

# The *Stropharia semiglobata* group in NW Europe

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Six species are recognized in the *Stropharia semiglobata* group in NW Europe: *S. alcis* Kytöv., spec. nova, *S. arctica* Kytöv., spec. nova, *S. dorsipora* Esteve-Rav. & Barrasa, *S. islandica* Kytöv., spec. nova, *S. luteonitens* (Vahl : Fr.) Quél. and *S. semiglobata* (Batsch : Fr.) Quél. *S. semiglobata* is common throughout the study area and *S. alcis* in Fennoscandia, *S. dorsipora* and *S. luteonitens* are rare or very rare and possibly decreasing in Fennoscandia, *S. islandica* is known from Iceland, and *S. arctica* from Iceland and arctic Russia. The distribution of each species in the study area is mapped, and their taxonomy, ecology and relationships are discussed.

Key words: *Stropharia*, Psilocybe, coprophilous, Fennoscandia, mapping, taxonomy.

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## Introduction

The *Stropharia semiglobata* group, as interpreted by the present author, has commonly been supposed to be represented by two species in NW Europe, one, *S. semiglobata*, being very common and the other, *S. luteonitens*, very rare. When studying the material collected during the Tenth Nordic Mycological Congress at Hoverud, Sweden, in 1990, an existence of a third species in the group became evident to me. Subsequent studies showed the group to be still more complicated and revealed six species instead of the two commonly recognized. Meanwhile one of them has been described as new, viz. *S. dorsipora* Esteve-Rav. & Barrasa (Esteve-Raventós & Barrasa 1995).

## Material and methods

Specimens were checked in the following herbaria: AMNH, BG, C, H, JOE, JYV, KUO, MA, O, OULU, S, UME, UPS, TRH, TROM, TUR and TURA (the symbols are those of Holmgren et al. 1990).

Microscopical characteristics were examined under a Leitz Laboulx 12 microscope, at magnifications of about 625 and 1560. Spores, basidia and cystidia were drawn with a Leitz drawing tube at a magnification of 2000. Spores were examined, measured (with an ocular micrometer) and drawn from slides showing the surface view of pieces of gills of dried basidiocarps, mounted in Melzer's reagent. Only spores in a horizontal position were measured; young, anomalous, very small or gigantic spores were excluded. Length and width were measured from the same spore, and the length/width ratios were calculated for individual spores.

Basidia and cystidia were drawn from slides with squashes of gill pieces mounted in Melzer's reagent. Measurements were mostly made from drawings. Pileipellis and stiptipellis were examined from slides with small scalpels or from sections of dried basidiocarps made (without moistening) with a razor blade, mounted in Melzer's reagent.

## Key to species

- 1 Stipe dry, not very long and slender, spores  $< 12 \times 7 \mu\text{m}$  ..... *Stropharia* spp. (not treated)  
 – Stipe viscid to slimy, long and slender, spores  $> 12 \times 7 \mu\text{m}$  ..... 2  
 2 Chrysocystidia absent ..... 3  
 – Chrysocystidia present, basidia 4-spored ..... 4  
 3 Basidia 4-spored ..... 5. *Stropharia islandica*  
 – Basidia 2-spored ..... 6. *S. luteonitens*  
 4 On elk dung, spores mostly  $< 8.3 \mu\text{m}$  wide ..... 3. *S. alcis*  
 – Mostly on dung of cow or horse, or on manured soil, spores mostly  $> 8.3 \mu\text{m}$  wide ..... 5  
 5 Chrysocystidia abundant on stipe, spores with large, central germ pore ..... 1. *S. semiglobata*  
 – Chrysocystidia absent on stipe ..... 6  
 6 Spores with large, central germ pore ..... 4. *S. arctica*  
 – Spores with smaller, dorsal germ pore ..... 2. *S. dorsipora*

### 1. *Stropharia semiglobata* (Batsch : Fr.) Quél. (Figs. 1, 3 6–9)

*Stropharia semiglobata* (Batsch : Fr.) Quél., Champ. Jura et Vosges 1:143. 1872. – *Agaricus semiglobatus* Batsch, Elench. Fung. Cont. 1:141, pl. 21, fig. 110. 1786; Fr. Syst. Mycol. 1:284. 1821. – *Geophila semiglobata* (Batsch : Fr.) Quél., Enchir. Fung. 112. 1886. – Type: not typified.

*Stropharia stercoraria* (Schumach. : Fr.) Quél., Champ. Jura et Vosges 1:143. 1872. – *Agaricus stercorarius* Schumach., Enum. Pl. 2:286. 1803; Fr. Syst. Mycol. 1:291. 1821. – *Geophila stercoraria* (Schumach. : Fr.) Quél., Enchir. Fung. 112. 1886. – *S. semiglobata* var. *stercoraria* (Schumach. : Fr.) J.E. Lange, Fl. Agaric. Danica 4:67, 1939. – Type: not typified.

*Illustrations:* Cooke (1884: pls. 538 as *Agaricus stercorarius*, 539), Ricken (1915: pl. 63), Konrad & Maublanc (1924: pl. 55), Bresadola (1931: pls. 838 as *S. stercoraria*, 839) Lange (1935: pls. 142A, 142D), Michael et al. (1985: figs. 253, 254), Phillips (1981: 171), Dähncke (1993: 602, 603).

Pileus 1–4.5 cm, hemispherical to broadly subglobose with or without a low, broad umbo, expanding broadly convex, viscid to strongly glutinous, straw yellow, ochraceous at the disk. *Lamellae* segmentiform or slightly arcuate at first, later fairly broad, subventricose, slightly decurrent to adnate to shallowly emarginate with a low tooth, somewhat greenish blackish to blackish brownish with white edge, mostly three lamellulae between the whole ones. *Stipe* 3–15 cm, slightly evenly thickening towards the mostly somewhat clavate base, 1.8–5 mm thick at the apex, 2.5–7 mm thick at the base, hollow, with a narrow cavity, with a thin, rudimentary, glutinous annulus 0.5–3(–5) cm below the gills, white straw

yellowish and strongly glutinous below, dry and somewhat whitish pruinose above the ring zone. Smell none, taste mild.

*Spores*  $15.4\text{--}21.3 \times 9.1\text{--}11.3 \mu\text{m}$  ( $\bar{x} = 16.2\text{--}19.6 \times 9.8\text{--}10.8 \mu\text{m}$ , 308 spores of 19 spec.), length/width ratio  $Q = 1.64\text{--}2.00$  ( $\bar{q} = 1.69\text{--}1.88$ ), ellipsoid, very slightly flattened ventrally (adaxially), smooth, bay to dark brick in Melzer's reagent, thick-walled, with some guttules mostly at both ends, germ pore distinct, central, 2.0–2.5  $\mu\text{m}$  wide.

*Basidia* broadly clavate,  $28\text{--}40(\text{--}46) \times 11\text{--}15 \mu\text{m}$  (74 bas. of 13 spec.), 4-spored with broad sterigmata. *Pleurocystidia* chrysocystidia, mostly broadly clavate,  $33\text{--}52 \times 11.5\text{--}16.5 \mu\text{m}$  (184 chrysoc. of 20 spec.), apex rounded obtuse to broadly mucronate, with orange brown inclusion in Melzer's reagent, fairly abundant, mostly present at gill edge. *Cheilocystidia* narrowly lageniform,  $34\text{--}59 \mu\text{m}$  long (230 cheiloc. of 21 spec.), with 5.5–10.5 thick base and long, 3–6  $\mu\text{m}$  thick, mostly straight apical part, which may be slightly tapering or very indistinctly swollen just at the apex (sometimes even subcapitate) but not clavate; evenly distributed at the edge. Gill edge sterile.

*Caulocystidia* on stipe top in form like cheilocystidia,  $37\text{--}72 \mu\text{m}$  (64 cauloc. of 7 spec.), in fascicles. *Chrysocystidia* present on the whole stipe; on the top above the ring in form similar as those on gills but somewhat smaller, patent, between the hyaline cystidia; on the slimy part below the ring variable in form and size, closely appressed, wholly deeply embedded in the slime, most numerous at the stipe base (checked from 85 specimens).

*Cap cuticle* an ixocutis with thick slime layer with few, 1.5–4 µm thick, embedded hyphae, in the lower part with somewhat thicker (to 7 µm), not (or very finely) encrusted. *Stipe cuticle* an ixocutis as in the cap but hyphae more numerous, near the surface 2–4 µm thick, deeper a little thicker (to 5 µm), not or very finely spirally encrusted, encrustation strongest at the stipe base. Clamps present at all septa.

### Ecology and distribution

In Finland *Stropharia semiglobata* most often grows on decayed dung of cow or horse in pastures or in newly manured soil. In the material of Arnolds (1982) the dung of sheep was the most important substrate, but that dung appears very seldom in the present material. Some collections are also from decayed elk dung in forests (Fig. 7). Nowadays cattle is in Finland mostly grazed in fairly young, heavily fertilized hay fields, and the rotation is too quick for coprophilous basidiomycetes. According to Arnolds (1982) the use of artificial fertilizers strongly diminishes the occurrence of *S. semiglobata*. The species is commonest in older, more extensively grazed pastures or in woodland pastures, which, however, are now rare in Finland. Near stables there are suitable places such as training or riding tracks, but the pastures proper are often too intensively grazed.

The growing period of *Stropharia semiglobata* is long (practically all the time when ground is free of snow or frost), but the optimum seems to be from the middle of July to the end of September (Fig. 9). Single collections have been made in February (Denmark), in March and April (Finland, Iceland) and in December (Iceland).

First collection of *Stropharia semiglobata* in the material examined is from the year 1843 (Gottlund, H). Thereafter collections have been made in all decades (except the 1910's), and the amount increased strongly after the Second World War (Fig. 8). The high peak in the 1960's is evidently due to the activities in the new research station at Kevo (in Utsjoki, northernmost Finland) and the new herbaria of OULU (North Finland) and AMNH (Iceland). That peak is not seen in the other species treated here.

*Stropharia semiglobata* is fairly common throughout the NW Europe (Fig. 1), but has nowadays somewhat reverted in most areas owing to

the changes in the countryside living (diminishing of woodland pastures and disappearing of horses in forestry and agricultural work). In forest regions it is rare and replaced by *S. alcis*. The gaps in the map in Swedish and Finnish Lapland, at least, may be real. Along the Norwegian coast, in Iceland and in the Faeroes it is common. Farther south in Europe *S. semiglobata* is common (e.g. Kreisel 1987, Krieglsteiner 1991, Watling & Gregory 1987), but that information includes also *S. dorsipora*. According to the collections in herbaria and my own experience in the field *S. semiglobata* s.str. is nowadays less common in Central Europe than in the north.

### Discussion

*Stropharia semiglobata* is easily recognized by its large spores with large, central germ pore, narrowly lageniform cheilocystidia and presence of chrysocystidia on the stipe. *S. dorsipora* also has large spores but with eccentric germ pore, *S. alcis* distinctly smaller spores and apically swollen cheilocystidia, *S. arctica* smaller spores and narrowly clavate cheilocystidia. All the three latter lack chrysocystidia on the stipe. *S. luteonitens* and *S. islandica* lack chrysocystidia wholly. Also species of *Psilocybe merdaria* group can be similar, but those have dry stipe, smaller and slightly hexagonal spores and lack chrysocystidia.

