Impact Of Organic Waste On Mycelial Growth And Yield Of Oyster Mushroom

Sandeep Kumar[1*], Rajendra Prasad[2], Neha Saini[3]

[1*]School of Agriculture, Uttaranchal University, Dehradun-248007, Uttarakhand, India
Email: skpatho93@gmail.com
[2]School of Agriculture, Uttaranchal University, Dehradun-248007, Uttarakhand, India
Email: rajenpd@gmail.com
[3]School of Agriculture, Uttaranchal University, Dehradun-248007, Uttarakhand, India
Email: neha.saini783@gmail.com

***Corresponding Author**: Sandeep Kumar
Email: skpatho93@gmail.com

Abstract
The present research an objective to improve the quality of mushroom by organic waste (leaf extract and leaf powder) was caried to enhance production. The experiment was conducted in seven treatments with three replications at mushroom unit and plant pathology laboratory at Uttaranchal university, Dehradun. In this article observe effect of botanical waste to be recorded on mycelial growth, spawn production and sporophore production. The observation to be recorded after 9th days maximum radial growth was observed in T_6 (90.00 mm) and minimum radial growth was observed in T_4 (24.00 mm). The effect of botanical powders on spawn production after 15th days maximum mycelial growth was observed in T_6 (9.00 cm) and minimum mycelial growth observed in T_4 (5.03 cm). Minimum DFSR in T_6 (11.33 days) was observed and maximum DFSR (16.00 days) was observed in T_4. The minimum DFFH (17.67 days) was observed in T_6 and maximum DFFH (29.00 days) observed in T_4. Minimum DFCP were observed T_6 (47.33 days) and maximum DFCP (60.33 days) observed in T_4. The maximum number of sporophore was found in T_6 (15.67) and minimum number of sporophore (5.00) observed in T_4. The maximum production was observed in T_6 (550.00 g/kg of dry wt. substrate) with 55.00% biological efficiency and minimum yield (453.33 g/kg of dry wt. substrate) with 45.33% biological efficiency observed in T_4 respectively.

Keywords: Organic, mycelial growth, quality, yield and oyster mushroom

Introduction

Mainly Phyto-extract used against inhibition of competitor moulds was due to the presence of antifungal and antibacterial molecules azadirachtin, limonoid and terpinoids (Nathan *et al*., 2005 and Jarvis and Morgan, 2000). Leaf extracts of *A. Indica* having antifungal properties against *Aspergillus parasiticus* an aflatoxin producer (Allameh *et al*., 2002), it's azadirachtin and meliantrioletc. However, the biochemical mechanisms still remain largely unknown. Also oyster mushrooms have beta-1, 3/1, 6-glucan that are known as stimulant for the immune system which also have Mevinolin compound (lowers the cholesterol). These are also known to prevent excessive blood pressure, recovering from fatigue and lengthen life (Quimio, 2004). *Pleurotus djamor* (Rumph. ex Fr.) Boedijn is one such popular oyster mushroom which is known as food in whole world and also have more economic value. Researchers are much involved in this species as it possess many phytochemical compound familiar with *Pleurotus ostreatus, florida, pulmonarious* and *P. sajor-caju* (Guo *et al*., 2007; Suseem *et al*., 2011). *Allium sativum* and *Allium cepa* have known for its medicinal values for ages and possess biological activities such as antimicrobial, anti-oxidant, anti-mutagenic, anti-carcinogenic, anti-asthmatic, immunomodulatory and prebiotic activities. Garlic extract found to inhibit the growth of *T. harzianum* (Verma *et al*., 2012). And these biological compounds have for curing diseases such as cholesterol, hypertension, diabetes, thrombus and cyst. (MartaCorzo-Martínez *et al*., 2007). These plant extracts provides a good choice which are environmental friendly and are safer to use. In view of the above, an attempt was made to cultivate an appropriate practice against the competitor fungi and moulds of *Pleurotus djamor* in an eco- friendly manner under the agro-ecological condition.

