

## Novelties in *Russula*: *R. olivobrunnea*, *R. intermedia* and *R. groenlandica*

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*Russula olivobrunnea* Ruots. & Vauras is described as a new species, known from Finland, Sweden, Norway and Austria. Its distribution in Fennoscandia is mapped, and its ecology and relationships are discussed. It is a boreal species growing with *Picea abies* in moist herb-rich forests. A neotype is selected for *R. intermedia* P. Karst., which is an older, legitimate name for the well-known species *R. lundellii* Singer. The distribution of *R. intermedia* in Finland is mapped. The new name *R. groenlandica* Ruots. & Vauras is proposed for *R. claroflava* var. *viridis* Knudsen & T.Borgen. The importance of examining pileipellis characteristics with the reagent fuchsin is emphasized, even those of the acrid yellow-spored *Russula* species.

Key words: Agaricales, Basidiomycetes, Fennoscandia, *Picea abies*, *Russula claroflava*, *R. fusconigra*, *R. groenlandica*, *R. intermedia*, *R. lundellii*, *R. olivobrunnea*, taxonomy

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### Introduction

Recently we described (Ruotsalainen & Vauras 1990) two new *Russula* species growing in moist boreal spruce forests. A *Russula* with ecology and Finnish distribution similar to *Russula olivina* Ruots. & Vauras, and sometimes sharing growth sites with that species, is described here as the new species *R. olivobrunnea*. Further, we publish the results of our type studies on *R. fusconigra* M.M.Moser, *R. intermedia* P. Karst., *R. aurantiolutea* Kauffman and *R. claroflava* var. *viridis* Knudsen & T.Borgen.

### Material and methods

To find specimens of *Russula olivobrunnea* in herbarium material, we studied specimens filed as *R. fusconigra* in IB, as *R. mollis* in PRM, as *R. olivascens* in H, KUO, M, O, OULU, PRM, S, TAA, TUR and UPS, and as *R. fusconigra*, *R. integra* and *R. nauseosa* in H, KUO, OULU,

TAA and TUR. In addition, most *Russula* spp. in H, KUO, OULU, TAA and TUR were checked. All specimens of *R. intermedia*, mostly filed as *R. lundellii*, rarely as *R. mesospora*, were examined in H, JOE, Joensuu Research Station, JYV, KUO, OULU, TUR and TURA. To find specimens of *R. groenlandica*, we checked all available specimens of *R. claroflava* var. *viridis* from C, *R. claroflava* from TUR and the greenish specimens of *R. claroflava* from O (the symbols according to Holmgren et al. 1990).

The colours of fresh specimens were compared with those in Küppers (1981) and Cailleux (1981). Spore masses from spore prints were placed between microscope slides and colour matched against the colour chart prepared by C. Dagron (Paris). Spores were studied and drawn in Melzer's reagent, and dermatocystidia of pileipellis, taken about half way between the margin and the centre, were studied and drawn from material treated with fuchsin and 5% hydrochloric acid and mounted in water. Other microscopical characters were drawn in 10% NH<sub>4</sub>OH, after staining with Congo Red. The spores were measured excluding the ornamentation, and the basidia lengths excluding the sterigmata. Soil samples were collected from the humus layer to a depth of 10 cm and analysed by Soil Analysis Service Ltd. (Finland).



Figs. 1–2. *Russula olivobrunnea*, photographed in situ. — 1: Young fruit bodies in rainy weather, x 0.9 (Ruotsalainen 2756F, KUO). — 2: Mature fruit bodies, x 0.8 (type). Photographs Juhani Ruotsalainen (1), Jukka Vauras (2).

**Russula olivobrunnea** Ruots. & Vauras, spec. nova — Figs. 1–7

Species media, pileo 3–18 cm lato, convexo, dein depresso, multicolore, saepe centro subnigro vel viridifusco et margine vinosobrunneo, margine obtuso et sulcato. Lamellae cremeae, postea flavescens. Stipes 6–13 cm longus, 1–2.5 cm crassus, albus. Carne alba, odore indistincto, sapore miti. Sporae in cumulo flavae (Romagnesi IVd), 9–12 x 7.5–10.5  $\mu\text{m}$ , verruculosae, verrucis usque ad 1.5  $\mu\text{m}$  altis. Basidia 4-sporigera, 37–71 x 13–20  $\mu\text{m}$ . Cystidia hymenii 65–115 x 10–19  $\mu\text{m}$ . Cutis cum dermatocystidiis 3–12  $\mu\text{m}$  latis. Habitatio: plerumque in silva calcarea in propinquitatem Picearum (*Picea abies*).

Type: Finland. Perä-Pohjanmaa: Rovaniemi rural municipality, Jaatila, Jaatilanvaara, Savioja, herb-rich mixed forest, by a brook, with *Picea abies*, *Betula*, *Populus tremula*, *Alnus incana*, *Prunus padus*, *Actaea erythrocarpa*, *A. spicata*, *Filipendula ulmaria*, *Oxalis acetosella*, *Paris quadrifolia*, Grid 27°E: 73490:4266, alt. 87 m, 19.VIII.1992 Juhani Ruotsalainen & Jukka Vauras 6877F (TURA 2606, holotype; KUO, isotype).

*Pileus* (3–)5–11(–18) cm in diam, first convex, soon depressed at centre, mixed of various colours, centre blackish, brown-black (Küppers S90Y20M30), dark brown (Y99M70C80), yellow-red-brown, green-brown (Y70M60C80, Cailleux 67R), brown-green (Y70M50C60, 77R, 89R), yellow-brown-greenish (Y70M30C30), greenish (Y99M50C70), margin red-brown (49R), yellow-red-brown (Y50M40C30), black-red-brown (Y99M70C80), dirty brown (Y50M40C40), brown-red, dirty brown-violet (35R, 25R), violet (Y50M60C60), yellow-green, blunt, sometimes undate, when young smooth, soon sulcate (up to 2 cm); surface shining when dry, viscid when moist, not pruinose, somewhat uneven, half of pileipellis peeling.

*Lamellae* normally crowded, thin, up to 16 mm broad, first cream coloured, later yellow (S00Y30M10), some forking at stipe apex, interveined, margin even, often up to 3 mm brown-red at pileus margin, no lamellulae; taste mild.

*Stipe* 6–13 cm long, 1–2.5 cm wide, mostly subclavate, longitudinally rugulose, not pruinose, base rounded; white, sometimes slightly brown at base when old, in exsiccatae mostly with pale brown tint; flesh in stipe moderately firm, spongy inside.

*Context* white, not colouring when cut, under pileipellis whitish to pale red-brown;  $\text{FeSO}_4$

gradually turning stipe red-brown, guaiacol fairly rapidly brown-red. Smell indistinct. Taste mild.

