

Hebeloma (Fr.) P. Kumm.

JAN VESTERHOLT

Hebelomina Maire

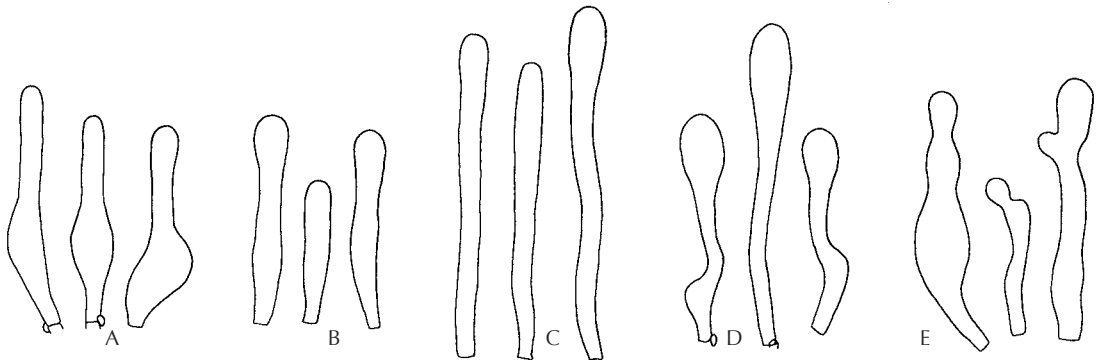
Frb collybioid to tricholomatoid, with viscid cap and often with raphanoid or sweetish smell. Cap slightly hygrophanous or not, glabrous, rarely tomentose, viscid to dry, whitish, pinkish buff, clay buff, cinnamon, umber or sepia. Gills emarginate or adnate, white to pale greyish or pale buff, becoming clay buff to brown, in some species exuding droplets. Stem minutely to coarsely floccose, at least at the top, in many species discolouring brown from the base. Universal veil present or absent, in one species membranous; partial veil cobweb-like or absent. Smell raphanoid in most species, in other species sweetish, like marzipan, cocoa, soap, tea or fruit or indistinct. Taste raphanoid, indistinct or bitter. Sp deposit clay buff to brown.

Sp ellipsoid, amygdaloid or almost citriform, almost smooth to rugose or verrucose under light microscope, SEM shows a fine to coarse ornamentation of branched ridges, in some species with a loosening perispore, dextrinoid or without iodine reactions, a positive reaction best observed after a short while in sp floating freely in the preparation. Cheilocystidia present. Pleurocystidia mostly absent. Pileipellis an ixocutis to an ixotrichoderm. Clamps present.

Mycorrhizal, on soil in association with trees and shrubs, some species playing an important role as pioneer mycorrhizal species.

39 species in the Nordic countries, 40 species in the key. Several species are slightly poisonous and none are considered edible.

Lit.: Bruchet 1970, Gröger & Zschieschang 1981, La Chiusa 1999, Romagnesi 1965, 1984, Vesterholt 1989, 1995, 2005.



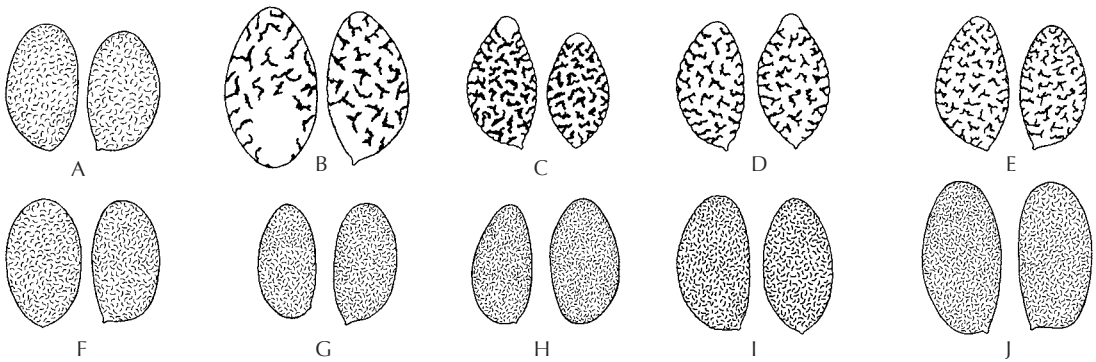
Cheilocystidia typical for *Hebeloma* sections: A: sects *Hebeloma* and *Sinapizantia*, B: sect. *Theobromina*, C: sect. *Velutipes*, D: sect. *Denudata*, E: sects *Myxocybe* and *Sacchariomentia*.

Main key

1. Universal veil forming a membranous ring on the stem; stem continuing into a strongly rooting base; smell like marzipan, rarely weak Key F sect. *Myxocybe* p. 814
 - Universal veil present or absent, but not forming a membranous ring on the stem; stem rooting or not; smell not like marzipan 2
2. Partial veil cobweb-like, but often fugacious; stem only pruinose at the top; cheilocystidia with a ± cylindrical apical part, often widened in lower half (fig. 347A); perispore not loosening Key A sect. *Hebeloma* p. 807
 - Partial veil absent; stem often entirely pruinose or floccose; cheilocystidia often with a different shape; perispore loosening or not 3
3. Smell strong and sweet Key G sect. *Sacchariomentia* p. 816
 - Smell indistinct or like radish, cocoa, soap, tea or fruit 4
4. Stem often ± rooting; smell without radish-like components; gills without droplets; cheilocystidia ± cylindrical or variable in shape (fig. 805E) Key F sect. *Myxocybe* p. 814
 - Stem not rooting; smell usually with radish-like components; gills with or without droplets; cheilocystidia well differentiated and cylindrical, clavate, capitate or lageniform 5
5. Sp without iodine reactions or faintly dextrinoid Key E sect. *Denudata* p. 810
 - Sp distinctly to strongly dextrinoid 6
6. Sp on av 4.4-5.3 μm broad Key C sect. *Theobromina* p. 809
 - Sp on av > 5.5 μm broad 7
7. Many cheilocystidia lageniform with a cylindrical, apical part (fig. 805A) 8
 - Cheilocystidia cylindrical to clavate or capitate, sometimes both widened at apex and at base (fig. 805D) 9
8. Stem coarsely floccose in transverse belts, especially in upper part, not discolouring from base; nearly all cheilocystidia lageniform Key B sect. *Sinapizantia* p. 808
 - Stem finely pruinose, especially in upper part, discolouring from base; lageniform cheilocystidia are intermixed with clavate cheilocystidia Key D sect. *Velutipes* p. 809
9. Cheilocystidia typically widened both at apex and base Key E sect. *Denudata* p. 810
 - Cheilocystidia cylindrical to subclavate, typically not much widened at apex or base (fig. 805C) Key D sect. *Velutipes* p. 809

