EVALUATION OF BIOACCUMULATION FACTOR FOR SOME HEAVY METALS AT *LACTARIUS PIPERATUS* SPECIES IN THE VIEW OF UTILIZE IT IN ENVIRONMENTAL BIOTECHNOLOGIES

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Abstract

The aim of this work is the evaluation of bioaccumulation factor for some heavy metals at *Lactarius piperatus* species. Biological samples consisted in *Lactarius piperatus* harvested from forestry ecosystems of Dambovita county. Were determinate the iron, manganese and nickel content of biological samples and of soil under them. Also were determinate the pH of soil samples. The chemical content was analyzed by EDXRF method with fluorescence spectrometer ELVA-X. For the validation of results obtained by EDXRF were used the NIST SRM 1571-Orchard leaves standards of references. Was calculated the value of bioaccumulation factor for each metal species and for cap and stipe separated. The value of bioaccumulation factor for iron in case of *Lactarius piperatus* samples harvested from Bolboca forest was approximately 3510% in cap and 1532% in stipe of mushroom. At the samples prelevated from Mogoi forest, the value of bioaccumulation factor for iron was 686% in cap and 555% in stipe. It must be mention that the pH of soil samples was in all cases 6,7. In case of *Lactarius piperatus* samples harvested from Bolboca, the value of bioaccumulation factor for manganese was 130500% in cap. A part of samples prelevated from Mogoi had a value of bioaccumulation factor for manganese 36183% in cap. The results obtained for bioaccumulation factor of nickel indicated values between 0,5 şi 0,7% as well in stipe as in cap at all samples, no matter the sit of prelevation.

Key words: bioaccumulation factor, heavy metals, *Lactarius piperatus*

This work is made toward the most new researches direction and belongs to the studies which precede the environmental biotechnologies (Barros et al., 2008; Frankland et al., 2010; Gast et al., 1988; Jentschke and Godbold, 2000; Krupa 1997; Yamaça et al, 2006). In the world there are many researches concerning the possibility of using the biosystems as „tools" in bioremediation activities for soil or aquatic ecosystems polluted (10). In the frame of this researches is waiting for the identification of some macromycetes species which are hyper accumulators for some heavy metals, species which are very common in the spontaneous flora of forestry ecosystems in south of Romania. The aim of this work is the evaluation of bioaccumulation factor and translocation factor for some heavy metals at *Lactarius piperatus* species, very common in forestry ecosystems of Dambovia County, in the view to establish the utilization potential of this macromycetes species in environmental biotechnologies.

MATERIAL AND METHOD

Biological samples consisted in fresh mushrooms exemplars of *Lactarius piperatus* harvested from two forestry ecosystems of Dambovita County, two common oak forests one on tableland Mogoi and the other on the tableland Bolboca. The identification of species was made after Ettore Bielli, 2009. Simultaneous were prelevated soil samples under each exemplar of *Lactarius piperatus* which were also analyzed. It was determinated the concentrations of iron, manganese and nickel of biological samples and substrate. Also it was determinated the values of pH of soil samples. For each determination were used minimum 2 and maximum 5 exemplars of *Lactarius piperatus* prelevated from the same sit.

Biological samples and their substrate were weighted and dried in drying stove at 60^0C for some hours. After drying the samples were weighted again and grinded to a fine dusty. The samples prepared in this way were analyzed by EDXRF method with spectrometer of fluorescence ELVA-X at The Institute for Multidisciplinary Researches of Valahia University. It was analyzed by component parts of mushrooms, cap and stipe. For results validation obtained by EDXRF method were used the standards of reference NIST SRM 1571 - Orchard leaves (Arai, 2004; Eurachem Guide, 2003; Winefordner, 1999). The sensibility of method is 1ppm. The results were exprimated in ppm. It was mathematical calculated the value of bioaccumulation factor and translocation factor for each metal and for each cap and stipe.

