KAVAKA 49:10-14(2017)

Some noteworthy additions to family *Polyporaceae* from Himachal Pradesh

Ramandeep Kaur, Harpreet Kaur, Avneet Pal Singh*, Gurpreet Kaur** and Gurpaul Singh Dhingra
Department of Botany, Punjabi University, Patiala 147002, Punjab, India
***Department of Agriculture, Khalsa College, Amritsar 143002, Punjab, India*
**Corresponding author Email: avneetbot@gmail.com*
(Submitted in September, 2017; Accepted on November 30, 2017)

ABSTRACT

This paper provides an account of 8 species [*Diplomitoporus allantosporus* Ryvarden & Iturr., *D. flavescens* (Bres.) Domanski, *D. overholtsii* (Pilát) Gilb. & Ryvarden, *Earliella scabrosa* (Pers.) Gilb. & Ryvarden, *Hexagonia hirta* (P. Beauv.) Fr., *Pycnoporus cinnabarinus* (Jacq.) P. Karst., *Trichaptum abietinum* (Pers. ex J.F. Gmel.) Ryvarden and *Trametes versicolor* (L.) Lloyd] of family *Polyporaceae* (order-*Polyporales*, class-*Agaricomycetes*, subphylum-*Agaricomycotina* and phylum-*Basidiomycota*). Of these, *Diplomitoporus allantosporus*, *D. flavescens*, *D. overholtsii*, *Hexagonia hirta* and *Pycnoporus cinnabarinus* are being described for the first time from the state of Himachal Pradesh and all the three species of genus *Diplomitoporus* are also first reports from India.

