
Three new reports of Basidiomycetous mushrooms (*Russula* and *Lactarius*: Russulaceae) from northern regions of Kashmir Himalaya, India

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The northern regions of Kashmir Himalaya are covered by dense forests with mainly conifers like fir, pine, deodar etc., which support a number of ectomycorrhizal fungal species including mushrooms belonging to family Russulaceae. However, due to remoteness, security reasons and being covered by actual line of control (L.O.C.), most of these areas are either least or fully unexplored. In the present study, an endeavour towards the exploration of ectomycorrhizal Russulaceous mushrooms was taken with regular field surveys from 2018-2020 in northern district areas of Kashmir Himalaya. A total of ten ectomycorrhizal mushrooms (*Russula atropurpurea*, *R. aurea*, *R. cyanoxantha*, *R. turci*, *R. emetica*, *R. sanguinaria*, *R. brevipes*, *Lactarius deterrimus*, *L. rufus* and *L. sanguifluus*) were collected, and identified based on macro and micro-morphological attributes and host specificity, as well as by using field guides and available literature. *Russula turci*, *Lactarius rufus* and *L. sanguifluus* are hitherto unreported, and hence reported for the first time from Jammu and Kashmir, India. The taxonomic description of all the collected *Russula* spp. and *Lactarius* spp. is given in the present study.

Keywords: Basidiomycetes mushrooms, fungi, morpho-anatomical features

INTRODUCTION

Fungi, also known as the “Forgotten Kingdom,” are essential components of life on this planet. Fungi are indispensable to terrestrial ecosystems as mycorrhizal symbionts, decomposers, and habitat quality indicators. Among the large resources of fungi, basidiomycete mushrooms represent a substantial and much profitable group of higher fungi, however, these have scarcely been examined and explored (War *et al.* 2022).

Distinctive fungal species like bracket fungi, puffballs, and gilled mushrooms all belong to the Basidiomycota, which contains the most advanced and evolutionary evolved members of the Kingdom Fungi. The estimated number of fungi on earth ranges between 2.2 to 3.8 million species, out of which only 120,000 have been described and

41000 are known to be macro fungi (Hawksworth and Lücking, 2017).

The genera *Russula* Pers. and *Lactarius* Pers. belong to family *Russulaceae* of Basidiomycota with ca. 2000 species (Buyck *et al.* 2018, Adamčík *et al.* 2019) and 583 species (Lee *et al.*, 2019) respectively at global level. The family is cosmopolitan in distribution, and is well-known for its ectomycorrhizal relationship with a wide variety of plant communities, from tropical rain forests to northern coniferous forests (Buyck *et al.* 2018, Looney *et al.* 2018). They also perform crucial ecological roles in maintaining forest biodiversity and provide a source of income for local people as well as nutrients for certain animals (Buyck, 2008; Li *et al.* 2019; Yuan *et al.* 2019). The gilled mushrooms *Lactarius* and *Russula* share a distinct appearance that sets them apart from all others. Their pilei are convex to funnel-shaped, and are composed of heteromeric tissues with decorated

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amyloid spores (Sarnari, 2005; Buyck *et al.* 2010; Li *et al.* 2019). Species belonging to the genus *Russula* can be identified by their colourful, brittle sporocarps (fragile pileus), context mainly composed of sphaerocytes, amyloid spore ornamentation and the presence of *gloeoplerous* elements that do not form a branching lactiferous system ending in *pseudocystidia* at the *basidiome* surface (Buyck *et al.* 2018). The presence of latex and *lactifer* networks in the *subhymenium* distinguishes the genus *Lactarius* from its sister genus *Russula*.

