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Review

Ethnomycology of *Pleurotus tuber-regium* and its use in food, medicine and bioremediation

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Abstract

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Pleurotus tuber-regium is a mushroom of the Pleurotaceae family, native to tropical Africa and the Australasia-Pacific region. It grows on the dead or decaying wood of certain trees such as *Daniellia oliviera*, *Terminalia superba* and *Blighia sapida*. *Pleurotus tuber-regium* is the only species of oyster mushroom that produces sclerotium. In traditional African medicine, the sclerotium is used to treat various ailments such as headaches, skin diseases and diabetes. The fruiting body and sclerotium are edible and contain essential amino acids such as methionine, lysine and tryptophan. Polysaccharides from *Pleurotus tuber-regium* show promise in delaying the progression and complications of diabetes in insulin-resistant rats due to pleuturegin, a ribosome-inactivating protein. It has anti-tumour, immunomodulatory, antioxidant, anti-inflammatory, hypocholesterolaemic, antihypertensive, antihyperglycaemic, antimicrobial and antiviral properties. *Pleurotus tuber-regium* has been used in the bioremediation of soil contaminated with hydrocarbons. The fungus releases microdroplets toxic to nematodes, indicating potential for soil pest control. *Pseudomonas tolaasii* and *Lycoriella solani* are among the organisms that infect *Pleurotus tuber-regium* during cultivation. This review discusses the ethnomycology of *Pleurotus tuber-regium* and its uses in food, medicine and bioremediation.

Keywords: culinary, ethnomedicine, fungi, mushrooms, sclerotium.

INTRODUCTION

Pleurotus tuber-regium (Fr.) Singer is a saprotrophic fungus that usually grows on dead wood such as *Daniellia oliveri* (Rolfe) Hutch & Dalziel, *Treculia africana* Decne. ex Trécul, *Terminalia superba* Engl. & Diels, *Terminalia ivorensis* A.Chev. and many others (Zoberi, 1973; Okhuoya & Okogbo, 1990). It is a basidiomycete commonly found in tropical Africa and the Australasian region of the world (Oso, 1977; Isikhuemhen & LeBauer, 2004). One of the distinguishing features of *Pleurotus tuber-regium* is its non-pleurotoid habit (Isikhuemhen & Nerud, 1999). As *Pleurotus tuber-regium* decomposes the wood, it produces a tuber-like structure, a sclerotium, sometimes within the decomposing wood or in the soil beneath. The fungus is the only member of the genus *Pleurotus* that produces true sclerotia (Isikhuemhen et al., 2000). The sclerotium, which can be up to 30 cm in diameter, is ovoid or spherical.

If the conditions surrounding the sclerotium are favourable, fruiting bodies can be produced for as long as the nutrients in the sclerotium will support them. The sclerotium and the fruiting bodies are edible (Oso, 1977). Naturally, the sclerotium is produced in response to growth under harsh conditions to sustain the life of the *Pleurotus tuber-regium* under such unfavourable conditions. The sclerotium is usually produced when the substrate on which the fungus is growing becomes exhausted, or the available nutrients in the growth medium are depleted.

In Nigeria, it is usually collected from the wild. However, this is becoming increasingly difficult due to the extensive use of herbicides and various chemicals in agriculture and the annual occurrence of bush burning. The species, which has a tetrapolar mating system (Chen & Huang, 2004), has been recorded in tropical and subtropical Africa (Nigeria, Sierra Leone, Zimbabwe, Ghana, Kenya, Cameroon, Zambia, Uganda, Republic of Chad, Republic of Zaire, Samoa, Tanzania, Burundi and Ivory Coast), Australasia and the Pacific (Australia, Hunan Province of China, Sri Lanka, India, Malaysia, Indonesia, Burma and Papua New Guinea). *Pleurotus tuber-regium* is internationally recognised, and its use in modern medicine is being studied worldwide (Akpaja et al., 2003).

Phenotypically, *Pleurotus tuber-regium* is remarkably similar to *Pleurotus ostreatus*, but whereas the pileus of *Pleurotus tuber-regium* is curved upwards, that of *Pleurotus ostreatus* is curved downwards. Microdroplets of *Pleurotus tuber-regium* are nematophagous (Hibbett & Thorn, 1994). Industrial cultivation is not yet common, but many studies have demonstrated how organic wastes such as cardboard, sawdust and maize can be used for cultivation (Okhuoya & Okogbo, 1991; Isikhuemhen & Okhuoya, 1995; Isikhuemhen & LeBauer, 2004; Afolabi et al., 2021). The mycelia have been found to grow well within a temperature range from 15 °C to 40 °C, between pH 4–9, although optimum growth is at a temperature of 30 °C to 35 °C (Oso, 1977; Fasidi & Ekuere, 1993).

