

The group *Cortinarius paragaudis* Fries in Sweden

Karl Soop

Abstract

The paper attempts to clarify the specific variety in the group containing *Cortinarius paragaudis* Fr. and *C. haematochelis* Bull.:Fr. An analysis of twelve collections from Central Sweden is presented, and it is shown that the material can be split roughly into two groups, separated mainly by spore size. Finally, a new species, resembling a *C. paragaudis* with a white veil, is described.

Note: Comments appearing in brackets have been added after publication.

Introduction and Summary

In Swedish boreal and hemi-boreal spruce forests one often encounters *Cortinarii* that superficially resemble the very common *C. armillatus* Fr., but present a duller, more greyish, hue, also in the veil. These fungi exhibit a bewildering variation in colour. In some collections the fruiting bodies are pale, grey-brown, in some reddish or yellow brown, and yet in others they darken, finally to umber.

This author has wondered for many years whether we are faced with a complex of many species and varieties, or whether it is a question of one taxon with many chromatic forms (Soop 1987). In order to gain some clarity, I have collected, observed, and analysed a number of related taxa over the last four years, often in collaboration with my cortinarist colleague H.G. TORESSON. The latest season having yielded an unusually generous crop, I think the time has come to publish the results.

As will be argued in the following, the collections can be ascribed to a single species, with two varieties, separated by spore size. Moreover, I subscribe to the conclusion of E. BENDIKSEN (1989), that this species should be called *C. paragaudis* Fr., relegating *C. haematochelis* Bull.:Fr. to a *nomen dubium*. Finally, I believe our collections are regionally representative, in the sense that the species, not uncommon in Central Swedish spruce forests, and answering the description below, is in fact the true *C. paragaudis* of FRIES.

As regards the chromatic variation, it seems due to two factors: (a) individual velar abundance; and (b) extreme variability of the veil colour with time. These different forms are described and discussed below. In addition, we have found several collections of a similar species, but with a *white* veil. This is described last as a *sp. nov.*

Brief characterisation of *Cortinarius (Sericeocybe) paragaudis* Fr.

The habit is typically sericeocyboid, with a silky, fibrillose cap and a clavate stipe. In some collections the cap is slightly hygrophanous, but this occurs mainly in old age and towards the margin, or else under exceptionally wet conditions. By and large, we have here a non-hygrophanous (or "pseudo-hygrophanous") fungus, which I have no hesitancy in assigning to the subgenus *Sericeocybe* Orton, along with its close relative *C. armillatus* Fr. (cf. Soop 1988).

The fruiting body is generally pale greyish tan, including the context and gills. The veil is most prominent on the stipe, where one usually finds several thin girdles. As mentioned above, it is in the velar colour one finds the most variation. It is usually stated as being brownish red to vinaceous in the literature, but I often find this a misleading characterisation. In young specimens, the veil is normally greyish pink — a rather pale hue, but during development it darkens to reddish brown, vinaceous brown, and finally to snuff brown, as adult often without any red component. In some collections the veil is more reddish from the start, even to the extent of colouring the entire cap. In yet other collections, the red pigment is almost lacking, which led me to several wrong determinations in the field in the early years. The veil then appears pale grey-brown (sometimes

orange grey), darkening to umber with age, and the fungus is easily confused with certain forms of *C. brunneus* Fr., together with which it often grows.

Most frequently the spores are subglobose, in sharp contrast to the elongated spores of *C. armillatus*. However, I describe below a variety with obtusely ellipsoid spores of an intermediate size. All collections have abundant clavate to capitate basidiols on the gill edge.

A final noteworthy character is the smell and taste, which, though faint, are always pleasant, somewhat reminiscent of *Agaricus campestris* (the taste was distinctive only in the Var. B).

Spore distribution

The following scatter diagrams depict the spore width vs. length, averaged per collection. For comparison, a few measurements of *C. armillatus* have been added (Fig.2).

The diagrams show a clear separation into two groups, where the sole collection KS-CO301 (Fig.2) is intermediary. Despite this embarrassing exception, it is this author's current position that the two groups point at a taxonomic distinction at varietal level. The nomenclature question is dealt with below.

