THE INFLUENCE OF MICROELEMENTS ON GERMINATION AND CHLOROPHYLL QUANTITY IN *SINAPIS ALBA L.* SEEDS

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Abstract

The mineral nutrition of plants is a physiologic feeding process of plants with nutritive substances. In Cormophyta plants this process takes places through the root system and through leaves.

The influence of some microelements, as Fe, Cu, Pb and Ni on the Sinapis alba L. seeds germination and chlorophyll quantity we studied in this paper.

We observed that the metals studied, Ni and Cu have high toxicity, inhibited seed germination, even at low concentrations administered. Lead and iron are toxic in high concentrations, but the lowest concentration we observed the seeds germination.

The action of metals studied the amount of chlorophyll decreases, however there is a slight increase in the amount of chlorophyll b. Not significantly affect the total amount of pigment chlorophyll. The ratio of the amount of chlorophyll a and chlorophyll b decreased significantly.

Keywords: microelements, gemination, chloroplyll quantity

INTRODUCTION

Elements in plant nutrition are structural components of substances that constitute protoplasm and cell wall, but also are part of enzyme systems that includes all metabolic processes.

Quantitative proportion of chemical elements in plant body ranges, which are conventionally divided into macronutrients, micronutrients and ultramicroelemente.

Trace elements are present in small quantities in plant body, but their presence is indispensable. The most important trace elements are : Fe, Mn, B, Sr, Cu, Zn, Ba, Li, I, Br, Al, Ni, Mo, Cd, As, Pb, Va, Rb, being present in amounts ranging between 0.00001 and 0.001% of dry plant. They occur in general metabolism, in plant growth and development, in the immune processes (Chaney, R.L. et al 2000, Pallag A., 2007).

Lack of a trace can lead to physiological diseases accompanied by slowing or stopping the growth of roots, the stem, leaves and fruits. Excessive increase in the quantities of these substances in soil, mainly due to pollution also leads to metabolic disorders in plants, but also affects the quality of the food that may be harmful to health (Baker, A.J.M., P.L. Walker., 1990,

Bathory D. et al 1997, Baker, A.J.M et al., 2000). Uptake and distribution of trace elements and metals were studied with great attention to crops due to power of their importance (Pallag Annamaria et al., 2006. Sumalan Radu, 2006).
Distribution of metals in plants depends on the concentration, type of metal and the plant. Most times the highest concentration was found in the roots, because they are in direct contact with toxic environment. Influence of microelements in plant life is present in all biological levels. (Assche, F., 1990, Nanthi S. et al. 2003, Gâdra Ștefania, 2009)

MATERIAL AND METHODS

Preparation of biological material
To establish the effect of microelements on germination bioassay was used the "Compared test Constantinescu" (Agrios G. N., 1978). They put lots of 30 *Sinapis alba L*. seeds on germination in Petri dishes on filter paper soaked with common water boiled and cooled. The seeds were kept 24 hours in darkness and temperatures of 20-24^{0}C, during which germinates and the root goes to a maximum of 1-2 mm length.

Preparation of test solutions
Prepare distilled and demineralized water solutions:
$Fe_2(SO_4)_3$ at concentrations of 2%, 1%, 0.5%, 0.25%;
$CuSO_4$ at concentrations of 2%, 1%, 0.5%, 0.25%;
$Pb(NO_3)_2$ at concentrations of 2%, 1%, 0.5%, 0.25%;
$NiCl_2$ at concentrations of 2%, 1%, 0.5%, 0.25%;

Spectrophotometry is the branch of optics that deals with determining the intensity of monochromatic radiation which is composed of a spectrum.

RESULTS AND DISSCUTIONS

The influence of studied elements in seed germination of Sinapis alba L.
In case of control the percentage of germinated seeds is 97%.

Fig.1. Organization of study groups

Table 1.

