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IMPACT OF VARIOUS SUBSTRATES ON THE *IN-VITRO* GROWTH OF OYSTER MUSHROOM (*Pleurotus ostreatus*)

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ABSTRACT:

Introduction:

Pleurotus ostreatus (Oyster mushroom) ranks as the second most cultivated edible mushroom globally after *Agaricus bisporus*, known for its ecological and medicinal benefits. This study aimed to investigate the impact of various substrates on the growth and biological efficiency of Oyster mushrooms.

Materials and Methods:

Different substrates including Wheat straw, Groundnut straw, Soybean straw, and various sizes of sawdust were sterilized in boiling water at 120°C for 1 hour prior to spawn inoculation. The experiment was conducted in a controlled environment with humidity maintained at 80-85% in a dark room.

Results:

Throughout the growth period, various morphological characteristics such as spawn germination time, mycelium formation, pinhead formation, fruiting body formation time, and biological efficiency of Oyster mushrooms were evaluated. The study highlighted that Groundnut substrate exhibited rapid growth in terms of spawn germination, mycelium growth, pinhead formation, and fruiting body development. Additionally, Soybean substrate demonstrated the highest biological efficiency and moisture content.

KEY WORDS: Oyster Mushroom, Substrates, Biological Efficiency & Moisture Content

Introduction:

Mushrooms have been valued as a significant food source for centuries, with increasing utilization due to their nutritional benefits and medicinal properties. Belonging to the genus *Pleurotus* within the class Basidiomycetes, Oyster mushroom (*Pleurotus ostreatus*) stands out for its palatable flavor and taste. Widely cultivated across Asia and Europe, *Pleurotus* species are renowned for their straightforward and cost-effective production methods and high biological efficiency (Onifade, 2019)[1].

Species Diversity:

Various species of *Pleurotus* have been identified worldwide, many suitable for cultivation. Among them are *Pleurotus ostreatus*, *Pleurotus columbinus*, *Pleurotus florida*, *Pleurotus*

salignus, *Pleurotus spodoleucus*, *Pleurotus pulmonarius*; and subspecies including *Pleurotus sajor-caju*, *Pleurotus sapidus*, *Pleurotus populinus*, *Pleurotus cornucopiae*, *Pleurotus djamor*, *Pleurotus flabellatus*, *Pleurotus eryngii*, *Pleurotus cystidiosus*, *Pleurotus calyptratus*, *Pleurotus dryinus*, *Pleurotus purpureo-olivaceus*, and *Pleurotus tuber-regiu* (Nadir et al., 2016). However, *Pleurotus ostreatus* remains the most cultivated species due to its ease of cultivation, culinary appeal, and economic viability using various organic waste materials (Kong, 2004)[2].

Health Benefits:

Oyster mushrooms are associated with numerous health benefits. They are highly nutritious, supporting immune system health, aiding in healthy blood sugar regulation, and providing antioxidant and anti-inflammatory properties. The benefits of Oyster mushrooms include high nutritional value, antioxidant effects, anti-inflammatory properties, heart health support, reduced cancer risk, blood sugar maintenance, brain health enhancement, dental health promotion, and energy provision[3].

Substrate Utilization:

Several species of Oyster mushrooms thrive on lignocellulosic materials, forest by-products, and agricultural wastes (Carrera, 1998). They can be cultivated on a wide range of plant waste substrates such as sawdust, paddy straw, sugarcane bagasse, corn stalks, corn cobs, waste cotton, leaves, banana pseudostems, water hyacinth, duckweed, and rice straw. This cultivation method is cost-effective, requiring minimal processing and enrichment materials (Quimio, 1980; Chow, 1980; Bano et al., 1979)[4].

This study aimed to investigate the influence of various substrates on the in vitro growth of Oyster mushroom (*Pleurotus ostreatus*). The substrates tested included Wheat straw, Sawdust, Soybean Straw, and Groundnut Straw. Specifically, the study focused on evaluating the effects of these substrates on spawn running time, Pinhead formation, and Fruiting body formation time of *Pleurotus ostreatus[5]*.

Materials and Methods

Title of Investigation: Effect of different substrates on the in vitro growth of Oyster mushroom.

