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Mushrooms of Kashmir VII

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Abstract: Eight species of mushrooms of family Russulaceae are described for the first time from Azad Jammu and Kashmir. These were *Russula aeruginea*, *R. chamaeleontina*, *R. baghensa* sp. nov., *R. hullera* sp. nov., *R. lepida*, *R. nauseosa*, *R. kashmira* sp. nov. and *R. vesca*. One species *Russula emetica* was redescribed from Kashmir. *R. baghensas* sp. nov., *R. hullera* sp. nov., *R. kashmira* sp. nov., are new to science. Different macro- and micro characters were taken into consideration for their proper identification and biochemical analysis of few species was also performed.

Key words: Russulaceae, species, mushroom, science, Kashmir

Introduction

Azad Jammu and Kashmir is in the form of a long, narrow, strip, which lies on the north- east side of Pakistan. It lies between 730-750 longitude and 330-360 latitude with an area of 13,297 square Kilometers. Its topography is mainly hilly and mountainous with valleys and stretches of plains. The main rivers are Jhelum, Neelum and Poonch. Its climate is of sub- tropical highland type with an average annual rainfall of 150 cm. The elevation ranges from 360 meters in the south to 6325 meters in the north. The snow line in winter is around 1200 meters above sea level, while in summer it rises to 3300 meters (Anonymous, 1994). The soil is clayey (pH. 6.5-7.5, Gardezi, 1993). Ahmad (1980) contributed to the study of mushroom flora of Pakistan and described 183 species belonging to 60 genera and 13 families of the order Agaricales. Khan *et al* (1980) reported four edible fungi from Baluchistan, these were: *Agaricus rodmani*, *Coprinus atramentarius*, *Phellorina inquinans* and *Podaxis pistillarlis*. Gardezi (1993) reported six species of the genus *Agaricus* from Rawalakot Azad Kashmir. Gardezi and Ayub (1996) reported three edible species of mushrooms for the first time from Azad Jammu and Kashmir. Gardezi and Khan (1999) collected and described five edible mushrooms from Azad Jammu and Kashmir. These are *Armillaria mellea*, *Cantharellus cibarius*, *Craterellus cornucopioides*, *Flammulina velutipes* and *Macrolepiota procera*. Siddique and Gardezi (1999) described two edible species from Azad Jammu and Kashmir. These are *Pleurotus dryinus* and *P. pulmonarius* reported for the first time from Azad Jammu and Kashmir. Gardezi (2002a, b, c) reported following mushrooms from Kashmir (a) *Amanita elliptica* sp. nov. (b) *Amanita muscaria* var. *Alba*, *Ramaria aurea*, *R. botrytis*, *Phallus impudicus*, *Morchella elata* and *M. semilibra*. (c) *Amanita ceciliae*,

A. subglobosia sp. nov., *A. pantherina*, *A. virosa*, *Volvariella bombycina* and *V. speciosa*. The taxonomy of mushrooms from various region of the world has been described by several authors. The present investigation include the general survey and description of various species of mushrooms from Azad Jammu and Kashmir. The area is famous for mushrooms abundance and diversity. The investigation is first of its kind in the area, therefore, most of the species described are either reported first or are studied in detail using available resources.

The present studies were carried out to collect mushrooms from Poonch, Bagh, Muzaffarabad and identify new mushrooms and investigate their characteristics.

Materials and Methods

Specimens were dug out of the ground with care to avoid damage to the volva and soil was removed by washing with water. Smell was noted at the time of collection and again in the laboratory. Field notes on the macro characters and habit were completed and the collection were individually wrapped, brought in the laboratory and dried in the oven at temperature of 45°C. All measurements were taken and illustrations of micro characters were made with the aid of camera lucida. Spore size range was obtained by measuring twenty mature spores. Reagents used during studies were 3% KOH and Melzers reagent as described by Ainsworth and Bisby (1971). Cultures were routinely attempted. Mushrooms were collected from Muzaffarabad, Poonch, and Bagh from the period 1994-97. Colour standard and nomenclature were used that of Ridgway (1912). Previously described keys were used and local names are given in parentheses. The bio- chemicals contents were

calculated on dry matter basis at National Agricultural Research Centre (NARC) Islamabad. The specimens were collected and identified by following Anon (1970), Neuner (1978), Arora (1986) and deposited in the collections of Herbarium of Department of Plant Pathology, University College of Agriculture, Rawalakot, Azad Jammu and Kashmir.

Results and Discussion

Family Russulaceae Pers. ex. S. F. Gray
Nat. Arrang. Brit. Pl. 1: 918 (1821).

RUSSULA Pers. ex S.F. Gray
Nat. Arr. Brit. Pl. 1: 618. 1821.