Keywords: *Basidiomycota, Agaricomycetes*, Sirmaur, Himalaya

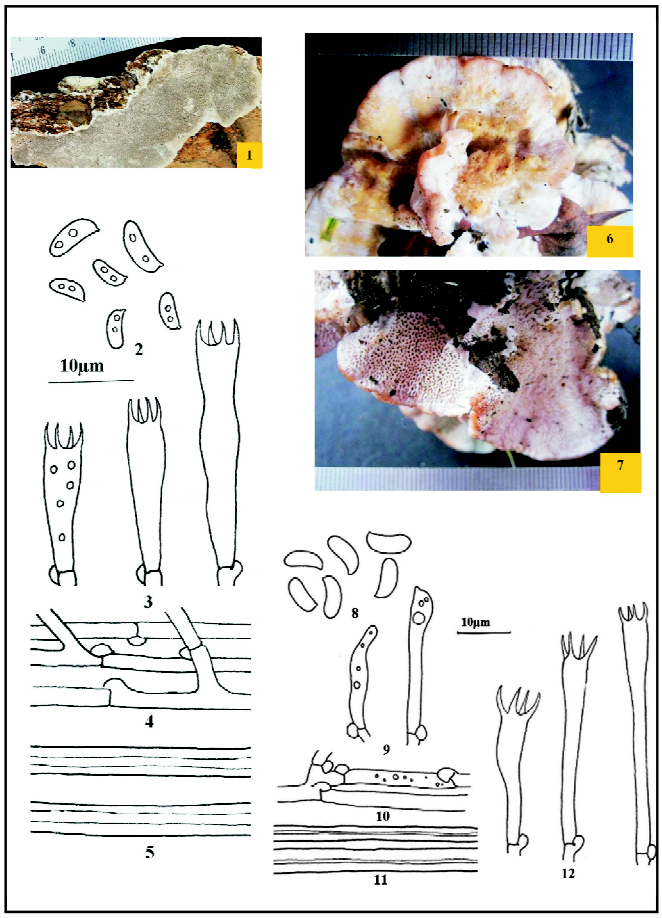
INTRODUCTION

Family *Polyporaceae* is characterized by resupinate, effused, reflexed to pileate, sessile to stipitate basidiocarps with gymnocarpic, unilateral hymenium lining the pores, color varying from whitish to some shades of yellow, grey, brown, violet, blue or red, hyphal system monomitic, dimitic or trimitic, cystidia present or absent, setae absent, basidiospores cylindrical to allantoid, usually thin-walled, subhyaline, smooth, not stained in Melzer's reagent. As per Hibbet *et al.* (2007) and Kirk *et al.* (2008), the family has been placed in order *Polyporales*, class *Agaricomycetes*, subphylum *Agaricomycotina* and phylum *Basidiomycota*. An account of 8 species belonging to 6 genera (*Diplomitoporus* - 3 species and 1 species each of *Hexagonia*, *Earliella*, *Pycnoporus*, *Trichaptum* and *Trametes*) of this family has been provided, which is based on collections made from Himachal Pradesh. All the 8 species have been identified on the basis of their macroscopic and microscopic features by consulting their descriptions given by Berkeley (1854), Domanski (1970), Bakshi (1971), Sharma (2000 and 2012), Ryvarden and Iturriaga (2004), Ryvarden and Melo (2014), Baltazar *et al.* (2014) and Mycobank (2017). These include five new records namely *Diplomitoporus allantosporus* Ryvarden & Iturr., *D. flavescens* (Bres.) Domanski, *D. overholtsii* (Pilát) Gilb. & Ryvarden, *Hexagonia hirta* (P. Beauv.) Fr. and *Pycnoporus cinnabarinus* (Jacq.) P. Karst. and three re-reports namely, *Earliella scabrosa* (Pers.) Gilb. & Ryvarden, *Trichaptum abietinum* (Pers. ex J.F. Gmel.) Ryvarden and *Trametes versicolor* (L.) Lloyd for the study area. It is pertinent to mention here that all the three species of *Diplomitoporus* are also first reports from India. The specimens pertaining to these species have been deposited in the herbarium of the Department of Botany, Punjabi University, Patiala (PUN). The color standards used are as per Methuen's Handbook of colors by Kornerup and Wanscher (1978). The taxonomic descriptions and illustrations of taxonomic details of the species included in this manuscript is given in the ongoing account.

TAXONOMY

1. ***Diplomitoporus allantosporus*** Ryvarden & Iturr., *Mycologia* **95**(6): 1067, 2004. **Figs. 1-5**

Basidiocarp annual, resupinate, adnate, up to 5 mm thick in section; hymenial surface poroid, greyish red when collected, not changing much on drying; pores round to angular, 3-4 per mm; dissepiments thin, entire; context up to 1 mm thick, yellowish white; pore tubes up to 4 mm deep, greyish red; margins thinning, fimbriate under lens, paler concolorous,



Figs 1-5. ***Diplomitoporus allantosporus****:* 1. Basidiocarp showing hymenial surface (fresh); 2. Basidiospores; 3. Basidia; 4. Generative hyphae; 5. Skeletal hyphae.
6-12. ***Diplomitoporus flavescens****:* Basidiocarp showing 6. Abhymenial surface (fresh); 7. Hymenial surface (fresh); 8. Basidiospores; 9. Cystidioles; 10. Generative hyphae; 11. Skeletal hyphae; 12. Basidia.

sterile up to 1 mm. **Hyphal system** dimitic. Generative hyphae branched, septate, clamped, up to 3 µm wide, thin- to slightly thick-walled. Skeletal hyphae unbranched, non-septate, up to 4 µm wide, thick-walled. **Cystidia** absent. **Basidia** clavate, usually sinuous, 14-26 × 4.2-4.7 µm, 4-sterigmate, with basal clamp; sterigmata up to 4.2 µm long. **Basidiospores** allantoid, 4.2-7 × 1.8- 2.4 µm, smooth, thin-walled, with oily contents, give negative reaction in Melzer's reagent as well as cotton blue.

Collection examined- Himachal Pradesh**:** Sirmaur, Rajgarh, on log of *Cedrus deodara*, Ramandeep and Avneet 8755 (PUN), September 13, 2016.

Remarks- This species is characteristic in having resupinate basidiocarp in combination with allantoid basidiospores and is being described for the first time from India. Earlier, it has been reported from Venezuela and Brazil [Ryvarden and Iturriaga (2004), Baltazar *et al.* (2014) and Mycobank (2017)].

2. ***Diplomitoporus flavescens*** (Bres.) Domański, *Acta Societatis Botanicorum Poloniae* **39**: 191, 1970. *Trametes flavescens* Bres., *Annales Mycologici* **1**(1): 81, 1903. **Figs. 6-12**

