

## The genus *Pleospora* s. l. from Svalbard

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A critical account is given of the thirteen species of *Pleospora* s. l. recognized from Svalbard, viz. *Cilioplea coronata*, *Montagnula spinosella*, *Pleospora androsaces*, *P. arctica*, *P. ascodedicata*, *P. comata*, *P. glacialis*, *P. helvetica*, *P. penicillus*, *P. spetsbergensis*, *P. wulfii*, *Pyrenophora raetica*, and *Pyr. subalpina*. *Pleospora arctica* Karst. is reinstated for *P. arctagrostidis* Oud. It is not a synonym of *P. islandica* Johans., as generally believed. The latter species is not known from Svalbard, but a very close ally is *P. wulfii* Lind. Several species recorded from Svalbard by Lind have not been found in this study, and the records seem doubtful. An obvious trait of Svalbard *Pleosporae* is the tendency towards the reduction of the setae. These are considered to have a protective function against mycophagous arthropoda, and their reduction in Svalbard collections may be related to the paucity of these animals there.

Keywords: Taxonomy, floristic study, Pleosporales, Ascomycetes.

During the ISAM III Symposium on Svalbard, 11–20 August 1988, several ascomycetes were collected. Holm & Holm (1993) have described the ascomycetes growing on *Dryas octopetala* in Svalbard. This paper describes species of *Pleospora* s. l., including *Cilioplea* Munk, *Montagnula* Berl., and *Pyrenophora* Fr. As the group presents many taxonomic problems, it is appropriate to treat it in detail.

During the last decades *Pleospora* has been thoroughly studied by several investigators. Wehmeyer's (1961) world monograph is still the basic reference, even though his taxonomic conclusions sometimes can be disputed. Other works include Eriksson's (1967) treatment of the Scandinavian graminicolous species, and Crivelli's (1983) monograph, with emphasis on the taxa of Central Europe. Noteworthy also are the contributions by Scheuer (1988) and Nogrsek (1990). However, *Pleospora* is still an exasperating assembly. Several Svalbard specimens proved difficult to be accommodated in the current classification schemes and we found ourselves compelled to modify them in some respects, especially with regard to the *P. helvetica* complex.

Specimens cited are preserved at UPS and collected by the authors, if not otherwise stated.

### Some characters and concepts

#### Setae

The presence or absence of setae on the ascomata is a feature generally considered to be of great taxonomic value, and it is frequently used in identification keys. However, the character should be used with caution, as emphasized by Barr (1968: 800) referring to the Venturiaceae. Eriksson (1967: 371, as *Pleospora subalpina*) drew attention to the fact that *Pyrenophora subalpina*, whilst setose in the Alps, is non-setose in Svalbard. This situation applies also to *Pyr. raetica*. Eriksson (1967: 371) has also pointed out that both setose and non-setose forms of *Pyr. subalpina* occur in northern Scandinavia. Apparently the character is unstable. This is confirmed by the study of collections of *Pleospora penicillus* and *P. helvetica* from Svalbard. Strongly setose ascomata occur, but forms with more or less reduced setae are also frequent and have often incorrectly been identified as *P. scrophulariae* (syn. *P. vulgaris*) and *P. herbarum*, respectively. The setae may have a protective function against mycophagous arthropoda, and their apparent reduction in the Svalbard collections may be related to the paucity of these animals there.

The setae are generally dark brown, but the degree of pigmentation is variable and probably genetically determined. Light setae are often seen in arctic forms of *P. helvetica* and *P. comata*, and are said to characterize the problematic taxon *P. tragacanthae* (see discussion of *P. helvetica*).

Because of this variability we have attempted to construct a key without referring to the setae.

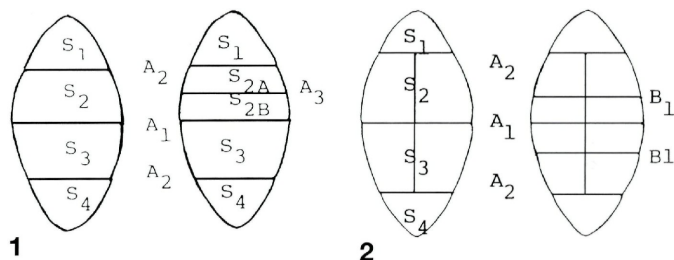
#### Spores and spore terminology

Eriksson's (1967: 342) spore terminology is adopted here, slightly modified as follows: All *Pleospora* spores pass through an early 4-celled stage. These cells correspond to the future segments S<sub>1</sub>–S<sub>4</sub>. The first septa in these segments are often longitudinal septa (cfr. Fig. 2, or the illustrations of *Pleospora herbarum* by Crivelli 1983: 49), but especially S<sub>2</sub> and S<sub>3</sub> can also be divided into subsegments by additional transversal septa (A-septa) before any longitudinal septa are inserted. These subsegments are referred to by letters (Fig. 1). In Fig. 1, S<sub>2</sub> in the spore on the left-hand side corresponds to S<sub>2A</sub> + S<sub>2B</sub> in the spore on the right. We believe that this method of designation will facilitate comparison between different spores.

The spore morphology in many species is quite complex because of the three-dimensional septation with numerous transverse and longitudinal septa, many of which are incomplete. To fully ascertain the mode of construction would demand a study of serial transverse sec-

tions (cfr. Figs. 3M, 5D). Thus the reports on septation, particularly the number of longitudinal septa, are mostly simplified and refer to a given optical section.

The spore wall ornamentation in some species is a constant and reliable character, as in *P. androsaces* and *Montagnula spinosella*, but in other cases it seems to be variable and of doubtful taxonomic value, as in the *P. helvetica* complex. In many samples the spores have a minutely rough wall, as seen in oil immersion; in others the spores seem to be perfectly smooth.