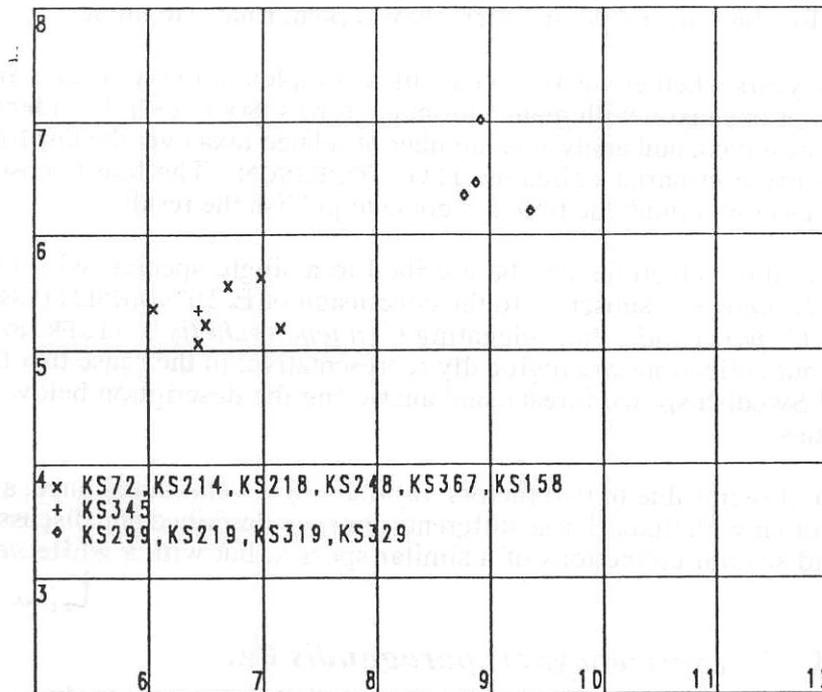


Fig.1 Main collection set (herbarium numbers, see below)

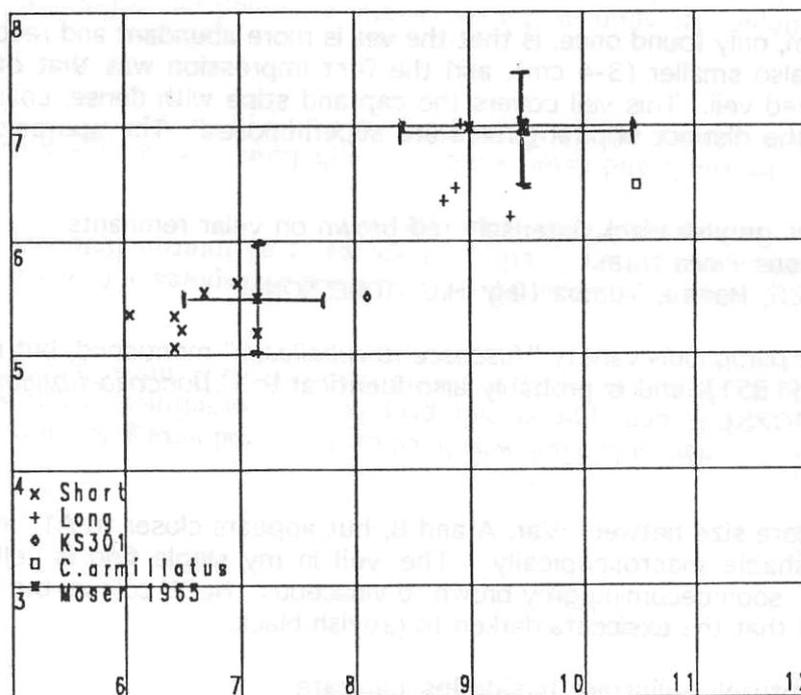


Fig.2 All collections, including *C. armillatus* and (with bars) Moser (1965)

Descriptions of Collections

Variety A (sp. subglobose)

Form A1

Cap 3.5–7 (10) cm; hemispherical, then campanulate with broad, obtuse umbo.