Basidiocarps annual, effused, reflexed to pileate, imbricate, pilei up to 4 × 3 × 0.6 cm, conchate, coriaceous when collected, hard on drying; abhymenial surface, azonate, smooth to tomentose, whitish when young, greyish orange to brownish orange with maturity and on bruising, scrupose, greyish orange to brownish orange on drying; hymenial surface poroid, orange white to greyish orange to brownish orange when fresh, somewhat darker on drying; pores round to angular to elongate, 1-2 per mm; dissepiments thin, entire to lacerate; pore tubes up to 4 mm deep, concolorous with hymenial surface; context up to 2 mm thick, orange white; margins acute, regular to irregular, somewhat incurved on drying, sterile up to 1 mm, concolorous. **Hyphal system** dimitic. Generative hyphae branched, septate, clamped, up to 3.3 µm wide, with oily contents, thin-walled in subhymenium, thick-walled in context and trama, subhyaline. Skeletal hyphae unbranched, non-septate, up to 5.2 µm wide, thick-walled, subhyaline. **Cystidia** absent, but fusoid cystidioles with oily contents (21-30 × 2.6-3.3 µm) present. **Basidia** clavate to subclavate, 25-47 × 4.6-5.2 µm, 4-sterigmate, with basal clamp; sterigmata up to 6.5 µm long. **Basidiospores** allantoid to ellipsoid, 7.5-8.5 × 2.6-3.6 µm, smooth, subhyaline, thin-walled, give negative reaction in Melzer's reagent as well as cotton blue.

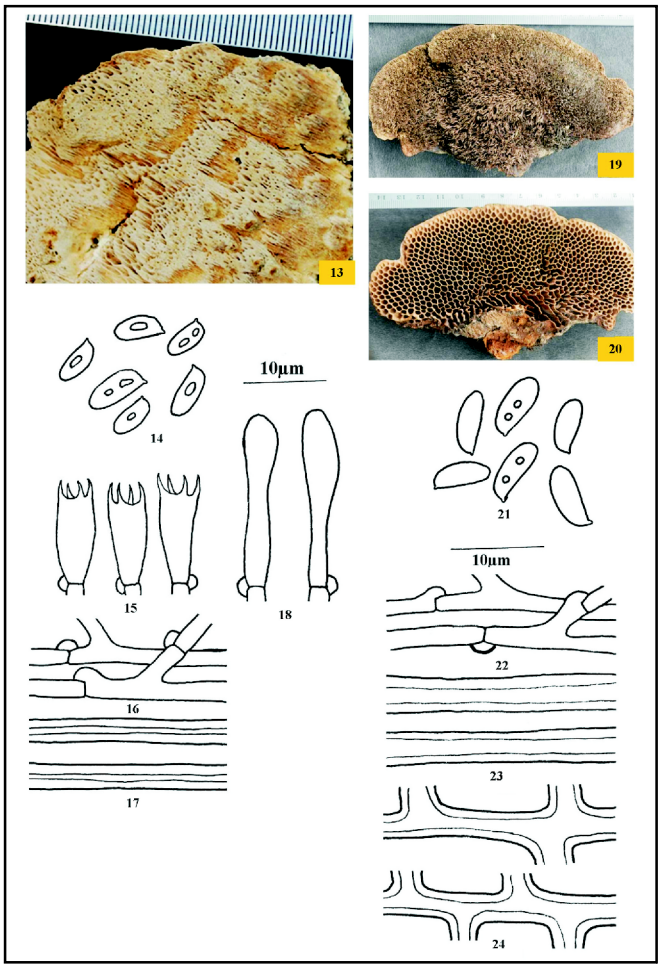
Collections examined- Himachal Pradesh: Chamba, Dalhousie, Ahla Panjpula forest, on gymnospermous log, Harpreet 5341 (PUN), September 16, 2009; Ahla Panjpula forest, on gymnospermous log, Dhingra 5342 (PUN), September 16, 2009; Mandi, Rewalsar, on angiospermous wood, Harpreet 5791 (PUN), July 31, 2011.

Remarks- This species is characteristic in having effused, reflexed to pileate, imbricate basidiocarps in combination with allantoid to ellipsoid basidiospores and is being described for the first time from India. Earlier, it has been reported from Austria, Poland, Czechoslovakia, Germany, France, Italy, China and Japan [Domanski (1970) and Mycobank (2017)].

