PRELIMINARY REPORT ON A COLLECTION OF HEPATICAE FROM THE DULUTH-SUPERIOR DISTRICT.
STATES OF MINNESOTA AND WISCONSIN.

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The specimens in this report, were collected within the territory which will hereafter be designated, the Duluth-Superior District. This District is confined by a circle with the Twin Ports, Duluth and Superior as the centre, and the distance of fifty miles more or less as a radius. Such a territory would include a part of St. Louis County along the lake shore in Minnesota and the whole of Douglas County, Wisconsin. The northeast corner of Carlton County, Minnesota, where the St. Louis River enters the dalles near the villages of Thompson and Carlton, and the vicinity of Lutsen, Cook County, Minnesota, one hundred miles down the north shore, are also included. The St. Louis River divides the District so that the two states of Wisconsin and Minnesota are about equally represented, and so far as observed the hepatic flora is very similar in the states of the District if similar habitat be chosen in collecting.

The immediate topography of the two cities, however, is very dissimilar. Duluth, Minn., is situated on the North Shore Range of Lake Superior. This range extends from Carlton, Minn., on the southwest to the extreme northeast international boundary. This highland parallels the lake shore, and has an altitude varying from 1000 to 1500 feet above sea level. As Lake Superior is 600 feet above the sea, the range rises from 400 to 900 feet above the lake. This altitude is obtained within a few miles from the lake shore. In places there are bold outcroppings of rock and ledges. In other places the rise is more
gradual, and the whole range was originally heavily timbered. In the immediate vicinity of Duluth the forest has been removed, except in a few parks, which still retain some of the old pines. Fortunately, outside of the city limits there is a good growth of hardwood, and northward along the lake shore, more virgin conditions prevail. The rock is Archean-gabro, of volcanic origin. Similar rock formations occur in the Adirondacks and in the neighborhood of Baltimore, Md. In fact the Lake Superior basin itself may be regarded as a primitive depression of the earth crust, antedating the Huronian period. There are many intrusions of eruptive rock, arranged more or less concentric to the basin, with the newest nearest the lake, and it is thought that the depression is an ancient and deep seated centre of volcanic activity.\footnote{International Encyclopedia} Faults occur in the rock formation, especially at Carlton, Minn., where the Huronic slates appear. It is here that the water of the St. Louis River finds egress to Lake Superior, rushing over the displaced ledges, and eroding a gorge of great extent and beauty.

The whole North Shore Range which really begins at Carlton, Minn., twenty miles up the St. Louis River, is cut by many small streams and rivers which drain the upland valleys and swamps. These streams make the drop to the lake level, sometimes within a short distance. This produces a series of cascades, waterfalls, and rapids, rocky ravines and eroded ledges. Each of these streams has its own peculiar charm, and when heavily wooded afford to the bryologist as well as the angler, a paradise of interest. Within the city limits of Duluth the places referred to in this report are Oneota ravine with its bald peak, and canyon cliff; Spirit Lake ravine, with its narrow, deep perpendicularly-walled watercourse often bridged by old logs, and large rocks; Chester Creek and Lester Rivers preserved as public parks, and still growing a rich hepatic and moss flora. Beyond the city along the north shore, at intervals of every few miles are the larger rivers, Sucker, French and Knife. On account of the accessibility of these places, the collecting done in Minnesota has been along these rocky water-ways. Swamps and bogs, and deep wood at the
higher altitudes are numerous, but they have not yet been visited.

That these places will yield similar plants to those found in the Wisconsin swamps is reasonably certain.

In contrast to the rocky north shore, the country adjacent to Superior, Wis., presents a more or less level plain, extending back from the south lake shore for twelve or fifteen miles. This plain or basin was once the bed of the lake. The soil is therefore a deep clay deposit, which rises about thirty feet to the mile from the lake southward. This clay is cut by rivers, creeks and ravines for surface drainage, and was once heavily timbered on the more dry and higher places. The natural hollows with less drainage, were covered with dense tamarack or balsam swamps, with often an accompanying sphagnum and heath bog.

Within the city of Superior are many of these swamps, now partially dried, some covered with alder or willow thickets, others much overgrown with grass, but in places having moisture enough to preserve the characteristics of the bog proper. It is in these places which grow in quantity Scapania irrigua, Lophozia incisa, Lepidozia reptans, Cephalozia lunulæfolia, Riccardia latifrons, R. palmata and the swamp form of Cephalozia.
the pine is here largely removed, enough forest of birch, maple, poplar and conifers is left to preserve the necessary moisture for the support of a rich bryophytic flora. The writer has never been in the White Mountains and knows the region of Franconia only from his Bradford Torrey and the many specimens in the hepatic herbarium, but to him Manitou Falls on Black River is the “Flume” of Douglas Co., Wisconsin. As might be expected the plants collected here are similar to those on the North Shore Range. *Scapania nemorosa, Scapania curta, Lophozia heterocalpa, Jungermannia pumila, Cololejeunea Biddlecomiae* are some of the common mesophytic rock loving species. On the other hand the North Shore Range, at the higher altitudes, present in places a xerophytic habitat. In such places only, has been found *Lophozia alpestris, L. excisa, L. bicrenata, Scapania umbrosa, Sphenolobus Heterianus, and Cephalozia myriantha*. The severe long winter of continued cold, and rather hot, dry summers of intense growth of all forms of vegetation; the presence of only two months of the year devoid of frost; the rather high dry rocks and upland bogs and lakes; all these approach a semi-alpine, semi-arctic habitat. In evidence of this we find *Cephalozia pleniceps, C. connivens, Mylia anomala, Lophozia alpestris, L. heterocarpa, L. Muelleri* and *Blepharostoma trichophyllum*, the latter growing freely on the ground. South and southeast of the Copper Range the country is broken into ridges of clay and sand, gradually becoming a typical pine barren toward the southern limit of the District—the country of jack pine and sweet fern, of blueberry, arbutus and scrub oak, of innumerable deep clear lakes, with their edging of sandy beaches or cranberry bogs trailing off into a balsam and tamarack swamp. Collections were made from such places as Solon Springs, Gordon Lakes, Lake Nebagamon, Brule River and Winneboujou. Such is the general environment of the hepaticae of the Duluth-Superior District. Dr. Alexander W. Evans has kindly verified the 80 species here reported, and a duplicate set has been placed in his herbarium. The writer gratefully acknowledges his indebtedness to both Dr. Evans and Miss C. C. Haynes for their invaluable assistance.
HEPATICAE COLLECTED IN DULUTH-SUPERIOR DISTRICT.

