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New records of the genus *Cortinarius* for India

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ABSTRACT

During the survey of mycorrhizal mushroom, three species of *Cortinarius* viz. *C. bulliardii, C. dionysae,* and *C. pseudoglaucopus* were encountered. In the present study these species were described morphologically and anatomically, *C. dionysae* and *C. pseudoglaucopus* are new for India.

Key words: *Cortinarius*, mycorrhizal, morphology, taxonomy

The Cortinariaceae is a large family of gilled mushrooms found worldwide, containing over 2100 species (Kirk *et al*., 2008). The genus *Cortinarius* alone containing over 2000 species with a worldwide distribution (Garnica *et al*., 2005; Moser *et al*., 1994; Peintner *et al*., 2004) and 29 (app.) species reported from India (Moser, 1960; Watling and Gregory, 1980; Sathe and Daniel, 1980; Manjula, 1983). The members of this genus are terrestrial can range from small to large and fleshy (Singer, 1986) and exhibit mycorrhizal associations with forest trees (Smith, 1939, 1944; Phillips, 1991; Moser, 1993; Thorn and Malloch, 1994; Moser and Ammirati, 1996, 1999, 2000; Thiers and Smith, 1969; Cripps and Miller, 1994). *Cortinarius* spp. contains a partial veil which is a cortina and usually rusty brown due to the presence of rusty brown spores which are mostly ornamented (warty) (Moser, 1983) and regular hymenophoral trama (Singer, 1986; Brandrud, 1996). Presently three species of *Cortinarius* have been studied with their taxonomic details. *C. bulliardii* was reported first time from Himachal Pradesh and *C. dionysae* and *C. pseudoglaucopus* are new for India.

MATERIALS AND METHODS

Identification of specimen was based on morphological and anatomical characters. The morphological features such as the cap size, shape, colour, surface texture and surface moisture, gill colour, attachment, spacing, the stem size, shape, surface texture, the presence or absence of partial and universal veils, flesh colour and texture were recorded. All colour citations and codes were recorded from Methuen handbook of colour (Kornerup and Wanscher, 1978). After recording all the characters the fruit bodies were dried in hot air oven and preserved in poly propylene bag with naphthalene ball and some crystals of 1,4 dichlorobenzene. For anatomical features dried specimen were revived with 3% KOH. Spores and free hand sections were stained using 2% congo red, 1% cotton blue and Melzer's reagent and examined under oil immersion using light microscope (Motic 310). The specimens were deposited in the Herbarium of ICAR-Directorate of Mushroom Research (ICAR-DMR), Solan, Himachal Pradesh, India. Scanning Electron

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Microscope (SEM) illustrations of basidiospores were obtained from dry spores from spore print, with EMCRAFT microscope.

RESULTS AND DISCUSSION

Cortinarius bulliardii (Pers.) Fr., Epicrisis Systematis Mycologici: 282, 183

Figs. 1 (A–G) and 2 (A–F)

Pileus diameter up to 4.0 cm wide, convex to plane with slight umbo, cinnamon brown (6D-6), surface non hygrophanous, zonate, margin irregular, non-striate, inflexed, dry, scales absent, fully peeling, pileus consistency fleshy, flesh colour light brownish, no colour change on touch or handling and confluent pileus separation. Lamellae adnate to shortly decurrent, unequal, present in 4 sets of lamellulae, distant, 8 lamellae per cm near the margin, brown (6D-8), fleshy, separable, slightly serrate, gill size 1.4 × 0.3 cm. Stipe central, equal, brown (6D-4) at the top and reddish orange (7A-7) at the base, 7.0 × 1.0 cm, terete, bulbous, slightly rooting, glabrous, context stuffed, fleshy, veil remnants present.

