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RESEARCH ARTICLE

Diversity of family Meruliaceae from Jammu Division (J&K), India

Jyoti*, Avneet Pal Singh & Gurpaul Singh Dhingra
Department of Botany, Punjabi University, Patiala, 147002 India

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Corresponding Author

Jyoti Sharma

Abstract

An account of eight resupinate, non-poroid taxa (Crustoderma corneum, Gyrophanopsis polonensis, Hyphoderma argillaceum, H. hjortstamii, H. setigerum, H. setigerum var. bicystidium, Hypochnicium wakefieldiae, Radulodon indicus) of family Meruliaceae (Class- Agaricomycetes, Phylum- Basidiomycota) has been given. All these are new reports for the Jammu Division in the state of Jammu and Kashmir (J&K). Of these, Hyphoderma hjortstamii is a new record for India, Hypochnicium wakefieldiae new for the North Western Himalaya, Crustoderma corneum, Gyrophanopsis polonensis and H. setigerum var. bicystidium new for J&K.

Introduction

While conducting fungal forays in the different localities of Jammu division in the state of Jammu and Kashmir (India), twelve collections of resupinate, non-poroid Agaricomycetous fungi were made. On the basis of comparison of macroscopic and microscopic features in the published literature (Thind & Rattan 1970, Eriksson & Ryvarden 1975, Rattan 1977, Eriksson & Ryvarden 1976, Eriksson et al. 1981, Wu SH. 1990, Stalpers 1998, Nakasone 2001, Bernicchia & Gorjón 2010), these have been identified as Crustoderma corneum, Gyrophanopsis polonensis, Hyphoderma argillaceum, H. hjortstamii, H. setigerum, H. setigerum var. bicystidium, Hypochnicium wakefieldiae and Radulodon indicus. All these eight taxa are the first reports from the study area. Of these, Radulodon indicus is a published new species, Hyphoderma hjortstamii new record for India, Hypochnicium wakefieldiae new for the North Western Himalaya, Crustoderma corneum, Gyrophanopsis polonensis and H. setigerum var. bicystidium new records for J&K. The material of all the specimens have been deposited at the Herbarium, Botany Department, Punjabi University, Patiala (PUN). The color standards used are as per Methuen's Handbook of colors by Kornerup and Wanscher (1978).

Materials and methods

Collection of samples Present study is based on twelve collections made from different localities of Jammu division (J&K). All the collections have been made in association with gymnospermous hosts. The fruiting bodies of specimens were collected from different localities of J&K, India, during the monsoon months (July-September) of the year 2012. Field notes concerning host, name of locality, etc. were recorded for the collected specimens. Voucher specimens of all the specimens have been deposited at the herbarium of the Department of Botany, Punjabi University, Patiala (PUN).

Macroscopic and microscopic evaluation The specimens were identified on the basis of macroscopic and microscopic characters (Dhingra, 2005). For light microscopy, details of structures such as hyphae and basidiospores were observed by making crush mounts and free-hand sections in water and 3% KOH solution and staining in cotton

blue (1% in lactophenol), Congo red (1% in distilled water), Phloxine (1% in distilled water) and Melzer's reagent. Line diagrams of different structures were made using camera lucida.

Results and discussion

Crustoderma corneum (Bourdot & Galzin) Nakasone, Mycologia 76(1): 45, 1984. – Peniophora gigantea subsp. cornea Bourdot & Galzin, Hyménomyc. de France (Sceaux): 318, 1928. Plates I & II, Figs. 1, 22-25

Basidiocarps resupinate, adnate, effused, up to 700 µm thick in section; hymenial surface tuberculate, orange white to pale orange when fresh, somewhat darkening on drying; margins thinning, paler concolorous, to indeterminate. **Hyphal system** monomitic. Generative hyphae up to 3.6 µm wide, branched, septate, clamped, thin–walled; basal hyphae loosely interwoven, parallel to the substrate; subhymenial hyphae denser, vertical. **Cystidia** 93.0–163.0 × 4.9–6.0 µm, subcylindrical, thin– to thick–walled, with several retraction septa and basal clamp; projecting up to 50 µm out of the hymenium. **Basidia** 50.0–65.0 × 6.4–8.0 µm, narrowly clavate, 4–sterigmate, with basal clamp; sterigmata up to 7.2 µm long. **Basidiospores** 7.0–11.6 × 3.6–6.0 µm, ellipsoid to broadly ellipsoid, apiculate, thin–walled, smooth, inamyloid, acyanophilous.

