

Russula Pers. HENNING KNUDSEN, JUHANI RUOTSALAINEN & JUKKA VAURAS

Frb with normally developed central stem and gills and crumbling texture. Cap 20-200 mm, hemispherical to convex or plane, later depressed or umbonate, uniformly coloured or more often a mixture of various colours, in a few species dull white, grey, brown or blackish; margin smooth, sulcate or tuberculate-sulcate; surface mat or shining, dry to viscid, sometimes pruinose; cuticle $\pm$ peeling in most species. Gills almost free to slightly decurrent, crowded to distant, in some species with lamellules, sometimes forked or with anastomoses or $\pm$ interveined, white to yellow, fragile, rarely elastic, rarely with pink shine or blackening, becoming brown spotted or yellowing. Stem 20-150 x 5-30 mm, cylindrical, more rarely clavate or tapering, solid to with cavities, in most species white, but also red, pink, violaceous, lilaceous or purple, in some species yellowing, browning, greying or blackening when bruised or old. Flesh white, soft to hard, in some species yellowing, browning, reddening or blackening; consistency characteristically granulose-cheesy, not fibrous. Taste mild to unbearably acrid, rarely bitter or oily. Smell insignificant or in many species characteristic, fetid, fruity, of *Pelargonium* etc. Sp deposit from pure white to whitish (Ia-Ib), pale cream to dark cream (IIa-IIc), pale ochre to deep ochre (IIIa-d) or pale yellow to orange yellow (IVa-d). If the exact nuance is necessary, it is recommended to gather the sp deposit with a razorblade to a mm-thick layer and place this between two object-glasses and then compare the colour to the scale in e.g. Romagnesi (1967) or to a well known species.

Sp subglobose, more rarely ellipsoid, with characteristic amyloid ornamentation, varying from low warts to spines and crests and from no or few connections to almost completely reticulate. Macrocystidia on gill edge $\pm$ lanceolate or cigar-shaped, often with a small appendix, in most species becoming blue with sulpho-vanillin (SV) and black with sulpho-benzaldehyde (SBA). Pileipellis of undifferentiated hyphae except in some species, where the apical cell may be strongly tapering. In most species one or more additional structures can be found: dermatocystidia (dcy) (figs 123 C, E) reacting with SV and SBA like the cystidia, non-septate or multi-septate; primordial hyphae, often slightly thick-walled and smooth or more often incrustated, incrustations reacting with fuchsin (fig. 141F); thick-walled, rigid and tapering brown or hyaline hairs (fig. 115I). Flesh consisting of a mixture of normal hyphae and groups of spherocysts (heteroiomerous). Clamps absent.

All species in the Nordic countries are strictly mycorrhizal. The most important hosts are *Fagus*, *Picea*, *Betula*, *Quercus* and *Pinus*, less important are *Populus*, *Alnus*, *Tilia*, *Salix* and *Carpinus*, in arc./alp. areas dwarf *Betula*, *Salix*, *Dryas* and *Polygonum viviparum* act as hosts. Early summer to late autumn. All mild species with a pleasant taste are edible.

152 species in the Nordic countries, 153 species in the key.

Lit.: Adamčík 2004, Einhellinger & Marxmüller 1985, Marchand 1977, Marstad 2004, Rayner 1985, Romagnesi 1967, Sarnari 1998, 2005, Schäffer 1952, Svrček, Erhart & Erhartova 1984.

Main key

1. Frb white or whitish, often bruising brownish or yellowish; flesh firm, not or only slightly bruising when cut; cap often developed underground and thus dirty with adhering soil and with a rugged, irregular surface; many gills short, not reaching the stem Key A, sect. *Lactarioides* p. 110
 - Frb coloured *or* if white then fragile and without short gills 2
2. Frb with brown, grey or black colours *or* if white then strongly blackening when bruised; many gills short, not reaching the stem; flesh firm, reddening or blackening when cut or bruised Key B, sect. *Compactae* p. 110
 - Almost all gills reaching from stem to cap margin; flesh firm or fragile; cap colour red, purple, lilac, violet, green, blue, yellow, brown, etc. 3
3. Frb either with a sticky, yellow, brown or grey cap, a tuberculate-sulcate margin and a $\pm$ hollow stem *or* if cap cream then stem solid and taste very acrid; stem concolorous with cap or paler; smell often remarkably strong and unpleasant; taste often acrid or unpleasant, nauseating; sp deposit white to cream; smooth dcy present; primordial hyphae absent Key C, sect. *Ingratae* p. 112
 - Cap either with other colours *or* the combination of colour, margin and stem different *or* sp deposit darker *or* pileipellis different 4
4. Cap dry or slightly greasy, mat or shining, green, blue, grey, lilac, brown, yellow or flesh-coloured, smooth or in a few species granulose scaly, with smooth or very slightly sulcate margin; gills white or cream, often with rust-coloured spots when old; stem white or rarely with a flush of cap colour, at base often tapering and with rust-coloured spots; flesh white, not bruising when touched, firm, in some species slowly becoming orange or red with FeSO₄, in others becoming greyish green to bluish green or unchanging; taste mild or slightly acrid; smell mostly insignificant; sp deposit white to cream, rarely ochre; apical cells in pileipellis often tapering and supported by short, almost isodiametrical cells; dcy present in most species, small and narrow, non-septate, darkening or not in SV; a few species with brown thick-walled setae-like hairs especially near centre; many species with dark intracellular grains in the pileipellis when fresh Key D, sect. *Heterophyllae* p. 116
 - Cap with other colours *or* gills ochre to yellow *or* stem bruising yellow or grey *or* flesh fragile *or* taste acrid *or* sp deposit darker *or* pileipellis with other characters 5
5. Taste moderately acrid to very acrid; cap red, lilac, purplish, vinaceous, violet or bluish; sp deposit white to ochre or pale yellow; stem white or concolorous with cap, not or only in a few species bruising yellow; pileipellis with $\pm$ inflated, non-septate or more often septate, smooth dcy becoming strongly bluish black with SV; primordial hyphae absent, incrustations in pileipellis absent except in *R. viscida*; frb sharing the above combination except being mild either have a yellow cap and a white sp deposit or a strongly greying stem and grow with *Alnus* Key E, sect. *Russula* p. 120
 - Taste mild or if acrid then sp deposit ochre to yellow; pileipellis with primordial hyphae, dcy if present incrustated, or flesh yellowing when bruised or bluish green with FeSO₄ 6
6. Stem when bruised or cut becoming brown; frb when mature and old with a smell of cooked shell-fish (trimethylamine); FeSO₄ on stem bluish green; sp deposit cream to ochre; taste mild; pileipellis with smooth dcy, primordial hyphae and incrustations absent Key F, sect. *Polychromae* subsect. *Xerampelinae* p. 128
 - Stem when bruised unchanging or if yellowing or browning then smell absent or different; FeSO₄ on stem not becoming bluish green; sp deposit white to yellow; taste

mild to acrid; pileipellis with dcy or primordial hyphae or both; incrustations present or absent

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7. Taste mild or if moderately acrid then stem and flesh yellowing; stem and flesh distinctly yellowing in most species; pileipellis with conspicuous, often multi-septate dcy, strongly darkening with SV and SBA; lactifers in stem cuticle blackening in the same reagents; frb fragile; cap in most species 30-70 mm, in a few up to 150 mm; cap red, purple, lilac, violet, often mixed with green or yellow, often shining, dry or viscid, margin often sulcate tuberculate; gills cream to yellow; stem often clavate; smell mostly indistinct; sp deposit cream to yellow; pileipellis without primordial hyphae and any incrustations [Key G, sect. *Polychromae* subsect. *Puellarinae* p. 130](#)
- Either taste acrid, or $\pm$ incrustated dcy or primordial hyphae present, or any differentiated hyphae in the pileipellis absent 8
8. Dcy smooth, long or voluminous and strongly reacting with SV, in many species slightly diverticulate-knobby; primordial hyphae absent; sp deposit ochre or yellow; taste acrid to very acrid or in alpine species almost mild; sp often with isolated spines [Key H, sect. *Polychromae* subsect. *Urentes* p. 134](#)
- Dcy if present either slightly incrustated or accompanied by primordial hyphae; sp deposit white to yellow; taste mild to acrid; sp with spines, crests or reticulate 9
9. Sp deposit white or pale cream; taste mild or resembling menthol; pileipellis with strongly incrustated primordial hyphae; well characterised dcy absent; cap mat, often pruinose [Key I, sect. *Polychromae* subsect. *Lilaceinae* p. 137](#)
- The combination of sp deposit, taste and pileipellis different; sp deposit white to yellow; cap mat or shining; taste mild or acrid; pileipellis with incrustated primordial hyphae and/or slightly incrustated dcy, or with undifferentiated hyphae 10
10. Pileipellis with slightly incrustated primordial hyphae and/or slightly incrustated dcy, at least at the base; some species distinctly greying; sp deposit yellow, rarely ochre; taste mild or acrid, not bitter [Key J, sect. *Polychromae* subsect. *Integroidinae* p. 139](#)
- Pileipellis with smooth dcy, incrustated primordial hyphae or without any differentiation in the pileipellis; taste mild; sp deposit ochre to yellow, in a few species cream 11
11. Dcy smooth, becoming blue or black with SV [Key K, sect. *Polychromae* subsects *Integriforminae* and *Melliolentinae* p. 143](#)
- Dcy absent or if present not reacting with SV; incrustated primordial hyphae present or absent [Key L, sect. *Polychromae* subsect. *Polychromae* p. 145](#)

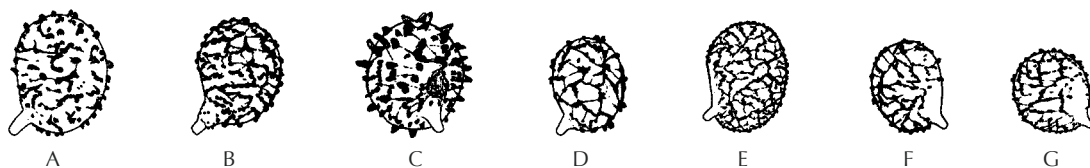
Key A: Sect. *Lactarioides* (Bataille) Konrad & Joss.

The section is in strong need of a revision.

1. Sp deposit deep cream to pale ochre 2
 - Sp deposit white to pale cream 3
2. Sp deposit pale ochre (III); taste slightly acid. Cap 50-110 mm, deeply depressed and funnel-shaped, whitish but soon dirty yellowish, rugose and practically always including some debris and grains of soil; gills decurrent, narrow, some very short, some forked and anastomosing, soon ochre; stem 20-50 x 15-25 mm, white, very firm; flesh white, at the base of the stem dirty greyish. Sp 8-9.5 x 6-6.5 μm , verrucose; dcy scattered. In deciduous forests; autumn; very rare in temp.; DK (DD). – FAD 178A, M&H 5:68.
R. pseudodelica J.E. Lange
 - Sp deposit dark cream (IIcd); taste mild, then bitterish aromatic. Cap 80-200 mm, depressed but not deeply, yellowish white, often with ochraceous patches; gills short decurrent, crowded, later dark cream, often with an orange tinge; stem 35-60 x 20-35 mm, cylindrical or tapering downwards, firm, white to concolorous with cap; smell aromatic to fruity. Sp 8-10.5 x 6.5-8 μm , with small warts and at least partially reticulate (fig. 111A). In mixed forests on calcareous soil; autumn; very rare in hemib.; FI (DD, A: Hammarland). – Sar 1:205, Schff 6.
R. pallidospora Romagn.
3. Number of gills/cm margin < 10; gills 6-14 mm broad. Cap 50-150 mm, depressed at centre, soon broadly funnel-shaped, soon with straight margin, rugose, white with yellow brown patches, practically always including some debris and grains of soil; gills decurrent, of different lengths, whitish, edge sometimes becoming turquoise when dry; stem 20-45 x 15-30 mm, stout, often widest at the top and base slightly tapering, solid, sometimes with a narrow turquoise band around the top; flesh white, hard; taste mild, later acid; smell fruity, then somewhat herring-like. Sp 8-11 x 6.5-8.5 μm , verrucose, $\pm$ catenulate, connections few, warts up to 1 μm (fig. 111B); dcy cylindrical, greying in SV. All over the area, from forests in temp. to arc./alp. heaths; summer to autumn; common in temp.-hemib., rare in suba.-arc./alp.; DK (LC), FI (DD), FO, IS, NO (LC, incl. Svb), SE (LC). – Däh 836, Phil 46b, R&H 529, Ves 420.
R. delica Fr.
 - Number of gills/cm margin > 10; gills 4-7 mm broad. Cap 50-150 mm, depressed at centre, soon broadly funnel-shaped, long time with inflexed margin, rugose, white with yellow brown patches, practically always including some debris and grains of soil; gills decurrent, of different lengths, whitish, edge sometimes becoming turquoise when dry; stem 20-50 x 15-30 mm, stout, mostly cylindrical, even, solid, sometimes with a narrow turquoise band around the top; flesh white, hard; taste acid; sp deposit white (Iab). Sp 8-11 x 7-9 μm , echinulate, spines 1-1.5 μm , with many fine connections (fig. 111C); dcy cylindrical, greying in SV. Summer to autumn; apparently common but difficult to estimate since limits against *R. delica* are ill-defined; DK (LC), FI (LC), IS, NO (LC), SE (LC). – Mar 401, Marst 8, Sar 1:197, 201, ☉.
R. chloroides (Krombh.) Bres. var. *chloroides*
 var. *trachyspora* (Romagn.) Sarnari differs in the sp having spines > 1.5 μm . This seems to be the most common taxon of this section in Fennoscandia, but the distinction against *R. delica* is not constant.

Key B: Sect. *Compactae* Fr.

1. Gills remarkably thick and distant. Cap 60-200 mm, convex then depressed, whitish but soon dull sooty brown, becoming blackish, firm; stem 30-70 x 15-25 mm, soon brown, firm; flesh thick and hard, white but soon dull red when bruised, then entirely grey to black; taste mild, but unpleasant; smell indistinct; sp deposit white (Ia). Sp 6.5-8 x 6-7 μm , verrucose, with fine connections forming a weak partial reticulum (fig. 111D); dcy indistinct, cylindri-



Spores: A: *Russula pallidospora*, B: *R. delica*, C: *R. chloroides*, D: *R. nigricans*, E: *R. albonigra*, F: *R. anthracina* (from holotype), G: *R. acrifolia*.

cal. In deciduous and coniferous forests; late summer to autumn; very common in temp., occasional in hemib., rare in bore., in the western part of the area north to 64°, in the eastern part to 61°; DK (LC), FI (LC), NO (LC), SE (LC). – Phil 46c, R&H 529, Sar 1:155, 157, Schff 1, Ves 386, ☉.

R. nigricans (Bull.) Fr.

- Gills neither remarkably thick nor distant 2
- 2. Macrocystidia and dcy with yellowish contents in SV, without any blackening; flesh rapidly blackening. Cap 60-100 mm, viscid then dry, white, but soon browning or blackening; gills white, remarkably contrasting the black stem and flesh; stem white, soon blackening, 20-60 x 15-30 mm; taste slightly bitter, causing a chilly feeling on the tongue; smell fresh, but weak; sp deposit white (Ia). Sp 7.5-9.5 x 6-7.5 μ m, verrucose with hardly visible connections (fig. 111E); dcy long, slightly swollen at the apex, with brown necropigment, not reacting with SV. In coniferous and deciduous forests on better soil; summer to autumn; rare in temp.-bore.; DK (vU), FI (LC), NO (NT), SE (LC). – Mar 404, Marst 6, R&H 530, Sar 1:179, Schff 3, ☉.

R. albonigra (Krombh.) Fr.

- Macrocystidia and dcy scattered and sometimes difficult to find, with greyish or blackish contents in SV; flesh reddening or blackening 3
- 3. Gills acrid to very acrid; flesh reddening, then blackening or rapidly blackening 4
- Gills mild or slightly acrid; flesh reddening, then blackening 5
- 4. Flesh rapidly blackening, occasionally with a trace of pink first; pileipellis with dark globules of pigment. Cap 60-100 mm, white or cream but soon browning or blackening; gills cream, with or without a flush of pink; stem 30-60 x 15-25 mm, stout, concolorous with cap; taste acrid in the gills; smell indistinct; sp deposit white (Ia). Sp 7.5-10 x 6-8 μ m, verrucose with rather distinct, $\pm$ complete reticulum (fig. 111F); macrocystidia with greyish contents in SV. In deciduous and coniferous forests; summer to autumn; rare in temp.-bore., in NO only from Østf; DK (vU), FI (LC), NO (NT), SE (NE). – Däh 837, Mar 408 (var. *carneifolia*), Marst 6, Schff 2a.

R. anthracina Romagn.

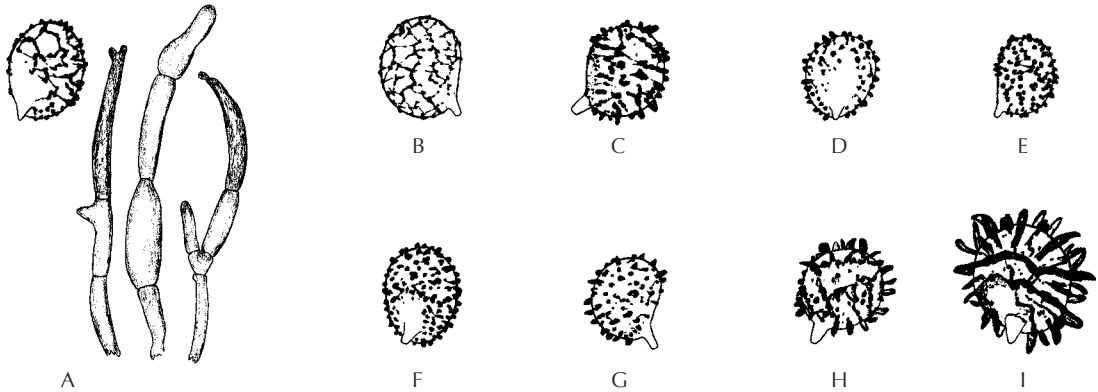
Note: some varieties differ mainly in their mild taste and red tinge of the gills (var. *carneifolia* Romagn., var. *insipida* Romagn. nom. inval.); Sarnari (1998) described *R. atramentosa* with a mild taste. The complex needs further investigation.

- Flesh reddening, then slowly blackening; pileipellis without dark globules. Cap 50-100 mm, viscid at least at centre, brown or greyish brown, darkest at centre; gills forked at stem, $\pm$ anastomosing and irregularly wavy, whitish to cream; stem 30-60 x 10-25 mm, whitish, soon concolorous with cap; taste acrid in the gills; smell indistinct; sp deposit white (Ia). Sp 7-9.5 x 6.5-7.5 μ m, verrucose, with a $\pm$ complete reticulum (fig. 111G); dcy and hyphae in pileipellis generally < 5 μ m broad. In deciduous and coniferous forests, on rich soil; summer to autumn; occasional in temp.-hemib., rare in bore., in NO north to Troms, in SE and FI to 66°; DK (LC), FI (LC), IS, NO (LC), SE (LC). – Däh 842, R&H 530, Sar 1:151, 153, Schff 2 (left), Ves 387.
- R. acrifolia* Romagn.

5. Gills with a distinct pink tinge see *R. anthracina* 4
 - Gills without pink 6
6. Gills regular, crowded, with many lamellules, but not forked; cap soon dry and mat. Cap 40-80 mm, white, then grey brown with a tinge of olivaceous brown to black, at margin remaining whitish for a long time; gills narrow, thin, white to cream; stem 30-60 x 10-20 mm, whitish, then concolorous with cap; taste mild or slightly acid; smell indistinct; sp deposit white (Ia). Sp 6.5-8 x 5.5-7 μ m, verrucose with some connections (fig. 113A); pileipellis with dcy and hairs generally 5-10 μ m broad. In deciduous and coniferous forests, on rich soil; summer to autumn; common in temp., occasional in hemib., rare in bore., in FI north to Ks; DK (LC), FI (DD), NO (LC), SE (LC). – Däh 839, Mar 407, Sar 1:165, 167, Svp 46:7, Ves 386.
R. densifolia Gillet
- Gills irregular, medium spaced to distant, with many lamellules, forked and anastomosing; cap $\pm$ viscid, when dry glossy. Cap 40-150(-180) mm, umber to sepia, margin often whitish; gills pale, soon dirty cream; stem 30-70 x 15-30 mm, white, browning when bruised, at base irregularly inflated; flesh pale then slightly reddening becoming grey brown to black; taste mild; smell of old wine casks; sp deposit white (Ia). Sp 7.5-9 x 6-7.5 μ m, verrucose, with partial, hardly visible reticulum (fig. 113B). Associated with *Pinus* on acid soil; summer to autumn; common in temp.-bore.; DK (LC), FI (LC), NO (LC), SE (LC). – Mar 405, Phil 47d, Sar 1:161, Schff 4, Ves 387, ☉.
R. adusta (Pers.: Fr.) Fr.

Key C: Sect. *Ingratae* (Quél.) Maire (incl. sect. *Subvelatae* Singer)

1. Cap with grey to grey-brown colours; if yellowish is also present, then completely mild 2
 - Cap with yellow to brown colours; taste bitter, acid or unpleasant oily, at least in the gills 4
2. Taste mild; smell weak, fruity. Cap 40-75 mm, irregular wavy-lobed, with incurved margin, smooth but soon $\pm$ sulcate, dry or slightly viscid, from dark dirty brown to greyish and yellowish; gills medium spaced, interveined, whitish to cream, becoming finely brown spotted; stem 22-50 x 10-16 mm, cylindrical or slightly swollen at base, white, at base yellowish, especially when dried or bruised, finally $\pm$ hollow; flesh at stem base red with ammonia or KOH; sp deposit ochre (IIIab). Sp 6.5-8 x 5.5-7 μ m, echinulate, up to 1 μ m, with some connections and crests (fig. 113C); dcy small and not well developed; near cap margin, especially at 'protected' areas and at stem base provided with well characterised, tapering apical hyphae incrustated with numerous small, yellow granules (in water) and sometimes with greyish contents in SV. In deciduous forests, parks and open land; summer to autumn; rare or confused with similar species; DK (DD). – E&M 18, Mar 427, Sar 1:477, S,E&E 26, ☉.
R. insignis Quél. (*R. livescens* (Batsch) Quél. s. Bres.)
- Taste acid; smell of Camembert cheese 3
3. Sp 6.5-8.5 x 5.5-7 μ m, subglobose, warts up to 0.4 μ m, connections few (fig. 113D). Cap 40-110 mm, sticky-viscid, finely rugose and radially fibrillose, umber to sepia or dark greyish brown, at margin first vaguely then distinctly tuberculate-sulcate; gills dirty whitish to greyish cream, often with brown spots; stem 20-60 x 15-25 mm, whitish to greyish or dirty greyish brown, with rust-coloured spots at base; taste gradually acid; smell resembling Camembert cheese or spermat; sp deposit cream (IIbc). Dcy slender, tapering. In mixed and deciduous forests, often associated with *Quercus* on neutral or rich, clayey soil; summer to autumn; occasional in temp., with few records from NO; DK (LC), NO (NE). – Däh 848, Mar 425, Marst 23, Sar 1:458, 459, Ves 390.
R. sororia (Fr.) Romell (*R. consobrina* (Fr. : Fr.) Fr. var. *sororia* Fr.)
- Sp 7-8.5 x 5-6.5 μ m, ellipsoid, warts up to 0.8 μ m (fig. 113E), with some connections. Cap 30-65 mm, sticky-viscid, dark umber to grey brown or pale grey brown, sometimes paler when



Spores and pileipellis elements: A: *Russula densifolia*, B: *R. adusta*, C: *R. insignis*, D: *R. sororia*, E: *R. amoenolens*, F: *R. pallescens* (from lectotype), G: *R. farinipes*, H: *R. illota*, I: *R. grata*.

old, paler at margin, at first vaguely then distinctly tuberculate-sulcate; gills dirty whitish to greyish cream, often with brown spots; stem 20-55 x 10-15 mm, whitish or pale dirty greyish, sometimes almost as if lacquered; taste somewhat acrid; smell of Camembert cheese or spermiac; sp deposit cream (IIab). Dcy long, slender, tapering. Mycorrhizal with *Quercus* and *Pinus* on acid, sandy ground; summer to autumn; occasional in temp.-hemib., but confused with *R. sororia*; DK (LC), NO (LC), SE (LC). – Mar 426, Sar 1:453, 455, Schff 47, S,E&E 23, Ves 390.