Basidiospores (6.3)9.2–(10.4)–12.8 × (4.9)5.4–(6.0) µm (Q=1.7), brown, warted, broadly ellipsoidal, apiculate, germ pore absent, oil globule present, cyanophilic and non amyloid. Basidia (24.2)31.0–(34.8) × (6.3)7.3–(8.8) µm (Q=4.2), clavate, 4-spored, sterigmata up to 2.7 × 1.7 µm, thin walled, oil globule present, basal septa with clamps. Marginal cells (13.0)21.1– (32.4) × (3.7)6.8–(10.0) µm. Pileipellis (3.0)4.3–(5.8) µm, exocutis, regular, branched, septate, clamp connections present. Hymenophoral trama (4.4)5.8–(8.3) µm thick, regular. Subhymenium 8–10 µm. Hymenium 24–30 µm. Stipe cuticle (2.6)4.6–(6.1) µm, regular, branched, septate, clamp connections present.

Collection examined: India- Himachal Pradesh-Shimla- Narkanda-Oddi: alt. 2621 m a.s.l; GPS 32°9'52''N 76°16'39''E, coniferous forest, Pine community, on soil among grasses, solitary. Shilpa Sood, DMR Acc. No. 64/14, September 21, 2014.

Stocky and fleshy *Telamonia* is easily recognised in the field by its striking cinnabar-red stipe base. It is confused with *C. cinnabarinus* whose entire stipe is cinnabar-red in colour. It is already reported from Kashmir (Abraham, 1993; Beig *et al*., 2011) but first from the forests of Himachal Pradesh.

Cortinarius dionysae Rob. Henry, Bull. Soc. mycol. Fr.: 230, 1933

Figs. 3 (A–H) and 4 (A–F)

Pileus diameter up to 7.0 cm wide, hemispherical to plane, greyish orange (5B-3–5B-6), surface non hygrophanous, margin irregular, non-striate, inflexed, dry, scales present in the center, pileus consistency fleshy, context colour light brown to creamish, thickness 0.5 cm, no colour change on touch or handling and confluent pileus separation. Lamellae adnexed, unequal, present in 5 sets of lamellulae, crowded, caramel brown (6C-3), fleshy, separable, gill edges crenate, gill size 3.3 × 0.5 cm. Stipe central, equal 3.6-8.0 × 1.6 cm, golden brown (5D-7) with greyish violet (19B-3) apex, sometime lower part is white, terete in cross section, bulbous, smooth, fibrous, myceloid, context stuffed than hollow, fleshy, annulus absent, veil remnants present.

Basidiospores (10.0)10.6–(11.4) × (5.4)6.0–(6.7) µm (Q=1.8), ovoid to lemon shaped, brown in colour, thick walled, warts present, apiculate, germ pore absent, oil globule present, cyanophilic and inamyloid. Basidia (22.4)28.0–(32.0) × (5.8)7.6–(10.2) µm (Q=2.4), clavate, embedded basidia, 4-spored, sterigmata upto 3.5–8.0 × 1.8 µm, thin walled, oil globules present, basal septa with clamps. Cystidia absent. Marginal cells (13.6)18.4–(26.4) × (7.0)7.7–(9.1) µm, clavate to cylindric, oil globule absent, basal septa with clamps. Pileipellis (3.5)3.7–(5.2) µm thick, thin walled, irregular, brown, with encrustations, septate, with blunt ends, branched, clamps frequent.

Fig. 1. (A–G). *C. bulliardii*: A. Basidiocarps in natural habitat; B. Pileus surface; C. Shortly decurrent gill with slightly serrate margin; D. Basidiospores in light microscope; E. Basidia with basal clamp; F. Section showing marginal cells; G. SEM of spores. Scale bars: D–F=10 µm; G=2 µm

