Journal on New Biological Reports
JNBR 4(1) 1 – 6 (2015)

ISSN 2319 – 1104 (Online)

Published by
www.researchtrend.net

Two new records of *Cortinarius* from Sikkim (India)

Kanad Das* and Dyutiparna Chakraborty

Botanical Survey of India, Cryptogamic Unit, P.O. – B. Garden, Howrah 711103, India
***Corresponding author:** daskanadbsi@gmail.com

| Received: 16 December 2014 | Accepted: 30 January 2015 |

ABSTRACT

Two interesting species of wild mushrooms belonging to the family Cortinariaceae, namely, *Cortinarius variicolor* (subg. *Phlegmacium*) and *C. salor* (subg. *Myxacium*), are reported for the first time from India with their macro- and micromorphological descriptions along with the supporting illustrations. Both are compared with the respective allied taxa.

Key Words: Macrofungi, Cortinariaceae, taxonomy, distribution, Sikkim, India.

INTRODUCTION

Explorations of the diverse mycobiota with the emphasis on fleshy wild mushrooms in North district of Sikkim (one of the small states in India) had been undertaken since 2011 by Botanical Survey of India. During routine macrofungal surveys to this district in 2013 and 2014, a number of wild mushrooms were collected. Thorough macro- and micromorphological examination of these specimens revealed some interesting species (Das & Chakraborty 2013, 2014a–d; Das *et al.* 2013, 2015a & b) for the Indian mycobiota. Two of those species: *Cortinarius variicolor* (Pers.) Fr. and *C. salor* Fr., hitherto unreported from India are described in the present communication with macro- and micromorphological illustrations. They were also compared with the close taxa

MATERIAL AND METHODS

Macromorphological features were noted from the fresh basidiomata of different developmental stages in the field and base-camp. After recording the macromorphological characters, basidiomata were dried with a field drier. Photography of these fresh and/or dissected basidiomata were made with the aid of Nikon D300s and Olympus C-5060 cameras. Colour codes and terms (mostly) follow Methuen Handbook of Colour (Kornerup and Wanscher, 1978).

Micromorphological features were noted with the help of a light (compound) microscope: Nikon eclipse N*i* from dry samples mounted in a mixture of 5% KOH and phloxin, Congo red and 30% glycerol or separately in 5% KOH. Spore measurements were noted in side view from twenty randomly selected basidiospores. Spore-size measurements and length/width ratios (Q) are presented as: minimum–**mean**–maximum. Herbarium name is after Holmgren *et al.*, (1990). Scanning Electron Microscope (SEM) images of basidiospores were obtained from dry spores (from spore print) that were directly mounted on a double-sided adhesive tape pasted on a metallic specimen-stub and then scanned with gold coating of 5 nm at different magnifications in high vacuum

