RESEARCHES CONCERNING THE DETERMINATION OF MINERAL COMPOSITION OF NORWAY SPRUCE EMBRIONS THROUGH QUANTITATIVE ELECTRONMICROSCOPY

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ABSTRACT

Through determination of mineral composition we can establish if a certain provenance was cultivated on a certain soil and so being able to discern between provenances. The method used was SEMQuant (quantitative scanning electronmicroscopy) and the quantitative method was ZAF.

We used 5 Norway spruce provenances and we where able to establish the mineral spectrum for each of them. The analyses showed the presence of both normal elements and toxic ones in the embryos. The presence or absence of an element and its concentration was a criterion for discerning between provenances.

Keywords: elctronmicroscopy, markers, mineral analysis, Norway spruce.

INTRODUCTION

Mineral substances have a variable and complex role in the growth and development of plants. They influence in principal the metabolic activities in tissues and cells and they are an important factor in maintaining the integrity of cells constitution. Each chemical element can be found in different organs of the plant, in certain proportions, the deficiency or the excess of these substances being often the cause of major effects on plant metabolism or development. From this chemical elements, same of them are usually present in plants and are having a well determined role in plants metabolism, and others are accumulated in different organs due to their capture from the soil and have usually a toxic effect if their concentration exceed certain limits.

Through determination of mineral composition we can establish if a certain provenance was cultivated a certain soil, in this way being able to discern between provenances.

Material and method

Plant material. We used Norway spruce seeds from 5 provenances from different geographical areas, which are the following:

1. O.S. Beliş, U.P. I, u.a. 30-32.
2. O.S. Sinaia, U.P. II, u.a. 34.
3. O.S. Topliţa, U.P. 4, u.a. 21-29.
4. O.S. Turda, U. P. 4, u.a. 86A, 102.
5. O.S. Breaza, U.P. 3, u.a. 105A.

Embryos were excised from the seeds and then they were cut longitudinally and after that all resins were removed because they are a cause of poor visualisation at the electronmicroscope.

The method of analysis. The method we used was SEMQuant (quantitative scanning electronomicroscopy) which consists in mineralisation of the sample and after that its examination with an electrons probe. The system resolution was of 192eV and the voltage was of 30kV.

For calculating the concentration of the mineral elements we used ZAF quatitative method with a sigma correction factor <2.

Results and discussion

In provenance 1 we discern the presence in measurable quantities of 7 elements which are normally present in seed embryos, but also the presence of other substances which have a toxic effect on plants. All the 7 elements are present in normal quantities for conifer embryos and we could not determine any quantitative variation compared with the other provenances, with the exception of copper which is present in a 7 times larger quantity then in the case of provenance 4 and 5 (fig. 1.).

Also, provenance 1 is the only provenance in which zinc was detected in relatively large quantity, so this element can be considered a selection element between the provenances. As regarding the toxic elements which have no role in plants metabolism and which can produce, if it is present in large quantities, severe metabolic changes, we detected the presence of chromium and arsenic (fig. 2.).

In provenance 2 we observed the presence of 12 usual elements and two toxic elements. From the usual elements, the magnesium is in a concentration almost equal with the one we observed in the case of provenance 3, but which is 10 times grater than the one we record for provenances 4 and 5 (fig. 3). Also, some elements are in a lower concentration than in the case of the other provenances as for example sulfur, which is present in a concentration 8 times lower than in provenence 3 and 13 times lower than in provenence 4 and 5. An other element that was detected was copper which had a concentration approximately equal with the one we observed in case of provenence 3 and 4 times lower than provenance 4 and 5.

