

Studies on effect of incubation temperature and light intensity on mycelial growth of oyster species

M. K. ROUT, ¹K. B. MOHAPATRA, P. MOHANTY AND ²S. S. CHANDAN

Krishi Vigyan Kendra, Kendrapara-754211, ¹Deptt. of Plant Pathology, College of Agriculture

²Krishi Vigyan Kendra, Bolangir-767002

Orissa University of Agriculture and Technology, Bhubaneswar-751003

Received : 08.01.2015, Revised : 07.10.2015, Accepted : 20.11.2015

ABSTRACT

The investigation on the influence of incubation temperature on the linear mycelial growth of oyster species showed that the growth at 25°C was superior and could produce an ample biomass of eight of the ten species evaluated. The extent of mycelial growth reduced drastically beyond the incubation temperature of 3 °C and was completely inhibited at a temperature of 40°C whereas, at low temperature (10°C) growth declined drastically in all the test species. The effect of different light intensity on the mycelial growth of ten oyster species indicated the superiority of 200 lux light is producing the highest linear mycelial growth of all the test species (63.92-78.89mm). The growth was observed to decline substantially (21.79-51.66mm) as the light intensity improved from 200 -1000lux. However, growth performance was found moderate (48.38-57.77mm) in darkness.

Keywords: Light intensity, mycelial growth, oyster mushroom, temperature

Edible and medicinal properties of mushrooms were known to many ancient civilizations. Only the reproductive structure comes out of the substrates and forms a fruiting body which is visible, called “mushroom” which may be edible. Most of the edible mushrooms belong to Ascomycotina and Basidiomycotina (Pathak *et al.*, 2003). The mushroom cultivation is a profitable agribusiness and particularly oyster mushroom which is edible having excellent flavour and taste (Shah *et al.*, 2004). Growing oyster mushroom has become more popular throughout the world, because of their abilities to grow at a wide range of temperature utilizing various lingo-cellulosic substrates (Khan and Garcha 1984). *Pleurotus* is one of the edible mushroom generally referred as “Oyster mushroom or Dhingri mushroom” in India. It relatively new to the mushroom industry but has gained popularity at a tremendous pace and today it is the third largest cultivated mushroom in the world and its annual production is around 8,75,000 tons. Considering obvious potentialities of *Pleurotus*, an experiment was designed to ascertain the effect of temperature and light intensity on the mycelial biomass of the species of fungus under laboratory condition for improving standardization of production techniques for increasing yield.

MATERIALS AND METHODS

The experiment on light intensity was conducted to ascertain the effect of different light intensities such as complete darkness, 200 lux, 400 lux, 600 lux, 800 lux and 1000 lux on the mycelial biomass of the

Email: routmanoj6@gmail.com

test fungus under laboratory condition in 250 ml conical flasks potato dextrose broth @ 100 ml each was dispensed, plugged and sterilized at 15 psi in autoclave for 15-20 minutes. For each treatment (light intensity) six replications were maintained in randomized block design. Conical flasks were inoculated with 5mm fungal disc, cut out from the growing margin of 15 days old culture and incubated at 26 ± 1°C for 15 days. For maintaining different light intensities, one set comprising of six flasks was maintained in each situation *viz.* Darkness, 200 lux, 400 lux, 600 lux, 800 lux, and 1000 lux as measured by luxmeter. At the end of the experimental period, the mycelia mats were filtered from the conical flask with the help of whatman No.1 filter paper and the collected mycelia mats along with the filter paper put into hot air oven at 60± 1°C for 6 hours for complete drying and dry weight was recorded. The dry weight of all mycelia mat was obtained by subtracting the weight of the filter paper from the weight of the filter paper along with the mycelia mat.

This experiment was designed to ascertain the effect of different incubation temperatures such as 5°, 10°, 15°, 20°, 25° and 30° on the mycelia biomass of the species of test fungus under laboratory condition.

In order to determine the optimum temperature required for the growth of different oyster species, 20ml of the melted and sterilized PDA medium was poured into each petridish and cooled down to 40-45°C for solidification under aseptic conditions. Five mm mycelia disc of the fungus was cut from the growing margin of 15 days old pure petriplate culture

by means of sterilized cork borer and transferred carefully to the centre of each petriplate with the help of sterilized inoculating needle under aseptic condition. Four such petriplates were maintained for each species and all the petriplates were incubated in BOD incubators at 5, 10, 15, 20, 25 and 30°C for 15 days. Linear growth by measuring the diameter in fixed directions were recorded in mm with the help of a transparent plastic scale. The colony was measured in crosswise directions and the average was calculated.

