
Ectomycorrhizal mushrooms of Central India-IV : *Boletus* and *Leccinum*

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This paper includes detailed and illustrated account of three species of genus *Boletus* and *Leccinum*, namely, *B. badius*, *B. chrysenteron*, *B. variegates*, *B. granulatus*, *Boletus* sp. 1, *Boletus* sp. 2, *Boletus* sp. 3, *Boletus* sp. 4, *Boletus* sp. 5, *Leccinum* sp. 1, *Leccinum* sp. 2.

Key words : Ectomycorrhizal mushrooms, Central India, *Boletus*, *Leccinum*

INTRODUCTION

During the surveying Central India to study the ectomycorrhizal mushrooms, several species of *Boletus* and *Leccinum* were collected under sal (*Shorea robusta* cif.) from different districts. These collections have rare record from India and not listed in Fungi of India (Bilgrami *et al.*, 1991, Jamaluddin *et al.*, 2004) hence are described with their full morphological, anatomical and microscopical details.

MATERIALS AND METHODS

Basidiomes of 19 collections were examined (Table 1). Specimens of ectomycorrhizal mushrooms, *Boletus* and *Leccinum*, were collected from various districts of Madhya Pradesh and Chhattisgarh and brought to the laboratory for processing. Microscopic examinations were made on lactophenol cotton blue mounts of gills using Nikon Eclipse E800 microscope at varying magnifications and microphotographs were taken with Nikon H-II camera attached to the microscope. Descriptions recorded were organized in worksheets, or computer formats for field descriptions. After macroscopic and microscopic studies, the edible ECM specimens were keyed out to their respective families, genera and species level. Air dried samples were deposited in Mycological Research Laboratory, Department of Biological Sciences, R. D. University, Jabalpur. Authoritative monographs, papers and books were

consulted/referred for correct identification. Literature consulted includes: Singer (1986); Purkayastha and Chandra, (1985); Wilkinson and Buczaki (1982); Findlay, (1977); Fluck, (2002); Jordan, (1999); Rayner, (1979); Mancinelli and Mancinelli, (1974); Lincoff, (1981); and Keizer, (1998).

OBSERVATIONS

The taxonomy of ectomycorrhizal mushrooms of *Boletus* and *Leccinum* that were encountered during this investigation are as under :

***Boletus badius* (Fr.) Fr., *Trans. Am. phil. Soc.* **2(4)**: 155, 1832.**

Pileus first hemispheric, then convex or plane, 4-14 cm, sometimes rather uneven, yellowish-brown, at times very dark, other times discoloured, ochraceous, cuticle dry, velvety, slightly viscid in humid weather, not easily removable from the cap. *Tubes* adherent to the stem, lemon-yellow turning blue-green on cutting. *Pores* angular, rather large, whitish at first then greenish yellow, blue-green when bruised. *Stipe* 6-10×2-3 cm. more or less cylindrical brown, paler than the cap, slightly streaky, sometimes thick, sometimes thin, stuffed, fibrillar much paler than the cap, except at the base where it is of the same colour as the cap. *Flesh* firm, then soft, finally flaccid, fibrous in the stem, whitish, but here and there yellowish, brown just under the

Table 1 : Specimens collected from different localities in Central India during the present study

