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## A note on the pdf-links

The key to Cortinarius is divided into a main key to the subgenera and secondary keys to the sections and groups. In this pdf-version we have linked down this hierarchy to the sections. To go back up there are two arrows at the base of each page, the large linking to the main key, the small to the start of the keys to the sections of the present subgenus.

*Cortinarius* (Pers.) Gray

TUULA NISKANEN, ILKKA KYTÖVUORI,  
EGIL & KATRIINA BENDIKSEN, TOR ERIK BRANDRUD,  
TOBIAS GULDBERG FRØSLEV, KLAUS HØILAND,  
THOMAS STJERNEGAARD JEPPESEN, KARE LIIMATAINEN & HÅKAN LINDSTRÖM

Frb mycenoid, collybioid or tricholomatoid, with rusty sp-deposit and fugacious veil. Cap (5-)20-140(-200) mm, usually convex to low convex, silky smooth to rarely scaly, dry to glutinous, hygrophanous or not. Gills emarginate or adnate, variously coloured when young, soon becoming brown. Stem usually cylindrical, clavate or abruptly bulbous. Universal veil present, in some species very sparse, white, yellow, red, blue, greenish, brownish or blackish. Partial veil cobweb-like, remains often as loose threads on upper part of stem, becoming cinnamon brown from the fallen sp. Smell indistinct or significant, often best observed in gills, sometimes in flesh, gills and flesh may have a different smell. Flesh variously coloured. KOH reaction on surface or flesh is an important character, especially in subgen. *Phlegmacium*. Taste mild, sometimes bitter, seldom farinaceous. Since a few *Cortinarius* species are toxic, even in only small quantities, tasting them is not recommended for beginners. Sp deposit cinnamon brown to fulvous.

Sp subglobose, ellipsoid, amygdaloid, citriform or fusiform, weakly to strongly verrucose, without a germ pore, pale ochre fulvous to rusty, in most species dextrinoid. Marginal cells often basidiiform, rarely with true cheilocystidia, but cheilocystidia prominent in some few species. Pleurocystidia mostly absent. Pileipellis a cutis or an ixocutis, subpellis present or not. Clamps present, rarely absent.

Ectomycorrhizal, on soil, in association with trees and shrubs, one *Dermocybe* species reported to grow with *Carex*; often late summer to autumn. *C. orellanus*, *C. rubellus* and possibly also *C. splendens* are deadly poisonous, some slightly poisonous, e.g. species in sect. *Dermocybe*, some edible and some good for dyeing.

*Cortinarius* is the biggest genus of *Agaricales*, and many species are still very poorly known or not known at all. Based on recent phylogenetic studies it is assumed that at least 900 species occur in the Nordic countries, but many are poorly known, 369 species in the key. The infrageneric classification of *Cortinarius* will change during the coming years, but here the classification in subgenera largely follows Brandrud et al. 1989.

Lit.: Bidaud et al. 1992, 1993, 1994ab, 1995, 1996, 1997, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, Brandrud et al. 1989, 1992, 1994, 1998, Consiglio et al. 2003, 2004, 2005, 2006, Moënné-Loccoz et al. 1990ab, 1991, Moser 1983, Soop 2006.

## Key to subgenera

1. Universal veil forming on stem a distinct, protruding ring which comes off easily. Cap 50-130 mm, hemispherical, then low convex to almost plane, sometimes with a low and broad umbo, often radially wrinkled and rimy at the centre, pale ochraceous brown, sometimes with violet tints, not hygrophanous; gills crowded to medium spaced, first pale greyish, later brownish; stem 70-150 x 10-20 mm, cylindrical, dirty whitish fibrillose, often with zigzag pattern above the ring; universal veil whitish or sometimes pale violet; flesh whitish; smell weak, pleasant; taste mild. Sp 12-13.5 x 7-8(-8.5)  $\mu\text{m}$ , citriform (fig. 663A), moderately to fairly strongly verrucose, fairly strongly dextrinoid; gill trama hyphae smooth, some with granulose contents. In coniferous forests with *Picea* and *Pinus*, in deciduous forests with *Fagus* or *Quercus*, in subalpine forests with *Betula*, and in alpine areas with *B. nana*; late summer to autumn; common, locally very common in hemib.-arc./alp., but rare in IS, rare in temp.; DK (vu), FI (lc), IS, NO (lc), SE (lc). – Lud 78.1, Nyl 521, R&H 524, Sieniop 250, Ves 343, ☉.  
*C. caperatus* (Pers.: Fr.) Fr. (*Rozites caperatus* (Pers.: Fr.) P. Karst.)
  - Universal veil indistinct or forming girdles or zones on the stem 2
2. Cap viscid to glutinous when moist 3
  - Cap dry or faintly viscid when moist 4
3. Stem viscid to glutinous, often cylindrical or tapering at base subgen. *Myxacium* p. 672
  - Stem dry, often with bulbous base subgen. *Phlegmacium* p. 680
4. Taste  $\pm$  bitter in cap cuticle; cap whitish, ochraceous to greyish ochraceous subgen. *Myxacium* p. 672
  - Taste mild in cap cuticle; cap white to yellowish, brown or black 5
5. KOH-reaction yellow subgen. *Phlegmacium* p. 680
  - KOH-reaction different, not yellow 6
6. Cap and stem with bright colours: red, yellow, orange, olive, green or dark violet subgen. *Cortinarius* p. 662
  - Cap and stem without bright colours, but can be very blue, or the stem may have bright coloured universal veil belts subgen. *Telamonia* p. 721

Subgen. *Cortinarius* TUULA NISKANEN, ILKKA KYTÖVUORI & KLAUS HØILAND

Cap and stem dry. Frb entirely dark violet, or with bright colours: red, yellow, orange, olive or green, sometimes in gills only. Cap 20-110 mm, often tomentose or scaly, often not hygrophanous. Universal veil brightly coloured and most often also mycelium. Smell indistinct, raphanoid, like cedar-tree or iodoform. Sp subglobose, ellipsoid or amygdaloid.

31 species included in the key, but the real number of the species in the Nordic countries is not known.

1. Frb dark violet, fleshy; cap usually 50-110 mm; sp > 11  $\mu\text{m}$  long; true cheilo- and pleurocystidia present Key A sect. *Cortinarius* p. 663
  - Frb not dark violet; cap 10-100 mm; sp usually < 11  $\mu\text{m}$  long; only with small, basidioform marginal cells 2
2. Cap 10-60(-70) mm, not or only slightly hygrophanous; young gills bright orange, yellow or red; sp ellipsoid to amygdaloid Key D sect. *Dermocybe* p. 667
  - Cap (20-)40-100 mm, hygrophanous or not; young gills white, yellowish white, brownish yellow, olivaceous or reddish brown, but not bright; sp subglobose, amygdaloid, ellipsoid or fusiform 3



Spores: A: *Cortinarius caperatus*, B: *C. violaceus*, C: *C. hercynicus*, D: *C. cotoneus*.

3. Sp broadly ovoid to subglobose 4  
 - Sp amygdaloid, ellipsoid or fusiform 7
4. Frb olivaceous green, olivaceous yellow to yellowish brown [Key B sect. \*Veneti\* p. 664](#)  
 - Frb yellow, yellowish red to red brown 5
5. Universal veil absent or very thin; cap 20-60 mm; sp 6-7 x 4.5-5.5  $\mu\text{m}$ , subglobose [see \*Telamonia\* key M, sect. \*Renidentes\* p. 762](#)  
 - Universal veil present; cap usually 30-110 mm; sp usually bigger 6
6. Smell indistinct, like raw potatoes, faintly of cedar wood, a just extinguished candle or warm iron or faintly raphanoid; universal veil yellow to orange; with deciduous or coniferous trees [Key C sects \*Limonii\*, \*Orellani\* & \*Humicolae\* p. 665](#)  
 - Smell strong, raphanoid or earthy; universal veil usually white, sometimes yellow, rarely bright orange; with deciduous trees [see \*Telamonia\* key N, sect. \*Hinnulei\* etc. p. 762](#)
7. Flesh staining distinctly yellow when cut, initially whitish; sp on av < 4.5  $\mu\text{m}$  wide [see \*C. rubicundulus\* p. 715](#)  
 - Flesh not staining yellow when cut, initially  $\pm$  brownish; sp on av > 4.5  $\mu\text{m}$  wide 8
8. Whole frb cinnabar red [see \*C. cinnabarinus\* p. 736](#)  
 - Whole frb not cinnabar red 9
9. Stem < 5 mm wide [see \*Telamonia\* key Q, sect. \*Anthracini\* etc. p. 775](#)  
 - Stem usually > 5 mm wide 10
10. Sp broadly ovoid to amygdaloid; smell indistinct, like cedar-wood or faintly raphanoid [Key C sects \*Limonii\*, \*Orellani\* & \*Humicolae\* p. 665](#)  
 - Sp subglobose, ellipsoid or obovoid; smell raphanoid or earthy [see \*Telamonia\* key N, sect. \*Hinnulei\* etc. p. 762](#)

**Key A: Subgen. *Cortinarius* sect. *Cortinarius*** TUULA NISKANEN & ILKKA KYTÖVUORI

Two species in the Nordic countries. Ecology and distribution of the species not fully known.

Suppl. lit.: Brandrud 1983.

1. Sp 11.5-13.5 x 7.5-8(-8.5)  $\mu\text{m}$ , amygdaloid, moderately verrucose (fig. 663B); presumably in deciduous forests with *Populus tremula*, *Betula* or *Fagus*. Cap 50-120 mm, hemispherical then low convex, sometimes with a low and broad umbo, tomentose to finely scaly, not hygrophanous, violet; gills medium spaced to distant, rather broad, dark violet, later purplish brown; stem 60-140 x 10-20 mm, clavate to bulbous, violet; universal veil dark grey, forming incomplete girdles and zones on the stem; flesh violet; smell rather strong, recalling pen-

cil; KOH-reaction blood red on flesh. Cheilo- and pleurocystidia 60-95 × 15-25 µm, usually lageniform-fusiform to weakly lageniform, with bluish to brownish content, abundant. Autumn; occasional in temp.-bore.; DK (LC), FI (LC), NO (LC), SE (LC). – CFP C37, Ves 343, ☉.

*C. violaceus* (L.: Fr.) Gray

Note: photos of *C. violaceus* s. lato: GCI B199, Nyl 434, Phil 186b, R&H 488, Sieniop 223.

- Sp 11-13.5 × (7.5-)8-9 µm, broadly ovoid, strongly verrucose (fig. 663C); presumably in *Picea*-dominated forests, often on rich soil. Cap 50-120 mm, hemispherical, then low convex, sometimes with a low and broad umbo, tomentose to finely scaly, not hygrophanous, violet; gills medium spaced to distant, rather broad, dark violet, later purplish brown; stem 60-140 × 10-20 mm, clavate to bulbous; universal veil dark grey, forming incomplete girdles and zones on the stem, violet; flesh violet; smell rather strong, recalling pencil; KOH-reaction blood red on flesh. Cheilo- and pleurocystidia 60-95 × 15-25 µm, usually lageniform-fusiform to weakly lageniform, with bluish to brownish content, abundant. Autumn; occasional in hemib.-bore.; FI, SE. – CFP A21.

*C. harcynicus* (Pers.) M.M. Moser ('*harcynicus*')

**Key B:** Subgen. *Cortinarius* sect. *Venetii* Konrad & Maubl.

TUULA NISKANEN & ILKKA KYTÖVUORI

Frbs with yellowish, olivaceous or greenish colours; cap (20-)40-100 mm, tomentose to scaly, not or only slightly hygrophanous; stem cylindrical or clavate; universal veil olivaceous yellow, olivaceous green or blackish brown; sp subglobose; KOH-reaction in most species red to red brown on flesh; fluorescence yellow.

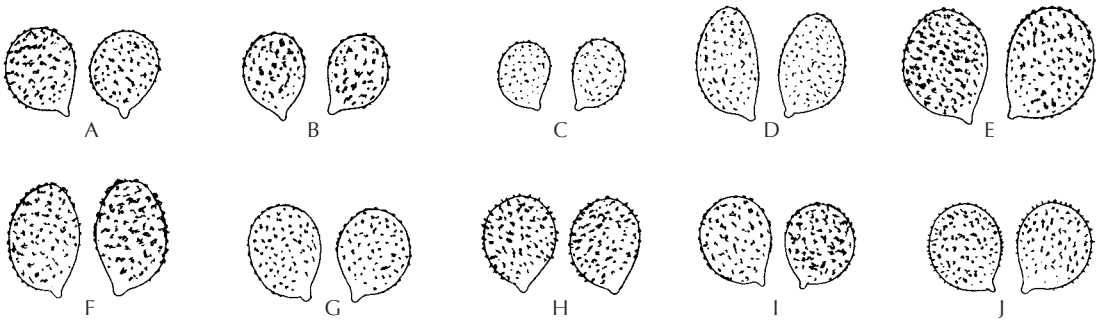
1. Sp 8.5-9.5(-10) × (7-)7.5-8 µm; with thermophilous deciduous trees; frb stout; cap (40-)50-100 mm. Cap hemispherical then convex to low convex, tomentose to finely scaly, margin often down-curved, olivaceous greenish yellow to olivaceous brown, not hygrophanous; gills medium spaced, olivaceous yellow; stem 50-110 × 8-20 mm, clavate to bulbous, up to 30 mm broad at base, pale olivaceous greenish; universal veil olivaceous green to olivaceous brown, forming zones and girdles on the lower 2/3 of the stem; flesh pale olivaceous to yellowish brownish; smell distinctly of radish; KOH-reaction red on cap, flesh and gills; fluorescence yellow; exsiccates with yellow-brown cap, olivaceous-yellowish brown gills and yellow stem. Sp subglobose, strongly and coarsely verrucose (fig. 663D), thick-walled, strongly dextrinoid. In deciduous forests with *Corylus*, *Fagus*, *Quercus* and *Tilia*, often on calcareous soil; late summer to late autumn; rare in temp.-hemib., more rare towards the northern parts, very rare in southern bore.; DK (vu), NO (vu), SE (LC). – CFP B01, M&J 110, Nyl 435, Ves 345, ☉.

*C. cotoneus* Fr.

- Sp < 8 × 7 µm; most often with coniferous trees; frb usually more slender; cap 30-70 mm    2
- 2. Cap without dark scales but can be tomentose or with small, concolorous scales; universal veil olivaceous yellow, often sparse, forming incomplete girdles on stem; sp subglobose (fig. 665A). Cap 20-70 mm, hemispherical later low convex, olivaceous green to olivaceous brown later more red brown, slightly hygrophanous; gills medium spaced, pale olivaceous greenish, later more brownish; stem 40-80 × 5-10 mm, cylindrical to somewhat clavate, olivaceous yellow; flesh pale olivaceous-yellowish-brownish; smell faintly of radish; KOH-reaction red to brown red on cap and flesh; fluorescence yellow; exsiccates with yellowish-greenish brown cap, pale yellowish-brownish stem, olivaceous-brownish gills and yellow mycelium. Sp 6.5-7.5 × 5.5-6 µm, moderately to strongly verrucose, moderately to strongly dextrinoid. In mesic *Picea* forests, or rarely with *Pinus*, very rarely with *Fagus* (SE: Sk) or *Tilia* (west NO), on calcareous soil; late summer to autumn; rare in hemib.-bore., locally abundant; DK (LC), FI (NT), NO (LC), SE (NT). – CFP A15 C55, R&H 489, Nyl 435.

*C. venetus* (Fr.: Fr.) Fr.

- Cap with dark scales; universal veil dark, blackish brown, abundant, forming



Spores: A: *Cortinarius venetus*, B: *C. melanotus*, C: *C. phrygianus*, D: *C. humicola*, E: *C. rubellus*, F: *C. orellanus*, G: *C. limonius*, H: *C. tofaceus*, I: *C. callisteus*, J: *C. citrinofulvescens*.

distinct incomplete girdles and zones; sp obovoid-subglobose

3

3. Smell of parsley or radish; cap tomentose to finely dark scaly, olivaceous brown to olivaceous green, at centre dark blackish brown; stem with blackish brown veil remnants; sp 6.5-7.5(-8) x 5-6  $\mu\text{m}$  (fig. 665B). Cap 30-80 mm, hemispherical, later low convex, margin often down-curved, not hygrophanous; gills medium spaced, pale olivaceous yellowish brownish; stem 30-80 x 6-12 mm, cylindrical to tapering downwards, firm, whitish yellowish; flesh whitish yellow to pale olivaceous yellowish; KOH-reaction red brown on flesh; fluorescence yellow; exsiccates with dark olivaceous brown cap, olivaceous-brownish gills, olivaceous-yellowish stem and yellow mycelium. Sp strongly verrucose, strongly dextrinoid. In *Pinus* forests on calcareous soil; late summer to autumn; very rare in hemib.; SE (vu, Gtl, ÖL: Halltorps Hage). – CFP D56, M&J 1.

*C. melanotus* Kalchbr.

- Smell indistinct; cap distinctly dark scaly, ground colour olivaceous yellow to reddish yellow; stem with olive-brown veil girdles; sp 5.5-6.5 x 4.5-5  $\mu\text{m}$  (fig. 665C). Cap 30-70 mm, hemispherical later low convex, not hygrophanous; gills crowded to medium spaced, ochraceous yellow; stem 40-80 x 6-12 mm, cylindrical to clavate, whitish yellowish; KOH-reaction greenish yellow or negative on flesh; fluorescence yellow; exsiccates with dark brown cap, brown gills and yellowish brown stem. Sp fairly finely to moderately verrucose, moderately dextrinoid. In dry to mesic coniferous forests with *Pinus*, often on calcareous soil; late summer to autumn; very rare in hemib.-bore.; FI (NT), NO (EN), SE (vu). – CFP A30, Nyl 436, Sieniop 212.

*C. phrygianus* (Fr.) Fr.

**Key C:** Subgen. *Cortinarius* sects *Limonii* Nezdajm., *Orellani* M.M. Moser, *Humicola* Liimat. & Niskanen in press and *Callistei* Liimat. & Niskanen in press

TUULA NISKANEN, HÅKAN LINDSTRÖM & ILKKA KYTÖVUORI

Frb yellowish, dull orange or red brown; cap usually 40-90(-110) mm; sp broadly amygdaloid to subglobose. Seven species in the key, but at least a few more species, still not fully known, occur in the Nordic countries.

1. Stem usually < 6 mm broad; cap 30-60 mm, strongly hygrophanous see *C. gentilis* p. 735
- Stem usually > 6 mm broad; cap 40-90(-110) mm, less or not hygrophanous 2
2. Cap greyish to yellowish white, with red scales see *C. bolaris* p. 730
- Cap yellow, yellowish brown to red brown, without red scales 3



3. Cap and stem distinctly recurved scaly; in *Fagus* forests, often on somewhat richer soil. Cap 20-60 mm, conical, then convex with an acute umbo, dull yellow, not hygrophanous; gills medium spaced, yellowish white, later pale brownish yellow; stem 40-100 x 5-10 mm, cylindrical to tapering downwards, ochre yellow, whitish at the top; universal veil yellowish brown, forming distinct scales on the stem; flesh whitish at stem top, darker yellow brown towards the base; smell faint of cedar wood; exsiccates entirely ochraceous red brown. Sp 8.5-9.5 x (5-)5.5-6  $\mu\text{m}$ , broadly ovoid to amygdaloid, fairly finely to moderately verrucose (fig. 665D), moderately dextrinoid. Late summer to autumn; very rare in temp.-hemib.; DK (EN), NO (CR, Tel: Kragerø), SE (VU). – CFP C17, GCI D111, M&J 111, Nyl 440, Phil 188a, ☉.  
*C. humicola* (Qué.) Maire
  - Cap small scaled to smooth; stem not scaly; in deciduous or coniferous forests 4
4. Sp > 9  $\mu\text{m}$  long; young gills saturated red brown to orange brown, distant 5
  - Sp < 9  $\mu\text{m}$  long; young gills whitish yellow to yellowish brown, medium spaced 6
5. In hemib.-bore. in damp to mesic, oligotrophic *Picea* forests, in western Norway also in mixed *Betula-Pinus* forests, rarely with *Fagus*; cap often with an acute umbo; universal veil forming distinct zones on the stem; sp > 7  $\mu\text{m}$  wide, Q < 1.4 (fig. 665E). Cap 30-80 mm, conical, then low convex, tomentose to finely scaly, saturated reddish to orange brown, not hygrophanous; gills distant and broad, saturated red brown; stem 50-130 x 7-15 mm, clavate and often pointed at the base, sometimes cylindrical, ochraceous yellow, then reddish brown; universal veil yellow, contrasting with the darker stem; flesh pale yellowish white to more red brown; smell faintly of radish; exsiccates with red brown, somewhat dark cap, brown gills and red brown stem. Sp 9-10.5(-11) x 7-8(-8.5)  $\mu\text{m}$ , ovoid to obovoid-subglobose, fairly finely to moderately and densely verrucose, weakly dextrinoid. Often in *Sphagnum*, but especially in coastal areas also with other mosses; autumn; common in hemib.-middle bore., occasional in northern bore., most frequent in oceanic areas, rare in temp.; DK (LC), FI (LC), NO (LC), SE (LC). – CFP A58, Nyl 438, R&H 491, Sienip 214, Ves 344, ☉. – Deadly poisonous  
*C. rubellus* Cooke (*C. speciosissimus* Kühner & Romagn., *C. orellanoides* Rob. Henry)
  - In temp.-hemib. in dry, thermophilous, deciduous forests, mainly with *Quercus*, *Tilia* and *Corylus*, but also with *Fagus*; cap usually without an umbo; universal veil sparse; sp < 7  $\mu\text{m}$  wide, Q > 1.4 (fig. 665F). Cap 30-80 mm, hemispherical, then low convex, tomentose to finely scaly, saturated orange red brown to ochraceous brown, darkening with age, not hygrophanous; gills distant and broad, saturated orange red brown; stem 40-100 x 7-15 mm, cylindrical to somewhat tapering downwards, yellowish, later more red brown; universal veil yellowish; flesh pale yellowish, darker at the base; smell indistinct or faintly of radish; exsiccates with red-brown, somewhat dark cap, brown gills and red-brown stem. Sp 9-10(-10.5) x 6-6.5  $\mu\text{m}$ , amygdaloid to broadly amygdaloid, fairly finely to moderately and densely verrucose, weakly dextrinoid. Often on acid soil, thermophilous; late summer to autumn; very rare in temp.-hemib., less rare in southernmost NO, very rare in DK; DK (VU), NO (LC), SE (LC). – CFP A20, M&J 63, Nyl 438, R&H 490, Ves 344. – Deadly poisonous.  
*C. orellanus* Fr.
6. Cap when young orange to orange brown, smooth, hygrophanous; stem cylindrical or often tapering downwards. Cap 30-80 mm, hemispherical, then low convex to almost plane, often with a low and broad umbo, with age slightly scaly towards the margin and more reddish brown, as dry yellowish; gills medium spaced, yellow, then brownish yellow; stem 50-110 x 6-18 mm, yellow, fibrillose; universal veil yellow to orange brown, forming incomplete girdles on the stem; flesh yellowish, reddish brown towards the base; smell indistinct; exsiccates with red-brown cap, brown gills and yellow-brown stem. Sp 7.5-8.5 x 6-6.5  $\mu\text{m}$ , subglobose, often somewhat more elongate, fairly finely to moderately verrucose (fig. 665G), weakly dextrinoid. In mesic to damp *Picea* forests and in *Pinus* forests on shallow soil; summer to autumn; common in hemib.-bore., rare in the north, rare in temp.; DK (LC), FI (LC), NO (LC),

SE (LC). – CFP B34, Nyl 439, R&H 493, Sieniop 205, Ves 345.

*C. limonius* (Fr.: Fr.) Fr.

- Cap when young yellow, golden yellow to brownish yellow, scaly or almost smooth, not or somewhat hygrophanous; stem clavate to cylindrical 7
- 7. Cap distinctly and minutely scaly to almost tomentose; stem cylindrical to slightly clavate; smell like raw potatoes or old cellar; sp subglobose to somewhat more elongate,  $Q_{av} > 1.25$ . Cap 40-110 mm, hemispherical, then low convex to almost plane, golden to orange yellow, scales and later the whole cap orange brown, not hygrophanous; gills medium spaced to distant, yellowish brown to more brown with age; stem 40-100 x 7-15(-20) mm, yellowish, with age more brownish; universal veil orange yellow, later more brownish, forming incomplete girdles; flesh ochre yellow to almost white in the cap, orange brown in stem base; exsiccates with orange-brown cap, brown gills and yellow-brown stem. Sp 7.5-8 x 5.5-6.5  $\mu$ m, subglobose to somewhat elongate, moderately verrucose (fig. 665H), moderately dextrinoid. In deciduous forests with *Fagus*, *Quercus* and *Corylus*, but also in coniferous forests; very rare in temp.-hemib.; DK (EN), FI, NO (EN), SE (NT).

*C. tofaceus* Fr.

- Cap smooth or punctulate to very finely scaly; stem clavate; smell often strong, like a just extinguished candle (ozone) or like apples; sp subglobose,  $Q_{av} < 1.25$  8
- 8. Cap dull yellow, soon brownish yellow to orange brown; in exsiccates red brown to fairly dark yellow brown; universal veil yellowish, soon yellow brown; smell usually strong, like just extinguished candle (ozone), more seldom like apples; sp 7-7.5(-7.7) x 5.5-6.5  $\mu$ m subglobose to obvoid-subglobose, moderately verrucose (fig. 665I). Cap 30-90 mm, hemispherical, later low convex, punctulate to very finely scaly at the centre, not hygrophanous; gills moderately crowded, light yellow, later brownish yellow; stem 40-120 x 8-15 mm, light yellow at the top, downwards yellow brown; universal veil forming zones on the stem; flesh yellow, orange brown towards the base. Sp fairly weakly dextrinoid. In mesic coniferous forests, usually with *Picea*, sometimes with *Pinus*, on rich to calcareous soil; rare in hemib.-bore., more rare towards the north, very rare in temp.; DK (RE), FI (LC), NO (LC), SE (LC). – CFP E22.

*C. callisteus* (Fr.: Fr.) Fr.

- Cap bright yellow, often with an orange tint at the centre; exsiccates lighter, with golden yellow to somewhat more brownish cap; universal veil persistently yellow; smell often faint and then more like apples, sometimes stronger, like a just extinguished candle (ozone); sp 7.5-8.2 x 6-6.5  $\mu$ m, ovoid-subglobose, finely and sharply verrucose (fig. 665J). Cap 30-90 mm, hemispherical, later low convex, smooth to punctulate or very finely scaly, somewhat hygrophanous; gills medium spaced, whitish yellow, later more brownish yellow; stem 40-120 x 8-15 mm, light yellow, often almost white at the top; universal veil forming incomplete girdles on the stem; flesh whitish yellow, golden yellow to yellowish brown towards the base. Sp weakly dextrinoid. In mesic *Picea* forests, often on rich soil; occasional in bore., more common towards the north, rare in hemib.; FI, SE. – CFP E23, Soop 04:6, Sieniop 193 (as *callisteus*).

*C. citrinofulvescens* M.M. Moser (*C. callisteus* (Fr.: Fr.) Fr. s. auct. p.p.)

#### Key D: Subgen. *Cortinarius* sect. *Dermocybe* Pers.

KLAUS HØILAND

Frb with central stem. Cap 10-80(-100) mm, conical, convex to plane, smooth, felty to depressed scaly, yellowish to red or brownish. Gills as young vivid yellow, orange, olivaceous, red or carmine, as older more rust coloured by the spores. Stem yellowish to red or brownish. Veil insignificant or forming belts on stem and remnants on cap margin. Smell indistinct or like radish. Taste mild. Sp deposit rusty brown.

Sp ellipsoid to amygdaloid, verrucose, but nearly smooth and cylindrical in one species, verrucose, brown. Cystidia not present, but sterile cells usually present on gill edge. Pileipellis usually



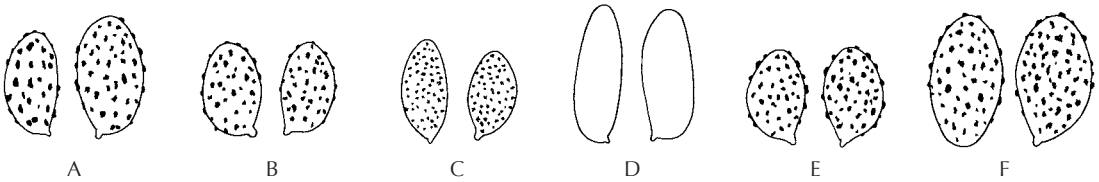
an epicutis of more or less parallel hyphae, subpellis weakly developed, except in *C. olivaceofuscus* that has a distinct subpellis of swollen hyphae. Clamps present.

Ectomycorrhizal, most common in forests on poor soil, in mires or in alpine vegetation.

18 species in the Nordic countries. The species contain pigments in the form of variously coloured anthraquinones, which have played an important role in chemotaxonomy. These colours can be used in dyeing of wool.

Suppl. lit.: Høiland 1981, 1984, Moser 1972, 1973, 1974a, 1974b, 1976.

1. Young gills red, red brown or carmine red 2  
- Yong gills yellow, olivaceous or orange 8
2. Cap hygrophamous 3  
- Cap not hygrophamous 4
3. Entire frb cinnabar red see *C. cinnabarinus* p. 736  
- Cap dull purple brown to dull purple see *C. anthracinus* and *C. danicus* p. 775
4. Cap and stem dark red to carmine 5  
- Cap and stem ochraceous to brownish 6
5. Cap when young without a brownish tint; entire frb deep carmine. Cap 25-45 mm, umbonate to plane; stem 30-85 x 3-7 mm. Sp (6-)6.5-8.5(-10) x (4-)4.5-5.5(-6)  $\mu\text{m}$ , usually ovoid (fig. 669A). On rather moist, mossy soil in dense *Picea* forests, rarely with deciduous trees; late summer to autumn; common in hemib.-bore., north to Finnm and InL, occasional in temp.; DK (LC), FI (LC), NO (LC), SE (LC). – CFP A57, Däh 710, Phil 205e, R&H 486, Ves 346, ☉. – Excellent for dyeing.  
*C. sanguineus* (Wulfen: Fr.) Fr. var. *sanguineus*  
- Cap when young somewhat brownish; frb elsewhere deep carmine. Sp usually amygdaloid. In other characters like the main variety. On rather moist, mossy soil in dense *Picea* forests; late summer to autumn; occasional in hemib.-bore.; FI, NO, SE. – Excellent for dyeing.  
*C. sanguineus* (Wulfen: Fr.) Fr. var. *vitiosus* M.M. Moser
6. Gills when young deep orange red brown to rusty red. Cap 19-85 mm, conical to plane, bright red brown to purplish chestnut; stem 29-105 x 3-12 mm, with orange, red or red-brown veil remnants, at the base with bright orange-yellow to orange mycelial felt. Sp 6-8.5(-10) x 4-5.5(-6)  $\mu\text{m}$ , ovoid to amygdaloid. In damp *Picea* forests on intermediate to rich soil, rarely under *Pinus*; summer to autumn; occasional in hemib.-suba., rare in temp., not in western NO; DK (DD), FI (LC), NO (LC), SE (LC). – CFP A14, Svp 4:70. – Excellent for dyeing.  
*C. fervidus* P.D. Orton  
- Gills when young blood red to carmine 7
7. Cap when young pale olivaceous brown to ochraceous brown; stem pale with ochraceous veil remnants, reddish at base. Cap 20-82 mm, conical to plane; stem 33-70 x 5-10 mm. Sp (5-)5.5-7.5(-9) x 3.5-5(-6)  $\mu\text{m}$ , ovoid to amygdaloid (fig. 669B). On raw humus, needle litter or among mosses in poor coniferous forests, often on sandy soil in open *Pinus* forests, rarely in other forest types, occasionally with *Picea*, rarely with *Betula* or *Fagus*; summer to autumn; very common in temp.-bore.; DK (LC), FI (LC), NO (LC), SE (LC). – CFP A13, Däh 709, Phil 205f, R&H 486, Ves 347, ☉. – Excellent for dyeing.  
*C. semisanguineus* (Fr.: Fr.) Fr.  
- Cap when young red brown; stem ochraceous with red veil zones. Cap 15-80 mm, conical to plane; stem 30-80 x 5-12 mm. Sp (5.5-)6-8(-9.5) x 3-4.5(-5)  $\mu\text{m}$ , usually amygdaloid (fig. 669C). Often on sandy soil with *Pinus*, sometimes and especially in the western parts on mossy soil in *Picea* forests, seldom with other trees; late summer to autumn; occasional in temp.-bore.; DK (LC), FI (LC), NO (LC), SE (LC). – B&K 5:161, CFP C47, Phil 206d, Svp 4:71, Ves



Spores: A: *Cortinarius sanguineus* var. *sanguineus*, B: *C. semisanguineus*, C: *C. phoeniceus*, D: *C. aureifolius*, E: *C. cinnamomeus*, F: *C. cinnamomeoluteus*.

347. – Excellent for dyeing.

*C. phoeniceus* (Vent.) Maire (*C. purpureus* (Pers.) Fuckel s. auct.)

8. Sp narrow, cylindrical, nearly smooth, reminiscent of *Inocybe lacera* (fig. 669D). Cap c. 55 mm, convex to plane, brown to dark brown; gills yellow orange to ochraceous orange when young; stem 40-50 x 10-12 mm, with rather coarse, brown veil remnants. Sp 10-14 x 3.5-4.5  $\mu$ m. On sandy soil in open *Pinus* forests; autumn; very rare in hemib.-bore.; FI (NT), SE (NE).

*C. aureifolius* Peck

- Sp ovoid, ellipsoid or amygdaloid, verrucose 9
- 9 Sp rarely > 9.5  $\mu$ m long 10
- Some sp always > 9.5  $\mu$ m long 18
- 10. Gills orange when young 11
- Gills yellow, orange yellow or olivaceous when young 14
- 11. Veil bright orange; cap margin covered with orange veil remnants. Cap 17-51 mm, conical to plane, ground colour red brown, yellow brown or hazel brown; gills bright orange to ochraceous orange; stem 24-44 x 5-10 mm, covered with yellow veil remnants; flesh olivaceous. Sp (5-)5.5-7(-7.5) x 3.5-4.5(-5)  $\mu$ m, ovoid to amygdaloid. In coniferous forests, usually with *Picea* and often also with *Alnus*, seldom with other trees, often on rich soil; summer to autumn; occasional in temp.-bore., north to Finnm and KiL; DK (LC), FI (LC), NO (LC), SE (LC). – CFP A56, FAD 95D, R&H 485, Svp 4:70, Ves 348. – Excellent for dyeing.

*C. malicorius* Fr.

- Veil brownish, ochraceous or nearly lacking, but not bright orange, cap margin covered with indistinct, not orange veil remnants 12
- 12. Gills when young deep orange red brown to rust red see *C. fervidus* 6
- Gills when young orange to ochraceous orange 13
- 13. Gills bright orange when young; cap yellow brown to orange when young. Cap 12-60 mm, umbonate to convex, yellow brown to dark red brown or chestnut brown; stem 18-65 x 4-10 mm, pale yellow, olivaceous yellow or yellow brown, base usually orange-red felty, covered with  $\pm$  significant red brown, ochraceous brown or grey brown veil remnants. Sp (5.5)-6-8.5(-9.5) x (3.5)-4-5(-6)  $\mu$ m, ovoid to amygdaloid (fig. 669E). On sandy soil, humus or among mosses in forests, heathland, or along roadsides or tracks in forests, mycorrhizal with *Picea*, *Pinus* or *Betula*, seldom with other trees; summer to autumn; very common in temp.-suba.; DK (LC), FI (LC), FO, NO (LC), SE (LC). – CFP B39, Däh 709, Phil 206a, R&H 485, Ves 349. – Good for dyeing.

*C. cinnamomeus* (L.: Fr.) Gray

- Gills ochraceous orange when young; cap dull ochraceous brown to chestnut brown when young, often with darker, concentric zones. Cap 13-70 mm, conical to convex; stem 38-80 x 5-9 mm, pale ochraceous to pale ochraceous yellow, base usually ochraceous yellow felty,

covered with pale red-brown, ochraceous brown or dirty brown veil remnants. Sp (6-)6.5-8.5 (-9.5)  $\times$  4-5(-5.5)  $\mu\text{m}$ , ovoid to amygdaloid. Usually in damp, shady coniferous forests, usually with *Picea*, seldom with *Pinus*; late summer to autumn; common in hemib.-bore., north to NT and SoL, occasional in temp.; DK (LC), FI (LC), NO (LC), SE (LC). – B&K 5:164, Svp 4:70, CFP A44. – Good for dyeing.

*C. sommerfeltii* Høil.

14. Gills olivaceous when young; cap usually acute and smooth; in rich deciduous forests, usually on calcareous soil. Cap 12-41 mm, umbonate to almost convex; stem 25-55  $\times$  3-10 mm, olivaceous green with grey brown veil remnants. Sp 6.5-8(-9)  $\times$  (3.5-)4-5(-5.5)  $\mu\text{m}$ , usually amygdaloid. With *Fagus*, *Quercus*, *Corylus*, *Carpinus*, possibly also *Tilia*, more seldom in rich *Picea* forests; late summer to autumn; rare in temp.-hemib., north to M&R; DK (LC), FI (CR), NO (LC), SE (LC). – C&D 1123, CFP A16, Svp 4:66, Ves 348.

*C. olivaceofuscus* Kühner

- Gills yellow when young; cap usually obtuse and felty to somewhat scaly; usually on poor soil 15
15. Lower fifth to third of stem bright orange. Cap 14-42 mm, umbonate to convex, fibrillose felty, pale ochraceous to ochraceous brown with an olivaceous tint; stem 60-125  $\times$  3-7 mm, at base with an orange mycelial felt. Sp (6.5-)7.5-9.5(-10.5)  $\times$  (4-)4.5-5.5(-6)  $\mu\text{m}$ , ovoid to ellipsoid. Among mosses, often *Sphagnum*, on moist soil in coniferous forests, seldom on drier soil, mycorrhizal with *Picea*, *Pinus* or *Betula*; late summer to autumn; occasional in temp.-bore., in NO north to NTr; DK (LC), FI (LC), NO (LC), SE (LC). – CFP C18, Svp 4:67.  
*C. bataillei* (M.M. Moser) Høil.
  - Lower part of stem not bright orange 16
16. Cap 22-100 mm. Cap umbonate to convex, fibrillose felty, pale olivaceous yellow or yellow brown, margin usually paler than centre; gills usually pure yellow, seldom orange yellow or with an olivaceous tint; stem 52-108  $\times$  4-9 mm, lemon yellow to pale ochraceous yellow, base pale olivaceous yellow. Sp 6-9  $\times$  4-5.5  $\mu\text{m}$ , ovoid to amygdaloid. On moist soil in rich *Picea* forests mixed with *Betula*, seldom *Pinus*, usually on higher elevations or north facing slopes, seldom in conifer plantations; autumn; occasional in (hemib.-)bore.; NO (NE), SE.  
*C. sylvae-norvegicae* Høil.
  - Cap usually < 50 mm 17
17. Cap fibrillose felty, pale yellow brown to dark brown or red brown, seldom with curved margin; gills usually pure yellow, but varying from mustard yellow to yellow with an orange tint. Cap 14-60 mm, umbonate to convex; stem 30-80  $\times$  3-10 mm, yellow to ochraceous grey, base usually yellow to pale orange, felty, covered with yellow to brown veil remnants. Sp (5.5-)6.5-9(-11)  $\times$  (3.5-)4-5.5(-6)  $\mu\text{m}$ , ovoid to amygdaloid. On humus or mossy soil in forests with *Picea*, *Pinus* and *Betula*, but also with various broadleaved deciduous trees, in heathland, mires, or along roadsides or tracks in forests; summer to late autumn; very common in temp.-arc. / alp.; DK (LC), FI (LC), FO, IS, NO (LC), SE (LC). – B&K 5:155, C&D 1119, CFP B16, Svp 4:66, Ves 349. – Good for dyeing.  
*C. croceus* (Schaeff.: Fr.) Gray subsp. *croceus*
  - Cap strongly fibrillose, reddish cinnamon brown to red brown, usually with curved margin; gills ochraceous yellow to orange yellow, soon cinnamon brown. In other characters like the main subsp. In heathland, usually with *Betula nana*, in alpine environments, seldom in upper boreal *Betula* forests, seldom with *Pinus* or *Picea*, possibly also with *Salix*; summer to autumn; common in suba.-arc. / alp.; FI (LC), IS (Na, Au), NO (NE), SE (NA). – CFP A54, Svp 4:66.  
*C. croceus* (Schaeff.: Fr.) Gray subsp. *norvegicus* (Høil.) Brandrud & H. Lindstr.
18. Gills olivaceous when young 19
  - Gills yellow to orange when young 20

19. KOH-reaction on gills usually red brown to carmine; some basidia contain yellow, granular pigment. Cap dark olivaceous brown to hazel brown; gills olivaceous when young. In other characters like the main variety. Usually among *Sphagnum* in fens, bogs or swamp forests, most frequent under *Pinus*, more seldom *Picea* or *Betula*; summer to autumn; occasional in hemib.-suba., rare in temp.; FI, NO, SE. – B&K 5:158, Däh 705, Svp 4:66.  
*C. huronensis* Ammirati & A.H. Sm. var. *olivaceus* Ammirati & A.H. Sm. (*Hydrocybe palustris* M.M. Moser, *C. palustris* (M.M. Moser) Nezdajm. nom. inval.)
- KOH-reaction on gills always dark brown, the basidia without yellow, granular content. Cap 11-28 mm, shape, radially fibrillose felty, seldom scaly, yellow brown to reddish brown; stem 25-115 x 3-6 mm, usually long and slender, with or without grey-brown veil remnants. Sp (7.5-)8-12(-13.5) x (4.5-)5-6.5(-7.5)  $\mu\text{m}$ , ellipsoid. Always among *Sphagnum* in fens, bogs or swamp forests, most common under *Betula*, seldom with *Picea* or *Pinus*; summer to autumn; occasional in hemib.-suba., rare in temp.; DK (LC), FI (LC), NO (LC), SE (LC). – B&K 5:165, Svp 4:70 (too dark).  
*C. tubarius* Ammirati & A.H. Sm. (*C. sphagnetii* P.D. Orton)
20. Cap when young red to brick red; stem covered with red veil remnants. Cap 16-85 mm, first conical, then umbonate, often with an acute umbo, radially fibrillose, smooth, silky; gills first bright yellow, then orange brown to rust brown; stem 30-70 x 3-13 mm. Sp (7-)8-11.5 (-12) x (4.5-)5-6.5(-7)  $\mu\text{m}$ , ovoid to ellipsoid. On moist soil in rich forests, scrubs, on riverbanks, near lakes or on dune slacks, mostly under *Salix*, but also under *Alnus* or *Fagus*; late summer to autumn; common in temp.-suba.; DK (LC), FI (LC), NO (LC), SE (LC). – B&K 5:166, CFP D49, D50, Phil 204d, Svp 4:67, Ves 348, ☉. – Good for dyeing.  
*C. uliginosus* Berk. f. *uliginosus*
- Cap when young red brown to yellow brown, dark brown or yellowish, if red to brick red, then not under *Salix* on moist soil; stem without distinct red veil remnants 21
21. Cap olivaceous yellow or pale yellow brown to orange yellow when young 22
- Cap orange brown, red brown, brown, or olivaceous brown when young 24
22. The lower part of stem bright orange see *C. bataillei* 15
- The lower part of stem not bright orange 23
23. Cap when young olivaceous yellow to pale ochraceous yellow. Cap 14-35 mm, often with an acute umbo, radially fibrillose, with age more brown; stem 35-95 x 3-7 mm, sulphur yellow, with insignificant pale yellow veil remnants. Sp (7-)7.5-10.5(-12) x (4.5-)5-6.5(-7)  $\mu\text{m}$ , ovoid to broadly ellipsoid (fig. 669F). On moist soil in mires, swamp forests, scrubs, riverbanks, or snow beds, mostly under *Salix*, but also under *Alnus*, most frequent at higher elevations; summer to autumn; rare, but locally occasional in temp.-arc./alp.; DK (LC), FI (LC), IS, NO, SE (LC). – Däh 706, Svp 4:67.  
*C. cinnamomeoluteus* P.D. Orton
- Cap when young pale yellow brown, golden brown or dirty orange yellow. Stem with pale yellow brown to somewhat rose veil remnants. In other characters like the main variety. On moist soil in rich forests, scrubs, on riverbanks, near lakes or on dune slacks, mostly under *Salix*, but also under *Alnus* or *Fagus*; late summer to autumn; rare in temp.-bore.; DK, FI, NO, SE. – Svp 4:67.  
*C. uliginosus* Berk. f. *luteus* (Gabriel & Lamoure) Nežpiak
24. In arc./alp. among *Salix herbacea*, *S. polaris* or *S. reticulata*. Cap 5-45 mm, conical to convex, very early expanded, fibrillose felty to appressed scaly, dark chestnut brown to dark hazel brown; gills first mustard yellow, then more rust brown; stem 15-30 x 2-5 mm, with brown veil remnants. Sp (7-)7.5-12(-13) x (4.5-)5-6.5(-7)  $\mu\text{m}$ , ovoid to ellipsoid. In snow beds, on open ridges or tundra among dwarf *Salix*; summer to autumn; common on SvB, elsewhere occasional or rare, most frequent in the middle arctic zone; IS, NO, SE (LC). – AAF 1:31.  
*C. polaris* Høil.

- In the lowlands, or if in alpine environments, then not among *Salix herbacea*,  
*S. polaris* or *S. reticulata* 25
- 25. Cap red brown to orange brown when young 26
- Cap brown to olivaceous brown when young 27
- 26. Cap usually conical with a persistent umbo; gills when young yellow to orange yellow. Cap 10-40 mm, radially fibrillose, first tawny brick red, red brown or orange brown, then darker red brown to chestnut; stem 23-80 x 2-8 mm, silky fibrillose, with pale reddish to red-brown veil remnants. Sp (6.5-)7-10.5(-12.5) x (4-)4.5-6(-7)  $\mu\text{m}$ , ovoid to ellipsoid. Among mosses, often *Sphagnum*, on moist soil with *Picea* and *Pinus*, rarely under *Betula*; late summer to autumn; common in hemib.-suba., occasional in temp.; DK (LC), IS, FI (LC), NO, SE (LC). – CFP C13, Svp 4:67. – Good for dyeing.  
*C. croceoonus* Fr.  
Note: may be similar to *C. uliginosus*, from which it differs by duller colour, usually smaller size, and its ecology.
- Cap hemispherical, convex or plane; gills when young orange. Cap 15-60 mm, radially fibrillose felty, often covered with minute, appressed scales, cinnamon brown to mahogany red brown; stem 31-45 x 2-7 mm, with red brown veil remnants. Sp (6.5-)7-10(-10.5) x (4-)4.5-5.5(-6)  $\mu\text{m}$ , ovoid to ellipsoid. On dry, sandy soil, often on established sand dunes, or on heathland and grasslands, sometimes without any woody plants, sometimes probably mycorrhizal with *Salix*; late summer to autumn; rare in temp.-suba.; DK (DD, Fyn: Helnæs), FO, NO. – C&D 1124, Svp 4:66.  
*C. pratensis* (Bon & Gaugué) Høil.
- 27. KOH-reaction on gills usually red brown to carmine; some basidia contain yellow, granular pigment. Cap 13-45 mm, convex, plane or umbonate, radially fibrillose felty, sometimes with minute, appressed scales, dark yellow brown to hazel; stem 32-100 x 2-6 mm, with or without grey-brown veil remnants. Sp (7-)7.5-11(-14) x (4-)4.5-6(-7.5)  $\mu\text{m}$ , ovoid to ellipsoid. Usually among *Sphagnum* in fens, bogs or swamp forests, mycorrhizal with *Picea*, *Pinus*, *Betula*, or more seldom *Salix*; summer to autumn; common in hemib.-arc./alp., rare in temp.; DK (DD), FI (LC), IS, NO, SE (LC). – B&K 5:158, Svp 4:67.  
*C. huronensis* Ammirati & A.H. Sm. var. *huronensis*
- KOH-reaction on gills always dark brown; basidia without yellow, granular content see *C. tubarius* 19

### Subgen. *Myxacium* (Fr.) Trog

EGIL BENDIKSEN, KATRIINA BENDIKSEN,  
TUULA NISKANEN & ILKKA KYTÖVUORI

Cap and stem glutinous when moist, or if faintly viscid then with bitter taste. Cap (10-)25-130 mm. Gills pale ochre, pale bluish or whitish when young. Stem usually clavate or cylindrical, base sometimes tapering downwards. Universal veil white, yellow or bluish violet, in some species very sparse. Flesh whitish to pale ochre. Smell in many species indistinct, unpleasant or like radish, honey or iodoform.

Sp 10-16 x 5.5-9.5  $\mu\text{m}$ , citriform, amygdaloid to slightly fusiform, or 5.5-9.5 x 4-8  $\mu\text{m}$  and subglobose to ellipsoid, in most species dextrinoid. Marginal cells clavate or basidioform. Pileipellis forming an ixocutis. Clamps present or absent.



25 species in the key. The subgenus has been divided in four sections. Sections *Defibulati* and *Myxacium* are monophyletic, but phylogenetic analyses confirm that members in other sections are more closely allied with other subgenera. The current taxonomy needs revision to reflect phylogenetic relationships.

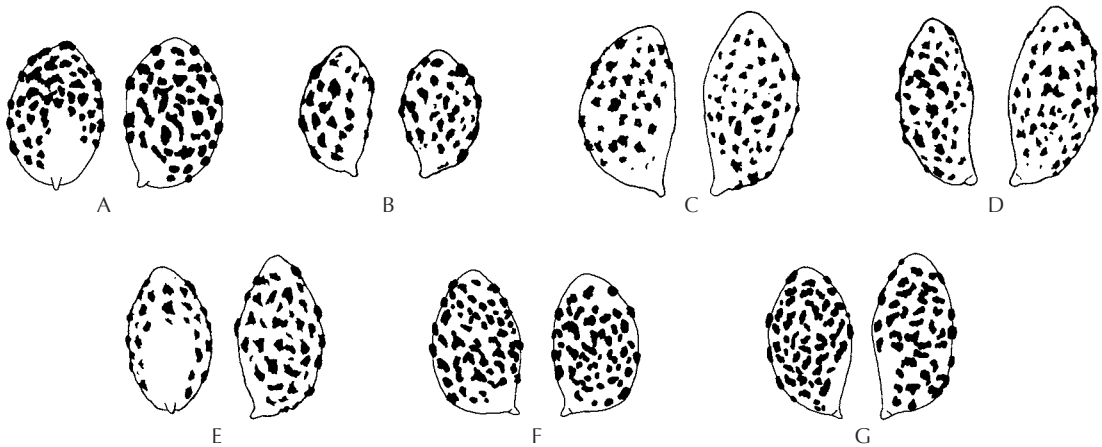
Suppl. lit.: Bendiksen et al. 1993, Seidl 2000, Kärcher 2004.



1. Sp subglobose; cap and universal veil yellowish or bluish Key C, sect. *Delibuti* p. 675  
 - Sp amygdaloid, ellipsoid, broadly ellipsoid or citriform; cap yellow, brown or bluish; universal veil whitish or bluish 2
2. Taste bitter; cap 10-60 mm; sp < 9.5  $\mu$ m long Key D, sect. *Vibratiles* p. 677  
 - Taste mild; cap 60-130 mm; sp > 9.5  $\mu$ m long 3
3. Sp amygdaloid, ellipsoid or slightly fusiform, coarsely verrucose; clamps present; marginal cells small, basidioform; smell indistinct; stem turning brown at the base Key A, sect. *Myxadium* p. 673  
 - Sp  $\pm$  citriform, densely verrucose; clamps absent; marginal cells large, clavate to spheropedunculate, abundant; usually with smell of honey when thumbbed; stem not turning brown at the base Key B, sect. *Defibulati* p. 674

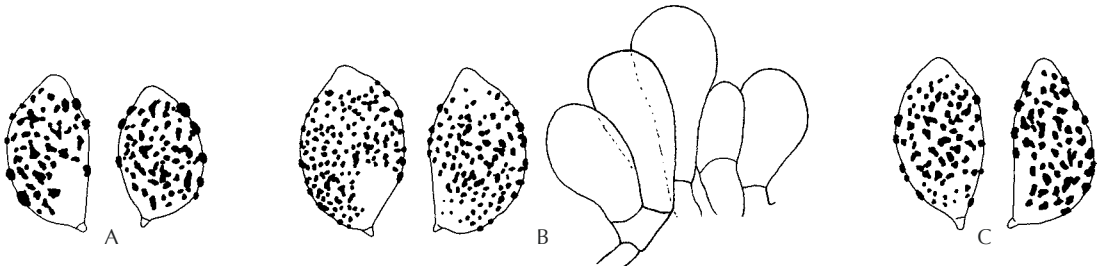
**Key A: Subgen. *Myxadium* sect. *Myxadium*** EGIL BENDIKSEN & KATRIINA BENDIKSEN

1. With dwarf *Salix* in arc. / alp. Cap 15-45 mm, convex to low convex, sometimes obtusely umbonate, glutinous, somewhat hygrophanous, but soon drying, dark golden red brown to rusty brown, sometimes with an olivaceous tinge, often with dark centre; gills pale greyish, sometimes with a violet tinge when young; stem 22-55 x 3-10(-12) mm, white, sometimes with a faint reflex of violet, often soon drying and veil cracking. Sp 11.5-14 (-14.5) x 7-8.5  $\mu$ m, ellipsoid to faintly amygdaloid, strongly and coarsely verrucose (fig. 674A). In poor and rich snow bed vegetation; summer to autumn; common; FI (LC), IS, NO (LC), SE (LC). – AAF 1:33, B&K 5:279, R&H 512,   
*C. alpinus* Boud. (*C. favrei* D.M. Hend.)  
 - Not with dwarf *Salix* species, if in alpine zones, then with *Betula* or in thickets of larger *Salix* species 2
2. Stem with thick veil remnants cracking in separate annulate scales or girdles or a net-like structure; young gills violet grey to greyish blue, more rarely pale ochraceous grey; with deciduous trees or shrubs. Cap 40-70 mm, convex to low convex, sometimes with a broad umbo, strongly glutinous, slightly hygrophanous, colour variable, pale to dull ochraceous, olivaceous brown to vividly red brown, especially in arc. / alp. often bicoloured with pale honey-coloured centre and vivid ochraceous colours in outer part; stem 60-135 x 6-20 mm, exposed surface between veil remnants becoming ochraceous, with pale ochraceous, sometimes olivaceous veil. Sp 10.5-12.5(-13) x 6-7.5  $\mu$ m, amygdaloid to ellipsoid or citriform, strongly and coarsely verrucose (fig. 674B, *Populus* form). Mainly under *Salix* and *Populus*, but also e.g. *Betula*, *Quercus* and *Fagus*, on poor and rich soil; late summer to autumn; common in temp.-low arc. / alp.; DK (LC), FI (LC), IS, NO (LC), SE (LC). – AC 10:287, CFP A36, Däh 784, R&H 513, Ves 367.  
*C. trivialis* J.E. Lange s.l.  
 Note: a complex of more taxa, but until further treated as a collective species.  
 - Veil on stem not cracking into annulate scales or net-like girdles; gills without violet or bluish tinges; with coniferous trees 3
3. Sp 13-16 x 7.5-9.5  $\mu$ m; in poor subxeric and submesic coniferous forests under *Picea*. Cap 30-100 mm, convex to low convex, sometimes with a broad umbo, often hygrophanous at margin, strongly glutinous, red brown, often rather dark; gills pale greyish; stem 50-100 x 6-23 mm, violet from universal veil, which cracks in irregular girdles. Sp amygdaloid, coarsely verrucose (fig. 674C). In poor coniferous forests, often under smaller trees of *Picea* in forests where *Pinus* dominates; late summer to autumn; very common in hemib.-bore. and coniferous part of suba., common in temp.; DK (LC), FI (LC), NO (LC), SE (LC). – B&K 5:283 (as *muscigenus*), CFP A34, Nyl 482, Phil 170a, R&H 513,   
*C. collinitus* (Sowerby: Fr.) Gray  
 - Sp  $\leq$  14  $\mu$ m long; under *Pinus* or deciduous trees 4



Spores: A: *Cortinarius alpinus*, B: *C. trivialis* (*Populus* form), C: *C. collinitus*, D: *C. mucosus*, E: *C. septentrionalis*, F: *C. fennoscandicus*, G: *C. absarokensis*.

4. Sp narrowly amygdaloid,  $Q_{av} = c. 2$ ; under *Pinus*. Cap 40-100 mm, hemispherical to low convex, glutinous, sienna to orange brown with dark centre, sometimes with an olivaceous tinge; gills pale greyish or ochraceous; stem white, very seldom violet. Sp  $11.5-14 \times 5.5-7(-7.5) \mu m$ , narrowly amygdaloid to citriform, coarsely verrucose (fig. 674D). In poor, often very dry, lichen-dominated sites; autumn; common in more continental parts of bore., from eastern NO and eastwards, occasional in temp. and more oceanic parts of bore.; DK (LC), FI (LC), NO (LC), SE (LC). – B&K 5:282, CFP B33, M&J 72, Nyl 482, R&H 512.  
*C. mucosus* (Bull.: Fr.) J.J. Kickx
  - Sp broader,  $Q = 1.6-1.7$ ; under deciduous trees 5
5. Cap vividly orange to golden yellow with darker centre. Cap 35-100 mm, hemispherical to convex, later low convex, typically with a broad umbo, strongly glutinous, the bright part of the cap sometimes with darker, red-brown spots, slightly hygrophanous in outer part; gills pale greyish or ochraceous; stem 60-125(-180)  $\times$  7-25 mm, white or pale violet, with age cracking in irregular girdles. Sp  $11-13(-13.5) \times 6.5-8.5 \mu m$ , amygdaloid, less often ellipsoid-citriform, coarsely verrucose (fig. 674E). With *Betula*, including *B. nana*, in subxeric and submesic (to mesic) sites; late summer to autumn; common in suba. and low arc./alp., rare but locally occasional in bore.; FI (LC), IS, NO (LC), SE (LC). – CFP B04, Jordst 11(2), Nyl 483.  
*C. septentrionalis* Bendiksen, K. Bendiksen & Brandrud
  - Cap without orange or golden yellowish colours 6
6. In mountain *Betula* woods and dry low alpine *Betula nana* heathland; stem mostly taller than cap diam. Cap 25-75(-100) mm, hemispherical to obtusely umbonate, later plane, sometimes with a faint umbo, strongly glutinous, sometimes translucently striate at margin, dull ochraceous with olivaceous tinge, when moist often fairly dark, at least centre, but may also be pale ochraceous, even when moist, often strongly hygrophanous; gills greyish beige to ochraceous; stem 40-100  $\times$  (4-)6-15(-20) mm, white, sometimes violet, with peronate veil, sometimes cracking in narrow, appressed girdles. Sp  $11-13(-13.5) \times 6.5-8.5 \mu m$ , mostly amygdaloid, coarsely verrucose (fig. 674F). Preferably on poor soil, subxeric and submesic habitats, also in mixed *Pinus-Betula*-woods; late summer to autumn; common in suba.-low arc./alp., rare in bore., occasional in IS; FI (LC), IS, NO (LC), SE (LC). – CFP B36, Jordst 11(2), Nyl 483.  
*C. fennoscandicus* Bendiksen, K. Bendiksen & Brandrud



Spores and cheilocystidia: A: *Cortinarius elatior*, B: *C. stillatitius*, C: *C. mucifluus*.

- In moist, alpine *Salix* scrubs; stem mostly shorter than cap diam. Cap (30-)50-110(-130) mm, irregularly hemispherical, finally plane and somewhat depressed, glutinous, not translucently striate, pale ochraceous to fulvous, sometimes with darker spots; gills pale greyish; stem 30-65 x 10-22 mm, white, with peronate veil, sometimes cracking in narrow, appressed girdles. Sp 12-16.5 x 7-9  $\mu\text{m}$ , amygdaloid, coarsely verrucose (fig. 674G). The species was recently reported from NO (Hord, Busk) in low arc./alp. in late summer, but it belongs to a difficult complex which is under revision – M&J 27.

*C. absarokensis* M.M. Moser & McKnight

#### Key B: Subgen. *Myxacium* sect. *Defibulati* M.M. Moser

EGIL BENDIKSEN & KATRIINA BENDIKSEN

1. Cap conical, strongly sulcate when old, becoming bell-shaped or convex and finally plane with an umbo. Cap 40-130 mm, strongly glutinous, colour from dark brown, often olivaceous to pale ochraceous, partly because of being hygrophanous; gills somewhat wrinkled, pale greyish; stem 70-150(-200) x 10-22 mm, tapering and slightly rooting, distinctly striate above cortina zone, violet, peronate from universal veil, often cracking to belts in lower part; smell honey-like. Sp 11-14 x 6.5-9  $\mu\text{m}$ , citriform, verrucose, with mixed coarse and fine ornamentation (fig. 675A). With deciduous and coniferous trees, mostly in poor *Fagus* or *Quercus* forests and coastal *Picea* forests or even dry *Pinus* forests; autumn; very common in temp., occasional, but locally common in hemib., rare in southern bore.; DK (LC), FI (LC), NO (LC), SE (LC). – AC 10:264, 265, CFP A41 (as *lividoochraceus*), Däh 789, Mar 755, Ves 366, Ⓢ. *C. elatior* Fr. (incl. *C. pumilus* J.E. Lange, *C. lividoochraceus* (Berk.) Berk. s. auct.)
- Cap not or only slightly conical and sulcate 2
2. Stem violet; cap dark olivaceous red brown (water-soaked) to paler ochraceous. Cap 30-80 mm, convex to plane, sometimes with an umbo, strongly glutinous; gills pale greyish; stem 60-100 x (8-)10-15(-20) mm, with peronate veil; smell honey-like. Sp 13-16 x 7-9  $\mu\text{m}$ , citriform, densely verrucose (fig. 675B). Mainly in *Vaccinium myrtillus*-*Picea* forests, more rarely with *Pinus*, in mountain *Betula* forests or in *Fagus* forests; summer to autumn; common in hemib.-bore., occasional in temp. and suba.; DK (LC), FI (LC), NO (LC), SE (LC). – CFP A33, Däh 786 (as *collinitus*), 788, Mar 756, Nyl 485, R&H 515. *C. stillatitius* Fr. (*C. integerrimus* Kühner nom. inval., *C. pseudosalor* J.E. Lange s. auct.)
- Stem white, sometimes with a very faint tinge of violet when young; cap normally paler ochraceous, probably because of hygrophanity and often dry habitat, when young and in moister habitats close to the colour of *C. stillatitius*. Cap 30-120 mm convex to plane, sometimes with an umbo, strongly glutinous; gills pale greyish; stem 60-120(-200) x (8-)10-15 mm, often rooting deeply in soil, with peronate veil, in lower part typically cracking in 2-4 broad girdles; smell honey-like. Sp 12-16(-17) x 7-8.5(-9)  $\mu\text{m}$ , citriform, densely verrucose (fig. 675C). With *Pinus* and *Picea*, in the southern part mainly in poor dry and subxeric *Pinus*

forests, but also in wooded ombrotrophic bogs, in central NO and SE also common in *Vaccinium myrtillus*-*Picea* forests; summer to autumn; common in hemib.-bore., presumably less common in the eastern part, occasional in temp.; DK (LC), FI (LC), NO (LC), SE (LC). – M&J 72, R&H 514, Ves 367.

