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Effect of temperature and pH on the growth of myceiia of *Lentinus squarrosulus, L. polychrous, Agrocybe broadwayi* and *Astraeus hygrometricus*

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It was found that 30°C is the optimum for mycelial growth of all four test organisms under submerged condtition while pH 6.5, 6.5, 7.5 and 6.0 are for *L. squarrosulus*, *L. polychrous*, *A. broadwayi* and *A. hygrometricus* respectively. Mycelial growth was maximum after 21 days in case of *A. hygrometricus* whereas the rest three test fungi grew best after 14 days of incubation period.

Key words: Mycelial growth, *L. squarrosulus*, *L. polychrus*, *A. broadwayi* *A. hygromentricus*, temperature, hydrogen ion concentration

It is an established fact that temperature and hydrogen-ion-concentration affect growth, spore germination, reproduction and, indeed, all activities of organisms. The present communication deals with the comparative growth requirement of *Lentinus squarrosulus*, *L. polychrous*, *Agrocybe broadwayi*, and *Astraeus hygrometricus*. The purpose of this study is to evaluate the effect of different physical factors and to determine the optimal conditions for mycelial growth in submerged culture of four test fungi.

MATERIALS AND METHODS

Fresh young basidiocarp of *L. squarrosulus* Mont., *L. polychrous* Lev., *Agrocybe broadwayi* (Mont.) Dennis and *Astraeus hygrometricus* (Pers.) Morg. were

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collected during July to September from the different parts of Bankura district, W. B. India.

A small portion of the pileus tissue was removed aseptically from the freshly exposed surface and transferred to sterilized 2% malt extract agar slants and incubated stationary at 30°C. The cultures, thus obtained, were maintained on the same medium.

For determining the optimum growth 50 ml. of the liquid synthetic 'Lutz' (modified by Singer, 1975) medium (vitrumus malt extract—10.0g, ammonium nitrate 1.0g, ammonium phosphate (dibasic) 1.0g, magnesium sulphate—0.1g, ferric sulphate 0.1g, manganese sulphate 0.025g, agar—25g, distilled water —1000 ml) for *L. squarrosulus*, *L. polychrous*, *A. broadwayi* and 'Hagem' (modified by Modess, 1941) (glucose, 5g., malt extract, 5g., potassium dihydrogen phosphate, 0.5g. magnesium sulphate, 0.5g., ammonium chloride, 0.5g, 10 drops of a 1% solution of ferric chloride, agar, 20g., distilled water 1000 ml) medium for *A. hygrometricus* was taken in 250 ml Erlenmeyer flasks, plugged and sterilized at 15 p. s. i. for 15 minutes.

Table 1. Data showing the effect of different temperature on mycelial growth of *L. sqnarrosulus* and *L. polychrous* after different incubation periods

Temp. (°C)	Dry weight of mycelia (mg/50 ml)* Incubation (days)							
	L. squarrosulus		*L. polychrous*		*A. broadwayi*		*A. hygrometricus*	
	14	*21*	*14*	*21*	*14*	*21*	*14*	*21*
15	—	—	—	—	—	—	—	—
20	92.3 ±6.8	63.3 ±5.5	100.3 ±2.0	103.0 ±3.0	64.6 ±4.7	50,3 ±1.5	79.0 ±10.1	98.3 ±4.0
25	99.3 ±6.0	75.0 ±1.0	114.3 ±11.9	123.0 ±11.1	69.6 ±4:0	52.6 ±3.7	100.6 ±10.5	138.6 ±7.0
30	119.6 ±8.0	78.3 ±4.0	141.3 ±4.9	138.3 ±4.0	82.3 ±6.1	58.6 ±3.5	112.3 ±6.8	148.3 ±1.5
35	—	—	30.3 ±10.1	20.3 ±2.5	—	—	68.3 ±2.0	93.0 ±6.5
40	—	—	—	—	—	—	—	—

* Mean of three replicates.

Table 2. Data showing the effect of different pH on the mycelial growth of *Agrocybe broadway* and *Astreeus hygrometrious* at different incubation periods

