Distribution and ecology of Arctic-alpine species of *Galerina* and *Phaeogalera* in the northern and southern hemisphere

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About 82 names relating to arctic-alpine species of *Galerina* and *Phaeogalera* (Agaricales, Basidiomycota) have been traced in 252 citations. These taxa are reported to occur in Arctic-alpine habitats both in the northern and southern hemisphere. Based upon the pattern of the presently known records of *Galerina* s. l. in Arctic-alpine ecosystems, six natural distribution regions with the following geographical boundaries are proposed: 1. Alps, Riesengebirge, Kaukasus. – 2. Eurasian Subarctic including Scandinavia, Scotland, Faeröes, Iceland, Jan Mayen, Svalbard (Spitsbergen), northern Russian coast (bordering the North Polar Sea) and Siberian mountain ranges). – 3. North American Subarctic including Greenland, northern Canada and Alaska and the northern Rocky Mts. – 4. Andes. – 5. Antarctica and subantarctic islands. – 6. Equatorial Africa (Ruwenzori Mts., Zaire). Taxa belonging to the genera *Galerina* and *Phaeogalera* are typical and dominant elements in Arctic-alpine habitats. The type localities of more than 25 taxa are actually situated in these regions. Except for a few species growing on rotting wood, most Arctic-alpine *Galerina* are found to be saprobic on living, decaying or dead (peat) plant debris, predominantly originating from mosses and lichens, but less often also from grasses, sedges, dwarf *Salix* species and other substrata. Species of *Galerina* and *Phaeogalera* have been observed to be more or less closely associated with about 68 different bryophytes occurring in sites and niches characterized by an unusually wide ecological range (e. g. tundra, snow-beds, swamps, bare alluvial silt, sand or gravel). Despite their small, fragile and ephemeral basidiomes, most species of *Galerina* are physiologically well adapted to the harsh edaphic and microclimatic impacts in the Arctic-alpine environment.

Keywords: Agaricales, *Galerina*, *Phaeogalera*, Arctic-alpine distribution, northern hemisphere, southern hemisphere, ecology, substrate relationships, mosses.

This contribution presents a compilation of Arctic-alpine (AA) species of *Galerina* Earle and *Phaeogalera* Kühner recorded in 125 of the most important papers dealing with this ecologically distinctive group of agarics. Despite the monographs of Kühner (1935) and Smith & Singer (1964), including several subsequent publications focussing on the systematics of this cortinariaceous genus (Kühner, 1972a; 1972b; Gulden, 1987; 1988; Horak, 1982; Horak & Miller, 1992), the

taxonomy of *Galerina* in general, and of its AA taxa in particular, is far from being settled. Members of *Galerina* are found world-wide and this genus is actually one of the few represented in all five continents. In addition, the extraordinary range of distribution of most of its taxa interconnects locations in tropical lowlands (Horak, 1992) or AA biomes both in the northern and southern hemisphere (Horak, 1982). The data presented in this paper demonstrate that - within the limits of ecologically defined ecosystems - many species of *Galerina* s. l. as indicated in the current literature have in fact a much wider area of distribution. Accordingly, it can be safely predicted that a critical revision of the genus will reveal numerous synonyms especially of taxa which possibly have been collected at distant but ecologically similar localities.

In this survey of 81 AA species of *Galerina* and *Phaeogalera*, the names published in the original literature have been listed, regardless of the fact that in several cases commonly accepted synonyms are available. This applies also to the nomenclature of the mosses reported to be the host substrate(s) for *Galerina* s. l. This decision has been enforced by the fact that the identity of many taxa, both in *Galerina* and mosses, is and will remain obscure because of the lack of voucher material needed to allow re-examination. Conversely, the citation of the original names makes sure that attention is drawn again to interesting records which in the dispersed literature have been either overlooked or sunk in lists of synonyms.

Arctic-alpine regions and abbreviations

Region (R1): Alps-Tatra-Kaukasus:		Region (R 2): Scandinavia-Arctic:	
AU	Austria	FA	Færöes
CH	Switzerland	IS	Iceland
CS	Czechoslovakia	JM	Jan Mayen
DE	Germany	NO	Norway
FR	France	SW	Sweden
IT	Italy	SC	Scotland
KA	Kaukasus	SF	Finland
PL	Poland	SP	Svalbard (Spitsbergen)
SR	Russia (Subarctic Islands, North Coast, Altai Mts.)		

Region (R 3): North America:		Region (R 4): South America:	
AL	Arctic Alaska (USA, N-Rocky Mts.)	AN	Andes (from Colombia to southern Argentina)
CA	Arctic Canada	GR	Greenland

Region (R 5): Antarctica:

AC Antarctica and Subantarctic Islands (Brabant Is., Falkland Is., Kerguelen, New Amsterdam Is., Macquarie Is., Marion Is., S. Georgia, S. Orkney, S. Sandwich Is.)

Region R 6): Africa:

ZA Zaire (Ruwenzori).

AA	Arctic-alpine	mu	muscicolous
*	publication with original diagnosis	R.	Region
a	acidiphilous, soil-substrate with low pH	sa	saprobic
b	basiphilous, soil-substrate with high pH	su	swampy habitat
lign	lignicolous	tr	terrestrial
li	lichenicolous		

Enumeration of Arctic-alpine species of *Galerina* and *Phaeogalera*

(Numbers in brackets refer to literature records, cf. References)

1. *Galerina acris* Gulden 1980. Norw. J. Bot. 27: 236.

Distribution. – (R 2): NO (30*).
Ecology (tr, lign). – On sand and on rotten timber at construction site.
Altitude. – <1200 m.
Remarks. – Known only from two localities near Finse; probably adventitious in alpine-subalpine zone.

2. *Galerina aimara* Singer in Smith & Singer 1964. Galerina, 112.

Distribution. – (R 4): AN: Bolivia (115*).
Ecology (tr, mu). – On and among mosses (Tab. 4).
Altitude. – <3000 m.
Remarks. – Endemic on eastern slopes of the Andes (Nor Yungas). – Revision and key in (43).

3. *Galerina alpestris* Singer 1974. Bull. mens. Soc. linn. Lyon 43: 392.

Distribution. – (R 1): CH (102, 104, 110*).
Ecology (tr, mu, a-b). – On soil among moss (Tab. 4) and on sand-silt among *Epilobium fleischeri* or in snow beds with *Salix reticulata*, *retusa* or *serpyllifolia* (110).
Altitude. – <2380 m.
Remarks. – Endemic in the Alps of Central Switzerland.

4. *Galerina annulata* (Favre) Singer 1973. Sydowia Beih. 7: 90.
Bas.: *Galerina rubiginosa* var. *annulata* Favre 1955. Ergebn. wiss. Unters. Schweiz. Nat. Park 33: 150.

Distribution. – (R 1): AU (39), CH (24*).
Ecology (tr, mu, a-b). – On soil among moss (Tab. 4) and *Salix herbacea* in snow beds (24*); on sandy soil among *Pohlia gracilis* (39).
Altitude. – <2640 m (CH).
Remarks. – Endemic to the alpine-nival zone of the Central Alps in eastern Switzerland and western Austria (Tyrol). Probably widely distributed but mistaken for *G. atkinsoniana* s. l. or *G. vittaeformis* s. l.

5. *Galerina antarctica* Singer in Singer & Corte 1963. Contr. Inst. Ant. Arg. 71: 13.

Distribution. – (R 5): AC: W-Antarctica (Palmer Peninsula and off-shore islands, 111*), S. Georgia (20, 88, 111), S. Orkney Is. (88).
Ecology (sa, mu). – On decaying culms and leaves of tussock (*Deschampsia* sp., *Poa flabellata*, also on moss).
Altitude. – About sea-level.
Remarks. – Distribution map in W-Antarctica is found in (109); cf. also (40).

6. *Galerina antheliae* Gulden 1980. Norweg. J. Bot. 27: 245.

Distribution. – (R 2): NO (30*), SC (see below), SP (31, 33), SR (81).
Ecology (tr, mu, li; b-a). – Among moss (detailed data in 30) in wet habitats and tundra (Tab. 4).
Altitude. – (R 2): < 1400 m (NO).
Remarks. – This rather rare but distinctive species (restricted to R 2) is predominantly associated with *Salix herbacea* and *Anthelia* sp. and occurs only on acid soil in snow beds. The two Russian records (81) are reported from tundra in the northern Urals.
Vellinga & Bas (1986) consider the present species to be contaxic with *Phaeomarasmius harrisonii* Dennis (Kew Bull. 19: 112, 1964). In case this proposal proves correct, the above species becomes a later synonym of *Galerina harrisonii* (Dennis) Bas & Vellinga in Vellinga (Persoonia 13: 24, 1986). According to R. Watling (pers. comm.) this species, originally described from the Isle of Rhum, is commonly encountered in the Scottish mountains.

7. *Galerina arctica* (Singer) Nezdojminogo 1982. Mikol. Fitopatol. 16: 209.
Bas.: *Cortinarius arcticus* Singer 1938. Acta Inst. bot. Komarov Akad Sci. SSSR 4: 15.

