



# Economical Method of Oyster Mushroom Cultivation in Urban Areas

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**Abstract**— Mushrooms are a rich source of proteins and contain all essential amino acids. Eating mushrooms not only provides essential nutrients but also combats many diseases like cancer and diabetes. Oyster mushrooms are popular edible mushroom species which grow easily on paddy straw, wheat straw, paper waste, etc. The present paper discusses a very economical and eco-friendly method of growing mushrooms in urban areas like kitchen gardens and balconies. In the present protocol, no chemicals were used and steam sterilization was done to maintain aseptic conditions. The procedure to grow oyster mushrooms is affordable, and it is relatively easy to start a small-scale entrepreneurship business from home. Using this protocol, the first harvest was obtained within 25-30 days, and mushrooms were found fit for human consumption.

**Keywords**— Oyster mushroom, *Pleurotus ostreatus*, urban farming, sustainable agriculture, food security.

## I. INTRODUCTION

Mushrooms are saprophytic macro-fungi belonging to the family Basidiomycetes. Their mycelium penetrates deep into the substratum to absorb nutrition and forms the spore-bearing umbrella-shaped fruiting body above the substratum. The umbrella-like fruiting body is called the pileus and consists of gills and a stalk called the stipe. There are around 200 species of mushrooms that are edible. Oyster mushrooms (*Pleurotus* spp.), white button mushrooms (*Agaricus bisporus*), and milky mushroom (*Calocybe indica*) are widely grown mushrooms for edible purposes. The most cultivated mushroom species in the world is *Agaricus bisporus*, followed by *Lentinula edodes* and *Pleurotus* spp. (Aida et al., 2009). Mushrooms are highly nutritious, rich sources of antioxidants, potassium, zinc, and fibre. They are very good for weight loss as they are low in calories. Mushrooms have anti-cancer and anti-diabetic properties and also decrease cholesterol (Kurtzman, 1976; Priyadarshini and Kumar, 2020; Sahoo et al., 2021). Proteins of mushrooms have nutritional value comparable to meat, eggs, and milk, as they contain essential amino acids and have complete amino acid composition (Liu et al., 2025). They can serve as an alternative source to animal proteins in a vegetarian diet (Pashaei, 2024).

Foods that contain all essential amino acids are called complete proteins. Complete proteins are obtained from animal products like meat, poultry, and milk. Mushrooms contain all the essential amino acids, which include valine, isoleucine, phenylalanine, histidine, lysine, leucine, methionine, tryptophan, and threonine (Bach et al., 2017). These essential amino acids cannot be synthesized by humans and have to be supplied from the diet. Mushrooms are not only rich in all essential amino acids but also have dietary fibre and are complete proteins. They also contain  $\beta$ -glucans, which are polysaccharides present in the cell wall of mushrooms. They help in gastro-intestinal and bowel movement and are therefore good for digestion (Bach et al., 2017).  $\beta$ -glucans are also associated with prevention of cancer as they help in absorption of toxic substances in the body (Rosli et al., 2015; Ruthes et al., 2015; Bach et al., 2017).

Bach et al. (2017) evaluated nine edible mushrooms and concluded that they contain fibre content in the range of 24.4 to 46.62% and protein content varying from 16.47–36.96%, with very low fat content in the range of 1.40–2.08%. They also found that all nine mushrooms were rich in minerals like phosphorus, potassium, iron, copper, and zinc, and the sodium content was negligible.

In the present study, oyster mushroom *Pleurotus ostreatus* was used. It is known as "Dhingri" in India. It has a fan or oyster-shaped cap and can be grown easily on decaying wood or straw (Sharma, 2015).

The objective of the present study was to develop an economical and affordable protocol for the cultivation of oyster mushroom in small spaces like balconies using minimal methods without requiring much infrastructure. Our study shows that mushrooms can be grown easily in small spaces like kitchen gardens and urban balconies at low cost. It is a quite affordable way of growing them at home without using much infrastructure. It can be an alternative source to fulfil the requirement of animal proteins for vegetarians. Mushrooms can be grown in small areas, hence farmers with very small tracts of land can also make it a good source of livelihood.

