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Biologiske Meddelelser **XI**, 2.

STUDIES ON THE GEOGRAPHICAL
DISTRIBUTION OF ARCTIC
CIRCUMPOLAR MICROMYCETES

BY

J. LIND



KØBENHAVN
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Introduction.

The Botanical Museum of Copenhagen has with the greatest liberality placed the whole of its exceedingly valuable material of Arctic vascular plants at my disposal, so that I could examine what there was to be found of micromycetes on them. I should like here to express my grateful thanks, to the Botanical Museum, and especially to its superintendent Mr. CARL CHRISTENSEN for his unfailing readiness to assist me during the ten years I have worked on this subject.

I have examined these exceptionally rich collections from all arctic regions to procure information about what species of parasites and saprophytes are to be found in the Polar countries. The famous Polar expeditions (Dijmphna, Vega, Gjøa, Maud etc.) have with the greatest difficulty brought home excellent collections of flowering plants and ferns, which have been scientifically studied for many purposes, the micromycetes only have hitherto been neglected in an inexcusable degree.

E. ROSTRUP however, examined all collections from Greenland in the same way, and long ago published the results of his investigations. I have myself published lists of fungi from later expeditions to that land. Therefore I have not occupied myself with Greenland, except in the case of a few plants which were kindly sent me from Disko by M. P. PORSILD after the death of E. ROSTRUP.

I shall now give a list of the collections with which we are here concerned, and mention each country, beginning with the northernmost part of Norway and continuing eastwards, so as to end with Greenland and Jan Mayen. It is necessary to make this list of collectors and collecting-places quite detailed, to save the many repetitions in the text.

The degrees given are always north latitudes. And the altitudes given are always in metres.

Eurasia.

The northernmost part of Norway has often been visited by botanists and several very good collections from there are incorporated in our Botanical Museum even from about the year 1800 when P. V. DEINBOLL, a clergyman in Vadsø, sent plants down to CHR. FR. SCHUMACHER in Copenhagen. A little north of the polar circle is Salten and Salten Fjord, where the Rev. SEV. CHR. SOMMERFELT lived when he published his "Supplementum Florae Lapponicae" in 1826, with no less than 346 species of fungi from this region. G. WAHLENBERG also collected plants here in 1807, and J. M. NORMAN has botanized in the neighbouring town, Bodø.

I visited the town of Narvik, $69^{\circ}30'$, in 1930. And Målselven, $69^{\circ}10'$, has been visited by I. M. NORMAN (his collections have never any date). The town of Tromsø $69^{\circ}10'$ is the seat of a scientific establishment, Tromsø Museum, where G. LAGERHEIM worked in 1892—1895; it, together with the neighbouring localities Lyngen, Kvalø and Mt. Fløjfjeldet, was visited by C. I. LALIN (1884), I. M. NORMAN, ANDR. NØTØ (1896) and THORILD WULFF (1899). Further the fjord Kvanangen $69^{\circ}50'$ and Mt. Sliravare 700 m, by ANDR. NØTØ in the year 1900.

The town of Alten 70° together with the river Alten Elv

and Alten-Fjord, Kåfjord, Talvik, Bosekop and Komag-Fjord have been visited by many diligent botanists viz.: JENS VAHL (1838), ANDERSEN (1864), A. BLYTT, L. L. LÆSTADIUS, EUGEN WARMING (1885), I. E. ZETTERSTEDT (1868), I. M. NORMAN (1868), C. I. LALIN (1884) and C. I. LINDEBERG in 1888.

The town of Hammersfest $70^{\circ}40'$ and the islands Sørø and Kvalø beside the sound Kvalsund and Næver-Fjord were visited by JENS VAHL in 1838 and by I. M. NORMAN. Further the island Magerø 71° and Mt. Nordkap by TH. M. FRIES in 1864 (see THORE M. FRIES: En botanisk resa i Finmarken 1864, Botan. Notiser 1865) and C. I. LALIN in 1883.

Varanger-Fjord $70^{\circ}10'$ and the town of Nyborg, Mt. Mortensnæs and Karlbotn were visited by N. LUND in 1842 (see Botan. Notiser 1846 p. 33—48 and p. 65—95), TH. M. FRIES in 1857 and 1864, A. G. NORDVI in 1859 and 1869, A. BLYTT, C. I. LALIN in 1883 and S. HENSCHEN in 1864 and finally the town of Kautokeino in the interior of Finmarken 69° at the source of Alten-Elv was visited by OVE DAHL in the year 1915.

E. ROSTRUP (1886) examined the plants which E. WARMING brought home in 1885 and some information concerning the micromycetes of the northernmost parts of Norway is to be found in J. SCHROETER, G. LAGERHEIM, A. BLYTT, IVAR JØRSTAD and others, see the list of literature at close.

Lapponia Suecica. There are to be sure very few plants in our Botanical Museum from the regions of Sweden north of the polar circle, that is, Luleå Lapmark and Torneå Lapmark. We have some collections of the Rev. L. L. LÆSTADIUS from the years 1821 to 1839 from Karesuando, Kirkevara and Nyrefernando, further some plants from Jukka-

sjärvi, collected in 1842 by MALME and some from Torneå Träsk collected by FR. BJÖRNSTRÖM in 1852. But in 1930 I visited Torneå Lapmark, especially the localities Björkliden, Abisko $68^{\circ}10'$ and Mt. Nuolja, all near the lake of Torneå Träsk, the town of Kiruna $67^{\circ}50'$, Kaalasluspa, Niko-lahti, the town of Gelivare, Mt. Dundret and Mt. Kebnekaise. The same district has been visited earlier by numerous botanists and even by mycologists (O. H. JUEL, TYCHO VESTERGREN, G. LAGERHEIM, J. A. NANNFELDT and others) and there is much information concerning micromycetes from Lapponia Suecica to be found in literature even J. SCHROETER's publication (1881) on Wichura's collections 1856 near Kvikkjokk 67° .

Finland (Fennia) is by Finnish botanists divided into several districts; from all the districts north of the polar circle I have seen herbarium-plants, viz.:

Lapponia Kemensis, between 66° and 68° immediately east of Sweden, was visited by G. WAHLENBERG, and by FELLMAN in 1821.

Lapponia Tulomensis 68° — 70° with the town of Kola and the island Kildin in the Arctic Ocean was visited by FR. NYLANDER in 1844 and by V. F. BROTHNERUS in 1887.

Lapponia Murmanica forms the main part of the north coast of the peninsula Kola. It was visited by V. F. BROTHNERUS in 1885 and 1887 and by OSW. KIHLMAN in 1889.

Lapponia Ponojensis 66° — 68° forms the east coast of the peninsula Kola, visited by OSW. KIHLMAN in 1889.

Lapponia Varsugae is the southern part of Kola. I. A. PALMÉN made collections here in 1887 and OSW. KIHLMAN in 1889.

Lapponia Imandrae with the town of Kantalax was visited

by J. ÅNGSTRÖM in 1843, by A. OSW. KIHLMAN in 1887 and 1892 and by BROTHÉRUS in 1887.

Concerning these investigations of northernmost Finland, see V. F. BROTHÉRUS: *Botanische Wanderungen auf der Halbinsel Kola* in *Botan. Centralbl.* 1886, A. OSW. KIHLMAN: *Floran i Inare Lappmark*. Soc. pro Fauna et Flora Fennica 11. 1884, and A. OSW. KIHLMAN: *Planzenbiologische Studien aus Russisch Lappland*. Helsingfors 1890. None of these, however, mention the micromycetes. On the other hand, we have very good accounts of all micromycetes from Finland (KARSTEN, LIRO, RAINO), but, strange to say, this is not the case with the micromycetes from Sweden.

Spitzbergen (also Svalbard) 75°—80°. Extensive botanical collections have been made here from as far back as 1827 (Keilhau) and to the present day. I have published (1928) a list of all the micromycetes, I have seen from this place.

Russia. I have only seen very few plants from the continent of European Russia, but all the more from the islands in the Arctic Ocean, viz.: Kolgujev 68° visited by H. F. FEILDEN in 1895 and by R. POHLE in 1902, the island Waigatsch 70°, separated from the continent by the Jugor Strait east of Dolga Bay, visited by F. R. KJELLMAN and A. N. LUNDSTRÖM on the Swedish Polar Expedition in 1875, again by KJELLMAN on the Vega Expedition (1878) and by TH. HOLM on the Dijmphna Expedition (1882) (see CHR. F. LÜTKEN: *Dijmphna Togtets zoologisk-botaniske Udbytte*, København 1887), further by Fisher in 1894 (see: *Voyage of S. Y. WINDWARD*) and by H. W. FEILDEN in 1897 (see: H. I. PEARSON: *Beyond Petsora Eastward*, London 1899).

The double-island Novaya-Zemlya 72°—78° has been investigated by all the same expeditions, and by others too, thus by OTTO EKSTAM in 1891 and in 1895, E. JØRGENSEN in

1896 and H. LYNGE in 1921. Some of the collections from Novaya-Zemlya have been studied by FÜCKEL (1874), OUDEMANS (1885), JØRSTAD (1923) and by me (1924). I have, however, found still a good number of micromycetes on the same plants.

Franz Josef Land 80° — 85° was visited by H. FISHER, who took part in the JACKSON-HARMSWORTH Polar Expedition (1895—1896).

There is in our Botanical Museum an abundance of plants from all the northern coast of Siberia, which is the more welcome, because this wide territory has formerly been quite unknown by mycologists. It is especially F. R. KJELLMAN, Botanist of the Vega Expedition, whom we have to thank for the excellent collections during the years 1878 and 1879 from the following places:

August 4—8, 1878, Peninsula Jalmal $72^{\circ}50'$ and the island Hvide Ø 73° .

— 6—10, 1878, Dickson Harbour near the mouth of Jenisei $73^{\circ}28'$.

— 14—18, 1878, Actinie Bay and Taimyr Island $76^{\circ}15'$.

— 19—20, 1878, Cape Tscheljuskin $77^{\circ}36'$.

— 24, 1878, Preobraschenie Island $74^{\circ}45'$.

September 12, 1878, Irkapij $68^{\circ}55'$.

— 29, 1878, to July 18, 1879, Pitlekai $67^{\circ}5'$.

July 28—30, 1879, Konyam Bay $64^{\circ}49'$.

Concerning the Vega Expedition see: F. R. KJELLMAN: Om Växtligheten på Sibiriens Nordkyst. Öfv. Kgl. Vet. Ak. Förh. Nr. 9, Stockholm 1879.

Besides the plants from the Vega Expedition, I have, however, seen many other very good collections from Arctic

Siberia, some plants collected as far back as 1816 on Kamtschatka by WORMSKJOLD, others collected by CHAMISSO and by LEDEBOUR. From recent times I have seen from the delta of the river Jenisei 69° — 73° A. N. LUNDSTRÖM's collections from 1875 and those of H. VILH. ARNELL and M. BRENNER from 1876, especially from the places Nikandrowskij Island $70^{\circ}20'$, Dudino, Tolstoinos $70^{\circ}10'$, Lebedjevo and Selivanova.

The peninsula Taimyr $71^{\circ}15'$ to 74° was investigated by the "Expeditio Siberica Academica" (A. TH. VON MIDDENDORFF and M. BRANTH) in the year 1843, see MIDDENDORFF: Reise in den aussersten Norden und Osten Sibiriens, Bd. VI, Sct. Petersburg 1867, I have seen many of the plants, esp. from Boganida $71^{\circ}15'$.

Ostia Lenae, the mouth of the river Lena, about 72° , was visited in 1882 by A. THORNAM. Further A. BUNGE has visited the mouth of the Lena, Jana in East Siberia 70° and the island Ljackow in the years 1883 and 1885.

All the above mentioned collections are from the last century. From this century there are only a few plants f. inst. from the Wrangel Island near Bering Strait, collected by ALAN CRAWFORD.

America.

I have seen many excellent collections from Arctic America, viz.: Sct. Lawrence Island $63^{\circ}40'$ south of the Bering Strait, visited by the Vega Expedition in 1869.

Alaska. From Alaska I have seen plants collected by the Vega Expedition in Port Clarence $65^{\circ}5'$ in the year 1879, further FRITZ JOHANSEN has collected plants in 1913 and 1914 by Camden Bay 70° , Icy Reef $69^{\circ}41'$, Sadlerochit River and Sandspit. RICHARDSON also, a member of the Franklin

Expedition, collected plants at the mouth of the Mackenzie River 70° .

Wollaston Land 69° and Coronation Gulf $67^{\circ}46'$ were visited by FRITZ JOHANSEN in 1915 as well as by I. R. COX and I. I. O'NEILL, members of the Canadian Arctic Expedition (1915).

King William Land 69° was visited by the Gjøa Expedition under Captain ROALD AMUNDSEN from 1904 to 1906 and GODFRED HANSEN and A. H. LINDSTRØM also collected plants at Gjøa Harbour $68^{\circ}38'$, King Point $69^{\circ}6'$ and Herschell Island $69^{\circ}35'$. The same region was visited by "The Canadian Arctic Expedition" from 1913 to 1916, where FRITZ JOHANSEN made collections on Herschell Island, Bernhard Harbour $68^{\circ}47'$ and Cape Bathurst $70^{\circ}35'$.

Cokburn Island 70° — 71° visited by L. E. BORDEN in 1904.

Hudson Bay, it is true, is south of the Polar Circle, I have, however, seen quite a number of plants from there, the oldest collected by PARRY in 1821; later on I. M. MACOUN made abundant collections chiefly at Churchill $58^{\circ}50'$, Cape Eskimo $61^{\circ}05'$, Cape Fullerton $63^{\circ}57'$ and Sct. Irvin Island in the years 1886, 1887 and 1910, further on Ranken Inlet $62^{\circ}45'$, Wager Inlet $65^{\circ}15'$ and by Hudson Strait (Port Burwell) in 1910.

Baffin Land 65° — 70° was visited by I. D. SOPER 1923, especially Cumberland Gulf, Admiralty Inlet and Ponds Inlet 72° .

Lancaster Sound 75° visited by L. E. BORDEN in 1904.

North Devon, esp. Beachy Island 76° visited by I. D. SOPER 1923.

Ellesmere Land, next to the west side of North Greenland, was investigated by the Second Norwegian Polar Expedition

in the years 1898 to 1902 and very plentiful collections from there were made by H. G. SIMMONS, esp. from Muskox Fjord, Harbour Fjord $76^{\circ}30'$, Fram Fjord $76^{\circ}23'$, Goose Fjord, Cocked Hat Island, Hayes Sound, Bedford Pim Island $78^{\circ}04'$ and Cape Rutherford. I. D. SOPER also visited Ellesmere Land viz.: Crag Harbour 76° in the year 1923.

Grant Land, north of Ellesmere Land, was visited in 1920 by GODFRED HANSEN, esp. Fort Conger $81^{\circ}44'$, Albert Valley and Cape Richardson $82^{\circ}35'$. MACGREGOR also visited Grant Land $82^{\circ}30'$ with the Peary Arctic Club North Polar Expedition in 1910.

I have, besides, seen some plants from southerly places in East-Canada especially Mt. Albert, 950 m., in Eastern Quebec 55° , collected by I. F. COLLINS in 1905.

Labrador. HOHENACHER collected plants at Hebron in 1848 and A. P. COLEMAN in the same place in 1915. Further WOODWORTH collected at Torngat Region in 1926.

From New Foundland I have seen some plants collected by B. L. ROBINSON, H. SCHRENK and M. L. FERNALD.

From Greenland I have seen only very few plants, collected at Disko 70° by M. P. PORSILD. On the other hand, I have seen several very good collections from the little isolated island Jan Mayen, 71° , which was visited by C. H. OSTENFELD in 1896, by C. KRUSE and NIC. HARTZ in 1900 and by JOHS. GANDRUP in 1919.

Several of the above mentioned collections from America have been studied before, and there exist the following accounts of micromycetes found in Arctic North America:

From Alaska: SACCARDO, PECK and TRELEASE 1904.

From King William Land: J. LIND 1910 and JOH. DEARNESS 1923.

From Ellesmere Land: E. ROSTRUP 1906.

From Baffin Land: G. Winter 1890.

From Jan Mayen: E. ROSTRUP 1897.

From Greenland numerous publications by L. FÜCKEL, E. ROSTRUP, A. ALLESCHER and myself, see the list of literature at close.

Plan and limitation of the work.

Each perennial flowering plant which is brought home from the Polar Countries, and which is now deposited in the museum, will as a rule have some withered leaves and dry stems. And these are often, or nearly always, coated with microscopical fungi of many different species. None of the plants studied have been preferred by the collector for the sake of its micromycetes. On the contrary, it can surely be said that the collector has rejected the specimens with spotted leaves and attacked shoots, in order to preserve the "finest" specimens for his herbarium.

Were it possible for me to go up to those regions to make the collections of flowering plants most suitable for my purpose, there would be a far greater result, but the difficulties of travelling in the Polar Countries justify my use as far as possible of collections which have been brought home by others.

Consequently the genuine parasites, such as *Peronospora*, *Uredo* and *Ustilago*, have been neglected, and the small *Pyrenomycetes*, which are to be found on dead parts of the plants, are comparatively much better represented.

It is 60 years since the first work of this kind was published (viz.: FÜCKEL 1874), but all the older mycologists have occupied themselves with plants from a limited part of the Polar Countries. The present paper is the first to try to unite all the scattered investigations of the last 60

years, and to obtain continuity in our knowledge of the geographical extension of the arctic micromycetes. I am, perhaps, to blame for not having mentioned all the species that are known in the Arctic up to now, it would, however, take us too far afield. I am unable to treat other species than those I have seen myself. The list contains only localities not hitherto published for the particular species.

For most of the species treated I have tried to draw a picture of the geographical extension taken from the literature I have at hand. Here also my work is incomplete, partly because I am sure I have not seen all the papers concerning the distribution of the said micromycetes, partly because I might have procured further information by examining herbarium plants from the highest mountains in Europe, Asia and America. I have a great desire to do this, for it would be a task well worth the trouble but I must be content to recommend to younger mycologists to continue where I have stopped.

All the species studied are arranged according to ERNST GÄUMANN: *Vergleichende Morphologie der Pilze*, Jena 1926, but the Discomycetes partly according to I. A. NANNFELDT: *Studien über die Morphologie und Systematik der Discomyceten*, Uppsala 1932.

All the specimens examined are deposited in the Botanical Museum at Copenhagen.

List of arctic Micromycetes from localities not hitherto published.

1. Cl. Archimycetes.

1. *Synchytrium Groenlandicum* All.

Saxifraga rivularis. Taimur.

Saxifraga cernua. Hudson Bay (63°57').

Originally described from Umanak in West-Greenland (70°), also found in Spitzbergen, Novaya Zemlya and Iceland, accordingly of circumpolar distribution. I think it is related to *Synchytrium saxifraga* Rytz on *Saxifraga* sp. in the Alps.

2. Cl. Phycomycetes.

2. *Cladochytrium Sparganii-Ramosi* Büsg.

Sparganium submuticum. Lapponia Imandrae (Jimpjok).

3. *Physoderma comari* (Berk. & White) Lagerh.

Comarum palustre. Abisko.

Decidedly a North-European species of a rather limited distribution, quite often recorded from northern Scandinavia (Tromsø, Kvikkjokk, Luleå etc.) as far south as Stockholm, once recorded from northernmost Jutland, and a few times from Scotland and England.

4. *Plasmopara pusilla* (de By.) Schroeter.

Geranium silvaticum. Common in Lapponia Suecica (Abisko, Kalixfors etc.) but not above or north of the tree-limit.

5. *Plasmopara Halstedii* (Farlow) Berl. & de Toni, Syn. *Rhysotheca Halstedii* (Farl.) Wilson.

Solidago virgaurea. Abisko and Kalixfors.

An arctic-subarctic species found in Norway at Tromsø (SCHROETER 1885 p. 210), Lyngseidet (LAGERHEIM 1894). In Sweden at Kvikkjokk (LAGERHEIM 1884 and LINDFORS 1913 p. 41) and in Herjedalen (CURT FALCK 1912). In Scandinavia it is only found on *Solidago virgaurea* and *Saussurea alpina*, but in U. S. A. (esp. in Wisconsin) it is known on numerous hosts of Compositae.

Synchytriaceae and Phycomycetes do not thrive well north of the arctic circle. Several other species, however, are to be found, I think, through further research, f. inst. *Peronospora alsinearum* and *Peronospora parasitica* are frequently found in arctic regions.

2. Ord. Exoascales.

6. *Taphrina alpina* Johanson.

Betula nana. Kebnekaise.

Indigenous in northernmost Sweden as far south as Dalarne.

7. *Taphrina carnea* Johanson.

Betula odorata. Kebnekaise.

Known in Sweden from the northernmost parts of the country down to the mountains of Jemtland.

8. *Taphrina betulina* Rostrup.

Betula odorata. Dundret near Gelivare.

Commonly distributed over the greater part of Europe.

9. *Taphrina betulae* (Fuck.) Johans.

Betula odorata. Gelivare.

A southern species rarely found so far north.

10. *Taphrina lapponica* Juell.

Betula odorata. Abisko.

As far as is known, till now only found in Lapponia Suecica.

For the systematology and classification of the Taphrina-ceae in arctic regions see H. O. JUEL (1909 and 1912).

4. Ord. Perisporiales.

11. *Erysiphe graminis* Fries S. M. II p. 242.

Poa alpina. In several places at Abisko.

Poa glauca. The same.

Poa pratensis. The same.

The northernmost place for this species is Greenland 77°.

12. Erysiphe cichoriacearum Fries.

Gnaphalium norvegicum. Abisko.

13. Sphaerotheca macularis (Fries) Lind 1913, Syn.: **Spaer humuli** (de C.).

Alchimilla vulgaris. Narvik, Kiruna.

14. Sphaerotheca fuliginea (Fries) Lind.

Thalictrum alpinum. Norway (Kaafjord), Kebnekaise.

Astragalus alpinus. Abisko.

Taraxacum arcticum. Kebnekaise, Spitzbergen (Adventbay).

Of all Erysiphaceae this species occurs farthest towards the north. I have seen it from North-Western Greenland (79°).

15. Podosphaera clandestina (Fries) Lev.

Vaccinium uliginosum. Labrador (Torngat Region).

By far the greater number of species of Erysiphaceae have a more southern distribution; the five species mentioned here are exceptions to the rule. It is, however, a remarkable fact that *Erysiphe graminis*, *Erysiphe cichoriacearum* and *Sphaerotheca macularis* are only able to develop conidia in arctic regions, not perithecia. On the other hand, *Sphaerotheca fuliginea* and *Podosphaera clandestina* develop only perithecia and scarcely any conidia.

As to *Erysiphe graminis* another peculiarity may be noted. In the northernmost places it does not thrive on all the species of Gramineae attacked by it farther south, even if they are found up there. Both *Erysiphe graminis* and *Sphaerotheca*

fuliginea are divided in many formae speciales and each of them has evidently its own northern limit. See also JØRSTAD (1925), who arrived at the same conclusion.

5. Ord. Myriangiales.

Fam. *Pseudosphaeriacea*.

16. *Physalospora alpestris* Niessl.

Carex aquatilis. Abisko.

Carex brunnescens. Alten, Lapponia Ponojensis (Orlow).

Carex stans. Novaya Zemlya.

An arctic-alpine species, recorded from the northernmost part of Norway and from the mountains of Jemtland (Åre), Spitzbergen and Greenland, totally lacking in the European lowlands, but found again in Helvetia and Austria.

17. *Physalospora empetri* Rostrup 1901 p. 310, Syll. XVII p. 583.

Empetrum nigrum. Lapponia Murmanica (Subovi), Konyam Bay.

Recorded from numerous northern places, f. inst.: Spitzbergen, Alaska, Herschel Island and Greenland, not wanting, however, in more southern regions, f. inst.: The Færøe Islands, Denmark and Germany (Cuxhaven).

18. *Didymella glacialis* Rehm.

Carex subspathacea. Tromsø.

Aira caespitosa. Siberia Jenisei.

Alopecurus alpinus. Franz Josef Archipelago (Cape Flora).

Arctic-alpine species; in arctic regions known from Spitzbergen and as far south as the Færøes (62°). In the Alps

known in Tyrol (2010 m) and Helvetia (Zermatt 2250 m, Furkapass 2450 m).

19. *Didymella proximella* (Karsten) Sacc., Syll. I p. 558.

Carex aquatilis. Østfinmarken.

Triticum caninum. Abisko

20. *Didymella inconspicua* Johanson 1884.

Saxifraga aizoides. Abisko.

Saxifraga oppositifolia. North Devon (Beachy Island).

Hitherto only known from Iceland on *Saxifr. oppositifolia* (JOHANSON l. c.).

21. *Didymella hyperborea* (Karsten) Sacc., Syll. I p. 551,

Syn.: ***Paradidymella hyp.*** (K.) Petrak 1927 p. 241.

Cassiope tetragona. Nuolja (1000 m) at Abisko, Pitlekaj, King Point.

A true arctic species, only known from the northernmost parts of Scandinavia, Spitzbergen, King William Land, Labrador and Greenland (77°54'). Its southernmost place is Bardo in Norway (69° see ROSTRUP 1904 p. 21).

22. *Didymosphaeria dryadis* (Fuckel) Berlese, Syll. IX p. 733.

Dryas octopetala. Novaya Zemlya (in several places), Taimyr, Mouth of Lena, Konyam Bay, Maud Harbour.

Dryas integrifolia. Ellesmere Land (Fram Harbour).

It was originally described from Nov. Zemlya, and is also known from Spitzbergen, King William Land and Greenland, it must consequently be characterized as having a circumpolar distribution. It is never found south of the arctic circle.

23. *Didymosphaeria fenestrans* (Duby) Wt.

Epilobium angustifolium. Abisko.

This species is very common in Central Europe and Italy,

it has hardly been found so far north (68°) before. Its appearance is somewhat different from the same species in southern places, its ostiolum was rather elongated and cylindrical, just as it is found in the species of *Gnomonia*.

24. *Didymosphaeria cassiopes* Rostrup 1894.

Cassiope tetragona. Abisko.

ROSTRUP originally described it from East Greenland.

25. *Leptosphaeria lycopodina* (Mont.) Sacc. Syll. II p. 81, Syn.: *Lept. crepini* (West) de Not., *Lept. marcyensis* (Peck) Sacc. Examination of numerous specimens has convinced me that the three names mentioned cover one and the same species.

Lycopodium annotinum. Gelivare, Nikolahti, Kaalaluspa, Abisko, Kebnekaise, Lapponia Murmanica.

Lycopodium clavatum. Abisko, Lapponia Murmanica.

It is a true parasite, mostly found on all bractees on the same host, its mycelium seems to be perennial. It is extremely common in all circumpolar regions viz.: Fennia, Baffin Island, U. S. A., Greenland and Iceland. It is, however, not lacking in the Central European lowlands, and it has been collected on many different species of *Lycopodium*.

26. *Leptosphaeria lycopodicola* Peck.

Lycopodium clavatum. Abisko.

It has evidently not been found since PECK collected it in U. S. A. in the Adirondack Mountains.

27. *Leptosphaeria equiseti* Karsten, Syll. II p. 81.

Equisetum scirpoides. Nuolja.

KARSTEN has described it from Spitzbergen, from where I also have seen it. It has moreover been found in Greenland (79°) and Iceland (P. LARSEN 1932 p. 473). It is easily recognized by its long, cylindrical spores ($36-42 \mu \times 7-8 \mu$), obtuse at both ends, with 7-13 septa and the cells remark-

ably irregular, alternately long and short, not always equally broad either. It is limited to *Equ. scirpoides* and *Equ. variegatum*, whereas *Leptosphaeria arvensis* Speg., *Lept. hiemalis* Sacc. and *Lept. limosa* Fautr. are limited each to its separate species of Equisetum.

28. Leptosphaeria luzulae Wt.

Luzula parviflora. Abisko.

A very rare species, known from Tyrol and Iceland.

29. Leptosphaeria littoralis Sacc.

Scirpus caespitosus. Kebnekaise.

30. Leptosphaeria caricis Schroeter, Syn.: **Lept. occulta** mihi (1913 p. 218 c. fig.).

Carex dioeca. Abisko.

I found it once at Åre, and ROSTRUP mentions it from Ås in Southern Norway. SCHROETER has described it (1881 p. 175) on *Carex sparsiflora* from Kvikkjokk, and he has later on found it in Silesia (1908 p. 367), Voss has found it in Oberkrain and Feltgen in Luxemburg. It is evidently exactly the same as I have described and pictured from Denmark (l. c.), consequently it seems to have a wide distribution, but to be of very rare occurrence.

31. Leptosphaeria caricinella Karsten, Syll. II p. 65, Syn.: **Lept. junciseda** Karsten and **Lept. vagans** Karsten, Syll. II p. 59.

Carex aquatilis. Jugor Strait.

Carex canescens. Mt. Dundret near Gelivare.

Carex compacta. Hudson Bay.

Carex pulla. Lapponia Imandrae, Novaya Zemlya, Waigats, Jugor Strait.

Carex rigida. Abisko, King William Land (Bernard Harbour).

Carex rostrata. Lapponia Norvegica (Nyborg 70°).

Carex rotundata. Lapponia Suecica.

Luzula arcuata. Nuolja.

Luzula confusa. Ellesmere Land (Cocked Hat Island).

Juncus filiformis. Bosekop.

Juncus nodulosus. Alten.

Eriophorum polystachyum. Hudson Bay.

