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Preliminary investigation of wood-rotting fungi from two forest stands of Mizoram, North East India

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Abstract

A survey and collection of wood-rotting fungi from the Dulte disturbed forest stand and Khawrihnim protected forest stand were conducted in 2021 and 2022. Thirty-one species belonging to 23 genera and 15 families of fungi were identified. Three species belonged to the phylum Ascomycota, while the remaining 28 species belonged to the phylum Basidiomycota. Most of the wood-rotting fungi (65%) were collected from the Khawrihnim protected forest stand and the remaining 35% were collected from Dulte disturbed forest stand. Among the various substrata, wood trunks supported the highest number of decaying fungi (60%), followed by twigs (17%), tree stumps (15%), and living trees (8%). *Microporus affinis, M. xanthopus, Trametes hirsuta, T. gibbosa*, and *Ganoderma* sp. were collected (100 percent frequency). More wood-rotting species were collected during the autumn (43%) compared to summer (34%), winter (16%), and spring (7%). It was also observed that white rot fungi were more prevalent (60%) than brown rot fungi (40%) among macrofungi.

Keywords – diversity – mizoram – seasons – substrata – wood rot fungi

Introduction

According to Morrell (2002), wood decaying fungi can be divided into white-rot, brown-rot, and soft-rot types. By secreting extracellular enzymes like oxidases and hydrolytic enzymes, they can degrade lignin, cellulose, or hemicellulose that make up plant cell walls in wood and utilize the by-products as nutrition (Procópio & Barreto 2021). Wood decay fungi are some of the most significant decomposers in the forest ecosystem (Hottola et al. 2009, Riley et al. 2014, Hyde et al. 2016, Ameen et al. 2020, 2022). They also help improve agricultural growth and contribute to the material cycle in forest ecosystems. Given its significance, wood-rotting fungi have drawn more and more attention. There are few studies on the wood-rotting fungi in India, notably in the northeast (Lyngdoh & Dkhar 2014). This region is essential for studying wood-rotting fungi due to its extensive forest cover, enormous variety, and novel discoveries. Fifty-three wood-rotting fungi species were identified from various forest stands in the Mizoram districts of Aizawl, Mamit, Kolasib, Champhai, and Saiha between 2006 and 2010 (Zothanzama 2011). Fifteen species of wood-rotting fungi were found in the Pachhunga University College Campus in Aizawl, Mizoram (Zothanmawia et al. 2016). Fifty-two species gathered from various regions of the state were described by Bisht (2011). Additionally, a new species (*Ganoderma mizoramense*) was discovered

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from Mizoram by Zothanzama et al. (2017). The current exploratory analysis focuses on the diversity framework of wood-rotting fungi from Khawrihnim and Dulte villages, which have disturbed forests.

Experimental procedures

Research locations and data collection

Dulte and Khawrihnim villages were chosen as the study locations. Dulte Village lies between 23°64' North and 93°06' East in the most eastern region of Mizoram. The survey area is located at an elevation of 981 meters above sea level. In summer, the temperature is moderately warm, with average temperatures of 20 to 30 °C with temperatures falling between 11 and 21 °C in winter.

Khawrihmin village (Reserved Forest) is in western Mizoram at 23°62' North and 93°62' East. The vegetation in the research area is classified as tropical semi-evergreen woods at 950 meters above sea level.

Specimen were collected in 2021 and 2022 on a seasonal basis (spring: April to May, summer: July to September, autumn: October to November, and winter: December to February). All the sporocarps and clusters of sporocarps of the same species on a log or a tree were counted as one occurrence, independent of the number of sporocarps.

Calculation of frequency percentage of occurrence

The frequency percentages of seasons were calculated using the formula as:

$$\text{Frequency \% of occurrence} = \frac{\text{Number of seasons in which species is present}}{\text{Total number of seasons studied}} \times 100$$

Individualization of specimens

Photographs of the natural environment and the morphological characteristics of the samples were taken. Specimens were identified based on literature (Ryvarden & Johansen 1980, Gilbertson & Ryvarden 1986, Núñez & Ryvarden 2000, Lodge et al. 2004, Bisht 2011). The specimens were immersed in a 5% KOH solution for microscopy, sectioned with a scalpel blade and stained with either cotton blue or Melzer's reagent.

