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New records of genus *Macrolepiota* Sing. from India

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ABSTRACT

The present paper deals with the collections of *Macrolepiota* Sing**.** made from various localities of North India. The three species of the genus, namely, *M. fuliginosa* (Barla) M. Bon., *M. excoriata* (Schaeff.: Fr) Wasser and *M. heimii* Locq.: Bon. are studied for its taxonomic features and illustrated over here.

Key Words: Basidiomycetes, taxonomy, Macrofungi, India.

INTRODUCTION

The genus *Macrolepiota* is agaricoid member of family *Agaricaeae*, represented by 30 species worldwide (Kirk et al., 2008). Carpophores are large, lepiotoid usually with squamulose with fine granulose squamules over the pileus, free lamellae, collariate, white to pale, broad, close, stipe often with a bulbous base, and movable, complex, persistent annulus, basidiospores large, broadly ellipsoid to amygdaliform, apically truncated by a germ pore, with or without hyaline cap over the germpore, dextrinoid, congophilous, cyanophilous, strongly metachromatic in cresyl blue and pileus cuticle a disrupted trichoderm or hymeniderm or palisade. The genus *Macrolepiota* Sing. can be delimited from the other genera of the tribus Leucocoprineae on the basis of large sized, strongly metachromatic spores, pure white to creamish spore print and presence of double, movable annulus. Singer established the genus *Macrolepiota* (Singer 1948). Some of the significant contributions on macrolepiotoid mushrooms are by Heinemann (1948), Moser (1983), de Kok (1998), Wang et al., (1999), Chang et al., (2001), Chou and Chang (2005), Vellinga (2003 a,b,c, 2004) and Ge et al. (2010) analyzed the morphological and molecular phylogenetic analyses of species of *Macrolepiota.*

Ghosh and Pathak (1965), Ghosh et al., (1976) and Sharma et al., (1977) documented species of *Macrolepiota* from India. Presently four collections belonging to three new taxa have been worked out for their macroscopic and microscopic details. There is a need to study these mushrooms from India as there are more number of additional species to be identified.

MATERIALS AND METHODS

Standards methods for collection, preservation and description of agarics have been followed, using the terminology of Atri et al., (2005). Colour notations in the macroscopical descriptions are from Kornerup and Wanscher (1978). The specimens were hot air dried and preserved in cellophane paper bags containing 1-4 dichlorobenzene. Macroscopic examination was carried out on fresh specimens in the field itself. Microscopic characters were studied from free hand sections mounted in 5% KOH, stained with 1% Congo red. Microscopic line drawings were made with the aid of a camera lucida at 1000 x. Basidium length excludes the length of sterigmata.

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The spore shape quotient (Q+ L/W) was calculated considering the mean value of length and width of 20 basidiospores. The specimens have been deposited in the Herbarium of Botany Department, Punjabi University, Patiala (Punjab), India.

RESULTS

Taxonomic Observations

Macrolepiota excoriata (Schaeff.: Fr) Wasser in *Ukr. Bot. Zh*. **35**: 516. 1987 [Fig. 2 & 5].

Synonyms

Agaricus excoriatus Schaeff., *Fung. Bavariae* **4**: pl. 18-19, 1974
Agaricus excoriatus Schaeff Fr. *Syst, mycol.* **1**: 21, 1821
Lepiota excoriata (Schaeff.: Fr.) Kumm., Fuhr. *Pilzk:* 135, 1871
Lepiotophyllum excoriatus (Schaeff.: Fr.) Locq. in *Bull. Mens, Soc. linn. Lyon* **11**: 40, 1942
Leucoagaricus excoriatus (Schaeff,: Fr.) Sing. in *Sydowia* **2**: 35, 1948
Macrolepiota excoriata (Schaeff.: Fr.) Mos. Rohrlinge, Blatter – Bauchpilze, 2 *Aufl.:* 130, 1955.