Cuticle dry; hygrophanous only towards the margin when old; pale grey brown ("cardboard brown") to tan, young sometimes with frosty, pinkish grey cover and sparse radial brownish red fibrils; centre more red brown, darkening; innately fibrillose, later finely squamulose; margin pale buff to grey; difficult to peel.

Stipe 6–9 cm × 6–12(20) mm; cylindrical to clavate, in one collection very robust; filled; pale buff, covered by a pale greyish, silky layer, which absorbs on pressure; with brownish red, sparse fibrils, forming 2–5 fuzzy, zig-zag, thin, adpressed girdles that later become snuff brown; apex pale grey; mycelial base white, often tinged greyish violet, imbedded in the humus, sometimes deeply.

Veil pink to pale red brown or brownish red, sometimes grey brown without red component, darkening; rather sparse.

Cortina white, fugaceous.

Gills pale cinnamon, edge greyish; broad; fairly distant (L=40–50, but also 30 seen, l=2–3); adnate, later broadly emarginate.

Flesh pale buff to greyish brown, marbled cinnamon; sometimes darkening on exposure and with age; in one young specimen greyish blue at stipe apex; rather soft; odor pleasant, agaricoid; taste mild.

Reactions: NaOH flesh and gills trivial, umber on stipe cortex, vinaceous on velar remnants.

Spores: (5)5.5–7(8) × 4.5–6 mm, globose to subglobose; *basidiols* containing numerous droplets, capitate, protruding 15–20 mm.

Habitat: in oligotrophic forests of *Picea abies*, among *Vaccinium*; fairly common.

Collections: KS-CO72 1985-08-06, Käglan, Fellingsbro; KS-CO158 1986-08-30, Styggforsen, Boda; KS-CO214 1987-08-07, KS-CO218 1987-08-09, KS-CO248 1987-09-04, Rölfors, Arboga; 1988-09-03, Ryssbol, Upsala; KS-CO367 1988-09-18, Almunge, Upsala.

Form A2

The main difference of this form, only found once, is that the *veil* is more abundant and redder than in form A1. The *cap* is also smaller (3–4 cm), and the first impression was that of a small *C. armillatus* with a dark red veil. This veil covers the cap and stipe with dense, coarse brown-red fibrils, upon which the distinct stipital girdles are superimposed. The *spores* are identical to those of Form A1.

Reactions: NaOH flesh and cuticle greyish black, intensely red brown on velar remnants.

Habitat: rich, probably calcareous *Picea* forest.

Collection: KS-CO345 1988-08-26, Hamra, Tumba (leg: H.G. Toresson).

This taxon agrees well with the *paragaudis* variety "*fuscescenti-rubellus*" mentioned, but not formally introduced, by FRIES (1851), and is probably also identical to *C. floccoso-fibrillosus* Britz. as described by HENRY (1978).

Form A3

This form is intermediate in spore size between Var. A and B, but appears closer to A1, from which it is almost indistinguishable macroscopically. The *veil* in my single find is yellow brown with a faint orange tinge, soon becoming grey brown to vinaceous. NaOH colours the veil remnants red. I have observed that the *exsiccata* darken to greyish black.

Spores: 7–8.5 × 5.5–6 mm, obtusely ellipsoid; *basidiols* capitate.

Habitat: in a rich *Picea* forest.

Collection: KS-CO301 1988-08-13, Lejondal, Kungsängen.

Variety B (sp. broadly ellipsoid)**Form B1**

Although the description largely coincides with that of Form A1, it is given in total, due to the possibility of varietal distinction.

Cap 4.5–8.5 (10) cm; hemispherical with flattened top, then convex with broad umbo.

Cuticle dry; weakly hygrophanous towards the margin only when old; pale grey brown to tan, centre young more red brown; innately fibrillose with sparse tufts; centre cracking in age; margin greyish, young long involute with red brown fibrils; difficult to peel.

Stipe 8–10 cm × 13–16 mm; clavate, often robust; filled; pale buff, covered by a white or greyish, silky layer, which absorbs on pressure; with 1–3 brown red to brick, fuzzy, zig-zag, thin, fibrous, adpressed girdles; apex darker grey; base darker reddish brown, up to 29(36) mm.

Veil pink to greyish brick, later red brown to vinaceous, or even snuff brown; rather sparse.