Key A: Sect. *Hebeloma*

1. Sp ovoid-amygdaloid to citriform, mostly brownish, weakly to strongly dextrinoid, rarely almost without iodine reactions (subsect. *Amygdalina* Vesterh.) 2
 - Sp ellipsoid to ellipsoid-ovoid, mostly yellowish in water and KOH mounts, without iodine reactions or weakly dextrinoid (subsect. *Hebeloma*) 7
2. Cap dark reddish brown, umber, sepia or almost black, sometimes almost to the margin 3
 - Cap clay buff to orange brown with a paler margin 4
3. Sp ellipsoid to ovoid (fig. 807A); with dwarf *Salix* in arc./alp.; exsiccates rather coriaceous. Cap 10-45 mm, hemispherical, then convex to expanded with or without an umbo, almost dry, umber to sepia; gills medium spaced; stem 30-60 x 3-6 mm, cylindrical, sparsely floccose above the cortina zone, whitish, turning clay buff from the base; smell raphanoid. Sp 9-13 x 5-7.5 μm , rugulose, without iodine reactions, perispore not loosening; cheilocystidia lageniform with a cylindrical to subclavate apex, apex on av 6-7 μm broad. Summer; locally common; IS, NO (LC, incl. SvB). – FNE 3:49.
H. polare Vesterh.
 - Sp ovoid to amygdaloid (fig. 807B); with *Salix* in arc./alp. and in lowland bogs and sand dunes; exsiccates rather fragile. Cap 8-30(-40) mm, hemispherical, then convex to expanded, viscid to nearly dry, umber to dark brick, sepia or almost black, margin sometimes paler; gills medium spaced to distant; stem 12-40(-65) x 1.5-4(-6) mm, cylindrical, sparsely floccose above the cortina zone, sordid whitish to clay buff, discolouring to sepia from the base; smell raphanoid. Sp 9-13.5 x 5.5-8 μm , rugulose, faintly to distinctly dextrinoid, perispore not loosening; cheilocystidia lageniform with a cylindrical apex, apex on av 4.5-6 μm broad. Summer to autumn; common in temp.-arc./alp.; DK (LC), FI (LC), IS, NO (LC), SE (LC). – AAF 3:53, FNE 3:51&53, M&J 8,16, Ves 334.
H. nigellum Bruchet (*H. kuehneri* Bruchet, *H. atrobrunneum* Vesterh., *H. candidipes* s. auct. p.p.)
4. Sp amygdaloid to subcitriform, often with a papilla-like apex (fig. 807C), strongly dextrinoid; exsiccates nearly always discoloured to dark brown; under *Betula*, *Corylus*, *Quercus* and *Fagus*. Cap (15-)20-50 mm, hemispherical, then convex to expanded, viscid to slimy, clay buff to yellowish brown at centre, pale to white at margin; gills crowded; stem 25-90 x 4-8 mm, \pm clavate, sparsely floccose above the fugacious cortina zone, white, discolouring to sepia from the base; smell raphanoid. Sp 8-12.5 x 5-7.5 μm , rugose, perispore not loosening; cheilocystidia lageniform with a cylindrical apex, apex on av 5-5.5 μm broad. Mostly in humid places, also on landslide slopes; summer to autumn; rare in temp.-bore.; DK (VU), FI (DD), IS (Na), NO (LC), SE (LC). – B&K 123, End 3376, FAD 118E, FNE 3:59, Ves 335.
H. sordescens Vesterh. (*H. testaceum* Quél. s. auct.)
 - Sp amygdaloid to ovoid, not with a papilla-like apex, dextrinoid, but not strongly so; exsiccata typically not discoloured to dark brown; under *Salix*, possibly also other hosts 5
5. Stem 1-3 mm thick; cap 8-24 mm broad; in alpine habitats see *H. nigellum* 3
 - Stem (2-)3-8 mm thick; cap 15-50 mm broad; in lowland and alpine habitats 6
6. Cap margin white, contrasting the orange-brown centre; stem white with an orange-brown base; with *Salix* in humid forests. Cap 15-35 mm, convex to expanded, viscid; gills medium spaced; stem 35-70 x 3-5 mm, cylindrical or slightly widened at base, sparsely floccose above the cortina zone; smell raphanoid. Sp 9.5-13 x 5.5-6.5 μm , amygdaloid, rugose (fig. 807D), distinctly dextrinoid, perispore not loosening; cheilocystidia lageniform with a cylindrical apex; apex on av 4.5-5 μm broad. Autumn; very rare in temp.-bore., but possibly



Spores: A: *Hebeloma polare*, B: *H. nigellum*, C: *H. sordescens*, D: *H. candidipes*, E: *H. monticola*, F: *H. marginatum*, G: *H. sordidum*, H: *H. mesophaeum*, I: *H. collariatum*, J: *H. psammophilum*.

overlooked; DK (NA), SE. – FNE 3:57.

***H. candidipes* Bruchet**

- Stem and cap less contrasting, appearance like *H. mesophaeum*; with *Salix* in arc./alp., less often with *Salix* or *Betula* in woodland and mires in bore.-suba. Cap 21-40(-55) mm, hemispherical, then convex to expanded or even depressed, viscid to almost dry, clay buff to dark brick at centre, paler towards margin; gills medium spaced to crowded; stem 25-80 (-110) x 2-6 mm, cylindrical, sparsely floccose above the cortina zone, pale cream, turning clay buff from base; smell raphanoid. Sp 9.5-13 x 5.5-7 μ m, ovoid to amygdaloid, rugulose (fig. 807E), slightly dextrinoid, perispore not loosening; cheilocystidia lageniform with a cylindrical apex, apex on av 4.5-5.5 μ m broad. Summer to autumn; common in suba., occasional in bore., rare in hemib.; FI (LC), IS, NO (LC), SE (LC). – FNE 3:55.

***H. monticola* Vesterh. (*H. remyi* Quad. s. Bruchet)**

- 7. With dwarf *Salix* or *Dryas* in suba.-arc./alp. 8
- In different habitats 10
- 8. Cap umber to sepia, almost to the margin; exsiccates coriaceous see *H. polare* 3
- Cap \pm unicoloured clay buff, Isabella, cinnamon to yellowish brown, or margin distinctly paler than the centre; exsiccates fragile to fairly tough 9
- 9. Sp on av > 10.3 μ m long and > 5.8 μ m broad (fig. 807F); cap 10-24 mm broad, not fully expanding. Cap hemispherical, then convex, slightly viscid to dry, nearly unicoloured cinnamon to yellowish brown, often with veil remnants; gills medium spaced to distant; stem 15-32 x (2-)3-5 mm, cylindrical, pruinose above the cortina zone, whitish, turning clay buff; smell faintly raphanoid. Sp 9-12 x 5.5-7 μ m, ellipsoid, slightly rugulose, without iodine reactions, perispore not loosening; cheilocystidia lageniform with a cylindrical to subclavate apex, apex on av 4.5-5.5 μ m broad. With dwarf *Salix*; summer; rare in suba.-arc./alp., but possibly overlooked; IS, NO (LC), SE. – FNE 3:43.

***H. marginatum* (J. Favre) Bruchet**

- Sp on av < 10.5 μ m long and < 6 μ m broad; cap 15-50(-70) mm broad, fully expanding with age see *H. mesophaeum* 11
- 10. Cap initially fairly pale, \pm unicoloured cream to clay buff; stem (4-)6-14 mm broad, often becoming sordid with age; with deciduous trees and conifers, not known from sand dunes.

