

New records of *Phaeocollybia* from North Western Himalayas, India

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ABSTRACT

Two mushroom species, namely *Phaeocollybia attenuata* subsp. *mexicana* Singer and *Phaeocollybia similis* (Bres.) Singer, collected from the hills of North West Himalayas are illustrated and described for the first time from India.

Key words: *Basidiomycota*, macrofungi, taxonomy, ectomycorrhizae, *Phaeocollybia*.

INTRODUCTION

The genus *Phaeocollybia* R. Heim. belongs to family *Cortinariaceae* R. Heim ex Pouzar and order *Agaricales* Underw. and has been recorded from temperate, subtropical and tropical forests. There are about 86 species reported from the world and distributed mainly in Mexico and American continent (Guzman and Montoya, 1987; Bandala *et al.*, 1996). However, only 9 spp. are known from Asia. There are only 4 spp. of *Phaeocollybia* earlier recorded from India namely *P. latispora* Guzmán, Bandala & Montoya, *P. rancida* E. Horak and *P. spoliata* E. Horak from North West Himalayas and *P. coniuncta* E. Horak from North East Himalayas (Horak, 1974, 1980; Upadhyay and Kaur, 2003).

During the course of investigation on ectomycorrhizal mushrooms of north west Himalayas several interesting mushroom specimens of *Phaeocollybia* were collected. Out of which, two collections belonging to *Phaeocollybia attenuata* subsp. *mexicana* Singer and *Phaeocollybia similis* (Bres.) Singer, collected from Khada Pather and Narkanda (Himachal Pradesh), respectively are illustrated and described. The examined collections have been deposited in the Herbarium of ICAR, Directorate of Mushroom Research, Chambaghat, Solan.

MATERIALS AND METHODS

The morphological features such as colour, shape, size and change in colour on bruising of carpophores on touch and injury were described from the fresh specimens. The specimens were dried in hot air oven after recording all the morphological characters and preserved in polypropylene bags with naphthalene ball and some crystals of 2,4-dichlorobenzene. The microscopic structures were studied from the material revived in 3% KOH, stained using 2% congo red, 2% phloxine, 1% cotton blue and Melzer's reagent and examined under oil immersion (Motic BA 310). The line diagrams of microscopic structures were drawn with the aid of camera lucida. The spores were studied from the spore deposits. Scanning electron microscopy was done using IMCRAFT microscope. All colour citations are from Maerz and Paul (1930).

TAXONOMY

Phaeocollybia attenuata subsp. *mexicana* Singer, *Sydowia* 11: 367, 1958.

Figs. 1(A-B) & 2(A-G)

Pileus initially campanulate finally applanate with short obtuse umbo, non striate, non hygrophanous, dry, 1.7 - 4.4 cm

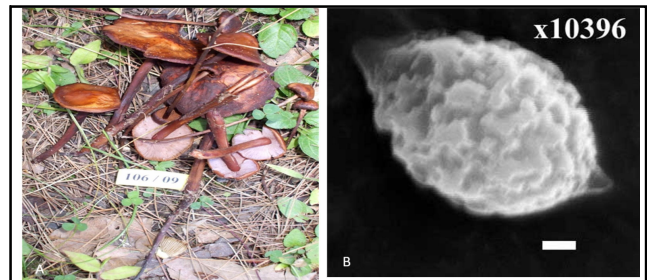


Fig. 1(A-B): A. *Phaeocollybia attenuata* subsp. *mexicana* in natural habitat; B. SEM of Basidiospore; Scale bar: B=1µm.