ORDER 1. Ricciaceae.
1. Riccia fluitans L.
   No. 287  Superior, Wis., Aug. 3, 1907.

Very abundant along the shore in still water of the St. Louis Bay. Although collected only from the Wisconsin side, it undoubtedly could be found in the numerous back-waters of the Minnesota side of the bay. One other Riccia have been reported, R. arvensis Aust. from Madison. It has not been observed here. Ricciocarpus natans (L) Corda is reported from both states, but has failed to appear in the District, although a special search has been made along the bays, rivers, and upland lakes.

ORDER 2. Marchantiaceae.
2. Conocephalum conicum (L) Dumort.
   No. 431  Woodland, Duluth, Minn., May 30, 1909 (fruiting).
   No. 1024  Winneboujou, Brule, Wis., Apr. 9 (fruiting).
   No. 1180  Lutsen, Cook Co., Minn., Sept. 1911.

3. Preissia quadrata (Scop.) Nees.
   No. 1181  Lutsen, Cook Co., Minn., Sept. 1911.

4. Marchantia polymorpha L.
   No. 82  Gordon, Wis., Sept. 16, 1906.
   No. 918  Billings Park, Superior, Wis., Sept. 9, 1906.
   No. 534  Copper Creek, Wis., Aug. 5, 1909.
   No. 289  Copper Creek, Wis., Aug. 29, 1907.
   No. 1182  Lutsen, Cook Co., Minn., Sept. 1911, Duluth, Minn., etc.

Conocephalum conicum is very common in wet swampy places, and along banks of streams. It fruits here about May 30th, when Epigaea repens is in flower. In 1910 it was in full fruit April 9th, which was an unusually early season.
Preissia quadrata is rather common in the bed of the streams which cut the ranges, on rocks just above the usual water course. In high water these plants would be submerged. It never grows on high banks or dry rocks. It likes the rock crevices filled with silt, and favors a rather full exposure to the sun, but always insists on getting a drink in torrential storms and rainy seasons. It fruits in summer. Asterella tenella has been reported from Minnesota. Grimaldina fragrans and Reboulia hemispherica from both states. Conocephalum conicum, Marchantia polymorpha and Preissia quadrata from both states.

ORDER 3. METZGERIACEAE.

5. Riccardia latifrons Lindb.
   No. 776 Superior, Wis., July 18, 1909.
   No. 1171 Lutsen, Cook Co., Minn., Sept. 1911.

6. Riccardia multifida (L) S. F. Gray.
   No. 1134 Lutsen, Cook Co., Minn., Sept. 20, 1911.
   No. 1097 Brule River, at Winneboujou, May 7, 1911.

7. Riccardia galmarata (Hedw.) S. F. Gray.
   No. 280 Copper Creek, Wis., Aug. 29, 1907.
   No. 1010 Carlton, Minn., Oct. 16, 1910.

8. Riccardia pinguis (L) S. F. Gray.
   No. 1184 Lutsen, Cook Co., Minn., Sept. 1911.
   No. 1099 Brule River, Wis., May 20, 1911.
   No. 1216 Lake Nebagamon, Wis., Sept. 3, 1911.

   No. 1185 Lutsen, Cook Co., Minn., Sept. 1911.
       Duluth, Minn., Superior, Wis., etc.

    No. 1026 Brule River, at Winneboujou, Wis., April 9, 1911.
11. *Pellia Neesiana* (Gottsch.) Limpr.
   No. 316 Gordon, Wis., Sept. 16, 1906.
   No. 100 Solon Springs, Wis., May, 1908.
   No. 1108 Fairmount Park, Duluth, Minn., July 4, 1911.
   No. 1188 Lutsen, Cook Co., Minn., Sept. 22, 1911.
   No. 1027 Winneboujour, Brule, Wis.

12. *Blasia pusilla* L.
   No. 873 Chester Creek, Minn., July 20, 1909.
   No. 1040 Black River Falls, Wis., Oct. 3, 1910. Spirit Lake
   and French River, Minn., etc.

Both *Riccardia latifrons* and *R. palmata* are found on logs, *R. latifrons* usually mixed with mosses, on very rotten wood, *R. palmata* always growing alone on old water soaked, but not very rotten wood in dense shade and dampness. *R. pinguis* and *R. multifida* grow about boggy springs, in dense shade.

*Pellia Neesiana* is common in the springy swamps at high altitudes in the jack pine region, and fruits freely in May with *Conecephalum conicum*. It is also common along the rocky water-ways of both states.

*Pellia epiphylla* grows along the sand and clay banks of all the streams and is common in swamps at the lower levels.

*Pellia Fabroniana* has been found only on old moss covered logs in wet swamps.

*Blasia pusilla* effect the clay banks along the streams wet with springs. At Chester Creek, Duluth, Minn., it covers quite an area. At Black and French Rivers it grew along the river banks in thin bright green rosettes.

**Order 4. Jungermanniaceae.**

13. *Jungermannia lanceolata* L.
   No. 772 Oneota Ravine, Duluth, Minn.
   No. 1026 Winneboujour, Wis., April 9, 1911.
   Superior, Wis., etc.

   No. 888 Chester Creek, Duluth, Minn., July 24, 1909.
No. 551 Copper Creek, Wis., Aug. 5, 1909.

