

The agaric genera *Galerina* Earle and *Phaeogalera* Kühner in Greenland

Gro Gulden

Abstract

Gulden, Gro, 2006. The agaric genera *Galerina* Earle and *Phaeogalera* Kühner in Greenland. – Meddelelser om Grønland Bioscience 56, Copenhagen, The Commission for Scientific Research in Greenland, pp. 60-88.

Twenty-two *Galerina* species (one with two varieties) and one *Phaeogalera* species are recognised. Fourteen of the species are recorded for the first time in Greenland and *G. chionophila* Senn-Irlet is reported for the first time from the N Atlantic – Arctic region. Taxonomic, ecological and geographical features are discussed and a key is given to all taxa known to occur in the N Atlantic-Arctic region. *Galerina terrestris* Wells & Kempton is considered a later synonym of *G. minima* A.H. Sm. & Singer and *G. badipes* (Pers.) Gulden is redefined in the sense of Persoon.

Keywords: *Galerina*, *Phaeogalera*, Cortinariaceae, Agaricales, Greenland, Arctic-Alpine mycology.

Gro Gulden, University of Oslo, Natural history museums and Botanical garden, p. o. box 1172 Blindern, N-0318 Oslo, Norway.

Introduction

This paper ends a series of revisions of the genera *Galerina* and *Phaeogalera* in the N Atlantic region north of the British Isles (Gulden 1980, 1987, Noordeloos and Gulden 1992, Gulden and Vesterholt 1999, Gulden and Hallgrímsson 2000). It is mainly based on material collected by a group of Danish mycologists during the last ca. 20 years with the intention of producing a macromycete flora for Greenland. I have also

examined collections made by M. Lange and P. M. Petersen, partly in relevés during their mycosociological and mycoecological studies in the Kangerlussuaq (inner Sdr. Strømfjord) and the Qeqertarsuaq (Disko) regions (Lange 1957, Petersen 1977). A very important source of material has been collections made by T. Borgen during his more than 20 years stay in Paamiut in S Greenland. In August 2000 I had the opportunity to collect galerinas myself during a 10 days' visit to SW Greenland, to the Kangerlussuaq and Sisimiut (Holsteinsborg) regions, both at the latitude of the Arctic Circle, together with participants of ISAM VI. These 'Arctic circle stations' represent a considerable oceanic-continental gradient, with a continental, almost desert like climate near the Inland Ice at Kangerlussuaq and an oceanic climate on the coast about 175 km further west, at Sisimiut.

Greenland stretches from about 60° N to almost 84° N and has a 10-200 km wide rim of vegetation along the coasts surrounding the great Inland Ice. The climate ranges from subarctic in the inner fjord districts in the south to high arctic in the north, the E coast being generally colder than the W coast. Inner districts have considerably higher summer temperatures and colder winters than coastal sites. In the southern, 'warm', subarctic region monthly temperature means in summer (June-August) may reach +10° C and at the coast the temperatures may stay above 0° C most of the year. At the high arctic meteorological stations in contrast, the mean temperatures vary between ca 0° and +4° C during the summer months (July-August) and the mean annual temperature is between ca -10° C and -20° C. Precipitation may be locally high in the south (ca 700-1100 mm yr in the SW and ca 1300-2400 mm yr in the SE) and gradually decreases northwards. Yearly amounts in the middle and high arctic zones are low (ca 25-285 mm); arctic

deserts prevail in coastal areas north of 80° N (Bay 1997, Feilberg 1984).

The climatic zones of Greenland range from sub-arctic to high arctic (Bay 1997). The subarctic zone, present in a small area in the inner south at 60–61° 30', has birch forests (*Betula pubescens*) with trees up to 10 m tall, *Alnus crispa* scrubs, and several boreal plants. Here, as also in the low arctic zone, herb-rich and grassy slopes are common. However, in the low arctic zone, found all along the coast up to about 70° N, dwarf-shrub heaths dominate. In inner, continental parts heaths with *Betula nana*, *Salix glauca* and Ericales, e.g. *Vaccinium uliginosum* and *Ledum*, prevail. At the coast, where the snow cover in winter becomes substantial, the dwarf birch becomes scarce, *Empetrum* is the dominant ericoid, and *Salix herbacea* snow-beds are common. Bogs, fens and marsh-land are frequent along the many watercourses, lakes and ponds. In the middle arctic zone, found on both coasts at 70°–80° N, *Dryas* and *Cassiope tetragona* heaths take over. At higher altitudes and in the high arctic zone, from about 80° N, there are extensive fell-fields with scanty, fragmented plant cover, mainly of herbs at the coast and *Carex*–*Dryas*–*Salix* communities inland (Bay 1999). Biogeographically Greenland is more closely related to N America than to Europe (Bay 1997).

Material and Methods

Most of the material is retained in the Botanical museum in Copenhagen (C). My own collections are in the Botanical museum in Oslo (O). In total, about 350 collections, to some extent annotated, have been examined.

Collectors are abbreviated as follows:

DB: David Boertmann
 DL: Denise Lamoure
 FT: Frede Terkelsen
 GG: Gro Gulden
 HD: Henry Dissing
 HK: Henning Knudsen
 JHP: Jens H. Petersen
 ML: Morten Lange
 PMP: Peter M. Petersen
 SAE: Steen A. Elborne
 TB: Torbjørn Borgen
 TL: Thomas Læssøe

The methods applied are the same as those referred in Gulden and Hallgrímsson (2000) and colour codes are according to Munsell (1975). In previous studies of *Galerina* and *Phaeogalera* I have included descriptions (gross-morphology and anatomy), illustrations (mostly of anatomical features), and ecological observations, all based on the examined collections from the various regions. Since the present revision will form a basis for the treatment of these genera in a 'Macro-mycete flora of Greenland' species descriptions and illustrations are omitted for most taxa. Instead selected published descriptions and illustrations are indicated for each taxon.

In the 'material examined' sections for the various taxa the collections are entered according to their occurrence in the floristic units ('provinces' divided into 'districts') defined by Böcher *et al.* 1957 and later revised by Bay (1997). These units are based on characteristic distribution patterns of vascular plants and reflect responses to temperatures and continental/oceanic conditions. Table 1 shows the occurrence of the *Galerina* and *Phaeogalera* species in these floristic units and may thus serve as a rough indication of the distribution of the different species in Greenland.

Results

The material included 22 species and one variety of *Galerina* and one species of *Phaeogalera* (*P. stagnina*) and 14 of the species are recorded for the first time from Greenland. Three species previously recorded from Greenland are excluded.

The following solutions to taxonomic and nomenclatural problems have been found: (i) *Galerina badipes* has been accepted as a species which also includes *G. cedretorum* var. *bispora* and var. *microspora* as described by Smith and Singer (1964). The name is referred to Persoon, the original author of the epithet, and neotype material has been selected, (ii) *Galerina minima* (Peck) A.H. Sm. & Singer has been adopted as the correct name for the species previously often called *G. terrestris* Wells & Kempton (e.g. in Gulden 1980), (iii) the epithet *hypnorum* has been used ± in the sense of Kühner 1935, *i.e.* to also include material with clearly calyptrate spores referable to, e.g. *G. calyptrata* and *G. cerina*.

Table 1 shows the occurrence of the taxa in (1)

GRO GULDEN

Table 1. Ecology and distribution of *Galerina* and *Phaeogalera* taxa in Greenland. Floristic provinces and districts: CN-NW are geographic designations; the subdivisions in floristic districts within the provinces are indicated with small letters in the body of the table where m = middle district, n = north district (n1 and n2 are divisions of n), s = southern district, si = inner southern district, so = southern oceanic district, + = presence. Vegetation zones: sa = subarctic, la = low arctic, ma = middle arctic, ha = high arctic. Oc = exclusive occurrence in oceanic parts, E = occurrence on the E coast, Alt = maximum recorded altitude, in meters. Floristic provinces and districts and vegetations zones are according to Bay 1999.

Taxon	Floristic provinces						Vegetation zones						Max. alt.
	CN	CE	S	SW	CW	NW	sa	la	ma	ha	Oc	E	
<i>G. arctica</i>	+		+	s, n		si		+	+	+		+	
<i>G. atkinsoniana</i> var. <i>atkinsoniana</i> f. <i>atkinsoniana</i>		m	+	s	m, n	si		+	+			+	
<i>G. atkinsoniana</i> var. <i>atkinsoniana</i> f. <i>quadrispora</i>			+	s, n				+					
<i>G. badipes</i>			+	s, n			+	+					
<i>G. cephalotricha</i>			+	s				+			+		
<i>G. chionophila</i>				s	m			+	+			+	500
<i>G. clavata</i>	+	n1	+	s, n	m, n	si, so, n	+	+	+			+	200
<i>G. fallax</i>			+	s				+			+		
<i>G. harrisonii</i>		m	+	s		so, n		+	+				500
<i>G. hypnorum</i>			+	s				+			+	+	
<i>G. leptocystis</i>			+	s				+			+	+	
<i>G. marginata</i>			+	s	n	so	+	+	+				
<i>G. minima</i>			+	s	n			+	+				250
<i>G. mniophila</i>			+	s	m			+					
<i>G. paludosa</i>			+	s	n		+	+					
<i>G. pseudocerina</i>		n1, m		n				+	+			+	500
<i>G. pseudomniophila</i>			+	s	m, n			+					
<i>G. pseudomycenopsis</i>		n1, n2, m	+	s, n	m, n	si, so, n	+	+	+			+	800
<i>G. pumila</i> var. <i>pumila</i>			+		m		+	+					
<i>G. pumila</i> var. <i>subalpina</i>		m	+		m			+	+			+	500
<i>G. sphagnum</i>			+	s				+					250
<i>G. stordalii</i>			+					+			+		
<i>G. subclavata</i>			+					+			+		
<i>G. vittiformis</i> var. <i>vittiformis</i> f. <i>tetraspora</i>			+	s				+					300
<i>G. vittiformis</i> var. <i>vittiformis</i> f. <i>vittiformis</i>		n1, m	+	s	m		+	+	+			+	
<i>P. stagnina</i>		m	+	s	m, n			+					200

floristic provinces and districts and in vegetation zones according to Bay 1997 (as printed in Jensen 1999 p. 182-183), (2) presence of taxa on the E coast of Greenland (E), (3) exclusive presence in oceanic parts (Oc), and (4) presence at higher altitudes (Alt).

Relatively little collecting has taken place in the rather limited subarctic zone in S Greenland, and only

seven species from this zone have been identified. In the low arctic zone all the recognised taxa in Greenland were found; eleven species occurred in the middle arctic zone, and only one species, *G. arctica*, in the high arctic zone. The E coast has only ten recognised species, all of them occurring also on the W coast (where considerably more collecting has taken

place). In one single, well documented area, the Paamiut area on the SW coast, all but two of the taxa (*G. chionophila* and *G. pseudocerina*) have been collected. At least ten species were found at higher altitudes in Greenland (200–800 m a.s.l.). Of these *G. clavata*, *G. minima*, *G. sphagnum*, *G. vittiformis* and *P. stagnina* occurred up to ca 2–300 m, *G. chionophila*, *G. harrisonii*, *G. pseudocerina* and *G. pumila* var. *subalpina* up to 500 m, and *G. pseudomycesopsis* at 800 m. All taxa occurred in the oceanic parts of Greenland, but only six of them exclusively there: *G. cephalotricha*, *G. fallax*, *G. hypnorum*, *G. leptocystis*, *G. stordalii* and *G. subclavata*.

Label information and personal field notes supported the ecological grouping of the species as follows – based on their typical kind of habitats:

G. atkinsoniana, *G. mniophila*, *G. chionophila*, *G. pseudomniophila*, *G. pumila* (both varieties) – in mossy dwarf-shrub and ericaceous heaths. *Galerina chionophila* and *G. pumila* also occurred in lichen heath facies.

G. cephalotricha, *G. fallax*, *G. hypnorum*, *G. leptocystis*, *G. stordalii* and *G. sphagnum* – in peaty sites, mostly on *Sphagnum* and *Polytrichum*, also on other bryophytes such as *Dicranum*. *Galerina atkinsoniana* may also occur here.

G. arctica, *G. clavata*, *G. paludosa*, *G. sphagnum* and *P. stagnina* – in wet to moist mats of bryophytes such as *Calliergon*, *Drepanocladus*, *Philonotis*, *Aulacomnium* and *Sphagnum*, along streams and lakes and in marshlands and fens. All but *G. arctica* occurred on *Sphagnum* and *G. paludosa* and *G. sphagnum* were exclusively on *Sphagnum* – a hygrophilous group of species.

G. pseudomycesopsis, *G. subclavata*, and *G. vittiformis* in moist, often more grassy habitats – a mesotrophic to slightly basiphilous group of species. (*G. pseudomycesopsis* had a great range of habitats and may be referred to most of the groups).

G. pseudocerina in fairly dry, grassy and herb rich sites – a basiphilous-calcicolous species.

G. harrisonii and *G. chionophila* in late melting *Salix herbacea* snow-beds.

G. minima in barren fell-fields and snow-beds, on silt and mineral soils, mostly moist and among small mosses.

G. badipes and *G. marginata* in willow and birch copses and more ruderal habitats.

Discussion

Almost all *Galerina* species that up to now are known from the N Atlantic-Arctic region have been recognised in the present material, and it thus appears that the *Galerina* diversity in Greenland may be fairly well known by now. However, especially in the subarctic South, where little collecting has taken place, some more taxa probably occur. Also *G. jaapii* A.H. Sm. & Singer, typical of wet moss carpets on banks of ponds and watercourses, and *G. lubrica* A.H. Sm. (better known as *G. pseudotundrae* Kühner), that typically grow in alpine snow-bed vegetation could be expected to occur in Greenland.

Galerina clavata, *G. pseudomycesopsis* and *Phaeogalera stagnina* are the most frequently collected species and probably the most common ones in Greenland. These, along with *G. harrisonii*, *G. mniophila* and *G. pseudocerina*, have been found in all the investigated parts of the N Atlantic – Arctic region (Table 2). Most of them, all except *G. mniophila*, were also found at high altitudes in Greenland. To this group of common species in Greenland may be added *G. minima*, a species that probably has been undercollected due to its preference for barren habitats that generally are little visited.

Galerina arctica is the only species that has been collected in the high arctic vegetation zone in Greenland and it may be the only truly arctic *Galerina* species. Within the N Atlantic-Arctic region it has previously been found only in the arctic archipelago of Svalbard. Furthermore, it is a species with a confirmed circumpolar distribution (Horak 1993).

The following nine of the Greenland species may be considered 'cold climate species' since they do not prevail in boreal or warmer regions: *G. arctica*, *G. chionophila*, *G. harrisonii*, *G. minima*, *G. pseudocerina*, *G. pseudomniophila*, *G. pseudomycesopsis*, *G. stordalii* and *P. stagnina*. Of these only *G. arctica* seems limited to the north; all the others also occur in alpine regions further south, and *G. pseudomycesopsis* has even been recorded from Antarctica (Horak 1993). Some of the taxa only found in the low arctic zone and not further north in Greenland may have a climatic limit in this

GRO GULDEN

Table 2. Taxa of *Galerina* and *Phaeogalera* in the Arctic-N Atlantic region (Gulden 1980, 1987, Gulden and Vesterholt 1999, Gulden and Hallgrímsson 2000).