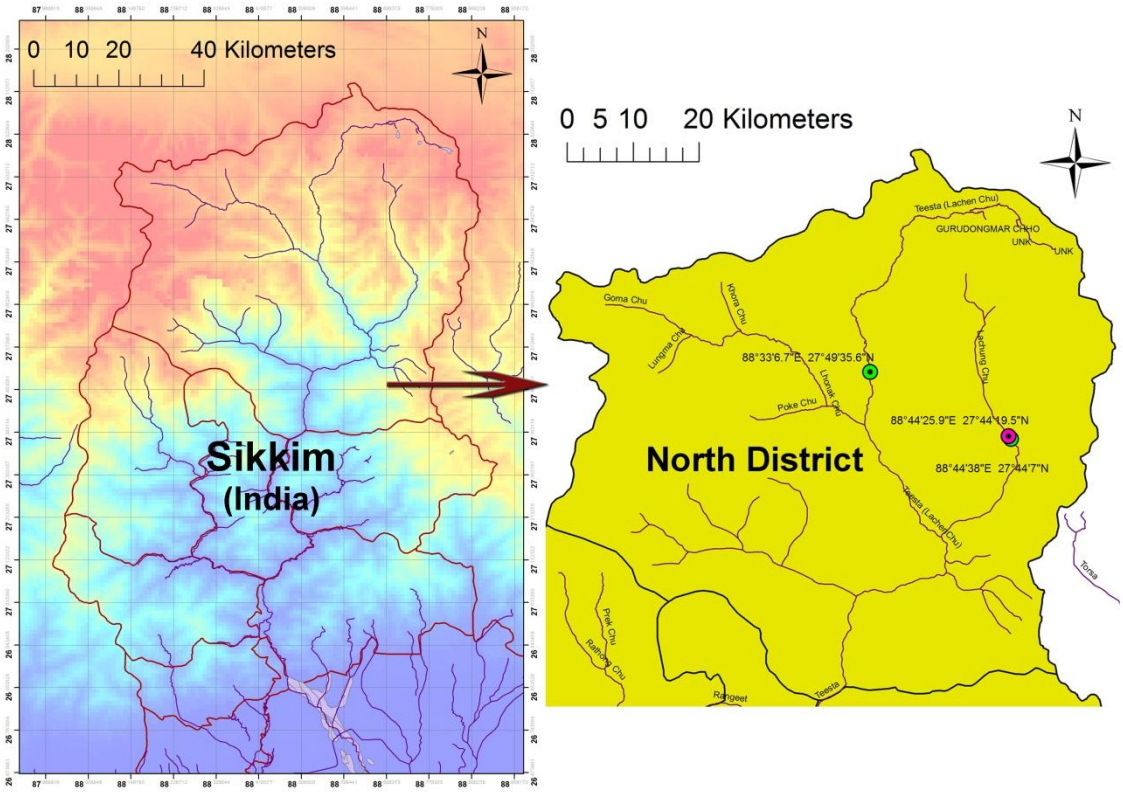

Fig. 1: A map showing the geographical distribution of *Cortinarius variicolor* (green spots) and *C. salor* (magenta spot) in Sikkim (India).

mode (20 KV) to observe patterns of spore-ornamentation. SEM study was carried out with a FEI's Quanta FEG 250 model imported from the Netherlands and installed at the S.N. Bose National Centre for Basic Sciences, Kolkata, India.

TAXONOMIC DESCRIPTION

Cortinarius variicolor (Pers.) Fr., Epicr. Syst. Mycol. 259 (1838);
syn.: *Agaricus variicolor* Pers.

Figs. 1 & 2

Pileus 60–140 mm. diam.; hemispherical when young, gradually becoming convex to planoconvex or rarely plane at least at centre; surface smooth, viscid and slimy when wet, fibrillose, often radially cracked and/or torn from the margin, light brown (6D4 to 6D5) when young becoming brown-grey with maturity; margin distinctively incurved throughout, wavy, light violet when young becoming violet-white to pale violet (16A2 to 16A3) with brown (7E5) areas at maturity, remained attached with stipe by white cortina that becoming brownish with spore-deposition. Lamellae adnate to subdecurrent, close to rather-crowded (13/cm at margin of pileus), forked, pale violet to pastel violet (18A3–18A4) when young, becoming brown (7E5) with maturity; lamellulae in 4 series; edges crenate. Stipe 72–110 × 20–25 mm, central, cylindric, sometimes with tapeing/bulbous to subbulbous base, with an indistinct annular zone; surface longitudinally fibrillose, greyish ruby to dark ruby (12E4 to 12F4) when young, becoming light brown (5D5) or brown when bruised or at maturity leaving greyish ruby to dark ruby (12E4 to 12F4) or violet at apex. Context solid to hollow, white to blue-violet or violet-white (19A2) and pale violet to pale blue (19A3 to 20A3) towards margin, changing to greyish red (9B5) with guiac, then violet brown (10E7) after 10 minutes. Odor earthy or dust-like, unpleasant. Taste mild. Spore print brown to rusty brown.

