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EVALUATION OF WHEAT STRAW AS AN AGRO-BASED CARBON SOURCE FOR THE CULTIVATION OF *PLEUROTUS* SP.

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Abstract

The study was designed to investigate the process of cultivation for the production of imported *Pleurotus* sp. mushroom. Culturing was done on agar media under aseptic conditions in the Applied Botany Lab, Department of Botany, Government College University, Lahore. Substrate formation of both spawning and fruiting was done in Mushroom Spawning Lab situated in the Botanical Garden of Government College University, Lahore. The culture was obtained at 25˚ C incubation temperature after 10 days of inoculation. The washed and sterilized wheat grains were used for spawn production under aseptic conditions. Jar which was filled ¾ with wheat grains took 14 days to be fully colonized again at 25˚C. Lastly, the wheat straw was used for fruiting, inoculated bags filled with wheat straw were kept in dark at 25˚C incubation temperature. The bags were fully colonized with mycelium in three weeks. After that sudden environmental changes like 18˚ C temperature, light, high moisture level and gas exchange cause fruiting in 2-3 days.

Keywords: Culturing, Fruiting, Cultivation, Spawn

Introduction

Mushroom cultivation has the potential to remove destitute and improve the living conditions of effected human population (Imtiaj and Rahman, 2008). This is especially important in low-income countries where food shortages are common (Beetz and Kustudia, 2004; Tibuhwa, 2013). Food security is a global challenge, especially in middle and low -income countries. It is very important to work on different ways to increase food production to meet the demands of a growing population. Oyster mushrooms are useful as they have therapeutic components such as dietary fibers and phenolic compounds, which make them an important source of bioactive ingredients. Mushroom cultivation is also an alternative and effective way to reduce agricultural and agro-industrial wastes. Pleurotus species have the capability to decompose agricultural plant by-products, such as hemicelluloses, cellulose, and lignin materials, which make them useful in converting forest and agricultural wastes into nutritious food. This process is economical and environmentally friendly, and it provides a solution to the problem of organic waste disposal. It has been estimated that the organic matter yielded every year through photosynthetic process is approximately 200 billion tons; most of this material is not edible and cause pollution to our environment. Mushroom

cultivation is a vital, for producing various foods obtaining ways by working on different environmental wastes. Oyster mushrooms are useful for converting the lignocellulose residues from forests and agricultural fields into protein-rich biomass. (Rowel *et al*., 2000).

Oyster mushrooms cultivation can serve as a process of environmental waste management and disposal, and it can provide economic value and addressing the issue of global food security. As population of Pakistan is growing and facing problems like malnutrition and immune system related health problems (National Nutrional Survey, 2018). The study aims to identify the substrate for oyster mushroom cultivation. This will provide healthier food and managing the agricultural waste produced in our country. Therefore, it is important to cultivate mushroom in a controlled environment by providing the environmental parameters which are similar to those in the natural environment.

Material method

Study material

Oyster mushroom (Pleurotus sp.) fruiting bodies were procured from House of mushroom, a small company working on mushroom business in Lahore, Pakistan. Solution of potato dextrose agar and malt extract was used to make the pure culture by cloning method. Agro-industrial waste namely wheat straw was collected from local market. The material which were used for this experiment are the plastic bag, hood, Petri plates, autoclave, sprayer, aluminum foil, jar, hot plate, burner, metric ruler, measuring glove, incubator, electronics balance, cotton, and measuring cylinder (Besufekad *et al*., 2020).

Preparation of culture media

Agar media was prepared using potato dextrose agar, peptone, agar and malt extract agar. 60 g of malt extract agar, 78 g of potato dextrose agar, 10 g of peptone and 30 g of Agar was poured to into 1000 mL of distilled water. Bunsen burner was used to mix the solution. To dissolve the media the solution was placed on hot plate. After that it was put into the autoclave for sterilization at 121°C for 15 min. 15 mL of the sterilized media was poured in each petri-plate. Inoculated was done in aseptic conditions from oyster mushroom culture using inoculating needle and incubated at 25°C (Besufekad *et al*., 2020).