RESULTS ND DISCUSSION

The linear growth of the ten test species on PDA medium on exposure to six different light intensities from darkness to 1000 lux at seven days of inoculation was recorded and presented in table1.

Table1: Effect of light intensity on mycelial growth of 10 oyster species

Light	<i>P. eous</i>	<i>P. florida</i>	<i>P. sajor-caju</i> (CTMRT strain)	<i>P. citrinopileatus</i>	<i>P. fossulatus</i>	<i>P. flabellatus</i>	<i>P. platypus</i>	<i>P. ostreatus</i>	<i>H. ulmarius</i>	<i>P. sajor-caju</i> (DMR strain)
Darkness	56.17	48.24	57.77	53.55	48.38	52.38	52.56	49.41	54.52	50.63
200 lux	63.92	76.94	77.87	78.89	70.27	68.49	68.38	72.72	77.45	70.70
400 lux	39.90	47.79	53.31	42.52	37.83	45.71	48.69	38.35	51.66	42.97
600 lux	33.64	37.59	40.06	40.37	34.06	42.67	39.80	34.71	42.72	39.15
800 lux	29.94	33.74	31.96	33.71	29.95	41.51	31.43	31.96	36.21	36.83
1000 lux	23.07	28.92	27.84	30.30	23.94	30.06	27.08	21.79	28.76	24.79
LSD (0.05)	0.48	0.69	1.04	1.00	0.55	0.63	0.49	0.73	0.98	2.49
CV (%)	0.78	1.00	1.44	1.42	0.90	0.89	0.72	1.17	1.33	3.74

Table 2: Effect of incubation temperature on mycelial growth of 10 oyster species

Temperature (°C)	<i>P. eous</i>	<i>P. florida</i>	<i>P. sajor-caju</i> (CTMRT strain)	<i>P. citrinopileatus</i>	<i>P. fossulatus</i>	<i>P. flabellatus</i>	<i>P. platypus</i>	<i>P. ostreatus</i>	<i>H. ulmarius</i>	<i>P. sajor-caju</i> (DMR strain)
10	38.88	0.00	0.00	29.64	19.98	0.00	19.77	14.79	0.00	0.00
15	49.25	35.10	34.70	28.82	35.62	28.33	29.19	28.78	21.75	35.47
20	49.01	35.16	41.00	27.75	35.80	35.96	35.85	28.69	28.47	42.22
25	35.65	70.31	73.30	32.01	64.74	57.03	63.60	36.05	63.86	70.25
30	28.25	63.39	66.12	21.64	57.11	56.77	56.62	49.82	42.97	60.99
35	0.00	0.00	58.55	1.31	33.82	8.57	0.00	5.88	0.00	18.84
40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LSD (0.05)	0.60	2.45	0.75	0.73	0.89	0.54	0.63	0.55	0.47	2.22
CV (%)	1.40	5.84	1.29	2.64	1.69	1.35	1.44	1.57	1.40	4.60

Being a sub-tropical mushroom, mycelial growth of all the *Pleurotus* spp. can take place between 20-30°C. However, for fruiting different species have different temperature requirement. The growing temperature not only affects yields but also the quality of produce. In order to ascertain the optimum temperature requirement for both vegetative growth as well as yield, a trial was designed with temperature regimes from 10-40°C and the growth obtained there from was recorded and is presented in table1.

Analysis of data showed significant difference among the quanta of light in terms of mycelial growth of the fungus species. Significantly highest linear growth of all the test species was observed at 200 lux light intensity. The growth was observed to decline substantially as the light intensity was improved from 200-1000 lux. Growth performance was found to be moderate in darkness in all the species. Therefore, it was ascertained that low light intensity (near darkness or darkness) proved to be superior in facilitating vegetative growth of all the *Pleurotus* species. On the other hand, profuse light substantially reduced the vegetative growth of the oyster species evaluated. Further, the extent of growth was found to be highest in *P. citrinopileatus* (78.89 mm) and lowest in *P. eous* (63.92 mm) at 200 lux light intensity.

Analysis of data indicated significant difference among the treatments in terms of colony diameter of the test species. The growth temperature of 15-20°C was found superior for *P. eous*. However, *P. florida*, *P. sajor-caju* (CTMRT strain), *P. citrinopileatus*, *P. fossulatus*, *P. flabellatus* and *P. sajor-caju* (DMR strain) could exhibit good growth at 25°C. *P. ostreatus* produced good growth at an incubation temperature of 30°C. The extent of mycelial growth reduced drastically beyond the incubation

temperature of 30°C and it was recorded that the growth was completely inhibited at temperature of 40°C in all the test species at seven days of incubation, likewise, at low temperature (10°C) growth declined drastically in all the test species (Table 2). The overall finding of the investigation indicated that a growing temperature of 15-30°C was by and large suitable for all the test species of oyster mushroom. Temperature extremes (below or beyond the optimum range) were deleterious for vegetative growth.