Type species: *R. emetica* (Schaeff. ex Fr.) Pers. ex S. F. Gray

RUSSULA Pers. ex S.F. Gray
Nat. Arr. Brit. Pl. 1: 618. 1821.

Type species: *R. emetica* (Schaeff. ex Fr.) Pers. ex S. F. Gray

Key to the Kashmiri species of the genus *Russula*

1. Pileus 3- 9 cm broad, convex becoming plane or slightly depressed, basidiospores 5-9 X 5-7 μm , ornamentation strongly amyloid globose to subglobose.....*R. aeruginea*
1. Pileus 2.5- 10 cm broad, ovoid to reniform, not depressed, basidiospores 4. 5-11 X 4-8 μm ornamentation non amyloid, ellipsoid to subovoid..... 2
2. Pileus 2.5- 10 cm broad, convex to plane or somewhat depressed, basidiospores 4.5- 8 X 4- 6 μm , conical or blunt verrucae.....*R. chamaeleontina*
2. Pileus 3- 12 cm broad, round convex becoming plane or broadly depressed basidiospores 9- 11 X 6- 8 μm , ellipsoid to subovoid.....3
- Pileus 3- 12 cm broad, not campanulate and expanded, basidiospores 9- 11 X 6- 8 μm , warts 0.4- 0.7 μm , ellipsoid to subovoid.....*R. emetica*
3. Pileus 5- 15 campanulate then expanded, basidiospores 7- 13. 5 X 4. 5-7.5 μm , clavate to ovoid.....4
4. Pileus 3- 12 cm broad, glabrous or somewhat slightly pruinose, basidiospores 5-11 X 4-7 μm , ornamented with very fine amyloid verruculae*R. baghensa* sp. nov.
4. Pileus 5- 15 cm broad, not glabrous, gelatinous or somewhat slimy, basidiospores 6- 13. 5 X 4- 7. 5 μm , echinulate, ornamentation variable.....5
5. Pileus 4-18 cm broad, deeply infundibuliform expanding cyathiform, basidiospores 11-12.5 X 6- 7. 5 μm , cylindrical to conic- obtuse*R. hullera* sp. nov

5. Pileus 2- 12 cm broad, convexo- depressed to plano depressed, basidiospores 6-12 X 4-7 μm , broadly globose.....6
6. Pileus 2- 12 cm broad, surface glutinous to slimy basidiospores 6- 9 X 4-6 μm , broadly globose, partialreticulum.....*R. lepida*
6. Pileus 2- 12 cm broad, surface moist, viscid when wet, basidiospores 7-13 X 3-7 μm , oval, reticulate ornament,7
7. Pileus 5- 9 cm broad, plano- depressed at maturity, basidiospores 7-12 X 4-7 μm , polygonal alveole.....*R. nauseosa*
7. Pileus 3- 6 cm broad, basidiospores 5- 13 X 3- 8 μm , fusiform, hemispherical to pointed conical..... 8
8. Pileus 13- 26 cm broad, convex soon expanded, basidiospores 8-11 X 2-5.5 μm , elliptical*R. kashmira* sp. nov.
8. Pileus 5- 18 cm broad, plane or depressed, basidiospores 5.8-8.7 X 4.5-8 μm , short ellipsoid.....*R. vesca*

***Russula aeruginea* Lindbl., apued. Fries, Monogr. Hymen. Suec. 2: 198 (1863). (Drag)**

Pileus 3- 9 cm broad, convex becoming plane or slightly depressed, surface viscid when moist, dull green to dark green, sometimes with brown, gray or yellowish tints or blotches, glabrous margin often striate, subacute or obtuse. Context white, brittle, unchanging firm, eventually rather fragile. Lamellae adnate to adnexed or free, close, brittle, white becoming pale yellowish, often with brownish stains. Stipe 3- 9 cm long 1.5- 2 cm thick, equal or with tapered base, white or faintly yellow, base often with pale brown stains, initially subpruinose, glabrescent, slightly longitudinally rugulose, solid, the stuffed or hollow. Odour none, taste mild. Spore print creamy to pale yellow or pale- orange yellow. Basidiospores 5- 9 X 5- 7 μm , globose to subglobose, hyaline with a strongly amyloid reticulate ornament, reticulum complete, hemispherical to pointed conical verrucae 1- 2 μm , high. Basidia 36- 51 X 8- 12 μm , elongate, clavate, with four small sterigmata. Lamellae edge sterile or heteromorphous, with crowded cheilocystidia. Cheilocystidia macrocystidioid, 34- 46 X 8-14 μm , fusoid to mucronate, hyaline, thin- walled, with granular contents. Pleurocystidia numerous, cystioid, 61-79 X 7-13 μm , fusoid pedicelate, sometimes with a mucronate apex, originating in the trama, hyaline, thin- walled, with oliaginous contents. Hymenophoral trama irregular and intermixed, hyaline, with thin- walled hyphae, 2.5- 6 μm , diam and sphaerocystes. Subhymenial layer pseudoparenchymatous, 4- 9 μm wide. Pileal surface a discontinuous trichodermial palisade of small fascicles of



