



Research article

Taxonomy and diversity of the Genus *Phellinus* Qué. s.s. (Basidiomycota, Hymenochaetaceae) in Koderma wildlife sanctuary, Jharkhand, India

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Abstract: The Genus *Phellinus* Qué. s. s. is a diverse genus in the Family *Hymenochaetaceae*, which is represented by 12 species in the Koderma Wildlife Sanctuary (KWS), Jharkhand. In the present communication important macro- and micro-morphological features of the species of *Phellinus* Qué. s.s. present in KWLS is given. An artificial key to the species present in KWLS is also provided.

Keywords: *Phellinus* - Taxonomy - Macrofungi - Koderma - Jharkhand.

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INTRODUCTION

Traditionally genus *Phellinus* Qué. (a macrofungal genus causing serious wood rot) was considered as one of the largest genera of the family Hymenochaetaceae. This genus was described to encompass poroid Hymenochaetaceae (Hymenochaetales, Basidiomycota) with perennial basidiomata and a dimitic hyphal system (Larsen & Cobb-Pouille 1990, Wagner & Fischer 2002) but these characteristic features gradually appeared to be artificial because many intermediate forms have also been reported by many workers (Fiasson & Niemelä 1984, Corner 1991, Dai 1995, 1999, 2010, Fischer 1995, Wagner & Fischer 2001). Molecular phylogenetic studies on this genus further suggest that *Phellinus* is polyphyletic, with a large number of species and a diverse range of morphological features constituting a genus complex *i.e.* *Phellinus s.l.* Exclusively based on morphological features it is quite difficult to segregate different species present in *Phellinus s.l.* For a more natural classification of species present in *Phellinus s.l.* many molecular studies (Niemelä *et al.* 2001, Wagner & Fischer 2001, Fischer & Binder 2004, Larsson *et al.* 2006, Tomšovský *et al.* 2010, Drechsler *et al.* 2016, Pildain *et al.* 2018, Chen *et al.* 2019) have been carried out which helps in the subdivision of *Phellinus s.l.* into several genera with a better delimitation. Presently, *Phellinus s.l.* is divided into *Phellinus s.s.* (type species: *P. igniarius*), *Porodaedalea*, *Fomitiporia*, *Fuscoporia*, *Phellinidium* and *Phylloporia* (Wagner & Fischer 2001, 2002).

The *Phellinus s.s.* mainly belongs to the *Phellinus igniarius* group, which is characterized by basidiomata perennial, ungulate with a crust on the pilear surface; hyphal system dimitic; hymenial setae subulate and hyaline; subglobose, ovoid or broadly ellipsoid basidiospores (Tomšovský *et al.* 2010). This is a large genus in the family Hymenochaetaceae with 150 valid species, 03 sub-species, 22 varieties and 11 forms (<http://www.indexfungorum.org>). As *Phellinus s.s.* seems to be more natural hence species come under this are discussed in the present communication.

Koderma Wildlife Sanctuary is located between 24° 26' N to 24° 36' N and 85° 28' E to 85° 42' E in the state of Jharkhand, India. This sanctuary comprises mainly dry deciduous forest dominated by *Shorea robusta* Gartner and different types of other tree species which serves as host to the growth and development of different taxa of wood rotting fungi. Several macro fungal forays were undertaken during 2010–2017 to this sanctuary by

one of us (AP) to study the diversity of wood rotting fungi of this area. A careful systematic study of the samples collected from this area reveals that 8 species of the genus *Phellinus* Quél. are present in this sanctuary. All these species of genus *Phellinus* with their important Macro- and micro-Morphological characters coupled with illustrations with their distribution is given in the present communication.

MATERIALS AND METHODS

Macrofungal survey tours were undertaken from 2010–2017 to collect the macrofungi samples from different locations of the Koderma Wildlife Sanctuary (KWS), Jharkhand. Field photographs of different samples (Basidiomycota/Ascomycota) were taken with the aid of Olympus C 5060, and Cannon Powershot A 450 camera. Photographs were captured to show different macro-morphological characters like colour of pileus, surface, hymenophore, colour and colour change on bruising etc., which are the key features in the determination of the systemic position of a species. Samples were collected in brown paper bags. GPS data were recorded with the help of a Garmin 12 XL machine for almost all the sites. A specific field number was provided for each collection. In the base camp a detailed macro-morphological characterization was done and several characters i.e. shape, size, colour, colour change of pileus, stipe (if present), hymenophore and context etc. were recorded for each sample and their photographs with scale (showing range of morphological features) were captured. Colour codes mostly based on Kornerup & Wanscher (1978). After recording all important details all the samples were dried in the sun. In the laboratory micromorphological characterization were undertaken from the freehand sections of the dry basidiomata either mounted in lactophenol, cotton blue and Melzer's reagent separately or treated in a mixture of 5% KOH, phloxine, and Congo red and then mounted in 30 % glycerol and observed with the help of Olympus CX 41 microscope, in order to proper identification of the collected specimens. All the specimens were deposited at herbarium CAL. Herbarium codes follow Thiers (2015) (continuously updated).

RESULTS

A thorough study of collected samples of the Genus *Phellinus* reveals that 11 species of this genus are found in the Koderma Wildlife Sanctuary, Jharkhand. The macro- and micro-morphological details of all the species are given below. A taxonomic key based on macro and micro-morphological features is also provided.

1. ***Phellinus adamantinus*** (Berk.) Ryvardeen, *Norw. Jl. Bot.*, 19: 234 (1972); *Polyporus adamantinus* Berk., *Hook. J. Bot. Kew Gard. Misc.* 6: 141 (1854). **(Fig. 1)**

Basidiomata perennial, solitary, pileate. Pileus 35 × 45 mm, up to 25 mm thick near the base, dimidiate, pilear surface glabrous with a thick crust, sulcate, zonate, rimose, dark blackish brown. Hymenophore poroid, mustard brown (5E6) to linoleum brown (5E7); pores 5–6 per mm, round, regular. Context up to 5 mm thick, solid, hard, a black line present in between the context, brown (5F4) to soot brown (5F5).

Hyphal system dimitic; generative hyphae 2–4 µm wide, hyaline; skeletal hyphae 4–6 µm wide, pale yellow. Basidiospores 4.5–6.5 × 4.0–5.5 µm, globose to drop shaped, thin- to slightly thick-walled, hyaline to pale yellow, inamyloid.

Specimens examined: INDIA, Jharkhand, Koderma, KWLS, Koderma enclosure, alt. 390 m, N 24° 29' 18.70" E 85° 35' 50.10", on a dead wood log, 08.09.2010, *Arvind Parihar* AP 44961; *ibid.*, Near taraghati, alt. 316 m, N 24° 32' 16.8" E 85° 35' 41.4", on a dead wood log, 27.09.2013, *Arvind Parihar* AP 6690.

Notes: Perennial, solitary and dimidiate basidiomata with rimose, crusty pilear surface; the presence of black line in context is the important distinguishing field characters. Microscopic characters, like thick-walled pale yellow skeletal hyphae and thin- to moderately thick-walled, hyaline to pale yellow basidiospores are very distinct in the specimen examined and are in conformity with that of *Phellinus admantinus* reported from India (Sharma 1995, 2012) and abroad (Ryvardeen & Johansen 1980).

2. ***Phellinus allardii*** (Bres.) S. Ahmad, *Basidiomyc. W. Pakist.* 6: 57 (1972); *Fomes allardii* Bres., *Bull. Jard. Bot. Etat Brux.* 4: 19 (1910). **(Fig. 2)**

Basidiomata perennial, resupinate to pileate, widely effused. Effused portion up to 150 mm long and 65 mm wide, pileus 10–40 × 10–30 mm (when pileate), 10–25 mm thick near the base, dimidiate to appanate; pilear surface velutinate to tomentose, sulcate, weakly zonate, with a distinct black crust at the base, brownish orange (5C6) to light brown (5D6). Hymenophore poroid, yellowish brown (5E5); pores 5–6 per mm, round, regular. Context very thin, up to 2 mm thick, sometimes almost absent, solid, hard, brownish yellow (5B7).

Hyphal system dimitic; generative hyphae 2.0–3.5 µm wide, occasionally branched; skeletal hyphae 2.5–5.0

μm wide, yellowish brown. Basidiospores $5\text{--}7 \times 4.5\text{--}6.0 \mu\text{m}$, abundant, globose to broadly ellipsoid, thick-walled, smooth, light yellow to pale rusty brown, inamyloid.

