THE VALORIZING OF DIFFERENT WOODY WASTES AS NATURAL SUBSTRATES FOR INTENSIVE CULTIVATION OF MUSHROOMS

TEODORESCU RĂZVAN IONUȚ[1)], STĂNICĂ FLORIN[1)], TUDOR VALERICA[1)], BACAU CRISTINA[2)], ROSCULETE CATALIN[4], ȚONEVLAD[1)], BARBULESCU DIANA[3)]

[1]University of Agronomic Sciences and Veterinary Medicine of Bucharest
59 Mărăști Avenue, Bucharest, 011464, Romania,
[2]University of Agricultural Sciences and Veterinary Medicine of Banat
"Regele Mihai I al Romaniei" from Timisoara,
[3]SC.Pharmacorp Innovation S.R.L,
[4]University of Craiova, Romania

** Correspondence author. E-mail: razvan.iteodorescu@gmail.com*

Keywords: biotechnology edible and medicinal mushrooms, wastes from wood processing industry

ABSTRACT

This paper presents the results of laboratory experiments regarding the valorizing of different types of lignocellulosic wastes coming from woody species through controlled cultivation of two mushroom species, namely Ganoderma lucidum and Pleurotus ostreatus. Both mushroom species were cultivated in controlled conditions of temperature, humidity, and aeration in order to get their carpophores. The main aim of this work was focused on finding out the best way to convert the woody wastes into useful food products, such as mushroom fruit bodies, by using them as growing sources for the mentioned edible and medicinal mushrooms. The final produced carpophores were weighted and the results were compared to find out the optimal variant to be applied for intensive cultivation of mushrooms.

INTRODUCTION

The forestry works as well as the industrial activities related to forest management and wood processing have generally been matched by a huge formation of wide range of waste products (Ropars et al., 1992; Smith, 1998).

A lot of these lignocellulosic wastes cause serious environmental pollution effects, if they are allowed to accumulate in the forests or much worse to be burned for uncontrolled domestic purposes (Chahal, 1994; Carlile & Watkinson, 1992; Leahy & Colwell, 1990).

The main aim of this work was focused on finding out the best way to convert the wood wastes into useful bioproducts, such as mushroom fruit bodies (Stamets, 1993).

MATERIAL AND METHODS

The woody materials were chopped, mixed and hydrated (for 24-30 h) with a water solution made of peptone (1.5 %) and yeast extract (3%). Then, there were set up three variants of mushroom cultivation substrates

consisting of lignocellulosic wastes belonging to the following tree species: beech (S1), oak (S2) and white poplar (S3), mixed with wheat bran (5% w/w) and barley bran (5% w/w).

These materials were placed in glass vessels (jars) of 1,000 mL as well as thermoresistant propylene bags of 5 Kg and sterilized in autoclave at 121 ^{o}C, for 30 min. After cooling, the contents of glass recipients and bags were aseptically inoculated with the pure cultures of mushroom species *G. lucidum* and *P. ostreatus*, as it is shown in figure 1.

Figure 1. Glass vessels (jars) containing the lignocellulosic substrates inoculated with pure mycelia of *G. lucidum* și *P. ostreatus*, and incubated at 23^{o}C

All the culture substrates for mushroom growing were inoculated using liquid inoculum with the age of 5–7 days and the volume size ranging between 3-7% (v/w). During the period of time of 18–20 d after this inoculation, all the fungal cultures had developed a significant biomass on the culture substrates.

The optimal temperature for incubation and mycelia growth was maintained at 23 °C, the relative humidity of air was kept between 95-97% UR and the exchange numbers of air volumes per hour inside the culture rooms were between 5 and 7.

The whole period of mushroom growing from the inoculation to the fruit body formation lasted between 30–60 days, depending on each mushroom species used in experiments (Smith, 1998).

RESULTS AND DISCUSSIONS

The experiments were carried out inside such *in vitro* growing rooms, where the main culture parameters (temperature, humidity, aeration) were kept at optimal levels to get the highest production of mushroom fruit bodies (Moser, 1994).

The carpophore amounts registered during the cultivation cycle of *G. lucidum*, on three variants of cultivation substrates are presented in Table 1, and those belonging to *P. eryngii* mushrooms on the same substrates are shown in Table 2.

Table 1

The carpophore amounts during the cultivation cycle of *G. lucidum* on three different substrates

Crop stages	Carpophore production on S1 (g/5 kg substrate)	Carpophore production on S2 (g/5 kg substrate)	Carpophore production on S3 (g/5 kg substrate)
I	550	510	530
II	430	450	410
III	375	350	370
IV	310	290	300
V	270	250	280

Table 2

The carpophore amounts during the cultivation cycle of *P. ostreatus* on three different substrates

Crop stages	Carpophore production on S1 (g/5 kg substrate)	Carpophore production on S2 (g/5 kg substrate)	Carpophore production on S3 (g/5 kg substrate)
I	750	610	770
II	590	550	610
III	475	430	470
IV	370	375	420
V	320	350	370

The final produced carpophores were weighted and the results were compared to find out the optimal variant to be applied for intensive cultivation of mushrooms. Thus, it is obvious that the carpophores production of *G. lucidum* on the substrate S1 is higher than the other two, and the same thing is in registered for *P. ostreatus* growth on substrate S3.

CONCLUSIONS

According to the registered results, the best substrate for *G. lucidum* cultivation is S1 and for *P. ostreatus* mushroom species is seems to be S3. However, in-depth experiments regarding the optimal valorizing of different types of lignocellulosic wastes coming from woody species through controlled cultivation of the mushroom species *G. lucidum* as weel as *P. ostreatus* are going to be carried out in the next period in order to select the best biotechnological procedure to be applied.

ACKNOWLEDGMENT

This work was supported through the grant awarded by the Romanian National Authority for Scientific Research and Innovation, CNCS/CCCDI-UEFISCDI

for the project PN-III-P2-2.1-PED-2016-1769, in the framework of PNCDI III, Funding Contract no 196 PED/2017

REFERENCES

Beguin, P., Aubert, J.P., 1994. The biological degradation of cellulose. *FEMS Microbiol. Rev*., 13:25-58

Carlile, M.J. & Watkinson, S.C. 1996. Fungi and Biotechnology. In: Carlile, M.J and Watkinson, S.C. (Eds), *The Fungi*. Academic Press: London, p. 56-70.

Chahal, D.S. 1994. Biological disposal of lignocellulosic wastes and alleviation of their toxic effluents. In: Chaudry, G.R. (ed.), Biological Degradation and Bioremediation of Toxic Chemicals. Chapman & Hall, London, p. 114-128

Leahy, J.G., Colwell, R.R. 1990. Microbial Degradation of Hydrocarbons in the Environment, *Microbial Rev.*, 54:305 – 315

Moser, A., 1994. Sustainable biotechnology development: from high-tech to eco-tech. *Acta Biotechnology* 12:2-6

Ropars, M., Marchal, R., Pourquie, J., Vandercasteele J.P. 1992. Large scale enzymatic hydrolysis of agricultural lignocellulosic biomass. *Biores. Technol.*, 42:197 - 203.

Smith, J.E., 1998. Biotechnology. Cambridge University Press, third edition, p. 151-164.

Stamets, P., 1993. Growing Gourmet and Medicinal Mushrooms. Ten Speed Press, Berkeley, Toronto, p. 390-400