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Contributions to the Geoglossaceae of Norway

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INTRODUCTION

The Geoglossaceae of Norway were monographically first treated by Imai (1940). Two years later Nannfeldt (1942) published a monograph of the Swedish Geoglossaceae in which he also made a revision of the Norwegian material. In most cases there is good accordance between the determinations made by the said authors. But some discrepancies occur.

According to Imai (1940) 17 species were known from Norway. Of these Nannfeldt did not accept *Mitrella muscicola* E. Henn. and *Spathularia rufa* Sw., finding these species identical with *Mitrella gracilis* Karst. and *Spathularia flavida* Pers. ex Fr. respectively. All our five collections of *Cudonia*, by Imai placed in *C. circinans* (Pers. ex Fr.) Fr., were by Nannfeldt found to represent not the true *C. circinans* but the very similar *C. confusa* Bres. On the other hand Nannfeldt (1942) found that two of the three collections of *Geoglossum nigratum* (Fr.) Cke. actually belonged in the new species *G. starbaeckii* Nannf. Finally Nannfeldt was able to add *Microglossum viride* (Pers. ex Fr.) Gill, based on a collection that had been made after Imai had finished his studies of our Geoglossaceae.

Summing up we find that according to Nannfeldt (1942) the following 17 species were known from Norway in 1942:

- Corynetes arenarius* (Rostr.) Dur.
C. atropurpureus (Batsch ex Fr.) Dur.
C. globosus (Sommerf.) Dur.
Cudonia confusa Bres.
Geoglossum fallax Dur.
G. glabrum Pers. ex Fr.
G. nigratum (Fr.) Cke.
G. starbaeckii Nannf.
Leotia lubrica Pers. ex Fr.
Microglossum viride (Pers. ex Fr.) Gill
Mitrella abietis Fr.
M. gracilis Karst.
M. multiformis (E. Henn.) Mass.
M. paludosa Fr.
Spathularia flavida Pers. ex Fr.
Trichoglossum hirsutum (Pers. ex Fr.) Boud.
T. walteri (Berk.) Boud.

At the same time Nannfeldt (1942) listed 26 species from Sweden and only 15 from Denmark. To Nannfeldt this meant that Sweden was rather rich in Geoglossaceae.

To me these numbers rather imply that at that time Sweden was far better investigated in this respect than Norway and Denmark. A comparison between the total number of Swedish collections, more than 350, recorded by Nannfeldt and the mere 80 Norwegian collections reported on by Imai and Nann-

feldt, clearly shows that this was the case. To make statements about the richness (in number of species) of any component of the flora of a given area it is first of all necessary to make an evaluation of the intensity of the investigations in this and in the areas with which it is to be compared. Since 1942 only one species has been added to the Geoglossaceae of Sweden, viz., *Corynetes arenarius* (Andersson 1950). In Denmark Bille-Hansen (1954) has recently added 7 species to the Danish flora. The present study has brought the number of Norwegian Geoglossaceae up to 27.

TAXONOMY

Our delimitation of the family is the same as that of Nannfeldt (1932, 1942) thus excluding the genera *Apostemidium* and *Vibrissa* (see below). It is, however, not at all certain that the remaining genera form a phyletic homogeneous group. The genera *Geoglossum* and *Trichoglossum* are very close to each other, differing only in the presence of spines in the hymenium of the latter. *Corynetes* comes close to the above genera differing from these (like the rest of the Geoglossaceae) in having hyaline spores. A species like our *Corynetes geoglossoides* (p. 141) with mostly hyaline but also a few slightly coloured spores undoubtedly forms a connecting link between *Corynetes* and *Geoglossum*. *Microglossum* again shows close relationships to *Corynetes*, indeed so much that Mains (1955) united these genera. We would not go so far. On account of *Corynetes geoglossoides* it seems more difficult to draw the line between *Geoglossum* and *Corynetes* on the one hand, than between *Corynetes* and *Microglossum* on the other hand. The consequence would be that if one unites *Microglossum* and *Corynetes*, *Geoglossum* should be included too. In that case it would be quite inconsistent to keep *Trichoglossum* as a separate genus. The separation or union of these four genera seems to be more or less a matter of taste.

The remaining European genera, *Mitrella*, *Cudonia*, *Spathularia* and *Leotia* are separated from the preceding ones more on form and colour than any other character, though it should be remembered that *Microglossum* contains a section *Ochroglossum* Imai with yellow-brown colours. The above-mentioned genera do not seem to be closely related. At least *Leotia* with its gelatinous ascocarps occupies a very isolated position within the family and was recently transferred to Helotiaceae by Korf (1958). In this paper we have preferred to retain it in Geoglossaceae to accord with Nannfeldt's treatment of the Scandinavian Geoglossaceae. Also very isolated is the mostly extra-European *Spragueola*. On the other hand some of these genera, e. g. *Mitrella* and *Cudonia*, show close relationship to stiphitate forms of Helotiaceae, in fact at present it is impossible to point out any other difference between them than the form of the ascocarp, being pileate or clavate in the former genera against stiphitate and cupulate to flat or only slightly convex in Helotiaceae. The difficulties in drawing a line between these genera on the one hand and

! The number may be even higher, as Bille-Hansen does not clearly indicate which species had not been recorded from Denmark before; furthermore he only treats the genera *Geoglossum*, *Trichoglossum*, *Corynetes*, and *Microglossum*.

Helotium on the other have been clearly demonstrated by Mains (1956 a) in a recent study of *Helotium actulare* and related species. Careful anatomical studies of a number of species in both families are needed to clarify these problems.

As regards *Sarcoleotia* Imai, see under *Corynetes globosus*.

Finally some words must be said about the taxonomic position of the genera *Vibrissa* Fr. and *Apostemidium* Karst. Both genera were included in the Geoglossaceae by Durand (1908). Nannfeldt (1932) transferred both to the new order Ostropales on account of the narrow cylindrical asci and the very long, illiform, purisepitate, hyaline spores. Later on Mains (1956 b) replaced *Vibrissa* in the Geoglossaceae arguing that the apices of the asci in *Vibrissa* actually do not possess the characteristics assigned to them by Nannfeldt, and furthermore as regards the spores (Mains op. cit. p. 703): 'Since there is great variation in the ascospores of the Geoglossaceae, this is not sufficient to exclude it from the family'. On the other hand Mains did not include *Apostemidium* in Geoglossaceae as the ascocarps of this genus are sessile and pulvinate. The apex of the ascus in *Apostemidium* and *Vibrissa* was studied in detail by Bellemère (1960), who found that these genera were almost identical in this respect although very different from the rest of the Ostropales. He therefore preferred to place both genera in a special group, the Pseudo-Ostropales. Furthermore, the anatomy of the ascocarps of *Apostemidium vibrissoides* (Peck) Boud. and *Vibrissa truncorum* (A. & S.) Fr. was studied by Kjöller (1960) who found them to be so similar in all details, spores, asci, paraphyses and excipulum, that she deemed it reasonable to give up the separation of the two genera altogether.

The observations made by Bellemère and Kjöller point directly to our first conclusion as regards the taxonomic position of *Apostemidium* and *Vibrissa*: they cannot be placed in different families as done by Mains.

