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RESEARCH REGARDING THE GERMINATION PROCESS IN *OCIMUM BASILICUM* L. IN AN EXPERIMENTAL ENVIRONMENT

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ABSTRACT. The tolerance of lead in some varieties of *Ocimum basilicum* L. has been investigated using seed germination and plant growth bioassays. The aim of this paper is to test the ability of their seeds to germinate and their seedlings to develop in a heavy metal contaminated environment. In the investigated species, seed germination and seedling development were affected by the tested concentrations of lead solutions (100 mg/l, 300 mg/l and 500 mg/l), the critical concentration of lead in the soil being 100 mg/l. The tested lead solutions had inhibitory effect on seedling growth in *Ocimum basilicum*, as compared to the control. Inhibition was observed on the root and hypocotyl lengths.

Keywords: medicinal plant, lead, seed germination, *Ocimum basilicum*

INTRODUCTION

The presence and concentration of heavy metals as cadmium, lead and zinc that are naturally present in the environment has gradually been increasing with the increase of industrialization and chemical usage. Medicinal and aromatic plants are a good choice for phytoremediation since these species are mainly grown for secondary products (volatile oils) thus the contamination of the food chain with heavy metals is eliminated. Aromatic and medicinal plants have an ability to accumulate heavy metals that has been demonstrated (Schneider et al., 1996; Scora et al., 1997; Zheljazkov et al., 1996) but these metals do not appear in their essential oils (Scora et al., 1997; Zheljiazkov et al., 1996). This paper represents a start point in our research regarding the impact of heavy metals on medicinal plants. The aim of this study is to test three varieties of *Ocimum basilicum* for heavy metal tolerance, by testing the ability of their seeds to germinate and the ability of their seedlings to develop in a heavy metal (lead) contaminated environment.

MATERIALS AND METHODS

The research material is represented by three varieties of the aromatic species *Ocimum basilicum* L.: 'Spice Boys Yeatis', 'Purple Ruffles' and 'Fin Vert'. The seeds were immersed for 3 h in distilled water (control) and lead nitrate ($Pb(NO_3)_2$) treatment solution of different concentrations (experimental variants: V_1- 100 mg/l-, V_2 - 300 mg/l / and V_3 - 500mg/l). The selected concentrations of lead solutions were applied starting from the critical concentration of lead in soil (100mg/l). The selected seeds were placed on filter paper in Petri dishes and kept at room temperature, with distilled water periodically added. Samples of ten seeds in three replications were used. Root length and hypocotyl length of geminated seeds were measured at the end of the experimental trial (after 14 days). The obtained data was statistical analyzed using Anova test (Microsoft Excel). Significant differences were defined at a 0.05 level. The seed germination bioassay has been evaluated according to Tam et al. (1994), relative seed germination (%), relative root elongation (%) and germination index (GI) being calculated for each experimental variant.

RESULTS AND DISCUSSIONS

The tested lead solutions had different effect on seed germination in the three varieties of the investigated species. The lead influenced the germination of the three varieties of *Ocimum basilicum* seeds reducing it , the percentages of germination being 96,66 % (in V1) and 83,33 % (in V2 and in V3), as compared to the control in 'Spice Boys Yeatis' variety, 96,66 % (in V1) and 76,66 % (in V2 and in V3) in 'Purple Ruffles' variety, 80 % (in V1), 70 % (in V2) and 66,66 % (in V3) in 'Fin Vert' variety (Fig. 1). Lead solutions reduced relative root elongation in all three investigated varieties and also reduced relative hypocotyl elongation with the exception of 100 mg/l concentration in 'Spice Boys Yeatis' and 'Fin Vert' varieties in which a slight enhancement of growth is noticed (Fig. 2, Fig. 3). The seeds of all three *Ocimum basilicum* varieties analyzed presented germination indexes (GI) under the value of 100% for all tested lead solutions (Fig. 4). The germination index has been proved to be a very sensitive index indicating (when greater than 80%) the disappearance of phytotoxicity of the substrate (Tiquia et al., 1996). All tested lead solutions had inhibitory effect concerning root length of seedlings in the three varieties of *Ocimum basilicum* studied, as compared to control (Fig. 5, Fig. 7, Fig. 9) (Anova Single Factor, F>F crit.). Root growth has been proven to be an indicator of metal tolerance in plants (Wilkins, 1978), the roots being responsible for the absorption and accumulation of metals. Thus, metal concentration affects the roots more than the aerial parts of the plant (Oncel et al., 2000).

