

## Some interesting records of corticioid and poroid fungi from district Kullu (Himachal Pradesh)

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### ABSTRACT

An account of three corticioid fungi i.e., *Byssomerulius corium* (Pers.) Parmasto, *Crustoderma drynium* (Berk. & M.A. Curtis) Parmasto, *Skvortzovia georgica* (Parmasto) G. Gruhn & Hallenb. and four poroid species i.e., *Earliella scabrosa* (Pers.) Gilb. & Ryvardeen, *Ganoderma australe* (Fr.) Pat., *Physisporinus lineatus* (Pers.) F. Wu, Jia J. Chen & Y.C. Dai and *Pycnoporus sanguineus* (L.) Murrill, is presented based on the collections made from district Kullu (Himachal Pradesh). All these seven species are new additions to the mycoflora of district Kullu (Himachal Pradesh). Of these, *Skvortzovia georgica* and *Pycnoporus sanguineus* are being described as new record for India and Himachal Pradesh, respectively. It is also important to mention here that five of the genera namely, *Byssomerulius*, *Crustoderma*, *Earliella*, *Pycnoporus* and *Skvortzovia* are being described for the first time from the study area.

**KEYWORDS:** Corticioids, polypores, wood rotting fungi, resupinate, basidiocarp.

### INTRODUCTION

The corticioid and poroid fungi (*Agaricomycetes*, *Basidiomycota*) are characteristic in having annual to perennial, resupinate to effused-reflexed to pileate, sessile to stipitate basidiocarps. The hymenium is exposed, organised either in the form of a sheet on the substrate (corticioid fungi) or is lining the tubes (poroid fungi) that open through pore. These fungi are mainly responsible for wood decay and few of them are forest pathogens. Some of these fungi are also used in the traditional medicinal system. Earlier workers (Rattan, 1977; Singh, 2007; Dhingra *et al.*, 2014; Priyanka, 2012; Kaur, 2012; Sharma, 2012; Kaur, 2013 and Prasher and Ashok, 2013) described 271 taxa of these fungi from district Kullu in Himachal Pradesh. During the fungal forays conducted in different localities of district Kullu in Himachal Pradesh in the rainy season of the years 2014-2016, some interesting specimens of corticioid and poroid fungi were collected. The morphotaxonomic details of these fungi when compared with the literature, (Bakshi, 1971; Rattan, 1977; Bernicchia and Gorjon, 2010; Sharma, 2000, 2012; Ryvardeen and Melo, 2014; Kaur, 2017; Kaur *et al.*, 2017a,b, 2018; Brar *et al.*, 2018; Mycobank, 2019) resulted in the identification of three corticioid i.e. *Byssomerulius corium* (Pers.) Parmasto, *Crustoderma drynium* (Berk. and M.A. Curtis) Parmasto, *Skvortzovia georgica* (Parmasto) G. Gruhn & Hallenb. and four poroid species i.e. *Earliella scabrosa* (Pers.) Gilb. & Ryvardeen, *Ganoderma australe* (Fr.) Pat., *Physisporinus lineatus* (Pers.) F. Wu, Jia J. Chen & Y.C. Dai and *Pycnoporus sanguineus* (L.) Murrill. All the seven species are new additions to the mycoflora of district Kullu (Himachal Pradesh). It is pertinent to mention here that *Skvortzovia georgica* is being described for the first time from India and *Pycnoporus sanguineus* is a new record for Himachal Pradesh. Five genera i.e. *Byssomerulius*, *Crustoderma*, *Earliella*, *Pycnoporus* and *Skvortzovia* are new generic records for the study area. The colour standards followed are as per Kornerup and Wanscher (1978).

