

# Type studies in *Russula* 1: on two species described by Kühner

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Based on a detailed study of holotypes, emended descriptions of two somewhat problematic species are given. Recent material of those taxa is also presented with colour photographs. *Russula nuoljae* and *R. purpureofusca* were both described by Kühner based on one or two fruitbodies collected from Scandinavian fjelds. *R. cupreola* is shown to be synonymous with *R. purpureofusca*.

Key words: Agaricales, *Russula*, Kühner, montane, arctic-alpine mycology, Fennoscandia

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## Introduction

*Russula* Pers. is a large and difficult genus. Relatively variable characters are used in species delimitation. This places special requirements for type specimens. Contradictory to that, numerous taxa are based on scanty, juvenile or mixed type specimens, even though they are not very old taxa. In this series of articles we will offer detailed observations of such specimens to help future studies. For instance, in 1975 Kühner described five new species and two new varieties of alpine/montane *Russulas*. Four of these were based partly or totally on Scandinavian material (Kühner 1975). The new taxa were described without any pictures or microscopic drawings. Combined with the fact that Kühner's herbarium was practically not available before it was annexed to Geneve, it is not surprising that unanimous circumscription of these taxa was not reached. They have been included in some papers (Romagnesi 1985, Bon 1988, Sarnari

1998, 2005, Adamčík 2004, Adamčík & Knudsen 2004, Ronikier 2008, Knudsen et al. 2012) but the way they were described and the scarce original material have made interpretations difficult. Hence, fresh material collected in northern Fennoscandia has been difficult to name. The four species and their subsequent subsections were: *R. pseudocampestris* Kühner (Integrinae), *R. heterochroa* Kühner, *R. purpureofusca* Kühner (Tenellae), *R. nuoljae* Kühner (Viridantinae). In this paper we present detailed drawings of microscopical features of the two last-mentioned, as well as informative colour photos of recent specimens.

## Material and methods

The specimens were studied with Leitz Laborlux 10 and characters drawn using a drawing apparatus. Spores were



Fig. 1. *Russula nuoljae*, Ruotsalainen JR.6612F. – Photo: J. Ruotsalainen.



Fig. 2. *Russula nuoljae*, same population with older fruitbodies. – Photo: J. Ruotsalainen.

observed in Melzer's Reagent (using  $\times 1250$  magnification). Preparations were made from gills (from types), from recent collections spores were illustrated both from spore prints and gill preparations. Elements of the cap cuticle were studied in water, using  $\times 800$  magnification. They are illustrated from preparations made in water.

***Russula nuoljae*** Kühner, Bull. Soc. Mycol. Fr. 91: 388. 1973 – Figs. 1–4

The Latin diagnosis is relatively short and is based on a single fruitbody: "Pileo 57 mm, purpureo; stipite haud purpureo; massa sporarum pallide ochracea. Sporis 7.7–9.2  $\times$  6.5–7.5  $\mu$ , verrucis fere omnibus singularibus. Pleurocystidiis permultis, sulfopiperonalis ope nigrescentibus. Species praesertim insignis carentia dermatocystidiorum. – In zona alpina Lapponica. – Typus: Herb. Kühner n° 67.129."

The species was placed in subsection Viridantinae by Kühner. Although he gives additional characters in the description, it has been problematic to affiliate the name to modern collections, because the sole fruitbody in the type collection is somewhat juvenile. Hence, cap colour and the colour of spore print have not been straightforwardly applied to newer collections. The taste, which is rather soon somewhat acrid, was not mentioned by Kühner either. The number of spores in the holotype is scarce, indicating a juvenile fruitbody, as well as the larger fruitbodies (80–110 mm in diam) frequently met. Especially problematic young specimens are in alpine material, where the "true" ornamentation and spore-print colour would need a type collection containing truly mature fruitbodies (cf. Fig x). The colour of spore-print was given as deep ochre (ocre clair) In our material it shows some variability (as often in alpine collections): Romagnesi IId – IIIa(–b), Dagron 8–9(–10). Spores in recent material have been found out to be slightly bigger than those seen by Kühner. It is unclear whether Kühner studied the spores from gills or from a spore print. In our material spores measure 8–9.5  $\times$  7.2–7.8  $\mu$ m (n= 50, from 12 populations). Comparing spores in gill preparation and in spore-prints one can verify that Kühner's type is a juvenile fruitbody. In the type the spores have a somewhat deviating ornamentation; warts are smaller and with more connectives (Fig x, holotype; Fig x, lowermost spore) than in mature spores.