Taxon	Greenland	Iceland	Norway Finse	Faroe Islands	Svalbard
<i>G. arctica</i>	X				X
<i>G. atkinsoniana</i> var. <i>atk.</i> f. <i>atkinsoniana</i>	X	X	X	X	
<i>G. atkinsoniana</i> var. <i>atk.</i> f. <i>quadrispora</i>	X	X	X		
<i>G. badipes</i>	X	X	X ¹		
<i>G. cephalotricha</i>	X (cf.)		X ²	X (cf.)	
<i>G. chionophila</i>	X		X ²		
<i>G. clavata</i>	X	X	X ³	X	X
<i>G. embolus</i>					X (cf.)
<i>G. fallax</i>	X				
<i>G. harrisonii</i>	X	X	X ⁴	X	X ⁴
<i>G. hypnorum</i> (incl. <i>G. calyptрата</i>)	X		X	X	X
<i>G. hypophaea</i>			X		
<i>G. jaapii</i>		X	X		
<i>G. leptocystis</i>	X				
<i>G. lubrica</i>		X	X ⁵	X ⁵	
<i>G. marginata</i>	X	X ⁶	X ⁶	X ⁶	
<i>G. minima</i>	X	X ⁷	X ⁷		
<i>G. mniophila</i>	X	X	X ²	X	X
<i>G. norvegica</i>			X		
<i>G. paludosa</i>	X		X	X	
<i>G. perplexa</i>		X			
<i>G. pseudocerina</i>	X	X	X	X	X
<i>G. pseudomniophila</i>	X		X	X (cf.)	
<i>G. pseudomycenopsis</i>	X	X	X ⁸	X	X
<i>G. pumila</i> var. <i>pumila</i>	X	X			X
<i>G. pumila</i> var. <i>subalpina</i>	X	X	X		X ⁹
<i>G. sphagnorum</i>	X	X	X		
<i>G. stordalii</i>	X	X	X	X	
<i>G. subarctica</i>				X (cf.)	
<i>G. subclavata</i>	X	X	X		
<i>G. tibiicystis</i>				X	
<i>G. vittiformis</i> var. <i>vittiformis</i> f. <i>tetraspora</i>	X	X	X		
<i>G. vittiformis</i> var. <i>vittiformis</i> f. <i>vittiformis</i>	X	X	X	X	
<i>P. stagnina</i>	X	X	X	X	X
<i>P. subfusispora</i>				X	
Total no. of taxa (forms not counted)	24	19	24	18	11

¹ as *G. cedretorum* var. *bispora* and *G. acris*,

² identified later,

³ as *G. heterocystis*,

⁴ as *G. antheliae*,

⁵ as *G. pseudotundrae*,

⁶ s. lat., incl. *G. praticola* and *G. unicolor*,

⁷ as *G. terrestris*,

⁸ as *G. moelleri*,

⁹ as *G. pseudomyniophila*.

zone, e.g., *G. badipes*, *G. cephalotricha*, *G. paludosa*, *G. sphagnorum*, *G. subclavata*, and *G. vittiformis*, although *G. sphagnorum* occurred up to 2-300 m. None of these have yet been found in arctic Svalbard, but all have been encountered in the low alpine zone in Norway (Table 2).

Among the vascular plants considerable response has been found to the oceanity-continentiality gradient in Greenland and similar adaptation of macrofungi has been considered, e.g. by Lange (1957) and Borgen (this volume). Six *Galerina* species have been exclusively found in oceanic parts of Greenland

(Table 1) and may perhaps represent an oceanic element.

Except for *G. cephalotricha* and *G. chionophila*, all species are known from the N American continent, but *G. cephalotricha* may be identical with the N American *G. luteolosperra*. Two species originally described from the N American continent, are found new to the N Atlantic-Arctic region viz., *G. fallax* A.H. Sm. & Singer and *G. leptocystis* Wells & Kempton.

Taxonomic part

Synopsis of recognised taxa in Greenland

Genus *Galerina* Earle

Subgenus *Tubariopsis* (Kühner ex Bas) Bon

1. *G. arctica* (Singer) Nezdoym.
2. *G. clavata* (Velen.) Kühner
3. *G. pseudocerina* A. H. Sm. & Singer
4. *G. stordalii* A.H. Sm.
5. *G. subclavata* Kühner

Subgenus *Naucoriopsis* Kühner ex Gulden

6. *G. badipes* (Pers.) Gulden
7. *G. marginata* (Batsch) Kühner
8. *G. pseudomycenopsis* Pilát

Subgenus *Galerina*

9. *G. atkinsoniana* A.H. Sm. var. *atkinsoniana*
- 9a. f. *atkinsoniana*
- 9b. f. *quadrispora* Gulden
10. *G. minima* (Peck) A.H. Sm. & Singer
11. *G. vittiformis* (Fr.) Singer var. *vittiformis*
- 11a. f. *vittiformis*
- 11b. f. *tetraspora* A.H. Sm. & Singer

Subgenus *Mycenopsis* (A.H. Sm. & Singer) Bon

12. *G. cephalotricha* Kühner
13. *G. chionophila* Senn-Irlet
14. *G. fallax* A.H. Sm. & Singer
15. *G. harrisonii* (Dennis) Bas & Vellinga
16. *G. hypnorum* (Schrank : Fr.) Kühner *sensu lato*
17. *G. leptocystis* Wells & Kempton
18. *G. mniophila* (Lasch) Kühner
19. *G. paludosa* (Fr.) Kühner
20. *G. pseudomniophila* Kühner
21. *G. pumila* (Pers. : Fr.) M. Lange non *sensu* M. Lange
- 21a. var. *pumila*
- 21b. var. *subalpina* A.H. Sm.
22. *G. sphagnorum* (Pers. : Fr.) Kühner

Genus *Phaeogalera* Kühner

23. *P. stagnina* (Fr.) Kühner ex Pegler & T.W.K. Young

Key to *Galerina* and *Phaeogalera* in the Arctic – North Atlantic region

Species not yet recognised in Greenland are marked by an asterisk (*).

av = average in Greenland material.

1. Pleurocystidia present (often scarce), voluminous, distinctly ventricose with fusoid to cylindrical necks and acute to capitate tips, apical inflation always smaller than ventral. Fruitbody fleshy (for a *Galerina*) to tiny, veil forming an annulus or evanescent/absent 2
1. Pleurocystidia absent, cheilocystidia smaller than above choice, if 50-70 µm long, then with narrow ventral inflation. Fruitbody tiny to medium, exceptionally with a small membranous annulus (*G. jaapii*) 8
2. Pileus ± fleshy and young margin incurved, ± translucently striate, veil usually well developed and forming an annulus or annulate zone, cystidia on stipe restricted to apex, stipe ± darkening to bistre from base upwards (subgen. *Naucoriopsis*) 3
2. Pileus membranaceous and distinctly translucently striate to disc, margin straight, veil absent or evanescent, or at the most forming a fibrillose annulus, stipe never bistre but usually fulvous to red-brown from base (subgen. *Galerina*) 5

GRO GULDEN

3. Basidia 2-spored, veil remnants usually scanty (occasionally as an apical annulate zone), on herbaceous or woody remains 6. *G. badipes*
3. Basidia 4-spored, veil remnants varying from a membranous annulus to almost nil, substrate variable 4
4. Spores almost smooth, no loosening perispore. Typically in moist, mossy or grassy habitats and in *Salix herbacea* snow-beds 8. *G. pseudomycenopsis*
4. Spores distinctly rugulose with loosening perispore. Often on woody remains 7. *G. marginata*
5. Apex of stipe pruinose, lower part glabrous or ± fibrillose from veil, veil remnants often as a brim on pileus margin occasionally also ± annuliform on stipe, taste farinaceous, basidia 4-spored. Among moss in pioneer habitats on mineral soil 10. *G. minima*
5. Stipe pruinose from cystidia over entire length, veil absent, taste mild (none), basidia 2- or 4-spored. Bryophilous 6
6. Pileocystidia absent 11. *G. vittiformis*
6. Pileocystidia present 7
7. Pileocystidia ventricose like the hymenial cystidia, basidia 2- or 4-spored 9. *G. atkinsoniana*
7. Pileocystidia narrow, setae-like, basidia 4-spored, most spores < 10 µm long * *G. perplexa*
8. Cystidia tibiiform 9
8. Cystidia not tibiiform 15
9. Basidia 2-spored 5. *G. subclavata*
9. Basidia 4-spored 10
10. Clamps present at all septa 11
10. Clamps absent or rare 13
11. Spores practically smooth 12. *G. cephalotricha*
11. Spores distinctly ornamented 12
12. In *Sphagnum*, stipe cystidiate over entire length, taste none, spores < 11 x 7 µm * *G. tibitcystis*
12. Not in *Sphagnum*, in dryer, base rich habitats (± calciphilous), taste farinaceous, spores larger, 11.0-13.5(-15.0) x 7.0-9.5 µm, coarsely ornamented 3. *G. pseudocerina*
13. Clamps few (present at base of basidia and some hymenial septa, but absent in pileipellis), spores small, 8.7-10.6 x 4.5-5.8 µm, with apical pore; in *Sphagnum* bogs 4. *G. stordalii*
13. Clamps absent, spores larger, without pore; in moist moss mats 14
14. Spores practically smooth, many collapsing in mounts of KOH, 9.8-12.6 x 5.3-7.3(-8.2) µm 1. *G. arctica*
14. Spores distinctly verruculose, not collapsing in KOH, 12.6-15.5 x 6-8.7 µm 2. *G. clavata*
15. Spores calyptrate, distinctly so or with only tiny blisters somewhere on the surface, tawny in KOH, with distinct plage 16
15. Spores not calyptrate, no perisporeal loosening, often pale (yellow to yellow-brown) in KOH; plage absent or present 19

16. Cystidia either narrowly lageniform or \pm vesiculose, veil present, evanescent	17
16. Cystidia different, \pm ventricose-capitate, veil present or absent	18
17. Cystidia lageniform (ventricose-cylindric) and narrow, veil evanescent	17. <i>G. leptocystis</i>
17. Cystidia vesiculose to pyriform, mostly apically wider than ventrally	16a. <i>G. hypnorum</i> forma
18. Veil absent, spores small, only rarely 10 μ m long or 6 μ m wide	14. <i>G. fallax</i>
18. Veil present (evanescent), spores larger	16. <i>G. hypnorum</i> s. lat.
19. Basidia 2-spored, spores narrowly amygdaliform	20
19. Basidia 4-spored	21
20. Stipe annulate, fruitbody \pm ochre, spores rugulose-verruculose, cystidia ventricose-capitate	* <i>G. jaapii</i>
20. Stipe not annulate, fruitbody red-brown, spores smooth, cystidia capitate with narrow ventral inflation	* <i>G. lubrica</i>
21. Spores truly smooth, no plage, with distinct pore, appearing truncate	22
21. Spores faintly ornamented to smooth, plage present (but sometimes visible only in profile) or absent, pore/callus present or absent, apex never truncate	23
22. Spores ellipsoid, truncate, cystidia large, 45-60 μ m long, narrowly ventricose, apically irregular and often \pm capitate. In moist moss, often <i>Sphagnum</i>	23. <i>P. stagnina</i>
22. Spores narrowly amygdaliform, cystidia small (20-40 μ m long) and lageniform. On peaty soil	* <i>P. subfusispora</i>
23. Cystidia voluminous, vesiculose to pyriform, apically often wider than ventrally	16a. <i>G. hypnorum</i> forma
23. Cystidia otherwise	24
24. Stipe darker towards base	25
24. Stipe pale, white or with shade of pileus colour, but not darkening from base	28
25. Cystidia narrowly ventricose to cylindric, with long necks, mostly \pm capitate	13. <i>G. chionophila</i>
25. Cystidia ventricose-capitate to lageniform	26
26. Spores small, < 11 x 6 μ m	14. <i>G. fallax</i>
26. Spores distinctly larger, especially broader, width 6-12 μ m	27
27. On <i>Sphagnum</i>	19. <i>G. paludosa</i>
27. Not sphagnophilous	15. <i>G. harrisonii</i>
28. Cystidia long, without or with narrow ventral inflation, often flexuous and irregularly inflated at apex	29
28. Cystidia lageniform to ventricose-capitate	30
29. Spores smooth, plage absent, amygdaliform-ellipsoid, fairly large, 9.8-13.5 x 6.0-8.2 μ m	21a. <i>G. pumila</i> var. <i>pumila</i>
29. Spores faintly ornamented, plage present but indistinct (seen in profile), amygdaliform, slightly smaller, 9.8-12 x 5.8-7.5 μ m	21b. <i>G. pumila</i> var. <i>subalpina</i>

30. Cystidia mainly ventricose-capitate 12. *G. cephalotricha*
 30. Cystidia mainly lageniform 31
31. On *Sphagnum* 22. *G. sphagnum*
 31. Not sphagnophilous 32
32. Pileus dull brown, lamellae dull brownish, spores with fairly distinct plage 18. *G. mniophila*
 32. Pileus warm ochre-brown to yellow-brown, lamellae ochre to ochre-brown, plage visible
 in profile view 20. *G. pseudomniophila*

Species account

Genus *Galerina* Earle

Subgenus *Tubariopsis* (Kühner ex Bas) Bon

The subgenus encompasses the species with tibiiform cystidia and non-dextrinoid spores. Most of them also lack a plage on the spores and clamp connections. The subgenus is well represented with five species in Greenland, of which *G. clavata* is one of the most common of all the Greenland galerinas and *G. pseudoceri-na* apparently is common in habitats on basic bed-rocks. *Galerina subclavata* and *G. arctica* have been only little collected and *G. stordalii* appears to be rare.

1. *Galerina arctica* (Singer) Nezdoym

Selected descriptions and figs: Gulden and Jenssen 1988: 49 (colour plate), Horak and Miller 1992: 417, Figs 5-9.

Material examined: CN Greenland: Peary Land: Kap København, in wet moss, in *Carex stans*-fen, 18 VII 1987, leg. C. Bay. S Greenland: Paamiut (Frederikshåb) area: Paamiut, N slope with moist moss and *Cerastium*, 31 VII 1992, TB 92.025. SW Greenland (s) Sisimiut (Holsteinsborg) area: Main valley E of the town, in wet moss, *Calliergon*, 18 VIII 2000, GG 138/00 and at Sømmandshjemmet, 19 VIII 2000, leg. R. Petersen, GG 169/00 and leg. P.-A. Moreau, GG 169b/00. (n): Qeqertarsuaq (Godhavn), small bay beyond the harbour, under *Salix glauca* and with *Marchantia*, 25 VII 1977, DL 77-53. NW Greenland (si): Tasiusaq at Qarassap nunataa, at the head of Uummannaq fjord, 12 VIII 1972, PMP 72.245.

Ecology and Distribution: Gregarious in wet moss. Finds in Greenland are from the low arctic to the high

arctic vegetation zones and from both coasts (E and W coasts). New to Greenland. The species has a circum-polar, subarctic to high arctic distribution and is previously known from Svalbard, subarctic Russia, Canada and U.S.A. (Gulden 1980, Horak and Miller 1992). Possibly this is a true arctic (northern) *Galerina*; there are no records of the species from alpine sites at more southern latitudes, but compare *G. griseipes*.

Comments: Gross-morphologically *G. arctica* resembles *G. clavata* and they grow in similar habitats. It differs clearly microscopically by having almost smooth and thin walled spores that mostly are \pm collapsed in mounts. The cheilocystidia are also on an average smaller.

Several species have been described with smooth or practically smooth, thin-walled spores in section *Tubariopsis*, but most of them have smaller spores than *G. arctica*. A rather general character of the group seems to be the darkening stipe, especially the base, caused by small, dark, inter- and epicellular granules. This feature is typical of *G. griseipes* Kühner and *G. nigripes* A.H. Sm., but has also been found sporadically in *G. laevis* (Pers.) Singer, *G. arctica*, and *G. clavata* (Kühner 1972 p.142, Gulden 1987). I have previously suggested that *G. arctica* and *G. griseipes* might be conspecific, but Horak and Miller (1992) found the size and ornamentation of the spores in type and topotype material of *G. griseipes* (from the Alps) to be different from those of *G. arctica*. The spores of the Greenland material measure: 9.8-12.6 x 5.3-7.3(-8.2) μm , av (40/4): 11.2 x 6.4 μm .

2. *Galerina clavata* (Velen.) Kühner

Selected descriptions and figs: Singer and Smith 1964: 34, Gulden and Jenssen 1988: 51 (colour plate), Horak and Miller 1992, Figs 10-12.