3. *Diplomitoporus overholtsii* (Pilát) Gilb. & Ryvarden, *Mycotaxon* **22**(2): 364, 1985. *Poria overholtsii* Pilát, *Studia bot. cechosl.*: 2, 1940. **Figs. 13-18**

Basidiocarp annual, resupinate, adnate, up to 2 mm thick in section; hymenial surface poroid, greyish red when collected, not changing much on drying; pores angular, 3-4 per mm; dissepiments thin, lacerate; context up to 1 mm thick, greyish red; pore tubes up to 1 mm deep, greyish red; margins thinning, irregular, sterile up to 1mm, paler concolorous, or indeterminate. **Hyphal system** dimitic. Generative hyphae branched, septate, clamped, up to 2.3 µm wide, thin- to thick-walled. Skeletal hyphae rarely branched, non-septate, up to 3 µm wide, thick-walled. **Cystidia** absent, but fusoid cystidioles (21-22 × 4-5 µm) present. **Basidia** clavate, sometimes constricted, 11-12 × 4.2-4.7 µm, 4-sterigmate, with basal clamp; sterigmata up to 3 µm long. **Basidiospores** subfusiform to ellipsoid, 5.6-7.5 × 2.3-3 µm, smooth, thin-walled, with oily contents, give negative reaction in Melzer's reagent as well as cotton blue.

Collection examined- Himachal Pradesh**:** Sirmaur, Paonta



Figs 13-18. ***Diplomitoporus overholtsii****:* 13. Basidiocarp showing hymenial surface (fresh); 14. Basidiospores; 15. Basidia; 16. Generative hyphae; 17. Skeletal hyphae; 18. Cystidioles.

19-24. ***Hexagonia hirta***: Basidiocarp showing 19. Abhymenial surface (fresh); 20. Hymenial surface (fresh); 21. Basidiospores; 22. Generative hyphae; 23. Skeletal hyphae; 24. Binding hyphae.

Sahib, near Gurudwara sahib, on angiospermous stump, Ramandeep 8756 (PUN), October 7, 2016.

Remarks- This species differs from *Diplomitoporus allantosporus* in having fusoid cystidioles and subfusiform to ellipsoid basidiospores. It is being described for the first time from India. Earlier, it has been reported from Arizona and North America [Gilbertson and Ryvarden (1985) and Mycobank (2017)].

4. *Earliella scabrosa* (Pers.) Gilb. & Ryvarden, *Mycotaxon* **22**(2): 364, 1985. *Polyporus scabrosus* Pers., *Botanique (Nagpur)* **5**: 172, 1827.

Collections examined- Himachal Pradesh**:** Una, on stump of *Populus* sp, Harpreet 5629 (PUN), August 23, 2011; Bilaspur, Manjari, on dried trunk of *Morus alba*, Harpreet 5626 (PUN), August 23, 2011; Manjari, on log of *Dalbergia sissoo*, Harpreet 5628 (PUN), August 23, 2011; Kangra, Darkata, on angiospermous log, Dhingra 5627 (PUN), October 10, 2012; Darkata, at the base of tree of *M. alba*, Dhingra 5630 (PUN), October 4, 2012; Sirmaur, Paonta Sahib, Rajban, on log of *Shorea robusta*, Ramandeep 8757 (PUN), October 7, 2016; about 2 km from Rajban towards Staun, on log of *S. robusta*, Ramandeep 8758 (PUN), October 7, 2016.

Remarks- This species is characteristic in having reddish brown to dark brown cuticle. From India, it has earlier been reported by Berkeley (1854) as *Trametes hookeri* as well as *Daedalea emodensis* from West Bengal and Sikkim respectively, Bose (1920, 1928 and 1937) as *T. persoonii* and *T. hookeri* from West Bengal, Mitter and Tondon (1932) from Uttarakhand, Singh *et al.* (1961) from South Andamans as *T. persoonii*, Thind and Chatrath (1960) from Uttarakhand, Bakshi (1971) from plains of India as *T. corrugata*, Dhanda (1977) from Uttarakhand, Sharma and Ghosh (1989) from West Bengal, Sharma (1997) from Sikkim, Leelavathy and Ganesh (2000) from Kerala as *Trametes scabrosa*, Sharma (2000 and 2012) from district Kangra (H.P.) and Uttarakhand as *Earliella scabrosa*.

5. *Hexagonia hirta* (P. Beauv.) Fr., *Epicrisis Systematis Mycologici*: 496, 1838. *Favolus hirtus* P. Beauv., *Flore Oware Benin*: 74, 1806. **Figs. 19-24**