### TAXONOMIC DESCRIPTIONS

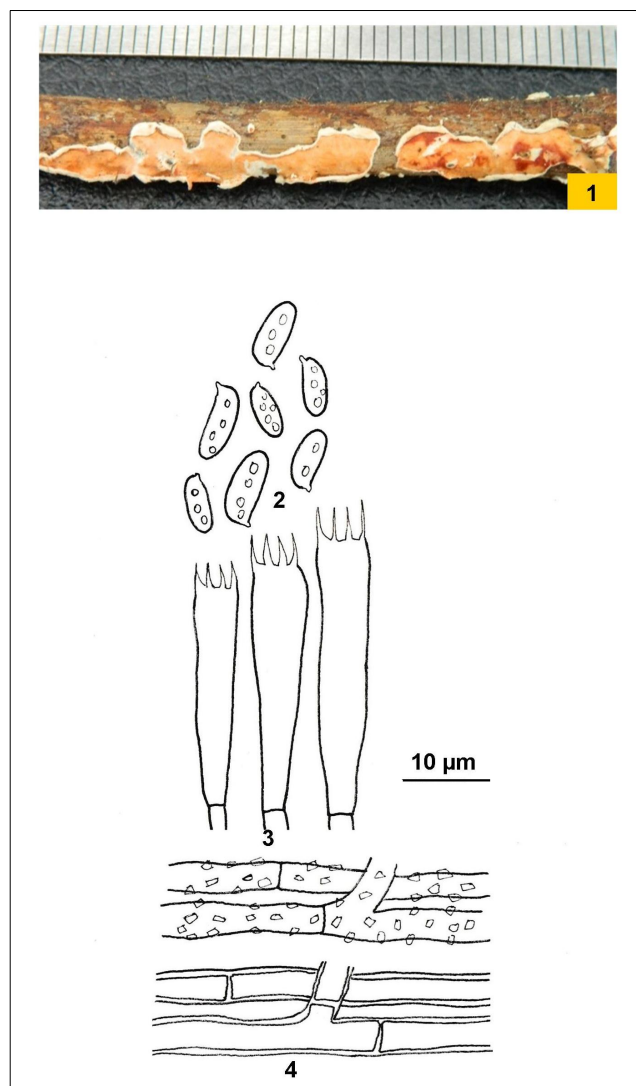
**1. *Byssomerulius corium*** (Pers.) Parmasto, *Eesti NSV Teaduste Akadeemia Toimetised* 16: 383, 1967.

*Thelephora corium* Pers., *Synopsis methodica fungorum*: 574, 1801.

**Figs. 1-4**

**Basidiocarp** resupinate, effused, adnate, ≤ 250 µm thick in

section; hymenial surface merulioid, orange white to pale orange when fresh, grayish orange on drying; margin thinning, become reflexed with age, paler concolorous to indeterminate. **Hyphal system** monomitic. Generative



**Figs. 1-4 *Byssomerulius corium*:** 1. Basidiocarp showing hymenial surface; 2. Basidiospores; 3. Basidia; 4. Generative hyphae.

hyphae branched, septate, without clamps, incrustated with needle like crystals; basal hyphae up to 5  $\mu\text{m}$  wide, thick-walled, loosely interwoven; subhymenial hyphae up to 3.2  $\mu\text{m}$  wide, thin- to somewhat thick-walled, compact, vertical. **Cystidia** none. **Basidia** 27-34  $\times$  5.6-6.8  $\mu\text{m}$ , narrowly clavate, without basal clamp, 4-sterigmate; sterigmata up to 4.8  $\mu\text{m}$  long. **Basidiospores** 5-7  $\times$  2.4-3  $\mu\text{m}$ , ellipsoid, thin-walled, smooth, acyanophilous, inamyloid.

**Collection examined:** Himachal Pradesh: Kullu, Banjar, Manglore, on sticks of *Rubus ellipticus*, Ellu 9559 (PUN), 6.08.2014.

**Remarks:** Bakshi (1971) described this species for the first time from India as *Merulius corium* from Dehradun (Uttarakhand). Later, Dhingra *et al.*, (2011) listed it as *Byssomerulius corium* from Eastern Himalaya. Sharma (2012) and Sanyal (2014) described it from Uttarakhand. Ranadive (2013) also listed it but without mentioning the specific localities, in his check list. Recently, Kaur *et al.*, (2018) described it from district Shimla in Himachal Pradesh.

**2. *Crustoderma dryinum*** (Berk. & M.A. Curtis) Parmasto, *Consp. System. Corticiac. (Tartu)*: 88, 1968.

*Corticium dryinum* Berk. and M.A. Curtis, *Grevillea* **1**(12): 179, 1873

**Figs. 5-9**

**Basidiocarp** resupinate, effused, adnate,  $\leq$  300  $\mu\text{m}$  thick in section; hymenial surface smooth to tuberculate, orange white to pale orange to light grayish orange when fresh, somewhat darkening on drying; margin thinning, paler to concolorous. **Hyphal system** monomitic. Generative hyphae up to 6  $\mu\text{m}$  wide, branched, septate, clamped; basal hyphae thick-walled; subhymenial hyphae thin- to thick-walled. **Cystidia** 94-112  $\times$  9-10  $\mu\text{m}$ , subcylindrical, thick-walled, with basal clamp; projecting up to 58  $\mu\text{m}$  out of the hymenium. **Basidia** 20.5-32.5  $\times$  5.5-7  $\mu\text{m}$ , clavate, with basal clamp, 4-sterigmate; sterigmata up to 5  $\mu\text{m}$  long. **Basidiospores** 6.8-10  $\times$  3-4.3  $\mu\text{m}$ , ellipsoid to subcylindrical, thin-walled, smooth, inamyloid, acyanophilous.

