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Role of Amino Acids and Vitamins in Fungal Nutrition

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Abstract

Fifteen amino acids and six vitamins were evaluated *in vitro* for their relative efficacy in sustaining the mycelia growth of *Calocybe indica* in submerged culture. Among the amino acids, glycine produced the highest mycelial dry weight followed by tryptophan and threonine. Alanine also sustained satisfactory growth. Valine, proline, phenyl alanine, aspartic acid and glutamic acid had inhibitory effect on fungal growth. The increase in mycelia growth with the remaining amino acids was insignificant along with control. Among the vitamins, thiamine (50 ppm), nicotinic acid (25 ppm) and ascorbic acid (25 ppm) induced higher biomass production. Vitamins such as riboflavin, biotin and folic acid caused growth retardation.
Key words : Amino acid, Vitamin, Mushroom, *Calocybe indica.*

Though the cultivation substrates are considered self sufficient for growing mushrooms, they still respond to the external supply of micronutrients including vitamins, minerals, hormones and amino acids. Amino acids play central roles both as building blocks of proteins and as intermediates in metabolism. Proteins not only catalyze all (or most) of the reactions in living cells, they control virtually all cellular processes. A large number of amino acids are considered as good nutritional sources for fungi. However, closely allied fungal species are known to differ in their amino acid requirements. Vitamins in minute quantities are also effective in many of the biochemical reactions of the cell which obviously reflects their catalytic role as co-enzymes or constituent parts of co-enzymes. It is due to this account that vitamins are essential for diverse group of organisms including mushrooms. Keeping the essentiality of the nutrients in mushroom species and the apparent lack of literatures pertaining to summer white mushroom (*Calocybe indica*), it was thought imperative to study the effect of external supply of amino acids and vitamins on the biomass production of the fungus in liquid culture.

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Table 1. Effect of different amino acids on the growth of *Calocybe indica.*

Amino acids	Mycelial dry weight (mg)	Average dry biomass production (mg/day)	Per cent increase (+) or decrease (–) over control
Alanine	235.3	11.2	(+) 18.5
Arginine	225.8	10.7	(+) 13.7
Aspartic acid	167.8	7.9	(–) 15.4
Cystine	228.9	10.9	(+) 15.3
Glutamic acid	170.5	8.1	(–) 14.1
Glycine	302.7	14.4	(+) 52.4
Hystidine	201.7	9.6	(+) 1.6
Lysine	199.3	9.4	(+) 0.4
Leucine	203.4	9.6	(+) 2.4
Methionine	200.5	9.5	(+) 1.0
Proline	170.3	8.1	(–) 14.2
Phenyl Alanine	165.2	7.8	(–) 16.7
Threonine	287.0	13.6	(+) 44.5
Valine	149.7	7.1	(–) 24.5
Tryptophan	291.5	13.8	(+) 46.8
Control	198.5	9.4	–
CD (0.05)	34.52		

Table 2. Effect of different vitamins on the growth of *Calocybe indica.*

Vitamins	Mycelial dry weight (mg) at concentrations (ppm) 25	50	100
Riboflavin	360.1	270.6	190.5
Nicotinic acid	470.5	300.8	300.1
Biotin	370.1	350.6	270.6
Folic acid	320.5	240.6	270.0
Thiamine	450.1	480.9	240.6
Ascorbic acid	460.0	351.4	200.9
Control	420.7	420.7	420.7
CD (0.05)	31.95	27.83	90.44

Methods

Fifteen different amino acids such as alanine, arginine, aspartic acid, cystine, glutamic acid, glycine, histidine, lysine, leucine, methionine, proline, phenyl alanine, threonine, tryptophan and valine were included in the study. The chemicals were mixed in the potato dextrose medium in the conical flasks at 25 ppm concentration. In another experiment, growth response of *C. indica* to six vitamins viz. riboflavin, thiamine, biotin, folic acid, nicotinic acid and ascorbic acid was studied. Each of the vitamins was added to potato dextrose medium separately at 20, 50 and 100 ppm concentrations. Conical flasks devoid of either any amino acid or vitamin served as control. The flasks were sterilized in autoclave at 15 lb psi for 30 minutes, allowed to cool to room temperature and then inoculated with 5 mm mycelia disc cut out from the margin of an actively growing mushroom culture under strict aseptical conditions. Three replications were maintained for each treatment. After 21 days of incubations, mycelial mats were collected, dried in hot air over at 60 C for 48 hours and mycelial dry weights were recorded till constant weights were achieved. Average biomass production per day and per cent increase or decrease in biomass production over control was also calculated. Data were subjected to statistically analysis.