*C. mucifluus* Fr. (*C. pinicola* P.D. Orton)


**Key C: Subgen. *Myxacium* sect. *Delibuti* (Fr.) Sacc.**

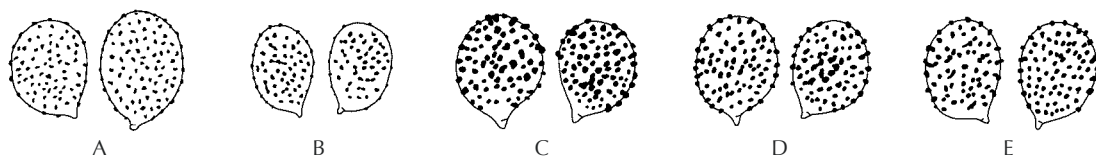
EGIL BENDIKSEN & KATRIINA BENDIKSEN

1. Cap ochraceous, normally not violet in any part. Cap 20-80 mm, hemispherical to broadly convex, glutinous, yellow to ochre with paler greyish ochre margin, sometimes with tinge of olivaceous, or in extreme forms also violet; gills from distinctly violet to pale greyish violet and in rare cases pale flesh to clay coloured (sometimes separated as *C. illibatus* Fr.); stem 50-100 x 5-10 mm, with mostly clavate up to 22 mm broad base, pale violet when young, remaining for longest time at the top, with yellow veil, sometimes with an olivaceous tinge in the irregular, appressed belts. Sp 7-9 x 6-8  $\mu$ m, subglobose, densely verrucose (fig. 677A). With a very wide ecology, from poor *Fagus* forests via boreal and subalpine forests under *Picea* or *Betula*, mostly in rich forest types, to heathland with *Betula* and *Salix* in the mountains; summer to autumn, mostly not numerous but common in temp.-arc./alp.; DK (LC), FI (LC), IS, NO (LC), SE (LC). – AC 3:70, CFP C11, Nyl 479, R&H 516, Ves 365.

*C. delibutus* Fr.

Note: a variable species, possibly a complex of closely related taxa.

- Cap violet, at least in outer part as young 2
- 2. Whole frb persistently pale greyish violet to steel blue without contrast between cap and stem; with long-lasting, glutinous universal veil. Cap 30-70 mm, convex, bell-shaped, later plane with a broad umbo, often irregular, glutinous, slowly fading to pale greyish ochre; gills greyish violet when young; stem 60-100 x 7-12 mm, cylindrical or more often with a  $\pm$  clavate base, strongly glutinous for a long time. Sp 6.5-8.5 x 5.5-7  $\mu$ m, subglobose, densely verrucose (fig. 677B). Mostly in coniferous forests, mostly herb-rich, submesic and mesic *Picea* forests, but also in deciduous forests with *Quercus*, *Tilia* or *Corylus* (south and west NO), mountain *Betula* forests and low alpine *Betula nana* heathland (FI); summer to autumn; rare in temp.-suba.(-arc./alp.); DK (EN), FI (LC), NO (LC), SE (NA). – AC 1:9b (as *epipoleus*), B&K 5:278 (as *epipoleus*), CFP A03, Nyl 481, Sieniop 200.
- C. emunctus* Fr. (*C. griseolilacinus* Britzelm., *C. griseoviolaceus* A.H. Sm.)
- With a distinct contrast between cap colour and the paler stem, soon fading to ochraceous from cap centre; universal veil not so persistently glutinous 3
- 3. Cap dominantly deep violet when young; stem paler, but with the same tinge of deep violet when young. Cap 40-90 mm, hemispherical to broadly convex, glutinous, becoming ochraceous from centre; gills violet, later greyish; stem 60-120 x 5-15 mm, base normally clavate, up to 23 mm broad, with veil fading to pale ochraceous, sometimes appressed belted. Sp 7.5-10 x 6-8.5  $\mu$ m, subglobose, rather strongly and densely verrucose (fig. 677C). On calcareous soil in deciduous forests with *Fagus*, *Quercus*, *Tilia* and *Corylus* and in herb rich *Picea* forests; autumn; rare in temp.-southern bore.; FI (DD), IS, NO (VU), SE (LC). – AC 1:9, B&K 5:285, CFP A02, Mar 758, .
- C. salor* Fr.
- Colours more greyish violet 4
- 4. Cap often with an olivaceous tinge, (30-)40-90 mm, hemispherical to convex, later plane with a broad umbo, glutinous, soon becoming brownish ochre to yellowish from centre, keeping a bluish-lilac component for a while; gills with a faint violet tinge when young, very soon more greyish or flesh-coloured; stem 40-140 x 5-20(-25) mm, cylindrical or more often a with clavate base, with veil forming appressed belts, at first with a tinge of violet,



Spores: A: *Cortinarius delibutus*, B: *C. emunctus*, C: *C. salor*, D: *C. transiens*, E: *C. betulinus*.

later ochraceous on a pale background. Sp 7.5-10 x 6-8.5  $\mu\text{m}$ , subglobose, densely verrucose (fig. 677D). Mostly in mesic and submesic, eutrophic *Picea* forests, also in mountain *Betula* forests (SE); summer to autumn; occasional in upper part of middle and northern bore., rare in southern bore. and suba.; FI (LC), IS, NO (DD), SE (LC). – CFP A39, Nyl 480, R&H 516, Sieniop 218.

*C. transiens* (Melot) Soop (*C. epipoleus* Fr. s. auct.)

- Cap not olivaceous, 20-50(-75) mm, broadly convex to plane with a faint umbo, glutinous, outer part pale greyish violet or pale greyish when young, ochraceous yellow in inner part, with age spreading to entire surface, sometimes darker ochraceous at centre; gills pale bluish grey or greyish ochre; stem 40-90 x 3-8 mm, with a faintly bulbous, up to 12 mm broad base, pale greyish, sometimes with very faint bluish tinge, with veil becoming slightly ochraceous, sometimes as faint belts. Sp 8-10 x 6.5-8.5  $\mu\text{m}$ , subglobose, rather densely verrucose (fig. 677E). In poor forests with *Picea* and in mountain *Betula* forests, in DK in lowland mires; late summer to autumn; common, but mostly not numerous in hemib.-suba., possibly most frequent in the north, very rare in temp.; DK (VU), FI (LC), NO (LC), SE (LC). – CFP C32, Fav 48:3.4-6, Jordst 10(1).

*C. betulinus* J. Favre

## Key D: Subgen. *Myxacium* sect. *Vibratiles* Melot

TUULA NISKANEN & ILKKA KYTÖVUORI

Cap 10-75 mm, in most species 20-60 mm, glutinous to viscid when moist; stem whitish, glutinous to viscid when moist; universal veil very sparse, often white; taste usually bitter, sp often < 9  $\mu\text{m}$  long. 10 species in the key, but the real number of the species in the Nordic countries might double that.

1. Cap violaceous to lilac, at least when young. Cap 20-45 mm, hemispherical, then low convex, first violaceous, later at least partly ochraceous, viscid, not hygrophanous; gills crowded to medium spaced, pale greyish, sometimes with a bluish tint, later yellowish brown; stem 40-90 x 4-8 mm, cylindrical to clavate with a tapering base, white, later somewhat ochraceous, slightly viscid; universal veil white to violaceous; fairly sparse; flesh pale yellowish; smell sweetish; taste very bitter; exsiccates with greyish-yellowish to yellowish-brownish cap and whitish stem. Sp 7.5-8.5 x 4.5-5(-5.5)  $\mu\text{m}$ , ovoid-ellipsoid, moderately and coarsely verrucose (fig. 679A), weakly to moderately dextrinoid. With deciduous trees, especially *Fagus*, on calcareous soil; autumn; rare in temp., very rare in hemib.; DK (NT), NO (EN), SE (VU). – AC 10:290, CFP B49, GCI D59, M&J 28, Ves 364.

*C. croceocaeruleus* (Pers.: Fr.) Fr.

- Cap without violaceous or lilac colours or tints 2
- 2. Taste in the cap cuticle mild or rarely slightly bitter; most sp < 4  $\mu\text{m}$  wide. Cap 30-60 mm, hemispherical, then low convex to almost plane, sometimes rimy at the centre, apricot yellowish to apricot brownish, slightly viscid to viscid but soon drying, hygrophanous; gills medium spaced, first pale greyish yellowish, later apricot yellowish; stem 50-100 x 5-10 mm,



cylindrical to clavate, sometimes tapering downwards, white, practically dry; universal veil white, almost indistinct; flesh yellowish; smell indistinct; exsiccates with greyish yellowish to pale brownish cap and white stem. Sp 5-6 x (3-)3.5-4  $\mu\text{m}$ , ellipsoid to very slightly ovoid (fig. 679B), smooth to very finely verrucose, without iodine reactions to weakly dextrinoid. In dryish to mesic coniferous forests with *Picea* and *Pinus*; late summer to autumn; very rare in temp., occasional in hemib.-bore.; DK (DD), FI (LC), NO (NE), SE (LC). – AC 10:292, FAD 199D, GCI B99, Soop 04:65

*C. microspermus* J.E. Lange

- Taste in the cap cuticle  $\pm$  bitter; most sp > 4  $\mu\text{m}$  wide 3
- 3. Cap whitish when young 4
- Cap yellowish to reddish brown when young 5

- 4. Cap covered with a white to greyish white coating, often soon becoming ochraceous, very slightly viscid to almost dry; taste slightly bitter to bitter in the cuticle, often mild in the flesh. Cap 30-70 mm, hemispherical, then low convex to almost plane, not or only slightly hygrophanous; gills medium spaced, pale greyish yellowish, later yellowish brownish; stem 40-70 x 5-10 mm, cylindrical to tapering downwards, whitish, weakly viscid; universal veil white, sparse; flesh white to somewhat yellowish; smell indistinct; exsiccates with whitish to pale brownish, mat cap and whitish stem. Sp 7-8(-8.5) x 4.2-4.7  $\mu\text{m}$ , narrowly amygdaloid to narrowly ellipsoid, almost smooth to finely verrucose (fig. 679C), weakly dextrinoid. In mixed forests of *Fagus*, *Quercus*, *Picea*, *Pinus* and *Abies*; autumn to late autumn; rare, but locally occasional in temp.-hemib.; DK (NT), SE. – AC 10:295, FAD 93D (as *ochroleucus*), M&J 128 (as *causticus*).

*C. emollitoides* Bidaud, Moënné-Locc. & Reumaux (*C. causticus* Fr. s. auct., possibly also *C. galeobdolon* Melot)

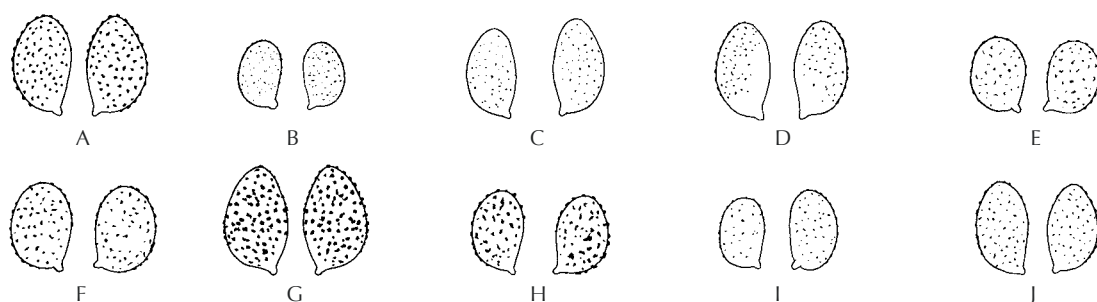
- Cap white when young, later often only slightly ochraceous, glutinous when young, later viscid; taste bitter in cap cuticle and flesh. Cap 30-70 mm, hemispherical, then low convex, hygrophanous; gills crowded to medium spaced, greyish white, later brownish yellow; stem 40-80 x 6-14 mm, cylindrical to tapering downwards, white, later slightly ochraceous, viscid when young; universal veil white, very sparse; flesh first white, later somewhat yellowish; smell unpleasant, sweetish-raphanoid; exsiccates with pale whitish grey brown cap and whitish stem. Sp 7.5-8(-8.5) x 4.5-5  $\mu\text{m}$ , amygdaloid, finely to moderately verrucose (fig. 679D), weakly dextrinoid. In deciduous forests with *Quercus*, *Fagus* and *Carpinus*; autumn; occasional in temp., rare in hemib.; DK (LC), NO (NT), SE (LC). – CFP B56, M&J 128 (as *eburneus*), Ves 364, ☉.

*C. barbatus* (Batsch: Fr.) Melot

- 5. With *Salix* or *Alnus*; cap 8-20 mm. Cap conical, later low convex, often with a small umbo, sometimes narrowly pellucid-striate, slightly viscid, pale apricot yellow, with whitish margin, hygrophanous; gills crowded to medium spaced, pale yellowish brown; stem 20-40 x 1.5-5 mm, cylindrical to slightly clavate, white, almost dry; universal veil white, very sparse; flesh yellowish; smell sweetish, unpleasant; taste bitter; exsiccates with brownish cap and whitish stem. Sp 6-7 x 4.5-5  $\mu\text{m}$ , ellipsoid to broadly ellipsoid, moderately and coarsely verrucose (fig. 679E), weakly dextrinoid. In damp mixed forests; late summer to autumn; rare in hemib.-bore., poorly known; FI, SE. – AC 10:298.

*C. croceocristallinus* Rob. Henry var. *alneti* Bidaud

- With *Quercus*, *Fagus* or coniferous trees; cap often > 15 mm broad. 6
- 6. Most sp > 5  $\mu\text{m}$  wide 7
- Most sp < 5  $\mu\text{m}$  wide 8
- 7. Cap and stem very glutinous when moist; sp 7-7.5(-8) x 5-5.5  $\mu\text{m}$  (fig. 679F). Cap 20-45 mm, hemispherical, then low convex to almost plane, sometimes with a very low and broad umbo, apricot yellowish brown, but drying very pale yellowish, hygrophanous; gills



Spores: A: *Cortinarius croceocaeruleus*, B: *C. microspermus*, C: *C. emollitoides*, D: *C. barbatus*, E: *C. croceocrystallinus* var. *alneti*, F: *C. vibratilis* s. Brandrud et al., G: *C. lustrabilis*, H: *C. causticus* s. Brandrud et al., I: *C. pluvius* s. Brandrud et al., J: *C. vibratilis* s. Kytövuori et al.

crowded to medium spaced, greyish white, later pale brownish yellow; stem 50-100 x 3-6 mm, cylindrical to slightly clavate, whitish, soon yellowish due to age or handling; universal veil white, very sparse; flesh yellowish; smell fairly strong, especially in flesh, sweetish-raphanoid, unpleasant; taste bitter; exsiccates with greyish-brownish to brownish cap and whitish stem. Sp broadly ellipsoid to ellipsoid, moderately and fairly coarsely verrucose, weakly dextrinoid. In mesic coniferous forests with *Picea*; late summer to autumn; common in hemib.-bore.; FI, SE. – CFP D26.

*C. vibratilis* (Fr.: Fr.) Fr. s. Brandrud et al. 1998 (*C. pluvius* (Fr.: Fr.) Fr. s. auct.)

- Cap slightly viscid to almost dry when moist; stem dry; sp 8.5-9.5 x 5-6  $\mu$ m (fig. 679G). Cap 35-60 mm, hemispherical, then low convex, sometimes depressed in the middle, vivid apricot yellow to more reddish brown, hygrophanous, at least at first rimy fibrillose due to drying, in contrast with the wet and darker background; gills crowded to medium spaced, yellowish brown, later brownish; stem 60-100 x 7-12 mm, cylindrical or tapering downwards to slightly clavate, thinly covered with white silky fibrils which soon disappear revealing the yellow flesh; universal veil white, sparse, presumably slightly viscid; flesh yellow; smell sweetish; taste slightly bitter, at least in the cap context; exsiccates with greyish brown to more vivid reddish brown cap and greyish white stem. Sp ovoid to amygdaloid, finely to moderately and separately verrucose, more strongly at apex, weakly dextrinoid. In dry to mesic coniferous forests; autumn; very rare in hemib.-bore.; FI, NO (NE). – AC 10:294, Kar 46:14, Sienil 58(4):105.

*C. lustrabilis* Moëgne-Loec.

8. Cap apricot yellow to vivid red brown, very finely papillose or rugulose, especially at centre; with *Pinus*; sp ovoid-ellipsoid, moderately and coarsely verrucose (fig. 679H). Cap 20-45 mm, hemispherical, then low convex to almost plane, sometimes narrowly pellucid-striate, viscid, hygrophanous; gills crowded to medium spaced, greyish white, later pale greyish brown; stem 40-90 x 4-9 mm, cylindrical to clavate, white, slightly glutinous; universal veil white, sparse; flesh whitish; smell faint; taste very bitter; exsiccates with reddish brown cap and whitish stem. Sp 6.5-7.5 x 4.3-4.8  $\mu$ m, weakly dextrinoid. In dry, sandy heath forests but also in mixed coniferous forests, with *Pinus*; autumn; common in hemib.-bore., occasional in suba. in IS, very rare in temp.; DK (DD), FI (LC), IS, SE. – CFP D24.

*C. causticus* Fr. s. Brandrud et al. 1998

- Cap greyish yellow to yellowish red brown, smooth; with deciduous or coniferous trees; sp ellipsoid to amygdaloid, finely verrucose
9. Cap 12-30 mm; sp < 7  $\mu$ m long, ellipsoid to very slightly ovoid (fig. 679I), fairly weakly to moderately dextrinoid. Cap conical to hemispherical, later low convex to almost plane,

often with a small and low, but acute umbo, pale greyish brown to ochraceous brown, with whitish edge, sometimes pellucid-striate 1/3 to 1/2 from margin, very slightly viscid and soon drying, weakly hygrophanous; gills medium spaced, pale greyish when young, later yellowish brown; stem 35-70 x 3-5 mm, cylindrical to slightly clavate, first whitish fibrillose, later pale yellowish brownish with age or handling, slightly viscid to almost dry; universal veil white, fairly sparse; flesh yellowish to pale brownish yellowish; smell slightly sweet, sometimes iodoform-like; taste bitter to slightly bitter at least in the cuticle; exsiccates with pale greyish yellowish to brownish cap and whitish stem. Sp (5.5-)6-7 x (3.7-)4-4.5  $\mu$ m, finely verrucose. In dry sandy *Pinus* heath forests, and in submesic to mesic coniferous forests with *Pinus*; late summer to autumn; occasional in hemib.-bore.; FI (LC), NO, SE. – CFP D23, D25.

*C. pluvius* (Fr.: Fr.) Fr. s. Brandrud et al. 1998 (*C. pluviolum* (Jul. Schäff.) M.M. Moser s. auct.)

- Cap 30-75 mm; sp > 7  $\mu$ m long, amygdaloid, weakly dextrinoid 10
- 10. Cap saturated apricot yellow to yellowish red brown, glutinous; in hemib.-bore. Cap 35-75 mm, conical to hemispherical, then low convex with, sometimes with a low umbo, hygrophanous; gills crowded to medium spaced, greyish white, later pale brownish yellow; stem 50-150 x 5-12 mm, cylindrical to clavate, often with a pointed base, white, somewhat glutinous; universal veil white, very sparse; flesh whitish; smell slightly raphanoid to sweetish; taste very bitter, sometimes first sweet; exsiccates with ochraceous to reddish brown cap and whitish stem. Sp 7-8 x 4.3-4.8  $\mu$ m, amygdaloid, very finely verrucose (fig. 679J), almost without iodine reaction. In dry to mesic coniferous forests with *Picea* and presumably also with *Pinus*; late summer to autumn; common in hemib.-bore., occasional in suba. in IS; FI (LC), NO, SE. – Soop 04:66, M&J 28.
- C. vibratilis* (Fr.: Fr.) Fr. s. Kytövuori & Niskanen, Moser and possibly also Soop
- Cap greyish ochraceous to ochraceous, very slightly viscid; in temp.-hemib. see *C. emollitoides* 4

## Subgen. *Phlegmacium* (Fr.) Trog

THOMAS STJERNEGAARD JEPPESEN,  
TOBIAS GULDBERG FRØSLEV & TOR ERIK BRANDRUD

Cap glutinous to almost dry and stem dry. Cap (15-)30-140(-200) mm, hemispherical to low convex, viscid, glutinous to almost completely dry, glabrous, tomentose or innate fibrillose, with universal veil remnants or not, white, grey, olivaceous, green, yellow, violaceous, blue or brown. Gills emarginate, crowded to  $\pm$  distant, serrulate or not, narrow to broad, white, grey, olivaceous, green, yellow, violaceous, blue or brown. Stem 20-200 x 5-50 mm, radicating, cylindrical, clavate or  $\pm$  abruptly bulbous, white, grey, olivaceous, green, yellow, violaceous, blue or brown, often with conspicuous partial veil (cortina) remnants becoming cinnamon to rust brown from spores, with or without girdles of universal veil. Flesh white, grey, olivaceous, green, yellow, violaceous, blue or brown, in many species with a malt-like or slightly earth- or dust-like smell, some species with smell of banana peel, honey, flour, radish, marjoram, lemon cake, *Prunus padus* flowers (cf. *Hebeloma sacchariolens*), parsley, plums, celery or very strong and unpleasantly earthy.

Sp citriform, amygdaloid, ellipsoid or subglobose, with fine to coarse ornamentation, rarely smooth and pale. Cap cuticle of two types, either: a) simplex: one-layered of thick epicutis and hyphae often with intracellular (more rarely incrusting) pigment, 2-5(-8)  $\mu$ m wide; or b) duplex: two-layered, with thin epicutis, hyphae often hyaline, 4-8  $\mu$ m wide, and subpellis of  $\pm$  subcellular 10-25(-30)  $\mu$ m wide hyphae, often with incrusting pigment.

On soil, forming ectomycorrhiza with *Fagus*, *Quercus*, *Tilia*, *Corylus*, *Carpinus*, *Betula*, *Populus*, *Picea*, *Pinus* or more rarely with *Salix*, *Dryas* or *Helianthemum*, most species associated with one or only a few coniferous or deciduous host species. Many species calciphilous and restricted to habitats with long continuity and/or habitats with a high species diversity, and therefore considered

valuable indicators of important habitats/localities in terms of natural conservation. *C. splendens* has been reported to cause deadly poisoning, and it is generally recommended not to consume species of subgen. *Phlegmacium*, as species identification is difficult and our knowledge of potential toxic substances is scarce.

162 species in the key of which 154 are recorded from the Nordic countries.

Suppl. lit.: Brandrud 1996, 1998, Frøslev et al. 2005, 2006, 2007, Garnica et al 2003, Moser 1960, Orton 1955.

- |    |                                                                                                                                                                                                                                                                                                                                                                                                 |                               |
|----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|
| 1. | Stem bulbous with a rounded bulb to abruptly bulbous with a $\pm$ margined bulb                                                                                                                                                                                                                                                                                                                 | 2                             |
| -  | Stem cylindrical, clavate or rooting                                                                                                                                                                                                                                                                                                                                                            | 5                             |
| 2. | Gills and/or flesh initially yellow, green or olivaceous                                                                                                                                                                                                                                                                                                                                        | <a href="#">Key A p. 681</a>  |
| -  | Gills and/or flesh whitish, violaceous, brownish, cream or ochraceous, not yellow, green or olivaceous                                                                                                                                                                                                                                                                                          | 3                             |
| 3. | Cap cuticle initially violaceous or blue, at least at margin                                                                                                                                                                                                                                                                                                                                    | <a href="#">Key B p. 689</a>  |
| -  | Cap cuticle initially without violaceous or blue colours, but sometimes with violaceous veil remnants                                                                                                                                                                                                                                                                                           | 4                             |
| 4. | Gills initially with violaceous or blue colours <i>and/or</i> bulbipellis distinctly pink with KOH                                                                                                                                                                                                                                                                                              | <a href="#">Key C p. 694</a>  |
| -  | Gills initially with whitish, cream or ochraceous colours; bulbipellis unchanging or brownish with KOH, not distinctly pink                                                                                                                                                                                                                                                                     | <a href="#">Key D p. 701</a>  |
| 5. | Gills initially dark olivaceous brown; flesh bitter; sp subglobose                                                                                                                                                                                                                                                                                                                              | <a href="#">Key E p. 707</a>  |
| -  | Gills initially white, cream, violaceous, blue, yellow to greenish; flesh mild; sp ellipsoid, amygdaloid or citriform, rarely subglobose                                                                                                                                                                                                                                                        | 6                             |
| 6. | Gills yellow or greenish                                                                                                                                                                                                                                                                                                                                                                        | 7                             |
| -  | Gills whitish, brownish or bluish to violaceous                                                                                                                                                                                                                                                                                                                                                 | 8                             |
| 7. | Pileipellis simplex; cap not hygrophanous, at centre purplish, red or olivaceous with KOH; smell like banana-peel, apple or marjoram                                                                                                                                                                                                                                                            | <a href="#">Key F p. 708</a>  |
| -  | Pileipellis duplex; cap often bicoloured hygrophanous, at centre negative to brownish with KOH; smell indistinct to honey-like in flesh                                                                                                                                                                                                                                                         | see <i>C. scaurus</i> key A 2 |
| 8. | Cap cuticle finely to coarsely granulate-diffracted at centre, appearing minutely cracked, towards margin glabrous, centre often $\pm$ purplish brown or olivaceous to olivaceous brown with KOH; stem with appressed, $\pm$ glutinous veil girdles; smell like maize, mown grass or banana-peel; gills ochraceous white or slightly whitish rose                                               | <a href="#">Key F p. 708</a>  |
| -  | Cap cuticle innately fibrillose to glabrous, not granulate-diffracted; not minutely cracked, but maybe coarsely cracked with age or with small spot-like veil remnants; centre negative or brownish with KOH; stem with or without veil girdles, not glutinous; smell trivial, unpleasantly earthy, like honey, farinaceous or like old cheese; gills whitish, brownish or bluish to violaceous | 9                             |
| 9. | KOH in flesh yellow, sometimes as a ring                                                                                                                                                                                                                                                                                                                                                        | <a href="#">Key G p. 710</a>  |
| -  | KOH in flesh unchanging to brownish, not yellow                                                                                                                                                                                                                                                                                                                                                 | <a href="#">Key H p. 713</a>  |

**Key A:** Subgen. *Phlegmacium*: Stem bulbous; gills and/or flesh initially yellow, green or olivaceous

- |    |                                                                                                                                                                 |   |
|----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
| 1. | Cap $\pm$ hygrophanous, often bicoloured, or with dark, hygrophanous spots; pileipellis duplex, with a $\pm$ cellular subpellis; smell honey-like; sp ellipsoid | 2 |
| -  | Cap not hygrophanous; pileipellis simplex, without a subpellis; smell not honey-like; sp amygdaloid-citriform                                                   | 3 |

2. Stem 40-80 x 5-10 mm; cap 25-60 mm. Cap hemispherical to convex, then expanded, brown with an olivaceous tinge, at centre dark brown, at margin greyish green tinged when young; gills greenish to olivaceous, soon brownish; stem with a  $\pm$  marginate bulb, initially pale bluish to bluish green, with age yellowish grey, lower part of stem/bulb with pale greenish veil remnants; flesh brownish-whitish, in stem initially greenish blue to olivaceous. Sp 9-11 x 6-7  $\mu$ m, ellipsoid, densely verrucose (fig. 687A). With conifers on silicious soil; summer to autumn; common in hemib.-bore., rare in temp.; DK (LC), FI (LC), NO (LC), SE (LC). – CFP C21, Däh 759, FAD 84B.

*C. scaurus* (Fr.: Fr.) Fr.

- Stem 40-80 x 10-20 mm; cap 40-90 mm. Cap hemispherical to convex, then expanded, rather pale ochraceous brown to greyish ochre, then olivaceous brown, at margin first greyish green; gills greenish to olivaceous, often also with a distinct bluish tinge; stem with  $\pm$  marginate bulb, initially distinctly violaceous, at least in upper part, lower half  $\pm$  olivaceous, bulb covered with pale greenish veil; flesh whitish in cap, in stem distinctly violaceous to bluish green. Sp 9-10.5 x 6-7  $\mu$ m, ellipsoid, densely verrucose. Mostly with conifers, often in young plantations, but rarely also with *Betula* and *Fagus*, on silicious to  $\pm$  eutrophic soil; summer to autumn; occasional in hemib.-suba., very rare in temp.; DK (DD, EJyl: Rold Skov 1900), FI, NO (LC), SE (LC). – CFP C08, Däh 760, FAD 83C.

*C. herpeticus* Fr.

3. Smell strong and sweet like *Prunus padus* flowers and *Hebeloma sacchariolens*, also with a component of black pepper when bruised / cut. Cap 30-70 mm, hemispherical to convex, then expanded, green, greenish yellow to olivaceous green, sometimes with small, appressed, dark olivaceous green to blackish velar scales at centre; gills pale yellowish green when young, then olivaceous to olivaceous green, sometimes with a violaceous tinge towards cap margin; stem 40-70 x 10-15 mm, with a marginate bulb, greenish yellow; veil at bulb margin and basal mycelium greenish yellow; flesh white, often with a violaceous tinge in stem top when young, greenish in bulb; KOH on cap initially brownish to olivaceous brown, becoming purplish brown within minutes, in flesh negative. Sp 9.5-11 x 5.5-6.5  $\mu$ m, amygdaloid (to citriform), coarsely verrucose. In deciduous forests, mainly *Carpinus* and *Fagus* on calcareous soil; autumn; very rare in temp.-hemib.; DK (EN), SE (VU). – Svp 27:46, 40:19, Ves 374.

*C. odoratus* (M.M. Moser) M.M. Moser (*C. joguetii* Melot)

- Smell faint, weak malty, farinaceous, like black pepper, boiled potatoes, aniseed, radish, unripe banana, apple, marjoram or lemon cake 4
  - 4. KOH on cap distinctly red, purplish red to purplish brown or blackish 5
  - KOH on cap negative, brownish to  $\pm$  red brown, or weakly olivaceous 20
  - 5. Smell like black pepper 6
  - Smell faint, weak malty, like boiled potatoes or aniseed 7
  - 6. Gills greenish yellow to olivaceous yellow; with conifers. Cap 50-100 mm, hemispherical to convex, then expanded, at margin green, often with darker fibres, towards centre olivaceous green, olivaceous brown to blackish; stem 40-80 x 12-20 mm, with a marginate bulb, greenish yellow; veil at bulb margin and basal mycelium greenish yellow; flesh bright greenish yellow in bulb and stem cortex, paler in cap and stem centre; KOH on cap black, in flesh olivaceous green. Sp 9.5-11 x 5.5-6.5  $\mu$ m, amygdaloid, coarsely verrucose. On calcareous soil; autumn; rare in hemib.; NO (NTr: Frosta), SE (VU, Gtl). – CFP B27, Däh 763, Nit 257.
- C. atrovirens* Kalchbr.
- Gills greyish to violaceous; with *Quercus*, rarely *Fagus*. Cap 50-80 mm, hemispherical to convex, then expanded, at margin green, often with darker fibres, towards centre olivaceous green, olivaceous brown to blackish; stem 40-70 x 10-15 mm, with a marginate bulb, greenish yellow; veil at bulb margin and basal mycelium greenish yellow; flesh bright greenish



yellow in bulb and stem cortex, paler in cap and stem centre; KOH on cap black, in flesh olivaceous green. Sp 9.5-11 x 5.5-6.5  $\mu\text{m}$ , amygdaloid, coarsely verrucose. On warm, dry calcareous soil; autumn; DE. – CFP D06.

*C. ionochlorus* Maire

7. Gills, cap, stem and flesh initially yellow without greenish yellow or olivaceous tinges; cap red with KOH and still red after 15 min.; exsiccates not vinaceous or purplish 8
- Gills, cap, stem or flesh initially with greenish yellow or olivaceous tinges; cap purplish red, purplish brown, greenish or red and then becoming dark purplish red to  $\pm$  blackish after 15 min; exsiccates usually distinctly vinaceous or purplish 9

8. Cap centre usually covered with numerous small umber-brown to purplish brown velar scales; frb not becoming saffron orange with age; sp amygdaloid to slightly citriform. Cap 50-100 mm, hemispherical to convex, then expanded, yellow at margin, with age golden yellow to yellow brown; gills curry yellow; stem 40-80 x 10-20 mm, with a marginate bulb, pale yellow, often with pale yellow mycelial strands; flesh pale yellow to almost whitish in cap, persistently yellow in bulb; KOH on cap blood red, in flesh greyish rose, darker red in base of bulb. Sp 10-11.5 x 5.5-6.5  $\mu\text{m}$ , coarsely verrucose. In deciduous forests on  $\pm$  calcareous soil, mainly with *Fagus*, but also *Corylus*; autumn; rare in temp., very rare in hemib.; DK (LC), SE (VU). – CFP D19, Däh 766 (as *guttatus*), Svp 40:14, Ves 371.

*C. alcalinophilus* Rob. Henry (*C. majusculus* Kühner, *C. fulmineus* (Fr.) Fr. s. Moser)

- Cap usually without, or only with few velar scales at centre; frb becoming saffron orange with age, especially on bulb margin and in damages; sp distinctly citriform. Cap 50-140 mm, hemispherical to convex, then expanded, yellow, becoming  $\pm$  saffron orange from centre with age; gills bright yellow; stem 40-100 x 12-25 mm, with a marginate bulb, pale yellow; flesh yellow, pale yellow to almost whitish, in bulb becoming  $\pm$  saffron orange; KOH on cap red, in flesh greyish rose, more reddish in base of bulb. Sp 9-11 x 5.5-6.5  $\mu\text{m}$ , coarsely verrucose. In open forests, scree forests (west NO), parks and wooded meadows, in rich to calcareous soil, mainly with *Corylus*, more rarely *Quercus* or *Fagus*; autumn; very rare in temp., rare in hemib.; DK (NT), FI, NO (VU), SE (NT). – CFP D02, Nit 252, Phil 174a, R&H 506, Svp 40:14.

*C. olearioides* Rob. Henry (*C. subfulgens* P.D. Orton, *C. fulmineus* (Fr.) Fr. s. Brandrud, Ryman)

9. Smell distinct of aniseed. Cap 40-100 mm, hemispherical to convex, then expanded, at margin olivaceous grey, yellowish green to bluish green, towards centre olivaceous brown, with age red brown; gills greenish yellow; stem 50-100 x 10-20 mm, with a marginate bulb, olivaceous green to greenish yellow; cap flesh not with a distinct violaceous line below cap cuticle; KOH on cap deep red, becoming dark purplish, in flesh red. Sp 10.5-12 x 6.5-7.5  $\mu\text{m}$ , amygdaloid to slightly citriform, coarsely verrucose. With conifers on calcareous soil; autumn; rare in hemib.-bore., and with an eastern distribution; FI (NT), SE (LC). – CFP C15, Däh 761, Nit 255, R&H 504.

*C. odorifer* Britzelm.

- Smell not of aniseed 10
10. Cap margin on young frb greenish yellow 11
- Cap margin on young frb green, olivaceous or  $\pm$  violaceous 15
11. Sp > 11.5  $\mu\text{m}$  long 12
- Sp < 11.5  $\mu\text{m}$  long 13
12. With *Fagus*; flesh in stem without violaceous tinges. Cap 70-130(-150) mm, hemispherical to convex, then expanded, bright yellow to slightly greenish yellow, with age often turning warm orange to orange brown from the centre; gills greenish yellow; stem 60-120 x 15-30 mm, with a marginate bulb, greenish yellow; flesh whitish, in bulb and stem cortex with

greenish yellow tinges; KOH on cap deep red, becoming dark purplish within minutes, in yellow parts of flesh red, otherwise negative. Sp 12.5-15 x 8-9.5  $\mu\text{m}$ , citriform, coarsely verrucose. On calcareous soil; autumn; rare in temp.; DK (VU), SE (EN). – CFP C54, Nit 249, Phil 173d, Svp 40:22, Ves 371, ☉.

*C. elegantissimus* Rob. Henry (*C. aurantioturbinatus* (Secr.) J.E. Lange s. auct., nom. illeg.)

- With conifers; flesh in cap and/or stem violaceous, at least in young specimens (or with KOH). Cap 50-90 mm, hemispherical to convex, then expanded, bright greenish yellow, with age often warm orange, orange brown to red brown from centre; gills greenish yellow; stem 40-70 x 10-20 mm, with a marginate bulb, greenish yellow, sometimes with a violaceous tinge in upper part; flesh violaceous to whitish, in bulb and cortex with greenish yellow tinges; KOH on cap deep red, becoming dark purplish within minutes. Sp (11.5-)12-13.5(-14) x 7.5-9  $\mu\text{m}$ , amygdaloid to slightly citriform, coarsely verrucose. On calcareous, sandy soil; autumn; very rare in bore.-hemib.; SE (EN).

*C. cedretorum* Maire

13. Gills olivaceous, towards edge  $\pm$  wax yellow, sometimes also with a violaceous tinge; with *Quercus* or *Carpinus* see *C. prasinus* 18
  - Gills greenish yellow, without violaceous tinge; with *Fagus* or conifers 14
14. With *Fagus*; flesh in cap and/or stem violaceous, at least in young specimens (or with KOH). Cap 50-90 mm, hemispherical to convex, then expanded, bright greenish yellow, with age often warm orange, orange brown to red brown from centre; gills greenish yellow; stem 40-70 x 10-20 mm, with a marginate bulb, greenish yellow, sometimes with a violaceous tinge in upper part; flesh violaceous to whitish, in bulb and cortex with greenish yellow tinges; KOH on cap deep red, becoming dark purplish within minutes, in yellow parts of flesh reddish. Sp 9.5-11.5 x 5.5-7  $\mu\text{m}$ , amygdaloid to slightly citriform, coarsely verrucose. On calcareous soil; autumn; very rare in temp.; DK (EN), SE (EN). – Svp 40:23.

*C. caesiolatus* Bidaud & Reumaux (*C. cedretorum* Maire var. *suberetorum* Maire s. auct., *C. cedretorum* Maire s. auct. p.p.)

- With conifers; flesh in cap and stem whitish. Cap 40-80 mm, hemispherical to convex, then expanded, at margin  $\pm$  greenish yellow, at centre darker ochraceous yellow, with age orange brown to red brown from centre; gills greenish yellow; stem 40-90 x 8-15 mm, with a marginate bulb, greenish yellow; flesh in bulb and cortex with  $\pm$  greenish yellow tinges; KOH on cap deep red, becoming dark purplish within minutes, somewhat reddish in yellow parts of flesh. Sp 10-11.5 x 6-7  $\mu\text{m}$  citriform, coarsely verrucose. On  $\pm$  calcareous soil; autumn; rare in hemib.-bore.; FI (LC), NO (NT), SE (VU). – CFP C36, Nit 256.

*C. aureofulvus* M.M. Moser

15. With conifers. Cap 50-120 mm, hemispherical to convex, then expanded, at margin greyish green to olivaceous grey, sometimes with a  $\pm$  bluish tinge, at centre olivaceous brown, and soon becoming deep brownish red to copper red; gills olivaceous green to olivaceous yellow, rarely slightly violaceous towards cap margin when young; stem 50-100 x 12-25 mm, with a marginate bulb, pale greyish green to olivaceous, sometimes with bluish tinges, veil at bulb margin greyish green, becoming purplish brown; KOH on cap blackish purple, in flesh initially greenish yellow, becoming vinaceous red brown. Sp 10-11.5 x 6.5-7.5  $\mu\text{m}$ , amygdaloid-citriform, coarsely verrucose. On calcareous soil; autumn; rare in hemib.-bore., very rare in temp.; FI (LC), NO (NT), SE (NT). – CFP C42, Nit 256, R&H 504, Sieniop 197.

*C. cupreorufus* Brandrud (*C. orichalceus* (Batsch) Fr. s. Moser)

- With deciduous trees, thermophilous 16
16. Stem and cap initially grey to violaceous grey, without greenish or greenish yellow tinges, sometimes with an olivaceous tinge. Cap 50-100 mm, hemispherical to convex, then expanded, oxidizes intensely vinaceous, reddish to violet red from centre, sometimes  $\pm$  scaly at centre; gills olivaceous green; stem 40-80 x 10-20 mm; with a marginate bulb, universal

veil on bulb margin oxidizes intensely vinaceous/purplish; KOH on cap and flesh initially olivaceous green, becoming dark reddish to blackish after few minutes. Sp (10.5-)11-12.5 x 6.5-7.5  $\mu\text{m}$ , strongly citriform, coarsely verrucose. Thermophilous, with deciduous trees on calcareous soil; autumn; rare in temp.-hemib.: DK (VU), NO (CR), SE (NT). – CFP B23, Nit 254, Phil 178a, Svp 40:19, Ves 375, ☉.

*C. rufolivaceus* (Pers.: Fr.) Fr.

- At least stem, usually also cap initially with greenish yellow to greenish tinges 17
- 17. Flesh in stem pale greyish yellow to pale greenish yellow or almost whitish, sometimes with a violaceous tinge in top; cap initially blood red with KOH, becoming dark purplish brown to blackish within minutes; veil at bulb margin becoming vinaceous to purplish red with age or when exposed; exsiccates  $\pm$  vinaceous to purplish 18
- Stem flesh bright yellow to greenish yellow, not violaceous; KOH on cap initially olivaceous brown, red brown to  $\pm$  purplish brown, but not blackish within minutes; veil at bulb margin unchanging or somewhat brownish to red brown with age; exsiccates  $\pm$  brownish 19
- 18. Flesh with a distinct violaceous line below cap cuticle; cap usually also with distinct violaceous tinges when young; gills bright greenish yellow. Cap 40-100 mm, hemispherical to convex, then expanded, margin olivaceous green to distinctly violaceous blue, at centre bluish grey to olivaceous grey when young, becoming red brown to copper red with age; stem 40-80 x 10-20 mm, with a marginate bulb, greenish yellow, distinctly rooting below bulb margin; flesh yellowish white in cap, more greyish yellow to greenish yellow in stem, turning purplish brown in base of bulb with age; smell faint, somewhat like boiled potatoes; KOH on cap deep red, becoming dark purplish within minutes, in flesh reddish to purplish red, sometimes initially greenish. Sp 9-11 x 5.5-7  $\mu\text{m}$ , citriform, coarsely verrucose. With *Quercus*, mainly in open woodland on calcareous soil; autumn; very rare in hemib.; SE (VU, Gtl, ÖL). – Mar 710, M&J 23.

*C. xanthophyllus* (Cooke) Rob. Henry

- Cap and cap flesh without lilac tinges; gills greyish green, olivaceous grey,  $\pm$  wax yellow towards edge, sometimes with a violaceous tinge towards cap margin. Cap 50-100 mm, hemispherical to convex, then expanded, pale greyish green to olivaceous green, from centre olivaceous brown, with age often  $\pm$  red brown; stem 40-80 x 12-22 mm, with a marginate bulb, pale greenish, bulb margin with pale greenish yellow to  $\pm$  violaceous universal veil; flesh whitish, initially sometimes slightly greenish in cap and bulb, sometimes  $\pm$  violaceous in stem; KOH on cap reddish to purplish red, in flesh rose, red to deep red brown. Sp 10-11.5 x 6-7  $\mu\text{m}$ , amygdaloid to slightly citriform, coarsely verrucose. With *Quercus*, *Carpinus*, *Corylus* and possibly also *Tilia*, mainly in open,  $\pm$  grassy woodland meadows, on calcareous soil; autumn; very rare in hemib.; NO (CR), SE (EN). – CFP B11.

*C. prasinus* (Schaeff.: Fr.) Fr.

- 19. With  $\pm$  fugacious violaceous tinges on stem and/or gill edge; cap not blushing reddish from centre; flesh uniformly yellow in all parts. Cap 40-100 mm, hemispherical to convex, then expanded, olivaceous green to greyish green, becoming chestnut brown to purplish brown from centre, sometimes with  $\pm$  fugacious violaceous tinges, with distinct, small umber brown to purplish brown velar scales, slightly innately fibrillose; gills yellow to olivaceous yellow or olivaceous green, sometimes with  $\pm$  violaceous edge; stem 40-80 x 10-20 mm, yellow to olivaceous green, and often with  $\pm$  violaceous tinges; flesh becoming slightly saffron orange in bulb when exposed. Sp 9-10.5(-11) x 5.5-6.5  $\mu\text{m}$ , amygdaloid, coarsely verrucose. With *Quercus* on warm and dry calcareous soil; autumn; DE. – FND 29:52.

*C. splendificus* Chevassut & Rob. Henry

- Without violaceous tinges on stem and gill edge; cap blushing  $\pm$  reddish from centre; flesh in cap and bulb pale yellowish, in stem yellow to greenish yellow, strongest in cortex. Cap 50-100 mm, hemispherical to convex, then expanded, yellow to ochraceous, margin initially

olivaceous green to olivaceous yellow, centre olivaceous brown, becoming  $\pm$  reddish striate from centre, slightly innately fibrillose; gills olivaceous yellow; stem 40-80 x 10-20 mm, yellow to yellow green; smell and taste indistinct, mild. Sp (9.5-)10-12(-13) x 6-7.5  $\mu$ m, amygdaloid to  $\pm$  citriform, coarsely verrucose. With *Carpinus*, *Quercus* and possibly also *Fagus* on warm and dry calcareous soil; autumn; DE. – JEC 2006:92.

*C. glaucescens* (Jul. Schäff.) M.M. Moser

20. Young gills brown; flesh brown in stem top, otherwise greenish yellow. Cap 40-80 mm, hemispherical to convex, then expanded, greenish yellow to greenish, becoming olivaceous brown from centre, sometimes with brownish velar scales; stem 40-70 x 8-15 mm, pale yellow in upper part, towards base more greenish yellow; bulb very distinctly marginate, recalling that of *C. calochrous*, with greenish yellow veil, basal mycelium greenish yellow; KOH on cap indistinctly olivaceous, in cap and bulb flesh olivaceous, in stem flesh dark red brown to purplish black. Sp 9-10.5 x 5.5-6.5  $\mu$ m, amygdaloid, fairly coarsely verrucose. With *Fagus* on calcareous soil; autumn; very rare in temp.; DK (EN), SE (EN). – CFP D03.

*C. fulvocitrinus* Brandrud

- Young gills greenish yellow, flesh in stem top not brownish when young 21
- 21. Flesh in both bulb and cap bright yellow or greenish yellow (K&W 1A5-A8 or 2A5-A8); frb intensely coloured 22
- Flesh at least in the cap less bright coloured; frb intensely coloured or not 24
- 22. With conifers. Cap 40-100 mm, hemispherical to convex, then expanded, strongly yellow, at centre olivaceous yellow brown, darkening, with numerous small, distinct, chestnut brown to almost purplish black velar scales; gills bright yellow; stem 40-70 x 12-20 mm, with a marginate bulb, bright yellow, yellow veil on bulb margin soon becoming dark amber to olivaceous brown; flesh strongly yellow; smell strong of black pepper; KOH on cap olivaceous green to olivaceous brown. Sp 9.5-11 x (5.5-)6-6.5  $\mu$ m, citriform to amygdaloid, coarsely verrucose. On calcareous soil; autumn; rare in hemib., very rare in bore.; FI (VU), NO (VU), SE (NT). – CFP A50, Däh 764 (as *vitellinus*), Nit 257.

*C. meinhardii* Bon (*C. vitellinus* M.M. Moser non (Pers.: Fr.) Bigeard & H. Guill.)

- With *Fagus* or very rarely *Tilia* 23
- 23. Frb bright greenish yellow when young. Cap 40-80 mm, hemispherical to convex, then expanded, sometimes slightly innately fibrillose, greenish yellow to greenish, soon becoming olivaceous grey brown from centre, sometime olivaceous to purplish black with age, without or with few distinct velar scales; gills bright sulphur to greenish yellow when young; stem 35-70 x 8-15 mm, with a marginate bulb, greenish yellow, greenish yellow veil at bulb margin soon becoming olivaceous/purplish brown; flesh greenish yellow; smell somewhat of malt/black pepper. KOH negative to very weakly olivaceous on cap, in flesh negative. Sp 8.5-10 x 5-5.5(-6)  $\mu$ m, amygdaloid to slightly citriform, coarsely verrucose. With *Fagus* on  $\pm$  calcareous soil; autumn; rare in temp.; DK (LC), SE (NT). – CFP D05, FAD 84E, 85B, Svp 40:18, Ves 370.

*C. citrinus* (J.E. Lange) P.D. Orton (*C. pseudosulphureus* P.D. Orton)

- Frb bright yellow, hardly with any greenish tinges when young. Cap 30-70 mm, hemispherical to convex, then expanded, bright lemon yellow, soon with more yellow to fulvous brown centre, sometimes becoming  $\pm$  orange to red brown at centre, sometimes with small dark brown to blackish scales at centre; gills bright lemon yellow when young; stem 30-70 x 8-15 mm, with a marginate bulb, bright lemon yellow; flesh bright yellow, smell indistinct; KOH on cap olivaceous, in flesh indistinctly reddish. Sp 9.5-11.5 x 5.5-6  $\mu$ m, amygdaloid, coarsely verrucose. With *Fagus*, rarely with *Tilia cordata*, in deep litter on calcareous soil; autumn; very rare in temp.-hemib.; DK (VU), NO (EN), SE (VU). – CFP B57, Däh 765, Nit 252, Svp 40:15, Ves 370, ☉. – Reported to be deadly poisonous.

*C. splendens* Rob. Henry





Spores: A: *Cortinarius scabrus*, B: *C. elegantior*, C: *C. flavovirens*, D: *C. sulfurinus*, E: *C. xanthochlorus*, F: *C. eucaeruleus*.

24. KOH in bulb flesh rose to reddish 25  
 - KOH in bulb flesh negative 28
25. Sp 12.5-15 x 7.5-9  $\mu\text{m}$  (fig. 687B). Cap 60-150 mm, hemispherical to convex, then expanded, often somewhat innately fibrillose, yellow brown, sometimes with an olivaceous tinge, then darker brown, often with pale yellow to brownish velar scales at centre; gills wax yellow to straw yellow when young; stem 60-120 x 15-30 mm, with a marginate bulb, pale yellow, flesh pale yellow, often slightly saffron yellow to salmon pink in bulb; KOH negative on cap and in stem and cap flesh, in bulb flesh reddish to vinaceous. Sp citriform, very coarsely verrucose. On calcareous soil, mostly with conifers, but sometimes with *Betula*, *Corylus* or *Quercus*; autumn; rare but locally occasional in hemib., very rare in bore.; FI (EN), NO (LC), SE (NT). – CFP D01, Däh 768, 769.  
*C. elegantior* (Fr.) Fr.  
 - Sp 11-12.5 x 6.5-8  $\mu\text{m}$  26
26. Smell distinct like lemon cake, apple or marjoram, *C. percomis* smell see *C. majoranae* key F3  
 - Smell faint like unripe banana 27
27. Cap lemon yellow, almost uniformly coloured, not oxidizing red brown to purplish brown from centre with age; basal mycelium pale yellow to whitish. Cap 40-80 mm, hemispherical to convex, then expanded, sometimes indistinctly and finely granulate-diffracted at centre, with age often with darker innate fibrils; gills greenish yellow to sulphur yellow; stem 40-70 x 10-20 mm, with a  $\pm$  marginate bulb, greenish yellow to sulphur yellow, veil at bulb margin at first greenish yellow, becoming orange yellow to honey yellow; flesh pale greenish yellow, stronger in stem cortex and almost whitish in cap; smell like unripe banana; KOH greenish to olivaceous on cap, in bulb flesh indistinctly reddish, otherwise negative. Sp (10.5-)11-12.5 x 6.5-7.5  $\mu\text{m}$ , amygdaloid, coarsely verrucose. On calcareous soil with *Tilia*, *Corylus* and possibly also *Quercus*; autumn; very rare in hemib.; SE (Öl, Vg). – Svp 56:55.  
*C. xanthosuavis* Bon & Trescol  
 - Cap lemon yellow with greenish yellow margin, soon becoming red brown to chestnut brown at centre; basal mycelium saffron orange. Cap 50-100 mm, hemispherical to convex, then expanded,  $\pm$  granulate-diffracted at centre; gills greenish yellow to olivaceous yellow; stem 50-80 x 10-25 mm, greenish yellow, with a  $\pm$  marginate bulb, veil at bulb margin yellow, becoming orange yellow to honey yellow, without reddish brown to umber or purplish brown veil girdles; flesh greenish yellow. Sp (10-)10.5-12(-12.5) x 6.5-7.5  $\mu\text{m}$ , amygdaloid, coarsely verrucose. With *Quercus* on warm calcareous soil; autumn; DE.  
*C. aurilicis* Chevassut & Trescol (*C. nanceiensis* Maire var. *bulbopodius* Chevassut & Rob. Henry)
28. Smell and taste distinctly farinaceous or or radish to earthy 29  
 - Smell and taste indistinct, slightly malty or parsley-like 31
29. Smell and taste farinaceous; sp 9-10.5 x 5-6  $\mu\text{m}$  (fig. 687C). Cap 50-100(-120) mm, hemispher-



ical to convex, then expanded, at margin pale greenish yellow to olivaceous, at centre olivaceous brown, with age brownish, somewhat innately fibrillose; gills pale olivaceous, straw yellow to almost greyish; stem 40-80 x 10-20 mm, with a marginate bulb, pale olivaceous yellow, bulb margin more greenish; flesh whitish; KOH negative. Sp amygdaloid, coarsely verrucose. On calcareous soil, mostly with *Quercus*, *Corylus* and *Tilia*, but also found with *Fagus*; autumn; very rare in temp., rare in hemib.; DK (EN), FI (VU, V: Lohja), NO (EN), SE (VU). – CFP A29, Nit 253, Svp 40:23.

*C. flavovirens* Rob. Henry

- Smell and taste not farinaceous; sp > 10 µm long 30
- 30. Sp 10-11.5 x 6-7 µm; cap initially pale greenish yellow to olivaceous grey brown. Cap 50-120 mm, hemispherical to convex, then expanded, at centre pale olivaceous brown with age; gills pale straw yellow; stem 50-90 x 15-23 mm, pale straw yellow, when young sometimes slightly greenish yellow, with a broad and flattened bulb, veil at bulb margin whitish to yellowish, rarely faintly violaceous spotted; flesh whitish; smell radish-like/earthy, sometimes also slightly sweetish; KOH negative. Sp citriform, coarsely verrucose. With *Fagus* and *Quercus* in deep litter, on calcareous soil; autumn; very rare in temp.-hemib.; DK (EN, Lol: Maribo Søndersø), SE. – CFP D07.

*C. humolens* Brandrud (*C. claroflavus* Rob. Henry s. Moser)

- Sp 11-12.5 x 6.5-7.5 µm; cap initially pale yellowish. Cap 30-70 mm, hemispherical to convex, then expanded, often becoming ochraceous brown at centre, sometimes with whitish veil patches; gills pale straw yellow; stem 40-70 x 8-15 mm, with a marginate bulb, whitish, when young slightly yellowish white, veil at bulb margin pale yellowish; flesh whitish; smell radish-like/earthy; KOH negative. Sp citriform, coarsely verrucose. With *Tilia cordata* and possibly also *Corylus* in mixed *Tilia-Corylus* forests on calcareous soil; autumn; very rare in hemib.; NO (CR, Oslo, Tyrifjord).

*C. osloensis* Brandrud, T.S. Jeppesen & Frøslev

- 31. Basal mycelium and mycelial strands distinctly pink to blood red with KOH. Cap 50-120 mm, hemispherical to convex, then expanded, olivaceous yellow, with a greenish yellow to greyish green tinge towards margin when young, at centre becoming olivaceous brown, often with small, dark brown velar scales; gills pale greenish yellow; stem 50-100 x 10-22 mm, with a marginate bulb, pale yellow to pale greenish yellow, veil greenish yellow on bulb margin when young; flesh pale greenish yellow to almost white when young; smell like parsley or carrot; KOH negative on cap and in flesh. Sp 11.5-13 x 6.5-7.5 µm, amygdaloid to slightly citriform, coarsely verrucose (fig. 687D). On ± calcareous soil in mossy coniferous forests, rarely with *Fagus* or *Tilia*; autumn; rare in hemib.-bore.; FI (LC), NO (LC), SE (NT). – CFP A25, Sieniop 217.

*C. sulfurinus* Quél. (incl. *C. sulfurinus* Quél. var. *fageticola* Brandrud)

- Basal mycelium and mycelial strands negative with KOH 32
- 32. Sp (9-)9.5-10.5(-11) x 5.5-6.5 µm; cap with thick whitish to pale greenish yellow veil patches. Cap 30-80 mm, hemispherical to convex, olivaceous green, margin greenish yellow when young, with age sometimes slightly innately fibrillose towards margin; gills olivaceous green to pale greenish yellow or greyish, most distinctly coloured towards edge, adnexed to slightly emarginate; stem 30-70 x 10-15 mm, with a broad and flattened bulb, pale greenish yellow to almost whitish, sometimes with a violaceous tinge at top; flesh whitish, in stem cortex greenish yellow, sometimes slightly violaceous in stem top; smell and taste indistinct; KOH on cap brownish, in cap flesh yellow brown, in flesh otherwise pale rose brownish to negative. Sp amygdaloid, fairly coarsely verrucose. With *Quercus* in warm and dry, calcareous soil; autumn; DE. – Cons 3:C139, FND 22:35.

*C. natalis* D. Antonini & M. Antonini

- Sp > 11 µm; cap without thick whitish to pale greenish yellow veil patches 33

33. Cap 60-140 mm, often with numerous chestnut brown velar scales,  $\pm$  copper brown with age and when growing exposed; sp 11-13  $\times$  6.5-8  $\mu\text{m}$ , on av < 12.5  $\mu\text{m}$  long. Cap hemispherical to convex, then expanded, olivaceous to greenish when young, margin persistently greenish to olivaceous; gills yellow, with an olivaceous tinge; stem 60-100  $\times$  15-30 mm, with a marginate bulb, greenish yellow to olivaceous yellow, veil at bulb margin greenish yellow; basal mycelium yellowish white to greenish yellow; flesh in stem cortex greenish yellow, otherwise whitish; KOH on cap negative to  $\pm$  brownish, in flesh negative. Sp citriform to amygdaloid, coarsely verrucose. With *Quercus* in warm and dry calcareous soil; autumn; very rare in hemib.; SE (vu). – CFP D18.  
*C. quercilicis* (Chevassut & Rob. Henry) Rob. Henry (*C. eufulmineus* Rob. Henry s. auct., *C. cereifolius* M.M. Moser s. auct.)
- Cap 40-80 mm, rarely with velar scales and then scales whitish becoming dark olivaceous brown to purplish black; sp 12-14  $\times$  (6.5-)7-8  $\mu\text{m}$ , on av > 12.5  $\mu\text{m}$  long (fig. 687E). Cap hemispherical to convex, then expanded, somewhat innately fibrillose, bright greenish yellow, centre olivaceous green, soon becoming dark olivaceous brown to almost blackish from centre; gills bright yellow with an olivaceous tinge; stem 40-60  $\times$  10-20 mm, with a marginate bulb, greenish yellow; basal mycelium whitish, rarely with a fugacious violaceous tinge; flesh in stem greenish yellow, otherwise whitish; KOH on cap negative to  $\pm$  brownish, in flesh negative. Sp citriform to amygdaloid, very distinctly and rather densely verrucose. With *Quercus* in warm and dry, calcareous soil; autumn; very rare in temp.-hemib.; DK (CR, EJyl: Elbæk Skov), SE (EN). – FND 28:25, Jordst 17(3):62, Svp 56:48.  
*C. xanthochlorus* Rob. Henry (*C. olivascentium* Rob. Henry s. auct)

**Key B:** Subgen. *Phlegmacium*: Stem bulbous; cap cuticle initially violaceous or blue, at least at margin

- |    |                                                                                                                                                                   |   |
|----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
| 1. | Pileipellis duplex; bulbipellis not distinctly pink with KOH; sp distinctly verrucose with isolated warts; cap often innately radially fibrillose                 | 2 |
| -  | Pileipellis simplex; bulbipellis in most species distinctly pink with KOH; sp coarsely verrucose, with irregular warts; cap rarely distinctly radially fibrillose | 8 |
| 2. | Sp ellipsoid                                                                                                                                                      | 3 |
| -  | Sp amygdaloid or citriform                                                                                                                                        | 4 |
3. Cap very strong and deep violaceous blue; sp 9.5-12  $\times$  6-7  $\mu\text{m}$  (fig. 687F). Cap 40-110 mm, hemispherical to convex, then expanded, finely innately fibrillose, with age sometimes discolouring ochraceous yellowish from centre; gills violaceous when young, becoming violaceous grey; stem 40-80  $\times$  10-20 mm, with a marginate bulb, pale bluish white, soon becoming greyish white, somewhat ochraceous yellow with age, with distinctly violaceous blue veil at bulb margin; flesh greyish white, often violaceous to violaceous grey in stem top when young; smell somewhat *Scleroderma*-like. Sp ellipsoid, distinctly and densely verrucose. With *Quercus*, *Carpinus*, *Tilia* and *Corylus*, rarely with *Fagus*, on calcareous soil; autumn; rare in hemib., very rare in temp.; DK (CR), NO (CR), SE. – CFP B24, Svp 27:43, Ves 369.  
*C. eucaeruleus* Rob. Henry (*C. terpsichores* Melot var. *calosporus* Melot, *C. terpsichores* Melot s. auct. p.p.)
- Cap at margin with light blue colours, at centre ochraceous yellow, even in young frb; sp 8.5-10  $\times$  5.5-6.5  $\mu\text{m}$  (fig. 691A). Cap 40-90 mm, hemispherical to convex, then expanded, (finely) innately fibrillose; frb becoming  $\pm$  yellowish when handled or damaged; stem 40-80  $\times$  8-15 mm, with a marginate bulb, pale blue, strongest towards base; gills greyish to slightly violaceous grey; flesh greyish, becoming yellowish in bulb; smell somewhat *Scleroderma*-like. Sp ellipsoid, finely and densely verrucose. On calcareous soil, with *Pinus*, in central Europe also with deciduous trees; autumn; very rare in Gtl; SE (vu). – AC 5:111 (as *caesioflavescens*).  
*C. terpsichores* Melot (*C. caesioflavescens* Reumaux)

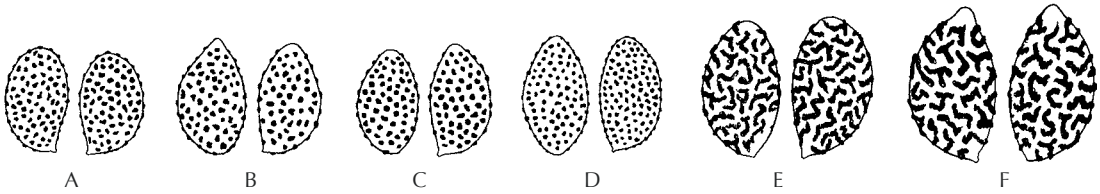
4. Gill edge distinctly violaceous and contrasting the almost greyish gill surface; sp distinctly citriform. Cap 30-70 mm, hemispherical to convex, then expanded, violaceous blue to dark violaceous grey, with radial hygrophanous streaks when young, soon becoming greyish with darker, grey brown centre and  $\pm$  hygrophanous appearance, without or with a very thin and indistinct frosty veil, becoming yellow brown under adhering grass, leaves, etc.; stem 40-60 x 8-15 mm, with a marginate bulb, blue at first, discolouring whitish from below, with violaceous blue veil at bulb margin; flesh whitish, in stem bluish at first, soon becoming whitish; smell and taste indistinct to slightly malt-like. Sp 8.5-11 x 5-6  $\mu$ m, distinctly and densely verrucose. With *Fagus* and *Quercus* on calcareous or clayey soil; autumn; very rare in temp.; DK (CR, EJyl: Vosnæs, Elbæk Skov). – FND 28:25 (as *imperialis*), Svp 43:21 (as *camptoros*).

