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REGULAR ARTICLE

EFFECT OF TEMPERATURES ON THE GROWTH OF FLORAL WASTE DEGRADING FUNGI

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ABSTRACT

The goal of present study was to find out optimum growth temperature of isolated floral waste degrading fungi viz. *Aspergillus fumigatus, Aspergillus flavus, Alternaria alternate* and *Aspergillus terreus.* Eleven different temperature range (20°C, 22°C, 24°C, 26°C, 28°C, 30°C, 32°C, 34°C,36°C,38°C,40°C) were selected to find the optimum growth of these fungi on floral extract-basal medium for flask experiments. The optimum growth temperature of all four fungal strains was found at 32°C±1°C. Beside *Alternaria alternate*, remaining other three selected fungal strains showed growth at all selected temperatures. At optimum growth temperature (32°C±1°C), the highest growth occurred in *Aspergillus fumigates* and *Aspergillus terreus* (155 mg/50 ml/7 days) while lowest growth was observed in *Aspergillus flavus* and *Alternaria alternata* (140 mg/50 ml/7 days). At minimum selected growth temperature (20°C), maximum growth was found in *Aspergillus flavus* (45 mg/50 ml/7 days) and lowest growth occurred in *Alternaria alternata* (35 mg/50 ml/7 days) while at maximum selected growth temperature (40°C) highest growth seen in *Aspergillus fumigatus* and *Aspergillus flavus* (30 mg/50 ml/7 days) and no growth recorded in *Alternaria alternata* (00 mg/50 ml/7 days).

Keywords: Vermicomposting, Temple waste, *Aspergillus fumigatus, Aspergillus flavus, Alternaria alternate***,** *Aspergillus terreus*

INTRODUCTION

Bio-composting is an environmental friendly process which accompanying with sustainable cleaning of biological waste. Process of composting mainly carried out by different type of microorganisms among these fungi play vital role due to their filamentous structure, variety and ability to produce variable types of enzyme (**Miller, 1996; Taiwo & Oso, 2004; Peters *et al*., 2000**). Decomposer nature of fungi influenced by several physical and chemical factors, among them temperature also play strategic role. In the nature, temperature chiefly governs by environmental condition and their alteration extremely affects the physiology and growth of the fungi (**Rayner and Boddy, 1988**). The impact of temperature on the fungi concerning the bioremediation of different organic waste is well documented by several researchers (**Messner *et al.*, 2002; Buyuksonmez *et al*.,** 2000**; Pedro *et al*.,** 2003**; Schloss *et al*.,** 2003**; Zeng *et al*.,** 2011).

Radha *et al.* (2005) studied on decolorisation of synthetic dyes using *fungal strain* and got better result at temperature between 25 to 35°C. **Abd El-Ghany (2016)** found fast degradation of organo-phosphorus insecticides at 35°C using fungal species. Biodegradation of polyester polyurethane by fungi was also well documented (**Zafar *et al*.,2013**).Some fungal genera viz. *Aspergillus and Alternaria* were believed to their tremendous role in degradation of Polyurethane (**Ibrahim *et.al*.,2011**),dye (**Ali *et al*.,** 2009), tree bark degradation (**Ashraf *et al*., 2007**), rice stubble (**Islam and Borthakur ,2007**), pesticide (**Rohilla and Salar,2012**), Pinus leaf litters (**Song *et al*., 2010**), dairy waste (**Kaurand Sonia Chaman,2014**) etc.

Presently, management of solid waste is a foremost task in Indian scenario but composting is better way to resolve organic waste. Temple waste contributes major part of municipal solid waste in holy city like Ujjain. These waste vermicomposted with addition of cattle dung. Cattle dung contains several groups of fungi (**Mohammed *et al*., 2017**). Among these fungi, some species *viz. Aspergillus fumigatus*, *Aspergillus flavus*, *Alternaria alternata* and *Aspergillus terreus* play pivot role in floral waste degradation (**Singh *et al*., 2014; Shouche *et al*.,2015**). To get rid of this floral waste degradation, knowledge of optimum temperature range of fungi should be known, which has not yet been studied. The prime determination of the existing effort is to study the effects of diverse temperatures on the growth of fungi isolated from the vermicomposting of the temple waste and to find out optimum temperature at which fungi carried out maximum growth.

MATERIALS AND METHODS

Collection of samples

Vermicompost samples was collected in sterile petri's dish (Borosil,90 mm) from floral waste vermicomposting bins, Govt. Madhav Science College, Ujjain (M.P.) India and was store at 4°C until the processing (**Azaz, 2003**).

