

POLYPOROID FUNGI OF DISTRICT MANDI (HIMACHAL PRADESH).

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The hitherto unexplored Mandi district (H.P.) has been surveyed and thirteen species of Polyporoid fungi belonging to five families (Hymenochaetaceae, Phanerochaetaceae, Polyporaceae, Schizophyllaceae, Steccherinaceae) and ten genera (*Phellinus*, *Phanerochaete*, *Daedalea*, *Gloeophyllum*, *Lenzites*, *Hexagonia*, *Trametes*, *Poria*, *Schizophyllum*, *Irpex*) are being recorded and described.

Key Words : Polyporoid Fungi, Systematics, Mandi, Himachal Pradesh.

The Western Himalaya and particularly the state of Himachal Pradesh have been floristically explored for Polyporoid fungi by different workers like Fries 1855, Thind 1964, Thind *et al.* (1965, 1966, 1967), Thind and Rattan (1967, 1972), Thind and Sharma (1985, 1986), Sharma and Thind (1990), Prasher *et al.* (2003, 2006, 2007), Dargan and Singh (2008) and Mani and Kumarsan (2009). A review of this literature reveals that in spite of massive exploration carried out in this area some districts of Himachal Pradesh like Mandi have not been floristically analysed for Polyporoid fungi. The district of Mandi and its adjoining areas have therefore been explored for Polyporoid fungi.

STUDY AREA

The historic town of Mandi (Fig.1) (800m is situated along the banks of river) Beas. Latitude of Mandi is 31°43'N and longitude is 76°58'E. Mandi is known as the 'Kashi of the Hills'. The mean annual rainfall is 1380 mm, temperature varies from -3 to 24°C. Forest types include Sub-tropical Pine, Ban Oak, Moru Oak, Deodar, Western mixed Coniferous, Temperate Deciduous, Kharsu Oak and Sub High altitude forests.

MATERIALS AND METHODOLOGY

Specimens were collected from five localities, Bajahi, Dhanotu, Hra-Baag, Nerchowk and Sinihardi. The field data such as texture, size, colour, macroscopic features along with trophic level and form have been noted in the field. The collected specimens were placed in polyethylene bags of suitable size, along with the required data *viz.* collection number, details of locality, host/substrate, date of collection and name of collector. The species have been described in detail using recent techniques. Attempts have been made to identify collection by comparing with authenticated identified specimens deposited in PAN (Herbarium, Botany Department, Panjab University, Chandigarh.)

The various mountants/stains used for the taxonomical investigation of fungi are: Amann's Lactophenol: (used for mounting of microscopic structures) Phenol-20 g, Lactic acid-20 g, Glycerol-40 g, distilled water 20 ml; 5% Potassium hydroxide: (used for microchemical tests and softening of the study materials) Potassium hydroxide 5 g, distilled water 100 ml; Melzer's Iodine: (used to check amyloidity of the sporulating structures)



Fig. Map of district of Mandi.