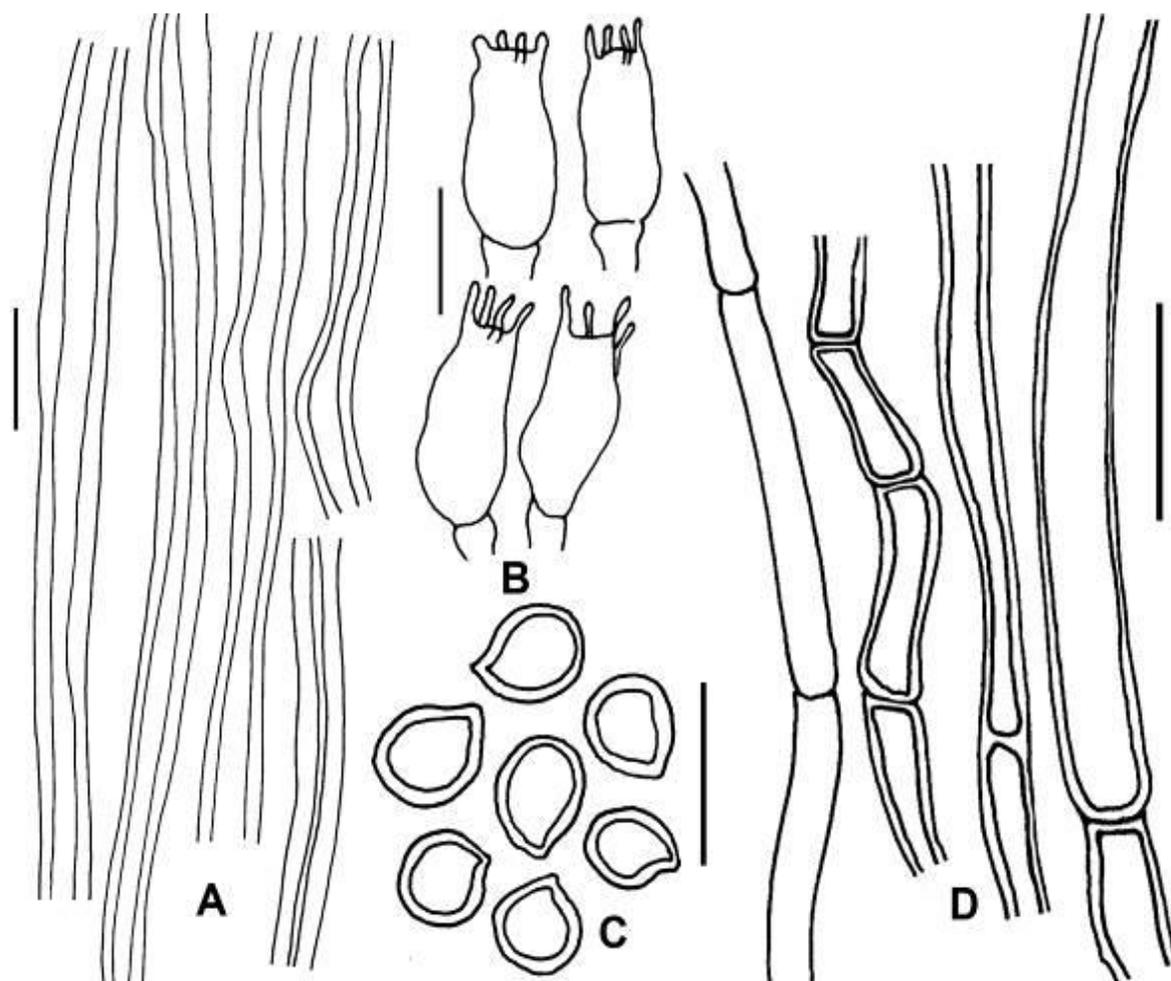


Figure 1. *Phellinus adamantinus* (Berk.) Ryvarden: **A**, Skeletal hyphae; **B**, Basidia; **C**, Basidiospores; **D**, Generative hyphae. [Scale bars: A–D = 10 μm]

Specimens examined: INDIA, Jharkhand, Koderma, KWLS, Koderma enclosure, alt. 389 m, N 24° 28' 56.1" E 85° 35' 39.6", on a dead standing wood log, 08.9.2010, *Arvind Parihar* AP 44955; *ibid.*, KWLS, Meghatari, Suggi point, alt. 190 m, N 24° 33' 54.7" E 85° 34' 55.2", on a dead wood log, 05.10.2012, *Arvind Parihar* AP 6545; *ibid.*, KWLS, Basraun, Koderma, alt. 280 m, N 24° 34' 45.9" E 85° 37' 40.2", on deadwood log, 11.10.2012, *Arvind Parihar* AP 6610.

Notes: This is a highly variable species in the genus *Phellinus* but macroscopic features like heavy and very hard widely effused to pileate basidiomata with a distinct black crust, gradually cracking with age and microscopically absence of hymenial setae, abundant sub-globose to broadly ellipsoid, thick-walled, light yellow to pale rusty brown basidiospores makes it distinct.

3. *Phellinus badius* (Cooke) G. Cunn., Bull. N.Z. Dept. Sci. Industr. Res., Pl. Dis. Div. 164: 273 (1965); *Fomes badius* Cooke, Grevillea 14:18 (1885). (Figs. 3 & 4)

Basidiomata perennial, sessile, pileate. Pileus 50–90 \times 35–65 mm, up to 30 mm thick near the base, dimidiate, hoof-shaped to unguulate, heavy when dry; pilear surface glabrous, rimose, crusty, zonate, brown (6E6–6E7). Hymenophore poroid, yellowish brown (5E7–5E8); pores 6–8 per mm, round, regular. Context up to 20 mm thick, solid, hard, lustrous when fresh, almost black in dry specimens.

Hyphal system dimitic; generative hyphae 3–4 μm wide, rarely branched, pale yellow; skeletal hyphae 3–7 μm wide, thick-walled light brown. Hymenial setae absent. Basidiospores 6–7 \times 5–6 μm , subglobose to broadly ellipsoid, thick-walled, pale yellow to light brown, inamyloid.

Specimens examined: INDIA, Jharkhand, Koderma, KWLS, Meghatari, Suggi point, alt. 199 m, N 24° 33' 45.2" E 85° 33' 21.0", on a dead wood log, 15.08.2011, *Arvind Parihar* AP 45058; *ibid.*, KWLS, Meghatari, Sambhu bhura mines, alt. 210 m, N 24° 35' 00.8" E 85° 35' 18.9", on a deadwood log, 03.10.2012, *Arvind Parihar* AP 6511; *ibid.*, KWLS, Meghatari, Suggi point, alt. 185 m, N 24° 34' 04.0" E 85° 34' 50.5", on a www.tropicalplantresearch.com

deadwood log, 05.10.2012, *Arvind Parihar* AP 6543; *ibid.*, KWLS, Khalakhtambhi forest, alt. 310 m, N 24° 32' 15.3" E 85° 35' 11.5", on a living tree, 10.10.2012, *Arvind Parihar* AP 6607; *ibid.* KWLS, near Tara ghati sanctuary gate, alt. 310 m, N 24° 35' 08.80" E 85° 34' 59.60", on a deadwood log, 27 Sept., 2013, *Arvind Parihar* AP 6686.