## II. MATERIALS AND METHODS

The kit to grow oyster mushroom was procured from a commercial seller on an online platform (Figure 1A). The kit consisted of very affordable and easily available materials. The kit had spawn, paddy straw substrate, two polypropylene (PP) growing bags, a spray bottle, a cutter, and a manual. The manual consisted of a step-by-step guide on how to make a bed for cultivating oyster mushroom. All the experiments were done in the month of October-November 2025. Clean conditions were maintained to prevent any contamination by other fungi and bacteria.

### Protocol:

1. Paddy straw provided in the kit was taken according to one polypropylene (PP) plastic bag.
2. Paddy straw was soaked in clean tap water overnight, and excess water was removed by straining in a porous tray for 1-2 hours.
3. The straw was boiled in a big container for 1 hour, and it was kept covered for an hour for steam sterilization (Figure 1B).
4. After one hour, the straw was taken out and spread on a clean cloth. It was kept for air-drying for 3-4 days and covered with a very thin cloth to prevent contamination (Figure 1C).
5. To check whether the straw was ready for making the bed, one straw was taken and pressed between fingers. When no water came out but moisture was present, the straw was ready to make the bed.
6. The spawn provided in the kit was broken in a plate and divided into 8 parts. For one PP bag, four parts of spawn were taken (Figure 1D-F).
7. Each PP bag was filled with two inches of straw and spread with one part of spawn. Again, it was filled with two inches of straw and spread with one part of spawn. This was continued until the fourth part (Figure 1G).
8. Finally, the top spawn was covered by two inches of straw, and the top of the PP bag was tied tightly with the help of a rubber band.
9. For aeration, eight to ten small holes were made with the help of a safety pin in the PP bag (Figure 1G).
10. The PP bags were kept in a clean plastic hanging pot (cleaned with a hand sanitizer) and covered with a clean cloth. They were kept in the balcony in a shaded region behind palm leaves and covered with cloth in such a way that dark conditions were maintained (Figure 1H-I).
11. The bags were left undisturbed for 15-20 days and sprayed with a little water to keep the cloth moist until the straw turned whitish in colour.
12. After 15-20 days, some more holes were made with pins in the PP bag.
13. After 25-30 days, the fruiting bodies of oyster mushroom started emerging from the holes (Figure 1J-K).
14. The whole set-up was kept moist all the time to prevent dehydration.

15. The first harvest was ready for collection after 25-30 days. Mushrooms were harvested when fully mature (Figure 1L).
16. Mushrooms were harvested from the beds by twisting from the bottom, taking care not to damage the remaining mycelium (Figure 1L).
17. After harvest, oyster mushrooms were eaten and were found fit for human consumption.

### III. RESULTS AND DISCUSSION

After the COVID-19 pandemic, people have become more health-conscious and seek healthy vegetarian food options. Herbal drugs and organic food have become very popular. Home-grown vegetables rich in fibre and protein have become healthy and popular food choices. People have started growing vegetables for daily consumption at home as well as for small start-up businesses. Mushrooms have emerged as an alternative source of animal proteins, as they are rich in all essential amino acids. They are also rich in vitamin D. Mushrooms contain large amounts of the plant sterol "ergosterol," which is a precursor of vitamin D (Sharma, 2015). When stimulated by light, it converts to vitamin D. Mushrooms have all the good qualities of a rich source of nutrients, proteins, and vitamin D.

Proteins for human consumption mainly come from animal sources like meat, milk, and eggs, which contain all essential amino acids. However, mushroom proteins can be an alternative source of animal proteins, as mushroom proteins show similarity to animal proteins (Liu et al., 2025). Their proteins have similarities to both animal and plant proteins (Kurtzman, 1976; Ayimbila and Keawsompong, 2023). Mushrooms contain an average of 23.80 g/100 g dry weight of proteins (Ayimbila and Keawsompong, 2023). Apart from proteins, mushrooms also contain niacin and biotin (Chand and Singh, 2022). Thus, mushroom proteins are complete sources of all essential amino acids and nutrients, but when compared to other vegetables, they are quite expensive to buy. However, they can be easily grown at home for daily consumption.