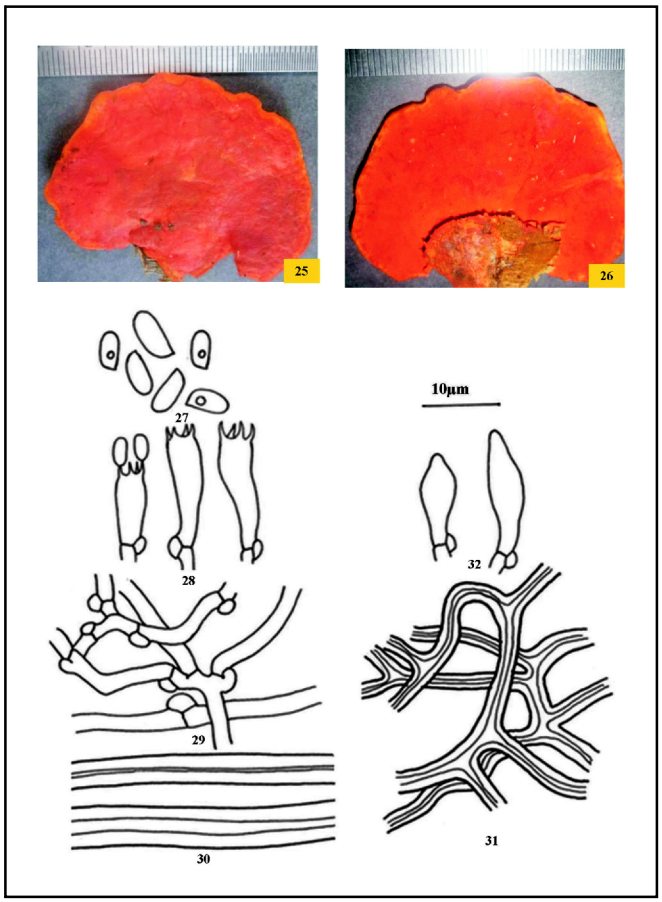
Basidiocarp annual, pileate, narrowly attached, solitary to imbricate, pilei up to 14×7×1.7 cm (without hair), dimidiate to flabelliform; abhymenial surface densely covered with dark hair, reddish brown to dark brown when collected, not changing much on drying; hymenial surface poroid, reddish brown to dark brown when collected, not changing much on drying; pores hexagonal, up to 3 mm wide; dissepiments thick, entire; pore tubes up to 12 mm deep, reddish brown; context up to 5 mm thick, soft, reddish brown; margins thinning, irregular, acute, concolorous on hymenial as well as abhymenial sides, sterile up to 2 mm. **Hyphal system** trimitic. Generative hyphae hyaline, thin-walled, clamped, up to 2.3 µm wide. Skeletal hyphae yellowish to pale brown, thick-walled, sometimes with few secondary septa, up to 2.8 µm wide. Binding hyphae subhyaline to yellowish, with slightly thickened walls, weakly to heavily branched, non-septate, up to 3.7 µm wide. **Cystidia** absent. **Basidia** not seen. **Basidiospores** cylindrical, 4.7-7 × 2.3-3.2 µm, smooth, thin-walled, give negative reaction in Melzer's reagent as well as cotton blue.

Collection examined- Himachal Pradesh**:** Sirmaur, Paonta Sahib, about 2 km from Rajban towards Staun, on log of *Shorea robusta*, Ramandeep 8759 (PUN), October 7, 2016.

Remarks- This species is peculiar in having abhymenial surface densely covered with dark hair and large hexagonal pores. From India, it has earlier been reported by Berkeley (1854) as *Hexagonia wightii* from Bihar, Bakshi (1971) as *H. sinensis* from North Western Himalaya and Sharma (2000 and 2012) as *H. hirta* from Arunachal Pradesh. Here, it is being described for the first time from Himachal Pradesh.

6. *Pycnoporus cinnabarinus* (Jacq.) P. Karst., *Revue Mycologique Toulouse* **3**(9): 18, 1881. *Boletus cinnabarinus* Jacq., *Flora Austriaca* **4**: 2, 1776. **Figs. 25-32**

Basidiocarps annual, pileate, solitary to rarely imbricate, pilei up to 5.2 × 4 × 0.3 cm, dimidiate; abhymenial surface smooth to tuberculate, azonate to faintly zonate, greyish orange to reddish orange to brownish red when collected, brownish red to reddish brown on drying; hymenial surface poroid, greyish red to brownish red when collected, not changing much on drying; pores round to angular, 4-5 per mm; dissepiments thick, entire; pore tubes up to 1 mm deep, light orange; context up to 2 mm thick, orange; margins acute



Figs 25-32. ***Pycnoporus cinnabarinus:*** Basidiocarp showing 25. Abhymenial surface (fresh); 26. Hymenial surface (fresh); 27. Basidiospores 28. Basidia 29. Generative hyphae; 30. Skeletal hyphae; 31. Binding hyphae; 32. Cystidioles.