Distribution. – (R 2): SR (107*, 80), SP (31, 32, 46), NO (31). – (R 3): AL (44), CA (44).
Ecology (tr, mu). – Mostly found on and among moss (detailed data in 31, 44) in swampy localities along creeks or pools in tundra (Tab. 4).
Altitude. – (R 3): < 1500 m.
Remarks. – Originally reported from Novaya Zemlya, this taxon has a wide circumpolar distribution. First records for the Alaskan and Canadian Arctic in (44). – Cf. *G. griseipes* Kühner (31).

8. *Galerina atkinsoniana* (2-spored) Smith 1953. Mycologia 45: 894.

Distribution. – (R 1): CH (55, 102, 103), FR (102). – (R 2): NO (30, 55).
Ecology (mu, su, tr, a-b). – In bogs dominated by *Sphagnum* (30, 55) or in wet habitats (102) associated with *Carex davalliana* (55), but less often also in dry habitats,

e. g., in *Salix herbacea* and *S. retusa-reticulata* snow beds or in open tundra (30, 102, 103) (Tab. 4).
Altitude. – (R 1): <2550 m (CH). – (R 2): <1450 m (NO).
Remarks. – This species is characterized by its remarkably wide ecological range. – Cf. *G. muricellospora*.

9. *Galerina atkinsoniana* (4-spored) Kühner 1972. Bull. Soc. mycol. France 88: 84.

Distribution. - (R 1): CH (103, 104). – (R 2): NO (29, 30), SC (125), SW (55).
Ecology (tr, mu, a-b). – On soil among moss in *Salix herbacea* snow beds or in tundra.
Altitude. – (R 1): <2315 m (CH), <1200 m (NO), <850 m (SW).
Remarks. – Older records often do not refer to the number of sterigmata on the basidia.

10. *Galerina badipes* (Fries) Kühner 1935. Encycl. Myc. 7: 222.

Distribution. – (R 2): SR (81). – (R 3): GR (63).
Ecology (tr). – Reported from subarctic tundra.
Altitude. – About sea-level.
Remarks. – Characterized by 2-spored basidia. Considered to be a synonym of *G. cedretorum* (55).

11. *Galerina boliviana* Singer in Smith & Singer 1964. Galerina, 58.

Distribution. – (R 4): AN: Bolivia.
Ecology (mu). – On *Sphagnum* sp.
Altitude. – <3000 m.
Remarks. – This sphagniphilous species occurs on the eastern slopes of the Andes. Revision and key in (43).

12. *Galerina calyptrata* Orton 1960. Trans. Brit. mycol. Soc. 43: 237.

Distribution. – (R 1): CH (104). – (R 2): NO (29, 30), SC (125), SP (31), SR (81).
Ecology (tr, mu, su, a-c). – Both on *Sphagnum* (NO, SP) and in dry habitats on soil among moss (Tab. 4).
Altitude. – <2315 m (CH), - <1200 m (NO).
Remarks. – Rarely encountered species whose AA records probably represent *G. hypnorum* (cf. 30, 31).

13. *Galerina cedretorum* (2-spored) Maire) Singer 1950. Acta Inst. bot. Komarov Acad. Sci. USSR, ser. II, 6: 470.

Distribution. – (R 1): FR (23, 55, 58). – (R 2): NO (30).
Ecology (tr, mu, su, a-c). – On moss (Tab. 4) in swampy habitats with *Salix arbuscula* (55) or terricolous on silt among moss (30).
Altitude. – <2750 m (FR), <1200 (NO).
Remarks. – Only reported from one delimited region in the French Alps and from one location in southern Scandinavia (Finse). The morphological characters of this 2-spored species are described by Kühner (1935) as *G. badipes* (see above).

14. *Galerina chionophila* Senn-Irlet 1986. Myc. Helv. 2: 44.

Distribution. – (R 1): CH (101*, 102, 103, 104).
Ecology (tr, mu, a). – On soil in snow bed among *Polytrichum sexangulare* (Tab. 4) and *Salix herbacea*, mostly found late in the season.
Altitude. – <2350 m.
Remarks. – Information about productivity and mycoecological relationships in (103). Endemic to the Alps in Central Switzerland but probably widely distributed in snow beds on acid bedrock.

15. *Galerina clavata* (Velenovski) Kühner 1935. Encycl. Myc. 7: 171.

Distribution. – (R 1): CH (24), FR (92). – (R 2): FA (77), IS (36), SC (125), SW (11), SP (31, 32). – (R 3): AL (44), GR (63).
Ecology (su, mu, rarely tr). – On and among hygrophilous moss (Tab. 4) in swamps, wet tundra, etc., occasionally terrestrial in snow bed with *Salix herbacea* (24) or *Salix* spp. (63).
Altitude. – <2550 m (CH), <1050 m (IS), <400 m (GR).
Remarks. – The majority of records have been taken at locations characterized by mosses preferring moist to very wet conditions. Quantitative ecological data from GR (63) and AL tundra (44).
Probably conspecific with *G. heterocystis* auct. pl. europ. (31), but microcharacters of type specimen are definitely different (Horak, unpubl.).

16. *Galerina dimorphocystis* Smith & Singer 1955. Mycologia 47: 558.

Distribution. – (R 2): NO (56), SW (56), SR (82). – (R 3): GR (60).
Ecology (tr, su, mu). – On soil among moss (Tab. 4) with *Salix herbacea* and *S. lapponum* (NO) in snow bed, rarely also on *Sphagnum* (NO).
Altitude. – <1450 m (NO), <900 m (SW).
Remarks. – Ecologically poorly documented species (3 records from southern N, 56).

17. *Galerina embolus* (Fries) P. D. Orton 1960. Trans. Brit. mycol. Soc. 43: 176.

Distribution. – (R 2): SP (31, 48).
Ecology (tr, mu). – On soil among *Polytrichum* sp. (Tab. 4).
Altitude. – ?
Remarks. – Only known from two doubtful records from Svalbard (cf. also 84). The scarce ecological data relate to but one modern collection (48).

18. *Galerina glebarum* (Berkeley) Singer 1969. Nova Hedw. Beih. 29: 309.

Distribution. – (R 5): AC: Falkland Is. (3*), Kerguelen Is. (4), Marion Is. (4).
Ecology (sa). – On decaying leaves and culms of Umbelliferae (*Bolax* sp. at type locality; *Azorella* sp. at the two other locations on the Subantarctic islands).
Altitude. – About sea-level.
Remarks. – Fresh collections of this species are needed (cf. also 40) to prove the peculiar host relationships.

19. *Galerina griseipes* Kühner 1972. Bull. Soc. mycol. France 88: 153.

Distribution. – (R 1): FR (56*, 58).
Ecology (tr, mu). – Among moss on rocky soil in alpine meadows.

Altitude. – <2500 m.
Remarks. – Endemic species from the French Alps (Vanoise); no detailed ecological data available. Cf. *G. arctica* (31).

• *Galerina harrisonii* Bas & Vellinga in Vellinga (1986).
For discussion cf. *G. antheliae*.

20. *Galerina heterocystis* (Atkinson) Smith & Singer 1958. Sydowia 11: 447.
Bas.: *Galerula heterocystis* Atkinson 1918. Proc. Am. Phil. Soc. 57: 362.

Distribution. – (R 1): CH (102, 104), FR (9, 56, 58, 59), IT (8). – (R 2): NO (30, 34, 56), SW (45, 56). – SR (80, 81, 115, 117, 118, 119, 121). – (R 3): AL (44, 66, 67, 75), GR (51, 60, 89, 122).
Ecology (tr, su, mu, b-a). – Reported from ecologically diverse habitats ranging from *Sphagnum* bogs (34, 51), from peat in temporarely inundated mires in high Arctic tundra (e. g.: SR: Taimyr Peninsula, 117; AL: 44, 66, 75), from hygrophilous mosses in fens (102, 56, 30) and from bogs with *Carex* spp. (102, 56), but also from soil among moss in dry locations or in snow beds with *Salix* sp. (34), *S. glauca-herbacea* (89), *S. herbacea* (59) or *S. retusa-reticulata* (9).
Records on soil are reported both from acid and base-rich habitats, e. g. in (R 1: 9, 58, 102) or in (R 2: 45).
Altitude. – (R 1):. <2490 m (CH), <2800 m (FR). – (R 2): <1450 m (NO), < 1050 m (SW), < 2700 m (SR: Altai Mts., 115).
Remarks. – For additional ecological data (56, 89). Cf. also *G. clavata*.

21. *Galerina hypnorum* (2-spored) (Schrank: Fries) Kühner 1935. Encycl. Myc. 7: 194.

Distribution. – (R 1): CH (24), FR (92).
Ecology (tr, mo). – On acid soil.
Altitude. – <2350 m (CH), <2025 m (FR).
Remarks. – Doubtful species with scarce ecological information.

22. *Galerina hypnorum* (4-spored) (Schrank: Fries) Kühner 1935. Encycl. Myc. 7: 194.

