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Review Article

Food, medicinal and ecological significance of *Termitomyces microcarpus* (Berk. & Broome) R. Heim

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Abstract: *Termitomyces microcarpus* (Berk. & Broome) R. Heim is a wild edible mushroom belonging to the family Lyophyllaceae and is well known for its obligate mutualistic association with termites of the subfamily Macrotermitinae. This species is widely distributed across tropical regions of Asia and Africa and plays significant ecological, nutritional, medicinal, and socioeconomic roles. The present communication reviews the taxonomic status, morphology, food value, ethnomedicinal applications, and ecological significance of *T. microcarpus*. The mushroom is highly valued as a nutritious food source due to its rich content of proteins, dietary fibre, essential amino acids, vitamins, minerals, and bioactive compounds. Traditional communities utilize it for the treatment of fever, colds, fungal infections, and other ailments, indicating its ethnopharmacological importance. Ecologically, *T. microcarpus* contributes to the decomposition of lignocellulosic materials, nutrient cycling, soil enrichment, and maintenance of forest ecosystem productivity through its symbiotic relationship with termites. Additionally, it serves as a source of income and food security for rural and tribal populations. Despite its importance, the species remains largely dependent on natural habitats and lacks established cultivation techniques. Further research on its bioactive constituents, conservation, domestication, and commercial cultivation may enhance its sustainable utilization and contribute to livelihood development and food security in forest-dependent communities.

Keywords: Amino acids, Ethnomycology, Forest ecosystems, Macrotermitinae, Nutraceuticals, Symbiosis

Introduction

Mushrooms have long been recognized as valuable natural resources because of their nutritional, medicinal, and ecological importance (Singh et al., 2025). Among them, termite mushrooms belonging to the genus *Termitomyces* (family Lyophyllaceae, order Agaricales) are highly esteemed for their unique flavour, rich nutrient composition, and close ecological association with termites of the subfamily Macrotermitinae (Paloi et al., 2023). The genus was established by Heim in 1942 and currently

comprises approximately 30 recognized species distributed mainly in tropical and subtropical regions of Asia and Africa (Kone et al., 2018). These fungi exhibit an obligate mutualistic relationship with termites, forming specialized fungal combs within termite nests that facilitate the decomposition of lignocellulosic plant materials and nutrient recycling in forest ecosystems (da Costa et al., 2019). Among the members of this genus, *Termitomyces microcarpus* (Berk. & Broome) R. Heim is a widely distributed edible species that appears during the rainy season and is frequently collected by rural and tribal communities for food and income generation (Sitotaw et al., 2020). The species is appreciated for its pleasant taste and contains substantial amounts of proteins, carbohydrates, dietary fibre, essential amino acids, vitamins, minerals, and diverse bioactive compounds (Thu et al., 2020). Traditional communities in India, Nepal, Tanzania, Cameroon, and several African countries have also utilized this mushroom for the treatment of fever, colds, fungal infections, gonorrhoea, and other ailments, highlighting its ethnomedicinal importance (Teke et al., 2018; Kumari et al., 2022; Bastos et al., 2023;). Despite its ecological and socioeconomic value, information on *T. microcarpus* remains scattered across diverse scientific disciplines, including mycology, ethnobiology, nutrition, and ecology. Furthermore, habitat degradation, deforestation, and declining termite populations pose potential threats to its natural occurrence and sustainability. A comprehensive understanding of this species is therefore necessary to support its conservation, sustainable utilization, and future domestication. The present study aims to compile and synthesize available information on the taxonomy, morphology, nutritional composition, medicinal applications, ecological functions, and socioeconomic significance of *T. microcarpus*. By bringing together current knowledge, this work highlights the potential of this wild edible mushroom as a valuable bioresource for food security, traditional healthcare, biodiversity conservation, and sustainable livelihood development. The review also identifies future research priorities related to bioactive compounds, cultivation techniques, value addition, and conservation strategies for the sustainable management of this ecologically important species.