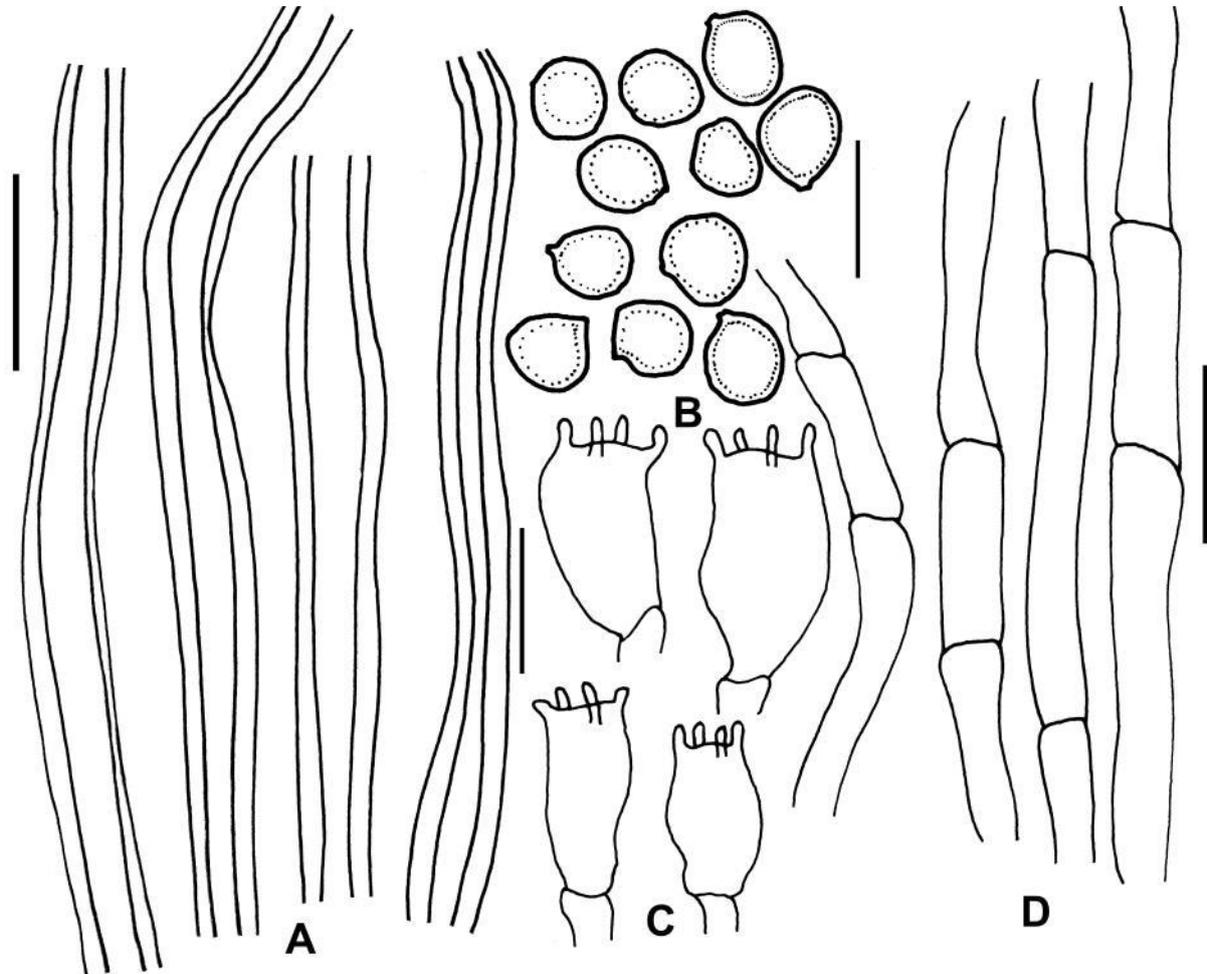


Figure 2. *Phellinus allardii* (Bres.) S. Ahmad: **A**, Skeletal hyphae; **B**, Basidiospores; **C**, Basidia; **D**, Generative hyphae. [Scale bars: A–D = 10 μ m]

Notes: This species is very distinct due to its radiately striate and shallow cracks on pilear surface. *Phellinus rimosus* (Berk.) Pilát is a closer relative to *P. badius* due to similarities in macro- and microscopic features as well as the habitat. Though, comparatively deep cracked pilear surface appearing as polygonal woody scales (at maturity) and larger pore size immediately key out the former.

4. *Phellinus crocatus* (Fr.) Ryvar den, Norw. J Bot. 19: 234 (1972); *Polystictus crocatus* Fr., Nova Acta R. Soc. Scient. Upsal., Ser.3 1(1): 91 (1851) [1855]. **(Fig. 5)**

Basidiomata perennial, effused reflexed to pileate, imbricate. Pileus 20–70 \times 10–40 mm, 10–15 mm thick near the base, pilear surface glabrous to velutinate, weakly sulcate, strongly zonate, crusty, golden yellow (5B7) to brownish yellow (5C7). Hymenophore poroid, oak brown (5D6) to yellowish brown (5D7); pores small, regular, round, 4–5 per mm. Context thin (up to 2 mm thick), solid, hard, brownish yellow (5C8) to light brown (5D7).

Hyphal system dimitic; generative hyphae 2–6 μ m wide, hyaline to pale yellow to pale brown; skeletal hyphae 5–8 μ m wide, dark brown. Basidiospores 4.5–5.5 \times 4.5–5.0 μ m, globose to subglobose, thin-walled, pale yellow to pale brown, acyanophilic, inamyloid.

Specimens examined: INDIA, Jharkhand, Koderma, KWLS, Meghatari, Sambhu bhura mines, alt. 290 m, N24° 35' 03.6" E 85° 34' 40.4", on a dead wood log, 03.10.2012, *Arvind Parihar* AP 6508.

Notes: The perennial woody, hard compound basidiome consists of many small pilei which laterally fused together, simultaneously many other small pilei also grows in up and down forming imbricate appearance of large Basidiome. Additionally, dark brown hymenophore with minute pores, thin context, globose to subglobose basidiospores are characteristic features of this species.

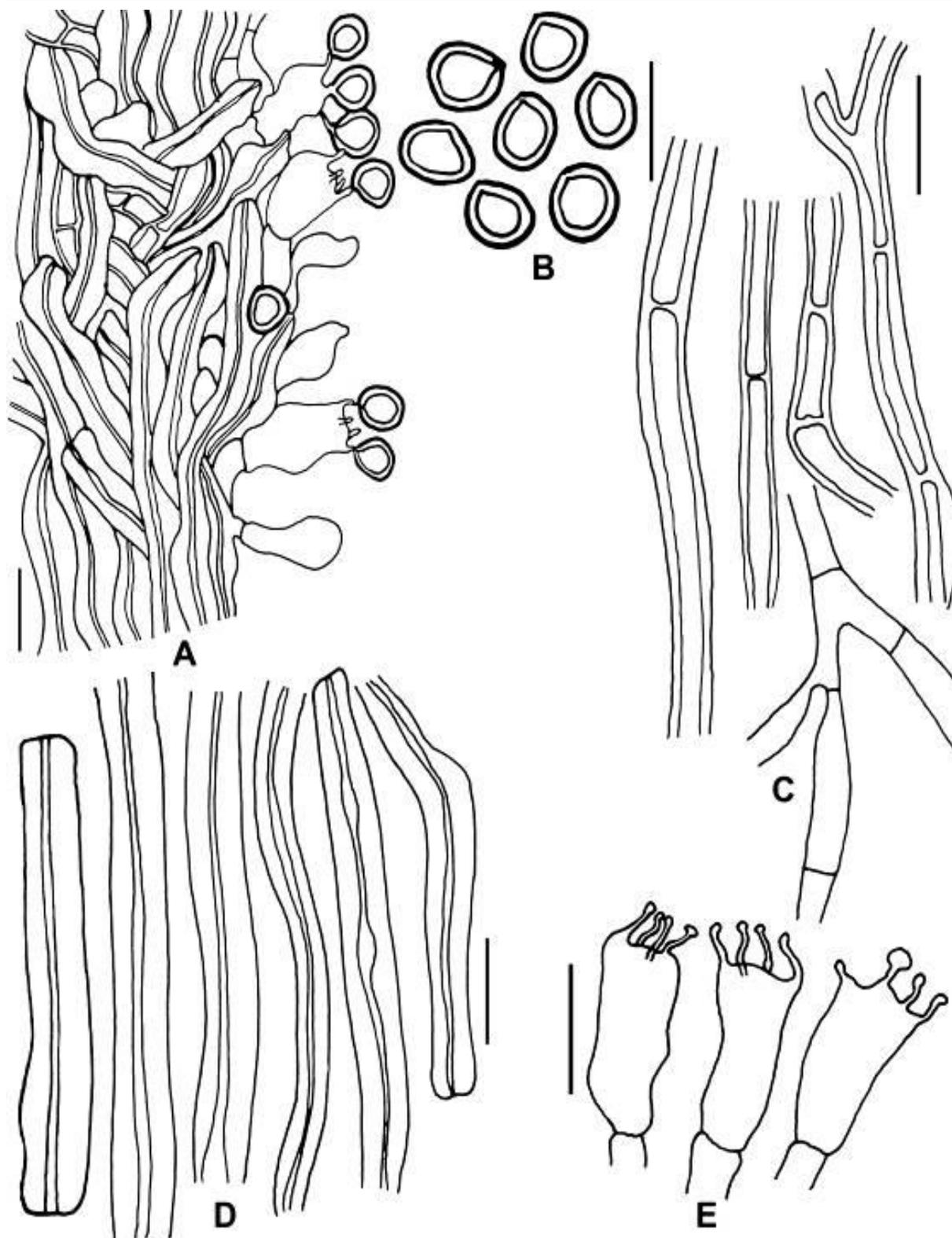


Figure 3. *Phellinus badius* (Cooke) G. Cunn.: **A**, Section through the tubes; **B**, Basidiospores; **C**, Generative hyphae; **D**, Skeletal hyphae; **E**, Basidia. [Scale bars: A–E = 10 μ m]

5. *Phellinus fastuosus* (Lév) S. Ahmad, *Basidiomyc. W. Pakist.*: 56 (1972); *Polyporus fastuosus* Lév. *Annls Sci. Nat., Bot., Sér.* 19: 234 (1972). **(Figs. 6 & 7)**

Basidiomata perennial, solitary, attached with a contracted base, pileate. Pileus 75–110 \times 55–70 mm, up to 40 mm thick near the base, conchate to applanate. Pilear surface matted to velutinate, sulcate, distinct black crust arising from the base, light orange (5A5) to melon (yellow) [5A6]. Hymenophore poroid, bronze (5E5) to mustard brown (5E6); pores 7–10 per mm, round, regular to sinuate. Tubes up to 5 mm deep, clay (5D5). Context up to 10 mm thick, solid, brownish orange (5A6).