Isolation and identification of fungi

Collected vermicompost sample were subjected to 10 fold serially diluted in saline (0.85 % NaCl solution) (photograph no.1). 0.1 ml of diluted sample (10^{-1} and 10^{-2}) transferred on Plates containing Potato dextrose agar medium (PDA) by performing of spread plate method. Plates were incubated at 28°C until the sporulation of fungal colonies occurred. . The developed fungi were transferred to the same growth medium using single-spore technique for purification and then transferred to slant PDA. Isolated colonies were identified by reference manual (**Gilman, 1957; Thom and Raper, 1945**). Among isolated fungal strains, four test fungi *viz. Aspergillus fumigatus*, *Aspergillus flavus*, *Alternaria alternate* and *Aspergillus terreus* were selected on their maximum biomass production in floral waste –basal medium.

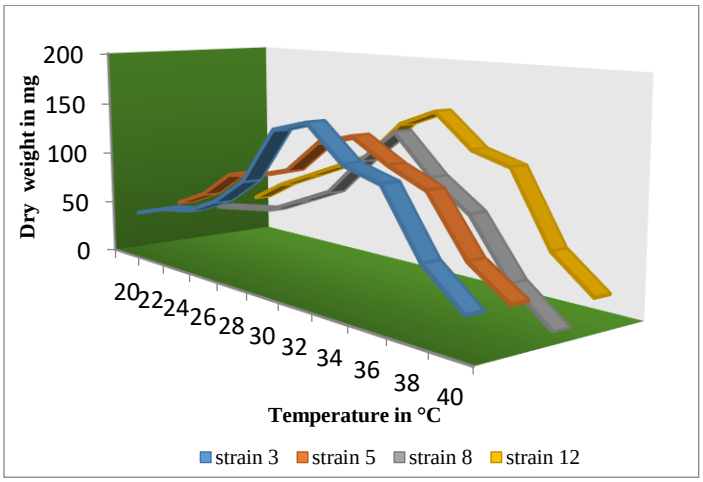
Note: 1=10^{-1}, 2=10^{-2}, 3=10^{-3}, 4=10^{-4}, 5=10^{-5}, 6=10^{-6}
Figure 1 Serial dilution of vermicompost sample.

Effect of different temperatures on growth

Selected floral waste degrading fungi *i.e. Aspergillus fumigatus* , *Aspergillus flavus* ,*Alternaria alternata* and *Aspergillus terreus* were taken to see the effect of variable temperature on their growth.To know the effect of temperature ,10 % floral extract (**Allen, 1957**) + basal medium (**Li Gao Xingzhongliu , 2010**) was prepared and dispensed 50 - 50 ml in each 100 ml capacity Erlenmeyer borosilicate flasks. Media were sterilized at 15 psi (120°C) for 20 min. Flasks were then inoculated with test fungi by micro tip method (**Bhati *et al.*, 2012**). After inoculation, flasks were incubated at different temperatures *viz*. 20°C, 22°C, 24°C, 26°C , 28°C , 30°C , 32°C , 34°C, 36°C, 38°C and 40°C for seven days (**Khanzyda *et al.*, 2006**). After seven days incubation, the mycelia mat of each flask was separated on pre weighted dry filter paper (Whatman no.1). Adhered agar medium from the mycelia mat was removed by straining. The mycelia mat was washed with distilled water 3–4 times and placed in a hot air oven at 80°C ± 1°C for 24 hrs. A digital electronic balance was used to weight the mycelium mat of fungi (**Zain *et al., 2009***).(Tab.1).

Table 1 Effect of temperatures on the growth of four test fungi.

Temperature in degree centigrade (°C)	Name of test fungi							
	Aspergillus fumigatus		***Aspergillus flavus***		***Alternaria alternata***		***Aspergillus terreus***	
	Dry weight in mg		**Dry weight in mg**		**Dry weight in mg**		**Dry weight in mg**	
	Control	**Average**	**Control**	**Average**	**Control**	**Average**	**Control**	**Average**
20	00	40	00	45	00	35	00	40
22	00	50	00	60	00	40	00	60
24	00	55	00	85	00	45	00	75
26	00	70	00	90	00	60	00	90
28	00	95	00	100	00	75	00	105
30	00	145	00	130	00	110	00	140
32	00	155	00	140	00	140	00	155
34	00	125	00	120	00	105	00	125
36	00	115	00	105	00	80	00	115
38	00	60	00	55	00	30	00	50
40	00	30	00	30	00	00	00	20
Difference	**00**	**30-155**	**00**	**30-140**	**00**	**30-140**	**00**	**20-155**