Description

T. microcarpus (Berk. & Broome) R. Heim, Mem. Acad. Sci. Inst. France 64: 72 (1942), is a small-sized agaricoid mushroom that grows in association with termite colonies. Basidiomata emerge from ejected termite nest remnants on the soil surface and lack a pseudorhiza. The species is characterized by its obligate symbiotic relationship with termites and is commonly found on termite mounds during the rainy season. The pileus is small, measuring approximately 0.5–1.0 cm in diameter, initially campanulate to convex and becoming expanded with maturity. It is often umbonate with a papillate projection at the centre. The cap surface is whitish to cream-coloured, becoming olivaceous or darker towards the umbonal region. The surface is dry and glabrous, while the margin frequently splits radially at maturity, giving the appearance of flower petals. The lamellae are thin, white, moderately crowded, subfree to adnexed, and interspersed with a few lamellulae. The stipe is central, slender, hollow, smooth, and white, measuring 4.5–10.0 cm in length and 0.5–0.9 cm in diameter. It is fleshy-fibrous, uniformly thick, slightly enlarged below the soil surface, and lacks an annulus or other velar remnants. The flesh is soft, whitish, and possesses a pleasant flavour. Microscopically, the hyphae are hyaline, thin-walled, and soft-textured. Inflated pleurocystidia are present. Basidia are tetrasporic, each bearing four sterigmata

with a single basidiospore on each sterigma. Basidiospores are ellipsoid to subglobose, smooth, thin-walled, hyaline, and inamyloid. The spore print is pale pinkish in colour. These morphological features collectively distinguish *T. microcarpus* from other species of *Termitomyces* and facilitate its identification in natural habitats (Mahapatra et al., 2013; Figure 1).

Figure 1: *T. microcarpus* growth in wild

Food values

Mushrooms have been consumed for centuries as an important source of food owing to their distinctive flavour, palatability, and nutritional richness. In recent years, they have gained considerable attention as functional foods because of their health-promoting properties and potential role in preventing various human diseases (Valverde et al., 2015). Among edible mushrooms, termite mushrooms (*Termitomyces* species) are particularly prized for their superior taste and are widely distributed in tropical regions of Asia and Africa. *Termitomyces microcarpus* is highly valued by local communities as a seasonal delicacy due to its pleasant aroma, unique flavour, and perceived health benefits. Upon cooking, the fruiting bodies develop a soft, pulp-like texture and impart a meat-like taste, making them a preferred ingredient in traditional cuisines (Aryal et al., 2022). The fruiting bodies of *T. microcarpus* possess remarkable nutritional value and are considered a rich source of proteins, dietary fibre, carbohydrates, and essential micronutrients while containing relatively low levels of fat. In addition, the mushroom contains several bioactive compounds, including phenolics, flavonoids, alkaloids, ascorbic acid, β-carotene, and lycopene, which contribute to its antioxidant potential and nutritional significance. It is also rich in essential minerals such as sodium, potassium, calcium, magnesium, phosphorus, iron, zinc, copper, and manganese, along with vitamins including vitamin A, thiamine, ascorbic acid, and tocopherol. Furthermore, *T. microcarpus* contains a diverse range of amino acids, including histidine, isoleucine, leucine, lysine, methionine, phenylalanine, threonine, valine, arginine, aspartic acid, serine, glutamic acid, proline, glycine, alanine, cysteine, and tyrosine. Owing to its rich nutritional composition and bioactive constituents, *T. microcarpus* represents a valuable natural food resource with considerable potential for improving nutrition, food security, and human health.