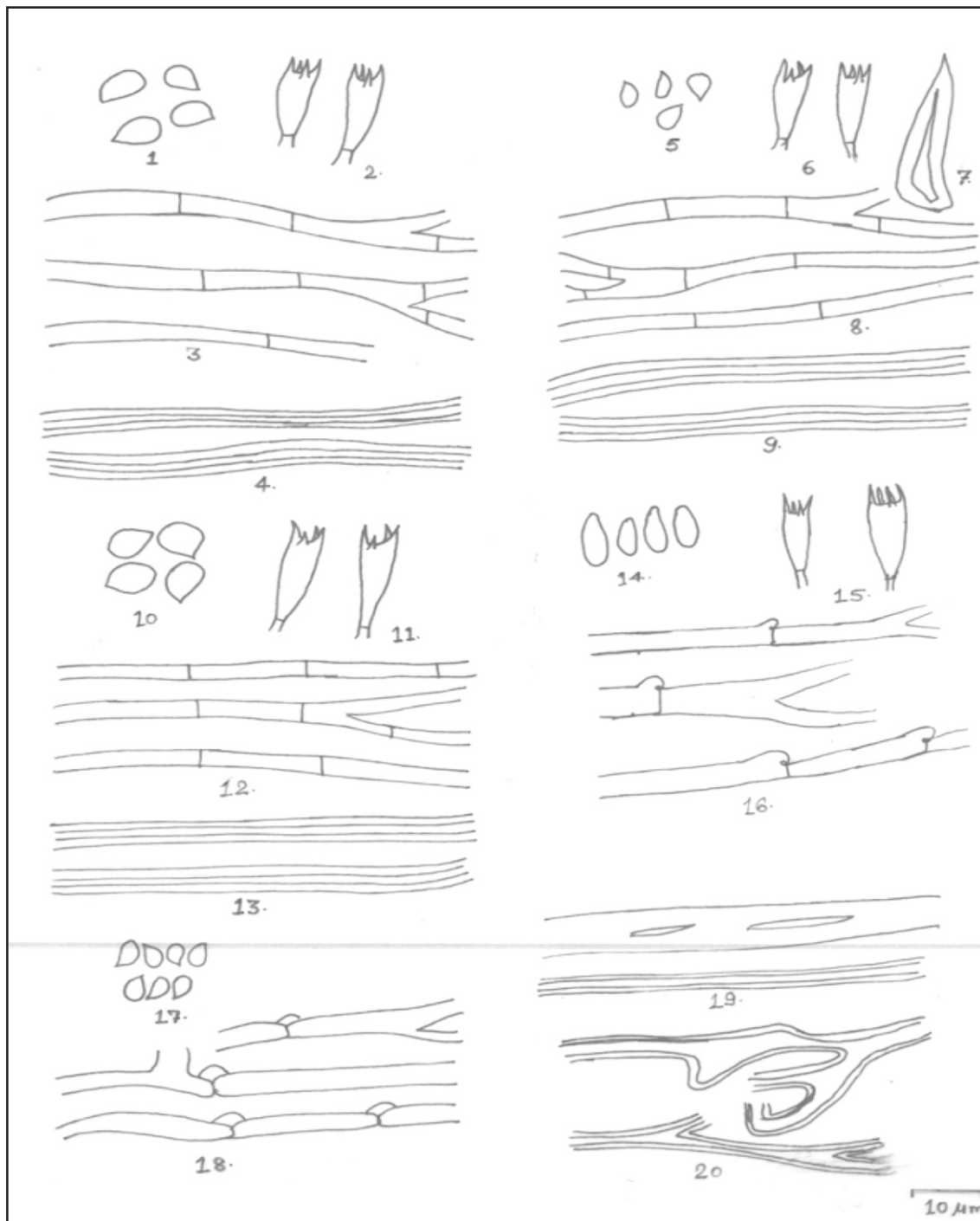
Chloral hydrate- 22g, Iodine -0.5 g, KI- 1.5 g, distilled waters-20 ml; 1% Phloxine: (used to stain and observe septation in spores and mycelium) Phloxin 1 g, distilled water 100 ml, Cotton blue: (used to stain the cytoplasm of the fungal cells and also to observe cyanophilly of the microscopic structures) Cotton blue-0.01 g, Lactic acid 100 ml; and Congo red: (used to determine the clamp connection and type of hyphal system) Congo red 0.2 g, Liquid Ammonia 100 ml,

for anatomical characters. All the specimens have been deposited in the herbarium of Botany Department (PAN), Panjab University, Chandigarh, India. After critical evaluation, 13 species are being identified and recorded as new reports from the study area.