But are we then to include both in the Geoglossaceae? According to Mains, as cited above, the variation of spore form within this family is so great that it may as well include forms with spores like *Vibrissa* (and *Apostemidium*). In this we cannot agree; the form of the ascospores in these two genera lies distinctly outside the range of variation within Geoglossaceae sensu Nannfeldt. In fact, the kind of spores displayed by *Vibrissa* and *Apostemidium* is extremely rare among the Ascomycetes, and among Discosmycetes is only found in the few genera belonging to Ostropales. Although Bellemère stresses the differences in the apex of ascus, we would nevertheless prefer to place *Vibrissa* and *Apostemidium* close to the rest of Ostropales, and on no account in the Geoglossaceae.

The genera and species are treated below in alphabetical order.

The following abbreviations indicate the herbaria in which specimens are deposited:

(O) Botanical Museum, Oslo

(B) Botanical Museum, Bergen

(T) Dept. of Botany, Det Kgl. Norske Videnskabers Selskab, Trondheim

(Tromsø) Dept. of Botany, Tromsø Museum, Tromsø.

1. *Corynetes arenarius* (Rostk.) Dur.

Fig. 2 A.

New records:

Rogaland : Ognå: The Ognå sand-dunes, on naked sand Aug. 29th 1952 FEE (O).
— Sola: The Sola sand-dunes, on naked sand Aug. 29th 1952 FEE (O).
Finmark : Alta: between Tomasbakken and Storgjerden on the sandy

banks of the river Alta Aug. 13th 1961 FEE (O).

Microscopical details : Ascii narrowly clavate $130-160 \times 25-35 \mu$, 8-spored. Spores almost cylindrical with rounded ends or slightly clavate, hyaline, nonseptate, $27-37 \times 3.5-5 \mu$. Paraphyses almost filiform, strongly agglutinated (Fig. 2 A).

In Norway *C. arenarius* was previously known from only one place, Risdø-bank at Mandø, South Norway (Imai 1940 p. 274). The ecology of this species was studied by Andersson (1950) who found that in Scania it occurred on the sheltered side of the high inner sand-dunes in sparse vegetation and on a

substratum that had a moderately acid reaction. It may, however, also occur in inland sandy localities. Our southern collections are from sand-dunes, whereas the one from Alta was made on the sandy shores of the river Alta. In the latter place it grew together with *Empetrum hermaphroditum*, *Juncus communis*, the mosses *Drepanocladus uncinatus*, *Ptilidium ciliare*, *Polytrichum alpinum*, and *Scapania* sp., and *Corynetes globosus*.

The total area of distribution of *C. arenarius* was mapped by Andersson (1950). It seems to have a rather restricted distribution, being known only from both sides of the North Atlantic Ocean, and with its centre of distribution along the coasts of the North Sea.

Our record from Alta is the most northerly collection known to the writer, on 69°54' North (Previously Nuak on the island of Disko, Greenland, on 69°45').

2. *Corynetes atropurpureus* (Batsch ex Fr.) Dur.

New record:

Akershus : Asker: Skaugum, in a rather dry, grassy meadow Oct. 30th 1960 FEE (O).

The species is widely distributed in Europe, but rather rare in North America. Very probably it has a southern distribution within Scandinavia, as was indicated by Nannfeldt (1942 p. 4). In Norway *C. atropurpureus* was previously known from five localities in the vicinity of Oslo, and one in Kvinnherad, W. Norway (vide Imai 1940 p. 273). It seems to be rather rare in Scandinavia. This, however, may partly be explained by the late appearance of its fruit-bodies. Almost half of the Scandinavian findings have been made in October, the earliest collection on August 18th.

C. atropurpureus is easily recognized by the hyaline or almost hyaline, only slightly enlarged paraphyses which are strongly agglutinated by a vinous-brown amorphous matter. The spores in our specimens are typical, $20-32 \times 4-5 \mu$. We were, however, unable to find any septated spores as reported by Durand (1908 p. 414).

3. *Corynetes geoglossoides* Eckblad sp. n.

Fig. 1 F, 2 B.

Ascomata solitaria vel gregaria, 1.2-3 cm alta, clavata vel irregulares, *C. arenaria* similia. Clavula satis crassa, 5-10 mm lata, saepe compressa, a stipite non distincte determinata. Stipes brevis, 2-10 mm, interdum paene deliciens, colore olivaceo nigro, leviss. — Ascii anguste clavati, $120-150 \times 11.5-13.5 \mu$, apice rotundati, 8 sporidia continentes, 1+ — Sporidia \pm bini-ordinibus posita, $28-38 \times 5.5-6 \mu$, cylindrata, raro cylindrato-clavata, per-umque hyalina et aseptata, raro colore pallido fulvo, 0-1-septata. — Paraphyses numerosae, distincte separatae, non agglutinatae, in inferiore parte filiformes, in superiore parte fuscantes, remote septatae, ad apicem versus paulo crassiores factae (ad 6μ), subrectae vel curvatae vel paene circinatae.

Hab. inter *Empetrum* in solo arenoso, in Norvegia septentrionali.

Typus: Eckblad No. 61-198. in Herb. Oslo.

Finmark: Kistrand: Lakseiv, on the eastern sandy banks of the river, near the hotel, among *Empetrum* Aug. 16th 1961 FEE No. 61-198 (O).

Description: Ascocarps solitary or gregarious, clavate to somewhat irregular in shape resembling *C. arenarius*, 1.2-3 cm high, 5-10 mm broad, clavate. Small specimens, 2-10 mm long, olivaceous black, smooth. Ascii narrowly clavate, $120-150 \times 11.5-13.5 \mu$, 8-spored, 1+. Spores $28-38 \times 5.5-6 \mu$, cylindrical with rounded ends, rarely slightly clavate, mostly hyaline and aseptate, some ascii, however, containing pale brown spores which may be 1-septate. Paraphyses filiform below, somewhat enlarged above, up to 6μ thick, brown, remotely septated, straight or more often curved, sometimes almost circinate. Admittedly *C. geoglossoides* is very close to *C. arenarius*, occurring as it does in similar habitats, and approaching it in form. The taxonomic value of the tendency in *C. geoglossoides* to form coloured spores is hard to evaluate. In any case it is a singular character in *Corynetes*, and we have therefore preferred to treat *C. geoglossoides* as a distinct species rather than a variety of *C. arenarius*. The latter species, however, should be closely inspected for coloured spores in its typical habitats.

Secondly we have compared it with *Geoglossum littorale* (Rostk.) Nannfeldt. (*Leptoglossum littorale* Rostk.), a species described from a similar habitat in Denmark. This species was described by Rostrop (1892) and later by Lind (1913) as having hyaline spores and with paraphyses of the same kind as found in *C. arenarius*. Nannfeldt (1942), however, studying the type specimen, found that the spores finally take a very faint greyish-brown colour, and transferred the species to *Geoglossum*.

