

Some hitherto unreported macromycetes from coniferous forests of Kashmir Himalaya (India)

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Abstract: Mushrooms are part of the rich funga of Kashmir Himalaya (India) due to its diverse physiography, expansive forest communities, diverse weather patterns and numerous tree species that facilitate the growth of many species of macrofungi. In order to document the macrofungal biodiversity of coniferous forests of Kashmir Himalayas, a survey was conducted in five different coniferous forests sites viz. Gulmarg, Yusmarg, Pahalgam, Doodhpatheri, and Hirpora wild life sanctuary from November 2011 to November 2012. During the study 109 species belonging to 61 genera were recorded, out of them six species viz. *Phyllotopsis nidulans*, *Helvella leucomelaena*, *Cortinarius violaceus*, *Sarcodon imbricatus*, *Lactarius hepaticus* and *Polyporus brumalis* are recorded for the first time from the state Jammu and Kashmir. The macro- and microscopic features, habit and habitat, site of collection, seasonal occurrence, local names and edibility of the hitherto unreported macrofungi are presented.

Zusammenfassung: Im Kaschmir Himalaya (Indien) wird aufgrund der vielfältigen Physiographie, ausgedehnten Waldgesellschaften, unterschiedlichen Wetterbedingungen und zahlreichen Baumarten das Wachstum vieler Arten der Großpilze ermöglicht. Um die Diversität der Makromyzeten in den Nadelwäldern von Kashmir Himalaya zu dokumentieren, wurden die Makromyzeten von fünf verschiedenen Nadelwald-Gebieten, nämlich Gulmarg, Yusmarg, Pahalgam, Doodhpatheri und Hirpora wild life sanctuary, von November 2011 bis November 2012 untersucht. Es konnten 109 Arten aus 61 Gattungen registriert werden. Darunter sind sechs Arten, nämlich *Phyllotopsis nidulans*, *Helvella leucomelaena*, *Cortinarius violaceus*, *Sarcodon imbricatus*, *Lactarius hepaticus* und *Polyporus brumalis* Erstfunde für den indischen Bundesstaat Jammu und Kaschmir. Deren makro- und mikroskopische Merkmale, Habitus und Lebensraum, Fundorte, saisonales Auftreten, lokale Pilznamen und Angaben zur Genießbarkeit werden vorgestellt.

The state Jammu and Kashmir harbours a rich macrofungal diversity due to wide agro-climatic variations, diverse physiography and undulating topography. The coniferous temperate forests of Kashmir have been a provenance for the diversity of macrofungi in India and Jammu and Kashmir in particular. More than 160 species of macrofungi have been reported from the Kashmir Himalayas (WATLING & ABRAHAM 1992; BEIG & al. 2008; DAR & al. 2009, 2010; WANI & al. 2010; PALA & al. 2011, 2012), but documentation of the macrofungal richness of Kashmir is still in an exploratory stage and undoubtedly there are many more species to be recorded. In this background a

survey was carried out with the main objective to benchmark diversity of macrofungi from coniferous forests of Kashmir Himalayas.

Materials and methods

Regular field trips were carried out to different sites viz. Gulmarg, Yusmarg, Doodhpaheri, Pahalgam, and Hirpora wild life sanctuary (Fig. 1) from November 2011 to November 2012. In the study area, the coniferous forests are dominated by *Pinus roxburghii*, *Pinus wallichiana*, *Cedrus deodara*, *Abies pindrow*, *Taxus baccata*, *Picea* spp., and *Cupressus* spp. These field trips were organised as per HAILING (1996). Standard method of collection, preservation and macro- and microscopic studies were followed (KUMAR & al. 1990; ATRI & al. 2003, 2005; PALA & al. 2011). Samples were kept in separate perforated paper bags to avoid mixing and were taken to the laboratory. The spore prints were taken according to KUO (2001). Reagents used for preparation of spore slides were 3% KOH, cotton blue, lactophenol and MELZER's reagent. To elicit the necessary information regarding their edibility and vernacular name local people were interviewed. Photographs of the sporocarps were taken in their natural habitats using a Cyber shot Sony 10.1 megapixel Camera. The fungal specimens were preserved in formalin solution and deposited in the fungal collection of KASH herbarium of plant taxonomy, division of botany, university of Kashmir.