Collections examined– India, J&K, Ramban, about 2 km from Patnitop towards Batote, on stump of Cedrus deodara, October 10, 2011, Jyoti, 5129 (PUN); Karlah, Nag Mandir Road, on stump of C. deodara, October 10, 2011, Jyoti, 5130 (PUN); about 15 km from Patnitop towards Sanasar, on stump of C. deodara, September 10, 2012, Jyoti, 5131 (PUN).

Remarks: This species has earlier been described from India by Priyanka (2012) on the basis of a collection made from district Solan (Himachal Pradesh) and later listed by Dhingra et al. (2014) from the same area. However, it is a new record for J&K.

Gyrophanopsis polonensis (Bres.) Stalpers & P.K. Buchanan, N. Z. Jl. Bot. 29(3): 333, 1991. – Kneiffia polonensis Bres., Annls mycol. 1(2): 103, 1903. Plate I & III, Figs. 2, 26-29

Basidiocarps resupinate, adnate, effused, up to 260 µm thick in section; hymenial surface hypochnoid to almost smooth, grayish white when fresh becoming yellowish white to pale yellow on drying; margins thinning, paler concolorous, to indeterminate. **Hyphal system** monomitic. Generative hyphae septate, clamped; basal hyphae up to 6.8 µm wide, less branched, loosely interwoven, parallel to the substrate, thick–walled; subhymenial hyphae up to 5.9 µm wide, more branched, denser, vertical, thin–walled. **Cystidia** 180.0–225.0 × 4.6–7.5 µm, hyphoid, septate, clamped, thick–walled, covered with thin crust of crystals that dissolve in 3% KOH solution; projecting up to 80 µm out of the hymenium. **Basidia** 17.0–30.0 × 5.2–7.5 µm, subclavate to clavate, 4–sterigmate, with oily contents, with basal clamp; sterigmata up to 5.2 µm long. **Basidiospores** 6.5–9.0 × 3.9–5.5 µm, ellipsoid to broadly ellipsoid, apiculate, thick–walled, smooth, cyanophilous, inamyloid.

Collections examined– India, J&K, Ramban, Nathatop, Ladhadhar, on burnt gymnospermous stump, October 11, 2011, Jyoti, 5132, 5133 (PUN).

Remarks: This species has earlier been described from India by Thind and Rattan (1970) from districts Chamba and Shimla (H.P.), followed by Rattan (1977) from districts Kullu (H.P.) and Gobind Dham (Uttarakhand) as Hyphoderma polonense. Later, it has also been reported by Dhingra (1997) from Meghalaya and W. Bengal (Eastern Himalaya), by Priyanka (2012) from H.P. (North Western Himalaya) and listed by Dhingra et al. (2011) from the Eastern Himalaya as Hypochnicium polonense. Dhingra et al. (2014) listed it as Gyrophanopsis polonensis from H.P. However, it is the first report of this species from J&K.

Hyphoderma_argillaceum (Bres.) Donk, Fungus, Wageningen 27: 14, 1957. – Corticium argillaceum Bres. Fung. trident. 2(11-13): 63, 1898. Plate I & III, Figs. 3, 35-38

Basidiocarps resupinate, adnate, effused, up to 200 µm thick in section; hymenial surface smooth to grandinioid under lens, whitish when fresh not changing much on drying; margins thinning, paler concolorous, to indeterminate.

Hyphal system monomitic. Generative hyphae septate, clamped; basal hyphae up to 5.9 µm wide, sparsely branched, parallel to the substrate, thick–walled; subhymenial hyphae up to 4.6 µm wide, richly branched, vertical, thin–walled. **Cystidia** 87.0–110.0 × 7.5–8.5 µm, tubular, basally widened, clamped, thin–walled, smooth; projecting up to 50 µm out of the hymenium. **Basidia** 23.0–34.0 × 5.2–6.5 µm, clavate, 4–sterigmate, with basal clamp; sterigmata up to 4.2 µm long. **Basidiospores** 8.0–10.5 × 3.9–5.0 µm, ellipsoid to subcylindrical, apiculate, thin–walled, smooth, with oily contents, inamyloid, acyanophilous.

Collection examined– India, J&K, Kathua, Billawar, about 8 km from Sukrala towards Masheedi, on the bark of Pinus roxburghii, September 8, 2013, Jyoti, 6594 (PUN).