Pleurotus tuber-regium has significant economic value due to the consumption of its sclerotia and the mushrooms cultivated from it (Lau & Abdullah, 2016). The sclerotia are typically collected from the wild and used for food and medicine. The sclerotium of *Pleurotus tuber-regium* is used for recreational purposes as it is chopped and used to make tyres for toy cars (Kamalebo et al., 2018). The discovery by Oranusi et al. (2014) that there is no significant difference ($p > 0.5$) in the colony-forming units per millilitre of heterotrophic organisms on *Pleurotus tuber-regium* sclerotium agar, plate count agar, and nutrient agar has shown that *Pleurotus tuber-regium* sclerotium agar can be standardised and used as a low-cost medium for the culture of heterotrophic organisms. In addition, sclerotium has been found to function well as a coagulant and disinfectant, making it useful in treating natural and wastewater (Yongabi, 2004). This study aimed to discuss the ethnomycology of *Pleurotus tuber-regium*, and present its uses in food, medicine and bioremediation.

MATERIALS AND METHODS

To conduct this study, relevant and current information was gathered from reliable databases and platforms such as *ScienceDirect*, *PubMed*, *ResearchGate*, *Springer* journals and international laboratory websites. Valuable information and data were collected from these platforms and databases by using words, clauses, and phrases such as *Pleurotus tuber-regium*, medicinal benefits of *Pleurotus tuber-regium*, nutritional value of *Pleurotus tuber-regium*, *Pleurotus* and nematodes, cultivation of *Pleurotus tuber-regium* and others. All articles containing the above keywords and clauses were downloaded. Approximately 123 articles, textbooks and lectures were reviewed, but only those published (63) by reputable sources were analysed and cited.

This analysis used the scientific names of fungi, plants and other organisms as they appear in the references analysed.

ETHNOMYCOLOGY

Pleurotus tuber-regium is known as *Lentinus tuber-regium*, referred to as "sclerotia-producing *Pleurotus*" or "King Tuber Oyster mushroom" and recognised as "hunai" in China (Chen & Huang, 2004; Lau & Abdullah, 2016). In Nigeria, the Yoruba people of the southwest call it "olu ohu" because the sclerotium can continue to produce fruiting bodies if kept in a moist place for a long time (Akinyele, 2020). It is known as "osu" or "ero nsu" in the southeastern part of the country, while in the Hausa language, it is known as “katala” or “rumbagada” (Oso, 1977).

African tribespeople use the tuber-like sclerotia of *Pleurotus tuber-regium* to treat a wide range of health problems, including skin diseases, child malnutrition, inflammatory headaches, stomach problems, colds, asthma, fever, diabetes, hypertension and smallpox (Oso, 1977; Chen & Huang, 2004). Oral knowledge of mushrooms’ edible properties and traditional therapeutic uses has been passed down through generations (Ayodele et al., 2011; Oyetayo, 2020). Oso (1977) has revealed that some indigenous doctors use different blends of herbs and additional components in their therapeutic practices. Some of these mixtures include *Pleurotus tuber-regium* and are used to treat hypertension, asthma, smallpox, headache, stomach problems, colds and fevers (Akpaja et al., 2003). It is used to treat obesity, cough and asthma in the people of Edo State, Nigeria, and heart problems in the southeast of the country (Isikhuemhen & Okhuoya, 1995; Isikhuemhen & LeBauer, 2004).

Pleurotus tuber-regium is used in Ghana as an element in funeral embalming and medicine for ailments associated with childhood anaemia and malnutrition (Okhuoya et al., 1998). *Pleurotus tuber-regium* has historically been used by herbal healers in various Ghanaian tribes to treat ailments such as hypertension, asthma, childhood and underweight (Dzomeku, 2009). In addition, *Pleurotus tuber-regium* is used in the Democratic Republic of Congo to treat bedwetting and bronchitis and to stimulate breast milk in lactating women (Kamalebo et al., 2018). Chasing birds away from rice fields with powder of *Pleurotus tuber-regium* sclerotium is practised in some areas of the Democratic Republic of Congo (Kamalebo et al., 2018).