Materials and Methods

Experimental site

For the present investigations, experiments were conducted at Plant Pathology Laboratory, School of Agriculture, Uttaranchal University, Dehradun-248007 (Uttarakhand) situated on the foothills of the Himalayas and situated between two mightiest rivers of India; the Ganges in the East and the Yamuna in the West. The district Dehradun is situated between 30° 20' 27" north latitude and 77° 57' 16" east longitude.

Collection of culture

The pure culture was obtained from Directorate of Mushroom Research, Solan, Himachal Pradesh.

Isolation, Maintenance of pure culture

The culture of *P. florida* was isolated and maintained on PDA medium Petri plates by regular sub culturing of the fungi. Potato Dextrose Agar (PDA) Petri plates were prepared and culture of *P. florida* was inoculated aseptically to the PDA containing Petri plates and culture were allowed to grow for 7 to 10 days. The inoculated Petri Plates were kept for incubation at 23 to 25ºC till complete growth is seen.

Media preparation

Piled Potato	200g
Agar-agar	20g
Dextrose	10g
Distilled Water	1000ml

Potato Dextrose Agar, regularly documented as PDA (Ainsworth,1961), is a typical microbial development media produced using a mixture of potato and dextrose. It is quite possibly the most widely utilized media for growing fungi.

Plant powder

The plant powder from three different plants were prepared and evaluated at different levels for *Pleurotus florida* cultivation.

Table.1 Plants used in the present study

Common Name	 Scientific Name	Family
Onion	*Allium cepa*	Amaryllidaceae
Garlic	*Allium sativum*	Amaryllidaceae
Coriander	*Coriandrum sativum*	Apiaceae

Plate:1

Preparation of plant extracts:

The efficiency of *Allium cepa, Allium sativum and Coriandrum sativum* was evaluated in leaf powder form. The experiment were conducted by Poisoned food technique (Grover and moore, 1962) was followed to test different plants extract on mycelial growth of *Pleurotus florida*.

Spawn preparation:

The procedures of spawn production (Ram *et al*., 2013) were followed with certain modifications.

Oyster mushroom cultivation

The straw was collected from the local market and chopped into small pieces of 2-3 inches. Spawning method by Multi-layered technique (Bano and Srivastava, 1962). The procedures of Krishnakumari *et al*., 2014 were followed with certain modification.

Statistical Analysis

Data was analysed by using complete randomized design (CRD) with the help of analysis of variance table (ANOVA) wherever required. The F value will be calculated and critical difference (CD) was tested at five per cent level of significance for comparing treatment means (Steel, 1997).

Result and Discussion:

Radial growth

The result obtained on radial growth and radial growth rate of *Pleurotus florida* in poison food technique is presented in table 2. All the six plants extract had a significant radial growth of mycelium. After the inoculation of *P. florida* in botanicals extract media observations were recorded at 3, 6 and 9 DAI. After 9th maximum radial growth was observed in coriander leaf extract @ 4% (90.00 mm) followed by coriander leaf extract @ 3.5% (88.00 mm) and 81.67 mm in control (without any plant extract). Minimum radial growth was observed in garlic leaf extract @ 4% (24.00 mm) followed by garlic leaf extract @ 3.5% (41.00 mm).

The experiment was conduct for the study of effect of botanical powder on spawn (mycelium growth) of *Pleurotus florida*. The observations of mycelial growth were recorded on 5th, 10th and 15th days after inoculation as shown in Table-3 and Plate-2. After 15th maximum mycelial growth was observed in coriander leaf extract @ 4% (9.00 cm) followed by coriander leaf extract @ 3.5% (8.60 cm) and 8.17 cm in Onion leaf powder @ 3.5%. Minimum mycelial growth was observed in garlic leaf extract @ 4% (5.03 cm) followed by garlic leaf extract @ 3.5% (6.17 cm).

Effect of different botanical powder on yield of *Pleurotus florida*.

