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Two new records of the genus *Termitomyces* from North India

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ABSTRACT

Two agarics namely, *Termitomyces reticulatus* and *Termitomyces schimperi* have been illustrated and described, of which *T. reticulatus* is a new record for India where as *T. schimperi* is being described for the first time from North India. The above agarics were collected from North India during monsoon season.

Key words : Taxonomy, Termitophilous mushrooms, India

Genus *Termitomyces* is a basidiomycetous fungus belonging to the family *Lyophyllaceae*. Unifying characteristics of *Termitomyces* species are that fruiting bodies of these species grow in intimate association with termites and connected to combs in the termite nests. Carpophores are very small to large, usually with prominent perforatorium, free lamellae, whitish to pinkish gills, stipe with or without root like long pseudorrhiza, ovoid to ellipsoid smooth inamyloid basidiospores, absence of clamps and prominent cystidia (Heim 1977). Genus *Termitomyces* is one of the important genuses, which is highly valued as food, (Oso, 1977; Parent and Theon, 1977; Ogundana and Fagade, 1981). A major contribution has been made by Heim (1941) towards this highly priced edible genus. As a matter of fact a number of species of this genus have been described mainly from tropical areas particularly Southern Africa, Southeast Asia and throughout equator (Pegler and Vanhaecke 1994). In India, there is a good deal of interest for these fungi due to their edible nature. Local people gather these mushrooms in bulk for consumption and commercialize large quantity during monsoon season. The earlier reports of *Termitomyces* species from India are by Butler and Bisby (1931), Bose (1923), Batra and Batra (1966), Purkayastha and Chandra (1975), Natarajan (1975, 1977a, 1977b, 1979), Natarajan and Raman (1981), Thite *et al.* (1976), Sathe and Despande (1980), Bhavani Devi *et al.* (1980), Roy and Smajpati (1982), Rawla *et al.* (1983), Atri *et al.* (1995, 2004), Vrinda and Pradeep (2009). As a part of studies on Termitophilous mushrooms of North India, several species of *Termitomyces* were collected from different localities of North-west India, of which two are described here.

MATERIALS AND METHODS

The field characters pertaining to gross morphology, shape, color and size of pileus, stipe, etc. were noted down on the field key to mushroom collector (Atri *et al.* 2005). The colour terminology used was that of Kornerup and Wanscher (1978). The specimens were hot air dried and preserved in cellophane paper bags containing 1,4-dichlorobenzene. The microscopic structures were observed by cutting free hand sections after reviving a part of the dried specimens in 5% KOH solution

and staining the sections in 1% cotton blue and 2% congo red. All collections have been deposited under PUN in the Herbarium of Botany Department, Punjabi University, Patiala (Punjab), India. The photographs and microscopic details are given in figures 1 to 4.

RESULTS AND DISCUSSION

Termitomyces reticulatus Van der Westhuizen and Eicker, *Mycol. Res.* **94** (7):923 937, 1990. **Figs. 1&3 (A-F)**

Fruitbodies 34.5-38.6 cm long including pseudorrhiza. Pileus 2.4-5.1 cm in diameter, convex to broadly conical with rounded broad umbo, surface white with greyish tinge in the centre, brown patches of soil particles adhering on the pileus surface around the umbo; margin smooth, without radial striations, splitting at maturity, veil prominently hanging from the margin, velar elements white; cuticle fully peeling; fleshy, flesh unchanging, 0.6 mm thick near the umbo, white; taste and odour fruity. Lamellae free, crowded, unequal with lamellulae of 3 lengths, 4 mm in width, white; gill edges smooth to finely crenate. Stipe central, solid in young carpophores, 5-6 cm in the epigeal portion, solid, slightly expanding downward before tapering into white to creamish 29.5-33 cm long pseudorrhiza, which appear brownish due to adhering soil particles and closely appressed fibril forming a ridged annular veil; fibrils in young carpophores mostly attached to the pileal margin and stipe leaving a torn area midway on the stipe, which appear stretched across the lamellae exposing white surface underneath, stipe surface of partially mature carpophores appears patchy due to shredding of the cuticular surface in a circular fashion.