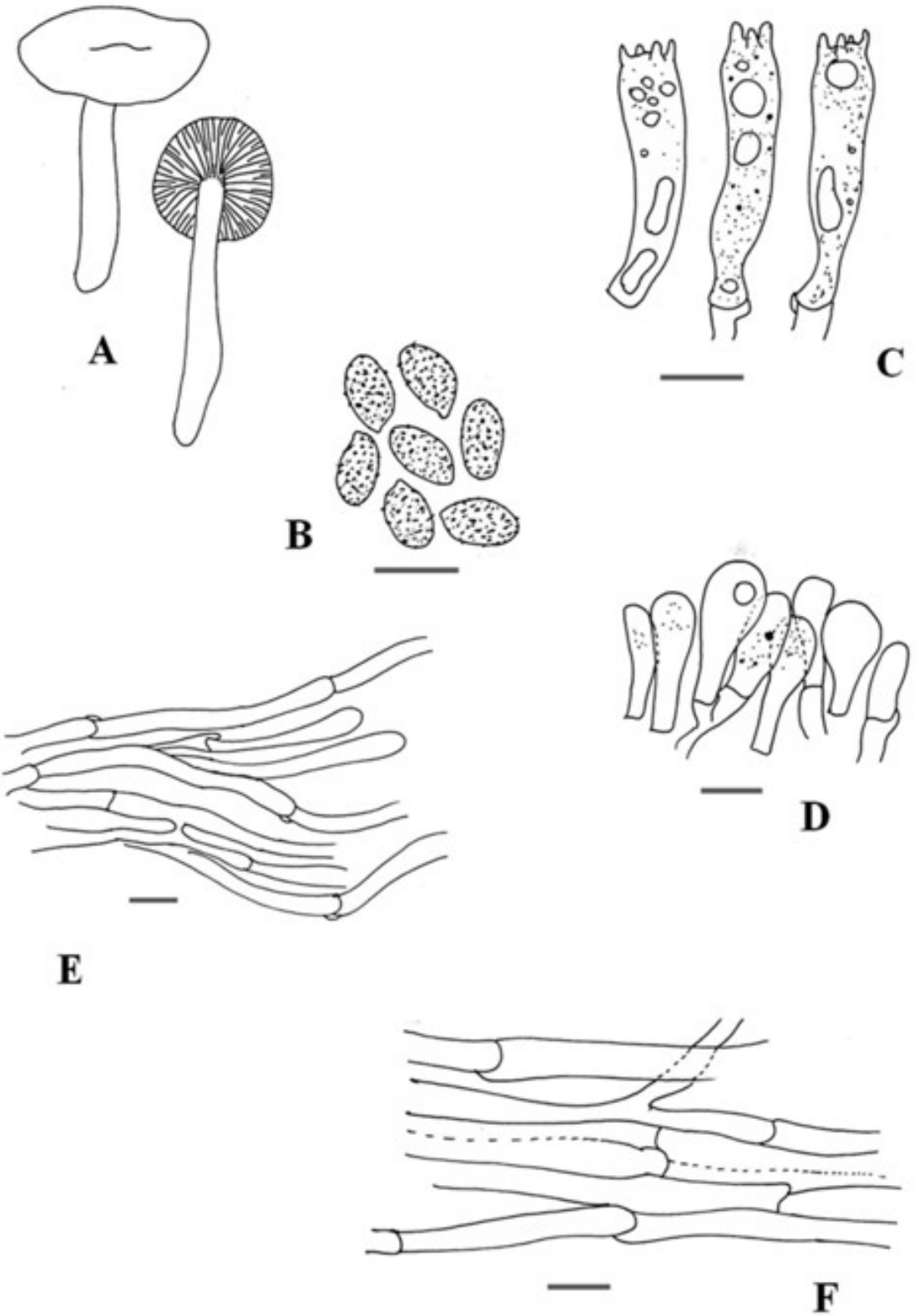

Fig. 2. (A–F) *C. bulliardii*: A. Basidiocarps; B. Basidiospores; C. Basidia; D. marginal cells; E. Pileipellis; F. Stipe cuticle. Scale bars: B–F=10 µm