The result obtained on days for spawn run in substrate, days for pinhead formation, days for first harvesting, days for cropping period, number of sporophore, Length of pileus (cm), Width of pileus (cm), yield, Av. Dry weight (g) and increases biological efficiency. The experiments results indicated that *P. florida* minimum days for spawn run in T_6 (11.33 days) were observed followed by (12.00 days) in T_5 & T_2 and (12.67) in T_1 which was significantly less than all treatments. The maximum days for spawn run (16.00 days) were observed in T_4. The minimum days for pinhead formation were observed in T_6 (14.33 days) followed by (14.67 days) in T_5 and (15.33 days) in T_2 which was significantly less than all treatments. The maximum days for pinhead formation (22.00 days) were observed in T_4. The minimum days for first harvesting (17.67 days) were observed in T_6 followed by (18.00 days) in T_5 and (18.33 days) in T_2 which was significantly less than all treatments. The maximum days for first harvesting (29.00 days) were observed in T_4. Minimum days for cropping period were observed T_6 (47.33 days) followed by (54.33 days) in T_5 and (57.33 days) in T_2 which was significantly less than all treatments. The maximum days for cropping period (60.33 days) were observed in T_4. The maximum number of sporophore were found in T_6 (15.67) followed by (14.00) in T_5 & T_2 and (13.67) in T_1 which was significantly less than all treatments. The minimum number of sporophore (5.00) were observed in T_4.

Maximum yield of *Pleurotus florida* were observed in T_6 (550.00 g/kg of dry substrate) with 55.00% biological efficiency followed by (536.67 g/kg of dry substrate) in T_5 & T_2 with 53.66% biological efficiency and (513.33 g/kg of dry substrate) in T_1 with 51.33% biological efficiency which was significantly less than all treatments. The minimum yield (453.33 g/kg of dry substrate) with 45.33% biological efficiency were observed in T_4.

Mainly Phyto-extract used against inhibition of competitor moulds was due to the presence of antifungal and antibacterial molecules azadirachtin, limonoid and terpinoids (Nathan *et al*., 2005 and Jarvis and Morgan, 2000). Leaf extracts of *A. Indica* having antifungal properties against *Aspergillus parasiticus* an aflatoxin producer (Allameh *et al*., 2002), it's azadirachtin and meliantrioletc. Many workers phyto-extract was used against *Pleurotus* in higher concentration and find all phytoextract inhibit the growth of mycelium so in my research the use of phyto-extract in low concentration and found some extract inhibin and promote the groth of mycelium of *Pleurotus* spp. Pervez *et al*. (2012) were similarly observed mycelial growth in lantana extract 51.25% and neem extract (47.75%) in 5 and 10% concentration. Among the botanicals, *A. indica* (neem) showed found less effective against the mycelium growth of *P. ostreatus* (4.4%). The extent of inhibition of mycelium growth of *P. Ostreatus* and different competitor moulds varied considerably with different botanicals used. Among the botanicals, *A. indica* (neem) showed maximum inhibitory effect (54.1 to 71.6 %) against the growth of four competitor moulds fungi i.e. *Aspergillus niger*, *Trichoderma viride*, *Coprinus* spp. and *Penicillium* sp., and found less effective against the mycelium growth of *P. ostreatus* (4.4%). This was followed by extracts of *Pongamia pinnata* (karanja) 42.4 to 61.3% (mould fungi) and 6.7 % (*P. ostreatus*) and *Clerodendron indicum* (clerodendron) which inhibited 40.0 to 53.8 % and 8.9 % mycelium growth of mould fungi and *P. ostreatus* respectively Biswas (2015). Kumar *et al.* (2019) similarly evaluated different botanicals against *Pleurotus sapidus* in *in-vitro* condition for the growth *viz.* Neem leaf extract, Lantana leaf extract and Eucalyptus leaf extract in two different concentrations 2% and 4% respectively. The maximum mycelia growth was observed at 9 DAI *i.e*. 88.25 mm in lantana leaf extract @ 4% which is followed by 87.25 mm in lantana leaf extract @ 2%. The least mycelial growth was observed in Eucalyptus *i.e.* 15.75mm and 46.00 mm @ 4% and 2% respectively.

Table-2: Effect of botanicals extract on radial growth of *Pleurotus florida*.

