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# THE BOTANY OF ICELAND

EDITED

BY

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AND

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## PART II

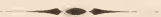
### 3. ERNST ØSTRUP:

MARINE DIATOMS FROM THE COASTS OF ICELAND. WITH ONE PLATE.

### 4. AUG. HESSELBO:

THE BRYOPHYTA OF ICELAND. WITH 39 FIGURES IN THE TEXT.

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3.

# MARINE DIATOMS FROM THE COASTS OF ICELAND

BY

ERNST ØSTRUP

WITH ONE PLATE





THE material used for this paper has been entrusted to me for examination by the Botanical Garden, Copenhagen. It embraces in all 438 samples collected by the following: cand. O. Davidsen (O. D. †), Dr. phil. Helgi Jónsson (H. Js.), Professor Chr. Grønlund (Grld. †), Mag. scient. R. Hørring (Hør.), Inspector W. Lundbeck (Lb.), Dr. phil. C. H. Ostenfeld (C. H. O.), Dr. phil. O. Paulsen (O. P.) and Adjunkt B. Sæmundsson (B. S.).\*)

Dr. Thoroddsen has given me valuable assistance as regards the spelling of the names of the various localities, and has also shewn me the kindness to go through my list of names, without which my paper, in this respect, would scarcely have been in agreement with his work: The Botany of Iceland I, and for this assistance I tender him my hearty thanks. As regards the habitats given by the various collectors, I have specified these when a form appears in up to 3 samples, by adding the parts of the coast where it has been collected, as well as the name of the finder. In case a form is found in more than 3 samples, the number of samples and the parts of the coast are given only. As to the limitation of the different parts of the coast, see Helgi Jónsson, the Botany of Iceland I, 1, page 6, and the map page 7. The samples are, according to the parts of the coast, apportioned as follows:

South,	given in the text as S. ....	58 samples
South-West — - - —	S.W. ....	191 —
North-West — - - —	N.W. ....	30 —
North — - - —	N. ....	98 —
East — - - —	E. ....	53 —
No locality — - - —	S. L. (sine loco) .....	8 —
Total. ....		438 samples

\*) The letters in brackets affixed to the names of the collectors indicate the abbreviations of their names, as used in the text; a † signifies, that the person is by now deceased.

The names Europe, Africa, Asia, America, Australia, Greenland, Arctic Seas are abbreviated in the text respectively as follows: Eu., Afr., As., Am., Austr., Grl., A. S.

Freshwater forms are frequently found in the samples examined from the coasts of Iceland; these are however excluded in this paper, but will be included in a future work dealing with the fresh-water diatoms of Iceland. On the other hand, several forms found in brackish water are here included.

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# PENNATÆ

## Diraphideæ

**Tropidoneis** Cl. 1891. Cl. Syn., I, 22.

**Tropidoneis lepidoptera** (Greg.) Cl. Cl. Syn., I, 25; V. H. Trt., Tab. V, fig. 287 (Amphiprora lep.).

Stykkishólmur (S.W.), H. Js.

Area: Ubiquist, A. S.

**Pleurosigma** W. Sm. 1853. Cl. Syn. I, 32.

**Pleurosigma cuspidatum** Cl. Cl. Syn. I, 35; Per. Pleur., Tab. V, fig. 16 (P. lanceolatum var. cusp.).

Skálholtsvik (N.), H. Js.

Area: Eur., Aust.

**Pleurosigma elongatum** W. Sm. Cl. Syn. I, 38; V. H. Trt., Tab. VI, fig. 262.

7 samples (S.W. 4, N. 1, E. 2).

Area: Ubiquist, Grl., A. S.

**Pleurosigma longum** Cl. Cl. Syn. I, 38; Cl. & Gr. A. D., Tab. III, fig. 71.

Skórðarstraumur (S.W.), H. Js.

Area: Grl., A. S.

**Pleurosigma Nubecula** W. Sm. Cl. Syn. I, 34; W. Sm. Syn., Tab. XXI, fig. 201.

Skálholtsvik (N.), H. Js.

Area: Eur., Afr., As., Am., Grl.

**Pleurosigma Stuxbergi** Cl. & Grun. Cl. Syn. I, 41; Grun. Fz. J. L., Tab. I., fig. 56.

Reykjavik (S.W.), H. Js.

Area: Grl., A. S.

**Caloneis** Cl. 1894. Cl. Syn., I, 46.

**Caloneis brevis** (Greg.) Cl. Cl. Syn. I, 61; V. H. Trt., Tab. IV, fig. 180 (Navicula br.).

Aðalvík (N.W.), Lb., Búðir (S.W.), H. Js.

Area: Ubiquist, Grl., A. S.

**Caloneis brevis** var. *distoma* Grun. forma *laticor*, Cl. Syn., l. c.; Cl. & Gr. A. D., Tab. I, fig. 25 (Navicula brevis dist.).

Dyrafjörður (N.W.), C. H. O.

Area: As., A. S.

**Caloneis brevis** var. *vexans* Grun. Cl. Syn., l. c.; Tab. nost., fig. 1.

Búðir (S.W.), H. Js.

Area: Eur., As., A. S.

I have given a drawing of this species, as it differs somewhat, by its very narrow apical and small central areas from the figures in A. S. N. S. D. tab. II, fig. 14 and fig. 14 in Per. Diat. mar. tab. X. I have not been able to see any punctuations of the striae, as shown in V. H. Syn. tab. XI fig. 18; besides concerning this form see the remarks by Peragallo in D. mar. p. 81.

**Caloneis formosa** (Greg.) Cl. Cl. Syn. I, 57; V. H. Trt., Tab. V, fig. 199 (Navicula form.).

4 samples (S.W. 3, N.W. 1).

Area: Ubiquist, Grl.

**Caloneis Liber** (W. Sm.) Cl. var. *genuina* Cl. Cl. Syn., I, 54. V. H. Trt., Tab. V, fig. 219. (Navicula L.).

8 samples (S. 1, S.W. 4, N.W. 3).

Area: Ubiquist, Grl., A. S.

**Caloneis Liber** var. *elongata* Grun. Cl. Syn., I, 55. A. S. N. S. D., Tab. II, fig. 42 (Navicula elong.).

Reykjavík (S.W.), B. S.

Area: Eur., Afr., As., Am., Grl., A. S.

**Caloneis Liber** var. *linearis* Grun. Cl. Syn., I, 54; V. H. Trt., Tab. V, fig. 220. (Nav. L. lin.).

8 samples (S.W. 6, N.W. 1, N. 1).

Area: Eur., Afr., As., Am.

**Diploneis** Ehr. 1840. Cl. Syn., I, 76.

**Diploneis æstiva** (Donk.) Cl. Cl. Syn., I, 94; A. S. Atl., Tab. VII, fig. 8.

Eyrarbakki (S.W.) H. Js., Dyrafjörður (N.W.) C. H. O., Miðhus(?) H. Js.

Area: Eur., Afr., As., Am., A. S.



**Diploneis bomboides** A. S. var. *media* Grun. Cl. & Gr. A D., 41, Tab. III, fig. 54.

Steinaklettur (S.W.) H. Js.

Area: Eur., Grl., A. S.

**Diploneis chersonensis** (Grun.) Cl. Cl. Syn., I, 91; V. H. Trt., Tab. XXVI, fig. 738. (*Navicula chers.*)

8 samples (S. 1, S.W. 5, N.W. 1, N. 1).

Area: Ubiquist.

In a sample (Broddanes (N.) H. Js.) I have found a form, which agrees well with *Navicula apis* (see Per. Diat. mar., 121, tab. XIX, fig. 3—8) which by Cleve l. c. is referred to *Dipl. cherson*.

**Diploneis coffæiformis** (A. S.) Cl. Cl. Syn., I, 81; A. S. N. S. D., Tab. I, fig. 22.

Grjótnes (N.), C. H. O.

Area: Eur., As., Am., Grl.

**Diploneis constricta** (Grun.) Cl. Cl. Syn., I, 83; Donk. Br. D., Tab. VII, fig. 6. (*Navicula Musca*).

Isafjörður (N.W.), H. Js.

Area: Eur., As., Am., Grl., A. S.

**Diploneis contigua** (A. S.) Cl. var. *Eudoxia* A. S. Cl. Syn., I, 83; Per. D. mar., Tab. XVII, fig. 6. (*Navicula E.*) Tab. nost., fig. 2.

Vestmannaeyjar (S.), H. Js.

Area: Eur., Afr., As., Am., A. S.

I have given a drawing of this species, as the form found by me is somewhat more contracted in the middle than the figure shown by Peragallo. The other figures quoted by Cleve l. c. have all approximately rectilinear sides.

**Diploneis Crabro** (Ehr.) Cl. var. *minuta* Cl. Cl. Syn., I, 102; Per. D. mar., Tab. XV, fig. 7.

Vestmannaeyjar (S.), H. Js., Reykjavik (S.W.), H. Js.

Area: Eur., Aust.

**Diploneis didyma** (Ehr.) Cl. Cl. Syn., I, 90; V. H. Trt., Tab. III, fig. 147.

Höfði (N.), H. Js.

Area: Ubiquist, Grl., A. S.

**Diploneis elliptica** (Kütz.) Cl. var. *grandis* Grun. Cl. Syn., I, 92; Pant. Ung. III, Tab. XI, fig. 182 (*Nav. præclara*).

Búðir (S.W.), H. Js.

Area: Eur.

**Diploneis fusca** (Greg.) Cl. var. *subrectangularis* Cl. Cl. Syn., I, 93; A. S. Atl., Tab. VII, fig. 4.

Brokey (S.W.), H. Js., Dyrafjörður (N.W.), C. H. O.

Area: Eur., As.

**Diploneis incurvata** (Greg.) Cl. Cl. Syn., I, 84; V. H. Trt., Tab. XXVI, fig. 733. (Navicula inc.).

22 samples (S. 1, S.W. 13, N.W. 3, N. 4, E. 1).

Area: Eur., Afr., Am., A. S.

**Diploneis interrupta** (Ktz.) Cl. Cl. Syn., I, 84; V. H. Trt., Tab. III, fig. 145. (Nav. int.).

13 samples (S. 7, N.W. 4, N. 1, E. 1).

Area: Ubiquist, Grl., A. S.

**Diploneis lineata** (Donk.) Cl. Cl. Syn., I, 85; V. H. Trt., Tab. XXVI, fig. 736. (Nav. lin.).

Vestmannaeyjar (S.), H. Js., Reykjavik (S.W.), Grld.

Area: Eur., Afr.

**Diploneis littoralis** (Donk.) Cl. Cl. Syn., I, 94; A. S. Atl., Tab. VII, fig. 25. (Nav. litt.).

Skógarnes (S.W.), H. Js.

Area: Ubiquist, Grl., A. S.

**Diploneis major** Cl. Cl. Syn., I, 96; V. H. Trt., Tab. IV, fig. 151. (Nav. Smithi).

Vestmannaeyjar (S.), H. Js.

Area: Ubiquist, Grl.

**Diploneis notata** sp. nov., Tab. nost., fig. 3.

Long: 41  $\mu$ , lat: 18  $\mu$ , str. 11 in 10  $\mu$ .

Valva elliptica. Sulcis in medio leniter contractis. Linea apicali, utroque in latere costas in medio secante, præsentis. Striis in sulcis absentibus, mediæ in valva modo juxta nodulum centalem striæ paucae abbreviatæque adsunt.

Vestmannayjar (S.), H. Js.

**Diploneis Smithi** (Bréb.) Cl. Cl. Syn., I, 96; Grun. Fz. J. L., Tab. I, fig. 41. (Nav. Sm. var. borealis f. minor.).

4 samples (S.W. 3, N. 1).

Area: Ubiquist, Grl., A. S.

**Diploneis splendida** (Greg.) Cl. Cl. Syn., I, 87; A. S. N. S. D., Tab. I, fig. 3 (Nav. subc.).

Steinaklettur (S.W.), H. Js.

Area: Ubiquist, Grl., A. S.

**Diploneis subcincta** (A. S.) Cl. Cl. Syn., I, 86; V. H. Trt., Tab. XXVI, fig. 737 (Nav. subc.).

7 samples (S.W. 4, N.W. 2, N. 1).

Area: Eur., Afr., Am., Grl., A. S.

**Diploneis? inæqualis** sp. nov. Tab. nost., fig. 4.

Long:  $18 \mu$ , lat:  $7 \mu$ .

Valva elliptica. Striis uno in latere valvæ 11 in  $10 \mu$ , altero in latere 14 in  $10 \mu$ .

Dyrafjörður (N.W.), C. H. O.

It is with great hesitation that I refer this small species to *Diploneis*. It seems closely allied to *Navicula Reichardti* Grun. var. *Tschutchschorum* Cl. Cl. Syn. II, 65; Cl. Vega, tab. XXXVII, fig. 48. Cleve places *Nav. Reich.* among »*Naviculæ lyratae*«.

In *Diat. mar.* p. 129 Peragallo places *Nav. Reich.* among *Diploneis*, but remarks as follows: »Cette espèce n'est pas un vrai *Diploneis*, mais ce n'est pas non plus une vraie *lyrée* car il n'y a pas de stries entre les fourches ou aires centrales et le raphé.«

### **Naviculæ Fusiformes** Cl. 1894. Cl. Syn., I, 105.

**Navicula Acus** Cl. Cl. Syn., I, 106; *Per. D. mar.*, Tab. VIII, fig. 23.

Reykjavik (S.W.), C. H. O.

Area: Eur.

**Navicula fusiformis** Grun. var. *ostrearia* Gaillon. Cl. Syn., I, 106; V. H. Trt., Tab. XXVII, fig. 769.

4 samples (S. 2, S.W. 2).

Area: Eur., Grl.

**Navicula glabra** sp. nov. Tab. nost., fig. 5.

Long:  $41 \mu$ , lat:  $8 \mu$ .

Valva lanceolata. Raphe area augustissima cincta. Poris centralibus raphes distinctis. Structuram ullam valvæ perspicere non potui.

Reykjavik (S.W.), H. Js.

This species somewhat resembles the unnamed *Navicula* (from Hvidingsø), delineated in *A. S. N. S. D.*, tab. III, fig. 8, which in Cleve (*Syn.* I, 106) is found under the name of *Nav. Schmidtii*, but Cleve, as well as Peragallo (*Diat. mar.* p. 67) give the number of striae as 17 in  $10 \mu$ , consequently a distinct striation, while I have not been able to see any. By great enlargement however the valves assume the peculiar misty appearance, indicating a very fine structure.

### **Naviculæ Orthostichæ** Cleve 1894. Cl. Syn., I, 107.

**Navicula halophila** Grun. Cl. Syn., I, 109; V. H. Trt., Tab. IV, fig. 191. (*N. cuspidata* v. *hal.*).

Reykjavik (S.W.), C. H. O.

Area: Eur.

**Navicula Kryokonites** Cl. var.? *islandica* v. nov. Tab. nost., fig. 6.

Long: 45  $\mu$ , lat: 8  $\mu$ .

Valva anguste-lanceolata. Striis subtilissimis et, quoad perspicere potui, subradiantibus, media in valva fasciam latam relinquuntibus.

Brokey (S.W.), H. Js.

It is with some hesitation I refer this form to Nav. Kryokonites Cl. It has no slight outward resemblance to Nav. Kryok. var. subprotracta Cl. (Cl. Syn. I, 109; Cl. Vega Exp., tab. XXXVII, fig. 46) and has also, in common with this, the fairly broad fascia; it differs partly by being somewhat larger, but especially by the very fine striae, which, as far as I could see, are slightly radiate. Nav. Kryok. subprotracta has 22 parallel striae, at right-angles to the raphe, in 10  $\mu$ , and is found at Cape Warekarema and off East-Greenland.

**Amphipleura** Ktz. 1844. Cl. Syn., I, 125.

**Amphipleura rutilans** Trentepohl. Cl. Syn., I, 126; V. H. Trt., Tab. V, fig. 255. (Berkeleya Dillwynii An.)

6 samples (S.W. 2, N.W. 2, N. 2).

Area: Eur., Afr., As., Grl.

**Naviculæ Mesolejæ** Cleve 1894. Cl. Syn., I, 127.

**Naviculæ mutica** Ktz. forma *Cohnii* Hilse. Cl. Syn., I, 129; V. H. Trt., Tab. IV, fig. 167. (Nav. mut.)

Vestmannaeyjar (S.), H. Js.

Area: Ubiquist, A. S.

**Navicula (Dickeia) ulvacea** Berk. Cl. Syn., I, 129; V. H. Trt., Tab. XXVII, fig. 781.

Isafjörður (N.W.), H. Js.

Area: Eur.

**Naviculæ Microstigmaticæ** Cl. 1894. Cl. Syn., I, 141.

**Naviculæ (Schizonema) Grevillei** Ag. Cl. Syn., I, 152; V. H. Trt., Tab. V, fig. 243.

24 samples (S.W. 19, N. 4, E. 1).

Area: Eur., As., Am., Grl., A. S.

In conformity with Cleve l. c. I include under Nav. Grevillei the following:

*Schizonema apiculatum* Ag. V. H. Syn., Tab. XVI, figs. 4—8.

*Schizonema comoides* Ag. V. H. Syn., l. c. fig. 3.

*Navicula Delognei* H. V. H. V. H. Syn., Tab. XI, fig. 13.



**Navicula Libellus** Greg. Cl. Syn., I, 153; Donk. Br. D., Tab. IX, fig. 1.  
Öndverðarnes (S. W.), H. Js., Flatey (S. W.), H. Js.  
Area: Eur., As.

**Navicula rhombica** Greg. Cl. Syn., I, 152; Greg. T. M. S. IV, Tab. V, fig. 1.

31 samples (S. 5, S. W. 20, N. 3, E. 3).  
Area: Eur., As., Grl.

**Navicula (Libellus) complanata** Grun. var.? cnfr. Cl. Syn., I, 153. 7.  
Tab. nost., fig. 7.

Long:  $56\ \mu$ , lat:  $10\ \mu$ .

Valva lanceolata, apicibus rotundatis. Raphe area hyalina angusta, in medio in areolam rotundatam dilatata, cincta. Striis media in parte valvæ ægrè modo perspicendis, ibiqve 17 in  $10\ \mu$ , apices versus densioribus.

Búðir (S. W.), H. Js.

I consider this *Navicula* belonging to the form-series of *N. complanata*, perhaps most closely allied to *N. compl. var. hyperborea* Grun. (see Gr. Fz. J. L., tab. I, fig. 10) of which, as far as I know, no figure exists viewed from the valve-surface.

**Stauroneis** Ehr. 1843. Cl. Syn., I, 144—151 (sub. Nav. Microst.).

**Stauroneis constricta** (Ehr.?) W. Sm. Cl. Syn., I, 145; A. S. Atl., Tab. XXVI, figs. 35—39 (St. amphoroides).

4 samples (S. W. 1, N. W. 1, E. 2).  
Area: Eur., Am.

**Stauroneis Gregorii** Ralfs. Cl. Syn., I, 145; V. H. Trt., Tab. I, fig. 52.  
Búðir (S. W.), H. Js., Dyrafjörður (N. W.), C. H. O.  
Area: Eur., Am.

**Stauroneis salina** W. Sm. Cl. Syn., I, 145; V. H. Trt., Tab. I, fig. 54.  
Olafsvik (S. W.), H. Js., Skálanes (E.), H. Js.  
Area: Eur., Afr., Am., Aust., Grl., A. S.

**Gomphonema** Ag. 1824. Cl. Syn., I, 178.

**Gomphonema exiguum** Ktz. Cl. Syn., I, 188; Heib. D. D., Tab. V, fig. 18.

91 samples (S. 15, S. W. 40, N. W. 10, N. 16, E. 10).  
Area: Eur., As., Grl.

**Gomphonema kamschaticum** Grun. Cl. Syn., I, 188; V. H. Syn., Tab. XXV, fig. 29.

28 samples (S. 4, S. W. 9, N. W. 3, N. 5, E. 7).  
Area: Grl., A. S.

**Gomphonema kamtschaticum** Grun. var. *islandicum* v. nov. Tab. nost., fig. 8.

Long: 36  $\mu$ , lat: 10  $\mu$ . Str. minime 22 in 10  $\mu$ .

Valva clavata, apice superiori rotundato. Raphe area hyalina angustissima, in medio in areolam parvam dilatata, cincta. Striis radiantibus, ægre perspiciendis.

Einarslón (S.W.), H. Js., Grimsey (N.), O. D.

Owing to its central area and the radiating striae, I consider this small species more likely allied to *G. kamt.* than to *G. exig.*

### **Trachyneis** Cleve 1894. Cl. Syn., I, 190.

**Trachyneis aspera** (Ehr.) Cl. var. *intermedia* Grun. Cl. Syn., I, 192; A. S. Atl., Tab. XLVIII, fig. 14 (Nav. asp. int.).

19 samples (S.W. 11, N.W. 3, N. 4, E. 1).

Area: Eur., Am., Grl., A. S.

**Trachyneis aspera** (Ehr.) var. *pulchella* Cl. Syn. I, 191; W. Sm. Donk. Br. D., Tab. X, fig. 1 (Nav. pulch.).

51 samples (S. 10, S.W. 33, N.W. 3, N. 4, E. 1).

Area: Eur., Aust.

**Trachyneis Clepsydra** (Donk.) Cl. Cl. Syn., I, 192; A. S. Atl., Tab. XLVIII, figs. 7—8 (no name).

Eyrarbakki (S.), H. Js.

Area: Eur., Am.

**Trachyneis velata** (A. S.) Cl. Cl. Syn., I, 194; A. S. Atl., Tab. XLVIII, figs. 33—34 (Nav. vel.).

Reykjavik (S.W.), C. H. O., Stykkishólmur (S.W.), H. Js.

Area: Afr., As., Am., Aust.

### **Naviculæ Lineolatæ** Cleve 1895. Cl. Syn., II, 10.

**Navicula ammophila** Grun. var. *flanatica* Grun. Cl. Syn., II, 30; V. H. Syn., Suppl. A, fig. 17.

Hafnafjörður (S.W.), H. Js.

Area: Eur.

**Navicula anglica** Ralfs var. *subsalsa* Grun. Cl. Syn., II, 22; V. H. Trt., Tab. III, fig. 137 (N. a. v. subsalina).

Skagafjörður (N.), Grld.

Area: Eur.

**Navicula arenaria** Donk. var. *arcuata* Per. Per. D. mar. 101, Tab. XIII, figs. 4 & 6.

4 samples (S.W. 3, N.W. 1).

Area: Eur.

**Navicula avenacea** Bréb. Cl. Syn., II, 15; V. H. Trt., Tab. V, fig. 241. (Schizonema Smithii Ag.)

7 samples (S. W. 3, N. W. 1, N. 2, E. 1).

Area: Eur., Afr., As., Aust., Grl., A. S.

**Navicula Bolleana** Grun. Cl. Syn., II, 25; A. S. Atl., Tab. XLVII, fig. 18.

Grjótnes (N.). C. H. O.

Area: Eur., Grl., A. S.

**Navicula bottnica** Grun. Cl. Syn., II, 20; V. H. Syn., Tab. VII, fig. 33.

14 samples (S. W. 6, N. W. 2, N. 2, E. 4).

Area: Eur., Afr., As., Am., Grl., A. S.

**Navicula cancellata** Donk. Cl. Syn., II, 30; V. H. Trt., Tab. III, fig. 128.

Aðalvík (N. W.), Lb.

Area: Ubiquist, Grl., A. S.

**Navicula cancellata** Donk. var. *subapiculata* Grun. Cl. Syn., l. c.: A. S. N. S. D., Tab. II, fig. 22 (Nav. Gregorii).

In the same sample as the main species.

Area: Eur., Grl., A. S.

**Navicula digito-radiata** Greg. Cl. Syn., II, 20; V. H. Trt., Tab. III, fig. 130.

4 samples (all S. W.).

Area: Ubiquist, Grl., A. S.

**Navicula digito-radiata** Greg. var. *Cyprinus* (Ehr.) W. Sm. Cl. Syn., l. c. V. H. Trt. l. c., fig. 131.

Brokey (S. W.), H. Js., Látravík (N. W.), C. H. O.

Area: Eur., Am., Grl.

**Navicula directa** W. Sm. var. *genuina* Cl. Cl. Syn., II, 27; V. H. Trt., Tab. XXV, fig. 722.

24 samples (S. 5, S. W. 11, N. W. 3, N. 4, E. 1).

Area: Eur., Afr., As., Am., Grl., A. S.

**Navicula directa** W. Sm. var. *remota* Grun. Cl. Syn., l. c., A. S. N. S. D., Tab. III, fig. 2 (Nav. (Pinnularia) longa).

Grjótnes (N.). C. H. O.

Area: Eur., Afr., Am., Grl., A. S.

**Navicula directa** W. Sm. var. *subtilis* Greg. Cl. Syn., l. c.; V. H. Trt., Tab. XXV, fig. 723.

17 samples (S. 3, S. W. 11, N. W. 1, N. 1, E. 1).

Area: Eur., Grl., A. S.

**Navicula distans** W. Sm. Cl. Syn., II, 35; V. H. Trt., Tab. III, fig. 133.

11 samples (S. W. 10, N. 1).

Area: Eur., Am., Grl., A. S.

**Navicula fortis** Greg. Cl. Syn., II, 31; Donk. Br. D., Tab. VIII, fig. 8.

Bildudalur (N. W.), H. Js.

Area: Eur., Am., Grl., A. S.

**Navicula inflexa** Greg. Cl. Syn., 31; Per. D. mar., Tab. XIII, fig. 3.

Olafsvik (S. W.), H. Js.

Area: Eur., A. S.

**Navicula lanceolata** (Ag.) Ktz. var. *phyllepta* Ktz. Cl. Syn., II, 22; V. H. Trt., Tab. III, fig. 141.

Stykkishólmur (S. W.), H. Js.

Area: Eur.

**Navicula peregrina** Ehr. Cl. Syn., II, 18; V. H. Trt., Tab. III, fig. 101.

8 samples (S. 1, S. W. 6, N. W. 1).

Area: Eur., Afr., As., Am., Grl., A. S.

**Navicula (Schizonema) Bryopsis** (Ktz.) Grun. Grun. Bot. Cent. 1509; V. H. Syn., Tab. XV, fig. 26.

6 samples (S. W. 4, N. 2).

Area: Eur.

**Navicula (Schizonema) mollis** W. Sm. f. *major* Cl. Syn., II, 26; V. H. Syn., Tab. XV, fig. 22.

Fossavik (E.), H. Js.

Area: Eur., Afr., Am., Grl.

**Navicula (Schizonema) ramosissima** Ag. Cl. Syn., I, 26; V. H. Trt., Tab. V, fig. 244.

35 samples (S. 2, S. W. 18, N. W. 6, N. 6, E. 3).

Area: Eur., Am., Grl.

**Navicula (Schizonema) ramosissima** forma *amplior* Cl. Syn., l. c.; V. H. Syn., Tab. XV, fig. 3 (Schiz. amplius).

Reykjavik (S. W.), H. Js.

Area: Eur., Afr., Am.

**Naviculæ Punctatæ** Cleve 1895. Cl. Syn. II, 37.

**Navicula granulata** Bail. Cl. Syn., II, 48; Per. D. mar., Tab. XXVII, figs. 12—13 (N. Bailejana).

Stykkishólmur (S. W.), H. Js.

Area: Eur., As., Am., Aust., Grl.



**Navicula humerosa** Bréb. Cl. Syn., II, 43; V. H. Trt., Tab. IV, fig. 182.

6 samples (S. 1, S.W. 2, N.W. 1, N. 2).

Area: Eur., Afr., As., Am., A. S.

**Navicula humerosa** Bréb. var. *constricta* Cl. Cl. Syn., l. c.; Per. D. mar., Tab. XXVII, fig. 21.

Hafnarfjörður (S.W.), H. Js.

Area: Eur., As.

**Navicula latissima** Grun. Cl. Syn., II, 43; V. H. Trt., Tab. XXVII, fig. 762.

Vestmannaeyjar (S.), H. Js.

Area: Eur., As., A. S.

**Navicula pusilla** Greg. Cl. Syn., II, 41; V. H. Trt., Tab. IV, fig. 186.

6 samples (S. 1, S.W. 5).

Area: Ubiquist, A. S.

**Naviculæ Lyratæ** Cleve 1895. Cl. Syn., II, 52.

**Navicula abrupta** Greg. Cl. Syn., II, 61; V. H. Trt., Tab. IV, fig. 162.

Dyrafjörður (N.W.), C. H. O., Aðalvík (N.W., two samples), Lb.

Area: Eur., Afr., As., A. S.

**Navicula abrupta** Greg. var. *densestriata* var. nov. Tab. nost., fig. 9.

Long:  $32\ \mu$ , lat:  $11\ \mu$ , str. 16 in  $10\ \mu$ .

Valva lineari, apicibus cuneatis. Areis lateralibus angustis, modice procul ab apicibus terminantibus.

Aðalvík (N.W.), Lb.

In spite of its small size and close striation this peculiar species shall probably be placed under the form-series of *Nav. abrupta*, as its short lateral areas especially seem to indicate its place there.

**Navicula forcipata** Grev. Cl. Syn., II, 65; Per. D. mar., Tab. XXI, fig. 28.

4 samples (S. 1, S.W. 2, N.W. 1).

Area: Eur., Afr., Am., Grl.

**Navicula forcipata** Grev. var. *densestriata* A. S. Cl. Syn., II, 66; Per. D. mar. l. c., figs. 29—30.

Isafjörður (N.W.), H. Js., Aðalvík (N.W.), Lb., Skagafjörður (N.), Grld.

Area: Eur., Afr., As., Am., Grl.

**Navicula Hennedyi** W. Sm. Cl. Syn., II, 57; V. H. Trt., Tab. IV, fig. 160.

Vestmannaeyjar (S.), H. Js., Búðir (S.W.), H. Js.

Area: Eur., Afr., As., Am., Grl., A. S.

**Navicula Hennedyi** W. Sm. var. *circumsecta* Grun. Cl. Syn., II, 58; A. S. N. S. D., Tab. I, fig. 42. (N. polysticta var. circ.)

Vestmannaeyjar (S.), H. Js.

Area: Eur., Afr., As., Am., A. S.

**Navicula Lyra** Ehr. var. *atlantica* A. S. Cl. Syn., II, 63; A. S. N. S. D., Tab. I, fig. 34.

Isafjörður (N. W.), H. Js.

Area: Eur.

**Navicula Lyra** Ehr. var. *Ehrenbergi* Cl. Cl. Syn., I. c.; V. H. Syn., Tab. X, fig. 1.

Isafjörður (N. W.), H. Js., Dyrafjörður (N. W.) C. H. O.

Area: Ubiquist, Grl., A. S.

**Navicula Lyra** Ehr. var. *islandica* var. nov. Tab. nost., fig. 10.

Long: 43  $\mu$ , lat: 21  $\mu$ , str. 11 in 10  $\mu$ , subtiliter punctatis.

Valva lineare-elliptica apicibus rotundatis. Areis lateralibus angustis, usque ad apices pertinentibus ibique convergentibus.

Aðalvik (N. W.), Lb.

This form does not correspond completely with any of the numerous previously described variations of Nav. lyra. It differs from var. elliptica by being more finely striated; from var. atlantica by the lateral areas almost reaching the apices, and from var. Ehrenbergi by the lateral areas converging at the apices. Perhaps it is most closely allied to Nav. lyra var. granulata Per. from »la Manche«, delineated, but not described in Per. D. mar., tab. XXIII, fig. 5.

**Naviculæ Lævistriatæ** Cleve 1895. Cl. Syn., II, 66.

**Navicula elegans** W. Sm. Cl. Syn., II, 68; Per. D. mar., Tab. X, fig. 25.

4 samples (S. W. 3, E. 1).

Area: Eur., Afr., As., Am.

**Navicula palpebralis** Bréb. Cl. Syn., II, 70; V. H. Trt., Tab. IV, fig. 175.

7 samples (S. 4, S. W. 2, N. W. 1).

Area: Eur. Afr., As., Am., A. S.

**Navicula palpebralis** Bréb. var. *angulosa* Greg. Cl. Syn., I. c.; Per. D. mar., Tab. X, fig. 22.

Hvammssfjörður (S. W.), H. Js.

Area: Eur.

**Pinnularia** Ehr. 1843. Cl. Syn., II, 71.

**Pinnularia quadratarea** A. S. Cl. Syn., II, 95; V. H. Trt., Tab. XXV, fig. 704 (Navicula qv.).

Reykjavik (S.W.), C. H. O.

Area: Eur., Am., Aust., Grl., A. S.

**Pinnularia Trevelyana** Donk. Cl. Syn., II, 98; V. H. Trt., Tab. II, fig. 73 (Nav. Trev.).

Dyrafjörður (N.W.), C. H. O.

Area: Eur., As., Am.

**Amphora** Ehr. 1840. Cl. Syn., II, 99.

Subgenus *Amphora* Cleve 1895. Cl. Syn., II, 100.

**Amphora marina** (W. Sm.) H. V. H. Cl. Syn., II, 103; V. H. Trt., Tab. I, fig. 14.

22 samples (S. 3, S.W. 5, N.W. 7, N. 4, E. 3).

Area: Eur., As., Am., Grl., A. S.

**Amphora Proteus** Greg. Cl. Syn., II, 103; A. S. Atl., Tab. XXVII, fig. 3.

16 samples (S. 1, S.W. 11, N.W. 1, N. 2, E. 1).

Area: Ubiquist, Grl., A. S.

**Amphora Proteus** Greg. var. *contigua* Cl. Cl. Syn., l. c. A. S. Atl., l. c., figs. 7—9.

10 samples (S. 2, S.W. 7, N.W. 1).

Area: Eur., As., Aust.

**Amphora Pusio** Cl. Cl. Syn., II, 102; Per. D. mar., Tab. XLIV, fig. 8.

Eyrarbakki (S.), H. Js.

Area: Am., Aust., Grl.

**Amphora robusta** Greg. Cl. Syn., II, 103; Greg. Cl., Tab. XIII, fig. 79.

Isafjörður (N.W.), C. H. O.

Area: Eur., As., Aust., A. S.

Subgenus *Diplamphora* Cleve 1895. Cl. Syn., II, 107.

**Amphora crassa** Greg. Cl. Syn., II, 109; A. S. Atl., Tab. XXVIII, figs. 30—33 (A. cr. var. *punctata*).

Vestmannaeyjar (S.), H. Js., Hrótafjörður (N.), H. Js.

Area: Eur., Afr., As., Am., Grl., A. S.

Subgenus *Halamphora* Cleve 1895. Cl. Syn., II, 117.

**Amphora exigua** Greg. Cl. Syn., II, 123; Greg. Cl., Tab. XII, fig. 75.

Reykjavik (S.W.), H. Js.

Area: Eur., Am., Aust.

**Amphora Terroris** Ehr. Cl. Syn., II, 122; A. S. Atl., Tab. XXV, fig. 17—19 (A. *cymbifera*).

5 samples (S. 1, S.W. 1, N.W. 1, N. 1, E. 1).

Area: Eur., As., Am., Aust., Grl., A. S.

Subgenus *Oxyamphora* Cleve 1895. Cl. Syn., II, 125.

**Amphora lævis** Greg. Cl. Syn., II, 130; A. S. Atl., Tab. XXVI, fig. 10.

Olafsvik (S.W.), H. Js.

Area: Eur., As., A. S.

**Amphora lineolata** Ehr. Cl. Syn., II, 126; V. H. Trt., Tab. I, fig. 10. Eyrarbakki (S.), H. Js., Reykjavik (S.W.), H. Js., Dyrafjörður (N.W.), C. H. O.

Area: Eur., As., Am., A. S.

Subgenus *Cymbamphora* Cleve 1895. Cl. Syn., II, 134.

**Amphora angusta** (Greg.) Cl. var. *typica* Cl. Cl. Syn., II, 135; A. S. Atl., Tab. XXV, fig. 15 (A. ang. var. *gracilentata*).

5 samples (S.W. 3, N. 2).

Area: Eur., Afr., As., Am., Grl., A. S.

**Amphora cymbelloides** Grun. Cl. Syn., II, 136; A. S. Atl., Tab. XXVI, figs. 61—62 (A. angusta var. *glaberrima*).

Skálholtsvik (N.W.), H. Js.

Area: Eur., Afr., As., Am.

**Mastogloia Thwaites** 1898. Cl. Syn., II, 142.

**Mastogloia elliptica** Ag. Cl. Syn., II, 152; V. H. Syn., Tab. IV, fig. 19 (M. Danseï var. *ell.*).

Reykjavik (S.W.), C. H. O., Öndverðarnes (S.W.), H. Js., Búðir (S.W.), H. Js.

Area: Eur., Am.

**Mastogloia elliptica** Ag. var. *Danseï* Thw. Cl. Syn., l. c.; V. H. Syn., l. c., fig. 18 (M. Danseï).

Area: Eur., Aust.

**Mastogloia exigua** Lewis. Cl. Syn., II, 151; V. H. Trt., Tab. II, fig. 63.

Dyrafjörður (N.W.), C. H. O.

Area: Ubiquist, A. S.

## Monoraphideæ

**Achnantheæ** Cl. 1895. Cl. Syn. II, 163.

**Rhoicosphenia** Grunow 1860. Cl. Syn., II, 165.

**Rhoicosphenia curvata** Ktz. Cl. Syn., II, 165; V. H. Trt., Tab. VII, fig. 319.

143 samples (S. 17, S.W. 74, N.W. 16, N. 27, E. 7, S. L. 2).  
Area: Ubiquist, Grl., A. S.

**Cocconeis** (Ehr. 1835) Grun. 1868. Cl. Syn., II, 168.

Subgenus *Cocconeis* Cleve 1895. Cl. Syn., II, 168.

**Cocconeis grata** A. S. Cl. Syn., II, 172; Per. D. mar., Tab. III, figg. 6—7.

12 samples (S. 1, S.W. 10, N. 1).  
Area: Eur., Am.

**Cocconeis levis** sp. nov. Tab. nost., fig. 11, a, b.

Hypotheca: Long.:  $23\ \mu$ , lat.:  $10\ \mu$ , striis inconspicuis.

Valva elliptica: Raphe ægre perspicienda, area hyalina angustissima cincta.

Epitheca(?): Long.:  $16\ \mu$ , lat.:  $7\ \mu$ .

Valva forma Hypothecæ. Raphe deest. Striis in margine modo difficillime perspiciendis.

Skagafjörður (N.), Grld.

This small species offers very few marks for identification. I think my fig. b. in spite of its smaller size, may represent the epitheca. Both valves occur in the same slide. This species somewhat resembles the form delineated in A. S. Atl., tab. CXCI, fig. 2, which Cleve refers to *Coc. placentula*.

**Cocconeis Scutellum** Ehr. var. *genuina* Cl. Cl. Syn., II, 170; V. H. Trt., Tab. VIII, fig. 338.

160 samples (S. 18, S.W. 74, N.W. 15, N. 38, E. 15).  
Area: Ubiquist, Grl., A. S.

**Cocconeis Scutellum** Ehr. var. *ornata* Grun. Cl. Syn.; l. c., V. H. Syn., Tab. XXIX, figs. 6—7.

9 samples (S. 1, S.W. 5, N. 3).  
Area: Eur., A. S.

**Cocconeis Scutellum** Ehr. var. *parva* Grun. Cl. Syn., l. c., V. H. Trt., Tab. VIII, fig. 339.

8 samples (S. 2, S.W. 6),  
Area: Eur., Am., A. S.

**Cocconeis Scutellum** Ehr. var. *stauroneiformis* W. Sm. Cl. Syn., l. c., V. H. Syn., Tab. XXIX, figs. 10—11.

14 samples (S. 3, S.W. 7, N.W. 1, N. 3).

Area: Eur., Am., Aust., Grl., A. S.

Subgenus *Euocconeis* Cleve 1895. Cl. Syn., II, 173.

**Cocconeis molesta** (Ktz.) Grun. var. *crucifera* Grun. Cl. Syn., II, 174; A. S. Atl., Tab. CXCIII, figs. 49—51.

Arnarfjörður (N.W.), Lb.

Area: Eur., Afr.

**Cocconeis dirupta** Greg. Cl. Syn., II, 175; V. H. Trt., Tab. VIII, fig. 343.

28 samples (S. 3, S.W. 16, N.W. 1, N. 2, E. 6).

Area: Ubiquist, Grl., A. S.

**Cocconeis dirupta** Greg. var. *decipiens* Cl. Cl. Syn., l. c., Cl. A. S., Tab. I, fig. 6 & Tab. II, fig. 11 a (*C. arctica*).

Vattarnes (E.), H. Js.

Area: Eur., As., Am., Grl., A. S.

**Cocconeis dirupta** Greg. var. *Sigma* Pant. Cl. Syn., II, 176; A. S. Atl., Tab. CXCVIII, fig. 10 (*C. sigmoradians*) & figs. 22—24 (*C. Oculus Cati*).

4 samples (S. 1, S.W. 2, E. 1).

Area: As., Am., Grl., A. S.

**Cocconeis pseudomarginata** Grun. Cl. Syn., II, 178; V. Trt., Tab. XXIX, fig. 824.

Vestmannaeyjar (S.), H. Js.

Area: Ubiquist, Grl., A. S.

Subgenus *Pleuroneis* Cleve 1895. Cl. Syn., II, 181.

**Cocconeis britannica** Nægeli. Cl. Syn., II, 181; V. H. Syn., Tab. XXX, figs. 1—2.

Hrisey (N.), H. Js.

Area: Eur., Am.

**Cocconeis costata** Greg. Cl. Syn., II, 182; V. H. Trt., Tab. XXIX, fig. 816.

119 samples (S. 10, S.W. 49, N.W. 18, N. 28, E. 14).

Area: Eur., Am., Aust., Grl., A. S.

Subgenus *Heteroneis* Cleve 1895. Cl. Syn., II, 182.

**Cocconeis Pelta** A. S. Cl. Syn., II, 184; A. S. Atl., Tab. CXCI, fig. 6.

Arnarfjörður (N.W.), Lb.

Area: Eur.



**Achnanthes** Bory.

Subgenus *Microneis* Cleve 1895. Cl. Syn., II, 187.

**Achnanthes Hauckiana** Grun. Cl. Syn., II, 190; V. H. Syn., Tab. XXVII, figs. 14—15.

Isafjörður (N. W.). C. H. O.

Area: Eur., Am., Aust.

**Achnanthes islandica** sp. nov. Tab. nost., fig. 12.

Long.:  $24 \mu$ , lat:  $9,5 \mu$ , str., utriusque in valvis, 12 in  $10 \mu$ , punctatis.

Epitheca: Valva elliptice-lanceolata, area apicali angusta, media in valva posita.

Hypotheca: Valva elliptica. Striis ut in epitheca, parallelis, apices versus tamen leniter radiantibus, media in parte valvæ fasciam transapicalem satis latam relinquentibus.

Stykkishólmur (S. W.) H. Js.

In am not sure of the place of this small form within the Achnantheae. It scarcely belongs to the form-series of *Achn. brevipes*. Perhaps it is more closely allied to *Achn. hungarica* (Cl. Syn., II, 190. V. H. Trt., tab. VIII, fig. 328). It has been found in a sample, also containing fresh-water species, an occurrence not rare in the samples from the coasts of Iceland, examined by me.

Subgenus *Achnantheidium* (Ktz. 1844) Heib. 1863. Cl. Syn., II, 191.

**Achnanthes brevipes** Ag. var. *typica* Cl. Cl. Syn., II, 193; V. H. Trt., Tab. VIII, fig. 324.

24 samples (S. 4, S. W. 7, N. W. 4, N. 7, E. 2).

Area: Ubiquist, Grl., A. S.

**Achnanthes brevipes** Ag. var. *intermedia* Ktz. Cl. Syn., II, l. c.; V. H. Trt., Tab. VIII, fig. 325. (*A. subsessilis*.)

29 samples (S. 5, S. W. 7, N. W. 3, N. 11, E. 3).

Area: Ubiquist, Grl., A. S.

**Achnanthes brevipes** Ag. var. *linearis* Øst. Øst. K. D., 330, Tab. II, fig. 9.

Reykjavik (S. W.), H. Js.

Area: Grl.

**Achnanthes brevipes** Ag. var. *parvula* Ktz. Cl. Syn., II, l. c.; V. H. Trt., Tab. VIII, fig. 326.

30 samples (S. 2, S. W. 19, N. W. 2, N. 4, E. 3).

Area: Eur., Am., Grl.

In a sample from Kolbeinsá (N.) H. Js. I have found an *Achn. brev. typica*, having only  $5\frac{1}{2}$  str. in  $10 \mu$ , an uncommonly wide striation, and in a sample from the same locality (H. Js.) I have also found the short



and broad form of *Achn. brev.* mentioned in my »Kyst Diat. fra Grønland«, delineated in table II, fig. 13.

***Achnanthes Groenlandica*** Cl. Cl. Syn., II, 195; Cl. A. D., Tab. IV, fig. 23.

Hvammsfjörður (S.W.), H. Js.

Area: Am., Grl., A. S.

Subgenus *Achnanthes* (Bory). Cl. Syn. II, 195.

***Achnanthes longipes*** C. Ag. Cl. Syn., II, 195; V. H. Trt., Tab. VIII, fig. 323.

Prestbakki (N.), H. Js.

Area: Eur., Afr., As., Am., Grl.

## Kalyptoraphideæ

### Eschatoraphideæ

***Surirella*** Turpin 1827. V. H. Trt., 368.

***Surirella fastuosa*** Ehr. V. H. Trt., 372, Tab. XIII, fig. 583.

Vestmannaeyjar (S.), H. Js., Reykjavik (S.W.), H. Js., Isafjörður (N.W.), H. Js.

Area: Ubiquist.

***Campylodiscus*** Ehr. 1841. V. H. Trt., 375.

***Campylodiscus angularis*** Greg. V. H. Trt., 378, Tab. XXXV, fig. 909.

Viðey (S.W.), H. Js.

Area: Eur., Grl., A. S.

***Campylodiscus biangulatus*** Grev. Per. D. mar., 242, Tab. LV, fig. 9.

Isafjörður (N.W.), C. H. O.

Area: Eur., Afr., As., Aust., Grl.

***Campylodiscus fluminensis*** Grun. Per. D. mar., 244, Tab. LV, fig. 11.

Vestmannaeyjar (S.), H. Js., Reykjavik (S.W.), H. Js.

Area: Eur.

***Campylodiscus Samoensis*** Grun. Per. D. mar., 241, Tab. LIV, figs. 6—8.

Skálholtsvik (N.W.), H. Js.

Area: Eur., Am., Aust.

***Campylodiscus Thureti*** Bréb. V. H. Trt., 378, Tab. XIV, fig. 595.

Reykjavik (S.W.), H. Js., Seydisfjörður (E.), H. Js.

Area: Eur., Afr., As., Am., Grl.

**Tropidoraphideæ.****Hantzschia** Grun. 1877. V. H. Trt., 380.**Hantzschia marina** (Donk.) Grun. V. H. Trt., 382, Tab. XV, fig. 489 b.

Höfði (N.), H. Js.

Area: Eur., Am., Grl.

**Hantzschia virgata** (Roper) Grun. V. H. Trt., 381, Tab. XV, fig. 488 b.

Dyrafjörður (N.W.), C. H. O.

Area: Eur., Afr., As., Am., A. S.

**Nitzschia** (Hassall 1845; W. Smith), Grun. Ch. emend. 1880. V. H. Trt., 382. *Tryblionella* W. Smith partim, Grun. 1880. V. H. Trt., 384.**Nitzschia Tryblionella** Hantzsch var. *littoralis* Grun. V. H. Trt., 385, Tab. XV, fig. 496.

Stykkishólmur (S.W.), H. Js.

Area: Eur., Am.

*Apiculatæ* Grun. 1880. V. H. Trt., 387.**Nitzschia acuminata** (W. Sm.) Grun. V. H. Trt., 388, Tab. XV, fig. 506.

Kolbeinsá (N.), H. Js., Grjótnes (N.), C. H. O., Brimnes (E.), H. Js.

Area: Eur., As., Am.

**Nitzschia apiculata** (Greg.) Grun. V. H. Trt., 387, Tab. XV, fig. 505.

6 samples (S. 1, S.W. 3, N. 2).

Area: Eur., As., Am., Grl., A. S.

**Nitzschia marginulata** Grun. Per. D. mar., 270, Tab. LXX, figs. 14—17.

5 samples (S.W. 2, N.W. 1, N. 2).

Area: Eur., Am., Aust., A. S.

As regards var. *subconstricta*, which I have found together with the main species, I agree with Peragallo l. c. when he says: „... ses variétés constricta et subconstricta ne sont pas acceptables. la constriction médiane étant essentiellement variable chez cette espèce très polymorphe.“

*Bilobatæ* Grun. 1880. V. H. Trt., 389.**Nitzschia bilobata** W. Sm. V. H. Trt., 389, Tab. XV, fig. 512.

Stykkishólmur (S.W.), H. Js., Öndverðarnes (S.W.), H. Js., Isafjörður (N.W.), H. Js.

Area: Ubiquist, Grl.

**Nitzschia bilobata** W. Sm. var. *minor* Grun. V. H. Trt., 390, Tab. XV, fig. 513.

Isafjörður (N.W.), C. H. O.

Area: Cum typo (De Ton. Syll., II, 514).

*Bacillaria* Grun. 1880. V. H. Trt., 392.

**Nitzschia paradoxa** (Gmel.) Grun. V. H. Trt., 392, Tab. XVI, fig. 518.

Ísafjörður (N.W.), C. H. O.

Area: Eur., Afr., As., Am., Grl., A. S.

**Nitzschia socialis** Greg. Cl. & Grun. A. D., 85: V. H. Syn., Tab. LXI, fig. 8.

9 samples (S. 1, S.W. 3, N.W. 1, N. 3, E. 1).

Area: Eur., Afr., As., Am., Grl., A. S.

*Vivaces* Grun. 1880. V. H. Trt., 392.

**Nitzschia islandica** sp. nov. Tab. nost., fig. 13.

Long.: 94  $\mu$ , lat.: 12  $\mu$ , str. 19—20 in 10  $\mu$ , punct. car. 6,5 in 10  $\mu$ .

Valva late-lineari, media in parte leniter contracta, apices apiculatos versus attenuata. Carina admodum excentrica, sinuata.

Kolbeinsá (N.), H. Js.

I think the somewhat excentric keel qualifies this species to be classed under »Vivaces«. See also fig. 522 of *N. vivax* in Per. D. mar., tab. XVI.

*Spathulatæ* Grun. 1880. V. H. Trt., 393.

**Nitzschia angularis** W. Sm. V. H. Trt., 393, Tab. XVI, fig. 521.

10 samples (S. 2, S.W. 6, N.W. 1 N. 1).

Area: Eur., As., Am., Aust., Grl., A. S.

**Nitzschia angularis** W. Sm. var. *affinis* Grun. V. H. Trt. l. c., Tab. l. c., fig. 522.

4 samples (S. 1, S.W. 2, E. 1).

Area: Eur., Grl.

*Dissipatæ* Grun. 1880. V. H. Trt. 394.

**Nitzschia dissipata** (Ktz.) Grun. var. *Acula* Hantzsch. V. H. Trt., 395, Tab. XVI, fig. 527. (N. v. d. *acuta*).

Ísafjörður (N.W.), C. H. O., Prestbakki (N.), H. Js.

Area: Eur., Aust.

I have retained the name »Acula«, as this undoubtedly is the correct one. This form is, as far as I know, first described in Cl. & Gr. A. D. (1880), pag. 90 under the name of *Nitzschia Acula* Hantzsch. It is found under the same name as a var. of *N. dissipata* in V. H. Syn. (1885), pag. 178, and in the text to tab. LXIII, fig. 4. But »Acula« is everywhere altered to »acuta« in De Toni Syll. (1892) pag. 527, V. H. Trt. (1899), pag. 395 and in Per. D. mar. (1897—1908), pag. 281. If »Acuta«, by Hantzsch or Grunow, has been considered an error in writing, I do not know, but »Acula« is however, perhaps not a particularly good Latin word, meaning »a small needle« (see Arnesen: »Ny latinsk Ordbog«, Kjøbenhavn 1848, pag. 56) but the term is very apposite to the variety in question.

*Sigmata* Grun. 1880. V. H. Trt., 396.

**Nitzschia Sigma** W. Sm. V. H. Trt., 396, Tab. XVI, fig. 531.

12 samples (S. 1, S.W. 8, N. 1, E. 2).

Area: Ubiquist, Grl., A. S.

**Nitzschia Sigma** W. Sm. var. *rigida* (Ktz.) Grun. V. H. Trt., l. c., fig. 533.

Búðir (S.W.), H. Js.

Area: Eur., Afr.

*Lineares* Grun. 1880. V. H. Trt., 398.

**Nitzschia vitrea** Norman var. *Salinarum* Grun. V. H. Trt., 399, Tab. XVI, fig. 546.

Njarðvík (S.W.), C. H. O.

Area: Eur.

*Lanceolatae* Grun. 1880. V. H. Trt., 400.

**Nitzschia lanceolata** W. Sm. V. H. Trt., 400, Tab. XVII, fig. 548.

Reykjavík (S.W.), B. S.

**Rhopalodia** O. Müller 1895. V. H. Trt., 307.

**Rhopalodia Musculus** (Ktz.) O. M. V. H. Trt., 297, Tab. IX, fig. 359.  
(*Epithemia* Musc.)

Steingrímsfjörður (N. 3 samples), H. Js.

## Arraphideæ

**Synedra** Ehr. 1831. V. H. Trt., 307.

**Synedra affinis** Ktz. V. H. Trt., 314; Per. D. mar., 318.

I have found *Synedra affinis* with variants as delineated in V. H. Syn., tab. XLI, in Per. D. mar., tab. LXXX, and in A. S. Atl., tab. CCCIV, in all in 184 samples (S. 13, S.W. 77, N.W. 27, N. 50, E. 17).

Of the numerous variants, difficult to distinguish from each other, I have noted the following:

**Synedra affinis** var. *gracilis* Grun. V. H. Syn., Tab. XLI, fig. 15 B.

Area: Eur., Grl.

**Synedra affinis** var. *fasciculata* Ktz. V. H. Syn., l. c., fig. 15.

Area: Eur., As., Grl., A. S.

**Synedra affinis** var. *lancettula* Grun. V. H. Syn., l. c., fig. 28.

Area: Am., Grl.

**Synedra affinis** var. *parva* Ktz. V. H. Syn., l. c., fig. 23.

Area: Eur., Afr., Aust., Grl., A. S.

**Synedra affinis** var. *rupicola* Grun. V. H. Syn., l. c., fig. 27.

Area: Eur., Grl.

**Synedra affinis** var. *tabulata* Ktz. V. H. Syn., l. c., fig. 9 A.

Area: Eur., Aust., Grl.

**Synedra affinis** var. *typica* Ktz. A. S. Atl., Tab. CCCV, figs. 6—12.

Area: Ubiquist, Grl., A. S.

Amongst these, the most frequently occurring species are:

*typica*: 106 samples (S. 17, S.W. 48, N.W. 20, N. 11, E. 10).

*tabulata*: 44 samples (S. 4, S.W. 20, N.W. 6, N. 13, E. 1).

*gracilis*: 41 samples (S. 2, S.W. 12, N.W. 7, N. 17, E. 3).

*parva*: 14 samples (S. 2, S.W. 5, N.W. 3, N. 2, E. 2).

**Synedra crystallina** (Lyngb.) Ktz. V. H. Trt., 315, Tab. X, fig. 435.

Vestmannaeyjar (S.), H. Js.

Area: Eur., Afr., As., A. S.

**Synedra curvata** sp. nov. Tab. nost., fig. 14.

Long.: 104—178  $\mu$ , lat.: media in valva, 3,6—5  $\mu$ , str. 19—20 in 10  $\mu$ .

Valva lineari, apices versus leniter attenuata, curvata. Striis marginalibus.

Isafjörður (N. W.), C. H. O.

Owing to its marginally situated striae, this species is probably most closely allied to the form-series of *Synedra affinis*. It has no connection with *Syn. curvata* Ktz. Bacil., 65, tab. XV, fig. II (a fresh-water species from Nordhausen in Saxony).

**Synedra Gailloni** Ehr. V. H. Trt., 312, Tab. X, fig. 424.

16 samples (S. 1, S.W. 15).

Area. Eur., Afr., As., Am.

In a sample from Melvik, near Reykjanes (S.W.), C. H. O., I have found a *Synedra*, which corresponds well with *Syn. capensis* Grun. V. H. Syn., tab. XLII, fig. I, a form closely allied to *Syn. Gail*.

**Synedra Henedyana** Greg. V. H. Trt., 317, Tab. X, fig. 438.

Vattarnes (E.), H. Js.

Area: Eur.

**Synedra investiens** W. Sm. V. H. Trt., 313, Tab. X, fig. 425.

62 samples (S. 17, S.W. 25, N.W. 5, N. 8, E. 7).

Area: Eur., Grl.

**Synedra kamtschatica** Grun. Cl. & Gr. A. D., 106; Øst. Østg. mar., Tab. VII, fig. 85.

8 samples (S.W. 1, N.W. 1, N. 4, E. 2).

Area: Grl., A. S.

**Synedra provincialis** Grun. Trans. Mic. Soc. XVIII, 166; V. H. Syn., Tab. XL., fig. 8.

Reykjavik (S.W.), Grld.

Area: Eur.

The species found by me is a forma minor (long. 54  $\mu$ ). The length of the typical Syn. provinc. is given by Grunow as: 65—110  $\mu$ .

**Synedra pulchella** Ktz. V. H. Trt., 309, Tab. X, fig. 402.

15 samples (S. 3, S.W. 2, N.W. 5, N. 4, E. 1).

Area: Eur., As., Am., Grl., A. S.

**Thalassionema** Grun. V. H. Trt., 319.

**Thalassionema nitzschioides** Grun. Per. D. mar., 320, Tab. LXXXI, figs. 17—18.

Eyrarbakki (S.), H. Js.

Area: Eur., Am.

**Thalassiothrix** Cl. & Grun. 1880. V. H. Trt., 321.

**Thalassiothrix Frauenfeldi** Grun. Per. D. mar., 321, Tab. LXXXI, fig. 15.

Prestbakki (N.), H. Js.

Area: Eur., As., Grl.

**Fragilaria** Lyngbye 1819. V. H. Trt., 323.

**Fragilaria hyalina** (Ktz.) Grun. V. H. Trt., 324, Tab. XI, fig. 443.

5 samples (S.W. 2, E. 3).

Area: Eur., Afr., As.

**Fragilaria striatula** Lyngb. V. H. Trt., 324; Per. D. mar., Tab. LXXXI, fig. 5.

82 samples (S. 12, S.W. 30, N.W. 5, N. 13, E. 20, S. L. 2).

Area: Eur., Am., Aust., Grl., A. S.

**Fragilaria vitrea** Ktz. Per. D. mar., 326, Tab. LXXXI, fig. 2.

28 samples (S. 3, S.W. 6, N.W. 5, N. 11, E. 3).

Area: Eur., Am.

Var. minima Per. D. mar. l. c., fig. 3, I have found interspersed among the main-species.

**Rhaphoneis** Ehr. 1844. V. H. Trt., 329.

**Rhaphoneis ampiceros** Ehr. var. *rhombica* Grun. V. H. Trt., 330, Tab. X, fig. 395.

Búðir (S.W.), H. Js.

Area: Ubiquist.



**Dimeregramma** Ralfs 1861. V. H. Trt., 335.

**Dimeregramma minus** (Greg.) Ralfs var. *nanum* Greg. V. H. Trt., 336, Tab. X, fig. 393.

Broddanes (N.), H. Js.

Area: Eur.

**Plagiogramma** Grev. 1859. V. H. Trt., 337.

**Plagiogramma Gregorianum** Grev. V. H. Trt., 338, Tab. X, fig. 390.

Kolbeinsá (N.), H. Js., Bildudalur (N.W.), H. Js.

Area: Ubiquist, Grl., A. S.

**Licmophora** Agardh. 1827. V. H. Trt., 341.

**Licmophora anglica** (Ktz.) Grun. V. H. Trt., 343, Tab. XI, fig. 458.

32 samples (S. 1, S.W. 14, N. 8, E. 9).

Area: Eur., Afr., As., Am., Grl.

**Licmophora anglica** (Ktz.) forma *elongata* V. H. Syn., Tab. XLVI, fig. 15.

6 samples (S.W. 1, N. 1, E. 4).

Area: De Toni Syll. pag. 733: »cum specie«.

**Licmophora anglica Jürgensi** Ag. V. H. Trt., 343, Tab. XXXI, fig. 850.

4 samples (S.W. 1, N. 2, E. 1).

Area: Eur., Grl., A. S.

**Licmophora Oedipus** (Ktz.) Grun. Per. D. mar., 356 (L. Jürgensi var. *Oedipus*); V. H. Syn., Tab. XLVII, figs. 2—3.

44 samples (S. 5, S.W. 12, N.W. 5, N. 11, E. 11).

Area: Eur., As.

**Licmophora Oedipus** forma *elongata*. V. H. Syn., Tab. XLVII, fig. 1.

Stykkishólmur (S.W.), H. Js., Höfði (N.), H. Js.

Area: Eur.

**Licmophora paradoxa** (Lyngb.) Ag. V. H. Trt., 344, Tab. XXXI, fig. 855.

32 samples (S.W. 14, N.W. 7, N. 8, E. 3).

Area: Eur., Afr., Am., Grl.

**Grammatophora** Ehr. 1839. Per. D. mar., 352.

**Grammatophora angulosa** Ehr. 1839. Per. D. mar., 357, Tab. LXXXVIII, figs. 11—13.

60 samples (S. 16, S.W. 34, N.W. 4, N. 4, E. 2).

Area: Ubiquist.

**Grammatophora angulosa** Ehr. var. *hamulifera* Ktz. Per. l. c., 358, Tab. l. c., figs. 16—17.

19 samples (S. 5, S.W. 10, N. 1, E. 3).

Area: Eur., As., Am.



**Grammatophora angulosa** Ehr. var. *islandica* Ehr. Per. l. c., 358, Tab. l. c., figs. 14—15.

125 samples (S. 23, S.W. 61, N.W. 10, N. 21, E. 10).

Area: Eur., Am., Grl., A. S.

**Grammatophora arcuata** Ehr. Grun. Øst. Diat., 1862, 420, Tab. XI, fig. 7.

21 samples (S. 7, S.W. 5, N.W. 2, N. 6, E. 1).

Area: Aust., Grl., A. S.

**Grammatophora marina** (Lyngb.) Ktz. P. D. mar., 353, Tab. LXXXVII, figs. 6—8.

155 samples (S. 31, S.W. 98, N.W. 11, N. 12, E. 3).

Area: Ubiquist.

**Grammatophora oceanica** Ehr. var. *macilenta* W. Sm. Per. D. mar., 355, Tab. LXXXVII, figs. 14—17.

28 samples (S. 3, S.W. 17, N.W. 4, N. 4).

Area: Eur.

**Grammatophora oceanica** forma *minuscula* Per. Per. l. c., 355, Tab. l. c., fig. 13.

66 samples (S. 19, S.W. 38, N.W. 4, N. 5).

Area: Eur.

In a sample from Skerjafjörður (S.W.), H. Js. I have found a curved Gram. oc. macil., of which I have given a figure in tab. nost. fig. 15. It has the dimensions: long. 73  $\mu$ , lat. 6.5  $\mu$ .

**Grammatophora serpentina** Ehr. Per. D. mar., 356, Tab. LXXXVIII, figs. 2—5.

Vestmannaeyjar (S., 2 samples), H. Js.

Area: Ubiquist.

**Rhabdonema** Ktz. 1844. V. H. Trt., 360.

**Rhabdonema adriaticum** Ktz. V. H. Trt., 360. Tab. XII, fig. 486 a.

Vestmannaeyjar (S., 3 samples), H. Js.

Area: Ubiquist.

**Rhabdonema arcuatum** (Ag.) Ktz. V. H. Trt., 360, Tab. XII, fig. 487 a.

303 samples (S. 38, S.W. 126, N.W. 21, N. 77, E. 36, S. L. 5).

Area: Ubiquist, Grl., A. S.

*Rhabdonema arcuatum* is a form which, as regards its outline, is variable, and in the samples examined by me, it appears with recti-linear as well as with more or less curved sides (see Cleve's var. *ventricosum* in Cl. Arct. S., 24, tab. IV, fig. 21). The curved species may perhaps be identical with *Rhabd. Crozieri* Grun. Concerning this see Mann, Albat. 322 under *Tessela catena* Ehr.

**Rhabdonema minutum** Ktz. V. H. Trt., 361, Tab. XII, fig. 488 a.  
231 samples (S. 34, S. W. 113, N. W. 27, N. 42, E. 15).  
Area: Ubiquist, Grl., A. S.

**Rhabdonema robustum** Grun. Grun. Øst. Diat., 422; A. S. Atl., Tab. CCXXI, figs. 17—23.

Vestmannaeyjar (S.), H. Js.  
Area: Am.

**Striatella** Agardh 1832. V. H. Trt., 362.

**Striatella delicatula** (Ktz.) Grun. V. H. Trt., 363, Tab. XII, fig. 483 a.  
Skógarnes (S. W.), H. Js.  
Area: Eur., Afr., As., Am.

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## CENTRICÆ

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**Rhizosolenia** (Ehr. Brightw.) Per. em. 1892. Gr. N. P., 46.

**Rhizosolenia hebetata** Bail. f. *semispina* Hensen. Gr. N. P., 55, fig. 67 b.

Einarslón (N.), H. Js.

Area: »Ozeanische Form, besonders im nordwestlichen Teile des Gebietes einheimisch«. (Gr. l. c.).

**Chætoceras** Ehr. 1844. Gr. N. P., 58.

**Chætoceras boreale** Bail. Gr. N. P., 73, fig. 87.

Arnarnes (N.) H. Js.

Area: Ubiquist, Grl., A. S.

**Chætoceras Diadema** Ehr. Gr. N. P., 84, fig. 102 b.

5 samples (S. W. 2, N. W. 1, N. 2).

Area: Eur., As., Am., Grl., A. S.

Only spores have been found.

**Chætoceras furcellatum** Bail. Gr. N. P., 95, fig. 121.

Reykjavik (S. W.), H. Js.

Area: Eur., Grl., A. S.

Only spores have been found.

**Chætoceras Ingolfianum** Ostenf. Gr. N. P., 90, fig. 115.

Hafranes (E.), H. Js.

Area: Eur.

Only spores have been found.

**Thalassiosira** Cl. 1872. Gr. N. P., 16.

**Thalassiosira gravida** Cl. Gr. N. P., 18, fig. 12; spore, A. S. Atl., Tab. LVIII, fig. 44 (*Coscinodiscus subglobosus*).

7 samples (all S.W.), H. Js., Grld., C. H. O.

Area: Eur., Am., Grl., A. S.

Only spores have been found.

**Melosira** Agardh 1824. V. H. Trt. 438:

**Melosira nummuloides** (Bory) Ag. V. H. Trt. 440, Tab. XVIII, fig. 608.

26 samples (S. 3, S.W. 9, N.W. 4, N. 7, E. 3).

Area: Ubiquist, Grl., A. S.

**Melosira sulcata** (Ehr.) Ktz. V. H. Trt., 444, Tab. XIX, fig. 624.

81 samples (S. 5, S.W. 61, N.W. 9, N. 6).

Area: Eur., Afr., As., Am., Grl., A. S.

**Melosira sulcata** f. *radiata*. Grun. Fz. J. L., 42, Tab. V, fig. 35.

8 samples (S.W. 6, N.W. 1, N. 1).

Area: Eur., A. S.

**Podosira** Ehr. 1840. V. H. Trt., 447.

**Podosira hormoides** (Mont.) Cl. & Gr. A. D., 118; A. S. N. S. D., Tab. III, fig. 40.

156 samples (S. 24, S.W. 79, N.W. 19, N. 17, E. 14, S. L. 3).

Area: Eur., Am., Grl.

In several of the samples examined by me *Podos. horm.* occurs with a diameter of up to 70  $\mu$  and of a very fine structure. For this reason it may perhaps be considered as a forma major of *Podos. horm.* var. *glacialis* Grun., see Fz. J. L., 56, tab. V, fig. 32. I have found it with the more distinct punctuations indicated in the figure, as well as without these.

**Hyalodiscus** Ehr. 1854. V. H. Trt., 448.

**Hyalodiscus subtilis** Bail. Per. D. mar., 443, Tab. CXIX, fig. 7.

7 samples (S.W. 1, N. 3, E. 3).

Area: Eur., Afr., As., Am., Grl., A. S.

**Hyalodiscus subtilis** Bail. var. *scoticus* (Ktz.) Grun. Per. l. c. 443, Tab. l. c., fig. 8.

209 samples (S. 28, S.W. 110, N.W. 24, N. 39, E. 7, S. L. 1).

Area: Eur., Am., Aust., Grl., A. S.

**Isthmia** Ag. 1830. Per. D. mar., 375.

**Isthmia nervosa** Ktz. Per. D. mar., 375, Tab. XCI.

64 samples (S. 20, S.W. 24, N.W. 3, N. 7, E. 7, S. L. 3).

Area: Eur., Am., Grl., A. S.

**Biddulphia** Gray 1831. V. H. Trt. 466.

**Biddulphia antediluviana** (Ehr.) H. V. H. V. H. Trt., 475, Tab. XXI, fig. 642.

Vestmannaeyjar (S.), H. Js.

Area: Eur., Afr., Am.

**Biddulphia aurita** (Lyngb.) Bréb. V. H. Trt., 471, Tab. XX, fig. 631.

180 samples (S. 14, S.W. 83, N.W. 29, N. 34, E. 17, S. L. 3).

Area: Eur., Afr., As., Am., Grl., A. S.

**Biddulphia (Odontella) obtusa** Ktz. Per. D. mar., 381; V. H. Syn., Tab. C, figs. 11—14.

4 samples (S.W. 2, N.W. 1, E. 1).

Area: Ubiquist.

**Trigonium** Cl. 1867. Per. D. mar., 377.

**Trigonium arcticum** (Bright.) Cl. Per. D. mar., 379. Brightv. Tric., Tab. IV, fig. 11 (Triceratium arct.).

Flatey by Husavik (N.), Hørr.

Area: Eur., Afr., Am., Grl., A. S.

**Actinoptychus** Ehr. 1838. V. H. Trt., 493.

**Actinoptychus undulatus** (Ehr.) Ralfs. V. H. Trt., 496, Tab. XXII, fig. 648.

5 samples (all S.W.), Grld., H. Js.

Area: Ubiquist, Grl.

**Actinocyclus** Ehr. 1840. V. H. Trt., 522.

**Actinocyclus Barkleyi** (Ehr.) Grun. Ratt. Actinoc., 158; V. H. Syn., Tab. CXXIV, fig. 12.

Vestmannaeyjar (S.), H. Js.

Area: Am., Aust.

**Actinocyclus crassus** H. V. H. V. H. Trt., 523, Tab. XXIII, fig. 660.

Vestmannaeyjar (S.), H. Js., Reykjavik (S.W.), H. Js.

Area: Ubiquist.

**Actinocyclus Ralfsi** (W. Sm.) Ralfs. Per. D. mar., 414, Tab. CXIII, fig. 2.

Vestmannaeyjar (S.), H. Js., Hafnafjörður (S.W.), H. Js., Reykjavik (S.W.), H. Js.

Area: Ubiquist, Grl.

**Actinocyclus subtilis** (Greg.) Ralfs. V. H. Trt., 524, Tab. XXIII, fig. 661.

Melvik (S.W.), C. H. O.

Area: Ubiquist.

**Coscinodiscus** Ehr. 1838. V. H. Trt., 525.

**Coscinodiscus excentricus** Ehr. V. H. Trt., 531, Tab. XXIII, fig. 666

Steingrimsfjörður (N.), H. Js.

Area: Ubiquist, Grl., A. S.



# TABULAR SURVEY





		Universal distribution						Distribution in the different parts of the coasts of Iceland					
		Eur.	Afr.	As.	Am.	Aust.	Grl.	A. S.	S.	S.W.	N.W.	N.	E.
<b>Achnanthes</b>													
1	— brevipes . . . . .	x	x	x	x	x	x	x	x	x	x	x	x
2	— — linearis . . . . .						x			x			
3	— — intermedia . . . . .	x	x	x	x	x	x	x	x	x	x	x	x
4	— — parvula . . . . .	x			x		x		x	x	x	x	x
5	— — var. . . . .						x		x	x			
6	— groenlandica . . . . .				x		x	x		x			
7	— Hauckiana . . . . .	x			x	x					x		
8	— longipes . . . . .	x	x	x	x		x				x		
<b>Actinocyclus</b>													
9	— Barkleyi . . . . .				x	x			x				
10	— crassus . . . . .	x	x	x	x	x			x	x			
11	— Ralfsi . . . . .	x	x	x	x	x	x		x	x			
12	— subtilis . . . . .	x	x	x	x	x				x			
<b>Actinoptychus</b>													
13	— undulatus . . . . .	x	x	x	x	x	x			x			
<b>Amphipleura</b>													
14	— rutilans . . . . .	x	x	x			x			x	x	x	
<b>Amphora</b>													
15	— angusta . . . . .	x	x	x	x		x	x		x		x	
16	— crassa . . . . .	x	x	x	x		x	x	x			x	
17	— cymbelloides . . . . .	x	x	x	x							x	
18	— exigua . . . . .	x			x	x				x			
19	— lævis . . . . .	x		x				x		x			
20	— lineolata . . . . .	x		x	x		x	x	x	x	x		
21	— marina . . . . .	x		x	x		x	x	x	x	x	x	x
22	— Proteus . . . . .	x	x	x	x	x	x	x	x	x	x	x	x
23	— — contigua . . . . .	x		x		x			x	x	x		
24	— Pusio . . . . .	x				x	x		x				
25	— robusta . . . . .	x		x		x		x			x		
26	— Terroris . . . . .	x		x	x	x	x	x	x	x	x	x	x
<b>Biddulphia</b>													
27	— antediluviana . . . . .	x	x		x				x				
28	— aurita . . . . .	x	x	x	x		x	x	x	x	x	x	x
29	— obtusa . . . . .	x	x	x	x	x					x		
<b>Caloneis</b>													
30	— brevis . . . . .	x	x	x	x	x	x	x		x	x		
		26	16	21	23	16	18	13	15	21	15	11	7

		Universal distribution						Distribution in the different parts of the coasts of Iceland					
		Eur.	Afr.	As.	Am.	Aust.	Grl.	A. S.	S.	S.W.	N.W.	N.	E.
31	( <i>Caloneis brevis</i> ) <i>distoma</i> . . . . .			x				x			x		
32	— <i>formosa</i> . . . . .	x	x	x	x	x	x		x	x	x		
33	— <i>Liber genuina</i> . . . . .	x	x	x	x	x	x	x	x	x	x		
34	— — <i>elongata</i> . . . . .	x	x	x	x		x	x		x			
35	— — <i>linearis</i> . . . . .	x	x	x	x				x	x	x		
<b>Campylodiscus</b>													
36	— <i>angularis</i> . . . . .	x					x	x		x			
37	— <i>biangulatus</i> . . . . .	x	x	x		x	x				x		
38	— <i>fluminensis</i> . . . . .	x						x	x				
39	— <i>Samoensis</i> . . . . .	x		x		x					x	x	
40	— <i>Thureti</i> . . . . .	x	x	x	x		x		x				x
<b>Chætoceras</b>													
41	— <i>boreale</i> . . . . .	x	x	x	x	x	x					x	
42	— <i>Diadema</i> . . . . .	x		x	x		x	x		x	x	x	
43	— <i>furcellatum</i> . . . . .	x					x	x		x		x	
44	— <i>Ingolfianum</i> . . . . .	x											x
<b>Cocconeis</b>													
45	— <i>britannica</i> . . . . .	x			x							x	
46	— <i>costata</i> . . . . .	x			x	x	x	x	x	x	x	x	x
47	— <i>dirupta</i> . . . . .	x	x	x	x	x	x	x	x	x	x	x	x
48	— — <i>decipiens</i> . . . . .	x		x	x		x	x	x			x	x
49	— — <i>Sigma</i> . . . . .			x	x		x	x	x	x			x
50	— <i>grata</i> . . . . .	x			x				x	x		x	
51	— <i>molesta</i> . . . . .	x	x								x		
52	— <i>Pelta</i> . . . . .	x									x		
53	— <i>pseudomarginata</i> . . . . .	x	x	x	x	x	x	x			x	x	x
54	— <i>Scutellum</i> . . . . .	x	x	x	x	x	x	x	x	x	x	x	x
55	— — <i>ornata</i> . . . . .	x						x	x	x			
56	— — <i>parva</i> . . . . .	x			x			x	x	x			
57	— — <i>stauroneiformis</i> . . . . .	x			x	x	x	x	x	x	x	x	
<b>Coscinodiscus</b>													
58	— <i>excentricus</i> . . . . .	x	x	x	x	x	x				x		
<b>Dimeregramma</b>													
59	— <i>minus nanum</i> . . . . .	x								x			
		27	12	16	18	11	17	17	12	18	13	12	8

		Universal distribution						Distribution in the different parts of the coasts of Iceland					
		Eur.	Afr.	As.	Am.	Aust.	Grl.	A. S.	S.	S.W.	N.W.	N.	E.
<b>Diploneis</b>													
60	— <i>æstiva</i> .....	x	x	x	x			x		x	x		
61	— <i>bomboides media</i> .....	x					x	x		x			
62	— <i>chersonnensis</i> .....	x	x	x	x	x			x	x	x	x	
63	— <i>coffæiformis</i> .....	x		x	x		x					x	x
64	— <i>constricta</i> .....	x		x	x		x	x			x		
65	— <i>contigua Eudoxia</i> .....	x	x	x	x			x		x			
66	— <i>Crabro minuta</i> .....	x				x			x				
67	— <i>didyma</i> .....	x	x	x	x	x	x	x				x	
68	— <i>elliptica grandis</i> .....	x								x			
69	— <i>fusca subrectangularis</i> .....	x		x						x	x		
70	— <i>incurvata</i> .....	x	x		x			x	x	x	x	x	x
71	— <i>interrupta</i> .....	x	x	x	x	x	x	x		x	x	x	x
72	— <i>lineata</i> .....	x	x						x	x			
73	— <i>littoralis</i> .....	x	x	x	x	x	x	x		x	x		
74	— <i>major</i> .....	x	x	x	x	x	x		x				
75	— <i>Smithi</i> .....	x	x	x	x	x	x	x		x		x	
76	— <i>splendida</i> .....	x	x	x	x	x	x	x		x			
77	— <i>subcineta</i> .....	x	x		x		x	x		x	x	x	
<b>Fragilaria</b>													
78	— <i>hyalina</i> .....	x	x	x						x			x
79	— <i>striatula</i> .....	x			x	x	x	x		x	x	x	x
80	— <i>vitrea</i> .....	x			x				x	x	x	x	x
<b>Gomphonema</b>													
81	— <i>exiguum</i> .....	x		x			x		x	x	x	x	x
82	— <i>kamtschaticum</i> .....						x	x	x	x	x	x	x
<b>Grammatophora</b>													
83	— <i>angulosa</i> .....	x	x	x	x	x			x	x	x	x	x
84	— — <i>hamulifera</i> .....	x		x	x				x	x		x	x
85	— — <i>islandica</i> .....	x			x		x	x	x	x	x	x	x
86	— <i>arcuata</i> .....					x	x	x	x	x	x	x	x
87	— <i>marina</i> .....	x	x	x	x	x			x	x	x	x	x
88	— <i>oceanica macil.</i> .....	x					x		x	x	x	x	
89	— — <i>minuta</i> .....	x							x	x	x	x	
90	— <i>serpentina</i> .....	x	x	x	x	x			x				
<b>Hantzschia</b>													
91	— <i>marina</i> .....	x			x		x					x	
92	— <i>virgata</i> .....	x	x	x	x			x			x		
		31	17	19	22	13	17	16	18	24	19	19	13

		Universal distribution						Distribution in the different parts of the coasts of Iceland					
		Eur.	Afr.	As.	Am.	Aust.	Gr.	A. S.	S.	S.W.	N.W.	N.	E.
<b>Hyalodiscus</b>													
93	— subtilis . . . . .	x	x	x	x		x	x		x		x	x
94	— — scoticus . . . . .	x			x	x	x	x	x	x	x	x	x
<b>Isthmia</b>													
95	— nervosa . . . . .	x			x		x	x	x	x	x	x	x
<b>Licmophora</b>													
96	— anglica . . . . .	x	x	x	x		x		x	x		x	x
97	— Jürgensi . . . . .	x					x	x		x			x
98	— Oedipus . . . . .	x		x					x	x	x	x	
99	— — elongata . . . . .	x								x		x	
100	— paradoxa . . . . .	x	x		x		x			x	x	x	x
<b>Mastogloia</b>													
101	— elliptica . . . . .	x			x					x			
102	— — Dansei . . . . .	x				x					x		
103	— exigua . . . . .	x	x	x	x	x		x			x		
<b>Melosira</b>													
104	— nummuloides . . . . .	x	x	x	x	x	x	x	x	x	x	x	x
105	— sulcata . . . . .	x	x	x	x		x	x	x	x	x	x	
106	— — radiata . . . . .	x						x		x	x	x	
<b>Navicula</b>													
107	— abrupta . . . . .	x	x	x				x			x		
108	— Acus . . . . .	x								x			
109	— ammophila flantica . . . . .	x								x			
110	— anglica subsalina . . . . .	x										x	
111	— arenaria arcuata . . . . .	x								x	x		
112	— avenacea . . . . .	x	x	x		x	x	x		x	x	x	x
113	— Bolleana . . . . .	x					x	x				x	
114	— bottnica . . . . .	x	x	x	x		x	x		x	x	x	x
115	— cancellata . . . . .	x	x	x	x	x	x	x			x		
116	— — subapiculata . . . . .	x					x	x			x		
117	— digito-radiata . . . . .	x	x	x	x	x	x	x		x			
118	— — Cyprinus . . . . .	x			x		x			x	x		
119	— directa . . . . .	x	x	x	x		x	x	x	x	x	x	x
120	— — remota . . . . .	x	x		x		x	x				x	
121	— — subtilis . . . . .	x						x	x	x	x	x	x
122	— distans . . . . .	x			x		x	x					
123	— elegans . . . . .	x	x	x	x					x			x
124	— forcipata . . . . .	x	x		x		x			x	x		
		32	15	13	18	7	19	19	9	23	20	17	12

	Universal distribution							Distribution in the different parts of the coasts of Iceland					
	Eur.	Afr.	As.	Am.	Aust.	GrI.	A. S.	S.	S.W.	N.W.	N.	E.	
125	( <i>Navicula forcipata</i> ) <i>densestriata</i>	x	x	x	x		x				x	x	
126	— <i>fortis</i> . . . . .	x			x		x	x			x		
127	— <i>fusiformis ostrearia</i> . . . . .	x					x		x				
128	— <i>granulata</i> . . . . .	x		x	x	x	x		x				
129	— <i>Grevillei</i> . . . . .	x		x	x		x	x		x		x	
130	— <i>halophila</i> . . . . .	x							x				
131	— <i>Hennedyi</i> . . . . .	x	x	x	x		x	x		x			
132	— — <i>circumsecta</i> . . . . .	x	x	x	x		x		x				
133	— <i>humerosa</i> . . . . .	x	x	x	x		x	x	x	x	x		
134	— — <i>constricta</i> . . . . .	x		x					x				
135	— <i>inflexa</i> . . . . .	x					x		x				
136	— <i>lanceolata phyllepta</i> . . . . .	x							x				
137	— <i>latissima</i> . . . . .	x		x	x		x	x					
138	— <i>Libellus</i> . . . . .	x		x				x	x				
139	— <i>Lyra Ehrenbergi</i> . . . . .	x	x	x	x	x	x			x			
140	— — <i>atlantica</i> . . . . .	x								x			
141	— <i>mutica Cohni</i> . . . . .	x	x	x	x	x	x	x					
142	— <i>palpebralis</i> . . . . .	x	x	x	x		x	x	x	x			
143	— — <i>angulosa</i> . . . . .	x							x				
144	— <i>peregrina</i> . . . . .	x	x	x	x		x	x	x	x			
145	— <i>pusilla</i> . . . . .	x	x	x	x	x	x	x	x				
146	— <i>rhombica</i> . . . . .	x		x			x		x	x	x	x	
147	— <i>ulvacea</i> . . . . .	x							x		x		
148	— ( <i>Schizonema</i> ) <i>Bryopsis</i> . . . . .	x						x			x		
149	— — <i>mollis</i> . . . . .	x	x		x		x					x	
150	— — <i>ramosissima</i> . . . . .	x		x			x		x	x	x	x	
151	— — <i>f. amplior</i> . . . . .	x	x		x				x				
<b>Nitzschia</b>													
152	— <i>acuminata</i> . . . . .	x		x	x						x	x	
153	— <i>angularis</i> . . . . .	x		x	x	x	x	x	x	x	x		
154	— — <i>affinis</i> . . . . .	x					x		x	x		x	
155	— <i>apiculata</i> . . . . .	x		x	x		x	x			x		
156	— <i>bilobata</i> . . . . .	x	x	x	x	x	x		x		x		
157	— <i>dissipata Acula</i> . . . . .	x				x				x	x		
158	— <i>lanceolata</i> . . . . .	x		x			x		x				
159	— <i>marginulata</i> . . . . .	x			x		x			x	x		
160	— <i>paradoxa</i> . . . . .	x	x	x	x		x	x		x			
161	— <i>Sigma</i> . . . . .	x	x	x	x	x	x	x	x	x	x	x	
162	— — <i>rigida</i> . . . . .	x							x				
163	— <i>socialis</i> . . . . .	x	x	x	x		x	x	x	x	x	x	
		39	15	24	23	9	19	18	13	28	16	14	8

		Universal distribution						Distribution in the different parts of the coasts of Iceland					
		Eur.	Afr.	As.	Am.	Aust.	Grl.	A. S.	S.	S.W.	N.W.	N.	E.
164	(Nitzschia) Tryblionella littoralis	x			x					x			
165	— vitrea salinarum . . . . .	x	x							x			
<b>Pinnularia</b>													
166	— quadratarea . . . . .	x			x	x	x	x		x			
167	— Trevelyana . . . . .	x		x	x						x		
<b>Plagiogramma</b>													
168	— Gregorianum . . . . .	x	x	x	x	x	x	x			x	x	
<b>Pleurosigma</b>													
169	— cuspidatum . . . . .	x				x				x			
170	— elongatum . . . . .	x	x	x	x	x	x	x		x		x	x
171	— longum . . . . .						x	x		x			
172	— Nubecula intermedia . . . . .	x	x	x	x		x					x	
173	— Stuxbergi . . . . .						x	x		x			
<b>Podosira</b>													
174	— hormoides . . . . .	x			x	x	x		x	x	x	x	x
<b>Rhabdonema</b>													
175	— adriaticum . . . . .	x	x	x	x	x			x				
176	— arcuatum . . . . .	x	x	x	x	x	x	x	x	x	x	x	x
177	— minutum . . . . .	x	x	x	x	x	x	x	x	x	x	x	x
178	— robustum . . . . .				x				x				
<b>Raphoneis</b>													
179	— amphiceros . . . . .	x	x	x	x	x				x			
<b>Rhoicosphenia</b>													
180	— curvata . . . . .	x	x	x	x	x	x	x	x	x	x	x	x
<b>Rhopalodia</b>													
181	— Musculus . . . . .	x	x	x	x	x			x		x		
<b>Stauroneis</b>													
182	— constricta . . . . .	x			x					x		x	x
183	— Gregoryi . . . . .	x			x					x	x		
184	— salina . . . . .	x	x		x	x	x	x		x			x
<b>Striatella</b>													
185	— delicatula . . . . .	x	x	x	x					x			
		19	12	11	18	12	11	9	6	16	8	8	7



		Universal distribution						Distribution in the different parts of the coasts of Iceland					
		Eur.	Afr.	As.	Am.	Aust.	Gr.	A. S.	S.	S.W.	N.W.	N.	E.
<b>Surirella</b>													
186	— <i>fastuosa</i> . . . . .	x	x	x	x	x			x	x	x		
<b>Synedra</b>													
187	— <i>affinis</i> . . . . .	x	x	x	x	x	x	x	x	x	x	x	x
188	— — <i>gracilis</i> . . . . .	x					x	x	x	x	x	x	x
189	— — <i>fasciculata</i> . . . . .	x		x			x	x		x			
190	— — <i>lancetula</i> . . . . .				x		x		x				
191	— — <i>parva</i> . . . . .	x	x			x	x	x	x	x	x	x	x
192	— — <i>rupicola</i> . . . . .	x					x		x				
193	— — <i>tabulata</i> . . . . .	x				x	x		x	x	x	x	x
194	— <i>crystallina</i> . . . . .	x	x	x				x	x				
195	— <i>Gailloni</i> . . . . .	x	x	x	x				x	x			
196	— <i>Hennedyana</i> . . . . .	x											x
197	— <i>investiens</i> . . . . .	x					x		x	x	x	x	x
198	— <i>kamtschatica</i> . . . . .						x	x		x	x	x	x
199	— <i>provincialis</i> . . . . .	x								x			
200	— <i>pulchella</i> . . . . .	x		x	x		x	x	x	x	x	x	
<b>Thalassionema</b>													
201	— <i>nitzschioides</i> . . . . .	x			x				x				
<b>Thalassiothrix</b>													
202	— <i>Frauenfeldi</i> . . . . .	x		x			x					x	
<b>Thalassiosira</b>													
203	— <i>gravida</i> . . . . .	x			x		x	x		x			
<b>Trachyneis</b>													
204	— <i>aspera intermedia</i> . . . . .	x			x		x	x	x	x	x	x	x
205	— — <i>pulchella</i> . . . . .	x				x				x	x	x	x
206	— <i>Clepsydra</i> . . . . .	x			x				x				
207	— <i>velata</i> . . . . .		x	x	x	x				x			
<b>Trigonium</b>													
208	— <i>arcticum</i> . . . . .	x	x		x		x	x				x	
<b>Tropidoneis</b>													
209	— <i>lepidoptera</i> . . . . .	x	x	x	x	x		x		x			
	Total . . . . .	195	95	113	134	75	115	107	87	145	101	92	64
	% . . . . .	93	45	54	64	36	55	49	42	69	48	44	31

As regards the universal distribution, it appears from the above list, that the Icelandic coastal flora, as far as the Diatoms are concerned, has a predominant European character, but about one half of the European species can also occur in colder seas. The list of the distribution of the Diatoms in the different parts of the coast shows, that out of 209 species found in the samples, 145 or 69% were found in *S.W.*, 101 or 48% in *N.W.*, 92 or 44% in *N.*, 87 or 42% in *S.* and 64 or 31% in *E.* The Diatom-life therefore is most abundant on the South-West coast.

