**Lactifluus volemus**: An Addition to the Fungi of Pakistan

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**Abstract**

*Lactifluus volemus* (Fr.) Kuntze, an edible mushroom, was collected from moist temperate coniferous forests of Miandam Valley, Swat, Khyber Pakhtunkhwa. The species is reported and described for the first time from Pakistan. Distinguishing features are reddish to orange color, azonate pileus, creamy white milk, crowded gills, sub-cylindrical to sub-fusiform pleuromacrocystidia, cheilocystidia and globose to subglobose reticulated spores. © 2016 Friends Science Publishers

**Keywords:** *Lactifluus volemus*; Fungi; New records; Pakistan

**Introduction**

The genus *Lactifluus* (Pers.) Roussel, belongs to Russulaceae Lotsy, which is a large family of ectomycorrhizal basidiomycetes that plays an important role in forest ecosystems throughout the globe. Miller et al. (2006) described many genera out of which hardly 8–10 are currently in use and bulk of the species belong to the agaricoid genera only. Until recently only two agaricoid genera were identified namely *Lactarius* (Pers.) and *Russula* (Pers.), however recent research (Verbeken and Nuytinck, 2013) showed that, the family consists of four main agaricoid genera (*Lactarius, Russula, Lactifluus* and *Russula*) and includes some corticioid species (Buyck et al., 2008). *Lactarius*, once characterized as monophyletic group (Miller et al., 2006) with a striking character of exuding milk is now split into two genera, *Lactarius* and *Lactifluus* and is paraphyletic. Out of these *Lactifluus* seems the most variable, which mainly consists of tropical species and recent studies (Putte et al., 2009; Stubb et al., 2010) have shown a large cryptic diversity within the genus. Morphologically, this genus can be differentiated from *Lactarius* by complete absence of zonate and glutinose caps, includes all annulate species and may contain species with veils and velvety caps (Buyck et al., 2008).

Miandam Valley is an important summer resort situated at a distance of 56 km on northeastern side of Saidu Sharif, the capital city of District Swat. It is located between 34° 34 to 35° 07 N latitudes and 72° 36 to 73° 35 E longitudes in the Hindu Kush mountain range (Akhtar et al., 2013). Total area of the valley is 17166 acres with a population of 20529 individuals (Latif et al., 2006). The valley contains 5 main villages namely Barhampatai, Jukhtai, Senay, Khairabad and Miandam and many small hamlets in the mountains. Altitude of the area ranges from 1200 to 3600 m. Single main stream “Mindam Khwar” drains the whole valley assisted by large number of springs providing water for household use.

Climatically the area fall under moist temperate zone, where the winters are long and severe with heavy snowfall that occur from December to March. Melting of snow starts from March and completes to the end of May. On the other hand, summer is pleasant with plenty of monsoon rains that occur in July and August. Forests of the study area are lush green and thick, dominated by coniferous trees mainly *Abies pindrow* (Royle ex D. Don) Royle and *Pinus walliciana* A.B. Jacks. These forests host variety of important medicinal and aromatic plants (Sher et al., 2015) together with a huge diversity of macrofungal species (Sher et al., 2010). But relative to plants, macrofungal surveys have been rarely conducted and a small fraction of the existing species are reported (Ahmad et al., 1997). Sharif (2012) worked on the molecular and morphological characterization of Pezizales from Himalayan moist temperate forests of Pakistan and reported 40 species belonging to 13 different families. Razaq et al. (2013) reported *Lepiota acutesquamosa* (Weinn.) P. Kumm. and *L. cristata* (Bolton) P. Kumm. from Himalayan moist temperate forest of Pakistan. Nawaz et al. (2013) reported a new species of macrofungi (*Lepiota vellingana* sp. nov.) from Lahore Pakistan. Hanif et al. (2014) reported a new club fungus species of *Clavariadelphus pakistanicus* sp.nov. from moist temperate forests of Pakistan. Razaq et al. (2014) worked on taxonomy and phylogenetics of *Hygrophorus chrysodon* from western Himalayan forest of Pakistan. Saba and Khalid (2014a) reported *Callistosporium puteolivaceum* (Berk. & M.A. Curtis) Singer, for the first time from western Himalayan forests of Pakistan. Saba and Khalid (2014b) reported *Melanoleuca cinereofolia* (Bon) Bon, for the first time from moist temperate forest of Pakistan. Hussain et al. (2015) worked on macrofungi of Malakand district and reported a new species of *Tulostoma*...
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Materials and Methods