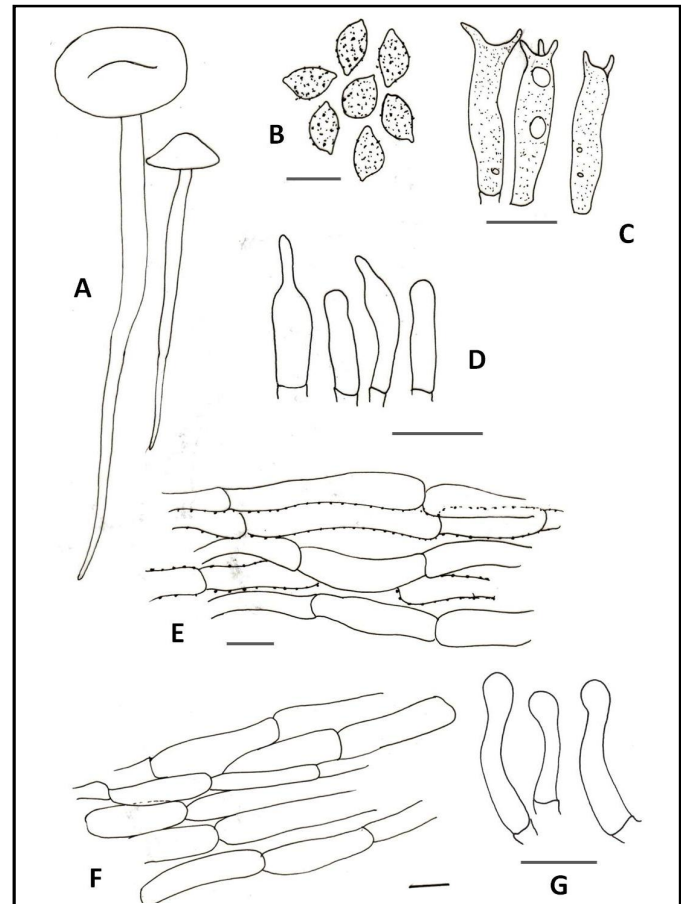


Fig. 2(A-G): *Phaeocollybia attenuata* subsp. *mexicana*: A. Basidiocarp; B. Basidiospores; C. Basidia; D. Cheilocystidia; E. Pileipellis; F. Stipitopellis; G. Tibiform diverticula; Scale bar: BG=10µm.

in dia, copper leaf (6J-11), margin incurved, pileus surface slightly rugulose or pitted, odour fungoid, pleasant, no colour change on bruising. Lamellae unequal 5-6 sets, crowded to densely crowded, livid brown (6D-3), after glow (42B-5), lavender (43C-5), adnexed, 3 mm broad, gill margin serrate to crenulate. Stipe central, maroon (7L-7) brazil brown (8L-8), 3.5-9.5 × 0.3-0.6 cm excluding pseudorrhiza, very long, 5-6 cm, tapering down and pointed, plum (47J-9), fibrous, brittle, hollow.

Basidiospores (9.1) 9.5-(10.7) × (5.0) 5.9-(7.1) μm (Q=1.6), brown, thick walled, limoniform to limoniform-globose, warted, plage present, germ pore present, oil globule (1 no.), cyanophilic and inamyloid. Basidia (14.3) 18.5-(25.9) × (4.3) 5.4-(6.6) μm (Q=3.4), clavate, 2-4-spored, sterigmata up to 3.4 × 1.4 μm, thin walled, oil globule present in some basidia, basal septa without clamp. Pleurocystidia absent, cheilocystidia present, claviform to cylindrical claviform, (9.7) 13.3-(15.7) × (2.6) 3.3-(4.1) μm, without clamp connections. Pileipellis (2.3) 3.2-(4.1) μm thick, hyphae regularly arranged, with encrustations, thin walled, septate, branched with blunt ends, septa without clamps. Subhymenium 7-10 μm. Hymenium 12-20 μm. Stipitopellis made up of longitudinally arranged cylindric cells, (9.0) 15.5-(20.6) μm, septate, branched, septa without clamps. Tibiform diverticula frequent on stipitopellis, short 15.3 × 3.6 μm with 2-3 μm capitellum with no apical droplet and without clamps.

Habit and habitat: Growing on soil among pine needles in coniferous forest.

Collection examined: India-Himachal Pradesh- Khada Pathar. alt. 2632 meter above sea level; GPS N31°7'1.38" and E 77°37'12.2". 18.09.2009, Herbarium Acc. No.106/09.

Phaeocollybia similis (Bres.) Singer, *Lilloa* 22: 567, 1951.

Figs. 3(A-B) & 4(A-G)

Pileus diameter up to 5.5 cm wide, conic to umbonate, greyish yellow to corn (4B-5) in the margin, oxide yellow in the center (5C-7), surface non hygrophanous, slightly visid, glabrous, margin irregular, non-striate, inflexed, scales absent, cuticle half peeling, pileus consistency fleshy, context colour cream, up to 0.2 cm thick, no colour change on touch or handling, pileus confluent. Lamellae free, separable, serrate, crowded, greyish yellow (4B-5) to orange yellow (4B-8), fleshy, gill 2.5 × 0.4 cm, unequal, present in 6 sets of lamellulae. Stipe central, amber yellow (4B-6) at the top, light orange (5A-5) to reddish brown (5D-8) in the center and violet brown (11E-5) at the base, clavate to cylindrical, very long 11 × 1.2 - 1.6 cm