Results

Thirty-one species belonging to 23 genera and 15 families were identified (Fig. 1) and presented in Table 1. Three (3) species belonged to the phylum Ascomycota, while the remaining 28 species belonged to the phylum Basidiomycota. Among the families, Schizophyllaceae (6 species) was found to be dominant, followed by Polyporaceae (4 species), Auriculariaceae, Ganodermataceae, and Fomitopsidaceae (3 species each), and two species each from Xylariaceae and Hymenochaetaceae, and one species each from Hypoxylaceae, Marasmiaceae, Meruliaceaee, Psathyrellaceae, Stereaceae, Incertae sedis, Dacrymycetaceae and Clavariaceae A higher number of wood-rotting fungi (65%) were collected from the Khawrihnim protected forest stand (Fig. 2) compared to 35% of wood-rotting fungi from Dulte disturbed forest stands. Among the various substrata, wood trunks supported the most significant number of decaying fungi (60%), followed by twigs (17%), tree stumps (15%), and living trees (8%) (Fig.3).

The present study revealed that wood-rotting species diversity was more significant at lower altitudes than at higher altitudes. In all four seasons, *Microporus affinis*, *M. xanthopus*, *Trametes hirsuta*, *T. gibbosa*, and *Ganoderma* sp. were collected (100 percent frequency). More wood-rotting species were collected during the autumn (43%), summer (34%), winter (16%), and spring (7%), as shown in Fig. 4. White rot fungi were also more prevalent (60%) than brown rot fungi (40%) among macrofungi.

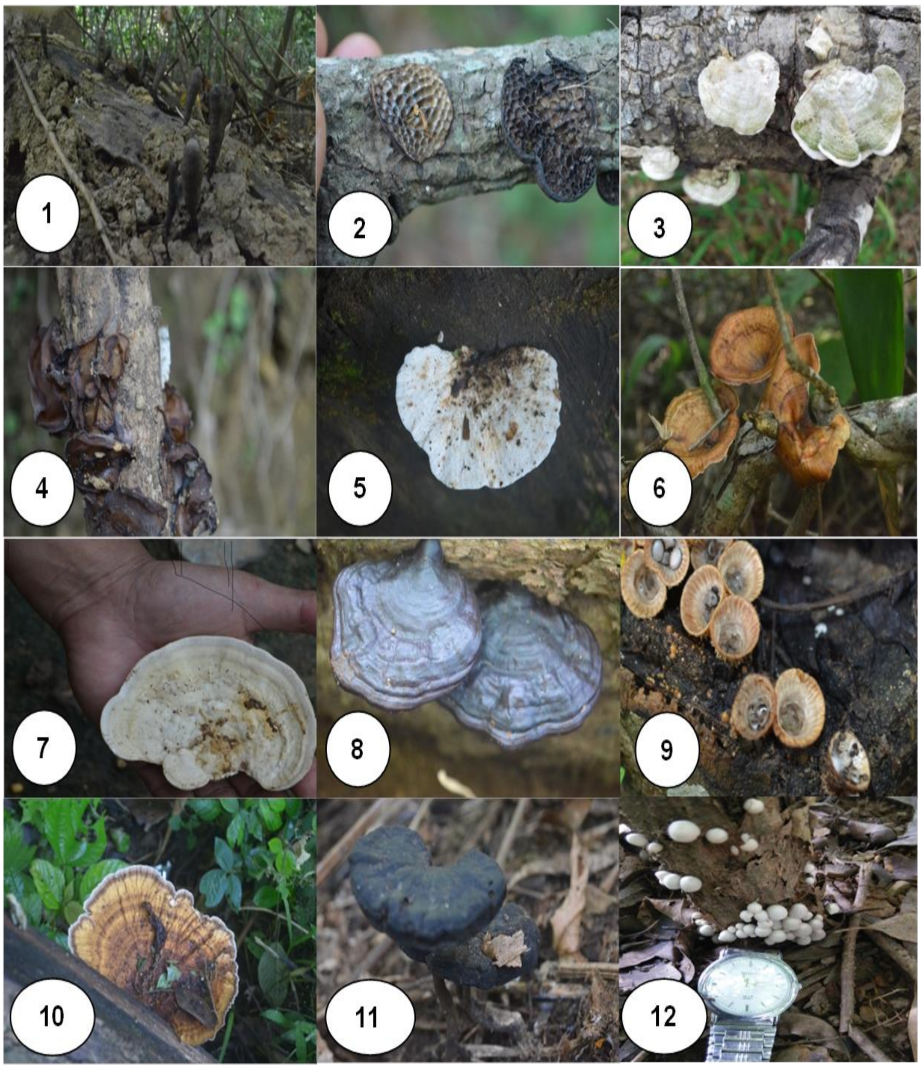

Fig. 1 – Common wood rotting fungi. 1 *Xylaria longipes*. 2 *Pseudofavolus tenuis. 3 Trametes hirsuta*. 4 *Auricularia auricula-judae*. 5 *Microporus affinis*. 6 *Microporus xanthopus*. 7 *Trametes gibbosa*. 8 *Ganoderma* sp. 9 *Cyathus stercoreus*. 10 *Sanguinoderma rugosum*. 11 *Sanguinoderma rude*. 12 *Coprinellus disseminatus.*