### List of the species found in more than 50 samples.

	Total 438 samples		S. 58 samples		S.W. 191 samples		N.W. 30 samples		N. 98 samples		E. 53 samples	
	Number of samples	%	Number of samples	%	Number of samples	%	Number of samples	%	Number of samples	%	Number of samples	%
<i>Rhabd. arcuat.</i> .....	303	69	38	66	126	66	21	70	77	79	36	68
— <i>minut.</i> .....	231	53	34	60	113	59	27	90	42	43	15	28
<i>Hyal. subt. v. scotic.</i> .....	209	48	28	48	110	58	24	80	39	40	7	13
<i>Biddulph. aurit.</i> .....	180	41	14	24	83	43	29	97	34	35	17	32
<i>Syn. aff. + var.</i> .....	174	40	13	22	77	40	27	90	50	51	17	32
<i>Coccon. Scutell.</i> .....	160	37	18	31	74	39	15	50	38	39	15	28
<i>Podos. horm.</i> .....	156	36	24	41	79	41	19	63	17	17	14	26
<i>Grammat. mar.</i> .....	155	35	31	53	98	51	11	37	12	12	3	6
<i>Rhoicosph. curv.</i> .....	143	33	17	29	74	39	16	53	27	28	7	13
<i>Grammat. ang. v. isl.</i> ....	125	29	23	40	61	32	10	33	21	21	10	19
<i>Coccon. cost.</i> .....	119	27	10	17	49	26	18	60	28	29	14	26
<i>Fragil. striat.</i> .....	82	19	12	21	30	16	5	17	13	13	20	38
<i>Gomphon. exig.</i> .....	91	21	15	26	40	21	10	33	16	16	10	19
<i>Melos. sulc.</i> .....	81	18	5	9	61	32	9	30	6	6	0	0
<i>Grammat. ocean. v. min.</i> ..	66	15	19	33	38	20	4	13	5	5	0	0
<i>Isthm. nerv.</i> .....	64	15	20	34	24	13	3	10	7	7	7	13
<i>Syn. invest.</i> .....	62	14	17	30	25	13	5	17	8	8	7	13
<i>Grammat. ang.</i> .....	60	14	16	28	34	18	4	13	4	4	2	4
<i>Trach. asp. var. pulch.</i> ...	51	12	10	17	33	17	3	10	4	4	1	2

Not considering *N. W.* in the above list, which, owing to the small number of samples, gives a misleading percentage, it appears, that, of the frequently occurring species, the following are especially prominent:

in *S.* (with more than 50%): *Rhabd. arc.* (66%), *Rhabd. minut.* (60%), *Gramtph. marina* (53%).

In S. W. (with more than 50 %): Rhabd. arc. (66 %), Rhabd. min. (59 %), Hyal. subt. scot. (58 %), Gramtph. marina (51 %).

In N. (with more than 40 %): Rhabd. arc. (79 %), Syn. aff. + var. (51 %), Rhabd. min. (43 %).

In E. (with more than 30 %): Rhabd. arc. (68 %), Frag. striat. (38 %), Bidd. aur. (32 %), Syn. aff. + var. (32 %).

This shows, that Rhabd. arc. ist the most predominant Diatom along the coasts of Iceland.

### CHARACTERISING FORMS.

By »characterising forms« I understand species, which, by their, frequent occurrence in a sample, may be considered to be characteristic for this. »Characterising forms« are of course far from being always found in a sample, but on the other hand, several such forms may very well be present in the same sample.

In the list below, I have given a synopsis showing the genera or species of Diatoms characteristically associated with the various genera of Algae. Where a figure is attached to the name of the Diatom it indicates the number of the samples in which the genus

	<b>Rhodophyceæ</b>	Number of samples	
		125	
1	Antithamnion	7	Grammatophora (2), Hyalodiscus scoticus, Podosira.
2	Bangia	6	Rhabd. arc.
3	Calithamnion	6	Achnanthes, Cocconeis, Grammatophora, Rhoicosphenia curv., Rhabd. arc. (2), Synedra.
4	Ceramium	9	Amphipleura rutilans, Podosira.
5	Chantransia	10	Cocconeis, Frag. striat., Licmophora (2), Rhabd. arc., Rhabd. min. (2), Synedra (2).
6	Delesseria	7	Cocconeis, Isthmia (2).
7	Halosaccion	9	Rhabd. arc., Rhabd. min. (2).
8	Lomentaria	2	Isthmia.
9	Melobesia	3	Grammatophora.
10	Petrocelis	5	Isthmia.
11	Phyllophora	1	Cocconeis.
12	Polysiphonia		Cocconeis (2), Grammatophora (3), Isthmia, Rhabd. arc. (2).
		15	
13	Porphyra	10	Licmophora (2), Synedra.
14	Ptilota	4	Cocconeis, Grammatophora.
15	Rhodochorton	19	Cocconeis (2), Gomphonema exiguum, Grammatophora (3), Rhabd. arc. (3), Rhoicosphenia curv., Synedra (2).
16	Rhodomela	7	Cocconeis (2), Isthmia, Licmophora, Rhabd. arc. (2).
17	Rhodymenia	4	Licmophora.
18	Turnerella	1	Rhabd. min.

or species in question is found; where no figure is added it means, that the genus or species in question has only been found in one sample.

The following are some of the more conspicuous characterising forms on Rodophyceae:

Rhabd. arcuat in 12 samples = 9.6 %, Cocconeis and Grammatophora each in 11 samples = 8.9 %, Licmophora and Synedra each in 6 samples = 4.8 %.

	Phæophyceæ	Number of samples	
		108	
1	Ascocyclus	1	Frag. vitrea.
2	Ectocarpus	38	Biddulphia aur., Gomphonema exiguum, Frag. striat. (3), Hyalodiscus scoticus, Licmophora, Navicula rhombica, Podosira, Rhabd. arc. (2), Rhoicosph. cur., Synedra (5).
3	Elachista	8	Rhabd. arc. (2).
4	Fucus	6	Isthmia, Rhabd. arc.
5	Isthmoplea	6	Frag. striat., Synedra.
6	Laminaria	1	Grammatophora, Podosira, Navic. (Schizonema).
7	Leptonema	2	Rhoicosph. cur., Synedra.
8	Lithoderma	4	Frag. striat., Grammatophora, Licmophora (3).
9	Myrionema	6	Biddulphia aur., Cocconeis (2), Frag. vitrea, Podosira, Rhabd. min.
10	Phyllitis	7	Cocconeis (2), Frag. striat.
11	Pogotrichum	9	Biddulphia aur., Cocconeis, Podosira, Rhabd. arc., Synedra (2).
12	Punctaria	1	Frag. striat., Synedra.
13	Ralfsia	8	Diploneis incurvata.
14	Sphacelaria	7	Cocconeis (3), Rhabd. min.
15	Stictyosiphon	4	Licmophora.

The following are some of the more conspicuous and characterising forms on Phaeophyceae: Synedra 10 samples, or 9.3 % of the samples, Cocconeis 8 samples or 7.4 %, Fragilaria striat. 7 samples or 6.5 %, Rhabd. arc. 6 samples or 5.6 %.

The following are some of the more conspicuous, characterising forms on the Chlorophyceae: Cocconeis 19 samples or 20.6 % of the samples, Fragil. striat. and Synedra each 6 samples or 6.5 %, Licmophora and Rhabd. arc. each 5 samples or 5.4 %.

It appears therefore, that on the Rhodophyceae, Rhabd. arc. and to some extent also Cocconeis and Grammatophora principally are the characterising forms; on the Phaeophyceae the Synedra

	Chlorophyceæ	Number of samples	
		92	
1	Acrosiphonia	25	Cocconeis (8), Licmophora (3), Frag. striat., Rhabd. arc. (4), Synedra.
2	Chætomorpha	2	Cocconeis, Rhabd. arc.
3	Cladophora	15	Amphora, Cocconeis (6), Synedra.
4	Codiolum	2	Frag. striat.
5	Enteromorpha	20	Achnanthes, Cocconeis (2), Melosira num., Navicula bottnica, Rhab. min. (2), Synedra (3).
6	Monostroma	11	Frag. striat., Melosira num.
7	Ochlochæte	1	Cocconeis, Synedra.
8	Rhizoclonium	5	Achnanthes (2), Cocconeis, Navicula pusilla.
9	Ulvella	1	Frag. striat.
10	Urospora	10	Biddulphia aur., Fragil. striat. (2), Licmophora (2), Rhabd. min.

is the most conspicuous form, while Cocconeis takes the lead on the Chlorophyceæ.

When examining how matters stand as regards the occurrence of the characterising forms in the 6 groups of Marine Algæ given by Helgi Jónsson in Bot. of Icel. part 1, pages 58—62, it appears, that in

Group	Character	I have found 1 charact. form in 3 samples
— A, The Arctic Group	I	— — 13 — — - 14 —
— B, The Subarctic Group, Subdiv. I	II	— — 36 — — - 32 —
— C, The Boreal-Arctic Group		— — 22 — — - 17 —
— D, The Cold-Boreal Group		— — 37 — — - 32 —
— E, The Warm-Boreal Group		— — 1 — — - 5 —

This shows, that the characterising forms are most frequent in groups B, C and D, which agrees well with the paramount European character of the Icelandic coastal Diatom-flora.

Finally, considering the occurrence of the characterising forms during the different months of the year, as far as this has been given in the samples, the facts are the following:

	Number of samples	Charact. forms	%		Number of samples	Charact. forms	%
January . . . . .	3	1	33	July . . . . .	57	12	21
February . . . . .	0	0	0	August . . . . .	51	14	27
March . . . . .	10	5	50	September . . . . .	42	19	45
April . . . . .	37	16	43	October . . . . .	18	2	11
May . . . . .	72	27	38	November . . . . .	0	0	0
June . . . . .	107	37	35	December . . . . .	0	0	0

Apart from the months, January, March and October, in which less than 37 samples are present, the rest must be placed in the following order, according to their percentages: September 45, April 43, May 38, June 35, August 27, July 21.

This shows, that the number of the characterising forms increases with July in both directions.

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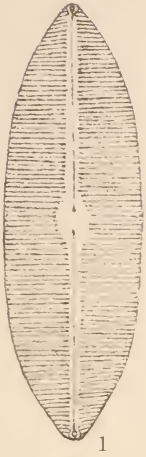
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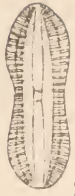
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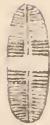
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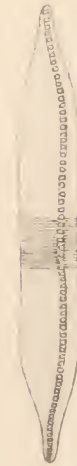
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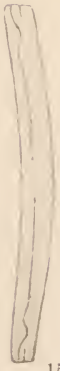
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4.

# THE BRYOPHYTA OF ICELAND

BY

AUG. HESSELBO

WITH 39 FIGURES IN THE TEXT



## INTRODUCTION.

PREVIOUS to the time when Grönlund made botanical collections in Iceland (1868 and 1876) the Bryophyta of the island was very little known. Earlier botanists, who occasionally collected specimens also of the Bryophyte Vegetation, have only exceptionally given information as regards localities, and the older lists consist merely of an enumeration of species without any information as regards distribution or frequency. To this must be added that the older determinations of species are very uncertain, and in many cases undoubtedly erroneous or quite improbable, and that the lists are compiled quite uncritically without stating the name of the collector or the source of the information. For instance, more than half of the 149 mosses and 54 hepatics enumerated in Lindsay's list are undoubtedly wrongly determined, and the majority of them beyond doubt do not occur in Iceland. Therefore, in preparing the following list of the Bryophyta of Iceland, older records have been taken into consideration only when it has been possible to verify them by means of specimens in the collections.

The material dating from older collections (previous to Grönlund's) is but very scanty. Mörch was the first to contribute anything of importance to our knowledge of the Bryophyta of Iceland. In 1820 he collected a rather considerable number of species, among which are many that were not found again until quite recently, and even several which have not since been found by others. Mörch's collections are in the Botanical Museum in Copenhagen, but unfortunately he has in only quite a few cases recorded the habitat on the wrappers. W. J. Hooker (1809), Lindsay (1860) and Carroll (1861) collected mosses and hepatics in Iceland, but as mentioned above, Lindsay's list; in which

these finds are enumerated, is so full of mistakes that it is quite worthless.

Japetus Steenstrup collected (1839 - 40) some Bryophyte samples in West and North Iceland and in the interior of the country.

But it was not until Grönlund's investigations that the foundation was laid of a real knowledge of the Bryophyte Vegetation of Iceland, he not only critically revised the older lists, but also prepared lists of his own collections. It was also Grönlund who was the first to give real descriptions of moss societies. Grönlund's journeys in 1868 and 1876 extended over West and North Iceland, from Reykjavik across Esja to Borgarfjörður and thence to Skagafjörður, Eyjafjörður and Mývatn. He did not visit East, South and North-west Iceland.

In recent times the Iceland botanists Ólafur Davidsson, Stefán Stefánsson and Helgi Jónsson have contributed considerably to our knowledge of the Bryophyta of Iceland.

Ólafur Davidsson (died 1902) made, during 1899—1900, very considerable and valuable collections in North Iceland around Eyjafjörður and Skagafjörður and on the small island of Grimsey north of the Arctic Circle. His collections, which belong to the Reykjavik Museum, have only now been determined.

Stefán Stefánsson, the head of a school in Möðruvellir and member of the Althing up to 1916, has made collections during many years, especially in North and North-east Iceland. The greater part of his material is published in Grönlund's list.

Helgi Jónsson, Dr. phil. and teacher in Reykjavik, on his numerous journeys to almost all the different parts of the island, has everywhere collected specimens of the Bryophyte Vegetation, and in his descriptions of the vegetation of Iceland has usually mentioned the Bryophyta also. His collections, which are preserved in the Botanical Museum in Copenhagen, are determined by C. Jensen. Besides the botanists mentioned above, a few others have also occasionally collected specimens of the Bryophyte Vegetation. C. Ostenfeld, during a few short visits, has especially investigated the lava-fields and the hot springs near Reykjavik and on the peninsula of Reykjanes. A. Feddersen (1884—86) made some collections in South and West Iceland. Dr. C. Hansen, Professor Th. Thoroddson and Pétur Sophoniasson collected mosses



in several places. The majority of these collections are determined by C. Jensen and included in Grönlund's list (1895).

My own investigations were made on three journeys, viz. in 1909 and 1912 by the aid of the Carlsberg Fund, and in 1914 by the aid of the Botanical Travelling Fund, and Japetus Steenstrup's Legacy. In 1909 I investigated in the beginning of June the region around Reykjavik and Hafnarfjörður, and made a five day's trip to the Esja mountains. On June 9th I sailed to Hornafjörður in South-east Iceland, and after staying a few days there went straight through East Iceland to Seydisfjörður, where I arrived on June 30th. On the way I stopped at several farms, viz. Stafafell, Hof, Djupivogur, Berufjörður, Höskulstadr and Vallanes. On July 9th I took the coast steamer to Husavik in North Iceland, and after some days sojourn there went into the interior of the island across Ás and Svinadal to Reykjahlid near Mývatn, and after having stayed a few days there to Akureyri. Unfortunately investigation in this interesting region was almost entirely prevented by continual rain and fog. I stayed five days in Akureyri and then continued my journey westwards through North Iceland to Stadur near Hrutafjörður, stopping at the farms Tverá in Øxnadalur, Vidimýri, Vidivellir, Geitaskard, Hnausar and Lækjarmot. From Stadur I rode across Haukadalsheidi and Brattabrekki to the farm Dalsmýnni in Nordredalur, where I arrived on August 2nd. After staying a few days there in continual rain, I was obliged to abandon my original plan of travelling by land to Reykjavik and, instead, to ride to Borgarnes and take the steamer to Reykjavik.

In 1912 I arrived at Reykjavik on June 2nd and rode thence past Kolvidarhol to Reykir, where the vegetation around the hot springs was investigated, and thence to Skálholt, Laugardalur and Thingvellir, staying a few days at each place, and then back again to Reykjavik, whence I sailed on June 15th to Dýrafjörður in North-west Iceland. On the way I had an opportunity during a 24 hours stay in Stykkisholmur to investigate the immediate neighbourhood. After a three days stay at Dýrafjörður I rode on June 20th to Isafjörður, whence, during the following three weeks, I made numerous excursions, partly, on foot, to the surrounding country and to Sugandafjörður, and partly to the north-west side of the fjord and the district around Jökulsfjörður, to Hesteyri and the whole tract of land from the head of Jökulsfjörður to Stadur, and from Bæir to Arngerdareyri.

## I. LIST OF THE BRYOPHYTA.

## I. HEPATICÆ.

## FAM. RICCIACEÆ.

1. *Riccia bifurca* Hoffm.

N. Iceland: Hrossaberg (St.)!; Vidimýri (Gr.)!; Mývatn!. S. Iceland: Near Reykjanes lighthouse (Ostf.)!; Kverkfjall (Wegener.)!

In all these localities it grows on warm, damp clayey flats near hot springs. Near Mývatn — where it grew abundantly around fumaroles, from which issued aqueous vapours containing sulphuretted hydrogen — the temperature of the soil was about  $40^{\circ 1}$  about one cm. below the surface. Near Reykjanes lighthouse Ostenfeld (Bot. Tidskrift, vol. XXII, 1899, p. 239) gives the temperature of the soil as  $20^{\circ}$ — $30^{\circ}$ . All the plants investigated bore capsules.

2. *Riccia sorocarpa* Bischoff.

N. Iceland: Reykjalaug in Fnjoskadal (O.D.)!. S. Iceland: Grafarbakki near the Minni Laxá (F.)!; Laugaráshver!.

Like the preceding species, *R. sorocarpa* grows on warm, damp clayey flats. Near Laugaráshver it was found abundantly on clayey slopes stretching down towards the boiling hot spring. There the temperature of the soil was about  $25^{\circ}$ — $30^{\circ}$ . All the plants investigated bore capsules which in the plants from Laugaráshver were fully ripe at the end of July.

3. *Riccia crystallina* L.

S. Iceland: Thorlakshver near Skálholt!. (27. 7. 1914).

The plants, which had fully developed capsules, grew widely scattered on clayey flats, otherwise bare of vegetation, around some small holes from whence issued boiling water accompanied by vapours slightly impregnated with sulphuretted hydrogen.

Note. *Riccia glauca* L. is mentioned by Zoëga and is recorded by Hornemann as occurring abundantly near Geysir. But as no specimens of it are to be found in the collections, and during the search made in 1914, no species of *Riccia* were found near Geysir, it is impossible to determine what species is meant.

<sup>1</sup> Here and throughout the book the centigrade scale is meant.

## FAM. MARCHANTIACEÆ.

4. *Sauteria alpina* Nees.

N. Iceland: Grænuhnukr in Brattafjallgardi between Mödruvellir and Brú (St.).

5. *Reboulia hemisphærica* (L.) Raddi.

SW. Iceland: Hafnarfjörður (H. J.)! S. Iceland: Drángshlid (H. J.); Holt!; near Skógafos!; Seljaland!.

This plant was found only in the southern part of the country, but it appears to occur there rather frequently. Near Hafnarfjörður it was found in a lava cave; in S. Iceland it was collected everywhere from the somewhat damp faces of tuff rocks, especially from the base of the sides of illuminated caves in tuff cliffs; in this situation it usually grew in company with *Preissia commutata*, *Fegatella*, *Marchantia*, *Anoetangium compactum*, *Distichium montanum*, etc. It was found everywhere in fruit which was almost ripe at the end of July.

6. *Fimbriaria pilosa* (Wahlb.) Taylor.

N. Iceland: Hof (O. D.)!; Boggverstadadalur (O. D.)! NW. Iceland: Bæir on Snæfellsstrand!.

Near Bæir it grew abundantly on a stony slope facing south and stretching down towards the sea, upon rather dry, humus-covered rocks. It was everywhere collected in fruit which near Bæir had just ripened on June 6, 1912.

7. *Fegatella conica* Corda.

*Hepatica conica* Lindb.

S. Iceland: Drángshlid (H. J.)!; Merkjáfoss (F.)!; Breidabolstadr!; Barkastadr!; Seljaland!; Holt!; Drángshlid!; Skógafos!.

This plant was not found except in S. Iceland, but there it was common in all the parts which were investigated. It grew there everywhere on faces of tuff rocks, especially on those of caves and clefts, and more particularly on the faces with a southern exposure where it may occur very abundantly, sometimes on the damp tuff rocks themselves and sometimes creeping over mosses, for instance *Hyppnum filicinum*, *Eurynchium Swartzii*, etc. Sterile specimens only have been found.

8. *Preissia commutata* (L.) Nees.

*Chomocarpon quadratus* Scop.) Lindb.

N. Iceland: Hof, fr. (O. D.)!; Mödruvellir (O. D.)!; Hrossaberg on warm clayey flats, fr. (St.)!; Stora Gjá near Mývatn! NW. Iceland: Stadr on Snæfellsstrand, fr. (Stp.)! W. Iceland: common near the hot springs in Reykholtalur!; Hafnarfjörður! S. Iceland: Thingvellir (Gr.)!

Laugardal (Gr.); Reykjanes near hot springs (Ostf.); common everywhere on faces of tuff rocks in Fljotshlid and below Eyjafjallajökull!

*Preissia commulata* occurs both on more or less damp ground and on damp rocks, and also on warm clayey flats near hot springs. In the last situation, as in Reykholtalur, it covers large areas on slopes stretching down towards the boiling hot water. In E. Iceland it has not yet been found; in N. and NW. Iceland it is rather rare and grows there on damp rocks, along river-banks or in rock-clefts. In S. and SW. Iceland it is frequent in lava-clefts near Thingvellir and Hafnarfjörður, and in S. Iceland proper it is very common. There it grows at the base of, or some way up the rock faces, especially upon those with a southern exposure, or in sheltered clefts, and often occurs in great abundance, and fruiting richly. The fruit was not quite ripe even at the end of July.

### 9. *Marchantia polymorpha* L.

Common all over Iceland on damp soil, on rocks, by rivers, in marshes and in moss bogs, and very often found with fruit or antheridiophores. It is extremely common especially in NW. Iceland, and covers banks of streams often in great abundance, to a height of about 300 metres. In S. Iceland it is also very common on damp tuff rocks.

This species is most widely distributed in the birch zone to a height of about 300—400 metres above sea-level where it usually grows on marshy or gravelly ground along small streams, or occurs in abundance in moss bogs or in marshes among mosses. But it is also met with upon mountain heights, as for instance near Berufjörður, Seyðisfjörður and Isafjörður, where it has been collected abundantly up to a height of 600—700 metres.

### FAM. ANEUREÆ.

#### 10. *Aneura pinguis* (L.) Dum.

*Riccardia pinguis* (L.) Gr.

Very common on damp ground both in marshes and on gravelly soil by rivers and also on damp rocks. It usually grows intermixed in the tufts of other Bryophyta, rarely forming tufts by itself; it has been collected in fruit in a few localities only (near Eyjafjörður, and near Seljaland at an altitude of about 500 metres). It is most widely distributed in the lowlands up to about 300 metres, but it is also frequently met with upon mountain heights.

#### 11. *Aneura multifida* (Lindb.) Dum.

*Riccardia multifida* (Lindb.) Lindb.

E. Iceland: Lon!, on swampy ground among *Sphagnum rubellum*;  
W. Iceland: Reykholtal!, frequent near hot springs intermixed in the

tufts of other Bryophyta such as *Sphagnum rubellum*, *Scapania irrigua*, and *Pellia Neesiana*. In one place it was growing on a stone which protruded slightly above hot water of a temperature of about 50°; there it was growing intermixed in a tuft of *Enthostodon ericetorum*, *Scapania irrigua* and *Anthoceros punctatus*.

This species is recorded by Mörch from Iceland, but no specimens of it are to be found in the collections.

## 12. *Aneura latifrons* Lindb.

*Riccardia latifrons* (Lindb.)

N. Iceland: several places near Eyjafjörður (O. D.); Akureyri!; Husavik!. NW. Iceland: Laugarland!. SW. Iceland: Reykjavik!; Kollafjörður!.

This plant usually grows on peaty soil intermixed in the tufts of other Bryophyta such as *Dicranella crispa*, *Lophozia Kunzeana*, *Sphagnum* spp. and *Aneura pingvis*. Near Husavik it was growing among *Leptobryum pyriforme* on damp gravelly ground.

### FAM. METZGERIÆ.

## 13. *Metzgeria furcata* (L.) Lindb.

Commonly distributed all over Iceland in dry rock-clefts and on rock-faces, usually associated with *Radula complanata*. In S. Iceland, where it is very common on rock-sides in clefts of tuff rocks, it is sometimes found also in rather damp localities. Only sterile specimens have been found.

*Metzgeria furcata* is a typical lowland-plant. In Iceland it has not been found at a higher altitude than about 300 metres.

### FAM. HAPLOLENEÆ.

## 14. *Pellia Neesiana* (Gottsche) Limpr.

*Marsilia Neesiana* Lindb.

Very common on wet ground especially along river-banks, in moss bogs and on inundated ground; somewhat more rare in marshes. It grows almost always intermixed in the tufts of other Bryophyta, and usually as an erect, elongated form among *Philonotis*, *Mnium cinclidioides*, *Acrocladium cuspidatum*, *Marchantia*, etc., more rarely it grows in unmixed tufts on damp ground. Fruit appears to be produced rather rarely and also rather sparingly.

This species has its main distribution in the lowlands up to about 300—400 metres, and it is only by exception that it has been found above this level.

*Pellia epiphylla* (L.) Lindb. is enumerated in the majority of the



older lists, and Grönlunds records it from many localities in Iceland, but all the specimens found in the collections under this name are those of *Pellia Neesiana*.

### 15. *Blasia pusilla* L.

N. Iceland: Reykum (Gr!); Melar (Gr!); several places near Mödruvellir near Eyjafjörður (O. D.); Reykjalaug in Fnjoskadalur (O. D.); Öxnadalur!; Stadur near Hrutafjörður!. W. Iceland: Gilsbakki!; common in Reykholtadalur!. S. Iceland: Reykirdalur!.

Only the ♂ plant has been found in Iceland.

This species occurs in rock-clefts and along the banks of streams, on wet gravelly ground, and also on clay near hot springs. For instance, it grows abundantly in Reykholtadalur, and more scantily in Reykirdalur on the damp, steaming clayey flats, the temperature of which just below the surface is about 25°–40°; it is found associated with *Gymnocolea inflata*, *Haplozia crenulata* and *Fossombronia Dumortieri*.

On banks of streams it usually grows rather scantily and associated with *Dicranella crispa*, *Pellia Neesiana*, *Didymodon rubellus*, *Angströmia longipes*, *Scapania subalpina*, etc.

Note. *Mörchia Blyttii* (Mörch) Brockm. is recorded by Grönlund to occur in Brynjudalur, but the specimens preserved in the Botanical Museum in Copenhagen belong to *Blasia pusilla*.

## FAM. CODONIEÆ.

### 16. *Fossombronia Dumortieri* (Hüb. et Genth) Lindb.

N. Iceland: near Mývatn!. S. Iceland: near hot springs on Reykjanes (Ostf.!; Reykir!; Thorlákshver!; Laugaráshver!; Sydri Reykjahver!; Thingvellir!; Kolvidarhól!; Geysir (Ho.:)). W. Iceland: common near hot springs in Reykholtadalur!.

*Fossombronia Dumortieri* is one of those species which are rarely absent from the neighbourhood of any hot springs if only the water does not contain too much sulphuretted hydrogen. There it grows on warm clayey flats with a temperature of about 40°, and especially on damp slopes along the outlets of springs; as a rule it sets fruit which ripens during June–July.

In Reykholtadalur it is common near all the hot springs, also near the springs on Riskupstungur, near Geysir and on Reykjanes. In Reykirdalur, where the majority of the springs give out abundance of sulphuretted hydrogen in their vapours it occurred less frequently, but nevertheless was found near several springs, also around some small fumaroles near Kolvidarhol from which issued aqueous vapours impregnated with sulphuretted hydrogen. It grows in all these localities associated with other Hepaticæ, for instance *Gymnocolea inflata*, *Haplozia crenulata* and *Anthoceros punctatus*. Near Mývatn it was growing around a fumarole, on a damp clayey flat with a temperature of about 40°, associated with *Riccia bifurca* and *Haplozia crenulata*. The only place

where the plant has been found on other than warm ground is near Thingvellir where it was growing in a ditch along the road to Hrafnagjá, on clay washed together into a heap; there it had for companions *Dicranella crispera*, *Didymodon rubellus*, *Eucalyx subellipticus* and tiny plants of *Pohlia*, *Bryum*, etc.

#### FAM. EPIGONANTHÆ.

##### 17. *Gymnomitrium corallioides* Nees.

S. Iceland: Thingvellir (Stp.; Grl.;!); Seljaland (Stp.;!). SW. Iceland: Reykjavik (Grl.;!); frequent in Esja!; Hafnarfjörður!. E. Iceland: frequent!. N. Iceland: Akureyri!.

Occurs rather commonly, but as a rule, not abundantly in SW., E. and probably also N. Iceland; in NW. Iceland it has not yet been found. It usually grows on the top of blocks of basalt and lava in small greyish cushions, and rarely on the dry gravelly soil of *Grimmia*-heaths. On the heath in Seljaland it occurred on blocks of basalt up to a height of about 400 metres; in Esja it has been found up to about 500 metres. Only sterile specimens have been found.

##### 18. *Gymnomitrium concinnatum* (Lighthf.) Corda.

Commonly distributed over the whole of Iceland.

In the lowlands it is especially common in the lava-fields, where it grows both on the top of blocks of rock and in crevices and caves, generally mixed with other Hepaticæ such as *Lophozia alpestris*, *L. quinqueidentata* and *Pleuroclada albescens* v. *islandica*; but it is also frequently met with in clefts mixed with other Bryophyta and creeping over stones. But it has its greatest distribution from about 300—400 metres upwards towards the snow-line, where it grows both on more or less damp ground and on rocks either in low, extensive cushions or mixed with other Bryophyta such as *Lophozia alpestris*, *L. ventricosa*, *Pleuroclada albescens*, *Dicranum Blyttii* and *D. fulvellum*, usually also woven into dense cushions of *Conostomum boreale*.

In NW. Iceland especially, where it is one of the most frequently occurring Bryophyta, it grows on gravelly flats on mountain heights in extensive carpets associated with *Anthelia nivalis*, *Alicularia minor*, *Polytrichum sexangulare* and the other above-mentioned Bryophyta. Near Seljaland, at about 650 metres, it was growing in great masses on weathered basalt rocks associated with *Marsupella emarginata*, *Polytrichum sexangulare* and *Dicranum Blyttii*.

Fruit not rare: it ripens, according to altitude, during June—July.

##### 19. *Gymnomitrium varians* (Lindb.) Schiffner.

NW. Iceland: Dýrafjörður! (at an altitude of about 350 metres) on damp gravelly ground; Reykjaheidi, in a lava-cleft!. Near Dýrafjörður it was growing abundantly in low, blackish-brown mats associated with *Anthelia nivalis* and *Alicularia minor* on ground saturated with melting snow.



## 20. *Gymnomitrium revolutum* (Nees) Phil.

NW. Iceland: Sugandafjörður! (at an altitude of about 200 metres). It occurred here, on wet gravelly soil upon a slope, scantily among *Hypnum callichroum*, *Dicranum Starkei*, *Scapania uliginosa* and *Lophozia Floerckei*.

## 21. *Marsupella Funckii* (W. et M.) Dum.

E. Iceland: Hof!, in brownish-black cushions about one cm. high, in rock-clefts associated with *Lophozia alpestris* and *Dicranum Andersoni*; Seljaland! (at about 350 metres), on the ground between blocks of basalt and mixed with *Marsupella emarginata* and *Dicranum Blyttii*.

## 22. *Marsupella emarginata* (Ehrh.) Dum.

NW. Iceland: Dyrafjörður on damp rocks at an altitude of about 250 metres!. S. Iceland: Holt! (at about 400 metres), on marshy ground among *Hypnum sarmentosum*, *Oncophorus virens*, etc.; Seljaland!, in several places from an altitude of 350 to 650 metres, both on gravelly soil and on rocks.

This species is recorded by Mörch from Iceland (figured in *Flora Danica*, tab 1945), and by Grönlund from Thingvellir and Hafnarfjörður. The specimen from Hafnarfjörður has proved to be *Anthelia julacea*. Mörch's specimens are not to be found in the collections.

## 23. *Marsupella aquatica* (Lindb.) Schiffner.

NW. Iceland: Kaldalon! by the bank of a small lake intermixed in a tuft of *Hypnum sarmentosum* and *H. exannulatum*; Isafjörður!, abundantly in an almost dried up river, at an altitude of about 250 metres.

## 24. *Alicularia scalaris* (Schrader) Corda.

Very common over the whole of Iceland.

*Alicularia scalaris* is one of the most commonly occurring Hepaticae in Iceland, and is of almost equal frequency in the lowlands as in the higher mountainous regions. Fruit is rather common.

It grows especially on a somewhat damp substratum, both on rocks and on gravelly ground and also by streams and in bogs, sometimes as pale green or — in exposed localities — brownish mats, sometimes sprinkled in the tufts of other Bryophyta. On peaty ground it often forms extensive, continuous carpets in company with *Pogonatum urnigerum*. On warm clayey flats it also occurs abundantly, and forms together with *Haplozia crenulata* dense, reddish-brown or pale green mats along the warm water near both sulphurous and alkaline springs.

25. *Alicularia geoscypha* De Not.

*Nardia minor* (Nees) Arnell, *N. haematosticta* Lindb.

Commonly distributed all over Iceland and, as a rule, fruiting.

This species doubtless occurs as frequently in the lowlands as on mountain heights upwards to the limit of plant-growth. It is generally met with on damp gravelly ground associated with other Hepaticæ, for instance by streams with *Cephalozia bicuspidata*, *Scapania subalpina*, *S. curta*, *Lophozia alpestris* and *L. Wenzelii*, or on damp gravelly ground on rocky flats with *Pohlia gracilis*, *P. commutata*, *Aongstroemia longipes* and several other species. On mountain heights, especially in NW. Iceland, it generally grows in company with *Anthelia Juratzkana* on gravelly flats irrigated by melting snow.

Var. *insecta* (Lindb.) K. M. was collected near Isafjörður (at about 300 metres alt.) together with the type.

Note. *Alicularia compressa* (Hooker) Nees is figured in Flora Danica, tab. 1772, fig. 2, and is recorded to have been found near Grönnefjord (?) by Mörch, but no specimens of it are to be found in the collections.

26. *Eucalyx subellipticus* (Lindb.) Breidler.

E. Iceland: Berufjörður!; Seydisfjörður!. N. Iceland: Hof near Eyjafjörður (O. D.)!; Öxnadalur. NW. Iceland: Kaldalon!; Laugarland!; Grunnavik (at about 350 metres alt.); Gnupsdalur!. W. Iceland: Gilsbakki; Esja, several places!; Kolvidarhól!. S. Iceland: Thingvellir, several places!. It has been collected everywhere in fruit.

It is no doubt rather common but often overlooked on account of its diminutive size and resemblance in habit to the far more frequently occurring small species of *Alicularia* and *Haplozia*, with which it is generally associated. It is usually found on damp gravelly ground, more rarely on damp rocks or in lava-clefts; now and then in unmixed tufts, but generally mixed with *Alicularia scalaris* and *A. geoscypha*, *Scapania curta*, *Dicranella crispa*, *Pohlia* spp., etc. Near Hof it grew mixed with *Haplozia pumila*; in Almunnagjá it occurred in many places at the bottom of clefts or on humus-covered ledges associated with *Lophozia alpestris*, *Alicularia geoscypha* and *Scapania subalpina*. Near Seydisfjörður it occurred creeping over stones by the river and mixed with *Haplozia atrovirens*.

27. *Haplozia crenulata* (Sm.) Dum.

*Nardia crenulata*.

Near Geysir (Mörch; Stp.); figured in Flora Danica, tab. 1774, fig. 1, "in uliginis Islandiæ frequens, A. Mörch." Common near all the hot springs in Reykholtalur!, Reykirdalur!, on Biskupstungur!, on Reykjanes (Ostf.)!, near Laugarvatn!, in Lundurreykjadalur! and near Mývatn!. It was found also in W. Iceland: Borgarnes!, at several places along the road; Lækjarmot!, on wet ground in bogs. NW. Iceland: Laugarland!, on boggy ground.

*Haplozia crenulata* is in Iceland a decidedly warm-soil species which is hardly absent from any hot spring, whether sulphurous or alkaline. It grows there in abundance on warm clayey flats which have a temperature of 20°–35°, near Mývatn even at a temperature of about 40°. It occurs far more rarely on peaty soil, and then only scantily. Curiously enough, these habitats, also, are situated in districts where there are hot springs. Near Laugarland, for instance at the edge of the marsh, there is a small spring with lukewarm water, but the heat from it can exert no influence on *Haplozia crenulata*, nor does the latter occur in the immediate neighbourhood of the spring.

This species varies considerably in colour, size, thickness of the cell-walls and as regards the leaf-margin. In the low, reddish-brown forms which grow on warm ground nearest to the hot water the cell-walls are more highly thickened, and are especially distinctly collenchymatous, while the more vigorous, green forms which grow at some distance from the spring on more boggy ground, among other Bryophyta, have thin-walled cells which are indistinctly collenchymatous. The marginal cells are sometimes large and thick-walled, sometimes scarcely larger than the other leaf-cells and then only slightly thickened; in such cases it may be difficult to distinguish the plant from the forms of *Haplozia sphaerocarpa* and *Alicularia scalaris* with which it is often found associated. Under high magnifying powers the marginal cells will however always be seen to be somewhat papillose, which is never the case in *Alicularia*.

## 28. *Haplozia sphaerocarpa* (Hook.) Dum.

S. Iceland: Grafarbakki near a hot spring (F.)!; Thorlákshver among *Catharina undulata*!; Sydri Reykjahver among *Oligotrichum hercynicum*!; Laugarvatnshver among *Sphagnum cymbifolium*!; Isafjörður on a rocky flat (300–400 metres above sea-level)!

All the forms found, which are quite sterile, stand slender and erect among other Bryophyta and must doubtless be referred more particularly to the type.

This species, like its companion *Oligotrichum*, has a very peculiar distribution in Iceland, having two such widely different areas of distribution as the warm clayey flat with a temperature of 25°–30° and the rocky flat.

Note. A liverwort is figured in Flora Danica, tab. 2195, under the name *Jungermannia pumila*; it is recorded to have been found by Mörch near Lejrå. Lindberg, in his critical revision of the mosses in Flora Danica, refers it to *Jungermannia caespiticia*, but the specimens are not to be found in the collections.

## 29. *Haplozia cordifolia* (Hook.) Dum.

Very common and often fruiting richly. It grows especially on rocks, in or by waterfalls; or submerged in rivers, where it sometimes covers large surfaces of the firm rocky bottom with its blackish-green mats. But it may also be met with on irrigated gravelly ground or in

moss bogs associated with species such as *Philonotis seriata*, *Chiloscyphus polyanthos* v. *fragilis* and *Scapania undulata*.

It is most widely distributed in the lowlands up to a height of about 300 metres, but is also frequently met with up to about 500 metres, for instance in Esja.

### 30. *Haplozia riparia* (Tayl.) Dum.

Vestmannaey. S. Iceland: Flokastadagil!; Klitnafoss!; Barkarstadr!; Holt!.

In all the above-mentioned localities the plant was growing on tuff and was, as a rule, fruiting. On Vestmannaey it was growing on "Stora Klit," on the surface of dripping tuff-rocks facing north, associated with *Hymenostylium curvirostre*, *Hypnum filicinum* and *Anomobryum filiforme*. In S. Iceland it is fairly common in damp ravines on Fljotshlid and below Eyafjall, and grows there partly associated with the above-mentioned species, partly in company with *Fegatella conica*, *Preissia commutata*, *Bryum oenum*, etc.

*Haplozia riparia* is recorded by Grönlund from Brynjudalur and Seydisfjörður, but the specimens from these localities must be referred to *Haplozia atrovirens*.

### 31. *Haplozia atrovirens* (Schl.) Dum.

Common on damp rocks, more rare on damp gravelly ground.

It occurs sometimes in low, blackish-green cushions, sometimes intermixed in the tufts of other Bryophyta. Male plants and fruiting plants are frequently met with, sometimes in separate tufts, sometimes mixed in the same tuft. Like *Haplozia cordifolia* it occurs most commonly to a height of about 300 metres, but is also frequently met with up to about 500 metres. Var. *sphaerocarpoidea* (De Not.) Mass. has a distribution similar to that of the type, and occurs in the same localities as the latter. Both forms pass evenly into each other.

The cuticle of the leaves, in the majority of the plants, is more or less distinctly rough with striae, and rarely smooth.

### 32. *Haplozia pumila* (With.) Dum.

N. Iceland: Hof, near Eyjafjörður (O. D.)!. It was growing there intermixed in a tuft of *Eucalyx subellipticus*.

The rest of the specimens referred by Grönlund and Jensen to this species all belong to *Haplozia atrovirens*.

### 33. *Jamesoniella autumnalis* (De Cand.) Steph.

S. Iceland: Nuphlidarháls (Stp.)!.

### 34. *Sphenobolus minutus* (Crantz) Steph.

SE. Iceland: Lon, scantily among *Sphagnum rubellum* and *Fissidens osmundoides*. NW. Iceland: Hesteyri, in a tuft of *Dicranum elongatum*. W. Iceland: Grund in Skorradalur, among *Polytrichum strictum*.

This plant was first found by Mörch and figured in *Flora Danica*, tab. 2190, without a more precise notification of its habitat.

Grönlund's record of the occurrence of this species in Esja is due to an erroneous determination.

### 35. *Sphenolobus saxicola* (Schrad.) Steph.

"in Islandia leg Mörch" (M. B. H.)!. Figured in *Flora Danica*, tab. 2693, fig. 1, but no habitat is given.

### 36. *Sphenolobus politus* (Nees) Steph.

Isaffjörður! c. coles.

It was growing there in several localities at an altitude of about 200—300 metres, sometimes along the banks of streams associated with *Harpantus Flotowianus*, sometimes in bogs associated with *Sphagnum teres*, *Lophozia quinquedentata* and *L. Kunzeana*.

### 37. *Lophozia quinquedentata* (Huds.) Cogniaux.

Very common all over Iceland.

*Lophozia quinquedentata* is doubtless the liverwort of most frequent occurrence. It is met with, up to the snow-line, in all possible localities which are somewhat damp, now and then in unmixed tufts, but generally woven into the tufts of mosses. Female plants and fruit are rather rare, male plants are far more frequent; plants bearing gemmæ are also often met with.

It varies extremely as regards size, habit and leaf-form. The extreme members of the variation-series are the large var. *turgida* Lindb. which is common on boggy ground and the delicate, often only one mm. broad, var. *tenera* C. Jens. which is frequent in dry localities, as for instance on humus-covered rocks and in lava-fields.

### 38. *Lophozia lycopodioides* (Wallr.) Cogniaux.

Almost as common as the preceding species on drier ground. It is found especially on stony or grass-covered slopes, creeping over humus-covered rocks, in birch coppices, and on the top of knolls in bogs, sometimes in large, unmixed, yellowish-green tufts, sometimes intermixed with other Bryophyta. Only sterile specimens have been found. It varies considerably in size. Delicate forms (var. *parvifolia*), often only one mm. broad, grow on dry rocks woven into the tufts of other Bryophyta, while the large, vigorous forms are especially met with on slopes overgrown with *Hylocomium*. Now and then forms also occur which approach very closely to *Lophozia Hatscheri* (Evans) Steph. But plants which can with certainty be referred to this species have not been found in Iceland.

*Lophozia lycopodioides* is most widely distributed in the birch-zone, up to about 400 metres above sea-level, and is especially wide-spread towards the north-west while it occurs more sparingly in S. Iceland.



In the district around Isafjörður it is also met with abundantly on the rocky flat, 500—600 metres above sea-level, and near Akureyri it was collected, although sparingly, near the snow-line (at about 770 metres alt.).

### 39. *Lophozia Floerckei* (W. et M.) Schiffner.

NW. Iceland: Dýrafjörður; Isafjörður; Hesteyri!; Grunnavik!; Kaldalon!; Arngerðareyri!. SW. Iceland: Svinahraun!.

In the majority of the older lists of Bryophyta from Iceland *L. Floerckei* is recorded from rather a considerable number of habitats, but all the specimens from these habitats preserved in the Botanical Museum in Copenhagen, have been wrongly determined; the majority of them must be referred to *Lophozia lycopodioides*. The only specimen in the collections, correctly determined, was gathered by Mörch, but no habitat is given.

This species has a very peculiar distribution as it is very common in the north-west, and is also found abundantly on the highly situated Svinahraun in the south-west (about 300 metres), but has not otherwise been found in Iceland. In NW. Iceland it ascends from the low land to the rocky flat, but is most frequently met with from 200 to 400 metres above sea-level. There it grows on fairly dry ground in bilberry heaths, both on the ground and creeping over rocky blocks, associated with *Dicranum fuscescens*, *D. scoparium*, *D. molle*, *Lophozia lycopodioides* and *L. quinquedentata*. At a higher level it grows especially on the *Salix-herbacea*-flats, associated with *Lophozia ventriosa*, *L. alpestris*, *Dicranum Starkei*, *Pleuroclada albescens*, etc., but also occurs on a more damp bottom.

In Svinahraun it occurred commonly between the lava-blocks and also in a damp depression at the edge of the lava-field, associated with *Polytrichum commune*.

### 40. *Lophozia quadriloba* (Lindb.) Evans.

E. Iceland: Berufjörður!; Lon!; common near Seydisfjörður; Val-  
lanes!. N. Iceland: Husavik!; Akureyri!; about Eyjafjörður (O. D.;!). NW.  
Iceland: Kaldalon!; Isafjörður!. W. Iceland: Melar (Gr!);!; Esja, several  
places!. S. Iceland: Svinahraun!; Holt!; Hornafjörður!. The Vestmanna-  
eyjar!.

This plant is no doubt common, but usually it occurs so scantily that it is only found by close search of the Bryophyte collections under the microscope. It grows both on damp humus-covered rocks and on boggy ground, from the low land upwards to the mountain-tops. Thus, near Isafjörður it was collected at about 440 metres. Near Seydisfjörður it is frequent up to about 500 metres and near Akureyri it was found on cliffs at an altitude of 900 metres.

*Lophozia quadriloba* hardly occurs in unmixed tufts, but always mixed with other species, for instance with *Dicranum* spp. or on rocks among *Distichium montanum*, *Tortella fragilis*, *Oncophorus*, or with other Hepaticæ such as *Cephalozia*, *Lophozia alpestris* and *Aneura pinguis*. On

boggy ground it is found interwoven with *Hypnaceæ* in their tufts, but rarely in those of *Cinclidium*, *Lophozia Kunzeana* or other bog-mosses.

The majority of the specimens investigated are small and delicate, and must partly be referred to forma *heterophylla* Bryhn et Kaalaas, and partly to forms transitional between this and the type. Only sterile plants have been found.

#### 41. *Lophozia Kunzeana* (Hüb.) Evans.

Very common in bogs, on damp rocks, damp gravelly ground, etc.

It is most widely distributed in bogs where it grows woven into, or creeping over tufts of other Bryophyta, especially *Sphagnum*. Near Akureyri, for instance, it commonly occurs in bogs up to a height of about 600 metres. In S. Iceland it is rather rare in the bogs of the lowlands, but is met with abundantly at an altitude of 200—400 metres.

#### 42. *Lophozia barbata* (Schmid.) Dum.

E. Iceland: Árbær, among *Grimmia canescens* (H. J.)!. W. Iceland: Bjarnarhöfn (H. J.)!; Berserkjahraun (H. J.)!; Reynivellir (Gr.)!; Nordredalur in the district of Borgarfjörður!; Álafoss!.

In addition to the above-mentioned localities Grönlund and Helgi Jónsson record this species from several other localities, but some of the specimens which have been investigated proved to be wrongly determined (being, as a rule, forms of *L. lycopodioides*), so only those localities are enumerated here from which authentic specimens are known.

*L. barbata* appears to be rather rare. It has as a rule been collected, intermixed rather sparingly in tufts of other Bryophyta especially *Grimmia* and *Hylocomium* spp. and belongs to the *Grimmia*-heaths or to the mossy bottoms of birch coppices; thus in Nordredal it frequently occurred in birch coppices among *Hylocomium* spp., *Dicranum scoparium*, *Ptilidium ciliare*, etc.

Note. *Lophozia gracilis* (Schl.) Stephani is recorded from several localities, but all the specimens which have been investigated have been wrongly determined, being mostly *Lophozia lycopodioides* var. *parvifolia*.

#### 43. *Lophozia ventricosa* (Dicks.) Dum.

Common on more or less damp ground, both boggy and gravelly ground, and on rocks on mountain heights.

This species is very common especially in NW. Iceland, and occurs there on a heathy bottom woven into tufts of *Dicranum*; along the banks of streams associated with *Harpanthus*, *Lophozia quinqueidentata* and *Cephalozia bicuspidata*; and in bogs among *Sphagnum*. It appears, on the whole, to be more frequent the higher it ascends; undoubtedly its main distribution is from a height of about 300—400 metres upwards.

Var. *porphyroleuca* (Nees) Hartm. is likewise commonly distributed and occurs, for instance, frequently interwoven with *Conostomum* in its compact tufts, and also in tufts of *Dicranum* and *Sphagnum* on damp ground.



It is hardly possible to draw any distinct boundary line between this form and the type, the thickenings of the leaf-cells showing all transitional stages from quite thin-walled to decidedly collenchymatous cells, and the colour also varying according to the habitat. Fruit is rare; gemmæ are as a rule present.

Var. *confertifolia* (Schiffn.) syn. *Lophozia confertifolia* Schiffner. Plants agreeing exactly with the description of this form and with the figure in Rabenhorst's *Kryptogamenflora*, fig. 314, occur rather commonly on damp gravelly soil in NW. Iceland associated with all the transitional forms of *L. ventricosa*; I think they can only be regarded as Alpine forms of the present species.

#### 44. *Lophozia Wenzelii* (Nees) Steph.

E. Iceland: Seydisfjörður!; Vallanes!. N. Iceland: Tverá in Öxnadalur!. NW. Iceland: Isafjörður, (at about 200 metres alt.!). SW. Iceland: Svinaskard (at about 400 metres alt.).

It grows on wet gravelly soil or peat, especially along streams where it forms low, dense carpets or grows mixed with *Alicularia scalaris*, *Dicranella crispa*, *Distichium inclinatum* and other Bryophyta. Near Isafjörður it was growing by a small stream together with *Sphagnum squarrosum*.

#### 45. *Lophozia alpestris* (Schleich.) Evans.

Very common all over Iceland.

It generally grows woven into tufts of other Bryophyta, but now and then forms tufts by itself. It is found on almost every kind of substratum, from the sea-level to mountain heights. It occurs most frequently on rocks, especially those which are somewhat damp, but is also met with on damp ground along the bank of streams, on the gravelly flats of mountain heights, in lava-clefts and woven into the moss-carpets of *Grimmia*-heaths.

Fruit and calyces occur rarely and have been found only in NW. Iceland: Gnupsdal! and in S. Iceland: Seljaland (at about 350 metres!); Svinahraun!. Male plants are rather common, and gemmæ are very often present.

#### 46. *Lophozia excisa* (Dicks.) Dum.

S. Iceland: Reykir!; fr.

It grows there on damp gravelly soil by a small stream associated with *Eucalyx subellipticus*, *Scapania curta* and *Dicranella crispa*.

This species is recorded from Iceland by Mörch, but of the two specimens found in the collection in the Botanical Museum in Copenhagen under this name, one is *Lophozia ventricosa* var. *porphyroleuca* and the other *L. heterocolpos*.

Note. *Lophozia bicrenata* (Schmid.) Dum. is recorded to have been found near Krisuvík by Steenstrup, but the packet contained only a mixture of several other species of *Lophozia*.

#### 47. *Lophozia Schultzii* (Nees) Schiffner.

E. Iceland: Seydisfjörður; Vestdalur (at an altitude of about 200 metres)!. N. Iceland: Akureyri!. W. Iceland: Stykkisholmur!.

It was collected everywhere only in small quantities together with bog-mosses such as *Hypnum revolvens*, *H. stellatum*, *Mnium Seligeri*, etc.; it was as a rule sterile. Near Stykkisholm it was collected in unmixed tufts with antheridia and young calyces.

#### 48. *Lophozia Mülleri* (Nees) Dum.

Common, but occurred almost always in small quantities intermixed in tufts of mosses.

This species is most frequent in the lowlands up to about 300-400 metres above sea-level, but it also occurs at great altitudes in the Alpine region, for instance, at about 600 metres on Berufjördurskard. It is almost always sterile.

*Lophozia Mülleri* occurs on very different substrata, most frequently on rocks, but it may also be found on damp ground along streams, or even in bogs. It varies exceedingly in size according to the degree of dampness of the habitat. Xerophilous forms from rocks are usually small and delicate, while bog forms which grow in the tufts of *Hypnaceæ* are considerably larger and often approach so closely to *L. Hornschuchiana* that they are difficult to distinguish from the latter. On the damp, vertical sides of the clefts of the tuff rocks of S. Iceland, for instance on Fljotshlid, a vigorous, blackish-green form is frequently met with forming large, pure mats.

#### 49. *Lophozia Hornschuchiana* (Nees) Macoun.

*Jungermannia bantryensis*, Hooker.

E. Iceland: Seydisfjörður, frequent up to about 400 metres!. N. Iceland: Akureyri!; Hof; Eyjafjörður (O. D.)! c. coles. NW. Iceland: Isafjörður. W. Iceland: Dalsmýnne in Nordredal!; Mulakot!; Botnsdalur!; Reykjavik!; Kollafjörður.

Occurs rather frequently, but as a rule scantily, on boggy ground among mosses (*Hypnum*, *Sphagnum*, etc.), more rarely on stones in rivers. In Nordredal, for instance, it was found abundantly in a small river on submerged stones.

#### 50. *Lophozia heterocolpos* (Thed.) Howe.

N. Iceland: Spönsgerde near Eyjafjörður (O. D.)!. NW. Iceland: Bæir!; Kaldalon!. SW. Iceland: Hafnarfjörður!; Esja!, at an altitude of about 400 metres; Thingvellir (Grl.;!).

In all the above localities it was found on humus-covered rocks, especially in clefts. Near Kaldalon it grew on damp rocks woven into a tuft of *Meesea trichoides* and *Dicranella subulata*; on Esja it grew upon damp tuff-rocks. In Thingvallahraun it is widely distributed in clefts

and caves in the lava-fields, usually mixed with *Blepharostoma trichophyllum*, *Amblystegium Sprucei*, *Diplophyllum albicans* and *Plagiothecium denticulatum*. The characteristic gemmiferous shoots occur always, but plants in fruit have not been collected.

### 51. *Gymnocolea inflata* (Huds.) Dum.

"In Islandia" leg. Mörch! and figured in Flora Danica, tab. 1945, fig. 2; SW. Iceland: Krisuvik (Stp.)!; Laugarvatn (Stp.)!; Reykholt (Gr!.);!; Reykirdalur!; Kolvidarhol!. NW. Iceland: Laugarland!.

Grönlund records this species from several other localities besides those mentioned above, but the specimens in the Botanical Museum in Copenhagen are all wrongly determined and must be referred to *Lophozia Mülleri* or to *L. alpestris*.

In Iceland *Gymnocolea inflata* is a decidedly warm-soil plant which, with the exception of a single locality, was found exclusively on the steaming clayey flats around hot springs in SW. Iceland. Near Laugarland it was growing rather sparingly in a bog. *Haplozia crenulata* was growing in its neighbourhood, and as there was a small spring with lukewarm water at the edge of the bog it is possible that the occurrence of the two species is connected with the spring, although there was no characteristic vegetation around the spring, but only the common bog-plants.

In Reykirdalur, where it is found in abundance near almost all the hot springs, it forms extensive brownish-black or almost entirely black mats on warm ground with a temperature of as much as 40° around fumaroles or on slopes stretching down towards the boiling hot basins. At some distance from the spring it will grow woven into the tufts of *Polytrichum commune* or mixed with *Cephalozia bicuspidata* which likewise occurs in brownish-black forms.

It was collected with calyces only at Laugarvatnshver.

### 52. *Plagiochila asplenioides* (L.) Dum.

Very common everywhere.

*Plagiochila asplenioides* occurs on almost every substratum, on damp or on dry rocks, in bogs, on earth, etc. It is most frequent up to a height of about 300 metres above sea-level, but often occurs as far upwards as about 600–700 metres. Usually it grows intermixed in the tufts of other Bryophyta, more rarely it forms tufts by itself. The majority of the specimens which have been collected are small, only 1–2 mm. broad, with leaves slightly dentate or entire. Larger forms with leaves typically dentate occur mostly on somewhat damp ground, for instance among stones on a talus of loose blocks and debris (Urd) or in caves. Only sterile specimens have been found.

### 53. *Leptoscyphus anomalus* (Hook.) Lindb.

E. Iceland: Stöd (H. J.)!.

#### 54. *Lophocolea cuspidata* Limpr.

Vestmannaey!. S. Iceland: Holt!.

On Vestmannaey it was found in several places at the base of cliffs and in specially large quantities in Heljusdal where it grew abundantly among stones on an Urð usually mixed with *Eurynchium*, *Stockesii* and *Mnium undulatum*. Near Holt it was found in several places, but everywhere only in small quantities in clefts of tuff-rocks, woven into the tufts of mosses. Only sterile specimens have been found.

#### 55. *Lophocolea minor* Nees.

N. Iceland: Hálsskógur (O. D.)!. S. Iceland: Reykirdalur!; Vestmannaey: Heljusdal!.

In Reykirdalur it was growing rather sparingly on a grass-covered slope stretching down towards a stream. On Vestmannaey it occurred in several places associated with *L. cuspidata* sometimes intermixed in its tufts. In all the localities only sterile specimens were collected, but bearing the characteristic gemmæ.

#### 56. *Chiloscyphus polyanthus* (L.) Corda.

Common in wet localities or in water, on gravelly ground and occasionally in bogs and on wet rocks. Only sterile specimens were found.

It occurs sometimes in unmixed cushions, which are usually blackish-green in colour in water and yellowish-green in boggy ground, sometimes mixed with other Bryophyta such as *Marchantia*, *Philonotis*, *Dicranella squarrosa* and *Mnium* spp. It is most widely distributed in the lowlands up to about 300 metres and does not appear to ascend much higher than 400 metres.

The typical form was collected only in S. Iceland on damp tuff-rocks near Holt. All the other plants which have been investigated belong to var. *fragilis* (Roth) K. M. It varies considerably as regards size and colour, but the form of the leaves and the size of the leaf-cells are almost always the same.

Note. *Chiloscyphus pallescens* is recorded from several places by Mörch, Grönlund and Helgi Jónsson, but all the specimens referred to this species belong to *Chiloscyphus polyanthos* var. *fragilis*.

#### 57. *Harpanthus Flotowianus* Nees.

E. Iceland: Seydisfjörður, several places!. N. Iceland: several places around Eyjafjörður (O. D.)!; Stadr near Hrátafjörður!. NW. Iceland: Dýrafjörður; Sugandafjörður; Isafjörður; Grunnavig; Kaldalon; Arngerdareyri!. W. Iceland: Ólafsdalur in Dalasýsla (H. J.)!; Esja, several places!.

In NW. Iceland this species is of the most frequent occurrence among all the Bryophyta and is met with everywhere on wet ground up to a height of about 300 metres above sea-level. In the other parts of the country it is wanting or rare; on Esja it is however rather fre-

quent. It occurs both in bogs and along the banks of streams, and also on inundated gravelly ground, usually intermixed in tufts of mosses such as *Cinclidium*, *Mnium cinclidioides*, *Sphagnum* and *Hypnum* spp.; also on wet gravelly soil associated with *Lophozia quinquedentata*, *Cephalozia bicuspidata* and other Hepaticæ. Only sterile specimens have been found.

## FAM. TRIGONANTHÆ.

58. *Cephalozia bicuspidata* (L.) Dum.

Very common on earth, damp gravelly soil, humus-covered rocks, and in bogs up to a height of about 600 metres above sea-level, especially in NW., N. and in parts also of E. Iceland, while it appears to be more rare in S. Iceland. It grows partly in large cushions, for instance on damp ground by streams, partly intermixed in tufts of mosses especially *Sphagnum* and *Dicranum* spp. and thrives best on a somewhat damp substratum. Found as a rule in fruit. It varies considerably as regards size and colour.

Var. *Lammersiana* (Hüb.) Breidler grows on very wet ground, for instance along banks of streams, where it forms large green mats in association with other Hepaticæ. It is especially common in NW. Iceland. The bog-forms, which grow erect among *Sphagnum*, are slender with spreading leaves. On damp slopes a dark-brown-to-black form frequently occurs, often forming very extensive carpets; it corresponds most closely with var. *Loeskeana* (Schiffner) K. M., in previous lists it was referred to var. *Lammersiana*. At the head of deep lava-caves and at the bottom of lava clefts it occurs in association with *Alicularia scalaris* as much elongated shade-forms.

Note. *Cephalozia Francisci* is recorded by Mörch from Hafnarfjörður, but the specimen in the Botanical Museum is *C. bicuspidata*.

59. *Cephalozia ambigua* C. Mass.

NW. Iceland: Laugarland, fr.!

It grew there in small brownish tufts on the damp ground at the bottom of the valley.

60. *Cephalozia pleniceps* (Aust.) Lindb.

Common in all parts of Iceland except in the southern part, where it appears to be rare. It is especially common in NW. Iceland and forms there one of the most frequently occurring Hepaticæ.

It occurs especially on damp ground and in bogs, woven into tufts of *Sphagnum*, *Dicranum* and *Mnium hornum* or associated with *Lophozia Kunzeana*, *L. quinquedentata* and other Hepaticæ and as a rule bears calyces or fruit. It occurs most frequently up to a height of about 300 metres, but it is also often met with at far greater altitudes.

Var. *macrantha* (Kaalaas et Nichols.) K. M. is widely distributed on wet ground, and grows in association with similarly elongated forms of



*C. bicuspidata* and *Cephaloziella Hampeana*, woven into the tufts of *Sphagnum* spp., but is as a rule sterile.

Note. *Cephalozia connivens* is recorded by Mörch and Grönlund as found in Iceland, but all the specimens which have been investigated belong to *C. pleniceps*.

### 61. *Cephalozia media* Lindb.

N. Iceland: Arnarfellsaurar (St.;!); NW. Iceland: Grunnavik!, intermixed in tufts of *Dicranum fuscescens*.

### 62. *Pleuroclada albescens* (Hook.) Spruce.

E. Iceland: Seydisfjörður!, common above a height of about 400 metres. N. Iceland: Akureyri!, common above 500 metres; Hestahraun (St.)!. NW. Iceland: Very common above 300 metres!. Var. *islandica* (Nees) Spruce. N. Iceland: Reykjaheidi!. S. Iceland: Thingvallahraun (Mörch; Stp.; Grl.;!); Hafnarfjörður!.

The typical form is no doubt common on mountain heights, at any rate in N., NW., and E. Iceland. In S. Iceland it has not yet been found. On mountain heights it grows on stony flats associated with *Dicranum* spp. (*D. Starkei*, *D. molle* and *D. fuscescens*), *Lophozia* spp. and *Cesia concinnata* or associated with *Polytrichum sexangulare*, *Lophozia ventricosa*, *Cesia concinnata*, etc., on *Salix-herbacea*-flats.

The variety belongs especially to the lava-fields and grows there at the bottom of deep clefts, creeping over blocks of lava, often in abundance. It occurs there either in large whitish-green cushions or mixed with *Hylocomium* spp., *Rhacomitrium hypnoides*, *Polytrichum alpinum*, *P. sexangulare*, *Lophozia* spp., etc. Only sterile specimens of each form have been found.

### 63. *Cephaloziella Hampeana* (Nees) Schiffn.

Very common, but occurs only as scattered shoots intermixed in the tufts of mosses, sometimes, however, also in tiny, yellowish-green, brownish or reddish tufts upon these.

It occurs on highly different substrata. On rocks and on earth it grows in tufts of *Dicranum* spp., *Ditrichum flexicaule*, *Distichium montanum*, *Tortella fragilis*, etc.; in bogs it has been found woven into tufts of *Sphagnum*, *Sphaerocephalus palustris*, *Hypnaceæ*, *Oncophorus* spp. and several others. Bog-forms, with elongated stems and widely spreading, very much projecting leaves, agreeing most closely with var. *erosa* Warnst., occur very commonly in *Sphagnum* cushions.

The leaf-tissue varies very considerably, the leaf-cells, even on the same plant, being sometimes quite thin-walled, sometimes more or less thickened; the leaves also are more or less outspread, so that all possible transitional forms between this species and *Cephaloziella rubella* are known.

64. *Cephaloziella rubella* (Nees.) Warnst.

Typical specimens of this species were collected in the following localities:

S. Iceland: Hornafjörður!. E. Iceland: Seydisfjörður!. N. Iceland: Hafstrandur (St.)!; Akureyri!, at an altitude of about 500 metres!; Hof (O. D.)!. SW. Iceland: Kollafjörður!. S. Iceland: Holt!.

It was found everywhere woven into tufts of *Sphagnum* spp. and *Dicranum* spp. (*D. fuscescens* and *D. angustum*) and usually mixed with *Cephalozia bicuspidata* and *Lophozia* spp., now and then also with *C. Hampeana*. Near Isafjörður it grew sparingly in a tuft of *Mnium hornum*, which was densely interwoven with *Cephalozia pleniceps*. It was collected everywhere in fruit.

*C. rubella* is an uncertain species which when sterile is in many cases hardly distinguishable from *C. Hampeana*.

*C. divaricata* and *C. bifida* are recorded from several places in Iceland, but the specimens belong either to *C. Hampeana* or to *C. rubella*. Grönlund's *C. divaricata* from Melar is *Lophozia quadriloba*.

65. *Odontoschisma Sphagni* (Dicks.) Dum.

W. Iceland: Snældubeinstadahver in Reykholtadalur!

It was found in the above locality in small quantity woven into a tuft of *Sphagnum rubellum* on a warm substratum.

This species is recorded from Iceland in several old lists and is figured in Flora Danica, tab. 2251 (leg. Mörch), but all the specimens found in the collections under this name are those of *O. elongatum*.

66 *Odontoschisma elongatum* (Lindb.) Evans.

"In Islandia" (Mörch!). E. Iceland: Hof!; Lon!; frequent near Seydisfjörður!. N. Iceland: Hvarf (St.)!; Akureyri!. W. Iceland: Budahraun (H. J.)!; Grund in Skorradalur!; common around Reykjavik!. S. Iceland: Holt! at an altitude of about 400 metres.

It grows usually woven into tufts of bog mosses such as *Sphagnum*, *Hypnum* and *Oncophorus* spp., *Meesia trichoides*, *Lophozia Kunzeana*, more rarely upon moss-tufts or on wet ground, in small brownish tufts. Only sterile specimens have been found.

A specimen collected by Mörch, having tiny, inconspicuous underleaves and less thickened cell-walls bearing fine warts, forms a transitional form to *O. Sphagni*.

67. *Odontoschisma denudatum* (Mart.) Dum.

W. Iceland: Braudarholt near Reykjavik! ♂.

It grew in the above locality on boggy ground among other Bryophyta.



68. **Odontoschisma Macouni** (Aust.) Underwood.

S. Iceland: Bergarfoss near Hornafjörður!; E. Iceland: Grottafoss near Seydisfjörður! at an altitude of about 200 metres. N. Iceland: Hof (O. D.)!. SW. Iceland: Svinhraun!.

This plant grows partly in small unmixed tufts, partly mixed with other Bryophyta such as *Anoetangium lapponicum*, *Distichium montanum*, *Pohlia cruda*, *Blepharostoma trichophyllum* on damp humus-covered rocks. In Svinhraun it grew in lava-clefts filled with humus.

69. **Calypogeia Trichomanis** (L.) Corda.

N. Iceland: near Mývatn (Gr.!) ; Reykjahlid!. W. Iceland: near several hot springs in Reykholtalur!; Tunguhver (probably Deildatunguhver) (Gr.!) ; Kollafjörður!. S. Iceland: Laugaráshver!; Geysir!. Moreover, Grönlund records this species from Hvammur, but no specimens of it are to be found in the collections.

The plant grows in all the above localities on a warm substratum. Near Reykjahlid it covered the roof of a lava-cave which had a temperature of about 25°. In the other localities it occurred on a warm damp substratum woven into mosses such as *Sphagnum*, *Hypna* and *Polytrichum*, or in pale green to brownish cushions above them. In Reykholtalur where it occurred abundantly in several localities, the temperature in the tufts was from 25° to 27°.

70. **Lepidozia setacea** (Web.) Mitten.

S. Iceland: Merkjáfoss (Feddersen)!.

It was found very sparingly in the above locality associated with *Cephalozia planceps* and woven into a tuft of *Dicranum scoparium*.

## FAM. PTILIDIOIDEÆ.

71. **Blepharostoma trichophyllum** (L.) Dum.

Very common from the lowlands up to about 500–600 metres above sea-level.

This species rarely forms unmixed tufts, but grows almost always woven into tufts of other species and is met with in the most varied localities, on boggy ground and damp gravelly ground along rivers, in lava-fields, on damp rocks, and especially in abundance in rock-caves where it often covers the roof and walls in association with *Amblystegium Sprucei*, with a thin dark-green layer.

Fruit occurs rather rarely; but it is found plentifully in Almanagjá!, and near Hof in N. Iceland (O. D.)!.

72. **Chandonanthus setiformis** (Ehrh.) Lindb.

In the herbarium of the Botanical Museum there is a specimen, labelled by Mörch "In Islandia, among *Trichostomum canescens*, Aug. 1820."

73. *Anthelia julacea* (L.) Dum.

Common in the lowlands on damp gravelly ground and creeping over wet stones in streams, occasionally also on damp boggy soil; fruit is not rare. It does not appear to ascend higher than about 400 metres above sea-level.

74. *Anthelia Juratzkana* (Limpr.) Trevis.

*Anthelia nivalis* (Sw.) Limpr. ex. p.

Very common on damp gravelly flats irrigated by melting snow, somewhat rarer on damp gravelly ground along streams or on damp rocks.

This plant has its main distribution on mountain heights where, on the clayey or gravelly flats next to the snow-covered areas, it forms large, continuous carpets of a peculiar bluish-black colour, often mixed with *Salix herbacea* or with other Bryophyta such as *Alicularia geoscypha*, *Lophozia ventricosa* and *Polytrichum sexangulare*. In NW. Iceland, where the snow on slopes with a northern exposure may remain during the greater part of the summer, these *Anthelieta* often descend to sea-level. The plants growing on damp rocks or gravelly ground in lower levels differ from the typical form from mountain heights in being lighter in colour, usually yellowish green, and in the tufts being as a rule higher, with less close-set leaves; or it may also grow intermixed with other Bryophyta especially Hepaticæ.

*A. Juratzkana* and *A. nivalis* are so closely related that in many cases it is impossible to determine them when sterile. While the typical *A. Juratzkana*, as it occurs in abundance on mountain heights, is very characteristic because of its extensive low carpets, quite typical specimens of *A. julacea* are far more rarely met with on the damp soil of the lowlands. Of far more frequent occurrence are forms which pass, more or less, in habit, size of leaf-cells and thickness of cell-walls from *A. julacea* towards *A. Juratzkana*.

75. *Ptilidium ciliare* (L.) Hampe.

Very common both on dry and on somewhat damp ground.

The plant grows both among *Hylacomium* spp. on slopes and intermixed in heaths of *Rhacomitrium hypnoides* and *R. canescens* on more or less damp rocks coated with soil, and also in clefts in lava-fields and on knolls in bogs. It occurs most frequently in low-lying regions up to about 300—400 metres, but may also occasionally be met with on mountain heights. Only sterile specimens have been found.

## FAM. SCAPANIOIDEÆ.

76. *Diplophyllum albicans* (L.) Dum.

"In Islandia" (Mörch!). W. Iceland: Budahraun (H.J.); Hafnarfjörður (GrI.; H. J.); Svinahraun!; Mödruvellir in Kjos!. S. Iceland: Thingvalla-

hraun (Grl.; Stp.!) ; Krisuvik (Stp.!) ; Holt! ; Reykirdalur!, at an altitude of about 260 metres.

*Diplophyllum albicans* is a plant characteristic of the lava-fields of West and South Iceland and occurs there in great abundance on vertical rock-sides in clefts and caves, while it appears to be entirely absent from the lava-fields of North Iceland. Outside the lava-fields it has been gathered only extremely sparingly among stones on heaps of debris at foot of cliffs (Urd). In Reykirdalur it grew scantily on a warm substratum among large blocks of basalt. Only sterile specimens have been found.

### 77. *Diplophyllum obtusifolium* (Hook.) Dum.

"In Islandiae montibus leg. Mörch" and figured in *Flora Danica*, tab. 1831, fig. 2. No specimens of it are to be found in the herbarium of the Botanical Museum. In the district of Seydisfjörður!, on a damp rock-face by the river it occurred in a small quantity in a tuft of *Dicranum molle* and *Lophozia Kunzeana*. In N. Iceland: Ásbyrgi!, it was found on the ground among fallen blocks of lava. Only sterile specimens have been found.

### 78. *Scapania subalpina* N. ab Es.

Common on damp ground along streams, on damp rocks, in clefts and on damp slopes of the low land. It does not appear to ascend much higher than about 300 metres.

♂ plants are very common; calyces and fruit occur occasionally.

The plant varies in having deeply toothed to almost entire leaves. It is usually green or yellowish-green in colour, but sometimes reddish or brownish to almost blackish-brown in more exposed localities.

### 79. *Scapania remota* Kaalaas.

N. Iceland: Akureyri!.

The plant, which agreed exactly with the description and figure in Karl Müller's *Monographie der Lebermoosgattung Scapania*, grew in the above locality, in a bog 400 metres above sea-level, intermixed in tufts of *Oncophorus virens*.

### 80. *Scapania irrigua* (Nees) Dum.

Very common on damp ground, in bogs, along streams and on damp rocks.

This species is most widely distributed in the lowlands up to about 300 metres above sea-level, but may also frequently be met with at high altitudes in the Alpine regions. In wet localities, especially in bogs, where it occurs everywhere woven into the tufts of other Bryophyta, it is usually yellowish green in colour. The leaves are entire or fewly toothed towards the apex with thin-walled or slightly collenchymatous cells. But occasionally vigorous, brownish-green forms

also occur with more highly thickened cell-walls. In somewhat drier localities it is usually brownish in colour and more compact with more deeply toothed leaf margins, sometimes almost as in *S. subalpina* and with more thick-walled cells. Small forms from damp sandy soil often constitute transitional stages to *S. curta*, while vigorous aquatic forms approach closely to *S. undulata*. A very vigorous form with leaves which were as deeply toothed as in *S. subalpina* was found in abundance in lava-clefts near Thingvellir.

♂ plants are common; calyces and fruit occur rather rarely.

Note. *Scapania compacta* is recorded by Grönlund from Esja, but the specimen in the Botanical Museum is really *Scapania irrigua*.

### 81. *Scapania uliginosa* (Sw.) Dum.

E. Iceland: Stöd (H. J.)!. NW. Iceland: Gnupsdal in Dýrafjörður!; Sugandafjörður!; Isafjardarheidi!; Dýnjandi!; Arngerðareyri.

With the exception of a single locality in E. Iceland this species was found only in NW. Iceland where it is rather common on very wet or irrigated soil along streams, often occurring in great abundance up to a height of about 400 metres. Near Arngerðareyri it grew abundantly in a bog in reddish-brown tufts associated with *Hypnum* spp. The leaf-form and habit in this form were typical, but the leaf-cells had brownish and rather thickened walls and a roughly granular cuticle.

The plant from Sugandafjörður differed from the type in its leaves being sometimes distantly toothed and the cells very slightly thickened at the angles, in which respects it approached *S. irrigua*.

### 82. *Scapania paludosa* C. M.

NW. Iceland: Gnupsdal in the district of Dýrafjörður, c. coles.! Grunnavik ♂!; Isafjörður ♂!.

In Gnupsdal the plant grew abundantly in the water in small streams, where it formed large, loose, green to brownish mats. The leaves were highly decurrent, with indistinct teeth or entire margins, and thin-walled cells.

Near Isafjörður and Grunnavik it grew on wet boggy ground. The leaves in both these forms were shortly decurrent and more or less toothed with a broadly reniform or (often in the same plant) cordate postical lobe which was occasionally furnished with a small point as in *S. irrigua*; the leaf-margin was often reflexed as in *S. undulata*; the cells were thin-walled, but towards the margin occasionally somewhat thick-walled. The commissure is typically short and strongly curved with broad wings.

### 83. *Scapania dentata* Dum.

*Scapania purpurascens* (Hook.) Pearson.

E. Iceland: Berufjörður!; Seydisfjörður!, common up to about 400 metres. Kirkjuból (H. J.)!. N. Iceland: Stora Gjá!. W. Iceland: Hvammur

(Gr.)!; Esja!, common up to about 400 metres above sea-level; Hafnarfjörður!. S. Iceland: Krisuvík (Stp.)!; Krókr (H. J.)!; Almannagjá!; Holt!; Seljaland!; Austerhlid near Geysir!.

This species has its main distribution in E. and SW. Iceland and it has not been found in NW. Iceland. It grows especially on wet rocks and often in the water itself, but also on gravelly soil along the margin of streams. Thus, near Seydisfjörður it occurred abundantly along several rivers. In such localities it forms extensive reddish-brown cushions several centimetres deep.

On damp soil and on rocks it forms low cushions, green, rose-red or reddish-brown in colour. In the lava-fields near Hafnarfjörður and Thingvellir and in Stora Gjá it usually grew at the bottom of the comparatively dry caves and clefts in small, flat tufts of a peculiar yellowish-green or beautiful rose-red colour. Such forms from comparatively dry localities have always deeply-toothed leaves while the aquatic forms have less deeply-toothed, sometimes almost entire leaves, in which feature they approach *S. undulata* very closely. The cell-walls are however always more highly thickened than in the latter species, especially at the angles, and the postical lobe of the leaves are longer and narrower obovate (in *S. undulata* almost circular). ♂ plants and fruit are of frequent occurrence.

#### 84. *Scapania undulata* (L.) Dum.

Very common on stones and gravelly soil in rivers, occasionally also on inundated ground in swamps and moss bogs.

This plant occurs most frequently in the low land up to about 300 metres, and forms there, especially creeping over stones in the shallow water along rivers, extensive growths in association with *Chiloscyphus polyanthus* var. *fragilis* and *Haplozia cordifolia*. Not rarely it is also met with at higher levels, for instance near Dyrafjörður, where it grew abundantly on slopes irrigated by melting snow, 400—500 metres above sea-level; and near Holt below Eyjafjall, where it was found abundantly in a stream even at an altitude of about 600 metres. The aquatic forms are usually green; in swamps and moss bogs it often forms extensive, thick carpets, reddish-brown or almost purple in colour. It is frequently found in fruit.

The leaves are entire or have a few obtuse teeth at the margin, but forms sometimes occur with more deeply toothed leaves or even with the leaf-margin entirely toothed, in the latter case it may be difficult to distinguish the plant from *S. dentata* and from the large aquatic forms of *S. irrigua*. The latter, however, have always cells more thick-walled especially at the angles, while *S. undulata* has always thin-walled leaf-cells.

#### 85. *Scapania curta* (Mart.) Dum.

Common on rocks coated with soil, damp sandy or gravelly ground and on peat, occasionally also on boggy ground up to about 400 metres above sea-level. Near Isafjörður and in Esja it was collected at an



altitude of almost 500 metres. ♂ plants are common, fruit rather rare. The majority of the plants bear gemmæ.

Var. *geniculata* (Mass.) C. M.

S. Iceland: Reykir!; Vestmannaey! NW. Iceland: Ármuli!.

Var. *rosacea* (Corda) Carr. is only exceptionally met with typically developed, while forms transitional between the present variety and the type are rather common.

The plant is usually green or brownish-green, more rarely reddish. On damp ground it becomes larger and approaches *S. irrigua*. The leaves vary somewhat in form. The antical lobe is usually pointed, in the lower leaves it is, however, often rounded; it is more rare for all the leaves to be rounded. The leaf-cells are as a rule thin-walled or somewhat thickened at the angles. Forms with highly thickened, reddish-brown cell-walls are more rare, and occur always in exposed localities.

### 86. *Scapania Bartlingii* (Hampe) Nees.

*Scapania Carestiae* de Not.

S. Iceland: Drángshlid associated with *Amphidium Mougeottii* and *Bryum archangelicum* (H. J.)!.

Note. *Scapania nemorosa* is enumerated in the majority of the older lists, but all the specimens in the collections belong to *Scapania undulata*.

## FAM. RADULOIDEÆ.

### 87. *Radula complanata* Dum. Gottsche.

S. Iceland: Hornafjörður! E. Iceland: Hof!; Djupivogur!; Seydisfjörður! N. Iceland: Thrastarhólsárgil, fr. (O. D.)! W. Iceland: Flatey (Gr!); Budahraun (H. J.)! Common in SW. and S. Iceland!.

The plant is common in E., W. and S. Iceland, while it appears to be absent from NW. Iceland and to be rare in N. Iceland.

It occurs only in the lowlands and rarely ascends higher than about 300 metres. In a few localities in Esja and near Kolvidarhol it was collected at an altitude of about 400 metres. It grows especially on dry, or only slightly damp, shaded rock-sides, mostly in clefts and caves, in company with *Metzgeria furcata*, *Lejeunea cavifolia*, etc., and often bears gemmæ and in S. Iceland fruit also. It was sometimes collected on the bark of trees, viz. on birch on Flatey and on mountain ash in Budarhaun.

## FAM. MADOTHECOIDEÆ.

### 88. *Madotheca Cordæana* (Hübener) Dum.

*Madotheca rivularis* (Dicks.) Nees.

"In Islandia" (Mörch)! E. Iceland: Hof!; Seydisfjörður (H. J.)!; Berufjörður! NW. Iceland: Dýrafjörður! at an altitude of about 150 metres;

Dýnjandi!; Grunnavík! at an altitude of about 270 metres. W. Iceland: Nordredalur!; Brynjudalur (Gr!.)!; Reykjavík (Gr!.;!); several places in Esja!. Common in S. Iceland!. Vestmannaey!

This plant is most widely distributed in S. Iceland where, as on Vestmannaey, it is common on more or less damp rock-sides especially in clefts of the tuff mountains on Fljótshlíð and below Eyjafjall. On Vestmannaey it grew sometimes in abundance among fallen stones in Heljusdalur, and sometimes on slopes associated with *Thuidium abietinum* and *Hylocomium* spp. In E. and NW. Iceland it was rarer and generally occurred only sparingly on faces of basalt rocks immediately above the surface of the water of rivers or on damp slopes among stones. This species has not yet been recorded from N. Iceland.

#### FAM. JUBULÆÆ.

##### 89. *Frullania dilatata* Nees.

W. Iceland: Flatey, on mountain ash (name of finder not stated); Dalasýsla, Melar, on sea-fowl cliffs (H. J.)!. Only sterile specimens have been found.

##### 90. *Frullania Tamarisci* Nees.

Common both on dry and on somewhat damp rocks in company with *Hypnaceæ*, *Grimmia* spp., *Antitrichia curtispindula*, etc.; in *Rhacomitrium* heaths (both *R. canescens* and *R. hypnoides*); on slopes among *Hylocomium* spp.; on the top of knolls in marshes, etc.

I do not think the plant occurs at a much higher altitude than about 300 metres and it is always sterile.

##### 91. *Frullania fragilifolia* Tayl.

SW. Iceland: Hafnarfjörður, in a lava cave (Gr!.)!; Kolvidarhol!; on a rock-face at an altitude of about 400 metres associated with *Radula* and *Lejeunea*.

##### 92. *Lejeunea cavifolia* (Ehrh.) Lindb.

*Lejeunea serpyllifolia* (Dicks.) Spr.

"In Islandia" (Mörch)!. W. Iceland: Snæfellsnes!; Sandur in a lava cave (H. J.)!; Hafnarfjörður in lava caves!; Kolvidarhol!. S. Iceland: Seljaland (Stp.)!; common on Fljótshlíð and below Eyjafjall!: Thingvallabraun!.

This plant is common in S. Iceland where it grows especially on shady rock-sides in the clefts and caves of tuff mountains, associated with *Metzgeria furcata*, *Madotheca Cordæana*, *Amphidium Mougeotii*, etc. The habitat of greatest altitude is near Kolvidarhol at about 400 metres above sea-level, there it grew on a rock-face associated with *Radula* and *Frullania fragilifolia*.



Besides in the tuff districts, it is also rather frequent in the lava-fields where it grows at the bottom of deep, damp clefts, but as a rule only in small quantities. Sterile specimens only have been found.

FAM. ANTHOCEROTACEÆ.

93. **Anthoceros punctatus** L.

W. Iceland: Reykholtdalur (Ho.; Grl.;!). S. Iceland: Reykirdalur!; Sydri Reykjahver!. This species was first collected by Koenig and figured in *Flora Danica*, tab. 396.

It occurs near the majority of the hot springs in Reykirdalur. It grows there abundantly on damp clay-flats with a temperature of 20°—30°, associated with *Fossombronia*, *Haplozia crenulata* and *Archidium*, especially on slopes immediately above the hot water. It almost always bears numerous capsules.

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## II. SPHAGNALES.

### 1. *Sphagnum imbricatum* (Hornsch.) Russow.

*S. Austini* Sull.

S. Iceland: Thorlákshver and Laugaráshver near Skálholt!. It grew there on the warm substratum along the outlets from the hot springs in immense yellowish-brown cushions as much as 25 cm. deep.

### 2. *Sphagnum cymbifolium* (Ehrh.) Hedw.

W. Iceland: near several hot springs in Reykholtalur!. S. Iceland: Thorlákshver!; sydri Reykjahver!; Laugarvatnshver!; Hurdarbak (H. J.!).

In all the above localities it grows on damp ground around hot springs.

### 3. *Sphagnum medium* Limpr.

NW. Iceland: Bæir!; Ármuli!. S. Iceland: Common in the district around Skálholt!. W. Iceland: Reykjavik!

The plant grows everywhere in wet bogs.

### 4. *Sphagnum papillosum* Lindb.

W. Iceland: Reykjavik!, common on boggy ground; Reykholtalur (Gr!;!), around numerous hot springs. S. Iceland: Hraun; Grimstadr (H. J.!).; Hraundalshraun (H. J.!).; Sydri Reykjahver!.

In Reykholtalur *Sphagnum papillosum* constitutes the bulk of the vegetation around the hot springs and, for instance at Deildatunguhver, covers large areas of the warm, damp ground with cushions as much as about 20 cm. deep. It appears to be rather widely distributed in S. Iceland and is found there, as near Reykjavik, on the knolls in the bogs, sometimes on a rather dry substratum.

### 5. *Sphagnum inundatum* Russow.

W. Iceland: Grundarfjörður (H. J.!). S. Iceland: Thorlákshver!; Sydri Reykjahver!.

In the two latter localities it grew along the outlets from the hot springs, near Sydri Reykjahver it grew also on the knolls in a small bog near the spring.

### 6. *Sphagnum Gravetii* Russow.

NW. Iceland: Hesteyri!.

It grew there in pools in company with a very large form of *Hypnum revolvens* v. *Cossoni*.

### 7. *Sphagnum compactum* De Candolle.

*S. rigidum* Schimp.

S. Iceland: Nuphlidarháls near Krisuvik (Stp.)!

### 8. *Sphagnum teres* (Schimp.) Ångst.

Very common everywhere on damp ground up to a height of about 600 metres above sea-level.

*S. teres* is the most commonly occurring species of this genus and is almost as frequent in the lowlands as in the Alpine region, at high levels. It grows both on knolls in bogs and on more or less damp slopes and is also common on warm ground.

It is almost always green or pale yellowish-green in colour. Forms with appressed leaves are by far the most frequent; f. *squarrosulum* (Lesq.) is met with here and there, e. g.: Esja, Akureyri, Stadr near Hrutafjörður and Laugaráshver. The walls of the chlorophyll-cells are very often distinctly papillose. Only sterile specimens have been found.

### 9. *Sphagnum squarrosum* Crome.

N. Iceland: Mývatn (Gr!.); Litlu Borgarkatlar (St.)!; Grimsey (O. D.)!. NW. Iceland: Isafjörður!; Grunnavik!; Sugandafjörður!.

In NW. Iceland it is rather common up to about 300 metres above sea-level. It grows there sometimes on knolls in bogs and sometimes on more dry ground, thus, near Isafjörður it grew in several places on slopes stretching down towards the rivers. Only sterile specimens have been found.

### 10. *Sphagnum fimbriatum* Wils.

N. Iceland: Akureyri!; Geitaskard!. NW. Iceland: Dýnjandi!; Laugarland!. W. Iceland: Ketilstadr (H. J.)!; Stykkisholmur (H. J.)!; Nordredalur in the district of Borgarfjörður!. S. Iceland: Geldingsey (H. J.)!.

This plant grows usually on very wet ground in bogs and is no doubt commonly distributed in northern and western Iceland. Thus, near Stykkisholm it was common in bogs, and also around Akureyri where it occurred abundantly up to about 400 metres above sea-level.

### 11. *Sphagnum Girgensohnii* Russow.

E. Iceland: Eskifjörður (H. J.)!; common near Seydisfjörður!. N. Iceland: common near Eyjafjörður (O. D.;!)!; Geldingafell (St.)!; Hafrardalur

(St.)!. Hvaneyrardalur (St.)!. NW. Iceland: common near Isafjörður!; Dýrafjörður!; Dýnjandi!. W. Iceland: Budir (H. J.)!; Nordredalur in Borgarfjörður!. S. Iceland: Almannagjá!; Laugarvatn!; Ingjaldshóll (H. J.)!; Heidi in Mýrdalur (H. J.)!; Seljaland!.

Commonly distributed both on knolls in bogs and on drier ground. Thus, in lava-clefts near Thingvellir, it is frequently met with on humus-covered blocks associated with *Rhacomitrium hypnoides* and *Hylocomium* spp. It is of most frequent occurrence in the lower country, but near Eyjafjörður it ascends to about 600 metres and near Isafjörður to about 400 metres above sea-level. Fruit was found in several places. It occurs especially in orthocladous forms.

### 12. *Sphagnum Russowii* Warnst.

S. Iceland: Thingvellir!.

### 13. *Sphagnum Warnstorffii* Russow.

Common on knolls in bogs and on damp ground on slopes up to a height of about 500 metres.

Reddish forms are of most frequent occurrence, violet, green and yellowish-green forms are far more rarely met with. Only sterile specimens have been found.

### 14. *Sphagnum rubellum* Wils.

Common on knolls in bogs and on wet slopes especially in the lowlands, but it also frequently ascends to about 500 metres above sea-level. Red and violet forms are frequent, green ones are rarer. Only sterile specimens have been found.