Two names, *Stropharia semiglobata* and *S. stercoraria*, have long been used in the present species group. They are treated as different species in e.g. Schumacher (1803), Fries (1821, 1836, 1874), Cooke (1871, 1884), Quélet (1872, 1886), Gillet (1878), Karsten (1879), Saccardo (1887), Ricken (1915), Kauffman (1918), Rea (1922), Lange (1923) and Bresadola (1931). Later *S. stercoraria* has been reduced to the varietal level or noticed not at all (e.g. Konrad & Maublanc 1924, Lange 1935, Arnolds 1982, Michael et al. 1985, Kreisel 1987, Moser 1983, Watling & Gregory 1987, Krieglsteiner 1991). The separating characteristics are obscure and contradictory and all forms are well represented in the present material of *S. semiglobata* s.str. Thus both the epithets above must be regarded as synonyms and neither of them can be applied to the other species treated here.

Karsten (1882) described a dry-stiped form *Stropharia semiglobata* subsp. *siccipes* (treat-

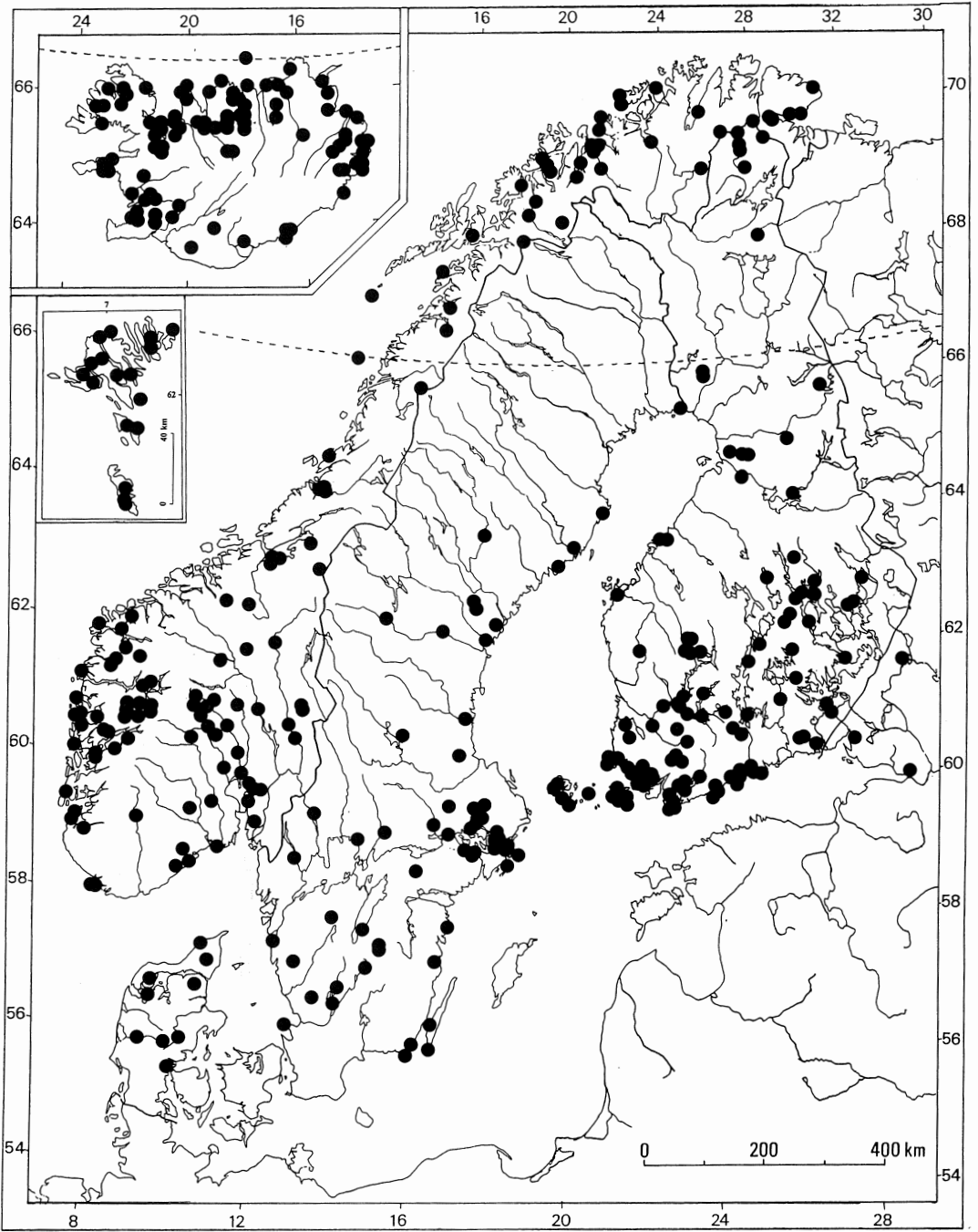


Fig. 1. Distribution of *Stropharia semiglobata* in NW Europe according to the material examined.

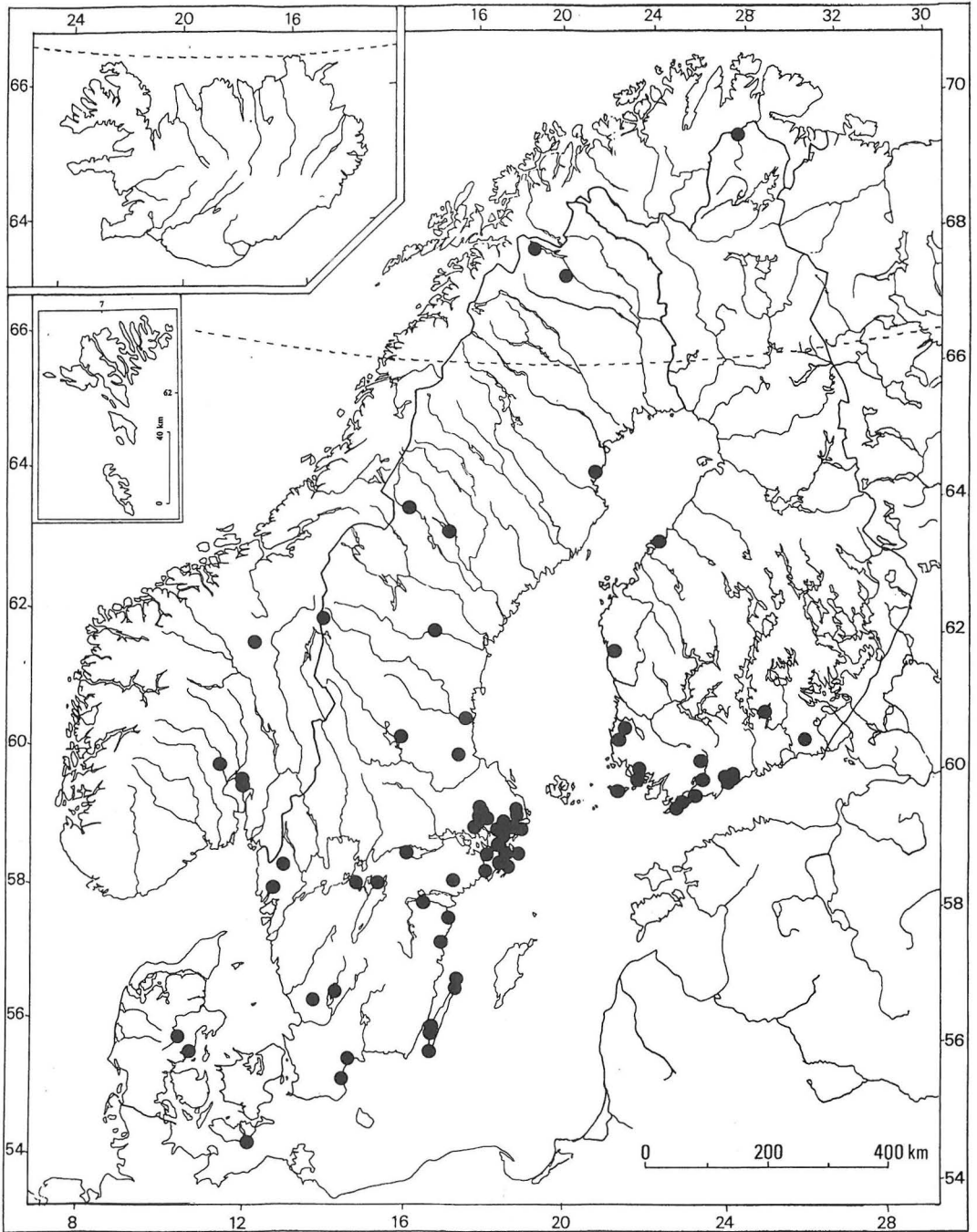


Fig. 2. Distribution of *Stropharia dorsipora* in NW Europe according to the material examined.

ed as species by Saccardo 1887) as an intermediate between *S. semiglobata* and *S. stercoraria*. However, according to the type, it belongs to the *Psilocybe merdaria* group.

*Specimens examined:* **Iceland.** 118 ex. leg. Hallgrímsson (AMNH), 1 ex. (C), 1 ex. (O). **Denmark.** 28 ex. (C, incl. 20 ex. from *Faeroes*) 5 ex. (H), 4 ex. (*Faeroes*, KUO). **Norway.** 30 ex. (BG), 5 ex. (H), 81 ex. (O), 1 ex. (OULU), 5 ex. (TRH), 42 ex. (TROM), 2 ex. (TUR). **Sweden.** Fungi Exs. Suec. Ups., ed. Lundell & Nannfeldt, no. 1143, from Småland, Femsjö, is a mixed collection of *S. semiglobata* and *S. dorsipora* (examined from C and S). 3 ex. (C), 10 ex. (H), 57 ex. (S), 1 ex. (UME), 27 ex. (UPS, incl. 5 moist chamber cultivations of N. Lundqvist). **Finland.** 1 ex. (C), 106 ex. (H), 4 ex. (KUO), 14 ex. (OULU), 51 ex. (TUR), 13 ex. (TURA). **Russia.** 3 ex. (H), 1 ex. (S). **Great Britain.** 1 ex. (S). **Germany.** 1 ex. (H). **France.** 1 ex. (H). **Italy.** 5 ex. (herb. Bresadola, S).

## 2. *Stropharia dorsipora* Esteve-Rav. & Barrasa (Figs. 2, 4, 6–9)

*Stropharia dorsipora* Esteve-Rav. & Barrasa, Rev. Iberoamer. Micol. 12:71. 1995. – Type: Spain, El Barco de Avila, in stercore vaccino, 11.V.1974 G. López (MA-Fungi 32018). Examined.

*Pileus* smaller than in *Stropharia semiglobata*, 0.5–2.5(–4), hemispherical with a broad umbo, expanding rounded convex, straw-coloured to yellowish brownish, viscid to glutinous. *Lamel-lae* segmentiform to somewhat arcuate to subventricose, adnate to shallowly emarginate with a low tooth, somewhat brownish blackish with white edge. *Stipe* fairly short, 2–10 cm long, slenderer than in *S. semiglobata*, straw-coloured, viscid, annulus ascending at least at first, more persisting and distinct than in most other species treated here, 0.6–3.5 cm below the gills (relatively lower down than in *S. semiglobata*, sometimes near the middle of the stem). The description above is based on dried specimens, but the dimensions agree fairly well with the fresh material, too, because fairly many collections contain basidiocarps longitudinally sectioned and then pressed and dried between papers in the same manner as phanerogams.