Distribution. – (R 1): CH (10, 24), KA (106).
(R 2): FA (14, 77, 97), IS (65), JM (37, 64, 90 and 96 (in both under "*G. hypni*"), NO (6, 30), SC (125), SW (11, 61), SC (18, 21 - Shetland Is.), SF (47, 49), SP (22, 31, 48, 71, 72), SR (70, 73, 81, 108 - Altai Mts., 120).
(R 3): AL (44, 116), CA (17, 98), GR (1, 28, 63 ?, 93, 94, 95).
(R 5): AC: Subantarctica: Kerguelen Is. (4, 40).
Ecology (tr, mu, li, a-b). – On soil (or peat) on and among moss (rarely on *Sphagnum*, Tab. 1) or lichens in ecologically widely different locations (e. g. alluvial plains with pioneer communites, mires, fens, heath, tundra, snow-beds) or on decaying plant debris (tufts of *Azorella* sp. in Kerguelen Is.). Phytosociological data largely unknown in most collections.
Altitude. – <2640 m (CH), <3600 m (KA), <1200 m (NO), <1800 m (SW), <760 m (SC), <500 m (SP)
Remarks. – Within the ecological limits of AA habitats, *G. hypnorum* s. l. is a rather rare but wide-spread species and the very first *Galerina* recorded from AA ecosystems (Lindblom 1841). According to the number of records in the literature, this

Galerina ranges on top of the citation list. However, most of the old references referring to this taxon appear doubtful (cf. also 63) unless the voucher material (most often not available) is revised (cf. "*G. hypnorum*" from Ellesmere Is. (98) actually represents *G. pseudomycenopsis*, see 31). In addition, the majority of these collections lack any ecological data about the place of their discovery.– Cf. also *G. calyptrata*.

23. *Galerina hypophaea* Kühner 1972. Bull. Soc. mycol. France 88: 152.

Distribution.– (R 2): NO (30, 55, 56*).– (R 3): AL (66).
Ecology (tr, mu, su).– On soil in moist habitat with *Salix lapponum* (type material), in heath and in moist fens with hygrophilous moss (30; Table 1) or in polygon tundra (66).
Altitude.– <1200 m (NO).
Remarks.– For the AL record no ecological data are available.

24. *Galerina hypsizyga* Singer in Smith & Singer 1964. Galerina, 174.

Distribution.– (R 4): AN: Venezuela (19, 115*).
Ecology (tr, su, mu, a).– On peat with moss and *Cladonia*.
Altitude.– <3560 m.
Remarks.– Only known from type locality in the Sierra de St. Domingo. Additonal information and key cf. (43).

25. *Galerina infernalis* Singer in Smith & Singer 1964. *Galerina*, 268.

Distribution.– (R 4): AN: Argentina (115*).
Ecology (sa).– On decaying debris of *Stipa* sp.
Altitude.– <3000 m.
Remarks.– Ecological data based upon single record. Habitat and morphology of both macro- and microcharacters recall *G. pseudomycenopsis* (cf. key in 43).

26. *Galerina jaapii* Smith & Singer 1955. Mycologia 47: 574 (ss. Kühner 1935).

Distribution.– (R 1): CH (55, 102).– (R 2): NO (30), SR (81).
Ecology (tr).– On calcareous soil (55) and in tundra (81).
Altitude.– <2450 m (CH).
Remarks.– Apart from the Russian reference, there is only one doubtful record reported from the alpine zone in Switzerland (55). The material described in (30) and (102) has been collected in the upper subalpine zone both in Switzerland and Norway.– Cf. *G. mycenopsis*.

27. *Galer(in)a kerguelenensis* (Berkeley) Saccardo 1887. Syll. Fung. 5: 864.

Distribution.– (R 5): AC: Kerguelen Is. (5*).
Ecology (tr, mu, su).– On soil among moss in bog.
Altitude.– About sea-level.
Remarks.– Doubtful species reported to be related to *G. hypnorum*.

28. *Galerina longinqua* Smith & Singer 1958. Mycologia 50: 477.

Distribution. – (R 5): AC: Macquarie Is. (115, 114*), Antarctica (109), S. Sandwich Is. (88).
Ecology (tr, mu). – On soil among moss.

Altitude. – <185 m (88).
Remarks. – A rather large, 2-spored species, endemic to Antarctica (map of distribution cf. 109) and Subantarctic Islands. Additional information cf. (40).

29. *Galerina macquariensis* Smith & Singer 1958. Mycologia 50: 478.

Distribution. – (R 5): AC: Macquarie Is. (115, 114*).
Ecology (tr, mu). – On peat among mosses.
Altitude. – About sea-level.
Remarks. – Only known from type locality. Additional information cf. (40).

30. *Galerina macrospora* (Velenovsky) Singer 1950. Acta Inst. bot. Komarov Akad. Sci. USSR, ser. II, 6: 473.

Distribution. – (R 3): AL (67, 75).
Ecology (tr, su, mu, a). – ?
Altitude. – About sea-level.
Remarks. – Probably on peat among aquatic mosses, lichens, sedges and dwarf *Salix* in tundra.

31. *Galerina mainsii* var. *tetraspora* Singer 1974. Bull. Soc. linn. Lyon, num. spéc. 43: 401.

Distribution. – (R 1): CH (110*).
Ecology (tr, mu). – On soil among moss.
Altitude. – ?
Remarks. – Endemic to western Swiss Alps. No mycoecological data available.

32. *Galerina marginata* (Batsch: Fries) Kühner 1935. Encycl. Myc. 7: 225.

Distribution. – (R 1): FR (57). – (R 2): IS (65, 16), SF (47). – (R 3). GR (63, 94).
Ecology (lign, mu, sa). – On decaying imported timber and logs (63, 94) or rotten wood (47, 65); on moss (57, 65, 16).
Altitude. – <2200 m (57).
Remarks. – This species usually grows on rotten wood and accordingly must be excluded from the list of typical AA *Galerina*. Exceptions are the strictly moss-inhabiting collections (cf. also *G. unicolor*) made in the alpine zone of the French Alps (57) and in Iceland (65, 16).

33. *Galerina mniophila* (Lasch) Kühner 1935. Encycl. Myc. 7: 192.

Distribution. – (R 2): SC (18, 123, 125), FA (77), SP (72, 91). – (R 3): AL (75), GR (63 ?, 94).
Ecology (tr, mu, a-c). – In dry habitat on soil among moss (18), on peat in polygon tundra (75), or on *Hypnum* sp. (77; Table 1).
Altitude. – <500 m (18).
Remarks. – Concerning its ecology and substrate relationships poorly documented species.

34. *Galerina mölleri* Bas 1960. Persoonia 1: 310.

Distribution. – (R 1): CH (55), FR (58). – (R 2): FA (2*, 77), NO (30, 34, 55, 57), SC (125), SP (84), SR (80, 81), SW (11, 45, 55, 57). – (R 3): AL (50, 66, 67), GR (2, 60, 89,

122). – (R 5): AC: Antarctica (40, 109 with distribution map, 111) and Subantarctica: S. Georgia (20, 88), S. Orkney (88), Brabant Is. (125).
Ecology (tr, mu, li, su, sa, a-b). – (R 1): On soil among moss in snow bed (with *Salix herbacea*, 55), in marsh (with *Carex fusca*, 58). – (R 2): On soil among moss (*Dicranum* sp. at type locality in FA), in *Dryas* heath (45) or snow beds with acidophilous and calciphilous *Salix* spp. (NO, SW), in bogs with hygrophilous moss (SP) or on peat in tundra (SR). Rarely on *Sphagnum* (45, 57). – (R 3): On peat among lichen and moss (AL) or both in fen with hygrophilous moss and in snow bed or heath with *Dryas* and *Salix* spp. (89, 122). – (R 5): On soil and on peat among moss (Tab. 4), but mostly on detritus of decaying *Deschampsia antarctica* and *Rostkovia magellanica*.
Altitude. – (R 1): <2550 m (CH). – (R 2): <800 m (FA), <1500 m (NO), <1130 m (SW).
Remarks. – Common in (R 2), (R 3) and (R 5) but rather rare in (R 1). Found in ecologically very diverse habitats (ranging from sun-exposed alluvial plains, snow beds or marshy and swampy localities). Comprehensive mycoecological data are found in (89).
Further information cf. *G. pseudomycenopsis*.

35. *Galerina muricellospora* (Atkinson) Kühner 1935. Encycl. Myc. 7: 203.
Syn.: *G. rubiginosa*, 2-spored, ss. Kühner 1935).

Distribution. – (R 1): CH (24). – (R 2): SC (18).
Ecology (tr, mu, a). – On soil among moss (Tab. 4) and in snow bed with *Salix herbacea* (24) or among grass and moss in heath (18).
Altitude. – (R 1): <2640 m (CH). – (R 2): <830 m (SC).
Remarks. – Cf. *G. atkinsoniana*.

36. *Galerina mycenoides* (Fries) Kühner 1935. Encycl. Myc. 7: 209.

Distribution. – (R 2): SR (70, 73).
Ecology (tr, mu). – On soil among moss in tundra.
Altitude. – ?.
Remarks. – Only encountered in tundra at localities near the Russian coast of the Arctic Sea.

37. *Galerina mycenopsis* (Ricken) Kühner 1935. Encycl. Myc. 7: 190.

Distribution. – (R 1): PL (78, 79). – (R 2): IS (62, 65), JM (35), NO (34), SC (125), SF (47, 49). – (R 3): AL (116), GR (63 ?).
Ecology (tr, mu, a). – (R 1): Among moss with *Salix herbacea* in snow beds of the High Tatra Mts. (PL). – (R 2, R 3): On soil among moss (Tab. 4) in alluvial plains (AL), Subarctic heath (GR) and tundra (IS).
Altitude. – <2080 m (PL). – (R 2): <1650 m (NO).
Remarks. – Rarely encountered species whose ecology is not yet well known. Mycosociological data are published from an Alaskan glacier "vorfeld" (116) and from *Betula* dwarf shrub heath in GR (63; doubtful record). Cf. *G. pumila*.