*Spores* in mass yellow (Romagnesi IVd), (9–)9.5–11.5(–12) x (7.5–)8–9.5(–10.5)  $\mu\text{m}$ , total range of mean values 10.0–10.9 x 8.2–9.2  $\mu\text{m}$ ,  $\bar{x}$  = 10.4 x 8.6  $\mu\text{m}$  (5 collections, 100 spores),  $Q$  = (1.1–)1.15–1.3, the average  $Q$  of 5 collections 1.22, warts large and isolated, cylindrical to cone-shaped, up to 1.5  $\mu\text{m}$  high, plage moderately amyloid, apiculus fairly small.

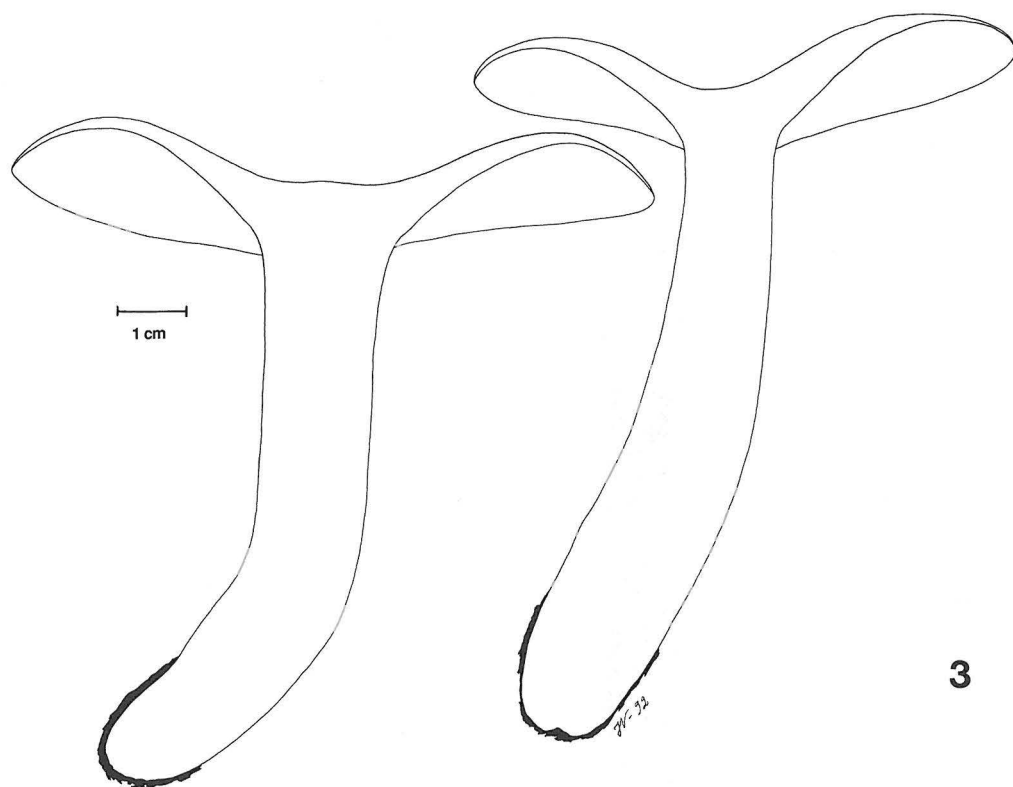
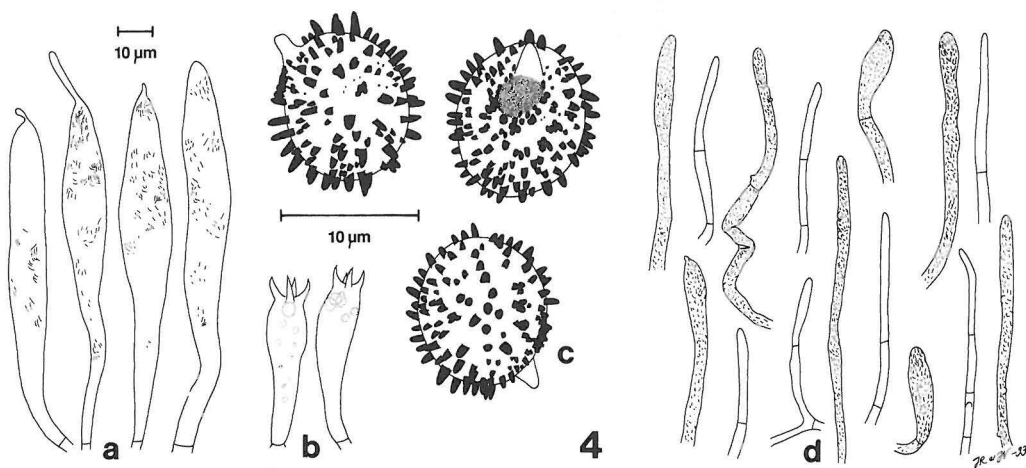
*Basidia* 37–71 x 13–20  $\mu\text{m}$ , clavate, 4-spored. *Hymenial cystidia* 65–115 x 10–19  $\mu\text{m}$ , blunt, acute or appendiculate.

*Apical cells of pileipellis* 1–4  $\mu\text{m}$  broad, cylindrical or tapering to apex. *Dermatocystidia* moderately abundant, 3–12  $\mu\text{m}$  broad, 0–3 septate, cylindrical to clavate, often with small lateral knobs, without encrusted elements.

## Distribution, ecology and phenology

*Russula olivobrunnea* is a fairly demanding, calciphilous species. In Finland it is found in eutrophic forests, with a distribution extending from the SW part of the country (Hemiboreal zone) up to Lapland (Northern Boreal zone), but concentrated in the northern part of the country (Fig. 5). The localities in Sweden and Norway are comparable with those in Finland. According to the label, the Austrian specimen was found in “saurer Nadelwald”, but in parentheses there is an addition “genauer Standort nicht ermittelbar”. This specimen was found among the material loaned from IB filed as *R. fusconigra* M.M.Moser.