In these characters *Leptoglossum littorale* seemed very close to our species. We have, however, had the type specimen on loan, and notwithstanding its poor condition, e. g. the paraphyses being mostly completely disintegrated, we found it to contain a protrusion of spores. The spores are cylindrical with narrowed ends or slightly clavate. The majority of spores are hyaline with

This species was hitherto known only from the type collection from Saltdal (Sommerfelt 1826 p. 287, Table III). Sommerfelt was evidently uncertain about its taxonomic position. Ultimately he described it as a species of *Mitrella*, but Aug. 16th 1961 FEE (O).
 New records: Hordaland: Ulvik: Finse, N of the Hardanger glacier, S of height 1393, on sand and gravel at 1320 m alt. Aug. 10th 1960 FEE (O).
 Finmark: Alta: Alta, between Tomasbakken and Storgjerden, on the sandy banks of the river Alta, among junipers, *Empetrum*, *Drepanocladus uncinatus*, *Polytrichum alpinum*, *Ptilidium chloro*, *Scoparia* sp., and *Corynetes arenarius*, Aug. 13th 1961 FEE (O). — Kistrand: Lakselv, between the hotel and the river, sandy roadside

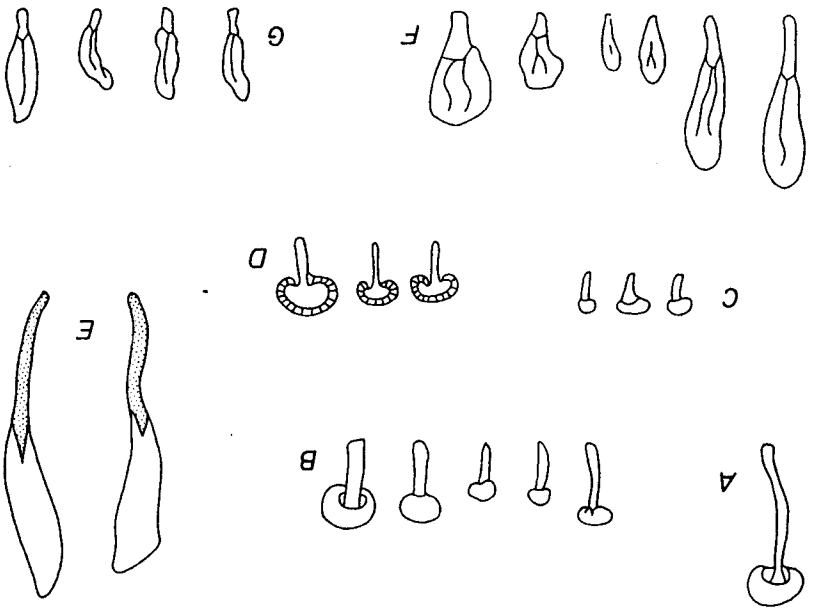
Fig. 1 A-D, 2 C-E.

Syn.: *Mitrella globosa* Sommerf.

4. *Corynetes globosus* (Sommerf.) Dur.

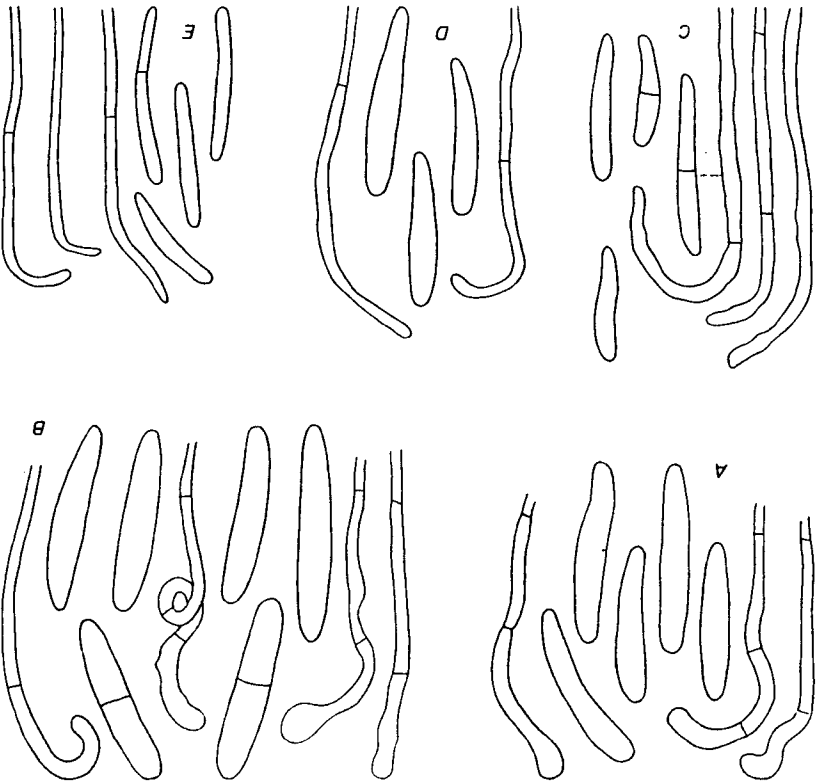
1-5 septa, but a number of slightly coloured spores with (3)-5-7 septa are clearly seen. These latter spores measured 60-77 μ in length. Consequently, the spores are typical of the genus *Geoglossum*, and there can be not the slightest doubt that *L. littorale* belongs in that genus, and that it is widely different from our species.

Fig. 1. A-D *Corynetes globosus* A. Big specimen from Lakselv FEE 61-193, B from Alta FEE 61-159, C from Finse 60-26, D from Alta FEE 61-159 in section, hymenium hatched. E. *Geoglossum vienghanum*, Kolvikneset FEE 61-207, F. *Corynetes geoglossoides*, Lakselv FEE 61-198, type specimen. G. *Geoglossum alpinum*, Lom, Møralselva FEE 57-11, type specimen. — Nat. size.



before that he had labelled the specimens as *Leotia globosa*. He never bothered to change the name on the label in his herbarium. Durand (1908) studied the copy in Herb. Fries and found that it was a species of *Corynetes*. Imai (1940) studied the holotype in Herb. Oslo, gave a detailed description of the species, and confirmed Durand's view as regards its taxonomic position. Nannfeldt (1942) studied both the holotype and the copy, found them identical, and confirmed the opinion of Durand and Imai. Furthermore, Nannfeldt strongly opposed Durand's view that *C. globosus* might be identified with *C. arenarium*.
 We have been able to restudy the holotype in Herb. Oslo, and have little add to Imai's description of it. We found the spores to be of rather variable size 21.5-33 \times 3-4.5 μ , mostly continuous but some few were one-septate. We were unable to find any plicate spores as did Imai, but this seems to be a usual difficulty with many of the hyaline-spored Geoglossaceae.

Fig. 2. Spores and paraphyses. A. *Corynetes arenarius*, Alta FEE 61-163. B. *C. geoglossoides*, Lakselv FEE 61-198, type specimen. C-E. *C. globosus*, C from Saltdal, type specimen, D from Finse FEE 60-26, E from Alta FEE 61-159. — \times 840.



We have compared our recent collections with the type and found them to be identical. A description of the fresh specimens runs as follows:

Asocarps stipitate, first capitata becoming pileate. Stipe 5–10 mm long, 1–2.5 mm thick, tapering below, pale brown, slightly squamulose. Pileus ± globose, 3–8 mm broad, fuscous black to almost pure black, margin of pileus usually free with a distinct groove between pileus and stipe or confluent with the stipe in one or two places. Asci clavate 100–125 × 6.5–7.5 μ, 8-spored, J +. Spores hyaline, rather variable in form and size: Usually cylindrical clavate, rarely cylindrical with rounded ends, 21–33 × 2.5–4.5 μ, usually continuous, but some few spores with one septum have been seen. Paraphyses filiform, mostly curved in the upper part 1.5–2.5 μ thick, pale fuliginous above, hyaline below, remotely septate.

The only notable difference between the type specimen and our specimens seems to be that some of the paraphyses are broader, up to 3.5 μ thick, in the type. Our specimens are much darker than the one depicted by Sommerfelt, but as the paraphyses are of the same colour, it seems reasonable to think that his figure was miscoloured in printing.

