicum Bulnh. A very little smaller than the measurements given by Wolle. Sides in end view distinctly concave, removing it from *S. hirsutum*, which it resembles although slightly smaller. Maine is the only New England state from which this has been reported. Diam. 65 μ.

The following forms were identified in a collection made near Stony Brook Station, Massachusetts, the last week in March, 1903, by Mr. A. F. Blakeslee. As but very little material was examined it will be seen from the following that it was rich and varied in its contained forms. No filamentous forms were noted in the material examined.

Closterium acerosum (Schrank) Ehrb. Length 650 μ. Diam. 45 μ. Very common.

Closterium lineatum Ehrb. Length 540 μ. Diam. 38 μ. Slightly larger than the measurement of Wolle. Common.

Closterium cucumis Ehrb. Length 325 μ. Diam. 50 μ. Wolle gives size in a comparative way only. The specimen fits the figure well and the size as given. Very slight ventral swelling noted.

Cosmarium speciosum Lund. Length 54 μ. Diam. 36 μ. Isthmus 15 μ. Chlorophyll with a morulate appearance, of large granules. Another specimen measures: Length 47 μ. Diam. 32 μ. Isthmus 13 μ.

Cosmarium broomei Thwaites. Length 32 μ. Diam. 30 μ. Isthmus 9–10 μ. Central inflation present, thus separating it from the following species.

Cosmarium pseudobroomei Wolle. Length 50 μ. Diam. 40 μ. Isthmus 15 μ. No distinct central inflation thus separating it from the preceding. Decided difference in this case in size between the two. Wolle considers the inflation the only difference. Apparently new to New England. Wood Lake, New Jersey, is the only locality mentioned by Wolle.

Cosmarium tumidum Lund. Length 29 μ. Diam. 25 μ. Isthmus 8 μ. Maine is the only other of the New England States from which this has been previously reported.

Cosmarium laeve Rab., var. *septentrionale* Wille. Length 25 μ. Diam. 18 μ. Isthmus 7 μ. A little larger than the dimensions given by Wolle. He gives no locality in his mention of this form.

Cosmarium tetrophthalmum (Kg.) Breb. Length 72 μ. Diam. 58 μ. Isthmus 22 μ. Wolle simply mentions this species as "common" without giving any definite localities for it. Not reported before from New England.

Cosmarium octhodes Nord. Length 72 μ. Diam. 54 μ. Isthmus 18 μ. Apices slightly retuse in center.

Cosmarium pyramidatum Breb. Length 62 μ. Diam. 50 μ. Isthmus 15 μ.

Cosmarium amoenum Breb. Length 50 μ. Diam. 25 μ. The typical form.

Cosmarium subcrenatum Hautzsch. Length 38 μ. Diam. 25 μ. Isthmus 14 μ. Common. Reported previously from Maine also.

Cosmarium coelatum Ralfs. Length 50 μ. Diam. 42 μ. Isthmus 12 μ. A somewhat aberrant form with three lateral lobules instead of one as is usually the case. This variation is indicated in Ralfs' figures but not in his description. The specimen in question agrees exactly with one of his original figures (The British Desmidieæ Pl. xvii, fig. 1*c*). This species is new to New England.

Arthrodesmus incus (Ehrb.) Hass. Diam. without spines 20 μ. Length 15 μ. Length of spine 15 μ.

Micrasterias americana (Ehrb.) Kg. Length 145 μ. Diam. 97 μ. Isthmus 30 μ. Form slightly narrower than usual.

Euastrum elegans Kg. Length 32 μ. Diam. 22 μ. Isthmus 7 μ. Of the form of the smaller variety from Steep Brook, Massachusetts.

Staurastrum orbiculare (Ehrb.) Ralfs. Length 22–32 μ. Diam. 22–27 μ. Isthmus 7–9 μ. Specimens are very common and as the measurements indicate they show a considerable variation in size.

The mucous covering is present, causing specimens to stick to the slide so firmly that they are with difficulty turned over for examination. The dimensions are considerably smaller than those given by Wolle.

Staurastrum pseudosebaldi Wille. Length 30 μ. Diam. 61–70 μ. Isthmus 13–15. Found frequently in the material examined. One specimen apparently of this same species was much broader comparatively, measuring. Length 36 μ. Diam. 72 μ. Isthmus 10 μ.

Staurastrum muticum Breb. var. *minor* Wolle. Length 20–25 μ. Diam. 22–25 μ. Isthmus 7 μ. Common in this material and showing many zygospores. These are of very similar character to those of *S. mucronatum* Ralfs as figured by him. Zygospore very spinose, spines acute at ends showing no tendency to branch. Diameter of zygospore without spines, 32 μ.

Staurastrum hirsutum (Ehrb.) Breb. Length 45 μ. Diam. 42 μ. Isthmus 18 μ.

Staurastrum echinatum Breb. Length 33 μ. Diam. 32 μ. Isthmus 12 μ. Slightly larger than the measurements of Wolle. More densely clothed with ocelli but far less so than in *S. hirsutum*. About fourteen on a side in end view.

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ARABIS DRUMMONDI AND ITS EASTERN RELATIVES.

M. L. Fernald.

In late July, 1902, Mr. Emile F. Williams and the writer found in open sandy woods and on the adjacent sand-dunes of "the commons," on the north shore of the Baie des Chaleurs, at New Carlisle, Quebec, an unfamiliar Arabis with pink flowers on divergent pedicels, spreading or loosely ascending pods, and basal leaves quite covered with stellate usually 3-forked hairs. A week later, on ledges and cliffs near the confluence of the Rivière du Loup and the St. Lawrence

another Arabis was found strongly resembling the New England plant with strict inflorescence which has been known as *Arabis confinis*, but with the pods much broader than in New England specimens. This strict plant of Rivière du Loup had the basal leaves, like those of the New England plant which it resembled, glabrous or with some simple stiff hairs usually attached at the middle (malpighiaceous hairs) but rarely 3-forked. The two plants were so very different that the result of the first comparison of them with the current manuals and with extensive herbarium material was a complete surprise, for, according to these sources of information, both plants were *Arabis confinis*, Watson (*A. brachycarpa*, Britton). Further study showed that both *Arabis confinis* and *A. brachycarpa* have been the source of much confusion.

When, in 1887, Dr. Watson described *Arabis confinis*, he included at least two plants, and his description which follows gives little clue to the special form he intended as typical of his species:

"ARABIS (TURRITIS) CONFINIS. Biennial, rarely somewhat glaucous; stems erect, one or several, usually simple, 1 to 3 feet high: lower leaves oblanceolate, usually dentate, finely stellate-pubescent or sometimes glabrous, the cauline oblong to linear-lanceolate, auriculate: flowers white or pinkish: pods more or less spreading or suberect, a line broad or less, straight or slightly curved, usually more or less attenuate above and beaked: seeds small, narrowly oblong, winged.—*A. laevigata*, Hook. Fl. Bor.-Am. 1. 43. *Turritis glabra*, and var. *β*, Torr. & Gray, Fl. 1. 78 and 666. *T. brachycarpa*, Torr. & Gray, l. c. 79. *T. stricta*, Torr. Fl. N. Y. 1. 53, not Grah.; Gray, Gen. Ill. 1. 144, t. 59. *A. Drummondii*, Gray, Manual, 69. From the lower St. Lawrence (Tadoussac, *Pickering*) along the Great Lakes to Lake Winnipeg (*Bourgeau*), and more rarely southward (Mt. Willard, *Faxon*; Dracut, Concord, and Brookline, Mass., *Dame, Deane, Faxon*; Thimble Islands, Conn., *A. L. Winton*; Cayuga Co., N. Y., *Dudley*; Elgin and Dixon, Ill., *Vasey*). It includes all the '*A. Drummondii*' of the Atlantic region."[1]

As shown by the herbarium specimens as well as by studies of the plants in the field, the characters, "leaves .... finely stellate-pubescent" and "pods more or less spreading," belong to one plant; while the characters, "leaves .... sometimes glabrous" and "pods .... suberect," are exhibited by a plant of quite different habit, habitat, and geographic range. Of the specimens cited by Dr. Watson, those from Tadousac, Lake Winnipeg, and Dixon, Illinois, belong to the

[1] Watson, Proc. Am. Acad. xxii. (1887) 466.

species with basal leaves stellate-pubescent and the pods spreading; while those from the other stations have the lower leaves glabrous or with some malpighiaceous hairs and the pods on erect pedicels.

As already stated, there is nothing in the descriptive text of Dr. Watson to show which plant he intended as *Arabis confinis*. Judging from the two differential features, the leaves and pods, the precedence given in the description to the characters, "leaves finely stellate-pubescent" and "pods more or less spreading," as well as the citation first of the Tadousac plant would indicate one species; while the citation of *Arabis laevigata*, Hook.[1] as the leading synonym points to the plant with smoother leaves and erect pods, though the remaining synonymy points partly to the former plant. Nor does the separation in the 6th edition of the Manual of var. *brachycarpa* (following *A. Drummondii*, var. *brachycarpa* of the 5th edition) merely on the length of the pod sufficiently clear the two plants; while the somewhat fuller definition of the plants in the Synoptical Flora still allows *A. confinis* with leaves either "finely stellate-pubescent or glabrate."

The only clue now obtainable as to Dr. Watson's conception of *Arabis confinis* is from the note following his description, where he says. "Of related species, A. DRUMMONDII, Graham [Gray], is confined to the western mountains, glaucous and glabrous, or usually pubescent below with appressed hairs attached by the middle, with broader straight erect blunt pods, and broadly elliptical winged seeds."[2] From this note the natural assumption might be that by *A. confinis* was meant the plant with stellate pubescence and spreading pods; but since most of the specimens cited are of the other plant it is more probable that Dr. Watson, following an artificial principle still too prevalent, was simply separating from the supposedly local Rocky Mountain species "all the 'A. Drummondii' of the Atlantic region." At any rate, there is little reason to keep up for either of the eastern plants a name so indefinitely applied as *A. confinis*, especially since both the components of that compound species were already clearly defined.

[1] "*A. laevigata*; erecta, glabra, glauca, foliis radicalibus obovatis petiolatis sinuato-dentatis, caulinis linearibus sessilibus intigerrimis, siliquis erectis, seminibus marginatis . . . . . .

Hab. About Lake Huron. *Dr. Todd.*— A foot high. *Pedicels* 3–4 lines long. *Siliquae* quite erect, 1½ to 2 inches long, linear, plane, tapering at the extremity into a very short style." Hook. Fl. Bor.-Am. i. 43 (1829).

[2] Watson, l. c.

In 1838 Torrey & Gray described as follows

Turritis brachycarpa: glabrous and glaucous; radical leaves spatulate, toothed; cauline ones linear-lanceolate, acute, sagittate and somewhat clasping; siliques short, rather broadly linear; pedicels of the flowers pendulous, of the fruit spreading or ascending.

Fort Gratiot, Michigan, and Shore of Lake Superior, *Dr. Pitcher!* — 2 Stem 1–2 feet high, simple or sparingly branched above. Radical leaves pubescent. Flowers rather large, pale purple; the pedicels mostly bent downward. Silique about an inch long and nearly a line wide, straight or somewhat curved, usually spreading at right angles to the stem. Seeds mostly abortive, in 2 distinct rows when young; the ripe and perfect ones nearly as broad as the cell, winged on the margin. — The whole plant is sometimes of a purple color. Nearly related to the preceding [*T. retrofracta*, Hook. *Arabis retrofracta*, Graham, probably *A. Holboellii*, Hornem.]; but distinguished by its short siliques."[1]

From the description alone it is tolerably clear that Torrey & Gray had a plant habitally resembling the Tadousac-Winnipeg component of *Arabis confinis*. This interpretation has been further strengthened by a tracing and by fragments of the original Pitcher material from Fort Gratiot kindly furnished the writer by Dr. John K. Small of the New York Botanical Garden. This material shows that not only in habit but in the closely stellate basal leaves is *Turritis brachycarpa* exactly the plant found by Mr. Williams and the writer at New Carlisle, and included by Dr. Watson under *A. confinis* from Tadousac, Lake Winnipeg, and Dixon, Illinois. This characteristic plant should be known, therefore, as *Arabis brachycarpa*, Britton, based upon *Turritis brachycarpa*, Torr. & Gray, the first clearly defined name for the plant with spreading pods and stellate-pubescent basal leaves.

The other component of *Arabis confinis*, the plant with erect pods and with the basal leaves glabrous or somewhat pubescent with centrally attached hairs, although separated by Dr. Watson from *A. Drummondi*, presents surprising similarities to that species. In fact, the very characters by which the "western" *A. Drummondi* was distinguished from the eastern plant are present in this second component of *A. confinis*.

A. Drummondi, Gray, was based upon *Turritis stricta*, Graham, "which is a true *Arabis*. — *A. Drummondi*."[2] *Turritis stricta*, Graham, based upon material raised in the Royal Botanic Garden at

[1] Torr. & Gray, Fl. i. 79 (1838).

[2] Gray, Proc. Am. Acad. vi. 187 (1866).

Edinburgh from Rocky Mountain seed collected by Drummond, was a plant with "foliis omnibus glabris, subintegerrimis, radicalibus in petiolam attenuatis, caulinis amplexicaulibus, sagittatis; siliquis strictissimis, pedicello stricto, glabro, quadruplo longioribus," and further, with leaves "at the root attenuated into petioles as long as themselves, both the leaf and petiole being ciliated with minute reflected hairs." [1]

A "rubbing" from the Drummond plant is in the Gray Herbarium and in the letter accompanying it Mr. Daniel Oliver wrote from Kew to Dr. Gray, under date of April 17, 1866: "I have been looking this afternoon at our specimens of *Turritis stricta* with a view to the settlement of the question put in yours of the 2nd inst. I enclose a 'rubbing' from the fruiting branch of Drummond's Rocky Mountain specimen. This plant agrees entirely with Bourgeau's plant sent out — apparently through mistake — under the name *T. patula*, Grah. (Rocky Mountains — Alpine region — 18 Augt., 1858), excepting that the petals of Drummond's plant are, in its present state, white, while in the Bourgeau plant they are tinged with purple."

The Drummond plant and the Bourgeau specimen identified by Mr. Oliver with it and labelled by Dr. Gray *Arabis Drummondi* are the narrow-podded plant (in the Drummond specimen pods 5.3–6 cm. long, 1.6–2.3 mm. broad; in the Bourgeau specimen 7 cm. long, 2 mm. broad) represented by many western plants (for example, Wolf & Rothrock's nos. 657, 658, 660 from Colorado; Baker, Earle and Tracy's no. 128 from Colorado; C. F. Baker's no. 48 — *Arabis oxyphylla*, Greene — from Colorado; Henderson's no. 2396 from Mt. Adams, Washington; and M. E. Jones's no. 1177 from Utah) and by most of the so-called *A. confinis* of the East. That the two plants are identical in habit, foliage, pods and seeds, and the occasional presence upon the basal leaves of malpighiaceous hairs, and only rarely of 3-rayed hairs like those of *A. brachycarpa*, is very apparent from examination of a large suite of specimens; and in view of these identities of characters and the lack of any apparent points of difference there seems no reason to separate from *A. Drummondi* the strict plant which in the East has passed as *A. confinis*.

The large plant with broad pods, found at Rivière du Loup and referred to in the introduction to these notes, differs from *Arabis*

[1] Graham. Edinb. New Phil. Jour. 1829, 350.

Drummondi only in its much wider pods (mostly 3 mm. wide). A plant quite like it in habit and with similarly broad pods is represented in the Gray Herbarium by several Rocky Mountain specimens, one of which, Hall & Harbour's no. 35, was apparently a source of some perplexity to Dr. Gray, who first referred to it as *Streptanthus augustifolius*[1] and later took it to be *Turritus brachycarpa* "a short-fruited form of *T. stricta*, Graham."[2] Other similar specimens from Colorado (as Patterson's of 1875) and from Washington (Henderson's no. 2397) have passed as true *A. Drummondi*, while a recent Colorado collection (Baker's no. 341) has been made the type of a proposed new species, *A. connexa*, Greene. As an extreme of *A. Drummondi* this plant seems very well marked, but with the same habit and pubescence, and with only the inconstant tendency to broader pods, it seems better treated as a variety of that widely distributed plant.

The three eastern plants which have been associated as *Arabis Drummondi* and the ill-defined *A. confinis* may be briefly distinguished, then, as follows.

* Basal leaves glabrous or with some simple centrally attached hairs: pods erect or strongly ascending.

A. DRUMMONDI, Gray. Biennial, usually slightly glaucous, glabrous throughout (except for the occasionally pubescent basal leaves), 2 to 9 dm. high: basal leaves oblanceolate, slender-petioled, entire or dentate; cauline erect or strongly ascending, oblong- to linear-lanceolate, entire, sagittate-clasping: flowers pink or whitish, 7 to 10 mm. long, on slender erect pedicels: pods erect (except in age), straight or slightly curved, normally flat, 3.5 to 10 cm. long, 1.3 to 2.3 mm. broad, bluntly pointed: seeds in 2 irregular rows, short-oblong to broadly elliptical, winged. — Proc. Am. Acad. vi. (1866) 187. *A. Drummondii* Gray, Man. ed. 5, 69, in part; Watson, Syn. Fl. i. pt. 1, 166, in part. *A. laevigata*, Hook. Fl. Bor.-Am. i. 43 (1829), not Poir. *A. confinis*, Watson, Proc. Am. Acad. xxii. (1887) 466; Wats. Syn. Fl. l. c. 163; in part; Watson & Coulter, in Gray, Man. ed. 6, 67, in part. *A. brachycarpa*, Britton, Mem. Torr. Cl. v. (1894) 174, Ill. Fl. ii. 150 and Man. 464; in part. *A. oxyphylla*, Greene, Pittonia, iv. (1900) 196. *Turritis stricta*, Graham, Edinb. New Phil. Jour. 1829, 350; Hook. l. c. 40; Torr. & Gray, Fl. i. 79; Torr. Fl. N. Y. i. 53; Gray, Gen. Ill. i. 144, t. 59; not *Arabis stricta*, Huds. *T. glabra*, β., Torr. & Gray, l. c. 78, 666. *Streptanthus angustifolius*, Nutt. in

[1] Gray, Proc. Acad. Phila. 1863, 57.
[2] Gray, Proc. Am. Acad. vi. 187.

Torr. & Gray, l. c. 76 (1838). — Rocky or ledgy banks, northern Maine to the Rocky mountains of British Columbia, south to Nova Scotia, eastern Massachusetts, Rhode Island, southern Connecticut, central and western New York, Ottawa Co., Ohio, Kane Co., Illinois, and along the mountains to Colorado, Utah, and Oregon, and California (?).

Var. **connexa**, n. comb. Stout: the pods 3 to 3.3 mm. broad. — *A. connexa*, Greene, Pittonia, iv. (1900) 197.— Mountains of Colorado and Washington, and at Rivière du Loup, Quebec. Passing gradually to the species.