to round, regular to wavy to somewhat lobed, sterile up to 2 mm, light orange. **Hyphal system** trimitic. Generative hyphae branched, septate, clamped, thin-walled, subhyaline, up to 2.6 µm wide. Skeletal hyphae rarely branched, aseptate, thick-walled, yellowish brown, up to 6 µm wide. Binding hyphae much branched, thick-walled, yellowish brown, up to 3.3 µm wide. **Cystidia** absent, but fusoid cystidioles (12-17 × 5.2-6.5 µm) present. **Basidia** clavate to subclavate, subhyaline, 9.8-15 × 4-4.6 µm, 4-sterigmate, clamped at the base; sterigmata up to 1.8 µm long. **Basidiospores** ellipsoid to subcylindrical, 5.2-6.5 × 2.6-3.3 µm, smooth, subhyaline, give negative reaction in Melzer's reagent as well as cotton blue.

Collections examined- Himachal Pradesh**:** Sirmaur, Rajgarh, on bamboo poles, Harpreet 5285 (PUN), August 08, 2011; about 4 km from Paonta Sahib towards Rajban, on log of *Shorea robusta*, Harpreet 5284 (PUN), August 02, 2010; about 2 km from Rajban towards Staun, on log of *Shorea robusta*, Ramandeep 8760 (PUN), October 7, 2016.

Remarks- This species is characteristic in having reddish orange basidiocarps. From India it has earlier been described by Currey (1874) from West Bengal, Murrill (1924) from Jammu and Kashmir, Banerjee (1947) from West Bengal as *Polystictus cinnabarinun,* Bakshi (1971) from Madhya Pradesh, West Bengal and Kashmir as *Polyporus cinnabarinus*, Roy and De (1996) from Jammu and Kashmir, Madhya Pradesh and West Bengal, Dhanda (1977) and Sharma (2012) from Uttarakhand as *Pycnoporus cinnabarinus*. Here, it is being described for the first time from Himachal Pradesh.

7. *Trichaptum abietinum* (Pers.: J.F. Gmel.) Ryvarden, *Norwegian Journal of Botany* **19**: 237, 1972. *Boletus abietinus* Pers.: J.F. Gmel., *Systema Naturae* **2**: 1437, 1792.

Collection examined- Himachal Pradesh**:** Sirmaur, Rajgarh, Nauradhar, on log of *Quercus leucotrichophora*, Ramandeep and Avneet 8761 (PUN), September 12, 2016.

Remarks- This species is characteristic in having basidiocarps with violet to purple-grey poroid hymenial surface. From India it has earlier been reported by Bose (1934), Bagchee and Singh (1960), Thind and Rattan (1971), Bakshi (1971) from North Western Himalaya as *Polyporus abietinus*. Dhanda (1977) listed it from Chamba, Shimla, Kinnaur, Kangra (H.P.), Uttarakhand and Jammu and Kashmir. Sharma (1985 and 2000) reported it from Jammu and Kashmir and Uttarakhand, Singh (1987) from Eastern Himalaya, Roy and De (1996) from Madhya Pradesh, Uttarakhand, West Bengal, Kinnaur and Mandi (H.P.) and Prasher and Ashok (2013) from Shimla, Chamba, Kinnaur and Kangra (H.P.) as *Trichaptum abietinum*.

8. *Trametes versicolor* (L.) Lloyd, *Mycological Writings* **65**: 1045, 1921. *Boletus versicolor* L., *Species Plantarum*: 1176, 1753.

Collection examined- Himachal Pradesh**:** Sirmaur, Rajgarh, Nauradhar, on log of *Quercus leucotrichophora*, Ramandeep and Avneet 8762 (PUN), September 12, 2016.

Remarks-This is the most common species amongst the poroid taxa in Himachal Pradesh and is characteristic in having basidiocarps which are extremely variable in the color of abhymenial surface. From India it has earlier been reported by Thind and Chatrath (1957) from Uttarakhand as *Polystictus versicolor*, Thind and Dhanda (1978) from Uttarakhand as *Coriolus azureus*, Dhanda (1977) from Shimla, Kullu and Chamba (H.P.), Jammu and Kashmir, Uttar Pradesh and Nepal, Singh (1987) from Arunachal Pradesh, Meghalaya, Tripura, Manipur, West Bengal and Mizoram as *Coriolus versicolor* and *Coriolus azureus*, Dulat (1992) from Punjab as *Coriolus versicolor*, Roy and De (1996) from Shimla (H.P.), Tamil Nadu, Uttarakhand and West Bengal as *Trametes versicolor*, Dargan *et al.* (2006) from Punjab as *Coriolus versicolor*, Ranadive *et al.* (2011) and Ranadive (2013) from Maharashtra as *Trametes versicolor*, Sharma (2000 and 2012) from Shimla (H.P.) and Uttarakhand as *Trametes versicolor.*

