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Galerinas in cold climates

Gro Gulden

Natural History Museum, University of Oslo, P.O. Box 1172 Blindern, NO-0318 Oslo, Norway

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Corresponding author: G. Gulden, gro.gulden@nhm.uio.no. Accepted for publication July 16, 2010.
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Abstract: The paper presents a key to 30 *Galerina* species known to occur in parts of the Arctic (Greenland and Svalbard), on the north Atlantic islands (Iceland and the Faroe Islands), and in European alpine regions. The key is accompanied by descriptions of the species and notes on subordinate and unclear taxa. Photos of most of the species and drawings of microscopic characters are provided for most of the species. The occurrence of the different species within the selected Arctic-alpine region is given in an accompanying table.

Key words: biodiversity, *Galerina*, *Galerina* key, arctic-alpine

Introduction: The present text summarizes my experiences collecting Galerinas in the Arctic (Svalbard, Greenland), in the North Atlantic region (Iceland, the Faroe Islands), in the Norwegian alpine zone (Hardangervidda at

Finse) and, in a few instances, the Swiss and French Alps and the Alaskan Arctic. My interest in the genus started in the late 1970's as I began to investigate the composition of macromycete fungal communities in different vegetation types

in an alpine region and found it impossible to identify a majority of the numerous *Galerinas* that occurred there. I still incur problems identifying *Galerinas* to species, however many taxa now seem clearly delineated to me and are included in the following key.

The key is accompanied by a short presentation of each taxon and a table (Tab. 1) indicating the regions in which the taxa are known to occur. The table does not pretend to give a full overview outside the regions where I have personally collected. My information on occurrence in the European Alps is drawn mainly from the publications of Kühner (1972) and Senn-Irlet (1987). For North America I have refrained from trying to extract information from the important *Galerina* monograph by Smith and Singer (1964) since the authors only rarely include information on the place of origin for their collections and generally do not indicate the altitude or vegetation zone. Some of the species treated in the following paper appear to be truly arctic-alpine or at least well adapted to cold climate regions, others however, appear to be primarily 'lowland' species extending their life area into colder areas. More collecting will likely reveal additional species of this kind – which will then need to be included in the key.

The methods and terminology I have applied are carefully outlined in Gulden & Hallgrímsson (2000). A microscope with very good optical quality and phase contrast equipment is needed in order to identify *Galerina* taxa. Chemicals can be restricted to KOH (5 %), Melzer's reagent and a Cotton blue/lactic acid solution. Spore colors in the text refer to color in mounts of 5% KOH. By far most of the taxa have a more or less evanescent veil, some have a membranous ring and a few taxa lack a veil. A close check for the veil in tiny buttons is important in order to solve some of the taxonomic problems in this genus. Smell and taste are also important, however in my experience the smell is generally hard to tell, especially in tiny fruiting bodies. The taste is

more convenient to test in most cases and these characters match in that a farinaceous smell only occurs in fruiting bodies with a farinaceous taste. Hence in the key I have used the mode 'smell/taste'.

Sometimes in the text it has been convenient to refer to subgenera or sections (*Galerina*, *Tubariopsis*, *Naucoriopsis* and *Mycenopsis*) following the classification applied in Gulden (2006). But recently DNA-analyses have shown that the genus *Galerina* is polyphyletic (Gulden et al. 2005). New genera and subgeneric categories await formalization, and some notoriously problematic complexes will hopefully soon be settled by sequencing techniques and analyses. Key to *Galerinas* in cold climates is presented in Box 1.

Presentation of species and subordinate taxa

Galerina arctica (Singer) Nezdoym.

Figs. 3d and 8A

Syn.: *G. griseipes* Kühner, *G. nigripes* A.H. Sm. & Singer (?)

Diagnosis: A brightly coloured, medium sized *Galerina* very similar to *G. clavata*; distinguished by fairly large, smooth, thin-walled spores, tibiiform cystidia, and a lack of clamps.

Description: Cap 5-17(-26) mm, conical, campanulate to convex-umbonate, striate almost to apex, fatty-shiny, fulvous to ochre; gills ascending, adnexed-adnate, subdistant to distant, yellow, then warm ochre to cinnamon; stipe 15-70 x 1-3 mm, ± clavate at base, white silky fibrillose, generally cream to pale ochre, sometimes ± fulvous to brownish, base occasionally hyaline or discolouring greyish; veil evanescent, white, seen as fibrils on stipe and occasionally on cap margin; flesh brittle, without particular smell/taste.

Table 1. Taxa of *Galerina* in the Arctic-North Atlantic and Alpine regions. Information is from Gulden (1980, 1987), Gulden & Vesterholt (1999) and Gulden & Hallgrímsson (2000), Gulden (2006), Kühner 1972, Senn-Irlet (1987) and some collections identified by Gulden in 2000-2010. North American records and my own collections there and in the Alps have not been considered.

Taxon	Greenland	Iceland	Finse	The Faroes	Svalbard	European Alps
<i>G. arctica</i>	X				X	X ¹
<i>G. atkinsoniana</i> var. <i>atk. f. atkinsoniana</i>	X	X	X	X		X
<i>G. atkinsoniana</i> var. <i>atk. f. quadrispora</i>	X	X	X			
<i>G. badipes</i>	X	X	X ²			X ²
<i>G. calyptrata</i>	X		X	X	X	X
<i>G. cephalotricha</i>	X		X	X (cf.)		X
<i>G. chionophila</i>	X		X			X
<i>G. clavata</i>	X	X	X ³	X	X	X
<i>G. harrisonii</i>	X	X	X ⁴	X	X ⁴	
<i>G. hybrida</i>				X ⁵		
<i>G. hypnorum</i> s. lato	X		X		X	X
<i>G. jaapii</i>		X	X			X
<i>G. lacustris</i>		X ⁶				
<i>G. leptocystis</i>	X					
<i>G. lubrica</i>		X	X ⁷	X ⁷		X ⁷
<i>G. marginata</i> s. lat.	X	X	X ⁸	X		X ⁸
<i>G. minima</i>	X	X ⁹	X ⁹			X ⁹
<i>G. mniophila</i>	X	X	X	X	X	X
<i>G. norvegica</i>			X			X ¹⁰
<i>G. paludosa</i>	X		X	X		X
<i>G. perplexa</i>		X				
<i>G. pseudocerina</i>	X	X	X	X	X	X
<i>G. pseudomniophila</i>	X		X	X(cf.)	X	X
<i>G. pseudomycenopsis</i>	X	X	X ¹¹	X	X	X ¹¹
<i>G. pumila</i> var. <i>pumila</i>	X	X	X	X	X	
<i>G. pumila</i> var. <i>subalpina</i>	X	X				
<i>G. sphagnorum</i>	X	X	X			
<i>G. stordalii</i>	X	X	X	X		X ¹²
<i>G. subannulata</i>						X ¹³
<i>G. subclavata</i>	X	X	X			X
<i>G. vittiformis</i> var. <i>vittiformis</i> f. <i>tetraspora</i>	X	X	X	X		X
<i>G. vittiformis</i> var. <i>vittiformis</i> f. <i>vittiformis</i>	X	X	X			X ¹⁴

¹ As *G. griseipes*

² As *G. cedretorum* var. *bispora* and *G. acre*

³ As *G. heterocystis*

⁴ As *G. antheliae*

⁵ As *G. tibiicystis*

⁶ As *G. permixta*

⁷ As *G. pseudotundrae*

⁸ As *G. unicolor*

⁹ As *G. terrestris* and *G. rubiginosa* var. *annulata*

¹⁰ As *G. gibbosa*

¹¹ As *G. moelleri* and *G. pumila* f. *oreina*

¹² As *G. dimorphocystis*

¹³ As *G. vittiformis* var. *vittiformis* f. *vittiformis*

¹⁴ As *G. rubiginosa*

Box 1. Key to *Galerina* species in cold climates

frb = fruiting body, sp = spores

1.	Pleurocystidia voluminous, ampullaceous, i.e. distinctly ventricose with fusoid to cylindric necks and acute to subcapitate tips, numerous to few, cheilocystidia similar. Frb tiny to fleshy (for a <i>Galerina</i>), veil often forming a ring, sometimes evanescent or absent	2
1.	Pleurocystidia absent, cheilocystidia lageniform, ventricose-capitate or narrow and $\pm$ hyphoid, smaller than above choice, if more than 50-80 μ m long, then with only slight ventral inflation. Frb tiny to medium, veil present or absent, rarely forming a ring	9
2.	Cap $\pm$ fleshy and young with incurved margin, $\pm$ translucently striate; cystidia on stipe restricted to apex, stipe $\pm$ darkening to bistre from base upwards, veil present, often well developed and forming a ring or a ring zone (subgen. <i>Naucoriopsis</i>)	3
2.	Cap membranous and distinctly translucently striate mostly to disc; margin straight, caulocystidia present over entire length; stipe never bistre but usually fulvous to red brown from base upwards, veil absent or evanescent, or at the most forming a small fibrillose ring (subgen. <i>Galerina</i>)	5
3.	Basidia 2-spored, veil remnants present, occasionally forming a ring zone. On herbaceous or woody remains	<i>G. badipes</i>
3.	Basidia 4-spored, veil typically forming a membranous ring. Substrate variable	4
4.	Sp almost smooth, no loosening perispore. In moist, eutrophic habitats, often mossy or grassy, also in <i>Salix herbacea/polaris</i> snow-beds	<i>G. pseudomycenopsis</i>
4.	Sp distinctly rugulose with loosening perispore. Often on woody remains and in $\pm$ man-made habitats, also terricolous in heaths and pastures	<i>G. marginata</i>
5.	Veil absent, stipe pruinose from cystidia over entire length, smell and taste not farinaceous	6
5.	Veil present, forming a small ring, a rim on pileus margin or simply as fibrils in the lower part of stipe; cystidia over entire length, but scanty in lower part of stipe; smell/taste farinaceous	8
6.	Pileocystidia present	7
6.	Pileocystidia absent	<i>G. vittiformis</i>
7.	Pileocystidia ventricose-fusiform like the hymenial cystidia; basidia 2- or 4-spored, sp length $\geq 10 \mu$ m	<i>G. atkinsoniana</i>
7.	Pileocystidia narrow, setae-like; basidia 4-spored, most spores $< 10 \mu$ m long	<i>G. perplexa</i>
8.	Veil forming a small ring, basidia 2-spored	<i>G. subannulata</i>
8.	Veil as fibrils on stipe and often as a rim on cap margin, occasionally as a ring, basidia 4-spored	<i>G. minima</i>
9.(1)	Cystidia tibiiform	10
9.	Cystidia not tibiiform but lageniform, ventricose-capitate to $\pm$ hyphoid (subgen. <i>Mycenopsis</i>)	16