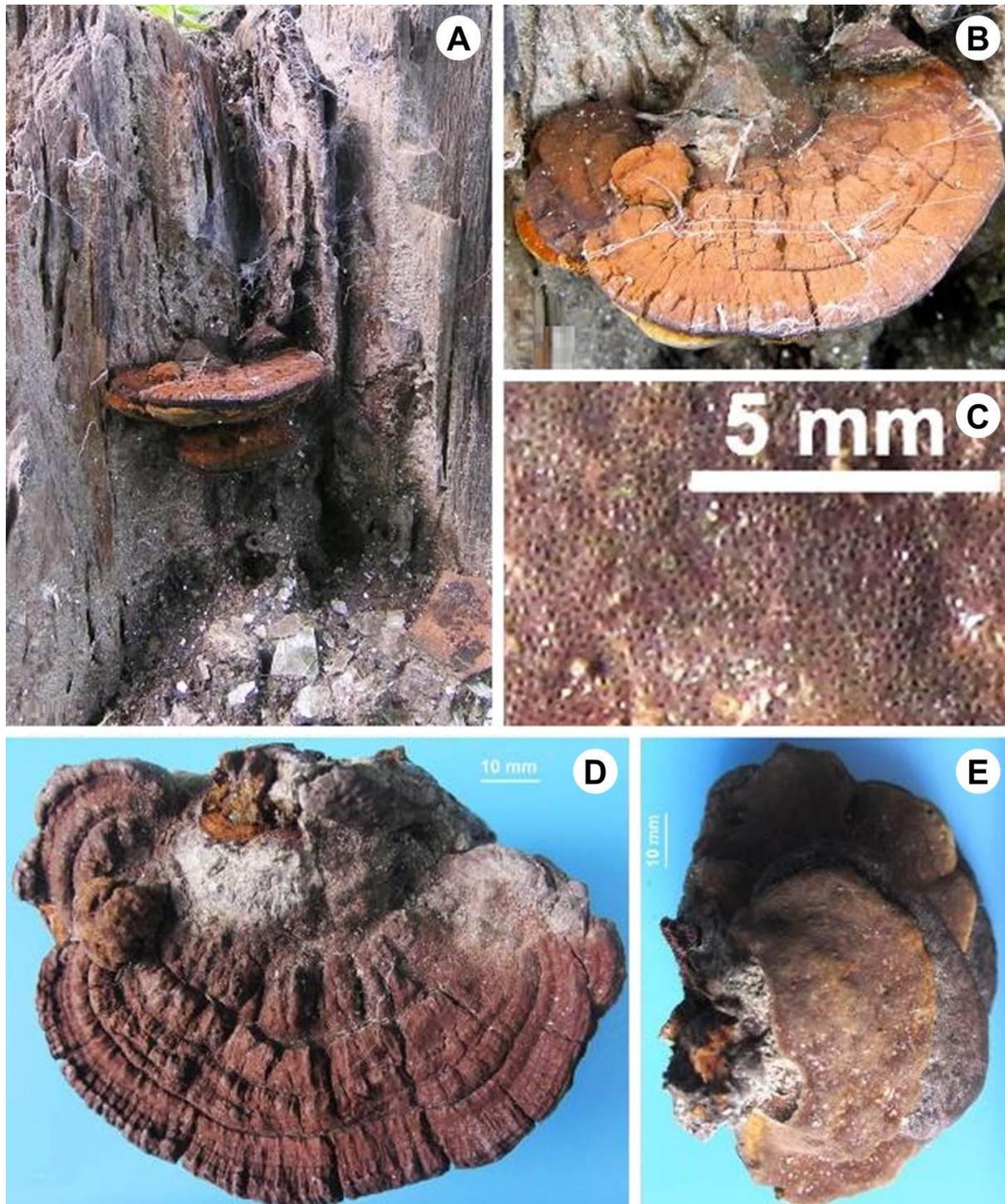


Figure 4. *Phellinus badius* (Cooke) G. Cunn.: **A**, Habitat; **B**, Habit; **C**, Pores; **D**, Basidioma showing cracked pilear surface; **E**, Basidiomata showing pore surface. [Scale bar: C = 5 mm; D & E = 10 mm]

Hyphal system dimitic; generative hyphae 3.0–4.5 μm wide, thin-walled, wall less than 1 μm , hyaline; skeletal hyphae 4–7 μm wide, pale yellow. Hymenial setae absent. Basidiospores 4–6 \times 4–5 μm , globose to broadly ellipsoid, thin- to slightly thick-walled, light brown, inamyloid.

Specimens examined: INDIA, Jharkhand, Koderma, KWLS, Meghatari, Shambhu bhura mines, alt. 186 m, N 24° 35' 01.2" E 85° 34' 40.40", on a dead wood log, 03.10.2012, *Arvind Parihar* AP 6507; *ibid.*, KWLS, Koderma NRF, Jamsoti Forest, alt. 298 m, N 24° 30' 35.2" E 85° 35' 40.2", on a dead wood log, 09.10.2012, *Arvind Parihar* AP 6593; *ibid.*, KWLS, Koderma NRF, Jamsoti Forest, alt. 321 m, N 24° 32' 19.7" E 85° 34' 51.0", on a living tree, 19.10.2013, *Arvind Parihar* AP 6641.

Notes: The present survey supports the comments that mentioned by earlier workers (Sharma 1995, 2000, 2012, Ryvardeen & Johansen 1980) and indicating that *Phellinus fastuosus* is a common tropical polypores on various hardwoods.

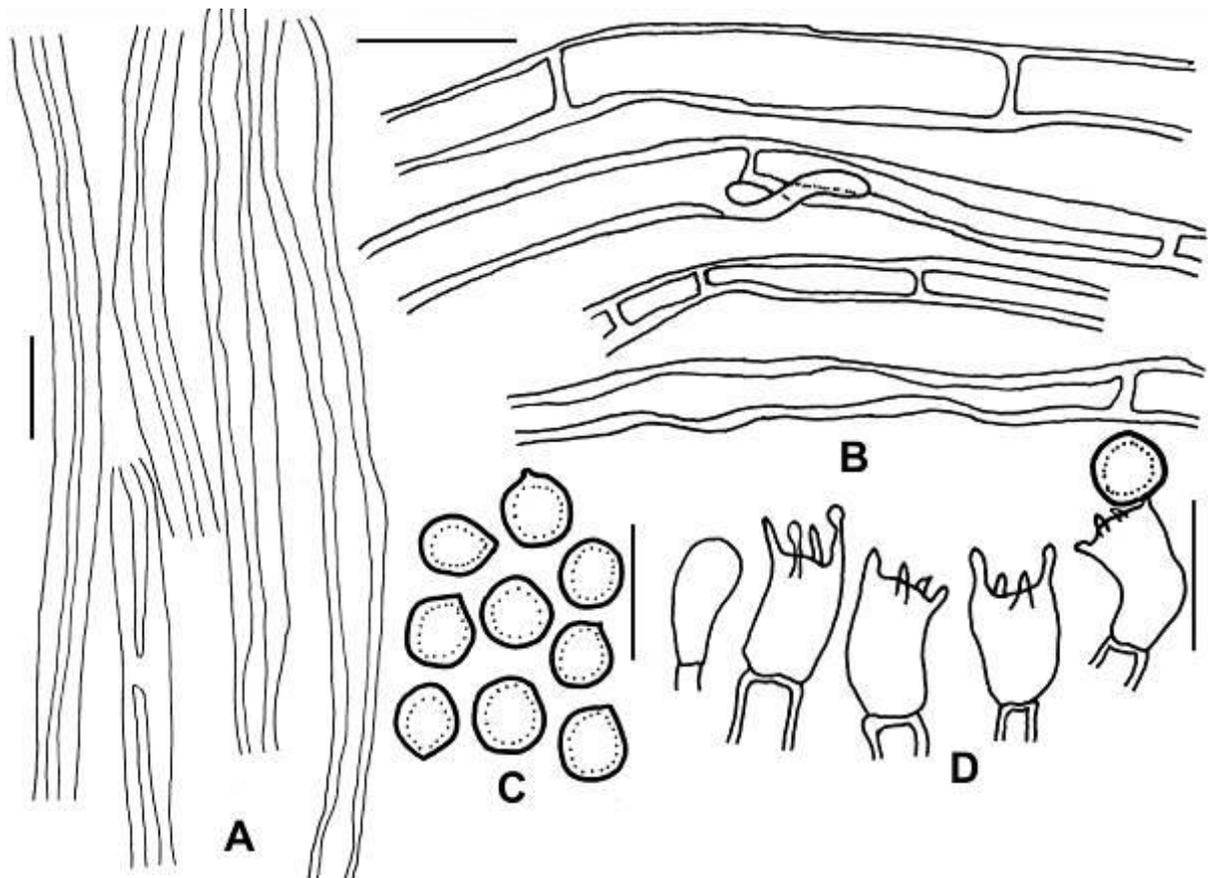


Figure 5. *Phellinus crocatus* (Fr.) Ryvarden: **A**, Skeletal hyphae; **B**, Generative hyphae; **C**, Basidiospores; **D**, Basidia. [Scale bars: A–D = 10 μ m]