15. Jungermannia sphaerocarpa Hook
   No. 1155 Lutsen, Cook Co., Minn., Sept. 20, 1911.

   No. 607 Billings Park, Superior, Wis., Nov. 14, 1909.
   No. 410 Solon Springs, Wis., Oct. 1907.
   No. 594 Copper Creek, Wis., Aug. 5, 1909.
   No. 242 Albert, Minn., Aug. 1906.
   No. 447 Woodland, Duluth, Minn., May 30, 1909.

*Jungermannia pumila* loves the rocks in streams on the shady side and grows on the bare rocks without soil where it can occasionally be wet with spray. The rhizoids penetrate deeply the minute crevices of the fractured rocks. The under side of over-hanging shady cliffs, or little caves close to the waterline are often covered with this tiny plant in a thin tracery of dark green. It is almost impossible to remove the plant from the substratum.

*Jungermannia lanceolata* is found in the usual habitat, old rotten logs in shade and moisture with other mosses. It is rarely collected in the sterile condition because of its similarity to *Jamesoniella autumnalis*. When the purse string puckered perianth of the species is present it can be distinguished at a glance. *Jamesoniella autumnalis* is one of the most common of the hepatics in the District. Its perianth is so persistent and it fruits so freely that it is recognized with little difficulty. It adapts itself to a great variety of habitat and therefore is more or less variable. When it grows on the ground in full exposure to the sun the leaves are apt to be imbricated, and tinged a red wine color. The plants growing on old birches, now freely exposed to sun and winds have much reduced leaves resembling an *Odontoschisma*; while those growing in deep woods on old logs with plenty of moisture expand to luxurious size. Such a variety of form is puzzling to the beginner, and is exceeded by
only two other common hepatics, viz, Plagiochila asplenioides and Lophocolea heterophylla. The rare J. sphaerocarpa was found only once at Lutsen, along a rocky brooklet draining a cedar swamp, growing with J. pumila.

17. Lophozia alpestris (Schleich.) Evans.
   No. 790 Oneota, Duluth, Minn., Aug. 15, 1907.
   No. 933 Oneota, Mt. Bald, Aug. 15, 1909.

18. Lophozia attenuata (Mort.) Dumort.

19. Lophozia barbata (Schreb.) Durmot.
   No. 1175 Lutsen, Cook Co., Minn., Sept. 1911.
   No. 1086 Black River Falls, and
   No. 222 Copper Creek, Douglas Co., Wis., etc.

20. Lophozia bicrenata (Schmid.) Dumor.
   No. 910 Carlton, Minn., Sept. 26, 1910.
   No. 652 Carlton, Minn., Sept. 26, 1910.

21. Lophozia excisa (Dicks.) Durmot.
   No. 885 Chester Creek, Duluth, Minn., July 24, 1909.
   No. 1107 Fallmount Park, Duluth, Minn., July 4, 1911.

   No. 556 Copper Creek, Wis., Aug. 5, 1909.
   No. 878 Chester Creek, Minn., July 28, 1909.
   No. 1118 Lutsen, Cook Co., Minn., Sept. 20, 1911.
   Knife River, Lester Park, Duluth, Minn., etc.

23. Lophozia incisa (Schrad.) Dumort.
   No. 529 Copper Creek, Wis., Aug. 5, 1909.
   No. 1130 Lutsen, Cook Co., Minn., Sept. 23, 1911.
   No. 775 Superior, Wis., July 18, 1907.

24. Lophozia Kaurini (Limpr.) Steph.
   No. 1125 Lutsen, Cook Co., Minn., Sept. 20, 1911.

   No. 821  Oneota, Duluth, Minn., June 27, 1909.
   No. 826  Knife River, Minn., Aug. 1, 1909.
   No. 920  Copper Creek, Wis., Aug. 5, 1907.
   No. 1191  Lutsen, Cook Co., Minn., Sept. 1911.
   No. 1046  Black River, Douglas Co., Wis.


   No. 724  Superior, Wis., Sept. 6, 1909.

29. *Lophozia ventricosa* (Dicks) Dumort.
   No. 888  Chester Creek, Duluth, Minn., July 29, 1909.
   No. 653  Carlton, Minn., Sept. 27, 1909.
   No. 939  Oneota Ravine, Duluth, Minn., Sept. 1909.
   No. 691  Knife River, Minn., Aug. 1, 1909.

*L. alpestris* has been collected only at Oneota, on high flat narrow rock ledges on the north side of the cliff. Near by the perpendicular wall was covered with great green patches of fruiting *L. barbata* and *L. Lyoni*, while the very small rock crevices in the more open places were outlined with *Scapania curta* and *Cephaloziella*.

Only one station was found for *L. bicrenata* along a well beaten path close to the edge and at the top of the cliff below the dam at Thompson, Minnesota. It grew in full exposure to the sun on rather dry thin earth on rocks. This was in full fruit September 26, 1909. Collected also in the same locality in 1910 and 1911.

*L. excisa* was observed only at Chester Creek, and Fairmount Park, Duluth, Minn., in both instances at the top of the cliff by the upper falls, near the boulevard. At Chester Creek it grew on a half buried upturned stump spreading out on the loose sandy clay and was in splendid fruit July 29, 1909. It has a vivid green color and is a larger plant than *L. bicrenata*, resembling in the field a stunted form of *L. Lyoni*. 
L. attenuata usually called ubiquitous in places where it occurs, is far from omnipresent in this District. It was found once in limited quantity growing with Sphenolobus Hellerianus, Sphenolobus exsectus, and S. exsectaeformis on old wood at French River, Minnesota. At Lutsen, Cook County, it is more common and grew mixed with mosses on old logs in a cedar swamp.

L. barbata and L. Lyoni are very common on damp rock in deep shady ravines along the water ways. Both are often found growing in pure colonies in dense mats and fruiting freely.