10.	Basidia 2-spored	<i>G. subclavata</i>
10.	Basidia 4-spored	11
11.	Clamps abundant, probably present at all septa	12
11.	Clamps absent or rare	14
12.	Sp almost smooth, pale yellow brown (in KOH), up to 6.5 µm wide	<i>G. cephalotricha</i>
12.	Sp distinctly ornamented, yellow brown to tawny (in KOH)	13
13.	Sphagnicolous, sp small, up to 6 µm wide, taste not farinaceous	<i>G. hybrida</i>
13.	Not on <i>Sphagnum</i> , in dryer sites, basiphilous, sp 6-9.5 µm wide, taste farinaceous	<i>G. pseudocerina</i>
14.	Clamps rare, mainly at the base of basidia, sp small (av 8.8 x 5.5 µm) with apical pore; in <i>Sphagnum</i> bogs	<i>G. stordalii</i>
14.	Clamps absent, sp larger, 8-15 µm long, without pore	15
15.	Sp distinctly verruculose, not collapsed in mounts of KOH	<i>G. clavata</i>
15.	Sp smooth to practically smooth, frequently collapsed in KOH mounts	<i>G. arctica</i>
16.(9)	Basidia 2-spored	17
16.	Basidia 4-spored	18
17.	Ring present, cap yellow brown to ochre, sp narrowly amygdaloid, tawny, verruculose with distinct plage	<i>G. jaapii</i>
17.	Ring absent, cap red brown, fatty-viscid, sp ellipsoid, practically smooth, pale, plage indistinct	<i>G. lubrica</i>
18.	Sp truly smooth, ellipsoid-truncate or fusoid, with apical pore	19
18.	Sp practically smooth to distinctly ornamented, amygdaloid, without apical pore	20
19.	Sp 12-16 x 7-10 µm, ellipsoid, truncate, cheilocystidia 40-60 µm long; cap evenly red brown with ± remnants of a white veil at margin and a white ring zone; bryophilous, in moist sites, often on <i>Sphagnum</i>	<i>Phaeogalera</i> (<i>Galerina</i>) <i>stagnina</i>
19.	Sp 9-12.5 x 4-5 µm, narrowly fusoid, cheilocystidia < 30 µm long; cap ochre-fulvous with paler margin; terricolous, on peaty soil	<i>Psilocybe</i> (<i>Galerina</i>) <i>subfusispora</i>
20.	Sp ± calyptrate, sometimes with only small blisters in the basal and/or apical part, practically smooth, well coloured (rusty/tawny) in KOH, plage distinct, veil evanescent	21
20.	Sp not calyptrate, pale yellow brown to deeply coloured, plage present but sometimes nearly inconspicuous, veil present or absent	24
21.	Sp small, length mostly < 10.5 µm, width ≤ 6 µm, smell/taste farinaceous	22
21.	Sp larger, up to 12.5 µm, smell/taste farinaceous or not	23

22.	Cheilocystidia elongate with only slight ventral inflation, ± inflated towards apex	<i>G. leptocystis</i>
22.	Cheilocystidia ventricose-capitate	<i>G. hypnorum</i>
23.	Smell/taste farinaceous	<i>G. calyptrata</i>
23.	Smell/taste not farinaceous	<i>G. cerina</i>
24.	Sphagnicolous	25
24.	Not sphagnicolous	27
25.	Veil well developed, forming flocks on cap margin and on stipe beneath a ring zone	<i>G. paludosa</i>
25.	Veil absent or evanescent	26
26.	Cystidia lageniform to ventricose-capitate	<i>G. sphagnorum</i>
26.	Cystidia elongate, narrow in basal part, at apex often inflated to clavate/capitate	<i>G. norvegica</i>
27.	Veil copious, sometimes forming a ring-zone, sp large, width 6.5-10 µm	28
27.	Veil evanescent, sp narrower, 5-7 µm wide	29
28.	Cystidia cylindrical-flexuous	<i>G. chionophila</i>
28.	Cystidia ventricose-capitate	<i>G. harrisonii</i>
29.	Cystidia without or with slight ventral inflation and often inflated at apex	30
29.	Cystidia lageniform to ventricose-capitate	31
30.	Terricolous, cystidia with apical inflations and 'collars' of incrustations, sp narrowly amygdaloid, plage present but indistinct	<i>G. lacustris</i>
30.	Bryophilous, cystidia without 'collars', not or moderately inflated apically, sp ± ellipsoid, plage absent	<i>G. pumila</i>
31.	Cystidia with globose tips, nearly tibiiform	<i>G. cephalotricha</i>
31.	Cystidia lageniform to ventricose-capitate	32
32.	Pileus dull brown, lamellae buff to dull brownish, taste indistinct, sp with fairly distinct plage	<i>G. mniophila</i>
32.	Pileus more yellow brown, lamellae ochre to ochre brown, taste farinaceous, plage visible in profile view only	<i>G. pseudomniophila</i>

Spores (9.5-)10-12.5(-13) x 5.5-7.5(-9) µm, ovoid-amygdaloid, broadest in basal part and ± attenuated toward apex, thin-walled, mostly collapsed in mounts of KOH, practically smooth, without plage, golden yellow to yellow amber, without iodine reactions; basidia 4-spored; cheilocystidia 25-35(-70) x 5.5-12.5 x 2-3(-5) x 2.5-6.5(-10.5) µm, tibiiform; pleurocystidia absent; caulocystidia tibiiform, scattered over

entire length; pileocystidia similar, rare to occasional; clamps absent.

Bryophilous, gregarious in mats of various mosses such as *Calliergon*, *Drepanocladus*, *Philonotis* and *Tomenthypnum*, in moist to very moist habitats, even in running water, along brooklets, ponds, springs in snow-bed meadows and manured sites under bird roosting cliffs.

Notes: Kühner (1972) described an alpine species, *Galerina griseipes* Kühner, with practically smooth spores in the same range as *G. arctica*, being unaware then of the existence of *G. arctica* which had originally been described by Singer (1938) as a *Cortinarius* species and was not included in the *Galerina* monograph (Smith and Singer 1964). The epithet *griseipes* refers to epi- and intercellular, grey granules that are frequently found in the stem base of older fruiting bodies and produce a more or less greyish stipe base, a feature also characteristic of *G. nigripes* and occasionally detected in *G. clavata* and *G. graminea* (Velen.) Kühner. Judging from the description of *G. griseipes*, Gulden (1980) concluded that *G. arctica* and *G. griseipes* were probably conspecific. Also *G. nigripes* has a dark stipe base, thin-walled, very minutely ornamented and frequently collapsing spores, and is probably also conspecific, albeit the spores are described as slightly smaller (8-11 x 5-5.5 µm) and almost elliptic.

In *G. similis* Kühner, another species described with thin-walled and collapsing spores in the size range of those of *G. arctica*, the spores are ellipsoid and not amygdaloid as in *G. arctica*. Ellipsoid spores were also described for *G. nigripes* and confirmed by Kühner (1972). I have seen material with ellipsoid spores referable to *G. similis* in alpine habitats of Norway (Fig. 4b), but the status of the species needs further verification.

***Galerina atkinsoniana* A.H. Sm.**

Figs. 2a and 8B

Diagnosis: A species distinguished by the large, ampullaceous cystidia in all parts of the frb, the absence of a veil and lack of a farinaceous taste; cap darker and stipe more uniformly colored than in *G. vittiformis*.

Description: Cap 3-14 mm, bluntly conical-paraboloid, expanding to campanulate or hemispheric, distinctly striate-subsulcate to disc,

shiny, young red brown becoming more ochre brown to cinnamon brown with age; gills ascending-adnate, medium spaced, young pale ochre, then yellow brown to tawny; stipe 25-50 x 0.5-1.5 (-2) mm, pruinose over entire length from cystidia (lens!), honey colored to fulvous brown, darkening somewhat from base but largely ± evenly colored; smell/taste none.

Spores ovoid to amygdaloid, distinctly verruculose, with plage, tawny, dextrinoid; hymenial cystidia (both cheilo- and pleuro-) 42-70 x 12.5-16.5(-20) µm, ampullaceous with blunt to subcapitate apex (2.5-5 µm); pileocystidia similar, numerous, visible on cap of young, fresh frb (lens!); caulocystidia similar, over entire length; clamps abundant.

Bryophilous, gregarious or in small groups especially on *Polytrichum* and *Dicranum*, also on *Sphagnum*, in acid lichen heathlands and bogs.

Var. *atkinsoniana* has 2-spored basidia, sp 10-13(-16.5) x (6-)7.5-9.5 µm; this is the more common.

Var. *atkinsoniana* f. *quadrispora* Gulden has 4-spored basidia and sp 9-11 x 5.5-6.5(-7) µm.

Var. *atkinsoniana* f. *tetraspora* Kühner has 4-spored basidia and sp 13.5-15 x 8.5-9 µm.

Notes: *Galerina atkinsoniana* is characterized primarily by the presence of large pileocystidia. Occasionally there is an evanescent veil which has been observed by Kühner (1972) and myself a few times. Also the taxon described by Singer (1974) from the Swiss Alps as *G. annulata* (J. Favre) Singer, with ampullaceous pleuro-, cheilo- and pileocystidia and 4-spored basidia seems to belong in the *G. atkinsoniana* complex, but differs from *G. atkinsoniana sensu stricto* by having a well developed veil seen as a small ring. Anyway, this taxon is different from Favre's *G. rubiginosa* var. *annulata*, to which Singer refers, since Favre (1955) described a variety without

pileocystidia and with mainly 2-spored basidia – and needs another name.

***Galerina badipes* (Pers.) Gulden** – Fig. 1a

Syn.: *G. cedretorum* (Maire) Singer var. *bispora* A.H. Sm. & Singer

Diagnosis: A small to fairly large species growing on woody and herbaceous remains, with a somewhat rigid stipe that becomes dark brown in basal parts and with veil remnants, sometimes $\pm$ annulate. Microscopically distinguished by 2-spored basidia and fairly narrow, almost smooth spores.

