International Journal of Biotechnology and Microbiology
www.biotechnologyjournals.com
Online ISSN: 2664-7680, Print ISSN: 2664-7672
Received: 03-03-2025, Accepted: 02-04-2025, Published: 18-04-2025
Volume 7, Issue 2, 2025, Page No. 7-10

A review on *Oyster mushroom* cultivation on different substrates

Navnath V Pawar[1], Dr. Sachin B Jadhav[2]
[1] Department of Botany, K.R.T. Arts, B.H. Commerce and A.M. Science (KTHM) College, Nashik, Maharashtra, India
[2] Department of Botany, K.K. Wagh Arts, Science & Commerce College. Pimpalgaon Baswant, Maharashtra, India

Abstract
Mushroom belongs to the macro fungi, famous about its variety of characters like its attractive structures and colours, poisonous attribute, medicinal properties, delicacy in food etc. People doing oyster mushroom cultivation from ancient time and now mushroom is cultivated commercially by using some advance practices. In this article we focusing on traditional and modern methods of mushroom cultivation. Discuss methods and technique for mushroom cultivation. Various diseases like bacterial, fungal, insect, nematodes, viruses attacking on oyster mushroom, they are managed by using best sanitation practices and some pesticides. Oyster mushroom have high value of nutritional content and it grow in less maintenance.

Keywords: Mushroom, cultivation, substrates, traditional, modern, disease

Introduction

The beautiful word "Mushroom" derived from the French word moss (mousse); it means the one kind of delicious food dish. Variety of mushroom species are present in the world but in which some are edible and some not. Why every mushroom species is not edible? The reason behind that is some mushroom species having poisonous substances like alkaloids, alpha-aminitin, phallotoxin, orellenine, muscardin etc., and these poisons are deadly or non-lethal to humans. Apart from that we know the benefits of edible mushrooms that carries so many nutritious and beneficial components like protein, fat, carbohydrates, dietary fibers, vitamins, calcium etc. Mushroom species are popular due to its delicious test and flavours. Every species having its own characteristics and this made them different from others. Now day's mushroom cultivation is a very popular business due to increasing mushroom demands in the market. Some varieties of mushrooms like *Agaricus bisporus* (Button Mushroom), *Pleurotus* (Oyster Mushroom), *Volvariella volvacea* (Paddy Straw Mushroom), *Lentinula edodes* (Shiitake Mushroom), *Morchella esculenta* (Morel's mushroom), *Calocybe indica* (Milky white mushroom) etc. are the popular worldwide. Farmers using various advance practices for cultivation of mushrooms. Mushroom is a simple fungus and it is depended on various kind of lignocellulosic materials or substrates for its nutrition and growth. We can easily grow mushroom on different substrates and normal environmental conditions, but this is restricted for few species like oyster mushrooms. Every mushroom grower tries to gate maximum production on every substrate, but it is not possible due to variabilities in substrates nutrient content. Mushroom wants main nutrients like carbon and nitrogen and material contains lignin, cellulose and hemicellulose. Substrates is varied on the basis of areas; farmers mostly use locally available substrates for mushroom production. Substrates like paddy straw, wheat straw, Soybean straw, bajara stalk, sugar cane bagasse, groundnut leaves, banana leaves and their combinations are used for cultivation. Evry year India produces near about 350 million tons agricultural waste and its management is not easy. In mushroom cultivation vast variety of substrates used for cultivation is actually agricultural waste and farmers utilises such kind of material for cultivate mushrooms, in this way they automatically solve the problem of Agri-waste management. Oyster mushroom also having different edible mushroom verities like *Pleurotus pulmonarius* (phonix oyster mushroom), *Pleurotus erygii* (King oyster mushroom), Pleurotus florida (White oyster mushroom), *Pleurotus cystidiosus* (Maple oyster mushroom), *Pleurotus citroniopileatus* (Yellow oyster mushroom), *Pleurotus flabellatus* (Red oyster mushroom), *Pleurotus sajor caju* (Grey oyster mushroom), *Pleurotus ostreatus* (Blue oyster mushroom), *Pleurotus dajmor* (Pink oyster mushroom), *Pleurotus dryinus* (Veiled oyster mushroom) etc, these all varieties are cultivated most in all oysters. This review article provides general idea about oyster mushroom cultivation, its maintenance and its nutritional importance.

