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Effect of Physiological Parameters on Mycelial Growth of Blue Oyster [*Hypsizygus ulmarius* (Bull.:Fr.) Redhead] Mushroom

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A B S T R A C T

Mushrooms are the fruiting bodies of macro fungi which serve as food, tonic and medicine. They are capable of producing the highest quantity of protein per unit area and time from agri-residues. This study was aimed to find out the physiological requirements for mycelial growth and biomass production of *Hypsizygus ulmarius* (Bull.: Fr.) Redhead. Four level of temperature (15±1˚C, 20±1˚C, 25±1˚Cand 30±1˚C) and pH (5.0, 6.0, 7.0 and 8.0) were studied to find out the best temperature and pH using PDA medium to obtain maximum mycelial growth and biomass. Temperature level at 25±1˚C (89.8 mm; 2.6 g/250 ml) and pH at 7 (90 mm; 2.5 g/250 ml) proved to be most favourable, recording the maximum mycelial growth and biomass production.

Introduction

Mushrooms, the fruiting bodies of macro fungi comprise a large heterogeneous group and vary in shape, size, colour, appearance and edibility. Mushrooms are a good source of protein, vitamins and minerals and are known to have a broad range of uses as food, tonic and medicine. A high nutritional values of blue oyster mushrooms has been reported with 23.2 per cent crude protein, 56.1 per cent carbohydrates, 1.9 per cent starch and 9.1 per cent fiber on dry weight basis (Sethi *et al.,* 2012). More than fifteen thousand fleshy fungi have been identified of which, two thousands are edible. About three hundred mushroom species have been reported from India and only few are cultivated. They are capable of producing the highest quantity of protein per unit area and time from agri-residues which is available to the tune of more than 700 million tonnes per annum in India (Vijay *et al.*, 2012). *Pleurotus spp*. constitute 30 per cent of total mushroom production and ranks third among the cultivated mushrooms grown widely in temperate, sub-tropical and tropical regions of the world (Thakur, 2014). Blue oyster mushroom [*Hypsizygus ulmarius* (Bull.:Fr.) Redhead] is a basidiomycetous fungus and belongs to family tricholomataceae of order agaricales. *H.ulmarius* is a high yielding

mushroom and is gaining popularity in Asia and Europe owing to its simple and low cost production technology and higher biological efficiency (Mane *et al.,* 2007). To standardize its cultivation technology in India, a little effort was made by Rai (2004) but it could not reach the commercial level. Efforts were done to standardize its physiological requirements for maximum biomass production of *H. ulmarius*.

Materials and Methods

Culture used for the study

The pure culture of *Hypsizygus ulmarius* was obtained from Directorate of Mushroom Research (DMR), Chambaghat, Solan (HP). The pure culture was maintaned on Potato Dextrose Agar (PDA) medium.

Preparation of Potato Dextrose Agar (PDA) media

Potato dextrose agar (PDA) medium was prepared by using 200 g peeled potato, 20 g dextrose and 20 g agar in a litre of water. Prepared media sterilized in an autoclave at 15 psi for 15 minutes

Preparation of Potato Dextrose Broth (PDB) media

Potato dextrose broth (PDB) medium was prepared by using 200 g peeled potato and 20 g dextrose in a litre of water. Prepared media sterilized in an autoclave at 15 psi for 15 minutes.

Physiological studies

Effect of temperature on mycelial growth

The influence of temperature on growth and biomass of *H. ulmarius* was studied at four temperature levels *viz.,* 15±1˚C, 20±1˚C, 25±1˚C and 30±1˚C using potato dextrose agar medium as basal medium. Conical flasks containing desired quantity of potato dextrose broth were plugged and sterilized at 15 psi in autoclave for 15 - 20 minutes. The Petri plates and flasks containing desired quantity of medium were inoculated with 5 mm mycelial bit of actively growing pure culture (10 days old) of *H. ulmarius*. The Petri plates and the flasks were incubated at 15±1˚C, 20±1˚C, 25±1˚C and 30±1˚C temperature in the BOD incubator.