*C. lepistoides* T.S. Jeppesen & Frøslev in press

- Gill edge not distinctly violaceous, not contrasting the gill surface; sp citriform to amygdaloid 5
- 5. With *Corylus* and possibly also *Quercus* in open woodland; stem with a  $\pm$  conspicuous volva, which is often violaceous on the inner side; cap blue with radial brownish, hygrophanous streaks or spots; often with persistently whitish, thick, skin-like patches of veil at centre. Cap 40-90 mm, hemispherical to convex, then expanded, often with a low umbo, discolouring greyish with age; gills greyish, to slightly violaceous; stem 40-80 x 8-15(-20) mm, with a marginate bulb, bluish, fibrillose; flesh whitish, becoming somewhat orange yellow, distinctly violaceous in stem cortex; smell and taste indistinct to slightly malty. Sp 9.5-10.5 x 5.5-6.5  $\mu$ m, amygdaloid, verrucose (fig. 691B). On calcareous soil; autumn; very rare in Gtl, Vgl and Öl; SE. – AC 5:102, Svp 56:51.
- C. moëgne-loccozii* Bidaud (*C. volvatus* A.H. Sm. s. auct.)
- With *Fagus* or conifers; stem rarely with volva-like veil remnants, volva-like remnants not violaceous on the inner side; cap blue, without brownish, hygrophanous spots/streaks, often with  $\pm$  abundant, thin, appressed, whitish veil remnants, that discolour ochre yellow 6
- 6. With *Fagus*. Cap 50-100 mm, hemispherical to convex, then expanded, often with a low umbo, blue, becoming paler bluish to greyish blue with age, innately fibrillose, with abundant, appressed whitish to yellowish veil patches at centre; gills grey to bluish grey; stem 40-80 x 10-20 mm, with a marginate bulb, pale bluish, discolouring yellow brown with age, with whitish to yellowish veil at bulb margin; flesh blue in stem, whitish in cap and bulb, in bulb often becoming  $\pm$  yellowish; smell and taste indistinct to slightly malty, with age unpleasant. Sp 8.5-10 x (4.5-)5-5.5  $\mu$ m, amygdaloid, verrucose (fig. 691C). On  $\pm$  calcareous or clayey soil, often in litter; autumn; rare in temp.; DK (LC), SE (EN). – CFP B51, Phil 176c, Ves 368, ☉.

*C. caerulescens* (Schaeff.) Fr.

- In coniferous forests 7
- 7. Sp 8.5-9.5 x 5-6  $\mu$ m, amygdaloid, densely verrucose; cap rarely with sparse whitish veil patches. Cap 40-90 mm, hemispherical to convex, then expanded, bluish to blue grey when young, centre ochraceous brown to dark brown, innately fibrillose; gills grey to bluish grey; stem 40-70 x 10-20(-25) mm, with a marginate bulb, pale bluish, with age becoming whitish; veil initially bluish tinged, later whitish to yellowish; flesh whitish, in stem cortex bluish, often becoming  $\pm$  yellowish to yellow brown in bulb; smell and taste indistinct to slightly malty, with age unpleasant. With *Pinus* and *Picea* on calcareous soil, in Central Europe with *Abies*; autumn; very rare in hemib.-bore.; FI (VU), NO (EN), SE (VU, Gtl). – AC 5:102, CFP B42.
- C. caesiocanescens* M.M. Moser
- Sp (9-)9.5-10.5 x 5-6  $\mu$ m, acutely amygdaloid to citriform, distinctly and densely verrucose (fig. 691D); cap with fairly abundant, whitish to ochraceous yellow veil patches. Cap 40-90 mm, hemispherical to convex, then expanded, bluish to dark violaceous when young, centre



Spores: A: *Cortinarius terpsichores*, B: *C. moëgne-loccozii*, C: *C. caerulescens*, D: *C. aurantiobasilis*, E: *C. insignibulbus*, F: *C. aureopulverulentus*.

ochraceous brown to dark brown, innately fibrillose; gills grey to bluish grey; stem 40-70 x 10-20 mm, with a marginate bulb, fairly distinctly blue, with age becoming paler; veil initially tinged bluish, later whitish to yellowish; flesh whitish, in stem cortex bluish, becoming  $\pm$  yellowish to yellow brown in bulb; smell and taste indistinct to slightly malty, with age unpleasant. With *Picea* on calcareous soil; autumn; very rare in bore.; NO. – AC 5:101.  
***C. aurantiobasilis* Bidaud**

- 8. KOH on bulbipellis negative 9
- KOH on bulbipellis distinctly pink 12

- 9. With an intense and sweet smell, like *Hebeloma sacchariolens* or *Prunus* flowers; sp (11-)11.5-13(-13.5) x 6.5-7.5(-8)  $\mu$ m. Cap 40-100 mm, hemispherical to convex, then expanded, pinkish violaceous, discolouring yellowish white from centre, centre often with appressed white veil, discolouring yellowish; stem 40-80 x 10-18 mm, with a marginate bulb, pinkish violaceous, discolouring from below; gills pinkish grey to violaceous grey; flesh whitish, pinkish violaceous in stem cortex; KOH negative in all parts. Sp citriform to amygdaloid, coarsely verrucose. With deciduous trees on calcareous soil; autumn; very rare in temp.-hemib.; DK (CR), NO (EN), SE (CR). – Cons B163, B103, M&J 54, Mos 101.

***C. suaveolens* Bataille & Joachim**

- Smell trivial or faintly earthy; sp on av < 11 x 6.5  $\mu$ m 10
  - 10. Cap cream, pale olivaceous to pale yellowish, with a violaceous tinge, glabrous; sp on av. < 10 x 6  $\mu$ m see *C. lilacinovelatus* key B 21
  - Cap predominantly grey, pale brown to date brown, with a reddish to violaceous tinge, often somewhat innately fibrillose; sp on av > 10 x 6  $\mu$ m 11
  - 11. Many pileipellis hyphae with incrusting, yellow-brown pigment,  $\pm$  zebra striate; cap red brown with KOH. Cap 50-70 mm, hemispherical to convex, then expanded, initially greyish, soon becoming darker red brown to date brown, sometimes with indistinct brownish veil patches; gills persistently violet; stem 40-70 x 10-15 mm, entirely violaceous, with a marginate bulb; veil on bulb margin violaceous on young specimens, staining brownish; flesh whitish; smell and taste indistinct; KOH on cap red brown. Sp 10-11.5 x 6-7  $\mu$ m, amygdaloid, coarsely verrucose. With *Corylus* in  $\pm$  open woodland on calcareous soil; autumn; very rare in hemib.; SE (Öl). – JEC 7:52,53.
- C. ionodactylus* Knutsson & Soop**
- Pileipellis hyphae smooth or with sparse epiparietal granules; cap almost unchanging with KOH see *C. vesterholtii* key C 22

- 12. KOH in flesh distinctly pink; gill edge  $\pm$  sterile with conspicuous sterile elements. Cap 60-100 mm, hemispherical to convex, then expanded; initially violaceous, sometimes  $\pm$  rose at margin, centre soon becoming violaceous grey; gills grey to pale greyish violaceous; stem 50-100 x 12-20 mm, with a relatively narrow, not sharply marginated bulb, distinctly violaceous; flesh whitish, in stem cortex distinctly violaceous; smell indistinct or slightly malty,



taste distinctly bitter; KOH on cap slowly  $\pm$  pinkish. Sp 9.5-11(-11.5)  $\times$  6-7  $\mu\text{m}$ , amygdaloid, coarsely verrucose. With *Abies alba* on  $\pm$  calcareous soil, also found with sclerophyllous *Quercus* spp. on eutrophic, but not calcareous soil; autumn; DE. – CFP C26.

*C. dibaphus* Fr.

- KOH in flesh negative to greyish rose; gill edge  $\pm$  fertile, without conspicuous sterile elements 13
  - 13. KOH on cap weakly rose; cap predominantly cream to ochraceous, usually only with a weak pinkish tinge or only slightly bluish at margin; with frondose trees; microchemical pileipellis reaction pink in a few isolated areas, with abundant extracellular crystals see *C. selandicus* key C 7
  - KOH on cap usually distinctly pink to red, at least on blue areas of cap; cap usually with more distinct blue or grey to violaceous grey colours, at least at margin; with frondose or coniferous trees; microchemical pileipellis reactions without pink colours or distinctly and predominantly pink 14
  - 14. With conifers 15
  - With deciduous trees 16
  - 15. Cap almost whitish, pale ochraceous to greyish brown, later more ochraceous brown from centre, sometimes with  $\pm$  distinct violaceous to lilaceous colouration in patches, at margin grey white to violaceous to lilaceous cream. Cap 60-120 mm, hemispherical to convex, then expanded; gills grey with a lilaceous edge to persistently lilaceous; stem 50-80  $\times$  15-22 mm, greyish white, sometimes with faint violaceous tinges at top; flesh whitish; smell and taste indistinct or  $\pm$  earthy; KOH on cap blood red, on bulbipellis pink, in flesh weakly rose. Sp (10.5-)11-13  $\times$  (6.5-)7-8(-8.5)  $\mu\text{m}$ , amygdaloid to citriform, coarsely verrucose. With *Pinus* on calcareous soil; autumn; very rare in hemib.; NO (EN), SE (NE, Gtl). – Mos 102.
- C. spectabilis* M.M. Moser
- Cap mottled with dark violaceous blue, bluish to olivaceous colours, at least margin, olivaceous grey to grey blue at centre, with age ochraceous grey brown to brown. Cap 50-80 mm, hemispherical to convex, then expanded, sometimes with sparse dark velar scales at centre; gills greyish to pale violaceous grey, edge sometimes more distinctly violaceous; stem 30-60  $\times$  11-17 mm, whitish to pale violaceous; veil at bulb margin violaceous to olivaceous; flesh whitish; smell and taste indistinct or  $\pm$  earthy; KOH on cap blood red, on bulbipellis pink, in flesh weakly rose. Sp 10.5-12(-12.5)  $\times$  6-7(-7.5)  $\mu\text{m}$ , amygdaloid to slightly citriform, coarsely verrucose. With *Picea* on calcareous soil; autumn; rare in bore.; FI, NO, SE (NE). – BCat 662 (as *caesiocanescens*), Mic Due 66.
- C. caesiocinctus* Kühner
- 16. Sp (10.5-)11-12(-12.5)  $\times$  6-7.5  $\mu\text{m}$ . Cap 40-70 mm, hemispherical to convex, then expanded, mottled with violaceous, blue-green to greyish colours like *Russula cyanoxantha*, with age becoming ochraceous grey to brownish,  $\pm$  covered with appressed, initially yellowish white veil that discolours brownish and cracks into small scales, margin slightly fibrillose with age; gills violaceous; stem 30-70  $\times$  6-12 mm, with marginate,  $\pm$  flattened bulb, violaceous blue, discolouring yellowish white from below with age; veil at bulb margin olivaceous grey to violaceous; flesh whitish, in stem cortex violaceous; smell and taste indistinct or  $\pm$  earthy, cap cuticle  $\pm$  bitter; KOH on cap brownish where covered with veil, on violaceous areas of cap dark rose to vinaceous, on bulbipellis pink, in flesh negative. Sp amygdaloid, coarsely verrucose. With *Tilia cordata* on calcareous scree soil, possibly also with *Quercus* and *Corylus*; autumn; very rare in hemib.; NO, SE.
- C. cordatae* T.S. Jeppesen, Brandrud & Frøslev in press
- Sp on av < 11  $\mu\text{m}$  long 17
  - 17. Microchemical KOH reaction of all pileipellis hyphae pale brownish; cap initially and



especially with time mottled in dark blue, brown and grey colours, often with abundant appressed, yellowish to brownish, fairly thick universal veil or with numerous small brown velar scales. Cap 50-100(-130) mm, low convex, then expanded; gills greyish to violaceous; stem 50-90 x 9-20 mm, with flattened bulb, violaceous, discolouring yellowish white from below with age, veil at bulb margin whitish to somewhat violaceous, staining brownish with age; flesh whitish, in stem cortex violaceous, often with a distinct violaceous line below cap cuticle; smell and taste indistinct or  $\pm$  earthy, sometimes slightly bitter in cap cuticle; KOH pinkish on violaceous areas of cap, but with fairly slow onset compared to *C. sodagnitus*, on bulbipellis pink, in flesh negative to slightly rose. Sp (9-)9.5-10.5(-11) x 5.5-6.5(-7)  $\mu$ m, amygdaloid to almost ellipsoid, coarsely verrucose. With *Quercus* on calcareous soil; autumn; very rare in temp.-hemib.; SE. – AC 6:122 (as *caesiocinctus*), 11:343, Cons B103 (lower, as *molochinus*).

*C. violaceipes* Bidaud & Consiglio (*C. parasuaveolens* (Bon & Trescol) Bidaud, Moëgne-Locc. & Reumaux s. auct.)

- Microchemical KOH reaction of most pileipellis hyphae pink, usually no or few brownish reacting hyphae; cap initially with  $\pm$  clean, pinkish, violaceous or pale to deep blue colours 18
- 18. Sp 9.5-11 x 5.5-6.5  $\mu$ m; cap pinkish violaceous when young, at least at margin; frb often fairly large. Cap 55-100 mm, hemispherical to convex, then expanded, with age often turning  $\pm$  brownish at centre, margin discolours cream to ochraceous white, often with small patches of whitish veil at centre; gills pinkish violet to violaceous grey; stem 45-75 x 12-20 mm, with a flattened bulb, whitish, sometimes with a pinkish to violaceous tinge at stem top when young, with yellowish veil at bulb margin, discolouring ochraceous brown; bulbipellis often slightly violaceous when young; flesh whitish; smell and taste indistinct or  $\pm$  earthy; KOH pink on cap and bulbipellis, weakly rose in flesh. Sp amygdaloid, coarsely verrucose. With deciduous trees on calcareous soil, mainly *Quercus*; autumn; very rare in hemib.; NO, SE. – AC 6:124, 11:350 (middle, as *subarquatus*).  
*C. molochinus* Bidaud & Ramm
- Sp (8.5-)9-10(-10.5) x 5-6(-6.5)  $\mu$ m; cap violaceous blue to distinctly blue; frb often fairly small 19
- 19. Cap initially uniformly, distinctly and deep blue, when young usually with drop-like spots at margin, without patches of universal veil. Cap 40-70(-80) mm, hemispherical to convex, then expanded, discolouring whitish, yellowish to  $\pm$  brass brown with age; gills greyish to violaceous; stem 40-70 x 7-15 mm, with a flattened bulb, whitish with violaceous top to entirely violaceous, discolouring yellowish to brass brown with age; veil at bulb margin usually sparse, whitish to violaceous; flesh whitish, sometimes violaceous in stem cortex; smell and taste indistinct or  $\pm$  earthy, sometimes slightly bitter in cap cuticle; KOH on cap distinctly pink to blood red, on bulbipellis pink, in flesh negative to pale rose. Sp 9-10(-10.5) x 5-6(-6.5)  $\mu$ m, amygdaloid, coarsely verrucose. On calcareous soil with *Fagus*, more rarely *Quercus*; autumn; very rare in temp.; DK (VU), NO (CR), SE (EN). – CFP B19, M&J 17, Phil 176b.  
*C. sodagnitus* Rob. Henry
- Cap margin initially pale violaceous blue, centre cream to pale ochraceous yellow; margin without drop-like spots, often with sparse whitish veil patches at centre. Cap 35-50(-60) mm, hemispherical to convex, then expanded, discolouring whitish to yellow brown from centre; gills greyish to pale violaceous; stem 30-50 x 7-12 mm, with a flattened bulb, whitish, often with violaceous top; veil at bulb margin whitish, becoming somewhat yellowish; flesh whitish; smell and taste indistinct or  $\pm$  earthy; KOH on cap and bulbipellis distinctly pink, in flesh negative. Sp 8.5-10 x (5-)5.5-6  $\mu$ m, ellipsoid to amygdaloid, coarsely verrucose. With *Fagus* and *Quercus* on calcareous soil; autumn; very rare in temp.-hemib.; DK (CR, Lol: Møns Klint), NO (CR). – AC 5:151, Phil 126 (as *rickenianus*).  
*C. nymphicolor* Reumaux (*C. rickenianus* Maire s. auct. p.p.)

**Key C:** Subgen. *Phlegmacium*: Stem bulbous; gills initially with violaceous or blue colours and/or bulbipellis distinctly pink with KOH

1. Bulbipellis or flesh distinctly pinkish with KOH or universal veil on bulb edge with a red to deep red-brown reaction with KOH; sp on av > 9  $\mu\text{m}$  long 2
  - Bulbipellis and flesh not distinctly pink with KOH; KOH negative to brownish on universal veil on bulb edge; sp on av < 9  $\mu\text{m}$  long or not 16
2. Flesh distinctly pink with KOH; gill edge  $\pm$  sterile with conspicuous sterile elements. Cap 50-120 mm, hemispherical to convex, then expanded, uniformly orange brown to rose brown, rarely with whitish or violaceous veil patches; gills greyish white, sometimes with a violaceous edge; stem 40-120 x 12-20 mm, whitish, rarely slightly violaceous, often with distinctly violaceous veil at bulb margin; flesh whitish; smell weak, malt-like; taste bitter. Sp (9-)9.5-10.5 x 6-7  $\mu\text{m}$ , amygdaloid, coarsely verrucose. Mainly with *Quercus*, but also with *Corylus* and *Fagus*, on calcareous soil, mostly in open woodland; autumn; rare in hemib., very rare in temp.; DK (CR), NO, SE (VU). – AC 6:123, Däh 738, GCI 2:B15, M&J 54.  
*C. arcuatorum* Rob. Henry
  - Flesh not distinctly pink with KOH, but may be faintly greyish rose; gill edge  $\pm$  fertile, without conspicuous sterile elements 3
3. Cap whitish, cream or pale olivaceous, at least towards margin 4
  - Cap more lively coloured or darker brownish 8
4. In coniferous forests. Cap 40-70 mm, hemispherical to convex, then expanded, cream to pale yellowish towards margin, towards centre yellow brown to pale ochraceous brown, often  $\pm$  conspicuously bicoloured, sometimes with indistinct whitish to ochraceous brown veil patches; gills violaceous grey to grey with a slightly violaceous edge; stem 40-70 x 7-12 mm, whitish, with whitish veil, becoming  $\pm$  ochraceous at bulb margin; flesh whitish; KOH on cap  $\pm$  rose/reddish to brownish, on bulbipellis pink. Sp (9.5-)10-11(-11.5) x 6-7  $\mu\text{m}$ , amygdaloid to slightly citriform, coarsely verrucose. Calciphilous, probably associated with *Pinus*, in Central Europe with *Abies*; autumn; very rare in hemib.-bore.; SE (Gtl).  
*C. subgracilis* Moënné-Locc. (*C. parvus* Rob. Henry s. lato)
  - In deciduous forests 5
5. KOH on cap distinctly pink to blood red; gills cream to very pale violaceous. 6
  - KOH on cap negative, brownish to pale rose; gills often distinctly violaceous, at least on edge 7
6. Cap whitish to pale ochraceous white. Cap 40-100 mm, hemispherical to convex, then expanded, with age often irregularly brownish spotted or striate at centre; gills greyish white, rarely faintly violaceous; stem 35-100 x 7-14 mm, whitish, with a flattened bulb; flesh whitish; KOH on bulbipellis pink. Sp 9.5-11 x 5.5-6.5(-7)  $\mu\text{m}$ , amygdaloid, coarsely verrucose. With *Fagus* and *Quercus* on calcareous soil; autumn; very rare in temp.; DK (CR, EJyl: Vosnaes). – Myr 110:1048.  
*C. albertii* Dima, Frøslev & T.S. Jeppesen (*C. parvus* Rob. Henry s. lato)
  - Cap pale olivaceous to pale yellow see 14
7. Sp 10-11.5 x 6-7  $\mu\text{m}$ , amygdaloid (fig. 691E); gills often distinctly and persistently violaceous lilac. Cap 25-55 mm, hemispherical to convex, then expanded, almost persistently pale cream, becoming slightly brownish towards centre, often with small dark brown velar scales at centre; stem 25-50 x 5-10 mm, entirely violaceous lilac when young, with a flattened bulb; flesh whitish, violaceous in stem cortex; KOH on cap negative to weakly brownish, on bulbipellis pink. Sp coarsely verrucose. With *Fagus*, possibly also *Carpinus*, on calcareous soil; autumn; very rare in temp.; DK (EN, Sj: Allindelille, Lol: Møns Klint). – AC 11:342, 330 (as

*calochrous* f. *violascens*), 341 (as *subamethystinus*).

*C. insignibulbus* Bidaud & Moënne-Loec.

- Sp 9-10.5 x 5.5-6.5  $\mu\text{m}$ , (ellipsoid-)amygdaloid; gills often very pale violaceous to almost greyish white, but often with a more distinctly violaceous edge. Cap 35-80 mm, hemispherical to convex, then expanded, initially olivaceous cream, becoming  $\pm$  olivaceous brown, sometimes even with faint pinkish to violaceous streaks on the least exposed parts, often with larger patches of veil; stem 35-60 x 6-11 mm, whitish to entirely violaceous, but most often violaceous at top; flesh whitish, violaceous in stem cortex; KOH on cap pale rose to rose brown, on bulbipellis pink. Sp coarsely verrucose. With *Fagus* on calcareous soil; autumn; very rare in temp.; DK (EN). – MyR 110:1048.

*C. selandicus* Frøslev & T.S. Jeppesen

- 8. Cap brown, olivaceous brown to greyish, without yellow tinges 9
- Cap yellow, olivaceous or yellow brown 11
- 9. Bulb narrow and root-like tapering; KOH on bulbipellis negative, but deep red to red brown on veil at bulb margin. Cap 25-50 mm, hemispherical to convex, brown, towards margin sometimes with an olivaceous tinge, at centre  $\pm$  red brown with age, sometimes with small patches of pale yellow veil; gills violaceous to violaceous grey; stem 35-65 x 7-12 mm, whitish, sometimes slightly violaceous in upper part, with sparse yellow veil at bulb margin; flesh whitish. Sp 10.5-11.5 x 6-7  $\mu\text{m}$ , amygdaloid-citriform, coarsely verrucose; pileipellis slightly duplex, basally with broader hyphae. With *Fagus* on calcareous soil; autumn; very rare in temp.; DK (EN). – JEC 5:30, Svp 51:37.

*C. aureocalceolatus* M.M. Moser & Peintner

- Bulb broad, not root-like tapering; KOH on bulbipellis distinctly pink 10
- 10. In coniferous forests see *C. caesiocinctus* key B16
- In deciduous forests see *C. cordata* key B 16 and *C. violaceipes* key B 17
- 11. Sp (11.5-)12-14 x 7-8.5  $\mu\text{m}$ ; with conifers 12
- Sp 9.5-11.5(-12) x 5.5-7.5  $\mu\text{m}$ ; with deciduous trees or conifers 13
- 12. Cap with  $\pm$  innate, radial striae or fibres, with a distinctly mottled appearance of olivaceous to brown, golden yellow or rarely bluish colours; veil on bulb margin and cap margin glutinous in young frb, yellow, becoming  $\pm$  orange; sp distinctly citriform. Cap 35-80 mm, hemispherical to convex, then expanded, margin bright lemon yellow to olivaceous, towards centre olivaceous to  $\pm$  olivaceous brown; gills distinctly but rarely deeply violaceous or greyish violaceous; stem 40-70 x 10-18 mm, whitish to pale violaceous; flesh in stem greyish violet, otherwise whitish; cap and universal veil at bulb instantly blood red with KOH. Sp 12.5-14 x 7-8.5  $\mu\text{m}$ , with very coarse ornament (fig. 691F); pileipellis slightly duplex, basally with bundles of wider, brown incrustated hyphae. With *Picea* on calcareous soil, often in ant-hills; autumn; occasional in hemib., rare in bore.; FI (LC), NO (LC), SE (vu). – M&J 58, Sieniop 190.

*C. aureopulverulentus* M.M. Moser

- Cap without radial striae or fibres, yellow; veil on bulb margin not distinctly glutinous, not becoming orange; sp amygdaloid to citriform. Cap 40-90 mm, hemispherical to convex, then expanded, yellow at first, sometimes with bright lemon-yellow margin, but discolouring ochraceous yellow to ochraceous with age, with whitish to brownish veil patches or scales; gills distinctly, but rarely deeply violaceous or greyish violaceous; stem 40-100 x 10-18 mm, whitish, sometimes violaceous in upper part, sometimes entirely violaceous when young; KOH on cap pinkish red, on veil pinkish to rose brown, on bulbipellis pink; flesh whitish. Sp (11.5-)12-13(-13.5) x 7-8.5  $\mu\text{m}$ , coarsely verrucose. With conifers, mainly *Picea* on calcareous soil; autumn; very rare in hemib.-bore.; FI, NO, SE. – CFP A48 (as *calochrous* var. *barbaricus* [originally as var. *haasii*]).

*C. barbaricus* (Brandrud) Frøslev, T.S. Jeppesen & Brandrud

13. KOH on bulbipellis negative to weakly rose, on bulb margin distinctly red brown. Cap 45–80 mm, hemispherical to convex, then expanded, yellow, brownish yellow, sometimes with pale greenish yellow margin, sometimes with  $\pm$  diffuse whitish veil patches, without small dark scales; gills violaceous lilac; stem 35–70  $\times$  10–14 mm, whitish, sometimes violaceous at top; flesh whitish. Sp (9.5–)10–11(–11.5)  $\times$  6–7  $\mu\text{m}$ , amygdaloid(–citriform), coarsely verrucose. With deciduous trees in open woodland on calcareous soil or with *Helianthemum* in alvars; autumn; rare in hemib., very rare in temp.; DK (CR, Sj: Vejlsø Skov), SE. – CFP A18 (as *calochrous* var. *caroli*), MyR 110:1048.  
*C. cisticola* Frøslev & T.S. Jeppesen
- KOH on bulbipellis and bulb margin distinctly pink 14
14. Gills greyish white. Cap 40–100 mm, hemispherical to convex, then expanded, usually ochraceous yellow to yellow, sometimes ochraceous brown, often uniformly colored, sometimes with sparse small velar scales at centre, sometimes with darker spots or striae with age; stem 40–80(–100)  $\times$  10–20 mm, whitish, glabrous, universal veil at bulb margin whitish ochraceous yellow to yellow; flesh whitish. Sp (10–)10.5–11.5(–12)  $\times$  5.5–6.5(–7)  $\mu\text{m}$ , acutely amygdaloid to citriform, fairly coarsely verrucose. With *Picea* on rich, but never strictly calcareous soil, often in deep moss; autumn; very rare in bore.; NO, SE.  
*C. kristinae* Brandrud in press
- Gills violaceous 15
15. With deciduous trees on calcareous soil. Cap 40–70 mm, hemispherical to convex, then expanded, usually pale ochraceous yellow to yellow, almost whitish at margin when young, sometimes cream with a faint olivaceous tinge, with age often with yellow–brown spots or streaks, sometimes with sparse, small velar scales at centre; gills violaceous; stem 30–60  $\times$  7–12 mm, whitish, universal veil at bulb margin whitish ochraceous yellow; flesh whitish. Sp 9.5–10.5  $\times$  5.5–6.5  $\mu\text{m}$ , ellipsoid (to amygdaloid), fairly coarsely verrucose (fig. 697A). Autumn; very rare in temp.–hemib.; DK (EN), NO (EN), SE. – CFP B53, GCI 1:A19 (upper only).  
*C. catharinae* Consiglio (*C. parvus* Rob. Henry s. lato)
- With conifers on calcareous soil. Cap 40–90 mm, hemispherical to convex, then expanded, often yellow at first, sometimes with bright lemon–yellow margin, but discolouring ochraceous yellow to ochraceous with age, with whitish to brownish veil patches or scales; gills distinctly but rarely deeply violaceous lilac or greyish violaceous; stem 40–100  $\times$  10–18 mm, whitish, sometimes  $\pm$  violaceous; flesh whitish, sometimes violaceous in cortex. Sp (9.5–)10–11.5(–12)  $\times$  6–7.5  $\mu\text{m}$ , amygdaloid–citriform, coarsely verrucose. Autumn; rare in hemib.–bore.; FI, NO (NT), SE. – AC 11:353.  
*C. barbarorum* Bidaud, Moënne-Locc. & Reumaux (*C. calochrous* (Pers.: Fr.) Gray var. *barbaricus* Brandrud s. lato)
- 16(1) Cap cuticle bitter; smell sweetish plum- to celery-like and often earthy. Cap 50–140 mm, hemispherical to convex, then expanded, initially olivaceous yellow, soon becoming ochraceous yellow to yellow brown, sometimes with  $\pm$  whitish veil patches; gills violaceous, soon discolouring; stem 45–90  $\times$  12–25 mm, whitish, often violaceous blue when young, with a rounded bulb with ochraceous yellow veil; flesh whitish, bluish in stem top when young. Sp 10–12  $\times$  6–7  $\mu\text{m}$ , citriform, distinctly and densely verrucose (fig. 697B). With *Fagus*, very rarely *Tilia*, on rich to calcareous soil; autumn; occasional in temp., very rare in hemib.; DK (LC), NO (EN), SE (VU). – CFP B52, Phil 176a (as *amoenolens*), Ves 372.  
*C. anserinus* (Velen.) Rob. Henry
- Cap cuticle mild or bitter; smell not sweetish plum- or celery-like 17
17. Sp subglobose, Qav < 1.3 (fig. 697C). Cap 50–100 mm, hemispherical to convex, then expanded, with age distinctly innately fibrillose, initially greenish olivaceous to olivaceous brown, with age becoming yellow brown from centre; gills persistently violaceous to greyish violaceous; stem 45–80  $\times$  12–22 mm, initially violaceous blue, with age discolouring





Spores: A: *Cortinarius catharinae*, B: *C. anserinus*, C: *C. prasiocyaneus*, D: *C. calochrous*, E: *C. vesterholtii*, F: *C. purpurascens*.

± olivaceous; flesh whitish, sometimes with a faint greenish yellow tinge, in stem cortex ± violaceous. Sp 9.5-11.5 × 8-8.5 µm, coarsely verrucose. With *Corylus*, *Tilia* and *Quercus* on calcareous soil; autumn; very rare in hemib., rare on ÖI.; NO (CR), SE (EN). – Svp 56:53.

*C. prasinocyaneus* Rob. Henry

- Sp ellipsoid, amygdaloid or citriform, Qav > 1.3 18
- 18. Pileipellis simplex, without a (sub)cellular subpellis; sp with a coarse ornamentation of irregular, ± interconnected warts and crusts; cap rarely innately fibrillose, not hygrophanous; smell often slightly earthy 19
  - Pileipellis duplex, with a distinct (sub)cellular subpellis; sp with regular, isolated warts; cap ± innately fibrillose or hygrophanous, smell ± malt-like 24
- 19. Mycelial strands and/or bulbipellis sulphur to lemon yellow 20
  - Mycelial strands and bulbipellis whitish, pale ochraceous or violaceous 21
- 20. Sp 9-10(-10.5) × 5-6 µm (fig. 697D). Cap 35-70 mm, hemispherical to convex, then expanded, bright lemon yellow, later more ochraceous yellow, often with small, dark brown velar scales at centre; gills distinctly and rather persistently violaceous lilac; stem 30-60 × 7-12 mm, with flattened bulb, whitish; bulbipellis and mycelial strands yellow, veil on bulb margin distinctly yellow; flesh whitish, sometimes slightly grey brown at stem top. Sp amygdaloid, coarsely verrucose. In deciduous forests, mainly with *Fagus*, on ± calcareous soil; autumn; occasional in temp., very rare in hemib.; DK (LC), NO (EN), SE (LC). – Däh 739, Mos 109 (as *Phlegmacium citrinolilacinum*), Ves 372, Ⓢ.
 

*C. calochrous* (Pers.: Fr.) Gray (*C. citrinolilacinus* M.M. Moser)

  - Sp 10.5-12.5 × 6-7 µm. Cap 40-90 mm, hemispherical to convex, then expanded, olivaceous yellow to yellow brown, with paler yellow to greenish yellow, sometimes more greyish ochre margin when young, often with larger ± whitish veil patches that discolour brownish; gills bright and fairly persistently violaceous lilac to greyish violaceous; stem 40-75 × 10-20 mm, violaceous, at least in upper part, often deeply and persistent at top, otherwise ± whitish; veil on bulb margin whitish, ochre yellow to violaceous, discolouring brownish; flesh whitish, often with a violaceous tinge in stem cortex. Sp amygdaloid to slightly citriform, coarsely verrucose. Probably with *Pinus*; in Central Europe mainly with *Abies*, on calcareous soil; autumn; rare in hemib.; SE (Gtl). – CFP C27 (as *calochrous* var. *haasii*), Mos 114.

*C. haasii* (M.M. Moser) M.M. Moser
- 21. Cap pale cream to pale olivaceous 22
  - Cap yellow, yellow brown or date brown 23
- 22. Universal veil initially violaceous, often indistinctly so and only visible on young frb as violaceous veil patches on cap or /and as a violaceous bulbipellis. Cap 35-70 mm, hemispherical to convex, then expanded, cream to pale yellowish or olivaceous, becoming ± ochraceous with age; gills violaceous grey; stem 30-60 × 7-12 mm, with a flattened bulb, whitish, sometimes with a violaceous tinge at top, often with violaceous veil at bulb margin, at least if bruised; flesh whitish, with a ± greyish tinge in stem top, and sometimes viola-



ceous in cortex. Sp 8.5-10 x 5-6  $\mu\text{m}$ , amygdaloid, coarsely verrucose. With deciduous trees, mainly *Fagus*, on calcareous soil; autumn; rare in temp.; DK (vu), SE. – AC 11:333, Däh 742 (as *subarquatus*), Svp 27:42 (as *rickenianus*).

*C. lilacinovelatus* Reumaux & Ramm (*C. parvus* Rob. Henry s. lato p.p.)

- Universal veil cream or pale ochraceous. Cap 40-90 mm, hemispherical to convex, then expanded, cream to pale yellowish or olivaceous grey brown, becoming  $\pm$  ochraceous from centre with age, often with veil patches; gills violaceous grey; stem 40-75 x 10-20 mm, with a flattened bulb, whitish, sometimes with a violaceous tinge at top, with whitish to ochraceous white veil at bulb margin; flesh whitish, with a  $\pm$  greyish tinge in stem top. Sp (9-)9.5-10.5(-11) x (5-)5.5-6.5  $\mu\text{m}$ , amygdaloid, coarsely verrucose. With deciduous trees, mainly *Fagus*, on calcareous soil; autumn; rare in temp.; DK (DD), SE. – Mos 111.

*C. platypus* (M.M. Moser) M.M. Moser (*C. parvus* Rob. Henry s. lato p.p.)

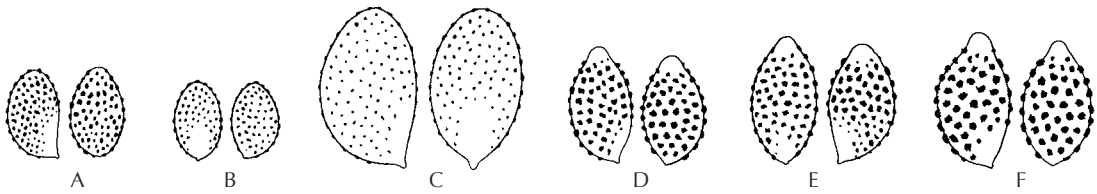
23. Stem distinctly and fairly persistently violaceous, often with violaceous veil at bulb margin; with deciduous trees. Cap 50-90 mm, hemispherical to convex, then expanded, often somewhat innately fibrillose, ochraceous brown to date brown, with somewhat yellow-brown margin, rarely with grey-red tinges, rarely with appressed pale ochraceous veil patches, without small velar scales; gills violaceous lilac; stem 35-70 x 10-17 mm; flesh whitish, often with violaceous tinge in stem cortex. Sp 10-11.5 x 5.5-6.5  $\mu\text{m}$ , amygdaloid to citriform, coarsely verrucose (fig. 697E). On calcareous soil; autumn; very rare in temp.; DK (EN), SE. – AC 11:341, MyR 110:1048, Svp 56:38,42.

*C. vesterholtii* Frøslev & T.S. Jeppesen (*C. provencalis* M.M. Moser s. auct.)

- Stem whitish, with yellowish veil at bulb margin, without violaceous tinges; with *Picea*, rarely *Pinus*. Cap 35-70 mm, hemispherical to convex, then expanded, yellow to warm yellow brown, sometimes orange brown at centre, often with brownish, radial streaks and numerous small dark brown velar scales; gills faintly violaceous grey; stem 40-70 x 7-12 mm; flesh whitish. Sp 9.5-10.5 x 6-7  $\mu\text{m}$ , amygdaloid to slightly citriform, coarsely verrucose. On calcareous soil; autumn; rare, but locally occasional in hemib.-bore.; FI, NO (NT), SE.

*C. piceae* Frøslev, T.S. Jeppesen & Brandrud (*C. calochrous* (Pers.: Fr.) Gray var. *coniferarum* (M.M. Moser) Quadr. s. auct.)

24. Cap cream to pale ochraceous see key D 9  
 - Cap darker 25
25. Gills and stem becoming violaceous lilac when bruised 26  
 - Gills and stem not becoming violaceous lilac when bruised 27
26. Stem with a distinct, marginate bulb; in coniferous forests, rarely with deciduous trees. Cap 40-90 mm, hemispherical to convex, then expanded, innately fibrillose, with small hygrophanous spots or streaks or sometimes a narrow ring near margin, greyish yellow brown, brown to somewhat red brown, at margin grey brown to bluish grey, sometimes violaceous blue when developed after frost; gills violaceous to bluish grey; stem 40-80 x 12-20 mm, initially bluish, discolouring whitish, with violaceous blue veil at bulb margin; flesh whitish, bluish in stem top. Sp 8-9 x 5-6  $\mu\text{m}$ , broadly ellipsoid, very distinctly verrucose (fig. 697F). On rich but rarely calcareous soil, often in young *Picea* plantations; autumn; occasional in hemib.-bore., rare in temp.; DK (LC), FI (DD), NO (LC), SE (LC). – Mos 131a & b.  
*C. purpurascens* (Fr.) Fr.  
 - Stem  $\pm$  clavate; in deciduous forests see *C. subpurpurascens* key H 14
27. Sp on av < 8.5  $\mu\text{m}$  long 28  
 - Sp on av > 8.5  $\mu\text{m}$  long 30
28. Bulb broad and flattened, often twice as broad as stem; stem base below bulb margin acutely tapering; universal veil thick, seen as appressed olivaceous or ochraceous, fibrillose veil remnants towards cap margin, skin-like patches at cap centre or as a volva at bulb



Spores: A: *Cortinarius glaucopus*, B: *C. pansa*, C: *C. reideri*, D: *C. luhmannii*, E: *C. subhygrophanus*, F: *C. viridicoeruleus*.

margin; in deciduous forests. Cap 60-150 mm, hemispherical to convex, then expanded, very coarsely innately fibrillose, at margin initially green to olivaceous, at centre becoming yellow brown to umber brown; gills deep violaceous to violaceous grey when young, bluish tinges soon fading; stem 40-110 x 14-28 mm, violaceous blue, at least in upper part, discolouring yellow brown, sometimes with a greenish reflex, often with a yellowish white to pale olivaceous tinge, usually with volva from veil at the bulb margin; flesh violaceous blue in stem when young, otherwise whitish, becoming somewhat orange brown in bulb; universal veil olivaceous or ochraceous. Sp (6.5-)7-8 x 4.5-5.5  $\mu\text{m}$ , ellipsoid (to amygdaloid), verrucose. On calcareous soil, mostly in open woodland; autumn; rare in hemib., very rare in temp.; DK (CR), SE (NA). – Phil 172c (as *glaucopus*), Svp 43:20 (bottom, as *glaucopus*).

*C. magicus* Eichhorn

- Bulb fairly narrow, rarely twice as broad as stem; stem base below bulb margin not acutely tapering; universal veil normally thin and appressed, leaving the cap centre with a frosty appearance, rarely with volva at bulb margin; mainly in coniferous forests
- 29
29. Sp 7-8.5 x 4.5-5.5  $\mu\text{m}$ , ellipsoid (to amygdaloid), verrucose (fig. 699A). Cap 50-120 mm, hemispherical to convex, then expanded, finely to more irregularly innately fibrillose, yellow brown to brown, at margin pale greyish yellow to olivaceous green when young, usually with thin and appressed universal veil, leaving the cap centre with a frosty appearance; gills deep violaceous to violaceous grey when young, bluish tinges soon fading; stem 40-90 x 12-25 mm, violaceous blue, at least in upper part, discolouring whitish to yellow brown, sometimes with a greenish reflex; flesh violaceous blue in stem when young, otherwise whitish, becoming somewhat orange brown in bulb. On nutrient rich to  $\pm$  calcareous soil, mainly with conifers, more rarely with deciduous trees; autumn; occasional, but locally common in hemib.-bore.: FI (LC), NO (LC), SE (LC). – CFP C30, C52, Däh 724 (as *fulminoides*), 741 (as *glaucopus* var. *olivaceus*).
- C. glaucopus* (Schaeff.: Fr.) Fr.
- Sp (6-)6.5-7.5 x 4-5  $\mu\text{m}$ , ellipsoid, finely verrucose (fig. 699B). Cap 40-90 mm, hemispherical to convex, then expanded, margin pale greyish yellow to more olivaceous green, at centre yellow brown to warm orange brown or red brown, finely to irregularly innately fibrillose or hygrophanously veined, sometimes with larger hygrophanous patches or a dark, hygrophanous marginal zone, without or with very thin frosty veil at centre; gills greyish blue, but bluish tinges soon fading; stem 30-80 x 12-20 mm, cylindrical with bulb reduced to a  $\pm$  sharp margin at the very base, pale bluish at first, colour strongest at top, sometimes with a greenish yellow reflex, with age discolouring brass brown; flesh whitish with a bluish tinge in stem cortex, yellowish at base. In  $\pm$  oligotrophic coniferous forests, often in plantations, at roadsides or somewhat disturbed soil; autumn; occasional in hemib.-bore.: FI, NO, SE.
- C. pansa* Fr.
30. Sp on av > 11  $\mu\text{m}$  long, ellipsoid; bulb rounded 31
- Sp on av < 11  $\mu\text{m}$  long or citriform to amygdaloid; bulb marginate 32

31. Cap orange brown, towards margin yellow brown, sometimes with a slight olivaceous tinge; in coniferous forests. Cap 50-110 mm, hemispherical to convex, then expanded, innately fibrillose, sometimes with whitish fibrillose veil at margin; gills violaceous blue; stem 60-120 x 12-22 mm, with rounded bulb, violaceous blue in upper part, downwards discolouring brownish, sometimes with a greenish reflex; flesh violaceous blue in stem when young, otherwise whitish. Sp 12-13.5 x (7.5-)8-9  $\mu\text{m}$ , broadly ellipsoid, distinctly verrucose (fig. 699C). In  $\pm$  oligotrophic forests; autumn; occasional in hemib.-bore.; FI (LC), NO (LC), SE. – AC 9:216 (as *fulvo-ochrascens* var. *umbrinus*), 217 (as *fulvo-ochrascens* var. *marginato-ochrascens*).

*C. riederi* (Weinm.) Fr. (*C. fulvo-ochrascens* Rob. Henry)

- Cap pale grey brown to pale ochraceous, appearing silvery grey due thin appressed veil; with *Quercus*, *Tilia* and possibly also *Betula*, *Populus* and *Corylus*, often steep scree forests. Cap 40-90 mm, hemispherical to convex, then expanded, dry; gills violaceous blue to pale violaceous grey; stem 60-90 x 12-22 mm, with a rounded bulb, bluish to pale bluish white; flesh whitish, in stem top violaceous blue. Sp 11-13.5 x 7.5-9  $\mu\text{m}$ , broadly ellipsoid, distinctly verrucose. Often on calcareous ground; autumn; rare in hemib.-bore.; FI (DD), NO (VU), SE (EN). – Mos 96.

*C. argenteolilacinus* M.M. Moser

32. Taste and smell distinctly farinaceous. Cap 40-80 mm, hemispherical to convex, then expanded, finely, innately fibrillose, grey brown to dark greyish, sometimes with a faint olivaceous tinge at margin, with age becoming ochraceous brown; gills inpersistently violaceous to violaceous grey, with a whitish edge; stem 40-90 x 10-15 mm, violaceous blue to violaceous grey, at least in upper part, with age discolouring yellowish white; flesh violaceous blue in stem, otherwise whitish. Sp 8.5-10.5 x 5-6  $\mu\text{m}$ , citriform, distinctly and densely verrucose. In coniferous forests on calcareous soil; autumn; rare in hemib.-bore., with an eastern distribution; FI (VU), SE (NT). – CFP B50.

*C. dionysae* Rob. Henry

- Taste and smell not farinaceous 33
33. Sp amygdaloid; cap evenly hemispherical to low convex, usually with fairly thick veil remnants seen as patches on cap centre 34
- Sp citriform; cap often unevenly wavy, with age often radially wrinkled, usually without veil remnants 35
34. Universal veil at bulb margin olivaceous grey to ochraceous; sp 9-10 x 5-6  $\mu\text{m}$ , amygdaloid, distinctly verrucose (fig. 699D). Cap 30-65 mm, hemispherical to convex, then expanded, initially pale grey olivaceous, becoming olivaceous grey to olivaceous brown, reminiscent of the colours of *C. infractus*, eventually yellow brown, with large and distinct, skin-like, ochraceous yellow veil patches, not hygrophanous; gills with deep, but fugacious violaceous to violaceous grey colours; stem 35-70 x 8-15 mm, violaceous blue in upper part when young, otherwise olivaceous to greyish; flesh violaceous blue in stem when young, otherwise whitish, becoming somewhat orange brown in bulb; taste  $\pm$  bitter in cap cuticle when young. In *Fagus* forests on calcareous soil, rarely also with *Tilia*; autumn; rare in temp.; DK (LC), NO (CR), SE (VU). – Svp 43:21 (as *caesiogriseus*).
- C. luhmannii* Münzmay, Saar & Oertel
- Universal veil at bulb margin pale bluish; sp (9.5-)10-11.5 x 5.5-6.5  $\mu\text{m}$ , amygdaloid, verrucose (fig. 699E). Cap 35-80 mm, hemispherical to convex, then expanded, initially brown with an olivaceous grey margin and chestnut-brown, hygrophanous spots or streaks, at margin sometimes with fibrillose, appressed violaceous veil, at centre with appressed ochraceous yellow veil patches, hygrophanous; gills violaceous to violaceous grey; stem 35-80 x 8-18 mm, violaceous blue in upper part when young, otherwise greyish white, sometimes with a greenish reflex; flesh violaceous blue in stem when young, otherwise yellowish white, becoming somewhat orange brown in bulb; taste mild. With *Corylus* and possibly

*Quercus*, often in open forests or wooded meadows on calcareous soil; autumn; very rare in hemib., (Vg, Öl); SE. – FND 29:34, Svp 56:52 (both as *subhygrophanus*).

*C. acrifolius* Rob. Henry

35. Cap innately fibrillose see *C. multiformium* D 32  
 - Cap not innately fibrillose 36
36. Gill greyish with a distinctly violaceous blue edge. Cap 40-70 mm, hemispherical to convex, then expanded, often with a low umbo, at margin olivaceous grey at first, towards centre olivaceous ochre brown to grey brown, at centre often grey brown, yellow brown to orange brown, often conspicuously bicoloured with hygrophanous outer part, often with rust brown spots or streaks; stem 40-70 x 8-15 mm, violaceous blue in upper part, towards base discolouring yellowish white; flesh in stem violaceous blue when young, otherwise whitish. Sp 10-11.5 x 6-7  $\mu\text{m}$ , citriform, distinctly and densely verrucose (fig. 699F). With *Fagus* and *Quercus* on calcareous soil; autumn; very rare in temp.-hemib.; SE. – Svp 56:49.  
*C. viridocoeruleus* Chevassut & Rob. Henry (*C. camptoros* Brandrud & Melot s. lato p.p.)  
 - Gills very pale and fugacious violaceous grey, without distinctly violaceous edge. Cap 40-70 mm, hemispherical to convex, then expanded, often with a low umbo, often bicoloured with hygrophanous outer part, towards margin grey brown to dark olivaceous brown, warmer yellow brown to sometimes red brown at centre; stem 40-70 x 8-15 mm, violaceous blue in upper part, soon discolouring yellowish white; flesh in stem violaceous blue when young, otherwise whitish. Sp 9.5-11.5 x (5.5-)6-7  $\mu\text{m}$ , citriform, distinctly and densely verrucose. On calcareous, often scree soil with *Tilia* and possibly also *Corylus*; autumn; very rare in hemib.; NO (EN), SE (VU). – CFP C24.  
*C. camptoros* Brandrud & Melot

**Key D:** Subgen. *Phlegmacium*: Stem bulbous; gills and flesh whitish, cream or ochraceous

1. Basal mycelium or universal veil at stem base whitish at first, becoming rose when exposed; sp < 8.5  $\mu\text{m}$ , almost smooth and very pale see *C. turmalis* and *C. variegatus* key H 15  
 - Basal mycelium universal veil at stem base not becoming rose when exposed; sp > 8.5  $\mu\text{m}$  long and/or distinctly ornamented and/or not very pale 2
2. Stem, bulb margin or flesh with violaceous to greyish blue tinges, at least when young 3  
 - Stem, bulb margin and flesh without violaceous to greyish blue tinges 9
3. Pileipellis duplex 4  
 - Pileipellis simplex 5
4. Universal veil at bulb margin greenish yellow; cap brown to dark brown, with radial hygrophanous streaks or spots, sometimes entirely hygrophanous see *C. sphagnophilus* key H 31  
 - Universal veil at bulb margin whitish, ochraceous yellow or violaceous; cap ochraceous white, greyish to grey brown, not hygrophanous see 18
5. With conifers 6  
 - With deciduous trees 7
6. Sp 11-13 x 7-8  $\mu\text{m}$ , amygdaloid to citriform (fig. 703A); with distinct radish-like smell and taste. Cap 40-100 mm, hemispherical to convex, then expanded, olivaceous grey to olivaceous brown, with age somewhat innately fibrillose; gills pale ochraceous grey, often with an olivaceous tint; stem 40-80 x 10-20 mm, with a marginate bulb, pale violaceous grey, olivaceous grey or pale greenish yellow, with violaceous veil at bulb margin; flesh whitish to olivaceous grey, often with a violaceous tinge in stem top when young. Sp coarsely ver-

rurose. With *Pinus*, more rarely *Picea* in dry calcareous forests; autumn; rare in hemib.-bore.; FI (NT), NO (EN), SE (VU). – CFP A43.

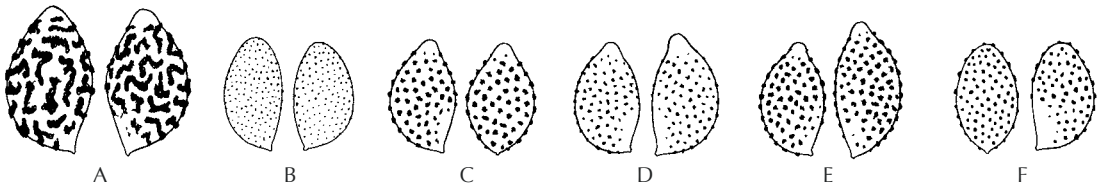
*C. pseudoglaucopus* (M.M. Moser) Quadr.

- Sp 10-11.5 x 6-7  $\mu\text{m}$ , ellipsoid to slightly amygdaloid; smell and taste indistinct. Cap 40-90 mm, hemispherical to convex, then expanded, orange brown to yellow brown, rarely slightly violaceous from veil at margin, glutinous, sometimes with few hygrophanous streaks or spots, with age sometimes  $\pm$  granulate-diffracted at centre; gills greyish white; stem 40-90 x 8-15 mm, with a marginate bulb, violaceous at first, soon discolouring whitish or ochraceous yellow, universal veil at bulb margin violaceous; flesh whitish. Sp distinctly verrucose. With *Pinus* on chalk; autumn; very rare in hemib.; SE (DD, Gtl).

*C. pseudoarcuratorum* Rob. Henry (*C. delaportei* Rob. Henry)

- 7. Sp 8.5-10 x 5-6  $\mu\text{m}$  see *C. lilacinovelatus* key C 22
- Sp (9.5-)10-12.5 x 6-7.5(-8)  $\mu\text{m}$  8
- 8. Cap uniformly whitish to cream see *C. caroviolaceus* 17
- Cap uniformly olivaceous, olivaceous yellow to olivaceous brown. Cap 70-120 mm, hemispherical to convex, then expanded, becoming  $\pm$  ochraceous brown with age, often fibrillose from cortina at margin, centre with patches of veil; gills greyish white, rarely with a violaceous tinge near cap margin; stem 60-100 x 15-25 mm, with a marginate bulb, initially violaceous to almost whitish, but often with a persistent violaceous tinge; flesh whitish, sometimes violaceous in stem cortex; smell and taste indistinct to  $\pm$  malt-like. Sp (10.5-)11-12.5 x 6.5-7.5(-8)  $\mu\text{m}$ , amygdaloid to slightly citriform, coarsely verrucose. With *Quercus*, *Carpinus*, *Tilia* and *Corylus* on dry, calcareous soil; autumn; very rare in hemib.; SE (Vgl). – AC 16:1100.
- C. flavidolilacinus* Bidaud
- 9. Cap whitish, cream, pale ochraceous or pale grey brown 10
- Cap yellow, yellow brown, orange brown to brown 21
- 10. Sp on av < 7.5  $\mu\text{m}$  long, ellipsoid and very pale; in dry *Pinus* forests, less often with *Picea* see *C. leucophanes* key H 9
- Sp on av > 7.5  $\mu\text{m}$  long, ellipsoid or not, cinnamon brown; with coniferous or deciduous trees 11
- 11. KOH in flesh  $\pm$  yellow; with *Pinus*, more rarely *Picea*, on acid, sandy soil 12
- KOH in flesh not yellow; with deciduous or coniferous trees, on acid, sandy soil or not 13
- 12. Frb slender; stem < 15 mm thick, longer than cap diam.; stem becoming  $\pm$  yellowish when bruised see *C. pinophilus* key H 8
- Frb robust; stem > 15 mm thick, shorter than cap diam.; stem not becoming yellowish when bruised see *C. areni-silvae* key G 18
- 13. Smell and taste distinctly farinaceous. Cap 60-120 mm, hemispherical to convex, then expanded, white to silvery grey, with age pale ochraceous at centre and finely innately fibrillose towards margin, usually with abundant cortina remnants at margin, sometimes with appressed whitish veil patches at centre; gills greyish; stem 40-90 x 15-30 mm, white, with a broad  $\pm$  rounded bulb, veil at bulb margin abundant and fairly thick, ochraceous white, becoming slightly brownish with age; flesh whitish. Sp 10.5-12.5 x 6-7(-7.5)  $\mu\text{m}$ , citriform, distinctly and densely verrucose. With *Quercus* on warm calcareous soil; autumn; DE.
- C. aleuriosmus* Maire
- Smell and taste not farinaceous 14
- 14. Pileipellis simplex 15
- Pileipellis duplex 18
- 15. With a strong and sweet smell, like *Hebeloma sacchariolens*. Cap 40-80 mm, hemispherical to convex, then expanded, initially whitish to cream, soon becoming pale ochraceous yellow,





Spores: A: *Cortinarius pseudoglaucopus*, B: *C. multiformis*, C: *C. multiformium*, D: *C. luteoimmarginatus*, E: *C. gracilior*, F: *C. xanthoochraceus*.

with age often becoming ± ochraceous to brownish, often as spots or streaks, without veil remnants; gills greyish white; stem 40-60 × 7-15 mm, whitish, with a broad, flattened bulb; veil at bulb margin whitish; flesh whitish. Sp 8.5-10 × 5-6 μm, amygdaloid to citriform, coarsely verrucose. On calcareous soil, mainly with *Fagus*, but also *Quercus* and *Tilia*; autumn; very rare in temp.-hemib.; DK (EN), NO (EN). – Phil 174c, Ves 374.

*C. osmophorus* P.D. Orton

- Smell different 16
- 16. Cap margin finely tomentose when young, somewhat innately fibrillose from appressed cortina towards margin. Cap 35-80 mm, hemispherical to convex, then expanded, whitish to cream at first, soon discolouring ± yellow brown to ochraceous brown from centre, sometimes with sparse whitish veil patches; gills pale greyish white; stem 40-60 × 10-18 mm, with a marginate bulb, whitish, with whitish veil remnants at bulb margin; flesh whitish, when young with a greyish tinge in stem top; smell and taste indistinct. Sp (9-)9.5-11 × 6-7 μm, amygdaloid to citriform, coarsely verrucose. With *Quercus*, mostly in ± open woodlands, on calcareous soil; autumn; very rare in hemib.; SE. – Svp 56:54.  
*C. rapaceotomentosus* Delaporte & Eyssartier
- Cap margin glutinous to viscid when young, not innately fibrillose 17
- 17. With *Picea*. Cap 50-100 mm, hemispherical to convex, then expanded, initially pale ochraceous to café-au-lait, with age becoming paler ochraceous white to cream, sometimes with dark orange brown velar scales; gills pale greyish white, often serrulate; stem 40-80 × 15-25 mm, with a marginate bulb, whitish, with whitish to pale yellowish veil at bulb margin; flesh whitish, when young with a greyish tinge in stem top; smell and taste indistinct. Sp (9.5-)10-11.5(-12) × 6-7(-7.5) μm, amygdaloid, coarsely verrucose. On calcareous soil; autumn; rare in hemib.-bore.; FI (LC), NO (NT), SE (VU). – Mos 13, M&J 101.  
*C. corrosus* Fr.
- With *Quercus* or *Fagus*. Cap 50-100 mm, hemispherical to convex, then expanded, white to cream, later more ochraceous, usually very uniformly colored; gills greyish white; stem 60-80 × 10-20 mm, with a broad, marginate bulb, whitish, sometimes ± violaceous blue at the top, veil at bulb margin fairly abundant, whitish, staining somewhat brownish; flesh whitish, sometimes ± violaceous blue in stem top; smell indistinct to somewhat sweetish, taste mild. Sp (9.5-)10-11.5 × 6-7 μm, citriform, coarsely verrucose. On calcareous, warm soil; autumn; DE. – Cons B127 (as *rapaceus*), JEC 7:27.  
*C. caroviolaceus* P.D. Orton (*C. rapaceus* Fr. s. auct., *C. albidus* Peck subsp. *europaeus* (M.M. Moser) Quadr., *C. aleuriosmus* Maire var. *aphanosmus* M.M. Moser)
- 18. Sp amygdaloid to slightly citriform 19
- Sp ellipsoid to slightly amygdaloid 20
- 19. Cap cuticle mild; cap pale brownish or grey brown, but most often covered with abundant, appressed, whitish to ochraceous yellow universal veil or with large patches at centre. Cap 40-100(-120) mm, hemispherical to convex, then expanded, sometimes with a low umbo,

innately fibrillose; gills greyish or sometimes violaceous; stem 40-90 x 10-22 mm, with a marginate bulb, greyish, often with a violaceous tinge at the top, discolouring  $\pm$  ochraceous yellow; flesh whitish, with a greyish tinge in stem top, sometimes with distinct violaceous colours in stem; smell and taste initially  $\pm$  malt-like, with age unpleasant. Sp 9.5-10.5 x 5.5-6.5  $\mu$ m, amygdaloid to  $\pm$  citriform, distinctly verrucose. With *Fagus* on  $\pm$  calcareous soil; autumn; occasional in temp.; DK (LC), SE (EN). – Mos 78, 72 (as *boudieri*).

*C. foetens* M.M. Moser (*C. subalbescens* Reumaux, *C. boudieri* Rob. Henry s. Moser et al.)

- Cap cuticle bitter; cap whitish, cream or pale ochraceous yellow, sometimes with a greyish tinge, without abundant appressed universal veil. Cap 40-80 mm, hemispherical to convex, then expanded, innately fibrillose; gills greyish white, sometimes with a faint bluish tinge when young; stem 40-80 x 10-15 mm, with a marginate but narrow bulb, whitish, rarely pale bluish when young; flesh whitish, sometimes with a bluish tinge in stem top; smell indistinct. Sp 7.5-9.5 x 4.5-5.5  $\mu$ m, amygdaloid to citriform, distinctly verrucose. Mostly in coniferous forests, but also found with deciduous trees, on  $\pm$  calcareous soil; autumn; very rare in temp., rare in hemib.-bore.; DK (EN), FI (LC), NO (LC), SE (NT). – CFP A28, Däh 723, Sieniop 193.

*C. caesiostramineus* Rob. Henry

20. Sp ellipsoid, 9-11 x 5.5-6.5  $\mu$ m; in deciduous forests on calcareous soil. Cap 35-90 mm, hemispherical to convex, then expanded, pale greyish, with grey brown centre, often with a slightly bluish tinge towards margin when young; gills grey, sometimes with a bluish tinge; stem 40-70 x 10-20 mm, with a marginate bulb, greyish to  $\pm$  greyish blue or violaceous, becoming ochraceous yellow with age; flesh whitish, often with a violaceous blue tinge in stem top when young; smell somewhat *Scleroderma*-like. Sp distinctly verrucose. With *Quercus*, *Corylus*, *Carpinus* and *Tilia*, rarely *Fagus*; autumn; rare in hemib., very rare in temp.; DK (CR, Ejyl: Trelde), NO (EN), SE (VU). – CFP B17, Ves 368.

*C. coerulescentium* Rob. Henry

- Sp ellipsoid to slightly amygdaloid, 10.5-12 x 6.5-7.5  $\mu$ m; in mesic, herb-rich *Picea* forests, on  $\pm$  siliceous soil. Cap 40-90 mm. hemispherical to convex, then expanded, innately fibrillose, cream, sometimes ochraceous brownish with age; gills violaceous blue to pale violaceous grey; stem 50-90 x 10-18 mm, with a somewhat marginate bulb, bluish to pale bluish, sometimes only at top, and then otherwise whitish; flesh pale bluish in stem, at least when young, otherwise whitish. Autumn; rare in hemib.-bore.; FI (LC), SE.

*C. anomaloochrascens* Chevassut & Rob. Henry

21. With conifers 22
- With deciduous trees 28
22. KOH in flesh  $\pm$  yellow; cap almost dry; with *Pinus* on acid, sandy soil see 11
- KOH in flesh not yellow; cap distinctly viscid; with *Pinus* or not, rarely on acid, sandy soil 23
23. In May-June. Cap 60-110 mm, hemispherical to convex, then expanded, with ochraceous brown margin, at centre streaking to dark red brown, innately fibrillose; gills pale greyish white; stem 50-80 x 15-30 mm, whitish, with a rounded bulb, with a red brown veil girdle on or above bulb margin; flesh whitish; smell distinctly malt-like. Sp 10.5-12.5 x 6.5-7  $\mu$ m, amygdaloid, distinctly verrucose. In dry, calcareous coniferous forests, often buried in litter; very rare in bore.; NO (EN), SE (VU). – CFP A10.
- C. inexpectatus* Brandrud
- In ultimo July to October 24
24. Sp 8-9.5 x 5-5.5  $\mu$ m (fig. 703B); smell in flesh  $\pm$  honey-like; cap often with hygrophanous spots or streaks, and with age often  $\pm$  hygrophanous towards margin; pileipellis duplex. Cap 40-80 mm, hemispherical to convex, then expanded, homogeneously dark ochraceous yellow, orange yellow to red brown; gills greyish white, often somewhat serrulate; stem 40-

80 x 10-15 mm, with a small rounded bulb, initially whitish, staining somewhat brass brown with age; cortina very sparse; flesh whitish. Sp ellipsoid to amygdaloid, weakly verrucose. In coniferous forests; autumn; common in hemib.-bore., rare in temp.; DK (LC), FI (LC), NO (LC), SE (LC). – CFP A45.