Percentage of seeds germinated after 72 hours

Concentration	Cu	Ni	Pb	Fe
2,00%	0%	0%	15%	5%
1,00%	0%	0%	15%	10%
0,50%	0%	0%	85%	10%
0,25	5%	0%	90%	80%

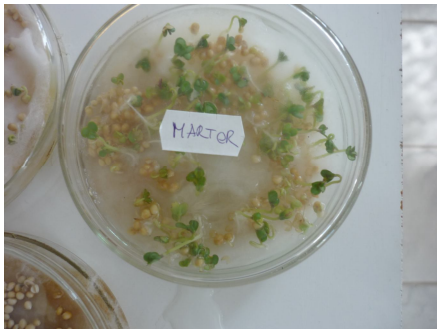

Fig 2. Control

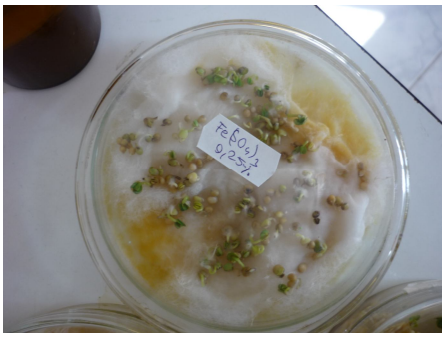

Fig 3. $Fe_2(SO_4)_3$ 0,25% solution

All $NiCl_2$ concentrations used in this study lead to total inhibition, 100% germination of seeds of Sinapis alba L., becoming whitish.

Similar results were obtained for $CuSO_4$ solutions in concentrations of 2%, 1%, 0.5%, where seed germination has not occurred.

For concentration of 0.25% was obtained seed germination, but only 5%, seedlings are small, shriveled leaves, stained, roots is undeveloped, their average length was 0.40 cm.

At the solutions of $Pb(NO_3)_2$, for the seed lot treated with solutions of $Pb(NO_3)_2$ 2% and 1%, we get a percentage of 15% of seeds germinated, but these concentrations are toxic. At lower concentrations, 0.5% and 0.25% we observed a significant increase germination capacity, up to 85% and 90%, demonstrating concentrations to be less toxic.

Fig.4. Control at 72 hours

Fig.5. $CuSO_4$ 0,25% solutions at 72 hours

Fig.6. $Fe_2(SO_4)_3$ 2% solutions at 72 hours

$Fe_2(SO_4)_3$ solutions by different concentrations acted differently on germination capacity. At higher concentrations, the germination is inhibited, seedlings are less developed compared to the control group, leaves

yellowish stains. Only at the concentration of 0.25% was obtained 80% of seeds germinated.
The best results after 72 hours were obtained for $Fe_2(SO_4)_3$ solution 0.25% concentration, where the average length of roots is close to the values obtained for control, the leaves are well developed , green.

The influence of trace elements on the amount of chlorophyll

We obtained a mixture of chlorophyll pigments in the leaves of Sinapis alba, from different lots.
Leaves were used to lots of factor inhibition <50%:
- Group treated with the solution of $Pb(NO_3)_2$ 0.50%
- Group treated with the solution of $Pb(NO_3)_2$ 0.25%
- Group treated with the solution of $Fe_2(SO_4)_3$ 0.25%
- Control group

They were harvested and 1 g of leaves were grinded in mortar with 10-15 ml 70% ethanol, then filtered. The filtrates represents the samples. We calibrate the spectrophotometer. Readings were made using alcohol as a witness. We measured the absorbance at 646.6 nm wavelength (the wavelength at which absorption is maximum chlorophyll b), respectively 663.6 nm wavelength (the wavelength at which absorption is maximum chlorophyll a).

The chlorophyll quantity of samples was calculated using the formulas of Porra (2002) (Azervedo R.A., Lea P.I., 2005, Gâdra Ştefania, 2009).

[Chl a] = 12.25 E663.6 – 2.55 E646.6 µg/ml

[Chl b] = 20.31 E 646.6 – 4.91 E663.6 µg/ml

[Chl a+b] = 17.76 E 646.6 + 7.34 E 663.6 µg/ml

[Chl a/b] = 12.25 E663.6 – 2.55 E646.6 / 20.31 E 646.6 – 4.91 E663.6 µg/ml

Obtained results

Table 2.