**Collection examined:** Himachal Pradesh: Kullu, Banjar, Manglore, Tippra, on decaying stump of *Cedrus deodara*, Ellu 9560 (PUN), 25.09.2015.

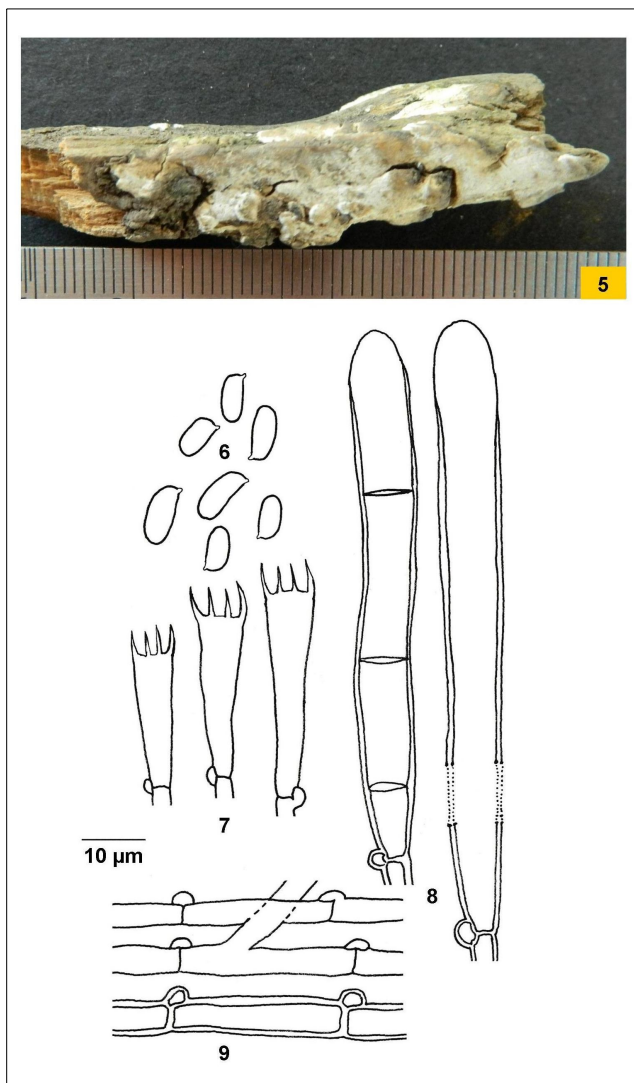
**Remarks:** *Crustoderma dryinum* was reported for the first time from Eastern Himalaya by Thind and Dhingra (1985). Besides Eastern Himalaya, it is also known from district Shimla, Chamba and Solan in Himachal Pradesh based upon the reports by Singh (2007), Priyanka (2012) and Dhingra *et al.* (2014).

**3. *Earliella scabrosa*** (Pers.) Gilb. & Ryvarden, *Mycotaxon* **22**(2): 364, 1985.

*Polyporus scabrosus* Pers., *Botanique (Nagpur)* **5**: 172, 1827.

