

NEW AND RARE TAXA OF RUSSULA FROM GREENLAND

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A new species and a new variety of *Russula* based on a number of annotated collections, photographs and field observations are described. *Russula violaceoincarnata* Knudsen & Borgen, spec. nov., presumably belongs in section *Polychromae* Maire and is associated with *Betula* and *Salix* in southwest Greenland. *Russula claroflava* var. *viridis* Knudsen & Borgen, var. nov., is associated with *Betula* and known from Greenland and Norway. *Russula maculata* Quél. ssp. *alpina* (Sing.) Knudsen & Borgen, stat. nov., is proposed and reported from Greenland, Svalbard and Siberia, and *R. citrinochlora* Sing. and *R. consobrina* Fr. are reported as new to Greenland.

In a preliminary paper Knudsen & Borgen (1982) presented a list of *Russula* species from Greenland. However, already at that time, we were unable to identify a number of the species. Some of these are described or commented on in this paper, but it should be emphasized that many other species have been recorded since the 1982 paper; they will be treated in a forthcoming flora of Greenlandic basidiomycetes.

Unless otherwise stated the colours referred to are from Kerner & Wanscher (1974). Unfortunately it was not possible to study the microscopical details in fresh condition. They were studied on herbarium material in Melzer's solution or sulphovanillin (epicutis). The spore-measurements are exclusive of the ornament. All material cited is deposited at the Herbarium at Copenhagen (C).

Russula violaceoincarnata Knudsen & Borgen, spec. nov.—Pl. 1, Fig. 1

Pileus 4–11 cm latus, rubro-violaceus vel fuscido-violaceus, in parte centrali vel aliis partibus mox pallescens, viscidus, margine laevi; lamellae colorem ochraceum lente trahentes; stipes 2.5–6 cm altus, 0.8–2.6 cm crassus, cylindricus, albus, lente fuscescens; sapor mitis vel paululum acer; odor exiguus, fructuosus. Sporae 7–8(–9.5) × (5.5–)6.5(–7) μm magnae, late ellipsoides vel subglobulares, lineis subtilibus et costis catenulatis reticulatae, in massa ochraceae vel dilute flavae (Romagnesi IV a). Epicutis dermatocystidia praebens satis longa, 4–8 μm lata, sulphovanillino colorata. *Betulae* spp. et *Salici* spp. associata.

Holotypus die 21 Augusti anni 1983 ad nemus Rosenvinges Plantage prope oppidum groenlandicum Narsarsuaq situm sub numero 83.622 a H. Knudsen, T. Borgen, J.H. Petersen lectus, siccus in Museo Botanico Hauniensi depositus.

Pileus at first slightly convex but soon becoming applanate and eventually slightly depressed at centre, 4–11 cm broad, somewhat viscid, becoming smooth and shining in dry weather; margin rather obtuse, even, smooth or indistinctly sulcate in old specimens; cap cuticle peeling up to half-way; flesh underneath with tinge of pileus colour; margin and young

