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Effect of different media on the growth characteristics of shiitake mushroom

Tarushi Attri* and Deepika Sud

Department of Plant Pathology, CSKHPKV, Palampur (H.P.)-176062
Corresponding Author; E-Mail: attritarushi947@gmail.com

Shiitake mushroom, [*Lentinula edodes* (Berk.) Pegler] belongs to division Eumycota, sub-division Basidiomycotina, class Agaricomycetes, order Agaricales and family Marasmiaceae. The fungus consists of an umbrella shaped cap, which is convex and brownish in colour. There is the presence of white coloured gills under the cap. The spore print of this fungus is white in colour. The fungus exhibits saprotrophic mode of nutrition (Petruzzello, 2015). The stipe of the mushroom is white or cream in colour and turn brown as the fruit body matures. In the beginning, it has an invisible network of mycelium, a tiny mass of thread-like structures called hyphae. The hyphae of this fungus feed on the hardwood tree species and utilize cellulose, lignins and other nutrients for its growth. (Gukov and Komin, 2020).

Many Asian countries are producing Shiitake mushroom due to its medicinal and culinary properties. *L.edodes* has become one of the most important mushrooms as it contributes 26% in the total mushroom production in the world (Singh *et al.,* 2021). The production of this mushroom is drawing attention of customers because of its medicinal properties (Wasser, 2002; Rahman and Choudhury, 2012). Its nutritional components include bio-active polysaccharides such as b-D-glucan, heteroglucan, xylomannan, lentinan and eritadenine; free sugars including arabinose, arabitol, mannose, mannitol, trehalose and glycerol; vitamins (B2, B12 and D2) and dietary fibre (Hobbs, 2002). This mushroom has potential to fight tumors because of the presence of a polysaccharide compound known as lentinan. This mushroom is considered as the good source of vitamin D. It consists of 47.6 g carbohydrates, 28.8 g fibres, 32.93 g proteins, 3.73 g fats per 100 g of dried shiitake mushroom (Kakraliya, 2020). The shiitake powder is used in production of medicinal drugs to treat physical and emotional stress, osteoporosis, gastric ulcer, and chronic hepatitis, to improve the quality of life of patients with diabetes, and especially to stimulate the immune system (Gukov and Komin, 2020). This mushroom can be grown on different media (Nidhi and Sud, 2023) and further use to produce the spawn by using pure culture. There are different substrates on which fungus can be grown such as grains, wood chips and synthetic logs (Tarushi and Sud, 2020; Sud and Sud, 2022). Different additives (paddy straw, wheat straw etc.) are used to enhance the growth of the mushroom and produce healthy spawn and fruiting bodies of the mushroom (Thakur *et al*., 2023). Due to its high demand in the market and easy availability of substrates, farmers are willing to grow this mushroom at commercial level for income generation and higher economic returns (Sud and Riya, 2023).

For the cultivation of the mushroom, healthy mycelia culture needs to be prepared. The present studies were carried out to standardize the media to

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grow the Shiitake mushroom pure and fast growing culture. These studies will be helpful for scientists, farmers and mushroom growers for obtaining the pure culture of Shiitake mushroom and further for the production of spawn and fruiting bodies of this mushroom.

The pure culture of Shiitake mushroom (*L. edodes*) (Fig 1) represented was procured from the Directorate of Mushroom Research Chambaghat, Solan and maintained on Poratao dextrose agar plates. The growth of the mycelium was observed on the slants after 7- 10 days of incubation. The culture was further maintained for laboratory studies and stored at 4°C in the refrigerator.

Fig. 1. Pure culture of Shiitake mushroom

Five different solid media viz., potato dextrose agar (PDA), potato sucrose agar (PSA), malt extract agar (MEA), corn meal agar (CMA), yeast malt agar (YMA) were evaluated to find out the best medium for the growth of *L.edodes*. Complete growth of fungal colony was observed in the Petri dishes after 10 days of incubation and was measured in centimetres. The temperature during the incubation process was 22± 2°C. The results recorded on mycelial growth have been presented in table 1 and Fig. 2.

Fig. 2. Growth of Shiitake on five different solid media

The results recorded revealed that maximum growth of *L.edodes* was observed on PSA (9.10 cm) followed by MEA (8.97 cm) and PDA (8.23 cm).

Table 1. Effect of various solid media on the mycelial growth of *Lentinula edodes*

S. No.	Medium	Colony diameter (cm) after 10 DAI	Colour	Mycelial growth characteristics
1.	PDA	8.23	White	Cottony growth
2.	PSA	9.10	White	Cottony growth
3.	MEA	8.97	White	Submerged growth
4.	CMA	4.75	White	Strandy mycelial growth
5.	YMA	2.33	White	Cottony growth
	CD (0.05)	0.96		

* DAI= Days after Incubation

These results were found statistically on par with each other. Minimum mycelial growth was observed on YMA (2.33 cm) medium which was significantly different from the observations recorded on all other media. Similar results were found the study conducted by Pacumbaba and Pacumbaba (1999) who reported that PSA, YMMBSA, YVMBSA, YVMS and MVBS supported the best mycelial growth of shiitake mushroom. Arif *et al*. (2015) used five media for the growth of shiitake mushroom which included PDA, MEA, Walksman agar, Saboured agar and corn meal agar and reported Potato dextrose agar as the best medium for culturing the shiitake mushroom on large scale. Reddy *et al*. (2017) made an attempt to find out the best media to study physiological properties of the specimen of two wild mushrooms *Schizophyllum commune* (SC-1) and *L.edodes* (LE-1). Higher mycelial growth rate of SC-1 was found on Potato dextrose agar (17.00 mm per day) and LE-1 on MEA media (12.32 mm per day).

Table 2. Effect of liquid media on the vegetative growth of *Lentinula edodes*

S. No.	Medium	Av. Fresh weight of mycelial mat (mg / ml)	Av. Dry weight of mycelial mat (mg / ml)
1.	Potato dextrose broth	7.4	2.7
2.	Potato sucrose broth	18.8	7.8
3.	Malt extract broth	9.4	3.0
4.	Oat meal broth	18.4	7.1
5.	Yeast sucrose broth	12.8	4.0
	CD (0.05)	0.4	0.2

*Average of three replications

The growth of the Shiitake mushroom was observed after 7 days of incubation and results revealed that maximum weight of mycelial mat was observed on Potato sucrose broth followed by Oat meal broth and these were found statistically on par with each other whereas, least biomass production was recorded on Potato dextrose broth, which was statistically different from all other media. It was found that all the media were suitable for the growth of Shiitake mushroom. These studies were in accordance with the Atri and Lata (2013) who studied 11 liquid media and recorded mean dry weight (mg/ml) of *Lentinula cladopus* on all the media. They reported Malt extract agar broth as the best medium for the good vegetative growth of shiitake mushroom.

Fig. 3. Growth of mycelium on different types of liquid broth

From the research study conducted, it was found that Potato sucrose agar and Potato dextrose broth are found to be the best growth media for the culturing of the Shiitake, *Lentinula edodes* (Berk.) Pegler. The importance of the study conducted is that best media could be used to produce the healthy pure culture. The better the culture produced, better will be the fructification of the mushroom on the substrate.

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