Cortina whitish to grey, abundant.

Gills rather dark greyish clay with a faint purple shade, in one case even violet tinged; edge greyish; broad; fairly distant (L=42, l=2); adnate, later broadly emarginate.

Flesh grey brown, sometimes almost "pastel" beige, marbled darker with faint violet tinge; odor and taste pleasant, agaricoid.

Reactions: NaOH trivial, except dark vinaceous brown on velar remnants; lugol, formalin, AgNO₃ nil; FeSO₄, guayac trivial; NH₃ releases a brown pigment from the gills in preparations.

Spores: 8.5–9.5(10.5) × 6.5–7.5 mm, obtusely ellipsoid; *basidiols* capitate, protruding 25 mm.

Habitat: in a rich *Picea* forest, dried-out bog bed among conifer needles; in a calcareous *Picea* forest among *Vaccinium*.

Collections: KS-CO219 1987-08-11, KS-CO299 1988-07-31, 1988-08-20, Tyresta, Stockholm; KS-CO329 1988-08-17, Sörviken, Hede.

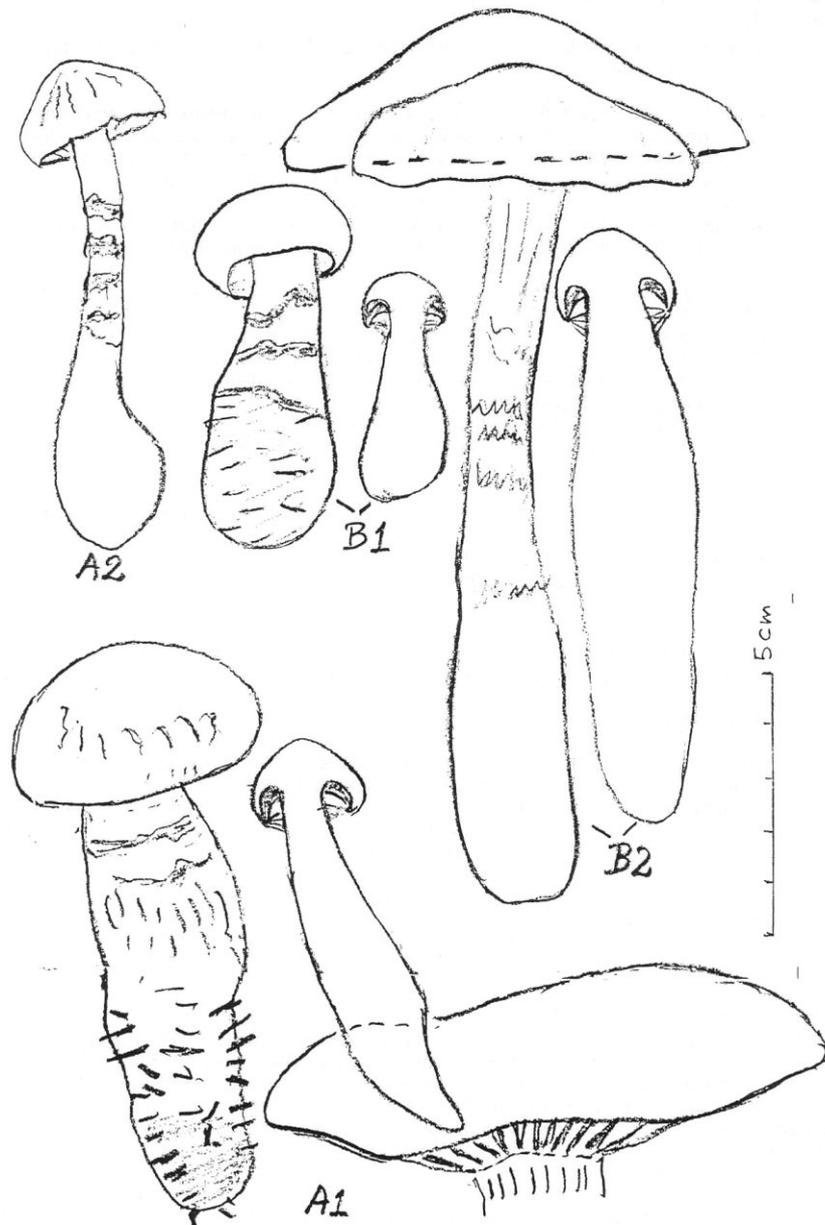


Fig.3 Fruiting bodies of *C. paragaudis*, the principal forms

Form B2

This form was only found in the northern, sub-alpine area of Central Sweden. It differs from form B1 in a darker *veil* that becomes even darker during development. As a consequence the entire fruiting body is darker, except the *gills*, which are paler than in Form A1, with a crenelated, almost pruinose, edge. The *spores* are similar.

The *cuticle* is dark brick, covered young with paler pinkish fibrils, later cinnamon, then darkening to blackish brown. The *stipe* has the same colour as in Form B1, but darkens, also on manipulation, and in some cases I detected a faint violet tinge on the lower half. The stipe is also longer (up to 17 cm) and cylindrical, reaching deep down in the coarse humus and *Vaccinium* litter that covers the vast spruce forests in the mountains.

Reactions: NaOH flesh and cuticle black, mauve on velar remnants.

Habitat: calcareous *Picea* forest.

Collection: KS-CO319 1988-08-14, Sörviken, Hede.

Taxonomic Separation

Undoubtedly the two main taxa, tentatively called "Var. A" and "Var. B", are very similar. Apart from spore size, they have very little consistent distinction. Macroscopically, Var. B appears darker, and this is due mainly to the darker veil in some collections, and to darker gills and flesh in others. On the other hand, one collection displays the paler colour of Var. A, yet possessing the more elongated spores. Var. B appears somewhat more robust, and seldom exhibits any hygrophanity whatsoever.