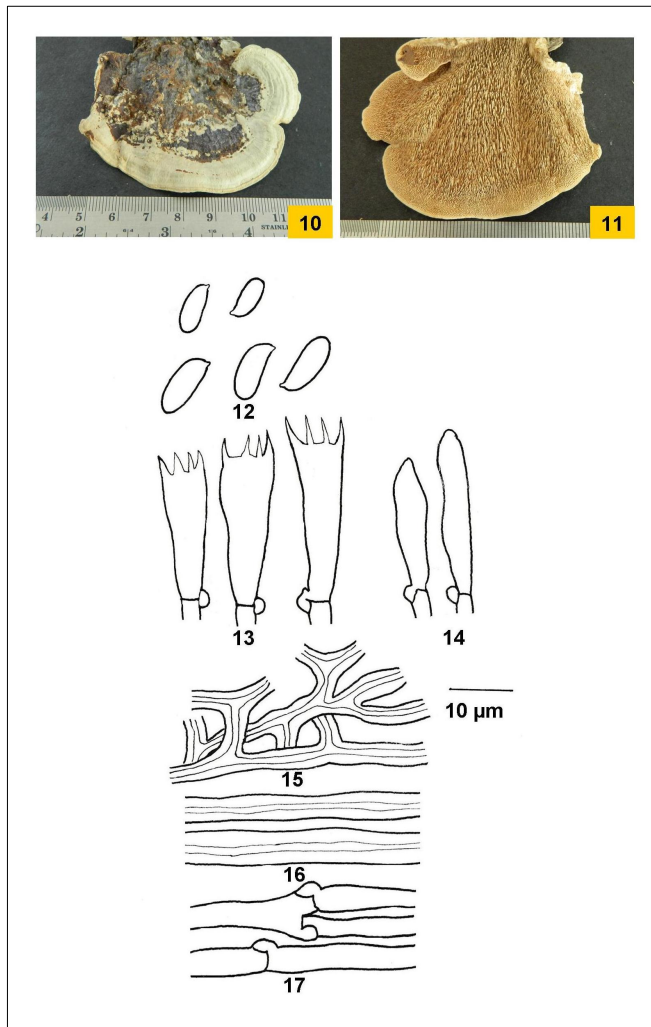
**Figs. 10-17**

**Basidiocarp** annual, effused-reflexed to pileate, solitary to imbricate; pilei up to 4  $\times$  3  $\times$  0.8 cm, applanate, coriaceous to tough when fresh, hard and woody on drying; abhymenial surface smooth to tomentose, radially sulcate, azonate to zonate, yellowish white to greyish orange and covered with a thin, reddish brown to dark brown cuticle which starts from



**Figs. 5-9 *Crustoderma dryinum*:** 5. Basidiocarp showing hymenial surface; 6. Basidiospores; 7. Basidia; 8. Cystidia and 9. Generative hyphae.

the base and extends towards the margins when fresh, somewhat darkening on drying; hymenial surface poroid, orange white to greyish orange when fresh, somewhat darker on drying; pores round to angular to daedaleoid, 2-3 per mm; dissepiments thin, entire; context homogenous, up to 5 mm thick, orange white; pore tubes up to 3 mm long, concolorous with hymenial surface; margins acute to obtuse, regular to somewhat wavy, sterile up to 1 mm on the hymenial surface, concolorous on both the sides. **Hyphal system** trimitic. Generative hyphae up to 4  $\mu\text{m}$  wide, branched, septate, clamped, thin-walled, subhyaline; skeletal hyphae up to 5.6  $\mu\text{m}$  wide, unbranched, aseptate, thick-walled; binding hyphae up to 3.7  $\mu\text{m}$  wide, irregularly branched, aseptate, thick-walled. **Cystidia** absent, but cystidioles present in the hymenial layer, 20.6-26  $\times$  4-5  $\mu\text{m}$ , fusoid, thin-walled, with basal clamp. **Basidia** 20-25  $\times$  6.8-8  $\mu\text{m}$ , clavate, subhyaline, with basal clamp, 4-sterigmate; sterigmata up to 4  $\mu\text{m}$  long. **Basidiospores** 6.8-10  $\times$  3-4.3  $\mu\text{m}$ , ellipsoid to subcylindrical, smooth, subhyaline, inamyloid, acyanophilous.



**Figs. 10-17 *Earliella scabrosa*:** 10. Basidiocarp showing abhymenial surface; 11. Basidiocarp showing hymenial surface; 12. Basidiospores; 13. Basidia; 14. Cystidioles; 15. Binding hyphae; 16. Skeletal hyphae; 17. Generative hyphae.

