

Original Research Article

<https://doi.org/10.20546/ijcmas.2019.802.050>

Three Records of *Russula* Mushroom from Sal Forest of Central India

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ABSTRACT

Keywords

Agaricomycetes,
Distribution, Ecto-
mycorrhiza,
Russula, Sal forest

Article Info

Accepted:
07 January 2019
Available Online:
10 February 2019

Three records of genus *Russula* namely: *Russula brevipes*, *Russula luteotacta* and *Russula silvicola* were reported for the first time from central India. These mushrooms were collected from sal forest of Dindori, Madhya Pradesh. Earlier these fungi are reported from Kerala and Uttarakhand.

Introduction

Family Russulaceae was established by Roze in 1876 and it is one of the largest ectomycorrhizal families. The members of this family generally form ectomycorrhizal association in different angiosperm and gymnosperm trees like *Abies*, *Acer*, *Betula*, *Diospyros*, *Hopea*, *Larix*, *Myristica*, *Rhododendron*, *Shorea*, *Tsuga*, *Vateria*, etc. The genus is represented by about 130 taxa from India (Das *et al.*, 2014). Recently 124 species of the genus were listed from India and most of them including north-western subtropical and temperate forests of Himalayan region of Uttarakhand (Verma *et al.*, 2018). Many species of *Russula* are

edible, for example, *R. crustosa*, *R. lutea*, *R. olivacea*, *R. parvovirescens*, *R. senecis*, *R. virescens* (Atri *et al.*, 2010; Das *et al.*, 2002; Bhatt and Lakhanpal, 1988a, b; Kalita *et al.*, 2016; Khatua *et al.*, 2015; Semwal *et al.*, 2014). The present paper reports 3 species of *Russula*, namely *Russula brevipes*, *Russula luteotacta* and *Russula silvicola* as new records from sal forest of central India.

Materials and Methods

Specimens of mushrooms were collected from sal forests of Dindori district, Madhya Pradesh during rainy seasons. A part of collected sample was preserved in 70% alcohol just after collection for microscopic

study. The fruit bodies of fungi were dried under the sun or in the wooden box lighted with 100W electric bulb. Microscopic slides were prepared by using stain, mountant, clearing and softening chemicals. Slides were observed under advanced research microscope (Leica, Germany) using 5x, 10x, 20x, 40x objectives and 10x and 15x eyepieces. Observations under phase contrast and dark field were also made whenever required. Photomicrography was done with the help of a digital camera (make, Leica) attached to the advanced microscope. Identification of fungi has been done with the help of published literature, monographs, books, keys, etc. (Abraham *et al.*, 1980; Atri and Kour, 2003; Atri and Saini, 1986, 1990a; 1990b; 1990c; Atri *et al.*, 1992, 1997, 2016; Bhatt *et al.*, 1995, 2007; Buyck and Atri, 2011; Chaudhary and Tripathy, 2016; Crous *et al.*, 2016; Das and Sharma, 2001, 2003, 2005a,b; Das *et al.*, 2002c; 2005, 2006, 2008; 2010; 2013a,b; 2014; 2017; Dhancholia, 2011; Dutta *et al.*, 2015; Farook *et al.*, 2013; Ghosh and Das, 2017; Hedawoo, 2010; Joshi *et al.*, 2012; Kaur *et al.*, 2011; Kumar *et al.*, 2014; Manimohan and Deepna, 2011; Mohanan, 2011, 2014; Natarajan and Raman, 1983; Pavithra *et al.*, 2017; Pradeep and Vrinda, 2007, 2010; Rawla, 2001; Rawla and Sarwal, 1983; Saini *et al.*, 2010; Saini and Atri, 1981, 1984, 1989a, b; Saini *et al.*, 1988, 1989; Sarwal, 1984; Sathe *et al.*, 1980; Shaffer, 1962; Shajahan and Samajpati, 1995; Sharma and Das, 2002; Varghese *et al.*, 2010; Verma *et al.*, 2018; Vishwakarma *et al.*, 2012; Vrinda *et al.*, Vrinda *et al.*, 1997a, b; Watling and Gregory, 1980).

Results and Discussion

Taxonomic description

Russula brevipes Peck (Figures 1-6)

(Russulaceae, Russulales, Incertae sedis, Agaricomycetes, Basidiomycota, Fungi)

=*Russula brevipes* Peck var. *brevipes*
=*Russula brevipes* var. *acrior* Shaffer
=*Russula brevipes* var. *megaspora* Shaffer
=*Agaricus chloroides* Krombh. =*Russula delica* var. *glaucophylla* Quéf.
=*Russula delicula* Romagn.