So far, I have found Var. B, exclusively on richer soil, either in the calcareous forests of the North (Härjedalen), or in mixed, plant-rich woodland among patches of spruce. Conversely, Var. A seems to favour poorer, acid forests, and I have never found it in the North. One might perhaps attribute the spore difference to geological factors. Var. A is by far the most common one in the low-land parts of Central Sweden (Södermanland, Västmanland).

The collections from the North — all Var. B — are quite common in the mountainous areas. They are on the average more robust than those from Västmanland. I have seen them and photographed them many times in the Hede and Björnrike areas over the years, but only recently started collecting them. This taxon is macroscopically related to *C. canabarb* Mos., not uncommon in the area, and to the rarer *C. fuscoperonatus* Kühn., with which it sometimes grows. Var. B can attain the size of the former, but is more likely to be confused with *C. fuscoperonatus*, which displays the same general habit and colours, though the belts on the stipe are more grey-brown. The veil of *C. canabarb* is originally pale greyish, but darkens quickly to snuff-brown; a process that is almost identical in the *C. paragaudis* case, albeit then with a pink hue. These close relatives do, in my opinion, form with *C. paragaudis* a natural group within *Sericeocybe*, even though any phylogenetic bond must remain speculative.

The presence of a blue to purple coloration in the fruiting body is an interesting character, to my knowledge not previously reported for *C. paragaudis*. It was only observed in Var. B, but is not always present. In Form B1, it appears as a bluish tinge in gills and flesh, and in Form B2 as a faint violet to purple coloration of the stipe cortex. In some collections the cap is almost copper brown, and the overall impression of this tall fruiting-body with its reddish girdles on a smoke-grey stipe is beautiful and bizarre.

Comparing the subject taxa with *C. armillatus*, one finds that the latter has an overall brighter coloration: more yellow-brown to tan. The veil is coral-red of a hue that was never found in our collections, and it changes but negligibly with time. The cap is also more squamulose in the centre, and of course the spores are significantly longer (9–11.5 × 6–7 μm).

[Later molecular studies have shown that "Var. B" is a separate species, *C. luteornatus* (Mos.) Bidaud & al., also known as *C. paragaudis* var. *œnochelis* Lindstr., whereas the name *C. paragaudis* is reserved for "Var. A". Collections of "Var. B" with a violaceous tinge are specifically distinct, described as *C. subœnochelis* Kytöv. et al.]