History of mushroom cultivation in India

Thought to be mushroom cultivation was started in India had many centuries ago but initial reference was probably given by scientist N. W. Newton in year 1886 and exhibited mushrooms at the annual show of Agriculture and Horticulture Society of India at Calcutta. In year 1896-97 chemical analysis of mushroom was done by Dr. B. C. Roy at Calcutta Medical College. Edible species of mushroom was investigated by scientist Sir David Prain in year 1908. In year 1921 Dr. S. R. Bose successfully cultivate *Agaricus* mushroom on sterilized dung medium and his work was published in Indian Science Congress held at Nagpur in 1926. In year 1943 first time *Oyster* mushroom was cultivated by scientist Thomson and his group at Coimbatore (Tamil Nadu). After independence progress in mushroom cultivation was made by government of India by taking interest in mushroom cultivation. First time mushroom cultivation was started under the project entitled by "Development of Mushroom cultivation in Himachal Pradesh" in year 1961 at mushroom city Solon in state Himachal Pradesh collaboration with Indian Council of Agricultural Research. Agaricus Bosporus cultivation was started at experimental level in year 1964 by CSIR at Jammu and Kashmir government at Srinagar. Mushroom development project was sanctioned by Himachal Pradesh

government in year 1977 under the aegis of the U.N.D.P by the department of Horticulture. Indian Council of Agricultural Research during VI plan sanction the creation of National Centre for Mushroom Research and Training on 23rd October 1882 with various objective related to mushroom production and preservation and utilization. Simultaneously ICAR sanctioned VI, All India Co-ordinated Mushroom Improvement Project and develop almost nine mushroom research centres in different states.

Methods and Techniques

Peoples cultivate mushroom from many years by using traditional and modern methods. In ancient time mushroom cultivation was not easy due to poverty of knowledge. Day by day peoples get interest in mushroom cultivation and discover some new and easy practices that gives more production to farmers.

Traditionally oyster mushroom cultivation has been practiced from centuries from 300BC but as usual starting years was not well documented. It is native from Asia and specially from Chaina. Japan and Korea where also two countries are there. There are some evidences available that shows us in ancient time Chinese people use mushroom in their medicine. In middle age trade route was develop and knowledge of mushroom cultivation has been spread all over the world. Day by day farmers use some advance practices and techniques for cultivation at the time of 17th to 19th centuries and these practices and techniques are handover to the next generation by framer communities. At the early 20th century researcher gate interested in mushroom cultivation along with farmers and change point of view to cultivation of oyster mushroom cultivation. In modern days of 21st century oyster cultivation is done with control environment, using advance practices, different substrates and innovations expand production capabilities. Here we are discus both the two methods that are used in modern and ancient time people as following:

Traditional Method

Traditionally mushroom cultivation has been done by using agricultural waste and very low maintenance. At that time farmers use rice straw, wheat straw, cotton waste, banana leaves and even tea leaves as a substrate. These substances provide necessary nutrient for oyster mushroom growth. These substances are easily available in local areas and in very cheap cost. As compare to other mushroom varieties oyster is much easier to cultivate. Simplest method they peoples use for substrate sterilization is boiling method. They chop the substrates into small pieces and put them in a boiling water for few minutes, after that this substrate is taken out from boiling drum and spread it on floor for removal of excess moisture content. When substrate is sufficiently dry, they fill this substrate into wooden trays, sometime before filling the substrates in the trays they inoculate the substrate by spwan and then filled it into the tray or they fill the trey by substrate and then inoculate it by using spwan. Spwan are taken from the previously grown mushroom or they purchase it from the market. Spwan is evenly distributed in the tray and trays are placed in the pack shed or room. Mycelia start to grow on the substrate and this growth has easily seen by eyes. They maintain some conditions like low temperature, humidity and darkness. All these conditions are maintained in shaded house or in a special chamber. After fully colonized mycelium gate aggregated and gown in the form of tiny pinheads, these pinheads are grown as a mushroom. Fully grown mushroom harvested from the trays and use as a delicious food. Traditional peoples use mushrooms not only for foods but also, they know the mediational importance of mushroom. Day by day people's research on mushroom like their properties and develops modern methods for mushroom cultivation.

Modern Method

In modern days of mushroom cultivation, growers use scientific knowledge in addition to traditional knowledge. How to grow mushroom? Answer of this question they learn from their last generations but now growers develop their new strategies not only for how to grow mushrooms but also for how to increase its production, how to improve its nutritional content, how to use it medicinally and how it will fulfil growers' commercial need. Every mushroom grower follows hygiene practices to grow mushroom. We know that oyster doesn't want high maintenance but still farmers give their hundred percent effort to grow oyster mushroom on the basis of proper cultivation steps. Some of the steps are discuss below:

1. Substrates for cultivation

Variety of substances used for cultivation of oyster mushroom. Mushroom are basically grown on material that contains lignin, cellulose, hemicellulose with carbon and nitrogen in small amount. Substrate like paddy straw, wheat straw, Soybean straw, bajara stalk, sugar cane bagasse, groundnut leaves, banana leaves, coffee leaves and their combinations are used for cultivation. All kinds of substrates are easily available in agriculture as a agricultural waste.