Basidiome small sized, pileus 4.5-6 cm diam, convex to applanate often slightly depressed; surface grayish orange, to pinkish white, hygrophanous, drying pale ochraceous, weakly striate, glabrous to occasionally becoming fibrillose scaly. Lamellae sub-decurrent to decurrent, pale pinkish brown to pale pinkish, sub-distant. Stipe 3.5- 5 cm long, with 2-8 μm wide hyphae. Basidia 20-32.5 \times 6-7.5 μm , clavate, 4-spored. Basidiopores 6-8.7 \times 5-7.5 μm , sub-globose to globose or ellipsoid, echinulate. Macrocystidia, 38.5-45 \times 5-6.5 μm , filamentous, hyaline, hyphae hyaline, 2.5-7 μm wide. Pileipellis (uppermost layer of hyphae in the pileus, it covers the trama, fleshy tissue of the fruit body) of interwoven with scattered fascicles of erect to sub-erect hyphae, terminal cells slightly swollen, sub-clavate or capitate, pale yellowish brown in mass.

Collection examined

On base of *Shorea rubusta* tree in sal forest of Karanjaya, Dindori, Madhya Pradesh, 20/07/2018, specimen deposited at Mycology Herbarium, Tropical Forest Research Institute, Jabalpur, TF 4047

Russula luteotacta Rea (Figures 7-12)

=*Russula sardonica* sensu Bresadola
=*Russula luteotacta* Rea var. *luteotacta*
=*Russula luteotacta* var. *intactor* Jul. Schäff.
=*Russula luteotacta* var. *semitalis* J. Blum
=*Russula luteotacta* var. *serrulata* J. Blum
=*Russula luteotacta* f. *alba* Fillion & Frund
=*Russula luteotacta* f. *griseoalba* Bidaud & Frund

=*Russula luteotacta* var. *cyathiformis*
Reumaux & Frund

=*Russula luteotacta* var. *duriuscula* Reumaux
& Frund

=*Russula luteotacta* var. *terrifera* Reumaux &
Frund

Taxonomic description

Basidiome small to medium sized, pileus 5-7cm, fleshy, convex with a broad depression at the centre; surface grayish – pink, sometimes with white tints at the place, sticky when wet, translucent straight at the margin, pellicle peels off easily up to mid radius, faint smell; Margin crenate, incised, lamellae adnexed, appearing free when mature, pale pink, crowded without lamellulae, rarely bifurcated, context white, unchanging brittle, gills pale-cream, free of the stem, crowded, brittle to touch. Cap convex becoming flattened with slight depression in the middle, pink or pale red with white underneath, flesh white. Stipe 4-8 x 1-1.5cm, central slightly broader at base, stuffed; surface white, smooth with a faint red colour at the apex and middle, stem white with pale pink, sometimes red marks, annulus absent. Basidia, clavate, 25-37.5 x 7.5-12.5 µm 4-spored. Lamellaedge heteromorphous, cheilocystidia and pleurocytidia macrocystidioid, rare, 75-100 x 7.5-12.5µm, broadly clavate with an apical projection which is filled with refractive contents. Basidiospores 6.2-10 x 5-7.5µm, subglobose, ornamentation moderately thick, forming a more or less complete reticulum, superhilar area in myloid, spore print, off-white. Subhymenium pseudoparachymatous, trama heteromorphous with abundant sphaerocytes. Pleipellis a gelatinized trichodermium. It is a poisonous and rare species.

Collection examined: On base of *Shorea rubusta* tree in sal forest of Karanjjiya, Dindori (Madhya Pradesh), 2007/2018, specimen deposited at Mycology Herbarium,

Tropical Forest Research Institute, Jabalpur, TF 4048.

***Russula silvicola* Shaffer (Figures 13-22)**

Basidiome small sized, cap 3-5cm diam., convex at first but becoming flattened in age, sometime developing a sunken center, bright red to pinkish red, surface of cap smooth; gills attached to the stem; close to moderately well spaced; stipe 5-7cm long, 1-1.5cm thick, dry fairly smooth. Hyphae 5-7.5µm wide. Basidiospores 7.5-11.2 x 7-9µm, mostly with isolated extending warts. Basidia 25-45 x 8.7-12.5µm, clavate, 4-spored. Lamella edge sterile; macrocystidia, 87.5-107.5 x 10-12.5µm. Sterigmata 5-7.5 µm long.