Accession Number	Mushroom species	Source
FGCCB 2025	<i>Boletus badius</i>	Mandha, Sidhi, Madhya Pradesh state
FGCCB 2031	<i>Boletus badius</i>	Gopalpur, Dindori, Madhya Pradesh state
FGCCB 3013	<i>Boletus badius</i>	Chada, Dindori, Madhya Pradesh state
FGCCB 1019	<i>Boletus chrysenteron</i>	Amarkantak, Shahdol, Madhya Pradesh state
FGCCB 2022	<i>Boletus chrysenteron</i>	Chada, Dindori, Madhya Pradesh state
FGCCB 2023	<i>Boletus chrysenteron</i>	Mandha, Sidhi, Madhya Pradesh state
FGCCB 1013	<i>Boletus chrysenteron</i>	Achanakmar, Bilaspur, Chhattisgarh state
FGCCB 1013	<i>Boletus granulatus</i>	Mandha, Sidhi, Madhya Pradesh state
FGCCB 1014	<i>Boletus varuegatus</i>	Baiyar, Balaghat, Madhya Pradesh state
FGCCB 1014	<i>Boletus</i> sp. 1	Chada, Dindori, Madhya Pradesh state
FGCCB 3015	<i>Boletus</i> sp. 2	Mawai, Mandla, Madhya Pradesh state
FGCCB 1022	<i>Boletus</i> sp. 3	Pandutala, Mandla, Madhya Pradesh state
FGCCB 1016	<i>Boletus</i> sp. 3	Mawai, Mandla, Madhya Pradesh state
FGCCB 1021	<i>Boletus</i> sp. 4	Baiyar, Balaghat, Madhya Pradesh state
FGCCB 1016	<i>Boletus</i> sp. 4	Achanakmar, Bilaspur, Chhattisgarh state
FGCCB 3021	<i>Boletus</i> sp. 5	Chada, Dindori, Madhya Pradesh state
FGCCB 3016	<i>Boletus</i> sp. 5	Bajaag, Dindori, Madhya Pradesh state
FGCCL 3017	<i>Leccinum</i> sp. 1	Madha, Sidhi, Madhya Pradesh state
FGCCL 3018	<i>Leccinum</i> sp. 2	Madha, Sidhi, Madhya Pradesh state

cuticle of the cap, becoming bluish when exposed to air, especially near the tubules and along the stem.

Habit & Habitat: terrestrial, solitary or scattered, found in sandy soil,

Ecology: grows under sal forests,

Edibility: non-edible,

Accession Number: FGCCB 3013,

Place of collection: Chada, Gopalpur, Mandha,

Distribution: New record for India, Fig. 1a.

***Boletus chrysenteron* Bull., *Histoire des champignons*: 328-1791.**

=*Xerocomus chrysenteron* (Bull.) Qué., 1888.

Pileus hemispherical to convex, finally flat, 8.5 cm in diameter at young and 18 cm at maturity, easily cracking into red and yellow fissures revealing sub cuticle substratum dingy brown to olivaceous brown, occasionally with pink-red tinge, cuticle dry velvety. *Tubes* are sulphur-yellow, sometimes turning green-blue when bruised. *Stipe* 3-8×11-12 cm, firm, yellow,

with red striae in the upper part, with red dots or spots or striae in the lower part, when bruised, it becomes blue, stuffed, solid, cylindrical. *Flesh* soft, yellow, red under the cuticle, brownish at the base, when exposed to air, the flesh near the tubules becomes bluish, while that of the stem becomes reddish. *Pores* large, angular, yellowish. *spores* brown, fusiform, 11.5-15.5×4-7 μ m.

Habit & Habitat: terrestrial, solitary or scattered, found in sandy soil,

Ecology: grows under sal forests,

Edibility: non-edible,

Accession Number: FGCCB 2013,

Place of collection: Chada, Gopalpur, Mandha,

Distribution: Although there are no reports in Fungi of India but it's a common fungi. Fig. 1b, c.

***Boletus granulatus* L. 1753**

Pileus 4-14 cm, brown tending to ocher, yellow or red and discolours with age, viscid or dry depending

