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Relevance Of Mushroom As A Food Product: A Brief Report On The Culture And Production Aspect Of Paddy Straw Mushroom

Tapasi Devi[1]. Aakankshya Pradhan[2]. Swetaleena Tripathy[3*]

[1]*School of Biotechnology, Gangadhar Meher University, Amruta Vihar, Sambalpur, Odisha, Mail id: tapsidevi20@gmail.com*

[2]*School of Biotechnology, Gangadhar Meher University, Amruta Vihar, Sambalpur, Odisha, Mail id: aakankshya20@gmail.com*

[3*]*School of Biotechnology, Gangadhar Meher University, Amruta Vihar, Sambalpur, Odisha, Mail id: stripaty@gmuniversity.ac.in*

***Corresponding Author:** Swetaleena Tripathy*
**School of Biotechnology, Gangadhar Meher University, Amruta Vihar, Sambalpur, Odisha, Mail id: stripaty@gmuniversity.ac.in*

Abstract

Paddy straw mushrooms are specifically seen in the rainy season. This mushroom has numerous medicinal properties. People have enjoyed eating and appreciating paddy straw mushrooms for their flavor, economic and ecological benefits, and therapeutic capabilities. They contain a chemical composition that is desirable for nutritional values. The mycelium of this mushroom is developed in potato dextrose agar (PDA) media by tissue culture method and incubated at 30^0C for 2-3 weeks. After the growth of the mycelium, it is transferred to a suitable substrate and incubated at 30^0C for 10 days. In order to produce commercial spawn, a thick layer of mycelium is grown in the substrate known as mother spawn and then transferred to a fresh substrate. Accurate temperature and favorable substrates are required for good-quality spawn production.

Keywords: Paddy straw mushroom, Mycelium, Substrate, Temperature

Introduction

Commercial biotech healthcare products made from mushrooms that have both preventive and curative benefits are now widely sold and consumed on the global market. Khan et al. (2013) and Standish et al. (2008) explain that nutritious foods containing biotechnologically grown mycelia of edible medicinal mushrooms, such as Hericium erinaceus and Tremella spp., in addition to other organic components like medicinal plants and algae, have immune-stimulating and beneficial antioxidant qualities which help to regulate blood sugar and lipid levels. De Baets (2001) found that hydrophilic agent glucuronoxylomannan (GXM), a polysaccharide with anti-inflammatory and wound-healing characteristics, was found in *Tremella* mushrooms and is widely utilized in the cosmetics industry. Neurodermatitis and sclerodermatitis can both be treated with *Tremella* cosmetics. They promote blood circulation and stop skin pigmentation. Biotechnological farming of therapeutic mushrooms is made possible because of the biological properties of mycelia, especially their rapid growth and ease of reproduction under culture conditions. This helps to produce necessary bioactive compounds and biotechnological products.

Mushrooms as a means of sustainable livelihoods

Mushroom farming can directly improve people's quality of life by providing benefits in the areas of nutrition, medicine, and the economy. But some kinds of mushrooms are lethal, making it necessary to use extra caution when identifying due to their poisonous properties. Abate (2014) suggested that typically the most toxic mushroom is *Chlorophyllum molybidites* which is difficult for locals to distinguish from edible ones since it resembles other *Agaricacea* members that are edible.

Therapeutic value of mushrooms

One of the key characteristics of mushrooms is the presence of bioactive substances and their therapeutic benefits. Properties including immunity, improvement, homeostasis, maintenance, regulation of biorhythms, as well as major treatment and prevention of fatal illnesses like cardiovascular disease, cancer, and stroke, are all categorized as pharmaceutical properties of mushrooms.

Medicinal properties of mushroom

Historically, most of medicinal mushroom species were quite rare and only found in the forests, where they grew on dead or living trees as well as on the forest floor. They were typically prepared for therapeutic uses as hot water extracts, concentrates, or in powdered form. Today, almost all of the significant medicinal mushrooms have undergone extensive artificial cultivation on a large scale using solid substrate or low moisture fermentation, eliminating the historical scarcity factor and allowing for the development of large commercial operations. Muhammad et al. (2015) explain that recent developments in chemical technology have made it possible to separate and purify some of the important molecules specifically those polysaccharides that have potent immune-modulatory and anti-cancer effects.

