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EFFICACY OF DIFFERENT PHYSIOLOGICAL PARAMETERS ON MYCELIAL GROWTH OF ELM OYSTER MUSHROOM [*HYPSIZYGUS ULMARIUS* (BULL) REDHEAD]

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ABSTRACT

Physiological studies along with the growth and biomass of *Hypsizygus ulmarius* was studied on different suitable media, temperature, duration of light, and pH. Oat meal agar medium was found suitable medium for the growth of *H. ulmarius.* Optimum temperature for maximum radial growth (83.25 mm) was observed at 24°C. Complete darkness and zero hour of light duration shows significantly maximum mycelial growth of *H. ulmarius* (85.00 mm). Maximum mycelial growth of *H. ulmarius* (85.00 mm) was obtained at pH 8 and pH 6 in PDA medium.

Introduction

Mushroom production represents one of the most commercially important steps towards diversification of agriculture based on microbial technology for large – scale recycling of agro waste in an agricultural country like India. The cultivation of edible mushrooms has become an attractive economic alternative over past few years, mainly due to increase in its demand and market value (Chang, 2006).

Hypsizygus ulmarius (Bull. ex. Fr.) Redhead commonly known as blue or elm oyster mushroom is one of the popular edible mushroom in the world (Jatav *et al*., 2012). *Hypsizygus ulmarius* (Bull. ex. Fr.) Redhead Syn: *Pleurotus ulmarius* (Fr.) P. Kumm., deriving its name Hypsimeans "high" and zygusmeans a "yoke" *Hypsizygus*, then referring to position of this mushroom often high in the tree. Ulm - refers to "elm" tree which is one of the common substrates for this fungus and popularly cultivated in Japan, China, North America and other Asian countries. This mushroom closely parallels the morphology of oyster mushroom but it is far better in flavour and texture. Nutritionally, this mushroom contains 23.6 per cent protein, 2.2 per cent fat, 52.4 per cent carbohydrate and 12.9 per cent fiber on dry weight basis (Chang, 1999; Usha and Suguna, 2015).

Blue oyster mushroom (*Hypsizygus ulmarius*) is a basidiomycetous fungus and belongs to family tricholomataceae of order agaricales. *H. ulmarius* is a high yieldingmushroom and is gaining popularity in Asiaand Europe owing to its simple and low costproduction technology and higher biologicalefficiency (Mane *et al*., 2007). To standardizeits cultivation technology in India, a littleeffort was made by Rai (2004) but it could notreach the commercial level. Keeping these in view, an experiment was conducted to check physiological requirement of *H. ulmarius* for its growth and biomass production.

Materials and Methods

Collection of culture

Pure culture of *Hypsizygus ulmarius* was obtained from ICAR-DMR, Chambaghat, Solan (HP) and maintained on Potato Dextrose Agar (PDA) medium.

Preparation of PDA and PDB

Potato Dextrose Agar (PDA) and Potato Dextrose Broth (PDB)was prepared by using formulations and method of preparation explained by Tuite, 1969 and Ainsworth, 1971.

Effect of different media on mycelial growth of *H. ulmarius*

Five different culture media *viz.,* Potato Dextrose Agar(PDA), Malt Extract Agar (MEA), Corn Meal Agar (CMA), Oat Meal Agar (OMA) and Czapek dox Agar (CDA)have been used to check their effect on mycelial growth of *Hypsizygus ulmarius.* All media were prepared by using standard method of preparation explained by Tuite, 1969 and Ainsworth, 1971. Five replications were maintained and the mycelial growth of *H. ulmarius* was recorded.

Effect of temperatures on mycelial growth of *H. ulmarius*

Evaluation has been carried out to find the suitable temperature for the mycelial growth of *H. ulmarius*. The different temperatures such as 21°C, 22°C, 23°C, 24°C and 25°C were maintained in digital incubator. Five replications have been maintained for each treatment (temperature) and observations were recorded for radial growth on PDA at different temperatures when the growth in the control plate is completed.

