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RESEARCH ARTICLE

NEW RECORDS OF WOOD ROTTING FUNGI IN PRUNED INDIAN SANDALWOOD (*SANTALUM ALBUM* LINN.) PLANTATIONS

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Abstract: This paper highlights new records of wood rotting fungi in pruned Indian sandalwood plantations.

Keywords: New records, Sandalwood, Fungi

INTRODUCTION

The Indian sandalwood tree (*Santalum album* Linn.), commonly known as the "royal tree of India", is among the most valuable and medicinally important native species found in the country. It holds a prominent place in Indian forestry, and is closely associated with Indian culture and history (Sundararaj, 2014). This tree has maintained its prestigious status as a highly regarded source of fragrance materials for over 3000 years, with a continuous history up to the present-day (Sundararaj, 2026). India has been the world's top producer and exporter of sandalwood oil since more than 5000 years ago (Hansda, 2009). But the decline in ecological integrity and ecosystem services due to rapid deforestation has led to the alarming disappearance of Indian sandalwood tree from their natural habitats, despite their remarkable adaptability to diverse ecological conditions. Since implementing the liberation policies for its cultivation, sandalwood cultivation has increased in areas outside of forests (Sundararaj et al., 2019a). Under the cultivdation of sandalwood, the trees are regularly pruned resulting in most detrimental effect on the health, growth, and productivity of sandalwood trees. The longevity of pruned plants is drastically reduced depending upon the level of pruning as they become very susceptible to decaying fungi and wood-feeding insects (Mooter and Kuhns, 1991, Mohan et al., 2022). Usually, a fungal fruiting body is an indicator of decay, but by the time fruiting bodies are produced, the fungus has already-established itself in the core and is typically revealed when the tree is broken, thrown by the wind, or felled (Kumar et al., 2022). This communication presents the first report of three wood-rotting fungal species infesting pruned sandalwood plantations, confirmed by the occurrence of characteristic fruiting bodies.

MATERIALS AND METHODS

Extensive surveys were undertaken during 2020-2025 to assess the health status of Indian sandalwood plantations covering the states of Andhra Pradesh, Karnataka, Kerala, Tamil Nadu and Telangana. The fruiting bodies of fungi observed on pruned sandalwood trees were collected, preserved and identified them with the help of fungal taxonomists.

RESULTS AND DISCUSSION

The survey revealed the infestation by several wood-rotting fungi in pruned sandalwood trees. The commonly encountered wood-rotting fungi are *Auricularia polytricha* (Mont.), *Cubamyces flavidus* (Lév.), *Daldinia concentrica* (Bolton), *Flavodon flavus* (Kl.), *Fomes* sp., *Ganoderma applanatum* (Pers.), *G. lucidum* (Lingzhi), *Hexagonia tenuis* (Fr.), *Hymenochaete* sp., *Microporus* sp., *Phellinus punctatus* (P.Karst.), *Polyporus* spp., *Porostereum* sp., *Schizophyllum commune* Fries, *Stereum gausapatum* (Fr.), *Trametes* sp. and *Trametes versicolor* (L.). Among these the infestations of the basidiomycetes *Cubamyces flavidus* and *Hexagonia tenuis*, and the agaricomycetes *Hymenochaete* sp., form the first reports on sandalwood. *C. flavidus* (Fig. 1) is one of the common wood-rotting tropical polypore in India that attacks structural and standing timbers (Banerjee ,1947), that can cause considerable damage to both sapwood and heartwood and heartwood of many tree species including Sal are ‘non-resistant’ to the attack of the fungus (Banerjee. and Samadder, 1957). *Hexagonia tenuis* (Fig. 2) causes white rot of its host (Roy and De 1979, Leite