Fig. 1: *Russula aeruginea*

erect, unbranched, septate hyphae, individual elements 4-34 X 1.5- 7 μm , subglobose to narrow cylindrical, terminal elements attenuate fusoid, not encrusted, with coloured contents. Clamp connections absent in all tissues (Fig. 1).

Edibility: Edible

Chemical composition (%): Protein 23. 58, fiber 17. 85, moisture 10. 17, ash 17. 01, fat 2.66.

Habitat and Distribution: Solitary, scattered or in groups in wood, widely distributed. Hullar July 4, 1995, alt. 1333 m, Lectotype: Gardezi 758. Kahuta Aug. 2, 1995, alt. 1820 m, Gardezi 759. Nar Sher Ali Khan July 7, 1996, alt. 1770 m, Gardezi 760. Athmuqam Aug. 5, 1996, alt. 1371 m, Gardezi 761.

The collected specimens of the species agree with published descriptions of Hesler (1961). There are several similar species, including *R. parazurea*, a beautiful green capped species with a matt appearance, firm white stipe and white spores.

New record: This species has been recorded for the first time from Azad Jammu and Kashmir.

Type: *Russula aeruginea* Lindbl. apud. Fries

Russula chamaeleontina Fr.

(Drag)

Pileus 2.5- 10 cm broad, ovoid to reniform, not depressed, surface shiny, viscid when moist, thin, fragile, purplish to lilac- coloured, reddish violet or brownish purple, often darker at the centre and paler towards margin, but sometimes brown to yellowish at centre, minutely rugulose, white to pale yellow, cream colour, cream- buff, yellow, straw yellow, light ochraceous buff, maize yellow, elastic when young, soon brittle, margin striate, unchanging, at least obscurely. Flesh thin, fragile, white, cuticle separable near the disc. Lamellae close, white or creamy soon, becoming yellow and finally dull ochre- yellow, adnate to adnexed or free rarely anastomosing, intervenose. Stipe 3- 8 cm long, 0.5- 2 cm thick, equal or slightly thicker at either ends, surface dull, dry, glabrous



Fig. 2: *Russula chamaeleontina*

to minutely pruinose to scurfy along entire length or only at apex, longitudinally rugulose, white to cream, sometimes with a pale pinkish or pinkish cream tints in age, trama firm when young, soon hollow to spongy. Odour not distinct, taste mild. Spore print pale cream. Basidiospores 4.5- 8 X 4- 6 μm , broadly obovate, obovate to broadly ellipsoidal, ornamentation amyloid, up to 0.3 μm high, consisting of scattered to crowded, small conical to blunt verrucae and many fine particles. Basidia 28- 45 X 7- 15 μm , cylindrical to narrow clavate, four sterigmata. Lamellar trama composed of sphaerocysts and connective hyphae. Cheilocystidia 35- 46 X 6- 15 μm , similar to the pleurocystidia. Pleurocystidia abundant 45- 67 X 7- 12 μm , macrocystidioid, elongate- clavate to fusoid, frequently mucronate, thin- walled, with refractive, hyaline or yellowish contents. Pileus cuticle 30- 212 μm thick, without gelatinous material. Hymenophoral trama irregular and intermixed, hyaline, thin- walled 2- 6 μm diam. Subhymenial layer interwoven, 4- 8 μm wide. Pileal surface a disrupted trichodermium of thick walled, hyaline, elements, 7- 22 X 4- 12 μm , often encrusted with a brown pigment. Clamp connections absent (Fig. 2).

Edibility: Edible

Chemical Composition (%): Protein 22. 21, Fiber 14. 14, Moisture 10. 99, Ash 13. 95, Fat 0. 05.

Habitat and Distribution: Solitary to scattered or gregarious in woods, associated mainly with conifers. Hajipir July 7, 1995, alt. 1950 m, Lectotype: Gardezi 762. Dhirkot Aug. 5, 1995, alt. 1676 m, Gardezi 763. Pir Chanasi July 8, 1996, alt. 1830 m, Gardezi 764. Tolipir Aug. 5, 1996, alt 1930 m Gardezi. 765.