C. globosus is a very characteristic species, and in shape rather out of place in *Corynetes*. The asocarps are distinctly pileate, which, though unnoticed by earlier students, is clearly seen also in Sommerfelt's specimens. Older specimens look more like a small, black *Cudonia* or *Leotia* than anything else. From these genera it differs in the distinctly coloured paraphyses and the amyloid ascus. Judging from description and pictures the genus *Sarcotelia* Imai (1934), with a single species, *S. nigra* (S. Ito & Imai) Imai, comes very close to *C. globosus*. In fact the only differences seem to be the non-amyloid ascus and the pink colour of the hyaline spores *en masse* in *Sarcotelia*.

5. *Cudonia circinans* (Pers. ex Fr.) Fr.

Akershus: Skedsmo: Brauternesene Oct. 10th 1961 (FEE) (O). — Fet: Tien-skogen Sept. 17th 1950 FEE (O). — Nes: Seterstø, Bollrud Sept. 21th 1951 O. Røssing (O).
 Oslo: Ulsrudvatn in Østmarka July 30th 1953 FEE (O); Østmarka Aug. 1953 Inger Anne Lysebratne (O).
 Oppland: Vestre Toten: Steffensrud Aug. 4th 1953 A. Bratsberg (O). — Ringe-lu: Fåvang, near Kampen Sept. 18th 1960 FEE (O).
 Buskerud: Drammen: Underlia, Bragernes Sept. 8th 1961 Gro Gulden (O). — Nes: Nesbyen, at the museum Aug. 17th 1960 FEE (O).
 Nordland: Voss: Flatlandsmo — Vindbergetsetra Sept. 9th 1950 J. Stordal No. 5212 (B).
 Sør-Trøndelag: Trondheim: Baklidammen Sept. 15th 1953 J. Stordal (O). — Strinda: At Follsjøen Sept. 17th 1953 FEE (O). — Malvik: Hommelvik, at the river E of Håkenstad Sept. 4th 1951 J. Stordal No. 6677 (T).
 Nord-Trøndelag: Stjørdal: Kvithamar Oct. 18th 1953 E.H. Roll-Hansen (O). Troms: Lyngen: Øvre Karnes, Bakkeia Sept. 4th 1958 S. Sivertsen (Tromsø); Øksvik, Brønsmøttbakkene, in dense *Alnus*-forest Aug. 26th and Sept. 14th 1961 S. Sivertsen (O) and (Tromsø).

New to Norway. For the difference between this and the following species, see Nannfeldt 1942 pp. 10–11. As in Sweden *C. circinans* is far less common than *C. confusa*.

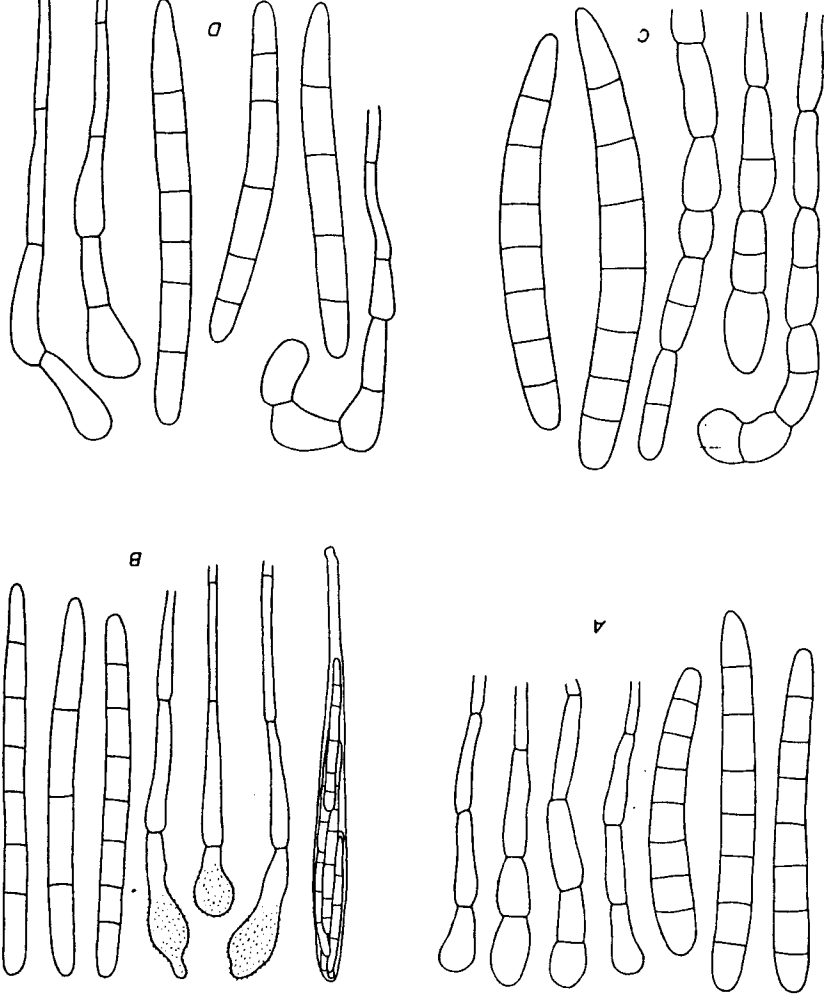


Fig. 3. *A. Geoglossum alpinum* FEE 57—11 spores and paraphyses, type specimen. B. *G. glutinosum*, Tyrtava, 1953 FEE, ascus, paraphyses and spores. C. *G. simile*, Lerdal, Movatskolien 1953 F. Wischmann, paraphyses and spores. D. *G. vluugellaanum*, Kotvikneset FEE 61—207, spores and paraphyses. — Ascus × 350, spores and paraphyses × 840.

6. *Cudonia confusa* Bres.

Counties and parishes (municipalities) of Norway in which it is known to occur:

Östfold: Berg, Rakkestad. — Akershus: Ski, Nes, Nittedal. — Oslo: Several places in spruce forests. — Hedmark: Våler, Elverum. — Oppland: Gran, Nord-Aurdal, Ringebu. — Buskerud: Drammen, Hole, Nes. — Vestfold: Våle. — Telemark: Tinn, Heddal, Fyresdal. — Hordaland: Voss, Vossstrand. — Sør-Trøndelag: Selbu, Buvik, Trondheim, Strinda, Stadsbygd. — Nord-Trøndelag: Stjørdal. — Troms: Lyngen.

During the later years of more intensive collecting of Norwegian fungi, *C. confusa* has proved to be one of the most common Geoglossaceae in the eastern parts of our country. In Western Norway it is very rare, and has so far been found only in the natural spruce forest at Voss.

7. *Geoglossum alpinum* Eckblad sp. n.

Fig. 1 G, 3 A.

Ascomata pusilla, clavata, 1.4–1.8 cm alta, atra; clavula anguste lanceolata, subcompressa, 1.2 cm longa, 1–5 mm lata, a stipite non distincte determinata. Stipes tenuis, levis vel verruculosus. — Asci clavati, 130–150 × 18–22 μ , apice rotundati, 8 sporidia continentes. — Sporidia bi-vel multiseriata, clavata, interdum leviter curvata, 5.5–7.0 (plus minusve 6.5 μ) × 5.5–7.5 μ , fulgineo-brunnea, viligo 7-seriata. — Paraphyses numerosae, filiformes, in infertore parte subhyalinae, 1–3 μ crassae, in superiore parte claviformiter incrassatae (ad 5–7 μ), colore brunnea, remote septatae, ad septa non vel leviter constrictae, rectae, valde agglutinatae, materia brunnea amorphae inspersae. Hab. in solo arenoso semitarum, in Norvegia alpina vel subalpina.