**Collection examined:** Himachal Pradesh: Kullu, Banjar (Tandi), on angiospermous log, Ellu 9561 (PUN), 26.09.2015.

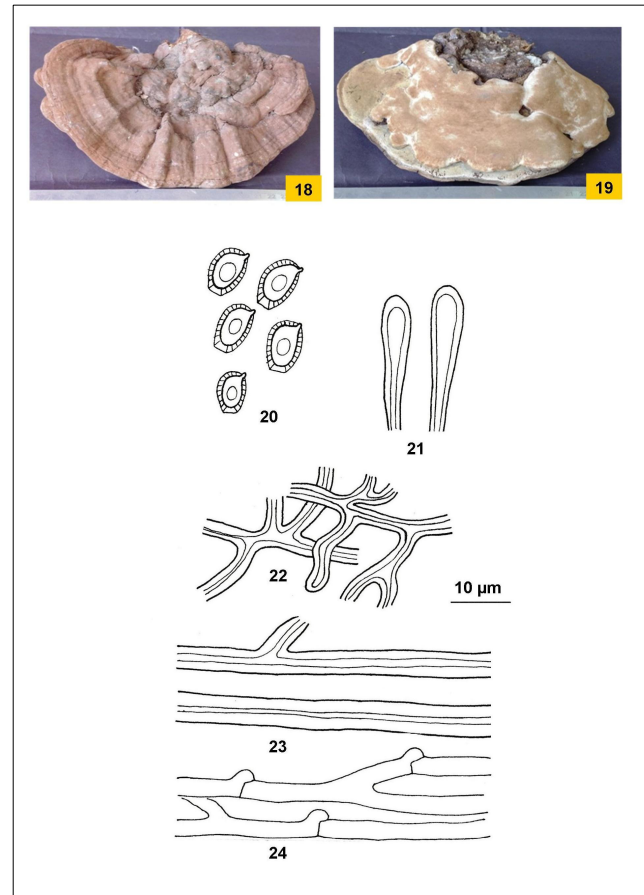
**Remarks:** From India, *E. scabrosa* was first described by Berkeley (1854) as *Trametes hookeri* based on specimens collected from Darjeeling (West Bengal). Sharma (1997) and Leelavathy and Ganesh (2000) reported it as *Trametes scabrosa* from Sikkim and Kerala, respectively. However, Sharma (2000) listed it as *Earliella scabrosa* in the genera of Indian polypores. Kaur (2013) and Kaur *et al.* (2017a) also described it as *Earliella scabrosa* from districts Una, Bilaspur, Sirmaur and Kangra in Himachal Pradesh.

**4. *Ganoderma australe*** (Fr.) Pat., *Bulletin de la Société Mycologique de France* 5: 71, 1889.

*Polyporus australis* Fr., *Elenchus Fungorum* 1: 108, 1828.

**Figs. 18-24**

**Basidiocarp** perennial, pileate, sessile, solitary to imbricate; pile up to 15 × 12 × 4 cm, dimidiate to applanate, corky to woody; abhymenial surface non-laccate, smooth to



**Figs. 18-24 *Ganoderma australe*:** 18. Basidiocarp showing abhymenial surface; 19. Basidiocarp showing hymenial surface; 20. Basidiospores; 21. Cuticular elements; 22. Binding hyphae; 23. Skeletal hyphae; 24. Generative hyphae.

rough to tuberculate, concentrically sulcate and weakly zonate, brown to dark brown when fresh, not changing much on drying, covered with spores; hymenial surface poroid, greyish yellow to brown when fresh, not changing much on drying; pores round, 3-4 per mm; dissepiments thin, entire; context homogenous, up to 3 cm thick, brown to dark brown; pore tubes up to 1 cm long, indistinctly stratified, brown, stuffed with white mycelium; margin thin, obtuse, regular, somewhat wavy, sterile, up to 1 mm on the hymenial surface, concolorous; pilear crust anamixodermis, very hard, not easily broken when depressed by nail, dark brown to blackish, shiny. **Hyphal system** trimitic. Generative hyphae up to 3.7 µm wide, branched, septate, clamped, thin-walled, subhyaline; skeletobinding hyphae up to 5 µm wide, arboriform, less branched near the stalk, more branched near the distal end, aseptate, thick-walled, brown; binding hyphae up to 3 µm wide, irregularly branched, aseptate, thick-walled. **Basidia** not seen. **Basidiospores** 7.5-9.3 × 5-6 µm, ellipsoid, truncate at the apex; exospore, thin, subhyaline, smooth; endospore, thick, echinulate, inamyloid, acyanophilous.