In India, the genera *Lactarius* and *Russula* have about 92 and 180 taxa, respectively, as of 2022 (Ghosh *et al.* 2021, Verma *et al.* 2022). Since multiple authors have recently published novel *Lactarius* and *Russula* taxa from the nation, this area has become a hotspot for the investigation of undiscovered Russulaceae species (Verma *et al.* 2019, Ghosh *et al.* 2021, Kumar & Atri 2022). Jammu and Kashmir in north western India is mostly a Himalayan landscape. Due to the extensive agro-climatic differences, varied physiography, and undulating topography, it has a rich diversity of macrofungi (Wani *et al.* 2020, Talie *et al.* 2021). Most of the work on family Russulaceae in Jammu and Kashmir was carried out by (Beig *et al.* 2008, Dar *et al.* 2009, Pala *et al.* 2012, Itoo *et al.* 2013). In Kashmir Province, alpine desert or dry cold desert flora predominates, with huge diversity of broad-leaved evergreen woods (*Buxus wallichiana*, *Ilex dipyrena*, *Quercus semicapifolia* etc), conifers (*Pinus roxburghii*, *Cedrus deodara*, *Abies pindrow*, *A. spectabilis*, *Taxus wallichiana*, *Picea smithiana*) and deciduous forests (*Aesculus indica*, *Populus alba*, *Acer caesium*, *Viburnum* spp., *Salix* spp., *Alnus* spp.) (Verma *et al.* 2019). This diversified vegetation hosts Russulaceae mushrooms, which develop ectomycorrhizal relationships with these plants, however, many of them have not yet been thoroughly studied and the region is yet fully unexplored for mushroom diversity. In the present study, extensive macrofungal forays have been undertaken in different parts of northern Kashmir for exploration of genus *Russula* and *Lactarius*. An attempt was made to cover the maximum possible morphological traits/features of collected specimens for their proper identification. Morpho-anatomical description, habitat as well as location of collected specimens is given in the present paper.

MATERIALS AND METHODS

Sampling and morphological study

Regular field surveys were designed to various locations of northern Kashmir (Fig.1) for collection of mushroom specimens (basidiocarps) by following the standard protocol given by Halling (1996). During the present study, nineteen sites were surveyed which belong to three districts of northern Kashmir i.e., Baramulla, Kupwara and Bandipora. These surveys were mainly conducted in the months of May to November in 2018-2020. The specimens were photographed and macromorphological attributes were recorded in the notebook there in the field. For macromorphological description of collected mushroom specimens, we followed Atri (2005), Verbeke and Walley (2010), Adamčík *et al.* (2019). The reference for color codes used to describe specimens was taken from the Methuen Handbook of Colour (Kornerup and Wanscher, 1978). The specimens were later air dried at 35-45 °C and labelled in separate paper bags for their preservation and micromorphological studies. 3-5% (w/v) KOH was used to separate the intact fungal hyphae, and Melzer's reagent or cotton blue was used for staining of spores and other elements.

Microscopic measurements were done at 400× using optical microscope (Nikon Eclipse 80i, Japan). The identification of collected mushroom specimens was done by comparing their maximum possible macro and micro-morphological characters and habitat specificity with field guides and available literature on the family Russulaceae (Sarnari 2005; Kränzlin 2005; Park and Lee 2011), as well as by the authenticity of mushroom experts. Followed identification, the mushroom specimens were deposited in Mycological Section of internationally recognized herbarium (KASH) at Centre for Biodiversity and Taxonomy (CBT), Department of Botany, University of Kashmir, Srinagar, Jammu and Kashmir, India, with voucher specimen numbers 8642-8651 KASH-Herbarium.