Arctagrostis latifolia. Novaya Zemlya, Taimyr, Flum:
Boganida.

Calamagrostis confinis. Lapponia Norvegica (Mortensnæs).

Deschampsia caespitosa. Flum: Boganida.

Dupontia Fisheri. King William Land (Bernard Harbour).

Hierchoë pauciflora. Novaya Zemlya.

Trisetum spicatum. Lapponia Tornensis.

The species is rather plurivorous, it is common in Spitzbergen, Novaya Zemlya and Greenland as far north as 82°45'. All the said places are arctic and circumpolar. OUDEMANS only mentions it from Holland (1904 p. 257), I think this must be due to some mistake.

32. *Leptosphaeria microscopica* Karsten, Syll. II p. 59.

Carex caespitosa. Abisko.

Carex glareosa. Novaya Zemlya.

Carex maclohdiana. Lapponia Norvegica (Maalselven).

Carex membranopacta. Ellesmere Land (Fram Fjord 76°23').

Carex nardina. Greenland (Kuganguat Valley).

Carex norvegica. Lapponia Norvegica.

Carex pulla. Lapponia Norvegica, Novaya Zemlya.

Carex rigida × *salina*. Lapponia Tulomensis (Kildin).

Eriophorum polystachyum. King William Land (Bernard Harbour).

Juncus arcticus. Abisko.

Calamagrostis deschampsiioides. Lapponia Varsugae.

Calamagrostis neglecta. Lapponia Murmanica (Voroninsk).

Festuca ovina. Jan Mayen.

Festuca rubra. Novaya Zemlya.

Deschampsia alpina. Norway (Hopen 63°25'), Novaya Zemlya.

Deschampsia arctica. Ellesmere Land.

Deschampsia caespitosa. Waigatsch (70°).

Phleum alpinum. Lapponia Norvegica (Sörö 70°40'), Abisko.

Pleuropogon Sabinei. Novaya Zemlya (several places).

Poa alpina. Abisko, Jan Mayen.

Poa arctica. Siberia (Nikandrovskej Island).

Trisetum spicatum. Alten, Dovre, Summits of Rocky Mt.

Vahlodea atropurpurea. Lapponia Kemense.

Tofieldia palustris. Kebnekaise.

From this comparison it is evident, that this plurivorous and commonly distributed species is at least quite as common in all high-arctic regions as it is in the lowlands of Central Europe on many different species of Monocotyledones.

(32b.) *Leptosphaeria algida* Rostrup.

Catabrosa algida. Jan Mayen.

Till now only noticed from Western Greenland and Spitzbergen. I think it ought to be united with *Leptosphaeria microscopica*.

33. *Leptosphaeria insignis* Karsten, Syll. II p. 71, Syn.:

Lept. elymi Larsen (1932 p. 474).

Carex caespitosa. Abisko.

Carex vaginata. Abisko.

Alopecurus alpinus. Actinieviken.

Arctagrostis latifolia. Preobraschenie Island.

Calamagrostis confinis. Lapponia Norvegica (Tanaelv).

Calamagrostis Holmii. Jugor Strait.

Calamagrostis neglecta. Alten, Abisko.

Colpodium fulvum. Preobraschenie Island (74°45').

Deschampsia arctica. Ellesmere Land.

Dupontia Fisheri. Novaya Zemlya (71°24'), Wai-
gatsch, Hvite Ön, King William Land (Bernard
Harbour).

This species which macroscopically is very insignificant, as KARSTEN intimates by its name, is microscopically easily recognized by its large spores, which are pale yellowish brown and not green as in BERLESE'S illustration (1894 p. 79). The third cell is much longer and broader than the other five. All this accords well with P. LARSEN'S description of *Lept. elymi* and his excellent sketch (l. c.). It is originally described from Spitzbergen, where it is quite common (see LIND 1928 p. 79), besides all the above named circumpolar places it has also been noticed south of the arctic circle, thus P. LARSEN has found it in Iceland on *Elymus arenarius* and ROSTRUP found it once on the same host in Denmark (see LIND 1913 p. 219).

34. Leptosphaeria hierochloae Ouds. Syll. IX p. 793.

Hierochloë alpina. Tromsø, Lapponia Ponojensis (Or-
low), Novaya Zemlya (Silverbay).

Hierochloë pauciflora. Novaya Zemlya, Siberia Jeni-
sei, Actinieviken, King William Land (Gjøa Har-
bour).

It is a very peculiar species, the asci very large and not filled by the spores, the spores measure 27—37 μ \times 9—13 μ , divided into six cells, the two extreme cells small, the 5th

cell both longer and broader than the others. It was originally described from Novaya Zemlya, later on I have seen it from Greenland (77° see LIND 1910 p. 154). Its occurrence here as well as in the above mentioned localities shows, that this species has a circumpolar distribution, all its localities being situated north of the arctic circle.

35. Leptosphaeria graminum Sacc. Syn.: **Metasphaeria gram.** Sacc. Syll. II p. 174.

Calamagrostis confinis. Lapponia Norvegica (Mortensnæs), Abisko.

Poa arctica. Jan Mayen.

Till now only found in Spitzbergen, Norway, Sweden, Silesia, Luxemburg and Italy. PETRAK has given a detailed description of this species (Annal. Mycol. XX p. 8).

36. Leptosphaeria Eustoma (Fries) Sacc.

Poa glauca. Ellesmere Land (Goose Fjord).

37. Leptosphaeria culmifraga (Fries) Ces. Syll. II p. 75.

Carex Buxbaumii. Lapponia Norvegica.

Carex lulvola. Lapponia Murmanica (Litsa).

Carex rariflora. Novaya Zemlya (70°31').

Luzula pilosa. Lapponia Murmanica (Voroninsk).

Juncus triglumis. Abisko.

Arctagrostis latifolia. Lapponia Norvegica (Mortensnæs).

Calamagrostis lanceolata. Abisko.

Calamagr. Langsdorffii. Lapponia Norvegica (Boosekop).

Calamagr. neglecta. Kebnekaise.

Calamagr. strigosa. Alten.

Catabrosa algida. Jan Mayen.

Deschampsia caespitosa. Abisko.

Festuca ovina. Jan Mayen.

Melica nutans. Abisko.

Milium effusum. ibd.

Phleum alpinum. ibd.

Poa alpina. Abisko, Kolgujev.

Poa arctica. Jan Mayen.

Poa compressa. Kebnekaise.

Poa glauca. Ellesmere Land (Goose Fjord and Fram Fjord).

Poa nemoralis. Abisko.

Poa pratensis. Siberia Jenisei (Selivanova).

Triticum caninum. Abisko.

It was found abundantly on many of the grasses mentioned, especially on the thickest joints of dead straws, it is abundantly distributed under different climatic conditions and thrives on many different hosts. Its northernmost finding-place is Greenland (82°48'), it is common in U.S.A.

38. *Leptosphaeria culmicola* (Fries) Karsten. Syll. II p. 70.

Carex lachenalii. Abisko.

Calamagrostis sp. Kiruna.

Deschampsia caespitosa. Abisko.

Poa sp. Kebnekaise.

Phleum alpinum. Abisko.

Triticum caninum. ibd.

Of continuous distribution, known from Spitzbergen and Iceland as well as from Denmark and other European countries.

39. *Leptosphaeria arundinacea* (Fries) Sacc.

Calamagrostis confinis. Lapponia Norvegica (Mortensnæs).

Calamagr. neglecta. Siberia Jenisei (Nikandrovskij Island).

Widely distributed just as the previous two species, it

seems, however, to prefer the more robust species of Gramineae f. inst. *Elymus*, *Phragmites* etc.

40. *Leptosphaeria coniformis* (Fries) Schroeter.

Trollius europaeus. Abisko.

Commonly distributed in temperate regions, hitherto never found so far north as here (68°).

41. *Leptosphaeria silenens acaulis* de Not. Syll. II p. 47, Syn.: *Lept. stellariae* Rostrup Syll. IX p. 783.

Cerastium alpinum. Hudson Bay (South Irvin Island).

Silene acaulis. Kebnekaise.

Stellaria humifusa. Preobraschenie Island.

Stellaria longipes. Siberia (Belucka Bay, Jalmal, Nikandrovskij Island, Cape Tcheljuskin), Arctic America (Bernhard Harbour, Gjöa Harbour, Cape Richardson 82°35').

Typical arctic-alpine distribution. Found in all high-arctic countries: Spitzbergen, Unalaska and Labrador but lacking in Finland (KARSTEN 1885). Mainly found on *Stellaria longipes* but also on other spec. of Caryophyllaceae. It is totally wanting in the lowlands from Dovre 62° to the Tyrolese Alps (46°30'), Krain, Albula Pass and Italy.

42. *Leptosphaeria brachyasea* Rostrup 1891 p. 618, Syll. XI p. 321.

Alchimilla alpina. Norway (Tindfjæld).

A very rare species, hitherto only found on *Saxifraga* from Dovre, Spitzbergen (LIND 1928 p. 23 c. fig.) and Greenland. Its occurrence may rather be called circumpolar.

43. *Leptosphaeria doliolum* (Fries) Ces.

Angelica Archangelica. Abisko and Nuolja.

Very common in southern regions, but less frequent in the north, f. inst. in Finland right up to the arctic ocean and also in Iceland.

44. *Leptosphaeria andromedae* (Awd.) Sacc. Syll. II p. 49.

Cassiope tetragona. Alten, Abisko, Ellesmere Land
(Hayes Sound and Craig Harbour), Labrador.

A high arctic species of circumpolar distribution, known from northernmost Scandinavia, Spitzbergen, Baffin Island and Greenland, never found south of the arctic circle except in Greenland. Its spores differ very much in shape from the spores of other spec. of *Leptosphaeria*, the immature spores are for a long time 1-septate and hyaline, later on 3-septate and finally brown.

45. *Leptosphaeria ogilviensis* (Berk. & Br.) Ces. Syll. II p. 34.

Trollius europaeus. Nuolja.

Rhinanthus minor. Abisko.

Gentiana tenella. ibd.

Sausurea alpina. ibd.

Solidago virgaurea. Abisko, Nikolahti.

Cirsium heterophyllum. Abisko.

Gnaphalium norvegicum. ibd.

A southern species, formerly not found so far north. Also recorded from U.S.A.

46. *Leptosphaeria modesta* (Desm.) Awd. Syll. II p. 39.

Ranunculus sp. Abisko.

Trollius europaeus. Several places at Abisko.

Linnaea borealis. Lapponia Norvegica (Komagfjord
70°15').

Melandrium rubrum. Abisko.

Primula stricta. Juckosjärvi, Lapponia Imandrae.

Castilleja pallida. Lapponia Imandrae, Alaska (Port
Clarence).

Solidago virgaurea. Gelivare.

Antennaria dioeca. ibd.

Like the preceding species it is rather omnivorous and ubiquitous, recorded from all over Europe from Fennia and Lapponia down to Graubünden and Caucasus.

47. *Leptosphaeria helminthospora* Ces.

Solidago virgaurea. Abisko.

48. *Leptosphaeria dolioloides* Awd.

Alsine biflora. Lapponia Norvegica (Vasbottenfjæld).

Cerastium alpinum. Lapponia Murmanica.

Achillea millefolium. Abisko and Gelivare.

Cirsium heterophyllum. Abisko.

Known from all over Europe.

49. *Leptosphaeria agnita* (Desm.) Ces.

Hieracium sp. Abisko.

Common, recorded from Denmark, U.S.A. (Pennsylvania), Greenland etc.

50. *Metasphaeria arabis* Johanson, Syn.: *Sphaerulina islandica* Rostrup.

Arabis alpina. Kebnekaise, Kolgujuk, Disko, Jan Mayen.

Hitherto this species has only been known from Kerortusok in Western Greenland (ROSTRUP 1888 p. 560) and from Iceland where it has been found and described, almost contemporaneously, by JOHANSON (1884) and E. ROSTRUP (1885), moreover from Dovre (ROSTRUP 1891) and Jemtland (Starbäck).

It is consequently an arctic-subarctic species of rare occurrence, but still found in very scattered places all round the arctic circle.

51. *Metasphaeria borealis* Rostrup 1888 p. 561.

Tofteldia coccinea. Konyambay.

It is not quite certain, that the specimen in question is identical with ROSTRUP's, the asci I have seen measure

$78 \mu \times 45 \mu$, the spores $51 \mu \times 15 \mu$ with 7 septa, thus they are much larger than ROSTRUP'S, I think he has had immature specimens. ROSTRUP has described it from Umanarsuk in Western Greenland, it has not been found elsewhere.

52. *Metasphaeria annae* Ouds. 1885 p. 157 c. fig.

Ranunculus sulfureus. Novaya Zemlya, Waigatsch and Alaska (Camden Bay).

It has always been found on the same host and hitherto only in Novaya Zemlya (see LIND 1924 p. 13) therefore it was a great surprise to me to see it from Alaska. Like the other species of *Metasphaeria* discussed here it is of a curiously rare and scattered occurrence.

53. *Metasphaeria cassiopes* Rostrup 1888 p. 561.

Cassiope tetragona. Alten, Sackavare, Boganida $71^{\circ}15'$, Taimyr 74° , Ostia Lenae, Pitlekai and Hudson Bay (Ranken Inlet $62^{\circ}45'$).

Originally described from Western Greenland $64^{\circ}45'$ and later on found in Northern Greenland $82^{\circ}48'$ (see LIND 1924 p. 297 c. fig.) and in North-Western Greenland $77^{\circ}54'$ besides near Tromsö and in Spitzbergen. Consequently it is a high arctic species, found only once south of the arctic circle (viz. Hudson Bay).

54. *Metasphaeria sepalorum* Vleugel 1908 p. 369 c. fig.

Juncus trifidus. Kebnekaise, Mt. Dundret near Geli-vare.

Juncus balticus. North-Western Iceland (Myrar).

I have formerly seen the same species on *Juncus filiformis* and *Luzula nivalis* from a few places in North-Sweden (Umeå and Åre) and from Spitzbergen. It is exclusively found on the glumes; in that, and in the broader spores it differs from *Metasphaeria junci* (Ouds.) Sacc, which is very much like it and is found on the same host-plants.

55. *Metasphaeria thalietri* (Wt.) Sacc.

Thalictrum alpinum. Scotland, Jemtland (Frösön).

A typical arctic-alpine species, known in the north from Eastern Greenland and in the Alps from Tirol.

56. *Metasphaeria trollii* Karsten.

Trollius europaeus. Lapponia Suecica (Nuolja and Kalixfors).

The specimens examined were not completely developed and KARSTEN'S description also shows plainly enough that his specimens was immature. It is found in a very few places only, STARBÄCK has seen it from Jemtland and KARSTEN has described it (*Symbolae* XV p. 149) as he says "Ad caules *Trollii europaei* emortuas prope piscinam Olenji Maris glacialis". The fungus infects the living stems and produces its perithecia on the dead stems next year. v. HÖHNEL thinks it identical with *Heterosphaeria Morthieri* Fuckel (see *Fragmente z. Mykol.* 1106). I can not follow him in this.

57. *Clathrospora pentamera* (Karsten) Berl. Syll. II p. 266.

Concerning its nomenclature see LIND 1926 p. 165.

Carex aquatilis. Abisko.

Carex Hepburnii. Ellesmere Land (Fram Fjord 76°23').

Carex incurva. ibd.

Carex misandra. Ellesmere Land (Harbour Fjord 76°30').

Carex stans. Alaska (Camden Bay 70°).

Elyna bellardi. Ellesmere Land.

Kobresia schoenoides. Jakutsk (Bulkur 72°).

Luzula nivalis. Ellesmere Land (Bedford Pim Island).

Juncus arcticus. Disko.

Juncus spec. Ellesmere Land (Cape Rutherford).

- Alopecurus alpinus*. Spitzbergen, Novaya Zemlya,
Cape Tscheljuskin.
- Calamagrostis strigosa*. Alten, Kiruna.
- Deschampsia arctica*. Ellesmere Land (Fram Fjord).
- Deschamp. caespitosa*. Abisko.
- Festuca ovina*. Ellesmere Land (Goose Fjord, Fram
Harbour, Bedford Pim Island).
- Hierochloë alpina*. Arctic America (Cockburn Island).
- Poa abbreviata*. Ellesmere Land (Cape Rutherford,
Bedford Pim Island).
- Poa glauca*. Ellesmere Land (Fram Harbour, Goose
Fjord, Harbour Fjord).
- Puccinellia tenella*. Alaska.
- Pucc. Vahliana*. Ellesmere Land (Harbour Fjord).
- Trisetum spicatum*. Dovre.
- Melandrium apetalum*. Ellesmere Land (Goose Fjord
and Harbour Fjord).
- Papaver radicum*. Arctic America (Lancaster Sound
75°).
- Astragalus alpinus* Alten.
- Saxifraga caespitosa*. Norway (Bolvatn 67° and
Dovre).
- Saxifraga tricuspidata*. Hudson Bay (Churchill).
- Androsace chamaejasmes*. King William Land (Ber-
nard Harbour).
- Statice elongata*. *ibd.*
- Taraxacum hyparcticum*. Ellesmere Land (Fram
Harbour).

In connection with our previous knowledge of this very interesting species (see LIND 1928 p. 30), the above collections show clearly how little fastidious it is in its selection of host-plants. It is found not only on monocotyledones and

dicotyledones but even on Filices. Its distribution is typically arctic-alpine, in the north it is found as far south as Finland (60°), Dovre (61°30') and the Færøes (62°), but after this, on the other hand, it is not found again before we reach Italy and Pamir. Also noticed from the Rocky Mountains (Utah).

58. *Clathrospora planispora* (Ellis) Berlese.

Poa pratensis. Franz Josef Land (Mabel Island) and Ellesmere Land (Fram Fjord).

Originally described on grass from Utah, further recorded from the north coast of Greenland (82°28').

59. *Clathrospora elynae* Rabenh. Syll. II p. 273.

Carex rupestris. Ellesmere Land (Harbour Fjord).

Carex scirpoidea. Hudson Bay (Churchill).

Juncus arcticus. Norway (Lom 61°50'), Disko.

Luzula confusa. Novaya Zemlya, Ellesmere Land.

Its selection of host-plants is very peculiar, the fact is that it is able to grow on many different genera, but within each genus it has only one single or two main hosts and some few secondary hosts.

On *Juncus*, mainly on *J. arcticus* (subsidiary *J. trifidus*, *Jacquinii*).

On *Luzula*, mainly *L. confusa* (subs. *L. arctica*).

On *Carex*, mainly on *C. Hepburnii* (subs. on *C. curvula*, *rupestris*, *scirpoidea*, *supina* and *nardina*).

On *Elyna*, only on *El. spicata*.

On *Eriophorum*, only on *Er. polystachyum*.

On *Poa*, only on *P. alpigena*.

On *Deschampsia*, only on *D. alpina*.

I think it is on the point of forming several biological races. Its distribution is typically arctic-alpine. Very common in Spitzbergen, Artic America (incl. Greenland) and Ice-

land, on the other hand till now it has not been recorded from Novaya Zemlya or from Scandinavia where it seems to be very rare. It is common in the Alps (Sellajoch 2100 m, Furchapass 2450 m, Simplon 2020 m, Albulapass 2313 m) and I have recently seen it on *Juncus arcticus* from East-Switzerland (Val Bévères), and SACCARDO mentions it from Italy also.

60. Pleospora macrospora Schroeter Syll. II p. 263.

Colpodium fulvum. Preobraschenie Island 74°45'.

Trisetum spicatum. Novaya Zemlya.

Hierochloë alpina. Lapponia Norvegica (Alten, Lyngen, Sliravare in Kvanangen 1900 m), Lapponia Suecica, Lapponia Fennica (on several places), Novaya Zemlya (ibd.), Waigatsch, Konyambay, Hudson Strait (Port Burnvell), Eastern Quebec (Mt. Albert 950 m).

NANNFELDT refers it to *Clathrospora* because the spores are oblate. But at the same time its perithecia are furnished with stiff hair, which designates it as a *Pyrenophora*. In other words it connects *Leptosphaeria*, *Pleospora*, *Clathrospora* and *Pyrenophora*. I think it must be a very old type, representing the species from which the four said genera have their origin. Its nearest congeneric species are *Leptosphaeria mirabilis* Niessl, *Leptosphaeria hierochloae* Ouds., *Pyrenophora trichostoma* (Fries) Fuck. and others of this type with 2 or 3 transverse septa in the spores, longitudinal wall in a single cell only, few asci and extraordinarily large spores. (See also F. PETRAK 1923).

Pleospora macrospora was originally described from Lapponia Suecica on *Hierochloë alpina*, later on it has been found in several places in northernmost Scandinavia, Spitzbergen, Artic America and Greenland, so its distribution

may be characterized as high arctic, circumpolar. It is mainly found on dead leaves of *Hierochloë alpina*, but may occasionally be found on other grasses.

61. Pleospora lycopodiicola spec. nov.

Peritheciis sparsis, globoso-conoideis, glabris, atris, 300 μ diam. ostiolo papillato. Ascis crassis, clavatis, sursum late rotundatis basi in stipitem brevissimum, nodulosum desinentibus, octosporis, 105—110 $\mu \times 24 \mu$. Paraphysibus numerosis, guttuligeris, 2—2.5 μ crassis. Sporidiis laxe distichis, utrinque subacuminatis, ad medium constrictis, parte superiori crassiori, transverse 7-septatis, verticaliter 1—3 septatis, flavis, 30—36 $\mu \times 10$ —14 μ . In bracteis exsiccatis subputridis Lycopodii.

Lycopodium annotinum. Lapponia Suecica (Nyrefernando, LÆSTADIUS leg.).

Lyc. clavatum. Mt. Dundret prope Gelivare (ipse leg.).

Lyc. alpinum. Kebnekaise (ipse leg.).

I have further seen the same species on *Lycopodium clavatum* from Denmark (Anholt).

62. Pleospora straminis Sacc. et Speg.

Trisetum spicatum. New Foundland (Doctor Brook).

63. Pleospora Karstenii Sacc. Syll. II p. 271, Syn.: **Pleospor. islandica** Johans.

Carex scirpoidea. Bernard Harbour.

Carex rupestris. Lapponia Imandrae (Chibina).

Alopecurus alpinus. Spitzbergen, Kong Karls Land (78°50'), Novaya Zemlya, Siberia (Tolstojnos).

Arctagrostis latifolia. Lapponia Tulomensis (Kildin), Novaya Zemlya, Waigatsch.

Bromus arcticus. Coronation Gulf.

Calamagrostis neglecta. Lapponia Suecica (Kiruna,

Torne Träsk, Nuolja 800 m), Siberia Jenisei (Nikandrovskij Island).

Deschampsia caespitosa. Cape Tcheljuskin.

Dupontia Fisheri. Novaya Zemlya.

Elymus mollis. Hudson Bay (Ranken Island).

Festuca rubra. Novaya Zemlya.

Hierochloë pauciflora. Preobraschenie Island, Alaska (Camden Bay).

Koeleria asiatica. Waigatsch.

Trisetum spicatum. Norway (Jotunfjæld 61°30'),
Novaya Zemlya, New Foundland (Belle Isle).

It is an arctic-alpine species, common in all polar regions as far north as Greenland (83°2'), on many different host-plants of Glumiflorae. In the Alps it has only been found once, viz. in Berninaalp 2600 m.

64. *Pleospora dura* Niessl.

Carex incurva. Hudson Bay (Ranken Inlet).

It is surprising to find this species, originally described on *Melilotus*, *Echium* and several other dicotyledonous plants at Brünn, now occurring on a *Carex* in America, there is, however, nothing in NIESSL's description which does not agree with our specimen. It belongs to the leptosphaerioidical species of *Pleospora*, the spores of which are divided midway by a marked constriction (as in *Pleosp. vagans*, *coronata* etc.), the transverse septa are numerous, but a longitudinal septum is only found in a single or two cells.

The species is very rare, I have collected it in Sweden (Åre) but otherwise it is not recorded from other places than Tyrol, Eisleben, Mähren and North Italy (BERLESE 1900 p. 25 and PETRAK 1927 p. 364). According to the description it is quite identical with *Pleospora leptosphaerioides* Allescher (1897 p. 48) from West-Greenland.

65. **Pleospora vagans** Niessl, Syll. II p. 267, Syn.: **Pleosp. deflectens** Karsten, Syll. II p. 266.

Carex norvegica. On the coast of the White Sea.

Carex parallela. Siberia Jenisei.

Arctagrostis latifolia. Lapponia Norvegica (Beljock),
Lapponia Tulomensis (Kildin), Waigatsch, Novaya
Zemlya.

Calamagrostis confinis. Lapponia Norvegica (Varan-
ger).

Calamagr. neglecta. ibd. (Sörö), Kiruna, Kolgujev,
Siberia Jenisei.

Colpodium fulvum. Siberia Arctica.

Deschampsia alpina. Lapponia Norvegica, Novaya
Zemlya.

Deschamp. caespitosa. Siberia Jenisei.

Hierochloë alpina. New Foundland (Belle Isle).

Poa arctica. Lapponia Ponojensis (Orlow), Siberia
(Irkapij).

Poa glauca. Scotland (Ben Lewis 1000 m), King Point
(69°6').

Puccinellia retroflexa. Lapponia Murmanica (Semo-
strow).

Vahlodea atropurpurea. ibd. (Woronin).

Oxyria digyna. Novaya Zemlya.

Phaca frigida. Abisko.

Oxytropis campestris. Lapponia Norvegica (Mortens-
næs), Novaya Zemlya.

Oxytr. leucantha. Alaska (Port Clarence).

Plantago maritima. Waigatsch.

Pleospora deflectens and *Pleospora vagans* have hitherto been co-ordinated, as two nearly allied yet independent species. Before this tradition becomes too old I think it is time to

establish, that there is no difference to be found. *Pleospora vagans* is a very plurivorous and variable species, found both on monocotyledons and on dicotyledons and it is quite as common in arctic as in temperate regions.

66. *Pleospora junci* Passer. & Beltrani, Syll. II p. 273, Syn.:

Pleosp. spinosella Rehm, Syll. II p. 272.

Juncus arcticus. Dovre (Jerkind), Abisko.

Juncus triglumis. Hudson Bay (Churchill).

It is an arctic-alpine species, formerly known from Tirol (2010 m) and from Sicily, I have also seen it on *Juncus arcticus* from Val Bévers in East-Switzerland and from Spitzbergen, and P. LARSEN (1932 p. 471) has collected it on *Juncus balticus* in Iceland.

67. *Pleospora maritima* Rehm, Syll. XIV p. 600.

Triglochin palustris. Hudson Bay (Churchill).

It is as yet impossible to have any opinion of the geographical distribution of this very rare species.

68. *Pleospora gigaspora* Karsten, Hedwigia 1884 p. 37,

Syn.: ***Pleosp. gigantasea*** Rostrup 1903, ***Pleosp. amplispora*** Ell. & Ev. 1884.

Eriophorum polystachyum. Siberia (flum. Boganida 71°15').

The spores are light yellow, $105 \mu \times 51 \mu$ divided transversely by 16 septa and 6—8 times longitudinally, the cells are cubic and immediately disjoined. KARSTEN has described it from Lapponia Tulomensis (Kildin). ROSTRUP has described it on *Elymus arenarius* from Iceland, where later on it has also been found on the same host (P. LARSEN 1932 p. 471). ELLIS and EVERHARD have described it on dead stems of *Lupinus* from Mt. Paddo, Washington, and finally I have found it here in Denmark on dead stems of *Hypochaeris radicata*. In other words it is able to grow on

very different spec. of host-plants and is collected in extremely scattered localities. I think it is a very old species.

69. Pleospora magnusiana Berlese.

Alopecurus alpinus. Novaya Zemlya, Ellesmere Land.

Catabrosa algida. Franz Josef Archipelag, Ellesmere Land, Jan Mayen.

Catabrosa concinna. Siberia (Jalmal).

Poa abbreviata. Grant Land.

Poa alpina. Hudson Bay (Churchill).

Poa arctica. Novaya Zemlya, Jugor Strait, Dickson Harbour, Preobrascheni Island, King William Land (Bernard Harbour), Ellesmere Land (Goose Fjord).

Poa glauca. Wollaston Land 70°, Ellesmere Land (Goose Fjord and Harbour Fjord).

Poa pratensis. Ellesmere Land (Hayes Sound 80°).

Puccinellia angustata. Waigatsch, Ellesmere Land (Harbour Fjord).

Puccinellia Vahliana. Novaya Zemlya.

I have formerly (1928 p. 26) rendered an account of the nomenclature and history of this species, at that time it was known from Spitzbergen only, now it appears to be quite common on many grasses and in many circumpolar regions.

70. Pleospora discors (Dur & Mont.) Ces. Syll. II p. 230.

Eriophorum Scheuchzeri. Jugor Strait.

Luzula nivalis. Ellesmere Land.

Carex aquatilis. Lapponia Murmanica.

Carex atrata. Abisko.

Carex atrofusca. ibd.

Carex brunnescens. Kebnekaise.

Carex incurva. Bernard Harbour (68°47').

Carex lagopina. Lapponia Imandrae.

