DIVERSITY OF POROID MUSHROOMS IN PUNJAB: FAMILY HYMENOCHAETACEAE

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ABSTRACT

The present paper deals with the diversity of poroid members of family Hymenochaetaceae in Punjab. Fourteen species belonging to four genera i.e. Fuscoporia (F. gilva), Inocutis (I. rheades), Inonotus (I. patouillardii) and Phellinus (P. fastuosus, P. badius, P. xeranticus, P. grenadensis, P. rimosus, P. pectinatus, P. melleoporus, P. purpureogilvus, P. rhabarbarinus, P. robustus and P. conchatus) are being described. Ten species are being described for the first time from the study area.

Keywords: Basidiomycota, Agaricomycetes, Punjab

INTRODUCTION

Family Hymenochaetaceae (Agaricomycetes, Hymenochaetales) is characteristic in having resupinate to pileate, smooth to poroid basidiocarps, xanthochroic tissue, hyphae without clamps, presence/absence of setae, two to four sterigmate basidia and thin- to thick-walled basidiospores. Several taxa of the family are reported to be implicated in many diseases of broad-leaved and coniferous trees, causing various types of rots and diseases. A large number of the species have medicinal and nutritional importance [1].

OBSERVATIONS

Key to the genera

1. Hyphal system monomitic .................................................................................................................................................. 2
2. Hyphal system dimitic ..................................................................................................................................................... 3

2. Setal structures present .................................................................................................................................................... Inonotus
3. Setal structures absent ...................................................................................................................................................... Inocutis

3. Generative hyphae usually encrusted ............................................................................................................................... Fuscoporia
4. Generative hyphae usually not encrusted ............................................................................................................................ Phellinus


Basidiocarp annual, pileate, applanate, solitary; pileus up to 15 × 7 × 4 cm; abhymenial surface smooth to tomentose, somewhat zonate, pale orange to greyish orange when fresh, brownish orange on drying; hymenial surface poroid, orange grey to brownish orange, when fresh, greyish orange to brown on drying; pores round, 3–4 per mm; dissepiments thin, entire; context up to 9 mm thick, light brown, homogeneous, fibrous; pore tubes up to 5 mm long, brownish orange; margins thinning, obtuse, wavy to irregular, sterile up to 5 mm, greyish orange on the hymenial surface, concolorous on the abhymenial surface. Hyphal system monomitic. Generative hyphae up to 5.0 µm wide, branched, simple septate, thin- to thick-walled, subhyaline to yellowish brown. Setal hyphae up to 115.0 × 15.2 µm, thick-walled, abundant, mostly horizontal in trama. Setae up to 33.0 × 8.8 µm, ventricose, thick-walled, dark brown. Basidia 30.0–36.0 × 7.2–9.8 µm, clavate to somewhat sinuous, subhyaline, with oily contents, simple septate at the base, 4-sterigmate; sterigmata up to 4.7 µm long. Basidiospores 5.2–7.6 × 4.0–5.8 µm, broadly ellipsoid, smooth, pale yellow, thick-walled, with oily contents, cyanophilous, inamyloid.
**Collection examined** – Punjab: Patiala, Urban Estate Phase II, on *Alstonia* sp., Gurpreet 7062 (PUN), August 13, 2013.

**Remarks** – This species is characteristic in having smooth to tomentose abhymenial surface, conspicuous setal hyphae and broadly ellipsoid basidiospores. Earlier it has been reported from India by Sharma [2-4] and Harpreet [5]. However, it is being described for the first time from Punjab.


**Basidiocarp** annual, effused-reflexed to pileate, applanate; pileus up to 5.5 × 3 × 2 cm; abhymenial surface sulcate, indistinctly zonate, brownish yellow to brown to dark brown when fresh, greyish orange to dark brown on drying, with brownish-black, hard cutis; hymenial surface poroid, orange grey to greyish orange when fresh, brownish grey on drying; pores angular, 4–5 per mm; dissepiments thin, entire; context up to 5 mm thick, homogeneous, brownish yellow; pore tubes up to 2 mm long, stratified with greyish brown zone near the context layer and dark brown zone towards hymenial surface; margins obtuse, wavy to irregular, sterile up to 1 mm, concolorous on both hymenial and abhymenial surfaces.

**Hyphal system** monomitic. Generative hyphae up to 3.4 µm wide, branched, simple septate, thin- to thick–walled.

**Setal hyphae** absent.

**Cystidioles** 10–12.5 × 3–3.7 µm, fusoid, thin-walled, simple septate at the base.

**Basidia** 10.6–13.5 × 5.6–7.5 µm, clavate to subclavate, subhyaline, simple septate at the base, 4–sterigmate; sterigmata up to 2 µm long. **Basidiospores** 5–6.5 × 4.3–5.7 µm, broadly ellipsoid to subglobose, smooth, dark brown, thick-walled, with oily contents, inamyloid, acyanophilous.