Figs. 1-2. - 1. Schematic young spores with symbols for septa, segments, and sub-segments (explanation in text). - 2. *Pyrenophora raetica*, schematic spores (explanation in text).

In most species the spores are provided with a mucous sheath, often as thick as the spore or thicker. However, the size of the sheath is apparently variable, and, in fact, the sheath may even be lacking in sundry spores (cfr. Fig. 6B).

*Pleospora* spores, especially the pluriseptate ones, reach their full maturity only very late, often not until outside the asci, which can greatly affect their size and septation. Bewildering is also the great variability in spore type inherent in many species and often seen in the same ascoma. Thus a given species is characterized rather by several spore types than by one, though one spore type may be most frequent.

### Species concept

The delimitation of *Pleospora* taxa is quite problematic in several cases (see also Wehmeyer, 1961). In Svalbard particularly the *P. helvetica* complex comprises a continuous series of forms, from *P. penicillus* with small, 5-septate spores to *P. comata* with large, up to

11-septate spores. We are using a practical, empirical species concept and our taxonomic judgments are sometimes necessarily subjective. However, at present nothing else seems workable. It is a moot question whether or not a biological species concept is at all applicable in *Pleospora*. Crivelli (1983) found that practically all of the species were capable of forming their teleomorphs in monospore cultures. They are apomicts and consequently could be a counterpart of e. g. *Hieracium* among the vascular plants, with innumerable 'microspecies' classified into a number of sometimes vaguely defined 'macrospecies'. However, the situation may be more complicated with only facultative apomixis: We cannot exclude the occurrence of vegetative anastomoses between different mycelia, leading to heterocaryosis, possibly also parasexuality.

### Artificial key

- |    |   |                              |
|----|---|------------------------------|
| 1  | Spores hyaline, multiseptate; on <i>Dryas</i> wood ...  | 9. <i>P. ascodedicata</i>    |
| 1* | Spores yellow brown to dark brown .....   | 2                            |
| 2  | Spore wall with a network of cracks .....   | 5. <i>P. androsaces</i>      |
| 2* | Not so .....  | 3                            |
| 3  | Spore wall strongly verrucose, reddish brown .....  | <i>Montagnula spinosella</i> |
| 3* | Spore wall smooth or almost so .....  | 4                            |
| 4  | Spores with light end cells; on <i>Stellaria</i> .....  | 8. <i>P. wulffii</i>         |
| 4* | Not so .....  | 5                            |
| 5  | Ascomata reddish brown when moist; mostly on monocots .....   | 7. <i>P. arctica</i>         |
| 5* | Ascomata dark brown .....   | 6                            |
| 6  | Caudate spores frequent; ascomata 'crowned' by thick-walled hairs .....   | <i>Cilioplea coronata</i>    |
| 6* | Not so .....  | 7                            |
| 7  | First spore septum (A <sub>1</sub> ) supramedian; on <i>Dryas</i> wood .....  | 6. <i>P. spetsbergensis</i>  |
| 7* | First spore septum (A <sub>1</sub> ) median.....  | 8                            |
| 8  | Each hemispore subdivided by a subterminal A <sub>2</sub> -septum; a layer of narrower cells on each side of A <sub>1</sub> ..... | 9                            |

- 8\* Each hemispore subdivided by a median A<sub>2</sub>-septum; the cells next to A<sub>1</sub> not markedly narrow ..... 10
- 9 Spores mostly with 5 transversal septa ..... 1. *Pyr. raetica*
- 9\* Spores mostly with 7 transversal septa ..... 2. *Pyr. subalpina*
- 10 Most spores with 5 – 6 transversal septa ..... 1. *P. penicillus*
- 10\* Spores with more transversal septa ..... 11
- 11 Most spores with 7 transversal septa ..... 12
- 11\* Most spores with 8–11 transversal septa ..... 4. *P. comata*
- 12 Most spores with length/width ratio = 2. 0 ..... 3. *P. glacialis*
- 12\* Most spores with l/w ratio = 2. 2–2. 5 ..... 2. *P. helvetica*

**Cilioplea** Munk, Dansk Bot. Ark. 15(2): 113 (1953)

The genus was established for *Pleospora coronata* Niessl and is well characterized by the caudate spores and the ostiolar 'corona' of bristle-like hairs. In fact, it is not close to *Pleospora* s. str., but rather to *Nodulosphaeria* Rabh., as suggested by Crivelli (1983: 170).

*Cilioplea coronata* (Niessl) Munk, Dansk Bot. Ark. 15(2): 113 (1953). – Figs 3A, 4A–C.

The great variability in spore form and spore septation is a characteristic trait of this species, also in the Svalbard material. The spores are 18–25(–30) x 7–9. 5 µm in size, with 4–8 (most frequently 6) transversal septa, and 1 longitudinal septum in one or more subsegments, rather irregularly. Young spores are yellow, older spores brownish. A gelatinous sheath seems to be lacking, though present consistently in Central Europe (*vide* Crivelli 1983: 173).

*C. coronata* has not been reported from Svalbard before, but there are unverified records from Novaya Zemlya and Waigatsch (Lind 1934: 44, as *Pleospora coronata*).

Svalbard specimens seen. – On *Cerastium arcticum*: Kongsfjord area, W of the Lovén glacier, 12. 8. 1988, 5063c. – Treurenberg Bay, Pt Crozier, 2. 7. 1899, Wulff. – On *Draba corymbosa*: Isfjorden area, N shore of Gipsvika, 15. 8. 1988, 5135e. – On *Oxyria digyna*: Ny-Ålesund, 11. 8. 1988, 5020e. – 14. 8. 1988, Lundqvist 17384b. – On *Papaver dahlianum*: Ny-Ålesund, 14. 8. 1988, 5123a. – Isfjorden area, Endalen, 17. 8. 1988, 5191f.