Basidiospores 9.7–**11.2**–12.3 × 5.0–**5.8**–6.5 µm (n = 20, Q = 1.63–**1.90**–2.10), ellipsoid to amygdaliform, verrucose, yellow-brown. Basidia 25–38 × 8–10 µm, clavate, 4-spored, with basal clamp. Pleuro- and cheilocystidia not found. Lamellae edge fertile, composed of basidia and marginal cells; marginal cells 12–27 × 7.5–10.6 µm, cylindrical to narrowly clavate, clamped. Pileipellis 170–190 µm thick, an ixocutis; suprapellis composed of repent parallel to interwoven hyphae submerged in a thin gelatinized layer, hyphae 3.0–6.5 µm wide, septate, clamped; subpellis composed mostly of interwoven hyphae;

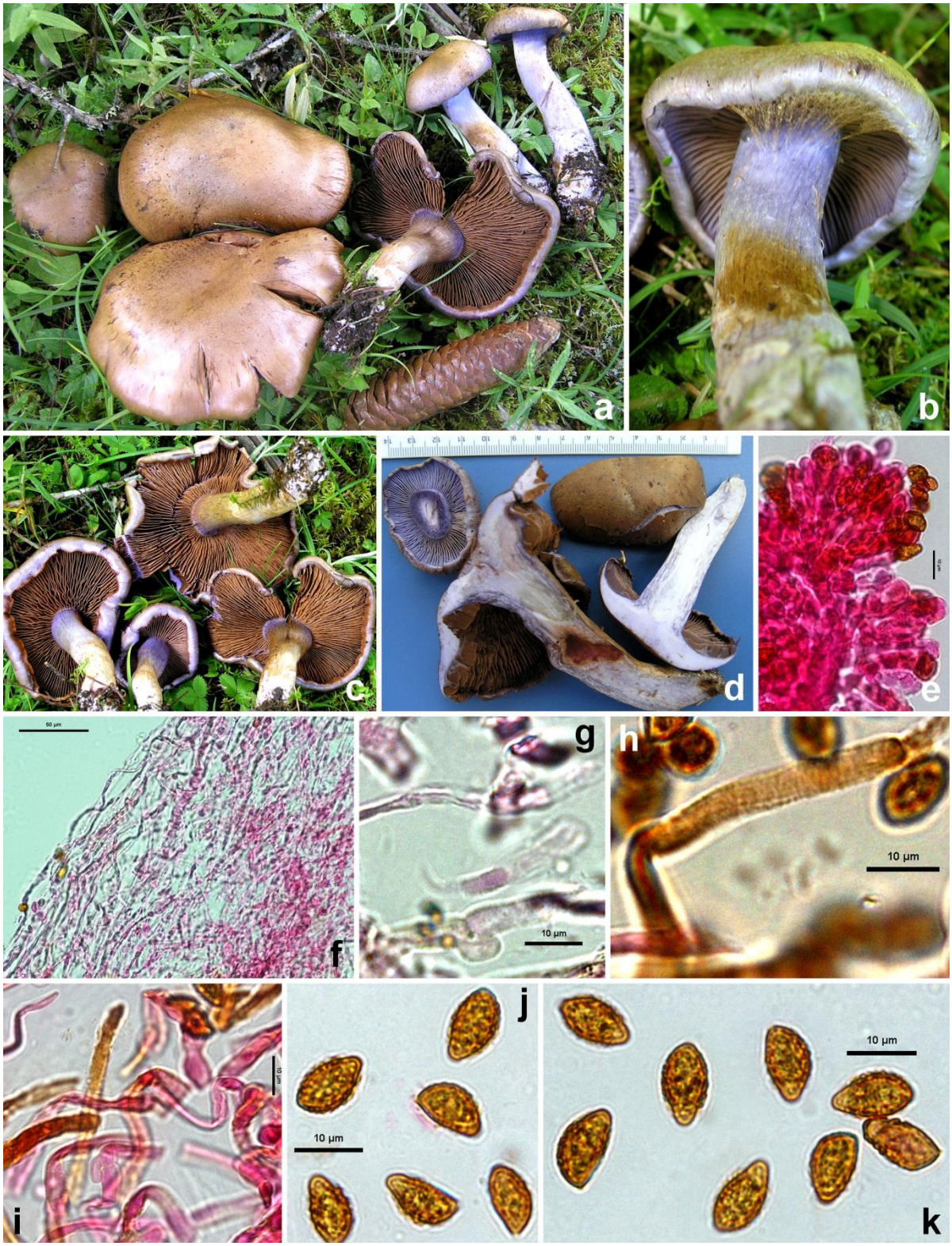

Fig. 2: *Cortinarius variicolor* (Pers.) Fr.: a–b Fresh basidiomata in the coniferous forest showing dorsal and ventral sides; c Basidiomata showing incurved pale violet margin; d Dissected basidiomata; e Lamella-edge showing marginal cells; f Cross-section through pileipellis; g Clamped hyphae in pileipellis; h–i Brown pigmented encrusted hyphae; j–k Verrucoid basidiospores. Scale bars: e, g–k = 10 µm; f = 50 µm.