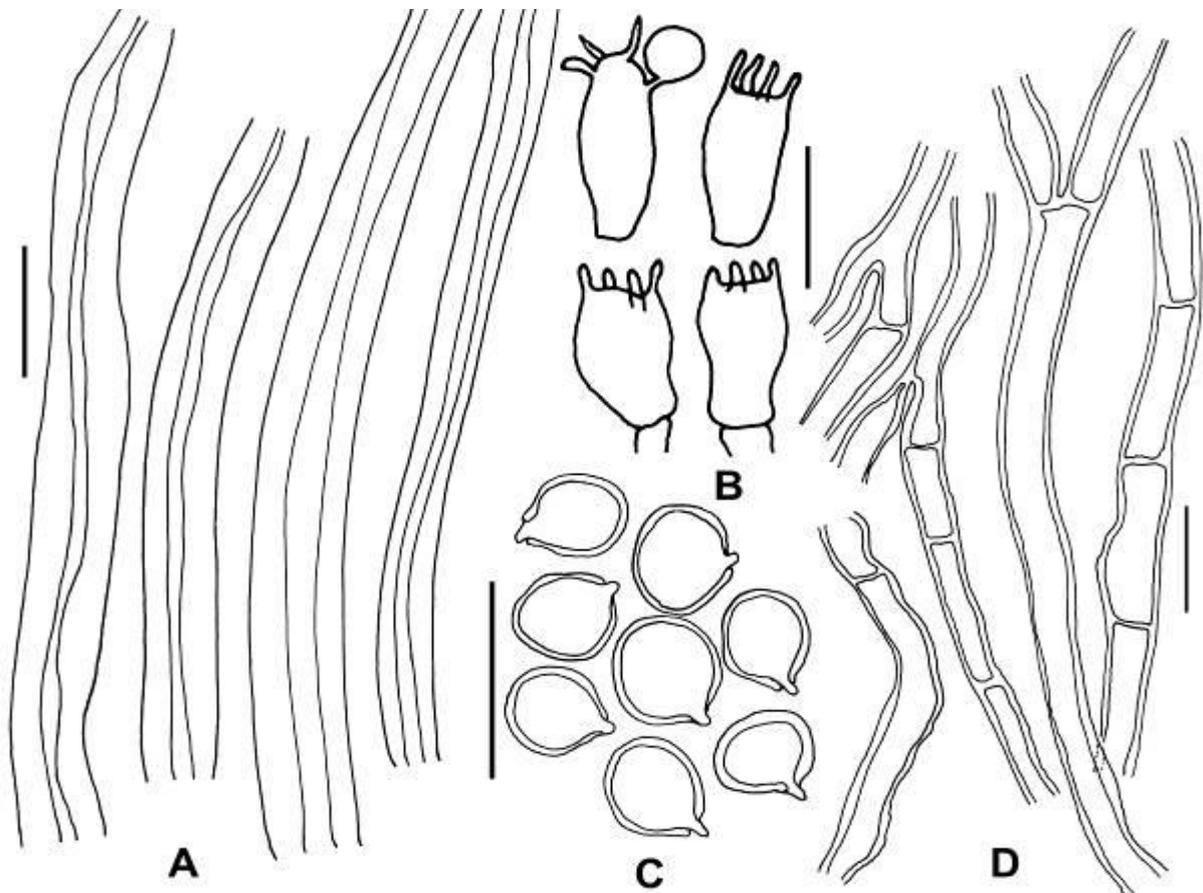


Figure 6. *Phellinus fastuosus* (Lév) S. Ahmad: **A**, Skeletal hyphae; **B**, Basidia; **C**, Basidiospores; **D**, Generative hyphae. [Scale bars: A–D = 10 μ m]

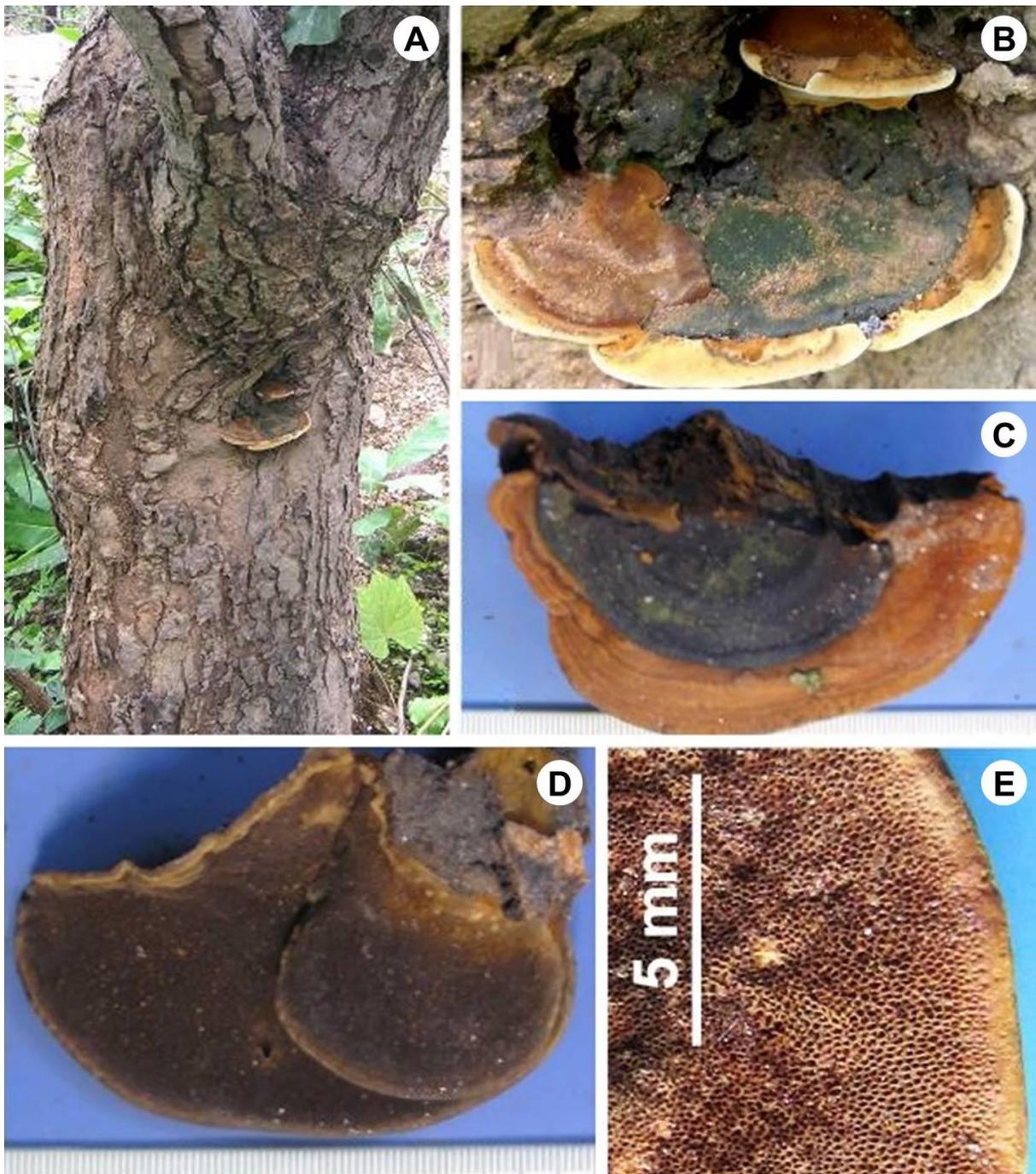


Figure 7. *Phellinus fastuosus* (Lév) S. Ahmad: **A**, Habitat; **B**, Habit; **C**, Basidiomata with scale showing pilear surface; **D**, Basidiomata showing pore surface; **E**, Basidiomata showing pores and margin. [Scale bar: E = 5 mm]

6. *Phellinus gilvus* (Schwein.) Pat., *Essai Tax Hyménomyc.* (Lons-le-Saunier): 82 (1900); *Boletus gilvus* Schwein., *Schr. Naturf. Ges. Leipzig* 1: 96 (1822). **(Figs. 8 & 9)**

Basidiomata annual, single to imbricate, effused reflexed to pileate. Pileus 20–65 × 20–40 mm, 10–15 mm thick near the base, dimidiate to applanate, pilear surface more or less glabrous to velutinate, weakly zonate, crusty, golden yellow (5B7) to brownish yellow (5C7–5C8) with a reddish tint. Hymenophore poroid, yellowish brown (5E7–5E8); pores 5–7 per mm, regular, round. Context up to 6 mm thick, solid, hard, golden yellow (5B7) to orange (5B8).