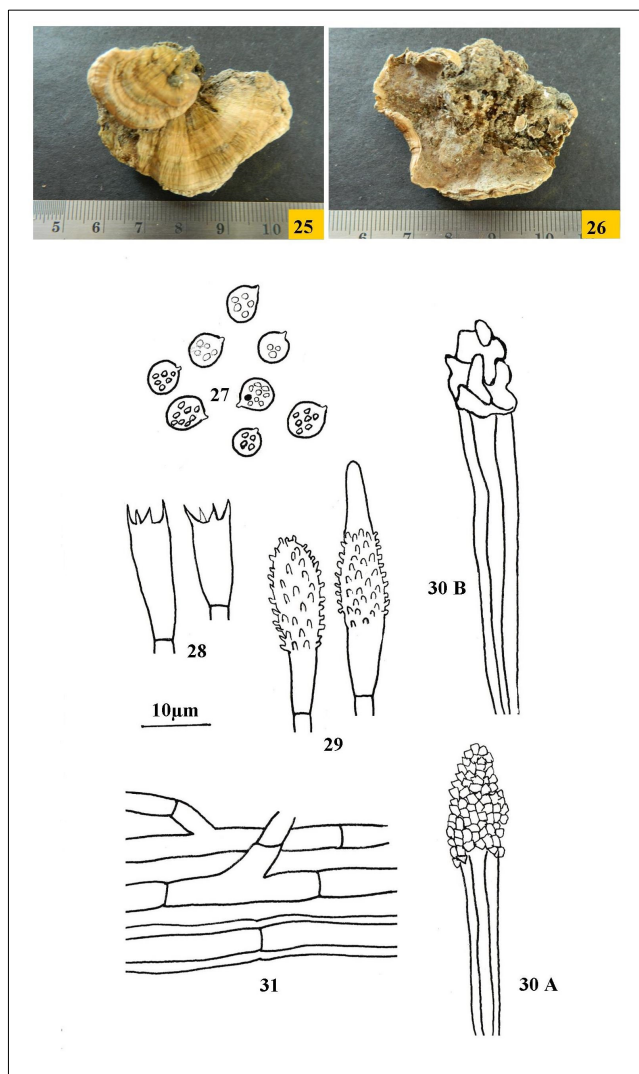
**Collection examined:** Himachal Pradesh: Kullu, Banjar, Manglore, on *Prunus persica* log, Ellu 9562 (PUN), 17.08.2015.

**Remarks:** *G. australe* was reported earlier from West Bengal, Kerala, district Kangra (Himachal Pradesh) and Union Territory of Chandigarh (Sharma and Ghosh, 1989; Leelavathy and Ganesh, 2000; Kaur, 2013; Kaur *et al.*, 2017b).

**5. *Physisporinus lineatus*** (Pers.) F. Wu, Jia J. Chen & Y.C. Dai, *Mycologia* **109** (5): 160, 2017.

*Polyporus lineatus* Pers., *Botanique* **5**:174, 1827. **Figs. 25-31**

**Basidiocarp** annual, effused-reflexed to pileate; pilei up to 6 × 4 × 0.6 cm, dimidiate, imbricate, coriaceous when fresh, woody hard on drying; abhymenial surface smooth, with fine concentric zones, yellowish white to pale orange to greyish orange to greenish (because of algal growth) when fresh, not changing much on drying; hymenial surface poroid, pale orange to greyish orange when fresh,



**Figs. 25-31** *Physisporinus lineatus*: 25. Basidiocarp showing abhymenial surface; 26. Basidiocarp showing hymenial surface; 27. Basidiospores; 28. Basidia; 29. Acanthocystidia; 30A Cystidium with encrustation; 30B. Cystidium with dissolved encrustation; 31. Generative hyphae.

not changing much on drying; pores round to angular, 6-9 per mm; dissepiments thin, entire; context homogenous up to 4 mm thick, orange white to pale orange; pore tubes up to 2 mm long, orange white; margin thinning, regular to wavy to lobed, incurved on drying, sterile up to 1 mm, paler to concolorous. **Hyphal system** monomitic. Generative hyphae up to 6.8 μm wide, branched, simple-septate, thin- to thick-walled, subhyaline. **Cystidia** 40.6-56 × 8-9 μm, cylindrical with somewhat swollen apical region, coarsely encrusted, thick-walled; generally embedded in trama to partly projecting into hymenium. **Acanthocystidia** 25-33 × 6-7 μm, generally present at the apex of dissepiments, hyaline, thin-walled, without basal clamp. **Basidia** 12-16.8 × 5-5.6 μm, clavate to subcylindrical, without basal clamp; 4-sterigmate; sterigmata up to 3 μm long. **Basidiospores** 4.3-5.6 × 4.3-5 μm in diameter, globose to subglobose, smooth, subhyaline, with oily contents, inamyloid, acyanophilous.

**Collection examined:** Himachal Pradesh: Kullu, Banjar, Manglore on angiospermous wood, Ellu 9567 (PUN), 10.10. 2014.

**Remarks:** *Physisporinus lineatus* was first recorded from India as *Polyporus zonalis* by Hennings (1900), Bose (1920) and Banerjee (1947). However, Bakshi (1971), Dhanda (1977), Leelavathy and Ganesh (2000) and Kaur (2013) described it under genus *Rigidoporus*.