Description: Cap 5-23 mm, hemispherical to convex, faintly striate, fatty-sticky to viscid, ochre to yellow brown, when young with white veil remnants at margin; gills adnexed to adnate with tooth, medium spaced, cream to ochre or rusty brown; stipe 2-50 x 1.5-3(-4) mm, pale at top, darkening to chestnut brown or bistre from base, with $\pm$ distinct veil remnants, at the most with a fibrillose ring-zone and patches and fibrils below; smell indistinct; taste farinaceous to bitter.

Spores (7.5-)9.5-12 x (5-)5.5-7 μ m, amygdaloid to narrowly amygdaloid, minutely verruculose-rugulose, with distinct plage and minute apical pore, yellow brown to tawny, dextrinoid; basidia 2-spored; cheilocystidia 35-90 x 7-12(-15) μ m, ampullaceous, at apex 2-3 μ m or up to 9 μ m broad when subcapitate; pleurocystidia similar, numerous; clamps abundant.

Single to subfasciculate, on woody and herbaceous litter.

Notes: There is much variation in the veil condition and with regard to taste in this species. While it has no distinctive smell, the taste has been reported as: indistinct, mild, not farinaceous, bitter and even as acrid-burning. *Galerina acris* Gulden was conceived as a distinct species mainly on account of an acrid-burning taste, but was later considered conspecific with *G.*

badipes (Gulden and Hallgrímsson 2000). The species is poisonous, containing γ -amanitin.

***Galerina calyptrata* P.D. Orton**

Figs. 7b and 8C

Syn. *G. cerina* A.H. Sm. & Singer var. *calyptrata* (P.D. Orton) Arnolds

Diagnosis: A small, brightly colored *Galerina* with evanescent veil and often with a bulbous stipe base and farinaceous smell/taste. The spores are fairly large and distinctly calyptrate.

Description: Cap 3-15 mm, conico-convex, $\pm$ umbonate/papillate, translucently striate, fatty-shiny, fulvous to orange brown, paler ochraceous at margin; gills adnate, medium spaced to subdistant, ochre yellow to rusty brown; stipe 15-45 x 0.5-1.5 mm, base often bulbous, pale and becoming $\pm$ yellow ochre or concolorous with the cap, with faint veil remnants; taste/smell farinaceous.

Spores 10-12.5 x 6-6.5(-7.5) μ m, distinctly calyptrate, practically smooth, with distinct plage, tawny, dextrinoid; basidia 4-spored; cheilocystidia 25-45(-70) x 7-10 x 3-8(-10) μ m, lageniform with blunt to inflated apex; pleurocystidia absent; clamps abundant.

Bryophilous, in bogs on bare peat and on various mosses, e.g. *Dicranum*, *Polytrichum* and *Sphagnum*.

Notes: The more or less calyptrate *Galerina* taxa are badly in need of taxonomic revision. According to Arnolds (1983) Orton's species is better considered a variety of *G. cerina*, differing from the typical *G. cerina* only by the presence of a farinaceous taste, and this is more or less also the opinion of Smith and Singer (1964), although they indicate many small differences as for example a stipe without basal thickening in *G. cerina*.

Galerina farinacea A.H. Sm. is another calyptrate species described with a farinaceous taste, but this species has no veil. Its spores are

given as slightly smaller than those of *G. calyptrata*.

***Galerina cephalotricha* Kühner**

Figs. 6b and 8D

Syn. G. mniophila (Lasch) Kühner var. *cephalotricha* (Kühner) De

Haan & Walley, *G. luteolosperma* A.H. Sm. & Singer (?)

Diagnosis: A rather dull, ochre-brownish-honey colored, bryophilous *Galerina* occasionally occurring on *Sphagnum*, characterized by distinctly capitate, nearly tibiiform cystidia combined with clamped hyphae.

Description: Cap 5-15 mm, bluntly conical to campanulate, not umbonate, expanding to convex, honey-colored to yellow brown with greyish tinge, paler towards margin, striate almost to center, young with evanescent veil remnants at margin; gills ascending-adnate, medium spaced, pale beige to dull honey brown; stipe 28-60 x 0.5-1.5 mm, cylindrical, ± clavate at base, evenly buff to hyaline grey brown, with evanescent veil fibrils; smell/taste farinaceous.

Spores (8-)8.5-11.5(-12.5) x 5-6.5 µm, amygdaloid, practically smooth, plage inconspicuous, only visible in profile view, pale, ochre or pale yellow brown, dextrinoid; basidia 4-spored; cheilocystidia 21-44 x (2.5-)6-8.5(-10) x 2-3 x 2.5-8(-14) µm, ventricose-capitate with heads abruptly set apart from the neck, sometimes nearly tibiiform; pleurocystidia absent; clamps abundant.

Bryophilous, in small groups, mostly on mosses such as *Dicranum*, *Polytrichum*, *Ptilidium* and *Hypnum*, but also on *Sphagnum* in mires.

Note: The species resembles *G. mniophila* but clearly differs in the shape of the cystidia. When growing on *Sphagnum* it may easily be confused with *G. sphagnorum*, another species with an

evanescent veil and farinaceous taste. *Galerina luteolosperma* A. H. Sm. & Singer, originally described on the basis of a single collection of fruiting bodies growing on *Sphagnum* has, according to the description similar cystidia and similar pale, yellowish spores. Probably this is identical with *G. cephalotricha* but the spores are described as slightly smaller (8-11 x 5-5.5 µm).

***Galerina cerina* A.H. Sm. & Singer**

Diagnosis: A small *Galerina* with rather evenly 'tawny' cap, evanescent veil and no farinaceous smell/taste; spores distinctly calyptrate and fairly large.

Description: Cap 5-15 mm, fatty-shiny, translucently striate, evenly red brown, ochre brown, gills adnate, medium spaced to subdistant, pale ochre to rusty brown; stem 20-45 x 1-2(-3) mm, cylindrical, pale at apex and becoming ± concolorous with cap in the lower portion, with faint veil remnants; no farinaceous smell/taste.

Spores 8.5-12.5 x 5.5-6.5(-7.5) µm, with distinct plage and 'ears' around the apiculus, practically smooth, tawny, dextrinoid; basidia 4-spored; cheilocystidia 30-40(-50) x 6-12 x 3-5 x 5-10 µm, variable, in general with inflated ventral part and broad necks with blunt to clavate-subcapitate apices; pleurocystidia absent; clamps abundant.

Bryophilous; gregarious in heaths and bogs, on peat and mosses such as *Polytrichum* and *Dicranum*, occasionally on *Sphagnum*.

Notes: The whole complex of small *Galerinas* with calyptrate spores is badly in need of taxonomic revision. Keen observations on e.g. veil and taste are necessary in order to arrive at a plausible name in current keys. Smith & Singer (1964) described nine varieties of *G. cerina* – all lacking a farinaceous taste and having a fugacious

veil. Also *G. calyptrósora* Kühner (= *G. sahleri* (Quél.) Kühner *sensu* J. Favre 1948) growing on peat and turf, has an evanescent veil and is inodorous according to Favre, but seems distinct on account of a very acute cap and a stipe that becomes dark rusty brown. *Galerina calyptrata* as described above may well represent a variety of *G. cerina* as suggested by Arnolds (1983), but has a farinaceous taste.

***Galerina chionophila* Senn-Irlet**

Figs. 5c and 8E

Diagnosis: A slightly fleshy, mainly convex and brown *Galerina* with substantial veil, broad spores, and characteristic long, narrow-elongate cystidia; growing in late-melting snow-beds.

Description: Cap 3-17 mm, broadly conical to hemispherical, expanding to convex-plane, slightly umbonate, with incurved margin when young, mat, striate up to 1/2 of radius, cinnamon brown to rusty brown; gills adnate, ascending-horizontal, subdistant, thickish, ochraceous brown to rusty ochre; stipe 10-22 x 1-2 mm, cylindrical, often bent, yellowish ochre, darkening to dark brown from base, young with a cream to beige ring or ring-zone, below with fibrils, veil remnants sometimes present also on cap margin; smell/taste indistinct.

Spores 10-12.5(-13.5) x (6-)6.5-8 µm, broadly ellipsoid, amygdaloid to citriform, finely punctate, with indistinct plage, with callus, tawny, dextrinoid; basidia 4-spored; cheilocystidia (30-)42-85(-100) x 5-8(-16) x 2-7 µm, cylindrical or narrowly ventricose, often flexuous and constricted, with blunt apex, rarely more acute or beaked; pleurocystidia absent; clamps abundant.

Terricolous, in groups among *Polytrichum sexangulare* Brid. in acid late-melting snow-beds.

Note: The species was described from the Swiss Alps, and has recently also been found in alpine Norway (J.-A. Moreau, *pers. comm.*) in a place where *G. harrisonii* is also known to occur. The two species have much in common, differing mainly in cystidial shape, and a closer analysis of the cystidia and their development or sequencing of the types seems appropriate to test their identity.

***Galerina clavata* (Velen.) Kühner**

Figs. 3c and 8F

Syn. *G. heterocystis* (Atk.) A.H. Sm. & Singer

Diagnosis: A fairly large *Galerina* with a bright yellow, ochre to yellow brown, fatty-shiny cap and a whitish, silky fibrillose stipe, often slightly bulbous (clavate) at base. Microscopically distinct by the combination of tibiiform cystidia, large, verruculose spores without plage and hyphae without clamps.

Description: Cap 5-28 mm, obtusely conic, campanulate, to convex-umbonate, striate to 2/3 to apex, fatty-shiny, brightly yellow, fulvous to deep ochre, sometimes more yellow brown, young more reddish brown; gills ascending, adnexed to adnate, moderately spaced to subdistant, pale yellow, then ochre yellow to yellow brown; stipe 30-95 x 1.2-2.0 mm (base up to 3 mm), ± clavate, apex white pruinose, downwards ± silky fibrillose, whitish, pale yellowish beige, distinctly paler than the cap, occasionally becoming greyish from base upwards. Veil evanescent, white, seen in small buttons between cap and stipe, occasionally also as thin remnants on cap margin, and typically as fibrils on the stipe; without particular smell and taste.