- Carex pulla*. Lapponia Norvegica.
Carex ustulata. Hudson Bay (Churchill).
Carex stans. Novaya Zemlya.
Arctagrostis latifolia. Novaya Zemlya, Coronation Gulf.
Calamagrostis confinis. Lapponia Murmanica (Voronsk).
Calamagr. Holmii. Jugor Strait (69°49'), Waigatsch.
Calamagr. neglecta. Kebnekaise, Abisko.
Calamagr. strigosa. Lapponia Norvegica (Alten and East-Finmark).
Colpodium fulvum. Siberia Jenisei (70°20'), Preobrascheni Island.
Elymus mollis. Framsnæs.
Phleum alpinum. Abisko.
Poa alpigena. ibd.
Poa alpina. ibd.
Poa alpigena × *arctica*. Novaya Zemlya.
Poa arctica. ibd. (Packsussow Island 74°24').
Trisetum spicatum. Dovre, Lapponia Suecica, Colorado (Dead Lake 3500 m), also from Pic Orizaba.

Found on many different species of Glumiflorae and common in all circumpolar regions (see also LIND 1924 c. fig.). Not entirely lacking in the Central-European lowlands, quite common, however, in the Alps. NIESSL says (1877): "Wie es scheint besonders in den Alpen", WINTER has collected it at Albulapass (2313 m) and it is also recorded from Italy (Mt. Cenicio) and from Algier.

- 71. Pleospora serophulariae** (Desm.) v. Høhnel, Syn.:
Pleosp. infectoria Fuckel, Syll. II p. 265, **Pleosp. vulgaris** Niessl Syll. II p. 243, **Pleosp. media** Niessl Syll. II p. 244.

Carex macrochaeta. Siberia (Konyam Bay 64°49').

Eriophorum Scheuchzeri. King William Land (Gjøa Harbour).

Luzula nivalis. Fram Fjord.

Tofieldia palustris. Abisko.

Anthericum serotinum. Alaska (Camden Bay).

Festuca altaica. King William Land (King Point).

Poa abbreviata. Ellesmere Land (Cape Rutherford).

Poa alpina. Jan Mayen.

Poa arctica. Novaya Zemlya, King Point, Bernard Harbour.

Thalictrum alpinum. Kebnekaise.

Trollius europaeus. ibd.

Polygonum viviparum. Bernard Harbour.

Arabis humifusum. Hudson Bay (55°).

Arab. petraea. Novaya Zemlya.

Braya purpurascens. Waigatsch.

Papaver radicum. Franz Josef Archipelago (Cape Flora), Cape Tscheljuskin, Ellesmere Land (Fram Harbour and Goose Fjord).

Alsine stricta. Lapponia Ponojensis (Orlow).

Cerastium alpinum. Lapponia Murmanica.

Stellaria longipes. Franz Josef Archipelago.

Melandrium apetalum. Abisko (800 m), Novaya Zemlya, Harbour Fjord.

Silene acaulis. Novaya Zemlya.

Astragalus alpinus. ibd.

Trifolium pratense. Kiruna.

Oxytropis leucantha. Hudson Bay (Wager Inlet).

Saxifraga aizoides. Abisko, Ellesmere Land (Harbour Fjord 76°30').

Saxifr. caespitosa. Norway (Finse 1400 m), Franz

Josef Archipelago (Cape Meale), Novaya Zemlya,
Ellesmere Land.

Saxifr. hirculus. King William Land, Ellesmere Land.

Saxifr. oppositifolia. Cape Tscheljuskin.

Rhinanthus minor. Abisko.

Euphrasia latifolia. ibd.

Eritrichium villosum. Siberia (Ostia Lenae).

Achillea millefolium. Kalixfors.

Saussurea alpina. Abisko.

Solidago virgaurea. Abisko, Nuolja, Gelivare.

In view of priority v. HÖHNEL has applied the name *Pleosp. scrophulariae* to this species, hitherto known under several other names. FÜCKEL has described it as *Pleos. infectoria* and NIESSL has further described it twice. I have now examined a sufficiently large material of this very common and very variable species, and I have found it impossible to fix the characteristics described by NIESSL and FÜCKEL. NIESSL says (1876 p. 188): "Kennt man aber einmal beide, so wird man sie nicht wieder verwechseln", but the characteristics, described by him with respect to both species (colour and size of the spores) may be found again in the same host-plant, nay in the same perithecium. The colour of the spores does not depend on the degree of maturity only, in arctic regions I have always found it considerably darker than in Denmark. I think NIESSL may possibly have examined lowland forms with lighter spores and forms from the high mountains at Brünn with darker spores.

In the above proposed limitation *Pleospora scrophulariae* is an extremely plurivorous species, and ubiquitous, just like *Pleosp. herbarum*, *Pleosp. vagans* and other.

72. *Pleospora herbarum* (Fries) Rabenh. Syll. II p. 247.

Primula borealis. Alaska (Camden Bay).

- Arabis humifusum*. Hudson Bay (55°).
Hedysarum Mackensii. Hudson Bay (Churchill).
Astragalus alpinus. Flumen Boganida.
Astrag. frigidus. Abisko, Preobraschenie Island.
Oxytropis Belli. Hudson Bay (Ranken Inlet).
Oxytr. campestris. Norway (Eastern Finmark, Varranger), Lapponia Imandrae.
Oxytr. deflexa. Lapponia Norvegica (Kontokeino).
Potentilla nivea. Laponia Suecica (Njunnats), Newfoundland (Pistolet Bay).
Saxifraga caespitosa. Canada (Canmore), Washington (Goat Montains).
Euphrasia latifolia. Abisko.
Chrysanthemum integrifolium. Bernard Harbour.
Taraxacum glabrum. Novaya Zemlya.
Arnica alpina. Bernard Harbour.
Youngia pygmaea. Alaska (Port Clarence 65°5').

Like the above mentioned, a species of very frequent occurrence; I have also seen it on *Potentilla nivea* from Mt. Altai, Central Asia, 2600 m and on *Potentilla nivalis* from Montpellier (St. Christophe 1800 m). In the literature it is mentioned from all the tolerably well examined countries in Europe, and in America it is common from Greenland to México, recorded even from Teneriffa, Madeira and Mesopotamia. Early authors have confounded it with other related species, especially with *Pleospora discors*. The difference between the two, however, is obvious, not only in the structure of the spores (in *Pl. herbarum* the upper half is considerably broader than the lower one, the constriction more pronounced than in *discors*, the spores of which are more evenly broad and larger), but also in its selection of host-plants, *Pleosp. discors* being only found on

Glumiflorae while *Pl. herbarum* is found on nearly all species of dicotyledons and also on the genera *Allium*, *Orchis*, *Asparagus* and *Convallaria*, but never on Glumiflorae. It prefers, however, dead stems of Papilionaceae and Compositae.

73. Pleospora arctica Fuckel Syll. IX p. 882.

Epilobium latifolium. King William Land (Gjøa Harbour), Ellesmere Land (Harbour Fjord).

A very rare species, one collected on this one host and only from high-arctic regions. ROSTRUP proposes (1888 p. 563) to unite it with *Pleospora herbarum*, but in this I do not quite agree with him.

74. Pleospora rubicunda Niessl Syll. II p. 252.

Cerastium trigynum. Norway (Bosekop).

Ascis cylindraceis, $153 \mu \times 18 \mu$, sporidiis 12-septatis, $27-30 \mu \times 10-12 \mu$, castaneis, paraphysibus numerosis, ascis longioribus.

Originally described on *Sambucus Ebulus* from Brunn, extremely rare.

75. Pleospora papillata Karsten Syll. II p. 261.

Angelica Archangelica. Kebnekaise.

76. Pleospora Wulfii Lind 1928 p. 27 c. icone.

Stellaris longipes. Jugor Strait.

Hitherto it was only recorded from Spitzbergen, on the same host, recently I have seen it from East Greenland (leg. TYGE BÖCHER 1932).

77. Pleospora pyrenaica Niessl Syll. II p. 254.

Draba alpina. West-Greenland (Arsuk $61^{\circ}10'$).

Melandrium triflorum. Greenland (Kugsinarcuak, Vaigat).

Described from the highest Pyrenees on *Draba tomentosa*; I think it is an arctic-alpine species, very rare.

78. Pleospora mendax (de Not.) Sacc. Syll. II p. LXIII.*Saxifraga caespitosa*. Ellesmere Land (Goose Fjord).

Described on *Saxifraga* from Italia Borealis, like Nr. 77 an arctic-alpine, very rare species.

79. Pleospora coronata Niessl, Syn.: **Pyrenophora cor.** (N.)

Sacc. Syll. II p. 283.

Achillea millefolium. Gelivare.*Pedicularis Oederi*. Jugor Strait.*Braya purpurescens*. Waigatsch.

Arctic-alpine species, wanting in the Central-European lowlands.

80. Pyrenophora hispida (Niessl) Sacc. Syll. II p. 284.*Melandrium affine*. Lapponia Norvegica (Alten and Bosekop), Boganida.*Melandr. apetalum*. Lapponia Norvegica, Lapponia Suecica (Torneå).*Minuartia rubella*. Novaya Zemlya.

Arctic-alpine species, recorded from many circumpolar places (Hardanger, Lapponia Suecica, Spitzbergen, Labrador) as well as from many alpine localities (Zermatt 2300 m, Tyrol, Brünn, Graz, and Italy).

81. Pyrenophora setigera (Niessl) Sacc. Syll. II p. 281.*Melandrium apetalum*. Abisko.*Minuartia rubella*. Hudson Bay (Churchill).*Saxifraga caespitosa*. Dovre.*Pedicularis lanata*. Bernard Harbour.

Arctic-alpine species, recorded from Spitzbergen and northernmost Scandinavia and further from Mähren and Crestamora. I have recently seen it on *Saxifraga caesia* from Engadin (1800 m).

82. *Pyrenophora phaeocomoides* (Berk. and Br.) Sacc. Syll. II p. 280.

Primula sibirica. Hudson Bay.

Androsace chamaejasme. Alaska.

Andros. triflora. Novaya Zemlya (diff. places), Siberia orientalis (Ljachow Insel).

The specimens of *Androsace triflora* from Novaya Zemlya (Bessimyannya Bay, Feilden legit, August 12, 1897) are surely the same that Pearson has studied (1899 p. 228), he asserts that he has found *Pyrenophora helvetica* on it. The spores I have seen are, however, five-septate like *Phaeocomoides* and not eight-septate like *Helvetica*.

It is an arctic-alpine species, collected in Britannia, Moravia, Stygia and Italy.

83. *Pyrenophora filicina* Lind 1910 p. 157 Syll. XXII p. 280.

Cystopteris fragilis. Lapponia Imandrae (Mt. Schellesnoja).

Hitherto recorded from Spitzbergen, Novaya Zemlya and Greenland (77°).

84. *Pyrenophora chrysospora* (Niessl) Sacc. Syll. II p. 285 and Syll. IX p. 896.

Equisetum scirpoides. Nuolja.

Chamaerepes alpina. Lapponia Suecica (Titir).

Tofieldia palustris. Abisko and Greenland.

Anthericum serotinum. Alaska (Camden Bay).

Alnus incana. Abisko.

Trollius europaeus. ibd.

Anemone parviflora. Bernard Harbour, Hudson Bay (Churchill).

Potentilla nivea. Dovre.

Papaver radicum. Cape Tscheljuskin.

- Eutrema Edwardsii*. Lapponia Ponojensis (Orlow),
Ellesmere Land, (Muskox Fjord).
- Silene acaulis*. Lapponia Norvegica (Talvik), Kebne-
kaise, Ellesmere Land (Harbour Fjord).
- Cerastium alpinum*. Alten, Jan Mayen.
- Arenaria ciliata*. Lapponia Imandrae.
- Minuartia rubella*. Lapponia Norvegica, Bernard Har-
bour.
- Astragalus alpinus*. Lapponia Murmanica.
- Bupleurum americanum*. Alaska (Port Clarence).
- Pachypleurum alpinum*. Novaya Zemlya.
- Saxifraga caespitosa*. Novaya Zemlya, Ellesmere Land
(Goose Fjord).
- Saxifr. hirculus*. Novaya Zemlya.
- Saxifr. oppositifolia*. Novaya Zemlya.
- Saxifr. tricuspidata*. Hudson Bay (Churchill).
- Euphrasia minima*. Abisko.
- Bartsia alpina*. Abisko.
- Pedicularis hirsuta*. Lapponia Norvegica (Talvig).
- Androsace chamejasme*. Taimyr, St. Lawrence Bay.
- Plantago maritima*. Waigatsch.
- Plant. juncoides*. Labrador (Torngat Region).
- Myosotis silvatica*. Siberia (Tolstoinos 70°10').
- Antennaria alpina*. Kebnekaise.
- Achillea millefolium*. Abisko.
- Artemisia borealis*. Novaya Zemlya (71°24').
- Artem. comata*. Alaska (Camden Bay 70°).
- Artem. hyperborea*. Bernard Harbour.
- Arnica alpina*. ibd. and King William Land (Herschell
Island).
- Cirsium heterophyllum*. Nuolja.

Saussurea alpina. Abisko.

Pyrethrum bipinnatum. Waigatsch.

Typical arctic-alpine species, in earlier papers often confounded with the following, both host-plants and distribution are the same. The southernmost localities in Scandinavia are Åreskutan 63°30' and Dovre 62°. It has again been found in the high Alps. WINTER writes (1880 p. 173): "Die häufigste Art am Albula" and further (1887 p. 514), that it is a true alpine species not found in the lowlands. JAAP, VOSS and BERLESE mention it from the mountains of Helvetia, Krain, Italy and Montenegro.

85. *Pyrenophora Cerastii* (Ouds.) Lind 1924 p. 18, Syn.:

Pyren. glacialis (Niessl) Berlese, *Pyren. chrysospora*

(Niessl) Sacc. var.: *polaris* Karsten Syll. IX p. 896,

Pyren. pestalozzae Magnus 1903 p. 582.

Salix rotundifolia. Alaska (Camden Bay).

Polygonum viviparum. Ellesmere Land (Harbour Fjord).

Oxyria digyna. Alaska (Camden Bay).

Ranunculus affinis. Hudson Bay (Ranken Inlet).

Anemone Drummondii. King Point.

Anem. narcissiflora. St. Lawrence Bay.

Alsine arctica. ibd.

Alsine macrocarpa. Novaya Zemlya, Dickson Harbour, Taimyr, Dudino, Ostia Lenae, King Point.

Alsine stricta. Kebnekaise.

Melandrium apetalum. Alaska (Icy Reef).

Cerastium alpinum. Lapponia Norvegica (Alten, Kaafjord), Kiruna, Lapponia Murmanica, Novaya Zemlya (70°34'), Harbour Fjord, Greenland (Disko), Jan Mayen.

Cerast. Regelii. Siberia Jenisei.

- Minuartia rubella*. Ellesmere Land (Fram Fjord 76°23'), Greenland (Disko).
- Sagina nodosa*. Lapponia Varsugae.
- Stellaria longipes*. Grant Land (Cape Richardson 82°35').
- Silene acaulis*. Novaya Zemlya.
- Arabis petraea*. ibd.
- Astragalus alpinus*. Lappona Murmanica, Novaya Zemlya.
- Hedysarum obscurum*. Siberia (Konyambay).
- Oxytropis campestris*. Lapponia Norvegica, Lapponia Imandrae, Novaya Zemlya.
- Oxytropis sordida*. Lapponia Murmanica, Hudson Bay (Churchill).
- Oxytropis nigrescens*. St. Lawrence Island.
- Saxifraga aizoides*. King William Land (Bernard Harbour), Hudson Bay (Churchill).
- Saxifraga cernua*. Novaya Zemlya, Fram Harbour.
- Saxifraga hirculus*. Novaya Zemlya, Ellesmere Land (Harbour Fjord).
- Saxifraga nivalis*. Novaya Zemlya.
- Saxifraga tricipidata*. Ellesmere Land (Harbour Fjord).
- Epilobium latifolium*. Novaya Zemlya.
- Pedicularis lanata*. Alaska, Baffin Land, Ellesmere Land.
- Eritrichium villosum*. Novaya Zemlya.
- Androsace chamejasme*. King William Land (Bernard Harbour).
- Linnaea borealis*. Abisko.
- Campanula rotundifolia*. Lapponia Ponojensis.
- Campan. uniflora*. Hudson Strait (Port Burwell).

Valeriana capitata. Waigatsch.

Chrysanthemum arcticum. Lapponia Murmanica,
Hudson Bay.

Achillea millefolium. Lapponia Norvegica (Mortens-
næs).

It is an arctic-alpine species like the other mentioned species of *Pyrenophora*, never found in temperate lowlands, but MAGNUS (1903) reports it from Phrygia, and I have seen it on *Potentilla nivea* from Mt. Altai.

86. *Pyrenophora androsaces* (Fuckel) Sacc., Syll. II p. 284.

Oxyria digyna. Waigatsch, Novaya Zemlya, Preobraschenie Island, Ellesmere Land (Cape Rutherford), Jan Mayen.

Ranunculus glacialis. Nuolja 1000 m.

Silene acaulis. Tromsø.

Cerastium Regelii. Novaya Zemlya.

Melandrium affine. Siberia (Boganida), Bernard Harbour, Skraeling Island.

Alsine arctica. King Point.

Arabis petraea. Novaya Zemlya.

Braya pilosa. At the mouth of the Mackenzie River.

Potentilla bipinnatifida. Hudson Bay (Churchill).

Pot. emarginata. Siberia (Maud Harbour).

Pot. littoralis. Hudson Bay (Churchill).

Pot. multifida. Hudson Bay (Churchill).

Pot. pulchella. Novaya Zemlya, Ellesmere Land (Castle Rock, Goose Fjord), Grant Land (Fort Conger 81°40').

Pot. rubricaulis. Ellesmere Land (Fram Harbour, Falcon Cliff).

Pot. sericea. Waigatsch, Novaya Zemlya.

Oxytropis campestris. Novaya Zemlya.

Libanotis spec. Siberia (Ostia Lenae).

Saxifraga nivalis. Ellesmere Land (Fram Harbour).

Halianthus peplodes. Kolgujev, Waigatsch, Pitlekai.

Polemonium boreale. Lapponia Norvegica (Sydvanger), Kolgujev, Siberia (Wrangel Island).

Pedicularis capitata. Taimyr, St. Lawrence Bay, Duckett, Ellesmere Land.

Pedicularis sudetica. Novaya Zemlya, King Point.

Very common in arctic regions far up in North-Greenland $83^{\circ}6'$, it was unknown in Scandinavia, till I found it in some of the northernmost localities (Tromsø, Nuolja 1000 m); entirely wanting between 68° and 47° , where it is found again on the highest mountains (1000 m to 2313 m) in Switzerland, Tyrol and Oberkrain.

87. Pyrenophora comata (Niessl) Sacc.

Oxyria digyna. Alaska (Camden Bay).

Anemone Drummondii. Alaska (Sadlerochit River), King Point.

Anem. hirsutissima. King Point.

Ranunculus sulfureus. Alaska (Camden Bay), Ellesmere Land (Goose Fjord).

Eutrema Edwardsii. King William Land.

Braya purpurascens. Ellesmere Land (Harbour Fjord, Muskox Fjord).

Arabis petraea. Novaya Zemlya.

Cardamine bellidifolia. Waigatsch.

Matthiola nudicaulis. Novaya Zemlya, Taimyr, Herschell Island.

Pachypleurum alpinum. Novaya Zemlya.

Libanotis villosus. Ostia Lenae.

Oxytropis deflexa. Lapponia Norvegica (Kontokeino).

Oxytropis campestris. Lapponia Norvegica (Østfinmarken), Kolgujev.

Saxifraga caespitosa. Novaya Zemlya.

Saxifr. cernua. Novaya Zemlya, Ellesmere Land.

Saxifr. hirculus. King William Land.

Mertensia pilosa. King William Land (King Point).

Pedicularis hirsuta. Greenland (Igpik).

Pedicularis sudetica. Novaya Zemlya, King William Land.

Taraxacum arcticum. Novaya Zemlya (Olenje Island).

Just like the species of *Pyrenophora* mentioned before, a typical arctic-alpine species, collected in Norway (Dovre), Sweden 900 m, Spitzbergen, Novaya Zemlya, Arctic America (Kingua Fjord), Alaska, Greenland, up to 79°8', and in Iceland. In the Alps it is known from Brünn, München, Starnberg, also from Kaukasus.

88. *Pyrenophora polyphragmia* Sacc. Syll. II p. 286.

Polemonium boreale. King Point.

Polemonium coeruleum. Lapponia Tulomensis (Kildin Island).

Arctic-alpine species, recorded from Jemtland 700 m, from Tyrol and Montenegro; I think it is identical with or very nearly related to *Pleospora multiseptata* Starb. and with *Pleospora fenestrata* Niessl.

Most species of *Pyrenophora* are remarkably plurivorous. Three of them only viz.:

Pyrenophora filicina on *Cystopteris*.

Pyren. venturia on *Dryas*.

Pyren. paucitricha on *Salix*

are limited to a single genus of host-plants. Most of them occur on Dicotyledones, *Pyrenophora trichostoma*, *Pyr. relicina*, *Pyr. phaeocomes*, and *Pyr. Wichuriana* only are exclusively restricted to Monocotyledones. I have found the above *Pyrenophora polyphragmia* on *Festuca* and *Calama-*

grostis (1928 p. 67) while SACCARDO reports that he has found it "in caulibus herbarum majorum", it is the only one that has been found both on Mono- and Dicotyledones. In one that regard to distribution, there is a remarkably sharp boundary between the arctic-alpine species mentioned above, and the species (*Pyr. phaeocomes*, *Pyr. relicina* and *Pyr. trichostoma*) which are found in the lowlands only. The latter are more typical (with peritheciis sclerotiaceis), the former are not at all sclerotiaceis.

From the above comparison of collections from arctic regions it is evident that most species of Pyrenophora may be found on many different host-plants while on the other hand many dead stalks of Polemonium, Pedicularis, Potentilla or Silene may house 2—4 species of Pyrenophora socially. There must be a natural reason for the fact that these species with hairy or prickly peritheciis thrive much more vigorously in arctic than in temperate regions, but I cannot see any safe explanation of this phenomenon.

Pyrenophora hispida seems inclined to specialize on Melandrium and some other spec. of Caryophyllaceae.

6. Ord. Hypocreales.

89. *Nectria dacrymella* (Nyl.) Karsten.

Trollius europaeus. Kebnekaise.

Hitherto recorded from Fennia and Tyrol only.

90. *Nectriella carnea* (Desm.) Sacc.

Carex aquatilis. Abisko.

91. *Gibbera Vaccinii* Fries.

Vaccinium vitis idaea. Abisko.

Commonly distributed in all European countries.

92. *Claviceps microcephala* (Wallr.) Tul. Syll. II p. 565.

Alopecurus nigricans. Lapponia Norvegica (Sydværanger).

7. Ord. Sphaeriales.

1. Fam. *Fimetariaceae*.

93. *Sordaria discospora* (Awd.) Niessl.

In fimo anserino. Abisko.

94. *Sporormia intermedia* Awd.

In fimo leporino etc. Abisko.

According to the plan of the present work, which only covers parasites and saprophytes on phanerogams, these few Fungi Fimicoli might as well have been passed by in silence.

2. Fam. *Sphaeriaceae*.

95. *Coleroa alchimillae* (Fries) Wt. Syll. I p. 593.

Alchimilla acutangula. Lapponia Rossica.

Common all over Europe, Caucasus and Greenland.

96. *Chaetosphaeria potentillae* Rostrup 1894 p. 23.

Alchimilla alpina Norway (Telemarken).

Originally described from Greenland and found in several places in Greenland up to 70° and 82°29', but never before observed outside of Greenland.

97. *Herpotrichia nigra* Hartig Syll. IX p. 858, Syn.: *Herpot. mucilaginosa* Starb., *Herpot. juniperi* (Duby) Petrak 1925 pp. 43 & 214.

Juniperus communis. Kebnekaise.

In the literature it is mentioned on *Juniperus* from Sweden (ALLESCHER 1889 p. 57), Iceland, Norway, Greenland 60°—61° and on *Juniperus*, *Picea* and *Pinus* on mountains in Bavaria and Helvetia. It is not entirely wanting in Denmark and the European Lowlands, but it is rare, probably because its occurrence depends on the host plant being long covered with snow during the winter, therefore it is also wanting in West Norway (JØRSTAD 1925 p. 108).

98. Melanomma cinereum (Karsten) Sacc.

Salix Richardsonii. King William Land (Herschell Island).

99. Melanomma dryadis Johanson Hedwigia 1890 p. 160, Syll. IX p. 804.

Dryas octopetala. Boganida.

Dryas integrifolia. Grant Land 82°30'.

It seems to be very rare; hitherto only known from Jemtland and from North-East Greenland 83°15'.

100. Lizonia distincta Karsten, Syll. I p. 574.

Hierochloë alpina. Lapponia Ponojensis (Orlow).

The finding place mentioned, does not fall outside the narrow circle from which this species has hitherto been recorded viz. Spitzbergen and Åbo in South Finland 60°20'.

7. Fam. **Lophiostomaceae.**

101. Lophiostoma arundinis (Fries) Ces., Syll. II p. 600 & IX p. 1090. Syn.: **Lophiost. semiliberum** (Desm.) Ces.

Milium effusum. Abisko.

A southern species, never before found so far north. In South Finland it has been found at Mustiala.

8. Fam. **Mycosphaerellaceae.**

102. Laestadia graminicola Rostrup 1888 p. 548.

Poa glauca. Ellesmere Land (Harbour Fjord, Baren Vallies and Fram Harbour).

F. PETRAK and H. SYDOW (1924 p. 355) have examined an "äusserst dürftige Probe des Originalexemplares", there seems to be some misunderstanding, the spores are described as "1-zellig", but afterwards they write: "Als Laestadia

kommt sie, der 2-zelligen Sporen wegen, jedenfalls gar nicht in Betracht''.

The species is known from Greenland and Iceland, always on the same host.

103. *Laestadia potentillae* Rostrup 1891 p. 615.

Potentilla maculata. Abisko.

F. PETRAK and H. SYDOW (1924 p. 358) have examined ROSTRUP'S original specimens without finding the same fungus. Hitherto known from Greenland and Iceland.

104. *Laestadia veronicae* Rostrup 1903 p. 300.

Veronica saxatilis. Lapponia Norvegica (Talvik).

Originally described from Iceland, but never found again.

105. *Ascospora melaena* (Fries) Wt., Syn.: *Asteroma melaenum* (Fries) Niessl, *Asterina mel.* Sacc., Syll. I p. 48, *Sphaerella mel.* Awd., Syll. I p. 513.

Phaca frigida. Kalixfors.

I think it must be designated as arctic-alpine, it is known from Dovre and is common in Sweden (FRIES: Syst. Myc. II p. 431), but is wanting in Denmark. It appears again in Luxembourg, Bavaria, Austria and Tyrol.

106. *Mycosphaerella equiseti* (Fuckel) Schroeter, Syll. I p. 534.

Equisetum pratense. Abisko.

Equ. palustre. ibd.

Nearly related to *Mycosph. Tassiana* but it has more slender asci, the perithecia are more globular, the spores more elliptical $16-18 \mu \times 6-7 \mu$.

Known from Austria, Denmark, Krain and Helvetia (Montagny).

107. *Mycosphaerella lycopodii* Peck.

Lycopodium annotinum. Abisko.

Very seldom collected in Europe, I have, however, seen it once from Denmark.

- 108. *Mycosphaerella juncaginearum*** (Lasch) Schroeter 1908 p. 369, Syn.: ***Phaeosphaerella junc.*** Sacc., Syll. XI p. 312, ***Dothidea junc.*** Lasch, ***Diaporthe junc.*** Rostrup 1895 p. 208 and 1903 p. 319, Syll. XI p. 311. The sterile mycelium is called ***Asteroma juncaginearum*** Rabenhorst, Syll. III p. 214, ***Ectostroma trigloch.*** Ouds. Syll. XVI p. 1109 and ***Asteroma Calvadosii*** Desm., Syll. III p. 214.

Triglochis palustris. Hudson Bay (Churchill).

Just like *Ascospora himantia* and *Ascospora reticulata* this species has a sterile mycelium, which was previously called by a special name (*Asteroma*, *Ectostroma* etc.) although it cannot produce conidia or any other form of fructifying organs.

Mycosphaerella juncaginearum is a southern species, known from many places in Europe (Holland, Denmark, Germany etc.). It is never found north of the arctic circle, the northernmost place is Umeå in Sweden 64° and Iceland 64°. It has not been found outside of Europe before.

- 109. *Mycosphaerella perexigua*** (Karsten) Johanson, Syll. I p. 528.

Luzula arcuata. Nuolja, Lapponia Murmanica.

Luz. campestris. Siberia Jenisei.

Luz. confusa. Abisko, Piteå Lappmark, Lapponia Murmanica, Lapponia Rossica, Waigatsch, Actinieviken, St. Lawrence Island, Ellesmere Land (Goose Fjord).

Luz. spicata. Abisko.

Luz. sudetica. ibd.

Luz. Wahlenbergii. Lapponia Murmanica, Novaya Zemlya, Siberia 50°5'.

Juncus arcticus. Dovre (Jerkind), Abisko, Bjørkliden.

Junc. arcuatus. Lule Lappmark (Kjerkevare).

Junc. biglumis. Abisko, Bjørkliden, Waigatsch, Novaya Zemlya, Actinieviken.

Junc. trifidus. Lapponia Norvegica (Hammersfest and Sakkabani), Kebnekaise, Abisko, Gelivare, Lapponia Murmanica.

Junc. triglumis. Hammersfest, Abisko, Lapponia Murmanica, Lapponia Ponojensis (Orlow).