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1994) and its infestation was found on living plant of *Nerium odorum* in Burdwan, West Bengal, and its development is not affected by diameter of the wood of host plants (De, 2018). The genus Hymenochaete (Fig. 3) encompasses more than 200 species of wood-decomposing fungi worldwide inhabiting woody hosts (Spirin et al., 2015). Hembrom, et al. (2023) recorded 134 species including species of Hymenochaete, from branches, stems or roots of trees and shrubs responsible for decaying of wood either by parasitic or saprophytic mode from Valmiki National Park, Bihar (India). Sundararaj (2026) recorded 18 and 24 species of wood-rotting fungi in standing sandalwood trees and sandalwood logs in storage, respectively. Decay by these wood-rotters result in hollowness in the wounded stem and thereby heavy loss of heartwood (Fig. 4). Pruning and other mechanical injuries significantly predispose sandalwood trees to biodeterioration by decay fungi and wood-feeders, leading to heartwood losses ranging from 22.6 to 34.5% during extraction (Sundararaj et al., 2019) and computed mean loss of 8.19% was recorded in processed wood in the Marayur sandalwood depot (Kantha Reddy et al., 2021). The science of pruning is the principle of perishing invaluable wood species (Sundararaj et al., 2022a), and it is essential to understand that mechanical damage results in permanent weakening of the tree, diminishing its value, and possible death. (Sundararaj et al., 2022b; Sundararaj & Raja Rishi, 2022).

Numerous biotic and abiotic factors contribute to the decay processes, with wounds or injuries acting as primary predisposing factors, as, regardless of the age, sandalwood virtually lacks any wound-healing mechanism, and once a wound occurs, it remains unhealed for the entire duration of the tree's life (Sundararaj, 2026). Mohanan (1994) commented that often the decay induced by wounds or injuries cannot be cured completely by any means. Heart rot resulting from decay of the central core does not immediately kill the tree; instead, affected trees continue to grow and often exhibit a healthy external appearance despite substantial destruction of standing heartwood (Mohan et al., 2022). The presence of cavities due to biodeterioration in the extracted woods plays a key role in the classification of sandalwood that is followed by the state forest departments in India, and it is the prime factor for the loss of heartwood. (Kantha Reddy et al., 2021). Hence it is almost impossible to get first class of heartwood from pruned/wounded trees. The study on the health status and heart-rot disease severity of sandalwood trees in Marayur Forest Reserves revealed that only 17% of the trees were devoid of any heart-rot symptoms (Sundararaj et al., 2022c). Contrary to pests and diseases, humans's expectations of higher wood yields through pruning were identified as the primary culprit for degrading the health, growth, productivity, and failure of sandalwood plantations. Pruning and other mechanical injuries in Indian sandalwood act as entry points for various biodeteriorating organisms, which cause loss of heartwood. Commonly used pesticides for wound dressing are largely ineffective, as many biodeteriorating agents have developed resistance. It is crucial to avoid pruning and to take all necessary precautions to prevent any other mechanical damage to live trees for preventing wood decay and loss of heartwood (Sundararaj, 2026).