Collection examined: On soil surface under *Shorea rubusta*, in sal forest of Karanjjiya, Dindori, Madhya Pradesh, 20/07/2018, specimen deposited at Mycology Herbarium, Tropical Forest Research Institute, Jabalpur, TF 4049.

Recently 124 species of *Russula* reported from different parts of India were listed (Verma *et al.*, 2018). *Russula brevipes* was reported on *Monotropa uniflora*, a mycoheterotrophic plant found in eastern and western North America (Bidartondo and Bruns 2001). It is a common ectomycorrhizal fungus associated with several hosts (conifers to hardwoods) across temperate forest ecosystems. Typical hosts including trees belonging to genera like, *Abies*, *Picea*, *Pseudotsuga*, *Shorea* and *Tsuga*. It was recorded associated with *Pinus wallichiana*, producing fruit bodies singly or in groups and fruiting season occurs from summer to autumn. This mushroom is quite commonly encountered in late autumn. The species has been reported from western North America (Illinois, Québec, Pennsylvania, Michigan, California, and Colorado) and Himalayan moist temperate forests of Pakistan (Shaffer, 1975).

Fig.1-2 *Russula brevipes*: 1 fruit bodies growing in sal forest around coppiced stump, 2 broken fruit body showing gills and fleshy stem



Fig. 3-6 *Russula brevipes*: 3 epithelial element, 4 macrocystidia and basidia, 5-6 basidiospores