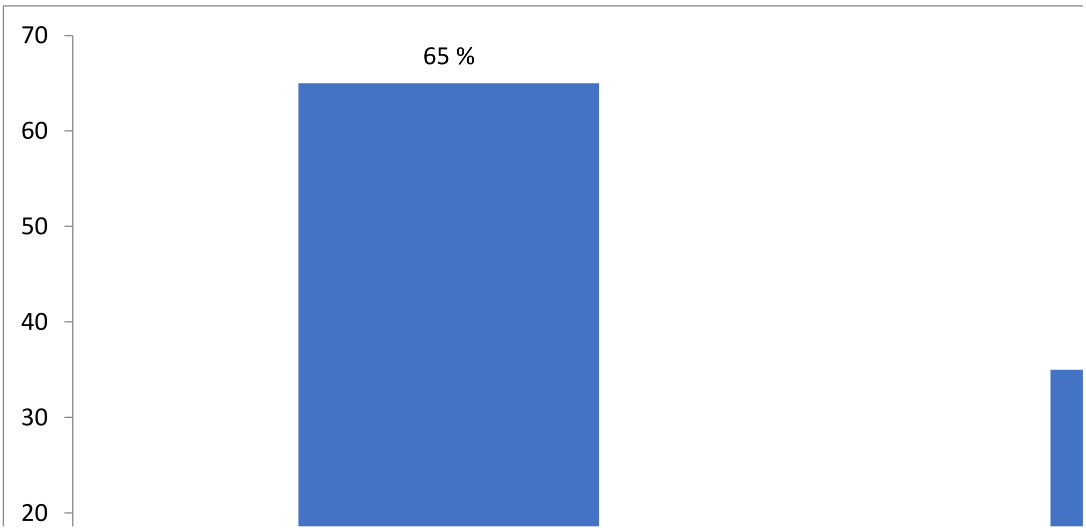

Fig. 2 – Number of wood-rotting fungi in two forest stands.