Effect of duration of light on mycelial growth of *H. ulmarius*

Effects of duration of light were studied on mycelial growth of *H. ulmarius*. Petri plates has been exposed to

different light intervals such as (i) 0 hr light (ii) 6 hrs light (iii) 12 hrs light (iv) 18 hrs light and (v) 24 hrs light. Five replications have been maintained for each treatments.

Effect of different pH on mycelial growth of *H. ulmarius*

Different levels of pH (4, 5, 6, 7 and 8) were studied to find out the optimum pH for growth of *H. ulmarius*. The pH was maintained in PDA medium and broth with the help of digital pH meter by adding 0.1N HCl and 0.1N NaOH solution. Each treatment was replicated 5 times. Each inoculated plates were incubated at 25±1°C. The observations on radial growth has been recorded at 48 hrs interval.

Statistical Analysis

All the experimental data was analyzed with Completely Randomized Design and critical differences (C.D.) was calculated at 5% probability by using statistical package of program OPSTAT (2006).

Results and Discussions

Effect of different media on growth of *H. ulmarius*

To find out the suitable medium for the mycelial growth of *H. ulmarius*, five different media were used under *in-vitro* condition. Maximum mycelial growth was recorded in Oat Meal Agar (85.00 mm) followed by Potato Dextrose Agar (83.00 mm) followed by Malt Extract Agar (81.70mm). These three media were found superior to remaining all media (Table 1). It was followed by Corn Meal agar medium (68.99mm). The lowest mycelial growth was recorded on Czapeks dox agar medium of (67.22mm). White and fluffy mycelial growth of *H. ulmarius* was found in three media i.e. OMA, PDA and MEA but, in CMA and CDA, growth was very thin and sparse (Fig. 1).Similar findings have been reported by Mishra *et al.,* 2015 and Jatav *et al.,* 2012.

Effect of different temperatures on mycelial growth of *H. ulmarius*

Different temperature were stuided invitro to find out the suitable temperature for the growth of elm oyster mushroom. The results clearly indicate that the variation in the temperature significantly influenced the radial growth of elm Oyster mushroom *H.ulmarius* (Table 2). Among these temperatures, 24°C gave significantly higher radial growth (83.25mm) followed by 23°C (80.25mm) followed by 25°C (79.50mm) follwed by 22°C (58.75mm) and least in were recoded at 21°C (46.00mm). Regarding growth characters of *H. ulamrius,* white mycelial growth with irregular margins have been observed at 22°C and 23°C and absolute white mycelia with regular margins have been observed at 24°C and 25°C (Fig. 2). Similar findings were reported by Sethi *et al*., 2012; Rout *et al*., 2015; Kumar and Eswaran, 2016.Kushwaha *et al.,* 2011; Wange and Patil, 2007 also reported same results in *H. ulmarius* which has strongly supported results of present study.

Effect of duration of light on mycelial growth of *H. ulmarius*

The duration of light was found to influence significantly the growth of *H. ulmarius.* The radial growth was observed significantly more in zero hour light (complete darkness) (85.00 mm) followed by 12 h dark and 12h light (78.25 mm) followed by 24h light (75.50 mm). However less growth was observed on 18h light and 6h darkness (64.50 mm) and 6h light and 18h darkness (74.50 mm) (Table 3). White fluffy growth with regular margin was observed in T_2 and T_4, and with irregular margin was observed in T_1 (Fig. 3).Present results are of accordance with the results of Jatav *et al.,* 2012.