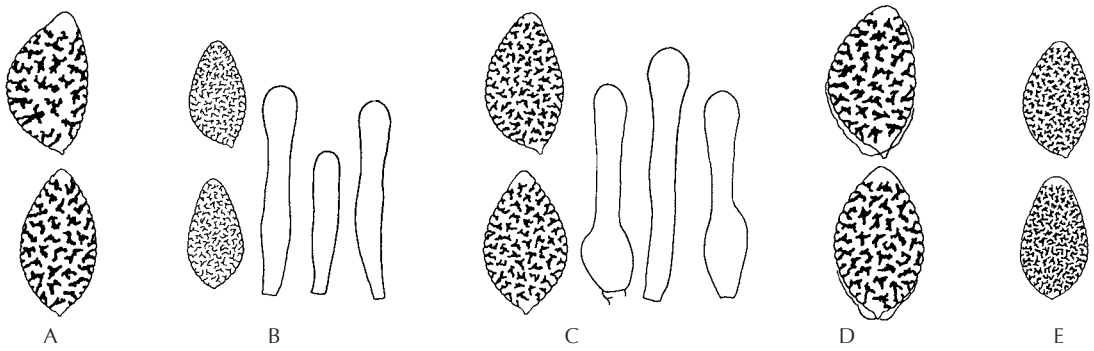
Cap 25-60 mm, hemispherical to convex, then expanded, viscid to almost dry; gills crowded; stem 50-110 x (4-)6-14 mm, cylindrical, floccose above the cortina zone, whitish, soon turning clay buff to umber from the base; smell faint. Sp 8.5-12.5 x 5-7 μm , ellipsoid, slightly rugulose (fig. 807G), without iodine reactions, perispore not loosening; cheilocystidia lageniform with a cylindrical apex, apex on av 5-6 μm broad. Spring to autumn; rare in temp.-hemib.; DK (VU), FI (DD). – BCat 414, C&D 985, FAD 118F, FNE 3:39, M&J 17.

H. sordidum Maire (*H. pallidum* Malençon, *H. malenconii* Bellù & Lanzoni, *H. mesophaeum* (Pers.) Quél. var. *lacteum* Vesterh.)

- Cap mostly with a clay-buff to cinnamon or umber centre and a paler, often greyish margin; stem often narrower; in sand dunes or other habitats 11
- 11. Sp on av < 10.5 μm long. Cap 15-50(-70) mm, hemispherical to convex, then expanded, viscid to slimy, clay buff to cinnamon or umber at centre, usually paler and more greyish towards margin; gills medium spaced to crowded; stem 20-70(-90) x 2-8(-12) mm, cylindrical, floccose above the cortina zone, whitish to cream, turning clay buff to umber from the base; universal veil sometimes forming a woolly stem covering; smell faintly raphanoid. Sp 8-11 x 4.5-6.5 μm , ellipsoid to ovoid, appearing almost smooth (fig. 807H), without iodine reactions, perispore not loosening; cheilocystidia lageniform with a cylindrical apex, apex on av 4.5-5.5 μm broad. With deciduous and coniferous hosts in forests, dunes and arctic/alpine habitats; summer to autumn, less often in spring; very common in temp.-arc./alp.; DK (LC), FI (LC), FO, IS, NO (LC), SE (LC). – C&D 986, 987, Däh 682, 683, FNE 3:35, 37 & 41, R&H 478, Ves 334, ☉.
- H. mesophaeum* (Pers.) Quél. (*H. strophosum* (Fr.) Sacc., *H. mesophaeum* (Pers.) Quél. var. *crassipes* Vesterh., incl. *H. bruchetii* Bon, *H. repandum* Bruchet)
- Sp on av > 10.5 μm long 12
- 12. Stem pale from the beginning, but not whitish, soon discolouring to brown from base; under *Salix*, *Betula* or *Populus*, often with *Salix* in coastal dunes; sp ellipsoid to ovoid (fig. 807I). Cap 10-55 mm, convex, then expanded, slightly viscid to almost dry, clay buff to dark brick at centre, paler and more greyish towards margin; stem (20-)30-90 x (2-)3-8(-12) mm, cylindrical, floccose above the cortina zone; smell faintly raphanoid. Sp 9.5-13 x 5.5-7 μm , rugulose, without iodine reactions or very faintly dextrinoid, perispore not loosening; cheilocystidia lageniform with a cylindrical apex, apex on av 5-6.5 μm broad. Sometimes subfasciculate; spring to autumn; common in sand dunes in DK, elsewhere rare or overlooked in temp.-middle bore.; DK (LC), FI (DD), U: Hanko, Kn: Valtimo), IS (Au), NO (LC), SE (LC). – B&K 3:105, FNE 3:45, Ves 335.
- H. collariatum* Bruchet
- Stem whitish, but discolouring and becoming brown striate with age; only recorded with *Salix* in coastal dunes; sp ellipsoid to subangular-cylindrical or ovoid (fig. 807J). Cap 23-55 mm, convex, then expanded, slightly viscid, mostly with appressed sand particles, nearly unicoloured cinnamon to umber or dark brick; gills crowded; stem 45-90 x 7-14 mm, cylindrical, floccose above the cortina zone; smell faintly raphanoid. Sp 10-13.5 x 5.5-7.5 μm , slightly rugulose, without iodine reactions, perispore not loosening; cheilocystidia lageniform with a cylindrical, less often subcapitate apex, apex on av 5.5-6.5 μm broad. Autumn; rare in temp.; DK (DD). – C&D 989, FNE 3:47.
- H. psammophilum* Bon

Key B: Sect. *Sinapizantia* (Quad.) Vesterh.

Cap 30-120 mm, hemispherical, then convex to expanded, viscid to slimy, pinkish buff to fawn or brick, unicoloured or paler towards margin; gills crowded; stem 30-135 x 8-25 mm, cylindrical with a bulbous, 10-35 mm broad base, strongly floccose in transverse belts, whitish; smell raphanoid. Sp 9.5-13.5 x 6-8 μm , broadly citriform, verrucose (fig. 809A), strongly dextrinoid, perispore rarely loosening; cheilocystidia lageniform with a cylindrical apex,



Spores and cheilocystidia: A: *Hebeloma sinapizans*, B: *H. theobrominum*, C: *H. quercetorum*, D: *H. aestivale*, E: *H. incarnatum*.

apex on av 5-7 μm broad. On \pm calcareous soil with deciduous trees, less often conifers; summer to autumn; common in temp., occasional in hemib., rare in southern-middle bore.; DK (LC), FI (LC), NO (LC), SE (LC). – C&D 1005, FNE 3:61, Phil 215f, R&H 479, Ves 339, \odot .
H. sinapizans (Paulet) Sacc.

Key C: Sect. *Theobromina* Beker, U. Eberh. & Vesterh.

