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Biotransformation of plant substrates during the cultivation of *Auricularia polytricha* (Mont.) Sacc.

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ABSTRACT: *Auricularia polytricha* (Mont.) Sacc. was cultivated on wheat and rape straw, mixture of wheat or rape straw with beech or elder sawdust (4:1). The increase of crude protein content of 25-200% was observed on all investigated substrates after fructification compared to the content in substrates before inoculation. In the process of fructification of *A.polytricha* the content of cellulose in substrates was decreased by 19-30%. The quantity of crude protein in the fruit bodies *A.polytricha* was higher in case cultivating them on wheat or rape straw than on their mixtures with sawdust.

1 INTRODUCTION

Auricularia polytricha (Mont.) Sacc. is one of the popular species of cultivated edible mushrooms. In 1991 the production of *Auricularia* spp. was 465 thousand tons and is still intensively increasing. During the five year period 1986-1991 its production increased by 291% (Chang,1993). Along with their usage as a food product, *A.polytricha* is also a source of many pharmacological substances (Yang, Jong 1989). Some positive results have been obtained using fermented wood sawdust, wheat and rape straw, corn cobs, mixtures of sawdust and rice brans, sugar canestraw and wastes of coffee production as substrates for *A.polytricha* cultivation (Jablonsky *et al.* 1985 ; Bhandal, Mehta 1989; Martinez-Carrera 1989; Khan *et al.* 1991). The biological efficiency has reached 101% (Sharma, Jandaik 1992). However, such problems as specificity of degradation of various plant substrates by these mushrooms and the resulted change in the chemical composition fruit bodies essential for the biotechnology of *A.polytricha* cultivation have not yet been studied. The investigation of those problems is the purpose of this work.

2 MATERIALS AND METHODS

2.1 Fungal strain

The *A.polytricha* strain 354 was supplied by the Biology Institute of Viet-Nam Academy of Sciences (Hanoi, Viet-Nam). The culture was maintained on malt agar medium. Spawn mycelium was prepared on wheat grain (Bis'ko,.Dudka, 1987).

2.2 *Substrates for cultivation*

Wheat and rape straw was cut into fragments of 1-3 cm. Wheat or rape straw was mixed with beech or elder sawdust in weight ratio of 4:1. Water was added at 200 ml per 100 g of substrate. 600 g of moistened substrate was placed in plastic bags and fermented for 2 days at 50°C and for 6 h at 60°C.

2.3 *Conditions for cultivation*

After cooling, the bags were inoculated with grain spawn (5% w/w). Inoculated bags were sealed with a cotton-wool cover and incubated at 32°C for 4 weeks. Fructification occurred in a cultivation room at 30°C (air temperature) and 80-90% humidity.

2.4 *Chemical analysis*

Fruit bodies of *A.polytricha* were harvested and dried at 60°C. Total nitrogen, cellulose and ash content were measured in substrates before inoculation and after the first wave of fructification. Ash content was determined by burning substrates in a muffle oven at 500°C; cellulose content according to the method of Kurshner and Ganek (1974); and nitrogen by the Kjeldahl method (Pleshkov 1976).

3 RESULTS AND DISCUSSION.

The observation of *A.polytricha* growth and development on the above-mentioned plant substrates, shows that it completely overgrows wheat straw and the mixture of wheat straw with beech sawdust by the 23rd day after inoculation; and on mixture of wheat straw with elder sawdust and all substrate samples containing rape straw by the 28th day. Fruit bodies occurred on wheat straw and on the mixture of wheat straw with beech sawdust on the 52nd day after inoculation, with the rest of the substrates on day 56. The results obtained indicate that the initial substrates differed in their nitrogen and ash contents (Table 1). The higher content of mineral elements and nitrogen was typical for samples containing rape straw. It is known that intensive cultivation of wood destroying edible mushrooms on cellulose-lignin containing plant wastes, involves destruction of the basic components of substrates associated with discharge of CO_2 and H_2O (Zadrazil 1978). All studied substrates were characterized by some increase in nitrogen content after fructification that confirmed predominance of nitrogen concentration due to metabolic activity of *A.polytricha* mycelium over its discharge along with fruit bodies. Besides, N content in wheat straw substrates was 1.5 - 2.0 times higher and rape straw 1.2 - 1.3 times higher than that in the substrates before inoculation (Table 1). The initial higher content of nitrogen in rape straw remained after fruiting.

Decrease in ash element content was observed in all samples with rape straw after fruiting. These results indicate that a considerable predominance of mineral elements occur in the composition of fruit bodies on these substrates as compared to wheat straw and its mixtures with sawdusts. This is also confirmed by a considerable

Table 1. Changes of composition of substrates and fruit bodies of *A.polytricha* during cultivation (%a.d.m.)

Substrate	Substrate						Fruit bodies		
	before inoculation			after inoculation					
	N	Crude protein	Ash	N	Crude protein	Ash	N	Crude protein	Ash
WS	0,44	2,75	4,26	0,96	6,00	4,90	1,92	12,00	2,79
WS + beech sawdust	0,38	2,38	3,29	0,80	5,00	3,77	1,36	8,50	2,96
WS + elder sawdust	0,52	3,25	4,04	0,64	4,00	3,84	1,86	11,63	2,57
RS	0,81	5,06	8,89	1,00	6,25	7,76	2,06	12,88	5,69
RS + beech sawdust	0,67	4,19	8,20	0,88	5,50	6,42	1,36	8,50	5,40
RS + elder sawdust	0,68	4,25	7,53	0,92	5,76	6,03	1,75	10,94	5,59

WS – weat straw
RS– rape straw

amount of ash in fruit bodies of *A.polytricha*. Its content during the cultivation on rape straw and its mixtures is 2.5 - 2.7 times higher than during cultivation on substrates of wheat straw (Table 1). Thus, before inoculation and after fruiting, rape straw substrates contained ash elements 2.0 - 2.5 times higher than that of wheat straw substrates. Determination of cellulose in substrates consisting of wheat straw with beech or elder sawdust after fruiting shows that its content in straw with elder sawdust decreased to 32.7% (by 19.2% as compared to non-inoculated ones) and in straw with beech sawdust to 30.0% (by 29.7% as compared to non-inoculated ones). Fruit bodies of *A.polytricha* grown on different substrates differed in crude protein content (Table 1). Its higher content was observed in rape and wheat straw. It is interesting to note that although wheat and rape straw differed in their crude protein content (1.8 times), the content of crude protein in fruit bodies of *A.polytricha* differed in this index by only by 7.0%. Similar results were obtained for *Pleurotus ostreatus* fruit bodies during their cultivation on various substrates (Bis'ko, Dudka 1987). Fruit bodies produced on wheat and rape straw with beech or elder sawdust were also characterized by insignificant differences despite a considerable difference in initial substrates (Table 1).

The results obtained indicate that in *A.polytricha* carpophore production, wheat and rape straw promotes accumulation of a higher nitrogen concentrations compared to the same substrates with sawdust.

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