Elyna Bellardi. Ellesmere Land.

Eriophorum vaginatum. Abisko.

Eriophorum angustifolium. Greenland (Disko).

Scirpus caespitosus. Abisko.

Carex rotundata. ibd.

I have also seen it on *Juncus arcticus* from Helvetia (Val Bévers). It is certainly very common on *Juncus* and *Luzula*, but ignored on account of its smallness.

110. *Mycosphaerella pusilla* (Awd) Johanson, Syll. I p. 530.

Carex brunnescens. Kebnekaise.

Carex Buxbaumii. Norway (Magerø).

Carex membranopacta. Hudson Bay (Fullerton), Ellesmere Land.

Carex norvegica. Lapponia Norvegica (Varanger).

Carex pedata. Lapponia Norvegica (Næver Fjord), Lapponia Imandrae (Kantalax), Siberia Jenisei (Dudino).

Carex pulla. Lapponia Imandrae, Waigatsch.

Carex rigida. Boganida.

Carex rotundata. Lapponia Imandrae, Siberia Jenisei (Dudino).

- Carex rostrata*. Abisko.
Eriophorum russeolum. Alten.
Festuca ovina. Nuolja 1000 m.
Poa glauca. King Point.
Colpodium fulvum. Preobraschenie Island.
Alopecurus alpinus. Taimyr.

Generally distributed not only in all circumpolar regions but also in the temperate regions of Europe, right down to Naples, and in America. On many different host-plants of Glumiflorae.

111. *Mycosphaerella lineolata* (Desm.) Schroeter, Syll. I p. 531.

- Carex atrata*. Lapponia Norvegica (Sörö).
Carex glareosa. Nuolja.
Carex rigida. Hudson Bay (Fullerton).
Scirpus sp. Kebnekaise.
Arctagrostis latifolia. Lapponia Norvegica (Mortensnæs).
Calamagrostis neglecta. Abisko, Kiruna, Siberia Jenisei.
Poa glauca. Nuolja 900 m.
Poa nemoralis. Nuolja.
Milium effusum. Abisko.
Triticum caninum. ibd.

Common in temperate regions, mostly on *Calamagrostis*. Known from Minussinsk in Siberia (see SACC. 1896 p. 17).

112. *Mycosphaerella wichuriana* (Schroeter) Johans., Syll. I p. 530.

- Luzula confusa*. Dickson Havn.
Juncus triglumis. Hudson Bay (Churchill).
Carex aquatilis. Abisko.
Carex atrofusca. ibd.

- Carex capitata*. Lapponia Murmanica.
Carex dioeca. Abisko.
Carex ornithopoda. ibd.
Carex rariflora. Novaya Zemlya.
Carex rigida. Hammersfest, Abisko.
Carex rupestris. Lapponia Norvegica (Salten 67°30').
Carex salina. Lapponia Norvegica.
Carex stans. Siberia (Flumen Boganida 71°5').
Carex ustulata. Hudson Bay.
Eriophorum opacum. Lapponia Norvegica (Mortensnæs).
Erioph. polystachyum. Novaya Zemlya, Dickson Havn, Actinieviken.
Erioph. russeolum. Lapponia Norvegica (Alten).
Scirpus caespitosus. Kebnekaise.
Poa glauca. Grants Land (Fort Conger), Ellesmere Land (Harbour Fjord), Hudson Bay (Ranken Inlet).
Festuca ovina. Nuolja 1000 m.
Dupontia Fisheri. Franz Josef Archipelago (Mabel Island).
Arctagrostis latifolia. Waigatsch, Novaya Zemlya, Taimyr, Siberia Jenisei (Nicandrovsy Island), Alaska (Icy Reef 69°), King Point.
Calamagrostis confinis. Lapponia Norvegica (Tana Elv).
Calamagr. deschampsiioides. Lapponia Varsugae.
Calamagr. neglecta. Lapponia Murmanica (Tsipnavolak).
Calamagr. strigosa. Lapponia Norvegica (Alten).
Trisetum arostideum. Siberia Jenisei (Dudino).
Trisetum spicatum. Dovre (Kongsvold).

It is widely distributed and very common in all arctic and subarctic regions, the southernmost localities are: The Färöes, Dovre in Norway and Jemtland in Sweden and here only on the mountains. It was originally described from Lapponia Suecica (Kvikkjokk 67°).

113. *Mycosphaerella tassiana* (de Not.) Johanson, Syll. I p. 530.

Lycopodium alpinum. Nuolja.

Triglochin palustris. Hudson Bay (Churchill).

Juncus biglumis. Björkliden, Ellesmere Land (Fram Harbour).

Juncus triglumis. Abisko.

Luzula arcuata. Nuolja.

Luz. nivalis. Grant Land (Cape Richardson), Ellesmere Land (Fram Fjord).

Eriophorum polystachyum. Ellesmere Land (Bedford Pim Island).

Erioph. Scheuchzeri. Lapponia Norvegica (Bosekop).

Erioph. vaginatum. Abisko.

Carex alpina. Lapponia Norvegica (Alten).

Carex atrata. Abisko.

Carex canescens. Lapponia Norvegica (Sörö).

Carex incurva. Ellesmere Land.

Carex membranopacta. ibd.

Carex ornithopoda. Abisko.

Carex pedata. Lapponia Norvegica (Varanger).

Carex stans. Abisko, Coronation Gulf, Ellesmere Land (Alexandra Fjord), Hudson Bay (Ranken Inlet).

Festuca ovina. Novaya Zemlya, Grant Land (Cape Richardson 82°35'), King William Land (Gjøa Harbour), Ellesmere Land, Jan Mayen.

Festuca rubra. Novaya Zemlya, Disko, Jan Mayen.

- Poa abbreviata*. Grant Land (Fort Conger), Ellesmere Land (Bedford Pim Island and Cape Rutherford).
Poa alpina. Abisko, Nuolja, Kolgujuk, Wajgatsch.
Poa arctica. Franz Josef Archipelago, Ellesmere Land.
Poa cenisia. Disko.
Poa glauca. Norway (Hallingdalen 1200 m, Alten), Abisko, Ellesmere Land (Fram Fjord, Goose Fjord, Harbour Fjord).
Poa pratensis. Ellesmere Land (Fram Fjord, Skraeling Island).
Catabrosa algida. Ellesmere Land (Cape Sabine).
Catabrosa concinna. Novaya Zemlya.
Puccinellia angustata. Wajgatsch, Ellesmere Land.
Pucc. phryganodes. Preobraschenie Island, Disko.
Pucc. tenella. Alaska.
Pucc. Vahliana. Ellesmere Land (Harbour Fjord, Fram Fjord).
Deschampsia arctica. Ellesmere Land.
Hierochloë alpina. Lapponia Suecica, Siberia Jenisei (Dudino), New Foundland.
Hierochl. pauciflora. Novaya Zemlya, Alaska (Camden Bay).
Dupontia Fisheri. Actinieviken.
Trisetum aristideum. Siberia Jenisei (Dudino).
Tris. spicatum. Norway (Dovre, Hornlis, Ramsfjord, Lapmark), Lapponia Suecica (Kiruna, Torneå, Luleå), Siberia Jenisei (Dudino), Bernard Harbour, Ellesmere Land, Hudson Bay (Churchill), Colorado (Minnehaha 2600 m, Leadville, Rocky Mt. 3000 m).
Milium effusum. Abisko.
Arctagrostis latifolia. Lapponia Murmanica (Kildin Island), Grants Land (Cape Richardson), Ellesmere Land.

- Calamagrostis Langsdorffii*. Siberia Jenisei (Tolstoinos
70°10').
- Calam. neglecta*. Alten, Siberia Jenisei.
- Calamagr. phragmitoides*. Lapponia Norvegica (Boose-
kop).
- Calamagr. strigosa*. Lapponia Norvegica (Alten).
- Koeleria asiatica*. Taimyr.
- Phleum alpinum*. Lapponia Norvegica (Hammers-
fest), Lapponia Lulense.
- Alopecurus alpinus*. Ellesmere Land.
- Alopec. nigricans*. Lapponia Murmanica.
- Alopec. nigrescens*. Lapponia Imandrae.
- Alopec. pratensis*. Waigatsch.
- Tofieldia palustris*. Abisko.
- Lloydia serotina*. Novaya Zemlya.
- Rumex acetosella*. Boganida.
- Polygonum viviparum*. Nuolja, Novaya Zemlya, Elles-
mere Land.
- Oxyria digyna*. Grant Land (Cape Richardson).
- Sagina Linnaei*. Lapponia Norvegica (Alten).
- Cerastium alpinum*. Lapponia Norvegica (Alten, Kaa-
fjord, Varanger), Kebnekaise, Lapponia Murma-
nica, Disko.
- Cerast. trigynum*. Kebnekaise.
- Alsine arctica*. Fretum Sanjewin.
- Alsine stricta*. Abisko, Kebnekaise, Disko.
- Arenaria ciliata*. Novaya Zemlya.
- Minuartia rubella*. Novaya Zemlya, Hudson Strait.
- Minuartia verna*. Lapponia Norvegica (Sakkabani).
- Halianthus peplodes*. Lapponia Ponojensis, Wai-
gatsch, Novaya Zemlya, Pitlekai.
- Stellaria longipes*. Franz Josef Archipelago, Siberia

- Jenisei, Alaska (Sandspit), Hudson Bay (Ranken Inlet and Churchill), Ellesmere Land, Disko.
- Stell. graminea*. Lapponia Norvegica (Alten).
- Melandrium affine*. Lapponia Norvegica (Alten, Boosekop), Boganida, Bernard Harbour, Ellesmere Land (Alexandra Fjord).
- Melandrium apetalum*. Lapponia Norvegica, Abisko, Novaya Zemlya, Siberia Jenisei (Tolstinos), Ellesmere Land.
- Viscaria alpina*. Lapponia Norvegica (Alten, Kaafjord), Abisko.
- Silene acaulis*. Alten, Novaya Zemlya.
- Silene maritima*. Lapponia Norvegica (Kaafjord), Lapponia Murman.
- Claytonia acutifolia*. St. Lawrence Island.
- Claytonia sarmentosa*. Taimyr.
- Trollius europaeus*. Abisko.
- Ranunculus affinis*. Ellesmere Land (Seagull Rock).
- Papaver radiculatum*. Norway (Dovre), Novaya Zemlya, Jalmal, Maud Harbour, Bernard Harbour, Hudson Strait, Lancaster Sound, Ellesmere Land (Goose Fjord).
- Lesquerella arctica*. Ellesmere Land.
- Draba alpina*. Disko.
- Draba Fladnitzensis*. ibd.
- Matthiola arctica*. King William Land.
- Matth. nudicaulis*. Novaya Zemlya.
- Arabis petraea*. ibd.
- Rhodiola rosea*. Kebnekaise.
- Saxifraga hirculus*. Ellesmere Land.
- Saxifr. rivularis*. Labrador (Hebron).
- Sanguisorba officinalis*. Lapponia Varsugae.

- Potentilla elegans*. St. Lawrence Bay.
Pot. emarginata. Hudson Strait.
Pot. multifida. Lapponia Lulensis.
Pot. nivea. Dovre (Kongsvold).
Sibbaldia procumbens. Dovre (Jerkind).
Oxytropis Hudsonicus. Hudson Bay (Ranken Inlet).
Pachypleurum alpinum. Novaya Zemlya, Taimyr.
Epilobium latifolium. Novaya Zemlya.
Libanotis sp. Ostia Lenae.
Androsace chamaejasmes. Alaska.
Armeria arctica. Boganida, Taimyr.
Statice elongata. Bernhard Harbour 68°47'.
Polemonium humile. Taimyr, Wrangel Island.
Mertensia maritima. Bernhard Harbour, Baffin Land
(Ponds Inlet).
Euphrasia brevifolia. Abisko.
Pedicularis arctica. Ellesmere Land (Hayes Sound).
Plantago maritima. Lapponia Norvegica (Alten).
Gentiana tenella. Abisko.
Campanula uniflora. Hudson Strait.
Antennaria carpatica. Lapponia Norvegica (Maals-
elv).
Antenn. dioeca. Abisko.
Artemisia Richardsoniana. Bernhard Harbour.
Hieracium sp. Björkliden.
Cirsium heterophyllum. Nuolja.
Achillea millefolium. Lapponia Norvegica (Mortens-
næs).

It would have been far more easy to say that *Tassiana* was found on practically all the phanerogams examined and in all the localities examined. But the whole plan of this special work demands that every detail is recorded. In the material

examined I have found *Tassiana* on 110 different host-plants, but another species on 20 hosts only, and a third species of microfungi is limited to one or two hosts. It shows clearly this side of the relation between the fungus and its hosts. And further: when *Tassiana* has been found 200 times on the very same material, where another species has been found only a few times, we have obtained a good picture of their relative frequency. In many endophytes, moreover, a more or less advanced tendency, to divide in species sorores or biological races is seen. In *Tassiana* no tendency of that kind occurs according to the material examined. But earlier mycologists have arbitrarily divided *Tassiana* in many species according to host-plants only (see LIND 1926 p. 164).

A precise definition of the host-plants and the localities of each species will also be of assistance in finding the connection between the Ascomycetes and their conidial forms.

If we look more closely at the above mentioned localities for *Tassiana*, it will be seen that it thrives in all arctic and subarctic regions. Its frequency is great and is the same all round the pole. Like most of the subarctic species it is still common in Dovre and at Åre, thereafter it is very rare. It is not entirely wanting in Denmark, but has been found very rarely (and only on *Glumiflorae*); in the Alps it is quite common again, I have seen it on *Trisetum spicatum* from Chur 2400 m, SCHROETER (1890 p. 59) mentions it from Serbia (Mt. Kopaonik), Traverso (1913) writes, that it is common throughout North Italy, PETRAK (1928 p. 211) mentions it from Mt. Altai in West Siberia, and I have seen it on *Oxyria digyna* from the Altai Mountains in Pamir (2600 m, leg. OVE PAULSEN). In the United States it is found in Delaware etc.

114. *Mycosphaerella confinis* (Karsten) Lind, Syn.: *Sphaerella carniolica* Niessl, Syll. I p. 502.

Polygonum bistorta. St. Lawrence Bay, King Point.

Thalictrum alpinum. Abisko.

Cochlearia officinalis. Jan Mayen.

Matthiola nudicaulis. Novaya Zemlya, Boganida.

Armeria elongata. Lapponia Murmanica (Semostrov),
Taimyr, Pitlekai.

Eutrema Edwardsii. Ellesmere Land (Muskox Fjord).

Minuartia rubella. Lapponia Norvegica.

Moehringia lateriflora. Lapponia Norvegica (Syd-
Varanger), Lapponia Murmanica (Voroninsk).

Braya purpurascens. Novaya Zemlya.

Melandrium affine. Boganida.

Viscaria alpina. Abisko, Kebnekaise.

Veronica saxatilis. Lapponia Suecica (Njunnats), Lap-
ponia Imandrae.

Campanula uniflora. Novaya Zemlya.

Saussurea alpina. Abisko.

Erigeron unalaschensis. Spitzbergen.

Erig. compositus. Bernhard Harbour.

It is an arctic-alpine species more common in the arctic regions than in the Alps. Formerly reported from Norway (Dovre), Fennia, Spitzbergen, Novaya Zemlya, Arctic America, Greenland and from Mt. Nanos near Präwald in Kärnten.

115. *Mycosphaerella conglomerata* (Wallr.).

Alnus incana. Abisko.

This species which I found everywhere in the neighbourhood of Abisko on the dead leaves of *Alnus* is not known in the European lowlands; on the other hand, it is reported from Italy.

116. Mycosphaerella Capronii (Sacc.) Lind.

Salix myrsinites. Tromsö.

Salix polaris. Bosekop.

Salix Richardsonii. Hudson Bay (Churchill).

117. Mycosphaerella polaris (Karsten) Lindau, Syll. I p. 486.

Salix spec. Novaya Zemlya.

118. Mycosphaerella silenes acaulis Maire 1907 p. 335.

Silene acaulis. Jan Mayen.

Arctic-alpine species which hitherto has not been sufficiently searched for, first described from Hühnenspiel in Tyrol 2300 m.

119. Mycosphaerella ranunculi (Karsten) Lind, Syll. IX p. 611, Syn.: **Sphaer. fuispora** Fuckel, Syll. IX p. 611.

Ranunculus acer. Novaya Zemlya.

Ran. affinis. Hudson Bay (Ranken Inlet).

Ran. glacialis. Norway (Dovre and Telemarken).

Ran. hyperboreus. Disko.

Ran. nivalis. Preobrascheni Island, Alaska (Camden Bay), Ellesmere Land (Bedford Pim Island, Fram Fjord).

Ran. Pallasii. Lapponia Rossica.

Ran. pygmaeus. Kolgufjew, Hudson Strait (Port Burwell), Jan Mayen.

Ran. sulphureus. Jugor Strait, Novaya Zemlya.

Anemone narcissiflora. St. Lawrence Bay.

Anem. parviflora. Alaska (Camden Bay).

Trollius europaeus. Abisko.

Thalictrum alpinum. Björkliden, Lapponia Murmanica.

Concerning the description and nomenclature of this species see LIND (1926 p. 166). It is sufficiently different from Tassiana with regard to the form both of perithecia

and spores. On the other hand it is not quite certain that it is different from *Sphaerella thalictri* Allescher 1889 (*Mycosphaerella Allescheri*) on *Thalictrum alpinum* from Munich. It is common in all circumpolar regions but hitherto has not been recorded from as southerly localities as the above mentioned from Norway (59°40'). Whether it is collected in the Alps has not yet been decided.

120. *Mycosphaerella innumerella* (Karsten) Starb., Syll. I p. 506.

Comarum palustre. Abisko.

A southern species, not found so far north before. In Norway it has been found at Trondhjem (SCHROETER 1885 p. 211), in Sweden at Umeå (VLEUGEL), Jemtland (JOHANSON) and Upsala (ELIASSON) and in Finland at Helsingfors. In Denmark it is common; it is also recorded from Nuremberg.

121. *Mycosphaerella melanoplaca* (Desm.) Lindau.

Alchimilla acutidens. Gelivare.

Alchim. alpestris. Abisko.

Arctic-alpine species, recorded on Geum and Alchimilla from Norway (Tronfjæld 1663 m, 62°), Greenland and Iceland, further from Austria and Italy. PETRAK has found it in the Carpathian Mountains and give a good description of it (1925 p. 231).

122. *Mycosphaerella potentillae* (Ouds.).

Potentilla emarginata. Novaya Zemlya.

Pot. maculata. Kolgужew.

123. *Mycosphaerella ootheca* (Sacc.) Magnus., Syll. I p. 506.

Dryas integrifolia. Ellesmere Land (Goose Fjord).

Dryas octopetala. Abisko, Kebnekaise.

Arctic-alpine species; exclusively living on *Dryas* (see TRAVERSO 1913 p. 594); in the Alps it has been found in Tyrol and Venetia; moreover reported from Arctic America.

124. *Mycosphaerella minor* (Karsten) Johans., Syll. I p. 519.

Saxifraga aizoides. Abisko.

Sax. caespitosa. Norway (Finse 1200 m).

Sax. hirculus. Lapponia Norvegica, Waigatsch, Novaya Zemlya.

Sax. nivalis. Novaya Zemlya.

Sax. rivularis. St. Lawrence Island.

Common in various species of dicotyledons in arctic regions viz.: on *Epilobium* from Kola, further from Spitzbergen, Arctic Canada, Greenland, the Färöes and the Dovre Mountains in Norway. Entirely absent in Central Europe and recurring in Northern Italy (on *Galium silvaticum*), consequently an arctic-alpine species.

125. *Mycosphaerella densa* (Rostrup) Lind, Syll. IX p. 622.

Thalictrum alpinum. Novaya Zemlya.

Cardamine bellidifolia. Taimyr, King Point.

Cardam. pratensis. Novaya Zemlya.

Saxifraga hieracifolia. Jugor Strait, Boganida.

Saxif. hirculus. Boganida, Bernhard Harbour, North Baffin Land (Admiralty Island).

Saxif. nivalis. Lapponia Norvegica (Talvik).

Saxif. rivularis. St. Lawrence Island.

Saxif. stellaris. Novaya Zemlya.

It has hitherto only been recorded from Sweden (Åreskutan 63°30'), Spitzbergen (quite common), Novaya Zemlya and Iceland (64°). Contrary to most of the fungi of this genus it is a genuine parasite producing dead spots on living leaves of the host, the mycelium entirely penetrating the living plant.

126. *Mycosphaerella saxifragae* Passer.

Saxifraga caespitosa. Jan Mayen.

127. *Mycosphaerella vivipari* (Wt.) Lind, Syll. XI p. 299.

Polygonum viviparum. Abisko.

Hitherto only found in Baffin Land (Kingua) and on Spitzbergen.

128. *Mycosphaerella polygonorum* (Crié) Lind, Syll. I p. 512.

Polygonum bistorta. Waigatsch.

Arctic-alpine species, recorded from Spitzbergen, King William Land, Ellesmere Land, Greenland and Iceland and further from France and Caucasus.

129. *Mycosphaerella umbelliferarum* (Rabenh.).

Angelica Archangelica. Nuolja.

130. *Mycosphaerella inconspicua* (Schroeter) Vgr., Syll. I p. 499.

Cassiope tetragona. Lapponia Norvegica (Alten and Mt. Sakkabani), Abisko, Boganida, Pitlekai, Hudson Bay (Ranken Inlet), Ellesmere Land.

Loiseleuria procumbens. Gelivare.

Arctic-subarctic species, recorded in the literature from Lapponia Suecica (SCHROETER 1881 and VESTERGRÉN 1909), Spitzbergen, Arctic America, Labrador and Greenland.

131. *Mycosphaerella pedicularidis* (Karsten) Lind, Syll. I p. 501.

Bartsia alpina. Abisko.

Pedicularis lanata. Novaya Zemlya, Ellesmere Land.

Pedic. lapponica. Lapponia Norvegica (Magerø).

Pedic. sudetica. Novaya Zemlya, Boganida, Taimyr, King William Land.

Arctic-subarctic species, recorded from many arctic and Scandinavian localities viz.: Spitzbergen, Novaya Zemlya, Arctic America, Greenland, Dovre and once from Denmark.

132. *Mycosphaerella vaccinii* (Cooke) Schroeter, Syll. I p. 493.

Vaccinium uliginosum. Ellesmere Land.

Recorded from Fennia, Caucasus, U.S.A. (Georgia,

Florida, New York) and further from the European Lowland (Denmark, Brandenburg, Bavaria).

133. *Mycosphaerella pirolae* (Rostrup) Lind.

Pirola rotundifolia. Tromsö.

Recorded from Novaya Zemlya and Greenland (66°56' and 69°56').

134. *Mycosphaerella grumiformis* (Karsten) Starb., Syn.:

Phaeosphaerella grum. Sacc. 1896 p. 17.

Arctostaphylos alpina. Abisko.

Known from Norway (from Bosekop in the north to Kongsberg in the south), Sweden (Jemtland), Lapponia Rossica, Novaya Zemlya, and Siberia Jenisei.

135. *Mycosphaerella primulae* (Awd.), Syn.: *Mycosphaerella clandestina* (Niessl).

Androsace villosa. Siberia (Konyam Bay).

Arctic-alpine. Described from Transsilvania, Styria, Helvetia (Albula and Canton Vaadt) and Bavaria (Berchtesgaden).

136. *Mycosphaerella parnassiae* (Rostrup 1903 p. 302).

Parnassia Kotzebuensis. Herschell Island.

Hitherto only found in Iceland.

137. *Mycosphaerella gentianae* (Niessl).

Gentiana nivalis. Abisko.

Immature, as is always the case.

138. *Mycosphaerella polemonii* spec. nov.

Peritheciis sparsis, globosis, 200 μ diam., ascis numerosis, fasciculatis, cylindraceo-clavatis, octosporis, 45—50 μ \times 10 μ , aparaphysatis. Sporidiis distichis, hyalinis, 1-septatis, utrinque acutiusculis, 18 μ \times 3—3.5 μ .

In foliis siccis Polemonii humili. King Point June 28, 1906, leg. LINDSTRÖM.

139. Mycosphaerella caulicola (Karsten).*Gnaphalium norvegicum*. Abisko.

Formerly recorded from Lapponia Fennica and Italy.

140. Mycosphaerella eriophila (Niessl) Lind.*Erigeron uniflorus*. Novaya Zemlya.

Formerly recorded from Spitzbergen, Alaska, Arctic America, Greenland and Iceland as well as from the mountains of Helvetia and Germany, consequently an arctic-alpine species.

141. Mycosphaerella compositarum (Awd.).*Hieracium* spec. Bjørkliden.*Hierac. alpinum*. Lapponia Murmanica.*Matricaria inodora*. Novaya Zemlya.*Arnica alpina*. Herschell Island.**142. Mycosphaerella taraxaci** (Karsten) Lind, Syll. I p. 509.*Taraxacum arcticum*. Spitzbergen, Novaya Zemlya.*Tarax. glabrum*. Novaya Zemlya, Waigatsch.*Tarax. hyperboreum*. King William Land.*Tarax. platylepium*. Novaya Zemlya.*Tarax. lateritium*. Taimyr.

Recorded from many arctic and subarctic localities.

143. Mycosphaerella nebulosa (Fries) Lind.*Solidago virgaurea*. Abisko.*Melandrium rubrum*. Nuolja.

On the first mentioned host-plant it is common, but on the last mentioned it has never been observed before. It is an arctic-alpine species, recorded from Helvetia, Montagny, the Carpathian Mountains and Italy but wanting in the lowlands.

144. Venturia chlorospora (Ces.) Karsten, Syll. I p. 586.*Salix* spec. Kiruna, Ellesmere Land.*Salix recutita*. Abisko.

A common species, from northernmost Greenland to the Alps and Italy.

145. *Venturia ditricha* (Fries) Karsten, Syll. I p. 587.

Betula nana. Siberia Jenisei.

Bet. odorata. Common near Abisko in many places.

Alnus incana. Abisko.

It is common on *Betula* all over Europe and North America, but it has never before been found on *Alnus*. I cannot, however, see that the specimens I found in quantity at Abisko differ from the same *Venturia* on *Betula*. I see that STRASSER (1907 p. 314) has found *Venturia ditricha* on *Berberis vulgaris*.

146. *Venturia islandica* Johanson 1884 p. 168 c. fig.

Dryas integrifolia. Hudson Bay (Churchill), Eastern Quebec (Mt. Percé).

It has been described in 1884 from Iceland and found once again in the Färöes, but nowhere else in the intervening fifty years, so it must be characterized as very rare.

147. *Venturia aretostaphyli* Cooke and Harkn.

Arctostaphylos alpina. Siberia (Petschora).

148. *Venturia Dieckiei* (Berk. & Br.) Sacc., Syn.: *Metacderoa Dieck*. Petrak 1927 p. 330.

Linnaea borealis. Mt. Dundret near Gelivare.

Common in Scandinavia and Finland, not known in Denmark, but it recurs on Rostocker Heide, Riesengebirge, Graubünden and U. S. A. (New Hampshire, Wisconsin and New York).

149. *Sphaerulina arctica* (Rostrup) comb. nov., Syn.: *Laestadia arc.* Rostrup 1888 p. 547, *Lizonia halophila* Bomm. Rous. Sacc., Syll. IX p. 680 (1891), *Sphaerulina halophila* (B. R. S.) Starb. 1896.

Halianthus (Honckenya) peploides. Kolgujev, Novaya Zemlya, Pitlekai.

The perithecia, placed very closely, form a circular, black crust on dead or drying leaves of *Halianthus*. There are only few asci in each perithecium, the asci are broad bellied below and the ascus wall is thickened above; the spores are quite colourless and ripen very slowly, most frequently they are 2-celled with 2—4 oildrops in each cell, at last they become 4-celled. For that reason SACCARDO has first described it as *Lizonia*, and ROSTRUP has even taken it for a *Laestadia*. F. PETRAK and H. SYDOW have (1924 p. 356) examined ROSTRUP'S original specimen of *Laestadia arctica* from Disko and found 3—4 septa in each spore.

If we combine these scattered communications, it appears that it is found at Stockholm, Skanör at the Sound, Belgium and Disko in Greenland, in addition to my three localities in Asia. Occurring exclusively on *Honckenya*, it can only be found on sandy beaches. The infection only takes place in the living leaves (in June) and the perithecia are not ripe until June the following year.

150. *Pleosphaerulina vitrea* (Rostrup) Berlese 1900 p. 98, Syn.: ***Pleospora vitrea*** Rostrup 1888 p. 620, ***Catharina vit.*** Sacc., ***Leptosphaerulina vit.*** Woronich.

Alchimilla alpina. Scotland (Killin 300 m), Norway (Telemarken).

Originally described from Holstenborg in Greenland 66° on *Potentilla maculata*, later on found in few and scattered places, (in addition to the above mentioned only Norway, Iceland and Caucasus), it seems to have a subarctic-alpine distribution, and always on the same two genera: *Alchimilla* and *Potentilla*.

151. *Massaria dryadis* (Rostrup) nov. comb., Syn.: *Massarina dryadis* Rostr. 1888 p. 560.

Dryas integrifolia. Hudson Bay (Churchill).

Dryas octopetala. Lapponia Norvegica (Alten).