**Montagnula** Berlese, Icon. Fung. 2: 68 (1896).

The genus was erected to accommodate two *Pleospora* species on *Agave*, but has later been considerably broadened by Wehmeyer

(1961: 242, as *Pleospora* subg. *Montagnula*) and by Crivelli (1983), who included *Pleospora spinosella* Rehm and its allies (as *Montagnula* subg. *Rubiginospora*), and *P. opaca* Wegelin.

*Montagnula spinosella* (Rehm) Crivelli, Diss. ETH Zürich 7318: 160 (1983). – Fig. 4D.

This species is distinctive by its copper brown, strongly verrucose spores. Both Eriksson (1967: 369) and Crivelli (1983: 161) emphasize the great variability in spore form, a trait, however, that we have not noticed in the Svalbard material. On the contrary, this seems rather uniform, with spores 36–42 × 13–16 µm, predominantly 7-septate, with 1–2 longitudinal septa in the median subsegments.

Lind (1928: 25) recorded the species from Svalbard under the dubious name *P. junci* Pass. & Beltr. 'on *Juncus arcticus*, *Juncus biglumis* and *Luzula nivalis* from Bell Sound and a few places in Ice Fjord'. This statement is open to doubt. In C two samples are identified as '*P. junci*' by Lind: (1) Svalbard, Bell Sound, July 1838, Vahl, and (2) on *Juncus arcticus*, Sweden, Torne Lappmark, Björkliden, July 1930, Lind. In the first sample we have found only *P. helvetica*, in the second one only *P. islandica*. Anyhow, *M. spinosella* does occur on Svalbard, though hardly common.

Svalbard specimens seen. – On *Carex misandra*: Kongsfjord area, near the Lovén glacier, 12. 8. 1988, 5044c. – On *Colpodium vahliianum*: Ny-Ålesund, 14. 8. 1988, 5121f. – On *Deschampsia caespitosa*: 17. 8. 1988, Lundqvist 17501a (S). – On *Luzula confusa*: Ny-Ålesund, 11. 8. 1988, 5004b.

***Pleospora*** Rabenhorst ex Cesati & De Notaris, Comment. Soc. Critt. Ital. 1: 217 (1863).

*Pleospora* s. str. should ideally be confined to the type, i. e. *P. herbarum*, and its relatives. Among the species treated here, a few seem to be true *Pleosporae*, viz. *P. androsaces* and the *P. helvetica* group (*P. penicillus*, *P. helvetica*, *P. glacialis*, and *P. comata*). Perhaps also *P. spetsbergensis* should be included here. On the other hand, *P. arctica*, *P. ascodedicata*, and *P. wulfii* are only provisionally kept in the genus, for lack of a better alternative.

Members of the *P. helvetica* group are among the most common constituents of the mycoflora on dicotylous herbs in Svalbard and probably in the Arctic in general. Unfortunately the group is taxonomically very troublesome. The four species recognized here can schematically be defined as follows:



Fig. 3. - Spores (oil droplets and mucous sheaths not indicated). - A. *Cilioplea coronata*. - B. *Pleospora penicillus* 'var. *penicillus*'. - C. *P. penicillus* 'var. *ambigua*'. - D. *P. helvetica*. - E. *P. 'tragacanthae'*. - F. *P. glacialis*. - G. *P. comata*. - H. *P. spetsbergensis*. - I. *P. arctica*. - J. *P. wulfii*. - K. *Pyrenophora raetica*. - L. *Pyr. subalpina*. - M. *P. gigantasca*, transverse section. - Bar = 20  $\mu$ m.

- spores with 5–6, rarely 7 transversal septa and 1 longitudinal septum (*P. penicillus*);
- spores mostly with 7, rarely 8 transversal septa and 2–3 longitudinal septa, twice as long as wide (*P. glacialis*), or longer (*P. helvetica*);
- spores with 8 or more transversal septa and mostly 3 longitudinal septa (*P. comata*).

It is doubtful whether any of these taxa can be clearly delimited. Intermediate forms between *P. penicillus* and *P. helvetica* are well known; they have often been referred to as a species of their own, *P. ambigua* (Berl. & Bres.) Wehm., e. g. by Barr (1959: 52) and by Wehmeyer (1961: 190) who emphasized that certain collections 'must be placed arbitrarily'.

1. *P. penicillus* (Schmidt: Fr.) Fuckel, Jahrb. Nassauischen Vereins Naturk. 27/28: 23 (1873). – Figs. 3B–C, 4E–F.

We follow Crivelli (1983: 74) in his circumscription of this taxon, with inclusion of *P. ambigua*. It is characterized by 5–7 transversal septa and as a rule 1 longitudinal septum in 2–4 segments. The Svalbard material has comparatively large and dark spores, (16–)18–28(–30) x (8–)10–14  $\mu\text{m}$ . The setae are very variable in size, from almost absent to at least 80  $\mu\text{m}$  in length.

Crivelli (1983) recognized two infraspecific taxa, *P. penicillus* var. *penicillus* and *P. penicillus* var. *ambigua*, the former characterized by spores with constantly 5 transversal septa and the terminal segments either non-septate or with one longitudinal septum, whilst var. *ambigua* is more variable with 5–7 transversal septa. It seems doubtful whether var. *penicillus* sensu Crivelli (1983) occurs in Svalbard at all. However, we are inclined to assign a few collections to var. *penicillus*, although sundry spores may have a Y-septum in the terminal segments (cfr. Fig. 3B).