Cap 30-60 mm, hemispherical, then convex to expanded, viscid, fawn to brick or orange brown almost to margin, often with a greyish pruina when young; gills crowded; stem 22-65 \times 6-13 mm, cylindrical, pruinose in upper part, whitish; smell faintly cocoa-like to raphanoid. Sp 8-11 \times 4-5.5 μm , narrowly amygdaloid, rugulose (fig. 809B), strongly dextrinoid, perispore rarely loosening; cheilocystidia cylindrical to clavate and \pm widened in lower half, apex on av 5.5-7.5 μm broad. With deciduous trees or conifers; summer to autumn; occasional in temp.-bore.; DK (LC), FI (LC), NO (LC), SE (LC). – C&D 992, Däh 692, 693, FNE 3:63, Phil 217f, Ves 339, \odot .

H. theobrominum Quad. (*H. truncatum* (Schaeff.) P. Kumm. s. auct.)

Key D: Sect. *Velutipes* Vesterh.

1. With a mixture of lageniform and clavate cheilocystidia (fig. 809C). Cap 20-55 mm, convex to expanded, viscid to slimy, pinkish buff to clay buff or yellowish brown; gills crowded; stem 28-80 \times 6-13 mm, cylindrical or widened to 12-17 mm at base, pruinose, whitish, but discolouring to brown from the base; smell raphanoid. Sp 10.5-13.5 \times 6-8 μm , amygdaloid to broadly citriform (fig. 807C), rugulose to verrucose, strongly dextrinoid, perispore sometimes loosening; apex of cheilocystidia on av 6-7 μm broad. With deciduous trees on calcareous soil; autumn; rare in temp.-hemib., but possibly overlooked; DK (NA), NO, SE. – FNE 3:71.

H. quercetorum Quad.

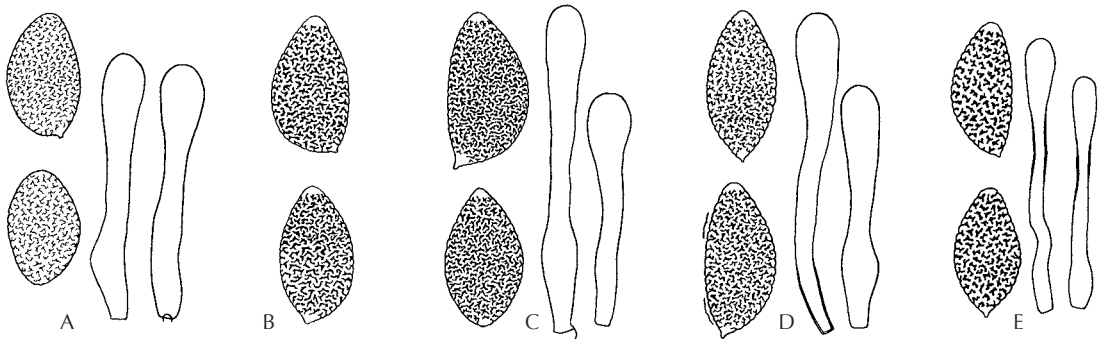
- Cheilocystidia cylindrical to subclavate (fig. 805C) 2
2. Perispore distinctly loosening in most sp (fig. 809D); stem base without a bulb, often with mycelial chords. Cap 17-70 mm, convex, then expanded, viscid to slimy, clay buff to cinnamon at centre, paler towards margin; gills crowded; stem 19-95 \times 5-15 mm, cylindrical, floccose, whitish; smell faintly cocoa-like to raphanoid. Sp 11-14 \times 6-8 μm , broadly amygdaloid to citriform, verrucose, dextrinoid; cheilocystidia cylindrical to subclavate, apex on av 5.5-7 μm broad. With deciduous trees in parks and forests; summer to autumn; occasional in temp.; DK (LC), SE. – FM 1:63, FNE 3:69, Ves 337.

H. aestivale Vesterh.

- Perispore not or only rarely slightly loosening; stem with a rounded basal bulb, without distinct mycelial chords 3
- 3. Cheilocystidia on av 4.6-5.9 μm broad at apex; in coniferous forests, often in *Sphagnum*. Cap 19-60 mm, hemispherical to convex, then expanded, viscid, pinkish buff to clay buff or cinnamon, sometimes with hygrophanous flecks; gills crowded; stem 40-130 x 4-13 mm, cylindrical, basally widened to 6-20(-30) mm, pruinose, whitish, with age turning buff from the base; smell raphanoid. Sp 8.5-11.5 x 5-6.5 μm , amygdaloid, rugulose (fig. 809E), strongly dextrinoid, perispore not loosening; cheilocystidia cylindrical to subclavate. Summer to autumn; rare in temp., common in hemib.-bore.; DK (LC), FI (LC), NO (NE), SE (LC). – FM 1(2) cover, FNE 3:67, Svp 40:10.
H. incarnatum A.H. Sm. (*H. bryogenes* Vesterh.)
- Cheilocystidia on av > 6.9 μm broad at apex; under various trees and shrubs 4
- 4. Frb dominated by greyish colours; cap 13-21 mm broad. Cap convex to expanded, almost dry, hygrophanous, fawn at centre, more greyish towards margin; gills medium spaced to distant; stem 14-21 x 2-3 mm, cylindrical, pruinose, pale greyish, turning brownish from the base; smell raphanoid. Sp 9.5-12.5 x 6-7.5 μm , ellipsoid-ovoid to subamygdaloid, rugulose (fig. 811A), slightly to distinctly dextrinoid, perispore not loosening; cheilocystidia clavate, sometimes widened in lower half, apex on av 8-9.5 μm broad. With dwarf *Salix*; summer; rare in suba.-arc./alp., but possibly overlooked; FO (Suduroy), NO (LC, Oppl: Vågå, S&F: Sogndal). – FNE 3:87.
H. subconcolor Bruchet
- Frb dominated by whitish colours; cap mostly larger 5
- 5. Cap 20-28 mm; sp on av > 6.7 μm broad; cheilocystidia distinctly clavate, apex on av 8.5-10.1 μm broad; only in alpine habitats see *H. alpinum* E 4
- Cap 19-75 mm; sp on av < 6.6 μm broad (fig. 811B); cheilocystidia subclavate, apex on av 6.9-8.9 μm broad; in lowland as well as in alpine habitats. Cap convex, then expanded, slightly viscid, whitish to cream, or centre pinkish buff to clay buff or cinnamon; gills crowded; stem 19-100 x 5-11 mm, cylindrical with a bulbous, up to 20 mm broad base, velvety, whitish, more brownish with age; gills often with small droplets; smell raphanoid. Sp 9-12.5 x 5.5-7 μm , broadly amygdaloid, rugose, strongly dextrinoid, perispore rarely loosening. With deciduous and coniferous trees, also in sand dunes and in arc./alp.; summer to autumn; very common in temp.-arc./alp.; DK (LC), FI (LC), FO, IS, NO (LC), SE (LC). – FM 1:62, FNE 3:65, Svp 25:16, Ves 336.
H. velutipes Bruchet (*H. leucosarx* P.D. Orton s. auct. p.p.)