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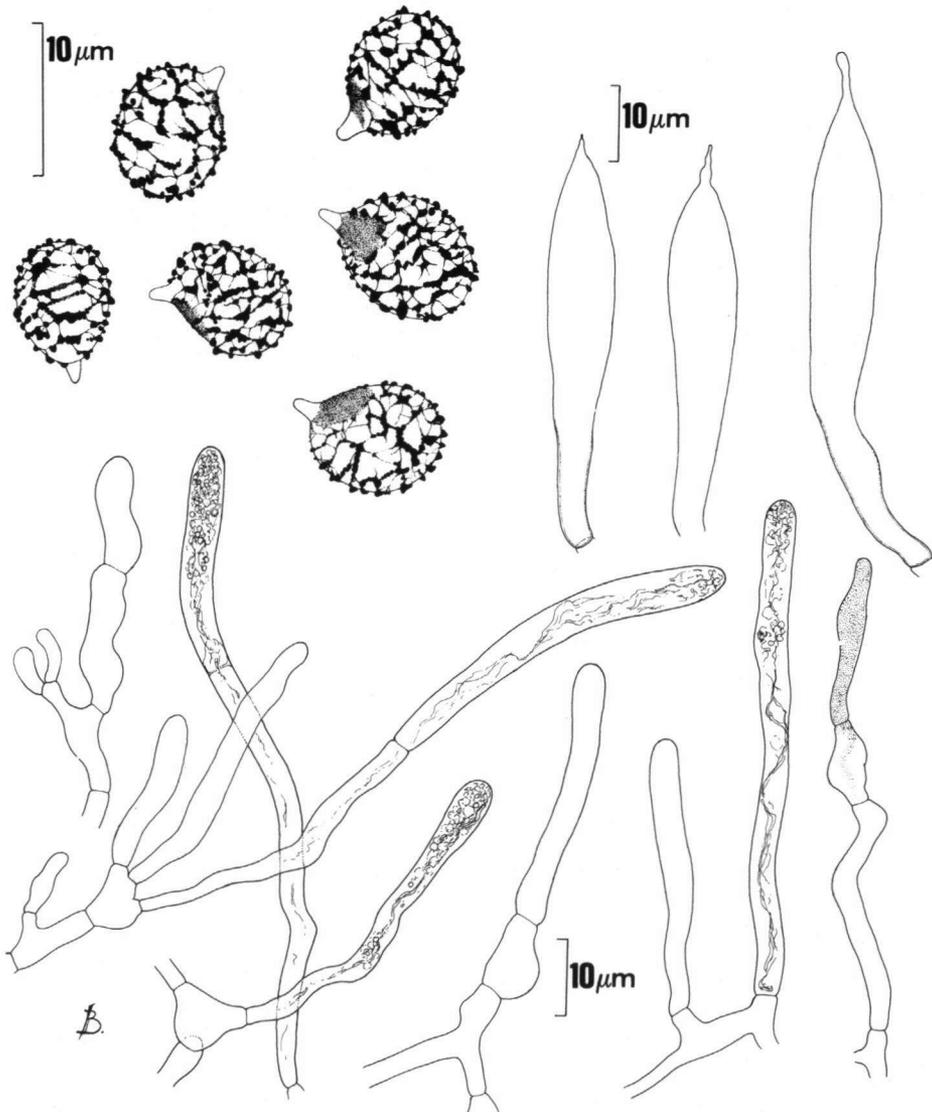


Fig. 1. *Russula violaceoincarnata*.—Spores, cheilocystidia and elements from epicutis (from type).

pilei greyish brown-red (9 E 5–6, 9 CD 4–5; Séguy c. 111, 'chatain'), violaceous brown (11 E 4; Séguy 115), greyish ruby (12 E 5–6; Séguy 687), brownish orange (7 CD 4; Séguy 177–179) or greyish violet (17 E 4–5; Séguy 26–28), fading towards centre to paler tinges and at centre rapidly discolouring to greyish with pale olivaceous shine (2 B 2; Séguy 329,

'glaucque verdâtre'), buff, off-white or yellowish, more rarely greyish yellow (4 C 4; Séguy 261–262, 'vert bistré, vert pyrite'). Lamellae at first whitish, slowly becoming ochre, finally with brown dots, adnate-adnexed or slightly emarginate, slightly ventricose to almost horizontal, normally spaced (c. 10 per cm at margin), 4–5 mm broad, fragile; lamellules absent; gill edge even. Stipe cylindric or slightly swollen at base, more rarely almost obclavate, 2.5–6 × 0.8–2.6 cm, dry, mat, pruinose, surface slightly venose-reticulate, white, slowly becoming brown or brownish incarnate towards the base. Flesh in stipe firm, in pileus firm and generally as thick as the lamellae are broad except at margin of cap, white, very slowly becoming pale brown when cut. Taste mild or slightly acrid in young lamellae. Smell weak, indistinct or sweetish-fruity. Spore-print pale yellow (IVa in Romagnesi's (1967) system). Chemical reactions: ferrosulphate in stipe rapidly dirty vinaceous, then more brownish yellow; guaiacol immediately dark apricot becoming paler than brick.