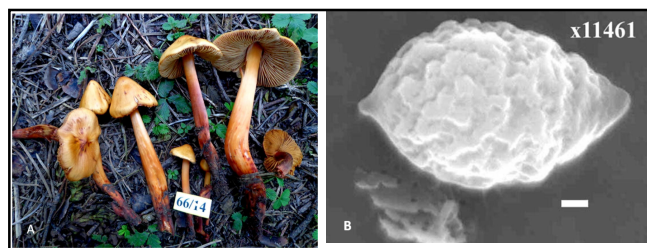


Fig. 3(A-B): A. *Phaeocollybia similis* in natural habitat; B. SEM of Basidiospore; Scale bar: B=1μm.

above ground and 16 cm total with underground part, compressed, rediccate, fibrous, glabrous, dry, single furrow, context stuffed, fleshy, scales absent, stipe trama cream coloured.

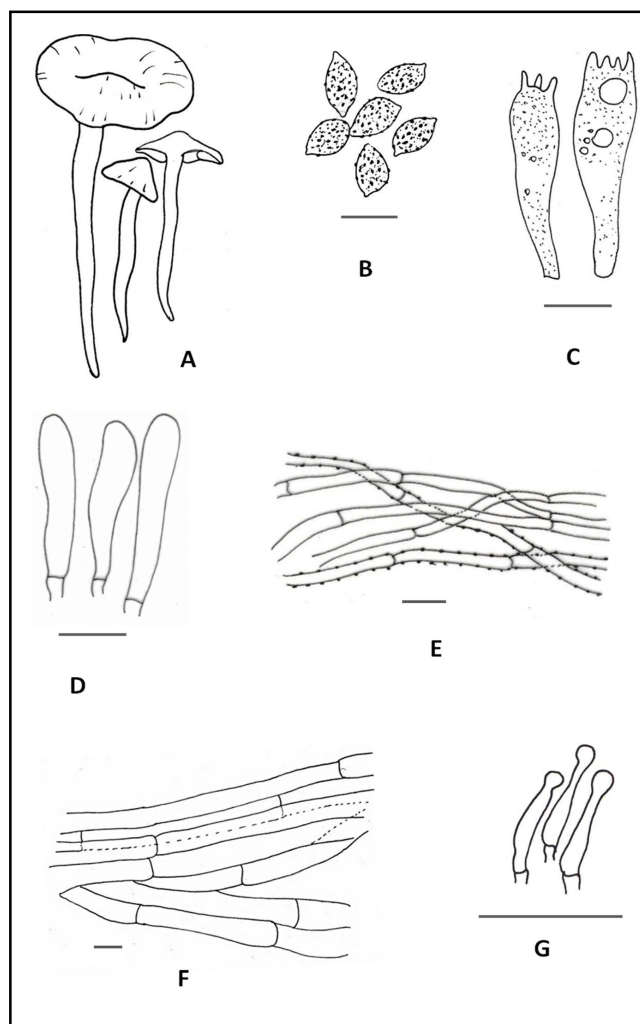


Fig. 4(A-G): *Phaeocollybia similis*: A. Basidiocarp; B. Basidiospores; C. Basidia; D. Cheilocystidia; E. Pileipellis; F. Stipitopellis; G. Tibiform diverticula; Scale bar: BG=10 μm.

Basidiospores (8.2)10.2-(11.9) × (4.8) 5.5-(6.2) μm (Q=1.9), brown, thick walled, limoniform to limoniform-globose, warted, plage present, germ pore present, oil globule (1 no.), cyanophilic and inamyloid. Basidia (26.5) 31.7-(36.1) × (5.6) 4.7-(8.3) μm (Q=4.5), clavate, 4-spored, sterigmata up to 4.3 × 1.8 μm, thin walled, oil globule present, basal septa without clamps. Pleurocystidia absent, cheilocystidia present, clavate (14.6) 26.1-(35.5) × (4.4) 5.7-(7.3) μm, clamp connections absent. Pileipellis consists of 3 types of cells, outer epicutis (2.9) 4.2-(6.5) μm thick, hyphae regularly arranged, with encrustations, thin walled, septate, branched, blunt ends, septa without clamps, middle cutis (7.0) 10.5-(14.0) μm made up of regularly arranged, thin walled, branched, septate, clamp-connections absent, inner most hyphodermium: (7.3) 11.2-(16.3) μm thin walled irregularly arranged, septate, brached, clamp connection absent. Hymenophoral trama

(5.0) 8.1-(9.5) μm thick, regular. Subhymenium 7-9 μm . Hymenium 25-30 μm . Stipitopellis made up of longitudinally arranged cylindrical cells, (7.8) 10.7-(14.6) μm wide, septate, branched, septa without clamps. Tibiform diverticula formed on stipitopellis very short 8.0×1.2 with 1-1.5 μm capitellum, no clamp connections.