Hyphal system dimitic; generative hyphae up to 4 μm wide, hyaline to pale yellow; skeletal hyphae up to 4 μm wide, yellowish brown. Hymenial setae 22–29 × 5–8 μm, thick-walled, sharp, subulate, abundant. Basidiospores 3.2–5.0 × 3.0–4.8 μm, globose to ellipsoid to ovoid, thin-walled, pale yellow to light brown.

Specimens examined: INDIA, Jharkhand, Koderma, KWLS, Mughlamaran, alt. 369 m, N 24° 30' 58.2" E 85° 34' 29.6", on a dead wood log, 03.10.2010, *Arvind Parihar* AP 44901; *ibid.*, KWLS, Phulwariya, alt. 366 m, N 24° 29' 37.5" E 85° 35' 21.5", on living tree of *Terminalia tomentosa*, 04.10.2010, *Arvind Parihar* AP 44924;

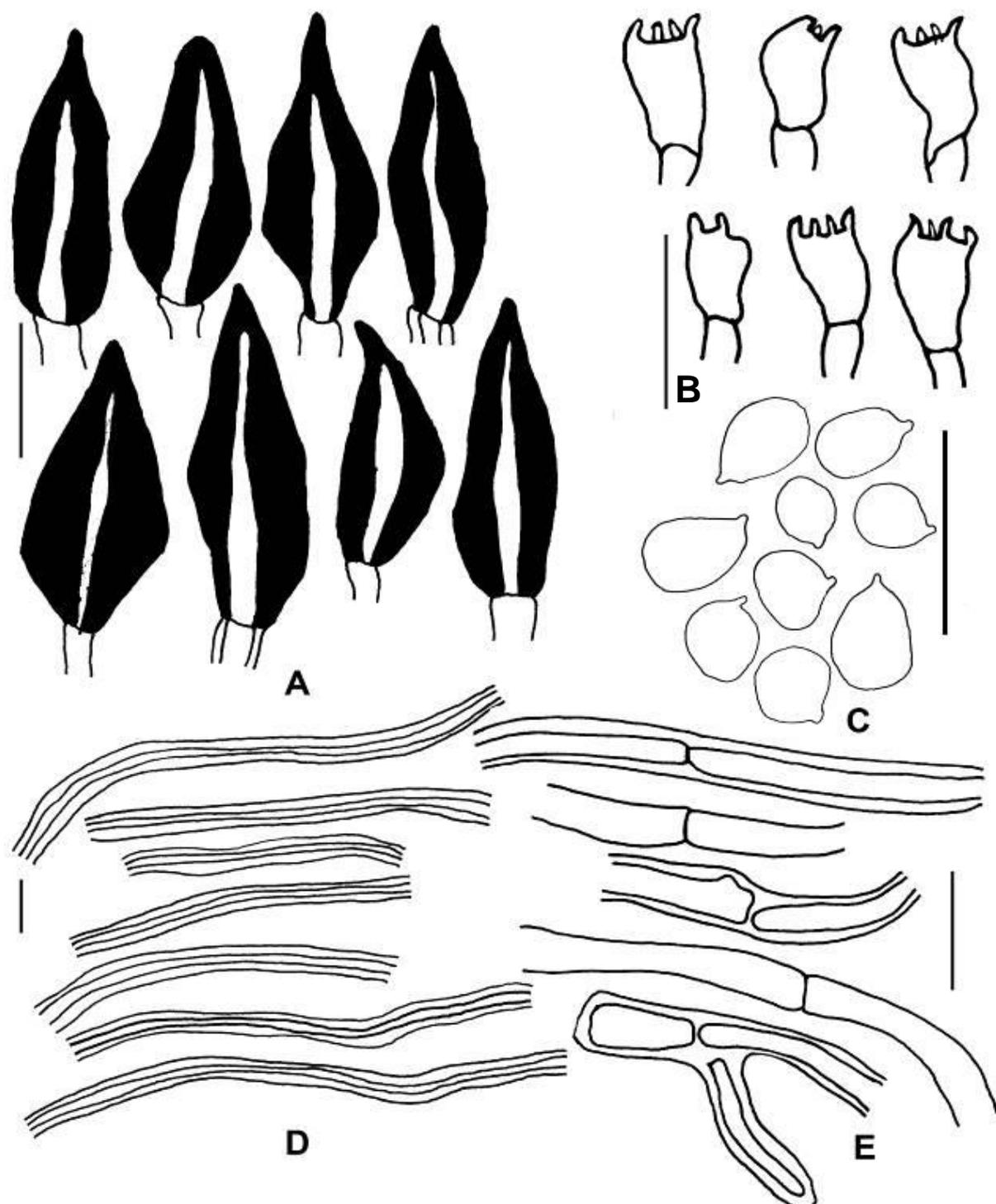


Figure 8. *Phellinus gilvus* (Schwein.) Pat.: **A**, Hymenial setae; **B**, Basidia; **C**, Basidiospores; **D**, Skeletal hyphae; **E**, Generative hyphae. [Scale bars: A–D = 10 μ m]

ibid., KWLS, Basraun, alt. 210 m, N 24° 34' 48.9" E 85° 37' 44.8", on dead wood log, 06.09.2010, *Arvind Parihar* AP 44937; ibid., KWLS, Koderma enclosure, alt. 390 m, N 24° 29' 18.7" E 85° 35' 50.1", on dead wood log, 16.09.2010, *Arvind Parihar* AP 44982; ibid., KWLS, Koderma enclosure, alt. 390 m, N 24° 29' 18.7" E 85° 35' 50.1", on dead wood log, 11.08.2010, *Arvind Parihar* AP 45018; KWLS, ibid., Chatarbar, alt. 379, N 24° 28' 01.90" E 85° 32' 13.10", on dead wood log, 13.08.2010, *Arvind Parihar* AP 45029, AP 45031; ibid., KWLS, Koderma NRF, Jamsoti road, Koderma NRF, alt. 396 m, N 24° 30' 02.4" E 85° 35' 03.5", on a dead wood log, 09.10.2012, *Arvind Parihar* AP 6588.

Notes: Basidiomata with golden yellow to brownish-yellow pilear surface with a reddish tint, imbricate habit, yellowish-brown minute pores and short tubes are quite distinct macromorphological characters. Microscopically, presence of abundant hymenial setae and ellipsoid, hyaline to pale yellow basidiospores are the characters that make this species distinct.



Figure 9. *Phellinus gilvus* (Schwein.) Pat.: **A**, Habitat; **B**, Habit; **C**, Basidiomata showing pore and margin; **D**, Basidiomata with scale showing pilear surface and pore surface. [Scale bar: C = 5 mm]

7. *Phellinus grenadensis* (Murrill) Ryvar den, Norw. JI Bot. 19: 234 (1972); *Pyropolyporus grenadensis* Murrill, *N. Amer. Fl.* (New York) 9(2): 107 (1908). Club 34: 479 (1907). **(Fig. 10)**

Basidiomata perennial, sessile, pileate. Pileus 35 × 40 mm, up to 15 mm thick near the base, dimidiate, applanate, unguulate, hard and woody when dry, pilear surface velutinate to tomentose, sulcate, azonate, greyish orange (5B5) to brownish orange (5C5). Hymenophore poroid, light brown (5D5–5D6); pores 6–7 per mm, round, regular, minute. Context up to 8 mm thick, solid, hard, light orange (5A5).