*Spores* 15.9–20.4(–22) × 9.1–11.6 μm ( $\bar{x}$  = 17.2–19.5 × 9.8–11.0, 401 spores of 23 spec.), length/width ratio  $Q = 1.61$ –1.91 ( $\bar{q}$  = 1.71–1.80), very slightly ovoidly ellipsoid in face view, slightly ventrally flattened, brick reddish brown to umber in Melzer's reagent, with darker colour and thicker wall than those in *S. semiglobata*, germ pore

dorsal (abaxial) and/or slightly eccentric sideways, 1.2–1.7 μm wide, clearly smaller and less distinct than in *S. semiglobata*. The eccentric dorsal germ pore is usually well demonstrated when the spore is seen exactly in profile.

*Basidia* broadly clavate, 30–42 × 11.5–14.5 μm (71 bas. of 12 spec.), 4-spored, with broad sterigmata. *Pleurocystidia* chrysocystidia, 30–50 × 11–16 μm (196 chrysoc. of 13 spec.), clavate with mostly mucronate to rostrate apex and yellowish brown inclusion, scarcer than in *S. semiglobata*, mostly absent at gill edge. *Cheilocystidia* 26–50 μm (310 cheiloc. of 14 spec.), in form between those of *S. semiglobata* and *S. alcis*, with base 4.5–10 μm thick, middle part 2.5–6 μm thick, almost straight to distinctly flexuous and apex somewhat swollen 3–7 μm thick, evenly distributed on the edge. Gill edge sterile. *Caulocystidia* on the stipe top above the ring zone similar with cheilocystidia, 25–62 μm long (65 cauloc. of 5 spec.). Chrysocystidia absent on the stipe, both on the top above and on the slimy part below the ring (checked from 55 specimens).

*Cap cuticle* an ixocutis with thick slime layer with few, 2–4 μm thick, embedded hyphae, in the lower part somewhat thicker (to 7 μm), not (or very finely) encrusted. *Stipe cuticle* an ixocutis as in the cap but hyphae more numerous, near the surface 2–4 μm thick, deeper a little thicker (to 5 μm), not or very finely spirally encrusted, encrustation strongest at the stipe base. Clamp-connections present at all septa.

## Ecology and distribution

According to the present material *Stropharia dorsipora* favours horse dung, some specimens being collected from cow dung and some from manured soil (Fig. 7). In ten collections information is only "on dung" and the rest are without exact information. The collections are (when informed) from dryish meadows, road sides, open or woodland pastures or yards. 17 specimens are mixed with *S. semiglobata*, but it is unknown, whether the basidiocarps have grown on exactly same dung heaps.

*Stropharia dorsipora* seems to produce basidiocarps fairly evenly throughout the warm period of the year from the beginning of May to the end of October with a slight optimum in the midsummer (Fig. 9).

The first collections of *Stropharia dorsipora* in the material studied are from the 1890's. Most of collections are from between the years 1940 and 1961. The history of the species differs strikingly from that of the most other species treated here. The vast majority of the specimens of *S. semiglobata* and especially *S. alcis* has been gathered after 1960. That maximum cannot at all be seen in the material of *S. dorsipora* (Fig. 8). After the 1950's horse is completely replaced with machines in forestry and agricultural work in Fennoscandia. In the same time *S. dorsipora* seems to have disappeared or become rare.

*Stropharia dorsipora* seems nowadays to be a fairly rare species in Finland. Most of the collections are from the coastal areas. Only one is from farther from the southern interior (Etelä-Häme, Heinola, 1977 Vainio 29, H), from a town lawn. New lawns in public parks and roadsides in towns and villages, set up on nutrient rich composted community waste, may offer a new possible habitat to that species. Many other coprophilous fungi are often abundant on such new lawns. One solitary record is known from Utsjoki in northernmost Lapland (Fig. 2).

In Scandinavia *Stropharia dorsipora* has been fairly common in the eastern part, from Uppland to Öland. Outside that area only sporadic collections exist, the northernmost at Abisko in Torne Lappmark (Fig. 2). Obviously the species is declining also in Scandinavia, but it is not known in certainty because the whole group is poorly collected during the last years in Sweden. I myself have never seen the species in Sweden. In Norway it is rare and known in the SE part only. In Denmark it seems to be commoner but more material is needed.

In Europe outside Fennoscandia *Stropharia dorsipora* is known from Germany (H), Netherlands (Noordeloos 1996), Great Britain (H), France (H, S), Switzerland (Noordeloos 1996), Greece (O), Italy (S) and Spain (Esteve-Raventós & Barrasa 1995). Outside Europe the species is known from Lake Baical region, in Russian Asia (H), and from New York (S) and California (Noordeloos 1996) in America.

In view of the small material outside the study area specimens of *S. dorsipora* are much more numerous from there than from Fennoscandia when compared with *S. semiglobata*. The former is a southern species in Fennoscandia and seems to be clearly commoner farther in the south.

## Discussion

*Stropharia dorsipora* is best recognized by the combination of large, dark-coloured spores with an eccentric dorsal germ pore and presence of chrysocystidia (however, lacking on the stipe). Macroscopically the more distinct ring is distinctive.

*Stropharia dorsipora* was included in the scope of *S. semiglobata* and *S. stercorearia* in old literature, but because either of them can be fixed for the present species (cf. discussion under *S. semiglobata*), the creation of a new name, *S. dorsipora*, by Esteve-Raventós & Barrasa (1995) is well justified. The different habitat – cow dung against that of horse – is most likely due to their very small material.

*Specimens examined:* **Denmark.** 6 ex. (C). **Norway.** 1 ex. (H), 3 ex. (O). **Sweden.** Fungi Exs. Suec. Ups., ed. Lundell & Nannfeldt, no. 1143, from Småland, Femsjö, is a mixed collection of *S. semiglobata* and *S. dorsipora* (examined from C and S). 51 ex. (S), 30 ex. (UPS, incl. 13 moist chamber cultivations of N. Lundqvist). **Finland.** 34 ex. (H), 3 ex. (OULU), 5 ex. (TUR). **Russia.** 1 ex. (H). **Great Britain.** 1 ex. (H). **Germany.** 1 ex. (H). **France.** 1 ex. (H). **Hungary.** 1 ex. (C). **Italy.** 7 ex. herb. Bresadola (S). **Spain.** Type (MA). **Greece.** 1 ex. (O). **U.S.A.** 1 ex. (S).

### 3. *Stropharia alcis* Kytöv., spec. nova (Figs. 4, 6–10)

*Illustrations:* Ryman & Holmåsen 1984: 441 (as *Stropharia semiglobata*).

*Facie graciliore, colore quasi lutescenti, sporis aliquantum minoribus (12.5–16.3 × 7.0–8.6 μm), cheilocystidiis anguste clavatis, stipite chrysocystidiis nullis, et habitatione in fimo alcis (Alces alces) a Stropharia semiglobata distinctus. In silvis borealibus Fennoscandiae frequens.*

*Holotypus:* Finland, Koillismaa, Kuusamo, Jussinlamminvaara, rich spruce-hardwood forest with open, spring-fed, low eutrophic depressions, on elk dung, 2.IX.1992 Kytövuori 92–1530 (H).

*Pileus* 1–5.5 cm, hemispherical to broadly subglobose with a very low, broad umbo, later broadly convex, viscid to strongly glutinous, straw yellow, ochraceous at the disk, slightly more vivid than in *Stropharia semiglobata*. *Lamellae* segmentiform or slightly arcuate at first, later fairly broad, subventricose, adnate to shallowly