*R. olivobrunnea* is typically a species of rich grass-herb forests dominated by *Picea abies* (Fig. 6), and *Picea* is its probable mycorrhizal host. Other trees recorded at the sites of *R. olivobrunnea* include *Alnus incana*, *Betula*, *Populus tremula*, *Salix caprea*, *Prunus padus* and *Pinus sylvestris*. Most growing sites of the species are moist, e.g. brook-sides and slope depressions with moving nutrient-rich water. In the southernmost Finnish locality in Paimio municipality, *R. olivobrunnea* was found at the margins of an abandoned limestone quarry. Typical herbs at the sites of *R. olivobrunnea* include *Oxalis acetosella*, *Paris quadrifolia* and *Rubus saxatilis*. Often it grows in the same locality with the rare and threatened orchids *Calypso bulbosa* and *Cypripedium calceolus*. In fact, many localities of *R. olivobrunnea* in Fin-

**3****4**

Figs. 3–4. — 3: Fruit bodies of *Russula olivobrunnea*, x 1 (type). — 4a–d: Microscopical details of *Russula olivobrunnea* (from type). a) hymenial cystidia, b) basidia, c) spores, d) elements of pileipellis. Scales: spores x 2000, others x 500



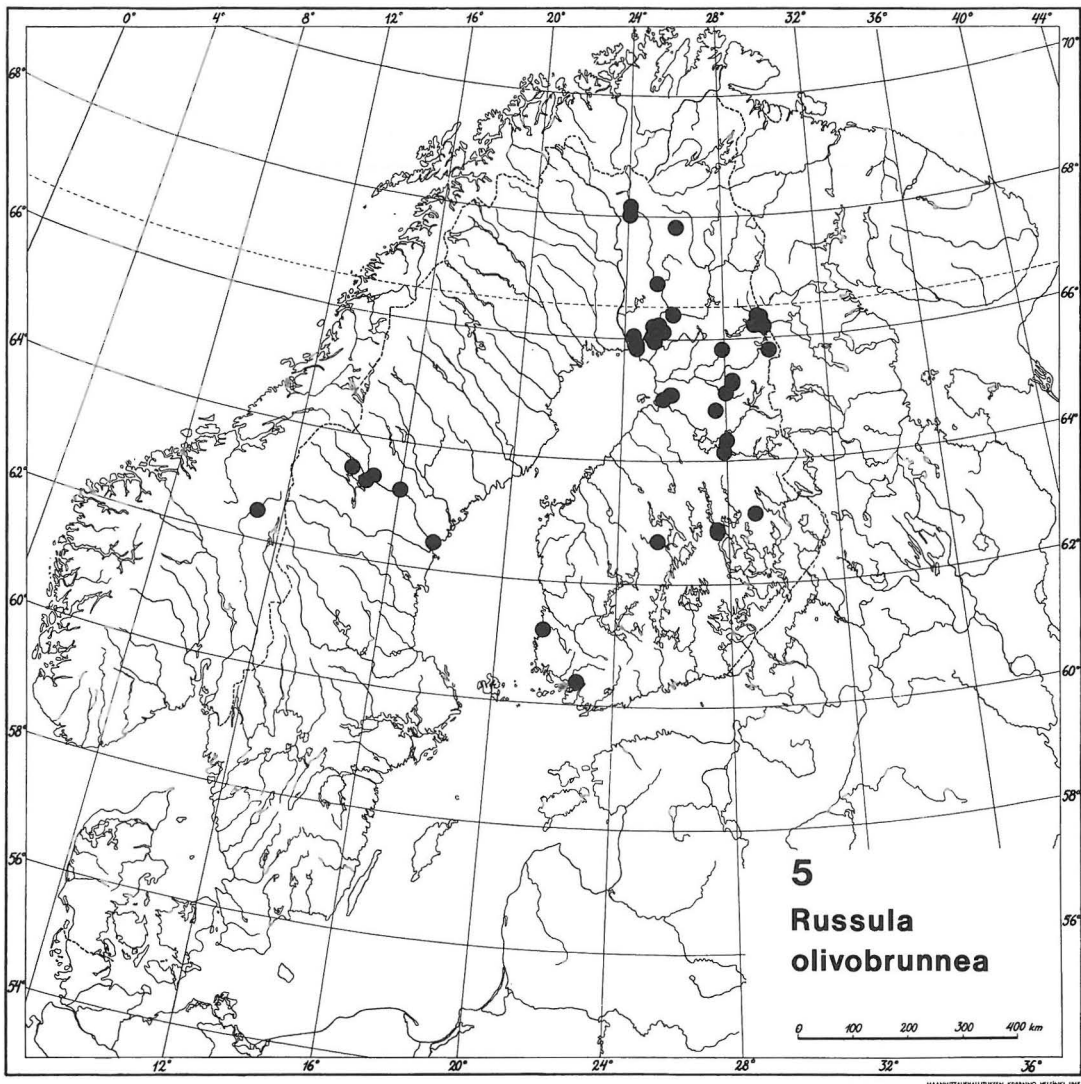


Fig. 5. Distribution of *Russula olivobrunnea* in Fennoscandia according to the material examined.

land are included in the national protection programme for herb-rich forests.

Fungi sharing localities with *R. olivobrunnea* include *Calocybe onychina* (Fr.) Donk, *Gerronema prescottii* (Weinm.) Redhead, *Inocybe armeniaca* Huijsman, *I. leucoblema* Kühner, *I. maculata* Boud., *I. muricellata* Bres., *I. nitidiuscula* (Britzelm.) Sacc., *Lactarius deterrimus* Gröger, *L.*

*scrobiculatus* (Scop.: Fr.) Fr., *L. zonarioides* Kühner & Romagn., *Russula nauseosa* (Pers.) Fr., *R. olivina* Ruots. & Vauras, *R. postiana* Romell, *R. queletii* Fr., *R. formula* Jul. Schöff., and *Tephrocybe rancidum* (Fr.) Singer. The soil pH of two sites of *R. olivobrunnea* analysed was 5.6 and 6.3. Further soil analysis data are given in Table 1.



Fig. 6. Growing site of *Russula olivobrunnea* in Finland, Koillismaa, Kuusamo, Oulanka National Park, S foot of the hill Ampumavaara. Photograph 23.VIII.1992 Jukka Vauras.

In Finland the fruiting period of *R. olivobrunnea* starts in late July, reaching a maximum in mid-August — mid-September, and ceasing in late September — mid-October (Fig. 7). The species has been collected in Finland every year since 1986. According to the number of collections examined, the most favourable years for the fruiting of the species were 1986, 1988 and 1992. Several collections even date from 1987, when the summer was rainy and exceptionally cool.