ROSTRUP has described it from East-Greenland (Shannon Islands 75°), in the literature it is also mentioned from the north coast of Greenland 82°50', north-western Greenland 77°52', King William Land, Iceland and Norway (Dovre), further from the Altai Mountains in West Siberia (see PETRAK 1928 p. 221). PETRAK calls it a Pleospora and thinks it is related to Wettsteinia, but as the spores have no longitudinal walls it is hardly a Pleospora. PETRAK asserts that the figure drawn by Mr. OVE ROSTRUP for me (1924 p. 300) is not like; he had better have said that he had occasionally seen some spores that were not like the figure. The large number of figures which O. ROSTRUP through many years has made for me have all been drawn with the most praiseworthy accuracy.

152. *Massaria macrotheca* (Rostrup) Lind 1928 p. 31 c. fig., Syn.: *Metasphaeria mer.* Rostrup 1888 p. 561.

Carex aquatilis. Jugor Strait.

Carex microglochis. Lapponia Norvegica (Bodö).

Carex rigida. Lapponia Murmanica (Vaidaguba).

Poa pratensis. Siberia Jenisei (Selivanova).

Like the above, its spores are first colourless, 2-celled; long afterwards they become 4-celled and brown. It is known from Dovre, Spitzbergen, Greenland and Iceland, it has thus an arctic-subarctic distribution. A drawing of ROSTRUP's original specimen with unripe spores is found in Berlese: Icones Fungorum tab. CLII fig. 3.

- 153. *Massaria eucarpa*** (Karsten) Lind 1926 and 1928 c. fig.,
Syn.: ***Sphaerella eucarp.*** Karsten, Syll. I p. 512.

Polygonum bistorta. King Point.

Polyg. viviparum. Novaya Zemlya.

An arctic-alpine species, hitherto only recorded from few places viz.: Spitzbergen, West-Greenland 62° and 80°1', East-Greenland as well as from Caucasus. It is found on two genera as different as *Polygonum* and *Pedicularis* and is very nearly related to the following species.

- 154. *Massaria thalictri*** (Rostrup) Lind 1928 p. 67, Syn.:
Lizonia thal. Rostrup 1888 p. 556, ***Cryptoderis oligo-***
thea Starb. 1890 p. 9.

Thalictrum alpinum. Norway (Tofte in Gudbrandsdalen, Dovre), Lapponia Suecica (Abisko and Kvikkjokk), Lapponia Fennica (Kilpisjaur 69°), Novaya Zemlya (Mejduscharskij, Karmakola and Beluka Bay), Quebec (Banks of the Grand River) and Greenland.

In addition I have seen it on the same *Thalictrum* from Engadin, it is consequently an arctic-alpine species with a rather wide distribution in arctic and subarctic regions from Umanak in West-Greenland 70°40' down to the mountains in Scandinavia, as Åre, Dovre and Tofte. This is the first report of it from the Alps.

- 155. *Ophiobolus herpotrichus*** (Fries) Sacc., Syll. II p. 352.

Poa alpina. Abisko.

A southern species which has not been observed before north of the arctic circle.

- 156. *Ophiobolus rudis*** (Riess) Rehm.

Oxytropis campestris. Lapponia Immandrae (Mt. Dsakyn).

9. Fam. **Gnomoniaceae.**

157. **Hyospila rhytismoides** (Bab.) Niessl, Syn.: **Laestadia rhyt.** Sacc., Syll. I p. 424, **Didymella dryadis** Spegaz. (see HÖHNEL Annal. Mycol. 1918 p. 63 and PETRAK ibd. 1922 p. 131).

Dryas octopetala. Lapponia Norvegica (Mortensnæs),
Novaya Zemlya, King William Land.

Arctic-alpine species exclusively found on *Dryas* spp., very common in all arctic and subarctic regions viz.: Norway (down to Dovre), Sweden, Spitzbergen, Novaya Zemlya, Siberia (Minussinsk see THÜMEN 1880), King William's Land (King Point), common in Greenland even up to 82°54' as well as in Iceland, the Färöes and the mountains of Scotland. Wanting in Central Europe but recurring in the Bavarian Alps, Tyrol, Engadin, Krain and Italy.

158. **Gnomonia campylostyla** Awd.

Betula odorata. Common in many places near Abisko.

It is an arctic-alpine species, found towards the north in Greenland as well as in northern Scandinavia, Finland and Iceland, entirely wanting in Denmark but reappearing in Bohemia and Tyrol; not found in Italy.

159. **Gnomonia linnaeae** Awd.

Linnaea borealis. Gelivare.

A very rare species, AUERSWALD has described it from Germany and ALLESCHER mentioned it from Bavaria (Immenstadt). I have collected it in Sweden on Åreskutan but otherwise it is not mentioned in the literature.

160. **Gnomoniella comari** (Karsten) Sacc., Syll. I p. 415.

Comarum palustre. Kolgujev.

It is common in Finland (Mustiala and Åbo) also found in Denmark but never south of Denmark.

10. Fam. **Valsaceae.**

161. **Valsa salicina** Fries. Summ. Veg. p. 412, Syll. I p. 131.
Salix spp. Abisko and Kebnekaise.
162. **Valsa Schweinitzii** Nitschke.
Salix hastata. Boganida.
163. **Diaporthe salicella** (Fries) Sacc.
Salix arbuscula. Kebnekaise.
164. **Diaporthe Berkeleyi** (Desm.) Nitschke.
Anthriscus silvester. Abisko.
165. **Diaporthe linearis** (Fries) Nke.
Solidago virgaurea. Nuolja.

8. Ord. **Dothideales.**

166. **Dothidella betulina** (Fries) Sacc., Syll. II p. 628, Syn.:
Eurhychora bet. Schroeter, **Atopospora bet.** Petrak
1925 p. 101.

Betula nana. Kebnekaise, Gelivare, Kiruna.

Common all over Europe, Caucasus, Siberia and North America including Greenland. The form on *Betula nana* is sometimes called *Dothidella betulae nanae* (Wahlenb.) Sacc., it has a perennial mycelium, a single plant had all leaves attacked while a neighbour was quite intact.

167. **Dothidella frigida** Rostrup 1886, Syn.: **Phyllachora frig.** Rostrup 1891, **Euryachora frigida** (Rostr.) Theisen et Sydow Annal. Myc. 1915 p. 359.

Phaca frigida. Abisko, Lapponia Murmanica (Kildin).

Originally described from Norway (Dovre and Sakka-bani). It has never been found outside of the 4 places in Fennoscandia mentioned here, THEISEN and SYDOW's report of it from Greenland is due to a misunderstanding.

- 168. *Dothidella adusta* (Fuckel) Lind 1924 c. fig., Syn.: *Asterella chamaenerii* Rostrup 1888 p. 545.**

Epilobium latifolium. Ellesmere Land (Harbour Fjord).

It is known from Novaya Zemlya, Alaska and Greenland. But in the Alps (Sonntagsberg in Niederösterreich) and in America (Adirondack) an *Euryachora epilobii* (Fries) Höhnel, Fragmente 1181, Syn.: *Asteroma epilobii* Fries, S. M. II p. 559, *Ascospora epilobii* (Fries) Jacz. has been found, which has hitherto been rather insufficiently described, it is quite possible that they are both identical.

- 169. *Dangeardiella macrosporus* (Schroeter) Sacc. et Sydow, Syll. XIV p. 683, Syn.: *Monographus maer*. Schroeter 1897 p. 477, *Lophiostoma aspidii* Rostrup 1904 p. 12, *Lophiotrema aspidii* Jaap, Verh. Brandb. 1912 p. 22 and Annal. Mycol. 1917 p. 105.**

Aspidium spinulosum. Kebnekaise.

Asplenium alpestre. Lapponia Murmanica.

Its anatomy has been fully described by v. HÖHNEL in Fragmente zur Mycologie 1151. It is an arctic-alpine species, recorded from Norway (Alstadhaug 63°45'), Silesia (Riesengebirge), Switzerland (Chamonix), and Schwarzwald.

- 170. *Phyllachora caricis* (Fries) Sacc.**

Carex norvegica. Hudson Bay (Cape Eskimo 61°05').

Carex rostrata. Abisko.

It has formerly been recorded from several places in northernmost Scandinavia and from U. S. A.

- 171. *Phyllachora junci* (Fries) Fuckel, Syn.: *Endothorella junci* Theiss. & Sydow.**

Juncus filiformis. Abisko.

Asci and spores were well developed at Abisko, asci $60 \mu \times 3.5 \mu$, paraphys. $61 \mu \times 3 \mu$, spor. $9 \mu \times 2.5 \mu$. It is

common in Europe and North America but is rarely found with well developed spores as here. Its northernmost localities are West-Greenland and Spitzbergen.

172. *Phyllachora graminis* (Fries) Fuckel, Syll. II p. 602 and IX p. 1026.

Calamagrostis confinis. Lapponia Suecica (Karesuando), Lapponia Murmanica.

Widely distributed all over Europe and North America, even at Teneriffa.

173. *Phyllachora gangraena* (Fries) Fuckel, Syn.: *Homostegia gang.* Winter.

Arctagrostis latifolia. Lapponia Norvegica (Mortensnæs and Beljok).

JÖRSTAD (1930) has found it in the northernmost parts of Norway from Telemarken and northward; common on *Deschampsia*, *Arctagrostis* and *Poa* (*alpina*, *nemoralis* and *pratensis*), ROSTRUP also (1904) mentions it from Telemarken. In addition it is recorded from Greenland (Jacobs-havn 69°) on *Alopecurus alpinus*.

All the species of Dothideales mentioned here have perennial mycelium. Whenever a *Betula nana* is found with *Dothidella* or a *Juncus* with *Phyllachora*, all leaves on the plant are attacked, while another plant close by may be entirely free from the parasite. This fact is, of course, of great importance in these regions where the summer is short. It is well known from other genera (*Puccinia*, *Ustilago*) where also the species with perennial mycelium are predominant. As soon as the leaves of the host-plant expand or the stalks are full-grown, they are densely covered with sori. They do not ripen the same year, but the following summer, on the dead parts of the host.

9. Ord. Hysteriales.

174. *Hypoderma ledi* (Fries) Nannf.

Ledum palustre. Pitlekaj.

175. *Hypoderma degenerans* (Karsten) Nannf. 1932 p. 230,
Syn.: *Pseudophaacidium deg.* Karsten, Syll. VIII p. 778,
Myxophaacidium deg. Höhnelt, Annal. Mycol. 1917
p. 330.

Vaccinium Myrtilus. Abisko.

Recorded from arctic Scandinavia and Finland, Spitzbergen, Greenland, Iceland, not entirely absent in Central Europe (Denmark, Königstein, Algäu and Alsace) but more common in the Alps (Engadine etc.).

176. *Lophodermium juniperinum* (Fries) de Not., Syll. II
p. 794.

Juniperus communis. Abisko.

177. *Lophodermium caricinum* (Desm.) Duby, Syll. II
p. 797.

Carex aquatilis. Abisko.

Carex Goodenoughii. St. Lawrence Bay 63°30'.

Carex rigida. Abisko.

Carex vaginata. ibd.

Eriophorum vaginatum. ibd.

It is known from Lapponia Norvegica, Lapponia Suecica (Kvikkjokk), Spitzbergen, Iceland and the Färöes, but is entirely wanting in Central Europe, e. g. in Denmark and Germany; everywhere, however, it occurs very rarely.

178. *Lophodermium arundinaceum* (Fries) Chev., Syll. II
p. 795.

Agrostis borealis. Lapponia Norvegica (Tromsö).

Anthoxanthum odoratum. Kolgufjew.

Calamagrostis confinis. Lapponia Norvegica (Alten,
Tanaelv, Mortensnæs).

Calamagr. lanceolata. Nuolja, Kiruna.

Calamagr. neglecta. Abisko, Kebnekaise, Kolgujuk.

Calamagr. strigosa. Lapponia Norvegica (East-Finmark).

Deschampsia spec. Abisko.

Elymus arenarius. Coronation Gulf 67°46'.

Festuca duriuscula. Abisko.

Fest. ovina. Abisko, Novaya Zemlya, Ellesmere Land, Disko, Jan Mayen.

Poa alpigena. Abisko.

Poa alpina. Abisko, Nuolja, Jan Mayen.

Poa glauca. Abisko.

Poa nemoralis. ibd.

Puccinellia phryganoides. Disko.

Triticum caninum. Abisko.

It has a continuous distribution throughout the northern hemisphere from the extreme north of Greenland 83°6' to the summits of the Alps.

179. *Lophodermium alpinum* Rehm, Syll. II p. 795.

Puccinellia Vahliana. Ellesmere Land (Harbour Fjord).

I have found the asci to be 45—63 μ \times 16—21 μ , the spores 42—48 μ \times 2—3 μ , thus entirely different from those of *Lophodermium arundinaceum* and in very good accordance with REHM'S statements. It is an arctic-alpine species, known from Greenland 77° and quite common in Tyrol and the Swiss Alps.

180. *Lophodermium versicolor* (Fries) Schroeter, Syn.: ***Hysterium vers.*** Wahlenberg 1812 p. 522 c. icon.

Salix phyllicifolia. Abisko and Kiruna.

An arctic-alpine species common in northernmost Scandinavia down to Dovre (see VLEUGEL 1908 p. 377, NANN-

FELDT 1932 p. 238, LIND 1910 c. fig.), Alaska, King William Land, Greenland and Iceland as well as Berner Oberland.

181. *Lophodermium maculare* (Fries) de Not.

Vaccinium uliginosum. Lapponia Suecica (Nuolja 1000 m), King William Land (Bernhard Harbour), Baffin Land (Cumberland Gulf, Ellesmere Land.

Commonly distributed both in highlands and lowlands even as far north as West-Greenland 78°40'; both in Europe and in America.

182. *Lophodermium cladophilum* (Lév.) Rehm.

Vaccinium myrtillus. Kebnekaise.

Andromeda polifolia. Mt. Dundret near Gelivare.

Common in Europe and North America.

183. *Lophodermium tumidum* (Fries) Rehm.

Sorbus aucuparia. Björkliden 630 m.

Both NANNFELDT and I found it in abundance on dead leaves of *Sorbus* near Abisko. SOMMERFELD (1826 p. 228) also has found it in Nordland and SCHROETER (1885) has collected it at Trondhjem. It has been found in many places in Scandinavia as far down as Bohuslen 58°, but never in Denmark and other European lowlands. It recurs in Tyrol and Helvetia. It is consequently a typical arctic-alpine species although the host-plant has a continuous distribution.

10. Ord. Hemisphaeriales.

184. *Phacidina gracilis* (Niessl) Höhnelt, Syn.: *Myiocropon lycopodii* Rostrup, Syll. XI p. 379.

Lycopodium alpinum. Kalixfors and Kebnekaise.

Lycopod. complanatum. Mt. Dundret near Gelivare.

It has certainly never been found in Scandinavia nor in arctic regions before, on the other hand it is quite common on the same two host-plants in the Alps (known on *Lyc-*

podium alpinum in Silesia and on *Lycop. chamaecyparissus* from Krain) and it also occurs in the lowlands, e. g. in Denmark. Concerning its systematical position see THEISSEN in Annal. Mycol. 1917 p. 324 and 1918 p. 187, v. HÖHNEL in Ber. Deutsch. Bot. Ges. 1917 p. 418 and NANNFELDT 1932 p. 212.

185. *Microthyrium arcticum* Ouds. 1885 p. 160 c. fig.,
Syll. IX p. 1058.

Sieboldia procumbens. Kebnekaise.

It was originally described by OUDEMANS on *Potentilla emarginata* from Novaya Zemlya; later on SCHROETER (1888 p. 283) found it on *Potentilla* from West-Greenland. I have seen it from Spitzbergen (1928 p. 17) and NANNFELDT has found it on *Potentilla Crantzii* from Lapponia Suecica, consequently it seems to be of very common distribution in high northern regions on dead leaves of *Potentilla* and *Sieboldia* spp.

11. Ord. Phacidiales.

186. *Coccomyces coronatus* (Fries) de Not.

Betula odorata. Abisko.

A southern species never previously found so far north.

187. *Phacidium Vaccinii* Fries Syst. Myc. II p. 575.

Vaccinium vitis idaea. Abisko.

Found in company with its supposed conidial stage *Ceuthospora latitans*.

188. *Cryptomyces maximus* (Fries S. M. II p. 566) Rehm,
Syll. VIII p. 707.

Salix arbuscula. Abisko.

It is a very peculiar species (see NANNFELDT 1932 p. 206 c. fig.). Distributed over an extensive area but in spots,

it is never common. In the literature it is mentioned from most countries in Europe (England, Scotland, Iceland, Norway, Sweden, Denmark, Brandenburg, Bavaria, Bohemia, Tyrol) and from U. S. A.

189. Rhytisma salicinum Fries, Syll. VIII p. 732.

Salix myrsinites. Abisko, Lapponia Ponojensis.

Salix nigricans. Lapponia Suecica (Karesuando).

Salix polaris. Jugor Strait.

Salix recutita. Abisko.

Salix Richardsonii. Hudson Bay (Churchill).

Very commonly distributed over Europe, Asia and America, quite distinctly prefers certain species of *Salix* to others, which probably designates a beginning biological division of the species.

190. Rhytisma andromedae Fries, Syll. VIII p. 755.

Andromeda polifolia. Kebnekaise, Abisko, Lapponia Varsugae.

Common throughout Europe and in U. S. A. (Wisconsin).

191. Rhytisma empetri Fries, Syll. VIII p. 751, Syn.: **Duplicaria empetri** (Fries) Fuckel, **Sphaeria empetri** Fries, S. M. II p. 522.

It has been found quite often in northernmost Scandinavia as far south as Åre 1000 m, as well as in Spitzbergen and the Färöes; in the lowlands it is practically absent (found only once in Denmark); it reappears in Bavaria (Berchtesgaden), Tyrol and Helvetia.

192. Sphaeropezia empetri (Fries) Rehm, Syn.: **Metasphaeria empetri** Sacc., Syll. II p. 171, **Excipula emp.** Fries, Syst. Myc. II p. 190, Syll. III p. 668.

Empetrum nigrum. Lapponia Suecica (common), Waigatsch, Konyam Bay.

Like the above an arctic-alpine species of about the same

distribution; although *Empetrum nigrum* is extremely common in Denmark this *Sphaeropezia* is never found here; in Scandinavia it is found as far south as Hardanger 60°20' and Åreskutan 63° but only in the highlands. Recorded from Fennia, Spitzbergen, Alaska, King William Land and Iceland as also from Tyrol, Helvetia and Caucasus.

193. Sporomega degenerans (Fries) Cda., Syn.: **Hysterium deg.** Fries, **Clithris deg.** Rehm.

Vaccinium uliginosum. Siberia (Konyam Bay).

Formerly recorded from Iceland, Sweden, Tyrol and U. S. A., wanting in Denmark, consequently rather arctic-alpine.

12. Ord. Pezizales.

Fam. **Helotiales** (NANNFELDT 1932).

194. Belonopsis graminea (Karsten) Keissl., Syn.: **Mollisia graminea** Karst., Syll. VIII p. 352.

Carex aquatilis. Kabarowa.

Anthoxanthum odoratum. Kolgujukew.

Arctagrostis latifolia. Varanger.

Calamagrostis confinis. Kvikkjokk, Lapponia Murmanica.

Triticum caninum. Abisko.

A true arctic-alpine species, recorded from Fennia, Spitzbergen and Novaya Zemlya.

195. Mollisia atrata (Fries) Karsten, Syn.: **Pyrenopeziza atr.** Fuckel, Syll. VIII p. 354.

On dead stalks of *Trollius europaeus*. Abisko.

Ubiquitous.

196. Mollisia luzulina Karsten.

Luzula parviflora. West Greenland (Engelskmandens Havn and Kugkuak c. 70°).

197. *Belonidium lacustre* (Fries) Phill.

Scirpus caespitosus. Abisko.

Eriophorum polystachyum. Novaya Zemlya.

A circumpolar species, not, however, restricted to the arctic regions, but widely distributed also in subarctic regions and in the lowlands farther south.

198. *Trochila phacidioides* (Fries) Karsten, Syll. VIII p. 711.

Diapensia lapponica. Kebnekaise and Gelivare.

Most frequently sterile or very undeveloped.

199. *Hysteropezizella macrospora* (Karsten) Nannf. 1932 p. 119, Syn.: *Phragmonaevia maer*. Karsten.

Carex rostrata. Abisko.

Wichura first found it in Lapponia Suecica, in 1856, later on it has also been found in Finland, Graubünden and Engadin, consequently a typical arctic-alpine species.

200. *Hysteropezizella pusilla* (Lib.) Nannf. 1932 p. 120, Syn.: *Stietis Niesslii* Roumieg. (conf. REHM 1912 p. 144), *Naevia puss*. Rehm, Syll. VIII p. 662., *Trochila juncicola* Rostrup, Syll. VIII p. 732.

Juncus arcticus. Lapponia Norvegica (common), Björkliden, Lapponia Varsugae, Lapponia Murmanica, Hudson Bay (Churchill).

Junc. arcuatus. Lapponia Norvegica (Talvik), Nuolja, Lapponia Murmanica.

Junc. biglumis. Lapponia Suecica (Nicolaathi and Björkliden), Novaya Zemlya, Waigatsch, Aktinie Viken, Ellesmere Land (Fram Harbour).

Junc. filiformis. Abisko.

Junc. trifidus. Hammersfest, Kebnekaise, Abisko, Gelivare, Lapponia Murmanica.

Junc. triglumis. Hammersfest, Abisko, Lapponia Ponojensis, Lapponia Murmanica.

Luzula confusa. Abisko, Lapponia Rossica, Novaya Zemlya, Waigatsch, Actinie Viken, Ellesmere Land (Cocked Hat Island, Goosefjord, Harbour Fjord).

Luz. nivalis. Ellesmere Land (Bedford Pim Island).

Luz. spicata. Abisko.

Luz. sudetica. ibd.

Luz. Wahlenbergii. Novaya Zemlya.

It may be found on every *Juncus* and *Luzula* from all arctic and subarctic regions, the species is widely distributed, very common and very plurivorous.

But another question is the correct division of these extremely diminutive fungi (*Naevia*, *Trochila* or *Hysteropezizella*); in 1928 I called attention to this matter, and all mycologists, I am sure, agree that *Naevia pusilla* and *Trochila juncicola* are identical and limited to *Juncus* and *Luzula*. On all dead leaves of *Carex* and Gramineae, however, are found similar species, which formerly were called *Naevia diminuens* and *Naev. ignobilis* as the descriptions were very similar. But NANNFELDT'S examination of KARSTEN'S original material has now brought to light that KARSTEN'S *Trochila diminuens* is identical with REHM'S *Stegia subvelata* (nr. 204), and all the forms of *Hysteropezizella* on *Carex* spp. are surely not identical. It is, however, a very difficult question, how many different species we have on Glumiflorae; I venture to use the name *Hysteropezizella ignobilis* as a collective name for the present.

201. *Hysteropezizella Lyngei* (Lind) Nannf. 1932 p. 119, Syn.: *Naevia Lyngei* Lind 1924 p. 8 c. fig.

Arctagrostis latifolia. Lapponia Norvegica (Nordvaranger), Lapponia Murmanica (Semostrov), Admiralty Peninsula, Jugor Strait.

I have originally described it from Novaya Zemlya, and

NANNFELDT has seen it from Spitzbergen and Lapponia Ponojensis.

202. *Hysteropezizella rigidae* Nannf. 1932 p. 121.

Carex rigida. Lapponia Norvegica (Hammersfest and Syltefjord), Abisko, Lapponia Imandrae, Kolgужew, Novaya Zemlya (in several places), Taimyr, Boganida, Camden Bay and Hudson Bay (several places).

In other words, it has a totally circumpolar distribution. NANNFELDT mentions it from Lapponia Suecica and I have seen it once as far south as Jemtland.

203. *Hysteropezizella ignobilis* (Karsten) ad interim, see above no. 200.

Carex alpina. Hammersfest, Lapponia Imandrae, Lapponia Murman.

Carex aquatilis. Eastfinmark, Abisko, Lapponia Varsugae, Lapponia Rossica, Jugor Strait.

Carex atrata. Lapponia Norvegica (Sörö, Magerö), Abisko, Kildin.

Carex Brenneri. Siberia Jenisei.

Carex brunnescens. Lapponia Norvegica, Kebnekaise.

Carex Buxbaumii. Lapponia Imandrae.

Carex caespitosa. Abisko.

Carex canescens. Lapponia Norvegica (Sörö), Gelivare.

Carex capillaris. Hudson Bay (Ranken Inlet).

Carex ericetorum. Lapponia Imandrae.

Carex filiformis. Abisko.

Carex Halleri. Lapponia Suecica (Torneå Träsk).

Carex lagopina. Lapponia Norvegica, Lapponia Imandrae, Pitlekai, Greenland (Jakobshavn).

Carex limosa. Lapponia Varsugae.

Carex livida. Lapponia Murmanica.

- Carex loliacea*. Lapponia Imandrae, Lapponia Murmanica.
- Carex Magellanica*. Hammersfest.
- Carex microstachya*. Lapponia Imandrae.
- Carex Norvegica*. Lapponia Norvegica (Lyngen and Alten).
- Carex ornithopoda*. Abisko.
- Carex parallela*. ibd.
- Carex pedata*. Lapponia Norvegica, Lapponia Lulense, Lapponia Imandrae.
- Carex Personii*. Lapponia Murmanica.
- Carex pulla*. Lapponia Norvegica (Persfjord 70°30'), Hudson Bay.
- Carex rariflora*. Lapponia Suecica (Karesuando), Lapponia Murmanica, Lapponia Imandrae, Lapponia Ponojensis, Novaya Zemlya, Hudson Bay.
- Carex rostrata*. Abisko.
- Carex rotundata*. ibd.
- Carex rupestris*. Lapponia Norvegica (Sörö 70°40').
- Carex stans*. Novaya Zemlya, Alaska (Camden Bay).
- Carex ustulata*. Lapponia Ponojensis, Harbour Fjord.
- Carex vaginata*. Abisko.
- Eriophorum callithrix*. Taimyr.
- Erioph. intercedens*. Novaya Zemlya.
- Erioph. opacum*. Lapponia Suecica (Kvikkjokk).
- Elyna Bellardi*. Luleå, Ellesmere Land (Harbour Fjord).
- Deschampsia alpina*. Lapponia Murmanica.
- Deschamp. flexuosa*. Hammersfest.
- Calamagrostis confinis*. Alten.
- Calamagr. neglecta*. Abisko.
- Calamagr. strigosa*. Alten.

Festuca ovina. Novaya Zemlya, Jan Mayen.

Fest. rubra. Jan Mayen.

Hierochloë alpina. Novaya Zemlya.

Phleum alpinum. Lapponia Lulense.

Poa alpina. Jan Mayen.

Poa arctica. Novaya Zemlya.

Trisetum spicatum. Lapponia Tornense.

Vahlodea atropurpurea. Lapponia Norvegica.

In the future it may possibly be divided into several nearly related species. I have often found it on the dead ends of leaves of which the lower half was still alive.

204. *Hysteropezizella diminuens* (Karsten) Nannf. 1932 p. 114, Syn.: ***Trochila dimin.*** Karsten, ***Stegia subvelata*** Rehm var. ***Winteri***, ***Mollisia euparaphysata*** Schroeter, ***Hysteropezizella caricis*** (Peck) Sydow.

Carex aqualitis. Lapponia Norvegica, Kebnekaise,
Lapponia Murmanica, Kolgujew, Jugor Strait.

Carex atrata. Abisko.

Carex caespitosa. ibd.

Carex ericetorum. Lapponia Rossica.

Carex filiformis. Lapponia Norvegica.

Carex Halleri. Lapponia Suecica (Torneå Träsk).

Carex obtusata. Abisko.

Carex rigida. Lapponia Murmanica.

Carex rostrata. Lapponia Suecica.

Carex sparsiflora. Lapponia Imandrae.

Carex stans. Novaya Zemlya.

Carex vaginata. Abisko.

It is an arctic-alpine species, widely distributed in arctic countries and recurring in the Alps (Tyrol, Interlaken 2075 m, Albulapass, Fürstenalp, Graubünden, Ortler and St. Gotthard).

205. **Hysteropezizella melanophaea** (Rehm) Nannf. 1932 p. 122.

Carex aquatilis. Abisko.

Carex stans. Novaya Zemlya.

206. **Hysteropezizella fuscella** (Karsten) Nannf. 1932 p. 115.

Carex aquatilis. Lapponia Suecica (Torneå Träsk).

Carex caespitosa. Abisko.

Carex rigida. Lapponia Tulomensis and Lapponia Murmanica.

Widely distributed in arctic regions especially on dead leaves of *Carex*, recorded from northernmost Scandinavia and Finland, Spitzbergen, Novaya Zemlya, King William Land (Gjøa Harbour), Greenland, Iceland and the Färöes. In Denmark it has been found only once, and south of this country it seems to be quite absent.

207. **Laetinaevia erythrostigmoides** (Fries) Nannf. 1932 p. 191, Syn.: **Calloria eryth.** Rehm, **Helotiella erythrostigma** (Rehm) Sacc., Syll. VIII p. 476.

Cerastium alpinum. Tromsø, Lapponia Murmanica.

It is most frequently met with on this host, but also occasionally on *Cerast. nigrescens* or *Cerast. Regelii*. Arctic-alpine species, recorded from northernmost Scandinavia, Spitzbergen, Novaya Zemlya, Greenland and Iceland, lacking in the Central-European lowlands and recurring (see NANNFELDT 1928 p. 118) in Krain 1300 m, the French Pyrenees and Helvetia.