L. incisa is readily detected by its vivid green color and the usual powdery gemmiporous condition of the leaves. At Lutsen the wood paths through cedar swamps were vivid green with large patches of this beautiful hepatica. The substratum is usually very rotten wood even when growing on the ground. It is frequently found on old logs in wet swamps.

Of the Muelleri group three very interesting species; L. heterocolpa (Thed.) M. A. Howe, L. Muelleri (Nees) Dumort, and L. Kaurini (Limpr.) Steph. occur in the District.

About two years ago a few plants were found, resembling a slender form of Lophocolea heterophylla which had bifid underleaves and gemmiporous branches with strangely modified leaves. It was finally referred to the genus Lophozia until it could be collected again in quantity. About a year later Dr. Evans saw the slide mount of the plants and determined it L heterocolpa (Thed.) M. A. Howe, the Jungermannia Wattiana Aust. of Gray’s Manual. Since then it has been largely collected in all the rocky streams of both the north and south ranges at Copper Creek and Black River, Wisconsin; Carlton, Knife, French and Lester Rivers and northward in Minnesota.

It favors mossy rock ledges at the lower levels. It is easily recognized by the usual gemmiporous condition. The habitat is similar to Plagiochila asplenioides, the form that effects the wet banks along streams, and not the robust form of that species which clings with its firmly rooted radicles, in patches to perpendicular rock walls below the water falls of the higher altitudes.
At Lutsen, *L. heterocolpa* was found once covering a shady log over a sphagnum run in a cedar swamp, at least three feet above the moss covered ground, a very unusual habitat for the species.

*L. Muelleri* was collected once at Black River on a shady ledge of rock below the Falls, at the bottom of the gorge, just above the high water line. It was growing with *Scapania curta*. *L. Muelleri* as collected at Black River resembles *L. badensis* in its small size and small trigones but the stems bear quite regularly well developed underleaves, and the leaf cells are too small to be *L. badensis*.

The specimen bears plenty of perianths with the mouths contracted into little beaks plainly seen with the hand lens.

*L. Muelleri* is closely related to *L. heterocolpa* which fruits so rarely that out of hundreds of specimens examined the past two years, only one perianth was observed. On the other hand *L. Muelleri* fruits freely, no gemmiperoe branches occurring, while in *L. heterocolpa*, the gemmiporous branches are plainly the chief characteristic.

*L. Kaurini* is larger than *L. heterocolpa* and has been found always associated with *Preissia quadrata*. Its occurrence in the Duluth-Superior District marks a third regional station for the species in North America.\(^2\)

*Lophozia ventricosa* has always been found in the rock crevices and on rock ledges, at the higher altitudes in rather shady damp places. Its bog sister *L. porphyroleuca* is much more robust and the large perianths on the bright green plants creeping on rotten wood or sphagnum in company with the pale *Scapania irrigua* is strikingly noticeable, in the partially dried up swamp adjacent to Superior.

*L. longidens* has been found only at Lutsen, Cook County, Minn., where it is rather common, growing on old logs in wet woods. The plants here are rarely tufted, of a bright green color, and freely gemmiporous. The angular red gemmae hang at the tips of the transversely attached leaves like mina-

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ture popcorn balls. Once recognized this rare species can usually be detected in the field.

   No. 529 Copper Creek, Douglas Co., Wis., May 5, 1909.
   No. 784 Oneota River, Duluth, Minn.
   No. 1190 Lutsen, Cook Co., Minn., Sept. 1911.

   No. 774 Oneota, Duluth, Minn., June 27, 1909.
   No. 618pp Knife River, Minn., Aug. 1, 1909.
   No. 1189 Lutsen, Cook Co., Minn., Sept. 1911.

32. *Sphenolobus Hellerianus* (Nees) Steph.
   No. 1119 Lutsen, Cook Co., Minn., Sept. 20, 1911.

   No. 1109 Solon Springs, Douglas Co., Wis., July 30, 1911.
   No. 1123 Lutsen, Cook Co., Minn., Sept. 20, 1911.

The plants of this genus are interesting both for their great beauty and for the easy determination of the species, which the gemmae afford.

*Sphenolobus Hellerianus* is more difficult, especially if associated with *Lophozia attenuata*. It is distinguished from the other species by the small size of the plants, and the club shaped upright gemmiporous branches covered with dark blood red gemmae. All the leaves on these stems are quite different from the ordinary leaves, being slightly emarginate, closely appressed and covered with gemmae as well as the apex of the stem. It is usually mixed with other hepatics, *Lophozia incisa, Jamesoniella autumnalis, Blepharostoma trichophyllum, L. reptans*, etc., and often little can be distinguished with the hand lens except the minute almost black red clubs. It has been found sparingly only in Minnesota at Carlton, and French River, but
at Lutsen it grew in dense patches on old wet logs in deep woods associated with *Sphenolobus Michauxii*.

*Sphenolobus Michauxii* is rare in the immediate vicinity of the Twin Ports, but is very common at Lutsen, Cook County, Minn., where every old moss covered log in a cedar swamp grew patches of it. At Solon Springs it covered a large log across a brook. The plants here were very slender and delicate, although fruiting, while at Lutsen the normal size of the species was attained.

*Sphenolobus erectus* has oval gemmae and the leaf cells are uniformly thickened and average 9x18\(^a\).

*Sphenolobus cajeteaformis* has angular gemmae and the leaf cells are thin walled or with small but distinct trigones and average 22x36\(^a\). Fortunately the species rarely fail to produce gemmae. Both affect old wood, preferably a bare rotten stump or log in damp woods.

34. *Plagiochila asplenoides* (L.) Dumort.
   No. 542 Copper Creek, Wis., Aug. 5, 1909.
   No. 294 Solon Springs, Wis., 1907.
   No. 973 Oneota, Duluth, Minn., Sept. 19, 1909.
   No. 1188 Lutsen, Cook Co., Minn., Sept. 1911.