Effect of different pH on mycelial growth of *H. ulmarius*

Hydrogen ion concentration governs several physiological activities of microorganisms. Different fungi require a different pH level for their growth. Therefore five different pH levels such as 4, 5, 6, 7 and 8 were tested to find out the optimum pH for the mycelial growth of *H. ulmarius* on PDA medium (Table 4). Different level of pH showed significant difference in radial growth of elm oyster mushroom. Among the evaluated pH, pH 8 gave significantly more (85.00 mm) followed by pH 6 (85.00mm) followed by pH 5 (82.60 mm) followed by pH 7 (75.00mm) and least was recorded on pH 4 (62.80 mm). White mycelial growth with rings and regular margins have been observed with all pH tested excepted pH 4, in which irregular margin has been observed (Fig 4).

Effect of different pH on biomass of *H. ulmarius* on PDB

Potato Dextrose Broth (PDB) has been tested to check the growth of *H. ulmarius*. Therefore five different pH levels such as 4, 5, 6, 7 and 8 were tested to find out the optimum pH for the biomass of *H.ulmarius*(Fig. 5). It was tested under *in-vitro* condition. Fresh mycelial weight and dry mycelial weight has been calculated by using weighing balance. Different level of pH showed significant difference in radial growth of elm oyster mushroom (Table 5). Among the evaluated pH it is found that pH 7 has maximum biomass of (2.92 g) followed by pH 6 (2.7 g) followed by pH4 (2.22g) and pH 5 (1.96g) and least was recoded on pH 8 (1.89 g).

The present findings are partially in agreement with the work carried out by Kushwaha *et al.* (2011). They worked on effect of different pH on growth of *H. ulmarius* and suggested that pH 7.0 favoured the growth and biomass of *H. ulmarius* followed by pH 8.0. Similar finding was also reported in *H. ulmarius* by Singh and Kushwaha, 2007.

Table 1: Effect of different media on mycelial growth of *H. ulmarius*:

Symbol	Media	Radial growth (mm)*	Growth Characters
T_1	Oat Meal Agar	85.00	White fluffy growth raised in centre and flat at periphery
T_2	Potato Dextrose Agar	83.00	White mycelial growth dense fluffy with concentric rings and regular margin
T_3	Malt Extract Agar	81.70	Absolute white mycelium growth abundant fluffy at centre with concentric rings
T_4	Corn Meal Agar	68.90	Very thin sparse mycelial growth
T_5	Czapak Dox Agar	67.20	Very thin sparse mycelial growth
S.E. (±)		**3.545**	
C.D. (@5%)		**0.062**	

*Average of five replications

Table 2: Effect of temperatures on mycelial growth of *H. ulmarius:*

Symbol	Temperature (°C)	Radial growth (mm)*	Growth Characteristics
T_1	21	46.00	White Mycelial growth fluffy at centre
T_2	22	58.75	White Mycelial growth with irregular margins
T_3	23	80.25	White Mycelial growth with irregular margins
T_4	24	83.25	Absolute White Mycelial growth with concentric rings and regular margins
T_5	25	79.50	Absolute White Mycelial growth with concentric rings and regular margins
S.E. (±)		**1.541**	
C.D. (@5%)		**5.231**	

Table 3: Effect of duration of light on mycelial growth of *H. ulmarius:*

Symbol	Duration	Radial growth (mm)*	Growth characteristics
T_1	24h light	75.50	Absolute White Fluffy Mycelial Growth with concentric rings and irregular margin
T_2	18h light +6h darkness	64.50	White mycelial growth with concentric rings and regular margin
T_3	12h dark + 12 h light	78.25	Absolute white mycelial growth with concentric rings
T_4	6 h light +18h darkness	74.50	Absolute white mycelial growth with fluffy in nature with regular margins
T_5	24 h darkness	85.00	Absolute white mycelial growth suppressed in centre and raised from concentric region
S.E. (±)		**0.543**	
C.D. (@5%)		**1.575**	

*Average of five replications

Table 4: Effect of different pH on radial growth of *H. ulmarius*:

Symbol	pH	Radial growth (mm)*	Growth characters
T_1	4	62.80	White mycelial growth with concentric rings and irregular margin
T_2	5	73.60	White mycelial growth with concentric rings and regular margin
T_3	6	85.00	White mycelial growth with concentric rings and regular margin
T_4	7	75.00	White mycelial growth with concentric rings and regular margin
T_5	8	85.00	White mycelial growth with concentric rings and regular margin
S.E. (±)		**1.87**	
C.D. (@5%)		**5.77**	

*Average of five replications

Table 5: Effect of different pH on biomass of *H. ulmarius* on PDB:

Symbol	pH	Fresh Mycelial weight (g)*	Dry Mycelial weight (g)*
T_1	4	2.22	0.19
T_2	5	1.96	0.22
T_3	6	2.70	0.31
T_4	7	2.92	0.33
T_5	8	1.89	0.13
S.E. (±)		**0.412**	**0.06**
C.D. (@5%)		**1.281**	**0.02**

*Average of five replications

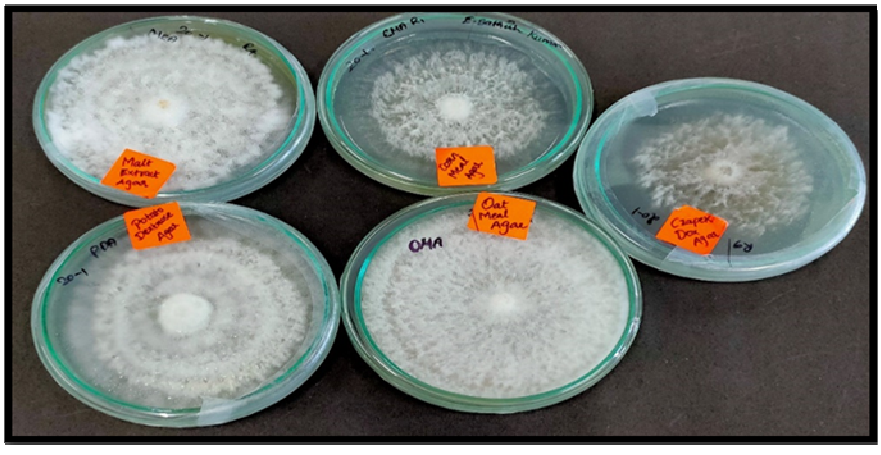

Fig. 1: Effect of different media on mycelial growth of *H. ulmarius*

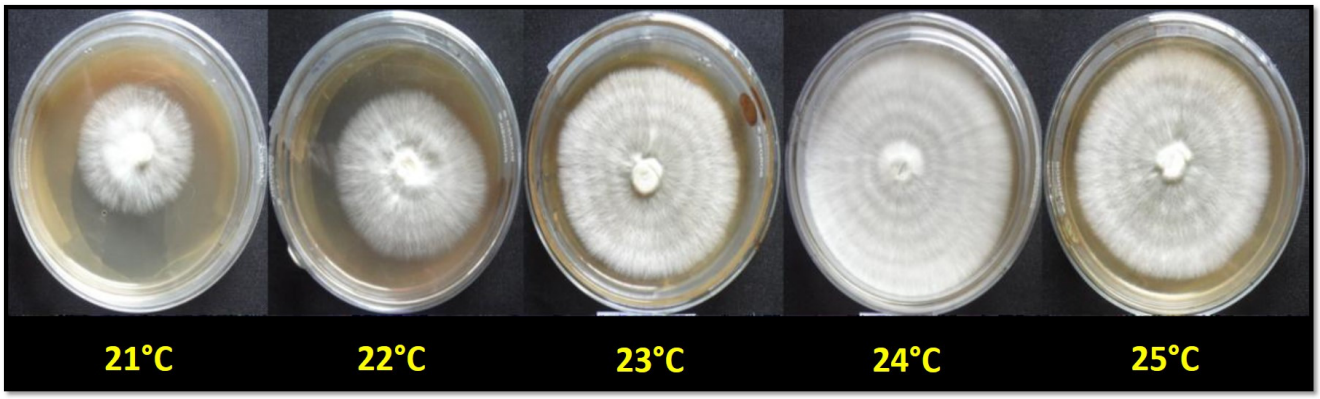

Fig. 2: Effect of temperatures on mycelial growth of *H. ulmarius*

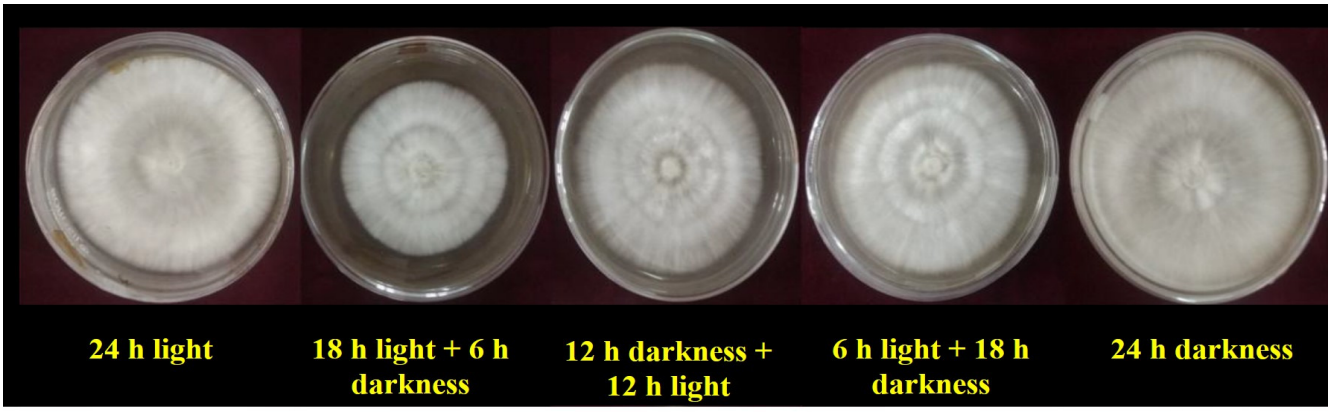

Fig. 3: Effect of duration of light on mycelial growth of *H. ulmarius*

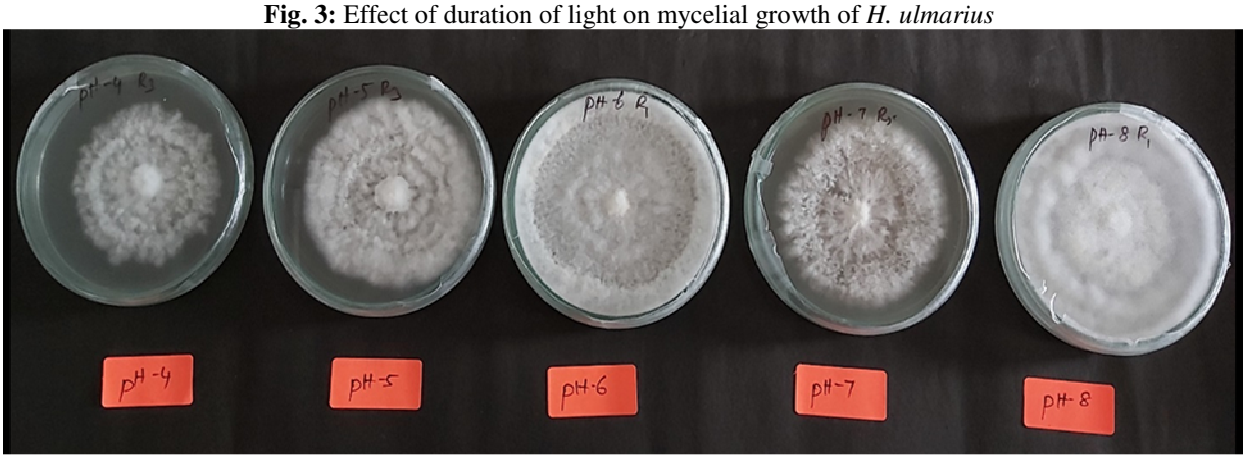

Fig. 4: Effect of different pH on radial growth of *H. ulmarius*

Fig. 5: Effect of different pH on biomass of *H. ulmarius* on PDB

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References

