

Notes on Occurrence of Anti HIV-1 Medicinal Macrofungi *Tyromyces chioneus* in Hamirpur district, Himachal Pradesh

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ABSTRACT: *Tyromyces chioneus* (Fr.) P. Karst has a circumpolar distribution, in temperate boreal pine forests, including Asia, Europe, and North America. It is being reported for the first time from district Hamirpur of Himachal Pradesh. This basidiomycete macrofungi is commonly known as white cheese polypore. It is a wood rotting fungi and causes white rot of dead pine trees in Hamirpur district. It contains a novel cadinane sesquiterpene named 4 β ,14-dihydroxy-6 α ,7 β H-1(10)-cadinene. This molecule has significant anti HIV-1 activity.

Keywords: Cadinane sesquiterpene; fruiting body; macrofungi; polypore; wood rot

INTRODUCTION

The macrofungi includes fungi with the macroscopic fructifications/thalli belonging to Ascomycota and Basidiomycota. The macrofungi produce the visible fruiting bodies (ascmata in case of ascomycota and basidioma in case of basidiomycota) for their reproduction. The ascomata and basidioma play a significant role in the taxonomy of macrofungi. They are categorized into fleshy fungi (mushrooms), polypores, jelly fungi and puffballs etc. A large number of these fungi are edible and medicinally important and is considered as one of the important non-wood forest products (NWFP) collected world over and used for subsistence purpose as well as sold on local markets and elsewhere.¹ The dead wood inhabiting fungi that decompose wood are called wood rot fungi. 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. The detailed review of published records of macrofungi reveals that whereas, a lot of exercises to explore macrofungi of India, North Western Himalaya and Himachal Pradesh have been carried out by various workers, however diversity of macrofungi in Hamirpur is data deficient and understudied.²⁻³⁵ There are a lot of studies available on environmental issues and flora of Hamirpur.³⁶⁻⁴⁰ However, studies pertaining to diversity, mapping of distribution, status, substrate relationship, economic and ecological importance of macrofungi in the study area are data deficient. Only twenty two species of macrofungi have been reported earlier from Hamirpur district of Himachal Pradesh.⁴¹

Study Area: Hamirpur District (H.P.): Total geographical area of Hamirpur district is 1,118 km², of which 219 km² area (19.6%) is under forest. It is situated between 76°17'50" to 76°43'42" East longitudes and 31°24'48" to 31°53'35" North latitudes. It is located in the South Western part of Himachal Pradesh. It is covered by lower Himalayas (Shivalik hills) and the elevation varies from 400 m to 1232 m. The maximum temperature of the district ranges from 37 °C to 39 °C during summer season and the minimum from 3 °C to 5 °C during winter season. Average temperature is 21.6 °C. Annual precipitation is about 1572 mm. The driest month is November, with 14 mm of rainfall. Most precipitation falls in July, with an average of 478 mm. The warmest month of the year is June, with an average temperature of 30.3 °C. In January, the average temperature is 11.7°C. It is the lowest average temperature of the whole year. The difference in precipitation between the driest month and the wettest month is 464 mm. The average temperatures vary during the year by 18.6 °C. The main hill ranges of the district are known as Jakh Dhar & Sola Singhi Dhar. These ranges are covered with pine forests. The Jakh dhar runs in continuation of Kali Dhar range in the Kangra district. It enters in Hamirpur district near Nadaun and transverses it into South-Eastern direction. Hamirpur district is bounded in the North by river Beas which separates it from Kangra district. In the East, Bakar and Seer Khads separate it from Mandi district. In the South, It is bounded by Bilaspur district and in the west by Una district. The forests of the study area are of two types.⁴²

- **Shivalik chil pine forests:** The chil (*Pinus roxburghii*) is the dominant species and occurs in the zone ranging from 600 m to 1100 m height. It generally forms pure forest on the Western and South-Western slopes of the Jakh Dhar and in the Chabutra Dhar, the proportion

of chil is reduced and scrubs of miscellaneous broad leaved species cover the ground.