*P. asplenoides* presents the usual variability of the species in the District. It is common along the rocky banks of all the streams which cut the North Shore and the Copper Ranges. Upon the high, dryer, wooded, rocky banks the slender form known as *P. porelloides* occurs. More robust forms occur on the rocks in the bed of the stream etc. The underleaves can usually be determined but these are slender and fugacious.

   No. 1104 Superior, Douglas Co., Wis., June 4, 1911.

This species was first found in a sphagnum bog one half mile west of the upper falls on Black River. A part of the cranberry, tamarack, and balsam swamp has escaped a recent "burning over." The dry season of 1910 rendered the swamp nearly
dry. Scapania irrigua, Lophozia porphyroleuca, Cephaloza lunulaefolia, Riccardia latifrons and Lepidozia reptans are associated hepatics.

The next year it was found in quantity at South Superior. Some ten years previously a street had been laid out and ditched through a sphagnum balsam swamp, where cranberries and blueberries still grew and bore fruit. During the summer of 1911 the shady side of the cut peat of this ditch was lined with Mylia anomala, freely gemmiferous but lacking perianth. Ceph. pleniceps and Ceph. lunulaefolia were associated hepatics, and Drosera rotundifolia flowered freely among the sphagnum at the bottom of the ditch.

36. Lophocolea heterophylla (Schrad.) Durmot.
No. 304 Chéster Creek, Duluth, Minn., July 20, 1909.
No. 630 Knife River, Minn., Aug. 1, 1909.
No. 379 Copper Creek, Douglas Co., Wis., Aug. 29, 1909.
No. 769 Superior, Wis., July 18, 1909.
No. 1174 Lutsen, Cook Co., Minn., Sept. 1911.

37. Lophocolea minor Nees.
No. 1192 Lutsen, Cook Co., Minn., Sept. 1911.

Rightly named, Lophocolea heterophylla does not belie its appellation in the District. It is the most variable of all the species observed. Side by side the beginner can not believe that the large leaved fruiting plant growing on wet ground can be the same species, as the small bifid leaved, cephaloza-like plant, spreading out its delicate tracery on old bare wood. Learning to recognize the variability of this species, is one of the first real troubles to overcome by the student, for it is exceedingly common and effects a great variety of habitat.

Lophocolea minor confines itself to rocks along streams, usually of the higher altitudes, and is rather common in such places. It has been found along all the streams which cut the ranges.
38. *Chiloscyphus pallescens* (Ehrh.) Dumort.
   No. 914 Oneota Ravine, Duluth, Minn.
   No. 250 Copper Creek, Wis., Sept. 15, 1902.
   No. 591 Copper Creek, Wis., Aug. 5, 1908.
   No. 522 Gordon, Wis., Aug. 1907.

39. *Chiloscyphus polyanthus* L. Corda.
   No. 458 Copper Creek, Wis., Sept. 15, 1902.
   No. 446 Woodland, Duluth, Minn., May 30, 1909.
   No. 718 Superior, Wis., Sept. 12, 1909.

40. *Chiloscyphus polyanthus rivularis* Nees.
   No. 1013 Winneboujou, Brule River, Wis., Apr. 9, 1910.

   No. 470 Solon Springs, Wis., July 1, 1909.
   No. 777 Oneota, Duluth, Minn., July 27, 1909.
   No. 822 Knife River, Minn., Aug. 1, 1909.

42. *Geocalyx graveolens* (Schrad.) Nees.
   No. 445 Woodland, Duluth, Minn., May 30, 1907.
   No. 1194 Lutsen, Cook Co., Minn., Sept. 1911.
   No. 1080 Winneboujou, Douglas Co., Wis., April 9, 1910.

*Chiloscyphus polyanthus* has its usual habitat. The variety, *rivularis* grew in a brooklet draining a dense swamp into the Brule River near Winneboujou, Wis. *Pellia Neesiana* and *Conocephalum conicum* were fruiting on the nearby logs and trailing their fronds, into the springy pools. The bed of the brook and submerged twigs and stones were covered with the variety fruiting. When collected again in June 1911 few perianths were found.

*Chiloscyphus pallescens* is found rarely, having been collected in the three localities only. It fruited freely in 1909.

*Harpanthus scutatus* deserves special mention because it occurs so often in the District in the gemmiporous state. It humps itself into little cushions of pale, upward stems, very different from the ordinary form of growth. These gemmiporous branches resemble quite closely *Cephalozia Francisci* (Hook.) Dumort. in the crowded, rounded, rounded bifid leaves, closely
approssed to the stem. The subulate underleaves however on the horizontal parts of the stem, distinguishes the plant from the Cephalozia, but these portions of the stem are often rotted away. The perianth of Cephalozia Francisci as well as its habitat on the ground distinguishes the species from Harpantthis scutatus which so far as observed grows on old wood.

Geocalyx graveolens grows on old rotten wood preferably buried. At Lutsen the yellowish green color of the colonies distinguished the species at a glance from the vivid bright green of its common associate, Lophogiu incisa.

43. **Cephalozia bicuspidata (L.) Dumort.**
   No. 335 Minnesota Point, Duluth, Minn., Sept. 15, 1907.
   No. 783 Billings Park, Superior, Wis., July 5, 1909.

44. **Cephalozia connivens (Dicks.) Dumort.**
   No. 1166 Lutsen, Cook Co., Minn., Sept. 23, 1911.
   No. 1017 Solon Springs, Douglas Co., Wis., July 1, 1911.

45. **Cephalozia curvifolia (Dicks.) Dumort.**
   No. 270 Cooper Creek, Wis., Aug. 29, 1907.
   No. 407 Solon Springs, Wis., May, 1907.
   No. 222 Albert, Minn., Oct. 1907.
   No. 865 Knife River, Minn., Aug. 1, 1909.
   No. 1176 Lutsen, Cook Co., Minn., Sept. 1911.