RESULTS AND DISCUSSION

Seven species of *Russula* (*R. atropurpurea*, *R. aurea*, *R. brevipes*, *R. cyanoxantha*, *R. emetica*, *R. turci* and *R. sanguinaria*) and three of genus *Lactarius* (*L. deterrimus*, *L. rufus* and *L. sanguifluus*) were collected and identified from

different areas of northern Kashmir Himalaya, India. These species were found associated mainly with conifers like pines and spruces, and with hardwood deciduous trees like birch and beech. In the present study, most of the species were collected from Gulmarg area of district Baramulla. This area is diverse in habitats with varied vegetation types and covered by meadows, grasslands and alpine to sub-alpine forests dominated by coniferous trees. The present study revealed two species of *Lactarius* (*L. rufus* and *L. sanguifluus*) and one species of *Russula* (*R. turci*) as the new reports from Jammu and Kashmir, India. Morphological observations including macroscopic and microscopical characters such as size, shape, texture, color, smell, gill attachment, spore print, spore size etc. were recorded. The description of all ten species along with their habitat and site of location is given as follows:

Taxonomic treatment:

Phylum: Basidiomycota R. T. Moore

Class: Agaricomycetes Doweld

Order: Russulales Kreisel ex P. M. Kirk, P. F.

Cannon & J. C. David

Family Russulaceae Lotsy

Genus *Russula* Pers.

***Russula atropurpurea* (Krombh.) Britzelm.,
Botan. Zbl. 54(4): 99 (1893) (Fig. 2 A)**

Synonym (s): *Russula krombholzii* Shaffer,
Russula undulata Velen.

Cap 3-10 cm diameter, reddish purple at rim, dark purple at center but sometimes almost black, cap initially convex, later flattens and slightly depressed at maturity, entire and smooth, cap cuticle peels 1/3 to the center. Gills broad, dense at beginning, then averagely spaced, forked to the stem, lamellulae few or lacking, adnexed to almost free, pale cream. Stem 3-10 × 0.6-2.2 cm, central, white, later turns grey, cylindrical to sub-cylindrical, firm, smooth, spongy, brittle, without ring, flesh is white, spongy and firm, hot taste with fruity smell like that of apples, however, inedible because of acidity. Spores 5-9 µm, spherical to ellipsoidal, amyloid, with warts and ridges, spore print whitish to creamy.

Habitat: solitary, in late summer to autumn, mycorrhizal, in association with broad-leaved trees and conifers, especially pines.

Sample examined: Gulmarg (34°2'51"N, 74°22'30"E), 2675 m asl, Baramulla district, Jammu and Kashmir, INDIA; 25 August 2018, coll. War J.M. (8642-KASH-Herbarium).

***Russula aurea* Pers., *Observ. mycol. (Lipsiae)*
1: 101 (1796) (Fig. 2 B)**

Synonym (s): *Agaricus auratus* With., *Russula aurata* (With.) Fr.

Cap 4-8 cm diameter, blood-red or reddish orange or a mixture of orange and yellow, initially spherical, later turns convex and then flat tens with depressed center, cap surface smooth, margin sulcate (grooved) at maturity, peeling of cap cuticle is halfway to the center, with thick whitish and brittle flesh. Gills broad, moderately crowded, adnexed or free, creamy or pale ochre color with yellow or golden-yellow edges. Stem 2-7 cm long, 1-2.5 cm thick, smooth and without ring, brittle, initially white or cream, then golden-yellow with age, flesh white or yellowish with mild taste, edible. Spores 7-9.5 × 6-9 µm, ellipsoid, echinate with conical warts (1.5 µm), spore print is ochraceous.

Habitat: grows in scattered groups or solitary on ground in summer to early autumn, it is uncommon, occasionally under spruce trees and mainly under broad-leaved deciduous woodlands.

Sample examined: Gulmarg (34°2'N 47" N, 74°22' 36" E), 2778 m asl, Baramulla district, Jammu and Kashmir, INDIA; 25 August 2018, coll. War J.M. (8643-KASH-Herbarium).

***Russula cyanoxantha* (Schaeff.) Fr., *Monogr. Hymenomyc. Suec.* (Upsaliae) 2(2): 194 (1863)
(Fig. 2C)**

Synonym (s): *Agaricus cyanoxanthus* Schaeff.