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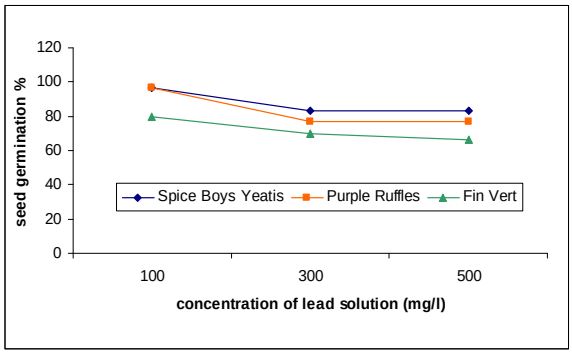

Fig. 1 Percentage of seed germination in three varieties of *Ocimum basilicum* for different concentrations of lead solution

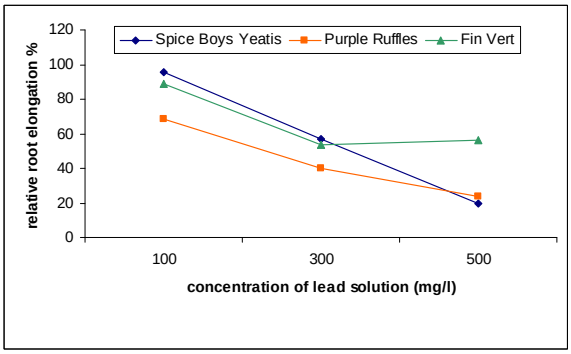

Fig. 2 Relative root elongation in three varieties of *Ocimum basilicum* for different concentrations of lead solution

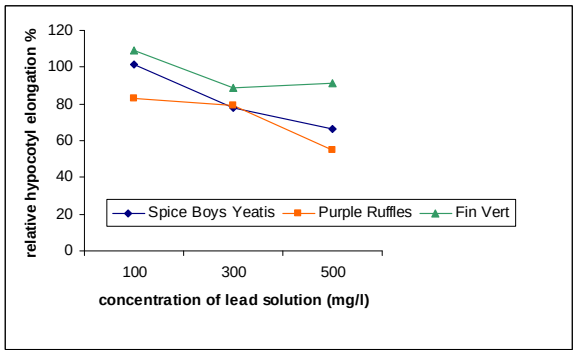

Fig. 3 Relative hypocotyl elongation in three varieties of *Ocimum basilicum* for different concentrations of lead solution

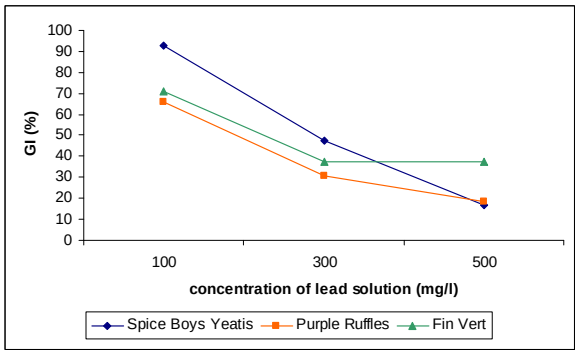

Fig. 4 Germination index (GI) in three varieties of *Ocimum basilicum* for different concentrations of lead solution