Experimental Location and Site

The experiment was conducted at Jalvihar Society, Modasa, under home conditions from February 2022 to April 2022. Modasa city is situated at an elevation of 197 meters above mean sea level, located at coordinates 23.47° N 73.3° E.

Experimental Materials

- **Mushroom Spawn:** 350 g of Shroomness Premium Mushroom Spawn was purchased online from Flipkart.

- **Substrates:** Wheat Straw, Soybean Straw, and Groundnut Straw were sourced from agricultural farms near Modasa. Two types of sawdust were obtained from a local wooden mill in Modasa.
- **Equipment:** Polythene bags, rubber bands, and a temperature and humidity meter were utilized.

Climatic Requirements

Temperature: The optimal temperature range for Oyster mushroom species (*Pleurotus spp.*) during cultivation is between 20-30°C under normal conditions. Care was taken to avoid temperature shocks during the cultivation process, as cap coloration depends on temperature, varying from light brown to pale yellowish[6].

Relative Humidity: Maintaining a relative humidity of 70-85% during fruiting stages is crucial for *Pleurotus spp.* Depending on seasonal variations, water spraying was adjusted accordingly. During hot and dry weather, 2-3 sprays per day were administered, whereas hot and humid conditions required one light spray[7].

Light: While mushrooms do not require direct sunlight for food synthesis from dead organic plant material, diffused light is essential for fruit body formation. Adequate lighting and air circulation were provided to support the growth and development of Oyster mushrooms[8].

Preparation of the Substrate

Four types of substrates were utilized in this study. Wheat straw, soybean straw, and groundnut straw were gathered from agricultural farms. Two types of sawdust, categorized as small size and large size, were collected from a local wooden mill. Subsequently, the collected straws underwent cleaning procedures[9].

Figure 1: Preparation of the Substrate

Figure 2: Inoculation & Incubation of bags

Sterilization

The sterilization process involved soaking the different types of straw in water, followed by boiling for 1 hour at the required temperature. Afterward, the substrates were partially dried to achieve 60% moisture content.

Inoculation & Incubation of Bags

For inoculation, the substrate and Pleurotus ostreatus spawn were thoroughly mixed by hand. Cotton was added to the holes of the polythene bags to ensure adequate aeration. The

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polythene bags were then placed in an environment with temperatures ranging from 20 to 30°C, with relative humidity maintained at approximately 70-85%.

Figure 3: Cropping Room temperature

Figure 4: Fruiting Body & Harvesting

Fruiting Body & Harvesting

The first harvests of fruiting bodies were conducted between 34 to 42 days from the start of cultivation.

Biological Efficiency

The biological efficiencies of the oyster mushrooms grown on the experimental substrate mixtures were determined using the following equation:

$$\frac{\text{Fresh Weight of Harvested Mushroom (g)}}{\text{Dry Weight of Used Substrate(g)}} \text{X100}$$

Moisture content was determined by dividing the weight of available moisture after harvesting and drying by the weight of the fresh sample, expressed as a percentage.

$$\frac{\text{Weight of Fresh Sample} - \text{Weight of Dry Sample}}{\text{Weight of Fresh Sample}} \text{X 100}$$

Results & Discussion

Pleurotus oyster mushrooms demonstrated the capability to grow on various substrates. In the present study, oyster mushrooms were evaluated on Wheat Straw, Soybean Straw, Groundnut Straw, Large Sawdust, and Small Sawdust. The results pertaining to Spawn Germination, Mycelium Growth, Pinhead Formation, Fruiting Body Formation (1st and 2nd yield), Biological Efficiency, and Moisture Content are summarized in the table below.

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v. CONCLUSION

The study aimed to investigate the impact of different substrates on the in vitro growth of oyster mushrooms, along with assessing their biological efficiency and moisture content. Based on the findings, groundnut straw emerged as the optimal substrate for the growth and development of oyster mushrooms (Pleurotus ostreatus). Therefore, groundnut straw is recommended for achieving higher production compared to other substrates. Additionally, the Soybean substrate exhibited the highest biological efficiency and moisture content among the substrates tested, suggesting its suitability for maximizing these aspects. Further research could focus on optimizing environmental conditions, such as temperature and humidity, to further enhance the growth and development of oyster mushrooms.

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