Evaluation of Storage Level for Some Heavy Metals and Others Elements into Lichens Species Growing On Larix Decidua in Bucegi Area

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Abstract: It is well known the affinity of lichens for heavy metals absorption, and used as biomonitors in environmental protection [4]. Also they are studied for their hyper accumulation level in the view to be used as natural’s sources for rare and noble metals. This work is about two lichens species which are growing on Larix decidua’s bark. It was collected and analyzed Usnea barbata and Peltigera canina. Both lichens species were growing in closer association each other on bark.

The samples were analyzed by EDXRF (fluorescence –spectrometer) method with ELVA-X.

In this way were registered all the elements which were in a concentration higher then 1ppm. It were determinate the concentrations of iron, copper, zinc, chromium, manganese, lead, cobalt. In some analysed cases were registered nickel, strontium and gold. Most important there were the absorption features of lichens which was different from a place to other in studied aria. In the east of this zone both lichens had the same characteristics of storage heavy metals.

Keywords: lichens, Usnea barbata, Peltigera canina, heavy metals.

INTRODUCTION

All over the world are increasing the researches studies about chemical content of different lichens species which are growing on bark of trees [3, 5]. American studies relieved that the large expansion of lichens is the effect of global climatic change. But another cause is the enlarge pollution of environmental components [1, 2, 4]. The lichens species studied here have the features of invaders because their large expansion on Coniferrals species. It seems to becoming parasitic organisms. In Europe in France, Romania, Russian and others country, lichens association are growing on many Coniferrals species, as Larix decidua. In our country on can see a disaster in Bucegi Mountains from this point of view. A large number of Coniferrals which are invaded by lichens associations as in case of Larix decidua.

MATERIALS AND METHODS

Biological material consisted in Usnea barbata and Peltigera canina collected from some Larix decidua’s bark in Busteni aria from south (Poiana Costiei), east (Poiana Izvoarelor) and north (Pichetu Rosu). Biological samples and their substrate were drying at 60°C for 1 hour. The elemental content of samples was determinate using Elva-X Spectrometer having a X-ray tube with Rh anode. The samples were excited for 300s and the characteristic X-rays were detected by a multichannel spectrometer based on a solid state Si-pin-diode X-ray detector with a 140 mm Be window and a energy resolution of 200eV at 5.9keV. In this way were registered all the elements which were in a concentration higher then 1ppm. For the evaluation of EDXRF results was used a certified reference sample (NIST SRM 1571-Orchard leaves). Every result represents the average of some determinations.
The final results were reported to dry substances and calculated in percent. It was calculated the accumulation level for each metal species, considering its value finde in substrate as being 100%.

RESULTS AND DISCUSSIONS

Into thallus of both lichens species harvested from *Larix decidua* growing in south aria it was registered iron, copper, zinc, chromium, manganese, lead, but differs the concentrations (Fig. 1). *Usnea barbata* accumulated this metal species in lower concentrations as 5,556% of substrate. In spite that, the iron concentration was important: 2,63% lower as 3,11% find in *Peltigera canina*. It was registered in trace copper, chromium and manganese in *U. barbata* thallus. *Peltigera canina* absorbed chromium, manganese in higher concentrations as the substrate, zincum and copper in the same concentration appreciatively with those of substrate. The bark of *Larix decidua* was rich in iron and had a medium content of zinc and copper. Chromium and manganese was in trace.

*Usnea barbata* accumulated lead, cobalt and nickel only in trace in all cases analysed (Fig. 2). *Peltigera canina* stored cobalt and nickel in higher concentration comparatively to that of substrate. Also it was find one important content of lead in samples of *Peltigera canina*. Substrate had cobalt and nickel in trace. The bark of *Larix decidua* had over 0,27% the concentration of lead.
In the samples from north (Fig. 3) the situation of iron and zinc storage was similar with those obtained at samples from south (Fig. 1). Concerning the values registered at copper, chromium and manganese the situation was different. The lowest content of copper, chromium and manganese was in *Peltigera canina*, very closed as value find in bark.

Concerning the lead content, the highest was in bark, the values find in *Usnea barbata* and *Peltigera canina* were the same one (Fig. 4). *Usnea barbata* stored the highest quantity of cobalt and nickel, and in bark and *Peltigera canina* these metal species were in trace. The concentration of gold had maximum in *Peltigera canina* a little over as that find in bark.