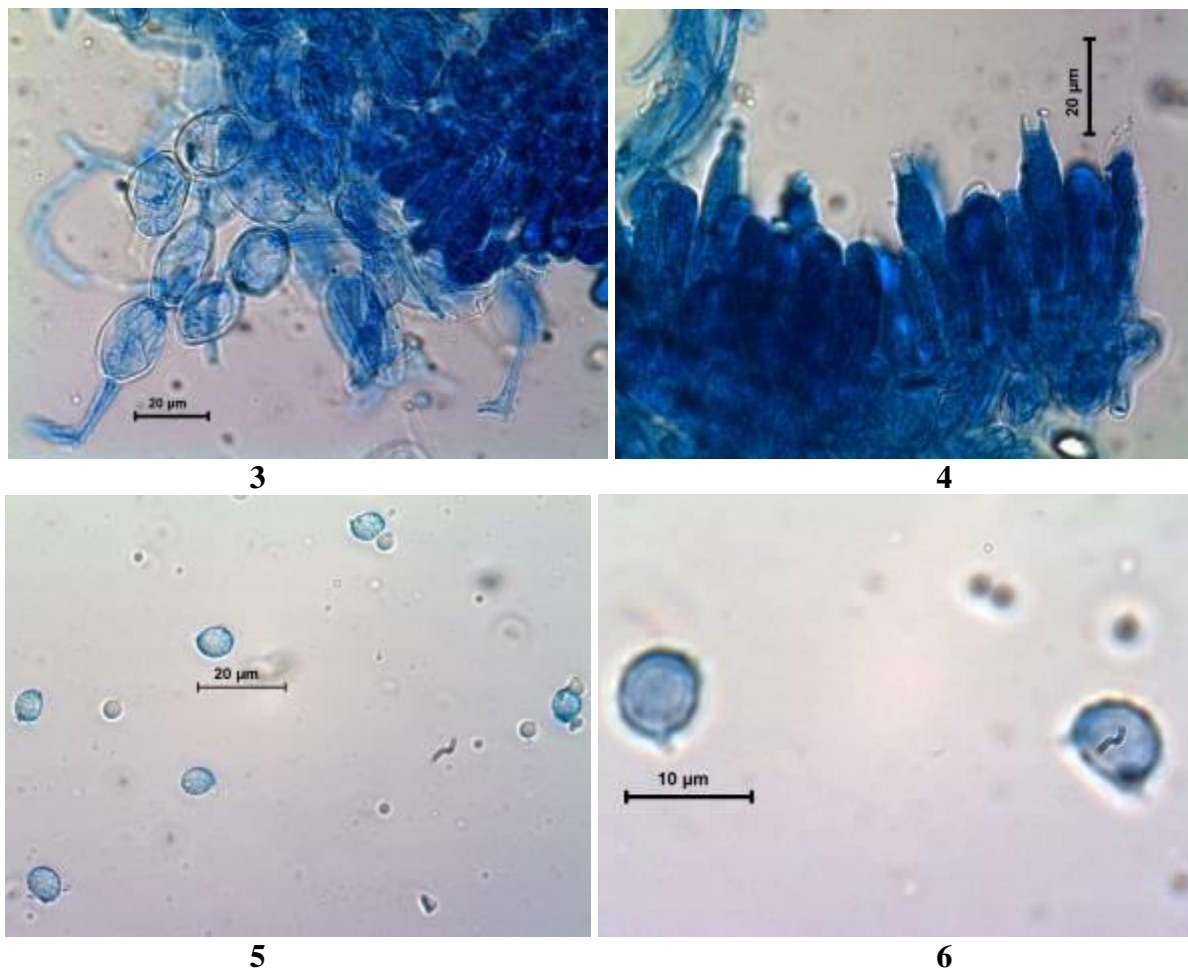


Fig.7-8 *Russula luteotacta* 7 fruit bodies in habit, 8 showing gills and stipe



Fig.9-12 *Russula luteotacta* 9 epithelial element, 10-11 basidia and macrocystidia, 12 basidiospores

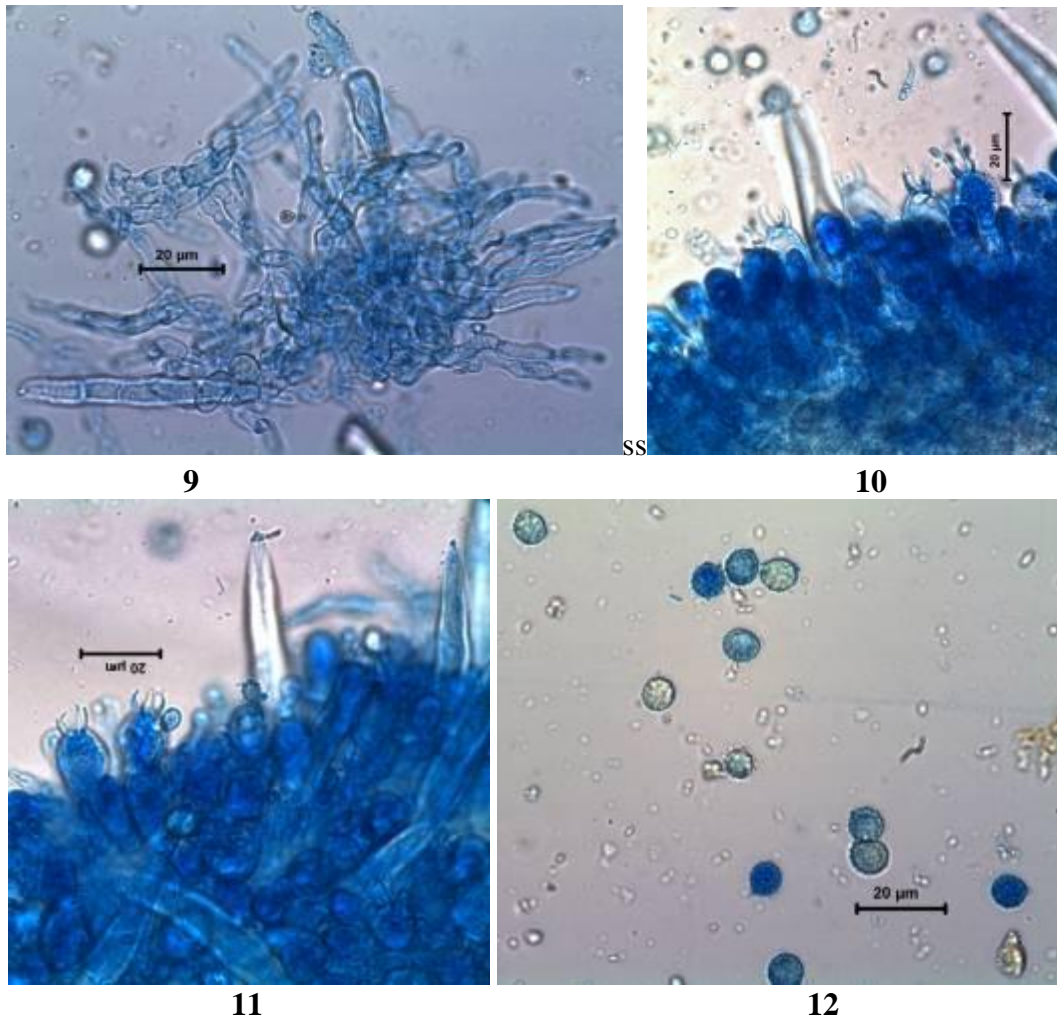


Fig.13-16 *Russula silvicola*, 13 emerging fruit body in habit, 14 young fruit body, 14 pileus upper surface and 16 arrangement of gills