**Collection examined** – Chandigarh (UT): lake reserve forest, on angiospermous stump, Dhingra and Gurpreet 7063 (PUN), August 15, 2013.

**Remarks** – *Inocutis rhades* is characteristic in having sulcate abhymenial surface with brownish–black, hard cutis, absence of setal structures and broadly ellipsoid basidiospores. Earlier it has been reported from India by Sharma [6, 7] as *Inonotus rhades*. The present collection is different from the earlier descriptions from India in lacking the granular core and is a new report for the study area.


**Basidiocarps** annual, pileate, imbricate; pileus 7.0 × 4 × 0.7 cm, hard; abhymenial surface strigose to hirsute, faintly zonate to azonate, light orange to orange when fresh, brownish orange to light brown on drying; hymenial surface poroid, greyish red to reddish brown when fresh, brown on drying; pores round to angular, 6–9 per mm; dissepiments entire; context up to 5 mm thick, brownish yellow to brownish orange; pore tubes up to 4 mm long, brown; margins thinning,
acute, entire to somewhat wavy, sterile up to 1 mm, concolorous on the hymenial surface, paler concolorous on the abhymenial surface. **Hyphal system** dimitic. Generative hyphae up to 3 µm wide, simple septate, subhyaline, thin-walled, frequently branched, encrusted; thin-to somewhat thick-walled. Skeletal hyphae up to 4.1 µm wide, rarely branched, aseptate, thick-walled, yellowish brown. **Setae** 17.0–23.0 × 7.0–7.6 µm, subulate, acuminate, thick-walled, dark brown in 3% KOH solution, projecting up to 20 µm out of hymenium. **Basidia** 8.0–10.5 × 3.5–4.7 µm, clavate to subclavate, subhyaline, simple septate at the base, 4-sterigmate; sterigmata up to 2.4 µm long. **Basidiospores** 3.5–4.7 × 2.0–3.3 µm, ellipsoid, smooth, thin-walled, subhyaline, inamyloid, acyanophilous.

**Collection examined** – Punjab: Hoshiarpur, Panyali Khurd, on angiospermous stump, Gurpreet 7061 (PUN), August 2, 2013.

**Remarks** – A fairly common species in India, reported earlier by Bose [8-10], Banerjee [11], Thind and Chatrath [12], Dhanda [13], Singh [14], Bakshi [15], Sharma [16, 2, 7], and Leelavathy and Ganesh [17]. However, it is a new record for the study area.

**Plate 2**: Figs. 14-20: *Fuscoporia gilva*: 14. basidiocarp showing abhymenial surface; 15. basidiocarp showing hymenial surface; 16. basidiospores; 17. basidia; 18. generative hyphae; 19. setae.

**Key to the species of Phellinus**

1. Setae present .............................................................................................................................. 2
2. Setae absent ............................................................................................................................... 5
3. Setal hyphae present ............................................................................................................ *P. conchatus*
4. Setal hyphae absent .............................................................................................................. 3
5. Basidiocarps pileate ........................................................................................................... *P. rhabarbarinus*
6. Basidiocarps resupinate ........................................................................................................ 4
7. Cystidioles present ............................................................................................................... *P. pupureogilvus*
8. Cystidioles absent ............................................................................................................... *P. xeranticus*
9. Basidiocarps resupinate ........................................................................................................ 6
10. Basidiocarps pileate ............................................................................................................ *P. melleoporus*
11. Pilear surface rimose ........................................................................................................... 7
12. Pilear surface not as above .................................................................................................. 8
13. Pilear surface deeply cracked forming polygonal woody scales with age ................. *P. rimosus*
14. Pilear surface not deeply cracked, no polygonal scales .................................................. *P. badius*
15. Basidiospores dextrinoid ..................................................................................................... *P. robustus*
16. Basidiospores not dextrinoid ............................................................................................... 9
17. Basidiospores subglobose, basidiocarps concentrically sulcate .................................. *P. fastuosus*
18. Basidiospores broadly ellipsoid, basidiocarps not as above ........................................... *P. grenadensis*
19. Cutis present ....................................................................................................................... 10
20. Cutis absent ......................................................................................................................... *P. pectinatus*