38. *Galerina norvegica* Smith in Smith & Singer 1964. *Galerina*, 146.

Distribution. – (R 2): NO (30).
Ecology (mo, su). – On *Sphagnum* spp. (Tab. 4).
Altitude. – <1200 m.

Remarks. – Recorded only once in NO growing on *Sphagnum* (*Sph. nemoreum*, *parvifolium*, *russowii*).

39. *Galerina paludosa* (Fries) Kühner 1935. Encycl. Myc. 7: 184.

Distribution. – (R 2): NO (30, 55, 124), SW (11), SC (21, 123, 125), SF (47), SR (81, 120).
Ecology (tr, mo, su). – On *Sphagnum* spp. (all records in NO and on Shetland Is.) or on soil among moss (Tab. 4) in marshy heath (SC) or tundra.
Altitude. – <1200 m (NO).
Remarks. – So far only recorded in Scotland, Scandinavia and along the northern coast of Russia.

40. *Galerina perplexa* Smith in Smith & Singer 1964. Galerina, 321.

Distribution. – (R 3): GR (60).
Ecology. – ?
Altitude. – ?
Remarks. – No mycoecological data available.

41. *Galerina perrara* Singer 1963. Contr. Inst. Ant. Arg. 71: 15.

Distribution. – (R 5): AC: Antarctica (88, 109 - with distribution map, 111*) and Subantarctica: Brabant Is. (125), S. Georgia (88), S. Orkney (88), S. Sandwich Is. (88).
Ecology (tr, mu, sa). – On soil or peat among moss (Tab. 4) and on decaying tussock of *Deschampsia* sp. (88) or *D. antarctica* (125).
Altitude. – About sea-level.
Remarks. – Based upon the present records this *Galerina* seems to be common in western Antarctica and its off-shore islands. Additional ecological data in (40).

42. *Galerina polytrichorum* Singer in Smith & Singer 1964. *Galerina*, 194.

Distribution. – (R 4): AN: Bolivia (115).
Ecology (tr, mu). – On soil among moss (Tab. 4).
Altitude. – <3000 m.
Remarks. – Only known from the type locality. – Key and list of related taxa in (43).

43. *Galerina praticola* (Möller) P. D. Orton 1960. Trans. Brit. mycol. Soc. 43: 176.
Bas.: *Pholiota praticola* Möller 1945, Fungi Faeröes 1: 231.

Distribution. – (R 2): FA (2, 77*), IS (62), SC (123, 125). – (R 3): AL (44), CA (44). – (R 5): AC: Antarctica: Brabant Is. (125).
Ecology (tr, mu, su, sa). – On soil and peat among moss (Tab. 4) and grasses (FA, IS, CA), on peat with aquatic mosses and plant debris in polygon mires (AL) or on decaying tussock of *Deschampsia antarctica* (125).
Altitude. – About sea-level (R 3, R 5).
Remarks. – Both at the type locality and in the Alaskan tundra, this species has been recorded with *G. pseudomycenopsis* in similar habitats, and accordingly it may represent a mere phenotypic morph of the latter very polymorphic taxon (44). In the Alaskan tundra *G. praticola* was commonly found on peat associated with hygro-

philous mosses (*Drepanocladus*, *Calliergon*, *Campylium*, rarely also *Sphagnum*) in and along the margin of polygon troughs.

44. *Galerina pseudocerina* Smith & Singer 1958. Mycologia 50: 483.

Distribution. – (R 1): CH (102, 103), FR (7, 54, 55, 58), IT (55). – (R 2): NO (30, 54, 55, 124), SC (124, 125), SP (31, 32, 91), SR (80, 81), SW (55). – (R 3): CA (44, 86), GR (124).
Ecology (tr, mu, b). – (R 1, R 2, R 3): On calcareous soil among moss (with *Dicranum* sp. at type locality in Colorado, USA; Table 1) in snow-bed (Salicetum retuso-reticulatae), in *Dryas* heath and in calciphilous plant communities. Fruiting early in season (30, 55, 102, 103).
Altitude. – (R 1): <2330 m (CH), <2500 m (FR), <2200 m (IT). – (R 2): <1350 m (NO), <950 m (SW).
Remarks. – The majority of records indicate that *G. pseudocerina* is predominantly found in rather dry snow beds at base-rich sites. Accordingly its most common dwarf shrub associates are several calciphilous *Salix* (*S. retusa, reticulata, polaris*) and *Dryas* (*D. octopetala, integrifolia*). Results in mycoecology and productivity at an alpine location in Switzerland are found in (103).

45. *Galerina pseudomniophila* Kühner 1972. Bull. Soc. mycol. France 88: 152.

Distribution. – (R 1): CH (55*). – (R 2): NO (30, 55), SC (125), SP (31, 124), SW (55). – (R 3): CA (83), GR (124).
Ecology (tr, mu, su). – On soil among moss (Tab. 4) in dry tundra and heath (CH, NO, SW, SP) but also in snow-bed with *Salix herbacea* (type locality in CH, 55; 83) or *Betula nana*. Once associated with *Sphagnum* (55).
Altitude. – <2500 m (CH, type locality), <1300 m (NO), <950 m (SW).
Remarks. – Cf. also *G. "pseudombrophila"* (124, misprint).

46. *Galerina pseudomycenopsis* Pilát in Pilát & Nannfeldt 1954. Friesia 5: 19.
Cf.: *Galerina mölleri* Bas 1960.
Galera pumila f. *oreina* Favre 1955.
Galerina pseudopumila P. D. Orton 1960.
Galerina subannulata (Singer) Smith & Singer 1964. – Cf. (44, p. p.).

Distribution. – (R 2): SP (25, 31, 33, 46 - with distribution map). – (R 3): AL (44), CA (44, 98 "*G. hypnorum*" cf. 31). – (R 4): AN: Argentina (43).
Ecology (tr, mu, li, su, a). – On soil and peat among moss (Tab. 4), lichens and plant debris in dry (heath with *Salix* spp.) to very moist, often permanently swampy (polygon mires) locations, also on *Sphagnum* (31, 33, 44).
Altitude. – <3200 m (43).
Remarks. – Regarding macro- and microcharacters this specis is very polymorphic and colonizes habitats of widely differing ecology. Detailed taxonomic and mycoecological data on Alaskan and Canadian records are found in (44).
For further information refer to names listed under synonyms.

47. *Galerina pseudopumila* P. D. Orton 1960. Trans. Brit. mycol. Soc. 43: 176.

Distribution. – (R 2): SP (91, 124).
Ecology (tr, mu, su). – On sandy soil among moss in dry and wet habitats.
Altitude. – About sea-level.
Remarks. – Further data relating to ecology and synonymy cf. *G. pseudomycenopsis*.

48. *Galerina pseudotundrae* Kühner 1972. Bull. Soc. mycol. France 88: 152.

Distribution. – (R 1): AU (41), CH (41, 55, 102, 104), DE (12, 99), FR (55*, 58), IT (55). – (R 2): NO (30).
Ecology (tr, mu, a-b). – On acidic soil among moss (Tab. 4) in snow-bed with *Salix herbacea*, on naked peat (41, 30) or in dry or wet habitats with sedges on calcareous bed-rock in DE (12) and CH (41, 102).
Altitude. – <2260 m (AU), <2700 m (CH), <2060 m (DE), <2500 m (FR), <2200 m (IT). – (R 2): <1200 m (NO).
Remarks. – Except for the Norwegian collections (30), all other scattered records have been reported from the Alps. Based upon the present data, this 2-spored species (41) can be expected in several ecological niches both on acidic and calcareous soil.

49. *Galerina pumila* (Persoon: Fries) M. Lange 1961. Medd. Grønl. 148: 37 (ex Singer 1961. Persoonia 2: 41).

Distribution. – (R 2): FA (77), NO (30), SP (31, 91, 112, 113), SR (80, 81, 115), SW (45). – (R 3): AL (75), GR (63, 93). – (R 5): AC: S. Georgia (40, 88).
Ecology (tr, mu, sa). – On soil or peat among moss (Tab. 4) in dry and wet habitats (heath, tundra), in mossy snow-bed with *Salix* (*S. arctophila, glauca, herbacea*) and *Betula nana*, or saprobic on decaying tussock of *Deschampsia antarctica* (88).
Altitude. – (R 2): <800 m (FA), <1050 m (SW), <400 m (SP).
Remarks. – According to (63), *G. pumila* is one of the most common representatives of the genus in GR. Furthermore, its mycoecological and phytosociological relationships are exceptionally well documented from several plots in different plant associations (63).
Further data relating to ecology and synonymy cf. *G. pseudomycenopsis*.

50. *Galera pumila* f. *oreina* Favre 1955. Ergebn. wiss. Unters. schweiz. Nat. Park 33: 149.

Distribution. – (R 1): CH (24*). – (R 3): AL (67).
Ecology (tr, mu, su, a). – On swampy soil among hygrophilous mosses (CH) or in polygon mires (AL).
Altitude. – < 2550 m (type locality, CH).
Remarks. – Further data relating to ecology and synonymy cf. *G. pseudomycenopsis*.