The larger material has shown some variabil-

ity in cap colour (Figs. 1, 2) within and between populations. Olivaceous caps were not seen in our material. Hence, we do not support the synonymy suggested by Adamčík (2004) and Adamčík & Knudsen (2004). Based on a study of the type of *R. nuoljae*, they concluded that Kühner's species could be a synonym of *R. clavipes* Velen., a predominantly olivaceous-capped species. The clear difference in cap colour of *R. nuoljae* was suggested to be due to longer exposure to sun (Adamčík 2004). Based on our wider observations, we treat *R. nuoljae* as a separate species. In addition, the stipe is always white; reddish colour has not been observed in the field in the 12 studied populations (mentioned as a common feature by Adamčík 2004).

Kühner collected the specimen amongst *Salix reticulata* and *Betula nana* at fjeld Nuolja at Abisko (North Sweden). Newer collections indicate that the species is relatively easy to find from alpine heaths e.g. near Kilpisjärvi, growing with dwarf *Salix spp.* and with *Betula pubescens* var. *czerepanovii* and *B. nana*. It is also found at lower level mountain birch forests.

**Specimens examined: FINLAND. Enontekiön Lappi.** Enontekiö, Kilpisjärvi, Goallarrässa, E-slope, alt. ca 600 m., with *Betula* and *Salix*, 11.VIII.1986 *Metsänheimo & Ruotsalainen JR.295F* (KUO); Kilpisjärvi, Malla Strict Nature Reserve, Pikku-Malla, SW-slope, alt. ca 600 m., 21.VIII.1995 *Vauras & Ruotsalainen JR.1743* (KUO); Kilpisjärvi, at the Biological Research Station, alt. ca 500 m., with *Betula*, 12.VIII.1990 *Vauras & Ruotsalainen JR.1757F* (KUO); same site, 15.VIII.1990 *Ruotsalainen JR.1809* (KUO); Kilpisjärvi, Jehkas, alt. ca 580 m., arctic heath with *Salix reticulata* and *Betula nana*, 16.VIII.2004 *Vauras & Ruotsalainen JR.6612F* (KUO, TUR), 24.VIII.2014 *Campo & Ruotsalainen JR.9187*, 24.VIII.2014 *Ruotsalainen JR.9188*, 22.VIII.2015 *Kukkola & Ruotsalainen JR.9322* (KUO). **NORWAY. More og Romsdal.** Nesset, alt. ca 800 m., 21.VIII.2004 *Larsen 7-04*, det. *Ruotsalainen* (O). **Troms.** Storfjord, Helligskogen, Rihpojávri 1 km W., alt. ca 700 m., arctic heath with *Salix herbacea*, *S. reticulata* and *Dryas*, 27.VIII.2015 *Ruotsalainen JR.9358* (KUO). **RUSSIA. Murmansk Oblast.** Kirovsk, Lake Vudjaur, N-side, at tree line, alt. ca 470 m., with *Juniperus communis*, *Salix cf. myrsinites*, *Betula nana*, *Betula pubescens*, 16.VIII.2004