2. Substrate preparation

As usual farmers follow traditional practices for substrate preparation like soaking of substrate in water for overnight and then team it and use for cultivation. In other method some farmers boil the substrate for 40 min and then remove excess water by dried it over the floor. Then used it for cultivation. In some cases, farmers use some chemicals like formalin and Bavistin for substrate sterilization, they add this chemical in a water and soak the substrate in a water. Basically, heat or chemical treatment used for substrate preparation.

3. Spawning or inoculation

When substrate is cool down after boiling or sufficiently dry it will fill in the plastic bags or trays. Then this substrate is inoculated by using oyster mushroom spwan. Spwan has been purchase from market or make it from previous batch. Spwan is fill in the bag by layering method or mix the spwan in a substrate and then inoculated substrate is fill it in the bag.

4. Spwan run or incubation

After inoculation mushroom bags are put at dark condition for mycelial run. It is incubated at room temperature between 20°C to 25°C. another factor is humidity. Oyster needs 80% to 90% humidity for its growth and it is maintained by using continuous spraying or by using foggers. Some farmers use humidifier for maintaining humidity.

5. Colonization

Mycelium gate aggregated and colonized in the substrate. This will take 2 to 3 weeks depending upon conditions maintain by grower. In between if there is any kind of contamination are observed portion of these part will be removed or control by using some contamination controlling chemicals. Within 15 to 20 days mycelium get completely colonize and forms pinheads near the whole.

6. Harvesting

In between 20 to 25 days pinhead will completely develop into mature mushrooms. Cap of oyster mushroom is tonguing shape and its margin is wavy shape. These mushroom does not have a specific shape and size. It will harvest by using sharp knife or simple by clockwise or anticlockwise twisting. On an average farmer harvest 1 to 2 kg mushroom from every bag.

7. Agroclimatic requirement

Oyster mushroom need very less agroclimatic conditions. Oyster mushroom will grow in small budget and no need of too much processing & maintenance. Only two factors are necessary to control growth of mushroom. i.e. temperature and humidity. Oyster will grow in normal room temperature between 20°C to 25°C. Minute fluctuation of temperature is easily tolerated by oyster species. Another factor is humidity. Humidity will maintain by using sprayers or foggers in between 80% to 90%. In rainy and summer season humidity automatically maintain by nature. In case there is need to increase humidity, farmers use sprays and foggers.

Disease Management and Pest Control

Several types of disease occur on mushroom which are controlled by traditional as well as modern method. As per the quote “"prevention is better than cure”, in case of mushroom it is rightly applied. If farmer take a precaution and properly maintain a good sanitation practice there is less or even no chance of disease development. Oyster mushroom is susceptible to different diseases like bacterial, fungal, insect, nematodes, viruses, etc. some of which discuss bellow:

1. Bacterial Blotch Disease

Discolouration of pileus tissue occurs due to this disease and it is cause by bacteria *Pseudomonas tolaasi*. Its main source is substrate because *Pseudomonas tolaasi* is present in or on substrate. If disease occurs farmer should be removing infected compost or isolate diseased area by covering it through polyethene paper. It is also prevented by isolated area drenched with 0.5% formalin or 150ppm chlorine recommended at every watering.

2. Brown Rot Disease

Discoloration and rotting of basidiocarp happens in this disease. It is fungal disorder cause due to generally two fungal species namely *Gliocladium deliquescens* and *Gliocladium virens*. This disease is avoided by good hygiene practices in farm because we cannot use routine fungicides in fungal diseases. Some fungicides are recommended to treat this disease like Carbendazim or zineb. We can spray it on infected area.

3. Green Mold Disease

It is also a common fungal disorder cause by fungus *Penicillium Spp*. It is severe disease because it inhibits the mycelial growth and reduce yield. Many farms are affected by this disorder. If it is occurring in bag or trey it’s better to remove infected area as early as possible or we can use some fungicides like Carbendazim, Zineb, Chlorothalinin and Benomyl.

4. Ppv Disease

It is viral disorder cause by virus *Pleurotus pulmonarius virus* and it cause deformed basidiocarp in mushroom. Virus infected spores can remain viable for many years and even at the end stage of mushroom. There is no proper treatment form viral disorder so its should be better to farmer go with proper disinfectant before reuse the farm. And in many cases farmers need to change the strain.

5. Pygmy mites

Pygmy mites are an insect disorder cause by insect *Pygmaeophorus stercoricola*. In this disease mycelia cannot grow or in late condition mushroom appear dirty. It is avoided by proper ventilation in mushroom farm it reduces the further growth of insect. Some insecticides are used to treat insect disorder in mushroom like Diazinon, Dichlorvos, Chlorfenvinphos, Malathion, Resmethrin, etc.