Results and Discussion

It was revealed that all the amino acids excepting valine, proline, phenyl alanine, aspartic acid and glutamic acid helped the fungus to maximize the vegetative growth over control to varying degrees. Glycine produced the highest mycelial dry weight (302.7 mg) followed by tryptophan (291.5 mg) and threonine (287.0 mg). The biomass production was 44.5 to 52.4% higher compared to control. There was no significant difference among these amino acids in inducing the vegetative growth of the fungus. This finding corroborates similar reports by Chandra and Purkayastha (1). However, Chang-Ho (2) stated that glycine could not produce better growth of paddy straw mushroom compared to control. Satisfactory growth of the test fungus (235.3 mg) inducing 18.5% higher growth compared to control was recorded in the culture medium enriched with alanine which is in agreement with earlier report (3). The marginal increase in average mycelial dry weights in response to cystine (228.9 mg), arginine (225.8 mg), leucine (203.4 mg), hystidine (201.7 mg), methionine (200.5 mg) and lysine (199.3 mg) and control appeared to be insignificant. Among the amino acids, valine, proline, phenyl alanine, aspartic acid and glutamic acid had inhibitory effects on mushroom growth as they exhibited 14.1—24.5% growth retardation compared to control.

It was further revealed that the mycelial biomass production varied depending upon the concentrations of vitamins used in the basal medium. Some vitamins stimulated the biomass production while few others exhibited their inhibitory effects. Addition of thiamine to the culture medium at 50 ppm concentration sustained highest mycelial dry weight (480.9 mg) of the fungus compared to other vitamins. It was 14.3% more compared to the medium devoid of any vitamin source. At 25 ppm, higher dry biomass production (450.1 mg) was achieved while at 100 ppm, this vitamin showed an inhibitory effect. Impense (4) has also reported that paddy straw mushroom (*Volvariella diplasia*) showed absolute preference to thiamine. Thiamine as the most preferred vitamin source was also reported in other edible mushrooms (3, 5). At the lowest concentration, nicotinic acid and ascorbic acid also produced higher vegetative multiplication (460.0—470.5 mg). There was not much difference in mycelial dry weights recorded in response to thiamine (50 ppm), nicotinic acid (25 ppm) and ascorbic acid (25 ppm). Vitamins such as riboflavin, biotin and folic acid caused 12.0 to 54.7% retardation in mycelial growth.

References

1. Chandra A. and R. P. Purkayastha. 1977. Physiological studies on Indian edible mushrooms.*Trans. British Mycol. Soc.* 69 : 63—70.
2. Chang-Ho Y. 1980. *Some factors affecting cellulose utilization by Volvariella volvace Singer.* Mycol. Works. 26 Jan. York Univ., Toronto, Ontario.
3. Mehta K. B. 1985. *Studies on physiology and cultivation of Pleurotus sapidus (Schulzer) Kalch.* Ph. D. thesis. Himachal Pradesh Krishi Vishwa Vidyalaya, College of Agriculture, Solan, India.
4. Impense R. 1970. Reierches Sur la Croissance due mycelium de *Volvariella volvacea var. Masseei* Sing. III Misc en evidence de la thiamino heterotrophic. *Bull Rech. Agron. Genbloux N S.* 5 : 534—549.
5. Kaur M. and T. N. Lakhanpal. 1995. Effect of nutrient elements, vitamins and growth regulators on the vegetative growth of *Lentinus edodes. Mush. Res.* 4 : 11—14.