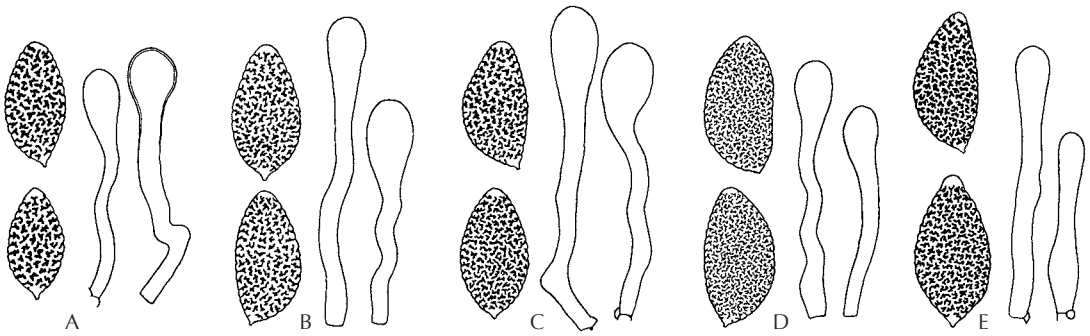
Key E: Sect. *Denudata* (Fr.) Sacc.

- 1. With dwarf *Salix* or *Dryas* in suba.-arc./alp. 2
- Not with dwarf *Salix* or *Dryas* in suba.-arc./alp. 6
- 2. Stem > 4 mm broad 3
- Stem < 4 mm broad 5
- 3. Cap 20-28 mm broad; sp on av 6.7-7.1 μm broad (fig. 811C). Cap hemispherical to bell-shaped, later expanded, viscid, not hygrophanous, yellowish cream to yellowish ochraceous; gills medium spaced; stem 20-30 x 4-8 mm, cylindrical or with slightly widened base, pruinose, whitish, turning brownish from base; smell raphanoid. Sp 11.5-14 x 6-7.5 μm , amygdaloid to subcitriform, rugose, weakly dextrinoid, perispore rarely loosening; cheilocystidia clavate, apex on av 8.5-10 μm broad. With dwarf *Salix* and *Dryas*; summer; often confused with other species and distribution poorly known; IS (Au). – FNE 3:79.
H. alpinum (J. Favre) Bruchet
- Cap often > 30 mm broad; sp on av 5.5-6.5 μm broad 4



Spores and cheilocystidia: A: *Hebeloma subconcolor*, B: *H. velutipes*, C: *H. alpinum*, D: *H. minus*, E: *H. fragilipes*.

4. Cheilocystidia clavate-stipitate, rarely widened in the lower part, apex on av 7.5-11 μm broad see *H. crustuliniforme* 9
 - Cheilocystidia clavate, often constricted and thick-walled in the median part and widened near the base, apex on av 6.5-7.5 μm broad see *H. hiemale* 13
5. Sp ellipsoid-ovoid to subamygdaloid, on av 10.1-11.4 x 6.3-6.7 μm (fig. 811A); frb dominated by greyish colours see *H. subconcolor* key D 4
 - Sp amygdaloid to citriform, on av 11.4-12.8 x 6.1-6.3 μm (fig. 811D); cap clay buff to yellowish brown; stem greyish white to pale cream. Cap 8-18 mm, convex to expanded, viscid to slimy, slightly hygrophanous; gills medium spaced to distant; stem 10-25 x 1.5-3.5 mm, cylindrical, pruinose; smell slightly raphanoid. Sp 11-14 x 5.5-7 μm , rugose, indistinctly dextrinoid, perispore sometimes loosening; cheilocystidia clavate, sometimes widened in lower half, apex on av 7.5-9 μm broad. With dwarf *Salix*; summer; rare in suba.-arc./alp., but possibly overlooked; IS (Au), NO (LC, Oppl: Øyer). – FNE 3:85.
H. minus Bruchet
6. Cap dominantly white or whitish, at least in outer part, at centre often with yellow or brownish yellow tinges; sp pale yellow in the microscope 7
 - Cap \pm brown or with greyish colours; sp brownish yellow to brownish in the microscope 10
7. Cheilocystidia on av < 7 μm broad at apex, in median part often remarkably constricted and/or with wall thickenings (fig. 811E). Cap 17-55 mm, convex to expanded, viscid, not hygrophanous, white to pale cream, at centre sometimes with a pinkish buff tinge; gills medium spaced to crowded, often with small droplets; stem 25-80 x 3-8 mm, cylindrical or with slightly widened base, flocculose, whitish, occasionally turning brownish from the base; smell raphanoid. Sp 9.5-12 x 5-6.5 μm , amygdaloid to narrowly citriform, verrucose, weakly dextrinoid, perispore sometimes loosening; cheilocystidia narrowly clavate. With deciduous trees; summer to autumn; occasional in temp.-suba.; DK (LC), FI (LC), IS, NO (LC, S&F: Luster), SE (LC). – Bol Bres 41:111, End 368, FNE 3:77, Ves 337.
H. fragilipes Romagn. s. lato
 - Cheilocystidia on av > 7 μm broad at apex, in median part not remarkably constricted or with wall thickenings 8
8. Stem 2-4(-5) mm broad; sp on av < 5.5 μm broad (fig. 812A). Cap 10-35 mm, hemispherical to convex, later expanded, often with a crenulate margin, viscid to slimy, not hygrophanous, whitish to pale cream with a clay-buff to cinnamon centre; gills medium spaced to crowded, often with conspicuous droplets; stem 15-70 mm long, cylindrical, floccose, whitish, some-



Spores and cheilocystidia: A: *Hebeloma helodes*, B: *H. lutense*, C: *H. crustuliniforme*, D: *H. pusillum*, E: *H. alvarense* var. *alvarense*.

times turning brownish from the base; smell raphanoid. Sp 9-11 x 4.5-6 μm , narrowly amygdaloid, verrucose, without iodine reactions, perispore sometimes loosening; cheilocystidia clavate to capitata, apex on av 8.5-10.5 μm broad. Under *Salix*, less often *Populus*; summer to autumn; common in temp.-suba.; DK (LC), FI (LC), FO, NO (LC, S&F: Luster, Sogndal), SE (LC). – End 370, FM 1:63, FNE 3:75, M&J 14, ☉.

H. helodes J. Favre

- Stem mostly > 5 mm broad; sp on av > 5.5 μm broad 9

9. Sp distinctly dextrinoid; only recorded with *Salix* on \pm sandy or gravelly soil. Cap 14-60 mm, convex, later expanded, viscid, not hygrophanous, whitish to pale pinkish buff with a brick to orange-brown centre; gills medium spaced to crowded, often with small droplets; stem 35-70 x 3-11 mm, cylindrical, pruinose, whitish; smell raphanoid. Sp 10-12 x 5-6.5 μm , amygdaloid to narrowly citriform, verrucose (fig. 812B), perispore rarely loosening; cheilocystidia clavate, often flexuous, apex on av 6.5-8 μm broad. In deciduous and mixed forests, sometimes at lake shores; autumn; rare in temp. and suba., but possibly overlooked; DK (DD), SE. – C&D 998, FNE 3:101.