Material examined: CE Greenland (n1): Zackenberg, TB 99.035, 99.364, 99.406, 99.419. (m): Kong Oscar Fjord, E Skeldal, leg. T.T. Elkington 1962; Jameson Land, SAE, JHP 89.006, 89.205, 89.446, 89.548, 89.617. S Greenland: Qinnua valley at Tasermiut fjord, TB 91.072; Narsarsuaq, ML 46-61, PMP 64.018, TB 85.025; Kangilinnuit (Grønnedal), ML 46-75, TB 84.046; Paamiut (Frederikshåb) area, Paamiut, PMP 73.166, 73.273, TB 79.133, 79.157, 81.101, 83.026, 85.281, 88.145, 93.072, 93.108, 00.180, 00.244; at the head of Eqaluit, TB 88.126; Nigerleq 1966, L.B. Jørgensen and S. Larsson; Qassit Kangerluarsua, TB 92.032. SW Greenland (s): Qeqertarsuatsiaat (Fiskenæsset) area, Fiskenæssetfjorden, PMP 73.579; Nuuk (Godthåb) area, Nuuk, FT 55.013, ML 46-79; near the airport, 200 m a.s.l., TB 87.128; Sisimiut (Holsteinsborg) area, PMP 72.B49, 72.B50, GG 99/00, 101/00, 102/00, 118/00, 123/00, 126/00, 145/00, 164/00, 169c/00. (n): Qeqertarsuaq (Godhavn) area, FT 55.071, 55.089, ML 67-143, 67-144, 67-145, 67-474, PMP 70.049, 70.086, 70.097, DL 77-28, 77-32, 77-50, 77-118, 77-181, leg. T. Bernth 82.413, 82.645, TB 86.028, 86.030, 86.035, 86.067, 86.075, 86.077, 86.078, SAE 86.055, 86.098, at the head of Disko fjord, TB 86.054, 86.055. CW Greenland (m): Kangerlussuaq (Inner Sdr. Strømfjord) area, ML 46-229a, PMP 73.012, GG 15/00, 16/00, 45/00, 58A/00. (n): Ilulissat (Jacobshavn) area, Ilulissat, PMP 71.028; Serfarsuit, PMP 72.030, 72.033. NW Greenland (si): Drygalski peninsula, PMP 72.275; Eqalugaarsuit Sulluat (Laksefjorden), PMP 72.339. (so): Nuussuaq peninsula, PMP 72.218; Maligiaq, PMP 72.307. (n): Dundas, SAE 88.024, 88.232; Qaanaaq (Thule), SAE 88.144.

Ecology and Distribution: This is a characteristic species of wet, mossy sites such as banks of small lakes and streams, by springs, and in floating moss carpets. It generally grows \pm gregariously in deep moss, e.g. in moss cushions of *Calliergon* and *Drepanocladus*. Occasionally it occurs on *Sphagnum* (four of the Greenland collections). It is reported from many different plant communities by Lange (1957) and Petersen (1977) and spans a wide pH range. It has for example been found in oligotrophic, moist heath vegetation with *Betula nana* and *Carex rariflora* as well as in rich fens with *Philonotis calcarea* (pH = 9). Collections TB 86.077 and 86.078 are from hot springs with *Paludella* or *Drepanocladus*.

Galerina clavata may be characterised as a bryophilous, hygrophilous, and acidiphilous to basiphilous species. It has been recorded in association with more than twenty different bryophyte species in arctic-alpine regions (Horak 1993). Favre (1948) recorded *G. clavata* as a rare species in the raised bogs in the Jura Mountains, growing in very wet places but not invading the main *Sphagnum* patches. Senn-Irlet (1993) reported *G. clavata* as a characteristic species of Swiss alpine fens and as a constant species of the investigated mesotrophic fens. Kühner (1972) described *G. clavata* as hygrophilous, occurring in acid and basic habitats in alpine Norway. Favre (1955) collected it in acid sites in the Swiss national park.

Galerina clavata is common in Greenland and has been collected from the subarctic south (61° 10' N) to the middle arctic north (77° 28' N), on both coasts, and in oceanic as well as continental parts. It is previously recorded from Greenland by Kobayasi *et al.* (1971), Lamoure *et al.* (1982), Lange (1957), Petersen (1977), and Watling (1977). According to Lange it is much more common in oceanic than in subcontinental sites in W Greenland. It has a wide distribution in the N Atlantic-Arctic region.

Comments: This is a fairly large *Galerina* that generally can be recognised in the field by a fatty-shiny, brightly yellow, ochre to fulvous pileus and a pale stipe, often slightly bulbous at base. The stipe is \pm fibrillose and pruinose. The very similar *G. arctica* seems to be constantly without bulbous base. Also *G. subclavata* and *G. pumila* var. *pumila* (of subgenus *Galerina*) are quite similar. All these have \pm fatty-shiny, brightly coloured pilei, pale, \pm fibrillose stipes, and (sub)distal, adnate-ascending lamellae, and they lack a distinctive smell/taste. Microscopically they can easily be distinguished by differences in spores, cystidia and number of sterigmata.

3. *Galerina pseudocerina* A.H. Sm. & Singer

Selected descriptions and figs: Gulden and Jenssen 1988: 53 (colour plate), Gulden and Hallgrímsson 2000: 20, Gulden and Vesterholt 1999, Figs 4, 5 (colour plates).

Material examined: CE Greenland (n1): Zackenberg, 20 VII-25 VIII 1999, TB 99.020, 99.021, 99.060, 99.242, 99.314, 99.348, 99.391, 99.441. (m): Jameson Land,

springs of Lollandselv, 26 VII 1989, HK, SAE, JHP 89.315. SW Greenland (n): Qeqertarsuaq (Godhavn) area: Kildedalen, 1 VII 1971, PMP 71.009, on Skarvefjeld, 500 m a.s.l., TB 86.039, Blæsedalen 26 VII 1986, TB 86.056 and 86.057.

Ecology and Distribution: In heaths and grassland, dry to rather moist; among moss, grass, herbs, heather, willows and lichens (e.g. *Aulacomnium*, *Arctagrostis latifolia*, *Vaccinium uliginosum*, *Cassiope tetragona*, *Salix arctica*, *Dryas*, and *Peltigera*); basi- to calciphilous. The frequent presence of this species in the Zackenberg and the Qeqertarsuaq districts, where basic, basaltic bed-rocks dominate, and its absence in the much better investigated regions Paamiut, Kangerlussuaq, and Sisimiut, where acidic conditions prevail, illustrates well its dependence of basic habitats.

Distributed in Greenland on both coasts, but collected only in northern districts, north of the Arctic Circle (68° 30'N to 74° 30'N). Collections are from the low arctic to the middle arctic vegetation zones, and it has been found up to 500 m a.s.l. Previously recorded from Kong Oscar fjord near Mestersvig (CE Greenland (m)) by Watling (1983). Known from all the N Atlantic islands and from northern and/or high-elevation sites in Europe, Russia and N America (Gulden and Hallgrímsson 2000).

Comments: This is a slightly fleshy *Galerina*, fairly characteristic by its often almost hemispheric, brightly orange- to rusty-brown or ± apricot coloured pileus, broad, ± horizontal lamellae, pale stipe with shades of the pileus colour (mainly in the middle part), and a distinctly farinaceous taste. Microscopically it is also easy to recognise by the broad, coarsely ornamented spores (exhibiting a great variation in shape and ornamentation) combined with tibiiform cystidia. In contrast to the other species of the subgenus, *G. pseudocearina* has constantly clamped hyphae and dextrinoid spores. Studies of the infrageneric structure in *Galerina* based on DNA sequencing (nuclear rDNA-analyses) supports the placement of this species in subgenus *Tubariopsis* (Gulden *et al.* 2001, 2005).

4. *Galerina stordalii* A.H. Sm.

Selected descriptions and figs: Gulden 1980: 229-230, Gulden, Jenssen and Stordal 1985: 39.

Material examined: S Greenland: Paamiut (Frederikshåb) area, ca 4 km E of Paamiut, below 50 m a.s.l., in moist snow-bed/moist heath, in *Sphagnum*, 10 VIII 2002, TB 02.039.

Ecology and Distribution: Sphagnicolous; generally occurring in bogs and moist snow-beds with *Sphagnum*. Found in the low arctic zone on the W coast at 62° N. New to Greenland. Lamoure *et al.* (1982) recorded *G. aff. dimorphocystis* A.H. Sm. & Singer from Greenland, a species which in the French tradition following Kühner (1972) is the same as *G. stordalii* (see Gulden 1980), but revision of the collection (DL 77-53) showed it to belong in *G. arctica*. *Galerina stordalii* appears to be rare in Greenland. It was searched for quite intensively in the Kangerlussuaq and the Sisimiut regions without results. The species is known from all parts of the N Atlantic region and occurs also in temperate regions of N America and Eurasia.

Comments: A small size, a bright pileus often with reflexed margin, and a whitish, fully pruinose stipe are typical features of this characteristic *Galerina* species.

5. *Galerina subclavata* Kühner

Selected descriptions and figs: Kühner 1972: 132-137, Gulden and Hallgrímsson 2000, Figs 4, 5, de Haan and Walley 2002, Fig. 3 (colour plate).

Material examined: S Greenland: Paamiut (Frederikshåb) area, at the head of Eqaq, on *Polytrichum* in grassy, herb rich slope with *Festuca*, *Carex*, *Coptis trifolia*, *Huperzia selago*, *Cladonia* and other lichens, 13 IX 1997, TB 97.202.

Ecology and Distribution: In Greenland found in low arctic, grass-herb vegetation. Other recorded habitats for this species are *Salix herbacea* snow-beds, moist bryophyte sites e.g., with *Pellia* and *Sphagnum*, among *Solidago* close to birch and willow scrubs (Gulden and Hallgrímsson 2000, Kühner 1972). According to Senn-Irlet (1993) it is a characteristic species of alpine, oligotrophic, *Salix* rich fens in Switzerland.

This is the first record of the species from Greenland, but Lange (1957) stated that both 2- and 4-spored fruitbodies occurred in the material he referred to *G. clavata*; the two-spored most probably has been of *G. subclavata*. Other northern records of the species are

from Iceland, Scotland, and Norway (Gulden and Hallgrímsson 2000, Watling and Gregory 1993). Its general distribution is not clear since it has mostly been dealt with as a 2-spored form of *G. clavata* (Kühner 1935, Lange 1957, and Smith and Singer 1964). The species is not restricted to alpine or northern sites and has been recorded from England, France, The Netherlands, Switzerland and Czechoslovakia in Europe and from Washington in N America (Arnolds 1983, Gulden and Hallgrímsson 2000).

Comments: The combination of constantly 2-spored basidia, tibiiform cystidia, and distinctly ornamented spores, is unique for this species. In the field it may easily be confused with similar species as *G. arctica* and *G. clavata*, but *G. subclavata* apparently prefers different, mostly dryer habitats.

Subgenus *Naucoriopsis* Kühner ex Gulden

Three species are recognised in the material from Greenland, but especially the material referred to *G. pseudomycenopsis* exhibits a considerable variation and may eventually turn out to include more than one taxon. *Galerina unicolor* as recorded by Watling (1977) is considered conspecific with *G. marginata* (compare Gulden *et al.* 2001).

6. *Galerina badipes* (Pers.) Gulden comb. nov.

Basionym: *Agaricus badipus* Pers., Synop. method. Fung. 1801 p. 318. Neotypus: Norway: N-Trøndelag, Steinkjer, 7 IX 1982, leg. J. Dietrichson, JD 275.82 (O).

Synonym: *Galerina acris* Gulden, Norw. J. Bot. 27 p. 236. 1980.

Selected descriptions and figs: Gulden and Hallgrímsson 2000: 27 and Figs 4, 7.

Material examined: S Greenland: Kangilinnuit (Grønødal), on imported wood, 12 IX 1946, ML 46-541, Kangilinnuit, 75-125 m a.s.l., in low *Alnus crispa* scrub on humus, 12 VIII 1985, TB 85.116; Paamiut (Fredrikshåb) area, Avigaat (Avigait), eutrophic vegetation in abandoned settlement, among moss and *Salix*, 11 IX 1988, TB 88.141. SW Greenland (s): Sisimiut (Holsteinsborg) area, on/among *Polytrichum*, 20 VIII 2000, GG 181/00 and town area, on/among *Polytrichum* in *Betula nana* snow-bed, leg. C. Cripps, GG 183/00. (n): Qeqertarsuaq (Godhavn), 19 VIII 1967, ML 67-180. Norway: N-Trøndelag: Steinkjer, Solnestangen, Klin-

gebukta, *Alnus incana* – *Prunus padus* forest, 7 VIII 1982, leg. J. Dietrichson, JD 275.82 (neotypus).

Ecology and Distribution: In scrubs and snow-beds, on humus and various plant debris. Collected on the W coast between ca. 61° and 70° N, in the subarctic to low arctic vegetation zones. Previously recorded from Greenland (Kangilinnuit) by Lange (1957). In the north Atlantic region known from Greenland, Iceland and the British Isles (Gulden and Hallgrímsson 2000).

Comments: *G. badipes* as understood here is anatomically characterised by presence of numerous, large cheilo- and pleurocystidia, 2-spored basidia, and the following spore characters: low ornamentation, apical callus/pore, and no perispore loosening. A slightly fleshy pileus with incurved margin, a distinctly darkening stipe, and a veil that leaves ± remnants on the stipe, occasionally an annular zone, are good field characters together with its habit of growing on humus, herbaceous or woody litter, often in loose clusters. *Galerina badipes* in this sense covers both *G. badipes* and the two varieties of *G. cedretorum* (Maire) Singer, viz., var. *bispora* and var. *microspora* as described by Smith and Singer (1964). These authors distinguished what they called ‘*G. badipes* (Fr.) Kühner sensu Fr. non Kühn.’ from *G. cedretorum* on a more strongly developed veil in the former, often forming a superior fibrillose annulus.

The present broad concept of *G. badipes* agrees well with the concept of Kühner (1935) who preferred to use the designation *Galera badipes* (Ricken) in order to show that he found the Friesian and other old presentations of *Agarius badipes* impossible to interpret, primarily due to lack of microscopic data. Fries described *Agaricus badipes* for the first time in 1838 with reference to Persoon (1801) but never used the name in any of his ‘sanctioning’ publications and the name should thus be referred to Persoon without reference to Fries. I find that the Persoonian description of *A. badipus* covers our species well. Lack of microscopic data is the rule, not the exception in the agaric world. There is no material of this species in Persoon’s herbarium in Leiden (Noordeloos, *pers. comm.*) and a neotype is therefore selected.

There is a certain variation with regard to the pileus surface (dry or slightly viscid-shiny), taste (mild or bitter), and spore size in the material. One collec-

tion was described with a faintly raphanoid smell and taste by T. Borgen (TB 88.141) and one collection (GG 183/00) was found to be bitter by me and without any bitter component by E. Horak. Previously Hallgrímsson and I, on separate occasions, have found Icelandic specimens to be bitter and consequently we reduced the acrid tasting *G. acris* Gulden to a synonym of *G. badipes* (Gulden and Hallgrímsson 2000). Its taste is generally announced in the literature as mild or slightly farinaceous; the only other reference to a bitter taste in *G. badipes/cedretorum* I am aware of is in Dietrichson and Høydahl (1984) who studied galerinas in Norway.

Four of the collections from Greenland have quite small spores, rarely reaching a length of 10 µm and a width of 6 µm (7.8-10.2 x 5.0-6.0 µm, av (30/3): 9.5 x 5.6 µm). One collection (TB 88.141) has larger spores 10.6-12.6 x 5.8-6.8 µm, av (20/1): 11.2 x 6.2 µm, more in agreement with material from Iceland and alpine Norway and corresponding to the size generally assigned to *G. badipes*. The material with the smaller spores may eventually be referred to a var. *microspora* of *G. badipes*.