Spores (9.2-)10.8-15(-18.4) x (5.0-)6.0-8.2(-9.3) µm, ellipsoid to amygdaloid in front view, inequilateral in profile with a plane to slightly depressed area around apiculus, tawny in KOH,

verruculose, no plage, no pore, without iodine reactions; basidia 4-spored; cheilocystidia 25.0-61.0(-87.5) x 5.0-15.0 x 2.1-4.0(-5.0) x (2.0-)4.0-8.2(-12) μm , tibiiform, initially clavate, sometimes with neck proliferating through the head and forming a new neck above, or with branched or bent necks, or without heads, occasionally with strongly inflated ventral portion (- 35 μm); pleurocystidia absent; caulocystidia $\pm$ over entire stipe, similar to cheilocystidia but often longer and less(not) inflated; pileocystidia sometimes fairly numerous, similar; clamps absent.

Bryophilous, growing gregariously and in small groups on various mosses, also *Sphagnum*; occasionally subfasciculate, often in wet or moist moss mats at ponds, in fens, palsa mires, boggy sites in meadows and pastures, also in wet tundra and grassland.

***Galerina harrisonii* (Dennis) Bas &**

Vellinga – Figs. 7c and 9A

Syn.: *G. antheliae* Gulden; *G. tundrae* A.H. Sm. & Singer *sensu* Kühner 1972

Diagnosis: A brown, mainly convex *Galerina* with substantial veil, growing in late-melting snow-beds; microscopically characterized by its broad spores and ventricose-capitate cystidia.

Description: Cap 5-15(-25) mm, broadly conical to hemispherical, expanding to almost plane or slightly depressed, initially with incurved margin, mat, striate up to 2/3 of radius, deep yellow brown to red brown, margin pale from veil remnants; gills emarginate-adnate, subdistant to distant and $\pm$ horizontal, whitish, warm ochre to yellow brown; stipe 5-20 x 1-2 mm, cylindrical, yellow brown, bistre from base upwards, with fibrils from veil, occasionally a fibrillose ring-zone; smell and taste indistinct.

Spores 11.5-16 x (7.5-)8-9.5(-10.5) μm , ovoid to broadly amygdaloid-ellipsoid, thick-walled, practically smooth, marbled, with plage, tawny, dextrinoid; basidia 4-spored; cheilocystidia 45-75

x 7-14 x 3-6 x 2.5-12(-16) μm , lageniform, ventricose-capitate, occasionally only slightly ventrally inflated; pleurocystidia absent; clamps abundant.

Terricolous, gregarious among *Anthelia juratzkana* (Limpr.) Trevis. and *Polytrichum sexangulare* in late melting alpine snow-beds.

Note: Horak (2005) considers *G. harrisonii* conspecific with *G. hypophaea* Kühner, a species described with an extremely fugacious veil, a distinctly farinaceous taste, and smooth spores, growing under *Salix lapponum* L. close to a *Sphagnum* mire. I consider this fundamentally wrong, but type material of *G. harrisonii* and *G. chionophila* should be compared. They share the same type of habitat, seem macroscopically similar, and apparently deviate mainly in the shape of the cystidia which are variable in both species.

***Galerina hybrida* Kühner** – Figs. 3a and 9B

Syn.: *G. tibiicystis* (G.F. Atk.) Kühner *sensu auct.*

Diagnosis: A sphagnicolous *Galerina* devoid of a veil but with caulocystidia over the entire stipe, without farinaceous taste.

Description: Cap 5-18 mm, young conical to campanulate, expanding to almost plane with distinct, and often sub-transparent umbo, fatty-shiny, red brown when young, then yellow brown to ochre; gills ascending, adnexed-adnate, medium spaced, whitish to pinkish buff when young, becoming yellow brown to red brown; stipe 40-100 x 1.5-3 mm, minutely pruinose (lens!), initially translucent, soon becoming honey-colored, ochre to beige in exposed parts; veil absent; smell/taste indistinct, not farinaceous.

Spores (7.5-)8.5-11(-11.5) x 5-6(-6.3) μm , narrowly amygdaloid, on av. $\leq$ 6 μm wide, verruculose, with indistinct plage, dorsal profile

straight to only slightly convex, with acute, triangular apex, mostly drawn-out to a callus, golden brown to tawny, dextrinoid; basidia 4-spored; cheilocystidia $23-55 \times 2.5-10(-12.5) \times 2-3 \times 3-7(-9.3) \mu\text{m}$, with long, thin, $\pm$ attenuated necks that are $\pm$ confluent with the ventral part, occasionally without heads and then $\pm$ fusiform; pleurocystidia absent; caulocystidia over entire length of stipe, often without heads and appearing $\pm$ vermiform; pileocystidia occasional; clamps numerous.

Sphagnicolous, gregarious or in small groups in bogs and oligotrophic mires, in dry parts, but also on floating mats of *Sphagnum*, early in the season.

Note: This species differs from *G. tibiicystis* in the shape of the spores and the cystidia. The difference in gross-morphology is subtle and best seen in the color of the young stipe apex as compared to the young gills: the stipe apex is pale and hyaline-translucent while the gills are somewhat more colored. In *G. tibiicystis* the stipe apex is greyish and darker than the young gills. Further, the basal portion of the stipe in *G. hybrida* appears $\pm$ fibrillose from mycelium (not a veil). It starts fruiting early in the season while *G. tibiicystis* is a late fruiting species. According to Bouteville and Moreau (2005) *G. tibiicystis* seems to be more continental than *G. hybrida* .. These authors also gave *G. tibiicystis* the new name *G. mairei* since they doubted a true identity with the original North American *G. tibiicystis*. None of these appear to reach the alpine zone, but *G. hybrida* has been found on the Faroe islands, recorded as *G. tibiicystis* (Gulden & Vesterholt 1999)

***Galerina hypnorum* (Schrank : Fr.)
Kühner *sensu* Haan & Walley 2002**

Figs. 7a and 9C

Diagnosis: A small bryophilous *Galerina* with fairly bright cap color, evanescent veil, and a farinaceous taste. The spores are small, deeply

colored, with a distinct plage and with only small blisters if any.

Description: Cap 5-15 mm, broadly conical, expanding to campanulate and convex-umbonate, rusty ochraceous brown and fading to yellow brown, striate almost to centre, fatty-shiny; gills adnate to slightly decurrent with tooth, medium spaced, ochraceous brown to rusty brown; stipe 15-35 $\times$ 1-1.5(-2) mm, base mostly? bulbous, with evanescent veil fibrils, pale yellowish at apex, downwards $\pm$ colored like the cap; smell/taste farinaceous.

Spores (7.5-)8-10(-10.5) $\times$ (4.5-)5-5.5(-6) μm , almost smooth, with distinct plage, some with small blisters in apical and/or basal parts, sometimes apparently without blisters, tawny, dextrinoid; basidia 4-spored; cheilocystidia 30-45 $\times$ 6-12 $\times$ 5-8 μm , $\pm$ lageniform to ventricose-capitate; pleurocystidia absent; clamps abundant.

Bryophilous, in small groups on various mosses, probably also on *Sphagnum*.

Notes: The more or less calyptrate *Galerina* taxa (the *G. hypnorum* complex) are badly in need of taxonomic revision, and close examination of taste and veil condition is necessary in order to arrive at a name using the classical keys. For the time being I recognize *G. hypnorum* as a taxon with small spores, almost all smaller than 10 μm , and with no or only small blisters. Taxa with larger spores and larger blisters, i.e. truly calyptrate spores, I refer to either *G. calyptrata* or *G. cerina* – the latter is distinguished mainly by the lack of a farinaceous taste.

The shape of the cheilocystidia varies a lot in the *hypnorum-cerina* group and a series of subspecific taxa of *G. cerina* have been described with reference to cystidial shape (cf. Smith and Singer 1964). In principle the cystidia have a ventricose basal part and a $\pm$ cylindric to clavate-capitate apical part; sometimes the cystidia are considerably longer than normal, with less ventral inflation, and then are more cylindrical to

clavate; possibly the cystidia may change (elongate) during the growth and aging of the fruiting bodies? *Galerina hypnorum* as described by Smith & Singer (1964) with distinctly acute cystidia clearly represents another species and according to Singer (1974 p. 395) is possibly *G. subhypnorum* (G.F. Atk.).

There have been taxa described as totally devoid of a veil in this group of $\pm$ calyptrate species, notably *G. fallax* A.H. Sm. & Singer, *G. sphagnicola* (G.F. Atk.) A.H. Sm. & Singer, and *G. subcerina* A.H. Sm. & Singer. The first of these, *G. fallax*, was reported from Greenland by Gulden (2006). The material has small spores comparable to those of *G. hypnorum* (as conceived here) and, since the lack of a veil is hard to confirm in exsiccate material (4 collections) I have left the species out of consideration in this key.

***Galerina jaapii* A.H. Sm. & Singer** – Fig. 5a

Syn.: *G. mycenoides* (Fr.) Kühner

Diagnosis: Characterized by the small ring and the narrowly amygdaloid spores borne on two-spored basidia and the wet, mossy type of habitat.

Description: Cap 4-18 mm, campanulate to convex, $\pm$ umbonate, yellow brown, ochre at margin, striate up to 2/3 of radius; gills ascending-adnate, becoming horizontal and distant, pale brownish, later ochre tawny; stipe 20-100 x 1-2.5 mm, with small ring, pale honey-colored, darkening to rusty brown from base; smell/taste indistinct.

Spores 10-14(-19) x 5-7(-7.5) μ m, narrowly amygdaloid, at apex thin-walled, apparently with a pore, finely verruculose, with distinct plage, tawny, dextrinoid; basidia 2-spored; cheilocystidia 35-80 x 6-10(-15) x 3-6 x 3-11 μ m, ventricose-capitate; pleurocystidia absent; clamps abundant.

Scattered to gregarious, in wet sites such as banks of streams and ponds, wet depressions, and fens; on soil and mud, among moss e.g. *Calliergon*, not on *Sphagnum*; basiphilous.

***Galerina lacustris* A.H. Sm.**

Figs. 7f and 9D

Syn.: *G. tundrae* A.H. Sm. & Singer, *G. (Naucoria) permixta* (P.D. Orton) Pegler & T.W.K. Young, *G. cephalescens* (T.J. Wallace) Pegler & T.W.K. Young

Diagnosis: A mainly red brown *Galerina* growing on soil and herbal debris in moist and often flooded sites, well characterized by the cheilocystidia which often have conspicuous apical inflations and collars of incrustations.