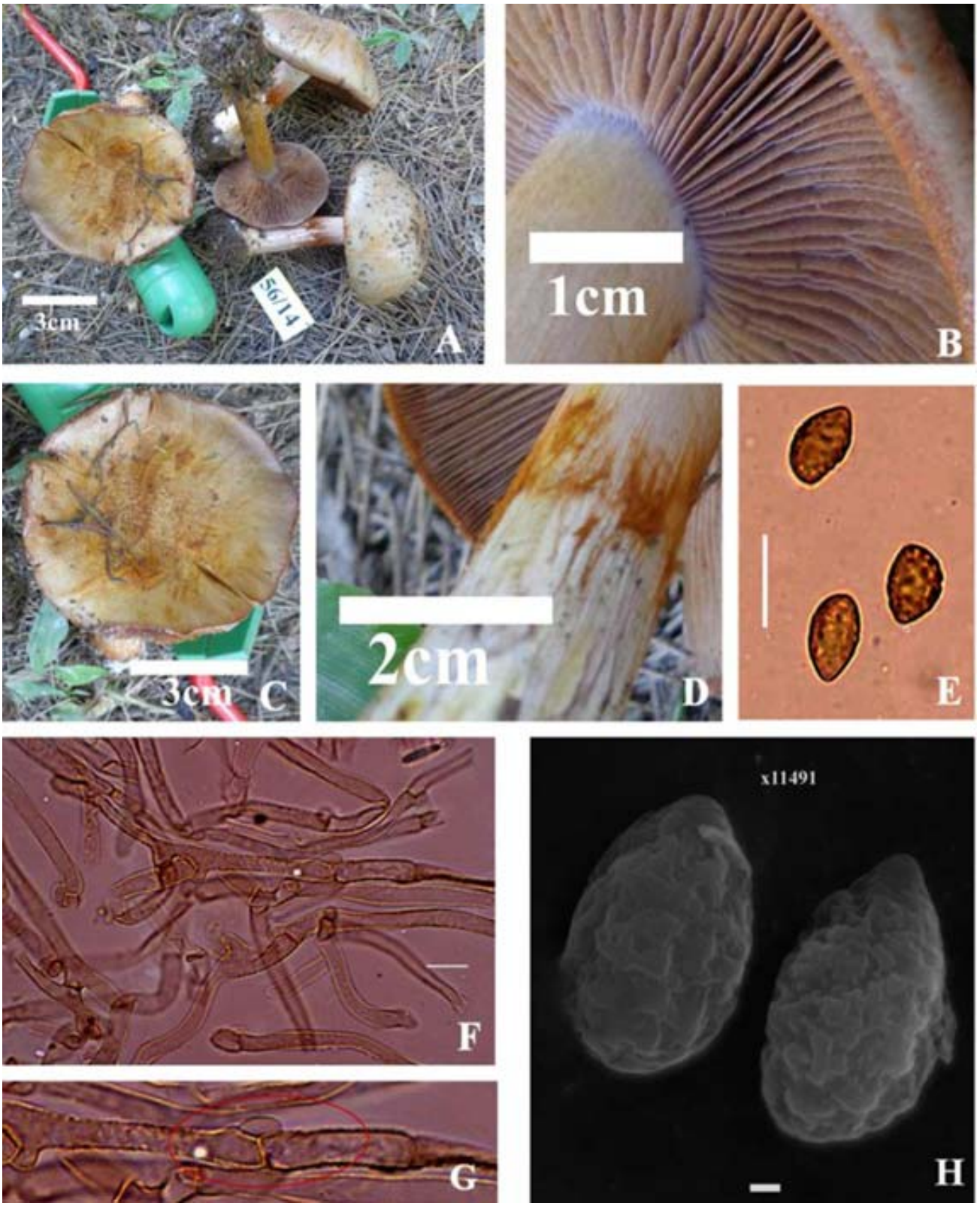

Fig. 3. (A–H). *C. dionysae*: A. Basidiocarps in natural habitat; B.; Adnate gill with toothed margin C. Pileus surface showing scales; D. Veil remnants on stipe; E. Basidiospores in light microscope; F. Pileipellis with encrusted hyphae; G. Clamp connection in pieipellis; H. Basidiospores in SEM showing warts. Scale bars: E–G=10 µm; H=1 µm