ACKNOWLEDGEMENTS

The authors are grateful to the Head, Department of Botany, Punjabi University, Patiala for providing necessary laboratory facilities and University Grants Commission, New Delhi for financial assistance under UGC DSA-I programme.

REFERENCES

Bagchee, K. and Singh, U. 1960. List of common names of fungi attacking Indian forest trees, Timber and the Herbaceous and Shrubby undergrowths and list of cultures of forest fungi. *Ind. For. Rec.* (N.S.) **1**(10): 199-348.

Bakshi, B.K. 1971. *Indian Polyporaceae* (on trees and timber). Indian Council of Agricultural Research, New Delhi. 246pp.

Baltazar, J.M., Ryvarden, L and Gilbertoni, T.B. 2014. *Diplomitoporus* (*Polyporales*, *Basidiomycota*) in Brazil revisited. *Mycol. Progress* **13**: 313-319.

Banerjee, S.N. 1947. Fungus flora of Calcutta and suburb-I. *Bull. Bot. Soc. Beng*. **1**: 37-54.

Berkeley, M.J. 1854. Decades XLVII, XLVIII. Indian Fungi. *In Hook. J. Bot.* **6**: 204-212.

Bose, S.R. 1920. Fungi of Bengal: *Polyporaceae* of Bengal-III. *Bull. Carmichael medical College* **1**: 1-5.

Bose, S.R. 1928. *Polyporaceae* of Bengal- VIII. *J. Dept. Sci. Calcutta Univ.* **9**: 27-34.

Bose, S.R. 1934.*Polyporaceae* of Bengal-X. *J. Dep. Sci. Calcutta Univ.***11**: 1-18.

Bose, S.R. 1937. *Polyporaceae* from Lokra hills, Assam. *Ann. Mycol*. **35**: 119-137.

Currey, F. 1874. On a collection of fungi made by Mr. Sulpiz Kurz, Curator of the Botanical Garden, Calcutta. *Trans. Linn. Soc. Lond.*, *II. Ser., Bot.* **I**: 119-131.

Dargan, J.S.,Dhingra, G.S., Lalji K. and Singh, A.P 2006. Mycoflora associated with *Bauhinia Purpurea* Linn. *Bionature* **26**(1): 33-38.

Dhanda, R.S. 1977. *Studies on Polyporaceae of North Western Himalayas*. Ph.D. Thesis. Panjab University, Chandigarh. 500 pp.

Domanski, S. 1970. Wood-inhabiting fungi of Bialowieza virgin forests in Poland. XIII. Two species of *Diplomitoporus* Doman., gen. nov. *Acta Societatis Botanicorum Poloniae* **39**:191-207.

Dulat, A.K. 1992. *Mycoflora associated with pathological problems of some multipurpose tree species of Punjab*. M.Phil. Thesis. Punjabi University, Patiala. 135pp.

Gilbertson, R.L. and Ryvarden, L.1985. Some new combinations in the *Polyporaceae*. *Mycotaxon* **22**: 363-365.

Hibbett, D.S., Binder, M., Bischoff, J.F., Blackwell, M., Cannon, P.F., Eriksson, O.E., Huhndorf, S., James, T., Kirk, P.M., Lücking, R.H., Lumbsch, T., Lutzoni, F., Matheny, P.B., McLaughlin, D.J., Powell, M.J., Redhead, S., Schoch, C.L., Spatafora, J.W., Stalpers, J.A., Vilgalys, R., Aime, M.C., Aptroot, A., Bauer, R., Begerow, D., Benny, G.L., Castlebury, L. A., Crous, P.W., Dai, Y.C., Gams, W., Geiser, D.M., Griffith, G.W., Gueidan, C., Hawksworth, D.L., Hestmark, G., Hosaka, K., Humber, R.A., Hyde, K.D., Ironside, J.E., Kõljalg, U., Kurtzman, C.P., Larsson, K.H., Lichtwardt, R., Longcore, J., Miądlikowska, J., Miller, A., Moncalvo, J.M., Standridge, S.M., Oberwinkler, F., Parmasto, E., Reeb, V., Rogers, J.D., Roux, C., Ryvarden, L., Sampaio, J.P., Schüßler, A., Sugiyama, J., Thorn, R. G., Tibell, L., Untereiner, W.A., Walker, C., Wang, Z., Weir, A., Weiss, M., White, M.M., Winka, K., Y.J. and Zhang, N. 2007. A higher - level phylogenetic classification of the Fungi. *Mycol. Res.* **111**: 509-547.