Spores (Fig. 1) 7–8(–9.5) × (5.5–)6.5(–7) μm, Q = 1.2–1.4, broadly ellipsoid with distinct ribs or catenulate connections forming a reticulum with prominent warts up to 0.7 μm high, with amyloid plage and large apiculus. Basidia 40–50 × 8–12 μm, clavate, 4-sterigmate. Cheilocystidia (Fig. 1) fusoid, often mucronate, rather sparse, 50–60(–70) × 6–8(–10) μm. Epicutis (Fig. 1) with scattered, long, cylindric or slightly clavate dermatocystidia, 4–8 μm broad, non-septate or with a single septum, reacting brown or more rarely bluish black in sulphovanillin.

E c o l o g y.—Solitary or in small groups in dwarf scrub heath with *Betula nana*, *B. glandulosa*, *B. pubescens*, and *Salix glauca*, also in *Salix herbacea*-communities and in more luxuriant scrubs with *Betula pubescens*. Found throughout August and in the beginning of September.

D i s t r i b u t i o n.—At a number of localities from southernmost Greenland (60°N) up to the Godthåbsfjord-area (64°N). Collected on most of the expeditions to these areas. We consider it to be rather common in the southwestern part of Greenland both in the subarctic and in the arctic area.

M a t e r i a l e x a m i n e d.—*T. Borgen* 82.87, 82.90, 83.13, 84.43, 85.121, 86.263, 87.24, 87.47, *H. Knudsen, T. Borgen & J. H. Petersen* 83.481, 83.622 (holotype), *H. Knudsen & T. Læssøe* 84.298, *P. M. Petersen* 73.454.

Russula violaceoincarnata is recognized by the colours of the margin of the cap, the discolouring cap centre, the mild taste and the yellow spore-print. Additionally, the spores and the browning of the flesh are distinctive characters. In the well-argued system proposed by Romagnesi (1967) for the European species of *Russula* it should be placed in sect. *Polychromae* Maire, and presumably in subsect. *Integrinae* Maire on account of the browning flesh, the presence of normally reacting dermatocystidia, and the variegated colours.

Russula citrinochlora Sing.—Pl. 1, Fig. 2

Russula citrinochlora Sing. in Bull. trimest. Soc. myc. Fr. 54: 137. 1938.

M i s a p p l i e d n a m e.—*Russula citrina* ss. Bresadola, Iconogr. mycol. 9: 438. 1929; non Gillet.

Pileus at first convex then applanate, sometimes slightly depressed at centre, 3–4.5(–5.5) cm broad, with obtuse, even, or sometimes irregularly incised margin, in young specimens slightly pruinose but soon smooth, becoming slightly greasy and shining when moist, when old becoming mat and sometimes slightly furcate, peeling up to half-way; margin or whole cap in young fruit-bodies from dark brown (8 F 4–5; Séguy 116, 'bistre foncé', 701, 'terre

d'ombre'), dirty greyish brown (6 E 4; Séguy 131, 'brun havane') to brownish orange (5 C 4) or a warm orange-red (8 B 8, 7 B 8; Séguy 181, 'rouge saturne'), becoming pure yellow towards centre (4 A 5) or paler (4 A 4), sometimes totally without brown and marginal zone or whole cap greenish yellow, pale yellow, yellowish buff, pale greenish or greyish incarnate, discolouring from centre to buff, when old becoming greyish or greyish buff, with an incarnate to olivaceous brown tinge. Lamellae whitish, becoming cream-coloured, when old with greyish reflex, adnate to adnexed or slightly decurrent, rather narrow (3–5 mm) and horizontal, fragile, with even edge, normally spaced, c. 10 lamellae per cm at margin, sometimes with a few lamellules; with indistinct veins between lamellae. Stipe cylindrical to slightly obclavate, 1.5–3.5(–5) × 0.7–1.4(–1.9) cm, often ≤ diam. of cap, white or with a yellow, brown or green flush of cap colour, pruinose, when old becoming smooth and finely venose, greying much in the same manner as in *R. ochroleuca*. Flesh firm except in central part of stem, white, slowly and weakly greying when cut. Taste mild or very slightly acrid in young lamellae. Smell weak, indistinct. Spore-print pale cream (Romagnesi 2a). Chemical reactions: ferrosulfate normal, pale salmon-coloured; phenol normal, dark chocolate brown.