**Basidiocarp** perennial, pileate, suborbicular, sessile, solitary; pileus up to 27 × 21 × 15 cm; abhymenial surface sulcate, indistinctly zonate, greyish orange to orange grey to brownish orange when fresh, brownish orange to brown on drying; hymenial surface poroid, greyish orange to brownish grey to brown when fresh, light brown to brown on drying; pores round, 7–8 per mm; dissepiments thin, entire; pore tubes up to 1.6 cm long, stratified, brown, separated by thin, homogeneous, brown context layers, up to 4 mm thick; margins indeterminate. **Hyphal system** dimitic. Generative hyphae up to 3.4 μm wide, simple septate, subhyaline, thin-walled, frequently branched. Skeletal hyphae up to 4.7 μm wide, aseptate, thick-walled, unbranched, dark brown. **Setal hyphae** up to 16.5 μm wide, thick-walled. **Setae** 22.0–57.0 × 7.0–8.0 μm, abundant, subulate to ventricose, thick-walled, reddish brown. **Basidia** not seen. **Basidiospores** 5.0–6.3 × 4–5.1 μm, ovoid to subglobose, smooth, thick-walled, pale brown, inamyloid, acyanophilous.


**Remarks** – This species is characterized by the presence of setal hyphae, setae and ovoid to subglobose basidiospores. Earlier, this species has been reported by Bose [18], Banerjee [11], Bakshi [15] as *Fomes conchatus*, whereas by Sharma [6, 7] and Kuldeep Lalji [19] as *Phellinus conchatus*. Presently it is being reported for the first time from Punjab.


**Collection examined** – Punjab: Patiala, Punjabi University campus, on the trunk of *Cassia fistula*, Gurpreet 7066 (PUN), October 6, 2013.

**Remarks** – *P. rhabarbarinus* is characteristic in having perennial, solitary, applanate, sulcate, brownish context and smaller (3.7–5 × 2.1–3.1 μm) ellipsoid basidiospores. Earlier, it has been reported from Punjab by Kuldeep Lalji [19].


**Basidiocarp** annual, resupinate, not easily separable, up to 2 mm thick; pore surface light brown when fresh, brown on drying, uneven, pores round to angular, 5–6 per mm, dissepiments thin, entire, tubes not stratified, brown; margins thinning, fibrillose to irregular, whitish to paler concolorous, to indeterminate. **Hyphal system** dimitic. Generative hyphae up to 2.5 μm wide, simple septate, hyaline, thin-walled, branched. Skeletal hyphae up to 3.7 μm wide, aseptate, thick-walled. **Setae** 13.0–37.0 × 5.6–8.7 μm, subulate, apex pointed, thick-walled, dark brown. **Cystidioles** 15.0–16.2 × 4.3–5.6 μm, fusoid, subhyaline, thin-walled, simple septate at the base. **Basidia** 12.5–15.6 × 6.2–8.1 μm, clavate, subhyaline, simple septate at the base, 4-sterigate;
sterigmata up to 3.4 mm long. Basidiospores 5.6–6.2 × 5.0–5.6 μm, broadly ellipsoid to subglobose, smooth, thick-walled, inamyloid, acyanophilous.

**Collection examined** – Punjab: Patiala, Punjabi University campus, on angiospermous log, Gurpreeet 7064 (PUN), August 2, 2013.

**Remarks** – This species is characterised by resupinate basidiocarps and presence of subulate setae. Earlier, it has been reported by Sharma and Ghosh [20] and Sharma [7]. However, it is being reported for the first time from Punjab.


Basidiocarp annual, resupinate, widely effused, not easily separable, up to 2 mm thick; pore surface greyish red to brown when fresh, not changing much on drying, uneven, pores angular, 5–7 per mm, dissepiments lacerate, tubes not stratified, brown, up to 2 mm long; margins thinning, whitish to paler concolorous, to indeterminate. **Hyphal system** dimitic. Generative hyphae up to 2.5 μm wide, simple septate, subhyaline, thin-walled, branched. Skeletal hyphae up to 3.4 μm wide, aseptate, thick-walled, yellowish brown. Setae 26.0–58.0 × 6.8–8.8 μm, subulate, abundant, apex pointed, thick-walled, dark brown. Basidia 13.0–15.0 × 5.0–5.6 μm, clavate, subhyaline, simple septate at the base, 4–sterigmate; sterigmata up to 2.8 μm long. Basidiospores 4.3–5.9 × 2.5–3.7 μm, ellipsoid, hyaline, smooth, thin-walled, with oily contents, weakly cyanophilous, inamyloid.

**Collection examined** – Punjab: Ludhiana, Punjab Agricultural University, on *Dalbergia sissoo*, Gurpreeet 7068 (PUN), September 8, 2013.