Remarks: This species has earlier been reported from India by Thind and Rattan (1970) from districts Kullu, Chamba (H.P.) and Pehalgam (J&K). Later, Dhingra (1989) reported it from the Eastern Himalaya. Dhingra et al. (2014) listed it from districts Kangra, Solan, Shimla (H.P.). However, it is the first report from J&K.

Hyphoderma hjortstamii Sheng H. Wu, Acta bot. fenn. 142: 65, 1990.

Plate I & II, Figs. 4, 14-17

Basidiocarp resupinate, adnate, effused, membranaceous, up to 250 µm thick in section; hymenial surface smooth to rough to tuberculate, grayish yellow to grayish orange when fresh, cracked on drying without much change in the color; margins thinning, pruinose, paler concolorous, to indeterminate. **Hyphal system** monomitic. Generative hyphae up to 3.4 µm wide, branched, septate, clamped, thin–walled; basal hyphae loosely interwoven, less branched, parallel to the substrate; subhymenial hyphae denser, much branched, vertical; crystalline matter common in the subiculum and adjacent subhymenium. **Cystidia** 47.0–68.0 × 6.8–8.0 µm, cylindrical to subfusiform, somewhat capitate, with basal clamp, thin– to somewhat thick–walled, with or without yellowish brown apical resinous matter; projecting up to 20 µm out of the hymenium. **Basidia** 23.0–39.0 × 6.5–7.0 µm, clavate, 4–sterigmate, with basal clamp, filled with oily contents; sterigmata up to 5.2 µm long. **Basidiospores** 9.0–12.6 × 3.9–4.6 µm, suballantoid to allantoid, apiculate, thin–walled, smooth, with oily contents, inamyloid, acyanophilous.

Collection examined– India, J&K, Ramban, Sanasar, on the under surface of log of Pinus wallichiana, September 11, 2012, Jyoti, 5134 (PUN).

Remarks: Earlier, it has been reported on a branch of Atrocarpus sp. and an angiospermous twig from Taiwan (Sheng H. Wu, 1990). However, presently it has been collected in association with a log of Pinus wallichiana and is a new record for India.

Hyphoderma setigerum (Fr.) Donk, Fungus, Wageningen 27: 15, 1957.– Thelephora setigera Fr., Elench. fung. (Greifswald) 1: 208, 1828. Plate I & III, Figs. 5, 39-42

Basidiocarps resupinate, adnate, effused, up to 250 µm thick in section; hymenial surface smooth to grandinioid under lens, yellowish white when fresh becoming orange white on drying; margins thinning, paler concolorous, to indeterminate. **Hyphal system** monomitic. Generative hyphae branched, septate, clamped; basal hyphae up to 6.0 µm wide, sparsely branched, parallel to the substrate, thick–walled; subhymenial hyphae up to 4.6 µm wide, richly branched, vertical, thin–walled. **Cystidia** 87.0–110.0 × 7.4–8.6 µm, hyphoid, septate, clamped, thick–walled, encrusted with crystalline matter; projecting up to 50 µm out of the hymenium. **Basidia** 23.0–34.0 × 5.2–6.6 µm, clavate, 4–sterigmate, with basal clamp; sterigmata up to 4.2 µm long. **Basidiospores** 8.0–10.6 × 3.8–5.0 µm, ellipsoid to subcylindrical, apiculate, thin–walled, smooth, with oily contents, inamyloid, acyanophilous.

Collections examined– India, J&K, Ramban, Batote, on the under surface of log of P. roxburghii, October 10, 2011, Jyoti, 5135 (PUN); about 8 km from Patnitop towards Batote, on the under surface of log of P. roxburghii, October 10, 2011, Jyoti, 5136 (PUN).

Remarks: This species has earlier been reported from India by Thind and Rattan (1970) from district Anantnag (J&K); Rattan (1977) from district Shimla (H.P.). Later, Dhingra et al. (2014) listed it from districts Chamba,

Kangra, Kullu, Kinnaur, Solan, Shimla and Sirmaur. However, it is the first report of this species from Jammu division (J&K).