FOOD USE

Both the sclerotium and the fruiting body are edible. After peeling off the outer brown part of a *Pleurotus tuber-regium* sclerotium, the inner white part is ground into a fine powder and added to a soup, which expands and increases the volume of the soup (Iwuagwu & Onyekweli, 2002). The sclerotium can also be mashed with melon or chopped into small pieces to make a soup. It can replace melon in vegetable or okra soups. It also thickens “nkwobi”, a famous pepper soup in Nigeria. In Nigeria, the thickening of soups is one of the most popular uses of *Pleurotus tuber-regium* sclerotium in food preparation. Sclerotium of *Pleurotus tuber-regium* is widely consumed in Nigeria and among several tribes in sub-Saharan Africa. It has been demonstrated that the sclerotia can be dried to an exceptionally low moisture content without losing its therapeutic and nutritional properties (Gbasouzor & Ileleji, 2023).

According to Oso (1977), the stipe and pileus of *Pleurotus tuber-regium* are chopped, boiled, and served in vegetable or okra soups. High levels of trace elements and mineral components in *Pleurotus tuber-regium* aid in human body growth and tissue repair (Aloma et al., 2018). Studies of sporophores and sclerotia have revealed that they are low in fat and high in minerals, vitamins, proteins, and carbohydrates (Isikhuemhen & LaBauer, 2004). Ogundana & Fagade (1982) have reported that the mushroom has 16.5% of dry matter, of which 7.4% is crude fibre, 14.6% is crude protein, and 4.0% is made up of lipids and oils. The fat content is like that of other mushrooms. A total sugar content of 18.6% has been reported, with a high concentration of galactose and a low content of maltose and glucose. Levels of oxalic acid (which reduces nutritional value) and harmful hydrogen cyanide are low in *Pleurotus tuber-regium*.

The amount of vitamin C present in *Pleurotus tuber-regium* is low. Studies by Jonathan et al. (2006) have shown that the mushroom’s lipid and ethanol-soluble sugar content is typically low. Eating this mushroom is safe for people with diabetes, heart problems or weight problems. Of all edible wild mushrooms, *Pleurotus tuber-regium* has the highest crude fibre content (Jonathan et al., 2006). Young *Pleurotus tuber-regium* fruiting bodies have been found to have a higher protein content than mature ones.

According to Ikewuchi & Ikewuchi (2011), the proximate composition of *Pleurotus tuber-regium* sclerotia is as follows: moderate amounts of ash (2.20% wet weight and 2.44% dry weight), crude fibre (2.89% wet weight and 3.20% dry weight), carbohydrate (20.00% wet weight and 22.15% dry weight) and protein (64.31% wet weight and 71.21% dry weight). It has also been found that 100 g of sclerotia of *Pleurotus tuber-regium* contain 6.15 g of aromatic amino acids, 1.50 g of sulphur-containing amino acids and 25.93 g of essential amino acids. It has a high content of essential amino acids such as phenylalanine, leucine, and histidine, with sulphur-containing amino acids (cystine and methionine) as the limiting amino acid(s). Compared to egg protein, adult requirements, and human milk, chemical values of 26%, 88%, and 36% have been recorded, respectively (Ikewuchi & Ikewuchi, 2011). Therefore, in remote areas where fish and meat are not readily available, the fruiting bodies and sclerotia of the mushroom can be used as a source of protein or as a substitute for these foods. In addition, vegans can supplement their diet with this mushroom to benefit from its high protein content.

Sclerotium is sometimes used to induce weight gain in malnourished infants (Ikewuchi & Ikewuchi, 2011). The high protein content of this mushroom can help meet a person's daily protein requirement, typically between 23 and 56 grams (Chaney, 2006). There is also a significant amount of crude fibre in the sclerotia. It suggests that eating sclerotia may help reduce the incidence of diseases such as obesity, high blood pressure, colon cancer, diabetes and some digestive disorders (Ikewuchi & Ikewuchi, 2008; Adeyi et al., 2021). Fibre changes the environment in the colon, which protects the colon by increasing stool volume, which reduces the higher concentrations of bile acids associated with a high-fat diet (Dillard & German, 2000).