The collected specimens of the species agree with published descriptions of Courtenay and Burdsall (1982). *R. placita* is closely related species of *R. chamaeleontina* described by Arora (1986).

New record: This species has been recorded for the first time from Azad Jammu and Kashmir.

Type: *Russula chamaeleontina* Fr.



Fig. 3: *Russula emetica*

***Russula emetica* (Schaeff. ex Fr.) S. F. Gray, Nat. Arr. Brit. Pl. 1: 618 (1821).**

(Drag)

Agaricus emeticus Schaeff. Fung. Bavar 4: Ind. 9: 15 (1774)- Fries, Syst. Myc. 1: 56 (1921).

Pileus 3- 12 cm broad, rounded convex becoming plane or broadly depressed, surface viscid when moist, smooth, bright red to scarlet, the centre often darker, fading in age or wet weather to pink, orange or blotched with white, margin eventually striate sometimes obscurely. Context white, brittle. Lamellae white or creamy white, brittle, close, adnate to adnexed or free. Stipe 4- 12 cm long, 0.5- 1.8 cm thick, equal or thicker below, dry, white or whitish. Spore print white. Basidiospores 9- 11 X 8- 9 μm , ellipsoid to subovoid, warts 0.4- 0.7 μm high, catenulate or isolated with bands and lines forming a more or less complete reticulum. Basidia 22- 35 X 6- 12 μm , broadly clavate, bearing four sterigmata. Lamellae edge heteromorphous. Cheilocystidia 45- 67 X 7- 12 μm , fusoid to ventricose, acute or mucronate, granular or banded. Pleurocystidia abundant 40- 60 X 10- 12 μm , ventricose, apices acute, often appendiculate, macrocystidioid. Hymenophoral trama irregular and intermixed, hyaline. Pileal surface an epicutis of erect or semi repent hyphae, 1.2- 2 μm diam., loosely arranged, intermixed with pileocystidia 45- 62 X 3- 9 μm , supported by a broad hypodermium, 360- 456 μm thick, of repent, gelatinized hyphae, 1- 3.8 μm wide. Clamp connections not present (Fig. 3).

Edibility: Poisonous.

Habitat and Distribution: Solitary, scattered or in groups in pine and oak forest. Hullar July 5, 1995, alt. 1333 m,

Lectotype: Gardezi 766. Las Dana July 26, 1995, alt. 1870 m, Gardezi 767.

Arora (1986) reported that this species is easily recognized by its red pileus, white stipe and lamellae, *R. mairei* is similar to *R. emetica* in colour but associated with hardwoods and with firmly texture and smaller spores 6-8 X 5- 7 μm . Hesler (1961) reported that spore size and height of the spore ornamentations suggest this species would be *R. emetica emeticella* (Singer) Singer. Gardezi (1986) reported this species from Kashmir.

New record: All the above localities.

Type: *Russula emetica* (Schaeff. ex Fr.) S. F. Gray.

***Russula baghensa* Gardezi sp. nov.**

(Drag)

Pileus 3- 12 cm diam., campanulate then expanded, glabrous or sometimes slightly pruinose on the margin, slightly gelatinized during rainy weather, margin obtuse not true rounded, centre broadly depressed, cuticle separable nearly to the disc, sometimes receding from the margin, surface viscid and shiny when wet, otherwise dry, dull, minutely scurfy, velvety, white to reddish white, cream colour, cream buff, straw yellow, warm buff, light ochraceous buff, maize yellow, trama firm, elastic when young soon brittle, white unchanging. Lamellae adnate, close to medium, with rare lamellulae, forked near the stipe, not anastomosing, intervenose up to 5 mm broad, white to cream colour, edges even. Stipe 5-10 cm X 1-5 mm, equal or slightly inflated towards the base, tough and flexuous, cylindrical, hollow, surface concolorous with the pileus towards the apex. Context white, firm, up to 3 mm thick at the disc, of slightly inflated, thin-walled hyphae 3- 8 μm diam. Odour not distinct, taste moderately acrid. Spore print pale cream. Basidiospores 5-11 X 4-7 μm , clavate to ovoid, hyaline, ornamented with very fine, amyloid verruculae. Basidia cylindrical to narrowly clavate, 25-56 X 10-13 μm , bearing four sterigmata. Cheilocystidia 26- 65 X 7-16 μm , narrowly to broadly clavate, with obtuse to rounded apex. Pleurocystidia 55- 85 X 6- 9 μm , sinuous, lanceolate fusoid, often constricted or mucronate, with abundant granular contents. Hymenophoral trama irregular and intermixed, hyaline. Subhymenial layer 22- 59 μm thick, well developed, pseudoparenchymatous. Pileal surface a trichodermial palisade of inflated clavate, obpiriform or subglobose elements 23-75 X 5-16 μm , thin-walled. Clamp connections not present (Fig. 4).