Hyphoderma setigerum var. bicystidium Dhingra & Nishi Singla, J. Indian Bot. soc. 72: 31, 1993. Plate I & III, Figs. 6, 30-34

Basidiocarp resupinate, adnate, effused, up to 250 µm thick in section; hymenial surface smooth to tuberculate, creamish white when fresh, cracking and becoming orange white to orange gray on drying; margins thinning, paler concolorous, to indeterminate. **Hyphal system** monomitic. Generative hyphae up to 4.0 µm wide, branched, septate, clamped, thin–walled; basal hyphae loosely interwoven, less branched, parallel to the substrate; subhymenial hyphae denser, much branched, vertical. **Sterile structures of 2 types: I. Cystidia** 92.0–100.0 × 6.2–8.0 µm, hyphoid, septate, clamped, thick–walled, encrusted with crystalline matter; projecting up to 60 µm out of the hymenium. **II. Leptocystidia** 57.0–77.0 × 5.8–6.6 µm, tubular to subcylindrical, thin–walled, smooth, with basal clamp. **Basidia** 18.0–28.0 × 4.6–5.6 µm, clavate, 4–sterigmate, with basal clamp; sterigmata up to 4.6 µm long. **Basidiospores** 7.0–10.6 × 3.8–5.0 µm, ellipsoid to subcylindrical, apiculate, thin–walled, smooth, with oily contents, inamyloid, acyanophilous.

Collection examined– J&K: Ramban, Batote, on the under surface of log of P. roxburghii, October 10, 2011, Jyoti, 5137 (PUN).

Remarks: This new variety has been described by Dhingra and Singla (1993) on the basis of presence of two types of sterile structures from district Chamba (H.P.). Dhingra et al. (2014) rereported it from districts Kangra, Kinnaur, Solan and Shimla (H.P.). However, it is the first report of this variety from J&K.

Hypochnicium wakefieldiae (Bres.) J. Erikss., Symbolae Botanicae Upsalienses 16 (1): 101, 1958. – Hypochnicium caucasicum Parmasto, Eesti NSV Tead Akad. Toim., Biol. Seer 16(4): 385, 1967. Plate I & II, Figs 7, 18-21

Basidiocarp resupinate, adnate, effused, up to 350 µm thick in section; hymenial surface smooth to tuberculate, orange white to pale orange when fresh, becoming pale orange to grayish orange on drying; margins thinning, paler concolorous, to indeterminate. **Hyphal system** monomitic. Generative hyphae branched, septate, clamped; basal hyphae up to 6.6 µm wide, loosely interwoven, parallel to the substrate, thick–walled; subhymenial hyphae up to 5.2 µm wide, denser, vertical, thin–walled. **Cystidia** 94.0–133.0 × 9.0–10.0 µm, subcylindrical, somewhat sinuous, thin–walled, covered with thin crust of crystals at the apex that dissolves in 3% KOH solution; projecting up to 50 µm out of the hymenium. **Basidia** 32.0–51.0 × 5.9–7.6 µm, subclavate to clavate, somewhat sinuous, 4–sterigmate, with basal clamp; sterigmata up to 6.2 µm long. **Basidiospores** 6.0–9.0 × 4.6–6.0 µm, broadly ellipsoid to subglobose, apiculate, thick–walled, verrucose to echinulate, cyanophilous, inamyloid, uniguttulate.

Collection examined– India, J&K, Ramban, Patnitop, on stump of C. deodara, September 10, 2012, Jyoti, 5139 (PUN).

Remarks: This species has earlier been reported from India by Dhingra (1997) from Meghalaya in the Eastern Himalaya as Hypochnicium caucasicum and later listed by Dhingra et al. (2014) from the North Western Himalaya. However, it is being described as a new record for J&K as well as for the North Western Himalaya.