#### *Specimens examined*

**Finland.** Varsinais-Suomi: Paimio, Kurki, 1991 *Ruuskainen & Vauras* 6230, 6231 (TUR), 1992 *Vauras* 7575 (TURA, KUO, M, O), 1993 7577 (TURA, S), 7870 (TURA), 1993 *Vauras* 9010 (TUR). Satakunta: Rauma rural municipality, Sorkka, 1991 *Vauras* 6133 (TURA). Pohjois-Häme: Saarijärvi, Linnankylä, 1989 *Vauras & Ruotsalainen* 1538 (KUO). Pohjois-Savo: Kuopio, Matkusjärvi, 1986 *Ruotsalainen* 453 (KUO), 1987 *Ruotsalainen* 602, 660a (KUO), 660b (TAA), 682b (KUO), 683F (KUO, O, TUR), 708, 827 (KUO), 1988 *Vauras & Ruotsa-*

Table 1. Surface soil characteristics at two growing sites of *Russula olivobrunnea* in Finland. 1) Varsinais-Suomi: Paimio, Kurki, old limestone quarry, 29.IX.1992. 2) Perä-Pohjanmaa: Rovaniemi rural municipality, Jaatila, Savioja (type site), 24.VIII.1991.

Growing site	pH	Ca mg/l	K mg/l	Mg mg/l	P mg/l
1	5.6	4280	99	147	7
2	6.3	3150	120	700	7

lainen 1000, Ruotsalainen 1001F, 1147 (KUO), Ruotsalainen & Vauras 3129F (TURA), Vauras 3131F (TURA, MICH, UPS), 1989 Ruotsalainen 1452, Vauras & Ruotsalainen 1543, Ruotsalainen 1548 (KUO), Vauras 3777 (TURA), 1990 Ruotsalainen 1866, 1976 (KUO), 1991 Ruotsalainen 2338a (KUO), 1992 Ruotsalainen 2632, 2756F, 2757 (KUO), Vauras 6799 (TURA), 1993 Ruotsalainen 3295 (KUO), Vuorilampi, 1986 Ruotsalainen 411 (KUO). Pohjois-Karjala: Juuka, Polvela, 1993 Ruotsalainen 3323a, 3323b (KUO). Kainuu: Paltamo, Mieslahti, 1988 Kytövuori 88–829 (H); Puolanka, Pihlajavaara, 1990 Kytövuori 90–230 (H), 1992 Kytövuori 92–2162 (H), Suolijärvi, 1988 Kytövuori 88–885, 88–887 (H); Sotkamo, Kontinijoki, 1986 Ulvinen (OULU); Suomussalmi, Kurkikylä, 1992 M. Ohenoja (OULU). Oulun Pohjanmaa: Kiiminki, Kesikylä, 1970 E. & M. Ohenoja (OULU), Ulvinen (OULU), 1990 E. Ohenoja (OULU), 1991 Kaukonen et al. (OULU); Oulu, Patamäki, 1988 E. Ohenoja (OULU). Perä-Pohjanmaa: Keminmaa, Kallinkangas, 1986 E. Ohenoja (OULU), (2 ex.) Tammilehto (OULU), 1987 (2 ex.) Tammilehto (OULU), 1989 M. Ohenoja (OULU), 1990 Ulvinen (OULU); Rovaniemi rural municipality, Jaatila, 1990 Vauras 4892 (TURA, C), Meltaus, 1976 Ulvinen (OULU), Taipale, 1988 Kytövuori 88–1482 (H); Tervola, Lehmikumpu, 1978 Ulvinen (OULU), Pahtaoja, 1986 E. Ohenoja & Vuorinen (OULU), Peura, 1986 Ulvinen (OULU), 1992 Kytövuori 92–1791 (H), Vähäjoki, 1992 Kytövuori 92–1714 (H); Tornio, Kalkkima, 1986 (2 ex.) Ulvinen (OULU), 1989 Vauras (KUO), 1992 Höijer 614 (TUR), Runteli, 1992 Kytövuori 92–1908, 92–1909 (H). Koillismaa: Kuusamo, Ampumavaara, 1988 Kytövuori 88–933 (H), Ruotsalainen 1137 (KUO), 1992 Vauras & Ruotsalainen 2722F, 2723F (KUO), Ruotsalainen & Vauras 7014 (TURA), Iivaara, 1978 Korhonen & Tuomikoski 2209 (H), 1993 Ruotsalainen 3202aF, 3202b (KUO), Liikasenvaara, 1977 Ulvinen (OULU), Paljakka, 1992 Kytövuori 92–1494, 92–1495 (H), Valtavaara, 1987 Ulvinen (OULU); Taivalkoski, Katajavaara, 1986 E. Ohenoja (OULU), Kylmälä, 1972 E. & M. Ohenoja (OULU). Kittilän Lappi: Kittilä, Pallasjärvi, 1990 Kytövuori 90–300 (H), Tarpomapää, 1988 Kytövuori 88–1171 (H). Enontekiön Lappi: Enontekiö, Vuontisjärvi, 1988 Kytövuori 88–1351 (H).

**Norway.** Hedmark: Tynset, Tolga–Os, Höystad, 1986 Kytövuori 86805 (H).

**Sweden.** Medelpad: Alnön, Alnö, 1986 Kytövuori 86663 (H); Torp, Tubbo, 1989 Vauras & Ruotsalainen 1507 (KUO). Jämtland: Lit, Häggenäs, Storhögen — Högarna, 1989 Kytövuori 89–556 (H); Offerdal, Västerberg, 1982 E. Ohenoja (OULU); Rödön, Äs, Åskott, 1989 Kytövuori 89–534 (H).

**Austria.** Tirol: Mutters, 1978 Klima (Moser 78–350; IB).

## Discussion

*Russula olivobrunnea* is an intermediate species between the sections *Puellarinae* (Singer) Jul. Schäff. and *Polychromae* Maire. However, as a species closely related to *R. olivina* Ruots. & Vauras, we prefer to place it in the first-

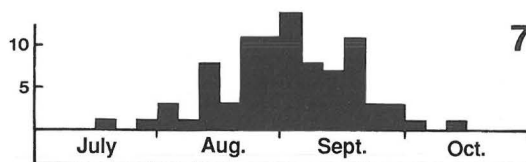


Fig. 7. Fruiting period of *Russula olivobrunnea* according to the material examined, divided into pentads.

mentioned section, and further in subsection *Laricinae* (Romagn.) Bon.

The ecology and Nordic distribution of *R. olivobrunnea* and *R. olivina* are fairly similar, and the species are about equally rare. Although they have much in common in macroscopical and microscopical characters, they also differ in many ways. *R. olivobrunnea* is more robust, the colours of the pileus are darker, the spores are darker in mass (Romagnesi IVd versus IVb(c) in *R. olivina*) and basidia are 4-spored. Further, the spores of *R. olivobrunnea* are somewhat smaller and have shorter and broader spines (cf. Ruotsalainen & Vauras 1990). The pileus of *R. olivina* is characteristically yellow-green to brown-green. However, in 1992, in Kuusamo, Oulanka National Park, Ampumavaara, we saw a few fruit bodies of *R. olivina* that had a reddish tint at the margin of their pileus. Green forms of *R. olivobrunnea* are easily recognized under the microscope by the 4-spored basidia and the ornamentation of spores.