208. **Laetinaevia stellariae** (Rostrup) nom. nov., Syn.: **Naevia stell.** Lind 1924 p. 8 c. fig., **Trochila stell.** Rostrup 1888 p. 540, Syll. VIII p. 731.

Stellaria longipes. Franz Josef Archipelago, Novaya Zemlya, Cape Tcheljuskin, Ellesmere Land.

Stell. palustris. Lapponia Murmanica.

It is most frequently met with on *Stell. longipes* and very seldom on *Stell. palustris*. Its distribution is circumpolar, known from Spitzbergen, Novaya Zemlya and Greenland (up to 82°53').

209. *Laetinaevia Epilobii* (Karsten) Nannf. 1932 p. 191,
Syn.: *Naevia epilobii* Karsten, *Briardia hysteropezi-*
zoides Rehm.

Epilobium angustifolium. Kebnekaise.

Arctic-alpine species, known only from northernmost Scandinavia and from Tyrol (Ortler).

210. *Laetinaevia minutula* (Sacc. & Malbr.) Nannf. 1932
p. 192, Syn.: *Agyrium solidaginis* (Ces.) de Not.,
Naevia solid. Rehm 1912 p. 142.

Solidago virgaurea. Abisko.

A southern species, never found so far north as here.

211. *Laetinaevia minutissima* (Rostrup) Nannf. 1932 p. 253,
Syn.: *Orbilium minut.* (Rostrup) Sacc.

Angelica Archangelica. Kebnekaise.

Originally described on the same host from Greenland (Kobbefjord 64°11').

212. *Laetinaevia luzulina* (Karsten) Nannf. 1932 p. 192,
Syn.: *Phragmonaevia luz.* (Karsten) Rehm.

Luzula confusa. Novaya Zemlya.

Luz. parviflora. Abisko.

Luz. pilosa. ibd.

Luz. spicata. ibd.

213. *Laetinaevia arctica* (All.) Nannf. 1932 p. 191, Syn.:
Orbilium arct. Allescher.

Comarum palustre. Abisko.

Potentilla alpestris. Novaya Zemlya.

Pot. emarginata. Maud Harbour and North Zeim
Island.

Pot. verna. Lapponia Norvegica (Bodö, Alten, East Finmark).

Sibbaldia procumbens. Lapponia Murmanica, Kologujew.

NANNFELDT mentions it (1928 p. 131) from Norway, Sweden, Greenland and Iceland. In addition to the above mentioned circumpolar localities I have also seen it on *Alchimilla alpina* from Loweswater in Cumberland and on *Potentilla minor* from Vagnay in the Vosges (Herbarium Hafniense), it is consequently of arctic-alpine distribution.

214. Unguicularia diaphana (Rehm) Höhnelt, Syn.: **Naevia diaf.** Rehm.

Arnica alpina. Ellesmere Land.

215. Pyrenopeziza chamaenerii Nannf. 1928 p. 134.

Epilobium angustifolium. Abisko and Kebnekaise.

216. Pyrenopeziza Morthieri (Fuckel) Rehm.

Trollius europaeus. Abisko.

Usually it is found somewhat undeveloped, I found, however: asci cylindraceo-clavati, apice aculeati, $32-45 \mu \times 8-10 \mu$, 8-spor. sporidiis hyalinis, non septatis, monostichis, $12 \mu \times 1 \mu$.

217. Pyrenopeziza lychnidis (Sacc.) Rehm.

Melandrium apetalum. Lapponia Norvegica.

218. Pyrenopeziza potentillae (Rost.) Nannf. 1928 p. 136, Syn.: **Trochila potentillae** Rostrup 1888 p. 540.

Alchimilla alpina. Ben Lomond.

Potentilla emarginata. Novaya Zemlya, Waigatsch, Taimyr, Maud Harbour and Ellesmere Land.

Pot. pulchella. Igloolik (leg. PARRY 1822).

Pot. sericea. Siberia (Khabourowa).

Pot. verna. Novaya Zemlya.

Sibbaldia procumbens. Norway (Röros), Kebnekaise, Lapponia Murmanica.

Very common in all arctic regions on *Potentilla* and *Sibbaldia* on dead leaves and stems, recorded from northernmost Scandinavia, Spitzbergen, Novaya Zemlya, King Point and from northernmost Greenland up to 83°6'. Never seen in Iceland or the Färöes.

219. *Pyrenopeziza rhinanthi* (Fries) Sacc., Syll. VIII p. 358.
Rhinanthus minor. Abisko.

It is rather commonly distributed but not easily perceptible; known from Lapponia Norvegica (see SOMMERFELT 1826 p. 220), Sweden, Greenland, the Färöes, Denmark, Central Europe and Tyrol, thus from many different latitudes and from the highlands as well as from the lowlands. Concerning its nomenclature see REHM 1912 p. 192 and v. HÖHNEL Fragmente 67.

220. *Belonopeziza advena* (Karsten) Nannf. 1928 p. 118, Syn.: *Niptera adv.* Lind 1928 p. 12 c. fig., *Mollisia adv.* Karsten, Syll. VIII p. 352.

Eriophorum polystachyum. Kolgужew, Novaya Zemlya, Alaska.

Erioph. Scheuchzeri. Kolgужew, Novaya Zemlya, King William Land.

Erioph. vaginatum. Wajgatsch.

Formerly reported from Lapponia Suecica, Spitzbergen, Novaya Zemlya, King William Land, Greenland and Iceland. Consequently of circumpolar distribution, it has scarcely been found farther south than Åre 63° and Iceland c. 65°.

221. *Diplocarpon agrostematis* (Fuckel) Nannf. 1932 p. 173, Syn.: *Niptera lychnidis* (Fuckel) Lind.

Alsine biflora. Lapponia Suecica (Mt. Nuolja 1000 m).

Melandrium apetalum. Novaya Zemlya.

- 222. Pseudorhytisma bistortae** (Fries) Juel, Syn.: **Pseudopeziza bist.** Fuckel, Syll. VIII p. 113.

Polygonum viviparum. Abisko, Jan Mayen.

It is an arctic-alpine species, recorded from many circumpolar places, but absent from the European lowland, as also the host; recurring very often in Bohemia, Tyrol, Helvetia, the Vosges, Bavaria and Caucasus.

- 223. Naevia rubella** (Wt.) Rehm.

Trollius europaeus. Lapponia Suecica (Kalixfors and Kebnekaise).

- 224. Beloniosecypha melanospora** Rehm.

Carex misandra. Ellesmere Land 76°30'.

A very rare species, characterized by its dark coloured spores.

Fam. Hyaloscyphae.

- 225. Lachnum Rehmii** (Staritz) Rehm.

Juncus arcticus. Björkliden.

Junc. trifidus. Lapponia Norvegica (Sakkabani), Lapponia Suecica (Mt. Dundret).

- 226. Lachnum callimorphum** Karsten, Mycol. Fennic. p. 173, Syn.: **Dasyscypha callim.** Sacc., Syll. VIII p. 451.

Carex sparsiflora. Lapponia Murmanica.

Hitherto reported from Sweden, Finland, Silesia and Austria.

- 227. Lachnum albotestaceum** (Desm.) Karsten.

Calamagrostis neglecta. Lapponia Murmanica, Kolgujukew.

Hitherto only known from southern regions.

- 228. Lachnum aeutipilum** Karsten.

Hierochloë pauciflora. Novaya Zemlya (Olenje).

NANNFELT has found it throughout Sweden (1928 p. 122).

229. Lachnum nidulus (Fries) Karsten.

Trollius europaeus. Kebnekaise.

Epilobium angustifolium. ibd.

A commonly distributed species, inter alia from Caucasus.

Fam. **Helotiaceae.**

230. Godronia andromedae Henning.

Andromeda polifolia. Lapponia Suecica (Mt. Dundret).

231. Helotium scutula (Fries) Karsten.

Carex stans. Novaya Zemlya. 70°31'.

232. Cenangium arcticum Fries.

Cassiope tetragona. King William Land (King Point).

233. Scleroderris ledi (Fries) Nannf. 1932 p. 286.

Ledum palustre. Lapponia Suecica (Mt. Dundret).

234. Allophyllaria pusiola (Karsten) Nannf. 1932 p. 290,

Syn.: *Godronia pus*. Karsten, Syll. VIII p. 604.

Carex rupestris. Lapponia Imandrae.

Alopecurus nigricans. Lapponia Murmanica.

Phleum alpinum. Kolgujukew.

Poa arctica. Nuolja, Waigatsch, Novaya Zemlya (in many places), Ellesmere Land (Goose Fjord), Jan Mayen.

Poa glauca. Nuolja 900 m, Hudson Bay (Ranken Inlet), New Foundland (Mt. Steepmore 180 m).

Poa nemoralis. Abisko.

Festuca ovina. Jan Mayen.

Festuca rubra. ibd.

Deschampsia alpina. Nuolja.

Desch. caespitosa. Novaya Zemlya 71°24'.

It is found principally on *Poa* (*arctica* and *glauca*), always on dead leaves of this year, often in great quantity on the

same leaf. It is known from many circumpolar regions, Spitzbergen, Novaya Zemlya etc., and it is quite possible (see NANNFELDT 1928 p. 122) that it has been found in the Alps and described under other names.

235. *Sclerotinia Vahliana* Rostrup 1891 p. 607.

Eriophorum polystachyum. Lapponia Immandrae (Kantalax).

Formerly recorded from Ellesmere Land, Greenland (from Egedesminde 68°42' to Umanak 63°) as well as from several places in Iceland.

236. *Heterosphaeria patella* Fries.

Thalictrum alpinum. Novaya Zemlya.

Angelica archangelica. Kebnekaise.

237. *Phialea cyathoidea* (Fries) Gill.

Trollius europaeus. Abisko, Kebnekaise and Kalixfors.

Wahlbergella apetala. Abisko.

Melandrium rubrum. ibd.

Angelica archangelica. Abisko, Nuolja, Kebnekaise.

Phaca frigida. Björkliden, Abisko.

Gnaphalium norvegicum. Lapponia Murmanica.

Saussurea alpina. Abisko.

Achillea millefolium Gelivare.

Solidago virgaurea. Abisko.

A southern species, equally common in Central-Europe and in the North.

Discomycetes operculatae.

238. *Macropodium corium* (Web.) Sacc.

On the ground near Abisko, common.

Never seen in Denmark.

239. Lachnea stereorea (Fries) Gill.

On manure of reindeer. Abisko.

240. Perrotia flammea (Fries) Boud., Syn.: **Lachnella flam.**
Fries.

On decorticated branches of *Betula* and *Salix*. Abisko
and Kebnekaise.

Never seen in Denmark.

241. Lasiobolus papillatus (Fries) Sacc., Syn.: **Las. equinus**
(Müller) Karst.

On manure of reindeer. Kebnekaise.

4. Kl. **Basidiomycetes.** 2. Ord. **Uredinales.**

242. Uromyces alchimillae (Pers.) Lév.

Alchimilla vulgaris (coll.). Kebnekaise, Disko.

Only st. III occurs in the two places mentioned, it is the form which SYDOW calls *Uromyces melosporus* (Therry) and ED. FISCHER calls *Uromyces alchimillae alpinae*. The mycelium is perennial in the rhizom. If the lowland-forms, which chiefly produce st. II, are united with the arctic-alpine forms, which only produces st. III, this species is very common in all European countries, as well as in Asia Minor, Iceland and Greenland (Disko 70°) in all places, where the host is found.

243. Uromyces lapponicus Lagerh., Syn.: **Urom. carneus**
(Nees) Hariot.

Astragalus alpinus. Kebnekaise, st. I only.

St. I is perennial. It is a typical arctic-alpine species, known from the Fichtel-Mountains and the Seiser-Alps in Tyrol 1900—2100 m (see SYDOW and P. MAGNUS 1905 and 1926) and from Helvetia (FISCHER 1904). In Norway it is recorded from Alten in the north down to Dovre 61°, in Sweden from Lapmarken down to Jemtland, in Fennia

it has only been found in Ostrobotnia borealis and in Kuusano (both 66°). In North-America it is collected in the Rocky Mountains of Colorado and northward up to the mouth of Mackenzie River 69° (see ARTHUR 1928 p. 42).

244. Uromyces solidaginis (Sommerf.) Niessl.

Solidago virgaurea. Abisko.

A micro-uromyces of typical arctic-alpine distribution. Lacking in Denmark and Britain etc., it may be found throughout Norway from Tromsö down to Oslo and Frederikshald 59°, and in Sweden even as far south as Mt. Tabor 57°50'. In Fennia it is especially common towards the east. In the Alps it has been recorded from the highest summits of Riesengebirge and from Tyrol, Moravia, Helvetia (Berneroberland and Engadin), France, and from Italy likewise only on the highest mountains. It is further common towards the east in Russia, Caucasus, Asia (Himalaya and Simla) for which reason LIRO (1908 p. 42) thinks it is of Asiatic origin. In North America it is collected in the Rocky Mountains (Colorado, Montana and Washington).

245. Puccinia borealis Juel, Syn.: **Aecidium thalietri** Karsten.

Thalictrum alpinum. St. I. Kebnekaise.

Anthoxanthum odoratum. St. II. Nuolja.

An arctic-alpine species of a rather limited distribution, known only from the Färöes, northernmost Norway, Sweden down to Herjedalen 62°, rare in Finland and recurring in the Tyrolese Alps 2450 m (see MAIRE 1907).

246. Puccinia thulensis Lagerh., Syn.: **Aecidium trollii** Blytt, Pucc. **Dietrichiana** Tranzsch., Annal. Mycol. 1907 p. 418.

Trollius europaeus. St. I. Abisko (quite common).

It is only known from the northernmost regions of Scandinavia and a single place in Russia at the river Onega; never found in Finland.

JØRSTAD (1932) unites no. 245 and no. 246 with many other species into a single one: *Puccinia elymi* West. with aecidia on a long series of ranunculaceous hosts.

247. *Puccinia triseti* Eriks.

Trisetum spicatum. Norway (Alten and Randsværk),
Kolgujew, Siberia Jenisei.

Widely distributed hemipuccinia.

248. *Puccinia anthoxanthi* Fuckel.

Anthoxanthum odoratum. Kolgujew.

A southern species. Both species 247 and 248 and several others are united into a single species by JØRSTAD: *Puccinia poae-sudeticae* (West); he grants each of the older species a certain independence, however, as he writes (1932 p. 327): *Pucc. poae sudeticae* as understood by me is a polymorphous species, consisting of a number of forms showing slight morphologic differences", and further: "No doubt it embraces many physiologic races."

249. *Puccinia* spec.

Cirsium heterophyllum. St. I. Abisko, quite common.

The aecidia which I have found on *Cirsium heterophyllum* both at Abisko and also previously at Åre, while many other mycologists have collected it in Sweden and Finland, cannot in my opinion always belong to *Puccinia dioecae*, partly because *Carex dioeca* is not always found in the neighbourhood, partly because *Cirsium heterophyllum* is never attacked by aecidia in Denmark, where *Pucc. dioecae* is quite common. I think that we have here a *Puccinia*, the host-changes of which have not yet been sufficiently examined.

250. Puccinia oxyriae Fuckel.*Oxyria digyna*. Abisko.

Arctic-alpine species of a rather scattered distribution. In Norway from Alten 70° to Hardanger 60°, in Sweden recorded from very few places (Kvikkjokk), from Spitzbergen only from a single place and never found in Finland or Siberia. In northernmost America it has been found in King William Land 68°37' and in the Rocky Mountains from Central Colorado and Utah to Brit. Columbia and Alberta, finally once in Iceland and once in the Färöes. In Britain it is mentioned from Skye and Braemar, it is never found in Central Europe and only in very few places in Helvetia and Tyrol.

251. Puccinia septentrionalis Juell.*Thalictrum alpinum*. St. I. Abisko.*Polygonum viviparum*. St. II and III. Common in Lapponia Suecica.

In all arctic and alpine regions *Uredo* and *Teleuto* occur on the leaves of *Polygonum viviparum* belonging to *Aecidia* on different host-plants. But they are practically able to propagate without *Aecidia*. The special form belonging to the *aecidia* on *Thalictrum* has been recorded from northernmost Scandinavia down to Åre and Trondhjem 63°30', as also from Finland, Greenland and Iceland. In the Alps it has been found in Tyrol, Helvetia and the Sudetes.

252. Puccinia polygoni vivipari Karsten.*Polygonum viviparum*, everywhere in arctic-alpine regions.**253. Puccinia Trollii** Karsten.*Trollius europaeus*. Lapponia Suecica (Kalixfors and Kaalasluspa).

It is a micropuccinia with a marked arctic-alpine distribution, although the host is commonly found also in the lowlands. In Norway it occurs in the northernmost regions only (Tromsö, Svendborg, Nordkap, from $71^{\circ}10'$ to $69^{\circ}20'$), in Sweden it is found in Herjedalen (JOHANSON 1886). In northernmost Finland (Kola) as well as in northernmost Russia it is quite common. In the Alps it is recorded from Berner-Oberland, Engadin Cellerina and Rigi.

254. *Puccinia rhytismoides* Johanson.

Thalictrum alpinum. Lapponia Suecica (Abisko, Nikolahti and Kebnekaise), Lapponia Kemensis.

Micropuccinia of a very limited distribution, it is here the first time it has been recorded from Finland, hitherto it has been known only from the northernmost parts of Scandinavia between 70° and 62° .

255. *Puccinia cochleariae* Liro.

Cochlearia officinalis. Jan Mayen.

Micropuccinia of a marked arctic-alpine distribution, only known from very few and extremely scattered localities, although the host-plant is common enough. Hitherto recorded only from Spitzbergen and West-Greenland in the north and from the Pyrenees in the south. If it is identical with *Puccinia eutremae* Liro, as JØRSTAD (1932 p. 347) thinks, its geographical distribution becomes more circumpolar.

256. *Puccinia Leveillei* Mont., Syn.: *Pucc. Leveilleana* de

Toni, Syll. VII p. 696, *Pucc. geranii-silvatici* Karsten.

Geranium silvaticum. Abisko and Kiruna.

Micropuccinia of arctic-alpine distribution. In Norway it is common from Tromsö $69^{\circ}40'$ to Oslo 60° , in Sweden from Abisko $68^{\circ}30'$ to Jemtland 63° , in Fennia it is especially

common towards the east. Wanting in Central Europe, it recurs in the Austrian and Swiss Alps (2100 m). Further reported from Himalaya (Simla 2159 m), the Andes (Chile) and Rocky Mountains (Southern Colorado and Utah to Montana and Eastern Washington) as well as from Alaska.

257. *Puccinia gigantea* Karsten, Syn.: *Pucc. annulata* Ell. and Ev., *Pucc. pileata* Mayor.

Epilobium angustifolium. Abisko (on several places abundantly).

The infected plants were never flowering. It is a micro-puccinia of arctic-alpine distribution though the host has a quite continuous distribution. In Norway it is recorded from Bosekop 70° down to Dovre Hardanger and Tinn 60°, in Sweden from Kvikkjokk down to Herjedalen 62°, common in Finland. In the Swiss Alps it is only found in a few places, viz.: Zermatt 2100 m and Dorcken Platten 1740 m, in North America in the Rocky Mountains from Western Montana to Southern Alberta.

258. *Puccinia epilobii* de Cand.

Epilobium lactiflorum. Greenland (Disko).

Epilob. Hornemanni. ibd.

Micro-puccinia, the mycelium is perennial in the subterranean parts of the host. Its distribution is typically arctic-alpine. On the Disko island where M. PORSILD has collected it for me, it is extremely common and has been found there before by NIC. HARTZ. In Iceland and the Färöes it is rather common, GROVE characterizes it from Britain as "rare" without further specification. From Norway it has been recorded from Hammersfest 70°45' (see FÜCKEL 1874) down to Dovre and Lomseggen lat. 51°50' alt. 2000 m, in Sweden it has been found in Lappmarken on *Epilobium*

Hornemanni (see LINDFORS 1913), in Finland it is common on *Epilobium davuricum*, *Hornemanni* and *palustre*. It is not entirely wanting in Denmark (once in Jutland and once in Sealand), but in Helvetia, Hungary and in the Pyrenees it is quite common again. In North America it is found in the circumpolar regions from the mouth of St. Lawrence to Greenland as also in the Rocky Mountains (Wyoming) and in Quebec.

259. *Puccinia scandica* Johanson.

Epilobium anagallidifolium. Kebnekaise.

Micropuccinia, very nearly related the preceding, hitherto found only in northernmost Norway from Tromsö and Javroaive 70° down to Dovre 60°, in Sweden down to Åreskutan 63°, further in northernmost Finland and in the Rocky Mountains from British Columbia to Utah.

260. *Puccinia albulensis* Magnus.

Veronica alpina. Lapponia Suecica (Mt. Nuolja 900 m).

Leptopuccinia with perennial mycelium. Of typical arctic-alpine distribution. In Norway it is recorded from Hammersfest and Tromsö 70° down to Tin and Dovre 60° and Hardanger, in Sweden down to the mountains of Herjedalen and Jemtland, lat. 62° alt. 800 m, in Britain only in the mountains of Scotland. It is entirely wanting throughout Central Europe but reappears in Helvetia and Tyrol (Albula 2313 m, Eggischhorn 2800 m, Stockhorn 1900 m); common in the mountains of Western North America southwards to Colorado and Utah as well as in Greenland (Godhavn, Frederikshaab, Kangarsuk, Sauerut and Ivigtut from 61° to 70° and from Jameson's Land in East Greenland alt. 400 m) and Iceland.

261. Puccinia taraxaci Plowr.

Taraxacum croceum. Lapponia Suecica (Kebnekaise and many other places).

Extremely common, in southern regions as well as in Greenland up to Kingigtok 70°8'.

262. Puccinia hieracii Mart.

Hieracium spec. plur. Lapponia Suecica, common. Ubiquitous like the preceding and the following.

263. Puccinia cirsii Lasch.

Cirsium heterophyllum. Abisko.

264. Gymnosporangium juniperinum Fries.

Sorbus aucuparia. St. I. Abisko and Gelivare.

Common throughout Europe and North America.

265. Gymnoconia interstitialis (Schlecht) Lagerh., Syn.: **Puccinia Peekiana** Howe.

Rubus arcticus. Nikolahti.

Arctic-alpine species of fairly wide distribution, recorded from northernmost Scandinavia, Finland and Ösel (Arensburg) as well as from Bavaria (Munich), Tyrol (Bozen 1250 m) and Helvetia; further from all northernmost Asia (its type locality is Kamtschatka), Alaska, Canada and U.S.A. It has perennial mycelium.

266. Phragmidium perforans (Dietr.) Liro, Syn.: **Phragm. rubi saxatilis** Liro.

Rubus saxatilis. Gelivare.

Commonly distributed throughout Europe.

267. Pucciniastrum vacciniorum (Link) Lagerheim.

Vaccinium myrtillus. Abisko (very scarce and only st. II).

Commonly distributed throughout Europe and in North America as far south as Florida.

268. Puccinastrum sparsum (Wt.) Ed. Fischer.

Arctostaphylos alpina. Mt. Dundret near Gelivare,
st. II only.

Noticed from all Norway, and in Sweden from Torneå to Stockholm as well as from Gotland. In Finland it is only found in the northernmost regions and in Denmark likewise only in few places. It recurs in Helvetia (type locality St. Gallen 2000 m), and is common in North America from the Atlantic to the Pacific Coast and southwards in the Rocky Mountains (California and Southern Mexico).

269. Melampsora betulina (Pers.) Desm.

Betula nana. Common in Lapponia Suecica.

Betula odorata. ibd.

It is a curious fact that this species, so extremely common in all northern parts of Europe, Asia and America, is quite absent in Spitzbergen, Greenland and Iceland, though *Betula odorata* is so common in these places. In Iceland, however, it is mentioned from a special locality only viz.: "on seedlings in a nursery garden" (see P. LARSEN 1932 p. 511).

270. Melampsora salicina Lev.

Salix arbuscula, *Sal. lanata* et spec. plur. Lapponia Suecica, common.

Several different physiological races of this species no doubt exist in the arctic countries, I have often seen a certain bush very strongly attacked and its nearest neighbours very sparingly attacked or quite free.

271. Melampsora arctica Rostrup, Syll. VII p. 594 and Syll. IX p. 296, Syn.: **Mel. reticulatae** Blytt, **Mel. alpina** Juel, Syll. XI p. 183 and Syll. XIV p. 289.

Salix reticulata. Abisko, Kebnekaise, Bernhard Harbour.

An arctic-alpine species, especially common in all circumpolar regions, I have found it as far down as Gothenburg 57°50' as well as in Scotland at 1000 m. Absent in the European lowland but found again in Helvetia and Montenegro. In North America it occurs in the northernmost regions (Ellesmere Land, Labrador) and in the Rocky Mountains (Colorado and Wisconsin).

272. *Chrysomyxa empetri* (Pers.) Schroeter.

Empetrum nigrum. Kebnekaise and Lapponia Murmanica.

ED. FISCHER (1904 p. XXXVI) classes it with the arctic-alpine species, I am, however, of opinion that it is too commonly distributed in Denmark and North Germany to be anything but continuous. It may be found far towards the north both in Europe and in America and high up in the mountains viz.: the Vosges (Type Locality), Zermatt 2000 m, Ober-Engadin etc. In U.S.A. it is found as far south as New York.

273. *Chrysomyxa pirolae* (De Cand.) Rostrup.

Pirola spp. Abisko and Kalixfors. St. II only.

It has the same wide and continuous distribution as no. 272, recorded from Alaska, Greenland and found both in lowlands and in the highlands down to France (Jura) and Helvetia. In America down to Pennsylvania, Ohio and Nevada.

Since the Uredinales have been examined more thoroughly and are better known than the other micromycetes both with regard to their distribution and their biology, it is of greater interest to study the present species especially to see how each species is able to overcome the difficult conditions of life that exist north of the arctic circle. The

short growing-period as well as the very scattered and scanty vegetation in the arctic field makes it difficult for the parasites to find their way from one host-plant to the other.

We see that comparatively many of them have a perennial mycelium in the host, and are thereby able to grow out with it as soon as its growth begins. To this category belong:

<i>Uromyces alchimillae</i>	<i>Phragmidium perforans</i>
<i>Uromyces lapponicus</i> (st. I)	<i>Melampsora betulina</i>
<i>Puccinia epilobii</i>	<i>Melampsora salicina</i> (partim)
<i>Puccinia scandica</i>	<i>Melampsora arctica</i> (st. I and
<i>Puccinia albulensis</i>	st. II)
<i>Gymnosporangium juniperinum</i>	<i>Chrysomyxa empetri</i> (st. I)
<i>Gymnoconia interstitialis</i>	<i>Chrysomyxa pirolae</i> (st. II).

Many species which under more favourable conditions are pleomorphous, reduce the number of spore-forms to 1 or 2 in arctic regions. This may be accomplished in many different ways. It is most complete in the microforms which never have more than a single generation every year. They undoubtedly originate from trimorphic forms which are plainly divided into two different species, a eu-puccinia in the warmer regions and a micropuccinia in the arctic and alpine regions. We have a typical example in *Puccinia epilobii* the spores of which are very similar to the spores of *Puccinia epilobii tetragoni*; both are found on the same host-plants, but the trimorphic form is common in Central Europe and has its northern limit in Scandinavia at 64°, whereas *Pucc. epilobii* is found almost exclusively north of that latitude. And in the mountains the same difference is seen viz.: the trimorphic species only in the valley and the parallel-species with a single form of spores only in high places.

In the present case the division is so old that we consider the two forms as independent. In other cases the division has not been so complete. I think, for instance, there is no sufficient reason to give the arctic form of *Uromyces alchimillae* any special name, there surely exists a series of transition-forms that connect *Uromyces alchimillae* with *Uromyces alchimillae-alpinae*.

Many species of arctic Uredineae reduce in arctic regions the number of their spore-forms by not developing aecidia and teleuto and carry on exclusively through uredo. This is a little surprising as the teleuto-stage is generally considered better qualified to withstand the cold. And yet we observe that no less than 12 species of the 33 species mentioned here preferably develop uredo (often combined with perennial mycelium in the host), they are:

<i>Puccinia borealis</i>	<i>Pucciniastrum sparsum</i>
<i>Puccinia triseti</i>	<i>Melampsora betulina</i>
<i>Puccinia anthoxanthi</i>	<i>Melampsora salicina</i>
<i>Puccinia polygoni-vivipari</i>	<i>Melampsora arctica</i>
<i>Gymnoconia interstitialis</i>	<i>Chrysomyxa empetri</i>
<i>Pucciniastrum vacciniorum</i>	<i>Chrysomyxa pirolae</i>

The same 12 species may also be found in warmer climates as isolated uredo-forms, consequently it is not even the arctic conditions that have impressed themselves on the uredineae, but rather conversely, that these species with a single spore-form are best suited for propagation in the short polar summer.

Of the 33 arctic Uredineae 9 are genuine micro-forms viz.:

<i>Uromyces solidaginis</i>	<i>Puccinia gigantea</i>
<i>Puccinia trollii</i>	<i>Puccinia epilobii</i>

Puccinia rhytismoides

Puccinia scandica

Puccinia cochleariae

Puccinia albulensis

Puccinia Leveillei

With the exception of a single spec., *Pucc. scandica*, all of them have arctic-alpine distribution, their habits are well suited for these barren, stony, desolate regions. Most of them have perennial mycelium, in order that they may produce millions of spores year after year from a single attacked host-plant. And the species without perennial mycelium winter on the dead stalks of perennial plants, in order that the sori seated on the dead parts of the stalk may infect the fresh shoots of the same plant next year. Or the broken stalks and leaves covered with sori are carried away by the drifting snow together with seeds and fruits of the same plant, then kept in a sheltered place, and in the following spring the seeds will shoot forth and are then infected by the simultaneously germinating spores.

