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Evaluation of mycelial growth of oyster mushroom (*Pleurotus floridanus* Singer) on different media and cereal grains

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Abstract

The oyster mushrooms are cultivated all over the world. It has a high nutritional as well as medicinal value. The present study was carried out to find the best medium for pure culture preparation and best cereal grains for suitable spawn preparation. For preparation of pure culture six media viz., Potato Dextrose Agar (PDA), Potato Sucrose Agar (PSA), Malt Extract Agar (MEA), Corn Meal Agar (CMA), Yeast Extract Agar (YEA) and Water Agar (WA) were used. Among all the media the best mycelial growth (11.100 mm/day) was occurred on Potato Dextrose Agar. For spawn preparation nine type of cereal grains viz., Sorghum, Wheat, Oat, Bajra, Bean, Maize, Soy Bean, Chick Pea, Pegion Pea grains were used in three forms, Control, Addition of Lime 2% and Gypsum 4% + Lime 2%. The best mycelial(10.658 mm/day) growth was recorded on Sorghum grains with Gypsum 4% + Lime 2%.

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Introduction

Oyster mushrooms are food of high nutritional value and have delicious taste (Furlaniand Godoy, 2007). It can be easily cultivated on different agro-waste materials under a broad range of temperature (15- 30 ^{o}C) for the production of food and large number of pharmaceutical purposes (Gregori *et al.*, 2007; Jonathan *et al.,* 2012).On the basis of consumption the oyster mushroom is on the second position after button mushroom word widely (Sanchez, 2010). Cultivated mushrooms contain high quantity of protein, nutrient, Vit B, Vit D, Vit K, Vit A, and Vit C (Manzi *et al.,*2001). They are well known for conversions of plant remains to variable protein, hence can be grown easily and with low costs (Banikand Nandi, 2004). The amount of protein found in mushroom is intermediate between of vegetables and animals (Kurtzman, 1976). Due to high marketing demand, its cultivation increases on large scale day by day from past few years (Chang, 2006). *P. florida* serves as reservoirs of different nutrients along with Vit B, it includes niacin flavin and pyridoxine. Among acid it includes malate, shikimate, fumarate. Among carbohydrate it includes glucans, in lipids diterpeniods and monoterpenoides, in proteins hydropobins and trace elements such as selenium (Solomkoand Eliseeva1988). *Lentinula edodes*, is used for treatment of various disease viz., blood sugar, high blood pressure, high cholesterol level (Chihara *et al.,* 1969, 1970). Healthy mycelial growths in used medium show a best protection from several stress factors (Herdeiro *et al.,* 2006). Rawte and Diwan (2011) tested the biomass and yield of *P. columbinus*, *P. florida* and *P. flabellatus* on different media. They investigated that PDA medium is best in both liquid and solid form. Spawn seeds act as starting material for mushroom cultivation (Stanley and Awi-Waadu, 2010). Shah *et al.,* (2004) found that the spawn of different grains greatly affect the mycelial running and other parameters. Mamiroand Royse (2008) investigated that using of small grains for spawning is better than large grains it is because the rapid mycelial growth occur on smaller grains as compared to large grains. Oei *et al.,* (2005) recorded that spawn of sorghum grains is favorable for mycelial growth and used all over the world. Curvetto *et al.,* (2002) found that the addition of calcium carbonate is essential for maintenance of best mycelial growth. The growth of *Pleuroatus* species is highly effective by the addition of some other nutrients to the substrate. These additive nutrients are gram flour, ammonia sulphate, groundnut cake, urea, soyabean meal and molasses are used (Narain *et al.,* 2009). The mycelial growths depend upon the abundance and suitable absorbable nutrient and pH of medium. Therefore our aims of present work to find out a best medium for pure culture preparation and suitable cereal grains for spawn preparation, which results high yield and less contamination on commercial cultivation of *Pleurotus floridanus.*

Material and method

The experiment was carried out in mushroom house of the Department of Plant Pathology and Laboratory work was conducted in the Department of Agricultural Chemistry, The University of Agriculture, Peshawar.