### 15. *Sphagnum acutifolium* Ehrh.

"In Islandia leg. Mörch"! N. Iceland: Hof (O. D.)!. NW. Iceland: Isafjörður!; Ármuli!. W. Iceland: Reykholtalur on warm ground (Gr!.;!); Reykjavik!; between Thingvellir and Geysir (Gr!.).

Occurs here and there on boggy ground in the lowlands and as a rule rather sparingly. Near Isafjörður it was found in a bog at an altitude of 250 metres. Only sterile specimens have been found.

### 16. *Sphagnum subnitens* Russ. et Warnst.

NW. Iceland: Bæir!; Thorvaldsdalur (St.)!. W. Iceland: Grund!; Snældubeinstadahver in Reykholtalur!; Reykjavik (H. J.;!). S. Iceland: Laugaráshver!; Borg (H. J.)!; Krisuvik (St.)!.

Found here and there in NW., W. and S. Iceland where it occurs both in bogs and along the margin of hot springs. It is frequent around Reykjavik where it was also gathered in fruit. It is as a rule pale yellowish-green in colour. Near Laugaráshver a f. *violascens* was found growing in large cushions on warm ground.

17. **Sphagnum Lindbergii** Sch.

W. Iceland: Ketilstadr among *S. fimbriatum* (H.J.)!

18. **Sphagnum riparium** Ångst.

NW. Iceland: Thoroddstadaengjar (St.)!; common in pools and in very wet parts of bogs near Jökulsfjörður!

19. **Sphagnum angustifolium** C. Jens.

N. Iceland: Akureyri!. W. Iceland: Reykholtalur near a number of hot springs!. S. Iceland: Reykirdalur!; Laugaráshver!.

This species occurs abundantly along outlets from the hot springs in deep cushions of a pale green, yellowish or light brownish-yellow colour. The leaves are distinctly wavy in all the plants from a warm substratum. Its occurrence at Akureyri is peculiar; there it grew at an altitude of about 500–600 metres on wet boggy ground as a slender, pale-green, but otherwise typical, form. Only sterile specimens have been found.

20. **Sphagnum Dusenii** C. Jens.

W. Iceland: Snældubeinstadahver in Reykholtalur!.

In the above locality it grew in large yellowish-brown tufts in warm water of a temperature of 25°, near a hot spring.

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## MUSCI VERI

## FAM. ANDREÆACEÆ.

1. *Andreæa petrophila* Ehrh.

Very common all over Iceland. In the lowlands it grows in small round cushions on blocks and on rocks in dry situations and in such localities it is often the dominant species. On mountain heights, where it is frequently met with right at the upper limit of vegetation, it often descends upon the ground, even upon damp gravelly flats, where it forms extensive cushions almost black in colour. Fruit is almost always present.

Note. *Andreæa rupestris* L. = *A. Rothii* W. M. is recorded by Mörch from Iceland and is figured in Flora Danica, tab. 2125, but Mörch's specimens must be referred to *A. petrophila*.

## FAM. ARCHIDIACEÆ.

2. *Archidium phascoides* Bridel.

W. Iceland: Reykholtalur!, near all the hot springs (Grl.;!); Englandshver!. S. Iceland: Reykirdalur!; Reykjanes (Ostf.)!; Kolvidarhol!; Thorlákshver!; Laugaráshver!; Sydri Reykjahver!; Geysir!.

*Archidium phascoides* occurs in the collections under different names. It was first collected by Grönlund and determined by Zetterstedt as *Leskea nervosa*. Afterwards this specimen with several others were re-determined by Grönlund as *Catoscopium nigratum* var. *Grönlundii* established by C. Jensen. All the plants collected by Ostenfeld from Reykjanes are determined by C. Jensen as *Pohlia nutans* v. *filicaulis*. The reason for all these erroneous determinations will be found in the fact that the plant is almost always found barren and in leaf-form and cell-tissue presents a certain resemblance to mosses belonging to quite different groups, which often leads to the belief that the specimens in question are stunted forms or have been affected by the warm substratum: thus, certain forms bear a striking likeness to a slender *Amblystegium compactum*. The plant is typical of warm clay flats, and in S. and W. Iceland it is met with around every hot spring. On the warm clay flats with a temperature of 20<sup>0</sup>—40<sup>0</sup>, it forms extensive yellowish-green mats 1—2 cm. high. On slopes stretching down towards the boiling water and along outlets from the springs it is also frequently found growing within a few centimetres from the water, usually mixed



with *Haplozia crenulata* and *Fossombronia Dumortieri*, more rarely with *Gymnocolea inflata*. It is almost always sterile; on plants from Thorlákshver flowers as well as a few ripe capsules were found, besides, here and there at the bottom of the tufts, the characteristic large spores (9. 6. 1912).

Note. *Phascum cuspidatum*, *Ephemerum serratum* and *Sphærangium muticum* are enumerated on older lists, but no specimens of these species are to be found in the collections and their occurrence in Iceland is very improbable.

#### FAM. WEISIACEÆ.

### 3. *Gymnostomum rupestre* Schleich.

E. Iceland: Geithellir!. N. Iceland: Akureyri!; Möðruvellir; Hof (O. D.)!. W. Iceland: Brynjudalur (Grl.)!; Esja!. S. Iceland: Skálholt!; Thingvellir!.

Around Eyjafjörður it is common on damp rocks up to a height of about 300 metres; it was also found in numerous localities in SW. and S. Iceland and is common, for instance in Esja. It occurs especially on damp rock-sides near waterfalls and in clefts, often forming extensive mats; now and then it is also found in dry localities. Only sterile specimens have been found.

### 4. *Hymenostylium curvirostre* (Ehrh.) Lindb.

*Barbula curvirostris* Lindb.

N. Iceland: Mývatn (Grl.)!. W. Iceland: Reykholt (Grl.)!, in both localities sparingly and also sterile. S. Iceland: Merkjáfoss (F.)!; Barkarstadr, fr.!; Holt, fr.!; Vestmannaey, fr.!

In S. Iceland the plant is no doubt common on faces of damp tuff-rocks. In several localities near Barkarstadr and Holt it occurred abundantly in clefts along rivers or in caves and in depressions in tuff rocks; it was usually richly in fruit, and associated with *Preissia comutata*, *Fegatella*, *Haplozia riparia*, etc. On "Kleven" on the island of Vestmannaey it grew on the face of a tuff rock, through which water was percolating, forming with *Haplozia riparia* large cushions which were saturated with water.

### 5. *Anoetangium compactum* Schwgr.

*Pleurozygodon æstivus* (Hedw.) Lindb.

"In Islandia" leg. Mörch! and figured in Flora Danica, tab. 1893, fig. 2, under the name of *Gymnostomum curvirostre*.

E. Iceland: Seydisfjörður, common!; Berufjörður, common!. W. Iceland: Grundarfjörður (H. J.)!; Hafnarfjörður (Grl.); Esja!; Svinahraun!. S. Iceland: very common!; Vestmannaey!.

This plant is very common in S., SW. and E. Iceland, but it does not appear to occur in N. and NW. Iceland. It grows especially on damp



rocks, e. g. on rock-sides along waterfalls and in clefts, where it forms large cushions, often almost one square metre in size, of a peculiar verdigris colour. In the lava-fields of SW. Iceland it is one of the most frequent species on the walls of caves and the sides of clefts. It hardly ascends higher than about 300 metres above sea-level. It is almost always sterile. The only fruiting specimen was collected by Mörch, but no habitat is given.

#### 6. *Weisia crispata* (Br. germ.) Jur.

SW. Iceland: Reykjavik, fr.!. SE. Iceland: Hornafjörður!; SW. Iceland: Álafoss!.

Near Reykjavik it grew in crevices of basalt rocks associated with *Encalypta rhabdocarpa* and *Bryum elegans* var. *carinthiacum*. The fruit had just ripened on June 6, 1909. Near Hornafjörður also it grew in small crevices of basalt. Only sterile specimens have been found.

#### 7. *Weisia viridula* (L.) Hedw.

S. Iceland: Vik, associated with *Brachythecium velutinum* (H. J.)!. Vestmannaey, Helgafell!, on a humus-covered block of lava.

Only sterile specimens have been found.

The species is recorded by Mörch from Iceland, but no specimens of it are to be found in the collections.

#### 8. *Weisia Wimmeriana* (Sendtn.) Br. eur.

N. Iceland: Hof near Eyjafjörður (O. D.)!, fr.

It grew there mixed with *Eurynchium diversifolium* on rocks coated with soil.

#### 9. *Dicranoweisia crispula* (Hedw.) Lindb.

Very common all over Iceland.

*Dicranoweisia crispula* is one of those species which is of equal frequency in all parts of Iceland, both at the coasts and in the highlands, and at all altitudes up to the snow-line. In the low land it grows, like *Andreaea*, on dry stones and rocks, but like the latter, it descends to the ground on mountain heights where it forms, both on the ground or on blocks of rock, dense, jet-black cushions. It is almost always found in fruit.

Note. *Dicranoweisia cirrata* is recorded by Hornemann, but has undoubtedly been confused with *D. crispula*.

#### 10. *Dicranoweisia compacta* (Schleich.) Schimp.

N. Iceland: Hof near Eyjafjörður (O. D.)!. Only sterile specimens have been found.

## FAM. RHABDOWEISIACEÆ.

11. *Cynodontium polycarpum* (Ehr.) Schimp.

Seydisfjörður (C. Hansen)!

This species together with the var. *strumiferum*, is recorded by Vahl, but has without doubt been confused with another species, probably a *Dicranum* or *Oncophorus*. Mörch also records both forms from Iceland, but of his specimens in the Botanical Museum in Copenhagen some are *Dicranum Starckeii*, and some are *Ceratodon purpureus*.

*Cynodontium gracilescens* var. *tenellum* is recorded by Carrington from Akureyri, but has undoubtedly been confused with another species.

12. *Dichodontium pellucidum* (L.) Schimp.

Very common everywhere on damp ground.

This plant is most widely distributed in the lowlands and is found there everywhere on damp ground, both in bogs and on gravelly soil along streams, and also on soil-covered rocks. In the lowlands it usually grows mixed with all kinds of other mosses in their tufts and is, as a rule, low in growth and short-leaved. On rocks near the water, where it is also frequent, more vigorous forms occur in unmixed tufts, 2—4 cm. high. At higher levels it occurs more sparingly, but is nevertheless frequently found up to about 600 metres above sea-level. Only sterile specimens have been found.

## FAM. AONGSTRÆMIACEÆ.

13. *Aongstrœmia longipes* (Sommerf.) Br. eur.

E. Iceland: Hornafjörður!; Hof!; Seydisfjörður!; Vallanes!. N. Iceland: Akureyri (O. D.;!); Husavik!; Vidimyri!; the Tverá!; Dettifoss!; Stadr near Hrutafjörður!. NW. Iceland: Armuli!. W. Iceland: Haukadal!; Lundur!; Álafoss!. S. Iceland: Breidabolstadr!; Barkarstadr!; Seljaland!.

This species is doubtless common everywhere, but is often overlooked on account of its minute size. It grows on damp ground, most frequently as single specimens scattered among other mosses; more rarely, as for instance near Hornafjörður and Breidabolstadr, abundantly on peat along ditches. Near Lundur it grew abundantly associated with *Dicranella Schreberi*, *Bryum lacustre*, *Dichodontium* and other species in places where the peat had been pared off.

In the majority of the cases the specimens were not found until the material brought home had been investigated, because in habit they exactly resemble the tiny *Pohlia*-forms of wide occurrence, or a small, sterile *Anomobryum*.

On boggy ground it was usually collected together with *Dichodontium pellucidum*, *Oncophorus Wahlenbergii*, *Mesia trichoides*, *Bryum* spp., etc. On gravelly soil near Stadr it was found associated with *Dicranella crisa*, *Didymodon rubellus*, *Blasia pusilla* and *Haplozia atrovirens* and in several places with *Distichium inclinatum*. It occurs both in the low

lands and up to 500–600 metres above sea-level. Near Akureyri it was found on a damp flat at about 500 metres. Near Barkarstadr it occurred abundantly on boggy ground at about 530 metres, and near Seljaland it was also frequent at an altitude of about 500 metres on a moss-grown gravelly flat. Only sterile specimens have been found.

#### FAM. DICRANACEÆ.

##### 14. *Oncophorus virens* (Sw.) Brid.

Very common on damp ground. It grows both on wet humus-covered rocks and in bogs, and also on damp gravelly ground, sometimes as unmixed tufts and sometimes mixed with other mosses; it is of equal frequency at all altitudes as far upwards as 600–700 metres. It often occurs in great quantities and usually fruits richly. In the lower districts the fruit ripens about July 1st. In S. Iceland this species is either wanting or rare in the lowlands up to a height of about 300 metres (it has not been found on Vestmannaey), but from this height up to the snow-line it occurs abundantly in bogs.

Var. *serratus* Br. eur. occurs occasionally on wet rocks.

##### 15. *Oncophorus Wahlenbergii* Brid.

One of the most commonly occurring mosses; it is found everywhere in damp localities just like *O. virens*. It is very common especially in bogs, except in S. Iceland where, like *O. virens*, it has its distribution from an altitude of 300 metres upwards.

Var.  $\beta$  *compactus* (Funch) Br. eur. E. Iceland: Skreiddal!; Seydisfjörður!. It grew in both localities on knolls in bogs.

Var. *elongatum* Hagen. W. Iceland: Nordredalur!. It grew there on boggy ground in association with *Sphagnum teres*, *S. rubellum* and *S. fibriatum* in loose tufts about 6 cm. high.

Although typically developed forms of *Oncophorus Wahlenbergii* and *O. virens* differ so widely from each other that they are not likely to be confused, yet so many transitional forms occur, especially in Alpine habitats, that very often it is a matter of opinion to which species such a form should be referred. On the same plant leaves may be found which, as regards the cells of the leaf-base, resemble sometimes *O. Wahlenbergii* and sometimes *O. virens*; also the leaf-margin is more or less recurved or plane.

##### 16. *Dicranella squarrosa* (Starke) Schimp.

E. Iceland: Seydisfjörður!; Skorastadr (H. J.)!. N. Iceland: Husavik!; near Eyjafjörður (O. D.;!), fr.; Lækjarmot!. NW. Iceland: Very common!. W. Iceland: Vögur (H. J.)!; Esja!; Reykholtalur!. S. Iceland: Holt!.

This plant grows almost always in water, especially on inundated gravelly ground by streams, on stones and in moss bogs, more rarely on wet marshy ground. In NW. Iceland it is one of the mosses of most frequent occurrence being found in abundance associated with

*Philonotis seriata*, *Oncophorus Wahlenbergii*, *Scapania uliginosa*, *Haplozia cordifolia* and *Chiloscyphus polyanthus* var. *fragilis* on inundated gravelly ground up to about 300—400 metres above sea-level. In N. Iceland it is also rather common. Near Seydisfjörður it was found only at a height of about 300 to 500 metres above sea-level, but was common there in small streams associated with *Scapania undulata*, *Hypnum exannulatum*, *Haplozia cordifolia*, etc. In Reykholtalur this species was found in several places near hot springs, even on stones in warm water with a temperature of 30°. In SW. and S. Iceland it occurs rarely and more sparingly; near Holt it grew in several places at an altitude of 150—600 metres.

The plant is almost always found sterile. One specimen collected by O. D. near Hof in Eyjafjörður (12. 6. 1897) bore a few capsules which had thrown off their lids. The ♂ plant was found only near Bæir in NW. Iceland growing in low tufts, about 1 cm. high.

### 17. *Dicranella Schreberi* (Sw.) Schimp.

*Anisothecium crispum* (Schreb.) Lindb.

N. Iceland: Hof near Eyjafjörður (O. D.)!; Akureyri ♀!. W. Iceland: Lundur!.

Near Akureyri it grew in damp, peaty ground immediately north of the town and near Lundur, associated with *Bryum lacustre*, *Aongstromia longipes* and *Dichodontium pellucidum*, on a wet flat from which the peat had been pared off.

### 18. *Dicranella crispa* (Ehrh.) Schimp.

Very common on damp ground, both on peat and on sandy or gravelly soil by streams. It occurs only in the lowlands, and has hardly been found higher than at an altitude of about 200 metres. Fruit is always present in abundance and ripens about August 1st. At this time also the setæ of the capsules of the ensuing year have reached their full length.

Note. *Dicranella heteromalla* is recorded by Zoëga and Hornemann from Iceland, but was undoubtedly confused with another species.

### 19. *Dicranella subulata* (Hedw.) Schimp.

*Dicranella secunda* (Sw.) Lindb.

Iceland (Mörch)!, some of the specimens are correctly determined, some must be referred to *Ditrichum homomallum*. Krisuvik (Stp.)!. N. Iceland: Husavik!. NW. Iceland: Kaldalon!; Gnupsdalur near Dýrafjörður!. Moreover, Grönlund records it from Hvammur and Thingvellir, but both specimens are wrongly determined, being *Dicranella crispa* and *Dicranum Blyttii*.

This species was collected in small quantities only, but everywhere in fruit. Near Husavik it grew on peat, and on July 11, 1909 it bore

both quite young capsules and also old lidless capsules. In Gnupsdalur it grew along the banks of streams with *Scapania subalpina* and *Cephalozia bicuspadata*.

## 20. *Dicranella cerviculata* (Hedw.) Schimp.

Iceland: (Mörch)!. NW. Iceland: Stadr on Snæfjallaströnd (Stp.)!; Dýnjandi!. W. Iceland: Borgarnes!; Kollafjörður!; Reykjavík (Gr!.)!. S. Iceland: Thjorsá (Stp.)!.

The plant was found everywhere in fruit. Near Borgarnes and Reykjavík the fruit was almost ripe at the beginning of August. It grows on peat, especially on the rather dry margins of turf pits and ditches and occurred abundantly especially in several places near Reykjavík.

## 21. *Dicranum fulvellum* (Dicks.) Sm.

Collected in Iceland by Mörch (no doubt near Middalur) and figured in Flora Danica, tab. 2002, under the name of *D. Mörchianum* Hornsch. S. Iceland: Holt!; Seljaland!; Thingvallahraun!. SW. Iceland: Svinahraun!.

This species is recorded by Grönlund from Svinaskard and Thingvalla, but the specimens from both localities are wrongly determined, being really *D. falcatum* and *D. Blyttii* respectively.

*Dicranum fulvellum* has been only found in the south-western part of Iceland, where it appears to be frequent. In Svinahraun, where the altitude hardly exceeds 300 metres, it was found rather sparingly (June 3rd) on the top of lava-blocks, in fruit which was almost ripe. On Eyjafjall it occurred in several localities above Holt and Seljaland at an altitude of 300–700 metres. It grew either on blocks of basalt or more rarely on gravelly ground in company with *Gymnomitrium concinatum*. At the end of July the fruit was ripe everywhere, and generally the capsules had thrown off their lids.

## 22. *Dicranum Andersonii* (Wich.) Schimp.

SE. Iceland: Hof!; coastal cliffs near Alftafjörður!. S. Iceland: Holt!; Vestmannaey!; Thingvellir!.

Near Hof it occurred rather commonly on low basalt ridges, where it usually grew in crevices in small cushions about 3 cm. high. Here the fruit had just ripened on June 15th and the lids still persisted. Near Holt it was found rather frequently on tuff rocks up to a height of about 300 metres. Thus, it grew abundantly, for instance on the vertical northern face of a tuff rock sometimes in small tufts, sometimes mixed with *Grimmia apocarpa*, *Pogonatum urnigerum*, *Pohlia grandiflora*, *Anthelia nivalis* and *Gymnomitrium concinatum*. On Vestmannaey the plant grew abundantly on blocks of lava lying on the slope of Helgafell. It occurred there everywhere in small scattered tufts associated with *Grimmia apocarpa*, *Rhacomitrium sudeticum*, *R. fasciculare* and *Andreea petrophila*. The fruit was ripe on July 5th; a few had thrown off their lids.



In Iceland *Dicranum Andersonii* is a decidedly lowland plant, which is probably widely distributed in the southern and south-eastern parts of the country. It occurs especially near the coast; in the interior of the country it has been found only near Thingvellir, where it grew very sparingly on a lava block in company with *D. fulvellum*, which it resembles in the fact that the peristome teeth are wide-spreading when dry. *Dicranum Andersonii* is however easily distinguished by its shorter seta and by the extremely thick-walled cells of the capsule-walls and by the absence of stomata.

### 23. *Dicranum falcatum* Hedw.

E. Iceland: Lonsheidi!, at an altitude of about 400 metres; Berufjörður!. N. Iceland: Ljosavatnsberg!. NW. Iceland: Dýrafjörður!; Isafjörður!. W. Iceland: Snæfellsnes: Saxarhol (H. J.)!; Frodarheidi (H. J.)!; Reynivellir (Gr!.)!; Svinaskard (Gr!.)!; Kolvidarhol!; Esja!. S. Iceland: Holt!; Seljaland!. The plant is recorded by Mörch from Iceland and figured in *Flora Danica*, tab. 2003, but Mörch's specimens in the Botanical Museum in Copenhagen belong to *Dicranoweisia crispula*.

*Dicranum falcatum* is a plant characteristic of the damp gravelly flats of mountain heights, where it often occurs abundantly in large, compact, rounded cushions in the neighbourhood of patches of snow. Usually it is not met with until an altitude of about 600 metres; near Kolvidarhol, however, it was common even at an altitude of about 400 metres. This species is very common in NW. and in S. Iceland and occurred also abundantly on Ljosavatnsberg. It is probably common everywhere on mountain heights, but, as for instance in E. Iceland, it has only been collected scantily, as its habitats are snow-covered in June when that part was explored.

The fruit, which is always present abundantly, ripens about the middle of July.

### 24. *Dicranum Blyttii* Schimp.

*Dicranum Schisti* (Gunn.) Lindb.

E. Iceland: Hamarfjörður!. N. Iceland: Reykjaheide!; Vidvik (P. S.)!; Hof (O. D.)!. NW. Iceland: Patreksfjörður (Wiinstedt!); Gláma (St.)!, common on mountain heights!. W. Iceland: Øxarrhyggur!; Svinahraun!; Hafnarfjörður!. S. Iceland: Seljaland!, from an altitude of 350 metres upwards; Holt!, common on mountain heights; Thingvallhraun!.

This species is common, at any rate in NW. and SW. Iceland, while it has been found but scantily in E. Iceland and only in a few localities in N. Iceland. But the same is probably the case here as mentioned for *Dicranum falcatum*, that its habitats, at the time when E. Iceland was explored (June 1909), were covered with snow.

*Dicranum Blyttii* belongs to the Alpine region and is not met with until an altitude of 300—400 metres. Near Hamarfjörður, however, it grew in the lowlands on rocks near the coast. It grows partly on stones and partly on gravel, and is especially frequent at a height of 600—800 metres, both on gravelly flats soaked by the melting snow,

and on scattered blocks of rock. It often forms there extensive, blackish-green or almost black cushions, 2—3 cm. deep.

In lava-fields it occurs associated with several other Alpine species at the bottom of ravines, as on Reykjaheide (at an altitude of about 300 metres), in Thingvallhraun, where it was rather common on fallen blocks in ravines (Gjá), and near Hafnarfjörður, where it was also rather frequent in lava-clefts. In Svinhraun it grew abundantly on damp ground in a large depression at the edge of the lava-field.

The leaves usually spread erectly, more rarely, for instance in plants from Thingvellir, they are secund. The fruit ripens almost at the same time on mountain heights and in the lava-fields, viz. at the end of July. Near Thingvellir it was found on July 29th with fully ripe capsules, some of which had thrown off their lids.

## 25. *Dicranum Starckeii* Web. et Mohr.

“In Islandia” (determined by Mörch as *Dicranum polycarpon*).

Widely distributed all over Iceland.

This species is most widely distributed on damp gravelly flats from an altitude of about 400 metres upwards to the snow-line and is often there, especially from about 400—600 metres, the most abundant constituent of the vegetation, growing in extensive, continuous mats, 2—3 cm. deep. It occurs however also on stones and damp rocks. It is found more scantily in the more low-lying parts of the country, although, especially in NW. and N. Iceland, it is frequent, mixed with other mosses, on gravelly ground by streams. In the southern part of the country it does not appear to descend to a lower level than 300—400 metres.

Like *Dicranum Blyttii* this species grows also in lava-clefts, and it was common on fallen blocks both near Hafnarfjörður and Thingvellir. The plants from these localities were often 5—6 cm. high, with longer leaves, in which feature they approached very closely to *D. molle*.

The direction of the leaves varies considerably, orthophyllous forms are the most frequent, especially on the ground; highly drepanophyllous forms occur more particularly in drier localities, for instance on rocks.

Fruit is almost always present. The majority of the specimens collected (June—July) had old, empty capsules, and also young green ones or half-ripe ones which probably ripen late in the summer.

## 26. *Dicranum molle* Wils.

*D. arcticum* Schimp. *D. glaciale* Berggr.

E. Iceland: Seydisfjörður!, at an altitude of about 200 metres. N. Iceland: Akureyri!. NW. Iceland: Dýrafjörður!; Sugandafjörður!; Isafjörður!; Kaldalon!; Dýnjandi!. W. Iceland: Snæfellsnes, Mafahlid (H. J.)!, at an altitude of about 300 metres; Budahraun (H. J.)!; Dalasysla, Vighólsstadir (H. J.)!, 550 metres alt.; Olafsvig (Mörch)!; Svinaskard (F.)!; Esja, Mödruvellir!. at an altitude of about 450 metres; Hafnarfjörður!. S. Iceland: Thingvallhraun!.

This species is also recorded from several localities by Grönlund,



but the specimens in the Botanical Museum are wrongly determined; most of them must be referred to *D. Starckeii* or *D. angustum*.

*Dicranum molle* usually grows on damp gravelly ground on mountain heights. In NW. Iceland it is one of the most commonly occurring mosses on rocky flats, and is common down to about 200 metres above sea-level; but also frequently descends as far down as the bottom of the valley. It grows both on gravelly flats soaked by melting snow and on damp slopes; also on lower levels on heathy soil, with other *Dicranum* spp. (*D. scoparium* and *D. fuscescens*), among *Vaccinium*, *Empetrum*, etc., in large tufts which are usually closely interwoven with *Lophozia lycopodioides*, *L. Kunzeana*, *L. quinquedentata*, *L. Floerkei*, *L. ventricosa* and other Hepaticæ. Near Möðruvellir it grew partly on damp gravelly ground, partly intermixed in abundance in *Racomitrium hypnoides*-heaths; in this latter locality also it was mixed with *Lophozia* spp.

In lava-fields it usually grows in company with *D. Starckeii*, commonly, as for instance in the clefts near Thingvellir, in cushions as much as 10 cm. deep. The plants from the latter locality and from Hafnarfjörðurhraun are sometimes not quite typical and approach so closely to *D. Starckeii*, that they can hardly be distinguished. The leaves are sometimes orthophyllous, sometimes drepanophyllous. The fruit, which is always present abundantly, ripens during July. In the district of Isafjörður, however, ripe fruit was frequently found as early as in the latter days of June.

## 27. *Dicranum Bonjeani* de Not.

*D. palustre* Br. eur.

SE. Iceland: Hornafjörður!; Lon!. N. Iceland: near Eyjafjörður (O. D.)!. W. Iceland: Dalasysla: Ketilstadr (H. J.)!; Reykholtalur (Grl.)!; Reykjavik!.

The plants from all the above-mentioned localities agree exactly with *D. Bonjeani*, but being quite sterile they cannot be determined with perfect certainty. Bog-forms of *Dicranum scoparium* have often erect leaves, slightly undulate at the apex, and are then extremely difficult to distinguish from *D. Bonjeani*. This species grows in bogs, usually on knolls, and is common around Reykjavik and near Hornafjörður.

Note. In several older lists *Dicranum undulatum* is enumerated as found in Iceland by Mörch and is also recorded by Grönlund from Reykholt and Reykjavik, but all the specimens in the herbaria must either be referred to *D. scoparium* or *D. palustre*.

## 28. *Dicranum angustum* Lindb.

E. Iceland: Hornafjörður!; Berufjörður!; Lon!; Hof!. N. Iceland: Mývatn (Grl.; determined as *D. arcticum*)!; Stadr near Hrutafjörður!. NW. Iceland: Dýnjandi!. W. Iceland: Stykkisholmur!; Reykjavik!. S. Iceland: Asolfskálaheidi near Holt!, at an altitude of about 400 metres.

This species is no doubt widely distributed over the whole of Iceland; it is, at any rate, rather common in E. and SW. Iceland, where

it often occurs abundantly. It grows on wet boggy ground in loose tufts as much as 6 cm. high, either pure or mixed with *Sphagna* and *Hypnum stramineum* and interwoven with Hepaticæ such as *Lophozia quinquedentata*, *Scapania irrigua*, *Cephalozia pleniceps*, etc. Only sterile specimens have been found.

This species is most widely distributed in the lowlands and has only once been collected at an altitude of 400 metres on Asolfskálaheidi, where it grew plentifully in a bog.

Hagen (*Musci Norv. Borealis*, p. 22) states that *D. angustum* differs from all nearly allied species, and especially from *D. scoparium*, in having thin-walled cortical cells; but this distinction does not suffice as regards bog-forms of *D. scoparium* as in the latter species all transitional stages are found from the thin-walled, hyaline cortical cells of plants from wet ground to the thick-walled, brown cells of xerophilous forms.

### 29. *Dicranum majus* Smith.

NW. Iceland: Dýrafjörður!; Sugandafjörður!; Isafjörður!. W. Iceland: Neshraun (H. J.)!; Budabraun (H. J.)!.

In the two habitats in W. Iceland, both of them on Snæfellsnes, the plants were collected in depressions in the lava-field. In NW. Iceland, where it is commonly distributed, it grows on the ground on slopes covered with birch coppice, *Vaccinium*, etc., as far upwards as about 300 metres above sea-level.

The majority of the plants collected have slightly secund leaves and entirely resemble *D. scoparium* in habit. A vigorous form with strongly falcate leaves was found in a birch coppice near Dýrafjörður at an altitude of about 150 metres. Only sterile specimens have been found.

### 30. *Dicranum scoparium* (L.) Hedw.

Very common.

*D. scoparium* is most widely distributed in the more low-lying parts of the country up to a height of about 400—500 metres, but also ascends frequently to about 700 metres above sea-level. In S. Iceland it appears to be more rare and, as for instance on Fljótshlid and south of Eyjafjall, was only found in a few localities and very scantily. It grows both on rather dry and on damp ground, and also on rocks and on knolls in bogs, and varies considerably. Orthophyllous forms are the most common, especially on damp ground, while more or less distinctly drepanophyllous forms grow by preference in dry localities, for instance in lava-fields and on rocks. In bog-forms the leaves are slightly undulate at the apex, in which feature it approaches *D. Bonjeani*. The leaf-apex, especially in orthophyllous forms, is usually short and broad, and faintly toothed, or even quite entire, at the margin, at the same time the lamellæ on the back of the leaves develop more slightly or disappear almost entirely. Such forms agree well with var. *integrifolium* Lindb.

Fruit is found rather rarely; in Nordredalur it was fully developed on August 2nd, but was still green.

31. *Dicranum fuscescens* Turn.

Iceland (Wiinstedt, determined by Berggren as *D. Scottianum*). NW. Iceland: very common!. W. Iceland: Nordredalur!.

In NW. Iceland *D. fuscescens* is the most frequently occurring species of this genus and is very common from the bottom of the valley up to a height of 400—500 metres. It is most widely distributed from about 100 to 300 metres on somewhat damp slopes covered with *Vaccinium-Empetrum* heath, where it often constitutes the bulk of the Bryophyte vegetation in association with *D. molle*, *D. scoparium* and occasionally, *D. majus*. It is also common on the top of knolls in bogs. The densely matted tufts, which are as much as 10 cm. high, are almost always interwoven with Hepaticæ, especially *Lophozia* spp., *Cephalozia pleniceps*, *C. bicuspidata* and *Plilidium ciliare*. In Nordredal it was growing in birch coppices in company with *Hylocomium* spp.

The fruit, which occurs rather frequently, was quite green even in the beginning of July.

All the Iceland specimens differ from the typical form and, more or less, especially approach *Dicranum congestum* without, however, forming any real transitional form to the latter. As a rule the leaf-nerve occupies about  $\frac{1}{4}$  the width of the leaf-base, but occasionally  $\frac{1}{5}$ — $\frac{1}{6}$  only. The cells of the leaf-apex are usually quadrate or roundish, mixed with numerous ones that are irregular in form; rarely, in the main, shortly rectangular, in which feature it approaches var. *angustifolium* Arn. et Jensen; most frequently arranged more or less distinctly in rows; papillose at back, more rarely almost smooth, but in the same tuft or even on the same stem rather considerable variations occur as regards the development of the cell-tissue and the papillæ of the leaves.

32. *Dicranum congestum* Brid.

Very common in E. and N. Iceland and probably also in W. Iceland, somewhat rarer in S. Iceland. It appears to be quite absent from NW. Iceland and to be replaced there by *D. fuscescens*.

It grows both on a dry and on a somewhat damp substratum, on earth and humus-covered stony slopes and on the top of knolls in bogs, and extends as far upwards as to the snow-line, for instance near Akureyri up to about 900 metres above sea-level. In S. Iceland it has not been found in the low land, but plentifully in several places on the rocky flat, for instance near Barkastadr, 500 metres above sea-level.

Var. *subspadicum* Arn. et Jensen occasionally occurs in localities similar to those of the type, but transitional forms are of more frequent occurrence.

Var. *flexicaule* (Brid.) Br. eur. N. Iceland: Ljosavatn!. in *Betula-nana* heath; Hof (O. D.)!.

Only sterile specimens have been found.

*Dicranum congestum* is so variable a species that it is hardly possible to find two plants which are exactly alike. The nerve occupies  $\frac{1}{6}$ — $\frac{1}{10}$  the width of the leaf at its base, usually  $\frac{1}{8}$ — $\frac{1}{9}$ . The leaf-cells

are irregular in form more or less far down the leaf, sometimes far below the middle, sometimes only at the leaf-apex itself; slightly or hardly porose, occasionally strongly porose in the lower half of the leaf, more rarely to near the apex, in the last case the walls are strongly incrassate.

*Dicranum brevifolium* Lindb. is recorded from Vatnsdalsfjall (Grl., Tillæg til Islands Kryptogamflora, Bot. Tids., 20), but the plant from the latter locality is only a form of *D. congestum* in which the irregularly shaped cells are strongly incrassate and extend down below the middle of the leaf. Such forms, which, as a rule, are also distinguished by very strong nerves, have been found in several localities, for instance near Berufjörður and about Eyjafjörður. The true *D. brevifolium*, which is distinguished by its shorter leaves, crisped when dry, and its thin-walled cells, which are in a great measure quadrate and in rows, has not been found in Iceland.

### 33. *Dicranum spadiceum* Zett.

W. Iceland: Hvitidalur (H. J.)!. E. Iceland: Hornafjörður!; Seydisfjörður!. N. Iceland: Hof (O. D.)!; Vatnsdalsfjall (St.)!.

Grows on a damp substratum, especially on knolls in bogs. Only sterile specimens have been found.

### 34. *Dicranum elongatum* Schleich.

"In Islandia" Mörch! (fr.). N. Iceland: By Hrutafjörður!. NW. Iceland: Dýnjandi!; Hesteyri!. W. Iceland: Stykkisholmur!. This species is also recorded from some localities by Grönlund, but the specimens in the collections are wrongly determined, being *D. Starckeii*, and others.

*D. elongatum* grows everywhere on wet, boggy ground. By Hrutafjörður it was common on knolls in bogs along the eastern side of the fjord from Stadrakki to Stadr, and it was also frequent in bogs near Stykkisholmur.

All the specimens collected were quite typical. The nerve was about  $\frac{1}{4}$  the width of the leaf at its base. With the exception of the specimen found by Mörch only sterile specimens have been collected.

Note. According to Gliemann, *Dicranum montanum* was found in Iceland by Mörch, but no specimens of it are to be found in the collections, and the record of this species is undoubtedly due to an erroneous determination.

### 35. *Campylopus Schimperii* Milde.

N. Iceland: Geitaskard!. E. Iceland: Hornafjörður!; Lon!; Berufjörður!. W. Iceland: Reykjavik!; Esja (Grl.)!. S. Iceland: Breidabolstadr!.

Commonly distributed in South-western and South-eastern Iceland on damp ground in bogs, where it forms compact cushions, 2—3 cm. deep. It has only been found in the low land.

36. **Campylopus flexuosus** (L.) Brid.

N. Iceland: Mývatn (GrI.)!; Reykir near Svinavatn (GrI.)!. W. Iceland: Near hot springs in Reykholtdalur: Deildatunguhver (GrI.;!) ; Skribla (GrI.)!; Hagindishver!, etc.

This species has been found only on steaming clayey flats near hot springs in North and West Iceland. In Reykholtdalur it is frequent on a warm substratum, and was found, for instance near Deildatunguhver, in large mats, about 2 cm. deep, on warm clayey flats with a temperature of about 40° just below the surface.

37. **Campylopus fragilis** (Dicks.) Br. eur.

S. Iceland: Laugaráshver near Skálholt.

It grew there on warm clayey flats close to the outlet from the spring.

38. **Trematodon ambiguus** (Hedw.) Hornsch.

W. Iceland: near Borgarnes!.

It grew there rather scantily on damp peaty soil by the road, in company with *Bryum inclinatum*, *Pogonatum nanum*, *Scapania curta*, etc. The fruit had just ripened on Aug. 2nd, but the lids had not been thrown off.

Note. *Leucobryum glaucum* is recorded by Vahl and Hornemann as found in Iceland, but neither the name of the finder nor the habitat is given. No specimens of this species are to be found in the collections.

## FAM. FISSIDENTACEÆ.

39. **Fissidens bryoides** (L.) Hedw.

N. Iceland: Hof near Eyjafjörður (O. D.)!. S. Iceland: Krokur (H. J.)! Almannagjá!.

In Almannagjá it grew very scantily among other mosses on soil-covered stones at the bottom of a lava-cleft. Near Hof it grew on damp ground by a waterfall. The fruit, on the specimens from both localities, was ripe when collected (June 12).

40. **Fissidens osmundoides** (Sw.) Hedw.

Common on damp ground in bogs, at the base of rocks, in rock-clefts, etc., sometimes in low, dense tufts, sometimes mixed with other mosses. The plants are almost always found sterile. Only in Reykholtdalur, where it grows very abundantly on warm, boggy ground, has it been collected in fruit. It is most widely distributed in the lowlands up to about 300 metres above sea-level, but it may occur, although scantily, as high as about 500–600 metres.



41. **Fissidens adianthoides** (L.) Hedw.

N. Iceland: Hof near Eyjafjörður, fr. (O. D.)!. W. Iceland: Kleppjarnsreykir (Grl.); Laugarnir near Reykjavik (Grl.)!; bog near Reykjavik, fr.!; Kollafjörður!

Rare and scanty on boggy or warm ground.

Note. *Fissidens taxifolius* is recorded by Zoëga and Hornemann from Iceland (without finder, habitat or specimens in the collections) and by Grönlund from Mývatn; but Grönlund's specimen belongs to *F. osmundoides*.

42. **Fissidens decipiens** De Not.

W. Iceland: Sandur (H. J.)!; Hafnarfjörður!.

This plant grew in both localities in lava-clefts, associated with *Lejeunea serpyllifolia*.

## FAM. SELIGERIACEÆ.

43. **Blindia acuta** (Huds.) Br. eur.

Very common on wet rocks in or by rivers and waterfalls up to about 400—500 metres above sea-level, occasionally also on the ground and often in great abundance. The fruit, which is almost always present, ripens in the beginning of July.

At a greater altitude it occurs more scantily, but may nevertheless be met with as far upwards as 600—700 metres.

## FAM. DITRICHACEÆ.

44. **Ceratodon purpureus** (L.) Brid.

Common on rocks, lava-flats, sandy soil, peat, etc. especially in N. and NW. Iceland, and on lava-flats in the interior of the country. It is less frequent in E. and S. Iceland. The fruit, which is usually present, ripens in the first half of July.

It varies considerably, especially in leaf-form. Forms with shortly pointed or almost obtuse leaves (var. *brevifolius*) are the most frequent.

45. **Ditrichum tortile** (Schrad.) Lindb.

E. Iceland: Seydisfjörður!, sterile.

It was growing there on damp gravelly soil along a river, interspersed in a Hepaticæ-mat formed by *Alicularia scalaris*, *A. geoscypha*, *Anthelia Juratzkana*, *Lophozia ventricosa*, etc.

46. **Ditrichum nivale** (C. M.) Limpr.

E. Iceland: Berufjardarskard!, at an altitude of about 500 metres, fr.

The plant was growing very scantily in a cushion of *Anthelia Juratzkana*.



The entire height of the plant was about 6 mm. The seta was about 5 mm. high. The capsules were, without the lid, about 0.5 mm. long.

#### 47. *Ditrichum homomallum* (Hedw.) Hampe.

Fl. Dan. tab. 2688, ex Islandia leg. Mörch. E. Iceland: Vestdalur near Seydisfjörður!, sterile. N. Iceland: Hof near Eyjafjörður (O. D.)!, sterile. W. Iceland: Reykjavík (GrL.!), fr.; hot spring near Grafarbakki (F.)!, sterile; Hafnarfjörður, at the bottom of a lava cave!, sterile. S. Iceland: Geysir! ♀.

Around Reykjavík it was rather common along the side of ditches. There the fruit was ripe on August 7th. Near Geysir it occurred in extensive mats, about 1—2 cm. deep, on warm clayey flats with a temperature of 35—40°.

#### 48. *Ditrichum flexicaule* (Schleich.) Hampe.

One of the most commonly occurring mosses; it is met with on almost every substratum and at all altitudes. It grows both on damp or soil-covered rocks and in bogs, where it especially occurs woven into the tufts found there, and on damp or on more dry gravelly soil, in lava caves, in grass fields, in heaths, etc.

This species varies considerably, especially as regards the length and direction of the leaves. Short-leaved forms (*f. brevifolia*) are frequent on more dry ground, where they form dense tufts with stiffly erect or slightly secund leaves. On damp ground and especially in sheltered localities, for instance among stones, or in clefts, the leaves become longer, often strongly secund, and the tufts higher and looser. Fruit it very rare. Near Seydisfjörður, in the beginning of July, the setæ had not developed to their full length and the capsules were barely formed.

#### 49. *Sælania cæsia* (Vill.) Lindb.

*Ditrichum glaucescens* (Hedw.) Hampe.

E. Iceland: Breiddalur!; Hallormstadr!. N. Iceland: Vidimýri (GrL.)!; several places near Eyjafjörður (O. D.!). W. Iceland: Husafell (GrL.)!; Kalmanstunga (GrL.)!; Gilsbakki!; Hafnarfjörður!; Esja!. S. Iceland: Skálholt!; common near Thingvellir!.

This species is rather common, especially in W. and SW. Iceland, in soil-filled rock and lava clefts, as a rule associated with *Mnium orthorrhynchum*, *Plagiothecium Roeseanum*, *P. pulchellum*, *Pohlia cruda*, *Distichium montanum*, etc.

In the wood by Hallormstadr it was growing on the ground in company with *Bartramia ityphylla*, *Pohlia cruda*, *Distichium inclinatum* and *Ditrichum flexicaule*. The fruit, which is almost always present, ripens in the middle or at the end of June. The plant has not been observed at a higher altitude than about 200—300 metres.

### 50. *Distichium montanum* (Lam.) Hagen.

*Distichium capillaceum* (Sw.) Br. eur.; *Swartzia montana* (Lam.) Lindb.

Very common all over Iceland.

*Distichium montanum* is one of the most widely distributed mosses in Iceland. It is found everywhere on almost every kind of substratum, with the exception of that which is very wet, from the bottom of the valley up to a height of about 500—600 metres above sea-level. At greater altitudes it is more rare, but may nevertheless be met with as far upwards as to the snow-limit, in sheltered localities among stones.

This species has its main distribution in the more low-lying regions where, either intermixed with other species or in unmixed tufts, it is hardly absent from any cleft or soil-filled rock-crevice, but it also occurs everywhere intermixed in the moss-covering at the bottom of grass-fields, in bogs, on rocks, etc.

The fruit, which is almost always present, ripens in the latter half of July.

### 51. *Distichium inclinatum* (Ehrh.) Br. eur.

*Swartzia inclinata* Ehrh.

E. Iceland: Vallanes!. N. Iceland: Near Dettifoss!; Husavik!; Hof near Eyjafjörður (O. D.)!; Öxnadalur!; Vidimýri!. NW. Iceland: Gnupsdalur in Dýrafjörður!.

It was also collected by Steenstrup, but no habitat is given. Grönlund records this species from Hafnarfjörður, but the specimens in the Botanical Museum belong to *Distichium montanum*.

This plant was only found in the northern half of Iceland, where it occurred in many places from Vallanes in the east to Dýrafjörður in the north-west, and especially in North Iceland proper. It grows as a rule on damp ground, although not very abundantly, for instance along streams, associated with *Dichodontium*, *Didymodon rubellus*, *Hepaticæ*, etc. Near Vidimýri it was growing along the banks of streams, mixed with *Scapania curta*, *Lophozia Mülleri*, *Haplizia atrovirens*, *Dichodontium* and *Bryum pallens*; near Dettifoss on glacier-sand, in company with *Ceratodon purpureus* and *Aongstræmia longipes* and near Husavik on damp sandy soil, with *Aongstræmia*, *Dichodontium* and *Philonotis tomentella*. In several places it was collected on peaty soil in association with *Meesia trichoides*, *Caloscopium nigratum*, *Barbula rubella*, *Aongstræmia*, *Lophozia Wenzelii*, etc.

In North Iceland proper the fruit was almost ripe at the end of July.

### 52. *Bryoxiphium norvegicum* (Brid.) Mitten.

*Eustichium norvegicum* Br. eur.

S. Iceland: Krisuvik (Mörch)!; Thingvellir (Mörch)!; glacier originating from the Jökul (Stp.)!; Kolvidarhol!; Flokastadagil!; Barkarstadr!; Drángshlid!.

This species was only found in the south-western part of the

country, where it is common in many places and often occurs in enormous quantities. Mörch records that it grows in holes in the lava. Near Kolvidarhol it was found everywhere on tuff, from the farm (at about 250 metres) up to about 450 metres above sea-level; it was found in extensive mats, especially on the vertical or overhanging sides of the tumbled-down blocks, and in the interior of holes and clefts. It was most frequent on Fljótshlid and south of Eyjafjall. There it was growing in many places on the vertical sides of tuff-rocks in the ravines and on the fallen blocks, for instance in Flokastadagil near Breidabolstadr it covered long stretches of the perpendicular sides of a ravine, from a distance of a few cm. above the water-level of the river upwards, with a dark-green closely adhering mat in which almost no other mosses were intermixed. In this part of the country it has only been met with up to about 100 metres above sea-level. Only sterile specimens have been found.

*Bryoxiphium norvegicum* is the only Iceland moss which does not occur on the European continent or in the British Isles. Outside Iceland it has only been known to occur in a few localities in North America (Ohio, Kentucky and Wisconsin).

#### FAM. POTTIACEÆ.

##### 53. *Pottia Heimii* (Hedw.) Br. eur.

Iceland (Mörch)!

E. Iceland: Hornafjörður!. N. Iceland: near Eyjafjörður (F.)!; Saudanes (St.)!; Grimsey (O. D.)!. NW. Iceland: Ármuli!. W. Iceland: Reykjavik (Gr.)!; Borgarnes!. S. Iceland: Vestmannaey!.

This species grows on sandy or muddy soil near the sea, and is probably commonly distributed along the whole coast in such localities. Around Reykjavik, on Vestmannaey and near Hornafjörður it was common, and was frequently found also on soil-covered rocks and in rock-clefts close to the sea.

The fruit ripens about July 1st; on Grimsey the fruit was fully ripe on July 14th, but the lids had not been thrown off. Near Ármuli it was hardly ripe during the first days of July.

##### 54. *Pottia latifolia* (Schwägr.) C. M.

N. Iceland: Hof near Eyjafjörður (O. D.)!; Ós (O. D.)!, with ripe capsules on June 17th.

Note. *Pottia truncatula* and *P. lanceolata* are enumerated in older lists as found in Iceland, but no specimens of these species are to be found in the collections, and their occurrence in Iceland is very improbable.

##### 55. *Didymodon rubellus* (Hoffm.) Br. eur.

*Barbula rubella* (Hoffm.) Mitten.

Very common everywhere on a more or a less damp substratum, in rock-clefts, on the ground, on rocks and gravelly soil by rivers, in bogs, etc. It grows sometimes in unmixed tufts and sometimes inter-

mixed with other mosses, and as a rule sets fruit, which ripens late in August or early in September. It is most frequent in the low land up to about 300 metres above sea-level, but is also met with, although scantily, and often sterile, as far upwards as to the mountain heights, for instance on Isafjardarheidi, about 600 metres above sea-level.

Forms which must be referred to var. *brevifolia* Lindb. et Arnell occur commonly together with transitional forms to the type. Near Seydisfjörður the variety was found abundantly in reddish brown, dense tufts, about 5 cm. high, in rock-fissures filled with soil.

Note. *Didymodon tophaceus* is recorded by Lindsay from Iceland, but no specimens are in the collections and the record is probably due to an erroneous determination.

### 56. *Didymodon rufus* Lorentz.

E. Iceland: Stafafell!; Geithellir!. N. Iceland: Stadr near Hrutafjörður!; Akureyri, at an altitude of 900 metres!. W. Iceland: Lundur! Breidabolstadr in Reykholtdalur!.

The plant, which was only found sterile, grew in all the above localities in loose tufts, a few cm. high, on damp gravelly ground, as a rule rather scantily. Near Akureyri it grew scantily among *Sphaerocephalus turgidus* and *Rhacomitrium hypnoides*.

### 57. *Leptodontium flexifolium* (Dicks.) Hampe.

N. Iceland: Grimsey (O. D.)! (f. *compacta*).

Enumerated in Lindsay's list, but neither the name of the finder nor the habitat is given.

### 58. *Trichostomum littorale* Mitten.

*Mollia littoralis* (Mitten) Braithw.

S. Iceland: Helgafell on Vestmannaey, on blocks of lava!; Hafnarfjörður, in a lava cave!; on warm clayey flats near Reykjanes light-house (Ostf.)!, associated with *Preissia*, *Riccia* and *Archidium*.

### 59. *Tortella inclinata* (Hedw.) Limpr.

*Mollia inclinata* (Hedw.) Lindb.

E. Iceland: Vallanes (H. J.)!.

### 60. *Tortella tortuosa* (L.) Limpr.

*Mollia tortuosa* (L.) Schranck.

Very common all over Iceland.

This species has its main distribution in the low land up to about 400 metres above sea-level. It appears to be rare everywhere at higher levels, and hardly ascends higher than about 600 metres. It grows

both on rocks and on earth. In lava-fields it is one of the most commonly occurring species, and grows there in enormous cushions on rock-sides in caves and clefts, in association with *Amphidium Mougottii*, *Anacælangium compactum* and *Grimmia torquata*. On rocks it grows on perpendicular faces, on soil-covered ledges, and in clefts. On the ground it is found especially where it is not too damp, for instance in grass-fields and on the top of knolls in bogs, usually intermixed in tufts of other mosses. At higher altitudes it rarely grows on rocks, but as a rule on gravelly ground or in bogs. Only sterile specimens have been found.

This species varies considerably in the size and length of the leaves. Forms from shady and protected localities, especially from lava-clefts, form very tall and loose tufts with exceedingly long and strongly crisped leaves.

### 61. *Tortella fragilis* (Drumm.) Limpr.

*Mollia fragilis* (Drumm.) Lindb.

Commonly distributed all over Iceland.

This species grows in localities similar to those of *T. tortuosa*, and often in company with the latter, but as a rule rather scantily. It usually occurs in unmixed tufts on soil-covered rocks and on somewhat damp ground, but only sterile specimens have been found. Around Reykjavik, for instance, it was common on knolls in boggy tracts which had been partially drained. In NW. Iceland it is rather rare, and has only been found in a few localities near Kaldalon.

### 62. *Barbula unguiculata* (Huds.) Hedw.

var. *cuspidata* (Schultz) Braithw.

S. Iceland: Vestmannaey!, on damp gravelly soil near the town. It has previously been collected here by an unknown finder (H. Jónsson believes by G. Brynjólfson). W. Iceland: Saurbær near Hvalfjörður, at an altitude of about 100 metres, on soil-covered rocks. In both places only sterile specimens have been found.

### 63. *Barbula fallax* (Hedw.).

S. Iceland: Reykir ♀. W. Iceland: Saudlauksdalur (H. J.).

Var. *levifolia* n. var.

In wide dense cushions, 2—3 inches deep, rusty brown in the interior, brownish green at the top. The lower leaves as in the type, the uppermost shortly pointed with rounded, broad and flat apex, into which the strong nerve runs out, widely revolute to near apex, with two deep plicæ at the base. Leaf-cells in form and size as in *B. fallax*, in the lower half of the uppermost leaves, however, more thin-walled, shortly rectangular; all quite smooth or, more rarely, indistinctly papillose. The innermost perichæatial leaves ovate or widely lanceolate, with faint or indistinct nerves.



S. Iceland: Thorlákshver, on warm clayey ground.

Although this form differs somewhat from *B. fallax* in habit, in the smooth leaves with rounded apex, and in the divergent form of the perichætal leaves, yet there is hardly any doubt that it must be referred to this species. Setting apart the absence of papillæ the leaf-tissue is quite typical, and the form and the plication of the lower leaves are exactly as in *B. fallax*. It should be remembered that the occurrence on a warm substratum produces very divergent forms also in other mosses, e. g. *Philonotis*, *Catharinaea* and *Oligotrichum*. Near Reykir, *B. fallax* was collected both on stones by the river, in sand-

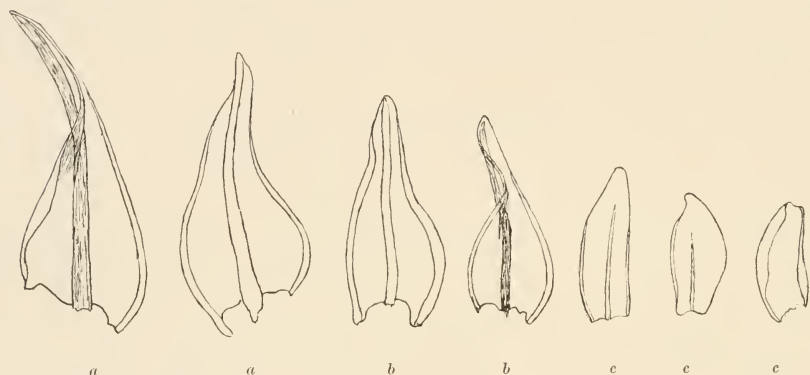


Fig. 1. *Barbula fallax* Hedw. a, Leaves of the plant from Reykir ( $\times 20$ ). b, Leaves of var. *levifolia*; c, perichætal leaves of same.

filled tufts about 2 cm. high, in a somewhat typical form, and on a warm, damp substratum. Plants from the latter locality form a transitional stage to var. *levifolia*. It grew in somewhat loose tufts, 3–4 cm. high, which in colour and appearance agreed with var. *levifolia*. The lowermost leaves are pointed, the uppermost rounded; the perichætal leaves are lanceolate, rounded, with rather faint nerve. The leaf-cells are distinctly papillose, sometimes as highly as in the typical form, sometimes much more faintly.

#### 64. *Barbula cylindrica* (Tayl.) Schimp.

N. Iceland: Hof near Eyjafjörður (O. D.)!. S. Iceland: Vestmannaey!; Ýtri Skogur (H. J.)!; Fljótshlid!; Holt!; Drángshlid!; Hornafjörður!. W. Iceland: Esja near Kollafjörður!.

This species occurred commonly, and often abundantly, on tuff-rocks in S. Iceland and on Vestmannaey. There it also grew abundantly on sandy soil and on lava blocks near the sea. In the other localities it was found but scantily. Fruit was collected only near Holt, where, at the end of July, both old and yet green capsules were collected from the same tuft.



65. **Barbula icmadophila** Schimp.

SE. Iceland: Hornafjörður!, in several places in small quantities. N. Iceland: Skagafjörður (Grl.)!; Hofsfjall near Eyjafjörður (O. D.)!. W. Iceland: Esja, at an altitude of 400 metres!.

This species has been collected everywhere only in small quantities, in cushions 1—2 cm. deep, on humus-covered rocks.

66. **Desmatodon latifolius** (Hedw.) Br. eur.

*Tortula latifolia* (Hedw.) Lindb.

E. Iceland: Djupivogur!, common near the sea; Vallanes!; Hamar-fjörður!; Berufjörður!. N. Iceland: Husavik! at an altitude of about 400 metres; Reykjahlid!; Grimsey (O. D.)!; Stadr near Hrutafjörður!. NW. Iceland: Isafjörður!; Grunnavik!; Hesteyri!; Arngerdaeyri!; W. Iceland: Stykkisholmur!.

Var. *muticus* Brid.

Grimsey (O. D.)!; Reykjahlid!; Isafjörður!, 450 metres above sea-level. Found in all the localities together with the type.

In NW. Iceland *D. latifolius* is one of the most frequently occurring species, and the same appears to be the case in E. Iceland. It occurs especially near the sea on sandy soil or, also, on humus-covered rocks, and often abundantly. Near Vallanes it grew in masses on peat walls and on dikes around the farm, associated with *Encalypta rhabdocarpa*, *Tortula subulata*, *Ceratodon purpureus*, *Bryum argenteum*, *Bartramia ityphylla*, etc.

In N. Iceland this species occurs more sporadically. Near Husavik only a single little tuft was found on the top of Husavikurfjall; near Reykjahlid it was common in lava-fields, in places covered by a thin humus-layer, associated with *Ceratodon purpureus*, *Tortula ruralis*, *T. subulata*, etc., and near Stadr it grew on the peat walls of the farm exactly as it grew near Vallanes. From SW. and S. Iceland this species appears to be quite absent, and in W. Iceland it was only found near Stykkisholmur, where it was found abundantly on earth and rocks along the shore.

It is only by exception that *Desmatodon latifolius* has been found at higher altitudes. Near Isafjörður it occurred here and there on the rocky flat up to a height of about 500 metres, for instance on a stony slope 450 metres above sea-level, associated with *Bryum elegans*, *Bartramia ityphylla*, *Pohlia commutata*, *Scapania curta* and *Encalypta rhabdocarpa*. The fruit, which was present everywhere in abundance, ripens at the end of June.

67. **Desmatodon cernuus** (Hüb.) Br. eur.

*Tortula cernua* (Hüb.) Lindb.

N. Iceland: Hof (O. D.)!; Hjalteyri (O. D.)!.

On the plant from Hjalteyri the fruit had just ripened on September 5, 1897.

68. *Tortula obtusifolia* Schleich.

S. Iceland: Flokastagil on Fljótshlid!; Drángthlid!.

This very rare species was found in both places in very small cushions, only 5–6 mm. deep, with numerous capsules which were almost fully ripe in the latter half of June. In Flokastadagil it grew here and there on fallen blocks, especially in small fissures on the vertical rock-faces. Near Drángthlid it was found in small quantity on the dry faces of tuff-rocks in company with *Tortula muralis*, *Grimmia Doniana* and *Orthotrichum anomalum*.

69. *Tortula muralis* (L.) Hedw.

S. Iceland: Vestmannaey!; Drángthlid!.

The plant was found very scantily in both places on dry faces of tuff-rocks. On Vestmannaey it grew on a rock-face with a southern exposure, associated with *Grimmia maritima* and *Barbula cylindrica*; near Drángthlid it grew in association with *Grimmia Doniana* and *Tortula obtusifolia*.

70. *Tortula subulata* (L.) Hedw.

Commonly distributed over the whole of Iceland.

The plant grows almost exclusively in the low land up to about 300 metres above sea-level, and only in quite a few localities in S. Iceland has it been found at a higher level, for instance near Barkastadr at an altitude of 410 metres. It is most frequent in S. and E. Iceland; in N. and NW. Iceland it is somewhat less common, but has nevertheless been collected from a great number of places. It usually grows on a rather dry substratum, e. g. humus-covered rocks, in rock-clefts, on dikes and on peat walls of houses, mostly associated with *Bartramia ityphylla*, *Pohlia cruda*, *Encalypta rhabdocarpa*, *Brachythecium albicans* and other species. Fruit, which is always present, ripens in the end of June or in the beginning of July.

71. *Tortula mucronifolia* Schwgr.

Vestmannaey!.

It occurs here in localities quite similar to those of *Tortula subulata*, for instance on dikes, in sandy soil and on humus-covered rocks, and appears to be as frequent as this. The fruit was not yet quite ripe towards the middle of June.

72. *Tortula ruralis* (L.) Ehrh.

Commonly distributed over the whole of Iceland.

*Tortula ruralis* is a decidedly xerophilous species, and has, therefore, its widest distribution in the driest parts of the country. In the lava-fields in the interior, for instance around Mývatn, it occurs abundantly; in NW. Iceland it is also more frequent than in the other parts

of the country, especially E. Iceland, where it occurs but scantily in many districts.

It grows in sandy soil, upon soil-covered rocks and at the base of vertical rock-faces, and is most frequent in the low land. Near Akureyri it was found with ripe fruit (20. 7. 1909). Near Grunnavik in Jökulsfjörður it was found in fruit at an altitude of 270 metres. In Esja it has been collected up to about 420 metres above sea-level. Near Vallanes the fruit was ripe about July 1st. At the coast, near Reykjavik, it grew abundantly in large tufts which were quite filled with sand.

73. **Tortula aciphylla** (Br. eur.) Hartm.

*T. norvegica* (Web.) Wahlb.

NW. Iceland: Dýrafjörður!, at an altitude of 150 metres.

It grew there in cushions, about 2 cm. deep, on humus-covered rocks. The capsules were quite green on June 17th.

The leaf-form, nerve and leaf-hair in these specimens were quite typical, but the cells of the leaf-base were occasionally chlorophyllose towards the margin, forming a more or less distinct border, in which feature it approached *Tortula ruralis*.

FAM. GRIMMIACEÆ.

74. **Schistidium maritimum** (Turn.) Br. eur.

E. Iceland: Hornafjörður!; Hof!; Hamarfjörður!; Djúpivogur!. N. Iceland: Husavik!; Grimsey (O. D.)!. NW. Iceland: Common everywhere along the coasts!. W. Iceland: Stykkisholmur; Hafnarfjörður!; Reykjavik (Gr!.); by Hvalfjörður (Gr!.)!. S. Iceland: Vestmannaey!.

This plant doubtless occurs everywhere along rocky shores. It is, however, absent from, or only occurs scantily in, the interior of deep, narrow fjords. Thus, around Berufjörður it is very common towards the entrance of the fjord, near Djúpivogur, while it is entirely absent from the head of the fjord.

As a rule it grows only on rocks quite close to the sea, and up to a height of some 10 metres. More rarely, for instance near Djúpivogur and on Vestmannaey, it descends to the sandy ground at the foot of cliffs.

Fruit is almost always present abundantly.

75. **Schistidium apocarpum** Br. eur.

*Grimmia apocarpa* Hedw.

Subsp. *vulgare* (Chal.) Loeske.

Common over the whole of Iceland.

It grows, as a rule, on rather dry rocks, occasionally also in gravelly soil, but then rarely in any great abundance. It is most frequent

in the more low-lying parts of the country, but may, however, occasionally be met with upwards of 600 metres above sea-level.

### 76. *Schistidium apocarpum* Br. eur.

Subsp. *gracile* (Schwägr.) Loeske.

Very common.

One of the most frequent mosses, and met with from the lowlands up to mountain heights. It occurs, in numerous forms, both on dry and on damp rocks, and on more or less damp gravelly soil. On gravelly flats, especially above an altitude of about 300 metres, it often forms extensive growths. It occurs also very abundantly on tuff-rocks (for instance in Esja and below Eyjafjall) in a low, reddish-brown form. Fruit is always present.

### 77. *Schistidium apocarpum* Br. eur.

Subsp. *confertum* (Funck) Dixon.

E. Iceland: Hof!; Seydisfjörður!. N. Iceland: Husavik, at an altitude of about 400 metres!; Reykjahlid!; between Hnausar and Lækjarmot!; Vidvik (P. Sólóniasson)!, several places near Eyjafjörður (O. D.)!.

This form has its main distribution in N. Iceland, where it is rather common; thus, near Reykjahlid it was found abundantly on lava-blocks. It grows by preference on rather dry rock-faces, or upon stones, and has been gathered everywhere in fruit.

### 78. *Schistidium alpicola* (Sw.) Limpr.

Var. *rivularis* (Brid.) Wahlb.

Very common in E., N. and W. Iceland, more rare in S. Iceland, where it is absent from many localities.

This species grows on stones and rock surfaces in rivers, often in great abundance, covering the banks and the stones in the water for long distances. It does not appear to ascend much higher than about 300—400 metres above sea-level.

The chief reason for its occurring more scantily in South Iceland must be sought in the fact that the water in many rivers is turbid, owing to the glacier-clay carried in them. In this part of Iceland it is met with especially in rivers with clear water, at an altitude of 200—400 metres, more rarely in the low land.

Var. *eualpicola* Loeske. *Grimmia alpicola* Swartz.

N. Iceland: Dettifoss!, fr.

This form, which in the above locality grew on blocks of basalt at some distance from the waterfall, but nevertheless exposed to the spray, appears to be as rare in Iceland as in most of the rest of Europe. Forms, intermediate between this form and var. *rivularis*, have not been collected.

79. **Grimmia commutata** Hübener.*Grimmia ovalis* (Hedw.) Lindb.

N. Iceland: Mývatnsbraun (St.)!. W. Iceland: Budir (H. J.)!. In the supplement to "Isl. Kryptogamflora" (B. T., vol. 20, p. 105) Grønlund has recorded *G. ovata* from Mývatnsbraun and *G. commutata* from Vallanes and Kolfreyjustadr. But according to the specimens in the Botanical Museum in Copenhagen, determined by C. Jensen, the plant from Mývatn is *Grimmia commutata* and those from the two other localities are *G. ovata*. Grønlund has, therefore, probably confused the two names (*G. ovata* and *G. ovalis*) used by C. Jensen.

80. **Grimmia Doniana** Smith.

E. Iceland: Common from Hornafjörður to Seydisfjörður!. N. Iceland: Hólar (Gr.)!; Vidimýri (Gr.)!. NW. Iceland: Dýrafjörður!; Gnupsdalur!; Dýnjandi!. Common in SW. and S. Iceland.

With the exception of N. Iceland, where it appears to be rare, this species is widely distributed in the more low-lying districts of the country, as it is only by exception that it ascends higher than 200—300 metres. Near Holt in S. Iceland it has, however, been collected plentifully at about 500 metres above sea-level. It usually grows in small, round tufts on loose blocks, more rarely in wide cushions, irregular in form. In South Iceland proper — for instance near Drángshlid — it occurs also on faces of tuff-rock. The fruit, which occurs everywhere, was hardly ripe even at the end of July.

81. **Grimmia alpestris** Nees.

E. Iceland: Arnkelsgerdi; Eidar (H. J.)!, sterile. S. Iceland: Hafursholt!, fr.

82. **Grimmia ovata** W. et M.*Grimmia ovalis* Lindb.

Iceland leg Mörch!. E. Iceland: Kolfreyjustadur (H. J.)!; Vallanes (H. J.)!; Seydisfjörður!; Berufjörður!. N. Iceland: Hnausar in Vatnsdalur!; Reykjaheidi!; Herjardalsheidi (Gr.)!. Only sterile specimens have been found.

This species grows on dry stones and rocks; it is rather frequent in East and North Iceland, but has not been found in the other parts of the country.

83. **Grimmia incurva** Schwgr.

E. Iceland: Vallanes!.

It was growing in the above locality on a slightly inclined, partly inundated rock-surface in the river Lágárfljot.



84. **Grimmia patens** (Dicks.) Br. eur.*Dryptodon patens* Brid., Limpr.

E. Iceland: Hornafjörður!. W. Iceland: Budahraun (H. J.); Hafnarfjörður!.

In Budahraun it was growing in the clefts in the lava-field; near Hafnarfjörður it was found in abundance associated with *Orthotrichum rupestre* and *O. Sturmii* on the face of a dolerite rock with a northern exposure.

85. **Grimmia funalis** (Schwgr.) Sch.

Widely distributed over the whole of Iceland.

*G. funalis* is by far the most frequent species of this genus. It grows everywhere on dry rocks, especially on the vertical sides of ravines and lava-clefts, where it forms immense cushions, often 5–6 cm. deep, which very easily break up into pieces when loosened from the substratum. The fruit, which occurs rather frequently, was not ripe even in August. This species is most frequent up to about 300–400 metres above sea-level, but often ascends, however, to somewhat above 500 metres, for instance near Akureyri.

86. **Grimmia torquata** Hornsch.

E. Iceland: Hornafjörður!, very common; Seydisfjörður!. N. Iceland: near Hrutafjörður (H. J.)!. NW. Iceland: Dýnjandi!; Grunnavik!; Arngerðareyri!. W. Iceland: Melar (Grl.)!; Hafnarfjörður (Grl.); Budahraun (H. J.)!. Very common in SW. Iceland!.

This species is very common in SE., S. and SW. Iceland, rather rare in N. and NW. Iceland. It grows on dry rock-faces in ravines and lava-clefts, but only sterile specimens have been found.

Note. *Grimmia pulvinata* is enumerated in several older lists, but these records are probably due to a confusion with other species.

87. **Rhacomitrium sudeticum** (Funck) Br. eur.*Grimmia microcarpa* (Gmel.) Lindb.

Common over the whole of Iceland.

In many parts of Iceland *R. sudeticum* is one of the most frequent species, being found from the sea-level up to the gravelly flats of mountain heights. It is most widely distributed in NW. Iceland and along several fjords in E. Iceland, for instance Seydisfjörður, while it appears to occur less abundantly in N. Iceland. It grows on rather dry rocks and blocks of lava, in clefts, and on wet stones in and by streams. In mountain heights, especially in NW. Iceland, it forms the bulk of the vegetation on gravelly flats from about 300 metres upwards.

It varies considerably in size, habit, colour and length of hair point. On wet rocks it becomes very large, and almost black, with very short hair point, while the forms growing on dry rocks are as a rule very low in growth and slender, often occurring in small round, compact tufts, blackish green or brownish red in colour, with longer



hair point. In the birch coppices of NW. Iceland a form frequently occurs on larger, scattered stones which, in habit, reminds one of *R. fasciculare*. The tufts are flat towards the edge, dark-green; the hair point is very short and often wanting. The forms from mountain heights are often jet-black (var. *atrata*) or — on damp gravelly flats — yellowish green at the top, and grow in extensive, discontinuous mats, a few cm. thick. The fruit, which is very common, ripens in the beginning of June.

### 88. *Rhacomitrium heterostichum* (Hedw.) Brid.

E. Iceland: Hornafjörður!; Hof!; Geithellir!; Berufjörður!. N. Iceland: Akureyri!, at an altitude of 350 metres. NW. Iceland: Patreksfjörður!; Arngerðareyri!. Common in S. and W. Iceland!.

Common throughout E. Iceland, from Berufjörður, and southwards through the whole of S. and W. Iceland.

In W. Iceland it occurs abundantly at the head of Isafjörður, near Arngerðareyri, but has not been collected about the fjord further outwards towards its entrance; it was also common by Patreksfjörður. It appears to be more rare in N. Iceland.

The plant grows most frequently on dry rocks, and more rarely on those that are damp; it occurs in masses, for instance, in the lava districts of SW. Iceland. It is most common in the low land, but is, however, also met with at about 600 metres above sea-level. Fruit is rather common.

### 89. *Rhacomitrium microcarpum* Brid.

*Grimmia ramulosa* Lindb.

N. Iceland: Hof by Eyjafjörður (O. D.)!. sterile.

Recorded by Grönlund from Reykjavik and Husafell, but the specimens in the Botanical Museum in Copenhagen must be referred to *R. canescens*.

### 90. *Rhacomitrium canescens* (Weis) Brid.

Very common.

Next to *R. hypnoides* the most widely distributed species, and met with as frequently on mountain heights as in the low land, and in numerous forms. It grows both on rocks and on earth, especially where it is somewhat damp. In the "*Grimmia* heath" it often covers the more low-lying tracts with its light yellowish-green to greyish-green mats, while *R. hypnoides* grows in the more dry parts, but both species often occur mixed. It is also the most abundant constituent of the vegetation on damp sandy or gravelly soil by streams, in grass-fields with a poor soil, etc. Forms with the hair point entirely or almost wanting (*f. pilosa*) are frequent in wet localities.

Fruit is only rarely and scantily met with. Near Hof in E. Iceland plants were found in the middle of June with old capsules, and near Sugandafjörður about July 1st with yet green capsules.

91. **Rhacomitrium hypnoides** (L.) Lindb.

*Grimmia hypnoides* Lindb.; *Rhacomitrium lanuginosum* (Ehrh.) Brid.

Very common over the whole of Iceland.

*Rhacomitrium hypnoides* is by far the most common plant in Iceland. In all parts of the country, both along the coasts and on the mountain heights, it covers, almost without any mixture of other plants, vast tracts of land — the *Grimmia* heaths so well-known also from other Arctic countries — with its thick greyish-white mats. It also occurs in almost every locality where it is not too damp, and very often intermixed in tufts of other mosses. Thus, it is very common on rocks and stones, and often covers large tracts of lava-fields with cushions one foot deep. In bogs it grows, as a rule, on the top of the knolls, in company with species of *Hylocomium*, and in birch copices it forms, in association with *Hylocomium* spp, *Hypnum uncinatum* and several other species, the moss carpet of the floor. Only sterile specimens have been found.

92. **Rhacomitrium fasciculare** (Schrad.) Brid.

Very common in the Southern, Western and Eastern parts of Iceland. In N. and NW. Iceland it appears to be somewhat less plentiful, but nevertheless it must also there be regarded as one of the more commonly occurring species.

It occurs at all altitudes up to the limit of vegetation on mountain heights. It forms, there, like *R. sudeticum*, black Alpine forms on dry rocks.

This species usually grows on stones and rocks in dry situations, but it also occurs frequently in gravelly soil. Occasionally it may even be found in the lowermost portion of birch-trunks. The fruit, which is rather common, ripens in the lowlands in the first half of June.

93. **Rhacomitrium aciculare** (L.) Brid.

Very common on wet rocks in and by rivers and waterfalls everywhere in the low-lying parts of the country. It does not appear to ascend much higher than 300—400 metres. The fruit, which occurs everywhere, ripens, as a rule, in the beginning of June.

Note. *Grimmia* (*Rhacomitrium*) *elliptica* is recorded in older lists as found in Iceland by Mörch. The specimens in the collections belong to *R. fasciculare*.

*Cinclidotus fontinaloides*, also, is recorded by Hornemann as found in Iceland, but it was undoubtedly confused with another species. Specimens are not to be found in the collections.

94. **Hedwigia albicans** (Web.) Lindb.

*Hedwigia ciliata* Ehrh.

SW. Iceland: Hafnarfjörður (Gr!.)!, sterile.

## FAM. ORTHOTRICHACEÆ.

95. **Amphidium lapponicum** (Hedw.) Schimp.*Anæctangium lapponicum* Hedw.

Very common.

This species usually grows on damp rocks, especially in clefts and crevices, but may also occur on a more dry substratum, for instance in lava caves and among stones on heaps of debris at foot of cliffs (Urd). It grows both on bare rocks and on humus in rock-clefts, occasionally also in gravelly soil or on earth, and even upon the sides of knolls in bogs. It does not appear to ascend to any great height on the mountains; it is most widely distributed up to 200—300 metres above sea-level, but it has, however, been found, although scantily, up to about 500 metres above sea-level.

The fruit was usually ripe in the first half of June.

96. **Amphidium Mougeotii** (Br. eur.) Schimp.*Anæctangium Mougeotii* Lindb.

Iceland (Mörch; Stp.)!. E. Iceland: Seydisfjörður!; Stód (H. J.)!; Hof near Eyjafjörður (O. D.)!; Hrutafjörður (St.)!; Myvatn (Gr.)!. NW. Iceland: Kaldalon!; Bæir!; Arngerdareyri!; Dýnjandi!. West, South-west and South Iceland: common!.

Common all over the southern and western part of the country and probably also in NW. Iceland, certainly everywhere north of Isafjörður. In N. Iceland it appears to be rarer, but occurs abundantly near Eyjafjörður. In E. Iceland it is common everywhere around Seydisfjörður and is probably also frequent elsewhere. It usually grows in large, thick cushions on damp rock-sides in clefts, and by waterfalls, but is also one of the species most commonly found in lava-caves.

This species rarely ascends to any great height on the mountains. In Esja it occurred 400 metres above sea-level, and has nowhere been collected at a greater altitude. Only sterile specimens have been found.

97. **Ulota phyllantha** Brid.*Ulota maritima* C. M. et Kindb.*Weissia maritima* Britt.

E. Iceland: Everywhere along the coast from Hornafjörður to Berufjörður!. NW. Iceland: Frequent around Isafjörður!. W. Iceland: Snæfellsnes (H. J.)!; Stykkisholmur!; common near Reykjavik, Hafnarfjörður and everywhere around Hvalfjörður!. S. Iceland: Vestmannaey!.

This species is probably common everywhere along the coasts, where it grows in company with *Grimmia maritima* quite close to the sea-side. It is only rarely met with at a distance from the sea, as, for instance, around Reykjavik, and in a few places in the lava-fields near Hafnarfjörður. The reason why it has not been collected in North

Iceland is probably due to the fact that the coast there has been but little investigated. At Husavik the coast cliffs consist of easily weathered tuff which is very poor in mosses, the surface being too much inclined to crumble away. *Grimmia maritima* occurred also very sparingly there, and *Uloa* was not found at all. Like *Grimmia maritima* it keeps chiefly to the shores of broad fjords; therefore it was not found, or was very rare, in the interior of the deep fjords of East and North-west Iceland, nor did these two species occur at Akureyri. On Vestmannaey *Uloa phyllantha* was the most commonly distributed moss; it occurred abundantly everywhere, reaching up the face of the cliffs and being also found on that side of the latter which faced the interior of the island. It often descended to the ground, it was thus found on the knolls in a wind-torn grass-field on the slopes of Helgafell associated with *Rhacomitrium hypnoides* and *Hylocomium* spp.

#### 98. *Orthotrichum anomalum* Hedw.

S. Iceland: Vestmannaey!; Drángshlid (H. J.:!).

On Vestmannaey it was rather frequent on tuff-rocks at the foot of Stora Klit and in Heljusdal. The fruit was ripe in the first days of June. Near Drángshlid it was found on dry tuff-rocks, associated with *O. rupestre*, *Grimmia Doniana* and *Homalothecium*. The plants from this habitat form a transition to *O. saxatile*, as slender cilia, which easily fall off, are often found on them. The capsule is however 8-striate, and the diameter of the spores is 0,012—0,018 mm. as in *O. anomalum*.

#### 99. *Orthotrichum saxatile* Schimp.

SE. Iceland: Hornafjörður!, on rocks in company with *O. Sturmii*. The fruit was ripe in the middle of June.

#### 100. *Orthotrichum cupulatum* Hoffm.

S. Iceland: Vestmannaey!, fr.

It was growing in the above locality on fallen blocks of tuff at the foot of Stora Klit; in the first days of June it had capsules which had just ripened.

In older lists this species as well as *O. affine* and *O. lejocarpum* is recorded from Iceland as collected by Mörch; the habitats are not given more particularly, and no specimens of these species are to be found in the collections, so all the records are probably due to confusion with *O. Blyttii*.

#### 101. *Orthotrichum rupestre* Schleich.

Common all over Iceland except in the north-west, where it has been observed only at the head of Isafjörður near Arngerdareyri.

It grows on dry rocks and detached blocks in the lowlands, and probably does not ascend higher than about 400 metres above sea-level. The fruit ripens in the first half of July.

102. *Orthotrichum Sturmii* Hornsch.

E. Iceland: Hof!; Hornafjörður!. W. Iceland: Hafnarfjörður!; near Hvalfjörður!.

Growth similar to that of *O. rupestre*, and usually found in company with it. Near Hafnarfjörður it was found abundantly on the dry northern face of a dolerite-rock.

The plant from Hornafjörður forms in regard to the eight coarse cilia a transition to *O. rupestre*, but the upper half of the leaf consists of two layers of cells instead of only one in *O. rupestre*.

103. *Orthotrichum Killiasii* C. M.

E. Iceland: Seydisfjörður!. N. Iceland: Ásbyrgi!. W. Iceland: Dalasýsla, Melar on a cliff inhabited by sea-fowl (?) (H. J.)!.

The plant from Melar, which was quite sterile, was determined by C. Jensen, but owing to the absence of fruit the determination is doubtful.

Near Seydisfjörður, where it grew on rocks close to the sea shore, the fruit was ripe about the 1st of July.

104. *Orthotrichum Blyttii* Schimp.

Iceland (Stp.)!. E. Iceland: Djupivogur!; Seydisfjörður!. N. Iceland: Geitaskard!; Vidimýri (Grl.;!). NW. Iceland: Arngerðareyri!. W. Iceland: Stykkisholmur!; Esja (Grl.)!.

Grows on rocks, especially near the coast. Thus near Djupivogur Seydisfjörður, Arngerðareyri and Stykkisholmur it was found abundantly on the rocks of the coast. But it occurs also in the interior of the country; for instance, abundantly in several localities in Blönddalur and eastwards to Vidimýri.

Grönlund's specimens are determined by Lindberg as *Orthotrichum arcticum*, but on comparing numerous specimens of *O. arcticum* and *O. Blyttii* it has not been possible for me to find any real difference between these two forms. Hagen (*Musci Norvegiae Borealis*, p. 83) also regards *O. arcticum* as a variety of *O. Blyttii*, from which it is said to differ both by its shorter and broader leaves and by the shorter striæ of its capsule; but both these features vary so greatly in the Iceland plants, that there is hardly any basis for establishing variety, still less for separating them into two species. The perichæcial leaves are usually about 2—5 times as long as they are broad, with margins which are revolute from a short distance below the apex down to the base. The capsule is usually striated along its whole length, rarely (as in the plant from Stykkisholmur) in the upper half only. The peristome-teeth are finely papillose, rarely marked with faint sinuose lines in their lower half.

105. *Orthotrichum lævigatum* Zett.

N. Iceland: Grimsey (O. D.)!; Akureyri, 350 metres above sea-level!; Vidimýri!. NW. Iceland: Arngerðareyri!. W. Iceland: Kalmanstunga (Grl.)!.



Like *O. Blyttii* it grows on dry rocks and in many places in company with this. It has been everywhere collected in fruit.

### FAM. ENCALYPTACEÆ.

#### 106. *Encalypta ciliata* (Hedw.) Hoffm.

*Leersia laciniata* Hedw.

Iceland (Mörch)!. E. Iceland: Hornafjörður!; Djupivogur!; Hof!; Berufjörður!. N. Iceland: Ljosavatn!; Tverá in Óxnadalur!. W. Iceland: Stykkisholmur!. Common in South and West Iceland (Gr!.;!). Vestmannaey!.

This species has its widest distribution in the southern part of the country, where it is common from Berufjörður in East Iceland and thence southwards and westwards as far as Borgarfjörður. It has not been found in NW. Iceland and it is less frequent in North Iceland.

It grows sometimes in small colonies on humus-covered rocks, sometimes in rock-fissures filled with soil, usually associated with *Mnium orthorrhynchum*, *Anoetangium lapponicum*, *Bartramia ityphylla*, *Pohlia cruda*, *Distichium*, *Myurella* spp. etc. It has its main distribution in the lowlands. In Esja it ascends on exception to about 400 metres above sea-level.

In E. Iceland the fruit was quite unripe at the end of June; at Ljosavatn it had just ripened on July 19, but the calyptra still persisted. In S. Iceland, also, it ripens in the latter half of July.

#### 107. *Encalypta rhabdocarpa* Schwgr.

*Leersia rhabdocarpa* Lindb.

Common in localities similar to those of the preceding species; it often occurs abundantly also on the peat-walls of houses and on walls. It is met with both near the coast and in the interior of the country — for instance, abundantly at Reykjahlid — and is frequent as far upwards as almost 500 metres above sea-level.

The fruit ripens, as a rule, at the end of June, but both overripe and just ripe capsules may frequently be found in the same tuft much later in the year.

Var. *pilifera* (Funck) Br. germ. frequently occurs in company with the type.

#### 108. *Encalypta contorta* (Wulf.) Lindb.

*Leersia contorta* Lindb.

W. Iceland: Budahraun, on lava (H. J.)!, sterile.

Note. *Encalypta vulgaris* is recorded by Zoëga and Mörch, and *E. commutata* by Lindsay, but no specimens of either species occur in the collections. *Georgia pellucida* is recorded by Zoëga and Vahl as found in Iceland, but of this species, also, no specimens are found in the collections, and all the above records are no doubt due to erroneous determinations.



## FAM. SPLACHNACEÆ.

109. **Dissodon splachnoides** (Thunb.) Grev.*Tayloria lingulata* (Dicks.) Lindb.

Iceland (Mörch)!. E. Iceland: Seydisfjörður. N. Iceland: Common everywhere!. NW. Iceland: Sugandafjörður!; Isafjörður!; Ármuli!; Arngerdareyri!. W. Iceland: Brattabrekka!. S. Iceland: Barkarstadr!, 550 metres above sea-level.

Grows on damp boggy ground, almost always mixed with other mosses such as *Hypnaceæ*, *Cinclidium*, *Meesia trichoides*, *Dichodontium* and *Bryum ventricosum*. In N. Iceland, where it is most widely distributed, it extends from the lowlands to a height of upwards of 600 metres above sea-level. Thus, near Husavik, it was very common in *Hypnum* bogs, and near Akureyri it was found especially in bogs at an altitude of 500–600 metres. Near Seydisfjörður it was common from about 100 metres upwards to the mountain heights. From the south-western and southern part of the country it appears to be absent, or is at any rate very rare; it was found in this part of the country only in a *Hypnum* bog near Barkarstadr, at an altitude of 530 metres.

110. **Tetraplodon bryoides** (Zoëga) Lindb.*Tetraplodon mnioides* (L. fil.) Br. eur.

E. Iceland: Djupivogur!; Berufjörður!. N. Iceland: Akureyri (Carrington); Mývatn (Grl.)!; Reykir near Svinavatn (Grl.)!; Flateyarsalsheidi (St.)!; near Eyjafjörður (O. D.)!. NW. Iceland: Dynjandi!. W. Iceland: Husafell (Grl.)!; Brunnar (Grl.)!; Reynivellir (Grl.)!; Kolvidarhol!; Hafnarfjörður!. S. Iceland: Draupahlid (Wiinsted)!

Occurs here and there all over the country, but as a rule only in single tufts on the bodies of dead animals. Near Djupivogur a large tuft was found on a rotten fish.

The fruit, which occurs abundantly everywhere, ripens at the end of June.

111. **Splachnum sphæricum** (L. fil.) Swartz.*Splachnum pedunculatum* (Huds.) Lindb.

Iceland (Mörch)!; commonly distributed!.

Grows on cow-dung in wet, marshy ground, often mixed with *S. vasculosum*, but is less frequent than the latter. It occurs most frequently in North Iceland and also, to a certain extent, in East Iceland (Seydisfjörður and Vallanes), where it is met with abundantly in many localities, it is somewhat rarer in South and South-west Iceland and probably does not ascend higher than 300–400 metres above sea-level.

The fruit ripens rather irregularly, so that in the same tuft both ripe and also quite young capsules may be found. The majority of the

fruits ripen during July; near Seydisfjörður many were found to be ripe on July 1st, and in South Iceland ripe capsules were collected between 10—15 June.

*Splachnum tenue* is recorded by Gliemann to have been collected by Mörch, but the specimens in the herbarium collected by Mörch belong partly to *Splachnum sphaericum* and partly to *S. vasculosum*.

### 112. *Splachnum vasculosum* L.

Commonly distributed.

Like the preceding species it grows, often abundantly, on cow-dung in wet marshy ground. It is most frequent in the lowlands, but ascends also as far upwards as to the mountain heights. Thus at Seydisfjardarheidi it was common up to about 600 metres above sea-level, and in NW. Iceland also it was found as far upwards as about 500 metres. Such forms from mountain heights are as a rule low in growth and have short setæ.

As is the case with *Splachnum sphaericum* the fruit ripens at different times during the course of the summer, from the first half of June into August.

*Splachnum ampullaceum*, as recorded to have been found by Koenig, is undoubtedly nothing else but *S. vasculosum*.

## FUNARIACEÆ.

### 113. *Funaria hygrometrica* L.

Commonly distributed all over the country.

It usually grows on peaty ground, associated with *Dicranella crispera*, *Polytrichum gracile*, *P. juniperinum*, *Bryum* spp., etc., but is also found on humus-covered rocks and on tuff. It does not occur abundantly, as a rule, and it does not ascend to any great height, doubtless not higher than to an altitude of 300—400 metres. The fruit ripens in the beginning of August. The spores vary considerably in size in this species, from 0.011 to 0.021 mm., in plants which otherwise show no deviation from the type.

### 114. *Entosthodon ericetorum* (Bals. et De Not.) Br. eur.

*Funaria obtusa* (Dicks.) Lindb.

W. Iceland: Kleppjarnsreykir in Reykholtalur!; Englandshver!. In both places with ripe fruit (25—30 July).

This species grew in the above localities on warm ground. Near Englandshver it grew along the outlet of a spring. Near Kleppjarnsreykir it was found both on a stone standing in water of a temperature of about 50°, mixed with *Blindia acuta*, *Aneura multifida*, *Anthoceros* and *Scapania irrigua*, and also on warm, damp ground mixed with *Fissidens osmundoides*.

Note. *Entosthodon fascicularis* is said to have been found by Hornemann near Reykjavik, but no specimens of it can be found in the collections, and the occurrence of this species in Iceland is not probable.

## FAM. BRYACEÆ.

115. *Leptobryum pyriforme* (L.) Schimp.

Very common in the majority of the districts of Iceland. This species, especially in N. and NE. Iceland, is common on peat or damp ground, but also on rocks, especially in soil-filled fissures. In S. Iceland it occurs abundantly on damp rock-sides, in the clefts of tuff rocks, and by rivers. It is only in NW. Iceland that it appears to be rarer. There it is common along the sea-side around Nauteyri and Arngerðareyri, but is otherwise rare in this part of the country and has only been found close to the coast.

The fruit ripens late in summer. In N. Iceland only some of the fruits were ripe at the end of July. In specimens collected near Eyjafjörður by O. Davidsson in Sept.—Oct. the capsules were ripe, but the lids were not yet thrown off.

116. *Anomobryum filiforme* (Dicks., Lindb.) Husnot.

E. Iceland: Hornafjörður!; Berufjörður!; Stafafell!. W. Iceland: Patreksfjörður!, at an altitude of about 150 metres; Botnsdalur!; Esja, Möðruvellir!, at an altitude of about 200 metres; Álafoss!. S. Iceland: Fljótshlid, common!; Eyjafjall, common!.