Bioaccumulation factor was calculated after the following equation:

$$F_B\% = \frac{C_m}{C_s} \times 100$$

were: FB% = bioaccumulation factor;

Cm = metal's concentration in cap/stipe of mushroom;

Cs = metal content of substrate.

Translocation factor was calculated by mathematical relation:

$$F_T = \frac{C_c}{C_s}$$

were: FT = translocation factor;

Cc = metal's concentration in cap;

Cs = metal's concentration in stipe.

RESULTS AND DISCUSSIONS

Iron concentrations were between 37,88ppm and 54,86ppm in *Lactarius piperatus* samples harvested from Mogoi forest (*figure 1*). In mushrooms samples prelevated from Bolboca forest the iron content had an average value of 97,32ppm in stipe and 222,94ppm in cap. The concentrations find in soil samples prelevated under *Lactarius piperatus* stipe had the values between 6,35ppm and 7,99 ppm.

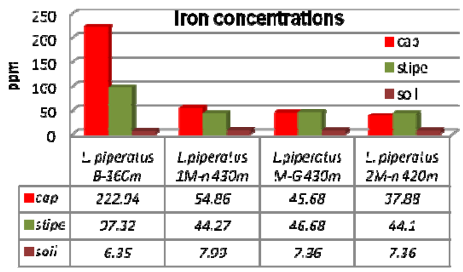

Figure 1 **Iron content of biological samples and soil**

On can observe that the bioaccumulation factor for iron had values which were between 514,8% and 686,61% at *Lactarius piperatus* samples harvested from Mogoi forest (*figure 2*) enough appropriate. The values of bioaccumulation factor were extremley higher in case of samples prelevated from Bolboca forest (1532,6 % - 3510,87%).

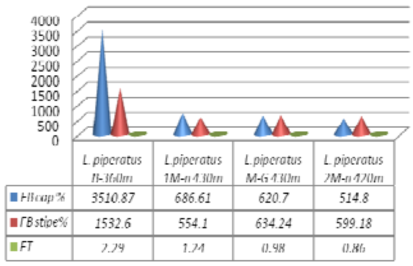

Figure 2 **The Indicators for evaluation of iron accumulation**

For the mushroom samples harvested from Mogoi forest, the translocation factor for iron from stipe into cap of mushrooms were between 0,86 şi 1,24 (*figure 3*). At the biological samples from Mogoi forest the translocation factor of iron from stipe into cap had an average value of 2,29, that means double at least comparatively to the others analyzed cases.

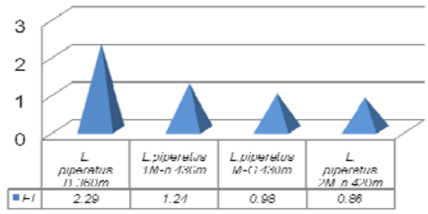

Figure 3 **Translocation factor for iron**

Conformily with the data from figure 4 manganese concentrations were higher only in a half of *Lactarius piperatus* samples which proceed from Mogoi forest (21,71ppm in average) but for all samples prelevated from Bolboca forest (26,1ppm in average). In the others analyzed samples manganese concentrations were in trace. In soil samples under mushrooms' stipe the concentrations of manganese varied between 0,02 ppm and 7,36ppm.

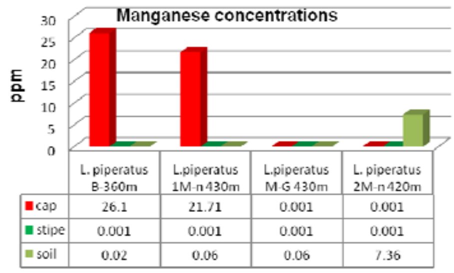

Figura 4 **Manganese content of biological samples and soil**

Bioaccumulation factor for manganese was extremely lower in half of samples harvesting from Mogoi forest, only 1,66% as well in stipe as in cap (Figure 5). In the other half of samples the bioaccumulation factor for manganese was lower in stipe (1,66%), but in cap was extremely higher (36183,33%). The value of bioaccumulation factor for manganese at the samples from Mogoi forest was lower in stipe (5%) and extremely higher in cap (130500%).