Description: Cap 5-20 mm, first conical to campanulate, with papilla or bluntly umbonate, expanding to convex-plane or slightly depressed around umbo, $\pm$ fatty-shiny, striate up to 1/3 of radius, initially with faintly incurved margin, rusty brown, ochre to yellow at margin; gills adnexed-adnate or with decurrent tooth, $\pm$ horizontal, subdistant to distant, yellow to ochre brown; stipe 15-30(-60) x 1-2(-3) mm, cylindrical or subbulbous at base, often curved or flexuous, yellowish at top, red brown to dark brown downwards; faint veil remnants often present on cap margin and as fibrils or sometimes patches on stipe; flesh brittle; smell indistinct, taste subfarinaceous.

Spores (7-)9-10(-12.5) x (4-)5-5.5(-6) μ m, amygdaloid, practically smooth, faintly marbled, with indistinct plage, pale yellow brown, dextrinoid; basidia 4-spored; cheilocystidia (29-)35-55(-70) x (3-)6-7(-15) x 2-6(-7) x (2-)5-9(-22.5) μ m, rather variable, mostly with a narrow ventral inflation and long necks, apices mostly inflated, clavate to globose or beaked, some also with blunt or supfusoid apices, often with a collar of incrustations below an inflated tip; pleurocystidia absent; clamps abundant.

Terricolous, growing gregariously in moist sites with *Salix* and *Alnus*, in regularly inundated places and dried-up pools, on soil, peat, and among dead parts of *Scirpus*, *Carex* and *Juncus*.

Note: Like some other mainly brown *Galerina* species this has also been described as a *Naucoria*.

***Galerina leptocystis* Wells & Kempton**

Diagnosis: A small *Galerina*, cap up to 1 cm, with $\pm$ calyptrate spores and long, filamentose to narrowly ventricose cheilocystidia, 34-53 μm long, 3.5-6.5 μm wide. Spores 8.5-11 x 5-6 μm , with $\pm$ small blisters, tawny. Evanescent veil present and a farinaceous smell and taste; gregarious on living *Sphagnum* in Kenai Peninsula, Alaska (Wells & Kempton 1969).

Note: Specimens belonging in the *hypnorum-cerina* complex with $\pm$ calyptrate spores are very abundant on moss and turf in bogs and in acid, moist heath vegetation with *Sphagnum* and *Polytrichum*. The present taxon may be distinct, but there seems to be much variation in the shape of cystidia in this group and a better understanding of this variation is needed. The spores in this group on the other hand vary only slightly in size and degree of calyptration and appear to add little useful information. In *G. leptocystis* the cystidia constitute the most prominent character. Material corresponding to the above diagnosis with fairly small, $\pm$ calyptrate spores and an evanescent veil, was collected in Greenland on a few occasions (Gulden 2006). The cystidia described for *G. leptocystis* are comparable to those of *G. cerina* var. *ampullicystis* A.H. Sm. & Singer and *G. cerina* var. *longicystis* A.H. Sm. & Singer, both taxa with $\pm$ calyptrate spores and veil, but deviating by being inodorous. No definite statements of smell accompanied the Greenland material, so the identification was uncertain.

***Galerina lubrica* A.H. Sm. – Fig. 5b**

Syn.: *G. pseudotundrae* Kühner, *Naucoria macrospora* J.E. Lange var. *borealis* F.H. Møller

Diagnosis: Macroscopically the red brown color shades in all parts of the fruiting body, the somewhat lubricose cap and a very evanescent veil, are characteristic features; the fairly large spores borne on 2-spored basidia further characterize the species.

Description: Cap 1-3 mm, broadly conical, expanding to convex and finally depressed, slightly umbonate, striate up to 2/3 of radius, fatty to viscid, shiny, red brown to hazel brown, yellow brown at margin; gills emarginate to adnate, subdistant to distant, pale yellow, warm ochre becoming brown $\pm$ like the cap; stipe 20-40 x 1-3 mm, young with yellow brown top, becoming evenly ochre brown to red brown from base, somewhat silky fibrillose from veil; smell/taste indistinct or faintly farinaceous.

Spores 12-14.5 x 6.5-8(-9) μm , ellipsoid-amygdaloid, marbled, with indistinct plage, rather pale yellow brown, dextrinoid; basidia 2-spored; cheilocystidia 35-50 x 6-11 x 3-4.5 x 2.5-12.5 μm , lageniform or ventricose-capitate, head often wider than ventral part; pleurocystidia absent; clamps abundant.

Terricolous, gregarious on naked peat and soil, in late melting snow-beds, in paths and depressions, among wet moss, grass, *Salix herbaceae* L., *Gnaphalium supinum* L., *Polytrichum sexangulare*; on neutral to acid soils.

***Galerina marginata* (Batsch) Kühner s.l.**

Figs. 1b and 9E

Diagnosis: The largest of the *Galerina* species, often growing on woody remains; characterized by a ring and rugulose spores with a slightly loosening perispore.

Description: Cap 5-30(-70) mm, generally hemispherical with incurved margin when young, rarely conical, expanding to convex or slightly depressed, rarely umbonate, sticky to viscid and shiny when moist, striate at margin, ochre, yellow brown to red brown; gills adnate or with small decurrent tooth, medium spaced, pale yellowish to yellow brown; stipe 20-70 x (1-)2-5(-10) mm, cylindrical or thicker downwards, becoming fistulose, silky white fibrillose below a membranous ring or a distinct ring-zone, beige at top, downwards greyish brown to dark brown; smell faintly farinaceous; taste farinaceous.

Spores 7.5-10.5(-13) x 4.5-6.5(-7) μ m, amygdaloid to ellipsoid or $\pm$ citriform, rugulose-verruculose, with slightly loosening perispore, with distinct plage, yellow brown, dextrinoid; basidia 4-spored; cheilocystidia 28-77(-95) x (5-)8-18 μ m, ampullaceous, tapering to 2-4 μ m, apex up to 8 μ m broad when subcapitate; pleurocystidia similar, numerous; pileipellis with upper layer of gelatinized hyphae; clamps abundant.

Gregarious to clustered, generally on rotting wood such as stumps, branches, duff, chips, sawdust, also non-lignicolous and then growing in pastures and coastal ericaceous heaths among *Calluna*, grass, herbs and bryophytes.

Notes: Woody debris and duff appear to be the main substrate of *G. marginata* (syn. *G. autumnalis* (Peck) A.H. Sm. & Singer); terrestrial specimens growing among grass and heather have often been identified as *G. unicolor* (Vahl) Singer and *G. praticola* (F.H. Möller) P.D. Orton. The latter was described with slightly larger spores than *G. marginata*. The species contains α -amanitins and is extremely poisonous.

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

Syn.: *G. terrestris* V.L. Wells & Kempton, *G. vittiformis* var. *vittiformis* f. *tetraspora* sensu Kühner 1972, *G. caulocystidiata* Arnolds

Diagnosis: A small species in the *vittiformis* complex with veil, farinaceous smell/taste, 4-

spored basidia, and small spores; common in pioneer vegetation.

Description: Cap 3-8 mm, hemispherical, conical to convex, distinctly striate to disc, fatty-shiny, red brown to ochraceous brown, paler at margin; gills adnate-uncinate, subdistant-distant, pale beige, ochre to red brown; stipe 15-30 x 0.5-1 mm, yellow to ochre at apex, red brown downwards, veil present as fibrils in lower part of stipe and often as a white rim at cap margin; smell/taste farinaceous.

Spores (8.5-)9-11 x 5-7 μ m, ovoid to broadly amygdaloid, verruculose with plage, tawny to yellow brown, dextrinoid; basidia 4-spored; hymenial cystidia (cheilo- and pleuro-) 42-68 x 8-20 μ m, at apex 2.5-7.5 μ m broad, ampullaceous with blunt to subcapitate apices; caulocystidia similar, numerous at stipe top, more scanty in basal half; pileocystidia absent; clamps abundant.

Gregarious and common among small bryophytes and liverworts, often in moss cushions of *Rhacomitrium*, but not growing directly on the moss, on silt and sand in moist, often periodically inundated sites and pioneer habitats in glacier forefronts, also in *Salix herbaceae* snow-beds, acidophilic.

Notes: The species differs from *G. vittiformis* by the distinct veil and the farinaceous smell/taste. It agrees very well with *G. terrestris* as described by Wells & Kempton (1969), but is most probably conspecific with the previously described *G. minima* (in spite of no mention of smell/taste by Smith and Singer).

f. annulata nom. prov.: Specimens with a distinct ring otherwise sharing the characters of *G. minima*, e.g. 4-spored basidia, fairly small and broad spores (9.0-12 x 5.8-7.3 μ m), and a farinaceous smell/taste, probably is just a form of the distinctly velate *G. minima*. It has been found on Iceland and in alpine sites of Norway, and

several times in the Alps (Kühner 1972, p. 75). It occurs in small groups on bryophytes, in mossy, moist sites, in fens and late-melting *Salix herbacea* snow-beds, in eutrophic sites.

Notes: *Galera rubiginosa* var. *annulata* J. Favre, which according to Favre (1955) mostly has 2-spored basidia, agrees in all other characters with our '*G. minima* f. *annulata*'. Favre also records occasional 4-spored specimens of his var. *annulata*. The combination *G. annulata* (J. Favre) Singer (published in 1973) based on Favre's original description of *Galera rubiginosa* var. *annulata*, represents a different taxon with pileocystidia according to Singer (1974), which is probably related to *G. atkinsoniana*.

Galerina alpestris Singer as recorded by Senn-Irlet (1987) from the glacier foreland in the Swiss Alps agrees with *G. minima* in all essential characters, except that it lacks pleurocystidia. It was identified as *G. vittiformis* in the field and it probably belongs in *G. minima* (see also *G. alpestris* below).

Galerina caulocystidiata Arnolds, another species with a small ring, corresponds in all main characters to our '*G. minima* f. *annulata*', except that this species according to the description (Arnolds 1983) lacks pleurocystidia (and was described from a lowland meadow). As discussed below, under *G. alpestris*, the abundance of pleurocystidia varies considerably in taxa of the subgenera *Galerina* and *Naucoriopsis* and this variation has probably been one reason for descriptions of many phantom species; also see comment under *G. vittiformis*.

***Galerina mniophila* (Lasch) Kühner**

Figs. 6c and 9F

Diagnosis: A fairly dark, dull brown, fatty-shiny *Galerina* becoming remarkably pale on drying; with lageniform cystidia and practically smooth, pale spores.