Cap 5-12 cm diameter, initially spherical, then turns convex and finally flatten with shallow depression at center, color much variable from purple to grey, tinted slate grey or brownish violet (variegated), cap surface smooth and greasy when wet, flesh is firm and violet-purple, taste is mild, peeling is halfway to the center, margin not lined. Gills adnate to sub-decurrent, arched, white, soft, greasy, flexible, do not break upon touch (pliable, which is unusual in *Russula* species), densely packed, forked near stem. Stem 7-10 cm long, 1.5-2.5 cm thick, cylindrical, white, spongy to firm, lower portion

slightly ventricose, smooth and without ring. Spores 6-7 × 5-6.5 μm, ellipsoidal, reticulate, warts isolated (0.2-0.4 μm), spore print is white.

Habitat: mycorrhizal, commonly under beech woods and conifers like spruce, fruiting occurs in summer to early fall, either alone, scattered or gregariously.

Specimen examined: Vodhpura Natnussa (34°26'3" N, 74°17'11" E), 1708 m asl, Kupwara district, Jammu and Kashmir, INDIA, 28 July 2020, coll. War J.M. (8644-KASH-Herbarium).

***Russula turci* Bres., *Fung. trident.* 1(2): 24 (1882) (Fig. 2 D)**

Synonym (s): *Russula turci* var. *gilva* Einhell.; *Russulina turci* (Bres.) F. Kauffman

Cap 6-9 cm diameter, color varies from liliac-purple or reddish-violaceous to dark amethyst-violet, convex to flattened with shallow depression at center, slimy or viscid when wet, cap margin even, later develops striations, paler than dark center, context is white edible. Gills initially crowded, then moderately spaced, intervenose (connected by veins), cream to light ochre. Stem 4-7 cm long, 1-2.5 cm thick, white, almost evenly thick, slightly wrinkled, flesh brittle, spongy, firm, white with sweet taste, stem base reflects iodine-like smell. Spores 6.5-8.6 μm ellipsoidal to globose, echinulate, reticulate, spore print is ochraceous.

Habitat: grows in sandy soil or clay, commonly found in conifer forests (spruces, pines) either scattered or in groups, late summer to autumn.

Specimen examined: Vodhpura Natnussa (34°25'57" N, 74°17'43"E), 1789 m asl, Kupwara district, Jammu and Kashmir, INDIA, 17 October 2020, coll. War J.M. (8645-KASH-Herbarium).

***Russula emetica* (Schaeff.) Pers., *Observ. mycol. (Lipsiae)* 1: 100 (1796) (Fig. 2 E)**

Synonym (s): *Agaricus emeticus* Schaeff.; *Russula clusii* Fr.

Cap 4-9 cm diameter, smooth, sticky, convex to flattened, sometimes centrally depressed with small umbo, cap color is red or scarlet which fades in wet weather turning pink or orange with white blotches, margins incurved with finely radial grooves, peeling up to the center, flesh brittle and

white, taste is sharp and peppery with spicy or fruity smell. Gills off-white to white, then turns pale cream, broad, free or adnexed, densely packed, intervenose and forked near cap margin. Stem 3-9 cm long, 1-2.5 cm thick, off-white, smooth, dry, cylindrical, base slightly enlarged (clavate), brittle with wrinkled texture due to longitudinal grooves, partially hollow or stuffed. Spores 7-10 × 6.5-8 μm, amyloid, ellipsoidal, reticulate, warty (0.7-1.0 μm), spore print is pale cream or white.

Habitat: mycorrhizal, isolated or in groups, mainly with conifers like spruces and pines or even on mosses in the months of July to October.

Specimen examined: Gulmarg (34°2'56" N, 74°23'2"E), 2694 m asl, Baramulla district, Jammu and Kashmir, INDIA, 28 August 2018, coll. War J.M. (8646-KASH-Herbarium).

***Russula sanguinaria* (Schumach.) Rauschert., *Ceská Mykol.* 43(4): 204 (1989) (Fig. 2 F)**

Synonym (s) *Agaricus rosaceus* Pers.; *Russula rosacea* (Pers.) Gray.