H. lutense Romagn.

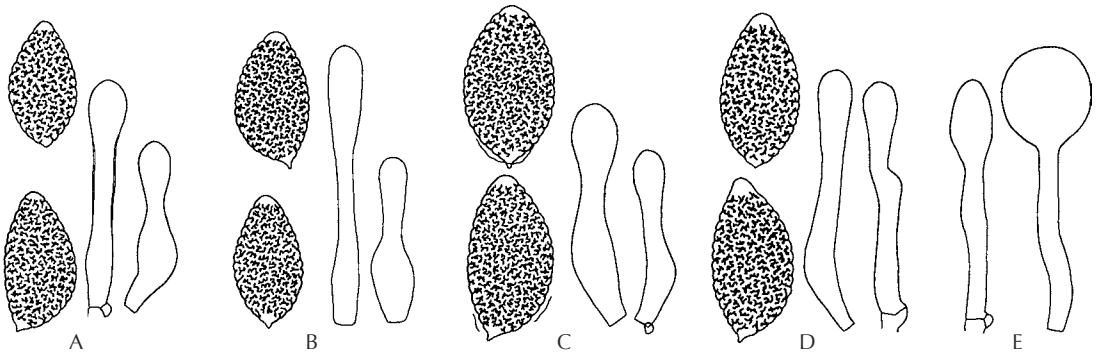
- Sp without iodine reactions; recorded with a wide range of broadleaved trees and conifers. Cap 20-100 mm, convex, later expanded, often with a crenulate margin, viscid, not hygrophanous, whitish to pale pinkish buff, at centre to pinkish buff or clay buff; gills crowded, often with conspicuous droplets; stem 25-70(-130) x 6-14 mm, cylindrical or widened near the base, transversely floccose, whitish; smell raphanoid. Sp 9.5-12.5 x 5-6.5 μm , amygdaloid, verrucose (fig. 812C), perispore sometimes loosening; cheilocystidia clavate-stipitate, often flexuous, apex on av 7.5-11 μm broad. Summer to autumn; common in temp.-alp.; DK (LC), FI (LC), FO, IS, NO (LC), SE (LC). – C&D 993, Däh 687, FNE 3:73, R&H 479, Ves 336, ☉.

H. crustuliniforme (Bull.) Quél. s. lato

10. Stem 1-3 mm broad; with *Salix* in bogs. Cap 5-23 mm, convex, later expanded, sometimes umbonate, viscid to slimy, not distinctly hygrophanous, cinnamon to brick at centre, much paler at margin; gills medium spaced, often with small droplets; stem 15-40 mm long, cylindrical, pruinose, whitish, often turning brownish from the base; smell raphanoid. Sp 10.5-13 x 5.5-6.5 μm , narrowly amygdaloid, rugose (fig. 812D), indistinctly dextrinoid, perispore not loosening; cheilocystidia clavate to capitata, apex on av 8-10 μm broad. Summer to autumn; locally common in temp.-bore.; DK (LC), FI (LC), IS, NO (LC), SE (LC). – FAD 120C, FNE 3:83, Ves 338, Win 93:48, ☉.

H. pusillum J.E. Lange

- Stem 3-10 mm broad; with *Salix* or other hosts 11



Spores and cheilocystidia: A: *Hebeloma hiemale*, B: *H. cavipes*, C: *H. alvarens* var. *hinnuleum*, D: *H. vaccinum* var. *vaccinum*, E: *H. vaccinum* var. *cephalotum*.

11. Ixocutis very thin, about 25 μm ; cap cinnamon to the margin; sp narrowly amygdaloid to fusiform (fig. 812E); found in a *Juniperus* alvar with *Pinus sylvestris*. Cap 13-38 mm, convex, later expanded, dry; gills medium spaced; stem 30-38 x 3-6 mm, cylindrical, floccose, whitish; gills with small droplets; smell raphanoid. Sp 11.5-13.5 x 5.5-7 μm , verrucose, weakly dextrinoid, perispore often loosening; cheilocystidia clavate, often widened in lower half, apex on av 6.5-7.5 μm broad. Autumn; EE. – FNE 3:95.
H. alvarens Vesterh. & Vauras var. *alvarens*
- Ixocutis rather thick, 50-150 μm ; cap with less vivid colours, at least in the outer part; sp amygdaloid to citriform; with broadleaved trees or conifers 12
12. Sp on av < 6.5 μm 13
- Sp on av > 6.5 μm 15
13. Some cheilocystidia thick-walled in the median part. Cap 15-55 mm, convex, later expanded, sometimes umbonate, viscid to slimy, not distinctly hygrophanous, clay buff to cinnamon to brick at centre, pinkish buff towards margin; gills medium spaced, often with small droplets; stem 25-75 x 3-8 mm, cylindrical or widened at base, pruinose, sordid whitish, turning brownish from the base; smell raphanoid. Sp 10.5-13 x 5.5-7 μm , amygdaloid to citriform, verrucose (fig. 813A), slightly dextrinoid, perispore rarely loosening; cheilocystidia clavate, often widened in the lower half, apex on av 6.5-7.5 μm broad. In deciduous forests; late summer to autumn; rare in temp.-bore., but possibly overlooked; DK (DD), NO (S&F: Hønefoss, Samsjöen). – FNE 3:81.
H. hiemale Bres.
- Cheilocystidia rarely thick-walled in the median part 14
14. Cheilocystidia often widened in the lower half, not remarkably flexuous; perispore sometimes loosening. Cap 28-74 mm, hemispherical to convex, later expanded, slightly viscid to almost dry, not hygrophanous, greyish buff to clay buff or pale pinkish buff; gills medium spaced to crowded; stem 37-55 x 7-15 mm, cylindrical, flocculose, whitish; smell raphanoid. Sp 9.5-12.5 x 5-6.5 μm , broadly amygdaloid to citriform, verrucose (fig. 813B), distinctly dextrinoid; cheilocystidia subclavate, apex on av 6-7.5 μm broad. In lawns and on naked soil under deciduous trees, less often with conifers; late summer to autumn; locally common in temp.; DK (NE), FI. – FNE 3:99.
H. cavipes Huijsman (incl. *H. vejlense* Vesterh.)
- Cheilocystidia rarely widened in the lower half, often remarkably flexuous in the lower part; perispore not loosening see *H. lutense* 9

15. Cap not hygrophanous; stem (5-)7-13 mm broad, not fragile. Cap 14-80 mm, bell-shaped to convex, later expanded, viscid, centre fawn, towards margin clay buff to whitish; gills medium spaced to crowded; stem 30-65 mm long, cylindrical or up to 19 mm broad at the base, floccose, whitish; smell raphanoid. Sp 11.5-14 × 6.5-8 μm, broadly amygdaloid to citriform, verrucose (fig. 813C), distinctly dextrinoid, perispore sometimes loosening; cheilocystidia clavate, often widened in lower half, apex on av 6.5-8 μm broad. Under deciduous trees on peaty or sandy soil; late summer to autumn; rare in temp.-suba., but possibly overlooked; DK (DD), IS (Au). – FNE 3:97.

H. alvarene Vesterh. & Vauras var. *hinnuleum* Vesterh.

Note: morphologically different from the main variety in several characters, but apparently not genetically.