13



14

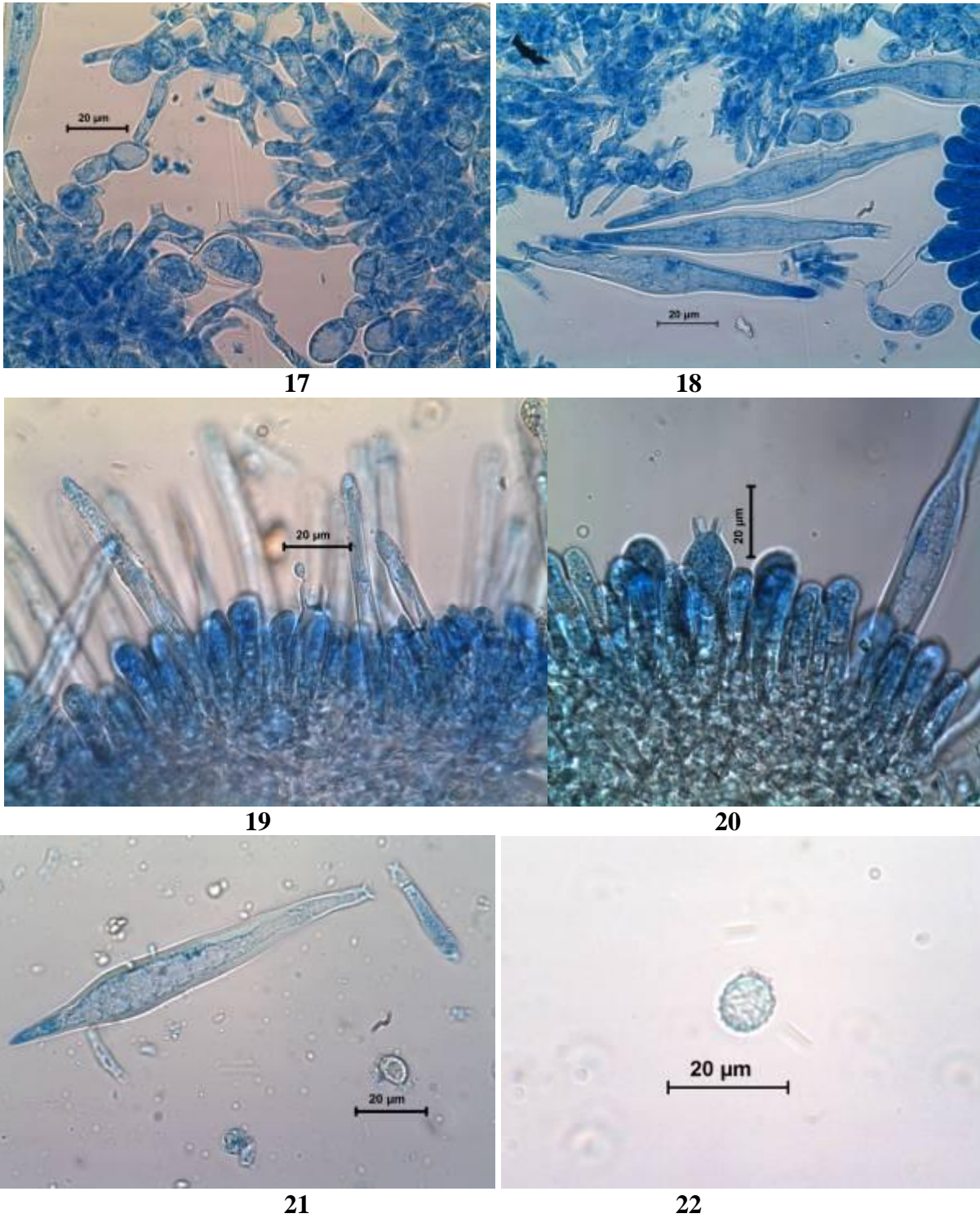


15



16

Fig.17- 22 *Russula silvicola*, 17 epithelial element, 18 macrocystidia 19 macrocystidia and basidia, 21 macrocystidia, 22 basidiospore



From India it was reported from Jageshwar, Almora, Mayawati and Champawat,

Uttarakhand (Das and Sharma, 2005b), from Nagaland (Kumar *et al.*, 2014) and from

Jammu and Kashmir (Watling and Gregory, 1980). In the present article it is being reported from sal forest of Dindori, Madhya Pradesh.