	Dry weight of mycelia (mg/50 ml)* Incubation periods (days)							
	A. broadwayi		*A. hygrometrious*		*L. squarrosulus*		*L. polychrous*	
pH	*14*	*21*	*14*	*21*	*14*	*21*	*J4*	*21*
4.0	25.3	18.6	53.6	72.3	69.6	64.0	87.6	74 0
	±5.5	±3.5	±6.5	±4.9	±5.0	±2.6	±10.0	±1.0
4.5	47.0	40,0	62.3	82.0	90.0	80.0	106.0	79.6
	±5.5	±3.0	±3.5	±6.5	±12.0	±9.0	±6.5	±2.0
5.0	65.6	58.6	68.0	112.3	111.3	87.0	154.3	82.6
	±6.8	±9.6	±3.0	±6.4	±9.0	±3.4	±4.1	±3.0
5.5	98.3	79.3	71.3	116.0	117.6	90.6	155.6	94.3
	±10.0	±1.5	±7.5	±6.2	±7.5	±3.2	±3.5	±7.5
6.0	106.0	84.6	83.0	125.3	118.6	94.0	160.3	95.3
	±9.6	±3.2	±5.0	±6.1	±3.2	±4.5	±9.2	±1.5
6.5	112.0	91.6	32.6	56.3	131.3	96.3	168.6	105.3
	±6.5	±3.7	±4.0	±4.0	±5.8	±1.5	±8.5	±7.0
7.0	120.0	95.6	18.0	52.3	130.3	71.3	121.3	97.3
	±10.5	±3.5	±1.0	±3.5	±4.5	±3.2	±1.5	±3.7
7.5	127.0	100.3	12.3	43.0	122.3	65.6	115.3	90.0
	±4.0	±8.7	±0.5	±5,2	±4.7	±4.9	±4.0	±6.2
8.0	119.3	87.6	10.0	36.6	104.6	63.6	109.6	82.3
	±1.5	±6.8	±2.0	±4.9	±8.9	±4.7	±3.0	±7.0

* Mean of three replicates.

For studying effect of temperature media with pH adjusted to 6.0 by 0.2 M. phosphate buffer in flasks were inoculated with an agar block (5 mm diam.) from 7 days old mycelia of the test fungi and incubated under static conditions in diffused light for 14 and 21 days at 15°C, 20°C, 25°C 30°C, 35°C, and 40°C (± 0.5°C).

For the pH experiment, the basal medium was adjusted to different pH sets (4.0, 5.0, 5.5, 6.0, 6.5, 7.5, 8.0) with the help of 0.2 M sodium phosphate buffer. Subsequently the flasks containing medium were inoculated with 7 days old agar

block (5 mm diameter) and incubated at 30°C (± 0.5°C) for 14 and 21 days under static condition.

Finally, the mycelia were harvested by filtration through a tarred filter paper and washed several times with distilled water to remove any trace of the medium and dried at 60°C for 96 hours, cooled in a desiccator and weighed. Average of three replicates was calculated and the results were presented in Tables 1.1—1.2 and 2.1—2.2.

RESULTS AND DISCUSSION

Table 1 indicate that 30°C is the optimum for growth of all the test fungi. *L. squarrosulus* and *A. broadwayi* fail to grow at 15°C, 35°C and 40°C while *L. polychrous* and *A. hygrometricus* grow moderately at 35°C but fail to grow at 15°C and 40°C. In all cases, growth of *A. hygrometricus* is less than the rest three test fungi. The growth is maximum after 14 days in case of *L. squarrosulus*, *L. polychrous*, and *A. broadwayi* which declines thereafter.

In case of *Astraeus hygrometricus* the growth is maximum at 21 days which means that due to slow growth the nutrients are not utilized in appreciable amount within 14 days of incubation period.

Table 2 indicate that the pH 6.5 was the optimum for mycelial growth of *L. squarrosulus* and *L. polychrous* while 6.0 and 7.5 for mycelial growth of *A. hygrometrious* and *A. broadwayi* respectively. Among the test organisms, *A, hygrometricus* grew well in the acidic range of pH 4.0—6.0, than the alkaline one. *L. polychrous* also grew well in the range of pH 5.5-6.5. But *L. squarrosulus* and *Agrocybe brondwayi* grew well within the alkaline range pH 6.5—7.5 and pH 7.0—8 0 respectively. *L. squarrosulus, L. polychrous* and *A. broadwayi* showed highest growth after 14 days of incubation where as *A. hygrometricus* showed after 21 days which might be due to non-exhaustion of the nutrients from the medium due to its slower growth.

From the results obtained it reveals that 30°C is the optimum temperature for the best mycelial growth and yield of both species of *Lentinus* and the other two test fungi in submerged culture.

Brodziak (1980) reported that *Lentinus edodes* grew best at 35°C where as Chandra and Purkayastha (1977) found that *Lentinus subnudus* grew best at 25°C. Styer (1928) found that 25°—30°C to be the most favourable temperature range for many mushroom. Jandaik *et. al.* (1975) reported *Pleurotus inquinans, P. pistillaris*, and *P. sajar-caju* to show their best mycelial growth at 40°C, 35°C and 25°C respectively. Litchfield *et al.* (1963) showed that three species of *Morchella* grew best at 25°C. So from the previous literature and the present experimental

data it can be visualized that different mushrooms have different optimal temperature ranging from 25°—40°C for their mycelial growth on synthetic liquid media.

The data on the effect of different pH on the effect of different pH on the growth of mycelial biomass in submerged condition indicated that the test fungi could grow within a range of pH 4.0—7.0 but *Agrocybe broadwayi* exhibited best growth at pH 7.5.

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