46. **Cephalozia tunulacea Dunort**
   No. 743 Superior, Wis., Sept. 12, 1909.
   No. 1016 Solon Springs, Wis., July 1, 1909.
   No. 309 Minnesota Point, Duluth, Minn., Sept. 15, 1907.
   No. 1172 Lutsen, Cook Co., Minn., Sept. 1911.

47. **Cephalozia Macounii Aust.**
   No. 1048 Black River, Douglas Co., Wis.
   No. 1053 Manitou Falls, Oct. 2, 1911.
   No. 216 Superior, Wis., July 15, 1909.
   No. 1109 South Superior, Wis., Oct. 3, 1911.
   No. 1165 Lutsen, Cook Co., Minn., Sept. 23, 1911.

49. Cephalozia serriflora Lindb.
   No. 1048 Black River, Douglas Co., Wis.
   No. 1053 Manitou Falls.

*Cephalozia bicuspidata* is one of the rare species in the District.

*C. lunulaefolia* is very common on logs, and rotten wood in swamps and dense woods.

*Cephalozia curvifolia* is very common on logs in the forest, preferring bark denuded logs and before the growth of mosses have invaded the host. Large logs have been observed covered with the species, green, brown or reddish in color depending upon the amount of exposure to the sun.

*Cephalozia pleniceps* grows on cut peat on buried stump roots along old paths through cedar swamps. *Cephalozia conivens* in wet springy places on old wood.

*Cephalozia Macounii* and *Cephalozia serriflora* collected only once, and growing together, were found thickly covering an old log in one of the most inaccessible places of the Black River gorge at Manitou Falls. Rarest of our tiny plants, they could not have chosen a place of greater security.

50. Cephalozietta myriantha (Lindb.) Schiffn. det. Donin.
   No. 687 Carlton, Minn., on rocks Sept. 26, 1909.
   No. 748 Stinson Ave. Swamp, Superior Wis., on ground and stump, Sept. 12, 1909.


Many forms of the composite *Cephalozietta divaricata* (Smith) Dumort. occur in this District. The two species above only have been determined from material sent Prof. Donin. Until his monograph of the genus is available for study the bulk of material remains undetermined.
Cephaloziella myriantha occurs in the high alpine rocks in full exposure to sun.

52. Calypogeia Neesiana (Massal & Carest.) C. Mull. Frib.
   No. 1157 Winneboujou, Brule River, Douglas Co., Wis., May 7, 1911.

53. Calypogeia Trichomanis (L.) S. F. Gray.
   No. 609 Billings Park, Superior, Wis., Nov. 14, 1909.
   No. 531 Copper Creek, Douglas Co., Wis., Aug. 5, 1909.

54. Bassania trilobata (L.) S. F. Gray.
   No. 317 Albert, Minn., Sept. 1905.
   No. 565 Copper Creek, Wis., Aug. 5, 1909.
   No. 1167 Lutsen, Cook Co., Minn., Sept., 1911.

55. Lepidostoma reptans (L.) Dumort.
   No. 611 Billings, Park, Superior, Wis., July 5, 1909.
   No. 859 Knife River, Minn., Aug. 1, 1908.
   No. 218 Copper Creek, Wis., Aug. 24, 1907.
   No. 420 Chester Creek, Minn., May 11, 1907.
   No. 1173 Lutsen, Cook Co., Minn., Sept., 1911.

56. Biebrarostoma trichophyllum (L.) Dumort.
   No. 580 Copper Creek, Wis., Aug 5, 1909.
   No. 778 Oneota, Duluth, Minn., July 27, 1909.
   No. 538 Knife River, Minn., Aug. 1, 1909.
   No. 734 Superior, Wis., Sept. 12, 1909.
   No. 1179 Lutsen, Cook Co., Minn., Sept., 1911, and Black River, Wis.

57. Pitidiium ciliare (L.) Nees.
   No. 690 Carlton, Minn., Sept. 26, 1909.
   No. 588 Copper Creek, Wis., Aug. 5, 1909.
   No. 1198 Lutsen, Cook Co., Minn., Sept., 1911.
58. *Ptilidium pulcherrimum* (Web.) Hampe.
   No. 917 Gordon, Wis., Sept. 15, 1906.
   No. 730 Superior, Wis., Sept. 12, 1909.
   No. 1020 Albert, Minn., Sept., 1905.
   No. 1021 Lester Park, Duluth, Minn., Oct. 17, 1906.
   No. 662 Carlton, Minn., Sept. 26, 1909.
   No. 166 Solon Springs, Wis., Aug. 26, 1908.
   *N.* 782 Oneota, Duluth, Minn., Aug. 15, 1909.
   No. 1189 Lutsen, Cook Co., Minn., Sept. 28, 1911.

*Calypogeia Trichomanis* is not common. It prefers a gravel or sandy clay bank.

*C. Neesiana* grows in swamps on wood or sphagnum, or woody peat, near wet springy bogs.

*Blepharostoma trichophyllum* is usually found on logs mixed with other hepatics and mosses, but at the higher altitudes it grows on the ground along wood paths and at Black River, Wis., it was found in quite pure patches on the flat rocks one half way up the falls in the higher beds of the streams, where in high water it would, for a while, be submerged.

*Ptilidium pulcherrimum* is one of the most common hepatics of the District. It grows on old wood, and rocks, and humus soil which usually covers the remains of an old log or stump.

*P. ciliare* is found at the higher altitudes growing on the ground among rocks where it forms little cushions of upright growth of an inch or more in thickness.

*Bazzania trilobata* is common, and grows spreading out over the perpendicular surfaces of rocks, or mossy banks. In the swamps it grows in large tufts on the ground with usually a substrate of rock.

*Lepidonia reptans* is the ubiquitous hepatic of the District and grows everywhere except on the trunks of living trees.

59. *Tricholea tomentella* (Ehrh.) Dumort.
   No. 1198 Winneboujou, Brule River, Douglas Co., Wis., in wet sphagnum swamp. May 20, 1911.

