

Preliminary Investigations on Diversity of Wood Rot Fungi in Hamirpur District, Himachal Pradesh

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ABSTRACT: Wood rot fungi play an important role in ecological nutrient cycling due to their ability to decompose lignified cells of coarse woody material through enzymatic action of lignocellulolytic enzymes. Keeping in view, the ecological and economic importance of wood rot fungi and in contrast to the insufficient data available on the geographical distribution and diversity of wood rot fungi in Hamirpur district of Himachal Pradesh, the floristic investigations were initiated to describe and preserve the wood rot fungi of this region. During the present investigation, eight species of wood rot fungi have been recorded from the study area. Out of these eight species, one species viz. *Daldinia concentrica* (Bolt. ex Fr.) Ces & de Not., belongs to a genus (*Daldinia* Ces. & De Not.) of a family (Xylariaceae) of ascomycota, whereas other seven species viz. *Auricularia auricula-judae* (L.:Fr.) Schroet., *Fomitopsis dochmia* (Berk & Broome) Ryv., *Hexagonia sulcata* Berk., *Polyporus hirsutus* Wulf. ex Fr., *Schizophyllum commune* Fr.:Fr., *Trametes gibbosa* (Pers.:Fr.) Fr. and *T. versicolour* (L.:Fr.) Pilat, belong to six genera of four families (Auriculariaceae, Fomitopsidaceae, Polyporaceae and Schizophyllaceae) of basidiomycota. Seven species viz. *Auricularia auricula-judae* (L.:Fr.) Schroet., *Daldinia concentrica* (Bolt. ex Fr.) Ces & de Not., *Fomitopsis dochmia* (Berk & Broome) Ryv., *Hexagonia sulcata* Berk., *Polyporus hirsutus* Wulf. ex Fr. and *Trametes gibbosa* (Pers.:Fr.) Fr. and *T. versicolour* (L.:Fr.) Pilat have been recorded for the first time from the study area..

Keywords: Diversity; Wood Rot Fungi; lignocellulolytic enzymes; Basidiomycota.

INTRODUCTION: The dead wood inhabiting fungi that decompose wood are called wood rot fungi. The enzymatic systems of wood rot fungi are capable of oxidizing C-C components of wood polymers. Basically, there are two categories of wood rot fungi- the white-rot and brown-rot fungi. White-rot fungi decay the lignin molecules, whereas the brown-rot fungi decompose celluloses and hemicelluloses. Wood-inhabiting fungi mainly belong to Ascomycota, however, taxa of Basidiomycota especially belonging to the order Polyporales of class Agaricomycetes are the efficient decomposers of wood. Wood inhabiting fungi are characterized by having a wonderful parallel morphological adaptation for sporulation over various wood substrates. Wood rot fungi are obligate-parasites of living or dead woody substrates and produce macroscopic fruiting bodies for reproduction. These fungi produce a variety of hydrolytic/lignocellulolytic enzymes and obtain nutrition for their growth via hydrolysis of wood components (cellulose and lignin).¹ Review of literature reveals that, only fifteen species of wood rot macrofungi have been reported from

some parts of Hamirpur district of Himachal Pradesh.²⁻⁴¹ Owing to the ecological and economic importance and in contrast to the insufficient data available on the geographical distribution, floristic and diversity of wood rot fungi in Hamirpur district of Himachal Pradesh, the floristic investigations were initiated to describe and preserve the wood rot fungi of this region.

MATERIAL AND METHODS:

Study Area: Hamirpur District (H.P.): Hamirpur district of Himachal Pradesh area occupies an area of 1,118 km². It is situated between 76°17'50" to 76°43'42" E longitude and 31°24'48" to 31°53'35" N latitude. Hamirpur district comprises six, Barsar, Nadaun, Bhoranj, Bijhari and Bamsan. The area is hilly covered by Shivalik range and the altitude varies from 450 meters -1,100 meters. Temperature ranges between 2°C to 43°C. The hilly slopes are mostly covered with *Pinus roxburghii* (Chir pine) forest.