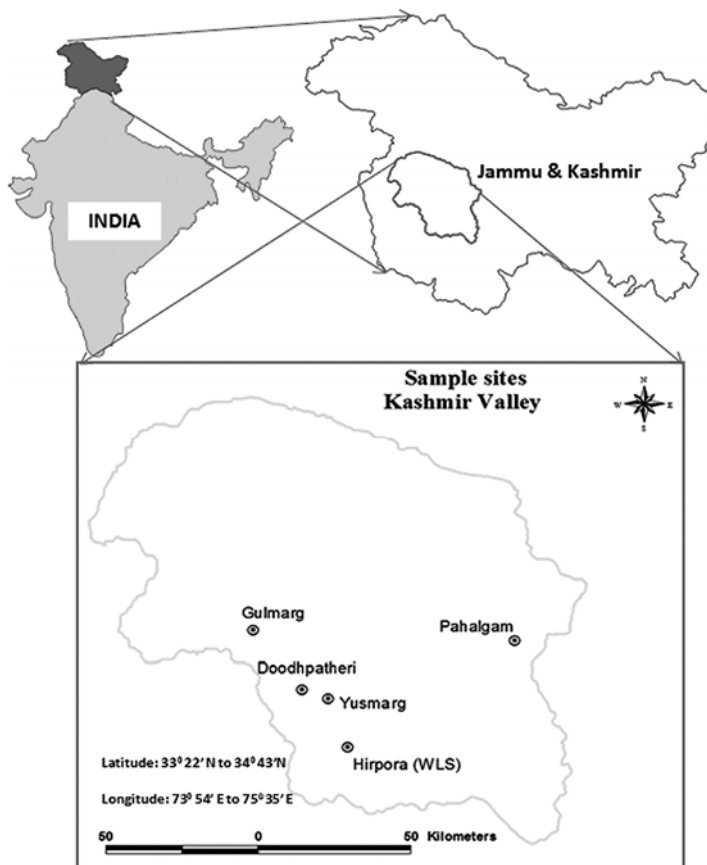


Fig. 1. Map showing the study sites in India.

Results

During the study 109 species belonging to 61 genera were accounted (PALA & al., unpubl.), out of which the six species are reported for the first time from Kashmir valley. (one Ascomycetes and five Basidiomycetes).

***Phyllotopsis nidulans* (PERS.) SINGER** (Fig. 2)

Common names: Orange Oyster, Mock Oyster

Local name: Ladderlash

Pileus: 2-7 cm across, more or less fan- or kidney-shaped attached laterally to substrate, margin inrolled when young, light yellow to orange when young, tawny buff at maturity, with densely haired upper surface (glabrous). Lamellae: close to intermediate, radiating from a sessile attachment point, bright orange-yellow. Stipe: absent. Flesh: pale orange, soft, smell unpleasant. Spores: $5-7 \times 2-3 \mu\text{m}$, bean-shaped, smooth, inamyloid, pale pink to creamish in deposit. Sociability and habitat: gregarious or forming overlapping shelves on dead logs or branches in coniferous forests. Season: autumn and early spring. Edibility: inedible.

Material investigated: India: Kashmir, Gulmarg, on *Picea* stumps/logs, 12. 12. 2011, leg. SHAUKET PALA, herbarium accession no.: SH-KASH-28871M.

***Helvella leucomelaena* (PERS.) NANNF.** (Fig. 3)

Common name: White-footed Elf cup

Local name: Kanpatri

Pileus: Deeply cup-shaped 1-3 cm wide, 1.0-2.4 cm high, glabrous, dark brown to blackish interior, light brown or gray outer surface that whitens near the stem. Stipe: 0.4-1.4 cm high, 0.6-1.3 thick, white with blunt ribs or folds, often buried underground. Flesh: white, thin, brittle, smell not distinctive. Spores: $20-24 \times 12-14 \mu\text{m}$, round oblong, smooth, with a single oil droplet in centre, inamyloid, white in deposit. Sociability and habitat: scattered to gregarious in coniferous forests frequently under pine. Season: April-June. Edibility: edible after cooking.

Material investigated: India: Kashmir, Yusmarg, under *Pinus*, *Taxus*, 17. 4. 2012, leg. SHAUKET PALA, herbarium accession no.: SH-KASH-28741M.

***Cortinarius violaceus* (L.) GRAY** (Fig. 4)

Common name: Violet Webcap

Local name: Millewoan

Pileus: 4-10 cm wide, initially convex with margin incurved, becoming broadly convex to nearly flat at maturity with dark violet to blue-black colouration, covered with fine downy scales. Lamellae: adnate, intermediate to nearly distant, initially dark violet, becoming rusty brown at maturity, covered by a violet cortina when young. Stipe: 8-12 cm long, 1-2 cm thick, cylindrical with a bulbous base, dark blue to violet, covered by woolly fibrils. Flesh: violet, but darker in the stem and below the cuticle of the pileus, thick, soft, smells slightly of cedarwood. Spores: $11-14 \times 6.5-8 \mu\text{m}$, ellipsoid to almond-shaped, rough, rusty brown in deposit. Cheilocystidia: flask-shaped, $72-80 \times 20-24 \mu\text{m}$. Sociability and habitat: scattered or singly on ground in coniferous forests. Season: autumn and late summer. Edibility: edible.