51. *Galerina pumila* var. *subalpina* Smith in Smith & Singer 1964. Galerina, 189.

Distribution. – (R 2): SR (115). – (R 3): AL (66), CA (83).
Ecology (tr, mo). – On soil in snow-bed with *Salix herbacea* (CA) or in tundra.
Altitude. – ?.
Remarks. – The ecological data for this variety of *G. pumila* are rather scarce.

- *Galerina rubiginosa* var. *annulata* Favre 1955. Ergebn. wiss. Unters. schweiz. Nat. Park 33: 150.
  Cf. *G. annulata*.

52. *Galerina rubiginosa* (4-spored) (Persoon: Fries) Kühner 1935. Encycl. Myc. 7: 200.

Distribution. – (R 1): AU (39). – (R 2): SC (18, 125).

Ecology (tr, mu, su). – On swampy soil in sandy habitats (AU) or in wet moor among *Molinia* sp. and *Juncus* sp. (SC).
Altitude. – <2300 m (A).
Remarks. – Rarely encountered species which probably is contaxic with *G. vittaeformis* s. l.

53. *Galerina rubiginosa* (2-spored) (Persoon: Fries) Kühner 1935. Encycl. Myc. 7: 200.

Distribution. – (R 1): FR (92). – (R 2): SC (125).
Ecology. – Collected near timberline close to *Larix decidua*.
Altitude. – <2160 m.
Remarks. – Identification doubtful. The few ecological data suggest that this species has probably not been collected in the alpine zone proper.

• *Galerina rubiginosa* var. *muricellospora* (Atkinson) Kühner.
Cf. *G. muricellospora*.

54. *Galerina sahleri* (Quélet) Kühner in Favre 1948. Beitr. Krypt. Fl. Schweiz 10: 136.

Distribution. – (R 2): SC (18).
Ecology (tr). – On bare peat (Scirpetum caespitosi).
Altitude. – ?
Remarks. – Single record reported from the Hebrides.

55. *Galerina sideroides* (Fries) Kühner 1935. Encycl. Myc. 7: 215.

Distribution. – (R 5): AC: Subantarctica: S. Orkney, Signy Is. (88).
Ecology (tr, mu, sa). – On soil among moss (Tab. 4) and on decaying debris of *Poa alpestris*.
Altitude. – About sea-level.
Remarks. – In the northern hemisphere, this lignicolous species is commonly observed on rotten conifer logs. Its occurrence in Subantarctica, at least as a saprobic fungus on moss and on rotting tufts of *Poa alpestris*, is remarkable.

56. *Galerina* sp. 1. Cf. Kobayasi & al. (1967). Ann. Rep. Inst. Ferm. Osaka, No. 3: 91.

Distribution. – (R 3): AL (50).
Ecology (tr, su). – On peat in swampy habitat.
Altitude. – About sea-level.
Remarks. – Reported from Cape Thompson. Probably representing *G. pseudomycenopsis* (= *G. mölleri*).

57. *Galerina* sp. 2. Cf. Kobayasi & al. (1967). Ann. Rep. Inst. Ferm. Osaka, No. 3: 91.

Distribution. – (R 3): AL (50).
Ecology (tr, su). – On soil among moss in tundra.
Altitude. – About sea-level.
Remarks. – Collected near Lake Peters.

58. *Galerina* sp. 3. – Cf. Kobayasi & al. (1977). Trans. mycol. Soc. Japan 18: 76.

Distribution. – (R 6): ZA (52).
Ecology (tr, mo, su). – On soil among moss in high mountain moorland.
Altitude. – <4300 m.
Remarks. – Reported from the western slopes of Mt. Ruwenzori (Zaire, Central Africa).

59. *Galerina* sp. 4. Cf. Dennis (1955) Kew Bull. 1955: 125.

Distribution. – (R 2): SC (18).
Ecology (tr, mu). – On soil among moss.
Altitude. – <660 m.
Remarks. – Gathered on soil among *Nardia scalaris* at Ben Loyal, northern SC.

60. *Galerina sphagnorum* (Persoon: Fries) Kühner 1935. Encycl. Myc. 7: 179.

Distribution. – (R 2): NO (30), SC (21, 125), SF (49), SR (70). – (R 3): AL (15).
Ecology (mo, su). – Strictly growing on *Sphagnum* spp. (Tab. 4).
Altitude. – <1200 m (NO).
Remarks. – The cited records indicate that this sphagnicolous species occurs rarely (NO) in the alpine zone proper. The other collections have been made at lower altitude or in localities with less harsh climatic conditions, i. e. Shetland Is. (Yell), Finnish Lapland or on Kodiak Is. in Alaska (15).

61. *Galerina (Phaeogalera) stagnina* (Fries) Kühner 1935. Encycl. Myc. 7: 187.

Distribution. – (R 1). – CH (102, 104), FR (56). – (R 2): IS (16), JM (64), NO (29, 30), SP (31, 33). – (R 3): AL (44, 67, 75), GR (63). – (R 5): AC: Subantarctica: New Amsterdam Is. (38, 40).
Ecology (mo, su). – Among and on hygrophilous or aquatic mosses (Tab. 1: rarely on *Sphagnum*) in wet marshes, bogs, swamps or polygon troughs.
Altitude (R 1). – <2420 m (CH). – (R 2): <1280 m (NO).
Remarks. – This taxon is rarely observed in lowland sites and hence must be considered a true boreal to AA element (63). Detailed data about its ecology and relationships to plant communities are recorded for locations in GR, cf. (63). An analysis of the bryoflora associated with this agaric in the Alaskan tundra is presented in (44).
The subantarctic collection (38) of *G. (Phaeogalera) stagnina* relates to *Psilocybe vanhoeffenii* Henn. (40).

62. *Galerina (Phaeogalera) stagnina* var. *pallida* (Favre) Smith & Singer 1964. Galerina, 208.
Bas.: *Galera stagnina* var. *pallida* Favre 1955. Ergebn. wiss. Unters. Schweiz. Nat. Park 33: 204.

Distribution. – (R 1): CH (24*).
Ecology (tr, mu, su). – On aquatic moss (but not *Sphagnum*) in bog.
Altitude. – <2400 m.
Remarks. – Cf. *G. (Phaeogalera) zetlandica.*

63. *Galerina stordalii* Smith in Smith & Singer 1964. *Galerina*, 203.

Distribution. - (R 1): CS (26, 27). – (R 2): NO (30, 33). – (R 3): AL (67, 75).
Ecology (mu, su). – On and among aquatic moss, predominantly *Sphagnum* spp. (Tab. 4), rarely also on peat.
Altitude. – <1200 m (NO).
Remarks. – The records from Riesengebirge (CS) and from Barrow, Alaska (67, 75), lack any documentation regarding macro- and micromorphological characters or ecology; hence their identity remains doubtful.

64. *Galerina subannulata* (Singer) Smith & Singer 1964. *Galerina*, 293.

Distribution. – (R 3): AL (13, 68, 69, 74, 75, 76).
Ecology (tr, mu, sa). – On soil among organic debris and on peat in tundra (often along polygon troughs), usually associated with aquatic mosses.
Altitude. – About sea-level.
Remarks. – According to (74, 75) the most abundant fungus in the Alaskan tundra near Barrow. In the above mentioned literature accurate data about quantity vs. distribution of below-ground mycelium, ecology of microhabitats, and rôle in the local subarctic ecosystem are found.
The revision (44) of the specimens identified and published as *G. subannulata* demonstrates that they actually belong to the *G. pseudomycenopsis-praticola* - complex (see there).

65. *Galerina subarctica* Smith & Singer 1964. *Galerina*, 54.

Distribution. – (R 3): AL (66).
Ecology (tr, mu). – On soil and peat in tundra.
Altitude. – About sea-level.
Remarks. – About this AA record no ecological data are available. The type material has been described from conifer forest near Anchorage (Alaska).

66. *Galerina subbadipes* Huijsman 1955. Fungus 25: 21.

Distribution. – (R 3): CA (83).
Ecology (tr, mu). – On soil with *Salix herbacea* and *Betula pumila*.
Altitude. – ?
Remarks. – Documented by a single record from Labrador, Newfoundland. The species (belonging to the *G. hypnorum* - complex) has been originally described from wetlands in The Netherlands growing on decaying debris of moss, *Carex* and *Typha*.

67. *Galerina subclavata* Kühner 1972. Bull. Soc. mycol. France 88: 152.

Distribution. – (R 1): CH (102, 104), FR (7, 56*, 58), CS (26, 27). – (R 2): NO (30).
Ecology (tr, mu). – On soil among moss in dry and wet habitat (Tab. 4), also associated with *Salix* spp. (NO).
Altitude. – <2340 m (CH), <2450 m (FR), <1200 m (NO).
Remarks. – In general the ecological data for this rarely recorded, 2-spored *Galerina* are poor or unknown concerning the finds in CS (Riesengebirge).

68. *Galerina subclavata* var. *canescens* Kühner 1972. Bull. Soc. mycol. France 88: 152.

Distribution. – (R 1): FR (56*).
Ecology (tr, mu). – On soil among *Pellia* sp. (Tab. 4).
Altitude. – <2100 m.
Remarks. – Further ecological data are not available.