Preparation of pure culture

The culture was prepared from the fruiting body of the mushroom on six media viz., Potato dextrose agar (potato 200 g, dextrose 20 g), malt extract agar (malt extract 20 g, peptone 1 g), potato sucrose agar (potato 200 g, sucrose 20 g), corn meal agar (corn meal 20 g), yeast extract agar (yeast extract 20 g), water agar. Agar was added at amount of 20 g to all media and volume was made 1000ml by distal water and autoclaved at 121^{o}C for 15 minutes. After cooling of media Streptomycin (antibacterial) was added @1 g/L. After this the media was taken ¼ in Petri plats. Inoculation was made by a single piece (3 cm) of inner tissue of fresh fruiting body of mushroom. Five replicates were taken for each treatment and kept for incubation on 25 ^{o}C until the white mycelial covered the entire medium.

Production of Spawn

Different types of cereal grains viz., sorghum, wheat, oat, bajra, maize, soybean, chick pea, pegion pea, were used in pure form and addition of lime 2%, and lime 2% $Ca(OH)_2$ + gypsum 4% $Ca(SO_4)$ for spawn preparation. The grains were boiled for 20-30 minutes and removed excess water. The tubes were filled and plugged through nonabsorbent cotton and autoclaved at 121°C for 15 minutes. Inoculation was made by a small bit of 2 cm in diameter from pure culture and kept in incubator at 25°C with five replicates for each treatment.

Statistical analysis

All the recorded data were subjected to analysis of variance (ANOVA) by using a completely randomized design (Steel *et al.,* 1996). For analysis the statistical software package Statistix 8.1 was used. Means were separated by least significant difference (LSD) test at P = 0.05. Each mean was calculated from five replicate values.

Result and discussion

Mycelial growth on different media

The result of used media showed a significant different at P < 0.05 level. The best mycelial growth (11.10 mm/day) was occurred on potato dextrose agar followed by Potato Sucrose Agar (10.36 mm/day), whereas the lowest growth was recorded on yeast extract agar (7.36 mm/day) as shown in Table 1.

Table 1. Mycelial growth (mm/day) of *Pleurotus floridanus* on different media.

S. No	Media	Growth rate (mm/day)	Culture character
1	Potato Dextrose Agar	11.100 a	Pure white
2	Malt Extract Agar	10.100 ab	Pure white
3	Potato Sucrose Agar	10.367 ab	Pure white
4	Corn Meal Agar	9.700 ab	Pure white
5	Yeast Extract Agar	7.367 c	Pure white
6	Water Agar	9.133 b	Pure white

The results are mean of five replicates. Data with different letters with in the same column indicate the significant difference at P <0.05.

Table 2. Mycelial growth (mm/day) of *Pleurotus floridanus* on different cereal grains using in different forms; Control, Addition of Lime 2%, Addition of Lime 2% and Gypsum 4%.

S. No	Substrate	Growth rate (mm/day)		
		Control	Lime 2%	Lime 2% and Gypsum 4%
1	Wheat	6.5833 c	6.909 d	7.6667 c
2	Check pea	1.9167 f	2.255 f	2.5833 g
3	Oat	6.6667 c	7.182 cd	8.3333 bc
4	Bean	1.7500 f	4.727 e	4.7869 f
5	Bajra	7.6667 b	8.545 b	9.000 b
6	Maize	5.6667 d	6.833 d	6.8333 d
7	Soybean	4.6667 e	5.333 e	5.8243 e
8	Pegion pea	5.8333 d	7.833 c	8.4613 b
9	Sorghum	8.3333 a	10.000 a	10.658 a

The results are mean of five replicate. Data with different letters with in the same column indicated the significant difference at P < 0.05.

Our result was similar with Gregori *et al.,* (2007), Rawte and Diwan (2011) who found a best mycelial growth and biomass yield of *P. florida, P. columbines* and *P. flabellatus*on potato dextrose agar. Kumla *et al.,* (2013) observed the best mycelial growth of *Pleurotus giganteus* on potato dextrose agar. Khandakar *et al.,* (2008) observed maximum mycelial growth of *P. citrinopileatus* on corn meal agar. However mycelial growth of fungus is highly effected by changing the contents of media Chang and Miles (2004).