In Finland, *R. postiana* Romell also grows on rich *Picea abies* sites, and sometimes in the same forests as *R. olivobrunnea* but on drier sites. In general it has a more southern distribution than *R. olivobrunnea*, but is also known up to Perä-Pohjanmaa (Keminmaa municipality) and Koillismaa (Kuusamo municipality). Typical characters of *R. postiana*, distinguishing it from *R. olivobrunnea*, are the more even and, when dry, more matt pileus; the often inflexed pileus margin; the more orange tinted lamellae; the more pruinose stipe, often with a clear smell of iodoform at base when collected; the smaller spores, often with crests; and the pileipellis with primordial hyphae strongly encrusted.

*R. nauseosa* (Pers.) Fr. has sometimes been found at the same sites as *R. olivobrunnea*. The fruit bodies of *R. nauseosa* also have a pileus with sulcate margin. However, they are usually smaller and more slender, the spore mass is paler (IVb), and the spores are smaller. *R. integra* (L.) Fr. s. Maire is a more robust species with a southern distribution in Finland.

*R. fusconigra* M.M.Moser differs from *R. olivobrunnea* in the paler (IIIa-c in mass) and somewhat smaller spores ( $8-11 \times 6.8-8 \mu\text{m}$ ), ornamented with a few connections, and in the narrower ( $8-12 \mu\text{m}$ ) hymenial cystidia. According to Moser (1978) the species grows "in silvis coniferis paludosis vel sphagnetis sub *Pino silvestri*". We have studied the holotype of *R. fusconigra* (Sweden, Småland, Femsjö, E side of the lake Södra Färjen, 28.VIII.1976 M. Moser 76-187 (IB)). Drawings of some microscopic characters from the holotype are given (Fig. 8) for comparison and to complete the original description in Moser (1978). In our opinion *R. fusconigra* comes close to *R. sphagnophila* Kauffman, and belongs to the section *Puellarinae*. *R. fusconigra* has been reported from Finland by Ulvinen et al. (1981) and Korhonen & Vauras (1986). However, we did not find in Finnish herbaria any specimens fitting to the type of that

species.

The acid species *R. firmula* Jul. Schäff. also has been met in Finland, close to *R. olivobrunnea* in calcareous spruce forests. If not tasted, it may be confused with *R. olivobrunnea* or *R. postiana*. As exsiccatae, *R. firmula* differs from *R. olivobrunnea* in its somewhat smaller spores ( $8-10 \times 7-8.5 \mu\text{m}$ ) with spines in a denser pattern, and in its pileipellis with encrusted pileocystidia. The last is an overlooked character which we have encountered in some taxa of the section *Urentinae* (Maire) Schäff. We recommend the study of pileipellis with fuchsin instead of or in addition to sulphovanillin as a routine practice in the examination of this section.

### *Russula intermedia* P.Karst. — Figs. 9–11

*Russula intermedia* P.Karst., Medd. Soc. Fauna Flora Fennica 16: 38. 1888. — Type: Finland. Tavastia australis: Tammela, Harju, VIII. 1894 P.A. Karsten 3211 (H, neotype; selected here).

*Russula aurantioleuca* Kauffman, Rep. Michigan Acad. Sci. 11: 81. 1909. — Type: USA. Michigan: Emmet Co., Bay View, 19.IX.1906 C.H. Kauffman (MICH, lectotype; selected by Shaffer 1970, Art. 8.3. (Greuter & McNeill 1993:209)).

*Russula pulcherrima* S.Lundell & Jul.Schäff., Ann. Mycol. 36: 31. 1938, nom illeg. (Art. 64.1., non *Russula pulcherrima* Velen.). — Type: Sweden. Upland: Upsala, Stadsparken, about 200 m S of Skogshall. Amongst mosses

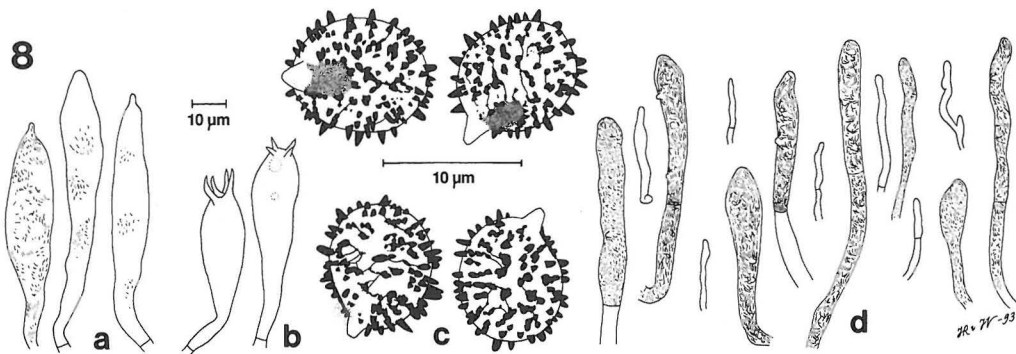


Fig. 8a–d. Microscopical details of *Russula fusconigra* (from holotype, IB). — a) hymenial cystidia, b) basidium, c) spores, d) elements of pileipellis. Scales: spores  $\times 2000$ , others  $\times 500$ .



and grasses, *Equisetum hiemale* and *Rubus saxatilis*, under birches and mountain-ashes in moist spot in mixed wood, 30.VII. & 12.VIII.1936 *Seth Lundell*; Lundell & Nannfeldt, Fungi Exs. Suec. Ups. 723 (UPS, lectotype; selected here).

*Russula lundellii* Singer, Bull. Soc. Mycol. France 54: 159. 1938. — Type: homotypic with *R. pulcherrima* S. Lundell & Jul. Schäff.

*Russula mesospora* Singer, Bull. Soc. Mycol. France 54: 161. 1938. — Type: not existing ?.

P.A. Karsten described only a few new species of the genus *Russula*. One of those was *R. intermedia*. Unfortunately this name has been nearly completely overlooked. Romagnesi (1967) interpreted it as a synonym to *R. badia* Quél. (with a question mark). The protologue of *R. intermedia* (Karsten 1888) is brief, giving the idea of a yellow-spored acrid species, which in Karsten's sense was "inter *R. emeticam* Harz. et *R. integrum* Linn. media", growing in SW Finland, the municipality of Tammela "in regione Mustialensi rara". No type material of *R. intermedia* exists in H. Later (Karsten 1891), the same description was published in Swedish. After a further find of the species ("in betuleto prope Harju in Tammela"), Karsten gave a fuller description in 1894 in Swedish and in 1895 in Latin. Fortunately, this last collection, consisting of three fruit bodies matching those of the well-known species *R. lundellii* (cf. Fig. 9), is preserved in fairly good condition in H. There is no disagreement

between Karsten's description and the present concept of *R. lundellii*, and the collection is selected here by us to represent the neotype of *R. intermedia*.