As *P. penicillus* s. l. is apparently common and widespread in Svalbard on a large number of dicotylous herbs, the list of the material examined is omitted here. Rather noteworthy is a collection on *Dryas* wood (Longyearbyn, 19. 8. 1988, 5257b). Lind (1928) did not mention *P. penicillus* at all, but his '*P. infectoria*' (Lind, 1928: 25) was certainly *P. penicillus*, at least in part. It was said to be 'very common on many different host plants of Dicotyledones as well as Monocotyledones'. Lind apparently overlooked the often insignificant setae, whilst strongly setose specimens were evidently referred to '*Pyrenophora setigera* (Niessl) Sacc.' (Lind, 1928: 28). Barr (1959: 53, as *P. ambigua*) also found the species to occur 'on both monocotyledons and dicotyledons' in the Canadian Eastern Arctic. In our experience *P. pe-*



*nicillus* is rare on monocots, at least in Svalbard, as we have come across it only once on such a host (*Poa alpina*, Lomme Bay, Cape Fanshave, 1861, Malmgren). Crivelli (1983), too, did not report any collections on monocots.

2. *P. helvetica* Niessl, Verh. Naturf. Vereins Brünn 10: 191 (1876). – Figs. 3D–E, 4G.

Syn.: *P. cerastii* Oudemans, Verslagen Meded. Afd. Natuurk. Kon. Akad. Wetensch., ser. 3, 2: 155 (1885) sensu Lind, non Oudemans (?).

?*P. tragacanthae* Rabenhorst, Hedwigia 16: 118 (1877).

As already mentioned, we include in *P. helvetica* all forms with predominantly 7-septate spores having a length/width ratio generally above 2.0, mostly 2.2–2.5. The longitudinal septa are mostly 2, in large spores often 3 in some subsegments. With this wide circumscription, the spore size will vary from at least  $24 \times 10 \mu\text{m}$  to  $40 \times 18 \mu\text{m}$ . With respect to the setae, *P. helvetica* is a parallel of *P. penicillus*, with a variation from strongly setose ascromata to almost naked ones. Forms of the latter type were identified as *P. herbarum* by Lind (1928: 27), who considered this species to occur on numerous hosts and to be 'found in all localities visited on Spitsbergen and Bear Island'. We strongly doubt this identification and the occurrence of *P. herbarum* in Svalbard or in the Arctic as a whole. All arctic material labelled '*P. herbarum*' examined, including material determined by Lind, represents forms of *P. helvetica* with poorly developed setae. It is noteworthy that *P. herbarum* is apparently lacking in the herbarium collections from the Alps, but is common as an endophyte in alpine plants, *vide* Crivelli (1983: 48).

Several authors have considered the large-spored forms to represent a species of their own, named '*Pyrenophora cerastii*' by Lind (1928: 28), and *P. tragacanthae* by Barr (1959: 61) and Wehmeyer (1961: 198). Barr (1959: 62) remarked that this taxon is 'much like *P. helvetica* in its setose ascostromata and in spore shape and septation. It is larger in all respects'. Wehmeyer (1961: 199) noticed that 'this species is an extension of the morphologic range of *P. helvetica*, and there is some doubt whether it should be kept distinct.' The borderline seems diffuse; moreover, the diagnostic criteria in Wehmeyer's identification key are not in good agreement with his description and illustrations.

*P. tragacanthae* may be more than just a large-spored *P. helvetica*. According to Crivelli (1983: 79), it is characterized by hyaline setae and mainly restricted to leguminous hosts, especially *Astragalus* and *Oxytropis*. The type material is from the French Alps, on *Astragalus tragacantha*. Unfortunately, pigmentation of the setae is an unstable character, and Crivelli (1983: 79) himself pointed out that 'mehrere

Kollektionen aus der Ostschweiz . . . haben schwarze Borsten und sind deshalb schwierig von *Pl. helvetica* zu trennen'. Nevertheless, we have seen two samples of *P. tragacanthae* with almost hyaline setae, both on Leguminosae, (1) on *Astragalus alpinus*, Sweden, Torne Lappmark, Mt Nuolja, 6. 7. 1927, Nannfeldt 837b, (2) on *Oxytropis sordida*, Novaya Zemlya, Jugor Scharr, 15. 9. 1882, Th. Holm. Future research may shed more light on the *tragacanthae*-problem.

*P. helvetica* s. l. is very common in Svalbard on dicotylous herbs. We have seen four collections only on other substrates.

Specimens examined (other than dicotylous herbs). – On *Lycopodium selago*: Longyearbyen, Nybyen, 16. 8. 1988, 5157a. – On *Poa 'colpodea'*: Liefdebay, 2. 9. 1868, Th. Fries (sub *P. herbarum*, det. Karsten). – On *Luzula arctica*: Ny-Ålesund area, near the Lovén glacier, 12. 8. 1988, 5042c. – On *Salix reticulata* leaves and catkins: Blomstrand-halvöya, 13. 8. 1988, 5086.

3. *P. glacialis* Niessl in Rehm, Hedwigia 24: 236 (1885). – Figs. 3F, 4H. Syn.: *P. cerastii* Oudemans, Verslagen Meded. Afd. Natuurk. Kon. Akad. Wetensch., ser. 3, 2: 155 (1885) sensu Oudemans (?), non Lind.

This species is characterized by relatively broad spores, 26–34 x 15–18 µm, with 7 (occasionally 8) transversal septa and usually 3 longitudinal septa in several subsegments. The length/width ratio is generally close to 2. 0, though narrower spores as well as still wider ones may occur.