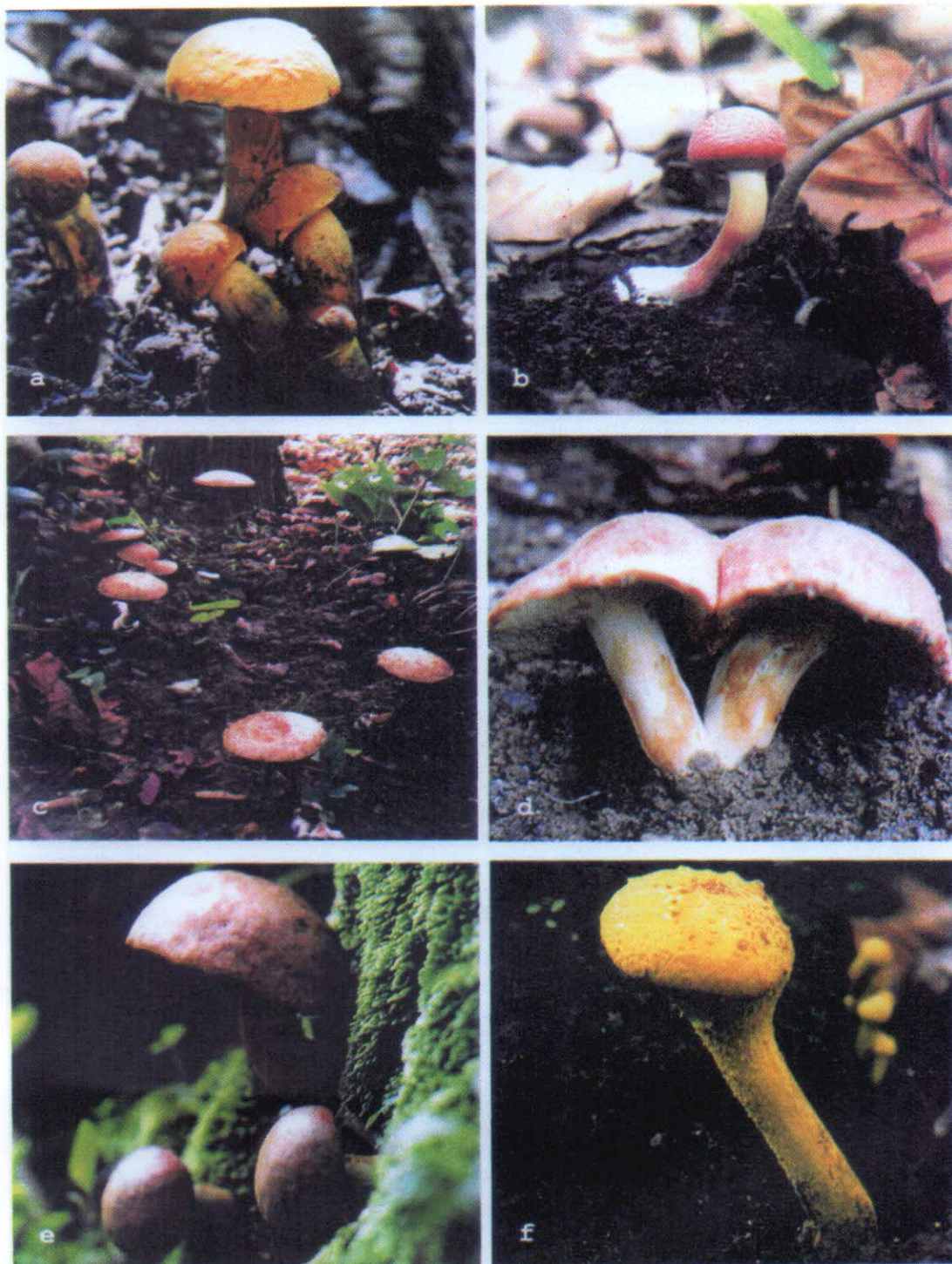


Fig 1. Sporocarps of Ectomycorrhizal Mushrooms-Boletaceae : **a.** *Boletus badius*, **b.** *B. chrysenteron* (When young), **c.** *B. chrysenteron* (When mature in large numbers), **d.** *B. granulatus*, **e.** *B. variegatus*, **f.** *Boletus* sp.1.