Typus: Eckblad n. 57–11, in Herb. Oslo.

Hedmark: Follid: Dølliselet, where the Døllil rivulet runs into Einunna, on a footpath Aug. 2nd 1946 J. Lid (O).
Oppland: Lom: At Soløgen, on the road about 3 km S of Medalsseter, on the roadside Aug. 19th 1957 FEE No. 57–11 (O) (Type!).

Ascocarps clavate 1.4–1.8 cm high, somewhat compressed, black, ascligerous portion not sharply delimited from the stipe. Stipe shorter than the fertile portion, glabrous or faintly verruculose. Asci clavate 130–150 × 18–22 μ , 8-spored. Spores simultaneously coloured and septated, fuliginous brown, clavate, 5.5–7.0 μ long (mean of 20 spores: 6.5 μ) and 5.5–7.5 μ broad, 7-seriata. Paraphyses brown, strongly agglutinated by a dark brown amorphous matter, filiform, 1–3 μ thick and almost hyaline below, gradually enlarged and coloured above, straight, uppermost cell 5–7 μ thick, only little broader than the lower ones.

This species clearly belongs in the group with early and simultaneously coloured and 7-septated spores. It seems to be closely related to *G. glabrum* and allied species from which it differs in much smaller size, smaller spores and that the paraphyses are not or only slightly constricted at the septa.

8. *Geoglossum fallax* Dur.

The species was recorded by Imai (1940) from two places in the vicinity of Oslo. No new information about its occurrence in Norway is available. As it is rather common in South and Central Sweden it may have a south-eastern distribution within Fennoscandia.

9. *Geoglossum glabrum* Pers. ex Fr.

New records:

Akershus: Nittedal: Nordre Movavn Sept. 22nd 1957 Per Sunding (O). — Asker: Nesøyløret Aug. 7th 1949 Finn Wischmann (O).
Buskerud: Øvre Eiker: At a small mere between Svendsrud and Røkkeberg-Østfold: Stokke: In a bog NE of Brattekeverne Sept. 18th 1956 Finn Wischmann (O).
Hordaland: Vossstrand: S of Vinje Hotel, among *Sphagnum* Aug. 15th 1950 J. Stordal No. 5017 (B).
Nordland: Nord-Rana: Guldsmedvik N of Mo, in a *Sphagnum*-bog Aug. 10th 1954 FEE (O).
Troms: Lyngen: the Karnes-bog below Leine. Aug. 14th 1961 Sigmund Sivertsen No. 150 (O).

Previously known from six localities in Norway. This is one of the most common species of the genus and is easily recognized by its habitat, viz. exclusively on *Sphagna*, and by its peculiar paraphyses.

10. *Geoglossum glutinosum* Pers. ex Fr.

Akershus: Oppgård: Gjørsjøen, Tyrigrava, sandy roadside Nov. 15th 1953 FEE (O).

New to Norway. Clavate, viscid and thus becoming somewhat glossy when dried. Asci very long, up to 200 μ , and narrowly clavate. Spores tardily coloured and septated, but 6- and 7-septate spores not uncommon, 60–70 × 4–5 μ . Paraphyses mostly straight, pale brown, very thin below, apical cell mostly abruptly pyriform or almost globose, slightly granular, up to 8.5 μ broad.

11. *Geoglossum montanum* Nannf.

Finmark: Kistrand: Lakselv at the hotel, on a sandy footpath among mosses in birchwood, Aug. 8th 1961 FEE (O).

New to Norway. The species was described from Sweden (Nannfeldt 1942) and so far it is endemic to Norway and Sweden. Nannfeldt suggests that it has a montane distribution, and as, generally speaking, montaneous plants in Northern Norway tend to grow also in the lowlands, our find corroborates Nannfeldt's view.

Microscopical details: Asci clavate, 4–7-spored. Spores cylindrical-clavate, 5.5–7.0 × 5.5–7 μ , almost simultaneously 7-septated and fulgineous brown. Paraphyses filiform and hyaline below, not adherent, straight or

more often curved, rarely circinate above, distinctly coloured and gradually thickened above, not or only slightly constricted at the septa, the apical cell usually somewhat swollen, to 7 μ thick.

The species is not too well characterized, having many features in common with *G. nigritum* and also *G. starbaeckii*. It is, however, readily recognized by the asci hardly ever being 8-spored. In a count of number of spores per ascus in 50 asci we found in our specimens that four was the most common number.

Number of spores per ascus 2 4 5 6 7
Number of asci 1 21 16 9 3

12. *Geoglossum nigritum* Cooke

New records:

Finnmark: Karasjok: Karasjok, dry, sandy roadside outside the Lapp continuation school July 18th 1961 O. Skille & FEE (O). — Båtsfjord: Svarnes by Vardø, on sand among *Empetrum* and mosses Aug. 23rd 1961 FEE (O).

In Norway previously only known from Bærum (vide Nannfeldt 1942 p. 36).

13. *Geoglossum simile* Peck

Fig. 3 C.

Vestfold: Lardal: Movatnskollen (E. of Movatn in Siljan) Aug. 21st 1952 F. Wischmann (O).

New to Norway. *G. simile* has a wide distribution in North America and is also recorded from Japan. It was quite unknown in Europe until recently when Bille-Hansen (1954) found a single specimen in an old collection from Denmark.

Microscopical details: Asci clavate, 180—220 \times 22—28 μ , 8-spored. Spores cylindrical-clavate, 7-septate, 65—90 \times 6.5—7.5 μ . Paraphyses not agglutinated, basally filiform and hyaline, in the upper part brown, closely septated and conspicuously constricted at the septa forming chains of barrel-shaped cells or constrictions often occurring only at every second septum, apical cells 5.5—8 μ thick.

The paraphyses of this species are very characteristic and, together with other differentiating characters, make it easily recognizable (Fig. 3 C).

14. *Geoglossum starbaeckii* Nannf.

New records:

Hedmark: Nes: About 0.25 km S of Stavsjo church, on a dry slope June 27th 1961 Finn Wischmann (O).
Oppland: Dovre: Tofteemo, W of the river at Tofteemo boarding-house, in a pine forest at 485 m alt. Aug. 7th 1952 Finn Wischmann (O).
Hordaland: Etne: The Meland forest, moist place among mosses Aug. 5th 1952 J. Stordal No. 7471 (B).
Møre & Romsdal: Sunnylven: Rurdal, in a pine forest Aug. 15th 1951 Johannes Ild (O).

Troms: Kålfjord: Kålfjordalen, Kilien-Skaide, grassy place at the old mining road Aug. 15th 1961 Sigmund Sivertsen No. 293 (O).
Finnmark: Kistrand: Kolvikneset, among mosses Aug. 17th 1961 FEE (O).

Previously known from two localities in Norway (Nannfeldt 1942). The species appears to be one of the most common *Geoglossa* in Scandinavia and was reported by Nannfeldt (op. cit.) from numerous places in Sweden. It has recently been recorded from Denmark too (Bille-Hansen 1954). For the present *G. starbaeckii* has not been found outside Scandinavia and Denmark.

15. *Geoglossum vluugelianum* Nannf.

Fig. 1 E, 3 D.

Finnmark: Kistrand: Kolvikneset, on slightly wet soil among mosses Aug. 17th 1961 FEE (O).