Experimental: The specimens were collected from five localities viz. Chamboh, Hamirpur, Kalanjari, Kot and Kot Langsa of Hamirpur district of Himachal Pradesh during January-April, 2017. The field data such as texture, size, colour and macroscopic features have been recorded in the field data book during the excursions (Mueller et al. 2004).⁴² A hand lens (20 X), knife, and a saw were the tools used while collecting the specimens. The collected specimens were placed in paper packets of suitable size and a paper slip containing the field data such as collection number, details of collection site, host/substrate and date of collection was placed in each paper packet. The fragile specimens were placed in card boxes of suitable size. The fresh specimens were observed for morphological investigations and sun dried at the camping site. The specimens were then brought to the Botany Laboratory at Department of Biosciences, Career Point University, Hamirpur for further taxonomic studies and preservation. The following mountants/stains were used for the taxonomic investigations pertaining to different groups of macrofungi during the present study:

- I. **Amann's Lactophenol:** It was used for mounting of microscopic structures and composed of 20g Phenol, 20ml Lactic acid, 40ml Glycerol and 20ml distilled water.
- II. **Glycerine:** It was used for mounting of microscopic structures and composed of 2ml Glycerine in distilled water to make 100ml.
- III. **Potassium hydroxide:** It was used for micro-chemical tests and softening of the study materials and composed of 5g KOH in distilled water to make 100ml.
- IV. **Melzer's Iodine:** It was used to test amyloidity of the sporulating structures and composed of 22g Chloral hydrate, 5g Iodine, 0.5g Potassium iodide and 20ml distilled water.
- V. **Distilled water:** It was used for observing the natural colour of the microcopic structures.
- VI. **Erythrosine B in ammonia:** It was used for observing septation in spores & mycelium and composed of 1g Erythrosine B, 10ml Ammonia and 90ml distilled water.
- VII. **Phloxine:** It was used to stain and observe septation in spores & mycelium and composed of 1g Phloxine and distilled water to make 100ml.
- VIII. **Cotton blue:** It was used to stain the cytoplasm of the fungal cells & also to observe cyanophilly of the microscopic structures and composed of 0.01g Cotton blue in 100ml Lactic acid.
- IX. **Lugol's iodine:** It was used to check amyloidity and composed of 5g Iodine, 10g Potassium Iodide and 100ml distilled water.
- X. **Congo red:** It was used to stain ascus wall, paraphyses, ascospores & excipular tissues and composed of 2% Congo red or 1% Congo red in 50% ammonia.
- XI. **Potassium hydroxide-phloxine-glycerine:** It was used to stain the cytoplasm bright pink & for clarity of the septa and walls. The thin sections were placed in 2% KOH on the slide, to which a drop of 1% aqueous phloxine was added after 10-15 minutes the sections were transferred to a drop of 50% glycerine (slightly acidified) and then the cover slip was placed on it.
- XII. **Sulfobenzaldehyde:** It was used to stain gloeocystidia and composed of 1.5ml distilled water, Sulphuric acid 5.0ml and 4.5ml benzaldehyde.

The specimens were identified by consulting latest literature and comparing with authenticated specimens. Naphthalene balls were placed in each herbarium packet containing specimen to avoid insects attack and all the specimens were deposited in Herbarium of Department of Biosciences, Career Point University, Hamirpur.

RESULTS AND DISCUSSION: During the present investigations eight species of wood rot fungi have been recorded from the study area (Table 1), out of these seven species have been recorded for the first time from the study area (Table 2).

Table 1: Wood rot fungi recorded during the present study.

Sr. No.	Family	Genus	Species
1.	Auriculariaceae	<i>Auricularia</i>	<i>Auricularia auricula-judae</i>
2.	Fomitopsidaceae	<i>Fomitopsis</i>	<i>Fomitopsis dochmia</i>
3.	Polyporaceae	<i>Trametes</i>	<i>T. gibbosa</i>
4.			<i>T. versicolour</i>
5.		<i>Hexagonia</i>	<i>H. sulcata</i>
6.		<i>Polyporus</i>	<i>Polyporus hirsutus</i>
7.	Schizophyllaceae	<i>Schizophyllum</i>	<i>S. commune</i>
8.	Xylariaceae	<i>Daldinia</i>	<i>Daldinia concentrica</i>

Table 2: New record of wood rot fungi from Hamirpur.