In Fig. 5 the accumulation curves of iron was completely different as in the first two cases (Fig. 1 and Fig. 3). The highest quantity of iron was registered in *Usnea barbata* thallus and the lowest in bark. Also was different the situation in case of zinc, copper and chromium. The highest content of zinc was in bark and the lowest was found in *Usnea barbata*. Concentrations of copper were equal in both lichens species, higher then in bark. The highest content of chromium was in *Usnea barbata* and the lowest one in bark. Manganese was stored in the greatest concentration in *Peltigera canina* and the lowest was also into bark. It is very interesting the different features of absorption of lichens which are growing in east part comparatively with those from south and north.
Lead content had maximum value in *Peltigera canina* and minimum in *Usnea barbata* (Fig. 6). The others elements were in traces in all cases. On can see some increasing quantities of cobalt in *Usnea barbata*, and strontium in both lichens species.

Tab. 1 contains data concerning the accumulation level for iron, zinc, copper, chromium, manganese, lead, cobalt and nickel in thallus of both lichens species harvested from south. On can see that only in one case *Usnea barbata* had a good absorption, it is zinc. *Peltigera canina* stored higher quantities of chromium, manganese, cobalt and nickel.

<table>
<thead>
<tr>
<th>Type of samples</th>
<th>Fe%</th>
<th>Zn %</th>
<th>Cu%</th>
<th>Cr%</th>
<th>Mn%</th>
<th>Pb%</th>
<th>Co%</th>
<th>Ni%</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Usnea barbata</em></td>
<td>47</td>
<td>160</td>
<td>-</td>
<td>-</td>
<td>100</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><em>Peltigera canina</em></td>
<td>56</td>
<td>97</td>
<td>96</td>
<td>210</td>
<td>378</td>
<td>32</td>
<td>550</td>
<td>280</td>
</tr>
<tr>
<td><em>Larix decidua</em> bark</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

In case of *Usnea barbata* collected from north part of studied aria, on registered a highest accumulation for zinc, copper, chromium, manganese, cobalt and nickel (Tab. 2). *Peltigera canina* accumulated in higher concentrations only zinc and manganese. Concerning iron accumulation it was a lowest one as well as in cases of lichens species collected from the south part of studied aria.
Tab. 2
Level of accumulation for some heavy metals in samples from north

<table>
<thead>
<tr>
<th>Type of samples</th>
<th>Fe%</th>
<th>Zn %</th>
<th>Cu%</th>
<th>Cr%</th>
<th>Mn%</th>
<th>Pb%</th>
<th>Co%</th>
<th>Ni%</th>
<th>Au%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Usnea barbata</td>
<td>42</td>
<td>210</td>
<td>107</td>
<td>221</td>
<td>258</td>
<td>50</td>
<td>1100</td>
<td>300</td>
<td>-</td>
</tr>
<tr>
<td>Peltigera canina</td>
<td>63</td>
<td>110</td>
<td>74</td>
<td>86</td>
<td>116</td>
<td>45</td>
<td>-</td>
<td>-</td>
<td>150</td>
</tr>
<tr>
<td>Larix decidua bark</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

The aspects concerning the concentrations of metals in *Usnea barbata* and *Peltigera canina* are generally the same with little variations of values from a case to other (Tab. 3). Only in case of zinc accumulation was obtained negative results in all samples collected from east.

Tab. 3
Level of accumulation for some heavy metals in samples from east

<table>
<thead>
<tr>
<th>Type of samples</th>
<th>Fe%</th>
<th>Zn %</th>
<th>Cu%</th>
<th>Cr%</th>
<th>Mn%</th>
<th>Pb%</th>
<th>Co%</th>
<th>Ti%</th>
<th>Sr%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Usnea barbata</td>
<td>361</td>
<td>61</td>
<td>166</td>
<td>320</td>
<td>700</td>
<td>300</td>
<td>300</td>
<td>1500</td>
<td>300</td>
</tr>
<tr>
<td>Peltigera canina</td>
<td>258</td>
<td>77</td>
<td>177</td>
<td>190</td>
<td>250</td>
<td>300</td>
<td>200</td>
<td>2500</td>
<td>100</td>
</tr>
<tr>
<td>Larix decidua bark</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

CONCLUSIONS

- *Usnea barbata* had a good accumulation of manganese in absolutely all cases.
- *Usnea barbata* hyper accumulated zinc, copper, chromium and cobalt in 2/3 of cases.
- *Peltigera canina* also had higher concentrations of manganese in all samples.
- *Peltigera canina* hyper accumulated chromium and cobalt in 2/3 of cases.
- Only in samples collected from east were find great concentrations of iron in both studied lichens species.
- In case of lichens species harvested from east their absorption features for heavy metals were simillary.

REFERENCES