*P. glacialis* was a largely neglected species, until Crivelli (1983: 84) revived it as a taxon characterized by 'oval' spores and confined to *Cerastium latifolium* s. l. Lind (1928: 28, 1934: 47) synonymized *P. glacialis* with *P. cerastii* sensu Lind, which was essentially a large-spored *P. helvetica*, more or less corresponding to the concept of '*P. tragacanthae*', and Wehmeyer (1961: 199) identified it with *P. tragacanthae*.

There is a broad-spored *Pleospora* on *Cerastium* in Scandinavia and in the Arctic which is a close match of the type of *P. glacialis* from the Austrian Alps (on *Cerastium latifolium*, Tyrol, Sulden, July 1884, Rehm, Ascomyceten no. 829, S). It is apparently rather frequent as we have been able to find it on several collections of *Cerastium arcticum* and *C. regelii*, both species closely related to *C. latifolium*, in UPS. Crivelli (1983) found it only on leaves; it may be more common on leaves than on stems, perhaps with some preference for the leaf apices.

*P. glacialis* is probably not restricted to *Cerastium*, as we have come across three samples on *Oxyria digyna* which on a morphological basis can hardly be distinguished from *P. glacialis*. It should be noted that Crivelli (1983) also recognized some other species with wide spores, e. g. *P. leontopodii* (Cruchet) Müller, which is said to occur on al-



Fig. 4. - A. *Cilioplea coronata*, apical 'corona' (Wulff). - B. *C. coronata* (5020c). - C. *C. coronata* (5123a, Ind. ink). - D. *Montagnula spinosella* (5044c). - E. *Pleospora penicillus* (5215b, Ind. ink). - F. *P. penicillus* (5104b, upper spore in Ind. ink). - G. *P. helvetica* (5096a, Ind. ink). - H. *P. glacialis* (5008a, Ind. ink). - I. *P. androsaces* (5129a). - Bar = 20  $\mu$ m.

pine Compositae, but is also a 'Sammelart für alle auf Blättern lebenden *Pleospora*-Arten mit ovalen, 7-querseptierten Ascosporen' (Crivelli, 1983: 85). To discriminate between *P. leontopodii* and *P. glacialis* probably is a difficult task. Crivelli (1983: 87), however, referred some large-spored arctic collections to *P. leontopodii*.

A special problem is the interpretation of *P. cerastii* Oud., based on material that Oudemans (1885) had found on *Cerastium regelii*, collected by M. Weber on Novaya Zemlya in August 1881 (as *Cerastium alpinum*). According to Wehmeyer (1961: 343), no material is left in Oudemans' herbarium and he concluded that 'the epithet *cerastii* is best dropped, as its application is a mere guess'. Certainly the original description is very poor, hardly leaving other guidance than the spores, said to be 7-septate. However, there is a possibility to identify Oudemans' fungus by examining original material of the host plant. A duplicate of Weber's collection of *Cerastium regelii*, from Matotschkin Scharr, is in UPS, and Nannfeldt succeeded in finding an ascoma on it, as is evident from a slide in UPS. We have also been able to discover a couple of fruit bodies on that material. It seems reasonable to suppose that those ascomata represent Oudemans' *P. cerastii*, and they certainly belong to *P. glacialis*. However, we cannot exclude the possibility that what Oudemans described was *P. helvetica*, which also occurs on *Cerastium*. Both *P. cerastii* and *P. glacialis* were published in 1885. The chronological order of publication can perhaps be ascertained, but it seems preferable to stick to the unequivocal name *P. glacialis*.

Svalbard specimens seen. - On *Cerastium arcticum*: Sørkapp, 25. 7. 1872, Kjellman. - Ny-Ålesund, near the Station, 11. 8. 1988, 5008a. - On *Cerastium regelii*: Björndalen, 14. 8. 1915, Asplund. - Green Harbour, 21. 7. 1915, Asplund. - On *Oxyria digyna*: Adventdalen, 18. 8. 1988, 5224a. - Longyearbyen, 19. 8. 1988, 5251a. - Ny-Ålesund, 14. 8. 1988, Lundqvist 17384 (S).

4. *P. comata* Auerswald & Niessl in Niessl, Verh. Naturf. Vereins Brünn 10: 180 (1872). - Figs. 3G, 5A-D.

The spores of *P. comata* are large, (35-)40-50(-52) x (16-)18-24 µm, and at least a majority of them will, when fully mature, get one or more quaternary septa, which results in 8-11-, exceptionally 14-septate spores. Such forms are not rare in the Arctic (Rostrup, 1888). However, Rostrup's and subsequent identifications are doubtful.

*P. comata* was described on material from a lowland locality (Moravia, Brünn) on *Pulsatilla vulgaris* (syn. *Anemone pulsatilla*). Crivelli (1983: 83) enumerated 7 collections, all on *Anemone* s. l. and all presumably from the lowland. Furthermore, the sole Scandinavian material of *P. comata* known to us is from South Sweden, on *Anemone*



Fig. 5. - A. *Pleospora comata* (5177b, Ind. ink). - B. *P. comata* (5177b). - C. *P. comata* (5177b, Ind. ink). - D. *P. comata*, transverse sections (Kjellman). - E. *P. spetsbergensis* (immature spore on the left, Ind. ink). - F. *P. wulfii* (5166b). - G. *P. wulfii* (5166b, Ind. ink). - H. *P. islandica* (L. H. 1158). - I. *P. ascodedicata*, immature (5091h). - J. *P. ascodedicata*, mature (Switzerland, 3245). - Bars = 40 µm (A), 20 µm (B - J).