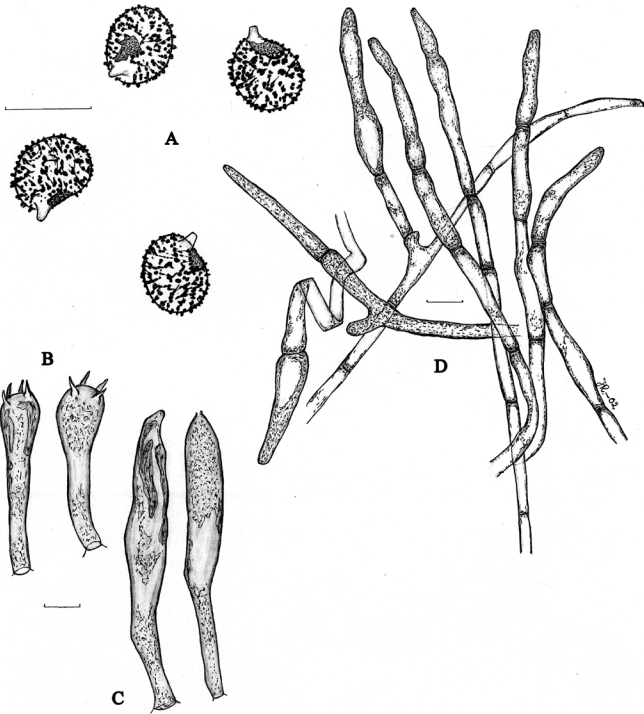


Fig. 3. Microscopical characters of *Russula nuoljae*, holotype. A = spores, B = basidia, C = pleurocystidia, D = pileocystidia. – Scales = 10 um.

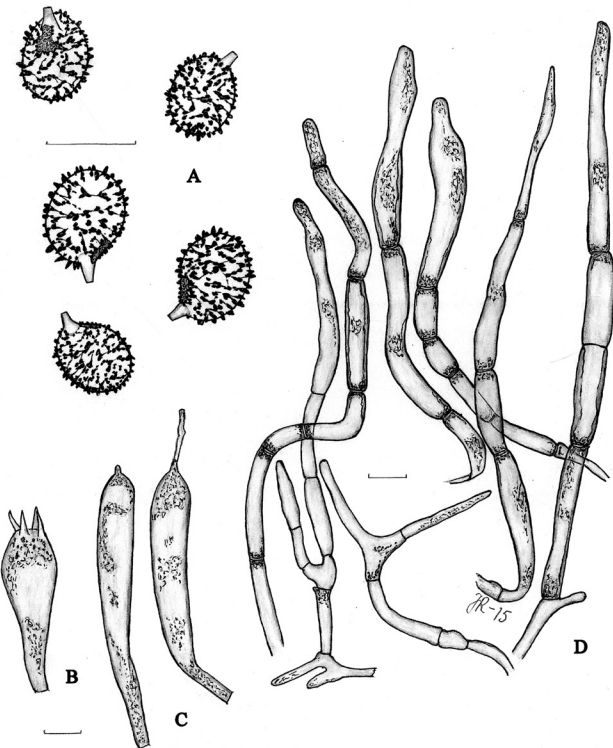


Fig. 4. Microscopical characters of *Russula nuoljae*, Ruotsalainen JR.6612F. A = spores, B = basidia, C = pleurocystidia, D = pileocystidia. – Scales = 10 um.



Fig. 5. *Russula purpureofusca*, Ruotsalainen JR.9032F. – Photo: J. Ruotsalainen.



Fig. 6. *Russula purpureofusca*, Ruotsalainen JR.8195F. – Photo: J. Ruotsalainen.

*A.-L. Ruotsalainen*, det. *Ruotsalainen* (OULU). **SWEDEN. Jämtland.** Undersåker, Renfjellet, close to the summit, alt. ca 900 m., with *Betula* and *Salix reticulata*. 25.VIII.2001 *Vauras & Ruotsalainen JR.5831* (KUO).

***Russula purpureofusca*** Kühner, Bull. Soc. Mycol. Fr. 91: 389. 1973 – Figs. 5–8

= ***Russula cupreola*** Sarnari, Boll. Assoc. Micol. Ecol. Romana 7 (20–21): 64. 1990

The Latin diagnosis of *R. purpureofusca* is relatively short and is based on two fruitbodies: “Pileo 25–27 mm, sorde e rubro brunneo; stipite albo; odore acido; sapore acri; massa sporarum medio-criter crema. Sporis 8–8.7 × 6.7–7.5 μ, punctis humilibus atque tenuibus, cum connexivis tam subtilibus ut facile neglegantur. Dermatocystidiis angustis, 3.5–6 μ, septatis. Pigmenta proxima sunt pigmentis *R. norvegicae* Reid et *R. saliceticolae* Singer, sed differunt praesentia russularhodinae II. – In zona alpina Norvegica. – Typus: Herb. Kühner n° 72.60.”