R. amoenolens Romagn.

4. Cap margin smooth or weakly sulcate, taste very acrid or bitter 5
- Cap margin distinctly sulcate, often tuberculate-sulcate and sticky-viscid; taste acrid to almost mild or oily 7

5. Mycorrhizal mainly with conifers, mainly *Pinus silvestris*. Cap 20-50 mm, often rimosely cracking when old, at first pale yellow, later ochraceous; gills narrow, medium spaced to distant, whitish; stem 25-50 x 10-18 mm, often widest in upper part, pointed towards base, almost smooth, white with a yellow tinge; taste very acrid; smell indistinct; sp deposit white (Ia). Sp 7-9 x 6-7.5 μ m, verrucose with a few crests (fig. 113F); dcy slightly tapering. In coniferous forests on poor sandy soils, mainly along paths, but even found in alpine localities near *Betula nana* and dwarf *Salix*; summer to autumn; rare in bore.-arc./alp.; FI (LC), NO (LC), SE. – Sar 1:417.

R. pallescens P. Karst.

- Mycorrhizal with deciduous trees, esp. *Fagus* and *Quercus* 6
6. Taste extremely bitter; cap with smooth margin, buff to yellow brown see *R. fellea*, key E 8
- Taste very acrid; cap with slightly tuberculate-sulcate margin, cream to pale ochraceous. Cap 30-70 mm, thin, but rather firm and elastic, soon plane, hardly peeling; gills rather narrow, distant, whitish; stem 30-80 x 10-15 mm, almost cylindrical, pruinose above, whitish or with a tinge of cap colour, hard and rigid; smell slight, fruity; sp deposit white (Ia). Sp 6-8 x 5-7 μ m, with conical isolated warts up to 0.8 μ m (fig. 113G); dcy long, tapering into a small irregular appendix. In deciduous forests; summer to autumn; occasional in temp.-hemib., rare in bore.; DK (LC), FI (LC), NO (NE, Østf: Fredrikstad, Vestf: Tønsberg), SE (LC). – Phil 41c, R&H 531, Sar 1:413, 415, Schff 44, Ves 391, ☉.

R. farinipes Romell

7. Gill edge brown punctate, at least in part and when young. Cap 60-120(-150) mm, at margin strongly tuberculate-sulcate, viscid, yellow brown to dull brown, often spotted darker brown, sometimes with a slight violaceous greyish tinge; gills whitish to cream, becoming

brown spotted; stem 60-120 x 15-25 mm, whitish, but soon becoming dirty brown punctate from below, with cavities; flesh whitish, becoming brownish when cut; taste acrid; smell a mixture of nauseating and bitter almonds; sp deposit cream (IIb). Sp 7-9 x 6-8 μm , with coarse crests (fig. 113H); dcy long and narrow. In deciduous forests especially with *Quercus* on rich soil; summer to autumn; occasional in temp.-hemib.; DK (LC), FI (EN), NO (LC), SE (LC). – Mar 424, Marst 21, Sar 1:445, 446, Ves 389, ZM 46(2):1.

R. illota Romagn.

- Gill edge not brown punctate 8
- 8. Smell strong and pleasant, of bitter almonds or marzipan 9
- Smell strong and unpleasant, sweetish nauseating, of burnt rubber, oily 10
- 9. Cap 50-100 mm; stem 13-20 mm broad. Cap tuberculate-sulcate at margin, slightly viscid, soon becoming dry, ochraceous to pale brown; gills whitish to pale cream, becoming brown spotted; stem 40-80 x 13-20 mm, whitish, becoming brown spotted especially at base; flesh whitish, brown spotted; taste from almost mild to acrid; smell strong of bitter almonds; sp deposit cream (IIab). Sp 7.5-10 x 8-8.5 μm , with very conspicuous crests, up to 2 μm high (fig. 113I); dcy long and narrow. In deciduous forests; summer to autumn; occasional in temp.-hemib., in FI only in A, U and V; DK (LC), FI (NT), NO (LC), SE (LC). – Däh 846, Phil 45d, Sar 1:439, 441, Schff 45a, Ves 389, ☉.

R. grata Britzelm. (*R. laurocerasi* Melzer)

- Cap 100-130 mm; stem 20-30 mm broad. Cap with tuberculate-sulcate margin, slightly viscid, ochraceous to yellow brown with reddish tint; gills whitish, becoming brown spotted, edge sometimes browning, but not punctate; stem 100-140 x 20-30 mm, persistently whitish above, remarkably contrasting the browning at the lower part; flesh whitish, becoming brownish; taste of gills acrid, $\pm$ mild elsewhere; smell very strong and persistent of bitter almonds and aniseed, even when dried; sp deposit cream (IIb). Sp 8-10 x 7-9 μm , with crests and isolated spines up to 1 μm (fig. 115A); dcy cylindrical or tapering. In deciduous forests on rich soil; late summer to autumn; very rare, only a few records from DK (CR). – Sar 1:449, 451.

R. fragrantissima Romagn.

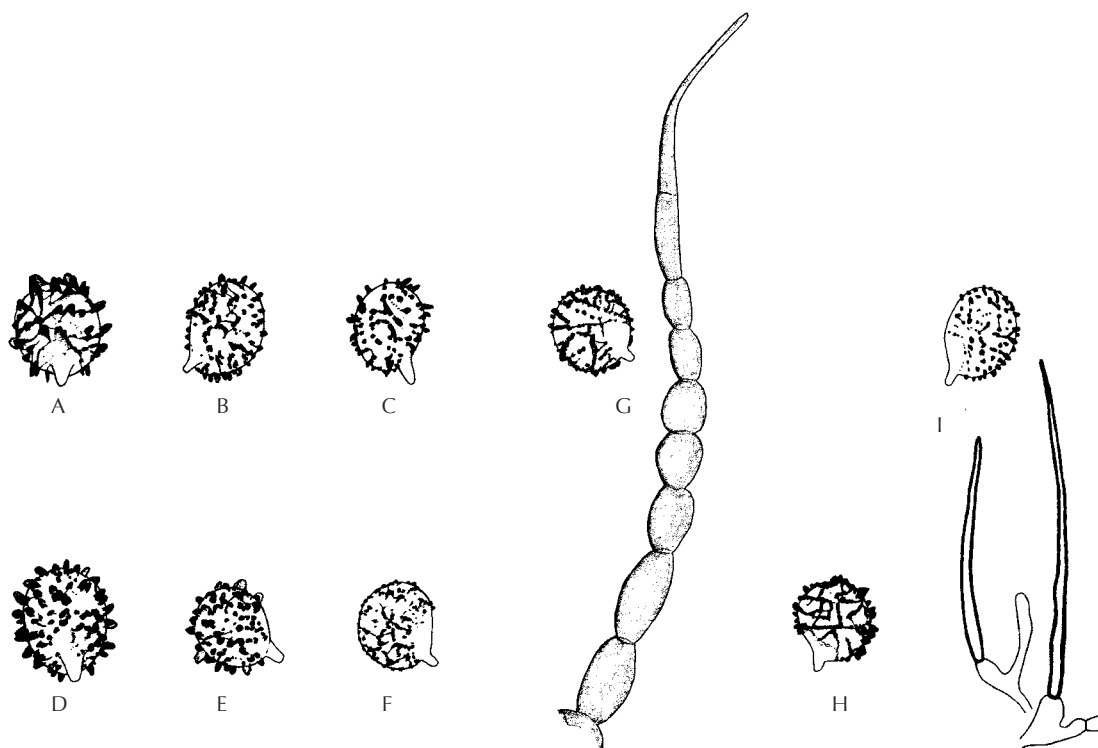
- 10. Frb when old becoming spotted copper red, stem < 50(-60) mm high and < 20 mm thick 11
- Copper red spots absent, stem > 50 mm high and > 15 mm thick 12
- 11. Taste mild or only slowly slightly acrid. Cap 30-80 mm, at margin distinctly tuberculate-sulcate, viscid, buff, pale ochre to brown, centre grey brown; gills cream; stem 30-45 x 10-20 mm, white, browning, rust, copper red to apricot at base; smell oily; taste unpleasant, oily, astringent on tongue; sp deposit cream (IIcd). Sp 7-8.5 x 6-7 μm , echinulate, connections few (fig. 115B); dcy small, non-septate, tapering. Mainly in parks and at forest margins, especially with *Quercus* and *Tilia*; summer to autumn; common in temp., occasional in hemib., rare in bore.; DK (LC), FI (LC), NO (LC), SE (LC). – Däh 847, Mar 428, Schff 46, Sienil 52:53, Ves 391, ☉.

R. pectinatoides Peck

Note: Sarnari (1998) described *R. praetervisa* to cover the South-European taxon similar to the American *R. pectinatoides*. We prefer to keep the traditional name for the species until DNA-sequencing have shown a difference.

- Taste very acrid. Cap 35-85 mm, at margin tuberculate-sulcate, sticky-viscid, pale yellowish; gills white, then cream; stem 30-50 x 10-20 mm, white to dirty yellowish, becoming copper spotted at base; smell fishy or somewhat nauseating; sp deposit cream (II). Sp 7-9 x 5.5-6.5 μm , echinulate, connections few (fig. 115C); dcy small, non-septate, tapering. In deciduous forests, mainly with *Quercus* on calcareous soil; autumn; rare in temp.-bore., in FI only in A: Lemland; FI (CR), SE (LC).

R. pectinata Fr. (see note p. 911)



Spores and pileipellis elements: A: *Russula fragrantissima*, B: *R. pectinatoides*, C: *R. pectinata*, D: *R. foetens*, E: *R. subfoetens*, F: *R. virescens*, G: *R. violeipes*, H: *R. amoenicolor*, I: *R. vesca*.

12. Sp 7.5-10 x 7-8.5 μm , broadly ellipsoid, echinulate, almost without connections, warts up to 1.5 μm (fig. 115D); cap 60-150 mm. Cap convex, at margin strongly tuberculate-sulcate, viscid to glutinous, soon becoming applanate, dull brownish, ochre to honey, often darker at centre or with darker brown patches; gills whitish to pale straw, becoming brown spotted; stem 60-120 x 15-30 mm, cylindrical to lageniform, dirty whitish to brownish, brown spotted when bruised, hollow; flesh whitish, browning when cut, with KOH very pale yellow; taste of gills very acrid, stem almost mild; smell strong, fetid, oily or rancid; sp deposit cream (IIbc). Dcy in pileipellis not reacting with SV. In deciduous and coniferous forests; summer to autumn; common in temp.-bore., rare in suba., but occasional in IS; DK (LC), FI (LC), IS, NO (LC), SE (LC). – Phil 44b, R&H 532, Sar 1:423, Sienil 52:52, Ves 388, .

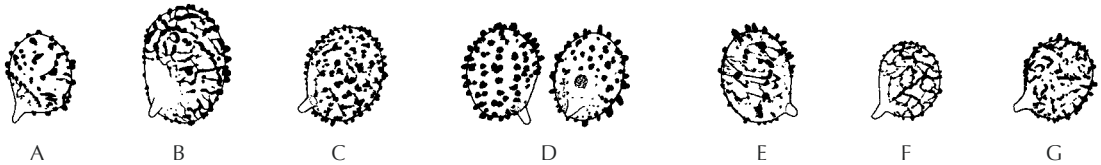
R. foetens Pers.: Fr.

- Sp 7-9.5 x 6-7.5 μm , ellipsoid, verrucose with some crests, warts up to 0.8 μm (fig. 115E); cap 50-100(-140) mm. Cap convex, soon becoming applanate, at margin tuberculate-sulcate, sticky, pale yellow, yellow to brown or red brown; gills whitish to dirty cream, becoming brown spotted when old; stem 50-80 x 15-25 mm, whitish, becoming brown spotted, $\pm$ hollow; flesh whitish, but distinctly yellowing, especially after treatment with KOH; taste moderately acrid in the gills; smell weak, slightly fruity; sp deposit cream (IIbc). Dcy in pileipellis not reacting with SV. In deciduous forests with *Betula*, *Populus*, *Fagus* and *Quercus* and in herb-rich *Picea* forests; summer to autumn; rare in temp.-bore., but possibly confused with related species; DK (LC), FI (LC), NO (NE), SE (LC). – Mar 421, Marst 24, Sar 1:431, 432, Sienil 52:52, Ves 388.

R. subfoetens W.G. Sm.

Key D: Sect. *Heterophyllae* Fr. (incl. subgen. *Amoenula* Sarnari and sect. *Virescentinae* (Singer) Sarnari)

1. Dcy absent 2
 - Dcy present 4
2. Cap cuticle when young areolately broken up into granulose green to dull green scales mixed with ochraceous buff or cream patches; smell indistinct; sp deposit whitish (I); stem white. Cap 50-100 mm, convex, at margin smooth or slightly sulcate; gills white to cream; stem 30-80 x 10-20 mm, white, slightly browning; flesh soon red with FeSO₄; taste mild. Sp 6.5-8.5 x 6-7 μ m, varying from almost reniform to subglobose, ornamentation variable, from isolated warts to a $\pm$ complete reticulum (fig. 115F); apical cells of pileipellis tapering, originating from pyriform or subsphaerical cells; dcy absent. In dry deciduous and coniferous forests, especially with *Fagus*; summer to autumn; occasional in temp., rare in hemib., only few records from NO (VA); DK (LC), NO (NT), SE (NT). – Däh 855, Phil 38c, R&H 536, Sar 1:377, 379, 380, Ves 396, .
R. virescens (Schaeff.) Fr.
 - Cap with a different colour or smooth; smell similar to that of cooked Jerusalem artichokes or *Lactarius volemus*; sp deposit cream (IIad); stem often flushed with purple, violet or yellow 3
3. Sp 7-9 x 6-7.5 μ m, with a prominent, $\pm$ complete reticulum (fig. 115G), most warts up to 0.5 μ m; apical cells of pileipellis tapering, supported by almost subglobose cells. Cap 40-80 mm, greenish yellow, olivaceous yellow or lemon yellow, sometimes more green, sometimes mixed with vinaceous or purplish patches or completely so; gills narrow, crowded, strongly interveined, forked near the stem, whitish to pale buff; stem 40-70 x 10-20 mm, white or more often flushed with yellow, purple or violet, often pruinose at top; flesh hard, slowly pale orange brown with FeSO₄; taste mild; smell weak, resembling that of cooked Jerusalem artichokes or *Lactarius volemus*; sp deposit pale cream (IIab). In deciduous and coniferous forests on rich soil; summer to autumn; occasional in temp.-hemib.; DK (LC), NO (NT), SE (LC). – Marst 17, Phil 38a, R&H 538, Sar 1:401, Ves 410, .
R. violeipes Quél.
 - Sp 6.5-8 x 6-7 μ m, with prominent crests and warts up to 1 μ m (fig. 113H); apical cells of pileipellis tapering, supported by elongate, not isodiametrical cells. Cap 30-80 mm, at margin smooth or slightly sulcate, mat, deep dirty violet, blackish purple, dark vinaceous, olivaceous or almond green; gills flexible, cream; stem 30-70 x 8-15 mm, cylindrical or pointed at base, firm, often flushed with lilac or purple, rarely white, mat, pruinose; taste mild; smell of cooked Jerusalem artichokes or *Lactarius volemus*; flesh slowly pale orange brown with FeSO₄; sp deposit deep cream (IIc). In deciduous and coniferous forests on rich soil; autumn; very rare in temp.; DK (DD), NO (NE). – Mar 410, Marst 10, Sar 1:391, 393-395, S,E&E 6.
R. amoenicolor Romagn.
4. Cap especially at centre with scattered, thick-walled, brownish and setiform hairs; sp deposit white 5
 - Cap without setiform hairs; sp deposit white or darker 6
5. Cap cuticle often not reaching the margin, showing some white flesh. Cap 50-100 mm, depressed and characteristically finely veined at centre, with sharp margin, soon flesh-coloured to reddish brown, sometimes lilac to greenish at margin; gills narrow, crowded to medium spaced, forked near stem, whitish; stem 30-60(-80) x 15-25 mm, firm, white, often pointed and brown spotted at the base; flesh soon orange red with FeSO₄; taste mild; smell indistinct; sp deposit white (Ia). Sp 6.5-8 x 5-6 μ m, finely scattered verrucose, sometimes with a few connections (fig. 115I); dcy inconspicuous; especially at the centre with scattered, thick-walled, brown hairs, easily disappearing when dried. In deciduous and coniferous forests; early summer to autumn; common in temp.-hemib., occasional in bore.-suba., rare



Spores: A: *Russula heterophylla*, B: *R. mustelina*, C: *R. cyanoxantha*, D: *R. medullata*, E: *R. aeruginea*, F: *R. parazurea*, G: *R. atroglaucula*.

in IS; DK (LC), FI (LC), IS, NO (LC), SE (LC). – Däh 859, Phil 30a, R&H 538, Sar 261, 263, Ves 397, ☉.

***R. vesca* Fr.**

- Cap cuticle mostly reaching the margin. Cap 50-100 mm, green or greenish but often mixed with various other colours, brownish, yellowish or olivaceous or faintly bluish, firm, only margin peeling; gills somewhat flexible, crowded, strongly forked at stem, greasy, white; flesh soon pink with FeSO_4 ; taste mild; smell indistinct; sp deposit white (Ia). Sp $5.5\text{--}7 \times 4.5\text{--}6 \mu\text{m}$, with isolated warts, of which some are comma-shaped or with a few, very thin connections or crests (fig. 117A); dcy sometimes with enlarged apex; at the centre with scattered, thick-walled hyaline or rarely brown hairs, easily disappearing when dried. In deciduous forests; summer to autumn; occasional in temp.-bore., more rare in the northern part; DK (LC), FI (DD), NO (LC), SE (LC). – Mar 413, Phil 36a, Sar 1:255, 257, 259, Schff 8, Ves 397.

***R. heterophylla* (Fr.: Fr.) Fr.**

6. Cap uniformly brown, ochre brown to reddish or brownish ochre; mycorrhizal with *Picea*. Cap 50-100(-150) mm, convex, with smooth margin; gills strongly forked and anastomosing near the stem, soft, cream; stem 30-80 x 15-40 mm, strongly pruinose above, becoming spotted or entirely brown; flesh hard, white, then brownish, soon orange with FeSO_4 ; taste mild; smell indistinct; sp deposit cream (IIb). Sp $7\text{--}10.5 \times 5.5\text{--}7.5 \mu\text{m}$, verrucose, $\pm$ catenulate (fig. 117B); dcy scattered, slender. In coniferous forests, usually on acid soil, more rarely also on rich soil; summer to autumn; rare but locally occasional in bore.-hemib., rare in temp., in SE north to Vb; DK (VU), FI (NT), NO (LC), SE (LC). – Däh 860, Marst 15, Sar 1:267, 269, 271, Schff 7, Svp 46:10, ☉.

***R. mustelina* Fr.**

- Cap green, grey, violet, lilac, yellow to almost white, if brown then mixed with other colours and with another mycorrhizal host 7
7. Sp deposit white (Ia); FeSO_4 reaction on stem bluish green or none; gills white, flexible and greasy when touched. Cap 50-150 mm, with smooth margin, greasy and shining, firm, variously coloured, often dull lilaceous mixed with bluish, violaceous, purplish and green; stem 50-100 x 15-30 mm, robust, white, sometimes slightly flushed lilaceous; taste mild; smell indistinct. Sp $7\text{--}9 \times 6\text{--}7.5 \mu\text{m}$, with isolated warts of which some are comma-shaped (fig. 117C); dcy $2\text{--}4 \mu\text{m}$ broad, sometimes with a small appendix, easily overlooked. Summer to autumn; very common in deciduous forests in temp.-hemib., north to 61° , in FI only in A, V and U; DK (LC), FI (LC), NO (LC), SE (LC). – Däh 856, 857, Phil 35d, R&H 537, Sar 1:235, 236, 239, 241, 242, 245, 247, Ves 398, ☉.

***R. cyanoxantha* (Schaeff.) Fr.**

Note: a number of closely related taxa have been described, see Sarnari (1998).

- Sp deposit cream to ochre (IIa-IIIc); FeSO_4 reaction on stem orange, pink, red or brownish; gills whitish to ochre, not so flexible 8
8. Sp deposit ochre (IIIbc). Cap 40-100 mm, shining and greasy, when young greyish green, greyish olivaceous or pale green all over, when mature with a discoloured, ochre, pale brown, brown or red brown, often cracking at centre, becoming paler yellowish towards the

greenish margin; gills fairly thick, forked near stem, cream, later ochre; stem 40-70(-90) x 10-25(-30) mm, often subclavate or cylindrical, white, becoming pale brownish when dried; taste mild; smell indistinct. Sp 7-8.5 x 6-7 μm , finely and regularly verrucose, with or without a few fine connections (fig. 117D); dcy non-septate, cylindrical; hyphae of pileipellis 3-6 μm broad, short-celled. Occasional in hemib. with *Populus*, in bore.-arc./alp. common with *Betula* incl. *B. nana* and dwarf *Salix* species, also with *Dryas* and *Polygonum*; summer to autumn; FI (LC), NO (NE), SE (LC). – E&M 20, Jordst 1984(3) cover, Mar 419, Marst 14, Sar 1:349, 351.