*pulsatilla*. There are good reasons to consider *P. comata* as a southern species, restricted to *Anemone* s. l. However, we cannot discriminate, on a morphological basis, between the true *P. comata* and the arctic forms, and we refer them to *P. comata* s. l.

Another taxonomic problem is the delimitation towards *P. glacialis* and *P. helvetica*. Sundry spores of these species, especially of the *tragacanthae*-type, may get quaternary septa. In a sample from Novaya Zemlya (on *Polemonium boreale*, Sinus Rogatschew, July 1875, Kjellman & Lundström) besides normal *comata* spores with 7–11 transversal septa, a few have up to 14 septa. This material may correspond to *P. abbreviata* Fuckel sensu Wehmeyer (1961: 211).

The arctic form of *P. comata* seems to be lacking in the Alps. Many collections from different hosts were reported by Lind (1928: 29).

Svalbard specimens seen. – On *Oxyria digyna*: Longyearbyen, 16. 8. 1988, 5158a. – On *Ranunculus sulphureus*: Longyearbyen, 16. 8. 1988, 5164b. – On *Cochlearia officinalis*: Endalen, 17. 8. 1988, 5177b.

5. *P. androsaces* Fuckel, Jahrb. Nassauischen Vereins Naturk. 29/30: 19 (1875). – Fig. 4I.

An easily recognized species with characteristic spores, which are basally pointed and have a wall with a network of fine cracks. In our collection the spores are 50–58 x 21–24 µm in size and 7-septate. *P. androsaces* is evidently mainly restricted to *Silene acaulis* (never on *Androsace*!). No other host plant was recorded by Crivelli (1983: 89), but Nogršek (1990: 194) also cited two records on *Minuartia gerardii* and one on *Ranunculus alpestris*. Lind (1928, 1934) reported it to be common on many other hosts: 'it is never absent on dead leaves and stems of *Polemonium humile* or *Potentilla pulchella*' (Lind 1928: 29, as *Pyrenophora androsaces*). These statements are dubious and need to be verified by voucher specimens. In UPS of the five samples from Svalbard identified by Lind as '*P. androsaces*' three are on *Polemonium pulchellum* (syn. *P. humile*), the other two on *Arnica alpina* and *Pedicularis lanata*. In all cases the fungus is *P. comata*.

*P. androsaces* is hardly common in the Arctic, and was not mentioned by Barr (1959). Kobayasi & al. (1967) reported it from Alaska, from *Draba lactea*, but this fungus might rather have been *P. comata*.

Svalbard specimen seen. – On *Silene acaulis*: Bünsow Land, N shore of Gipsvika, 15. 8. 1988, 5129a.

6. *P. spetsbergensis* K. Holm & L. Holm, *Bibl. Mycol.* 150. 1993. – Figs. 3H, 5E.

A lignicolous species with asymmetric spores with a submedian constriction; the distal hemispore is shorter and also narrower than the proximal one. Besides, the spores are unusually variable, (16–)20–25(–30) x 6–9(–11)  $\mu\text{m}$ , mostly with 4–5 transversal septa and 1 longitudinal septum. Numerous oil droplets are present in young as well as in mature spores. The species is grown in culture, UPSC 2733, but no anamorph has been formed so far (O. Constantinescu, pers. comm.).

This species would perhaps be better accommodated in *Teichospora*. It has hitherto been found only on *Dryas* wood, and is apparently rather common in Svalbard. A list of localities can be found in Holm & Holm (1993).

7. *P. arctica* Karsten, Öfvers. Förh. Kongl. Svenska Vetensk. –Akad. 2: 97 (1872). – Figs. 3I, 6A–D.

Syn.: *P. arctagrostidis* Oudemans, *Verlagen Meded. Afd. Natuurk. Kon. Akad. Wetensch.*, ser. 3, 2: 154 (1885).

The name *P. arctica* has mostly, but erroneously, been taken as a synonym of *P. islandica* Johans. Eriksson (1967) presented strong reasons to synonymize *P. arctica* with *P. arctagrostidis*. However, he had no access to fully mature material, therefore his spore data are not wholly adequate.

His alternative interpretation of *P. arctica* as a synonym of *P. islandica* is improbable, as the latter species is hardly known from Svalbard, whereas *P. arctica* is very common there. *P. arctica* can already be recognized macroscopically, with a hand lens or under a stereo microscope, by the colour of its ascomata: The fruit bodies are light reddish brown, especially when wet, turning dark only later on. The ascoma wall has a peculiar structure, the outermost layer being formed by rather loosely interwoven, somewhat darker hyphae.

The spore shape is rather variable but can always be derived from a basic type, with 6 A-septa and 1 longitudinal septum in the distinctly swollen segment S<sub>2</sub>. In exceptional cases the septation will stop at this stage, but as a rule the spores have up to 11 transversal septa (A and B) and up to 3 longitudinal septa in several subsegments. Two angular septa are often laid down terminally, forming a 'V'. The spores are pale yellow when young, brown or greyish brown when ripe, very often contain numerous small oil drops, and are (30–)35–45(–50) x 12–18(–20)  $\mu\text{m}$ , mostly provided with a thick mucous sheath.

Extreme spore shapes are in fact so dissimilar that we were at first inclined to regard them as different taxa, but they are intergra-

ding. One extreme has obtuse spores with septum  $A_1$  distinctly supra-median (0.4) because of a stronger growth of the distal hemispore.  $S_2$  is markedly swollen, which makes the spore look 'mummy-shaped'. The other extreme has more pointed and also narrower spores, with  $S_2$  less prominent. The septum  $A_1$  will remain median or can even be somewhat submedian. Most of the material studied is more or less close to the first-mentioned form: Here belongs, e. g., the co-type of *P. arctagrostidis* traced by Eriksson (1967: 355; on *Arctagrostis latifolia*, Novaya Zemlya, Matotschkin Scharr, Aug. 1881, Weber, UPS). The other extreme, with pointed spores, seems to be less common, but is apparently the fungus reported by Lind (1928: 24) as *P. karstenii* Sacc., and erroneously identified as *P. islandica*. The neotype of *P. arctica* (on *Poa 'colpodea'*, Svalbard, Liefdebay, 2. 9. 1868, MICH) designated by Wehmeyer (1961: 86) is closer to the second extreme (cfr. Fig. 6A).