Rather common in E. Iceland as far as Berufjörður, and in W. Iceland; common in S. Iceland; not found in the northern part of the country. It grows, as a rule, scantily on damp rocks, mixed with other mosses, such as *Blandia acuta*, *Anæctangium compactum*, *Amphidium lapponicum*, *Aneura pinguis*, etc., occasionally, however, also in large, pure cushions. In S. Iceland it occurred everywhere on the faces of damp tuff rocks, mixed with other mosses. Fruit was found only near Holt in S. Iceland.

117. *Anomobryum concinnum* (Spr.) Lindb.

S. Iceland: Hrutafell!.

It was growing here rather scantily on the face of a damp tuff rock, mixed with *Blandia acuta*, *Metzgeria furcata*, *Barbula rubella*, *B. cylindrica* and *Myurella julacea*.

118. *Plagiobryum Zierii* (Dicks.) Lindb.

E. Iceland: Stafafell!; Berufjörður!. N. Iceland: Mývatn (Gr!.)!. NW. Iceland: Arngerðareyri!; Patreksfjörður!. W. Iceland: Nordredalur by Borgarfjörður!; Esja, in several places!; Lundur!; Bardshellir (Gr!.)!;

Hafnarfjörður (Grí.); Geitháls!. S. Iceland: Skálholt!; Thingvellir!; Breidabolstadr!; Vestmannaey!.

Frequent in the western and south-western parts of the country from Borgarfjörður southwards, rarer in the other parts. It chiefly occurs in humus-filled rock-fissures and in lava caves, but also upon damp rocks by waterfalls, in small reddish tufts, or mixed with other mosses such as *Plagiothecium pulchellum*, *Mnium orthorrhynchum*, *Pohlia cruda*, *Myurella apiculata*, *M. julacea*, *Blepharostoma trichophyllum*, etc. It does not appear to ascend higher than about 300 metres above sea-level. Fruit has been found only in Almannagjá and very scarcely; ♀ plants are rather common.

### 119. *Plagiobryum demissum* (H. et H.) Lindb.

W. Iceland: Mödruvellir in Esja!.

It was growing here in company with *Anomobryum filiforme* on a stony slope at an altitude of about 200 metres. The fruit was ripe on July 17th, but the lids had not yet been thrown off.

### 120. *Pohlia acuminata* Hornsch.

W. Iceland: Geitabergsvatn!. S. Iceland: Seljaland!, 250 metres above sea-level; Thingvallahraun near Tintron!; Almannagjá!.

This species grows on dry stony ground in birch coppices or on rock-ledges. Thus on Thingvallahraun it grew on small slopes in the birch coppice in company with *Pohlia nutans* and *Heterocladium squarrosulum*. Near Geitabergsvatn, also, it grew on the ground in the coppice in unmixed tufts, 5—10 mm. high, with setæ, 10—15 mm. long. On July 20th the capsules were ripe, dark brown, with lids low and conical, muticous.

### 121. *Pohlia polymorpha* H. et H.

W. Iceland: Mödruvellir in Esja!.

It was growing in the above locality on a tuff-slope at an altitude of about 400 metres.

### 122. *Pohlia cruda* (L.) Lindb.

Very common.

This is one of the most commonly occurring mosses, and is of almost equal frequency at all altitudes. It usually grows in rock-clefts filled with soil and on soil-covered ledges, but is also met with both on rather dry and on damp ground, as for instance on knolls in bogs.

The fruit, which is very frequent, ripens in the first half of August.

123. *Pohlia nutans* (L.) Lindb.

E. Iceland: Seydisfjörður!; Vallanes!. N. Iceland: Myvatn (Gr!.); Hálsskogur!; Heljardalsheidi (Gr!.)!. NW. Iceland: Dýrafjörður!; Isafjörður!; Sugandafjörður!; Jökulsfjörður!. W. Iceland: Breidabolstaðr!; Reykjavík (Gr!). S. Iceland: Frequent near Thingvellir (Gr!.); Draupahlid (Wiinsted)!.

*P. nutans* was first found in Iceland by Steenstrup, who did not, however, give the habitat. It is also recorded by Mörch, but all the specimens collected by him have been wrongly determined. It usually grows on a rather dry substratum. In the majority of the localities it occurred on the ground in birch coppices, as for instance in NW. Iceland, where it is common everywhere in the coppices at the head of the fjords. In that part of the country it also grows both frequently and abundantly on peat, and has been collected up to a height of about 350 metres above sea-level.

In the other parts of the country it is rather rare, and was as a rule found in small quantities only. Only around Thingvellir was it rather common in the birch coppices. In NW. Iceland the fruit was ripe about July 1st.

124. *Pohlia cucullata* (Schwägr.) Bruch.

Iceland (Mörch)!; Holtevad heath (Gr!.)! (determined by Zetterstedt as *Webera Ludwigi*). N. Iceland: Akureyri, at an altitude of about 800 metres. NW. Iceland: Isafjörður!, at an altitude of about 350 metres; Dýnjandi!; Arngerðareyri!.

Near Akureyri it was growing in gravelly soil saturated with melting snow, associated with *Polytrichum sexangulare*, *Dicranum Starcke*, *Pleuroclada albescens*, etc. The fruit was almost ripe on July 23rd. In NW. Iceland it was common in several places north of Isafjörður on damp ground (peat) at the bottom of the valley. Here the fruit was not quite ripe in the beginning of July.

125. *Pohlia Ludwigi* (Sprengel) Schimp.

*Pohlia Weigeli* (Schimp.) Lindb.

N. Iceland: Ljosavatnsberg!.

In the above locality it grew abundantly on damp gravelly soil at an altitude of about 500 metres. Only sterile specimens were found.

126. *Pohlia commutata* (Schimp.) Lindb.

Very common.

*Pohlia commutata* is one of the most frequent species, especially in the Alpine region; at elevations from about 300 to 600 metres it is met



with everywhere on damp ground, often forming the bulk of the vegetation, for instance in several places in NW. Iceland. It is, however, also common in the more low-lying districts, where it grows especially on damp soil along streams.

*Pohlia commutata* is a most variable species, and occurs in Iceland in numerous forms. The tufts are, as a rule, loose, and as much as 6 cm. high. In more particularly sheltered localities, for instance in lava-clefts near Thingvellir, the plants are very vigorous, and form deep, not-coherent tufts which are hardly tomentose. But in damp depressions on the mountain heights they often form extensive, deep and dense cushions which are brownish grey in the interior and yellowish green only at the top; compact forms like this occurred abundantly on damp gravelly flats, 400—500 metres above Isafjörður. The single plants are slender, with a thin fragile stem, and with leaves appressed, shortly pointed, slightly toothed towards the apex and longly decurrent. The leaf-cells are shorter, sometimes thin-walled, sometimes rather highly thickened and porous, but both the form of the leaves and of the cells, and the thickness of the walls may vary considerably in the same tuft or even on the same plant.

The fruit, which occurs rather frequently, was usually ripe at the end of July.

### 127. *Pohlia gracilis* (Schleich.) Lindb.

Very common.

In the lowlands this species grows, as a rule, on damp ground along streams, either in unmixed tufts or, more often, associated with *Alicularia scalaris*, *Lophozia quinquedentata*, *Cephalozia bicuspidata*, *Pohlia commutata*, etc. On cold, wet gravelly ground it is sometimes the most abundant constituent of the vegetation; thus it was growing in enormous quantity below the "Jökull" in Kaldalon (NW. Iceland). In the Alpine region from about 300—700 metres, *Pohlia gracilis* is one of the most frequently occurring species, and grows everywhere on damp gravelly flats, chiefly scattered among other mosses such as *Anthelia Juratzkana*, *Alicularia* spp., *Polytrichum sexangulare* and *Oligotrichum hercynicum*, more rarely in larger, unmixed growths.

The fruit, which occurs very frequently, ripens on the mountain heights usually at the end of July, in the lowlands a month earlier (Kaldalon, June 22).

### 128. *Pohlia Rothii* (Correns) Broth.

*Pohlia annotina* (L.) Lindb.

N. Iceland: Husavik ♂!; Stadr near Hrutafjörður!

It was growing in both places on damp sandy soil, associated with *Dicranella crista*, *Aongstroemia longipes* and *Hepaticæ*. The gemmæ, which occurred only few in number, were quite typical.

*Webera annotina* Hedw. is recorded from the peninsulas of NW. Iceland (Stp.) and from Hafnarfjörður (Grl.), but as the collections con-



tain no specimens from these localities it cannot be decided which species is meant.

### 129. *Pohlia tenuifolia* (Schimp.).

*Webera bulbifera* Warnst.

E. Iceland: Hamarfjörður!; Berufjörður!; Seydisfjörður!. N. Iceland: Geitaskard!; Hnauasar!. W. Iceland: Reykjavík! ♂.

*P. tenuifolia* is the most frequent of the small gemmiferous species of *Pohlia*. It usually grows on damp sandy soil, and often very abundantly, always bearing the characteristic gemmæ. Near Geitaskard it covered in company with species of *Bryum* the bottom of a dried up lake. The leaves in all the Iceland plants are very longly decurrent.

### 130. *Pohlia grandiflora* H. Lindberg.

S. Iceland: Reykir!; Laugarvatn! ♂; Barkarstadr!; Midskálagil near Holt!; cave near Steinafjall!.

Near Reykir it was growing on the ground along a stream, associated with *Dicranella crista*, *Pogonatum urnigerum*, *Scapania curta* and *Lophocolea minor*. Near Laugarvatn it was found abundantly on a warm clayey flat, associated with *Aongstromia longipes*, *Gymnocolea inflata* and a small sterile *Philonotis*. ♂ flowers were very numerous, but gemmæ were absent. In the other places it was found on faces of tuff rocks, associated with *Bartramia ityphylla*, *Pohlia cruda*, *Didymodon rubellus* and *Distichium montanum*. The gemmæ were quite typical in all these species.

*Pohlia tenuifolia* is an excellent species, easily known, even when gemmæ are absent, by the strong sheen and the narrow, longly decurrent leaves, in the upper half of which the cells are very narrow and often wavy.

### 131. *Pohlia proligera* Lindb.

N. Iceland: Vidimýri!.

It grew here rather scantily on damp sandy ground along a stream, bearing typical gemmæ.

### 132. *Mniobryum albicans* (Wahlb.) Limpr.

*Pohlia albicans* Lindb.

Very common.

Var. *glacialis* (Schleich.) Limpr.

Very common.

Both the type and the variety are the most common mosses everywhere on damp ground. The type grows on the ground along streams,

in bogs and on damp rocks. Var. *glacialis* grows always in cold water, especially in moss bogs, where in company with *Philonotis* it usually forms the bulk of the vegetation. In the Alpine region *Pohlia albicans* occurs abundantly, even at a height of about 600 metres. There it grows especially in and along watercourses, often filling up their — during summer — dried up beds by growing in large cushions both on the ground and on stones. As in *P. commutata*, the Alpine forms become more compact, with shorter, concave, appressed leaves and looser cell-tissue. Such forms have been found, for instance, near Dýrafjörður at an altitude of 300—400 metres, Esja at an altitude of about 500—600 metres and near Seljaland at an altitude of about 500 metres. Fruit occurs rather rarely, and in the type, as a rule, in a small quantity only. Fruiting specimens of the type were collected near Akureyri (ripe July 22), Holt (ripe July 19) and Breiddal (hardly ripe June 19). Var. *glacialis* was collected in fruit near Eyjafjörður (O. D.) and near Kaldalon in NW. Iceland, where the plant grew abundantly on inundated ground along small streams, and was often covered with fruit which was not quite ripe at the end of June.

### 133. *Bryum purpurascens* (R. Br.) Br. eur.

E. Iceland: Seydisfjörður!, common; Vallanes! (H. J.). N. Iceland: Mývatn (Gr!); Akureyri!, common; Husavik!, common. NW. Iceland: common about Isafjörður and Jökulsfjörður!. W. Iceland: Reykholtalur (Gr!); Nordredalur!; Grímsunga (Gr!); Bardshellir (Gr!); S. Iceland: Traustholtsholm in the Thjorsá (F!).

Grows on damp peaty or sandy soil, especially near the coast. It occurs abundantly chiefly in places where the peat has been pared off. Near Seydisfjörður it was collected up to a height of about 400 metres. The fruit ripens in the beginning of August.

*Bryum purpurascens* varies rather considerably in the form of the capsule and in the structure of the peristome. The capsule is usually symmetrical, sometimes slightly asymmetrical, and then reminds one of *B. uliginosum*, from which it is, however, easily distinguishable by the large lid. The base of the peristome teeth (fundus) is often large and reddish yellow, and in the majority of the plants which have been investigated the lamellæ are sinuose in the middle, sometimes as strongly so as in *Bryum lapponicum*. The dorsal transverse segments are more or less distinctly transversely striated. The spores vary somewhat in size, from 0.024—0.035 mm.

It is a peculiarity with this species that the capsule, on being cut through and warmed in diluted ammoniacal water, imparts to the latter a substance which is intensely, but temporarily coloured red by the oxygen in the air. The same is often the case also with *B. uliginosum*. In the course of time the old capsules turn almost black in colour.

### 134. *Bryum lacustre* Blandow.

E. Iceland: Berufjörður!; Vallanes (H. J.); N. Iceland: Common near Husavik!; common near Eyjafjörður (O. D.); Saudanes (St.); Svinadalur!;

NW. Iceland: Bildudalur (C. H.)!. W. Iceland: Lundur!. S. Iceland: Traustholtsholm in the Thjorsá (F.)!; Breidabolstadr!.

Rather common, especially in N. and E. Iceland. It grows on damp sandy or peaty soil, especially in places where the peat has been pared off, and by the sides of ditches. Near Husavik it was growing plentifully on damp slopes stretching down towards the sea, in association with *Leptobryum*, *Aongstromia*, *Bryum inclinatum*, etc. Near Lundur it was growing in company with *Dichodontium*, *Aongstromia*, *Dicranella Schreberi* and *Bryum inclinatum* on peaty flats which had been pared off. The fruit was ripe near Berufjördur on June 20th, near Breidabolstadr on July 16th.

### 135. *Bryum Kaurini* Philib.

E. Iceland: Berufjördur (Gr.)!.

The specimens, which are quite typical, were gathered with ripe fruit on July 6th, 1878, and determined by Berggren as *B. inclinatum*.

### 136. *Bryum archangelicum* Br. eur.

NW. Iceland: Hesteyri!. W. Iceland: Esja (Gr.)!; Brjanslækur (H. J.)!. S. Iceland: Dráangshlid (H. J.)!.

Both rare and scanty on rather dry, sandy ground or on soil-covered rocks. The fruit ripens at the end of July.

### 137. *Bryum Jörgensenii* Kaurin.

SW. Iceland: Thingvellir!.

The Iceland plant agrees exactly with *B. archangelicum* in habit. The leaves are narrowly and indistinctly bordered; the perichætal leaves have their margins revolute to the apex. The plants are often purely ♀; usually, however, a few antheridia and many archegonia are present. In none of the plants investigated did the lamellæ show the slightest sinuosity. The spores, which were yellow and almost smooth, were of very much the same size as in *B. archangelicum*.

### 138. *Bryum inclinatum* (Sw.) Br. eur.

Very common everywhere on a more or less damp substratum, on peat, sand and gravel, on soil-covered rocks, and in rock-clefts. It does not appear to ascend higher than about 300—400 metres above sea-level.

*Bryum inclinatum* varies so considerably in all its parts, in habit and size, in the length of the setæ, in the form and degree of inclination of the capsule, in the structure of the peristome, the size of the spores and in the form and cell-tissue of the leaf, that it is hardly possible to collect two tufts which do not show diversities in one respect or another. Perhaps on a closer investigation many of the forms might possibly be referred to some of the numerous "small species" established by

Hagen, Bryhn, Ryan, Arnell, Limpricht and other authors, or might with as great justice be described as new species. But without comparison with original specimens, and only according to the descriptions, it is impossible to form any opinion of the value of these species, which have very often been collected only in small quantity, and from a single locality, and which will therefore in many cases prove to be maintainable only so long as there does not exist more than the one specimen. It is very probable that it will not even be possible to maintain as varieties a great many of these forms which have been given specific rank, the characters used for separating the species being so variable that, on having abundant material for investigation, it is impossible to draw any boundary line between the forms. Here, only thorough investigations made at the habitat will be able to throw some light on the influence of the external conditions on the specific characters.

The height of the tufts and the length of the stems vary according to the degree of dampness, so that plants from dry and exposed habitats are low in growth with close-set leaves, and from damp localities, as a rule, higher, with elongated stems and more distant leaves. Also in places, slightly illuminated, for instance among grass and *Carex*-tufts, do the plants become higher with elongated stems. The leaves in *Bryum inclinatum*, in contradistinction to those in several other species of the same group, are stated to be not decurrent. This feature appears, however, to vary considerably, and to be closely connected with the habit of the plant, forms with short stems having close-set, not decurrent leaves, while the leaves on elongated stems are, as a rule, more or less decurrent. In such forms the uppermost close-set leaves have almost always a rounded, not decurrent base, while the leaves further down on the stem become more strongly decurrent the further they occur apart from one another. The form of the cells of the basal angles of the leaf also vary greatly according to the position of the leaf on the stem. The not decurrent leaves have a rounded base with quadrate, somewhat widened and thin-walled cells, but as the leaves downwards become more and more decurrent, the cell-form becomes elongate rectangular. The leaf-form varies from narrow-lanceolate to almost ovate, with a shorter or longer point. The lower leaves are usually shorter and broader, and the nerve vanishes just below the apex. The leaf-margin is revolute to the apex, more rarely it is plane in the upper part. The form of the leaf-cells is partly dependent on the leaf-form, long, narrow leaves having elongated cells, while broad, short leaves have broader cells, and even in leaves of the same plant the cell-form may vary considerably. The cell-walls vary somewhat in thickness. Xerophilous forms have often thick cell-walls, while bog-forms with large, broad leaves have thin-walled cells. The capsule varies in form from obovate to elongate-ovate. The neck of the capsule is usually straight, more rarely slightly curved.

The peristome teeth vary in colour from pale yellow to brownish yellow, being very strongly coloured where inserted. The "insertion" may be very differently developed, all transitions are met with, from a slightly indicated yellowish-brown or orange ring at the base of the peristome teeth to a highly developed compact thickening (fundus)



which may be almost as large as, for instance, that in *B. retusum*. It is, however, not usual for the thickening to be distinctly localized around the base of each individual peristome tooth; it has more the character of a continuous ring, 0.02—0.07 mm. broad. Hagen (*Musci Norv. Borealis*, p. 141) pronounces the opinion that ultimately all the species with a distinct fundus will be united together in a separate group in a natural system of species of *Bryum* (*Brya hæmotostomata*). The feature in question appears, however, to be too variable for that purpose. It is especially in the group of forms of *inclinatum* that this peculiar development of the peristome base occurs, but it is also met with in other groups, although less frequently, for instance in *B. purpurascens* (where it may be almost as large as in *Brya hæmotostomata* Hagen) and in *B. uliginosum*. *B. curvatum* Kaur. & Arnell, which Hagen refers to *B. hæmotostomata*, also belongs to the *purpurascens pallens* group. On the other hand, forms may also be met with in which the fundus is rather slightly developed or even quite wanting, for instance *B. Kaurini*, *B. retusum* and *B. Graefianum*, referred by Hagen to *B. hæmotostomata*. This diminishes the value of the character in question, and it does not appear to have greater systematic importance than has the peculiar structure of the lamellæ for the group *Hemisynapsium*, which structure is especially met with in the group of species in which the fundus formation occurs. Both the fundus formation and the indentation of the lamellæ, as also the occurrence of perforations in the median line of the peristome teeth, are probably connected with certain external influences, and are very often met with together. Here it is especially the degree of salinity of the substratum which is of importance, aulacodonte peristomes being found almost exclusively in *Bryum* forms collected from localities close to the coast, while forms with a distinct fundus-formation, although most frequent in the vicinity of the sea, yet have also been found far inland, or at a height of 400—500 metres above sea-level. In Iceland indented lamellæ and peristome teeth more or less perforated in the median line have been observed in forms of *B. inclinatum*, *B. retusum*, *B. archangelicum*, *B. calophyllum* and *B. purpurascens*, in the last-mentioned species, however, the peristome teeth are never perforated.

The spores vary somewhat in size, most frequently 0.022—0.025 mm., more rarely as much as 0.029 mm.

*Bryum lapponicum* Kaurin has not been found in Iceland, but forms which approach this species by having broader and longly decurrent leaves are rather frequent.

### 139. *Bryum retusum* Hagen.

N. Iceland: Hnausar in Vatnsdalur!; Vidimýri!; W. Iceland: Stykkisholmur!; Borgarnes!.

This species grows on peat or soil-covered rocks. The capsules ripen in the beginning of July. Near Stykkisholmur they were almost ripe on June 15th. In all the plants referred to this species the leaves were shorter and broader than in *B. inclinatum*, with the nerve vanishing in the apex and shortly excurrent in the perichætal leaves. The capsule

is narrower than in *Bryum inclinatum*, not-glossy, dark brown, finely pitted (in *B. inclinatum* smooth and glossy), with a high and conical lid. The peristome teeth are narrow, dark yellow, with a very large, red fundus which is very easily loosened from the mouth of the capsule and falls off together with the peristome tooth belonging to it, equally wide to the middle or gradually tapering from the base, and very differently formed in the same peristome. Lamellæ 12–18 in number, very differently developed even in the same peristome, straight or sinuous,

frequently also porous in the median line of the teeth. The spores vary somewhat in size, from 0.020 mm. (Borgarnes) to 0.024–30 mm. (Vidimýri).



Fig. 2. *Bryum islandicum* (X 2).

#### 140. *Bryum islandicum* n. sp.

Cæspites densi ad 5–6 mm. alti.

Caulis ruber, fragilis, valde tomentosus, innovationibus brevibus, numerosis.

Folia caulina inferiora decurrentia, 1.5 mm. longa et 0.7–0.9 mm. lata, superiora non vel vix decurrentia, ovata, longius cuspidata, apicem versus parce denticulata, 2–2.2 mm. longa et 0.75 mm. lata, ad basin rubra; margine tota longitudine reflexa, seriebus 3–4 cellularum angustiorum limbata. Cellulæ leptodermes paulum porosæ, basiales rectangulæ, 0.03–0.04 mm. longæ et 0.02 mm. latæ, ceteræ elongato hexagonæ, 0.03–0.04 mm. longæ et 0.015–0.018 mm. lata. Costa ad insertionem rubra, in aristam longam excurrens.

Folia perichætialia intima anguste lanceolata, vix limbata, costa excurrente longiuscule cuspidata.

Inflorescentia synoica; antheridia et archegonia numerosa.

Seta ad 15–20 mm. longa et 0.16 mm. crassa, rubra.

Capsula pendula, deoperculata ca. 3 mm. longa et 1 mm. crassa, opaca fusca leptodermis, sicca leviter rugulosa. Operculum humile conicum. Annulus latus. Cellulæ exothecii leptodermes, marginales in serie 3–4 transverse rectangulæ-polygonæ quadratæ, ceteræ irregulares.

Exostomii dentes e fundo fusco-aurantio 0.4 mm. longi et 0.065 mm. lati, fusco-aurantii apice lutei, anguste limbati, subtiliter punctulati. Lamellæ 14–16, inter se liberæ, marginibus integris. Endostomium exostomio haud connatum, luteolum, parce papillosum; processibus lanceolatis, in carina ovaliter fenestratis, ciliis pro more rudimentariis.

Sporæ 0.039–0.038 mm. diam. olivacæ, punctulatæ.

N. Iceland: Akureyri, on damp ground at an altitude of about 300 metres. July 20th, 1909.



141. *Bryum calophyllum* R. Brown.

E. Iceland: Vallanes!, on wet boggy ground. The capsules were quite green even on June 27th.

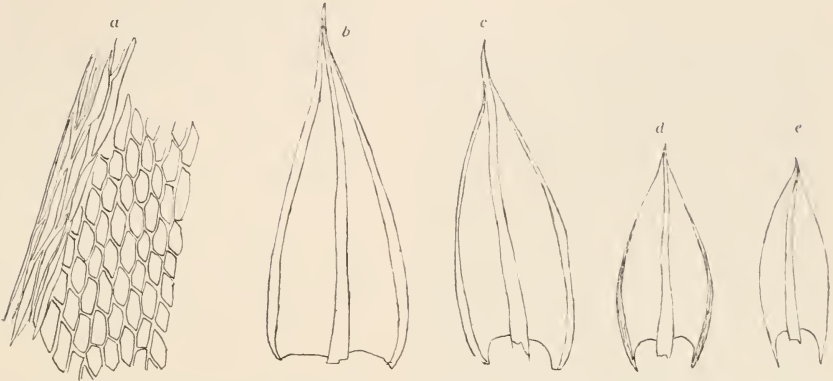


Fig. 3. *Bryum islandicum*. a, Leaf margin ( $\times 120$ ); b and c, perichaetial leaves; d and e, leaves.

142. *Bryum uliginosum* (Bruch) Br. eur.

N. Iceland: Husavik!; Svinadalur!. W. Iceland: Haukadalsheidi!, at an altitude of about 300 metres.

In all the above localities it grew abundantly on damp, sandy ground.

On Haukadalsheidi the fruit was ripe on Aug. 1st, in the other localities it was unripe in the middle of July.

Besides  $\sigma$  and  $\rho$  flowers, a few hermaphrodite flowers also occur frequently. The papillæ of the peristome are in the lowermost transverse segments often distinctly arranged in transverse rows, and sometimes there are also distinct transverse bars as in *B. purpurascens*. As is the case in the latter species, the ripe capsule contains a colouring matter which on being treated with ammonia assumes a red colour in the air.

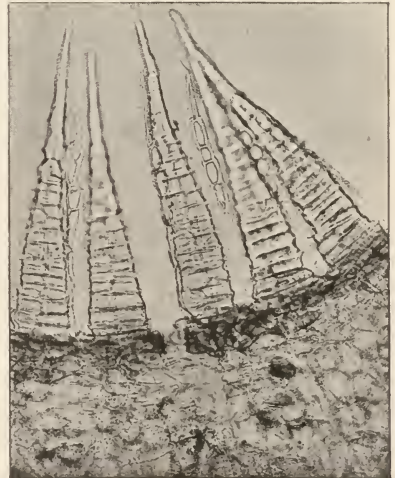


Fig. 4. *Bryum islandicum*. Peristome ( $\times 120$ ; phot.).

143. *Bryum Grœnlundii* n. sp.

Cæspites laxiusculi, ca. 1.2 cm. alti, superne virides, subnitentes; surculi innovationes tenues.

Folia caulina decurrentia, inferiora ovata, breviter cuspidata, superiora longius cuspidata, breviter vel non decurrentia, 2.3 mm. longa et 0.9—1 mm. lata, apice integra vel leviter dentata; margine ad apicem reflexa, seriebus 2—4 cellularum angustiorum limbata. Cellulæ foliæ leptodermes, indistincte porosæ, basilares rectangulæ, 0.035—0.050 mm. longæ et 0.018—0.020 mm. latæ, ad insertionem rubræ; illæ folii medii elongato-hexagonæ, vel rhomboideæ 0.05—0.08 mm. longæ et 0.015—0.018 mm. latæ, apicales angustiores. Costa fusco-lutea, ad insertionem 0.08 mm. lata, in foliis inferioribus sub apice desinens. in superioribus in cuspidem integram excurrans.



Fig. 5. *Bryum Groenlundii* ( $\times 3$ ).

W. Iceland: Haukadalsheidi on damp gravelly ground at an altitude of about 350 metres, August 1st, 1909.

#### 144. *Bryum fallax* Milde.

N. Iceland: Geitaskard!, fr.

It was growing here in a dried up pool among *Pohlia tenuifolia*.

#### 145. *Bryum œneum* Blytt.

*Bryum rutilans* Brid.

E. Iceland: Djupivogur!; Seydisfjörður!; at an altitude of 400 metres.

N. Iceland: Akureyri!, at an altitude of 350 metres. NW. Iceland: Bildu-

dalur (C. Hansen)!. NW. Iceland: Lundur!, fr. S. Iceland: Vestmannaey!, fr.; Skálholt!, Austerhlið near Geysir!, Breidabolstadr!, Barkarstadr!, Holt!, fr.; Drángshlið!.

Common in the southern part of the country and on Vestmannaey; rarer in the other parts of the country. In S. Iceland it grew especially

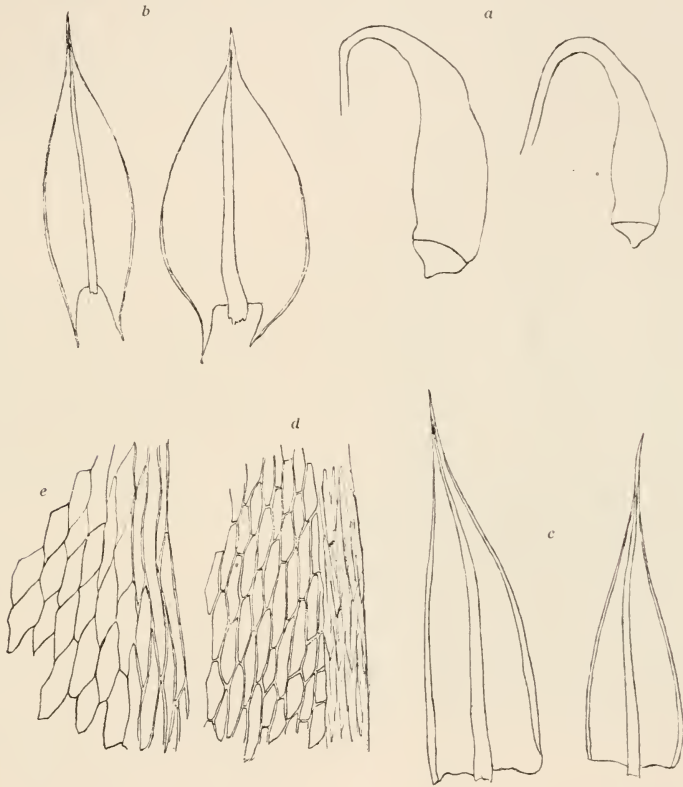


Fig. 6. *Bryum Graentundii*. a, Capsules ( $\times 20$ ); b, leaves ( $\times 20$ ); c, perichaetial leaves ( $\times 20$ ); d, leaf margin at base, and e, from the middle of the leaf ( $\times 120$ ).

abundantly everywhere in clefts of tuff rocks, and on Vestmannaey it was also frequent on the faces of damp tuff rocks. It was found in several localities in fruit, which was quite green even in the beginning of July. Near Lundur it was found on damp ground, associated with other *Bryum* spp. and *Dichodontium*, and had ripe fruit at the end of July. In several of the fruiting specimens from this locality a few hermaphrodite flowers were found besides the numerous ♀ flowers. ♀ plants occur everywhere, but ♂ plants have not been found.

In the leaf-angles of all the plants investigated hair-formations were found, consisting of readily falling, 8–10 celled, brown, papillose hairs, which very easily break into pieces of 2–4 cells. The leaves vary from shortly pointed, with nerve vanishing just below the apex, and shortly

rhomboid, equilateral-hexagonal or almost quadrate cells (forms from Akureyri), to more or less longly pointed, with excurrent nerve, and narrower, rhomboid or elongate-hexagonal cells.

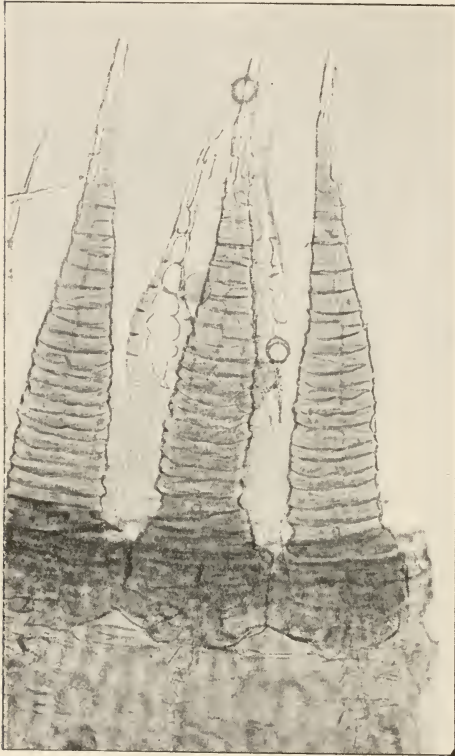


Fig. 7. *Bryum Groenlundii*. Peristome ( $\times 250$ ; phot.).

#### 146. *Bryum bimum* Schreb.

E. Iceland: Vallanes.

It has been collected only scantily on damp ground, with capsules which were not ripe at the end of June.

Two sterile *Brya*, collected by Helgi Jónsson near Stöd in E. Iceland and in Budahraun, are referred to this species by C. Jensen. The leaves in both the plants taper to a long point, are longly decurrent, have narrow basal cells, and the nerve excurrent; therefore, the plants probably belong to *Bryum affine*, but owing to the absence of fruit the determination is quite uncertain.

#### 147. *Bryum affine* (Bruch) Lindb.

*Bryum cuspidatum* Schimp.

Commonly distributed.

One of the most frequent species of *Bryum*, and occurs everywhere in the lowlands on damp sandy or peaty ground, and on humus-covered rocks. The fruit ripens in the first half of July. It varies exceedingly in all its parts. It is said to differ from the very nearly allied *B. cirratum* in its sex, the smaller, smooth spores, and the decurrent leaves with the broader cells; but all these features are so variable that in reality it is hardly possible, at least in the Arctic countries, to separate these two species.

The plant is usually synoicous, but ♂ flowers are also almost always present; ♀ flowers are more rare. The spores vary in size from 0.008 to 0.020 mm., and often differ rather considerably in size in the same capsule, or in different capsules from the same tuft; the most frequent size is 0.012–0.017 mm.; they are sometimes smooth, sometimes finely papillose. The leaves vary in form from about ovate to lanceolate, tapering more or less to a long point, and with the nerve longly excurrent. In form the leaf-cells correspond nearly with the leaf, so that short leaves have broader cells than have those which are long and narrow.

The leaf-base, at any rate in the lower leaves, is decurrent, with elongated, narrow alar cells. The close-set uppermost leaves are usually not decurrent, and then have the base rounded, with quadrate, somewhat widened alar cells.

The structure of the leaf-base evidently depends on the degree of dampness of the habitat. *Bryum cuspidatum* usually grows on boggy ground and forms here tufts, 1—3 cm. high, with rather long innovations. On such elongated shoots the leaves are always decurrent. On a more dry and exposed substratum, for instance on rocks, the tufts become lower in growth and denser, and then the leaves are only slightly, or not at all, decurrent, and in connection with this the alar cells are short as in *Bryum cirratum*.

#### 148. *Bryum cirratum* Hoppe et Hornsch.

Rather common.

Grows in drier localities than does *B. affine*, for instance in gravelly soil, on slopes and among grass. It is especially common in NW. Iceland, and occurred abundantly for instance on stony slopes near Dýrafjörður.

The forms which are here referred to *B. cirratum* have ♂, ♀ and numerous ♂ flowers. The leaves are not decurrent, taper to a very long point, with narrow, almost linear cells in the upper portion. The spores are 0.014—0.020 mm., yellow, and finely papillose. *Bryum affine* and *B. cirratum* form a continuous series of forms, in which *B. affine* represents the hygrophilous and *B. cirratum* the xerophilous adaptation-form.

#### 149. *Bryum intermedium* (Ludw.) Brid.

N. Iceland: Grimsey (O. D.)!; Vidimýri!; Stadr near Hrutafjörður!.  
S. Iceland: Merkjáfoss (F.)!

Rather rare and scanty on damp soil. Near Stadr the fruit was ripe on August 1st, but the lid still persisted.

#### 150. *Bryum pallescens* Schleich.

Widely distributed.

One of the most frequent species everywhere up to a height of about 300 metres above sea-level. It usually grows on damp rocks, where it often forms very large and deep cushions, with numerous capsules; but it also occurs on damp soil. In South Iceland it is very common everywhere on faces of tuff rocks. The plant is, as a rule, monoicous, but very often hermaphrodite flowers are also met with, containing many antheridia and a few archegonia.

#### 151. *Bryum subrotundum* Brid.

S. Iceland: Uxavatn (F.)!



152. *Bryum capillare* L.

E. Iceland: Hamarfjörður!. N. Iceland: Mödrufellshraun (St.)!; Grimsey (O. D.)!. W. Iceland: Hvammur (Gr.)!; Hafnarfjörður!; Videy!, several places near Reykjavík!. S. Iceland: Breidabolstadr!; Holt!. Vestmannaey!.

This species occurs, as a rule only sparingly, on humus-covered rocks and in lava-clefts. Only on Vestmannaey was it common, occurring especially on the tumbled-down blocks at the foot of cliffs inhabited by sea-fowl.

The nerve usually vanishes just below the hair-shaped leaf-point. In the plant from Mödrufellshraun and in the majority of the specimens from Vestmannaey the nerve varied considerably in length, sometimes reaching scarcely beyond the middle of the leaf, sometimes almost to the apex. The plants from the former habitat, in addition, bore clusters of easily falling brown threads in the uppermost leaf-angles, quite similar in appearance to those in *Bryum aeneum*.

153. *Bryum caespiticium* L.

Iceland (Krabbe, 1863)!. E. Iceland: Seydisfjörður!; Vallanes (H. J.;!)!; Hallormstáðaskogur!. N. Iceland: Hálsskogur!; Stáartunga (O. D.)!; Víðvík (P. Sofóniasson)!. S. Iceland: Almannagjá!.

Grönlund records this species from Reykjavík and Laugardalur, but there are no specimens of it from these localities in the collections.

Grows in dry sandy soil, especially in birch coppices, and appears to be rather frequent in North and East Iceland. It occurred abundantly in several localities in Hálsskogur. Near Vallanes it occurred sometimes on dry sandy soil, sometimes on the dikes and peat-walls of the farm. In Hálsskogur the fruit was ripe on July 19th, but some of the lids still persisted.

154. *Bryum comense* Schimp.

N. Iceland: Reistarárgil (O. D.)! ♀; Hof (St.)!.

Both the above localities are situated on the east side of Eyjafjörður.

155. *Bryum elegans* N. v. Es.

E. Iceland: Djúpivogur! ♂; Berufjörður (Gr.)!. N. Iceland: Reykjahlid! ♂. NW. Iceland: Isafjardarheidi, at an altitude of 450 metres! ♂ and ♀. W. Iceland: Hafnarfjörður!; Svinahraun!. Vestmannaey!.

Not common, but sometimes abundant in humus-filled rock and lava clefts, etc. Near Reykjahlid it was common in the lava-field.

Varies considerably in leaf-form, the length of the nerve, etc. The plant from Isafjörður has distinctly bordered, erect spreading, and narrower leaves, and belongs most nearly to var. *carinthiaca* (Br. eur.) Breidl. In lava-clefts there usually occurs a low, compact form with



concave, adpressed, and not bordered leaves, with loose cell-tissue and not excurrent nerve, which agrees most closely with var. *Ferchelii* (Funck) Breidl.

### 156. *Bryum argenteum* L.

Commonly distributed.

This species has been found only in the lowlands, where it is especially frequent around inhabited localities. It grows there on the peat walls of the houses, on the dikes and on the ground in the neighbourhood of the dwelling houses, and prefers, on the whole, a well-manured substratum. It is also common near the sea-side, both on sandy soil and upon stones, and occurs especially abundantly below cliffs inhabited by sea-fowl, for instance on Vestmannaey.

### 157. *Bryum Neodamense* Itzigs.

Var. *orata* (Jur.) Lindb. et Arnell.

E. Iceland: Seydisfjörður!, sterile.

It was growing here in cushions about 6 cm. high, in water in a stream, at an altitude of about 100 metres.

### 158. *Bryum Duvalii* Voit.

Very common.

Grows everywhere on very wet ground or in water, especially in moss bogs or along the banks of streams, where it often forms large vinous red cushions in the light green patches of *Philonotis*, *Bryum ventricosum* and *Mniobryum albicans*. As a rule it does not ascend higher than 300—400 metres. Near Barkarstadr in S. Iceland it was found at an altitude of 500 metres. The fruit, which ripens in the middle of July, is rare, and has been found only rather scantily near Berufjörður, Ljosavatn and Tverá in Öxnadalur.

### 159. *Bryum pallens* Sw.

Widely distributed.

Grows on a damp substratum, both on soil and on rocks. In S. Iceland it is very common on faces of damp tuff rocks. It grows especially on the marginal strip of soil and on the slopes along streams, in small reddish tufts, associated with *Dichodontium*, *Philonotis* and *Dicranella crispa*, but it is very often sterile. On the promontory near Reykjavik it grew in enormous quantities on damp peaty ground, with masses of capsules which, in the first week of August, were ripe, but the lids were not yet thrown off.

It is only by exception that *Bryum pallens* ascends higher than about 300 metres above sea-level. Near Berufjörður it has been collected at an altitude of about 500 metres.

Note. *Bryum turbinatum* is recorded from Iceland by Mörch, Hornemann and Grönlund, but all the specimens in the collections are wrongly determined.

### 160. *Bryum ventricosum* Dicks.

Very common.

One of the most frequent mosses, which occurs in numerous forms everywhere on a damp substratum, both on soil and on rocks. In water, for instance in moss bogs and along the banks of streams, it forms extensive, light green mats. The plants are only slightly tomentose, with large, spreading leaves, and thin-walled cells. In bogs, where it occurs everywhere in abundance, it is sometimes low in growth, sometimes as much as 6—7 cm. high, and often richly fruiting. Forms from a more dry substratum, for instance from rocky clefts, are low in growth and densely tomentose. It is common upwards of 600 metres above sea-level.

### 161. *Bryum arcticum* (R. Br.) Br. eur.

This species is widely distributed over the whole of Iceland, but occurs, as a rule, rather sparingly.

It grows on peat, on damp sandy soil and on humus-covered rocks, usually mixed with other *Brya*, and hardly ascends higher than 200—300 metres. The fruit ripens at the end of July.

It varies rather considerably. The capsule is sometimes short and inflated, sometimes more slender. The spores vary from 0.020—0.035 mm. The lamellæ are usually connected by one or two transverse bars. Near Seydisfjörður a form has been collected with a partly aulacodont peristome and very few transverse bars.

### 162. *Bryum pendulum* (Hornsch.) Schimp.

N. Iceland: Hof (O. D.)!. W. Iceland: Reykjavik!; Reykholtalur!. S. Iceland: Gilfoss (F.)!; Barkarstaðr!; Breidabolstaðr!. Vestmannaey! In previous lists some more habitats have been enumerated for this species (Grl.; H. J.), but they are all due to confusion with other species, mostly with *B. arcticum*.

*Bryum pendulum* appears to be rather rare and, as a rule, has been found only in small quantity mixed with other *Bryum* spp. on damp sandy soil or on damp tuff rocks. Fruit ripens in the beginning of August.

As in *Bryum inclinatum* the base of the peristome may be rather differently developed. Thus, in a specimen from Breidabolstaðr, a rather large reddish-yellow thickening had been developed which could be loosened from the mouth of the peristome together with the peristome tooth belonging to it, as in the species of Hagen's *Brya hamatostoma*.

One of the specimens from Hof, collected by O. Davidson, was monoicous, but was otherwise quite typical.

163. **Bryum Brownii** Br. eur.

N. Iceland: Hof (O. D.)!. W. Iceland: Reykjavik!.

On the peninsula near Reykjavik it occurred abundantly on damp sandy ground in company with *Bryum pallens* and *B. inclinatum*. Fruit was ripe on August 5th.

It is also recorded from several localities which are enumerated in Grönlund's lists, but all the corresponding specimens in the collections are wrongly determined.

164. **Mnium hornum** L.

*Astrophyllum hornum* Lindb.

E. Iceland: Common from Hornafjörður to Berufjörður!; Seydisfjörður!; Vallanes (H. J.)!. N. Iceland: Akureyri!; Hof near Eyjafjörður (O. D.)!; Geitaskard!; Vatnsdalur!. NW. Iceland: Common everywhere about Isafjörður!; Bildudalur (C. H.)!; Dyrarfjörður!; near Jökulsfjörður!. W. Iceland: common everywhere (Grl.; H. J.;!). S. Iceland: Common! Vestmannaey!.

Common in East, South, West and North-west Iceland, rarer northwards. It occurred abundantly even in Vatnsdal and Blónddal (Geitaskard), but further eastwards it was collected only in a few localities near Eyjafjörður. It appears to be quite absent, for instance, from the district around Husavik. It grows almost exclusively on somewhat damp, peaty ground, especially on knolls or along the sides of ditches, more rarely on soil-covered rocks. ♀ plants occur rather frequently; on the other hand, it has not been found in fruit.

165. **Mnium orthorrhynchum** Brid.

*Astrophyllum orthorrhynchum* Lindb.

Very common everywhere in soil-filled rock-clefts, and ravines, on faces of damp tuff rocks, etc., and occurs in wide-spread unmixed tufts or more often mixed with other mosses. ♂ flowers are rather common; on the other hand, it has not been collected in fruit. It does not appear to ascend higher than 400—500 metres above sea-level.

166. **Mnium serratum** Schrad.

*Astrophyllum marginatum* (Dicks.) Lindb.

N. Iceland: Hof near Eyjafjörður (O. D.)!. Vidvik (P. Sofóniasson)!. W. Iceland: Giljáfoss and Kleppjarnsreykir in Reykholtsdalur (Grl.)!; Kalmanstunga (Grl.)!; Fell near Kollafjörður (St.)!; Alafoss!. S. Iceland: Flokastadagil!; Barkarstadr!; Holt!; Austarhlid near Geysir!. Vestmannaey!.

It grows on damp, shady rock-sides in caves and clefts in the lowlands, and is rather common in the southern part of the country,

where it often occurs abundantly in the clefts of tuff rocks. In West Iceland it is met with here and there, while it is rare in North Iceland and has not yet been found in East Iceland. The fruit, which is found everywhere, ripens in the first half of June.

167. **Mnium spinosum** (Voit) Schwægr.

*Astrophyllum spinosum* Lindb.

N. Iceland: Ásbýrgi (St.)!; Hof near Eyjafjörður (O. D.)!; Akureyri!

In all the above localities it was found on dry grass-covered ground growing among *Hylocomium proliferum*, *H. squarrosus*, *H. triquetrum*, *Hypnum uncinatum* and *Lophozia lycopodioides*. Near Akureyri it occurred, however, also on a somewhat damp slope (200 metres above sea-level), intermixed in a large tuft of *Mnium stellare*. Only ♀ flowers have been found.

168. **Mnium undulatum** (L.) Weiss.

*Astrophyllum undulatum* Lindb.

W. Iceland: Kollafjörður!, at an altitude of 100 metres. S. Iceland: Vik; Hnappavellir; Hjörleifshöfði (H. J.)!; Reykir!; Breidabolstadr!; Barkarstadr!; Seljaland!; Holt!; Drángshlid! Vestmannaey!

This species has been found only in the south-western part of the country, where it is common on Flótshlid and along Eyjafjall. It was found in several places on Vestmannaey, for instance abundantly in Heljusdalur. It grows as a rule in damp soil at the foot of rock-walls and in clefts, especially in localities which are well protected and have a luxuriant grass-vegetation. It is also met with in damp caves, for instance near Reykir. Only sterile specimens have been found.

169. **Mnium cuspidatum** (L.) Leysy.

*Astrophyllum silvaticum* Lindb.

N. Iceland: Hof near Eyjafjörður (O. D.)! S. Iceland: Holt! Vestmannaey!

Near Holt it grew at the bottom of and up on the sides of a small tuff-cave. On Vestmannaey it was found rather abundantly among grass on a somewhat damp slope.

*Mnium cuspidatum* is enumerated in Vahl's list, and has, moreover, been recorded from several localities by Grönlund, Stefansson and Helgi Jónsson. All these specimens are, however, wrongly determined, and the majority of them belong to *M. affine*.

170. **Mnium medium** Br. eur.

*Astrophyllum medium* Lindb.

SE. Iceland: Hornafjörður.

It grew here on boggy ground mixed with *M. affine* and *M. cinclidioides*.

171. *Mnium affine* Blandow.*Astrophyllum cuspidatum* (L.) Lindb.

Very common.

This species grows both in bogs, where it occurs everywhere and almost always intermixed with other bog mosses, especially *Hypnaceæ*, *Cinclidium stygium* and *Mnium cinclidioides*, and on the ground among grass, as also on rocks. It is most frequent in the lowlands, and hardly ascends higher than 400—500 metres above sea-level. ♀ plants are very common; on the other hand it has not been collected in fruit.

It varies considerably in habit, leaf-tissue and serrature of the leaf-margin. In very wet localities the annual shoots become erect and the stems often highly tomentose (var. *elata* Lindb.). On a more dry substratum, especially on humus-covered rocks, the annual shoots are bent downwards in a curve, and are rooting at the apex, and the fertile shoots are quite short. The leaves are only very slightly or not at all decurrent. In the forms from a dry substratum the leaf-cells are rather thick-walled, distinctly porous, and often collenchymatous; in bog-forms they are more thin-walled and slightly porous. The teeth of the leaf-margin are usually unicellular and obtuse, more rarely 2—4-cellular; forms are very frequently met with in which the teeth are very slightly developed or almost quite wanting, so that all transitions to var. *integrifolia* Lindb. occur. The latter form is occasionally met with, especially on rocks.

172. *Mnium Seligeri* Jur.*Astrophyllum Seligeri* (Jur.) Lindb.

E. Iceland: Hornafjörður!; Berufjörður!; Seydisfjörður!; Vallanes (H. J.)!. N. Iceland: Husavik!; Akureyri!; Ljosavatn!; Helgavatnsfloi (St.)!. W. Iceland: Stykkisholmur!. Very common in SW. Iceland!.

Grows on a very wet substratum, in marshes, moss bogs and along streams, and often very abundantly. ♀ plants are almost always met with; on the other hand, ♂ plants or plants in fruit have not been collected.

*M. Seligeri* is one of the mosses of most common occurrence in the south-western part of the country, from Hvalfjörður southwards, and also about Hornafjörður; it often forms the bulk of the vegetation, for instance in the great bogs in Ölfus. In E. Iceland it is rather common, and is also hardly rare in N. Iceland, but from NW. Iceland it appears to be quite absent. It is easily distinguished from *M. affine* by its broadly decurrent leaves, which are concave on the under surface. The leaf-cells are, as a rule, somewhat smaller than in *M. affine*, 0.04—0.07 mm., more thick-walled than in the latter species and decidedly collenchymatous; forms are, however, often found with thin-walled and somewhat larger cells, which are then hardly to be distinguished from *Mnium affine* v. *elatum* except by the decurrent leaves.



173. **Mnium stellare** Reich.*Astrophyllum stellare* Lindb.

E. Iceland: Berufjörður!; Hof!. N. Iceland: Akureyri!, fr.; Tverá in Öxnadalur!. W. Iceland: Waterfall in Brynjudalur (Grl.)!. S. Iceland: Holt!; Vestmannaey!.

This species grows on damp soil, in rock-clefts, and on tuff, and as a rule sparingly. Near Akureyri it was found mixed with *M. spinosum* on a damp slope, and in fruit which was ripe on July 20th, but the capsules had not then thrown off their lids. Near Berufjörður it grew in the fissures in the basalt, mixed with *Pohlia cruda*, *Distichium montanum* and *Plagiothecium pulchellum*. In Heljusdalur on Vestmannaey it covered the vertical faces of large, tumbled-down blocks of tuff rock in company with *M. serratum* and *M. orthorrhynchum*.

174. **Mnium cinclidioides** (Blytt) Hübén.*Astrophyllum cinclidioides* (Blytt) Lindb.

Very common over the whole of Iceland.

The most common species of *Mnium*. It is hardly absent from any bog, where it often forms the bulk of the vegetation, and it is also found everywhere in moss bogs and along the banks of streams. It is common even at a height of above 400 metres above sea-level, and occurs, for instance near Seydisfjörður and Akureyri, in bogs at an altitude of about 500 metres. ♀ plants are common, ♂ plants and fruit have not been found in Iceland.

175. **Mnium punctatum** (L.) Hedw.*Astrophyllum punctatum* (L.) Lindb.

Very common all over Iceland.

Grows everywhere in damp localities, in marshes, where it often forms the bulk of the vegetation, in moss bogs, along the banks of streams, on wet rocks, by waterfalls, etc. It is most frequent in the lowlands up to 300—400 metres, but very often it ascends considerably higher, for instance in Svinaskard to about 500 metres above sea-level, and in Berufjardarskard to about 550 metres.

♀ plants are common; the fruit, which is frequently found, was overripe in the middle of June, and the capsules had thrown off their lids (E. Iceland).

176. **Mnium subglobosum** Br. eur.*Astrophyllum pseudopunctatum* (B. S.) Lindb.

E. Iceland: Hornafjörður!, sterile. N. Iceland: Hof near Eyjafjörður (O. D.)!, fr.; Stadr near Hrutafjörður!, fr.; Mödruvellir (St.); Mývatn (Grl.)!, sterile. W. Iceland: Reykjavik!. The other habitats recorded by Grönlund belong to *Cinclidium stygium*.



This species is no doubt rather widely distributed, but often overlooked on account of its great resemblance to the far more frequently occurring *M. punctatum*. Like the latter it grows on wet boggy ground. Fruit was unripe both near Hornafjörður (June 11th) and near Stadr (July 29th).

### 177. *Cinclidium stygium* Sw.

Very common.

In East and North Iceland this species is one of the mosses of most common occurrence, and is found everywhere in bogs, where it is often the most abundant constituent of the vegetation. Here it grows by preference in the wettest parts, growing even in the shallow water on inundated ground or along streams, but it occurs also on more dry ground, and then usually mixed with other bog mosses, for instance, *Hypna*, *Mnia* and *Sphagna*. In the other parts of the country it is also common, although there it does not occur so abundantly; in South Iceland I have only observed it growing intermixed — as a rule scantily — with other bog mosses in, I think, every bog, but never in large growths. Near Akureyri it is frequent as far upwards as about 600 metres above sea-level, and in East Iceland, for instance near Berufjörður, it was collected up to a height of 550 metres. The fruit, which is common especially in North Iceland, ripens at the end of July.

Note. A small sterile plant, collected by Helgi Jónsson near Höfði, was by C. Jensen referred with doubt to *Cinclidium subrotundum*, but a closer investigation has proved that it must be referred to *C. stygium*.

## FAM. MEESEACEÆ.

### 178. *Paludella squarrosa* (L.) Brid.

This species has a similar distribution to that of *Cinclidium stygium*. It grows in bogs and is exceedingly common especially in N. Iceland, where it sometimes occurs mixed with other bog mosses, sometimes in large, pure cushions. It is also common in E. Iceland, at any rate from Berufjörður northwards, in NW. Iceland and in W. Iceland. In S. Iceland it is far more rare, and has not been found, for instance, on Fljótshlid or below Eyjafjall. It does not appear to ascend very much higher than about 400 metres above sea-level. Fruit was found only near Eyjafjörður.

### 179. *Amblyodon dealbatus* (Dicks.) P. Beauv.

N. Iceland: Hof near Eyjafjörður (O. D.)!, fr.

It was growing here scantily, intermixed in a tuft of *Distichium montanum*, *Ditrichum flexicaule*, *Myurella julacea*, etc.

### 180. *Meesea trichoides* (L.) Spruce.

*Meesea uliginosa* Hedw.

Very common.

This species grows especially on boggy ground, but is also frequent

on wet sandy or gravelly ground and on damp rocks. In the greater part of the country it is very common in such localities; only in NW. Iceland and partly in S. Iceland does it occur more scantily, for instance on Fljótshlid and below Eyjafjall. It is most frequent in the low land, but nevertheless often ascends up to a height of 500—600 metres above sea-level. The fruit, which is always present plentifully, ripens at the end of July.

181. **Meesea triquetra** (L.) Ångstr.

*Meesea tristicha* Br. eur.

Common in E. and N. Iceland!. NW. Iceland, Arngerdareyri!; W. Iceland: frequent about Reykjavik and Esja!; rarer and most scanty in S. Iceland.

It grows on boggy ground, sometimes in small unmixed tufts, sometimes intermixed with other mosses such as *Hypnaceae*, *Paludella*, *Mnium affine*, etc. Only sterile specimens have been found.

182. **Catoscopium nigratum** (Hedw.) Brid.

Very common in E., N. and W. Iceland, more rare and rather scanty in NW. and S. Iceland. It grows on wet boggy ground, where it sometimes forms very dense tufts about 8—10 cm. high, sometimes grows interspersed in tufts of other mosses. It occasionally occurs so abundantly, especially in N. Iceland, that it may form the main part of the vegetation in the bogs.

Grönlund records that this species is one of the character-plants of the warm ground, and C. Jensen (Bot. Tid. XIV 1885) has described a var. *Grönlundii*: "filiformis, humilis, superne flavescens, inferne nigrescens. Folia subremota imbricata, minima, ovata lanceolata, integra vel subintegra, costa crassa in apicem evanida, cellulis minoribus, incrassatis et papillois," which was collected by Grönlund near a hot spring in Reykholtdalur. In Grönlund's collections in the Botanical Museum in Copenhagen there are some mosses determined as *Catoscopium nigratum* or *C. nigratum* var. *Grönlundii* from a warm substratum. Of these only one specimen from Reykholtdalur belongs to var. *Grönlundii*, and I have collected similar forms rather scantily near other hot springs. This form differs only slightly from the type, chiefly only in being less tomentose and in having shorter leaves. Almost all the other specimens of *Catoscopium* collected by Grönlund were wrongly determined, as they belong to *Archidium phascoides*, and on the whole *Catoscopium* occurs only accidentally and scantily on a warm substratum.

The fruit, which occurs very frequently and plentifully, was in June-July either old and emptied from the previous year or yet quite unripe.

183. **Conostomum boreale** Swartz.

*Conostomum tetragonum* (Vill.) Lindb.

Widely distributed over the whole of Iceland.

In W. and S. Iceland this species is found only by exception at a

lower level than about 250 metres, and not until a height of about 400 metres and upwards is it common. In N. and E. Iceland it is also most frequent in the Alpine region, but grows, however, abundantly down to the low land in many places, for instance near Hof in the south-east. In NW. Iceland it is very common from the sea-level up to the snow-line.

It usually grows on dry and stony — more rarely damp — ground, most frequently on rocky flats, where it forms exceedingly dense and compact cushions, as much as 10 cm. deep, which occur wedged very firmly into the substratum. The cushions are, as a rule, interwoven with hepatics such as *Lophozia alpestris*, *L. ventricosa* v. *porphyroleuca*, *Pleuroclada albescens*, *Cephalozia pleniceps*, etc.

Like many other Alpine species *Conostomum* also occurs in the lava-fields, for instance abundantly in the clefts near Thingvalla; the tufts are here considerably looser and less tomentose than in the Alpine form. Fruit, which occurs everywhere, ripens in the first half of August.

#### FAM. AULACOMNIACEÆ.

##### 184. *Aulacomnium palustre* (L.) Schwägr.

*Sphærocephalus palustris* (L.) Lindb.

Very common on damp boggy ground along the banks of streams, and on damp, soil-covered rocks. It occurs most abundantly on knolls in bogs, in company with species of *Sphagnum*, and among *Carices* in damp tracts of meadow land. Only sterile specimens have been found.

##### 185. *Aulacomnium turgidum* (Wahlb.) Schwägr.

*Sphærocephalus turgidus* (Wahlb.) Lindb.

E. Iceland: Hof!; Seydisfjörður!; Skreiddal!; Berufjardarskard!, at an altitude of 540 metres; Djupivogur!. N. Iceland: Vatnsdalsfjall (St.); Lækjarmot!, at an altitude of 350—450 metres; Akureyri!, at an altitude of about 900 metres. NW. Iceland: Grunnavik!, at an altitude of 260 metres; Armuli!, at an altitude of 150 metres. W. Iceland: Esja!, at an altitude of 420 metres. S. Iceland: Holt near Eyjafjall!; in several places from the low land up to 400 metres above sea-level.

This species is rather common especially in E. Iceland, in fact it may almost be called common there; for instance, near Hof in SE. Iceland it was very frequent and, in several localities, plentiful. It appears to be of almost equal frequency in the lowlands and on the mountain heights.

It grows especially on somewhat damp gravelly ground, more rarely on soil-covered rocks, associated with *Hylacomium*, *Rhacomitrium canescens*, *Dicranum congestum*, *Hypnum uncinatum*, etc. Near Hof it grew in great abundance along the river, on the gravelly flats covered with *Grimmia canescens*. Near Lækjarmot it was common as an intermixture in the *Rhacomitrium hypnoides* heath on the mountain slopes, about 350—400 metres above sea-level, and near Grunnavik it grew on damp rocks among other mosses. Only sterile specimens have been found.

## FAM. BARTRAMIACEÆ.

186. *Bartramia ityphylla* (Haller) Brid.

Very common.

One of the most frequent mosses, both on a dry and on a somewhat damp substratum, from the lowlands to far up in the Alpine region. It grows in soil-filled rock-clefts, on dikes and house-walls, on peat and on the top of knolls in bogs. As a rule, it grows in small, unmixed tufts, but occasionally also mixed with other mosses. The fruit, which ripens during August, occurs plentifully everywhere.

187. *Plagiopus Æderi* (Gunn.) Limpr.

*Bartramia Æderi* (Gunn.) Sw.

E. Iceland: Berufjörður!, fr. N. Iceland: Hóf near Eyjafjörður (O. D.)!; Reistarárgil (O. D.)!, fr.

Near Berufjörður it grew abundantly on a wet rock-face with a northern exposure, in cushions, about 3 cm. high, with numerous capsules which were ripe at the end of June.

188. *Philonotis fontana* (L.) Brid.

Very common over the whole of Iceland.

One of the most frequent and abundantly occurring species which grows everywhere on a wet substratum, in marshes and moss bogs, along streams, and on wet rocks, but is also common on a more dry substratum, for instance in grass fields or on humus-covered rocks. It is of almost equal frequency at all elevations upwards to the limit of vegetation. The fruit, which is found very frequently, ripens in the low land about August 1st.

*Philonotis fontana* is extremely variable, and conditions pertaining to dampness especially exercise great influence over the appearance of the plant. The usual bog forms are highly tomentose, with erect or more or less falcato-secund leaves (f. *falcata* Warnst.). On a more dry substratum the tufts usually become denser and more highly tomentose, and the plants more slender.

In the cold water in moss bogs and on inundated ground along rivers where the temperature during summer is often only 4<sup>0</sup>–6<sup>0</sup> this species, in association with *Pohlia albicans* var. *glacialis*, *Brachythecium rivulare* and species of *Mnium*, often forms the main part of the vegetation. Here it forms very high and loose, in fact hardly cohering, tufts, which often resemble *P. seriata* in habit. The stems are flaccid and hardly tomentose; the leaves are short and appressed or slightly secund, and often obtuse or cucullate at apex. The nerve is very broad and widened at the base. Such cold-water forms agree exactly with Loeske's *P. fontana-adpressa* (L. Loeske, Kritische Bemerkungen über einige Formen von *Philonotis*, *Hedwigia*, vol. 45, p. 100, and Kritische Übersicht der eur. *Philonoten*, *Hedwigia*, vol. 45, p. 195). That it is the cold water which checks the growth of the radicles and causes the



characteristic form of the leaves and the looser cell-tissue is seen from the fact that, in situations where the water-level is altered, forms may be found growing in tufts, in the lower part of which the stems are tomentose and the leaves normal, while all the young shoots which have developed after the habitat has been inundated have the typical *depressa* appearance. Likewise are found all possible transitions between *P. fontana* and the *depressa* form.

On mountain heights, where the snow lies long, the slopes are often covered with *f. nigrescens* Loeske, with black, prostrate and hardly to-



Fig. 8. *Philonotis fontana* (L.) Brid. Slender form from warm ground (Thorlákshver; nat. size).

mentose stems and light yellowish-green annual shoots. This form has beyond doubt originated from the pressure of the snow-covering. The leaves are, as a rule, shortly pointed. Where the water from the melted snow remains and soaks the tufts the leaves become still more shortly pointed and the cell-tissue looser (*f. borealis*, Hagen, Loeske). By hot springs *P. fontana* often occurs abundantly both in the lukewarm water and on the warm clayey flats. Here it forms very soft, not cohering tufts. The stems are erect and very slender; the leaves are small, often strongly falcato-secund, longly pointed, highly papillose, and sharply toothed along the margin, with narrow (0.05—0.06 mm. broad) nerve.

Note. *P. calcarea* from Frodarheidi (leg. H. J.) is *P. seriata*.

### 189. *Philonotis Arnellii* Husnot.

N. Iceland: Hof near Eyjafjörður (O. D.)!. SW. Iceland: Thingvellir!; between Reykjavik and Hafnarfjörður!.

Near Thingvellir it grew on a soil-covered rock-ledge in a cleft, in association with *Eucalyx subellipticus*, *Bartramia ityphylla* and *Pohlia cruda*. All the specimens found were ♂ plants.

### 190. *Philonotis seriata* (Mitt.) Lindb.

E. Iceland: Berufjörður!; Seydisfjörður!; Kirkjuból (H. J.)!. N. Iceland: Husavík!, at an elevation of 200—300 metres; several places near Eyjafjörður (O. D.;!)!; Mývatn (Gr.)!; common in Öxnadalur!. NW. Iceland: Very common by all the fjords from Dýrafjörður northwards!. W. Iceland: Frodarheiði (H. J.)!; Esja, many places!. S. Iceland: Seljaland (Stp.)!.

Grows on inundated ground, as a rule in the water itself, for instance along streams and in moss bogs.

In NW. Iceland it is one of the most frequently occurring species, and is met with abundantly up to a height of above 400 metres above sea-level. It often forms in association with *Pohlia albicans*, *Scapania uliginosa*, *Haplozia cordifolia* and *Chiloscyphus polyanthus* v. *fragilis* the main portion of the moss-carpet along streams. In the other parts of the country — with the exception of S. Iceland where it has been found only near Seljaland — it is rather common. It is usually met with from about 250 to 500 metres above sea-level, but frequently ascends up to about 600 metres, for instance by Berufjörður. The fruit, which was quite green even in the first half of July, has been found only in a few localities in the district of Isafjörður and near Eyjafjörður, and only scantily.

### 191. *Philonotis tomentella* Mol.

*P. alpicola* Jur.

Widely distributed over the whole of Iceland.

*P. tomentella* usually prefers drier localities than does the closely allied *P. fontana*. In N. Iceland, where it is very common, it grows abundantly everywhere on partially dry, grass-covered ground, and is easily distinguished from *P. fontana* by its more slender growth and by the extremely dense tufts, with stems covered with brown tomentum almost to their summit. It grows, also, both on rather dry and on damp rocks and on wet boggy ground in company with *P. fontana*, without, however, extending into the water itself.

It varies very considerably in habit and size. The leaves are more or less falcato-secund, and forms especially from dry rocks have leaves strongly falcato-secund (f. *falcata*). In shady localities, for instance in rock-clefts and caves, slender to almost thread-like forms (var. *capillaris*) are frequently met with. Forms growing in bogs are more vigorous than are those growing on a dry substratum, and are also less densely tomentose.

On damp rocks and in humus-filled rock-clefts there frequently occurs a slender form with numerous slender, easily falling branches which probably serve for vegetative propagation (f. *flagellifera*).

Limpricht (Kryptogamenflora, vol. II, p. 573) records that the



cortex in this species consists of 3—4 layers of sharply defined, small stereids covered with a sphagnoid outer cortex, while *P. fontana* has not a sharply differentiated cortical layer. This feature appears, however, to be closely connected with the degree of dampness of the habitat, so that forms from a dry substratum, both of *P. tomentella* and of *P. fontana*, have several layers of thick-walled cortical cells, while bog-forms have thin-walled cortical cells, and (as in *Dicranum scoparium* and *D. angustum*) all possible transitions may be found between thin-walled and thick-walled cortical cells.

Fruit occurs very frequently and ripens at the end of July or in the beginning of August.

#### FAM. TIMMIACEÆ.

##### 192. *Timmia norvegica* Zett.

E. Iceland: Hof!; Vallanes (H. J.)!. N. Iceland: Pollar (St.)!; Akureyri!, at an altitude of 300 metres; Hof near Eyjafjörður (O. D.)!; Vidimýri (Gr.)!. S. Iceland: Vestmannaey!.

It grows on earth and in rock-clefts, but has been collected everywhere only scantily. Near Hof (E. Iceland) it grew on gravelly ground in association with *Oncophorus virens*, *Ditrichum flexicaule*, *Myurella julacea* and *M. apiculata* at an altitude of about 150 metres. Near Akureyri it was found sometimes in rock-clefts, in company with *Mnium orthorrhynchum*, sometimes on rocks mixed with *Philonotis tomentella*. Only sterile specimens have been found.

##### 193. *Timmia austriaca* Hedw.

Very common especially in N. and E. Iceland, but more rare in NW. Iceland (Dýrafjörður, Isafjörður, Grunnavík!). It grows on earth or on soil-covered rocks, and often in masses. Thus in several places in Hallormstadsakogur it was the most abundant member of the moss-carpet under the birches, especially on knolls and soil-covered stones. In several places in N. Iceland, for instance in Öxnadalur, it covered the slopes along streams, often greatly mixed with other species.

*Timmia austriaca* is most frequent in the lowlands up to a height of about 300—400 metres, but is also often found on mountain heights (for instance on Seljaland at an altitude of about 620 metres) although usually in small quantity. Fruit has been found only near Tverá and Vidimýri in N. Iceland; it occurred plentifully in both places and had just ripened at the end of July.

#### FAM. POLYTRICHACEÆ.

##### 194. *Catharinea undulata* (L.) Web.

E. Iceland: Hornafjörður!; Lon!; Berufjörður!. N. Iceland: Hof near Eyjafjörður (O. D.)!; Reykir near Svinavatn (Gr.)!. W. Iceland: Reykja-

vik (Mörch;!); near hot springs in Reykholtalur (Grl.!!); Borgarfjörður!. Common in SW. and S. Iceland!.

Commonly distributed in SE., S. and W. Iceland from Lon in the south-east to Borgarfjörður in the west. In N. Iceland it has been found only near Eyjafjörður, and it has not been collected in NW. Iceland. It grows sometimes on peat, sometimes on damp clayey ground, for instance by sides of ditches, and is occasionally found in fruit, which about Reykjavik was quite undeveloped even in August. It is a decidedly low-land species, and has not been found at a higher elevation



Fig. 9. *Catharinea undulata* (L.) Web. var. *thermophila* (nat. size).

than 50–100 metres above sea-level. The usual forms of this species are low in growth, 1–2 cm. high, with leaves which are as a rule 4–6 mm. long, narrowly lanceolate, obtuse or shortly pointed, only slightly undulate with a few spines at the back, and the margin often with single teeth.

*Catharinea undulata* is one of the species which is found most frequently and abundantly on warm ground, where it occurs in rather divergent forms. Usually it resembles the southern woodland forms with long, strongly undulating leaves, very rough at the back. A very peculiar form is

Var. *thermophila* n. var.

Loose cushions as much as 10 cm. high. Leaves evenly distributed along the whole length of the stem, or somewhat denser at the top, often falcato-secund, 6–7 mm. long, linear-lanceolate, sharply pointed, with 4–5 lamellæ at the back. Lateral shoots are often developed along

the stems. This form grew abundantly near the hot springs about Skálholt, especially on the slopes stretching down towards the outlets of the springs.

### 195. *Oligotrichum hercynicum* (Ehrh.) Lam.

*Oligotrichum incurvum* (Huds.) Lindb.

Iceland (Mörch). E. Iceland: Seydisfjardarheidi!. N. Iceland: Ljosa- vatn!, common 350 metres above sea-level and upwards; Askja (Caroc)!. NW. Iceland: Very common!. W. Iceland: Stadarfell (Stp.); Esja!, at an altitude of 400—500 metres; Reykholtalur (Gr.;!); Hafnarfjörður!. S. Iceland: Common from about 350 metres and upwards!; Krisuvík (Stp.)!; everywhere near hot springs!.

This species has a very peculiar distribution in Iceland. It has its main area of distribution on the mountain heights, where it doubtless occurs over the whole of Iceland, and often in masses. It grows here on damp gravelly flats, especially in the neighbourhood of the snow-patches, in association with *Anthelia Juratzkana*, *Pleuroclada albescens*, *Pohlia gracilis*, *Polytrichum sexangulare*, etc., and as a rule sets fruit. Scarcely anywhere has it been found until at a height of 350—400 metres, and was most abundant at about 500—700 metres above sea-level. Only in NW. Iceland, where it is exceedingly common, did it descend to a lower altitude, in many places as low as to the sea-level. In the greater part of the country it is quite absent from the low land; in SW. Iceland it has been found only scantily in a lava cave near Hafnarfjörður.

This species has another area of distribution near the hot springs in SW. and W. Iceland. Here it has been collected near a great number of springs in Reykholt- and Reykirdalur, around Skálholt and in several other places, where it often occurs abundantly on the warm clayey flats, but only sterile. These warm-soil forms differ somewhat from the Alpine forms. As a rule they are quite low in growth, about 5—10 mm. high, with softer leaves, twisted or incurved when dry, with a few (5—6) lamellæ at the back. The leaf-cells are more thin-walled, chlorophyllous, larger and more regularly quadrate and transversely elongated, usually 0.015—0.018 mm., but occasionally also 0.025 mm. in diameter, shortly rectangular at the base, 0.018 mm. broad. The nerve is often only half as broad as in the Alpine form. Such forms grow especially on the warm clayey flats, in company with *Anthoceros*, *Fossombronia*, *Haplözia crenulata* and other hepatics. Near Deildartunguhver in Reykholtalur it grew on the warm ground among other mosses, in tufts about 3 cm. high. Forms exactly resembling the Alpine forms occur also frequently on the warm ground.

In the majority of the localities in NW. Iceland the fruit was ripe in the latter half of June, on the mountain heights early in July.

196. *Psilopilum lævigatum* (Wahlb.) Lindb.*Oligotrichum glabratum* Lindb.*O. lævigatum* Br. eur. *Psilopilum arcticum* Brid.

E. Iceland: Hornafjörður!; Berufjörður!; Seydisfjörður!. N. Iceland: Husavík!; Akureyri!; Hof near Eyjafjörður (O. D.)!; Geitaskard!. NW. Iceland: Isafjörður!; Snæfellsströnd!. W. Iceland: Stykkisholmur!; Stadarfell (Stp.)!; Hafnarfjörður!; Reykjavík (Mörch; Ho.; Stp.;!). S. Iceland: Common in Ölfus!.

Commonly distributed everywhere near the coasts. It grows there on rather dry peaty ground, and often in great abundance. For instance near Reykjavík it covers in association with *Dicranella crispa*, *Bryum pallens*, *Scapania curta*, etc. large tracts of ground on the peninsula. It appears to thrive more particularly in drained bogs whence peat is being cut; thus around Husavík, Akureyri and Isafjörður it occurred in very great abundance, partly on the ground and partly on the piled up heaps of cut peat, which were often quite covered by it. *Funaria hygrometrica* and *Pogonatum urnigerum* often occurred abundantly in company with it. Fruit ripens in the beginning of (Reykjavík) or at the end of June (N. Iceland).

Note. F. Hagen in his preliminary works on a Frondose-Moss Flora of Norway (XIX, *Polytrichaceæ*) supposes that *Psilopilum tshuctschicum* (Müll. Hal.) Par. has been collected in Iceland by W. F. Hooker. All the specimens I have had an opportunity of investigating, both numerous older specimens collected by Mörch, Krabbe, Grönlund and others and my own specimens collected in a considerable number of habitats from all parts of Iceland, belong to *Psilopilum lævigatum*, which is doubtless the only species of this genus found in Iceland.

197. *Pogonatum polytrichoides* (L.) Brockm.*Pogonatum nanum* (Schreb.) P. B. *P. subrotundum* Lindb.

Iceland (Ho.; Mörch)!. W. Iceland: Reykjavík (Gr!.;!); Stykkisholmur (Stp.)!; Sletta (Stp.); in the district of Borgarfjörður!. S. Iceland: Near the Thjorsá (Stp.)!; frequent in Ölfus!.

This species was found only in SW. and W. Iceland, but was rather common in both places on somewhat damp and especially peaty soil, for instance by the sides of ditches and along roads. In the district of Borgarfjörður it was common along roads. Around Reykjavík it was found everywhere by the sides of ditches. Fruit was found everywhere, the capsules were partly old specimens from the previous year and partly such as were quite young even in August.

Note. *Pogonatum aloides* (Hedw.) is recorded to have been collected by Steenstrup near Sletta, Stykkisholmur and the Thjorsá, but all the specimens belong to *P. polytrichoides*.



198. **Pogonatum dentatum** (Menz.) Brid.Var. **minus** (Wahlb.) Hagen.

Reykjavik!

Here it grew in several places on peaty soil, and in one place very abundantly, with numerous capsules, some of which were almost ripe in the first half of August.

199. **Pogonatum urnigerum** (L.) P. B.*Polytrichum urnigerum* L.

Widely distributed over the whole of Iceland.

Grows usually scattered as individual plants, or a few plants together, among other mosses on dry, humus-covered rocks or on the ground, both dry and somewhat damp; for instance along the banks of streams. It occurs in large quantities on peat, often forming large light-green patches, interwoven with *Alicularia scalaris* and, occasionally, *Scapania curta*. On somewhat damp, moss-grown slopes it often forms large tufts several centimetres high among *Hylocomium* spp., *Hypnum uncinatum* and *Polytrichum alpinum*; such vigorous forms are also frequently met with in South Iceland on somewhat damp ground, for instance by the sides of ditches. It is most frequent in the lowlands and does not appear to ascend above 300—400 metres. The fruit, which only occurs on large plants growing in tufts, was ripe or overripe in the beginning of June.

200. **Polytrichum alpinum** L.

Very common everywhere both on dry and on somewhat damp ground, and almost equally frequent from the sea-level up to the limit of vegetation on mountain heights. It grows both mixed with species of *Hylocomium* and interspersed in *Rhacomitrium*-mats on knolls in bogs, on peat, in grass-fields and on the stony slopes of mountain heights. The fruit, which occurs very frequently, ripens in the lowlands about August 1st.

Varies considerably in habit, length of leaf, form of capsule, etc., but the majority of the forms, however, approach closest to the type. Forms agreeing more or less with var. *septentrionale* (Sw.) Brid. are also common.

201. **Polytrichum formosum** Hedw.

W. Iceland: "Sæluhusid" in Sókkólfaldalur (F.)!, sterile.

202. **Polytrichum gracile** Dicks.

Rather common over the whole of Iceland.

This species grows in peaty soil, often abundantly, and sets fruit almost always. It occurs only in the low land and has hardly been

found at a higher level than 200—300 metres. Near Akureyri the fruit was ripe at the end of July.

Var. *anomalum* (Milde) Hagen.

Hof near Eyjafjörður (O. D.)!. NW. Iceland: Hesteyri!.

In both these places it was collected scantily only. Near Hof it occurred as a few scattered individuals in a specimen of the vegetation taken from wet boggy ground. Near Hesteyri it grew on very wet boggy ground. The plants were about 3 cm. high and sterile. Some of them agreed with var. *anomalum*; in some the leaves at the base of the stem resembled in structure those of the variety in having thin-walled cells 0.020—0.025 mm. in size, while the leaves in the upper part of the stem resembled in structure those of the type in having cells 0.015—0.020 mm. in size.

Var. *anomalum* is undoubtedly a hygrophilous form of *P. gracile*, which develops when the habitat is inundated.

### 203. *Polytrichum sexangulare* Floercke.

Iceland (Mörch)!. N. Iceland: Ljosavatn!; Reykjaheidi!; common near Eyjafjörður (O. D.;!). NW. Iceland: Very common!. W. Iceland: Esja!; Kolvidarhol!. S. Iceland: Seljaland!; Holt!; Thingvallabraun!.

Var. *vulcanica* C. Jens.

“Seta perbrevis usque ad 4 mm. longa; apophysis valde indistincta; capsula non angulata, vetusta nigrescens et irregulariter 4—5-gona; Cetero typo simile.”

S. Iceland: The volcano on the road to Holt (Stp.)!.

Var. *tenellum* n. var.

Plants 1—2 cm. high, more slender than the type, with shorter, narrower, more slightly incurved and not secund leaves, when dry; the nerve excurrent in a short mucro; otherwise exactly like the type.

S. Iceland: Barkarstadr!; Drángshlid!; Seljaland!.

*Polytrichum sexangulare* has a very peculiar distribution in Iceland. The type is a decidedly Alpine plant which does not feel quite at home until near the snow line, on the gravelly flats soaked by the melting snow. In N. Iceland it has been collected only at elevations of above 500 metres. In NW. Iceland, where the species is very common, it is met with everywhere from about 200—300 metres upwards. On northern slopes where the snow lies long it sometimes descends as far down as to the sea-level. Near Kolvidarhol it was common at about 400 metres, and on Esja everywhere at elevations of above 500 metres.

*P. sexangulare* has not yet been collected in E. Iceland, but the reason can hardly be that it does not occur there, it must rather be due to the fact that the mountain heights were almost everywhere snow-covered at the time of the year (June, 1909) when there was an opportunity of making collections there. This species has an area of distribution not only on the mountain heights, but also in the lowlands.





Fig. 10. *Polytrichum sexangulare* Floercke var. *tenellum*.  
*a*, in a damp, and *b*, in a dry condition ( $\times 6$ ).

In lava clefts near Thingvellir and in deep lava clefts on Reykjarheidi (at an altitude of about 250 metres) it was found abundantly in several places in association with several other Alpine species, for instance *Gymnomitrium concinnalum*, *G. varians*, *Pleuroclada albescens* and *Pohlia commutata*. The occurrence of this species in such localities is undoubtedly connected with the fact that there the conditions pertaining



Fig. 11. *Polytrichum sexangulare* Floercke var. *tenellum*.  
*a*, *b* and *c*, leaves ( $\times 15$ ); *d*, leaf-apex ( $\times 100$ ).

to soil present certain points of resemblance to the mountain heights, as the snow in the deep clefts, the bottom of which is never reached by the rays of the sun, often remains till late into the summer. The occurrence of var. *tenellum* is more peculiar. It has been found only in S. Iceland, where it grew exclusively on dry or slightly damp blocks of tuff in the lowlands. But only near Seljaland did a few small tufts occur on a block of tuff at an altitude of about 600 metres. Near Drángshlid it grew abundantly on the fallen blocks of rock at the foot of the rock-wall behind the farm. There in company with *Hypnum cupressiforme*, *Ceratodon*, *Didymodon rubellus*, *Racomitrium fasciculare* and *Bryum argenteum* it formed tufts of varying size on the top of the blocks in dry situations. Near Barkarstadr it was found on a somewhat damp tuff-face, and creeping over fallen blocks of rock, in association with *Pohlia cruda*, *P. grandiflora*, *Anæclangium compactum*, *Bryoxiphium norvegicum* and *Anthelia* spp. The plants from these habitats were quite sterile, and exactly alike in all respects.

The fruit, which is common in the Alpine form, ripens in August (Akureyri: ripe Aug. 13th; near Isafjörður: green in the first half of July).

#### 204. *Polytrichum piliferum* Schreb.

*Polytrichum pilosum* Neck.

Iceland (Mörch)!. E. Iceland: Vallanes (H. J.;!); N. Iceland: Reykjahlid (Gr!;!); NW. Iceland: Bildudalur (C. Hansen;!); Gnupr near Dýrafjörður!; Ármuli!; Arngerðareyri!. W. Iceland: Stykkisholmur (H. J.;!); Grund in Skorradalur!; common near Reykjavik!; Videy!; Hafnarfjörður (Winstedt)!. S. Iceland: Krisuvik (Stp.;)!; Drángshlid!.

Occurs here and there, and is rather rare in the majority of the districts of Iceland. It grows on dry sandy ground, upon soil-covered rocks and on dikes, often singly among other mosses. It is absent from or rare in the most rainy parts of the country, for instance at the East coast and in South Iceland and is most frequent in those districts where the rainfall is least. Thus it occurs abundantly near Mývatn, where it is common in the lava-field. It is also rather widely distributed in NW. Iceland, here it is often found in abundance, for instance on sandy fields near Ármuli and on rocks near Arngerðareyri. Fruit is common and ripens in the latter half of June.

#### 205. *Polytrichum juniperinum* Willd.

Commonly distributed.

It grows on more or less dry ground, for instance on knolls in bogs, in the *Racomitrium-canescens* heath, on slopes among *Hylocomium* and *Racomitrium* etc., usually scattered among other mosses, more rarely in cohering tufts, and almost always sets fruit which ripens at the end of June and in the beginning of July (Seydisfjörður, July 6th; Isafjörður, June 24th).

It is most widely distributed in the lowlands and does not appear to ascend much higher than about 400 metres above sea-level.

206. *Polytrichum strictum* Banks.

E. Iceland: Hornafjörður, common!. N. Iceland: Husavík!; Akureyri, common to about 600 metres above sea-level!; Hof near Eyjafjörður (O.D.)!; common from Geitaskard westwards to Hrutafjörður!. NW. Iceland: Common around Ísafjörður!; Grunnavík!; Kaldalon!. W. Iceland: Grund in Skorradalur!; Ólafsdalur (H. J.)!; Reykholtalur, common!; Reykjavík!. S. Iceland: Skálholt!, ♂; Geysir (Stp.)!.

Occurs rather commonly and often abundantly on wet boggy ground, but always sterile. In Reykholtalur it also grows on warm ground.

207. *Polytrichum commune* L.

Widely distributed on damp ground, both in bogs and along the banks of streams, but as a rule rather scantily.

In the low land, where *P. commune* has its greatest distribution, the large coarse form is usually met with. In higher regions, where it is found up to a height of about 500 metres, it usually becomes slenderer and lower in growth. Thus, near Akureyri, it occurred abundantly in a bog at an altitude of 500 metres as a low-growing, slender form, mixed with *Hypnum stramineum*.

*P. commune* is one of the most frequent species near hot springs, where it grows sometimes mixed with *Sphagnum* and is then large and vigorous, sometimes in extensive mats interwoven with hepatics and is then usually low in growth with shorter leaves. On a warm substratum it often fruits freely, while it has or else been found in fruit only near Grunnavík in NW. Iceland.

Var. *fastigiatum* (Lyl.) Wils.

SW. Iceland: Svinahraun!, abundantly on damp soil at the edge of the lava-field.

208. *Polytrichum Swartzii* Hartman.

NW. Iceland: Bæir!, sterile.

Var. *nigrescens* (Warnst.) Hagen. Syn. *Polytrichum inconstans* Hagen.

NW. Iceland: Thoroddstadaengjar (St.)!; Dýnjandi!.

The type grew on a damp slope in not-coherent tufts, about 15 cm. high; the plants were quite typical with sharply toothed leaves, and with lamellæ, the marginal cells of which had the irregular form peculiar to *P. Swartzii*. The variety grew on very wet or inundated ground in company with *Hypnum stramineum*, *H. giganteum* and *Mnium cinclidioides* similarly to *P. gracile* var. *anomalum*, and may be regarded as a form similar to the latter: as in aquatic forms of other species, both forms have flaccid-soft leaves with slightly developed stereom in the nerve and broader, slightly toothed leaf-margin; in the plant from Dýnjandi the leaf-margin was almost entire.

## FAM. BUXBAUMIACEÆ.

209. *Diphyscium sessile* (Schmid.) Lindb.*Webera sessilis* Lindb.

Common in East, South and West Iceland, and rather frequent in North-west Iceland, where it is common for instance in the district of Dýrafjörður. In North Iceland it has not been found east of Blóndudalur.

It grows on firm, bare ground, especially on the top of knolls or on small elevations of earth on slopes, where it forms low, dense cushions, dark brown in colour; it is common, at any rate in E. Iceland, as far upwards as 600—700 metres above sea-level. Fruit, which occurred only scantily in all places, was collected near Reykjavik, near Lundur in West Iceland and near Geitaskard in Blóndudalur.

## FAM. FONTINALACEÆ.

210. *Fontinalis antipyretica* L.

Found in all parts of the country and common on stones in brooks and rivers, and sometimes also in stagnant water, up to about 300—400 metres above sea-level. Near Ljosavatn in N. Iceland it was found abundantly in a river even at an altitude of 300—400 metres, and near Isafjörður it occurred frequently as far upwards as 300 metres. It varies considerably in size, leaf-form and colour. In stagnant water (thus in very wet bogs near Jökulsfjörður) it becomes very robust, light brownish-yellow, with broad leaves.

In swiftly flowing water there often occur slender, dark-green or brownish-green forms with strong metallic sheen, which agree most closely with var. *montana* H. Müller. In such forms the basal angles of the leaves are often somewhat concave, and formed of a single layer of cells, in which respects it comes very near to *F. gracilis*. This species is recorded from several localities by Grönlund, H. Jónsson and Feddersen, but all the specimens which have been investigated belong either to *F. antipyretica* or to *F. androgyna*. Only sterile specimens have been found.

211. *Fontinalis islandica* Cardot.

E. Iceland: Faskrudsfjörður (Jardin, 1865) (specimens not inspected).

212. *Fontinalis longifolia* C. Jensen (Bot. Not. 1885, p. 83).

“Gracilis, viridis et flavoviridis, elongata, mollis, rubricaulis, ramulis brevibus, patulis subremotis. Folia laxa, imbricata vel erecto-patentia mollia, carinata, annosiora, bifida, ovato-lanceolata, sensim longe acuminata, integra vel ad apicem lenissime serrulata, decurrentia, cellulis

flexuoso-linearibus, apicalibus brevioribus, angulorum multo majoribus, rectangulis. Folia ramulorum angustiora. Flores et fructus ignoti."

This species, which was first found by Feddersen in the Helgá in S. Iceland, grew very abundantly on stones in the Reykirdalsá in SW. Iceland. This river has copious influx from the hot springs, so that, in the first days of June, the temperature of the water was about 12°, which was essentially higher than in the majority of the other rivers where the temperature was, as a rule, only about 4°–6°.



Fig. 12. *Fontinalis longifolia* C. Jens. (Reykir; somewhat reduced).

*Fontinalis longifolia* agrees most closely with *F. hypnoides* R. Hartm. The plant from the Reykirdalsá is rather robust, as much as 25 cm. long, very strongly and irregularly branched, with rhizoid-cushions around all the points whence the branches issue, and with plane or somewhat concave, longly tapering, very soft leaves, which only exceptionally are folded along the median line. The ♂ plant is more slender than is the ♀ plant, with very numerous, narrowly ovate ♂ flowers, which often occur in clusters of 2–4 on the main axis and branches and contain each 2–4 antheridia. The fruit, which in the beginning of June was developed to almost full size, but was as yet quite green, so that the peristome and spores could not be investigated, was found scantily on the lowermost part of the stem. As in *F. hypnoides* the capsule was half-exserted.