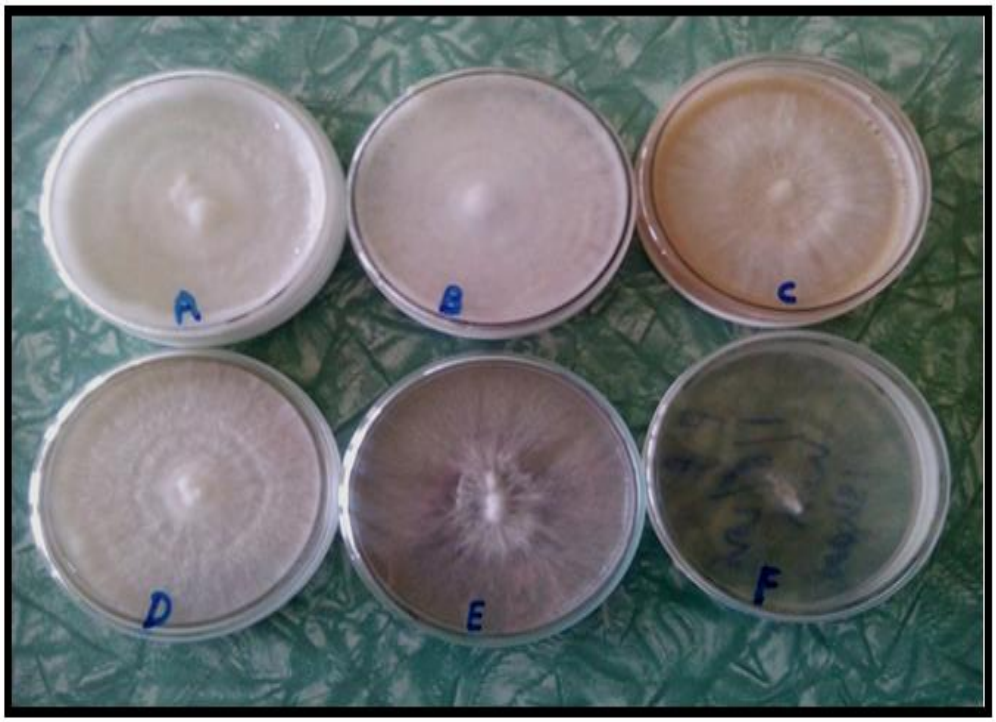

Fig. 1. Mycelial growth of *Pleurotus floridanus* (A) Potato dextrose Agar, (B) Potato Sucrose Agar, (C) Malt Extract Agar, (D) Corn Meal Agar, (E) Yeast Extract Agar and (F) Water Agar Mycelial growth on different cereal grains.

Fig. 2. Mycelial growth of *Pleurotus floridanus* on Sorghum, Bajra, Wheat, Pegion pea, Oat, Maize, Soybean, Check pea, and Bean grains.

Twenty seven types of substrates having five replicates were used for determination of linear mycelial growth of *P. floridanus*. The result were significant different at $P < 0.05$ level.

The best mycelial growth was recorded on sorghum grains having lime 2% and gypsum 4% followed by sorghum grains having lime 2% and sorghum grains in control form as shown in table 2.

The minimum growth was recorded on bean in control form. On the basis of presence and absence of lime and gypsum such variation of mycelial growth was also found on other grains. The presence of lime could adjust the pH level and gypsum prevents the coagulation of substrate that is why the maximum mycelial growth was found on substrates having lime and gypsum. The addition of lime increases the production of lignocellulolytic enzymes which improve the mycelial growth in *Pleurotus* and *lentinus* spp (Munoz *et al.,* 1997). Thulasi *et al.,* (2010) observed that sorghum grain was the most significant substrate for the preparation of spawn of *P. florida* and *P. eous*. The sorghum grains use all over the world for the preparation of spawn of oyster mushroom Oei and Nieuwenhuijzen (2005). The sorghum, wheat, barley and maize grains are used for spawn preparation in commercial level of edible mushroom (Sharma *et al.,* 2006).

Conclusion

From the present investigation it is concluded that for preparation a best culture the potato dextrose media (PDA) is the best as compared to other media. Among all the used grains the best mycelial growth was found on sorghum grains having 2% lime and 4% gypsum, so it is a best source of spawn preparation.

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