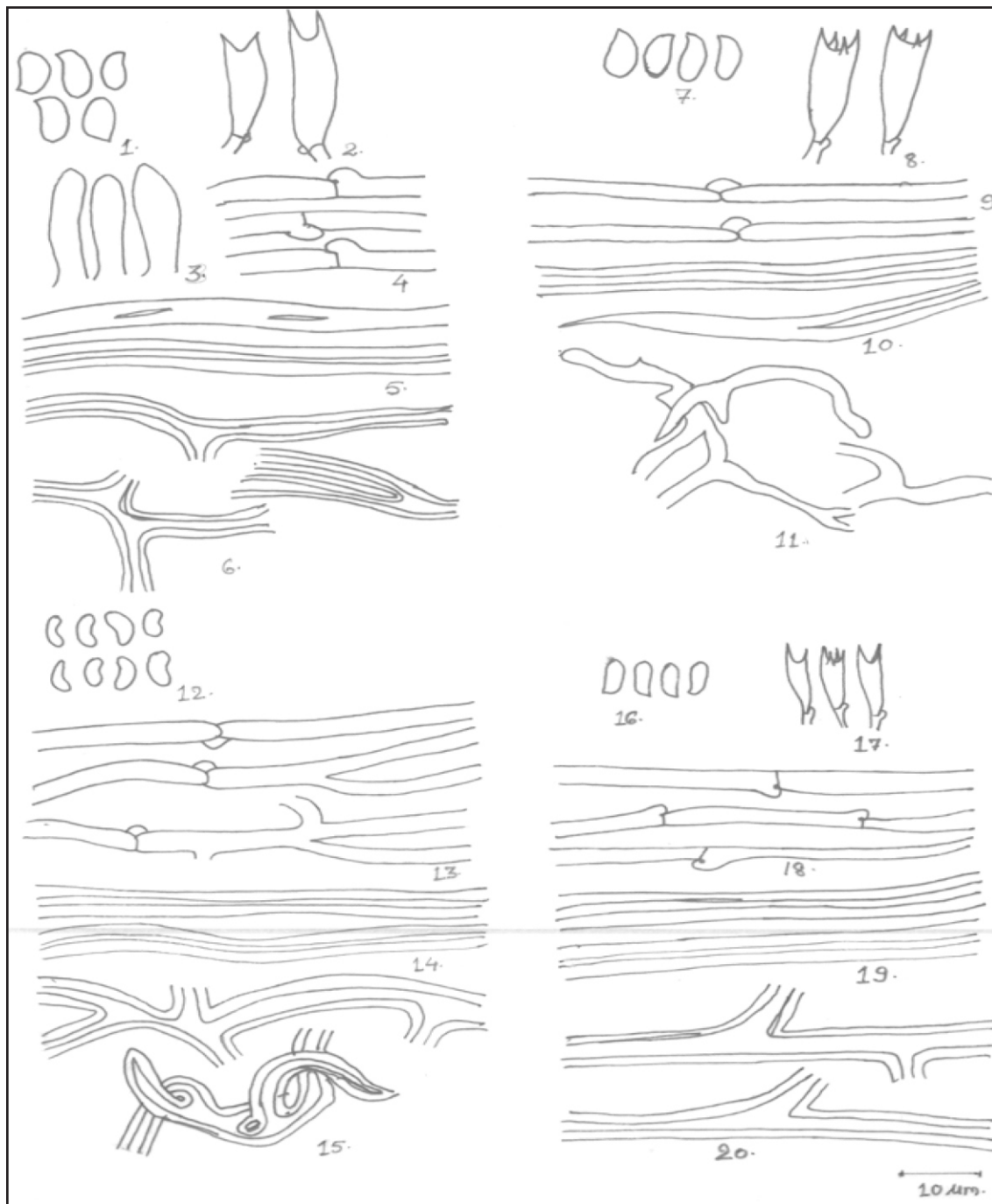
TAXONOMY

Family- Hymenochaetaceae

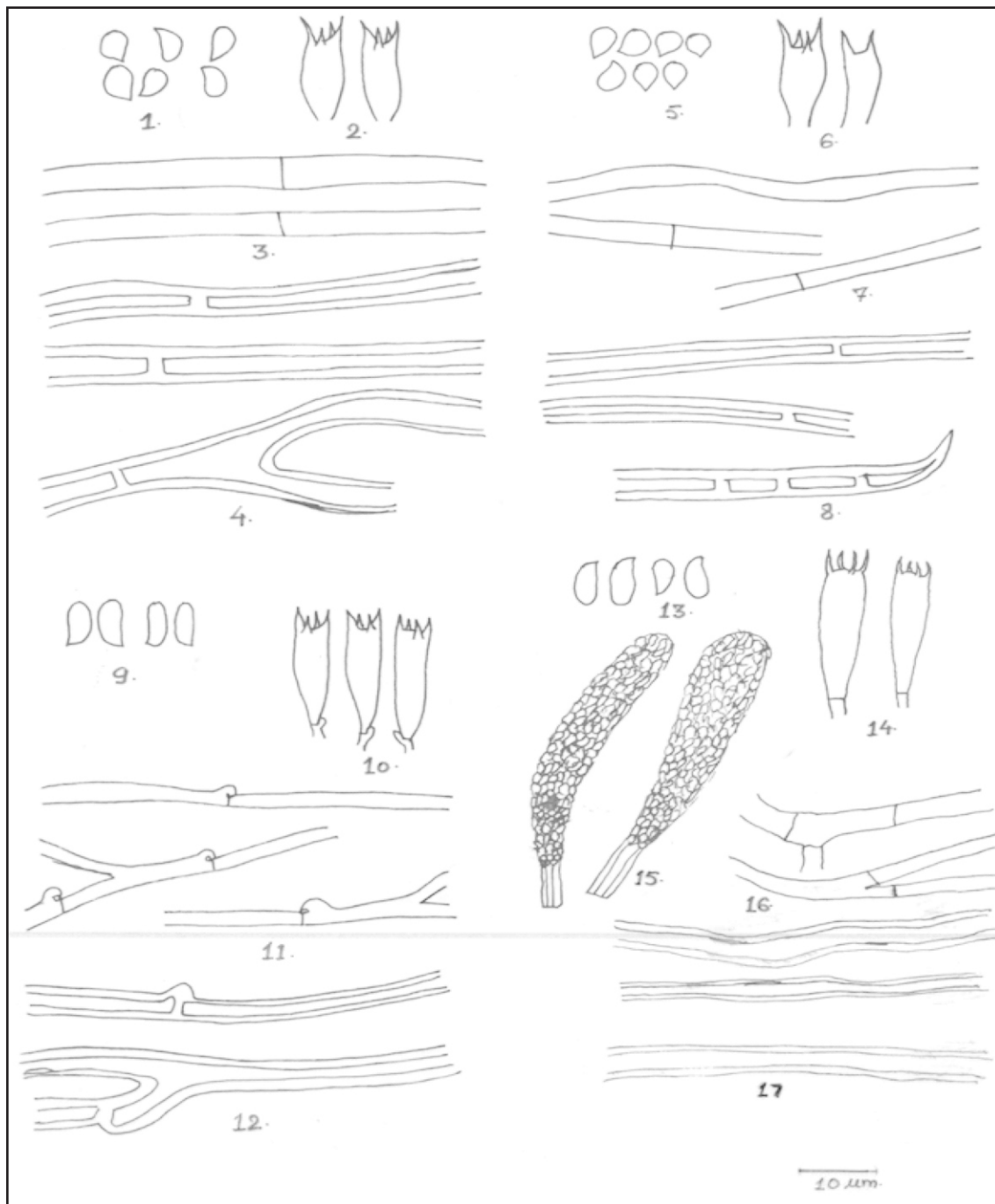
Phellinus caryophyllii (Rac.) Ryv., *A Pre.*

**Mandi****Plate 1** (Figures 1-20):

Phellinus caryophyllii (Rac.) Ryv. (1) Basidiospores (2) Basidia (3) Generative hyphae (4) Skeletal hyphae; *Phellinus gilvus* (Schw.) Pat. (5) Basidiospores (6) Basidia (7) cystidia (8) Generative hyphae (9) Skeletal hyphae; *Phellinus igniarius* (L.) Quél. Quél. (10) Basidiospores (11) Basidia (12) Generative hyphae (13) Skeletal hyphae; *Phaenerocheate flavidoalba* (Cooke) Rattan. (14) Basidiospore (15) Basidia (16) Generative Hyphae; *Daedalea flavida* Lev. (17) Basidiospores (18) Generative hyphae (19) Skeletal hyphae (20) Binding hyphae;

**Plate 2 (Figures.1-20):**

Gloeophyllum sepiarium (Wulf.ex Fr.) P. Karst.(1) Basidiospores (2) Basidia (3) Cystidia (4) Generative hyphae with clamps (5)Skeletal hyphae (6)Binding hyphae; *Hexagonia tenuis* Hook. (7) Basidiospores (8) Basidia (9) Generative hyphae (10) Skeletal hyphae (11) Binding hyphae; *Lenzites eximia* Berk. & Curt. (12) Basidiospore (13) Generative hyphae (14) Skeletal hyphae (15) Binding hyphae ; *Trametes versicolor* (L.) Lloyd Atl. Champ.(16)Basidiospores (17)Basidia (18) Generative hyphae with clamps (19) Skeletal hyphae (20) Binding hyphae.