R. medullata Romagn.

- Sp deposit cream (II) 9
- 9. Dcy 50-80 x 4-7 μm , cylindrical and mostly capitate, normal hyaline hyphae of pileipellis 70-140 x 3-5 μm , with few septa; mycorrhizal with *Betula* or *Picea*. Cap 40-90 mm, smooth or radially veined, $\pm$ shining, at margin smooth or slightly sulcate, cuticle covering to the margin, green, yellowish green or greyish green, centre usually darker, often with rust-coloured spots; gills whitish with an ochraceous reflex, often with rust-coloured spots, somewhat acrid; stem white, often with rusty spots at the base; flesh slowly pink with FeSO_4 ; taste mild or slightly acrid in young gills; smell indistinct; sp deposit cream (IIc). Sp 7-8.5 x 5.5-7 μm , verrucose, with some connections (fig. 117E). Summer to autumn; with *Betula*, common on acid, sandy or peaty soil in the whole area except arc./alp., where it is occasional, more rarely with *Picea* on more rich soil; DK (LC), FI (LC), IS, NO (LC), SE (LC). – Phil 39d, R&H 536, Sar 1:371, 373, Ves 396, ☉.

R. aeruginea Lindblad

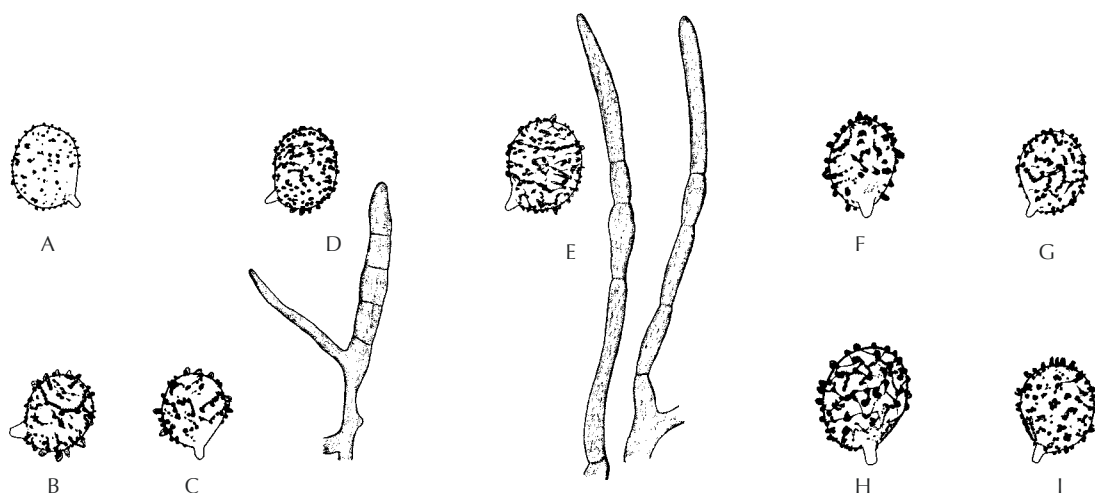
Note: the author is differently cited. Fries published it in Monographia in 1863 as '*R. aeruginea* Lindbl. Mscr.', here, and later in Hymenomycetes Europaei (1874), directly pointing to Lindblad as the person, who first 'distinguished' it. The correct citation would thus be Lindblad in Fr., which in this work is abbreviated to Lindblad.

- Dcy mainly shorter and broader, normal hyaline hyphae of pileipellis mainly shorter, broader and with several septa; mycorrhizal with various hosts, incl. *Betula* and *Picea* 10
- 10. Sp partly reticulate 11
- Sp with isolated warts or with a few connections 12
- 11. Mycorrhizal with various deciduous and coniferous trees on acid soil, incl. *Quercus*, *Betula* and *Picea*; most cells of pileipellis hyphae 4-7 μm broad, > than 5 times longer than broad, apical cells long and slightly tapering. Cap 30-60(-80) mm, often remarkably velvety-pruinose at least partially, mat, rather dark greyish green, greyish olivaceous, greyish or greenish, sometimes pale greyish blue or with rust-coloured patches, often uniformly coloured; gills cream; stem 30-60 x 7-15 mm, cylindrical or slightly tapering, white, but often with rust-coloured spots at the base; flesh brownish pink; smell insignificant; taste mild; sp deposit cream (IIb). Sp 6-8 x 5-6.5 μm , verrucose, partially reticulate (fig. 117F). Often occurring solitary or a few together; summer to autumn; occasional in temp.-hemib. and in suba. in IS; DK (LC), FI (DD), IS, NO (NT), SE (LC). – AM 32 pl. 1, Phil 37de, Schff 13, Sienil 52:49, Ves 398.

R. parazurea Jul. Schäff.

- Mycorrhizal with *Populus tremula* and *Betula* on calcareous soil; pileipellis hyphae with cells 5-10 μm broad, 2-5 times longer than broad, apical cells cylindrical and obtuse. Cap 25-65 mm, finely velvety or smooth, mat, smooth or very slightly sulcate at margin, dark greyish green, olivaceous green, dark olivaceous, with greyish tones, centre darkest; gills cream; stem 30-60 x 7-15 mm, cylindrical, but often tapering, white, at base with rust-coloured spots; flesh pink with FeSO_4 ; smell insignificant; taste mild; sp deposit cream (IIbd). Sp 6.5-8.5 x 5.5-7 μm , verrucose, warts up to 1 μm , with some connections and crests (fig. 117G). Summer to autumn; rare in temp.-bore.; FI (LC), NO (LC), SE (LC). – Marst 10, Sar 1:333, 335, ☉.

R. atroglaucula Einhell.



Spores and pileipellis elements: A: *Russula sublevispora*, B: *R. pseudoaeruginea*, C: *R. stenotricha* (from holotype), D: *R. ionochlora*, E: *R. grisea*, F: *R. galochroa*, G: *R. faustiana*, H: *R. consobrina*, I: *R. solaris*.

12. Sp with 0.1-0.2 μm high warts with few connections (fig. 119A). Cap 40-110 mm, pale grey brown, margin often violet and centre mixed with olivaceous, brownish and pale patches; gills cream; stem 30-65 x 15-30 mm, white; smell indistinct; taste mild; sp deposit cream to pale ochre (IIc-IIIa). Sp 6.5-8 x 5.5-6.5 μm ; dcy non-septate, often appendiculate. In deciduous forests; summer; rare in hemib.; FI (DD, Kaarina), SE (Flemingsberg). – Sar 1:345, 346, SMT 28:60.
R. sublevispora (Romagn.) Romagn. (*R. ferrerii* Singer var. *sublevispora* Romagn.)
 - Sp with larger warts 13
13. Cap pale green, bright green, greyish green or olivaceous green, without any lilac, bluish or dark green 14
 - Cap pale, pale brown to almost whitish, or with traces of lilac, violet or bluish 15
14. Apical cells of pileipellis strongly tapering, almost thick-walled and very pointed, supported by $\pm$ inflated cells. Cap 40-80(-120) mm, at margin becoming somewhat sulcate, green to olivaceous green, shining; gills whitish with ochraceous reflection; stem 40-60 x 15-20 mm, white, with rust-coloured spots at base; taste mild or slightly acrid in gills; smell indistinct; sp deposit cream (IIbd). Sp 6.5-8 x 5.5-6.5 μm , verrucose with crests forming a few meshes (fig. 119B); dcy short, non-septate, often clavate. In deciduous forests on rich soil; summer to autumn; distribution and frequency poorly known, confirmed records from DK (NE) and FI (DD). – Marst 16, Sar 1:301, 303.
R. pseudoaeruginea (Romagn.) Kuyper & Vuure
 - Pileipellis with short obtuse or slightly tapering apical cells, of almost same width as the basal cells. Cap 40-70 mm, with smooth margin, bright green, pale green, at centre discolouring yellowish green; gills cream; stem 40-70 x 8-15 mm, cylindrical, white, with small rust-coloured spots; taste mild; smell indistinct; sp deposit cream (IIb). Sp 6.5-8 x 5-6 μm , with crests (fig. 119C); dcy short, non-septate, often clavate. In deciduous forests with *Fagus* on rich soil; rare, but possibly confused with similar species; DK (NE), SE (LC). – Sar 1:297.
R. stenotricha Romagn.
15. Cap a mixture of blue, violet, lilac, grey, yellow and green, smooth and often shining; stem white or with a flush of cap colour; apical cells in pileipellis distinctly tapering 16
 - Cap grey, green, olivaceous, buff or cream, smooth or velvety, mat; stem white; apical cells in pileipellis cylindrical or slightly tapering 17

16. Apical cells in pileipellis tapering, supported by short rectangular cells, 5-10 μm broad (fig. 119D); sp deposit pale cream (IIa). Cap 40-80 mm, often lobed, with smooth margin, centre pale green, green or olivaceous, especially near the margin mixed with lilac or violet; gills cream; stem 30-60 x 10-20 mm, firm, white or with a slight violet or yellowish green tinge; flesh bright orange pink with FeSO_4 ; taste mild or slightly acrid of gills; smell indistinct. Sp 6.5-7.5 x 5-6 μm , finely verrucose without or with a few connections; dcy non-septate, cylindrical or slightly clavate. Mycorrhizal, mainly with *Fagus* in deciduous forests; summer to autumn; occasional in temp.-hemib.; DK (LC), FI (DD), NO (NE), SE (LC). – E&M 17, Phil 36c, Sar 1:286-288, Sienil 56:40, Ves 399.

R. ionochlora Romagn. (*R. grisea* Fr. s. Schäffer)

- Apical cells in pileipellis tapering, supported by oblong cells, 3-6 μm broad (fig. 119E); sp deposit dark cream (IIc). Cap 40-120 mm, depressed, often shining, greyish blue, greyish olivaceous, lilaceous, greyish lilaceous to almost blackish at margin, centre paler, cream, brownish or pale lilaceous; gills whitish; stem 30-80 x 10-25 mm, white, often with a lilac tinge; flesh pink with FeSO_4 ; taste mild; smell indistinct. Sp 7-8.5 x 5.5-6.5 μm , verrucose to echinulate, forming connections and crests; dcy non-septate, cylindrical. In deciduous forests with *Fagus* and *Quercus*; summer to autumn; occasional but distribution and frequency unclear due to confusion with related species; DK (LC), FI (LC), NO (NE), SE (LC). – E&M 14, Mar 418, Phil 36b, Sar 1:291, 293, Ves 399, ☉.

R. grisea Fr. s. Gillet

17. Cap cuticle at least near margin velvety, irregularly cracking. Cap 40-100 mm, soon depressed at centre, typically dark olivaceous, sometimes with an additional grey or brown tinge; gills whitish to cream; stem 20-60 x 10-15 mm, firm, white becoming brown spotted, especially near base; flesh becoming pale brownish pink with FeSO_4 ; sp deposit dark cream (IIId). Sp 6.5-8 x 6-7 μm , verrucose, without connections (fig. 119F); dcy 4-10 μm broad; hair-like hyphae in pileipellis very variable in shape, 5-8 μm thick. Mycorrhizal with *Betula*, possibly also with other hosts; distribution and frequency poorly known, but confirmed records from DK, FI (DD), IS (Au), NO (NE) and SE (NA). – Sar 1:337, 339.

R. galochroa (Fr.) Fr. (*R. heterophylla* Fr. var. *galochroa* Fr., *R. anatina* Romagn.)

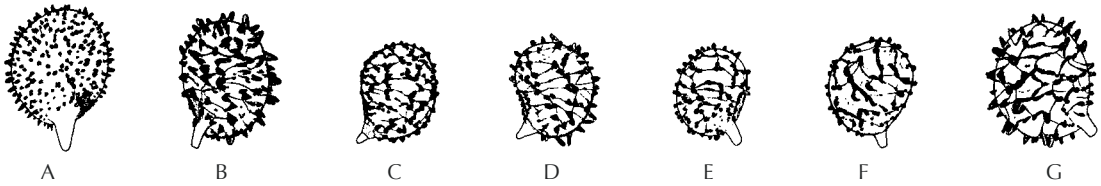
Note: The interpretation of this species has varied among the authors. We put the emphasis on Fries description that it is greenish-floccose (resembling *R. virescens*) and growing with *Betula*.

- Cap cuticle near margin mat and pruinose but not velvety. Cap 40-100 mm, convex becoming slightly depressed, at margin finally short sulcate, mat, $\pm$ pruinose, cream, buff, pale greyish to pale greyish olive, centre brownish; gills sometimes forked, whitish; stem 30-70 x 10-20 mm; flesh pink with FeSO_4 ; taste mild; smell insignificant; sp deposit cream. Sp 6.5-8 x 5.5-6.5 μm , with some ridges (fig. 119G); dcy clavate with pointed apex, mixed with hair-like hyphae with an inflated base and tapering apical cells. Mycorrhizal with *Fagus* on calcareous soil; summer; occasional in temp.; DK (LC), SE (NA). – FAD 188A, E&M 13, Sar 1:327, 329, Svp 34:36.

R. faustiana Sarnari

Key E: Sect. *Russula* (excl. subsects *Urentes* Maire and *Rubrinae* (Melzer & Zvara) Singer, incl. sects *Felleinae* (Melzer & Zvara) Sarnari and sect. *Viscidinae* (Sarnari) Sarnari)

1. Cap yellow, greenish yellow, grey or greyish brown, rarely with a weak orange flush near the margin 2
 - Cap red, lilac, violet, purple, brownish, olivaceous, green or a mixture of these 10
2. Cap pale greyish, greyish sepia or umber. Cap 50-120 mm, radially veined, often shining and almost viscid, margin smooth; gills medium spaced, white with a greyish tinge, then pale cream; stem 60-100 x 15-30 mm, whitish, then greyish; flesh white, greying; taste very acrid; sp deposit cream (IIbc). Sp 8.5-10 x 7.5-9 μm , verrucose with $\pm$ complete reticulum



Spores: A: *Russula innocua*, B: *R. ochroleuca*, C: *R. citrinochlora*, D: *R. fellea*, E: *R. raoultii*, F: *R. nana*, G: *R. betularum*.

(fig. 119H); dcy long, irregular, often slightly capitate at apex. In forests of *Picea*, with *Betula* on mountains; summer to autumn; common in bore., occasional in hemib., rare in temp. and suba.; FI (LC), NO (LC), SE (LC). – Cet 200, Marst 18, R&H 534, Sar 1:589,591, Schff 47a, ☉.

R. consobrina (Fr. : Fr.) Fr.

- Cap yellow or greenish yellow, rarely with a faint orange flush near the margin 3
- 3. Sp deposit cream (IIbc); cap bright yellow or darker yellow at centre and pale yellow to almost white near the margin, tuberculate-sulcate. Cap 20-70 mm, convex then slightly depressed, fragile; gills white then cream with a yellowish reflection; stem 30-60 x 5-14 mm, soft and fragile, white, when old sometimes with ochraceous patches; taste very acrid; smell distinct, resembling *Pelargonium*. Sp 7-8 x 5-7 μ m, echinulate, spines up to 1 μ m, connections very few (fig. 119I). Mycorrhizal with *Fagus* and *Quercus* on rich soil; summer to autumn; occasional in temp., rare in bore., in NO only in Vestf, in FI in V; DK (LC), FI (DD), NO (NT), SE (NT). – E&M 27, Marst 38, Sar 1:543, 544, Schff 49, Ves 411.

R. solaris Ferd. & Winge

- Sp deposit white to whitish (Ia-IIa); cap yellow, dull yellow or greenish yellow 4
- 4. Taste mild or slightly acrid 5
- Taste very acrid or very bitter 7
- 5. Sp with isolated spines up to 1.8 μ m (fig. 121A). Cap 20-40 mm, sulcate at margin when old, mat, towards centre pale green to pale greyish green with a yellow flush, whitish at margin; gills distant, whitish; stem 20-40 x 5-10 mm, slightly swollen below, white, greying; taste mild or slightly acrid; smell indistinct or fruity; sp deposit whitish (IIa). Sp 7.5-10 x 6.5-9 μ m; dcy 5-9 μ m broad. Mycorrhizal with deciduous trees, e.g. *Fagus*, on rich clayey soil; summer to autumn; very rare in temp.-hemib., very rare in DK (EN), one record from NO (NT, Vestf: Nøtterøy), two from SE (NE, Sk, ÖI). – E&M 16, FAD 187B, Marst 13, Sar 1:601, 603, Svp 38:14.

R. innocua (Singer) Bon

- Sp reticulate 6
- 6. Cap 50-120 mm. Cap ochre, yellow or rarely yellowish green; gills whitish, medium spaced to distant, rarely forked; stem 30-70 x 10-20 mm, firm then rather fragile, white to pale ochre, when old greyish water-soaked; taste mild or slightly acrid; smell indistinct; sp deposit white (Iab). Sp 8-10 x 7-8 μ m, echinulate, warts up to 1.3 μ m, with a partial reticulum (fig. 121B); dcy few and scattered; apical cells of pileipellis often finely, golden yellow incrustated. In deciduous and coniferous forests (*Fagus*, *Picea*); autumn; very common in temp.-bore., but rare in FI; DK (LC), FI (LC), NO (LC), SE (LC). – Däh 850, Marst 21, Phil 42a, Sar 2:862, 864, Ves 410, ☉.

R. ochroleuca Pers.

- Cap 30-45(-55) mm. Cap margin first brownish or brownish orange, but soon pure yellow or greenish yellow, discolouring to greyish buff at centre; gills whitish to cream; stem 15-35(-50) x 7-14(-19) mm, white or with a flush of the cap colour; taste mild; smell indistinct; sp

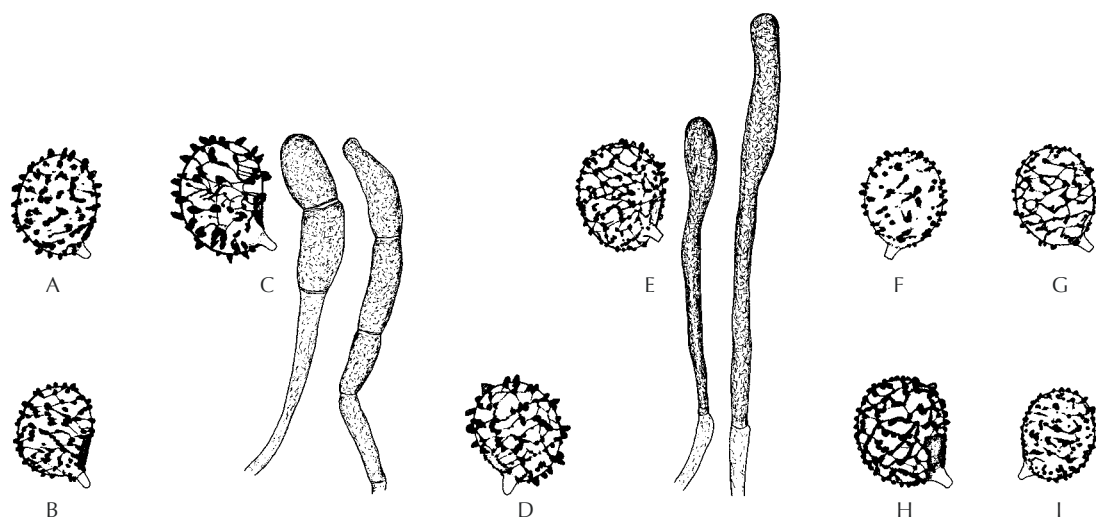
deposit whitish (Ib). Sp 8-9(-9.5) x 6.5-7.5(-8) μm , finely reticulate, warts up to 0.5 μm (fig. 121C); dcy long, clavate, up to 8 μm broad. Mycorrhizal, in arc./alp. areas with dwarf *Salix*, e.g. *S. herbacea*, *S. glauca* and *Polygonum viviparum*, in hemib.-bore. with *Picea* and *Betula* in fairly moist forests; summer to autumn; recently redescribed species known from FI (DD), NO (NE), SE. – Bor 79, Marst 27, Pers 14:516, Sar 1:549, Sieniop 62.

R. citrinoclora Singer

7. Taste very bitter. Cap 30-80 mm, convex to plane, yellow, ochraceous, buff or yellow brown; gills whitish with a tinge of the cap colour; stem 30-70 x 10-20 mm, concolorous with cap; flesh white, then honey-coloured; smell sweetish, of apple compote; sp deposit white (Ia). Sp 7.5-9 x 6-7 μm , verrucose, with many connections (fig. 121D); dcy septate. Mycorrhizal with *Fagus*, occasionally with other trees; summer to autumn; very common in temp., occasional in hemib., rare in bore., in NO north to M&R, in SE to Upl.; DK (LC), NO (LC), SE (LC). – Däh 849, Phil 42c, R&H 533, Sar 1:483, Ves 411, ☉.

R. fellea (Fr.: Fr.) Fr.

- Taste very acrid 8
8. In coniferous forests; sp with isolated warts or a few connections see *R. pallescens*, key C 5
 - In deciduous forests 9
9. Gill edge entire; smell of coconut; dcy non-septate. Cap 20-70 mm, lemon yellow, with whitish, smooth or finely tuberculate-sulcate margin; gills white to pale cream, sometimes strongly interveined in front; stem 20-40 x 8-15 mm, whitish, slightly greying or brown-ing; taste acrid; sp deposit white (Ia). Sp 7-8.5 x 5.5-7 μm , partially reticulate (fig. 121E). In deciduous forests on acid ground; summer to autumn; occasional in temp.-hemib., rare in bore.; DK (LC), NO (LC), SE (LC). – Mar 440, Marst 36, Sar 1:539, 540, Schff 53b, ZS pl. 8, ☉.
- R. raoultii*** Quéél.
- Gill edge serrulate; smell of fruit drops (amylacetate); dcy septate. DK, FI, SE. – E&M 11. Yellow forms of *R. fragilis* (Pers.: Fr.) Fr., see also 34.
10. Cap pure red, sometimes $\pm$ discolouring to pink or whitish, without any trace of lilac, purple or violet; stem pure white, often greying when old; sp deposit whitish; frb slender and fragile 11
 - Cap either having other colours or if pure red then stem concolorous with cap and gills slightly decurrent or sp deposit darker; sp deposit white, cream or ochre; frb slender or robust 16
11. Mycorrhizal with *Betula*, dwarf *Salix* or *Polygonum viviparum* 12
 - Mycorrhizal with other hosts 13
12. Cap blood red when young; mycorrhizal with *Betula*, *Salix* or *Polygonum viviparum* in arc./alp., in bore.-hemib. in moist, mixed forests with *Betula*. Cap 15-60(-80) mm, convex but soon plane or depressed, at margin $\pm$ undulating, blood red at centre, red near margin, in mountains soon fading to red and discolouring whitish in patches; gills white; stem 15-80 x 5-20 mm, often short, white then greying, fragile; smell slightly of cocoa; taste moderately acrid, when old almost mild; sp deposit white (Ia). Sp 7.5-9.5 x 6.5-7.5 μm , with warts up to 0.5 μm and $\pm$ complete reticulum (fig. 121F); dcy non- or few-septate. June to Aug.; common in suba.-arc./alp., occasional in hemib.-bore.; FI (LC), FO, IS, NO (LC, incl. Svbb), SE (LC). – FF 2d, G,J&S 47, Marst 34, R&H 551, Sar 1:571, 573.
- R. nana*** Killerm. (*R. alpina* (Blytt) F.H. Møller & Jul. Schäff.)
- Cap pale pink when young; mycorrhizal with *Betula* in forests. Cap 20-50 mm, depressed at centre, at margin smooth or slightly sulcate, pink, often with darker and paler patches, discolouring to white; gills white; stem 30-60 x 5-10 mm, white; taste very acrid; smell indistinct; sp deposit white (Ia). Sp 8.5-11.5 x 7.5-8.5 μm , with obtuse spines, up to 1 μm , and a nearly complete reticulum (fig. 121G); dcy non- or few-septate. Summer to autumn;



Spores and pileipellis elements: A: *Russula luteotacta*, B: *R. mairei*, C: *R. emetica* var. *emetica*, D: *R. emetica* var. *silvestris*, E: *R. griseocens* (from holotype), F: *R. sanguinea*, G: *R. rhodopus*, H: *R. helodes*, I: *R. renidens* (from holotype).

common in temp.-bore., in NO north to Troms, in FI to InL; DK (LC), FI (LC), NO (LC), SE (LC). – Däh 901, R&H 549, Phil 20b, Sar 1:529, 530, Ves 414.