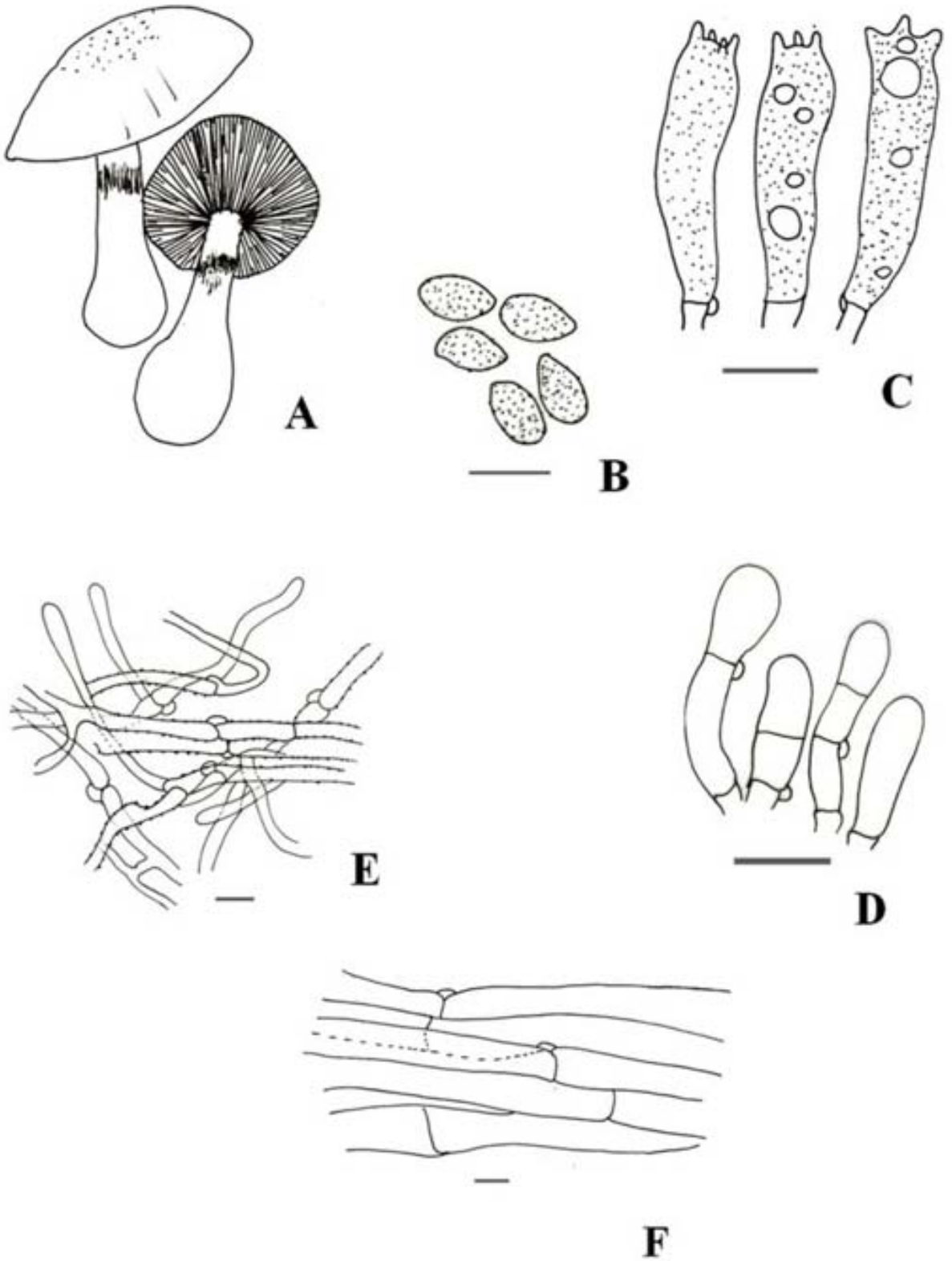

Fig. 4. (A–F) *C. dionysae*: A. Basidiocarps; B. Basidiospores; C. Basidia; D. Marginal cells; E. Pileipellis; F. Stipitopellis**.** Scale bar: B–F=10 µm