Russula luteotacta is distributed in moist-deciduous to evergreen forest. The species is a poisonous mushroom and occurs solitary or scattered in small-groups on soil under *Hoea ponga*, *H. parviflora*, *Vetaria indica*, *Diospyros malabarica* and *Shorea robusta* forming ecto-mycorrhizal association. It also grew in broad leaved woodland or under individual broad leaved trees. The species is distributed in Denmark and in India. The species was reported from Kerala (Pradeep and Vrinda, 2010; Mohanan, 2011, 2014). In the present article it is being reported for the first time from sal forest of central India.

Russula silvicola was reported from Pauri Grahwal, Uttarakhand (Bhatt *et al.*, 2007). The species was earlier recorded from oak and beech rotten woods. It was found throughout eastern Durham, New Hampshire and North America (Michigan). The species was reported to form ectomycorrhizal association with these forest trees like oak and beech (Shaffer, 1975). *R. silvicola* is the only species of *Russula* in which the cap is some shade of red or pink, it is often difficult to distinguish one species from another on the basis of features that can be observed in the field. This species is often confused with the very similar species like, *R. emetica*, *R. congoana* and *R. cremicolor*.

In conclusion, three new records of macro-fungi, namely *Russula brevipes*, *R. luteotacta* and *R. silvicola* were reported from sal forest of central India.

Acknowledgements

The work presented here was conducted under project ID No. 224/TFRI/2016/Patho-

1(22) funded by Indian Council of Forestry Research & Education (ICFRE), Dehradun.

References

- Abraham SP, Kachroo JL, Kaul TN (1980). Fleshy fungi of Gulmarg forest -I. Kavaka 8(1): 29-39.
- Atri NS, Kour H (2003). Some unrecorded light spored mushrooms from Punjab. Indian Journal of Mushrooms 21:1-4.
- Atri NS, Saini SS (1990a) Studies on *Russula* Pers. Section *Decolorantes* (Maire) Sing. Geobios New Reports 9: 10–13.
- Atri NS, Saini SS (1990b). North Indian Agaricales–VIII. The section compactae Fr. of *Russula* Pers. in India. Journal of the Indian Botanical Society 69, 343–346.
- Atri NS, Saini SS (1990c). North Indian Agaricales-VIII. The Section Compactae Fr. of *Russula* Pers. Journal of Indian botanical Society 69: 343-346.
- Atri NS, Saini SS, Saini MK (1997). Studies on genus *Russula* Pers. from North Western Himalayas. Mushroom Res. 6: (1) 1-6.
- Atri NS, Saini SS, Saini MK, Gupta AK (1992). Two new records of the genus *Russula* from India. Geobios new Reports 11: 101-103.
- Atri NS, Saini, SS (1986). Further contributions on the studies of northwest Himalayan Russulaceae. *Geobios New Reports* 5: 100–105.
- Atri NS, Sharma Samidha, Kaur M, Das K (2016). Researches on Russulaceous Mushrooms - An Appraisal. Kavaka 47: 63-82.
- Bhatt RP, Bhatt VK, Gaur RD (1995). Fleshy fungi of Gahwal Himalaya: The genus *Russula*. Indian Phytopathology 48: 402–411.
- Bhatt RP, Purnima S, Semwal KC (2007). New records of *Russula* from Garhwal Himalaya. Mushroom Research 16(2):