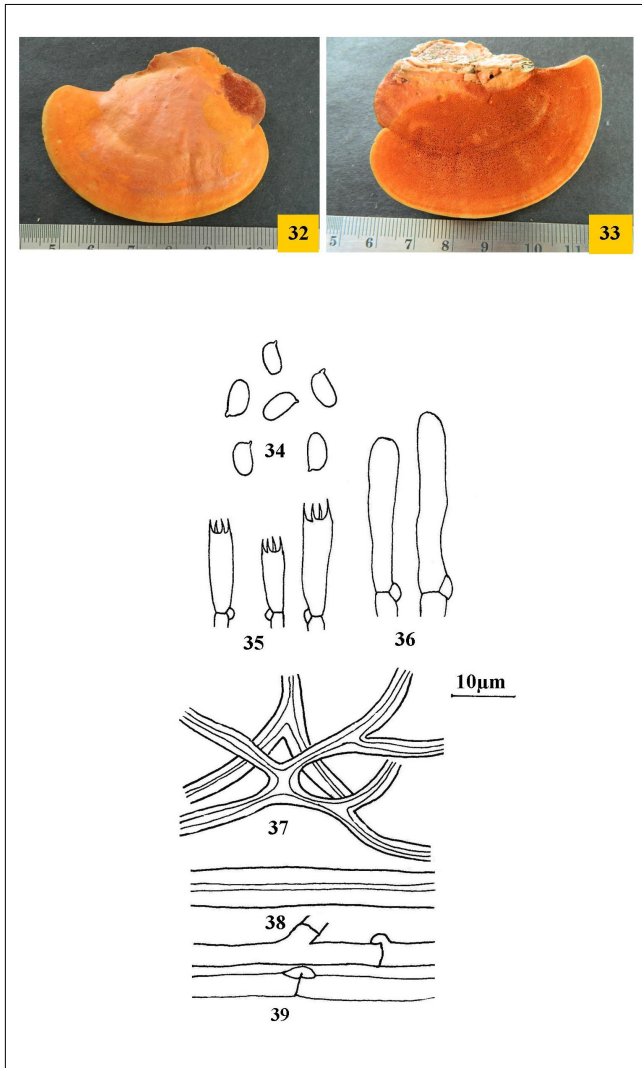
**6. *Pycnoporus sanguineus*** (L.) Murrill, *Bulletin of the Torrey Botanical Club* **31** (8): 421, 1904.

*Boletus sanguineus* L., *Species Plantarum*: 1646, 1763.

**Figs. 32-39**

**Basidiocarp** annual, effused-reflexed to pileate; pilei up to 5.2 × 4 × 0.3 cm, dimidiate, solitary to rarely imbricate; abhymenial surface smooth to tuberculate, azonate to faintly zonate, greyish orange to reddish orange when fresh, brownish red to reddish brown on drying; hymenial surface poroid, greyish red to brownish red when fresh, not changing much on drying; pores round to angular, 4-5 per mm; dissepiments thick, entire; context homogenous, up to 2 mm thick, orange; pore tubes up to 1 mm long, light orange; margin acute to round, regular to wavy to somewhat lobed, sterile up to 2 mm, light orange on both abhymenial and hymenial surface. **Hyphal system** trimitic. Generative hyphae up to 3.6 μm wide, branched, septate, clamped, thin-walled, subhyaline; skeletal hyphae up to 6 μm wide, rarely branched, aseptate, thick-walled, yellowish brown; binding hyphae up to 3 μm wide, irregularly branched, thick-walled, yellowish brown. **Cystidia** absent, but cystidioles present in hymenial layer, 23-28 × 4-4.5 μm, fusoid, thin-walled, with basal clamp. **Basidia** 9-15 × 4-5 μm, clavate to subclavate, with basal clamp, subhyaline, 4-sterigmate; sterigmata up to 2 μm long. **Basidiospores** 5-6 × 2.5-3 μm, ellipsoid to subcylindrical, smooth, subhyaline, inamyloid, acyanophilous.

**Collection examined:** Himachal Pradesh: Kullu, Banjar, Bahu, on angiospermous log, Ellu 9566 (PUN), 26. 09. 2015.



**Figs. 32-39** *Pycnoporus sanguineus*: 32. Basidiocarp showing abhymenial surface; 33. Basidiocarp showing hymenial surface; 34 Basidiospores; 35. Basidia; 36. Cystidioles; 37. binding hyphae; 38. Skeletal hyphae; 39. Generative hyphae.