Cap 5-10 cm diameter, first convex, then flattened with slight depression at center, bright red with whitish blotches, color may fade to pink or lavender-pink, smooth, margin striate and not lined, cuticle peels at margin only, flesh white, bitter or peppery taste, inedible. Gills adnate, averagely spaced, pale ochre to cream, forking, spore print is same as gill color. Stem 5-11 cm long, 1-2.5 cm thick, blushed with cap colour or greyish pink, tapering towards apex, streaked, dry, smooth, without ring, firm, brittle, flesh white, unchanging, stuffed or hollow. Spores 6.5-9 × 6-8 μm, spherical to sub-ellipsoidal, warty (0.7-1.0 μm), reticulations diffused.

Habitat: mycorrhizal with coniferous trees, mainly under pines, either alone, scattered or gregariously in summer to autumn season.

Specimen examined: Gulmarg (34°3'8"N, 74°24'7" E), 2604 m asl, Baramulla district, Jammu and Kashmir, INDIA, 19 September 2019, coll. War J.M. (8647-KASH-Herbarium).

***Russula brevipes* Peck, *Ann. Rep. Reg. N.Y. St. Mus.* 43: 66. (1890) (Fig. 2 G)**

Synonym (s): *Russula brevipes* var. *acrior* Shaffer; *Russula brevipes* var. *megasporea* Shaffer

Cap size large, 7-25 cm wide, broadly convex with depressed center, margin remains inrolled even at maturity, shallowly vase-shaped or nearly infundibuliform, cap surface bald, smooth, dry, skin fairly tight, peeling tough, whitish or creamy, later develop brownish discolorations, margin not lined, flesh thick, brittle, solid, white then yellowish with age, taste acrid. Gills decurrent, moderately crowded, white, becoming creamy and pale yellow with age, lamellulae present frequently. Stem short compared to pileus, 3-9 cm long 2-4 cm thick, solid, sturdy, almost equal, surface dry, bald, white, later turns yellowish to brownish with age, flesh is white. Spores 8-10 x 7.5-9 μm , subglobose to ellipsoid, reticulate to subreticulate and warted (0.8 μm), basidia 25-30 x 6.5 μm , four spored, pleurocystidia 35-45 μm , cylindrical or fusiform, hyaline; spore print is white to light creamy.

Habitat: mycorrhizal, in association with different genera of conifers and hardwood trees, commonly found under duff or masses of leaves/needles, growing solitary, scattered or in gregarious manner, fruiting occurs in summer to autumn.

Sample examined: Gulmarg (34°3'2''N, 74°22'44''E), 2729 m asl, Baramulla district, Jammu and Kashmir, INDIA; 25 August 2019, coll. War J.M. (8648-KASH-Herbarium).

Taxonomic treatment of genus *Lactarius*:

Phylum: Basidiomycota R. T. Moore

Class: Agaricomycetes Doweld

Order: Russulales Kreisel ex P. M. Kirk, P. F. Cannon & J. C. David

Family : Russulaceae Lotsy

Genus : *Lactarius* Pers.

***Lactarius deterrimus* Gröger, *Westfälische Pilzbriefe* 7: 10 (1968) (Fig. 3 A)**

Synonym (s): *Lactarius deliciosus* var. *piceus* Smotl.; *Lactarius deliciosus* var. *deterrimus* (Gröger) Hesler. & A. H. Sm.

Cap 5-13 cm diameter, orange brown to tangerine, fading to dull orange, green patches irregularly present, bruised areas greenish, initially convex, then flatten with shallow depression, lightly zoned, bald, sticky, wavy margin. Gills adnate to sub-decurrent, close, brittle, short gills frequent, orange, staining green on bruising, latex orange coloured that turns wine red after some time, milk bitter/acrid. Stem 6-9 cm long, 1-2.5 cm thick,

cylindrical, bright orange, apical zone white or paler, smooth, pot-holes lacking, ring absent, becomes hollow with age. Spores ellipsoidal to subglobose, 7-9.5 x 6-7.5 μm , ornamented with warts (0.4-0.5 μm), reticulum is diffused or incomplete, spore print is pale pinkish buff.