Spores (Fig. 2) 8–9(–9.5) × 6.5–7.5(–8) μm, Q = 1.2–1.3, broadly ellipsoid with amyloid ornamentation consisting of a fine reticulum with many verrucose to catenulate connections and some meshes; warts up to 0.5 μm. Basidia 35–50 × 8–10 μm, clavate, 2–4-sterigmate. Cheilocystidia (Fig. 2) 50–70 × 8–12 μm, clavate with obtuse apex or more rarely fusoid with short appendage, somewhat scattered. Epicutis (Fig. 2) with numerous dermatocystidia, rather long, clavate, up to 8 μm broad, becoming brown or bluish-black in sulphovanillin.

E c o l o g y.—Solitary or more often in small groups of up to 10–15 specimens, most often associated with *Salix herbacea* in snowbeds or in transition to herb-rich slopes, but also found in association with other *Salix* spp.; especially *S. glauca*, furthermore with *Polygonum viviparum* and scrubs with *Salix glauca* and *Betula glandulosa*. It occurs both at dry and moist localities. The records are evenly scattered over a period from the end of July throughout August.

D i s t r i b u t i o n.—Common in southwest Greenland, becoming rare towards the north, with the northernmost locality at Ilulissat/Jakobshavn (69°N, 51°W), but without records from the nearby, well-investigated island Disko and the fairly well-investigated Jamesonland-area at the same altitude in E-Greenland.

Singer (1938) described it from the Altai-mountains in central Asia, where he found it in mixed forests (*Abies*, *Populus*, *Betula*, *Pinus*) below the alpine zone. He also recorded it from Austria and referred Bresadola's plate 438 of *R. citrina* Gill. to this species. The plate resembles the Greenlandic specimens, but the spores are described as 'echinulate'. Bresadola gives no data on the locality of his specimens, but it may well have been in the Italian Alps close to where he lived, as suggested by Singer (1938). The species is poorly known and has never been seen by Romagnesi. It seems to be restricted to arctic and alpine regions, and this may explain the few records.

M a t e r i a l e x a m i n e d.—*D. Boertmann* 85.50, *T. Borgen* 78.37, 78.125, 80.83, 80.87, 81.162, 81.170, 81.180, 81.188, 81.216, 82.15, 82.17, 82.73ab, 83.30, 84.98, 85.177, *H. Knudsen* 87.26, 87.220, *H. Knudsen & T. Læssøe* 84.299, 84.569, 84.589, *H. Knudsen, T. Borgen & J.H. Petersen* 83.460, *M. Lange J* 71.57, *P.M. Petersen* 70.222, 73.59, 73.164, *F. Terkelsen* 7b, 25.

Russula citrinochlora was placed by Singer in sect. *Ingratae* Quél. stirps *Fellea* (Felleinae Melz. & Zv.) because of the yellow colours of the pileus and the (slightly) acrid taste.

Romagnesi (1967) referred it to his subsect. *Citrinae* Romagn. in sect. *Piperinae* Quél. containing yellow species. In view of the colours of the pileus observed in the Greenlandic specimens, in which – besides yellow and green – shades of orange are often seen in very