Nomenclature

Varieties A and B will not be formally introduced at this point, but I propose that the epithets *haematochelis* and *paragaudis* be reserved for future use as varietal names.

Fries' diagnosis and icon of *C. paragaudis* (1851) agree fairly well with my collections, though his species is somewhat darker in colour throughout and more hygrophanous. The coloration fits best with my Var. B, whereas the hygrophanity suggests Var. A. *C. craticius* is another close possibility for one of the forms, but no collection shows the telltale rimose formations on the cuticle, described by Fries.

M. MOSER (1965) describes Central European and Scandinavian finds of *C. haematochelis* and *C. paragaudis*, comparing the two taxa. Apart from spore size, the only significant difference is that *C. haematochelis* has cheilocystidia (probably corresponding to the basidiols found in all my collections). The macroscopic characters agree fairly well with my findings; one should note, however, that Moser's taxa are generally darker and more hygrophanous and therefore closer to Fries' *C. paragaudis*. The two spore sizes reported by Moser fit my Var. A and B, respectively (see Fig.2). The larger spores also agree with *C. armillatus* var. *luteornatus* Moser (*loc. cit.*), which has a similar general description, and might well be one of the forms (notably B2). I have also

considered *C. bovinus* Fr. ss Moser (1964), which appears at least related to the forms with a weakly red velar component. But since I have never encountered the latter taxon, I have not been able to ascertain whether it is in fact covered by the variational spectrum of our findings.

E. BENDIKSEN has recently (1989) described collections from Northern Norway that agree well with my Var. A. He has also examined several of my exsiccata, confirming my determination, and his spore measurements are included in Fig.1 and 2. In his paper, Bendiksen motivates the choice of the epithet *paragaudis* for the subject taxon, rejecting the name *haematochelis*.

Bendiksen's analysis has revealed the presence of anthraquinone pigment in the veil, but he mentions that Moser did not detect this compound in his *C. paragaudis*. I have no similar analysis of my own collections, but it is a fair assumption that the extreme variation I observe in the red velar component is paired with a gradient in anthraquinone content. My observations also indicate that the variation is due to individual abundance, as well as to a gradual decomposition of the pigment during development. At any rate, in the face of the present results, taxonomic distinction based on the presence of anthraquinone alone, in this particular species, appears untenable.

Another conclusion is that *C. paragaudis* seems intermediate between, on one hand *C. armillatus*, a species with incontestable anthraquinone pigment, and a group of several other sericeocyboid species lacking this compound (notably *C. fuscoaperonatus* Kühn.) on the other hand. Since the presence of anthraquinone is considered a significant phylogenetic factor (Høiland 1983), these observations are of utmost importance, not least in assessing the following taxon.

[Further observations of *C. fuscoaperonatus* have established that its veil in fact reacts with alkaline solutions, which suggests anthraquinonic contents. But molecular analyses have shown that this species is, in contrast to the others discussed, not part of sect. *Armillati*.]

***Cortinarius (Sericeocybe) suberi* Soop n. sp.**

Description

Cap 4–6.5 (10) cm; hemispherical with flattened top, then convex with turned-down border.

Cuticle dry; weakly hygrophanous only towards the margin; young shining white, fibrillose, later absorbing, becoming pale grey brown; centre yellowish grey, later more red brown; margin greyish; relatively easy to peel.

Stipe 6.5–10 cm × 9–12 mm; clavate, often robust; filled; pale grey brown, covered by a white, silky, fibrillose layer, which absorbs on pressure, and faint white girdles; base darker grey brown, up to 28 mm, imbedded in the humus; mycelial base aqueous, faintly violet tinged.

Veil and cortina pale grey to white; abundant .

Gills grey brown; edge concolorous; broad; free; fairly distant (L=44, l=2).

Flesh grey brown to grey, marbled darker; odor and taste faint, mild .

Reactions: NaOH nil everywhere; formalin nil or faintly pinkish in flesh; NH₃ releases a brown pigment from the gills in preparations.

Spores: 6.5–8 × 4.5–6 mm, obtusely ellipsoid to subglobose; *basidiols* sparse, capitate to cylindrical, protruding 20 mm; *exsiccata* darkening to greyish black.