Description: Cap 5-15(-20) mm, paraboloid to bluntly conical-convex, top obtuse, not or weakly umbonate, generally not much expanded, fatty-shiny, striate to 2/3 of radius, dull brown, olive brown, when young margin with faint veil remnants; gills ascending-adnate, medium spaced, cream when young, becoming beige and dull brown; stipe 17-50(-65) x 1-2(-3) mm, cylindrical or somewhat clavate at base, whitish, then pale honey colored to pale brownish, with scattered evanescent veil fibrils; smell/taste indistinct.

Spores (8-)9.5-12.5 x 5-6.5(-7) µm, amygdaloid, practically smooth, finely marbled, with faint plage, pale yellow brown, dextrinoid; basidia 4-spored; cheilocystidia (27-)33-50(-70) x 6-10(-12) x (2.5-)3-5 x 3-6(-7) µm, lageniform with blunt apex, occasionally slightly clavate to subcapitate; pleurocystidia absent; clamps abundant.

Bryophilous, in groups on bryophytes such as *Dicranum*, *Hylocomium* and *Polytrichum*, in nutrient-poor heathland; probably not reaching beyond the low alpine belt and the warmest parts of the Arctic.

Note: Characteristic of the *G. mniophila* group are their pale stipes in comparison to the caps, and the manner in which they dry out to a very pale white to cream color, starting from the top of the cap. They apparently all prefer the more nutrient poor, acid type of vegetation.

***Galerina norvegica* A.H. Sm.**

Figs. 7e and 10A

Syn. Galerina gibbosa J. Favre, *nom. nud.*

Diagnosis: A yellowish *Galerina* growing on *Sphagnum* in bogs with an umbonate cap, broadly attached gills, and a farinaceous taste, microscopically characterized by long, apically inflated cystidia.

Description: Cap 5-11(-16) mm, bluntly conical-campanulate, expanding to convex-umbonate, fatty-shiny, striate to umbo, yellow to ochre; gills broadly adnate and mostly with a small tooth, $\pm$ horizontal, subdistant to distant, initially white, becoming ochraceous yellow brown; stipe 20-40(-70) x 1-1.5(-3) mm, cylindrical or slightly clavate at base, yellowish, with evanescent veil fibrils; smell/taste farinaceous.

Spores 9.5-11(-12) x 5-6(-6.5) μ m, amygdaloid, practically smooth, with indistinct plage, yellow brown, dextrinoid; basidia 4-spored; cheilocystidia 30-68(-80) x 5-8(-11.5) x 5-7 x 5-12.5 μ m, $\pm$ filamentose-flexuose, with or without a slight ventral inflation, many with inflated, clavate to globose tips; pleurocystidia absent; clamps abundant.

Sphagnicolous, gregarious in bogs.

Note: Smith and Singer (1964) distinguished *G. norvegica* from *G. gibbosa* on account of smaller spores in *G. norvegica*. My study of the type of *G. norvegica* revealed larger spores than given by Smith & Singer (1964), i.e. 9.2-11.1(-11.8) x 5.0-5.6 (-6.3) μ m and cystidia in accordance with those in type material of *G. gibbosa*, although not well inflated.

***Galerina paludosa* (Fr.) Kühner**

Figs. 7d and 10B

Diagnosis: A brownish *Galerina* with distinct veil observed as white flocci on the cap margin and as patches beneath a ring zone on the stipe, growing on *Sphagnum* early in the season.

Description: Cap 10-28 mm, conical to campanulate, expanding to broadly convex, with acute to rounded umbo, mat and slightly felty-scurfy, striate up to 2/3 of radius, yellow brown to red brown, young covered by white veil fibrils and appearing greyish brown, young margin with rim of white veil remnants; gills adnate or with

small decurrent tooth, medium spaced, yellow brown to rusty brown; stipe 30-120 x 1-4 mm, cylindrical, evenly honey-colored to yellow brown, paler than cap; smell/taste faintly farinaceous.

Spores (7.5-)9-12.5 x 5-7(-8) μ m, broadly amygdaloid, often attenuated at apex, marbled to weakly verruculose, with plage, yellow brown to tawny, dextrinoid; basidia 4-spored; cheilocystidia 20-35(-52) x 5-12.5 x 5-8 μ m, lageniform to ventricose-capitate; pleurocystidia absent; clamps abundant.

Gregarious or in small groups, on *Sphagnum* in bogs and oligotrophic mires (in dry parts but also on floating mats), and also in wet meadows, fruiting early in the season.

***Galerina perplexa* A.H. Sm. - Fig. 2b**

Diagnosis: A species in the *G. vittiformis* complex characterized by setae-like pileocystidia and fairly small spores on 4-spored basidia.

Description: Cap 7-15 mm, conical, campanulate to convex, striate up to 2/3 of radius, yellow to orange brown, with paler, more yellow margin; gills adnexed, pale pinkish buff to clay color; stipe 30-60(-80) x 1-2 mm, pale yellow to ochre, darkening to red brown at base, veil absent; smell/taste indistinct, slightly raphanoid/slightly bitter .

Spores 7.5-10.5 x 5-6.5 μ m, broadly amygdaloid, distinctly verruculose with plage, yellow brown, dextrinoid; basidia 4-spored; hymenial cystidia (cheilo- and pleuro-) 50-75 x 9-12, apex 3-4 μ m wide, ampullaceous; pileocystidia narrower and more setae-like but thin-walled, (24-)45-60(-80) x 3.5-7(-10) μ m, with apex 2.5-3 μ m wide, narrowly fusiform to narrowly lageniform, mostly rather scarce; caulocystidia similar to the hymenial cystidia; clamps abundant.

Gregarious on bryophytes (*Rhytidiadelphus*), among grasses in pastures and grasslands.

Note: The species is included here on the evidence of a single collection from Iceland, studied as an *exsiccatum*. Colors given above for the fresh fruiting body are adapted from Smith and Singer (1964). The smell/taste as given above is cited from Hausknecht and Krisai-Greilhuber (1997), who recorded this apparently rare species from Austria, but from subalpine and lower levels. They indicate *G. perplexa* as a fairly dark, red brown species.

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

Figs. 4a and 10C

Diagnosis: A brightly fulvous, slightly fleshy *Galerina* with a pale, pruinose stipe and a distinctly farinaceous smell/taste, growing in calcareous/base-rich sites. Microscopically distinct by large, broad, coarsely ornamented spores, tibiiform cystidia, and abundant clamps.

Description: Cap 5-25 mm, hemispherical to campanulate or convex-umbonate, somewhat fleshy and when young with incurved margin, faintly striate, fulvous, apricot to red brown; gills adnate to emarginate, $\pm$ horizontal, subdistant, pale ochre, yellow brown to red brown; stipe 15-40 x 1-2.5 mm, white to pale beige at top, downwards with shades of cap color, silky fibrillose from evanescent veil; smell/taste farinaceous.

Spores 10-14(-15) x 6-9.5 μ m, broadly ellipsoid, ovoid or amygdaloid, deep amber to rusty brown, ornamentation coarse, seen as irregular ridges and rifts, appearing $\pm$ cracked, with indistinct plage, without iodine reactions; basidia 4-spored; cheilocystidia 20-45(-65) x 3-12 x 1-3.5 x 2.5-7 μ m, tibiiform; pleurocystidia absent, caulocystidia tibiiform, over entire length; pileocystidia absent; clamps abundant.

Bryophilous, in small groups on fairly dry sites among mosses, grass and herbs, for instance, in

Dryas heaths and eutrophic meadows, calciphilous; occurring early in the season.

Note: Smith and Singer (1964) and Horak and Miller (1992) did not note any farinaceous smell/taste in this species. The wide variation in spore shape may indicate, as Horak & Miller (1992) assumed, that two distinct, not yet clearly understood taxa, occurring in the same type of habitats, may be involved.

***Galerina pseudomniophila* Kühner** – Fig. 6d

Syn.: *G. mniophila* f. *pseudomniophila* (Kühner) Haan & Walley

Diagnosis: A close relative of *G. mniophila*, with a warmer coloration, drying to whitish cream from apex and a farinaceous taste.

Description: Cap 5-15(-20) mm, conical, campanulate to convex, $\pm$ fatty-shiny, striate to 2/3 of radius; brownish ochre to cinnamon brown; gills ascending, adnexed to adnate, medium spaced, young ochre becoming ochraceous brown; stipe 30-50 x 1-2(-3.5) mm, cylindrical, $\pm$ clavate at base, nearly hyaline, cream to pale yellow brown, with $\pm$ veil fibrils; smell/taste farinaceous but indistinct.

Spores 9.5-12(-14) x (5.5-)6-7(-7.5) μ m, amygdaloid, $\pm$ protracted at apex, practically smooth, marbled, with almost inconspicuous plage, yellowish, dextrinoid; basidia 4-spored; cheilocystidia 33-47 x 8.5-12(-16) x 3.5-7 x 3.5-10 μ m, lageniform, necks blunt, cylindrical to clavate, occasionally subcapitate at apex; pleurocystidia absent; clamps abundant.

Bryophilous, in groups in nutrient-poor heathland with e.g. *Empetrum*, *Arctostaphylos alpina* (L.) Spreng., *Betula nana* L., in *Salix herbacea* snow-beds, on moss or (according to Kühner 1972) directly on acid humus.

Note: A possible synonymy of this species with *G. pumila* var. *subalpina* has been discussed (Kühner 1972, Gulden 1980), but this taxon is described with distinctly longer, more polymorphic cystidia, well in accordance with the main variety of *G. pumila*.

***Galerina pseudomycenopsis* Pilát**

Figs. 1c and 10D

Syn.: *Pholiota pumila* (Fr.) Gill. *sensu* F.H. Möller, *G. moelleri* Bas

Diagnosis: A somewhat fleshy *Galerina* with ring, reminiscent of *G. marginata* but always growing among mosses and grasses, not on woody debris, and with deeper, warmer colours and different spores.

Description: Cap 5-40(-55) mm, hemispherical with incurved margin when young, expanding to convex or slightly depressed, rarely conical or umbonate, fatty-viscid and shiny when moist and faintly striate at margin, dark red brown to yellow brown; gills adnate or with small tooth, medium spaced, when young pale yellow brown to ochre, then cinnamon brown; stipe 20-50(-80) x 1-4(-6) mm, cylindrical or slightly thicker downwards, with membranous ring or ring-zone, below ring white silky fibrillose, pale yellow brown at top, turning brown to bistre from base upwards; smell/ taste farinaceous.