Carpophore up to 17.0 cm in height. Pileus up to 5.5 cm in diameter, surface dry, convex with prominent star shaped pale patch over the umbo; scaly, scales light brown and appressed over the yellowish white (4A2) background, scales more dense towards the center; margin irregular, splitting at maturity; cuticle half peeling; flesh white, unchanging on exposure, up to 0.5 cm thick; taste and odor mild. Lamellae free, collariate, subdistant to crowded, slightly ventricose, unequal, of 3 lengths, 0.4 cm broad, yellowish white (4A2); gill edges serrate. **Stipe** central, 15 cm long, 0.7 cm broad, yellowish white (4A2), slightly brownish on bruising, cylindrical with slightly expanded base, then finally tapering, first solid then hollow; annulus simple, tomentose, creamish with brownish edge, persistent, attached (Fig. 5A).

Figure 1. Field photographs: A. *Macrolepiota fuliginosa* B. *Macrolepiota heimii*

Basidiospores 10.8 - 16.6 (18.2) x 7.5 - 10 (11.6) µm (Q = 1.47 - 1.6), ellipsoid to amygdaliform, truncated by a narrow germpore, covered by hyaline cap, dextrinoid, strongly metachromatic in cresyl blue, congophilous, cyanophilous (Fig. 2A & 5B). Basidia 16.6 (19.9) – 41.5 (46.5) µm, clavate, thin walled, few with clamp connections, tetrasporic; sterigmata 1.6 - 6.6 µm long (Fig. 2B & 5C); gill edges sterile. Cheilocystidia abundant, 18.3 - 29.8 (38.2) x 7.5 - 11.6 µm, clavate to pyriform (Fig. 2C & 5D). Pleurocystidia absent.

Pileus cuticle composed of a trichoderm of upright hyphae with tubular or obtuse ends measuring 4.5 - 8.0 µm in width (Fig. 2D & 5E); context homoiomerous; trama regular, narrow, tramal hyphae 3.3 - 6.6 µm in width; subhymenium pseudoparenchymatous. Stipe cuticle hyphae parallel running throughout measuring 4.5 - 8.9 µm in width. Clamp connections present in stipe surface hyphae and at the base of few basidia. Veil tissue septate, measuring 2.5 – 5.0 µm in width.

Collection Examined: Himachal Pradesh, Mandi, Sarkaghat, Bakarta (850 m), growing on humicolous soil under grasses, Babita Kumari, PUN 4668, August 14, 2008.

Remarks: It is one of the most distinctive, edible, safest and tastiest species of *Macrolepiota*. The above examined collection is morphologically and microscopically well within the circumscription of *M. excoriata* as described by Vellinga (2001). This is a new fungus record for India.