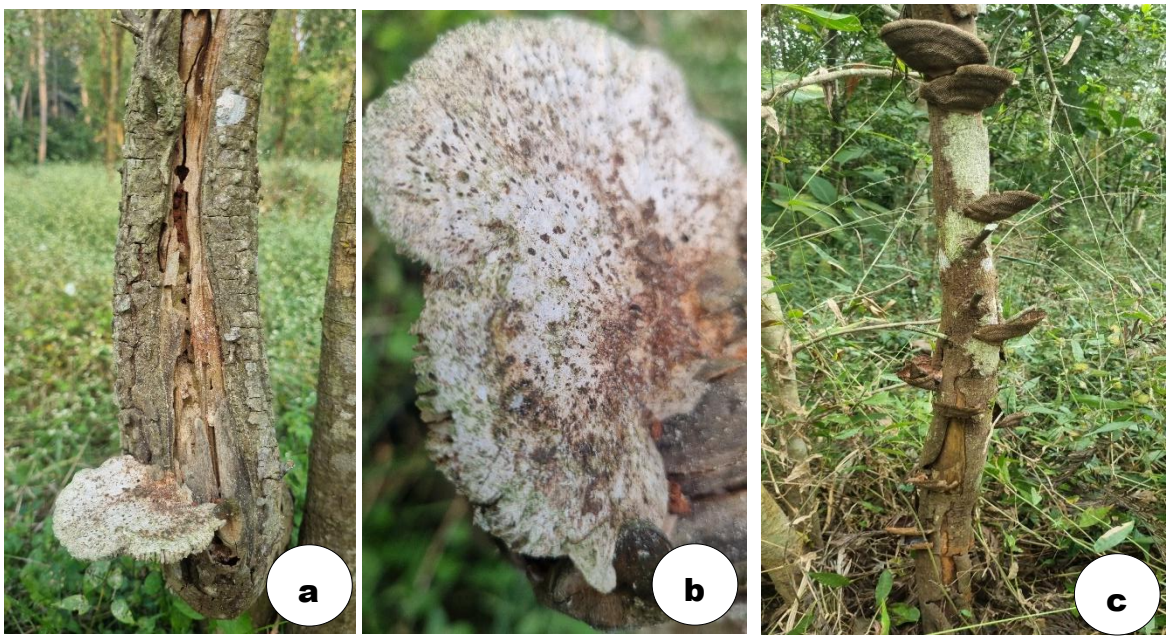

Figure 1. *Cubamyces flavidus* (a) Fruiting body on sandalwood, (b) Enlarged upper surface, (c) Enlarged under surface

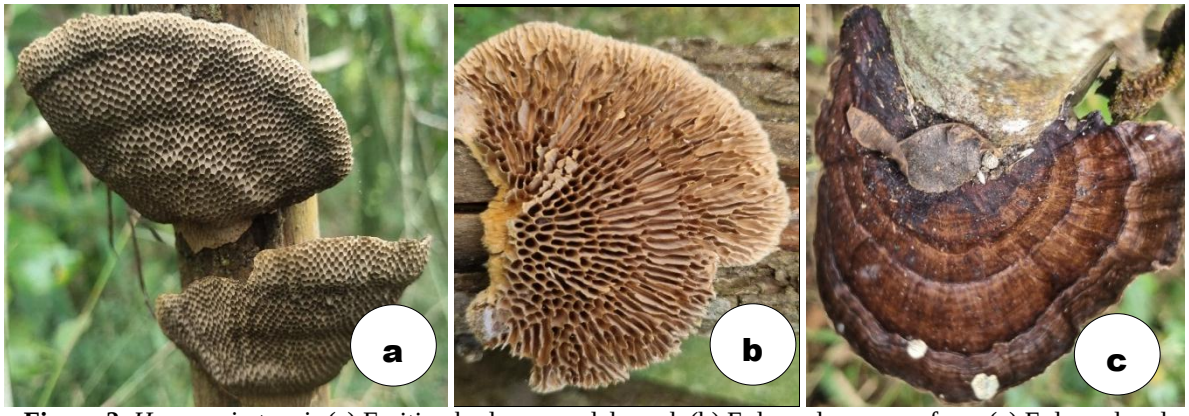

Figure 2. *Hexagonia tenuis* (a) Fruiting body on sandalwood, (b) Enlarged upper surface, (c) Enlarged under surface