Habit and habitat: Gregarious on soil under coniferous mixed forest.

Collection examined: India- Himachal Pradesh- Shimla-Narkanda- alt. 2712 meter above sea level; GPS 32°9'53"N 76°16'39"E. 21.09.2014, Herbarium Acc. No.66/14.

DISCUSSION

Phaeocollybia Bandala & Montoya is a genus of family *Cortinariaceae* having around 86 spp. recorded worldwide. They are characterized by conical to umbonate pileus, stipe base tapering, rusty brown spores and spore print and cheilocystidia always present. There are two sub genera *Fibulophaeocollybia* Bandala & Montoya, where clamp connections are frequently present and *Phaeocollybia* in which clamps are absent. The sub genus *Phaeocollybia* has 3 sections *Microspora* Singer (spores up to 6.5 μm), *Versicolores* Singer (cheilocystidia capitate or attenuate at apex) and *Phaeocollybia* Singer (where cheilocystidia are filamentous or cylindrical or clavate but never capitate). Both the above collections belong to section *Phaeocollybia* due to clavate cheilocystidia without any clamps. There are sixteen spp. in *Phaeocollybia*, namely *Ph. ambigua* E. Horak & Halling, *Ph. quercetorum* Singer, *Ph. similis* (Bres.) Singer, *Ph. christinae* (Fr.) R. Heim, *Ph. neosimilis* Singer, *Ph. singeri* Guzmán, Bandala & Montoya, *Ph. kauffmanii* (A.H. Sm.) Singer, *Ph. procera* E. Horak, *Ph. muscicolor* E. Horak, *Ph. odorata* E. Horak, *Ph. picea* A.H. Sm. & Trappe, (lilac color absent from stipe, pileus or lamellae) and *Ph. kauffmanii*, *Ph. fallax* A.H. Sm., *Ph. attenuata* (A.H. Sm.) Singer, *Ph. lilacifolia* A.H. Sm., *Ph. ruffipes* Norvell and *Ph. amygdalospora* Bandala & E. Horak where lilac tinge is present in stipe, pileus or lamellae (Bandala *et al.*, 1996; Norvell, 2002; Horak, 1977; Bandala and Montoya, 1994).

The pileus is glutinous in *Ph. fallax*, *Ph. lilacifolia*, *Ph. kauffmanii* and *Ph. ruffipes* and the spores are smaller in *Ph. ruffipes* (7.75 \times 4.45 μm) so the present specimens differs from all the four violet lilac species. The spores of *Ph. attenuata* and *Ph. amygdalospora* are similar but the basidiocarp is very small up to 15 mm in *Ph. amygdalospora*. Singer (1957, 1970) has described *Ph. attenuata* subsp. *mexicana* reported from coniferous forest which differs from *Ph. attenuata* subsp. *attenuata* on pileus colour being deep chestnut brown which fades to ochraceous brown or ochraceous tawny. The present collection from Khadapathar is exactly similar to *Ph. Attenuata* subsp. *mexicana*. It can be identified due to purplish lamellae, long pseudorrhiza, gill margin serrate and absence of pleurocystidia.

Among the non lilac species of *Phaeocollybia*, the basidiospores of *Ph. ambigua* and *Ph. singeri* are less than 9 μm while the spores of all the 9 species are more than 9 μm . *Ph. procera* and *Ph. singerii* both have been collected from angiospermous forest and *Ph. quercetorum* from *Quercus*

forest and *Ph. odorata* has long rooting stipe. The basidiospores of *Ph. christinae*, *Ph. similis*, *Ph. kauffmanii*, *Ph. procera* and *Ph. muscicolor* are more than 10 μm , however the plage is absent in *Ph. procera* and *Ph. muscicolor*, which is present in the presently examined collection from Narkanda. The basidiospores of *Ph. christinae* are 4.5 μm broad while *Ph. kauffmanii* and *Ph. similis* has broader spores (5 μm broad). The basidiocarp of *Ph. kauffmanii* is one of the largest in *Phaeocollybia* with reddish tinge and hygrophanous while the second specimen has no reddish tinge and are non hygrophanous. The taxonomic details of Narkanda collection are in complete agreement with the diagnostic features of *Ph. similis*.

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