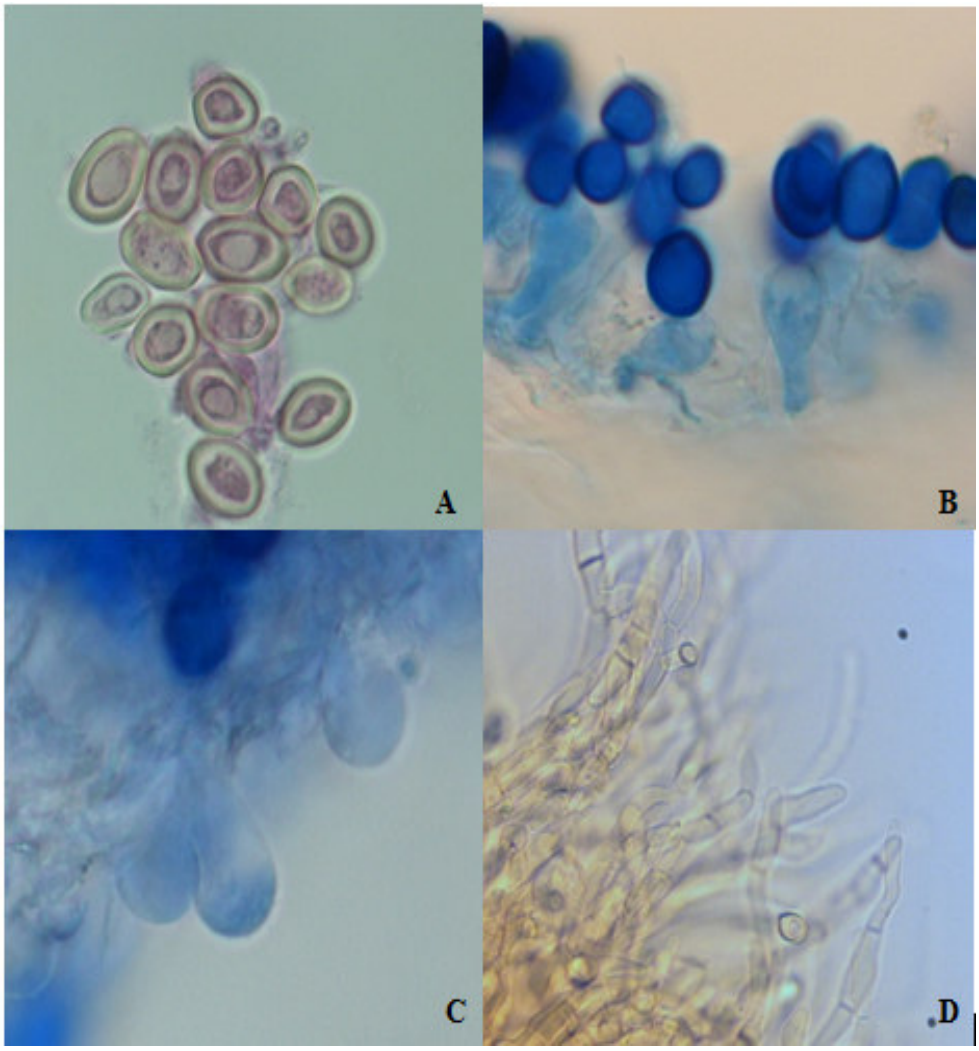

Figure 2. (A-D) *Macrolepiota excoriata* A. Basidiospores, B. Basidia, C. Cheilocysitidia, D. Pileus cuticle surface.

Macrolepiota fuliginosa (Barla) M. Bon *Doc. Mycol.* **11**(43)75, 1981 **[Fig. 1, 3 & 6].**

Synonyms

Lepiota procera var. *fuliginosa* Barla *Champ Alpes-Martense* **21**.1888

Leucocoprinus fuliginosus (Barla) Locq. in *Bull. Mens Soc. Inn Lyon* **14**: 92, 1945

Macrolepiota fuliginosa (Barla) M. Bon in *Doc. Mycol*.**7** (27-28): 20, 1997

Macrolepiota procera var. *fuliginosa* (Barla) Bellin & Lanzoni in *Beir Kemnnin. Pilze Mitreleur* **3**: 190, 1987.

Lepiota rhodosperma P.D. Orton in *Notes R. bot. Gdn Edimb* **41**: 591, 1984.

Macrolepiota rhodosperma (P.D.Orton) Migj. in *Bull. Gruppo micol. G. Bres.* N.S. **38**: 140-141, 1995.

Carpophores 10.0-14.0 cm in height. Pileus 4.0-7.2 cm in diameter, surface convex, yellowish white (4A2) with brown (6E4) to brownish orange (5C3) umbo covered by greyish brown to brown orange (5C3) recurved fibrillose scales over yellowish white background; margin irregular, splitting at maturity; sheath fringed, cuticle fully peeling; flesh white, unchanging, up to 0.5 cm thick; taste and odor mild. Lamellae free, collariate, crowded, unequal, of 4 lengths, 0.4-0.7 cm broad, yellowish white (4A2), to pinkish cream, ventricose; gill edges white, floccose; spore print white. **Stipe** central, 10.0-13.2 cm long, 0.7-0.9 cm broad, yellowish white (4A2) covered by light brown scales, pinkish red to brownish on bruising, obclavate; annulate, annulus fixed on the upper half of the stipe, finally movable, double, purplish pink underneath, fibrous (Fig. 1 A & 6A).