*C. multiformis* (Fr.) Fr.

- Sp (9.5-)10-12 x (5.5)6-7(-7.5)  $\mu$ m; smell in flesh indistinct, earth-like to  $\pm$  malty; cap not hygrophanous; pileipellis simplex to slightly duplex 25
- 25. Cap with abundant, small velar scales; KOH on cap and universal veil distinctly brown to red brown 26
- Cap without small velar scales or rarely with few at centre; KOH on cap and universal veil negative 27
- 26. Cap initially yellow with small, dark brown scales see *C. piceae* key C 23
- Cap pale brown to ochraceous brown, centre  $\pm$  orange brown to chestnut brown with age, at margin rarely  $\pm$  yellow brown, with small brown scales. Cap 40-80 mm, hemispherical to convex, then expanded, frequently with radial brown streaks or striae, pale brown to ochraceous brown, centre  $\pm$  orange brown to chestnut brown with age; gills pale greyish white, sometimes with violaceous margin; stem 30-60 x 10-15 mm, with a marginate bulb, whitish, with  $\pm$  brown veil at bulb margin; flesh whitish, sometimes with slightly brownish tinges in stem top or below cap cuticle; smell and taste indistinct to  $\pm$  earthy. Sp 9.5-11 x (5.5-)6-7  $\mu$ m, citriform, coarsely verrucose. In calcareous coniferous forests; autumn; very rare in bore.; NO (EN), SE (NE). – CFP B38.

*C. dalecarlicus* Brandrud

- 27. Cap  $\pm$  fibrillose, chestnut brown at centre, towards margin orange brown to pale brown. Cap 60-100 mm, hemispherical to convex, then expanded; gills greyish white; stem 60-100 x 8-18 mm, whitish, with age discolouring  $\pm$  brownish, with a rounded to slightly marginate bulb; basal mycelium whitish to bright yellow; flesh whitish; smell indistinct to  $\pm$  earthy when older. Sp 10-12 x 6-7(-7.5)  $\mu$ m, amygdaloid to citriform, weakly and not very coarsely verrucose. In  $\pm$  calcareous *Picea* forests, also in fairly young plantations; autumn; rare in hemib.-bore.; FI (LC), NO (LC), SE (VU). – Mos 14.

*C. napus* Fr.

- Cap not fibrillose, uniformly coloured, pale ochraceous brown see *C. corrosus* 17
- 28. Sp subglobose. Cap 40-120 mm, hemispherical to convex, then expanded, bright yellow towards margin, centre orange yellow, becoming orange brown or yellow brown with age, often as radial streaks or flames, sometimes with sparse, orange-brown velar scales at centre, often with abundant cortina remnants at margin; gills greyish white, often serrulate; stem 50-100 x 10-25 mm, with a characteristic, arrow-head shaped bulb; whitish, discolouring ochraceous yellow with age; flesh whitish, in young specimens becoming yellow with KOH; smell and taste  $\pm$  malt-like. Sp 8.5-10 x 7-8  $\mu$ m, very coarsely verrucose. In preferably  $\pm$  open deciduous forests on calcareous soil; autumn; rare in temp.-hemib.; DK (EN), NO (EN), SE (VU). – Mos 115a,b, 116, Svp 32:33.

*C. caesiocortinatus* Jul. Schäff.

- Sp ellipsoid, amygdaloid to citriform 29
- 29. Bulbipellis greenish yellow to sulphur yellow; cap distinctly red to red brown with KOH. Cap 60-120(-140) mm, hemispherical to convex, then expanded, yellow to ochraceous yellow, with age becoming yellow brown; with appressed, pale to greenish yellow universal veil, or sometimes with small brownish velar scales; gills greyish white; stem 50-100 x 10-25 mm, with a marginate bulb, whitish, with greenish yellow or sulphur-yellow veil at bulb margin; flesh whitish; smell malt-like to faintly curry-like when older; taste mild. Sp 11-12.5(-13) x 6.5-8  $\mu$ m, citriform, coarsely verrucose. With *Fagus* on bare  $\pm$  sandy, calcareous soil; autumn; very rare in temp.; DK (EN), SE. – MyR 110:1048.

*C. langeorum* Frøslev & T.S. Jeppesen

- Bulbipellis whitish; KOH on cap negative or indistinctly brownish 30
- 30. Cap 70-120(-140) mm, with thick, concentric, whitish to ochraceous brown velar patches; pileipellis simplex. Cap hemispherical to convex, then expanded, yellow-brown to orange brown, with age sometimes more red brown at centre; gills greyish white, often serrulate; stem 60-100 x 15-25 mm, whitish, with a broad, but rounded bulb, veil at bulb margin brown; flesh whitish; smell and taste malty. Sp 10-12 x 6-7  $\mu$ m, amygdaloid, coarsely verrucose. In deciduous forests on calcareous soil; autumn; rare in temp.-hemib.; DK (EN), NO (EN), SE (VU). – CFP B44, Phil 174b.  
*C. saporatus* Britzelm.
- Cap 15-100 mm, without concentric, whitish to ochraceous brown velar patches; pileipellis simplex or duplex 31
- 31. Sp citriform to slightly amygdaloid 32
- Sp ellipsoid to amygdaloid 34
- 32. Stem 10-18 mm broad; cap distinctly innately fibrillose. Cap 40-80 mm, hemispherical to convex, then expanded, often with a low umbo, yellow brown to brown, often with appressed fibrillose, whitish veil at margin, and often with frosty appearance at centre; gills greyish white, rarely with a fugacious violaceous tinge; stem with a rounded bulb, whitish, staining slightly brass brown with age; veil at bulb margin indistinct, whitish, sometimes with a viscid, yellow girdle; flesh whitish, rarely with a fugacious violaceous tinge; smell and taste indistinct to slightly malty; KOH on cap red brown, in flesh negative. Sp 10-11 x 6-7  $\mu$ m, citriform, distinctly verrucose (fig. 703C). With deciduous trees on calcareous soil; autumn; rare in temp.-hemib.; DK (EN), NO (EN), SE (EN). – Cons B123, FND 29:55 (as *polymorphus* var. *luteoimmarginatus*).  
*C. multiformium* Consiglio & Moënne-Locc. (*C. proteus* Consiglio & Moënne-Locc., *C. polymorphus* Rob. Henry s. auct. p.p.)
- Stem < 10 mm broad; cap only slightly innately fibrillose 33
- 33. Cap 30-60 mm, unevenly wavy, often slightly depressed at centre when older; stem becoming slightly yellowish with age, bulb distinctly marginate, with ochraceous yellow veil at margin. Cap ochraceous yellow, centre  $\pm$  yellow brown; gills greyish white; stem 30-60 x 5-10 mm, whitish; flesh whitish; smell and taste indistinct to  $\pm$  malt-like; KOH on cap red brown, in flesh negative. Sp 10-11 x 5.5-6.5  $\mu$ m, citriform to slightly amygdaloid, distinctly verrucose (fig. 703D). With deciduous trees on calcareous soil; autumn; very rare in temp.-hemib.; DK (EN), NO, SE.  
*C. luteoimmarginatus* Rob. Henry (*C. polymorphus* Rob. Henry s. auct. p.p.)
- Cap 15-40 mm, hemispherical to convex, then expanded; stem unchanging with age, bulb rounded, with indistinct whitish veil at margin. Cap pale yellow brown to ochraceous yellow, finely innately fibrillose, sometimes slightly hygrophanous, rarely with veil, and if so, then with an indistinct frosty appearance; gills greyish white; stem 20-40 x 4-7 mm, whitish with a rounded bulb; veil whitish, thin and fibrillose at bulb margin; flesh whitish; smell and taste indistinct to slightly malty; KOH on cap red brown, in flesh negative. Sp 10-12 x (5.5-)6-7  $\mu$ m, citriform, distinctly verrucose (fig. 703E). In deciduous forests on calcareous soil; autumn; very rare in temp.-hemib.; DK (EN, Sj: Allindelille, Lol: Møns Klint), NO (CR). – JEC 6, 35, Mos 4, Svp 56:45.  
*C. gracilior* (M.M. Moser) M.M. Moser
- 34. Sp 9.5-10.5  $\mu$ m long 35
- Sp < 9.5  $\mu$ m long 36
- 35. KOH in flesh negative; stem with a glutinous, yellow to yellow-brown veil girdle on or above the bulb margin; cap uniformly yellow, sometimes with indistinct hygrophanous spots or streaks, at centre sometimes very finely granulate-diffracted, not innately fibrillose.

Cap 50-100 mm, hemispherical to convex, then expanded, often with a low umbo, very glutinous; gills whitish; stem 45-90 x 10-20 mm, whitish, with a  $\pm$  rounded to slightly marginate bulb; flesh whitish; smell and taste indistinct to slightly malty. Sp 9.5-10.5 x 6-7  $\mu$ m, amygdaloid, distinctly verrucose. With *Fagus* on calcareous soil; autumn; very rare in temp.; DK (EN, Lol: Maribo Søndersø). – JEC 7, 26, Svp 56:44.

*C. cliduchus* Fr. (*C. langei* Rob. Henry s. auct. p.p.)

- KOH in stem flesh yellow, in bulb flesh orange brown; stem without a glutinous, yellow to yellow brown veil girdle on or above the bulb margin; cap innately fibrillose, brown to yellow brown, darkest at centre. Cap 35-80 mm, hemispherical to convex, then expanded, rarely with veil, and if so, then with an indistinct 'frosty' appearance; gills whitish; stem 35-65 x 8-20 mm, whitish, with a sharply marginate bulb; flesh whitish, when young with  $\pm$  greyish tinge in stem top, becoming  $\pm$  yellow in damages. Sp 9-10.5 x (5-)5.5-6.5  $\mu$ m, amygdaloid to ellipsoid, distinctly verrucose. With *Fagus* on calcareous soil; autumn; very rare in temp.; DK, SE.

*C. aquilanus* T.S. Jeppesen & Frøslev in press (*C. langei* Rob. Henry s. auct. p.p.)

36. Smell malty or yeast-like; stem with a sharply marginate, often fairly wide bulb; cap without hygrophanous spots. Cap 40-90 mm, hemispherical to convex, then expanded, yellow, homogeneously coloured, with little discolouration, smooth or very finely innately fibrillose, often with appressed, white veil patches; gills greyish white; stem 40-70 x 12-20 mm, whitish, with age discolouring  $\pm$  ochraceous yellow brown; flesh whitish. Sp (7.5-)8-9(-9.5) x (4.5-)5-6  $\mu$ m, amygdaloid to ellipsoid, distinctly verrucose (fig. 703F). With *Fagus* on calcareous soil; autumn; rare in temp.; DK. – ADC 11, 345 (as *aurantiotinctus*), V&K 29 (as *langei*).

*C. xanthoochraceus* P.D. Orton (*C. langei* Rob. Henry s. auct.)

- Smell honey-like in bulb flesh and when bruised; bulb rounded to slightly marginate; cap often with hygrophanous spots. Cap 40-80 mm, hemispherical to convex, then expanded, ochraceous yellow to pale yellow, sometimes with whitish, very thin and appressed, frosty veil at centre; gills greyish white, often somewhat serrulate; stem 40-80 x 10-15 mm, initially whitish, becoming somewhat brass-brown spotted, cortina very sparse; flesh whitish, with a distinct, honey-like smell. Sp 7.5-9.5 x 4.5-5.5  $\mu$ m, amygdaloid to ellipsoid, indistinctly verrucose. With *Quercus*, *Fagus* and *Betula* on oligotrophic to  $\pm$  eutrophic soil; autumn; common in bore., occasional, but locally common in hemib. and suba., very rare in temp.; DK (vu), FI (LC), IS (Au, Na), NO (LC), SE (LC). – CFP B47, Däh 726 (as *allutus*), Sieniop 218.

*C. talus* Fr.

**Key E:** Subgen. *Phlegmacium*: Stem  $\pm$  cylindrical; gills dark olivaceous brown; flesh bitter; sp subglobose

1. Young gills olivaceous ochre; pleuro- and cheilocystidia present,  $\pm$  lageniform, with epiparietal pigment; smell like cedar wood; pileipellis  $\pm$  simplex. Cap 40-100 mm, hemispherical to convex, then expanded, innately fibrillose, initially olivaceous, soon becoming ochraceous brown to yellow brown from centre, with hygrophanous spots; stem 50-100 x 10-18 mm, cylindrical, somewhat tapering at base, whitish, with appressed, fibrillose, whitish to ochraceous yellow veil; flesh in cap pale yellow brown, in stem greyish. Sp 7.5-9 x 5.5-6.5  $\mu$ m, distinctly verrucose (fig. 709A). In moist *Picea* forests on poor soil, often in bog margins, rarely also with *Fagus* on poor soil; summer to autumn; common in hemib.-bore., rare in temp.; DK (NT), FI (LC), NO (LC), SE (LC). – ADC 2:44, Däh 754, 755, GCI A155, M&J 21, Ves 377.

*C. subtortus* (Pers.) Fr.

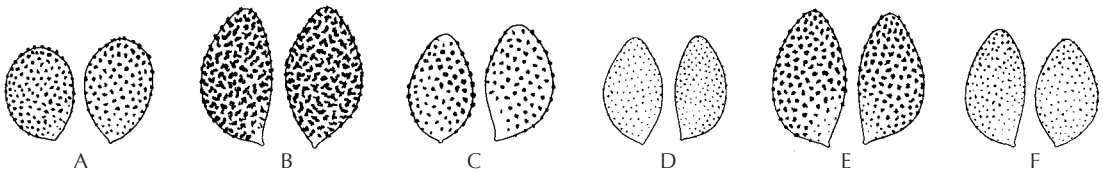
- Young gills dark olivaceous brown, to almost olivaceous black; cystidia absent or inconspicuous; smell not like cedar wood; pileipellis duplex. Cap 40-100 mm, hemispherical to convex, then expanded, olivaceous grey, dark olivaceous brown to umber brown, often becoming ochraceous brown to yellow brown with age, innately fibrillose; stem 40-80



x 10-25 mm, cylindrical to clavate, whitish to olivaceous grey, veil appressed fibrillose, initially whitish becoming ochraceous yellow; flesh whitish to olivaceous grey, sometimes violaceous in stem top. Sp 7-8.5 x 5.5-6.5  $\mu\text{m}$ , subglobose, distinctly and densely verrucose. Mostly in deciduous forests, with e.g. *Fagus* and *Quercus*, but also with conifers on calcareous ground; autumn; common in temp.-hemib., rare in bore.-suba.; DK (LC), FI (LC), NO (LC), SE (LC). – CFP A09, Däh 752, 753 (as var. *olivellus*), GCI B73, M&J 94, Phil 180a, Ves 376, ☉. *C. infractus* Berk.

**Key F:** Subgen. *Phlegmacium*: Stem  $\pm$  cylindrical; cap cuticle finely to coarsely granulate-diffracted at centre, appearing minutely cracked; stem with appressed,  $\pm$  glutinous veil girdles

1. Gills greenish yellow to sulphur yellow 2  
 - Gills whitish to greyish, rarely with a slight rose tint 5
2. Smell strong, like marjoram or apples; stem with inconspicuous pale greenish yellow veil girdles that become slightly ochraceous yellow to pale ochraceous brown 3  
 - Smell initially faint and pleasant, like banana peel, but may become strong and unpleasant with age; stem with viscid, olivaceous grey brown, reddish brown to purplish brown veil girdles 4
3. With *Picea*; cap orange yellow to yellow brown, when young with a greenish yellow tinge. Cap 40-90 mm, hemispherical to convex, then expanded, sometimes weakly granulate-diffracted into orange-brown scales at centre, sometimes with darker innate fibres with age, fairly uniformly coloured; gills greenish yellow to olivaceous yellow; stem 40-90 x 10-20 mm, cylindrical to slightly clavate, pale greenish yellow, with inconspicuous pale greenish yellow veil girdles that become slightly ochraceous yellow to pale ochraceous brown; flesh bright greenish yellow; smell strong, like marjoram or apples. Sp 11-12.5 x 6-7  $\mu\text{m}$ , amygdaloid to slightly ellipsoid, distinctly verrucose (fig. 709B); pileipellis pigment yellow to yellow brown, mainly incrusting. In coniferous forests on  $\pm$  calcareous soil; autumn; occasional in hemib.-bore.; FI (LC), NO (LC), SE (LC). – CFP C56, Däh 767, GCI A119, Nit 247. *C. percomis* Fr.  
 - With *Tilia*, *Corylus* and possibly also *Quercus*; cap at first bright lemon yellow, olivaceous to olivaceous brown at centre, when young with a greenish yellow tinge at margin. Cap 50-100 mm, hemispherical to convex, then expanded, often distinctly granulate-diffracted; gills greenish yellow to sulphur yellow; stem 50-80 x 15-25 mm,  $\pm$  bulbous, bulb rarely distinctly marginate, pale greenish yellow to sulphur yellow, in lower half with pale orange yellow to brownish veil remnants; bulb not distinctly marginate; flesh greenish yellow; KOH greenish to olivaceous on cap, in bulb flesh indistinctly reddish, in stem and cap flesh indistinctly olivaceous. Sp 11-12.5 x (6.5-)7-8  $\mu\text{m}$ , ellipsoid to slightly amygdaloid, coarsely verrucose. On calcareous soil; autumn; very rare in hemib.; SE (Öl). *C. majoranae* Frøslev & T.S. Jeppesen in press
4. KOH in flesh olivaceous, sometimes slightly reddish in stem base; stem with olivaceous grey brown veil girdles in lower half; smell initially faint, like unripe banana, becoming strong and unpleasant with age. Cap 40-100 mm, hemispherical to convex, then expanded, yellow, at margin greenish yellow, at centre becoming orange brown to red brown with an olivaceous tinge, at centre often coarsely granulate-diffracted into dark purple-brown to blackish scales; gills greenish yellow to olivaceous yellow; stem 50-90 x 8-35 mm, cylindrical, clavate to fusiform, greenish yellow; flesh greenish yellow. Sp 10-12.5 x 6.5-7.5  $\mu\text{m}$ , amygdaloid to slightly ellipsoid, strongly verrucose; pileipellis with incrusting-intracellular yellow to olive pigment. With coniferous trees on calcareous soil; autumn; rare in hemib.-bore.; FI (LC), NO (NT), SE (NT). – CFP D20, GCI A139, M&J 104, Sieniop 209. *C. mussivus* (Fr.) Melot (*C. russeus* Rob. Henry, *C. russeoides* M.M. Moser)



Spores: A: *Cortinarius subtortus*, B: *C. percomis*, C: *C. olidus*, D: *C. papulosus*, E: *C. varicolor*, F: *C. saginus*.

- KOH in flesh reddish; stem with reddish brown to umber or purplish brown veil girdles in lower half; smell faint, like unripe banana, not becoming strong and unpleasant with age. Cap 40-70 mm, hemispherical to convex, then expanded, yellow brown, with greenish yellow margin, soon becoming red brown to chestnut brown, at centre often  $\pm$  granulate-diffracted; gills greenish yellow to olivaceous yellow; stem 30-80 x 10-15 mm, cylindrical to clavate, sometimes slightly bulbous, greenish yellow; flesh greenish yellow; basal mycelium saffron orange. Sp 10-12 x 6-7  $\mu$ m, amygdaloid, strongly and rather coarsely verrucose; pileipellis with incrusting-intracellular, yellow to olive pigment, in exsiccates red brown. With deciduous trees on calcareous soil, sometimes in mixed stands with conifers, in Central Europe also with *Abies*; autumn; rare in hemib., very rare in temp.; DK (CR, Sj: Allindelille), FI, NO (VU), SE (NT). – CFP B21, M&J 104.  
*C. nanceiensis* Maire
- 5. Sp > 12  $\mu$ m long; flesh in stem pale olivaceous green to greenish yellow, pale greenish with KOH. Cap 40-70 mm, hemispherical to convex, then expanded, at margin initially yellowish green, at centre granulate-diffracted, olivaceous grey brown, becoming darker olivaceous brown with age; gills greyish white to ochraceous grey, rarely with a faint bluish tinge; stem 40-70 x 10-20 mm, pale whitish yellow to olivaceous yellow, with dark olivaceous grey to olivaceous brown veil girdles. Sp 12-13.5 x 6.5-8  $\mu$ m, amygdaloid, strongly and coarsely verrucose. With *Pinus* on calcareous soil, in Central Europe with *Abies*; autumn; very rare in hemib.; SE (Gtl). – Mos 163a,b.  
*C. citrinoolivaceus* M.M. Moser
- Sp < 12  $\mu$ m long; flesh in stem whitish, negative with KOH 6
- 6. Sp. 9.5-10.5 x 5.5-6.5  $\mu$ m (fig. 709C); with deciduous trees. Cap 40-100 mm, hemispherical to convex, then expanded, pale yellow, ochraceous yellow to yellow brown, often with an olivaceous tinge, at centre granulate-diffracted into small olivaceous brown scales; gills greyish white, rarely with a slightly rose tinge; stem 40-100 x 10-20 mm, cylindrical to slightly clavate, whitish, with pale yellowish to ochraceous yellow veil girdles; flesh whitish; smell like maize or mown grass. Sp amygdaloid to slightly ellipsoid, distinctly verrucose. Autumn; occasional in temp.-hemib., rare in southern bore.; DK (LC), FI (LC), NO (LC), SE (LC). – JEC 8:29, Phil 181c, Svp 48:57, Ves 377.  
*C. olidus* J.E. Lange (*C. cephalixus* Fr. s. auct., *C. cliduchus* Fr. s. auct.)
- Sp on av < 9.5  $\mu$ m long; with coniferous trees 7
- 7. Cap red brown to chestnut brown at centre, towards margin pale ochraceous brown to almost ochraceous white; stem with red-brown to chestnut-brown veil girdles. Cap 30-80 mm, hemispherical to convex, then expanded, at centre finely granulate-diffracted; gills greyish white; stem 30-80 x 10-15 mm, cylindrical to slightly clavate, whitish; flesh whitish; smell distinct, like maize or mown grass. Sp 8-9.5 x 4.5-5.5  $\mu$ m, amygdaloid to slightly ellipsoid, weakly verrucose (fig. 709D). With conifers, often on calcareous soil; autumn; occasional in hemib.-bore.; FI (LC), NO (LC), SE (LC). – ADC 9:224, CFP A35, M&J 55, Svp 48:55.  
*C. papulosus* Fr.

- Cap olivaceous yellow to yellow brown at centre, at margin greenish yellow, sulphur yellow to almost whitish; stem with greenish yellow to sulphur-yellow veil girdles. Cap 30-80 mm, hemispherical to convex, then expanded, at centre finely granulate-diffracted; gills greyish white, rarely with a slightly rose tinge; stem 30-80 x 10-15 mm, cylindrical to slightly clavate, whitish; flesh whitish; smell weak, like unripe banana. Sp 8.5-9.5 x 5.5-6  $\mu$ m, amygdaloid to slightly ellipsoid, weakly verrucose. With conifers, mainly mossy,  $\pm$  calcareous *Pinus* forests; autumn; occasional in hemib.-bore.; FI, NO, SE. – AC 9:225.

*C. olidoamethysteus* Rob. Henry & Ramm

**Key G:** Subgen. *Phlegmacium*: Stem  $\pm$  cylindrical; KOH on flesh yellow, sometimes as a ring

- |    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |   |
|----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
| 1. | Cap margin with violaceous or bluish colours, at least when young                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 2 |
| -  | Cap margin without violaceous or bluish colours                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 5 |
| 2. | Gills greyish white                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 3 |
| -  | Gills $\pm$ violaceous                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 4 |
| 3. | Cap centre dry, even on young frb, often cracked at centre, often with tomentose margin; in dry coniferous forests. Cap 50-120(-180) mm, hemispherical to convex, fibrillose, bluish at margin when young, $\pm$ brownish at centre; gills narrow, crowded, greyish white; stem 50-90 x 10-30 mm, whitish, with sparse, whitish veil remnants; flesh whitish. Sp 9.5-11.5 x 5-6.5 $\mu$ m, amygdaloid to slightly citriform, verrucose. Summer to autumn; common in hemib.-bore., very rare in temp.; DK (NA, Bornh: Almindingen), FI (LC), NO (LC), SE (LC). – CFP C60, M&J 108, GCI A7. |   |

*C. balteatus* (Fr.) Fr.

- Cap initially glutinous or viscid, centre not cracked, not with tomentose margin; with deciduous trees, mainly *Quercus*. Cap 60-150(-200) mm, hemispherical to convex, violaceous to violaceous grey at margin, brown to violaceous brown at centre; gills greyish white; stem 50-90 x 15-40 mm, whitish, with distinct violaceous veil remnants, that discolour brownish with age; flesh whitish. Sp 9.5-11 x 5-6  $\mu$ m, amygdaloid to slightly citriform, verrucose. Often in parks, cemeteries or old gardens, calciphilous; autumn; occasional in temp.-hemib., rare in southern bore.; DK (NT), FI (LC), NO (LC), SE (LC). – GCI A3.

*C. balteatocumatilis* P.D. Orton

- |    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |  |
|----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| 4. | Smell very strong and unpleasant, earthy, or to some people like banana peel; gelatinous hyphae in cap cuticle 4-6 $\mu$ m wide. Cap 50-110(-140) mm, hemispherical to convex, then expanded, with age innately fibrillose, initially with violaceous blue margin and greyish brown centre, soon discolouring to chestnut brown; gills violaceous to violaceous grey; stem 50-100(-140) x 15-25 mm, pale bluish grey to violaceous, with (sometimes indistinct) violaceous blue veil remnants, becoming brownish spotted with age or when handled; flesh pale violaceous grey in stem, otherwise whitish. Sp 10-11.5 x 5.5-6.5 $\mu$ m, amygdaloid to slightly citriform, verrucose (fig. 709E). In coniferous and deciduous forests on $\pm$ calcareous soil; autumn; common in hemib.-bore., less common in the eastern part, occasional in temp.; DK (LC), FI (LC), NO (LC), SE (LC). – AC 8:177, CFP B20, Däh 745, 749 (as <i>nemorensis</i> ), GCI B181, C175, M&J 15. |  |
|----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|

*C. varicolor* (Pers.: Fr.) Fr.

- Smell indistinct; gelatinous hyphae in cap cuticle 2.5-4  $\mu$ m wide. Cap 50-110 mm, hemispherical to convex, then expanded, with age sometimes slightly innately fibrillose, initially pale to distinctly bluish at margin, pale greyish brown at centre, soon discolouring to ochre brown; gills violaceous; stem 50-100 x 15-25 mm, whitish or bluish white, becoming brownish spotted with age or when handled; flesh bluish white to violaceous grey, often more distinctly violaceous in stem base. Sp (9.5-)10-11.5 x 5.5-6.5  $\mu$ m, amygdaloid to slightly citriform, verrucose. In deciduous forests on  $\pm$  calcareous soil, mostly with *Fagus*; autumn;

occasional in temp.-hemib.; DK (LC), FI (DD), NO (LC), SE (LC). – CFP D22, Däh 748, GCI B77, Phil 179f, ☉.

*C. largus* Fr. (*C. nemorensis* (Fr.) J.E. Lange)

- |    |                                               |                                       |
|----|-----------------------------------------------|---------------------------------------|
| 5. | Flesh staining yellow when exposed or bruised | 6                                     |
| -  | Flesh unchanging when exposed or bruised      | 7                                     |
| 6. | Sp 11.5-13.5 x 6.5-7.5 $\mu$ m                | see <i>C. pseudovulpinus</i> key H 33 |
| -  | Sp 6.5-9.5 x 3.5-5 $\mu$ m                    | see <i>C. rubicundulus</i> key H 12   |

7. Stem with distinct, flocculose, yellow brown to ochraceous brown veil girdles. Cap 60-120 mm, hemispherical to convex, then expanded, persistently glutinous, yellow, yellow brown to orange brown, towards margin ochraceous yellow; gills greyish white to pale bluish grey; stem 70-120 x 15-25 mm, whitish with a yellowish tinge towards base; flesh whitish; sp 10.5-12.5 x 6-7  $\mu$ m, amygdaloid, verrucose; pileipellis duplex. With *Betula pendula* on rich to  $\pm$  calcareous soil, often in parks, pastured woodlands and forest margins; autumn; locally common in hemib.-southern bore., occasional in middle bore., rare in temp. and northern bore., occasional in IS; DK (LC), FI (LC), IS, NO (LC), SE (LC). – AC 9:219, CFP A49, Däh 736, 737 (as *crocolitus*), Phil 185e, Svp 48:45, ☉.

*C. triumphans* Fr. (*C. crocolitus* Quél.)

- |    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |    |
|----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| -  | Stem without distinct, flocculose, yellow brown to ochraceous brown veil girdles                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 8  |
| 8. | Gills violaceous                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 9  |
| -  | Gills greyish, whitish or brownish                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 11 |
| 9. | Cap pale grey brown to ochraceous when young, sometimes almost whitish at margin, viscid, but soon dry. Cap 30-90 mm, hemispherical to convex, then expanded, with age brownish and innately fibrillose; gills pale violaceous blue to greyish white; stem 50-100(-120) x 8-15 mm, whitish blue to almost whitish grey, becoming distinctly vinaceous brown to brownish when handled, with indistinct, pale bluish veil remnants; flesh bluish white to greyish white, sometimes bluish green in stem base. Sp 10-11.5 x 5.5-6.5 $\mu$ m, amygdaloid, verrucose. With <i>Picea</i> in moist oligotrophic forests; summer to autumn; rare in hemib.-bore.; FI (LC), NO (LC), SE. – CFP D09, M&J 16. |    |

*C. patibilis* Brandrud & Melot

- |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |    |
|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| -   | Cap of young frb yellow, yellow brown, ochraceous brown to buff, persistently glutinous                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 10 |
| 10. | Stem greyish white with a violaceous tinge when young, becoming $\pm$ brownish when bruised; cap ochraceous brown to fulvous brown, slightly innately fibrillose with age. Cap 40-80 mm, hemispherical to convex, then expanded; gills pale violaceous blue to greyish white; stem 50-100 x 10-15(-20) mm; flesh greyish white, often with a bluish tinge in stem top. Sp 9.5-11 x (5.5-)6-6.5 $\mu$ m, amygdaloid to slightly citriform, verrucose. With <i>Picea</i> in mesotrophic-eutrophic forests; autumn; rare in hemib.-bore.; FI (DD), NO (LC), SE (NE). – CFP D10. |    |

*C. spadicellus* (M.M. Moser) Brandrud

- |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |  |
|---|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| - | Stem whitish, not becoming brownish when bruised; cap yellow to yellow brown, sometimes slightly orange brown at centre, not innately fibrillose. Cap 40-100 mm, hemispherical to convex, then expanded, gills distinctly lilac-violaceous; stem 40-100 x 10-20 mm, with indistinct, whitish fibrillose veil, often with an ochraceous white veil girdle; flesh whitish, sometimes slightly yellowish in stem top. Sp 9.5-11.5 x 5.5-6.5 $\mu$ m, amygdaloid, verrucose; pileipellis duplex. With <i>Picea</i> , calciphilous; autumn; occasional but locally common with a mainly southern distribution in hemib.-bore.; FI (LC), NO (LC), SE (LC). – AC 9:210, CFP B14, Däh 750, GCI B191, Sieniop 222, Svp 48:47. |  |
|---|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|

*C. varius* (Schaeff.: Fr.) Fr.

- |     |                                                                                                       |    |
|-----|-------------------------------------------------------------------------------------------------------|----|
| 11. | In subalpine <i>Betula</i> forests and alpine heathland with <i>Betula nana</i> or dwarf <i>Salix</i> | 12 |
|-----|-------------------------------------------------------------------------------------------------------|----|

- With conifers or thermophilous deciduous trees such as *Corylus* and *Fagus* 13
- 12. With *Betula*; cap 50-120 mm. Cap hemispherical to convex, then expanded, initially whitish to whitish brown, at least towards margin, partly due to thin whitish, appressed fibrillose veil, with age becoming more ochraceous brown to dark brownish; gills greyish white; stem 60-150 x 10-30 mm, cylindrical to clavate, greyish white to pale ochraceous brown, with fairly sparse, whitish to ochraceous veil; flesh whitish,  $\pm$  pale ochraceous grey in stem top, normally yellowish with KOH. Sp 10.5-12.5 x 5.5-6.5  $\mu$ m, amygdaloid to citriform, distinctly verrucose. Mainly in mesotrophic-eutrophic, low herb vegetation; summer to autumn; rare in suba.-arc./alp., very rare in bore.; FI (DD), IS, NO (LC), SE.  
*C. durus* P.D. Orton var. *durus* (*C. errabundus* Melot)
- With alpine dwarf *Salix*; cap 40-60 mm. Cap hemispherical to convex, then expanded, pale ochraceous brown with slightly darker centre and whitish margin; gills greyish white; stem 30-40 x 10-15 mm, clavate at base and slightly tapering below, persistently whitish; flesh not yellowish with KOH. Sp 12-13 x 6-6.5  $\mu$ m, amygdaloid, finely verrucose. Summer to autumn; very rare in suba.-arc./alp.; IS, NO.  
*C. durus* P.D. Orton var. *chamaesalicis* (Bon) Brandrud
- 13. Sp 10-12.5 x 5.5-7  $\mu$ m 14
- Sp 8-10.5 x 4.5-6  $\mu$ m 15
- 14. Cap 40-100 mm, pale ochraceous brown with (ochraceous) white margin, soon warm ochraceous to fulvous brown; sp 11-12.5 x 6-7  $\mu$ m. Cap hemispherical to convex, then expanded, sometimes with bluish veil patches at margin, appressed tomentose from veil at centre, rivulose/fibrillose; gills greyish white; stem 60-120 x 8-15 mm, whitish, becoming pale ochraceous brown from base, with sparse, whitish, fibrillose veil, often turning ochraceous brown; flesh whitish, slightly greyish in stem top. Sp acutely amygdaloid to slightly citriform, verrucose. In oligotrophic-mesotrophic *Picea* forests, often with *Vaccinium myrtillus* and *Dicranum* mosses; summer to autumn; rare in bore.-suba.; NO (LC), SE (NA). – Mos 34 (as *Phlegmacium latum*).  
*C. vacciniophilus* Brandrud
- Cap 30-70 mm, ochraceous brown to umber brown, outer half with appressed bluish veil; sp 10-11.5 x 5.5-6.5  $\mu$ m. Cap hemispherical to convex, then expanded, innately fibrillose, often appressed tomentose to scaly diffracted at centre, often with appressed, bluish veil at margin when young; gills greyish white, sometimes with a violaceous tinge towards cap margin; stem 40-70 x 8-12 mm, whitish with a greyish or bluish tinge at top; flesh whitish, sometimes with a bluish to blue-green tinge in stem when young. Sp amygdaloid to slightly citriform, verrucose. With *Picea* in oligotrophic forests, often in young plantations; summer to autumn; rare in bore.; NO (LC), SE (NA).  
*C. acidophilus* Brandrud
- 15. Stem of young frb turning distinctly vinaceous brown when bruised; cap grey brown, buff, red brown to umber brown 16
- Stem of young frb unchanging or yellowish when bruised; cap pale ochraceous to  $\pm$  yellow brown 17
- 16. Stem with conspicuous violaceous spots in lower half. Cap 40-90 mm, hemispherical to convex, then expanded, somewhat fibrillose towards margin, uniformly greyish brown, with age  $\pm$  umber brown; gills greyish white; stem 50-90 x 10-20 mm, greyish white or bluish white, becoming  $\pm$  brownish when handled; flesh whitish or grey brown, often distinctly violaceous in lower part of stem. Sp 8.5-10 x (4.5-)5-5.5  $\mu$ m, amygdaloid-ellipsoid, distinctly verrucose. With *Pinus* or *Picea* on calcareous soil, in mossy forests; autumn; rare in hemib.-bore.; NO (VU), SE (NE).  
*C. violaceomaculatus* Brandrud
- Stem without conspicuous violaceous spots in lower half. Cap 30-90 mm, somewhat



tomentose, completely dry, even when young, ochraceous brown to dark brown, innately fibrillose; gills brownish white; stem 50-120 x 8-20 mm, whitish, with whitish veil; flesh whitish, turning vinaceous brown, especially when bruised. Sp 9-10.5 x 5.5-6  $\mu\text{m}$ , acutely amygdaloid to slightly citriform, distinctly verrucose. With *Picea* on eutrophic to  $\pm$  calcareous soil, in mossy forests; summer to autumn; rare and with a continental distribution in hemib.-bore.; FI (LC), NO (VU), SE (NT). – CFP C35, C44.

*C. russus* Fr.

17. Stem < 15 mm broad, longer than cap diam., becoming  $\pm$  yellowish when bruised see *C. pinophilus* key H 8
- Stem usually > 15 mm broad, shorter than cap diam., not becoming yellowish when bruised 18

18. Sp 7.5-9.5 x 4.5-5  $\mu\text{m}$ , amygdaloid to fusiform. Cap 50-100 mm, hemispherical to convex, often slightly tomentose at the involute margin, often completely dry, whitish cream at first, soon becoming  $\pm$  ochraceous, sometimes  $\pm$  hygrophanous; gills narrow, crowded, whitish; stem 30-50 x 18-25 mm, clavate or with a rounded bulb, whitish cream; flesh whitish. Sp finely verrucose; cap cuticle simplex. Mainly in dry, sandy *Pinus* heathland, often with *Cladonia*, rarely in sandy plantations with *Picea*; autumn, rare but locally occasional in hemib.-bore., in FI with northern distribution, very rare in temp.; DK (VU), FI (LC), NO, SE. – Jordst 17(1):26.

*C. areni-silvae* (Brandrud) Brandrud

- Sp 9-10.5 x 5-5.5  $\mu\text{m}$ , irregularly amygdaloid to  $\pm$  citriform. Cap 40-100 mm, hemispherical to convex, with involute margin, often completely dry, whitish cream at first, soon becoming  $\pm$  ochraceous; gills narrow, crowded, greyish white; stem 40-70 x 10-30 mm, clavate or with a rounded bulb, whitish cream; flesh whitish. Sp finely verrucose; cap cuticle simplex. With thermophilous deciduous trees such as *Corylus* and *Fagus* on rich soil, more rarely with *Picea* in plantations; autumn; rare in temp.-hemib.; FI (DD), NO (EN), SE (NA). – CFP D21.

*C. balteatoalbus* Rob. Henry

**Key H:** Subgen. *Phlegmacium*: Stem  $\pm$  cylindrical; KOH on flesh unchanging to brownish

1. Flesh staining violaceous or reddish-vinaceous when bruised; stem violaceous 2
- Flesh not staining violaceous or reddish-vinaceous when bruised; stem violaceous or not 5
2. Cap fibrillose, viscosity very fugacious; gills and stem unchanging when bruised. Cap 40-100 mm, hemispherical to convex, viscid when young, but soon dry and fibrillose, violaceous grey, becoming dark grey brown from centre, at margin violaceous blue when young, with darker innate fibres; gills violaceous blue to blue grey; stem 50-100 x 10-25 mm, violaceous to blue grey, at base with blue mycelial felt; flesh initially bluish to bluish grey, becoming vinaceous-reddish on exposure, especially when bruised. Sp 8.5-10.5 x 5.5-6.5  $\mu\text{m}$ , ellipsoid to amygdaloid, verruculose; pileipellis  $\pm$  simplex. Mostly in rich and fairly moist *Picea* and *Betula* forests, but also with *Quercus*; autumn; occasional in hemib.-southern bore., rare in middle-northern bore., very rare in temp.; DK (EN), FI (LC), IS, NO (LC), SE (LC). – CFP B02, M&J 93, Sieniop 198.  
*C. cyanites* Fr.
- Cap smooth, persistently viscid-glutinous; gills and stem staining distinctly violaceous when bruised 3
3. Sp 10-12 x 5.5-7  $\mu\text{m}$ ; cap 15-40 mm; stem  $\leq$  5 mm broad. Cap hemispherical to convex, then expanded, violaceous grey to pale violaceous, with a somewhat silvery appearance, with

age ± ochraceous grey; gills deep violet at first; stem 25-50 x 2-5 mm, violaceous blue in upper part, below cortina zone covered with pale violaceous blue veil, soon discolouring to ± ochraceous grey; flesh pale violaceous, in stem cortex more distinctly violaceous, in lower part of stem also with a vinaceous tinge; gills, stem and flesh becoming vinaceous violet when touched; smell honey-like. Sp broadly ellipsoid, distinctly verrucose; pileipellis duplex. With *Quercus*, *Corylus*, *Fagus* and *Tilia* on somewhat acid to mesotrophic, not calcareous soil; autumn; rare in temp.-hemib.; DK (DD), NO (VU), SE (LC). – M&J 19, RdM 42:315, Svp 35:53.

***C. subporphyropus* Pilát**

- Sp on av < 10 µm long; cap > 40 mm; stem often > 5 mm broad 4
- 4. Cap pale ochraceous to silvery clay, rarely with a violaceous tinge, 40-70 mm. Cap hemispherical to convex, then expanded, margin somewhat innately fibrillose or with darker hygrophanous spots or streaks; gills violaceous to violaceous grey; stem 40-90 x 10-15 mm, violaceous in upper part, downwards whitish grey with whitish to slightly violaceous veil; flesh violaceous in cap and upper part of stem, otherwise whitish; gills, stem and flesh becoming vinaceous violet when touched; smell honey-like. Sp 8-9.5 x 5-6 µm, broadly ellipsoid, distinctly verrucose; pileipellis duplex. With *Betula* on mesotrophic, often moist soil; summer to autumn; common in hemib.-suba., rare in temp.; DK (VU), FI (LC), IS, NO (LC), SE (LC). – CFP B55, M&J 19.

***C. porphyropus* (Alb. & Schwein.) Fr.**

- Cap ochraceous brown to chestnut brown, sometimes with slightly violaceous grey margin when young, 50-120(-140) mm. Cap hemispherical to convex, then expanded, innately fibrillose, often with hygrophanous spots or streaks; gills violaceous to violaceous grey; stem 50-120 x 12-20(-25) mm, violaceous in upper part, downwards whitish grey with whitish to slightly violaceous veil; clavate to bulbous; flesh whitish with a violaceous tinge in stem cortex; smell honey-like; gills, stem and flesh becoming vinaceous violet when touched. Sp 8.5-10 x 5-6.5 µm, broadly ellipsoid, coarsely verrucose; pileipellis duplex. With *Fagus*, *Quercus*, *Corylus* and *Tilia*, on rich to ± calcareous soil; autumn; occasional in temp.-hemib., rare in southern bore.; DK (LC), FI (LC), NO, SE. – Däh 756, 757, M&J 18.

***C. subpurpurascens* (Batsch) Fr. s. auct. (*C. purpurascens* Fr. var. *largusoides* Rob. Henry)**

- 5. Stem with distinct, often somewhat woolly girdles of ochraceous brown to dark brown veil; in coniferous forests. Cap 60-120(-140) mm, hemispherical to convex, then expanded, yellow brown to orange brown, distinctly glutinous, with easily distinguishable brownish veil patches; gills greyish white; stem 50-100(-120) x 15-25 mm, whitish; flesh whitish; KOH in flesh dark red brown, in cap pale rose brown to negative. Sp 8-10 x 5-6 µm, ellipsoid, finely verrucose (fig. 709F); pileipellis simplex. Autumn; locally common in hemib.-southern bore., occasional in middle-northern bore, rare in coniferous suba.; FI (LC), NO, SE (LC). – CFP A01, Däh 735 (as *subvalidus*), GCI A159, M&J 10, Svp 48:45.

***C. saginus* (Fr.: Fr.) Fr. (*C. subvalidus* Rob. Henry)**

- Veil girdles on stem absent or pale whitish, ochraceous or violaceous or associated with deciduous trees 6
- 6. Sp on av < 9.5 µm long; associated with coniferous trees or *Populus* 7
- Sp on av > 9.5 µm long or associated with deciduous trees 20
- 7. Cap whitish to pale ochraceous 8
- Cap yellow brown to brown 10
- 8. Sp 8-9.5 x 5.5-6.5 µm; stem becoming ± yellowish when bruised. Cap 35-75 mm, hemispherical to convex, then expanded, hardly viscid, pale ochraceous to yellow brown, when young with yellow margin, covered with thin, frosty whitish veil, with age ochraceous brown; gills pale greyish white; stem 40-100 x 6-14 mm, clavate or with a rounded bulb, whitish to pale yellowish ochre, covered with a thin whitish veil, becoming more yellow when bruised;

flesh pale greyish white, with a yellow tinge; KOH in flesh slightly yellowish. Sp ellipsoid, verruculose; pileipellis duplex. With *Pinus* on sandy soil, often in *Cladonia* heathland; autumn; occasional in continental bore., most common in northeast Fennoscandia; FI (LC), NO (VU), SE (LC). - JEC 5:9, Jordst 17(1):25.

*C. pinophilus* Soop

- Sp 5.5-7.5 x 3.5-5  $\mu$ m; stem not becoming yellowish when bruised 9
- 9. Smell and taste farinaceous. Cap 20-50 mm, hemispherical to convex, then expanded, finely innately fibrillose, ochraceous at centre, towards margin whitish to cream, sometimes with appressed, whitish fibrillose veil at margin; gills whitish to cream or very pale violaceous grey; stem 30-45 x 6-12 mm, cylindrical to clavate, often slightly rooting at base, whitish, sometimes very pale violaceous at top, with appressed, fibrillose, whitish veil, with age brass-brown spotted; flesh whitish, sometimes slightly violaceous in stem top, becoming slightly yellowish in stem base. Sp 6.5-7.5 x 4.5-5  $\mu$ m, ellipsoid, verruculose; pileipellis duplex. With *Picea*, possibly also *Quercus*; autumn; very rare in suboceanic hemib.; NO (VU). - GCI C127, JEC 2:7.

*C. lustratus* Fr.

- Smell and taste indistinct, not farinaceous. Cap 30-60 mm, hemispherical to convex, then expanded, whitish to yellowish white; gills pale clay, often with a fugacious violaceous to rose tinge when young; stem 40-70 x 5-9 mm, cylindrical, often indistinctly bulbous, whitish, sometimes with violaceous top, with age  $\pm$  brass-brown spotted; flesh whitish, sometimes pale violaceous in stem top when young. Sp 5.5-7.5 x 3.5-4.5  $\mu$ m, ellipsoid, verruculose (fig. 719A); pileipellis duplex. Mainly in dry, sandy *Pinus* heathland, rarely with *Picea*; autumn; common in continental bore., occasional in hemib., very rare in temp.; DK (VU), FI (LC), NO (LC), SE (LC). - M&J 8, JEC 5:8, Sieniop 205.

*C. leucophanes* P. Karst.

- 10. Sp very broadly ellipsoid to subglobose. Cap 30-100 mm, hemispherical to convex, then expanded, faintly viscid to dry, ochraceous yellow to ochraceous brown, often with small, rust-brown spots, when young with thin whitish appressed fibrillose veil; gills ochraceous brown to greyish, rarely with a faint violaceous tinge; stem 50-100 x 7-15 mm, whitish, becoming brass-brown spotted with age, with rooting base, usually becoming vinaceous when touched; flesh whitish, with ochre, hygrophanous streaks in stem when young, ochre in bulb; smell somewhat like cedar wood. Sp 6-7 x 4.5-5  $\mu$ m, distinctly and densely verrucose; pileipellis duplex. With *Picea*, rarely with *Pinus* or *Fagus*; summer to autumn; occasional in hemib.-bore.; FI (LC), NO (LC), SE (LC). - CFP C41, GCI C183, M&J 9.

*C. vespertinus* (Fr.: Fr.) Fr. (*C. intentus* Fr.)

- Sp ellipsoid to amygdaloid 11
- 11. Gill edge with cylindrical to clavate cystidia or abundant sterile cells; cap dry; without hygrophanous spots, without silky-silvery veil remnants when young 12
- Gill edge without clavate cystidia or abundant sterile cells; cap viscid-glutinous, at least when young, glabrous or becoming fibrillose, often with hygrophanous spots, often with silky-silvery veil remnants when young 13
- 12. Flesh staining distinctly yellow when exposed. Cap 30-80 mm, hemispherical to convex, fibrillose to tomentose, orange yellow, yellow brown to red brown; gills narrow, white; stem 30-80 x 10-30 mm, clavate, white, but staining yellow; flesh initially whitish. Sp 6.5-9.5 x 3.5-5  $\mu$ m, ellipsoid to amygdaloid, very finely and indistinctly verrucose; pileipellis simplex to slightly duplex. With *Quercus* and *Fagus* on nutrient poor soil, also with *Picea* and then often on rich soil; summer to autumn; occasional in suboceanic hemib.-bore.; NO (LC), SE (LC). - CFP A24, Däh 716, Phil 187c.

*C. rubicundulus* (Rea) A. Pearson

- Flesh unchanging when exposed. Cap 40-100 mm, hemispherical to convex, fibrillose to

tomentose, buff, ochraceous brown to red brown; gills narrow, white; stem 40-110 x 10-25 mm, clavate to fusiform, white; flesh whitish with ochraceous hygrophanous streaks in stem when young. Sp 7-9 x 3.5-4.5  $\mu\text{m}$ , ellipsoid to amygdaloid, very finely and indistinctly verrucose; pileipellis simplex to slightly duplex. With *Picea*, rarely *Pinus* on nutrient poor soil, often in *Sphagnum*; summer to autumn; occasional in hemib.-bore.; FI (LC), NO (LC), SE (LC). – CFP B41, Däh 751, Sieniop 196.

*C. crassus* Fr.

13. Stem slightly rooting, with conspicuous, thick, white veil girdles. Cap 70-150 mm, hemispherical to convex, then expanded, often radially wrinkled towards margin with age, yellow brown to ochraceous brown, more chestnut brown at centre, often with abundant whitish veil patches; gills greyish white, rarely with a bluish tint; stem 60-130 x 10-30 mm, white, with conspicuous whitish veil girdles; flesh whitish. Sp 7-8.5 x 4-4.5  $\mu\text{m}$ , narrowly amygdaloid, almost smooth (fig. 719B). Mostly in oligotrophic coniferous forests, rarely with *Betula*; autumn; common in bore., occasional in hemib. and suba.; FI (LC), NO (LC), SE (LC). – CFP B48, GCI A29, M&J 109, Sieniop 195, Svp 48:57.  
*C. claricolor* (Fr.) Fr. (*C. turmalis* Fr. s. Moser)
  - Stem cylindrical, clavate to  $\pm$  bulbous, with more sparse, fibrillose veil remnants, sometimes with pinkish or ochre veil girdles 14
14. Universal veil girdles on stem or basal mycelium becoming pinkish rose to lilac when exposed; cap persistently glabrous; sp < 4  $\mu\text{m}$  broad, smooth and pale 15
  - Universal veil not becoming pinkish on stem or basal mycelia when exposed; cap becoming fibrillose; sp > 4  $\mu\text{m}$  broad, verrucose 16
15. Cap pale ochraceous yellow at margin, at centre bright yellow brown to more fulvous brown. Cap 40-100(-120) mm, hemispherical to convex, then expanded, often with some hygrophanous spots, when young with a thin, whitish, appressed, frosty veil at centre; gills greyish white, persistently pale ochraceous yellow; stem 50-90 x 10-15 mm, cylindrical, clavate to almost bulbous, whitish, with whitish veil, mycelial felt usually becoming rose after a while when exposed in air; flesh whitish. Sp 7-8.5 x 3.5-4  $\mu\text{m}$ , narrowly amygdaloid to almost ellipsoid, pale and smooth. In coniferous forests, very rarely in *Fagus* forests on poor soil; autumn; occasional in hemib.-bore.; FI (LC), NO (LC), SE (LC). – CFP C31, Däh 728 (as *sebaeus*), GCI B179, M&J 9, Svp 48:59.  
*C. turmalis* Fr. (*C. sebaeus* Fr. s. Moser)
  - Cap chestnut brown to dark red brown, becoming paler with age. Cap 40-100 mm, hemispherical to convex, then expanded, often with some hygrophanous spots, when young with a thin, whitish, appressed, frosty veil at centre; gills greyish white, persistently pale ochraceous yellow; stem 50-90 x 10-15 mm, clavate or with a faintly marginate bulb, whitish, with whitish veil girdles which become rose when exposed in air; flesh whitish. Sp 6.5-7.5 x 3-4  $\mu\text{m}$ , amygdaloid to ellipsoid, pale and smooth. In coniferous forests, rarely in *Fagus* forests on poor soil; late autumn; occasional in hemib.-bore., rare in temp.; FI (LC), NO (LC), SE (NE). – CFP C58, GCI A183, Sieniop 221.  
*C. variegatus* Bres. (*C. roseolimbatu*s Bigeard & Guillemin)
16. Taste slightly bitter, at least in the cap flesh see *C. lustrabilis* p. 679
  - Taste mild 17
17. With *Pinus* on sandy soil; KOH in flesh yellow see 8
  - With *Picea* or *Populus*; KOH in flesh red brown or negative 18
18. With *Populus* and *Betula*, rarely *Tilia*; subpellis weakly developed, hyphae rarely > 10  $\mu\text{m}$  wide. Cap 30-100 mm, hemispherical to convex, then expanded, centre sometimes tomentose-cracked with age, glutinous, yellow, ochraceous yellow to yellow brown, with whitish margin; gills ochraceous white to greyish white; stem 50-90 x 8-15(-20) mm, whitish, becom-

ing ochraceous yellow towards base when handled, with whitish to ochraceous yellow,  $\pm$  glutinous veil girdles; flesh fairly soft, whitish. Sp 7.5-8.5  $\times$  4.5-5  $\mu$ m, ellipsoid to slightly amygdaloid, finely verrucose. In thermophilous forests on rich to  $\pm$  calcareous soil; autumn; rare but locally occasional in hemib.-southern bore.; FI (LC), NO (VU), SE (LC). – CFP B46.

***C. populinus* Brandrud**

- With *Picea*; subpellis well developed, hyphae 10-25  $\mu$ m wide 19
- 19. KOH in flesh red brown; stem and flesh brownish. Cap 30-80 mm, hemispherical to convex, then expanded, ochraceous brown, yellow brown to buff, centre frequently appressed tomentose-cracked with age, sometimes with buff veil patches near margin; gills greyish white; stem 30-80  $\times$  5-15 mm, initially greyish white, soon becoming ochraceous brown from base; flesh whitish, with an ochraceous brown tinge, especially towards base. Sp 8-9  $\times$  5-6  $\mu$ m, ellipsoid, verruculose. With *Picea*; autumn; very rare in bore.; FI, (PK: Juuka), NO (VU), SE (VU). – CFP A26.

***C. norrlandicus* Brandrud**

- KOH in flesh negative; stem and flesh whitish see *C. multiformis* key D 24
- 20. Cap initially ochraceous white, pale ochraceous brown or silvery grey, or covered with appressed, whitish veil 21
- Cap initially yellowish, yellow brown, buff, grey brown, umber brown, violaceous grey to violaceous, not covered with appressed, whitish veil 25
- 21. Gills violaceous; stem clavate, violaceous at the top see *C. argenteolilacinus* key C 31
- Gills white; stem rooting to  $\pm$  cylindrical, white at top 22
- 22. In dwarf *Salix* heathland in arc./alp. see *C. durus* var. *chamaesalicis* key G 12
- Habitat different 23
- 23. Sp 12.5-14.5  $\times$  7-8  $\mu$ m; gills conspicuously distant. Cap 30-100 mm, hemispherical to convex, initially whitish or pale ochraceous and often covered with an appressed, silky-fibrillose veil, with age becoming  $\pm$  ochraceous at centre, and often with larger whitish fibrillose veil patches; gills white; stem 10-20  $\times$  40-110 mm, irregularly cylindrical, sometimes slightly rooting, whitish, with age brownish, often turning vinaceous and then bluish black in damages or where bruised after 1 hour or so; flesh whitish. Sp amygdaloid to slightly citriform, distinctly to coarsely verrucose. With *Picea* on calcareous soil; autumn; rare in hemib.-bore.; NO (NT), SE (NT). – CFP A07, M&J 11, Svp 48:49.

***C. fraudulosus* Britzelm.**

- Sp < 12  $\mu$ m long; gills not conspicuously distant 24
- 24. With *Populus*, often clayey, rich to calcareous soil; sp  $\leq$  6.5  $\mu$ m wide. Cap 30-100 mm, hemispherical to convex, sometimes with a low umbo, initially whitish or very pale ochraceous, and often covered with an appressed, silky-fibrillose veil, with age becoming  $\pm$  ochraceous at centre, and often with larger whitish fibrillose veil patches; gills white; stem 40-100  $\times$  10-15 mm, cylindrical, rooting, whitish, with fairly sparse, rarely abundant whitish fibrillose veil, often as girdles, with age ochraceous brown, often turning vinaceous and then bluish black in damaged spots or where bruised after an hour or so; flesh whitish. Sp 9.5-11.5  $\times$  5-6.5  $\mu$ m, amygdaloid, distinctly verrucose. Autumn; common in hemib.-southern bore., rare but locally occasional in middle bore., very rare in temp.; DK (DD, Fyn: Østre Gulstav, Lol: Flintinge Byskov), FI (LC), NO (LC), SE (LC). – CFP A52, M&J 114, Sieniop 188, Svp 48:49.

***C. argutus* Fr.**

- In oligotrophic-mesotrophic *Picea* forests, often in ant-hills; sp  $\geq$  6.5  $\mu$ m wide. Cap 40-70 mm, hemispherical to convex, ochraceous white to uniformly ochraceous yellow, completely fibrillose from veil when young, with age becoming ochraceous brown; gills white; stem 50-90  $\times$  7-15 mm, irregularly cylindrical, sometimes slightly rooting towards base, whitish, with age pale ochraceous brown, often with  $\pm$  ochraceous veil girdles, turning slightly yellowish



low when bruised; flesh whitish. Sp 9.5-12 x 6.5-8  $\mu\text{m}$ , fairly polymorphic, broadly ellipsoid to amygdaloid, sometimes subglobose, distinctly to coarsely verrucose. Autumn; rare but locally occasional in hemib.-bore.; FI (LC), NO, SE.

*C. rosargutus* Chevassut & Rob. Henry (*C. fraudulosus* Britzelm. var. *rosargutus* (Chevassut & Rob. Henry) Brandrud)

25. Stem  $\geq 20$  mm broad; sp 14-17 x 8-10  $\mu\text{m}$ . Cap 70-200 mm, hemispherical to convex, then expanded, purple brown, umber brown or cocoa brown, sometimes with whitish to pale violaceous veil patches, often radially wrinkled; gills grey, sometimes faintly violaceous when young; stem 70-150(-200) x 20-50 mm, clavate, whitish, with bluish to whitish veil girdles; flesh greyish white, sometimes slightly violaceous in stem top. Sp amygdaloid, coarsely verrucose; pileipellis duplex, with a well-developed, subcellular subpellis, elements with yellow brown walls. With *Quercus*, *Tilia*, *Carpinus* and *Corylus*, in Central Europe also with *Fagus*; summer to autumn; rare in hemib., very rare in temp.; NO (VU), SE (NT). – CFP A42, Däh 744, GCI B119, M&J 116, Svp 48:59, ☉.

*C. praestans* (Cordier) Gillet

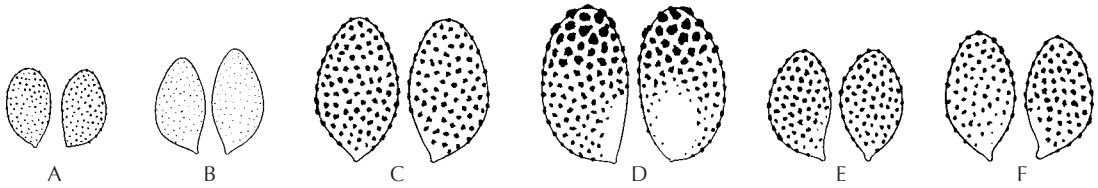
- Stem  $\leq 20$  mm broad; sp smaller 26
- 26. In coniferous forests; stem without or with indistinct whitish to violaceous girdles; cap rarely with veil remnants 27
  - In deciduous forests; veil distinct, leaving the stem whitish flocculose or with one or more distinct ochraceous to yellow-brown girdles; cap frequently with veil patches or  $\pm$  scaly from veil 32
- 27. Cap bluish to violaceous grey, at least when young 28
  - Cap grey brown, ochraceous brown, fulvous brown to dark brown 29
- 28. Pileipellis duplex, with a subcellular subpellis; stem 50-100 x 10-20(-25) mm, whitish, with a distinct violaceous blue veil girdle. Cap 50-100(-120) mm, hemispherical to convex, then expanded, initially fairly dark violaceous at centre, brighter violaceous blue at margin, partly due to thin, appressed veil, with some hygrophanous spots or streaks, with age becoming purplish brown and finally somewhat ochraceous yellow at centre; gills grey to greyish white, narrow; flesh whitish, when young sometimes with a greyish to grey-green tinge in stem top. Sp 10-12 x 5-6  $\mu\text{m}$ , narrowly amygdaloid, weakly verrucose. With *Picea*, very rarely *Tilia*, on rich, but rarely on calcareous soil; autumn; occasional in hemib.-bore., in FI very rare in southern bore.; FI (NT, V, U), NO (LC), SE (VU). – CFP A47, Däh 743, GCI C83, M&J 60, Nit 246.

*C. cumatilis* Fr.

- Pileipellis simplex; stem 50-90 x 8-13 mm, whitish, with indistinct, whitish to ochraceous yellow, glutinous veil. Cap 40-90 mm, hemispherical to convex, then expanded, margin initially greyish blue to pale violaceous, with more purplish grey-brown centre, becoming greyish brown with age; gills greyish; flesh whitish; smell when cut somewhat of maize or mown grass, like *C. olivus*. Sp 11-12.5 x 6-7  $\mu\text{m}$ , amygdaloid to slightly ellipsoid, weakly verrucose. With *Picea* on rich or calcareous soil; autumn; rare in hemib.-suba.; FI (LC), NO (LC), SE (NE). – CFP C25.

*C. serarius* Fr.

- 29. Sp  $> 11.5$   $\mu\text{m}$  long 30
  - Sp  $< 11.5$   $\mu\text{m}$  long 31
- 30. Gills violaceous blue; sp 12-13.5 x (7.5)-8-9  $\mu\text{m}$ , broadly ellipsoid, distinctly verrucose
  - see *C. riederi* key C 31
  - Gills greyish white; sp 11.5-13 x 6.5-7.5  $\mu\text{m}$ , amygdaloid to ellipsoid, weakly verrucose. Cap 25-60 mm, hemispherical to convex, then expanded, innately fibrillose, slightly viscid, soon dry, brownish grey to ochraceous brown; gills greyish white; stem 40-100 x 5-15 mm, whit-



Spores: A: *Cortinarius leucophanes*, B: *C. claricolor*, C: *C. vulpinus*, D: *C. obsoletus*, E: *C. tiliae*, F: *C. variiformis*.

ish, with violaceous veil girdles; flesh whitish, smell slightly honey-like. Pileipellis simplex to slightly duplex, basally with up to c. 15  $\mu\text{m}$  wide elements with amber-brown walls. In oligotrophic coniferous forests, mainly with *Picea*; autumn; rare in bore.-suba., in FI with a southern distribution; FI (LC), NO (vu), SE (vu). – CFP B26, JEC 5:70.