* * Basal leaves pubescent with mostly 3-forked stellate hairs: pods wide-spreading or loosely ascending.

A. BRACHYCARPA, Britton. Similar to *A. Drummondi:* radical leaves densely pubescent; cauline glabrous: flower-pedicels soon widely spreading or even pendulous: pods 1.7 to 9 cm. long, 1 to 2 mm. broad, mostly divergent, rarely even somewhat reflexed.— Mem. Torr. Cl. v. (1894) 174, Ill. Fl., l. c. and Man. l. c., in part. *A. Drummondi* and var. *brachycarpa*, Gray, Man. ed. 5, 69, in part. *A. confinis*, Watson, Proc. Am. Acad. xxii. (1887) 466, in part, and (including var. *brachycarpa*) Syn. Fl. l. c., in part; Watson & Coulter, l. c., in part. *A. divaricarpa*, A. Nelson, Bot. Gaz. xxx. (1900) 193. *Turritis brachycarpa*, Torr. & Gray, Fl. i. 79 (1838).— Sandy soil of open woods, banks and shores, more rarely on rocky banks, from Saguenay Co., Quebec, to Saskatchewan and Assiniboia, south to Restigouche Co., New Brunswick, Lake Memphremagog, Quebec, Lake Champlain, Vermont and New York, Jefferson Co., New York, the Great Lakes, Lee Co., Illinois, and along the mountains to Colorado.

GRAY HERBARIUM.

NOTES ON ALGAE,— VI.

F. S. COLLINS.

GRACILARIA CONFERVOIDES (L.) Grev. It has been the practice for many years to assign all specimens of *Gracilaria* from the New England coast to *G. multipartita* (Clem.) J. Ag., the broader forms as the type, the slenderer as var. *angustissima* Harv. Just outside of our limits, politically, Farlow[1] doubtfully reports another species.

[1] Report of the U. S. Commissioner of Fishes and Fisheries for 1871 & 1872, p. 289, 1873.

"In September, 1870, I found large masses of a *Gracilaria*, which I picked up by the armful at East Marion, Long Island. I think likely it was *G. confervoides* Grev., but have misplaced my specimens." In N. E. Marine Algae, p. 164 is a similar note, giving the locality as Orient. Other than this, there appears to be no record of anything but *G. multipartita* north of the Carolinas.

It is by no means easy to tell from a herbarium specimen of *Gracilaria* whether the living plant was flat, compressed or terete; and though the writer had seen several specimens from Buzzard's Bay that in every way resembled the European *G. confervoides*, he did not venture to consider them identical, as he could not be certain that the flattening shown in all the specimens in question was due to their pressing. On Sept. 14, 1902, however, he found on a muddy shore at Mattapoisett, Mass., quantities of *Gracilaria*, in dense rounded tufts, the fronds in every part terete with no trace of flattening; the branches long, attenuate, acute. There was no indication of the flattening at the axils, or of the palmatifid tips, characteristic of *G. multipartita* var. *angustissima*, and it would appear to be safe to add *G. confervoides* to the list of New England algae. The specimens have been distributed under that name as No. 1041, Phycotheca Boreali-Americana.

ACTINOCOCCUS PELTAEFORMIS Schmitz. This plant was formerly considered as the tetrasporic fruit of *Gymnogongrus Norvegicus* (Turn.) J. Ag.[1] but is now known to be a parasite on the latter, in the same way as *A. aggregatus* Schmitz is on *Gymnogongrus Griffithsiae* (Turn.) Mart. and *A. subcutaneus* (Lyng.) Rosenv. on *Phyllophora Brodiaei* (Turn.) J. Ag. It was found by the writer in July, 1902, at Cutler and at Baker's Island, near Harpswell, both on the Maine coast. It will probably be found wherever the host plant grows.

CODIOLUM PUSILLUM (Lyng.) Foslie. In RHODORA, Vol. III, p. 280, the writer noted the occurrence of this species at Marblehead, Massachusetts, but in a form different from the type, and to which Foslie gave the name forma *Americanum*, distinguished by the clava being nearly or quite as long as the stipe. At Cutler, Maine, in July, 1902, the same species occurred, forming a dense coating on rocks near high water mark, and composed of plants showing all stages from the typical European form to that of the Marblehead plant.

[1] Farlow, N. E. Marine Algae, p. 146.

The more one sees of *Codiolum*, the more difficult it is to draw sharp lines; forms can be found strikingly different from each other, but there are also many intermediate forms. The great need to clear up this matter is for some one to study them, in their natural conditions, through a whole season of growth: this might result in giving us reliable distinctions, or might result in uniting all under one name or a few names.

SPIROGYRA DECIMINA var. **triplicata** n. v. In a pool in the old slate quarry near Mystic Avenue, Somerville, Massachusetts, the writer found, May 20, 1902, a *Spirogyra* that does not agree exactly with any description accessible, but resembles *S. decimina* (Müll.) Kütz. so much that it seems best for the present to consider it a variety only. The type has two spirals, but occasionally three; cells two to four times as long as the diameter, which is 35–40 μ; spores broadly oval to subglobose. In the variety the spirals are uniformly three; the length of the cells varies from one and a quarter to five times the diameter, which is 40–45 μ; the spores in the shorter cells are nearly globose, in the longer cells cylindrical with rounded ends. The variety has been distributed as No. 960, Phycotheca Boreali-Americana.

In RHODORA, Vol. IV, p. 177, brief mention was made of the occurrence of *Plectonema Battersii* Gom. near Jonesport, Maine. It has since been found at Harpswell, Maine and Marblehead, Mass., and may naturally be expected anywhere along our northern coast, in the mixture of various minute Cyanophyceae which one so commonly finds in tide pools and under overhanging cliffs. It is nearly related to *P. Golenkinianum* Gom., which occurs in similar localities, but the filaments are somewhat larger, 2–3.5 μ in place of 1.2–2 μ, and the trichomes are pale aeruginous in color instead of roseate. In both the trichomes are somewhat torulose, with articulations one third to one quarter their diameter. While Gomont's description [1] represents the two as branching to the same extent, the American specimens show fewer pseudo-branches in *P. Golenkinianum* than in *P. Battersii*.

MICROCOLEUS TENERRIMUS Gomont, Monographie des Oscillariées, p. 93, Pl. XIV, figs. 9–11. The cosmopolitan species *M. chthonoplastes* (Fl. Dan.) Thuret is very common in warm bays, lagoons and marshes, all along our coast; in the Gulf States and in California

[1] Bull. Soc. Bot. de France, Vol. XLVI, pp. 35 & 36.

there has often been found growing with it a second species, *M. tenerrimus*. While the two are alike in general characters they are amply distinct by the following: *M. chthonoplastes* has trichomes 2.5–6 μ diam., densely packed in sheaths 20–30 μ wide. *M. tenerrimus* has trichomes 1.5–2 μ diam., few in number, in a sheath 10–15 μ wide. It was found in rather small quantity with *M. chthonoplastes* at Southwest Harbor, Mount Desert Island, Maine, by Mr. Isaac Holden, and is to be expected anywhere that the commoner species is found.

XENOCOCCUS KERNERI Hansgirg, Phys. & Alg. Studien, p. 111, Pl. I, 1887. The cells of this species form a denser and more membranous coating to the host plant than do the cells of *X. Schousboei* Thuret, our only species previous to this. Probably as a consequence of this arrangement, the cells are vertically elongated, and may reach a height of 10 μ with a diameter of 4 μ. The species was originally described as growing in fresh water in Bohemia; as No. 685 of Hauck & Richter, Phycotheca Universalis, specimens were distributed, collected in brackish water in East Africa; it was found by the writer growing abundantly on old plants of *Cladophora*, in a high tide pool at Cohasset, Mass., Oct. 12, 1901, and was distributed as No. 952, Phycotheca Boreali-Americana.

MALDEN, MASSACHUSETTS.

CHARLES JAMES SPRAGUE died August 5th at his summer home in Hingham in his eighty-first year. Mr. Sprague was born in Boston January 16th, 1823, and was a banker by profession, although he retired from active business many years ago, devoting himself thereafter to literary and botanical pursuits. He was a poet and musician of rare taste. For some years he was the botanical curator of the Boston Society of Natural History. He was an intimate friend of the late Dr. Asa Gray, to whose collections he contributed many valuable specimens and critical notes. Like the late Edwin Faxon, Mr. Sprague was more anxious to aid others in their investigations than to publish the results of his own patient and critical observations. Realizing the importance of specialization he directed his attention chiefly to the lichens. His valuable collection representing this difficult group of plants has for some time been property of the Boston Society of Natural History. One of Mr. Sprague's most important botanical papers was his treatment of the lichens contributed to Mr. John Robinson's Flora of Essex County, Massachusetts.

FURTHER NOTES ON THE TWELFTH PRELIMINARY LIST OF NEW ENGLAND PLANTS.— Most local lists of plants of central and southern New England have reported more or less definitely both *Cerastium vulgatum* and *C. viscosum*. But these reports must in most cases have rested upon some misunderstanding of the characters of these plants. The larger-flowered longer-pedicelled plant of the two (the *Cerastium vulgatum* of recent American works) is very common throughout New England, but the other species would according to our present knowledge, appear to be very rare in our region. After examining the *Caryophyllaceae* in many of the larger herbaria of New England the writer has been able to find only one specimen of the true *C. viscosum* from any New England locality. This is a bit collected at Providence in 1845 by Calder and preserved in the collection of Professor W. W. Bailey, now incorporated in the Herbarium of Brown University.

Stellaria longipes is another species reported in the older lists for various parts of New England, but this is certainly due to erroneous determinations of *S. graminea* made by persons consulting works like Wood's Classbook, from which the latter species is omitted.

A careful re-examination of the distinctions between *Arenaria serpyllifolia* and its so-called variety *tenuior* seems to show them of specific value and to make it desirable to classify the latter as a species under its first specific name, *A. leptoclados*, Guss. To the differences of leaves and inflorescence noted in the Synoptical Flora, the following distinctive traits may be added. In *A. serpyllifolia* the capsule at maturity is decidedly flask-shaped, and the walls are of a rather firm texture. In *A. leptoclados* (in which the whole flower is only half to two-thirds as large as in *A. serpyllifolia*) the capsule is subcylindric, and its walls are papery.

Lychnis alba, Mill., may now be definitely recorded from New Hampshire (Starrking, *Mrs. E. H. Terry*) and *L. Flos-cuculi*, L., from Vermont (Greensboro, *Miss H. M. Hodge*), specimens from these localities having been kindly deposited in the Gray Herbarium.

Tetragona expansa, Murr., was recently observed by Professor H. L. Clark as a transient ruderal plant near Woods Hole, Massachusetts, see RHODORA, iii, 88.

Silene apetala, Dame & Collins, Fl. Middles. Co., 15, not Willd., is *S. antirrhina*, L., var. *divaricata*, Robinson.

Silene nivea of Bishop's Cat. Pl. Ct. ed. 1901, p. 25, proves to

have been a Lychnis, either *L. alba*, Mill. or possibly a white-flowered form of *L. dioica*, L.

Buda marina, var. (?) *minor*, Wats. in Gray, Man. ed. 6, p. 90, seems to be only a dwarfed state of *Spergularia salina*, J. & C. Presl.

Sagina nodosa, Fenzl., var. *pubescens*, Koch, appears to have only formal value.—B. L. ROBINSON.

THE NINTH ANNUAL FIELD MEETING OF THE VERMONT BOTANICAL CLUB was held at Arlington and Manchester, Vermont. The Vermont Bird Club participated in the meeting and there were about thirty members of both clubs present. The projected trip to Stratton Mountain, proposed at the last winter meeting, had to be abandoned owing to the lack of suitable accommodations for so large a party. It is hoped, however, that the Club may be able to visit this mountain some future season. The place and time of meeting announced were Arlington, July 3rd, at noon. Five members, however, arriving somewhat in advance of the others, took a tramp in the forenoon, finding as a reward an abundance of *Acer Saccharum*, Marsh., var. *nigrum*, Britton, a tree which is pretty local in Vermont, although common in the Middle States. In the afternoon the Club tramped through Arlington Gap, where the Batterkill River cuts through the Taconic Range. *Desmodium cuspidatum*, Torr. & Gray, *Arabis Canadensis*, L., and *Collinsonia Canadensis*, L., were new to most of the members. Fine plants of *Viola sororia*, Willd., were also found, both on rocky hillsides and on interval land.

On the morning of July 4th, a train was taken for Manchester, and from there, some on foot and others riding, the party reached the top of Mt. Equinox about two in the afternoon. The most notable plant observed on the way was a pubescent form of *Viola rotundifolia*, Michx. *Botrychium matricariaefolium*, A. Br. and *B. lanceolatum*, Angst., were also found. After lunch the party descended the steep and slippery eastern slope of the mountain, being rewarded by one specimen of *Aspidium aculeatum*, Sw., var. *Braunii*, Koch, on the way, and *Galium boreale*, L., near the foot of the mountain.

The weather on both days was ideal and the meeting one of the pleasantest in the history of the Club. Thanks are due to Mrs. Munson, whose forethought and attention to the matter of teams and a guide, smoothed the way on the Mt. Equinox trip.—NELLIE F. FLYNN, Burlington, Vermont.

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INSECTICIDES USED AT THE GRAY HERBARIUM.

B. L. Robinson.

One of the questions most frequently asked by visitors at the Gray Herbarium is what means are employed to prevent the insect depredations to which all large collections of plants are to a greater or less extent exposed. This interest in the matter leads to the belief that it may be worth while to record the methods, which have been adopted, after a varied experience of many years, in dealing with this problem.

Until about 1885 it was the custom to poison with corrosive sublimate all specimens placed in the organized part of the Gray Herbarium. This was done in two ways. The first and crudest was to paint the specimens, after mounting, with an alcoholic solution of the sublimate, much to the disfigurement of the sheets. This way was soon abandoned as a general method and only resorted to in cases in which it was found that a sheet, already mounted, was infested by insects. The second method, used for many years, was to dip each dried plant, before mounting, into a shallow tray of the same solution and then dry it between blotters. This mode of procedure is, with various modifications, the one now followed in many private herbaria and in several of the great European collections. There is no doubt that it has a certain efficiency, but it also has considerable disadvantages. The slowness and expense of the treatment, while not burdensome in collections of moderate extent, become much more serious when the number of specimens mounts to many thousands annually. However, these are not the chief drawbacks. There is the difficulty of keeping an alcoholic solution at such a point of

density that it will be most effective and yet not deposit a perceptible coating of the sublimate upon the plant and thus alter the appearance of the surface, so that it loses to a certain extent its natural condition, so important in the identification of plants. In extreme cases it has been found that such a coating of sublimate may render it difficult to tell whether or not a given stem was glaucous in nature, or to determine with a hand lens the precise amount and character of minute pubescence. If, on the other hand, the density of the solution is allowed to sink much below saturation, a question arises whether the treatment is really effective. Many plants even in the dried state retain enough of their waxy super-cuticular coating to make it doubtful how thoroughly their tissues are reached by the solution during the brief wetting usually practiced. In this regard, however, it is to be admitted that an alcoholic solution would certainly be much more penetrating than an aqueous one.

There is an additional difficulty in this mode of poisoning from the fact that many dried plants, such as Potamogetons, aquatic Ranunculi, and others of delicate texture, quickly curl or become hopelessly tangled during an attempt to dip them into a solution of any kind. Other plants have a chlorophyll so delicate and tissues so easily penetrated by an alcoholic solution that they emerge from even a very short bath in a spotted and disfigured condition, the alcohol having partially exercised its well known solvent action upon the green coloring matter.

To prevent the curling of the specimens while they are drying after their bath, it is necessary, as already stated, to put them between driers, and these blotters draw off the greater part of the solution which the plants have taken up. Herein lies one of the chief reasons why the treatment is not more efficient, for it is probable that such parts of waxy-coated stems and leaves, as come into direct contact with the blotters, lose practically all the solution which may have adhered to them. Such exposed parts must become, especially after further cleansing, as for example through the friction of a towel during the process of mounting and the ordinary rubbing of superimposed sheets in the herbarium, vulnerable points for the attacks of the herbarium beetle. To overcome this difficulty, in some of the foreign herbaria, some more viscid substances and a small quantity of carbolic acid are added to the alcoholic solution of corrosive sublimate, rendering it more adhesive. However, this sort of perma-

nent more or less shellac-like coating over the specimens, even when very thin, affects the appearance of the surface.

A final annoyance in connection with the sublimate treatment arises from the circumstance that the substance is a violent poison to human beings as well as to insects. I am not aware that any case is on record of a person having been injured or even greatly annoyed by the use of corrosive sublimate in connection with an herbarium, although a physician once told me that he had experienced some irritation of the eyes while poisoning plants in this manner. However, although the danger to the amateur, whose herbarium work is confined to scattered hours of leisure, may be so slight as to be negligible, the question becomes more serious in a great herbarium in which an assistant would have to be engaged more or less continuously in such employment. The fact that corrosive sublimate is not a volatile substance doubtless much diminishes the danger, but in this connection it is to be remembered that during the changing of the driers and mounting of the plants subsequent to the dipping, many minute particles from the plants and driers are necessarily detached, forming a dust saturated with sublimate, which in this way must, to a considerable extent be inhaled by a person carrying on the work.

At the Gray Herbarium, however, it was not the difficulty, expense or even the danger (against which some expedients could probably be devised), which led to the abandonment of corrosive sublimate as an insecticide. It was its inefficiency. After many years experience with it Dr. Gray, annoyed by the poor results, declared with conscious hyperbole that the more the sublimate was used, the more insects came, — that they throve and grew fat on it.

About 1885 the sublimate was replaced at the Gray Herbarium by an alcoholic solution of acetate of arsenic. All plants added to the herbarium were dipped in this in the same way as above described for the sublimate solution. The acetate was selected from several salts of arsenic because of its deliquescent character, in consequence of which it was believed that it would be less likely to be detached as dust and render the atmosphere of the herbarium rooms unwholesome. This method was followed until 1890, when it was found on medical examination that two of the assistants, who had been suffering from some unknown irritation and general debility, had absorbed considerable quantities of arsenic, which in one instance had produced a temporary irritation of the kidneys. The

use of arsenic was then promptly given up and happily the physiological effects soon disappeared.