Edibility: Edible

Chemical Composition (%): Protein 22. 62, fiber 16. 01, moisture 10. 36, ash 16. 20, fat 2.68.

Habitat and distribution: Solitary to scattered or gregarious in mixed woods and under conifers. Hullar July



Fig. 4: *Russula baghensa*

4, 1995, alt. 1333 m, Holotype: Gardezi 868. Bagh July 15, 1995, 1840 m, Gardezi 869. Athmuqam July 15, 1996, alt. 1371 m, Gardezi 870.

Campanulate then expanded, glabrous, sometimes slightly pruinose on the margin, margin obtuse not true rounded, adnate lamellae stipe equal or slightly toward the base, spores subglobose to ovoid, none of the species of *Russula* known possess this combination of characters, therefore, new name has been given to the species. Its related species *R. maculata* group.

Type: *Russula baghensa* Gardezi sp. nov.

Derivation of name: The name of the species has been derived after the city Bagh from where the specimens were collected.

***Russula hullera* Gardezi sp. nov.**

(Drag)

Pileus 4- 18 cm diam., deeply infundibuliform expanding cyathiform, margin inflexed, not striate, surface gelatinous to slimy, white to dull white, disc frequently tinged pale brown to pale cream, glabrous or pruinose on the margin, slightly gelatinized, smooth, subacute or obtuse not truly round, surface convex, centre broadly not deep depressed, cuticle not separable from margin. Lamellae white, then cream colour, close to subclose, attenuate-attinent to subdecurrent, irregularly attached, not ventricose, rather narrow, in average specimens 4- 7 mm broad, equal and simple. Stipe 5- 8 cm, white, initially subpruinose, glabrescent, slightly longitudinally rugulose, solid, then stuffed or hollow, slightly tapering upwards, subequal. Context white, unchanging, firm, eventually rather fragile. Odour none, taste acrid. Spore print ivory yellow. Basidiospores 11- 12.5 X 5- 8 μm , hyaline, echinate, ornamentation rather variable 0.5- 1.2 μm high, spines irregularly arranged, dense to sparse,



Fig. 5: *Russula hullera*

mostly cylindrical but also conic- obtuse. Basidia 20-28 X 5- 9 μm ., cylindric- clavate, bearing four sterigmata up to 5 μm long. Cheilocystidia 41-90 X 10-14 μm , similar to pleurocystidia. Pleurocystidia abundant 31-55 X 5.5- 7 μm , microcystidioid, clavate, narrowly clavate to cylindrical with round apex, frequently pucronate, thin- walled, completely to partially filled with hyaline to yellow refractive contents in KOH. Hymenophoral trama regular, hyaline, with parallel hyphae, 3-7 μm diam., inflated to 15 μm diam. Subhymenial layer interwoven, 4-9 μm diam. Pileal surface an epicutis, of repent parallel hyphae, 2- 3 μm diam., loosely arranged, intermixed with numerous elongate pileocystidia, 32- 42 X 3-9 μm , supported by a broad hypodermium, 445-760 μm thick, of repent, gelatinized hyphae, 2-3.5 μm wide (Fig. 5).

Edibility: Edible

Chemical composition (%): Protein 27. 52, fiber 6.45, moisture 10. 80, ash 16. 40, fat 0.49.

Habitat and Distribution: Solitary to scattered or gregarious in mixed woods and under conifers. Sudhan Gali July 17, 1995, alt. 1902 m, Holotype: Gardezi 871. Chakar Aug. 15, 1996, alt. 1828, Gardezi 872. Hullar July 4, 1996, alt. 1333 m, Gardezi 873. Pir Chanasi Aug. 2, 1996, alt. 1830 m, Gardezi 874.

Pileus infundibuliform expanding cyathiform, lamellae attenuate- attinent to subdecurrent, spores mostly cylindrical but also conic obtuse, this combination of characters make the species new. Closely related species to *R. hullera* is *R. integra* group.

Type: *Russula hullera* Gardezi sp. nov.

Derivation of name: The name of the species has been derived from Hullar which is the locality of the specimen.