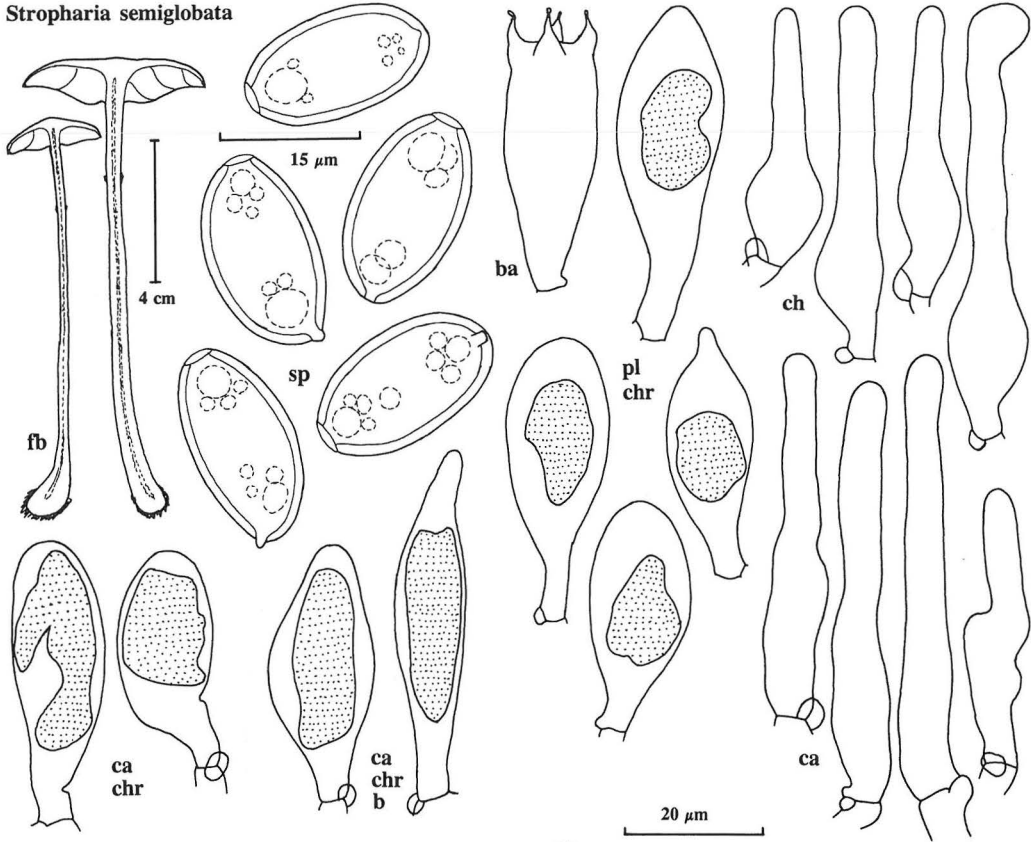
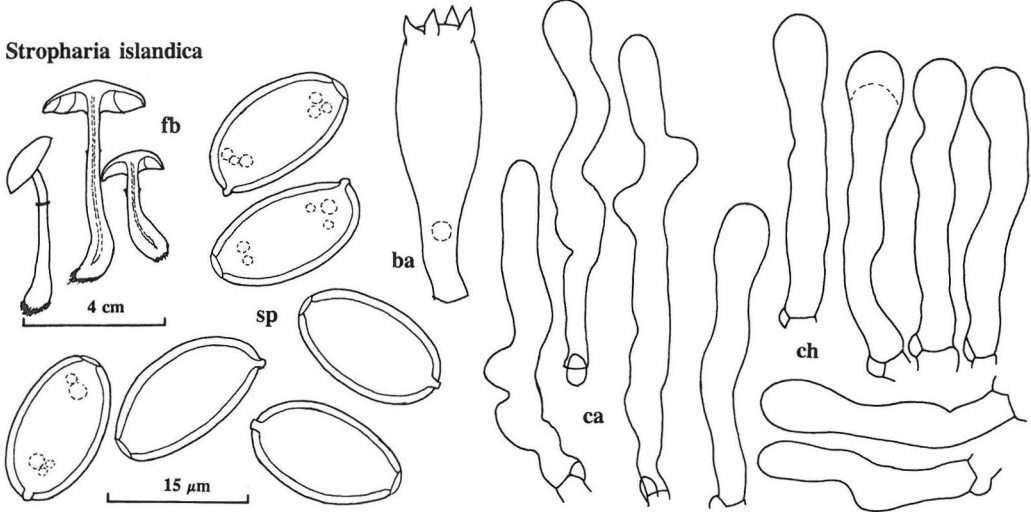
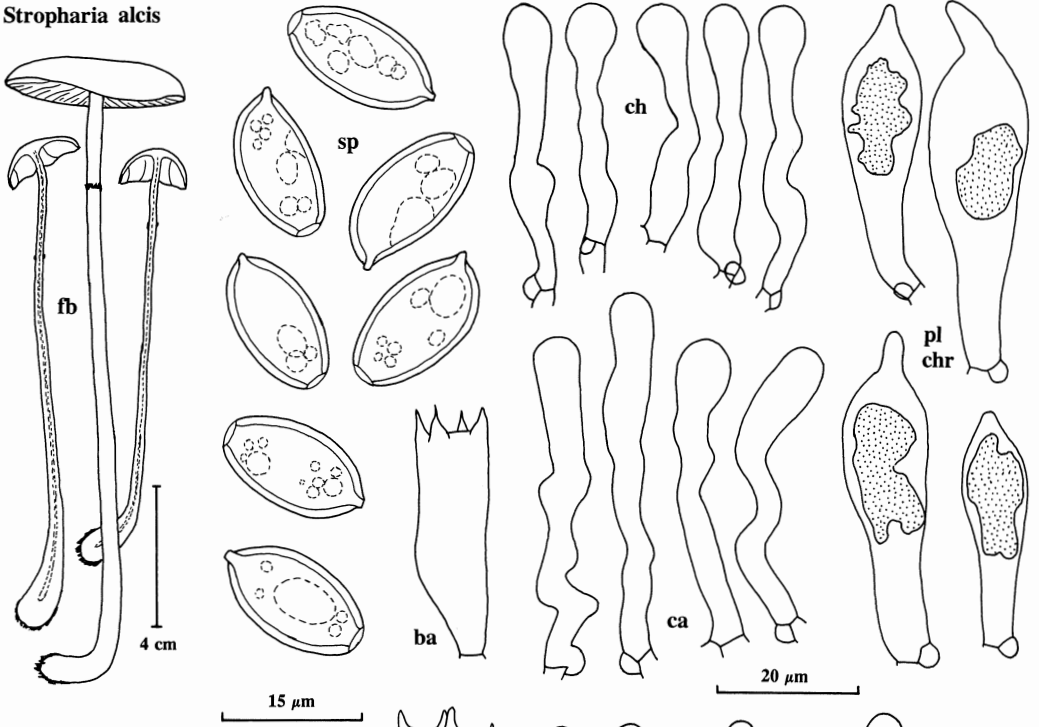
***Stropharia semiglobata******Stropharia islandica***

Fig. 3. Fruitbodies and microscopic details. *Stropharia semiglobata*: Finland, Keski-Pohjanmaa, Kokkola, 1951 (left) and 1952 (right) *Rauhala* (H, fruitbodies); Finland, Pohjois-Savo, Mikkeli r.c., *Kytövuori 92-2691* (H, microscopic details). *S. islandica*: Iceland, Eyjafjardar Sýsla, Glerardalur, *Hallgrímsson 5323* (AMNH, type). – ba: basidia, ca: caulocystidia (b: from stipe base; otherwise from the top), ch: cheilocystidia, chr: chrysocystidia, fb: fruitbodies, pl: pleurocystidia, sp: spores. Scale: fruitbodies  $\times 0.5$ , cystidia  $\times 1000$ , spores  $\times 1500$ .



***Stropharia alcis***



***Stropharia dorsipora***

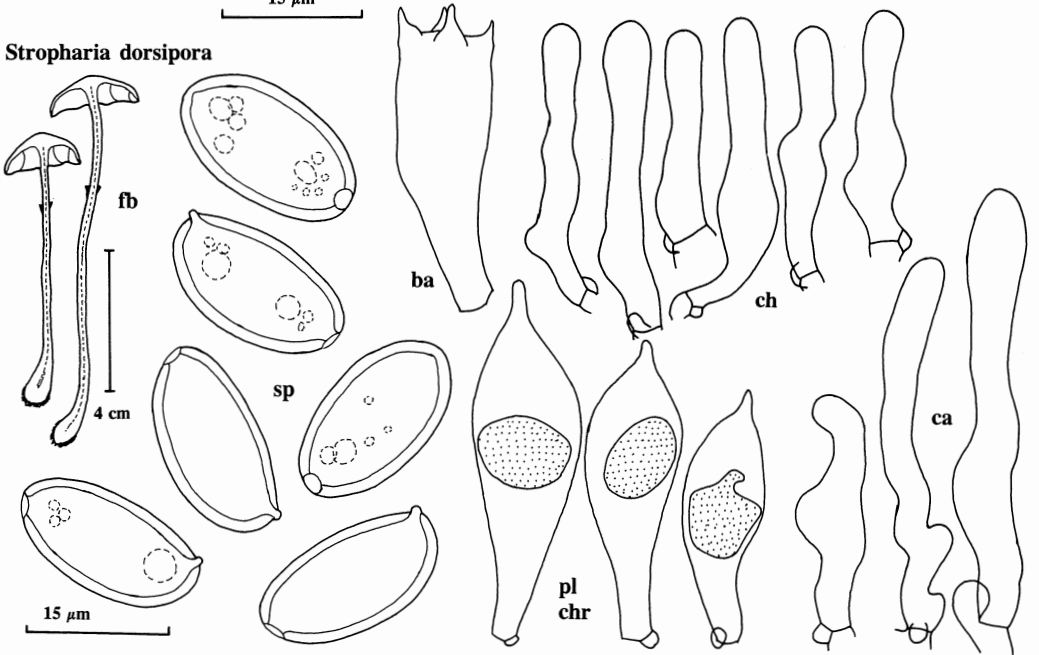


Fig. 4. Fruitbodies and microscopical details. *Stropharia alcis*: Finland, Koillismaa, Kuusamo, *Kytövuori* 92-1530 (H, type). *S. dorsipora*: Finland, Keski-Pohjanmaa, Kokkola, 17.VII.1951 (left) and 22.VII.1951 (right) *Rauhala* (H, fruitbodies); Uusimaa, Espoo, *Korhonen* 6430 (H, microscopical details). – ba: basidia, ca: caulocystidia, ch: cheilocystidia, chr: chrysocystidia, fb: fruitbodies, pl: pleurocystidia, sp: spores. Scale: fruitbodies  $\times 0.5$ , cystidia  $\times 1000$ , spores  $\times 1500$ .

emarginate with a low tooth, greenish blackish with white edge, mostly three (in large caps to 7) lamellulae between the whole ones. *Stipe* 3–17(–22) cm, slightly evenly thickening towards the mostly somewhat clavate base, 1.8–5 mm thick at the top, 2.5–7 mm thick at the base, hollow with a narrow cavity, with a thin, rudimentary, glutinous annulus 0.5–3(–5) cm below the gills, pale yellow and strongly glutinous below, dry and somewhat whitish pruinose above the ring zone. The stipe is relatively longer, more brightly coloured and the annulus more above than those of *S. semiglobata*. Smell none, taste mild.

*Spores* 12.5–16.3 × 7.0–8.6 μm ( $\bar{x}$  13.5–15.2 × 7.4–8.1, 356 spores of 20 spec.), length/width ratio  $q = 1.68$ –2.03 ( $\bar{q}$  1.74–1.93), slightly ovoidly ellipsoid, somewhat flattened ventrally (adaxially), smooth, amber in Melzer's reagent, thick-walled, with some guttules mostly at both ends, germ pore distinct, central, 1.8–2.0 μm (spores seem somewhat truncate owing to the relatively large germ pore).

*Basidia* broadly clavate, 27–35 × 9.5–11.5 μm (118 bas. of 16 spec.), 4-spored with fairly broad sterigmata. *Pleurocystidia* chrysocystidia, mostly broadly fusiform, 31–48 × 9.5–13 μm (120 chrysoc. of 11 spec.), apex sometimes obtuse, most often broadly mucronate to shortly rostrate, with yellowish brown inclusion, scarcer than in *Stropharia semiglobata*, mostly absent at gill edge. *Cheilocystidia* narrowly clavate, 25–45 μm long (275 cheiloc. of 18 spec.), with more or less swollen, 4.0–7.5 μm thick apex, but not distinctly capitate, middle part flexuous 2.5–4.0 μm thick and base 3.5–6.5(–8.5) μm thick; very abundant, in large, very dense fascicles. With dissecting microscope the gill edge of dried basidiocarps seems to be covered by white conglutinated lumps. Gill edge sterile. *Caulocystidia* on the stipe top above the ring zone similar with cheilocystidia, 29–50 μm long (57 cauloc. of 4 spec.). Chrysocystidia lacking on the whole stipe (both on the slimy part below and on the dry top above the ring; checked from 50 specimens).

*Cap cuticle* an ixocutis with thick slime layer with few, 2–4 μm thick, embedded hyphae, in the lower part somewhat thicker (to 7 μm), not (or very finely) encrusted. *Stipe cuticle* an ixocutis as in the cap but hyphae more numerous, near the surface 2–4 μm thick, deeper a little thicker (to 5 μm), hardly encrusted, encrustation strongest at the stipe base. Clamps present at all septa.

## Ecology and distribution

*Stropharia alcis* grows most often in conifer forests on more or less decayed dung heaps of elk (*Alces alces*). Elk dung decays slowly. Gradually the heap may become covered by a dense cluster of *S. alcis*, alone or mixed with other coprophilous agarics. Sometimes dense stands have been substituted by only few, but then very large basidiocarps (cf. Ohenoja 1976, Ryman & Holmäsén 1984). When decaying goes on, the amount of nutrients decreases, and year after year the stands become scarcer and the basidiocarps smaller. I do not know, how long one dung heap may produce basidiocarps, but often small, solitary basidiocarps are still found on dung totally covered by moss carpet, even of *Pleurozium*, *Hylocomium* or *Sphagnum*.

*Stropharia alcis* seems nearly always grow on elk dung (Fig. 7). One specimen of the material studied has been collected from hare pellets. On the other, hand eight specimens of *S. semiglobata* have been collected from elk dung. Two of the latter collections are mixed with *S. alcis*, but it is not noted whether the basidiocarps have grown exactly on the same heap. In Fennoscandia cow grazing in forests is now rare, and horse is not used in forestry. Thus the dung *Stropharias* in forests are now generally represented by *S. alcis*, whereas *S. semiglobata* is to be found on cultivated land.