**Plate 3 (Figures. 1-17):**

Poria auricoma (Lev.) Cooke. (1) Basidiospores (2) Basidia (3) Thin-walled generative hyphae without clamps (4) Thick-walled branched generative hyphae; *Poria melleopora* (Murr.) Sacc. (5) Basidiospores (6) Basidia (7) Thin-walled generative hyphae without clamps (8) Thick-walled generative hyphae; *Schizophyllum commune* Fr. (9) Basidiospore (10) Basidia (11) Thin-walled generative hyphae with clamps (12) Thick-walled generative hyphae with clamps; *Irpex lacteus* (Fr.) Fr. Elench. (13) Basidiospores (14) Basidia (15) Cystidia (16) Generative hyphae (17) Skeletal hyphae

Polp. Fl. East Afr.: 149 (1980).

Sporophore perennial, sessile effused-reflexed, solitary, hard, woody, dimidiate 6.3 × 4.4 cm; upper surface dark-brown, sulcate with ridges; margin brown, obtuse; context brown, fibrous; hymenial surface brown, pores small; hyphal system dimitic; generative hyphae hyaline, branched, septate, clamps absent, 2.4-3.7 µm in diameter; skeletal hyphae brown, thick-walled, unbranched, aseptate with narrow lumen up to 2.9-4.1 µm in diameter; setae absent; basidia clavate, 14.0-15.0 × 4.9-5.0 µm; basidiospores light brown, smooth, ellipsoid 5.2-7.0 × 4.0-4.5 µm. (Plate 1, figs. 1-4).

Collection examined: H.P.: Mandi, Bajahi, on fallen gymnospermous log [Lalita (22065) July 6, 2009].

***Phellinus gilvus* (Schw.) Pat., *Essai Tax.* : 97 (1900)**

Sporophore annual, sessile, imbricate, coriaceous when fresh, hard on drying, 3 × 2 cm; upper surface dark-brown, azonate; margin, thick, entire; context light brown, fibrous; hymenial surface brown, pores small, rounded, pore tubes in one layer; hyphal system dimitic; generative hyphae hyaline, branched, septate, 2.0-3.1 µm in diameter; skeletal hyphae brown, thick-walled with narrow lumen, unbranched, aseptate 3.5 -4.4 µm in diameter, setae abundant, thick-walled, subventricose, apices acute projecting beyond the hymenium 27.0 × 5.0 µm; basidiospores brown, smooth, ellipsoid, 4.5-5.0 × 2.0-3.0 µm. (Plate 1, figs. 5-9).

Collection examined: H.P.: Mandi, Dhanootu, on fallen log, [Lalita (22066) October 23, 2009].

***Phellinus igniarius* (L.) Quél., *Quél. Ench. Fung.* : 172 (1886)**

Sporophore perennial, sessile, effused-reflexed to conchate, hard and woody 10 × 8.3 cm; upper surface brown, older portion dark brown, concentrically sulcate; margin obtuse, entire, concolorous on upper surface; context brown

azonate, homogenous; hymenial surface reddish-brown, pores rounded; hyphal system dimitic; generative hyphae hyaline, thin-walled septate, clamps absent, branched, acyanophilous 1.5-3 µm in diameter; skeletal hyphae yellowish-brown, aseptate, thick-walled, unbranched, acyanophilous 3.5 -4.5 µm in diameter; setae absent; basidia hyaline, clavate up to 16.5-17.5 × 4.0-4.9 µm in diameter; basidiospores hyaline, thin-walled, smooth, sub globose, brown, 7.0-7.4 × 4.3-4.9 µm. (Plate 1, Figs. 10-13).

Collection examined: H.P.: Mandi, Bajahi, on fallen log, [Deepali (22067) August 19, 2009].