Fig. 6: *Russula lepida*

***Russula lepida* (Fr.) Fr., Sv. Aetl. Svamp: 50 (1836).**

(Drag)

Pileus 2- 12 cm broad, convexo- depressed to plano depressed, margin inflexed, striate, surface glutinous to slimy, carmine red, smooth, trama hard- rigid, brittle, white, unchanging. Lamellae free to adnexed, close, straight to slightly ventricose, anastomosing, white to yellowish white, with lamellulae, edges even. Stipe 2- 12 cm tall, 6- 20 mm broad, cylindrical to slightly clavate, surface dry, glabrous to minutely pruinose, white to reddish, trama hard, brittle, white, discolouring grayish to grayish orange, solid when young, becoming chambered to hollow in age. Spore print white in mass. Basidiospores 6- 9 X 4- 6 μm , broadly subglobose, ornamentation amyloid, warts 0.2-0.3 μm high, isolated, verrucae with partly interconnecting thin to thick ridges, forming a partial reticulum. Basidia 30- 54 X 6- 12 μm , clavate, bearing four sterigmata. Cheilocystidia abundant, 34- 67 X 6-12 μm , clavate to cylindrical, with rounded to acute apices, with refractive contents, pale yellow in KOH. Pleurocystidia abundant 43-67 X 8-12 μm , clavate, ventricose to subcylindric, obtuse, acute or mucronate, banded or empty. Hymenophoral trama composed of sphaerocysts and connective hyphae. Subhymenial layer 6- 9 μm thick, hyphae 2-6 μm wide, pseudoparenchymatous. Pileal surface gelatinous, epicutis consisting of ascending to erect hyphae, 2-4 μm wide, septate, branched, filamentous, with cylindrical end cells, hyaline in KOH. Clamp connections absent in all tissues (Fig. 6).

Edibility: Edible

Chemical composition (%): Protein 21. 86, fiber 8. 86, moisture 10. 33, ash 15. 04, fat 0. 22.

Habitat and Distribution: Scattered or in groups under both hardwoods and conifers. Hullar Aug. 6, 1996, alt. 1333 m, Lectotype: Gardezi 775. Anyaree Aug. 17, 1996, alt. 1640 m, Gardezi 776.

The collected specimens of the species closely resemble with the descriptions Hesler (1961). It is similar with *R. alutacea* described by Arora (1986)

New record: This species has been recorded for the first time from Azad Jammu and Kashmir.

Type: *Russula lepida* (Fr.) Fr.

***Russula nauseosa* Fr., Epicr. Myc.: 363 (1838).**

(Drag)

Pileus 5- 9 cm broad, plano- depressed at maturity, margin irregularly wavy, cuticle inseparable, surface moist, viscid when wet, radially streaked, with traces of brown fibrillar scurf, red to reddish brown, finely striate sulcate to the margin, with a tough, separable cuticle. Lamellae adnexed or with a decurrent tooth, arcuate, white to pale cream, narrow, 3-4 mm wide, moderately crowded, mostly equal but with occasional lamellulae, edge pruinose. Stipe 4- 6 tall, 1.5-3 cm wide, equal or slightly fluted at apex, surface dry, dull, scurfy, minutely scaly to areolate over entire length. Context thin, white to pale lilaceous, duplex, upper layer strongly gelatinized, with narrow loosely interwoven hyphae, 1-2. 5 μm diam., in a hyaline matrix, lower layer not gelatinized, with tightly interwoven hyphae, 1.5-3.5 μm diam., intermixed with small sphaerocysts, laticiferous hyphae also present, unchanging when cut. Odour and taste not distinct. Spore print pale cream. Basidiospores 7- 12 X 4-7 μm , oval, warts 0.6-1 μm high, hyaline, with a strongly amyloid reticulate ornament, reticulum complete, resulting in polygonal alveolae, uniting large, suprahilar plage inamyloid. Basidia 35-67 X 9-15 μm , elongate, clavate, with four small sterigmata. Lamellae edge sterile or heteromorphous, with crowded cheilocystidia. Cheilocystidia clavate, narrowly clavate to cylindrical with rounded apices, projecting up to 23 μm beyond the basidia, thin- walled hyaline. Pleurocystidia numerous, macrocystidioid, 59-80 X 7-13 μm , fusoid, pedicelate, sometimes with a mucronate apex, originating in the trama, hyaline, thin- walled, with oliaginous hyphae. Hymenophoral trama composed of sphaerocysts and connective hyphae. Subhymenial layer 15-45 μm thick, pseudoparenchymatous to prosenchymatous. with hyphal elements short, highly branched, nodular. Pileus surface two layered, 112-260 μm thick, hyaline to pale pink in KOH, epicutis 65-130 μm thick, a trichoderm or at



Fig. 7: *Russula nauseosa*

a time a distinct virescens- structure, epicuticular hyphae ends 12-123 X 3-6 μm , erect to suberect, cylindrical to ciliate, acicular or aculeate, often with irregular lobed or branched bases. Clamp connections absent in all tissues (Fig. 7).

Edibility: Unknown.