Effect of pH on mycelial growth

Four levels of pH *viz.,* 5.0, 6.0, 7.0 and 8.0 were maintained in the potato dextrose agar medium to find the most suitable pH for optimum growth and biomass of *H. ulmarius*. The desired pH was maintained by using 0.1 N HCl and 0.1 N NaOH solutions and it was measured by pH meter.

Conical flasks containing desired quantity of potato dextrose broth were plugged and sterilized at 15 psi in autoclave for 15 - 20 minutes. The Petri plates and flasks containing desired quantity of medium were inoculated with 5 mm mycelial bit of actively growing pure culture (10 days old) of *H. ulmarius*. These Petri plates and flasks were incubated at 25 ± 1 ˚C in a BOD incubator.

Measurement of radial mycelial growth and dry mycelium weight

Radial mycelial growth- colony diameter was recorded at 48 hrs interval till complete mycelial growth. Biomass weight - The broth having *H. ulmarius* from each flask was filtered individually after incubation for 15 days, on to a pre-weighed Whatmann filter paper No.1, dried in an oven at 60 ˚C, till it attained constant weight to record the dry mycelial weight.

The experiment was conducted in a

completely randomized design (CRD) with five replications for each treatment under *in vitro* conditions. Experimental data were analysed by using statistical package of program OPSTAT (2006). Critical differences (C.D.) were calculated at 5 per cent probability.

Results and Discussion

Physiological studies

Effect of temperature on mycelial growth

Temperature is the most important physical factor that plays an important role in the vegetative mycelial growth of fungus. *H. ulmarius* can grow at 15±1˚C, 20±1˚C, 25±1˚C and 30±1˚C but its growth was completely inhibited at temperature of 35 ± 1˚C.

However, it attained maximum mycelial growth at 25±1˚C (89.8 mm), followed by 30±1˚C (80.8 mm), 20±1˚C (71.6 mm) and 15±1˚C (63.1 mm) after 10 days of incubation (Table 1; Fig. 2). Thus a temperature of 25±1˚C was found to be the most suitable for mycelial growth of this mushroom which showed maximum radial growth of 89.8 mm after 10 days of incubation which was significantly higher than the other treatments.

Similar trend was observed regarding the effect of different temperature on *H. ulmarius* biomass production, which was significantly higher at 25±1˚C (2.6 g), followed by 30±1˚C (1.9 g), 20±1˚C (1.3 g) and 15±1˚C (0.7 g) after 15 days of incubation (Table 2; Fig. 1).

Effect of pH on mycelial growth

Hypsizygus ulmarius achieved maximum mycelial growth when the pH of the medium was 7.0 (90 mm) followed by pH 6.0 (85 mm), pH 5.0 (76.5 mm) and pH 8.0 (65.3 mm) after 10 days of incubation.

So, the pH 7.0 was found to be the most suitable for mycelial growth of *H. ulmarius* which showed maximum radial growth of 90 mm after 10 days of incubation, which was significantly higher than rest of the treatments (Table 3; Fig. 4).

Regarding the effect of different pH on *H. ulmarius* biomass production, it was significantly higher at pH 7.0 (2.5 g) followed by pH 6.0(1.9 g), pH 5 (1.7 g) and pH 8.0 (1.6 g) after 15 days of incubation (Table 4; Fig. 3).