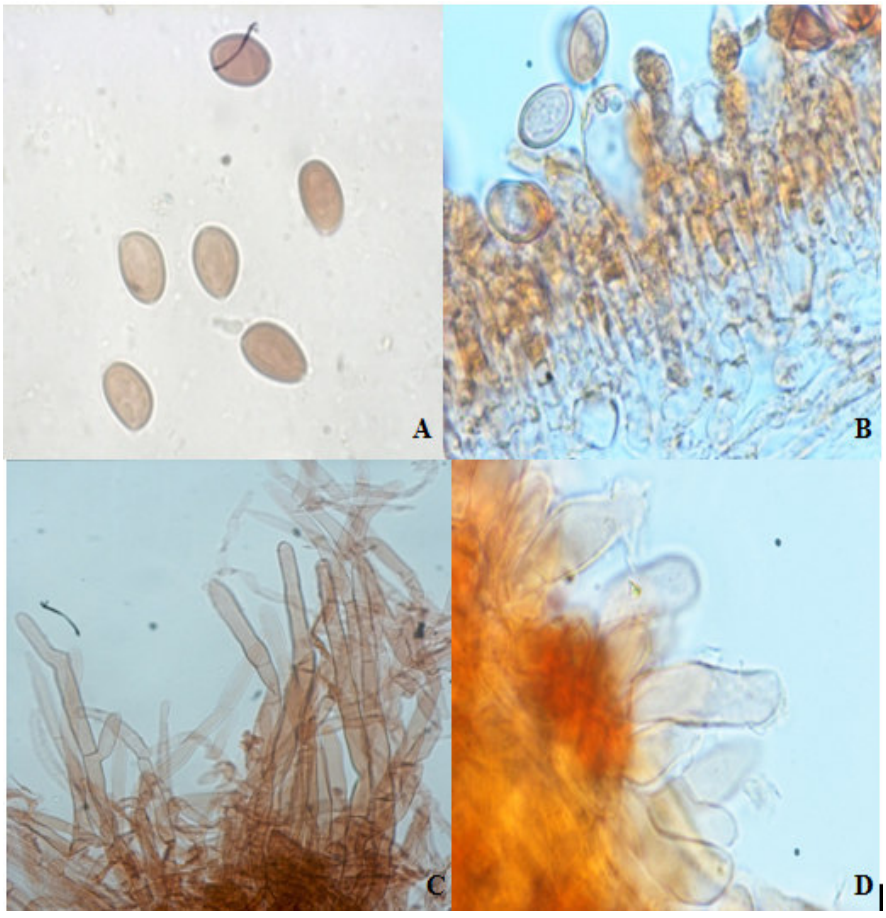

Figure 3 (A-D) *Macrolepiota fuliginosa*: A. Basidiospores, B. Basidia, C. Pileus cuticle surface, D. Cheilocysitidia

Basidiospores 12.0-16.0 (17.6) x 7.0 -9.0 µm (Q = 1.7), broadly ellipsoid to amygdaliform, truncated by a narrow germpore covered by hyaline cap, dextrinoid, metachromatic in cresyl blue, congophilous, cyanophilous (Fig. 3A & 6B). Basidia 33.8-48.3 x 9.6-13.7 µm, clavate, granular, thin walled, 2 to 4 spored; sterigmata 2.4-3.2 µm long, basidia with clamp connections (Fig. 3B & 6C); gill edges sterile. Cheilocystidia numerous, 22.5-48.3 x 7.2-12.8 µm, versiform, utriform to claviform or even pyriform, some of them cylindrical to subcapitate with basal clamp connection (Fig. 3D & 6D). Pleurocystidia absent

Pileus cuticle composed of a trichoderm consisting of branched, septate cylindrical to obtuse elements measuring 6.0-12.0 µm in width, often with clamp connections (Fig. 3C & 6E); context homoiomerous; trama regular; tramal hyphae measuring 8.0-12.0 µm in width; subhymenium pseudoparenchymatous. Stipe cuticle hyphae parallel running throughout, 8.0-12.0 µm in width, some projecting cylindrical to clavate elements 6.0-12.0 µm in width. Clamp connections present throughout.