Kühner’s species has remained a mystery, much due to the young fruitbodies in the type collection. From these he got a much too light spore print (Romagnesi IIc). Hence, collections from Fennoscandian mountains never seemed to match *R. purpureofusca*. Only after studying the holotype it became evident that material collected under the name *R. cupreola* could be Kühner’s species. This was verified by studying the holotype of Sarnari’s species: spores were identical in both holotypes and pileocystidia showed abundant lateral diverticulae. The main difference between the two holotypes lies in the width and septation of these elements, the type of *R. cupreola* showing the extremes in width and dense septation. Variability towards the other extreme (Kühner’s type) was already included in Sarnari’s (1990) plate illustrating pileipellis from three collections of *R. cupreola*.

The problem with the totally different spore print colours (given as IVc – IVd for the holotype of *R. cupreola*) was solved by observations from rich populations in the field. Young fruitbodies have almost pure white gills whereas in mature ones in the same collection they are clearly ochraceous (Fig. x). The variability in spore prints in our material is: from Romagnesi

IIIb – IIIc (Dagron 12–13) to IVb – IVc(–d) (Dagron 20 – 24). From young fruitbodies one can gain spore prints having the same colour Kühner reported.

Kühner (1973) did not notice the odour of *Pelargonium* which is mentioned for *R. cupreola* and is present in some of the alpine collections (*Pelargonium* to *Rhododendron tomentosum*). Two of the southernmost collections (cf. Fig. 6) from Finland (Kainuu) were sequenced (ITS1) and found to be conspecific with alpine collections. The type was collected amongst *Salix reticulata* and also the type of *R. cupreola* grew amongsts dwarf *Salix* species. Our material grew with various *Salix* species and many of the sites had also *Betula* spp.

**Specimens examined: FINLAND. Kainuu.** Paltamo, Tololanmäki, Kylmämpuro Nature Reserve, inundated brook margin, wooded mire, 16.VIII.2010 *Vauras & Ruotsalainen JR.8131F* (KUO); same locality, 20.VIII.2010 *Vauras & Ruotsalainen JR.8195F* (KUO); Saukkovaara, W-slope, tussock in a brooklet, 24.VIII.2011 *Ruotsalainen JR.8445F* (KUO); same locality, 17.VIII.2014 *Vauras 30625F* (TUR-A). **Koillismaa.** Kuusamo, Iivaara NE, eutrophic fen, 24.VIII.1992 *Vauras*, det. *Ruotsalainen*, *JR.2738* (TUR-A). **Perä-Pohjanmaa.** Rovaniemi, Hautapäänoja, rich brookside, 05.IX.2013 *Siuvatti*, det. *Ruotsalainen*, *JR.9083* (KUO); Ylitornio, Romppaat N, margin of a wooded mire, with *Betula*, *Picea* and *Pinus*, 03.IX.2013 *Ruotsalainen JR.9057* (KUO). **Enontekiön Lappi.** Enontekiö, Kilpisjärvi, Goallarrassa, E-slope, alt. ca 750 m., with *Salix reticulata*, 11.VIII.1986 *Metsänheimo & Ruotsalainen JR.294c*. (KUO); Kilpisjärvi, Malla Strict Nature Reserve, Pikku-Malla, NE-slope, 21.VIII.1995 *Walley, Buyck, Vauras & Ruotsalainen JR.4010* (H, sub. *R. cupreola*); Kilpisjärvi, Tšahkaljohka, alt. ca 500 m., brookside with *Betula* and *Salix*, 13.VIII.1990 *Vauras & Ruotsalainen JR.1772, JR.1774* (KUO); same site, 15.VIII.1990 *Vauras & Ruotsalainen JR.1796F* (KUO, TUR-A), *JR.1797F* (KUO, TUR-A, sub. *R. cupreola*, det. *Sarnari*); Kilpisjärvi, Possovarri, Possojoki-river, alt. ca 550 m., with *Betula* and *Salix*, 14.VIII.1990 *Ruotsalainen JR.1782* (KUO); Kilpisjärvi, Saana SW-slope, alt. ca 530 m., 16.VIII.1990 *Ruotsalainen JR.1829* (KUO). **NORWAY. Sør-Trøndelag.** Oppdal, Konsvold, alt. ca 900 m., alpine garden,