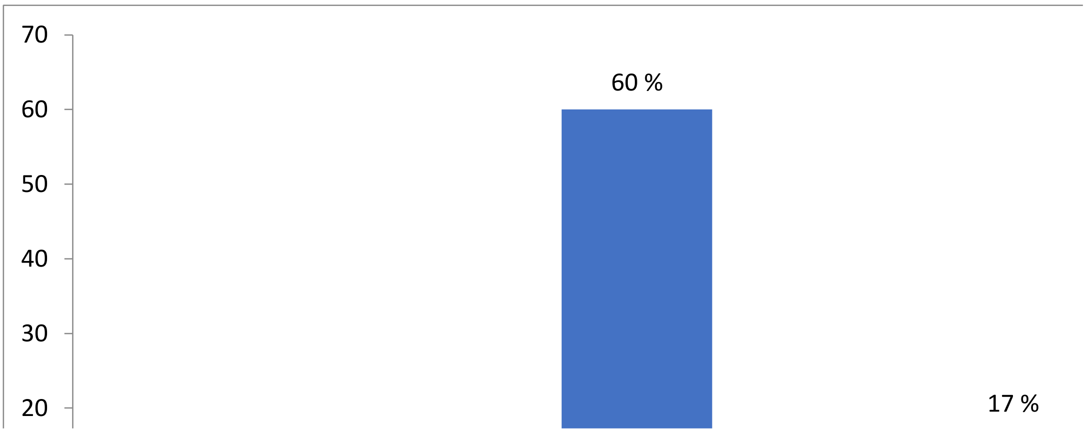

Fig. 3 – Number of wood-rooting fungi on different strata

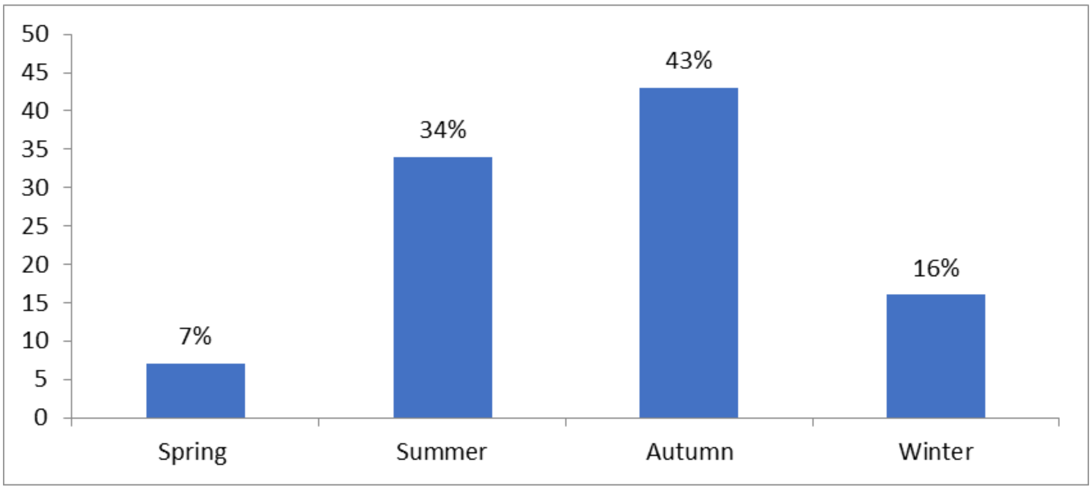

Fig. 4 – Number of wood-rotting fungi collected in different seasons.

Table 1 List of wood-rotting fungi collected from the two forest stands of Mizoram.

ASCOMYCETES	
Xylariaceae	*Xylaria longipes, X. hypoxylon*
Hypoxylaceae	*Daldinia concentrica*
BASIDIOMYCETES	
Auriculariaceae	*Auricularia auricula, A. cornea, A. polytricha*
Clavariaceae	*Ramariopsis kunzei*
Dacrymycetaceae	*Dacryopinax spathularis*
Fomitopsidaceae	*Rhodofomes cajanderi, Daedalea circularis, Postia* sp.
Ganodermataceae	*Amauroderma rude, A. rugosum, Ganoderma* sp
Hymenochaetacea	*Cyclomyces tabacinus, Phellinus* sp.
Marasmiaceae	*Marasmius* sp.
Meruliaceae	*Cymatoderma dentriticum*
Incertae sedis	*Cyathus stercoreus*
Polyporaceae	*Pseudofavolus tenuis, Polyporus dictyopus, P. tennuiculus, Pycnoporous sanguinius*
Psathyrellaceae	*Coprinellus disseminates*
Schizophyllaceae	*Schizophyllum commune, Microporus affinis, M. ochrotinctus, M. xanthopus, Trametes hirsuta, T. gibbosa*
Stereaceae	*Stereum* sp.

Discussion

The Khawrihnim reserved forest stand is a protected forest and it has rich natural vegetation and is home to a large number of wood-rotting fungus. This demonstrates how many fungal species coexist in a broad and robust plant environment. Hawksworth (1991) made a similar presumption, predicting that as tree species proliferate, so will the amount of fungus that inhabit plants. Only 35% of the wood-rotting fungi were collected from the disturbed forest stand in Dulte village. Anthropogenic activities are the primary cause of the decreased variety of wood-rotting fungi in the disturbed forest stand of Dulte. Locals removed the dead wood that had fallen to the ground, reducing substrate quantity and availability.

The variety of wood-rotting fungi is influenced by altitude. In the current investigation, it was discovered that the diversity of wood-rotting fungi decreases as altitude rises. According to a similar scenario reported from Central Europe (Pouska et al. 2010), elevation gradients modify the species makeup of wood decay fungi, lowering the fungal occurrence.

According to numerous studies,various types of fungi can grow on various substrata, including living trees, dead logs, and stumps (Jonsell & Weslien 2003, Lindhe et al. 2004). According to Norden & Paltto (2001), Penttila et al. (2006), Kuffer et al. (2008), and Abrego & Salcedo (2012), the availability and quantity of substrata play a significant role in the diversity of fungi in the forest ecosystem. Among the various substrata, wood logs contain more wood-rotting fungi (60%) than growing trees (8%). According to Berg et al. (1994), particular substrates like old trees and logs are necessary for the growth of wood rot fungi.

In all four seasons, *Microporus affinis*, *M. xanthopus*, *Trametes hirsuta*, *T. gibbosa*, and *Ganoderma* sp. occurred with 100 percent frequency. The highest presence of wood-rotting species (43%) was in autumn and the least (7%) was in spring. This may be because the fruiting bodies that appeared throughout the summer continued into the fall. In the current experiment, a large variety and abundance of wood-rotting fungi was in the dry season. Rayner & Todd (1979) reported a comparable case. Additionally, white rot macrofungi were discovered to be more prevalent (60%) than its brown rot counterpart (40%). Similar cases of brown rot were discovered in Meghalaya's temperate Himalayas (13%) and East Khasi highlands (10.4%) (Sharma 2006, Lyngdoh & Dkhar 2014). Several surveys are needed to accurately define the macrofungal communities and investigate the variety of wood-rotting fungi in a given location.

Conclusion

From this study, it can be concluded that there are more wood-rotting fungi in the Khawrihnim reserved forest stand compared to the Dulte disturbed forest stand. It may also be concluded that a large variety and number of wood-rotting fungi was observed in dry seasons.

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