Fig.1 Effect of different temperature on biomass of *Hypsizygus ulmarius*

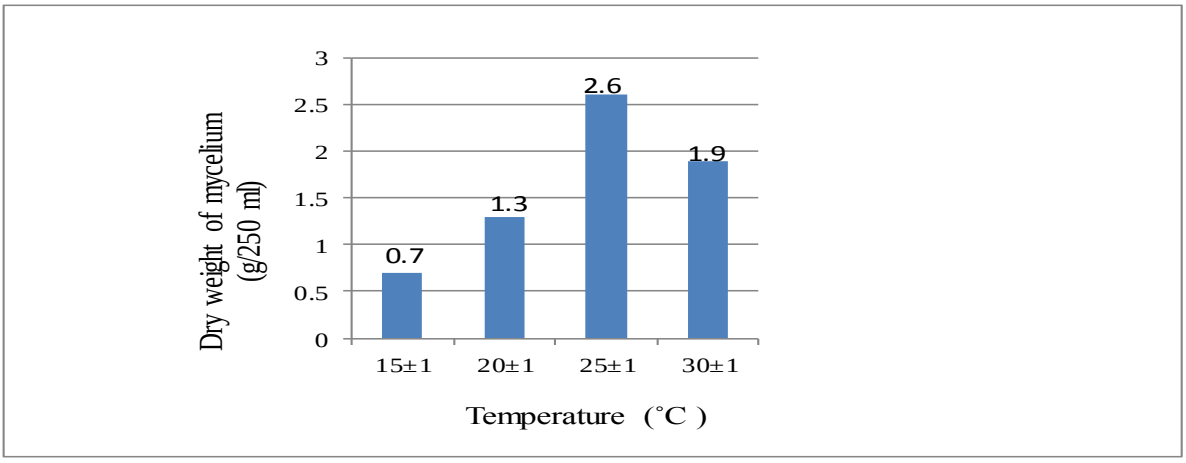

Fig.2 Effect of different temperature on mycelial growth of *Hypsizygus ulmarius*