Effect of different light intensity on the mycelial growth of 10 oyster species indicated the superiority of 200 lux light in producing the significantly highest linear mycelial growth of all the test species (63.92-78.89 cm). The growth was observed to decline substantially (21.79-51.66 cm) as the light intensity improved from 200-1000 lux. However, growth performance was found to be moderate (48.38-57.77 cm) in darkness. As such, mushrooms do not require light for the synthesis of food. This fact was substantiated by Zadrazil, 1973; Eger, 1978, Khan and Ali (1981) and Jatav *et al.*, 2012.

The investigation on the influence of incubation temperature on the linear mycelial growth of oyster species showed that the growth temperature of 25°C was superior could produce an ample biomass of eight of the ten species evaluated. The extent of mycelial growth reduced drastically beyond the incubation temperature of 30°C and was completely inhibited at a temperature of 40°C. On the other hand, at low temperature (10°C) growth declined drastically in all the test species. The finding of this investigation was substantiated with the findings of Bano, 1967; Jandaik and Kapoor, 1976; Zadrazil, 1978; Bhatti, 1984; Mehta and Bhandal, 1988; Bhattacharjee and samajpati, 1989; Moorthy, 1993 and Jandaik, 1997. The successful cultivation of oyster mushroom during the winter months in the coastal agro-ecological situation of the state justified the findings of this investigation.

REFERENCES

- Bano, Z. 1967. Studies on the cultivation of *Pleurotus sajor-caju*. *Mushroom J.*, **115**: 243-45.
- Bhattacharjee, N.K. and Samajpati, N.1989. Optimization of mycelial growth of *Pleurotus sajor-caju* in relation to some physical and nutritional factors. *Indian J. Mycol. Res.*, **27**:59-65.
- Bhatti, M.A. 1984. Mushrooms as commercial crop. *Prog. Farm.*, **4**: 5-10.
- Eger, G. 1978. Biology and breeding of *Pleurotus*. In. *The Biology and Cultivation of Edible Mushrooms* (Eds.), Acad. Press, New York, pp. 497-19.
- Jandaik, C.L. and Kapoor, J.N. 1976. Studies on cultivation of *Pleurotus sajor-caju*. *Mush. Sci.*, **9**: 667-72.
- Jandaik, C.L.1997. History and development of *Pleurotus* cultivation in the world and future prospects. In. *Advances in Mushroom Biology and Production* (Eds.), MSI, Solan, pp. 181.
- Jatav, R.S., Gupta, A.K, Doshi, A. and Meena, A.K. 2012. Studies on different physical factors on mycelial growth of blue oyster mushroom, *Hypsizygous ulmarius* (Bull.) Redhead. *J. Agric. Stat. Sci.*, **8**: 347-54.
- Khan, P. and Garcho, H.S. 1984. *Pleurotus* mushroom, a source of food proteins, *Mush. Newslet. Tropics*, **4**:9-14.
- Khan, S.M. and Ali, M.A. 1981. Cultivation of oyster mushroom (*Pleurotus* spp.) on cotton boll locules. *Mush. Sci.*, **11**: 691-95.
- Mehta, K.B. and Bhandal, M.S. 1988. Mycelial growth variation of six *Pleurotus* species at different temperatures. *Indian J. Mush.*, **14**: 64-65.
- Moorthy, N. 1993. Effect of Supplementing Rice Straw growt substrate with cotton seed and the analytical characteristics of mushroom, *Pleurotus florida*. *Food Chem.*, **92**: 255-69.
- Pathak, V.N, Yadav, N. and Gaur, M. 2003. *Mushroom Production and Processing Technology*. AGRIBIOS, India.
- Shah, Z.A., Ashraf, M. and Ishtiaq, Ch. M. 2004. Comparative study on cultivation and yield performance of oyster mushroom *Pleurotus ostreatus* on different substrates (wheat straw, leaves, saw dust). *Pakistan J. Nutr.*, **3**: 158-60.
- Zadrazil, F. 1973. *Anbauverfahren fur Pleurotus florida*. *Fovo. Sc. Chanpignon*, **13**:3.
- Zadrazil, F. 1978. Cultivation of *Pleurotus* spp. In. *The Biology and Cultivation of Edible Mushrooms* (Eds.), Chinese University Press.