New to Norway. Our collection consists of four specimens which are clavate, 3—5 cm high, with fertile portion olivaceous black and sharply delimited from the stipe which is dark fuliginous and distinctly squamulose (Fig. 1 E). Asci clavate, 8-spored. Spores cylindrical-clavate 60—75 \times 5.5—6.5 μ , up to 7-septate, fuliginous, but many spores only faintly coloured and with fewer septa. Paraphyses not adherent, stout, coloured almost from the base, rarely septate and about 3 μ thick below, upwardly clavate, straight or somewhat curved, more densely septate and apically swollen. Apical cell usually pyriform or almost globose, 6—10 μ thick.

Our specimens differ slightly in colour from Nannfeldt's description of the species (Nannfeldt 1942). His description, however, was based on a single collection, and the species may be expected to be more variable than appears from one collection only. We have seen one more collection, from the Finnish side of the border near Karasjok, which may be this species. The known localities for *G. vluugelianum* seem to indicate that it has a northern distribution.

16. *Leotia lubrica* Pers. ex Fr.

The following is a list of counties and parishes in which it is known to occur:

Östfold: Våler. — Akershus: Ski, Nesodden, Nes, Nittedal, Nannestad, Bærum, Asker. — Oslo: Several places in the forests. — Hedmark: Hamar, Buskerud: Nordrethov. — Vestfold: Holmestrand, Våle (Stordal 1953 p. 277), Sem, Nøtterøy, Larvik. — Telemark: Bamble, Gransherad, Fyresdal. — Vest-Agder: Kristiansand, Oddernes, Flekkefjord. — Rogaland: Lund, Gjeftal, Hetland, Haugeund. — Hordaland: Oien, Etne, Fjellberg, Skånvik, Os, Bergen, Laksveig, Asane, Voss, Granvin, Uvik, Vossestrand. — Møre & Romsdal: Herøy, Borgund. — Sør-Trøndelag: Trondheim, Strinda. — Nord-Trøndelag: Stjørdal, Frostå, Asen.

This species has proved to be one of the most common *Geoglossaceae* in Fennoscandia. We have therefore refrained from citing every locality in full, but have merely listed the counties and parishes from which it is known. It occurs only in the lowlands and has not been found above the tree-limit.

alt. on *Philonotis tomentella* Aug. 9th 1960 FEE (O); Finse, N of Hardangerfjokelen at the inlets W of height 1393, at 1320 m alt. on *Rhacomitrium canescens* Aug. 10th 1960 FEE (O).

Sör-Trøndelag: Oppdal: N. Knutshö, Sprenbekkskaret, on *Bryum pseudo-triquetrum*, *Calliergon sarmentosum* and *Philonotis fontana*, Aug. 21st 1953 R. Nord-hagen (O); S. Knutshö, at Biesebekken at about 1200 m alt., on *Paludella* Sept. 13th 1960 FEE (O).

Troms: Lyngen: Upper Karnes, the Karnes bog below Leine, on *Calliergon stramineum* and *Tomenthyphnum nitens* July 15th 1959 S. Sivertsen (O); Oksvik, Reinskaret, on *Paludella* Aug. 6th 1961 S. Sivertsen (O). — Kälfjord: the Kälfjord valley, Guolasjavre — Sabitjok, W of lower Akkejavre, on *Paludella* Aug. 22nd 1961 S. Sivertsen (O).

Note 1. The collection from Österdalen leg. M. N. Blytt by Inma (1940) referred to *M. gracilis*, by Nannfeldt (1942) referred to *M. paludosa*, according

to our criteria (see below) actually belongs in *M. gracilis*.

Note 2. In addition to the collections cited above, Mr. S. Sivertsen has observed *M. gracilis* in a number of places in Northern Norway: Troms:

Nordreisa: Gætkojavre, Coalmavagge and Somasjavre near the Finnish border, seems to be rather common in *Paludella*-bogs. — Finnmark: Kautokelino: Coalmjavre, and Karasjok: Gorzejokka at Uccagorze. Although not substantiated by herbarium specimens these notes on its occurrence in Finnmark should no doubt be taken into consideration when discussing the distribution of *M. gracilis* in Fennoscandia.

The species has a true arctic-alpine distribution and is now on record from the Scandinavian mountains, Switzerland, Greenland, Jan Mayen, and Iceland (Lange 1957). In North America it is known from Labrador (Durand 1908), Colorado, Idaho, Montana, Washington and Newfoundland (Mains 1955). It has recently also been reported from Spitsbergen by Skirgelle (1961), but her illustration seems to indicate another plant, and from Hohe Tatra in Czechoslovakia (Svrček 1962).

In the field *M. gracilis* is readily distinguished from *M. paludosa* by size, colour, usually also on the form of the ascigerous portion, and above all on habit; *M. gracilis* is growing on living mosses, especially *Paludella squarrosa*, whereas *M. paludosa* grows on rotten leaves of higher plants, sticks, etc. In the herbarium, however, it is far more difficult to distinguish between them. Upon drying the colour may become the same in both species, and especially when there are no indications of the substratum, the determination may be rendered rather difficult. The microscopic details of the hymenium, asci, spores and paraphyses, are of little use as they are almost identical in the two species. Small or young specimens of *M. paludosa* may easily be taken for *M. gracilis*, and vice versa.

In search for a reliable character we turned at last to the stipe. This consists entirely of longitudinally running septated hyphae. In the peripheral part of the stipe these hyphae are very much alike in both species, but we

L. lubrica seems to have a distinctly southern distribution within Fennoscandia, at present not being found north of Hammer in Asen parish, Nord-Trøndelag on 63°36' North.

17. *Microglossum olivaceum* (Pers. ex Fr.) Gill.

Akershus: Nes: Arnes, in a meadow at Glomma river, near Arnes public park Oct. 14th 1951 Gudrun Tansem (O) 1 km N. of Arnes, at Glomma river Sept. 1953 Gudrun Tansem (O).

New to Norway. In Sweden this species appears to be somewhat more common than the other species of this genus, *M. viride*. In Norway we have the reverse condition. This may indicate that *M. olivaceum* is a south-eastern species in Scandinavia, whereas *M. viride* has a more south-western distribution in this area, but the present material is too scanty for any definite conclusions.

18. *Microglossum viride* (Pers. ex Fr.) Gill.

Hedmark: Hamar Oct. 25th 1882 Johan Olsen (O).

Akershus: Asker: Billingstads, Bjerkelunden Aug. 25th 1953 FEE (O).
Hordaland: Skånevik: Milja, under *Corylus* on naked soil Aug. 8th 1952 Jens Stordal No. 7574 (B).

Troms: Tromsøysund: Tromsdalen, Storsteinnes, in birch forest Sept. 15th 1960 Ola Skitte No. 1615 (Tromsø).

In Norway previously known from only one place, Duedalen near Kristiansand S. (Nannfeldt 1942 p. 47). Easily recognized by the striking green colour. Very probably it is a rather rare species within Fennoscandia. It is much more common in Denmark.

19. *Mitula abietis* Fr.

New records:

Troms: Tromsøysund: Tromsøya SW of Prestevan, on spruce-needles Oct. 2nd 1960 Ola Skitte No. 1683 (Tromsø). — Lyngen: Övre Karnes, Bakkeia, on moist spruce-needles Aug. 21st 1959 S. Sivertsen (O).

In Norway this species was previously known from only two collections both made in Oslo more than a hundred years ago. Certainly it has been overlooked. Although it occurs on various conifers in Central-Europe and America, it has only been found on spruce-needles in Scandinavia.