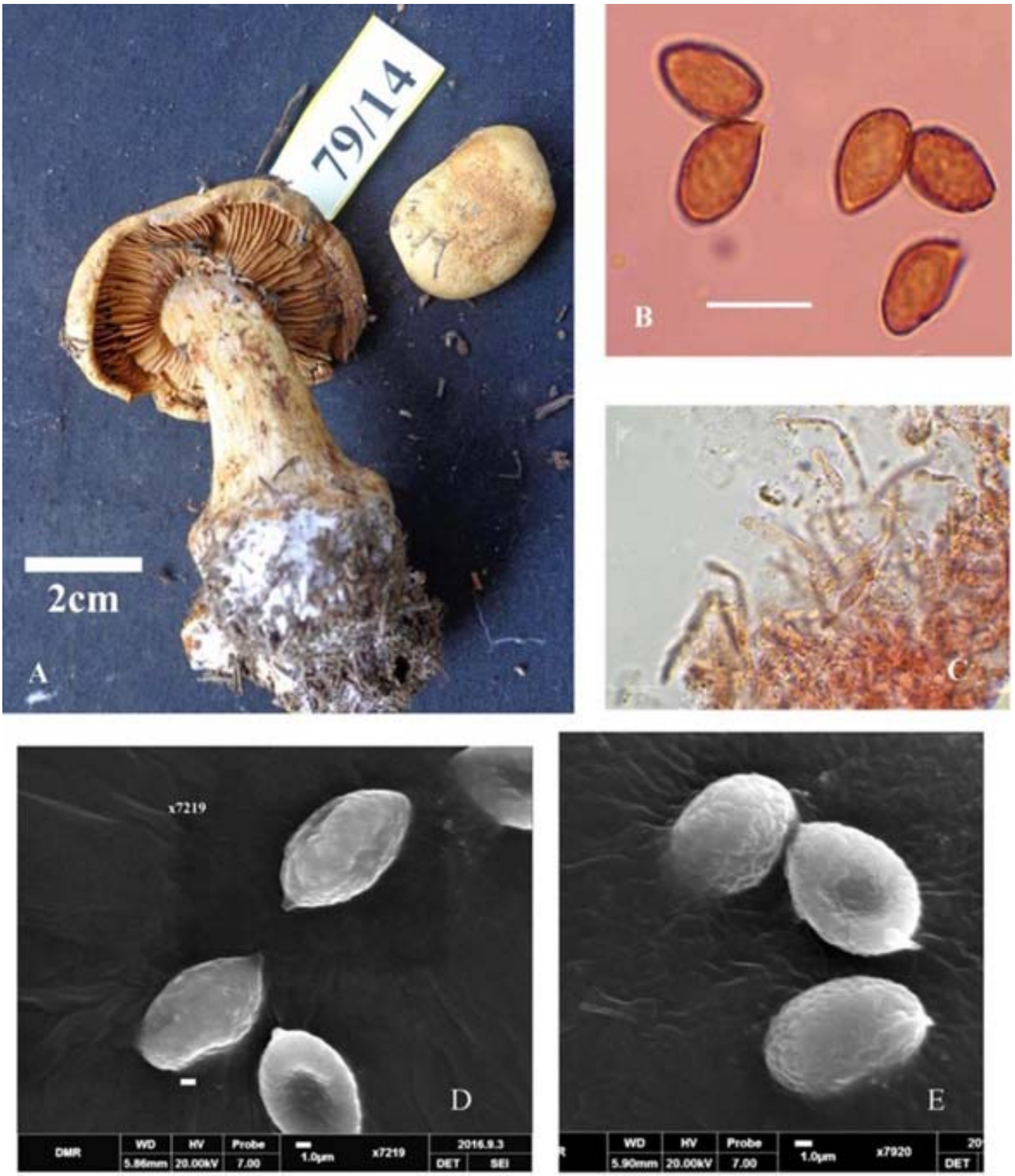

Fig. 5. (A–E). *C. pseudoglaucopus*: A. Basidiocarp; B. Basidiospores in light microscope; C. Pileipellis with encrusted hyphae; D and E. Basidiospores in SEM showing warts. Scale bars: B and C=10 µm; D and E= 1µm