R. betularum Hora (*R. emetica* (Schaeff: Fr.) Pers. var. *b.* (Hora) Romagn.)

13. Mycorrhizal with *Quercus*; gills distant, rather thick, white to pale cream, strongly yellowing when bruised, but sometimes only hours later, subdecurrent. Cap 30-70 mm, cuticle rugose, hardly separable, red or pink, sometimes discolouring to whitish; stem 30-60 x 5-10 mm, white, rarely $\pm$ red, rather firm; taste very acrid; smell indistinct or slightly of coconut; sp deposit white (la). Sp 7-9 x 6-7.5 μ m, verrucose, with or without a few connections (fig. 123A); dcy very long, non- or few-septate. Summer to autumn; on clayey soil; rare in temp.-hemib., in NO only in Østf; DK (NT), NO (NE), SE (LC). – E&M 19, Phil 20a, R&H 548, Sar 1:675, 677, Ves 415, ☉.

R. luteotacta Rea

- Mycorrhizal with other trees or gills different 14
- 14. Mycorrhizal with *Fagus*; gills often with a faint turquoise reflex, especially near the stem. Cap 30-60 mm, hemispherical to convex, mat, red or pink, sometimes discolouring to whitish; stem 25-45 x 8-15 mm, white, slightly yellowish at the base; smell acidulous, taste acrid; sp deposit white. Sp 6.5-8 x 5.5-6.5 μ m, verrucose, with warts up to 0.5 μ m, and a fine, $\pm$ complete reticulum (fig. 123B); dcy non-septate, short. Summer to autumn; common in temp., occasional with planted *Fagus* in hemib., in NO north to Hord, in SE north to Upl.; DK (LC), NO (LC), SE (LC). – Däh 904, Phil 19ef, R&H 550, Sar 1:567, 569, Ves 414, ☉.

R. mairei Singer

- Mycorrhizal with coniferous or deciduous trees; gills without a turquoise reflex 15
- 15. Mycorrhizal with *Pinus sylvestris*, *Fagus* etc. on acid soil; gills whitish and adnate. Cap 30-100(-120) mm, slightly sulcate at margin, shining scarlet or blood red, discolouring to whitish; stem 50-80 x 10-20 mm, clavate, rugulose, white; taste very acrid, smell clearly of cocoa; sp deposit whitish. Sp 8-11 x 7-8.5 μ m, with warts up to 1 μ m and a $\pm$ complete reticulum

(figs 123C-D); dcy long and multi-septate. Summer to autumn, mainly late in season; common in temp.-bore., in FI north to Ks; DK (LC), FI (LC), FO, NO (LC), SE (LC). – Däh 899, Phil 16a, R&H 549, Sar 1:555, 557, 561, Ves 415, ☉.

R. emetica (Schaeff.: Fr.) Pers. s. lato (incl. *R. e.* (Schaeff.: Fr.) Pers. var. *silvestris* Singer, *R. silvestris* (Singer) Reumaux)

- Mycorrhizal with *Picea abies*; gills soon greyish and slightly decurrent. Cap 20-60(-80) mm, blood red or pink, sometimes yellow at centre; stem 30-80 x 10-20 mm, often irregular, strongly greying, rarely with a pink tinge; sp deposit white; taste acrid; smell indistinct. Sp 7-9.5 x 6-8 μ m, with low warts (fig. 123E); dcy non- or one-septate. In moist *Picea* forests among *Sphagnum* and other mosses; summer; occasional in hemib.-bore.; FI (LC), NO (LC), SE (LC). – Marst 31, Sar 1:577, 579, Sieniop 71.

R. griseocens (Bon & Gaugué) Marti ('*griseascens*', *R. emetica* (Schaeff.: Fr.) Pers. var. *griseocens* Bon & Gaugué)

- 16. Cap red; stem either concolorous with cap, white or flushed with red 17
- Cap with a mixture of red, lilac, purple, violet and green; stem concolorous with cap or white 21

- 17. Mycorrhizal with coniferous trees 18
- Mycorrhizal with deciduous trees 20

- 18. Mycorrhizal with *Pinus* in grassy places, often in parks and at forest margins. Cap 50-100 mm, often characteristically rugose, dull red to blood red, red, often as small spots, with yellowish discoloured patches, sometimes without any red from beginning, then grey or pale cream, cuticle hardly peeling; gills somewhat forked, subdecurrent, when old rather distant, pale cream; stem 40-60 x 10-25 mm, mostly cylindrical, finely reticulate rugose, $\pm$ pink, rarely white, when old fading and greyish water-soaked; smell with *Lactarius*-like component; taste moderately acrid; sp deposit pale ochre (IIIa). Sp 7-8.5 x 6.5-7.5 μ m, verrucose with few connections (fig. 123F); dcy long, narrow, septate. Autumn; occasional in temp.-bore., in NO north to Troms, in FI north to Ks; DK (vu), FI (LC), NO (LC), SE (LC). – Däh 920, Mar 448, Phil 16b, R&H 552, Sar 1:619, 621.

R. sanguinea (Bull.) Fr. (*R. pallida* P. Karst.)

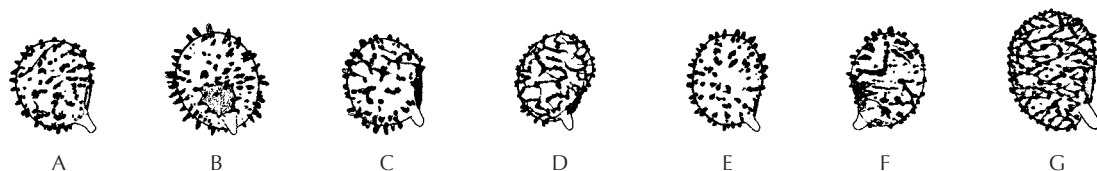
- Mycorrhizal with *Picea* 19
- 19. In mossy *Picea* forests; sp verrucose, with crests and numerous meshes (fig. 123G). Cap 50-100 mm, often with wavy margin, viscid, brilliantly shining red, often discolouring; gills almost free to adnate, pale cream; stem 40-100 x 10-20 mm, often clavately swollen and bent at base, surface even, $\pm$ red, sometimes in irregular patches, rarely white; taste moderately acrid; smell indistinct or fruity; sp deposit ochre (IIc-IIIb). Sp 7.5-9 x 6.5-7.5 μ m; dcy non- or few-septate. Summer to autumn; common in bore., occasional in hemib. and rare in temp., in FI north to InL; DK (vu), FI (LC), NO (LC), SE (LC). – Mar 451, R&H 552, Sar 1:623, 625, Schff 57, S,E&S 40.

R. rhodopus Zvára ('*rhodopoda*')

- In moist *Picea* forests; sp almost completely reticulate (fig. 123H). Cap 50-120 mm, soon depressed, with wavy margin, mat when dry, red to blood red, with paler yellowish patches, centre darker; gills subdecurrent, forked, cream; stem 40-100 x 15-30 mm, tapering at base, surface uneven, white or partly with a red tinge, greying from the base; taste moderately acrid; smell indistinct; sp deposit ochre (IIIab). Sp 8.5-10.5 x 7.5-8.5 μ m; dcy non-septate, finely diverticulate. Autumn; distribution and frequency not well known due to confusion with related species; rare in FI (DD), NO (LC) and SE (LC), very rare in DK (EN). – Cet 1088, Mar 452, Sar 1:627, 629, Schff 56.

R. helodes Melzer

- 20. Mycorrhizal with *Betula*; mostly in bore.-suba. Cap 30-80(-90) mm, shining blood red to violaceous purple, darkest at centre, often mixed with yellow, sometimes yellowish to greenish,



Spores: A: *Russula persicina*, B: *R. queletii*, C: *R. sardonias*, D: *R. torulosa*, E: *R. gracillima*, F: *R. depallens*, G: *R. alnetorum* (from lectotype).

discolouring to pink with cream areas; gills adnexed to subdecurrent, whitish, later cream; stem 30-100 x 10-22 mm, pruinose above, often soon grey with a red tinge, often with yellowish patches; smell indistinct to slightly fruity, smell weak, fruity, taste acrid; sp deposit dark cream (IIcd). Sp 7-9(-9.5) x 5.5-7(-7.5) μ m, verrucose, with or without some connections (fig. 123I); dcy narrow, 5-6 μ m broad, cylindrical. On rich, mostly moist soil; autumn; occasional in bore., rare in hemib.; FI (LC), NO (NE), SE (NE). – Marst 36, Sar 1:663-665.

R. renidens Ruots., Sarnari & Vauras (*R. persicina* Krombh. s. Knudsen & Stordal)

- Mycorrhizal with e.g. *Quercus*, *Fagus* and *Carpinus*; in temp.-hemib. Cap 40-90 mm, shining, pure red to blood red, sometimes cream at centre, cuticle hardly peeling; gills medium spaced to distant, cream; stem 30-70 x 10-25 mm, white, often partly red, yellowing later, pruinose above; smell slightly of cocoa, taste acrid; sp deposit cream (IIc). Sp 6.5-8.5 x 5.5-7 μ m, verrucose, with few connections (fig. 125A); dcy 4-8 μ m broad, cylindrical to clavate. Autumn; rare; DK (vu), FI (vu), SE (LC). – Cet 1081, Mar 438, 439, Marst 35, Sar 1:669, 671, Schff 55bc.

R. persicina Krombh.

- | | | |
|----|--|----|
| 21 | Stem partly or totally red or purple; sp deposit cream to pale yellow | 22 |
| - | Stem white, grey or yellowing, rarely locally with a pink flush; sp deposit white to cream | 27 |

22. Mycorrhizal with *Picea* on rich, clayey or calcareous soil. Cap 30-70 mm, dark purple to violet red, when young often umbonate; gills white to cream; stem 30-80 x 5-20 mm, concolorous with cap or paler; taste acrid; smell of gooseberry compote; sp deposit cream (IIcd). Sp 7.5-9 x 6.5-7.5 μ m, with isolated spines up to 1.2 μ m (fig. 125B). Late summer to autumn; occasional in temp.-suba., in NO north to Nordl, in FI north to SoL; DK (LC), FI (LC), NO (LC), SE (LC). – E&M 12, R&H 553, Sar 1:641, 643, Schff 59, Ves 416, ☉.

R. queletii Fr.

- | | | |
|-----|--|----|
| - | Mycorrhizal with <i>Pinus</i> or <i>Betula</i> | 23 |
| 23. | Mycorrhizal with <i>Pinus</i> | 24 |
| - | Mycorrhizal with <i>Betula</i> | 26 |

- | | | |
|-----|--|-------------------------------|
| 24. | Sp deposit dark ochre to pale yellow; taste first mild, gradually very acrid | |
| | | see <i>R. badia</i> , key H 4 |
| - | Sp deposit pale ochre | 25 |

25. Young gills lemon-yellow, becoming pink with ammonia. Cap 40-100 mm, when young often umbonate, dark violaceous purple, reddish purple or livid vinaceous, sometimes greyish olivaceous or with yellowish patches; stem 40-100 x 10-25 mm, livid vinaceous, pale lilac or pale purplish, at the base yellowish, firm; flesh pale lemon-yellow; taste very acrid; smell indistinct or fruity; sp deposit pale ochre (IIcd). Sp 7-9 x 6-7 μ m, verrucose, with crests or a few meshes to partially reticulate (fig. 125C); dcy long, narrow, non-septate. Mycorrhizal with *Pinus* on acid soil; mostly in late autumn; occasional in temp.-bore.; DK (LC), FI

(LC), FO, NO (LC), SE (LC). – Däh 924, Phil 26b, R&H 554, Sar 1:633, 635, Ves 416, ☉.

R. sardonica Fr. (*R. drimeia* Cooke)

- Gills cream, not becoming pink with ammonia. Cap 40-90 mm, plane, rugose, firm, reddish purple, vinaceous purple or red, often marbled olivaceous to brownish olivaceous or blackish at centre; stem 30-60 x 10-25 mm, remarkably short and stout, concolorous with cap or pale lilac to almost white, at base often whitish, yellowing; flesh firm; taste moderately acrid; smell fruity; sp deposit deep cream to pale ochre (IIId-IIIa). Sp 7-9 x 5.5-7 μ m, verrucose with low warts forming crests and also some connections (fig. 125D). Mycorrhizal with *Pinus* on sandy, calcareous soil; autumn; distribution and frequency not known, but with few records from DK (EN) and SE (NT). – Mar 450, Marst 39, Sar 1:647, 649, Schff 58a, Svp 46:24.

R. torulosa Bres.

26. Frb slender and fragile; stem usually $\pm$ pink, at least at base, rarely completely white, later greyish, 20-60 x 5-10 mm, usually clavately swollen; sp deposit pale cream (IIab). Cap 20-60 mm, convex, sometimes umbonate, but usually soon with depressed centre, shining, greasy, margin red or pink, centre dark purplish black, violaceous black or greenish black, often surrounded by a paler greenish or pale yellowish green zone or completely so; gills medium spaced to distant, pale straw and greyish; taste moderately acrid in the gills, soon mild; smell indistinct. Sp 7-8.5 x 5.5-6.5 μ m, with isolated warts up to 0.8 μ m (fig. 125E); dcy long, non-septate. Mycorrhizal with *Betula*, mainly in moist forests; summer to autumn; common in temp.-suba.; DK (LC), FI (LC), IS, NO (LC), SE (LC). – Phil 39e, R&H 551, Sar 1:658, 659, 670, Schff 60, Ves 403.

R. gracillima Jul. Schöff.

- Frb medium sized, stout; stem 30-60 x 10-20 mm, white, $\pm$ greying, rarely with a pink tint; sp deposit ochre (IIIac). Cap 40-100(-120) mm, when young red, but soon with discoloured, greyish, cream or greenish centre and a red, pink purplish or flesh-coloured margin, also entirely discoloured or green with a very narrow purplish margin; gills subdecurrent but slightly emarginate, cream; taste of gills moderately acrid, flesh mild. Sp 8-9.5 x 6-7 μ m, verrucose, catenulate, with many connections and partly reticulate (fig. 125F); dcy long, non- or few-septate. Mycorrhizal with *Betula* on rich, often naked calcareous soil, mainly in parks and at roadsides; early summer to autumn; common in temp.-bore., occasional in suba.; DK (LC), FI, IS, NO (LC), SE (LC). – Phil 32a, R&H 553, Sar 1:653, 655, Schff 61, Ves 417, ☉.

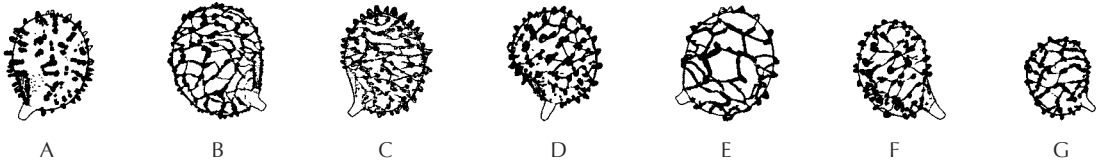
R. depallens (Pers. : Fr.) Fr. (*R. pulchella* I.G. Borshch.)

Note: Romagnesi (1967) and Sarnari (1998) use the name *R. exalbicans* for this species. However, according to the original description by Persoon (1801: 439) of *R. rosacea* var. *exalbicans*, it is smaller than *R. emetica* ('sequente minor'), which is not true for the present species. We therefore stick to the name that has been used for the species in Scandinavia for a long time.

27. Mycorrhizal with *Alnus* in moist, rich forests. Cap 25-40(-60) mm, $\pm$ sulcate, fragile, margin purplish to vinaceous or violaceous, centre blackish; gills medium spaced to distant, whitish to cream; stem 30-50 x 5-10 mm, fragile, first whitish, soon $\pm$ yellowing, when old and in moist weather strongly greying; taste moderately acrid to almost mild; smell indistinct; sp deposit whitish (Ib). Sp 8.5-10.5 x 7-8 μ m, $\pm$ completely reticulate (fig. 125G); dcy long, non- or few-septate. Late summer to autumn; rare in temp.-bore., in FI north to OP; DK (NT), FI (LC), NO (LC), SE (LC). – Mar 444, Marst 24, R&H 550, Sar 1:532, 533, 537, Ves 407, ☉.

R. alnetorum Romagn. (*R. pumila* Rouzeau & F. Massart)

- Mycorrhizal with other hosts 28
28. Mycorrhizal with *Populus tremula*, *P. alba* and *P. canescens*. Cap 20-70 mm, with smooth or almost smooth margin, purplish vinaceous, violet, greyish violet to pale olivaceous green or green, also more dull olivaceous brown or ochre; gills white; stem 20-50 x 7-10 mm, white, slightly greying, especially when wet, fragile; smell strong, of *Pelargonium*, when old more fishy; taste slightly acrid; sp deposit cream (IIab). Sp 7-9 x 6-7.5 μ m, with spines up to 1 μ m,



Spores: A: *Russula pelargonica*, B: *R. viscida*, C: *R. undulata*, D: *R. aquosa*, E: *R. fragilis*, F: *R. laccata* (from holotype), G: *R. atrorubens*.

partially to almost fully reticulate (fig. 127A); dcy septate, up to 9 μm broad. Summer to autumn; rare in temp.-bore, in FI north to KS; DK (vu), FI (lc), NO (lc), SE (ne). – E&M 16, Sar 1:597, 599, 605, 607, Ves 412.

R. pelargonica Niolle (*R. clariana* Kuyper & Vuure)

Note: some authors separate two species.

- Mycorrhizal with other hosts 29
- 29. Frb robust; cap 50-120 mm; taste almost mild to moderately acrid; stem when old greying or yellowing 30
- Frb fragile; cap 20-80 mm; taste acrid or if mild then stem white 33
- 30. Stem 40-80 $\times$ 15-35 mm, firm to hard, distinctly yellowing or browning, especially at base due to incrustated veil-hyphae. Cap 50-120 mm, convex or slightly depressed, $\pm$ viscid, mottled with vinaceous, purple, black, yellow and brownish green; gills strongly interveined, almost white, then cream; taste almost mild to moderately acrid; smell slightly fruity; sp deposit pale cream (IIab). Sp 8-11 $\times$ 6.5-9.5 μm , with a fine almost complete reticulum (fig. 127B); dcy one- to multi-septate, very finely yellow incrustated. In coniferous and deciduous forests, mostly on rich soil, often subfasciculate; summer to autumn; rare in temp.; DK (lc), SE (ne). – Mar 476, Sar 2:855,857, Schff 26, S,E&E 55, Ves 395, .
- R. viscida*** Kudřna
- Stem white or greying when old 31
- 31. Mycorrhizal with *Pinus*; stem remaining white when old; taste mild then very acrid see *R. badia*, key H 4
- Mycorrhizal with *Betula*, *Quercus* or *Fagus*; stem greying when old; taste mild or somewhat acrid 32
- 32. Mycorrhizal with *Quercus*, more rarely *Fagus* and conifers. Cap 40-100 mm, convex to slightly depressed, rather firm, dark reddish purple to almost black at centre, also more reddish or violaceous, often with yellowish irregular spots; gills white to pale cream; stem 30-60 $\times$ 10-20 mm, firm, then $\pm$ fragile, white or greying, at base with brown spots, rarely with a pink flush; taste $\pm$ acrid in the gills, almost mild in stem; with faint smell of apples; sp deposit white (Ia). Sp 6.5-9 $\times$ 6-7 μm , verrucose, incompletely reticulate (fig. 127C); dcy non- or few-septate. Summer to autumn; occasional in temp.-hemib., in NO north to Hord; DK (lc), FO, NO (lc), SE (lc). – Däh 907, Phil 22a, Sar 1:495, 497, Schff 51, Ves 401.
- R. undulata*** Velen. (*R. atropurpurea* (Krombh.) Britzelm. non Peck, *R. krombholzii* Shaffer)
- Mycorrhizal with *Betula*; cap strongly discolouring see *R. depallens* 26
- 33. Taste slightly acrid; smell insignificant. Cap 30-70 mm, with $\pm$ sulcate margin, greasy, purplish red, carmine or brownish red, darker at centre, shining; gills medium spaced, white; stem 40-80 $\times$ 7-20 mm, clavately swollen, white, with yellow tinge; sp deposit white (Ib). Sp 7-8.5 $\times$ 6-7 μm , with warts up to 0.8 μm and many connections (fig. 127D); dcy short, clavately swollen at apex, rarely with a septum. In coniferous forests, rarely with *Betula*; summer to late autumn; common in bore.-hemib., in FI north to EnL, occasional in temp., in DK only a few records; DK (na), FI (lc), NO (lc), SE (lc). – E&M 2, Mar 443, Sar 1:501, 503,

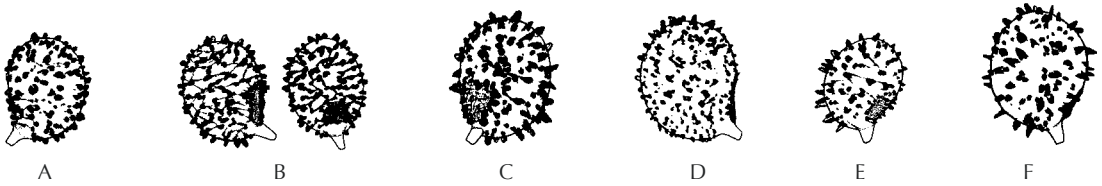
Schff 53a, Sieniop 58.