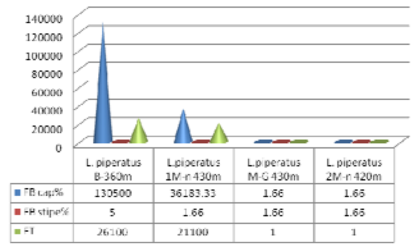

Figure 5 **The Indicators for evaluation of manganese accumulation**

In *figure 6* it is relieved the impressive difference of the value of translocation factor for manganese from stipe into mushroom's cap at the samples which had a very high accumulation factor for manganese in cap.

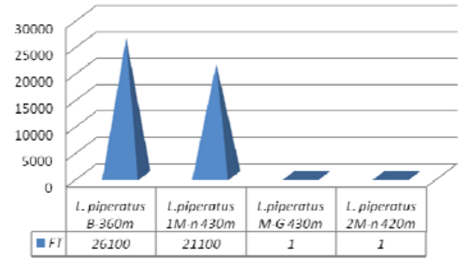

Figure 6 **Translocation factor for manganese**

Nickel was accumulated in very low concentrations between 0,5 ppm and 0,7 ppm in all cases which were analyzed (*figure 7*). Nickel concentrations in soil samples had one invariable value of 0,01 ppm.

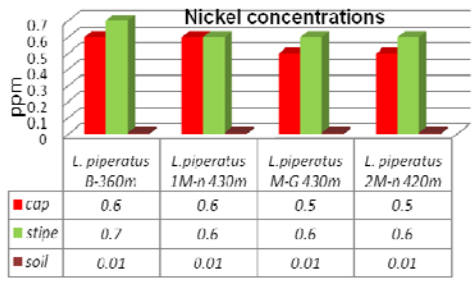

Figure 7 **Nickel content of biological samples and soil**

The value of bioaccumulation factor for nickel was higher and varied between 5000% şi 7000% (*figure 8*). At three part of samples analysed the value of bioaccumulation factor was find higher with 1000% in stipe picior than in cap. Only in some samples the values of translocation factor for nickel reached the value 1.

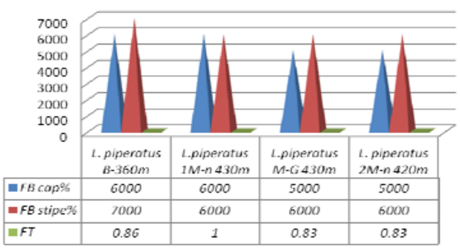

Figura 8 **The Indicators for evaluation of nickel accumulation**

From *figure 9* on can observe that the value of translocation factor for nickel from stipe into cap were in the great part of cases analyzed a little lower than 1.

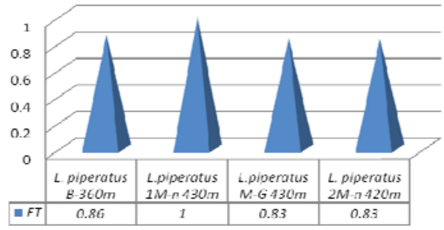

Figure 9 **Translocation factor for nickel**

CONCLUSIONS

Bioaccumulation factor for iron at the *Lactarius piperatus* species differed much from Mogoi samples to Bolboca samples.

Translocation factor of iron from the stipe into cap was higher at half of samples analyzed, no matter of harvesting sit.

Bioaccumulation factor for manganese was very higher at half of samples analyzed only in cap, in both sits of harvesting.

Translocation factor for manganese from the stipe into cap had also values extremely higher at half of samples no matter of the forest of harvesting.

Bioaccumulation factor for nickel had values higher, but more closed from one to others samples.

Translocation factor for nickel was under 1 in the great part of cases.

Species *Lactarius piperatus* has a hyper accumulation capacity for iron and nickel.

Only some exemplars of *Lactarius piperatus* had hyper accumulation capacity for manganese, others accumulated not very well this metal.

Aknowledgements

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