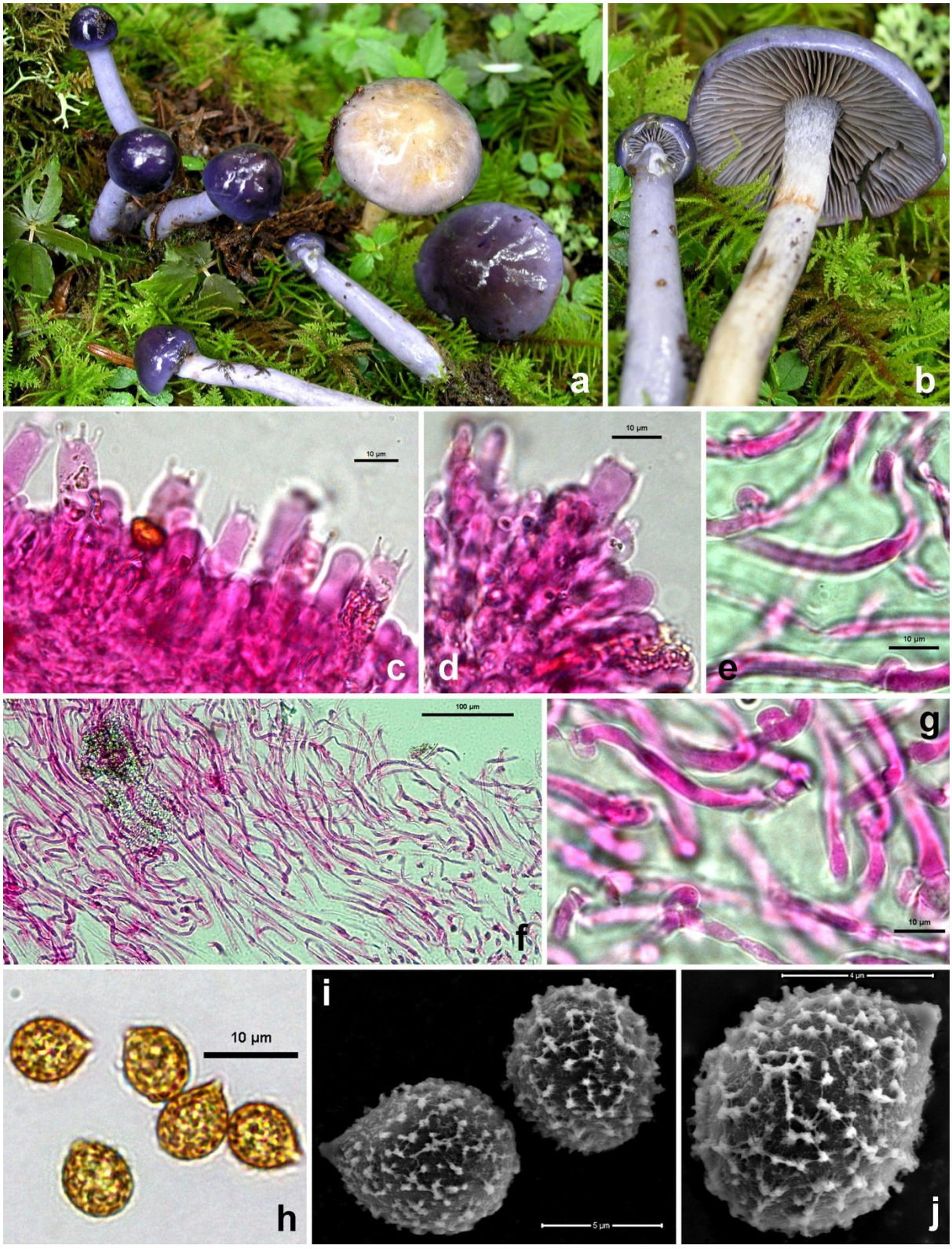

Fig. 3: ***Cortinarius salor*** **Fr.:** a–b Fresh basidiomata in the coniferous forest showing dorsal and ventral sides; c Hymenium layer showing basidia; d Lamella-edge showing basidia and marginal cells; e & g Clamped hyphae in pileipellis; f Cross-section through pileipellis; h Verrucoid basidiospores; i–j SEM microphotographs of basidiospores. Scale bars: c–e = 10 µm; f = 100 µm; g–h = 10 µm; i = 5 µm; j = 4 µm.

hyphae often septate, brown pigmented and encrusted.

Specimens examined: India, Sikkim, North District, Dombang, 2890 m, N27°44′07.0″ E88°44′38.0″, 23rdJuly, 2013, *K. Das*, KD 13-002 (CAL); ibid., North District, Samthang, 2890 m, N27°49′35.6″ E88°33′06.7″, 22ndJuly, 2014, *K. Das*, KD 14-007 (CAL).

Ecology: Uncommon, under *Picea* and *Abies* in subalpine coniferous forest.

NOTES

Cortinarius variicolor is characterized by viscid brown-grey pileus with violet to pale violet incurved margin, earthy odor of context, pale violet to violet lamellae that becoming brown with maturity, fibrillose non viscid stipe-surface, often with subbulbous stipe-base, ixocutis pattern of pileipellis with clamped encrusted and brown pigmented hyphae. It is placed under the subgenus *Phlegmacium*. Two other European species: *Cortinarius largus* Fr. and *C. lividoviolaceus* (Rob. Henry ex M.M. Moser) M.M. Moser appear to be close to *C. variicolor*. But, earlier two can be separated from the present species in the field by the occurrence in association with the broad-leaf trees and absence of distinct earthy odor (Breitenbach & Kränzlin 2000; Knudsen & Vesterholt 2012). Moreover, *C. lividoviolaceus* has comperatively smaller (8.5–10.7 × 5–5.9 µm) spores (Breitenbach & Kränzlin 2000).