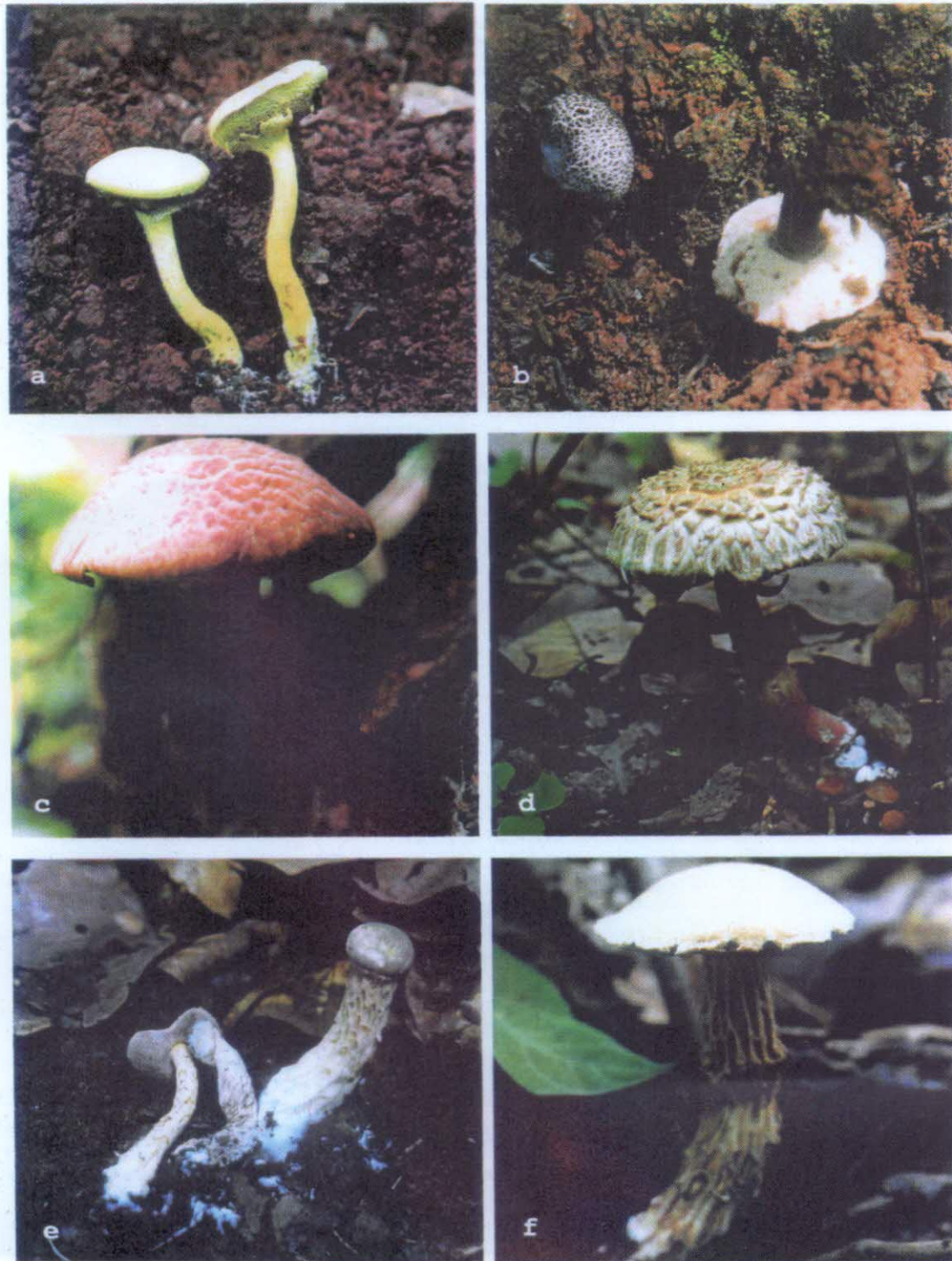


Fig 2. Sporocarps of Ectomycorrhizal Mushrooms-Boletaceae : a. *Boletus* sp.2, b. *Boletus* sp.3, c. *Boletus* sp.4, d. *Boletus* sp.5, e. *Leccinum* sp.1, f. *Leccinum* sp.2.

on weather, cuticle separable. *Stipe* thick, the upper part exudes, pores yellow with yellowish than brown granules. *Flesh* soft, yellow, the stem brownish, almost yellowish or straw coloured and lacks any hint of pink. *Pores* yellowish, Slightly angular. *Tubules* short, adhering to the stem, yellowish then olivaceous. *Spores* ochraceous, 8-11×3-4.5 μ m, sub-globose.