Thoroughly discouraged by the ineffectiveness and danger of the poisons hitherto employed, Dr. Sereno Watson, then in charge of the Herbarium, decided to give up the poisoning entirely, and to trust on the one hand to the tightness of the cases and on the other to the vigilance of the staff to protect the collection from insect depredations. After three or four years, however, it was found that both the small brown "herbarium beetle" (*Sitodrepa panicea*) and a more minute and colorless member of the Psocidae, the "book-louse" (*Atropos divinatoria*)[1] were increasing at an alarming rate and becoming pretty generally distributed in the collection. This was doubtless due in part to the fact that some large herbaria, acquired about that time, notably the collection of the late Dr. George Thurber, were badly infested by insects. In the injury to specimens at this period, it was clear that the recently inserted specimens, which had not received the corrosive sublimate or arsenic treatment, suffered most. This, however, cannot be taken as an unqualified proof of the value of these poisons, for many specimens of older date, known to have been so treated were found to be infested and injured by the insects, and the fact should be borne in mind that the first five years after the preparation of an herbarium specimen, before it reaches the final stage of complete desiccation, is the period when it is most liable to damage by insects.

The tightness of the cases, with the insects already inside, was naturally found to have only a negative value. Some more drastic means had to be found, and accordingly a tin can was devised for the fumigation of the sheets with carbon bisulphide. It was modelled upon a type of case successfully used by Mr. William Brewster in his valuable collection of birds, but was provided with eight shelves for herbarium sheets, of which it would hold about a thousand. The front of the case, which was also of tin, was provided on the edge with a metal phlange turning inward, which fitted into a metal groove in the case. This groove was lined with a convex strip of soft rubber, which being compressed by the phlange of the cover, when the latter was fastened on by ten external clasps, formed an essentially air-tight fitting. At the bottom of the can, under the lowest shelves, two spaces about two inches high were left for the insertion of shal-

[1] For the identification of these insects I am indebted to Mr. Samuel Henshaw.

low dishes of carbon bisulphide. About six or eight ounces of this were employed for each fumigation and the specimens were left in at least thirty-six and usually forty-eight hours. The effects were entirely satisfactory, so far as sure death to the insects was concerned; but it was soon found necessary to increase greatly the capacity of the apparatus, and four other cans, each capable of holding about two thousand sheets of specimens were installed. These were constructed upon the same plan, but the shallow pigeon-holes for the insertion of the sulphide were arranged at the top instead of the bottom, on the theory that the vapor of carbon bisulphide, being somewhat heavier than air would diffuse more effectively downward than upward. In regard to this point, it may be said that diffusion, although of unequal rate would doubtless occur effectively in both directions, and that theoretically it would be best to insert the sulphide somewhere about a fourth of the distance from the top to the bottom.

Working with the apparatus above described the staff of the herbarium fumigated the entire organized collection and the stored bundles of unworked specimens. Although the mere manual labor of the undertaking was considerable, the results were very repaying. For some months the herbarium was, so far as could be ascertained, entirely free from insects. After a year or so, a rare and sporadic reappearance of the herbarium beetle, led to a refumigation of considerable portions of the collection. Although since the use of the carbon bisulphide method, the number and depredations of the herbarium insects has certainly been reduced by 95 %, it has been thought best to employ in conjunction with this treatment some other precautions. An entomologist who was consulted said that the book-louse could be successfully kept out of any case by the use of camphor, naphthalin or, in fact, any agent producing a strong odor. In accordance with this suggestion flake naphthalin was purchased in large quantity and liberally sprinkled in each pigeon-hole of the herbarium cases. This was done immediately after the cases had been carefully cleaned while the specimens had been removed for their treatment with carbon bisulphide, the naphthalin being left in the cases when the herbarium specimens were replaced on the shelves. At the outset there was considerable scepticism regarding the value of naphthalin, but there is now good reason to believe that by discouraging a new immigration of insects, it is a useful adjunct to the carbon bisul-

phide treatment, especially in packages which are for any reason to be stored some months without opening.

Early in our battle with insects, it was felt that they would find a particular stronghold in what is known as the "bundle-room", where duplicates, unworked collections, etc., are kept, often for considerable periods, in separate packages. Accordingly, special precautions were taken with this room. All material was removed from it and the floors, standing woodwork and shelves were painted over with a nearly saturated alcoholic solution of corrosive sublimate — a treatment not to be recommended where woodwork is highly finished or its appearance a matter of consequence. This was done with the idea of sterilizing as far as possible any accumulations of organic dust, which might have lodged in the cracks of the woodwork in a manner to form food for insects. The packages were then brought back to this room only after a fumigation of at least forty-eight hours in the vapor of carbon bisulphide. Each package, tied in a preliminary manner, received a handful of flake naphthalin well sprinkled in among its sheets and was then securely wrapped in stout manila paper, tied, tagged, and placed on the sterilized shelves. This was done some years ago and the results have been most satisfactory. In fact, I am not aware that a live insect has been detected in the bundle-room since.

Even after the efficiency of these methods had thus been amply demonstrated, there was much left to be desired. Fumigation with carbon bisulphide is of necessity an annoying process from the extremely disagreeable and penetrating odor; and even if the cans or tanks, in which the fumigation is effected, are kept at a distance from the main rooms of the herbarium, the sheets retain for some days the odor, which is scarcely less disagreeable as it becomes fainter. The farther away the fumigating tanks are kept, the greater the labor of transporting the thousands of packages of herbarium sheets from the cases to the tanks and back again. To avoid the wear and tear upon the specimens, as well as to save much time and trouble, the attempt was made to fumigate the herbarium sheets directly in the wooden cases, where they are kept. This, however, proved a failure. Although about two pounds of the sulphide was used in a tightly closing twenty-six pigeon hole case and fumigation prolonged forty eight hours, it was found that living larvae of the herbarium beetle, which had been previously inserted among sheets in the case, although

apparently dead when taken out, became active again after two or three hours in air and sunshine. It is thus clear that carbon bisulphide fumigation to be effective must be conducted in metal cases.

Partly for this reason and partly with a view to the improvement of the fire precautions at the Gray Herbarium, much thought was devoted to the construction of a case for ordinary use in the herbarium, which should be at once gas-tight and fireproof. These features, which seemed simple enough, proved in combination rather difficult to realize, especially in a case which must open and close readily. After the supposed advantages of an all-metal case and a wooden case covered outside and in with sheet iron had been carefully weighed, sixteen trial cases of the second type were installed about a year ago. The doors, hinged at the side as usual, closed upon a continuous soft rubber buffer to render the fitting as air-tight as possible. These cases have proved satisfactory for purposes of fumigation, although they cannot be regarded as absolutely air-tight, a relatively small quantity of the vapor of the sulphide escaping around the doors. It is believed that they are also as fire-proof as cases can well be made. Unfortunately, however, it has been found impossible to treat the tinned sheet-iron covering in any way which does not make the case a crude and unsightly object. When, during the spring of the present year, it was again necessary to add a block of cases it was decided to have them made entirely of sheet steel, the plates of metal, wherever they came on the outside, being double with an air space of about five eighths of an inch intervening. This feature not only adds, on the well known principle of the hollow column, much strength to the structure as a whole, but is believed to insure practically as great protection against fire as the metal-covered wooden construction. Through the generosity of a liberal but anonymous friend of the Gray Herbarium it has been possible to have a trial block of eight such steel cases manufactured and recently set up in the main working room. They were made by the Art Metal Construction Company of Jamestown, New York, and the Gray Herbarium is much indebted to Messrs. Hine and Sullivan, the Boston representatives of the company, for their painstaking attention to this new application of their methods in steel work. In these cases, as in many safes, the doors fit with pressure against a smooth strip of piano felt, making a junction which is probably quite as effective as the rubber buffer above mentioned. The cases are handsomely japanned in light gray, are

provided with very firm and easy working latches, securing the door in three places at once, and are believed to represent an ideal herbarium case, so far as the subject is at present understood.

Since the instalment of the metal-covered and all-metal cases, much fumigation has been carried on in them. Of course, the great quantity of carbon bisulphide, which it is necessary to employ in cases of this size (twenty-six six-inch pigeon holes each)[1] would render any room disagreeable, and it is found desirable to carry on the fumigation during the summer vacation when students are away and the regular staff reduced to a minimum. However, if the ideal time ever comes when the whole of the great collection can be thus enclosed in metal, only rare fumigations will be necessary and these can be accomplished with the least possible difficulty.

The use of rubber buffers in closing a can employed for carbon bisulphide fumigation may be a surprise to those who recollect that this agent is a solvent for rubber. Experience, however, shows that the *vapor* of the sulphide exercises no appreciable injury to the rubber, which remains soft and pliant for a longer time than would be supposed.

The odor of carbon bisulphide, notwithstanding all the precautions which could be employed, being a great annoyance, experiments were undertaken with formaldehyde. In these Professor Charles Harrington of the Harvard Medical School, well known as an expert on the subject of disinfectants, was consulted and obligingly gave counsel and aid. The fumigation was carried on in one of the tin tanks with a capacity of about fifteen cubic feet, provided with a tin door closing against a soft rubber strip, thus essentially air-tight. The formaldehyde was produced first by the incomplete combustion of wood alcohol, then, in subsequent experiments, by volatilizing with an alcohol lamp the well known pastilles commonly used in disinfecting. The quantity of vapor produced in each manner was far in excess of the amount which experiment has shown ample to destroy disease germs. Owing to the successful work of the carbon bisulphide method, which had been in use many months, it was found impossible to obtain in the Gray Herbarium any living specimens of the "herbarium beetle" on which to try the effects of the formaldehyde fumigation, and *aphides* from the greenhouses were used instead. The surprising result was

[1] About two pounds in each case.

obtained that these soft, sluggish, and supposably non-resistent creatures came out of a formaldehyde fumigation of many hours duration without any apparent injury, although the same treatment is known to kill with certainty the bacterial germs of anthrax, diphtheria, etc. From these experiments, it was inferred that, however valuable as a disinfectant, formaldehyde would be likely to prove an unsatisfactory insecticide, and further experimentation with it was accordingly abandoned. Others, by varying the method, may have greater success with it.

In using carbon bisulphide, it should always be borne in mind that it is one of the most inflammable liquids known and that its vapor forms highly explosive mixtures with air. It is accordingly of the utmost importance for safety to keep both the liquid and vapor far from fire in any form or indeed from any source of heat, instances being on record in which carbon bisulphide has been ignited by the heat of steam pipes. It goes without saying that no match should be struck, lamp burned, or fire used in any manner in a room in which the fumigation is being conducted. The possibility of this easily inflammable agent acting chemically upon other substances employed in herbarium work and causing a heat-producing reaction sufficient to produce ignition, was early considered at the Gray Herbarium, and expert chemical advice sought. Happily, no such reaction appears possible with the other substances used. Where carbon bisulphide is to be used in quantity, it is a desirable precaution to store it in a remote out-building, bringing to the herbarium from time to time only such amounts as are to be used at once. The sulphide employed at the Gray Herbarium is kept in a small tool-shed at the back of the Botanic Garden. Some years ago it was kept in an old shed under a disused water tank, but one day the whole structure suddenly collapsing freed many pounds of the sulphide, which for some hours threatened an unwelcome fumigation to the entire neighborhood.

At the Gray Herbarium it has been found that no large group of vascular plants seems entirely immune from the attacks of insects. Probably the sedges are as little in danger as any; grasses and ferns also, if kept in perfectly dry cases are little subject to such injury, although one of the worst cases of insect work which has come to attention was on a collection of ferns stored for some years in Trinidad, doubtless in a damp atmosphere. Plants with a milky juice and

saprophytes seem especially attractive to insects. The Leguminosae and herbaceous Liliaceae also form vulnerable spots in an herbarium. In such groups as the Coniferae and Typhaceae, the staminate inflorescence is the chief point of attack.

The "herbarium beetle" is capable of eating almost any part of the plant, and includes lignescent stems and sometimes glue or even portions of the herbarium sheet in its diet. The book-louse, on the other hand, being especially attracted by pasty or saccharine substances, confines its injuries to delicate parts of the flower, chiefly the petals, anthers, and nectaries.[1]

Besides the insects mentioned, there are others peculiar to certain groups of plants, such as the gentians, irises, Peltandra, etc. These creatures, deposited as eggs in the base of the flower during the life of the plant, are apt to cause considerable annoyance by their ravages during and shortly after the drying of the specimen. The expedient of a short bath in steam or boiling water is only partially successful, since it usually results in a discolored or otherwise damaged specimen. How best to combat these most insidious insect enemies is a problem, to which it is hoped some amateur with leisure for experimentation and a taste for the refinements of herbarium technique may turn his attention. Probably the simplest way to avoid the difficulty in the case of the particular plants is to prepare specimens in some quantity and discard those injured while drying.

The burning of sulphur, practiced at some herbaria, to destroy insects, has never been tried at the Gray Herbarium, as it is difficult to feel quite satisfied that the methods ordinarily employed can be applied on a large scale without a slight fire danger. Furthermore, sulphurous acid exercises a strong bleaching action, and would be likely to affect the ink of the labels, even if not the plants themselves.

While the results of the experiments at the Gray Herbarium force us somewhat reluctantly to the belief that carbon bisulphide fumigation is the most efficient means of preventing insect depredations in herbaria of large size, I would not be taken as discouraging those who are employing corrosive sublimate. Several amateur botanists, with excellently appointed herbaria, ranging from ten to fifty thousand sheets, have told me that they have found the corrosive sublimate bath

[1] The carpet beetle (*Anthrenus varius*) and its larvae are occasionally found among herbarium sheets, but it has not been possible to ascertain whether it does any damage to the plants.

a perfectly satisfactory safeguard. On the other hand, I have recently learned with surprise that carbon bisulphide fumigation has been found ineffective in at least one herbarium of great size. This leads to the conclusion that, whatever method is adopted, success must come largely from care and thoroughness in its application. The danger from insects must be considerably greater in old buildings, and reduced to a minimum in new ones of modern construction with concrete floors and metal shelves. In any case, scrupulous neatness should be maintained in the surroundings of an herbarium. No accumulations of dust should be allowed on tables or shelves; dust-filled cracks in woodwork should be sterilized; all mouldy, imperfectly dried, or otherwise useless material should be promptly removed; and finally special attention should be taken to prevent the insect life in packages of stored duplicates, etc.

As efficient as the carbon bisulphide method has proved, its annoyance and danger are such as to stimulate investigations in other directions and at the suggestion of Professor W. E. Burke of the Engineering Department of Harvard University, some interesting experiments are being undertaken in the use of vacuum as a means of destroying insects. If it can only be demonstrated, that insects cannot survive in ordinary vacuum or, to speak more precisely, in an extremely attenuated atmosphere, much may be hoped from such a substitute for fumigation. Surely no other penetrating fatal agent could combine more happily so many desirable negative traits, such as perfect freedom from odor, poisonous fumes, and bleaching action, as well as from explosive, inflammable, or other qualities likely to render the herbarium rooms disagreeable or dangerous.

Gray Herbarium.

A NEW KOBRESIA IN THE AROOSTOOK VALLEY.

M. L. Fernald.

On June 29, 1899, the Josselyn Botanical Society of Maine spent the forenoon on the south bank of the Aroostook River at Fort Fairfield, Maine; and among other interesting plants collected by them was a slender wiry sedge first noticed by Miss Mabel P. Cook near the little spring above the long bridge over the Aroostook River. At

the time, a few specimens were prepared by the writer and the plant was laid aside for future study. The material was over-mature, with an inclination to shell; but the small oblong fruits were so unlike those of any known Carex of the *Elongatae* (to which group the plant seemed to have affinity) that it was recently described by the writer as a unique species, *Carex elachycarpa*.[1]

Subsequent trips to Fort Fairfield were too early or too late in the season for the local sedge to be found in good condition, until in early July, 1902, Messrs. J. Franklin Collins, Emile F. Williams and the writer spent a week at Fort Fairfield. Among the important objects of the first afternoon's excursion was, naturally, a visit to the original station of *Carex elachycarpa*. There, in the rain, we searched the seepy shore where Miss Cook had first called attention to the plant, and although we crept on hands and knees amongst the abundant *Triglochin palustris*, *Calamagrostis neglecta*, and *Juncus alpinus*, the only plant found resembling the little-known *Carex elachycarpa* was a tall slender and immature state of *Carex interior*. This result was of course most discouraging and it even led us against our own convictions to wonder if, after all, the material from which *Carex elachycarpa* had been described could have been an aberrant state of *Carex interior*. With this unsatisfactory ending of our first afternoon's work we returned to the hotel; but early next morning we visited a similar seepy and sandy spot on the north bank of the river. There almost immediately our discouragement was banished, for, mingled with *Carex interior*, *Triglochin maritima*, and *Juncus balticus*, was the wiry plant with the rigid spikes and characteristic little oblong subterete fruits of *Carex elachycarpa*. Abundant material in various stages of development was secured, and the remainder of the morning devoted to further exploration of the north bank of the river.

In the afternoon while Mr. Williams and the writer were putting up the morning's collection, Mr. Collins amused himself by studying the structure of the rediscovered *Carex elachycarpa*. This diversion, quite innocent in its motive, soon resulted in the investigator asking seriously "Is this a *Carex* after all?" An improvised dissecting microscope was soon constructed by fastening a Coddington lens on the blade of a partially open knife, and a series of dissections of the

[1] Proc. Am. Acad. xxxvii. 492, figs. 133, 134 (1902).

younger material quickly showed that our plant had the flower-structure not of Carex, but of the Himalayan and high-northern genus *Kobresia*.

In *Carex* the ovary is surrounded by an indehiscent closed pouch, the *perigynium* or *utriculus*. In *Kobresia* the ovary is wrapped about by a concave glume which is open on one side or with the margins merely united at the base. In *Carex elachycarpa* the glume has the margins united at the very base, but the mature achene protrudes between the free margins of the glume, and appears strongly exserted. On this account it may easily be mistaken for the perigynium of a Carex and only close examination will reveal its true nature. There is no question, however, that *Carex elachycarpa* has its affinities with Kobresia, a genus which is little known in North America; but like many of the species referred to Kobresia *Carex elachycarpa* is a problematic plant.

Besides the genus Carex the members of the *Cariceae* have been grouped by different modern authors into various ill-defined genera varying with the personal equation from two to five [1] while by early authors most of the better known species have been united with Carex. By Bentham & Hooker [2] four genera — *Kobresia*, *Hemicarex*, *Schoenoxiphium*, and *Uncinia* (besides *Carex*) were recognized, though Kobresia was placed in the *Sclerieae*. In his monograph of Hemicarex and its allies, in 1883, Mr. C. B. Clarke recognized [3] the same four genera, although he pointed out that they are based on somewhat artificial characters and that the original "*Kobresia* had the glume of the female flower concave, open or with the margins slightly connected near the base; *Carex* had a complete utricle. But in the considerable number of species now known of *Kobresia* (including

[1] Rafinesque in The Good Book — Number 1, or Amenities of Nature (1840) p. 23–24, says in his discussion of "The natural family of Carexides," "Yet they persist in deeming this vast assemblage a Genus! instead of a family!.... As I possess nearly 240 sp. of this group, American, Siberian and European, and have always deemed it a family, I may at last venture to split it into 22 Genera perfectly distinct"; yet it is surely disconcerting to present-day students of Carex to find that in the "perfectly distinct" genera of Rafinesque *Carex cephalophora* appeared as a "type" of both *Carex* and *Diemisa*; *C. crinita* as a "type" of both *Diemisa* and *Neskiza*; *C. lacustris* of both *Carex* and *Anithista*; *C. oligocarpa* of *Olotrema* and *Deweya* "(or *Meltrema* if Dewey has a G[enus].)"; and *C. pubescens* of *Enditria* and *Diemisa*. The excessively artificial nature of Rafinesque's genera is further shown when we find *Carex flava*, *Oederi*, and *viridula* (now often considered one species) as types of three "perfectly distinct" genera.