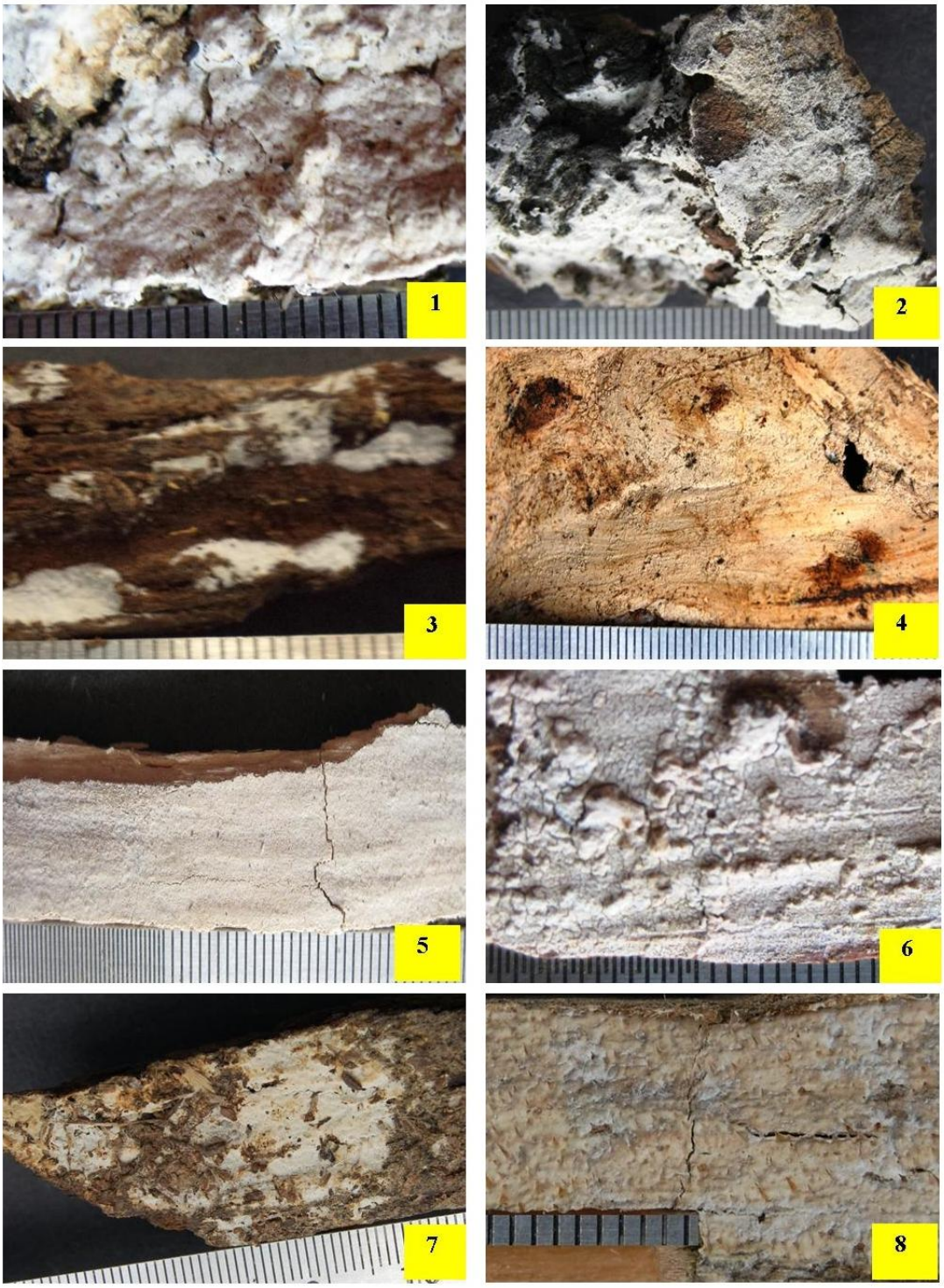
Radulodon indicus Jyoti & G.S. Dhingra, Syn. Fungorum 32: 38-40, 2014.

Plate I & II, Figs. 8, 9-13

Collection examined– India, J&K, Ramban, Nathatop, on the log of C. deodara, September 11, 2012, Jyoti, 5987 (PUN).