Habitat and Distribution: Solitary to scattered or gregarious in mixed woods and under conifers. Hullahar July 13, 1995, alt. 1333 m, Lectotype: Gardezi 777. Anyaree July 18, 1995, alt. 1640 m, Gardezi 778. Mujahidabad July 19, 1996, alt. 1840 m, Gardezi 779.

The collected specimens of the species agree with published descriptions of Hesler (1961). The related species *R. lutea* is described by Kibby and Milne (1979).

New record: This species has been recorded for the first time from Azad Jammu and Kashmir.

Type: *Russula nauseosa* Fr.

***Russula kashmira* Gardezi sp. nov.**

(Drag)

Pileus 13-26 cm broad, convex soon expanded often umbonate with incurved margin when young, soon plane to plano- depressed, margin striate to obscurely sulcate, or faintly tuberculate, sometimes rimose in old specimens,



Fig. 8: *Russula kashmira*

cuticle separable near to the disc, sometimes receding from the margin, viscid and shiny when wet, otherwise dry, dull, minutely scurfy, granular or velvety, becoming prominent upon drying, minutely rugulose, white to pale yellow, cream colour, cream buff, yellow, straw yellow, warm buff, light ochraceous buff, maize yellow, trama firm, elastic when young, soon brittle, up to 4.5 mm thick at midradius, yellow, unchanging. Lamellae adnate, close to medium, with rare lamullae, forked near the stipe, anastomosing, intervenose, white to cream colour, edges even. Stipe 3-7 cm tall, 0.8-1.5 cm wide, equal or slightly flared at apex or expanded or tapered toward the base, surface dry, brittle, glabrous to minutely pruinose to scurfy along entire length or only at apex, longitudinally rugulose, yellow to cream, trama firm when young, soon chambered or hollow, unchanging. Odour not distinct, taste slowly faintly to moderately acrid. Spore print pale cream. Basidiospores 8-11 X 2-5.5 μm , elliptical, fusiform, hyaline, with a strongly amyloid reticulate ornament, reticulum complete, hemispherical to pointed conical verrucae. Basidia 26-76 X 7-15 μm , elongate clavate, with four small sterigmata. Lamellae edge sterile or heteromorphous, with crowded cheilocystidia. Cheilocystidia macrocystidioid, 33-45 X 5-13 μm , fusoid to mucronate, hyaline, thin-walled, with granular contents. Pleurocystidia macrocystidioid, 51-73 X 5-14 μm , fusoid, pedicelate, sometimes with mucronate apex, originating in trama, hyaline, thin-walled. Hymenophoral trama irregular, hyaline, with more or less parallel hyphae, 4.5-9.5 μm diam. Subhymenial layer pseudoparenchymatous, 3-7 μm

wide. Pileal surface a discontinuous trichodermial palisade of small fascicle of erect, unbranched, septate hyphae, individual elements 3- 6 X 1- 5 μm , subglobose to narrow cylindric, terminal elements attenuate fusoid. Clamp connections absent (Fig. 8).

Edibility: Edible

Chemical composition (%): Protein 23. 55, fiber 13. 72, moisture 10. 19, ash 18. 27, fat 3.98.

Habitat and Distribution: Scattered or in small groups in hardwood and conifers. Hullar July 5, 1995, alt. 1333 m, Holotype: Gardezi 880. Anyaree Aug. 12, 1995, alt. 1640 m, Gardezi 881. Kahuta July 7, 1996, alt. 1820 m, Gardezi 882. Pileus convex soon expended and often umbonate, lamellae adnate close to medium, spores hemisphaerical to pointed conical verrucae, nonamyloid, on the basis of combination of these characters it is considered new species. *Russula claroflava* resembles with this species but also differ as its spores are 8- 9 X 6. 5- 7. 5 μm , ellipsoid, warts 0.4- 0.6 μm high, some catenulate, a few fine lines.

Type: *Russula kashmira* Gardezi sp. nov.

Derivation of name: The name of the species has been derived after the name of the Kashmir, where present research was conducted.

***Russula vesca* Fr. Epicr. Myc.: 352 (1838).**

(Drag)