Spores (8.5-)10-11(-15) x (6-)6.5-8(-10) µm, ovoid to broadly amygdaloid, practically smooth, with a distinct plage and tiny apical pore, tightly fitting perispore, dextrinoid; basidia 4-spored; hymenial cystidia (cheilo- and pleuro-) 37-65(-100) x 6-13(-19) µm, tapering to 3.5-6 µm, but up to 10 µm at apex when subcapitate, ampullaceous; pileipellis with a thin layer of gelatinized hyphae; clamps abundant.

Gregarious, sometimes forming arcs or rings, among grass and moss in moist, eutrophic sites such as snow-beds, marshes, fens, arctic wet

tundra, possibly parasitic (dead, brown moss observed).

Notes: This is a common species in the Arctic-Atlantic region and in alpine regions of Scandinavia. It is probably poisonous and may contain amanitin. The number of pleurocystidia varies a great deal: from quite abundant to very few or apparently lacking. Material totally lacking pleurocystidia was described from the alpine zone of Switzerland as *Galera pumila* f. *oreina* by Favre (1955) and later accepted as a variety, *G. moelleri* var. *oreina* (J. Favre) A.H. Sm. & Singer by Smith and Singer (1964).

***Galerina pumila* (Pers.) M. Lange var.**

pumila – Figs. 5d and 10E

Syn.: *G. mycenopsis* (Fr.) Kühner, *G. vexans* A.H. Sm. & Singer, *G. viscidula* P.D. Orton

Diagnosis: A vividly colored, somewhat shiny-viscid *Galerina* often with minute veil remnants on cap margin and stipe, and particular by its long cystidia and mainly ellipsoid, smooth, rather pale spores.

Description: Cap 8-20(-35) mm, hemispherical, conical to campanulate, expanding to convex and ± umbonate, striate almost to centre, fatty to viscid and shiny, bright yellow, fulvous to warm yellow brown, at margin often more yellow and center more rusty brown, white veil remnants often present on margin; gills adnexed-adnate, subdistant to distant, first pale yellow, then rusty yellow brown; stipe 20-85 x 1-3 mm, cylindrical or slightly thicker downwards, hollow and often flexuous and brittle, shiny, pale yellow brown, fibrillose from veil remnants; smell/taste indistinct.

Spores (8.5-)10-13.5(-15) x (4.5-)5-7(-8) µm, ellipsoid, in frontal view with rounded apex, more amygdaloid in profile, smooth, without plage, pale fulvous, pale ochre to beige, dextrinoid; basidia 4-spored; cheilocystidia 22-

60 x 5-11 x (2-)3-5(-7) x (2-)3-8(-10) μm , subcylindrical-subventricose, with blunt or slightly inflated or beaklike tips, often repeatedly constricted near apex; pleurocystidia absent; clamps abundant.

Bryophilous, on e.g. *Hylocomium*, *Dicranum*, *Ptilidium*, *Polytrichum* and *Racomitrium*; among lichens, in acid ericaceous heathland and mossy, poor grassland.

Notes: Sometimes rather dark, red brown fruiting bodies, more reminiscent of a *Naucoria* have been found in arctic habitats. Smith (Singer and Smith 1964) described a variety of *G. pumila*, var. *subalpina*, typical of cold wet moss beds of subalpine zones in North America and this has been difficult to distinguish from *G. pseudomniophila*. Compared to the main variety of *G. pumila* with smooth spores var. *subalpina* has slightly ornamented spores, that are more amygdaloid with a visible plage line. The cystidia are elongate and narrowly ventricose with rounded or occasionally subcapitate or beaked apices as in the main variety, thereby differing from *G. pseudomniophila* (see note on that species).

***Galerina sphagnorum* (Pers.) Kühner**

Fig. 6a

Diagnosis: A fairly large sphagnicolous *Galerina*, often umbonate or papillate, with pale stipe with remnants of an evanescent veil. The spores are pale and practically smooth, the cystidia are lageniform with $\pm$ inflated apex.

Description: Cap 15-30 mm, conical, expanding to convex-umbonate or often papillate, striate almost to centre, ochre to yellow brown at margin, at centre fulvous to red brown, with fugacious veil remnants at margin when young; gills broadly adnate, ascending to horizontal, medium spaced, whitish, pale beige to yellow brown; stipe 30-100 x 1-3 mm, cylindrical or thickened at base, whitish, pale beige to yellowish

ochre, with scanty veil fibrils; smell/taste (faintly) farinaceous.

Spores (8-)9-11.5(-12.5) x 5-6(-7) μm , amygdaloid to citriform, practically smooth, marbled, with faint plage, ochre to pale yellow brown, dextrinoid; basidia 4-spored; cheilocystidia (22-)30-40(-68) x 4-9(-13) x 3-4 x 3-7(-12.5) μm , lageniform to ventricose-capitate; pleurocystidia absent; clamps abundant.

Gregarious on various *Sphagnum* species, in mires, moist dwarf willow vegetation, shores of lakes and ponds.

Note: The species is apparently rare in arctic-alpine habitats. The farinaceous smell and taste is distinct according to Kühner (1969), faint according to Smith and Singer (1964), but the taste may help distinguish this species in the field from the fairly similar *G. hybrida* and *G. tibiicystis* that often occur together with *G. sphagnorum*. The other two also differ in the lack of a veil and are microscopically very different. The spores are pale in my experience, not tawny as described by Smith and Singer (1964).

***Galerina stordalii* A.H. Sm. – Fig. 3b**

Syn.: *G. dimorphocystis* A.H. Sm. & Singer p.p., *G. propinqua* Bas, *G. frigida* V.L. Wells & Kempton

Diagnosis: A small, brightly yellow to fulvous *Galerina* on *Sphagnum*, typical with a broadly conical cap, often reflexed, and a white, distinctly pruinose stipe. Microscopically it is unique for its small, verruculose spores with an apical pore and lack of a plage, combined with tibiiform cystidia and only occasionally clamped hyphae.

Description: Cap 3-10 mm, broadly conical, then plane to umbonate and often with reflexed margin, shiny, striate nearly to centre, yellow to fulvous; gills adnexed-adnate, subdistant to distant, pale yellow to warm ochre; stipe 12-30 x 1-1.5 mm, white to pale yellow, distinctly

pruinose and somewhat fibrillose, without particular smell or taste.

Spores (7-)9-11 x 4.5-6(-6.5) μm , amygdaloid and $\pm$ angular, attenuated towards apex, verruculose, fairly thick-walled, with apical pore, without plage, faintly dextrinoid; basidia 4-spored; cheilocystidia 19-35 x 4-10 x 1.5-2.5 x 2.5-5 μm , tibiiform; pleurocystidia absent; caulocystidia tibiiform present over entire length; pileocystidia similar, $\pm$ scattered; clamps rare, mostly at base of basidia.

Solitary or in small groups, growing mostly (always?) on *Sphagnum* or peat, in bogs and in moist snow-beds, from early in the season.

Note: Singer and Smith (1964) described *G. stordalii* as a member of section *Porospora* (subgenus *Galerina*) on account of the pore at the spore apex, and not as a member of subgenus *Tubariopsis* where they included most of the other species with tibiiform cystidia. Its exclusion from the appropriate key may have added to confusion regarding the identity of this very distinct species. Several names have been in common use, but type studies of *G. stordalii*, *G. propinqua* Bas and *G. frigida* V.L. Wells & Kempton have led me to the conclusion that these types belong to one and the same species (Gulden 1980). Kühner (1972) applied the name *G. dimorphocystis* A.H. Sm. & Singer, a name tied to a mixed type collection.

***Galerina subannulata* (Singer) A.H. Sm. & Singer**

Syn. Galera rubiginosa var. *annulata* J. Favre, *G. vittiformis* var. *vittiformis* f. *vittiformis sensu* Kühner (1972)

Diagnosis: A taxon in the *vittiformis* complex with a distinct ring and 2-spored basidia.

Description: Cap up to 13 mm, conical-convex, red brown, dark striate to disc, paler and sulcate at margin; gills ascending-adnate, broad,

subdistant to distant; stipe up to 30 x 1(-1.5) mm, with a tiny, white, fibrillose ring in upper part, pruinose in the upper two thirds, glabrous below, pale reddish brown at apex, red brown to rusty brown towards base. Taste raphanoid (according to Kühner (1972) farinaceous).

Spores 11.5-13(-14) x (6.5-)6.5-8.2 μm , amygdaloid, verruculose, with plage, tawny, dextrinoid; basidia 2-spored; cheilo-, pleuro- and caulocystidia ampullaceous, up to 60 x 13 μm ; pileocystidia absent (Kühner 1972).

Gregarious in wet moss, along brooks, ponds, small mires, on acid ground. Not yet recorded from the northern Atlantic-Arctic region.

Note: Favre (1955) described this taxon as *Galera rubiginosa* var. *annulata* from the Swiss Alps and this was considered identical with *Galerina subannulata* (Singer) A.H. Sm. & Singer by Smith and Singer (1964). Based on later type studies, Singer (1974) stated, however, that *G. vittaeformis* var. *subannulata* Singer (described from South America) is different from Favre's material of *Galera rubiginosa* var. *annulata*. The name *G. subannulata* is never the less applied here since a nomenclaturally correct name is unavailable at the present time.

***Galerina subclavata* Kühner – Fig. 10F**

Syn.: Galerina heterocystis (G.F. Atk.) A.H. Sm. & Singer *pro parte*

Diagnosis: A medium sized *Galerina* with bright, yellow to almost orange cap, fairly distant lamellae, a pale, pruinose stipe, and a fugacious veil; microscopically recognized by 2-spored basidia, large, $\pm$ ellipsoid, finely verruculose spores, tibiiform cystidia and a lack of clamps.

Description: Cap 5-20 mm, bluntly conical to hemispherical, striate almost to disc, young yellow brown, then bright yellow to fulvous-apricot, darker at apex, fatty-shiny; gills ascending-adnate, subdistant to distant, yellowish buff to yellow brown; stipe 15-50 x 1-2

(-3) mm, apex densely pruinose, $\pm$ pruinose further down, buff to pale beige, paler than cap, with fibrils from veil; smell/taste indistinct.

Spores 11-15.5(-17) $\times$ (6-)6.5-8.2 μm , ellipsoid-amygdaloid, finely verruculose, practically smooth, without plage, without iodine reactions, pale yellow brown; basidia 2-spored; cheilocystidia 20-38(-62) $\times$ 4.5-10.5 $\times$ 1.5-4.5 $\times$ 2.5-7.5(-9.5) μm ; pleurocystidia absent; caulocystidia similar, scattered over entire length; pileocystidia similar, scattered; clamps absent.