Habitat: mycorrhizal, grows commonly under spruces (while *L. deliciosus* is mainly found with pines), either solitary or gregariously in summer and fall season.

Specimen examined: Gulmarg (34°3'10'' N, 74°22'41'' E), 2715 m asl, Baramulla district, Jammu and Kashmir, INDIA, 28 August 2018, coll. War J.M. (8649-KASH-Herbarium).

***Lactarius rufus* (Scop.) Fr., *Epicr. syst. mycol. (Upsaliae)*: 347(1836-1838) (1838) (Fig. 3 B)**

Synonym (s): *Agaricus rufus* Scop.; *Agaricus rubescens* Schrad.

Cap medium sized, 4-9 cm diameter, dark brick red, first convex, then flattens with shallow depression having small umbo at center, smooth, surface dry and matt, slimy when wet, azonate, flesh is creamy to white, inedible. Gills sub-decurrent, moderately spaced or crowded, pale brick red, release unchanging watery-white milk when damaged, it tastes mild and later becomes acrid and hot. Stem 4.5-9 cm long, 0.7-1.8 cm thick, initially paler, then concolorous with cap, equal or subclavate, smooth, without ring, solid, becomes hollow with age. Spores 6-8.5 x 5.5-7.5 μm , globose to ellipsoidal, hyaline, reticulate, spore print is pale cream with salmon tinge.

Habitat: commonly under pines, rarely under birch trees, scattered to gregarious, late spring to late fall.

Specimen examined: Gulmarg (34°3'50'' N, 74°23'22'' E), 2804 m asl, Baramulla district, Jammu and Kashmir, INDIA, 15 July 2019, coll. War J.M. (8650-KASH-Herbarium).

***Lactarius sanguifluus* (Paulet) Fr., *Epicr. syst. mycol. (Upsaliae)*: 341 (1836-1838) (1838) (Fig. 3 C)**

Synonym (s): *Hypophyllum sanguifluum* Paulet; *Lactifluus sanguifluus* (Paulet) Kuntze

Cap 3-10 cm diameter, convex to flatten with slight depression at center, orange to grey-pinkish to pale

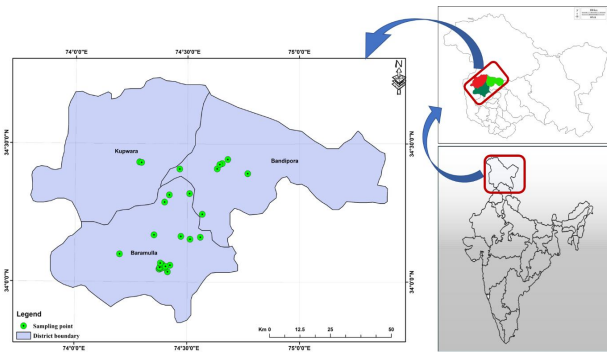


Fig.1: Map showing study sites of northern Kashmir Himalaya for the collection of *Russula* and *Lactarius* species



Fig.3:(A-C). Fruiting body and basidiospores of *Lactarius* species with different latex color. **A.** *Lactarius deterrimus*; **B.** *L. rufus*; **C.** *L. sanguifluus*.