7. *Galerina marginata* (Batsch) Kühner

Selected descriptions and figs: Gulden and Hallgrímsson 2000: 22 and Figs 4, 5, Gulden and Vesterholt 1999, Figs 9-10 (colour plate).

Material examined: S Greenland: Narsarsuaq, 6-11 VIII 1984, on humus underneath *Salix glauca*, HK and TL 84.435 and on buried wood HK and TL 84.515; Ivittuut (Ivigttut), 14 IX 1946, ML 46-551; Paamiut (Frederikshåb), NE end of the town, local depot, on gravelly ground almost touching a rotten beam, 11 IX 1994, TB 94.096. SW Greenland (s): Qeqertarsuaq (Fiskenæsset), Midgård area, 21-27 VIII 1973, PMP 73.361B; Sisimiut (Holsteinsborg), main valley E of the town, 18 VIII 2000, leg. SAE and GG 142/00; Qeqertarsuaq (Godhavn) Lyngmarksbugten, 12 VIII 1967, ML 67-110. CW Greenland (n): Annertussup Qaqqai, SW of Ikaamiut, 8 VIII 1972, PMP 72-107. NW Greenland (so): Kangarsuaq (Prøven), 1 VIII 1971, ML 71-6.

Ecology and distribution: On humus, wood, or connected to dead wood. Collected on the W coast from 61° 10' N to about 73° N, which is in the subarctic to middle arctic zones. Previously recorded from Greenland by

Lange (1957), Rostrup (1891), and Watling (1977, as *G. unicolor*) and from various N Atlantic regions by Gulden and Hallgrímsson (2000).

Comments: The material varies considerably in size; the smallest fruitbody (PMP 72-107) has a pileus of 4 mm and a stipe that is 1-1.5 mm thick, while the largest fruitbodies (TB 94.096) have pilei up to 26 mm wide and stipes 7-10.5 mm thick. Even greater differences in fruitbody size (pilei up to 50 mm across) have been observed in pastures in N Norway. Microscopically the species differs from the related *G. pseudomycesopsis* in spore characters. The spores are narrower than those of *G. pseudomycesopsis* and differ by being distinctly rugulose with ±perisporeal loosening along the entire circumference

8. *Galerina pseudomycesopsis* Pilát

Selected descriptions and figs: Gulden, Jenssen and Stordal 1985: 41 (colour plate), Gulden and Hallgrímsson 2000: 25, Horak and Miller 1992, Figs 32-35, Gulden and Vesterholt 1999, Figs 7, 8 (colour plates).

Material examined: CE Greenland (n2): Germania Land, DB 89-017. (n1): Zackenberg area, TB 99.031, 99.051, 99.206, 99.229, 99.230, 99.338, 99.361, 99.414. (m): Mestersvig/Kong Oscar fjord, lower E Skeldal, 1962, leg. T.T.Elkington (3 coll.), HD 82.146; Jameson Land: DB 89-051, HK, SAE, JHP 89.106, 89.172, 89.216, 89.309, 89.364, 89.425 (500 m a.s.l.). S Greenland: Qinngua valley, 1889, leg. N. Hartz, HK and TL 84.394, TB 91.076, 91.113, 91.117, 91.122; Narsarsuaq, ML 46-27, TB 85.058; Paamiut (Frederikshåb) area, PMP 73.173, 73.275, TB 78.041, 78.074, 78.090, 78.096, 78.132, 79.114, 79.116, 79.135, 79.137, 81.200a, 83.025, 83.088, 85.210, 93.071, 94.103, 94.104, 95.058, 95.133, 98.013, 00.046, DB 85-019; Nerutusog, head of the N branch, TB 00.206; Qassit Kangerluarsuaq, TB 92.037; Taartoq (Mørke fjord), 300 m a.s.l., TB 00.216. SW Greenland (s): Qeqertarsuaq (Fiskenæsset): Midgård area, PMP 73.428, 73.480, 73.482, 73.611; Nuuk (Godthåb) area, SAE 87.102, 87.140, HK 87.217; Sisimiut (Holsteinsborg) area, PMP 72.851, GG 94/00, 100/00, 112/00, 117/00, 121/00, 122/00, 144/00, 160/00, 162/00, 169a/00, 170/00, 171/00, 182/00. (n): Qeqertarsuaq (Godhavn) area, PMP 70.024, 70.032, 70.037, 70.041, 70.045, 70.047, 70.048, 70.079, 70.081, 70.085, 70.153, 70.210, 71.113,

72.246, 72.274, 72.276, V. Alstrup 75.003, DL 77-31, 77-63, 77-153, TB 86.012, 86.024, 86.031, 86.033, 86.044, 86.051, 86.076, 86.079, 86.099, 86.111, SAE 86.009, 86.097; in median part of Blæsedalen, about 15 km N of Qeqertarsuaq, 350 m a.s.l., TB 86.059, 86.063 and 83.064. CW Greenland (m): Kangerlussuaq (inner Sdr. Strømfjord) area, PMP 73.011, SAE 87.218, GG 18/00, 35/00, 51/00, 63a/00, 89/00. (n): Annertussup Qaq-qai, SW of Ikamiut, PMP 72.103, 72.104, 72.106, 72.108, 72.109; Serfarsuit, PMP 72.031; Ilulissat (Jakobshavn), ML 71-25. NW Greenland (si): Ummannaq, XI 1981, J. Kjærstrøm, PMP 72.211, 72.216, 72.217, 72.306, 72.340. (so): Upernavik, ML 71-7, 71-12. (n): Dundas, SAE 88.023, 88.096, 88.253, 88.273. Carey Islands (Isbjørnø) 1980, J. Just.

Ecology and Distribution: The species typically grows in moist to wet sites such as river beds, shores of lakes and ponds, and in fens. However, a multitude of ecologically fairly different habitats are cited for the Greenland material: In snow-beds with *Salix herbacea*, *Anthelia*, mosses, and lichens, on turf among *Cassiope* and *Salix arctica*, in scrubs of *Salix glauca*, in mossy habitats with mosses such as *Aulacomnium palustre*, *Hylocomium splendens*, *Mnium*, *Drepanocladus*, *Racomitrium*, in *Sphagnum*, among grass, in luxuriant herbaceous vegetation, in (moist) grassland, at a spring, and among *Polytrichum* and small mosses in ruderal site, in moss on kitchen compost, and on burns. According to Horak (1993) *G. pseudomycesopsis* has been recorded in association with 16 different bryophyte species in arctic-alpine regions.

The collections are from most parts of Greenland, from the southernmost parts to the far north and from both coasts, from the subarctic to the middle arctic vegetation zones, and up to 800 m a.s.l. (T. Borgen pers. com.). According to Borgen (1993) it grows 'everywhere' in Greenland and in many different vegetation types. Apparently it avoids the more oligotrophic sites. The species has been recorded by most students of Greenland agarics and it is one of the most commonly encountered species in the N Atlantic region (Gulden and Hallgrímsson 2000). Horak (1993) refers to the species as circumpolar as well as arctic-subantarctic, but it has not yet been reported from boreal-temperate regions.

Comments: *G. pseudomycesopsis* is one of the few galerinas that are easy to recognise in the field as well as in the microscope. Microscopically it differs clearly from the closely related *G. marginata* in spore characters (see *G. marginata*). However, differences between these taxa were not demonstrated in nuclear rDNA-analyses Gulden *et al.* (2001, 2005). Just like in other areas, the Greenland material exhibits a great variation as there are marked differences in fruitbody and spore size, and the veil that usually forms a membranous ring may be reduced to practically nil.

Subgenus *Galerina*

The subgenus has three species in Greenland. None of them has been collected particularly often. Most species of this section tend to become rarer at higher latitudes and altitudes. None in the section was met with in the arctic archipelago of Svalbard (Gulden 1987) and none was reported from the arctic Barrow region by Laursen and Chmielewski (1982) or from arctic-subarctic Alaska and Yukon (Horak and Miller 1992). One species, however, *G. minima* (Peck) A.H. Sm. & Singer (syn. *G. terrestris* Wells & Kempton) is a common pioneer fungus in northern and alpine regions.

Previous records from Greenland of species in this subgenus (of *G. vittiformis* in Kobayasi *et al.* 1971, Lamoure *et al.* 1982, Lange 1957, Petersen 1977, Watling 1983) include only scanty information on anatomical features and can not be sorted on species, e.g. *G. vittiformis* and *G. atkinsoniana*. Lamoure *et al.* (1982) recorded *G. cf. perplexa* A.H. Sm. from the Godhavn area. This is a little known species outside N America and differs from *G. atkinsoniana* by having narrow, \pm setiform pileocystidia. The collection is apparently lost, but I have received a description from D. Lamoure strongly suggesting its identity as *G. atkinsoniana*, since pileocystidia corresponding to those on the stipe, measuring 40-50 x 10 x 4 μ m are described.

9. *Galerina atkinsoniana* A.H. Sm. var. *atkinsoniana*

Large ventricose-fusoid cystidia on edges and sides of the lamellae, over the entire length of the stipe, and on the pileus distinguish the species. All the Greenland collections belong in the type variety, var. *atkinsoniana*, and are referred to two different forms according to the number of sterigmata on the basidia. *Galerina*

atkinsoniana apparently is a characteristic species of oligotrophic vegetation types (Gulden 1980, Senn-Irlet 1987, 1993). The species is common in the N Atlantic region and in alpine regions (Horak 1993) and has a wide distribution in temperate regions as well. It has not previously been recorded from Greenland.

9a. *Galerina atkinsoniana* var. *atkinsoniana* f. *atkinsoniana*

Selected descriptions and figs: Gulden and Hallgrímsson 2000: 30, Figs 5, 8a.

Material examined: CE Greenland (m): Kong Oscar fjord, lower E Skeldal, 150 m a.s.l., 17 VIII 1962, T.T. Elkington. S Greenland: Paamiut (Frederikshåb) area, Eqaluit, dwarf scrub heath with mosses and *Deschampsia flexuosa*, 11 IX 1993, TB 93.213. SW Greenland (s): Qeqertarsuatsiaat (Fiskenæsset), Midgård area, valley W of camp, 25 VIII 1973, PMP 73.566; Sisimiut (Holsteinsborg) area, ML 46-343a, GG 92/00, 97/00, 116/00, 141a/00, 157/00, 158/00, 166/00, 168a/00, 168b/00. CW Greenland (m): Kangerlussuaq area, GG 34/00, 38/00, 56a/00. (n): S side of Annertussup Qaqqai, SW of Ikamiut, 8 VIII 1972, PMP 72.102. NW Greenland (si): At the head of Eqalugaarsuit Sulluat (Laksefjord), 15 VIII 1972, PMP 72.348.

Ecology and Distribution: In heaths, bogs, and in *Salix herbacea* snow-beds, often growing on *Polytrichum* and also *Sphagnum*, once found among small mosses on almost naked soil, and one specimen found on *Peltigera*.

Collections are from both coasts, on the E coast from the Kong Oscar fjord region, at 72° N and on the W coast from Paamiut in the SW (at 62° N) and north to Upernavik at 73° N; that is in the low and the middle arctic vegetation zones

9b. *Galerina atkinsoniana* var. *atkinsoninana* f. *quadrispora* Gulden

Selected descriptions and figs: Gulden and Hallgrímsson 2000: 32, Figs 5, 8b.

Material examined: S Greenland: Paamiut (Frederikshåb) area, among moss in wet mire, not on *Sphagnum*, 30 IX 1985, TB 85.295, 'The Rotten Mountains', S of the town, 27 VIII 1988, TB 88.110, at the SE boarder of the town, in a fen, partly in *Sphagnum*, 26 VIII 1993, TB

93.157. SW Greenland (s): Sisimiut, main valley E of the town, on *Aulacomnium palustre*, 19 VIII 2000, GG 159/00; (n): Siniffik, 21 VIII 1967, ML 67-536.

Ecology and Distribution: Bryophilous on *Aulacomnium*, *Sphagnum*, and other mosses. Collected on the W coast, between 62° N and 69° N, i.e. in the low arctic vegetation zone.

10. *Galerina minima* (Peck) A.H. Sm. & Singer

Synonym: *G. terrestris* Wells & Kempton 1969, *G. vittiformis* var. *vittiformis* forma *tetraspora* sensu Kühner 1972.

Selected descriptions and figs: Gulden and Hallgrímsson 2000: 37, Gulden 1980, Fig. 13.

Material examined: S Greenland: Paamiut (Frederikshåb) area, Taartoq (Mørkefjord), on periodically inundated soil near river bank, on moist mineral soil, with *Empetrum hermaphroditum*, *Salix glauca*, *Vaccinium uliginosum*, *Carex* and *Pinguicula vulgaris*, 9 VIII 1993, TB 93.097*, in river course, among moss near *Salix*, 20 VIII 1997, TB 97.124*. SW Greenland (s): Qeqertarsuatsiaat (Fiskenæsset) area, Midgård, at the head of Fiskenæs fjorden, 23 VIII 1973, PMP 73.478; S of Nuuk (Godthåb), Uppik, on liverworts, 7 VIII 1987, HK 87.045; Sisimiut, roadside, in moss, 20 VIII, leg. C. Crips, GG 172/00. NW Greenland (n): Dundas, top of Akinaarsuk, 1 VIII 1988, snow-bed with low mosses, SAE 88.062, snow-bed, in dead moss, 18 VIII 1988, SAE 88.238 and S side of Akinaarsuk, 250 m a.s.l., snow-bed, in low moss on silty-sandy soil, 18 VIII 1988, SAE 88.239.

Ecology and Distribution: Typically growing among low mosses and liverworts on moist, periodically inundated, silty-sandy mineral soil, occurring also in *Salix herbacea* snow-beds.

Collected on the W coast north to the Thule region (around 76° 30' N) where it grows up to 250 m a.s.l.; collected in the low arctic to middle arctic vegetation zones. New to Greenland. The species seems to be rare (few collections), but has probably not been looked for in the right places in Greenland. It is otherwise known from northern and alpine regions in Europe and N America (Gulden and Hallgrímsson 2000).

Comments: Outstanding features of *G. minima* as compared to the other species of subgenus *Galerina* in the area are presence of a veil and a farinaceous smell/taste. Kühner (1972), however, includes such features in his concept of *G. vittiformis*. The white veil can be seen on the stipe, sometimes even as a small annulus, and often also forming a pale brim on the pileus margin. The pileus is fairly dark with red-brown shades, the lamellae are \pm horizontal and distant, and caulocystidia are seen mainly on the apical part but are also present further down the stipe. The basidia are always 4-spored and bear fairly small spores (7.2-10.6 x 4.5-7.0, av 40/4: 8.8 x 5.7 μ m). The preferred types of habitats – often in moss cushions of *Racomitrium* on silty banks of ponds and streams and in recently deglaciated sites – are also very characteristic.

In previous studies I have used the name *G. terrestris* Wells & Kempton for this species, because this was described with caulocystidia on the entire length of the stipe and with a \pm farinaceous smell and taste, features not indicated for *G. minima*. However, by comparing the original descriptions of *G. minima* and *G. terrestris*, considering also the very special type of habitats given for the two species, I am quite confident that they represent one and the same species. The only clear difference between the descriptions of the two seems to be the lack of smell and taste in *G. minima*, but to my experience the descriptions of these characters in Smith and Singer (1964) are often deficient. The original description of *G. minima* does not include any observations on caulocystidia, but simply gives the stipe as “glabrous except for an evanescent delicate zone of fibrils near mid-portion”. As the main species of stirps *Minima* it may be supposed that the stipe is not cystidiate in the lower part. However, this seems not to have been checked microscopically. When Wells and Kempton (1969) described *G. terrestris*, they only compared it with *G. vittiformis* in the text. In the key, however, where *G. terrestris* and *G. minima* form a pair (keypoint 20) they are separated on spore characters (in *G. terrestris* more distinctly ornamented and with a better delimited plage), and further by less veil remnants in *G. terrestris*. In my opinion these features hardly justify a specific distinction.