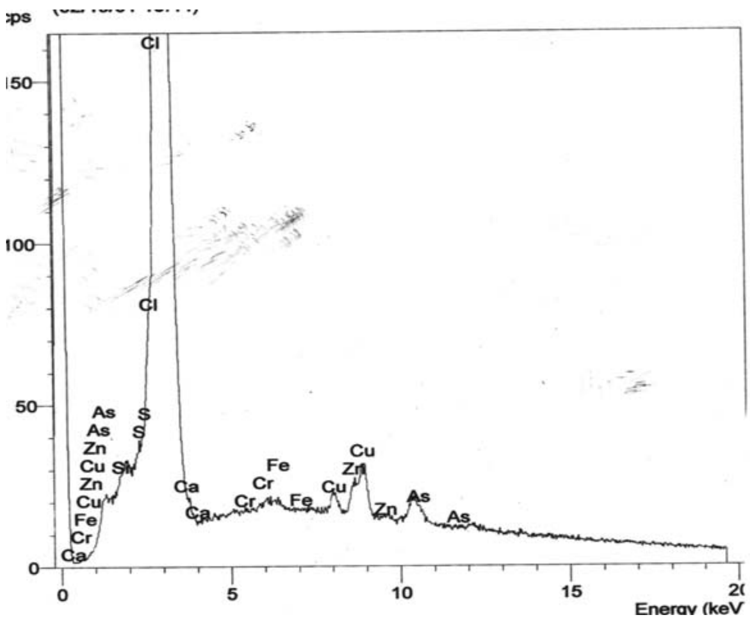

Figure. 1. Mineral substances spectrum for provenance 1

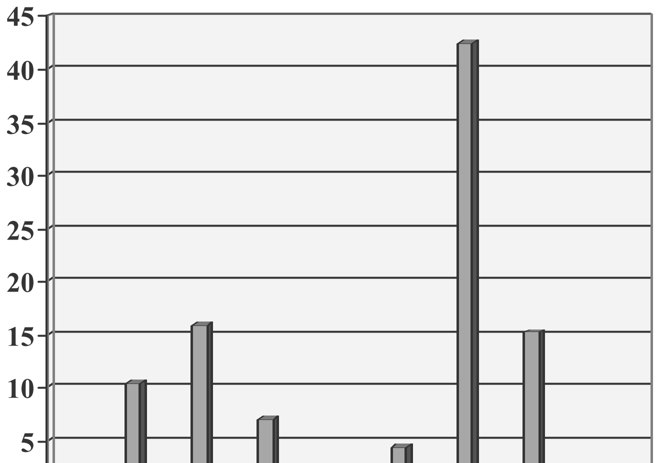

Figure 2. The variation of mineral substances concentration for provenance 1

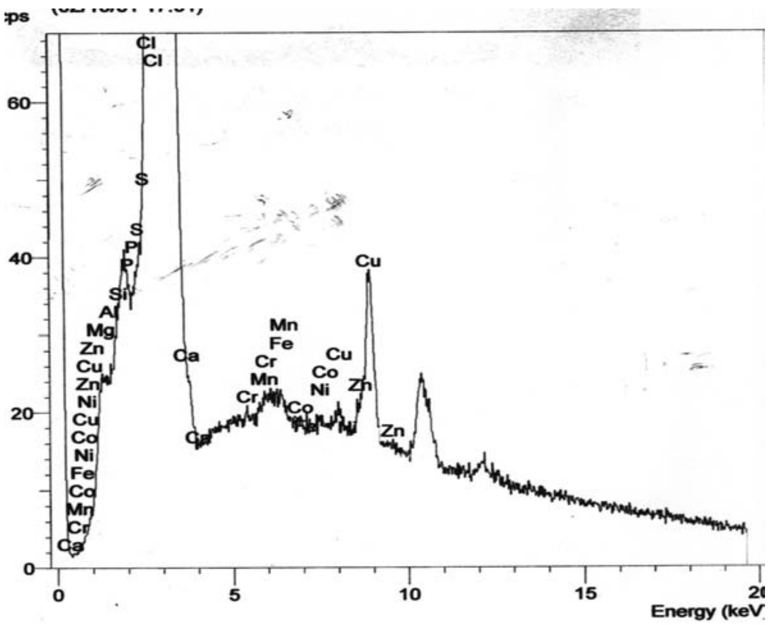

Figure 3. Mineral substances spectrum for proveance 2

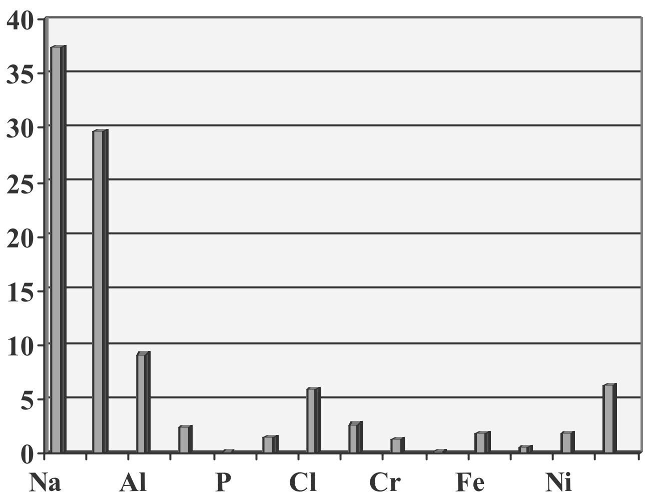

Figure 4. The variation of mineral substances concentration for provenance 2

There were observed, also, toxic substances, which was chromium and nickels, but the concentration of these substances are the same with the other provenances in which their presence was detected (fig. 4.).