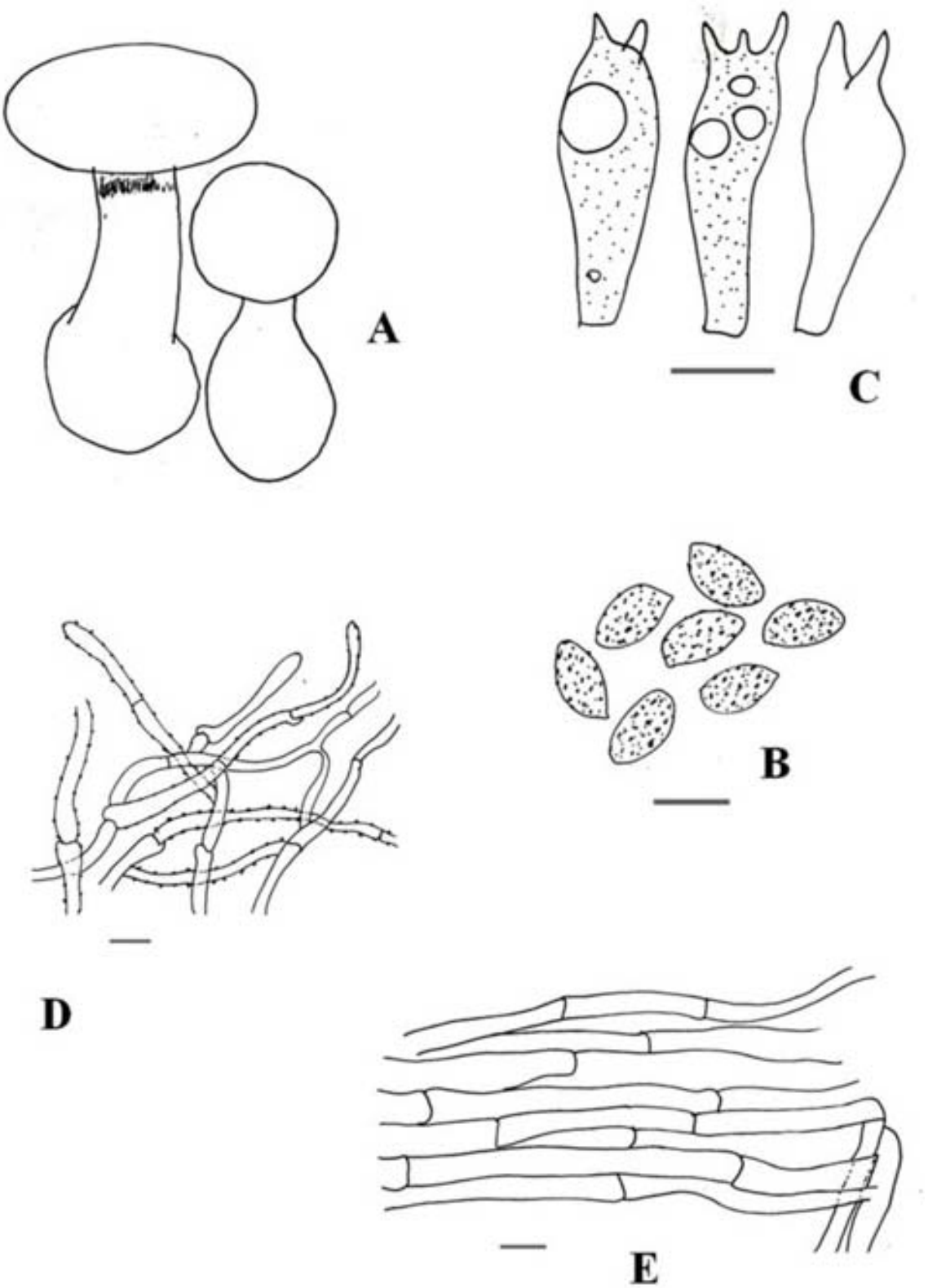

Fig. 6. (A–E) *C. pseudoglaucopus*: A. Basidiocarps; B. Basidiospores; C. Basidia; D. Pileipellis; E. Stipitopellis**.** Scale bars: B–E=10 µm