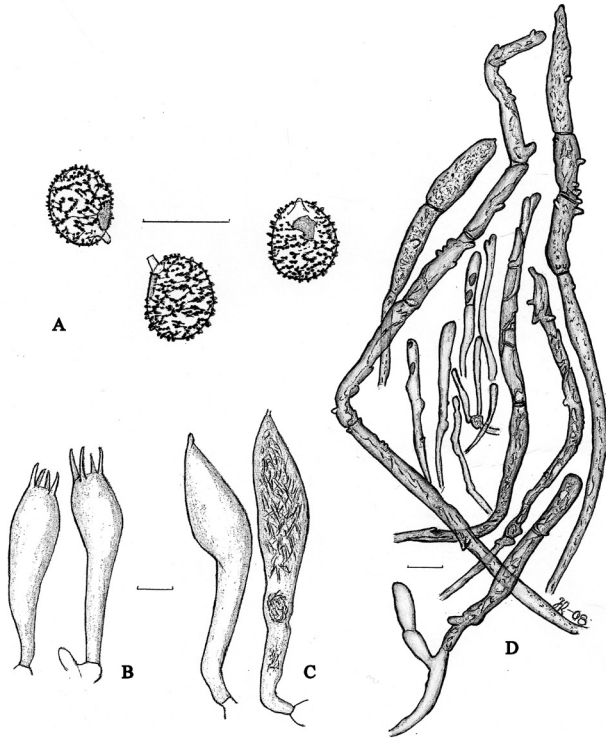


Fig. 7. Microscopical characters of *Russula purpureofusca*, holotype. A = spores, B = basidia, C = pleurocystidia, D = pileocystidia. – Scales = 10 um.

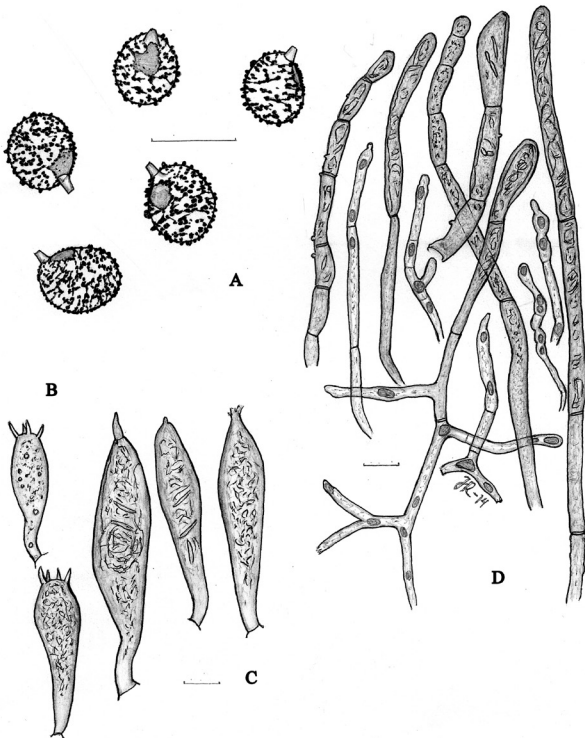


Fig. 8. Microscopical characters of *Russula purpureofusca*, Ruotsalainen JR.9032F. A = spores, B = basidia, C = pleurocystidia, D = pileocystidia. – Scales = 10 um.

with *Salix*, 8.VIII.1991 *Vauras & Ruotsalainen JR.2241F, JR.2243* (KUO). **Troms.** Storfjord, Salluoaiivi E-slope, alt. ca 850 m., with *Salix reticulata*, 22.VIII.1995 *Walley, Buyck, Vauras & Ruotsalainen JR.4028b* (KUO); Tromsø, Fløya, alt. ca 500 m., with *Salix herbacea*, 30.IX.2013 *Rämä & Ruotsalainen JR.9032F, JR.9033F, JR.9034F* (KUO); Storfjord, Paras, SW-slope, alt. ca 800 m., with *Dryas octopetala*, 12.VIII.1986 *Metsänheimo, Vauras & Ruotsalainen JR.309* (KUO). **SWITZERLAND. Ticino.** Val Corno, with *Salix herbacea*, *S. reticulata* and *S. retusa*, 17.VIII.1990 *Sarnari 1989/0550* (holotype of *R. cupreola*, IB)

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