Mushrooms grow easily on paddy and wheat stalks. Agricultural waste products like straw, leaves, stems, and roots can be used to grow protein-rich mushrooms. The use of agricultural waste in the production of mushrooms helps in the conversion of waste to food. It also helps in combating air pollution as it reduces stubble burning.

While growing mushrooms, paddy straw can be sterilized by either steam sterilization or chemical fungicides. During steam sterilization, the paddy straw is boiled for one hour and then kept covered in steam for sterilization. Boiling makes the straw soft and sterilizes it by killing harmful fungi, bacteria, and other pathogens. Mushrooms grow well on soft surfaces. In the present study, the steam sterilization method was adopted to avoid any chemical fungicides. Polypropylene bags used to cultivate mushrooms were also sterilized with hand sanitizer before putting the straw and spawn bedding. Hands were sterilized properly during the whole procedure to prevent any contamination.

In the protocol used in our study, layering in the polybag was done with alternating layers of straw and spawn until four layers of spawn were added. The bag was closed tightly by tying a knot with the help of a rubber band, and tiny holes were made for aeration. Polybags were kept in a clean location in hanging pots covered with a cloth and away from direct sunlight. After around 20-25 days, the polybag turned white at the spawning stage. After two to three days, fruiting bodies started emerging from the holes. Fully grown oyster mushrooms were ready for the first harvest within 3-4 days of emergence of the fruiting body. Rapid growth of oyster mushroom was observed during evening and night compared to daytime. It was observed that the second harvest was less vigorous in yield compared to the first harvest. After harvest, oyster mushrooms were cooked and eaten and were found to be very delicious and fit for human consumption.

According to the United Nations, sustainable food diets are environmentally friendly and help in food and nutrition security for present and future generations. Sustainable diets help in the conservation of biodiversity. They are economical, affordable, nutritious, healthy, and optimize natural and human resources (Burlingame and Dernini, 2012).

By using the protocol described in the present study, mushroom cultivation can be done at home year-round. The protocol is completely chemical-free and uses only organic materials, making it very eco-friendly and pocket-friendly. The protocol is easy to follow and yields a good amount of oyster mushrooms for daily home consumption. If done on a slightly larger scale, it is affordable to start a mushroom-selling business from home, as it does not require much infrastructure. It can also be used

to generate income through small-scale entrepreneurship by the sale of oyster mushrooms. It is a sustainable way of living, mitigating pollution, and utilizing waste to produce wonder. Farmers with very little land and with meagre means can grow mushrooms throughout the year and generate income, as the procedure is affordable.



(A)



(B)



(C)



(D)



(E)



(F)



(G)



(H)



(I)



(J)



(K)



(L)

**FIGURE 1: Steps in oyster mushroom cultivation:**

**(A) Commercial mushroom growing kit; (B) Steam sterilization of paddy straw; (C) Air-drying sterilized straw; (D-F) Spawn preparation and division; (G) Layering in polypropylene bag with aeration holes; (H-I) Bags placed in hanging pots covered with cloth; (J-K) Fruiting bodies emerging from holes; (L) Harvested mature oyster mushrooms.**

#### IV. CONCLUSION

The present study demonstrates a simple, economical, and eco-friendly method for cultivating oyster mushrooms in urban spaces such as balconies and kitchen gardens. The protocol uses steam sterilization instead of chemical fungicides, ensuring chemical-free produce. The materials required are affordable and easily available, making this method accessible to urban dwellers and small-scale entrepreneurs. The first harvest was obtained within 25-30 days, and mushrooms were found to be of good quality and fit for consumption. This method not only provides a sustainable source of protein-rich food but also utilizes agricultural waste, thereby reducing environmental pollution. It offers an opportunity for income generation through small-scale entrepreneurship and can be particularly beneficial for farmers with limited land resources. The protocol aligns with sustainable development goals by promoting local food production, reducing waste, and supporting nutrition security.

#### CONFLICT OF INTEREST

The author declares no conflict of interest

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