Kirk, P.M., Cannon, P.F., Minter D.W. and Stalpers, J.A. 2008. *Dictionary of the Fungi* (10th Ed.). Wallingford Oxon, UK. 771pp.

Kornerup, A. and Wanscher, J.H. 1978. *Metheun's Handbook of colours*, IIIrd Ed. Metheun and Co. Ltd. London. 252pp.

Leelavathy, K.M. and Ganesh, P.N. 2000. *Polypores of Kerala*. Daya Publishing House, Delhi. 166pp.

Mitter, J.H. and Tondon, R.N.1932. Fungus Flora of Nainital II. *J. Ind. Bot. Soc.* **11:** 178-180.

Murrill, W.A. 1924. Kashmir Fungi. *Mycologia* **16:** 133.

MycoBank. 2017. Fungal databases. Nomenclature and species banks. [Accessed: 27/1/2017].

Prasher, I.B. and Ashok, D. 2013. A Checklist of wood rotting fungi (non-gilled *Agaricomycotina*) of Himachal Pradesh. *Journal on New Biological Reports* **2**(2):71-98.

Ranadive, K.R. 2013. An overview of *Aphyllophorales* (wood rotting fungi) from India. *International Journal of Current Microbiology and Applied Sciences* **2**(12): 112-139.

Ranadive, K.R., Vaidya, J.G., Jite, P.K., Ranade, V.D., Bhosale, S.R., Rabba, A.S., Hakimi, M., Deshpande, G.S., Rathod, M.M., Forutan, A., Kaur, M., Naik-Vaidya, C.D., Bapat, G.S. and Lamrood, P. 2011. Checklist of *Aphyllophorales* from the Western Ghats of Maharashtra State, India. *Mycosphere* **2**: 91-113.

Roy, A. and De, A.B.1996. *Polyporaceae of India*. International Book Distributor, Dehradun. India. 287pp.

Ryvarden, L. and Iturriaga, T. 2004. Studies in neotropical polypores 10. New polypores from Venezuela. *Mycologia* **95**(6):1066-1077.

Ryvarden, L. and Melo, I. 2014. Poroid Fungi of Europe. *Synopsis Fungorum* **31**: 455pp.

Singh, S. 1987. *Studies on Polyporoid Fungi of Eastern Himalayas and adjoining areas*. Ph.D. Thesis. Panjab University, Chandigarh. 414pp.

Singh, S., Singh, B. and Bakshi, B.K. 1961. Fungus flora of South Andaman. *Ind. Forest*. **87**: 248-250.

Sharma, J.R. 1985. Studies on *Polyporaceae* of Himachal Pradesh. J*ournal of Economic and Taxonomic Botany* **7**: 95-101.

Sharma, J.R. 1997. Wood - rotting fungi (*Aphyllophorales*) from Sikkim. *Bull. Bot. Surv. Ind.* **34**: 89-99.

Sharma, J.R. 2000. *Genera of Indian Polypores*. Botanical Survey of India, Kolkata. 188pp.

Sharma, J.R. 2012. *Aphyllophorales of Himalaya*. Botanical Survey of India. Kolkata. 590pp.

Sharma, J.R. and Ghosh, P.K. 1989. Polypores that decay tree of Indian Botanic Garden. *Bull. Bot. Surv. Ind.* **31**: 95-102.

Thind, K.S. and Chatrath, M.S. 1957. The *Polyporaceae* of the Mussoorie hills-III. *Research Bulletin (N.S) Panjab university* **125**: 431-442.

Thind, K.S. and Chatrath, M.S.1960. The *Polyporaceae* of the Mussoorie hills-I. *Indian Phytopath.* **13**: 76-89.

Thind, K.S. and Dhanda, R.S. 1978. The *Polyporaceae* of India -XI. *Indian Phytopath.* **31**: 463-472.

Thind, K.S. and Rattan, S.S. 1971 . The *Polyporaceae* of India-V. *Indian Phytopath.* **24**: 50-57.