R. aquosa Leclair (*R. carminea* (Jul. Schäff.) Kühner & Romagn.)

- Taste acid; smell distinct, e.g. fruity or of *Pelargonium* or coconut 34
- 34. Gill edge serrulate (lens!); smell of coconut. Cap 20-60(-80) mm, convex, then depressed, often with wavy margin, purplish, purplish red, violaceous or dark olivaceous, centre often darker; gills white, then cream; stem 30-70 x 5-25 mm, often clavate, white, sometimes slightly yellowing; taste acid; sp deposit white (Ib). Sp 7.5-9 x 6-7.5 μ m, reticulate with warts not exceeding 0.5 μ m (fig. 127E); dcy multi-septate. Mycorrhizal mainly with *Quercus* and *Betula*, but also with other deciduous trees and conifers, always on acid, peaty or sandy soil; summer to autumn; common in temp.-bore., in FI only in A, V and U; DK (LC), FI (LC), NO (LC), SE (LC). – Däh 910, E&M 11, Phil 21c, Sar 1:505, 507, Ves 413, ☉.
- R. fragilis* (Pers. : Fr.) Fr.
- Gill edge entire; smell of fruit or *Pelargonium* 35
- 35. Mycorrhizal with *Salix*, in alpine areas also with *Polygonum viviparum*. Cap 15-40 mm, convex or plane, dark blackish purple, then fading to pinkish purple or discolouring to almost white, flushed with pinkish purple; gills with even edge, white; stem 10-30 x 3-8 mm, white, sometimes flesh-coloured near base, also in flesh; taste very acid, but soon evanescent; smell insignificant; sp deposit whitish to pale cream (Ib-IIa). Sp 6.5-9 x 6-7.5 μ m, verrucose, partially reticulate (fig. 127F); dcy non- or few septate. Autumn to late autumn; common in arc./alp., occasional in temp.-bore., especially in dunes with *Salix repens*; DK (LC), FI (LC), FO, IS, NO (LC, incl. Svb), SE (LC). – FRIC 6, pl. 48, Marst 31, Phil 24a, Sar 1:519, 523, Ves 412.
- R. laccata* Huijsman (*R. norvegica* D.A. Reid)
- Mycorrhizal with *Picea* and *Pinus*. Cap 40-80 mm, convex, then slightly depressed; typically red or purplish red, with olivaceous greenish or dark olivaceous to black centre; gills with even edge, medium spaced, white; stem 30-70 x 5-15 mm, white, sometimes slightly yellowing; smell fruity; taste very acid; reaction on flesh with guaiac strong; sp deposit white to pale cream (I-IIa). Sp 6-8 x 5-6.5 μ m, verrucose, with fine connections and few to numerous meshes (fig. 127G); dcy non- or few-septate. In coniferous forests; late summer to autumn; common in temp.-bore., in FI north to InL; DK (LC), FI (LC), NO (LC), SE (LC). – Däh 909, 915 (as *olivaceoviolascens*), E&M 3, Mar 446, Sar 1:511, 512, Svp 46:21, Ves 413, ☉.
- R. atrorubens* Quél. (*R. subaffinis* Bidaud & P.-A. Moreau)

Key F: Sect. *Polychromae* Maire subsect. *Xerampelinae* Singer

- 1. Associated with *Salix* and possibly also *Betula nana* 2
- Associated with other hosts 4
- 2. Cap 20-60 mm, slightly viscid, red, pink or purplish red, centre and often whole cap soon discolouring cream or yellow brown, convex, margin smooth or slightly sulcate; gills cream to ochre; stem white, yellowing, sometimes flushed pink at the base, clavate, 20-50 x 7-15 mm; FeSO₄ on flesh bluish green; taste mild; smell weak to rather strong of cooked shell-fish; sp deposit ochre (IIIbc). Sp 7-9 x 6-7 μ m, strongly verrucose, warts up to 0.5 μ m, connections absent or few (fig. 129A); dcy long, 0-2-septate, 5-10 μ m broad, irregularly knobby, not reacting with SV. With *Salix*; summer; occasional in arc./alp.; FI (DD), FO, IS, NO (LC, incl. Svb), SE (LC). – Fav 55:10.8, FF 2c, P,R&V 59, Sar 2:903, 904, ☉.
- R. pascua* (F.H. Møller & Jul. Schäff.) Kühner
- Cap 30-80 mm, mat, convex but soon depressed, dark violaceous brown, dark brownish red to brownish red; gills cream to ochre; stem 30-60 x 10-20 mm, $\pm$ pink especially at base, browning when bruised; FeSO₄ on flesh bluish green; smell when old of cooked shell-fish; taste mild or slightly bitter; smell slightly of cooked shellfish; sp deposit pale ochre (IIIa). Sp 8-10 x 6-7.5 μ m, verrucose to spinose, spines up to 1 μ m long, also with some crests (fig. 129B); dcy long, septate, without knobs. Mycorrhizal with *Salix repens* in scrubs and dunes



Spores: A: *Russula pascua*, B: *R. subrubens* (left: from holotype, right: from holotype of *R. chamiteae*), C: *R. xerampelina* (from epitype in IB), D: *R. favrei* (from holotype), E: *R. clavipes* (from holotype), F: *R. faginea*.

in temp. and in arc./alp. with other dwarf *Salix* species; summer to autumn; occasional; DK (LC), FI (DD), NO (NE), SE (LC). – FAD 190B, G,J&S 45, M&J 49, Ves 393.

R. subrubens (J.E. Lange) Bon (*R. graveolens* Romell var. *subrubens* J.E. Lange, *R. chamiteae* Kühner, *R. c.* Kühner var. *microsperma* Kühner)

3. Stem $\pm$ red. Cap 60-120 mm, with depressed centre, mat, smooth, dark purplish red to almost black centre, at margin red, sometimes becoming brownish or olivaceous; gills ochraceous; stem 40-80 $\times$ 15-30 mm, firm, $\pm$ red or pink, browning when bruised; FeSO₄ on flesh bluish green; taste mild; smell strong, of cooked shellfish; sp deposit ochre (IIIc). Sp 8-10 $\times$ 7-8.5 μ m, verrucose, without connections, warts up to 0.8 μ m (fig. 129C); dcy only slightly broader than hyphae of pileipellis and only weakly reacting with SV. Associated with *Pinus*, more rarely *Picea*; autumn; common in temp.-bore., occasional in suba., in FI north to Ks; DK (LC), FI (LC), IS, NO (LC), SE (LC). – Däh 887, R&H 544 (above), Sar 2:877, 879, Schff 24c, Ves 392, ☉.

R. xerampelina (Schaeff.) Fr. s. str. (*R. erythropus* Pelt., 'erythropoda')

- Stem white or with a faint pink flush, then browning 4
- 4. Cap some shade of olivaceous, brown or yellow, without any red, vinaceous and lilac 5
- Cap at least partly with red, vinaceous, lilac or green colours 6
- 5. Cap purplish brown, brown, olivaceous brown to blackish brown at centre. Cap 35-100 mm, mat, at margin smooth or slightly sulcate; gills cream to pale ochre; stem 35-90 $\times$ 10-25 mm, whitish, often with a pink flush either on one side or at the base, browning when bruised; FeSO₄ on flesh bluish green; taste mild; smell faint of cooked shellfish or sweetish; sp deposit ochre (IIIb). Sp 8-11 $\times$ 6-8.5 μ m, verrucose to spinose, spines up to 1 μ m, isolated or with a few connections (fig. 129D); dcy few-septate. Associated with *Picea* and *Pinus*; occasional in hemib.-bore.; FI (LC), NO (LC), SE (LC). – Marst 64, R&H 544C, Sar 2:885, 887.

R. favrei M.M. Moser

- Cap olivaceous, brownish olivaceous to yellow brown with olivaceous tinge, near margin sometimes vinaceous brown and with fine concentric crackings. Cap 40-85 mm, convex to low convex, with short striate margin, firm; stem 40-70 $\times$ 10-25 mm, often clavate, white or tinged pink, browning when bruised and old; FeSO₄ on flesh bluish green; taste mild; smell of cooked shellfish; sp deposit ochre (IIIb). Sp 8-9 $\times$ 6.5-7 μ m, verrucose to spinose, spines up to 1 μ m, connections few or absent (fig. 129E); dcy cylindrical, 4-8 μ m broad, reacting weakly with SV; a variable number of inflated, up to 12 μ m broad apical hyphae present especially at centre of cap. In coniferous and deciduous forests; late summer to autumn; occasional in temp.-suba.; DK (LC), FI (DD), NO (LC), SE (LC). – Bres 420, E&M 8, Mar 480, R&H 544 (centre), S,E&E 60.

R. clavipes Velen. (*R. xerampelina* (Schaeff.) Fr. var. *elaodes* Bres., *R. elaeodes* (Bres.) Bon)

Note: *R. nuoljae* Kühner was described based on one specimen from Norway. The microscopical characters are very close to *R. clavipes*, but the colours are generally reddish. The status of the taxon awaits further records.

6. Associated with *Fagus*. Cap 60-140 mm, rugose or finely concentrically wavy, with smooth

margin, mat, pale red, vinaceous red, brownish, pink, with ochraceous to pale olivaceous spots; gills ochraceous; stem 40-110 x 15-30 mm, firm, white, browning but sometimes slowly; FeSO₄ on flesh bluish green; taste mild; smell of cooked shellfish, sometimes faint; sp deposit ochre to pale yellow (IIIc). Sp 8.5-11 x 7.5-8.5 µm, spines isolated, 1-1.5 µm high (fig. 129F); dcy long and slender, 3-5 µm broad. Summer to autumn; occasional in temp.; DK (LC), NO (NE), SE (LC). – Mar 477, Marst 64, Schff 24d (as *barlae*), Ves 392.

R. faginea Romagn.

- Especially associated with *Quercus*. Cap 40-80(-100) mm, often with a fine concentric, wavy pattern near margin, mat, brownish purple to dark vinaceous or vinaceous brown, at centre sometimes slightly olivaceous; gills ochraceous; stem 40-80 x 10-25 mm, rather firm, white, with or without a pink tinge, browning; FeSO₄ on flesh bluish green; taste mild; smell of cooked shellfish; sp deposit ochre (IIIab). Sp 7.5-10 x 6-8 µm, verrucose with warts up to 0.5 µm; dcy long, 4.5-9 µm broad, attenuated. Summer to autumn; occasional in temp.-hemib.; DK (LC), FI (LC), NO (LC), SE (LC). – E&M 25, Mar 479, Ves 393.

R. graveolens Romell (*R. xerampelina* (Schaeff.) Fr. var. *purpurata* Crawshaw)

Key G: Sect. *Polychromae* Maire subsect. *Puellarinae* Singer (subgen. *Tenellula* Romagn., sect. *Tenellae* (Quél.) Sarnari)

1. Frb strongly yellowing. Cap 25-60 mm, with depressed centre, with ± sulcate margin, red, purple, vinaceous, reddish brown or dark brown, often discolouring to a pale mixture of these, centre usually darker to almost black; gills cream then yellowing; stem 30-60 x 7-15 mm, white, but almost always distinctly yellowing all over or in large patches; flesh yellowing; taste mild; smell indistinct; sp deposit cream (IIcd). Sp 6.5-9 x 5.5-7 µm, strongly verrucose to echinulate, spines up to 1.3 µm, connections few or absent (fig. 131A). In moist coniferous and deciduous forests; summer to autumn; common in temp.-hemib., occasional in bore., rare in suba.; DK (LC), FI (LC), IS, NO (LC), SE (LC). – Däh 886, Phil 27d, R&H 542, Sar 2:1149, 1150, Ves 394, ☉.

R. puellaris Fr.

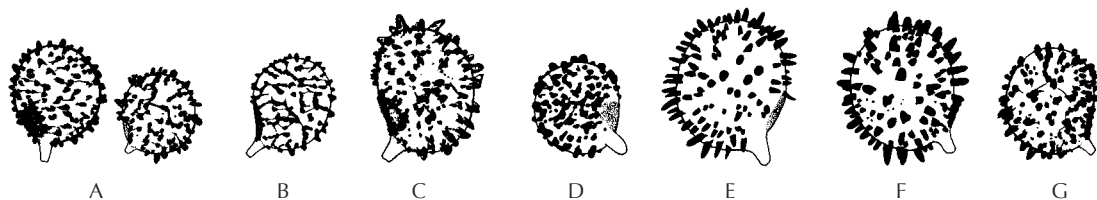
- Frb not yellowing or yellowing in isolated spots or in smaller parts 2
- 2. Mycorrhizal with conifers 3
- Mycorrhizal with deciduous trees or scrubs 8
- 3. Mycorrhizal with *Pinus*, often in parks, at forest margins and along paths. Cap 30-70 mm, finally with ± sulcate margin, mat or shining, red, vinaceous, violaceous, purplish, brown or pale lilac, centre often darker; gills broad, ± interveined, yellow; stem 30-70 x 5-15 mm, white; taste mild; smell indistinct; sp deposit yellow (IVbc). Sp 7.5-9 x 6.5-7.5 µm, verrucose with few to many crests and connections (fig. 131B); dcy none to multi-septate, apical cell cylindrical or clavate. Summer to autumn; common in bore., occasional in temp.-hemib.; DK (LC), FI (LC), NO (LC), SE (LC). – E&M 7, Sar 2:1253, 1255, Sieniop 61, Svp 46:13, Ves 406, ☉.

R. cessans A. Pearson

- Mycorrhizal with *Picea* 4
- 4. Stem white, soon yellow brown all over or in patches. Cap 20-85 mm, soon with depressed centre, becoming strongly sulcate at margin, centre blackish to greyish green, margin vinaceous; gills soon ochre and with yellow brown patches; stem 30-120 x 6-20 mm; taste mild, smell weak; sp deposit dark ochre to pale yellow (IIIc-IVa). Sp 8.5-11 x 7-8.5 µm, echinulate, slightly ridged (fig. 131C); dcy multi-septate, short-celled. In forests with *Picea abies* on rich soil; summer; rare in hemib.-bore.; FI (LC), NO, SE. – Marst 54, Sar 2:1261, 1263.

R. sapinea Sarnari

- Stem not or very slightly yellowing 5
- 5. Cap mat, red to brown; stem fairly thick and partly red; like a species of *R. xerampelina*-



Spores: A: *Russula puellaris* (right spore from holotype of *R. puellaris* var. *cupreovinosa*), B: *R. cessans*, C: *R. sapinea* (from holotype), D: *R. taigarum* (from holotype), E: *R. olivina* (from holotype), F: *R. olivobrunnea* (from holotype), G: *R. nauseosa*.

group, but without smell. Cap 30-150 mm, narrowly sulcate, dark vinaceous to brown, centre darker, blackish brown or paler, cream or green with a yellow-brown tinge; gills cream to pale yellow; stem 30-150 x 10-30 mm, not changing when bruised; taste of gills mild to slightly acid; smell weak; sp deposit ochre (IIIbc). Sp 8-10 x 7-9.5 μ m, with partial reticulum (fig. 131D); dcy cylindrical to clavate. In moist *Picea* forests on rich soil; summer; occasional in temp.-bore; FI (LC), NO (LC), SE (LC). – Jordst 12(1), Marst 55, Sar 2:977, 979, Sienil 48:81, Sieniop 83.

***R. taigarum* Ruots. & Vauras**

- Stem white, not like a species of the *R. xerampelina* group 6
- 6. Cap olivaceous green, brownish green to yellow green; basidia 2-spored. Cap 20-70(-90) mm, soon depressed, centre often darker or paler, e.g. dark green, brownish green or yellow; gills cream, then yellow; stem 30-90 x 8-20 mm, cylindrical to subclavate, soft and fragile, white; taste mild; smell weak; sp deposit pale yellow (IVb). Sp 10-12(-14) x 8.5-10(-11.5) μ m, echinulate, up to 2 μ m high (fig. 131E); dcy cylindrical to clavate. In moist *Picea* forests, preferably on calcareous soils; summer; rare in hemib.-bore.; FI (LC), SE (vu). – Marst 51, Sar 2:1257, 1259, Sieniop 75.

***R. olivina* Ruots. & Vauras**

- Cap with other colours, rarely green; basidia 4-spored 7
- 7. Frb medium sized; cap 50-110(-180) mm; stem 60-130 x 10-25 mm. Cap soon fairly strongly sulcate at margin, shiny, brown, often mixed with green or violet, rarely olivaceous green, centre darker or greenish to yellowish; gills broad, yellow; stem subclavate, white; taste mild; smell weak; sp deposit yellow (IVd). Sp 9.5-11.5(-12) x 8-9.5(-10.5) μ m, warts isolated and large, up to 1.5 μ m high (fig. 131F); dcy long, narrow, multi-septate and finely diver-ticulate. In moist *Picea* forests, on calcareous soils; summer; rare in hemib.-bore.; FI (LC), NO (NE), SE (vu). – Kar 34:22, Marst 51, Sar 2:1013, 1014, Sieniop 76.

***R. olivobrunnea* Ruots. & Vauras**

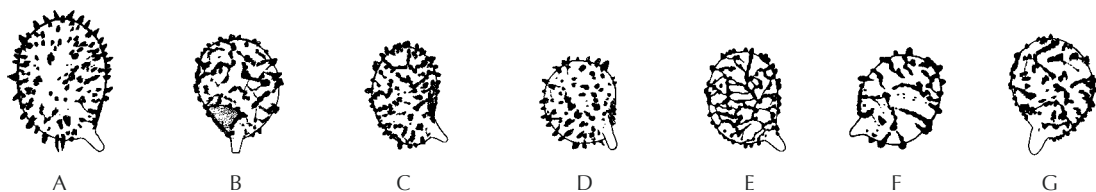
- Frb fairly small and slender; cap 20-70 mm; stem 20-70 x 5-15 mm. Cap shiny, pale, often with dull, mixed colours, dark vinaceous, red, brown, violaceous or olivaceous, centre often paler or darker, margin finally sulcate; gills broad, yellow; stem white; smell insignificant; taste mild; sp deposit yellow (IVb). Sp 7-10 x 6-8 μ m, with $\pm$ isolated spines (fig. 131G); dcy non- to few-septate, apical cell strongly clavate. Summer to autumn; in *Picea* forests and plantations, preferably on fairly moist, calcareous soils; early summer to autumn; occasional in temp.-bore.; DK (LC), FI (LC), NO (LC), SE (LC). – Phil 32b, Sar 2:1241, 1243, Schff 39, Sieniop 73, Ves 406.

***R. nauseosa* (Pers.) Fr.**

Note: *R. laricina* Velen. is possibly not specifically different. It is reported to have sp with more connections, smoother cap margin and being slightly acid.

- 8. Mycorrhizal with *Betula* or *Carpinus* 9

- Mycorrhizal with *Fagus*, *Quercus* or dwarf *Salix* 15
- 9. Cap margin strongly sulcate; in bogs and forests, often with *Sphagnum* 10
- Cap margin not or slightly sulcate; in forests, gardens, parks 11
- 10. Sp 7.5-10 x 6.5-8.5 μm , strongly echinulate, spines up to 1.5 μm , connections few or absent (fig. 133A); sp deposit ochre (IIIbc). Cap 20-60 mm, often umbonate when young, but soon depressed at centre, with strongly sulcate margin, purple, vinaceous, ochraceous or brownish, centre often discolouring; gills medium spaced, cream, then ochre, sometimes with a red edge near cap margin; stem 25-70 x 5-15 mm, clavate, fragile, white, often reddish at the base; taste of gills mild or slightly acrid; smell indistinct. Dcy multi-septate. With *Betula* in moist forests, but also in more dry sites, even in parks; summer to autumn; occasional in temp.-suba.; DK (LC), FI (LC), IS, NO (LC), SE (LC). – Däh 885, Phil 27e, Sar 2:1277, 1279, Schff 33, Ves 402.
R. nitida (Pers. : Fr.) Fr.
- Sp 8-9.5 x 6.5-8 μm , with spines and warts up to 1 μm and few to many connections (fig. 133B); sp deposit cream (IIcd). Cap 30-60 mm, depressed at centre, with strongly tuberculate-sulcate margin, fragile, shining, pale olivaceous brown, pale greyish olivaceous, pale vinaceous to dirty vinaceous; gills whitish to cream; stem 40-70 x 8-10 mm, widened towards base, white or watery grey; flesh soft and fragile; smell fruity. Dcy septate, apical cell sometimes with conical apex, up to 10 μm broad. In *Sphagnum* mires with *Betula*; summer to autumn; occasional in temp.-suba.; DK (LC), FI, NO, SE (LC). – E&M 28, FAD 193B, Mar 471, Sar 2:1271, 1273.
R. sphagnophila Kauffman (*R. venosa* Velen. var. *pallida* J.E. Lange)
- 11. Cap 15-50 mm, rarely larger; stem up to 10 mm broad 12
- Cap 40-150 mm; stem > 10 mm broad 13
- 12. Taste $\pm$ acrid and of iron, at least in the gills; sp deposit dark cream to pale ochre (IIId-IIIb); mycorrhizal with *Betula*. Cap 15-50(-70) mm, convex but soon depressed, $\pm$ sulcate at margin, colour very variable, dark olivaceous, green and brown mixed with purple, vinaceous, lilaceous or reddish; gills cream then ochre; stem 20-50 x 5-10 mm, white, often $\pm$ yellowing; smell indistinct. Sp 6-9 x 5.5-7 μm , variable, often oblong, verrucose, with few to many connections, sometimes with $\pm$ developed reticulum (fig. 133C); dcy multi-septate. Mainly in human-influenced localities; summer to autumn; occasional in temp.-suba.; DK (LC), FI (LC), IS, NO, SE (LC). – Däh 917, R&H 543, Sar 2:1165, 1167, Schff 23, Ves 407, ☉.
R. versicolor Jul. Schäff.
- Taste slightly acrid in the gills; sp deposit variable, ochre to pale yellow (III-IVa); mycorrhizal with *Carpinus* and *Betula*. Cap 20-50 mm, becoming depressed at centre, becoming sulcate at margin, shining, purplish vinaceous, brownish vinaceous mixed with olivaceous or brown, often mottled; gills ochre; stem 20-50 x 4-10 mm, white, slightly yellowing; flesh white, slightly yellowing, fragile; smell of *Pelargonium*. Sp 7-8.5 x 6-7 μm , without connections (fig. 133D); dcy multi-septate. In deciduous forests; very rare in temp. and bore.; DK, FI. – Sar 2:1159, 1161.
R. versatilis Romagn. (1962 nom. illeg., 1967 nom. illeg., validated later in 1967)
- 13. Sp deposit ochre to pale yellow (III-IVa); cap colour very variable, greyish brown red, violaceous brown, brownish orange, greyish violet, at centre blackish brown to greyish or pale olivaceous. Cap 40-150(-180) mm, with smooth or very slightly sulcate margin, shining; gills adnexed, pale ochre; stem 25-80 x 10-25 mm, often flaring at the top, pruinose, white, sometimes with a red flush, slowly slightly brownish towards the base; taste mild or slightly acrid; smell insignificant. Sp 7-9 x 6-7.5 μm , $\pm$ completely reticulate (fig. 133E); dcy non- or few-septate, often finely diverticulate, up to 8 μm broad. Mycorrhizal with *Betula* in forests, parks and tundra, mostly along roads and paths, in Greenland also mycorrhizal with *Salix*; summer; common in hemib.-arc./alp.; FI (LC), NO (NE), SE (LC). – Marst 61, Pers 14:516, Sar



Spores: A: *Russula nitida*, B: *R. sphagnophila* (from holotype of *R. robertii*), C: *R. versicolor*, D: *R. versatilis* (from holotype), E: *R. violaceoincarnata* (from holotype), F: *R. fulvograminea* (from holotype), G: *R. font-queri*.

2:1023, 1024, Sienil 47:48, 49, Sieniop 87.