Habitat: in calcareous *Picea* forests among *Vaccinium*.

Collections: KS-CO330 1988-08-17, Sörviken, Hede; KS-CO333 1988-08-18, Östbjörka, Rättvik.

Discussion

Generally, this is a fairly robust, barely hygrophanous, fibrillose, greyish fungus. As mentioned earlier, our first impression was *C. paragaudis* with a white veil, and as can easily be verified from the descriptions (copied almost verbatim from field notes, without a comparison in mind), they are indeed very similar. Due to the uncoloured veil, one also thinks about *C. malachius* Fr., a very common species in our forests, but the brownish flesh and short spores rule out any relation to the latter. We also had occasion to compare directly with *C. cf. bulbosus* Fr., a rare species in the same northern area, also rather similar, but possessing a hygrophanous, almost naked cap (Soop 1989).

[This species was later described as *C. brunneogriseus* Soop. (Agarica 1993), finally to be subsumed as a variety of *C. suberi* (Boll. Micol. Bresadola 2002), which is, in fact, genetically identical to the type.]

The subject species seems close to the group *Privigni*, and notably to *C. biformis* Fr., which is quite frequent in the Nordic countries (Soop 1989, Bendiksen 1989). The latter is a frankly hygrophanous fungus and a typical member of the subgenus *Telamonia*. It has a similar brownish flesh and identical spores, but the veil is sparser, and the general colour is warmer yellow (even orange) brown. In this group, *C. cf. bovinellus* Mos., which I have also found in the North, is quite similar, but possesses markedly larger spores.

C. privignus Fr. itself, while perhaps not well understood in the Nordic countries at present, has the same greyish colours as the subject taxon according to Fries, and grows in the same kind of forest. On the other hand, it has much sparser veil and is placed by Fries in the subgenus *Hydrocybe*, a fact which, in my opinion, alone rules out a direct identification. I have a few collections that I tentatively identify as *C. privignus*. It seems to be intermediate between *C. biformis* and the subject species, and produces the same spores, but is less robust and frankly hygrophanous.

Checking all likely Friesian species in the Monographia (1851), I have not found any that fits closely enough for a positive identification. With a key diverging feature in parentheses, the closest are: *C. licinipes* (cap glabrous), *C. triformis* (with a distinct girdle), *C. riculatus* (flesh white), *C. plumiger* (with dense squames), and *C. brunneofulvus* (cap glabrous). In general coloration, my species also resembles *C. diosmus* Kühn., which has been found in the area, but this has a distinct smell and longer spores.

In conclusion, the species belongs in, or close to, the sericeocyboid group of *C. paragaudis*, where it appears to form a bridge to the *Privigni* group in *Telamonia*. It is distinguished from the latter by a not (or weakly) hygrophanous cap, from the former by a white veil. One might speculate that it developed as an extreme form of *C. paragaudis*, where all coloured pigment has disappeared. Since I have not been able to positively identify it with any known taxon, I prefer to propose it as a new species, rather than forcing a fit to an extant description.

[*C. suberi* has finally been shown to nest in sect. *Malachii*.]

Cortinarius (Sericeocybe) suberi n. sp. *In silvis calcariis cum Picea, vix hygrophanus, solidus, C. paragaudi e C. biformi affinis. Pileo obtuso, deinde convexo, pallide cinereofusco, at primo albofibrilloso. Stipite clavato, carnosus, cum pileo concolore, reliquiis veli fibrilloso, leviter cingulato, tactu obscurato. Lamellis concoloribus, latis, subdistantibus. Carne pallide fusca, odore saporeque nullis. Velo cortinaeque canescentibus, fere copiosis. Sp. obtuse ellipsoideis vel subglobosis, 6.5-8 × 4.5-6 mm. React. carne ope NaOH vix ulla. Holotypus in herb. auct. sub num. KS-CO333 conserv.*

NILS SUBER, nestor mycologiæ suevicæ in memoriam.