- 55– 60.
- Bidartondo MI, Bruns TD (2001). Extreme specificity in epiparasitic Monotropoideae: wide spread phylogenetic and geographic structure. *Molecular Ecology* 10: 2285-2295.
- Buyck Bart, Atri NS (2011). A *Russula* (Basidiomycota, Russulales) with an unprecedented hymenophore configuration from northwest Himalaya (India). *Cryptogamie Mycologie*. 32(2): 185-190.
- Chaudhary Rohina, Tripathy Astha (2016). Diversity of wild mushroom in Himachal Pradesh (India). *International Journal of Innovative Research in Science, Engineering and Technology* 5(6): 10859-10886.
- Crous PW, Wingfield MJ, Richardson DM *et al.*, (2016). Fungal Planet description sheets: 400-468. *Persoonia* 36: 316-458
- Das K, Atri NS, Buyck B (2013a). Three new species of *Russula* (Russulales) from India. *Mycosphere* 4(4): 707–717.
- Das K, Atri NS, Buyck B (2013b). Three new species of *Russula* (Russulales) from Sikkim (India). *Mycosphere* 4(4): 722–732.
- Das K, Dowie NJ, Li GJ, Miller SL (2014). Two new species of *Russula* (Russulales) from India. *Mycosphere* 5(5): 612–622.
- Das K, Ghosh A, Chakraborty D *et al.*, (2017). Fungal Biodiversity Profiles 31-40. *Cryptogamie Mycologie* 38(3): 353-406.
- Das K, Miller SL, Sharma JR, Hemenway J (2008). Two new species of *Russula* from Western Ghats in India. *Indian Journal of Forestry* 31(3), 473– 478.
- Das K, Sharma JR (2001). *Russula rhodomelanea* Sarnari - a new record for India. *Mushroom Research* 10: 109–111.
- Das K, Sharma JR (2003). New records of *Russula* from Kumaon Himalaya. *Indian Journal of Forestry* 26: 320–326.
- Das K, Sharma JR (2005a). Russulaceae of Kumaon Himalaya. Botanical Survey of India, Ministry of Environment and Forests, Govt. of India, Kolkata, pp 255.
- Das K, Sharma JR (2005b). Russulaceae of Kumaon Himalaya. Botanical Survey of India, Ministry of Environment and Forests, Govt. of India, Kolkata, pp. 255.
- Das K, Sharma JR, Atri NS (2006). *Russula* in Himalaya 3: A new species of subgenus *Ingratula*. *Mycotaxon* 95, 271–275.
- Das K, Sharma JR, Bhatt RP (2002). *Russula flavida* Frost – an addition to the Indian ectomycorrhizic fungi. *Mushroom Research* 11: 9–10.
- Das K, Van de Putte K, Buyck B (2010). New or interesting *Russula* from Sikkim Himalaya (India). *Cryptogamie Mycologie* 31(4): 373–387.
- Dhancholia S (2011). New records of genus *Russula* from dry temperate zone of Lahul Valley of Himachal Pradesh. *Plant Disease Research* 26: 203.
- Dutta AK, Paloi S, Pradhan P, Acharya K (2015). A new species of *Russula* (Russulaceae) from India based on morphological and molecular (ITS sequence) data. *Turkish Journal of Botany* 39: 850-856.
- Dutta AK, Paloi S, Pradhan P, Acharya K (2015). A new species of *Russula* (Russulaceae) from India based on morphological and molecular (ITS sequence) data. *Turkish Journal of Botany* 39: 850-856.
- Farook VA, Khan SS, Manimohan P (2013). A checklist of agarics (gilled mushrooms) of Kerala State, India. *Mycosphere* 4(1): 97–131.
- Ghosh A, Das K (2017). *Russula* (Russulaceae) in western Himalaya 1: Two new species from subg. *Russula*. *Phytotaxa* 323(3): 337-

- 252.
- Hedawoo GB (2010). Wild mushroom flora from Amravati Region, Maharashtra, India. *Journal of Mycology and Plant Pathology* 40(3): 441–444.
- Joshi S, Bhatt RP, Stephenson SL (2012). The current status of the family Russulaceae in the Uttarakhand Himalaya, India. *Mycosphere* 3(4): 486–501.
- Kaur M, Atri NS, Sharma S, Singh Y (2011). Three taxa of genus *Russula* Pers section *Tenellae* from India. *Journal of Mycology and Plant Pathology* 41(4): 524-527.
- Kumar R, Tapwal A, Pandey S, Raja-Rishi R, Mishra G, Giri K. (2014). Six unrecorded species of *Russula* (Russulales) from Nagaland, India and their nutrient composition. *Nusantara Bioscience* 6(1): 33-38
- Manimohan P, Deepna Latha KP (2011). Observations on two rarely collected species of *Russula*. *Mycotaxon* 116: 125-131.
- Mohan C (2011). Macrofungi of Kerala. *Kerala Forest Research Institute, Hand Book # 27, Kerala, India, 597pp.*
- Mohan C (2011). Macrofungi of Kerala. *Kerala Forest Research Institute, Hand Book # 27, Kerala, India, 597pp.*
- Mohan C (2014). Macrofungal diversity in the Western Ghats, Kerala, India: members of Russulaceae. *Journal of Threatened Taxa* 6(4): 5636–5648.
- Mohan C (2014). Macrofungal diversity in the Western Ghats, Kerala, India: members of Russulaceae. *Journal of Threatened Taxa* 6(4): 5636–5648.
- Natarajan K, Raman N (1983). South Indian Agaricales. J. Cramer, Vaduz, Germany.
- Pavithra M, Sridhar KR, Greeshma AA (2017). Macrofungi in two botanical gardens in southwestern India. *Journal of Threatened Taxa* 9(3): 9962–9970.
- Peck CH (1890). Report of the Botanist (1889). Annual Report on the New York State Museum of Natural History. 43:51-97
- Pradeep CK, Vrinda KB (2007). Some noteworthy agarics from Western Ghats of Kerala. *Journal of Mycopathological Research* 45(1): 1-14.
- Pradeep CK, Vrinda KB (2010). Ectomyrrhizal fungal diversity in three types and their association with endemic, indigenous and exotic species in the Western Ghar forests of Thiruvanthapuram district Kerala. *Journal of Mycopathological Research* 48(2): 279-289.
- Pradeep CK, Vrinda KB (2010). Ectomyrrhizal fungal diversity in three types and their association with endemic, indigenous and exotic species in the Western Ghar forests of Thiruvanthapuram district, Kerala. *Journal of Mycopathological Research* 48(2): 279-289.
- Rawla GS (2001). Himalayan Species of *Russula* Pers. Ex S.F. Gray, 1-48. In: Plant Diversity of the Himalaya (eds. PC Pande, SS Samant). Gyanodaya Prakashan, Nainital, India, pp 1– 48.
- Rawla GS, Sarwal BM (1983). Taxonomic studies on Indian Agarics 1. Russulaceae. *Bibliotheca Mycologica* 91: 23–46.
- Rea C (1922). British Basidiomycetae: A handbook to the larger British fungi. Pp 1-799
- Saini MK, Atri NS, Sharma Samidha, Priya Janki (2010). Taxonomic Studies on the Genus *Russula* Pers. from Himachal Pradesh, India. *Journal of Mycology and Plant Pathology* 40 (1): 52-54.
- Saini SS, Atri NS (1981). *Russula foetens* (Pers.) Fr. – A new record for India. *Current Science* 10: 460-461.
- Saini SS, Atri NS (1984). Studies on the North-West Himalayan Russulaceae.