R. violaceoincarnata Knudsen & T. Borgen

- Sp deposit deeper yellow or cap colours ochre to orange or reddish 14
- 14. Cap colour very variable, at centre often olivaceous green, dull reddish green, pale brown to dull red brown, at margin red brown, violet brown or dull vinaceous, yellowish green or greyish green. Cap 50-120 mm, convex; gills yellow; stem 50-70 x 15-30 mm, white, unchanging; taste mild or slowly slightly acrid; smell fruity; sp deposit yellow (IVcd). Sp 7-9.5 x 6-8 μ m, with low warts and many crests (fig. 133F); dcy septate. Mycorrhizal with *Betula* on calcareous soil; summer; rare in hemib.-suba.; FI (NT), SE. – Marst 58, RdM 40:99, 104, 105, Sar 2:1037, 1038.

R. fulvograminea Ruots., Sarnari & Vauras

- Cap ochre, ochraceous orange, reddish orange, red or vinaceous, without any green. Cap 40-80 mm, smooth, becoming shortly sulcate at margin, centre often discolouring pale; gills pale becoming yellow; stem 30-70 x 10-20 mm, white or with a pink flush, especially at the lower part, becoming brownish when bruised; taste mild or slightly acrid; smell indistinct; sp deposit pale yellow (IVa). Sp 8-9 x 6.5-7.5 μ m, verrucose, with some connections (fig. 133G); dcy cylindrical, septate, near apex often with irregular knobby excrescences. Mycorrhizal with *Betula*; summer; rare in hemib.-suba., very rare in temp.; DK (NA), FI (LC), NO (NE), SE (LC). – Mar 469, SBT 80:313.

R. font-queri Singer (*R. integra* (L.) Fr. var. *aurantiaca* Jul. Schäff., *R. aurantiaca* (Jul. Schäff.) Jul. Schäff.)

- 15. Mycorrhizal with dwarf *Salix* in suba.-arc. / alp., also in bore. in bogs. Cap 15-40 mm, smooth or slightly sulcate at margin, shining, dark blood red, dark purple to dark violaceous purple, then paler; gills distant, cream, edge often reddish near cap margin; stem 15-45 x 5-15 mm, soft, fragile, white or often pink at least at base; taste mild; smell indistinct; sp deposit ochre (IIIb). Sp 8-11 x 7-9 μ m, verrucose, with partial reticulum (fig. 135A); dcy non- to few-septate. Summer; occasional; FI, FO, IS, NO (LC, incl. Sv), SE (LC). – Fav 55:10 (as *brunneoviolacea*), R&H 542, Sar 2:1283.

R. saliceticola (Singer) Knudsen & T. Borgen

- Mycorrhizal with *Fagus* or *Quercus* 16
- 16. Sp deposit yellow (IVc); mycorrhizal with *Quercus*. Cap 20-60 mm, smooth or sulcate at margin, shining, vinaceous purple or lilaceous, centre sometimes discolouring to greyish olivaceous, whole cap often with pale, washed-out colours; gills yellow; stem 30-50 x 5-10 mm, white or yellowing; taste mild; smell strong, sweetish-fruity, somewhat resembling *Pelargonium*. Sp 6.5-8.5 x 5.5-7 μ m, verrucose to echinulate, with numerous crests (fig. 135B); dcy septate. In deciduous forests; summer to autumn; occasional in temp.-hemib.; DK (LC), NO (NE), SE (LC). – E&M 21, Marst 50, Sar 2:1176, 1179, ☉.

R. odorata Romagn.

- Sp deposit cream or ochre, or mycorrhizal with *Fagus* 17

17. Sp deposit cream (IIbc); cap deep violet, sometimes purple or dark vinaceous. Cap 30-70 mm, thin-fleshed, margin smooth; gills cream; stem 30-60 x 8-15 mm, white, at the base often with a flush of lemon-yellow; taste mild; smell indistinct. Sp 7-9 x 6-7.5 μm , spines up to 2 μm long, with many fine connections or a partial reticulum (fig. 135C); dcy septate. Mycorrhizal with *Fagus*, often solitary; summer to autumn, mostly early in the season; occasional in temp.-hemib.; DK (LC), FI (DD), NO (LC), SE (LC). – Mar 470, M&H 5:95, Phil 29f, Sar 2:1285, 1289, Schff 21.
R. brunneoviolacea Crawshay
- Sp deposit darker or cap with red colours 18
18. Cap 20-35 mm, mat, finely velvety, bright red, darker towards centre, margin finely sulcate; dcy multi-septate, of short, almost isodiametrical hyphae. Gills pale, becoming pale yellowish; stem 25-35 x 4-6 mm; taste mild; smell fruity; sp deposit ochre (IIIb). Sp 6.5-8.5 x 5.5-7 μm , ellipsoid, verrucose; base of pileipellis with some $\pm$ isodiametrical, amorphous hyphae; dcy multi-septate, of short, almost isodiametrical hyphae. Mycorrhizal with *Fagus* and *Quercus*; very rare in temp.; DK. – FAD 192E, Mar 457, Sar 2:1208.
R. melzeri Zvára (*R. minutula* Velen. s. J.E. Lange)
- Cap 20-55 mm, dull red and mixed with purple or vinaceous, rarely also olivaceous; dcy without isodiametrical hyphae 19
19. Sp 6.5-8 x 5-7 μm , ellipsoid to subglobose, verrucose with warts up to 0.5 μm , with many connections forming crests (fig. 135D); sp deposit cream (IIbc). Cap 20-50 mm, smooth or weakly sulcate at margin, dark to pale carmine red to purplish red or vinaceous, paler towards the margin, centre darker, becoming yellow brown when old; gills cream, slightly yellowing or browning towards the edge; stem 15-50 x 5-15 mm, white, sometimes with a pink tinge at base, after some time with yellow brown patches; flesh white or with small yellow patches; smell insignificant; taste mild or very slightly acrid after some chewing; dcy multi-septate. Mycorrhizal with *Fagus*; summer to autumn; rare in temp.-hemib.; DK (EN), NO (LC), SE (LC). – BSMF 65 Atlas pl. 113 ('93'), E&M 24, MH 5:131, Sar 2:1199, Schff 22a.
R. puellula Ebbesen, F.H. Møller & Jul. Schäff.
- Sp 7-9 x 7-8 μm , subglobose, echinulate with 0.5-1 μm high, mostly isolated spines or with a few connections (fig. 135E); sp deposit pale ochre (IIIa). Cap 20-55 mm, slightly depressed, sometimes slightly sulcate, sometimes zonate, at centre often very dark surrounded by a pale zone, then a dark zone and a paler margin, generally dull red, flesh red to brownish red, margin sometimes with an olivaceous tinge; stem 30-40 x 7-12 mm, white, without yellow but sometimes with rust-coloured spots below; flesh white; smell insignificant, when drying cheesy; taste of gills acrid to very acrid; dcy multi-septate. Mycorrhizal with *Fagus*; summer to autumn; rare in temp., only few records known; DK (CR). – AM 32.3, FAD 191C, Schff 23a.
R. zonatula Ebbesen & Jul. Schäff.

Key H: Sect. *Polychromae* Maire subsect. *Urentes* Maire

1. In arc./alp.; mycorrhizal with *Salix* or *Dryas* 2
- In temp.-bore.; mycorrhizal with conifers or deciduous trees 3
2. Sp (7.5-)8-10 x 6.5-8 μm , finely verrucose, warts up to 0.5 μm , with few to many fine connections (fig. 135F). Cap 20-30 mm, plane, with a smooth margin, shining, brown with a purplish tinge, dull red brown, purple, or dull red, darker at centre; gills ochre; stem 15-30 x 5-13 mm, white; smell insignificant; taste first mild then very acrid; sp deposit yellow (IVc); dcy septate and diverticulate. Mycorrhizal with *Salix*; summer; rare in arc./alp.; FI (DD), NO (Busk). – Sar 1:733,734.
R. purpureofusca Kühner (*R. cupreola* Sarnari)
- Sp 8.5-11.5 x 7.5-10 μm , echinulate, connections absent, longest spines > 1 μm (fig. 137A).



Spores: A: *Russula saliceticola*, B: *R. odorata*, C: *R. brunneoviolacea*, D: *R. puellula*, E: *R. zonatula*, F: *R. purpureofusca* (left from holotype, right from the holotype of *R. cupreola*).

Cap 35-60 mm, with smooth margin, shining, slightly sticky-viscid, colour very variable, from deep brownish red, purplish red, dirty olivaceous green mixed with flesh-colour and brown, discolouring paler olivaceous yellow with a red-brown margin; gills ochre, then yellow, with a salmon tinge; stem 20-35 x 8-17 mm, white; smell insignificant, slightly fruity; taste mild or somewhat acrid; sp deposit yellow (IV). Basidia 2-4-spored; dcy septate. Mycorrhizal with *Dryas* in arc. / alp., also in suba. with *Betula*, occasional, especially in calcareous areas; summer; FI, IS, NO (NE, SvB), SE (LC).

R. heterochroa Kühner (*R. maculata* Quél. var. *alpina* Singer, *R. maculata* Quél. subsp. *alpina* (Singer) Knudsen & T. Borgen, *R. pseudocampestris* Kühner, *R. dryadicola* Fellner & Landa)

- 3. Mycorrhizal with conifers 4
- Mycorrhizal with deciduous trees 6

- 4. Taste first mild, then slowly burning; sp with low warts and few to many connections. Cap 60-120 mm, convex, with a slightly sulcate or smooth margin, deep brownish red to dark purplish, more rarely pure red, centre usually darker; gills pale ochre, then more yellow; stem 50-110 x 10-25 mm, hard, above pruinose and finely veined, white, often with a thin red flush or streaks; taste first mild, gradually very acrid; smell of pencil-wood or pepper; sp deposit deep ochre to pale yellow (IIIc-IVa). Sp 8-11 x 6.5-8.5 μ m, with connections forming crests or incompletely reticulate (fig. 137B); dcy multi-septate. Mycorrhizal with *Picea* and *Pinus*; mostly in late autumn; occasional in temp.-bore., in FI north to PH, in DK one record; DK (EN), FI (LC), NO (LC), SE (LC). – Däh 930, Mar 455, Marst 26, R&H 554, Schff 64. *R. badia* Quél.

- Taste immediately acrid; sp with isolated spines 5

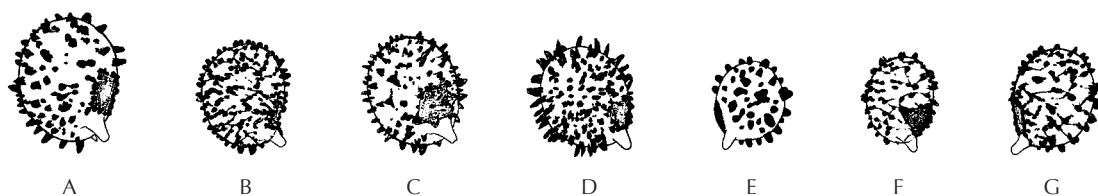
- 5. Cap 70-120 mm, dark umber, blackish brown or dark yellow brown, centre sometimes with olivaceous tinge, margin smooth, rarely slightly sulcate. Gills yellow; stem 40-80 x 15-25 mm, cylindrical, firm, white, becoming grey brown below; taste first mild then very acrid; smell resembling apple compote; sp deposit yellow (IVe). Sp 10-12 x 8-10 μ m, echinulate, spines up to 2 μ m (fig. 137C); dcy few to multi-septate; apical hyphae in pileipellis very thin and tapering. In coniferous forests, especially with *Picea*; summer to autumn; distribution and frequency poorly known due to confusion with related species, but occurring in hemib.-bore., in FI north to Ks; FI, NO (LC), SE (LC). – E&M 1, Mar 494, 496 (as *urens*), Sar 1:747, 749, Schff 68.

R. adulterina (Fr.) Peck s. auct. (*R. integra* (L.) Fr. var. *a.* Fr., *R. cinnamomicolor* Krombh. s. auct., *R. piceetorum* Singer)

- Cap 40-70 mm, dull dark purplish violet or purplish brown, centre almost black, shining, margin smooth. Gills yellow; stem 30-60 x 10-15(-20) mm, cylindrical, firm, white; smell of *Pelargonium*; taste very acrid; sp deposit yellow (IVe). Sp 8-10.5 x 7-8.5 μ m, echinulate, spines up to 1 μ m, isolated or with some fine connections (fig. 137D); dcy multi-septate; apical hyphae in pileipellis very thin and tapering, sometimes branched. Mycorrhizal with conifers; summer to autumn; boreal, but distribution poorly known due to confusion with

related species; FI (LC), NO (LC), SE (LC). – Marst 71, Rim 5:102, Sar 1:753, S,E&E 74.
R. firmula Jul. Schäff. (*R. transiens* (Singer) Romagn.)

6. Mycorrhizal with *Betula* 7
 - Mycorrhizal with *Quercus* and *Fagus* 8
7. Sp 7-8 x 6.5-7 μm , subglobose, with warts, low spines and a few crests (fig. 137E); dcy cylindrical, very long, non-septate, not diverticulate. Cap 70-160 mm, convex, then somewhat depressed, red, blood red, scarlet, orange or abricot; gills cream, then ochre; stem 60-100 x 15-25 mm, firm to hard, white, rarely with a pink or purplish flush, when old sometimes with ochre or orange patches; taste bitter and acrid; smell faintly of coconut; sp deposit yellow (IVd). Mycorrhizal with *Betula* on rich soil; summer to autumn; occasional in temp.-suba., in NO north to Finnm, only a few records from DK; DK (NE), FI (LC), IS, NO (LC), SE (LC). – Mar 498, 499 (as *mesospora*), Phil 29e, Sar 1:713, 715, Schff 69, Sieniop 71.
R. intermedia P. Karst. (*R. pulcherrima* S. Lundell & Jul. Schäff. non Velen., *R. lundellii* Konrad & Maubl., *R. mesospora* Singer)
 - Sp 7.5-9 x 6-7.5(-8) μm , broadly ellipsoid, with warts and low spines and a few crests (fig. 137F); dcy clavate, 0-2-septate, slightly diverticulate. Cap 40-120(-150) mm, convex then depressed, with smooth margin, pale red, pink or orange mixed with yellow, centre discolouring yellow; gills yellow; stem 40-90 x 17-30 mm, white or with a slight pink flush; taste first mild, then slowly very acrid, not bitter; smell indistinct; sp deposit yellow (IVbc). Mycorrhizal with *Betula* and *Picea* on calcareous soil; summer to autumn; recently described species, so far recorded as rare from hemib.-suba. in FI (LC), NO (NE) and SE (NE). – Sar 1:719, 721, Sieniop 59.
R. aurantioflammans Ruots., Sarnari & Vauras
8. Cap with small rust-coloured spots 9
 - Cap without rust-coloured spots 10
9. Sp 8-10 x 7-8.5 μm (fig. 137G). Cap 40-100 mm, pink to orange, brick or flesh-coloured, often with cream patches, typically with small rust-coloured dots; gills often strongly forked, ochre then yellow; stem 40-80 x 10-30 mm, firm or hard, white, browning, often $\pm$ pink, at least near the base; taste slightly to somewhat acrid, at least of gills; sp deposit yellow (IVcd). Sp verrucose to echinulate with spines up to 1 μm , connections fine, few to many, with or without a few meshes. In deciduous forests on rather dry, calcareous ground; summer to autumn; rare in temp.; DK (LC), NO (NT), SE (LC). – Mar 497, Phil 21d, Sar 1:697, 699, Schff 65, Ves 418, ☉.
R. maculata Quéf.
 - Sp 9.5-12 x 8-11 μm (fig. 139A). Cap 40-75 mm, pink to orange red, violet to copper brown, discolouring at centre to pale yellow; gills yellow; stem 40-70 x 12-25 mm, white; taste $\pm$ acrid; smell fruity; sp deposit yellow (IVd). Sp verrucose to echinulate with spines 1-1.5 μm ; dcy non- to few-septate. Mycorrhizal with deciduous trees, e.g. *Fagus*, *Quercus*, *Betula*; summer; occasional in hemib.-bore.; FI (LC), NO (NE), SE. – Marst 71, Sar 1:703, 705.
R. globispora (J. Blum) Bon
10. Apical cells in pileipellis diverticulate with short knobs (fig. 139B). Cap 30-70 mm, convex, then depressed, with $\pm$ sulcate margin, dark purple, violet, vinaceous to deep coral, red brown, ochre brown or olivaceous; gills deep yellow, fragile; stem 30-70 x 7-15 mm, white, slightly browning; smell insignificant; taste very acrid; sp deposit yellow (IVe). Sp 8-10 x 7-8.5 μm , strongly echinulate, spines up to 1.5 μm ; dcy septate. In deciduous forests and parks; summer to autumn; confused with related species and distribution unknown, but occasional in temp.; DK (LC), FI, NO (VU), SE (LC). – FAD 194E, Jordst 1985(3) cover, Mar 495, Marst 70, Sar 1:723, 725, Ves 418, ☉.
R. cuprea (Krombh.) J.E. Lange
 Note: *R. urens* was found by Romell under *Corylus* (aquarelle in S) and is possibly a synonym of *R. cuprea*, not of *R. adulterina*.



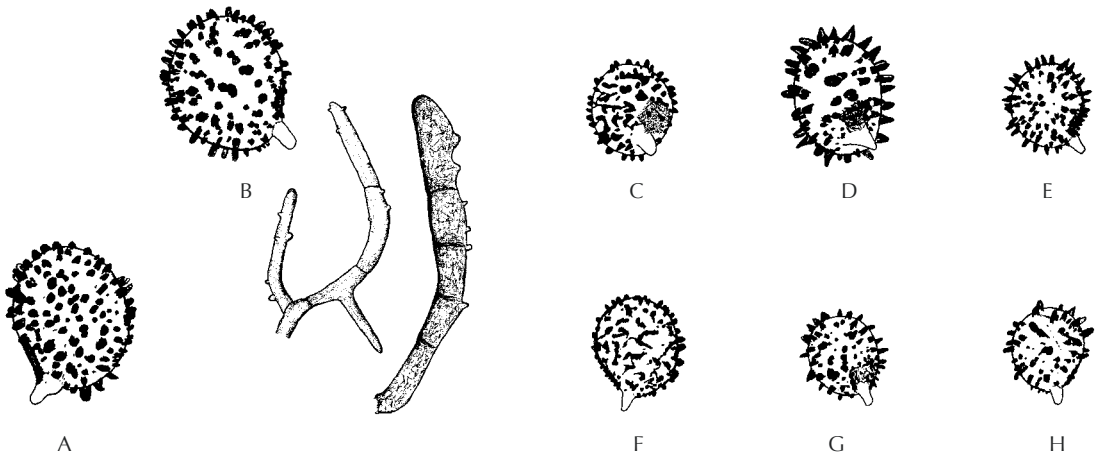
Spores: A: *Russula heterochroa* (from holotype), B: *R. badia*, C: *R. adulterina* s. auct., D: *R. firmula*, E: *R. intermedia* (from neotype), F: *R. aurantioflammans*, G: *R. maculata*.

- Apical cells in pileipellis not diverticulate 11
- 11. Cap uniformly pale to bright red; dcy slightly incrustated see *R. rutila*, Key J 12
- Cap not red or if red then mixed with olivaceous or green; dcy not incrustated 12
- 12. Sp with some connections, spines less than 1 μm (fig. 139C). Cap 40-100 mm, soon depressed, vinaceous, red or lilaceous brown, centre discoloured ochre; gills ochre to yellow; stem 40-100 x 10-20 mm, white, becoming slightly grey when old; taste mild to somewhat acrid; smell insignificant; sp deposit yellow (IVe). Mycorrhizal with *Quercus*; summer to autumn; rare in temp.-hemib.; DK (EN), FI (VU), SE (NE). – Mar 500, Marst 70, Sar 1:691, 693, S,E&E 79, Sienil 44:49.
R. decipiens (Singer) Svrček (*R. maculata* Quél. var. *decipiens* Singer)
- Sp with isolated spines up to 1.5 μm 13
- 13. Smell indistinct. Cap 40-90 mm, red brown, purplish brown or vinaceous, centre discolouring to ochre; gills ochre to yellow; stem 35-80 x 10-25 mm, white, firm but soon soft, slightly browning when dried; taste acrid at least of the gills; smell indistinct; sp deposit deep yellow (IVd). Sp 8-10 x 6.5-8 μm , with isolated spines up to 1.5 μm (fig. 139D); dcy non- to few-septate. Mycorrhizal with *Quercus* on rich clayey or calcareous soil; very rare in hemib.; FI (DD, V: Turku). – E&M 32, Sar 1:765, 767.
R. vinosopurpurea Jul. Schäff.
- Smell of honey. Cap 40-80 mm, convex but soon depressed, margin pink or violaceous, centre straw to buff or olivaceous buff; gills cream then ochre; stem 30-70 x 10-20 mm, at first firm but soon soft, white; taste almost mild to moderately acrid; sp deposit pale yellow (IVb). Sp 7-8.5 x 6-7 μm , with isolated spines up to 1 μm (fig. 139E); dcy 0-2-septate, with a short $\pm$ inflated apical cell. Mycorrhizal with *Fagus* on rich, clayey or calcareous soil; summer to autumn; occasional in temp.; DK (LC), SE (LC). – AM 32 pl. 4, E&M 30, Sar 1:761, Schff 66, Ves 419, ☉.
R. veteriosa Fr.

Key I: Sect. *Polychromae* Maire subsect. *Lilaceinae* (Melzer & Zvára) Jul. Schäff.
(subgen. *Incrustatula* Romagn. sect. *Lilaceinae* (Melzer & Zvára) Konrad & Joss., sect. *Incrustatae* Romagn. nom. inval.)

- 1. Cap bluish violet, brownish violet, greyish, sometimes mixed with olivaceous, centre darker. Cap 30-80 mm, convex, distinctly pruinose and mat, when moist viscid, often finely concentrically cracked, with smooth margin; gills white; stem 40-60 x 5-15 mm, white; smell insignificant; taste mild; sp deposit white (Ia). Sp 8-10 x 7-8 μm , verrucose with a few connections (fig. 139F); primordial hyphae strongly incrustated and prominent, up to 8 μm broad. Associated with *Picea* on acid soil; summer; rare in temp.-bore., in FI north to PS; FI (LC), NO (NT), SE (LC). – E&M 15, R&H 539, Sar 2:1337, 1339, S,E&E 45, Sieniop 60.
R. azurea Bres.