Collections Examined: Uttrakhand, Deoban (2200 m), growing scattered in *Cedrus deodara* forest, Babita Kumari, PUN 4323, July 18, 2010; Deoban (2200 m), growing scattered in *Quercus* and *Cedrus deodara* forest, Babita Kumari, PUN 4331, July 18, 2010.

Remarks: The details of this mushroom are in agreement with description given by Vellinga (2001). It is a new fungus record for India.

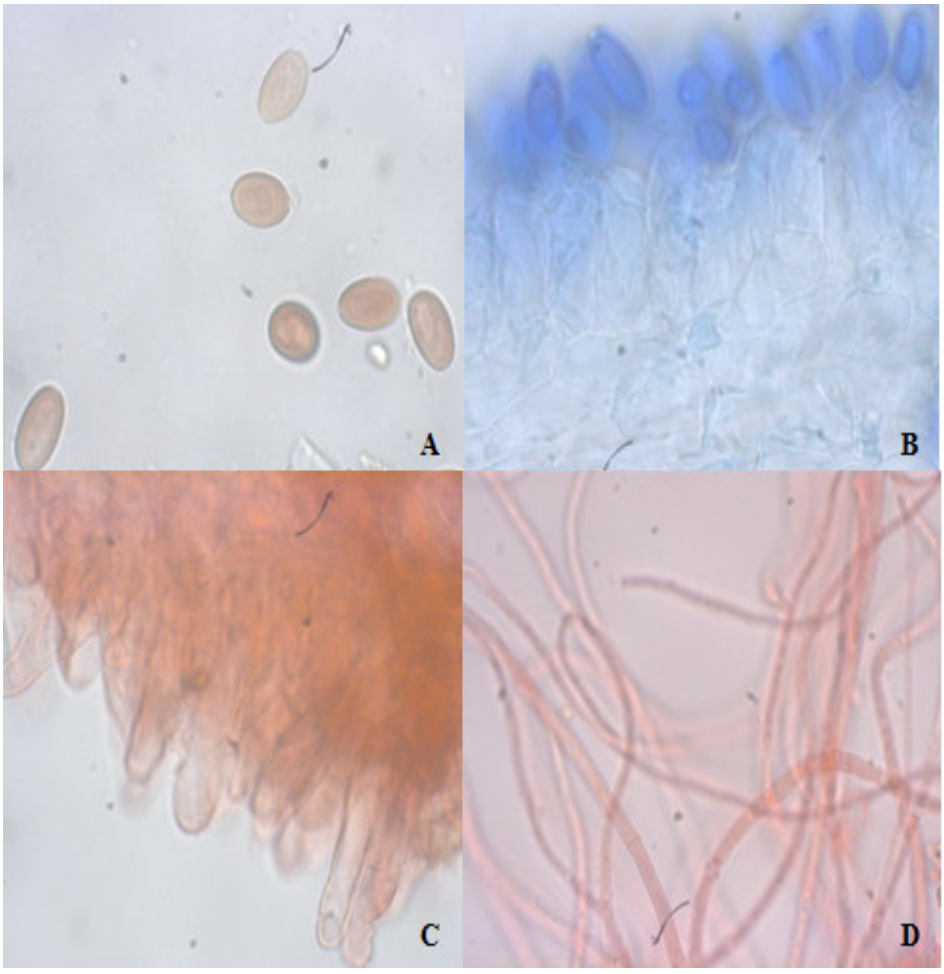

Figure 4 (A-D) ***Macrolepiota heimii*** **A. Basidiospores, B. Basidia, C. Cheilocysitidia, D. Pileus cuticle surface**.