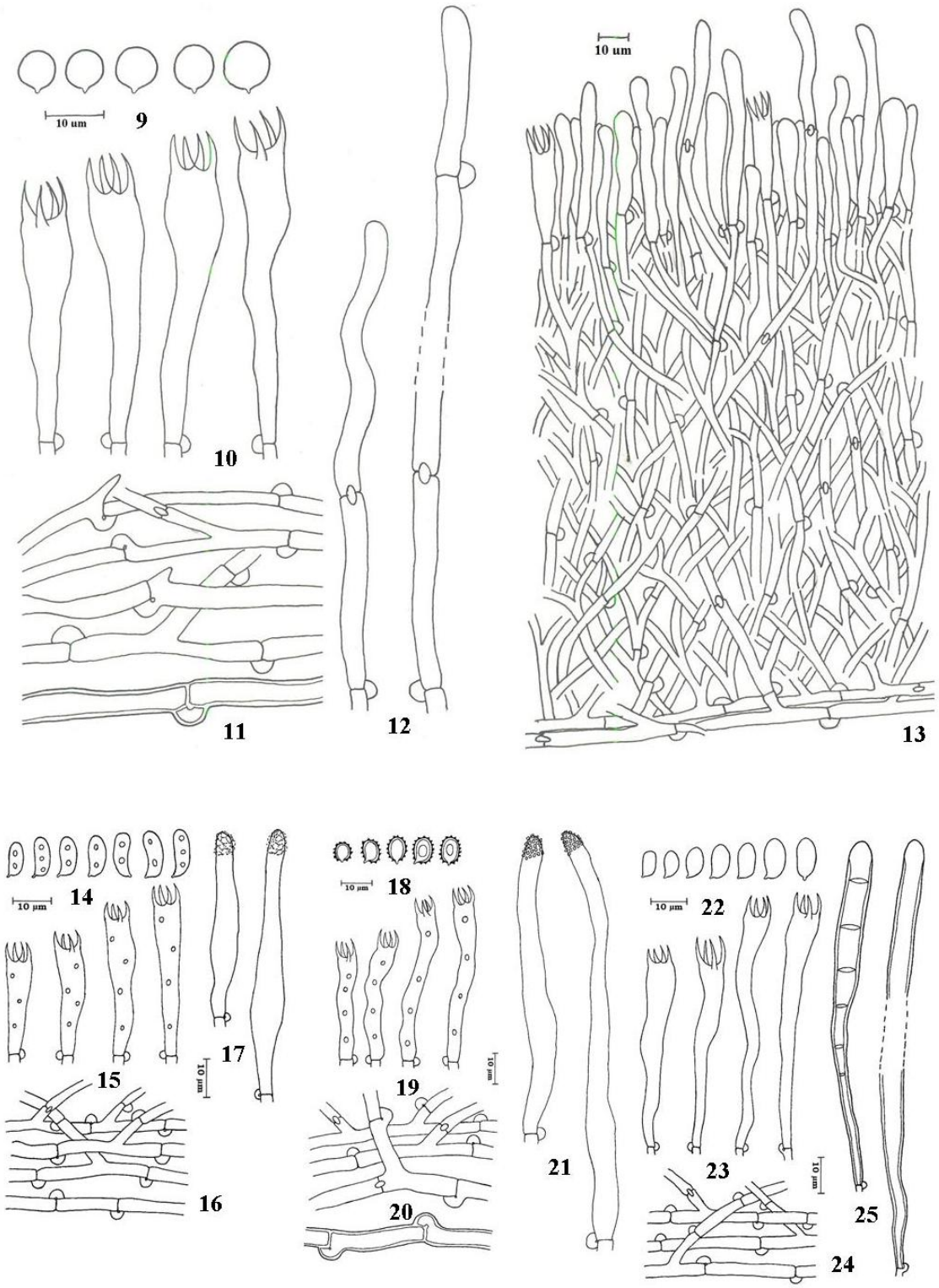
Remarks: The new species described by the authors earlier, differs from R. pseudomucidus (Petch) Stalpers (reported from Srilanka) in having scattered, conical spines, longer basidia and temperate origin.

Plate- I



FIGS 1-8: Basidiocarps: *Crustoderma corneum*, *Gyrophanopsis polonensis*, *Hyphoderma argillaceum*, *Hyphoderma hjortstamii*, *Hyphoderma setigerum*, *Hyphoderma setigerum* var. *bicystidium*, *Hypochnicium wakefieldiae* and *Radulodon indicus*.

Plate- II



Figs. 9-13: Radulodon indicus 9. Basidiospores. 10. Basidia. 11. Generative hyphae. 12. Cystidia. 13. Vertical section through basidiocarp.; **Figs.14-17: Hyphoderma hjortstamii** 14. Basidiospores. 15. Basidia. 16. Generative hyphae. 17. Cystidia.; **Figs. 18-21: Hypochnicium wakefieldiae** 18. Basidiospores. 19. Basidia. 20. Generative

hyphae. 21. Cystidia.; **Figs. 22-25: Crustoderma corneum** 22. Basidiospores. 23. Basidia. 24. Generative hyphae. 25. Cystidia.