Sr. No.	Family	Genus	Species
1.	Auriculariaceae	<i>Auricularia</i>	<i>Auricularia auricula-judae</i>
2.	Fomitopsidaceae	<i>Fomitopsis</i>	<i>Fomitopsis dochmia</i>
3.	Polyporaceae	<i>Trametes</i>	<i>T. gibbosa</i>
4.			<i>T. versicolour</i>
5.		<i>Hexagonia</i>	<i>H. sulcata</i>
6.		<i>Polyporus</i>	<i>Polyporus hirsutus</i>
7.	Xylariaceae	<i>Daldinia</i>	<i>Daldinia concentrica</i>

Table 3: List of wood rot fungi already recorded from Hamirpur.

Sr. No.	Family	Genus	Species
1.	Echinodontiaceae	<i>Echinodontium</i>	<i>E. taxodii</i>
2.			<i>E. himalayana</i>
3.	Ganodermataceae	<i>Ganoderma</i>	<i>G. applanatum</i>
4.			<i>G. lucidum</i>
5.	Hymenochaetaceae	<i>Hymenochaete</i>	<i>H. mougeotii</i>
6.		<i>Scytinostroma</i>	<i>S. cystidiatum</i>
7.	Meruliaceae	<i>Flavodon</i>	<i>F. flavus</i>
8.		<i>Steccherinum</i>	<i>S. oreophilum</i>
9.	Polyporaceae	<i>Dichomitus</i>	<i>D. leucoplacus</i>
10.		<i>Trametes</i>	<i>T. hirsuta</i>
11.		<i>Tyromyces</i>	<i>T. gollanii</i>
12.	Pterulaceae	<i>Coronicium</i>	<i>C. gemmiferum</i>
13.	Schizophyllaceae	<i>Schizophyllum</i>	<i>S. commune</i>
14.	Schizoporaceae	<i>Hyphodontia</i>	<i>H. arguta</i>
15.	Stereaceae	<i>Stereum</i>	<i>S. sanguinolentum</i>

Table 4: Checklist of wood rot fungi of Hamirpur.

Sr. No.	Family	Genus	Species
1.	Auriculariaceae	<i>Auricularia</i>	<i>Auricularia auricula-judae</i>
2.	Echinodontiaceae	<i>Echinodontium</i>	<i>E. taxodii</i>
3.			<i>E. himalayana</i>
4.	Fomitopsidaceae	<i>Fomitopsis</i>	<i>Fomitopsis dochmia</i>
5.	Ganodermataceae	<i>Ganoderma</i>	<i>G. applanatum</i>
6.			<i>G. lucidum</i>
7.	Hymenochaetaceae	<i>Hymenochaete</i>	<i>H. mougeotii</i>
8.	Lachnocladiaceae	<i>Scytinostroma</i>	<i>S. cystidiatum</i>
9.	Meruliaceae	<i>Flavodon</i>	<i>F. flavus</i>
10.		<i>Steccherinum</i>	<i>S. oreophilum</i>
11.	Polyporaceae	<i>Dichomitus</i>	<i>D. leucoplacus</i>
12.		<i>Hexagonia</i>	<i>H. sulcata</i>
13.		<i>Polyporus</i>	<i>Polyporus hirsutus</i>
14.		<i>Trametes</i>	<i>T. hirsuta</i>
15.			<i>T. gibbosa</i>
16.			<i>T. versicolour</i>
17.		<i>Tyromyces</i>	<i>T. gollanii</i>
18.	Pterulaceae	<i>Coronicium</i>	<i>Coronicium gemmiferum</i>
19.	Schizophyllaceae	<i>Schizophyllum</i>	<i>S. commune</i>
20.	Schizoporaceae	<i>Hyphodontia</i>	<i>H. arguta</i>
21.	Stereaceae	<i>Stereum</i>	<i>S. sanguinolentum</i>
22.	Xylariaceae	<i>Daldinia</i>	<i>D. concentrica</i>

CONCLUSION: Seven species viz. *Auricularia auricula-judae* (L.:Fr.) Schroet., *Daldinia concentrica* (Bolt. ex Fr.) Ces & de Not., *Fomitopsis dochmia* (Berk & Broome) Ryv., *Hexagonia sulcata* Berk., *Polyporus hirsutus* Wulf. ex Fr. and *Trametes gibbosa* (Pers.:Fr.) Fr. and *T. versicolour* (L.:Fr.) Pilat have been recorded for the first time from Hamirpur district of Himachal Pradesh..