*C. borgsjoeënsis* Brandrud

31. Sp 10-11.5  $\times$  6-7  $\mu\text{m}$ , ellipsoid to amygdaloid; stem base without pale greenish mycelial strands. Cap 40-100 mm, hemispherical to convex, then expanded, innately fibrillose, sometimes with few hygrophanous spots, ochraceous grey brown to dark ochraceous brown or pale orange brown, at margin ochraceous grey; gills violaceous, pale violaceous grey to greyish white; stem 60-100  $\times$  10-20 mm, whitish, when young with a faint greyish blue tinge at top, with whitish to ochraceous yellow, indistinct veil girdles; flesh whitish, bluish grey to ochraceous grey tinge in stem top when young. Sp verrucose. With *Pinus* on calcareous soil; autumn; very rare in hemib.-bore.; NO (vu), SE (vu). – CFP D15, D16.

*C. pini* Brandrud

- Sp 9-10.5  $\times$  6-7  $\mu\text{m}$ , broadly ellipsoid; stem base often with pale greenish mycelial strands. Cap 40-70 mm, hemispherical to convex, then expanded, brown to dark brown, with radial hygrophanous streaks or spots, sometimes entirely hygrophanous in outer part; gills initially grey brown or bluish grey; stem 40-100(-120)  $\times$  7-12 mm,  $\pm$  bulbous to slightly marginate bulbous, shiny, when young pale violaceous grey, to more distinctly bluish at top, discolouring brass brown; flesh whitish to brownish white, when young with a violaceous tinge in stem top; smell honey-like. Sp verrucose; pileipellis duplex. In coniferous forests on moist, silicious soil, even in ombrotrophic bogs; summer to autumn; common and widespread in hemib.-bore.; FI, NO (LC), SE. – CFP C06 (as *scaurus* var. *sphagnophilus*).

*C. sphagnophilus* Peck

32. Sp on av > 11  $\times$  6.5  $\mu\text{m}$ ; with *Fagus*, *Carpinus* or *Corylus* 33  
- Sp on av < 11  $\times$  6.5  $\mu\text{m}$ ; with *Quercus* or *Tilia* 35

33. Flesh turning yellow on exposure; smell unpleasant with age, like old camembert cheese; with *Carpinus* or rarely *Corylus*. Cap 40-90 mm, hemispherical to convex, sometimes with a low umbo, often  $\pm$  dry, initially ochraceous white, soon turning ochraceous brown, darker brown when bruised, with abundant appressed veil, rendering the cap fibrillose-tomentose; gills persistently pinkish lilac, especially towards edge; stem 50-100  $\times$  8-18 mm, cylindrical, whitish, becoming somewhat brownish from base, with abundant whitish veil girdles that become ochraceous brown; flesh whitish. Sp 11.5-13.5  $\times$  6.5-7.5  $\mu\text{m}$ , amygdaloid, distinctly verrucose; pileipellis simplex to slightly duplex, basal hyphae strongly yellow brown incrustated. On calcareous soil; autumn; rare in hemib.; NO (CR), SE (EN). – CFP B43, JEC 8:33 (top), Svp 48:53.

*C. pseudovulpinus* Rob. Henry & Ramm

- Flesh not turning yellow on exposure; smell not like old cheese with age; with *Fagus* 34
- 34. Sp amygdaloid, 11-13 x 6.5-7.5  $\mu$ m (fig. 719C); stem rooting towards base. Cap 40-100(-120) mm, hemispherical to convex or slightly conical, yellow brown to orange brown, becoming warm red brown with age, often with appressed, whitish to ochraceous fibrillose veil, at least at margin; gills greyish white to pale violaceous grey; stem 50-120 x 8-20 mm, whitish, with abundant whitish veil girdles that become ochraceous brown to yellow brown with age; flesh whitish. Sp distinctly verrucose; pileipellis duplex, subpellis with golden brown, amber-like thick walls. With *Fagus* on rich to calcareous soil; autumn; rare in temp.; DK (LC), SE (NT). – CFP B45, Däh 732, GCI C199, JEC 8:33 (bottom), Svp 48:51, ☉.  
*C. vulpinus* (Velen.) Rob. Henry (*C. rufoalbus* Kühner)
- Sp broadly ellipsoid, 11.5-13.5 x 7-8.5  $\mu$ m (fig. 719D); stem cylindrical to clavate. Cap 25-60 mm, hemispherical to convex, yellow brown to buff, unchanging with age, often with appressed, white fibrillose veil at margin; gills greyish white to pale violaceous grey; stem 35-70 x 7-15 mm, whitish, with whitish veil girdles, not becoming ochraceous brown with age; flesh whitish. Sp distinctly and densely verrucose, sometimes almost spiny; pileipellis duplex, subpellis with golden brown, amber-like thick walls. In deciduous forests, mainly with *Fagus*, on calcareous soil; autumn; very rare in temp.-hemib.; DK (DD, EJyl: Moesgård Skov, SJ: Allindelille), SE. – AC 9:239, JEC 8:31, M&J 11 (as *flurysi*), Phil 185f (as *fraudulosus*), Svp 56:46.  
*C. obsoletus* Kühner
- 35. Cap with abundant, brown to dark brown, finely scaly-fibrillose to scaly veil remnants, dry; stem finely scaly-fibrillose from abundant, brown veil, base rooting and turning distinctly brownish with age. Cap 30-80 mm, hemispherical to convex, ochraceous brown to dark grey brown; gills violaceous grey; stem 35-70 x 8-15 mm, whitish; flesh whitish. Sp (8.5-)9-10 x 5.5-6  $\mu$ m, broadly amygdaloid to ellipsoid, distinctly verrucose; pileipellis slightly duplex, basal hyphae with yellow, thick walls. With *Quercus* on calcareous, clayey soil; autumn; very rare in temp.; DK (CR, Fyn: Kasmose Skov). – AC 2:30, Svp 48:53.  
*C. maculosus* (Pers.) Fr. (*C. squameoradicans* Cheype)
- Cap not scaly-fibrillose to scaly, slightly viscid; stem with sparse yellow-brown veil girdles, cylindrical to slightly clavate 36
- 36. Sp 8.5-10 x 4.5-5.5  $\mu$ m (fig. 719E); with *Tilia cordata*. Cap 50-90 mm, hemispherical to convex, distinctly innately fibrillose, viscid, ochraceous yellow to yellow brown, margin pale ochraceous, sometimes with an olivaceous ochre tinge, often with appressed veil at margin; gills initially tinged bluish grey; stem 45-85 x 10-18 mm, whitish with indistinct, ochraceous white to  $\pm$  ochraceous brown veil girdles; flesh whitish when young, with a pale greenish yellow tinge in stem top. Sp amygdaloid to more ellipsoid, finely to distinctly verrucose; pileipellis duplex, subpellis subcellular, elements imbedded in yellow brown, amber-like wall pigment. In calciphilous forests; very rare in the Oslofjord area; autumn; very rare in hemib.; NO (EN). – Bendiksen et al. 1998 plate M, JEC 4:109, Svp 48:47 (top, as *variiformis*).  
*C. tiliae* Brandrud
- Sp 9.5-11.5 x 5.5-6.5  $\mu$ m (fig. 719F); with *Quercus*. Cap 40-100 mm, hemispherical to convex, sometimes finely innately fibrillose, yellow to yellow brown, centre often more brown to red brown; gills initially distinctly and sometimes persistently lilac blue; stem 40-120 x 8-20 mm, whitish with ochraceous yellow to pale brown veil, as girdles or somewhat volva-like; flesh whitish, greyish to bluish grey in stem top when young. Sp amygdaloid to ellipsoid, distinctly verrucose; pileipellis distinctly duplex, with a subcellular subpellis with amber brown, thick walls. On calcareous soil, mostly in open, grazed woodlands; autumn; very rare in temp.-hemib.; DK (CR, EJyl: Elbæk Skov), SE (EN). – CFP D11, D12, GCI B187.  
*C. variiformis* Malençon

Subgen. *Telamonia* (Fr.) TrogTUULA NISKANEN, KARE LIIMATAINEN,  
ILKKA KYTÖVUORI & HÅKAN LINDSTRÖM

Cap dry or fairly dry and stem dry. Cap 5-150 mm, hygrophanous or not. Stem cylindrical to clavate, base sometimes tapering downwards. Universal veil white or colourful, forming complete or incomplete girdles, scales or fibrils on stem, often constituting an important character for identification. Smell often indistinct or raphanoid (in a broad sense), in other species like cedar-wood (*Juniperus virginianus*, often very weak), iodoform, earth, aniseed, *Pelargonium*, potatoes, *Viola odorata* or parsley, pungent as in *Lepiota aspera*, etc. In *Telamonia* it is extremely important to observe cap colours from moist frb, because most *Telamonia* species have totally different colour and become very anonymous in dry weather. Exsiccates white to brown or blackish, often diagnostic for the species.

Sp fusiform to subglobose, not citriform. Marginal cells clavate or basidioform, very rarely as true cheilocystidia. Microscopical observations and measurements in Melzer's reagent, except in the most species in the keys O and P where they are in KOH. To describe the differences between species the dextrinoidity of the spores is described in five grade scale: weakly dextrinoid, fairly weakly dextrinoid, moderately dextrinoid, fairly strongly dextrinoid, strongly dextrinoid.

160 species and four varieties in the keys, but the real number of species in the Nordic countries is much higher. The species concept and limits have been confirmed by macro- and microscopic studies, except for the species in keys O and P, by sequencing c. 2-5 Nordic specimens per species. The nomenclature has been confirmed by sequencing type material, or in Friesian species by sequencing the photographed collections of the Cortinarius Flora Photographica (Brandrud et al. 1989-1998), exceptions are marked in the text (except in the keys C, O and P). The sections are based on the revision by Liimatainen, Niskanen & Kytövuori 2009. The vouchers of CFP photo plates have been studied, but the other photo references are just suggestive.

Suppl. lit.: Arnold 1993.

- |    |                                                                                                                                                                                                                                 |    |
|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| 1. | Upper part of stem usually < 4 mm broad; cap 5-30(-40) mm                                                                                                                                                                       | 2  |
| -  | Upper part of stem usually > 4 mm broad; cap (30-)40-100(-150) mm                                                                                                                                                               | 21 |
| 2. | Universal veil whitish, cream, greyish or brownish, can be sparse                                                                                                                                                               | 3  |
| -  | Universal veil red, reddish, orange, yellow or ochraceous, can be sparse                                                                                                                                                        | 6  |
| 3. | Smell at the base of stem iodoform-like (best observed when slightly dried) or raphanoid; frb without blue colours; cap smooth, yellow brown rusty to honey brown; stem white at least when young; flesh colour same as the cap |    |
|    | <b>Key K, sect. <i>Obtusi</i> p. 755</b>                                                                                                                                                                                        |    |
| -  | Not this combination of characters; smell not iodoform-like                                                                                                                                                                     | 4  |
| 4. | Whole exsiccate black; universal veil white, very sparse, almost absent; whole frb dark brown                                                                                                                                   |    |
|    | <b>Key E, sect. <i>Brunnei</i> p. 734</b>                                                                                                                                                                                       |    |
| -  | Exsiccate pale to dark, not blackish; universal veil white, cream, greyish or brownish, sparse or abundant; whole frb usually not dark brown                                                                                    | 5  |
| 5. | Stem becoming brownish to almost blackish towards base with age and after handling, not reddening, usually not swollen at base; flesh in stem usually with brownish incrusting pigments; cap often ± scaly                      |    |
|    | <b>Key O, sect. <i>Incrustati</i> etc. p. 764</b>                                                                                                                                                                               |    |
| -  | Stem not becoming brownish downwards with age, but often turning red at base and ± swollen; flesh in stem usually not brownish, hyphae without brownish incrusting pigment; cap usually not scaly                               |    |
|    | <b>Key P, sect. <i>Hydrocybe</i> p. 770</b>                                                                                                                                                                                     |    |
| 6. | Whole frb vivid yellow brown, red brown or cinnabar red                                                                                                                                                                         | 7  |
| -  | Whole frb not vivid yellow brown, red brown or cinnabar red                                                                                                                                                                     | 9  |
| 7. | Sp < 7 µm long                                                                                                                                                                                                                  |    |
|    | <b>Key M, sect. <i>Renidentes</i> p. 762</b>                                                                                                                                                                                    |    |

- Sp > 7  $\mu\text{m}$  long 8
- 8. Frb cinnabar red see *C. cinnabarinus* key E 8
- Frb vivid yellow brown to red brown **Key O, sect. *Incrustati* etc. p. 764**
- 9. Universal veil orange, pale pinkish, red or vinaceous red 10
- Universal veil yellow or ochre 12
- 10. Universal veil light pinkish to vinaceous red; cap mat or innately fibrillose,  
with vinaceous brownish tints; flesh yellowish brown **Key R, sect. *Fulvescentes* p. 776**
- Universal veil orange, blood red or red; cap not mat, often  $\pm$  glossy, without  
vinaceous tints; flesh greyish white, yellow brown, purplish brown or red brown 11
- 11. Universal veil distinct, orange or blood red **Key Q, sect. *Anthracini* p. 775**
- Universal veil sparse, white, turning slowly red **Key P, sect. *Hydrocybe* p. 770**
- 12. Cap scaly 13
- Cap not scaly 16
- 13. Sp > 9.5  $\mu\text{m}$  long 14
- Sp < 9.5  $\mu\text{m}$  long 15
- 14. With *Alnus* see *C. helvelloides* key O 2
- With *Pinus* see *C. bayeri* key R 2
- 15. Smell strong, pungent, chemical; with *Salix* see *C. croceocingulatus* key P 7
- Smell indistinct or raphanoid; with deciduous or coniferous shrubs or trees  
**Key O, sect. *Incrustati* etc. p. 764**
- 16. With deciduous trees 17
- With conifers 18
- 17. Most sp < 8.5  $\mu\text{m}$  long see *C. heterocyclus* key B 2
- Most sp > 8.5  $\mu\text{m}$  long **Key O, sect. *Incrustati* etc. p. 764**
- 18. Flesh in stem darkening towards the base to dark brown **Key O, sect. *Incrustati* etc. p. 764**
- Flesh in stem not darkening towards the base, whitish to yellowish brown 19
- 19. Cap  $\pm$  glossy **Key O, sect. *Incrustati* etc. p. 764**
- Cap mat 20
- 20. Flesh  $\pm$  whitish; frb often with bluish tints, especially at the top of stem  
see *C. anomalellus* key C 4
- Flesh yellowish brown; frb without bluish tints **Key R, sect. *Laeti* p. 776**
- 21(1) Universal veil yellow, red, greenish, grey, brown or blue, sometimes very sparse 22
- Universal veil white, greyish white, brownish white, cream, sometimes very sparse 46
- 22. Cheilocystidia present; smell strong, unpleasant see *C. camphoratus* key G 2
- Without true cheilocystidia; smell indistinct, raphanoid or fruity 23
- 23. Universal veil blue **Key G, sect. *Telamonina* p. 747**
- Universal veil yellow, red, grey, olivaceous or brown 24
- 24. Whole frb cinnabar red see *C. cinnabarinus* key E 8
- Whole frb not cinnabar red 25
- 25. Universal veil indistinct; sp 6-7 x 5-5.5  $\mu\text{m}$ , subglobose **Key M, sect. *Renidentes* p. 762**
- Universal veil  $\pm$  distinct; sp subglobose to fusiform, often larger 26
- 26. Universal veil orange, light pinkish, red or vinaceous red 27
- Universal veil yellowish, brownish, greyish or olivaceous 36



27. Cap completely covered with reddish scales see *C. bolaris* key C 2  
 - Cap without reddish scales or rarely with small red scales at the centre 28
28. With *Quercus*, *Fagus* or *Corylus*; universal veil orange, orange red or cinnabar red 29  
 - With deciduous or coniferous trees; universal veil light pinkish, red or vinaceous red 30
29. Universal veil orange red, forming girdles on stem; cap yellow to ochre brown see *C. hinnuleoarmillatus* key N 2  
 - Base of stem cinnabar red from universal veil; cap saturated red brown see *C. bulliardii* key E 9
30. Cap weakly hygrophanous, innately fibrillose or with small scales 31  
 - Cap hygrophanous, not innately fibrillose, nor with small scales 33
31. Universal veil red, often forming small patches, not girdles, on the stem; cap greyish brown, fairly pale Key C, sect. *Anomali* p. 730  
 - Universal veil pale pinkish, red or vinaceous red, forming complete and/or incomplete girdles on stem; cap reddish brown to ochraceous red brown, sometimes fairly dark 32
32. Cap somewhat silky shiny, smooth; sp obovoid Key B, sect. *Brunneotincti* p. 728  
 - Cap not silky shiny, smooth or sometimes with small scales; sp subglobose, ovoid, amygdaloid or ellipsoid Key A, sect. *Armillati* p. 726
33. Cap red brown, ± waxy-glossy when moist, not silky shiny or mat 34  
 - Cap greyish brown or with vinaceous red tints, mat or silky-shiny fibrillose 35
34. Universal veil brown red, sparse; sp amygdaloid see *C. aurantiomarginatus* key E 9  
 - Universal veil pale pinkish or vivid red, forming incomplete girdles or a thin sheath on the stem; sp subglobose or ellipsoid Key L, sects *Firmiores* and *Boulderenses* p. 758
35. Cap greyish brown, silky-shiny fibrillose; universal veil red Key C, sect. *Anomali* p. 730  
 - Cap red brown to vinaceous red brown, mat; universal veil pale pinkish or vinaceous red Key R, sect. *Fulvescentes* p. 776
36. Cap margin with distinct, greyish brown veil patches; universal veil abundant see *C. rusticus* key G 5  
 - Cap without veil patches; universal veil abundant or sparse 37
37. Universal veil brownish, without yellowish or olivaceous colours Key D, sects *Pholidei* and *Fuscoperonati* p. 734  
 - Universal veil yellowish, yellowish brown or olivaceous 38
38. Cap not hygrophanous, or cap weakly hygrophanous and innately fibrillose or with small scales 39  
 - Cap hygrophanous, neither innately fibrillose nor with small scales 41
39. Cap not hygrophanous, smooth, without fibrils or small scales; frb without olivaceous tints; gill trama hyphae often with hyaline crystals Key C, sect. *Anomali* p. 730  
 - Cap weakly hygrophanous, innately fibrillose, sometimes with small scales; frb with or without olivaceous tints; gill trama hyphae without hyaline crystals 40
40. Frb often with olivaceous tints *and/or* cap silky shiny, smooth Key B, sect. *Brunneotincti* p. 728  
 - Frb without olivaceous tints; cap not silky shiny, smooth or sometimes with small scales Key A, sect. *Armillati* p. 726
41. Universal veil, stem or sometimes other parts of frb with greenish or metallic tints Key E, sect. *Uracei* p. 734  
 - Frb without greenish or metallic tints 42

42. In temp.-hemib. with *Corylus* or *Quercus* **Key N, sect. *Himmulei* p. 762**  
 - In temp.-suba. with coniferous trees 43
43. Cap mat, greyish ochraceous brown or vivid yellow brown **Key R, sect. *Laeti* p. 776**  
 - Cap  $\pm$  waxy-glossy when moist, not mat, red brown to dark red brown or  
 olivaceous yellow brown 44
44. With *Pinus* or *Picea*; sp narrowly fusiform see *C. aureovelatus* key O 3  
 - With *Picea*; sp amygdaloid or subglobose 45
45. Cap red brown; stem 6-15 mm broad, without bluish tints; sp subglobose  
 see *C. illuminus* key F 15  
 - Cap olivaceous yellow brown or fairly dark red brown; stem 4-8 mm broad, top  
 sometimes with bluish tints; sp amygdaloid **Key E, sects *Uracei* and *Colymbadini* p. 734**
- 46(21) Cap  $\pm$  white, brownish white or greyish 47  
 - Cap  $\pm$  brown to almost black 56
47. Smell fruity in gills 48  
 - Smell indistinct 51
48. Flesh saturated yellow brown; with *Pinus* see *C. traganus* f. *ochraceus* key G 4  
 - Flesh pale; with *Picea* or deciduous trees 49
49. Smell strong, like in *C. traganus*; sp  $> 10 \mu\text{m}$  long see *C. niveotraganus* key G 9  
 - Smell fruity, not so strong; sp  $< 10 \mu\text{m}$  long 50
50. Cap silky shiny, with very thin hygrophanous streaks **Key L, sect. *Urbici* p. 758**  
 - Cap not or only slightly silky-shiny, not hygrophanous **Key I, sect. *Niveoglobosi* p. 751**
51. Cap often with big, cream-coloured veil patches near the margin  
 see *C. alborufescens* key I 5  
 - Cap without veil patches 52
52. Cap finely scaly see *C. malachius* key H 1  
 - Cap not scaly 53
53. With deciduous trees **Key L, sects *Firmiores* and *Urbici* p. 758**  
 - With coniferous trees 54
54. In mesic *Picea* forests on calcareous soil; frb without bluish tints **Key L, sect. *Urbici* p. 758**  
 - In coniferous forests with *Pinus*; frb usually with at least some bluish tints,  
 often best seen in stem top 55
55. Cap innately fibrillose; flesh greyish brown to brown; exsiccate with a fairly  
 dark, brown, silvery grey or blackish grey cap see *C. suberi* key H 1  
 - Cap not innately fibrillose; flesh greyish white; exsiccate pale, greyish to pale  
 greyish brown see *C. quarciticus* key L 4
56. Whole frb yellowish brown to ochraceous brown; smell raphanoid or earthy,  
 often strong; sp subglobose to ellipsoid, usually strongly verrucose  
**Key N, sects *Himmulei* and *Safranopedes* p. 762**  
 - Not this combination of characters; whole frb not yellowish brown 57
57. Smell fruity, as in *C. traganus*; sp ellipsoid to amygdaloid,  $8.5\text{--}11 \times 5\text{--}7 \mu\text{m}$ ; frb  
 usually with bluish tints; universal veil abundant **Key G, sect. *Telamonina* p. 747**  
 - Not this combination of characters; smell not as in *C. traganus* 58
58. Cap weakly hygrophanous or with hygrophanous streaks, sometimes coarsely  
 innately fibrillose or with small scales 59

- Cap distinctly hygrophanous, often  $\pm$  waxy-glossy when moist, without scales or fibrils 67
- 59. In temp.-hemib. in deciduous forests with *Fagus*, *Quercus*, *Carpinus*, *Tilia* or *Corylus* Key F, sect. *Bovini* etc. p. 740
- In temp.-suba. in coniferous forests or with *Betula* or *Populus* 60
- 60. Flesh entirely and distinctly violaceous when young see *C. ionophyllus* key G 11
- Flesh sometimes with bluish tints at stem top or without bluish tints 61
- 61. Smell fruity, sometimes as in *C. traganus* 62
- Smell indistinct, raphanoid or faintly aniseed-like 63
- 62. Cap with hygrophanous streaks; sp  $> 10 \mu\text{m}$  long see *C. niveotraganus* G 9
- Cap not hygrophanous; sp  $< 10 \mu\text{m}$  long Key I, sect. *Niveoglobosi* p. 751
- 63. Cap vivid yellow brown to dark brick red; gills pale greyish apricot brown to vivid brick red Key I, sects *Lanigeri* and *Balaustini* p. 751
- Cap greyish brown to dark brown; gills greyish brown to dark brown 64
- 64. Cap with small scales see *C. malachius* key H 1
- Cap without scales 65
- 65. Most sp  $> 9.5 \mu\text{m}$  long; with *Populus* see *C. lucorum* key F 3
- Most sp  $< 9.5 \mu\text{m}$  long; with deciduous or coniferous trees 66
- 66. Cap sand brown; flesh pale greyish brown; with deciduous trees Key I, sect. *Niveoglobosi* p. 751
- Cap greyish brown to dark brown; flesh greyish brown to dark brown; with coniferous trees Key E, sect. *Brunnei* p. 734
- 67. Smell iodoform-like, especially on drying; stem white, tapering downwards Key K, sect. *Acetosi* p. 755
- Smell not iodoform-like; stem clavate to tapering downwards 68
- 68. Stem tapering downwards, cartilaginous Key J, sect. *Duracini* p. 753
- Stem clavate to tapering downwards, not cartilaginous 69
- 69. Whole frb vivid yellow brown to red brown; sp obovoid-subglobose,  $< 5.5 \mu\text{m}$  broad Key M, sect. *Renidentes* p. 762
- Whole frb not vivid yellow brown to red brown; sp amygdaloid to ellipsoid or if subglobose then  $> 5.5 \mu\text{m}$  broad 70
- 70. Flesh in whole stem bluish see *C. evernius* key J 7
- Flesh only partly bluish or without bluish tints 71
- 71. Moist flesh in stem  $\pm$  brown to dark brown, often darkening towards the base, sometimes partly bluish 72
- Moist flesh in stem very pale, greyish white to brownish white, not darkening towards the base, sometimes partly bluish 73
- 72. Exsiccate with greyish black to brownish black cap and stem; cap and flesh usually brown to dark brown Key E, sect. *Brunnei* etc. p. 734
- Exsiccate with pale to fairly dark brown cap, stem often paler than the cap, not blackish; cap and flesh honey brown, grey brown, red brown to fairly dark brown Key F, sect. *Bovini* etc. p. 740
- 73. Smell fairly strong, cellar-like, earthy, radish-like or recalling parsley or faint and recalling cedar wood 74
- Smell indistinct 76


74. Smell of parsley see *C. phaeosmus* key F 7  
 - Smell cellar-like, earthy or recalling cedar wood 75
75. Sp < 4.5  $\mu\text{m}$  broad; cap vivid red brown; frb without bluish tints see *C. odhinnii* key P 5  
 - Sp > 4.5  $\mu\text{m}$  broad; cap fairly dark reddish brown to chocolate brown; frb often with bluish tints **Key J, sect. *Bicolores* p. 753**
76. Flesh slightly reddening when cut; sp almost smooth, narrowly ellipsoid to fusiform see *C. erubescens* key P 12  
 - Flesh not reddening when cut; sp weakly to strongly verrucose, subglobose, amygdaloid or ellipsoid 77
77. With coniferous trees **Key L, sect. *Firmiores* p. 758**  
 - With deciduous trees 78
78. With *Fagus* see *C. turgidus* key L 8  
 - With other deciduous trees **Key F, sect. *Bovini* etc. p. 740**

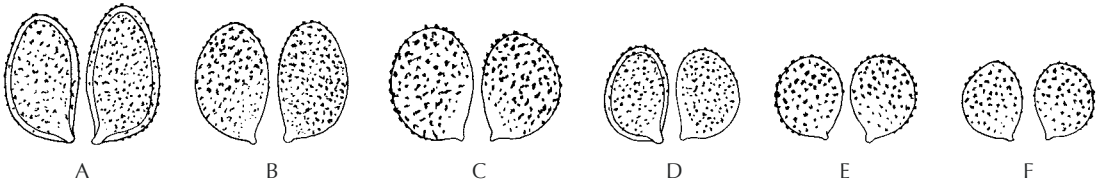
**Key A: Subgen. *Telamonia* sect. *Armillati* M.M. Moser**

TUULA NISKANEN & ILKKA KYTÖVUORI

Frb fleshy; cap usually 40–110 mm, innately fibrillose, with hygrophanous streaks; universal veil yellowish brown, pinkish, red or vinaceous red; smell indistinct or faintly raphanoid; exsiccates with a fairly dark red brown to greyish brown cap and a greyish stem,  $\pm$  red universal veil often still visible on the stem, mycelium white or pinkish; with anthrachinonic pigments; sp subglobose to ellipsoid.

Note: If a species does not match here, see also key B.

1. Sp > 8.5  $\mu\text{m}$  long 2  
 - Sp < 8.5  $\mu\text{m}$  long 4
2. Universal veil forming a distinct, cinnabar red girdle and incomplete girdles; sp strongly dextrinoid; with *Betula*. Cap 45–110 mm, hemispherical, soon low convex with a low and broad umbo, often with distinct, small, red scales, especially at the centre, yellowish red brown to yellow brown, with fine dark hygrophanous streaks; gills medium spaced, light brown when young, dark brown with age; stem 80–200  $\times$  8–15 mm, clavate, up to 25 mm broad at the base, rarely cylindrical, white fibrillose when young, later greyish brown; mycelium white; flesh grey brown; smell slightly raphanoid. Sp 10–12  $\times$  6–7  $\mu\text{m}$ , amygdaloid to slightly ellipsoid, thick-walled, usually moderately verrucose, sometimes more strongly at apex (fig. 727A). In deciduous and mixed forests, on damp to fairly dry, usually oligotrophic soil; summer to autumn; very common in hemib.-suba., rare in temp.; DK (LC), FI (LC), NO (LC), SE (LC). – AC 7:146 147, CFP B09, R&H 517, Sieniop 189, Ves 350, .  
*C. armillatus* (Fr.: Fr) Fr.  
 - Universal veil rose pink to vinaceous red, sometimes yellowish brown, forming complete and/or incomplete girdles; sp weakly to fairly strongly dextrinoid; usually with *Picea* 3
3. Frb with bluish tints on top of the stem and/or in gills, at least when young; sp ellipsoid to amygdaloid, Qav = 1.4–1.65 (fig. 727B). Cap 55–100 mm, hemispherical, soon low convex and often with a low and small umbo, small reddish veil scales especially at the centre, sand brown to more dark brown, with fine, dark hygrophanous streaks; gills medium spaced to distant, bluish brown, with age dark yellowish brown; stem 80–140  $\times$  7–14 mm, cylindrical or slightly clavate, up to 25 mm broad at the base, whitish fibrillose; mycelium white; universal veil vivid rose pink, sometimes turning vinaceous red with age, rarely yellowish brown, rather easily detectable; flesh marbled brown, later dark brown, bluish at stem top;



Spores: A: *C. armillatus*, B: *C. suboenochelis*, C: *C. luteo-ornatus*, D: *C. roseoarmillatus*, E: *C. paragaudis*, F: *C. pinigaudis*.

smell indistinct. Sp  $9-11 \times 6-7 \mu\text{m}$ , moderately verrucose, more strongly at apex, moderately to fairly strongly dextrinoid. In mesic *Picea* forests, often on somewhat rich soil; late summer to autumn; occasional in hemib.-bore.; FI, NO, SE. – AC 7:145.

*C. suboenochelis* Kytöv., Liimat. & Niskanen in press (*C. subarmillatus* Hongo var. *picetorum* Moëgne-Locc.)

- Frb without bluish tints; sp broadly ovoid to subglobose,  $Q_{av} = 1.3-1.45$  (fig. 727C). Cap 35-100 mm, hemispherical, soon low convex with a low and broad umbo, slightly scaly at the centre, finely fibrillose towards the edge, ochraceous brown, with fine branching hygrophanous streaks; gills medium spaced, pale brown, with age dark brown; stem 60-170  $\times$  8-15 mm, clavate, up to 27 mm broad at the base, rarely cylindrical, rather firm, white fibrillose; mycelium white; universal veil usually pale to more vivid pinkish, rarely yellowish brown, forming some belts or zones on the stem; flesh brown; smell indistinct. Sp  $9-10 \times 6.5-7.5 \mu\text{m}$ , thin-walled, moderately verrucose, more strongly at apex, weakly to moderately dextrinoid. In mesic to dry coniferous forests with *Picea*, and in subalpine *Betula* forests, often on somewhat rich soil; summer to autumn; common in hemib.-bore, occasional in suba.; FI (LC), NO (LC), SE. – AC 7:155, CFP B10.

*C. luteo-ornatus* (M.M. Moser) Bidaud, Moëgne-Locc. & Reumaux (*C. paragaudis* Fr. subsp. *oenochelis* H. Lindstr.)

4. Sp usually strongly dextrinoid, ovoid to obovoid-ellipsoid; universal veil vividly rose red. Cap 35-75 mm, hemispherical, soon low convex with a low and broad umbo, small-scaled at the centre, finely fibrillose towards the edge, rose brown, with fine branching hygrophanous streaks; gills medium spaced, pale brown, with age dark brown; stem 60-90  $\times$  6-13 mm, clavate, up to 27 mm broad at the base, rarely cylindrical, white fibrillose; mycelium white; universal veil forming some belts or zones, usually on the lower half of the stem; flesh brown; smell indistinct. Sp  $7-8 \times 5-6 \mu\text{m}$ , thick-walled, rather strongly verrucose, more strongly at apex (fig. 727D). In mesic, mixed forests, and in wooded yards, presumably with *Betula*, often on somewhat rich soil; late summer to autumn; rare in hemib.-bore.; FI, SE. – MycR 2009.

*C. roseoarmillatus* Niskanen, Kytöv. & Liimat. in press

- Sp not dextrinoid to weakly dextrinoid, subglobose to slightly ovoid; universal veil yellowish brown to vinaceous red
5. Most sp  $> 5.5 \mu\text{m}$  wide; universal veil usually vinaceous red, rarely yellowish brown in young frb, forming distinct, incomplete girdles on the stem; in mesic to damp *Picea* and *Pinus* forests and in subalpine *Betula* forests. Cap 30-60(-70) mm, hemispherical, later low convex with a small umbo, surface distinctly fibrillose, ochraceous brown to greyish brown, with hygrophanous streaks; gills medium spaced, pale brown, with age dark brown; stem 60-150  $\times$  6-12 mm, up to 30 mm broad at the base, rarely cylindrical, usually slender, white fibrillose when young, later greyish brown; mycelium white; flesh greyish brown; smell slightly raphanoid. Sp  $6.5-7.5 \times 5.3-6 \mu\text{m}$ , subglobose, dark-coloured, moderately verrucose, somewhat more strongly at apex (fig. 727E). Late summer to autumn; common in hemib.-bore., less common in western parts, occasional in suba., very rare in temp.; FI (LC), IS, NO



(LC), SE (LC). – CFP B32, AC7:151.

*C. paragaudis* Fr. (*C. bresadolianus* Moëgne-Loec. & Reumaux)

- Most sp < 5.5  $\mu\text{m}$  wide; universal veil first yellowish brown, later vinaceous red, forming one or few incomplete girdles; in dry, oligotrophic *Pinus* heath forests. Cap 30-80 mm, hemispherical, later low convex with a low and broad umbo, surface somewhat fibrillose, yellow brown to greyish brown, with hygrophanous streaks; gills medium spaced, pale brown, with age dark brown; stem 70-150 x 8-15 mm, clavate, up to 30 mm broad at the base, rarely cylindrical, rather firm, greyish white fibrillose when young, later greyish brown; mycelium white; flesh greyish brown; smell slightly raphanoid. Sp 6-7 x 4.8-5.5  $\mu\text{m}$ , ovoid-subglobose (fig. 727F), slightly dark-coloured, moderately verrucose, somewhat more strongly at apex. Often on sandy soil; late summer to autumn; common in hemib.-bore., less common in the western parts; FI, NO, SE. – Sieniop 210 (as *paragaudis*).

*C. pinigaudis* Niskanen, Kytöv. & Liimat. in press

**Key B:** Subgen. *Telamonia* sect. *Brunneotincti* M.M. Moser

TUULA NISKANEN & ILKKA KYTÖVUORI

Frb often  $\pm$  with olivaceous tints; cap usually (25-)40-80 mm, dark innately fibrillose or silky shiny, with dark hygrophanous streaks or spots; universal veil vinaceous red, yellow, yellowish brown, olivaceous brown or brown; smell often raphanoid; sp obovoid, ellipsoid or subglobose.

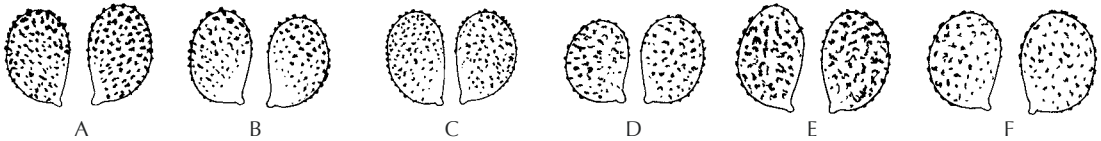
Note: If a species does not match here, see also key A.

1. Sp obovoid; universal veil vinaceous red, at least in old frb, or stem turning vinaceous red; cap usually strongly innately fibrillose with dark, branching fibres seldom not strongly fibrillose; exsiccates with dark cap and often with vinaceous red tints somewhere in the frb 2
  - Sp subglobose or ovoid-ellipsoid; universal veil yellow or olivaceous; stem not turning vinaceous red; cap not or only finely innately fibrillose; exsiccates usually with paler cap and olivaceous tints, often best seen in the stem 4
2. Cap 25-50(-80) mm; stem 3-7 mm broad; with *Betula*. Cap conical to hemispherical, later low convex to almost plane, with an umbo, silky shiny, dark innately fibrillose or not, dark vinaceous red brown to somewhat greyish, sometimes with an olivaceous tint, hygrophanous or with dark hygrophanous streaks; gills crowded to medium spaced, pale yellowish brown, later more brownish; stem 40-70 mm, cylindrical, rather firm, silky whitish grey fibrillose; universal veil vinaceous red, sometimes yellow brown when young, fairly floccose, forming girdles and zones on the stem, or occasionally almost forming a sheath over the lower half of the stem; flesh pale yellowish brown; smell raphanoid. Sp 7.5-8.5 x 5-5.5(-6)  $\mu\text{m}$ , obovoid, moderately verrucose, more strongly at apex (fig. 729A), moderately dextrinoid. In mixed and subalpine forests, often in young forests; late summer to autumn; rare in hemib.-suba., in some years more common; FI (DD), NO (NE), SE (NE). – Soop 04:83.

*C. heterocyclus* Soop

Note: includes three very closely related taxa for which the morphological differences are not known.

- Cap 40-85 mm; stem 5-14 mm broad; with *Betula* or *Populus* 3
- 3. Universal veil olivaceous yellowish brown; cap dark olivaceous brown to more ochraceous brown; exsiccates with a dark olivaceous brown cap, sometimes with vinaceous red tints and with pale, dirty greyish brown to partly on entirely vinaceous red stem. Cap hemispherical, later low convex to almost plane, sometimes with an umbo, with darker centre, usually with hygrophanous streaks or spots; gills crowded to medium spaced, pale olivaceous to yellowish brown when young, yellow brown with age; stem 50-100 mm, cylindrical or slightly clavate, sometimes radicating, whitish silky-fibrillose when young, then greyish yellow brown, turning vinaceous red with age or after handling; universal veil sparse, in zones or forming a thin sheath over the lower half of the stem; flesh whitish to pale yellow



Spores: A: *Cortinarius heterocyclus*, B: *C. caput-medusae*, C: *C. craticius*, D: *C. raphanoides*, E: *C. valgus*, F: *C. fillionii*.

brown, in lower part of the stem or sometimes in the whole stem reddish; smell radish-like. Sp 7-8 x 5-5.5  $\mu$ m, obovoid, moderately verrucose, somewhat more strongly at apex (fig. 729B), fairly weakly to moderately dextrinoid. In mesic, mixed forests with *Populus tremula*; autumn; rare in hemib.-bore., more rare towards the southern parts; FI (LC), SE (NE). – CFP D59.

***C. caput-medusae* H. Lindstr.**

- Universal veil vinaceous red to orange red; cap red brown to ochraceous red brown, sometimes slightly olivaceous; exsiccates with reddish brown cap, often with vinaceous red tints, often with entirely vinaceous red stem, except for in young frb. Cap 35-70 mm, hemispherical, later low convex to almost plane, with a low and broad umbo, center usually darker, usually with hygrophanous streaks or spots; gills crowded to medium spaced, pale yellowish brown when young, yellow brown with age; stem 50-90 x 5-10 mm, cylindrical or slightly clavate, sometimes radicating, whitish silky-fibrillose when young, later brownish, turning vinaceous red with age or after handling; universal veil sparse to somewhat more abundant, forming belts or zones or a thin continuous coat on the basal part of the stem; flesh pale yellow white to yellow grey, reddish at base of the stem or occasionally entirely reddish; smell slightly radish-like. Sp 7-8.5 x 5-5.5  $\mu$ m, obovoid to somewhat ellipsoid, moderately verrucose, somewhat more strongly at apex (fig. 729C), fairly weakly to moderately dextrinoid. In mixed forests with *Betula* or *Populus*; rare in hemib.-bore, more rare towards the northern parts; FI, SE (LC).

***C. craticius* Fr.**

4. Frb without olivaceous tints; sp subglobose to somewhat elongate, indextrinoid; gill trama hyphae often with hyaline crystals; with deciduous trees  
see key C sect. *Anomali* p. 730
  - Frb often with olivaceous tints; sp subglobose, broadly ellipsoid to ovoid-ellipsoid, weakly to strongly dextrinoid; gill trama hyphae without hyaline crystals; with *Betula* or *Picea* 5
  5. Cap olivaceous yellow brown; most sp < 8  $\mu$ m long; exsiccates with fairly dark or paler and not vivid brown gills; large, 3-10 x (3-)5-15  $\mu$ m, olivaceous spots present deep in the cap cuticle; with *Betula*. Cap 30-70 mm, conical to hemispherical, later low convex, with an umbo, finely innately fibrillose, with dark hygrophanous streaks; gills medium spaced, olivaceous yellow brown; stem 50-100 x 5-10 mm, cylindrical or slightly clavate, whitish silky-fibrillose at the top, lower part olivaceous yellow brown; universal veil olivaceous brown, somewhat floccose, forming girdles and zones on the stem; flesh pale olivaceous yellow brown, darker at the base, sometimes with a bluish tint at stem top; smell strongly raphanoid; exsiccates sometimes fairly dark. Sp 7-8 x 5-5.5(-6)  $\mu$ m, broadly ellipsoid to almost subglobose, moderately to strongly verrucose (fig. 729D), moderately dextrinoid; epicutis hyphae very finely spirally incrustated. In deciduous, mixed and subalpine forests; among mosses or leaf litter; late summer to autumn; very common in hemib.-suba., occasional in suba. in IS and in temp.; DK (LC), FI (LC), IS, NO (LC), SE (LC). – CFP B29, M&J 46, Sieniop 214.
- C. raphanoides* (Pers.: Fr.) Fr. (*C. betuletorum* M.M. Moser)**
- Cap fairly dark brown, sometimes with an olivaceous tint; most sp > 8  $\mu$ m long;

exsiccates with vivid, pale brown to brown gills; with small, 2-4 x 2-6(-10)  $\mu\text{m}$ , olivaceous spots deep in the pileipellis; with *Picea* or *Betula*

6

6. Universal veil very sparse; stem cylindrical; most sp < 6  $\mu\text{m}$  wide, fairly broadly ovoid-ellipsoid, fairly weakly to moderately dextrinoid. Cap 35-85 mm, conical to hemispherical, later low convex, with a low and broad umbo, often with concentric depressions, silky shiny fibrillose, with hygrophanous streaks or spots; gills medium spaced, pale grey brown, often with a bluish tint, later brownish; stem 50-100 x 5-13 mm, silky fibrillose, pale brownish, often bluish at the top; universal veil yellowish brown to somewhat olivaceous; flesh pale brownish yellow, darker towards the base of the stem, usually bluish at the top; smell faint, somewhat raphanoid. Sp 8-9 x 5.5-6  $\mu\text{m}$ , fairly strongly verrucose (fig. 729E); epicutis hyphae not or very finely incrustated, few olivaceous spots in the pileipellis. In mesic, coniferous and mixed forests, presumably with *Betula*; late summer to autumn; occasional but locally common in hemib.-bore., rare in temp. and suba.; DK (DD), FI (LC), NO (LC), SE (LC). – CFP B05.

*C. valgus* Fr.

- Universal veil more abundant, forming girdles and zones on the stem; stem cylindrical to somewhat clavate; sp > 6  $\mu\text{m}$  wide, broadly ellipsoid to almost subglobose, fairly thick-walled, fairly strongly to strongly dextrinoid. Cap 30-80 mm, hemispherical, later low convex to almost plane, sometimes with an umbo, silky shiny fibrillose, hygrophanous or with hygrophanous streaks or spots; gills medium spaced, pale grey brown, often with a bluish tint, later brownish; stem 50-130 x 5-12 mm, whitish silky-fibrillose, often bluish at the top; universal veil yellowish olivaceous to ochraceous yellow; flesh pale brownish yellow, darker towards the base of the stem, usually bluish, at least at the top; smell raphanoid. Sp 8-9 x 6-7  $\mu\text{m}$ , moderately verrucose, more strongly at apex (fig. 729F); epicutis hyphae finely to moderately incrustated, olivaceous spots often abundant in the pileipellis. In mesic *Picea* forests; late summer to autumn; occasional in bore.; FI, SE. – AC 7:149, Kar 48.

*C. fillionii* Bidaud, Moëgne-Locc. & Reumaux

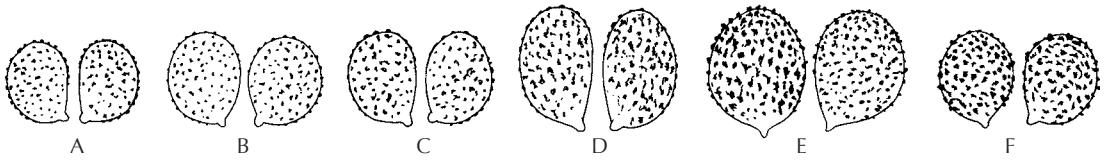
### Key C: Subgen. *Telamonia* sect. *Anomali* Konrad & Maubl.

HÅKAN LINDSTRÖM

1. Universal veil vinaceous to rusty or brownish red 2
- Veil brown, yellow, ochre or ochraceous white 3
2. Cap with brown-red to rusty-red scales or fibres on a white to light yellowish background. Cap 30-60 mm, hemispherical, soon expanded, seldom with a low umbo, with downcurved margin; gills crowded, pale yellowish grey, later ochraceous brown; stem 30-70 x 5-12 mm, cylindrical to somewhat clavate, sometimes tapering, white to yellowish white, reddish brown at base, yellowing when thumbed; universal veil abundant, at first pale, soon reddish, usually rendering the stem flocculose-fibrillose; flesh often hollow, white, becoming yellow when cut; smell faint; taste of pepper. Sp 6.5-7.5 x 5-5.5  $\mu\text{m}$ , subglobose, strongly to moderately verrucose (fig. 731A). Often caespitose in deciduous and mixed forests, mainly with *Quercus*, *Fagus* or *Betula*, often on dry, nutrient-poor soil; autumn; common in temp.-hemib., occasional in bore.; DK (LC), FI (LC), NO (LC), SE (LC). – B&K 5:167, CFP C23, GCI A11, Phil 190a, Ves 350, ☉.

*C. bolaris* (Pers.: Fr.) Fr.

- Cap greyish brown, more ochraceous at centre. Cap 20-50 mm, hemispherical, convex to expanded, often with a low and broad umbo, as young with a light silky covering, sometimes sticky, weakly hygrophanous, drying greyish ochraceous, seldom with a violet tinge, with remnants of reddish veil at margin; gills crowded, light greyish, sometimes with a violet tinge, later greyish brown; stem 40-100 x 4-10 mm, cylindrical, often compressed or with a somewhat clavate base, fibrous, greyish white, light brownish at base; universal veil usually distinct, brown red to vinaceous, in girdles or scales; flesh often hollow, greyish to yellowish brown; smell faint, raphanoid. Sp (6.5-)7-8 x (5-)5.5-6.5  $\mu\text{m}$ , subglobose, finely verrucose



Spores: A: *Cortinarius bolaris*, B: *C. spilomeus*, C: *C. violaceocinereus*, D: *C. anomalellus*, E: *C. cingulatus*, F: *C. caninus*.

(fig. 731B). In coniferous or mixed forests, mainly with *Picea*, but also *Larix* and *Pinus*, often in young stands on nutrient rich soil; autumn; occasional in temp, common in hemib.-bore.; DK (NT), FI (LC), NO (LC), SE (LC). – CFP C34, GCI B151, FAD 96D, Sieniop 217, Ves 351.

*C. spilomeus* (Fr.: Fr.) Fr

- 3 Sp broadly ellipsoid,  $Q_{av} = 1.3-1.6$ ; frb stout and tough, recalling *C. torvus*; cap, stem and flesh usually with a dingy lilac (to violet) tinge. Cap 40-65 mm, hemispherical, later low convex, sometimes slightly silky fibrillose, greyish brown, sometimes with lilac (to violet) tinge, weakly hygrophanous in streaks; gills medium spaced, first pale greyish, sometimes with a lilac tinge, soon fairly dark brown; stem 50-100 x 4-10(-20) mm, cylindrical to somewhat clavate, silky-fibrillose,  $\pm$  lilac upwards; universal veil light yellowish, in incomplete and complete girdles on stem, sometimes fairly indistinct; flesh lilac-violet, at least in stem top, sometimes turning reddish with age; smell faintly raphanoid. Sp (6.5-)7-8 x 5-6  $\mu$ m, moderately verrucose (fig. 731C), weakly dextrinoid. In mesic coniferous and mixed forests, mostly known with *Picea* and *Pinus*, also reported with *Betula* and *Fagus*, often on rich soil; autumn; occasional in temp.-southern bore., more frequent in oceanic areas, rare in middle and northern bore.; DK (vü), FI (LC), NO, SE. – FAD 91B,C.

*C. violaceocinereus* (Pers.: Fr.) Fr

- Sp subglobose to broadly ellipsoid,  $Q_{av} < 1.35$  or ellipsoid,  $Q_{av} > 1.6$ ; cap, stem or flesh often with a violaceous-bluish tinge 4
4. Sp ellipsoid,  $Q_{av} > 1.6$ ; with *Pinus*, mostly in sandy or rocky habitats. Cap 10-40 mm, hemispherical to convex, incurved at margin, dry, mat, weakly hygrophanous in a zone, greyish brown to purplish brown, sometimes violet bluish at margin, drying more yellowish brown; gills crowded to medium spaced, dark violet to violet brown; stem 30-50 x 3-6 mm, cylindrical to somewhat clavate at base, finely fibrous, white, but usually  $\pm$  violet in upper part, later light yellowish; universal veil moderately abundant, ochraceous yellow to yellowish brown, scattered to flocculose; flesh white but upwards violet blue, sometimes yellowing at base, yellowing; smell faint. Sp 9-10.5 x 6-7  $\mu$ m, moderately verrucose (fig. 731D). On dry, rich to nutrient-poor soil and in rocky forests; autumn; occasional in hemib.-bore.; FI (LC), SE. – Soop 05:30.

*C. anomalellus* Soop

- Sp  $\pm$  subglobose to broadly ellipsoid,  $Q_{av} < 1.6$ ; not with *Pinus* 5
5. Sp 9.5-10.5  $\mu$ m long; basidia usually 2-spored. Cap 30-100 mm, hemispherical, convex to expanded, sometimes with a low umbo, with incurved margin, sometimes wrinkled, when young often violet blue, then greyish ochraceous from centre and often persistently violet at margin, weakly hygrophanous or with fine streaks, somewhat sticky, micaceous when dry, often with remnants of veil at margin; gills crowded, deeply and long persistent violet to greyish brown; stem 40-120 x 6-10 mm, clavate to almost cylindrical, somewhat glossy, ochraceous white, often violet upwards, later greyish yellow from base; universal veil often abundant, dark yellow to ochraceous, in girdles and flocks; flesh greyish white, violet at top of stem, later yellowish; smell sometimes distinct, aromatic, like *Asarum*. Sp (9-)9.5-10.5 x (7-)7.5-8.5  $\mu$ m, (broadly ellipsoid to) subglobose, moderately and coarsely verrucose (fig. 731E). In broadleaved and mixed coniferous forests on calcareous soil; very rare in hemib.;

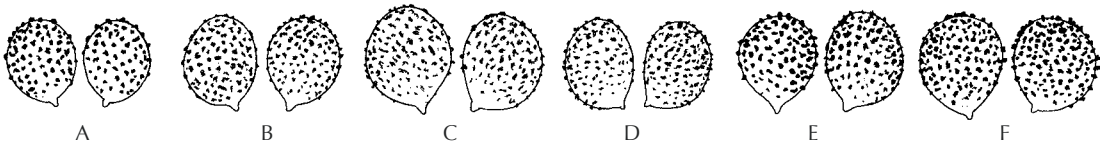


SE (Gtl). – AC 2:38, CFP E06.

*C. cingulatus* (Velen.) Moëgne-Locc. & Reumaux (*C. luteoperonatus* Bidaud & Cheype)

- Sp 7-9.5 µm long; basidia 4-spored 6
- 6. Cap dry and mat, even in young and wet condition, with dull brownish-greyish tinges 7
- Cap viscid in wet condition, shiny when dry, without brownish-greyish tinges 9
- 7. Universal veil brownish, usually in one narrow distinct girdle. Cap 30-100 mm, hemispherical, convex to expanded, seldom with a low umbo, with incurved margin, sometimes wrinkled or rimose at centre, when young almost sticky, mat, somewhat felty in old, with fine hygrophanous streaks, ochraceous brown, later reddish brown; gills crowded, bluish to greyish brown; stem 40-110 x 5-15 mm, cylindrical to clavate, fibrous, white, bluish at top, later greyish yellow, sometimes with bluish mycelial felt, often flocculose below the girdle; flesh whitish, bluish upwards, yellowing by age, formalin slowly gives a rose reaction; smell faint, raphanoid. Sp (7.5-)8-9 x 6-7 µm, (broadly ellipsoid to) subglobose, moderately and coarsely verrucose (fig. 731F). In coniferous forests, usually with *Picea* on nutrient rich soil, often in young stands and plantations; autumn; common in western temp.-bore., occasional in eastern bore.; DK (LC), FI (LC), IS, NO (LC), SE (LC). – AC 4:85, 86, B&K 5:254, CFP E07, FAD 93C, Mar 748.  
*C. caninus* (Fr.: Fr.) Fr.
- Universal veil yellowish 8
- 8. Frb slender; stem 4-8 mm broad; young cap dark greyish brown; usually with *Betula* on acid, nutrient-poor soil, possibly also with other deciduous trees. Cap 30-80 mm, hemispherical-conical, then expanded, sometimes with a small umbo, greyish brown, seldom bluish at margin, later lighter brownish, sometimes with patches or a narrow zone of veil; gill crowded, light greyish to bluish, later greyish brown; stem 40-100 x 4-8 mm, cylindrical to narrowly clavate, fragile, white and somewhat glossy, sometimes bluish upwards, yellow with age; universal veil yellow usually in distinct girdles and patches; flesh whitish, upwards in stem bluish, later yellowish; smell distinct, raphanoid. Sp 7-8(-8.5) x 5.5-6.5(-7) µm, subglobose, strongly verrucose (fig. 733A). Late summer to autumn; very common in the north, especially suba., rare in temp.; DK (DD), FI, NO, SE (NA). – AC 4:80 (as *anomalus* var. *subcaligatus*), 81, CFP E08, Cke 773, 850.  
*C. lepidopus* Cooke
- Frb fairly fleshy; stem 5-12 mm broad; young cap usually lighter greyish brown, soon whitish-greyish; mainly with different deciduous trees, often on rich soil. Cap 25-80 mm, hemispherical to convex, sometimes with a low umbo or depressed at centre, very seldom sticky, sometimes micaceous at margin, sometimes weakly hygrophanous in a zone or with diffuse streaks, greyish ochraceous to light brown, darker at centre, at margin often bluish, later more yellowing; gills crowded, greyish bluish violet to greyish, later greyish brown; stem 40-100 x 5-12 mm, cylindrical, usually with clavate base, glossy, white fibrous, usually bluish to violet upwards, later yellowing; universal veil usually thin, light yellowish, in bands or patches; flesh white, bluish violet upwards in stem, later yellowing; smell often distinct, raphanoid. Sp 7.5-8.5 x 6-7 µm, subglobose, moderately verrucose (fig. 733B). Mainly with *Quercus*, *Tilia*, *Betula*, *Fagus*, etc., possibly also with conifers; autumn; common in temp.-hemib., occasional in bore.; DK (LC), FI (LC), NO (LC), SE (LC). – AC 4:82 (as var. *anomalus*), B&K 5:249, CFP E09, R&H 511.  
*C. anomalus* (Fr.: Fr.) Fr.
- 9. Young cap yellow, yellowish, greyish ochre or tawny, seldom with a bluish tinge; sp moderately verrucose 10
- Ground colour of young cap whitish to light ochre, but often with a ± bluish cover; sp strongly verrucose 11
- 10. Cap 40-150 mm, fleshy, yellowish already when young; universal veil distinctly yellow; sp subglobose to broadly ellipsoid, Qav = 1.16-1.28. Cap hemispherical to convex-expanded,





Spores: A: *Cortinarius lepidopus*, B: *C. anomalus*, C: *C. xanthocephalus*, D: *C. tabularis*, E: *C. albocyaneus*, F: *C. lebretonii*.

seldom with a low umbo, in wet conditions sticky to viscid or glutinous, as dry shiny and often wrinkled, with fine, dark hygrophanous streaks, ochraceous yellow to yellow, later more brownish, slightly lighter at margin; gills crowded, pale greyish brown, seldom with a greyish bluish tinge; stem 50-160 x 4-12 mm, cylindrical to clavate, glossy, white, seldom bluish at top, later turning pale yellow; universal veil yellow, usually forming distinct girdles and spots; flesh white, often with darker spots, seldom bluish upwards; smell faint, raphanoid. Sp 8-9(-9.5) x 6.5-7.5(-8)  $\mu\text{m}$ , subglobose, moderately verrucose (fig. 733C). In deciduous forests and cultivated areas with *Populus*, *Betula*, *Quercus*, *Tilia*, *Fagus* and other trees, especially on nutrient rich and clayey soil; late summer to autumn; common in temp.-bore.; DK (LC), FI, NO (LC), SE. – AC 4:84 (as *acerbiformis*), CFP E11, E12, Mar 749 (as *diabolicus*).

*C. xanthocephalus* P.D. Orton

- Cap 20-70(-100) mm, thin to somewhat fleshy, tawny or light greyish ochre as young; universal veil usually scanty, pale ochre to light yellowish; sp broadly ellipsoid to ellipsoid, Qav = 1.21-1.37. Cap hemispherical, then convex, seldom with a low umbo, depressed at centre, faintly sticky-viscid when young, dry, somewhat glossy at margin, with fine darker hygrophanous streaks, later often with a reddish tint at centre and paler margin; gills crowded, pale greyish blue to greyish, later greyish brown; stem 40-120 x 4-15 mm, cylindrical to clavate at base, somewhat glossy, white, sometimes bluish at top, turning greyish yellow; universal veil thin, flocculose or  $\pm$  in girdles. Flesh brittle, light greyish blue to white with hygrophanous spots, later yellowing; smell faint, raphanoid. Sp 7.5-8.5 x 5.5-6.5  $\mu\text{m}$ , broadly ellipsoid to subglobose, moderately and coarsely verrucose (fig. 733D). In deciduous forests, especially with *Betula*, but also *Corylus* and *Quercus*, often in young stands, also with *Salix* in alpine heathland; late summer to autumn; common in hemib.-suba., occasional in temp. and arc./alp.; FI (LC), NO (LC), SE (LC). – CFP E13, E14, M&J 102.

*C. tabularis* (Fr.: Fr.) Fr.

11. Universal veil sparse, whitish-ochraceous; frb slender; in deciduous forests, especially with *Betula*, but also *Fagus*. Cap 20-70 mm, hemispherical, then convex to expanded, seldom with a low umbo, viscid in wet condition, when dry weakly glossy to micaceous, with fine hygrophanous streaks, young usually pale bluish, then greyish ochraceous to yellow from centre; gills crowded, thin, lilaceous-bluish to clay or greyish brown; stem 40-120 x 4-8 mm, cylindrical with a clavate base, fragile, glossy, fibrous, white to pale ochraceous, upwards bluish, turning greyish ochraceous; universal veil thin, indistinct, bluish or white, becoming light yellowish, flocculose or fibrous; flesh white with greyish spots, upwards usually bluish, becoming yellowish by age; smell faint, raphanoid. Sp (7.5-)8-9 x (6-)6.5-7.5  $\mu\text{m}$ , subglobose, strongly verrucose (fig. 733E). Mostly on damp and mesic to nutrient rich soil; late summer to autumn; common in temp.-bore.; SE. – CFP E15, E16, Mar 750 (as *azureus*).

*C. albocyaneus* Fr.

- Universal veil yellow, usually in girdles and patches; frb fairly robust; in broadleaved forests with *Tilia*, *Fagus*, *Quercus*, etc. Cap 30-60 mm, hemispherical to convex-expanded, with incurved margin, seldom with a low umbo, sometimes depressed at centre, with coarse hygrophanous streaks, viscid in wet condition, glossy when dry, often violaceous-bluish when young, later at margin, becoming ochraceous from centre; gills crowded, violaceous blue, later brown with a reddish tinge; stem 50-120 x 5-12 mm, cylindrical to clavate, white,

violaceous-bluish upwards, becoming a yellow to brownish yellow from the base; universal veil in  $\pm$  distinct bands or scattered patches; flesh white, violet bluish upwards, later yellowing; smell faint, raphanoid. Sp 8-9(-9.5)  $\times$  6.5-7.5  $\mu$ m, subglobose, strongly and densely verrucose (fig. 733F). Autumn; common in temp.-hemib.; DK (LC), NO, SE. – B&K 5:270 (as *viscidulus*), GCI C35 (as *C. azureus*), RdM 41:23.

***C. lebretonii* Quél**

Note: *C. azureus* Fr. is possibly the same, but has been interpreted in different ways.

**Key D:** Subgen. *Telamonia* sects *Pholidei* Melot and *Fuscoperonati* Liimat. & Niskanen in press

TUULA NISKANEN & ILKKA KYTÖVUORI

1. Cap distinctly brown scaly. Cap 30-70 mm, conical to hemispherical, later low convex to almost plane, fulvous to umber brown, not hygrophanous; gills crowded to medium spaced, pale and often bluish when young, later more brown; stem 50-110  $\times$  5-15 mm, cylindrical, firm, whitish silky-fibrillose and often with bluish tints at the top, lower part brownish; universal veil dark brown, forming distinct scales and girdles on stem; flesh white, darker at base, often with bluish tints at stem top; smell faint. Sp 7-8  $\times$  5-6  $\mu$ m, subglobose to broadly ellipsoid, moderately verrucose (fig. 735A), moderately to fairly strongly dextrinoid. Under *Betula* in forests, often on acid soil; late summer to autumn; common in hemib.-suba., less common in western parts, rare in temp.; DK (NT), FI (LC), NO (LC), SE (LC). – CFP B37, Phil 191d, R&H 510, Sieniop 212, Ves 361, ☉.

***C. pholideus* (Fr.: Fr.) Fr.**

- Cap smooth 2
- 2. Universal veil abundant, distinctly greyish brown to blackish brown; cap with hygrophanous streaks; sp 10.5-12  $\times$  6.5-7.5  $\mu$ m (fig. 735B). Cap 30-80 mm, hemispherical, then low convex with a broad umbo, reddish brown to blackish brown at centre, towards margin paler greyish brown; gills medium spaced, pale greyish brown when young, ochraceous brown with age; stem 30-100  $\times$  7-15 mm, clavate to slightly bulbous, up to 25 mm broad at the base, white to greyish white, with age brownish towards base, sometimes with a lilac tint at the top; universal veil forming girdles or scales on the stem; mycelium white; flesh brownish white, marbled hygrophanous; smell indistinct or faintly fruity; exsiccates with dark brown cap and greyish brown stem. Sp obovoid-ellipsoid, strongly verrucose. Mainly in mossy forests with *Pinus* and *Picea* on calcareous soil; autumn; very rare in temp.-bore.; FI (DD), NO (VU), SE (VU). – CFP A38.