213. *Fontinalis thulensis* C. Jensen (Bot. Tids. 20, p. 110).

“Laxe caespitosa, sat robusta, mollis, sordide luteola, inferne nigrescens subnitida. Caulis usque ad 25 ctm. longus, inferne plerumque nudus, plus minusque ramosus, ramis brevibus vel elongatis, erecto-patentibus, vel subsecundo-arcuatis, interdum acutis, cauli primario sat similibus. Folia dimorpha, tristicha; folia caulina erecto-patentia vel laxe imbricata, plus minusque distincta et recte carinata, interdum tantum complicata, late ovata-lanceolata, longe decurrentia integra vel apice indistincte denticulata, adultiora subobtusata, juniora acuta, nunquam bifida, superiora vulgo 5—6 mm. longa et 2—3 mm. lata, inferiora minor, latere uno versus basim reflexo; folia ramulina minora et subangustiora, vulgo 3—4 mm. longa et 1,5—2 mm. lata, inferiora multo minora omnia ecarinata, valde concava, interdum complicata, erecto patentia, inferiora ramorum arcuatorum arcte imbricata, superiora interdum subsecunda. Cellulae in media foliorum 0,007—0,013 mm. latae, 8—12 plo longiores. Alae basilares, planae, unistratae, e cellulis quadratis et hexagonis, aequae ac ceteris cellulis basilaribus, luteis formatae. Cetera ignota.

Speciei americana *F. Kindbergii* valde affinis, sed ramis erecto-patentibus, non pennatis, foliis eorum brevioribus et latioribus, cellulis angustioribus, colore luteolo (*F. Kindbergii* ferrugineus est) et nitore debiliore.”

W. Iceland: The Laxá (Hjarðarholt), 21.7.1886 (Feddersen).

Note. *Fontinalis squamosa* L. is enumerated on older lists, but of the specimens from Iceland, contained in the collections, some belong to *F. antipyretica*, some to *F. androgyna*.

214. *Fontinalis androgyna* R. Ruthe.

W. Iceland: The Ellidará near Reykjavik (Mörch; Grl.; H. J.;!).

In the Ellidará it grew abundantly in company with *F. antipyretica* on large stones and rocks under water. There not only  $\sigma^+$  buds were found, but also a few ripe capsules on the lowermost part of the stem (5. 8. 1909).

## FAM. CRYPHÆACEÆ.

215. *Leucodon sciuroides* (L.) Schwgr.

S. Iceland: Foss (H. J.); Drángthlid (H. J.); Stjörnarsandur (H. J.); Hrutafell!. SE. Iceland: Hornafjörður!; Hof!. SW. Iceland: Hafnarfjörður!.

All the Iceland specimens belong to var. *morensis* (Schwägr.) de Not. It grows on dry rock-walls with a southern exposure, both on tuff and on basalt, and appears to be rather frequent from Hof in SE. Iceland throughout S. Iceland to Hafnarfjörður in SW. Iceland. It occurred abundantly on Hrutafell and Drángthlid, and covered the vertical faces of tuff-rocks for long distances. Here it was also richly fruiting with capsules which were partly ripe at the end of June.



216. *Antitrichia curtispindula* (Hedw.) Brid.

E. Iceland: Hornafjörður, common!; Djúpivogur!; Hof!; Starmýri!; Berufjörður!. N. Iceland: Mödruvellir (Thóroddsen)!; Geitaskard!; common in Vatnsdalur!. NW. Iceland: Patreksfjörður!; Kaldalon!. Common in W. and SW. Iceland!.

Common in SE. Iceland as far as Berufjörður (where it was found in one locality only), in S. and W. Iceland and the western part of N. Iceland from Blóndudalur. Rare and scanty in NW., N. and E. Iceland. It grows usually on a rather dry substratum, on stony slopes, and soil-covered rocks, but especially on moss-grown slopes in company with *Hylacomium* spp., and on the ground in coppices. In Esja it is common up to a height of 300—400 metres above sea-level. Only sterile specimens have been found.

## FAM. NECKERACEÆ.

217. *Neckera complanata* (L.) Hüb.

W. Iceland: Gilsbakk!; Bardshellir (Gr!.)!. S. Iceland: Paradishellir (Stp.)!; Reykir!; Austarhlid near Geysir!; Breidabolstadr!; Barkarstadr!; Holt!; Drángshlid!; Hrutafell!.

Rare in W. Iceland, and rather common in S. Iceland. It grows everywhere on the roof and sides of dry caves, which it often covers with its extensive, dark-green mats. Only sterile specimens have been found.

## FAM. LESKEACEÆ.

218. *Myurella julacea* (Will.) Br. eur.

Very common on rocks, especially in humus-filled clefts: occasionally also on the ground, for instance on knolls in bogs. It often occurs in unmixed cushions, but far more frequently mixed with other mosses, and is met with both on a dry and on a somewhat damp substratum. On wet rocks it often grows in association with *Anæclangium Mougeottii*, *Philonotis*, *Blindia acuta*, etc.; in dry clefts in company with *Mnium orthorrhynchum*, *Plagiothecium Roesei*, *Bartramia ityphylla*, *Pohlia cruda*, etc.; or it may be met with on dry rocks woven into the tufts of *Hypnum revolutum* and *Grimmia* spp. It does not appear to ascend higher than 300—400 metres. Only sterile specimens have been found.

219. *Myurella tenerrima* (Brid.) Lindb.

*Myurella apiculata* (Hüb.) Br. eur.

Grows quite similarly to the preceding species and, as a rule, in company with it, and in the majority of the districts of Iceland is almost as common. In S. Iceland it appears, however, to be somewhat

rarer. It is most frequent in rather damp situations, for instance on rocks near waterfalls. Only sterile specimens have been found.

220. **Leskea nervosa** (Schwägr.) Myrin.

SE. Iceland: Hof!, on rocks in company with *Metzgeria furcata*, sterile. S. Iceland: Drángshlid!; Hrutafell!, sterile. In both the latter localities it occurred abundantly on dry tuff-faces or on large fallen blocks.

221. **Leskea catenulata** (Brid.) Mitten.

Nupsdal (Stp)!.

Here, Gnupsdalur near Dýrafjörður in NW. Iceland is probably meant.

222. **Anomodon viticulosus** (L.) Hook. et Tayl.

S. Iceland: Hrutafell!; cave near Skógafoss!. Vestmannaey!.

On Vestmannaey it grew at the foot of a dry, stony slope below Stora Klit; near Hrutafell it grew sometimes on rocks, sometimes on soil-covered rock-ledges. Only sterile specimens have been found.

223. **Pterigynandrum filiforme** (Timm) Hedw.

Very common everywhere.

The most frequent form is var. *decipiens* (W. et M.) Limpr., which occurs abundantly everywhere on dry rocks, especially on perpendicular basalt-faces, where it often forms very large cushions 5–6 cm. deep. Here all transitional forms are also met with between the type and the variety. The type is developed in deeper shade and occurs especially in clefts and crevices, where it forms thin, adherent mats on the surfaces of stones. Only sterile specimens have been found.

Both forms are common up to about 300–400 metres above sea-level.

224. **Lescuræa decipiens** (Limpr.)

*Ptychodium decipiens* Limpr.

E. Iceland: Berufjörður!♀, at an altitude of 80 metres.

var. *crassirete* n. var.

Leaf-cells very thick-walled, highly porous and distinctly papillose in the upper half of the leaf. Nerve very strong, 0.040–0.045 mm. broad for almost its entire length.

NW. Iceland: Gnupsdalur, at an altitude of 280 metres!.

*L. decipiens* is closely allied to *L. saxicola* and is often difficult to distinguish from the latter species. Peculiar to both are the narrow, highly thickened and porous leaf-cells, which in *L. decipiens* are more or less distinctly papillose with a papilla at each of the uppermost cell-angles, at the back towards the leaf-apex; while *L. saxicola* almost always has quite smooth leaves. In *L. saxicola* the upper half of the

leaf-margin is almost straight in outline, while in *L. decipiens* it is distinctly concave, as in *L. filamentosa*.

The variety grew abundantly on somewhat damp rocks; it is somewhat coarser and less branched than the type which it resembles exactly in leaf-form and size of the cells. The leaf-cells in this form are so highly thickened and porous that the walls almost appear like a string of beads and are often broader than the cell-space.



Fig. 13. a, Leaves of *Lescuræa Breidleri* ( $\times 20$ ); b, leaves of *L. radicata* ( $\times 20$ ); c, leaves of *L. decipiens* ( $\times 20$ ); d, leaves of *L. decipiens* v. *crassirete* ( $\times 20$ ); e, leaf-cells of *L. decipiens* ( $\times 320$ ); f, leaf-cells of *L. decipiens* v. *crassirete* ( $\times 320$ ).

### 225. *Lescuræa radicata* (Mitt.) Hagen.

*Lescuræa rigescens* (Wils.) Br. eur.; *Pseudoleskea radicata* (Mitt.) Lindb.  
*Ptychodium Pfundtneri* Limpr.

N. Iceland: Öxnadalur, Tverá!; sterile.

In the above locality it grew scantily on a stone by the river.

### 226. *Lescuræa filamentosa* (Dicks.) Lindb.

*Pseudoleskea atrovirens* (Dicks.) Br. eur.

Widely distributed.

Grows on stones and dry or somewhat damp rocks, and appears to be frequent, although not abundant, in all parts of the country up to about 300 metres above sea-level. In NW. Iceland it is very common on stony slopes, and is often richly fruiting while it has or less been found sterile only.

## 227. *Lescuræa Breidlerii* (Kindb.) Arn. et Jensen.

*Ptychodium oligocladium* Limpr.

E. Iceland: Berufjardarskard!, at an altitude of 600 metres; Seydisfjörður!, 500 metres. N. Iceland: Reykjahlid!; Akureyri, at an altitude of about 770 metres!. Grimsey (O. D.)!; Öxnadalshéidi (Gr.)!. NW. Iceland: Dyrafjörður!; Gnupsdalur!; Isafjörður!; Sugandafjörður!; Grunnavik!. S. Iceland: Barkarstaðr!, at an altitude of 530 metres.

Frequent on rocks and stones in the more highly situated parts of the country. It occurs in greatest abundance and in its most typical form on mountain heights at elevations of above 500—600 metres, where it is often the most abundant constituent of the vegetation. It has its main distribution in NW. Iceland, where, for instance around Isafjörður and Sugandafjörður, it occurs very abundantly on the rocky flats from about 200 metres upwards. ♀ plants are common, ♂ plants and fruit have not been observed.

*Lescuræa filamentosa* and *L. Breidlerii*, judging from the Iceland specimens, are well-defined forms which, as a rule, may easily be distinguished from each other.

*L. filamentosa* is the lowland form, which has its main distribution in the birch region, and does not ascend much higher than about 300 metres above sea-level. Here it forms low, dense, dark-green or blackish-green tufts on stones, and prefers somewhat damp localities. ♂ plants are very frequent, ♀ plants occur more rarely.

*L. Breidlerii* is the Alpine form, which descends only by exception to the upper limit of the birch region. It forms deep, loose, yellowish tufts of great extension upon the dry stony slopes of the mountain heights, or upon large blocks of rock. Only sterile ♀ plants have been found. Both the habit and the colour easily distinguish the two species from each other. *L. Breidlerii* is almost branchless, but with some long, ascending branches often hook-shaped at the apex; *L. filamentosa* is densely and irregularly branched. In its most lowly situated habitats, for instance near Reykjahlid at an altitude of about 300 metres, and in some localities in NW. Iceland, *L. Breidlerii* shows, however, a tendency to develop forms which approach in habit the vigorous forms of *L. filamentosa* var. *brachyclados*. The leaf-cells in all the investigated specimens of *L. filamentosa* were short, oval or roundish and thick-walled, more or less but always distinctly papillose, frequently as far down as to the leaf-base, the nerve was very rough at the back, which features most certainly distinguish doubtful forms from *L. Breidlerii*. In the latter species the leaf-apex is longer, the nerve is narrower towards the apex and usually smooth, rarely indistinctly toothed at the back. The leaf-tissue in *L. Breidlerii* is much more translucent than in *L. filamentosa*,

and is formed by prosenchymatous cells 0.008—0.009 mm. broad and 3—4 times, at the apex about 6 times, as long, which are, as a rule, quite smooth, more rarely slightly papillose towards the leaf-apex. The leaf-margin in *L. Breidlerii* is revolute for almost its entire length, so that only the apex itself is plane. In *L. filamentosa* the leaf-margin is sometimes plane, sometimes more or less revolute, and on the same plant leaves may be found with margins either quite plane or revolute to the apex, which effaces the difference between the type and the variety *brachyclados* (Schwägr.) Br. eur. This form, which occurs rather frequently in somewhat damp habitats, forms in several respects a transition to *L. Breidlerii*, and has, as the latter, a well-developed central strand, while the usual forms of *L. filamentosa* never have a central strand.

### 228. *Lescuræa patens* Lindb.

*Pseudoleskea patens* (Lindb.) Limpr.

E. Iceland: Berufjörður!, ♀, 500—600 metres above sea-level. N. Iceland: Grimsey (O. D.)! (fr.) NW. Iceland: Gnupsdalur near Dýrafjörður! fr.; Dýnjandi! ♂. W. Iceland: Reykjavík!; Kollafjörður! ♂; Mödruvellir!, in several places up to a height of about 200 metres, ♂. S. Iceland: Barkarstaðr, about 460 metres above sea-level.

*Lescuræa patens* appears to be rather widely distributed in all parts of Iceland. It is met with from the low land to high up in the Alpine region on somewhat damp, shady rocks or damp stony slopes, often very abundantly. Thus, in Gnupsdalur it occurred in masses on stony slopes from about 250—400 metres, in association with *L. filamentosa*, *L. Breidlerii*, *Pohlia commutata*, *Brachythecium reflexum* and *Lophozia* spp.; and with numerous fruit which had just ripened on June 19th. Near Reykjavík it grew on the ground among large stones in a damp meadow, in company with *Schistidium gracile*.

Note. *Ptychodium plicatum* (Schleich.) Schimp. is recorded by Grönlund from Grimstunga and Reykjavík. The plant from Grimstunga is only a form of *Brachythecium albicans*, and that from Reykjavík of *Camptothecium lutescens*.

### 229. *Heterocladium squarrosulum* (Voit) Lindb.

*Heterocladium dimorphum* (Brid.) Br. eur.

E. Iceland: Berufjörður!; Hof!. N. Iceland: Mývatn (Grl.)!; Ljosavatn!; Hof near Eyjafjörður (O. D.)!. SW. Iceland: Thingvallahraun!; Kollafjörður!. S. Iceland: Kihlhraun!.

Occurred here and there on dry ground, especially on moss-covered slopes or in birch coppices. Near Hof in E. Iceland it grew on a stony slope (about 100 metres above sea-level) covered with *Hylocomium* spp. and *Rhacomitrium*. In Thingvallahraun it was found associated with *Hypnum uncinatum*, *Pohlia nutans* and *P. acuminata* on a small slope in the birch coppice. Only sterile specimens have been found.



230. *Thuidium tamariscinum* (Hedw.) Br. eur.

Vestmannaey: Heljusdalur and Stora Klit!. S. Iceland: Barkarstadr!; Holt!; Seljaland!.

Gliemann records that this species was found by Mörch, but there are no specimens of it in the collections.

This species was found only in the southernmost part of Iceland, where it is frequent in several places on Vestmannaey and along the whole stretch of country south of Eyjafjall. Here it grows especially in the clefts at the foot of rock-walls or among large stones. Near Seljaland it was found abundantly on slopes stretching down towards the Seljalandsá, associated with *Thuidium delicatulum*, *Camptothecium lutescens*, *Scelopodium purum* and *Hylocomium* spp.

231. *Thuidium delicatulum* (Dill., L.) Mitten.

NW. Iceland: Dýrafjörður (Hartz)!. W. Iceland: Esja!. S. Iceland: Reykirdalur!; Skálholt!; Breidabolstadr!; Barkarstadr!; Seljaland!; Holt!; Drángshlid!. SE. Iceland: Hornafjörður!.

Common from Hornafjörður in SE. Iceland throughout the whole of S. and SW. Iceland to Hvalfjörður. There it grew on grass-covered slopes, especially on somewhat damp ground, up to a height of about 200—300 metres; occasionally also on more damp meadow land. Near Barkarstadr it was common even at an altitude of about 320 metres.

*T. delicatulum* becomes especially luxuriant on warm ground. By the hot springs near Skálholt it grew abundantly in cushions almost 10 cm. deep, associated with *Hypnum stramineum*, *H. Lindbergii* and *Hylocomium squarrosum*. Only sterile specimens were found.

232. *Thuidium Philiberti* Limpr.

SE. Iceland: Hornafjörður!. SW. Iceland: Álafoss!. S. Iceland: Reykirdalur!; Holt!; Vestmannaey!.

This species has a quite similar distribution to, and often grows in company with, *T. delicatulum* from which it cannot be distinguished in the field. Near Álafoss it grew on boggy ground along the river. In Reykirdalur it was common on rather dry, moss-grown slopes; it was also common around Holt, south of Eyjafjall.

*Thuidium Philiberti* is a weak species which in a sterile condition can be distinguished from *T. delicatulum* only by the length of the leaf-apex; the length varies considerably, however, in the Iceland plants, leaves being sometimes found in which the apex is elongated hair-shaped with 4—5 cells, and sometimes such leaves in which the apex consists only of a single cell or of two. Only sterile specimens have been found.

233. *Thuidium abietinum* (Dill., L.) Br. eur.

E. Iceland: Hof!; Vallanes (H. J.!)!. N. Iceland: Akureyri (Gr!.)!; Hof near Eyjafjörður (O. D.)!; Mývatn!; Vidimýri (Gr!.)!; Tverá in Öxnadalur!. W. Iceland: Esja!. S. Iceland: Barkarstadr!; Vestmannaey!.

Occurs here and there on dry stony or moss-grown slopes up to about 200 metres above sea-level, especially in N. Iceland, where it is rather common in many districts (around Eyjafjörður, in Öxnadalur, etc.).

234. **Thuidium lanatum** (Strömgr.) Hagen.

*Thuidium Blandowii* (W. et M.) Br. eur.

Very common from Höskuldstaðr in E. Iceland throughout N. and W. Iceland to Borgarfjörður. In NW. Iceland it occurs here and there, for instance near Isafjörður, Kaldalon and Dýnjandi near Jökulsfjörður, but everywhere scantily only. In E. Iceland it has not been observed south of Berufjörður, and in W. Iceland it appears to be absent from the south of Borgarfjörður. In S. Iceland it has been found rather plentifully near Holt and Barkarstaðr.

*T. lanatum* grows almost always in bogs, where, especially in N. Iceland, it is often the most abundant constituent of the vegetation. It is more rarely met with on wet, soil-covered rocks. It is most frequent in the lowlands up to about 300 metres; but near Akureyri it is frequent even at a height of 400—500 metres above sea-level, and near Barkarstaðr up to about 400 metres. Fruit, which occurs everywhere, ripens in the first half of July.

FAM. HYPNACEÆ.

235. **Orthothecium rufescens** (Dicks.) Br. eur.

*Stereodon rufescens* (Dicks.) Mitt.

W. Iceland: Melar (Gr!.)!, sterile.

236. **Orthothecium intricatum** (Hartm.) Br. eur.

*Stereodon subrufus* (Wils.) Lindb.

N. Iceland: Skagafjörður (Gr!.)!; Thrastarhólsárgil near Eyjafjörður (O. D.)!. S. Iceland: Breidabolstaðr!; Skógafoss!; Vestmannaey! SE. Iceland: Hornafjörður!.

On Vestmannaey it grew rather plentifully, sometimes on blocks of rock in Heljusdal, sometimes on damp slopes intermixed with other mosses. In the other stations it usually occurred on damp rocks, especially on tuff; thus on the sides of a cave near Skógafoss, and near Hornafjörður on the damp rock-faces near a waterfall.

237. **Orthothecium chryseum** Schwägr. (Br. eur.)

*Stereodon chryseus* Mitten.

Very common in E. and N. Iceland, rather scanty in NW. Iceland (Dýrafjörður and Sugandafjörður). In W. Iceland it was only found

rather scantily in Botnsdalur and in a few localities in Esja, and in S. Iceland it has not yet been observed.

It grows on a damp substratum, both on rocks and on soil up to about 400 metres above sea-level. Thus in N. and E. Iceland it is one of the most frequent species on wet gravelly ground. Only sterile specimens have been found.

238. **Cylindrothecium concinnum** (de Not.) Schimp.

*Entodon orthocarpus* Lindb.

N. Iceland: Vididalr (Grl.)!. S. Iceland: Vtri Skógar (H. J.)!.

239. **Climacium dendroides** (L., Dill.) W. et M.

Very common over the whole of Iceland.

Grows on damp substrata of every kind, especially in bogs, scattered among other mosses, but also on soil-covered rocks and damp gravelly ground; frequent also on more dry ground among grass. It hardly ascends higher than about 300 metres. Fruit was found only in E. Iceland below Fjardarheidi.

240. **Isothecium myurum** (Pollich) Brid.

SW. Iceland: Hafnarfjörður!. S. Iceland: Holt!; Hrutafell!; Drángshlid!; Vestmannaey!.

This species was only found in the south-western part of the country, where it was, however, rather frequent; and in the district south of Eyjafjall it was abundant in several localities, especially near Drángshlid, where it grew abundantly at the foot of perpendicular tuff-rocks facing south. Only sterile specimens have been found.

241. **Isothecium tenuinerve** Kindb.

*Isothecium myurum* var. *piliferum* C. Jens.

E. Iceland: Papey (St.)!. NW. Iceland: Dýnjandi!; Arngerðareyri!. W. Iceland: Stykkisholmur!; Budahraun (H. J.)!; the hot springs near Reykjavik (Grl.); Videy!; Esja!; Hafnarfjörður!; the lava-fields around Reykjavik!. S. Iceland: Holt!; Thingvellir!; Kihlhraun!; Krisuvík (Stp.)!.

Common in the southern and south-western parts of the country in lava caves and clefts, probably also common in W. Iceland. In NW. Iceland rarer; and only found in one locality in SE. Iceland. Occurs in greatest abundance in lava clefts, for instance abundantly near Thingvellir. Only sterile specimens have been found.

242. **Homalothecium sericeum** (L.) Br. eur.

Very common over the whole of Iceland.

Grows on dry, more rarely on damp rocks, and often abundantly

in very extensive mats. It ascends to a height of about 400 metres above sea-level, and, for instance in Esja, is found abundantly even at an elevation of between 300—400 metres. on dry, steep rock-ledges. Fruit was found only near Breidabolstadr in S. Iceland, and in July it was empty of its spores.

243. **Camptothecium lutescens** (Huds.) Br. eur.

*Hypnum lutescens* Huds.

Iceland (Wiinstedt)!. N. Iceland: Hnukr in Vatnsdalur (Sl.)!; common near Geitaskard in Blóndudalur!. NW. Iceland: Dýrafjörður!. W. Iceland: Breidabolstadr!; Lundur!; Esja!; Reykjavik (Grl.)!. S. Iceland: Common!; Vestmannaey!; E. Iceland: Djupivogur!; Hornafjörður!.

Common in the southern and western parts of the country from Hornafjörður in East Iceland to Blóndudalur in North Iceland. It has not been found in the remaining part of North Iceland or in the greater part of East Iceland from Berufjörður northwards, and it is rare in North-west Iceland. It usually grows on dry, stony or grass-covered slopes or in coppices, occasionally also on rocks, but hardly extends higher than 200—300 metres.

The leaves in this species have occasionally in their upper part cells which are shorter, and the angles of which are more or less distinctly shaped like a papilla. This is most distinctly seen in the forms from Reykjavik and Djupivogur, both of which grew on rocks.

244. **Camptothecium nitens** (Schreb.) Schimp.

*Hypnum trichoides* Neck., Lindb.

Very common.

One of the most frequent mosses on wet rocks. It occurs also frequently on soil-covered rocks or on more dry ground mixed with other mosses. In bogs it often forms the bulk of the vegetation and very frequently sets fruit, which ripens in the beginning of July. It occurs most frequently and abundantly in the low land, but ascends, however, to 400—500 metres above sea-level.

The tomentose form is by far the most frequent. The smooth form, var. *atrichum* Kindb., appears to grow especially on rocks. It was found abundantly on soil-covered rocks close to the coast below Geithellir in E. Iceland.

245. **Brachythecium Mildeanum** (Schimp.) Schimp.

E. Iceland: Seydisfjörður (H. J.)!; Hamarfjörður!. SW. Iceland: Alafoss!.

On wet boggy ground; near Hamarfjörður it grew abundantly on inundated ground along the river.

246. **Brachythecium salebrosum** (Hoffm.) Br. eur.*Hypnum plumosum* Huds.

Commonly distributed in all parts of the country.

This species grows, as a rule, on rather dry ground, for instance on grass-covered slopes and on stones; occasionally also on damp ground, but everywhere scantily only and usually mixed with other mosses. It is most frequent in the low land; near Akureyri it has, however, been found at an elevation of about 500 metres, and near Seydisfjörður about 400 metres above sea-level. Fruit has been found only near Reykir in S. Iceland.

247. **Brachythecium collinum** (Schleich.) Br. eur.

W. Iceland: Esja, Möðruvellir!, on damp rocks at an altitude of about 100 metres.

The form collected here differs in its somewhat more longly pointed stem-leaves and narrower, more slightly toothed, branch-leaves.

Note. *Brachythecium plumosum* (Sw.) Br. eur. is recorded by Grönlund from several localities, but all the specimens of it in the collections have been wrongly determined and the majority of them belong to *Hypnum palustre*.



Fig. 14. *Brachythecium longipilum*. Habit ( $\times 3$ ).

248. **Brachythecium longipilum** n. sp.

Monoicum. Flores masculini in cauli primario numerosa, antheridiis c. 10 sordide flavis et paraphysibus paucis. Cæspites humiles, densi



saturate virides, habitu fere formæ gracilis *Brachythecii velutini*. Caulis repens, dense tomentosus, 2—3 cm. longus, 0.25 mm. crassus, ramos erectos numerosos, 4—5 mm. longos emittens. Folia caulina non decurrentia e basi late ovata vel triangulo-cordata in cuspidem longissimum

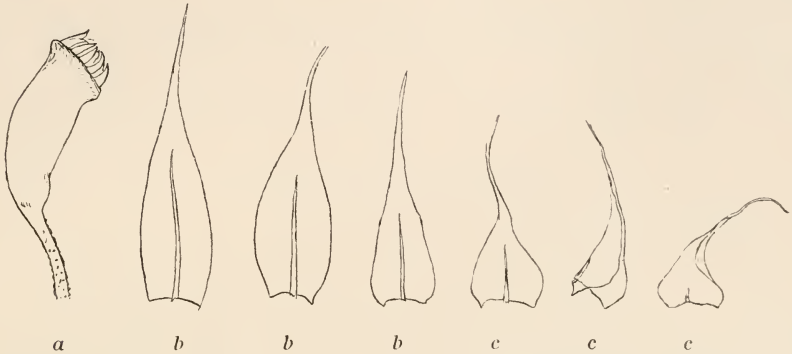


Fig. 15. *Brachythecium longipilum*. a, Capsule ( $\times 20$ ); b, branch-leaves ( $\times 20$ ); c, stem-leaves ( $\times 20$ ).

et tenuissimum recurvatum producta, per totam marginem denticulata, 1—1.2 mm. longa, 0.4—0.6 mm. lata, costa brevi et indistincta. Folia ramorum erecto-patentia aut subsecunda, lanceolata, longius acuminata, 1.4—1.6 mm. longa, 0.4—0.6 mm. lata, per totam marginem denticulata,

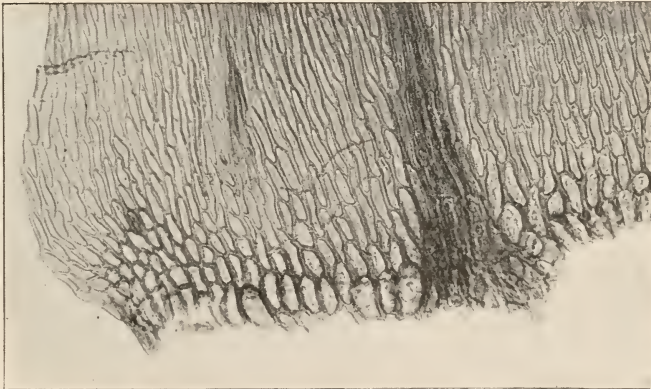


Fig. 16. *Brachythecium longipilum*. Leaf-base ( $\times 175$ ; phot.).

costa mediam partem folii paulo excedente. Cellulæ angustæ, sinuatæ, 0.004 mm. latæ, 0.060—0.075 mm. longæ, basilares in uno vel duo seriis, ovaes, porosæ, pachydermiæ, 0.010 mm. latæ, in angulis quadratæ vel ovaes, paucæ.

Perichætium e cauli primario egressum. Folia perichætialia exteriora apice brevi, interiora apice longo reflexo, ecostata vel costa perbrevis et

indistincta, margine leniter dentato. Seta 8 mm. longa, c. 14 mm. crassa, purpurea, in dimidia parte superiori rugosa, inferne glabra. Capsula fusca, obliqua, longe ovata, operculata 1.7 mm. longa, 0.5 mm. crassa, deoperculata sub orificio contracta. Operculum conicum 0.6 mm. altum. Dentes peristomii 0.46 mm. longi, 0.067 mm. lati, pallide lutei, apicibus hyalinis, basi aurantiaci et leniter transverse striati. Sporæ 0.021—0.024 mm., papillosæ.

S. Iceland: Flokastadagil, on stones at the margin of the river. The capsules were empty in the middle of July.

249. **Brachythecium populeum** (Hedw.) Br. eur.

*Hypnum populeum* Hedw.

S. Iceland: Vik (H. J.)!, fr.; Drángshlid!, fr.

Grew in both the above localities on rather dry tuff rocks.

250. **Brachythecium velutinum** (L.), Br. eur.

S. Iceland: Thingvellir (Grl.!)!; Vik (H. J.)!; Holt!, in a cave at an altitude of about 300 metres, fr.

Near Thingvellir it grew in a lava-cleft, associated with *Blepharostoma trichophyllum*, *Plagiochila asplenoides* and *Plagiothecium silvaticum*.

251. **Brachythecium glaciale** Br. eur.

*Hypnum glaciale* C. Hartm.

N. Iceland: Akureyri!, at an altitude of 770 metres. NW. Iceland: Sugandafjörður!, at an altitude of 450 metres. W. Iceland: Dalasysla, Melár, on a cliff inhabited by sea-fowl (H. J.)!

On damp gravelly flats. Near Sugandafjörður it grew abundantly, intermixed with *Hypnum stramineum*, *Mniobryum albicans* and *Philonotis fontana*, in cushions 3—4 cm. deep, on ground saturated by melting snow, and on stones. The plants were about 5 cm. long and irregularly branched with unequally long — mostly short — branches. The leaves were erectly spreading, not secund, and very longly decurrent with numerous quadrate, thin-walled cells at the basal angles of the leaves.

252. **Brachythecium reflexum** (Starcke) Br. eur.

Commonly distributed.

This species has its main distribution in gravelly spots on the rocky flat, especially on slopes and dry snowless patches on the mountain heights. It is especially abundant in NW. Iceland, where it is everywhere the most frequently occurring species on stony slopes. Here it is usually found associated with *Hypnum uncinatum*, *Lescuræa* spp., *Lophozia lycopodioides*, *L. Flørckeii*, etc., and is met with as high as about 500 metres above sea-level. In Esja, in SW. Iceland, it was common from about 200 metres upwards. In the low land it is rarer and appears

to occur more particularly in the lava-fields, for instance near Hafnarfjörður, Thingvallahraun and Kíhlhraun. It is found rather frequently in fruit.

253. **Brachythecium glareosum** (Bruch) Br. eur.

*Hypnum glareosum* Bruch.

E. Iceland: Seydisfjörður, on stones!. N. Iceland: Tverá in Öxnadalur, on damp gravelly ground!. W. Iceland: Botnsdalur, on damp rocks!.

254. **Brachythecium albicans** (Neck.) Br. eur.

*Hypnum albicans* Neck.

Commonly distributed over the whole of Iceland.

This species grows on a dry substratum, for instance on sandy or grass-covered ground, on soil-covered stones, on dikes and on the peat-walls of houses. It is most frequent in the low land up to a height of about 300 metres, but occasionally, for instance near Akureyri, it ascends as high as about 600 metres above sea-level. Only sterile specimens have been found.

255. **Brachythecium erythrorrhizon** Br. eur.

*Hypnum erythrorrhizon* Hartm.

N. Iceland: Hof near Eyjafjörður (O. D.)!; Ljosavatn!; Tverá in Öxnadalur!. W. Iceland: Esja!.

Found in all the localities only scantily intermixed in the tufts of other mosses on rather dry ground. Near Ljosavatn it grew in the *Betula nana* heath in association with *Hylocomium proliferum*, *Hypnum uncinatum*, *Heterocladium squarrosulum* and *Lophozia lycopodioides*; in Esja it grew on a slope with a southern exposure, in company with *Hylocomium* spp. and *Hypnum imponens*.

256. **Brachythecium rivulare** (Bruch) Br. eur.

*Hypnum rivulare* Bruch.

Very common over the whole of Iceland.

One of the most frequent mosses, which occurs everywhere on damp ground up to about 400—500 metres above sea-level. It occurs both in large and small streams, where it covers the stones or the gravelly soil along the banks with its extensive mats, and in bogs, and is also one of the species which is most frequently met with in moss bogs. Occasionally, however, it grows also on a more dry substratum, for instance on soil-covered rocks and among grass. Only sterile specimens have been found.

257. **Brachythecium latifolium** (Lindb.) Philib.*Hypnum latifolium* Lindb.Gjá near Alptagerdi (St.)!, in company with *Mnium punctatum*.258. **Scleropodium purum** (L.) Limpr.*Hypnum purum* L.

SW. Iceland: Álafoss!. S. Iceland: Breidabolstadr!; Barkardstadr!; Holt!; Drángshlid!; Skógafoss!.

This species has been found only in the southern part of Iceland, where it is frequent on Fljótshlid and below Eyjafjall. Near Álafoss it grew on the slope stretching down towards the river in which the temperature of the water was about 25°. Usually it grows at the foot of cliffs with a southern exposure, or in clefts, and, as a rule, in association with *Hylocomium* spp., *Eurhynchium piliferum*, *Mnium undulatum*, *Thuidium delicatulum* and *T. tamariscinum*.

259. **Eurhynchium strigosum** (Hoffm.) Br. eur.*Hypnum strigosum* Hoffm.Var. *præcox* (Hedw.) Lindb.

N. Iceland: Hof (O. D.)!; Vidimýri (Grl.)!. W. Iceland: Kalmanstunga (Grl.)!; Gilsbakki!; Reykjavik!. S. Iceland: Barkarstadr!.

Grows everywhere rather scantily on dry soil-covered rocks or on tuff.

260. **Eurhynchium diversifolium** (Schleich.) Br. eur.*Hypnum strigosum* var. *diversifolium* Lindb.

N. Iceland: Reykjahlid!; Hofsfjall near Eyjafjörður (O. D.)!; Akureyri, at an altitude of about 900 metres!.

Near Akureyri it grew in gravelly soil at the summit of the mountain, interspersed in tufts of *Spherocephalus turgidus*, *Dicranum congestum* and *Hylocomium proliferum*. Near Reykjahlid it grew intermixed in a tuft of *Timmia austriaca*.

*Eurhynchium præcox* and *E. diversifolium* are so closely allied that, according to my opinion, it is doubtful whether the last species can be regarded as anything more than a decidedly Alpine form of *Eurhynchium strigosum*. The leaves in the plants determined as *E. diversifolium* are longly decurrent. The cells of the basal angles of the leaves vary considerably in number, even on the same plant, usually they are very numerous; but specimens of *E. strigosum* var. *præcox* from Central Europe also vary considerably in this respect, and often have many more alar cells than has the type.

261. **Eurhynchium cirrosum** (Schwägr.) Limpr.*Brachythecium cirrosum* (Schwägr.) Schimp.

SW. Iceland: Esja!; Kolvidarhol!, at an altitude of about 300 metres.

In Esja it grew rather scantily on a damp slope, in company with *Hypnum chrysophyllum*. Near Kolvidarhol it grew abundantly on the ground among grass and species of *Carex*.262. **Eurhynchium piliferum** (Schreb.) Br. eur.*Hypnum piliferum* Schreb.

W. Iceland: Budahraun (H. J.); Álafoss near Reykjavik!; Hafnarfjörður!. SE. Iceland: Hornafjörður!. S. Iceland: Reykirdalur!, up to about 150 metres above sea-level; Breidabolstadr!; Holt!, in several places up to about 300 metres above sea-level; between Thingvellir and Geysir (Grl.); common around Thingvellir!; Drángshlid!; Vestmannaey!.

Rather common in the South-western and Southern parts of Iceland. It usually grows in protected localities, for instance in lava-clefts, but occasionally, for instance near Reykir, it occurs on moss-grown slopes in company with *Hylocomium* spp. Near Thingvellir it was found abundantly in Almagnagjá, at the grass-covered bottom of the ravine. Only sterile specimens have been found.263. **Eurhynchium Swartzii** (Turn.) Curnow.*Hypnum Swartzii* Turn.

S. Iceland: Drángshlid (H. J.); Merkjáfoss (F.); common on Fljóts-hlid and below Eyjafjall!; Reykirfoss!. SW. Iceland: Álafoss.

This species was found only in S. Iceland, but was common there on damp rocks, especially at the base of the sides of tuff rocks in clefts and in damp caves. Only sterile specimens have been found.

Note. *Eurhynchium hians* from Merkjáfoss (Jeg Feddersen) belongs to *E. Swartzii*.*Hypnum praelongum* is recorded from Iceland by Zoëga. There are no specimens of it in the collections, but perhaps it has been confused with *E. Swartzii*.264. **Eurhynchium Stockesii** (Turn.) Br. eur.*Hypnum Stockesii* Turn.

S. Iceland: Drángshlid!; Hrutafell!; Holt!; Seljaland!; Vestmannaey (H. J.;!).

Rather common south of Eyjafjall and on Vestmannaey. It usually grows rather scantily on the ground, between blocks of rock or in clefts. On Vestmannaey it occurred in several places; among other localities at the foot of cliffs, in company with *Mnium undulatum* and *Lophocolea cuspidata*. Only sterile specimens have been found.



265. **Rhynchostegium murale** (Neck.) Br. eur.*Hypnum murale* Neck.

S. Iceland: Drángshlid!; Hrutafell!.

In the above localities it grew rather abundantly at the foot of dry tuff rocks and on fallen blocks. The fruit was ripe in the latter half of July, but some of the lids still persisted.

266. **Rhynchostegium rusciforme** (Neck.) Br. eur.*Hypnum rusciforme* Neck.

N. Iceland: Near Eyjafjörður (O. D.)!. NW. Iceland: Isafjörður!. W. Iceland: Dalsmýnne in Nordredalur!; Lundurreykjadalur!; Esja!; Ellidará near Reykjavík!. S. Iceland: Tungufoss (F.)!; Vik (H. J.)!; Reykirdalur!, fr.; frequent on Fljóthlid and near Eyjafjall!.

Var. *atlanticum* Brid.

N. Iceland: Between Svinadalur and Dettifoss!; Husavík!. W. Iceland: Esja!, in several places. S. Iceland: Reykirdalur!; Holt!; Vik (H. J.)!.

The type is rather frequent in the Southern and Western parts of Iceland, rarer in North Iceland, and has not been found in East Iceland. It usually grows on wet rocks near waterfalls, or on stones in the rivers, as a rule rather scantily, and mixed with *Brachythecium rivulare*, *Hypnum ochraceum*, etc. Only in Reykirdalur did it occur abundantly in the river and on the rock-sides by the waterfall, also in fruit.

Var. *atlanticum* is found in swiftly flowing rivers, where it often covers the bottom and stones for long distances.

267. **Thamnium alopecurum** (L.) Brid.

W. Iceland: Dalasýsla. Vogur (H. J.)!; Jærngerðarstaðr (Sæmundson)!. S. Iceland: Reykirdalur!; Paradishellir (Stp.)!; common on Fljóthlid and below Eyjafjall!.

On wet shady rock-faces and in caves. In S. Iceland it is common in the tuff-clefts, especially on the inwardly sloping surfaces, and in the numerous dark, damp caves, where it often covers the roof and sides through which water is percolating. Only sterile specimens have been found.

268. **Plagiothecium silvaticum** (Huds.) Br. eur.

N. Iceland: Grimsey (O. D.)!. S. Iceland: Thingvellir (Grl.);!; Almannagjá!.

In Almannagjá it was found scantily at the bottom of a lava-cleft. Only sterile specimens were found.

269. **Plagiothecium Roeseanum** (Hampe) Br. eur.Syn. *Plagiothecium silvaticum* var. *Roesei* (Hampe) Lindb.

Commonly distributed, but as a rule rather scantily, in soil-filled rock-crevices, in company with *Mnium orthorrhynchum*, *Plagiochila*

*asplenioides*, *Pohlia cruda*, etc., up to about 300 metres above sea-level. Near Kolvidarhol and Seljaland it was found at an altitude of about 400 metres. Only sterile specimens have been found.

270. **Plagiothecium denticulatum** (L.) Br. eur.

N. Iceland: Mývatn (Gr.;!); Grimsey (O. D.); Hof (O. D.); Vidvik (P. Sófóniasson); Ásbýrgi!. NW. Iceland: Grunnavik!; Kaldalon!. W. Iceland: Gilsbakki!; Hafnarfjörður!; Reykjavík!. S. Iceland: Thingvellir!; Holt!; Vestmannaey!.

Found here and there on humus-covered rocks or in lava-clefts, but everywhere scantily only, and sterile.

Recorded by König and Steenstrup from Iceland, but there are no specimens of it in the collections.

*Plagiothecium undulatum* is recorded by Lindsay and *P. silesiacum* by Hornemann (from Geysir), but no specimens of either of these two species are to be found in the collections, so the determinations are undoubtedly erroneous.

271. **Plagiothecium pulchellum** (Dicks.) Br. eur.

*Isopterygium nitidum* v. *pulchellum* Lindb.

Iceland (Mörch). Commonly distributed over the whole of Iceland.

Grows in rock-crevices, caves, lava-clefts, etc.; either in small un-mixed tufts or, more often, intermixed with other mosses. It does not appear to ascend higher than about 400 metres above sea-level and, as a rule, sets fruit.

The majority of the plants which have been investigated belong to the type. Var. *nitidulum* (Wahlb.) L. et J. (*Isopterygium nitidulum* Lindb.) is far rarer, and grows by preference especially in deep shade; but, for the rest, this form is not very characteristic and passes without limit into the type.

272. **Plagiothecium depressum** (Bruch) Dixon.

S. Iceland: Holt!; Vestmannaey, Heljúsadalur!.

In Heljúsadalur it grew in masses on a talus of fallen blocks and debris (Urd), everywhere covering the ground between the large blocks with its brightly shining mats. Near Holt it was found mixed with *Brachythecium velutinum* at the bottom of a tuff cave at an altitude of about 300 metres.

273. **Plagiothecium elegans** (Hook.) Sull.

*Isopterygium elegans* (Hook.) Lindb.

S. Iceland: Reykirdalur!, at an altitude of 260 metres.

It was growing here on warm soil in the neighbourhood of a sulphur spring, on the ground below a projecting block of rock, in company with *Diplomyllum albicans* and *Pellia Neesiana*.

The form found is robust, light green, highly shining and differs in habit by the leaves being very decidedly two-rowed, spreading. Gemmæ, which were, by the by, quite typical, occurred only extremely few in number.

274. **Amblystegium Sprucei** (Bruch) Br. eur.

Commonly distributed over the whole of Iceland.

Grows in rock-clefts, dark ravines and caves, and among fallen blocks of rock, usually scantily woven into the tufts of other mosses such as *Plagiothecium pulchellum*, *Amphidium Mougeottii*, *Lophozia Mülleri*, *L. heterocolpos* and *Mnium orthorrhynchum*, but occasionally also in tiny cushions or as delicate, cobweb-like coverings on roofs in caves. In Esja it was found up to about 400 metres above sea-level. Only sterile specimens have been found.

275. **Amblystegium fluviatile** (Sw.) Br. eur.

SW. Iceland: Tungufoss (F.)!, determined by C. Jensen.

Only a few stems were found, intermixed with other mosses, for instance *Brachythecium rivulare*, *Hypnum ochraceum*, etc.

276. **Amblystegium serpens** (L.) Br. eur.

N. Iceland: Akureyri, fr. (Grl.)!; Mývatn, fr. (Grl.)! W. Iceland: Reykjavík!. Vestmannaey!, fr.

In Iceland this species is as variable as it is in other places. The specimens from Mývatn were very robust, with leaves 1.33 mm. long and 0.65 mm. broad, erectly spreading, and distinctly toothed in their lower half, with rather long and strong nerve, and cells 0.010—0.012 mm. broad and 4—6 times as long. Near Reykjavík it grew in large cushions, 1—2 cm. deep, on a stone wall near the sea-side. In the plant from the latter locality the leaves were broadly ovate, longly pointed and almost entire at the margin, with cells 0.009—0.011 mm. broad and 2—3 times as long. The form from Vestmannaey is very slender, with leaves 0.7 mm. long and 0.3 mm. broad, with very short nerve which in the branch leaves was just indicated immediately above the leaf-base. On Vestmannaey the fruit was quite unripe on July 6th; in N. Iceland it was ripe at the end of July.

277. \*Subsp. **Amblystegium Juratzkanum** Schimp.

N. Iceland: Fagriskogur (St.)!. S. Iceland: Drángshlid!, fr.; Vestmannaey!.

The plant from Drángshlid was quite typical and bore ripe capsules at the end of July. The specimens which were collected on the base of a birch-trunk in Fagriskogur agreed fairly well with the form described by Limpricht (*Kryptogamenflora*, vol. III, p. 323) under the name of *Amblystegium radicale*. The leaves taper from an ovate-lanceolate base

to a very long and slender point, and are about 1 mm. long and 0.4 mm. broad. The branch leaves are lanceolate and toothed along their entire margin, with short nerve. The cells at the base of the leaf are quadrate, yellow and rather thick-walled, 0.012–0.015 mm. broad; those in the upper half of the leaf narrowly prosenchymatous, 0.08 mm. broad, and 6–8 times as long, and often somewhat wavy.

278. Subsp. \* **Amblystegium littorale** (C. Jens.) Hesselbo.

Syn. *Amblystegium serpens* var. *littoralis* C. Jens. in "Færøernes Mosser".

N. Iceland: Grimsey (O. D.)!. W. Iceland: Reykjavik!; Brjanslækur (H. J.)!.

Both the plants agreed exactly with the specimens collected by C. Jensen in the Færøes. *A. littorale*, which is a Sub-arctic-Arctic form, is probably widely distributed. It has been found not only in the Færøes and in Iceland but also on Jan Mayen (Dusén) and in Sweden, on Gislö near Troså (Arnell). It has as yet been found sterile only.

279. **Amblystegium compactum** (C. M.) Br. eur.

Vestmannaey (H. J.;!). SW. Iceland: Öndverðarnes, in a well together with *Trentepohlia aurea* (H. J.)!.

On Vestmannaey this species occurred rather frequently on the sides of clefts and caves in tuff rocks. It grew there in company with *Trentepohlia*, especially in places where water was percolating through, and occurred sometimes in compact cushions several cm. deep, sometimes as a thin covering. The Iceland specimens agree exactly with North American plants of *A. compactum*; occasionally, however, the leaves especially of the forms growing as thin coverings are somewhat broader, with shorter cells.

V. Mönkemeyer and L. Loeske (Revision einiger Amblystegien aus dem Herbare Limpricht; Ungarischen bot. Blätter, 1911, p. 273) refer *Amblystegium salinum* Bryhn to *A. compactum* as var. *salinum* (Bryhn) Mkm. On investigating numerous specimens of *A. salinum* I have, however, arrived at the conclusion that these two species are in no way connected with each other. *Amblystegium compactum* forms compact, dark-green tufts with a somewhat silky lustre, closely interwoven in the interior with rusty brown rhizomes which proceed partly from the stem and partly, in very great numbers, from the under side of the stem-leaves. The stem is prostrate with apex rising upward, and with numerous branches. The leaves are very close-set, longly decurrent, erectly spreading and secund. The stem leaves taper from a broadly ovate base to a long and slender point with strongly curved back apex. The branch leaves are narrowly lanceolate, often with apex curved. The leaf-margin is sharply toothed along its entire length, and especially the lowermost teeth are often turned outwards or towards the base. In the branch leaves the nerve reaches to the apex and is of almost equal width along its entire length, straight, or sometimes slightly sinuous. The leaf-cells are narrower than in any other *Amblystegium*, 0.005–

0.006 mm. broad, and 6—10 times as long, thin-walled, pointed and wavy. On the whole, both the cell-tissue of the leaf and the form of the leaf-teeth call to mind far more an *Eurhynchium* or a *Rhynchostegium* than an *Amblystegium*.

*Amblystegium salinum* Bryhn grows in loose, yellowish green, hardly tomentose tufts. Rhizoids occur only on the lowermost part of the stem and scantily on the back of the nerve. The stems are erect or ascending, slightly and irregularly branched. The leaves are far more distant than in *A. compactum*, are spread out almost horizontally, very longly decurrent, ovate-lanceolate, with long, often somewhat obtuse apex; all are similar or the branch leaves are somewhat narrower. The leaf-margin is finely and obtusely toothed till towards the apex. The leaf-cells have the appearance typical of *Amblystegium*, and in the upper half of the leaf are 0.008 mm. broad and 4—6 times as long, with sinuose primordial utricle (the latter is usually wanting in *A. compactum*). The nerve is green and sinuose (as in *A. varium*) and vanishes just below, or in, the leaf-apex itself. *A. salinum* is undoubtedly a true *Eu-Amblystegium* which is nearest allied to *A. serpens*, but also approaches certain forms of *A. varium* (Hedw.) as regards the form of the basal cells of the leaf and the long sinuous nerve. It would also be remarkable if a species like *A. compactum*, which in North America grows on rocks and on damp ground in woods in the interior of the country, should in Europe turn into a decidedly salt-soil plant. *A. salinum* has been collected in many places along the coasts of Sweden and Norway; first by Zetterstedt on Öland and near Bosekop in Finmarken, and in the herbarium is named by him *Amblystegium serpens* var. *littorale*. Hagen has collected the same species in Salten in Nordland (65° 15' N. lat.), where it was growing in company with *A. littorale* (C. J.), and in a letter he named it *Amblystegium breve* n. sp. On the other hand, it is not known to me that the real *A. compactum* has been collected in Scandinavia. I have not seen the *A. compactum* from salty soil in North Germany mentioned by Loeske (loc. cit. pp. 272—273), nor have I seen Mönkemeyer's *A. compactum* from Bornholm.

### 280. *Amblystegium salinum* Bryhn.

Vestmannaey! on damp sandy soil near the coast, sterile.

### 281. *Amblystegium trichopodium* (Schultz) Br. eur.

N. Iceland: Grimsey (O. D.)!

Judging from the plentiful intermixture of Green Algæ, the plants from the above locality must have been growing on wet, probably muddy ground. ♂ and ♀ flowers were present in great numbers; fruit, on the other hand, had not been developed. The stem leaves were rather close-set, horizontally out-spreading, from an ovate base tapering to a long and slender point, finely toothed along the entire margin, 1.2—1.5 mm. long and 0.50—0.55 mm. broad, with green nerve, 0.04—0.045 mm. wide. The branch leaves were lanceolate, 0.95 mm. long and 0.30—0.35 mm. broad, with short green nerve. At the base of the leaf the cells were



green and rectangular, 0.018 mm. broad and 0.070 mm. long, in its upper half, 0.010 mm. broad and 4–7 times as long, with sinuous primordial utricle.



Fig. 17. *Amblystegium trichopodium* (Schultz). Habit ( $\times 3$ ).

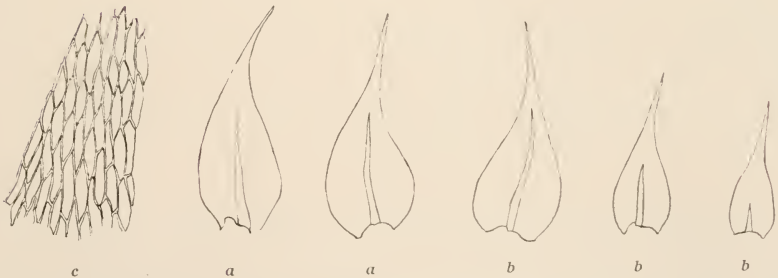


Fig. 18. *Amblystegium trichopodium* (Schultz) Br. eur. *a*, Stem-leaves and *b*, branch-leaves ( $\times 20$ ); *c*, leaf-cells near margin ( $\times 120$ ).

282. **Hypnum Sommerfeltii** Myrin.

N. Iceland: Stora Brekka near Eyjafjörður (O. D.)!. S. Iceland: Fell (Harder, 1908)!, a few stems among *Hypnum uncinatum*, *H. stellatum* and *Ditrichum flexicaule*.

283. **Hypnum chrysophyllum** Brid.

*Amblystegium chrysophyllum* (Brid.) Lindb.

E. Iceland: Berufjörður!. N. Iceland: Near Mývatn (Gr.)!. Hof near Eyjafjörður (O. D.)!. W. Iceland: Esja, several places (Gr.;!)!. S. Iceland: Geysir, on warm ground!. Vestmannaey, Heljusdalur!.

Var.  $\beta$  *tenellum* Schimp.

W. Iceland: Esja!.

On damp gravelly ground and on rocks, rather rare and scanty. Near Geysir it grew plentifully on warm damp ground over which the tepid water from the basin was flowing. Only sterile specimens have been found.

*Hypnum Zemlie* C. Jensen, which was collected by Steenstrup (but no habitat is given) is only a form of *Hypnum chrysophyllum*.

284. **Hypnum protensum** Brid.

*Amblystegium protensum* Lindb.

E. Iceland: Skreiddalur!; Seydisfjörður!. N. Iceland: Hof (O. D.)!; frequent in Esja!.

This species is probably widely distributed, but, on account of its great resemblance to the far more commonly occurring *H. stellatum*, cannot always be kept distinct from the latter species. It grows in somewhat damp localities, both on stones and on the ground, but only sterile specimens have been found.

285. **Hypnum stellatum** Schreb.

*Amblystegium stellatum* (Schreb.) Lindb.

Very common everywhere on a damp substratum, on rocks, on the ground and in bogs, and not rarely in fruit. It is abundant even at a height of 500–600 metres above sea-level.

286. **Hypnum polygamum** (Br. eur.) Wils.

*Amblystegium polygamum* Br. eur.

Very common on wet, boggy ground. It occurs especially abundantly in the neighbourhood of the coasts, but is also very common in the valleys further inland, and hardly ascends higher than about 300 metres. Fruit, which is met with very frequently, ripens at the end of June or in the beginning of July.

287. **Hypnum intermedium** Lindb.*Amblystegium intermedium* Lindb.

This species is no doubt common, at least in N. Iceland. where it occurs around Eyjafjörður up to about 500–600 metres above sea-level. Only sterile specimens have been found.

288. **Hypnum revolvens** Sw.*Amblystegium revolvens* De Not.

Very common over the whole of Iceland.

One of the most frequent and abundantly occurring mosses, which often forms the bulk of the vegetation in the bogs, both in the low land and in the Alpine region where it is plentiful even at an altitude of about 600 metres, for instance near Eyjafjörður. Fruit, which is often present abundantly, ripens in the beginning of July.

*Hypnum revolvens* is distinguished from *H. intermedium* only by the fact of its being monoicous. Therefore, in cases of the frequently occurring quite sterile plants, it is really impossible to decide whether they belong to the one or to the other species. This is especially true of the vigorous, slightly branched aquatic forms, which had previously been referred to *Hypnum Cossoni* Schimp. Both *H. revolvens* and *H. intermedium* form such *Cossoni*-forms, but as they are mostly quite sterile it is impossible to determine them with any certainty.

289. **Hypnum uncinatum** Hedw.*Amblystegium aduncum* (L.) Lindb.

Very common everywhere upwards to the limit of plant-growth.

Var. *orthothecioides* (Lindb.).

N. Iceland: Grimsey (O. D.)!. NW. Iceland: Arngardareyri!: Grunnavik!. E. Iceland: Kirkjuból (H. J.)!.

*Hypnum uncinatum* is one of the most common mosses and occurs everywhere both on dry and on damp substrata, on earth, on rocks, in bogs, etc.; and often in such quantities that it is the most abundant constituent of the moss-carpet. It varies exceedingly in size, habit and colour. *Hypnum orthothecioides* cannot be maintained as species; in addition to the forms found in the above-mentioned habitats, others forming all possible transitions to the type have been found in many other localities. Fruit, which is rather common, ripens in the first half of July.

290. **Hypnum Sendtneri** Schimp.*Amblystegium Sendtneri* (Schimp.) De Not.

N. Iceland: Helgavatnsfloi (Stp.)!.

291. **Hypnum Kneiffii** (Br. eur.) Schimp.*Amblystegium Kneiffii* Br. eur.

This species is common, especially in N. and E. Iceland, and is somewhat rarer in NW. and S. Iceland. It grows in very wet situations in bogs, in pools, along the banks of rivers or covering stones in the water.

Aquatic forms with slightly secund, longly pointed leaves are frequent: short and broad leaved orthophyllous or drepanophyllous forms occur more rarely. The size of the leaf-cells is dependent on the form of the leaf; in f. *brevifolia* they are short in the middle of the leaf, about 3—4 times as long as they are broad. In Esja a brevi-orthophyllous form was collected in a moss-bog at an altitude of 410 metres.

It has been collected in fruit only near Husavik in N. Iceland.

292. **Hypnum exannulatum** (Gümb.) Br. eur.*Amblystegium exannulatum* De Not.

Very common.

*Hypnum exannulatum* occurs in numerous forms everywhere on a damp substratum, often forming the bulk of the vegetation, either alone or mixed with other *Hypnaceae* (*H. stramineum*, *H. revolvens*, etc.), with *Cinclidium*, *Mnium* spp., and other bog mosses. It grows not only in bogs, but also in pools, moss-bogs, along streams, and occasionally on damp rocks. Near Akureyri it was abundant even at an altitude of 600 metres.

Var. *purpurascens* (Schimp.) (*Hypnum purpurascens* Limpr.) is the most frequent form, at any rate in N. and E. Iceland. It is usually purplish, more rarely green, erect, as much as about 20 cm. high, and often forms large, pure growths on very wet ground, especially in the water itself, for instance along the banks of small streams. In this form the leaf-base is never decurrent. In the plants which have been investigated the cells of the leaf-base are sometimes quite typical, forming a single row of large dilated cells across the entire leaf-base, and sometimes they approach those of the type by forming a more or less large, triangular group of empty cells towards the leaf-margin. In typical *Hypnum exannulatum* the leaves are always narrowly decurrent.

Var. *Rote* (De Not.) is without doubt an extreme aquatic form of var. *purpurascens*, with which it is closely connected by intermediate forms. It has the solid, tough stem with long, forwardly directed branches and very narrow, slightly secund leaves peculiar to all mosses growing in swiftly flowing water. The nerve is very strong, usually 0.10 mm. wide at the base and, as a rule, vanishing in the apex, more rarely excurrent. It grows in running water, often in streams flowing through boggy ground. Typical specimens were collected in the following localities: E. Iceland: Seydisfjörður!, rather common: Breiddalskard!; Fróðarheiði (H. J.)!. NW. Iceland: Kaldalon!; Dýnjandi!. W. Iceland: Hvammur (Gr.)!; Esja!, at an altitude of 100 metres. Only sterile specimens have been found.

Var. *serratus* (Warnst.).

Isafjörður!, in pools.

In *H. exannulatum* the length of the leaf-cells varies according to the shape of the leaf. In the most commonly occurring forms with longly pointed leaves the cells are narrow, 6—10 times as long as broad, while short-leaved forms have leaf-cells which are only 4—6 times as long as broad (var. *brachydictyon* (Ren.)), such forms are especially met with on cold, wet gravelly ground. Fruit is rather frequent, both in the type and in var. *purpurascens*, and ripens at the end of July.

### 293. *Hypnum fluitans* (Dill.) L.

*Amblystegium fluitans* (L.) De Not.

S. Iceland: Breidabolstadr (F.)!; Breidamerkursandur (Harder!).

N. Iceland: Blejkjuholt (St.)!; Mývatn (Gr.)!.

Monoicous forms, which may be referred to *H. fluitans* occur only very scantily and rarely in Iceland. The numerous older records of the occurrence of this species (Vahl, Mörch, Hornemann, Grönlund, etc.) are, without exception, due to erroneous determinations, and all the older specimens in the collections (except one) belong to *H. exannulatum* or *H. Kneiffii*.

*H. fluitans* grows everywhere in pools or on inundated ground. Near Blejkjuholt Stefánsson has collected a very peculiar form, with erect, obtuse leaves with short nerve. The cell-tissue of the leaves is very loose, and the cells of the leaf-base differ only slightly from the other cells.

Var. *falcatum* Schimp. (*Hypnum H. Schultzii* Limpr.)

This very characteristic form was found abundantly, and in fruit, on wet boggy ground near Kaldalon in NW. Iceland.

### 294. *Hypnum filicinum* L.

*Amblystegium filicinum* (L.) De Not.

Very common.

In the greater part of Iceland this species is one of the most frequent mosses on a damp substratum, especially on wet rocks, but also on gravelly ground and in bogs. In most part of N. Iceland it is somewhat rarer, and usually occurs more scantily. In S. Iceland it often covers the faces of wet tuff-rocks in enormous mats and not rarely sets a great quantity of fruit. In the rest of Iceland fruit is rarer and occurs most often in the large, tomentose bog-form. In S. Iceland fruit was ripe in the middle of July.

*Hypnum filicinum* varies exceedingly. Bog forms and forms from wet gravelly ground are usually densely tomentose and regularly pinnately branched. Rock forms, when growing on a more dry substratum, are slender and slightly branched; on wet rocks, especially on tuff, very large and vigorous, often almost like *Hypnum commutatum*.



*H. filicinum* has its main distribution in the lowlands up to about 300 metres above sea-level, but is also frequently met with, for instance near Berufjörður and in Esja, up to a height of about 500 metres. At this altitude it grows on rocks in low, dense cushions, more rarely on wet gravelly ground, and these Alpine forms constitute a distinct transition to *H. curvicaule* Jur., which is perhaps only a High Alpine form of *H. filicinum*.

### 295. *Hypnum curvicaule* Jur.

*Amblystegium curvicaule* (Jur.) Dicks. & James.

E. Iceland: Berufjardarskard!, 540 metres above sea-level; Seydisfjörður!, frequent from about 100—500 metres above sea-level. W. Iceland: Mödruvellir!, about 400 metres above sea-level.

Grows on damp gravelly ground and rocks on mountain heights up to 500—600 metres. On dry rocks the leaf-cells become longer and narrower and the alar cells more thick-walled. Near Seydisfjörður it was collected with quite young fruit (3. 7. 1909).

### 296. *Hypnum decipiens* (De Not.) Limpr.

*Amblystegium glaucum*  $\beta$ . *decipiens* Lindb.

E. Iceland: Very common near Seydisfjörður!; Dvergasteinn (H. J.)! N. Iceland: Husavik!; Ljosavatn!; Akureyri!; Öxnadalur!. W. Iceland Brattabrekka!.

Common from Seydisfjörður in E. Iceland throughout the whole of N. Iceland. The westernmost habitat of this species is Brattabrekka, south of Haukadalur. In the rest of Iceland it has not been observed.

*Hypnum decipiens* grows on very wet, especially gravelly, ground, for instance at the edge of moss-bogs or on inundated gravelly ground, and along small streams both on the ground and on stones. It hardly ascends higher than about 300 metres, and rarely sets fruit. Near Seydisfjörður, Husavik and Tverá in Öxnadalur it was collected in fruit.

### 297. *Hypnum commutatum* Hedw.

*Amblystegium glaucum* (Lam.) Lindb.

E. Iceland: Seydisfjörður (H. J.;!). N. Iceland: Husavik!; Reykjahlid!. W. Iceland: Lundur!; rather frequent in Esja!. S. Iceland: Rather common!.

Var. *falcatum* (Brid.) C. M. *Hypnum falcatum* Brid.

Very common.

*H. commutatum* is the more rarely occurring form. It is most frequent in SW. and S. Iceland, where it is especially abundant on wet tuff-rocks. It is rather rare and scanty everywhere else in Iceland.

Var. *falcatum*, together with all possible transitions to the type, is one of the most common mosses in the greater part of Iceland. Only in NW. Iceland is it scanty and met with only here and there. Both

forms grow on rocks in and by the water, on wet rock-faces and on the ground, both on wet gravelly ground and on the ground in bogs. It often forms, especially in N. Iceland, an essential part of the moss-carpet in bogs. It hardly ascends higher than about 300 metres above sea-level. ♀ plants are very common, ♂ plants and fruit are far rarer. It has been found in fruit near Stafafell, Seydisfjörður, Hrutafjörður and, rather frequently, in S. Iceland (both forms).

### 298. *Hypnum molluscum* Hedw.

*Ctenidium molluscum* (Hedw.) Schimp.

Iceland (Mörch)!; Bardshellir (Grl)!; Brynjudalur (Grl)!. W. Iceland: Common near the hot springs in Reykholtalur!; Botnsdalur!; common about Reykjavík!; common in Esja!; Kolvidarhol!, up to about 350 metres above sea-level. S. Iceland: Very common!. SE. Iceland: Hornafjörður!.

This species is very common in S. Iceland, especially on Fljótshlid and about Eyjafjall, but is also plentiful near Thingvellir, and frequent in SW. Iceland as far as Borgarfjörður, where it is, however, chiefly confined to the warm ground. It appears to be quite absent from the other parts of Iceland.

*H. molluscum* grows on a damp substratum, both on damp rocks, especially tuff, and on damp ground. Near Thingvellir it grew abundantly, covering the blocks at the bottom of the large lava-clefts. Around the hot springs in SW. and W. Iceland it occurs abundantly in several places. Thus in Reykholtalur it is one of the most frequent species of the warm clayey flats.

It occurs almost exclusively in the low land, and only near Kolvidarhol was it found about 350 metres above sea-level. Only sterile specimens have been found.

### 299. *Hypnum imponens* Hedw.

*Stereodon imponens* (Hedw.) Brid.

E. Iceland: Hof, on basalt rocks!. W. Iceland: Esja!; Braudarholt!. N. Iceland: Vidimýri, near a hot spring (Grl)!. W. and SW. Iceland: Near almost all the hot springs!.

In SW. and W. Iceland it grew with a few exceptions on warm ground. In Esja it grew in company with *Camptothecium lutescens* on a grass-covered slope, and near Braudarholt intermixed with other *Hynaceæ* on the top of knolls in bogs.

On a warm substratum *Hypnum imponens* grows especially on the drier clay-flats; there it often forms extensive mats, partly alone, partly mixed with *Hypnum stramineum*, *H. Lindbergii*, *H. molluscum*, *Hylocomium squarrosum* and other species. Only sterile specimens have been found.

300. **Hypnum Bambergeri** Schimp.*Stereodon Bambergeri* (Schimp.) Lindb.

W. Iceland: Breidabolstadr in Reykholtdalur!

It was growing there on a damp gravelly flat in company with *Ditrichum flexicaule*, *Mypurella julacea*, *Tortella tortuosa* and *T. fragilis*.301. **Hypnum revolutum** (Mitt.) Lindb.*Stereodon revolutus* Mitten.

Very common over the whole of Iceland.

It grows both on dry and on more or less damp rocks, occasionally also on gravelly soil, and is frequent up to about 600—700 metres above sea-level. It varies considerably in size, from quite slender forms (for instance on lava blocks) to very robust forms on damp stones in clefts. Fruit, which was ripe in the middle of July (but the lids still persisted), was found only near Breidabolstadr in S. Iceland, where *Hypnum revolutum* grew in deep cushions, covering stones in a cleft.302. **Hypnum cupressiforme** L.

E. Iceland: Berufjörður (Gr.;!); Hof!; Hornafjörður!. N. Iceland: Vidvik near Skagafjörður (P. Sófóniasson)!; Vídimýri!; common west of Blóndudalur!. W. Iceland: Stykkisholmur!; Botnsdalur!; common about Esja, Hvalfjörður. Reykjavik and Hafnarfjörður!. S. Iceland: Common!. Vestmannaey!.

Common from Berufjörður in E. Iceland throughout S. and W. Iceland and the western part of N. Iceland to Blóndudalur. In E. Iceland it has not been found further northwards than Berufjörður, and in NW. Iceland it has not yet been observed. East of Hunaflói it has been found only in a few localities near Skagafjörður.

It usually grows on rather dry rocks or on soil-covered rock-ledges, and does not appear to ascend higher than about 300 metres above sea-level. Only sterile specimens have been found.

Var. *ericetorum* is recorded from Ormarstadir in E. Iceland (leg. H. J., det. C. Jensen), but there are no specimens of it in the collections.303. **Hypnum hamulosum** Br. eur.*Stereodon hamulosus* Lindb.

E. Iceland: Hof!, at an altitude of 100 metres; Hornafjörður!. W. Iceland: Esja, Mödruvellir!, on tuff rocks, 250—400 metres above sea-level; Kolvidarhol!; common on tuff, from 250 to 450 metres. NW. Iceland: Grunnavik!, at an altitude of about 280 metres. S. Iceland: Holt!; Drángshlid!. Vestmannaey!.

Rather frequent in the South-western and South-eastern parts of Iceland. It has been found almost everywhere on tuff-rocks, where it

occurred abundantly in several places, for instance in Esja, but only sterile specimens were found.

### 304. *Hypnum callichroum* (Brid.) Br. eur.

*Stereodon callichrous* Brid.

E. Iceland: Seydisfjörður!. NW. Iceland: Common everywhere!. W. Iceland: Budahraun (H. J.)!; Grundarfjörður (H. J.)!; common everywhere in the lava-fields east of Reykjavik and around Hafnarfjörður!; Svinahraun!; Esja, in *Grimmia*-heath at an altitude of about 400 metres, and in many places along the banks of streams!. S. Iceland: Skálholt!; Thingvellir!; Holt!, common on tuff-slopes in clefts.

This species is common in the south-western part of Iceland, and very common in North-west Iceland. In North Iceland it has not been found, and in East Iceland only near Seydisfjörður. It occurs in Iceland in two forms. The most frequent form is the typical bog-soil form, which is exceedingly common especially in NW. Iceland, and sometimes forms the bulk of the vegetation in damp situations, especially along streams, on wet slopes and at the edge of bogs, usually in association with *Harpanthus*, *Lophozia quinquedentata*, *Cephalozia bicuspidata*, etc. Around Isafjörður it occurs up to a height of about 300 metres, and in S. and SW. Iceland up to almost 500 metres above sea-level.

Everywhere in the depressions and at the bottom of the clefts of the lava-fields of South-western and West Iceland a mesophilous form is found, which is distinguished by its size and by its almost regularly two-rowed ramification. It grows in deep, loose and soft cushions, either among grass or mixed with *Hylocomium* spp., *Racomitrium hypnoides* and species of *Dicranum* and of *Lophozia*.

Fruit was collected only in Kaldalon in NW. Iceland; it was quite undeveloped even at the end of June.

### 305. *Hypnum Lindbergii* Mitten.

*Stereodon arcuatus* Lindb.

Very common.

This species grows on wet ground, especially in bogs, associated with *H. revolvens*, *H. cuspidatum*, *Hylocomium squarrosum*, *Meesea*, etc.; but also on damp gravelly ground and on soil-covered rocks. It appears to be of almost equal frequency everywhere. Near Berufjörður it was collected up to a height of about 500 metres above sea-level, and on Eyjafjall in S. Iceland it was frequent at the same height. Near Akureyri it occurred abundantly on boggy ground even at an altitude of 500-600 metres. Only sterile specimens have been found.

*Hypnum pratense* is recorded by Grönlund from several localities, but the record is due to a confusion with *H. Lindbergii*.

Note. *Hypnum incurvatum* is recorded from Iceland by Mörch, but the specimens in his collection belong to *Plagiothecium pulchellum*.

306. **Hypnum palustre** Huds.*Amblystegium palustre* (Huds.) Lindb.

E. Iceland: Seydisfjörður!. N. Iceland: Akureyri (Gr!.); Vidimýri (Gr!.); Grimstunga (Gr!.); Ljosavatn!, at an altitude of about 300 metres; Melar (Gr!.)!. W. Iceland: Gilsbakki!; Reykholtalur (Gr!.); Lundur-reykjadalur!; Reykjavik!; common in Esja!; Alafoss!. S. Iceland: Common!.

This species is common in S. Iceland (Eyjafjall, Fljótshlid, etc.), SW. and W. Iceland, is found here and there in N. Iceland and is rare in E. Iceland. It has not yet been found in NW. Iceland. It grows everywhere on rocks and stones in and by rivers, and almost always sets fruit, which ripens during July. It does not appear to ascend higher than about 300 metres above sea-level.

Of the varieties only var. *δ subsphæricarpon* (Schleich.) Br. eur. is of any interest. It occasionally occurs in company with the type on stones in swiftly flowing rivers.

307. **Hypnum arcticum** Sommerf.*Amblystegium Smithii* (Sw.) Lindb.

W. Iceland: Hvammur (Gr!.)!. NW. Iceland: Bæir! fr. It is, moreover, recorded from Iceland by Mörch and from Akureyri (Gr!), but both the plants are wrongly determined.

Near Bæir it grew on wet rocks by a small waterfall.

308. **Hypnum alpestre** Sw.*Amblystegium rivulare* (Sw.) Lindb.

E. Iceland: Berufjörður!, common; Seydisfjörður!, common up to about 200—300 metres above sea-level; Breiddalskard!, at an altitude of about 400 metres; Vallanes (H. J.!), common on rocks along the sea; Skriddalur!. N. Iceland: Öxnadalur!, very common in the river. NW. Iceland: Isafjörður!, frequent up to about 200 metres; Sugandafjörður!; Arngardareyri!. W. Iceland: Lundur!. SW. Iceland: The Laxá (F.!); the Langá (H. J.!); the Öxarárá!.

Common in E., N. and NW. Iceland, rarer in W. and SW. Iceland. This species has its main distribution in E. Iceland, where it occurs everywhere in the rivers and often covers the stones along the banks for long distances. Fruit, which occurs rather commonly, ripens in July (Öxnadalur, July 24; Vallanes, hardly ripe on June 28th).

309. **Hypnum alpinum** Schimp.*Amblystegium molle*  $\beta$  *alpinum* Lindb.

E. Iceland: Berufjörður!. N. Iceland: Akureyri (Gr!.); Hof near Eyjafjörður (O. D.!); Holar (Gr!)! fr.; Lækjarmot! fr.; common in Öxnadalur! fr., NW. Iceland: Isafjörður! fr.; Dýrafjörður! fr.; Arngardareyri! fr.; Dýnjandi! fr.

Figured in Flora Dan. (tab. 2621, fig. 2) as *Hypnum molle*, leg Mörch.



This specimen is not to be found in the collections; on the other hand, a specimen from Iceland, determined by Mörch as *Hypnum arcticum*, belongs to *H. alpinum*.

Rather common in N. and NW. Iceland, where it grows on stones in rivers, like the other species of *Hygrohypnum*. It does not ascend higher than about 200 metres above sea-level (Isafjördur), and often sets fruit which ripens in N. Iceland in the latter half of July.

*Hypnum alpinum* varies considerably in leaf-form, leaf-tissue and habit.

The leaves, which are most often spreading, are occasionally falcato-secund along the entire length of the stem, in which feature it approaches *H. dilatatum* in habit. The Iceland specimens of *H. alpinum* approach, on the whole, *H. dilatatum*, both in habit, leaf-form and structure of cell-tissue. The cells of the base of the leaves are often thickened and slightly porous, and the alar cells are sometimes colourless and thin-walled, sometimes yellowish with slightly thickened walls. The leaf-form varies from almost orbicular to elliptic. The leaf-margin is almost always finely toothed all round.

I have, however, thought it more correct to refer all the Iceland plants to *H. alpinum*, as at any rate the capsule and the perichætium corresponded exactly to those in this species. Thus, fully developed cilia have never been found in the peristome. The leaf-cells are also shorter than in *H. dilatatum* and in size agree most nearly with those in *H. alpinum*.

### 310. *Hypnum ochraceum* Turn.

*Amblystegium ochraceum* Lindb.

Very common on stones in rivers up to 300—400 metres above sea-level, but only sterile specimens have been found.

Varies considerably in size, habit, etc.

Var. *uncinatum* Milde often occurs in company with the type.

Var. *filiforme* Limpr. is rather common in swiftly flowing rivers, where it often covers the bottom for long distances.

Note. *Amblystegium polare* Lindb. is recorded by Grönlund (Tillæg til Islands Kryptogamflora, Bot. Tids., 20, p. 113) to have been collected near Vallanes by H. Jónsson. The specimen in question is in the Botanical Museum in Copenhagen and is labelled "*Dichodontium pellucidum*, *Polytrichum alpinum*, *Amblystegium polare*. det. C. Jensen", but in spite of a careful search it was not possible to find *A. polare* among the specimens, so for the present the occurrence of this species in Iceland must be regarded as uncertain.

### 311. *Hypnum cordifolium* Hedw.

*Amblystegium cordifolium* De Not.

N. Iceland: Mývatn (Gr.)! NW. Iceland: Grunnavík!, fr.

This species is also recorded from the Ölfusá, Nesland, Litlu Borgarkatlar and Thorodstadaengjar, but the plants from all these localities

are only forms of *H. giganteum*, which often occurs in slender, slightly branched forms, which are very difficult to distinguish from *H. cordifolium*. As a rule, however, the old typical shoots from the previous year may be found at the bottom of the tuft, from whence the *cordifolium*-like shoots proceed. Near Grunnavik *H. cordifolium* grew abundantly on boggy, partly inundated ground, and there it was richly fruiting. On the damp ground it was flaccid and prostrate, in water erect in large, deep cushions.

### 312. *Hypnum Richardsonii* (Mitt.) Lesq. et James.

*Amblystegium Richardsonii* Lindb.

E. Iceland: Skorastadr (H. J.)! fr.: Seydisfjörður!, abundantly at an altitude of 350 metres. N. Iceland: Thorodstadaengjar (St.)!; Ljosavatn! fr., at an altitude of about 250 metres; Husavik!. NW. Iceland: Ármuli!. W. Iceland: Mödruvellir!, at an altitude of about 200 metres; Hjallaháls (H. J.)!. S. Iceland: Barkastadr!, at an altitude of 530 metres.

This species is probably more frequent than may be believed, judging from the few habitats, but it is often overlooked on account of its resemblance to the exceedingly common *H. cuspidatum* and *H. giganteum*. It grows in bogs, often abundantly, associated with *H. stramineum*, *H. sarmentosum*, *H. revolvens*, *H. exannulatum*, etc., and often sets fruit which ripens in the middle of July.

### 313. *Hypnum giganteum* Schimp.

*Amblystegium giganteum* De Not.

Very common.

Grows in bogs, where it is often the most abundant constituent of the vegetation, especially in the wettest situations, in channels and pools. Near Akureyri it was common in bogs even at an elevation of 600–700 metres. Fruit, which occurs rather frequently, ripens in the first half of July.

### 314. *Hypnum stramineum* Dicks.

*Amblystegium stramineum* De Not.

Very common over the whole of Iceland.

It grows on damp ground, usually intermixed in tufts of other *Hypnum* spp., *Sphagna*, *Cinclidium*, *Mnium*, etc. On very wet ground it often forms pure extensive growths. Thus, near Ljosavatn, it grew in the wettest parts of a bog at an altitude of 400 metres, in extensive, richly fruiting mats, 10–20 cm. deep. In depressions in the rocky flat it forms in association with *H. sarmentosum*, *H. revolvens* and *H. exannulatum* low, dense almost black growths.

Fruit was ripe near Ljosavatn on July 18th.

315. **Hypnum sarmentosum** Wahlb.*Amblystegium sarmentosum* De Not.

Commonly distributed on boggy ground, but as a rule not plentifully, mixed with other *Hypnaceae* or in unmixed tufts.

It varies considerably in size and colour. The slender High Alpine forms, which occasionally form the bulk of the vegetation at an altitude of 500—700 metres, sometimes approach so close to *H. stramineum* that it may be difficult to keep these two species distinct from each other.

In S. Iceland it has been found in many places from about 300 metres upwards, but it has not been found in the low land. In the other parts of Iceland it is distributed from the low land up to about 700 metres above sea-level, but appears to be most frequent above a height of about 200—300 metres. It has been collected in fruit near Hof in E. Iceland, Ljosavatn in N. Iceland where it occurred abundantly in bogs at an altitude of about 250—300 metres, and near Grunnavik in NW. Iceland where it was the most abundant constituent of the vegetation in a bog. The fruit, in the specimens from all these localities, was green in the middle of July.

316. **Hypnum trifarium** W. et M.*Amblystegium trifarium* De Not.

E. Iceland: Seydisfjörður!; N. Iceland: Vatnsskard!.

In both the above localities it was growing rather scantily on very wet boggy ground, in company with *Hypnum scorpioides*, *H. stramineum* and *H. revolvens*.

317. **Hypnum turgescens** Th. Jensen.*Amblystegium turgescens* Lindb.

E. Iceland: Djupivogur!. N. Iceland: Svinadalur!. S. Iceland: Barkarstadr!, at an altitude of 530 metres.

It grew everywhere abundantly on boggy ground, in company with *Hypnum revolvens*, *H. scorpioides* and *H. polygamum*.

318. **Acrocladium cuspidatum** (L.) Lindb.*Hypnum cuspidatum* L.

Very common.

This species grows on more or less damp ground, especially in bogs and damp meadows, but also in the water itself in moss bogs and pools, or on damp rocks. As a rule it does not ascend higher than 250—300 metres above sea-level. In S. Iceland it has been found, however, in several places up to a height of about 500 metres.

Fruit, which occurs rather frequently, was ripe about July 1st.

319. **Scorpidium scorpioides** (L.) Limpr.*Amblystegium scorpioides* Lindb.

Very common.

It usually grows in the wettest parts of the bogs, often in the water itself, in association with *Hypnum giganteum* and *H. exannulatum*. In the greater part of the country it is met with everywhere in such localities; only in SW. Iceland (Fljótshlíð and Eyjafjall) does it appear to be less frequent. It appears only by exception to ascend higher than about 300 metres, near Seydisfjörður it was collected at an altitude of 400 metres. Only sterile specimens have been found.

320. **Hylocomium proliferum** (L.) Lindb.*Hylocomium splendens* (Hedw.) Br. eur. -

Very common.

This species is found especially on a dry substratum, for instance on slopes, amongst grass, in heath-soil or as the most abundant constituent of the moss-covering on stones and in coppices. It occurs however also on damper ground, intermixed in tufts of *Sphagnum*, *Sphaerocephalus palustris*, *Rhacomitrium hypnoides*, etc., in bogs. *Hylocomium proliferum* is of almost equal frequency at all altitudes. Near Akureyri it was collected at an altitude of 990 metres. Only sterile specimens have been found.

321. **Hylocomium pyrenaicum** (Spruce) Lindb.*Hylocomium Oakesii* (Sull.) Schimp.

S. Iceland: Krisuvík (Stp.)!

322. **Hylocomium parietinum** (L.) Lindb.*Hylocomium Schreberi* (Willd.) De Not.

E. Iceland: Berufjörður!; Hornafjörður!. S. Iceland: Common everywhere!. Vestmannaey!. W. Iceland: Esja (Grí.!:); Stykkishólmur!; Borgarfjörður!. NW. Iceland: Common!.

Widely distributed in SE., S. and W. Iceland and on the peninsulas of NW. Iceland. In E. Iceland it has not been found north of Berufjörður, and it appears to be absent from the whole of N. Iceland. It usually grows on rather dry ground, for instance in birch coppices, where it almost everywhere forms an essential part of the vegetation, and on moss-grown slopes and in the *Rhacomitrium*-heath, but it occurs also on damper ground, especially on knolls in bogs. It rarely ascends higher than the birch. In NW. Iceland it was collected up to about 300 metres above sea-level, and in Esja it grew among *Rhacomitrium*

*hypnoides* at an altitude of about 450 metres. Only sterile specimens have been found.

### 323. *Hylocomium loreum* (L.) Br. eur.

W. Iceland: Esja (GrL.;!), common up to about 400 metres above sea-level; common in the coppices of the district of Borgarfjörður!; Berserkjarhraun; Arnarbotn; Budahraun (H. J.); Stykkisholmur!; Brynjudalur (GrL.); Hafnarfjörður (GrL.;!); Svinahraun!; Kolvidarhol!, up to about 350 metres. NW. Iceland: Sugandafjörður!, up to about 250 metres; Dýrafjörður!, up to about 200 metres. S. Iceland: Widely distributed!; Thingvellir!; Laugardalur!.

Widely distributed in the whole of the southern and south-western part of Iceland as far as Borgarfjörður and Snæfellsnes. It also occurs rather plentifully in some of the fjords of the north-west. It grows sometimes in clefts among fallen blocks of rock, sometimes on slopes together with other *Hylocomium* spp., *Dicranum scoparium*, *Rhacomitrium* spp., etc., or in the birch coppices. It was collected in fruit near Holt in S. Iceland, where a few old, empty capsules were found.

### 324. *Hylocomium triquetrum* (L.) Br. eur.

Iceland (Koenig). E. Iceland: Frequent from Berufjörður southwards!. N. Iceland: Asbjörgi!; near Eyjafjörður (O. D.;!); Ljosavatn (GrL.;!); common west of Blöndudalur!. NW. Iceland: Rather common in all the fjords!. W. Iceland: Rather common everywhere (GrL.;!). Vestmannaey! S. Iceland: Common!.

Commonly distributed from Berufjörður in E. Iceland throughout the whole of S., SW. and W. Iceland, and in the majority of the fjords of the north-west. It is rather rare in North Iceland proper, east of Blöndudalur, and occurs, as a rule, only scantily in the coppices or in the *Betula nana* heath.

Its growth is similar to the other species of *Hylocomium*, with which it is almost always found associated, especially in coppices and on moss-grown slopes. It has the same altitudinal distribution as *H. loreum* and *H. parietinum*, as it hardly ascends higher than to the upper limit of the birch. In Esja it is common up to 350–400 metres, near Kolvidarhol it was found in company with *H. loreum* at 350 metres, and in NW. Iceland it everywhere accompanies the birch to its upper limit at about 250 metres. Only sterile specimens have been found.

### 325. *Hylocomium squarrosum* (L.) Br. eur.

Very common over the whole of Iceland.

It grows both on a damp substratum, on stony flats as on boggy ground, and on a more dry substratum, associated with other *Hylocomium* spp., *Hypnum uncinatum*, etc. It is most frequent in the low land, but occurs, however, also at rather considerable altitudes. In Berufjardarskard it was found even at 500–600 metres, near Dýrafjörður at 330 metres and in S. Iceland in many places up to about



500—550 metres above sea-level. Only sterile specimens have been found.

32ö. **Hylocomium rugosum** (Ehrh.) De Not.

Widely distributed on dry grass or moss-grown slopes or flats, usually mixed with other Bryophyta such as *Hylocomium parietinum*, *H. proliferum*, *H. squarrosum*, *Rhacomitrium hypnoides*, *Dicranum scoparium*, *Ptilidium ciliare*, etc., rarely unmixed in large mats. It has the same altitudinal distribution as *H. triquetrum*, and hardly ascends higher than about 300—400 metres above sea-level. Only sterile specimens have been found.

## II. THE BRYOPHYTE COMMUNITIES.

As in the other Arctic and Sub-arctic countries, the Bryophyta play a very important part in the plant-covering of Iceland. They occur either as an essential component of, so to speak, all plant associations, and often in far greater numbers as regards species and individuals, than do the higher plants, or as distinct Bryophyte associations from which other plants are entirely absent, or in which they occur only as a subordinate component.

As a basis of classification it comes natural to distinguish between (1) Lowland Formations and (2) Highland Formations. Within these two main groups the formations are again arranged according to their water-requirements, commencing with those which are the most water-loving. Naturally, no sharp limit can be drawn between these formations; on the contrary, all possible transitions between them are constantly met with, which makes a comprehensive survey extremely difficult. In addition to this, the investigations are in many respects very incomplete, especially with regard to the history of development of the Bryophyte associations. Also, several of the formations occur both in the Highlands and in the Lowlands. This is especially the case with decidedly xerophilous formations like the *Rhacomitrium* heath and, partly, also other moss-heaths.

Mountain plateaus and slopes situated above the growth-limit of the birch and the heather moor are in this paper considered as belonging to the Highlands (the Alpine Region). The limit in question may lie at various levels and can, of course, never be drawn sharply, but is in many cases dependent on the structure of the mountains. The flat land along the coasts and at the bottom of the valleys rises, as a rule, in terraces inwards towards the high

land. As far upwards as about 200—400 metres the slopes and flats are covered with heaths and birch-coppices or bogs respectively. Then usually follow steep, bare slopes of gravel or abrupt cliffs, and the plateaus which follow these bear the scanty plant-covering of the rocky flat.

The conditions, however, differ somewhat in different parts of the country. In NW. Iceland there is almost no low land with the exception of the narrow stretch of coast along the narrow, deep fjords. The steep, often vertical cliff-faces rise to a height of 500—600 metres and have a talus of *débris* (Urd) at their foot, and cliffs rising in terraces occur almost exclusively at the head of some of the fjords. The entire surface at the top of the mountain belongs to the rocky flat, and the associations characteristic of the latter often occur on the slopes and flats right down to the level of the sea, especially on slopes facing north.

In S. Iceland, on the other hand, in sheltered valleys, localities are met with as far upwards as 500—600 metres above sea-level, which, according to the composition of the plant-covering, must be referred to the Lowland formations.

## I. THE LOWLAND FORMATIONS.

### The Littoral Bryophyte Vegetation.

There are only very few species which are restricted to the immediate vicinity of the sea, or which grow by preference in the neighbourhood of the coast. *Schistidium maritimum* and *Ulota phyllantha* doubtless occur wherever there are rocky coasts, and are rarely found many hundred metres from the coast. They chiefly occur along the sea-coast itself, and at the entrance to the larger fjords, and decrease in frequency inwards towards the head of the fjord. Near Berufjörður, for instance, both species are very common around Djupivogur, but are entirely absent from the inner part of the fjord, and this is also the case in Seydisfjörður. Around the broad Isalfjörður they are common as far inwards as Arngerdareyri, but are, as a rule, absent from the narrow branch-fjords. Both species grow on the coast rocks, but also frequently descend to the ground. On the island of Vestmannaey *Ulota* was very common on knolls in fields, where the grass-covering had been torn up by the wind, and *Schistidium maritimum* has been found in several places on damp sandy soil.