Family- Phaenerochetaceae

***Phaenerocheate flavidoalba* (Cooke) Rattan, *Bibliotheca Mycol.* 60:262 (1977).**

Fructification annual, lignicolous, resupinate, effused, appressed, adnate, membranous, hymenial surface smooth, greyish-orange, irregularly cracked; margin thick; hyphal system monomitic; generative hyphae hyaline, thin-walled, highly branched, septate, clamped, 3.2- 4.5 µm in diameter; cystidia conical to subcylindrical, thick-walled, encrusted, immersed to projecting; basidia clavate to sub clavate, hyaline, 4-sterigmate, 13-15 × 3.5-5.0 µm; basidiospores ellipsoid, hyaline, thin-walled, smooth, non-amyloid, acynophilous, 5.5-8.5 × 3-5 µm. (Plate 1, Figs. 14-16).

Collection examined: H.P.: Mandi, Dhanootu, on fallen gymnospermous log, [Lalita (22068) October, 23, 2009].

Family- Polyporaceae

***Daedalea flava* Lev., *Ann Sci. Nat., Ser. 3*, 2 : 198 (1844).**

Fructification annual to perennial, sessile, attached by broad lateral base, solitary to imbricate, hard and rigid when dry; pileus sessile, applanate, slightly convex, dimidiate; upper surface white to creamish, on drying becomes deep creamish, somewhat greyish or reddish at places, soft tomentose,

concentrically zonate; margin concolorous, sub obtuse, entire, not reflexed on drying, sterile below; pore surface creamish to light creamish-brown, even to uneven, dull; pores irregular, somewhat elongated near the margin, later mostly labyrinth form, large; context white, chalky, smooth, homogeneous, inconspicuously closely zonate, non-xanthochroic; tubes indistinctly stratified; hyphal system trimitic; generative hyphae hyaline, thin-walled, septate, clamped, branched, contents staining in cotton blue, 2-3.5 μm in diameter; skeletal hyphae subhyaline, thick-walled to almost solid, aseptate, sparsely branched, acyanophilous, 3.0-7.0 μm in diameter; binding hyphae hyaline, thick-walled, much branched, aseptate, 2.0-4.0 μm diameter; Cystidia absent; basidiospores hyaline, thin-walled, smooth, non-amyloid, cylindric-ellipsoid, 3.5-4.2 X 2.4-3.0 μm . (Plate 1, Figs. 17-20).

Collection examined: H.P.: Mandi, Siniardi, on fallen gymnospermous log, [Deepali (22069) October 8, 2009].

***Gloeophyllum sepiarium* (Wulf.ex Fr.) P. Karst.,** Finl.Hattsv. 2 : 80 (1879). Fructification annual, sessile, solitary to imbricate, coriaceous when fresh, becoming firm and rigid on drying ; pileus sessile, dimidiate, sometimes flabelliform, applanate, 2-7 X 2-10 X 0.5-1.2 cm ; upper surface sepia coloured to snuff-brown, sometimes brownish-yellow and tomentose near margin, indistinct zonate ; margin acute, concolorous, entire, not reflexed on drying ; pore surface lamellate, brown to dark-brown ; lamellae brown or brownish-grey, straight or wavy, unbranched to branched ; context brownish-yellow to brown, homogenous, occasionally zonate, soft and smooth in section ; hyphal system trimitic ; generative hyphae hyaline, thin-walled, septate, clamped, branched, acyanophilous, 2.5-3.6 μm in diameter; skeletal hyphae pale brown, thick-walled, aseptate, long,

unbranched, 3.0- 4.5 μm in diameter; binding hyphae scanty, subhyaline to very pale brown, thick-walled, branched, acyanophilous, 2.4-4 μm in diameter; cystidioles not very frequent, hyaline, thin-walled, more or less fusiform, either tapering at apex, with or without capitate incrustation; basidia hyaline, thin-walled, clavate, 2-4 spored, 16.9-23.2x4.5-5.1 μm ; basidiospores hyaline, thin-walled, smooth, cylindric-ellipsoid, slightly curved, non-amyloid, 6-8X 3.2-4.0 μm . (Plate 2, Figs. 1-6).

Collection examined: H.P.: Mandi, Siniardi, on fallen angiospermous log, [Lalita (22070) October 8, 2009].