According to Ohiri (2018), the sclerotium of *Pleurotus tuber-regium* has relatively high concentrations of potassium 60.66 ± 4.13 mg/kg and magnesium (41.79 ± 3.14 mg/kg) as major minerals, while manganese (1.20 ± 0.10 mg/kg) and zinc (0.95 ± 0.07 mg/kg) are micronutrients with the highest values. High levels of glutamic acid and aspartic acid have been recorded by Ohiri (2018), with values of 11.51 ± 1.01 mg/kg and 5.52 ± 0.86 mg/kg, respectively. Mushroom proteins are often classified as higher-quality proteins because they are more soluble and digestible than green vegetables and oranges (Jonathan et al., 2006; Zhou et al., 2020).

Due to their high concentration of phytochemicals and micronutrients, freshly collected mushrooms can be consumed as food or as a food additive and herbal medicine. Jiwuba et al. (2023) have reported that including *Pleurotus tuber-regium* in the diet of West African dwarf goats resulted in improved intake, body weight, nutrient digestibility and nitrogen utilisation. In the same vein, Wuanor et al. (2018) have reported that including groundnut shells biodegraded with *Pleurotus tuber-regium* in the diet of West African dwarf goats improved their growth performance. Better weight gain, feed conversion, lower cholesterol, creatinine, and alanine transaminase have been observed in rabbits fed with diets containing 50% to 70% sclerotium powder. They also have a greater caecal apical width while showing improved growth, gastrointestinal morphology and cholesterol metabolism with no adverse effects (Salami et al., 2021).

Recent studies have focused on how complex, indigestible long-chain polysaccharides and carbohydrates from *Pleurotus tuber-regium* could be used as novel prebiotics. There are reports that β-glucans isolated from the sclerotium of *Pleurotus tuber-regium* could enhance the growth of bifidobacteria such as *Bifidobacterium infantis*, *Bifidobacterium longum*, and *Bifidobacterium adolescentis* in vivo and as well as significantly improve their production of short-chain fatty acids (Lin et al., 2020).

MEDICINAL BENEFITS

In rats with insulin resistance, a study showed that the polysaccharides of *Pleurotus tuber-regium* can halt the development of diabetes and its associated problems. The antiviral, antibacterial, antihyperglycaemic, antihypertensive, hypocholesterolaemic, anti-inflammatory, antioxidant, immunomodulatory, and anti-tumour activities of *Pleurotus tuber-regium* have been demonstrated and primarily linked to the presence of pleuturegin, a ribosome-inactivating protein (Wang & Ng, 2001; Gregori et al., 2007). In addition, this ribosome-inactivating protein possesses N-glycosidase and translation inhibitory properties in the fruiting bodies, mycelia, fermentation broth and extracts of *Pleurotus tuber-regium*. The polysaccharides in *Pleurotus tuber-regium* appear to have potent anti-tumour and immunomodulatory effects and other beneficial properties. However, little is known about the molecular basis of these therapeutic effects. Isikhuemhen & LeBauer (2004) have demonstrated the presence of polysaccharides and other substances with potential medical benefits in the sclerotia of *Pleurotus tuber-regium*.

As an alternative to maize starch as a tablet disintegrant, the potential of the powder produced from the mycelia of this fungus has been demonstrated by Iwuagwu & Onyekweli (2002). When the disintegrating ability of *Pleurotus* powder is compared with corn starch in paracetamol tablets, *Pleurotus* powder demonstrates superior flow, swelling capacity, and high water retention capacity. At less than 10% w/w concentrations, tablets made with *Pleurotus* powder dissolve faster than those made with maize starch. The reason why *Pleurotus* powder could work as a tablet disintegrant is thought to be related to its ability to swell to more than three times its volume when wet. In addition, Badalyan et al. (2008) have found that the antagonistic or antifungal activity of *Pleurotus tuber-regium* against filamentous fungi can be exploited to create novel, potent antifungal drugs, which are critical for both the prevention and treatment of opportunistic fungal infections in immunocompromised hosts that spread widely and become resistant to treatment (such as mycoses).

The effects of carbon tetrachloride-induced damage to the testes and reproductive system have been ameliorated by adding *Pleurotus tuber-regium* to the rats' diet (Okolo et al., 2017). It suggests that the mushroom may be used to cure or manage cases of male sexual dysfunction, particularly those related to sperm concentration, motility, morphology, and hormonal imbalance caused by free radicals. At a test concentration of 32.5 µg/mL, Afieroho et al. (2013) have effectively inhibited the growth of clinical isolates of *Mycobacterium tuberculosis* using a dichloromethane extract of *Pleurotus tuber-regium* sclerotium. Adebayo et al. (2018) have also documented remarkable antibacterial and antioxidant properties in *Pleurotus tuber-regium.* The ability of the extracellular polysaccharide fraction of *Pleurotus tuber-regium* to protect liver cells from paracetamol-induced damage has been successfully demonstrated by Bamigboye et al. (2019a).