69. *Galerina subfusispora* (Möller) Horak 1986. Sydowia 39: 115.
Bas.: *Naematoloma subfusisporum* Möller 1945, Fungi Faeröes 1: 191.

Distribution. – (R 1): AU (41). – (R 2): FA (77*).
Ecology (tr). – On (sterile) peat.
Altitude. – <2280 m (AU).
Remarks. – Only two locations are known for this rare species which exclusively grows on naked exposed peat.

70. *Galerina tatooshiensis* Smith in Smith & Singer 1964. *Galerina*, 202.

Distribution. – (R 3): GR (51).
Ecology (tr, mu). – On soil among moss (Tab. 4).
Altitude. – ?
Remarks. – Single record from eastern Greenland, without particular ecological data.

71. *Galerina terrestris* Wells & Kempton 1969. Lloydia 32: 385.

Distribution. – (R 1): CH (102, 104, 105). – (R 2): NO (30).
Ecology (tr, a). – On silt and sand among moss (Tab. 4) in pioneer plant communities (Epilobietum fleischeri or with *Salix* sp.)
Altitude. – <2325 m (CH), <1200 m (NO).
Remarks. – Both in the Alps and in southern Norway, this inconspicuous *Galerina* has been registered only at inhospitable locations in alluvial sandy sites just being colonized by the first mosses and higher plants.

72. *Galerina tibiicystis* (Atkinson) Kühner 1935. Encycl. Myc. 7: 176.

Distribution. – (R 2): SC (125), SR (120).
Ecology (mu, sa). – On *Sphagnum* sp. (Tab. 4) in tundra.
Altitude. – ?
Remarks. – In boreal regions of the northern hemisphere, widely distributed and significant species in *Sphagnum* bogs which rarely enters locations situated in the AA zone proper.

73. *Galerina tundrae* Smith & Singer 1955. Mycologia 47: 584.

(ss. Kühner 1972. Bull. Soc. mycol. France 88: 96).
Distribution. – (R 2): NO (55), SW (55).
Ecology (tr, mu, li, a). – On acid soil among moss and *Anthelia* sp. (Tab. 4) in snow beds (associated with *Salix herbacea*), also among hepatics in swamps.
Altitude. – <1400 m (NO), <900 m (SW).
Remarks. – Endemic to Scandinavia. Cf. *G. antheliae*.

74. *Galerina unicolor* (Fries: Fl. Dan.) Singer 1936. Beih. Bot. Zbl., Abt. B 56: 170.

Distribution. – (R 1): CH (55, 102, 103, 104), FR (55, 58). – (R 2): NO (30), SC (125), SR (81). – (R 3): GR (122).
Ecology (tr, mu, su, a-b). – On soil among moss (Tab. 4), both in acid and base-rich locations (associated with *Dryas octopetala* and/or calciphilous *Salix* spp.), in swamps (FR: associated with *Carex foetida*), tundra (SR) and heath (GR).
Altitude. – <2340m (CH), <1200 m (NO).
Remarks. – Detailed data about autecology and productivity are published in (103). – The rather wide range of habitats observed may indicate that *G. unicolor* has been differently interpreted by the above mentioned authors (cf. also moss-inhabiting forms of *G. marginata*).

75. *Galerina velutinoaffinis* (Singer in Dennis) Horak 1988. Sydowia 40: 78.
Bas.: *Crepidotus velutinoaffinis* Singer in Dennis 1966. Kew Bull. 15: 145.

Distribution. – (R 4): AN: Venezuela (42).
Ecology (mu, sa). – On moss.
Altitude. – <3440 m.
Remarks. – This crepidotoid, bryophilous *Galerina* is based on a single collection from the type locality. For further information about its distinctive characters and ecology of related taxa saprobic on moss cf. (42).

76. *Galerina viscida* (Peck) Smith & Singer 1964. *Galerina*, 244.

Distribution. – (R 3): AL (66).
Ecology (tr, su). – In tundra on soil and peat among moss.
Altitude. – About sea-level.
Remarks. – Ecologically poorly documented collection. Identification doubtful.

77. *Galerina vittaeformis* (2-spored) (Fries) Singer 1950. Acta Inst. bot. Komarov Acad. Sci. USSR, ser. II: 6: 472.

Distribution. – (R 1): CH (55, 102, 103, 104), DE (100), FR (9, 55, 58). – (R 2): IS (62), NO (30, 34, 55), SR (81). – (R 3): GR (124).
Ecology (tr, mu, su, a-b). – On soil among moss (Tab. 4) in dry heath-tundra (SR) and wet habitats (fens, mires, swamps) with aquatic moss (NO), also in calcareous (CH) or acid soil (FR) in snow-beds (with calciphilous *Salix* spp.).
Altitude. – (R 1): <2450 m (CH), <2200 m (DE), <2600 m (FR). – (R 2): <1480 m (NO).
Remarks. – Informative data about the autecology of this 2-spored form of *G. vittaeformis* and its relationships to supporting plant communities are published in (103, CH) and (63, GR).

78. *Galerina vittaeformis* (4-spored) (Fries) Singer 1950. Acta Inst. bot. Komarov Acad. Sci. USSR, ser. II: 6: 472.

Distribution. – (R 1): CH (103), FR (9, 23, 55). – (R 2): IS (62), NO (30, 55), SR (115: Altai Mts., Novaya Zemlya ?). – (R 3): CA (87), GR (63).
Ecology (tr, mu, a-b). – On soil among moss (Tab. 4) in dry and swampy locations (30, 55), but also in snow-beds on calcareous (Salicetum retuso-reticulatae) and on acid soil (103).

Altitude. – (R 1): <2315 m (CH), <2750 m (FR). – (R 2): <1450 m (NO).
Remarks. – Cf. above.

79. *Galerina vittaeformis* var. *megaspora* Kühner 1972. Bull. Soc. mycol. France 88: 152.

Distribution. – (R 1): FR (23, 55*, 58).
Ecology (tr, mu, a). – On soil among moss (Tab. 4) in snow-beds of the upper alpine zone.
Altitude. – <2750 m.
Remarks. – Endemic taxon occurring at few locations in a restricted area of the French Alps. Mycoecological, edaphic and physiological data are presented in (23).

80. *Galerina vittaeformis* var. *pachyspora* Smith & Singer 1958. Mycologia 50: 488.

Distribution. – (R 3): CA (83). – (R 5): AC: Subantarctica: Macquarie Is. (114*), S. Georgia.
Ecology (tr, mu, a). – On peat among moss and decaying debris of *Juncus* sp. and *Rostkovia magellanica* (114*) or in tundra with *Salix herbacea*.
Altitude. – About sea-level.
Remarks. – Recently (83) this taxon, originally described from the Subantarctic Region (40), has been discovered in the Canadian subarctic tundra in Newfoundland.

81. *Galerina (Phaeogalera) zetlandica* (P. D. Orton) Bon 1990. Doc. Mycol. 20: 40.
Bas.: *Naucoria zetlandica* P. D. Orton. 1960. Trans. Brit. mycol. Soc. 43: 326.
Syn.: *Galerina stagnina* var. *zetlandica* (P. D. Orton) Singer & Smith. 1964. Galerina, 208.

Distribution. – (R 2): NO (56), SC: Shetland Is (85*).
Ecology (mu, sa, su). – On *Sphagnum* sp. (SC), also among moss and rotting plant debris of *Carex* sp., *Comarum* sp., *Eriophorum* sp. and *Salix lapponum* (NO).
Altitude. – <1280 m (NO).
Remarks. – Cf. *G.* (*Phaeogalera*) *stagnina* var. *pallida*.

Distribution of arctic-alpine *Galerina* and *Phaeogalera*

In the course in this survey 251 single location data have been evaluated. According to the resulting distribution patterns, six large geographically coherent areas (R 1- R 6) can be proposed which embrace biomes with ecosystems similar with or in regard to their post-glacial history, vegetation and climate. Some of the drawn boundaries are artificial, for instance in the northern circumpolar area between Region 2 and 3, where strong interrelationships of fauna and flora are out of question. Nevertheless, the suggested subdivision helps to define and to single out closely tied natural regions on the distribution map of *Galerina* s. l.

The analysis of the distribution data clearly indicates that the listed species of *Galerina* and *Phaeogalera* are actually significant

Tab. 1. – Distribution of AA *Galerina* s. l. in the northern hemisphere (Regions 1-3), southern hemisphere (Regions 4-5) and equatorial Africa (Region 6). Numbers in brackets in the second column refer to numbers of citation records. Numbers in third column refer to the species of *Galerina* listed above).