Ainsworth, G.C. (1971). Ainsworth and Bisby's Dictionary of the Fungi. Common wealth Mycological Institute Kew, Surrey, England, p. 663.

Chang, S.T. (1999). World production of cultivated edible and medicinal mushroom in 1997 with emphasis on *Lentinus edodes* (Berk) Sing. in China. *Int. J. Med. Mushroom*, 1: 291-300.

Chang, S.T. (2006). The world mushroom industry: Trends and technological development. Intl. J. Med. Mush, 8: 297-314.

Jatav, R.S.; Gupta, A.K.; Anila, D. and Meena, A.K. (2012). Studies of different physical factors on mycelia growth of blue oyster mushroom (*Hypsizygus ulmarius* (Bull.) Redhead). Int. J. Agric. Statist.; [Abstract], 347-354.

Kumar, S.R. and Eswaran, A. (2016). Effect of surface sterilants on the tissue germination and biomass production of *Hypsizygus ulmarius* (Bull. ex. Fr.) Redhead. (Blueoyster mushroom). Asian Journal of Science and Technology. 7(1): 2289-2293.

Kushwaha, K.P.S.; Singh, P.K.; Mishra, K.K. and Bhardwaj, S.B. (2011). Cultural and morphological studies of *Hypsizygus ulmarius*, blue oyster mushroom. Pantnagar J. Res., 9(2): 202-205.

Mane, V.P.; Patil, S.S.; Syed, A.A. and Baig, M.M.V. (2007). Bioconversion of low quality lignocellulosic agricultural waste into edible protein by Pleurotus sajor-caju (Fr.) Singer. Journal of Zhejiang University of Science, 8(10): 745-751.