Habit & Habitat: terrestrial, solitary or scattered, found in sandy soil,

Ecology: grows under sal forests,

Edibility: non-edible,

Accession Number: FGCCB 1013,

Place of collection: Mandha,

Distribution: New record for India, Fig. 1d.

***Boletus variegatus* Sw., Kongl. Vetensk. Acad. Nya Handl. 31: 8, 1810.**

Pileus hemisphere, then convex, 5-15 cm, or also plane, somewhat uneven, with thin margin, first covered with an unbroken ochraceous, moist, rough cuticle, then this cuticle becomes smooth and fragments into furfuraceous, brownish squamules. *Stipe* cylindrical, thick, stout, sometimes in the shape of a truncated cone, base often thickened and curved, generally covered with white down, smooth, more or less faded ochraceous yellow. *Flesh* thick, soft, yellowish or saffron or faded orange, but the flesh of the base of the stem reddish, becoming bluish when exposed to air. *Pores* small, then larger, olivaceous yellow, then fuliginous, becoming bluish when bruised. *Tubules* short, adnexed to the stem, not easily detachable from the cap, olivaceous. *Spores* olivaceous brown.

Habit & Habitat: terrestrial, solitary or scattered, found in sandy soil,

Ecology: grows under sal forests,

Edibility: non-edible,

Accession Number: FGCCB 1014,

Place of collection: Baiyar, **Distribution:** New record for India, Fig. 1e.

***Boletus* sp. 1**

Pileus 5-10 cm, grayish or brownish or fuliginous, becoming black when bruised, velvety, dry, not shining, cracked in lasting dry weather, margin thin, and initially involute toward the tubules. *Stipe* thick,

first oval, then cylindrical, often curved, sometimes slender, of the same colour as the cap, a little discoloured at the base, fibrillar covered with very fine, darker granular, but not rugose. *Flesh* thick, but thin at the margin of the cap. first firm, then soft, the stem fibrous, white then whitish, when exposed to air it becomes slate pink, especially at the top of the stem, but blue green near the tubules, then it becomes entirely blackish gray. *Pores* rather large, now round, then angular uneven, first cinereous cream, then gradually ochraceous, olivaceous gray, purple, brown, fuliginous brown, becoming greenish blue, then fuliginous at the touch. *Tubules* long, shorter, near the stem and only partly annexed to it, cinereous cream, then olivaceous gray, at contact with air they become purple pink. *Spores* dark brown.

Habit & Habitat: terrestrial, solitary or scattered, found in sandy soil,

Ecology: grows under sal forests,

Edibility: non-edible,

Accession Number: FGCCB 3014,

Place of collection: Mawai, Fig. 1f.

***Boletus* sp. 2**

Pileus sometimes with acute umbo, then expands, 5-14 cm, becoming uneven, gibbous, with the margin often lobate and festooned, cuticle dry like scale, covered with a coarse down, denser at the centre, darker than the background, which makes the cap reddish-brown. *Stipe* slightly lighter than the cap, but yellowish from the ring upward, and below purplish-red, generally barrel shaped, fragile and hollow, even in unripe specimen in the stem cavity, there is small amount of water. *Ring* white and glutinous, then cottony and yellowish. *Flesh* soft and yellowish in the cap, fibrous and with rosy shades in the stem or at least near the base. *Pores* large, angular, arranged in radial or curved-radial rows, larger near the stem, yellowish, *Tubules* short, decurrent, not easily detachable from the cap. *Spores* olivaceous, yellow.

Habit & Habitat: terrestrial, solitary or scattered, found in sandy soil,

Ecology: grows under sal forests,

Edibility: non-edible,

Accession Number: FGCCB 3015,

Place of collection: Mawai, Fig. 2a.