Bryophilous; solitary or in small groups, among grass and moss in meadows, along fens, springs, snow-beds, coastal sand dunes, often rather moist, occasionally among *Sphagnum*. In the Swiss Alps characteristic of alpine oligotrophic, *Salix* rich mires (Senn-Irlet 1993). Occurring late in the season.

Note: In previous studies, e.g. Kühner (1935) and Singer and Smith (1964), the species has been included as a 2-spored variation within *G. clavata/heterocystis*.

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

Figs. 2 c and d

Diagnosis: A species with fully pruinose stipe, lacking veil and without farinaceous taste/smell, characteristic by a fairly pale cap and a stipe that becomes well colored. Microscopically the large, ampullaceous cystidia in the hymenium and over the entire stipe (but not on the cap) are distinctive.

Description: Cap 5-20 mm, conical-campanulate, expanding to convex and nearly plane, distinctly striate to disc, brownish ochre, paler towards margin and between striae; gills ascending-adnate, subdistant, young pale yellow, then ochre and becoming $\pm$ concolorous with the cap; stipe 20-60 $\times$ 0.5-1 mm, densely pruinose over entire

length, young evenly pale yellow brown, but soon becoming dark red brown to chestnut brown from base upwards, distinctly contrasting the pale cap; veil absent; smell/taste none.

Spores ovoid to ellipsoid-amygdaloid, verruculose, with plage, tawny, dextrinoid; hymenial cystidia (pleuro- and cheilo-) 31-70 $\times$ 6-14(-16), apex 2.5-6(-10) μm , ampullaceous with blunt to subcapitate tips; caulocystidia similar, over entire length; pileocystidia absent to very rare; clamps abundant.

In groups on mosses, often in fairly eutrophic and dry grasslands, also in more moist sites and fens, occasionally also on *Sphagnum*.

Var. *vittiformis* f. *vittiformis* (syn. *Galera muricellospora* G.F. Atk., *G. rubiginosa* (Pers.) Kühner *sensu* Kühner (1972) has 2-spored basidia and sp 9.6-13.2 $\times$ 5.0-7.0 μm .

Var. *vittiformis* f. *tetraspora* A.H. Sm. & Singer has 4-spored basidia and sp 8-10.5 $\times$ 5.5-6.5 μm .

Notes: In arctic-alpine regions the form with 4-spored basidia appears to be the most common of the two. According to Kühner (1972) the 2-spored var. *vittiformis* (= *G. rubiginosa*) seems not to occur beyond subalpine levels in the Alps, but several collections have been made in the Arctic area.

Several species and many varieties and forms have been described in the *vittiformis* complex which is badly in need of revision. *Galerina vittiformis* as accepted here, in the sense of Smith and Singer (1964), is a species devoid of pileocystidia, veil and farinaceous smell/taste. Similar specimens with pileocystidia are referred to *G. atkinsoniana* and *G. perplexa* (small pileocystidia) and specimens with veils are referred to *G. minima* and *G. subannulata*. The veiled *G. vittiformis* var. *vittiformis* f. *tetraspora* as described by Kühner (1972) corresponds to *G. minima*. *Galerina vittiformis* var. *megaspora* Kühner, judging from the description, is *G.*

pseudomycenopsis.

Taxa not included in the key

G. alpestris Singer: The species as described by Singer (1974) from the alpine zone in Switzerland has large, ampullaceous cheilocystidia and similar caulocystidia (over the entire stipe, although scarcer in the lower portion). These features are typical of section *Galerina* (subgen. *Galerina*). But the species lacks the pleurocystidia that are 'obligatory' in this section. For strange reasons Singer referred *G. alpestris* to the *G. hypnorum* complex (subgen.

Mycenopsis) where pleurocystidia are lacking, but where the cystidial shape is quite different and caulocystidia do not occur. Sometimes pleurocystidia may be scanty and difficult to find in specimens belonging to both the subgenera *Galerina* and *Naucoriopsis* – and some times they are possibly lacking in taxa that normally have pleurocystidia. In my opinion *Galerina alpestris* should be considered a taxon in the *G. vittiformis* complex lacking pleurocystidia (*G. vittiformis* var. *alpestris*) in the same way as *G. pseudomycenopsis* (= *G. moelleri*) lacking pleurocystidia was treated as a variety (*G. moelleri* var. *oreina* (J. Favre) A.H. Sm. & Singer) by Smith and Singer (1964).

The material referred to *G. alpestris* by Senn-Irlet (1987) (in the field taken to be *G. vittiformis*) has veil remnants on the cap margin but *G. alpestris* has no veil according to the description. Her material as described fits *G. minima*.

G. fallax A.H. Sm. & Singer: See note under *G. hypnorum*.

G. hypophaea Kühner: The species was described on a single collection from the alpine belt in southern Norway (Hardangervidda) and later reported by Gulden (1980) from 12 sites in the same area. These collections have not been

restudied yet, and the true identity of this species is not clear to me. Some of the collections possibly belong in *G. pumila*.

G. pumila var. *subalpina* A.H. Sm.: This variety, described by Smith from the subalpine of North America has according to the original description (Smith and Singer 1964) cystidia corresponding to those of *G. pumila*, but its spores are more in accordance with *G. pseudomniophila*, that is amygdaliform with faint ornamentation and plage. I have previously referred some collections to this taxon, but have lately doubted their identity.

G. subarctica A.H. Sm. & Singer: One collection from 800 m altitude on the Faroe Islands was tentatively referred to this species. A restudy of the material has shown it to belong in *G. pseudomycenopsis*. Pleurocystidia were found and the loosening of the perispore previously reported was found to be negligible.

G. tibiicystis (G.F. Atk.) Kühner: Recorded from several low-land sites in the Faroe Islands (Gulden and Vesterholt 1999). Bouteville and Moreau (2005) have convincingly shown that *G. tibiicystis* as traditionally conceived is a mixture of *G. hybrida* Kühner and *G. tibiicystis* s.s.(= *G. mairei* Boutev. & P.-A. Moreau). Compare also the distinct separation of the two species in the phylogram presented in Gulden et al. (2005, fig. 2).

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Appendix: Figures: micro-drawings and photographs.

Fig. 1. Spores and hymenial cystidia of *Galerina* species (subgen. *Naucoriopsis*) with pleurocystidia and ring zone: **a.** *G. badipes*, **b.** *G. marginata* (cystidia not shown) and **c.** *G. pseudomycenopsis*.

Fig. 2. Spores and hymenial cystidia of *Galerina* species (subgen. *Galerina*) with pleurocystidia and caulocystidia: **a.** *G. atkinsoniana*, **b.** *G. perplexa* (pileocystidia), **c.** *G. vittiformis* 4-spored and **d.** *G. vittiformis* 2-spored variety. Other *Galerina* species with caulocystidia not shown are *G. minima* and *G. subannulata*.

Fig. 3. Spores of *Galerina* species (subgen. *Tubariopsis*) with tibiiform cheilocystidia: **a.** *G. hybrida*, **b.** *G. stordalii*, **c.** *G. clavata* and **d.** *G. arctica*. Cheilocystidia shown for *G. clavata* are similar for all species. Not shown *G. subclavata* (2-spored).

Fig. 4. Spores of additional *Galerina* species (subgen. *Tubariopsis*) with tibiiform cheilocystidia (not shown): **a.** *G. pseudocerina* and **b.** *G. similis*.

Fig. 5. Spores and cheilocystidia of *Galerina* species (subgen. *Mycenopsis*) with variously shaped cheilocystidia: **a.** *G. jaapi* and **b.** *G. lubrica* (both 2-spored); **c.** *G. chionophila* and **d.** *G. pumila*.

Fig. 6. Spores and cheilocystidia of additional *Galerina* species (subgen. *Mycenopsis*) with variously shaped cystidia: **a.** *G. sphagnorum*, **b.** *G. cephalotricha* (almost tibiiform), **c.** *G. mniophila* and **d.** *G. pseudomniophila*.

Fig. 7. Spores and cheilocystidia of more *Galerina* species (subgen. *Mycenopsis*) with variously shaped cystidia: **a.** *G. hypnorum* and **b.** *G. calyptrata* (both with calyptrate spores); **c.** *G. harrisonii*, **d.** *G. paludosa*, **e.** *G. norvegica* (cystidia only) and **f.** *G. lacustris*.

Fig. 8. *Galerina* species in alphabetical order: **A.** *G. arctica*– Svalbard, Kap Linné, 2009, GG 126/09, photo: G. Gulden. **B.** *G. atkinsoniana* var. *atkinsoniana* – Norway, Finse 2005, PAM NO05-05: photo P.-A. Moreau. **C.** *G. calyptrata*- Finland, Hyytiälä 2005, GG 114/05, photo: G. Gulden. **D.** *G. cephalotricha* - Finland, Hyytiälä 2005, GG 105/05, photo: G. Gulden. **E.** *G. chionophila* – Norway, Finse 2005, PAM NO05-35, photo: P.-A. Moreau. **F.** *G. clavata*- Norway, Eidsvoll 2006, GG 285/06, photo: G. Gulden.

Fig. 9. *Galerina* species in alphabetical order (continued): **A. *G. harrisonii*** – Norway, Finse 1981, GG 724/81, photo: Kolbjørn M. Jenssen. **B. *G. hybrida*** – Norway 2008, PM 076, photo: Per Marstad. **C. *G. hypnorum*** – JV02-845, photo: Jan Vesterholt. **D. *G. lacustris*** France 2006, photo: P.-A. Moreau. **E. *G. marginata*** –JV99-488, photo: J. Vesterholt. **F. *G. mniophila*** – Sweden, Skåne 2008, LÖ 227-08, photo: L. Örstadius.

Fig. 10. *Galerina* species in alphabetical order (continued): **A.** *G. norvegica* - Finland, Hyytiälä 2005, GG 86/05, photo: G. Gulden. **B.** *G. paludosa* - JV03-164, photo: J. Vesterholt. **C.** *G. pseudocerina* - Norway, Finse 2005, PAM NO05-66, photo: P.-A. Moreau. **D.** *G. pseudomycenopsis* - Norway, Finse 2005, PAM NO05-23, photo: P.-A. Moreau. **E.** *G. pumila* - JV93-1161, photo: J. Vesterholt. **F.** *G. subclavata* - JV02-908, photo: J. Vesterholt.