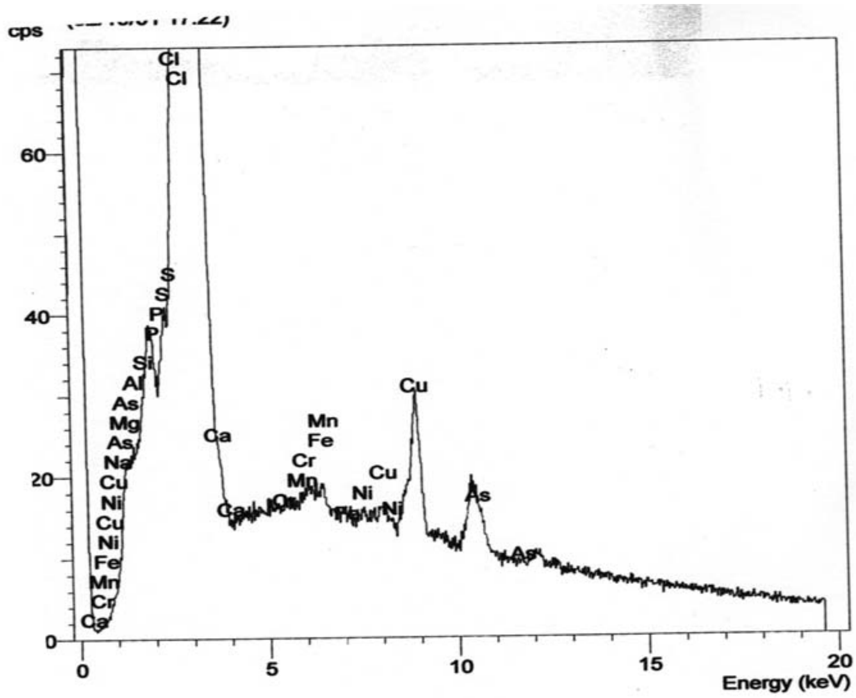

Figure 5. Mineral substances spectrum for proveance 3

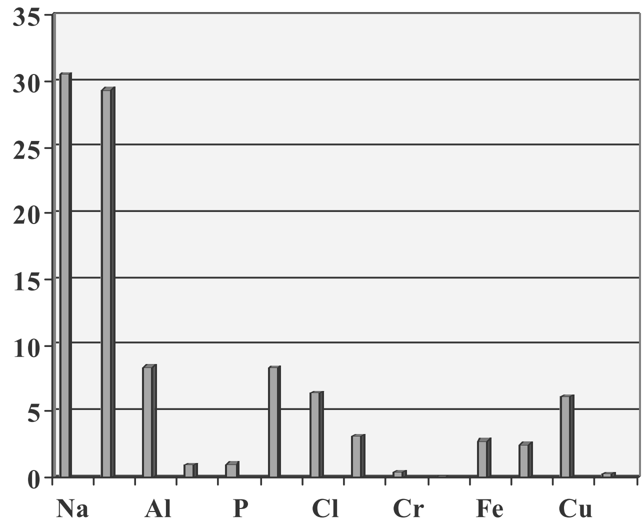

Figure 6. The variation of mineral substances concentration for provenance 3

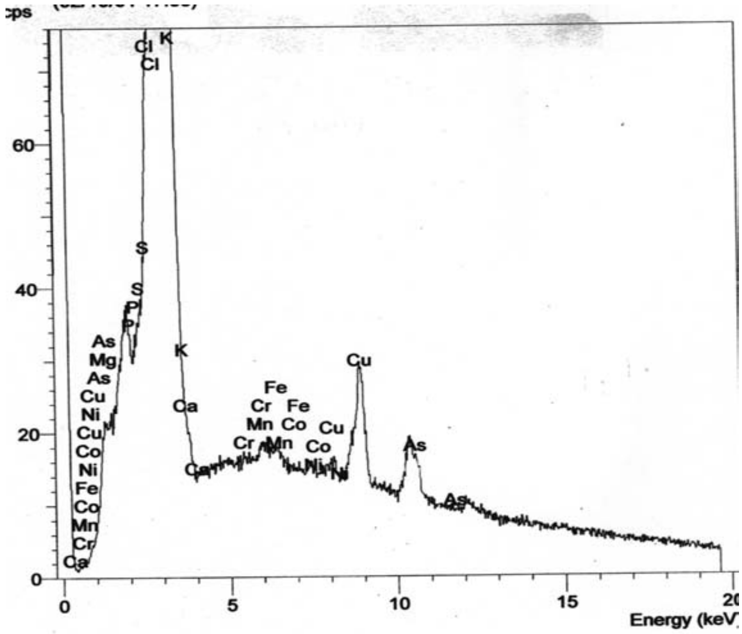

Figure 7. Mineral substances spectrum for provenance 7

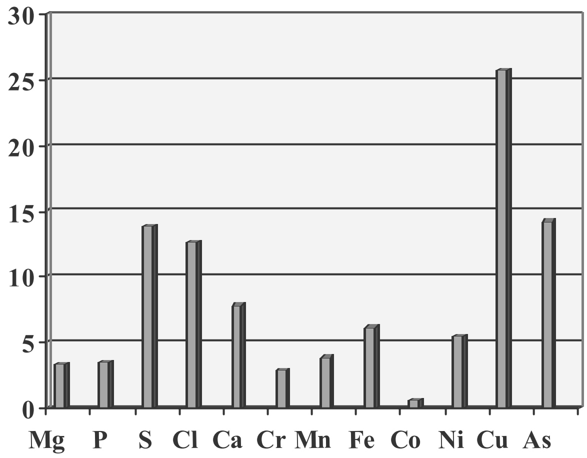

Figure 8. The variation of mineral substances concentration for provenance 4

For provenance 3 there were detected 11 usual substances and 3 toxic substances. From the usual substances, sodium has a approximately equal concentration with the one we observe in the case of provenance 3, but three times higher than the one in provenance 5. Also, aluminium has a concentration approximately equal with the one we observed in the case of provenance 2, this two provenances being the only ones in