Macrolepiota heimii Locq.: Bon *Mycologiques* **11**(43): 73, 1981 **[Fig. 2, 4 & 7].**

Carpophore up to 14.5 cm in height. Pileus up to 9.2 cm in diameter, surface dry, convex to hemispherical, surface dry, applanate with short umbo, greyish orange (5B4) near the center, covered by greyish orange (5B4) appressed fibrillose scales soon cracking into small pieces, dense towards the center and scattered towards the margin over orange white (4A2) background; margin feebly striate, reflexed, splitting at maturity; cuticle fully peeling; flesh up to 0.6 cm thick, off white, unchanging; taste and odor honey like. Lamellae free, collariate, crowded, unequal, of 2 lengths, subdistant to crowded, ventricose, 0.5 cm broad, yellowish white (4A2) in young specimens, brownish on bruising; gill edges minutely serrate. **Stipe** central, up to 12 cm long, 0.8 cm broad in the center and 2 cm broad near the base, obclavate with distinctly bulbous base, silky shining white with very tiny scales; annulus persistent, simple, attached (Fig. 1 B& 7A).

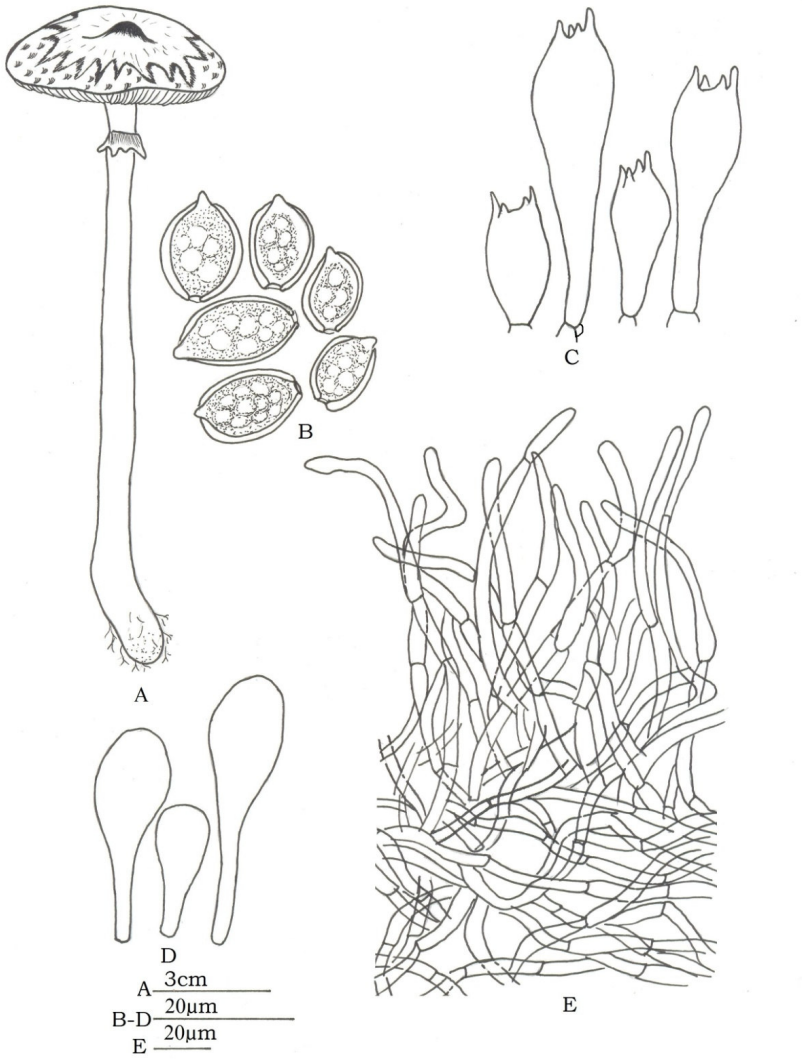

Figure 5 (A-E) ***Macrolepiota excoriata***: A. Carpophore, B. Basidiospores, C. Basidia, D. Cheilocystidia, E. Pileus trichodermal elements.