[2] Gen. Pl. iii. 1071, 1072.

[3] Journ. Linn. Soc. xx. 374.

Hemicarex, Benth.), this character is found to become illusory by degrees: the margins of the glume are exceedingly thin and brought close together; whether they are actually connate for more or less than half the length of the glume appears a matter of very slight importance to establish a genus upon, and from the exceeding fragility of the scarious margins it is exceedingly difficult to determine; different female flowers from the same plant, treated with every care under water, give different results."

In 1887 Pax essentially followed [1] Clarke's treatment, but separated *Elyna* from the *Kobresia* of Clarke. But in 1894 Clarke united [2] *Kobresia*, *Elyna* and *Hemicarex*, a course which seems far more satisfactory than the earlier one of separating them generically on illusory characters. In this treatment Clarke recognized 20 species of *Kobresia*: 13 confined to the Himalaya of northern India, occurring mostly at altitudes of 10,000 to 16,000 feet from Kashmir to Bhutan; 2 crossing the Himalaya from India to western Tibet; 1 in the Himalaya of northern India and western Tibet, and the Hindukush Range of Afghanistan; 1 extending from Tibet to Transbaikalia (Dahuria of Pallas); 1 from the Himalaya of northern India and western Tibet to Siberia and the Caucasus; and 2 of general arctic distribution, extending south in the north temperate regions to the Altai, Caucasus, Alps, and Pyrenees, and in the Rocky Mountains to Colorado.

Of the 20 known species of *Kobresia*, 19 have 3-cleft styles and trigonous achenes, and usually (if not always) male flowers with 3 stamens. In a single Tibetan species, *K. macrantha*, Boeckeler, the style is 2-cleft and the achene flat, not trigonous; and for this species differing from all others in these two characters Mr. Clarke has proposed the sectional name *Pseudokobresia*.

It is of great interest, therefore, to find in studying *Carex elachycarpa* of the Aroostook Valley that while it has the general floral structure of most Kobresias it has only 2 stamens and 2 style-branches instead of 3, and a compressed subterete, instead of trigonous, achene. Thus the Aroostook Valley plant most closely approaches in its characters the unique *Kobresia macrantha* of central Asia, but from that species it is very clearly distinct in its elongate narrow

[1] Engl. & Prantl, Nat. Pflanzenf. ii. Ab. 2, 121–122.

[2] Hook. f. Fl. Brit. Ind. vi. 694–699.

spike, subterete (only obscurely flattened) small achene, and in the male flowers with only 2 scarcely exserted stamens.

Differing from most other species in its 2-cleft style and from them all in its subterete achene and apparently in its 2 stamens, *Carex elachycarpa* might seem worthy generic separation from the essentially Himalayan *Kobresia*. But in view of the occurrence in *Carex* of either 2 or 3 style-branches and of either trigonous, subterete or strongly compressed achenes; in *Eleocharis* of terete or trigonous achenes; and especially in view of the subspathiform glume of *Carex elachycarpa* the plant is best treated as a unique *Kobresia*; and its discovery in northern New England suggests that further exploration may show that this remarkable genus is more generally represented in America than has been supposed.

From our more complete knowledge of the Aroostook River plant and its affinities it should be redescribed as

Kobresia **elachycarpa**. Densely tufted; the wiry compressed culms 2 to 5.5 dm. high, scabrous above; leaves flat (1 to 2 mm. wide), rather stiff, ascending, about half as long as the culms; spikes 1 to 2.5 cm. long, of 2 to 7 mostly remote appressed-ascending spikelets; spikelets either staminate (clavate), androgynous (staminate above, with 1 to several pistillate flowers below), or pistillate throughout (ovoid); bracteole (corresponding to the "scale" of *Carex*) ovate, concave; glume (corresponding to the "perigynium" of *Carex*) ovate, subspathiform, connate at base, emarginate at tip, more or less marked with green and brown: style with 2 long branches, the elongate base becoming chartaceous dark brown and subpersistent, finally separating from the truncate oblong subterete nerveless pale achene (1.2 to 1.5 mm. long): stamens 2, scarcely exserted, the anthers much exceeding the filaments.— *Carex elachycarpa*, Fernald, Proc. Am. Acad. xxxvii. 492, figs. 133, 134 (1902).— Maine, wet sandy banks of Aroostook River, Fort Fairfield, June 29, 1899 (*M. P. Cook, E. L. Shaw & M. L. Fernald*), July 15, 16, 1902 (*J. F. Collins, E. F. Williams & M. L. Fernald* in Plantae Exsiccatae Grayanae no. 115).

Gray Herbarium.

NOTES ON NEW ENGLAND DESMIDS,— II.

Joseph A. Cushman.

The Desmids reported here are from two different localities. One collection was made from a small pond on Misery Island, off Beverly Farms, Massachusetts, by the writer; the other from Kittery, Maine, by Dr. Roland Thaxter. Both contain species not hitherto definitely reported from New England and each includes species new to the state in which the collection was made. The specimens reported are in the herbarium of the writer, and they are indicated as H. C. no. 400, etc. The collection from Misery Island was from a small pond which at first glance would seem to be salt or at least brackish, but tides do not appear to reach the pond for it is fresh and contains fresh-water algae, among them many Desmids. It was thought at first that no filamentous forms were present, but a species of *Sphaerozosma* has turned up; curiously enough a species not before reported from New England. The assemblage of species is in many ways a curious one. Except where they have been reported from several localities in different states and are thus already known to have a wide range in New England, the previously reported localities are given. *Docidium* and *Penium* two of the common genera seem to be wanting. The following species were identified in the collection:

1. *Sphaerozosma spinulosum* Delp., var. Diam. 10 μ. A little wider than long, granules and not spines; otherwise like Delponte's species; more often two granules than three on each margin. In each semi-cell is a projection not shown in Wolle's figure of the species. Not common. *New to New England.* (Herbarium of J. A. Cushman, no. 376.)

2. *Closterium Jenneri* Ralfs. Diam. 15 μ, length across tips 70 μ. Rare. (H. C. no. 382.)

3. *Closterium lineatum* Ehrb. Diam. 50 μ, length across tips 80 μ. Not rare. (H. C. no. 337.)

4. *Closterium Lunula* Ehrb. Diam. 95 μ, length 540 μ. Seems to be rare. (H. C. no. 370.)

5. *Closterium subtile* Bréb. Diam. 6–7 μ, length 218 μ. The diameter is greater than that given by Wolle, but the plant otherwise fits the description and figures of the species. Reported before only from Orono, Maine. Rare. *New to Massachusetts.* (H. C. no. 382.)

6. *Cosmarium Bœckei* Wille. Diam. 28 μ, length 31 μ, isthmus 9.5 μ. The granules both in position and number are like the figure given by Wille. Frequent. Reported previously only from Orono, Maine. *New to Massachusetts.* (H. C. no. 379.)

7. *Cosmarium Botrytis* Menegh. Diam. 60 μ, length 71 μ, isth. 17 μ. Very abundant and varies considerably. (H. C. no. 400.) Zygospores present — measuring with spines 80 μ, without 62 μ. (H. C. no. 382.)

8. *Cosmarium intermedium* Delp. Diam. 40 μ, length 56 μ, isth. 12.5 μ. Occasional. *New to New England.* (H. C. no. 379.)

9. *Cosmarium laeve* Rab., var. *septentrionale* Wille. Diam. 18 μ, length 28 μ, isth. 6 μ. Like Pl. xliii, f. 14, Wolle 1892. Slightly larger than the measurements given there. Common. (H. C. no. 394.)

10. *Cosmarium protractum* (Naeg.) Arch. Diam. 30 μ, length 34 μ, isth. 9 μ. This form corresponds to that of Pl. xx, f. 29, Wolle. 1892, given as *Cosmarium ornatum*, var. *minor.* Reported previously from Orono, Maine. *New to Massachusetts.* Common. (H. C. no. 394, 387, etc.)

11. *Cosmarium punctulatum* Bréb. Diam. 28 μ, length 31 μ, isth. 10 μ. Very common. (H. C. no. 400.)

12. *Cosmarium Quasillus* Lund. Diam. 58 μ, length 68 μ, isth. 14 μ. Ends somewhat concave. Reported previously from Orono, Maine. *New to Massachusetts.* (H. C. no. 376.)

13. *Euastrum verrucosum* (Ehrb.) Ralfs. Diam. 68 μ, length 80 μ, isth. 16 μ. The typical form. Occasional. (H. C. no. 382.)

14. *Micrasterias Americana* Ralfs. Diam. 100 μ, length 125 μ, isth. 28 μ, diam. bas. pol. lobe 28 μ. Like the figure of *M. Americana* Ralfs, forma *genuina* Ralfs given by Maskell except that the two spines on the polar lobes are sometimes lacking. Frequent. (H. C. no. 346.)

15. *Micrasterias Americana* Ralfs, var. This differs from any of the reported varieties and will be reported at a future time. (H. C. no. 343.)

16. *Staurastrum dejectum* Bréb, var. *mucronatum* Ralfs. Diam. 21 μ, length 18. μ, isth. 5 μ. Small form. Reported previously from Steep Brook, Massachusetts. Occasional. (H. C. no. 387.)

17. *Staurastrum echinatum* Bréb. Diam. 40. μ, length 42 μ. More aculei than noted by Wolle, about one third larger, otherwise similar. Occasional. (H. C. no. 387.)

18. *Staurastrum muticum* Bréb., var. *minus* Wolle. Diam. 21 μ, length 24 μ, isth. 6.5 μ. Occasional. (H. C. no. 376.)

19. *Staurastrum punctulatum* Bréb. Diam. 30 μ, length 30 μ, isth. 12 μ. Usually joined in a series of two or more, often four. Common. (H. C. no. 394.)

20. *Staurastrum subarcuatum* Wolle. Diam. 25 μ without the spines. Common. Previously reported from Steep Brook, Massachusetts. (H. C. no. 347.)

The collection made by Dr. Thaxter at Kittery, Maine, contained the following species:

1. *Hyalotheca dissiliens* (Smith) Bréb. Diam. 22 μ. Very common, much of it in a fruiting condition. (H. C. no. 386.)

2. *Hyalotheca dissiliens* (Smith) Bréb., var. *hians* Wolle. Diam. 31 μ, diam. of mucous sheath 70 μ. Not so common as the typical species but not infrequent. It has been reported but once from New England, then from Amherst, Massachusetts. *New to Maine.* (H. C. no. 386.)

3. *Hyalotheca mucosa* (Mert.) Ralfs. Diam. 19 μ. Not infrequent *New to Maine.* (H. C. no. 371.)

4. *Bambusina Brebissonii* Kg. Diam. including projections 22 μ, average length of cells 25 μ. Scarce. (H. C. no. 342.)

5. *Desmidium aptogonium* Bréb. This species was noticed in looking over fresh material.

6. *Desmidium Baileyi* Ralfs. Diam. 27 μ, length 22 μ, av. diam. of excavation 9 μ, av. length of same 19 μ. Frequent. (H. C. no. 344.)

7. *Desmidium cylindricum* Grev. Diam. 36–46 μ, sheath 63 μ. Common. (H. C. no. 390.)

8. *Desmidium Swartzii* Ag. Diam. 42 μ. Large form. (H. C. no. 371.) Another measured diam. 36 μ. (H. C. no. 390.) Common.

9. *Arthrodesmus Incus* (Ehrb.) Hass. This species was noticed in looking over fresh material. *New to Maine.*

10. *Penium Digitus* (Ehrb.) Bréb. Diam. 48 μ, length 164 μ. Somewhat smaller than the measurements given by Wolle. Frequent. (H. C. no. 386.)

11. *Penium margaritaceum* Bréb. Diam. 36 μ, length 220 μ. A more compact form than that given by Wolle as a comparison of the measurements will show. Not common. (H. C. no. 342.)

12. *Closterium acuminatum* Kg. Diam. 25 μ, length across ends 190 μ. Frequent. Reported from Bridgewater, Massachusetts. *New to Maine.* (H. C. no. 391.)

13. *Closterium Ensis* Delp. Diam. 42 μ, length 550 μ. The diam. of this specimen exceeds that given by Wolle. Not infrequent. *New to New England* (H. C. no. 344.)

14. *Closterium juncidum* Ralfs. This species was noted among the fresh material with excellent zygospores.

15. *Closterium striolatum* Ehrb., var. *intermedium* Ralfs. Diam. 56 μ, length 490 μ. About 24 striae in all, distant. Frequent. *The variety is new to New England.* (H. C. no 371.)

16. *Closterium Venus* Kg. Diam. 10 μ, length across ends 48 μ. Frequent. (H. C. no. 384.)

17. *Docidium Trabecula* (Ehrb.) Naeg. Diam. at middle 28 μ, at end 16 μ, length 440 μ. Common. (H. C. no. 480.)

18. *Calocylindricus connatus* (Bréb.) Kirch. Diam. 63–65 μ, length 83 -87 μ, isth. 45–50 μ. The isthmus seems to be slightly narrower than in the figures given by Wolle. Common. (H. C. nos. 389 & 381.)

19. *Cosmarium Broomei* Thwaites. Diam. 32 μ, length 34 μ, isth. 12 μ. Frequent. (H. C. no. 377.)

20. *Cosmarium capense* Nordst. The specimen compares well with the figure given by W. & G. S. West (Jour. Linn. Soc. Lond. Bot. xxxiii, p. 301, Pl. 17, f. 3.) Rare. *New to New England.* (H. C. no. 480.)

21. *Cosmarium laeve* Rab., var. *septentrionale* Wille. Diam. 21 μ, length 27 μ. Common. *New to Maine.* (H. C. no. 377.)

22. *Cosmarium nitidulum* DeNot. Diam. 42 μ, length 50 μ, isth. 15 μ. Like the figure and description but considerably larger than the measurements given by Wolle. Rare. *New to Maine.* (H. C. no. 372.)

23. *Cosmarium Portianum* Archer. Diam. 25 μ, length 36 μ, isth. 9 μ. Reported but once before from New England, then also from Maine. Rare. (H. C. no. 377.)

24. *Euastrum* sp.? Two species of this genus were found but are not yet identified.

25. *Staurastrum muticum* Bréb., var. *minus* Wolle. Frequent. (H. C. no. 347.)

Boston Society of Natural History.

TWO PLANTS NEW TO THE FLORA OF LYNN, MASSACHUSETTS.

L. A. Wentworth.

It is a pleasure to call attention to two plants of considerable interest, which do not appear ever to have been recorded as occurring in this vicinity. The first of these is *Geranium pratense* L., a European species, already reported as well established in Maine. It occurs in a healthy and growing colony in a meadow at Swampscott, Massachusetts, and presents a pretty sight in the flowering season. In the size of its flowers and in its general habit it is not very unlike our native *G. maculatum*, L., but the leaves are cleft into narrower segments.

Centaurea solstitialis, L., seems more of a curiosity than the foregoing plant on account of its curious involucral spines and bright yellow florets, the latter feature being quite an oddity among our local members of the *Cynareae*, which, with few exceptions, bear purple flowers. The plant was first discovered in August, 1902, at Lynn, but its blossoming season here begins early in July, according to observations made this year. The plant is easily distinguished, not only by its well marked involucre but by its broadly winged stems, which are thickly covered with a cottony down and branch in an exceedingly sprawling manner; the lower leaves are also quite distinct in outline and remind one of the foliage of the Lactucas. The species seems not to have been reported from America before. It is a native of the Mediterranean region, although it is said to occur in Central Europe as a fugitive weed in cultivated ground. It is one of several species of this attractive although pernicious genus, which have rather recently made their appearance in New England.[1] As the group is very large in the Old World, still others may be expected.

Specimens of Geranium and Centaurea, above discussed, have been deposited in the Gray Herbarium of Harvard University.

While *Potentilla tridentata*, L., is a plant so frequent to the north-

[1] *Centaurea solstitialis*, L., has been found as a ballast weed in the vicinity of New York City; see Bull. Torr. Bot. Club. vi, 257, & xii, 39. It is also said to occur occasionally in the southern United States and in California; see, for instance, Hilgard, Gard. & For. iv. 424 (1891).

ward that it can scarcely pass as a particular rarity, still it is so local in Massachusetts that it is worth while to mention a station at Hamilton, observed July 4th. The plant is growing there in a little community of several hundred individuals, but I have found no trace of the species elsewhere in the vicinity, although it is frequent about Gloucester.

LYNN, MASSACHUSETTS.

A NEW STATION FOR ASPLENIUM EBENEUM HORTONAE.— Miss K. A. French has the honor of discovering a new station for the beautiful plumose variety of *Asplenium ebeneum* called *Hortonae*, which was fully described by Mr. Davenport in RHODORA, iii. 1–2, pl. 22, 1901.

The discovery of this interesting fern specimen in Pittsford (Vt.) July, 1903, swells the fern-list of a section already noteworthy for the choicest species which the fern-flora of the Eastern States can offer.

A study of environment only deepens the mystery of the origin of this remarkable variation. Old fronds about the base testify to the strength and age of the plant, the season's growth out of doors and the newer fronds, which have started up since the plant has been cultivated indoors, are all incised and frilled alike.

Not another plant of this kind was to be found in the locality, although this one was found in the midst of an abundance of the typical *Asplenium ebeneum*.

The overhanging ledge was lavishly decorated with *Woodsia Ilvensis* with a bit of *Polypodum vulgare* here and there. No other Aspleniums were in the near vicinity except a few specimens of *A. Trichomanes* lower down the hill.

All the fronds of the *A. ebeneum Hortonae*, both old and new, are thus far sterile. — G. A. WOOLSON, Pittsford, Vermont.

A NEW ENGLAND STATION FOR BUXBAUMIA INDUSIATA BRIDEL.— While botanizing on a mountain in Surry, New Hampshire, September 3, 1902, I noticed a large decayed log upon which were growing hundreds of peculiar little plants that I at once recognized as Buxbaumias. Several smaller pieces of decayed wood in the vicinity, presumably portions of the same tree, were also covered with the strange-looking objects. I had never before seen them growing, and

supposing them to be the immature capsules of the fairly common *B. aphylla*, only about fifty specimens were collected. I remembered having at my home in New Haven, Connecticut, a reprint of an article by Professor E. J. Durand, on *Buxbaumia* from the Bulletin of the Torrey Botanical Club. On my return a few days later, I was surprised and delighted to find that his description of the rare *B. indusiata* was the one which fitted my plants. Material was submitted to Mrs. E. G. Britton of New York for verification. So far as I am able to learn, this is the first time that the species has been collected in New England.