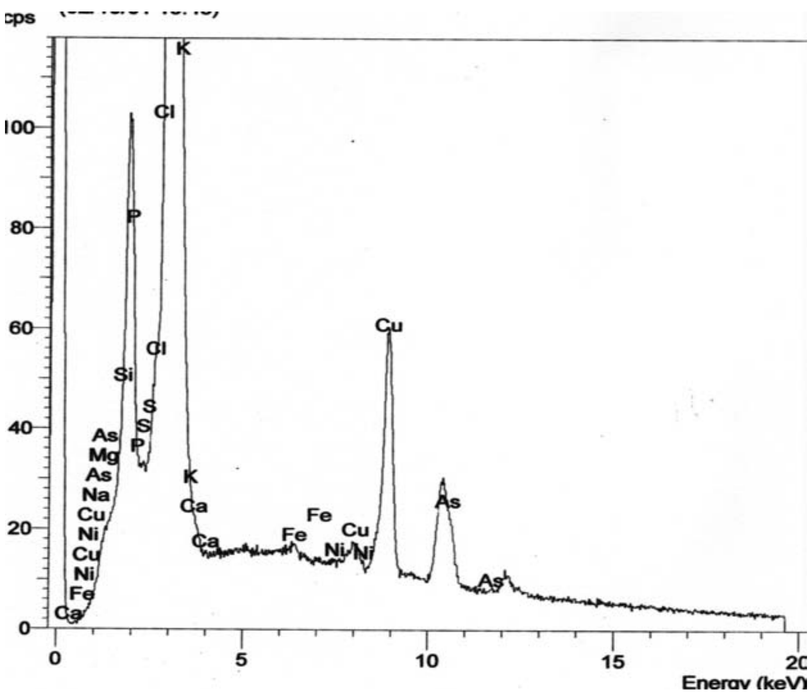

Figure 9. Mineral substances spectrum for proveance 5

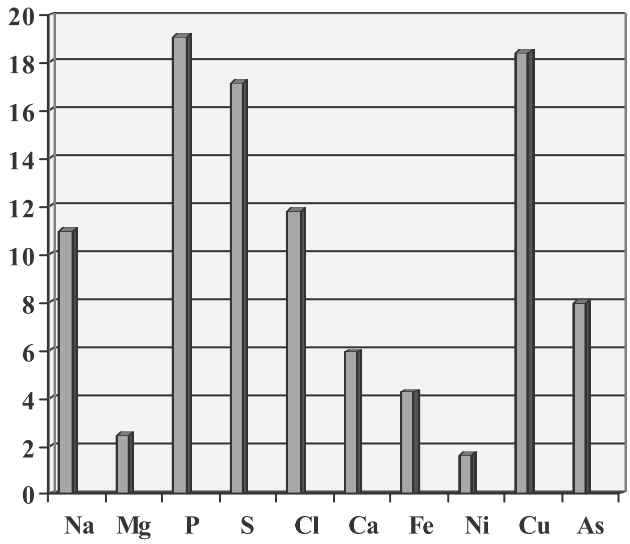

Figure 10. The variation of mineral substances concentration for provenance 5

which this element could be detected (fig. 5.).

From the toxic substances, chromium and nickel are present in concentrations comparable with the ones of the other provenances in which this elements were detected and, also, arsenic was present in a much lower concentration than the one we observed in the case of provenance 4 and 5 (fig. 6.).

In the case of provenance 4 we observed the presence of 9 usual substances and 3 toxic substances. From the usual substances, manganese is present in a much higher concentration than in provenances 2 and 3, and also copper had a concentration 4 times higher than the one in provenance 2 and 3, this concentration being almost the same with the one recorded in the case of provenance 5 (fig. 7.).

From the toxic substances, chromium has a concentration comparable with the other provenances in which this element was detected and nickel had a concentration higher than the one observed in the case of other provenances in which this substance was present (fig. 8.). An other element is arsenic, which had a concentration two times higher than in case of provenance 5, but much higher than in the case of provenance 3.

In provenance 5 we detected 8 usual substances and 2 toxic substances. From the usual substances phosphorus is in a concentration much higher than in other provenances, the same observation can be done for copper with the exception of provenance 4 in which copper had a comparable concentration (fig. 9.). As regarding the toxic substances, nickel had a concentration approximately equal with the one observed in the case of provenance 2 and 3, but much lower than in provenance 4 (fig. 10.). It could also be detected the presence of arsenic, which had a concentration two times lower than the one in provenance 4, but 7 times bigger than the one in provenance 3.

The establishment of mineral elements spectrum for the embryos from different Norway spruce provenances and also the determination of the concentration of this substances make possible to distinguish between provenances each one of them having a particular spectrum. The presence or absence of a substance can be markers for determination of the origin of the provenances for this forest species.

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