Basidiospores 11.5-16.0 x 7.0-10.0 µm (Q = 1.63), broadly ellipsoid to amygdaliform, dextrinoid, congophilous, cyanophilous, metachromatic in cresyl blue, with apical germpore covered by a hyaline cap, roughned inside (Fig. 4A & 7B). Basidia 25.0–36.0 x 10.0–15.0 µm, clavate, tetrasporic; sterigmata up to 2.5 µm long (Fig. 4B & 7C); gill edges sterile. Cheilocystidia versiform, varying from pyriform to clavate or even lageniform to shortly subcapitate in shape, 22.0-48.0 x 7.0-18.0 µm in size, crowded (Fig. 4C & 4D). Pleurocystidia absent.

Pileus cuticle composed of a trichoderm of loosely arranged thin long cylindrical septate up to 4.0 µm broad hyphae arising from the context (Fig. 4D & 7E), context homoiomerous; hymenophoral trama regular; tramal hyphae up to 15.0 µm in width; subhymenium pseudoparenchymatous, well developed. Stipe cuticle hyphae running parallel throughout measuring up to 20.0 µm in width with some projecting cylindrical elements measuring up to 4.0 µm in width. Clamp connections present.

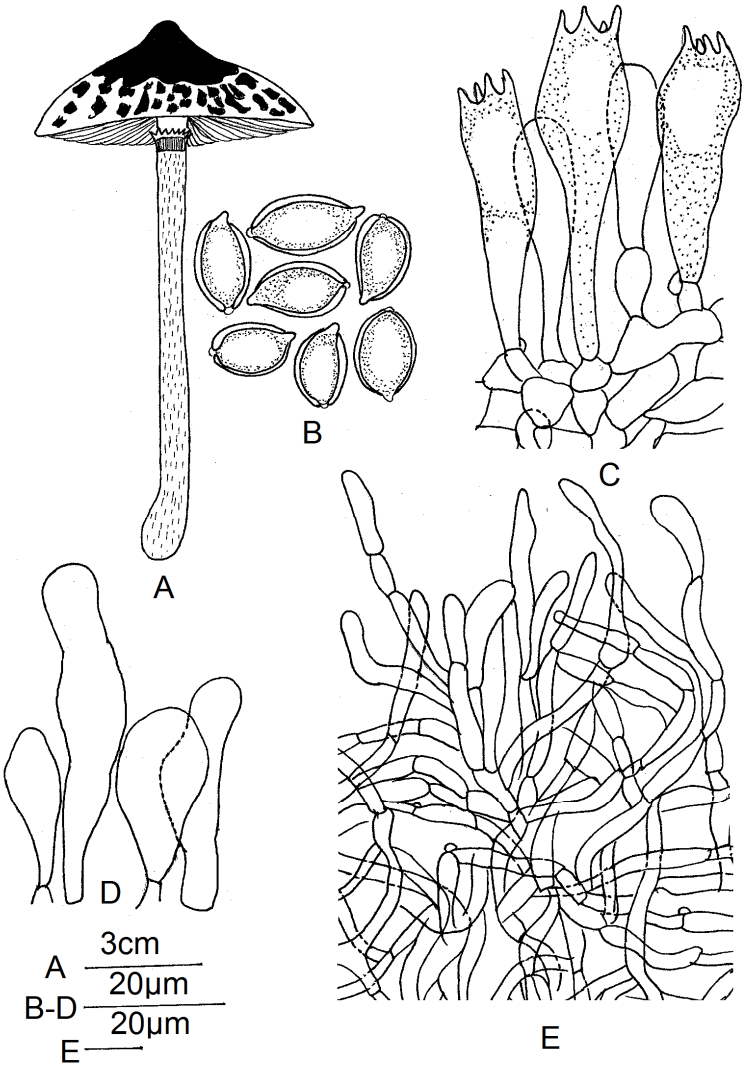

Figure 6 (A-E) ***Macrolepiota fuliginosa***: A. Carpophore, B. Basidiospores, C. Basidia, D. Cheilocystidia, E. Pileus trichodermal elements

