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Pleurotus tuber-regium (Fr.) Singer: Biology, Nutritional Composition, Nutraceutical Potential and Cultivation Strategies

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Abstract

Pleurotus tuber-regium is a tropical edible mushroom distinguished by its underground sclerotium and high nutritional and medicinal value. It grows on decaying lignocellulosic substrates and is widely distributed in Africa and Asia. The mushroom is rich in proteins, dietary fiber, vitamins, minerals and bioactive compounds such as polysaccharides and phenolics. It exhibits antioxidant, antimicrobial, antidiabetic and immunomodulatory properties. Its ability to grow on agro-wastes makes it a sustainable food source with significant applications in nutrition, medicine and environmental management.

Keywords: Proteins, Dietary fiber, Vitamins, Minerals, Polysaccharides, Antioxidant

Introduction

Pleurotus tuber-regium (Fr.) Singer is a distinctive edible and medicinal basidiomycete belonging to the family Pleurotaceae. Unlike most species within the genus *Pleurotus*, this mushroom is characterized by the formation of a large underground sclerotium a compact, hardened mass of mycelium that functions as a storage and survival structure under adverse environmental conditions such as drought and nutrient limitation (Oyetayo, 2011). The species is widely recognized for its dual role as a food source and therapeutic agent, particularly in tropical regions of Africa and Asia, where it has been traditionally consumed for centuries. The fruiting body emerges from the sclerotium under favourable environmental conditions, contributing to its ecological adaptability. Due to its rich nutritional composition and diverse pharmacological properties, *P. tuber-regium* has gained increasing attention as a functional food with potential applications in nutraceutical and pharmaceutical industries (Jonathan & Fasidi, 2003). Furthermore, its ability to degrade lignocellulosic substrates highlights its significance in environmental sustainability and agro-waste bioconversion.

Habitat and Worldwide Distribution

Habitat

Pleurotus tuber-regium is a saprophytic fungus that derives nutrients from decomposing organic matter. It commonly colonizes dead hardwood logs, forest litter and agricultural residues such as sawdust, straw and husks. The species secretes extracellular enzymes, including cellulases, ligninases and hemicellulases, enabling efficient degradation of lignocellulosic biomass and contributing to nutrient recycling in ecosystems (Isikhuemhen *et al.*, 2003). Optimal growth occurs under tropical climatic conditions, with temperatures ranging from 20–35°C and relative humidity levels of 70–90%.

Worldwide Distribution

The species is predominantly distributed in tropical and subtropical regions. It is widely reported across Africa (notably Nigeria, Ghana and Uganda), Asia (including India, Sri Lanka and Malaysia) and parts of Oceania. Africa is considered the primary center of diversity, utilization and ethnomycological importance of this species.

Taxonomy

Pleurotus tuber-regium (Fr.) Singer is a basidiomycetous fungus classified within the kingdom Fungi, phylum Basidiomycota, class Agaricomycetes order Agaricales and family Pleurotaceae. It belongs to the genus *Pleurotus*, which comprises the well-known oyster mushrooms. Historically, this species was placed under the genus *Lentinus* due to similarities in morphological characteristics of the fruiting

body. However, subsequent taxonomic revisions based on detailed morphological assessments and molecular studies confirmed its reclassification into the genus *Pleurotus* (Pegler, 1983). A distinguishing taxonomic feature of *P. tuber-regium* is the formation of a prominent underground sclerotium, a characteristic that sets it apart from most other species within the genus.

Distribution in India

In India, *Pleurotus tuber-regium* occurs sporadically in tropical and subtropical forest ecosystems, particularly in southern states such as Tamil Nadu and Kerala, as well as northeastern regions including Assam, Meghalaya and Nagaland. The species is typically observed growing on decaying logs during the monsoon season. Although not widely commercialized, experimental studies have demonstrated successful cultivation on agro-residues such as paddy straw, sawdust, coconut coir and sugarcane bagasse, indicating its potential for domestication and commercial exploitation.

Nutritional Values

Pleurotus tuber-regium is considered a nutrient-dense functional food due to its balanced composition of macronutrients and micronutrients.

Macronutrients

The mushroom is rich in carbohydrates, which serve as a primary energy source and contains significant amounts of high-quality proteins with essential amino acids such as lysine, methionine, leucine and tryptophan. It also provides dietary fiber that supports gastrointestinal health, while maintaining a low lipid content, making it suitable for low-fat diets (Aletor, 1995).

Micronutrients

It is a good source of essential minerals, including potassium, calcium, iron, magnesium and zinc, along with vitamins such as B-complex (B1, B2, B3), vitamin C and vitamin D.

Health Significance

The low cholesterol content and favourable nutrient profile make this mushroom suitable for individuals with metabolic disorders such as diabetes and hypertension, as well as for vegetarian diets requiring high-quality protein supplementation.

Nutraceutical Potential and Value

The nutraceutical significance of *P. tuber-regium* is attributed to its diverse bioactive compounds, including polysaccharides (notably β-glucans), phenolic compounds, flavonoids, alkaloids and terpenoids. These compounds confer multiple pharmacological properties, including antioxidant, antidiabetic, antimicrobial, anti-inflammatory, immunomodulatory and anticancer activities. The antioxidant properties help mitigate oxidative stress, while polysaccharides enhance immune responses and may inhibit tumor progression. Additionally, its role in glycemic regulation and inflammation control underscores its therapeutic potential (Wong *et al.*, 2009). These attributes position the species as a promising candidate for the development of functional foods and nutraceutical products.

Composition and Uses

Chemical Composition

The mushroom comprises proteins, essential amino acids, carbohydrates (including polysaccharides), minimal lipids and various bioactive phytochemicals that contribute to its nutritional and medicinal value.

Food Uses

It is widely consumed in soups and stews, while the sclerotium is often used as a thickening agent and meat substitute due to its firm texture.

Medicinal Uses

Traditionally, *P. tuber-regium* has been used in the management of asthma, hypertension, diabetes and inflammatory conditions.

Industrial and Pharmaceutical Applications

The species plays an important role in biodegradation and bioremediation processes due to its lignocellulolytic enzyme system. It is also explored in pharmaceutical applications as a source of natural antioxidants and bioactive compounds for drug development (Jonathan & Fasidi, 2003).

Cultivation

The cultivation of *Pleurotus tuber-regium* offers significant advantages in terms of sustainability, waste management and rural income generation. Commonly used substrates include paddy straw, sawdust, sugarcane bagasse, corncobs and rice husk. Spawn can be produced by following the method given by Kumar and Chhetri, 2024. The cultivation of this mushroom is not yet well explored in India and its consumption is still dependent on wild foraging from the forest areas. The species demonstrates efficient growth on agricultural wastes, supporting sustainable farming practices and

resource recycling (Isikhuemhen *et al.*, 2003).

Conclusion

Pleurotus tuber-regium is a unique and underutilized mushroom species with considerable potential in nutrition, medicine and environmental management. Its rich nutrient profile, diverse bioactive compounds and adaptability to agro-waste substrates make it an excellent candidate for functional food and nutraceutical development. Despite its limited commercialization in India, expanding research, awareness and cultivation efforts could significantly enhance its contribution to food security, rural livelihoods and sustainable agriculture. The integration of this species into mainstream agricultural and healthcare systems may provide long-term ecological and economic benefits.

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