In two of the Greenland collections from Paamiut (marked * above) the spores are very pale, almost hyaline to pale ochre, and nearly smooth, whereas tawny and distinctly verruculose-rugulose spores are typical.

11. *Galerina vittiformis* (Fr.) Singer var. *vittiformis*

Lack of pileocystidia in *G. vittiformis* seems to be the only clear discriminating feature between *G. vittiformis* and *G. atkinsoniana*. Apparently there is also an ecological difference, *G. vittiformis* being the more eutrophic of the two. In alpine Norway *G. vittiformis* was found in meso- to eutrophic communities (Gulden 1980) and in alpine fens in Switzerland it occurred mainly in the more mesotrophic sites (Senn-Irlet 1993). *Galerina vittiformis* is a commonly reported species in the N Atlantic and alpine regions (Horak 1993), and it has a wide distribution in temperate regions as well. It is not yet known from the Arctic. Most previous students of Greenland agarics have recorded finds of *G. vittiformis*.

11a. *Galerina vittiformis* var. *vittiiformis* f. *vittiiformis*

Selected descriptions and figs: Gulden 1980: 239, Fig. 12.

Material examined: CE Greenland (n1): Zackenberg, TB 99.373. (m): Jameson land: HK, SAE, JHP 89.187, 89.330, 89.429, 89.447, 89.477. S Greenland: Narsarsuaq, TB 85.056; Kangilinnugit (Grønnedal), ML 46-12 and 46-33; Paamiut (Frederikshåb) area, at the head of Eqaluit, TB 86.336 and 97.129. SW Greenland (s): Qeqertarsuatsiaat (Fiskenæsset) area, Midgård, PMP 73.402 and 73.425; Nuuk (Godthåb), ML 46-514; Sisiimiut (Holsteinsborg) area, PMP 72.052, GG 90/00, 91/00, 93/00, 95/00, 96/00, 98/00, 139/00, 147/00, 165/00; Qeqertarsuaq (Godhavn) area, PMP 71.073; Østerlien 14. VIII 1967, ML 67-196 and Engelskmandens havn ML 67-473. CW Greenland (m): Kangerlussuaq (inner Sdr. Strømfjord) area, ML 46-108, 46-215, 46-254, FT 55.157, 300 m a.s.l., TB 86.199, GG 40/00, 41/00, 45b/00, 46/00, 53/00, 69/00.

Ecology and Distribution: Mostly in moist sites such as river beds, *Salix* scrubs, and fens, on and among mosses (*Rhytidiadelphus*, *Aulacomnium*, *Polytrichum*, occasionally also *Sphagnum*).

Finds are from both coasts, from the very south to far beyond the Arctic Circle (74° 30'N), e.g. in subarctic to middle arctic vegetation zones.

Comments: Based mainly on microscopic features, I have previously applied the names *G. vittiformis* var. *pachyspora* A.H. Sm. & Singer (Noordeloos and Gulden 1992) and *G. vittiformis* var. *vittiformis* f. *vittiformis* (Gulden and Hallgrímsson 2000) for '2-spored' material of *G. vittiformis*, considering material with the larger spores as belonging to var. *pachyspora*. In fact neither of these taxa fit our N Atlantic material completely. The var. *pachyspora*, originally described from Tierra del Fuego, has according to the original description a rudimentary veil and fairly large spores ((7.5)11-13 x (6.2)7.2-8.5(8.8) μm) that are ca 0.7 μm broader in face than in profile view. The spores of the Greenland material measure: 9.6-13.2(-14.0) x 6.8-8.4(-9.0) μm , av (70/7): 11.8 x 7.7 μm , but are not laterally compressed, and there is no veil. On the other hand, the form *vittiformis* (of var. *vittiformis*) as described in Smith and Singer (1964) has smaller, especially narrower spores, 10-12.3 x 5-6.5 μm . This spore size agrees fairly well with material from Iceland with spores measuring 9.7-12 x 5.8-7 μm , av (30/3): 10.8 x 6.6 μm (Gulden and Hallgrímsson 2000). Until more collections of fresh material have been well studied (and features as veil, taste and colours are documented), I refer the 2-spored material to the main variety of *G. vittiformis*, as f. *vittiformis*.

11b. *Galerina vittiformis* var. *vittiformis* f. *tetraspora* A.H. Sm. & Singer

non *G. vittiformis* var. *vittiformis* f. *tetraspora* sensu Kühner (1972).

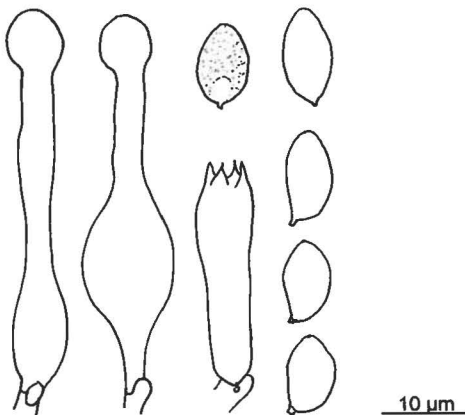


Fig. 1. *Galerina* cf. *cephalotricha*, PMP 73.387: cheilocystidia, basidium and spores.

Selected descriptions and figs: Gulden 1980: 239, Fig. 11.

Material examined: S Greenland: Paamiut (Frederikshåb), on moist ground in snow-bed among moss and *Salix herbacea*, 26 VIII 1986, TB 86.269; SW Greenland (s): Nuuk (Godthåb) area, W-end of the town, ruderal site, moist with moss, 20 m a.s.l., 16 VIII 1987, SAE 87.116 and 87.117; Qooqqut, river side, in *Sphagnum*, 13 VIII 1987, TB 87.096, and 14 VIII 1987, TB 87.105.

Ecology and Distribution: In moist moss, once found in *Sphagnum*. Finds are restricted to S and SW Greenland in the low arctic vegetation zone. The form seems much rarer in Greenland than in other N Atlantic regions.

Comment: The spore mean in this form in Greenland is (av (70/5): 9.5 x 6.3 μm) not much different from that of *G. minima*.

Subgenus *Mycenopsis* (A.H. Sm. & Singer) Bon

This appears to be the most diverse subgenus in Greenland with 12 recognised taxa. It is also a subgenus where many species seem to be very narrowly and insufficiently circumscribed, and hence species recognition has been most difficult. Also many of the collections were not well annotated, and some of my identifications are hence collective or tentative.

Kobayasi *et al.* (1971) recorded *G. tatooshiensis* A.H. Sm. of section *Mycenopsis* A.H. Sm. & Singer from the Ammassalik (Angmagssalik) region, SE Greenland. As originally described, this is a species resembling *G. marginata*, differing by having smooth spores and lacking pleurocystidia. I have not seen Kobayasi's material, but assume from the description that it represents *G. pseudomycenopsis* since a membranous annulus, pleurocystidia, and smooth spores are reported.

12. *Galerina cephalotricha* Kühner

Fig. 1

Synonym: *G. luteolosperma* A.H. Sm. & Singer (?)

Selected description: Kühner 1972: 107-110, De Haan and Walley 2002, Fig. 11 (colour plate).

Material examined: S Greenland: Paamiut (Frederikshåb), at the head of Eqaqut, on *Sphagnum*, 19 VIII 1973, PMP 73.287. SW Greenland (s): Qeqertarsuaat-

siaat (Fiskenæsset), Midgård area, at small lake near Ippiup Qava, on *Sphagnum*, 22 VIII 1973, PMP 73.387; Kuussuaq, at the waterfall, on *Sphagnum*, 24 VIII 1973, PMP 73.512, in deep moss PMP 73.588.

Ecology and Distribution: In *Sphagnum*. Finds are restricted to the southern part of the W coast and are from the low arctic vegetation zone. New to Greenland. The species has previously been reported from Canada and the Faroes (Noordeloos and Gulden 1992, Gulden and Vesterholt 1999), from alpine and sub-alpine sites in France (Kühner 1972), and from alpine and boreal sites in Norway.

Comments: The material is distinguished by unusually pale, practically smooth, yellowish to pale yellow-brown spores, $8.7\text{--}10.2 \times 5.3\text{--}6.3 \mu\text{m}$ (av (10/1): $9.5 \times 5.8 \mu\text{m}$), with a hardly visible plage (in profile only, as a minute hump). The cheilocystidia are mainly ventricose-capitate and the inflated heads are often abruptly delimited from the neck and may be somewhat angular; such distinctly capitate cystidia may resemble the tibiiform type. The material shares important characters with *G. sphagnorum*, e.g. pale stipe and white fibrillose veil remnants, but the specimens appear to be rather small compared to that species and microscopically it deviates by the many clearly capitate cystidia. According to Kühner (1972) *G. cephalotricha* is a species of the *G. mniophila* group with rather dull colours that occasionally grows on *Sphagnum* but more regularly on other bryophytes such as *Ptilidium crista-castrensis*. Microscopically it is particular in the *mniophila*-group by ventricose-capitate cheilocystidia. In most respects it matches the species described by Smith and Singer as *G. luteosperma* and *G. cainii*, both occurring on *Sphagnum*. Our material apparently shares all main characters with *G. luteosperma* A.H. Sm. & Singer, except that the spores are described as slightly narrower in the latter ($8\text{--}11 \times 5\text{--}5.5 \mu\text{m}$).

13. *Galerina chionophila* Senn-Irlet

Fig. 2

Selected descriptions and figs: Senn-Irlet 1986: 48, Hausknecht and Krisai-Greilhuber 1997, pl. 3 (colour plate).

Material examined: CE Greenland (m): Jameson land, springs of Lollandselv, 500 m a.s.l. 30 VII 1989, HK,

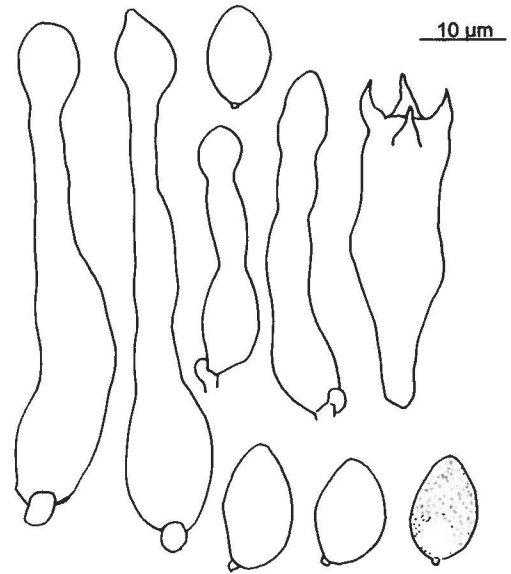


Fig. 2. *Galerina chionophila*, TB 87.138: cheilocystidia, basidium and spores.

SAE, JHP 89.424. S Greenland: Nuuk (Godthåb) area, Lille Malene at the airport, 300 m a.s.l., among moss in moist snow-bed, 17 VIII 1987, TB 87.138. SW Greenland (s): Sisimiut (Holsteinsborg), main valley E of the town, 18 VIII 2000, GG 140/00, 148/00, 149/00, 150/00. CW Greenland (m): Kangerlussuaq (inner Sdr. Strømfjord), Lake Helen area, 14 VIII 2000, leg. T. Borgen, GG 66/00.

Gross-morphology: Pileus 0.5–1.3 mm wide, parabolic to bluntly conic, with age with reflexed margin, smooth, only faintly translucently striate at margin, not viscid, matt, often with white veil remnants on margin, strongly hygrophanous, moist dark red-brown to date-brown, drying from apex to yellowish. Lamellae ascending-adnate, moderately close to subdistant, somewhat ventricose, initially pale beige, becoming yellow-brown (10 YR 5/4) like the stipe apex, edge white fimbriate. Stipe 20–50 × 1–2 mm, apex pruinose and pale brownish, becoming dark brown from base, with veil sometimes forming a ring zone in apical part and ±fibrils and patches below. No smell/taste.

Anatomy: Sp $10.0\text{--}12.6 \times 6.3\text{--}7.7 \mu\text{m}$, av (40/3): $11.0 \times 6.8 \mu\text{m}$, amygdaliform, yellow-brown to tawny (in KOH), practically smooth, surface marbled, plage present but indistinct, visible as pale area on surface and in profile, pore/callus absent. Basidia 4-spored, 24.0–

33.6 x 9.6-12.0 μm , \pm constricted. Cheilocystidia 36-62.4 x (3-)6-10.8 x 3.0-5.0 x 2.0-9.6(-11) μm , generally long, \pm flexuous and ventrally mostly narrowly inflated, neck long cylindrical often repeatedly constricted, apex blunt, clavate, ellipsoid to globose; pleurocystidia absent. Caulocystidia at stipe apex, not or at most narrowly ventricose, apically inflated. Pileipellis of radially repent hyphae, 3.5-18 μm wide, segments rather short to medium, \pm zebra-incrustated, no gelatinised hyphae, pileocystidia absent. Clamp connections numerous.

Ecology and Distribution: In dwarf-heath vegetation, in sloping mire, and in more lichen dominated sites, on mineral soil among *Polytrichum* and various mosses, but apparently not attached to bryophytes.

Collected in E Greenland at about 71° N and in the west at the Arctic Circle, in the low and middle arctic zones, and up to 500 m a.s.l. New to Greenland. This is the first record of the species in the N Atlantic-Arctic region, but the species has also recently been found in alpine Norway (P.-A. Moreau, pers. comm.).

Comments: Characteristic of the species are the dark colour of the moist pileus that gives way to a pale yellowish colour on drying, the dark lower part of the stipe contrasting a paler apex and fairly pale lamellae, and the veil remnants often seen on the pileus margin and as ring zone, fibrils and patches in the lower part

of the stipe. According to Senn-Irlet (1986) who described *G. chionophila* from alpine Switzerland, the species is terricolous and typically grows among *Polytrichum sexangulare* in silicate-snowbeds (*Salicetum herbaceae*).

In many ways the material is reminiscent of *G. pumila* var. *pumila*, but the colour is darker and the spores clearly different. Heteromorphic cheilocystidia, often with narrow ventral part and with variously inflated tips are typical also of *G. permixta* and *G. pumila* var. *pumila*. The spores in *G. chionophila* are considerably broader than described for *G. permixta* ((9)10-12 x 5-6 μm) and also those found in Icelandic material of that species (Gulden and Hallgrímsson 2000). The spores of *G. pumila* var. *pumila* differ by being distinctly paler, more ellipsoid in shape and lacking a plage. *Galerina tundrae* A.H. Sm. & Singer, described from tundra-like sites in western N America, is another brown *Galerina* of subgenus *Mycenopsis* which macroscopically may be reminiscent of *G. chionophila* and has characteristic, long cheilocystidia, but apparently this species has an evanescent veil. By examining authentic material of *G. tundrae* (cp. Gulden 1980, Fig. 20), I found the cystidia in general to be distinctly apically inflated with \pm crystals below the apex. The spores of the holotype were narrowly amygdaliform, 11-13 x 5-6 μm , and thus distinctly narrower than in *G. chionophila*. In paratype material of *G. tundrae* (AHSm. 40351 and 40353) the spores were broader and more similar to those of *G. chionophila*, 10.6-13.5 x 6.3-7.3 μm , but they were born on 2-spored basidia! Apparently the material Kühner (1972) described from alpine sites in Scandinavia under the name *G. tundrae* belongs in *G. chionophila*.

14. *Galerina fallax* A.H. Sm. & Singer

Fig. 3

Selected description: Smith and Singer 1964: 84.