Pileus 5- 18 cm broad, convex becoming plane or depressed, surface viscid when moist but soon dry, colour variable, pinkish lilac, dull purple, green, olive, yellow, blue green, white or brown, smooth, usually short to long sulcate or citriate, with broader incurved margin. Lamellae white becoming pale cream, unchanging or slightly staining brownish, crowded to subclose, plane, equal, forked, narrow, edge entire, anastomosing, narrowly adnexed to subdecurrent, Stipe 4- 15 cm, white, at times rusty or alutaceous, glabrous, hollow, slightly tapering downwards, ventricose or more rarely subequal. Context white, unchanging, thin to medium thick, firm elastic. Odour mild or pleasant, taste mild. Spore print white. Basidiospores 5.8- 8.7 X 4.5- 8 μm , short ellipsoid, punctate, the punctate warts isolated or more rarely with a few indistinct fine lines, not hemisphaerical to pointed conical verrucae. Lamella edge heteromorphous. Cheilocystidia 35-45 X 6-9 μm , ventricose, obtuse, banded, rare. Pleurocystidia 36-46 X 6-8 μm , mostly ventricose, a few obclavate, apices acute to mucronate or appendiculate, empty, scarce and mostly near the gill edge. Hymenophoral trama with large and numerous



Fig. 9: *Russula vesca*

sphaerocysts and large filamentous areas. Subhymenial layer narrow. Pileal surface a disrupted trichodermium by a broad hypodermium. Hypodermium 110- 123 μm thick, of tightly interwoven hyphae, slightly agglutinated (Fig. 9).

Edibility: Edible

Chemical Composition (%): Protein 20. 49, fiber 19. 04, moisture 11. 44, ash 19. 76, fat 0. 08.

Habitat and Distribution: Solitary, scattered or in groups under hardwoods or sometimes conifers. Sudhan Gali July 5, 1995, alt. 1902m, Lectotype: Gardezi 783. Hullar July 15, 1996, alt. 1333 m, Gardezi 784.

The collected specimens of the species agree with Hesler (1961).

New record: This species has been recorded for the first time from Azad Jammu and Kashmir. Closely related species is *R. cyanoxyntha* reported by Arora (1986)

Type: *Russula vesca* Fr.

Discussion

Locally collected species of *Russula aeruginea* revealed Pielus 3-9 cm broad, convex becoming plane or slightly depressed. The lamellae is adnate to adnexed or free. Stipe equal or with tapered base, white or faintly yellow. Kibby and Milne (1979) reported *Russula aeruginea* having Pileus 5-10 cm, convex then flattened, smooth dry. The lamellae yellow- buff, brittle, often forking. Stipe equal, fairly solid, white. The species of *R. chamaeleontina* collected during the present survey showed the following

characters: Pileus 2.5-10 cm broad, convex to plane or somewhat depressed. The lamellae close, adnate to adnexed free rarely anastomosing. Stipe 3-8 cm long, 0.5-2 cm thick, equal or slightly thicker at either ends. Courtenay and Burdsall (1982) reported *R. chamaeleontina* form USA with Pileus 2-6 cm, shades of red or purple fading to yellow, sticky margin lightly grooved. Lamellae almost free, close to crowded some forking. Stipe 2-6 cm, white, slightly ridged. The present studies on a local species of *R. emetica* resulted Pileus 3-12 cm broad, rounded convex becoming plane or broadly depressed. The lamellae adnate to adnexed or free white or creamy white. Stipe equal or thicker below, white or whitish. Species reported from USA with Pileus 5-10 cm, convex then expanded, margin sulcate. Lamellae pure white to pale cream. Stipe slightly bulbous, soft, fragile, pure white (Kibby and Milne, 1979). *R. lepida* produced Pileus 2-12 cm broad, convex depressed to plano depressed then margin inflexed. The lamellae free to adnexed, close, straight to slightly ventricose. Stipe cylindrical to slightly clavate. The species used for the comparison having Pileus 4-10 cm, convex then flattened, very firm fleshy. The lamellae crowded, narrow, off-white to cream. Stipe equal, very firm to hard fleshed (Kibby and Milne (1979). The fungi collected during present survey showed following characters: Pileus 5-18 cm broad relatively larger fruiting bodies, convex becoming plane or depressed. The lamellae crowded to subclose, plane, equal, forked. Stipe glabrous, hollow, slightly tapering downward. Species reported from USA with the following characters: Pileus 5-10 cm, convex then expanded, fleshy firm. Lamellae narrow, crowded, forking near stipe. Stipe firm, white, base often pointed (Kibby and Milne 1979). Gardezi (2002a, b, c) reported mushrooms from Kashmir are *Amanita elliptica*, *Amanita muscaria* var. *Alba*, *Ramaria aurea*, *R. botrytis*, *Phallus impudicus*, *Morchella elata* and *M. semilibra*, *Amanita ceciliae*, *A. subglobosia*, *A. pantherina*, *A. virosa*, *Volvariella bombycina* and *V. speciosa*. Thirteen species of mushrooms have been reported, two of them are new to science, nine new from Kashmir and two are redescribed. Eight species of mushrooms are described from Azad Jammu and Kashmir. Three of them are new to science, four are new to area and one is redescribed. All macro- and microcharacters were studied for their proper identification.

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