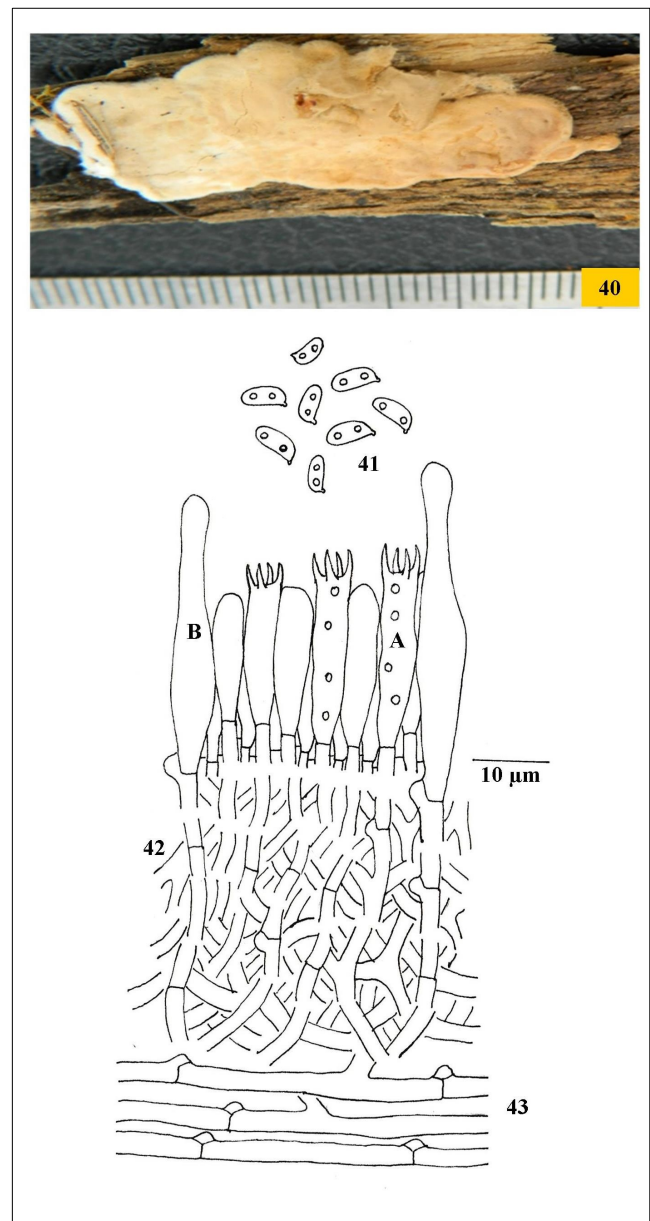
**Remarks:** Earlier reports of this species are from Uttarakhand (Dhanda, 1977; Sharma, 2012) and Kerala (Leelavathy and Ganesh 2000).

7. *Skvortzovia georgica* (Parmasto) G. Gruhn & Hallenb., *Bulletin Mycologique et Botanique Dauphiné-Savoie* **231**: 6, 2018.

*Phlebia georgica* Parmasto, *Eesti NSV Tead. Akad. Tom., Biol. seer* **16**:390, 1967.

**Figs. 40-43**

**Basidiocarp** resupinate, closely adnate, effused,  $\leq 280$  µm in section; hymenial surface, mostly smooth, creamish white when fresh, yellowish white on drying; margins varying, indeterminate. **Hyphal system** monomitic. Generative hyphae branched, septate, clamped; basal hyphae up to 3 µm, straight, sparsely branched, septate, thin- to thick-walled; subhymenial hyphae up to 2.5 µm wide, thin-walled, richly branched. **Cystidia** 35.6-43 × 5.6-6 µm, subfusiform, obtuse, often



**Figs. 40-43** *Skvortzovia georgica*: 40. Basidiocarp showing hymenial surface; 41. Basidiospores; 42. Reconstruction of hymenium and subhymenium (A. Basidium; B. Cystidium); 43. Generative hyphae.

subcapitate, thin-walled, with basal clamp; projecting up to 8 µm out of hymenium. **Basidia** 17-22 × 5-5.3 µm, clavate to subcylindrical, with basal clamp, 4-sterigmata; sterigmata up to 3 µm long. **Basidiospores** 5-6 × 1.8-2.5 µm, sub-allantoid, thin-walled, smooth, inamyloid, acyanophilous.

**Collection examined:** Himachal Pradesh: Kullu, Banjar, Gushaini, on *Cedrus deodara* log, Ellu 9565 (PUN), 10. 10. 2014.

**Remarks:** *Skvortzovia georgica* is unique in having somewhat smaller sub-allantoid basidiospores and is known from Russia, Sweden, Norway, USA (Mycobank, 2019). This is the first report of *Skvortzovia georgica* from India.

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