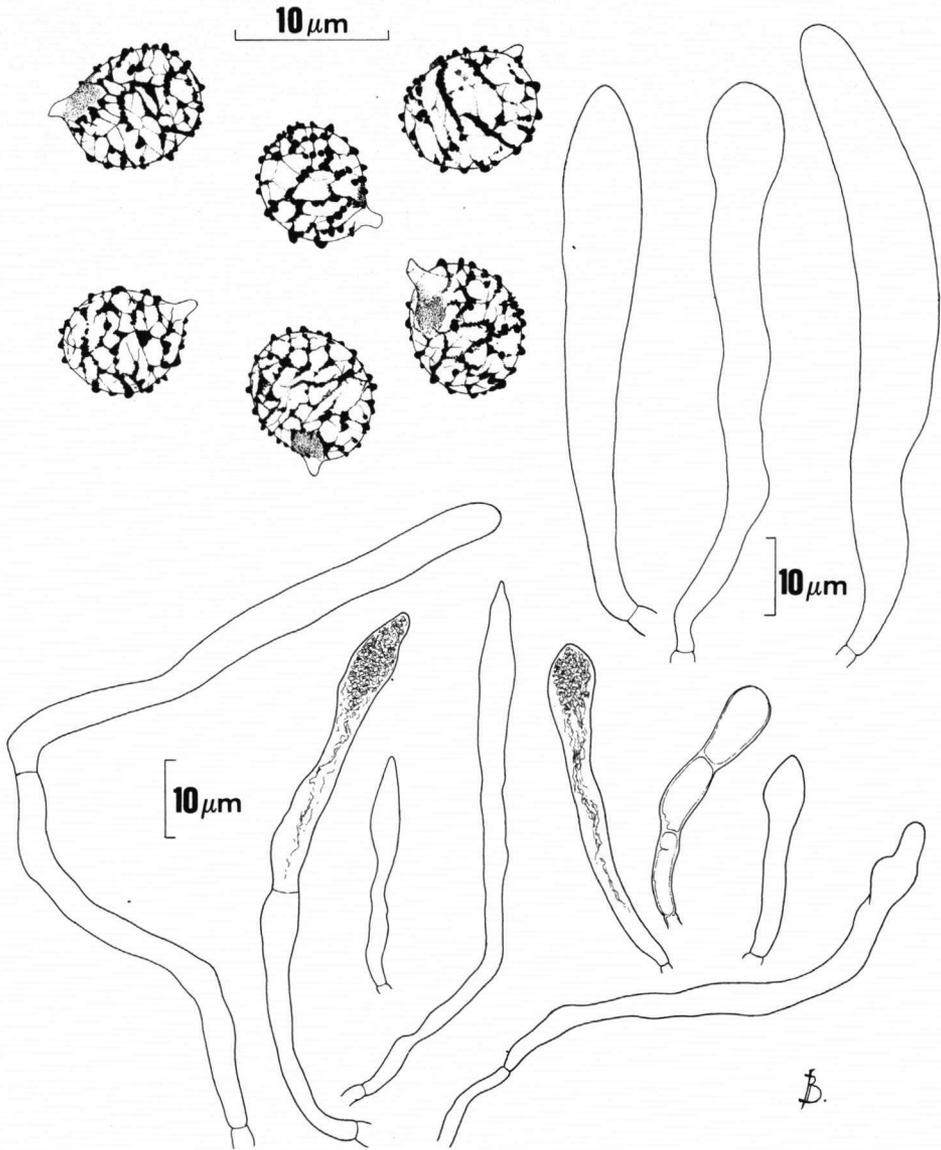


Fig. 2. *Russula citrinoclora*.—Spores, cheilocystidia and elements from epicutis (from Knudsen & Læssøe 84.569).

young specimens, it seems most correct to follow Romagnesi in order to avoid the introduction of new colours into sect. *Ingratae* Quéf. In general the characters and habitat of *R. citrinoclora* fits in nicely with the other members of *Citrinae* viz. *R. raoultii* Quéf. and *R. solaris* Ferd. & Winge.

Large specimens of *R. citrinoclora* may be confused with *R. claroflava* var. *viridis* in the field (see below), but that species greys strongly and has a much darker spore-print; microscopically they differ strongly in their spore ornamentation. *Russula raoultii* never has greenish or orange colours, has a very acrid taste and a white spore-print.