Hymenophoral trama (2.3)3.3–(4.0) µm thick, regular. Subhymenium 6–12 µm. Hymenium 26–30 µm. Stipitopellis made up of longitudinally arranged cylindric cells, (6.3)10.7–(14.6) µm wide, septate, branched, septa with clamps.

Collection examined: India- Himachal Pradesh- Shimla- Narkanda- Oddi: alt. 2621 m a.s.l; GPS 32°9'52"N 76°16'39"E, coniferous forest, Pine community, on soil, solitary. Shilpa Sood, DMR Acc. No. 56/14, September 21, 2014.

The fungus belongs to *C. dionysae* subgenus *Phlegmacium* due to its, dry stipe and lubricous to slimy pileus when moist. This species is confused with *C. glaucopus* var. *olivaceus* which occurs in coniferous forests. The pileus surface of *C. glaucopus* var. *olivaceus* is grey brown with wavy streaks and with conspicuous marginate basal bulb, while in *C. dionysae* the stipe ranges from cylindrical to with a basal bulb. Marginal cells of *C. dionysae* are cylindrical to clavate with two or three septa, the spores of *C. glaucopus* var. *olivaceus* are elliptical in shape while the spore of *C. dionysae* are ovoid to lemon shaped. This taxon is first time reported from India.

Cortinarius pseudoglaucopus (Jul. Schäff. ex M.M. Moser) Quadr., Documents Mycologiques 14 (56): 29, 1985

Figs. 5 (A–E) and 6 (A–E)

Pileus diameter up to 5.0 cm wide, hemispherical, golden yellow (5B-7), surface non hygrophanous, margin irregular, non-striate, revolute, dry, brown coloured scales in the center, pileus consistency fleshy, context colour orange white, thickness 0.5 cm, no colour change on touch or handling and confluent. Lamellae attached, brownish orange (5C-6), crowded, 0.3 cm in thickness, separable, serrate. Stipe central, brownish orange (5C-6), cylindrical, terete in cross section, bulbous, myceloid, context stuffed, fleshy, fine veil remnants present, volva absent.

Basidiospores (12.4)12.9–(14.2) × (6.4)7.1–(8.1) µm (Q=1.8), amygdaliform, warted, apiculate, germ pore absent, oil globule present, cyanophilic and inamyloid, spore deposit brown. Basidia (24.2)28.9–(33.0) × (7.9)9.3–(11.1) µm (Q=3.1), clavate, embedded basidia, 2,4-spored, sterigmata long upto 4.3 × 2.8 µm, thin walled, oil globule absent, basal septa with clamps. Cystidia absent. Pileipellis (3.6)4.6–(6.3) µm thick, hyphae irregularly arranged, thin walled, with encrustations, blunt ends, septate, branched, septa with clamps. Stipitopellis made up of longitudinally arranged cylindric cells, (4.2)5.7–(7.6) µm wide, septate, branched, septa with clamps.

Collection examined: India- Himachal Pradesh- Shimla- Narkanda: alt. 2712 m a.s.l; GPS 32°9'52"N 76°16'39"E, coniferous forest, Pine community, on soil, solitary. Shilpa Sood, DMR Acc. No. 79/14, September 21, 2014.

Cortinarius pseudoglaucopus can be abundant in conifer forests. It is somewhat similar in appearance to *C. glaucopus*, but differs by the dramatically larger spores (11-13 × 6.5-7.7µm) as compared to *C. glaucopus* (6-10 × 4-5.5 µm) and has a different shape. This fungus is new for India.

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