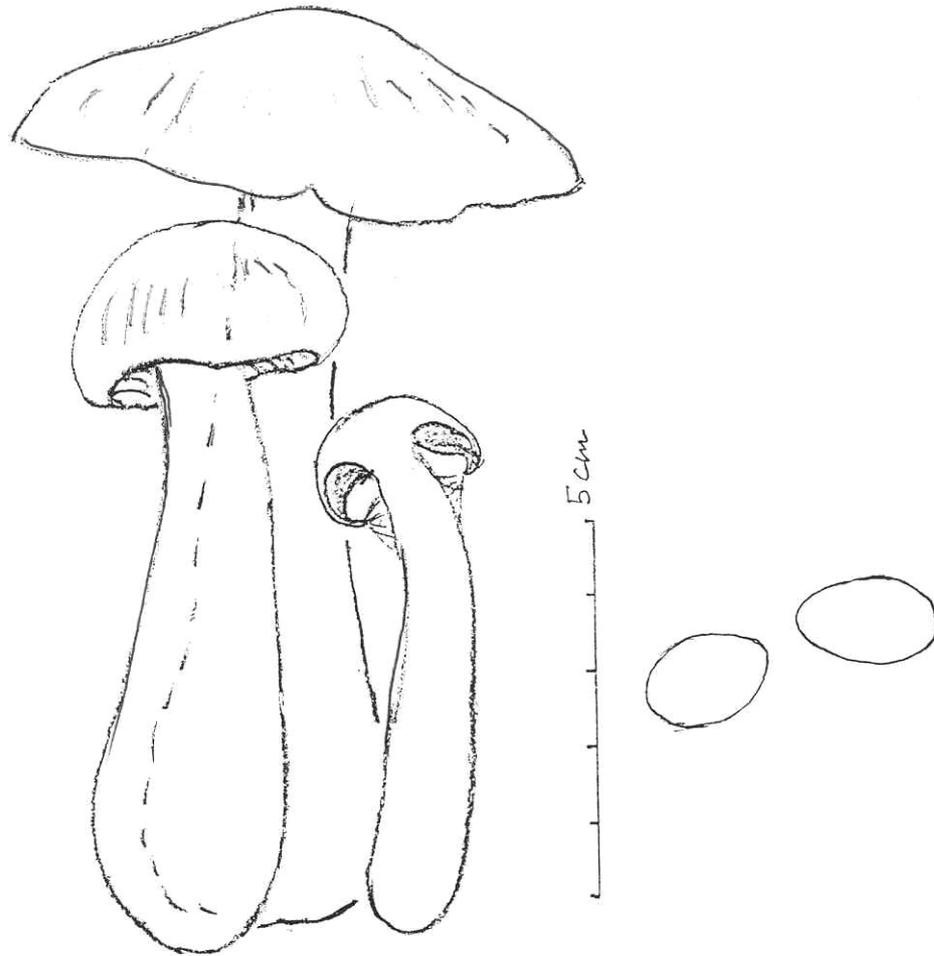


Fig.4 Fruiting bodies and spores of *C. suberi* nov. sp.

Acknowledgments

I would like to thank E. BENDIKSEN and J. MELOT for reviewing the manuscript.

References

- Bendiksen E. 1989: "Bidrag till soppfloraen i Skjomen, Nordland", in prep. for *Agarica*
- Fries E. 1851: *Monographia Cortinariorum Suecicae*, Uppsala
- Henry R. 1978: "Cortinaires nouveaux ou rares de la région Languedoc-Cévennes 1ère note)" — *Documents Mycologiques* 32, p 1
- Høiland K. 1983: "*Cortinarius*, subgen. *Dermocybe*" — *Opera Botanica* 71
- Moser M. 1964: "Über einige *Hydrocybe*-Arten mit graubraunem Velum" — *Schw. Z. für Pilzk.* 42 10: 145
- Moser M. 1965: "Studien zu *Cortinarius* Fr. Subgen. *Telamonia* Sect. *Armillati*" — *Schw. Z. für Pilzk.* 43,8: 113
- Soop K. 1987: "Notes et Observations sur les Cortinaires de Suède"— *Documents Mycologiques* 68: 45
- Soop K. 1988: "*Cortinarius cremeolaniger* Orton found in Sweden"— *Agarica* 1: 92
- Soop K. 1989: "Notes et Observations sur les Cortinaires (suite)", submitted to *Documents Mycologiques*