***Hexagonia tenuis* Hook.,** Epicr. Syst. Mycol. 498: (1838).

Sporophore annual, solitary, sessile, effused-reflexed, applanate coriaceous, 5.5 \times 3.7 cm; upper surface of pileus glabrous, smooth, light brown; margin thin, acute, undulate; context brown; hymenial surface light brown, pores present, hexagonal; hyphal system trimitic; generative hyphae hyaline, thin-walled, branched, clamped, 2.0-2.7 μm in diameter; skeletal hyphae brown, thick-walled, 4.0-5.0 μm ; binding hyphae, thick-walled, branched, aseptate up to 1.5-3.2 μm in diameter; basidia clavate, 19.5-20.0 \times 5.0-6.0 μm ; basidiospore hyaline, cylindric 7.0-8.5 \times 2.7-4.0 μm . (Plate 2, figs. 7-11).

Collection examined: H.P.: Mandi, Bajahi, on fallen log, [Lalita (22071) August 19, 2009].

***Lenzites eximia* Berk. & Curt.,** Hooker J. Bot. 6 : 134 (1854).

Fructification annual , sessile , mostly imbricate , attached by broad lateral base, coriaceous when fresh, on drying becomes hard ; pileus sessile, dimidiate, applanate; upper surface creamish- brown to light-brown to brown, sometimes becomes dark reddish-brown near base, glabrous, concentrically zonate, radially and concentrically striate ; margin acute, concolorous, reflexed on drying, fertile below ; pore surface lamellate, greyish-

brown, lamellae creamish to greyish-brown, straight to wavy, mostly entire, apices dentate, creamish-brown in section; context light buff, homogeneous, azonate, slightly darkening in KOH; hyphal system trimitic; generative hyphae hyaline, thin-walled, septate, clamped, branched, acyanophilous, 2.5-3.9 μm in diameter; skeletal hyphae subhyaline, thick-walled to mostly solid, long, aseptate, sparsely branched, acyanophilous, 4.5 μm in diameter; binding hyphae hyaline, thick-walled, aseptate, branched, acyanophilous, few in number, 4.0-6.0 μm in diameter; cystidia absent; basidia not seen; basidiospores hyaline, thick-walled, smooth, cylindric, allantoid, non-amyloid, 4.6-6.0 \times 2.0-2.5 μm . (Plate 2, figs. 12-15).

Collection examine : H.P.: Mandi, Bajahi, on an angiospermous log, [Deepali (22072) October 8, 2009].

***Trametes versicolor* (L.) Lloyd, Atl. Champ. Europ. 3: 261 (1939)**

Sporophore annual, pileate, sessile, imbricate, dimidiate, coriaceous when fresh, hard on drying, 3.7 \times 2.2 cm; upper surface tomentose, concentrically zonate, multicoloured, brown to dark-brown, greyish-blue to dark grey, alternating glabrous zones; margin thin incurved on drying; context white, azonate; hymenial surface cream, pores circular; hyphal system trimitic; generative hyphae hyaline, thin-walled branched, clamped acyanophilous 1.9-3.8 μm in diameter; skeletal hyphae subhyaline thick-walled with narrow lumen, aseptate, branched, acyanophilous, 4.2-6.0 μm in diameter; binding hyphae hyaline thick-walled, branched, acyanophilous 4.1-5.1 μm in diameter; basidia clavate hyaline, 11.1-12.4 \times 2.4-3.0 μm ; basidiospores thin-walled, smooth hyaline cylindrical, slightly curved on one side, 5.2-5.9 \times 2.0-2.4 μm . (Plate 2, Figs. 16-20).

Collection examined: H.P.: Mandi, Nerchowk, on fallen gymnospermous log, [Lalita (22073) October 8, 2009].

***Poria auricoma* (Lev.) Cooke, Grevillea 15:**

26 (1886).