Sr. No.	Treatments	3rd days radial growth (mm)	6th days radial growth (mm)	9th days radial growth (mm)	Growth rate at 9th days (mm)
1.	T_1-Onion leaf extract @ 3.5%	16.67	46.33	73.33	8.14
2.	T_2-Onion leaf extract @ 4%	14.00	42.00	68.67	7.63
3.	T_3-Garlic leaf extract @ 3.5%	10.00	16.00	41.00	4.55
4.	T_4-Garlic leaf extract @ 4%	3.50	9.00	24.00	2.66
5.	T_5-Coriander leaf extract @ 3.5%	25.33	48.00	88.00	9.77
6.	T_6-Coriander leaf extract @ 4 %	30.00	50.67	90.00	10.00
7.	T_7-Control (PDA)	16.00	48.00	81.67	9.07
	CD at 5%	1.482	2.078	3.781	-
	SE (m)	0.484	0.678	1.234	-

Table-3: Effect of botanicals powder on mycelial growth (spawn) of *Pleurotus florida*.

Sr. No.	Treatments	5th days radial growth (cm)	10th days radial growth (cm)	15th days radial growth (cm)	Growth rate at 15th days (cm)
1.	T_1-Onion leaf powder @ 3.5%	3.17	6.07	8.17	0.54
2.	T_2-Onion leaf powder @ 4%	2.70	5.50	7.70	0.51
3.	T_3-Garlic leaf powder @ 3.5%	1.93	4.73	6.17	0.41
4.	T_4-Garlic leaf powder @ 4%	1.20	3.57	5.03	0.33
5.	T_5-Coriander leaf powder @ 3.5%	4.43	7.10	8.60	0.57
6.	T_6-Coriander leaf powder @ 4 %	5.23	7.97	9.00	0.60
7.	T_7-Control	3.30	5.80	6.97	0.46
	CD at 5%	0.374	0.595	0.309	-
	SE (m)	0.122	0.194	0.101	-

Table-3: Effect of botanicals powder on spawn, cropping period, yield and biological efficiency oyster mushroom.

Sr. No.	Treatments	DFSR	DFPF	DFFH	DFCP	NOS	Length of pileus (cm)	Width of pileus (cm)	Yield (g/kg dry substrate)	Av. Dry weight (g)	Biological efficiency (%)
	T_1-Onion leaf powder @ 3.5%	12.67	16.67	21.33	57.67	13.67	9.00	12.00	513.33	7.17	51.33
	T_2-Onion leaf powder @ 4%	12.00	15.33	18.33	57.33	14.00	10.00	11.67	536.67	7.50	53.66
	T_3-Garlic leaf powder @ 3.5%	14.33	19.67	26.00	58.00	6.67	3.67	12.00	500.00	7.37	50.00
	T_4-Garlic leaf powder @ 4%	16.00	22.00	29.00	60.33	5.00	3.00	11.00	453.33	8.20	45.33
	T_5-Coriander leaf powder @ 3.5%	12.00	14.67	18.00	54.33	14.00	10.67	11.33	536.67	9.53	53.66
	T_6-Coriander leaf powder @ 4%	11.33	14.33	17.67	47.33	15.67	13.67	14.00	550.00	8.33	55.00
	T_7-Control	12.33	15.67	20.00	62.33	10.00	6.67	12.00	453.33	9.67	45.33
	CD @ 5%	1.39	1.49	1.89	3.27	2.113	1.543	1.591	17.256	0.622	-
	SE (m)	0.45	0.49	0.62	1.07	0.69	0.504	0.519	5.634	0.203	-

Conclusion

It can conclude that maximum radial growth of mycelium and yield of *P. florida* can be obtained from coriander leaf extract/powder @ 4% followed by 3.5%. Minimum radial growth of mycelium and growth rate of mycelium per day was found in garlic leaf extract/powder @ 4% followed by 3.5%. Thus, it was found that garlic leaf extract showed the toxicity to *Pleurotus florida* and inhibited the mycelial growth and also effect on production of mushroom.

Acknowledgment:

This research is supported by Division of Research & Innovation, Uttaranchal University, Dehradun, India.

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