The specimens were collected during a field visit to Minadam valley, Swat, Pakistan. Basidiocarps were dug out by using a sharp knife with great care and photographed. Size, shape, color, habitat and other relevant macromorphological characters were noted at the spot using a field notebook. Specimens were then sun dried, put in ziplock bags and kept in freezer for few days to kill any larvae or insect eggs. Microscopic observation were made by using light microscope fitted with camera Lucida for Drawing. Slides were prepared in 5% Potassium Hydroxide (KOH) as mounting medium and Congo red was used for staining purpose. Basidia, cystidia, spores and other anatomical features were analyzed, drawn and measured from three different basidiocarps. For Measurements 20 randomly selected spores, cystidia and basidia were measured and then averaged to get the final measurement. Properly dried and identified specimens were then deposited to the Herbarium University of Swat (SWAT).

Results

Macro and micro morphological characters confirms the specimen to be Lactifluus volemus after referencing it to the literature (Hesler and Smith, 1979; Mcknight and McKnight, 1987; Lalli and Pacioni, 1994; Montoya et al., 1996; McKnight and Peterson, 1998; Bessette et al., 2009; Putte et al., 2010). Review of literature also confirms this to be the first record of L. volemus from Pakistan and is not hitherto reported by Ahmad et al. (1997), Hanif (2011), Sultana et al. (2011), Sharif (2012), Fiaz (2013), Ilyas (2013), Yousaf (2014).

Description of Lactifluus volemus (Fr.) Kuntze

Synonyms: Agaricus lactifluus, Agaricus volemus, Lactarius volemus. Pileus 50-90 mm diameter, convex with an incurved margin at first then flat with a slightly depressed center, reddish orange when young, turning reddish brown at maturity, center more darkly colored compared to margins, cap surface appears velvety when young, then smooth with age, wrinkled towards margins. Lamellae slightly decurrent, crowded, reddish when young, turning whitish yellow at maturity, exudes creamy to whitish milk on cutting, bruising brown. Stipe 30-60 × 10–15 mm, central, tapered towards base, concolorous with cap with a lighter upper portion and a darker basal portion, stuffed, context cream colored (Fig. 1).

Basidiopores 7.5–9 × 7–8.5 µm, globose to sub globose, reticulated, reticulum complete, with prominent apiculus. Basidia 35–60 × 10–12 µm, clavate to cylindrical, thin-walled, 4-spored. Cystidia two types viz., pleuromacrocystidia and cheilocystidia. Pleuromacrocystidia large and numerous, 50–100 × 7.5–10 µm, sub cylindrical to sub fusiform with pointed ends, thick-walled, walls up to 3 µm. Cheilocystidia shaped like pleuromacrocystidia but smaller in size, 30–60 × 6–8 µm. Pileipellis composed of irregular cells, which appears to be lamprotichoderm. Pileocystidia 50–100 × 2.5–3.3 µm, cylindrical to setiform, scattered. Context composed of sphaerocytes, 25–30 µm (Fig. 2).

Habitat and distribution: Mycorrhizal, solitary or in small scattered groups under Abies pindrow and Pinus wallichiana trees.

Materials examined: Pakistan, Khyber Pakhtunkhwa, Miandam Swat, 35°2’31.01’’N 72°35’25.42’’E, altitude 2600 m a.s.l, 14. 08. 2014, Junaid (SWAT MM-42).
**Discussion**

*L. volemus* formerly known as *Lactarius volemus* is an edible mushrooms of Family Russulaceae. It is an important species that form mycorrhizal association with many trees species in the forests and thus is ecologically important. It is also valued as edible and is collected for personal use or even sometimes sold in markets especially in Asia. This species is sometimes misidentified due to the presence of few other morphologically similar species. One of the most similar species is *L. corrugis* (Peck) Kuntze, which can be differentiated from the former by its darker color, corrugated cap (Roody, 2003) and larger spore size ranging from 9–12 μ (Hesler and Smith, 1979; Montoya et al., 1996). Other similar species is *L. hygrophoroides* (Berk. & M.A. Curtis) Kuntze, which can be differentiated by widely spaced gills, lack of reticulated spores (McKnight and McNight, 1979; Pegler and Fiard, 1979) and lighter color. The fish like odor is another important character that characterize and distinguish *L. volemus* from its looks alikes.

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**References**


Ilyas, S., 2013. Molecular investigations to characterize ectomycorrhizal fungal communities associated with some deciduous trees of Galliyat, Pakistan. *Ph.D. Thesis* submitted to department of Botany, University of the Punjab, Lahore, Pakistan


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