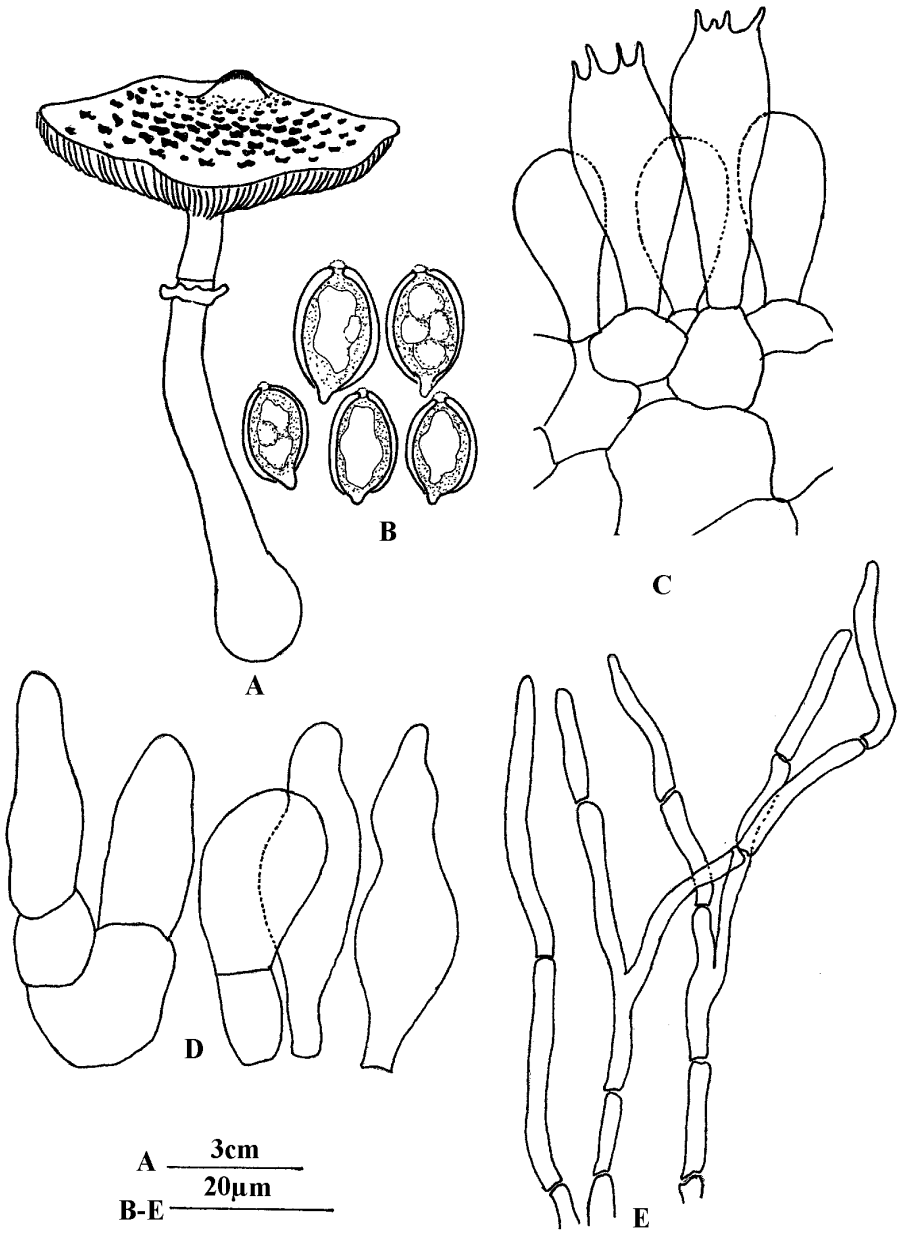

Figure 7 (A-E) ***Macrolepioa heimii***: A. Carpophore, B. Basidiospores, C. Basidia, D. Cheilocystidia, E. Pileus trichodermal elements.

Collection Examined: Himachal Pradesh, Kinnaur Nichar, (2499 m), growing scattered on soil, R.C.Upadhyay and Babita Kumari, PUN 4674, September 24, 2011.

Remarks: The above examined collection resembles with *M. heimii* in its macroscopic and microscopic details as given by Breitenbach and Kranzlin (1995).

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