Cortinarius salor Fr., Epicr. Syst. Mycol. 276 (1838); **Figs. 1 & 3**

Pileus 15–50 mm. diam.; globose to hemispherical when young, gradually becoming campanulate to convex mostly with a broad or blunt umbo at maturity; surface viscid to slimy or sticky, shiny, glabrous, smooth, dark purple (14F4 to 14F5 or 14F6) to violet when young slowly becoming paler to violet-brown (11E4 to 11E5) at center and paler at margin, finally discoloring ochraceous to yellowish white or pale yellow (3A2 to 3A3 or 4A3) with some blue-purple or violet patches with more maturity and exposure in rainfall; margin incurved to decurved. Lamellae narrowly adnate, sinuate, crowded (20/cm at margin of pileus), violet to reddish grey (12C2), becoming greyish orange (5B4) then rusty brown; lamellulae in 4 series; edges smooth. Stipe 52–95 × 7–11 mm, central, cylindric-clavate, gradually broader towards base, with an annular zone; surface viscid, longitudinally fibrillose, paler than pileus, dull violet to greyish violet (16D4 to 16D3) when young, becoming violet-white (16A2) at apex, gradually discoloring ochre-brown towards base. Context pithy at stipe after maturity, whitish to pale yellow (4A3), unchanging in $FeSO_4$ but changing to light orange (5A4) with guiac and greyish orange (5B4) with KOH. Odor indistinct. Taste mild. Spore print brown to rusty brown.