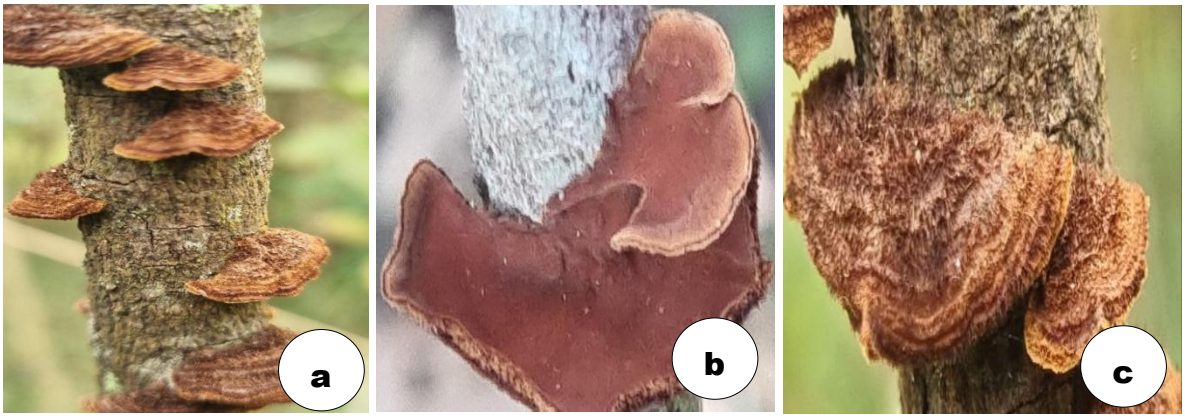

Figure 3. *Hymenochaete* sp., (a) Fruiting body on sandalwood, (b) Enlarged upper surface, (c) Enlarged under surface

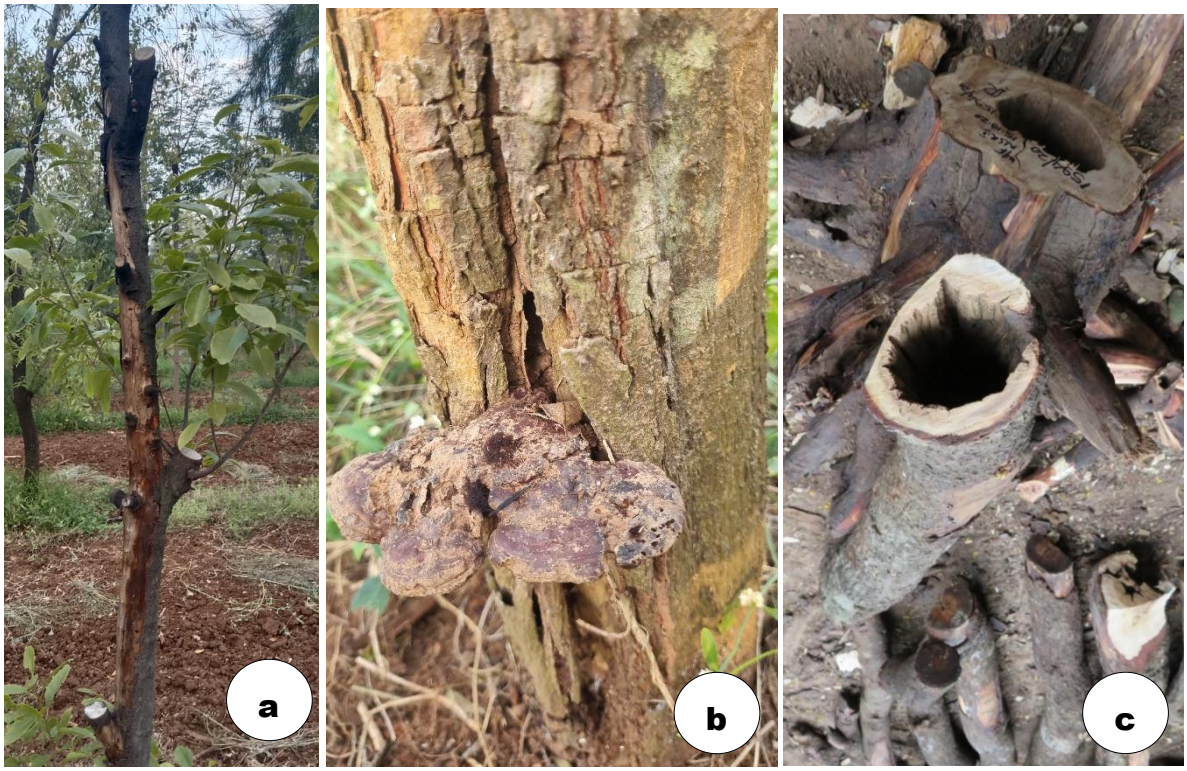

Figure 4. Impact of pruning resulting in loss of heartwood, (a) Severely pruned sandalwood, (b) Infection and establishment of wood rotting funus *Ganoderma lucidum*, (c) Visible loss of heartwood at the time of extraction

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REFERENCES

Banerjee, S.N. (1947). Funguous flora of Calcutta and Suburbs. *Bulletin of the Botanical Society of Bengal*, **1**:37-54.
Google Scholar