Of special interest are *Puccinia polygoni-vivipari*, *Puccinia septentrionalis* and all the nearly related species so extremely common in all arctic and alpine regions in st. II and st. III on living leaves of *Polygonum*. The aecidial stage is very rare or quite absent in the Arctic, and the explanation of the luxuriance of the species is surely that by VLEUGEL (1911 p. 342), that the bulbs in the axils of *Polygonum* in nearly every case are infected by the *Puccinia* before they leave the mother-plant; when they have wintered and are about to sprout, the parasite is just at hand and may infect the first leaves.

The result of this investigation is that, of all the Uredinae here mentioned, we have only a single species which absolutely requires two different host-plants, it is *Gymno-*

sporangium juniperinum. It is quite impossible to find this species in places where *Sorbus aucuparia* and *Juniperus* are not growing together.

3. Ord. Ustilaginales.

274. *Ustilago calamagrostidis* (Fuckel) Clinton, Syn.: *Tilletia calam.* Fuck.

Calamagrostis neglecta. Lapponia Suecica (Kebnekaise and Nuolja 800 m).

Perennial in the host, attacks all leaves on the same plant and prevents its flowering. In the literature it is recorded from Sweden, Finland, Central Europe (Denmark, Brandenburg, Bohemia), Caucasus and U. S. A. (New York, Vermont, Wisconsin, Wyoming and Indiana).

275. *Ustilago striiformis* (West.) Niessl.

Festuca spec. Abisko.

Also a southern species, which has rarely been found so far north before.

276. *Ustilago inflorescentiae* Maire, Syll. XVII p. 473 and Syll. XXI p. 498, Syn.: *Ustilago ustilaginea* (de Cand.) Liro.

Polygonum viviparum. Abisko, Kebnekaise, Jan Mayen.

Common in Fenno-Scandia as far south as in Scania, recorded from all arctic regions, e. g. Spitzbergen, Unalaska, Ellesmere Land, Greenland, Iceland and the Färöes. In the Alps (Riesengebirge, Albulapass, Sct. Moritz, Tyrol 2400 m, and Kärnten 1543 m) again very common, and further in the Rocky Mountains (Colorado).

277. *Ustilago vinosa* (Berk.) Tul.

Oxyria digyna. Abisko and Kebnekaise.

Arctic-alpine species, common in all circumpolar regions e. g. Norway, Sweden, Fennia, Spitzbergen, Novaya Zemlya, Alaska, Greenland, Iceland, the Färöes and Scotland. Recurs in the Alps (Albula 2313 m, Cresta Mora 1734 m) and in the Rocky Mountains (Washington, Wyoming and California).

The mycelium is perennial in the host (see LIRO 1924 p. 257).

278. Ustilago Kühneana Wolff.

Rumex acetosa. Gelivare.

A southern species, which has hardly been found so far north before, it is recorded from Norway (59°—61°), Sweden (Herjedalen), Denmark, Hannover, Graubünden and from Asia (Smyrne 700 m).

279. Ustilago violacea (Pers.) Gray.

Stellaria graminea. Lapponia Suecica (Kaalasluspa).

Very common on many different host-plants. Ubiquitous.

280. Schizonella melanogramma (de Cand.) Schroeter.

Carex rigida. Norway (Hammersfest), Abisko.

Carex vaginata. Abisko.

It is recorded on living leaves of many different species of *Carex*, but by no means equally common on all of them. It seems to be about to split in several physiological races. *Carex rigida* and *digitata* are found attacked more frequently than many other spec. of *Carex*. BECK has once (1880 p. 11) found it on *Carex Michellii* and none of the surrounding Carices was attacked. With regard to its geographical distribution it is rather arctic-alpine, that is to say, it may be found in many arctic regions, e. g. Scandinavia, Spitzbergen, Herschell Island, and it may be found in the high mountains also, e. g. Riesengebirge, Tyrol 2450 m, Mähren, Krain, Jura, Istria and Caucasus, just as it is found

in America in the Rocky Mountains (Wisconsin and Indiana very common) even in South America. But it is not entirely absent in the lowlands, in Norway it is collected as far south as Oslo 60°, in Sweden it is found in Gotland 57°, it has never been observed in Denmark but immediately south of Denmark on the Island Romø in the North Sea and on the Island Oesel in the Baltic 58° as well as in Brandenburg. *Sch. melanogramma*, in other words, stands halfway between the arctic-alpine spec. and the ubiquitous species.

281. Cintractia caricis (Pers.) Magnus, Syll. VII p. 464.

Carex atrofusca. Abisko.

Carex aquatilis. ibd.

Carex brunnescens. ibd.

Carex caespitosa. Common in Lapponia Suecica.

Carex capitata. Abisko.

Carex dioeca. ibd.

Carex ornithopoda. ibd.

Carex parallela. ibd.

Carex rigida. ibd.

Carex rupestris. Greenland (Disko).

Carex salina. Lapponia Varsugae.

Carex stans. Lapponia Imandrae 66°44'.

Carex vaginata. Abisko and Kebnekaise.

Although this species is unusually ubiquitous and attacks nearly all species of *Carex* it is not at all equally common on all Carices, it is very rarely found on *Carex ornithopoda*, *Car. dioeca* and *Car. leporina*, and it is never found on the Carices that stand in deep water. (*Carex filiformis*, *Car. vesicaria* etc.).

282. Cintractia scirpi (Kühn) Schellenberg.

Scirpus caespitosus. Abisko.

It is as yet undecided whether this is an independent species or only *Cintr. caricis* on a host-plant, which it only occasionally attacks. It is recorded from Greenland, Iceland and Norway.

283. *Tilletia arctica* Rostrup, Syll. VII p. 486, Syn.: ***Cintractia arc.*** Lagerh.

Carex brunnescens. Kebnekaise.

A very rare species, first described by ROSTRUP (1886 p. 235) from Lapponia Norvegica, later on it has been found a few times in Scandinavia (e. g. Herjedalen see FALCK 1912 p. 5) and once in Iceland.

284. *Entyloma* spec. nov?

Trisetum spicatum. Norway (Ramsfjord 69°35') and Kolgужew.

Resembles *Entyloma ambiens* as I know it on *Dupontia Fisheri* from Spitzbergen, but the genus *Entyloma* and all the nearest division of Ustilagineae requires a more detailed study. JOHANSON would (1884) unite *Entyloma ambiens* with *Ent. crastophilum* Sacc., which I cannot approve any more than I can follow Clinton in uniting *Entyloma ambiens* with *Schizonella melanogramma* (1906 p. 36).

285. *Entyloma ranunculi* (Bon.) Schroeter, Syll. VII p. 488.

Ranunculus acer. Abisko.

An ubiquitous species, recorded from Tromsö 69°40' and as far north as Novaya Zemlya. Common in all Europe, North America (Wisconsin) and Asia.

286. *Entyloma chrysosplenii* (Berk. and Br.) Schroeter, Syll. VII p. 491.

Chrysosplenium alternifolium. Novaya Zemlya.

A southern species which may only occasionally be found so far north.

- 287. Urocystis agropyri** (Preuss) Schroeter, Syll. VII p. 516.
Triticum repens. Lapponia Norvegica (Narvik).

The mycelium is perennial in the host-plant. It is recorded from all Europe, Novaya Zemlya, Caucasus and North America.

Fungi imperfecti.

- 288. Phyllosticta trollii** Trail, Syll. X p. 125.
Trollius europaeus. Abisko.
- 289. Phyllosticta gentianellae** Massal., Syll. XI p. 481.
Gentiana amarella. New Foundland.
- 290. Phoma graminis** West., Syll. III p. 167.
Poa arctica. Preobraschenie Island.
- 291. Phoma arundinacea** (Lev.) Sacc., Syll. III p. 164.
Calamagrostis neglecta. Nuolja.
- 292. Phoma herbarum** West., Syll. III p. 133.
Orchis spec. Björkliden.
Trollius europaeus. Nuolja.
Thalictrum alpinum. New Foundland.
Ranunculus pygmaeus. Greenland (Godhavn).
Arabis alpina. Disko.
Cardamine bellidifolia. Waigatsch.
Parrya nudicaulis. Novaya Zemlya.
Viscaria alpina. Lapponia Norvegica (Kåfjord).
Cerastium alpinum. Novaya Zemlya.
Polemonium humile. Lapponia Tulomensis (Kildin Island).
Polem. coeruleum. Lapponia Norvegica (Østfinmarken).
Phaca frigida. Abisko, Lapponia Tulomensis, Novaya Zemlya.
Astragalus alpinus. Abisko, Boganida.

Vicia cracca. Abisko.

Rhodiola rosea. Kebnekaise.

Anthriscus silvestris. Nuolja.

- 293. *Phoma urticae*** Schultz et Sacc., Syll. III p. 140.

Urtica dioeca. Björkliden.

- 294. *Phoma alchimillae*** Vestergr. 1897, Syll. XIV p. 873,
Syn.: *Phyllosticta alch.* (Vgr.) Allescher, ***Phoma alchimillae*** Rostrup 1903 p. 318.

Alchimilla alpestris. Scania.

Alch. alpina. Dovre, Scotland (Mt. Evermargent).

VESTERGREN first described it from Upsala. Later on E. ROSTRUP has seen it from Iceland but he has evidently not known VESTERGREN'S description as he has used quite the same name. As none of its localities are situated north of the arctic circle, strictly, it should not be mentioned here.

- 295. *Phoma spuria*** Vestergr., Syll. XIV p. 874.

Potentilla spec. Abisko.

Potent. multifida. Tomsk (Spaskoje).

Potent. nivea. Lapponia Lulensis (Njunnats), Lapponia Imandrae.

- 296. *Phoma nebulosa*** (Fries) Berk., Syll. III p. 135.

Stellaria longipes. Hudson Bay (Churchill).

- 297. *Phoma alpina*** Speg., Syll. III p. 136.

Saxifraga caespitosa. Waigatsch.

Originally described from the mountains of North Italy. Certainly arctic-alpine.

- 298. *Phoma anthrisei*** Brun., Syll. XI p. 490.

Anthriscus silvestris. Björkliden.

- 299. *Phoma complanata*** (Fries) Desm., Syll. III p. 126.

Arabis alpina. Kebnekaise.

Angelica archangelica. Abisko and Kebnekaise.

Castilleja pallida. King William Land (Bernhard Harbour).

Rhinanthus minor. Abisko and Kiruna.

Euphrasia minima. Abisko.

Euphrasia latifolia. ibd.

Pedicularis lapponica. Kolgufjew.

300. Phoma sceptri Karsten.

Pedicularis sceptrum Carolinum. Nuolja, Lapponia Murmanica.

Pedicularis hirsuta. Abisko.

An arctic-subarctic species, known from Lapponia Rossica, Iceland etc.

301. Phoma bartsiae Rostrup 1888 p. 568 and p. 583.

Bartsia alpina. Tromsö, Kebnekaise, Abisko, Lapponia Murmanica, Hudson Bay (Churchill).

A rich growth of *Phoma* is found on every stalk of *Bartsia alpina* as soon as it is dead. Microscopical investigation shows that the spores and the perithecia are by no means always equally large, the length of the spores is from $5\ \mu$ to $7\ \mu$, the breadth from $1\ \mu$ to $3\ \mu$. I am inclined to consider all the perithecia of *Phoma* found on *Bartsia* as a single species with varying size of spores, but ROSTRUP and others have formerly given them different names: *Phoma sceptri*, *Ph. irregularis*, *Ph. herbarum* or *Ph. complanata*. Our knowledge of these small, uniform fungi does not permit us to decide with certainty, which of these many names is the correct one.

302. Phoma pirolae Rostrup 1886 p. 234 and 1888 p. 569.

Pirola rotundifolia. Lapponia Norvegica (Sörö).

Pirola secunda. Lapponia Norvegica (Mortensnæs).

It is not identical with *Spaeria pirolae* Ehrenb. (*Phyllo-*

sticta pirolae (Ehrb.) Ell. and Ev.) nor with *Leptothyrium pirolae* Karsten.

Formerly recorded from Novaya Zemlya.

303. *Plenodomus svalbardensis* Lind 1928 p. 35.

Draba alpina. Abisko.

Originally described from Spitzbergen.

304. *Vermicularia herbarum* West., Syll. III p. 226.

Dianthus superbis. Lapponia Norvegica (Østfinmarken), Lapponia Murmanica (Subovi).

305. *Vermicularia dematium* Fries, Syll. III p. 226.

Thalictrum alpinum. Sweden (Jemtland), Canada (Anticosti).

306. *Asteroma alpinum* Sacc., Syll. III p. 206.

Arctostaphylos alpina. Abisko.

An arctic-alpine species, known from Lapponia Norvegica (Bosekop) and from North Italy, always sterile.

307. *Dothiorella latitans* (Fries) Sacc., Syll. III p. 241.

Vaccinium vitis idaea. Abisko, Lapponia Murmanica (Voroninsk), King William Land (Herschell Island), Baffin Land (Cumberland Gulf) and Hudson Bay (Ducket Bove).

308. *Placosphaeria onobrychidis* (de Cand.) Sacc., Syll. III p. 245.

Hedysarum Mackensii. Hudson Bay (Churchill).

309. *Fusicocum coronatum* Karsten.

Betula odorata. Lapponia Murmanica.

Hitherto recorded from Mustiala only.

310. *Cytospora salicis* (Corda) Rabenh., Syll. III p. 261.

Salix spp. Abisko.

Salix phylicifolia. Lapponia Murmanica.

Salix riphoclada. Alaska (Icy Reef).

- 311. Ascochyta caricis** Fautr. and Lamb., Syll. XIV p. 947.
Carex brunnescens. Lapponia Norvegica (Hammersfest).
Carex Lachenalii. Abisko.
- 312. Ascochyta graminicola** Sacc., Syll. III p. 407.
Poa glauca. Ellesmere Land (Fram Fjord).
Poa laxa. Lapponia Norvegica (Saltdalen).
Poa pratensis. Siberia Jenisei (Selivanova).
Pleuropogon Sabinei. Ellesmere Land (Fram Fjord).
- 313. Diplodina arundinacea** Sacc., Syll. III p. 413.
Calamagrostis confinis. Lapponia Suecica (Karesuando).
- 314. Diplodina arctica** Lind 1910 p. 14 c. fig., Syll. XXII p. 1046.
Poa arctica. Waigatsch, Novaya Zemlya, King William Land (Bernhard Harbour).
Festuca ovina. Hudson Bay (Cape Eskimo).
Triticum caninum. Abisko.
- A very constant and characteristic species, reported from all circumpolar regions (Spitzbergen, Novaya Zemlya, King William Land, the north coast of Greenland 82°28').
- 315. Diplodina graminea** Sacc., Syll. III p. 413.
Poa arctica. King William Land.
- 316. Diplodina teretiusecula** (Sacc. et Roum.) Died., Syn.: **Ascochyta teret.** Sacc. et Roum., Syll. III p. 405.
Luzula parviflora. Abisko.
- 317. Diplodina Rostrupii** Vgr. 1909, Syn.: **Ascochyta Rostr.** Vgr. 1906.
Andromeda hypnoides. Kebnekaise and Abisko.
- VESTERGREN originally described it from just the same region.

- 318. *Diplodina papaveris*** (Ouds.) Lind 1928 p. 36.
Papaver radicum. Novaya Zemlya and Khabourova.
Taraxacum arcticum. Novaya Zemlya.

- 319. *Diplodina euphrasiae*** (Oud.) Allescher.
Pedicularis sudetica. King William Land (Bernhard Harbour).

Formerly recorded from Spitzbergen only.

- 320. *Diplodina pedicularidis*** (Fuckel) Lind 1924 p. 21 c. fig.
Pedicularis sudetica. Novaya Zemlya.

Concerning its nomenclature see LIND 1924 and 1928 p. 36. Its mycelium penetrates the living host-plant. Formerly recorded from Novaya Zemlya, Taimyr (Tranzschel in a private letter), West Greenland 72° and East Greenland (Hold with Hope).

- 321. *Diplodina Lyngei*** Lind 1924 p. 21 c. fig.
Potentilla biflora. Alaska (Port Clarence).

Originally described from Novaya Zemlya.

- 322. *Darluca filum*** (Bivon.) Cast., Syll. III, p. 410.
Puccinia triseti on *Trisetum spicatum*. Kolgujew.
Puccinia poarum on *Poa glauca*. Quebec.

- 323. *Actinonema pirolae*** Allescher, Syll. X, p. 309.
Pirola grandiflora. Ellesmere Land (Cape Rutherford).

- 324. *Septoria caricis*** Passer., Syll. III, p. 566.
Carex subspathacea. At the White Sea.

- 325. *Septoria luzulae*** Schroeter, Syll. X, p. 384.
Luzula confusa. Abisko, Novaya Zemlya.
Luzula arcuata. Lapponia Norvegica.

- 326. *Septoria punctoidea*** Karsten, Syll. III p. 566.
Luzula confusa. Novaya Zemlya and Franz Josef Land.
Eriophorum opacum. Lapponia Tulomensis.

A specific high-arctic species, described by KARSTEN from Spitzbergen.

327. Septoria eriophori Ouds. 1885 p. 155 c. fig.

Eriophorum russeolum. Lapponia Norvegica (Bosekop).

Erioph. Scheuchzeri. Kolgujew and Novaya Zemlya.

Erioph. vaginatum. Alaska (Camden Bay 70°).

A high-arctic species, recorded from Spitzbergen, Novaya Zemlya and Greenland.

328. Septoria spec.

Elymus mollis. Hudson Bay (Ranken Inlet).

The spores are 50—75 μ long and 1—2 μ broad, therefore it is not identical with *Septoria elymi* Ell. & Ev. Journ. Mycol. VII p. 132, Syll. XI p. 547 on *Elymus canadensis* from Canada (Sp. 15—25 $\mu \times 1.5$ —2 μ), nor with *Septoria elymi* ROSTRUP 1899, Syll. XVI p. 974 with considerably broader spores (viz.: 38—70 $\mu \times 5$ —6 μ).

329. Septoria graminum Desm., Syll. III p. 565.

Trisetum spicatum. U.S.A. (Washington, Mt. Ramier 1900 m) and from Tyrol (Seisseralps).

Hierochloa alpina. New Hampshire (Mt. Washington).

Poa alpina. Abisko.

330. Septoria arctica Berk. and Co., Syll. III p. 560.

Dupontia Fisheri. Novaya Zemlya 71°24'.

Seems to be very rare. Originally described from "insula Orukampchatne maris pacifici".

331. Septoria orchidearum West., Syll. III p. 575.

Tofieldia palustris. Alaska (Port Clarence).

Three species at least are found, which according to the descriptions are absolutely identical with this species, all with remarkably wide open ostiolum and very weak

walls in the perithecium rather like a *Stagonospora*. They are *Septoria gymnadeniae* Thümen, *Septoria epipactidis* Sacc. and *Septoria listerae* Allescher. All of them have long and strongly curved spores.

- 332. *Septoria blenoroides*** (Karsten) Berlese, Syll. X p. 359 and XV p. 153.

Salix myrsinites. Lapponia Norvegica (Finmarken and Hammersfest), Lapponia Ponojensis (Orlow), Waigatsch.

Salix phylicifolia. Nuolja.

An arctic species, originally described from Mustiala.

- 333. *Septoria polygonina*** Thümen, Syll. III, p. 554.

Polygonum bistorta. Taimyr.

Thümen has described it from Siberia.

- 334. *Septoria trollii*** Sacc. and Wt., Syll. III p. 522, Syn.: ***Phleospora trollii*** (Sacc.) Jaap.

Trollius europaeus. Kalixfors and Abisko.

Formerly recorded from Bavaria, Switzerland and Tyrol.

- 335. *Septoria violae*** West., Syll. III, p. 518.

Viola labradorica. Labrador (Turnavik).

- 336. *Septoria lychnidis*** Desm., Syll. III, p. 517.

Melandrium diurnum. Lapponia Murmanica.

- 337. *Septoria stellariae*** Rob. et Desm., Syll. III p. 518.

Stellaria humifusa. Lapponia Murmanica, Novaya Zemlya.

Stellaria longipes. Waigatsch, Jugor Strait, Actinie Viken, Hudson Bay (Churchill).

- 338. *Septoria polemonii*** Thümen, Syll. III p. 536.

Polemonium coeruleum. Lapponia Norvegica (Østfinmarken).

- 339. Septoria empetri** Rostrup 1888 p. 574, Syn.: **Rhabstromina emp.** Diedicke Annal. Mycol. 1921 p. 296, **Coleophoma emp.** Petrak, Annal. Mycol. 1929 p. 331.

Empetrum nigrum. Nuolja 1000 m.

Originally described from Greenland (Kekertak 70°), later on found near Cuxhaven. Its ascigerous stage is *Phomatospora Crepiniana* (Sacc.) Theiss., Verh. zool. bot. Wien 1916 p. 389.

- 340. Septoria linnaeae** (Ehrb.) Sacc., Syll. X p. 358, Syn.: **Sept. borealis** Rostrup, Syll. XI p. 544.

Linnaea borealis. Lapponia Suecica (Mt. Dundret).

- 341. Septoria microsora** Speg., Syll. III p. 541.

Gentiana nivalis. Norway (Valders).

Arctic-alpine species. ROSTRUP has found the same in Dovre and SPEGAZZINI has collected it in the Alps.

- 342. Septoria armeriae** Allescher.

Armeria elongata. Lapponia Varsugae.

ALLESCHER has described it (1897 p. 52) from Greenland (Umanak 71°).

- 343. Septoria inconspicua** Berk. et C., Syll. III p. 554.

Plantago maritima. Lapponia Norvegica (Alten).

- 344. Septoria virgaureae** Desm., Syll. III p. 546.

Solidago virgaurea. Abisko, Konyam Bay.

- 345. Rhabdospora drabae** (Fuckel) Berlese, Syn.: **Selenophoma drabae** Petrak 1929 p. 393, **Septoria nebulosa** Rostrup, Syll. X, p. 385, **Septoria semilunaris** Johans., Syl. X, p. 363. See LIND 1926 pp. 168 and 176, and 1927 p. 27.

Eriophorum polystachyum. Ellesmere Land (Bedford Pim Island).

Carex dioeca. Torneå Träsk.

Carex Hepburnii. Ellesmere Land (Cape Rutherford 78°49').

Carex nardina. Greenland (Kuganguak).

Carex pulla. Lapponia Norvegica (Østfinmarken).

Carex ustulata. Lapponia Ponojensis (Orlow 67°12').

Poa alpina. Abisko.

Poa alpina × *arctica*. Novaya Zemlya.

Poa glauca. Hudson Bay (Churchill, Ranken Inlet), Fram Fjord.

Poa pratensis. Franz Josef Land (Mabel Island), Ellesmere Land (Goose Fjord).

Deschampsia caespitosa. Abisko.

Phleum alpinum. ibd.

Saxifraga brondialis. Dickson Havn.

Potentilla pulchella. Disko.

Arnica sibirica. Disko (Mudderbugt).

Arctic-alpina species.

346. *Rhabdospora pleosporoides* Sacc., Syll. III p. 588.

Anemone parviflora. King William Land (King Point).

Rumex arifolius. Abisko.

Oxyria digyna. Kebnekaise.

Viscaria alpina. ibd.

Saxifraga nivalis. Waigatsch.

Saxifr. oppositifolia. Hudson Strait (Cape Chudlup).

Viola canina. Lapponia Murmanica.

Viola epipsila. Siberia Arctica (Konyam Bay).

Gentiana tenella. Nuolja.

Armeria elongata. Ellesmere Land (Fram Fjord).

Rhinanthus minor. Abisko.

On *Viscaria alpina* from Kebnekaise it is found on dead leaves, on all the other hosts mentioned it is found on the dead stalks only. The spores are always numerous, filiform,

densely clustered, 1—1.5 μ thick and of varying length, from 48 μ to 75 μ . It has a continuous distribution, it is common in the circumpolar regions as well as in Central Europe, I have seen it recently on *Polygonum viviparum* from Tyrol (Mt. Brenner 1000 m).

347. Rhabdospora disseminata Sacc. et Paol., Syll. X, p. 392.

Thalictrum alpinum. Norway (Gudbrandsdalen).

Originally described from Siberia.

348. Rhabdospora sceptri Karsten.

Pedicularis sceptrum Carolinum. Lapponia Norvegica (Alten).

349. Rhabdospora cirsii Karsten, Syll. III p. 592.

Cirsium heterophyllum. Abisko.

350. Rhabdospora nubecula Sacc., Syll. III p. 592.

Solidago virgaurea. Lapponia Suecica (Abisko, Geli-vare, Nikolahti).

A very remarkable species with cupulated perithecia, shining like black lac, the spores are crescent-shaped, 12—18 $\mu \times 2 \mu$. SACCARDO has seen it from France and, just as here, in company with *Mycosphaerella nebulosa*.

351. Eriospora leucostoma Berk. et Br., Syll. III p. 600.

Trisetum spicatum. Novaya Zemlya.

352. Stagonospora caricis (Oud.) Sacc., Syll. III p. 452.

Carex spec. Abisko.

Carex brunnescens. Kebnekaise.

Carex stans. Hudson Bay (Ranken Inlet 62°45').

353. Stagonospora stricta Ell. et Ev., Syll. XI p. 535.

Carex aquatilis. Lapponia Murmanica.

Carex norvegica. Hudson Bay (Cape Eskimo 61°05').

Originally described from Kansas on *Carex stricta*.

- 354. Stagonospora gigaspora** (Niessl) Sacc., Syll. III p. 453,
Syn.: *Stag. macrosperma* Sacc. et Roum., Syll. III
p. 453.

Carex membranopacta. Ellesmere Land (Harbour
Fjord).

Carex pulla. Hudson Bay (Churchill 58°50').

- 355. Topospora proboscoidea** Fries, Syll. III p. 456 and
Syll. XI p. 536.

Salix lapponum. Lapponia Murmanica (Voroninsk).

Common in arctic and temperate regions, it is, no doubt,
genetically correlated with *Scleroderris fuliginosa* (Fries) Kar-
sten, see v. HÖHNEL Fragmente 960, NANNFELDT 1932 p. 285,
LIND 1913 p. 139 (inter alia). Northwards it is found in
Greenland (Gaaseland 70°), and EL. FRIES has found it in
Sweden.

- 356. Coniothyrium lycopodii** Sacc. et P.

Lycopodium selago. Abisko.

- 357. Coniothyrium fuligineum** (Karsten) Sacc., Syll. X p. 266

Salix ovalifolium. Alaska (Martin Pt.).

- 358. Coniothyrium Warmingii** nov. spec.

Peritheciis sparsis, lenticularibus, nigris, c. 100 μ diam.
Sporulis oblongis, fuscis 12 μ \times 3 μ . In caulibus siccis
Plantaginis maritimis, Lapponia Norvegica (Alten), leg.:
E. WARMING, July 6, 1885.

- 359. Chaetomella atra** Fuckel, Syll. III p. 321.

Poa alpina. Abisko.

- 360. Diplodia borealis** spec. nov.

Peritheciis membranaceis, innatis, denique apice papilli-
formi centro pertuso expositis, transverse 150—200 μ latis;
sporulis ellipticis, utrinque late rotundatis, medio septatis,
constrictis, 18—26 μ \times 6—8 μ , olivaceis. In caulibus siccis
Calamagrostidis purpurascendis, King William Land (Bern-

hard Harbour), leg. FRITZ JOHANSEN, August 14, 1915, etiam in *Poa arctica*, Piteravik, leg. NYGAARD, November 11, 1921.

361. *Diplodia Bessimyanii* Lind 1924 p. 22.

Deschampsia caespitosa. Siberia (Taimyr 75°15').

362. *Hendersonia juncicola* Sacc., Syll. III p. 438.

Juncus castaneus. Disko.

363. *Hendersonia gigantea* Lind 1910 p. 161 c. fig.

Carex pulla. Novaya Zemlya on several places.

Originally described on the same host from North-East Greenland 77°.

364. *Hendersonia heterospora* Passer, Syll. X p. 327.

Calamagrostis spec. Kiruna.

365. *Hendersonia arundinacea* (Desm.) Sacc., Syll. III p. 436.

Carex aquatilis. Abisko.

Carex brunnescens. Kebnekaise.

Juncus biglumis. Franz Josef Land.

Luzula sudetica. Abisko.

Arctagrostis latifolia. Lapponia Murmanica.

Puccinellia angustata. Novaya Zemlya, Ellesmere Land (Harbour Fjord 76°30').

Catabrosa algida. Ellesmere Land (Cape Sabine).

Deschampsia caespitosa. Abisko, Nikolahti, Novaya Zemlya, Actinie Viken, Cape Tscheljuskin.

Festuca ovina. King William Land.

Poa alpina. Nuolja.

Poa arctica. Lapponia Ponojensis.

Poa glauca. Ellesmere Land (Goose Fjord).

Poa pratensis. ibd.

Dupontia Fisheri. King William Land (Bernhard Harbour).

Trisetum spicatum. Lapponia Lulensis, Rocky Mt.
2500 m.