***Russula claroflava* var. *viridis* Knudsen & Borgen, var. nov.**

Pileo olivaceo; stipite saepe basi incrassato; sporis latoribus, 9.5–10.5 × 8–8.5 μm magnis a var. *claroflava* diversa.

Holotypus die 19 Augusti anni 1987 in monte Hasselfjeld prope portum aviatorium groenlandicum Søndre Strømfjord Airbase sub numero 87.230 a H. Knudsen lectus, siccus in Museo Botanico Hauniensi depositus.

The colour of the cap differs from var. *claroflava* in being olivaceous green (4 E 5–8, 'olive brown'; Séguy 221, 'vert olivier') and paler, also greyish yellow (4 C 5–8; Séguy 218, 219), dirty green (Séguy 276, 'vert mousse passé'), or more bright green (Séguy 305, 'vert neutre'), when old becoming more yellowish buff or brownish at centre. The stem is cylindrical or often swollen towards the base and somewhat more robust than in the main variety, in the type-collection being 4.5–5 × 1.5–2.5 cm.

Spores (11.5–)10.5–9.5(–8.5) × (10–)8.5–8(–7) μm, Q = 1.2–1.3, broadly ellipsoid or more rarely subglobose with amyloid plage, strongly verrucose up to 1 μm high with warts, also forming some fine, scattered connections. The composition of the epicutis as well as other characters not mentioned here are similar to that of the main variety as described by Romagnesi (1967).

E c o l o g y.—Associated with *Betula pubescens*, *B. glandulosa*, and *B. nana* mostly in dry dwarf scrub heath. Usually occurring separately from var. *claroflava*, but in one locality the two varieties were growing together.

D i s t r i b u t i o n.—Found in three well-investigated areas in Greenland, from Narsarsuaq in the southernmost part of Greenland to Paamiut and further north to the Søndre Strømfjord-area, c. 67°N. Seems to be uncommon, but this is also the case for var. *claroflava* in Greenland. Mr. J. Stordal (Gjøvik, Norway) found this new variety also in alpine localities in southern Norway (pers. comm.).

M a t e r i a l e x a m i n e d.—*T. Borgen* 84.195b; *H. Knudsen* 87.230 (holotypus); *H. Knudsen, T. Borgen & J.H. Petersen* 83.636; *H. Knudsen & T. Læssøe* 84.514.

In his monograph, Romagnesi (1967) correctly stated that *R. claroflava* is well-characterized and 'peu variable'. However, he mentioned that the cap may be 'subtilement nuancé de verdâtre' (Séguy 256), but in var. *viridis* the green colour is so intense that this variety is not likely to be confused with var. *claroflava*, neither in the field nor in herbarium material where the green colour remains distinct. The spores are broader than in the main variety, reported by Romagnesi (1967) to be 7.5–7.7 μm broad. We have found the same figures in collections from Greenland and Sweden (Fungi *Exsiccati* Suecici no. 2359) of the main variety. So far we have not seen intermediate forms between the two varieties.

***Russula consobrina* Fr.**

For modern descriptions of this species see Romagnesi (1967), Ryman & Holmäsén (1984), and Einhellinger (1985).

E c o l o g y.—Both collections from Greenland were associated with *Betula nana*. This host genus is unusual, but it was also recorded by Jacobsson (1984) from subalpine birch forest (*B. pubescens*) in Härjedalen in Sweden. *Picea* is normally cited to be the mycorrhizal host, but it does not occur in Greenland (except in a few plantations). So the occurrence with *Betula* on Greenland is a good example of a mycorrhizal host change from south to north.

D i s t r i b u t i o n.—*Russula consobrina* has only been found near Nuuk (64°N) in Greenland. The locality is a protected valley with a subarctic or close to a subarctic climate. It is rather common in the boreal zone in Scandinavia reaching further north (up to 70°N according to map in Ryman & Holmäsén 1984) becoming rare or absent in central and southern Europe (Romagnesi, 1967; Schäffer, 1952; Einhellinger, 1985).