Material examined: S Greenland: Paamiut (Frederikshåb) area, near the town, on *Sphagnum*, 15-18 VIII 1973, PMP 73.218; at the head of Eqaluit, on mosses, probably old burn on fairly hard heath soil, mixed with *G. atkinsoniana*, 28 VIII 1993, TB 93.163. SW Greenland (s): Nuuk (Godthåb) area, Uppik, on *Sphagnum*, 7 VIII 1987, HK 87.048; Sisimiut (Holsteinsborg), main valley E of the town, extracted from coll. of *G. atkinsoniana*, 18 VIII 2000, GG 141a/00.

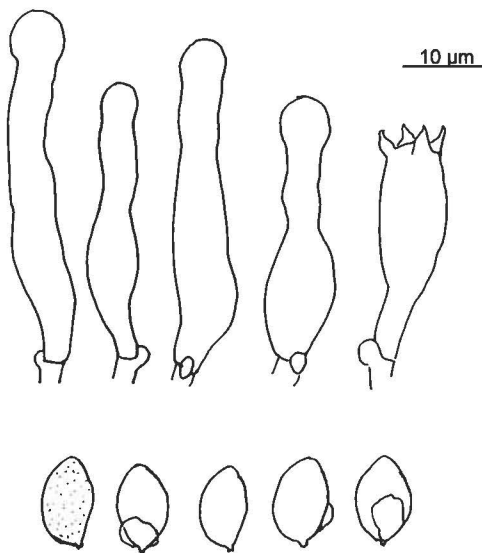


Fig. 3. *Galerina fallax*, TB 93.163: cheilocystidia, basidium and spores.

Ecology and Distribution: On *Sphagnum* and on peaty (and burned?) soil among *Dicranum* and *Polytrichum*, twice together with *G. atkinsoniana*. According to Smith and Singer (1964) the species typically grows on mossy logs, but specimens are also found on *Sphagnum*. Collected on the W coast from 62° N to the Arctic Circle, in the low arctic vegetation zone. New to Greenland. Recorded by Smith and Singer (1964) from across N America (from Washington to Quebec) and from Norway. I am not aware of other northern records.

Comments: *G. fallax* belongs in the *G. hypnorum* complex (see below), but has narrower spores and no veil. None to many spores in mounts of the Greenland material have small blisters; a plage is well delimited. The tawny and practically smooth spores hardly reach 10 µm in length and 6 µm in width, and measure: (8.2-)9.0-9.8(-10.8) x (4.8-)5.3-5.8(-6.5) µm, av (50/4): 9.3 x 5.5 µm. The medium sized cheilocystidia are lageniform to ventricose-capitate and fairly slender, 21.4-63 x 4.8-8.7 x 2.4-5.8 x 2.4-9.5 µm.

15. *Galerina harrisonii* (Dennis) Bas & Vellinga

Synonyms: *Phaeomarasmium harrisonii* Dennis, *Flammulaster harrisonii* (Dennis) Watling; *Galerina antheliae* Gulden.

Selected descriptions and figs: Gulden, Jenssen and Stordal 1985: 41 (colour plate, as *G. antheliae*), Gulden 1980: 245 and Fig. 19, Gulden and Hallgrímsson 2000: 42, Gulden and Vesterholt 1999, Fig. 16.

Material examined: CE Greenland (m): Jameson land, at the springs of Lollandselv, 500 m a.s.l., 31 VII 1989, SAE, HK, JHP 89.427. S Greenland: Paamiut (Frederikshåb), 15-18 VIII 1973, PMP 73.221, 17 VIII 1973, PMP 73.270, on "Telesletten", 8 VIII 1993, TB 93.089. SW Greenland (s): Qeqertarsuatsiaat (Fiskenæsset), Midgård area, 21-27 VIII 1973, PMP 73.371; Nuuk (Godthåb), at "Lille Marlene", 17 VIII 1987, HK 87.227; Sisimiut (Holsteinsborg), leg. P.-A. Moreau, GG 173/00. NW Greenland (so): At Tasiusaq on Nutaarmiut, 16 VIII 1972, PMP 72.395. (n): Qaanaaq (Thule), icecap near Qaanaaq glacier, 450 m a.s.l., 5 VIII 1988, mountain NE of town, 250 m a.s.l., 14 VIII 1988, SAE 88.115.

Ecology and Distribution: On almost naked, black, moist soil in late snow-beds with liverworts (*Anthelia*)

and sparingly *Carex bigelowii*, *Salix herbacea*, and mosses (*Polytrichum*).

Collected in the low arctic to the middle arctic vegetation zones, on both coasts, from 62° 00' N and north to 77° 28' N; in NE and NW found at high altitudes, 450 m and 500 m, respectively. New to Greenland. This is a fairly common species in the N Atlantic-Arctic region, known also from N America and from subarctic Russia (northern Ural tundra). It is common in the Scottish mountains and was originally described from Isle of Rhum (as *Phaeomarasmium harrisonii*). It is one of very few northern galerinas that has not yet been recorded from C European alpine regions, but it is known from a subalpine habitat near Lyman Glacier in Washington State, U.S.A. (Horak 1993, Gulden and Vesterholt 1999).

Comments: *G. harrisonii* is a distinctive species, although not always easy to recognise as a *Galerina* due to the rich veil remnants and the somewhat rough-scurfy pileus surface. In view of the pileipellis characters, Dennis (1964) and Watling (1967) not surprisingly referred the species to *Phaeomarasmium* and *Flammulaster*. One of the Greenland collections was also originally identified as *Flammulaster* sp. Among the northern galerinas, *G. harrisonii* is the species with the broadest spores.

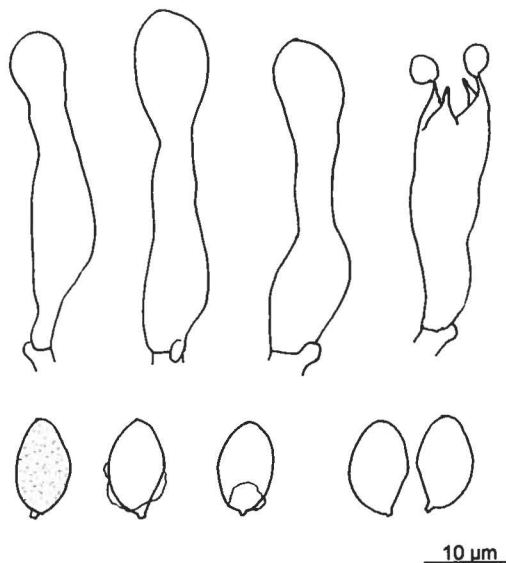


Fig. 4. *Galerina hypnorum*, TB 98.133: cheilocystidia, basidium and spores.

16. *Galerina hypnorum* (Schrank : Fr.) Kühner *sensu lato*

Fig. 4

Synonyms: *G. calyptrata* P.D. Orton, *G. cerina* A.H. Sm. & Singer, and *G. subcerina* A.H. Sm. & Singer).

Material examined: S Greenland: Paamiut (Frederikshåb), at the head of Eqaluit, among *Polytrichum* (on old burn?), 11 IX 1987, TB 87.213; SE end of the town, 6 VIII 1993, TB 93.083; at the head of Eqaluit, 15 VIII 1998, TB 98.133; at the head of Nerutusog, N branch, 19 IX 1993, leg. Birger Knudsen, TB 93.250. SW Greenland (s): Timmiangnuit, SW of Qooqut, on *Sphagnum* together with *Omphalina ericetorum*, 9 VIII 1987, SAE 87.44; Qequetarsuatsiaat (Fiskenæsset), Midgård 21-27 VIII 1973, PMP 73.386; Sisimiut (Holsteinsborg) area, main valley E of the town, 20 VIII 2000, GG 113/00; mountain slopes near the airport, 20 VIII 2000, GG177/00.

Ecology and Distribution: In *Salix herbacea* snow-beds, mossy dwarf willow heaths, on peat and old burns, on *Sphagnum* and *Polytrichum*. Collected on the W coast from 62°16' N to the Arctic Circle, in the low arctic vegetation zone. According to Rostrup (1891) *G. hypnorum* is probably one of the most common galerinas in Greenland and Lange (1957) also has several field entries of *G. hypnorum* (those examined, however, turned out to be *G. pumila* (syn. *G. mycenopsis*) and *G. mniophila*). These and other unverified records of *G. hypnorum* may represent several different species. The species, or members of the species complex are, however, probably very common in the N Atlantic region.

Comments: The differences described between the species mentioned in the heading are mainly gross-morphological and relate to colours (of pileus and stipe), pileus shape, presence or absence of a (faint) farinaceous taste and/or smell, and presence/absence of a fugacious veil. The Greenland material generally lacks information on these pertinent data from observations of fresh specimens and thus often can not be referred with confidence to any of the described species in the *G. hypnorum* complex. Since differentiating microscopic characters appear to be absent, the distinctiveness of these species is also questioned.

The spores of the examined material are tawny (in KOH), practically smooth, and the degree of spore

calypttration varies widely, from practically nil to conspicuous blisters present at spore base and/or apex. They exhibit a continuous variation in size within a relatively small range: (8.7-)9.5-10.8(-12.1) x (5.8-)6.3-7.0(-7.3) μm , av (60/5): 10.4 x 6.4 μm . The cheilocystidia are ventricose-capitate.

The epithet *hypnorum* has been used in many different ways, most confusingly though by Smith and Singer (1964) for a species with acute cheilocystidia and pale fulvous spores (in KOH). Most current descriptions of the species refer to the cystidia as ventricose-capitate and the spores as tawny, and thus correspond largely to *G. hypnorum* as described by Kühner (1935).

Based on examination of the type material of *G. calyptrata* P.D. Orton, Horak and Miller (1992) concluded that this species is conspecific with *G. hypnorum* ss. Kühner 1935. Arnolds and de Vries (1998) on the other hand considered *G. calyptrata* as a distinct species recognisable already in the field on a more acute and more vividly orange pileus than *G. hypnorum* and with slightly larger spores. American authors, e.g. Smith and Singer, following Atkinson (1918), apply the name *Galerina cerina* for material largely corresponding to Kühner's *G. hypnorum*. They claim that *G. cerina* differs from *G. calyptrata* by lacking its farinaceous taste. According to Kühner (1935) *G. hypnorum* has a "saveur douce, farineuse" while Arnolds (1983) described his material of *G. hypnorum* "with or without mealy smell". Obviously smell/taste are problematic characters to use in this group where the specimens often are very small and grow few together. *Galerina subcerina* A.H. Sm. and Singer that also may be present in our material differs from the other species of the complex by lacking a veil and by having an evenly coloured, pale stipe (no information on smell/taste for this species is given in the original description although lots of collections are cited in Smith and Singer (1964)). The complex obviously needs closer study. Any molecular analyses should be based on material with sufficient morphology data in order to sort out the correct names.

Some collections may be referable to one of the species in the complex: TB 87.213 with detailed field notes on gross-morphology fits *G. calyptrata* very well. Coll. TB 98.133, where smell/taste is noted as lacking and veil fibres are present, fits *G. cerina*. Collections PMP 73.386, SAE 87.44, TB 93.250, and GG 113/00 lack

information on veil condition as fresh and have no visible traces of veil when dry, and show fairly evenly coloured, pale yellowish stipes, and thus correspond to the description of *G. subcerina*.

16a. *Galerina hypnorum* forma

Fig. 5

Material examined: SW Greenland (s): Sisimiut area, E of the airport, in moist heath vegetation on the W-slope of the mountains, 20 VIII 2000, on *Sphagnum*, GG 178/00, on *Polytrichum*, GG 179a/00.

Gross-morphology: Pileus up to 10 mm, conic to conic-umbonate, striate to umbo, ochre with paler, honey-coloured apex, striae yellow-brown, yellow-ochre between striae. Lamellae adnate, subdistant, ochre. Stipe up to 35 x 1 mm, concolorous with the pileus or paler, apex pruinose, white veil remnants present. Smell and taste not noted.

Anatomy: Spores (9.8-)10-11.8 x 6.0-7.2 μm , av (20/2): 10.7 x 6.5 μm , amygdaliform, tawny in KOH, minutely rugulose, plage rather distinct, pore/callus absent, some with small blisters. Basidia 4-spored, 21.6-34.8 x 9.0-10.0 μm , \pm constricted in the middle part. Cheilocystidia 21.6-55.2 x 5.0-10.2 x 3-10 x 3.6-15.6 μm , apparently starting as globose to pyriform end-cells, gradually elongating and becoming constricted somewhere in the apical half, and finally appearing ventricose-capitate with the ventral portion often less inflated than the apical head; in between are some more normal, rather small, ventricose-capitate cystidia; pleurocystidia absent. Clamp connections numerous.

Ecology and Distribution: The two collections are from a mountain slope in the low arctic zone; GG178/00 was growing in a *Sphagnum* cushion while the fruitbodies of GG179a/00 occurred on adjacent *Polytrichum commune*; they possibly originate from the same mycelium. Other galerinas occurring close by in \pm the same type of habitat were: *G. hypnorum*, *G. leptocystis*, *G. mniophila*, and *G. sphagnum*.

Comments: The large and unique cystidia were seen in the specimens of both collections and along the entire edge of the lamellae. Horak and Miller (1992) reported on similar material, but with somewhat intermediate

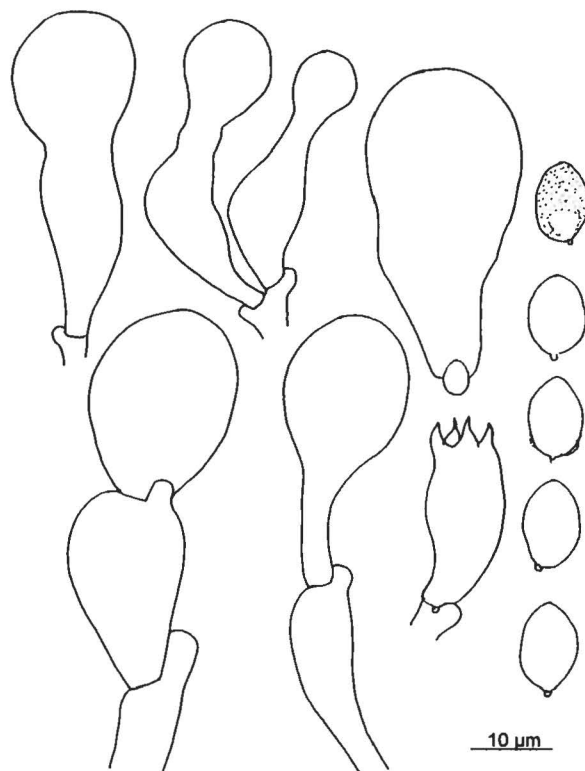


Fig. 5. *Galerina hypnorum* forma, GG 178/00: cheilocystidia, basidium and spores.

cystidia from Barrow (Alaska) as *Galerina* sp. 1, occurring in a fertilized plot in the wet tundra. The perisporeal loosening seems more pronounced in their material. Observation on smell/taste lacked also here. These authors suggested a taxonomic relationship with *G. hypnorum*. Sequencing (rDNA ITS and mtDNA LSU) of the Greenland material has been carried out resulting in identical characteristics with collections identified as *G. hypnorum* (Gulden *et al.* 2005).

The material matches the description of *G. bullulifera* Singer – characterised by large, vesiculose-pedicellate cystidia – surprisingly well. The main difference seems to be in the spores that are described as slightly smaller, 8-9 x 4.8-5.2 μm , without perisporeal loosening, and with a callus. *Galerina bullulifera* is one of many *Galerina* species described based on a single collection. It was found on trunks of hardwood in a subtropical Argentinean forest. A conspecificity with the Argentinean species seems improbable considering the big geographical disjunction and an apparently very different type of habitat, but the basis for subsection *Bulluliferinae* A.H. Sm. and Singer, established on

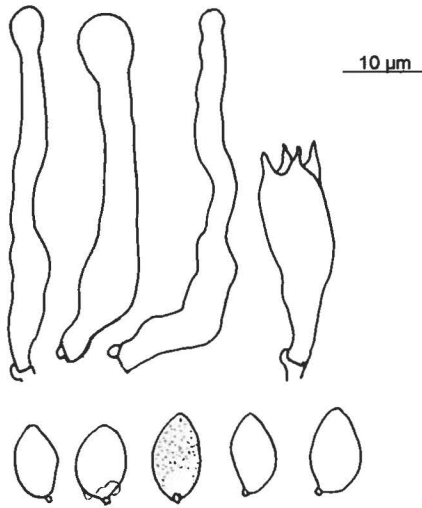


Fig. 6. *Galerina leptocystis*, GG 151/00: cheilocystidia, basidium and spores.

account of the aberrant cystidia in a single species, is questioned.