- Geobios New Reports 3: 4-6.
- Saini SS, Atri NS (1989a). North Indian Agaricales–IX section Ingratae Quel. of *Russula* Pers. Kavaka 17: 21–27.
- Saini SS, Atri NS (1989b). North Indian Agaricales XI-Section *Russula* Pers. in India, Indian Journal of Mycology and Plant Pathology 19: 44-49.
- Saini SS, Atri NS, Bhupal M (1988). North Indian Agaricales V. Indian Phytopathology 41: 622-625.
- Saini SS, Atri NS, Saini MK (1989). North Indian Agaricales VI. Journal of the Indian Botanical Society 68: 205–208.
- Sarwal BM (1984). Taxonomic studies on Indian Agarics II. Indian Phytopathology 37: 228-233.
- Sathe AV, Deshpande S, Kulkarni SM, Daniel J (1980) (1981). Agaricales (Mushrooms) of South-west India - Part I: Agaricales (Mushrooms) of Maharashtra State (MACS, Pune). Pp. 1-114.
- Shaffer RL (1964). The subsection Lactarioideae of *Russula*. Mycologia. 56(2):202-231
- Shaffer RL (1975). Some common North American species of *Russula* subsect. Emeticinae. Beihefte zur Nova Hedwigia 51: 207-237.
- Shajahan M, Samajpati N (1995). Ectomycorrhizal fungi of *Shorea robusta* G.G. from West Bengal. Indian Journal of Mycological Research 33: 105-117.
- Sharma JR, Das K (2002). New records of Russulaceae from India. Phytotaxonomy 2: 11-15.
- Varghese SP, Pradeep CK, Vrinda KB (2010). Mushrooms of tribal importance in Wayanad area of Kerala. Journal of Mycopathological Research 48(2): 311-320.
- Verma RK, Pandro V, Pyasi A (2018). Diversity and distribution of *Russula* in India with reference to central Indian species. International Journal of Current Microbiology and Applied Science 7(10): 3078-3103.
- Vishwakarma MP, Bhatt RP, Joshi Sweta (2012). Macrofungal diversity in moist temperate forests of Garhwal Himalaya. Indian Journal of Science and Technology 5(1): 1928-1932.
- Vrinda KB, Pradeep CK, Abraham TK (1997a). A new species of *Russula* from Kerala, India. Mycotaxon 62: 87-96.
- Vrinda KB, Pradeep CK, Abraham TK (1997b). A new species of *Russula* from Kerala, India. Mycotaxon 62: 389-394.
- Watling R, Gregory NM (1980). Larger fungi from Kashmir. Nova Hedwigia 32(2-3): 493-564.

How to cite this article:

Verma, R.K., V. Pandro and Rao, G.R. 2019. Three Records of *Russula* Mushroom from Sal Forest of Central India. *Int.J.Curr.Microbiol.App.Sci.* 8(02): 445-455.
doi: <https://doi.org/10.20546/ijcmas.2019.802.050>