- **Northern dry mixed deciduous forests:** Khair (*Acacia catechu*) is the predominant species. However, besides it, other broad leaved species are also found. The altitudinal range is from 400 m to 850 m. The various species of plants and forest trees found in the district are Kikar, Amla, Neem, Karal, Taur, Bil, Kasmal, Khair, Ber, Chil etc.

MATERIAL AND METHODS

The specimens were collected from chir pine forests of Hamirpur district of Himachal Pradesh during January-March, 2018. The field data such as texture, size, colour and macroscopic features have been recorded in the field data book during the excursions.⁴³ 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:

- **Amann's Lactophenol:** It was used for mounting of microscopic structures and composed of 20 g Phenol, 20 ml Lactic acid, 40 ml Glycerol and 20 ml distilled water.
- **Glycerine:** It was used for mounting of microscopic structures and composed of 2 ml Glycerine in distilled water to make 100 ml.
- **Potassium hydroxide:** It was used for microchemical tests and softening of the study materials and composed of 5 g KOH in distilled water to make 100 ml.
- **Melzer's iodine:** It was used to test amyloidity of the sporulating structures and composed of 22 g Chloral hydrate, 5 g Iodine, 0.5 g Potassium iodide and 20 ml distilled water.
- **Distilled water:** It was used for observing the natural colour of the microscopic structures.
- **Erythrosine B in ammonia:** It was used for observing septation in spores & mycelium and composed of 1 g Erythrosine B, 10 ml Ammonia and 90 ml distilled water.

- **Phloxine:** It was used to stain and observe septation in spores & mycelium and composed of 1g Phloxine and distilled water to make 100 ml.
- **Cotton blue:** It was used to stain the cytoplasm of the fungal cells & also to observe cyanophily of the microscopic structures and composed of 0.01 g Cotton blue in 100 ml Lactic acid.
- **Lugol's iodine:** It was used to check amyloidity and composed of 5 g Iodine, 10 g Potassium Iodide and 100 ml distilled water.
- **Congo red:** It was used to stain ascus wall, paraphyses, ascospores and excipular tissues and composed of 2 % Congo red or 1 % Congo red in 50 % ammonia.
- **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.
- **Sulfobenzaldehyde:** It was used to stain gloeocystidia and composed of 1.5 ml distilled water, Sulphuric acid 5.0 ml and 4.5 ml 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 CPUH (The Herbarium of Department of Biosciences, Career Point University, Hamirpur).

RESULTS AND DISCUSSION

Tyromyces chioneus (Fr.) P. Karst has a circum-polar distribution, in temperate boreal pine forests, including Asia, Europe, and North America. This basidiomycete macrofungi is commonly known as white cheese polypore. Its fruiting bodies are white, semi-circular and measure up to 8 cm broad, 10 cm wide with a thickness of 0.5–2 cm. The upper surface is initially white before aging to yellowish or grayish, and has a texture ranging from smooth to mentose. The undersurface features white to cream-colored, round to angular pores measuring 3-4 per mm. The flesh is soft and fleshy when young but becomes hard and brittle with age or on drying. It has a mild or indistinct taste and a pleasant odor. It is inedible but has medicinal properties.



Figure 1: Upper surface of *T. chioneus*



Figure 2: Lower poroid surface of *T. chioneus*

CONCLUSIONS

Tyromyces chioneus is being reported for the first time from district Hamirpur of Himachal Pradesh. It is a wood rotting fungi and causes white rot of dead pine wood in Hamirpur district. It contains a novel cadinane sesquiterpene (named 4 β ,14-dihydroxy-6 α ,7 β H-1(10)-cadinene). Cadinane sesquiterpenes are a group of molecules with the cadalane carbon skeleton chemically named 4-isopropyl-1,6 dimethyldecahydronaphthalene. This molecule has significant anti HIV-1 activity.⁴⁴

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