The stations given by Professor Durand are: — Catskill mountains, New York, 1869 (*C. H. Peck*); Seattle, Washington, 1889 (*C. V. Piper*); Traille river basin, Idaho, 1889 (*J. B. Leiberg*); and Enfield, New York, 1893 (*E. J. Durand*).

The Surry station was again visited in August, 1903, but although the log was identified after a thorough search, it had only a very few green capsules. Many dry capsules were present, the remains of last year's crop. Though *B. indusiata* is said to occur usually on decayed coniferous logs, a few undecayed knots and portions of the trunk proved this to be a poplar log, probably *P. tremuloides*, which grows abundantly in the vicinity. Specimens of this rare moss from Surry have been placed in the collections of Professor W. G. Farlow, Harvard University; Mr. J. F. Collins, Brown University; and in the Eaton Herbarium of Yale University.— B. Madeline Britton, New Haven, Connecticut.

Galinsoga in Maine. — On September 29, 1902, when in Andover, Maine, I was asked by a friend to look at a weed that was becoming very abundant in his garden. It proved to be *Galinsoga parviflora*, Cav., var. *hispida* DC., and was well established in both cultivated and waste ground. During the past summer on July 24th and other subsequent dates I found this plant also at Seal Harbor (Mount Desert), Maine. It was there growing in abandoned garden-plots to the practical exclusion of other weeds. These two stations I think, may be noteworthy as extensions of range. — Edward L. Rand, Boston.

A LEAFLET OF THE SEAL HARBOR VILLAGE IMPROVEMENT SOCIETY.

[It is well known that in the neighborhood of our summer resorts, many of our native plants are becoming less abundant every year, and some of them are in great danger of extermination. The number of plants gathered by plant lovers for various purposes is far greater than one would suppose. A year ago it was suggested to the Village Improvement Society at Seal Harbor, Maine, that something might be done to check unnecessary and careless gathering of the native plants in that part of Mount Desert Island. In consequence of this suggestion a committee was appointed to consider the matter. As one result of this action a circular was prepared by two members of the committee, Prof. Samuel F. Clarke and Mrs. Frances Theodora Parsons, which was widely distributed through the village. So many instances have been observed in which the recommendations of this circular have been adopted by the summer visitors that it seems well to give it a still wider circulation. It is therefore reprinted below with only a few unimportant omissions relating to local plants.— Ed.]

It is to the interest of every visitor to Mount Desert that its beautiful and characteristic plants be guarded from extermination. It is believed that everyone will be ready to aid in this work if once he, or she, fully realizes the danger with which these plants are now threatened.

It is not our wish to discourage unnecessarily the gathering of wild flowers and ferns for decorative purposes. We ask only that they be picked with care and discrimination. Such a flower, for example, as the blue-bell, which forms so beautiful a feature on the rocks along the shore, should always be cut with the scissors or a knife,* rather than picked, to prevent its being uprooted, and even when cut, care should be taken to gather it only where it grows most abundantly, that no picturesque tuft be so completely done away with as to set no seeds for another year.

Where there is an especially fine plant or colony, or where there is a single plant or small colony, why not leave at least half the flowers for seed, in the one case giving nature a chance to perpetuate and develop the best, and in the other, helping nature to extend her work of beautifying our surroundings?

The pink lady-slipper, or moccasin flower, the purple fringed orchid, the Calopogon, Pogonia, and indeed all the orchids, should be cut (not picked) fairly high up the stem, leaving, whenever possible the lower leaves intact.

If these flowers are not to be exterminated they should not be gathered at all unless found growing very abundantly, and then only

in moderation. Such fragile blossoms are more effective if not heavily massed, but arranged a few sprays by themselves.

From the purchase of the rarer flowers, especially of the purple-fringed orchid, by the roadside, we urge everyone to abstain. The country children who offer them for sale, are, innocently enough, the most dangerous enemies of all rare, salable flowers.

Ferns, also, should be picked with care, and not too freely, unless in spots where they are unusually abundant. The same caution should be used against breaking branches from shrubs and trees in so rude a fashion as not only to cause a temporary disfigurement, but perhaps a permanent injury.

The hobble-bush, whose effective leaves and brilliant berries decorate gaily the woods of late summer is frequently a victim to careless picking.

The flowers growing in the immediate neighborhood of the roadside are a joy to the many. Is it too much to ask that these be left to delight the eyes of the passer-by, and that the flowers desired for decorative purposes be sought a few feet from the highway, or even from the trail? These roadside plants are constantly enjoyed by those who, by reason of age or some infirmity, could otherwise never see them. Were this once realized few would hesitate to take the trouble entailed by half a dozen extra steps.

We should not fail to add that many of the most effective flowers may be gathered away from the wayside without fear of doing any permanent injury. Daisies, buttercups, clover, wild roses, meadow-sweet, steeple-bush, asters, golden-rod, and other vigorous and abundantly growing plants will yield ample material for decoration and may be gathered almost with impunity.

To sum up we urge:

1st. Moderation. (Not gathering too many flowers of the same kind in one locality.)

2nd. Care. (The use of scissors or knife.)

3rd. Judgment. (Guarding the roadside and conspicuous locations.)

4th. Occasional total abstinence. (In case of especially rare flowers.)

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NATURAL HYBRIDS IN SPIRANTHES AND HABENARIA.

Oakes Ames.

(Plate 47.)

An interesting natural hybrid derived from *Spiranthes gracilis*, Bigelow, and *S. praecox*, Watson, was detected recently in Easton, Massachusetts, growing in close proximity to the parent species in an open dry field. A single specimen, together with several specimens of *S. praecox*, was collected on September 3, 1903, by A. A. Eaton, who, though he suspected the origin of the odd specimen, sent it without comment to the writer. So it happened that independently of each other two people arrived at similar conclusions. A second and third trip to the same locality brought to light a dozen specimens, all quite intermediate in character and distinctly hybrid. The resemblance between these hybrids and one parent or the other would readily mislead a collector whose interests were not specially concerned with this particular group of orchids, and it would not be strange if such hybrids have been grouped arbitrarily with *Spiranthes praecox* or *S. gracilis*. To obtain the relatively few plants, which have been studied for the preparation of this note, a large area was searched and the material collected carefully examined.

The *Spiranthes gracilis* which should be regarded as a parent of the hybrids in question is the typical New England form, which blooms in late summer and early autumn. Likewise the *S. praecox*, with which we are concerned, is the New England form which usually completes its season of bloom by the end of the second week in September. These remarks may seem quite commonplace, but they are

made because of the seasonal differences in anthesis in several of the Spiranthes species in their northern and southern habitats, and because of segregates from *S. praecox*, which have been described recently.

Although the range of variation in most of our Spiranthes is astonishingly extensive, it would be difficult to account for the peculiarities of the Easton plants on any supposition other than hybridity. Some among these were much like *S. gracilis*, but the leaves, the pubescence, and the narrow hyaline margins of the floral bracts were decidedly similar to *S. praecox*. Of the plants resembling *S. praecox* in their inflorescence the broad, elliptic-lanceolate leaves and the green callosities near the base of the oblong lip were conclusive evidence of an unusual origin and constitution.

The leaves of the hybrids varied in form and in dimensions; they rarely attained the average length of *S. praecox* leaves, and were not as short as those of *S. gracilis*. However, they proved to be intermediate in varying degrees.

The pubescence of the scape, rhachis and capsules was distributed much in the same way as in *S. praecox*, but was decidedly shorter, less dense, and in some forms quite obscure. In fact the tendency toward glabrity in one parent and the tendency toward pubescence in the other produced a mean in the hybrids, an interesting consideration when contrasted with the dominant and recessive characters peculiar to Mendelian race-hybrids.

Several specimens with a distinctively *S. gracilis* aspect produced flowers which never expanded, and in one specimen which resembled *S. praecox* the same tendency, though less marked, was noted.

The flowers were variable in length, but for the most part intermediate in this respect. They were not so white as in *S. gracilis* nor so yellow as in the typical *S. praecox* of the region where the hybrids were found. The coloring of the lip was distinctive; yellow-green at the apical, greenish near the proximal end; the callosities or nipples were green at their base with a whitish apex. As far as observed the color of the callosities was decisive in the determination of the hybrids.

Spiranthes × **intermedia**, hyb. nov. Plants 27–42 cm. tall, slender; tubers about 7 cm. long, 6 mm. thick near the base; leaves lance-linear or elliptic-lanceolate, 4.5–8.5 cm. long, 8–15 mm. wide, passing into slender petioles; cauline bracts lance-linear, pointed; scape pubescent above, pubescence short, rather dense or sometimes

obscure; rhachis 6–16 cm. long; floral bracts ovate-lanceolate, abruptly acuminate, longer than the ovaries, with a faint hyaline margin; flowers 6–7 mm. long, in a spiral or one-sided spicate raceme; lateral sepals deflexed, lanceolate, margins involute, upper sepal oblong, obtuse, all the sepals sparsely pubescent; petals oblong, obtuse, tapering slightly to the base, equalling in length the upper sepal, and connivent with it; lip oblong, somewhat flaring at the strongly deflexed apex, green, or yellowish toward the proximal end, with a broad, whitish, erose margin; callosities green with a whitish or yellowish apex, partially pubescent. In dry upland fields, Easton, Bristol County, Massachusetts, Sept. 3, 8, 10, 1903. (*A. A. Eaton*).

Spiranthes × *intermedia* is a non-Mendelian hybrid. It is intermediate throughout, the characters of both parents being merged in all the important vegetative and floral parts. The capsules produce good seeds with plump embryos, and there is no reason to infer that the pollen has been impaired in efficacy through the influences of hybridization. The probabilities are, if horticultural experience with orchids is to count, that *S.* × *intermedia* can reproduce itself from seeds provided pollination and subsequent fertilization are effected by kindred pollen; and that the plants will act as species in their development. In fact, if seeds should germinate in a locality far enough removed from the parent species to make future pollination from them an exception rather than the rule, it would be rational to suppose that the hybrids would develop rapidly into a localized species. The plants increase by means of offshoots, and even when mingled with *S. praecox* and *S. gracilis* would survive long enough to ensure, through the laws of chance, an occasional successful cross with another hybrid, — a process which would tend to increase their number and so render more likely their perpetuation by seed.

The scattered occurrence of the hybrids forms the basis for the belief that more than one cross has been effected in the region of Easton. Furthermore, it is interesting to note that secondary hybrids may be represented by several ambiguous forms of *S. praecox* concerning which it has been thought best to withhold an opinion at this time.

In Rhodora (iii. 245) Mr. A. LeRoy Andrews described an odd form of Habenaria as a natural hybrid from *H. psycodes* and *H. lacera*. His specimens were collected in a wet meadow in Pownal, Vermont, on July 22, 1898, and on August 5, 1901. Mr.

Andrews sent to the writer a single specimen, which was collected on Aug. 5, 1902. This had more the appearance of *H. lacera* than of *H. psycodes*, but showed unmistakable evidences of hybrid origin. About a year ago, among specimens from the herbarium of Mr. John A. Wheeler, the writer found a single example of this hybrid, provisionally determined as *H. psycodes*, which Miss L. O. Eaton collected in South Chesterville, Maine. The flowers were quite intermediate in character, the petals and the deeply lacerate lip being indicative of the influences contributed by *H. lacera*. The plant has no date of collection, but it is interesting to note the fact that *H. psycodes* × *lacera* has been found in Maine.

Natural hybrids do not seem to be common among New England orchids, but intensive study may bring more to light. Often the characters which designate hybridity are extremely elusive, and hybrids are classed arbitrarily with the species to which they bear the closest resemblance. As a general rule orchids which hybridize freely give rise to progeny of an intermediate character, but when specific lines are closely drawn, and based on traits phylogenetically young, parental differences may not stand out with sufficient distinctness to attract special attention and so hybrids may well be overlooked.

How far the principles laid down by Gregor Mendel apply to *Orchidaceae* can not be stated with surety, but among the generally cultivated exotic species non-Mendelian hybrids seem to prevail. However, among such variable species as *Habenaria hyperborea*, from which questionable segregations have been made it may be probable that race-hybrids play an important part. Many of the *H. hyperborea* segegates are based on very slight variations in the vegetative and floral organs, on the relative proportions of the lip and spur, and on differences which can not be regarded as constant enough for critical determination. That these characters are of slight varietal value and perhaps merely racial, may explain away some of Dr. P. A. Rydberg's recently described species as simple Mendelian race-hybrids and their derivatives, which illustrate the remarkable peculiarities of recession and dominance and the redistribution of traits.

AMES BOTANICAL LABORATORY, North Easton, Massachusetts.

EXPLANATION OF PLATE 47.—Two forms of *Spiranthes* × *intermedia*, hyb. nov. Fig. 1, lip of *S. gracilis*, Big. (× 3); Fig. 2, of *S.* × *intermedia* (× 3); Fig. 3, of *S. praecox*, Wats. (× 3.)

REVERSIONARY STAGES EXPERIMENTALLY INDUCED IN DROSERA INTERMEDIA.

R. G. Leavitt.

The existing species of *Drosera*, more than 90 in number, without doubt have descended from a common original stock bearing leaves provided with tentacles like the tentacles found throughout the genus to-day. What the form, or outline, of the primitive Droseraceous leaf was, is a question which it is important to answer in considering the meaning of certain stages of development which make their appearance, under given conditions, in several species which I have had under observation. In the absence of actual relics of the very ancestors themselves, we must infer the original condition from a comparison of the living species, from the facts of their geographical distribution, and especially from their comparative ontogeny. If the results developed from these several kinds of data agree, we may have a good deal of confidence that our inferences are rightly drawn. The evidence can be given only in outline in this brief paper. The conclusion may be stated at the outset: the original type of leaf was probably not unlike that of our *Drosera rotundifolia*.

When we compare the Sundews of the world we find that, as to leaf-form, they fall into a few classes, with seemingly intelligible interrelationships. The transitions between the salient groups are marked by intergrading species. There is, first, the group with strictly linear, filiform leaves (*e. g. Drosera filiformis*), embracing eight species. The still fewer species with much elongated, narrow, spatulate leaves bridge the gap between the linear and the rounded. The roundish-leaved species number about 56; that is, species whose leaves approach the orbicular form found in *Drosera rotundifolia* much more than they do either that characteristic of *D. filiformis*, or that of *D. binata*. The next group, comprising about 15 typically Australian species, has the leaf-blades not elongated nor much broadened, crescent shaped or orbicular, and peltately attached. The affinities of this type are not clear, except from a study of the ontogenetic development; from this source, however the indications are unequivocal. Some members of the peltate group would afford a fairly satisfactory passage from the rounded type to the extremely

broad one appearing in *Drosera bimata*. This remarkable Australian species has leaves which sometimes attain a height of more than two feet. The blades are described as "2-forked," or "divided to the base into two long linear lobes." In reality the blade is entire. and is extraordinarily broadened, so that it extends transversely to the main axis of the leaf into two linear arms. These arms are turned upward and give the two-forked appearance. Of the same type is the little New Zealand *Drosera flagellifera*.

The above enumeration omits a few ambiguous — or for present purposes negligible — species. However, it fairly represents the genus, and will serve to illustrate the distribution of leaf-forms amongst the species.

The prominent types arrange themselves naturally in a series, beginning with the filiform, thence passing, by means of the elongated spatulate, to the rounded; then, by the accentuation of breadth, advancing through or near the crescent-shaped to the so-called two-forked. The series might represent a single line of evolution, with the point of origin at one end or the other; or the series may comprise two lines of development, having a common starting point in the round leaved group. Considering the course to have been a simple one, it is conceivable that the extremely broad may represent the primitive condition. But this supposition is improbable, upon the face of it, because the given form is so unusual in plants; it is in fact unique. The *D. bimata* type seems to be terminal rather than original. Or *Drosera filiformis*, at the other end of the line, may stand for the archetype. Three of the genera of *Droseraceae* have leaves of nearly the same description as those of *D. filiformis*, except as to the structure of the glandular hairs. The number of linear-leaved species of *Drosera*, however, is small; and furthermore, on grounds which cannot here be stated, two of these should be excluded from consideration in this connection. We have left six species which may be modern representatives of an original *Drosera* stock. But the filiform condition as seen in *Drosera filiformis* again, is unusual in plants and looks rather like the product of special evolution than like a stock-form. It might readily have been derived from the rotund by steps which to-day are preserved in *Drosera longifolia* and *linearis*.

The rounded style — under which I include the forms like or approaching that which obtains in *Drosera rotundifolia* — is clearly

related to that which characterizes the leaf in the two remaining genera of *Droseraceae*, namely *Dionaea* and *Aldrovanda*. It is not an unusual, extreme, or highly specialized figure among leaf-forms in general. It prevails overwhelmingly in the genus *Drosera*. From it all the types in the genus are derivable. From a study of the specific forms and their distribution within the genus, accordingly, it seems easiest to regard the roundish leaf as primitive.

The facts of geographical distribution point in the same direction. The *D. rotundifolia* type, with the more broadly spatulate leaves, is cosmopolitan and is most widely distributed, whether we consider the whole group or individual species. *Drosera rotundifolia*, for example, encircles the globe in the northern hemisphere, and in latitude ranges from within the arctic circle to the southern United States. *Drosera intermedia* is hardly less widely spread. Other types, on the contrary, are in comparison much restricted geographically. Thus the peltate-leaved group is practically confined to Australia and vicinity, though one member has found its way across the islands to India. Similarly *Drosera filiformis* is confined to the Atlantic border of the United States from Massachusetts to Mississippi. An extension for the general type, however, is found within apparently somewhat narrow limits in Brazil. Generally speaking those forms which have the appearance of being the most specialized and least likely to represent the ancestral stock are geographically most restricted. In so far as any conclusion at all may be arrived at from this kind of evidence, it is that the fundamental form amongst the Sundews is that of the round-leaved, or roundish-leaved, kinds, and that the other forms have been derived from it.

While the foregoing considerations, which necessarily lose some of their force from being much condensed, may not of themselves furnish a sure argument, they materially substantiate inferences drawn from a comparison of individual, or ontogenetic, development in several diverse species.

As is well known, organic beings often have a marked qualitative as well as quantitative development after birth or germination. At the beginning of its independent career, oftentimes the plant manifests properties which it subsequently adds to or diminishes or entirely loses. In infancy qualities appear which seem to be natural to infancy alone. These are later replaced by characters proper to approaching maturity. Finally the adult characteristics make their

appearance, while the earlier phases vanish wholly. Such a qualitative development of the individual has been shown to be in many cases essentially a recapitulation of the historical evolution of the species or family or larger group to which the individual belongs. And in a general way it may be said that the generations of animals and plants perpetually repeat the stories of their several races.