Material investigated: India: Kashmir, Hirpora Wild life Sanctuary, near *Pinus* tree, 5. 7. 2012, leg. SHAUKET PALA, herbarium accession no.: SH-KASH-28733M.

***Sarcodon imbricatus* (L.) P. KARST. s. l.** (Fig. 5)

Common names: Scaly Hedgehog, Shingled Hedgehog

Local name: Kukarpar

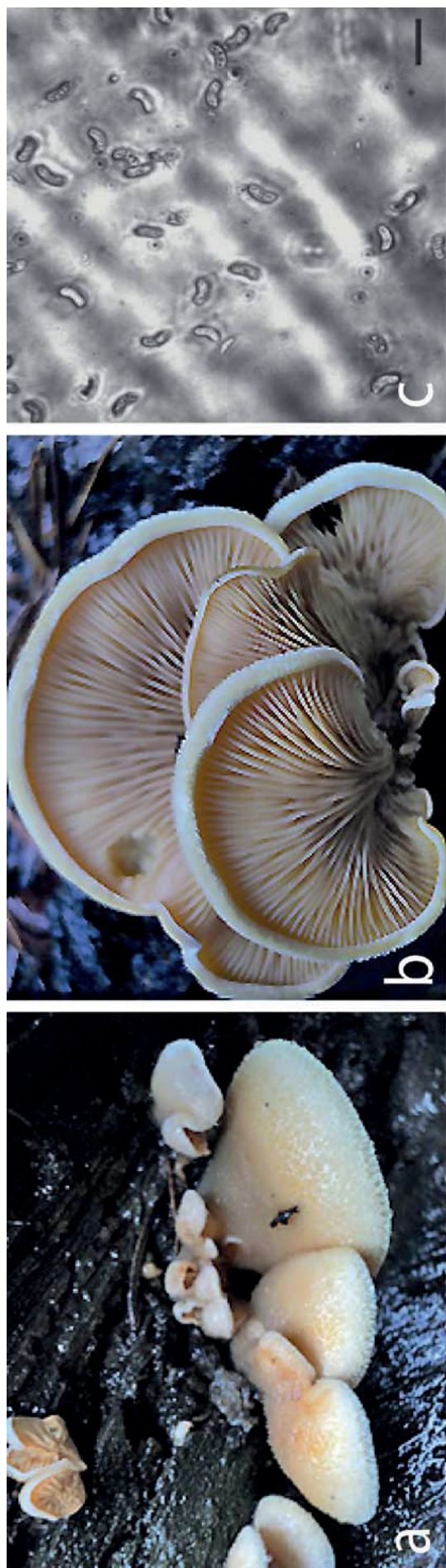


Fig. 2. *Phyllotopsis nidulans*, a dorsal view of fruiting bodies, b gills, c spores, bar: 10 μ m.



Fig. 3. *Helvella leucomelaena*, a dorsal view of fruiting bodies, b lateral view, c spores, bar: 20 μ m.

Pileus: 5-12 cm across, convex to flattened with a central depression, margin initially inrolled, becoming decurved or wavy, pale brown covered with coarse dark brown scales. Spines (teeth): pale grey, 0.5–1.0 cm long and brittle, descending onto the stipe (decurrent). Stipe: 4-8 cm long, 1.3-2.5 cm thick, stout, solid but at maturity hollow near apex, central to eccentric, light brown, fairly smooth except the upper portion where punctuated by aborted spines. Flesh: white to cream buff, unchanging on exposure, thick, soft, smell not distinctive. Spores: $5.0-6.5 \times 5-6 \mu\text{m}$, irregularly globose, asymmetrical, brown in deposit. Sociability and habitat: solitary, scattered or in small groups on the ground in coniferous forests. Season: late summer and autumn. Edibility: edible after cooking.

Material investigated: **India:** Kashmir, Pahalgam; near *Abies*, *Pinus* plants, 22. 11. 2012, leg. SHAUKET PALA, herbarium accession no.: SH-KASH-28811M.