Banerjee, S.N. and Samadder, K. R. (1957). **3** (1&2):1-23.
Google Scholar

De, A.B. (2018). Record of a new host of the wood-rotting fungus *Hexagonia tenuis*. *Plant Pathology and Quarantine*, **8**(1):58-62.
Google Scholar

Hansda, R. (2009). The outlook for non-wood forest products in Asia and Pacific. *Working Paper No. APFSOS II/WP/2009/18*. Food and Agriculture Organisations Regional Office, Bangkok, 89 pp.
Google Scholar

Kantha Reddy, M., Raja Rishi, R., Mondal, S. and Sundararaj, R. (2021). Biodeterioration in Indian Sandalwood *Santalum album* Linn. A prime factor for loss of heartwood. *Medicinal Plants*, **13**(2):175-179.
Google Scholar

Kumar, M., Pandey, A., Ezhumalai, R. and Shukla, S. (2022). Wood Decay by Fungi: Challenges and Prevention. In Sundararaj, R. (Ed.), *Science of Wood Degradation and its Protection, Springer*, Singapore, 33-85 pp. https://doi.org/10.1007/978-981-16-8797-62.
Google Scholar

Leite, C.L. (1994). Polyporaceae on the Santa Catarina Island (South Brazil) I1I: the genus *Hexagonia* Fr. Insula, *Florianopolis*, **23**:3-14.
Google Scholar

Mohan, V., Sundararaj, R. and Anish, V. P. (2022). Wounding of Trees: The Precursor of Wood Decay. In Sundararaj, R. (Ed.), *Science of Wood Degradation and its Protection*, Springer, Singapore, 87-114 pp.
Google Scholar

Mohanan, C. (1994). Decay of standing trees in natural forests. *KFRI Research Report*, **97**:134.
Google Scholar

Mooter, D. and Kuhns, M. (1991). "G91-1035 Tree Injuries - Prevention and Care (Revised July 2002)". Historical Materials from University of Nebraska-Lincoln Extension, 860 pp.
Google Scholar

Roy, A. and De, A.B. (1979). Interfertility studies on eight species of Polyporaceae. *Mycologia*, **71**(3):655-658.
Google Scholar

Spirin, V., Runnel, K. and Poldmaa, K. (2015). Studies in the bark-dwelling species of Hymenochaete (hymenochaetales, Basidiomycota) reveal three new species. *Cryptogamie, Mycologie*, **36**(2):167-176.
Google Scholar

Sundararaj, R. (2014). Importance of growing Indian Sandalwood (*Santalum album* Linn.), in the present scenario. In John William, S. (Ed.), *Achieving Sustainable Development: Our vision and mission*, Loyola College, Chennai, 242-256 pp.
Google Scholar

Sundararaj, R. and Raja Rishi, R. (2022). Impact of removing the bark of trees for numbering on the health and longevity of trees. *Journal of Plant Development Sciences*, **14**(12):1001-1005.
Google Scholar

Sundararaj, R., Mondal, S. and Kantha Reddy, M. (2019). Pruning Effects on the Health of Indian Sandalwood (*Santalum album* Linn) in Agroforestry Conditions of South India. *American Journal of Plant Biology*, **4**(1):1-6.
Google Scholar

Sundararaj, R., Padma, S., Manjula, K. N., Athulya, R. and Kavya, N. (2022a). How are we killing the productivity of the king of timber? *Wood is Good*, **3**(1): 105-108.
Google Scholar

Sundararaj, R., Swetha, P. and Raja Rishi, R. (2022b). Pathogenic diseases of Indian Sandalwood (*Santalum album* L.), a review. *Journal of Plant Pathology*, https://doi.org/10.1007/s42161-022-01208w.
Google Scholar

Sundararaj, R., Swetha, P., Mondal, S., Kantha Reddy, M., Raja Rishi, R. and Mamatha, N. (2022c). Incidence and effect of heart Rot in Marayur Sandalwood (*Santalum album* L.) reserve, Kerala, and its natural durability against fungi. *Forest Science*, **20**:1-10. https://doi.org/10.1093/forsci/fxac049.
Google Scholar