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Review Article

Recent Studies on Biotechnological Roles of Pleurotus spp

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Abstract

Pleurotus fungi are one of the biotechnologically treasured fungi may also be known as oyster or tree mushrooms. Pleurotus ostreatus is a widely used oyster mushroom. Edible mushrooms of this category are generally known for their significant roles in the various field of biotechnology like in food industries, bioremediation, enzyme production, medicinal biotechnology, bioengineering and so on. They have various biotechnologically valuable applications as promising bioremediation, anti-diabetic, anti-inflammatory, anti-cancerous, anti-microbial, anti-oxidant, and nematocidal and many more. This short review describes about the recent studies (year 2020) on the biotechnological applications of Pleurotus spp.

Keywords: pleurotus spp, pleurotus ostreatus, edible mushrooms, oyster mushrooms, biotechnological applications, medicinal applications, bioremediation

Introduction

Pleurotus spp are gilled mushrooms and some of them are world's most cultivated edible mushrooms [1, 2]. They may also be called as oyster or tree mushrooms [1, 2]. Pleurotus ostreatus, also commonly known as oyster mushroom, is a very commonly used edible mushroom known for their great nutritional values. Pleurotus spp have their worldwide presence in both tropical as well as temperate climates [2]. Most of their species are white rot fungi on hardwood trees, although some also decay conifer wood [3]. P. eryngii is unusual in being a weak parasite of herbaceous plants and P. tuber-regium produces underground sclerotia [4]. Pleorutus spp are also nematophagous in addition to being saprophytic by paralyzing them with a toxin [5, 6]. Such edible mushrooms are recognized for their pronounced nutritional potential as they are full of nutrients like protein, vitamins, minerals, carbohydrates and many other [7]. Pleurotus spp also have various valuable biotechnological applications [8-31] that have been summarized here based on recent reported studies on them [8-20].

Recent Biotechnological Applications

Castañeda-Ramírez et al (2020) describes about the role of edible mushrooms as nematocidal activity based on researches and their useful applications in controlling these parasitic nematodes adversely affecting crops and animals [8]. Jayasuriya et al. (2020) [9] investigated about anti-inflammatory activity and underlying mechanism of culinary mushroom Pleurotus ostreatus. They concluded that it may be used as functional food during inflammatory situations due to its promising activity against inflammation [9]. Functional bioactive molecules are abundantly found in Pleurotus mushrooms having nutritional components like proteins, carbohydrates, dietary fiber, essential amino acids, water-soluble vitamins and minerals. In this regard, Raman et al. (2020) wrote a review article provides an insight on cultivation and nutritional values of Pleurotus spp [10].

A study was performed on antibacterial activity of Pleorotus spp by Gashaw et al. (2020) [11]. In this study, they cultivated Pleurotus ostreatus and Pleurotus florida in order to evaluate the antibacterial activity. They used different agricultural wastes like coffee straw, pea straw, sorghum grain residue and wheat grain. Escherichia coli, Bacillus subtilis, Streptococcus faecalis, Pseudomonas aeruginosa, and Salmonella typhi like human pathogenic microorganisms were used in order to evaluate antimicrobial activity [11].

A paper on structure and properties of Pleurotus spp lectin has been developed by Perduca et al (2020). In this paper 3D structure and ligand-binding properties of Pleorotus ostreatus lectin has been reported. The lectin shows in vitro anti-proliferative effects against human cancer cell lines [12].

It is known that oyster mushroom has various types of pharmacological properties. In this regard a review article on various medicinal values has been described by Waktola and Temesgen (2020) [13]. Polysaccharides, proteins, lipopolysaccharides, glycoproteins, peptides, nucleosides, lectins, triterpenoids, lipids and their derivatives are valuable bio-components found to be present inside Pleurotus ostreatus in addition to its different beneficial medicinal components. Anti-tumor, anti-arthritic, antioxidant, anti-cancer, immune-modulatory, anti-inflammatory, hypo-cholesterolaemic, anti-hyperglycaemic, antigenotoxic, anti-hypertensive, antiplatelet aggregating, anti-viral and anti-microbial activities like

valuable pharmacological properties are found to be present in this mushroom [13].

Bamidele and Fasogbon (2020) performed study on nutritional and functional properties of composite flour based on maize-oyster mushroom and determined the effects of oyster mushroom flour on nutritional, functional and storage stability properties of this composite flour [14]. Kumar (2020) wrote a review article on nutraceutical potential and processing aspects of Pleurotus spp and concluded that due to the presence of important bioactive compounds and nutritional ingredients; they may play significant role as functional food [15]. Shamtsyan and Pogačnik (2020) studied on anti-radical and anti-diabetic activities of extracts of P. ostreatus. Their study showed anti-radical as well as considerable anti-diabetic activities [16].

Bindhu et al. (2020) performed studies on ethanol extract of Pleurotus ostreatus for knowing its antimicrobial, antioxidant and anticancer activities [17]. Flavonoids, saponins, phenols, terpenoids, tannins, lipids, amino acids and alkaloids were present in ethanol extract of P. ostreatus as confirmed by qualitative phytochemical analysis [17]. Extracts showed resistant against Bacillus cereus that may be beneficial in curing diarrheal related diseases. According to their study, ethanol extracts showed comparable antioxidant activity with ascorbic acid in both DPPH and FRAP method and IC50 of 39.29 µg/ml against HL60 cells [17].

Role of white rot fungi are also well known in the field of environmental biotechnology as they work as valuable bio-remediating agent in remediation of various pollutants. A work performed by Kaewlaoyoong et al. (2020) shows the role of Pleurotus pulmonarius in enhancing the remediation of field soil highly polluted with polychlorinated dibenzo-p-dioxins and furans [18]. They collected soil for their study from pentachlorophenol plant in southern Taiwan. The described fungus can bio-remediate successfully the aforementioned contaminated soil using solid state fermentation [18]. Šrédlová et al. (2020) used oyster mushroom substrate in bioremediation of polychlorinated biphenyls in contaminated water. They concluded the efficiency and suitability of spent oyster mushroom (Pleurotus ostreatus) substrate in a remediation practice. They found highest degradation efficiency (>80%) for 1-3 Cl-atoms containing polychlorinated biphenyls [19].

Kumar et al. (2020) collected four species of Pleurotus viz., P. ostreatus, P. florida, P. sajor-caju, and P. flabellatus for study of their efficacy in in terms of production of laccase and dye decolorization for the purpose of industrial application. They used five dyes viz. bromophenol blue, crystal violet, methyl red, methylene blue and brilliant blue for the study of decolorization on solid (Potato dextrose agar) as well as liquid medium (Potato-dextrose broth). They took three different concentrations as 100 ppm, 200 ppm and 500 ppm for study and fund that P. florida was most effective in decolorization of all four dyes in both solid as well as liquid medium [20].

Conclusion

Above discussions based on recent studies in the field (year 2020) clearly demonstrate about the encouraging roles of Pleurotus spp in the field of biotechnology. Species of Pleurotus have various applications in area of pharmacology, food industries, environmental sciences, nutritional advantages and many more. Researches also validate that biotechnological works on such fungi may have great future and they may be promising for various biotechnological, nutritional and pharmaceutical roles.

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