17. *Galerina leptocystis* Wells & Kempton

Fig. 6

Selected descriptions and figs: Wells and Kempton 1969: 371, Horak and Miller 1992: 421, Figs 13-16.

Material examined: S Greenland: Paamiut (Frederikshåb) area, at the head of Kangerluarsuk, 11 VIII 1993, TB 93.109. SW Greenland (s): Sisimiut (Holsteinsborg) area, main valley SE of the town, 19 VIII 2000, GG 151/00, 156/00; mountain slopes near the airport, 20 VIII 2000, GG 176/00, 180/00.

Ecology and Distribution: On *Sphagnum* in moist *Salix herbacea* snow-beds and in moist, mossy heath vegetation on mountain slope together with *G. hypnorum*, *G. mniophila*, and *G. atkinsoniana*. GG 180/00 had fruit-bodies both on *Sphagnum* and *Polytrichum*, and GG 151/00 was found in/on old, overgrown *Polytrichum* amongst peat. Collected on the W coast from 62° N to the Arctic Circle, in the low arctic vegetation zone. New to Greenland. Otherwise known from Alaska (Wells and Kempton 1969, Horak and Miller 1992).

Comments: The material is referred to *G. leptocystis* because of the characteristic cystidia that tend to be narrow, sometimes without ventral inflation, with long ± flexuous necks, and with mainly blunt to subcapitate tips. They are thus narrower and less capitate

than those typical in the *G. hypnorum* complex. The cystidia in fact match those described for *G. cerina* var. *ampullicystis* A.H. Sm. & Singer, a taxon described with relatively small spores which possibly is identical with *G. leptocystis*. The spores of our material are calyptrate, mostly with small blisters, yellow-brown to tawny, practically smooth, and measure 7.8-10.0(-11.8) × 4.8-6.3 µm, av (50/5): 9.3 × 5.6 µm, and agree well with those described for *G. leptocystis*. The species has according to the description an evanescent veil and a farinaceous smell and taste – features not observed in all the Greenland collections – and it is smaller than the typical sphagnicolous *Galerina* species.

Galerina leptocystis was originally described from SC Alaska based on a single collection of specimens growing on living *Sphagnum*. It has later been recorded from arctic Alaska, growing on and among *Polytrichum* and on peaty soil (Horak and Miller 1992). *Galerina leptocystis* is hence not a strictly sphagnicolous species.

18. *Galerina mniophila* (Lasch) Kühner

Selected descriptions and figs: Smith and Singer 1964: 166, Gulden and Vesterholt 1999, Figs 18, 19 (colour plates, dehydrated specimens), De Haan and Walley 2002, Fig. 9 (colour plate).

Material examined: S Greenland: Paamiut (Frederikshåb), TB 93.124. SW Greenland (s): Qeqertarsuaq (Fiskenæsset), Midgård area, PMP 73.525, 73.554, 73.568; Sisimiut (Holsteinsborg) area, GG 114/00, 115/00, 128/00, 132/00, 146/00 (leg. T. Borgen), 155/00, 179/00. CW Greenland (m): Kangerlussuaq (inner Sdr. Strømfjord) area, ML 46-213, GG 25/00, 36/00, 37/00, 45a/00, 54/00, 55/00, 56/00, 57/00, 62/00, 63b/00, 64/00, 81/00, 81b/00, 84/00, 87/00.

Ecology and Distribution: On *Polytrichum*, *Hylocomium* and other mosses, in moist *Salix herbacea* snow-beds and mossy, moist heaths with *Betula nana*, *Ledum palustre*, *Empetrum* and *Peltigera*, also close to small cushions of *Sphagnum*, and on a peat wall with the chionophilous lichen *Solorina crocea*.

Collected on the W coast from 62° N to the Arctic Circle, in the low arctic vegetation zone. Previously recorded from Greenland by Rostrup (1891) and Lange (1957). A common species in the N Atlantic region (Gulden and Hallgrímsson 2000).

Comments: A dull coloured but shiny pileus, sometimes with a watery hyaline translucent apex, a pale stipe, and a typical habitat on larger mosses in oligotrophic vegetation are good field characters, as is also the strong colour change of the pileus to become almost white when dehydrated.

19. *Galerina paludosa* (Fr.) Kühner

Selected descriptions and figs: Smith and Singer 1964: 142, Gulden 1980, Fig. 16, De Haan and Wallyen 2002, Fig. 14 (colour plate).

Material examined: S Greenland: Qinngua valley, Tarsersuaq lake, HK, TB, JHP 83.067, 83.450, TB 91.093; Narsarsuaq, TB 91.151 and 92.008; Paamiut (Frederikshåb) area: Paamiut, TB 78.048, TB 81.096, head of Eqluit, PMP 73.286 and TB 81.130; Nigerlikasik, TB 00.005 and TB 00.006; Qassit, near Ippik, TB 86.231; Qassit Kangerluarsua, TB 86.231 and TB 92.031. SW Greenland (s): Qeqertarsuatsiaat (Fiskenæsset), Midgård area, PMP 73.361a and 73.491, near small lake at Ippiup Qava, PMP 73.388, 73.395. CW Greenland (n): Ilulissat (Jakobshavn) area, Serfarsuit, PMP 72.032.

Ecology and Distribution: Confined to *Sphagnum*, in bogs. New to Greenland. This is a southern species in Greenland, found in the subarctic to low arctic parts. Considered not uncommon and present most years for instance in the Paamiut-Midgård region, but only once collected further north. The northern limit is somewhat north of the Arctic Circle (70° 15' N) on the W coast. Apparently a southern species in the N Atlantic region, known from the Faroes and the low alpine zone in Norway, but not on record from Iceland and Svalbard.

Comments: *G. paludosa* is easy to recognise in the field on the dark colour, the broad, adnate lamellae, the veil remnants (often on pileus margin and as a ± annular zone on the stipe apex with remnants further down), and the farinaceous smell/taste. It sometimes may resemble older specimens of *Phaeogalerina stagnina*, but that species lacks a farinaceous smell/taste.

20. *Galerina pseudomniophila* Kühner

Fig. 7

Selected descriptions and figs: Gulden and Vesterholt 1999: 702, Figs 20-21 (colour plates, half dry).

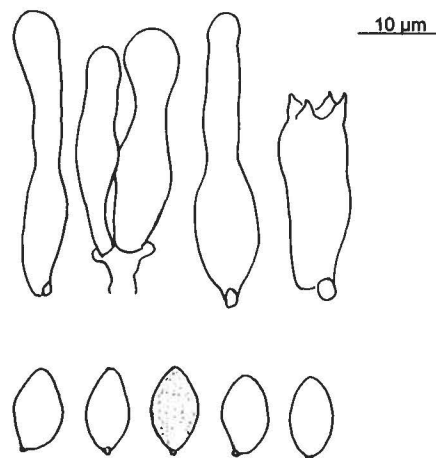


Fig. 7. *Galerina pseudomniophila*, PMP 72.105: cheilocystidia, basidium and spores.

Material examined: S Greenland: Paamiut (Frederikshåb), NE in the town, on eroded river bank, among mosses and grass, *Octospora* sp. and *Lepista multiformis*, 11 IX 1994, TB 94.094. SW Greenland (s): Sisimiut (Holsteinborg), main valley E of Sisimiut, 18 VIII 2000, GG 111/00. CW Greenland (m): Kangerlusuaq (inner Sdr. Strømfjord), at lake E of lake Helen, 14 VIII 2000, GG 65/00 and 80/00. (n): Annertussup Qaqqai, SW of Ikamiut, 8 VIII 1972, PMP 72.105.

Ecology and Distribution: Bryophilous, on various mosses. Collected on the W coast north to 68° 30' N, in the low arctic vegetation zone. New to Greenland. Previously recorded from alpine sites in Scandinavia, from the Faroes, and from subarctic Canada (Kühner 1972, Gulden 1980, Gulden and Vesterholt 1999, Noordeloos and Gulden 1992). The records from Svalbard under this name (Gulden 1987) relate to *G. pumila* var. *subalpina*.

Comments: Characteristic of the species are a brownish ochre to yellow-brown pileus, rather distant, ochre to yellow-brown lamellae, and a pale stipe. It is thus more brightly coloured than *G. mniophila*. Anatomically it comes close to *G. mniophila*, but has slightly smaller spores with a less distinct plage. It may resemble *G. pumila* var. *subalpina*, especially since both sometimes have a watery hyaline pileus centre, but differs particularly in the smaller and more regular cystidia.

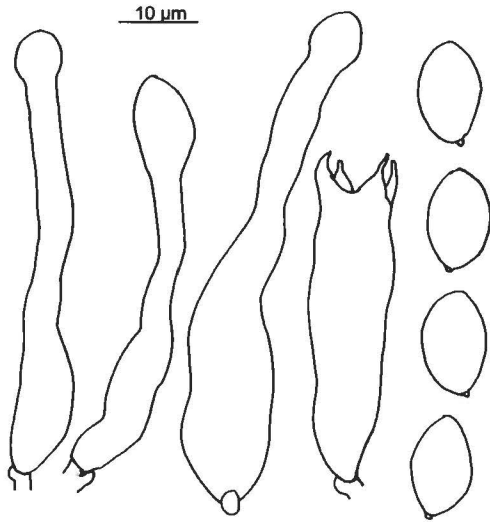


Fig. 8. *Galerina pumila* var. *pumila*, TB 98.151: cheilocystidia, basidium and spores.

21. *Galerina pumila* (Pers. : Fr.) M. Lange non sensu M. Lange

21a. *Galerina pumila* var. *pumila*

Fig. 8

Synonym: *G. mycenopsis* (Fr.) Kühner sensu Ricken

Selected descriptions and figs: Smith and Singer 1964: 188, Gulden 1980 Fig. 27.

Material examined: S Greenland: Ivittuut (Ivigut), 16 VIII 1991, TB 91.197. Paamiut (Frederikshåb) area: 'The Rotten Mountains' SE of the town, 30 VIII 1995, TB 95.III, *ibid.* 19 VIII 1998, TB 98.151, Søfartskolen, slightly moist heath with *Salix herbacea* and *Empetrum hermaphroditum* on eroded basalt, 13 VIII 1998, TB 98.II0, at the head of Nerutusog, N branch, on dry gravely moraine, with *Cetraria* and *Racomitrium*, 8 IX 2000, TB 00.269. SW Greenland: Midgård, lake S of Sallersua, N of Fiskenesfjorden, in deep moss, 26 VIII 1973, Midgård area, PMP CW Greenland (m): Kangerlussuaq (inner Sdr. Strømfjord) area: Store Saltsø area, 16 VIII 2000, GG 39/00, GG 82/00.

Ecology and Distribution: On moss (*Polytrichum*, *Racomitrium*) in dwarf-shrub heaths and snow-beds with *Salix herbacea*, *Empetrum*, *Cetraria*, *Peltigera* and in *Salix glauca* scrub. Collected on the W coast, north to the Arctic Circle, in the subarctic to low arctic vegeta-

tion zones. New to Greenland. Records of *G. pumila* from Greenland by Lange (1957) and Rostrup (1888) relate to the very common and very different *G. pseudomycenopsis* which in the past was named *G. (Pholiota) pumila*. Also known from Iceland and Svalbard in the N Atlantic – Arctic region. The species has a wide distribution in boreal and temperate regions as well.

Comments: This is a somewhat robust, brightly coloured *Galerina* with a \pm viscid-shiny pileus and a rather pale and thick, clearly hollow, often flexuous stipe. Veil remnants are often seen on the pileus margin and stipe. In the field it may be mistaken for *G. clavata*, but their preferred types of habitats are quite different. Smooth and pale spores without plage and tending towards an ellipsoid shape characterise the type variety. Together with *G. harrisonii* it has the largest spores in the subgenus in Greenland. Its long and fairly narrow cheilocystidia, often flexuous and with variously inflated tips, are also characteristic.

Few *Galerina* species have truly smooth spores, and even in *G. pumila* a faintly marbled surface indicates some type of ornamentation. There is an appplanation or shallow depression in the area of the plage, but no visible plage. Smith and Singer (1964) described a very minute pore in spores of *G. pumila* var. *pumila*, but a pore is elsewhere not reported for this species, and Singer (1961) did not report a pore in the proposed lectotype material of *G. pumila* from Persoon's herbarium.

21b. *Galerina pumila* var. *subalpina*

A.H. Sm.

Fig. 9

Selected descriptions and figs: Smith and Singer 1964: 189, Gulden and Hallgrímsson 2000 Figs 8, 16b.

Material examined: CE Greenland (m): Jameson Land, HK, SAE, JHP 89.425 (500 m a.s.l.). S Greenland: Paamiut (Frederikshåb), 'The Rotten Mountains', 12 VIII 1995, TB 95.059. CW Greenland (m): Kangerlussuaq (inner Sdr. Strømfjord) area: Sandflugtdalen, in moist moss with *Juncus*, on sand, leg. H. Knudsen, 12 VIII 2000, GG 17/00, Lake Helen area, among moss and *Peltigera*, 14 VIII 2000, GG 66a/00, and Store Saltsø area, on *Polytrichum* on sand, 16 VIII GG 83/00.

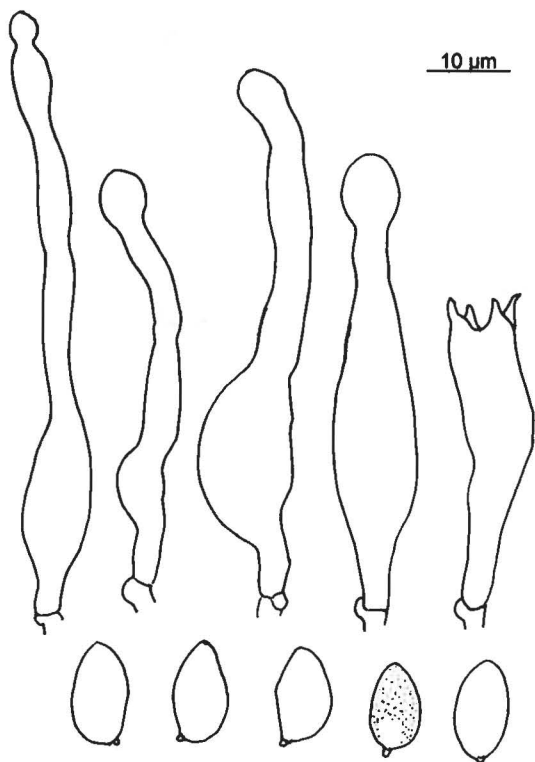


Fig. 9. *Galerina pumila* var. *subalpina*, GG 83/00: cheilocystidia, basidium and spores.

Ecology and Distribution: In moist, mossy sites, on *Polytrichum* and other mosses, on mineral soil and in heath vegetation, among *Peltigera*, *Vaccinium uliginosus*, *Empetrum hermaphroditum*, *Salix glauca*, *Jun-cus*. Collected on the E and the W coast between 62° N and 75° N, from the low to the middle arctic vegetation zone. New to Greenland. Recorded from alpine Norway, Iceland, and Svalbard (as *G. pseudomniophila*) in the N Atlantic-Arctic region.