Eurasia, North America:			
Region 1:	AU	(4)	4, 48, 52, 69.
	CH	(25)	3, 4, 8, 9 12, 14, 15, 20, 21, 22, 26, 31, 34, 35, 44, 45, 48, 50, 61, 62, 67, 71, 74, 77, 78.
	CS	(2)	63, 67.
	DE	(2)	48, 77.
	FR	(18)	8, 13, 15, 19, 20, 21, 32, 34, 44, 48, 53, 61, 67, 68, 74, 77, 78, 79.
	IT	(3)	20, 44, 48.
	KA	(1)	22.
	PL	(1)	37.
Region 2:	FA	(7)	15, 22, 33, 34, 43, 49, 69.
	IS	(8)	15, 22, 32, 37, 43, 61, 77, 78.
	JM	(3)	22, 37, 61.
	NO	(30)	1, 6, 7, 8, 9, 12, 13, 16, 20, 22, 23, 26, 34, 37, 38, 39, 44, 45, 48, 49, 60, 61, 63, 67, 71, 73, 74, 77, 78, 81.
	SC	(20)	9, 12, 15, 22, 33, 34, 35, 37, 39, 43, 44, 45, 52, 53, 54, 59, 60, 72, 74, 81.
	SF	(5)	22, 32, 37, 39, 60.
	SP	(13)	6, 7, 12, 15, 17, 33, 34, 44, 45, 46, 47, 49, 61.
	SR	(19)	6, 7, 10, 12, 16, 20, 22, 26, 34, 36, 39, 44, 49, 51, 60, 72, 74, 77, 78.
	SW	(11)	9, 15, 16, 20, 22, 34, 39, 44, 45, 49, 73.
Region 3:	AL	(22)	7, 15, 20, 22, 23, 30, 33, 34, 37, 43, 46, 49, 50, 51, 56, 57, 60, 61, 63, 64, 65, 76.
	CA	(10)	7, 22, 43, 44, 45, 46, 51, 66, 78, 80.
	GR	(18)	10, 15, 16, 20, 22, 32, 33, 34, 37, 40, 44, 45, 49, 61, 70, 74, 77, 78.
South America (Andes):			
Region 4:	AN	(7)	2, 11, 24, 25, 42, 46, 75.
Antarctica and Subantarctic Islands:			
Region 5:	AC	(13)	5, 18, 22, 27, 28, 29, 34, 41, 43, 49, 55, 61, 80.
Equatorial Africa:			
Region 6:	ZA	(1)	52

components in AA ecosystems. About 35% of the taxa referred to in the monograph of Smith & Singer (1964) are represented in AA habitats. Their strong affiliation to the AA biotope is further demonstrated by the fact that the type localities for more than 25 taxa (cf. asterisk in enumeration of species, below) are found in localities characterised by AA life conditions (Tab. 1).

Tab. 2. – Arctic-alpine species of *Galerina* s. l. (43 spp., cf. columns in Tab. 4) associated with 68 selected mosses. Numbers correspond to the enumeration of *Galerina* (1-81) and to the list of Tab. 4).

	Galerina s. l.		
2	*aimara*	41	*perrara*
3	*alpestris*	42	*polytrichorum*
4	*annulata*	43	*praticola*
6	*antheliae*	45	*pseudomniophila*
7	*arctica*	46	*pseudomycenopsis*
8	*atkinsoniana* (2-sp.)	48	*pseudotundrae*
11	*boliviana*	49	*pumila*
12	*calyptrata*	55	*sideroides*
13	*cedretorum*	60	*sphagnorum*
14	*chionophila*	61	*stagnina*
15	*clavata*	63	*stordalii*
16	*dimorphocystis*	68	*subclavata* var. *canescens*
17	*embolus*	70	*tatooshiensis*
20	*heterocystis*	71	*terrestris*
22	*hypnorum* (4-sp.)	72	*tibiicystis*
23	*hypophaea*	73	*tundrae*
33	*mniophila*	74	*unicolor*
34	*mölleri*	77	*vittaeformis* (2-sp.)
35	*muricellospora*	78	*vittaeformis* (4-sp.)
37	*mycenopsis*	79	*vittaeformis* var. *megaspora*
38	*norvegica*	81	*zetlandica*
39	*paludosa*		

Based upon the present data, *Galerina pseudomycenopsis* (incl. several of its closely related taxa) has by far the widest geographical distribution. Both in Eurasia and North America it has been registered in almost all listed AA localities. Furthermore, its area of distribution (cf. No. 46 in Tab. 1) stretches from the northern hemisphere via the Andes to the Subantarctic islands and even to the Antarctic continent.

If one assumes that the majority of older records are correctly identified, the spatial distribution pattern of *G. hypnorum* is also similar to that of *G. pseudomycenopsis*.

An example demonstrating evident circumpolar distribution in the northern hemisphere is *Galerina arctica*. Discovered on Nowaya Zemlya, further material has subsequently been gathered in Russia, Norway, and Svalbard. Recently this morphologically well defined taxon has also been registered in the Subarctic tundra of Alaska and western Canada (Horak & Miller, 1992).

Contrary to taxa with disjointed intercontinental areas of distribution there are some endemic species which (to present knowledge) occur only within a local delimited region. In the northern hemisphe-

Tab. 3. – Mosses (68 spp., cf. columns in Tab. 4) associated with 43 selected Arctic-alpine species of *Galerina* s. l.

	Bryophytes		
1	*Anthelia juratzkana* and sp.	21	*Mnium* sp (= *Rhizomnium* sp.)
2	*Aulacomnium* sp.	21a	*Mnium pseudopunctatum*
2a	*Aulacomnium palustre*	21b	*Mnium punctatum*
2b	*Aulacomnium turgidum*	22	*Nardia breidleri*
3	*Blepharostoma trichophyllum*	23	*Oncophorus* sp.
4	*Bryum* sp.	24	*Paludella squarrosa*
4a	*Bryum antarcticum* (= *algens*)	25	*Pellia* sp.
4b	*Bryum* cf. *pseudotriquetrum*	26	*Philonotis* sp.
5	*Calliergon* sp.	26a	*Philonotis calcarea*
5a	*Calliergon sarmentosum*	26b	*Philonotis fontana*
5b	*Calliergon stramineum*	26c	*Philonotis seriata*
6	*Campylium* sp.	26d	*Philonotis tomentella*
6a	*Campylium arcticum*	27	*Plagiothecium undulatum*
6b	*Campylium stellatum*	28	*Pleuroclad(ul)a albescens*
7	*Chorisdontium aciphyllum*	29	*Pleurozium schreberi*
8	*Cinclidium* sp.	30	*Pogonatum* sp.
9	*Climacium dendroides*	31	*Pohlia* sp.
10	*Conostomum tetragonum*	31a	*Pohlia filum* (= *gracilis*)
11	*Cratoneuron commutatum*	31b	*Pohlia nutans*
12	*Dicranum* sp.	32	*Polytrichastrum alpinum*
12a	*Dicranum fuscescens*	33	*Polytrichum* sp.
12b	*Dicranum scoparium*	33a	*Polytrichum strictum* (= *alpestre*)
13	*Drepanocladus* sp.	33b	*Polytrichum commune*
13a	*Drepanocladus exannulatus*	33c	*Polytrichum juniperinum*
13b	*Drepanocladus revolvens*	33d	*Polytr. sexangulare* (= *norvegicum*)
13c	*Drepanocladus uncinatus*	34	*Ptilidium ciliare*
14	*Eurhynchium* sp.	35	*Rhacomitrium* sp.
15	*Gymnomitrion* sp.	35a	*Rhacomitrium canescens*
16	*Hylocomium splendens* and sp.	36	*Rhytidiadelphus loreus*
17	*Hypnum* sp.	37	*Riccardia pinguis* (= *Aneura p.*)
17a	*Hypnum cupressiforme*	38	*Sphagnum* spp.
18	*Kiaeria* sp.	39	*Tomenthypnum* sp.
19	*Lophozia sudetica* (= *alpestris*)	39a	*Tomenthypnum nitens*
20	*Meesia triquetra*	40	*Tortula ruralis*

re, to this group belong for instance *Galerina dimorphocystis* (Norway), *G. norvegica* (Norway), *G. perplexa* (?, Greenland), *G. sahleri* (Scotland, but identity doubtful; R. Watling, in litt.). By comparison in the southern hemisphere the number of endemic taxa is higher (e. g. *G. aimara*, *G. boliviana*, *G. infernalis*) but this phenomenon is probably explained best by the very scattered sampling in the Regions 4 and 5, respectively.

The data presented in Tab. 1 yield further information about the geographical range of distribution for the taxa recorded so far from localities within the outlined AA ecosystems.

Tab. 4. Arctic-alpine species of *Galerina* and *Phaeogalera* (rows) and their association with mosses (columns). Explanation of numbers cf. Tab. 2 and 3.