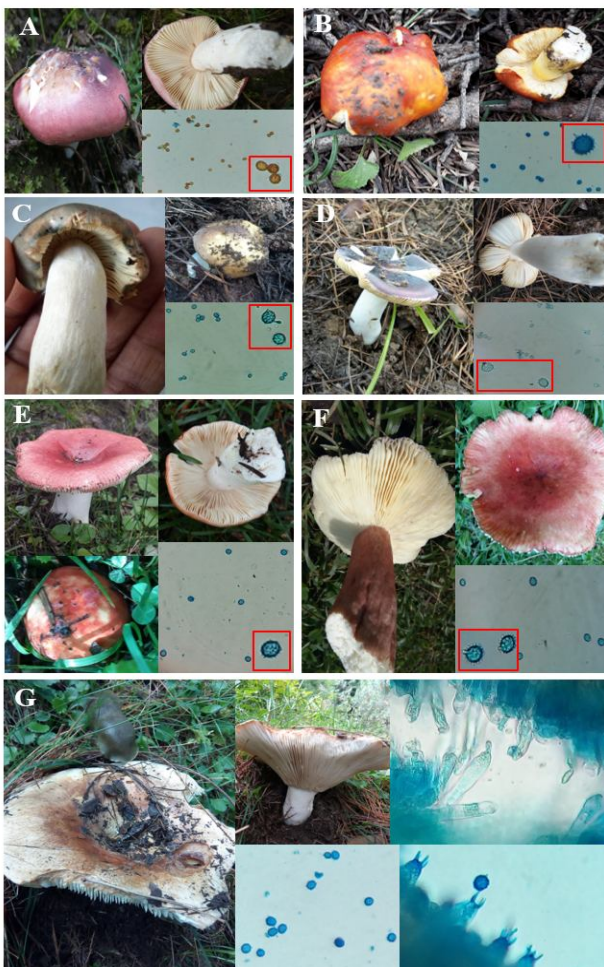


Fig.2:(A-G). Fruiting body and basidiospores of *Russula* species. **A.** *Russula atropurpurea*; **B.** *R. aurea*; **C.** *R. cyanoxantha*; **D.** *R. turci*; **E.** *R. emetica*; **F.** *R. sanguinaria*; **G.** *R. brevipes*.

ochraceous orange, with wine red or purplish russet tints, turning greyish-green when old, margins inrolled even at maturity, sticky when wet, smooth, light zonation or azonate, milk is blood red or reddish brown, flesh is brick coloured, fragile, taste is mild or bitter without significant odour, edible.

Gills adnate to slightly decurrent, averagely spaced, pale vinaceous or pinkish, oozes blood red milk when cut. Stem 3-7 cm long, 1.5-2.5 cm thick, reddish buff to orange-red, with a layer of thin white surface, whitish zone at apex, cylindrical, firm, smooth with few to many scrobicules, hollow, without ring. Spores 7-9 × 6.5-8 μm, subglobose to ellipsoidal, ornamented, reticulate.

Habitat: mycorrhizal, grows in mixed coniferous forests exclusively under pines, scattered or in groups, late summer to fall.

Specimen examined: Gulmarg (34°3'58"N, 74°22'55"E), 2735 m asl, Baramulla district, Jammu and Kashmir, INDIA, 30 August 2018, coll. War J.M. (8651-KASH-Herbarium).

Due to habitat diversity and favourable climatic conditions, the forests of Kashmir Himalaya support a large number of ectomycorrhizal species belonging to family Russulaceae. The present study was undertaken to unravel the macrofungal diversity (belonging to family *Russulaceae*) of northern Kashmir Himalaya. A total of nineteen study sites were surveyed which belong to three districts of northern Kashmir: Baramulla, Bandipora and Kupwara. During the survey, a total of ten species belonging to family Russulaceae were identified based on morpho-anatomical and other

characteristics. The seven species were identified belonging to genus *Russula* which include *R. atropurpurea*, *R. aurea*, *R. brevipes*, *R. cyanoxantha*, *R. emetica*, *R. turci* and *R. sanguinaria*, and three of genus *Lactarius* i.e., *L. deterrimus*, *L. rufus* and *L. sanguifluus*.