The study of the neotype of *R. intermedia* showed the following details. Spores 7–8 × 6–7 µm, mean value 7.4 × 6.3 µm, Q = (1.05–)1.1–1.25(–1.35), average Q = 1.17, subglobose, verruculose, occasionally with some jointure, warts often in rows, blunt, up to 1 µm high. Basidia 44–60 × 9–13 µm, clavate, 4-spored. Cheilocystidia 9–11 µm broad. Apical cells of pileipellis 2–3 µm broad, cylindrical to somewhat clavate, staining in fuchsin. Dermocystidia 4–10 µm broad, cylindrical, long, rarely septate, pale violet in sulphovanillin.

An excellent description of *R. intermedia* was given by Schäffer (1938) under the name *R. pulcherrima*. However, since that name had been appropriated earlier by Velenovsky (1920–1922) for another species, Singer (1938) gave the taxon a new name, *R. lundellii*. In the same paper, Singer described a new species, *R. mesospora*, which in our opinion is identical with *R. intermedia*. Schäffer (1938) described the stipe of *R. pulcherrima* as white: "Stipe immer bleibend reinweiss, nie rot". We have often seen *R. intermedia* in Finland in different localities and in abundant occurrences, and have never seen red on the stipes. However, red has been reported on the stipe of *R. lundellii*, at least

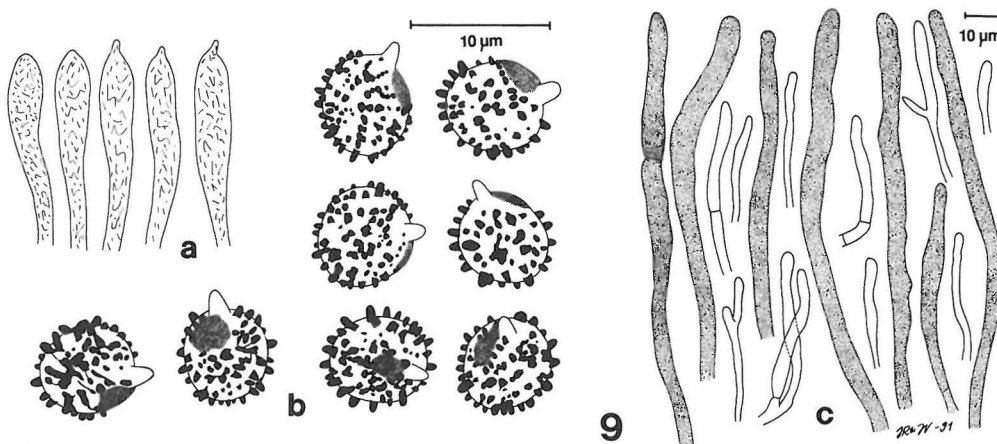


Fig. 9a–c. Microscopical details of *Russula intermedia* (from neotype, H). — a) hymenial cystidia, b) spores, c) elements of pileipellis. Scales: spores × 2000, others × 500.

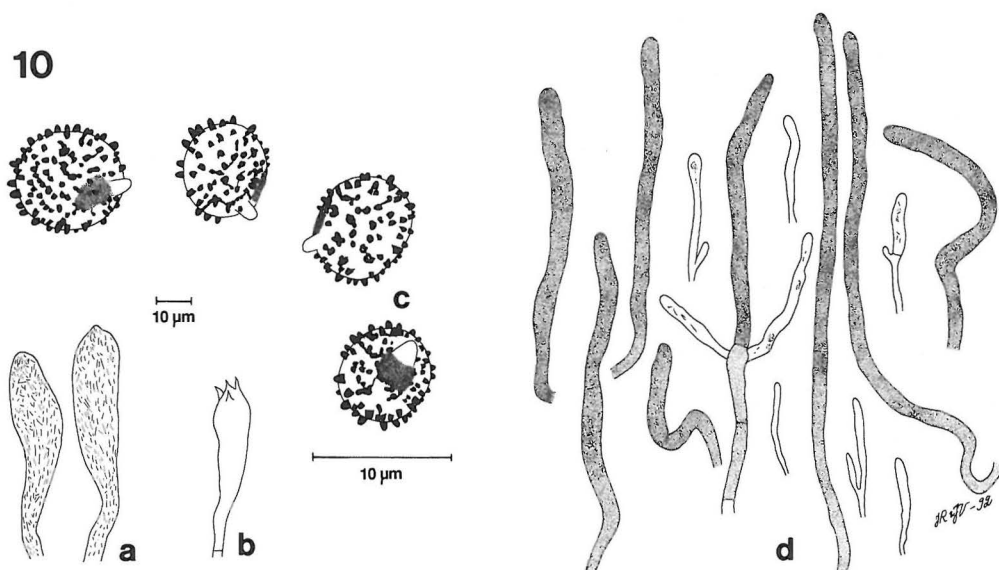


Fig. 10a–d. Microscopical details of *Russula intermedia* (from syntype of *R. aurantiolutea*, NY). — a) hymenial cystidia, b) basidia, c) spores, d) elements of pileipellis. Scales: spores  $\times 2000$ , others  $\times 500$ .

rarely, by Michael et al. (1983), Rayner (1985), Knudsen & Stordahl (1992), and Singer (1938) describes it for *R. mesospora*. Perhaps there has been some confusion with a species rare in Europe, *R. tenuiceps* Kauffman. To us, it is a more slender red to orange species with stipe often white but sometimes of a red shade. Its spores are in mass somewhat paler than those of *R. intermedia*. The species differs microscopically from *R. intermedia* in its more ellipsoidal spores ( $7\text{--}9 \times 6\text{--}8 \mu\text{m}$ ) and shorter and broader dermatocystidia. Moreover, it is much more acrid than *R. intermedia*, which, as Schäffer (1938) had noted in the protologue of *R. pulcherrima*, is “magis amaro quam acri”.