Wehmeyer (1961: 86) treated *P. arctica* as a variety of *P. heleocharidis* Karst. It is unlikely that the latter taxon, from southern Finland, would be conspecific with the high arctic *P. arctica*. The type material is not in a good state and fresh, well developed material is needed to evaluate the taxon.

The true generic position of *P. arctica* is uncertain. Eriksson (1967: 357) suggested *Phaeosphaeria*. An anamorph might shed light on the problem, but efforts to grow the species in culture have failed, as the ascospores did not germinate (O. Constantinescu, pers. comm.).

Svalbard specimens seen. — *P. arctica* is common in Svalbard and since it is the most frequent *Pleospora* found on grasses there, we refrain from listing all the collections. It occurs also on other monocots, although less often. We have found it on *Eriophorum scheuchzeri* (5147e, 5225c), *Juncus biglumis* (5175f), and *Luzula arctica* (5099c). More remarkable are a few records on dicots, viz. on *Draba corymbosa* (5105a), *Cerastium arcticum* (5155b), and *Ranunculus sulphureus* (5164 a). Most of these collections are of the '*arctagrostidis*-form', but 5105a and 5225c are closer to the other extreme.

8. *P. wulfii* Lind, Skrift. Svalbard Ishavet 13: 27 (1928). — Figs. 3J, 5F–G (5H = *P. islandica*).

This is an overlooked species, identified by Wehmeyer (1961: 85) as *P. heleocharidis* Karst., i. e. *P. islandica*. The close affinity to *P. islandica* is quite evident and the two taxa can hardly be separated on a morphological basis. Nevertheless, we think it is justified to treat *P. wulfii* as a distinct taxon, restricted to *Stellaria longipes* s. l. *P. islandica*, to the best of our knowledge, has not been found in Svalbard.

The material studied is fairly uniform, with spores 40–50 × 11–14 µm, generally with 7 transversal septa ('semper 7-septatis', *fide* Lind, 1928: 27) and 1 or 2 longitudinal septa usually in several subsegments.





Fig. 6. – A. *Pleospora arctica* (neotype). – B. *P. arctica*, upper spore without halo (5264b, Ind. ink). – C. *P. arctica* (Berlin). – D. *P. arctica* (5161c, Ind. ink). – Bar = 20  $\mu$ m.

The terminal cells are distinctly lighter as is typical for *P. islandica*, otherwise the spores are yellow-brown.

*P. wulfii*, like *P. islandica*, is not a true *Pleospora* but is certainly related to *P. arctica*. It is a northern species, restricted to *Stellaria longipes* s. l. It was described from Svalbard and has since been reported from Greenland and Novaya Zemlya (Lind 1934: 43).

Svalbard specimens seen. – On *Stellaria longipes* s. l.: Wijdebay, 17. 7. 1899, Wulff (isotype, S). – Longyearbyen, Nybyen, 16. 8. 1988, 5166b. – Endalen, 17. 8. 1988, Lundqvist 17485a (S).

9. *P. ascodedicata* K. Holm, L. Holm & Nogrased in Nogrased, *Bibl. Mycol.* 133: 194 (1990). – Fig. 5I–J.

A very peculiar fungus, only provisionally referred to *Pleospora* and as far as known restricted to old wood of *Dryas*. For a full description see Nogrased (1990). The small ascomata are superficial and the ascospores are hyaline, very large, at maturity divided by numerous septa into a large number of very small cells of equal size. Nogrased (1990) described the spores as being 46–86 x 18–32  $\mu\text{m}$ , with 14–18 transversal and 6–8 longitudinal septa.

Our Svalbard material is scanty and immature, but in all probability belongs to this species, previously known only from Scandinavia and the Alps.

Svalbard specimens seen. – Ny-Ålesund area, near the Lovén glacier, 12. 8. 1988, 5050n. – Blomstrand-halvöya, near Camp Mansfield, 13. 8. 1988, 5091h.

***Pyrenophora*** Fries, *Summa Veg. Scand.*, sect. post.: 397 (1849).

Crivelli (1983) has assigned *P. raetica* and its allies to *Pyrenophora*. *Pyr. raetica*, *Pyr. subalpina*, and *Pyr. phlei* (the latter only known from the type collection from the Alps on *Phleum phleoides*) form a characteristic, apparently arctic-alpine group confined to monocots, mainly grasses (Müller, 1951; Crivelli, 1983: 120).

The *Pyr. raetica*-group has an unusual spore type: The two A<sub>2</sub>-septa are not laid down medially in the hemispores, but are somewhat subterminal (cfr. Fig. 2 and Fig. 7). In addition, the two B<sub>1</sub>-septa are not median either in their segments (S<sub>2</sub> and S<sub>3</sub>, respectively), but are closer to A<sub>1</sub>, as already pointed out by Eriksson (1967: 370) for *Pyr. subalpina*. In this way two layers of short cells are formed, one on each side of A<sub>1</sub>. Otherwise the spore cells are large, e. g. when compared to the *P. helvetica*-group.