Fructification annual, resupinate, widely effused, forming large patches, 2-10 \times 1.5-6 \times 0.2-0.5 cm, adnate; margin dirty white to creamish, thin, myceloid, sterile; pore surface dirty white to creamish-brown, irregular, uneven; pores angular to irregular; context creamish, homogenous, thin, non xanthochroic: tubes not stratified, mostly obliquely placed on sloping surface, appearing irpiciform, creamish-brown in section; hyphal system monomitic; generative hyphae hyaline, thin to thick-walled, thick, septate, clamps absent, branched, non-amyloid, acyanophilous, contents staining weakly in cotton blue, 4.1-5.0 μm in diameter; Cystidia absent; basidia hyaline, clavate, 4-spored, 14.9-16.5 \times 4.2-5.0 μm in diameter; basidiospores hyaline to subhyaline, thin-walled, smooth, non-amyloid, acyanophilous, ellipsoid with one side somewhat flattened, minutely apiculate, 5.0-5.9 \times 2.1-3.7 μm . (Plate 3, Figs. 1-4).

Collection examined: H.P.: Mandi, Siniardi, on fallen twig, [Lalita (22074) October 8, 2009].

***Poria melleopora* (Murr.) Sacc. & Trott., Sylloge Fung. 21: 330 (1912).**

Fructification annual, resupinate, widely-effused, 6-12 \times 2-4 cm, up to 2 mm thick, adnate, inseparable; margin thinning, golden, myceloid, narrow to wide, sterile; pore surface yellowish-brown, even, brown where bruised; pores rounded to somewhat angular, elongated on sloping surface; context brown, thin, hard, darkening in KOH; hyphal system monomitic; generative hyphae subhyaline, yellowish-brown, thin to thick-walled, wall up to 1.1 μm thick, sparsely branched, septate, clamps absent, thin-walled hyphae cyanophilous, 3.0-3.5 μm in diameter; setae absent; basidia hyaline, thin-walled, clavate, 2-4 spored up to 14.5-16.0-4.1-6.0 μm in diameter; basidiospores subhyaline to pale brown, thin-

walled, smooth, non-amyloid, ellipsoid to subglobose, minutely apiculate, $4.0-5.0 \times 2.9-3.6 \mu\text{m}$. (**Plate 3, Figs. 5-8**).

Collection examined: H.P.: Mandi, Siniardi, on fallen log, [Deepali (22075) October 8, 2009].

Family- Schizophyllaceae

***Schizophyllum commune* Fr. Syst. Myc. 1: 330 (1821)**

Sporophore gregarious, often imbricate, effusedreflexed to laterally stipitate $3.5 \times 2.9 \text{ cm}$; upper surface whitish to grey, tomentose; margin even, wavy, lobed; context thin up to 1mm thick; hymenial surface brown, lamellate, gills, grey, narrow, radiating from the base, splitting and revolute at the edge; hyphal system monomitic; generative hyphae thin to thick-walled; thin-walled hyphae hyaline, branched, septate, clamped, $2.0-3.0 \mu\text{m}$ in diameter; thick-walled hyphae hyaline, branched, septate, clamped, $3.8-4.9 \mu\text{m}$ in diameter; basidia clavate $18.1-19.9 \times 3.9-4.8 \mu\text{m}$; basidiospores, hyaline, smooth, cylindrical $6.2-7.3 \times 2.0-2.9 \mu\text{m}$. (**Plate 3, Figs. 9-12**).

Collection examined: H.P.: Mandi, Nerchowk, on fallen log, [Lalita (22076) August 19, 2009].

Family- Steccherinaceae

***Irpex lacteus* (Fr.) Fr., Elench. Fung. 1: 145 (1828).**

Sporophore annual, effused-reflexed, coriaceous; upper surface cream, tomentose, azonate; margin entire, thin, incurved; context dull white, fibrous up to 1 mm thick; hymenial surface grey, pores angular, 3-4 per mm, pore tube up to 3.5 mm deep; hyphal system dimitic; generative hyphae, thin-walled, septate, branched, $2.0-4.0 \mu\text{m}$ in diameter; skeletal hyphae, hyaline, thick-walled, aseptate, unbranched, up to $2.5-5.8 \mu\text{m}$ in diameter;

cystidia present, encrusted, $5.0-10.0 \mu\text{m}$ wide; basidia clavate $22.0-24.0 \times 4.5-6.0 \mu\text{m}$; basidiospores cylindric-ellipsoid, hyaline, smooth, $5.5-7.0 \times 2.5-3.5 \mu\text{m}$. (**Plate 3, Figs. 13-17**).

Collection examined: H.P.: Mandi, Bajahi, on fallen log, [Lalita (22077) August 19, 2009].

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