Yet it is not safe to judge that whenever the infantile condition of a plant differs from the adult state, the former is due to reversion. In each instance regard must be had for inherent or adducible probability. To illustrate, and at the same time to come directly to the case in hand: when we find that seedlings of *Drosera intermedia* begin with rotund leaves and bear only round-bladed leaves until they are considerably advanced in age, we may suspect that the youthful leaf reproduces an ancestral type. For evidence which may throw more light upon the problem we should, however, study ontogenesis in other species. As a matter of fact we do find that several species which in the adult state differ widely in the leaf agree at an earlier period and bear rotund leaves like the infantile leaves of *D. intermedia*. From all the cases of ontogenetic progress which I have been able to observe, with one merely negative exception, the indications are the same, and point to the existence of a fundamental type such as that which *Drosera intermedia* realizes in its earliest phases, from which the several species considered have probably arisen.

Concordant ontogenetic evidence certainly has great value. Upon this principle and facts which cannot here be presented, the two-forked type embodied in *Drosera binata* and *flagellifera*, and the peltate type seen in *Drosera lunata* and fourteen related species, become derivatives from a rotund original. The African *Drosera cistiflora*, in its highest state characterized by long narrow lanceolate or linear-lanceolate leaves, and several closely allied species, may be traced back to a spatulate source; as may also *D. filiformis*. And the spatulate form in turn reverts to a rotund original.

I have now outlined the reasoning by which I am persuaded that the small leaves with orbicular blades bearing marginal tentacles of a curious structure to be described below, which seedling plants and small adventitious plants of *Drosera intermedia* put forth, are reversionary. Being satisfied as to their nature, I have made a number of experiments with a view to determine some of the conditions of

reversion. I have sought to make mature plants repeat the youthful, ancestral stages, and have succeeded by disturbing the nutrition. When these adult plants are starved for a time they begin to manifest the desired atavistic traits. Moreover, these traits are not altogether due to simplification. In the tentacles of reversionary leaves borne by the weakened plants I find an added complexity in a particular respect — a fact of great significance to the general theory of reversion.

I took as subjects of experiment, plants of several species of *Drosera*. I cut off the roots, the leaves, and all but a little of the stem, leaving a quarter of an inch of the summit, with the growing bud. I placed them in wet sphagnum in an upright position and under conditions favorable to growth. They continued to put out leaves, which I took off and examined about as fast as they were produced, and of which I kept a record. I shall use *D. intermedia* to illustrate the result.

Some of the plants of *D. intermedia* used had, before the experiments began, the full character leaf. Others, while full grown, were still putting out round bladed leaves. All were producing tentacles of the ordinary type. After being treated as above described the former bore at first leaves reduced in size but still spatulate. But after a few of these leaves had been taken off, and the leaves formed in the bud subsequent to the beginning of the experiment — as we may believe — had begun to appear, they were all found to be orbicular bladed. Those plants which began with round blades continued to bear them; while uninjured control plants growing beside them developed the normal adult leaf with spatulate blade. The experiment was continued throughout the summer with uniform result.

When full maturity is reached, the tentacles of *Drosera intermedia* are all essentially of one sort. The oval purplish gland, which secretes the viscid fluid for catching insects as well as the digestive juices that are poured upon captured prey, is terminal upon the stalk. The axes of gland and stalk coincide.

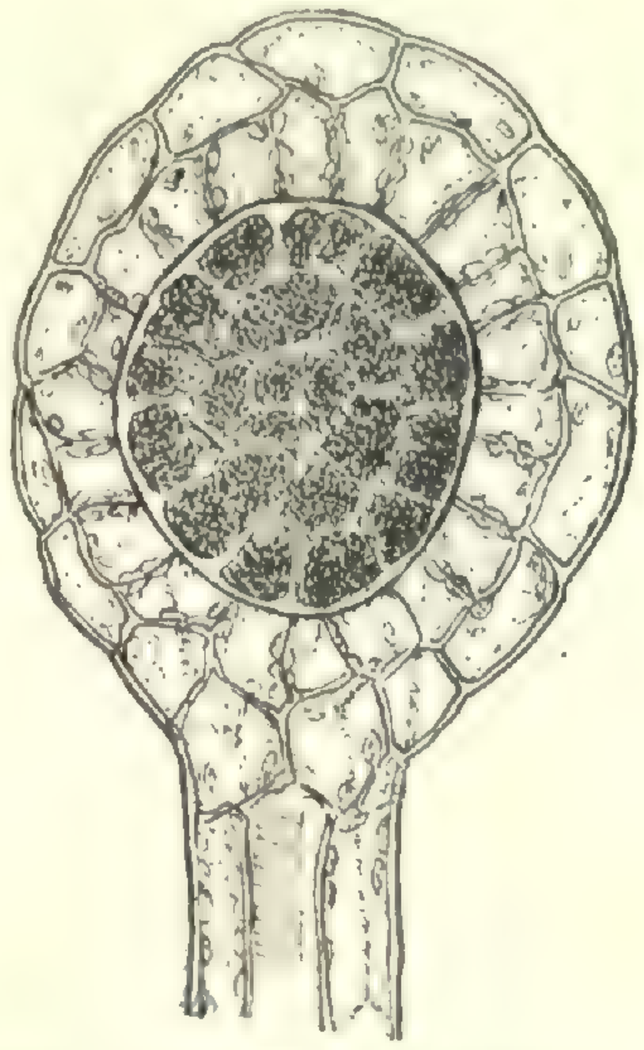


Fig. 1. Reversionary marginal tentacle of Drosera intermedia (magnified.)

This style of tentacle prevails throughout the genus. On the youthful leaves of all the species which I have been able to see in their early stages there are, however, two kinds of tentacles. Those on the margin of the leaf are more complex in this respect, that the gland is borne laterally upon the expanded extremity of the tentacle (Fig. 1). The axis of the gland is at right angles to that of the stalk.

The flattened, round, ovate, or elliptical extremity, serving as a support for the nearly hemispherical gland, extends on all sides beyond the base of the latter. Tentacles possessing such a structure are found on young individuals of, not only *Drosera intermedia*, but also *D. rotundifolia*, *capillaris*, and *binata*, and sometimes on *filiformis*. In the first three species named they persist nearly or quite to the maturity of the plant, but under a much changed aspect. In *Drosera intermedia* they disappear when the leaves become spatulate, if not before. In *Drosera rotundifolia* they may or may not be present in the modified form throughout life, while in *Drosera capillaris*, according to my material, they disappear. In several of the exotic orbicular-leaved species they are found in the adult, as I discover from herbarium specimens. In *Drosera binata* they begin to disappear as soon as the leaves depart from the primitive orbicular pattern, and are not found even in a modified form in the adult. They must be regarded as reversionary when they appear on leaves of primitive type in the species destitute of such tentacles at maturity, and also when they appear in those species which at maturity possess them only in a modified form. In *Drosera intermedia* they seem to me clearly to be products of reversion, and to constitute valuable indices for the study of the laws of reversion.

My experimental plants bore them seemingly as the direct result of the weakening to which I subjected them. The mode of their appearance was interesting. They appeared first at the tip of the leaf. Perhaps the first leaf to manifest the reversion would have but one tentacle of the flat-headed style, and in that case the very end tentacle would be the aberrant one. The next leaf would have perhaps three or four, at the end, affected. The atavistic tendency would then pass down the margin toward the base in succeeding leaves, until all the marginal tentacles had become reversionary, except one or two next to the petiole.

The effect recorded, namely the reappearance of ancestral traits

involving increased complexity of certain organs, was obtained when the supply of nourishment to the growing points where these organs were in process of formation was curtailed. Reversion seemed to be caused by disturbance of the nutrition.

Observations which I have made on the peculiarities of adventive growths of *Drosera binata* support the same conclusion. I have noted that when adventitious buds are formed on the flower scapes or on the roots — parts relatively large and affording abundant nourishment, especially in the case of the roots, which are stout and full of starch — the leaves produced are generally from the first of the *D. binata* type; that is, not reversionary. But if the plants are small and appear poorly nourished they are reversionary in leaf form and marginal tentacles. Buds arising from the leaves, relatively slender parts poor in nutritives, give small plants which bring forth rounded leaves for a time; that is, they revert.

In RHODORA, ii. 149, I published notes on reversion of *Berberis* leaves. The behavior of *Berberis* is like that of the *Drosera intermedia* of my experiments, in that a limited food supply (in the seedling) or decreased vigor (in autumnal leaves) is associated with reversion to a higher structural condition. The petiole is reduced to a mere rudiment in the full character leaf. The seedling leaf and oftentimes the last leaves of the season on fully matured bushes have not only blades entirely different from the ordinary blade, but in addition well developed petioles.

When, as in the petiole of *Berberis* and the tentacle of *Drosera intermedia*, the structure becomes more complex, we may speak of the reversion as ascending. Return to a simplified state may be termed descending reversion. The anatomical structure of the *gland* of the flat-headed reversionary tentacles in *Drosera* is simpler than that of the characteristic gland of the genus. In certain respects, therefore, the case of the *Drosera intermedia* upon which I have experimented is one of descending reversion. In other respects the reversion is ascending. Both sorts of reversion appear in this example to be occasioned by the same condition, namely limitation of the materials of construction.

The occurrence of reversionary leaves of simplified type on suckers springing from the bases of tree trunks is well known. Here reversion would seem to be due to — it is certainly correlated with — an increased stock of formative materials; for such suckers com-

monly are exceptionally vigorous. An interesting instance of return to an ancestral character of higher grade is described and illustrated by Dr. E. C. Jeffrey in his account of the resin ducts of *Sequoia*. The primitive structure reappeared where the food supply had been increased and growth had been stimulated as the result of a wound.

The foregoing facts are representative of a considerable body of data [1] which might be brought forward in support of certain general statements to which I may give the following form: (1) Reversions, in either an ascending or a descending direction, are sometimes occasioned in plants by a deficiency of the food materials supplied to developing parts; and (2) Reversions, in either direction, are sometimes occasioned by a superabundant food-supply in developing parts.

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ASPLENIUM EBENEUM PROLIFERUM.

C. E. WATERS.

THE most familiar instance of a fern with proliferous fronds is the walking-fern (*Camptosorus*). The greatly prolonged tip of the frond is pushed into the moss on the surface of the rock, and a young plant is developed. At first the tip thickens, then rootlets start out, and finally the small fronds appear. A tropical species (*Polystichum Plaschnickianum*) has almost the same outline of frond, and the same method of reproduction as the walking-fern. Scott's spleenwort (*Asplenium ebenoides*), which has now been definitely shown to be a cross between *Aspl. ebeneum* and *Camptosorus*, is occasionally seen with young plants at the tip of the frond, or even of the pinnae, a trait which has evidently been inherited from the walk ing fern. It is also said that the closely related *Aspl. pinnatifidum* is at times proliferous.

None of our other ferns has this trait, unless we except the bulbs

[1] Dr. R. T. Jackson, in a memoir too little known to botanists, has described a large number of instances of localized reversionary stages in plants and animals. This contribution to the subject of reversion is an extremely important one. Dr. Jackson recognizes the dependence of reversionary forms upon conditions of nutrition and growth. Memoirs Boston Society of Natural History, vol. 5, no. 4, 1899.

of *Cystopteris bulbifera*, which appear to be a special case of proliferation in which the young plants drop off at an early stage, instead of receiving sustenance from the parent until fully established. They differ also in being formed on the rachis and midribs, instead of only at the tips of the fronds or pinnae.

While cleaning the roots of a specimen of *Aspl. ebeneum*, I noticed what seemed to be a queerly shaped pinna on an otherwise bare stalk. It was soon seen that a small plant had sprung from the stalk. It was on the rachis of a sterile frond of the previous year, which had been covered with earth, and was at the point of attachment of the lowest pinna. The root was broken, but the part that remained was 8 mm. long. The first leaf, shaped somewhat like a small basal pinna, was 3.5 mm. in length. The second frond, nearly 4 mm. long including the stipe, had three lobes, the middle one being much the largest and three-notched at the end. One of the lateral lobes was slightly notched. The young plant did not seem to be in the axil of the old pinna, but exactly at the point of attachment.

I have been informed by Mr. B. D. Gilbert that this form was described about thirty years ago by Professor D. C. Eaton, who called it *Aspl. ebeneum proliferum*. It calls to mind the tropical ferns that bear buds and young plants on the upper side of the rachis, but these are produced normally, and not when the stalk is covered with earth. It may be that this is the determining cause in the case of our specimen, for it was normal in other respects. At the same time it must be admitted that this is not the only reason, for a careful search did not bring to light any more like it on other buried stalks.



It would be well worth while for some one to see whether this condition could be brought about experimentally. One might try, for instance, the effect of covering the rachis with earth at different seasons, and cover not only the perfect fronds but those that have part or all of the pinnae removed. The plant in question was growing in rather moist soil on the steep bank of a little stream.

Johns Hopkins University.

ADDITIONAL NOTES ON BOTRYCHIUM TENEBROSUM.

A. A. EATON.

(Plate 48.)

DURING the past season I have made a few additional observations on *Botrychium tenebrosum*, A. A. Eaton, and in making them public it seems advisable to incorporate them in a general description for the readers of RHODORA, so that they may familiarize themselves with this quite common but little known New England plant.

Botrychium tenebrosum (Plate 48) is a species found only in rich humus or leaf-mould, in deep moist shade. It is usually quite small, often thread-like, and fruiting even when covered by leaves, but sometimes growing to a height of 9 inches. Usually the plants are 3 to 4 inches high. They are yellowish green, very glabrous and shining when young, decumbent and stramineous when older, becoming thin and transparent when pressed. The sterile laminae are near the fertile, often overtopping them (Fig. 3). They are always simple with 2 to 8 distant, lunate, rarely incised lobes, the terminal usually retuse (Figs. 8, 9). The lobes are apparently never spread out flat, but are in the same position which they have in bud. The fertile lamina is usually simple, the large sporangia being sunk in the tissues of the broadened rachis. When the frond is compound, the ultimate segments are similar to the fruited segments of the sterile lamina, the rachis broad and leaf-like (Fig. 5).

It is apparently a northern species, being quite rare about North Easton and Brockton, Massachusetts, the southernmost point from which I have it. In southern New Hampshire and northern Massachusetts it usually is found in wet maple swamps, often in or around the depressions near sluggish streams in which leaves accumulate and decay. My first plants were growing in sphagnum. The sparse vegetation is often of *Onoclea sensibilis* and *Rhus Toxicodendron*, and it is often accompanied by *B. matricariaefolium* and *B. lanceolatum*, and even varieties of *B. ternatum*. In Maine, however, it appears to affect the mounds of humus in cedar swamps, farther from water.

As found in Madison, Maine, on July 2d last, it appeared to be more at home than farther south, as the plants were better developed and characteristic in appearance. It was also found to become

bulbous at the base and sheathed by the old remnants of stems as in *B. simplex*, which it also resembles in its general aspect and the size and markings of the spores, differing principally in having a simple lunate-segmented sterile lamina contiguous to the fertile, or at least above the middle of the stipe. The vernation is essentially that of *B. simplex*, both portions being erect, the very tip of the sterile flexed over the top of the fertile, but not bent down (Fig. 6). In a former paper [1] I have given its distinctive characters and shown it to be not *B. simplex* and later [2] I gave a detailed description. Mr. G. E. Davenport doubts the specific rank of this plant, regarding it as a depauperate *B. matricariaefolium*.[3] Both Prof. Underwood and I[4] replied to his criticisms, but it appears well in this place to give some of the chief points of difference between the species. In the accompanying plate Figures 1, 3, 4, and 5 represent pressed specimens of *B. tenebrosum*, natural size; while Fig. 2 shows a depauperate, but fruiting, specimen of *B. matricariaefolium*.

In vernation the buds of *B. matricariaefolium* are stout, the fertile lamina declined at the tip, resting on the top of the sterile of the succeeding year, the sterile of the year embracing the whole with its tip distinctly declined and enveloping the top of the fertile. In *B. tenebrosum*, on the other hand, the buds are much smaller even in plants of the same size, they usually bear a bulbous thickening of dead stalk-bases, and both segments are erect (Fig. 6), as in *B. simplex*. In habit *B. matricariaefolium* is relatively stout, erect, usually bluish as if pruinose, and has no remains of old stalks at the base; *B. tenebrosum* is slender and weak, shining, yellowish, and bears two or three years' accumulation of dead stalks. The aspect of the two is strikingly different when they are growing together.

The sterile lamina of *B. matricariaefolium* is more or less compound, the ultimate lobes being acute. Very rarely, indeed, a plant may be found, in which there are rounded lobes; the apex, however, is always acute (Fig. 10). In *B. tenebrosum* the sterile frond is essentially that of a very lax *B. lunaria*, although thinner and with the apex emarginate. In both species sporangia are borne on the sterile laminae, but in *B. matricariaefolium* they are usually on a transformed compound lobe, making a miniature spike, while in *B.*

[1] Papers Boston Meeting of Fern Chapter, 25.
[2] Fern Bulletin, VII. 7.
[3] Fern Bulletin, X. 22.
[4] l. c. X. 54.

tenebrosum they are always on the margin of the otherwise unaltered segment (Fig. 5). The differences in the sterile fronds are very noticeable even in the earliest stages of the plant.

The fertile lamina of *B. matricariaefolium* is decompound in full grown plants, the rachises are terete, the sporangia sessile or stalked, while in *B. tenebrosum* the spike is usually simple, rarely once pinnate, the rachises are broad, the sporangia sessile in rows or groups on each side, apparently buried in the tissues in life (Fig. 3, 4).[1]

The spores of *B. matricariaefolium* are 308–396 μ, averaging 352 μ, covered with coarse tubercles or warts; those of *B. tenebrosum* are 396–528 μ, average 484 μ, and are finely verrucose. I have previously[2] shown that the bud is elevated each year sufficiently to counterbalance the aggregation of leaves. The older portion of what may be considered as the rootstock persists for several years, and I found several plants in Maine, in which new plants were forming adventitiously from the oldest remaining nodes.

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Explanation of Plate 48. Figs. 1, 3, 4, 5 are of dried specimens of *Botrychium tenebrosum*, A. A. Eaton, natural size; Fig. 2 is of an herbarium specimen of *B. matricariaefolium*, natural size. Specimens 1, 3, 5 were collected in Skowhegan, Maine; specimen 4 in Brocton, Massachusetts. Nos. 1, 3, 5 have the sterile segment spread out in pressing; no. 4 shows it conduplicate in characteristic manner. At a, Fig. 3, an adventive shoot, springing from a root, is seen. Fig. 6 shows the bud of *B. tenebrosum*, magnified; Fig. 7, that of *B. matricariaefolium*, less magnified. Figs. 8, 9 show the apices of sterile fronds of *B. tenebrosum*; Fig. 10, that of the *B. matricariaefolium* figured above. Figs. 6–10 were drawn with the camera lucida. The others were traced from specimens.