***C. fuscoperonatus* Kühner**

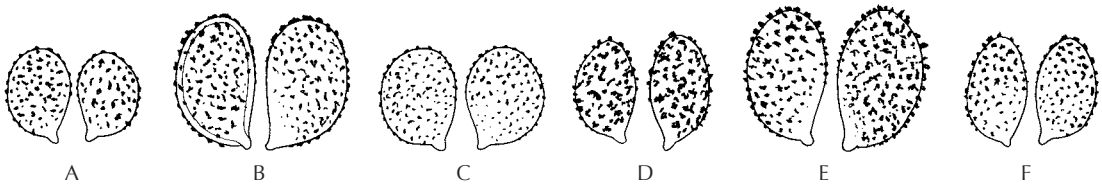
Note: type material has not been studied and the interpretation follows Brandrud et al. 1989.

- Universal veil sparse or fairly abundant, brownish or greyish; cap with or without hygrophanous streaks; sp on av < 10.5  $\mu$ m long 3
- 3. In coniferous forests; exsiccates with greyish black to brownish black cap and stem; sp subglobose to broadly ellipsoid see key E p. 734
- In coniferous forests on calcareous soil or in deciduous forests; exsiccates with pale to fairly dark brown cap, stem often paler, not blackish; sp amygdaloid to ellipsoid see key F p. 740

**Key E:** Subgen. *Telamonia* sects *Brunnei* Melot, *Cinnabarini* Melot, *Colymbadini* Melot, *Disjungendi* Kytöv., Liimat. & Niskanen in press and *Uracei* Melot

TUULA NISKANEN & ILKKA KYTÖVUORI

Cap dark brown, less often yellow brown to red brown or cinnabar red, sometimes with metallic tints, strongly hygrophanous or with hygrophanous streaks; exsiccates usually dark brown to blackish. 19 Nordic species are included, but the real number of the species might be much



Spores: A: *Cortinarius pholideus*, B: *C. fuscoperonatus*, C: *C. gentilis*, D: *C. colymbadinus*, E: *C. crassifolius*, F: *C. uraceus*.

higher; the identity of the following names is unclear and they are not included in the key: *C. irregularis* (Fr.) Fr., *C. isabellinus* (Batsch) Fr. and *C. zinziberatus* (Scop.) Fr.

1. Universal veil yellow, forming distinct girdles on the stem; sp subglobose to somewhat elongate. Cap 30-60 mm, conical to hemispherical, later low convex to plane, often with a small umbo, saturated red brown to yellow brown, soon yellow due to drying; gills broad, distant, yellow brown to red brown; stem 50-110 x 3-8 mm, cylindrical, base sometimes somewhat rooting, yellow to yellow brown, darker towards the base; flesh red brown; smell recalling raw potatoes; exsiccates brownish yellow. Sp 7.5-9 x 6-7  $\mu$ m, thin-walled, moderately verrucose (fig. 735C), weakly dextrinoid. In dry to mesic coniferous forests; late summer to late autumn; very common in hemib.-bore., occasional in temp.; DK (LC), FI (LC), NO (LC), SE (LC). – CFP B31, M&J 3, Nyl 439, R&H 492, Sieniop 201.

*C. gentilis* (Fr.: Fr.) Fr

- Universal veil white, brownish, reddish or greenish, if yellow then very sparse; sp subglobose, amygdaloid or ellipsoid 2
  - 2. Universal veil yellowish, reddish or greenish, usually sparse; sp amygdaloid to slightly amygdaloid, rarely ellipsoid 3
  - Universal veil white to brownish, sometimes sparse; sp subglobose, amygdaloid or ellipsoid 10
  - 3. Cap silky shiny fibrillose, with hygrophanous streaks or spots; sp broadly ovoid-ellipsoid, 8-9 x 5.5-6  $\mu$ m see *C. valgus* key B 6
  - Cap not silky shiny fibrillose, strongly hygrophanous; sp amygdaloid or obovoid-ellipsoid 4
  - 4. Universal veil greyish to greenish yellow 5
  - Universal veil yellowish orange to red, sometimes brownish red 8
  - 5. Cap chocolate brown to olivaceous yellow brown; exsiccates dark yellowish brown with a characteristic, metallic, olivaceous yellow shine, also on drying. Cap 30-60 mm, hemispherical, then low convex to almost plane, with a low umbo, hygrophanous; gills medium spaced, cinnamon brown, with yellow edge; stem 40-100 x 4-10 mm, cylindrical, greyish yellow silky-fibrillose; universal veil greenish yellow, sparse; flesh pale brownish, darker towards the base of the stem; mycelium greenish yellow; smell indistinct or slightly raphanoid; fluorescence yellow. Sp (8-)-8.5-9 x (4.5-)-5-5.5  $\mu$ m, amygdaloid, very strongly verrucose (fig. 735D), moderately dextrinoid. In mesic *Picea* forests, mostly on rich soil; summer to autumn, often precocious; occasional in hemib.- bore.; FI (LC), NO (NT), SE (LC). – CFP D55.
- C. colymbadinus* Fr.
- Note: exsiccates sometimes difficult to distinguish from *C. aurantiomarginatus*, but the latter has orange red base of the stem and does not fluoresce in UV-light.
- Cap dark brown, almost blackish brown; exsiccates blackish brown, sometimes with a purplish tint 6

6. Sp 11-12 x 7-7.5  $\mu\text{m}$ . Cap 35-80 mm, hemispherical, then low convex to almost plane with an umbo, often very narrowly pellucid-striate, strongly hygrophanous; gills medium spaced to distant, chocolate brown; stem 60-130 x 6-13 mm, clavate, greyish white fibrillose, later and after handling brown; universal veil very sparse, greyish, sometimes with a greenish tint; flesh dark brown; mycelium white; smell indistinct or slightly raphanoid. Sp obovoid-ellipsoid to slightly amygdaloid, very strongly verrucose, especially at the apex (fig. 735E), strongly dextrinoid. In herb-rich, mesic to damp, forests with *Picea* on calcareous soil; late summer to autumn; rare in hemib.-bore.; FI, SE.

*C. crassifolius* (Velen.) Bon s. Lindström, Niskanen & Kytövuori

- Sp < 10.5  $\mu\text{m}$  long 7
7. In mesic *Picea* forests; sp (8-)8.5-9.5 x 5-5.5(-6)  $\mu\text{m}$  (fig. 735F). Cap 30-65 mm, conical to hemispherical, then low convex with an umbo, often narrowly to 1/3 pellucid-striate, strongly hygrophanous; gills medium spaced, chocolate brown; stem 60-100 x 4-9 mm, cylindrical, rarely clavate, greyish white fibrillose, often with a greenish tint, especially at the top; universal veil greyish, often with a greenish tint; flesh dark brown; mycelium white; smell indistinct. Sp amygdaloid, some of them thick-walled, moderately to fairly strongly verrucose, especially at the apex, strongly dextrinoid, dark. Mostly on rich to calcareous soil; late summer to autumn; occasional in hemib.- bore.; FI (LC), NO (NT), SE (LC).

*C. uraceus* Fr. (*C. viridipes* M.M. Moser)

- In mixed forests of *Abies*, *Picea*, *Fagus*, *Quercus* and *Carpinus*; sp 9-10(-10.5) x 5.5-6.5  $\mu\text{m}$  (fig. 737A). Cap 35-65 mm, conical to hemispherical, then low convex with an umbo, strongly hygrophanous; gills medium spaced, dark brown; stem 40-80 x 4-11 mm, cylindrical or slightly clavate, yellowish grey fibrillose with a greenish tint; universal veil greyish yellow, very sparse; flesh dark brown with yellowish tint; mycelium white; smell indistinct. Sp amygdaloid, some of them thick-walled, fairly strongly to strongly and acutely verrucose, especially at apex, strongly dextrinoid, dark. On calcareous soil; DE. – CFP C40 (as *uraceus*).  
*C. rigidipes* M.M. Moser

Note: difficult to distinguish from *C. uraceus*, and its variability needs further studies.

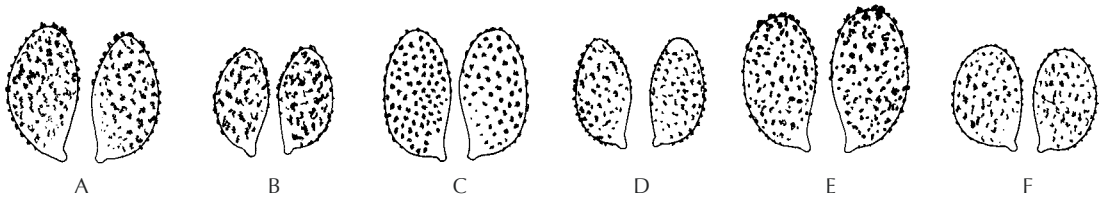
8. Whole frb cinnabar red to brownish red. Cap 30-60 mm, hemispherical, then low convex to almost plane, hygrophanous; gills medium spaced; stem 35-70 x 4-9 mm, cylindrical or slightly clavate; universal veil saturated red, sparse; flesh brownish red; mycelium bright red; smell slightly raphanoid; exsiccates cinnabar red to somewhat brownish. Sp 7.5-8.5 x 4.8-5.3  $\mu\text{m}$ , amygdaloid, strongly verrucose, with low warts (fig. 737B), strongly dextrinoid, somewhat dark. In deciduous forests with *Fagus*, *Tilia*, *Corylus* or *Quercus*, on mull soil; late summer to autumn; occasional in temp., rare in hemib.; DK (VU), FI (CR), NO (VU), SE (NT). – CFP C14, GCI A23, Nyl 478, R&H 487, ☉.

*C. cinnabarinus* Fr.

- At least cap brown 9
9. In deciduous forests; stem clavate, 7-14 mm broad, at base distinctly cinnabar red from universal veil. Cap 35-70 mm, hemispherical, soon low convex to almost plane, sometimes with an umbo, saturated red brown, strongly hygrophanous; gills crowded to medium spaced, bluish to greyish brown, later chocolate brown; stem 30-80 mm long, greyish white fibrillose, often with a bluish tint at the top when young; flesh greyish brown, sometimes with a bluish tint at stem top; mycelium bright red; smell indistinct; exsiccates with greyish brown to blackish brown cap, base of the stem cinnabar red. Sp (8.5-)9-10 x 5.5-6  $\mu\text{m}$ , slightly amygdaloid, strongly verrucose (fig. 737C), strongly dextrinoid. With *Quercus*, *Fagus* and *Corylus*, on calcareous soil; late summer to autumn; very rare in temp.-hemib.; DK (CR), SE (VU). – CFP A37, GCI B35, Nyl 478, Svp 27:49, Ves 351.

*C. bulliardii* (Pers.: Fr.) Fr.

- In herb-rich, mesic *Picea* forests; stem  $\pm$  cylindrical, 4-8 mm broad, base slightly orange red or not. Cap 25-60 mm, conical to hemispherical, then low convex to almost plane with an



Spores: A: *Cortinarius rigidipes*, B: *C. cinnabarinus*, C: *C. bulliardii*, D: *C. aurantiomarginatus*, E: *C. disjungendus*, F: *C. clarobrunneus*.

umbo, narrowly translucently striate, margin orange yellow from universal veil, vividly red brown, later darker, strongly hygrophanous; gills medium spaced, dark cinnamon brown, with yellowish edge; stem 40-100 mm long, greyish yellow fibrillose, often with a bluish tint at the top; universal veil golden or orange yellow to brown red, sparse; flesh brown, sometimes with a bluish tint at stem top, with age blackening at the base; mycelium orange; smell like cedar wood; exsiccates dark brown to blackish brown, mycelium often yellowish to red. Sp 7.5-8.5(-9) x 4.8-5.3  $\mu\text{m}$ , amygdaloid, fairly strongly and often sharply verrucose (fig. 737D), strongly dextrinoid. Often on calcareous soil; late summer to autumn; occasional in hemib.-bore.; FI (LC), NO, SE (LC). – CFP C48.

*C. aurantiomarginatus* M.M. Moser s. Brandrud et al. 1994

10. Cap brown and silvery fibrillose, especially near the margin; stem cylindrical and firm; sp > 9.5  $\mu\text{m}$  long. Cap 40-80 mm, hemispherical, then low convex to almost plane with a low and broad umbo, margin often long incurved, hygrophanous; gills medium spaced, pale greyish brown, later brown; stem 60-140 x 8-15 mm, whitish fibrillose, becoming brownish with age, especially at the base; universal veil white, fairly sparse, forming girdles on the stem; flesh pale greyish brown to brown, often darker at base of the stem, darkening with age; smell indistinct; exsiccates with dark greyish brown to blackish cap and somewhat paler stem. Sp 9.5-10.5 x 6-6.5(-7)  $\mu\text{m}$ , obovoid-ellipsoid, moderately verrucose (fig. 737E), weakly dextrinoid, somewhat dark. In deciduous and mixed forests with *Betula*; late summer to autumn; occasional, but locally common in hemib.-bore.; FI (LC), NO (LC), SE. – CFP D33.

*C. disjungendus* P. Karst.

- Cap dark chestnut brown to umber or brown, rarely greyish brown; stem clavate or cylindrical and not conspicuously firm; sp < 9.5  $\mu\text{m}$  long 11
- 11. Most sp > 5.5  $\mu\text{m}$  wide 12
  - Most sp < 5.5  $\mu\text{m}$  wide 16
- 12. Stem < 4 mm broad, cylindrical see *C. cicindela* 19
  - Stem > 4 mm broad, usually at least slightly clavate 13
- 13. Most sp < 6  $\mu\text{m}$  wide 14
  - Most sp > 6  $\mu\text{m}$  wide 15
- 14. Mainly with *Pinus*; cap pale greyish brown to brown; stem 8-15 mm broad; sp 7-8.5 x 5.5-6  $\mu\text{m}$  (fig. 737F). Cap 35-80 mm, bell-shaped to conical, later low convex with a rounded umbo, often narrowly pellucid-striate, strongly hygrophanous; gills medium spaced, greyish brown, later brown; stem 60-130 mm long, cylindrical or clavate, greyish white fibrillose, later pale brown; universal veil white to brownish white, often sparse, not forming a girdle on the stem; flesh red brown, later darker; mycelium whitish; smell indistinct or slightly raphanoid, sometimes pleasant and aniseed-like; exsiccates brownish black. Sp subglobose to broadly ellipsoid, moderately verrucose, more strongly at apex, weakly dextrinoid to dextrinoid, somewhat dark; gill trama hyphae not or very finely zebra-striate incrustated,

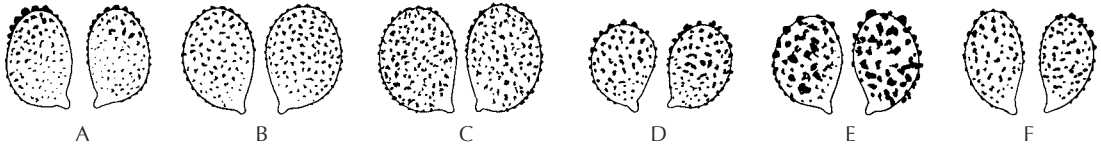


seldom spot-like incrustated. In dry forests, often in sandy *Pinus* heathland, but also in mesic coniferous forests; autumn; common in hemib.-bore., less common in western parts; FI (LC), NO (LC), SE. – CFP B08.

*C. clarobrunneus* (H. Lindstr. & Melot) Niskanen, Kytöv. & Liimat. in press

Note: compare with *C. neofurvolaeus* key F 30, which has longer, ellipsoid sp and dark brown exsiccates.

- With *Picea*; cap greyish brown to reddish brown, sometimes with bluish tints; stem 4-8 mm broad; sp  $7.5-9 \times 5-6 \mu\text{m}$  (fig. 739A). Cap 30-60 mm, conical to hemispherical, later low convex with a small umbo, very faintly innately fibrillose, up to  $1/2$  pellucid-striate, strongly hygrophanous; gills medium spaced to distant, brown to dark brown, sometimes bluish when young; stem 60-100 mm long, cylindrical to clavate, greyish white fibrillose, soon pale brown; universal veil white, often very sparse, not forming a girdle on the stem; mycelium whitish; flesh dark reddish brown, darker towards the base of stem, sometimes bluish at stem top; smell indistinct or slightly raphanoid, sometimes rubber-like; exsiccates brownish black. Sp ellipsoid to weakly ovoid-ellipsoid, finely to moderately verrucose, strongly at the apex, dextrinoid to fairly strongly dextrinoid, somewhat dark; gill trama hyphae not or finely zebra-striate incrustated. In mesic forests; autumn; occasional in hemib.-bore.; FI, NO, SE. – CFP B35 (only part of the frbs), MycR.
- C. caesiobrunneus* Kytöv., Niskanen & Liimat. in press
- 15. With *Picea*; stem 8-15 mm broad; universal veil usually forming a distinct girdle on the stem; sp  $8-9.5 \times 6-7 \mu\text{m}$  (fig. 739B). Cap 35-80 mm, bell-shaped to conical, later low convex with a rounded or sometimes conical umbo, sometimes narrowly pellucid-striate, dark red brown to umber, sometimes with bluish tints, strongly hygrophanous; gills medium spaced, dark brown; stem 60-130  $\times$  8-15 mm, cylindrical to clavate, greyish white fibrillose, later brown; universal veil white to brownish white; flesh dark red brown, sometimes with a bluish tint; with age blackish brown; mycelium white or bluish; smell indistinct or slightly raphanoid; exsiccates blackish. Sp broadly ellipsoid to subglobose, moderately verrucose, more strongly at apex, dextrinoid to fairly strongly dextrinoid; gill trama hyphae with dark spots,  $\pm$  zebra-striate incrustated, best seen in exsiccates. In mesic *Picea* forests; late summer to autumn; very common in hemib.-bore., occasional in temp.; DK (LC), FI (LC), NO (LC), SE (LC). – CFP B07, GCI B31, R&H 522, Sieniop 192, Ves 356.
- C. brunneus* (Pers.: Fr.) Fr.
- Usually with *Pinus*; stem 4-11 mm broad; universal veil often sparse, rarely forming a distinct girdle on the stem; sp  $8.5-10 \times 6-6.5 \mu\text{m}$  (fig. 739C). Cap 25-70 mm, conical to hemispherical, later low convex to almost plane, with a small, but distinct umbo, up to  $1/2$  pellucid-striate, dark yellow brown to dark red brown, strongly hygrophanous; gills medium spaced, pale greyish brown, soon dark brown; stem 60-140  $\times$  4-11 mm, cylindrical to slightly clavate, greyish white fibrillose, later brownish; universal veil white to brownish white; mycelium white, thick, attaching mosses at the base of the stem; flesh dark red brown, with age blackish brown; smell indistinct or slightly raphanoid; exsiccates blackish. Sp broadly ellipsoid, moderately verrucose, dextrinoid to fairly strongly dextrinoid; gill trama hyphae often not or very finely incrustated. In dry to damp coniferous forests, with *Pinus*, sometimes also with *Picea*; autumn; common in hemib.-bore., occasional in western parts and in temp.; FI (LC), NO, SE (LC). – CFP B35 (includes some frb of *C. caesiobrunneus*).
- C. glandicolor* (Fr.) Fr.
- 16. Cap strongly hygrophanous; stem 2-7 mm broad, cylindrical to tapering downwards or clavate 17
- Cap faintly hygrophanous or with hygrophanous streaks; stem 6-15 mm broad, clavate to cylindrical 20
- 17. Sp obovoid-subglobose,  $6-7.5 \times 5-5.7 \mu\text{m}$  (fig. 739D). Cap 20-55 mm, conical to hemispherical, later low convex with a small but distinct umbo, up to  $1/3$  pellucid-striate, dark red



Spores: A: *Cortinarius caesiobrunneus*, B: *C. brunneus*, C: *C. glandicolor*, D: *C. coleoptera*, E: *C. cicindela*, F: *C. carabus*.

brown; gills medium spaced, dark red brown; stem 40-90 x 4-7 mm, tapering downwards, greyish white fibrillose, later reddish brown; universal veil white, very sparse; flesh dark red brown; mycelium white, sparse; smell indistinct; exsiccates with greyish black cap and greyish stem. Sp fairly strongly verrucose, weakly dextrinoid, dark. In dry *Pinus* heath forests on sandy soil; autumn; common in hemib.-bore.; FI (LC), NO (NE), SE. – Soop 04:89.

*C. coleoptera* H. Lindstr. & Soop

- Sp ovoid, ellipsoid to weakly dacryoid, > 7.5  $\mu$ m long 18
- 18. Stem 4-8 mm broad, cylindrical to clavate; gill trama hyphae not or finely zebra-striate incrustated see *C. caesiobrunneus* 14
- Stem 2-4 mm broad, cylindrical; gill trama hyphae very strongly zebra- and spot-like incrustated 19
- 19. Sp 7.5-9 x 5-6  $\mu$ m, weakly ovoid (fig. 739E). Cap 10-30 mm, conical to hemispherical, very soon almost plane with an acute umbo, very faintly innately fibrillose, up to 1/2 pellucid-striate, dark brown; gills medium spaced, dark brown; stem 50-100 mm long, whitish fibrillose, soon brown to dark reddish brown; universal veil whitish, very sparse; flesh dark brown; mycelium white, sparse; smell indistinct; exsiccates with greyish black cap and stem. Sp very strongly and coarsely verrucose, weakly dextrinoid, dark; gill trama hyphae strongly zebra- and spot-like incrustated. In mesic to damp *Picea* forests, often in *Sphagnum*, but also in dry *Pinus* heath forests, often scanty; late summer to autumn; occasional in hemib.-bore.; FI, NO. – MycR.

*C. cicindela* Kytöv., Niskanen & Liimat. in press

- Sp 7.5-9 x 4.5-5  $\mu$ m, weakly dacryoid (fig. 739F). Cap 5-25 mm, conical to broadly conical, sometimes hemispherical, later low convex with a small umbo, dark brown to almost blackish brown; gills medium spaced, dark brown; stem 20-50 x 2-4 mm, cylindrical, greyish white fibrillose, later brown to dark brown; universal veil whitish, very sparse; flesh dark brown; mycelium white, sparse; smell indistinct; exsiccates with greyish black cap and stem. Sp moderately verrucose, strongly at apex, moderately dextrinoid, dark; gill trama hyphae strongly incrustated. In dry *Pinus* heath forests on sandy soil, but also in mesic coniferous forests with *Pinus*, often among low mosses or in paths; autumn; occasional in hemib., common in bore.; FI, SE. – MycR.

*C. carabus* Kytöv., Niskanen & Liimat. in press

- 20. Sp ellipsoid to obovoid-ellipsoid 21
- Sp subglobose 22
- 21. Cap greyish brown to brown; flesh greyish brown to brown, often darkening towards base; sp (7.5-)8-9 x 5-5.5  $\mu$ m see *C. suberi* key H 1
- Cap brown to fairly dark brown; flesh dark brown; sp 6.5-7.5 x 4.5-5  $\mu$ m (fig. 741A). Cap 45-80 mm, with a long down-curved margin, innately fibrillose, brown, faintly hygrophanous; gills medium spaced, greyish brown, sometimes with a bluish tint, soon dark chocolate brown; stem 60-110 x 8-13 mm, clavate, up to 25 mm broad at base, fairly firm, greyish white fibrillose, later brown; universal veil white, forming a sock-like sheath or thick girdles on the stem; flesh often with a bluish tint, strongest at the stem top; marbled hygrophanous;

mycelium white or sometimes bluish; smell indistinct or slightly raphanoid; exsiccates brownish black. Sp moderately and coarsely verrucose, weakly dextrinoid, somewhat dark. In mesic to dryish coniferous forests, with *Picea* or *Pinus*; rare in hemib.-bore.; FI, NO, SE. – AC 1:18.

*C. pseudorubricosus* Reumaux

22. Stem clavate; universal veil white, distinct, forming a girdle on the stem; sp 6-7 x 5-5.5(-6)  $\mu\text{m}$ , obovoid-subglobose, echinate-verrucose (fig. 741B). Cap 30-70 mm, hemispherical, later low convex with a low and broad umbo, innately fibrillose, yellow brown to greyish brown, with hygrophanous streaks; gills medium spaced, greyish brown, soon dark chocolate brown; stem 60-110 x 8-13 mm, up to 30 mm broad at base, greyish white fibrillose, later brown; flesh brown, with age and at stem base dark brown to blackish brown; mycelium white, smell indistinct; exsiccates blackish. Sp not very thin-walled, dark, weakly to moderately dextrinoid. In rich, mesic *Picea* forests on calcareous soil; late summer to autumn; very rare in bore.; FI. – MycR.

*C. albogaudis* Kytöv., Niskanen & Liimat. in press

Note: looks like *C. pinigaudis*, but with a white universal veil.

- Stem cylindrical; universal veil brownish, indistinct; sp 5.5-7 x 4.5-5.5  $\mu\text{m}$ , ovoid to ovoid-subglobose, finely verrucose (fig. 741C). Cap 30-70 mm, conical to hemispherical, later low convex with a small umbo, coarsely innately fibrillose, greyish brown to dark brown, with hygrophanous streaks; gills medium spaced, pale greyish brown, later brown; stem 40-80 x 6-11 mm, greyish white fibrillose, later brownish; flesh brown, often with a bluish tint, especially at stem top; marbled hygrophanous; mycelium white or bluish; smell indistinct; exsiccates blackish. Sp very thin-walled, without iodine reactions. In mesic to damp *Picea* forests; late summer to autumn; very rare in bore.; FI (NT), NO (NE), SE (VU). – AC 1:8, CFP B28 (2nd and 3rd frb from right, cap on the lower right of the three caps, and half frb on the left are *C. paragaudis*).

*C. ectypus* J. Favre

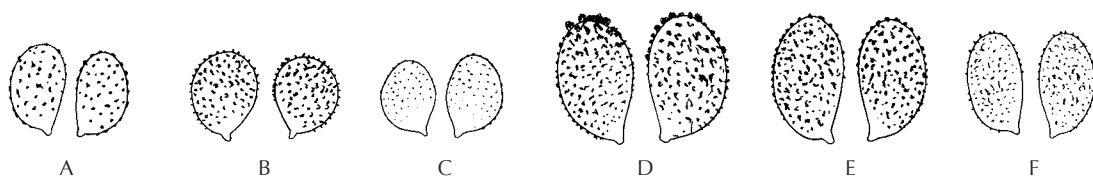
**Key F:** Subgen. *Telamonina* sects *Bovini* Liimat., Niskanen & Kytöv. in press, *Illumini* Liimat., Niskanen & Kytöv. in press, *Saturnini* Möenne-Locc. & Reumaux, *Sciophylli* (Möenne-Locc. & Reumaux) Liimat. & Niskanen in press, *Subbalaustini* Liimat., Niskanen & Kytöv. in press. and *Sordescentes* Melot

TUULA NISKANEN & ILKKA KYTÖVUORI

Cap  $\pm$  brown, mostly dark; universal veil white, greyish or brownish white; smell indistinct, raphanoid or pleasant; exsiccates often with dark brown cap. 19 species in the key, but the number of Nordic species is much higher, especially the species in temp.-hemib. deciduous forests are very poorly known.

Suppl. lit.: Bidaud et al. 2002.

- |    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |   |
|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
| 1. | Frb with bluish tints                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 2 |
| -  | Frb without bluish tints                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 5 |
| 2. | Sp > 9.5 $\mu\text{m}$ long                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 3 |
| -  | Sp < 9.5 $\mu\text{m}$ long                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 4 |
| 3. | With <i>Quercus</i> , <i>Tilia</i> , <i>Fagus</i> and <i>Corylus</i> ; cap dark brown with a violet tint, without veil patches; universal veil white, very sparse. Cap 35-65 mm, conical to hemispherical, later low convex with an umbo, strongly hygrophanous; gills distant, bluish or greyish brown when young, later chocolate to purplish brown; stem 35-70 x 5-11 mm, cylindrical to slightly clavate, whitish silky-fibrillose, later brownish; flesh greyish white, distinctly bluish at stem top; smell indistinct; exsiccates dark greyish brown. Sp 10-11(-11.5) x 6-7 $\mu\text{m}$ , obovoid-ellipsoid, moderately verrucose, strongly at the apex (fig. 741D), moderately dextrinoid. On |   |



Spores: A: *Cortinarius pseudorubricosus*, B: *C. albogaudis*, C: *C. ectypus*, D: *C. serratissimus*, E: *C. lucorum*, F: *C. saturninus*.

mull soil, often in groups; late summer to autumn; very rare in temp.-hemib., occasional in western NO; DK (EN), NO (NT), SE. – GCI D183, M&J 38.

*C. serratissimus* M.M. Moser (*C. sciophyllus* Fr. s. auct. Nord.)

- With *Populus*; cap purplish brown, soon very pale due to the drying, often with white veil patches near the margin; universal veil white to somewhat greyish, forming a sheath in young frb, later in broad zones on the stem. Cap 50-110 mm, hemispherical, then convex to low convex, hygrophanous; gills distant and broad, greyish violet, later purple brown; stem 50-100 x 8-18 mm, cylindrical or slightly clavate, fibrillose, whitish grey, pale brownish yellow with age; flesh pale grey to pale violaceous, more brownish towards the base; exsiccates with pale greyish brown to brown cap, brown to dark brown gills and greyish stem. Sp 9.5-11 x 5.5-6.5  $\mu$ m, obovoid-ellipsoid, moderately verrucose, strongest at apex (fig. 741E), moderately dextrinoid. In mixed forests, years and parks, on mull soil; late summer to autumn; occasional in temp.-southern bore., but locally abundant, rare in middle-northern bore.; DK (LC), FI (LC), NO (LC), SE (LC). – CFP C10, Sieniop 206, Ves 358.

*C. lucorum* (Fr.) J.E. Lange (non s. Lange)

4. In temp.-bore., rare in the northern parts, usually with *Salix caprea* or in sand dunes with *S. repens*, also on clay or mull soil. Cap 35-80 mm, hemispherical, later low convex to almost plane with a low and broad umbo, usually with white universal veil patches near the margin, chestnut brown, sometimes with a violet tint, whitish, silvery-micaceous fibrillose when young, distinctly hygrophanous; gills medium spaced, pale greyish brown, sometimes with a bluish tint, later chocolate brown; stem 50-100 x 6-13 mm, cylindrical or slightly clavate, whitish silky-fibrillose, often with a bluish tint at the top, later pale ochre brown; universal veil white, forming a thin sheath or zones on stem; flesh pale brownish, often with a bluish tint at stem top; smell indistinct; exsiccates with sordid to blackish brown cap and grey stem. Sp 8-9(-9.5) x 4.5-5  $\mu$ m, narrowly ellipsoid, moderately, sharply verrucose (fig. 741F), weakly dextrinoid. Often in groups; summer to autumn; common, but locally very common in temp., occasional in hemib.-bore.; DK (LC), FI (LC), NO (LC), SE (LC). – CFP C09, Sieniop 215, ☉.

*C. saturninus* (Fr.: Fr.) Fr.

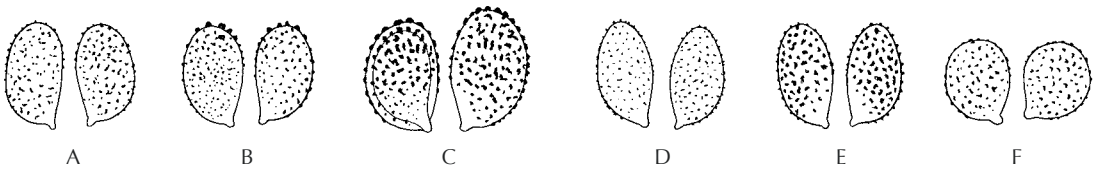
- In suba.-arc./alp. with dwarf *Salix* on rich soil. Cap 25-45 mm, hemispherical, later low convex to almost plane, sometimes with a low and broad umbo, often with white universal veil patches near the margin, chestnut brown, sometimes with a violet tint, distinctly hygrophanous; gills medium spaced, bluish when young, later chocolate brown; stem 25-50 x 5-10 mm, clavate, whitish silky-fibrillose, often with a bluish tint at the top, later pale ochre brown; universal veil white, often forming a sheath over the lower half of the stem; flesh greyish white, bluish at stem top; smell indistinct; exsiccates with sordid to blackish brown cap and greyish white stem. Sp 8-9 x (4.5-)5-5.5  $\mu$ m, ellipsoid, faintly to moderately verrucose (fig. 743A), weakly dextrinoid. Late summer to autumn; common in suba.-arc./alp.; FI (DD), IS, NO (LC), SE (LC). – CFP A04, M&J 69.

*C. subtorvus* Lamoure

Note: type material has not been studied and the interpretation follows Brandrud et al. 1989.

5. With deciduous trees 6
- With conifers 14
6. Usually with *Fagus*, *Quercus*, *Carpinus*, *Tilia* or *Corylus*, in temp.-hemib. 7
- Usually with *Betula* or *Salix*, rarely *Corylus*, in temp.-bore. 9
7. Smell usually distinct, recalling parsley; cap distinctly hygrophanous, smooth. Cap 40-65 mm, hemispherical, then low convex, brown, hygrophanous; gills medium spaced, brown; stem 100 x 8-10 mm, clavate to bulbous, first whitish fibrillose, later brownish; universal veil white, sparse; flesh pale brownish to brownish; exsiccates fairly dark brown. Sp 8-9(-9.5) x 4.8-5.3  $\mu\text{m}$ , narrowly obovoid to dacryoid, weakly to moderately verrucose, more strongly at apex (fig. 743B), faintly to moderately dextrinoid. In *Fagus* forests on mull or clayey soil; autumn; occasional in temp., rare in hemib., very poorly known; DK (LC), SE. – CFP B60 (only part of the frb, as *rheubarbarinus*), Nyl 452 (as *rheubarbarinus*).  
*C. phaeosmus* Rob. Henry
- Smell indistinct or pleasant, recalling flowers; cap weakly hygrophanous, innately fibrillose and/or silky shiny 8
8. Flesh whitish brownish to pale greyish brown; sp broadly ellipsoid to slightly ovoid, strongly verrucose (fig. 743C). Cap 50-100(-110) mm, hemispherical, then low convex, creamy greyish to pale reddish grey brown, innately fibrillose, weakly hygrophanous; gills crowded to medium spaced, pale brown, then fairly dark red brown; stem 50-90 x 9-20 mm, clavate to bulbous, sometimes with a pointed base, greyish white fibrillose, later more brownish; universal veil white, very sparse on the stem, more abundant on the cap, especially when young; flesh brownish white to pale greyish brown; smell indistinct or pleasant, recalling flowers; exsiccates with pale greyish brown cap and stem and dark gills. Sp (8.5-)9-10 x 6-6.5  $\mu\text{m}$ , thick-walled, strongly dextrinoid; gill trama hyphae  $\pm$  smooth. With *Quercus*, *Corylus*, *Tilia*, *Fagus* and possibly *Carpinus* on calcareous mull soil, often in groups; late summer to autumn; rare in temp.-hemib., but poorly known; DK (DD), NO (VU), SE (LC). – CFP A23 (three big frb from the left).  
*C. aprinus* Melot s. Brandrud et al. 1989  
 Note: type material has not been studied, and the name has been used collectively in the Nordic countries.
- Flesh whitish; sp slightly amygdaloid, moderately and densely verrucose (fig. 697C) *see C. erugatus* key L 8
9. Cap 15-40 mm; stem 35-50 x 3-5 mm. Cap hemispherical, then low convex with an obtuse umbo, sometimes narrowly pellucid-striate, honey brown to red brown, hygrophanous; gills medium spaced, pale brownish, later brown, with a whitish edge; stem cylindrical to slightly clavate, whitish fibrillose, later more brownish; universal veil white, sparse; flesh pale brownish; smell faintly raphanoid; exsiccates with dark brown cap, greyish to brownish stem and brown to fairly dark brown gills. Sp 8-9 x 4.5-5  $\mu\text{m}$ , narrowly amygdaloid, fairly finely verrucose (fig. 743D), weakly to moderately dextrinoid; gill trama hyphae very finely incrustated. In mesic, mixed forests with *Betula*; late summer to autumn; rare in hemib.-bore., but possibly overlooked; FI, SE. – MycP 2008, Soop 04:94 (as *erugatus*).  
*C. leiocastaneus* Niskanen, Liimat. & Soop in press (*C. erugatus* (Weinm.) Fr. s. Soop)
- Cap 35-80 mm; stem 40-100 x (5-)6-13 mm 10
10. Cap chestnut to purplish brown; mostly with *Salix*, but also with *Corylus* *see C. saturninus* 4
- Cap warm yellow brown, vivid red brown to brown; with *Betula* 11
11. Sp subglobose *see C. balaustinus* key I 1
- Sp ellipsoid to somewhat dacryoid 12
12. Cap vivid red brown; sp 8-9 x 4.5-5.5  $\mu\text{m}$  (fig. 743E). Cap 30-80 mm, hemispherical, then low convex, sometimes narrowly pellucid-striate, hygrophanous; gills medium spaced, pale yellowish brown, later more brown; stem 30-90 x 6-13 mm, clavate to bulbous, sometimes cy-





Spores: A: *Cortinarius subtorvus*, B: *C. phaeosmus*, C: *C. aprinus*, D: *C. leiocastaneus*, E: *C. subbalaustinus*, F: *C. illuminus*.

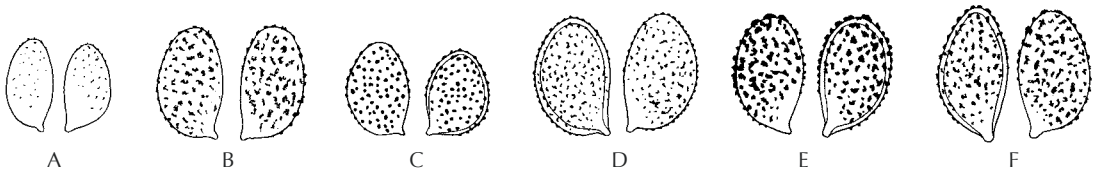
lindrical, whitish fibrillose when young, later red brown; universal veil white, fairly sparse, forming a sheath or incomplete girdles on stem; flesh pale red brown, somewhat darker towards base; smell indistinct; exsiccates with red-brown cap and pale greyish to brownish stem. Sp somewhat dacryoid to narrowly ellipsoid, strongly verrucose, moderately dextrinoid; gill trama hyphae smooth to finely incrustated. In mesic to dry, deciduous and mixed forests with *Betula*, often in lawns and yards or at roadsides; summer to autumn; occasional, but locally common in temp., rare but locally occasional in bore., rare in suba. in IS; DK (LC), FI (LC), IS, NO (LC), SE (LC). – CFP B03.

***C. subbalaustinus* Rob. Henry**

Note: type material has not been studied.

- Cap warm yellow brown to brown; sp  $> 5.5 \mu\text{m}$  wide 13
- 13. Cap brown and silvery fibrillose; sp  $9.5\text{--}10.5 \times 6\text{--}6.5\text{--}(7) \mu\text{m}$  see *C. disjungendus* key E 10
- Cap warm yellow brown to orange brown, innately fibrillose; sp  $8.5\text{--}9.5 \times 5.5\text{--}6 \mu\text{m}$  see *C. bivelus* key I 4
- 14. Sp subglobose 15
- Sp amygdaloid, ellipsoid or fusiform 16
- 15. Cap vivid red brown to dark red brown; with *Picea*; sp  $6\text{--}7\text{--}(7.5) \times (5\text{--})5.5\text{--}6 \mu\text{m}$  (fig. 743F). Cap 35–80 mm, hemispherical, later low convex to almost plane with an obtuse, often low umbo, hygrophanous, narrowly pellucid-striate; gills medium spaced, pale greyish to ochre brown, later fulvous brown; stem 60–140  $\times$  6–15 mm, cylindrical or slightly clavate, whitish silky-fibrillose when young, later yellowish brown; universal veil white, pinkish or yellowish, fairly sparse, forming incomplete girdles on the stem; flesh pale brown to brown; smell faintly raphanoid; exsiccates with dark brown cap and pale greyish brown stem. Sp moderately verrucose, fairly weakly to moderately dextrinoid; gill trama usually distinctly zebra-striate incrustated. In mesic *Picea* forests; summer to autumn; common in hemib.-bore; FI (LC), NO (LC), SE. – CFP B15.
- C. illuminus* Fr. s. lato**
- Cap pale brown to brown; with *Pinus*; sp  $7\text{--}8 \times 5.5\text{--}6 \mu\text{m}$  see *C. clarobrunneus* key E 14
- 16. Sp  $6.5\text{--}8 \times 4\text{--}4.5 \mu\text{m}$  (fig. 745A). Cap 40–90 mm, hemispherical, then low convex to almost plane, with an obtuse umbo, dark, honey brown to greyish yellow brown, often with an olivaceous tinge, hygrophanous; gills medium spaced, olivaceous yellow brown, later dark brown; stem 60–140  $\times$  8–17 mm, cylindrical, whitish fibrillose, later brownish; universal veil white, sparse; flesh yellowish brown; smell faint of cedar-wood; exsiccates with very dark, greyish brown to brown cap, very dark olivaceous gills and greyish stem. Sp fusiform, very finely verrucose, more strongly at apex, weakly dextrinoid; gill trama hyphae smooth to finely incrustated. In dry to mesic coniferous forests with *Picea*, also with planted *Picea sitchensis*; late summer to autumn; occasional in hemib.-bore., rarer in the western parts, rare in temp.; FI (LC), NO (NE), SE (LC). – CFP B12.
- C. melleopallens* (Fr.) Britzelm.**
- Sp  $> 4.5 \mu\text{m}$  broad 17

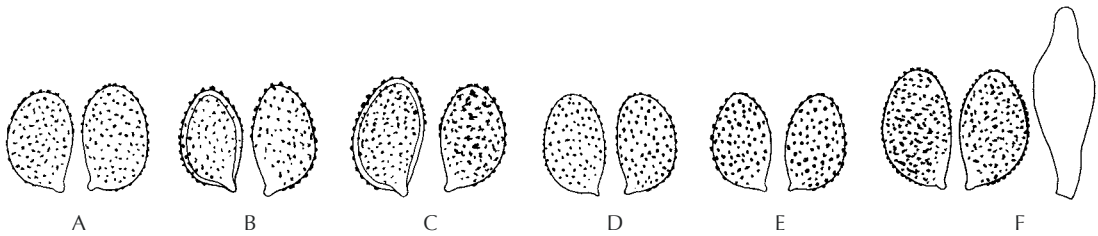
17. Smell aniseed-like or strong of *Viola odorata* 18  
 - Smell indistinct or slightly raphanoid 20
18. Smell strong, sweetish of *Viola odorata*, at least when mature and on drying; sp 9-10 x 5-6  $\mu\text{m}$ , narrowly ellipsoid (fig. 745B). Cap 35-75 mm, hemispherical, then low convex to almost plane, with an obtuse umbo, thin, narrowly pellucid-striate, with long incurved margin, fairly dark greyish brown to yellowish brown or reddish brown, hygrophanous; gills medium spaced, pale greyish brown, later fairly dark yellow brown; stem 50-110 x 4-10 mm, cylindrical, fairly stiff, whitish fibrillose, later brownish; universal veil white, forming incomplete girdles on the stem; flesh greyish brown; exsiccates with dark brown to sordid brown cap and greyish to brownish grey stem. Sp moderately verrucose, moderately to strongly dextrinoid; gill trama hyphae  $\pm$  smooth. In mesic coniferous forests with *Picea*, on rich to calcareous soil; late summer to autumn; very rare, but locally rare in bore., with northern distribution; FI, NO (NE), SE (LC). – CFP A51.  
*C. ionosmus* M.M. Moser, Nespiak & Schwöbel
- Smell aniseed-like; sp < 9  $\mu\text{m}$  long, subglobose, ovoid or broadly ellipsoid 19
19. Sp 7.5-9 x 5-6  $\mu\text{m}$ , ovoid (fig. 745C); with *Picea*. Cap 30-70 mm, hemispherical, soon low convex with a low umbo and narrowly down-curved margin, often narrowly pellucid-striate, saturated dull yellowish brown to somewhat reddish brown, sometimes with dark streaks or spots, hygrophanous; gills medium spaced, pale yellow brown, with age saturated brown; stem 50-120 x 4-10 mm, quite slender in the upper part, base clavate or bulbous, softening with age, top greyish white silky-fibrillose, downwards brown; universal veil white, forming a very thin, sock-like sheath, disappearing easily when bruised or with age, sometimes forming obscure zones; flesh reddish to yellow brown, darker towards the base; smell sometimes raphanoid; exsiccates dark, sordid brown. Sp weakly to clearly thick-walled, moderately to strongly dextrinoid, moderately verrucose; gill trama hyphae fairly finely scabrous. In mesic coniferous forests with *Picea*, often on calcareous soil, but also in ordinary *Vaccinium myrtillus* *Picea* forests; late summer to autumn; occasional in hemib.-bore., more common towards the north; FI (LC), NO, SE. – Kar 45:39.  
*C. anisatus* H. Lindstr., Kytöv. & Niskanen
- Sp 7-8 x 5.5-6  $\mu\text{m}$  subglose to broadly ellipsoid; with *Pinus* see *C. clarobrunneus* key G 14
20. Most sp > 9.5  $\mu\text{m}$  long 21  
 - Most sp < 9.5  $\mu\text{m}$  long 24
21. Sp obovoid-ellipsoid, 9.5-11.5 x 6-7  $\mu\text{m}$ ; stem often firm, cylindrical to slightly clavate; exsiccates blackish see *C. disjungendus* key E 10  
 - Sp ovoid, amygdaloid or ellipsoid, 9-11 x 5.5-6.5  $\mu\text{m}$ ; stem not conspicuously firm, clavate or cylindrical; exsiccates not blackish, but can be fairly dark 22
22. Cap innately fibrillose; exsiccates with pale brown to brown cap. Cap 50-100 mm, hemispherical, then low convex, sometimes with an umbo, greyish yellow brown to fairly dark brown, sometimes blackening in large spots, hygrophanous and with hygrophanous streaks; gills medium spaced, fairly broad, pale brown, soon chocolate brown; stem 50-100 x 9-15 mm, slightly clavate to clavate, greyish white fibrillose, soon brownish; universal veil greyish white, often forming a girdle and a thin sheath or incomplete girdles on stem; flesh brownish, darker towards the base; smell indistinct or weakly raphanoid; exsiccates with pale greyish or brownish stem. Sp 9-11 x 6-7  $\mu\text{m}$ , ovoid to broadly amygdaloid, thick-walled, finely to moderately and often evenly verrucose (fig. 745D), moderately dextrinoid; gill trama hyphae  $\pm$  smooth. In mesic coniferous forests with *Picea*, sometimes with *Pinus*, on calcareous soil; late summer to autumn; rare in hemib.-bore.; FI, SE.  
*C. fuscobovinus* Kytöv, Niskanen & Liimat. in press
- Cap not innately fibrillose; cap in exsiccates dark, at least at centre 23



Spores: A: *Cortinarius melleopallens*, B: *C. ionosmus*, C: *C. anisatus*, D: *C. fuscobovinus*, E: *C. bovinus*, F: *C. oulankaensis*.

23. Sp (8.5-)9-10.5 x 5.5-6.5  $\mu\text{m}$ , ellipsoid to ovoid-ellipsoid (fig. 745E); stem clavate to bulbous. Cap 40-80 mm, hemispherical, then low convex to almost plane, sometimes with a low and broad umbo, brown when young, later dark brown, hygrophanous; gills medium spaced to distant, pale greyish brown, later dark brown; stem 50-100 x 9-14 mm, greyish white fibrillose, soon brownish; universal veil greyish white to ochraceous white, darkening to greyish brown, forming a girdle and a thin sheath or incomplete girdles on stem; flesh greyish brown to brown; smell indistinct or weakly raphanoid; exsiccates with sordid brown to dark greyish brown cap and brownish greyish stem. Sp somewhat thick-walled, moderately verrucose, fairly strongly at apex, fairly strongly dextrinoid; gill trama hyphae  $\pm$  smooth. In mesic coniferous forests with *Picea*, on calcareous soil; late summer to autumn; rare in hemib.-bore.; FI (DD), NO (NE), SE (LC). – CFP E20, Soop 04:78.  
*C. bovinus* Fr.  
Note: the name has been used collectively in the Nordic countries.
- Sp 9.5-11 x 6-7  $\mu\text{m}$ , amygdaloid (fig. 745F); stem slightly clavate. Cap 45-80 mm, hemispherical, then low convex to almost plane with a low and broad umbo, brown with some greyish tints when young, later dark brown, hygrophanous; gills medium spaced to distant, pale greyish brown, later fairly dark brown; stem 55-80 x 9-13 mm, greyish white fibrillose, later brownish; universal veil greyish white to ochre white, often forming a thin sheath on lower half of stem; flesh pale greyish brown, darker towards base, marbled hygrophanous; smell indistinct or faintly raphanoid; exsiccates with dark brown, often minutely appressed scaly cap and pale greyish brown stem. Sp strongly and coarsely verrucose, dark, fairly weakly dextrinoid; gill trama hyphae mostly smooth. In mesic to damp coniferous forests with *Picea*, on calcareous soil; late summer to autumn; very rare in hemib.-bore.; FI, SE.  
*C. oulankaensis* Kytöv., Niskanen, Liimat. & H. Lindstr. in press
24. Stem cylindrical, tapering downwards or slightly clavate; flesh brownish white to pale brownish; gill trama hyphae smooth to zebra-striate incrustated 25  
- Stem clavate to bulbous; flesh pale greyish brown to brown, often darkening with age; gill trama hyphae smooth to very finely incrustated 27
25. Cap greyish brown to dark greyish brown; sp broadly ellipsoid, weakly to moderately dextrinoid; epicutis hyphae with numerous, circular, hyaline, refracting granules. Cap 35-60 mm, hemispherical, then low convex with an obtuse umbo, slightly mat, later with darkening spots, hygrophanous; gills medium spaced, pale greyish brown, later fairly dark greyish brown, with white edge; stem 60-130 x 6-12 mm, clavate or cylindrical, sometimes tapering downwards, whitish silky-fibrillose; universal veil white, sparse; flesh whitish, but soon becoming pale brownish, e.g. after handling or cutting; smell faintly raphanoid; exsiccates with a fairly dark, red-brown cap, greyish white to brownish stem and often fairly dark brown gills. Sp 8-9(-9.5) x 5.5-6.5  $\mu\text{m}$  moderately verrucose, more strongly at apex (fig. 747A); gill trama hyphae smooth to zebra-striate incrustated. In mesic to dryish coniferous forests, with *Picea*, often deep in mosses; late summer to autumn; occasional in hemib.-bore., more rare towards the north, possibly overlooked; FI, SE. – MycP 2008.  
*C. brunneifolius* Kytöv., Niskanen & Liimat. in press

- Cap reddish brown to chocolate brown; sp fusiform, amygdaloid to slightly ellipsoid, weakly to strongly dextrinoid; epicutis hyphae without hyaline granules 26
- 26. Smell indistinct; cap fairly mat, without veil patches or fibrils; sp 8-9(-9.5) x 5.3-5.7  $\mu$ m, amygdaloid to slightly ellipsoid (fig. 747B), fairly strongly to strongly dextrinoid. Cap 35-75 mm, hemispherical, then low convex to almost plane with an obtuse umbo, reddish brown, hygrophanous; gills medium spaced, pale brown, later vividly brick red to red brown; stem 70-150 x 6-15 mm, cylindrical or slightly clavate, often tapering downwards, whitish silky-fibrillose, later more brownish; universal veil white, sparse; flesh brownish white to pale brownish; exsiccates with a fairly dark red-brown cap, greyish white to brownish stem and often fairly dark brown gills. Sp sometimes thick-walled, moderately verrucose, more strongly at apex; gill trama hyphae distinctly zebra-striate and densely spot-like incrustated. In mesic to dry coniferous forests, usually with *Picea*, sometimes with *Pinus*, often deep in mosses; late summer to autumn; very common in bore., common in hemib.; FI (LC), NO (LC), SE (LC). – CFP D31, D36.  
*C. testaceofolius* H. Lindstr. & Soop
  - Smell faint, recalling cedar wood; cap waxy-glossy, but often with white universal veil fibrils or patches near the margin; sp 8.5-9.5 x 4.5-5.5  $\mu$ m, fusiform to amygdaloid, with a suprahilar depression; weakly dextrinoid to sometimes more dextrinoid see *C. dolabratus* key I 4
- 27. Sp often > 5.5 wide 28
  - Sp < 5.5  $\mu$ m wide 30
- 28. Sp subglobose to broadly ellipsoid; exsiccates blackish see *C. clarobrunneus* key E 14
  - Sp amygdaloid to ovoid; exsiccates not blackish but can be fairly dark 29
- 29. Cap often narrowly pellucid-striate; stem 4-10 mm broad, quite slender in upper part; exsiccates with dark, sordid-brown cap see *C. anisatus* key F 17
  - Cap not pellucid-striate; stem 8-13 mm broad, stout; cap in exsiccates usually with dark centre and pale brown to brown margin. Cap 40-70 mm, hemispherical, then low convex to almost plane, with a low and broad umbo, fairly pale greyish brown when young, later brown to dark brown, hygrophanous; gills medium spaced, pale greyish brown, later dark brown; stem 50-90 mm long, clavate to bulbous, whitish fibrillose, later brownish; universal veil white, forming a fairly thin sheath or incomplete girdles on stem; flesh pale greyish brown, later brownish; smell indistinct; exsiccates with pale greyish to brownish stem. Sp 8.5-9.5 x 5.5-6(-6.5)  $\mu$ m, fusiform-ovoid, moderately and acutely verrucose, more strongly at apex (fig. 747C), moderately to fairly strongly dextrinoid; gill trama hyphae smooth to finely incrustated. In mesic to dryish coniferous forests with *Picea* or *Pinus*, on calcareous soil; late summer to autumn; rare in hemib.-middle bore.; FI, SE.  
*C. anisochrous* Kytöv., Liimat., Niskanen & H. Lindstr. in press
- 30. In sandy *Pinus* heath forests; sp ellipsoid to very weakly amygdaloid (fig. 747D), moderately dextrinoid, fairly finely and evenly verrucose. Cap 30-70 mm, hemispherical, soon low convex with a broad umbo, deeply and dark saturated red brown, later with darkening to blackening spots, hygrophanous; gills medium spaced, pale yellowish brown when young, with age saturated brown; stem 50-120 x 5-12 mm, clavate or bulbous, finely whitish silky-fibrillose, later greyish yellow brown, with age dirty grey brown downwards; universal veil white, thin, sparse, often forming a distinct, but thin band in the middle of the stem; flesh brown to fairly dark brown; smell indistinct or slightly raphanoid; exsiccates variably brown, dark, not black. Sp (7.5-)8-8.5(-9) x 5-5.5  $\mu$ m; gill trama hyphae smooth to very finely incrustated. In mesic to dry coniferous forests with *Pinus* and maybe also with *Picea*; autumn; common in hemib.-bore.; FI (LC), SE. – Kar 45:38.  
*C. neofurvolaesus* Kytöv., Niskanen, Liimat. & H. Lindstr. (*C. furvolaesus* H. Lindstr. s. auct. p.p.)  
 Note: compare to *C. biformis* key L 14 which has bluish tints at stem top, whitish flesh and narrower sp.



Spores and cheilocystidia: A: *Cortinarius brunneifolius*, B: *C. testaceofolius*, C: *C. anisochrous*, D: *C. neofurvolaeus*, E: *C. sordidemaculatus*, F: *C. camphoratus*.

- In mesic *Picea* forests; sp ovoid to amygdaloid, weakly to strongly dextrinoid, moderately verrucose, sometimes slightly more verrucose at the apex 31
- 31. Cap greyish brown, umber to chestnut brown, not pellucid-striate; universal veil white to greyish white, fairly abundant, forming girdles on stem; sp amygdaloid, rather thin-walled. Cap 40-100 mm, hemispherical, soon low convex to almost plane with a low and very broad umbo, with age often ring-like depressed around the umbo, later blackening in large spots, hygrophane; gills medium spaced, pale yellowish brown to greyish brown, brown to dark brown with age; stem 70-130 x 7-15 mm, clavate to somewhat bulbous, rather coarsely greyish white fibrillose, later brown, darkening downwards; flesh yellowish brown to greyish brown, darkening downwards in stem; smell indistinct; exsiccates dark sordid but not black. Sp 8-9 x 5-5.5  $\mu$ m, moderately verrucose, slightly more verrucose at apex (fig. 747E), weakly to moderately dextrinoid; gill trama hyphae finely incrustated. Especially on rich or calcareous soil, but also on acid soil; late summer to autumn; occasional in hemib.-bore., rare in the western parts; FI (LC), NO (NE), SE. – CFP D41 (as *furvolaeus*), Kar 45:38.  
*C. sordidemaculatus* Rob. Henry (*C. furvolaeus* H. Lindstr.)
- Cap saturated dull yellowish brown to somewhat reddish brown, often narrowly pellucid-striate; universal veil white, fibrillose and thin; sp ovoid  
see *C. anisatus* key F 17

**Key G:** Subgen. *Telamonia* sects *Telamonia* (Fr.) Gillot & Lucand and *Camphorati* Liimat. & Niskanen in press

TUULA NISKANEN & ILKKA KYTÖVUORI

Frb often fleshy,  $\pm$  with bluish tints; cap usually (40-)50-110 mm; universal veil often abundant, whitish, yellowish, greyish brown or bluish; many species with a fruity, *C. traganus*-like smell. Eight species presented here, but at least four more species, still not fully known, occur in the Nordic countries.

1. Universal veil at least partly lilac 2
- Universal veil whitish, yellowish to greyish brown 5
2. Smell very strong, unpleasant; flesh bluish, later pale yellowish brown; cheilocystidia distinct (fig. 747F). Cap 35-100 mm, hemispherical, then low convex to almost plane, somewhat silky shiny, smooth, blue to almost white when young, later pale yellowish brown; gills crowded to medium spaced, bluish lilac, later cinnamon brown; stem 50-130 x 9-20 mm, cylindrical or clavate, pale bluish, later pale yellowish brown, silky fibrillose; universal veil pale bluish, later yellowish; exsiccates whitish to pale yellowish brown. Sp (9-)9.5-10.5 x (5.5-)6-6.5  $\mu$ m, amygdaloid to somewhat ellipsoid, finely and densely verrucose, weakly dextrinoid; cheilocystidia 30-60 x 10-15  $\mu$ m, cylindrical, lageniform-fusiform to weakly



lageniform. In mesic *Picea* forests, in western NO also in mixed *Pinus-Betula* forests; late summer to autumn; very common in hemib.-bore., rare in temp.; DK (VU), FI (LC), NO (LC), SE (LC). – CFP A12, Nyl 456, R&H 508, Sieniop 194, Ves 353, ☉.

*C. camphoratus* (Fr.) Fr.

Note: blue colours disappear totally with age, but the species can be recognized in the field by its persistent, strong smell.

- Smell ± fruity or indistinct; flesh pale ochraceous reddish-brownish to saturated yellow brown; without true cheilocystidia 3
- 3. Stem slender, cylindrical or slightly clavate, 60-130 x 5-12 mm, distinctly longer than cap diam. Cap 30-70 mm, hemispherical, then low convex to almost plane, usually with lilac veil patches at margin, slightly fibrillose, ochraceous brown, paler when young, not hygrophanous; gills crowded to medium spaced, pale ochre brown when young, later darker brown; stem rather firm, lilac when young, especially at top, becoming brownish from the base; universal veil lilac on cap and upper part of stem, elsewhere whitish, abundant, forming rings and girdles on the stem; flesh pale ochraceous brownish, violaceous at stem top; smell persistently fruity, recalling *C. traganus*; exsiccates with greyish brown cap, brown to fairly dark brown gills and greyish to lilac stem. Sp (9-)9.5-10.5 x 5.5-6.5 µm, ellipsoid, finely verrucose (fig. 749A), moderately dextrinoid. In mesic *Picea* forests and in suba. with *Betula*; late summer to autumn; occasional in middle bore.-suba., rare in hemib.-southern bore., very rare in temp.; DK (VU), FI (LC), NO (LC), SE (LC). – CFP A22 C50, M&J 36, Nyl 450, Sieniop 222, Svp 56:62.

*C. venustus* P. Karst. (*C. calopus* P. Karst.)

- Stem fleshy, clavate to bulbous, 50-110 x 9-20 mm, ± as long as the cap is wide 4
- 4. Cap pale lilac, later silvery grey; smell strong, fruity; sp mostly < 9.5 µm long. Cap 50-110 mm, hemispherical, then low convex, sometimes with a low and broad umbo, fleshy, slightly fibrillose, not hygrophanous; gills medium spaced, yellow brown, later vividly brown; stem 50-110 x 9-20 mm, distinctly fibrillose, pale lilac; universal veil abundant, forming woolly girdles; flesh saturated yellow brown, especially in the bulb; exsiccates whitish to whitish brownish, sometimes with lilac tints left in the universal veil. Sp 8-9(-9.5) x 5-6 µm, amygdaloid to slightly ellipsoid, moderately verrucose (fig. 749B), weakly dextrinoid. In dry to mesic coniferous forests, with *Pinus* and *Picea*; late summer to autumn; very common in hemib.-bore., very rare in temp.; DK (VU), FI (LC), NO (LC), SE (LC). – CFP C04, Phil 194a, R&H 508, Ves 353.

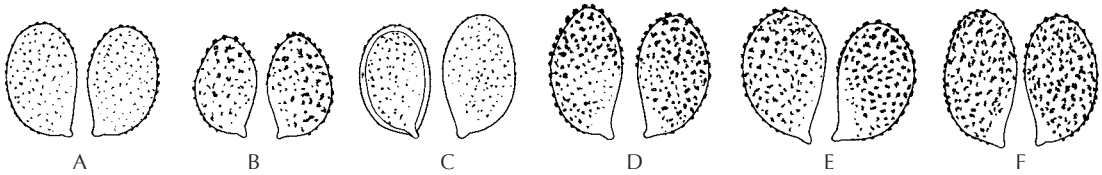
*C. traganus* (Fr.: Fr.) Fr. f. *traganus*

f. *ochraceus* M.M. Moser, Ammirati & M.T. Seidl lacks lilac colours. – Soop 04:28.

- Cap brick-red to dark vividly red brown; smell slightly raphanoid; sp mostly > 9.5 µm long *C. solis-occasus* key I 3
- 5. Universal veil grey to greyish brown, abundant. Cap 50-120 mm, hemispherical, then low convex, margin with greyish brown veil patches, fleshy, fibrillose-tomentose, pale grey to greyish brown, sometimes with violet or olivaceous tints, not hygrophanous; gills medium spaced, broad, brown; stem 60-130 x 10-25 mm, clavate to bulbous, greyish white, sometimes bluish at the top; universal veil abundant, forming girdles on the stem; flesh whitish violet, brownish towards base; smell faint, slightly sour; exsiccates with a greyish to (olivaceous) brownish cap, brown gills and rather pale, olivaceous-brownish stem. Sp 9.5-10.5 x 6-6.5 µm, ellipsoid, very finely verrucose, thick-walled (fig. 749C), strongly dextrinoid. In mesic *Picea* forests; late summer to autumn; occasional in middle-northern bore., rare in southern bore., very rare in hemib.; FI (LC), NO (NT), SE (LC). – CFP A53, M&J 32, Nyl 455, R&H 518, Sieniop 221.

*C. rusticus* P. Karst. (*C. canabarda* M.M. Moser)

- Universal veil whitish to brownish-yellowish, sparse or abundant 6



Spores: A: *Cortinarius venustus*, B: *C. traganus*, C: *C. rusticus*, D: *C. niveotraganus*, E: *C. torvus*, F: *C. agathosmus*.