***Lactarius hepaticus* PLOWR. (Fig. 6)**

Common name: Liver milk cap

Local name: Cheechad

Pileus: 3-7 cm across, initially convex, becoming flat or shallowly depressed at maturity, dark brick red to liver red or reddish brown with darker centre, smooth. Lamellae: adnate to subdecurrent, close, cream white to pale pink; Stipe: 4-8 cm long, 0.5-0.9 cm thick, cylindrical, reddish brown, smooth, solid. Flesh: white to pale, exuding white or watery latex when cut turning yellow on exposure, thin, brittle, smell not distinctive. Spores: $8-9 \times 6-8 \mu\text{m}$, widely elliptical to spherical, warty, creamy in deposit. Sociability and habitat: scattered or solitary on ground in coniferous forests usually under *Pinus* trees. Season: autumn. Edibility: inedible.

Material investigated: **India:** Kashmir, Doodhpatheri, with *Cedrus*, *Pinus*, *Taxus*, 25. 9. 2012, leg. SHAUKET PALA, herbarium accession no.: SH-KASH-28801M.

***Polyporus brumalis* (PERS.) FR. (Fig. 7)**

Common name: Winter Polypore

Local name: Wandbaton

Pileus: 2-9 cm across, initially convex then plane with shallow central depression, greyish-brown, margins often wavy and inrolled. Tubes and pores: cream white, pores large, 2-3 per mm, angular, regular in arrangement, tubes 0.5-2.0 mm long. Stipe: 2-5 cm long, 0.3-0.9 cm thick, more or less equal, central, greyish brown, smooth. Flesh: white, thin, corky, smell not distinctive. Spores: $6-7 \times 2-3 \mu\text{m}$, cylindrical to slightly curved, non-amyloid, smooth, hyaline in deposit. Sociability and habitat: solitary or gregarious on dead wooden logs or branches of coniferous trees. Season: late autumn to winter. Edibility: inedible.

Material investigated: **India:** Kashmir, Hirpora Wild life Sanctuary, on logs of *Abies*, *Pinus*, *Cedrus*, 3. 12. 2012, leg. SHAUKET PALA, herbarium accession no.: SH-KASH-28889M.

Discussion

The coniferous forests of Kashmir support a very rich macrofungal flora, including both saprobic and mycorrhizal ones by furnishing congenial habitats for their growth (DAR



Fig. 4. *Cortinarius violaceus*, a fruiting body, b lamellae, c spores, bar: 5 μ m.



Fig. 5. *Sarcodon imbricatus* s. l., a dorsal view, b teeth, c spores, bar: 5 μ m.

& al. 2010; PALA & al. 2011, 2012). Among the six species presented here three species viz. *Phyllotopsis nidulans*, *Helvella leucomelaena* and *Polyporus brumalis* are saprobic while *Cortinarius violaceus*, *Sarcodon imbricatus*, and *Lactarius hepaticus* are mycorrhizal (ARORA 1986). These species are accounted in other parts of the world also. *Phyllotopsis nidulans* has been widely described across North America and Europe and rarely in the Pacific Northwest (TRUDELL & AMMIRATI 2009). *Helvella leucomelaena* has been found in coniferous forests in South America (DISSING 1966) and Europe, e. g. in Spain (CALONGE & ARROYO 1990), but is said to be rare in North America (ABBOTT & CURRAH 1997). *Cortinarius violaceus* has been found in forests of North America, Europe, Central America, Japan, Australia, and New Zealand (ARORA 1986, PHILLIPS 1981, KIRK & al. 2008). SULTANA & al. (2011) reported it also from Pakistan. *Sarcodon imbricatus* s. l. occurs in pine and fir forests throughout the northern temperate zone in North America, Europe, and Asia (NEWTON & al. 2002). *Lactarius hepaticus* has been traced in pine forests in Europe and North America (PHILLIPS 1981). *Polyporus brumalis* occurs on dead wood in the forests of North America, Europe, and Asia (KIRK & al. 2008).

Three of the species recorded, namely *Helvella leucomelaena*, *Cortinarius violaceus* and *Sarcodon imbricatus*, are considered edible. However, consumption of *Helvella leucomelaena* fungus is not recommended as similar species in the *Helvellaceae* family contain the toxin gyromitrin, but there are reports of its edibility in some parts of world (ROMAN & BOA 2004). *Phyllotopsis nidulans*, *Lactarius hepaticus* and *Polyporus brumalis* are considered to be inedible.

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Fig. 6. *Lactarius hepaticus*, a) fruiting body, b) lamellae, c) spores, bar: 10 μ m



Fig. 7. *Polyporus brumalis*, a) dorsal view, b) pores, c) spore, bar: 10 μ m.

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