Gaylussacia dumosa and frondosa in New Hampshire: — A Correction. — Owing to a curious and quite unaccountable mixture of labels and specimens a misstatement was made by me in Rhodora, III, 1901, 193–194 under *Gaylussacia dumosa*. The specimen sent me by Mr. Alvah A. Eaton was collected by him at Muddy Pond, Nottingham, New Hampshire on September 15, 1899. Mr. Eaton collected *Gaylussacia frondosa* at French's Pond, North Hampton, New Hampshire (the station I gave for *G. dumosa*) on June 20,

[1] Since writing the above I have seen Prof. Underwood's fine series of specimens, one of which is somewhat ternate and similar to *B. simplex*, var. *subcompositum*.

[2] Papers Boston Meeting of Fern Chapter, 26.

1896 and has since sent me specimens. This makes a second authentic station for that species for the State, as I have already recorded it in RHODORA, I, 1899, 93, from a specimen sent me by Mr. W. S. Harris who collected it on the shore of Cobbett's Pond, Windham, on July 23, 1895. The label reads "Scarce. A tall slender bush, with slender clusters of berries." — WALTER DEANE.

THREE NEW VARIETIES OF ISOETES.

A. A. EATON.

IT has been frequently remarked that although the *genus* Isoetes is world-wide in distribution, the *species* are apt to be very circumscribed in range, often confined to a very small area. As new collections are made, however, it is found that old species are often extended in range as might be expected; but it has also been found that species at first considered to be distinct are only conditions in a series, and plants from new localities often fill the gaps. One remarkable instance is in the case of *I. riparia* and *I. saccharata*,[1] whose characters are found in such a series that the question arises if the latter is really more than a variety of the former.

In some instances the plants of a drainage area may be considered as incipient endemic species, evidently from the same original source as those of other water-courses, but presenting constant or slightly varying differences, apparently caused by geologic conditions in some instances.

The vicinity of North Easton, Massachusetts, exhibits a marked instance of this. The soil is mostly a fine gravel, and no clay has been found. During the past season I have found an abundance of Isoetes, but only three familiar ones, namely, *I. Tuckermani*. and *I. echinospora*, vars. *robusta* and *muricata*. Late in 1902 Mr. R. M. Grey found a small species abundant in the ponds of this vicinity and my search has revealed two others, all of which, although showing some distinctive characters, are best regarded as varieties. The first to be treated is a variety of the very variable *I. saccharata* Engelm. and may appropriately be named for the botanist near whose home it is abundant.

[1] Bot. Gaz. **36**: 187–202.

I. SACCHARATA, var. **Amesii**. Trunk 2- 3- 4- or 5-lobed, 4–10 mm. long, 2–5 mm. wide and high; roots very fine: leaves 8–30 cm. long, 1–1.5 mm. in diameter, slender, finely pointed, green and erect when gregarious, spreading when scattered, very narrowly winged to the surface of the soil, quadrangular, the frontal edges elevated, the back flattened; stomata few, bast-bundles none: velum $\frac{1}{3}$–$\frac{2}{3}$ indusiate; sporangia 4 mm. long and 3 mm. wide, white or with a few scattered dark brown cells, very turgid from abundance of spores: gynospores 420–600 μ, averaging 510 μ long, rather sparsely covered with low, fine, rough granules and thin, short, low walls, often reticulated; androspores 28–32 μ long, very finely granulated.

Very common in shallow streams and ponds about Easton, Massachusetts, in fine gravel with or without silt, often forming a dense border a few feet to a rod wide, just at the lowest stage of the water, soon disappearing if exposed to the air. It is peculiar in the various lobing of the trunk. Two handfuls obtained by scraping the soil just deep enough to include the plants and then washing out, were found to have an aggregate of 204 individuals, of which 95 were 2-lobed, 94 were 3-lobed, eleven 4-lobed, and four 5-lobed, a much larger percentage of other than two-lobed trunks than has been found before in the United States except in the three 3-lobed species of the Pacific coast. The only other species that shows a considerable tendency toward a plurilobate form is *I. Tuckermani*, which in some places has 20% with three or more lobes but it is not constant in this trait. Most species may have an occasional plant with a 3-lobed trunk, but our other local ones rarely show a half of one percent so developed. The variety here described differs from *I. saccharata* in its very fine leaves, with few stomata and heterolobing of its trunk.

I have seen what is apparently the same thing from the following localities: Lantern Hill Pond, North Stonington, Connecticut, *C. H. Bissell*, Head of Hambury Cove, Lyme, Connecticut, *Dr. C. B. Graves*, Peeksville, New York, *W. H. Leggett*.

Isoetes riparia has been thought to have a place in the New England flora, but after a thorough study of Dr. Engelmann's material I became convinced that it was not found here, or at least that all previous reports were erroneous. I have recently[1] dealt with most of the material so referred, but several collections made about Uxbridge, Massachusetts, between 1831 and 1864 by Robbins, were

[1] Bull. Torr. Bot. Club. **30**: 359.

of a different appearance and conclusions regarding them were held back until further investigation.

During the past summer I have been so fortunate as to find an abundance of this form at Watson's Pond in Taunton, in Mulberry Meadow Brook in Easton, and Winneconnet Pond, Norton. Its characters are the same in all respects as in Robbins' plants. Although offering several important differences it is quite closely related to *I. Canadensis* (Engelm.) A. Br. and would best be considered a variety of that species. In recognition of the fact that its first recorded collection in America was by one of the best New England collectors of his day I propose to name it

I. Canadensis, var. **Robbinsii.** Trunk bilobed, 8–15 mm. long: leaves, 15–30, 10–38 cm. long, 1–1.5 mm. wide, dark green, very rigidly erect both in water and out, fine-pointed, with stomata and 4 bast-bundles: velum $\frac{1}{5}$ to $\frac{1}{3}$ or more indusiate: sporangia covered with brown sclerenchyma cells; gynospores 450–600 μ, very thickly beset with anastomosing jagged walls (much as in *I. riparia*): androspores 28.7–32.8 μ in long diameter, rough or slightly papillose or with a few tubercles.

This variety differs from *I. Canadensis* principally in its rigid habit, broader velum, densely sclerenchymatous sporangia, and the dense sculpture of the spores, which strongly resemble those of *I. riparia.*

Uxbridge, Massachusetts, "in rather sandy still part of a small stream, leaves ten, 10 inches high, very finely and sharply pointed" *Robbins*, 1831; Millpond, Uxbridge, 1845 and 1864, *Robbins*; Easton, Mulberry Meadow River, Aug. 16, 1903, *A. A. Eaton*; Norton, Winneconnet Pond, *A. A. E.*; Taunton, Watson's Pond, *A. A. E., type.* Robbins' specimens were evidently a source of much uncertainty to Dr. Engelmann. One was annotated as follows: "*Tuckermanni*? *riparia*? *Braunii*? apparently *lacustris*, *I. riparia*?" Another is annotated "*riparia major*" and "*lacustris maxima.*" They were all finally included in *I. riparia.*

The aspect of this plant is very much like that of *I. Engelmanni*, especially when growing out of water. When submersed the leaves are rigidly erect and look much like those of some junci. The bulb and leaf bases so far as covered by the mud are apt to be pinkish or cream colored. The variety approximates the terrestrial habit fully as much as *I. Engelmanni*, being found on the border of shallow brooks and near the upper limit of water in ponds.

Associated with both of these at their various stations, but occupying an intermediate zone on the shore, *i. e.* lower down than the latter, but higher up than the former, is a large species, often with 80 to 100 reddish leaves from 10 to 15 inches long, with the appearance of *I. Gravesii*, A. A. Eaton or *I. Eatoni*, Dodge, the sporangia being darker than in those, but very flaccid owing to the comparatively few spores they bear. A careful study has convinced me however, that its affinities are really with *I. foveolata*, A. A. Eaton, from which it differs principally in the spores. In that species they have a generally immature appearance, and occasionally there is a spore that is covered with open, thin-walled reticulations. In this, all the spores are well formed and irregularly honeycomb-reticulated, similarly to those of *I. riparia*. This may be known as

I. FOVEOLATA, var. **plenospora**. Trunks bilobed, 1–2 cm. in long diameter, half as wide and one fourth as high; the bulb of sporanges 1–4 cm. in diameter: leaves 30–110, submersed, reddish or olive green, 1.5 mm. in diameter or more, 20–40 cm. long, fleshy, spreading, somewhat flexuous, the emersed light green, erect tortuous or straight, finely pointed, 1 mm. diameter, all with stomata but no bast-bundles: velum $\frac{1}{4}$–$\frac{1}{2}$ indusiate, sporangia very thickly covered with rather dark brown cells, the color showing through the very thin "area" on the back of the leaf-base: gynospores rather few to each sporangium, usually somewhat glaucous, 450–600 μ, average 510 μ in diameter, covered with irregular, tall, thin, rough, mostly honeycomb-reticulated walls: androsporangia scarce in early season, plentiful in September, the spores 27–33 μ in diameter, very finely granular or with occasional tubercles.

In aspect this variety appears like an overgrown *I. Tuckermanni*, the habit and color being similar. By spore-characters alone it could not be easily separated from the last, nor indeed from several of our reticulate spored species. The reddish color of the leaves appears always to be present, becoming brownish in dried plants. It is more pronounced in the inner leaves, fading as they grow older. Ames Pond, North Easton, Winneconnet Pond, Norton, and Watson's Pond, Taunton, *A. A. Eaton*, scattered rather thinly in silt-covered gravel or in mud where emersed for part of the summer. *Types* from these localities collected by *A. A. Eaton*, 1903.

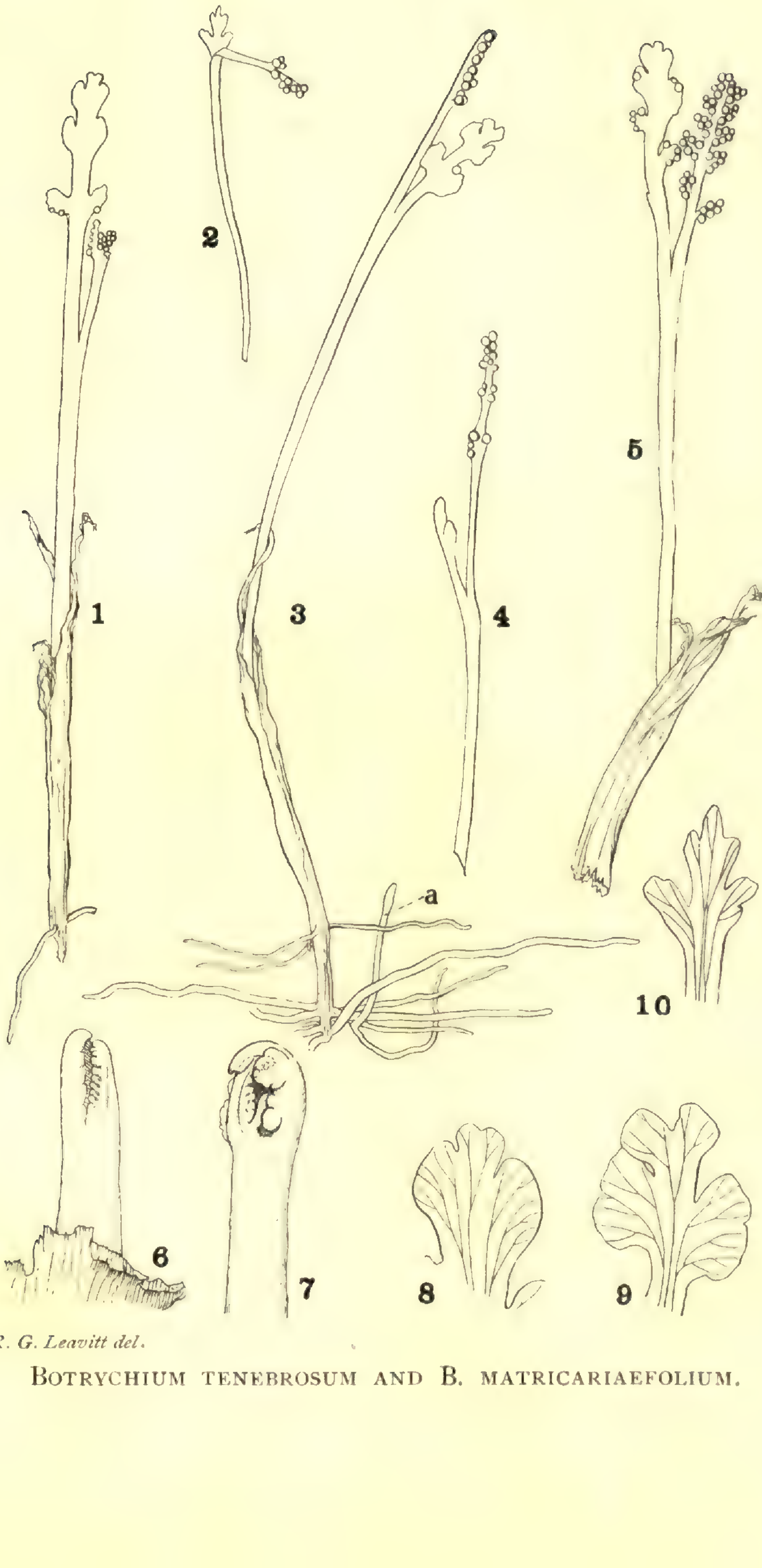
AMES BOTANICAL LABORATORY, North Easton, Massachusetts.

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Blanche Ames del

SPIRANTHES.



R. G. Leavitt del.

BOTRYCHIUM TENEBROSUM AND B. MATRICARIAEFOLIUM.

Rhodora

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PURSH'S REPORT OF DRYAS FROM NEW HAMPSHIRE.

M. L. Fernald.

In his *Flora Americae Septentrionalis* Pursh described in 1814 *Dryas tenella* from "the white hills of New Hampshire. *Prof Peck.* .... July. *v. s. in Herb. Banks*"[1]; and since that time American botanists have sought in vain for the plant and have wished in vain to know Peck's station in the "White Hills."

Pursh's description clearly places his plant with the earlier *Dryas integrifolia*, Vahl, of Greenland, and under this name it was taken up by Dr. Gray in five editions of his Manual, though, for some unaccountable reason, in the sixth edition Watson and Coulter altered the name and description to *D. octopetala*.

Three species of Dryas are generally recognized in high northern regions, all of them occurring in North America. *D. octopetala*, L., the only species of Europe, reappears in the mountains and on the coast of northwestern America, but is thus far unknown east of the Rocky Mountains. *D. integrifolia*, Vahl, with entire or subentire leaves and white petals, is definitely known from Greenland across Arctic America to Behring Straits, and south in the East to Newfoundland and Anticosti Island, Quebec. *D. Drummondii*, Richardson, the largest and handsomest of the genus, with coarsely toothed leaves and yellow petals, grows on sandy and gravelly shores in the northern Rocky Mountains, on Anticosti Island, and by the rivers of Gaspé County, Quebec.

According to Pursh's statement the original material of his *Dryas tenella* was collected by Prof. Peck[2] "on the white hills of New

[1] Pursh, Fl. 350.

[2] William Dandridge Peck, Massachusetts Professor of Natural History, Harvard College, 1805–1822.

Hampshire," and was in the herbarium of Sir Joseph Banks. During the past summer, therefore, the writer was interested to examine the material of Dryas in the Banksian Herbarium at the British Museum of Natural History. No material from Peck was found, and the only sheet clearly belonging in the original Banksian Herbarium was marked *Dryas tenella*, Pursh. This sheet contains three specimens, with the data indicated on the back of the sheet, two of the specimens collected before the publication of Pursh's species, the other a comparatively modern one from Labrador. The two older collections are from "1. Newfoundland, Inglie Island in the mouth of the harbour J. B[anks]," [1] and "2. Labrador, D. Nelson 1781."

Although there is the barest possibility that a Peck specimen may have once existed and is now lost, the fact that for nearly a century so conspicuous a plant as *Dryas integrifolia* has been sought in vain by the botanical explorers who have scoured the "White Hills" of New Hampshire, has long since thrown doubt upon the accuracy of Pursh's original data. Furthermore, since Pursh cited a specimen in the Banksian Herbarium and since there is in that Herbarium a plant which well agrees with the description of *D. tenella* and is so labeled, it seems still more probable that Pursh was in error in citing the plant from New Hampshire. As a result of examination of the data now at hand the following suggestion is offered as possibly explaining the source of error.

A detailed study of the charts of the United States Hydrographic Survey shows only one island on the Newfoundland coast which could have been intended by Banks as "Inglie" Island. This is Englée or Grévigneux,[2] a steeply scarped island hardly a mile in length, with its nine naked summits nearly hiding the entrance to Bide Arm, the northernmost fjord of Canada Bay. Directly west from Grévigneux (Englée) there rise from the shore of Canada Bay the Cloud Hills, 1195 feet high, an eastern lobe of the Long Range, which forms the backbone of western and northern Newfoundland and northward is generally referred to indefinitely as the White Hills; though in its most restricted sense the name White Hills is confined to the northernmost extension of the Long Range about Hare Bay, twenty-five miles north of Grévigneux (Englée) Island.

[1] Collected during the "voyage to Newfoundland and Labrador commencing April ye 7th and ending November ye 17th, 1766."

[2] See U. S. Hydrographic Survey Chart no. 794.

During the preparation of his Flora Pursh was associated with Banks,[1] who would naturally tell him of that portion of North America (Newfoundland and Labrador) which he, Banks, had explored but which Pursh had never seen. It is most probable that the White Hills were mentioned by Banks who had collected the Dryas on a rugged island off shore from some of the principal peaks of that range, and that Pursh, to whom Newfoundland was an unfamiliar region, confused the Newfoundland mountains with the "White Hills of New Hampshire," whose alpine plants were familiar to him through the collections of Peck.[2] This very natural error is rendered more probable by the fact that the data accompanying the Banksian plant is on the reverse side of the large herbarium-sheet and is not apparent to the hasty observer. And Pursh must have made hasty observations and notes; for the tremendous work of actually preparing his Flora was accomplished with almost unprecedented speed, in less than two years, during which time he not only organized his own material and notes secured during twelve years in America and examined among others the herbaria of Banks, Lambert, Clayton, Pallas, Plukenet, Catesby, Morison, Walter, and Sherard, but was constantly handicapped by the restless spirit which controlled his entire life.[3]

In view, then, of the evidence derived from the Banksian Herbarium there is little question that the original *Dryas tenella* came from an island close under the White Hills of northern Newfoundland, and that Pursh was in error in crediting it to New Hampshire. Should the plant be found hereafter on our own "White Hills" it may be safely considered a new discovery.

GRAY HERBARIUM.

[1] "Sir Joseph Banks, with his accustomed liberality, supported my undertaking by giving me access to his extensive library and herbarium."— Pursh, l. c. xvi.