Hyphal system dimitic; generative hyphae 3–4 μm wide, hyaline; skeletal hyphae 4–5 μm wide, dark brown. Basidiospores 4–6 × 4–5 μm, globose to ellipsoid, thick-walled, golden yellow to pale brown, inamyloid.

Specimens examined: INDIA, Jharkhand, Koderma, KWLS, Chatarbar, Mahuataan, alt. 319 m, N 24° 27' 59.3" E 85° 33' 56.7", on a dead wood log, 12.10.2012, *Arvind Parihar* AP 6620; *ibid.*, KWLS, Meghatari, Suggi point, alt. 320 m, N 24° 33' 43.8" E 85° 35' 20.1", on a dead wood log, 15.08.2011, *Arvind Parihar* AP 45061.

Notes: The size of pores, wide contextual hyphae and subglobose basidiospores delimit it under present taxon and are on the conformity with the earlier reports from India (Sharma 1995).

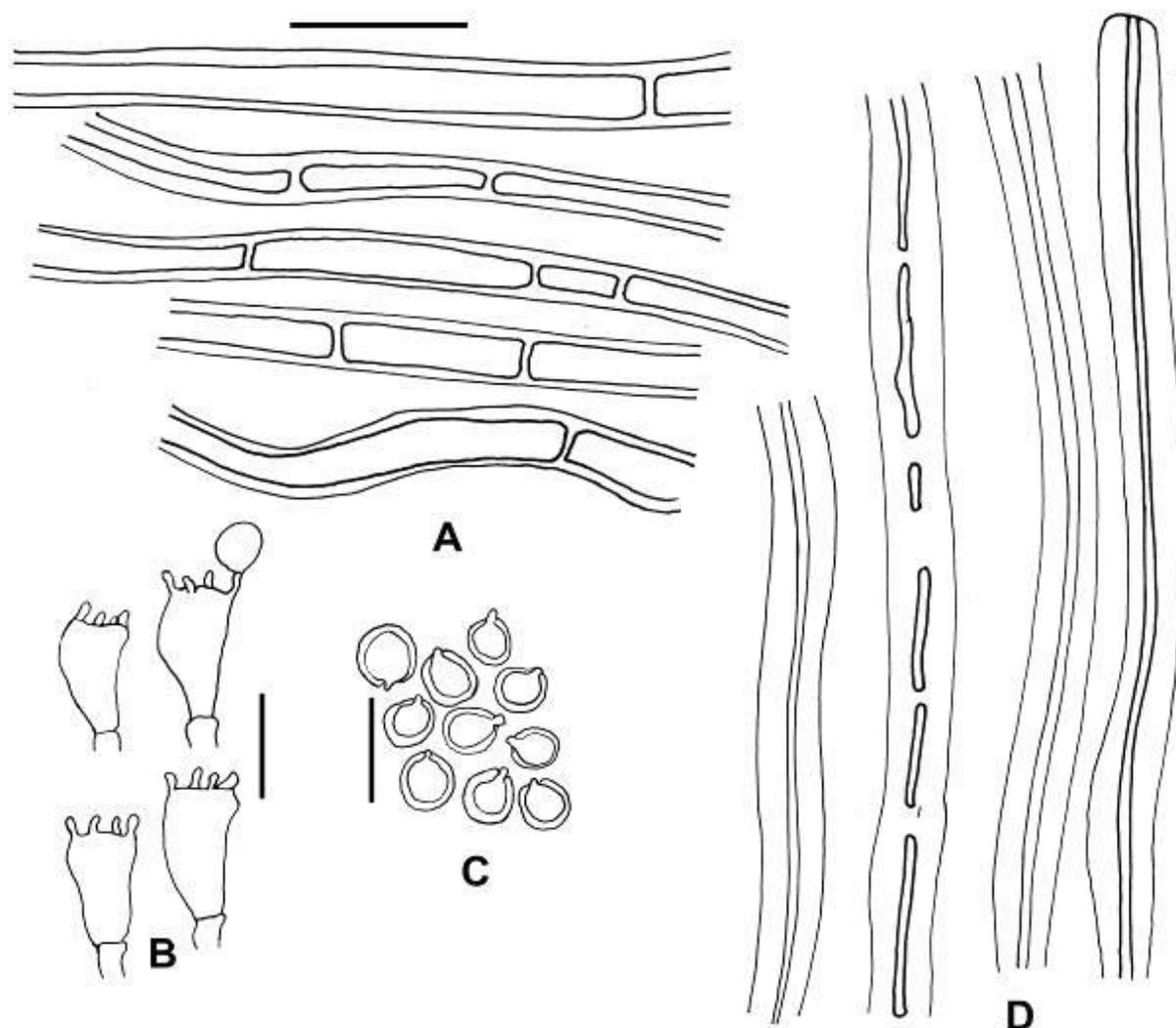


Figure 10. *Phellinus grenadensis* (Murrill) Ryvardeen: **A**, Generative hyphae; **B**, Basidia; **C**, Basidiospores; **D**, Skeletal hyphae. [Scale bars: A–C = 10 µm]

8. *Phellinus rimosus* (Berk.) Pilát, *Annls mycol.* 38(1): 80 (1940); *Polypores rimosus* Berk., *London J. Bot.* 4: 54 (1845). **(Figs. 11 & 12)**

Basidiomata perennial, solitary, pileate, attached with a contracted base. Pileus 45–110 × 40–50 mm, 25–40 mm thick near the base, dimidiate to applanate, woody, hard; pilear surface glabrous when young, rough when mature, rimose, sulcate, cracked and forming black polygonal shapes, zonate, yellowish-brown (5D5) to light brown (5D6) in young specimens while linoleum brown (5E7) to brown (5F7) in mature specimens. Hymenophore poroid, light brown (5D4) to clay (5D5); pores 4–6 per mm, round, regular. Context 10–30 mm thick, shiny, lustrous, hard, dark brown (7F7–8F7).

Hyphal system dimitic; generative hyphae 3–5 µm wide, hyaline to pale yellow; skeletal hyphae 4–8 µm wide, dark rusty brown to reddish-brown in KOH. Basidiospores 5.0–6.5 × 4.5–6.0 µm, globose to subglobose, slightly thick-walled, rusty brown, acyanophilic, inamyloid.

Specimens examined: INDIA, Jharkhand, Koderma, KWLS, near Jamsoti, alt. 329 m, N 24° 31' 52.8" E 85° 35' 54.1", on a dead wood log, 19.09.2013, *Arvind Parihar* AP 6645; *ibid.*, KWLS, Dhodhakhola, alt. 358 m, N 24° 32' 01.6" E 85° 35' 41.4", on a dead wood log, 28.09.2013, *Arvind Parihar* AP 6691.

Notes: The woody, hard basidiomata with zonate and deeply cracked pilear surface with polygonal scales are very characteristic features of this species. *Phellinus badius* is also a species which shares the characters like zonate basidiomata with cracked pilear surface but shallow cracks, absence of polygonal scales on pilear surface and smaller pores separate it from the present species. Microscopic features like the absence of any setal elements and thick-walled, globose to subglobose, rusty brown basidiospores are important and distinguishing features of this species.

Key to the species

- 1. Basidiomata cracked on maturity..... 2
- 1a. Not as above 4
- 2. Basidiospores rusty brown *Phellinus rimosus*
- 2a. Basidiospores pale yellow to light brown to hyaline 3
- 3. Basidiospores hyaline to pale yellow; Context up to 5 mm thick *P. adamantinus*
- 3a. Basidiospores pale yellow to light brown; Context up to 20 mm thick *P. badius*
- 4. Basidiospores distinctly thick-walled 5
- 4a. Basidiospores thin-walled 6
- 5. Basidiomata pileate; pilear surface without a distinct black crust at the base *P. grenadensis*
- 5a. Basidiomata resupinate to effused reflexed; pilear with a distinct black crust at the base *P. allardii*
- 6. Hymenial setae absent 7
- 6a. Hymenial setae present *P. gilvus*
- 7. Pores 4–5 per mm *P. crocatus*
- 7a. Pores 7–10 per mm *P. fastuosus*