Comments: The spores are pale and yellow-brown as in var. *pumila*, but smaller and slightly more ornamented with an inconspicuous plage. They are also more amygdaliform than in the type variety. The cheilocystidia are fairly narrow and irregular, mostly blunt to subcapitate at apex, but occasionally repeatedly constricted, fusoid or variously inflated. The distinction between *G. pumila* var. *subalpina* and *G. pseudomniophila* is problematic and was discussed already by Kühner (1972). Anatomically the differences are subtle, and mainly seen as a tendency of longer and somewhat more irregular cheilocystidia in *G. pumila* var. *subalpina* than in *G. pseudomniophila*.

22. *Galerina sphagnum* (Pers.: Fr.) Kühner

Fig. 10

Selected descriptions and figs: Noordeloos and Gulden 1992: 629, Figs 13-15.

Material examined: S Greenland: Paamiut (Frederikshåb) area, at the head of N branch of Nerutusog, on *Sphagnum*, 26 VIII 2000, TB 00.207. SW Greenland (s): Qeqertarsuaatsiaat (Fiskenæsset), Midgård area, at small lake near Ippiup Qava, on *Sphagnum*, 22 VIII 1973, PMP 73.401; at lake S of Sallersua, N of Fiskenæs fjorden, on *Sphagnum*, 26 VIII 1973, PMP 73.613; lake N of Kuannit Qaqqaat, 2-300 m a.s.l., in *Sphagnum* on lake shore, 14 VIII 1987, SAE 87.114; Sisimiut (Holsteinsborg) area, mountain slope near the airport, on *Sphagnum* in dwarf willow heath, 20 VIII 2000, GG 178a/00.

Ecology and Distribution: On *Sphagnum*; by lake shores and in dwarf willow heath. Finds are restricted to the southern part of the W coast and to the low arctic vegetation zone. New to Greenland. Widely distributed in temperate and boreal regions, only rarely collected in cold climate areas. Reported from the low alpine zone in Norway and in Iceland (Gulden and Hallgrímsson 2000).

Comment: The material referred to *G. cf. cephalotricha* apparently is more or less from the same localities, but has more capitate cheilocystidia and paler spores.

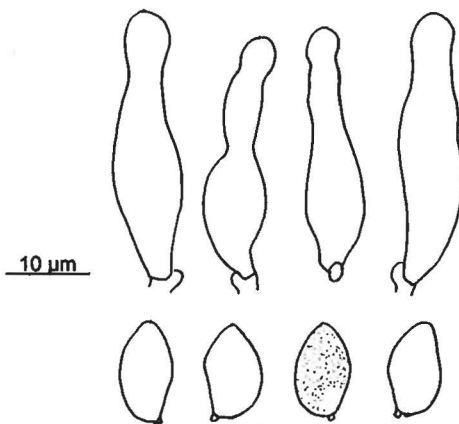


Fig. 10. *Galerina sphagnum*, TB 00.207: cheilocystidia and spores.

Genus *Phaeogalera* Kühner

Orton (1960) described two *Naucoria* species, closely related to *P. stagnina*, viz., *N. zetlandica* and *N. stagninoides*, the first based on one, the second on two collections. The stated anatomical and gross-morphological differences are in my opinion very slight, as is also the ecological evidence: *N. stagninoides* was said not to grow on *Sphagnum*, thereby differing from *N. stagnina* that occasionally does, and *N. zetlandica* was found on *Sphagnum*. The complex needs closer study for distinction of separate species.

23. *Phaeogalera stagnina* (Fr.) Pegler & T.W.K. Young

Selected descriptions and figs: Horak and Miller 1992: 416 and Figs 2-4, Gulden 1980: 231 and Fig. 5.

Material examined: S Greenland: Paamiut (Frederikshåb) area, PMP 73.176, TB 78.109, 79.118, 83.033, 85.214, 85.244; Kvanenøen, in the abandoned settlement Kangilineq, TB 84.163 and 85.244, Nerutusoq, at the head of the N branch, TB 00.198. SW Greenland (s): Qeqertarsuaq (Fiskenæsset), Midgård area, PMP 73.390, 73.432, 73.560; Nuuk (Godthåb) area, at the airport, 200 m a.s.l., TB 87.129; Kangerluarsunguaq (Kobbefjord), SAE 87.178; Qooqqut, SAE 87.100; Sisimiut (Holsteinsborg) area, GG 124/00, 143/00, 163/00, 185/00. CW Greenland (m): Kangerlussuaq (inner Sdr. Strømfjord) area, ML 46-200 and 46-355, TB 86.168, SAE 87.225, 58/00, 59/00, 60/00, 61/00.(n): Ilulissat (Jacobshavn), Sermermiut, ML 71-27.

Ecology and Distribution: In wet places such as along brooks, on lake banks, in fens, always on moss, often *Sphagnum*. Collected north to about 71° N on the west coast. All collections are from the low arctic vegetation zone. Lange (1957) recorded the species, as *Psilocybe stagnina*, from the Kangerlussuaq area, Nuuk (Godthåb) and Kangamiut, and considered it a rather rare species in Greenland. According to Borgen (pers. comm.) it is fairly common around Paamiut and Nuuk.

Phaeogalera stagnina is often considered a northern species (Fries 1838, Lange 1957). It occurs, but more rarely, in the Alps (Favre 1948, 1955, Senn-Irlet 1986). Senn-Irlet (1993) considered it a typical species in acid, *Salix* rich, alpine fens in Switzerland.

Erroneous or doubtful Greenland records

G. aff. dimorphocystis A.H. Sm. & Singer – Lamoure *et al.* (1982).

G. aff. perplexa – Lamoure *et al.* (1982).

G. tatooshiensis A.H. Sm. – Kobayasi *et al.* (1971).

Acknowledgements

I am indebted to Torbjørn Borgen for considerable help with geographic and vegetational items, for reading and commenting on the manuscript, and for excellent guidance during ISAM VI in Greenland. Thanks go also to Per Magnus Jørgensen, University of Bergen, for nomenclatural advice and to Henning Knudsen, Botanical Museum, Copenhagen for loan of material. Egon Horak and Roy Watling are gratefully acknowledged for valuable suggestions and linguistic corrections.

References

- Arnolds, E. 1983. *Ecology and coenology of macrofungi in grasslands and moist heathlands in Drenthe, the Netherlands*. Vol 2. – *Bibliotheca Mycologica* 90: 501 pp.
- Arnolds, E. and Vries, B. de 1988. On the identity of the new taxa of *Galerina* (Agaricales), provisionally described by J. J. Barkman. – *Persoonia* 17: 1-21.
- Atkinson, G. F. 1918. The genus *Galera* in North America. – *Proceedings of the American Philosophical Society* 57: 357-374.
- Bay, C. 1997. Floristic division and vegetation zonation of Greenland of relevance to a circumpolar arctic vegetation map. – *Occasional papers, Inst. Arctic Alpine Research, Univ. Colorado* 52: 27-31.
- Bay, C. 1999. Diversiteten af økosystemer. In: Jensen, D. B. (ed), *Grønlands Biodiversitet – et landestudie*. – Teknisk rapport nr. 27: 21-45, Pinngortitaleriffik, Grønlands Naturinstitut.
- Bon, M. 1991. Espèces "galéro-naucoroides": stat. et comb. nov. – *Documents Mycologiques* 21: 37-39.
- Bon, M. 1992. Cle monographique des espèces galéro-naucoroides. – *Documents Mycologiques* 21: 1-89.
- Borgen, T. 1993. *Svampe i Grønland*. – Atuakkiorfik, Nuuk: 112 pp.
- Borgen, T. 2006. Distribution of selected basidiomycota in oceanic dwarf-scrub heaths in Paamiut area, S-Greenland. – *Meddelelser om Grønland, Bioscience* 56.
- Böcher, T. W., Holmen, K. and Jakobsen, K. 1957. *Grønlands Flora*. – Copenhagen: 313 pp.

- De Haan, A. and Walley, R. 2002. Studies in *Galerina*. *Galerina Flandriæ* (1). – *Fungi non delineati*. Pars 23: 1-66.
- Dennis, R. W. G. 1964. The fungi of the Isle of Rhum. – *Kew Bulletin* 19: 112.
- Dietrichson, J. and Høydahl, H. 1984. *Taksonomisk undersøkelse av slekten Galerina Earle (Basidiomycetes, Agaricales) fra lavlandet i Norge*. – Thesis, Univ. Oslo, Oslo (unpubl.): 175 pp.
- Favre, J. 1948. *Les associations fongiques des hauts-marais jurassiens et de quelques régions voisines*. – *Matériaux Flora Cryptogamique Suisse* 10: 228 pp.
- Favre, J. 1955. *Les champignons supérieurs de la zone alpine du Parc Nationale Suisse*. – *Ergebn. Wiss. Untersuch. Schweiz. Nationalparks* 5 (N.F.) 33: 212 pp.
- Feilberg, J. 1984. A phytogeographical study of South Greenland. Vascular plants. – *Meddelelser om Grønland, Bioscience* 15: 1-72.
- Fries, E. 1836-1838. *Epicricis systematis mycologici*. – Upsala.
- Gulden, G. 1980. Alpine *Galerinas* (Basidiomycetes, Agaricales) with special reference to their occurrence in South Norway at Finse on Hardangervidda. – *Norwegian Journal of Botany* 27: 219-253.
- Gulden, G. 1987. The genus *Galerina* on Svalbard. In: Laursen, G. A., Ammirati, J. F. and Redhead, S. A. (eds), *Arctic & Alpine Mycology II*: 177-204. – Plenum Press, New York & London.
- Gulden, G. and Hallgrímsson, H. 2000. The genera *Galerina* and *Phaeogaleria* (Basidiomycetes, Agaricales). – *Acta Botanica Islandica* 13: 3-54.
- Gulden, G. and Jenssen, K. M. 1988. *Arctic and alpine fungi* – 2. – Oslo: 58 pp.
- Gulden, G. and Vesterholt, J. 1999. The genera *Galerina* and *Phaeogaleria* (Basidiomycetes, Agaricales) on the Faroe Islands. – *Nordic Journal of Botany* 19: 685-706.
- Gulden, G., Dunham, S. and Stockman, J. 2001. DNA studies in the *Galerina marginata* complex. – *Mycological Research* 105: 432-440.
- Gulden, G., Jenssen, K. M. and Stordal, J. 1985. *Arctic and alpine fungi* -1. – Oslo: 62 pp.
- Gulden, G., Stensrud, Ø., Schalchian-Tabrizi, K. and Kause-
rud, H. 2005. *Galerina* Earle: A polyphyletic genus in the consortium of dark-spored agarics. – *Mycologia* 97: 823-837.
- Hausknecht, A. and Krisai-Greilhuber, I. 1997. Some rare Agaricales with brown or darker spores. – *Fungi non delineati*. Pars II, Allassio: 32 pp.
- Horak, E. 1993. Distribution and ecology of Arctic-alpine species of *Galerina* and *Phaeogaleria* in the northern and southern hemisphere. – *Sydowia* 44: 346-376.
- Horak, E. and Miller, O. K., Jr. 1992. *Phaeogaleria* and *Galerina* in arctic-subarctic Alaska (U.S.A.) and the Yukon Territory (Canada). – *Canadian Journal of Botany* 70: 414-433.
- Jensen, D. B. (ed) 1999. *Diversiteten af økosystemer – et lan-
destudie*. – Teknisk rapport nr. 27, Pinngortitaleriffik, Grønlands Naturinstitut: 220 pp.
- Kobayasi, Y., Hiratsuka, N., Otani, Y., Tubaki, K., Udagawa, S., Sugiya, J. and Konno, K. 1971. Mycological studies of the Angmagssalik Region of Greenland. – *Bulletin of the National Science Museum Tokyo* 14(1): 96 pp.
- Kühner, R. 1935. Le genre *Galera* (Fries) Quélet. – *Encyclopédie Mycologique* 7, Paris: 240 pp.
- Kühner, R. 1969. *Galerina hybrida* Kühner sp. nov. et deux espèces sphagnicoles affines. – *Travaux Laboratoire de "La Jaysinia" à Samoëns (Haute-Savoie)* 3: 73-83.
- Kühner, R. 1972. Agaricales de la zone alpine. Genres *Galera* Earle et *Phaeogaleria* gen. nov. – *Bulletin trimestriel de la Societe mycologique de France* 88: 41-153.
- Lamoure, D., Lange, M. and Petersen, P. M. 1982. Agaricales found in the Godhavn area, W Greenland. – *Nordic Journal of Botany* 2: 85-90.
- Lange, M. 1957. Macromycetes Part. III. I. Greenland Agaricales (pars) macromycetes caeteri. II. Ecological and plant geographical studies. – *Meddelelser om Grønland* 148(2): 1-125.
- Laursen, G. A. and Cmielewski, M. A. 1982a. The ecological significance of soil fungi in Arctic tundra. In: Laursen, G. A. and Ammirati, J. (eds), *Arctic and Alpine Mycology*: 432-488. – University of Washington Press.
- Laursen G. A. and Cmielewski, M. A. 1982b. The FISAM in retrospect. In: Laursen, G. A. and Ammirati, J. (eds), *Arctic and Alpine Mycology*: 532-542. – University of Washington Press.
- Munsell 1975. *Soil Color Charts*. – Munsell Colour Compagny inc., Baltimore.
- Noordeloos, M. E. and Gulden, G. 1992. Studies in the genus *Galerina* from the Shefferville area on the Québec-Labrador peninsula, Canada. – *Persoonia* 14: 625-639.
- Orton, P. D. 1960. New check list of British Agarics and Boleti. Part III. Notes on genera and species in the list. Part 3. – *Transactions of the British mycological Society* 42: 159-439.
- Orton, P. D. 1988. Notes on British Agarics . IX. – *Transactions of the British mycological Society* 91: 545-571.
- Persoon, C. H. 1801. *Synopsis methodica fungorum*. – Göttingen: 706 pp.
- Petersen, P. M. 1977. Investigations on the ecology and phenology of the macromycetes in the Arctic. – *Meddelelser om Grønland* 199(5): 72 pp.
- Reid, D. A. 1984. A revision of the British species of *Naucoria* sensu lato. – *Transactions of the British mycological Society* 82: 191-237.
- Rostrup, E. 1888. Fungi Groenlandicae. Oversigt over Grønlands Svampe. – *Meddelelser om Grønland* 3: 516-590.
- Rostrup, E. 1891. Tillæg til "Grønlands Svampe". – *Meddelelser om Grønland* 3: 592-643.
- Senn-Irlet, B. 1986. *Galerina chionophila* (Agaricales, Basidiomycetes), eine neue Art aus der alpinen Stufe der Schweizer Alpen. – *Mycologica Helvetica* 2: 43-48.

- Senn-Irlet, B. 1987. *Ökologie, Soziologie und Taxonomie alpiner Makromyzeten (Agaricales, Basidiomycetes) der Schweizer Zentralalpen*. – Ph. D. Dissertation, Univ. Bern, Bern: 252 pp.
- Senn-Irlet 1993. The mycoflora of alpine mire communities rich in *Salix*. – *Bibliotheca Mycologica* 150: 235-249.
- Singer, R. 1961. Type studies in the Basidiomycetes. – *Persoonia* 2: 1-62.
- Smith, A. H. and Singer, R. 1964. A monograph on the genus *Galerina* Earle. – New York & London: 384 pp.
- Watling, R. 1967. The genus *Flammulaster*. – *Notes Royal Botanical Garden of Edinburgh* 26: 68.
- Watling, R. 1977. Larger fungi from Greenland. – *Astarte* 10: 61-71.
- Watling 1983. Larger cold-climate fungi. – *Sydowia* 36: 308-325.
- Watling, R. and Gregory, N. M. 1993. Cortinariaceae p.p. In: Henderson, D. M, Orton, P. D. and Watling, R. (eds) *British fungus flora Agarics and Boleti* 7: 131 pp. – Royal Botanic Garden, Edinburgh.
- Wells, V. L. and Kempton, P. E. 1969. Studies in the fleshy fungi of Alaska. III. The genus *Galerina*. – *Lloydia* 32: 369-387.