Lin et al. (2020) have demonstrated that hyperbranched β-glucans, the sclerotium of *Pleurotus tuber-regium* can be used to create a nanocarrier for the targeted delivery of gene therapy. It is envisaged that sclerotium-derived β-glucans, naturally occurring biopolymers, can be used as biocompatible functional nanomaterials (Lin et al., 2020). There is evidence that sclerotium-derived β-glucans may have a more significant function as a carbohydrate-based prebiotic in regulating the gut microbiome's modulation for human well-being (Lin et al., 2020). In addition, when *Pleurotus tuber-regium* is mutated, strains are produced, which produce nutritionally significant levels of vitamin D. Vitamin D is essential for the treatment and control of osteoporosis, cancer, autoimmune diseases and osteomalacia, particularly in situations where sunlight exposure is limited (Won *et al*., 2018; Bamigboye et al., 2019b).

It has been shown that feeding obese diabetic individuals with *Pleurotus tuber-regium* in their diet reverses their dyslipidaemia (Adeyi et al., 2021). Aqueous extract of *Pleurotus tuber-regium* has also shown impressive anti-ulcer properties when used to treat peptic ulcers (Onuegbu et al., 2023). Oghenemaro et al. (2020) have found that *Pleurotus tuber-regium* extracts, especially the aqueous extract, can be used as probiotic and prebiotic materials to maintain weight. Akinlabi et al. (2021) have also confirmed the efficacy of *Pleurotus tuber-regium* in successfully treating induced ocular hypertension, particularly during the light phase. It makes *Pleurotus tuber-regium* a candidate in searching for a novel drug to treat induced ocular hypertension. The mushroom has also been reported to explore plant sources and is useful for patients suffering from various bone, joint and inflammatory diseases such as arthritis (Cheung, 2013). Lin et al. (2014) have concluded from their work that ethanolic extract of *Pleurotus tuber-regium* may be a veritable source of angiogenesis inhibitors.

BIOREMEDIATION ABILITY

Bioremediation enhances living soil organisms such as bacteria, fungi, and plants, to degrade organic contaminants and hydrocarbons (Atlas & Bartha, 1992). To facilitate degradation, organisms and nutrients such as nitrogen and phosphate are added to the contaminated soil. Phosphate and nitrate amendments accelerate the biodegradation of oil. Adenipekun (2008) has stated that bioremediation is the process by which biological agents convert simple or complex chemical substances into non-hazardous ones, producing materials with improved nutritional values or simply reducing the final bulk of the product. As a result, several other compounds are produced, most of which are much more water soluble than the original hydrocarbon.

It is well known that white-rot fungi can break down lignin, a non-repeating structural polymer present in woody plants, which enables them to break down xenobiotic contaminants (Adenipekun, 2008; Fasiku et al., 2023). According to numerous studies, *Pleurotus* species have been used in bioremediation activities (Isikhuemhen et al., 2000; Adenipekun, 2008). It has been observed that the white rot fungus *Pleurotus tuber-regium* can improve crude oil-contaminated soil. The resulting soil sample can enhance the germination and growth of *Vigna unguiculata* seedlings (Isikhuemhen et al., 2000). *Pleurotus tuber-regium* has also been found to degrade inorganic substances such as polyethylene. It has reduced the weight of polyethylene strips by 13.25%, almost double the result obtained with *Pleurotus pulmonarius* (Hameed, 2022).

A thread of interwoven or interconnected strands of cells is called a mycelium. Sultana et al. (2007) have found that a colony can range from a few centimetres to several hectares, as in the case of *Armillaria*. The elegant lattice-like structure of the fungal mycelium, also known as the mycelial network, is ideally suited to act as a filtration membrane. Each colony spreads within clearly defined boundaries by forming long, intricate networks of cells that regularly divide in a matrix-like fashion. An avid consumer of nitrogen (N) and carbon (C), the mushroom's mycelium releases enzymes to dissolve organic compounds. The use of sawdust impregnated with mushroom mycelium in drainage basins downstream of livestock farms is an example of the use of mycelium for mycofiltration. The mycelium acts as a filter, capturing biological contaminants such as faecal bacteria from the water's surface as it flows directly into vulnerable watersheds (Sultana et al., 2007; Heide et al., 2023). The sclerotium of *Pleurotus tuber-regium* is an excellent disinfectant and coagulant that can be used in wastewater and natural water purification, according to Yongabi (2004).