Boletus sp. 3

Pileus hemispheric, then convex, more or less expanded, 3-10 cm, dark brown-black, cuticle not easily detachable from the cap, velvety, then glabrous and fragmented in many small irregular pieces against which paler background shows. *Stipe* ovoid, small, tapered at base, adorned with granules of the same colour. *Flesh* thick, firm, somewhat tough, whitish become brown-blackish. *Pores* large, angular, quite regular, bigger near stem, smaller near margins, whitish; reddish when bruised. *Tubules* long, annexed, to the stem and sometimes slightly decurrent. *Spores* brownish-yellow.

Habit & Habitat: terrestrial, solitary or scattered, found in sandy soil,

Ecology: grows under sal forests,

Edibility: non-edible,

Accession Number: FGCCB 1016,

Place of collection: Mawai, Pandutala,

Remarks: It is a new species but can be confirmed only after molecular analysis. It differs in morphological and anatomical features from other species Fig. 2b.

Boletus sp. 4

Pileus 5-14 cm, becoming uneven, with the margin lobate, cuticle dry, covered with coarse down, denser at the center, darker than the background, and which, depending on the colour, makes the cap reddish-brown or intermediate colour. *Stipe* slightly lighter than the cap, yellow on upper portion, fragile, hollow, *Flesh* soft, cottony and yellowish-white. *Pores* large, angular, arranged in radial rows. *Tubules* short, decurrent, not easily detachable from the cap. *Spores* olivaceous yellow.

Habit & Habitat: terrestrial, solitary or scattered, found in sandy soil,

Ecology: grows under sal forests,

Edibility: non-edible,

Accession Number: FGCCB 1016,

Place of collection: Chada, Fig. 2c.

Boletus sp. 5

Pileus initially whitish, then becomes rosy cinereous, cap grayish, hemispheric, then convex, more or less

expanded, 3-15 cm covered with large, woolly scales, darker than the background, triangular arranged like roof tiles and protruding, roof gutter-like from the margin, from which sometimes hang long, blackish, filamentous tails. *Stipe* long, thick, flared toward the cap and distinctly bulbous at the base, covered with darker, flocculose scales, but with a light reticulate on reddish white background above the ring. *Flesh* firm, somewhat tough, whitish, becoming reddish and then smoky violaceous in air. *Pores* large, polygonal, quite regular, bigger near the stipe, smaller near the margin of the cap; whitish, becoming reddish when bruised. *Tubules* long, annexed to the stipe and sometimes slightly decurrent, other times rounded toward the stipe and detached from it. *Spores* dark brown.

Habit & Habitat: terrestrial, solitary or scattered, found in sandy soil.

Ecology: grows under sal forests,

Edibility: non-edible,

Accession Number: FGCCB 3016,

Place of collection: Chada, Bajaag,

Remarks: It is a new species but can be confirmed only after molecular analysis. It differs in morphological and anatomical features from other species, Fig. 2d.

Leccinum sp. 1

Pileus 5 cm across, convex, mouse-grey with sepia, brownish grey, hazel or ochre mottling or stippling, distinctly fibrillose at first, becoming smooth, sticky in wet weather. *Tubes* white, tinged cream. *Pores* small, white or cream, bruising pale wine-coloured to rose. *Stipe* 12.5-18×2-2.5 cm, white, rough with small, white to smoke-grey scales which are joined to form a network towards the base, bruising greenish yellow and intensely green in the stipe base.

Habit & Habitat: terrestrial, solitary or scattered,

Ecology: grows under sal forests,

Edibility: non-edible,

Accession Number: FGCCB 3017,

Place of collection: Madha, Fig. 2e.

Leccinum sp. 2

Pileus 5-9 cm across, convex, light brownish grey,

distinctly fibrillose at first, becoming smooth. *Tubes* white, tinged cream. *Pores* small, white or cream, bruising ochre. *Stipe* 10-12x2-2.5 cm, white, rough with small, white to smoke-grey scales which are joined to form a network towards the base, bruising white or faintly light pink, with no blue-green in the stipe base.

Habit & Habitat: terrestrial, solitary or scattered,

Ecology: grows under sal forests,

Edibility: non-edible,

Accession Number: FGCCCL 3018,

Place of collection: Madha, Fig. 2f.

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