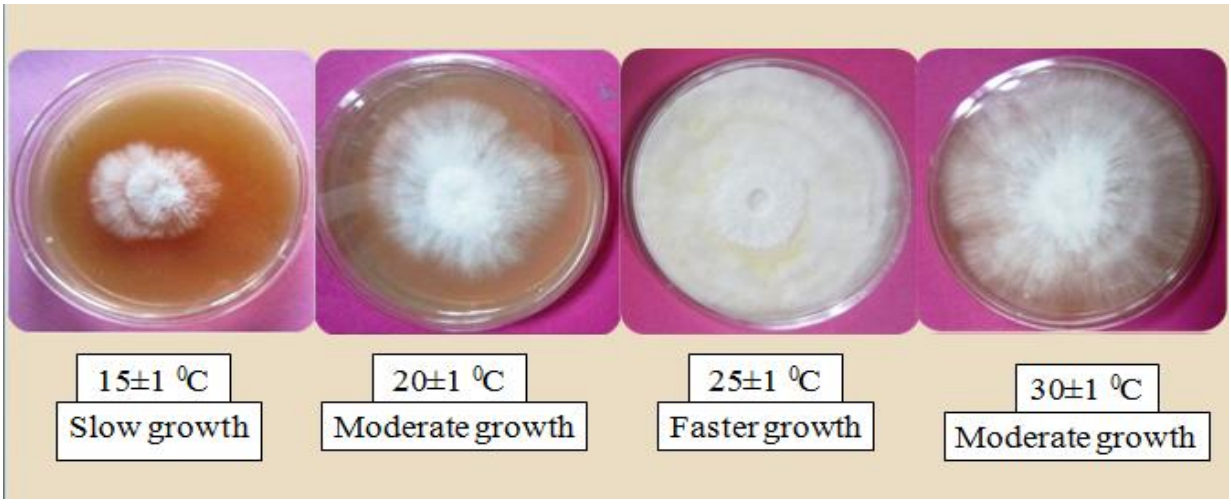

Fig.3 Effect of different pH on biomass of *Hypsizygus ulmarius*

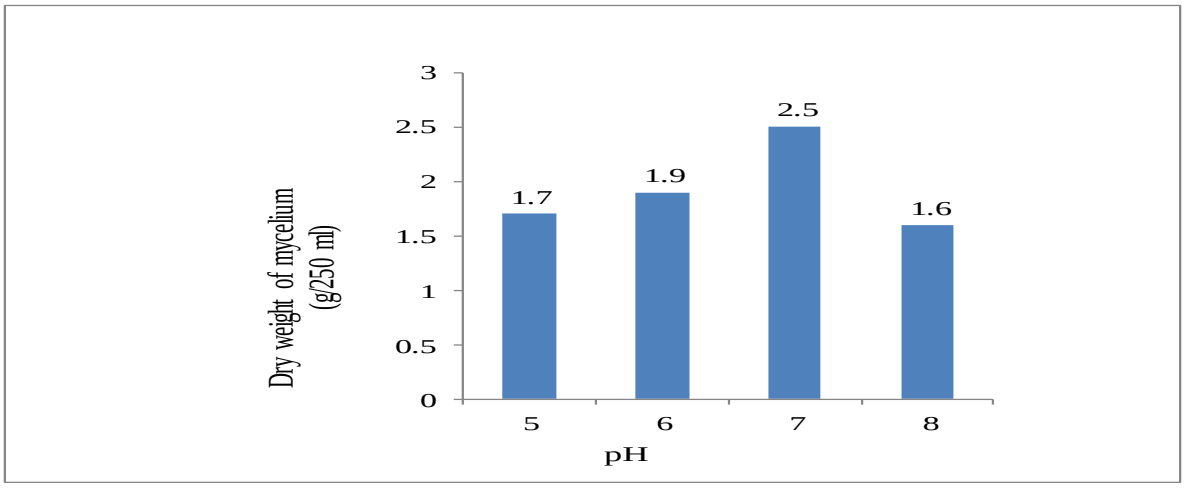

Fig.4 Effect of different pH on mycelial growth of *Hypsizygus ulmarius*

Table.1 Effect of different temperature on radial growth of *Hypsizygus ulmarius*

Sr. No.	Temperature (˚C)	Radial growth* (mm)					
		2 DAI	4 DAI	6 DAI	8 DAI	10 DAI	Mean
1	15	5.7	12.8	26.2	45.0	63.1	30.5
2	20	10.9	28.9	45.2	50.3	71.6	41.3
3	25	15.1	38.2	61.3	75.6	89.8	56.0
4	30	13.3	36.2	49.9	66.9	80.8	49.4
	Mean	11.2	29.0	45.6	59.4	76.3	
CD (0.05); Temperature = 1.9; DAI = 2.1; Temperature × DAI = 4.3							

*: Average of five replications; DAI: Days after incubation

Table.2 Effect of different temperature on biomass of *Hypsizygus ulmarius*

Sr. No.	Temperature (˚C)	Biomass* (g/250 ml)
1	15±1	0.7
2	20±1	1.3
3	25±1	2.6
4	30±1	1.9
CD (0.05)	**0.2**	

* Average of five replications

Table.3 Effect of different pH on radial growth of *Hypsizygus ulmarius*

Sr. No.	pH	Radial growth* (mm)					
		2 DAI	4 DAI	6 DAI	8 DAI	10 DAI	Mean
1	5	9.8	17.9	37.4	55.0	76.5	39.3
2	6	12.4	33.1	51.6	69.2	85.0	50.3
3	7	15.1	38.2	61.3	75.6	90.0	56.0
4	8	8.5	16.2	26.1	41.3	65.3	31.5
	Mean	11.4	26.3	44.1	60.3	79.2	
CD (0.05); pH =1.3; Days = 1.4; pH × Days = 2.9							

*: Average of five replications; DAI: Days after incubation

Table.4 Effect of different pH on biomass of *Hypsizygus ulmarius*

Sr. No.	pH	Biomass* (g/250 ml)
1	5	1.7
2	6	1.9
3	7	2.5
4	8	1.6
	CD (0.05)	**0.3**

*: Average of five replications

Effect of temperature on mycelial growth

In the present work mycelial growth of *H. ulmarius* was optimum at 25±1˚C followed by 30±1˚C, 20±1˚C and 15±1˚C. More or less similar findings were reported in *H. ulmarius* (Sethi *et al.,* 2012); (Rout *et al.,* 2015) and (Kumar and Eswaran, 2016). Thus present results are strongly substantiated

Effect of pH on mycelial growth

It is evident from the present investigation that maximum mycelial growth of *H. ulmarius* was recorded at pH 7. More or less similar findings were reported in *H. ulmarius* (Singh and Kushwaha, 2007); (Sethi *et al.,* 2012) and (Kumar and Eswaran, 2016). Thus present results are strongly substantiated.

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