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REFERENCES:

1. Zmitrovich I. V., Wasser S. P. and Tura D. (2015) Wood-Inhabiting Fungi. In: Misra J. K., Tewari, J. P., Deshmukh S. K. and Vagvolgyi C. (eds.) Fungi from Different Substrates. CRC Press, New York, pp. 17-74.
2. Bakshi B. K. (1971) Indian Polyporaceae, ICAR, New Delhi.
3. Bakshi B. K. (1966) Indian Polyporaceae. ICAR, New Delhi.
4. Dhingra G. S. and Rani M. (1991) Two New Records of the Genus *Pseudotomentella* from Dalhousie Hills. *Geobios. New Rep.*, 10, 125-127.
5. Dhingra G. S. and Rani M. (1994) North-West Himalayan Thelephoraceae (Basidiomycetes) Genus *Tomentella* from Dalhousie Hills, *Curr. Res. Pl. Sci.*, 43-56.
6. Dhingra G.S. and Singh A. P. (2008) A new species of *Ceraceomyces* (Basidiomycetes) from India. *Mycotaxon*, 106: 399-401.
7. Dhingra G. S. and Singh A. P. (2009) Diversity of Resupinate Aphyllophoraceous Fungi Himachal Pradesh: Family Coniophoraceae, *J. Indian bot. Soc.*, 88(1&2), 122-127.
8. Dhingra G. S. and Singla N. (1993) Studies in North-West Himalaya Corticiaceae (Basidiomycetes)-I: Some Interesting Species from Dalhousie Hill, *J. Indian Bot. Soc.*, 72, 29-33.
9. Dhingra G. S. and Singla N. (1997) North-West Himalayan Corticiaceae-Three Rare Species from Dalhousie Hills, *Geobios. New Rep.*, 16, 70-72.
10. Dhingra G. S. and Sood S. (1992) Two New Records of Genus *Tubulicrinis* from Dalhousie Hills, *Geobios. New Rep.*, 12, 62-64.
11. Dhingra G. S., Priyanka and Singh A. P. (2009) Three New Records of Genus *Sistotrema* from India, *J. Indian bot. Soc.*, 88, 76-79.
12. Dhingra G. S., Singh A. P. and Singla N. (2009) A new species of *Hyphoderma* (Basidiomycetes) from India, *Mycotaxon*, 108, 197-199.
13. Fries E.M. (1821) *Systema Mycologicum*. Vol. I. *Lundae*: 1-520.
14. Fries E. M. (1823) *Systema Mycologicum*. Vol. I. *Lundae*: 1-621.
15. Fries, E. M. (1832) *Systema Mycologicum*. Vol. 3. Greifswald: 1-524. Hymenomycetes Europaei. *Siva Epicriseous Systematis Mycologici, Upsaliae*, 756pp.
16. Fries E. M. (1928) *Elenchus Fungorum, sistens Commentarium. Systema Mycologicum*, 1: i 1-238.
17. Fries E. M. (1928) *Elenchus Fungorum, sistens Commentarium. Systema Mycologicum*, 2: i-vi, 1-154.
18. Hem Chander (2016) Diversity and Distribution of Macrofungi and Lichens in the Nanda Devi Biosphere Reserve. In: Arya M. K., Bharti P. K. and Joshi R. (eds.) Biological Diversity and Ecology. Discovery Publishing House, New Delhi, pp 184-207.
19. Hem Chander (2016) Diversity and Distribution of Macrofungi in the Valley of Flowers National Park, *J. Biol. Chem. Chron.*, 2(2), 36-41
20. Prasher I.B. and Hem Chander (2006) Polyporoid fungi of Nanda Devi Biosphere Reserve, *Pb. Univ. Res. J. (Sci.)*, 56, 123-136.
21. Prasher I. B. and Hem Chander (2007) A preliminary report on the macro fungi and lichens of the Nanda Devi Biosphere Reserve (Uttaranchal). In: Prasher I.B. and Sharma M.P. (eds.) Advances in Mycology and Plant Pathology. Bishen Singh Mahendra Pal Singh, Dehra Dun, pp 129-165.
22. Prasher I. B., Sharma P. and Hem Chander (2007) Edible and Medicinal Macrofungi of Chandigarh. In: Prasher I. B. and Sharma M. P. (eds.) Advances in Mycology and Plant Pathology. Bishen Singh Mahendra Pal Singh, Dehra Dun, pp 317-330.
23. Lakhanpal T. N. (1997) Diversity of mushroom mycoflora in the North-West Himalaya. In: Sati S. C., Saxena J. & Dubey R. C. (eds.) Recent Researches in Ecology, Environment and Pollution. Today and Tomorrow's Printers and Publishers, New Delhi, pp 35-68.
24. Paul Y. S. and Sharma R. C. (2003) Mycoflora of Northwest Himalayas: Himachal Pradesh. I. B. D. Dehradun, 244 p.
25. Prasher I. B., Lalita and Deepali A. (2012) Polyporoid fungi of District Mandi (H.P.), *J. Indian Bot. Soc.*, 91(1&2), 204-212.