- Cap ± hygrophanous; stem 2.5-7 mm broad, rather fragile 16
16. Cheilocystidia ± clavate, not abruptly capitate, 5-10(-12) μm broad (fig. 813D). Cap 13-40 mm, convex, later expanded, viscid to nearly dry, ± hygrophanous, fawn to dark brick at centre, paler and more greyish towards margin; gills medium spaced; stem 20-60 × 2.5-7 mm, cylindrical, pruinose, whitish to yellowish, sometimes turning clay buff from the base; smell raphanoid. Sp 12-14 × 6.5-7.5 μm, amygdaloid to citriform, verrucose, strongly dextrinoid, perispore sometimes loosening; apex of cheilocystidia on av 6.5-7.5 μm broad. Under *Salix* in bogs, dunes and mountains; summer to autumn; common in temp.-suba.; DK (LC), FI, IS (Au), SE (LC). – C&D 1003, FNE 3:89, Ger 01:292, Ves 338.
- H. vaccinum* Romagn. var. *vaccinum*
- Some cheilocystidia very strongly and abruptly capitate, 6-19(-22) μm broad, on av 9.7-11.8 μm broad (fig. 813E). In other characters like the main variety. In *Salix* bogs; autumn; rare in temp., but possibly overlooked; DK.
- H. vaccinum* Romagn. var. *cephalotum* Enderle & Vesterh.

Key F: Sect. *Myxocybe* (Fayod) Konrad & Maubl.

1. Universal veil forming a membranous ring on the stem; smell usually of marzipan (subsect. *Myxocybe*). Cap 25-110 mm, hemispherical to convex, later expanded, slimy, cream to buff, with appressed, brownish scales; gills crowded; stem 35-120 × 8-15 mm, cylindrical with a widened base, with a distinct to long pseudorrhiza, whitish, turning clay buff to brown from base. Sp 8-10 × 4.5-5.5 μm, amygdaloid, verrucose (fig. 815A), strongly dextrinoid, perispore sometimes loosening; cheilocystidia cylindrical or widened in the upper or lower part, apex on av 6.5-7.5 μm broad. In deciduous forests, favoured by nitrogen compounds, like in vole nests, badger burrows, etc.; summer to autumn; occasional in temp.-hemib.; DK (LC), NO (NT), SE (LC). – Däh 680, FNE 3:105, Phil 215e, Svp 29:17, Ves 340, ☉.
- H. radicosum* (Bull.: Fr.) Ricken
- Universal veil not forming a membranous ring on the stem; smell indistinct or like cocoa, soap, tea or fruit 2
2. Sp ± cylindrical (fig. 815B); in *Pinus* forests on poor and sandy soil. Cap 15-60 mm, hemispherical to convex, later expanded, viscid, hygrophanous, dark brick to orange brown at centre, clay buff towards margin; gills medium spaced to crowded; stem 30-90 × 3-10 mm, cylindrical or with widened base, often with a distinct pseudorrhiza, pruinose, whitish, turning clay buff to sepia from base; universal veil fugacious; smell faint or slightly fruity. Sp 8.5-11 × 4-5 μm, verruculose, strongly dextrinoid, sometimes with loosening perispore; cheilocystidia cylindrical to irregular, apex on av 4.5-5 μm broad. Late summer to autumn; common in temp.-bore.; DK (LC), FI, NO (LC, Østf: Hvaler), SE (LC). – C&D 991, FNE 3:115, M&J 7, Svp 29:21, Ves 341.
- H. cylindrosporum* Romagn.
- Note: the widely used name *H. cylindrosporum* should be conserved against the older name *H. angustispermum* A. Pearson.



Spores: A: *Hebeloma radicosum*, B: *H. cylindrosporum*, C: *H. syrjense*, D: *H. birrus*, E: *H. lundqvistii*, F: *H. laterinum*.

- Sp ± amygdaloid to citriform or fusiform; often in different habitats 3
- 3. Cap appearing dry; epicutis < 30 µm thick; in eutrophic springs and fens in coniferous forests, calciphilous. Cap 20-55 mm, convex to expanded, hygrophanous, dark greyish buff to clay buff; gills crowded; stem 70-110 × 4-7 mm, cylindrical or with a widened base, sometimes with a distinct pseudorrhiza, pruinose, cream, soon turning greyish brown to sepia from the base; smell weak, soap-like. Sp 7.5-9.5 × 4.5-5.5 µm, amygdaloid to citriform, verrucose (fig. 815C), distinctly to strongly dextrinoid, sometimes with loosening perispore; cheilocystidia cylindrical to subclavate, apex on av 5-6.5 µm broad. Late summer to autumn; rare in bore.; FI (NT), NO (LC, M&R: Molde), SE (LC). – FNE 3:113, M&J 11.
H. syrjense P. Karst. (*H. subsaponaceum* P. Karst.)
- Cap viscid to slimy; epicutis > 50 µm thick; often in different habitats 4
- 4. Perispore loosening many sp (fig. 815D). Cap 10-75 mm, convex to expanded, with or without umbo, ± hygrophanous, dark brick to yellowish brown or clay buff at centre, paler to whitish towards margin; gills medium spaced to crowded; stem 25-85 × 3-14 mm, cylindrical, often with a distinct pseudorrhiza, pruinose, whitish, turning brownish from the base; universal veil mostly fugacious; smell weak, like chocolate or soap. Sp 8-11(-13.5) × 5-6(-7.5) µm, amygdaloid, verrucose, strongly dextrinoid; cheilocystidia cylindrical to irregular, apex on av 4.5-5(-7.5) µm broad. In deciduous or coniferous forests, favoured by nitrogen compounds, also on burnt ground; late summer to autumn; occasional in temp.-bore.; DK (LC), FI (LC), NO (LC), SE (LC). – FAD 120A, FNE 3:117&119, M&J 4&6, Svp 29:21, Ves 341.
H. birrus (Fr.) Sacc. (*H. anthracophilum* Maire, *H. calyptrosporum* Bruchet, *H. danicum* Gröger, incl. *H. pumilum* J.E. Lange)
- Perispore not loosening or only slightly loosening in few sp 5
- 5. Under broadleaved trees 6
- Under conifers 7
- 6. Cap yellowish brown, sometimes slightly paler towards margin. Cap 23-50 mm, convex to expanded, viscid, not hygrophanous; gills crowded; stem 55-75 × 5-11 mm, cylindrical or with widened base, with a ± distinct pseudorrhiza, pruinose, whitish, turning ochraceous brown from the base; universal veil fugacious; smell weak, cocoa- or soap-like. Sp 9.5-11 × 5.5-6.5 µm, amygdaloid, verrucose (fig. 815E), strongly dextrinoid, perispore rarely loosening; cheilocystidia cylindrical to irregular, apex on av 6-6.5 µm broad. With broadleaved trees on calcareous soil; autumn; very rare in temp.-hemib.; DK (CR, Lol: Maribo), FI (A: Lemland), SE (NE, Dls: Ryrhalvön). – FNE 3:109.
H. lundqvistii Vesterh.
- Cap pale buff to pinkish buff. Cap 15-75 mm, convex to expanded, viscid to almost dry, not hygrophanous; gills crowded; stem 30-90 × 4-17 mm, cylindrical with a widened base, with a ± distinct pseudorrhiza, floccose, whitish, soon turning buff to sepia from base; universal veil fugacious; smell like cocoa or 'poires belle Helène'. Sp 8.5-11 × 5.5-6.5 µm, amygdaloid, verrucose (fig. 815F), distinctly dextrinoid, perispore rarely loosening; cheilocystidia cylindrical to irregular, apex on av 4.5-5.5 µm broad. With broadleaved trees and conifers on

calcareous soil; autumn; locally common in temp.-bore.; DK (LC), FI (NT), NO (LC), SE (LC). – C&D 1006, Däh 695, FNE 3:107, Svp 29:21, Ves 340.