We have seen *R. tenuiceps* in various parts of Finland, but fairly rarely. Most often it grows with *Betula*. Ohenoja (1992) has reported the species from northern Finland, Perä-Pohjanmaa, Keminmaa, Kallinkangas area. Further, some specimens included in an earlier map of *R. lundellii* in Finland (Vauras 1981) can now be identified as *R. tenuiceps*. A photograph of the species was published recently as *R. mesospora* (Dähncke

1993: 933). When we checked from C and UPS four syntypes of *R. pulcherrima* S.Lundell & Jul. Schäff., collected by S. Lundell in 1933, 1936 and 1937 we found each of them to include one fruit body of *R. tenuiceps*. However, the majority of fruit bodies of these collections represented *R. intermedia*, to which species the protologue of *R. pulcherrima* fits excellently. Apparently the exsiccate of Fungi Exs. Suec. Ups. 723 is a mixed collection. The exsiccate specimen housed in UPS includes, in addition to one fruit body of *R. tenuiceps*, one fruit body and three halves of *R. intermedia*. This last mentioned part of the specimen is selected here to represent the lectotype of *R. pulcherrima* S.Lundell & Jul.Schäff.

*R. intermedia* is fairly common in fertile forests of southern, central and eastern Finland, especially in eastern Finland, where it flourishes in forests slashed and burnt a century ago. Today, such forests often are mixed forests dominated by *Betula* and *Picea abies*. *R. intermedia* grows with *Betula*, but is rare in Northern Finland (Fig. 11). It is worth adding that we have found *R. intermedia* in two localities

close to the Mustiala College of Agriculture, where P.A. Karsten lived and taught (1985 Vauras 1698, KUO; 1990 Vauras 5073, TUR, TURA, UPS; 1991 Vauras 6194, TURA).

On the basis of our study of two syntype specimens of *R. aurantiolutea* and a close reading of Shaffer's (1970) paper, we interpret this North American species as conspecific with *R. intermedia*. We were unable to find any microscopical differences between the two species. However, according to the diagnoses by Kauffman (1909) and Shaffer (1970), the pileus of *R. aurantiolutea* is dominantly yellow, whereas the pileus of *R. intermedia* in Finland is dominantly red (like *R. paludosa* Britzelm.), though we have also seen fruit bodies of *R. intermedia* with a yellow to orange to even nearly white pileus in Finland. Some uncertainty remains, however, because Kauffman (1909) states that *R. aurantiolutea* is "often very acrid" and has "8–9 micr." long spores.

Our measurements of a syntype specimen of *R. aurantiolutea*, wrongly indicated as an isotype on the label (USA. Michigan: Houghton, 15.VIII.1906 C.H. Kauffman; NY), gave the following results. Spores  $6.5\text{--}7.5 \times 6\text{--}6.5 \mu\text{m}$ , mean value  $7.0 \times 6.1 \mu\text{m}$ ,  $Q = 1.1\text{--}1.2(-1.25)$ , average  $Q = 1.15$ . Basidia  $45\text{--}51 \times 10\text{--}12 \mu\text{m}$ , 4-spored. Hymenial cystidia  $11\text{--}14 \mu\text{m}$  broad. Apical cells of pileipellis  $2\text{--}4 \mu\text{m}$  broad. Dermatocystidia  $4\text{--}7 \mu\text{m}$  broad, long, cylindrical, without septa (Fig. 10). Another syntype collection studied: locality not indicated, 6.VIII.1906 Kauffman (MICH). In the protologue Kauffman (1909) states that he has seen *R. aurantiolutea* in collections made in "July, August and September. Earlier in southern Michigan." For this reason the specimen cited by Shaffer (1970) can not be the holotype. Shaffer's citation must, however, be treated as an unintentional lectotypification (Art. 8.3).

### ***Russula groenlandica* Ruots. & Vauras, nom. et stat. nov. — Fig. 12**

*Russula claroflava* var. *viridis* Knudsen & T.Borgen, Persoonia 14: 514, 1992. — Type: Greenland. Sønder Strømfjord, Hasselfjeld, with *Betula nana*, alt. 100 m, 19.VIII.1987 Hennig Knudsen 87.230 (C, holotype; examined).

After examining one freeze-dried fruit body of the holotype and four additional specimens of *Russula claroflava* var. *viridis*, determined by H. Knudsen, we concluded that this taxon is worthy of the rank of species. Already in the original description,

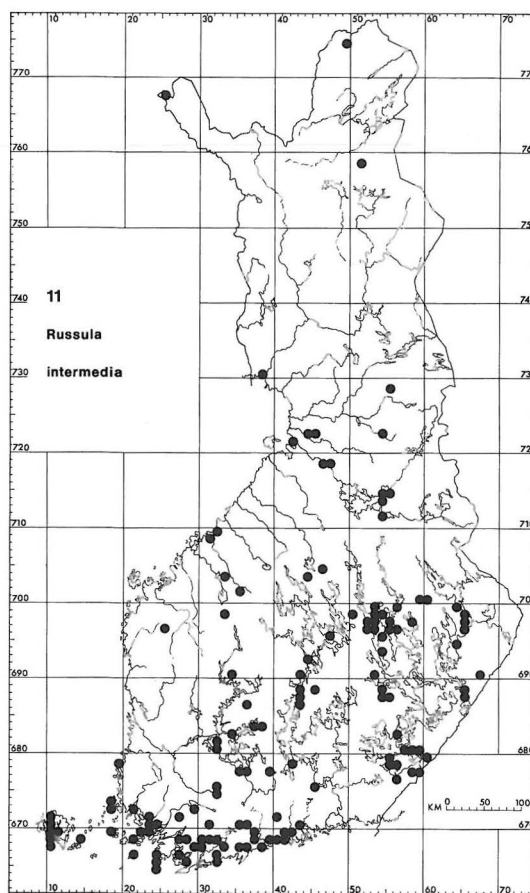


Fig. 11. Distribution of *Russula intermedia* in Finland according to the specimens examined.

Knudsen & Borgen (1992) reported two interdependent characters that distinguish *R. claroflava* var. *viridis* from *R. claroflava* var. *claroflava*: the intense green colour of the pileus and the broader spores. Our microscopical study revealed that the taxa also differ in spore ornamentation; in average length of spores, hymenium cystidia and basidia; and in pileipellis (Fig. 12, Table 2). The colour of *R. groenlandica* spores in mass is not yet exactly known. Because the name *Russula viridis* has been appropriated earlier (Velenovský 1920–1922, Cleland 1934), the present species needed a new name.

