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Full Length Article

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-cylindric 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 (*Multifurca*, *Lactarius*, *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; Stubbe *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 34º 34 to 35º 07 N latitudes and 72º 36 to 73º 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* (Weinm.) 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 luteoolivaceum* (Berk. & M.A. Curtis) Singer, for the first time from western Himalayan forests of Pakistan. Saba and Khalid (2014b) reported *Melanoleuca cinereifolia* (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*

ahmadii sp. nov. together with other fungi. Jabeen *et al.* (2016) reported a new species of Inocybe (Inocybe kohistanensis) from Swat Kohistan.

Review of literature reveals that the present state of knowledge of the macromycetes in Pakistan is satisfactory but the current data is still insufficient for a comparison among most ecoregions of the country or other regions of the world. There are very few published monographs, keys, or lists for the bulk of macrofungi of Pakistan. Most of the macromycetes of Pakistan in general and district Swat in particular awaits documentation, which is a costly and time-consuming task. The present study was therefore initiated with the aim to document the important macrofungal species from the study area.

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 clylinderical, thin-walled, 4-spored. Cystidia two types viz., pleuromacrocyatidia 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 lamprotrichoderm. 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).

Fig. 1: Pictorial presentation of *Lactifluus volemus*

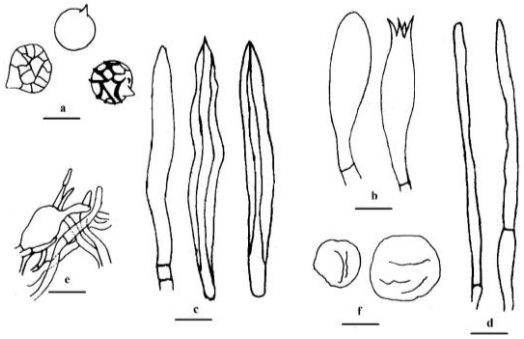

Fig. 2: a. Spores b. Basidia c. Pleuromacrocystidia and Cheilocystidia d. Pileocystidia e. Pileipellis f. Sphaerocytes. Bar = 9 µm for a, 11 µm for b, 10.4 µm for c, 10.34 µm for d, 9 µm for e, 13.75 µm for f

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 McKnight, 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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