**Remarks** – *P. xeranticus* is peculiar in having abundant subulate setae. Earlier, from India, it has been reported by Bose [10], Banerjee [11], Pegler [21], Rattan [22], Dhanda [13], Thind and Dhanda [23, 24], Sharma [16], Singh [14], Sharma [6] and Kuldeep Lalji [19]. However, it is being reported for the first time from Punjab.


**Collection examined** – Punjab: Patiala, Botanic Gardens, Punjabi University, on bark of *Pongamia* sp., Gurpreeet 7067 (PUN), September 6, 2013.

**Remarks** – It is characteristic in having resupinate, yellowish brown basidiocarp, absence of setae and small (3.2–4.2 × 2.3–3.2 μm), pale brown basidiospores. Earlier, Dargan et al. [25] reported it from the study area.


**Plate 4:** Figs. 35-40: *Phellinus xeranticus*: 35. basidiocarp showing hymenial surface; 36. basidiospores; 37. basidia; 38. generative hyphae; 39. skeletal hyphae; 40. setae. Figs. 41-47: *Phellinus robustus*: 41. basidiocarp showing abhymenial surface; 42. basidiocarp showing hymenial surface; 43. basidiospores; 44. basidia; 45. cystidioles; 46. generative hyphae; 47. skeletal hyphae.
Collection examined – Chandigarh (UT): Sector 1, backside of Sukhna Lake, on the trunk of *Acacia* sp., Dhingra 7070 (PUN), September 19, 2013.

Remarks – It is characterized by pileate basidiocarps, abhymenial surface deeply cracked, forming polygonal woody scales with age. Earlier, Kuldeep Lalji [19] reported it from the study area.


Collection examined – Punjab: Roopnagar, Balachaur, Maili, on angiospermous log, Avneet 7060 (PUN), September 22, 2013.

Remarks – It is peculiar in having pileate basidiocarps with rimose pilear surface and broadly ellipsoid to subglobose basidiospores. Earlier, it has been reported from the study area by Kuldeep Lalji [19].


Basidiocarp perennial, pileate, applanate, suborbicular, solitary; pileus up to 14.0 × 11 × 7.5 cm; abhymenial surface smooth to tomentose, azonate, yellowish brown to light brown when fresh, light brown to brown on drying; hymenial surface poroid, brown when fresh, not changing much on drying; pores round to angular, 4–5 per mm; dissepiments entire; pore tubes stratified, up to 5 mm long, separated by very thin layers of context, up to 5 mm thick; margins indeterminate. Hyphal system dimitic. Generative hyphae up to 3.1 μm wide, branched, simple septate, thin-walled, subhyaline. Skeletal hyphae up to 3.4 μm wide, rarely branched, aseptate, thick-walled, yellowish brown. Setae absent. Cystidioles 17.0–19.3 × 3.4–3.8 μm, fusoid, thin-walled, with tapering apex. Basidia 8.7–14.3 × 5.3–5.7 μm, clavate, subhyaline, simple septate at the base, 4-sterigmate; sterigmata up to 1.8 μm long. Basidiospores 5.0–6.2 × 3.7–5.7 μm, broadly ellipsoid to subglobose, thick-walled, smooth, yellowish brown, acyanophilous, dextrinoid.

Collection examined – Punjab: Patiala, Punjabi University campus, on trunk of *Cassia* sp., Gurpreet 7058 (PUN), September 18, 2013.

Remarks – *P. robustus* is characterised by very thick, applanate, suborbicular basidiocarp, smooth to tomentose abhymenial surface and absence of setal structures. From India, it has earlier been reported by Bakshi [15], Dhanda [13] and Sharma [16, 6, 7], Singh [14] and Harpreet [5] from different areas. However, it is being reported as a new record for the study area.


Basidiocarps perennial, pileate, imbricate, woody; pileus up to 15 × 12 × 1 cm; abhymenial surface sulcate, concentrically zonate, brownish grey to light brown when fresh, not changing much on drying; hymenial surface poroid, brownish orange to light brown to brown when fresh, brown on drying; pores round, 8–9 per mm, dissepiments entire; context up to 1.5 mm thick, homogeneous, brownish yellow; pore tubes up to 5 mm long, brownish orange; margins thinning, obtuse, irregular, sterile up to 9 mm, greyish brown on the hymenial surface, concolorous on the abhymenial surface. Hyphal system dimitic. Generative hyphae up to 3.4 μm wide, branched, simple septate, thin- to thick-walled. Skeletal hyphae up to 4.0 μm wide, rarely branched, aseptate, thick-walled, yellowish brown. Basidia not observed. Basidiospores 3.4–5.7 × 2.8–4.5 μm, subglobose, thick-walled, smooth, brown, acyanophilous, inamyloid.