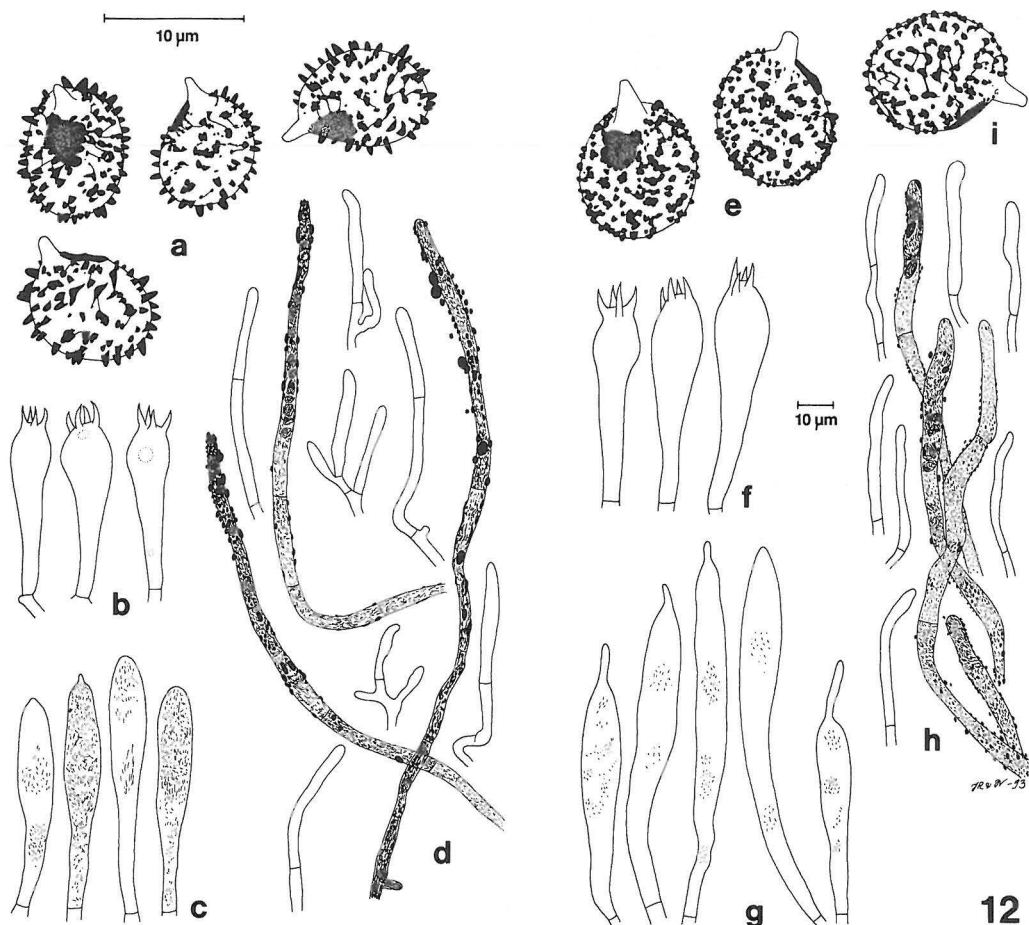


Fig. 12a-i. Microscopical details. — a-d. *Russula claroflava* (Finland, Pohjois-Savo, Vehmersalmi, Ruotsalainen 1269F, TURA). a) spores, b) basidia, c) hymenial cystidia, d) elements of pileipellis. — e-i. *R. groenlandica*. e, i) spores, f) basidia, g) hymenial cystidia, h) elements of pileipellis. (e-h from holotype of *R. claroflava* var. *viridis*, C; i from Knudsen, Borgen & Petersen 636, C). Scales: spores  $\times 2000$ , others  $\times 500$ .

Microscopically *R. groenlandica* shows affinity to *R. pubescens* A. Blytt. Both species have fairly similar ornamentation on the spores, and their encrusted fuchsinophile hyphae of pileipellis lie in clusters. *R. pubescens*, which has a wide boreal distribution, is a greying species closely related to *R. vinosa* Lindblad (Ruotsalainen & Vauras 1991).

In Finland, *R. claroflava* Grove is one of the most easily recognized *Russula* species, characterized by its beautiful yellow pileus, greying

flesh when old, and mild taste. When growing in shady sites, the pileus often is of mixed yellow and yellow-brown colour; but the greenish shade is much rarer and never intense.

#### *Specimens examined*

**Canada.** Newfoundland, Schaefferville, 30 km S of the town, 15.8.1963 Kallio 509 (TUR).

**Greenland.** Kangilineq, 28.VIII.1983 Borgen 84.195 (C). Narssarssuaq, 21.VIII.1983 Knudsen, Borgen & Petersen 636 (C), 9.VIII.1984 Knudsen & Laessøe 84.515 (C).



Table 2. Comparison of some characters of *R. claroflava* and *R. groenlandica*. Spore measurements are based on 100 spores from five collections of *R. claroflava* (spores from spore prints), and 50 spores from the holotype of *R. claroflava* var. *viridis* (spores lying on lamellae).

	<i>R. claroflava</i>	<i>R. groenlandica</i>
Pileus colour		
mainly	yellow	green
Spores		
ornamentation	warts mostly narrow, relatively acute	warts broader, blunt
Size	8–9.5(–10) x 6.5–7.5(–8) µm	8.5–10.5(–11) x (7–)7.5–8.5(–9) µm
$\bar{x}$	8.6–8.8–9.1 x 6.7–7.0–7.1 µm	9.3 x 8.0 µm
Q	(1.15–)1.2–1.35(–1.4)	(1.05–)1.1–1.25(–1.3)
Average Q	1.24–1.26–1.29	1.17
Basidia	39–57 x 9–17 µm	50–69 x 11–18 µm
Hymenium cystidia	61–83 x 9–13 µm	76–111 x 10–17 µm
Encrusted fuchsinophile hyphae of pileipellis	narrower, mostly even	broader, relatively uneven
Location	mainly diffuse	in clusters
Encrustation	relatively diffuse, as round granules	on hyphae, often plate-like

Søndre Strømfjord, Hasselfjeld, 19.VIII.1987 *Knudsen* 87.230 (holotype, C); Ravneklippen, 18.VIII.1946 *M. Lange* (C).

**Norway.** Oppland: Sør-Fron, syd for Langfjorna, 25.VII.1980 *Stordal* 20682 (O).

Specimens of *R. claroflava* used in microscopical measurements (Table 2): Finland. Ahvenanmaa: Lemland, Flaka, 10.IX.1992 *Vauras* 7409 (TURA). Varsinais-Suomi: Kustavi, Rahi, Leonsaari, 14.IX.1990 *Vauras* 5169 (TURA). Perniö, Mathildedal, 14.VIII.1991 *Vauras* 5753 (TURA). Pohjois-Savo: Vehmersalmi, Putroniemi, 14.VII.1989 *Ruotsalainen* 1269F (TURA). Oulun Pohjanmaa: Oulu, Sangin-suu, Peräkylä, 19.VIII.1989 *Vauras* 3617 (TURA).

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