Mishra, R.P.; Mohammad, S.; Sonika, P.; Manjul, P.; Deepshikha, and Mandvi, S. (2015). Characterization of Pleurotus sp. of mushroom based on phenotypic, biochemical and yield parameter. Afr. J. Microbiol. Res. 9(13): 934-937.

Rai, R. (2004). Production of edible fungi. Fungal Bio-technology in Agricultural, food and Environmental Applications, Pp. 233- 246.

Rout, M.K.; Mohapatra, K.B.; Mohanty, P. and Chandan, S.S. (2015). Studies on effect of incubation temperature and light intensity on mycelia growth of oyster species. Journal of Crop and Weed. 11(2): 44-46.

Sethi, S.; Sodhi, H.S.; Kapoor, S. and Khanna, P.K. (2012). Nutritional and mineral profile of blue oyster mushroom, *Hypsizygus ulmarius* (Bull.). Journal of Research Punjab Agricultural University. 49(4): 256-258.

Singh P.K. and Kushwaha K.P.S. (2007). Effect of different media and pH on mycelial growth of *Hypsizygus ulmarius.* J. Mycol. Pl. Pathol.; 37 (1): 177.

Tuite, J. (1969). Plant Pathological Methods: Fungi and Bacteria, 239p, Burgess Publishing Co. Minneapolis, U.S.A.

Usha, S. and Suguna, V. (2015). Studies on nutrient analysis of two strains of blue oyster mushroom (*Hypsizygus ulmarius* CO_2 and IIHR Hu1). Asian J. Dairy Food Sci. 34(2): 168-170.

Wange, S.S. and Patil, R.N. (2007). Cultural, physiological and spawn production studies with *Hypsizygus ulmarius.* J. Soils Crops. 17(2): 288-291.