Anti-cancer properties of mushroom

Wasser and Weis (1999) explain that there have been extensive in vivo studies demonstrating the anti-cancer properties of the extracted, purified glucan polysaccharides and polysaccharide peptides in animal models. These data make a compelling case for an immune-modulating mechanism of action. However, Borchers et al. (1999) suggested that, in vitro research, there is evidence that some of the polysaccharides have direct cytotoxic effects on cancer cells. Kidd (2000) found that most of the phase I, II, and III clinical trials for the proprietary mushroom polysaccharides were conducted in Japan and China, but some are currently taking place in the US. Many of the pure mushroom polysaccharides have been used in therapeutic settings for many years in various areas without any adverse effects report of any noteworthy short- or long-term negative effects. Although Kidd (2000) suggested that, these substances are not miracle cures, they can improve cancer patients' quality of life and possibly raise the likelihood that some cancer patients will survive.

Application of mushrooms as a food product

According to Alemu (2014), mushrooms stand out compared to other food crops due to their distinctive texture, flavor, and aroma. The local people do not use or know about the mushrooms found in exotic crops like *Pinus* and *Cupressus.* Mushrooms are a nutrient-dense, low-calorie food that contains high-grade proteins, vitamins, and minerals. Barros et al. (2008) found that, the economic and global value of mushroom is slowly rising as a result of an increase in demand as food and for their therapeutic qualities.

Role of mushrooms in compost preparation

Several microorganisms produce compost. Fungi are among the most significant microbes. Wax, proteins, hemicelluloses, lignin, and pectin are examples of materials that fungi can break down. Approximately 40% of the dry matter in compost is broken down by microorganisms during compost preparation and this dry matter is beneficial for the nourishment of *Agaricus bisporus*. Agrawal et al. (2014) suggested that, temperature gradients cause variations in the bacteria' community succession pattern in mushroom compost. Anastasi et al. (2005) suggested that, observing the fungal population in compost is crucial for determining the standard of the fungi since they have a specific time window to affect composting.

The mushroom market as per the world's scenario

According to Elaine and Tan (2009), approximately 35% of the world's fresh mushroom market comes from China. In 2018, the global market for fresh mushrooms was valued at 38 billion US dollars. Most worldwide species crops of paddy straw, oyster and milky mushrooms are grown from March to October. Paddy straw

mushrooms are relatively easy to cultivate, especially on agricultural waste like rice straw, and offer a reliable source of vitamins, fiber, and proteins.

A brief introduction to paddy straw mushroom

Volvariella volvacea or Paddy Straw mushroom is the third most significant farmed fungus in the world and is widely recognized for its flavor. According to Zhanxi and Zhanhua (2000), paddy straw mushrooms are known as Chinese mushrooms because Chinese people developed their cultivation. Nothing is as mysteriously flavored as mushrooms. It's amazing to see these mushrooms grow from tiny pinheads on a composting medium to buttons full of protein, vitamins, and minerals. Conversely, they are able to keep blood cholesterol levels at the ideal level. Chang et al. (1978) recommended that, for optimal and early hyphal development, *Volvariella volvacea* needs a high temperature of 35 ± 2 ºC and for fruiting body formation about 32 ± 2 ºC and 80–90% relative humidity are required. Straw by alone is insufficient as a composting material since it has a low nutritional content and a slow rate of breakdown. Therefore, Chang et al. (1978) pointed out that, straw mushrooms are cultivated in several different materials, including cotton waste, bagasse from sugar cane, dried banana leaves, and waste from oil farms.

Morphological structure of paddy straw mushroom

In *"Volvariella volvacea"* the word "volva" means a wrapper that entirely encloses the main fruit body. Primordia, which are distinct little clusters of white hyphal aggregates, are the precursors to the development of fruiting bodies, which then go through the "button", "egg", "elongation", and "mature" stages. The 'button' stage is where differentiation is initially visible. Ahlawat and Arora (2016) noted that when the volva ruptures, the buttons grow larger and produce fruiting bodies that resemble umbrellas. Ahlawat and Arora (2016) suggested that a volva is a cup-like structure that is less distinct in adult mushrooms. Stipe is long, spherical, dull-white to dull-brown in color with a smooth surface but the annulus is absent. The pileus is the fleshy, umbrella-like structure joined to the stipe which varies in size, while gills are radial with the vertical plates present in the lower surface of the pileus.