H. laterinum (Batsch) Vesterh. (*H. senescens* Sacc., *H. edurum* Bon)

7. Sp on av 5.1-5.9 μm broad (fig. 817A); cap colours \pm marbled, often with a lilac tinge; smell like tea. Cap 19-57 mm, convex to expanded, viscid, \pm hygrophanous, a mixture of pinkish buff and clay buff; gills medium spaced; stem 30-160 \times 4-12 mm, cylindrical, with a \pm distinct pseudorrhiza, pruinose, whitish to pale pinkish buff, soon turning greyish brown to sepia from base. Sp 9-11 \times 5-6 μm , amygdaloid to fusiform, verrucose, distinctly dextrinoid, perispore rarely loosening; cheilocystidia cylindrical to irregular, apex on av 5.5-6 μm broad. With conifers on calcareous soil; autumn; rare in hemib.-middle bore.; FI (DD), NO (LC), SE (LC). – FNE 3:111.

H. circinans Quél.

- Sp on av 5.9-6.3 μm broad; cap colours not marbled, without a lilac tinge; smell like cocoa or 'poires belle Helène' see *H. laterinum* 6

Key G: Sect. *Sacchariolentia* (Bon) Boyle

1. Cap dry, soon velvety or cracking up into small scales; cheilocystidia 12-30 \times 3-8 μm . Cap 15-90 mm, hemispherical to convex, pale cream to pale pinkish buff; gills medium spaced to distant; stem 30-110 \times 3-17 mm, cylindrical or tapering downwards, whitish; smell strong and sweetish. Sp 12-15 \times 6.5-8.5 μm , citriform, verrucose (fig. 817B), distinctly dextrinoid, often with a loosening perispore; cheilocystidia cylindrical to irregular, apex on av 5.5-7 μm broad. With *Salix* and *Alnus* on \pm calcareous soil; summer to autumn; rare in temp.-hemib.; DK (VU), NO (LC, Akh: Asker), SE (LC). – Bol Bres 38:73, End 378, FNE 3:127, RdM 38:52, Svp 29:21.

H. hetieri Boud. (*H. tomentosum* M.M. Moser)

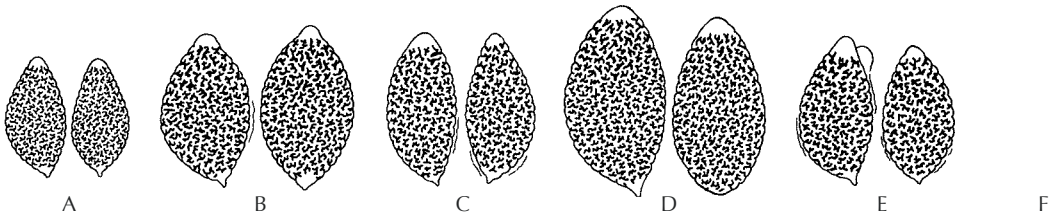
- Cap slightly to distinctly viscid, totally smooth or only slightly velvety at margin; cheilocystidia often longer 2
2. Sp narrowly amygdaloid to subfusiform, Qav > 1.9 (fig. 817C); cap 10-28 mm broad, white to pale cream; exsiccates not discoloured to dark brown. Cap hemispherical to convex, later expanded, viscid; gills medium spaced to distant; stem 30-70 \times 2-6 mm, cylindrical with a \pm pointed base, pruinose, white, turning pale pinkish buff; smell strong and sweetish. Sp 10.5-13.5 \times 5.5-7 μm , verrucose, strongly dextrinoid, perispore often loosening; cheilocystidia cylindrical to clavate, apex on av 5.5-9.5 μm broad. With *Salix*, rarely with other deciduous hosts; late summer to autumn; rare in temp.; DK (VU), FI, SE (NE). – BSMF 122:167, FNE 3:129, Svp 29:21.

H. fusisporum Gröger & Zschiesch.


- Sp broader, Q mostly < 1.9; cap 15-60(-85) mm broad, pale pinkish buff to greyish buff, clay buff or cinnamon; exsiccates often partly discoloured to dark brown 3
3. Sp 13-17 \times 7-9 μm (fig. 817D); in bogs with *Salix* or *Alnus*. Cap 15-50 mm, hemispherical to convex, later expanded, viscid to almost dry, pale clay buff to cinnamon, but paler towards margin; gills medium spaced to distant; stem 40-95 \times 3-9 mm, cylindrical, sometimes with a \pm pointed base, pruinose, whitish to pale brownish, turning darker brown from base; smell strong and sweetish. Sp broadly amygdaloid to citriform, verrucose, strongly dextrinoid, perispore often loosening; cheilocystidia cylindrical to irregular, apex on av 7.5-9.5 μm broad. Late summer to autumn; rare in temp.-bore., but possibly overlooked; DK (VU), FI (DD), SE (LC). – Däh 694 (as *sacchariolens*), FNE 3:125, Svp 29:20, Ves 341.

H. gigaspermum Gröger & Zschiesch.

- Sp 11-14 \times 6-8 μm (fig. 817E); on rich soil in forests and gardens with broadleaved hosts, often with *Quercus*. Cap 15-60(-85) mm, hemispherical to convex, later expanded, viscid to almost dry, pale pinkish buff to greyish buff; gills medium spaced to distant; stem 13-70 \times



Spores: A: *Hebeloma circinans*, B: *H. hetieri*, C: *H. fuisporum*, D: *H. gigaspermum*, E: *H. sacchariolens*.

2.5-8(-10) mm, cylindrical, sometimes with a \pm pointed base, pruinose, whitish, turning clay buff to umber from base; smell strong and sweetish, often nauseating. Sp broadly amygdaloid to citriform, verrucose, strongly dextrinoid, perispore often loosening; cheilocystidia cylindrical to lageniform or irregular, apex on av 6-8.5 μ m broad. Summer to autumn; common in temp.-hemib., rare but locally occasional in bore.; DK (vU), FI (LC), NO (LC), SE (LC). – FNE 3:121, Phil 217g, R&H 480, Svp 29:20, Ves 341, .

H. sacchariolens Quél. (*H. latifolium* Gröger & Zschiesch. non P. Karst., *H. pallidoluctuosum* Gröger & Zschiesch.)