Spores 6.4-8 x 4.8-5.7 µm (Q=1.4), ovoid to ellipsoid, inamyloid, cyanophilous, thin walled, lacking suprahilar depression, with single oil droplet. Basidia 17.7-25.8 x 6.4-8 µm, clavate, siderophilous granules present, thin walled, inamyloid, tetrasporic, sterigmata 1.6-2.4 µm long. Gill edges sterile to heteromorphous. Cheilocystidia crowded, 19.32-64.4 x 8-29 µm in size, clavate to pyriform with one basal cell, thin walled, inamyloid, hyaline. Pleurocystidia occasional, 23-32 (34.7) x 7-16 µm, inflated clavate to pyriform, inamyloid, several laticiferous ducts present on the gill edges and in the pileus context.

Pileus surface covered by a cutis of gelatinized hyphae measuring 4-5 µm in width, subcutis 2-3 layered, context homoiomerous, made up of 2-4 µm broad hyphae. Hymenophoral trama bilateral with numerous laticiferous ducts measuring 4.8-13 µm in width. Subhymenium pseudoparenchymatous, made up of hyaline thin walled hyphae measuring 1.6-3.2 µm in width. Stipe surface hyphae thin walled, hyaline 4.8-13 µm in diameter with some projecting hyphae measuring 1.6-3.2 µm in width. Clamp connections absent.

Collections examined: Patiala, Punjabi University Campus, Girls hostel road, growing scattered on sandy soil excavated by termites. Arpana Lamba, PUN 4249, July 17, 2010; Punjabi University Campus, along roadside, growing scattered on termitaria under *Lagerstroemia indica*, Harvinder Kour, PUN 3349, August 23, 2004.

The macroscopic and microscopic details of the above described collections are in conformity with the details of *T. reticulatus* (Van der Westhuizen and Eicker, 1990). The fungus is characterized by whitish pileus with patches of adhering soil particles over the surface, reticulate cuticle on the stipe surface, presence of thick laticiferous ducts and pedicellate cheilocystidia which are typical of *T. reticulatus.* The fungus is recorded for the first time from India.

Fig.1. *Termitomyces reticulatus* in their natural habitat

Fig.2. *Termitomyces schimperi* in their natural habitat

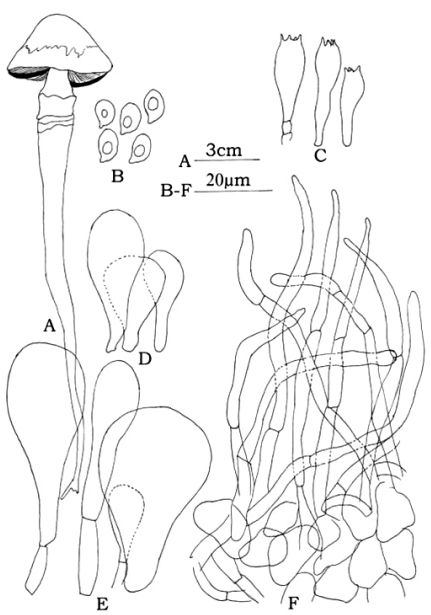

Fig.3(A-F). *Termitomyces reticulatus*: A. Carpophore, B. Basidiospores, C. Basidia, D. Pleurocystidia, E. Cheilocystidia, F. Pileus Cuticle elements

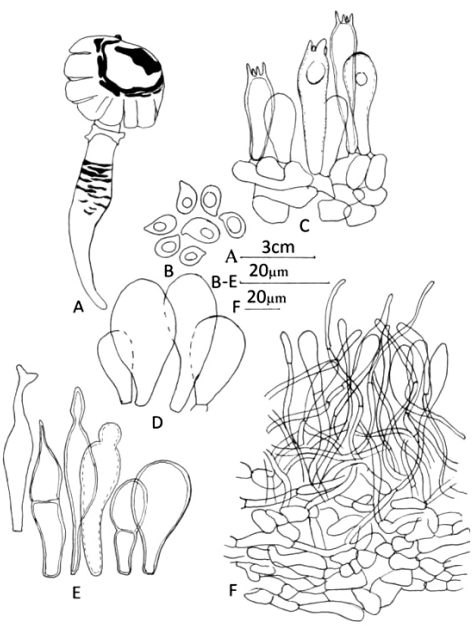

Fig.4(A-F). *Termitomyces schimperi*: A. Carpophore, B. Basidiospores, C. Basidia, D. Pleurocystidia, E. Cheilocystidia, F. Pileus Cuticle elements

Termitomyces schimperi (Pat.) Heim., *Arch. Mus. Hist. Nat. Paris Ser.* 6, **18**: 144, 1942. **Figs. 2 & 4 (A-F)**