60. *Scapania opiculata* Spruce.
   No. 530 Copper Creek, Wis., Aug. 5, 1909.
   No. 152 Spirit Lake, Duluth, Minn., Oct. 14, 1907.
No. 382 St. Louis Bay, Superior, Wis., Aug., 1905.
No. 1120 Lutsen, Cook Co., Minn., Sept. 20, 1911.

61. Scapania curta (Mart.) Dumort.
   No. 738 Superior, Wis., Sept. 12, 1909.
   No. 750 Oneota, Duluth, Minn., June 27, 1909.
   No. 651 Carlton, Minn., Sept. 26, 1909.
   No. 899 Chester Creek, Duluth, Minn., July 20, 1909.
   No. 390 Copper Creek, Douglas Co., Wis., Oct., 1907.
   No. 1193 Lutsen, Cook Co., Minn., Sept., 1911.

62. Scapania glaucocephala (Tayl.) Aust.
   No. 1112 Selon Springs, Douglas Co., Wis., Aug. 6, 1911.
   No. 1195 Lutsen, Cook Co., Minn., Sept. 20, 1911.

63. Scapania irrigua (Nees.) Dumort.
   No. 735 Superior, Wis., Sept. 12, 1909.
   No. 1019 Superior, Wis., Oct. 20, 1908.

64. Scapania nemorosa (L.) Dumort.
   No. 811 Oneota Cliff, Duluth, Minn., July 27, 1909.

65. Scapania umbrosa (Schrad.) Dumort.

66. Scapania undulata (L.) Dumort.
   No. 1156 Lutsen, Cook Co., Minn.

The Scapaniae have been the most interesting species to study in the Duluth-Superior District.

S. apiculata grows on bare moist wood not too old, in a spreading layer, usually gemmiferous and conspicuously alone. It was collected at Spirit Lake however in a thin mat, covering an old log, much mixed with mosses and Harpanthus scutatus. In this instance the plants were crowded and upright and had much enlarged upper leaves on the fruiting branches.

S. curta is very common in the rock crevices of all the streams cutting the North Shore and Copper Ranges. It also occurs on wood in the old swamps adjacent to Superior and on old logs
in deep woods about Solon Springs, Wis. It is very variable
in size.

*S. irrigua* is strictly a bog plant, and is common in suitable
places. It undoubtedly occurs in the Minnesota swamps, but
has not yet been collected from the State.

*S. glaucocephala*, reported also from Minnesota by Prof.
Holzinger in 1897 has occurred but rarely in this collection.
It was found at Black River in the upland woods of the gorge,
growing on old wood associated with gemmiporous form of
*Harpanthus scutatus* and *Jamesonievilla autumnalis,—also at
Wentworth, Wis. It has been found only at higher altitudes
of the District. At Lutsen it was collected in quantity, growing
on old bare wet logs in deep woods.

*S. nemorosa* is not common. It is found sparingly along
mossy banks of the rock streams. In one locality however,
at Oneota Cliff, Duluth, Minn., it grows in abundance, covering
the perpendicular wall of rock to a considerable extent.

*S. umbrosa* is the rarest of the *Scapaniae* in the District. A
few plants only were found on the cliff one mile up stream
from Knife River, St. Louis County, Minn.

*S. undulata* has been observed but once at Lutsen, growing
with the rare *J. sphaerocarpa* on rocks in a small brooklet draining
a cedar swamp.

   No. 573 Copper Creek, Wis., Aug. 5, 1909, on rocks.
   No. 751 Knife River, Minn., Aug. 1, 1909, on trees.
   No. 915 French River, Minn., Oct. 3, 1909, on rocks.
   No. 674 Carlton, Minn., Sept. 26, 1909, on rocks.
   No. 156 Gordon, Wis., Sept. 10, 1906, on cedar trees.
   No. 1197 Lutsen, Cook Co., Minn., Sept., 1911.

68. *Radula obconica* Sulliv.
   No. 963 Wentworth, Wls., Oct. 19, 1910, on tree in balsam
   swamp.

69. *Porella pinnata*.
   No. 958 Carlton, Minn., on rocks, Sept., 11, 1910.
70. *Porella platyphylla* (L.) Lindb.
   No. 841 Knife River, Minn., Aug. 1, 1909.
   No. 222 Albert, Minn., Aug., 1905.
   No. 325 Lester Park, Duluth, Minn.
   No. 1023 Solon Springs, Wis., May, 1907.
   No. 324 Superior, Wis.
   No. 1196 Lutsen, Cook Co., Minn., Sept., 1911.

   No. 549 Copper Creek, Douglas Co., Wis.
   No. 384 Copper Creek, Douglas Co., Wis.
   Carlton, Minn., Sept. 26, 1907, rocks.

72. *Lejeunea cavifolia* (Ehrh.) Lindb.
   No. 674 Carlton, Minn., Sept. 26, 1909, rocks.
   No. 547 Knife River, Minn., Aug. 1, 1909, rocks.
   No. 1163 Lutsen, Cook Co., Minn., Sept., 1911.

*Radula complanata* is common on rocks and humus cliffs and will sustain quite a full exposure to the sun. It grows on trees, cedar, balsam, tamarack, and birch.

*R. obconica* has been found only on trees in dense wooded swamps at the higher altitudes.

*Porella platyphylla* grows on rocks in shade, or mossy banks, at the base of trees in dense woods.

*Porella pinnata* grows only on rocks just above the high water line. Associated hepatics are, *Frullania inflata* and *R. complanata*.

*Cololejeunea Biddlecomiae*, is one of the smallest species in the District and grows on bare rocks and loose stones preferring a damp almost dark recess or cave or pile of stones deeply shaded by the overhanging bank. In these places it spread a thin film of grey green over large surfaces. The plants are almost impossible to remove from the substratum. Once only was it found growing on humus ground. It was at the base of a densely wooded cliff at Copper Creek, with a trout pool and rapid at its base, that the patch of pale green showed itself, surrounded by flowering plants of *Moneses grandiflora*. One has only to add to the scene the murmuring of the wind through the pine tops, the splashes of brilliant sunshine and
dense shadow of a summer's day and the rippling of the brook to visualize the wood picture. There are many moments of exaltation that are never forgotten by the collector, and it is the recollection of these which adds half of the pleasure of determining the specimens themselves in later days.