*Stropharia alcis* produces basidiocarps in Finland at the autumn from the beginning of August to the middle of October. The fruiting period seems to be shorter and the optimum later than in *S. semiglobata* (Fig. 9).

The first single *Stropharia alcis* collection in the present material dates from the year 1934 (Karjalohja, SW part of Finland, Frey, H). From Sweden the first collections are from the next decade (Uppland, Ö. Ryd, 1947 Berggren, S and Djurö, 1948 Rydberg, S). Thereafter the amount of collections has increased quickly and in recent years the species has been the most collected of the group (Fig. 8).

In the last century elk was rare in Finland and after World War I it disappeared totally from most part of the country, and also in Scandinavia the population was scanty and not continuous. Elk population began to increase in 1920's in Sweden and 1930's in Finland. Particularly conspicuous the increase was in the 1970's. Thereafter the pop-

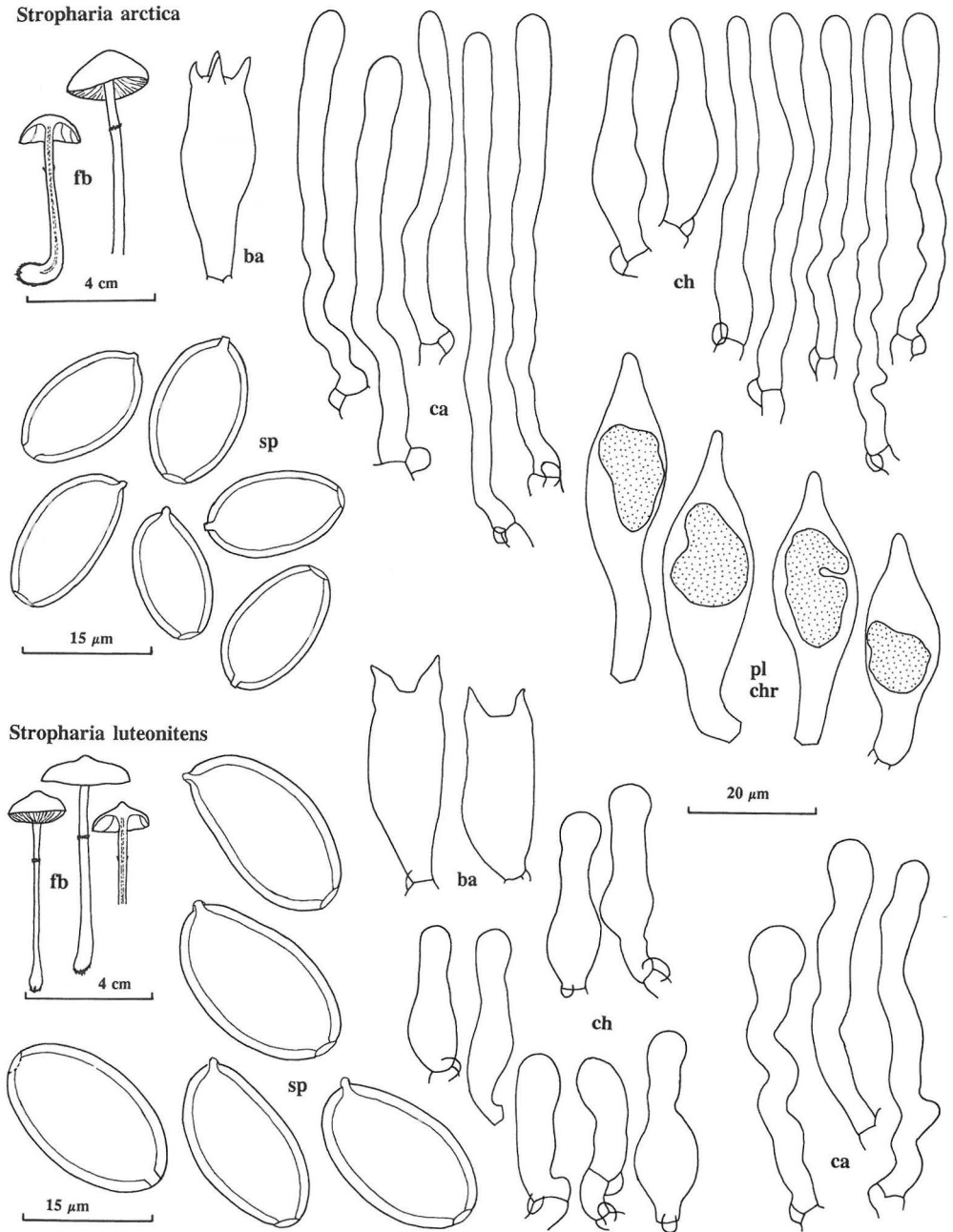


Fig. 5. Fruitbodies and microscopical details. *Stropharia arctica*: Iceland, Vestur-Húnavatns Sýsla, Ósar Vatnsnesi, Hallgrímsson 9510 (AMNH, type). *S. luteonitens*: Norway, Buskerud, Nes, Stordal 11146 aquarelle (O, fruitbodies); Finland, Etelä-Häme, Lammi, 1979 *Munsterhjelm* (H, microscopical details). – ba: basidia, ca: caulocystidia, ch: cheilocystidia, chr: chrysocystidia, fb: fruitbodies, pl: pleurocystidia, sp: spores. Scale: fruitbodies × 0.5, cystidia × 1000, spores × 1500.

ulation has somewhat decreased (Koivisto 1972, Cederlund & Markgren 1987, Nygren 1987, 1996, Østgård 1987). This history appears well in the material of *Stropharia alcis* (Fig. 8). Old collections lack completely. Also in Russia (especially in the European part) and in North America (mainly in Canada) the moose population has increased and expanded its range (Whitehead 1972, Kelsall 1987).

*Stropharia alcis* is common throughout Fennoscandia, where elk is common and abundant (Fig. 10). In the northern part of the area it is nowadays distinctly commoner than *S. semiglobata*. It is obvious that the distribution continues towards the east and to North America, but I have no material from there. Farther south in Europe the species is probably rare or absent owing to the lack of elk.

### Discussion

In the field *Stropharia alcis* is easily recognized by its habitat. Microscopically the identification is very easy to confirm from the spore size and the form of cheilocystidia. Dried basidiocarps can fairly reliably be identified by examining the gill edge with a dissecting microscope or a hand lens. In *S. alcis* the edge looks like if covered by white lumps, when in *S. semiglobata* the gill edge looks evenly minutely echinate or hairy (white).

It is unlikely that any old names would exist for *Stropharia alcis*, as older mycologists mostly lived outside the distribution area of elk or where elk was very rare at that time.

*Specimens examined*: Norway. 7 ex. (O), 4 ex. (TRH), 4 ex. (TROM), 1 ex. (TUR). Sweden. 17 ex. (H), 7 ex. (S), 3 ex. (UME), 3 ex. (UPS). Finland. 61 ex. (H), 1 ex. (JYV), 2 ex. (KUO), 11 ex. (OULU), 1 ex. (S), 23 ex. (TUR), 6 ex. (TURA). Estonia. 1 ex. (H), 2 ex. (TURA).

### 4. *Stropharia arctica* Kytöv., spec. nova (Figs. 5, 6–9, 11)

*Pileus* 0.5–3 cm *latus, hemisphaericus, deinconvexus, stramineus, viscidus vel glutinosus, stipite* 1–5 cm *longo, 1–3 mm crasso, cum basi clavata, sub annulo glutinoso et pileo aliquantem pallidiore. Sporae* 13.1–16.5 × 7.9–10.0 μm, *ellipsoideae, violaceo-atrae, poro distincto, centrali, 1.8–2.0 μm lato. Cheilocystidia fasciculatae, angustae, cylindricae, longae* (30–

75 μm), *basi et apice vix inflato. Chrysocystidia faciales praesentes, in stipite nulla. In fimo, in Islandia et Russia arctica cognita.*

*Holotypus*: Iceland, Vestur Húnavatns Sýsla, Ósar Vatnsnesi, moorland, on dung, 2.IX.1984 H. Hallgrímsson 9510 (AMNH).

*Pileus* 0.5–3 cm, semiglobose to convex, viscid to glutinous, pale straw yellow, more strongly at the disk. *Lamellae* arched to subventricose, slightly decurrent, blackish brown with white edge, mostly three lamellulae (one longer, two very short) between the whole gills. *Stipe* 1–5 cm long, 1–3 mm thick, at the base to 6 mm thick, hollow, with a membranous to very thin annulus 0.5–1.5 cm below the gills; below the ring slightly paler than the pileus, viscid to glutinous, at the top above the ring whitish pruinose, dry. (Above is based on the dried material).

*Spores* 13.1–16.5 × 7.9–10.0 μm ( $\bar{x}$  = 15.0–15.1 × 8.5–9.0 μm, 134 spores of 2 spec.), length/width ratio  $Q = 1.58–1.86$  ( $\bar{q}$  = 1.67–1.76), ellipsoid to very slightly ovoidly ellipsoid, very slightly flattened ventrally (adaxially), smooth, bay to dark brick in Melzer's reagent, thick-walled, with some guttules mostly at both ends, germ pore distinct, central, ca. 1.8 μm wide.

*Basidia* broadly clavate, 27–37 × 9.5–12.5 μm (45 bas. of 2 spec.), 4-spored, with broad sterigmata. *Pleurocystidia* chrysocystidia, 32–50(–58) × 10–13.5 μm (38 chrysoc. of 2 spec.), fusiform, apex broadly rostrate, with yellowish brown inclusion, scarcer than in *Stropharia semiglobata*, mostly absent at gill edge. *Cheilocystidia* long and narrow, very narrowly clavate, in form somewhat resembling those of *S. squamosa*, 30–75 μm (86 cheiloc. of 2 spec.), with slightly swollen, 3.5–5.5 μm thick apex, middle part flexuous, mostly 2.5–3.5 μm thick and base 2.5–5.5 μm thick; abundant, in large, dense fascicles. Between and outside the narrow flexuous cheilocystidia some narrowly lageniform ones with the base up to 11 μm and the middle part to 6 μm thick. Gill edge sterile. *Caulocystidia* on stipe top above the ring like cheilocystidia, 49–80 μm long (49 cauloc. of 2 spec.), in fascicles. Chrysocystidia absent on the whole stipe (both on the slimy part and above the ring).

*Cap cuticle* an ixocutis with thick slime layer with few, 2–4 μm thick, embedded hyphae, in the lower part somewhat thicker (to 7 μm), finely spirally encrusted. *Stipe cuticle* an ixocutis as in the

cap but hyphae more numerous, near the surface 2–4 µm thick, deeper a little thicker (to 5 µm), not or very finely spirally encrusted, encrustation strongest at the stipe base. Clamps present at all septa.

### Ecology and distribution

So far only two specimens of *Stropharia arctica* are known, one from Iceland (*Hallgrímsson 9510*, AMNH), the other from Russia, Bolshezemelskaya Tundra (*Ohenoja 1996/40*, OULU).