*Orthotrichum Blyttii* occurs here and there on coast rocks, or at any rate in the immediate neighbourhood of the coast. *Pottia Heimii* is commonly distributed along all flat coasts and *Amblystegium littorale* occurs here and there on damp sandy soil.

Besides these littoral species proper, there are several others which occur especially abundantly on the coast, but are also distributed in many other localities. *Bryum argenteum* and *B. capillare* grow especially below cliffs inhabited by sea-fowl, but their presence there is, no doubt, as much due to the abundant supply of organic manure as to the proximity of the sea. *Desmatodon latifolius*, *Leptobryum pyriforme* and *Tortula ruralis* are also typical of damp sandy soil and *Hypnum polygamum* of saline, boggy soil. On damp sandy soil on the beach low, scattered moss-cushions consisting of stunted individuals of many different and more casual species are often met with, for instance, *Distichium montanum*, *Didymodon rubellus*, *Ceratodon purpureus*, *Encalypta rhabdocarpa*, *Myurella julacea*, *Bryum* spp., etc.

### Hydrophilous Bryophyte Formations.

The water originating from rain and mist or from melting snow will, according to the local conditions and the inclination, either spread out over the ground and — if it consists of humus or sand — sink into it, or seek outlets in brooks and rivers. Where the water remains standing without being able to find a sufficient outlet, a bog vegetation is developed, or, in deeper hollows, a lake is formed. Part of the water which sinks down to the solid rocky substratum continues its way downwards along the latter until it sooner or later issues as a spring. Stagnant water contains humus substances, is not well aerated, and is warmed by the sun, while running water, both in streams and springs, is pure and clear and contains oxygen and carbonic acid. Running water has a very low temperature during the summer, at the most 4°—6°. Therefore the composition of the vegetation on boggy ground differs entirely from that on ground along streams and near springs, inundated or saturated by the pure water.

The hydrophilous formations may be classified as follows: --

- A. The Bryophyte Vegetation of Pure Water.
  - a. The Bryophyte Vegetation of Running Water and of Lakes.
  - b. The Bryophyte Vegetation of Inundated Gravelly Soil (slightly inclined ground and banks of streams).
  - c. The Bryophyte Vegetation on Muddy Soil near Springs (Dy).
- B. The Bryophyte Vegetation of Boggy Soil<sup>1</sup>.
- C. The Bryophyte Vegetation of Damp Sandy Soil.
- D. The Bryophyte Vegetation near Hot Springs.

### The Bryophyte Vegetation of Running Water and of Lakes.

The Bryophyte Vegetation of Lakes is extremely scanty, and often entirely absent. Along the shores of shallow lakes the surrounding swamp-vegetation may extend right into the water, especially species such as *Hypnum giganteum*, *H. exannulatum* and *H. scorpioides*, while rocky shores are usually quite bare of submerged Bryophyte vegetation or bear, here and there, one or other of the species growing in streams, such as *Fontinalis antipyretica* or a *Hypnum*-species. How far Bryophyta (for instance, *Fontinalis*) may occur in deeper water has not been investigated.

Glacier-rivers, on account of their torrential current and changeable course, as well as of the low temperature of their clay-containing water, are entirely devoid both of Bryophyte vegetation and of higher plants.

Brooks and Rivers. Where the bottom consists of loose gravel and smaller stones which are kept by the water in constant motion, Bryophyte vegetation is entirely absent. But if the bottom is of firm rock or larger stones it is, as a rule, covered with extensive moss-carpets which usually consist of *Hypnum ochraceum* or *Fontinalis antipyretica*, which may, either separately or together, cover large areas of the bottom. In very strong currents *H. ochraceum* forms the highly elongated and often thread-like var. *filiforme* which, together with *Rhynchostegium rusciforme* var. *atlanticum*, is a characteristic species of torrential rivers on much inclined ground. *H. ochraceum* var. *filiforme* is found especially in larger streams, where it is then the only species occurring, while *Rhynchostegium*

<sup>1</sup> In this paper no distinction has been made between swampy soil, marshy soil and boggy soil, the term "boggy" includes all three kinds of soil. The Danish term in all three cases is "sumpet".



appears to prefer smaller rivers with large loose blocks of rock at the bottom.

Several other Bryophyta occur either mixed with the above or occasionally as dominants in the Bryophyte vegetation. *Schistidium rivulare* is very common and often occurs abundantly. *Hypnum dilatatum*, *H. alpinum* and *H. alpestre* are common in the northern and eastern parts of the country, but are absent from or are rare in other parts. In the river Ellidará near Reykjavik the bottom was in several places covered with *Fontinalis androgyna*. In shallower water, and especially on inundated rock-surfaces in waterfalls, several other species also occur. Almost everywhere in such localities are found: *Haplozia cordifolia*, *Scapania undulata*, *Brachythecium rivulare*, *Rhynchostegium rusciforme*, *Hypnum palustre*, *H. falcatum*, *Philonotis fontana*, *Mniobryum albicans* var. *glacialis*, *Bryum Duvalii* and *Bryum ventricosum* together with some of the species which thrive best in places where they are outside the water during a part of the year.

Stones and rocks which protrude above the surface of the water and are inundated only during specially high water-levels are usually covered with a dense moss-carpet consisting of numerous species. In addition to the majority of the species of river-bottoms there occurs also an abundance of those belonging to damp rocks. Among the species which are rarely absent from such localities may be mentioned: *Hypnum falcatum*, *H. filicinum*, *Schistidium rivulare*, *S. gracile*, *Racomitrium aciculare*, *R. sudeticum*, *Blindia acuta*, *Dichodontium pellucidum*, *Amphidium Mougeotii*, *Haplozia atrovirens* and *Mnium punctatum*, and in North and East Iceland, in addition to the above-mentioned, *Philonotis seriata* and *Hypnum decipiens* are to be found. A somewhat different vegetation occurred in the river Rekyrdalsá in SW. Iceland, which is so well supplied from hot springs that in the beginning of June the water had a temperature of about 12°, while that of the streams flowing into it on both sides was only 4°—5°. *Hypnum ochraceum*, which is elsewhere so common, was entirely absent, and *Schistidium rivulare* occurred very scantily. On rock-surfaces and larger stones *Hypnum palustre*, *Brachythecium rivulare* and *Rhynchostegium rusciforme* grew abundantly, the last had also set fruit. *Fontinalis longifolia* covered the bottom in many places, and on stones protruding above the surface of the water *Hypnum filicinum* and *Schistidium gracile* were growing. In the cold tributary streams the usual vegetation occur-

red, consisting of *Hypnum ochraceum*, *H. falcatum*, *Schistidium rivulare*, *Rhynchostegium rusciforme* var. *atlanticum* and *Scapania undulata*.

### The Bryophyte Vegetation of Inundated Gravelly Soil (slightly inclined ground and banks of streams).

Where the water flows down the mountain sides and spreads over slightly inclined gravelly ground, and along the flat banks of streams which are periodically inundated, a vegetation composed mainly of Bryophyta is developed. The most conspicuous species growing on this gravelly ground, and one which is hardly ever absent, and is often the most abundant constituent of the moss carpet, is *Philonotis fontana*, and after it this community may be designated the *Philonotis* association (Ostf., 1907). Very frequently many other species also occur, either as an admixture in the *Philonotis* carpet, or replacing it over smaller or larger areas. In NW. Iceland *P. fontana* is often replaced by *P. seriata*. *Mniobryum albicans* var. *glacialis* is almost as common as *Philonotis*; and *Bryum ventricosum*, *B. Duvalii*, *Brachythecium rivulare* and *Acrocladium cuspidatum* are also among those species which are rarely absent.

As a few examples will best show the composition of this vegetation, the following are given: —

1. The Ellidará near Reykjavik: The mossy fringe along the banks consisted of *Philonotis fontana*, *Dichodontium pellucidum* and *Acrocladium cuspidatum*.

2. Husavik, along a stream: A broad belt of *Cinclidium stygium* together with some *Paludella squarrosa*.

3. Husavik, along the banks of smaller streams on a slope: *Mniobryum albicans* var. *glacialis*, *Mnium punctatum*, *Philonotis fontana*, *Marchantia polymorpha* together with some *Bryum Duvalii* and *Thuidium lanatum*.

4. Berufjördur, along a stream: *Philonotis fontana*, *Mnium Seligeri*, *Hypnum giganteum* and *Mniobryum albicans* var. *glacialis*.

5. Svinaskard, along a small stream: *Philonotis seriata*, *Scapania undulata*, *Chiloscyphus polyanthus* and *Pellia Neesiana*.

6. Kaldalon (NW. Iceland), in a small stream and on gravelly ground over which water was flowing: *Philonotis seriata*, *P. fontana*, *Dicranella squarrosa*, *Mniobryum albicans* var.

*glacialis*, *Bryum Duvalii*, *Chiloscyphus polyanthus* var. *fragilis*, *Harpanthus Flotowianus* and *Pellia Neesiana*.

7. Kaldalon, along the banks of a stream: *Hypnum callichroum*, *Sphagnum teres*, *Harpanthus Flotowianus* and *Cephalozia bicuspidata* var. *Lammersiana*.

8. Reykjavik, on ground over which water was flowing: slightly inclined surface with streamlets. The banks of the streamlets were fringed with *Philonotis fontana*, *Mnibryum albicans* var. *glacialis*, *Bryum ventricosum*, *B. Duvalii* and *Acrocladium cuspidatum*.

9. Gnupsdalur (NW. Iceland), gravelly ground, over which water was flowing, streamlets flowing down the sides of the valley: *Philonotis seriata*, *P. fontana*, *Dicranella squarrosa*, *Haplozia cordifolia*, *Chiloscyphus polyanthus* var. *fragilis*, *Scapania undulata* and *S. paludosa*. *Haplozia* formed large black or greenish-black, and *Scapania paludosa* very large reddish-brown patches in the water, which was a few centimetres deep.

In North Iceland several species of *Hypnum* occurred abundantly in gravelly soil over which water was flowing, and often formed pure Hypneta. Especially do *Hypnum exannulatum* var. *purpurascens*, *H. falcatum*, *H. decipiens* and sometimes *H. stramineum* and *H. sarmentosum* occur in such localities.

### The Bryophyte Vegetation on Muddy Soil near Springs (Dý).

The bright-green moss-carpet around and below the point of issue of the springs described by Helgi Jónsson (1900, p. 24: 1895, p. 73) as moss bogs (Icelandic Dý) are one of the most frequently occurring and characteristic plant communities of the Arctic and Sub-arctic regions. They were first mentioned by Grönlund (1877, p. 330) as mats of sapgreen mosses along small streams on mountain sides, consisting of *Bartramia fontana*, *Webera albicans*, *Brachythecium rutabulum* var. *rivulare* and *Hypnum uncinatum*, a description which includes both the moss bogs and the moss vegetation along smaller streams, which have also much in common.

Moss bogs develop in muddy soil, in all places where the ground water emerges as springs. They occur both on mountain slopes and at the bottom of valleys, occasionally also at higher levels, on rocky flats, but they are especially numerous on the lowest mountain slopes and in the flat boggy land below these

slopes. There they lie irregularly scattered in bright-green patches, differing greatly in size, and conspicuous even at a distance by their colour which is distinct from that of their surroundings. Higher up on the slopes at the foot of the bluffs, they frequently form continuous belts in connection with the mossy fringe along the downward-flowing streams (Helgi Jónsson, 1900, p. 25).

The vegetation consists of nearly the same species as those found on inundated gravelly soil, and the external conditions for the plants are also essentially the same in both places, since it is the cold, well-aerated water which determines the composition of the vegetation. During summer the temperature of the water is usually only 4°–5°, and this low temperature acts as a great check to the growth of higher plants, and is therefore indirectly favourable to the moss vegetation. The difference between the two vegetations is especially due to the substratum, that of the vegetation of inundated ground and stream-banks consisting of gravel, while the moss bog develops on mud. For this reason also, some of the species which occur in the gravelly soil are absent from the moss-bogs proper, for instance *Hypnum falcatum*, *H. decipiens*, *Dicranella squarrosa*, *Philonotis seriata*, *Haplozia cordifolia*, *Scapania paludosa* and *Chiloscyphus polyanthus* var. *fragilis*.

On flat ground moss bogs are, as a rule, almost circular in shape, and the species are arranged concentrically around the point of issue of the spring, whence the water gradually oozes through the moss carpet, and spreads out over the surrounding boggy ground. On sloping ground the moss bog is usually oblong in shape, and the spring emerges at its upper end (Fig. 19).

In the majority of cases the Bryophyte vegetation near springs (the Dý) is a *Philonotis-Mniobryum* association, in which other species of Bryophyta and a few higher plants occur scattered (Ostf., 1907, p. 69). On the soft mud around the point of issue of the spring — and often covering the latter — *Mniobryum albicans* var. *glacialis* usually grows, and outside the latter there is a broad belt of *Philonotis fontana*, which may be intermixed with or replaced by other mosses; and scattered in the moss carpet are a few flowering plants and vascular cryptogams, especially *Montia rivularis*, *Saxifraga stellaris*, *Epilobium* spp. and *Equisetum palustre*.



Fig. 19. Kaldalon (NW. Iceland). Slightly inclined ground below the stony slope. The light-coloured stripes are moss bogs, the darker, boggy ground or, on somewhat higher levels, patches covered with *Vaccinium-Empetrum* heath.

Besides the above-mentioned mosses the following plants are characteristic of the moss bog: —

<i>Brachythecium rivulare</i>	<i>M. Seligeri</i>
<i>Acrocladium cuspidatum</i>	<i>M. cinclidioides</i>
<i>Hypnum Kneiffii</i>	<i>M. affine</i> var. <i>elatum</i>
<i>Bryum ventricosum</i>	<i>Marchantia polymorpha</i>
<i>B. Duvalii</i>	<i>Pellia Neesiana</i>
<i>Mnium punctatum</i>	

But also other Bryophyta from bogs may occur intermixed with these, especially towards the edge, where the moss bog gradually passes into the common bog-vegetation. But of course all possible transitions also occur, between moss bog and bog vegetation as well as between moss bog and the vegetation of the banks of streams, all according to the nature of the underlying substratum.

As some examples will best show the composition of the moss bogs, the following are given: —

1. Seydisfjördur, numerous moss bogs on an almost hori-



zontal, boggy surface, below the slope of the mountain (Fig. 20). The vegetation was almost identical in all of them: In the middle, *Mniobryum albicans* var. *glacialis* was found intermixed with *Montia rivularis*, then came a belt of *Philonotis fontana*, often greatly intermixed with *Marchantia polymorpha* and with scattered plants of *Saxifraga stellaris*, *Equisetum palustre* and *Epilobium* spp. In some moss bogs a pure Hypnetum composed of *H. exanrulatum* var. *purpurascens* or *H. Kneiffii* had been developed.



Fig. 20. Moss bog near Seydisfjörður. The light-coloured patch in the middle is *Mniobryum albicans* var. *glacialis*. In the foreground and on the sides *Philonotis fontana*.

2. Husavik, moss bog on slightly inclined ground: In the middle *Mniobryum albicans* var. *glacialis* and *Marchantia polymorpha* were found, and around this a belt of *Bryum ventricosum* f. *major*, *Mnium affine* var. *elatum* and *Philonotis fontana*, and outside it all an almost pure belt of *Philonotis*.

3. Breidabolstadr, slightly inclined grassland with scattered moss bogs: In the middle *Mniobryum albicans* var. *glacialis* grew intermixed with *Bryum ventricosum* f. *major*; around this was a belt of *Philonotis fontana*, and outside it all *Mnium affine* var. *elatum* and *Acrocladium cuspidatum*. Some smaller moss bogs below the slope

were composed of *Brachythecium rivulare*, *Mniobryum albicans* var. *glacialis*, *Philonotis fontana*, *Bryum ventricosum*, *Mnium Seligeri* and *Mnium affine* var. *elatum*, which grew in patches intermixed.

4. Holt (S. Iceland), moss bog below a slope: *Acrocladium cuspidatum*, *Mniobryum albicans* var. *glacialis*, *Bryum ventricosum* f. *major*, *Mnium punctatum*, *M. Seligeri* and *Pellia Neesiana* grew intermixed, sometimes as single plants and sometimes in patches. In the middle *Montia rivularis* grew among the mosses.

The majority of the mosses growing near springs form special cold-water forms which are particularly characterized by their highly elongated, slightly branched stems of almost equal height, by which feature they all assume a homogeneous habit. *Brachythecium rivulare* forms a form with long, erects shoots of equal height and with appressed leaves. *Philonotis fontana* forms, when growing in very cold water, a highly elongated, hardly tomentose form with appressed, shortly pointed leaves with short leaf-cells and very broad nerve (forma *adpressa*). The cold-water form of *Bryum ventricosum* (f. *major*) is also higher in growth and more vigorous than is the bog-form, has stems bare of tomentum with large and broad, spreading leaves. *Mniobryum albicans* var. *glacialis* is also much more vigorous than the type, with larger and broader leaves. *Mnium* spp. develop *elatum*-forms with erect, sterile shoots of equal height.

### The Bryophyte Vegetation of Boggy Soil.

The bog vegetation is extensively distributed about Iceland, especially in the low land, and in many places it occupies almost the whole tract of land between the mountain slopes and the sea. The lower mountain plateaus and slightly inclined slopes up to a height of about 300—400 metres are also to a great extent covered with bogs (Sedge-bogs). The mode of formation of these bogs has been described by Helgi Jónsson (1895, p. 45). They originate partly from the further development of the vegetation of the springs and the banks of streams, and partly from shallow lakes first forming in depressions and afterwards becoming gradually filled up with plants in connection with sand transported by the wind. In the former case a drier bog (*mýri*, pl. *mýrar*) is formed, the sedges superseding the mosses; in the latter case a wet bog (*flói*, pl. *flóar*) is first formed, which, by gradually becoming overgrown with plants, develops into a “*mýri*”<sup>1</sup>.

<sup>1</sup> For a description of “*mýri*” and “*flói*” see also Thoroddson’s Physical Geography of Iceland, ante p. 323.

In "Die Moose des Sarekgebietes" (1910, p. 248) C. Jensen classifies the bog vegetation in four formations: The Willow bog, the Sedge bog, the Moss bog and the Peat bog. This classification cannot be entirely adopted as regards Iceland. Willow bogs proper (willow coppices in boggy soil) do not appear to be developed there. True, scattered individuals or small groups of *Salix* (*S. lanata*, *S. phylicifolia* and *S. glauca*) are often found in the sedge bogs, especially in NW. Iceland, but the moss vegetation there does not differ in any respect from that of the surrounding sedge bog.

The vegetation of boggy soil is composed mainly of mosses and sedges, greatly varying in abundance. Sometimes the sedges are the dominant plants, and then the moss carpet is less conspicuous at the bottom, among the *Carex* and *Eriophorum* spp.; sometimes there is a continuous moss-carpet in which the higher plants grow scattered, and then the one formation may be termed a sedge bog, and the other a moss bog, which, however, does not correspond with Helgi Jónsson's definition of a moss bog, but appears to agree with Warming's description (1887, p. 132). They are the same mosses which occur in the same manner in both formations, and all possible transitions are found between these.

Helgi Jónsson (1900, p. 20; 1905, p. 9) classifies the bog vegetation into Star-grass bogs and Moss bogs. The latter, which include the vegetation along streams, on inundated ground and near springs (Dý), and also some of the moss bogs in Warmings definition, have been treated in the preceding section. The star-grass bogs are again divided into "Mýrar" and "Flóar". In the Mýri the ground water stands on a level with the surface, the soil contains acid humus and is so closely interwoven with rhizomes and roots that it bears one like a carpet. In the Flói the ground water stands above the surface, the soil is muddy and produces a more scattered vegetation of *Carex* and *Eriophorum* tufts. As it is chiefly the height of the ground water which determines whether a Mýri or a Flói is developed, and the Flói is formed by the filling up of a shallow lake, there occur all transitions between lake and Flói, and through further development, between Flói and Mýri.

The Flói is poor in mosses. The soft muddy soil is not favourable to their growth, and it is only as an exception that some of the species are found which grow along the banks of lakes, but often the moss-covering is entirely absent. *Hypnum scorpioides* and *H. giganteum* are the most frequent species which

occur everywhere in pools and channels. *Hypnum exannulatum*, *H. revolvens* var. *Cossoni* and *Acrocladium cuspidatum* are also frequent. In many places in East Iceland *Cinclidium stygium* was found abundantly in Flóar, while *Hypnum cordifolium* and *H. fluitans* were found in a few places only.

The moss-covering of the Mýri is characterized by the fact of its being rich in species, which grow sometimes greatly intermixed, sometimes separately in large and small patches. The ground is usually knolly, and there is a great difference in the vegetation between and upon the knolls, the most hygrophilous species growing on the wet ground between the knolls, while on the top of the knolls mesophilous and xerophilous forms are met with, and between these all transitions occur, according to the height of the knoll and the degree of moisture. They are nearly the same species which are everywhere the most abundant constituents of the Mýri vegetation. The following species occur on the ground between the knolls: —

## Musci veri

- \**Hypnum revolvens*
- \* — *intermedium*
- \* — *stramineum*
- \* — *stellatum*
- \* — *polygamum*
- \* — *sarmentosum*
- \* — *Lindbergii*
- \* — *exannulatum*
- \* — *giganteum*
- *Richardsonii*
- *falcatum*
- *trifarium*
- *turgescens*
- \**Camptothecium nitens*
- \**Brachythecium rivulare*
- (\*NE.) *Thuidium lanatum*
- \**Acrocladium cuspidatum*
- \**Philonotis fontana*
- \**Meesea trichoides*

## Sphagna

- \**Sphagnum teres*
- \* — *rubellum*
- \* — *Warnstorffii*
- \* — *fimbriatum*
- \* — *medium*
- \* — *Girgensohnii*
- \* — *subnitens*

- Meesea triquetra*
- \**Paludella squarrosa*
- \**Catocopium nigratum*
- \**Cinclidium stygium*
- \**Mnium cinclidioides*
- \* — *punctatum*
- \* — *affine*
- \* — *Seligeri*
- \* — *subglobosum*
- \**Bryum ventricosum*
- \**Splachnum vasculosum*
- \* — *sphaericum*
- (\*NE.) *Dissodon splachnoides*
- \**Oncophorus Wahlenbergii*
- \* — *virens*
- Dicranum angustum*
- \**Fissidens osmundoides*
- \**Dichodontium pellucidum*
- Campylopus Schimperii*

- Sphagnum papillosum*
- *inundatum*
- *squarrosum*
- *acutifolium*
- *riparium*
- *Lindbergii*



## Hepaticæ

* <i>Pellia Neesiana</i>	* <i>Lophozia quinquedentata</i>
* <i>Aneura pinguis</i>	— <i>quadriloba</i>
* — <i>multifida</i>	— <i>Schultzii</i>
* <i>Cephalozia bicuspidata</i>	— <i>Hornschuchiana</i>
* — <i>pleniceps</i>	* <i>Scapania irrigua</i>
* <i>Cephaloziella Hampeana</i>	— <i>uliginosa</i>
* — <i>rubella</i>	— <i>undulata</i>
<i>Odontoschisma elongatus</i>	* <i>Blepharostoma trichophyllum</i>
* <i>Alicularia scalaris</i>	* <i>Anthelia julacea</i>
* <i>Lophozia Kunzeana</i>	

In the above list an asterisk is prefixed to those species which are common over the whole of Iceland, and which are met with in almost every considerable boggy tract. Some of the species are common in some districts and absent from others, for instance *Thuidium lanatum* and *Dissodon splachnoides*, which are very common in North and East Iceland, but are rare or entirely absent from other parts of the country, and *Campylopus Schimperii*, which is found only in the southern part.

The mosses often grow so much intermixed that a small collection may contain 15—20 or even more species, but often smaller and larger patches are found dominated by a single species. Thus *Catocopium*, *Philonotis*, *Cinclidium* or *Mnium* bogs occur, in each of which one of these species is the dominant member. On very damp ground the mass of the vegetation is formed by, for instance, *Mnium cinclidioides* or *Cinclidium stygium*, and in South Iceland by *Mnium Seligeri*. In North and East Iceland it is especially *Thuidium lanatum* which is often the most conspicuous species.

*Sphagnum* spp. grow almost always in scattered tufts, and *Sphagnum* bogs proper are rarely met with. Helgi Jónsson (1900, p. 25) records such bogs from Snæfellsnes, where they occurred on sloping ground and were composed of *Sphagnum teres*, *S. Warnstorffii* and *S. Girgensohnii* intermixed with *Paludella squarrosa*, *Hypnum stramineum*, *Hylocomium squarrosum* and *Polytrichum commune*. I have only seen a similar vegetation near Barkarstadr in South Iceland, where, on a wet boggy slope stretching down towards a river, there was an almost continuous growth of *Sphagnum rubellum* and *S. Warnstorffii* intermixed with a few other mosses, especially *Thuidium lanatum*, *Hylocomium squarrosum* and *Hypnum stramineum*.

*Sphagnum* spp. often play an important part in the knoll-formation of the mýri, the large *Sphagnum*-cushions being inter-



woven with mosses and hepatics, and different plants such as *Vaccinium* spp., *Betula nana*, *Comarum palustre* and several *Carices* then establishing themselves upon these cushions.

The numerous hepatics which occur are everywhere found interspersed in the moss carpet, especially in that upon the knolls, and, as regards all the species mentioned below, doubtless also in the ground vegetation between the knolls.

The Bryophyte Vegetation of Knolls<sup>1</sup> is dependent upon the varying degree of moisture, which is greatest on the ground between the knolls and least in their uppermost part. Some of the Bryophyta of the ground do not ascend higher than to the base of the knolls, while others, especially many of the pleurocarpous mosses, occur with equal frequency upon and between the knolls. In addition to the latter mosses the following species are found upon the knolls: —

*Hypnum uncinatum	*Mnium hornum
— imponens	*Rhacomitrium canescens
*Climacium dendroides	* — hypnoides
*Hylocomium squarrosum	*Ditrichum flexicaule
* — parietinum	*Dicranum scoparium
* — proliferum	* — congestum
Orthothecium chryseum (N. Icel)	* — elongatum
*Polytrichum alpinum	*Lophozia lycopodioides
* — strictum	*Plagiochila asplenioides
* — juniperinum	*Ptilidium ciliare,
*Aulacomnium palustre	

and besides these, numerous other species which belong to other formations and must rather be regarded as casual visitors.

The following examples will show the composition of the bog vegetation in the different parts of Iceland: —

1. Skálholt in SW. Iceland. The country here over a wide expanse is covered with vast boggy areas in which small, protrud-

<sup>1</sup> According to my observations these knolls are formed either by soil accumulating in tufts of *Sphagnum*, etc., in which other plants take root, among others sedges, when soil again accumulates, or by soil accumulating directly around roots of sedge-tussocks. This accumulation of soil and plants continues till big knolls are formed, some 60—70 cm. in height. These knolls occur in all stages of development, from tufts or tussocks with a slight accumulation of soil around their roots to completely rounded knolls in which the tussocks have entirely disappeared. In Danish "Tuc" stands both for "knoll" and for "tuft" and "tussock", which is very convenient when referring to one of the various stages of these "knolls". But the rendering into English has been difficult, though in each case the term most appropriate to the stage of development of the "knoll" has been carefully chosen.

ing masses of rock (holt) occur scattered. In the wettest parts of the mýri grew *Hypnum scorpioides*, *H. giganteum* and some *H. revolvens* v. *Cossoni*. The moss-covering of the ground between the knolls consisted mainly of *Hypnum revolvens*, *H. stellatum*, *H. Lindbergii*, *H. stramineum*, *Acrocladium cuspidatum*, *Hypnum polygamum*, *Hylocomium squarrosum*, *Camptothecium nitens*, *Mnium Seligeri*, *M. cinclidioides*, *Philonotis fontana* and *Bryum ventricosum*, all of which grew intermixed. Of more scanty occurrence were *Hypnum sarmentosum*, *Paludella squarrosa*, *Meesea trichoides*, *M. triquetra*, *Cinclidium stygium*, *Mnium punctatum*, *Splachnum vasculosum*, *S. sphaericum*, *Fissidens osmundoides*, *Oncophorus Wahlenbergii*, *Alicularia scalaris* and *Aneura pinguis*. The following hepatics grew both between and upon the knolls: — *Lophozia Kunzeana*, *L. quinquedentata*, *Scapania irrigua*, *Cephalozia pleniceps*, *C. bicuspidata* and *Cephaloziella Hampeana*. The knolls were usually formed by *Sphagna*, especially by *S. teres*, *S. Warnstorffii* and *S. rubellum*, and in very wet parts of the mýri also by *S. medium*. Woven into and above the *Sphagnum*-cushions grew *Hypnum uncinatum*, *Hylocomium squarrosum*, *H. proliferum*, *H. parietinum*, *Climacium dendroides*, *Aulacomnium palustre*, *Dicranum scoparium* var. *turfosum*, *Ptilidium ciliare*, *Plagiochila asplenioides*, and, uppermost, *Racomitrium hypnoides* and *R. canescens*.

2. Höskuldstadr in E. Iceland. Knolly sedge-bogs with a rich vegetation of mosses between the knolls, along the river at the bottom of the valley. The moss carpet of the ground between the knolls consisted of *Hypnum revolvens*, *H. giganteum*, *H. stellatum*, *Acrocladium cuspidatum*, *Mnium cinclidioides*, *Cinclidium stygium*, *Mnium affine* var. *elatum*, *Paludella squarrosa*, *Philonotis fontana*, *Meesea trichoides*, *M. triquetra*, *Bryum ventricosum*, *Aulacomnium palustre*, *Catoscopium nigratum*, *Oncophorus Wahlenbergii*, *Dichodontium pellucidum* and *Aneura pinguis*. All the Bryophyta, as a rule, grew intermixed, but some of them frequently formed large, pure growths, especially *Catoscopium nigratum* and in the wettest parts *Mnium cinclidioides* and *Cinclidium stygium*. Upon the knolls, which were sometimes formed by *Carex*, sometimes by *Sphagnum*, grew *Camptothecium nitens*, *Thuidium lanatum*, *Hypnum stramineum*, *H. uncinatum*, *Hylocomium squarrosum*, *Sphagnum teres*, *S. Warnstorffii*, and, uppermost, *Hylocomium parietinum*, *H. proliferum*, *Dicranum scoparium*, *Racomitrium hypnoides* and *Scapania curta*. Woven into the moss-covering, especially into that upon the knolls, were found *Lophozia Kunzeana*, *L. quinquedentata*, *Scapania irrigua*, *Blepharostoma tricho-*

*phyllum*, *Plagiochila asplenioides*, *Cephalozia bicuspidata* and *C. Hampeana*. The two sedge bogs described above may be regarded as types, and by far the greater majority of the sedge bogs have very nearly the same vegetation.

3. Breidabolstadr on Fljótshlid (S. Iceland). A flat, boggy tract of meadow-land beneath the low mountain-slope, intersected by ditches and, lowest of all, by a low dike in order to keep the water-level at a suitable height. The ground was even, without knolls, and covered by a vigorous vegetation of *Carices*, with a moss carpet at the bottom. Occasionally there were also patches where the moss-covering was dominant, and the species of *Carex* occurred in this as scattered individuals. The species were comparatively few in number and were usually dominant in spots. The most frequent species were *Philonotis fontana*, *Mnium Seligeri*, *M. cinclidioides*, *Cinclidium stygium*, *Bryum ventricosum* and *Acrocladium cuspidatum*. Here and there patches occurred with a more mixed vegetation, which, in addition to the plants mentioned above, consisted of *Hypnum revolvens*, *Meesea trichoides*, *Splachnum vasculosum*, *Lophozia quinquedentata*, and perhaps of several other species. Here and there were tufts formed by *Sphagnum rubellum* and *S. teres*.

A vegetation of about the same composition as that described above is very commonly met with in South Iceland, where tracts of meadow-land, by means of draining, irrigation or damming up, are kept at about the same ground-water level during the whole summer. The knolls disappear — or are not formed — and the moss-covering becomes poorer in species.

4. Ljósavatn in North Iceland. A rather large sedge bog on very wet ground, on the slightly inclined slope of the mountain. The moss-carpet was composed of *Cinclidium stygium*, *Mnium cinclidioides*, *M. Seligeri*, *Paludella squarrosa*, *Camptothecium nitens*, *Hypnum* spp., *Philonotis fontana*, *Bryum ventricosum*, *Thuidium lanatum*, *Lophozia Kunzeana* and *L. quinquedentata*. *Sphagnum rubellum*, *S. teres*, *S. Warnstorffii* and *S. Girgensohnii* occurred abundantly in large tufts. In the wettest parts, where the water reached above the surface, grew thick, extensive carpets of *Hypnum exannulatum*, *H. stramineum*, *H. sarmentosum*, *H. giganteum* and *H. Richardsonii*, all in very vigorous development, and in fruit. The *Hypnaceæ* sometimes grew intermixed, but usually they occurred separately, and were only slightly mixed with other Bryophyta and Cyperaceæ. This formation corresponds undoubtedly with C. Jen-

sen's *Amblystegium*-bog (1910, p. 253) and occurs rather commonly in North Iceland, but more rarely in the other parts of the country, probably because in North Iceland the climate is more continental than in the rest of Iceland. These moss bogs are most frequently composed of *Hypnaceae*, but often *Paludella squarrosa*, *Cinclidium stygium* or *Mnium cinclidioides* forms an essential part of them.

5. Isafjörður. The narrow strip of land, below the steep mountain slope (almost 600 metres in height) along the western side of the fjord, is covered with sedge bogs right to the head of the fjord. The most abundant constituents of the moss carpet between the knolls were *Hypnum revolvens*, *H. giganteum*, *H. exannulatum*, *Paludella squarrosa*, *Philonotis fontana*, *Mnium cinclidioides*, *M. punctatum*, *Cinclidium stygium* and *Bryum ventricosum*. Here and there in the moss carpet grew *Thuidium lanatum*, *Catoscopium nigratum*, *Meesea trichoides*, *M. triquetra* (scantly) and *Oncophorus Wahlenbergii*. *Splachnum sphaericum* and *S. vasculosum* grew on cow-dung. The knolls were formed by *Sphagnum teres*, *S. Warnstorffi*, *Polytrichum strictum*, *P. alpinum*, *Mnium hornum* and *Dicranum scoparium*. The following hepatics occurred woven into the moss-cushions: *Lophozia quinqueidentata*, *L. Kunzeana*, *L. Hornschuchiana*, *L. quadriloba*, *Scapania irrigua*, *Blepharostoma trichophyllum*, *Harpanthus Flotowianus*, *Cephalozia pleniceps*, *Cephaloziella Hampeana* and *C. rubella*.

6. Seydisfjörður. A boggy flat at an altitude of about 350 metres. The ground was covered with a blackish-brown moss carpet composed of *Hypnum giganteum*, *H. stramineum*, *H. sarmenosum*, *H. revolvens*, *H. Richardsonii*, *H. exannulatum* and *H. uncinatum*, occasionally alternating with patches of *Mnium cinclidioides*. Tufts of *Sphagnum teres* and *S. Girgensohnii* occurred frequently, and *Splachnum vasculosum* was common on dung. *Carex* spp. and *Eriophorum* were abundant without, however, occurring so densely as to cover the ground. This type of *Hypnum* bog, from which other plants are most frequently entirely absent, is common in North and East Iceland at elevations of about 200—500 metres, on flats where the snow lies long. The moss carpet is, as a rule, thin and bears distinct traces of having been long subject to the pressure of the snow-covering, the old stems being pressed closely together, and only the annual shoots growing up into the air.

**Peat Bogs.** In the course of time sedge bogs usually develop into peat bogs. Gradually, as the peat layer becomes thicker, the dampness



of the surface decreases, the most hygrophilous species disappear and some other species, chiefly mesophilous, take their place. Some of the latter are especially connected with this soil. The most marked species of peaty soil are *Psilopilum lævigatum*, *Polytrichum gracile*, *P. juniperinum*, *Pogonatum polytrichoides*, *Mnium hornum*, *Catharinea undulata* (also in warm soil) and *Dicranella cerviculata*. Some species which occur on other soils, but most abundantly on peat, are *Philonotis tomentella*, *Pogonatum urnigerum*, *Funaria hygrometrica*, many *Bryum* spp. (especially *B. inclinatum*, *B. affine*, *B. arcticum*, *B. lacustre* and *B. pallens*), *Pohlia nutans*, *Leptobryum pyriforme*, *Distichium inclinatum*, *Ceratodon purpureus* and *Dicranella crispa*. The above-mentioned species are all mesophilous, a few are xerophilous also (for instance *P. juniperinum* and *Ceratodon*), and the majority of them occur also in sandy soil, but in Iceland the peat is often abundantly mixed with fine sand, transported by the wind. The two rare species, *Trematodon ambiguus* and *Pogonatum capillare* var. *dentatum*, have also been found on peat.

The most decided character-plant of peaty soil is *Psilopilum lævigatum*, which occurs everywhere on peat-flats which have been laid bare, and may, for instance, entirely cover the piled-up heaps of cut peat with its numerous capsules, often in association with *Funaria hygrometrica*. Another characteristic vegetation of localities like these consists of extensive bluish-green mats of low-growing, sterile *Pogonatum urnigerum*, interwoven with *Alicularia scalaris*.

The following examples will show the composition of the peat bogs in the different parts of Iceland: —

1. Seydisfjörður. In a peat bog intersected by ditches: *Psilopilum lævigatum*, *Leptobryum pyriforme*, *Pogonatum urnigerum*, *Polytrichum juniperinum* and *P. alpinum* grew abundantly. Intermixed with the above occurred *Bryum inclinatum*, *B. arcticum*, *B. purpurascens*, *Distichium montanum*, *Ceratodon purpureus*, *Scapania curta*, *Alicularia scalaris* and *Lophozia Wenzelii*.

2. Akureyri. Behind the town, at the foot of the mountain, were large expanses of bogs from which great quantities of peat had been removed. The bared flats and the piled-up heaps of cut peat were often entirely covered with *Psilopilum* and *Funaria*. Commonly occurring species were *Polytrichum gracile*, *P. alpinum*, *P. juniperinum*, *Leptobryum pyriforme*, *Bryum inclinatum*, *B. affine*, *B. lacustre*, *B. arcticum*, *Philonotis tomentella*, *Ceratodon purpureus*, *Dicranella crispa*, *Didymodon rubellus* and *Scapania irrigua*.



3. Grunnavik near Jökulsfjörður. A deep layer of peat, here and there intersected with ditches. The following mosses were observed: *Polytrichum alpinum*, *P. Swartzii*, *Mnium hornum*, *Pohlia nutans*, *P. cucullata* (both common), *Bryum purpurascens*, *Ceratodon purpureus*, *Dicranella cerviculata*, *D. crispera*, *Lophozia quinquedentata* and a few tufts of *Tetraplodon bryoides*. *Psilopilum lævigatum* was found only scantily and after a long search.

4. Lundur in W. Iceland. On a damp peat-flat, the uppermost layer of which was pared off, grew *Dicranella Schreberi*, *Aongstroemia longipes*, *Bryum lacustre*, *B. inclinatum*, *B. cœneum*, *Dichodontium pellucidum*, *Philonotis fontana*, *Meesea trichoides* and *Aneura pinguis*.

### The Bryophyte Vegetation of Damp Sandy Soil.

The damp sandy or gravelly ground along streams, inundated only in the case of especially high water-levels, is often covered with a moss carpet of a very mixed composition. Here liverworts play an especially important part, and very frequently pure liverwort associations are met with, or other associations in which the liverworts are almost dominant. They are almost everywhere the same species which are the most abundant constituents of the moss carpet. The following *Hepaticæ* are the most frequent: *Scapania subalpina*, *Alicularia scalaris*, *A. geoscypha*, *Lophozia quinquedentata*, *Cephalozia bicuspidata* var. *Lammersiana*, *Anthelia julacea*, *A. Juratzkana*, and, especially in NW. Iceland, *Harpanthus Flotowianus*. Intermixed with the above occur a very great number of species of which the most frequent are *Pellia Neesiana*, *Aneura pinguis*, *Haplozia atrovirens*, *Cephalozia pleniceps*, *Dicranella crispera*, *Dichodontium pellucidum*, *Aongstroemia longipes*, *Didymodon rubellus*, *Distichium montanum*, *Pohlia commutata*, *P. gracilis*, *Bryum pallens*, *B. inclinatum*, *B. affine*, *Philonotis tomentella*, *P. fontana*, *Pogonatum urnigerum* and *Timmia austriaca*. A few less common species, such as *Blasia pusilla*, *Eucalyx subellipticus* and *Distichium inclinatum*, also belong to this community. Sometimes a moss-covering of another composition is also met with, *Racomitrium canescens* often forms extensive mats on wet sandy ground. In North Iceland *Timmia austriaca* and *Philonotis tomentella* are found plentifully in many places on the damp ground above the *Philonotis*-belt, as a rule abundantly mixed with other species. *Dicranella crispera* is also very often found in great quantities on damp sandy

ground. In North-west Iceland the development of the liverwort-mats was especially typical in many places (for instance in Gnupsdalur and near Isafjörður); they consisted chiefly of *Harpanthus Flotowianus*, *Alicularia geoscypha*, *A. scalaris*, *Cephalozia bicuspidata* var. *Lammersiana* and *Lophozia quinqueidentata*. Here *Oligotrichum hercynicum* also occurred abundantly in damp sandy localities.

On a somewhat damp, cold flat at the bottom of the fjord Kaldalon, below the Jökull, grew *Pohlia gracilis*, *Hypnum exannulatum* var. *brachydictyon*, *Philonotis tomentella* and *Eucalyx subellipticus*.

### The Bryophyte Vegetation near Hot Springs.

Iceland abounds in hot springs: they are not, however, equally distributed over the whole country, but are most numerous in districts in which the most volcanic activity occurs. The majority of these hot springs are found in the south-eastern part of the country, on Reykjanes, around Reykjavik, in the south-western low land, and in several of the valleys of West Iceland, especially in Reykholtdalur. In North Iceland, the district around Mývatn is rich in hot springs, but they are also found scattered singly over the whole of this part of the country. They are absent from East Iceland, but a few occur in North-west Iceland, especially around Isafjardardjup. Groups of hot springs are found in several spots in the inner high land, but the Bryophyte vegetation around these is quite unknown.

The majority of the hot springs of Iceland have a rather high temperature, the water being most frequently at about boiling point. Springs, the temperature of which is not much higher than that of their surroundings, are found for instance around Isafjardardjup near Laugarbol ( $50^{\circ}$ — $55^{\circ}$ ) and Nauteyri ( $25^{\circ}$ — $30^{\circ}$ ), yet no characteristic vegetation had developed there. According to Thoroddsen such springs also occur north of Vatnajökull, and have a temperature which is not many degrees higher than their surroundings.

The hot springs in Iceland may be classified as belonging to two different groups, viz. the Alkaline Springs and the Sulphur Springs.

The Alkaline Springs (thermæ) usually occur in districts where there has been no recent volcanic activity. They contain pure, clear water which often deposits siliceous sinter, and are always surrounded by a luxuriant vegetation. When the temperature reaches

boiling point, they are called in Icelandic "hver" (plur. "hverar"), if the temperature is lower, they are called "laug" (plur. "laugar").

The Sulphur Springs (Icelandic "brennistenshverar") are most numerous in districts where the effect of the volcanic activity is still felt, for instance near Mývatn and in many parts of South Iceland. The water contains sulphuretted hydrogen. These springs deposit sulphur, and the soil around them is greatly decomposed by the acid vapours which arise, and is transformed to red or yellowish clay-masses. Sometimes, as for instance in Reykirdalur, they also deposit siliceous sinter. As a rule, a group of springs consists of either the one or the other kind of spring, occasionally, however, a few springs containing sulphuretted hydrogen may be found together with the alkaline springs. The vegetation around sulphur springs is always very scanty, since only a few species of plants can thrive were they are exposed to hot vapours containing sulphuretted hydrogen.

The "Laugar" near Reykjavik. The vegetation has been described by Ostenfeld (Bot. Tid., vol. 22, pp. 233 et seq.), who has not, however, mentioned the moss vegetation. When I visited the springs in 1909 and 1912 I found no characteristic moss vegetation. Since the warm water had been used for washing purposes the ground surrounding the spring had been much trampled upon, and further downwards towards the warm outlet only the usual bog species were found. Here *Philonotis fontana* alone formed the elongated slender form known also from other hot springs.

**The Springs on Biskupstúngur.** On the low boggy tract of land between the rivers Bruará and Túngufljót in South Iceland (Biskupstúngur, so called because the old episcopal residence — Skálholt — was situated there), there are, on both sides, along the rivers several hot springs of considerable size, or groups of hot springs of which Thorlákshver and Laugaráshver in the southernmost part, near Skálholt, and Sýdri Reykjahver, further northwards near the Bruará, have been investigated. They all contain pure water free from sulphuretted hydrogen, with the exception of a few small holes near Thorlákshver.

Thorlákshver (Fig. 21) is situated a few kilometres west of Skálholt, close to the east bank of the Bruará. It consists of one larger and several smaller holes, from whence the boiling water flows out and gathers together into a rather large brook, which flows into the Bruará. The vegetation along the sloping

banks of this brook and of the flat boggy surroundings (which are partly influenced by the heat of the soil, partly inundated by the hot water) is very luxuriant. Both around the basins of the springs and along the brook formed by the outlets of the springs, grew a



Fig. 21. Thorlákshver near Skálholt. In the background the river Bruará; behind the fence to the left is a potato field, where the temperature of the ground was about  $25^{\circ}$ . The chief outlet of the spring is just behind the small elevation to the left, and the outlet-channel is from the right straight across the foreground. The "peninsula", in the middle of the figure, surrounded by the hot water, is partly covered with *Sphagnum* (the light patch) and partly with *Hypnum*-mats (the dark patch).

broad belt of enormous yellowish brown and pale-green *Sphagnum*-cushions, 25 cm. deep, chiefly formed by *S. imbricatum* (yellowish brown), *S. teres* and *S. cymbifolium* (whitish green) interwoven with *Hypnum stramineum*, *Hylocomium squarrosum* and here and there with *Acrocladium cuspidatum*, *Hypnum imponens* and *H. Lindbergii*. The



surface of the *Sphagnum* cushions was usually covered with the orbicular, closely appressed leaves of *Hydrocotyle vulgaris*. The temperature in the *Sphagnum* cushions was rather high, on the surface of the ground as much as  $50^{\circ}$ , chiefly on account of their feeble heat-conducting power, and the tufts were quite saturated with the moisture from the warm vapours. The *Sphagnum*-belt did not extend so far as to the hot water, but everywhere there was a strip (10—20 cm. broad), nearest the water, covered with low dark-green mats of *Fossombronia Dumortieri*, occasionally intermixed with *Haplozia crenulata* or *Alicularia scalaris*. The same vegetation of *Hepaticæ* was in fact found in all places where the banks were too steep to allow *Sphagna* to gain foothold. The temperature under the *Fossombronia*-covering was, as a rule, about  $40^{\circ}$  ( $34^{\circ}$ — $43^{\circ}$ ). Where the bank was flatter and on the warm, dry, clayey flats in the neighbourhood of the springs *Archidium phascoides* grew in great masses, and often formed, without intermixture of other species, extensive, dark-green mats, 1—2 cm. deep. It occurred also on the siliceous sinter deposited by the water, and here and there among the *Hepaticæ*. The temperature of the soil under the *Archidium*-mat was almost everywhere about  $40^{\circ}$ . In the brook formed by the outlet of the spring there was a small island which was partially inundated by the hot water, and here grew a great many large cushions of a peculiar form, a *Barbula fallax* (var. *le-vifolia* n. var.), and in one spot, on the slope, in the neighbourhood of the basin, grew *Anthoceros punctatus* together with *Fossombronia*.

Outside the *Sphagnum*-belt the ground was perceptibly warm even for a tolerable distance, and the vegetation there was likewise greatly exposed to the warm aqueous vapours. There *Hypnaceæ*, in particular, grew very luxuriantly on the rather dry substratum. *Hypnum imponens* and *H. Lindbergii* were often almost the only species to be found there, the latter growing in a peculiar, erect form, almost branchless. The temperature of the ground under the *Hypnum*-covering was, as a rule,  $25^{\circ}$ — $30^{\circ}$ .

A little below the spring the brook flowed along a steep bank about a metre high. Here the *Sphagnum*-belt disappeared and was replaced by a more mixed vegetation. Lowermost, at a height of about 10 cm. above the water, grew *Fossombronia*, *Haplozia crenulata*, *Alicularia scalaris*, and *Anthoceros*, then followed thick cushions of *Hylocomium squarrosum*, *Hypnum stramineum*, *Thuidium delicatulum*, *Sphagnum teres*, *S. imbricatum* and *Catharinea undulata*,



moreover, *Haplozia sphaerocarpa* woven into the *Catharinea*-cushions. All the mosses had developed to an unusual height and vigour, especially *Catharinea* which occurred in a peculiar form (f. *thermophila*) and formed large cushions more than 10 cm. deep. The same vigorous moss vegetation, associated with grasses and sedges, was also found on the flat above the steep bank, as far as the influence of the warm vapours was felt.

Where the banks were low, so that the hot water partially flowed over and mixed with the cold water of the boggy ground, the usual bog or stream-bank vegetation was developed, which nearest to the outlet, in hot water of a temperature of about 25°—30°, consisted of a very slender form of *Philonotis fontana*, associated with some *Hypnum stramineum* and *Catocopium nigratum*.

The *Hypnum*-belt mentioned above gradually merged into the usual grassland vegetation; most of the species of which (for instance *Racomitrium canescens*, *R. hypnoides*, *Philonotis*, *Mniobryum albicans* and *Hypnum uncinatum*) were also found intermixed with the thermophilous vegetation proper.

A short distance from the main group of the hot springs, on a small, flat piece of ground near the river, there are some small holes, some of which emit boiling water, and some vapours impregnated with sulphuretted hydrogen. The ground around these holes consists of a rather dry, warm (30°—40°), clayey soil, with a very sparse vegetation. *Archidium* is common everywhere; *Fossombronina* often grows around the holes, and here and there on the clayey flats *Riccia crystallina* and *Anthoceros punctatus*.

Laugaráshverir (Fig. 22) are situated in the southernmost part of Biskupstúngur, near the farm Laugarás. At the foot of the slope on which the farm is situated, and in the boggy ground below, there issue several boiling hot springs which, through several channels, unite and form a large brook which flows into the Túngufljót. The vegetation is very much like that in Thorlákshver. Next to the water there is a belt of *Fossombronina*, *Haplozia crenulata*, *Alicularia* and *Archidium* with a ground temperature of as much as 43°; then comes the *Sphagnum*-belt which is composed of *S. subnitens* var. *coerulescens*, *S. teres*, *S. angustifolium*, *S. cymbifolium*, *S. imbricatum* and *S. inundatum* in association with *Hypnum stramineum*. The warm ground between the channels was covered with extensive mats of *Hypnum imponens*, *H. Lindbergii*, *H. stramineum*, *Hylocomium squarrosum*, *Climacium dendroides*, *Thuidium delicatu-*

*lum*, *Calypogeia Trichomanis* and *Scapania irrigua*. *Aulacomnium palustre* was occasionally met with on wetter ground, and *Archidium phascoides*, *Ditrichum homomallum* and, on a single spot, *Campylopus fragilis* on rather dry, clayey soil. Under the *Hyp-*



Fig. 22. Laugaráshverir. The springs are situated at the foot of a hill; along the outlet-channel and next to the water there is a narrow, dark belt of *Hepaticae* and *Archidium*, then comes a broad belt of *Sphagnum*-cushions, and outside that (the dark patch in the foreground) are *Hypnum*-carpets.

*num*-mats there was an almost constant temperature of  $32^{\circ}$ , and under *Archidium* as much as  $46^{\circ}$ . On the slope above one of the largest springs *Riccia sorocarpa* grew in abundance, and where steep banks were formed along the outlets grew *Hypnum*, *Thuidium* and *Catharinea undulata* f. *thermophila*; as was the case near Thorlákshver.

Further northwards near the Bruará is Sýdri Reykjahver. This consists of a large round basin from the centre of which the spring rises, bubbling up at short intervals and ejecting a considerable amount of boiling hot water which flows over the edge of the basin and gathers together into a brook which flows into the river.

On the somewhat higher and eastern side of the basin there is luxuriant grassland, while the lower western side bears a vigorous Bryophyte vegetation. Here, next to the water, grew extensive dark-green and reddish-brown mats of *Alicularia scalaris*, *Haplozia crenulata* and some *Catoscopium nigratum* in which bluish-green patches of *Fossombronia* occurred interspersed, and occasionally rosettes of *Anthoceros punctatus*. Here the temperature of the ground was 25°—27° just below the surface. Then followed a belt, about 2 metres broad, of *Sphagnum papillosum*, *S. cymbifolium* and fruiting specimens of *Polytrichum commune*, with a ground temperature of about 20°.

Lowermost on the steep bank (50—70 metres high) along the outlet grew the usual belt of *Hepaticæ* consisting of *Haplozia*, *Alicularia* and *Anthoceros*, then an abundance of *Oligotrichum hercynicum* interwoven with *Haplozia sphaerocarpa*, and uppermost along the edge large cushions of *Hypnum stramineum*, *Hylocomium squarrosum* and some *Sphagnum cymbifolium*, and here and there *Calypogeia Trichomanis*.

In a small bog by the side of the basin, into which the hot water no doubt frequently flowed, grew, in addition to the usual bog vegetation, numerous large cushions of *Sphagnum teres* and *S. inundatum*.

**The Hot Springs in Reykholtalur.** Throughout the whole of Reykholtalur, on both sides of the river Reykjadalsá, there occur very many hot springs, some of which discharge a great amount of water. Near the vicarage of Reykholt rise Dýnkur, Skribla, Snorralaus and other springs, which in part contain sulphuretted hydrogen. Some hundred metres more to the south, on the other side of the river, is Hagindishver, and farther down the valley are other hot springs, of which the largest are Deildatúnguhver, Snældubeinstadahver, Stúrlurreykjahver, Kleppjarnsreykir (probably Grönlund's Kleppholtsreykir) and Vellindishver; the last-mentioned is a fountain (geysir), which is situated on a small rock in the river, and is quite bare of vegetation. The

water in all these latter springs is pure and free from sulphuretted hydrogen.

Near the springs around Reykholt the Bryophyte vegetation is rather scanty, partly on account of the sulphuretted hydrogen, and partly on account of the constant disturbances caused by the traffic and the use of the hot water. *Sphagnum* is practically absent. Along the outlets of the springs liverworts grew almost exclusively. *Fossombronia* and *Blasia pusilla* were very common, the latter grew in the form of flattened rosettes. *Haplozia crenulata* and *Alicularia scalaris* were also frequent.

Around all the other springs in Reykholtalur there was a luxuriant vegetation of *Sphagna*. *S. papillosum* was especially dominant and occurred in very large cushions, often 20—25 cm. deep, but besides this many other species were found either intermixed or separately in yellow, greenish, red or brownish cushions. The following species have been found on warm ground in Reykholtalur: *Sphagnum papillosum*, *S. cymbifolium*, *S. angustifolium*, *S. rubellum*, *S. Warnstorffii* and *S. teres* were all common, *S. subnitens* (fr.), *S. acutifolium*, and *S. Dusenii* var. *falcatum* occurred only now and then.

The *Sphagnum* spp. grew partly as a belt along the outlets of the springs, partly on the boggy ground over which the hot water was flowing. Intermixed with these grew everywhere *Hypnum stramineum*, and in many places *Polytrichum commune* with ripe capsules. Near Snældubeinstadahver *Odontoschisma Sphagni* was scantily woven into tufts of *S. rubellum*.

The warm clayey flats next to the water, and especially the steep banks stretching down towards the outlets, were covered with a dense carpet of mosses and liverworts, in which the latter were usually in the majority. The bluegreen rosettes of *Anthoceros* were found almost everywhere, usually together with *Fossombronia*, *Blasia*, *Alicularia scalaris* and *Haplozia crenulata*. In such places *Archidium* also often grew in great abundance.

Grönlund records *Catoscopium nigratum* as occurring abundantly around hot springs in Reykholtalur, but he has confused it with *Archidium phascoides*. *Catoscopium* is found only exceptionally, and, as it were, accidentally on warm ground, sometimes in a somewhat divergent, slightly tomentose form (var. *Grönlundii* C. J.).

On warm boggy ground the *Sphagnum* carpet was often greatly intermixed with, or partly replaced by, a *Hypnum* vegetation to-



gether with some other Bryophyta. *Hypnum revolvens*, *H. exannulatum*, *H. stramineum*, *H. stellatum*, *Acrocladium cuspidatum*, *Scapania irrigua*, *Pellia Neesiana* and *Alicularia scalaris* were very common, *Aneura multifida* occurred here and there, especially in the *Sphagnum rubellum* cushions. Where the ground was less damp, especially on slightly inclined slopes stretching down towards the hot water, it was covered with a thick carpet of *Hypnum imponens*, *H. molluscum*, *H. stramineum*, *H. revolvens*, *Hylocomium squarrosum*, *H. parietinum*, *H. proliferum* and *Camptothecium lutescens*, in which were scattered cushions of *Sphagnum*, especially *S. rubellum* and *S. teres*. Sometimes *Preissia commutata* also could form bluish-green patches, about a metre in breadth, usually intermixed with some *Hypnum molluscum*.

Stúrlurreykjahver is situated on a slightly inclined slope stretching down towards the river Reykjadalásá. At the top, near the spring, there is the usual *Sphagnum* vegetation which, farther downwards where the ground on both sides of the outlet of the spring is rather boggy, is replaced by a greatly mixed vegetation, composed principally of *Hypnum imponens*, *Hylocomium squarrosum*, *Polytrichum gracile*, *Dicranum scoparium* var. *orthophyllum*, *Calyptogeia Trichomanis* and *Alicularia scalaris*. Alternating with the *Hypnum* carpet, extensive, dark-green mats of *Archidium* are found. The surface temperature of the ground under the *Sphagnum* carpet was, as a rule, 40°, whilst under the *Hypnum*-*Archidium* carpet there was an almost constant temperature of 37°. On stones in the tepid water, the temperature of which was at this spot 34°, grew large cushions of *Dicranella squarrosa*.

Kleppjarnsreykir is undoubtedly the same spring that Grönlund (1877, p. 350) calls Kleppholtsreykir. He states that at this spring the same two species of *Sphagnum* occur that are found near Túnguhver, and that near the spring and its outlet, among others, "*Distichium capillaceum*, *Mnium serratum*, *Hypnum ochraceum* and *Catoscopium nigritum*" are found. The two last-mentioned have been wrongly determined, and the two first do not at any rate belong to the species characteristic of the warm ground.

The outlet has for a tolerably long distance steep banks, about half a metre high, which are, at the foot, covered with the usual liverwort-vegetation: *Haplozia crenulata*, *Fossombronina*, *Anthoceros*, *Alicularia* and *Archidium*. The uppermost part is covered with a dense moss-carpet consisting of *Hylocomium squarrosum*, *H. proli-*



*ferum*, *Hypnum imponens*, *Mnium hornum*, *M. undulatum*, *M. serratum*, *Fissidens osmundoides* and *Enthostodon ericetorum*. On a stone partly inundated by the hot water, which had a temperature of about 50°, *Fissidens osmundoides*, *Blindia acuta*, *Dicranella squarrosa*, *Enthostodon ericetorum*, *Anthoceros punctatus*, *Aneura multifida* and *Scapania irrigua* grew intermixed.



Fig. 23. Deildatúnguhver. To the left is the slope with the hot springs. The part in the middle is saturated with the hot water and covered with *Sphagnum papillosum*, *Polytrichum commune* and *Hydrocotyle*.

Deildatúnguhver (Grönlund's Túnguhver) (Fig. 23) is situated north of the river and opposite to Kleppjarnsreykir. It is mentioned by Grönlund (1877, p. 349), who states that the surface temperature of the ground at the top of the hill was 23° R, and that there *Polytrichum commune*, *Sphagnum cymbifolium*, *S. cuspidatum* and a *Campylopus* (*C. flexuosus*) — not determined with certainty — grew in the warm ground. Deildatúnguhver is one of the hot springs of Iceland which discharge the greatest amount of water, and consists of a row of holes at the foot of a hill 6—8 metres high, whence an enormous quantity of water and steam is ejected with a great noise. The masses of steam, which can be seen for miles, enshroud the surroundings of the spring with so dense a cloud that it is hardly possible to approach without getting soaked through. Below the hill the water

gathers into a broad brook which flows into the river. The whole hill, which consists of reddish clay, is warm throughout, and at the top the temperature was  $36^{\circ}$ – $40^{\circ}$  just below the surface of the ground.

On the slope stretching down towards the springs *Blasia pusilla* grew abundantly, occasionally in company with *Fossombronia Dumortieri*. The dry ground on the top of the hill was covered with large patches of *Campylopus flexuosus* and *Hypnum imponens* intermixed with scattered tufts of *Catharinea undulata* and *Oligotrichum hercynicum* and entirely interwoven with *Gymnocolea inflata*. At the foot of the hill, but on the opposite side to that on which the springs lie and where the ground was damper, grew, in addition to the above-mentioned species, *Sphagnum cymbifolium* and *Polytrichum gracile*. Here some 5–6 small plants of the fern *Blechnum spicant* were also found.

The warm brook below the hill divides into several branches, which flow round some large islands saturating them with the warm water. Here *Sphagnum papillosum*, *S. angustifolium* and *Polytrichum commune* grew in enormous cushions, which were everywhere covered by the orbicular leaves of *Hydrocotyle vulgaris* and entirely enshrouded in hot vapours.

**Geysir.** On a low mound about one kilometre long and about  $\frac{1}{2}$  a kilometre broad, situated about 100 metres above sea-level, there are a great number of hot springs (about 40) besides the well-known Great Geysir. The majority of these springs consist of a larger or smaller hole, but sometimes of a basin, several metres in diameter, in which the boiling water usually reaches to the upper edge and flows over the somewhat raised rim, or is ejected at shorter or longer intervals. The soil consists of reddish clay, or nearest to the springs — especially to Geysir — of siliceous sinter. The water in the majority of the springs smells slightly of sulphuretted hydrogen. The whole district around the springs is warm, and in many places the temperature is so high that the tenants of the neighbouring farm (Laug) bake their bread by putting the dough into a pot and burying it about 30–40 cm. below the surface of the ground.

The siliceous sinters are quite bare of vegetation. The warm clay-flats situated on a higher level are, as a rule, dry, and either bear a greatly scattered Bryophyte vegetation or are quite bare. Under the scattered, low cushions of *Ditrichum homomallum*, *Archi-*

dium and *Fossombronina* which were growing here, the thermometer showed as high a temperature as  $34^{\circ}$  on the surface of the ground. On a slightly damp flat which was covered with a low-growing, dense form of *Climacium dendroides*, the surface temperature of the ground was  $43^{\circ}$ .

In the more low-lying tracts, where the ground was rather damp, or partially inundated with hot water, there had, in several places, developed a luxuriant vegetation of phanerogams and mosses, which was, however, often much trodden down. Here, in the boggy parts, grew a low vegetation of *Carex-Viola palustris*, greatly mixed with Bryophyta, of which the following species, which grew intermixed, were observed: *Hypnum stramineum*, *H. sarmentosum*, *H. imponens*, *Hylocomium squarrosus*, *Sphagnum cymbifolium*, *Catharina undulata*, *Calypogeia Trichomanis*, *Alicularia scalaris*, *Haplozia crenulata*, *Scapania irrigua*, *Aneura pinguis* and an undeterminable *Pohlia*. On damp clayey flats *Archidium*, *Fossombronina Dumortieri*, *Haplozia crenulata* and *Alicularia scalaris* formed low, dense mats in which *Anthoceros punctatus* occasionally occurred in small rosettes.

Below Great Geysir, *Hypnum chrysophyllum* grew on a clayey flat inundated with tepid water.

**Laugarvatnshverir.** By the shore of lake Laugarvatn, below the farm of the same name and along the water's edge, there is a row of springs containing boiling water saturated with sulphuretted hydrogen. The surrounding ground which consists of black basalt gravel is, owing to its exposed situation, quite bare of Bryophyte vegetation; and of higher plants only a few specimens of *Polygonum Persicaria* were found. By the northernmost of the springs only, which is situated at some distance from the lake shore, a warm, damp clayey flat was covered with a carpet of *Sphagnum cymbifolium*, *S. Girgensohnii*, *Polytrichum commune*, *Hylocomium squarrosus*, *Hypnum stramineum*, *Archidium phascoides*, *Pohlia grandiflora* ♀, *Aongstrœmia longipes*, *Gymnocolea inflata*

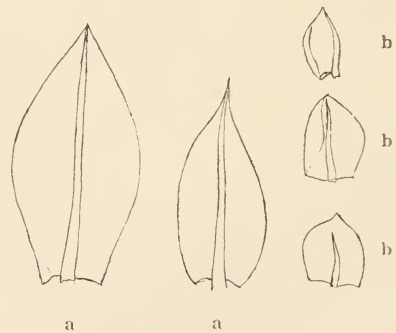


Fig. 24. *Bryum* sp. a, Older leaves developed before the plant was inundated with hot water; b, leaves from shoot developed in hot water (Geysir).

*c. coles.*, *Haplozia sphaerocarpa*, *H. crenulata*, *Alicularia scalaris* and *Scapania irrigua*.

At **Englandshverir**, some small hot springs which rise in Lundurreykjadalur, there was only opportunity for quite a short stay on the journey past. Here, on the warm ground along the outlet of the springs the following species were observed: *Sphagnum teres*, *Hypnum imponens*, *Catharinea undulata*, *Fissidens osmundoides*, *Enthostodon ericetorum*, *Catocopium nigratum*, *Archidium phascoides*, *Aneura pinguis*, *Pellia Neesiana* and *Fossombronina Dumortieri*.

The **Hot Springs near Reykir**. In the south-western part of Iceland, around the farms Reykir and Reykirfoss, about 45 kilometres south-east of Reykjavik, there is a very large group of hot springs which stretches towards the north and north-west, through the valleys, right up upon Hengill to a height of 400—500 metres above sea-level. To this group must also be reckoned the hot springs near Kolvidarhol and on Hellisheidi. The majority of the springs are situated around the farm Reykirfoss, and north of the latter, on both sides of the river from a height of about 50 to 90 metres above sea-level; most of them are in the neighbourhood of the river, and are in part situated directly upon the banks of the latter, several, however, lie upon the slope of Reykjafjall, up to about 100 metres above sea-level. Where the naked basalt does not protrude, the ground around the springs consists of greyish-white siliceous sinter almost bare of vegetation, and large tracts of it are warm and, so to speak, perforated like a sieve with numerous hot springs of all possible sizes. These appear in the form of (1) steaming holes (fumaroles) which range in size from quite fine pores to rather large funnels, (2) fountains (geysirs) which at short intervals eject boiling water ranging from quite a slender jet one foot in height to mighty columns of roaring water from 10 to 15 feet in height (Little Geysir), (3) mud-pools with bubbling, bluish-grey mud which is often ejected to a distance far beyond the surroundings of the pool, and (4) boiling basins or cauldrons which may measure 6—8 metres in diameter, and either have a quiet surface or boil up at short intervals, so that the water partially flows over the edge of the basin. The steam is everywhere impregnated with sulphuretted hydrogen, with the result that the vegetation is very poor and homogeneous. The luxuriant *Sphagnum*-vegetation known from the alkaline springs does not occur near these springs. Around these steaming holes,



geysirs and mud pools the ground is usually quite bare as far as the boiling water and the mud are able to spurt.

Near the boiling basins which occur in great number and generally have a diameter of 2—4 metres, the ground forms, as a rule, a slope on the one side with an angle of  $25^{\circ}$ — $40^{\circ}$ , whilst on the opposite side the water flows down a gentle slope which stretches as far as to the river. The ground for the first 10—20 cm. of this slope, which corresponds approximately to the different water-levels, is of a greyish-white colour and quite bare of vegetation. Then comes a belt of varying breadth formed of liverworts which, next to the water, are black or of a brownish black, above this of a reddish-brown or brownish-green, and at the top, green. This liverwort-carpet was everywhere composed of *Gymnocolea inflata*, *Haplizia crenulata*, occasionally also *Alicularia scalaris* f. *rufescens* and at the top *Cephalozia bicuspidata*. The temperature under the moss-covering was on an average  $20^{\circ}$ — $25^{\circ}$ .

*Polytrichum commune* grew scattered in the liverwort carpet, from which its bluish-green tops protruded several centimetres, but frequently it also formed large growths above the liverworts, partly interwoven with the latter. Only very few phanerogams were able to grow there, usually only flowerless specimens of *Viola palustris*, the short-stemmed leaves of which rested on the liverwort carpet. Besides the above-mentioned Bryophyta several others were found on the warm clayey flats, although far more scantily. *Anthoceros punctatus*, *Fossombronina Dumortieri*, *Blasia pusilla* and *Archidium phascoides* grew here and there. In several places *Oligotrichum hercynicum* occurred in tufts a few mm. high, and in one single locality *Alicularia geoscypha* and *Aongstromia longipes* were found in company with it. On warm ground between loose blocks of rock, at an altitude of about 260 metres, the following were found among others: *Polytrichum commune*, *Hylocomium loreum*, *Plagiothecium elegans* and *Diplophyllum albicans*.

In the neighbourhood of the farm Reykirfoss, on the western side of the river, and at the edge of the lava field, there is a rather large spring with pure water of a temperature of about  $37^{\circ}$ . Here the blocks of stone in the water were quite covered with *Pellia Neesiana*, in the tufts of which *Veronica Anagallis* had taken root.

Where the boiling water flowed over the slightly inclined slopes, it deposited greyish-white siliceous sinter, upon which grew blue-green algæ as soon as the water had cooled down to  $60^{\circ}$ — $70^{\circ}$ . The



Bryophyta appeared first at the edge of the outlet of the spring where the temperature was  $25^{\circ}$ – $40^{\circ}$ . The vegetation here resembled that of wet, cold ground, and was usually composed of *Philonotis fontana*, *Mnium Seligeri*, *Hypnum stramineum*, *Catoscopium nigrum*, and in a single spot of some *Sphagnum angustifolium*. On drier, warmer ground *Hypnum imponens* was found here and there in company with *Hypnum stramineum*, *Hylocomium squarrosum*, *Archidium phascoides*, etc.

Of the hot springs situated at higher levels only a few have been investigated. In the neighbourhood of Kolvidarhol, at an altitude of about 350 metres, on the warm ground around some holes whence issued vapours impregnated with sulphuretted hydrogen and where sulphur had been deposited, the following species were growing: *Gymnocolea inflata*, *Haplozia crenulata*, *Fossombronia Dumortieri*, *Aneura pinguis*, *Archidium phascoides* and *Polytrichum commune*. Here *Gymnocolea inflata* was not strictly confined to the warm ground, but appeared rather to prefer clay, as it also grew on clayey flats which had probably been warm previously, but were now quite cold.

The same species together with *Blasia pusilla* grew also in Reykjadalur (at an altitude of about 260 metres) on the damp base of a warm slope from which vapours, containing sulphuretted hydrogen, and water issued sparsely from numerous small holes. Near some mud-pools on Hellisheidi only *Gymnocolea inflata* and *Haplozia crenulata* occurred.

The **Sulphur Springs on Reykjanes** — which I myself had no opportunity of visiting — have been described by Ostenfeld (Bot. Tids., vol. 22, p. 239). They occur in two groups, near Reykjanes lighthouse and also near Krisuvik.

The Solfataras near Reykjanes lighthouse form a large group with numerous orifices of discharge, partly mud-pools, partly steaming holes, everywhere around which the ground is warm ( $20^{\circ}$ – $30^{\circ}$ ). Near the outlet of the largest mud-pool, Gunna, the damp ground, which had a temperature of about  $30^{\circ}$ , was covered with *Haplozia crenulata* to which, along the margin, came several other species, viz. *Fossombronia Dumortieri*, *Archidium phascoides* (recorded by Ostenfeld as *Pohlia nutans* v. *filicaulis*), *Trichostomum littorale* and *Bryum ventricosum*, all of which, however, only occurred sparingly. Around the steaming holes grew *Riccia bifurca*, *Preissia commutata*, *Fossombronia Dumortieri*, *Archidium phascoides*,

*Bryum ventricosum*, *Fissidens osmundoides* and *Philonotis fontana*.

The Sulphur Springs near Krisuvik are, according to Ostenfeld, rather bare of vegetation, and he mentions only *Haplozia crenulata* as growing near a few of these. The collections contain also *Gymnocola inflata* and *Polytrichum commune* which were gathered here by Steenstrup, so probably the same species occur on this spot as are, for instance, to be found near Kolvidarhol.

In the remaining part of Iceland the vegetation of the warm ground has hardly been investigated at all. During my stay at Mývatn in 1909 continual rain and fog prevented me from making a closer investigation of the numerous sulphur springs which occur there. The warm clayey flats were mostly quite bare, only around a single steaming hole, where the temperature of the surface was about 40°, grew *Riccia bifurca*, *Haplozia crenulata* and *Fossombronia Dumortieri*.

A moss-cushion from one of the Solfataras near Kverkfjall, (Eyafjallajökul) collected by Andr. Lundager, consisted of *Philonotis fontana* and *Riccia bifurca*.

By comparing what is known regarding the moss vegetation of warm ground, it is seen that the composition of the vegetation is dependent on the chemical nature of both the water and the escaping vapours, and also on conditions pertaining to soil.

Where the water is free from sulphuretted hydrogen, or where it, at most, contains a trace of it, the *Sphagnum* vegetation is very luxuriant, especially when the surroundings of the spring are boggy, as is the case in Biskupstúngur and near most of the springs in Reykholtalur. The condition for the formation of a continuous Sphagnetum, in addition to a warm, damp substratum, is an abundant development of vapour, which envelops the moss-cushions in a damp, warm atmosphere. The most frequent species is *S. papillosum*, which often constitutes the bulk of the *Sphagnum* carpet, in association with *S. cymbifolium*, *S. angustifolium* and *S. teres*, frequently replaced by, or intermixed in patches with, some other species. Scattered in the *Sphagnum* carpet grew, as a rule, a very vigorous, fruiting form of *Polytrichum commune*, and usually also *Hypnum stramineum*, *Hylocomium squarrosum* or *Acrocladium cuspidatum*.

Outside the *Sphagnum*-belt there occurs, on warm, boggy ground, a moss carpet interspersed with *Carex* spp. and other flowering plants, and chiefly composed of *Hypnaceæ*, occasionally also of *Philonotis*

*fontana*, *Aulacomnium palustre* or of an abundance of species intermixed. The commonest of these species are: *Hypnum imponens* and *H. Lindbergii*, which are often the most abundant constituents of the carpet, *H. stramineum*, *Hylocomium squarrosum*, *Acrocladium cuspidatum*, *Thuidium delicatulum*, and numerous other bog-mosses such as *Hypnum revolvens*, *H. molluscum*, *Catocopium nigratum*, *Fissidens osmundoides*, *Scapania irrigua*, *Pellia Neesiana*, *Aneura pinguis*, etc. Especially the first six species, however, occur everywhere in abundance, and often attain an unusual size and development.

As an intermixture in this moss carpet some species, for instance *Mnium hornum*, *Catharinea undulata* and *Polytrichum gracile*, are occasionally met with which partly occur also in other localities and are partly characteristic of warm ground, and in Iceland only occur in such. To the latter group belong — in addition to *Hypnum imponens*, which is rare elsewhere — *Enthostodon ericetorum*, *Calypogeia Trichomanis*, *Aneura multifida* (found scantily in one spot on cold boggy ground) and *Odontoschisma Sphagni*. Some species develop special warm-soil forms: *Catharinea undulata* f. *thermophila* is exceedingly vigorous, as much as 10 cm. high, with long, extremely wavy, secund leaves right up from the base. *Philonotis fontana* becomes thread-shaped in warm ground, with long, branchless, barely tomentose shoots (Fig. 8), *Hypnum Lindbergii* develops a similar form with almost branchless, erect stems with scattered leaves, and *Hypnum imponens* is also, as a rule, much elongated and slightly branched. Comp. further *Bryum* sp. (Fig. 24). On drier, clayey ground the *Hypnum* carpet is replaced by other species. *Archidium phascoides* is extremely common, and often forms extensive growths both near alkaline springs and near springs containing sulphuretted hydrogen. Here *Campylopus flexuosus*, *C. fragilis*, *Oligotrichum hercynicum*, *Catharinea undulata*, *Gymnocolea inflata* and several other species are also to be found.

In damp clayey soil, especially along the outlets of the hot springs, both where the water is pure and where it contains sulphuretted hydrogen in small quantities, without however depositing sulphur, a low Bryophyte carpet occurs composed of specie—smostly *Hepaticæ* — the majority of which are only met with in warm soil. *Haplozia crenulata*, *Fossombronina Dumortieri* and *Oligotrichum hercynicum* are also common. *Preissia commutata* is common in Reykholtdalur, *Alicularia geoscypha* and *Aongstræmia longipes* and a few other species occur here and there.

Where the surroundings of the spring consist of siliceous sinter, as is the case with the majority of the springs of the Geysir-complex, and in Reykirdalur, all species of *Sphagnum* are absent, or are to be found only as a subordinate component, and the moss vegetation is, on the whole, scanty, and consists of the same species as are to be found on clayey soil, together with some *Hypnaceæ*, *Philonotis*, etc. on damper soil.

Near the Sulphur Springs proper the Bryophyte vegetation is extremely scanty, and the ground is often quite bare of vegetation as far as the hot vapours extend. *Sphagnum* and *Hypnaceæ* are entirely absent, whereas the majority of the *Hepaticæ* are to be found, especially *Haplozia crenulata*, *Fossombronia Dumortieri*, *Gymnocola inflata*, *Alicularia scalaris*, *Preissia commutata* together with *Archidium phascoides*, *Polytrichum commune* and a few other mosses. *Riccia* spp. (*bifurca*, *sorocarpa* and *crystallina*) belong specially to the dry, warm ground in the neighbourhood of sulphur springs.

The following species have been found on warm ground:

1. Species which occur only on warm ground.

*Riccia crystallina* L. Thorlákshver.

*Riccia sorocarpa* Bisch. Laugaráshverir.

— *bifurca* (Hoffm.) Lindenb. Mývatn; Reykjanes; Kverkfjáll.

*Anthoceros punctatus* L. Common.

*Fossombronia Dumortieri* (Hüben.) Lindb. Everywhere.

*Calypogeia Trichomanis* (L.) S. F. Gray. Mývatn; Reykholtalur;

Englandshverir; Sydri Reykjahver; Geysir.

*Odontoschisma Sphagni* (Dicks.) Dum. Reykholtalur.

*Sphagnum imbricatum* Hornsch. Thorlákshver; Laugaráshverir.

*Sphagnum cymbifolium* (Ehrh.) Hedw. Common.

*Sphagnum Dusenii* C. Jens. v. *falcatum* Reykholtalur.

*Archidium phascoides* Brid. Very common everywhere.

*Entosthodon ericetorum* (Bals. et de Not.) C. M. Reykholtalur;

Englandshverir.

*Campylopus flexuosus* (L.) Brid. Reykholtalur.

*Campylopus fragilis* (Dicks.) Br. eur. Laugaráshverir.

*Barbula fallax* Hedw. var. *lavifolia* n. var. Thorlákshver.

*Catharinea undulata* (L.) Ehrh. f. *thermophila* Thorlákshver;

Laugaráshverir.

2. Species which are mainly distributed over warm

ground and only occur as an exception in other localities.

*Aneura multifida* (L.) Dum. Reykholtalur.

*Haplozia crenulata* (Sm.) Dum. Near all hot springs.

*Gymnocolea inflata* (Huds.) Dum. Reykholtalur; Reykirdalur; Krisuvik.

*Sphagnum papillosum* Lindb. Very common.

*S. angustifolium* C. Jens. Common near alkaline springs.

*S. inundatum* Russ. Laugaráshverir; Sýdri Reykjahver.

*Hypnum imponens* Hedw. Common near most hot springs.

*Haplozia sphaerocarpa* (Hook.) Dum. and *Oligotrichum hercynicum*.

These two species have a most peculiar distribution.

*Haplozia* has been found near several hot springs in SW. Iceland and also on mountain heights near Isafjörður.

*Oligotrichum hercynicum* is common near most alkaline springs, and also near a few containing sulphuretted hydrogen. It is, moreover, common on rocky flats at an altitude of 400—500 metres, and also in NW. Iceland; but is otherwise very rare.

3. Species which are also common in other localities.

*Aneura pinguis* Dum. Common.

*Pellia Neesiana* (Gottsche) Limpr. Common.

*Blasia pusilla* L. Near many springs.

*Preissia commutata* (L.) N. v. Es. Reykholtalur; Reykjanes.

*Alicularia scalaris* (Schrad.) Corda. Very common everywhere.

— *geoscypha* de Not. Reykirdalur.

*Cephalozin bicuspidata* (L.) Dum. Reykirdalur.

*Scapania irrigua* (Nees) Dum. Frequent.

*Sphagnum subnitens* Russ. et Warnst. Laugaráshverir; Reykholtalur.

*S. teres* (Schimp.) Ångstr. Very common.

*S. rubellum* Wils. Reykholtalur.

*S. Warnstorffii* Russ. Reykholtalur.

*S. Girgensohnii* Russ. Laugarvatnshverir.

*Dicranella squarrosa* (Schrad.) Sch. Reykholtalur.

*Fissidens osmundoides* (Sw.) Hedw. Frequent near alkaline springs.

*Blindia acuta* (Huds.) Br. eur. Reykholtalur.

*Ditrichum homomallum* (Hedw.) Hampe. Geysir; Reykirdalur.

*Trichostomum littorale* Mitten. Reykjanes.

*Catocopium nigritum* (Hedw.) Brid. Frequent.

*Mnium undulatum* (L.) Weiss. Reykholtalur.

*Mnium hornum* L. Common near alkaline springs.



*Mnium serratum* Schrad. Reykholtalur.

*Aulacomnium palustre* (L.) Schwägr. Common, several places in abundance.

*Philonotis fontana* (L.) Brid. Very common, often in masses.

*Catharinea undulata* (L.) W. et M. Common.

*Polytrichum commune* L. Common.

— *gracile* Dicks. Reykholtalur.

*Thuidium delicatulum* (L.) Mitten. Frequent.

*Hypnum molluscum* Hedw. Abundant near all the hot springs in Reykholtalur.

*Hypnum Lindbergii* (Lindb.) Mitten. Common everywhere.

*Hypnum revolvens* Sw. Common near many springs, especially in Reykholtalur.

*Hypnum chrysophyllum* Brid. Geysir.

— *sarmentosum* Whlb. Geysir.

— *stramineum* Dicks. Very common everywhere.

— *exannulatum* Gumb. Reykholtalur.

*Acrocladium cuspidatum* (L.) Lindb. Common.

*Climacium dendroides* (L.) W. & M. In many places, plentiful near Geysir.

*Hylocomium squarrosum* (L.) Br. eur. Common everywhere.

— *proliferum* (L.) Lindb. Common in Reykholtalur.

— *parietinum* (L.) Lindb. In several places plentiful.

Besides the species mentioned in the above list, several other species are, however, also found as more casual intermixtures in the moss carpet, especially species from boggy soil and from grassland, for instance *Rhacomitrium canescens*, *R. hypnoides* and *Hypnum uncinatum*.

### Mesophilous Bryophyte Formations.

The Bryophyta, as a rule, play a less prominent part in the plant-covering of soil of a middle degree of dampness, than in that of wet soil, because in the former the higher plants find more favourable conditions of life, and the Bryophyta are consequently driven more into the background and occur only as ground vegetation between the higher plants. Several other conditions are, however, of essential importance in this connection, for instance conditions pertaining to the light, the direction of the slope and the snow-covering. Bryophyta bear shade better than do the higher

plants and consequently develop better than the latter in localities which are less favourable as regards the light, for instance, on the northern sides of clefts and in caves. In valleys southern slopes are covered with grass or other herbaceous plants, while northern slopes are moss-grown. In the narrow tuff-clefts of South Iceland the sides are often covered with a luxuriant moss carpet consisting of *Hylocomium* spp., *Thuidium*, *Polytrichum*, etc. Here the snow-covering no doubt also plays an important part, since by remaining until far into the spring, it checks the growth of the higher plants far more than it does that of the mosses.

Grassland is mostly knolly, and the mosses grow abundantly on the ground between the grasses. Here it is especially species such as *Hypnum uncinatum*, *Hylocomium squarrosum*, *Climacium dendroides*, *Polytrichum alpinum* and *Rhacomitrium canescens* which are the most abundant constituents of the vegetation, but in addition to these many other species occur, for instance *Catharinea undulata*, *Timmia austriaca*, *Tortella tortuosa*, *Dicranum congestum*, *Ditrichum flexicaule*, *Distichium montanum*, *Bartramia ityphylla*, *Rhacomitrium hypnoides*, *Hylocomium* spp., *Hypnum Lindbergii* and *Lophozia quinqueidentata*. The composition of the vegetation varies according to the degree of dampness, therefore, we sometimes find species from boggy soil and sometimes xerophilous species of heathy soil intermixed in greater and smaller quantities.

Grass-slope and Herb-slope<sup>1</sup>. On the herb-slope the Bryophyta are very scantily represented. On the grass-slope the bottom is covered with a more or less dense carpet of mosses and liverworts in which the chief species are *Hylocomium proliferum*, *H. parietinum*, *H. squarrosum*, *H. rugosum*, *H. loreum*, *H. triquetrum*, *Hypnum uncinatum*, *Climacium dendroides*, *Camptothecium lutescens*, *Thuidium delicatulum* (S. Icel.), *Mnium affine*, *Timmia austriaca*, *Polytrichum alpinum*, *Pogonatum urnigerum*, *Rhacomitrium canescens*, *R. hypnoides*, *Ditrichum flexicaule*, *Lophozia lycopodioides* and *Plagiochila asplenioides*, but besides these, many other species occur as a more casual admixture.

On a stony substratum with a thin layer of soil mosses are dominant, and phanerogams grow scattered in the moss carpet. A "moss-slope" is then developed which, as a rule, is composed of the same species as those found on the grass-slope, most frequently

<sup>1</sup> See footnote in Thoroddsen's Physical Geography of Iceland, ante p. 330.

*Hypnum uncinatum*, *Hylocomium* spp., *Rhacomitrium* spp. and *Thuidium delicatulum* (S. Icel.). These are often associated with several of the xerophilous species, such as *Dicranum scoparium*, *Frullania Tamarisci*, *Ptilidium ciliare* and *Antitrichia curtipendula*, through which are formed transitional stages to the moss-heaths mentioned below. In South Iceland several of the southern species have their greatest distribution on well-sheltered, grass-covered slopes with a southern exposure, for instance *Scleropodium purum*, *Eurhynchium piliferum*, *E. Stokesii*, *Thuidium tamariscinum*, *T. Philiberti*, *T. delicatulum* and *Mnium undulatum*.

Birch coppices grow on a rather dry substratum. The wood-floor is either occupied by grassland or by heather moor, and the Bryophyte vegetation does not differ in any respect from that which occurs on a corresponding substratum outside the coppices. Most frequently it consists of *Hylocomium* spp. in association with *Hypnum uncinatum* and *Rhacomitrium* spp. (*R. canescens* and *R. hypnoides*).

Bryophyta grow only rarely and scantily on tree trunks. *Radula complanata* and *Frullania dilatata* have been found in one single spot on a tree trunk, but, as a rule, it is some ground species or other which grows a little way up on the slanting trunks. In some few places *Rhacomitrium fasciculare* has been found on tree trunks to which it had spread from neighbouring stones.

Laugardalsskógur. This coppice, which is open and of about a man's height, has its floor mostly covered with heather moor, with a thick moss carpet composed of *Hylocomium parietinum*, *H. proliferum*, *H. triquetrum*, *H. squarrosus*, *Hypnum uncinatum* and *Rhacomitrium hypnoides*, occasionally *Dicranum scoparium*, *Ptilidium ciliare*, *Lophozia lycopodioides* and *L. quinquedentata* also occurred. Of quite a similar composition was the moss carpet in almost all the coppices of South and West Iceland. A few other species also belong to this community, but are more rarely met with, for instance *Bryum caespiticium*, *Pohlia nutans*, *P. acuminata* and *Lophozia barbata*.

Hallormstadáskógur (East Iceland). The floor here rather varies in nature, and is sometimes covered with heather moor and sometimes with grassland or peat. In heathy soil *Hylocomium* spp. were dominant in connection with *Rhacomitrium hypnoides*, while especially *Hypnum uncinatum* grew abundantly on grassy ground. Where it was very shady *Timmia austriaca* grew abundantly on knolls.

Of other species the following were observed: *Pohlia nutans*, *P. cruda*, *Bryum caespitium*, *B. affine*, *Bartramia ityphylla*, *Polytrichum alpinum*, *P. juniperinum*, *Distichium montanum*, *Ditrichum flexicaule*, *Selania cæsia*, *Tortula subulata*, *T. ruralis*, *Dicranum scoparium*, *Ptilidium ciliare*, *Lophozia lycopodioides*, *L. quinquedentata*, *Frullania Tamarisci* and *Scapania curta*.

Birch coppice in Kaldalon (NW. Iceland). The south-western slope was covered with a low-growing and very dense birch coppice with a ground vegetation of numerous flowering plants (*Geranium silvaticum*, *Bartsia alpina*, *Taraxacum*, etc.) and a Bryophyte carpet of *Hylocomium proliferum*, *H. parietinum*, *H. squarrosum* and *Hypnum uncinatum* intermixed with *Dicranum scoparium*, *D. fuscescens*, *Pogonatum urnigerum*, *Polytrichum alpinum*, *Lophozia lycopodioides*, *L. quinquedentata*, *L. Flærckei*, *L. ventricosa*, *Cephalozia bicuspidata* and *C. pleniceps*. In open spots *Pohlia nutans* was very common, and *Polytrichum gracile* occurred frequently on knolls on the floor of the coppice.

Of a similar composition is the moss carpet of all the coppices of NW. Iceland. In several spots *Dicranum majus* and *Hylocomium triquetrum* also occurred.

Bryophyta of Soil recently laid bare. On slopes, on the sides of clefts, on soil covered rock-ledges and, on the whole, in all places where by weathering, by land-slips or by the action of water new soil is produced, which has not yet become inhabited by higher plants, a luxuriant Bryophyte vegetation occurs, which C. Jensen (1910, p. 258) includes in a group within the mesophilous associations, under the name "Moosvereine des frischen Erdbodens". A number of species are here met with, especially of the commonly occurring mesophilous forms, but also, several species belonging to damp sandy soil and to rocks. It is especially liverworts and the acrocarpous mosses which are represented here, while the pleurocarpous mosses occur but scantily. It is a condition for the growth of mosses that there is an abundant snow-covering during winter, which affords them protection from desiccation by wind.

The composition of the moss-covering varies greatly according to the prevailing degree of humidity, and the local conditions.