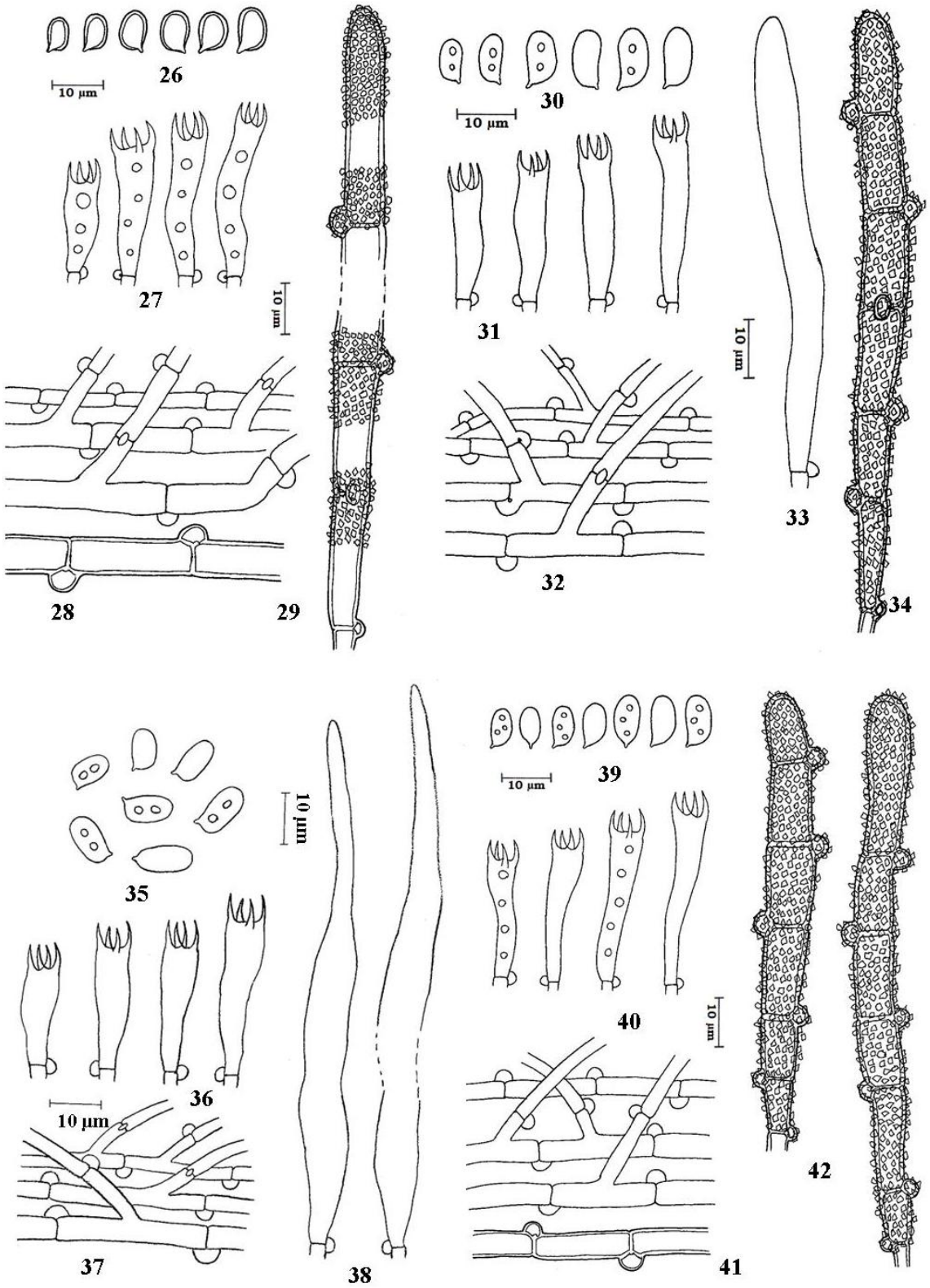


Plate- III

Figs. 26-29: Gyrophanopsis polonensis 26. Basidiospores. 27. Basidia. 28. Generative hyphae. 29. Cystidium. **Figs. 30-34: Hyphoderma setigerum var. bicystidium** 30. Basidiospores. 31. Basidia. 32. Generative hyphae. 33. Leptocystidium. 34. Cystidium; **Figs. 35-38: Hyphoderma argillaceum** 35. Basidiospores. 36. Basidia. 37. Generative hyphae. 38. Cystidia.; **Figs. 39-42: Hyphoderma setigerum** 39. Basidiospores. 40. Basidia. 41. Generative hyphae. 42. Cystidia.

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