Oyster Spawn production

Mushroom spawn is a mushroom growth medium that is used as an inoculum during mushroom cultivation process. Wheat grains were used to make spawn. The grains were properly washed in tap water and then soaked in it overnight. To avoid fermentation changing water was done time to time. After the grain preparation, they were boiled to make them soft but firm. After that they were spread over the paper for drying. After drying glass jars were filled three-fourths to their capacity. Then jars were put into the autoclave for sterilization at 121°C temperature and 15 Psi for 15 minutes. Then these jars were kept for cooling, after cooling these were inoculated under aseptic conditions and kept at 25°C temperature for incubation (Besufekad *et al*., 2020; Tesfaw *et al*., 2015)

Substrate preparation and inoculation

Wheat straw was washed and soaked in water overnight to absorb moisture. After that gypsum (3%) supplement was added. Then the polypropylene bags were filled with prepared wheat straw and were cotton-plugged. The

sterilization was done using an autoclave at 121°C for 15 mins and kept for cooling at room temperature. After sterilization, inoculated was done using pure culture of oyster mushroom under aseptic condition. Then the bags were covered with paper to keep them in dark at 25° C temperature and 90% relative humidity (Besufekad *et al*., 2020; Tesfaw *et al*., 2015).

Fruiting

After complete colonization of mycelium, the fruiting bodies were produced with the sudden environmental changes. Firstly, the initial primordial came out and later they turned into fruiting bodies. The covering on the bags which was keeping them in dark was removed to pour light, the temperature was lowered, gaseous exchange was turn on and moisture was enhance up to 90 % (Besufekad *et al*., 2020).

Harvesting

Mushroom fruiting bodies were harvested by individually twisting the stalk till it gets separated from the substrate. The humidity level during the harvesting was kept above 85%. After that they were dried at room temperature, and grounded for storage.

Results and discussion

Culturing

Pure culture was obtained at 25°C temperature after 10 days the whole petriplate got covered by the mycelium. The colour of mycelium was pure white like cotton.

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Figure 1. Culture of oyster mushroom

Spawning

The grains were washed, soaked and then boiled to get them softened so that it gets easier for the mycelium to grow or penetrate faster. After 14 days of incubation the glass jar was fully colonized at 25° C. This spawn was further used for fruiting.

Figure 2. Spawning (A. wheat grains soaked overnight, B. Boiling of grains, C. Boiled grains, D. Kept for drying, E. inoculated jar with culture and fully colonized)

Fruiting

Wheat straw was washed and soaked in water to imbibe water because moisture is an essential parameter for mushroom cultivation. $CaSo_4$ and $CaCo_3$ were added to maintain PH for mycelial growth..

Figure 3. Fruiting (A. Wheat straw soaked overnight, B. Kept for drying, C. Filling of bags, D. Sterilization)

Figure 4. Fruiting (E. Incubation and kept in dark, B. mycelium growth, C. bags fully colonized)

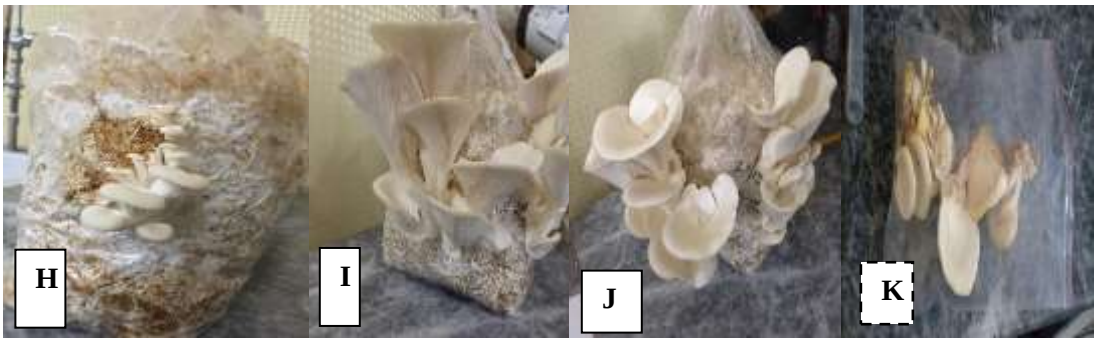

Figure 5. Fruiting (H. primordial stage, I and J. Fruiting, K. Dried mushroom)

For oyster mushroom, lower the temperature which was used for spawn run temperature 25° C to 18° C is the very useful method to induce stimulations for fruiting. The primordial sprouted in between 3 to 4 days and mushrooms fruiting bodies were ready to be harvested. After that these fruiting bodies were dried at room temperature and ground using pestle and mortar.

Conclusion

Culturing of oyster mushroom was done at 25 °C, took 10 days to fully colonize the whole petriplate. The spawning was done by using wheat grains at 25° C. The mycelium took 2 weeks to fully cover the glass jar. Finally, the fruiting was observed while keeping the poly propylene bags at 25° C incubation temperature. Sudden environmental changes like decreasing temperature, increasing moisture, light and gaseous exchange gave the eruption of fruiting bodies from the cuts in bags. About 25 to 30 % of the net weight produced from each bag.

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