Obtained absorbances

Nr crt	**Lot of study**	**Absorbances at 646,6 nm**	**Absorbances at 663,6 nm**
1	$Pb(NO_3)_2$ 0,50%	1,4150	0,3770
2	$Pb(NO_3)_2$ 0,25%	1,4310	0,4250
3	$Fe_2(SO_4)_3$ 0,25%	1,5130	0,9020
4	Control	1,2730	1,0730

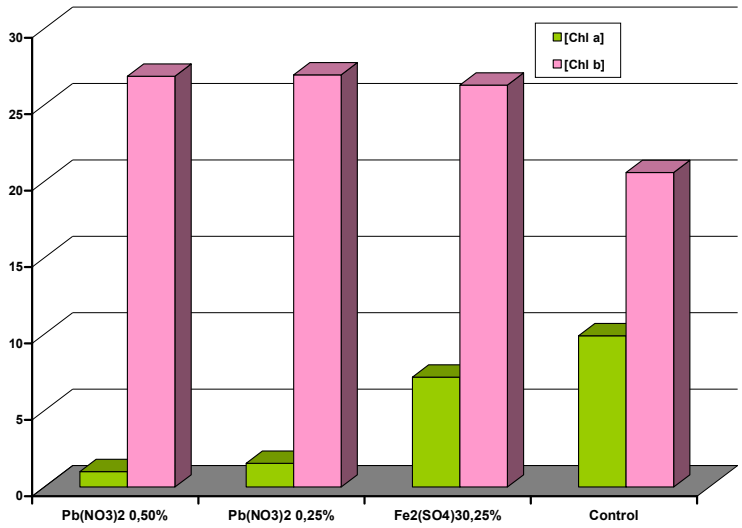

Fig.7. The chlorophyll quantity a and b

Table 3.

Results obtained for the chlorophyll a and b

Lot	$Pb(NO_3)_2$ 0,50%	$Pb(NO_3)_2$ 0,25%	$Fe_2(SO_4)_3$0,25%	Martor
[Chl a]	7,19 µg/ml	1,55 µg/ml	1,01 µg/ml	9,90 µg/ml
[Chl b]	26.30 µg/ml	26,97 µg/ml	26.88 µg/ml	20,58 µg/ml
[Chl a+b]	33,49 µg/ml	28,52 µg/ml	27,89 µg/ml	30,48 µg/ml
[Chl a/b]	0,273 µg/ml	0,057 µg/ml	0,037 µg/ml	0,481 µg/ml

Under the action of metals studied the amount of chlorophyll decreases, however there is a slight increase in the amount of chlorophyll b, compared to the control.

Not significantly affect the total amount of pigment chlorophyll (a and b). The ratio of the amount of chlorophyll a and chlorophyll b decreased significantly.

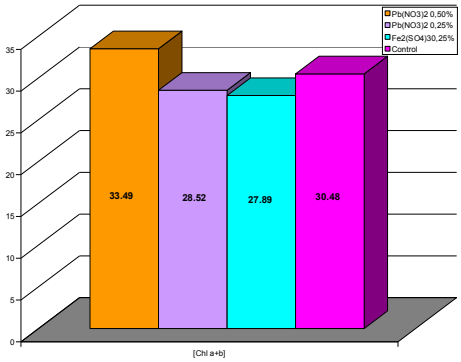

Fig.8. Total quantity of chlorophylic pigments

CONCLUSIONS

Influence of metals on the germination process differs depending on the species, the length of time the seeds were soaked in solutions studied metals.

Germination process underwent a profound morphological changes in the test conducted. Solutions at different concentrations tested caused distortions in the roots on their viability.

Solutions of high concentrations 2%, 1%, occurred specifically inhibiting the germination of all the elements under study.

Concentration of 0.5% and 0.25% nickel inhibited germination of 100%.

Among the metals studied, Ni and Cu have high toxicity, even at low concentrations administered.

Lead is toxic at high concentrations and less toxic at low concentrations, without affecting the germination process and the amount of chlorophyll.

Iron is toxic in high concentrations, but the lowest concentration of 0.25% results in seed germination, seedlings with leaf development, low chlorophyll a and b.

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