Common in all arctic regions as far up as the north coast
of Greenland 83°6'.

366. Hendersonia crastophila Sacc., Syll. III p. 438.

Juncus arcticus. Lapponia Varsugae.

Calamagrostis purpurascens. Disko.

Calamagr. Langsdorffi. Kolgujuk, New Foundland
(Rocky Hills).

Calamagr. strigosa. Lapponia Norvegica (Alten).

Deschampsia caespitosa. Abisko, Dickson Hamn.

Poa alpigena. Abisko.

Poa alpina. Nuolja 900 m.

Poa glauca. ibd.

Festuca ovina. Abisko.

367. Hendersonia Røstrupii Lind 1926 p. 177.

Carex membranopacta. Hudson Bay (Fullerton
63°57').

Calamagrostis Langsdorffi. Siberia Jenisei (Tolstoinos
70°).

Hierochloë alpina. Novaya Zemlya.

Poa alpina. Abisko.

Poa glauca. Norway (Hallingdal 60°40' 1200 m),
Siberia Jenisei, Ellesmere Land (Harbour Fjord).

Trisetum spicatum. Siberia Jenisei.

368. Hendersonia vagans Fuckel, Syll. III p. 427. LIND 1913
p. 447.

Salix spec. Kebnekaise.

Salix glauca. Lapponia Norvegica (Finmarken).

Salix lanata. Lapponia Ponojensis.

- 369. Hendersonia arabis** Rostrup 1888 p. 571, Syll. X p. 325.
Alsine biflora. Nuolja 1000 m.
Alsine stricta. Abisko.
 Recorded from Spitzbergen and West Greenland.
- 370. Hendersonia ambigua** Brun., Syll. X p. 319.
Alchimilla alpina. Lapponia Murmanica.
- 371. Camarosporium salicinum** Sacc., Syll. III p. 465.
Salix glauca. Lapponia Murmanica.
Salix phylicifolia. ibd.
- 372. Camarosporium bygdoeense** P. Henn.
Spiraea betulaeifolia. Pitlekai.
- 373. Leptothyrium subtectum** Sacc., Syll. III p. 636.
Luzula arcuata. Nuolja 900 m.
- 374. Leptothyrium tataricum** Brun., Syll. X p. 416.
Polygonum polymorphum. Siberia arctica (Sct. Lawrence Bay).
- 375. Leptothyrium arcticum** (Fuckel) Lind 1924 p. 23 c. fig.
Potentilla maculata. Novaya Zemlya.
Potent. emarginata. Novaya Zemlya, Waigatsch, Taimyr, Preobraschenie Island and Canada (North Zeim Island).
Sibbaldia procumbens. Canada (Mt. Arrowsmith).
 It is described from Novaya Zemlya and further reported from Spitzbergen, Greenland 77°47', and Iceland.
- 376. Leptothyrium macrothecium** Fuckel, Syll. III p. 633.
Sibbaldia procumbens. Svecia (Mullfjäll 60°30').
Alchimilla alpina. Lapponia Lulense and Åre.
- 377. Leptothyrium vulgare** (Fries) Sacc., Syll. III p. 633.
Cornus suecica. Lapponia Norvegica (Hammersfest and Sörö), Abisko.

Pinguicula villosa. Lapponia Norvegica (Alten).
Solidago virgaurea. Abisko.

378. *Leptostroma Henningsii* Allescher, Syll. XI p. 556.

Eriophorum vaginatum. Abisko.

P. HENNINGS thinks it is genetically correlated with
Lophium eriophori.

379. *Leptostroma caricinum* Fries, S. M. II p. 598, Syll. III
p. 645.

Carex Lachenalii. Kebnekaise.

Carex rigida. Lapponia Norvegica (Sörö).

Eriophorum vaginatum. Abisko.

Found in company with *Lophodermium caricinum* Desm.

380. *Leptostroma luzulae* Lib., Syll. III p. 644 and Syll. X
p. 421.

Luzula confusa. Abisko, Lapponia Murmanica.

Luzula parviflora. Lapponia Norvegica (Varanger).

381. *Leptostroma virgultorum* Sacc., Syll. III p. 639.

Rubus arcticus. Lapponia Norvegica (Alten Elv).

Rubus saxatilis. Abisko and Nuolja.

382. *Leptostroma virgaureae* Briand et Har., Syll. X p. 420.

Solidago virgaurea. Abisko and Gelivare.

383. *Leptostromella juncina* (Fries) Sacc., Syll. III p. 660.

Juncus trifidus. Gelivare.

384. *Excipula diapensiae* Rostrup 1894.

Diapensia lapponica. Labrador (Torngat Region).

Originally described from East Greenland (Danmarks Ø
70°30').

385. *Thyriostroma spiraeae* (Fries) Died., Annal. Mycol. XL
p. 176.

Spiraea ulmaria. Abisko.

386. *Heteropatella umbilicata* (Fries) Jaap, Syn.: *Rhabdospora cercosperma* (Rostrup) Sacc., Syll. X p. 391.

Polygonum viviparum. Jan Mayen.

Ranunculus pygmaeus. ibd.

Ranunc. acer. Novaya Zemlya.

Ranunc. glacialis. Norway (Hallingskarvet 60°45', 1600 m).

Ranunc. borealis. Kolgужew.

Ranunc. sulfureus. Novaya Zemlya.

Thalictrum alpinum. Lapponia Norvegica (Hammersfest).

Papaver radicum. Lapponia Imandrae, Disko.

Silene acaulis. Kebnekaise.

Alsine biflora. Kebnekaise and Jemtland.

Saxifraga comosa. Waigatsch, Jan Mayen.

Astragalus alpinus. Siberia Jenisei (Tolstoinos).

Astragalus frigidus. Lapponia Tulomensis (Kildin).

Polemonium coeruleum. ibd.

Eutrema Edwardsii. Lapponia Ponojensis (Orlow).

Pachypleurum alpinum. Novaya Zemlya, Siberia Arctica (Sokolje Ludni Island).

Cineraria frigida. Siberia Arctica (Cape Jakan).

Solidago virgaurea. Abisko, Gelivare.

Antennaria alpina. Kebnekaise, King William Land (Bernhard Harbour).

Antennaria carpatica. Lapponia Norvegica (Maalselven).

Achillea millefolium. Gelivare.

Erigeron borealis. Kebnekaise.

Since VESTERGRÉN (1900) published a monograph of this species, our knowledge of it has been much enlarged with regard to its distribution as well as its life history. It

is considered as the imperfect stage of a *Heterosphaeria*, possibly *Heterosphaeria alpestris*, but it is found almost exclusively as *Heteropatella*. It is quite possible that it makes its appearance on living leaves as a parasitical *Cercospora*, with spores quite identical with those of the *Heteropatella*-stage but placed on elongated threads and without any perithecium (see BUDDIN and WAKEFIELD 1926 and 1929). It is extremely common in all circumpolar regions down to Dovre and Jemtland 62°, then found quite exceptionally in the lowlands, but is rather common again in the Alps. I have seen it also on *Sibbaldia procumbens* from Afghanistan (Kurrum Valley 1600 m). It has been described afresh quite often, thus I can not see that *Kellermannia sisyrinchii* Ell. et Ev., Syn.: *Brencklea sisyr.* Petrak, Annal. Mycol. 1923 p. 326 deviates sufficiently from the present species.

387. *Gloeosporium lapponum* Lind 1908 c. fig., Syn.: ***Calogloeum lapp.*** Petrak et Sydow, Annal. Mycol. 1924 p. 401.

Salix glauca. Abisko.

Salix lapponum. Abisko and Gelivare.

388. *Gloeosporium alpinum* Sacc., Syll. III p. 708, Syn.: ***Gloeosporium exobasidioides*** Juel 1912 p. 370 c. fig., ***Exobasidium*** spec. Sacc. 1896 p. 26, ***Entyloma aretostaphyli*** Lagerheim 1894.

Arctostaphylos alpina. Abisko.

Hypophyllous on living leaves and on young twigs of *Arctostaphylos*; in many places near Abisko I found a very considerable portion attacked, as has also been found here in the same place by JUEL, NANNFELDT and doubtless by all previous investigators. It is, however, very difficult to decide, to which genus this parasite is to be referred. From the many

different synonyms mentioned above it is evident that it has been described quite often and under greatly differing names. JUEL's statement is particularly characteristic (1912 p. 370) viz.: "Zur Gattung *Gloeosporium* kann vielleicht dieser Pilz nicht gestellt werden, er dürfte aber irgendwo in die Nahe gehören". SACCARDO has (1896 p. 26) described it from Siberia and I take the liberty of quoting his description here: "*Exobasidium* sp.? Hab. in foliis adhuc vivis *Arctostophyli alpinae*, Ananino. Sunt pustulae amphigenae subrotundae epidermide velatae, flavicantes, ubi cellulae hinc inde deformatae intus gerunt conidia laxe stipata, varia, oblonga v. allantoidea subinde spurie 1-septata, 10—12 μ \times 3—4 μ , hyalina. Mihi fungus omnino incerta sedis. leg.: ALEX. KITMANOFF ab urbe Jeniseisk." It is the same species which P. MAGNUS has called *Exobasidium vaccinii* (see 1905 and 1926 p. 279) and placed under this false name in VESTERGREN: *Micromycetes rariores* Nr. 352.

It is allowable to suppose that all the said descriptions refer to the same species, so it is known from the following places: Lapponia Norvegica (Tromsø), Lapponia Suecica (common), Fennia, Siberia Jenisei and Iceland besides once in South Sweden (see JAC. ERIKSSON: *Fungi parasit. scandinav. exsicc.* 184b) and once in Denmark, again common in Tyrol.

389. *Marssonina delastrei* (de Lacr.) Magnus, Syll. III p. 770.

Melandrium rubrum. Abisko.

390. *Marssonina violae* (Passer.) Magnus, Syll. III p. 770.

Viola biflora. Abisko and Kalixfors.

391. *Septomyxa andromedae* Henn.

Andromeda polifolia. Gelivare.

- 392. *Cryptosporium androsaces*** Rostrup, Syll. X p. 506.
Androsace Vegae. Siberia (Cape Jakan 69°22').
Hitherto only known from Norway (Dovre).
- 393. *Ovularia haplospora*** (Speg.) Magnus, Syn.: ***Ovularia pusilla*** Sacc., Syll. IV p. 140.
Alchimilla vulgaris. Lapponia Norvegica (Narvik), Kiruna.
- 394. *Ovularia decipiens*** Sacc., Syll. IV p. 139.
Ranunculus acer. Lapponia Suecica (Nikolahti).
- 395. *Botrytis cinerea*** Fries, Syll. IV p. 129.
On dead stems of many herbs, often in company with
Sclerotium durum. Abisko, Nuolja and Kebnekaise.
- 396. *Didymaria didyma*** (Unger) Schroeter, Syn.: ***Didym. Ungerii*** Corda, Syll. IV p. 184.
Ranunculus acer. Lapponia Suecica (Nikolahti).
- 397. *Bostrychonema alpestre*** Ces., Syll. IV p. 185.
Polygonum viviparum. Abisko and Björkliden.
- 398. *Mastigosporium album*** Riess, Syll. IV p. 220.
Calamagrostis phragmitoides. Nuolja.
FRANK (Krankheiten der Pflanzen) has observed that the spores of this species sometimes have an appendix and sometimes lack the same, he is of opinion that the former case is peculiar to the lowland and the latter to the mountains. Here on Nuolja the spores have no appendage and it is further worth noticing that JØRSTAD (1930 p. 67) has not found these appendages in Norway, in either case FRANK'S observation is confirmed.
- 399. *Ramularia calthae*** Liro, Syll. XVIII p. 546.
Caltha palustris. Kalixfors and Kiruna.
- 400. *Ramularia aequivoeca*** (Cec.) Sacc., Syll. IV p. 201.
Ranunculus auricomus. Lapponia Suecica (Nikolahti), Kolgужew.

- 401. *Ramularia trolli*** (Jacz.) Iwanoff, Syll. XVIII p. 547.

Trollius europaeus. Abisko and Kalixfors.

Its distribution is arctic-alpine like several others of the micromycetes found on *Trollius*; recorded from Fennia and Smolensk and again from Tyrol. In Denmark and neighbouring countries it has only been found once although *Trollius* is common enough here.

- 402. *Ramularia gei*** (Fuckel) Ldau., Syll. XIV p. 1053 and XVIII p. 547.

Geum rivale. Abisko.

- 403. *Ramularia geranii*** (West.) Fuckel, Syll. IV p. 204, Syn.: **Ram. geranii silvatici** Vgr., Syll. XVI p. 1041.

Geranium silvaticum. Kiruna.

Commonly distributed all over Europe and Siberia.

- 404. *Ramularia punctiformis*** (Schlecht.) Höhnel, Syn.: ***Cercospora montana*** Sacc., Syll. IV p. 453.

Epilobium angustifolium. Kebnekaise and Abisko.

- 405. *Ramularia archangelicae*** Liro, Syll. XVIII p. 551.

Angelica archangelica. Abisko.

- 406. *Ramularia valerianae*** (Speg.) Sacc., Syll. IV p. 207.

Valeriana officinalis. Abisko.

- 407. *Torula herbarum*** Fries, Syll. IV p. 256.

Melandrium rubrum. Nuolja.

- 408. *Hormiscium antiquum*** (Corda) Sacc., Syll. IV p. 264.

Salix spec. Kebnekaise.

- 409. *Hormiscium stilbosporum*** (Corda) Sacc., Syll. IV p. 264.

Salix spec. Kebnekaise.

- 410. *Periconia pycnospora*** Fresen., Syll. IV p. 271.

Carex aquatilis. Abisko.

- 411. *Goniosporium puccinioides*** (de Cand.) Link, Syll. IV p. 280.

Carex spec. Abisko.

Carex pedata. Lapponia Norvegica (Vestfinnmarken).

Carex stans. Lapponia Murmanica (Litso), Novaya Zemlya.

Common in all circumpolar regions, but also southwards in the lowlands as well as in Helvetia and Italy.

- 412. *Arthrimum caricicola*** Fries, Syll. IV p. 279.

Carex ericetorum. Lapponia Rossica.

Carex vaginata. Abisko.

I have found that the spores measure $45-46\mu \times 11-15\mu$, thus they are considerably broader than reported by LINDAU (1907 p. 639).

- 413. *Arthrimum naviculare*** Rostrup, Syll. X p. 579.

Carex ericetorum. Lapponia Imandrae.

Carex pedata. Lapponia Norvegica (Vestfinnmarken), Lapponia Lulense, Ellesmere Land (Harbour Fjord).

Carex sparsiflora. Lapponia Murmanica.

Hitherto only reported from Lapponia Norvegica and from interglacial deposits in Denmark (see LIND 1913 p. 517 c. fig.).

- 414. *Scolicotrichum graminis*** Fuckel, Syll. IV p. 348.

Phleum alpinum. Abisko.

- 415. *Cladosporium graminum*** Corda, Syll. IV p. 365.

Carex aquatilis. Abisko.

Milium effusum. ibd.

Elymus mollis. Siberia (Irkajpii).

- 416. *Cladosporium herbarum*** Fries, Syll. IV p. 350.

Urtica dioeca. Abisko.

Pedicularis hirsutus. Greenland (Disko).

- Euphrasia latifolia*. Abisko.
Pachypleurum alpinum. Novaya Zemlya.
- 417. Cladosporium aecidiicola** Thümen, Syll. IV p. 368.
Aecidium carneum on *Astragalus*. Abisko.
Aecidium trollii on *Trollius*. ibd.
- 418. Cladosporium fuliginum** Bon., Syll. IV p. 368, Syn.:
Clad. exobasidii Jaap.
Exobasidium on *Andromeda polifolia*. Abisko.
- 419. Heterosporium echinulatum** (Berk.) Cooke, Syll. IV
p. 481.
Viscaria alpina. Lapponia Norvegica (Alten).
- 420. Cyliandrocolla alba** Sacc. et Roum., Syll. IV p. 674.
Deschampsia caespitosa. Abisko.
- The present fungus might just as well be called *Myro-
pyxis graminicola* Ces. there is certainly no difference.
- 421. Isariopsis alborosella** (Desm.) Sacc., Syll. IV p. 630.
Cerastium arcticum. Kebnekaise.
- 422. Radulum aterrimum** Fries S. M. I p. 416, Syll. VI p. 497,
Syn.: **Eutypa hydnoidea** (Fries) Höhnelt 1909 p. 1464.
Betula odorata. Abisko.

In this black, peculiar mycelium, which would often very extensively cover the branches of *Betula*, v. HÖHNEL has found an *Eutypa*, which I cannot detect in the present material. I have studied this attack on *Betula* in Denmark as well as in Lapponia and I have never found it on the branches of *Betula* growing under appropriate conditions; the attack is in a marked degree dependent on the ecologic conditions of the local soil.

Discussion.

These researches into the geographical distribution of some arctic micromycetes, which E. ROSTRUP began in 1888

with his wellknown researches on Greenland micromycetes have now been completed, as I have examined the available material of herbarium plants from all arctic regions and filled in the gaps in the earlier, scattered investigations.

I have examined all the species mentioned here myself, and in each case noted on which host species I have found them and all the places from which I have seen them.

While discussing the individual species, I have, with reference to the literature, compared my own observations with earlier ones and through them I think I am able to draw the following conclusions of more general interest.

It is a striking fact that we have not any genus of fungi especially indigenous to the northern polar regions. All the species in question belong to genera which are at the same time represented in subarctic and even more southern regions. The same is the case with the phanerogams. This warrants the conclusion that the arctic flora has not developed in the arctic habitats but is an intense mixture of species of highly different age and different origin. Most of them wandered long distances before they met one another under suitable conditions. Whenever the climate changed in the past geological periods, the flora moved and mingled in a new way. The particulars concerning the exact geographical distribution of all the species studied, give valuable information about their wanderings, when rightly interpreted. And future mycologists will be able to draw a still better picture of the special route of each species when more information is procured.

A large percentage of species are known both from Arctis and from the Alps, they can with great certainty be said to have grown in Central Europe, perhaps also in Russia, 15,000 years ago. As the margin of the land ice

withdrew, they followed after, higher up in the Alps and farther to the north. If we compare the specimens collected in the arctic with specimens of the same species collected in the Alps or in Pamir, no difference at all can be pointed out between these plants, although they have been without any contact for that period of years. Their appearance and their host-plants are the same, in other words, they have not been affected by the 15,000 years in any noticeable degree.

Another fact of general interest, which has not been sufficiently discussed before, may also be elucidated by these researches viz.: that the micromycetes which are able to thrive at all in these arid regions, most frequently have a wide geographical distribution. To be brief, we may say that the plurality of the species concerned are found all round the pole. During the foregoing discussion of the separate species it was pointed out over and over again that a species which, e. g., hitherto has only been known from northernmost Norway has now also been found in Spitzbergen and Ellesmere Land or other distant regions. What I formerly (1927 p. 12) wrote has been confirmed, that the aid of birds in transporting the seeds or the spores, as well as the hypothetical land bridges of many older writers are quite superfluous in arctic regions. In the course of the long winter prevalent in those regions, fragments of plants and the endophytes living upon them may easily be carried across the ice from one land to another.

As soon as the species has found its way up to these arctic regions, it may easily be scattered with the snow over the frozen ground and waters, provided it can find a host-plant where it arrives. For that reason the plurivorous endophytes predominate and the saprophytes with perennial

mycelium, which may be scattered with the host and continue their growth where the host takes root.

In this connection I may call attention to the island of JAN MAYEN, of volcanic origin, extremely isolated, more than 500 km from Greenland and Iceland. Mammals (e. g. foxes) and plants must necessarily have been transferred by floating icebergs or across the frozen sea by means of the wind, and yet a considerable number of fungi are found here. In the preceding list I have mentioned 19 species of micromycetes viz.:

- Nr. 32. *Leptosphaeria microscopica*
- 35. *Leptosphaeria graminum*
- 37. *Leptosphaeria culmifraga*
- 50. *Metasphaeria arabidis*
- 71. *Pleospora scrophulariae*
- 84. *Pyrenophora chrysospora*
- 85. *Pyrenophora cerastii*
- 113. *Mycosphaerella Tassiana*
- 114. *Mycosphaerella confinis*
- 118. *Mycosphaerella silenes acaulis*
- 119. *Mycosphaerella ranunculi*
- 126. *Mycosphaerella saxifragae*
- 178. *Lophodermium arundinaceum*
- 203. *Hysteropezizella ignobilis*
- 222. *Pseudorhizisma bistortae*
- 234. *Allophyllaria pusiola*
- 255. *Puccinia cochleariae*
- 276. *Ustilago inflorescentiae*
- 386. *Heteropatella umbilicata*.

E. ROSTRUP has (1897 p. 28) in addition mentioned the following epiphytous species of fungi from Jan Mayen:

Cantharellus lobatus Fries on moss
Puccinia saxifragae Schlecht. on *Saxifraga nivalis*
Melampsora arctica Rostrup on *Saxifraga caespitosa*
and *Hysteropezizella pusilla* (Lib.) Nannfeldt on *Luzula*
arcuata.

Each of these 23 species must have been carried more than 500 km from its original growing place in Greenland or Iceland, together with fragments of the host, over to this diminutive island in the great Arctic Ocean.

There is consequently plenty of evidence to show that the species of micromycetes, which are really suited for these difficult conditions, find their way easily from one growing place to the other through all circumpolar regions. Many of the species listed above show the same: see No. 57 *Clathrospora pentamera*, No. 84 *Pyrenophora chrysospora*, No. 113 *Mycosphaerella Tassiana*, No. 209 *Hysteropezizella ignobilis* and many others.

It is all the more remarkable that extremely rare species are found in these regions. The material I have examined, is very uniform, collected as it is in many places and by many different collectors.

The causes affecting the frequency of the different species are manifold, some of them are more easily pointed out than others.

- I. Southern species found only occasionally north of the polar circle. This circumstance is always mentioned under these species.
- II. Species of epiphytous micromycetes attached to a single host. When this host is not especially common in arctic regions as *Festuca ovina*, *Trisetum subspicatum*, *Papaver radicum*, *Oxyria digyna*, *Polygonum vivi-*

parum, *Dryas*, *Cassiope*, *Empetrum* etc., it may often be difficult enough for the epiphyte to maintain its existence.

III. New species that have not had time to spread from their original locality.

IV. Old species, becoming extinct.

We have not as yet gathered information enough about each species to be able to draw a precise map of their geographical distribution, but we can still catch a glimpse of the outlines with regard to some of them.

ad III. As remarkable examples of species with a narrowly limited distribution we may mention: No. 76, *Pleospora Wulffi* from East Greenland, Spitzbergen and Jugor Strait, No. 100, *Lizonia distincta* from Spitzbergen and Finland and No. 254, *Puccinia rhytismoides* which hitherto has only been found in the northernmost parts of Fenno-Scandia, although *Thalictrum alpinum* has been recorded from Novaya Zemlya, Arctic Russia, Arctic Siberia, Arctic America and Greenland as also from the Alps, the Pyrenees, Caucasus, the Altai Mountains and Himalaya.

ad IV. It is much easier to find examples of species that bear the stamp of having been more commonly distributed before, and now are only found in a few widely scattered localities, or in hosts which systematically are curiously isolated. I refer to what I have said previously about such species as:

- Nr. 34. *Leptosphaeria hierochloae*
- 42. *Leptosphaeria brachyasca*
- 50. *Metasphaeria arabidis*
- 52. *Metasphaeria Annae*
- 58. *Clathrospora planispora*

- Nr. 64. *Pleospora dura*
 - 68. *Pleospora gigaspora*
 - 74. *Pleospora rubicunda*
 - 77. *Pleospora pyrenaica*
 - 78. *Pleospora mendax*
 - 143. *Venturia islandica*
 - 144. *Venturia arctostaphyli*
 - 145. *Venturia Dieckiei*
 - 147. *Pleosphaerulina vitrea*
 - 150. *Massaria eucarpa*
 - 176. *Lophodermium caricinum*
 - 187. *Cryptomyces maximus*.

I consider the species with continuous distribution, found in many different hosts, to be "in their strength and prime". But if a species begins to specialize either geographically or physiologically, I think it is a sign of old age. In certain cases we may find signs of the dividing of it into two or more species, in other cases it isolates itself more and more and prefers a certain host to others. ERNST GÄUMANN (1926 p. 21) has observed the same, he writes thus: "Nach Beobachtungen an den natürlichen Standorten werden mehrere infolge der verschiedenartigen Lebensbedingungen und Pflanzengesellschaften entstandenen Rassen des Pilzes mit bestimmten Haupt- und Nebenwirten unterschieden, wobei die Hauptwirte ziemlich regelmässig infiziert werden können, während die Nebenwirte nur unter gewissen, noch unbekanntem Bedingungen befallen werden".

From circumpolar regions I have seen many striking examples of this fact, see e. g.:

- No. 60. *Pleospora macrospora* preferably on *Hierochloë alpina*, only seldom found on other grasses.

- No. 143. *Mycosphaerella nebulosa* common on *Solidago*, very rare on *Melandrium*.
- 145. *Venturia ditricha*, very common on *Betula odorata* and *Betula nana* but very rare on *Alnus* and *Berberis*.
 - 207. *Laetinaevia erythrosligmoides* is most frequently met with on *Cerastium alpinum*, occasionally also on *Cerastium nigrescens*.
 - 208. *Laetinaevia stellariae*, common on *Stellaria longipes*, rare on *Stellaria palustris*.
 - 234. *Allophyllaria pusiola* especially found on *Poa arctica* and *Poa glauca*, as a rare exception on other grasses.

As examples of species that are about to divide into several "species sorores" according to their host-plants, may be mentioned of genuine parasites *Melampsora salicina*, where the division is certainly quite advanced, but not yet sufficiently examined. Of hemiparasites No. 114, *Mycosphaerella confinis* which may be said to be rather plurivorous, it prefers, however, host-plants of the families Caryophyllaceae, Cruciferae and Compositae, and No. 125, *Mycosphaerella densa* which likewise prefers certain host-plants (*Thalictrum*, *Cardamine* and *Saxifraga* spp.) to others. Further No. 172, *Phyllachora graminis*, which apparently is about to divide the old species into many species.

As examples of real saprophytes that are about to divide see No. 59, *Clathrospora elyngae* and No. 153, *Massaria eucarpa*, known only on *Polygonum* and *Pedicularis*.

A very striking example of a species of saprophytes, divided not according to species of the host-plant, but according to the organs of the host, has been mentioned above,

No. 54, *Metasphaeria sepalorum* on the glumes, and *Metasphaeria junci* on the stems of the same spp. of *Juncus*.

Many species of micromycetes are not found north of the polar circle, and this is easily explained by the short summers, the rough conditions etc.

But on the other hand, there are many species of micromycetes which are found exclusively in arctic and alpine regions even if their whole habit is adapted to a single host with continuous distribution. I will here sum up some of the most striking examples.

Betula odorata is found evenly distributed over large regions of the globe, but *Taphrina bacteriosperma*, *Taphrina alpina*, *Taphrina carnea* and *Taphrina lapponica* are only found in a very limited area in northern Scandinavia etc. Most of them do not distinguish between as different host-species as *Betula odorata* and *Betula nana*, but on the other hand there are certain ecological circumstances that are of great importance for their geographical distribution. No. 158, *Gnomonia campylostyla* on dead leaves of *Betula* has a typical arctic-alpine distribution, but at the same time 166, *Dothidella betulina* has a quite undiversified distribution.

Epilobium angustifolium is quite as common in Central Europe as in Lapland, but I was surprised to find it near Abisko strongly attacked by No. 257, *Puccinia gigantea* and No. 168, *Dothidella adusta*, which are never found in the European lowlands.

On *Empetrum nigrum* I have found No. 191, *Rhytisma empetri* and No. 192, *Sphaeropezia empetri* exclusively in arctic and alpine regions, while No. 17, *Physalospora empetri* and No. 272, *Chrysomyxa empetri* are equally common in all places where *Empetrum* is found.

Trollius europaeus is just as common in Central Europe as in Lapponia Suecica and Lapponia Fennica, but here in the lowland it is rarely attacked by parasitical or saprophytical micromycetes; up there, on the other hand, it is strongly attacked on living leaves by No. 246, *Puccinia thulensis*, No. 253, *Puccinia trollii* and No. 401, *Ramularia trollii*, just as the dead stems and leaves are abundantly covered with saprophytes.

On *Arctostaphylos alpina* we have likewise No. 388, *Gloeosporium alpinum* and No. 268, *Pucciniastrum sparsum* which only attack this host in arctic and alpine localities.

Sorbus aucuparia also belongs to those trees that have a continuous distribution, but No. 183, *Lophodermium tumidum* is only found on dead leaves of Sorbus in arctic and alpine localities.

Solidago virgaurea is found in arctic and alpine localities attacked by No. 244, *Uromyces solidaginis*, but never in Central Europe.

Numerous other examples might be selected, which altogether show that the parasite and the host by no means always have the same territory, even the micromycetes that grow on fallen leaves require other ecological conditions than those which are most suitable for the host.

If the saprophytes prefer the dead leaves from cold localities to those from warmer places, I think it is chiefly owing to the fact that in the arctic regions they are free from competition on the part of bacteria and moulds, which in warmer climates more rapidly decompose the dead leaves of the host.

I hope that this investigation has shown quite clearly that there are still many problems relating to "The geographical distribution of circumpolar micromycetes" for future generations of mycologists to solve in continuation of the work I have carried on through thirty-five years.

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