The Icelandic specimen has been collected from a moor from dung without information of the animal. The Russian basidiocarps were grown in the tundra on droplets of hare (*Lepus timidus*). Any Greenlandish or American material has not been seen. Both specimens have been collected in early autumn. More material is needed to clear up the ecology and phenology of the species.

### Discussion

*Stropharia arctica* is characterized by the medium-sized spores in the group and by long and very narrow, flexuous cheilo- and caulocystidia resembling those of *S. squamosa*. From *S. semiglobata* it differs by smaller spores and lack of chrysocystidia on the stipe, from *S. alcis* by somewhat wider spores and narrower cheilo- and caulocystidia.

The basidiocarps of the two specimens seen by me are very different in their external habit. The Icelandic basidiocarps are fairly large and sturdy when compared with the other materials (e.g. *S. semiglobata*) from there (but small when compared with those in the Fennoscandian material). The Russian material demonstrates very small basidiocarps. However, the difference may be caused by different dung. Watling & Gregory (1987) and Arnolds (1982) describe very small *S. semiglobata* basidiocarps on rabbit pellets. Microscopically both specimens are very similar.

*Specimens examined*: See type. – Russia. Siberia, Tyumen Region, Yamalo-Nenetsia, Bolshezemelskaya Tundra, 1966 *Ohenoja 1996/40* (OULU).

### 5. *Stropharia islandica* Kytöv., spec. nova (Figs. 3, 6–9, 11)

*Pileus* 1–5 cm *latus*, *late subglobosus*, *dein plano-convexus*, *stramineus*, *viscidus*, *stipite* 2–5 cm *longo*, 2–5 mm *crasso*, *cum basi leviter clavata*, *sub annulo distincto viscido et pileo concolore*. *Sporae* 13.4–17.9 × 7.3–10.0 µm, *ellipsoidae*, *violaceo-atrae*, *poro distincto*, *centrali*, 1.6–1.8 µm *lato*. *Basidia late clavata* (28–40 × 11–15 µm). *Cheilocystidia anguste clavata* (25–60 µm), *apice ad 13 µm inflato*. *Chrysocystidia nulla*. *In fimo*, *in Islandia cognita*.

*Holotypus*: Iceland, Eyjafjarðar Sýsla, Glerardalur, near the water containers, on horse dung, 11.IX.1968 *H. Hallgrímsson 5323* (AMNH).

*Pileus* 1–5 cm, broadly subglobose to planoconvex, viscid to strongly glutinous, straw yellow, ochraceous at the disk. *Lamellae* broad, subventricose, slightly decurrent, blackish brownish, without greenish shade, with white edge, mostly three lamellulae (one longer, two short) between the whole gills. *Stipe* fairly short and stout, 2–5 cm long, slightly thickening towards the clavate base, 1.8–5.0 mm thick at the apex, 2.5–7.0 mm at the base, hollow, with fairly thin but distinct annulus 0.5–1.5 cm below the gills, straw yellowish and glutinous below and whitish pruinose and dry above the ring zone. (Above is based on dried material).

*Spores* 13.4–17.9 × 7.3–10.0 µm ( $\bar{x}$  = 14.5–16.7 × 8.2–9.5 µm, 124 spores of 7 spec.), length/width ratio  $Q$  = 1.65–1.89 ( $\bar{q}$  = 1.74–1.83), ellipsoid to very slightly ovoidly ellipsoid, very slightly flattened ventrally (adaxially), smooth, bay to dark brick in Melzer's reagent, thick-walled, with some guttules mostly at both ends, germ pore distinct, central, 1.6–1.8 µm wide.

*Basidia* broadly clavate, 28–40 × 11–15 µm (95 bas. of 7 spec.), 4-spored, with broad sterigmata. *Pleurocystidia* (chrysocystidia) absent. *Cheilocystidia* narrowly clavate, 25–60 µm (156 cheiloc. of 7 spec.), with more or less swollen apex, 4–13 µm thick, middle part mostly flexuous, 3–6 µm thick, base 4–9 µm thick; abundant, in large fascicles. Gill edge sterile. *Caulocystidia* on stipe top above the ring like cheilocystidia but somewhat longer, 36–80 µm (86 cauloc. of 7 spec.), in fascicles.

Fig. 6. Diagram showing the spore size of *Stropharia semiglobata*, *S. dorsipora*, *S. alcis*, *S. arctica*, *S. islandica* and *S. luteonitens*. The lines are drawn on the basis of scatter diagrams, and contain 95 % of the spores measured of each species. x axis: length of spores. y axis: width of spores.

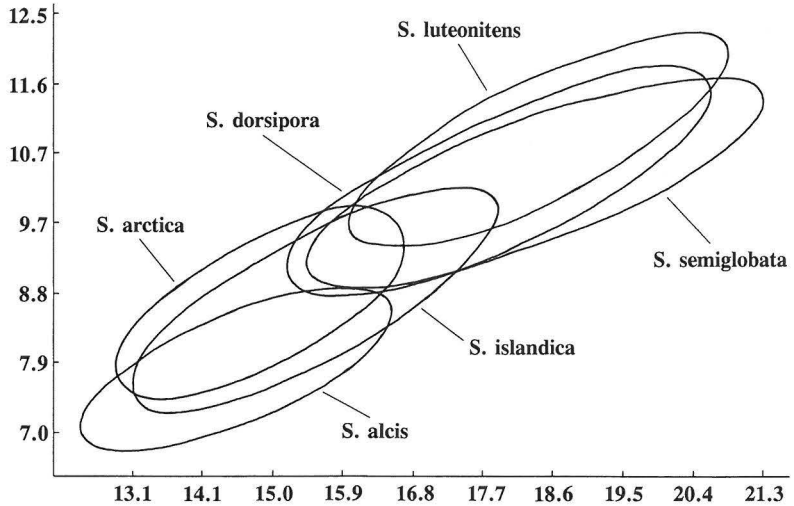
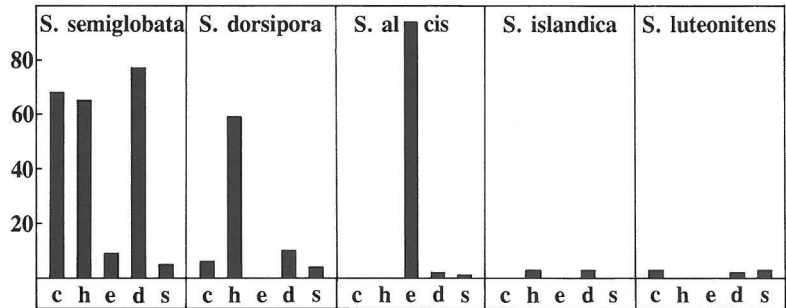


Fig. 7. Ecology of *Stropharia semiglobata*, *S. dorsipora*, *S. alcis*, *S. islandica* and *S. luteonitens* according to the specimens examined. c: cow dung, h: horse dung, e: elk dung, d: dung only, s: manured soil. Specimens without information of dung excluded. y axis: numbers of specimens.



*Cap cuticle* an ixocutis with thick slime layer with few, 2–4  $\mu\text{m}$  thick, embedded hyphae, which in the lower part are somewhat thicker (to 7  $\mu\text{m}$ ), finely spirally encrusted. *Stipe cuticle* an ixocutis as in the cap but hyphae more numerous, near the surface 3–5  $\mu\text{m}$  thick, deeper a little thicker (to 6  $\mu\text{m}$ ), finely spirally encrusted, encrustation strongest at the stipe base. Clamps present at all septa.

### Ecology and distribution

*Stropharia islandica* seems to occur in more or less open land mostly on dung. According to the labels three specimens are from horse dung,

three ones from dung and one is without information (Fig. 7). Collections are from the middle of August to the end of September (Fig. 9). The material is fairly recent, the first specimen from the year 1961 (Fig. 8), and chronologically strictly consistent with the Icelandic material of *S. semiglobata*.

So far *Stropharia islandica* is known from Iceland only, where it has been collected in a large area in the northern part of the country (Fig. 11). Four of the specimens have been collected as *S. semiglobata* (two mixed collections with the latter one with *Psilocybe semilanceata*, two as *P. merdaria* and one as *P. coprophila*). No specimens from Fennoscandia have been found,

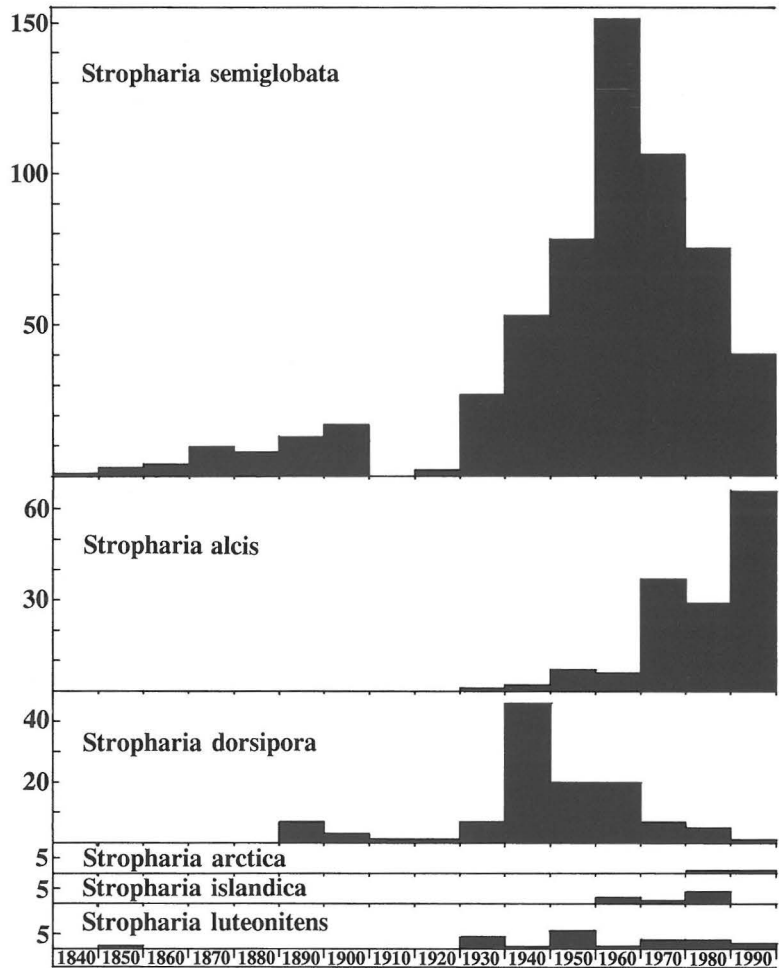


Fig. 8. Collections of *Stropharia semiglobata*, *S. dorsipora*, *S. alcis*, *S. arctica*, *S. islandica* and *S. luteonitens* according to the Nordic material examined. x axis: the time from 1840 divided in decades. y axis: numbers of specimens collected in each decade.

though also the material of *Psilocybe merdaria* and unidentified *Stropharia* from BG, TROM, TRH and the Finnish herbaria have been checked in addition to *S. semiglobata*.

## Discussion

Macroscopically *Stropharia islandica* is characterized by its fairly sturdy external appearance. It seems to be somewhat shorter and wider than *S. semiglobata* and with fairly short and stout stipe (also *S. semiglobata* seems to be distinctly lower in the Icelandic material than in Fennoscandia). The ring seems to be more distinct and persisting than in *S. semiglobata*.