Different workers have carried out the macrofungal surveys and reported many species of *Russula* and *Lactarius* from the Kashmir valley. The results of our study are in accordance with the results of previous studies. *Russula aurea* and *R. atropurpurea* were previously reported from northern Kashmir by Dar *et al.* (2010) under the canopy of pine trees in Gulmarg area. Similarly, *Russulabrevipes*, *R. sanguinea* and *Lactarius deterrimus* were pioneering reports of mycorrhizal fungi from Pahalgam and Gulmarg areas of Kashmir valley. [Note: *R. sanguinea* is a synonym, however, in our study, we described *Russula sanguinaria* as the correct name of the species]. Recently, a checklist was prepared by Verma *et al.* (2019) on the family Russulaceae of Jammu and Kashmir, India, and it reports a total of 51 species belonging to genera *Russula* (35 species), *Lactarius* (12 species) and *Lactifluus* (4 species). Two species of genus *Lactarius* i.e., *Lactarius rufus* and *L. sanguifluus* which were collected during the present study have not been reported from Jammu and Kashmir, India, till date, and hence they are reported for the first time from the Union Territory of Jammu and Kashmir. These two species were found in association with pine trees in Gulmarg area of Baramulla district. *Lactarius sanguifluus* is distributed throughout the world. In India, it is commonly found in mixed coniferous forests of Himachal Pradesh, where the natives consume it along with *L. deliciosus*. *Lactarius sanguifluus* belongs to section *Deliciosi* of *Lactarius*. Its gills are pale vinaceous with more reddish as compared to *L. deliciosus* but entirely paler than *Lactarius venosus* (Nuytinck and Verbeken, 2003). On the other hand, *Lactarius rufus* can be distinguished from other similar species by having a brick red color, strong acrid taste and its white latex that remains unchanged even after a long time (Barge and Cripps, 2016). Moreover, the frequent presence of *L. rufus* in the coniferous forests especially pineas observed in the present study is evidenced by already published data on the species (Cabo *et al.* 2013).

Pala *et al.* (2012) reported seven species of *Russula* (*R. emetica*, *R. aeruginea*, *R. aurea*, *R. atropurpurea*, *R. cyanoxantha*, *R. nobilis* and *R. delica*) from Hirpora Wildlife Sanctuary which lies in the Pir Panjal range of southern Kashmir Himalayas. Five species of *Russula* including *R. cyanoxantha*, *R. puellaris*, *R. lepida*, *R. tuberculosa* and *R. annulata* var. *evanescens* from Jammu region of J and K have also been reported earlier (Kumar and Sharma, 2012). In our study, we report *Russula cyanoxantha* for the first time from the coniferous forests of village Nutnussa of district Kupwara of northern Kashmir Himalaya, J and K, India. *R. cyanoxantha* can easily be distinguished from other related species by the presence of soft and pliable (flexible) gills with greasy feel and do not break. This characteristic feature is unusual in *Russula* species whose gills are brittle. *R. xerampelina* has similar cap color like that of *R. cyanoxantha* but with fishy smell. From the same locality, the present study also reports *Russula turci* as hitherto unreported from Jammu and Kashmir, India. No previous reports are available for this species from Jammu and Kashmir, India. *R. turci* is morphologically very similar to *R. amethystina* or *R. brunneopurpurea*, however, species of *R. turci* are easy to identify by its iodine like smell at base of the stipe, and purplish border of brightly coloured cap. We found different samples of the species, and observed no discoloration in young to old specimens- another characteristic feature that separates *R. turci* from *R. amethystina* or *R. brunneopurpurea*, whose cap surface on exposure to rain turns from violet to yellowish or off-white. The morphological characters used for describing *R. turci* in the present study are supported by the findings of (Jabeen *et al.* 2017; Alimammadova and Aghayeva, 2021). Moreover, there is also an articulated mesh network between the warts of its basidiospores, while in case of *R. amethystina*, the warts of basidiospores are sub-isolated with weak or diffused reticulum.

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