- Cap red, pink, orange pink, lilaceous or vinaceous 2
- 2. Sp with isolated spines or warts 3
- Sp with low warts and some crests or reticulate 4
- 3. Cap lilaceous red, vinaceous, brownish pink, margin sometimes pale olivaceous to greyish green, centre discolouring to brownish ochre. Cap 30-60 mm, with smooth margin, mat, strongly pruinose; gills pale cream; stem 25-50 x 5-15 mm, fragile, pruinose, white or tinged pink; taste mild; smell insignificant; sp deposit white (Ib). Sp 7-8.5 x 5.5-7 μ m, with isolated spines (fig. 139G); primordial hyphae up to 5 μ m broad, incrustated. Mycorrhizal with *Carpinus*, *Fagus* and *Quercus*; summer, less often in autumn; occasional in temp. and hemib., in FI only in V and EH; summer; DK (VU), FI (LC), NO (LC), SE (LC). – FAD 184B, C, Mar 459, Sar 2:1327, 1329, Schff 20, Svp 34:37, ☉.
R. lilacea Quél.
- Cap bright red. Cap 20-50(-60) mm, often irregular, becoming depressed at centre, pruinose, mat, margin often slightly sulcate; gills white, rather distant; stem 30-40 x 5-10 mm, cylindrical or inflated, pruinose, white or with pink flush at base; flesh slightly greying or browning; taste mild; smell insignificant; sp deposit white (Ia). Sp 6-8.5 x 6-7 μ m, with isolated spines up to 1 μ m long (fig. 139H); primordial hyphae up to 4 μ m broad, incrustated. In forests of *Fagus* on rich soil; summer; rare in temp.; DK (EN), NO (NE), SE (NT). – E&M 10, Sar 2:1313, 1315, Schff 20b, Svp 34:37.
R. emeticicolor (Jul. Schäff.) Singer (*R. lilacea* Quél. var. *emeticicolor* Jul. Schäff.)
- 4. Cap pale orange or orange pink, 20-60 mm. Cap convex, mat, with smooth margin, pale cream, yellowish cream to orange cream, sometimes with a greenish flush; gills white; stem 20-50 x 8-12 mm, white; taste mild; smell insignificant; sp deposit white (Ib). Sp 7-9 x 6.5-7 μ m, with low warts and numerous crests (fig. 141A); primordial hyphae up to 6 μ m broad, incrustated. Mycorrhizal with *Fagus* on rich, clayey soil; summer to early autumn; rare in temp.; DK (VU), NO (NT). – E&M 15 (as *incarnata*), Sar 2:1319, Svp 34:36.
R. roseoaurantia Sarnari (*R. incarnata* Quél. s. Blum)
- Cap red or pink or > 60 mm 5
- 5. Cap 15-30 mm. Cap mat, red, with smooth margin; gills cream; stem 15-30 x 4-8 mm, fragile, pruinose, white or with a pink tinge; a section of the flesh becoming red, sometimes slowly, with SV; smell of *Scleroderma* or *Lepiota cristata*; sp deposit white (Ib). Sp 6-8 x 5.5-7 μ m, finely verrucose or with partial reticulum (fig. 141B); some hymenial cystidia partly covered with a gelatinous sheath as seen in SV; primordial hyphae up to 4 μ m broad, slightly incrustated. In deciduous forests; summer; very rare in temp.-hemib.; DK (EN), FI, NO (NE, Østf: Kråkerøy), SE (NE). – Mar 457, Marst 43, MH 5:103, Sar 2:1353, 1355, Schff 17a.
R. minutula Velen.
- Cap larger 6
- 6. Taste bitter, resembling pencil wood or wood of *Cedrus*. Cap 40-120 mm, with a smooth margin, mat, firm, hardly peeling, red or discolouring to cream or whitish; gills pale cream; stem 30-80 x 10-30 mm, hard, concolorous with cap all over or partly, or whitish to cream; sp deposit pale cream (IIa). Sp 8-9 x 7-8 μ m, verrucose and almost completely reticulate (fig. 141C); dcy present but scattered and not reacting with SV or SBA; primordial hyphae not incrustated. Mycorrhizal with *Fagus* and *Quercus*; summer to autumn; common in temp., occasional in hemib., in NO north to M&R; DK (LC), FI (NT), NO (LC), SE (LC). – Marst 32 (incl. var. *lactea*), Phil 17d, R&H 539, Schff 16a, Ves 394, ☉.
R. lepida Fr. (*R. lepida* Fr. var. *lactea* (Pers.: Fr.) F.H. Møller & Jul. Schäff., *R. rosacea* (Pers.) Gray nom. illeg.)
- Taste totally mild 7
- 7. Stem $\pm$ pink, often as a very slight flush. Cap 40-70 mm, with smooth margin, dry, mat,



Spores and pileipellis elements: A: *Russula globispora*, B: *R. cuprea*, C: *R. decipiens*, D: *R. vinosopurpurea*, E: *R. veternosa*, F: *R. azurea*, G: *R. lilacea*, H: *R. emeticicolor*.

pruinose, uniformly red or red with a whitish sheen, often finely concentrically cracking; gills whitish to cream; stem 35–60 x 6–15 mm, cylindrical or clavate, pruinose-mealy or when old scaly, whitish but with a $\pm$ pale pink flush; flesh firm; smell insignificant; taste mild; sp deposit white (Ib). Sp 6.5–8 x 6–7 μ m, with low warts and some connections (fig. 141D); primordial hyphae up to 4.5 μ m, incrusting, apical cell tapering. In deciduous forests, mainly with *Quercus* and *Fagus* on acid ground; summer; rare in temp.-bore.; DK (EN), FI (CR), NO (NE), SE. – Marst 47, Sar 2:1305, 1307, Schff 19.

R. zvarae Velen.

- Stem white. Cap 40–100 mm, smooth, when old becoming rugulose at centre, red or pink or discolouring cream or whitish; gills much forked, white; stem 30–70 x 10–20 mm, pruinose above, white; a section of the flesh becoming red, sometimes slowly, with SV; taste mild, insignificant; sp deposit white (I), soon discolouring cream. Sp 6–8 x 5–6.5 μ m, low verrucose with few to many crests (fig. 141E); primordial hyphae slightly incrusting. In deciduous forests with *Quercus* and *Fagus*; summer to autumn; occasional in temp.-hemib.; DK (LC), FI (EN), NO (NE), SE (LC). – Däh 876, Phil 21e, Sar 2:1344, 1349, Schff 17, Ves 395, Ⓢ.
- R. velutipes* Velen. (*R. rosea* (Schaeff.) Quél. non Pers.)

Key J: Sect. *Polychromae* Maire subsect. *Integroidinae* (Romagn.) Bon (incl. subsect. *Paraintegrinae* Sarnari, sect. *Paraincrustatae* Sarnari subsect. *Integrae* Maire, sect. *Russula* subsect. *Rubrinae* (Melzer & Zvara) Singer)

- | | | |
|----|---|---|
| 1. | Frb distinctly greying, especially when old | 2 |
| - | Frb not or hardly greying | 6 |
| 2. | Mycorrhizal with conifers. Frb distinctly greying; cap 40–120 mm, with age with slightly sulcate margin, dark vinaceous, dark purplish, blood red to brownish red, centre darker than margin or paler, discolouring to brownish or yellowish, soon depressed, margin lilaceous pink, sometimes white pruinose; gills strongly interveined, ochre, edge blackening; stem 30–80 x 15–25 mm, cylindrical, strongly greying with age, firm, venose-reticulate; sp deposit ochre (IIIab). Sp 9–11 x 7–9 μ m, with isolated, slender, pointed spines up to 1 μ m (fig. 141F); primordial hyphae distinct, up to 7 μ m broad; dcy absent. In coniferous forests and in mountains also with <i>Betula</i> ; late summer to autumn; common in temp.-suba., in NO north | |

to Finnm, occasional in DK; DK (LC), FI (LC), NO (LC), SE (LC). – Mar 482, Phil 24b, R&H 535, Sar 2:1427, 1429, Schff 29, ☉.

R. vinosa Lindblad (*R. obscura* (Romell) Peck)

- Mycorrhizal with deciduous trees or scrubs 3
- 3. Mycorrhizal with *Quercus* in warm, temperate parkland. Cap 50-100 mm, plane or slightly depressed with obtuse margin, reddish purple, mixed with dark grey, especially near margin, shining; gills rigid, cream, becoming ochre, blackening from the edge; stem 30-60 x 10-15 mm, white but soon becoming dark grey; flesh when cut immediately vinaceous, then rapidly changing to grey, finally almost black; sp deposit yellow (IVc). Sp 8-10 x 6.5-8 μ m, echinulate with some fine connections (fig. 141G); dcy with yellowish contents, $\pm$ incrustated; primordial hyphae absent. Summer to early autumn; a southern species, very rare in temp., DK (CR, Lol: Skejten). – Mar 490, Sar 2:1065, 1067, Ves 400, ☉.

R. sepeirina Dupain

- Mycorrhizal with *Betula* 4
- 4. Cap with dull colours, variable and mixed, lilaceous brown, olivaceous yellow, reddish, with ochre patches, centre often greenish yellow, margin lilaceous red brown. Cap 70-130 mm, with smooth or sulcate margin when old, mat, when growing in suba. strongly pruinose-pubescent; gills cream to ochre, when old with greying edge; stem 65-100 x 20-30 mm, white, yellowing below, resembling a species from the *Xerampelinae*-group; flesh white, only very slowly becoming grey, firm; smell insignificant; taste mild; sp deposit pale yellow (IIIc-IVa). Sp 9-11.5 x 7-9 μ m, verrucose with a few connections or crests (fig. 141H); primordial hyphae up to 6 μ m broad, sparsely incrustated, clustering. In forests and scrubs with *Betula*, incl. *B. nana*; summer; recently rediscovered, occasional in hemib.-arc. / alp.; FI (LC), NO (LC), SE (LC). – Marst 45, Sar 2:1423, 1425, Sienil 43:40, Sieniop 78.

R. pubescens A. Blytt (*R. subalpina* O.K. Mill.)

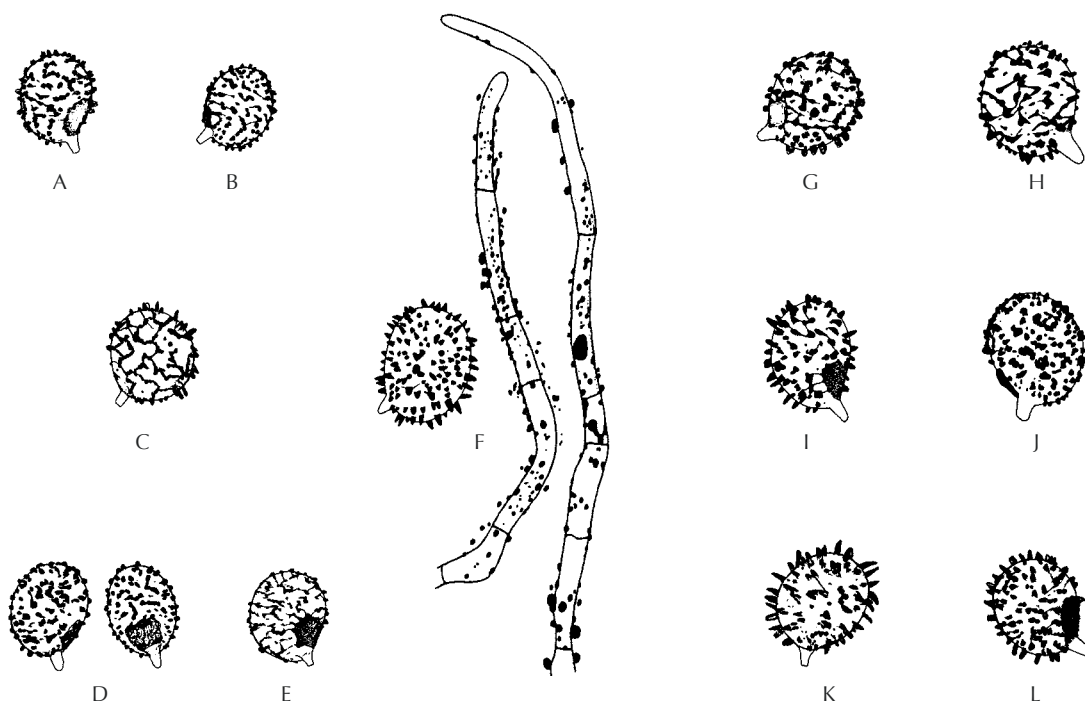
- Cap yellow, yellow green or green 5
- 5. Cap deep yellow, yellowish orange to deep chrome yellow. Cap 50-100 mm, firm; gills whitish to cream, but soon with ochraceous or greenish tinge, greying; stem 40-100 x 10-20 mm, white or yellowish soon greying; flesh distinctly greying; smell fruity; taste mild; sp deposit ochre (IIIc). Sp 8-9.5 x 6.5-7.5 μ m, with warts 0.5-1 μ m, with connections or a $\pm$ complete, fine reticulum (fig. 141I); primordial hyphae incrustated, mainly diffuse, up to 6 μ m broad; dcy absent. Mycorrhizal with *Betula*, mostly in moist sites such as mire margins; summer to autumn; common in temp.-suba., but rare in IS; DK (LC), FI (LC), IS (Ve), NO (LC), SE (LC). – Däh 852, Phil 40a, R&H 535, Sar 1432, 1434, Ves 401, ☉.

R. claroflava Grove (*R. flava* (Romell) Romell)

- Cap olivaceous green, olive brown to greyish yellow or more bright green, discolouring buff at centre. Cap 50-100 mm; gills ochre; stem 30-50 x 15-25 mm, clavate, white, soon greying; flesh distinctly greying; smell insignificant; taste mild; sp deposit not obtained, probably yellow (IV). Sp 8.5-11 x 7-9 μ m, verrucose, warts up to 1 μ m, with some connections (fig. 141J); primordial hyphae incrustated, up to 7 μ m broad, clustering; dcy absent. Mycorrhizal with *Betula* incl. *B. glandulosa* and *B. nana* in suba.-arc. / alp.; summer; recently described and so far only known from NO (LC) and Greenland.

R. groenlandica Ruots. & Vauras (*R. claroflava* Grove var. *viridis* Knudsen & T. Borgen)

- 6. Sp with isolated, slender spines up to 1.7 μ m long (fig. 141K), 8-11 x 7-9 μ m; cap umber, sepia, yellow brown or buff, often with a purple shin. Cap 60-120 mm, slightly depressed, shining, with margin smooth or becoming slightly sulcate; gills broad, thick, strongly interveined, medium spaced to distant, whitish, finally yellow; stem 50-100 x 15-30 mm, white, firm, becoming thicker at base; flesh spongy in stem; sp deposit yellow (IVc). Pileipellis with cylindrical or clavate, 4-7 μ m broad, finely incrustated dcy, and scattered, incrustated primordial hyphae. In coniferous forests and parks with *Picea* and *Pinus*, more



Spores and primordial hyphae: A: *Russula roseoaurantia*, B: *R. minutula*, C: *R. lepida*, D: *R. zvarae*, E: *R. velutipes*, F: *R. vinosa*, G: *R. seperi*, H: *R. pubescens*, I: *R. claroflava*, J: *R. groenlandica* (from holotype), K: *R. integra* s. Maire, L: *R. cremeoavellanea*.

rarely in deciduous forests, on rich soil; summer to autumn; common in hemib.-bore., rare in temp.; DK (vu), FI (LC), NO (LC), SE (LC). – Däh 893, Phil 31d, R&H 546, Sar 2:1089, 1091, Ves 409, ☉.

R. integra (L.) Fr. s. Maire (*R. polychroma* Hora)

- Sp without long isolated spines or cap red 7
- 7. Pileipellis with incrustated dcy and incrustated primordial hyphae 8
- Pileipellis with slightly incrustated dcy; primordial hyphae absent 11
- 8. Mycorrhizal with *Betula*; cap 40-80 mm, avellaneous brown to yellow brown or ochre, sometimes with a greenish tinge and a smooth pink or red brown margin. Gills broad, veined, yellow; stem 40-50 x 10-20 mm, veined, white becoming brownish when bruised; sp deposit yellow (IVc). Sp 7-8.5 x 6-7 μ m, with isolated short spines (fig. 141L); primordial hyphae slightly incrustated and narrow, weakly reacting; dcy weakly incrustated. Summer; occasional in hemib.-bore., in FI north to Ks; FI (LC), NO (NE), SE (LC). – Mar 492, Marst 67, Sieniop 64, SBT 79:315.
- R. cremeoavellanea*** Singer
- Mycorrhizal with *Fagus*, *Quercus* or *Carpinus* or cap stronger red 9
- 9. Mycorrhizal with *Fagus* and *Quercus*; primordial hyphae with scattered incrustations and with obtuse apex. Cap 30-70(-100) mm, with short sulcate margin, with red or pale red margin and orange to ochraceous centre, shining; gills ventricose, deep ochre; stem 30-40 x 10-15 mm, often obclavate, white; smell insignificant; taste mild; sp deposit yellow (IVa). Sp 8-9 x 7-8 μ m, with isolated spines up to 0.8 μ m or a few fine connections (fig. 143A); dcy cylindrical to slightly clavate, 3-5 μ m broad, some apical cells up to 8 μ m, finely incrustated. In

deciduous forests; summer to early autumn; rare in temp.-bore.; DK (VU), FI (DD), NO (NE), SE (VU). – AM 32 pl. 4, E&M 4 (as *borealis*), Sar 2:1113, 1115, Schff 36b, Svp 15:11.

R. laeta F.H. Møller & Jul. Schäff. (*R. borealis* Kauffman s. Romagnesi non Kauffman = a species of *Xerampelinae*)

- Mycorrhizal with *Quercus*, *Carpinus* or *Betula*; some primordial hyphae long tapering 10
- 10. Sp partially reticulate with very low warts (fig. 143B). Cap 45-85 mm, with smooth margin, purplish red, lilaceous red, becoming pink or brownish with a flesh-coloured tone, at centre sometimes discolouring cream; gills yellow; stem 35-60 x 15-30 mm, firm, white, sometimes partly pink especially below; smell insignificant; taste mild; sp deposit yellow (IVb). Sp 8-10 x 6.5-8 μ m, with a very low, $\pm$ complete reticulum; dcy smooth or incrustated, 1-2-septate; primordial hyphae incrustated, apical cells obtuse or long tapering. In deciduous forests, parkland and other open and warm localities; very rare; DE. – Sar 2:1096, 1099.

R. carminipes J. Blum

- Sp with spines up to 1.5 μ m and a few fine connections (fig. 143C). Cap 50-80 mm, convex but soon broadly depressed, with smooth or finely sulcate margin, shining, red to reddish brown or purplish brown, centre discolouring to olivaceous yellow or olivaceous brown; gills yellow; stem 45-70 x 10-20 mm, firm, white, slightly yellowing towards base and with some brown spots; smell insignificant or of honey; taste mild; sp deposit yellow (IVb). Sp 8.5-10 x 7-9 μ m; primordial hyphae with a long and strongly tapering apical cell, strongly incrustated below, smooth towards apex, incrustations becoming red in SV on dried frb; dcy not septate or 1-septate, incrustated below, either typically clavate or tapering to a narrow apex. Mycorrhizal with *Quercus*, *Betula* and *Carpinus* on clayey soil; very rare in temp.-bore.; FI (NT), NO (NE). – FRIC 4:16, Sar 2:1083, 1084.

R. melitodes Romagn.

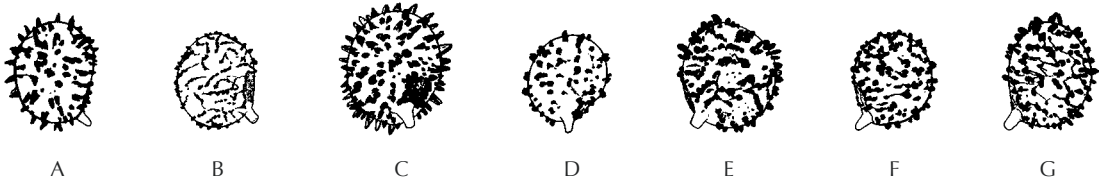
- 11. Sp deposit yellow (IVac); mycorrhizal with *Picea*. Cap 50-80 mm, with a smooth or very finely sulcate margin, mat when dry, shining when wet, red brown, reddish brown or reddish lilac, at centre discolouring to yellow or olivaceous green; gills yellow; stem 50-75 x 18-25 mm, slightly clavate, white or sometimes slightly pink in places; smell insignificant; taste mild. Sp 7-9 x 6-7 μ m, verrucose to echinulate, warts scattered, up to 0.5 μ m, connections few or scattered (fig. 143D); dcy long, septate, below with scattered incrustations; primordial hyphae absent. In coniferous forests on calcareous soil; summer; recently described, but seemingly occasional in bore.; FI (LC), SE. – Marst 59, Sar 2:1057.

R. integriformis Sarnari

- Sp deposit ochre or mycorrhizal with deciduous trees 12
- 12. Sp deposit yellow (IVc). Cap 20-60 mm, convex or slightly depressed, with smooth margin, mat, uniformly bright red to pink or orange red; gills pale yellow; stem 20-50 x 7-12 mm, cylindrical or tapering at base, white; smell weak, resembling that of *R. delica*; taste moderately to strongly acid. Sp 7.5-9.5 x 7-8 μ m, echinulate with some short crests, spines up to 1.3 μ m (fig. 143E); dcy multi-septate, finely and partly incrustated. Mycorrhizal with old *Quercus* on rich soil; summer to autumn; very rare in temp.-hemib.; DK (NA), NO (NT, Østf: Fredrikstad), SE (VU). – E&M 26, Marst 73, Sar 1:779, 781.

R. rutila Romagn.

- Sp deposit ochre 13
- 13. Taste acid; mycorrhizal with deciduous trees. Cap 40-100 mm, velvety, with smooth margin, mat, firm, cap cuticle hardly peeling, cinnabar red with a whitish tinge; gills adnexed to subdecurrent, medium spaced, forked and anastomosing, strongly interveined, cream then ochre; stem 30-80 x 10-25 mm, firm, pruinose, white, slightly greyish and yellowing when old and bruised; smell of honey; taste acid; sp deposit ochre (IIIbc). Sp 6.5-8.5 x 6-7.5 μ m, with isolated warts or a few crests (fig. 143F); dcy exuding very small red drops after treatment with fuchsin; primordial hyphae absent. In deciduous forests with *Betula*, *Quercus* and



Spores: A: *Russula laeta*, B: *R. carminipes*, C: *R. melitodes* (from holotype), D: *R. integriformis* (from holotype), E: *R. rutila*, F: *R. rubra*, G: *R. paludosa*.

Fagus; summer to autumn; rare in temp.; DK (EN), NO (EN). – Bres 415, E&M cover, Sar 1:773, 775, Schff 63, Ves 419.