In such localities as those mentioned above the following Hepaticæ occur: — *Aneura pinguis*, *Marchantia polymorpha*, *Gymnomitrium concinatum*, *Alicularia scalaris*, *A. geoscypha*, *Lophozia*

*quinqüedentata*, *L. ventricosa*, *L. Mülleri*, *L. alpestris*, *Cephalozia bicuspidata*, *Cephalozia Hampeana*, *Blepharostoma trichophyllum*, *Anthelia julacea*, *A. Juratzkana*, *Scapania subalpina*, *S. curta*, more rarely *Preissia commutata*, *Blasia pusilla*, *Eucalyx subellipticus*, *Lophozia excisa*, *L. heterocolpos* and *Lophocolea minor*. The following are the commonest mosses: — *Dichodontium pellucidum*, *Dicranella crispa*, *Distichium montanum*, *Didymodon rubellus*, *Tortula subulata*, *Desmatodon latifolius*, *Tortella tortuosa*, *T. fragilis*, *Schistidium apocarpum*, *S. gracile*, *Encalypta ciliata*, *E. rhabdocarpa*, the majority of the species of *Bryum*, *Leptobryum pyriforme*, *Pohlia commutata*, *P. cruda*, *Mniobryum albicans*, *Mnium punctatum*, *Bartramia ityphylla*, *Philonotis tomentella*, *Timmia austriaca*, *Pogonatum urnigerum*, *Myurella julacea*, *M. tenerima*, *Brachythecium reflexum*, *Plagiothecium Roeseanum*, *Hypnum hamulosum*, *H. callichroum*, *H. uncinatum*, *Hylocomium loreum*. Some rare species, for instance *Eurhynchium strigosum* var. *præcox*, *Heterocladium squarrosulum*, *Distichium inclinatum* and *Weisia viridula* are found especially in such localities as those mentioned above.

### Xerophilous Bryophyte Associations.

#### Heaths.

The heath formation is extensively distributed about Iceland. It occurs especially on dry slopes, and hardly ascends higher than about 300–400 metres above sea-level, where it is succeeded by the rocky-flat association.

Heather-moor (H. Jónsson, 1900, p. 69). The chief heath-forming plants are *Empetrum nigrum*, *Vaccinium uliginosum*, *V. Myrtillus*, *Arctostaphylos uva ursi*, *Betula nana* and, especially in E. Iceland, *Calluna vulgaris*. Mosses and liverworts often grow abundantly on the ground. The Bryophyte carpet is chiefly composed of *Hylocomium* spp. (especially *H. proliferum* and *H. parietinum*), *Racomitrium hypnoides*, *R. canescens* and *Hypnum uncinatum*, but *Dicranum* spp. (*D. scoparium*, *D. fuscescens* and others), *Lophozia* spp. *Ptilidium ciliare*, *Frullania Tamarisci* and several other species often occur in abundance. As examples will best show the composition of this vegetation, the following are given: —

In North-west Iceland heath-vegetation is extensively distributed, especially around Dórafjörður and Isafjörður. Here the heath-forming plants are mostly *Vaccinium Myrtillus*, *V. uliginosum*, *Empetrum nigrum* and occasionally *Betula nana*.



On heathy ground in Gnupdalur near Dyrafjörður a rather scattered Bryophyte vegetation was found, composed of *Hylacomium proliferum*, *H. parietinum*, *Hypnum uncinatum*, *Dicranum scoparium*, *D. molle*, *D. fuscescens*, *D. Starckeii*, *Conostomum boreale*, *Lophozia Flörckei*, *L. lycopodioides*, *L. Kunzeana*, *L. ventricosa* and



Fig. 25. Grunnavik near Jökulsfjörður in NW. Iceland. Stony slope. The low-lying parts are boggy, the somewhat higher ridges are covered with heath vegetation (*Empetrum*, *Vaccinium*, *Dicranum* spp., etc.), whilst the stony ridges situated highest (in the background) are bare of vegetation.

*L. alpestris*. The *Dicranum* spp. formed thick, extensive cushions, and the *Lophozia* spp. grew woven into these cushions.

Grunnavik near Jökulsfjörður (Fig. 25). Up to a height of 100—200 metres the mountain slopes were partly covered with heather-moor and partly with bog-vegetation or moss-bogs. The stony ridges, situated higher up, which had been formed by stones sliding down from the mountain above, were covered with heath, while the intervening depressions were boggy, and there along the channels, where the water formed streamlets or issued as springs, the usual “Dy” vegetation consisting of *Mniobryum albicans*, *Philonotis*, etc., had developed.

The Bryophyte carpet of the heath was composed of *Hylocomium parietinum*, *H. proliferum*, *Hypnum uncinatum*, *Racomitrium hypnoides*, *Dicranum scoparium*, *D. fuscescens*, *D. molle*, *Ptilidium ciliare*, *Lophozia Flærckeii*, *L. lycopodioides*, *L. ventricosa*, *Cephalozia bicuspidata*, *C. pleniceps* and scattered cushions of *Sphagnum Gir-*



Fig. 26. Knolly moor of *Betula nana* intermixed with *Salix lanata* and *Salix phylicifolia*. Ground vegetation: *Empetrum*, *Arctostaphylos uva ursi*, *Anthoxanthum odoratum* and *Polygonum viviparum*.

*gensohnii*. The *Dicranum* spp. especially *D. scoparium* often formed continuous carpets, which appears to correspond with the "Dicranum heaths" described by C. Jensen, 1910, p. 262.

Knolly *Betula nana* Heath near Ljosavatn (Fig. 26). In addition to *Betula nana*, which formed the bulk of the vegetation, there occurred scattered shrubs of *Salix phylicifolia*, *S. glauca* and numerous grasses and flowering plants. Mosses and liverworts grew abundantly on the knolls and on the ground between them. The following species were observed: *Hypnum uncinatum*, *Racomitrium canescens*, *R. hypnoides* (all in abundance), *Hylocomium proliferum*, *H. rugosum*, *H. squarrosum*, *Camptothecium nitens*, *Heterocladium squarrosulum*, *Brachythecium erythrorrhizon*, *Polytrichum juniperinum*, *Timmia austriaca*, *Conostomum boreale*, *Pohlia cruda*, *Bartramia ityphylla*, *Tortella tortuosa*, *Dicranum congestum*, *Ditrichum*

*flexicaule*, *Lophozia lycopodioides*, *L. Kunzeana* and *Plagiochila asplenioides*.

The Moss Heath. On dry stony tracts there often occurs a continuous growth of mosses, in which higher plants grow scattered without being able to give character to the vegetation. In heather-moors mosses often form a continuous carpet, and then all transitions between typical heather-moor and moss-heaths are found. By the decay of the mosses a humus-layer is gradually formed, and the moss-heath is thus the pioneer of other associations such as heather-moors, coppices and grassland (H. Jónsson, 1905, p. 41).

The moss heath occurs most frequently as a *Racomitrium*-heath (*Grimmia*-heath, H. J., 1895, p. 70; 1900, pp. 68 and 85; 1905, p. 40). It is found in the low land — where it is typically developed, especially in the lava fields, which are often entirely covered by it — as well as on mountain slopes, and in the Alpine region as far upwards as 600—700 metres above sea-level (Fig. 27). It also occurs in patches in other formations, for instance in grassland, where it is usually developed on the top of the knolls. *Racomitrium hypnoides* is the dominant species, and is often the only one found over considerable tracts; it forms a uniformly grey carpet, as much as a foot deep. There is only a very small intermixture of other Bryophyta. The most frequent are *Racomitrium canescens*, *Hylocomium proliferum*, *H. parietinum*, *Dicranum scoparium*, *Plitidium ciliare*, *Frullania Tamarisci*, rarer are *Lophozia lycopodioides*, *L. barbata*, and other species. The *Racomitrium* heath is extensively distributed in many places on the taluses of fallen blocks and débris (Urd), and there — in case conditions are favourable — by the mosses decaying and forming humus, it quickly passes into other associations, especially into grass-slopes and herb-slopes.

The *Racomitrium canescens* heath is developed on a somewhat damper substratum than is the *R. hypnoides* heath, and is met with, for instance, in patches in depressions in the latter, where it is immediately distinguished by its light greyish-green colour, which differs distinctly from the whitish-grey colour of its surroundings. Here it must frequently share the locality with *Hypnum uncinatum* and is often greatly intermixed with other Bryophyta, for instance *Polytrichum alpinum*, *Hylocomium* spp., *Lophozia lycopodioides* and *L. quinquedentata*, and several other species. As an example of such a *Racomitrium canescens* heath may be mentioned a slightly inclined gravelly flat near Holt in South Iceland, about 400 me-



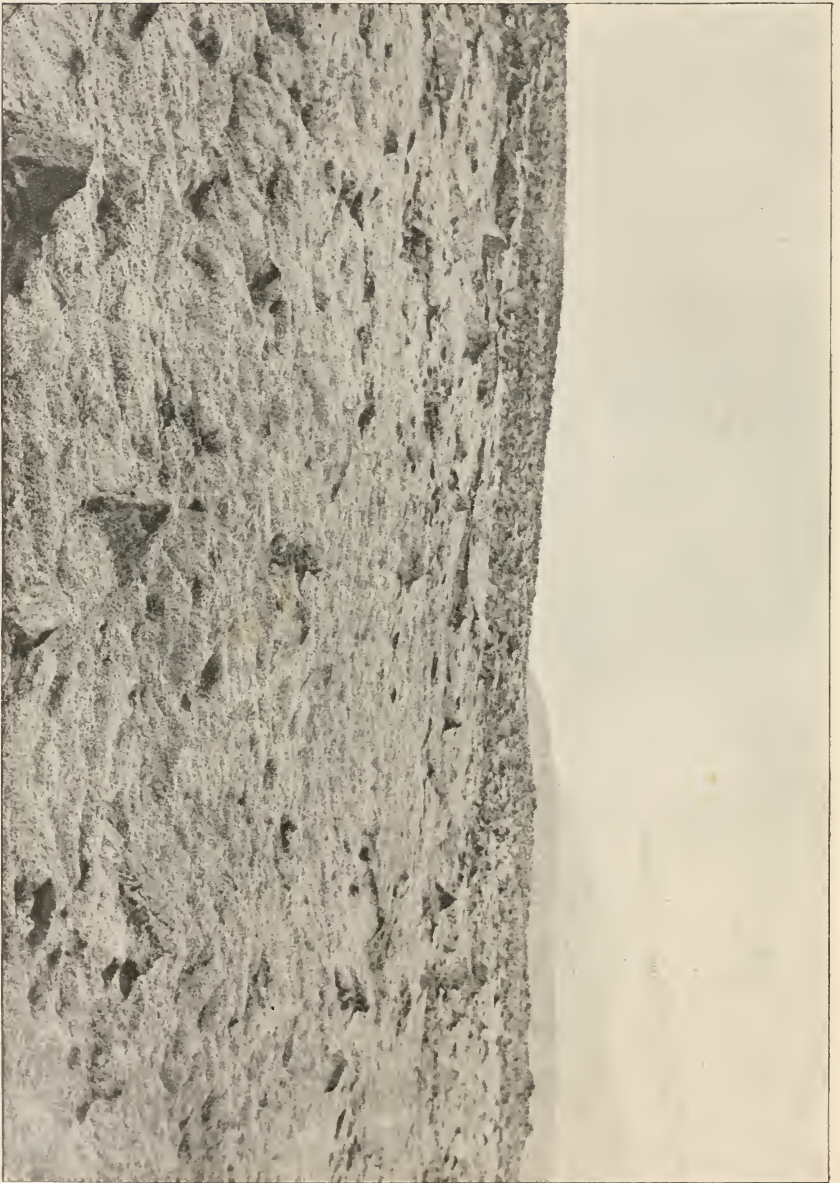


Fig. 27. *Rhacomitrium hypnoides* heath near Mådravellir (Egja), at an altitude of about 500 metres.

tres above sea-level, which was covered with a continuous carpet of *R. canescens*, in which *Hylocomium parietinum*, *Dicranum Starckeii*, *Conostomum boreale*, *Lophozia alpestris* and *L. lycopodioides* occurred scantily interspersed (Fig. 28).



Fig. 28. *Rhacomitrium canescens* heath near Holt in South Iceland. In the background is seen one of the deep clefts with vertical sides, so common in this district.

Near Hof in SE. Iceland there was a horizontal, somewhat damp gravelly flat covered with a continuous moss-carpet, of which the chief species were *Rhacomitrium canescens* and *Hylocomium proliferum*, abundantly mixed with *Hylocomium parietinum*, *H. rugosum*, *H. squarrosum* and *Hypnum uncinatum*. Spread about in the moss carpet there grew *Dicranum scoparium*, *D. congestum*, *Ditrichum flexicaule*, *Tortella tortuosa*, *Polytrichum juniperinum*, *P. alpinum* and *Aulacomnium turgidum*. *Conostomum boreale* was common and occurred in small, compact tufts, usually interwoven with *Lophozia ventricosa*, *Gymnomitrium concinnatum*, *Anthelia* and species of *Cephalozia*, and on prominent knolls of earth *Diphyscium sessile* in association with *Gymnomitrium concinnatum* formed compact blackish-brown coverings. *Aulacomnium turgidum* occurred abundantly in several spots, more or less intermixed with *Hylocomium squarrosum*, *Hypnum uncinatum* and *Rhacomitrium canescens*, and formed carpets. Spread about in the moss carpet grew numerous



*Juncus* and *Carex* tufts, and this formation must most nearly be termed a transitional form between moss-heath and meadow-land. On the whole, *Rhacomitrium canescens* thrives best in Iceland on somewhat damp ground, under quite similar conditions as *Aulacomnium turgidum*.

The Mixed Moss-heath (*Hylocomium-Rhacomitrium* heath) occurs especially on slightly inclined gravelly flats, under similar conditions as the heather moor, and is, as a rule, a pioneer for the latter. It may, however, also develop into a grass or herb slope, where the ground is wetter. The chief species of this moss carpet are *Rhacomitrium canescens*, *R. hypnoides* and species of *Hylocomium*, but as a rule many other species are found intermixed with these.

In a moss-heath near Mödruvellir (Esja), on a slightly inclined gravelly flat, at an altitude of about 100 metres, the chief species of the Bryophyte carpet were *Hylocomium proliferum*, *Rhacomitrium hypnoides*, *R. canescens* and *Hypnum uncinatum*; more scantily occurred: *Hylocomium loreum*, *H. squarrosum*, *Climacium dendroides*, *Antitrichia curtipendula*, *Brachythecium albicans*, *Polytrichum alpinum*, *P. urnigerum*, *Timmia austriaca*, *Pohlia cruda*, *Ditrichum flexicaule*, *Bartramia ityphylla*, *Distichium montanum*, *Ptilidium ciliare*, *Frullania Tamarisci*, *Lophozia lycopodioides*, *L. quinquedentata* and *L. quadriloba*. Scattered in the Bryophyte carpet grew a few flowering plants such as *Anthoxanthum* and *Galium verum*, and this moss-heath will undoubtedly develop into grassland.

On a flat interspersed with stones at an altitude of about 400 metres the Bryophyte carpet was composed of *Rhacomitrium hypnoides* abundantly mixed with *R. canescens*, *Hylocomium parietinum*, *Hypnum uncinatum* and *Dicranum Starckeii*. As an intermixture in the Bryophyte carpet occurred: *Timmia austriaca*, *Pohlia commutata*, *Distichium montanum*, *Lophozia quinquedentata*, *L. quadriloba*, *L. alpestris*, *Plagiochila asplenioides*, *Blepharostoma trichophyllum*, *Anthelia Juratzkana*, *Alicularia scalaris*, *Cephalozia pleniceps* and *C. bicuspidata*. Flowering plants were almost entirely absent.

On prominent knolls of earth occurring on heathland and grassland, on dry ledges and slopes, a very peculiar Bryophyte covering is often found: low, very compact cushions of *Diphyscium sessile* in connection with several liverworts, especially *Gymnomitrium concinatum*, are found covering the soil with a very dense

brownish-black carpet. *Conostomum boreale* also — usually interwoven with liverworts such as *Gymnomitrium concinnatum*, *Lophozia ventricosa*, *Pleuroclada albescens* and species of *Cephalozia* — forms exceedingly compact cushions on dry, stony ground. Both these species grow in particularly exposed localities, where the snow-covering is absent during winter, but their compact tufts, densely covered with tomentum to an unusual degree, protect them from being destroyed by strong winds. *Diphyscium* forms quite low (only one cm. high), but rather wide tufts, while *Conostomum* forms tufts a few cm. in diameter, but often more than 10 cm. in height. In the latter case the basal portion of the tuft is securely wedged into the gravelly substratum and attached to the stones with numerous rhizoids. *Diphyscium* is found at all levels, while *Conostomum* is most widely distributed on the rocky flats, but in the low land occurs only somewhat scantily in the heath formation.

### The Bryophyte Vegetation of the Rocks.

The rock vegetation includes formations of very various composition, with extremely different demands as regards light, moisture, etc. The substratum may consist of solid rock, for instance rock-faces, flats or large blocks, or it may consist of detached stones of various sizes, as on gravelly and stony slopes and on taluses. The distribution of the water is very unequal, since a quite dry part with decidedly xerophilous species may be met with next to a part where the water flows over the rock, and provides conditions for the growth of hygrophilous species.

The chemical and physical nature of the substratum exercises great influence upon the composition of the Bryophyte covering. On tuff and breccia the vegetation is far more luxuriant than on basalt, and the reason for this is partly because the uneven surface of the tuff affords better habitats for the plants, partly because the water penetrates into the tuff comparatively easily, and afterwards reappears through the fissures and porose parts of the rock-surface so that these are, as a rule, rather damp. The greater or smaller amount of lime present is also of importance for the frequency of many species. The direction of the exposure and the conditions pertaining to shelter play a great part with regard to the Bryophyte vegetation. Species growing on exposed rock-faces and flats must be able to endure complete desiccation by the sun during the summer, and by strong winds during the winter, while

the Bryophytes of the clefts and Urds live in a comparatively humid atmosphere and are protected by the snow-covering during the winter. The conditions pertaining to light are also of importance with regard to the composition of the Bryophyte vegetation. On the ground between the stones of the talus, grow other species than those to be found upon the stones. Caves and dark clefts contain species which belong specially to these localities, and the vegetation on vertical surfaces or slopes with a southern exposure is different to that found on the same kind of ground with a northern exposure.

Owing to the extremely different conditions to which plants are exposed when growing on rocks, all kinds of associations are met with there, from decidedly xerophilous to hygrophilous, light-forms, and species which thrive best in dark caves. The rocky substratum may be compared to a mosaic pavement, in which each particular piece of homogeneous conditions is exceedingly small.

The mosses grow partly on the rock itself (lithophytes) and partly in soil which has accumulated in fissures and depressions, or on ledges (chomophytes). The boundary line between these two groups has, however, been effaced to a great extent as many of the lithophytes proper also occasionally grow on gravel or even on soil, and it is not always possible to decide whether a moss-cushion has originally developed on humus-covered rock, or has itself formed humus by a process of decay. Especially on mountain heights the two groups merge one into the other, as species such as *Andreaea petrophila*, *Dicranoweisia crispula*, *Racomitrium fasciculare* and *R. sudeticum*, which in low-lying regions are decidedly lithophytes, descend to the ground on mountain heights and often form extensive growths on rocky flats. The following species may be referred to the lithophytes proper (those marked \* are common):

#### Species belonging to Coastal Rocks.

\**Ulota phyllantha*

\**Schistidium maritimum*

#### Water Lithophytes.

\**Schistidium rivulare*

\**Fontinalis longifolia*

\**Fontinalis antipyretica*

\**Rhynchostegium rusciforme*

— *androgyna*

\**Hypnum ochraceum*

— *thulensis*

— *alpinum*

— *islandica*

— *alpestre*

## The remaining Lithophytes.

* <i>Metzgeria furcata</i>	* <i>Rhacomitrium fasciculare</i>
* <i>Radula complanata</i>	* — <i>aciculare</i>
<i>Gymnomitrium coralloides</i>	<i>Hedwigia albicans</i>
* <i>Madotheca Cordæana</i>	* <i>Orthotrichum rupestre</i>
<i>Frullania fragilifolia</i>	— <i>anomalum</i>
* <i>Andræa petrophila</i>	— <i>saxatile</i>
* <i>Anæctangium compactum</i>	— <i>cupulatum</i>
<i>Weisia crispata</i>	— <i>Sturmii</i>
* <i>Dicranoweisia crispula</i>	— <i>Killiasii</i>
* <i>Blindia acuta</i>	— <i>Blyttii</i>
<i>Bryoxiphium norvegicum</i>	— <i>lævigatum</i>
<i>Tortula obtusifolia</i>	<i>Leucodon sciuroides</i>
— <i>muralis</i>	<i>Neckera complanata</i>
<i>Schistidium confertum</i>	<i>Leskea nervosa</i>
<i>Grimmia commutata</i>	* <i>Pterigynandrum filiforme</i>
— <i>alpestris</i>	<i>Lescuræa patens</i>
— <i>Doniana</i>	<i>Isothecium myurum</i>
— <i>ovata</i>	— <i>tenuinerve</i>
— <i>incurva</i>	* <i>Homalothecium sericeum</i>
— <i>patens</i>	<i>Thamnium alopecurum</i>
— <i>funalis</i>	<i>Hypnum Bambergeri</i>
* — <i>torquata</i>	* — <i>revolutum</i>
* <i>Rhacomitrium sudeticum</i>	* — <i>cupressiforme</i>
* — <i>heterostichum</i>	

In addition to the species mentioned above there are a great number of other species which are of equal frequency on bare rocks and on humus-covered rocks. To this group belong for instance *Haplozia atrovirens*, *Diplophyllum albicans*, *Amphidium Mougeotti*, *Hymenostylium curvirostre*, *Schistidium* spp. and *Hypnum hamulosum*.

To the chomophytes may be reckoned a numerous group of species which partly contain the chomophytes proper, i. e. species which properly speaking belong to humus-covered rock-ledges or to clefts, and partly a great number of species which are as frequently met with in other formations. The following species may be regarded as belonging to the chomophytes proper: —

<i>Reboulia hemisphærica</i>	* <i>Haplozia pumila</i>
<i>Sauteria alpina</i>	<i>Lophozia heterocolpos</i>
<i>Fimbriaria pilosa</i>	<i>Tortula mucronifolia</i>
<i>Fegatella conica</i>	* <i>Encalypta rhabdocarpa</i>
<i>Preissia commutata</i>	* — <i>ciliata</i>
<i>Haplozia riparia</i>	* <i>Amphidium lapponicum</i>
* — <i>atrovirens</i>	<i>Hymenostylium curvirostre</i>

<i>Sælania cæsia</i>	* <i>Orthothecium chryseum</i>
<i>Anomobryum filiforme</i>	— <i>intricatum</i>
* <i>Plagiobryum Zierii</i>	<i>Eurhynchium strigosum</i>
<i>Bryum œneum</i>	— <i>Swartzii</i>
— <i>pallescens</i>	* <i>Plagiothecium pulchellum</i>
— <i>capillare</i>	— <i>depressum</i>
* <i>Mnium orthorrhynchum</i>	— <i>Ræseanum</i>
— <i>serratum</i>	* <i>Amblystegium Sprucei</i>
— <i>stellare</i>	<i>Hypnum hamulosum</i>

Among the species met with here, which however cannot be reckoned to the chomophytes proper, the following are the most frequent: *Bartramia ityphylla*, *Pohlia cruda*, *Bryum inclinatum*, *B. ventricosum*, *Oncophorus virens*, *O. Wahlenbergii*, *Didymodon rubellus*, *Distichium montanum*, *Schistidium apocarpum*, *S. gracile*, *Ditrichum flexicaule*, *Philonotis tomentella*, *Marchantia polymorpha*, *Lophozia* spp., *Scapania curta*, *S. subalpina* and *Blepharostoma trichophyllum*.

**Stony and Gravelly Slopes.** The Bryophyte vegetation is, as a rule, rather poor in species, and not very characteristic. *Racomitrium* heaths are common where the slope is not too steep, but stony and gravelly slopes are often almost bare of vegetation, only here and there occur some cushions of *Dicranoweisia crispula* and species of *Racomitrium*.

A Stony Slope near Grunnavik in NW. Iceland consisted of large blocks at the foot, and in the upper and steeper part of smaller stones. Vegetation was absent at the top, but increased in abundance lower down as the ground gradually become more level, and the conditions thereby became more stable. Scattered among the stones grew plants of the rocky flat, for instance *Salix herbacea*, *Papaver radicum*, *Oxyria digyna*, *Sibbaldia procumbens* and in the shelter afforded by larger stones *Athyrium alpestre*, *Alchemilla alpina*, etc. Upon the stones grew *Racomitrium hypnoides*, *R. fasciculare* and *Dicranoweisia crispula* and on the ground between the stones *Brachythecium reflexum*, *Hypnum uncinatum*, *Lescuræa patens*, *L. filamentosa*, *Hylocomium squarrosus*, *Polytrichum alpinum*, *Dicranum fuscescens*, *Lophozia ventricosa*, *L. lycopodioides* and *Anthelia julacea*.

**Stony Slope near Berufjördur.** On the steep somewhat damp slope there grew *Racomitrium fasciculare*, *Schistidium gracile*, *Dicranoweisia crispula*, *Lescuræa decipiens*, *Heterocladium squarrosulum* and *Timmia austriaca*.



Talus of fallen blocks and débris (Urd). The conditions for the development of plants is far more favourable here than on the stony slope, which is constantly exposed to disturbances through the down-sliding of stones and earth. The most xerophilous species, viz. species of *Racomitrium* and *Grimmia*, *Dicranoweisia crispula*, *Orthotrichum rupestre* and *Hypnum revolutum* grow on the stones, while on the ground between the stones there are favourable conditions for a number of species which have greater requirements with regard to shelter, moisture and shade. The Urd is therefore very rich in species, since lithophilous species are found there on the blocks, and species, which grow on the ground, occur between the stones, and Bryophytes belonging to heathland and grassland, are found on the soil-covered stones and ledges.

In order to show how heterogeneous the composition of the Bryophyte vegetation may be, the Urd in HeljUSDalur on Vestmannaey may serve as an example. The valley is almost semicircular in shape, and open towards the south, and in consequence of this favourable situation combined with the comparatively mild, damp climate of the island, a considerable number of southern species are found there, while species such as *Ulota maritima* and *Schistidium maritimum* betoken the proximity of the sea. The rocks around the valley are inhabited by numerous sea-fowls, and they often rest on the blocks of the Urd, and on these spots, manured by the birds, it is species of *Bryum* (*B. argenteum* and *B. capillare*) which particularly make their appearance.

The fallen blocks are everywhere covered with cushions of mosses and liverworts. The commonest species are *Schistidium apocarpum*, *Ulota maritima*, *Hypnum cupressiforme*, *H. uncinatum*, *Orthotrichum rupestre* and *Ceratodon purpureus*. The following species were also observed on the blocks: *Radula complanata*, *Madotheca Cordeana*, *Plagiochila asplenioides*, *Cephaloziella Hampeana*, *Didymodon rubellus*, \**Barbula cylindrica*, *Tortella tortuosa*, *T. fragilis*, *Tortula subulata*, \**T. mucronifolia*, *Distichium montanum*, \**Orthotrichum anomalum*, *Encalypta ciliata*, *E. rhabdocarpa*, *Pohlia cruda*, *Bryum capillare*, *B. elegans*, *B. inclinatum*, *B. aeneum*, *Mnium serratum*, *M. stellare*, *M. orthorrhynchum*, *Myurella julacea*, *Orthothecium intricatum*, \**Isothecium myurum*, *Homalothecium sericeum*, *Amblystegium Sprucei*, \**A. serpens*, *Hypnum hamulosum* and *H. revolutum*. In the caves formed among the stones, into which the light penetrated but scantily, the walls were covered with light-green shining mats

of *\*Plagiothecium depressum*, the ground between the blocks was covered with a thick, dark-green carpet of *Hypnum uncinatum*, *Hylocomium squarrosum*, *Brachythecium salebrosum*, *\*Eurhynchium Stockesii*, *Plagiothecium Roeseanum*, *\*Thuidium tamariscinum*, *T. abietinum*, *\*Mnium undulatum*, *Ditrichum flexicaule*, *Dichodontium pellucidum*, *\*Lophocolea cuspidata*, *\*L. minor* and *Lophozia quinque-dentata*. On the soil-covered grassy ledges and slopes, between the stones, grew *Brachythecium albicans*, *B. salebrosum* (in masses), *Climacium dendroides* (in abundance), *Camptothecium lutescens*, *Hylocomium proliferum*, *H. parietinum* (sparingly) and *Mnium affine* (in abundance).

All the species marked \* are southern forms the majority of which have only been found in South Iceland. On the whole, the Urd affords favourable habitats for many species which do not thrive in more exposed localities.

On a dry Urd consisting of large blocks of basalt, near Holt, in South Iceland, the following species were growing: — *Rhacomitrium fasciculare*, *R. heterostichum*, *R. hypnoides*, *Grimmia Doniana*, *Schistidium apocarpum*, *Andreæa petrophila*, *Antitrichia curtispindula*, *Hypnum uncinatum*, *Hylocomium loreum*, *H. proliferum*, *H. parietinum* and *Frullania Tamarisci*.

Almost the same species are found on larger detached blocks. On blocks of lava round about Reykjavik there grew particularly *Rhacomitrium heterostichum*, *R. fasciculare*, *Andreæa petrophila*, *Schistidium apocarpum*, *Grimmia Doniana* and *Dicranoweisia crispula*.

On larger stones in the home-field (Tunet) near Vallanes (East Iceland) there grew *Pterigynandrum filiforme*, *Hypnum revolutum*, *Tortula ruralis* and *Encalypta rhabdocarpa*. Some large blocks near Hafursholt in South Iceland were quite overgrown with *Grimmia alpestris*. On some large blocks of basalt near Seljaland there grew *Grimmia Doniana*, *Rhacomitrium fasciculare*, *R. hypnoides*, *R. sudeticum*, *Dicranoweisia crispula* and *Gymnomitrium coralloides*.

The Vertical Rock-belts. Owing to the division into layers peculiar to the basalt, the mountain sides consist of numerous vertical scarps of varying height, alternating with slopes formed by fallen blocks and debris. As a rule, the first 100—200 metres of the mountain form a slope which is only slightly inclined at the bottom and becomes steeper higher up, and where only here and there small portions of the primitive rock protrude. This slope is limited by a precipitous rock-face of very varying height, sometimes ris-

ing to a height of several hundred metres, right up to the plateau on the mountain top, but usually divided into numerous steps, consisting of shelves or ledges of varying breadth. The rock-face is here and there intersected by deep fissures and clefts, excavated by the downward-flowing water, which partly drains away in



Fig. 29. Face of basalt rock (E. Iceland). Everywhere in the crevices small, black, moss-cushions (*Andreaea*, *Dicranoweisia crispula* and *Grimmia* spp.).

these channels, partly spreads over the ledges and from thence flows down the rock-faces or penetrates into the crevices of the rock, and then reappears once more further down. Consequently, the conditions pertaining to moisture vary greatly, and therefore the moss-covering also. As some examples will best show the composition of the latter, the following are given: —

1. Esja, low damp rock-face just above the slope:

*Philonotis tomentella*, *Mnium punctatum*, *M. orthorrhynchum*, *Amphidium Mongeottii*, *A. lapponicum*, *Anæctangium compactum*, *Didymodon rubellus* and *Schistidium gracile* grew abundantly in extensive cushions. *Lescuræa filamentosa* was found abundantly at the basal part of the rock-face. *Pohlia cruda*, *Bartramia ityphylla*, *Plagiothecium pulchellum*, *Myurella julacea*, *M. tenerrima*, *Radula complanata*, *Haplozia atrovirens* and *Marchantia polymorpha* grew partly in small tufts, partly intermixed with other species in the tufts formed by them.

2. Botnsdalur, Hvalfjörður: damp rock-face. The base of the rock-face, up to a height of about a few metres, was covered with extensive cushions of *Hypnum cupressiforme*, *H. molluscum*, *Brachythecium glareosum*, *Orthothecium chryseum*, *Philonotis tomentella* and *Distichium montanum*. Where the rock-face was wet with the downward-oozing water, large patches of it were covered with *Anomobryum concinnum*. Partly in the crevices of the rock-face, partly scattered in the tufts there occurred *Amblystegium Sprucei*, *Bryum pallescens*, *B. inclinatum*, *Lophozia quinquedentata*, *L. Mülleri*, *Blepharostoma trichophyllum* and *Aneura pinguis*.

3. Berufjörður, rock-face, where the water was oozing down from the ledge above: *Hypnum alpestre*, *Orthothecium chryseum*, *Blindia acuta*, *Onchophorus Wahlenbergii*, *Plagiopus Oederi*, *Philonotis fontana*, *Distichium montanum*, *Myurella julacea*, *M. tenerrima*, *Scapania subalpina*, *Lophozia quinquedentata*, *Haplozia atrovirens* and *H. cordifolia*.

4. Seydisfjörður, dry rock face with a northern exposure. On the dry rock face itself there grew: *Pterigynandrum filiforme*, *Homalothecium sericeum*, *Grimmia funalis*, *G. torquata*, *Hypnum revolutum* and *Orthotrichum rupestre*. The basal part of the rock-face was much weathered, presenting numerous crevices and small ledges. There grew: *Hypnum revolutum*, *H. filicinum*, *Orthothecium chryseum*, *Plagiothecium pulchellum*, *P. Roeseanum*, *Myurella julacea*, *M. tenerrima*, *Amphidium Mongeottii*, *Mnium orthorrhynchum*, *Bartramia ityphylla*, *Pohlia cruda*, *Plagiobryum Zierii*, *Meesea trichoides*, *Orthotrichum Blyttii*, *Distichium montanum*, *Distichium flexicaule*, *Fissidens osmundoides*, *Schistidium confertum*, *Didymodon rubellus*, *Metzgeria furcata*, *Blepharostoma trichophyllum* and *Odontoschisma elongatum*.

5. Akureyri, dry rock-face, 350 metres above sea-level. The rock-face was covered with extensive mats of *Homalothecium sericeum* and *Pterigynandrum filiforme* mixed with cus-



hions of *Grimmia funalis*, *Hypnum revolutum*, *Rhacomitrium heterostichum* and *Orthotrichum rupestre*. On the basal and somewhat damper portion of the rock-face there grew *Gymnostomum rupestre*, *Philonotis tomentella*, *Orthothecium chryseum*, *Hypnum uncinatum*, *Distichium montanum*, *Ditrichum flexicaule*, *Amphidium lapponicum*, *Pohlia cruda*, *Bartramia ityphylla*, *Ceratodon purpureus*, *Tortella tor-*



Fig. 30. *Grimmia torquata* on one of the sides of Flokastadagil.

*tuosa*, *Lophozia quinquedentata*, *L. quadriloba* and everywhere on the ledges large cushions of fruiting *Tortula ruralis*.

The two last quoted examples are typical of the vegetation of dry rock-faces. *Homalothecium sericeum* occurs there almost always, and is often dominant on exposed rock-faces as far upwards as 400—500 metres above sea-level, *Pterigynandrum* is also extremely common, especially in the low land. *Grimmia funalis* is rarely absent and often forms very large and deep, fruiting tufts, and especially in South Iceland *G. torquata* is extremely common and often covers large portions of the rock-faces with its irregularly-rounded cushions (Fig. 30).

6. Low, much weathered and fissured basalt rocks near Hof in SE. Iceland. On the top of the rocks it was espe-



cially *Racomitrium hypnoides* which grew abundantly on débris produced by disintegration. On the rocks there grew *Hypnum cupressiforme*, *H. revolutum*, *H. imponens*, *Pterigynandrum filiforme*, *Leskea nervosa*, *Racomitrium fasciculare*, *R. heterostichum*, *Grimmia funalis*, *G. Doniana*, *Schistidium apocarpum*, *S. confertum*, *Dicranoweisia crispula*, *Andreaea petrophila*, *Orthotrichum rupestre*, *O. Sturmii*, *Gymnomitrium coralloides*, *Frullania Tamarisci*, *Radula complanata*, *Metzgeria furcata* and at the base of the rock, *Madolthea Cordæana*. A southern rock-face was covered with *Leucodon sciuroides* var. *morensis*. In clefts and crevices and on soil-covered ledges there grew *Mnium orthorrhynchum*, *M. stellare*, *Pohlia cruda*, *Encalypta ciliata*, *E. rhabdocarpa*, *Bartramia ityphylla*, *Dicranum Andersonii*, *Distichium montanum*, *Ditrichum flexicaule*, *Didymodon rubellus*, *Amphidium lapponicum*, *Plagiochila asplenioides*, *Marsupella Funckii* and *Lophozia alpestris*.

The locality just described comes nearest to that known in Iceland as "Holt", *i. e.* low, stony ridges or protruding masses of rock in the low land. The vegetation upon these "Holts" is generally xerophilous in character and is, as a rule, not so rich in species as is the vegetation mentioned above. The ridges are usually more or less covered with soil which bears heath-vegetation, or are occupied by gravelly flats, therefore the Bryophyte vegetation consists chiefly of species belonging to heathland or grassland (*Hylacomium* spp., *Polytrichum alpinum*, *P. juniperinum*, *P. pilosum*, *Hypnum uncinatum*, *Frullania Tamarisci*, *Racomitrium* spp., etc.), while directly upon the rocks there grow species such as *Hypnum cupressiforme*, *H. hamulosum*, *H. revolutum*, *Orthotrichum* and *Grimmia* spp., and in the crevices *Bartramia*, *Pohlia cruda*, *Amphidium lapponicum*, *Mnium orthorrhynchum*, *Myurella*, *Distichium montanum* and other of the species found in rock-clefts in greater or smaller quantities.

### The Bryophyte Vegetation of the Tuff Rocks.

The reason why the Bryophyte vegetation of the tuff rocks is here treated in a separate section is that the life-conditions of the plants are essentially different on a basalt and on a tuff substratum. Tuff consists of consolidated fine-grained material (volcanic ash and dust) through which are scattered larger and smaller blocks of rock. While the basalt has a smooth surface, with fissures and depressions only here and there, the surface of the tuff is uneven and

rough, and therefore offers more favourable conditions to the mosses for attaching themselves to it. When a basalt and a tuff surface occur side by side, as is often the case, the difference is very obvious. Mosses grow more scantily on basalt, since it is distinctly seen that the majority of the tufts are situated in, or proceed from,



Fig. 31. Tuff cleft (Bleiksúgíl) near Barkarstadr.

a fissure, while tuff surfaces are often covered with a continuous moss-carpet, composed of many different species. It is also a fact of great importance that the water which flows down from above, and atmospheric humidity, are available to the mosses of basalt surfaces only as long as the water is flowing or is deposited, while the tuff is able to absorb water through its porous surface, and thus has a constant supply of necessary moisture for the vegetation. Owing to the slight power of resistance of the tuff against the ero-



Fig. 32. Side of tuff-cleft near Barkarstadr. At the foot of the cleft, among others *Mnium undulatum* grew abundantly. On the sides there grew *Hypnum filicinum* (at the top, to the right), *Fegatella conica* (in the middle and to the left), *Philonotis fontana*, *Mniobryum albicans* and many other mosses.

sive action of water, many more clefts and caves with damp surfaces are met with here than on the basalt, and these provide ideal habitats for a great number of mosses.

Tuff deposits of volcanic origin are found in many places in



Iceland, but the reason why in the following only the Bryophyte vegetation of South Iceland is mentioned, is because it is only this part of Iceland that has been somewhat thoroughly investigated.

Fljótshlíð. North of the great river Markarfljót, the country rises to a height of 200—600 metres. The slope stretching downwards to the Markarfljót is trenched by a great number of smaller streams, many of which flow at the bottom of deep, narrow clefts in the tuff-layers.

One of the longest and deepest clefts is Bleikságil near Barkarstadr (Fig. 31). This cleft has almost everywhere vertical or overhanging sides, 100 or more metres in height, and is so narrow at the top that in some places goats can jump across it. It is therefore quite inaccessible for the greater part of its length, hence only its lower part has been investigated. The sides were there usually covered with enormous mats of mosses of which the principal species were *Hypnum falcatum*, *H. filicinum*, *H. molluscum*, *Brachythecium rivulare* and *Philonotis fontana*, all of which were developed to an unusually luxuriant degree. *H. falcatum* and *H. filicinum* were in many places thickly covered with ripe capsules.

In this moss carpet a great number of other Bryophyta were found, partly intermixed with each other, partly in larger or smaller tufts or growths. The following species were observed: *Philonotis tomentella*, *Bryum aeneum*, *B. pallens*, *B. ventricosum*, *B. inclinatum*, *Mniobryum albicans*, *Mnium serratum*, *M. punctatum*, *Anomobryum filiforme*, *Encalypta ciliata*, *Didymodon rubellus*, *Barbula cylindrica*, *Distichium montanum*, *Hymenostylium curvirostre*, *Anæctangium compactum*, *Amphidium Mongeottii*, *A. lapponicum*, *Haplozia riparia*, *H. cordifolia*, *Lophozia quinqueidentata*, *L. Mülleri*, *Scapania irrigua*, *Blepharostoma trichophyllum*, *Madotheca Cordwana*, *Radula complanata*, *Metzgeria furcata* and *Marchantia polymorpha*. At the base of the rock-side grew, among others, *Mnium undulatum* and *Thuidium tamariscinum*. At the extreme end of the cleft, where the sun could shine on the rock faces, fruiting specimens of *Preissia commutata* often grew in abundance. The walls in the numerous caves were often covered with *Eurhynchium Swartzii* and *Fegatella conica*, in company with many, or a few, of the species found on the sides of the cleft, which, however, on the whole, did not thrive well in the scanty light. In many places *Fegatella* formed also a belt along the basal part of the rock-sides, especially where they projected. On the roof of the caves *Blepharostoma trichophyllum* and *Ambly-*

*stegium Sprucei* formed thin, dark-green coverings, and where the water flowed down the roof and walls *Thamnium alopecurum* occurred as pure growths.

A similar vegetation was found everywhere in clefts and caves, and where the conditions pertaining to light and moisture were more varying, the number of the species was still greater than in the vegetation described above. This was for instance the case in the deep and broad Flokastadagil near Breidabolstadr. There, on the damp walls, almost the same species were growing as in

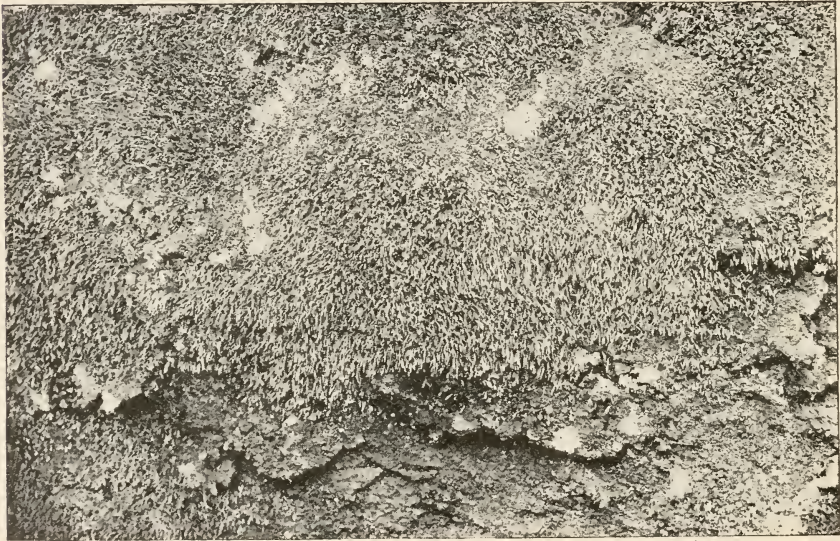


Fig. 33. *Bryoxiphium norvegicum* on one of the sides of Flokastadagil.

Bleikságil. A high, dry, perpendicular rock-face was for a considerable distance entirely covered with a shining, dark-green mat of *Bryoxiphium norvegicum* (Fig. 33), which has hardly been found elsewhere in such enormous quantities. In other places *Grimmia torquata* covered the rock-sides and blocks with its irregularly-rounded cushions, and *Hypnum palustre* was very common everywhere at the water's edge. *Neckera complanata* was common in dry ditches.

At the side of a small waterfall, Klitnafoss, there was a rather large cave, down one side of which some of the water from the waterfall was running. There *Thamnium alopecurum* grew abundantly, while the drier walls of the cave were covered with *Eurhynchium Swartzii* and *Mnium orthorrhynchum*. On the ground at the



bottom of the cave there grew *Tinmia austriaca*, *Bryum ventricosum*, *Brachythecium rivulare*, *Thuidium delicatulum* and *Marchantia polymorpha*, and at the entrance to the cave where the water was dripping down, *Mnium undulatum* occurred. The upper part of the walls and the roof were covered with *Blepharostoma trichophyllum*, *Amblystegium Sprucei*, *Metzgeria furcata* and *Radula complanata*, and in the better-lighted part around the entrance, the cave was covered with *Homalothecium sericeum* and *Orthothecium intricatum*.

The Southern Slope of Eyjafjall consists partly of basalt and partly of tuff-layers. The numerous rivers which issue from the Jökull usually flow at the bottom of deep, narrow clefts in the tuff-layers.

Holtsá, which is a glacier-river of rather considerable size, flows for almost its entire course, from the Jökull down to the low land, at the bottom of deep clefts which are accessible only in a few places, the water usually rising from the bottom up to the perpendicular rock-wall. The sides are, as a rule, rather damp, and the water from the slopes above often flows down the rock-faces. The Bryophyte vegetation is extremely luxuriant, and the sides of the clefts are, for considerable distances, covered with enormous carpets of mosses and liverworts. The following species covered the fallen blocks and débris at the base of the cleft-sides: *Hylocomium* spp. (especially *H. squarrosum* and *H. proliferum*), *Hypnum stellatum*, *Acrocladium cuspidatum*, *Climacium dendroides*, *Eurhynchium Stokesii*, *Thuidium tamariscinum*, *Mnium undulatum*, *M. punctatum*, *Tinmia austriaca*, *Marchantia polymorpha*, etc. In the numerous open caves and under overhanging rocks, a characteristic vegetation of *Marchantiaceae* was found. *Preissia comnutata* (fr.) and *Fegatella conica* covered the sides with metre-broad mats, and *Reboulia hemisphaerica* occurred abundantly in several places, and was also fruiting. Here *Eurhynchium Swartzii* also was at home, especially on the less damp rock-faces, while *Thamnium alopecurum* preferred spots where the water was flowing down. Where streamlets were running from above down the rock-sides, there grew *Rhynchostegium rusciforme*, *Brachythecium rivulare*, *Haplozia cordifolia* and, lowermost, *Thamnium*, while the more or less damp rock-faces were covered with a variegated carpet of mosses and liverworts, unusually rich in species and composed of *Hypnum filicinum* (in masses), *H. falcatum* (in masses), *H. molluscum* (in masses), *Philonotis tomentella*, *P. fontana* (in abundance), *Mnium serratum*, *M. stel-*

lare, *M. orthorrhynchum*, *Bryum aeneum*, *B. inclinatum*, *B. pallescens*, *B. ventricosum*, *Mniobryum albicans* (common), *Pohlia cruda*, *Plagiobryum Zierii*, *Anomobryum filiforme* (in one place in fr.), *Amphidium Mougeotii*, *A. lapponicum*, *Anaëctangium compactum*, *Hymenostylium curvirostre*, *Blindia acuta*, *Ditrichum flexicaule*, *Distichium montanum*, *Barbula cylindrica*, *Didymodon rubellus*, *Tortella tortuosa*, *T. fragilis*, *Grimmia apocarpa*, *Myurella julacea*, *Haplozia riparia*, *H. atrovirens*, *Madotheca Cordwana*, *Lejeunea serpyllifolia*, *Radula complanata*, *Metzgeria furcata*, *Chiloscyphus polyanthus*, *Lophocolea cuspidata* (scanty), *Scapania irrigua*, *Lophozia quinquedentata*, *L. Mülleri* and *Aneura pinguis*. The moss-carpet covering dry rock-faces and large blocks was chiefly composed of *Hylocomium loreum* (also in fr.), *H. proliferum*, *Hypnum uncinatum*, *H. hamulosum* and *H. callichroum*. In a dry cave above the cleft there grew *Neckera complanata*, *Brachythecium populeum*, *B. velutinum*, *Plagiothecium denticulatum*, *P. depressum*, *Isothecium tenuinerve*, *Mnium cuspidatum*, and on the roof of the cave there grew *Amblystegium Sprucei* and *Blepharostoma*.

The southern side of Drángshlidarfjall and the small neighbouring group of mountains, Hrótafjall (Fig. 34), consist, in a great measure, of dry, lofty faces of tuff-rock, as much as 200 metres high, the base of which is moss-grown. One of the commonest species here is *Leucodon sciuroides* var. *morensis* which covered the rock-face for a considerable distance upwards with its extensive and often richly-fruited mats. The following species were also common: *Homalothecium sericeum*, *Pterigynandrum filiforme*, *Hypnum revolutum* and *Grimmia torquata*. At the foot of the rock-faces there grew *Isothecium myurum* (in abundance), *Orthotrichum rupestre*, *Didymodon rubellus*, *Barbula cylindrica*, *Bryum capillare*, *Tortella tortuosa*, *Encalypta ciliata*, *Neckera complanata*, *Myurella julacea* and *Metzgeria furcata*, and where the water was oozing through cracks and crevices the rock-face was covered with *Blindia acuta* intermixed with *Hypnum molluscum*, *H. palustre* and the rare *Anomobryum concinatum*.

Among the large blocks of tuff on a small Urd there grew, among others, *Mnium undulatum*, *Eurhynchium piliferum*, *Rhynchostegium murale* (abundantly), *Amblystegium Juratzkanum*, *Leskea nervosa* and *Lejeunea cavifolia*.

The walls in the interior of a rather dry, open cave, were covered with *Preissia commutata*, *Fegatella conica*, *Marchantia polymorpha*, *Distichium montanum*, *Bryoxiphium norvegicum*, *Anaëctangium*

*compactum* (all in abundance), *Reboulia hemisphaerica*, *Mnium orthorrhynchum*, *Funaria hygrometrica*, *Bryum aeneum*, *B. inclinatum*, *Orthothecium intricatum*, *Blepharostoma trichophyllum* and, where it was somewhat damper, with *Eurhynchium Swartzii*.



Fig. 34. Hrútafell south of Eyjafjallajökull. The perpendicular face of tuff-rock in the centre, is about 200 metres high, and, at the foot is covered with extensive moss carpets, whilst caves occur in many places.

A very interesting kind of vegetation was found on the dry faces of a small isolated rock, Drángshellir. There grew *Leucodon sciuroides* var. *morensis*, *Homalothecium sericeum*, *Leskea nervosa*, *Grimmia Doniana*, *Barbula muralis*, *B. obtusifolia*, *Orthotrichum anomalum* and *O. rupestre*. Half of these species consist of xerophilous southern forms, which have their northern limit in South Iceland, and are there met with only in specially protected localities. Drángshlid, which has a height of 478 metres, protects this locality

from the cold, north winds, without, however, preventing the sun from warming the tuff-faces.

### The Bryophyte Vegetation of the Lava-fields.

A very great part of Iceland is covered with lava. According to Thoroddsen (1914, p. 219) the post-glacial lava-fields of Iceland cover an area of about 11,200 square km. or almost  $\frac{1}{9}$  of the entire area of the island. It is, however, only a very small part of this vast area which has been an object of bryological investigation. Grönlund (1874, p. 136 and 1890) was the first to mention the vegetation of the lava-fields, in his description of the *Rhacomitrium* heath as important for the further development of the plant covering. Ostenfeld (1898, p. 246) has given a description of the lava-fields of the peninsula of Reykjanes without, however, entering more closely into the subject of the Bryophyte vegetation. Helgi Jónsson (1900, p. 89) has given a very detailed account of the vegetation of Búdahraun and Eldhraun in West Iceland, also with regard to the Bryophyta, and the same author, in his description of the vegetation of South Iceland, mentions the Bryophyte vegetation of several lava-fields, especially modern ones. Lastly, A. Wegener in 1912 made a few collections on the high-lying Odáðahraun (600—1200 metres above sea-level).

Besides a small part of Mývatnshraun, around the farm Reykjahlid, which was very superficially investigated owing to the inclemency of the weather, my own investigations include only the lava-fields of SW. Iceland, especially Hafnarljáðarrhraun, Thingvallahraun and Svinahraun around Kolvidarhol.

The lava-field is no single formation, but, on the contrary, includes a great number of different formations, ranging from the dry rock-flats and the *Rhacomitrium* heath, through the heather moor and grassland to the bog formations in the deepest hollows, and the associations of damp rocks in clefts. When it is nevertheless described here in a separate section, as by Helgi Jónsson, the reason is that the vegetation of the lava-fields of the lowlands everywhere presents so many common features and peculiarities that we may be justified in describing the Bryophyte vegetation occurring there.

According to the nature of the surface, the lava-fields may be classified into two groups, viz. block-lava (Icelandic *Apalhraun*) and sheet-lava (Icelandic *Helluhraun*). The former consists of blocks of



lava thrown together into irregular heaps, while sheet-lava consists of large, irregularly broken surfaces, which are formed by a process of slow solidification, and are furrowed by innumerable clefts and fissures, both narrow and broad. Here vesicular hollows are also found, produced by the moisture of the substratum which has formed large steam-vesicles in the molten lava, and after solidification the



Fig. 35. Lava-field in the district of Borgarfjörður. The lava is covered to a depth of one foot with a layer of *Racomitrium hypnoïdes*. Projecting parts of the lava are covered with crustaceous lichens. Here and there a tuft of *Festuca ovina*. Birch coppice in the background.

roof of the vesicle has collapsed, and has formed a platform on the floor of the cavity. Such vesicles in the lava — which are characterized by very luxuriant vegetation, since they afford excellent shelter for the plants, and are inaccessible to sheep — may differ rather greatly in depth, according to the thickness of the lava-sheet. In Budahraun, according to Jónsson, their depth averages from 2—6 metres, but is usually somewhat above 2 metres, and in Hafnarfjardarrhraun the depth was also usually some 2 metres. The lava-fields are often furrowed by deep clefts or cracks, frequently of considerable length and with perpendicular sides. This is, for instance, the case in Thingvallahraun where the best-known cleft, Almannagjá, has a length of almost 15 kilometres.



The surface of the lava-field is very dry, because the water can easily drain away through the cracks, therefore, the vegetation there is decidedly xerophilous. As a rule, the *Racomitrium* heath (*R. hypnoides*) — in which other Bryophyta, such as *Dicranum scoparium*, *Hylocomium proliferum* and *Plilidium ciliare*, occur only extremely scantily — covers the greater part of the lava-fields, and there arrives at its fullest development, so that extensive areas may be found covered with foot-deep, soft, greyish carpets which hide all irregularities of the surface. The importance of the moss-covering for the further development of the plant-covering, partly by binding the drifting sand, partly by forming soil, has been demonstrated by Grönlund and Helgi Jónsson.

The chief reason for the extensive distribution of the moss-heath must undoubtedly be sought in the nature of the surface. This is, as a rule, highly vesicular, and contains numerous small holes and cavities, in which the plants find good conditions for taking root. Therefore, many of these cavities are filled up with small moss-cushions (Fig. 36), which, from thence, extend over the rock-surfaces and gradually merge into one another (Helgi Jónsson, 1900, p. 83).

The tops of the lava-cones and the protruding blocks are not covered with a continuous moss-carpet, but usually with scattered cushions of mosses, liverworts and lichens. The most frequent species there are *Racomitrium heterostichum*, *R. fasciculare*, *Grimmia apocarpa*, *G. funalis*, *Andreaea petrophila*, *Hypnum revolutum*, *Homalothecium sericeum*, *Pterigynandrum filiforme*, *Dicranoweisia crispula*, and occasionally *Gymnomitrium coralloides*, *G. concinatum*, *Dicranum fulvellum*, *Racomitrium sudeticum*, *Polytrichum pilosum*, besides which there are several other species. Thus, near Hafnarfjörður (and partly also in Búdahraun), in addition to the majority of the species mentioned above, there occurred *Orthotrichum rupestre*, *O. Sturmii*, *Grimmia patens*, *Leucodon sciuroides* var. *morensis*, *Isothecium tenuinerve* and *Frullania Tamarisci*. Near Thingvellir, where the surface of the lava is very dry, there grew upon the lava-cones many crustaceous lichens, *Racomitrium fasciculare* (in abundance), *Grimmia apocarpa*, *Andreaea petrophila*, *Polytrichum pilosum* and, here and there, some *Gymnomitrium coralloides* and *Dicranum fulvellum*; and, where some soil had accumulated, *Ceratodon purpureus* and *Pohlia nutans* grew scantily. In the depressions *Racomitrium hypnoides* was gradually replaced by *R. canescens*, heather moor and grassland, and in the deepest depressions small patches of bog and

swamp vegetation may occur. The *Racomitrium* heaths are gradually transformed into heather moors and birch coppices through the decaying of the mosses and their forming humus. But all these



Fig. 36. The surface of a lava block with small moss-cushions (*Andreaea*, *Grimmia* spp. and *Gymnomitrium coralloides*).

formations will not be treated of more fully here as the mosses occurring in them have been mentioned in previous sections. Very extensively distributed and very characteristic is the *Racomitrium-canescens* formation which often replaces *R. hypnoides* in flat depressions where the ground is somewhat damp, and where some sand has accumulated. It is often abundantly mixed with other Bryophyta such as *Hylocomium* spp., *Hypnum uncinatum*, *Dicranum scoparium*, *Polytrichum alpinum* and species of *Lophozia*.

Lava-clefts. The caves, clefts and cavities which occur everywhere in the lava-fields contain a Bryophyte vegetation very rich in species. In the broader clefts and in the lava-vesicles (Helgi Jónsson's "Herb-cavities", 1900, p. 90) the bottom is often covered



Fig. 37. Lava-cleft near Thingvellir (Almannagjá). The lava-blocks are quite covered with *Racomitrium hypnoides*.

with ferns and flowering plants, and especially in deeper clefts, or where the bottom is covered with loose blocks, there is also found a continuous carpet of mosses and liverworts in which *Hylocomium* spp. (*H. proliferum*, *H. parietinum*, *H. loreum*, *H. squarrosum* and *H. triquetrum*) together with species of *Racomitrium*, *Hypnum* and *Dicranum* play a prominent part, and are usually much interwoven with liverworts such as *Lophozia lycopodioides*, *L. quinquedentata*, *L. Kunzeana*, *Cephalozia* spp., *Alicularia scalaris*, *Ptilidium ciliare*, etc.



Very frequently a large form of *Hypnum callichroum*, with regularly two-rowed ramification, is the most abundant constituent of the vegetation, especially in somewhat damp and shady clefts. *Eurhynchium piliferum* is often met with very abundantly, especially where



Fig. 38. Lava-cleft near Thingvellir. At the bottom there is a very luxuriant vegetation of ferns, *Geranium silvaticum*, etc., and in the crevices large moss-cushions occur everywhere.

the bottom is grass-covered, and several other southern forms, for instance *Eurhynchium Stockesii* and *Isothecium myurum*, likewise have a preference for the sheltered lava-clefts.

In the very deep lava-clefts the conditions are somewhat different from the aforesaid. Where the cleft is broad enough to allow the sun to shine on the bottom during a part of the day, a luxuriant covering of ferns, flowering plants or mosses is found (Fig. 38); but where the cleft is so narrow that the light is strongly subdued, the

higher plants and the *Hylocomium* mats do not thrive. The snow lies here till far into the summer, and in many cases the temperature hardly ever rises above freezing point. The bottom of these clefts is therefore either quite bare of vegetation, or covered only with mosses. At the bottom of narrow clefts (15—20 metres or more in depth) near Thingvellir, where snow and ice were still to be found even at the end of July, *Anthelia* occurred on a damp substratum as they do on flats irrigated by melting snow on mountain heights. *Polytrichum sexangulare* and *Pohlia commutata* grew abundantly here as on rocky flats. The plants were considerably higher and more slender than on the rocky flats, and only slightly tomentose. The same was the case with *Conostomum boreale* and *Mniobryum albicans*, which likewise occurred in several clefts. The Bryophyte vegetation occurring there is affected both by the low temperature and also the deficient light and total absence of wind, which all combined contribute to produce a stronger longitudinal growth and a slighter development of rhizoids. Several other species, which have their main distribution on mountain heights, and are rare in or quite absent from the lowlands, are widely distributed about the lava-fields. In almost all the lava-fields of South-west Iceland, *Pleuroclada albescens* var. *islandica*, *Dicranum molle*, *D. Blyttii* and *D. Starckeii* are commonly found in clefts, not only in those that are narrow, but especially in the broad moss-grown clefts, where *Dicranum* spp. form large tufts on the blocks of lava.

On the sides of the clefts and of the fallen blocks, a great many mosses grow. *Diplophyllum albicans* is a character-plant of the lava-fields of SW. and W. Iceland; it is extremely common there, but is very rare and scanty in other localities. On the vertical, dry sides of clefts the mosses usually grow in large rounded cushions. The commonest species are *Tortella tortuosa*, *Anæctangium compactum*, *Amphidium Mougeotii*, *Grimmia torquata* and *G. funalis*, but many other of the species occurring on rocks and on the ground are always found both on the walls and also on, and among, the blocks. The Bryophyte vegetation of lava-clefts has the greatest resemblance to that found on the Urd, but some of the most light-loving species are absent, for instance *Orthotrichum*, several *Grimmia* and *Rhacomitrium* spp. and *Dicranoweisia crispula*, while, on the other hand, others are found which belong to damp clefts or which need more shelter. Mesophilous forms are in the majority, whilst hygrophilous forms are, as a rule, entirely absent.



In the following pages some examples of the Bryophyte vegetation of lava-clefts will be described.

Thingvallahraun. The lava-clefts (Icelandic Gjá) there, are peculiar on account of their unusual depth (as much as 20—30 metres). Several of those situated nearest to the lake of Thingvellir have deep water at the bottom.

The Bryophyte carpet at the bottom of the clefts is composed of *Hylocomium loreum*, *H. proliferum*, *H. parietinum*, *H. squarrosum*, *Hypnum uncinatum*, *H. callichroum*, *H. stramineum*, *H. molluscum*, *Eurhynchium piliferum*, *Antitrichia curtispindula*, *Polytrichum alpinum*, *Racomitrium hypnoides*, *R. canescens*, *Dicranum Blyttii*, *D. Starckeii*, *D. molle*, *Sphagnum teres*, *S. Girgensohnii*, *Lophozia ventricosa*, *L. quinquedentata*, *L. Kunzeana*, *L. alpestris*, *Ptilidium ciliare* and *Scapania irrigua*. On the sides of the clefts there grew especially *Anæctangium compactum*, *Grimmia torquata*, *G. funalis*, *Gymnostomum rupestre*, *Amphidium Mougeottii* and *A. lapponicum*. Intermixed with these, and in cushions on the ledges, in the crevices and among the blocks there grew: *Hypnum cupressiforme*, *Isothecium tenuinerve*, *Plagiothecium pulchellum*, *P. denticulatum*, *P. silvaticum*, *Amblystegium Sprucei*, *Neckera complanata*, *Schistidium gracile*, *Racomitrium sudecticum*, *Sælania cæsia*, *Ditrichum flexicaule*, *Tortella tortuosa*, *Fissidens osmundoides*, *F. bryoides* (rare), *Pohlia cruda*, *P. commutata*, *Bartramia ityphylla*, *Conostomum boreale*, *Philonotis tomentella*, *Mnium orthorhynchum*, *Bryum pallens*, *Plagiobryum Zierii*, *Distichium montanum*, *Diplophyllum albicans* (in abundance), *Lophozia heterocolpos*, *Lejeunea cavifolia*, *Blepharostoma trichophyllum*, *Alicularia scalaris*, *A. geoscypha*, *Anthelia Juratzkana*, *Scapania subalpina*, *Pleuroclada albescens* var. *islandica*, *Cephalozia bicuspidata*, *Eucalyx subellipticus*, *Gymnomitrium concinnatum*, *Metzgeria furcata*, *Radula complanata*, *Aneura pinguis* and *Preissia commutata*.

The above list is very long, but is nevertheless hardly complete, since some of the common chomophytes are not enumerated in it, and, at any rate, several of them were undoubtedly forgotten, while the list was being made on the spot, but it gives a good idea of the exceedingly great number of species which are found in these localities.

Hafnarfjardarhraun. Almost the same species are found there as in Thingvallahraun, but the situation close to the sea-side makes its influence felt. *Racomitrium heterostichum* and *R. fasciculare* are exceedingly common, and in several places *Ulota maritima*

occurs on lava-blocks and *Trichostomum littorale* on the sides of the clefts. *Scapania dentata* was frequent on the ground at the bottom of shady, damp clefts. *Reboulia hemisphaerica* and *Frullania fragilifolia* were found in a single spot on the walls of caves.

On the ground at the bottom of deep, dark caves, shade-forms are often found, especially of *Hepaticæ*, with greatly elongated shoots and expanded, widely scattered leaves. Here, it was especially the following species which were common: *Cephalozia bicuspidata*, *Pleuroclada albescens* var. *islandica*, *Alicularia scalaris* and *Blepharostoma trichophyllum*, occasionally also *Preissia commutata* and in a single spot *Ditrichum homomallum* and *Oligotrichum hercynicum*.

Svinahraun is situated about 30 km. south-east of Reykjavik, and about 250—300 metres above sea-level. The part which has been investigated is situated in the neighbourhood of the farm Kolvidarhol, and is of block-lava consisting of blocks and flags piled up into wild-looking heaps, some 10 metres high, with numerous clefts and caves. The top part is covered with an unusually thick and luxuriant mat of *Rhacomitrium hypnoides* from which other mosses and flowering plants are almost absent. On the walls there grew *Amphidium Mougeotii*, *Tortella tortuosa* and *Anæctangium compactum*. In caves and clefts there was a Bryophyte carpet consisting of *Hypnum uncinatum*, *H. callichroum*, *Hylocomium loreum*, *H. proliferum*, *H. parietinum*, *Lophozia quinqueidentata*, *L. lycopodioides*, *L. Flærckeï*, *Plagiochila asplenioides* and *Ptilidium ciliare*. *Diplophyllum albicans* was extremely common everywhere. In addition to the above the following were found more or less abundantly: *Polytrichum alpinum*, *Diphyscium sessile*, *Bartramia ityphylla*, *Conostomum boreale*, *Mnium orthorrhynchum*, *Pohlia cruda*, *P. commutata*, *Mniobryum albicans*, *Bryum elegans*, *Amphidium lapponicum*, *Rhacomitrium sudeticum*, *Schistidium gracile*, *Fissidens osmundoides*, *Dicranum scoparium*, *Distichium montanum*, *Sphagnum teres*, *Lophozia alpestris*, *L. quadriloba*, *Alicularia scalaris*, *Anthelia Juratzkana* and *Blepharostoma trichophyllum*.

It will be seen that the lava-fields here described greatly resemble each other, and that it is essentially the same species which constitute the bulk of the vegetation in all of them. Svinahraun is situated on the ridge of hills which extends along the whole length of the peninsula of Reykjanes, and the climate there is extremely cold and damp, which is proved by the fact that it is the *Rhacomitrium* heath which forms the last stage in the development

of the vegetation of the flats, and that many of the species of the low land are absent.

Unfortunately there was no opportunity of investigating the lava-fields of West Iceland more closely, since unfavourable atmospheric conditions with rain and fog, combined with a want of time, made a longer stay there impossible, but the conditions appear to be essentially the same as in South-west Iceland.

In his description of Búdahraun Helgi Jónsson has also mentioned some mosses, and, as far as is possible to judge from the lists which, however, are no doubt incomplete, the conditions there are exactly like those in Hafnarfjardarhraun. There also coastal species are found, for instance *Ulota maritima*, and southern species such as *Eurhynchium Stockesii* and *Lejeunea cavifolia*, and the dominant species are quite similar to those in the lava-fields of South-west Iceland.

In North Iceland the Bryophyte vegetation of the lava-fields has an essentially different composition from that in West and South-west Iceland. All the lava-fields there are situated at a distance from the coast, and at a higher level above the sea, the vegetation is therefore decidedly xerophilous both on exposed surfaces and in clefts and crevices. The immense lava-flats at a great height above sea-level, are deserts almost entirely void of vegetation; they have, however, been very little investigated. There are to hand only a few collections from Koch's tour across Odáðahraun in 1912, and these consist only of *Tortula ruralis*, *Ceratodon purpureus* and *Dicranoweisia crispula*, which grew here and there upon the lava.

The only lava-field which has been investigated is Mývatns-hraun, which is about 160 years old, and upon which the farm Reykjahlid stands. It was described by Grönlund in 1890 and does not appear to have undergone any great change since that time. The *Rhacomitrium* heath occurred only scantily in the depressions, while the lava-cones were bare of vegetation or covered with scattered moss-cushions and crustaceous lichens. In the intervening space between the farm and the lake the following species were observed: Upon the blocks and on the lava were found *Tortula ruralis*, *Ceratodon purpureus*, *Rhacomitrium hypnoides*, *Grimmia Doniana*, *Schistidium confertum*, *Dicranoweisia crispula*, *Polytrichum pilosum* and *Hypnum revolutum*, all of which were very common. In sandy soil, especially in depressions, there grew *Desmatodon latifolius* and *Rhacomitrium canescens*. In dark caves and clefts *Lophozia*

*lycopodioides* was usually the only species found and it formed there extensive mats. On the ground among the blocks and on the sides of these blocks as also on those of broad clefts there grew *Brachythecium reflexum*, *Lescurea filamentosa*, *Eurhynchium diversifolium* (scantly), *Polytrichum alpinum*, *Timmia austriaca*, *Bartramia ityphylla*, *Encalypta rhabdocarpa*, *Bryum elegans*, *B. inclinatum*, *Schistidium apocarpum*, *Didymodon rubellus* and *Plagiochila asplenioides*.

The above is a decidedly xerophilous flora from which not only all the mesophilous and hygrophilous forms from SW. Iceland, but also the lowland or southern forms proper, are entirely absent.

In several places in this lava-field the heat of the substratum makes itself felt in deep caves and clefts. In a warm, damp cave where the temperature was about 25° (outside 4°-5°) there grew *Fissidens osmundoides*, *Plagiothecium denticulatum*, *Calypogeia Trichomanis*, *Plagiochila asplenioides* and *Sphagnum rubellum*.

The development of the Bryophyte vegetation of the lava-fields has been very little investigated. The Bryophyta together with the lichens are the first plants which appear. The surface of the lava is very rough, consisting of small round cavities (lava vesicles) in which the spores find favourable conditions for germination, and form small rounded cushions which adhere very closely to the substratum and, if conditions are favourable, extend over the entire surface of the lava as a continuous carpet. It is, however, only in the most exposed parts of the lava-field, that the mosses are confined to the vesicles; this is not the case in the clefts.

Jónsson (1905, pp. 55 and 56) has given a description of Krakatindshraun near Hekla, a lava-field about 23 years old. The mosses grew there only in tiny, scattered cushions upon the lava, without anywhere forming continuous carpets; down in the clefts they grew somewhat more abundantly. There the following species were found: *Bartramia ityphylla*, *Pohlia cruda*, *P. commutata*, *Bryum pallens*, *Bryum* spp., *Ceratodon purpureus*, *Dicranoweisia crispula* (the commonest species), *Rhacomitrium hypnoides*, *R. canescens*, *Scapania curta* and *Lophozia alpestris*. The further development is exceedingly slow. On the flats *Rhacomitrium hypnoides* will usually grow over all the species and suppress them, but the formation of a continuous *Rhacomitrium* heath appears to require a very long time, in many cases, centuries, and the further development of the moss-heath into heather moor, birch coppice or other formations, through the decay of the mosses and their forming soil, undoubtedly takes place even more slowly.



## II. THE BRYOPHYTE VEGETATION OF MOUNTAIN HEIGHTS.

In "Vegetationen paa Snæfellsnes" (Helgi Jónsson, 1900) the plant formations of mountain heights are classified into three groups, viz., Rocky flat, *Grimmia* heath and Mountain bogs. Of these the *Grimmia* heath (*Racomitrium* heath) has already been described in a previous section.

### Rocky Flat.

By Rocky Flat Jónsson understands that part of the country which is situated above the upper limit of the heather moor (and the birch), with the exception of the mountain bogs and the *Racomitrium* heath. Its surface varies greatly, and consists sometimes of gravelly or clayey flats, sometimes of horizontal or sloping stony tracts, bare rocks or talus of débris, all of which, however, have one characteristic in common, viz., that higher plants do not form any continuous carpet, but grow scattered singly or in small societies in the most sheltered localities. The lower limit of the rocky flat varies greatly according to the local conditions. It generally begins at an altitude of about 300—400 metres, but often typical rocky-flat formations are met with at far lower levels, in NW. Iceland, for instance, as far down as to the sea-level.

Bryophyta play a very prominent part in the vegetation of the rocky flat, and are often dominant there, or form special Bryophyte associations.

The dry, gravelly flats are poor in plants, and are often quite devoid of vegetation. Of mosses, as a rule, only *Racomitrium hypnoides* is met with in scattered cushions, especially around somewhat large stones, where it can hold fast, and find some shelter. In somewhat damper and less exposed localities *Racomitrium* heaths are developed as in the lava-fields of the low land, but whilst the mosses in the low land gradually make room for other plant associations by accumulating the blowing sand around them, and by forming humus, this is not the case on the rocky flat. Here flowering plants occur extremely scantily in the *Racomitrium* heath, which therefore forms the final stage in the development of the plant-covering, and is not replaced by other formations.

On large stones on the rocky flat there grew jet-black cushions of *Andreæa petrophila*, *Dicranoweisia crispula*, *Racomitrium fasciculare*, *R. sudeticum* and *Schistidium apocarpum*.



On somewhat damper gravelly ground, especially where large blocks lie scattered and afford shelter, the Bryophyte vegetation becomes richer, so that here we sometimes find a continuous carpet of mosses and liverworts, through which the tops of the stones protrude. This carpet of mosses and liverworts is usually composed of a larger or smaller number of the following species: *Hylocomium proliferum*, *Hypnum uncinatum*, *Brachythecium reflexum*, *Lescuræa Breidlerii*, *Racomitrium hypnoides*, *R. fasciculare*, *R. sudeticum*, *R. canescens*, *Schistidium apocarpum*, *S. gracile*, *Bryum ventricosum*, *Pohlia commutata*, *P. cucullata*, *P. gracilis*, *Philonotis fontana*, *Conostomum boreale*, *Dicranum Blyttii*, *D. molle*, *D. Starckeii*, *D. congestum*, *Polytrichum sexangulare*, *Oligotrichum hercynicum*, *Lophozia alpestris*, *L. quinquedentata*, *L. ventricosa*, *L. lycopodioides*, *L. Flørckei*, *L. quadriloba*, *Alicularia scalaris*, *A. geoscypha*, *Pleuroclada albescens*, *Anthelia Juratzkana* and *Gymnomitrium concinnatum* besides some rare or more casual species, for instance *Eurhynchium diversifolium*, *Brachythecium glaciale*, *Aulacomnium turgidum*, *Bryum elegans*, *Bartramia ityphylla*, *Pohlia Ludwigii*, *Didymodon rubellus*, *D. rufus*, *Desmatodon latifolius*, *Dislichium montanum*, etc. Usually several species grow intermixed, but the moss carpet may also be formed by a single species or a few. At elevations above 500—600 metres *Racomitrium sudeticum* often forms extensive growths on gravelly flats. Flowering plants are entirely absent, but lichens (*Cetraria islandica*, *Cladonia* spp. and *Stereocaulon condensatum*) may occur abundantly in this moss carpet. In the more low-lying parts of the rocky flat *Racomitrium sudeticum* rarely occurs abundantly, but is replaced by *Schistidium gracile* and *Schistidium apocarpum*, which form low, blackish-brown or reddish-brown mats. *Lescuræa Breidlerii* is a common species, especially in NW. Iceland, where it is in many places the most abundant constituent of the vegetation on stony slopes. *Conostomum boreale* is also common, especially in NW. Iceland where, on the dry gravelly flats of the mountain heights, the intervening spaces between the stones are filled up with its compact tufts. *Brachythecium glaciale* in company with *Hypnum stramineum* covered the damp areas of the rocky flat near Isafjörður, at a height of 450—500 metres. In the channels, in which the water is drained away during the melting of the snow, the stones are often entirely covered with *Mniobryum albicans* var. *glacialis*, and in damp spots and near springs *Philonotis fontana* forms light-green cushions, as it does near the "Dý" in the more low-lying tracts. In the following

pages some examples of the rocky-flat vegetation will be given, it is, however, only in NW., SW. and in a few districts of N. and E. Iceland, that this vegetation has been somewhat closely investigated, whilst the whole of the interior high land is quite unknown as far as bryology is concerned.

1. South Iceland. Barkarstadr, dry stony flat at an altitude of 350 metres: Scattered cushions of *Schistidium apocarpum* v. *rufescens*, *Rhacomitrium hypnoides*, *R. fasciculare*, *Dicranoweisia crispula* and *Andreaea petrophila*.

2. Gravelly flat on Esja, at an altitude of about 550 metres: Moss carpet, partly torn up by the wind, composed of *Hypnum uncinatum* and *Schistidium apocarpum*, scattered in which occur rocky-flat plants such as *Silene acaulis* and *Saxifraga oppositifolia*.

3. Akureyri, rather dry gravelly flat, at an altitude of about 900 metres: Moss carpet composed of *Rhacomitrium hypnoides*, *Hypnum uncinatum*, *Hylocomium proliferum*, *Camptothecium nitens*, *Aulaconnum turgidum*, *Dicranum congestum*, *Didymodon rufus*, *Eurhynchium diversifolium*, *Lophozia quinquedentata* and *L. quadriloba*. Flowering plants entirely absent. On a dry slope at an elevation of about 770 metres there grew *Lescuræa Breidleri*, *Brachythecium glaciale*, *B. reflexum*, *Dicranum Starckeii*, *Lophozia lycopodioides* and *L. alpestris*, and on damp gravelly flats near the snow line there grew *Pohlia gracilis* (abundantly), *P. cucullata*, *P. commutata*, *Polytrichum sexangulare*, *Oncophorus virens*, *Dicranum Starckeii*, *Lophozia alpestris*, *L. ventricosa*, *L. quinquedentata*, *L. quadriloba*, *Pleuroclada albescens* and *Anthelia Juratzkana*.

*Salix herbacea*-*Sibbaldia* Vegetation (Helgi Jónsson, 1900, p. 33) occurs everywhere in damp depressions and on slopes where the subsoil consists of a layer of clay. This vegetation has its main distribution from 300—400 metres to about 700 metres, and here, close to the snow line, it is replaced by pure moss-communities, in which *Salix herbacea* occurs but scantily and at last disappears entirely. The moss community consists of a low, dense carpet of mosses and liverworts, interwoven with creeping stems of *Salix herbacea*, so that only the tips of the shoots protrude above the carpet. The most abundant constituent of this moss carpet is usually a low-growing form of *Hypnum uncinatum* or of *Dicranum Starckeii* in association with *Rhacomitrium canescens*, *Dicranum molle*, *Conostomum boreale*, *Polytrichum sexangulare*, *Anthelia Juratzkana*, *Pleuroclada albescens*, species of *Lophozia*, and sometimes other species.

*Anthelia* flats (Helgi Jónsson, 1900). In damp parts of the rocky flat, especially where the snow-water from the melting snow-flats spreads out over the ground, extensive flats of a greyish-black or bluish-black colour are very commonly met with, and these are principally formed of *Anthelia Juratzkana*. Interspersed in this Anthelietum occur several other Bryophyta of which the most frequent are *Alicularia scalaris*, *A. geoscypha* and *Lophozia alpestris*, while scattered plants of *Polytrichum sexangulare*, *Oligotrichum hercynicum* and *Pohlia gracilis* protrude here and there. *Pleuroclada albescens* is also occasionally met with.

Although the *Anthelia* vegetation also occurs in more low-lying tracts, yet it has its main distribution near the snow line, and must therefore be reckoned to the moss associations of the Snow region. There are only a few Bryophyta which occur in the Snow region. At the boundary between the *Anthelia*-flats and the drier gravelly flats *Dicranum falcatum* occurs in semiglobular cushions, densely matted with rhizoids, but it lies so loosely upon the gravel that one can lift up the whole cushion. Near Dýrafjörður *Gymnomitrium varians* grew in a similar manner to *Anthelia*, close to the melting snow-flats. *Dicranum Starckeii*, *D. Blyttii*, *Pohlia cucullata*, *P. commutata*, *Oligotrichum hercynicum* and *Polytrichum sexangulare* are also common near the snow line but, with the exception of a few species (*Dicranoweisia*, *Andreaea* and *Rhacomitrium* spp.) growing on rocks, the list is thereby exhausted.

### Mountain Bogs

are extensively distributed in great parts of Iceland, but have not yet been more closely investigated. The vegetation in the boggy depressions often consists of a low, black mat of *Hypnaceae*, mostly *Hypnum revolvens*, *H. exannulatum*, *H. sarmentosum* and *H. stramineum*; but the moss covering may also contain other species and, in composition, somewhat resemble the bog vegetation of the low land, although the species are fewer in number.

Near Akureyri boggy flats, situated 500—600 metres above sea-level, were partly covered with Hypneta and partly with *Cinclidium stygium* with scattered cushions of *Sphagnum* and species of *Lophozia*. On a wet flat, at an altitude of about 600 metres, there grew *Polytrichum commune* (in abundance), *Hypnum sarmentosum*, *H. stramineum*, *H. Lindbergii*, *H. uncinatum*, *Dicranum Starckeii*, *Sphagnum teres*, *S. Girgensohnii*, *Meesea trichoides*, *Bryum ventricosum*,



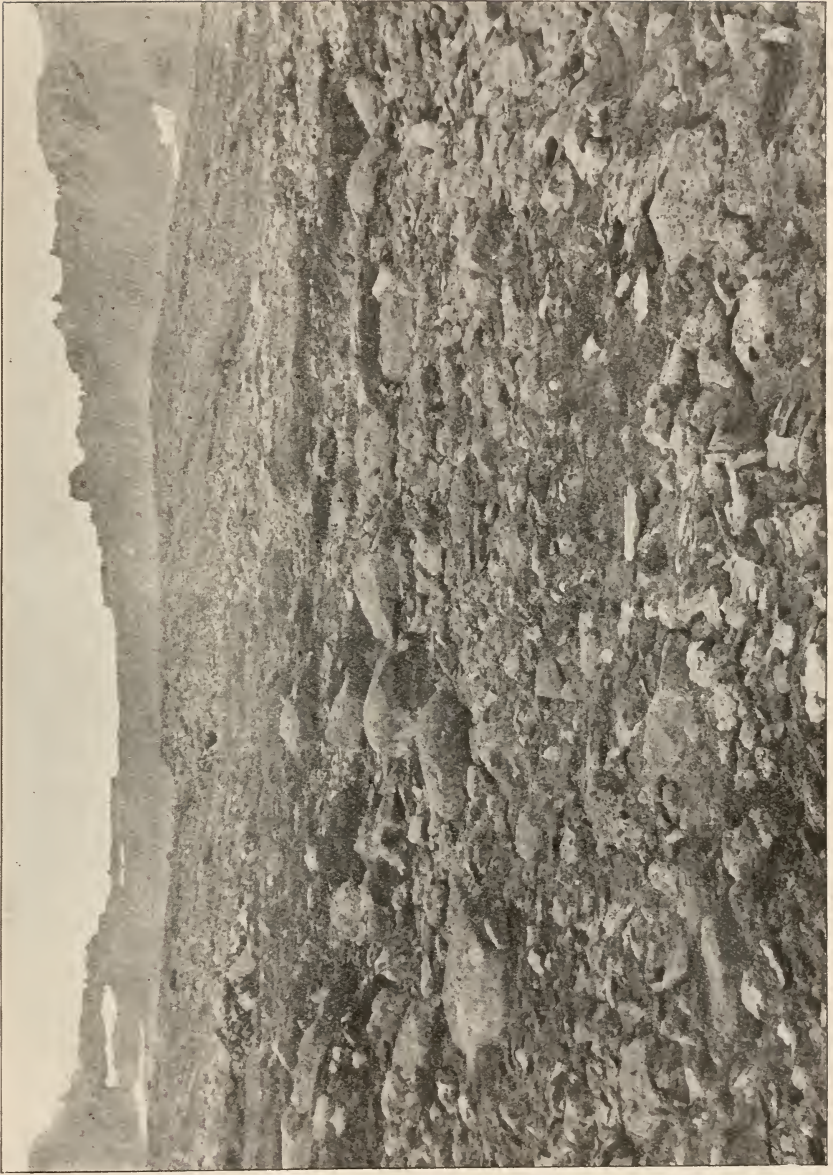


Fig. 39. Rocky flat near Isafjörður, about 500 metres above sea-level. On the larger stones *Rhacomitrium sudeticum* grows in extensive black cushions, and on the ground between the stones *Anthelia* and *Dicranum falcatum* occur

*Dissodon splachnoides*, *Dichodontium pellucidum*, *Aongstræmia longipes* and *Lophozia Kunzeana*.

Barkarstadr (South Iceland). On a tract of knolly bog-land, 530 metres above sea-level, there grew *Hypnum turgescens*, *H.*

*revolvens*, *H. exannulatum*, *H. Richardsonii*, *H. sarmentosum*, *H. polygamum*, *Hylocomium squarrosum*, *Oncophorus Wahlenbergii*, *Dichodontium pellucidum*, *Aongstræmia longipes*, *Bryum ventricosum*, *Pohlia gracilis*, *Dissodon splachnoides*, *Dicranum congestum* (in the *Sphagnum*-tufts), *Sphagnum teres*, *Alicularia scalaris*, *Scapania irrigua* and *Anthelia Juratzkana*.

Judged from a botanical point of view, the interior high land has been very superficially investigated. As regards the mosses, only a few collections are to hand, which were made by A. Wegener during Koch's tour through the island in 1912. But as regards almost all these collections, conditions pertaining to soil and height above sea-level have not been more closely notified.

Hvannalindir (altitude 656 metres): *Hypnum stellatum*, *H. revolvens*, *Philonotis fontana*, *Pohlia commutata* (fr.), *Distichium montanum*, *Splachnum vasculosum* and *Aongstræmia longipes*.

Eyolfsfjall (June 22nd): *Aulacomnium palustre*, *Philonotis tomentella*, *Bartramia ityphylla*, *Bryum ventricosum*, *Cinclidium stygium*, *Timmia norvegica*, *Mnium affine* var. *integrifolium*, *Pohlia cruda*, *Distichium montanum*, *Dichodontium pellucidum*, *Hypnum sarmentosum*, *Amblystegium Sprucei* and *Anthelia Juratzkana*.

Esjufjall. *Racomitrium canescens*, *R. hypnoides*, *Distichium montanum*, *Philonotis tomentella*, *Mnium orthorrhynchum*, *Pohlia cruda*, *Bryum* spp., *Hypnum uncinatum*, *H. revolutum* and *Anthelia Juratzkana*.

Wet Bogs and River banks; June 22nd (without more particular specification of the locality). *Hypnum exannulatum*, *H. Kneiffii*, *Aulacomnium palustre*, *Philonotis fontana*, *P. tomentella*, *Mniobryum albicans* var. *glacialis*, *Pohlia commutata*, *Distichium montanum*, *Schistidium gracile* and *Aongstræmia longipes*.

These lists almost exclusively contain species which are of common occurrence everywhere.



### III. THE COMPONENTS OF THE BRYOPHYTE FLORA.

IN consequence of the geographical situation and climate of the island, the vegetation of Iceland has a composition which corresponds most nearly to that of Scandinavia and South Greenland. With the exception of the species found only in Iceland, there is only one species (*Bryoxiphium norvegicum*) which has not been found in the other parts of Europe, but which has its home in North America, and one species (*Tortula obtusifolia*) which I do not think has been found in Scandinavia. The other species are all common to Iceland and Scandinavia. At present it is not possible to compare the Bryophyte flora of Iceland and Greenland, partly because there is no collective account of the distribution of the species found in Greenland, and partly because the older Greenland collections and lists of species greatly need revision.

The Bryophyta found in Iceland can be arranged in four geographical groups (Arnell and Jensen, 1910, p. 238): —

1. Ubiquitous species, which are almost equally distributed over the whole of North Europe as far as north of the Arctic Circle.
2. Meridional species, which are most frequent in Southern Scandinavia and far rarer in Northern Scandinavia.
3. Boreal species, which are more frequent in Northern than in Southern Scandinavia, and have their main distribution below the tree-limit.
4. Alpine species, which have their main distribution above the tree-limit.

In Table II and in the following Tables the plant-geographical character of the species is denoted by the initial letters u, m, b and a, which are prefixed to the name of the species. Icel. indicates that the plant is known only from Iceland. As already mentioned, the species found only on warm soil — almost all of which belong

to the meridional group — are not included in the present or following sections.

Table I. The Plant-geographical Groups.

	u	m	b	a	Icel.
Hepaticæ .....	28	18	19	22	
Sphagnales .....	11	2	4		
Musci veri .....	93	53	88	86	6
Total...	132	73	111	108	6

Of greatest interest in this connection is the comparatively large group of meridional species, which comprise about  $\frac{1}{6}$  of all the species. According to their distribution in the different districts of Iceland they can be divided as follows: —

a. Found only in the Southern part of Iceland (South Iceland and most nearly adjacent parts of South-east and South-west Iceland).

Reboulia hemisphærica.	Hedwigia albicans.
Fegatella conica.	Orthotrichum anomalum.
Fossombronina Dumortieri.	— saxatile.
Aneura multifida.	— cupulatum.
Marsupella Funckii.	Mnium undulatum.
Jamesoniella autumnalis.	Leucodon sciuroides.
Lophozia excisa.	Anomodon viticulosus.
Lophocolea cuspidata.	Thuidium tamariscinum.
Lepidozia setacea.	— Philiberti.
Frullania fragilifolia.	Isoetecium myurum.
Lejeunea cavifolia.	Scleropodium purum.
Sphagnum papillosum.	Eurhynchium piliferum.
Weisia crispata.	— Swartzii.
— viridula.	— Stockesii.
Trichostomum littorale.	Rhynchostegium murale.
Barbula unguiculata	Plagiothecium depressum.
var. cuspidata.	— elegans.
Tortula muralis.	Amblystegium fluviatile.
— mucronifolia.	Hypnum molluscum.

b. Most common in South Iceland, rarer in the other parts of the island.

Madotheca Cordæana.	Thuidium delicatulum.
Barbula cylindrica.	Thamnum alopecurum.
Mnium serratum.	Rhynchostegium rusciforme.
Catharinaea undulata.	Camptothecium lutescens.
Neckera complanata.	Hypnum commutatum.

c. Found only in a single locality, or in a few localities, in the different parts of Iceland.