Medicinal uses

Traditional knowledge associated with mushrooms has been developed and preserved by diverse ethnic communities worldwide. While countries such as China and Japan have extensively documented and integrated mushroom-based traditional medicine into modern healthcare systems, much of the indigenous knowledge in other regions remains inadequately recorded. Nevertheless, several species of the genus *Termitomyces* have been recognized for their ethnomedicinal importance among indigenous and rural communities across Asia and Africa. Among them, *Termitomyces microcarpus* is widely distributed and utilized in traditional healthcare practices for the treatment of various ailments. The species is known to contain bioactive compounds with potential antioxidant, immunomodulatory, antimicrobial, and antitumor properties, highlighting its therapeutic potential (Elkhateeb and Daba, 2020; Nguyen et al., 2022). In Nigeria, particularly among the Yoruba community, the mushroom is traditionally used in the treatment of gonorrhoea. In India, it is employed for managing fever, colds, and fungal infections (Tibuhwa, 2012; Kumari et al., 2022). In Tanzania and Nepal, local communities consume *T. microcarpus* as a tonic to enhance immunity and improve overall vitality. Indigenous people inhabiting the Kilum-Ijim Forest region of Cameroon use the mushroom to treat fever and promote bone development in children (Elkhateeb and Daba, 2020; Paloi et al., 2023). Traditional applications also include the use of mushroom ash for alleviating symptoms associated with chickenpox through inhalation. In certain tribal communities of India, the fruiting bodies are wrapped with ajwain (*Trachyspermum ammi*) seeds in banana leaves and smoked, with the resulting fumes believed to relieve postpartum pain and discomfort (Kumari et al., 2022). These diverse ethnomedicinal applications underscore the cultural and therapeutic significance of *T. microcarpus*. However, many of these traditional claims require further pharmacological and clinical validation to identify the active constituents and establish their efficacy and safety for future therapeutic applications.

Ecological significance

Termitomyces microcarpus is an ecologically important mushroom species belonging to the family Lyophyllaceae (Kumar et al., 2022). It is a symbiotic fungus closely associated with termites, particularly species of the genus *Odontotermes*. The fungus and termites maintain a mutualistic relationship in which termites cultivate the fungus within specialized structures known as fungus combs. This association plays a vital role in nutrient cycling and ecosystem functioning in tropical and subtropical forests. One of the primary ecological roles of *T. microcarpus* is the decomposition of lignocellulosic plant materials such as dead wood, leaf litter, and grasses collected by termites. The fungus produces enzymes capable of breaking down complex organic compounds, thereby accelerating the decomposition process. This activity contributes significantly to the recycling of carbon, nitrogen, and other essential nutrients, enhancing soil fertility and supporting plant growth. The species also contributes to soil formation and improvement. Through the degradation of organic matter and the activities of termite-fungus complexes, soil structure is enhanced, increasing aeration, water infiltration, and nutrient availability. Such improvements promote the establishment and growth of vegetation, thereby supporting ecosystem productivity. Furthermore, *T. microcarpus* serves as an indicator of healthy termite populations and stable forest ecosystems. Its occurrence reflects the presence of active

termite colonies and suitable environmental conditions. The mushroom also contributes to biodiversity by providing food resources for insects, small mammals, and humans in many rural communities. In addition to its ecological functions, *T. microcarpus* has socioeconomic importance as an edible wild mushroom, supporting local livelihoods and food security (Mishra et al., 2021; Kumar et al., 2022). Sustainable harvesting of this species can encourage the conservation of termite habitats and forest ecosystems.

Conclusion

Termitomyces microcarpus is a valuable wild edible mushroom with remarkable nutritional, medicinal, ecological, and socioeconomic importance. Its rich nutrient composition, diverse bioactive compounds, and widespread ethnomedicinal applications highlight its potential as a functional food and natural therapeutic resource. Ecologically, its obligate symbiotic association with termites contributes significantly to nutrient cycling, organic matter decomposition, soil enrichment, and the maintenance of forest ecosystem health. Furthermore, the species serves as an important source of food and seasonal income for many rural and tribal communities across Asia and Africa. Despite its multifaceted significance, the natural populations of *T. microcarpus* remain vulnerable to habitat degradation, deforestation, and unsustainable harvesting practices. Therefore, conservation of termite habitats and promotion of sustainable harvesting protocols are essential for ensuring its long-term availability. Future research should focus on the isolation and characterization of bioactive compounds, validation of traditional medicinal claims through pharmacological studies, nutritional profiling across different geographical regions, and the development of efficient cultivation and domestication techniques. Studies on its ecology, genetic diversity, climate resilience, and termite–fungus interactions are also needed to support conservation strategies. Such efforts will facilitate the sustainable utilization, value addition, and commercialization of *T. microcarpus*, thereby contributing to biodiversity conservation, food security, and livelihood enhancement in forest-dependent communities.

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