R. rubra (Lam.: Fr.) Fr. (*R. pungens* Beardslee, *R. kavinae* Melzer & Zvára)

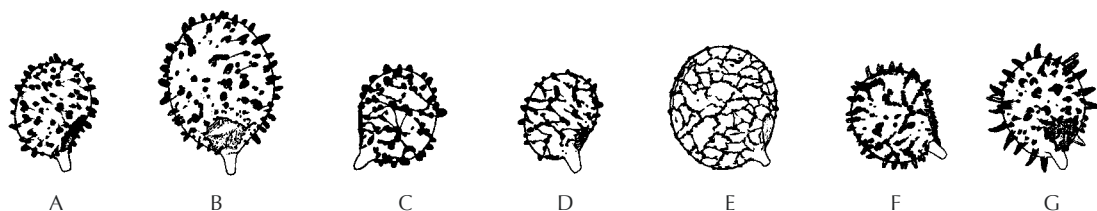
- Taste mild or if slightly acrid then mycorrhizal with conifers 14
- 14. Mycorrhizal with conifers, especially with *Pinus* on poor soil, in arc./alp. also with *Betula*; stem usually faintly flushed with red in most part, more rarely white, 60-130 x 15-35 mm. Cap 60-120 mm, convex to slightly depressed, shining, bright red, margin sometimes paler, centre or whole cap sometimes discolouring to ochraceous; gills cream then ochre; taste mild, when young often slightly acrid; sp deposit pale ochre (IIIb). Sp 8-11 x 7-9 μ m, verrucose to echinulate with few to many connections and crests (fig. 143G); dcy long, septate, 4-7 μ m broad, with scattered incrustations; primordial hyphae absent. Summer to autumn; common in temp.-arc./alp.; DK (LC), FI (LC), NO (LC), SE (LC). – Däh 895, Phil 23e, R&H 547, Sieniop 76, Ves 402, ☉.

R. paludosa Britzelm. (*R. elatior* Lindblad)

- Mycorrhizal with deciduous and coniferous trees, especially with *Betula* on better soil; stem white but often with a pink flush near the base, 30-80 x 10-15 mm. Cap 30-80 mm, with smooth to somewhat sulcate margin, mat when dry, blood red, red, brownish red or brownish pink, centre blackish or pale ochraceous to buff or pale olivaceous; smell insignificant; taste mild; sp deposit ochre (IIIb). Sp 6.5-9 x 6-7 μ m, verrucose to echinulate, with spines up to 0.8 μ m, connections few or absent (fig. 144A); dcy long, septate, with scattered incrustations; primordial hyphae absent. Summer to autumn; common in temp.-bore., in FI north to OP; DK (LC), FI (LC), NO (LC), SE (LC). – Phil 42b, R&H 547, Sar 2:1047, 1048, Schff 31, Ves 403. ***R. velenovskyi*** Melzer & Zvára

Key K: Sect. *Polychromae* Maire subsect. *Integriforminae* Bon and *Melliolentinae* Singer

- 1. Frb distinctly greying when old; stem tall compared to cap diam. 2
- Frb yellowing or unchanging when old; stem short compared to cap diam. 4
- 2. Sp echinulate, most spines isolated; frb incl. gills strongly greying. Cap 40-100 mm, with smooth margin, rather firm, pale to dark orange, reddish orange or brownish orange; gills strongly interveined, cream to ochraceous, edge blackening; stem 30-120 x 15-25 mm, often remarkably long, cylindrical, often rugose; flesh slightly reddening when cut then greying; sp deposit deep cream to pale ochre (IIc-IIIa). Sp 9-14 x 8-11 μ m, echinulate, spines up to 1.5 μ m, connections few (fig. 144B); dcy non- or 1-septate, not incrustated. In coniferous forests, especially with *Pinus*, but in suba. with *Betula*; summer to autumn; common in temp.-suba., rare in arc./alp., in DK rare, but occasional in WJyl; DK (LC), FI (LC), NO (LC), SE (LC). – R&H 534, Sar 2:949, Schff 27, Sieniop 65, Ves 400, ☉.
- R. decolorans*** (Fr.: Fr.) Fr.
- Sp verrucose with $\pm$ complete reticulum; frb except gills slightly greying 3



Spores: A: *Russula velenovskyi*, B: *R. decolorans*, C: *R. rivulicola* (from holotype), D: *R. vinososordida* (from holotype), E: *R. melliolens*, F: *R. curtipes*, G: *R. carpini*.

3. On moist ground. Cap 30-75(-100) mm, soon depressed, often with an undulate and soon slightly sulcate margin, shining, yellow brown, orange brown, reddish brown, dirty red, wine red, centre usually darkest; gills medium spaced to distant, some forking, pale ochre, edge concolorous; stem 25-80 x 7-25 mm, subclavate, soft, whitish, later greyish or watery blackish grey, base often yellowish brown; smell indistinct; taste in young frb slightly acrid, later mild; sp deposit pale ochre (IIc-IIIb). Sp 7-9 x 6-7.5 μm , subglobose, partly reticulate, warts rounded (fig. 144C); dcy cylindrical to clavate. Mycorrhizal, especially with *Betula* on better, moist ground; summer; rare in hemib., occasional in bore.-arc. / alp.; FI (LC), SE. – Marst 53, Mic Due 563, Sar 2:952, 954, Sienil 53:72.

R. rivulicola Ruots. & Vauras

- On mesic or dry ground. Cap 50-100(-190) mm, with margin becoming slightly sulcate, red, violet red, red brown, brown, rarely dirty greenish yellow, centre often dark and shining with yellowish patches around; gills crowded, some forking, ochre, edge concolorous, taste slightly to fairly strongly acrid; stem 40-80(120) x 15-30(-35) mm, cylindrical, white, later slightly greyish and with rust-coloured patches; smell weak, of cedar-wood; taste mild; sp deposit ochre (IIIac). Sp 7-8 x 5.5-7 μm , broadly ellipsoid, partly reticulate, warts rounded (fig. 144D); dcy cylindrical to clavate. In forests, especially with *Betula*, rarely with coniferous trees; summer to autumn; common in bore., occasional in hemib.; FI (LC), NO (NE), SE. – Marst 61, Mic Due 559, Sar 1:77, 2:959, 960, Sienil 53:69.

R. vinososordida Ruots. & Vauras

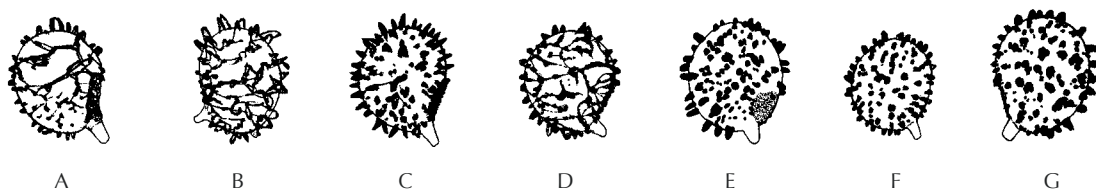
4. Smell characteristic, of honey, especially when dry; sp with hardly visible partial reticulum (fig. 144E). Cap 50-100 mm, with smooth or slightly sulcate margin, shining, from red to orange pink or purple, may be mixed with ochraceous patches; gills forked near stem, pale cream, ochraceous spotted; stem 50-100 x 10-30 mm, white, distinctly browning especially at base; smell of honey, especially when dried; sp deposit cream (IIab). Sp 8.5-11 x 8-9.5 μm ; dcy multi-septate, not incrustate. In deciduous forests on rich soil; summer to early autumn; rare in temp.-hemib.; DK (EN), NO (NE, Østf: Fredrikstad), SE (VU, Og). – Mar 475, Marst 60, Sar 2:919, 920, Schff 225, V&K 29, ☉.

R. melliolens Quéf.

- Smell insignificant; sp verrucose to echinulate 5
5. Mycorrhizal with *Fagus*. Cap 50-100(-120) mm, soon depressed, mat, dry, dark vinaceous to brown vinaceous or red with an ochraceous to greenish centre, margin often finely concentrically cracked; gills cream then pale yellow; stem 30-60 x 15-25 mm, firm, white; sp deposit deep ochre to pale yellow (IIIc-IVa). Sp 7-9.5 x 6-7.5 μm , verrucose to echinulate, with crests forming a few meshes (fig. 144F); dcy scattered and weakly differentiated, hardly reacting with SV; apical cell in hyphae of pileipellis attenuated at the apex but often $\pm$ ampulliform at the base. Summer to autumn; occasional in temp., rare in hemib.; DK (LC), NO (NE), SE (NT). – Däh 894, E&M 9, Sar 2:1003, 1005, Schff 35a, Ves 409.

R. curtipes F.H. Möller & Jul. Schff.

- Mycorrhizal with *Carpinus*. Cap 30-90 mm, with smooth or sulcate margin, shining, $\pm$ viscid,



Spores: A: *Russula aurea*, B: *R. romellii*, C: *R. olivacea*, D: *R. alutacea*, E: *R. olivascens*, F: *R. risigallina* var. *ochracea*, G: *R. vitellina*.

reddish orange, brownish orange, orange yellow, red or blood red, more rarely brownish with greenish or ochraceous centre or greyish olivaceous; gills yellow; stem 25-60 x 7-15 mm, often somewhat eccentric, white; sp deposit yellow (IVd). Sp 7.5-10 x 7-8 μ m, echinulate, without connections (fig. 144G); dcy multi-septate, not incrustated. Summer to autumn; rare in temp.; DK (VU), SE (NT). – BSMF 74 pl. 2, E&M 5, Marst 57, Sar 2:973, 975, Ves 408. *R. carpini* R. Girard & Heinem.

Key L: Sect. *Polychromae* Maire subsect. *Polychromae* (incl. subsect. *Auratinae* Bon)

1. Gill edge lemon-yellow; whole frb strongly yellowing. Cap 40-90 mm, blood red, red, pink, brownish pink to reddish orange, often partly yellow, convex, firm; gills cream then ochre, edge often lemon-yellow; stem 30-70 x 10-25 mm, rather firm, white but often partly or wholly yellowish; sp deposit ochre to yellow (IIIc-IVb). Sp 7-10 x 6-8 μ m, with prominent connections enclosing a $\pm$ well-developed reticulum (fig. 145A); pileipellis undifferentiated, without dcy and primordial hyphae. In deciduous forests and rich *Picea* forests; summer to autumn; occasional in temp., rare in hemib.-bore., in NO north to NTr, in SE north to Jmt., in FI north to Ps; DK (LC), FI (LC), NO (LC), SE (LC). – Däh 897, Phil 19d, R&H 548, Sar 2:1073, 1075, Ves 405, ☉.
R. aurea Pers. (*R. aurata* (With.) Fr.)
 - Gill edge concolorous with gills; frb not or only partly yellowing 2
2. Dcy present, either incrustated, or smooth and weakly reacting to SV 3
 - Dcy absent 5
3. Dcy smooth or incrustated below, normally reacting with SV; sp with a very low, $\pm$ complete reticulum see *R. carminipes*, key J 10
 - Dcy smooth and only slightly differentiated and weakly reacting with SV; sp verrucose to echinulate 4
4. Stem longer than cap diam. or of similar size, 60-130 mm long; cap shiny, greasy, not zonate. Cap 60-130 mm, convex or slightly depressed at centre, violaceous, vinaceous or purplish vinaceous, often mixed with grey, at centre yellow or greenish or black, or totally green; gills broad, cream, then yellow; stem 20-30(-40) mm broad, white, later browning; sp deposit yellow (IVd). Sp 6.5-9 x 5.5-7 μ m, verrucose to echinulate, with crests forming a partial to almost complete reticulum (fig. 145B); dcy hardly reacting with SV; apical cells in hyphae of pileipellis attenuated in whole length. Especially with *Fagus* and *Quercus* on rich soil; summer to autumn; occasional in temp., rare in hemib.; DK (LC), FI (LC), NO (LC), SE (LC). – FAD 192D, Mar 485, Marst 60, Sar 2:983, 985, Schff 35, ☉.
R. romellii Maire
 - Stem shorter than cap diam., 30-60 mm long; cap mat, often concentrically zonate see *R. curtipes* Key K 6
5. Pileipellis undifferentiated, without dcy and primordial hyphae 6

- Pileipellis ± differentiated, at least with incrustated primordial hyphae 7
- 6. Sp 8-11 × 7-9 μm, echinulate with isolated spines (fig. 145C); stem when mature with pink zone at top or all over, 50-100 × 20-30(-50) mm. Cap 70-140(-200) mm, low convex, centre depressed, dry, mat, green, greyish or olivaceous green, yellowish green, purplish, brownish purple, vinaceous to brownish vinaceous or purplish red, when mature with characteristic, fine, concentric crackings; gills broad, yellow; flesh violaceous purplish with phenol after minutes; smell insignificant; taste mild; sp deposit yellow (IVcd). Pileipellis of simple, long septate hyphae, terminal cell often ampulliform; dcyl and primordial hyphae absent. In deciduous forests; summer to autumn; common in temp., occasional in hemib., in FI only in A and V; DK (LC), FI (EN), NO (NT), SE (LC). – Däh 892, Phil 33e, R&H 546, Sar 2:1460, 1462, 1464, Ves 408, ☉.
R. olivacea (Schaeff.) Pers. (*R. alutacea* (Pers.: Fr.) Fr. s. J.E. Lange)
 - Sp 8.5-11 × 8-9.5 μm, with many crests or partially reticulate (fig. 145D); stem 40-70 × 15-30 mm, white, sometimes with a pink flush on the lower half, slightly browning. Cap 50-120 mm, with smooth margin, purplish red, vinaceous red or brownish red, centre discolouring to ochre or olivaceous yellow; gills distant, yellow; smell slightly fruity; flesh violaceous purplish with phenol after minutes; smell insignificant or slightly fruity; taste mild; sp deposit yellow (IVbc). Pileipellis of simple, long septate hyphae, terminal cell often ampulliform, dcyl and primordial hyphae absent. Mycorrhizal with *Fagus* and *Quercus* on rich soil; easily confused with related species and distribution poorly known; very rare in temp.; DK (NE), NO (LC), SE (NE). – Cet 189, Mar 139, Phil 33f, Sar 2:1467, 1470.
R. alutacea (Pers.: Fr.) Fr. s. Melzer & Zvára
- 7. Cap yellow, olivaceous or green 8
 - Cap red, pink, lilac, violet or purple, sometimes mixed with yellow or green 11
- 8. Mycorrhizal with *Picea* and *Pinus*. Cap 30-60 mm, with smooth margin, olivaceous yellow to dark olivaceous green, often mixed with brownish and violet; gills yellow to orange; stem 40-70 × 10-15 mm, often tapering below, white; flesh not reacting with SV; smell at stem base often of iodoform; taste mild; sp deposit yellow (IVd). Sp 8-10.5 × 7-9 μm, echinulate with few connections (fig. 145E); primordial hyphae slender, 3-6 μm broad, incrustated. In rich coniferous forests; summer to autumn; occasional in hemib.-bore., in NO north to NTr, in FI north to KS; FI (LC), NO (LC), SE (LC). – E&M 22, Mar 464, R&H 540, Sar 2:1407, 1410, 1412, Schff 38.
R. olivascens Fr. s. Romagnesi non Fries (*R. postiana* Romell, *R. multicolor* Bon)
 - Mycorrhizal with deciduous trees 9
- 9. Cap > 70 mm; stem > 20 mm thick see green forms of *R. olivacea* 6
 - Cap smaller and stem thinner 10
- 10. Mycorrhizal with *Fagus* or *Quercus*. Cap 40-70 mm, with smooth margin, mat, dry, ochre yellow; stem 40-85 × 10-20 mm, white; smell insignificant. Sp (fig. 145F). Otherwise similar to the main variety. A poorly known, more stout and differently coloured variety; summer; FI. – Sar 2:1388.
R. risigallina (Batsch) Sacc. var. *ochracea* (Fr. 1815, non 1838) Knudsen, Ruots. & Vauras (*R. lutea* (Huds.) Gray var. *ochracea* (Fr.) Singer, *R. chaemaeleontina* Fr. var. *ochracea* (Fr.) Romagn. comb. inval.)
 - Mycorrhizal with *Betula*, rarely *Picea*. Cap 20-50 mm, shining, with smooth or slightly sulcate margin, viscid, uniformly bright lemon yellow; gills deep yellow; stem 20-40 × 5-10 mm, white; smell slightly acidulous when old; taste mild; sp deposit yellow. Sp 7.5-9 × 6-7.5 μm, verrucose to echinulate, warts isolated or forming a few crests (fig. 145G); primordial hyphae incrustated, up to 5 μm broad. Summer to autumn; occasional in temp.-bore., in FI north to SoL; FI, IS, NO, SE. – Mar 466, R&H 541, Sar 2:1390, 1392, Sieniop 72.
R. vitellina Gray



Spores: A: *Russula roseipes*, B: *R. caerulea*, C: *R. turci*, D: *R. amethystina*, E: *R. pseudointegra*, F: *R. risigallina* var. *risigallina*, G: *R. sericatulula* (from holotype).

Note: when Persoon (1801) described *R. vitellina* he simultaneously listed *R. risigallina* as a synonym, thus creating a superfluous name. To use the name a conservation with another type and author will be necessary, a solution we prefer because the name is in general use. The alternatives are either to replace the name with *R. lutea* (Huds.: Fr.) Gray, a very dubious taxon, or to use the recently described replacement name, *R. acetolens* Rauschert, which has not won general acceptance.

11. Mycorrhizal with *Pinus* 12
 - Mycorrhizal with deciduous trees 15
12. Cap bright red, centre discolouring orange to yellow. Cap 30-60 mm, pink, reddish orange, red, mat, pruinose especially near margin; gills yellow; stem 30-60 x 5-10(-15) mm, partially or totally pink on white background; flesh white; smell at stem base often of iodoform; taste mild; sp deposit yellow (IVc). Sp 7-10 x 6-9 μm , verrucose, with crests (fig. 147A); primordial hyphae voluminous, strongly incrustated. In coniferous forests, associated with *Pinus*, mostly on sandy soils; summer to autumn; rare in temp.-bore.; FI (LC), NO (NT), SE (LC).
 - Mar 463, R&H 541, Sar 2:1361, 1363, Schff 43a, Sieniop 82.
R. roseipes Bres.
 - Cap bluish, violet, lilac or purplish, mixed with brown and green 13
13. Cap almost conical and usually distinctly umbonate, rarely depressed without an umbo. Cap 30-80 mm, dark violet, dark vinaceous or dark purplish, discolouring to dark brown, shining; stem 40-100 x 10-20 mm, rather long, often clavately swollen at base, white; stem surface bright red with SV; flesh mild, cuticle bitter; sp deposit yellow (IVab). Sp 8-9 x 6.5-8 μm , echinulate with spines up to 1 μm and $\pm$ connections and crests (fig. 147B); primordial hyphae sparsely incrustated. Mycorrhizal with *Pinus*, often in grassy localities; late summer to autumn; rare in temp.-bore., with an oceanic distribution in NO; DK (vu), FI (LC), NO (LC), SE (LC). - Däh 891, R&H 543, Sar 2:1445, 1447, Svp 46:17, Ves 417.
R. caerulea (Pers.) Fr. ('*coerulea*', *R. amara* Kučera)
 - Cap not umbonate 14
14. Sp 7.5-9 x 6.5-7.5 μm , verrucose, warts low, mostly 0.5(-0.8) μm , with many crests to almost reticulate (fig. 147C); stem base often with strong smell of iodoform when collected. Cap 40-100 mm, broadly depressed, with smooth margin, viscid when moist, mat when dry, $\pm$ pruinose especially near margin, usually dark coloured, dark purplish, bluish violaceous, lilaceous, brown vinaceous, more rarely pale vinaceous to reddish, centre sometimes almost blackish, margin paler, giving an impression of broad zonation; gills yellow; stem 30-70 x 10-20 mm, white, rarely with pink flush, when old slightly yellowing; sp deposit pale yellow (IVa). Primordial hyphae strongly incrustated, up to 7 μm broad. In coniferous forests on acid and sandy soil, especially with *Pinus*; autumn; occasional in temp.-bore.; DK (vu), FI (LC), NO (LC), SE (LC). - Däh 870, E&M 29, Mar 462, Phil 25d, Sar 2:1365, 1376.
R. turci Bres. s. Maire
 - Sp 7.5-9 x 6-7.5 μm , verrucose to echinulate, spines up to 1 μm , mostly isolated, but with a few connections (fig. 147D); smell faintly of iodoform. Cap 40-100 mm, broadly depressed, smooth or when old shortly and slightly sulcate at margin, when wet shining and viscid,

when dry mat, lilaceous red, purplish red, brownish red to dark violet, centre darker and often with an olivaceous tinge, strongly discolouring after rain to yellow; gills yellow; stem 30-80 x 10-25 mm, white or faintly flushed with pink; taste mild; sp deposit deep ochre to pale yellow (IIIId-IVa). Primordial hyphae strongly incrustated, up to 7 μ m broad. In coniferous forests, especially with *Picea*; confused and mixed with *R. turci* and distribution and frequency thus poorly known, assumed to be very rare in temp., rare in hemib.-bore.; DK (NE), FI (DD), NO (NT), SE (LC). – Cet 1064, Däh 871, Mar 461, Sar 2:1370, 1372.

R. amethystina Quéf.

15. Taste slightly bitter. Cap 40-100 mm, hemispherical to convex, then plane, mat, typically of a pure scarlet or blood red colour, sometimes with discoloured pale areas; gills cream, then ochre; stem 30-70 x 10-25 mm, firm, pure white, very occasionally with a pink flush near base; smell of fruit and menthol; sp deposit ochre to yellow. Sp 7-8.5 x 6.5-8 μ m, finely verrucose, with fine connections often forming a few meshes (fig. 147E); some hymenial cystidia partly covered with a gelatinous sheath; a microscopical section becomes red with SV; primordial hyphae conspicuous, 3-4 μ m broad, multi-septate, with scattered incrustations. Especially with *Quercus* on clayey ground; summer to autumn; occasional in temp.-hemib., in FI only in V and U, rare in NO; DK (LC), FI (LC), NO (VU), SE (LC). – E&M 23, Mar 458, Phil 17c, R&H 540, Sar 2:1451,1453, Ves 404, ☉.

R. pseudointegra Arnould & Goris

- Taste mild 16
- 16. Cap 20-50(-70) mm, yellow at centre with pink margin or yellowish orange. Cap convex, mat, margin smooth or slightly sulcate; gills yellow; stem 25-60 x 7-15 mm, white, slightly yellowing with age; smell strong, sweetish-fruity; sp deposit yellow. Sp 7.5-9 x 6-7.5 μ m, verrucose to echinulate, warts isolated or forming a few crests (fig. 147F); primordial hyphae incrustated, up to 5 μ m broad. Mycorrhizal with *Fagus* and *Quercus*; summer to autumn; temp.-hemib., common in DK, occasional in SE, rare in NO and FI; DK (LC), FI (LC), NO (LC), SE (LC). – Däh 878, E&M 22, Phil 41b, Sar 2:1380, 1382, Schff 43, Ves 404, ☉.

R. risigallina (Batsch) Sacc. var. *risigallina* (*R. chamaeleontina* Fr.)

- Cap 50-90 mm, purplish red, vinaceous red, vinaceous brown to brown, sometimes discolouring olivaceous green at centre. Cap convex, mat, near margin pruinose, margin smooth; gills yellow; stem 40-80 x 12-20 mm, white or in places flushed with pink, when old slightly greying; smell insignificant; taste mild; sp deposit yellow (IVb). Sp 7-9 x 6-7 μ m, with isolated spines up to 1 μ m or with a few connections (fig. 147G); primordial hyphae incrustated, up to 5 μ m broad, with scattered incrustations, multi-septate. Mycorrhizal with deciduous trees, especially *Carpinus*; summer; very rare, one record from FI (V: Turku). – Sar 2:1441.
- R. sericatula* Romagn.