26. Prasher I. B. and Deepali A. (2013) A Checklist of Wood Rotting Fungi (non-gilled Agaricomycotina) of Himachal Pradesh, *Journal on New Biological Reports*, 2(2), 71-98.
27. Prasher I.B., Lalita and Deepali A. (2011) Polyporoid fungi of District Bilaspur (H.P.), *J. Indian Bot. Soc.*, 90(3& 4), 268-273.
28. Rattan S. S. (1977) The Resupinate Aphyllophorales of the North Western Himalayas. *Bibliotheca Mycologica*, 60, 1-427.
29. Roy A. and De A.B. (1996) Polyporaceae of India. International Book Distributors, Dehra Dun.
30. Sharma A. D., Munjal R. L. and Jandaik C. L. (1982) Additions to the mycoflora of Himachal Pradesh – XIV, *Indian J. Mycol.Plant Pathol.*, 12(2), 214-216.
31. Sharma J. R. (1985) Studies on Polyporaceae of Himachal Pradesh. *J. Econ. Taxon. Bot.*, 7(1), 95-101.
32. Thind K. S. and Dhanda R. S. (1979) The Polyporaceae of India-IX, *Kavaka*, 7, 51-58.
33. Thind K. S. and Dhanda R. S. (1979) The Polyporaceae of India-IX, *Kavaka*, 7, 51-58.
34. Thind K. S. and Dhanda R. S. (1980) The Polyporaceae of India-X, *Kavaka*, 8, 59-67.
35. Thind K. S. and Dhanda R. S. (1980) The Polyporaceae of India.XI, *Indian Phytopath.*, 31(4), 463-472.
36. Thind K. S. and Dhanda R. S. (1980) The Polyporaceae of India-XIII, *Indian Phytopath.*, 33(3), 380-387.
37. Thind K. S. and Rattan S. S. (1971) The Polyporaceae of India-VII, *Indian Phytopath.*, 24(2), 290-294.
38. Thind K. S., Rattan S. S. and Dhanda R. S. (1969) The Polyporaceae of India-VI, *Indian Phytopath.*, 21, 109-117.
39. Thind K. S., Rattan S. S. and Dhanda R. S. (1969) The Polyporaceae of India-VI, *Research Bulletin (N.S.) of Panjab University*, 21(3), 109-117.
40. Thind K. S., Rattan S. S. and Dhanda R. S. (1970) The Polyporaceae of India-VI, *Research Bulletin (N.S.) of Panjab University*, 21(1-2), 109-117.
41. Chander H., Thakur S. and Sharma S. (2017). Investigations on Diversity of Wood Inhabiting Fungi in Sarkaghat Region of District Mandi, Himachal Pradesh, North-Western Himalaya, *J. Biol. Chem. Chron.*, 3(1), 41-54.
42. Mueller G. M., Gerald F. B. and Mercedes S. F. (2004) Biodiversity of Fungi – Inventory and Monitoring Methods. Elsevier Academic Press, Burlington, USA, pp 128-158.