The species are said to have strongly setose ascomata in the Alps, but they seem to be devoid of setae in Svalbard, as emphasized by Eriksson (1967: 371) for *Pyr. subalpina*. A sample from Greenland (on *Alopecurus alpinus*, Nordre Strömfjord, 8. 7. 1879, Kornerup) is a setose *Pyr.* cfr. *raetica*.

The members of the *Pyr. raetica*-group cannot be clearly delimited; in fact, *Pyr. phlei* was included in *Pyr. raetica* by Wehmeyer (1961: 129, as *Pleospora raetica*), and we have one collection (5143b)

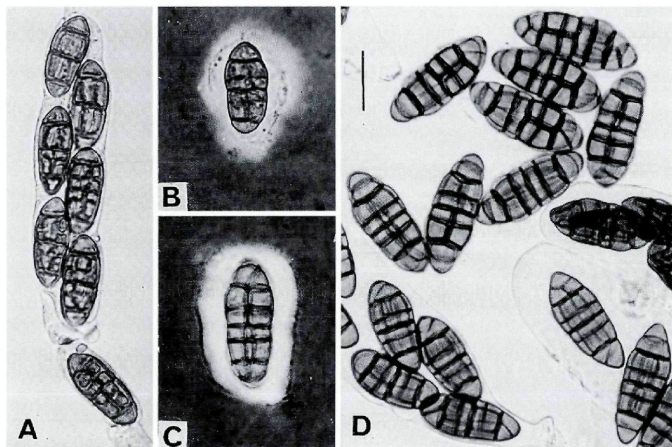


Fig. 7. – A. *Pyrenophora raetica* (5133a). – B. *Pyr. raetica* (5133a, Ind. ink). – C. *Pyr. subalpina* (5184c, Ind. ink). – D. *Pyr. subalpina* (5169d). – Bar = 20  $\mu$ m.

which seems fairly intermediate between *Pyr. raetica* and *Pyr. subalpina*.

1. *Pyr. raetica* (Müller) Crivelli, Diss. ETH Zürich 7318: 121 (1983). – Figs. 2, 3K, 7A–B.

Syn.: *Pleospora raetica* Müller, Sydowia 5: 272 (1951).

This species has so far been recorded only in the Alps, but it is apparently not rare in Svalbard. Except for the non-setose ascomata, our material agrees fairly well with the type. The spores are 24–34 x 11–17  $\mu$ m, generally 5-septate (3 A- and 2 B-septa) with 1 longitudinal septum in S<sub>2</sub> and S<sub>3</sub> and the terminal segments non-septate. It is not rare, though, that 2 longitudinal septa occur in S<sub>2</sub> and/or S<sub>3</sub>. One terminal segment (exceptionally both) may have an angular or a 'Y'-formed septum.

In the Alps *Pyr. raetica* has been found solely on *Trisetum distichophyllum* (a grass confined to the mountains of Central and South Europe), in Svalbard it seems to prefer the interrelated genera *Phippsia*, *Poa*, and *Puccinellia*. It must be mentioned that *Pyr. raetica* is so far not known from Scandinavia, but we have seen one sample from Iceland and one from Greenland.

Svalbard specimens seen. – On *Phippsia algida*: Advent Bay, 5. 8. 1868, det. O. Eriksson. – Brandewijne Bay, 5. 9. 1868, T. M. Fries, det. O. Eriksson. – Kobbe Bay, 8. 1868, T. M. Fries, det. O. Eriksson. – Nordkapp, 7. 9. 1868, T. M. Fries, det. O. Eriksson. – On *Poa alpigena*: Cape Thordsen, 1870, Nathorst. – On *Poa arctica*: Lomme Bay, 24. 8. 1861, Malmgren. – On *Puccinellia angustata*: Adventdalen, 18. 8. 1988, 5223a. – Gipsvika, 15. 8. 1988, 5133a. – A somewhat doubtful specimen, approaching *Pyr. subalpina*, is on *Dupontia pelligera* (Gipsvika, 15. 8. 1988, 5143b and Lundqvist 17401c, S).

2. *Pyr. subalpina* (Müller) Crivelli, Diss. ETH Zürich 7318: 120 (1983). – Figs. 3L, 7C–D.

Syn.: *Pleospora subalpina* Müller, Sydowia 5: 274 (1951).

A species closely related to *Pyr. raetica*, but generally distinctive by larger spores with septate end segments. In the Svalbard material the spores are (30–) 34–39 x 12–16  $\mu\text{m}$ , which is a little less than the figures given by Crivelli (1983: 121) for Swiss *Pyr. subalpina*. The type has strikingly long and narrow spores, 39–46 x 12–13  $\mu\text{m}$ . In *Pyr. subalpina* both terminal segments are generally septate, either by a transversal septum (never present in *Pyr. raetica*), or by an angular or a Y-formed septum, but never (?) a longitudinal septum.

*Pyr. subalpina* was recorded from Svalbard by Eriksson (1967: 366, 370) who also pointed out that '*Pleospora magnusiana* Berl. 'sensu Lind (1928: 26) apparently is this species. It seems to be fairly frequent in Svalbard on various hosts. In the Alps it has been found only on *Poa alpina* (Crivelli, 1983: 121).

Svalbard specimens seen. – On *Alopecurus alpinus*: Longyearbyen, 19. 8. 1988, 2564c. – On *Deschampsia alpina*: Longyearbyen, 16. 8. 1988, 5169d. – On *Juncus biglumis*: Endalen, 17. 8. 1988, 5175g. – On *Poa arctica*: Endalen, 17. 8. 1988, 5184c. – Lundqvist 17484. – On *Poa 'colpodea'*: Lommebay, Sep. 1868. – Liefdebay, 2. 9. 1868, T. M. Fries.

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