*Lejeunea caviifolia* has been collected only on the face of perpendicular cliffs of sandstone at Knife River on the Huronian slate at Carlton, Minn., and on the crumbling amygdaloid cliffs at Lutsen, Cook Co., Minn. It has not been found on the Copper Range, Wis. It would appear that the Copper Range has less stability of the cliff wall. At Black River and Copper Creek cleavage and fracture occur so frequently that the cliff loving species such as *Frullania Asagrayana*, *Lejeunea caviifolia*, *Lophosia ventricosa*, *L. alpestris* and *L. bicrenata* fail to attach themselves. The other conditions of habitat such as altitudes, rock formation, dryness and moisture are similar on the two ranges. On the North Shore Range where these species occur, the rock surface shows from the weather staining and moss flora, evidence of great age.

73. *Frullania Asagrayana* Mont.
No. 957 Carlton, Minn., Sept. 11, 1910, rocks.
No. 498 Knife River, Minn., Aug. 1, 1909, rocks.
No. 1142 Lutsen, Cook Co., Minn., Sept. 23, 1911, trees.

74. *Frullania Bolanderi* Aust.
No. 1150 Lake Nebagamon, Douglas Co., Wis., Sept. 2, 1911.

75. *Frullania Brittoniae* Evans.
No. 1148 Lake Nebagamon, Sept. 3, 1911.

76. *Frullania eboracensis* Gottsche.
No. 506 Copper Creek, Sept. 1, 1907, poplar bark.
No. 402 Albert, Minn., Aug., 1904, cedar bark.
No. 357 Nemadji River, Superior, Wis., ash trees.
No. 360 Nemadji River, Superior, Wis., balsam bark.
No. 1151 Lutsen, Cook Co., Minn., Sept. 20, 1911.
77. *Frullania inflata* (Gottsche) Evans.
   No. 995 Carlton, Minn., rocks, Oct. 11, 1910; also Sept. 11, 1910.

78. *Frullania Oakesiana* Aust.
   No. 661 Carlton, Minn., rocks, Oct. 11, 1910.
   No. 1143 Lutsen, Cook Co., Minn., Sept. 23, 1911, trees.

79. *Frullania Selwyniana* Pears.
   No. 1140 Lutsen, Cook Co., Minn., Sept. 23, 1911, cedar trees.

Order 5. *Anthocerotaceae.*

80. *Anthoceros laevis* L.
   No. 79 Billings Park, Superior, Wis.

*Frullania eboracensis* is common throughout the range, and has the usual habitat of trees and rocks. Along the North Shore Range it is common on the cliff walls. Along the Copper Range it is found only on trees.

*F. Brittoniae* is rare. It was collected at Solon Springs on a living but fallen tree growing about 20 feet from the ground, and on a fallen dead birch above Indian Spring at Lake Nebagamon, Douglas Co. Wis.; also at Gordon, Wis. in a dense cedar swamp on living trees. Near Carlton, Minn. at Thompson on the St. Louis River an immense concrete dam has diverted the water through a canal to the lower levels. The season of 1910 was usually dry and when the place was visited in September and October practically all the water was thus diverted. For the first time perhaps the river channel was dry, and one could walk dry shod down the west gorge over burnished boulders, and collect along the water and spray lines of the river wall. It was here that *F. inflata* was found, covering the perpendicular wall of the shady side of the gorge with patches four and six inches across, now dry and dusty with silt. It will undoubtedly disappear from the higher surfaces and become rare in a few years. Growing within a few feet, on the higher shaded rocks where collected *F. inflata*, *F. Asagrayana*, *F. eboracensis*, and *F. Oakesiana* growing on rock. This is the first record observed of such habitat for *F. Oakesiana*. As the ledges where
it grew once supported large trees, the occurrence of the species on rocks could easily come from contact.

Frullania Asagrayana at Lutsen was found growing in dense mats on birches. At Carlton and Thompson it was collected on rocks in thin spreading colonies on the wall of cliffs. At Lutsen F. Oakesiana grew on trees at the higher altitudes. Growing in a cedar swamp near Lutsen was found glistening patches of the rare F. Selwyniana, which looks in the field like a miniature F. Asagrayana. F. Bolanderi very rare East of the Rocky Mts. was found growing on white ash at Lake Nebagamon, Douglas Co. Wis., Sept. 26, 1911.

Anthoceros laevis L. is the only species of this genus yet found. Many sterile colonies of Anthoceros have been observed and other species doubtless occur.

Superior, Wisconsin,
December 31, 1911.

Additions.

During 1912 two additional species have been found—

81. Lophoria longiflora (Nees) Schiffn.

No. 1208 In swamp near Black River, Douglas Co., Wis., Oct. 3, 1912.

82. Scapania subalpina (Nees) Dumort.


The following species are either rare or newly reported for Wisconsin or Minnesota.

No. 1244 Scapania glaucecephala (Tayl.) Aust. on logs, Cusson, Wis., July 25, 1913.

No. 1240 Cololejeunea Biddlecomiae (Aust) Evans. on cedar bark. head of St. Croix Lake, Solon Springs, Wis., June 28, 1913.

No. 1229 Cephalozia Macounii Aust. Lake Nebagamon, Wis., May 10, 1913.

No. 1238 Cephalozia serriflora Lindb. Lake Nebagamon, Wis., May 10, 1913, and

No. 1223A Briery, Pike Lake Road, Minn., St. Louis Co., July 13, 1913.

No. 1239 Frullania Selwyniana Pears. Head of St. Croix Lake, Solon Springs, Wis., June 28, 1913. New to Wisconsin