Basidiospores 8.2–**8.4**–9.0 × 7.0–**7.3**–8.2 µm (n = 20, Q = 1.0–**1.09**–1.2), globose to subglobose or broadly ellipsoid, densely verrucose, under SEM some verrucae overlapping, connected by fine lines/connectors. Basidia 23–40 × 8.0–9.0 µm, clavate, 4-spored, with basal clamp; sterigmata 4.5–6 × 1–2 µm. Pleuro- and cheilocystidia not found. Lamellae edge fertile, composed of basidia and marginal cells; marginal cells cylindrical to clavate, clamped. Pileipellis 250–400 µm thick, an ixocutis, composed of erect hyphae which becomes subparallel at the top, submerged in a gelatinized layer; hyphae 5.0–6.5 µm wide, septate, clamped.

Specimens examined: India, Sikkim, North District, Shingba Rhododendron sanctuary, 3252 m, N27°44′19.5″ E88°44′25.9″, 25th July, 2013, *K. Das*, KD 13-032 (CAL).

Ecology: Uncommon, under *Abies* in subalpine coniferous forest.

NOTES

Cortinarius salor is recognized by the presence of viscid to slimy dark purple-violet pileus which always discolors yellow to ochreceous with maturity, violet to reddish grey lamellae that becoming brown when mature, dull violet stipe discoloring ochraceous in age, distinctly globose to subglobose or broadly ellipsoid (never ellipsoid or amygdaliform) spores and ixocutis nature of pileipellis. Because of viscid pileus and stipe it is easily placed under subgenus *Myxacium*. *Cortinarius transiens* (Melot) Soop and *C. epipoleus* Fr. appears to be quite similar to *C. salor*. But, pileus of *C. transiens* is mostly with olivaceous tinge, whereas, pileus of *C. epipoleus* rarely has ochraceous pileus (distinctive feature for *C. salor*) at maturity (Breitenbach & Kränzlin 2000; Knudsen & Vesterholt 2012).

ACKNOWLEDGEMENTS

The authors are grateful to the Director, Botanical Survey of India (BSI), Kolkata and the entire Forest Department of Sikkim for providing facilities during the present study. Dr. Md. Nehal Aziz (BSI, Cryptogamic Unit) and Dr. P. Lakshminarasimhan (BSI, Central National Herbarium) are duly thanked for helping the authors in many ways. The senior author is indebted to Ulrich Schmid (Switzerland) for providing some invaluable literature.

REFERENCES

Breitenbach J and Kranzlin F. 2000. Fungi of Switzerland Volume 5 Agarics 3rd part., Verlag Mykologia, Luzern, Switzerland.

Das K and Chakraborty D. 2013. New record of parasitic macrofungus from India. Indian J Pl Sc 2(4): 73–75.

Das K. and Chakraborty D. 2014a. Three interesting species of wild mushrooms from Sikkim (India). Indian J Pl Sc 3(1): 101-108.

Das K. and Chakraborty D. 2014b. *Boletus sharmae*, a new species from Sikkim, India. Indian J Pl Sc 3(1): 19–24.

Das K. and Chakraborty D. 2014c. *Cortinarius flammeus* Berk. – a poorly known species. NeBIO 5(2): 9–12.

Das K. and Chakraborty D. 2014d. *Lactarius vesterholtii*, a new species from India. Mycotaxon 129(2): 477-484.

Das K, Chakraborty D, Baghela A, Singh SK, Dentinger BTM. 2015b. *Boletus lakhanpalii*, a new species in Boletaceae from Sikkim (India) with uncertain phylogenetic placement. Sydowia 67: in press.

Das K, Chakraborty D, Parihar A. 2013. *Cortinarius trivialis*, a new record of wild mushroom from India showing intercontinental conspecificity. NeBIO 4(5): 91–93.

Das K, Parihar A, Hembrom ME. 2015a. A new species of *Bondarzewia* from India. Turkish J Bot 39: 128–133.

Holmgren PK, Holmgren NH, Barnett LC (editors). 1990. Index Herbariorum. Part I: The Herbaria of the world [Regnum Veg. vol. 120]. New York: New York Botanical Garden.

Knudsen H. and Vesterholt J. 2012. *Funga Nordica.* Vol. 2, agaricoid, boletoid, clavarioid, cyphelloid and gastroid genera, Nordsvamp, Denmark.

Kornerup A. and Wanscher JH. 1978. Methuen Handbook of Colour. 3rd ed. London, UK: Eyre Methuen Ltd. Reprint.