Most known fungal groups contain species that use adhesive or ingested spores or other features in vegetative hyphae to attack and consume worms. Cytoplasmic toxin-containing mycelia, paralysing toxin droplet-secreting cells, constricting and non-constricting rings, filaments, stephanocyts, nets and adhesive nubs are examples of hyphal adaptations for nematode attack or capture (Hibbett & Thorn, 1994). According to Sultana et al. (2007), the extracellular enzyme of *Pleurotus tuber-regium* stings these worms and acts as an anaesthetic, allowing the mycelium to grow directly into their paralysed bodies. Hibbett & Thorn (1994) have observed that *Pleurotus tuber-regium* cultures on agar produce poison droplets on stalked secretory processes of their aerial hyphae. Upon contact with the poison droplets, nematodes are paralysed and colonised by hyphae.

CHALLENGES OF CULTIVATION

Pests and competitors target mushrooms as they do other cultivated crops. *Sclerotium rolfsii* is the only fungus that produces stipe rot, as has been reported in the study by Okhuoya & Okogbo (1991); other fungi result in crop loss or deformation of the *Pleurotus tuber-regium*. The rot that inhibits the formation of a cap on the stipe is yellowish-brown. The stipe breaks off and disintegrates into the substrate over time. *Sclerotium rolfsii* is a soil-borne pathogen that can cause infections, including fruit rot and root rot. It is most common in tropical and subtropical regions.

The fungi found in the production of *Pleurotus tuber-regium* are rarely parasitic, but grow and develop on the substrate. *Aspergillus*, *Trichoderma*, *Penicillium*, *Trichothecium*, *Mucor*, *Fusarium*, *Coprinus*, *Botrytis*, and *Monilia* are among the genera commonly found growing on the substrates on which *Pleurotus tuber-regium* grows. If nitrogen-rich nutrients are added to the substrates, fungal infestation could become more problematic (Odeyemi et al., 2014). The likelihood of infection increases at temperatures above 35°C. Elevated substrate temperatures have the potential to damage mushroom spawn, reduce mycelial growth rates and expose the substrate to competitors such as green mould and *Coprinus* species (Royse, 2003).

Pseudomonas tolaasii is the most frequent bacterial problem in *Pleurotus tuber-regium* cultivation (Royse, 2003; Ghasemi et al., 2021). The brittleness of the basidiocarps, orange colouring and reduced yield are signs of infection by this organism. Infection of mushrooms reduces their shelf life. Growers of mushrooms such as *Pleurotus tuber-regium* and others suffer the greatest losses from insects that infest mushroom tissues, especially in the summer.

The families Phoridae (*Megaselia halterata*, *Megaselia nigra*), Sciaridae (*Lycoriella solani*), Scatopsidae, and Cecidomyiidae (*Mycophila speyeri*) are the major insect pests associated with *Pleurotus tuber-regium* (Odeyemi et al., 2014).

The extreme sensitivity of *Pleurotus tuber-regium* primordia to chemical vapours makes insect control with pesticides a challenge. Several types of fly traps and strict hygiene measures (especially during the spawning season) help keep fly populations below economic thresholds. Royse (2003) states several unknown causes of mushroom deformities exist. Still, most deformed mushrooms can be linked to many factors, including inadequate light, excessively low fruiting temperature (below 10°C), smoke, chemical vapours and overheated substrates during the spawning run. *Bacillus thurigiensis* var. *israeliensis* has been found to be effective against sciarid flies in the USA when added to the substrate during spawning.

CONCLUSIONS

This analysis showed that *Pleurotus tuber-regium* has enormous potential to solve several problems facing humanity today. *Pleurotus tuber-regium* has the potential to solve the problem of hidden hunger due to its high nutritional content. It can also serve as a source of bioactive compounds for treating and managing various medical conditions. *Pleurotus tuber-regium* could be used in the bioremediation of hydrocarbon-contaminated soils. However, the availability of *Pleurotus tuber-regium* through artificial cultivation to meet increasing demand is threatened by organisms such as *Pseudomonas tolaasii*, *Lycoriella solani* and other associated pests.

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