Fruitbodies up to 26 cm in height (including pseudorrhiza). Pileus 2.5-7.2 cm in diameter, convex with broad perforatorium; surface white with brownish orange (5C4) centre, moist; scales appressed fibrillose; cuticle alveolately shredded along the periphery with central unbroken plate, shreds equal and parallel; margin irregular, giving petaly appearance to pileus surface due to splitting at maturity; cuticle ½ peeling; flesh white, unchanging, up to 1 cm thick; taste and odour mild. Lamellae free, crowded, unequal, up to 7 mm broad, white; gill edges serrate. Stipe central, 4.3 cm long excluding pseudorrhiza which is up to 16.3 cm long and attenuating upward, broadening up to 0.8-1.5 cm in the middle then tapering downwards with a discoidal base, white, hollow, covered by thick squamules of veilar remains scattered in annulate fashion down the stipe; or patchy type scales remaining on lower portion of stipe; annulus persistent.

Spores 6.4-9 x 4.5-6.3(6.44) µm (Q=1.5), broadly ellipsoid, thin walled, inamyloid, cyanophilous, smooth with guttulate contents. Basidia 19.3-30.6 x 6.64-11.3 µm, inflated clavate to pyriform, siderophilous granules present, crowded, measuring 20.9-32.2 x 8-14.5 µm, thin walled, inamyloid. Pleurocystidia versiform with bifurcate to mucronate tip inamyloid, thin walled, some cystidia lanceolate to capitate-fusoid or even lageniform to flame shaped with tubular tip, some of them even pyriform, some with or without transverse septa measuring 22.5-44.2 x 6.44-12.8 µm in size.

Pileus surface a cuticle of radially arranged septate, inamyloid, thick walled, 4-6 µm broad hyphae, some of which are with inflated cells measuring up to 10-12 µm in width. Pileus context homoiomerous with numerous laticiferous elements. Gill trama almost regular, composed of 3.23 µm broad hyphae. Stipe hyphae septate with lateral branches measuring 8-20 µm in width with numerous laticiferous elements. Clamp connections always absent throughout. Veil tissue formed of an aggregation of inflated to cylindrical elements some of which are darkly stained measuring 6.4-12.8 µm in width.

Collections examined: Himachal Pradesh, Sirmour, Kotla Barog, growing solitary on moist soil of termites, Babita Kumari, PUN 4238, August 16, 2009; Punjab, Patiala, Punjabi University Campus, gregarious to scattered on sandy soil under *Cassia fistula*, Harvinder Kour, PUN 3356, August 30, 2003; growing in caespitose to scattered clusters on humicolous soil among grasses, Harvinder Kour, PUN 3338, August 23, 2004.

The above examined collections resemble *Termitomyces schimperi* in their macroscopic and microscopic details as given by Van der Westhuizen and Eicker (1990). The chief characters include the presence of thick alveolately cracked velar squamules over the pileus surface, absence of perforatorium and presence of versiform cystidia, some of which are septate. This species is described for the first time from North India. Recently Mohanan (2011) has also reported *T. schimperi* from Kerela (South India), which shows the wide distribution of this species from North as well as South India. Present collection is different from South Indian specimens, which was having larger spores (7-11 x 5-8 µm), absence of inflated cells and non septate cystidia, while the spores in our collection are smaller (6.4-9 x 4.5-6.3(6.4) µm, presence of inflated cells and septate cystidia, which are typical characters of *T. schimperi.*

Most species of the *Termitomyces* reported in India have been reported from Southern India (Natarajan *et al.* 1975, 1977a, 1977b, 1979; Natarajan and Raman, 1981). Both *T.*

schimperi and *T. reticulatus* are closely related to each other, however, *T. reticulatus* differs from *T. shimperi* in having well defined pendulus veil like membranous annulus on the stipe and the presence of squamules consisting of spherical cells over the pilei surface. *T. reticulatus* seems to be quite close to *T. striatus* in morphological and anatomical characters and by absence of pointed perforatorium and radial striations on its pileus. *T. reticulatus* also shows resemblance with *T. magoyensis* in having pustular velar squamules on the pileus surface, a narrow pseudorriza and narrow clavtae to fusiform and finely echinulate cystidia. The lageniform, transverse septate cystidia of *T. shimperi* are unique to distinguish it from all other *Termitomyces* species.

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