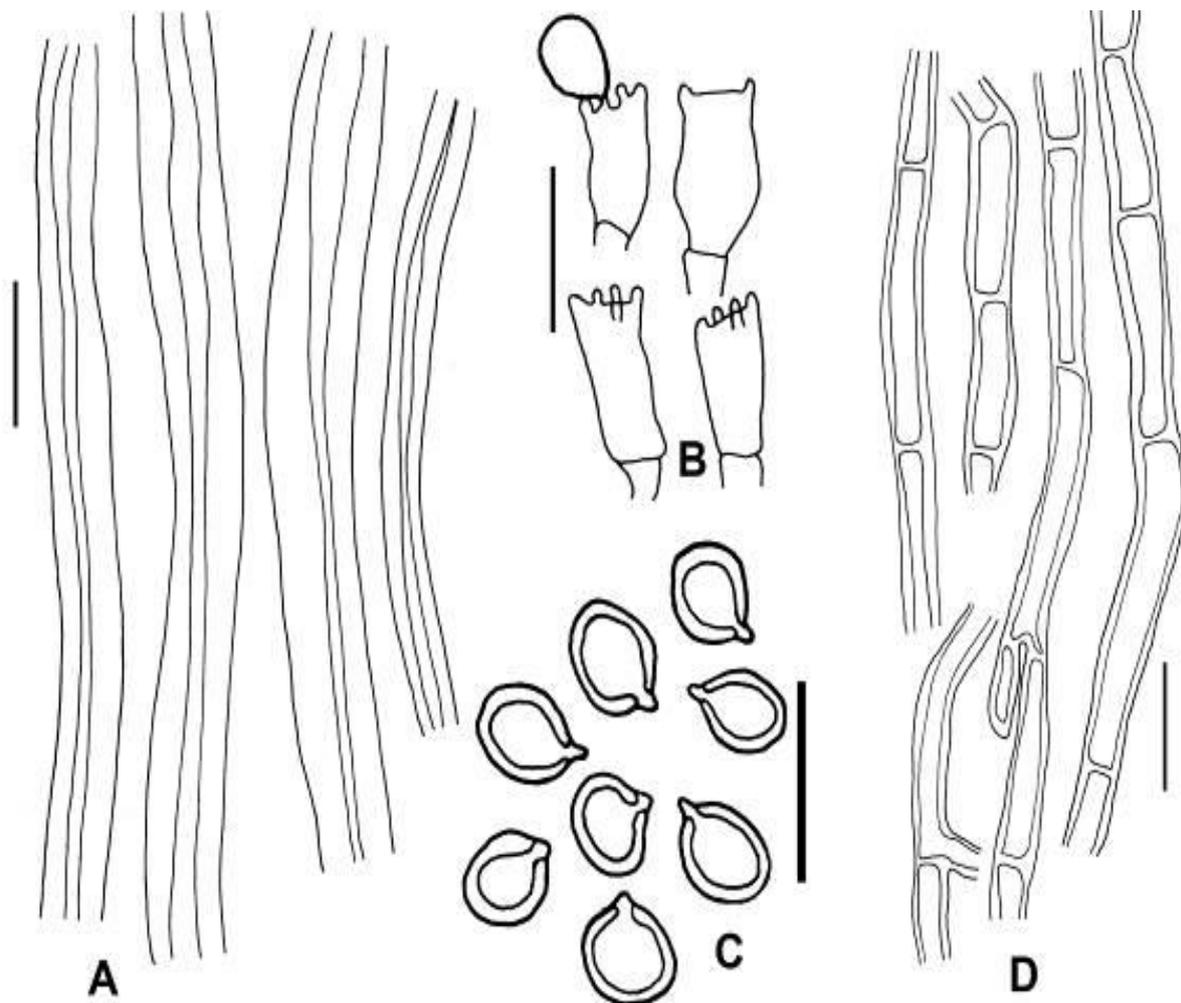


Figure 11. *Phellinus rimosus* (Berk.) Pilát: **A**, Skeletal hyphae; **B**, Basidia; **C**, Basidiospores; **D**, Generative hyphae. [Scale bars: A–D = 10 µm]

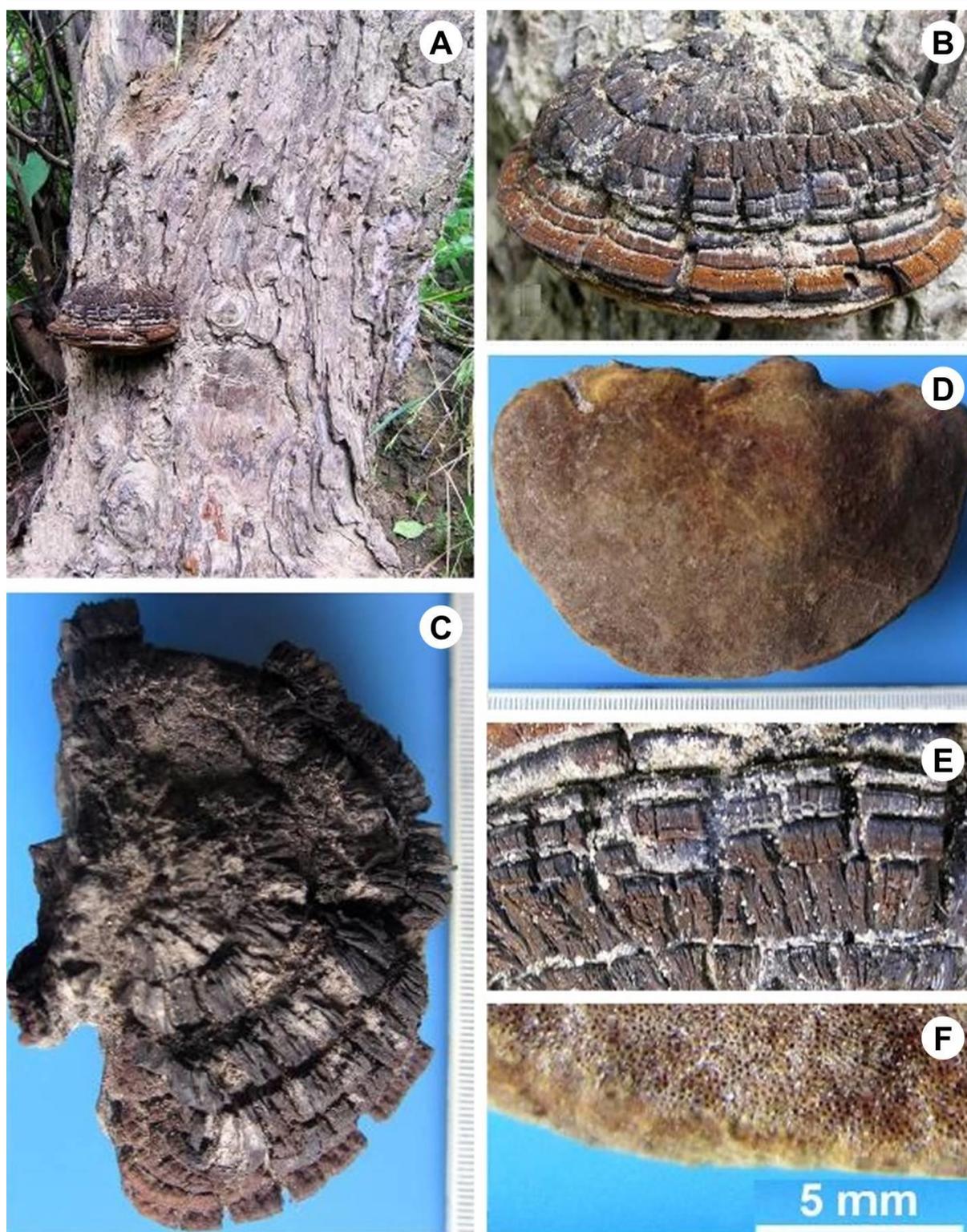


Figure 12. *Phellinus rimosus* (Berk.) Pilát: **A**, Habitat; **B**, Habit; **C**, Basidiomata with scale showing cracks on pilear surface; **D**, Basidiomata with scale showing pore surface; **E**, Cracks on pilear surface; **F**, Basidiomata showing pores. [Scale bar: F = 5 mm]

CONCLUSION

Phellinus, one of the dominating wood rotting genera of macrofungi in this sanctuary is well represented by 8 species. A wide range of variation in macromorphological features of different species are observed. The basidiomata are pileate to resupinate, pileus dark brown to black sometimes with a crust, surface hirsute to glabrous, often sulcate and radially cracked in older basidiomata, pores variable, tubes usually stratified, context thin and dense but sometimes with a black line present in the context. The micromorphological features of this genus show a wide range of variations as well, with hymenial setae absent or present spores of variable shape and size, hyaline to rusty brown, thin-walled to thick-walled. These species cause white rot to the trees and a www.tropicalplantresearch.com

lead to substantial loss of trees and probably the genus *Phellinus* is responsible for more timber loss than any other genus of wood destroying fungi (Larsen & Cobb-Pouille 1990). Distribution of different species in the study area varies as *Phellinus gilvus* is the most common species distributed in almost every part of the sanctuary with eight collections, followed by *Phellinus badius* with five collections from the different parts of the sanctuary. *Phellinus crocatus* seems to be rare and only a single collection could be collected.

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