6. Hygrophanous; with *Populus tremula*; smell indistinct or slightly raphanoid see *C. lucorum* key F 3
  - Hygrophanous or not; with *Picea*, *Betula*, *Quercus* or *Fagus*; smell distinctly fruity, recalling *C. traganus* or pleasant and somewhat fruity 7
7. Smell strong, unpleasant; cheilocystidia present see *C. camphoratus* 2
  - Smell distinctly fruity, recalling *C. traganus* or pleasant and somewhat fruity; without true cheilocystidia 8
8. Frb first whitish, later brownish; most sp < 6  $\mu\text{m}$  wide; with *Pinus*, *Picea* or *Betula* 9
  - Frb greyish brown to purplish brown; most sp > 6  $\mu\text{m}$  wide; with *Picea*, *Quercus* or *Fagus* 10
9. With *Betula*, early in the season, sometimes already in June; flesh brownish whitish, often with a bluish tint at stem top; sp 9-11 x 5.5-6(-6.5)  $\mu\text{m}$  (fig. 749D). Cap 40-90 mm, hemispherical, then low convex, with a low and broad umbo, when young covered with white fibrils, first white to greyish white, then brown, with hygrophanous streaks; gills medium spaced, whitish grey when young, often with a bluish tint, later brown; stem 60-110 x 9-15 mm, clavate, up to 25 mm broad at the base, first whitish, later brownish; universal veil white, often forming a sock-like sheath; flesh marbled hygrophanous; smell strong, fruity, recalling *C. traganus*; exsiccates greyish white to brownish grey with brown gills. Sp narrowly amygdaloid to somewhat ellipsoid, strongly verrucose, stronger at apex, dark, moderately dextrinoid. In deciduous forests and in wooded yards, often in planted *Betula* forests, mostly on somewhat rich soil; summer; rare in hemib.-suba.; FI, SE.  
*C. niveotraganus* Kytöv., Niskanen & Liimat. in press  
 Note: compare with *C. niveoglobosus* key I 6, which has smaller sp and not hygrophanous cap, and to *C. alboviolaceus* key L 8, which lacks smell and has silky shiny fibrillose cap and shorter and broader sp.
  - With *Pinus* or *Picea*, in August to October; flesh saturated yellow brown; sp 8-9(-9.5) x 5-6  $\mu\text{m}$  see *C. traganus* f. *ochraceus* 4
10. With *Fagus*, *Quercus*, *Tilia* and *Corylus*; frb usually stout and fleshy; stem clavate; universal veil forming a sock-like sheath and a collar or a ring. Cap 40-100 mm, hemispherical, then low convex, pinkish flesh brown to greyish brown, darker brown with age, when young covered with greyish white fibrils, slightly hygrophanous; gills distant, when young pale violaceous to greyish brown, later chocolate brown; stem 40-100 x 8-18 mm, robust, clavate and often tapering at the very base, greyish white, with a violaceous tint at the top; universal veil abundant, white to somewhat yellowish-brownish; flesh brownish white, violaceous at stem top; smell distinctly fruity, recalling *C. traganus*; exsiccates with greyish brown cap, dark gills and greyish stem, universal veil distinct, yellowish whitish. Sp 10-11.5 x 6-7(-7.5)  $\mu\text{m}$ , obovoid to broadly ellipsoid, moderately and densely verrucose, more strongly at apex (fig. 749E), moderately to fairly strongly dextrinoid. In forests on mull soil; autumn; very common in temp., occasional in hemib.; DK (LC), FI (LC), NO (LC), SE (LC). – CFP B13, Phil 195d, Ves 354, ☉.  
*C. torvus* (Fr.: Fr.) Fr.

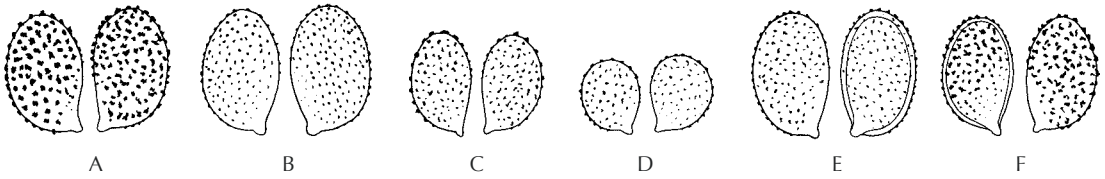
- With coniferous trees, very rarely *Betula*; frb more slender; stem long, mostly cylindrical; universal veil forming girdles on the stem 11
  - 11. Smell strong, fruity, recalling *C. traganus*; cap smooth and often radially wrinkled, hygrophanous; most sp < 6.5  $\mu\text{m}$  broad. Cap 40-80 mm, hemispherical, then low convex to plane, and with white veil remnants at margin, greyish violet to purplish brown; gills medium spaced, broad, pale greyish to violet, later more brownish; stem 60-130 x 6-15 mm, rather firm, whitish, violet at the top; universal veil white, abundant, forming often one complete ring and several incomplete girdles on the stem; flesh violet in stem top, yellowish brown towards base; exsiccates with brown cap, vivid brown gills and greyish stem. Sp 10-12 x 6-6.5  $\mu\text{m}$ , dacryoid-ellipsoid, fairly narrow, with a suprahilar depression, moderately verrucose (fig. 749F), moderately dextrinoid. In mesic *Picea* forests, very rarely under *Betula*, often on somewhat rich soil; late summer to autumn; occasional in bore., more common towards the northern parts, very rare in hemib.; FI (LC), NO (LC), SE (NT). – CFP A05.  
*C. agathosmus* Brandrud, H. Lindstr. & Melot
  - Smell faint, pleasant, not like *C. traganus*; cap fibrillose to finely scaly, with hygrophanous streaks; most sp > 6.5  $\mu\text{m}$  broad. Cap 30-80 mm, hemispherical, then low convex to plane, often with a low and broad umbo, greyish brown to purplish ochre brown; gills medium spaced to distant, dark violaceous, later more brownish; stem 60-130 x 5-11 mm, brownish-whitish with a violaceous tint; universal veil whitish to brownish-yellowish, rather abundant, forming distinct, incomplete girdles on the stem; flesh distinctly violaceous when young, later more brownish at stem base; exsiccates with fairly dark, greyish brown cap, dark gills and greyish brown stem. Sp 10-11.5 x 6.5-7  $\mu\text{m}$ , broadly ellipsoid, moderately verrucose, more strongly at apex (fig. 751A), moderately dextrinoid. In mesic *Picea* forests, often on somewhat rich soil; summer to autumn, often precocious; occasional in western middle-northern bore., rare in southern bore.; NO (NT), SE (NT). – CFP B22.  
*C. ionophyllus* M.M. Moser s. Brandrud et al. 1992
- Note: the name has been used collectively in the Nordic countries and type material has not been studied. A possibly continental species differs by 9-10.5 x 5.5-6.5  $\mu\text{m}$  sp; FI (LC), SE.

## Key H: Subgen. *Telamonia* sect. *Malachii* Melot

TUULA NISKANEN & ILKKA KYTÖVUORI

Frbs fleshy; cap 40-90 mm, innately fibrillose or finely scaly, fairly weakly hygrophanous; exsiccates often with a fairly dark, grey-brown cap. Two species in the key, but in addition at least one nameless species in the Nordic countries.

1. Cap finely scaly; flesh pale greyish white; sp (9.5-)10-11 x 6-7  $\mu\text{m}$  (fig. 751B). Cap 40-90 mm, hemispherical, then low convex to almost plane with a low and broad umbo, greyish brown, sometimes with a bluish tint, somewhat hygrophanous; gills medium spaced, pale greyish brown, sometimes with a bluish tint, later brown; stem 50-120 x 8-15 mm, cylindrical with a clavate to bulbous, up to 35 mm broad base, whitish fibrillose, often with a bluish tint at the top; universal veil white, forming a sock-like sheath when young, later forming incomplete, woolly girdles on stem; flesh bluish in stem top; smell indistinct; exsiccates with greyish brown to dark greyish brown cap, pale greyish brown stem and brown to fairly dark brown gills. Sp ellipsoid to weakly amygdaloid, finely verrucose, weakly to moderately dextrinoid; gill trama hyphae finely incrustated. In mesic *Picea* forests; late summer to autumn; occasional in hemib.-bore., but more common in oceanic areas; DK (LC), FI (LC), NO (LC), SE (LC). – CFP D54, D42, GCI B91, Nyl 453, R&H 509.  
*C. malachius* (Fr.) Fr.
- Cap smooth, but distinctly innately fibrillose; flesh greyish brown to brown; sp (7.5-)8-9 x 5-5.5  $\mu\text{m}$  (fig. 751C). Cap 40-90 mm, hemispherical, then low convex to almost plane with a low and broad umbo, often whitish greyish when young, later greyish brown, with pale fibers and dark hygrophanous streaks, becoming considerably darker with age; gills me-



Spores: A: *Cortinarius ionophyllus*, B: *C. malachius*, C: *C. suberi*, D: *C. balaustinus*, E: *C. laniger*, F: *C. solis-occasus*.

dium spaced, pale greyish brown, rarely with a bluish tint, later brown; stem 50-140 x 8-15 mm, cylindrical with a clavate, up to 30 mm broad base, whitish fibrillose, sometimes with a bluish tint at the top; universal veil white, fairly abundant, forming a sock-like sheath when young, later incomplete girdles on the stem; flesh sometimes bluish in stem top; smell indistinct; exsiccates with brown, silvery-grey or blackish grey cap, greyish stem with a white girdle and brown to blackish brown gills. Sp ellipsoid to weakly amygdaloid, finely to moderately verrucose, weakly to moderately dextrinoid; gill trama hyphae fairly finely, but distinctly incrustated. In dry to mesic coniferous forests with *Pinus* and *Picea*; late summer to autumn; common in hemib.-bore.; FI (LC), NO (LC), SE (LC). – Soop 04:21 22, M&J 145.

*C. suberi* Soop (*C. brunneogriseus* Soop)

Note: compare to *C. quarciticus* L 4, which has smooth cap, greyish white flesh and paler exsiccates.

**Key I:** Subgen. *Telamonina* sects *Balaustini* Moënné-Locc. & Reumaux, *Lanigeri* Melot and *Niveoglobosi* Kytöv., Liimat. & Niskanen in press

TUULA NISKANEN & ILKKA KYTÖVUORI

Frb often fleshy, usually without bluish tints; cap (30-)50-110(-130) mm, white, vividly yellow brown to dark brick red, not hygrophanous or hygrophanous; universal veil white or cream, rarely bluish; smell indistinct or slightly raphanoid.

1. Sp subglobose (fig. 751D); stem 5-12 mm broad, cylindrical to very slightly clavate; cap slightly hygrophanous, soon drying and then with hygrophanous streaks and innate fibres. Cap 30-80 mm, hemispherical to low convex, for long with an incurved margin, smooth, vivid yellow brown to orange brown; gills medium spaced, yellow brown to red brownish; stem 50-110 x 5-12 mm, white fibrillose, later more brownish; universal veil white, sparse; flesh pale ochraceous yellow; smell slightly raphanoid; exsiccates with fairly pale, greyish flesh-coloured cap and often dark gills. Sp 5.5-6.5 x 4.7-5.2  $\mu\text{m}$ , moderately verrucose, index-trinoid or very weakly dextrinoid; epicutis hyphae with dark brown granules or particles in Melzer. In deciduous and mixed forests with *Betula* and *Fagus*; late summer to autumn; common in bore, occasional in hemib. and suba.; FI (LC), NO (LC), SE (LC). – CFP B40.

*C. balaustinus* Fr.

Note: compare with *C. illuminus* key F 15, which grows with *Picea*, has vividly red-brown, strongly hygrophanous cap and does not have dark brown granules in epicutis hyphae.

- Sp fusiform, amygdaloid or ellipsoid; stem 8-22 mm broad, fleshy, slightly clavate to clavate; cap hygrophanous or not 2
- 2. Most sp > 9.5  $\mu\text{m}$  long; cap brick red to dark vividly brown, not hygrophanous; with coniferous trees 3
- Most sp < 9.5  $\mu\text{m}$  long; cap white, warm yellow brown or brick red, hygrophanous or not; usually with *Betula* or *Populus* 4
- 3. Frb without a lilac tint; universal veil white, usually abundant and woolly; cap fibrillose to tomentose to finely scaly, pale brick red to deep red brown; stem usually long compared to the



cap diam.; sp ellipsoid (fig. 751E). Cap 40-90 mm, hemispherical to low convex, sometimes with a low and broad umbo, fleshy; gills medium spaced, vivid brick red; stem 60-150 x 8-16 mm, usually cylindrical with a clavate base, whitish fibrillose, later more red brownish; universal veil forming a ring and girdles on the stem; flesh pale reddish brown; smell slightly raphanoid; exsiccates with fairly dark, brown to somewhat greyish brown cap and greyish white stem. Sp 10-11.5(-12) x 6-6.5(-7)  $\mu\text{m}$ , fairly finely to moderately and densely verrucose, thick-walled, strongly dextrinoid; gill trama densely hyphae spot-like incrustated. In mesic *Picea* forests, also in *Pinus* heathland with solitary *Picea*; late summer to autumn; common in hemib.-bore., very rare in temp.; DK (NA, EJyl: Addit Næs), FI (LC), NO (LC), SE (LC). – CFP C53 (big cap on the left is *C. solis-occasus*), GCI D123 (lower photo), M&J 76, Nyl 457, R&H 518, Sieniop 204.

*C. laniger* Fr.

- Universal veil and stem top usually lilac when young, later whitish, lilac tints most constant on cap margin; cap smoother, finely fibrillose, brick red to dark vividly red brown, often with purplish tints; stem stout, short compared to the cap diam.; sp somewhat amygdaloid (fig. 751F). Cap 40-110 mm, hemispherical to low convex, margin with pale lilac universal veil when young; gills medium spaced, vivid ochre brown, later more red brown; stem 50-90 x 8-20 mm, clavate, fleshy, whitish fibrillose, later more reddish brown, often with a bluish tint at the top; universal veil usually forming one ring and a sparse sheath which disappears with age; flesh pale reddish brown, usually with a bluish tint at stem top; smell slightly raphanoid; exsiccates with fairly dark brown, sometimes greyish brown cap and greyish white stem. Sp 9.5-10.5(-11) x 6-6.5(-7)  $\mu\text{m}$ , moderately to rather strongly verrucose, more strongly at apex, somewhat thick-walled, strongly dextrinoid; gill trama hyphae somewhat spot-like incrustated. In mesic *Picea* forests, also in *Pinus* heathland with solitary *Picea*, on calcareous soil; late summer to autumn; rare in hemib.-bore.; FI, NO (LC), SE (NA). – CFP C20, Nyl 458.

*C. solis-occasus* Melot

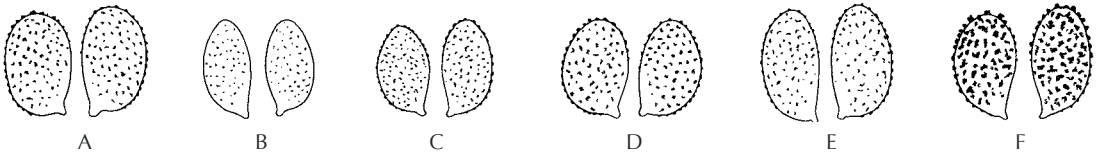
Note: type material has not been studied and the interpretation follows Brandrud et al. 1994.

4. Cap slightly hygrophanous; sp ellipsoid (fig. 753A). Cap 40-90 mm, hemispherical to low convex, smooth, fleshy, innately fibrillose, warm yellow brown to orange brown, often with tiny holes made by insects; gills medium spaced, pale greyish apricot brown when young, later vividly red brown; stem 60-130 x 9-18 mm, clavate, whitish fibrillose, later more apricot brown; universal veil white, forming often one ring and a sparse sheath or zones which disappear with age; flesh pale brownish; smell slightly raphanoid; exsiccates with brown to dark brown cap and greyish white stem. Sp 8.5-9.5 x 5.5-6  $\mu\text{m}$ , moderately verrucose, moderately to strongly dextrinoid; gill trama hyphae somewhat spot-like incrustated. In deciduous and mixed forests, but also in parks and forested yards with *Betula*; late summer to autumn; common in hemib.-suba., rare in temp.; DK (LC), FI (LC), IS, NO (LC), SE (LC). – CFP B30, R&H 519, Sieniop 191.

*C. bivelus* (Fr.: Fr.) Fr.

- Cap not hygrophanous; sp fusiform to amygdaloid (figs 751B-D) 5
- 5. Cap at first pale brownish to almost cream, later brick red; exsiccates with a fairly dark, greyish brown cap; sp  $Q > 1.7$  (fig. 753B). Cap 50-110 mm, hemispherical to low convex, with a long incurved margin, often with big, cream-coloured veil patches near the margin, fleshy, not hygrophanous; gills medium spaced, greyish red brown when young, later brick red; stem 60-150 x 9-16 mm, clavate, whitish fibrillose, later more reddish brown, often with bluish tints at the top, at least when young; universal veil cream, forming girdles and zones on the stem; flesh pale brownish, with bluish tints at stem top; smell slightly raphanoid. Sp 7-8 x 4-4.5  $\mu\text{m}$ , fusiform, finely verrucose, weakly dextrinoid. In deciduous and mixed forests and in road sides with *Betula*; late summer to autumn; occasional in hemib.-suba., more common in northern part, rare in temp.; DK (VU), FI (LC), NO (NE), SE (LC). – CFP E21,





Spores: A: *Cortinarius bivelus*, B: *C. alborufescens*, C: *C. niveoglobosus*, D: *C. alboglobosus*, E: *C. duracinus* s. Kytövuori & Niskanen, F: *C. duracinus* s. lato.

Nyl 467, Sieniop 187, Soop 04:13, Svp 56:59, 60.

*C. alborufescens* Immler s. Brandrud et al. 2008 (incl. *C. cremeolaniger* P.D. Orton, *C. pearsonii* P.D. Orton)

- Cap first white, later brownish; exsiccates whitish grey to brownish, usually with dark gills; sp Q < 1.7 (fig. 691D-E) 6
- 6. Sp 7-8.5 x 4.3-5 µm (fig. 753C). Cap 50-100 mm, hemispherical to low convex, smooth, first whitish, later brownish, not hygrophanous; gills crowded to medium spaced, pale greyish brown later darker; stem 40-90 x 10-22 mm, clavate, fleshy, whitish fibrillose, later brownish; universal veil white, rather sparse, forming often a sock-like sheath or broad zones on the stem; flesh pale greyish brown; smell not known. Sp narrowly amygdaloid to slightly fusiform, fairly finely verrucose, fairly weakly dextrinoid. In mixed forests, presumably associated with *Populus*, often on calcareous soil; late summer to autumn; poorly known, presumably very rare in bore.; FI, SE. – CFP B54.  
*C. niveoglobosus* H. Lindstr. (*C. pseudorusticus* Bidaud)  
 Note: the IUCN classification of the species in SE refers to another species. The true *C. niveoglobosus* has only been confirmed from two localities in the Nordic countries
- Sp 7.5-9 x 5-6 µm (fig. 753D). Cap 50-100 mm, hemispherical to low convex, smooth, first whitish, later brownish, not hygrophanous; gills crowded to medium spaced, pale greyish brown, later darker; stem 40-90 x 10-20 mm, slightly clavate, fleshy, whitish fibrillose, later brownish; universal veil white, fairly abundant, forming floccose girdles and zones; flesh pale greyish brown; smell fruity. Sp amygdaloid, finely to moderately verrucose, fairly weakly to moderately dextrinoid. In mixed forests, presumably associated with *Betula*; late summer to autumn; poorly known, presumably rare in bore.-suba.; FI, SE.  
*C. alboglobosus* Kytöv., Liimat. & Niskanen in press  
 Note: compare with *C. argillaceosericeus* key L 5, which has an innately fibrillose cap with hygrophanous streaks, narrower sp and grows with *Picea* or *Pinus*.

## Key J: Subgen. *Telamonia* sects *Bicolores* (M.M. Moser) Melot and *Duracini* Melot TUULA NISKANEN & ILKKA KYTÖVUORI

Frb often with violet tints; cap 25-90 mm, in most species 40-80 mm, strongly hygrophanous, yellowish brown to chocolate brown; stem radicating or cylindrical; universal veil white; smell indistinct, like cedar-wood, raphanoid or cellar-like, sp often somewhat fusiform. Seven species in the key. The real number of the species might double that and especially sect. *Duracini* is poorly studied. The identity of the names *C. candelaris* Fr., *C. licinipes* Fr., *C. scutulatus* (Fr.) Fr. and *C. imbutus* Fr. var. *vilior* P. Karst. is unclear, and they are not included in the key.

1. Stem radicating and cartilaginous, whitish 2
- Stem not radicating or flesh with distinct violet tints 3
2. Sp narrowly ellipsoid to somewhat fusiform, moderately verrucose (fig. 753E); in coniferous forests. Cap 45-70 mm, conical, later low conical, sometimes with an umbo, caramel to brown, strongly hygrophanous; gills medium spaced, pale greyish brown, later brown;

stem 80-170 x 8-15 mm, whitish silky-fibrillose, later pale brown; universal veil white, very sparse; flesh pale whitish brown; smell slightly raphanoid; exsiccates with brown, often black-centred cap and brownish white stem. Sp 8.5-9.5 x 5-5.5  $\mu\text{m}$ , moderately to fairly strongly dextrinoid. In mesic *Picea* forests, on rich to calcareous soil, often solitary; late summer to autumn; occasional in hemib.-bore.; FI (LC), NO, SE.

*C. duracinus* Fr. s. Kytövuori & Niskanen

Note: the name has been used collectively in the Nordic countries, the most common taxon in coniferous forests is presented above.

- Sp dacryoid to narrowly obovoid-ellipsoid, often strongly verrucose (fig. 753F); in coniferous and deciduous forests. Cap 30-70 mm, hemispherical to conical, later low conical, sometimes with an umbo, brownish, strongly hygrophanous; gills medium spaced, pale greyish brown, later brown; stem 50-160 x 6-14 mm, whitish silky-fibrillose, sometimes with a bluish tint at top, later pale brown; universal veil white, very sparse; flesh pale whitish brown; smell indistinct or raphanoid; exsiccates with brown to dark brown cap and brownish white stem. Sp 7.5-10 x 4.5-6  $\mu\text{m}$ , moderately to fairly strongly dextrinoid. Solitary or fasciculate; autumn; occasional in temp.-bore.; FI, NO (LC), SE. – CFP C28.

*C. duracinus* Fr. s. lato (non s. Kytövuori & Niskanen)

Note: the species in deciduous forests remind of *C. acetosus* key K 2, which has a smell of iodoform.

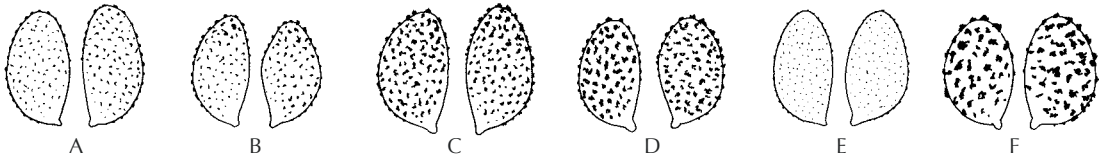
3. Smell faint of cedar wood 4
- Smell indistinct, radish-like or cellar-like as in *Russula adusta* 5
4. Flesh whitish, distinctly violet in stem top; in coniferous forests, in damp depressions, often in *Sphagnum*; sp 9-10.5 x 5-6  $\mu\text{m}$ , amygdaloid to ellipsoid (fig. 755A). Cap 25-70 mm, hemispherical, then low convex with down-curved margin, chocolate brown to dark purplish brown, strongly hygrophanous; gills medium spaced, saturated red brown, darkening with age; stem 70-120 x 5-10 mm, cylindrical, violet at the top; universal veil white; exsiccates with rather dark brown cap, brown gills, greyish white stem and white mycelium. Sp fairly faintly to moderately verrucose, fairly weakly to moderately dextrinoid; gill trama hyphae strongly incrustated. In mesic to damp *Picea* forests, usually in *Sphagnum*; late summer to autumn; common in hemib.-bore.; FI (LC), NO (LC), SE (LC). – CFP A06, Jordst 10(1).

*C. tortuosus* (Fr.: Fr.) Fr.

- Flesh whitish brown, rarely faintly violet in stem top; in mesic to dry coniferous forests; sp 8-9(-9.5) x 4.5-5.5  $\mu\text{m}$ , fusiform with a suprahilar depression (fig. 755B). Cap 30-80 mm, hemispherical, then low convex with a low and broad umbo, margin usually with white universal veil patches, dark red brown, often with a lighter ring around the umbo due to the drying, strongly hygrophanous; gills medium spaced, saturated red brown; stem 50-110 x 5-13 mm, cylindrical; universal veil white, mycelium white; exsiccates with rather dark brown cap, (dark) brown gills, greyish white stem and cream-coloured mycelium. Sp moderately verrucose, more strongly at apex, weakly dextrinoid. In dry to mesic coniferous forests with *Pinus* and *Picea*, most typically in dry *Pinus* heath forests on sandy soil; late summer to late autumn; common in hemib.-bore., very rare in temp.; DK (NA, EJyl: Skagen Klitpl), FI (DD), NO (NE), SE (LC). – CFP D52.

*C. dolabratus* Fr.

5. Sp obovoid-ellipsoid, 10-11(-11.5) x 6-7  $\mu\text{m}$ ; with *Quercus*, *Tilia* or *Corylus*  
see *C. serratissimus* key F 3
- Sp fusiform, amygdaloid or ellipsoid, < 6.5  $\mu\text{m}$  wide; with coniferous or deciduous trees 6
6. At least base of the stem violet; most sp > 5.5  $\mu\text{m}$  wide 7
- Only top of the stem violet; most sp < 5.5  $\mu\text{m}$  wide 8
7. In coniferous forests, often in *Sphagnum*, also in subalpine *Betula* forests; smell indistinct; sp 9.5-11 x 5.5-6.5  $\mu\text{m}$ , amygdaloid to somewhat fusiform, moderately verrucose (fig. 755C), fairly weakly dextrinoid. Cap 30-90 mm, convex, later low convex to broadly conical with



Spores: A: *Cortinarius tortuosus*, B: *C. dolabratus*, C: *C. evernius*, D: *C. cagei*, E: *C. imbutus*, F: *C. acetosus*.

an umbo, somewhat finely scaly with age, dark red brown to purplish brown, strongly hygrophanous and fairly soon drying very pale; gills often broad, medium spaced to distant, purplish brown, with distinctly paler edge; stem 70-150 x 5-15 mm, tapering downwards, usually stiff, violet over entire length, at least when young; universal veil white, forming distinct zones and girdles; mycelium white; flesh brownish in cap, violet in stem; exsiccates with pale brown cap, dark gills and greyish white stem with distinct cream-white universal veil zones. In damp to mesic *Picea* forests; summer to autumn; very common in hemib.-bore., rare in temp.; DK (LC), FI (LC), NO (LC), SE (LC). – CFP A11, Nyl 469, R&H 520, Sieniop 200.

*C. evernius* (Fr.: Fr.) Fr.

- In hemib.-temp. deciduous forests; smell cellar- or radish-like; sp 8.5-9.5(-10) x 5.5-6  $\mu$ m, amygdaloid to slightly ellipsoid, strongly verrucose (fig. 755D), moderately to strongly dextrinoid. Cap 15-60 mm, conical then low convex with an umbo, red brown, strongly hygrophanous and soon drying very pale; gills medium spaced, pale chocolate brown to purplish brown; stem 40-100 x 5-9 mm, cylindrical or tapering downwards, violet when young, later  $\pm$  violet at the base; universal veil white, sparse; mycelium white; flesh red brown in the cap,  $\pm$  violet in the stem; exsiccates with greyish to yellowish brown cap, brown gills, darker in young frb, stem yellowish to greyish white. In deciduous forests with *Fagus*, *Tilia* and *Corylus*, on rich soil; late summer to autumn; rare in temp.; DK (vu), NO (vu), SE (vu). – CFP D48, GCI A15, Nyl 469, RdM 41:12.

*C. cagei* Melot (*C. bicolor* Cooke nom. illeg.)

Note: there might be several closely related species in the Nordic countries. Type material has not been studied, and the interpretation follows Brandrud et al. 1998

8. Smell strong, cellar-like; with coniferous trees; exsiccates with a yellow to red-brown cap. Cap 30-90 mm, convex, then low convex to almost plane with undulate margin, dark red brown, strongly hygrophanous, soon drying very pale; gills often broad, distant, dark brown to purplish brown; stem 50-120 x 7-15 mm, cylindrical or slightly clavate, sometimes tapering; universal veil white, sparse; mycelium white; exsiccates with brown gills, yellowish or greyish white stem and white mycelium. Sp 9.5-10.5 x 5-5.5  $\mu$ m, fusiform, fairly faintly verrucose, stronger at apex (fig. 755E), weakly dextrinoid. In mesic *Picea* forests, often on somewhat rich soil; late summer to autumn; occasional in hemib.-bore., presumably less common towards the eastern parts; FI (LC), NO (NE), SE (LC). – CFP D60.

*C. imbutus* Fr.

Note: the name has been used collectively in the Nordic countries.

- Smell indistinct; with deciduous trees; exsiccates with dark greyish brown, sordid brown or blackish brown cap see key H p. 750

**Key K:** Subgen. *Telamonina* sects *Obtusi* Melot and *Acetosi* (Moënné-Locc. & Reumaux) Niskanen, Liimat. & Kytöv. in press TUULA NISKANEN & ILKKA KYTÖVUORI

Frb without bluish tints; cap warm yellow brown, red brown to dark brown, strongly hygrophanous; stem cylindrical or rooting, whitish, at least when young; universal veil white, sometimes very indistinct; smell at the base of stem iodoform-like, best observed when slightly dried. Five

species in the key, but the real number of the Nordic species is much higher. *Obtusi* species growing in deciduous forests are not in the key.

Suppl. lit.: Bidaud et al. 2003.

1. Flesh white to yellowish white, yellowing with age or handling; stem 4-14 mm broad; usually under deciduous trees, rarely under conifers, mainly in temp.-hemib.; most sp > 5.5  $\mu$ m broad 2
  - Flesh yellow brown; stem 1.5-6 mm broad; in coniferous and sometimes in deciduous forests, in temp.-bore.; most sp < 5.5  $\mu$ m broad 3
2. Cap red brown; smell iodoform-like or pleasant cellar-like; sp (8.5-)9-10(-10.5) x 5.5-6.5  $\mu$ m, ovoid to amygdaloid (fig. 755F). Cap 35-70 mm, conical, later low convex with an obtuse umbo, often somewhat rimy at the centre, sometimes narrowly pellucid-striate, strongly hygrophanous and fairly soon drying very pale; gills distant, waxy, brown, with white edge; stem 60-110 x 7-14 mm, rooting, often hard, whitish; universal veil white, very sparse; flesh yellowish white, yellowing with age or handling; exsiccates with pale brown to brown cap and brownish white stem. Sp very strongly verrucose, moderately to strongly dextrinoid; gill trama hyphae distinctly incrustated. With *Quercus*, *Tilia*, *Fagus* and *Corylus* on mull soil, often in groups or fasciculate; summer to autumn, often precocious; rare, but locally occasional in temp.-hemib., very rare in southern and middle bore.; DK (vu), FI (LC), NO (LC), SE. – GCI C3, Soop 04:71.

*C. acetosus* (Velen.) Melot (*C. rigens* (Pers.) Fr. s. J.E. Lange)

Note: compare with species in sect. *Duracini* p. 753, which lack the smell of iodoform. Taxonomy in the Nordic countries needs further studies.

- Cap brown to dark brown; smell in gills distinct, like cedar-wood, at the base of stem like iodoform; sp 7-8 x 5.5-6  $\mu$ m, ovoid-subglobose (fig. 757A). Cap 15-50(-60) mm, hemispherical, later low convex with an obtuse umbo, often somewhat rimy at the centre, narrowly pellucid-striate, hygrophanous; gills distant, pale brown, later brown, with white edge; stem 30-100 x 4-7 mm, cylindrical to somewhat rooting, white; universal veil white, very sparse; flesh whitish; exsiccates with dark brown cap and brownish white stem. Sp moderately verrucose, weakly dextrinoid; gill trama hyphae finely incrustated. In mixed forests of *Corylus*, *Pinus*, *Quercus*, *Abies alba* and *Betula* or mixed *Fagus* forests, mycorrhizal associate unknown, on calcareous soil; summer to autumn; very rare in temp.-hemib.; DK (EN, EJyl: Pamhule), NO (vu, Oslo, Hord: Kvam), SE. – AC 14:473, Svp 56:61.

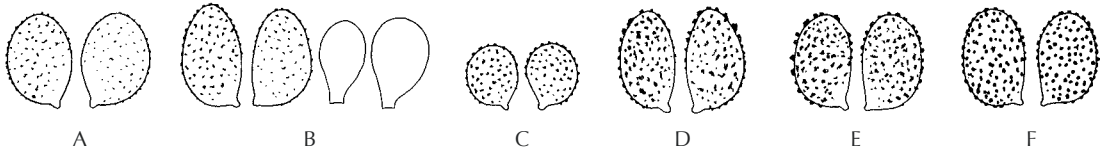
*C. fragrantior* Gaugué s. auct.

Note: type material has not been studied.

3. Frb *Galerina*-like; cap distinctly conical, with an acute umbo; sp 8-9(-9.5) x 4.5-5.5  $\mu$ m, ovoid to broadly amygdaloid, weakly to moderately verrucose (fig. 757B), weakly dextrinoid. Cap up to 2/3 pellucid-striate, yellow brown to pale red brown, strongly hygrophanous and fairly soon drying very pale; gills medium spaced, yellowish brown, with white edge; stem 25-60 x 1.5-3 mm, cylindrical, whitish fibrillose, soon yellowish brown; universal veil white, fairly sparse; flesh yellow brown; smell at the base of stem iodoform-like, best observed when slightly dried; exsiccates with yellow-brown to dark brown cap and pale greyish brown to yellow-brown stem. Gill trama hyphae distinctly incrustated; gill edge often with numerous, balloon-shaped, sterile cells. In mesic to damp, often somewhat eutrophic coniferous forests with *Picea*, often in low depressions, on needle litter or between low mosses, often in groups; summer to autumn; common in temp.-bore.; DK (LC), FI (LC), NO (LC), SE (LC). – CFP C46, GCI C7, M&J 43, Nyl 475.

*C. acutus* (Pers.) Fr.

- Frb not so *Galerina*-like; cap conical, bell-shaped to low convex; sp subglobose, amygdaloid or ellipsoid, moderately to strongly verrucose, moderately to strongly dextrinoid 4



Spores and cheilocystidia: A: *Cortinarius fragrantior*, B: *C. acutus*, C: *C. trossingenensis*, D: *C. obtusus* s. lato, E: *C. albovariegatus*, F: *C. rubrovioleipes*.

4. Sp (4.5-)5-5.5 x 4-4.5  $\mu\text{m}$ , subglobose (fig. 757C); cap 5-25 mm, usually without an umbo. Cap hemispherical, later low convex to almost plane, up to 1/3 pellucid-striate, red brown to dark red brown, strongly hygrophanous; gills medium spaced, yellowish brown, with white edge; stem 20-45 x 2-4 mm, cylindrical, white, soon yellowish brown to red brown; universal veil white, fairly sparse; flesh yellowish brown; smell at the base of stem weak, iodoform-like, best observed when slightly dried; exsiccates with brown to dark red-brown cap and pale greyish brown to yellow-brown stem. Sp moderately verrucose, moderately dextrinoid; gill trama hyphae very strongly zebra-striate and spot-like incrustated. In mesic coniferous forests with *Picea*, in needle litter or mosses, often in groups; summer, rarely later in the season; rare in hemib.-bore., but possibly overlooked; FI (LC), SE (LC). – CFP C39.

*C. trossingenensis* Melot s. lato

Note: type material has not been studied, and the interpretation follows Brandrud et al. 1994.

- Sp > 7  $\mu\text{m}$  long, amygdaloid or ellipsoid; cap 10-50 mm, often with an umbo 5
5. Sp (7.5-)8-9 x 4.5-5  $\mu\text{m}$ , amygdaloid (fig. 757D). Cap 20-50 mm, conical, often with an umbo, bell-shaped to hemispherical, up to 1/2 pellucid-striate, vividly red brown to dark red brown or yellow brown, strongly hygrophanous and fairly soon drying very pale; gills medium spaced, yellowish brown, often with white edge; stem 40-100 x 3-6 mm, cylindrical or rooting, white, soon yellowish brown; universal veil white, fairly sparse; smell at the base of stem often first raphanoid then iodoform-like, best observed when slightly dried; exsiccates with brown to dark red-brown cap and pale greyish brown stem. Sp strongly verrucose, moderately to strongly dextrinoid; gill trama hyphae distinctly incrustated. In mesic to damp coniferous forests with *Picea*, sometimes with *Pinus*, *Betula* and *Salix* dwarf shrubs, in needle litter or mosses; summer to late autumn, often precocious; very common in temp.-bore., occasional in suba.-arc. / alp.; DK (LC), FI (LC), IS, NO (LC), SE (LC). – CFP C57.

*C. obtusus* (Fr.: Fr.) Fr. s. lato

Note: the name has been used very collectively in the Nordic countries. Some photos of *C. obtusus*, e.g. Sieniop 209 and Ves 357 may represent other species.

- Sp 7.5-8.5 x 5-5.5  $\mu\text{m}$ , ellipsoid (fig. 757E). Cap 10-40 mm, conical, later low conical with an acute umbo, up to 1/2 pellucid-striate, red brown to dark red brown, strongly hygrophanous; gills medium spaced, yellowish brown, with white edge; stem 40-90 x 4-8 mm, cylindrical, first whitish, soon yellowish brown to reddish brown; universal veil white, forming complete and incomplete girdles on stem; flesh yellowish brown; smell at base of stem weak, iodoform-like, best observed when slightly dried; exsiccates with brown to dark red-brown cap and pale greyish brown to yellow-brown stem. Sp fairly strongly verrucose, moderately to fairly strongly dextrinoid; gill trama hyphae strongly zebra-striate and spot-like incrustated. In mesic to damp coniferous forests with *Picea*, often in groups; summer, less frequent later in the season; presumably occasional in hemib.-bore., poorly known; DK (LC), FI (LC), SE. – CFP A27.

*C. albovariegatus* (Velen.) Melot

Note: the taxonomy is unclear. Type material has not been studied, and the interpretation follows Brandrud et al. 1989.



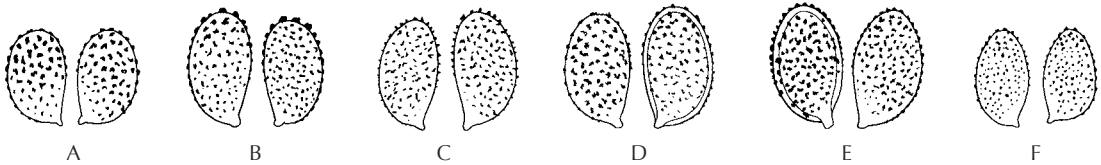
**Key L:** Subgen. *Telamonia* sects *Firmiores* (Fr.) Henn. (*Armeniaci* (M.M. Moser) Melot), *Urbici* Liimat., Niskanen & Kytöv. in press and *Boulderenses* Liimat., Niskanen & Kytöv.

TUULA NISKANEN & ILKKA KYTÖVUORI

Cap 40-90 mm, often slightly viscid-sticky when moist, strongly hygrophanous or with hygrophanous streaks, smooth; flesh in the stem often very pale, greyish white, brownish white to pale greyish brown; universal veil white or vividly red; smell often indistinct, in some species slightly fruity or raphanoid; exsiccates with pale brownish to brownish cap; sp amygdaloid to ellipsoid. 11 species in the key, but more species occur in the Nordic countries.

Note: If a species does not match here see also key F.

1. Universal veil yellow, pinkish or vividly red 2  
 - Universal veil white 3
2. Universal veil vivid red; stem  $\pm$  blue; sp ellipsoid (fig. 757F). Cap 20-60 mm, convex, soon low convex with a low and broad umbo, silky whitish fibrillose at margin, especially when young, red brown to dark red brown, strongly hygrophanous; gills medium spaced, pale greyish to yellowish brown, with age cinnamon brown; stem 45-90  $\times$  7-13 mm, cylindrical or slightly clavate, fibrillose; universal veil fairly abundant, in a continuous coating on basal part of the stem or forming belts or zones; flesh pale yellowish to greyish brown, bluish in the cortex; smell indistinct; exsiccates with a yellow-brown to light red-brown cap, red universal veil still visible on the stem. Sp (7.5-)8-9  $\times$  5-5.5(-6)  $\mu$ m, fairly finely verrucose, dextrinoid to strongly dextrinoid. In mesic *Picea* forests; late summer to autumn; very rare in bore.; FI, NO (EN, Oppl: Nordre Land). – Kar 46:2, Sienil 58:101.  
*C. rubrovioleipes* Bendiksen & K. Bendiksen  
 - Universal veil pale pinkish or yellow; stem whitish, later brownish; sp subglobose 15  
see *C. illuminus* key F
3. Cap whitish, greyish or bluish, with hygrophanous streaks 4  
 - Cap yellow brown, red brown to fairly dark brown, strongly hygrophanous 9
4. With *Pinus*; cap with distinct, broad and narrow, hygrophanous streaks and spots; sp 7.5-8.5  $\times$  4.8-5.3  $\mu$ m (fig. 759A). Cap 40-90 mm, hemispherical, then low convex to almost plane with a low and broad, often flattened umbo, silky shiny fibrillose, sometimes viscid-sticky when moist, pale greyish, later yellowish grey, at least at the centre; gills crowded to medium spaced, pale yellowish brown, sometimes with a bluish tint, later fairly vividly brown; stem 50-120  $\times$  8-15 mm, cylindrical with a bulbous to clavate, up to 35 mm broad base, often somewhat widening towards the top and with a bluish tint, silky whitish fibrillose, with hygrophanous streaks; universal veil white, fairly sparse, sometimes forming girdles on stem; flesh pale greyish white; smell indistinct; exsiccates greyish to pale greyish brown, with brown gills. Sp slightly obovoid to ellipsoid, fairly strongly verrucose, fairly thin-walled, moderately dextrinoid. In dry *Pinus* heath forests, especially on sandy soil; late summer to late autumn; common in hemib.-bore., less common in western parts, rare in temp.; DK (VU), FI (LC), NO (LC), SE (LC). – CFP C59 (1st, 2nd, 3rd and 5th frb from the left are *C. suberi*), M&J 145, Jordst 14(1) (as *pseudomalachius*), Sieniop 213.  
*C. quarciticus* H. Lindstr.  
 Note: compare with *C. suberi* key H 1, which has distinctly innately fibrillose cap, greyish brown flesh and brown to greyish black exsiccates.  
 - Usually with *Picea* or deciduous trees; cap with very fine pattern of silky, pale, superficial threads and hygrophanous streaks; sp > 8.5  $\mu$ m long 5
5. With coniferous trees, on calcareous soil. Cap 40-90 mm, convex, soon low convex to almost plane with a low umbo, silky shiny, innately fibrillose, white to pale brownish grey, with hygrophanous streaks; gills medium spaced, pale greyish to yellowish brown, later more




Spores: A: *Cortinarius quarciticus*, B: *C. argillaceosericeus*, C: *C. urbicus*, D: *C. albobviolaceus*, E: *C. turgidus*, F: *C. carneinatus*.

brownish; stem 45-90 x 6-15 mm, clavate or cylindrical, whitish silky-fibrillose; universal veil white, fairly sparse, in young frb often forming a thin sheath over the lower half of stem, disappearing very easily when thumbed; flesh pale greyish brown; smell faint, slightly fruity in gills, raphanoid in flesh; exsiccates with fairly dark, greyish cap, greyish white stem and brown to dark brown gills. Sp (8-)8.5-9.5 x 5-5.5(-6)  $\mu\text{m}$ , obovoid-ellipsoid, finely to moderately verrucose, more strongly at apex (fig. 759B), weakly to moderately dextrinoid; gill trama hyphae smooth to very finely incrustated. In mesic to dry forests; late summer to autumn; rare in eastern hemib.-bore.; FI (NT), SE (LC). – Soop 04:23 (as *diosmus*). *C. argillaceosericeus* Kytöv., Niskanen & Liimat. in press (*C. diosmus* Kühner s. Soop)

Note: compare with *C. niveoglobosus* and *C. alboboglobosus* key I 6 which have smooth, not hygrophanous cap and grow with deciduous trees.

- With deciduous trees, on acid to calcareous soil 6
- 6. Sp 8.5-9.5 x 5-5.5  $\mu\text{m}$  (fig. 759C), weakly to moderately dextrinoid. Cap 35-80 mm, convex, soon low convex to almost plane with a low umbo, silky shiny, innately fibrillose, white to pale brownish grey, with hygrophanous streaks; gills medium spaced, pale greyish to yellowish brown, later more brownish; stem 45-90 x 6-13 mm, clavate or cylindrical, whitish silky-fibrillose; universal veil white, fairly sparse, in young frb often forming a thin sheath over the lower half of stem; flesh pale greyish; smell faint, slightly fruity in gills, raphanoid in flesh; exsiccates with greyish cap, greyish white stem and brown to dark brown gills. Sp ellipsoid to obovoid-ellipsoid, finely to moderately and somewhat sharply verrucose, weakly to moderately dextrinoid; gill trama hyphae smooth to very finely incrustated. In deciduous and mixed forests, with *Betula*, *Corylus* and *Tilia*, often on rich to calcareous mull soil; late summer to autumn; rare in temp.-hemib.; DK (EN), FI (DD), NO (NT), SE (LC). – CFP C07.  
*C. urbicus* (Fr.) Fr.  
Note: *C. chevassutii* Rob. Henry with a marginate bulb is reported as very rare from the Nordic countries, but the taxonomy and nomenclature need further studies. Compare with *C. niveotraganus* key G 9, which has bigger sp and *C. traganus*-like smell, and *C. albobviolaceus* key L 8, which has a indistinct smell, often bluish tints in frb and strongly dextrinoid sp.
- Sp > 5.5  $\mu\text{m}$  wide, fairly strongly to strongly dextrinoid 7
- 7. Smell indistinct or pleasant, recalling flowers; flesh whitish brownish to pale greyish brown; exsiccates with pale greyish brown cap and stem, and dark gills see *C. aprinus* key F 8
- Smell indistinct; flesh whitish to whitish blue; exsiccates greyish white to pale greyish brown, with brown gills 8
- 8. With *Betula* and *Fagus*, possibly also *Tilia* and *Quercus*; at least young frb  $\pm$  with bluish colours; stem 50-120 x 5-10 mm, clavate. Cap 35-85 mm, hemispherical, then low convex to almost plane with a low and broad umbo, silky shiny, finely innately fibrillose, sometimes viscid-sticky when moist, pale silvery bluish grey to almost white, later ochraceous to greyish white; gills medium spaced, pale greyish brown with a bluish tint, later fairly vivid brown; stem silky whitish fibrillose, pale bluish white, later yellowish; universal veil whit-

ish, fairly thin, forming incomplete girdles on the stem; flesh whitish blue, later and towards base of the stem yellowish; smell indistinct; exsiccates very pale, greyish brown, often with vividly brown gills. Sp 8.5-10 x (5.5-)6-6.5  $\mu\text{m}$ , ellipsoid, thick-walled, moderately verrucose (fig. 759D). In deciduous and mixed forests; summer to autumn; very common in hemib.-suba., common in temp.; DK (LC), FI (LC), IS, NO (LC), SE (LC). – CFP A59, Phil 189f, R&H 510, Sieniop 187, Ves 352, .

*C. alboviolaceus* (Pers.: Fr.) Fr.

- With *Fagus*; frb usually without bluish colours, but may have bluish tints at stem top; stem 40-90 x 10-20 mm, fleshy, clavate to bulbous, up to 35 mm broad at the base, often with pointed base. Cap 40-100 mm, hemispherical, then low convex to almost plane with a low and broad umbo, silvery silky shiny, finely innately fibrillose, sometimes viscid-sticky when moist, slightly hygrophanous, pale brownish grey, later with a more yellow centre; gills medium spaced, pale brownish white, later fairly vivid brown; stem silky whitish fibrillose; universal veil white, sparse; flesh whitish; smell indistinct or somewhat fruity in flesh; exsiccates greyish white to pale brownish grey, with brown gills. Sp (9-)9.5-10.5 x (5.5-)6-6.5  $\mu\text{m}$ , slightly amygdaloid, thick-walled, moderately and densely verrucose (fig. 759E). In deciduous forests, also with *Quercus* and *Carpinus*, on bare soil or in leaf litter, often on calcareous soil; autumn; occasional in temp.; DK (LC), NO (vu), SE (vu). – CFP B58, GCI A179, M&J 84, Phil 193d, Ves 359.

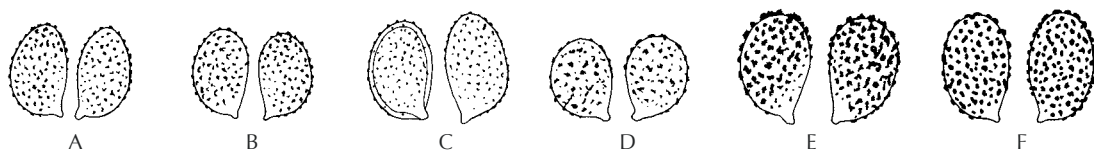
*C. turgidus* Fr.

9. With *Betula*; flesh light brown, without bluish tints, often darker at stem base 10
  - Under coniferous trees; flesh whitish, greyish to brownish white, often with a bluish tint at stem top 11
10. Cap 15-40 mm, honey brown to red brown; stem 35-50 x 3-5 mm; sp 8-9 x 4.5-5  $\mu\text{m}$ , narrowly amygdaloid, fairly finely verrucose see *C. leiocastaneus* key F 9
  - Cap 30-80 mm vivid red brown; stem 30-100 x 6-13 mm; sp 8-9 x 4.7-5.3  $\mu\text{m}$ , somewhat dacryoid to narrowly ellipsoid, strongly verrucose see *C. subbalaustinus* key F 12
11. Sp < 5  $\mu\text{m}$  wide 12
  - Sp > 5  $\mu\text{m}$  wide 15
12. Sp mostly > 8.5  $\mu\text{m}$  long see *C. dolabratus* key J 4
  - Sp mostly < 8.5  $\mu\text{m}$  long 13
13. Stem 50-120 x 7-13 mm, usually fleshy, at base up to 25 mm broad, only slightly longer than cap diam.; cap 35-80 mm; sp amygdaloid to ovoid, with a suprahilar depression; in mesic *Picea* forests, rarely with *Pinus*, often in younger plantations and even in wooded yards and at roadsides. Cap convex, soon low convex to almost plane, with a low umbo, somewhat shiny, sometimes viscid-sticky when moist, yellow brown to red brown, often with a purplish tint, strongly hygrophanous; gills crowded to medium spaced, pale greyish white, often with a bluish tint, later more vivid brown; stem clavate, silky whitish fibrillose, often with a bluish tint at the top; universal veil white, fairly sparse; flesh greyish white, usually bluish at stem top; smell indistinct; exsiccates with brownish cap and whitish stem. Sp 7.5-8.5 x 4.5-5  $\mu\text{m}$ , fairly finely to moderately verrucose, more strongly at apex (fig. 759F), moderately to fairly strongly dextrinoid. Often on slightly rich soil; late summer to autumn; poorly known, but considered occasional in hemib.-bore., more frequent in the western parts; FI, NO, SE. – Soop 04:75.

*C. carneinatus* Soop (*C. privignoides* Rob. Henry s. Brandrud in Nord. Macr.)

Note: can macroscopically recall *C. armeniacus* (pt. 15) with bluish tints.

- Stem 50-140 x 5-12 mm, at base up to 15 mm broad, usually distinctly longer than cap diam.; cap 35-65 mm; sp ellipsoid to slightly ovoid; in dry, sandy *Pinus* heathland to mesic *Picea* forests 14



Spores: A: *Cortinarius biformis*, B: *C. melitosarx*, C: *C. armeniacus*, D: *C. renidens*, E: *C. minutalis*, F: *C. hinnuleoarmillatus*.

14. Cap fairly dark grey brown to yellow brown; top of stem often with bluish tints. Cap 35-65 mm, convex, soon low convex to plane, with a low umbo,  $\pm$  silky-silvery shiny fibrillose, with some white universal veil remnants in the margin, sometimes viscid-sticky when moist, strongly hygrophanous; gills crowded to medium spaced, pale greyish, then yellowish brown, sometimes initially with a bluish tint, later more brownish; stem cylindrical to slightly clavate, silky whitish fibrillose, often turning somewhat ochraceous brown with age; universal veil white, forming incomplete girdles on the stem; flesh greyish white, usually bluish at stem top; smell indistinct; exsiccates with fairly light, yellow-brown to greyish brown cap and whitish stem. Sp (7-)7.5-8  $\times$  4.5-5  $\mu$ m, fairly strongly verrucose (fig. 761A), moderately to fairly strongly dextrinoid. In dry to damp coniferous forests and plantations with *Pinus* and *Picea*; late summer to late autumn; very common in temp.-bore.; DK (LC), FI (LC), IS (Su: Fingvellir), NO, SE (LC). – CFP C05, C22, Svp 22:4, Ves 356.

***C. biformis* Fr.**

- Cap yellow brown to red brown; top of stem without bluish tints. Cap 35-65 mm, convex, soon low convex to plane, somewhat shiny, strongly hygrophanous; gills crowded to medium spaced, pale yellowish, later more vivid brown; stem 50-140  $\times$  5-12 mm, cylindrical to clavate, silky whitish fibrillose, often turning somewhat ochraceous brown with age, sometimes stiff; universal veil white, forming incomplete girdles on the stem; flesh greyish to brownish white; smell indistinct; exsiccates with fairly light, yellow-brown to somewhat red-brown cap and whitish stem. Sp 7-7.5(-8)  $\times$  4.3-4.8  $\mu$ m, moderately verrucose (fig. 761B), weakly to moderately, sometimes fairly strongly dextrinoid. In dry to mesic coniferous forests with *Pinus*, typically in sandy heath forests; late summer to autumn; poorly known, considered common in hemib.-bore., very rare in temp.; DK (NA), FI (LC), SE. – Soop 04:73.

***C. melitosarx* Soop**

Note: *C. biformis* with yellow brown cap is difficult to distinguish from *C. melitosarx*.

15. Cap saturated apricot yellow to yellowish red brown; stem 50-120  $\times$  7-15 mm, clavate; flesh whitish, very rarely with a faint bluish tint at top of stem; sp often thick-walled, strongly dextrinoid. Cap 35-85 mm, convex, soon low convex to almost plane, with a low umbo, somewhat shiny, sometimes viscid-sticky, strongly hygrophanous; gills crowded to medium spaced, pale apricot yellow brown, later more brownish; stem silky whitish fibrillose; universal veil white, sparse; flesh marbled hygrophanous; smell indistinct; exsiccates with fairly light, yellow-brown to brown cap and whitish stem. Sp 8-9  $\times$  5-5.5  $\mu$ m, ellipsoid, fairly finely to moderately verrucose (fig. 761C). In coniferous forests with *Pinus* and *Picea*, typically in sandy *Pinus* heath forests; late summer to autumn; common in hemib.-bore., but very common in sandy heathland, rare in temp.; DK (vu), FI (LC), IS (Su: Fingvellir), NO (LC), SE (LC). – CFP A46, GCI C31, Nyl 465, R&H 519, Sieniop 189.

***C. armeniacus* (Schaeff.: Fr.) Fr.**

- Cap red brown, grey brown to chocolate brown; stem 60-150  $\times$  5-15 mm, cylindrical or slightly clavate, sometimes tapering downwards; flesh with some brownish tints or distinctly bluish at top of stem; sp rarely thick-walled, weakly to strongly dextrinoid

16

16. Flesh whitish, distinctly violet in top of the stem; often in *Sphagnum*; sp 9-10.5  $\times$

- 5.2-5.7  $\mu\text{m}$  see *C. tortuosus* key J 4
- Flesh brownish white, rarely faintly violet in top of the stem; usually not in *Sphagnum*; sp < 9.5  $\mu\text{m}$  wide 17
17. Cap greyish brown to dark greyish brown; sp broadly ellipsoid, weakly to moderately dextrinoid; epicutis hyphae with numerous, circular, hyaline, refracting granules see *C. brunneifolius* key F 25
- Cap reddish brown to chocolate brown; sp fusiform, amygdaloid to slightly ellipsoid, weakly to strongly dextrinoid; epicutis hyphae without hyaline granules 18
18. Cap waxy-glossy, but often with white universal veil fibrils or patches near the margin; sp 8.5-9.5  $\times$  4.5-5.5  $\mu\text{m}$ , fusiform to amygdaloid, with a suprahilar depression; weakly to sometimes moderately dextrinoid see *C. dolabratus* key J 4
- Cap fairly mat, without veil patches or fibrils; sp 8-9(-9.5)  $\times$  5.3-5.7  $\mu\text{m}$ , amygdaloid to slightly ellipsoid, fairly strongly to strongly dextrinoid see *C. testaceofolius* key F 24

**Key M:** Subgen. *Telamonina* sect. *Renidentes* Liimat. & Niskanen in press

TUULA NISKANEN & ILKKA KYTÖVUORI

Cap 20-50 mm, hemispherical, then low convex to almost plane, sometimes with a low umbo, orange brown to vivid red brown, strongly hygrophanous and fairly soon drying pale ochraceous brownish; gills medium spaced, pale yellowish brown; stem 25-70  $\times$  3-7 mm, cylindrical, yellowish to ochre brown fibrillose; universal veil and cortina absent; flesh yellow brown to red brown; smell indistinct or slightly raphanoid; exsiccates with pale reddish brown cap and pale brown stem. Sp 6-7  $\times$  5-5.5  $\mu\text{m}$ , obovoid-subglobose, fairly coarsely verrucose, with wide and low warts (fig. 761D), moderately dextrinoid; gill trama hyphae very finely incrustated. In mesic *Picea* forests, sometimes also in *Pinus*-dominated forests or *Tilia-Corylus* forests, on rich soil; late summer to autumn; occasional in hemib.-bore.; FI (LC), NO (LC), SE (LC). – CFP D53, GCI B131, M&J 123.

*C. renidens* Fr.

Note: compare with *C. gentilis* key E 1 which has distinct, yellow veil and larger sp.

**Key N:** Subgen. *Telamonina* sects *Hinnulei* Melot and *Safranopedes* Liimat., Kytöv. & Niskanen in press

TUULA NISKANEN & ILKKA KYTÖVUORI

Frb yellowish brown to ochre brown; cap smooth, often with blackening spots, strongly hygrophanous; universal veil white, rarely yellow or orange; smell usually strong, earthy or raphanoid; sp subglobose to ellipsoid, usually strongly verrucose; with deciduous trees. Five species in the key, but the real number of the species in the Nordic countries is much higher.

Suppl. lit.: Bidaud et al. 1997.

1. In suba.-arc./alp. with smaller and dwarfish *Salix* species; cap 10-25 mm. Cap hemispherical to conical, later low convex with a small and fairly acute umbo, saturated red brown to yellowish brown, often with blackening spots, hygrophanous; gills medium spaced to distant, pale yellowish brown, later cinnamon brown; stem 20-40  $\times$  3-6 mm, cylindrical, often first silky whitish fibrillose, later yellowish brown, darker towards the base; universal veil white, often forming a sock-like sheath and a ring; flesh brown, darker towards stem base; smell indistinct or slightly earthy; exsiccates yellow brown to slightly greyish brown. Sp 8-9  $\times$  5.5-6  $\mu\text{m}$ , obovoid, fairly strongly verrucose (fig. 761E), moderately dextrinoid. Summer to early autumn; occasional in suba.-Arct; FI, NO (LC). – CFP D46.

*C. minutalis* Lamoure

Note: type material has not been studied, and the interpretation follows Brandrud et al. 1998.

- In temp.-bore. with *Betula*, *Corylus*, *Fagus*, *Carpinus* and *Quercus*; cap (25-)30-60 mm 2





Spores: A: *Cortinarius hinnuleus* s. lato, B: *C. roseonudipes*, C: *C. safranopes*, D: *C. helvelloides*, E: *C. saniosus*, F: *C. aureovelatus*.

2. Universal veil orange red; gills  $\pm$  with violet tints. Cap 30-50(-60) mm, conical, later low convex with an umbo, with some orange-red universal veil remnants at the margin, orange to ochre brown, hygrophanous; gills distant, broad, ochre brown, later cinnamon brown, often retaining a violet tint; stem 60-100  $\times$  5-12 mm, cylindrical or slightly clavate, fibrillose, base somewhat rooting; universal veil fairly abundant, often forming rings on the stem; flesh ochre, darker towards the base; smell raphanoid or slightly earthy; exsiccates vividly yellow brown to brown, orange veil still visible on the stem, in some frb violet tints visible in the gills. Sp 9-10(-10.5)  $\times$  5.5-6.5  $\mu$ m, obovoid to weakly oblong-ellipsoid, somewhat thick-walled, moderately to strongly verrucose (fig. 761F), fairly strongly dextrinoid. In deciduous forests and parks with *Quercus*, on rich to calcareous soil, often on damp, mull soil; summer to late autumn; very rare in temp.-hemib.; FI (DD), SE. – AC Hors-serie 1:110, Jordst 25(3):12, Kar 46(1):2, Sienil 57(1):5.

*C. hinnuleoarmillatus* Reumaux

- Universal veil white or yellowish; gills without violet tints 3
3. Sp 7-8.5  $\times$  5-6.5  $\mu$ m, subglobose to obovoid-subglobose,  $Q < 1.5$  (fig. 763A). Cap 25-70 mm, hemispherical to conical, later low convex with an umbo, pale reddish to ochraceous brown, hygrophanous; gills distant, pale yellow to red brown, later cinnamon brown; stem 30-120  $\times$  5-12 mm, cylindrical, first whitish fibrillose, later yellowish brown, darker towards the base; universal veil white, forming a ring and incomplete girdles on the stem; flesh pale yellow brown, with age darker towards stem base; smell strong, earthy; exsiccates red brown. Sp strongly verrucose, fairly weakly to moderately dextrinoid. In mixed and deciduous forests and parks with *Quercus*, *Betula*, *Populus*, *Fagus*, *Corylus*, *Tilia* and *Carpinus*, on rich to calcareous soil, often on mull or clayey soil; late summer to late autumn; common in temp.-hemib., occasional in bore., less common in the north; DK (LC), FI (LC), NO (LC), SE (LC). – CFP A19, GCI D107, Sieniop 203, Ves 354.

*C. hinnuleus* Fr. s. lato

- Sp  $> 8.5$   $\mu$ m long, dacryoid to obovoid-ellipsoid,  $Q > 1.5$  4
4. Exsiccates yellow brown; sp narrowly obovoid to  $\pm$  dacryoid, fairly strongly and slightly spiny-verrucose (fig. 763B), weakly to moderately dextrinoid. Cap 25-60 mm, hemispherical to conical, later low convex with an umbo, yellowish brown, often with blackening spots, hygrophanous; gills distant, pale yellowish brown, later yellow brown; stem 40-120  $\times$  5-13 mm, cylindrical; universal veil white to possibly slightly yellowish, forming incomplete girdles on the stem; flesh pale yellowish brown, darker towards stem base; smell raphanoid. Sp 8.5-10  $\times$  5.5-6  $\mu$ m. In deciduous and mixed forests and parks, at least with *Corylus*, on mull soil; late summer to autumn; poorly known, but considered occasional in temp.-hemib.; FI. – AC Hors-serie 1:110.