Note: Strain no. -3: *Aspergillus fumigatus* Strain no. -5: *Aspergillus flavus*
Strain no. -8: *Alternaria alternata* Strain no. -12: *Aspergillus terreus*

Figure 1 Comparative study effect of different temperatures on the growth of test fungi

RESULT AND DISCUSSION

All four test fungi were grown in all selected temperature ranged from 20°C to 40°C ±1°C. Growth of test fungi determined as dry mycelial weight. Result obtained shows that, all test fungi were grown best at 32°C±1°C.The highest growth was achieved by *Aspergillus fumigatus* and *Aspergillus terreus* that was 155 mg/50 ml/7 days while lowest growth was observed in *Aspergillus flavus* and *Alternaria alternata* was 140 mg/50 ml/7 days. At lowest selected temperature (20°C), maximum growth was carried out by *Aspergillus flavus* (45 mg/50 ml/7 days) while lowest growth occurred in *Alternaria alternata* (35 mg/50 ml/7 days).Similarly at highest selected temperature (40°C), maximum growth was carried out by *Aspergillus fumigatus* and *Aspergillus flavus* (30 mg/50 ml/7 days) while no growth seen in *Alternaria alternata* (00 mg/50 ml/7 days). The detail of result is shown in table no. 1 and fig. no. 1.

In the present investigation selected strains of four different fungi viz. *Aspergillus fumigatus, Aspergillus flavus, Alternaria alternata* and *Aspergillus terreus* were detected for their optimum growth temperature. It was found that three strains viz. *Aspergillus fumigatus, Aspergillus flavus* and *Aspergillus terreus* showed growth in between 20 to 40°C±1°C while *Alternaria alternata* shown growth in between 20 to 38°C.Results obtained reveled that optimum growth temperature of all four strains was 32°C±1°C. Our present result supported by several researchers who carried out divers study on selected strains of fungi regarding temperatures effect directly on biomass growth or metabolic activities.It was reported that *A. fumigates* showed maximum elatase and amylase enzyme production at 32-33°C (**Denning *et al.*,1993;Ladokun and Adejuwon, 2011**). Study also suggested that biodegradation of phenol was done by *A. fumigatus* attemperature 30°C(**Balamurugan *et al.*,2012**).Superlative growth at 30-35°C was also supported by **Moss (1989)** and Shehu .and Bello,2011).**Domsch *et al.*(1993)** reveled that *A. fumigatus* grows within a very broad temperature range of 12–57°C but contrary to our expectations with optimum growth at 30– 35°C. Other floral waste degrading fungal strain *viz.Aspergillus flavus* were also shown best growth at 30-32°C temperature. This observation is supported by the report of several researchers (**Oladiran and Iwu,1993;Samapundo *et al.*,2007**) .**Ahmed et al. (2016)** also found 30°C as a best growth temperature for *A. flavus* on Czapek'sdox agar media and potato dextrose agar isolated from poultry feed.

In case of *Alternaria alternata*, different researchers showed different data somehow similar to our result and some were different. Pose *et. al.* concluded that the shortest germination time (1.5 days) in *A. alternata* , was observed at 35°C. Although **Fanta *et al.* (2003)** carried out study on *Alternaria alternata* and found best growth at 28°C. The maximum growth temperature reported for growth was in the range of 28–32 °C, (**Chandrashekar and Ball, 1980; Dickinson and Bottomley,1980; Magan and Lacey, 1984; Sautour *et al.*, 2002**).Optimum growth of *Aspergillus terreus* was recorded at 32°C. This finding compaired with results of **Denning *et al.* (1993**) who were show that *A. terreus* carried out optimum growth at 32°C±1. **Bhattacharyya and Jha, (2011)** also explore that when the incubation temperature raised from 25°C to 30°C then the growth of the *Aspergillus* strain also enhanced.**Rashid *et al.*(2011)** were also recorded that *A. terreus* produced maximum mannanase enzyme at 30°C.

CONCLUSION

Knowledge of the environmental factors (temperature) influencing fungal growth is important so that composting environments can be made favourable for decomposition of organic waste. Present investigation based upon the role of temperature on growth of *Aspergillus fumigatus, Aspergillus flavus, Alternaria alternata* and *Aspergillus terreus*isolated from floral waste. Result found in this study is explore optimum temperature range *i.e.* 30±2°C which reassurance better biomass development. This study also indicate that fungi may capable to grow at minimum (20°C) to maximum temperature (38°C)suitable to decompose organic waste in all three seasons i.e. summer, winter and rainy.

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