Microscopically *Stropharia islandica* is known by the lack of chrysocystidia, by its fairly large cheilocystidia with swollen apex and fairly small spores for the present group.

*Stropharia islandica* differs from *S. luteonitens* most easily by the 4-spored basidia and smaller spores. In this respect the species may resemble the 4-spored form of *S. luteonitens* mentioned by Parker-Rhodes (1951), Michael et al. (1985), Guzmán (1983), Watling & Gregory (1987) and Noordeloos (1996). However, many other differences exist between the latter species. The appearance of *S. islandica* is sturdier, reddish colours, typical to *S. luteonitens* on the disk, seem to be lacking (colours are rather pale

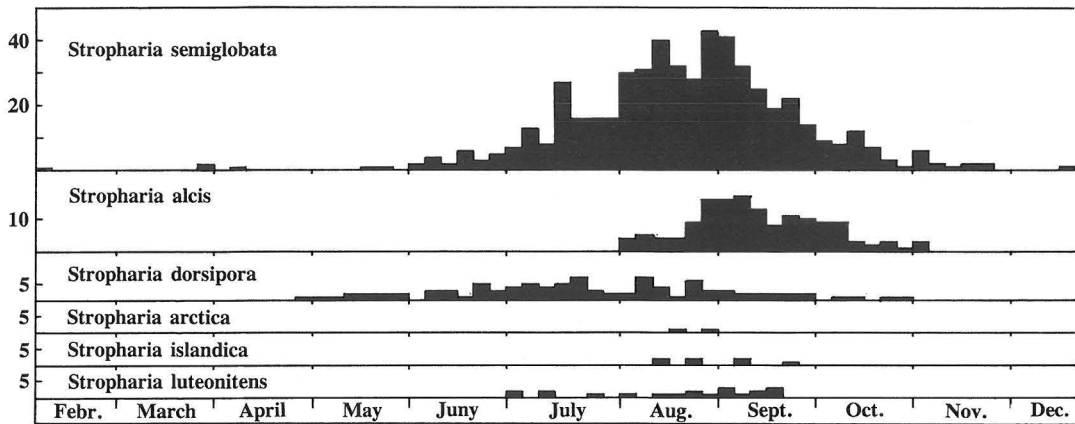


Fig. 9. Fruiting periods of *Stropharia semiglobata*, *S. dorsipora*, *S. alcis*, *S. arctica*, *S. islandica* and *S. luteonitens* in Nordic herbaria according to the specimens examined. x axis: the season from 6.II. to 21.XII. divided in pentads. y axis: numbers of specimens collected in each pentad.

or dirty as in *Psilocybe merdaria*), ring is more distinct, cheilo- and caulocystidia are larger and germ pore is strictly central and straight. *S. islandica* clearly represents a different species, not a 4-spored form of *S. luteonitens*.

*Specimens examined: Iceland:* Eyjafjarðar Sýsla: See type; Kotárborgir Akureyri, 1984 *Hallgrímsson 9557* (AMNH). Norður Múla Sýsla: Droplaugarstaðir Fljótstaðal, 1988 *Hallgrímsson 11861* (AMNH); Möðrudalur á Fjöllum, 1985 *Hallgrímsson 10003* (AMNH). Suður Thingeyjar Sýsla: Bakki Tjörnesi, 1983 *Hallgrímsson 9245* (AMNH); Mýlaugsstaðir Aðaldal, 1961 *Hallgrímsson 674* (AMNH). Vestur Húnavatns Sýsla: Reykir Hrutáfirði, 1972 *Hallgrímsson 8049* (AMNH).

## 6. *Stropharia luteonitens* (Vahl : Fr.) Quél. (Figs. 5–9, 12)

*Stropharia luteonitens* (Vahl : Fr.) Quél., Champ. Jura et Vosges 1:142. 1872. – *Agaricus luteonitens* Vahl, Fl. Danica 6 (fasc. 18): pl. 1057, fig. 1. 1792; Fr., Syst. Mycol. 1:511, 1821; 3:Index 28. 1832. – *Geophila luteonitens* (Vahl : Fr.) Quél., Enchir. Fung. 111. 1886. – Type: Not typified. – *Psilocybe luteonitens* (Vahl : Fr.) Park.-Rhodes, Trans. British Mycol. Soc. 34:364. 1951.

*Stropharia umbonatenscens* (Peck) Sacc., Syll. Fung. 5:1021. 1887. – *Agaricus umbonatenscens*, Peck, Ann. Rep. N.Y. St. Mus. 30:41. 1878. – Type: U.S.A. New York. Schenevus. Not seen.

*Illustrations:* Ricken (1915: pl. 63), Lange (1935: pl. 141A), Konrad & Maublanc (1924: pl. 54), Soc. Catal. Micol. (1983: pl. 95), Michael et al. (1985: 423).

*Pileus* 1–3 cm, mostly more distinctly and sharply umbonate than *Stropharia semiglobata*, vis-

cid to glutinous, pale straw yellow, reddish brown at the disk, very thin-fleshed, somewhat hygrophanous and translucent striate at the margin. *Lamellae* broad, subventricose, slightly decurrent, most often three lamellulae (one longer, two very short) between the whole gills, blackish brownish with whitish edge. *Stipe* slender, somewhat radicate, 3–8(–16) cm long, 1–3 mm thick, at the base somewhat thicker, with a very thin and soon disappearing annulus 1–4 cm below the gills, pale yellowish and viscid below, whitish and dry above the ring zone, hollow. Taste should be unpleasant, like that of *Tricholoma sulphureum*.

*Spores* 16.3–20.8 × 9.5–12.2 μm ( $\bar{x}$  = 17.3–19.7 × 10.2–11.4 μm, 333 spores of 19 spec.), length/width ratio  $Q$  = 1.60–1.85 ( $\bar{q}$  = 1.63–1.76), ellipsoid to very slightly amygdaliform, often with a very slight suprahilar depression, thick-walled, reddish brown in Melzer's reagent, germ pore ca. 1.8 μm wide, very slightly dorsally oblique (larger and less eccentric than in *S. dorsipora*).

*Basidia* 23–29 × 11.0–12.5 μm (126 bas. of 13 spec.), 2-spored, without or with very small pedicel. *Pleurocystidia* (chrysocystidia) absent. *Cheilocystidia* smaller and less abundant than in the other species treated here, cylindrical to narrowly lageniform, 25–37 μm long (320 cheiloc. of 16 spec.), with base 5.5–8.0 μm thick, middle part 3–5 μm thick, straight or slightly flexuous and apex tapering to slightly swollen, 3.0–7.5 μm



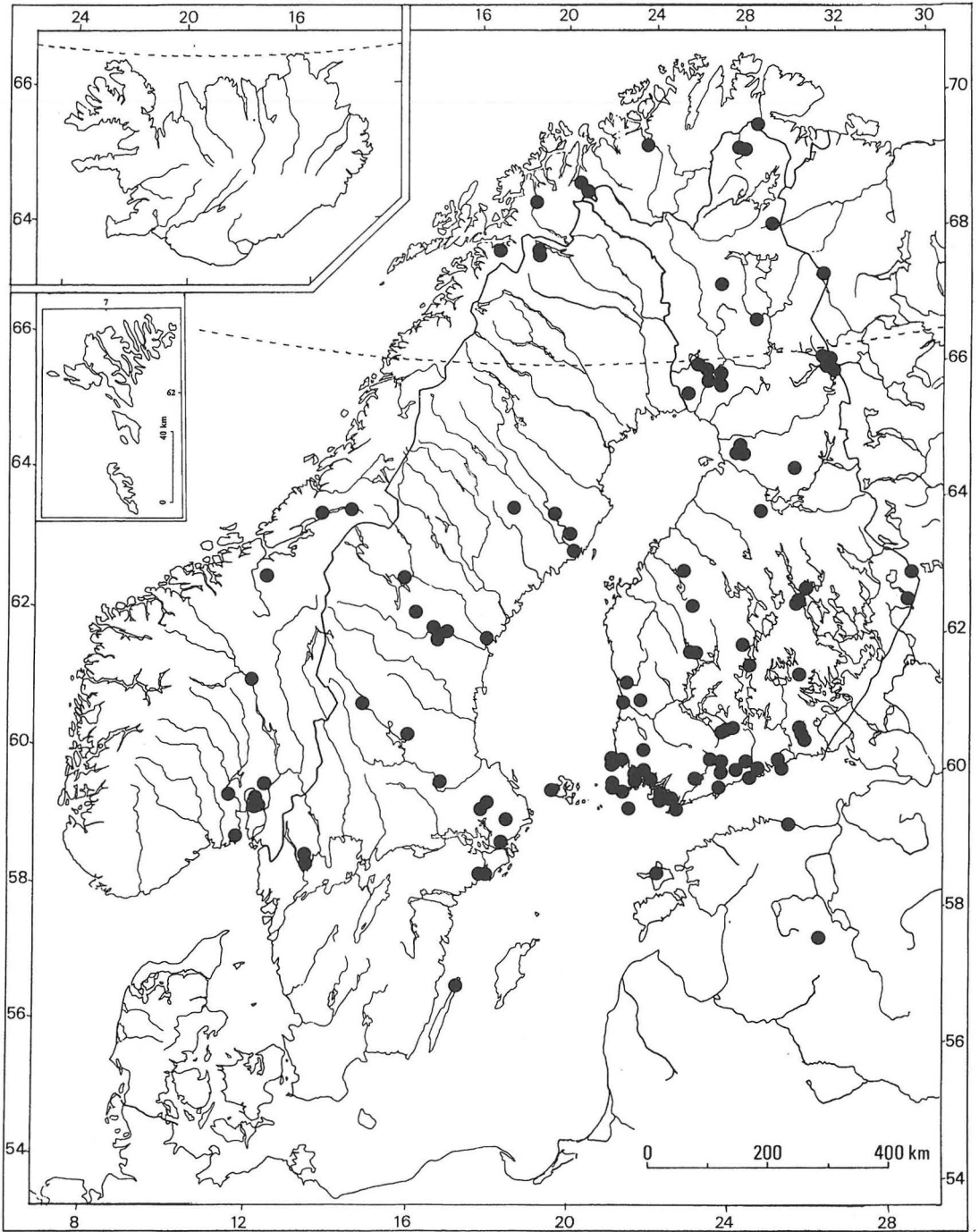


Fig. 10. Distribution of *Stropharia alcis* in NW Europe according to the material examined.