*C. roseonudipes* Rob. Henry & Moëgne-Locc.

- Exsiccates greyish; sp obovoid-ellipsoid to  $\pm$  dacryoid, very strongly and coarsely verrucose (fig. 763C), moderately to strongly dextrinoid. Cap 25-60 mm, hemispherical to conical, later low convex with an umbo, yellowish brown, sometimes with an olivaceous or grey ochre brown tinge, often with blackening spots, hygrophanous, soon drying pale greyish ochre;

gills medium spaced to distant, pale yellowish brown, later yellow brown, with whitish edge; stem 40-110 x 5-13 mm, cylindrical, often with an up to 20 mm broad, bulbous or pointed base, first whitish fibrillose, later yellowish brown, darker towards the base; universal veil white, forming incomplete girdles on the stem; flesh honey yellow, darker towards the base of the stem; smell raphanoid. Sp (8.5-)9-10 x 5.5-6.5  $\mu\text{m}$ , somewhat thick-walled. In deciduous forests and parks, under *Corylus*, *Fagus*, *Tilia* and *Quercus*, on rich to calcareous soil, often on bare mull soil; late summer to autumn; presumably rare in temp.-hemib., but often abundant; NO (vu), SE. – CFP C38 (as *conicus*).

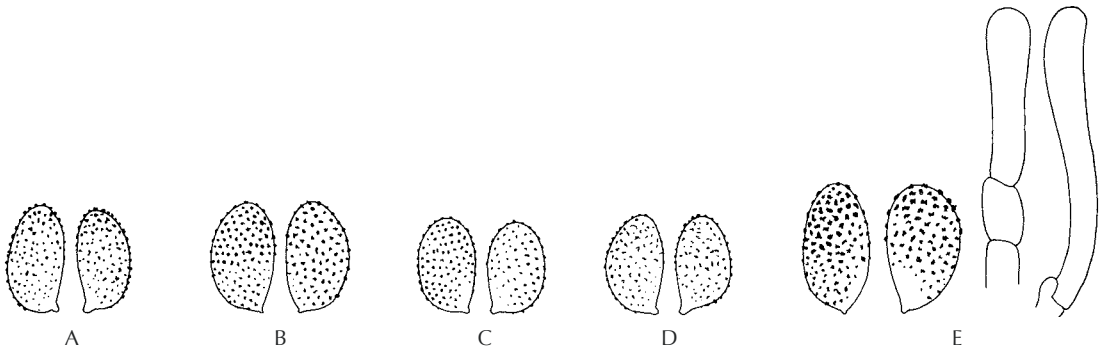
*C. safranopes* Rob. Henry (*C. conicus* (Velen.) Rob. Henry s. Brandrud et al. 1994)

Note: the name has been used very collectively in the Nordic countries.

**Key O:** Subgen. *Telamonia* sects *Incrustati* Melot, *Helvelloides* M.M. Moser, *Paleacei* Nespiak and *Saniosi* Moënné-Locc. & Reumaux

HÅKAN LINDSTRÖM

1. Veil distinctly golden yellow 2  
 - Veil not golden yellow 4
2. Cap finely scaly to fibrous from veil; gills remarkably distant, for a long time dark violet. Cap 5-30 mm, hemispherical to bell-shaped, then convex-expanded, often with a marked umbo, irregular, hygrophanous, dark brown with an olivaceous tinge, drying yellowish brown; gills somewhat decurrent, thick, later umber; stem 20-80 x 2-4 mm, cylindrical, often twisted and tapering downwards, yellow brown, dark brown downwards, often violet at top; universal veil abundant, sheathing the stem; flesh yellow brown, darker at base, often dark violet at top; smell indistinct. Sp 8-10 x 5-6.5  $\mu\text{m}$ , broadly ellipsoid to somewhat obovoid, faintly to moderately verrucose (fig. 763D); veil hyphae incrustated, 5-15  $\mu\text{m}$  wide. With *Alnus incana* and *A. glutinosa*, in moist, rich places; summer to autumn; locally common in temp.-bore.; DK (LC), FI (LC), IS, NO (LC), SE (LC). – B&K5 328, Bol Bres 39:95, CFP A17, Sieniop 202, Ves 363, ☉.  
*C. helvelloides* (Fr.: Fr.) Fr.  
 - Cap almost smooth, somewhat glossy; gills not remarkably distant, seldom with a violet tinge 3
3. Cap 5-30 mm, yellowish brown; stem 1-5 mm broad; sp 8.5-10 x 5-6.5  $\mu\text{m}$ ,  $Q < 1.8$ , broadly ellipsoid, coarsely verrucose (fig. 763E). Cap bell-shaped to convex with a distinct umbo, somewhat glossy, often dark brown at centre, hygrophanous, sometimes blackening in spots, sometimes more chestnut, often darker at centre, drying light yellowish brown; gills medium spaced to distant, brownish yellow, seldom with a violet tinge; stem 10-50 mm long, cylindrical, rather stiff, glossy at top, light ochraceous, yellowish brown at base; universal veil usually distinct, forming bands; flesh yellow to yellowish brown, light in top of stem, seldom with a violet tinge, dark brown at base; smell indistinct. With deciduous trees and bushes such as *Betula*, *Tilia*, *Quercus*, *Populus* and *Salix*. In forests, thickets and alpine/arctic heathland; summer to autumn; common in temp.-arc./alp., in IS very rare or overlooked; DK (LC), FI (LC), IS, NO (LC), SE (LC). – CFP E01, E02, FAD 103C, R&H 492, Soop 05:87.  
*C. saniosus* (Fr.: Fr.) Fr.  
 - Cap 40-70 mm, reddish brown; stem 4-9 mm; sp 7-9 x 3.5-4.5  $\mu\text{m}$ ,  $Q > 1.8$ , narrowly ellipsoid to cylindrical, finely verrucose (fig. 763F). Cap bell-shaped, expanded, sometimes with a low umbo, somewhat glossy, hygrophanous, sometimes blackening in spots, darker towards centre, drying orange to yellow brown; gills medium spaced to distant, yellowish brown; stem 20-70 mm long, cylindrical, rigid, pale greyish ochraceous at top, yellowish brown, darker at base; universal veil usually distinct, forming bands on the stem; flesh pale ochraceous to yellow brown, darker downwards in stem; smell indistinct. With *Pinus* and *Picea*, often on sandy soil, in suba. also with *Betula*, once recorded with *Fagus*; often early in



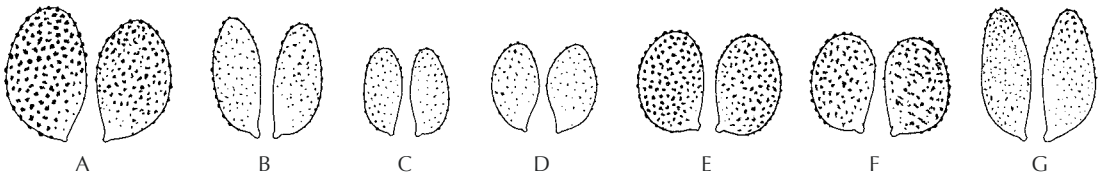
Spores and cheilocystidia: A: *Cortinarius helobius*, B: *C. comatus*, C: *C. anglesianus*, D: *C. psammocephalus*, E: *C. oreobius*.

season, summer to autumn; occasional in hemib.-suba.; FI (LC), NO (LC), SE. – CFP E03.

*C. aureovelatus* E. Bendiksen, K. Bendiksen & H. Lindstr.

4. Veil brownish or yellowish brown 5  
- Veil white, ochraceous to yellowish 8
5. Cap not scaly. Cap 4-15 mm, bell-shaped, later expanded, often with small umbo, finely fibrillose, sometimes striate, hygrophanous, dark brown, blackening in spots, drying paler yellow brown; gills medium spaced to distant, pale yellowish brown; stem 20-50 x 1-4 mm, cylindrical, fibrillose, light yellowish brown, darker downwards; universal veil ochraceous-brownish; flesh dark yellow, brownish downwards in stem; smell indistinct. Sp 8-9.5 x 4-5  $\mu\text{m}$ , ellipsoid, rather finely to moderately verrucose (fig. 765A); sterile cells clavate to globose. With *Picea* and *Pinus*, maybe also with deciduous trees, mostly on bare mineral soil at roadsides, often on rich soil; usually in early summer, sometimes later in the season; rare in temp.-bore., but occasional in DK; DK (LC), FI (DD), NO (LC), SE (LC). – CFP C43.  
*C. helobius* Romagn.  
- Cap finely scaly 6
6. Cap 5-15 mm; with *Salix*. Cap conical, convex with a  $\pm$  acute umbo, finely brownish scaly, later more smooth, hygrophanous, dark brown, drying yellow brown; gills medium spaced to distant, dark brown; stem 10-40 x 1-3 mm, cylindrical, yellowish brown, pale at top, darker downwards; universal veil in a brownish ring zone and finely scaly-floccose below; flesh dark brown, blackish at stem base; smell indistinct. Sp 9-11 x 5.5-6.5  $\mu\text{m}$ , broadly ellipsoid, finely verrucose (fig. 765B). In shrubs in lowlands and dwarf shrubs in alpine areas; summer to early autumn; rare in bore.-arc. / alp.; FI, FO, NO (LC), SE. – Fav 55:9.10, FND 32:39, M&J 48.  
*C. comatus* J. Favre  
- Cap 10-60 mm; not with *Salix* 7
7. With *Pinus* in sandy heathland or dry moraine and with *Picea* in moss rich *Vaccinium* forests. Cap 20-50 mm, bell-shaped, then convex to expanded, usually with a small, acute umbo, covered with yellow-brown scales, hygrophanous, dark brown to umber, drying yellow brown; gills medium spaced, dark brown; stem 40-90 x 2-6 mm, cylindrical to tapering downwards, fibrillose, ochraceous to pale yellowish brown, darker at base; universal veil abundant, yellowish brown to ochraceous; flesh yellowish brown to dull yellow, dark brown in stem base; smell faint. Sp 7-8.5 x 4.5-5.5  $\mu\text{m}$ , broadly ellipsoid, moderately verrucose (fig. 765C). Autumn; common in hemib.-bore.; FI (LC), NO (LC), SE (LC). – B&K 5:292, CFP C33, Däh 801, GCI C23, M&J 42.  
*C. anglesianus* A.H. Sm. (*C. strobilaceus* M.M. Moser)

- With deciduous trees, preferably *Quercus* on rich soil. Cap 10-30 mm, bell-shaped, then convex to expanded, usually with a small, ±acute umbo, hygrophanous, covered with dark brown scales on a concolourous background, drying pale yellow brown; gills fairly distant, dark yellow brown; stem 30-60 × 2-7 mm, cylindrical, fibrillose, yellow brown, dark amber towards base; universal veil abundant, forming a ring zone and flocculose below, dark yellow brown; flesh dark yellow brown, blackish in base of stem; smell faint. Sp 7.5-8.5 × 4.5-5 μm, moderately and fairly coarsely verrucose (fig. 765D). Late summer to autumn; occasional in temp., rare in hemib.; DK (LC), FI (DD), NO (EN), SE (LC). – CFP D57, FAD 99F, Sieniop 213.  
*C. psammocephalus* (Bull.) Fr.
- 8. Cap 5-20 mm, light brown or vivid red or yellow brown; with dwarf *Salix* in arc. / alp. heathland 9
- Cap bigger or with dark brown colours; rarely with dwarf *Salix* in arc. / alp. heathland 11
- 9. Gill edge sterile with abundant cheilocystidia (fig. 765E). Cap 8-20 mm, bell-shaped to convex, usually with a distinct umbo, fibrous at margin, hygrophanous, saturated reddish brown, darker at centre, drying more yellowish brown; gills distant, light reddish brown, edge often whitish; stem 10-30 × 1-3 mm, cylindrical, fibrillose, dark brown, paler upwards; universal veil sparse, whitish, flocculose to fibrillose; flesh dark reddish brown, paler at centre of stem; smell indistinct. Sp 9.5-11 × 5.5-6.5(-7) μm, ellipsoid to broadly ellipsoid, finely verrucose. In alpine heathland; summer to early autumn; very rare but probably overlooked in arc. / alp., known from NO (LC, Hord). – B&K 5:348, Fav 55:9.3, M&J 100.  
*C. oreobius* J. Favre
- Gill edge not sterile, sterile cells not abundant 10
- 10. Sp 8-9 × 5.5-6.5 μm, ellipsoid, strongly verrucose; smell earthy or indistinct  
see *C. minutalis* key N 1
- Sp 10-11 × (5-)6-7 μm, moderately verrucose (fig. 767A); smell sometimes like cedar wood. Cap 6-22 mm, bell-shaped to convex, sometimes with an indistinct umbo, smooth, glossy, hygrophanous, saturated reddish brown, drying pale brownish; gills medium spaced, dark ochraceous brown; stem 8-15 × 2-3 mm, cylindrical, reddish brown, downwards darkening; veil abundant, yellowish white, sock-like, loose, later fibrillose; flesh brown and blackening in stem base. In alpine heathland; summer to early autumn; rare but poorly known in suba-arc. / alp.; NO (LC), SE (LC).  
*C. lamoureae* Bon
- 11. Veil light ochraceous to yellowish white; frb relatively robust; stem on av > 5 mm broad, with deeply saturated colours in cap, gills and stem; pileipellis strongly incrustated; smell ± like cedar wood 12
- Veil whitish; frb relatively slender; stem on av < 5 mm broad; not with strong (yellow) brown pigments all over; pileipellis moderately incrustated; smell indistinct, *Pelargonium*-like or earthy 14
- 12. Sp 9-11 × 4-4.5 μm (fig. 767B); cap dark reddish brown. Cap 20-40 mm, bell-shaped, convex, usually with a small acute umbo, somewhat floccose from yellowish veil, hygrophanous, drying ochraceous brown; gills medium spaced, dark yellowish brown, seldom with a violet tinge; stem 20-50 × 3-7 mm, cylindrical, downwards sometimes tapering, firm, yellowish brown, dark brown at base; veil ochraceous forming a ring zone; flesh yellowish brown; smell faint or weakly of cedar wood. Sp narrowly fusiform, finely verrucose. With *Pinus*, usually on dry, sandy soil; autumn; occasional in temp.-bore.; DK (LC), FI (DD), SE (LC). – Arnold 25, Ves 357.  
*C. fusisporus* Kühner (*C. semivestitus* M.M. Moser)
- Sp < 8 μm long; cap yellowish brown 13



Spores: A: *Cortinarius lamoureae*, B: *C. fusisporus*, C: *C. lux-nymphae*, D: *C. andreae*, E: *C. flexipes* var. *flexipes*, F: *C. flexipes* var. *flabellus*, G: *C. violilamellatus*.

13. Cap yellowish scaly at margin; sp 6.5-8 x 3-3.5(-4)  $\mu$ m,  $Q > 1.8$ , narrowly fusiform, moderately verrucose (fig. 767C); usually in sandy *Pinus* forests, sometimes with *Picea*. Cap 20-50 mm conical, soon expanded, with inflected margin, often with a small umbo, hygrophanous, yellow brown to rust brown, drying more yellowish; gills medium spaced, yellowish brown, rarely violet tinged; stem 20-50 x 3-6 mm, cylindrical, firm, golden yellow to yellow brown, darker at base; veil whitish-ochraceous, forming a ring zone; flesh ochraceous to yellowish brown; smell none or weakly of cedar wood. Often on tracks or bare spots; summer to autumn; common in hemib.-bore.; FI (LC), NO (LC), SE (LC). – CFP C45, Sieniop 206.  
*C. lux-nymphae* Melot
  - Cap not scaly at margin; sp 6.5-7.5 x 4-4.5  $\mu$ m,  $Q < 1.8$ , fusiform, finely verrucose (fig. 767D); usually with *Picea*. Cap 15-55 mm, bell-shaped, expanded, usually with a small umbo, faintly fibrous, hygrophanous, yellowish brown, drying golden yellow, sometimes with black spots; gills medium spaced, yellowish brown; stem 40-70 x 3-9 mm, cylindrical, rather stiff, light yellowish brown, downwards darker; flesh ochraceous to yellow brown; veil yellowish white, floccose; smell often distinct of cedar wood. On dry, rich soil; summer to autumn; occasional in hemib.-bore.; FI (LC), NO (LC), SE. – CFP E17.  
*C. andreae* H. Lindstr.
14. Smell of *Pelargonium* 15
  - Smell indistinct or weakly of cedar wood 19
15. Cap 10-60 mm; stem 3-10 mm thick; sp broadly ellipsoid,  $Q < 1.5$ ,  $\pm$  rounded at apex; smell strong and with an acid component 16
  - Cap 5-25 mm; stem 2-5 mm thick; sp ellipsoid to cylindrical,  $Q > 1.5$ ,  $\pm$  pointed at apex; smell usually weak or with a rose-like component 17
16. Cap  $\pm$  acute, white scaly all over; stem top, gills and mycelial felt violet. Cap 10-40 mm, conical, then convex, usually with an acute umbo, dark greyish or violet brown; drying yellowish grey; gills crowded, dark violet; stem 40-100 x 3-7 mm, cylindrical, often tapering downwards, rigid, violet to greyish brown downwards; veil abundant, white, often forming a ring and floccose below; flesh dark violet brown to yellow brown. Sp 8-9(9.5) x 5-6  $\mu$ m, coarsely verrucose (fig. 767E). With deciduous trees, e.g. *Fagus*, *Betula* and *Quercus*, and with conifers, preferably in moist and acid habitats, often fasciculate; late summer to autumn; very common in temp.-arc./alp., especially in oceanic areas, less common in northern continental areas; DK (LC), FI (LC), FO, IS, NO (LC), SE (LC). – Arnold 22, B&K 5:323, CFP D43, Däh 820 (as *paleiferus*), Mar 793 (*C. paleifer*).  
*C. flexipes* (Pers.: Fr.) Fr. var. *flexipes* (*C. paleiferus* Svrček)
  - Cap variable, acute to expanded, white scaly at margin only; violet colours not striking. Cap 10-60 mm, bell-shaped to hemispherical, often with a low umbo; gills crowded, dark brownish, sometimes with a violet tinge; stem 40-100 x 3-10 mm, brown, upwards sometimes violet. Sp 7.5-8.5 x 5-6  $\mu$ m (fig. 767F). In other characters like the main variety. With conifers and sometimes with deciduous trees, *Fagus* and *Betula*, often on moist and acid habitats, often fasciculate; late summer to autumn; very common in temp.-bore.; DK, FI (LC), IS, NO,



SE. – B&K 5:322, CFP D35, D45, Mar 794 (as *rigidus*), 792 (as *paleaceus*).

*C. flexipes* (Pers.: Fr.) Fr. var. *flabellus* (Fr.: Fr.) H. Lindstr. & Melot

17. Cap finely scaly all over; with *Pinus* in sandy habitats. Cap 7-25 mm, conical, bell-shaped to convex usually with an acute umbo, hygrophanous, dark brown, drying pale yellow brown; gills medium spaced, often violet, sometimes greyish; stem 15-50 x 2-5 mm, cylindrical, yellow brown, seldom with violet top; veil abundant, yellowish white, forming a ring or floccose; flesh greyish brown, darker at base. Sp 9.5-11(-12) x 4.5-5.5  $\mu$ m, narrowly fusiform, with a suprahilar depression, finely verrucose (fig. 767G). Often fasciculate on bare spots; autumn; rare in hemib.-bore.; FI (LC), SE. – CFP D39.

*C. violilamellatus* P.D. Orton

- Cap usually fibrous (to finely scaly) at margin; in deciduous forests 18
18. Sp ellipsoid-fusiform,  $Q < 1.7$  (fig. 769A); with *Betula*, *Quercus*, *Fagus*, *Salix*, etc. Cap 5-25 mm, bell-shaped, conical, convex, often with a  $\pm$  acute umbo, often striate at margin, hygrophanous, dark greyish brown to buff, drying greyish ochre; gills crowded, usually deep violet, then greyish brown; stem 30-60 x 2-4 mm, cylindrical, whitish fibrous, often violet at top, brownish from base; veil white, floccose to fibrous; flesh yellow brown to greyish brown, darker at stem base; smell often with a rose-like component. Sp 8-9(-9.5) x 4.5-5.5(-6)  $\mu$ m, finely to moderately verrucose. Usually on nutrient rich soil; summer to autumn; common in temp.-arc. / alp.; DK (LC), FI, NO (LC), SE. – AC 43 (as *pelargoniobtus*), B&K 5:316, CFP D47.

*C. diasemospermus* Lamoure var. *diasemospermus*

Note: a nomenclatural revision is needed,

- Sp narrowly fusiform,  $Q > 1.7$  (fig. 769B); with *Salix* and *Tilia*. Smell often weak. Sp 8.5-10 x 4.5-5.5  $\mu$ m, often with a suprahilar depression, finely verrucose. In other characters like the main variety. Under deciduous trees in forests, parks and with shrubs, usually on nutrient rich or moist soil; summer to autumn; occasional, but often locally abundant in temp.-arc. / alp.; DK, NO, FI (LC), NO, SE. – Arnold 35 (*C. tiliaceus*), CFP D27, GCI D75.

*C. diasemospermus* Lamoure var. *leptospermus* H. Lindstr.

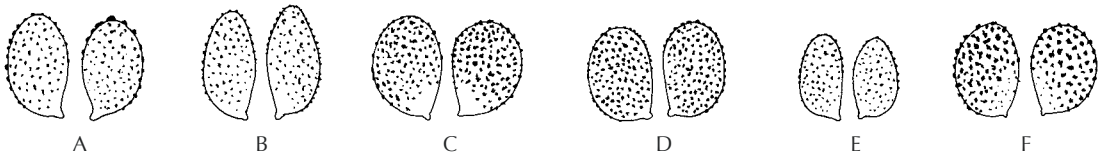
19. Cap  $\pm$  fibrous, not scaly 20
- Cap finely scaly, at least at margin, best visible when dry 22
20. Gills saturated brown when young. Cap 10-35 mm, bell-shaped, expanded with a  $\pm$  acute papilla, smooth, striate at margin, hygrophanous, dark reddish brown, drying greyish ochre; gills medium spaced, cinnamon to yellowish brown; stem 40-80 x 2-5 mm, cylindrical, somewhat stiff, white fibrillose, reddish brown, darker downwards; veil white, forming bands and flocculose; flesh pale reddish brown; smell indistinct. Sp 8-9.5 x 5.5-6.5  $\mu$ m, broadly ellipsoid, moderately verrucose (fig. 769C). With *Pinus* and *Picea*, often in *Sphagnum*; autumn; occasional in hemib.-bore.; FI, SE. – CFP E19, Fav 48:4.2-5.

*C. striaepilus* J. Favre

- Gills pale ochraceous when young 21
21. Sp 7.5-8.5 x 5-6  $\mu$ m, broadly ellipsoid (fig. 769D); frb not remarkably stiff; cap fibrillose, dull. Cap 10-50 mm, bell-shaped, expanded, with a  $\pm$  acute umbo, finely fibrillose, hygrophanous, dull reddish brown to greyish yellow brown, drying pale greyish yellow, often blackening in spots; gills medium spaced, light ochraceous to yellowish brown; stem 50-100 x 2-6 mm, cylindrical, often tapering at base, greyish brown, often with a reddish tinge, darker at base; veil white, floccose or in bands; flesh reddish brown to yellow brown, downwards dark in stem; smell indistinct. Sp finely to moderately verrucose. With *Picea* and *Pinus*, often in *Sphagnum*; autumn; occasional in hemib.-bore.; FI (DD), NO (LC), SE (LC). – CFP D38.

*C. flos-paludis* Melot

- Sp 6.5-7.5 x 3.5-4  $\mu$ m, narrowly ellipsoid (fig. 769E); frb stiff; cap not fibrillose, somewhat glossy. Cap 15-60 mm, globose to bell-shaped, expanded, sometimes with a small umbo,



Spores: A: *Cortinarius diasemospermus* var. *diasemospermus*, B: *C. diasemospermus* var. *leptospermus*, C: *C. striaepilus*, D: *C. flos-paludis*, E: *C. depressus*, F: *C. flexipes* var. *inolens*.

somewhat glossy, hygrophanous, dark reddish brown, sometimes almost black at centre, drying pale yellow brown; gills crowded to medium spaced, ochraceous to light yellowish; stem 20-90 x 3-8 mm, cylindrical to tapering at base, white fibrous, light reddish brown, often darker at base; veil white, floccose; flesh ochraceous to pale brownish yellow, darker downwards in stem; smell indistinct. Sp finely verrucose. With *Pinus* and *Picea* on nutrient poor soil, in dry to moist habitats; late summer to autumn; occasional, but locally common in temp.-bore.; DK (LC), FI (LC), NO (LC), SE (LC). – CFP B18, GCI C11.

*C. depressus* Fr.

- 22. Sp broadly ellipsoid to subglobose,  $Q < 1.6$ , moderately to coarsely verrucose; stem stiff; gills rather dark when young 23
- Sp ellipsoid to narrowly ellipsoid,  $Q > 1.6$ ; finely to moderately verrucose, stem not remarkably stiff; gills rather pale when young 24

- 23. Frb yellowish brown; sp broadly ellipsoid (fig. 769F); often with a marked band of veil on the stem contrasting the cortex. Cap 10-50 mm, yellow brown, drying pale yellow brownish; gills yellow brown; stem brownish yellow, rarely with violet tinge at top, darker at base; flesh yellow brown, darker downwards in stem; smell indistinct. Sp 8-9 x 5-6  $\mu\text{m}$ , moderately verrucose. In other characters like the main variety. With *Picea* and *Pinus* in nutrient poor forests and with *Betula* in suba.; late summer to autumn; occasional, in some years common in hemib.-suba.; DK, FI (LC), NO, SE. – CFP D29.

*C. flexipes* (Pers.: Fr.) Fr. var. *inolens* H. Lindstr.

- Frb reddish brown; sp subglobose (fig. 770A); usually without a marked white band of veil on stem. Cap 15-50 mm, bell-shaped to convex with an acute umbo, finely white scaly, at least at margin, hygrophanous, dark red brown, drying pale greyish brown; gills medium spaced, ochraceous to greyish brown; stem 40-90 x 3-6 mm, cylindrical, at base often tapering, stiff, white fibrillose, from below light greyish brown to reddish brown; veil abundant, white forming a protruding ring or floccose; flesh pale greyish to ochraceous brown, darker downwards in stem; smell indistinct. Sp 6.5-7.5 x 5-6  $\mu\text{m}$ , coarsely verrucose. With *Pinus* and *Picea*; autumn; occasional in temp.-bore.; FI (DD), NO (NE), SE (LC). – Arnold 17, CFP D58, GCI C75, M&J 51.

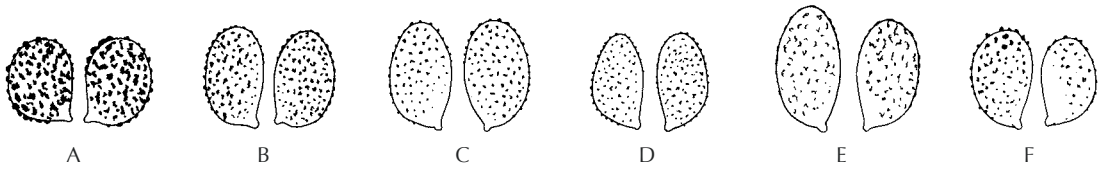
*C. comptulus* M.M. Moser

- 24. With conifers. Cap 15-30 mm, bell-shaped, convex to expanded, often with a small papilla, finely white scaly to fibrillose, hygrophanous, pale red brown, drying greyish ochre, often with blackish spots; gills crowded to medium spaced, ochraceous to greyish brown; stem 40-80 x 2-5 mm, cylindrical, fragile, white fibrillose, pale reddish to greyish brown, darker downwards; veil abundant, white, forming a ring and floccose below; flesh ochraceous to greyish brown; smell indistinct. Sp 7.5-9 x 4.5-5.5  $\mu\text{m}$ , ellipsoid, finely verrucose (fig. 770B). Usually with *Picea*, in nutrient poor forests; autumn; locally common in hemib.-bore.; FI (LC), NO (NE), SE (LC). – CFP D40.

*C. pilatii* Svrček

- With deciduous trees and shrubs


25



Spores: A: *Cortinarius comptulus*, B: *C. pilatii*, C: *C. gossypinus*, D: *C. hemitrichus*, E: *C. lilacinopusillus*, F: *C. americanus*.

25. In *Salix* scrubs. Cap 4-20 mm, bell-shaped, expanded with a  $\pm$  acute umbo, hygrophanous, densely covered with white scales or fibrils, light reddish to greyish brown, drying pale greyish ochre; gills medium spaced, dull yellow to yellow brown; stem 20-45  $\times$  2-4 mm, cylindrical, white fibrous, light greyish brown, darker at base; veil abundant, woolly, white, forming a ring and floccose; flesh yellow brown, darker at stem base; smell indistinct. Sp (8-)8.5-9.5  $\times$  5-5.5  $\mu$ m, narrowly ellipsoid to somewhat amygdaloid, finely verrucose (fig. 770C). At shores and along streams in lowlands, often fasciculate; summer to autumn; rare in hemib.-bore.; FI, SE. – CFP E18.

*C. gossypinus* H. Lindstr.

- With *Betula*. Cap 10-40 mm, bell-shaped, expanded with a marked umbo, hygrophanous, with white scales and fibrils, greyish to blackish brown, drying ochraceous grey; gills medium spaced, ochraceous to pale greyish brown; stem 30-70  $\times$  2-6 mm, cylindrical, white fibrous, pale greyish brown, darker downwards, rarely with a bluish tinge at the top; veil white, forming a ring zone and floccose; flesh ochraceous brown; smell indistinct. Sp 7-8.5  $\times$  4-5  $\mu$ m, narrowly amygdaloid to fusoid, moderately verrucose (fig. 770D). Usually in dry habitats, often fasciculate; autumn; common in temp.-suba.; DK (LC), FI (LC), IS, NO (LC), SE (LC). – Arnold 11, C&D 1140, CFP A31, Däh 821, .

*C. hemitrichus* (Pers.: Fr.) Fr.

**Key P:** Subgen. *Telamonina* sect. *Hydrocybe* (Fr.) Nezdajm.

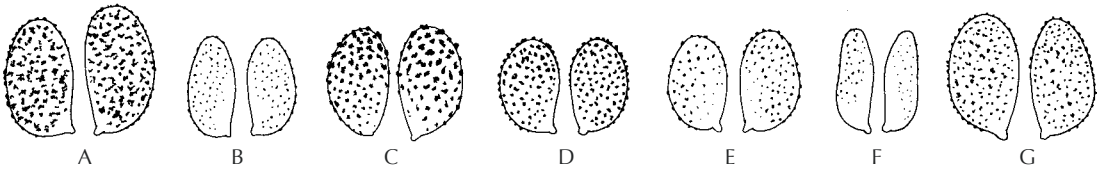
HÅKAN LINDSTRÖM

1. Cap lilac, yellowish, buff, orange brown or brown, but not dark brown 2
  - Cap dark brown to almost black 8
2. Young frb lilac to deeply violet; cap on av < 10 mm; with *Alnus* 3
  - Young frb not lilac or deeply violet; cap on av > 10 mm; mostly with other symbionts 4
3. Sp 9-10(-10.5)  $\times$  5-6.5  $\mu$ m (fig. 770E); cap persistently pale lilac or violet; gill trama hyaline. Cap 3-15 mm, bell-shaped to convex, with a small umbo, slightly fibrillose, hygrophanous, drying pale greyish; gills thick, medium spaced to distant, for a long time violet; stem 15-40  $\times$  1-3 mm, with a weakly bulbous base, sometimes turning red; universal veil flocculose, whitish; flesh violet; smell faint. Sp finely to rather coarsely verrucose; ellipsoid. With *Alnus incana* or *A. glutinosa*, usually in swamp forests; summer to early autumn; occasional, but locally common in temp.-bore.; DK (LC), FI (LC), NO, SE (LC). – CFP B25 (as *bibulus*), OPN 6B, Ves 363 (as *pulchellus*).

*C. lilacinopusillus* P.D. Orton (*C. bibulus* Quél. s. auct.)

Note: *C. pulchellus* J.E. Lange is possibly the same, but the original description is ambiguous with sp described as 9  $\times$  5  $\mu$ m.

- Sp 7.5-8.5  $\times$  4.5-5.5  $\mu$ m (fig. 770F); cap dark violet, later blackish from centre, soon light brownish; gill trama incrustated. Cap 4-17 mm, bell-shaped to convex, with a small umbo, slightly fibrillose as young, hygrophanous, drying greyish; gills not especially thick, medium spaced to distant, soon ochraceous brown; stem 15-40  $\times$  2-5 mm, weakly bulbous at



Spores: A: *Cortinarius casimiri*, B: *C. odhinnii*, C: *C. roseipes*, D: *C. parvannulatus*, E: *C. croceocingulatus*, F: *C. heterosporus*, G: *C. alnetorum*.

base, fibrous; universal veil flocculose, whitish; flesh dark brownish; smell faint. Sp ellipsoid, finely verrucose. With *Alnus incana* and *A. glutinosa*, in wet habitats in swamp forests; summer to early autumn; rare in temp.-bore.; DK (LC), FI, SE. – B&K 5:297.

*C. americanus* A.H. Sm.

4. Sp on av > 10  $\mu\text{m}$  long (fig. 771A); smell faint or raphanoid. Cap 10-40 mm, bell-shaped to convex with a distinct umbo, often rugose, when young woolly-fibrous, often striate, hygrophanous, red brown to somewhat greyish brown, darker at centre, sometimes with blackish spots, drying more ochraceous; gills distant, light reddish brown; stem 30-70 x 2-5 mm, with a harder bulb at base, white fibrous, light brown, sometimes violet at top, turning red; universal veil woolly, white; flesh reddish brown to whitish; smell none or raphanoid. Sp 10-11.5 x 6-7  $\mu\text{m}$ , broadly ellipsoid, coarsely verrucose; sterile cells clavate. Both with deciduous trees and conifers, on both acid and rich soil; autumn; very common in temp.-suba.; DK (LC), FI (LC), NO (LC), SE (LC). – Arnold 41, CFP D28, D32, M&H 4:124.

*C. casimiri* (Velen.) Huijsman (*C. subserotypes* Romagn.)

- Sp on av < 10  $\mu\text{m}$  long; smell distinctly chemical-pungent, like *Lepiota aspera* or intensively cedar-like 5
5. Frb stout; stem > 4 mm broad; universal veil not forming a collar; with *Pinus* in sandy habitats. Cap 30-60 mm, bell-shaped to convex, often with a small acute umbo, smooth and glossy, hygrophanous, vividly orange brown, drying light orange brown, with darker spots when old; gills broad, medium spaced, yellowish brown; stem 40-60 x 4-9 mm, sometimes tapering at base, rigid, yellowish white, later brass yellow; universal veil white to light yellowish, at first sock-like, later fibrous; flesh light yellowish; smell strong, pungent. Sp 7-9.5 (-10) x 4-4.5  $\mu\text{m}$ , narrowly ellipsoid to amygdaloid, very finely verrucose (fig. 771B); sterile cells frequent. In dry, sandy heathland; autumn; occasional in hemib.-bore., more common to the north and east; FI (LC), NO (LC), SE (LC). – CFP B06.
- C. odhinnii* Melot
- Frb slender; stem < 4 mm broad; universal veil often forming a collar; usually with deciduous trees, bushes or herbs 6
6. Flesh in stem reddening when cut; cap greyish brown; universal veil usually without a protruding collar. Cap 10-35 mm, bell-shaped to expanded with an acute umbo, hygrophanous, lighter yellow brown towards margin, drying ochraceous grey; gills medium spaced, yellowish brown. Stem 20-40 x 2-4 mm, grey or violet grey, fibrillose, often reddening at base; universal veil greyish-whitish; flesh greyish, after reddening becoming reddish brown; smell  $\pm$  distinct. Sp 8-10(-11) x 5.5-6.5(-7)  $\mu\text{m}$ , broadly ellipsoid, coarsely verrucose (fig. 771C); sterile cells clavate. Known with deciduous trees or *Helianthemum* on calcareous soil; autumn; very rare in hemib., but perhaps overlooked; SE (Öl). – AC 311, Soop 05:93.

*C. roseipes* (Velen.) G. Garnier

- Flesh in stem not reddening when cut; cap yellowish or orange brown; universal veil often forming a protruding collar on the stem 7

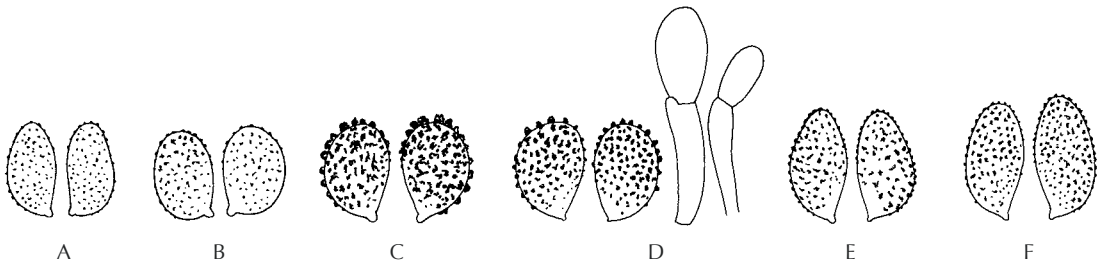
7. Universal veil white; cap smooth; sp rather strongly verrucose. Cap 8-30 mm, bell-shaped to convex with a  $\pm$  acute umbo, sometimes striate, hygrophanous, vivid yellow to orange brown, sometimes with a greyish shade; gills distant, yellowish brown, seldom with violet tinge, drying pale yellow; stem 30-60  $\times$  1-4 mm, light orange brown, often with a distinct universal veil forming a protruding collar, below flocculose; flesh pale orange brown; smell strong, pungent. Sp (7-)8-9  $\times$  4.5-5.5  $\mu\text{m}$ , ellipsoid to obovoid (fig. 771D), moderately to fairly strongly dextrinoid. With deciduous trees, *Salix* shrubs or dwarf *Salix*, seldom conifers; summer to autumn; common in temp.-arc. / alp.; DK (LC), FI (LC), NO (LC), SE (LC). – CFP A60.

*C. parvannulatus* Kühner (*C. cedriolens* M.M. Moser nom. inval.)

Note: a variable species.

- Universal veil ochre; cap fibrous; sp fairly finely verrucose. Cap 5-15 mm, bell-shaped to convex, often with a  $\pm$  acute umbo, sometimes striate, hygrophanous, dull reddish brown to buff, drying ochre; gills distant, ochraceous brown; stem 20-60  $\times$  1-3 mm, pale ochraceous brown, upwards often violet, with a distinct universal veil forming a protruding collar, below floccose; flesh ochraceous brown; smell strong, pungent. Sp 8-9.5  $\times$  5-5.5  $\mu\text{m}$ , ellipsoid (fig. 771E), fairly weakly dextrinoid. With *Salix* shrubs or dwarf *Salix*; summer to early autumn; rare in suba.-arc. / alp.; FI, NO, SE. – Arnold 18, Sieniop 211 (as *parvannulatus*).
- C. croceocingulatus* N. Arnold & E. Ludwig
8. Sp boletoid,  $Q > 2$  (fig. 771F); cap innately fibrillose, especially at margin (*Inocybe*-like). Cap 10-40 mm, bell-shaped, soon expanded to depressed, with decurved margin and low umbo, mat, weakly hygrophanous, dark reddish brown to umber, blackish at centre, drying somewhat paler brown; gills crowded, ochraceous to yellow brown; stem 20-60  $\times$  3-6 mm, sometimes with a small bulb, fibrous, pale greyish, seldom faintly violaceous at the top; universal veil greyish, sometimes reddening; flesh white-greyish with a rose tinge; smell indistinct. Sp 8.5-10(-10.5)  $\times$  2.5-3.5  $\mu\text{m}$ , very finely verrucose. With *Pinus* in sandy heathland; autumn; occasional in hemib.-bore., rare in temp.; DK (NA), FI (LC), SE. – Arnold 27, Soop 05:96.
- C. heterosporus* Bres.
- Sp not fusiform,  $Q < 2$ ; cap not innately fibrillose 9
9. With *Alnus*; universal veil abundant; flesh in stem almost black. Cap 10-40 mm, bell-shaped, convex, with long incurved margin, with an umbo, often very fibrous to felty, often floccose from universal veil at margin, hygrophanous, dark greyish brown, drying paler greyish; gills medium spaced to distant, greyish brown, seldom violet tinged; stem 25-70  $\times$  2-5 mm, whitish fibrous, becoming dark grey; universal veil greyish white, forming thick girdles; flesh sometimes with a violet tinge; smell faint or like cedar wood. Sp 9-10.5  $\times$  5-5.5  $\mu\text{m}$ , narrowly ellipsoid, moderately verrucose (fig. 771G); sterile cells clavate. With *Alnus incana* and *A. glutinosa*, both in swamp forests and on dry soil; summer to autumn; occasional in temp.-bore.; DK (LC), FI (LC), NO (LC), SE (LC). – Arnold 2, B&K 5:291, CFP A32.
- C. alnetorum* (Velen.) M.M. Moser
- Not with *Alnus*; universal veil not remarkably abundant; flesh in stem usually pale 10
10. Gills whitish or greyish brown when young, often with a bluish tinge; smell indistinct; stem base or universal veil distinctly red or turning red when thumbed 11
- Gills yellowish brown; smell distinct or indistinct; stem base only sometimes turning faintly red 14
11. Young gills crowded and whitish, often with a bluish tinge; sp finely to moderately verrucose 12
- Young gills not remarkably crowded or pale, seldom bluish; sp strongly verrucose 13
12. Frb stout; stem 4-8 mm broad; universal veil usually white or slowly turning red; sp narrowly ellipsoid to cylindrical (to slightly fusiform), av  $Q > 1.7$ . Cap 20-50 mm, bell-shaped, soon expanded, sometimes with an umbo, glossy, hygrophanous, blackish to dark reddish





Spores and cheilocystidia: A: *Cortinarius erubescens*, B: *C. praestigiosus*, C: *C. vernus*, D: *C. inops*, E: *C. umbrinolens*, F: *C. carbunculus*.

brown, drying paler greyish brown; gills becoming greyish; stem 25-60 x 4-8 mm, firm, whitish fibrous, later greyish; reddening at base; universal veil thin, white, sometimes turning red; flesh in cap dark brown, in stem greyish white, slightly reddening when cut. Sp (7-)7.5-8.5 x 4-5  $\mu\text{m}$ , almost smooth (fig. 773A); sterile cells scattered, clavate. With deciduous trees, e.g. *Betula*, *Fagus* and *Quercus*, and conifers, usually in dry habitats; autumn; occasional in temp.-suba.; DK (LC), FI (LC), NO (LC), SE (LC). – CFP D51.

*C. erubescens* M.M. Moser

- Frb slender; stem 2-4 mm broad; universal veil red or soon turning red; sp broadly ellipsoid, av  $Q < 1.7$ . Cap 8-40 mm, bell-shaped to convex, often with a small umbo, glossy, hygrophanous, dark reddish brown, at centre blackish, drying ochraceous grey; stem 30-60 mm long, whitish fibrous, later greyish, often bluish at the top; universal veil red or turning red; flesh dark brown in the cap, greyish white, with a purple tinge in the stem. Sp (7-)7.5-8.5 x 4.5-5.5  $\mu\text{m}$ , finely to moderately verrucose (fig. 773B); sterile cells scattered, clavate to lageniform. With deciduous trees, e.g. *Salix caprea*, *Betula* and *Fagus*, often in moderately wet habitats; autumn; occasional in temp.-bore.; FI (LC), NO (LC), SE (LC). – CFP E04.

*C. praestigiosus* (Fr.) M.M. Moser

13. With deciduous trees or shrubs in lowland habitats; cap 10-40 mm; stem 2-5 mm broad. Cap bell-shaped to convex, later expanded, hygrophanous, dark brown to blackish brown, drying greyish brown; gills medium spaced, beige; stem 20-70 x 2-5 mm, light greyish, reddening from base; universal veil whitish, sometimes reddening; flesh greyish white; smell faint. Sp 7.5-8.5 x 5-6  $\mu\text{m}$ , obovoid to subglobose, strongly verrucose (fig. 773C); sterile cells clavate to subglobose, abundant. With *Betula*, *Tilia*, *Quercus* and *Fagus*; spring and summer, but also in autumn; common in temp.-suba.; DK (LC), FI (LC), NO (LC), SE (LC). – ACI 2 (as *castaneus*), Arnold 20, CFP C51, M&J 74, Ves 363.

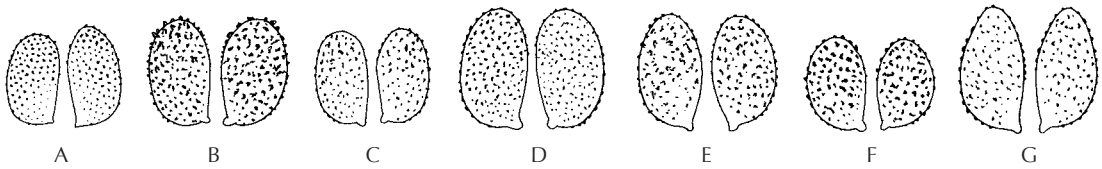
*C. vernus* H. Lindstr. & Melot (*C. erythrinus* Fr. s. auct.)

- With *Salix*, mainly in alpine habitats; cap 4-18 mm, stem 1-2(-3) mm broad. Cap bell-shaped to convex, sometimes with a small umbo; finely fibrillose, hygrophanous, blackish brown, drying dark brown; gills medium spaced, cinnamon; stem 10-30 x 1-2(3) mm, pale fibrillose, dark brown; universal veil scanty, whitish, fibrillose; flesh dark greyish, sometimes with a pink flush; smell faint. Sp 7.5-8.5 x (5-)5.5-6  $\mu\text{m}$ , obovoid to subglobose, strongly verrucose (fig. 773D); sterile cells clavate, abundant. With dwarf *Salix* and in *Salix* shrubs; summer to early autumn; rare, but probably overlooked, in suba.-arc. / alp.; NO, SE. – B&K 5:337, Fav 55:10.1, M&J 82.

*C. inops* J. Favre

Note: near is also *C. pusillus* F.H. Møller, but sp less strongly verrucose and probably not a synonym.

14. Smell earthy like *C. himmuleus* or beet rot 15  
 - Smell of cedar wood (*Juniperus virginianus*) or faint 16
15. With deciduous trees; cap dark brown; stem paler; smell strongly earthy; sp 8.5-9.5 x (4.5-)5-5.5  $\mu\text{m}$  (fig. 773E). Cap 15-40 mm, bell-shaped to expanded, usually with low umbo, often rimose at margin, hygrophanous, drying more greyish; gills crowded to medium spaced, yellowish brown; stem 30-70 x 3-7 mm, white fibrous, then greyish brown, sometimes reddening at base; universal veil whitish; flesh greyish brown, turning faintly reddish at base. Sp ellipsoid to amygdaloid, moderately verrucose; sterile cells clavate. Usually with *Betula*, but also *Fagus*; autumn; common in temp.-southern bore., occasional in middle-northern bore.; DK (LC), FI (LC), NO (LC), SE (LC). – CFP A08, Sieniop 220, Ves 362.  
*C. umbrinolens* P.D. Orton  
 - With *Picea*; cap and stem almost black; smell moderately strong, usually earthy; sp 9.5-10.5 x 5-6  $\mu\text{m}$  (fig. 773F). Cap 8-40 mm, bell-shaped to convex-expanded, with a small umbo, hygrophanous, drying greyish brown; gills crowded (to medium spaced), dark brown; stem 25-40 x 3-5 mm, almost black; universal veil greyish-brownish; flesh blackish brown. Sp ellipsoid to amygdaloid, moderately verrucose; sterile cells clavate (to lageniform). In wet forests, often with tall herbs; late summer to autumn; rare in hemib.-bore.; FI, SE. – CFP E05.  
*C. carbunculus* H. Lindstr. & H. Markl.
16. With conifers; smell faint see *C depressus* key P 21  
 - With deciduous trees or shrubs; smell of cedar wood or faint 17
17. In alpine habitats; universal veil often forming a protruding ring; sp av Q > 1.8, narrowly ellipsoid to cylindrical, finely verrucose (fig. 775A). Cap 10-20 mm, bell-shaped to convex, with a small umbo, hygrophanous, at first fibrous to almost scaly from a whitish veil, blackish brown, paler at margin, drying dark reddish brown; gills medium spaced, yellowish brown; stem 10-25 x 1-3 mm, brown; universal veil white, universal veil at first sock-like, later flocculose below the ring; flesh blackish brown in cap, reddish brown in stem; smell faint. Sp 8-9(-10) x 4-5  $\mu\text{m}$ . With *Salix* bushes and shrubs; summer; very rare but probably overlooked in suba.-arc./alp.; SE. – Fav 55:9.6.  
*C. albonigrellus* J. Favre  
 - Mainly in lowland habitats; universal veil not forming a protruding ring; sp ellipsoid to broadly ellipsoid, av Q < 1.8, moderately to coarsely verrucose 18
18. Cap 10-35 mm, bell-shaped to convex, universal veil remnants scanty, smell usually faint; sp (8-)8.5-10 x 5-6  $\mu\text{m}$  (fig. 775B). Cap with a small umbo, hygrophanous, dark greyish brown, drying paler yellowish brown; gills medium spaced, dull yellow brown; stem 30-60 x 2-5 mm, white fibrous, yellowish grey to brown, sometimes violet upwards; universal veil greyish white, forming faint girdles; flesh greyish brown. Sp broadly ellipsoid to obovoid, fairly finely to moderately verrucose, strongest at apex. With deciduous trees and bushes, e.g. *Salix* and *Betula*, often on somewhat moist soil; late summer to autumn; occasional in temp.-suba.; DK (LC), FI (LC), IS, NO (LC), SE (LC). – AC 29, C&D 1142, CFP C02, FAD 103D, Ves 362.  
*C. decipiens* (Pers.: Fr.) Fr. var. *decipiens*  
 - Cap 20-60 mm, bell-shaped to expanded, universal veil remnants abundant, smell usually strong of cedar wood; sp 7-8.5 x 5-5.5  $\mu\text{m}$  (fig. 775C). Cap sometimes with a small umbo, dark greyish to blackish brown; stem 40-90 x 2-6 mm; universal veil rendering the stem flocculose. Sp narrowly ellipsoid to ellipsoid, moderately verrucose. In other characters like the main variety. With *Betula*, *Populus*, *Quercus* and *Salix* bushes, often in young forests and in dry habitats; occasional, but locally common in temp.-suba.; DK (LC), FI (LC), NO, SE (LC). – B&K 5:314, CFP D44, FND 15:11a.  
*C. decipiens* (Pers.: Fr.) Fr. var. *atrocoeruleus* (M.M. Moser) H. Lindstr.



Spores: A: *Cortinarius albonigrellus*, B: *C. decipiens* var. *decipiens*, C: *C. decipiens* var. *atrocoeruleus*, D: *C. colus*, E: *C. anthracinus*, F: *C. danicus*, G: *C. bayeri*.

### Key Q: Subgen. *Telamonia* sect. *Anthracini* Melot

TUULA NISKANEN & ILKKA KYTÖVUORI

Cap 10-40 mm, red brown to dark purplish brown, hygrophanous; universal veil orange or red; with anthrachinonic pigments. Three species in the key, but in addition at least one nameless species occurs in the Nordic countries.

1. Universal veil very distinct, vividly orange red, often as a continuous coating on the basal part of the stem. Cap 10-30 mm, conical to hemispherical, later low convex, sometimes with a low umbo, red brown, hygrophanous; gills medium spaced, yellowish brown, later cinnamon brown; stem 40-70 × 2-5 mm, cylindrical to slightly clavate, whitish silky-fibrillose, later pale yellowish brown; flesh pale ochraceous brown; smell indistinct; exsiccates with brown cap, usually lower half of the stem orange red. Sp 9-10(-10.5) × 5.5-6.5 μm, ellipsoid, weakly to moderately verrucose, more strongly at apex (fig. 775D), moderately dextrinoid; gill trama hyphae distinctly zebra-striate incrustated. In mesic *Picea* forests, but also in dry *Pinus* forests; late summer to autumn; rare in hemib.-coniferous suba.; DK (RE), FI (LC), NO (LC), SE (LC). – CFP A55.

#### *C. colus* Fr.

Note: the name has been used collectively in the Nordic countries.

- Universal veil fairly sparse, fibrillose, orange or blood red 2
- 2. Universal veil orange; cap purplish brown to black; sp 8-10 × 5-6 μm (fig. 775E). Cap 10-30 mm, conical when young, soon almost plane with an often acute umbo, hygrophanous; gills medium spaced, yellowish brown, later cinnamon brown; stem 30-55 × 3-5 mm, cylindrical, silky-fibrillose, pale purplish; flesh pale purplish, often with a lilac tint; smell indistinct; exsiccates with greyish-blackish cap, purplish-blackish stem and cinnamon-brown gills. Sp ellipsoid to slightly amygdaloid, finely to moderately verrucose, weakly to moderately dextrinoid; gill trama hyphae finely to distinctly zebra-striate incrustated; basidia and sp sometimes with turquoise crystals; pileipellis with strongly purple subpellis. In mesic coniferous or deciduous forests with *Picea*, *Corylus*, *Fagus*, *Betula*, *Quercus* or *Tilia*, often on rich soil; late summer to autumn; occasional in hemib., rare in temp. and bore., more rare towards the north; DK (LC), FI (LC), NO (LC), SE (LC). – CFP C03, GCI D15, R&H 487, Nyl 477, Ves 363.

#### *C. anthracinus* (Fr.: Fr.) Fr.

- Universal veil blood red; cap dull red brown; sp 7.5-8.5 × 5-5.5 μm (fig. 775F). Cap 20-45 mm, conical, later low convex, often with an umbo, hygrophanous; gills medium spaced, brownish with a purplish tint; stem 30-55 × 3-5 mm, cylindrical, silky-fibrillose, rose to greyish rose, sometimes with a lilac tint at the top; flesh pale red brown; smell slightly raphanoid; exsiccates with a fairly dark brownish cap, vinaceous-blackish stem and cinnamon-brown gills. Sp ellipsoid to slightly amygdaloid, fairly strongly verrucose, weakly dextrinoid; gill trama hyphae finely zebra-striate incrustated. In deciduous forests with *Fagus* or *Quercus*; late summer to autumn; rare in temp.; DK (NT), SE.

#### *C. danicus* Høil.

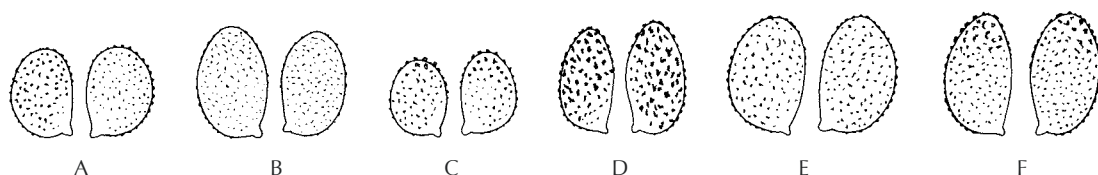
Note: type material has not been studied.

**Key R:** Subgen. *Telamonia* sects *Fulvescentes* Melot and *Laeti* Melot

TUULA NISKANEN &amp; ILKKA KYTÖVUORI

Cap 10-65 mm, mat, often thin, hygrophanous, with warm red brown, vinaceous red to ochraceous brown, rarely olive-brown colours; stem silky-shiny fibrillose; universal veil yellowish, ochraceous, pinkish or vinaceous, sometimes very indistinct; flesh  $\pm$  yellowish brown, not dark, nor darkening towards stem base. Seven species in the key, but the real number of the Nordic species is much higher.

1. Universal veil ochraceous or yellow 2  
 - Universal veil pinkish to vinaceous 4
2. In dry *Pinus* heath forests on sandy soil; cap 10-25 mm, with small, ochraceous scales. Cap conical to hemispherical, later low convex with an umbo, mat, yellow brown to dark red brown, hygrophanous; gills medium spaced, pale yellowish brown, with age yellow brown; stem 30-55 x 2-5 mm, cylindrical, whitish silky-fibrillose; universal veil yellow ochraceous, forming complete and incomplete girdles on stem; flesh yellowish brown; smell indistinct; exsiccates with a red-brown to dark brown cap and pale greyish yellow stem. Sp 9.5-11 x 5-6  $\mu$ m, narrowly amygdaloid, with a suprahilar depression, moderately verrucose (fig. 775G), weakly dextrinoid. Late summer to late autumn; occasional in hemib.-bore.; FI (LC), SE.  
 – Soop 04:91.  
*C. bayeri* (Velen.) Moënne-Loec. & Reumaux s. lato  
 Note: type material has not been studied, and the interpretation follows Lindström & Soop.  
 - In mesic *Picea* forests; cap 20-65 mm,  $\pm$  smooth 3
3. Cap pale greyish yellow brown, sometimes with olivaceous brown tints; universal veil ochraceous yellow; sp subglobose (fig. 777A). Cap 35-65 mm, conical to hemispherical, later low convex with an umbo, mat, hygrophanous; gills medium spaced, pale yellowish brown, with age yellow brown; stem 50-130 x 5-11 mm, cylindrical to somewhat clavate, whitish silky-fibrillose; universal veil forming complete and incomplete girdles on stem; flesh yellowish brown to yellowish grey; smell indistinct; exsiccates with a pale greyish yellow-brown cap and pale greyish brown stem. Sp 7.5-8 x 5.5-6  $\mu$ m, subglobose to broadly ovoid, moderately verrucose, weakly to moderately dextrinoid. In coniferous forests with *Picea*; late summer to autumn; common in bore., occasional in hemib., less common in western parts; FI (LC), NO (LC), SE (LC). – CFP C49, R&H 511.  
*C. ochrophyllus* Fr.  
 - Cap vivid yellowish brown; universal veil yellow to ochraceous yellow; sp ellipsoid to slightly amygdaloid (fig. 777B). Cap 20-50 mm, conical to hemispherical, later low convex with an umbo, mat, narrowly pellucid-striate, hygrophanous; gills medium spaced, pale yellowish brown, later cinnamon brown; stem 40-110 x 3-9 mm, cylindrical, whitish silky-fibrillose; universal veil fairly distinct, forming complete and incomplete girdles on stem; flesh yellowish brown; smell indistinct; exsiccates with a pale brown cap and pale yellowish brown stem. Sp 9-10 x 5.5-6(-6.5)  $\mu$ m, low verrucose to almost smooth, moderately to strongly dextrinoid. In mesic coniferous forests with *Picea*; late summer to autumn; rare in hemib.-bore.; FI (DD), NO (LC), SE (NE). – CFP C12.  
*C. detonsus* (Fr.: Fr.) Fr.
4. Universal veil vinaceous red to red brown, often distinct; stem 6-11 mm broad; sp 6.5-7.5 x 5-5.5  $\mu$ m, ovoid-subglobose (fig. 777C). Cap 35-60 mm, conical to hemispherical, later low convex with an umbo, mat, vinaceous red brown, darkest at the centre, hygrophanous; gills medium spaced, pale yellowish brown, with age vividly yellowish brown; stem 50-110 mm long, cylindrical, whitish silky-fibrillose; universal veil forming many thin patches or incomplete girdles on stem, sometimes sparse; flesh yellow brown; smell indistinct; exsiccates with a fairly dark brown cap and pale greyish stem. Sp moderately verrucose, moderately dextrinoid. In mesic coniferous forests with *Picea*, in western NO also in mixed *Pinus-Betula*



Spores: A: *Cortinarius ochrophyllus*, B: *C. detonsus*, C: *C. badiovinaceus*, D: *C. fulvescens*, E: *C. bulliardiioides*, F: *C. subfloccopus*.

forests, often solitary; late summer to autumn; occasional in hemib.-bore.; FI (LC), NO (LC), SE (NT). – AC 7:154, M&J 44.

***C. badiovinaceus* M.M. Moser**

- Universal veil vinaceous red to pale pinkish, distinct or indistinct; stem 3-9 mm broad; sp > 7.5  $\mu$ m long 5
- 5. With *Betula*; sp 7.5-8.5  $\times$  5-5.7  $\mu$ m, obovoid see *C. heterocyclus* key C 2
- With coniferous trees; sp > 8  $\mu$ m long, ovoid, amygdaloid or ellipsoid 6
- 6. Sp < 5.5  $\mu$ m broad. Cap 25-50 mm, conical to hemispherical, later low convex with an umbo, mat, narrowly pellucid-striate, red brown to vinaceous red brown, hygrophanous; gills medium spaced, pale yellowish brown, later cinnamon brown; stem 50-120  $\times$  3-9 mm, cylindrical, whitish silky-fibrillose; universal veil pale pinkish, hazy, forming incomplete girdles on stem; flesh yellowish brown; smell indistinct; exsiccates with a brown to fairly dark brown cap and pale greyish stem. Sp 8.5-9.5  $\times$  4.8-5.2  $\mu$ m, narrowly amygdaloid, moderately verrucose (fig. 777D), weakly to moderately dextrinoid. In mesic coniferous forests with *Picea*; late summer to late autumn; common in temp.-bore.; DK (LC), FI (LC), NO (LC), SE (LC). – Nyl 476.

***C. fulvescens* Fr.**

Note: the name has been used collectively in the Nordic countries, including most of the pinkish to vinaceous red veiled species. The name is here used for the common species with fairly big and amygdaloid sp.

- Sp > 5.5  $\mu$ m broad 7
- 7. Sp 8.5-10.5  $\times$  6-7  $\mu$ m, broadly ovoid (fig. 777E). Cap 35-60 mm, conical to hemispherical, later low convex with an umbo, mat, red brown to vinaceous red brown, hygrophanous; gills medium spaced, pale yellowish brown, later yellowish to cinnamon brown; stem 60-120  $\times$  4-9 mm, cylindrical, whitish silky-fibrillose; universal veil pale pinkish, forming incomplete girdles on stem; flesh honey brown; smell indistinct; exsiccates with brown cap and pale greyish stem. Sp finely, evenly verrucose, strongly dextrinoid; gill trama hyphae strongly incrustated. In mesic coniferous forests with *Picea*; late summer to autumn; occasional in hemib.-bore.; FI, NO, SE. – AC 7:149.

***C. bulliardiioides* Rob. Henry**

- Sp 9-10.5  $\times$  5.5-6.5  $\mu$ m, slightly amygdaloid to ellipsoid (fig. 777F). Universal veil fairly distinct, vinaceous red; often in *Sphagnum*. Cap 15-40 mm, conical to hemispherical, later low convex with an umbo, mat, translucently striate up to halfway, red brown to vinaceous red brown, hygrophanous; gills medium spaced, pale yellowish brown, later cinnamon brown; stem 50-110  $\times$  3-7 mm, cylindrical, whitish silky-fibrillose; universal veil forming many thin patches and incomplete girdles on stem; flesh yellowish brown; smell indistinct; exsiccates with a brown to fairly dark brown cap and pale greyish stem. Sp fairly finely verrucose, more strongly at apex, moderately dextrinoid. In mesic to damp coniferous forests with *Picea*; late summer to autumn; occasional in hemib.-bore., but overlooked; FI (LC), NO, SE. – AC 7:148 (as *floccopus* var. *gracilis*), Kar 48, M&J 79 (as *fasciatus*).

***C. subfloccopus* Kytöv., Niskanen & Liimat. in press** (*C. floccopus* Bidaud var. *gracilis* Bidaud & Fillion, *C. fasciatus* s. Kytövuori et al. 2005)