[2] "During my journey [from Wiscasset] towards New York, I had an opportunity of visiting Professor Peck of Cambridge College near Boston, and seeing his highly interesting collection of plants, collected on a tour to the alpine regions of .the White Hills of New Hampshire. As the season was too far advanced when I was in that country to suffer me to think of ascending those mountains, this collection was highly gratifying to me."— Pursh, l. c. xv.

[3] "The whole study must have been rapid. The despatch is wonderful. One can hardly understand the ground of the statement made by Lambert to my former colleague, Dr. Torrey, that he was obliged to shut Pursh up in his house in order to keep him at his work."—Gray, Am. Jour. Sci. 3, xxiv, 325.

LOBELIA × SYPHILITICO–CARDINALIS.

OAKES AMES.

(Plate 49.)

Lobelia × *syphilitico-cardinalis* was raised by means of artificial pollination many years ago. It has also been reported to occur as a natural hybrid where the parent species are associated. The plants referred to in this brief note were obtained from seeds by Mr. Robert G. Leavitt, who pollinated flowers of *L. syphilitica*, L., with pollen of *L. cardinalis*, L., in the late summer of 1901. During the following year flowers were produced by several of the hybrids and in August, 1903, nearly all of them came into bloom. The variation in flower color was well marked, and for the most part the color values were intermediate.[1] In several cases, however, the corollas showed not the faintest trace of blue, although their structural features were midway between the parent species. One plant had corollas with a white ground, suffused, minutely mottled, and sparingly spotted with pink. Sixteen plants gave rise to flowers of a rich shade of magenta-crimson, which exhibited an almost perfect mingling of the blue-violet of *L. syphilitica* and of the deep red of the pollen parent. Three had flowers of a peculiar red tone much like that of *L. cardinalis*.

In their structural details the hybrid plants were exactly intermediate. Beginning with the calyx a beautiful intermediary series was apparent in the formation of the tube and its auricles, in the relative length of the lobes, and in the length and density of the hairs. In all the plants which bloomed there was but slight variation in the essential characters indicative of the hybrid origin of this organ. The corollas, on the other hand, were more conspicuously intermediate, and owing to the vast dissimilarity between the parents this part of the flower offered unusual opportunities for a study of mingled parental traits. The corolla-tube of *L. cardinalis* is slender near the summit and broadest near the base, while just the reverse is true of *L. syphilitica*. In the hybrids, without exception, a tube approximately equal in diameter from base to top was a conspicuous mean. The corolla-lobes were as remarkable in outline, direction

[1] The term intermediate is used here to signify a mean between the parents.

and measurement. The lower lip showed plainly the influence of *L. cardinalis* on the form and width of the middle lobe and the tendency of *L. syphilitica* to shorten it. In the specimens studied the middle lobe of *L. cardinalis* measured 4.5 mm. in width by 19 mm. in length, of *L. syphilitica* 4 mm., by 12 mm., of the hybrid 4 mm. by 15 mm. Of the upper lip the lobes were not so divergent as in *L. cardinalis*, nor so convergent as in *L. syphilitica*, an interesting point to note, as it shows how far reaching are the effects of hybridization.

The occurrence of scattered hairs on the corolla of the hybrid was of course attributable to *L. syphilitica*, which has conspicuous hairs on the mid-veins of its corolla-lobes. The corolla of *L. cardinalis* is glabrous, and it is undoubtedly the tendency of this species toward glabrity which brought about the decided reduction in the number and length of the hairs in the hybrid. The usual effect of hybridization, when one parent is glabrous, is to reduce trichome structures in length and number, a tendency well illustrated by the case in hand and by *Spiranthes* × *intermedia* described by the writer in RHODORA, v. 261.

The texture, form and green of the leaves in *Lobelia* × *syphilitico-cardinalis* proved to be intermediate in all the plants examined; the surface, scabrous to the touch, indicated clearly the influence of *L. syphilitica* and at the point of origin from the stem the leaf-bases were midway in their resemblance to the parent species. Although in outline the leaves of *L. syphilitica* and *L. cardinalis* are quite unlike, it was not apparent at a casual glance just how the hybrid leaf resembled its parents. In the accompanying plate three leaves are shown which were selected at random. The one taken from *L. cardinalis* tapers gradually from the base upwards, while that of *L. syphilitica* is broadest above the middle, and conspicuously narrowed downwards. The hybrid leaf is broadest just above the middle and tapers both ways.

In *L. cardinalis* the style closely invested by its connate stamens ultimately projects beyond the corolla-tube by about half its length, in *L. syphilitica* on the contrary, the style projects but slightly beyond the mouth of the corolla-tube. The hybrid, however, was quite intermediate in this respect as the style exceeded the corolla-tube, at maturity, by less than half its length.

None of the hybrids produced seeds naturally in the garden where

they were grown, nor did fertilization follow when pollen was transferred to the stigmas by hand, although both *L. syphilitica* and *L. cardinalis*, near by, had well developed pods of fertile seeds.

The reverse cross of the hybrid was not obtained by Mr. Leavitt, but according to Carl Friedrich v. Gärtner in his "Versuche und Beobachtungen über die Bastarderzeugung im Pflanzenreich," page 223, it is not distinguishable from *Lobelia* × *syphilitico-cardinalis*. Often when species much given to variation are crossed, the hybrid progeny is apt to present many puzzling combinations of the parental traits. This frequently gives origin to the belief that certain peculiarities may be accounted for by the rôle played by the parent species according as one or the other happens to be male or female. However, some species may bring about extensive variations in hybrid forms no matter what part they have taken in fertilization and these variations will occur whether the species in question is used as a seed- or a pollen-parent. Of course it has been stated by hybridists, whose testimony cannot be doubted, that differences which show maternal and paternal influences in an unmistakable way, do occur in reciprocal crosses. But it has been the writer's experience that the variation in the progeny of reciprocal crosses, especially when distinct species are used, is not necessarily the result of the disposition of the parents as male and female, but the consequence of individual traits which are apt to appear in similar combinations no matter which of the parents bears the seed or furnishes the pollen.

The accompanying plate was carefully prepared from the first hybrid which bloomed, a plant with magenta-crimson flowers. For the sake of contrast the hybrid was placed in the centre of the plate with *L. cardinalis* on the left and *L. syphilitica* on the right.

AMES BOTANICAL LABORATORY, North Easton, Massachusetts.

WOODSIA GLABELLA IN MAINE.— On the 1st of September, 1903, I collected a few specimens of *Woodsia glabella*, R. Br., in Township No. 1, East of the Kennebec, Fifth Range of Bingham's Purchase. The specimens were well fruited but not very abundant. This rare and interesting species appears to have been hitherto unrecorded for Maine.— J. FRANKLIN COLLINS, Providence, Rhode Island.

RECORDS OF WOLFFIA COLUMBIANA IN MASSACHUSETTS.

B. L. Robinson.

In his valuable paper upon the Lemnaceae of America Mr. C. H. Thompson states that he has examined specimens of *Wolffia columbiana*, Karst. from "Massachusetts, Robbins, 1870." There seems to be good reason to doubt the accuracy of this record, and as at least one manual of our flora has already extended the range of the species in question, apparently on the basis of Mr. Thompson's revision, it is worth while to inquire whether the Massachusetts record is not founded merely on a clerical error.

It is true that Dr. J. W. Robbins did collect *Wolffia columbiana* on three occasions, namely in 1829, 1867, and 1870, but in all these instances he obtained his material from Connecticut. The earliest collection is represented in the Gray Herbarium and bears Dr. Robbins's quaint and formal Latin label, which reads: Plantae Novae Angliae Robbinsianae. *Wolffia* n. sp. Legit Sept. 1829 e lacuscule prope pagum New Milford, Con., cum tribus Lemnae speciebus, J. W. Robbins, M. D., Uxbridge, Mass." On the same sheet is a second collection by Robbins from Salisbury, Connecticut, the label bearing in Dr. Gray's hand the following amplification of the locality: "N. Canaan depot. In a large pool, a few rods (20–60) west of the bridge over the Housatonic, on the S. side of the road leading to Plumb's Pond — say a mile from the depot." These specimens were borrowed and examined by Mr. Thompson during his work on the Lemnaceae and on the sheet he has noted his identification of the specimens as *W. columbiana*. It will be noted that Mr. Thompson has cited in his monograph no specimens of this species from Connecticut, and that the date which he assigns to Robbins's collection was 1870. Inferring that he might have seen specimens of Robbins's collecting in some other herbarium also, I have written to Professor William Trelease, Professor N. L. Britton, and Dr. J. N. Rose, to learn if such specimens were to be found in the herbaria of the Missouri Botanical Garden, the New York Botanical Garden, or the National Museum respectively. None was found at St. Louis or at Washington, but in the Torrey Herbarium at New York, Dr. Britton found, and very kindly forwarded to me in

part, some specimens collected by Robbins at Dutcher's Bridge Salisbury, Connecticut, 13 August, 1870.

From the facts here presented, it must be inferred that in recording the stations for *Wolffia columbiana*, Mr. Thompson made that very natural clerical error of copying not the locality where Robbins obtained the plant but the personal address, Uxbridge, Massachusetts, which according to a practice once common and always likely to mislead, Robbins had had printed upon his labels. Connecticut is therefore the only New England state from which *Wolffia columbiana* has been secured with certainty. However, the northernmost station in Connecticut is so near the Massachusetts boundary that there is a considerable probability that the species extends over the line.

It seems a pity that Dr. Robbins, who not only discovered this our smallest New England flowering plant but had the rare discrimination to recognize its novelty and correct generic affinity, should never have recorded in print his observations concerning it. More than thirty-five years passed after the original discovery by Robbins before the species was characterized and named by Karsten in Germany upon the basis of type material from Colombia in South America.

GRAY HERBARIUM.

MATRICARIA DISCOIDEA IN NEW HAMPSHIRE.—While collecting New Hampshire plants with a party of botanists on June 14, 1903, I found by the roadside near the shore at Wallis' Sands in the town of Rye, a small colony of the Pine Apple Weed (*Matricaria discoidea*, DC.). The plants were of good size, but not many in number. At some distance, however, another much larger colony of smaller plants was found. From the observations I have made in Maine regarding the habits of this plant, I consider that in a very few years it will be abundant in this part of Rye. Mr. A. A. Eaton writes me that this *Matricaria*, so far as he knows, is not established in New Hampshire; and it does not appear in the Manchester List. It may be well, therefore, to record this station for a weed which has a most redeeming quality in its pleasant odor.—EDWARD L. RAND, Boston.

New Stations for Maine Plants.— In July, 1903, a few plants of a peculiar *Hieracium* were collected by the writer near Skowhegan, Maine, under the impression that they were *H. praealtum*, L. Specimens have since been determined at the Gray Herbarium as *Hieracium floribundum*, Wimm. & Grab. This species has previously been collected by Dr. Kennedy at Cutler, Me., (Rhodora, IV, 25.) and at St. John and Bathurst, N. B., by Mr. Williams and Mr. Fernald.

Later in the summer the writer and Mr. C. H. Knowlton found several specimens of *Polygonum exsertum*, Small, growing at the edge of salt marshes at Pine Point, Scarboro, Me., a station intermediate between that of Mr. Bicknell at York, Me., and that of Messrs. Williams and Fernald at Bathurst, N. B.

Scirpus rubrotinctus confertus, Fernald, is in my herbarium from Cumberland and Farmington, Me., localities which extend the range in both directions from the station at Greene, Me., mentioned by Mr. Fernald (Rhodora, II, 21.) in his description of the variety.— Edward B. Chamberlain, Washington, D. C.

The Genus Trisetum in Andover, Massachusetts.— On June 8, 1903, while collecting in a boggy meadow in Andover, Massachusetts, in which were growing *Salix myrtilloides*, *Poterium Canadense*, *Carex exilis*, and other plants of interest, I noticed a strange grass and gathered a few specimens of it. These were later identified for me at the Gray Herbarium as *Trisetum palustre*, Torr. This seems to be an unusually northern station for this species which is said by the Sixth Edition of Gray's Manual to grow from southern New York to Illinois and southward. I have seen specimens from Norwood, Massachusetts, and that vicinity; but it is possible that Andover is at present its northern known limit.

On September 19, of this same year, I visited the rocky banks of the Merrimac River in the northwestern part of Andover. Here grow many species not abundant in this section of the State (*e. g. Acer Pennsylvanicum*, *Kalmia latifolia*, *Campanula rotundifolia*), and here, in the clefts of steep ledges, I found the other of the two species of Trisetum mentioned in Gray's Manual — *Trisetum subspicatum*, Beauv., var. *molle*, Gray. On account of the lateness of the season the plants were in poor shape for collecting but were still perfectly recognizable. This species the Manual describes as found from

northern New England to Lake Superior and northward, but Britton takes it south *in the mountains* to North Carolina. Its occurrence in the eastern part of Massachusetts is interesting, and even more remarkable is the coincidence in one town of only moderate elevation of these two species of one genus, one of an essentially northern and mountainous range, the other perhaps reaching here its northern limit.— ARTHUR STANLEY PEASE, Andover, Massachusetts.

LYCOPODIUM SELAGO ON MT. HOLYOKE, MASSACHUSETTS.— As a new station for a rare plant is always of interest to botanists, it may be worth while to record in RHODORA the occurrence of *Lycopodium Selago* at a second station in Massachusetts. I say second although I am aware that it has been reported both at Greylock and on Mt. Watatic. Its occurrence in the latter place, however, I consider extremely doubtful since the only direct reference to its being there is found in a flora gotten up by high school students who, I am informed by persons who happened to know something of their methods, were not in every case sufficiently careful. Furthermore, I am unable to locate specimens coming from Mt. Watatic.

The new location which I mention is the extreme summit of Mt. Holyoke, just west of the "Notch," where the Lycopodium was found growing at an elevation of about 960 feet on the north side of cliffs. There was only one limited station and the plants were few in number.

A search of the neighboring peaks failed to show more of this species. Specimens from the Mt. Holyoke station may be found in the Gray Herbarium and in the herbarium of the Massachusetts Agricultural College.— GEORGE F. FREEMAN, Asst. Prof. of Botany, Mass. Agr. College, Amherst.

CUSCUTA TRIFOLIA IN MASSACHUSETTS.— Some time ago complaint was received at the Hatch Experiment Station from a farmer living in Winchester, Massachusetts, that a large field of red clover (*Trifolium pratense, L.*) had been greatly damaged by dodder. He claimed the dodder was so thickly established that raking the cut clover was practically impossible. Later a large bundle of the infested crop was sent to the Station. The dodder had so completely intertwined

itself around and between the stems of the clover, that not a single one could be separated from the others without breaking several of the parasitic filaments.

Specimens of the dodder were sent to Mr. F. H. Hillman, Assistant Botanist, Seed Laboratory, U. S. Department of Agriculture, Washington, who identified them as *Cuscuta trifolia*, Babgt. Mr. Hillman claims that this is distinctly different from *Cuscuta Epithymum*, Murr. This being true, we have to report a new species of *Cuscuta* from Massachusetts. But even if *C. trifolia* and *C. Epithymum* are conceded to be identical, we are unable to learn that a *Cuscuta* under the latter specific name has been reported from this State.

Later the same species was reported from Spencer, Massachusetts, where it had done much damage to a field of clover.— A. Vincent Osmun, Amherst, Massachusetts.

A new Station for Phaseolus perennis.— A station discovered by the writer Aug. 18, 1903, carries the known range of *Phaseolus perennis* about twenty-five miles northeasterly from the station noted by Mr. Bissell (Rhodora iv: 13) to a point near the Housatonic River in the town of Huntington. Mr. Bissell's description of the Norwalk station would apply almost word for word to this one, except that the marsh near the border of which it is located is hardly even brackish.— E. B. Harger, Oxford, Connecticut.

Corallorhiza innata and Taraxacum erythrospermum in Rhode Island.— Three species of *Corallorhiza* have been definitely recorded, in print, from New England. Two of these, *C. odontorhiza*, Nutt., and *C. multiflora*, Nutt., have been reported from all six of the states and the third, *C. innata*, R. Br., from all except Rhode Island. Mr. E. F. Williams mentions [1] having seen specimens of all three species from all the states recorded above with the exception of *C. odontorhiza* from New Hampshire. It is a pleasure to be able to report the finding of *C. innata* in Rhode Island. I collected several specimens of it in good flower on the 10th of May, 1903, in a swamp in North Smithfield.

On the same date and within half a mile of the same station

[1] Rhodora, 4: 18 (1902).

(and likewise in North Smithfield) I collected several specimens of *Taraxacum erythrospermum*, Andrz., growing in the sandy roadside. Messrs. R. L. Bowen and N. O. Howard, who were with me at the time, also took specimens. I believe this plant has never been reported from Rhode Island, although it was collected by Messrs. E. B. Chamberlain, E. E. Whipple and the writer in Lincoln, on the 15th of June, 1901. At the latter station it was growing in the crevices of a dry ledge.— J. FRANKLIN COLLINS, Providence, R. I.

[May 12, 1896, Miss E. L. Shaw found *Corallorhiza innata* on Taunton Avenue, East Providence, Rhode Island. A detailed and characteristic drawing of the plant was preserved by Miss Shaw.— Ed.]

ERRATA.

Page 11, line 12; for ARTICUM read ARCTICUM.
" 11, " 14; " LEPTODERUM read LEPTODERMUM.
" 14, " 41; " *Euteromorpha* read *Enteromorpha*.
" 33, " 23; " *Conioselium* read *Conioselinum*.
" 45, " 31; " *augustifolia* read *angustifolia*.
" 51, " 34; " *Temnomia* read *Temnoma*.
" 71, " 22; " *angusti, folia* read *angustifolia*.
" 97, " 9, page 100, line 34, and page 101, line 32, for *Simonsii* read *Simsoni*.
" 120, line 38; *for* 1902 *read* 1903.
" 126, " 29; " district *read* distinct.
" 165, " 25; " Lavalle *read* Laval.
" 176, " 11; " campanalate *read* campanulate.
" 176, " 21; " *Ravenellii* read *Ravenelii*.
" 203, " 40; " *nititans* read *nictitans*.
" 224, " 9; " *minor* read *minus*.
" 230, " 6; " *augustifolius* read *angustifolius*.
" 230, " 6; " *Turritus* read *Turritis*.
" 236, " 20; " Batterkill *read* Battenkill.
" 240, lines 33 and 35; *for* phlange *read* flange.
" 255, line 13; for *Calocylindricus* read *Calocylindrus*.
" 264, " 28; *for* segegates *read* segregates.
" 279, " 31; and 280, line 28; for *Tuckermanni* read *Tuckermani*.

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Blanche Ames del.

LOBELIA CARDINALIS, at the left. L. SYPHILITICA, at the right.
L. SYPHILITICO × CARDINALIS, in the middle.