Conclusion

It is concluded that *Oyster* mushroom is one of the leading mushrooms cultivated in world. Its valuable inputs in daily nutritional diet and impact in medicine industry as well as economic source for many farmers remark its importance in edible mushrooms. We discuss about it is very easy to cultivate because it can grow easily in room temperature and average humid climate. Its production is cheaper as compare to other mushroom varieties. We found that modern methods derived from traditional methods with some improvements make mushroom production easy and high yielding. We also mention some pest and disease in oyster mushroom can be controlled and manage by aseptic practices and various chemicals available in very cheaper rate. We found that *Oyster* mushroom is one of potential medicinal, nutritional, cultural and edible sources among the mushroom species.

References

1. Kala P. A review of chemical composition and nutritional value of wild-growing and cultivated mushrooms. Wiley Online Library J Sci Food Agric,2012:93:209–218.
2. Mondal SR, Rehana MJ, Noman MS, Adhikary SK. Comparative study on growth and yield performance of oyster mushroom (Pleurotus florida) on different substrates. J Bangladesh Agril Univ,2010:8:213-220.
3. Shah ZA, Ashraf M, Ishtiaq M. Comparative study on cultivation and yield performance of oyster mushroom (Pleurotus ostreatus) on different substrates (wheat straw, leaves, saw dust). Pak J Nutr,2004:3:158-160.
4. Chakravarty B. Trends in Mushroom cultivation and breeding. AJAE (Australian Journal of Agriculture Engineering),2011:2(4):102-109. ISSN: 1836-9448.
5. Fan L, Pan H, Soccol AZ, Pandey A, Soccol CR. Advances in mushroom research in the last decade. Food Technol Biotechnol,2006:44:303-311.

6. Nongthombam J, Kumar A, Patidar S. A Review on Study of Growth and Cultivation of Oyster Mushroom. Plant Cell Biotechnology and Molecular Biology,2011:22(5&6):55-65. ISSN: 0972-2025.
7. Kim MK, Seuk SW, Lee YH, Kim HR, Cho KM. Fungicide sensitivity and characterization of cobweb disease on a Pleurotus eryngii mushroom crop caused by Cladobotryum mycophilum. The Plant Pathology Journal,2014:30(1):82.
8. Ladli. A Review on Oyster Mushroom [Pleurotus ostreatus] Cultivation. International Journal of Current Microbiology and Applied Sciences,2020:11:1653-1665. ISSN: 2319-7706.
9. Badshah NN-R. Yield and quality of mushrooms grown on different substrates. Sarhad J Agric, 1992, 631-635.
10. Hatvani PS. The first report on mushroom green mould disease in Croatia. Arh Hig Rada Toksikol, 2012, 481-487.
11. Toth E. Sterile method for production of Pleurotus ostreatus. Gradinarstwo, 1970, 42-44.
12. Vijaykumar G, John P, Ganesh K. Selection of Different Substrate for Cultivation of Milky Mushroom (Calocybe Indica P & C). Indian Journal of Traditional Knowledge,2014:13(2):434-436.
13. Rahman MH, Islam MZ. Cultivation of Oyster mushroom (Pleurotus flabellatus) on different substrates. Int J Sustain Crop Prod,2009:4(1):45-48.
14. Rafique AN. Studies on the Cultivation of Mushroom Pleurotus species in Gujarat. PhD Thesis, Department of Microbiology, M.G. Science Institute, Navrangpura, Ahmedabad, India, 1996.
15. Pathak, Yadav, Gaur. Mushroom Production and Processing Technology. Agrobios (India), 2018. ISBN (10):81-7754-006-8.
16. Dey SC. Mushroom growing Gardening Series. Agrobios (India), 2013. ISBN (PB): 978-81-7754-271-4.
17. Suman, Sharma. Mushroom Cultivation and Use. Agrobios (India), 2013. ISBN (13): 978-81-7754-248-6.
18. Patil NN. Mushroom Cultivation, Processing and Uses. Universal Prakashan Agriculture Food Science and Technology Series, 2010. ISBN 978-81-87552-19-2.
19. Agarwal RK. How to grow mushroom? Indian Journal of Mushroom,1993:1:17-21.
20. Bhal N. Proceeding of the International Conference on Science and Technology of Edible Fungi, 1983, 203-209.
21. Sharma S, Yadav RK, Pokhrel CP. Growth and Yield of Oyster mushroom (Pleurotus ostreatus) on different substrates. Journal on New Biological Reports,2013:2(1):03-08. ISSN: 2319-1104.
22. Patil SS, Ahmed SA, Telang SM, Baij MMV. The nutritional value of Pleurotus ostreatus (Jacq.: Fr.) Kumm cultivated on different lignocellulosic agro-wastes. Inno Roma Food Biotech,2010:7:66-76.
23. Sangwan MS, Saini LC. Cultivation of Pleurotus sajor-caju (Fr.) Singer on agro-industrial wastes. Mush Res,1995:4:33-34.