Moss taxon	*Galerina* species: 2	3	4	6	7	8	11	12	13	14	15	16	17	20	22	23	33	34	35	37	38	39	41	42	43	45	46	48	49	55	60	61	63	68	70	71	72	73	74	77	78	79	81	Taxa of mosses associated with *Galerina* s. l.
1	–	–	–	x	–	–	–	–	–	–	–	–	–	–	–	–	–	x	–	–	–	–	–	–	–	–	–	x	–	–	–	–	–	–	–	–	–	x	–	–	x	x	–	6
2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	x	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1
2a	–	–	–	–	x	–	–	–	–	–	x	–	–	–	–	–	–	x	–	–	–	–	–	–	–	–	–	x	x	–	–	x	–	–	–	–	–	–	x	x	–	–	8
2b	–	–	–	–	–	–	–	–	–	–	x	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	x	x	–	–	x	–	–	–	–	–	–	–	x	–	–	5
3	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	x	–	x	–	–	–	–	–	–	–	–	–	–	–	–	–	2
4	–	x	–	–	–	–	–	–	–	–	x	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	x	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	3
4a	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	x	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1
4b	–	–	–	–	–	–	–	–	–	–	–	–	–	x	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1
5	–	–	–	–	x	–	–	–	–	–	x	–	–	x	–	–	–	–	–	–	–	–	–	–	x	–	x	–	–	–	–	x	–	–	–	–	–	–	x	–	–	–	7
5a	–	–	–	–	–	–	–	–	–	–	x	–	–	x	–	–	–	x	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	3
5b	–	–	–	–	–	–	–	–	–	–	x	–	–	–	–	–	–	x	–	–	–	–	–	–	–	–	–	–	–	–	–	x	–	–	–	–	–	–	–	–	–	–	3
6	–	–	–	–	x	–	–	–	–	–	x	–	–	–	–	–	–	–	–	–	–	–	–	–	x	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	3
6a	–	–	–	–	–	–	–	–	–	–	x	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	x	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2
6b	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	x	–	–	–	–	–	–	–	–	–	–	–	–	–	1
7	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	x	–	–	–	–	x	–	x	–	x	–	–	x	–	–	–	–	–	–	–	–	–	–	–	–	5
8	–	–	–	–	–	–	–	–	–	–	x	–	–	–	–	–	–	–	–	–	–	–	–	–	x	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2
9	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	x	–	–	–	1
10	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	x	–	–	–	x	–	–	–	–	–	–	–	–	–	–	–	x	–	3
11	–	–	–	–	–	–	–	–	–	–	–	–	–	x	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1
12	–	–	–	–	–	–	–	–	–	–	x	–	–	–	–	–	–	x	–	–	–	–	–	–	–	x	–	–	x	–	–	x	–	–	–	–	–	–	–	x	–	–	6
12a	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	x	–	–	–	–	–	–	–	–	–	–	x	–	–	2
12b	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	x	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1
13	–	–	–	–	–	–	–	–	–	–	x	–	–	x	–	x	–	–	–	–	–	–	–	–	x	x	x	–	–	–	–	x	–	–	–	–	–	–	x	–	–	–	8
13a	–	–	–	–	–	x	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	x	–	–	–	–	–	–	–	–	–	–	2
13b	–	–	–	–	x	–	–	–	–	–	x	–	–	–	–	–	–	x	–	–	–	–	–	–	–	–	–	–	–	–	–	x	–	–	–	–	–	–	–	–	–	–	5
13c	–	–	–	–	–	–	–	–	–	–	x	–	–	–	–	–	–	x	–	–	–	–	–	–	x	–	x	–	x	–	–	–	–	–	–	–	–	x	–	x	–	–	7
14	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	x	–	–	–	–	–	–	–	1
15	–	–	–	x	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1
16	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	x	–	–	–	–	–	–	x	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2
17	–	–	–	x	–	–	–	–	–	–	–	–	–	–	–	–	x	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2
17a	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	x	–	–	–	–	–	–	–	–	–	–	–	–	–	1
18	–	–	–	x	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1
19	–	–	–	–	–	–	–	–	x	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1

20	–	–	–	–	–	–	–	–	–	–	x	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1
21	–	–	–	–	x	–	–	–	–	–	x	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2
21a	–	–	–	–	–	–	–	–	–	–	–	–	–	x	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1
21b	–	–	–	–	–	–	–	–	–	–	–	–	–	x	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1
22	–	–	–	x	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1
23	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	x	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1
24	–	–	–	–	–	–	–	–	–	–	x	–	–	x	–	–	–	x	–	–	–	–	–	–	–	–	–	–	x	–	–	x	–	–	–	–	–	–	–	x	x	–	–	7
25	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	x	–	–	–	–	–	–	–	–	x	–	–	–	–	–	–	–	–	–	2
26	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	x	–	x	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	x	–	–	3
26a	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	x	–	–	–	1
26b	–	–	–	–	x	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	x	–	–	–	2
26c	–	–	–	–	–	x	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	x	–	–	–	–	–	–	–	x	–	–	–	3
26d	–	–	–	–	–	–	–	–	–	–	–	–	–	x	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1
27	–	–	–	–	–	–	–	–	–	–	–	–	–	–	x	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1
28	–	–	–	x	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1
29	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	x	–	x	x	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	3
30	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	x	–	x	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2
31	–	–	–	x	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	x	–	–	–	–	–	–	–	–	–	–	–	–	–	x	x	–	4
31a	–	–	x	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	x	–	–	–	–	–	–	–	2
31b	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	x	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1
32	–	–	–	–	–	x	–	–	–	–	–	–	–	–	–	–	–	–	–	x	–	–	–	–	x	–	–	–	x	–	–	–	–	–	–	–	–	–	–	–	x	–	–	5
33	x	–	x	–	–	–	–	–	–	–	x	x	x	–	x	–	–	–	x	–	–	–	–	x	x	x	x	x	x	–	–	x	–	–	–	–	–	–	–	–	x	–	–	15
33a	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	x	–	–	–	x	–	–	–	–	–	x	–	–	–	–	–	–	–	–	–	–	3
33b	–	–	–	–	–	x	–	x	–	–	–	–	–	–	x	–	–	–	–	–	–	–	–	–	–	–	x	x	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	5
33c	–	–	–	–	–	–	–	–	x	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1
33d	–	–	–	x	–	–	–	–	–	x	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	x	–	3
34	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	x	–	–	–	–	–	–	–	–	–	–	–	x	–	–	2
35	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	x	–	x	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2
35a	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	x	–	–	–	–	x	–	–	2
36	–	–	–	–	–	–	–	–	–	–	x	–	–	–	x	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2
37	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	x	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1
38	–	–	–	–	–	x	x	x	–	–	x	x	–	x	x	–	–	x	–	–	x	x	–	–	x	x	x	–	x	–	x	x	x	–	–	–	x	–	–	–	x	–	x	20
39	–	–	–	–	–	–	–	–	–	–	x	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	x	–	–	2
39a	–	–	–	–	x	–	–	–	–	–	x	–	–	–	–	–	–	x	–	–	–	–	–	–	–	–	x	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	4
40	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	x	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1
	1	1	2	8	7	5	1	2	2	1	21	2	1	10	5	2	2	14	2	4	1	1	3	2	15	4	16	5	15	1	1	12	2	1	1	2	1	1	1	8	16	3	1	

Number of moss taxa recorded with species of *Galerina* s. l.

Ecology of arctic-alpine species of *Galerina* and *Phaeogalera*

Except the few lignicolous species of *Galerina* (whose actual interpretation as AA representatives is doubtful), the great majority of taxa considered in this survey are saprobic on living, decaying or dead plant debris. Probably the main source of substrate is provided by mosses and lichens which both quantitatively and qualitatively are dominant and often indicative components in most AA habitats. To a lesser extent, saprobic *Galerina* are also supported by organic debris originating from rotting algae, grasses, sedges or dwarf *Salix*.

Most AA records of *Galerina* and *Phaeogalera* actually do not relate to substrate or plant association at the locality of discovery. Exceptions to this general rule are the mycoecological publications relating to AA *Galerina* records in Austria (Horak, 1960), France (Kühner, 1972a; 1972b), Greenland (Lange, 1957; Petersen, 1977), Norway (Gulden, 1987; 1988; Gulden & al., 1985), Scotland (Watling, 1981), Svalbard (Ohenoja, 1971; Gulden & Jenssen, 1988), Switzerland (Senn-Irlet, 1987; 1988a), and USA (Alaska: Horak & Miller, 1992).

From the phytosociological point of view, tree-less boreal and in particular subpolar localities are distinctly defined by moss associations which are reliable, long-term bioindicators reflecting the edaphic and microclimatic life conditions on the site. Since the vegetative mycelium of many AA *Galerina* also largely depends on living or dead mosses (preserved as peat), it seems appropriate to present data about the mutual (substrate-) relationships and the interdependence between these two groups of cryptogams. Unfortunately, about half of the *Galerina* and *Phaeogalera* records lack bryological data. Only 43 out of 81 records (Tab. 2, 3) include references to mosses found at the immediate neighbourhood of the collected basidiomes (Tab. 4). The total number of moss taxa observed with *Galerina* spp. in AA microhabitats amounts to 68. Fruit bodies of *Galerina* s. l. have been most frequently found either in association with aquatic or hygrophilous bryophytes (e. g. *Sphagnum* spp. 46%, *Aulacomnium palustre* and *Drepanocladus* spp. 19% each, *Calliergon* spp. and *Paludella squarrosa* 16% each) or mosses characterising often rather dry sites (mostly on peat), e. g. *Polytrichum* spp., present in association with 63% of the 43 species of *Galerina* and *Phaeogalera* considered. However, 24 mosses (35%) have been recorded only once in close association with the basidiomes of a given collection of these agarics.

Among the 43 species of *Galerina* s. l. discussed here, *G. clavata* is the least specialised. It was found in association with 21 different species of mosses (31%), whereas in records of *G. pseudomycenopsis* (incl. data relating to *G. mölleri*, *G. praticola*, and *G. pumila*) about 25% of the 68 mosses (Tab. 4) have been mentioned as partners. A similar range of possible moss relationships can be observed in *G. vittaefor-*

mis (4-spored form) which has been gathered in close connection with 16 out of 68 different bryophytes located in its AA microhabitats. 24% of the listed *Galerina* s. l. are reported to be restricted to but one particular species of moss. Further field work in AA ecosystems is needed to prove whether these *Galerina* species involved are actually specialised to these mosses as substrate or not.

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