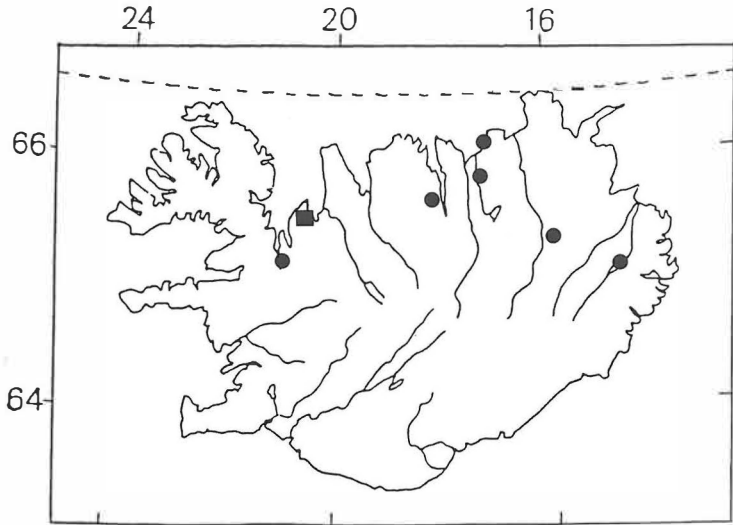


Fig. 11. Distribution of *Stropharia arctica* and *S. islandica* in NW Europe according to the material examined. Dots = *S. islandica*. Squares = *S. arctica*.

thick. Gill edge sterile. *Caulocystidia* on stipe top above the ring as cheilocystidia, but somewhat longer 26–53  $\mu\text{m}$  (88 cauloc. of 5 spec.) and more variable.

*Cap cuticle* an ixocutis with slime layer with few, 2–4  $\mu\text{m}$  thick, embedded hyphae, in the lower part somewhat thicker (to 7  $\mu\text{m}$ ) hyphae, finely spirally encrusted. *Stipe cuticle* an ixocutis as in the cap but hyphae more numerous, near the surface 2–4  $\mu\text{m}$  thick, deeper a little thicker (to 5  $\mu\text{m}$ ), finely spirally encrusted, encrustation strongest at the stipe base. Clamps present at all septa.

### Ecology and distribution

*Stropharia luteonitens* grows in forests, pastures, gardens etc. on manured soil or on decaying dung (cf. Ricken 1915, Lange 1935, Arnolds 1982, Ryman 1992). Rald (1992) emphasizes that the species mostly thrives in extensively used nature and avoids artificially fertilized ground.

The fruiting period of the species seems to be long. Material is scanty but collections are fairly evenly from the beginning of July to the end of September (Fig. 9). Rald's (1992) material is from September and October. According to Arnolds (1982) the species occurs very irregularly, and his records are from October. In the present material the first collection is from the year 1858 (*v. Post*, S) and since then the species has been collected

during all decades from 1930's, but the vast increase of collecting during the last five decades does not at all appear with this species (Fig. 8).

*Stropharia luteonitens* seems to be rare or very rare everywhere in its range. All the specimens earlier determined as *S. luteonitens* in the Finnish herbaria proved to be other species, but one indetermined *Stropharia* specimen (Etelä-Häme, Lammi, 1979 *Munsterhjelm*, H) is *S. luteonitens*. From Sweden it has not been recorded by Ryman (1992) or Hallingbäck (1994), but Hallingbäck & Aronsson (1998) reported the species from N, southern central and SE Sweden. Neither material nor other basis has not been cited. I found 4 old specimens (1858–1952) in the material of S, but only one of them was identified as *S. luteonitens*. In Denmark it was classified as extinct (Vesterholt & Knudsen 1990), but has been found again later (cf. Rald 1992). It is known also from Iceland and the Faeroes (Fig. 12).

According to Watling & Gregory (1987) several records of *Stropharia luteonitens* are known from Great Britain but the species is rarely found recently. The diminishing trend is seen also in the present material, especially when compared with the very numerous new collections of some other species of the group (Fig. 8). From the Baltic countries it is known from Estonia (Saaremaa, 1993 Kytövuori 93–1270, H) and Lithuania (Urbonas et al. 1986). In Germany and Netherlands it is

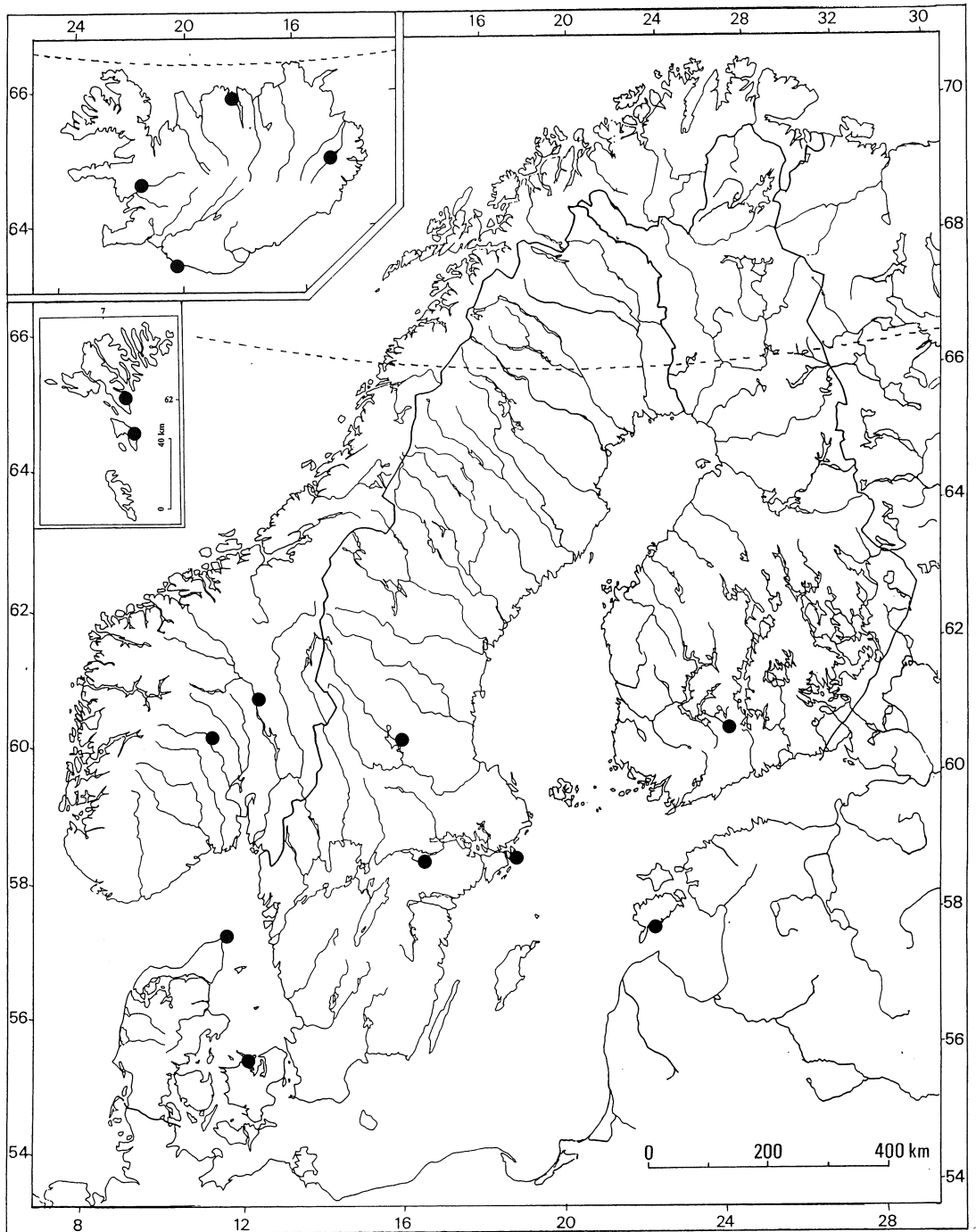


Fig. 12. Distribution of *Stropharia luteonitens* in NW Europe according to the material examined.

rare (Kreisel 1887, Krieglsteiner 1991, Arnolds 1982). On grounds of the present material *S. luteonitens* seems to be somewhat oceanic in its distribution.

## Discussion

Macroscopically *Stropharia luteonitens* is characterized by small size, slender habit, sharply umbonate pileus and weak ring fairly low on the stipe. Microscopically it is recognized by large spores with slightly eccentric germ pore, 2-spored basidia and lack of chrysocystidia. Based on the last character, it is, with *S. squamosa*, *S. magnivelaris* and *S. percevalii*, placed in *Psilocybe* by many authors. However, *S. percevalii* has chrysocystidia, even if rare and small and difficult to observe (Kytövuori 1992). It feels unnatural to separate *S. islandica* and *S. luteonitens* from *Stropharia* or to split the *S. squamosa* group into different genera, based on the presence of chrysocystidia only. Noordeloos (1995), following Smith (1979) and Kühner (1980), suggested to unite *Stropharia*, *Hypholoma* and *Psilocybe* into one genus *Psilocybe*. I cannot see any reason to such lumping. The problem in fungi are too large and heterogeneous genera, not too small ones.

According to Michael & al. (1985), Guzmán (1983), Watling & Gregory (1987) and Noordeloos (1996) *Stropharia luteonitens* has 4- or 2-spored basidia, whereas most other e.g. Konrad & Maublanc (1924), Lange (1935), Kühner & Romagnesi (1953), Arnolds (1982) and Ryman (1992) record 2-spored basidia only. Parker-Rhodes (1951) knows 4-spored basidia only, but his description is also otherwise doubtful (dry stipe, small spores,  $13 \times 8 \mu\text{m}$ ) and may represent another species. In the present material no 4-spored forms were found. *S. islandica* has 4-spored basidia, but it differs on the basis of many other characteristics, too (cf. above), and does not belong to *S. luteonitens*.

*Specimens examined:* **Iceland.** Eyjafjarðar Sýsla: Hóll Upsaströnd, 1967 *Hallgrímsson 3207* (AMNH). Norður Múla Sýsla: Skriðuklaustur Fljótsdal, 1987 *Hallgrímsson 11506* (AMNH). Hredavatn, 1984 *Elborne SAE-111-ISL* (C). Vestmannaeyjar, 1935 *Christiansen* (aquarelle only, very typical, C). **Denmark.** The Faeroes: Sandø, Skaalehoved, 1938 *Møller* (C), Strømmø, Tuorshavnøy, 1938 *Møller* (C). Nordjylland: Skagen, Pælebakke Klit, 1983 *Elborne SAE 0854* (C). Sjælland & surrounding islands: Sjælland, Odsherred, Bjergene, 1992 *Bruun &*

*Ejrnæs EB010992-1* (C). **Norway.** Opland: Øyer, Botrudhaugen, 1979 *Stordal 19933* (O); Sjøseterfjell, 1979 *Stordal 19943* (O). Buskerud: Nes, Nystølen-vollen, 1955 *Stordal 10179, 10180, 10181* (O); Nystølen, 1958 *Stordal 11146* (O). **Sweden.** Södermanland: Julita, Ås, 1858 *von Post* (S), Djurö, Runmarö, Vänö, 1948 *Rydberg* (S); Runmarö, 1952 *Haglund* (S). Dalarna: Rättvik, Vikarbyn, 1936 *Cortin* (S). **Finland.** Etelä-Häme: Lammi, Jahkola, Mataramäki, 1979 *Munsterhjelms* (H). **Estonia,** Saaremaa, Abruca, 1993 *Kytövuori 93-1270* (H). **Italy.** Two specimens in Herb. Bresadola, 1902, 1903 (S).

## Excluded taxa

*Stropharia semiglobata* subsp. *siccipes* P. Karst., Meddel. Soc. Fauna Fl. Fennica 9:46. 1882. – Lectotype: Finland, Etelä-Häme, Tammela, Mustiala, 6.VIII.1881 *P.A. Karsten* (H), selected here, = *Psilocybe merdaria* group).

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