20. *Mitula gracilis* Karst.

New records:

Buskjerud: Hol: Ustaoset, Einedalen, in a bog by the stream, on *Paludella squarrosa* Aug. 28th 1960 S. Sivertsen (O).

Hordaland: Eidfjord: Dyranut, on *Drepanocladus exannulatus* Aug. 14th 1960 FEE (O); S. Gjerånut, Gjeråbotn, on *Drepanocladus exannulatus* and *Dicranum majus f. condensatum* July 30th 1953 I. Jörstad (O); Finse, Finseskaret, at 1350 m

found that the width of the hyphae in the central part of the stipe affords a reliable differentiating character: In *M. gracilis* the majority of these hyphae are 3.5–5.5 μ broad, rarely exceeding 7 μ in width. In *M. paludosa* the majority are 13–22 μ broad, and not unusually even more, but rarely less than 8.5 μ. The difference is clearly visible at a magnification of about 400 ×. This character of the stipe has made it easy to identify doubtful specimens, and a blind-test on about 20 collections has convinced us of its reliability. Even in very young specimens of *M. paludosa* the hyphae of the stipe are distinctly broader than in *M. gracilis*. With this character at hand we have revised the older Norwegian collections of both species and found our determinations to agree closely with those of Imai and Nannfeldt, the only exception being mentioned above under Note 1.

As is well known *M. gracilis* usually grows on *Paludella squarrosa*; it may, however, occur on a number of other mosses as appears from our list of localities. Some slight differences in shape and colour of the ascigerous portion of the ascocarp from one collection to another indicate the possible presence of intraspecific taxa. If such taxa exist they will probably exhibit some specialization as regards the substratum, in the way that different taxa occur on different mosses. This does not mean that we should expect a usual host-parasite relation; on the contrary. The relation between *M. gracilis* and the mosses is on the whole not clearly understood. Nannfeldt (1942 p. 4) expressed his view in the following way: 'as the mosses look absolutely healthy, there is no reason to believe that this species is parasitical'. On the other hand we have repeatedly observed how the ascocarps of *M. gracilis* occurred within almost circular brown patches of the moss mats. This was especially beautifully developed in Flinneskaret August 9th 1960 where the numerous brown patches among the usual vivid green of *Philonotis tomentella* caught the eye. The fruit-bodies were absent in some of these patches, but in others the ascocarps even occurred in an almost perfect circle. Mr. S. Sivertsen has made similar observations in Northern Norway.

The above observations clearly indicate the activity of a fungus mycelium growing radially among the mosses. A microscopical examination of the brown parts of the moss mats, however, did not show any fungal hyphae within the cells of the moss. On the other hand the chloroplasts seemed to have been completely disintegrated and in some cases the cell walls of the leaves had been perforated. To us, these observations suggest that the fungus is not a parasite, but that it has a toxic effect on the moss.

More detailed field and laboratory studies are needed to reveal the true relation between fungus and moss.

The procedure used in making slides for the examination of the stipe is as follows: A small piece of the stipe is dipped in 96% alcohol for a few seconds, then placed in water for about 5 minutes. This swells the stipe to natural size. The stipe is then cut lengthwise with a sharp scalpel and placed with the inside turned up on a slide in 50–60% lactic acid stained with cotton blue.

21. *Mitrella multiformis* (E. Henn.) Mass.
In Norway this species is only known from the type collection on Hummel-fjell in Os, Hedmark (Hennig 1885). There is only one additional gathering, viz. from Lule Lappmark in Sweden (Nannfeldt 1942). The species is endemic to Fennoscandia. Lange's (1957) report of this species from W. Greenland is very probably based on *Helotium clavus*. No further information on its distribution is available.

22. *Mitrella paludosa* Fr.

Counties and parishes (municipalities) of Norway in which it is known to occur:
Östfold: Halden, Råde, Øymark. — Akershus: Frogn, Ås, Enebakk, Sør-Aurdal, Sør-Fron. — Buskerud: Hurum, Nore. — Vestfold: Stokke, Nøtterøy, Sandar. — Telemark: Kviteseid. — Aust-Agder: Fjostå, Fjære, Rogaland: Sokndal, Høyland. — Hordaland: Skånevik, Olen, Filtjar, Strandebarm, Odda, Kinsarvik, Ulvik, Granvin, Voss, Os, Fana, Bergen, Samnanger, Brunvik, Åsane, Askøy. — Sogn og Fjordane: Sognal, Førde, Bru, Kinn, Innvik. — Møre og Romsdal: Sunnivaen, Volda, Gryten, Bolsøy, Sør-Aukra, Erei. — Sør-Trøndelag: Oppdal, Trondheim. — Nord-Trøndelag: E. of Meraker, Leksvik. — Nordland: Alstendy. — Finnmark: Karasjok. E. of Karasjok, at Diljokka July 17th 1956 S. Sivertsen (Troms); the Annarjok-Gorzejok valley, by Azkasjokka near Conga July 23th 1961 S. Sivertsen (O).

For the difference between this species and *M. gracilis* see under that species.
M. paludosa has not been found above the tree-limit. In southern Norway it shows a slight tendency to coastal distribution. Its occurrence in Karasjok, however, clearly shows that it is not a true coast plant. The rather isolated stations in Karasjok are probably connected with occurrences in Northern Sweden where the species is found north to Pajala in Norrbotten (Nannfeldt 1942), or in Northern Finland. *M. paludosa* was recently reported from W. Greenland by Lange (1957) but his specimens are typical *M. gracilis*. *M. paludosa* is remarkable in that ascocarps usually appear in spring or early summer, with a distinct peak of frequency in June.

23. *Mitrella sclerotiorum* (Rostk.) Rostk.

This species was reported from Norway for the first time by Röed (1954). According to him it seems quite likely that *M. sclerotiorum* in fact does not have sclerotia, but is only parasitizing the sclerotia of *Sclerotium triflorum*. In that case the distinction Whetzel (1945) made between *Verpatinia* with sclerotia, and *Mitrella* without, has no standing at all. *Sclerotium* Imai (1941) was defined in much the same way as *Verpatinia* and is probably congeneric.

* Not in Opland as maintained by Nannfeldt (1942).

24. *Spathularia flavida* Pers. ex Fr.

New records:
 Åkershus : Nes : Arnes, above Vestesjøen Aug. 1952 and Aug. 24th 1960 Gudrun Tamsem (O). — Fet : Tienskogen Sept. 17th 1950 S. R. Manum, A. Hagen & FEE (O). — Eidsvoll : Minnesund, Bunes Aug. 11th 1957 M. & O. Sörum (O).
 Oslo : E of Greståsen Aug. 5th 1951 FEE (O).
 Hedmark : Nes : Sandvoll Aug. 23rd 1958 F. Wischmann (O); Herstad Aug. 19th 1960 F. Wischmann (O). — Furres : Brumundal Sept. 18th Kåre Prøven (O). — Øvre Rendal : Valley S of Trønneskampen, by Rybekken at about 650 m alt., Sept. 26th 1960 R. Berg (O).
 Oppland : Ringebu : Fåvang, near Kampen Sept. 18th 1960 FEE (O).
 Buskerud : Nes : Rukkedal, between Jordsjø and Storalhøfjellene Aug. 19th 1960 FEE (O).
 Vestfold : Larvik : Hamnerdalen Sept. 6th 1936 O. A. Høeg (T).
 Telemark : Gransherad : Bolkesjø Aug. 1948 A. Bratsberg (O).
 Sør-Trøndelag : Trondheim : Elsterparken Sept. 6th 1953 Mrs. Thaulow (T); Tiselndammen Sept. 3rd 1933 and Sept. 1st 1935 O. A. Høeg (T), and Sept. 3th 1954 T. Overland (T); Baklidammen Sept. 15th 1953 Maria Sveinungson (T); Bymarka, Gramskarret Aug. 16th 1954 O. Gjærevoll (T). — Strinda : Follsjøen Sept. 17th 1953 FEE (O).
 Nord-Trøndelag : Stjørdal : Kvithamar Sept. 16th and Oct. 18th 1953 E.H. Røll-Hansen (O).
 Troms : Lyngen : Øvre Karnes, Bakkeia, in spruce plantation Sept. 4th 1958, Aug. 21st 1959 and Sept. 3rd 1961 S. Sivertsen (O and Tromsø).