M a t e r i a l e x a m i n e d.—*H. Knudsen 87.161; 87.164.*

Russula maculata* ssp. *alpina* (Sing.) Knudsen & Borgen, *stat. nov.

Russula maculata var. *alpina* Sing. in *Z. Pilzk.* 5: 76. 1925 (nom. nud.); in *Hedwigia* 66: 197. 1926 (basionym).

Recently Kühner (1975) published an extensive description of this taxon (sub nom. *R. maculata*) from the French Alps. This covers our material very well, but some notes on ecology and the status of this taxon may be of interest.

E c o l o g y.—On the labels of all our collections with annotations on ecology it is stated that *Dryas* was present; the fungus either growing directly in the *Dryas*-cushions or at least near them. This was also reported by Singer (1925, 1926) and Kühner (1975). The latter, however, suggested that the mycorrhizal symbiont was *Juniperus*, which was present in most (all?) localities in the French Alps. In our opinion there is no doubt that the mycorrhizal symbiont is *Dryas* in all cases. Although *Dryas* has been known as an ectomycorrhizal symbiont from many arctic and alpine places for a long time (for references see e.g. Harley & Harley, 1987; Kohn & Stasovski, 1990), very few ectomycorrhizal fungi have been related to *Dryas*. Elkington (1971) mentioned *Hebeloma mesophaeum* from a flower pot with *Dryas*, and Bruchet (1974) found – both in the field and in laboratory experiments – that *H. alpinum* and *H. marginatum* form ectomycorrhiza with *Dryas*. From our field experience in northern Greenland it is evident that several species – described and undescribed – of *Cortinarius* (subgenera *Phlegmacium*, *Dermocybe*, *Telamonia*), *Hebeloma*, *Inocybe* and a few from the genera *Russula* (e.g. *R. delica* Fr.), *Lactarius dryadophilus* Kühn., *Tricholoma myomyces* (Pers.: Fr.) J. Lange and possibly *Entoloma* form ectomycorrhiza with *Dryas*.

D i s t r i b u t i o n.—Reported by Singer (1925, 1926) from Tyrol (Austrian Alps) and by Kühner (1975) from the French Alps. In Greenland it has not been recorded south of 70°N, but it is common in the northern part, where *Dryas integrifolia* and *D. octopetala* are common, especially on exposed, dry, basic, gravelly-sandy soil. It was also collected during the third symposium on arctic-alpine mycology on Svalbard in August 1988, and in August 1990 by one of us (HK) in the northern Ural mountains. We suspect it to be common everywhere in arctic-alpine localities of the northern hemisphere where *Dryas* is present.



Plate 1. (above) *Russula violaceoincarnata* Knudsen & Borgen (type) — (below) *R. citrinoclora* Sing. (from *Börger* 83.30).

Material examined.—GREENLAND: *H. Dissing* 87.54; *S.A. Elborne* 88.106; 88.176; *H. Knudsen, S.A. Elborne & J.H. Petersen* 89.60; 89.78; 89.305; 89.342; 89.378; 89.649; *B. Lauritsen* 7.8.1984 (4 coll.). —NORWAY: Svalbard, Bjørndalen near Longyearbyen, 16.8.1988, *N. Lundquist* (HK 88.82). —U.S.S.R.: Tjumenskaja oblast, northern Urals, Krasnij Chanmei, *H. Knudsen* 90.414.

This taxon was first described by Singer (1926) as an alpine variety of *R. maculata*. Kühner (1975) suggested that his *R. maculata* from the French Alps could be Singer's variety, although Singer's description was short. By comparing our field knowledge of this subspecies with the descriptions by Singer and Kühner we are convinced that it is the same taxon. Subspecies *alpina* clearly differs in a number of minor characters from the well-known *R. maculata* from deciduous forests in the temperate areas. In addition it has a different distribution from that of the main subspecies, and we therefore follow the general practice among the phanerogamists and erect this taxon to subspecific level. The main differences are smaller size, often mild taste, a different mycorrhizal host, 2-spored basidia (also seen in some other arctic-alpine *Russula*-species), and generally more variegated cap colours.

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