Collections examined – Punjab: Patiala, Baradari gardens, on base of *Eucalyptus* sp., Gurpreet 7065 (PUN), February 10, 2013.

Remarks – Chief features of this species are sulcate, concentrically zonate abhymenial surface, absence of hymenial setae and subglobose basidiospores. Previously it has been reported from India by Bose [26], Banerjee [11], Saxena [27],
Singh et al. [28] as *Fomes fastuosus* and by Dhanda [13], Sharma and Ghosh [20], Leelavathy and Ganesh [20] and Sharma [7] as *Phellinus fastuosus*. However, it is being reported for the first time from Punjab.


**Basidiocarp** perennial, pileate, applanate, ungulate, solitary; pileus up to 10.5 × 7 × 4 cm; abhymenial surface smooth to rugose, zonate, greyish orange to light brown to pale red when fresh, not changing much on drying, with brown cutis; hymenial surface poroid, light brown to brown when fresh, not changing much on drying; pores round, 3–4 per mm; dissepiments entire; context up to 2.5 cm thick, zonate, fibrous, light brown; pore tubes up to 1.5 cm long, brown; margins acute, somewhat incurved, sterile up to 3 mm, light brown on the hymenial surface, concolorous on the abhymenial surface. **Hyphal system** dimitic. Generative hyphae up to 2 μm wide, branched, simple septate, thin-walled. Skeletal hyphae up to 3.7 μm wide, rarely branched, aseptate, thick-walled, yellowish brown. **Setae** absent. **Cystidioles** 17.8–18.7 × 4.3–5.3 μm, fusoid, with tapering apex, thin-walled. **Basidia** 15.6–20.6 × 5.0–5.6 μm, clavate, subhyaline, simple septate at the base, 4–sterigmate; sterigmata up to 2.2 μm long. **Basidiospores** 5.0–6.8 × 3.4–5.3 μm, broadly ellipsoid, thick-walled, smooth, yellowish brown, acyanophilous, inamyloid.

**Collection examined** – Punjab: Patiala, near Gol market, Punjabi University, on angiospermous stump, Gurpreet 7069 (PUN), September 15, 2013.

Remarks – This species is characteristic in having applanate, ungulate basidiocarp and absence of setae. From India, it has earlier been reported by Dhanda [13] and Sharma [7]. Here it is being reported for the first time from Punjab.


**Basidiocarps** perennial, pileate, imbricate, woody; pileus up to 5.5 × 5 × 3 cm; abhymenial surface irregularly sulcate, light brown to brown to dark brown when fresh, not changing much on drying; hymenial surface poroid, light brown to brown when fresh, not changing much on drying; pores round to angular, 7–8 per mm; dissepiments entire; context up to 2.5 cm thick, homogeneous, hard, yellowish brown; pore tubes up to 5 mm long, golden yellow; margins thinning, obtuse, sterile up to 4 mm, deep yellow on hymenial surface, concolorous on abhymenial surface. **Hyphal system** dimitic. Generative hyphae up to 2.2 μm wide, branched, simple septate; thin- to thick-walled, yellowish brown. Skeletal hyphae up to 3.1 μm wide, aseptate, thick-walled, rarely branched, brown. **Setae** absent. **Cystidioles** 13.7–16.5 × 3.0–3.7 μm, fusoid, subhyaline, thin-walled, simple septate at the base. **Basidia** 8.0–8.7 × 5–5.6 μm, subovate, simple septate at the base, 4–
sterigmat; sterigmata up to 2 im long. **Basidiospores** 4.2–5 × 3–4 im, broadly ellipsoid, smooth, pale yellow to brownish, thin- to somewhat thick-walled, weakly cyanophilous, inamyloid.

**Collection examined** – Chandigarh (UT): Lake reserve forest, on base of *Acacia* sp., Gurpreet & Dhingra 7059 (PUN), September 14, 2013.

**Remarks** – It has earlier been reported by Bose [2, 9], Banerjee [1], Thind and Chatrath [12], Dhanda [13], Sharma and Ghosh [20], Sharma [7] and Harpreet [5]. Here it is being reported for the first time from the study area.

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**REFERENCES**


**Plate 6**: Figs. 60-66: *Phellinus pectinatus*: 60. basidiocarp showing abhymenial surface; 61. basidiocarp showing hymenial surface; 62. basidiospores; 63. basidia; 64. generative hyphae; 65. skeletal hyphae; 66. cystidioles.