The existence of a second species, *Sp. rufa* Sw., in Fennoscandia was discussed in detail by Nannfeldt (1942). *Sp. rufa* differs from *Sp. flavida* in not being bright vitellinous or golden yellow, but much duller, often brownish or greyish-brown. He concluded, however, that in reality the so-called *Sp. rufa* represents only a rare modification, induced perhaps by unfavourable weather conditions. While we are not absolutely convinced of the validity of the conclusion drawn by Nannfeldt, we feel the necessity of more field experience before re-establishing *Sp. rufa* as a distinct species.
Sp. flavida shows a distinctly eastern distribution within Fennoscandia, not being met with on the western coast of Norway.

25. *Spragueola vitellina* (Bres.) Nannf.

Oslo : Bänntjern in Nordmarka Aug. 21st 1906 J. Egeand (O).

New to Norway. The genus *Spragueola* is separated from *Mitruia* by the lack of paraphyses in the former. The genus was earlier unknown in Fennoscandia (cf. Imai 1940, Nannfeldt 1942). Evidently the present collection, correctly identified by Egeand as *Mitruia vitellina* (Bres.) Sacc., has gone unnoticed by the said authors. The determination has most kindly been verified by Professor Nannfeldt, who at the same time has informed me that the species has recently also been found in Sweden.

26. *Trichoglossum hirsutum* (Pers. ex Fr.) Boud.

New records:
 Ostfold : Eidsberg : Eidsberg Sept. 18th 1895 S. O. F. Omang (O).
 Åkershus : Berum : Fornebu, Langodden Sept. 2nd 1950 H. Rui & FEE (O).

27. *Trichoglossum walteri* (Berk. ex Cke.) Dur.

New records:
 Oslo : Lurhullet (between Movatn and Sandermossen) Sept. 15th 1946 F. Røll-Hansen (O).
 Åkershus : Asker : Near Tranevåln in Bergsmarka, grassy spots in coniferous wood Sept. 26th 1961 R. Berg & FEE (O).

In Norway this species was previously known from nine places (Imai 1940, Nannfeldt 1942). It occurs only in the lowlands, and our present knowledge seems to indicate that it has a slightly southern or south-eastern distribution within Fennoscandia. The ecological amplitude is, as pointed out by Nannfeldt (op. cit. p. 5), unusually wide; it may grow on rather dry naked soil, in moist sand and even in wet peatbogs.

Earlier known from three findings in the neighbourhood of Oslo (Imai 1940). Identified by the 7-septate spores of medium length (our specimens: 70—110 μ), and the rather filiform, straight or slightly curved paraphyses. Ascic clavate 200—250 \times 15—22 μ , 8-spored. Spores cylindrical clavate, tapering below, 70—100 \times 5.5—7.4 μ , ultimately 7-septate, but many ripe spores thick, straight or somewhat curved, not constricted at the septae, brown, somewhat agglutinated above. Setae few, brown, only uppermost cell with thickened and coloured walls, this cell 80—100 μ long.

DISTRIBUTIONAL PATTERNS WITHIN FENNOSCANDIA

It is quite evident that much more data on occurrence and frequency are needed to make definite statements about the distributional patterns of each species of the Geoglossaceae. Nevertheless some indications may be made, and below some of the species are tentatively grouped according to their distribution as we know it today.

Arctic-alpine:
Mitruia gracilis, most certainly, as indicated by Favre (1949), Lange (1957), and others.

Corynetes globosus, endemic, only known from alpine and northern places in Fennoscandia.

Geoglossum vlueningianum, endemic, only known from Northern Fennoscandia.

1. The taxonomy of the genera of Geoglossaceae is shortly discussed, and, contrary to Mains (1955), *Corynetes* is retained as a separate genus.

2. The taxonomic position of *Vibrisssea* and *Apostemium* is considered in view of recent studies by Bellemère (1960) and Kjølner (1960). These genera are inseparable and should not be placed in different families as was done by Mains (1956a). The spores are widely different from those of any member of the Geoglossaceae, and none of these genera should be included in that family.

3. An enumeration of the known Norwegian Geoglossaceae is given, raising the number of species occurring in the area to 27, including two new species, viz. *Corynetes geoglossoides* Eckbl., and *Geoglossum alpinum* Eckbl.

4. The width of the hyphae in the central part of the stipe is found to be a useful character in distinguishing dried specimens of *Mitrella gracilis* and *M. patudosa*. These hyphae are distinctly broader in *M. patudosa*.

5. Distribution within Fennoscandia. Some of the species are tentatively grouped in different floristic elements.

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SUMMARY

Montane-alpine :
Geoglossum montanum, endemic, several stations in the subalpine region of Norway and Sweden.
Geoglossum alpinum, endemic, only known from two places in the alpine-subalpine region of South-Central Norway.
Mitrella multiformis, Fennoscandia, only known from two places in the alpine-subalpine region.

North-European :
Geoglossum starbäckii, only known from Norway, Sweden and Denmark, but may have been misidentified in other countries.

Southern :
In this group we include species which occur only in the lowlands, and mostly have a distinct northern limit within the area studied.
Leotia lubrica, rather unevenly distributed, but neither on record above the tree-limit, nor known from Northern Fennoscandia.
Trichoglossum walteri. In Sweden occurring only in the South, in Norway only around Oslo.
Trichoglossum hirsutum? Decidedly southern in Norway, not so much so in Sweden. Ought perhaps to be grouped with the eastern species.
Mitrella patudosa has a slightly coastal distribution in Norway where it does not occur above the tree-limit.

Eastern :
In this group we include species which have a distinctly western limit in Fennoscandia. As these species seem to be more or less closely associated with coniferous woods, especially spruce-forests, it is possible that their restricted, eastern distribution is more dictated by edaphic than by climatic factors. If this is the case, *Mitrella abietis* certainly also belongs here. Its distribution within Fennoscandia, however badly known, is decidedly governed by the fact that it grows only on spruce-needles.
Cudonia circinans, not common. It occurs both in Sweden and Norway, but is not known to occur in Western Norway.
Cudonia confusa is more common than the preceding one, but with the same pattern of distribution.

Spathularia flavida is not known to occur above the tree-limit, or in Western Norway. In the north it has been found in plantations of spruce. Finally we have some species which have their distribution restricted by very narrow edaphic amplitudes: *Geoglossum glabrum* in *Sphagnum*-bogs only, *Mitrella sclerotiorum* parasitic on *Sclerotinia triflorum*, *Corynetes arenarius* on sand-dunes or in very sandy, moderately wet places, *Geoglossum cookianum* as the preceding species but less pronounced, and *Mitrella abietis* mentioned above.

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