Biological characteristics of paddy straw mushroom

Ahlawat and Arora (2016) suggested that the *Volvariella volvacea* is divided into six distinct phases of development which include the pinhead stage and the fruiting body resembles a knot of hyphal cells. At the tiny button stage, the top of the veil is brown and is wrapped around the mushroom. Paddy mushrooms are usually sold in the market at the tiny button stage. At the egg stage, the pileus is pushed out of the veil as a volva. At the elongation stage, the stipe reaches its maximum length. The pileus is still close and smaller than its mature stage. The mature stage is the last stage, where the pileus, stipe, and volva regions are separated. The pileus is spherical in growth with a finished edge and a smooth surface. The surface is light grey with a dark grey margin.

Mushroom culture

There are two recent techniques used to cultivate paddy straw mushrooms. The first step is formation of fruit bodies, which takes one to two months, whereas mycelia are grown in a couple of days. It is important to establish and preserve culture collections of diverse mushroom species in order to conduct research on biotechnological applications, genetic resources, and biodiversity. Gupta et al. (2018) suggested that, mycelia grown submerged is the most effective way to produce biomass and the necessary bioactive substances for the further development of reliable and secure medical mushroom biotech products which has enormous industrial potential.

Production of paddy straw mushroom

For many years, the vegetarian diet of the people of Odisha has included paddy straw mushrooms. In rural areas, people collect mushrooms which are flourished in the rainy season on straw. Paddy straw mushrooms are produced 8 to 10 months in a year. Paddy straw is produced in Odisha at a rate of roughly 10 million tons annually, and the majority of it is either burned on-site or allowed to degrade organically. As paddy straw is more available and affordable throughout the state, farmers use paddy straw for the cultivation of straw mushrooms.

Ahlawat and Arora (2016) found that the paddy straw mushroom is harvested before the volva breaks or just after it ruptures which is called the button or the egg stage. This mushroom grows fast and requires high temperature and moisture. From spawning to first crop harvest, this mushroom typically needs 9–10 days, and the first flush, which typically lasts for 3 days, constitutes about 70 to 90% of the expected mushroom

yield. The intervening period of 3 to 5 days requires thorough watering and maintaining of optimum conditions inside the rooms. The next flush survives for 2-3 days and yields less mushroom than the first flush. The second flush adds only 10 to 30% of the total crop. On reaching the harvestable size, the fruiting bodies should be carefully separated from the beds/substrate base by lifting and shaking slightly left or right and then twisting them off. The mushrooms should not be cut off by knives or scissors from the base of the stalk, because the stalks left behind on the bed/substrate will rot and will be attacked by pests and molds, which in turn will destroy the mushroom bed.

Nutritional value of paddy straw mushroom

Comparable to other edible mushrooms, this mushroom stands apart due to its unique flavor and texture. The paddy straw mushroom has a high moisture content of 90% and rich in unsaturated fatty acids and important amino acids such as serine, arginine, glycine, alanine. It also contains significant amounts of the vitamins biotin, thiamine, and riboflavin. Minerals including potassium, sodium, and phosphorus are particularly abundant in straw mushrooms. With the exception of nitrogen and phosphorous, which decrease at the elongation and mature stages of development, potassium, calcium, and magnesium levels are almost the same throughout all developmental stages. At various stages of development, the minor elements copper, zinc, and iron had minimal effects. Straw mushrooms have outstanding nutritional value in comparison to other mushrooms in terms of the amount of necessary amino acids content. Ranasingh and Chinera (2021) found that, paddy straw mushrooms actually have a higher concentration of vital amino acids than other types of mushrooms, with lysine being the most abundant. Leucine, isoleucine, and methionine are the remaining amino acids that are scarce in paddy straw mushrooms. Cheung et al. (2003) put forwarded that, mushroom extracts in methanol and water, which are thought to have strong antioxidant activity, lower the chance of developing certain chronic angiogenic disorders such as cancer, arthritis, cardiovascular disease.

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