Haplozia crenulata.	Bryum bimum.
Lophozia barbata.	Mnium cuspidatum.
Lophocolea minor.	— stellare.
Diplophyllum obtusifolium.	Cylindrothecium concinnum.
Sphagnum angustifolium.	Eurhynchium strigosum.
Dicranum Bonjeani.	Amblystegium serpens.
Trematodon ambiguus.	— Juratzkanum.
Fissidens bryoides.	— trichopodium.
Leptodontium flexifolium.	Hypnum Sommerfeltii.
Barbula fallax.	— Sendtneri.

d. Frequent everywhere, or in large parts of Iceland.

*Radula complanata*. Common in South, East and West Iceland, absent from North Iceland.

*Racomitrium aciculare*. Very common all over Iceland.

*Mnium hornum*. Common, especially in South Iceland, rarer in North Iceland.

*Pogonatum nanum*. Common in several parts of West and South-west Iceland.

*Metzgeria furcata*. Common over the whole of Iceland.

The majority of the meridional species (a = 37 species and b = 10 species) have a decidedly southerly distribution. Of the species belonging to group c only *Lophozia barbata*, *Diplophyllum obtusifolium* and *Bryum bimum* have been found, each in a separate locality in East Iceland. The other habitats are equally distributed over South, West and North Iceland.

Table I shows that there is an almost equal number of Boreal and Alpine species and a somewhat larger number of Ubiquists, but in order to obtain a really comprehensive view of these groups, showing which has the greatest importance with regard to the composition of the vegetation, it is also necessary to investigate how many species with a somewhat high degree of frequency are contained in each group.

If all the species are included, the frequency of which — throughout a larger part of Iceland (besides South Iceland) — is expressed by the figure 3 (see p. 644) or upwards, the number of species contained in each group will be as follows: —

Table II. Species with the Frequency of 3 or upwards throughout a larger part of Iceland.

	u	m	b	a	
Hepaticæ . . . . .	15	3	7	9	
Sphagnales . . . . .	4				
Musci veri . . . . .	55	4	49	24	
Total . . . . .	74	7	56	33	170

Group 1. Ubiquitous species.

* <i>Marchantia polymorpha</i> .	* <i>Cephalozia bicuspidata</i> .
* <i>Aneura pinguis</i> .	* — <i>Hampeana</i> .
* <i>Pellia Neesiana</i> .	* <i>Blepharostoma trichophyllum</i> .
* <i>Alicularia scalaris</i> .	* <i>Ptilidium ciliare</i> .
* <i>Lophozia quinquedentata</i> .	<i>Scapania dentata</i> .
— <i>ventricosa</i> .	* — <i>undulata</i> .
— <i>Mülleri</i> .	* <i>Frullania Tamarisci</i> .
* <i>Plagiochila asplenoides</i> .	
<i>Sphagnum Girgensohnii</i> .	<i>Funaria hygrometrica</i> .
* — <i>teres</i> .	* <i>Leptobryum pyriforme</i> .
— <i>Warnstorffii</i> .	* <i>Pohlia cruda</i> .
— <i>rubellum</i> .	* <i>Bryum inclinatum</i> .
	— <i>argenteum</i> .
<i>Gymnostomum rupestre</i> .	— <i>pallens</i> .
<i>Anœctangium compactum</i> .	* — <i>ventricosum</i> .
* <i>Dicranum scoparium</i> .	* <i>Mnium affine</i> .
— <i>congestum</i> .	— <i>Seligeri</i> .
<i>Ceratodon purpureus</i> .	* — <i>punctatum</i> .
* <i>Ditrichum flexicaule</i> .	<i>Meesea triquetra</i> .
* <i>Didymodon rubellus</i> .	* <i>Aulacomnium palustre</i> .
* <i>Tortella tortuosa</i> .	* <i>Bartramia ityphylla</i> .
<i>Tortula subulata</i> .	* <i>Philonotis fontana</i> .
— <i>ruralis</i> .	<i>Pogonatum urnigerum</i> .
<i>Schistidium maritimum</i> .	<i>Polytrichum juniperinum</i> .
— <i>apocarpum</i> .	<i>Diphyscium sessile</i> .
* — <i>gracile</i> .	<i>Fontinalis antipyretica</i> .
<i>Rhacomitrium heterostichum</i> .	<i>Antitrichia curtispindula</i> .
* — <i>canescens</i> .	* <i>Pterigynandrum filiforme</i> .
* — <i>hypnoides</i> .	* <i>Climacium dendroides</i> .
<i>Amphidium Mougeottii</i> .	<i>Brachythecium albicans</i> .
<i>Ulota maritima</i> .	<i>Plagiothecium Ræseanum</i> .
<i>Orthotrichum rupestre</i> .	* <i>Hypnum stellatum</i> .
<i>Encalypta rhabdocarpa</i> .	* — <i>uncinatum</i> .

*Hypnum exannulatum.	*Acrocladium cuspidatum.
* — filicinum.	*Scorpidium scorpioides.
— — cupressiforme.	*Hylocomium proliferum.
* — Lindbergii.	* — parietinum.
* — stramineum.	* — squarrosum.

## Group 2. Meridional species.

Metzgeria furcata.	Mnium hornum.
Madotheca Cordæana.	Catharinea undulata.
Radula complanata.	Camptothecium lutescens.
*Racomitrium aciculare.	

## Group 3. Boreal species.

*Alicularia geoscypha.	*Cephalozia pleniceps.
*Lophozia lycopodioides.	*Scapania irrigua.
* — Kunzeana.	* — curta.
*Chiloseyphus polyanthus.	
*Andræa petrophila.	Bryum pallescens.
*Dichodontium pellucidum.	* — Duvalii.
*Oncophorus Wahlenbergii.	*Mnium cinclidioides.
* — virens.	*Paludella squarrosa.
Dicranella squarrosa.	*Meesea trichoides.
* — crispa.	*Catoscopium nigrum.
Dicranum Blyttii.	*Philonotis tomentella.
Fissidens osmundoides.	*Timmia austriaca.
*Blindia acuta.	Polytrichum strictum.
*Distichium montanum.	— gracile.
Tortella fragilis.	*Myurella julacea.
Grimmia torquata.	— tenerrima.
*Racomitrium sudeticum.	Lescuræa filamentosa.
* — fasciculare.	Thuidium lanatum.
*Amphidium lapponicum.	*Camptothecium nitens.
Encalypta ciliata.	Brachythecium reflexum.
Dissodon splachnoides.	* — rivulare.
Splachnum sphaericum.	Plagiothecium pulchellum.
* — vasculosum.	*Hypnum polygamum.
*Pohlia gracilis.	* — revolvens.
*Mniobryum albicans.	— Kneiffii.
Bryum purpurascens.	— decipiens.
— lacustre.	* — falcatum.
— affine.	* — giganteum.
— cirratum.	Hylocomium rugosum.

## Group 4. Alpine species.

*Gymnomitrium concinatum.	Pleuroclada albescens.
*Haplozia cordifolia.	Anthelia julacea.
— atrovirens.	* — Juratzkana.
Lophozia quadriloba.	*Scapania subalpina.
* — alpestris.	



* <i>Dicranoweisia crispula</i> .	* <i>Mnium orthorrhynchum</i> .
<i>Aongstrœmia longipes</i> .	<i>Conostomum boreale</i> .
<i>Dicranum falcatum</i> .	<i>Philonotis seriata</i> .
* — <i>Starckeii</i> .	<i>Psilopilum lævigatum</i> .
— <i>molle</i> .	— <i>hercynicum</i> .
<i>Desmatodon latifolius</i> .	* <i>Polytrichum alpinum</i> .
* <i>Schistidium rivulare</i> .	— <i>sexangulare</i> .
<i>Grimmia Doniana</i> .	<i>Amblystegium Sprucei</i> .
* — <i>funalis</i> .	* <i>Hypnum revolutum</i> .
<i>Tetraplodon bryoides</i> .	— <i>alpestre</i> .
* <i>Pohlia commutata</i> .	* — <i>ochraceum</i> .
<i>Bryum arcticum</i> .	* — <i>sarmentosum</i> .

The species to which an asterisk has been prefixed have everywhere, or throughout the larger part of Iceland, the degree of frequency expressed by figure 4 (see p. 644), and consequently they constitute the bulk of the vegetation. Groups 1 and 3 include conjointly 75 (41 + 34) species, while group 4 has 15, and group 2 only one species which is very common everywhere.

#### IV. THE ALTITUDINAL DISTRIBUTION OF THE SPECIES.

THERE are only a few species which are equally common in the low land and on mountain heights. The majority of them are either Lowland forms, which rapidly decrease in frequency above a certain altitude and at last disappear completely, or Alpine forms which have their main distribution at greater heights above sea-level and decrease in frequency downwards. In countries with a continental climate it is, as a rule, not difficult to draw a somewhat sharp limit for the altitudinal distribution of plants, but the conditions for survey are far less favourable in a country like Iceland, where a cold and damp insular climate prevails in the coastal districts. On account of the low summer temperature, the majority of the Alpine species can thrive as far down as the low land, and conversely many of the lowland mosses will be able to establish colonies in favourable localities, which are situated essentially higher than their usual limit of growth. In South Iceland, for instance, I have seen a southern slope, at an altitude of above 500 metres, which was covered with species of *Hylocomium* together with other species belonging to the same formation.

As regards Iceland a fairly distinct boundary line may be drawn between the Lowland and Highland formations by taking the upper limit of the heather moor (and of the birch) as a basis for the classification (Helgi Jónsson, 1895—1899—1900); it is then seen that the upper limit of growth of a very great number of Bryophyta nearly coincides with the upper limit of the heather moor. The upper limit of the heather moor varies somewhat in the different parts of Iceland, and is also in a high degree dependent on local conditions such as shelter, direction of exposure, and conditions pertaining to moisture. In East Iceland the boundary line lies, as a rule, at about 300 metres, and the same is the case in the greater part of South-west, West and North Iceland. Around Mývatn, ac-

According to Thoroddsen's statement, the birch coppices ascend to 550 metres. In North-west Iceland the birch coppices in Dýrafjörður ascend to about 270 metres, and around Isafjardardjup probably not very far above 200 metres. In South Iceland the upper limit of the heather moor generally lies at an altitude of 300—350 metres, but in sheltered valleys both birch coppices and heather moor may be met with at an altitude of above 500 metres. On the whole, the upper limit of the heather moor may, however, be reckoned to lie, on an average, at an altitude of about 300—350 metres.

All that is situated above this limit is in the following designated the Alpine region, since the willow region which occurs in the mountains of Scandinavia and Central Europe is not typically developed in Iceland; not, at any rate, in the coastal districts. The reason for this must in a great measure be sought in the geological structure of the country. The gradually-ascending or terrace-formed land near to the coast rises to a height of 200—300 metres, and from here the mountains almost everywhere shoot abruptly upwards to a height of 600—700 metres, right up to the plateau on the mountain summit, from which again a few peaks or rock-masses protrude. This leaves very little room for vegetation between 300 and 600 metres, with the exception of the valleys, which are, as a rule, very narrow. This is very decidedly noticeable in North-west and East Iceland, where almost everywhere along the coasts, from a quite narrow coast-land, the mountains rise abruptly to an almost constant height of 600 metres, so that only at the head of the valleys do terraces occur at various levels as far upwards as the mountain heights. In North Iceland, especially towards the east, the country rises more gradually up towards the interior high land, and there — at any rate somewhat inland — willow coppices and willow swamps occur also, but their Bryophyte vegetation has been very little investigated.

Taking the above as a basis the vegetation may be classified into zones, according to altitude.

- A. The Lowland region which reaches to the upper limit of the heather moor and the birch.
- B. The Mountain region which includes slopes and flats to a height of about 600 metres.
- C. Alpine Heights (the Snow region) to which is reckoned all that is situated higher than about 600—700 metres. The vegetation there is very poor in species, and is strongly affected

by the severe climate and the snow, which remains over extensive tracts till late in the summer, and saturates the soil with ice-cold snow-water.

In the following table the first column consists of the species which have been found in the Lowland region, the second column the species which have been found in the Mountain region, and the third the species which have been found in the Snow region. A cross (+) indicates that the species has its main distribution in the region in question; a dash (—) indicates that the species in question decreases in frequency and extends to a more or less high level (or low level) in the region in question, and a dot (·) indicates, that the species has been found only in a few places close to the boundary of the region to which it belongs, or that it has, on the whole, been found so scantily that no opinion can be formed with regard to its distribution within the different altitudinal regions.

Table III. The Distribution of the Bryophyta in the different Altitudinal Regions.

	Up to 300 m.	300—600 m.	Above 600 m.		Up to 300 m.	300—600 m.	Above 600 m.
<b>Hepaticæ.</b>				<i>Alicularia scalaris</i> . . . . .	+	+	—
				— <i>geosecypha</i> . . . . .	+	+	+
<i>Sauteria alpina</i> . . . . .	·			<i>Eucalyx subellipticus</i> . . . . .	+	·	
<i>Reboulia hemisphærica</i> . . . . .	+			<i>Haplozia crenulata</i> . . . . .	+		
<i>Fimbriaria pilosa</i> . . . . .	·			— <i>sphærocarpa</i> . . . . .	·	·	
<i>Fegatella conica</i> . . . . .	+			— <i>cordifolia</i> . . . . .	+	—	
<i>Preissia commutata</i> . . . . .	+			— <i>riparia</i> . . . . .	+		
<i>Marchantia polymorpha</i> . . . . .	+	—		— <i>atrovirens</i> . . . . .	+	—	
<i>Aneura multifida</i> . . . . .	+			— <i>pumila</i> . . . . .	·		
— <i>latifrons</i> . . . . .	+			<i>Jamesoniella autumnalis</i> . . . . .	·		
<i>Pellia Neesiana</i> . . . . .	+	·		<i>Sphenolobus minutus</i> . . . . .	·		
<i>Metzgeria furcata</i> . . . . .	+			— <i>politus</i> . . . . .	·		
<i>Blasia pusilla</i> . . . . .	+			<i>Lophozia quinquedentata</i> . . . . .	+	+	+
<i>Fossombronina Dumortieri</i> . . . . .	·			— <i>lycopodioides</i> . . . . .	+	—	·
<i>Gymnomitrium coralloides</i> . . . . .	+	—		— <i>Flørckei</i> . . . . .	+	+	
— <i>concinatum</i> . . . . .	—	+	+	— <i>quadriloba</i> . . . . .	+	+	·
— <i>varians</i> . . . . .	·			— <i>Kunzeana</i> . . . . .	+	+	—
— <i>revolutum</i> . . . . .	·			— <i>barbata</i> . . . . .	+		·
<i>Marsupella Funckii</i> . . . . .	·			— <i>ventricosa</i> . . . . .	+	+	+
— <i>emarginata</i> . . . . .	·	·	·	— <i>Wenzelii</i> . . . . .	+	·	
— <i>aquatica</i> . . . . .	·			— <i>alpestris</i> . . . . .	+	+	+

Table III. The Distribution of the Bryophyta in the different Altitudinal Regions (continued).

	Up to 300 m.	300—600 m.	Above 600 m.		Up to 300 m.	300—600 m.	Above 600 m.
Lophozia excisa .....	.	.	.	Frullania Tamarisci .....	+	.	.
— Schultzii .....	+	.	.	— fragilifolia .....	+	.	.
— Mülleri .....	+	—	.	Madotheca Cordæana .....	+	.	.
— Hornschuchiana .....	+	—	.	Lejeunea cavifolia .....	+	.	.
— heterocolpos .....	+	—	.				
Gymnocolea inflata .....	.	.	.	<b>Sphagnales.</b>			
Plagiochila asplenioides .....	+	—	.	Sphagnum medium .....	+	.	.
Leptoscyphus anomalus .....	.	.	.	— papillosum .....	+	.	.
Lophocolea cuspidata .....	+	.	.	— inundatum .....	+	.	.
— minor .....	+	.	.	— Gravetii .....	.	.	.
Chiloscyphus polyanthus .....	+	.	.	— compactum .....	.	.	.
Harpanthus Flotowianus .....	+	.	.	— teres .....	+	+	.
Cephalozia bicuspidata .....	+	—	.	— squarrosum .....	+	.	.
— ambigua .....	.	.	.	— fimbriatum .....	+	—	.
— pleniceps .....	+	—	.	— Girgensohnii .....	+	—	.
— media .....	.	.	.	— Russowii .....	.	.	.
Pleuroclada albescens .....	.	—	+	— Warnstorffii .....	+	—	.
— var. islandica .....	+	.	.	— rubellum .....	+	—	.
Cephaloziella Hampeana .....	+	—	.	— acutifolium .....	+	.	.
— rubella .....	+	—	.	— subnitens .....	+	.	.
Odontoschisma elongatum .....	+	.	.	— Lindbergii .....	.	.	.
— denudatum .....	.	.	.	— riparium .....	+	.	.
— Macouni .....	+	.	.	— angustifolium .....	.	.	.
Lepidozia setacea .....	.	.	.				
Blepharostoma trichophyllum .....	+	+	.	<b>Musci veri.</b>			
Anthelia julacea .....	+	—	.	Andreaea petrophila .....	+	+	+
— Juratzkana .....	—	+	+	Gymnostomum rupestre .....	+	.	.
Ptilidium ciliare .....	+	—	.	Hymenostylium curvirostre .....	+	.	.
Diplophyllum albicans .....	+	.	.	Ancocetangium compactum .....	+	.	.
— obtusifolium .....	.	.	.	Weisia crispata .....	+	.	.
Scapania subalpina .....	+	.	.	— viridula .....	+	.	.
— remota .....	.	.	.	— Wimmeriana .....	.	.	.
— irrigua .....	+	—	.	Dicranoweisia crispula .....	+	+	+
— uliginosa .....	+	—	.	— compacta .....	.	.	.
— paludosa .....	+	.	.	Cynodontium polycarpum .....	.	.	.
— dentata .....	+	.	.	Dichodontium pellucidum .....	+	—	.
— undulata .....	+	—	.	Aongstroemia longipes .....	+	+	.
— curta .....	+	—	.	Oncophorus virens .....	+	+	—
— Bartlingii .....	.	.	.	— Wahlenbergii .....	+	+	—
Radula complanata .....	+	.	.	Dicranella squarrosa .....	+	+	.
Frullania dilatata .....	.	.	.	— Schreberi .....	+	.	.



Table III. The Distribution of the Bryophyta in the different Altitudinal Regions (continued).

	Up to 300 m.	300—600 m.	Above 600 m.		Up to 300 m.	300—600 m.	Above 600 m.
<i>Dicranella crispa</i> .....	+			<i>Tortella fragilis</i> .....	+	—	
— <i>cerviculata</i> .....	+			<i>Barbula unguiculata</i> .....	+		
— <i>subulata</i> .....	+			— <i>fallax</i> .....	+		
<i>Dicranum fulvellum</i> .....		+		— <i>cylindrica</i> .....	+		
— <i>Andersonii</i> .....	+			— <i>icmadophila</i> .....	+		
— <i>falcatum</i> .....		—	+	<i>Desmatodon latifolius</i> .....	+	—	
— <i>Blyttii</i> .....		+	+	— <i>cernuus</i> .....			
— <i>Starckeii</i> .....		+	+	<i>Tortula obtusifolia</i> .....			
— <i>molle</i> .....	—	+	—	— <i>muralis</i> .....	+		
— <i>Bonjeani</i> .....	+			— <i>subulata</i> .....	+		
— <i>angustum</i> .....	+	—		— <i>mucronifolia</i> .....	+		
— <i>majus</i> .....	+			— <i>ruralis</i> .....	+	—	
— <i>scoparium</i> .....	+	—		— <i>aciphylla</i> .....			
— <i>fuscescens</i> .....	+	—		<i>Schistidium maritimum</i> .....	+		
— <i>congestum</i> .....	+	+	—	— <i>apocarpum</i> .....	+	+	
— <i>spadiceum</i> .....	+			— <i>gracile</i> .....	+	+	—
— <i>elongatum</i> .....	+			— <i>confertum</i> .....	+		
<i>Campylopus Schimperii</i> .....	+			— <i>alpicola</i> .....			
<i>Trematodon ambiguus</i> .....	+			— — <i>v. rivularis</i> .....	+		
<i>Fissidens bryoides</i> .....	+			<i>Grimmia commutata</i> .....			
— <i>osmundoides</i> .....	+			— <i>Doniana</i> .....	+	—	
— <i>decipiens</i> .....				— <i>alpestris</i> .....	+		
— <i>adianthoides</i> .....	+			— <i>ovata</i> .....	+		
<i>Blindia acuta</i> .....	+	—		— <i>incurva</i> .....			
<i>Ceratodon purpureus</i> .....	+	+	—	— <i>patens</i> .....	+		
<i>Ditrichum tortile</i> .....	+			— <i>funalis</i> .....	+	—	
— <i>nivale</i> .....				— <i>torquata</i> .....	+		
— <i>homomallum</i> .....	+			<i>Rhacomitrium sudeticum</i> .....	+	+	—
— <i>flexicaule</i> .....	+	+		— <i>heterostichum</i> .....	+	—	
<i>Sælania cæsia</i> .....	+			— <i>microcarpum</i> .....			
<i>Distichium montanum</i> .....	+	+		— <i>canescens</i> .....	+	+	+
— <i>inclinatum</i> .....	+			— <i>hypnoides</i> .....	+	+	+
<i>Bryoxiphium norvegicum</i> .....	+			— <i>fasciculare</i> .....	+	+	+
<i>Pottia Heimii</i> .....	+			— <i>aciculare</i> .....	+		
— <i>latifolia</i> .....				<i>Hedwigia albicans</i> .....	+		
<i>Didymodon rubellus</i> .....	+	—		<i>Amphidium lapponicum</i> .....	+		
— <i>rufus</i> .....	+			— <i>Mougeottii</i> .....	+		
<i>Leptodontium flexifolium</i> .....				<i>Ulota phyllantha</i> .....	+		
<i>Trichostomum littorale</i> .....				<i>Orthotrichum anomalum</i> .....	+		
<i>Tortella inclinata</i> .....				— <i>saxatile</i> .....	+		
— <i>tortuosa</i> .....	+	—		— <i>cupulatum</i> .....	+		

Table III. The Distribution of the Bryophyta in the different Altitudinal Regions (continued).

	Up to 300 m.	300—600 m.	Above 600 m.		Up to 300 m.	300—600 m.	Above 600 m.
<i>Orthotrichum rupestre</i> .....	+	.		<i>Bryum uliginosum</i> .....	+		
— <i>Sturmii</i> .....	+	.		— <i>fallax</i> .....	.		
— <i>Killiasii</i> .....	+			— <i>œneum</i> .....	+	—	
— <i>Blyttii</i> .....	+			— <i>bimum</i> .....	.		
— <i>lævigatum</i> ....	.	.		— <i>affine</i> .....	+		
<i>Encalypta ciliata</i> .....	+			— <i>cirratum</i> .....	+		
— <i>rhabdocarpa</i> .....	+	—		— <i>intermedium</i> .....	+		
— <i>contorta</i> .....	.			— <i>pallescens</i> .....	+		
<i>Dissodon splachnoides</i> .....	+	+		— <i>subrotundum</i> .....	.		
<i>Tetraplodon bryoides</i> .....	+			— <i>capillare</i> .....	+		
<i>Splachnum sphæricum</i> .....	+	.		— <i>cæspiticium</i> .....	+		
— <i>vasculosum</i> .....	+	+	.	— <i>comense</i> .....	.		
<i>Funaria hygrometrica</i> .....	+			— <i>elegans</i> .....	+	—	
<i>Leptobryum pyriforme</i> .....	+			— <i>argenteum</i> .....	+		
<i>Anomobryum filiforme</i> .....	+			— <i>neodamense</i> .....	.		
— <i>concinnum</i> .....	.			— <i>Duvalii</i> .....	+	.	
<i>Plagiobryum Zierii</i> .....	+			— <i>pallens</i> .....	+	.	
— <i>demissum</i> .....	.			— <i>ventricosum</i> .....	+	+	.
<i>Pohlia acuminata</i> .....	+			— <i>arcticum</i> .....	+		
— <i>polymorpha</i> .....	.	.		— <i>pendulum</i> .....	+		
— <i>cruda</i> .....	+	+	—	— <i>Brownii</i> .....	.		
— <i>nutans</i> .....	+	—		<i>Mnium hornum</i> ..	+		
— <i>cucullata</i> .....	.	+	+	— <i>orthorrhynchum</i> .....	+	—	
— <i>Ludwigii</i> .....	.	+		— <i>serratum</i> .....	+		
— <i>commutata</i> .....	—	+	+	— <i>spinosum</i> .....	+		
— <i>gracilis</i> .....	—	+	+	— <i>undulatum</i> .....	+		
— <i>Rothii</i> .....	+			— <i>cuspidatum</i> .....	+		
— <i>tenuifolia</i> .....	+			— <i>medium</i> .....	+		
— <i>grandiflora</i> .....	+			— <i>affine</i> .....	+	—	
— <i>proligera</i> .....	.			— <i>Seligeri</i> .....	+		
<i>Mniobryum albicans</i> .....	+	+	+	— <i>stellare</i> .....	+		
<i>Bryum purpurascens</i> .....	+	.		— <i>cinclidioides</i> .....	+	—	
— <i>lacustre</i> .....	+			— <i>punctatum</i> .....	+	—	
— <i>Kaurini</i> .....	.			— <i>subglobosum</i> .....	+		
— <i>archangelicum</i> .....	+			<i>Cinclidium stygium</i> .....	+	+	
— <i>Jörgensenii</i> .....	.			<i>Paludella squarrosa</i> .....	+	—	
— <i>inclinatum</i> .....	+			<i>Amblyodon dealbatus</i> .....	.		
— <i>retusum</i> .....	+			<i>Meesea trichoides</i> .....	+	—	
— <i>islandicum</i> .....	.			— <i>triquetra</i> .....	+		
— <i>Grœnlundii</i> .....	.			<i>Catoscopium nigratum</i> .....	+	.	
— <i>calophyllum</i> .....	.			<i>Conostomum boreale</i> .....	—	+	+

Table III. The Distribution of the Bryophyta in the different Altitudinal Regions (continued).

	Up to 300 m.	300—600 m.	Above 600 m.		Up to 300 m.	300—600 m.	Above 600 m.
<i>Aulacomnium palustre</i> .....	+	+	.	<i>Pterigynandrum filiforme</i> ...	+	.	.
— <i>turgidum</i> .....	+	+	.	<i>Lescuræa decipiens</i> .....	.	.	.
<i>Bartramia ityphylla</i> .....	+	+	—	— <i>radicosa</i> .....	.	.	.
<i>Plagiopus Oederi</i> .....	.	.	.	— <i>filamentosa</i> .....	+	—	.
<i>Philonotis fontana</i> .....	+	+	+	— <i>Breidleri</i> .....	.	+	—
— <i>Arnellii</i> .....	.	.	.	— <i>patens</i> .....	+	—	.
— <i>seriata</i> .....	+	+	.	<i>Heterocladium squarrosulum</i>	+	.	.
— <i>tomentella</i> .....	+	+	.	<i>Thuidium tamariscinum</i> ....	+	.	.
<i>Timmia norvegica</i> .....	+	.	.	— <i>delicatum</i> .....	+	.	.
— <i>austriaca</i> .....	+	—	.	— <i>Philiberti</i> .....	+	.	.
<i>Catharina undulata</i> .....	+	.	.	— <i>abietinum</i> .....	+	.	.
<i>Oligotrichum hercynicum</i> ...	—	+	+	— <i>lanatum</i> .....	+	—	.
<i>Psilopilum lævigatum</i> .....	+	.	.	<i>Orthothecium rufescens</i> ....	.	.	.
<i>Pogonatum polytrichoides</i> ...	+	.	.	— <i>intricatum</i> ....	+	.	.
— <i>dentatum</i> var. <i>minus</i>	.	.	.	— <i>chryseum</i> ....	+	—	.
— <i>urnigerum</i> .....	+	.	.	<i>Cylindrothecium concinnum</i> .	.	.	.
<i>Polytrichum alpinum</i> .....	+	+	—	<i>Climacium dendroides</i> .....	+	.	.
— <i>formosum</i> .....	.	.	.	<i>Isothecium myurum</i> .....	+	.	.
— <i>gracile</i> .....	+	.	.	— <i>tenuinerve</i> .....	+	.	.
— <i>sexangulare</i> ....	.	—	+	<i>Homalothecium sericeum</i> ...	+	—	.
— —	.	.	.	<i>Camptothecium lutescens</i> ...	+	.	.
— var. <i>tenellum</i> .	+	.	.	— <i>nitens</i> .....	+	+	.
— <i>piliferum</i> .....	+	.	.	<i>Brachythecium Mildeanum</i> ..	+	.	.
— <i>juniperinum</i> ...	+	—	.	— <i>salebrosum</i> ..	+	—	.
— <i>strictum</i> .....	+	—	.	— <i>collinum</i> ...	.	.	.
— <i>commune</i> .....	+	—	.	— <i>populeum</i> ..	+	.	.
— <i>Swartzii</i> .....	+	.	.	— <i>velutinum</i> ..	+	.	.
<i>Diphyseium sessile</i> .....	+	+	.	— <i>glaciale</i> .....	.	+	+
<i>Fontinalis antipyretica</i> .....	+	—	.	— <i>reflexum</i> ....	—	+	—
— <i>islandica</i> .....	.	.	.	— <i>longipilum</i> ..	.	.	.
— <i>longifolia</i> .....	.	.	.	— <i>glareosum</i> ...+	+	.	.
— <i>thulensis</i> .....	.	.	.	— <i>albicans</i> ....	+	—	.
— <i>androgyna</i> .....	.	.	.	— <i>erythrorrhizon</i>	+	.	.
<i>Leucodon sciuroides</i> .....	+	.	.	— <i>rivulare</i> ....	+	—	.
<i>Antitrichia curtispendula</i> ...	+	.	.	— <i>latifolium</i> ...	.	.	.
<i>Neckera complanata</i> .....	+	.	.	<i>Scleropodium purum</i> .....	+	.	.
<i>Myurella julacea</i> .....	+	.	.	<i>Eurhynchium strigosum</i> ....	+	.	.
— <i>tenerrima</i> .....	+	.	.	— <i>diversifolium</i> ..	.	.	.
<i>Leskea nervosa</i> .....	+	.	.	— <i>cirrosum</i> ....	+	.	.
— <i>catenulata</i> .....	.	.	.	— <i>piliferum</i> ....	+	.	.
<i>Anomodon viticulosus</i> .....	+	.	.	— <i>Swartzii</i> .....	+	.	.

Table III. The Distribution of the Bryophyta in the different Altitudinal Regions (continued).

	Up to 300 m.	300—600 m.	Above 600 m.		Up to 300 m.	300—600 m.	Above 600 m.
<i>Eurhynchium Stokesii</i> . . . . .	+			<i>Hypnum filicinum</i> . . . . .	+	—	
<i>Rhynchostegium murale</i> . . . . .	+			— <i>curvicaule</i> . . . . .	—	+	
— <i>rusciforme</i> . . . . .	+			— <i>decipiens</i> . . . . .	+		
<i>Thamnum alopecurum</i> . . . . .	+			— <i>commutatum</i> . . . . .	+		
<i>Plagiothecium silvaticum</i> . . . . .	+			— — <i>v. falcatum</i>			
— <i>Reseanum</i> . . . . .	+			— <i>molluscum</i> . . . . .	+		
— <i>denticulatum</i> . . . . .	+			— <i>imponens</i> . . . . .	+		
— <i>pulchellum</i> . . . . .	+			— <i>Bambergeri</i> . . . . .	+		
— <i>depressum</i> . . . . .	+			— <i>revolutum</i> . . . . .	+	—	
— <i>elegans</i> . . . . .	+			— <i>cupressiforme</i> . . . . .	+		
<i>Amblystegium Sprucei</i> . . . . .	+	—		— <i>hamulosum</i> . . . . .	+	—	
— <i>fluviatile</i> . . . . .	+			— <i>callichroum</i> . . . . .	+		
— <i>serpens</i> . . . . .	+			— <i>Lindbergii</i> . . . . .	+	—	
— <i>Juratzkanum</i> . . . . .	+			— <i>palustre</i> . . . . .	+		
— <i>littorale</i> . . . . .	+			— <i>arcticum</i> . . . . .	+		
— <i>compactum</i> . . . . .	+			— <i>alpestre</i> . . . . .	+		
— <i>salinum</i> . . . . .	+			— <i>alpinum</i> . . . . .	+		
— <i>trichopodium</i> . . . . .	+			— <i>ochraceum</i> . . . . .	+		
<i>Hypnum Sommerfeltii</i> . . . . .	+			— <i>cordifolium</i> . . . . .	+		
— <i>chrysophyllum</i> . . . . .	+			— <i>Richardsonii</i> . . . . .	+	—	
— <i>protensum</i> . . . . .	+			— <i>giganteum</i> . . . . .	+	—	
— <i>stellatum</i> . . . . .	+	+	—	— <i>stramineum</i> . . . . .	+	+	—
— <i>polygamum</i> . . . . .	+			— <i>sarmentosum</i> . . . . .	+	+	—
— <i>intermedium</i> . . . . .	+	+		— <i>trifarium</i> . . . . .	+		
— <i>revolvens</i> . . . . .	+	+		— <i>turgescens</i> . . . . .	+		
— <i>uncinatum</i> . . . . .	+	+	—	<i>Acrocladium cuspidatum</i> . . . . .	+		
— <i>Sendtneri</i> . . . . .	+			<i>Scorpidium scorpioides</i> . . . . .	+		
— <i>Kneiffii</i> . . . . .	+			<i>Hylocomium proliferum</i> . . . . .	+	+	—
— <i>exannulatum</i> . . . . .	+	+		— <i>pyrenaicum</i> . . . . .	+		
— — <i>var. purpurascens</i> . . . . .	+	+		— <i>parietinum</i> . . . . .	+		
— — <i>var. Rotæ</i> . . . . .	+			— <i>loreum</i> . . . . .	+		
— — <i>var. ser-ratum</i> . . . . .	+			— <i>triquetrum</i> . . . . .	+		
— <i>fluitans</i> . . . . .	+			— <i>squarrosum</i> . . . . .	+	—	
— — <i>v. falcatum</i> . . . . .	+			— <i>rugosum</i> . . . . .	+		

Table I shows that of the 424 species enumerated in it (the habitat of *Sphenobolus saxicola* is not known) 416 occur in the low land, and that only 8 species (*Gymnomitrium varians*, *Pleuroclada*

*albescens*, *Scapania remota*, *Ditrichum nivale*, *Pohlia polymorpha*, *P. Ludwigii* and *Brachythecium glaciale*) have not been found below the upper limit of the birch.

In the Mountain region the number of species is as follows: —

42 Hepaticæ  
5 Sphagna  
134 Musci veri

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181 Total species.

Of these, however, 10 Hepaticæ and 31 Musci veri have been found only in the lowest part, at the boundary towards the Lowland region, whereby the number of species which in reality belong to the Mountain region, is reduced to 140. Of these, 2 Hepaticæ, viz. *Gymnomitrium varians* and *Scapania remota* and 3 Musci veri, viz. *Ditrichum nivale*, *Pohlia polymorpha* and *P. Ludwigii* have been found only in this region.

In the Snow region the number of species is as follows: — 16 Hepaticæ, 42 Musci veri, total 58, of which, 6 Hepaticæ and 10 Musci have been found only in a few localities and cannot be regarded as belonging to this region. In all, 42 species remain, of which, however, only 8 Hepaticæ and 20 Musci veri are fairly frequent, while the others have been found only in a few localities. The majority of the species belong to those which are of equal frequency at all altitudes, and only 4 species (*Pleuroclada albescens*, *Dicranum falcatum*, *Pohlia cucullata* and *Polytrichum sexangulare*) can be designated true Snow-region species.

The number of species decreases rapidly as the height above sea-level increases, and even at the upper limit of the heather moor the number falls to about 40 % of the total number of species. Above a height of about 600 metres the number scarcely reaches 15 % of all the species.



## V. THE HORIZONTAL DISTRIBUTION OF THE SPECIES.

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IN order to obtain a correct notion of the importance of each plant-species within a floral district it is necessary to know not only their distribution in the different parts of this district, but also their relative abundance (number of individuals) in comparison with other species. The following Table gives a summary of all the Bryophyta found in Iceland, with the exception of the species growing in warm soil, since, as regards these species, it is chiefly the heat of the soil and not the climatic conditions which determine their distribution. The frequency within the different districts is indicated by the figures 1—4, so that 1 indicates rare or very scantily occurring species; 2 those that occur here and there or only in a comparatively few localities and not in abundance; 3 frequent, but as a rule playing no important part in the moss-covering, or occurring only locally in abundance; and 4 the common and abundantly occurring species.

The majority of the species are not equally distributed in all the different altitudinal regions, and the frequency is therefore reckoned relatively to the region in which each species is most widely distributed. As regards species which grow only in quite definite areas (for instance littoral species) the frequency is reckoned separately.

The figures in the table are, however, in many cases somewhat doubtful, since many districts are too superficially investigated to allow one to form an opinion as to the frequency of the less commonly occurring species. This is the case, for instance, as regards the majority of the districts of East Iceland situated above an altitude of 300 metres, because in June, when I travelled through this part of the country, the mountains were still for a great part snow-covered, which in connection with continual fog made investigation almost impossible.

It must also be noted that the table is based only on the

coastal districts, and on the low land with the neighbouring heights. The high land of the interior, which is about 90,000 km<sup>2</sup>. in dimension and, usually, 600—1000 metres in height, is from a botanical point of view practically unknown. Outside the Jökulls it consists almost everywhere of gravelly flats which are practically bare of vegetation. According to Thoroddsen, however, there are in some places extensive mountain-bogs, but the Bryophyte vegetation of these is quite unknown.

Table IV. The Frequency of the Species in the different Districts of Iceland.

		E. Icel.	N. Icel.	NW. Icel.	W. Icel.	S. Icel.
<b>Hepaticæ.</b>						
a	<i>Sauteria alpina</i> .....		1*			
m	<i>Reboulia hemisphærica</i> .....					3*
a	<i>Fimbriaria pilosa</i> .....		1*	1*		
m	<i>Fegatella conica</i> .....					4
u	<i>Preissia commutata</i> .....		2*	1	2	3*
u	<i>Marchantia polymorpha</i> .....	4*	4*	4*	4*	4*
u	<i>Aneura pinguis</i> .....	4	4	4*	4	4*
m	— <i>multifida</i> .....					1
u	— <i>latifrons</i> .....		1	1	1	
u	<i>Pellia Neesiana</i> .....	4	4*	4	4	4
m	<i>Metzgeria furcata</i> .....	3	3	3	3	4
u	<i>Blasia pusilla</i> .....		2		1	
m	<i>Fossombronia Dumortieri</i> .....					1
a	<i>Gymnomitrium corallioides</i> .....	3	2		3	2
a	— <i>concinatum</i> .....	4*	4*	4*	4*	4*
a	— <i>varians</i> .....		1	1		
a	— <i>revolutum</i> .....			1		
u	<i>Marsupella emarginata</i> .....			1		2
u	— <i>aquatica</i> .....			1		
m	— <i>Funckii</i> .....	1				1
u	<i>Alicularia scalaris</i> .....	4*	4*	4*	4*	4*
b	— <i>geoscypha</i> .....	4*	4*	4*	4*	4*
a	<i>Eucalyx subellipticus</i> .....	2*	1*	2*	1*	1*
b	<i>Haplozia sphærocarpa</i> .....			1		
a	— <i>cordifolia</i> .....	4*	4*	4*	4*	4*
b	— <i>riparia</i> .....					3*
a	— <i>atrovirens</i> .....	3*	3*	3*	3*	3*
b	— <i>pumila</i> .....		1*			
m	— <i>crenulata</i> .....			1	1	
m	<i>Jamesoniella autumnalis</i> .....					1

Table IV. The Frequency of the Species in the different Districts of Iceland (continued).

	E. Icel.	N. Icel.	NW. Icel.	W. Icel.	S. Icel.
u	Sphenobolus minutus.....	1		1	1
b	— saxicola?.....				
a	— politus.....		1*		
u	Lophozia quinqueidentata.....	4	4*	4*	4
b	— lycopodioides.....	4	4	4	4
b	— Flørekei.....		4	2	
a	— quadriloba.....	3	2	2	2
b	— Kunzeana.....	4	4	4	4
m	— barbata.....	1		2	1
u	— ventricosa.....	3	3	4*	3
a	— Wenzelii.....	1	1*	1*	1
a	— alpestris.....	4	4	4*	4*
m	— excisa.....				1*
b	— Schultzii.....	1	1	1*	
u	— Mülleri.....	3	3	3	3
a	— Hornschuchiana.....	2	1*	1	2
b	— heterocolpos.....		1	1	1
u	Gymnocolea inflata.....			1	
u	Plagiochila asplenioides.....	4	4	4	4
u	Leptoscyphus anomalus.....	1			
m	Lophocolea cuspidata.....				2
m	— minor.....		1		1
b	Chilosecyphus polyanthus.....	4	4	4	4
b	Harpanthus Flotowianus.....	1	1	4	2
u	Cephalozia bicuspidata.....	4*	4*	4*	4*
a	— ambigua.....			1*	
b	— pleniceps.....	3*	3*	4*	3*
b	— media.....		1*	1*	?
a	Pleuroclada albescens.....	3	3	4	2
a	— — var. islandica...		1		2
u	Cephaloziella Hampeana.....	4*	4*	4*	4*
u	— rubella.....	1	1	2	1
u	Odontoschisma elongatum.....	2	1		3
u	— denudatum.....				1
a	— Macouni.....	1	1		1
m	Lepidozia setacea.....				1
u	Blepharostoma trichophyllum.....	4	4*	4	4
b	Chandonanthus setiformis?.....				4*
a	Anthelia julacea.....	3*	3*	3*	3*
a	— Juratzkana.....	4*	4*	4*	4*
u	Ptilidium ciliare.....	4	4	4	4
u	Diplophyllum albicans.....				3
m	— obtusifolium.....	1	1		3

Table IV. The Frequency of the Species in the different Districts of Iceland (continued).

		E. Icel.	N. Icel.	NW. Icel.	W. Icel.	S. Icel.
a	<i>Scapania subalpina</i> .....	4*	4*	4*	4*	4*
a	— <i>remota</i> .....		1			
b	— <i>irrigua</i> .....	4?	4*	4	4	4*
b	— <i>uliginosa</i> .....	1		3		
b	— <i>paludosa</i> .....			3*		
u	— <i>dentata</i> .....	3*	1*		2*	3*
u	— <i>undulata</i> .....	4*	4*	4*	4*	4*
b	— <i>curta</i> .....	4*	4*	4*	4*	4*
a	— <i>Bartlingii</i> .....					1
m	<i>Radula complanata</i> .....	3	1*		3	3*
m	<i>Madotheca Cordæana</i> .....	2		2	3	4
u	<i>Frullania dilatata</i> .....				1	
u	— <i>Tamarisci</i> .....	4	4	4	4	4
m	— <i>fragilifolia</i> .....				1	1
m	<i>Lejeunea cavifolia</i> .....				1	3
<b>Sphagnales.</b>						
b	<i>Sphagnum medium</i> .....			1	1	2
m	— <i>papillosum</i> .....				2	2
u	— <i>inundatum</i> .....				1	1
u	— <i>Gravetii</i> .....			1		
b	— <i>compactum</i> .....					1
u	— <i>teres</i> .....	4	4	4	4	4
u	— <i>squarrosom</i> .....		1	3		
u	— <i>fimbriatum</i> .....		2	2	3	1
n	— <i>Girgensohnii</i> .....	3	3	3	3	3
b	— <i>Russowii</i> .....					1
u	— <i>Warnstorffii</i> .....	3	3	3	3	3
u	— <i>rubellum</i> .....	3	3	3	3	3
u	— <i>acutifolium</i> .....		1	1	1	1
u	— <i>subnitens</i> .....			1	2	2
b	— <i>Lindbergii</i> .....				1	
u	— <i>riparium</i> .....			3		
m	— <i>angustifolium</i> .....		1			
<b>Musci veri.</b>						
b	<i>Andreæa petrophila</i> .....	4*	4*	4*	4*	4*
u	<i>Gymnostomum rupestre</i> .....	1	3		3	3
b	<i>Hymenostylium curvirostre</i> .....		1		1	3*
u	<i>Anœctangium compactum</i> .....	4			3	4
m	<i>Weisia crispata</i> .....				1	1*
m	— <i>viridula</i> .....					1*
a	— <i>Wimmeriana</i> .....		1*			

Table IV. The Frequency of the Species in the different Districts of Iceland (continued).

		E. Icel.	N. Icel.	NW. Icel.	W. Icel.	S. Icel.
a	<i>Dicranoweisia crispula</i> .....	4*	4*	4*	4*	4*
a	— <i>compacta</i> .....		1			
u	<i>Cynodontium polycarpon</i> .....	1*				
b	<i>Dichodontium pellucidum</i> .....	4*	4*	4*	4*	4*
a	<i>Aongstrœmia longipes</i> .....	3	3*	1	2	2
b	<i>Oncophorus Wahlenbergii</i> .....	4*	4*	4*	4*	4*
b	— <i>virens</i> .....	4*	4*	4*	4*	4*
b	<i>Dicranella squarrosa</i> .....	2	3*	4	2	1
u	— <i>Schreberi</i> .....		1		1	
b	— <i>crispa</i> .....	4*	4*	4*	4*	4*
b	— <i>subulata</i> .....		1	1		1
u	— <i>cerviculata</i> .....			2	2	1
a	<i>Dicranum fulvellum</i> .....					3*
a	— <i>Andersonii</i> .....	1*				3*
a	— <i>falcatum</i> .....	2*	2*	3*	2*	3*
b	— <i>Blyttii</i> .....	1*	1*	3*	3*	3*
a	— <i>Starekei</i> .....	4*	4*	4*	4*	4*
a	— <i>molle</i> .....	1*	1*	4*	3*	1*
m	— <i>Bonjeani</i> .....	1	1		2	
b	— <i>angustum</i> .....	3	1	1	2	1
u	— <i>majus</i> .....			3	1	
u	— <i>scoparium</i> .....	4	4	4*	4*	3*
u	— <i>fuscescens</i> .....			4*	1	
u	— <i>congestum</i> .....	4	4	?	3	2
a	— <i>spadiceum</i> .....	2	1		1	
a	— <i>elongatum</i> .....		2	2	2	
a	<i>Campylopus Schimperi</i> .....	1	1		2	1
m	<i>Trematodon ambiguus</i> .....				1	
m	<i>Fissidens bryoides</i> .....		1*			1*
b	— <i>osmundoides</i> .....	3	3	3	3*	3
u	— <i>adiantoides</i> .....		1*		2*	
u	— <i>decipiens</i> .....				1	
b	<i>Blindia acuta</i> .....	4*	4*	4*	4*	4*
u	<i>Ceratodon purpureus</i> .....	2*	3*	3*	3*	2*
u	<i>Ditrichum tortile</i> .....	1				
a	— <i>nivale</i> .....	1				
u	— <i>homomallum</i> .....	1	1		2*	1
u	— <i>flexicaule</i> .....	4*	4	4	4	4
a	<i>Saelania cœsia</i> .....	2*	2*		3*	2*
b	<i>Distichium montanum</i> .....	4*	4*	4*	4*	4*
u	— <i>inclinatum</i> .....	1*	2*	1*		
a	<i>Bryoxiphium norvegicum</i> .....					3
u	<i>Pottia Heimii</i> .....	2*	3*	1*	3*	3*



Table IV. The Frequency of the Species in the different Districts of Iceland (continued).

		E. Icel.	N. Icel.	NW. Icel.	W. Icel.	S. Icel.
a	<i>Pottia latifolia</i> . . . . .		1*			
u	<i>Didymodon rubellus</i> . . . . .	4*	4*	4*	4*	4*
b	— <i>rufus</i> . . . . .	1	1		1	
m	<i>Leptodontium flexifolium</i> . . . . .		1			
m	<i>Trichostomum littorale</i> . . . . .				1	1
u	<i>Tortella inclinata</i> . . . . .	1				
u	— <i>tortuosa</i> . . . . .	4	4	4	4	4
b	— <i>fragilis</i> . . . . .	3	3	3	3	3
m	<i>Barbula unguiculata</i> var. <i>cuspidata</i> . . . . .				1	1
m	— <i>fallax</i> . . . . .				1	1
m	— <i>cylindrica</i> . . . . .		1		1	3*
a	— <i>icmadophila</i> . . . . .	1	1		1	
a	<i>Desmatodon latifolius</i> . . . . .	3*	2*	3*	2*	
a	— <i>cernuus</i> . . . . .		1*			
a	<i>Tortula obtusifolia</i> . . . . .					1*
m	— <i>muralis</i> . . . . .					1*
u	— <i>subulata</i> . . . . .	3*	3*	3*	3*	3*
m	— <i>mucronifolia</i> . . . . .					1*
u	— <i>ruralis</i> . . . . .	2*	3*	3*	2	2
a	— <i>aciphylla</i> . . . . .			1*		
u	<i>Schistidium maritimum</i> . . . . .	3*	3*	3*	3*	3*
u	— <i>apocarpum</i> . . . . .	3*	3*	3*	3*	3*
u	— <i>gracile</i> . . . . .	4*	4*	4*	4*	4*
b	— <i>confertum</i> . . . . .	1*	2*			
a	— <i>alpicola</i> . . . . .		1*			
a	— — var. <i>rivularis</i> . . . . .	4*	4*	4*	4*	3*
b	<i>Grimmia commutata</i> . . . . .		1		1	
a	— <i>Doniana</i> . . . . .	3*	2*	2*	3*	3*
a	— <i>alpestris</i> . . . . .	1				1*
b	— <i>ovata</i> . . . . .	2	2			
a	— <i>incurva</i> . . . . .	1				
u	— <i>patens</i> . . . . .	1			1	
a	— <i>funalis</i> . . . . .	4*	4*	4*	4*	4*
b	— <i>torquata</i> . . . . .	2	1	2	3	4
b	<i>Racomitrium sudeticum</i> . . . . .	4*	3*	4*	3*	3*
b	— <i>microcarpum</i> . . . . .		1			
u	— <i>heterostichum</i> . . . . .	3	2	2	4	4
u	— <i>canescens</i> . . . . .	4*	4	4*	4	4
u	— <i>hypnoides</i> . . . . .	4	4	4	4	4
b	— <i>fasciculare</i> . . . . .	4*	3*	3*	4*	4*
m	— <i>aciculare</i> . . . . .	4*	4*	4*	4*	4*
m	<i>Hedwigia albicans</i> . . . . .					1
b	<i>Amphidium lapponicum</i> . . . . .	4*	4*	4*	4*	4*

Table IV. The Frequency of the Species in the different Districts of Iceland (continued).

		E. Icel.	N. Icel.	NW. Icel.	W. Icel.	S. Icel.
u	<i>Amphidium Mougeottii</i> .....	3	2	3	4	4
u	<i>Ulota phyllantha</i> .....	3	3	3	3	3
m	<i>Orthotrichum anomalum</i> .....					1*
m	— <i>saxatile</i> .....					1*
m	— <i>cupulatum</i> .....					1*
u	— <i>rupestre</i> .....	3*	3*	3*	3*	3*
u	— <i>Sturmii</i> .....	1*			1*	
a	— <i>Killiasii</i> .....	1*	1*		?	
a	— <i>Blyttii</i> .....	2*	1*	1*	1*	
a	— <i>laevigatum</i> .....		2*	1*	1*	
b	<i>Encalypta ciliata</i> .....	3*	2*		3*	3*
u	— <i>rhabdocarpa</i> .....	3*	3*	3*	3*	3*
u	— <i>contorta</i> .....				1	
b	<i>Dissodon splachnoides</i> .....	1*	4*	3*	1*	1*
a	<i>Tetraplodon bryoides</i> .....	2*	2*	2*	2*	2*
b	<i>Splachnum sphaericum</i> .....	3*	3*	2*	2*	2*
u	— <i>vasculosum</i> .....	3*	3*	3*	3*	3*
b	<i>Funaria hygrometrica</i> .....	3*	3*	3*	3*	3*
u	<i>Leptobryum pyriforme</i> .....	4*	4*	2*	3*	4*
a	<i>Anomobryum filiforme</i> .....	2		1	2	3*
a	— <i>concinnum</i> .....					1
b	<i>Plagiobryum Zierii</i> .....	2	1	1	2	2*
a	— <i>demissum</i> .....				1*	
a	<i>Pohlia acuminata</i> .....				1*	2*
a	— <i>polymorpha</i> .....				1	
u	— <i>cruda</i> .....	4*	4*	4*	4*	4*
u	— <i>nutans</i> .....	1*	1*	3*	1*	2*
a	— <i>cucullata</i> .....		1*	2*		
a	— <i>Ludwigii</i> .....		1*			
a	— <i>commutata</i> .....	4*	4*	4*	4*	4*
b	— <i>gracilis</i> .....	4*	4*	4*	4*	4*
b	— <i>Rothii</i> .....		1			
b	— <i>tenuifolia</i> .....	2	2		1	
b	— <i>proligera</i> .....		1			
b	— <i>grandiflora</i> .....					2
b	<i>Mniobryum albicans</i> .....	4*	4*	4*	4	4*
b	<i>Bryum purpurascens</i> .....	2*	3*	2*	2*	1
b	— <i>lacustre</i> .....	2*	3*	1*	2*	2*
a	— <i>Kaurini</i> .....	1*				
a	— <i>archangelicum</i> .....			1*	1*	1*
u	— <i>inclinatum</i> .....	4*	4*	4*	4*	4*
a	— <i>retusum</i> .....		2*	1*		
Icel.	— <i>islandicum</i> .....		1*			

Table IV. The Frequency of the Species in the different Districts of Iceland (continued).

		E. Icel.	N. Icel.	NW. Icel.	W. Icel.	S. Icel.
b	<i>Bryum calophyllum</i> .....	1*				
u	— <i>uliginosum</i> .....		2*		1*	
Icel.	— <i>Grœnlundii</i> .....				1*	
b	— <i>fallax</i> .....		1*			
a	— <i>cœneum</i> .....		1	1	1*	3*
m	— <i>bimum</i> .....	1*				
b	— <i>affine</i> .....	3*	3*	3*	3*	3*
b	— <i>cirratum</i> .....	2*	2*	3*	2*	1*
u	— <i>intermedium</i> .....		1*			1*
b	— <i>pallescens</i> .....	3*	3*	3*	3*	4*
a	— <i>subrotundum</i> .....					1*
u	— <i>capillare</i> .....	1	1		1	2*
u	— <i>cœspiticium</i> .....	2*	2*			1*
a	— <i>comense</i> .....		1			
u	— <i>argenteum</i> .....	3	3	3	3	3
a	— <i>neodamense</i> var. <i>ovatum</i> .....	1				
b	— <i>Duvalii</i> .....	4*	4*	4	4	4
u	— <i>pallens</i> .....	3	3	3	3*	4*
u	— <i>ventricosum</i> .....	4*	4*	4*	4*	4*
a	— <i>arcticum</i> .....	3*	3*	3*	3*	2*
u	— <i>pendulum</i> .....		1*		1*	2*
a	— <i>Brownii</i> .....		1*		1*	
a	— <i>Jørgensenii</i> .....					1*
m	<i>Mnium hornum</i> .....	3	2	3	3	4
a	— <i>orthorrhynchum</i> .....	4	4	4	4	4
m	— <i>serratum</i> .....		1*		2*	3*
u	— <i>spinosum</i> .....		1			
m	— <i>undulatum</i> .....					3
m	— <i>cuspidatum</i> .....		1			1
b	— <i>medium</i> .....	1				
u	— <i>affine</i> .....	4	4	4	4	4
u	— <i>Seligeri</i> .....	3	2		2	4
m	— <i>stellare</i> .....	1	1*		1	1
b	— <i>cinclidioides</i> .....	4	4	4	4	4
u	— <i>punctatum</i> .....	4*	4*	4*	4*	4*
b	— <i>subglobosum</i> .....		2*		1*	1
b	<i>Cinclidium stygium</i> .....	4*	4*	3*	3*	3*
b	<i>Paludella squarrosa</i> .....	4	4	3	3	2
b	<i>Amblyodon dealbatus</i> .....		1*			
b	<i>Meesea trichoides</i> .....	4*	4*	4*	4*	4*
u	— <i>triquetra</i> .....	3	3	2	2	2
b	<i>Catocopium nigratum</i> .....	4*	4*	2*	4*	2*
a	<i>Conostomum boreale</i> .....	3*	3*	4*	3*	3*

Table IV. The Frequency of the Species in the different Districts of Iceland (continued),

		E. Icel.	N. Icel.	NW. Icel.	W. Icel.	S. Icel.
u	<i>Aulacomnium palustre</i> .....	4	4	4	4	4
a	— <i>turgidum</i> .....	2	2	2	1	1
u	<i>Bartramia ityphylla</i> .....	4*	4*	4*	4*	4*
b	<i>Plagiopus (Ederi)</i> .....	1*	1*			
u	<i>Philonotis fontana</i> .....	4*	4*	4*	4*	4*
b	— <i>Arnellii</i> .....		1		1	1
a	— <i>seriata</i> .....	2	3*	4*	2	1
b	— <i>tomentella</i> .....	4*	4*	4*	4*	4*
a	<i>Timmia norvegica</i> .....	1	1			1
b	— <i>austriaca</i> .....	4	4*	2	4	4
m	<i>Catharinaea undulata</i> .....	2*	1*		3*	4*
a	<i>Oligotrichum hercynicum</i> .....	2*	2*	4*	2*	3*
a	<i>Psilopilum lævigatum</i> .....	3*	3*	3*	3*	3*
m	<i>Pogonatum polytrichoides</i> .....				2*	2*
a	— <i>dentatum</i> var. <i>minus</i> .....				1*	
u	— <i>urnigerum</i> .....	3*	3*	3*	3*	3*
a	<i>Polytrichum alpinum</i> .....	4*	4*	4*	4*	4*
m	— <i>formosum</i> .....				1	
b	— <i>gracile</i> .....	3*	3*	3*	3*	3*
a	— <i>sexangulare</i> .....	?	3*	4*	3*	3*
u	— <i>piliferum</i> .....	1*	2*	2*	2*	2*
u	— <i>juniperinum</i> .....	3*	3*	3*	3*	3*
b	— <i>strictum</i> .....	2	3	3	2	2
u	— <i>commune</i> .....	2	2	2	2*	2
b	— <i>Swartzii</i> .....			1		
b	— — var. <i>nigrescens</i> ..			1		
u	<i>Diphyscium sessile</i> .....	3	1*	2	3*	3*
u	<i>Fontinalis antipyretica</i> .....	3	3	3	3	3
Icel.	— <i>islandica</i> .....	1				
Icel.	— <i>longifolia</i> .....					2*
Icel.	— <i>thulensis</i> .....					1
b	— <i>androgyna</i> .....				1*	1*
m	<i>Leucodon sciuroides</i> .....	1			1	2*
u	<i>Antitrichia curtispindula</i> .....	2	2	2	3	3
m	<i>Neckera complanata</i> .....				1	2
b	<i>Myurella julacea</i> .....	4	4	4	4	4
b	— <i>apiculata</i> .....	3	3	3	3	2
b	<i>Leskea nervosa</i> .....	1				1
u	— <i>catenulata</i> .....			1		
m	<i>Anomodon viticulosus</i> .....					1
u	<i>Pterigynandrum filiforme</i> .....	4	4	4	4	4
a	<i>Lescurea decipiens</i> .....	1		1		
a	— <i>radicosa</i> .....		1			

Table IV. The Frequency of the Species in the different Districts of Iceland (continued).

		E. Icel.	N. Icel.	NW. Icel.	W. Icel.	S. Icel.
b	<i>Lescuræa filamentosa</i> .....	3	3	4*	3	3
a	— <i>Breidleri</i> .....	1	2	3		1
b	— <i>patens</i> .....	1	1*	2*	2	1
b	<i>Heterocladium squarrosulum</i> .....	1	1		1	1
m	<i>Thuidium tamariscinum</i> .....					3
m	— <i>delicatum</i> .....			1	2	3
m	— <i>Philiberti</i> .....				1	3
b	— <i>lanatum</i> .....	4*	4*	2*	2*	1*
a	<i>Orthothecium rufescens</i> .....				1	
a	— <i>intricatum</i> .....		1			2
a	— <i>chryseum</i> .....	4	4	2	2	
m	<i>Cylindrothecium concinnum</i> .....		1			1
u	<i>Climacium dendroides</i> .....	4*	4	4	4	4
m	<i>Isothecium myurum</i> .....				1	2
b	— <i>tenuinerve</i> .....	1		1	3	3
u	<i>Homalothecium sericeum</i> .....	4	4	4	4	4*
m	<i>Camptothecium lutescens</i> .....	2	2	2	3	3
b	— <i>nitens</i> .....	4*	4*	4*	4*	3*
u	<i>Brachythecium Mildeanum</i> .....	1			1	
u	— <i>salebrosum</i> .....	2	2	2	2	2*
a	— <i>collinum</i> .....				1	
Icel.	— <i>longifolium</i> .....					1*
u	— <i>populeum</i> .....					1*
u	— <i>velutinum</i> .....					2*
a	— <i>glaciale</i> .....		1	1	1	
u	— <i>reflexum</i> .....	3*	3*	3*	3*	3*
u	— <i>glareosum</i> .....	1	1		1	
u	— <i>albicans</i> .....	3	3	3	3	3
b	— <i>erythrorrhizon</i> .....		1		1	
b	— <i>rivulare</i> .....	4	4	4	4	4
b	— <i>latifolium</i> .....		1			
m	<i>Scleropodium purum</i> .....					3
m	<i>Eurhynchium strigosum</i> .....				1	
m	— — <i>var. præcox</i> ..		1		1	1
a	— <i>diversifolium</i> .....		1			
a	— <i>cirrosium</i> .....				1	
m	— <i>piliferum</i> .....				2	3
m	— <i>Swartzii</i> .....					3
m	— <i>Stockesii</i> .....					2
m	<i>Rhynchostegium murale</i> .....					1*
m	— <i>rusciforme</i> .....		1	1	2	3*
b	— — <i>v. atlanticum</i>		2		1	2
m	<i>Thamnum alopecurum</i> .....				1	3



Table IV. The Frequency of the Species in the different Districts of Iceland (continued).

		E. Icel.	N. Icel.	NW. Icel.	W. Icel.	S. Icel.
u	<i>Plagiothecium silvaticum</i> .....		1			1
u	— <i>Roeseanum</i> .....	3	3	3	3	3
u	— <i>denticulatum</i> .....		2	1	1	1
b	— <i>pulchellum</i> .....	3*	3*	3*	3*	3*
m	— <i>depressum</i> .....					1
m	— <i>elegans</i> .....					1
a	<i>Amblystegium Sprucei</i> .....	3	3	3	3	3
m	— <i>fluviatile</i> .....					1
m	— <i>serpens</i> .....		1*	1*		1*
m	— <i>Juratzkanum</i> .....		1*			1*
b	— <i>littorale</i> .....		1		1	
b	— <i>compactum</i> .....				1	1
b	— <i>salinum</i> .....					1
m	— <i>trichopodium</i> .....		1			
m	<i>Hypnum Sommerfeltii</i> .....		1			1
u	— <i>chrysophyllum</i> .....	1	1		1	1
u	— <i>protensum</i> .....	2	1		2	
u	— <i>stellatum</i> .....	4*	4*	4*	4*	4*
b	— <i>polygamum</i> .....	4*	4*	3*	4*	3*
u	— <i>intermedium</i> .....	?	3	?	?	?
b	— <i>revolvens</i> .....	4*	4*	4*	4*	4*
u	— <i>uncinatum</i> .....	4*	4*	4*	4*	4*
m	— <i>Sendtneri</i> .....		1			
b	— <i>Kneiffii</i> .....	3	3*	2	2	2
u	— <i>exannulatum</i> .....	4*	4*	4*	4*	3*
a	— — <i>var. Rotæ</i> .....	2		1	1	
u	— <i>fluitans</i> .....		1			1
a	— — <i>var. falcatum</i> .....			2*		
u	— <i>filicinum</i> .....	4*	3*	4*	4*	4*
a	— <i>curvicaule</i> .....	2*			1	
b	— <i>decipiens</i> .....	4	4*		1	
m	— <i>commutatum</i> .....	2	2	2	2	3*
b	— <i>falcatum</i> .....	4*	4*	4	4	4*
m	— <i>molluscum</i> .....	1			3	4*
b	— <i>imponens</i> .....	1			1	
a	— <i>Bambergeri</i> .....				1	
a	— <i>revolutum</i> .....	4	4	4	4	4*
u	— <i>cupressiforme</i> .....	2	2		3	4*
a	— <i>hamulosum</i> .....	1		1	2	2
a	— <i>callichroum</i> .....	1		3*	2	3
u	— <i>Lindbergii</i> .....	4	4	4	4	4
u	— <i>palustre</i> .....	1*	2*		2*	3*
a	— <i>arcticum</i> .....			1*	1*	

Table IV. The Frequency of the Species in the different Districts of Iceland (continued).

		E. Icel.	N. Icel.	NW. Icel.	W. Icel.	S. Icel.
a	<i>Hypnum alpestre</i> . . . . .	3*	3*	3*	2*	2*
a	— <i>alpinum</i> . . . . .	1*	3*	3*		
a	— <i>ochraceum</i> . . . . .	4	4	4	4	4
u	— <i>cordifolium</i> . . . . .		1	1*		
b	— <i>Richardsonii</i> . . . . .	2*	2*	1	1	1
b	— <i>giganteum</i> . . . . .	4*	4*	4*	4*	4*
u	— <i>stramineum</i> . . . . .	4	4*	4	4	4
a	— <i>sarmentosum</i> . . . . .	3	3*	3*	3	3
b	— <i>trifarium</i> . . . . .	1	1			
a	— <i>turgescens</i> . . . . .	1	1			1
u	<i>Acrocladium cuspidatum</i> . . . . .	4*	4*	4*	4*	4*
u	<i>Scorpidium scorpioides</i> . . . . .	4	4	4	4	3
u	<i>Hylocomium proliferum</i> . . . . .	4	4	4	4	4
b	— <i>pyrenaicum</i> . . . . .					1
u	— <i>parietinum</i> . . . . .	2		3	3	3
u	— <i>loreum</i> . . . . .			2	3	3*
u	— <i>triquetrum</i> . . . . .	2	1	2	3	3
u	— <i>squarrosum</i> . . . . .	4	4	4	4	4
b	— <i>rugosum</i> . . . . .	3	3	3	3	3

Of the 93 Hepaticæ, 20 Sphagna and 326 Musci veri found in Iceland, 7 Hepaticæ, 3 Sphagna and 4 Musci veri (besides 3 varieties) have been found only on warm soil. The other 425 species (87 Hepaticæ, 17 Sphagna and 322 Musci veri) enumerated in the above table can be arranged according to frequency in the following groups (Table V): —

- Dominant or very common species, the frequency of which is expressed by the figure 4 in all parts of Iceland or by 3 in only a few parts.
- Frequent species, the frequency of which is expressed by the figure 3 in the whole, or at any rate in the greater part, of Iceland.
- Species of which the frequency is expressed by the figures 1 à 2, or which have a higher degree of frequency only in a single district of Iceland.

Table V.

	Group a	Group b	Group c
Hepaticæ .....	23	14	49
Sphagna .....	1	3	13
Musci veri.....	64	82	176
Total...	88	99	238
	20.7 %	23.5 %	55.8 %

Iceland, according to the climatic conditions, may be divided into 5 districts, which division, also as regards the Land vegetation, coincides well with that employed by Helgi Jónsson (1912, p. 5) for the Marine vegetation along the coasts.

East Iceland, from Eystri Horn in the South-east to Langanes in the North-east.

North Iceland, from Langanes to Cape Horn in the North-west.

North-west Iceland, from Cape Horn to Látrabjarg.

West Iceland, from Látrabjarg to Reykjanes.

South Iceland, from the western point of the peninsula of Reykjanes to Eystri Horn.

The boundary lines between these districts are in most places formed by ridges or high-lying mountain plateaus. In the South-east, Lónsheidi (height about 400 metres) and Hofsjökul form the boundary between South and East Iceland. West Iceland is separated from South Iceland by the mountain-chain which stretches throughout the peninsula of Reykjanes, the lofty mountain of Hengill, the lake of Thingvall and the mountains situated north of a line drawn from Thingvellir to Geysir. Between North and East Iceland there is no sharp boundary line, either as regards climate or geography. South-east Iceland (from Seydisfjörður southwards) has a very damp climate with many foggy days (near Berufjörður on an average 171 annually), while the western part of North Iceland (the districts about Eyjafjörður, Skagafjörður and Hunafloi) has a greater difference between the summer and the winter temperature, considerably less precipitation and comparatively few foggy days. North-west Iceland, which comprises the country around the deep, narrow

fjords which open out towards the north-west, lies rather isolated, separated as it is from North and West Iceland by Jökulls and lofty mountain-ridges. The boundary between North and West Iceland is rather undefined. Several species which are common in West Iceland, but rare in or absent from North Iceland, are met with right in around Hunaflói. Here the range of hills east of Blóndudalur appears to form a natural boundary, since *Camptothecium lutescens* and *Rhacomitrium heterostichum*, for instance, have not been found east of this line, whilst other species common in North Iceland, for instance *Orthothecium chryseum*, *Hypnum decipiens* and *Thuidium lanatum*, are rare west of it.

Of the 87 Hepaticæ, 17 Sphagna and 322 Musci veri enumerated in Table II, 30 Hepaticæ, 4 Sphagna and 108 Musci veri (or collectively 33 %), are almost equally frequent in all the districts of Iceland, the frequency being (with a few exceptions) 3—4. The rest of the species can be grouped as follows: —

1. Species with a mainly Southern distribution.
2. » » » » Northern and Eastern distribution.
3. » » » » Western distribution.
4. Species which occur sporadically in several of the districts of Iceland.

### 1. Species with a mainly Southern Distribution.

a. Found only in South Iceland (the figure denotes frequency).

Meridional.		<i>Scleropodium purum</i> .....	3
<i>Reboulia hemisphærica</i> .....	3	<i>Eurhynchium Swartzii</i> .....	3
<i>Fegatella conica</i> .....	4	— <i>Stockesii</i> .....	2
<i>Fossombronia Dumortieri</i> .....	1	<i>Rhynchostegium murale</i> .....	1
<i>Aneura multifida</i> .....	1	<i>Plagiothecium elegans</i> .....	1
<i>Jamesoniella autumnalis</i> .....	1	— <i>depressum</i> .....	1
<i>Lophozia excisa</i> .....	1		
<i>Lophocolea cuspidata</i> .....	1	Boreal.	
<i>Lepidozia setacea</i> .....	1	<i>Haplozia riparia</i> .....	3
<i>Weisia viridula</i> .....	1	<i>Sphagnum compactum</i> .....	1
<i>Tortula muralis</i> .....	1	<i>Pohlia grandiflora</i> .....	2
— <i>mucronifolia</i> .....	1	<i>Amblystegium salinum</i> .....	1
<i>Hedwigia albicans</i> .....	1	<i>Hylocomium pyrenaicum</i> .....	1
<i>Orthotrichum anomalum</i> .....	1		
— <i>saxatile</i> .....	1	Alpine.	
— <i>cupulatum</i> .....	1	<i>Scapania Bartlingii</i> .....	1
<i>Mnium undulatum</i> .....	3	<i>Dicranum fulvellum</i> .....	3
<i>Anomodon viticulosus</i> .....	1	<i>Bryoxiphium norvegicum</i> .....	3
<i>Thuidium tamariscinum</i> .....	3	<i>Tortula obtusifolia</i> .....	1

Anomobryum concinnum . . . . .	1				Icelandic species.
Bryum Jörgensenii . . . . .	1				Brachythecium longipilum . . . . .
					Fontinalis thulensis . . . . .
					— longifolia . . . . .
					— velutinum . . . . .

*b. Found in South Iceland and in the most nearly adjacent parts of West and East Iceland.*

	S.	W.	E.		S.	W.	E.
Meridional.				Hypnum molluscum . . . . .	4	3	1
Marsupella Funckii . . . . .	1		1	Thuidium Philiberti . . . . .	3	1	
Frullania fragilifolia . . . . .	1	1					
Lejeunea serpyllifolia . . . . .	3	1		Boreal.			
Sphagnum papillosum . . . . .	2	2		Fontinalis androgyna . . . . .	1	1	
Weissia crispata . . . . .	1	1					
Barbula unguiculata var.				Alpine.			
cuspidata . . . . .	1	1		Dicranum Andersonii . . . . .	3		1
Trichostomum littorale . . . . .	1	1					
Leucodon sciuroides . . . . .	2	1		Ubiquists.			
Isothecium myurum . . . . .	2	1		Grimmia patens . . . . .		1	1
Eurhynchium piliferum . . . . .	3	2					

*c. Most frequent in South Iceland, rarer in the other districts of Iceland.*

	S.	W.	NW.	N.	E.		S.	W.	NW.	N.	E.
Meridional.						Grimmia torquata . . . . .	4	3	2	1	2
Radula complanata . . . . .	3	3		1	3	Plagiobryum Zierii . . . . .	2	2	1	1	2
Madotheca Cordæana . . . . .	4	3		2	2						
Barbula cylindrica . . . . .	3	1		1		Alpine.					
Mnium hornum . . . . .	4	3	2	2	3	Bryum æneum . . . . .	3	1	1	1	2
— serratum . . . . .	3	2		1							
Catharina undulata . . . . .	4	3		1	2	Ubiquists.					
Neckera complanata . . . . .	2	1				Sphagnum subnitens . . . . .	2	2	1		
Thuidium delicatulum . . . . .	3	2	1			Bryum capillare . . . . .	2	1		1	1
Rhynchostegium rus-						— pendulum . . . . .	2	1		1	
ciforme . . . . .	3	2	1	1		Mnium Seligeri . . . . .	4	2		2	3
Thamnium alopecu-						Antitrichia curtipe-					
rum . . . . .	3	1				dula . . . . .	3	3	2	2	2
Hypnum commutatum . . . . .	3	2	2	2	2	Hypnum palustre . . . . .	3	2		2	1
						— cupressiforme . . . . .	4	3		2	2
Boreal.						Hylocomium loreum . . . . .	3	3	2		
Sphagnum medium . . . . .	2	1	1			— triquetrum . . . . .	3	3	2	1	2
Hymenostylium cur-											
virostre . . . . .	3	1		1							

## 2. Species with a mainly Northern Distribution.

With the exception of the southernmost part of East Iceland — almost as far as Djúpivogur — and the westernmost part of North Iceland — as far as Blóndudalur — there is a very great



resemblance between the Bryophyte vegetation of East and North Iceland, therefore they will partially be mentioned collectively in the following lists.

*a. Found only in North Iceland.*

Meridional.		Alpine.	
Sphagnum angustifolium.....	1	Sauteria alpina.....	1
Leptodontium flexifolium .....	1	Scapania remota.....	1
Amblystegium trichopodium....	1	Weisia Wimmeriana.....	1
		Dicranoweisia compacta .....	1
		Pottia latifolia .....	1
		Desmatodon cernuus.....	1
		Bryum comense.....	1
		Pohlia Ludwigii.....	1
		Eurhynchium diversifolium ...	1
		Lescuræa rigescens .....	1
		Icelandic.	
		Bryum islandicum.....	1

*b. Found only in East Iceland.*

Meridional.			
Bryum bimum .....	1	Bryum neodamense var. ovatum.	1
		— Kaurini.....	1
		Grimmia incurva .....	1
		Ubiquists.	
		Cynodontium polycarpum.....	1
		Tortella inclinata.....	1
		Icelandic.	
		Fontinalis islandica .....	1

*c. Found only in North and East Iceland.*

Meridional.		N. E.		N. E.	
Diplophyllum obtusifolium ..	1 1	Plagiopus Ederi.....	1	1	1
		Hypnum trifarium.....	1	1	1
		Alpine.			
Schistidium confertum.....	2 1	Orthotrichum Killiasii .....	1	1	1
Grimmia ovata.....	2 2				

*d. Most widely distributed in East and North Iceland.*

Boreal.		E. N. NW. W. S.		E. N. NW. W. S.	
Dicranum congestum..	4 4 ? 3 2	Pohlia tenuifolia.....	2	2	1
Distichium inclinatum .	1 2 1	Bryum purpurascens..	2	3	2 2 1
		— lacustre.....	2	3	1 2 2
Dissodon splachnoides.	1 4 3 1 1	Paludella squarrosa... 4	4	3	3 2

	E. N. NW. W. S.		E. N. NW. W. S.
Cinclidium stygium . . .	4 4 3 3 3	Alpine.	
Thuidium lanatum . . . .	4 4 2 2 1	Aulacomnium turgidum	2 2 2 1 1
Orthothecium chryseum	4 4 2 2		
Hypnum decipiens . . . .	4 4 1	Ubiquists.	
— Richardsonii . . . .	2 2 1	Meesea triquetra . . . . .	3 3 2 2 2

### 3. Species with a mainly Western Distribution.

#### a. Found only in North-west Iceland.

Boreal.			
Haplozia sphærocarpa . . . . .	1	Tortula aciphylla . . . . .	1
Polytrichum Swartzii . . . . .	1	Hypnum fluitans var. falcatum . .	2
— var. nigrescens . . . . .	1		
Alpine.		Ubiquists.	
Gymnomitrium revolutum . . . . .	1	Marsupella aquatica . . . . .	1
Sphenobolus politus . . . . .	1	Gymnocolea inflata . . . . .	1
Cephalozia ambigua . . . . .	1	Sphagnum Gravetii . . . . .	1
		— riparium . . . . .	3
		Leskea catenulata . . . . .	1

#### b. Found only in West Iceland.

Meridional.			
Trematodon ambiguus . . . . .	1	Pohlia polymorpha . . . . .	1
Polytrichum formosum . . . . .	1	Pogonatum dentatum var. minus .	1
Pogonatum polytrichoides . . . . .	2		
Alpine.		Ubiquists.	
Plagiobryum demissum . . . . .	1	Fissidens decipiens . . . . .	1
		Encalypta contorta . . . . .	1

#### c. Most widely distributed in North-west Iceland.

	E. N. NW. W. S.		E. N. NW. W. S.
Boreal.			
Lophozia Flæckerkei . . . .	4 2	Philonotis seriata . . . . .	2 3 4 2 1
Harpanthus Flotowianus	1 1 4 2	Oligotrichum hercyni-	
Scapania uliginosa . . . .	1 3	cum . . . . .	2 2 4 2 3
Dicranella squarrosa . . . .	2 2 4 2 1	Polytrichum sexangulare	3 2 4 3 3
Bryum cirratum . . . . .	2 2 3 2 1	Lescuræa Breidlereri . . . . .	1 2 3 1
Alpine.		Ubiquists.	
Pleuroclada albenscens . . . .	3 3 4 2 2	Dicranum majus . . . . .	3 1
Pohlia cucullata . . . . .	1 2	— fuscescens . . . . .	4 1
		Pohlia nutans . . . . .	1 1 3 1 2

#### d. Most widely distributed in the western part of Iceland.

	E. N. NW. W. S.		E. N. NW. W. S.
Ubiquists.			
Dicranella cerviculata . . . .	1 2 2	Dicranum elongatum . . . . .	2 2 2
		Isothecium tenuinerve . . . . .	1 3 3
Boreal.		Meridional.	
Dicranum Blyttii . . . . .	1 1 3 3 3	Camptothecium lutescens	2 2 2 3 3
		Barbula fallax . . . . .	1 1

Table VI. Collective Survey of the Number of Species  
in the different Districts of Iceland.

Plant-geographical character	m		b		a		u		Number of Species
	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	
South Iceland.....	39	16	31	41	30	36	23	75	291
Found only in South Iceland	26	9	5	1	4	3	3		51
East Iceland.....	11	4	26	51	32	30	30	68	252
Found only in East Iceland	1		2		4		2		9
North Iceland.....	23	2	33	50	43	30	38	68	287
Found only in North Iceland	3		7		10				20
Found only in N. and E. Iceland.....	1		4		1				6
North-west Iceland.....	7	3	19	49	27	31	25	61	222
Found only in North-west Iceland.....			3		5		4	1	13
West Iceland.....	25	8	37	48	30	25	33	76	282
Found only in West Iceland	3				3		2		8

By comparing the Tables and Lists of species contained in the present section it is seen that: —

The Meridional species belong mainly to the southern part of Iceland, in the south-western part of which they arrive at their maximum, both as regards number and frequency, and from thence decrease in number and frequency towards north-west and east. In south-east Iceland there is a tolerably sharp limit for their distribution, whilst a great number of species are to be found — but with decreasing frequency — even throughout the whole of West Iceland. The respective percentages of the entire number of species are as follows: — South Iceland 19 %; East Iceland 6 %; North Iceland 9 %; North-west Iceland 5 % and West Iceland 12 %. A comparatively great number of species have been found in a single locality, or in a few localities, in North Iceland, especially around Eyjafjörður and eastwards in the valleys towards Mývatn, which may probably be due to the higher summer temperature of these districts.

The Boreal Group, over the whole of Iceland — with the exception of South Iceland — constitutes the same percentage of the vegetation (S. Icel. 24 %; E. Icel. 30 %; N. Icel. 29 %; NW. Icel. 31 % and W. Icel. 30 %), and the great majority of the species belong to those which are common everywhere (56 species are common to all the districts of Iceland, with a frequency of 3–4, corresponding to about 60–75 %).

The Alpine Group likewise shows almost the same percentage in all the districts (S. Icel. 23 %; E. Icel. 25 %; N. Icel. 26 %; NW. Icel. 26 % and W. Icel. 20 %) of which about half the number (some 30 species) are common to all the districts.

The Ubiquitous Group comprises chiefly species which have a great distribution in all parts of Iceland (S. Icel. 34 %; E. Icel. 39 %; N. Icel. 38 %; NW. Icel. 39 % and W. Icel. 38 %), 73 of which (67–85 %) are common to all the districts, with a frequency of 3–4.

The composition of the vegetation as regards percentage is thus very nearly the same everywhere as regards the three last groups, whilst, with regard to the meridional species, the country may be divided into a north-eastern and a south-western part.

The North-eastern part comprises East and North Iceland as far as Blóndudalur. The meridional species play a very slight rôle in the vegetation here. Two species only, *Metzgeria furcata* and *Racomitrium aciculare*, are common everywhere in this part, and five species, viz. *Radula complanata*, *Madotheca Cordæana*, *Catharina undulata*, *Mnium hornum* and *Hypnum commutatum*, are somewhat frequent in East Iceland, but are absent from, or are rare in, North Iceland.

Some few, principally Boreal and Alpine species, are characteristic of North and East Iceland.

*Hypnum decipiens* is very common from Seydisfjörður to Blóndudalur, but is absent from, or is rare in, the other parts of Iceland.

*Orthothecium chryseum* is one of the most commonly occurring species in the whole of East and North Iceland, but is absent from South Iceland, and is rather rare west of Hunaflóí.

*Grimmia ovata* has been found only in East and North Iceland. *Philonotis tomentella* is very common in meadow-ground in North and East Iceland, from Seydisfjörður; but is less frequent on damp rocks in other parts of Iceland.

*Cinclidium stygium*, *Meesea triquetra*, *Paludella squarrosa*, *Thuidium lanatum*, *Hypnum exannulatum*, *H. Richardsonii*, *H. sarmentosum* and *H. alpestre* occur far more abundantly in the northern half of Iceland than in the southern, and are often the most abundant constituents of the vegetation.

*Dicranum congestum*, which is one of the most commonly occurring species in North and East Iceland and occur there in numerous forms, is far more rare in South and West Iceland, and is evidently absent from North-west Iceland.

A rather considerable number of species, which are most frequent in South and West Iceland, decrease in frequency throughout East Iceland, and are absent from, or are rarer in, North Iceland, for instance *Scapania dentata*, *Anæctangium compactum*, *Grimmia torquata*, *Racomitrium heterostichum*, *R. fasciculare*, *Amphidium Mougeottii*, *Mnium Seligeri*, *Diphyscium sessile*, *Hypnum filicinum*, *H. cupressiforme*, *Hylocomium parietinum* and *H. triquetrum*.

South Iceland. The vegetation is primarily characterized by the presence of numerous meridional species, of which those with a frequency of 3—4 constitute an essential part of the moss-covering.

*Fegatella conica* and *Reboulia hemisphærica* in company with *Preissia commutata* and *Marchantia polymorpha* form special *Marchantiaceæ*-associations on damp shady tuff-faces. *Lejeunea cavifolia*, *Madotheca Cardæana*, *Barbula cylindrica*, *Mnium serratum*, *M. undulatum*, *Catharinea undulata*, *Thuidium tamariscinum*, *T. delicatulum*, *T. Philibertii*, *Eurhynchium piliferum*, *E. Swartzii*, *Rhynchostegium rusciforme*, *Scleropodium purum*, *Thamnium alopecurum*, *Hypnum molluscum* and *H. commutatum* are the most frequently occurring species in SW. Iceland. Of the boreal Bryophyta *Haplozia riparia*, *Hymenostylium curvirostre*, *Grimmia torquata* and *Plagiobryum Zierii* are most widely distributed in South Iceland; but this is no doubt chiefly due to the fact that a suitable substratum (tuff) abounds.

The Alpine species *Dicranum Andersonii*, *D. fulvellum* and *Bryoxiphium norvegicum* are common in the tuff districts of South Iceland, but have not been found in other parts of the country.

Several ubiquitous occur more frequently and abundantly in South Iceland than in the other districts, for instance *Mnium Seligeri*, *Antitrichia curtispindula*, *Hypnum palustre*, *H. cupressiforme*, *Hylocomium loreum*, *H. triquetrum* and *H. parietinum*. These species ascend only exceptionally above the limit of the birch.



The difference in the climate is also apparent from the fact that species, which in North and East Iceland are common as far down as the low land, in South Iceland are first met with in abundance at a higher altitude. This is for instance the case with *Schistidium rivulare*, *Oncophorus Wahlenbergii*, *O. virens* and *Dicranum congestum* which are not common until at a height of 200—300 metres. The Bryophyte vegetation in the higher-lying bogs (200—500 metres) also corresponds closely with the bog vegetation of the lowlands of North and East Iceland, while the bog vegetation of South Iceland differs somewhat considerably in character (p. 561).

North-west Iceland. The Bryophyte vegetation differs in several points from that of the other districts. From a narrow belt of coastal land the country rises abruptly to a height of about 500 metres, so that there is only room for the boggy tracts, so common in the other districts of Iceland, in those valleys which, from the head of the fjords, ascend towards the high land. Here the number of species is essentially smaller than in the other districts of Iceland, since many of the common species, as well as of the rare ones, are absent, on the other hand, however, there are some few species which are widely distributed in North-west Iceland, but are absent from, or rarer in the other districts. This, among others, is the case with regard to several of the species belonging to the heath formation.

*Dicranum fuscescens*, *D. majus* and *D. molle* are very common in NW. Iceland and, in association with other species (especially Hepaticæ), form *Dicranum* heaths (p. 591): a formation which is otherwise rare in Iceland. *Pohlia nutans* and *Bryum cirratum* are also common, especially in the birch coppices. *Polytrichum piliferum* is tolerably frequent and has been found in fruit in several places.

*Lophozia Flærkei* is very common as far upwards as about 500 metres above sea-level. It has, however, only been found in a lava-field in SW. Iceland.

There are also several hygrophilous species which are characteristic of NW. Iceland: *Sphagnum squarrosum* is frequent on damp slopes and *S. riparium* is rather common in pools. On inundated ground *Scapania uliginosa*, *S. paludosa*, *Harpanthus Flotowianus* and *Philonotis seriata* are very common and often form — either separately or collectively — the bulk of the vegetation. *Hypnum fluitans* var. *falcatum* occurred abundantly north of Isafjörður.

The rocky flat is very widely extended in NW. Iceland, since it comprises all the flats and plateaus above the mountain slopes, and on the north side of the mountains descends as far downwards as to the sea-level. Several rocky-flat plants are therefore more widely distributed here than in the other districts of Iceland. *Oligotrichum hercynicum*, *Rhacomitrium sudeticum*, *Conostomum boreale*, *Lescuræa Breidleri*, *Gymnomitrium concinnatum* and *Pleuroclada albescens* are very common. *Sphenobolus politus*, *Haplozia sphærocarpa*, *Gymnomitrium revolutum* and *G. varians* have been found only on the rocky flats of NW. Iceland.

*Lescuræa filamentosa* is very common and found fruiting on detached blocks and on rocks, and *L. patens* is also frequent and likewise sets fruit.

Some few species, which are widely distributed elsewhere in Iceland, are absent here, for instance *Scapania dentata*, *Radula complanata*, *Gymnostomum rupestre*, *Campylopus Schimperii*, *Selania cæsia*, *Mnium Seligeri*, *Hypnum cupressiforme* and *Hypnum palustre*, whilst others are rare, for instance *Preissia commutata*, *Leptobryum pyriforme*, *Catocopium nigratum*, *Timmia austriaca* and *Hypnum falcatum*. The comparatively abundant occurrence of species of *Sphagnum*, and the lesser frequency of the last-mentioned lime-loving species, appear to indicate that the soil here is less calcareous than in the other districts of Iceland.

The Bryophyte vegetation of NW. Iceland has, on the whole, a more decidedly xerophilous and Arctic character than that of the rest of Iceland.

West Iceland has, with the exception of the southern part as far as Borgarfjörður, been very superficially investigated and, apart from a few scattered collections made by Helgi Jónsson, especially in Búdahraun on Snæfellsnes, and my own collections near Stýkkisholmur, the whole stretch of coast north of Hvalfjörður and around Breidifjörður is, from a bryological point of view, quite unknown.

Several of the species characteristic of South Iceland occur here also, partially decreasing in frequency throughout West Iceland, for instance *Thuidium delicatulum*, *Hylocomium loreum*, *Eurhynchium piliferum* and (in the South-west) *Madotheca Cordæana*. Some species have a decidedly westerly distribution in Iceland, being of almost equal frequency in West and South-west Iceland and a few also in

the North-west, whilst they are absent from, or rare in, the other districts of the country. To this group belong: *Dicranella cerviculata*, *Dicranum Blyttii*, *D. elongatum* (western part of N. Iceland around Hunaflóí; NW. and W. Iceland), *Ditrichum homomallum* (common in the South-west), *Isothecium tenuinerve*, *Rhynchostegium ruscifforme*, *Hypnum hamulosum* and *Hylocomium parietinum*. Finally, *Diplophyllum albicans* is characteristic of all the lava-fields of West and South-west Iceland.

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## ERRATA.

- P. 429 l. 7 add Geysir!
  - 434 - 1 should read "I. Musci veri".
  - 438 - 25 for "elongatum" read "elongatus".
  - 463 - 10 from bottom for "Weissia" read "Weisia".
  - 471 - 6 for "Wiinsted" read "Wiinstedt".
  - 473 - 24 for "*tenuifolia*" read "*grandiflora*".
  - 588 - 19 for "Associations" read "Formations".
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