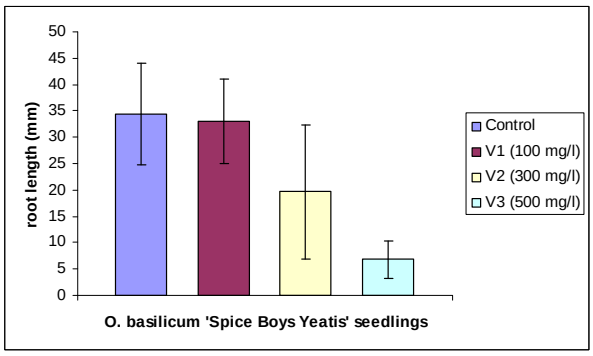

Fig. 5 Root length of *Ocimum basilicum* 'Spice Boys Yeatis' seedlings for different concentrations of lead solutions (±s.d., n=15)

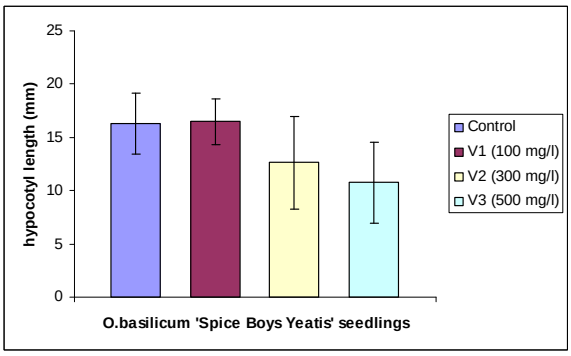

Fig. 6 Hypocotyl length of *Ocimum basilicum* 'Spice Boys Yeatis' seedlings for different concentrations of lead solutions (±s.d., n=15)

Lead solutions of 100 mg/l slightly promoted hypocotyl growth in 'Spice Boys Yeatis' and 'Fin Vert' varieties of *Ocimum basilicum* as compared to the control (Fig. 6, Fig. 8, Fig. 10). These results are statistical significant (Anova Single Factor, F>F crit.)

CONCLUSIONS

In all three varieties of *Ocimum basilicum* seed germination and seedling development were differently affected by the tested concentrations of lead solutions. Results from the conducted research indicate that lead solutions inhibit seed germination at all tested concentrations in all three varieties of *Ocimum basilicum*. Considering root growth and relative root elongation, results from the present study suggest that the three varieties of *Ocimum basilicum* studied could be used for phytoremediation of soil contaminated with lead.

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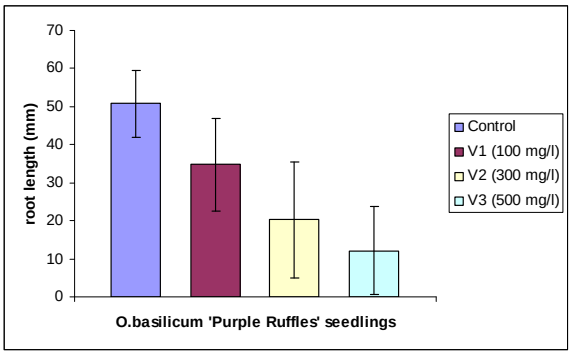

Fig. 7 Root length of *Ocimum basilicum* 'Purple Ruffles' seedlings for different concentrations of lead solutions (±s.d., n=15)

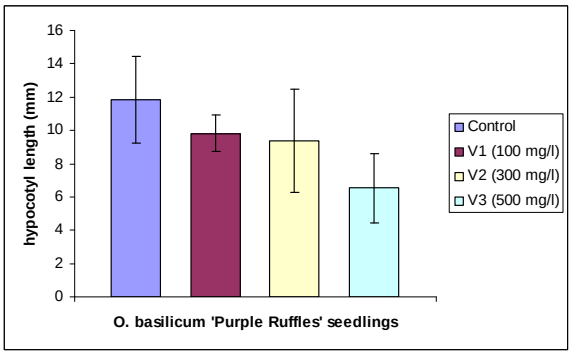

Fig. 8 Hypocotyl length of *Ocimum basilicum* 'Purple Ruffles' seedlings for different concentrations of lead solutions (±s.d., n=15)

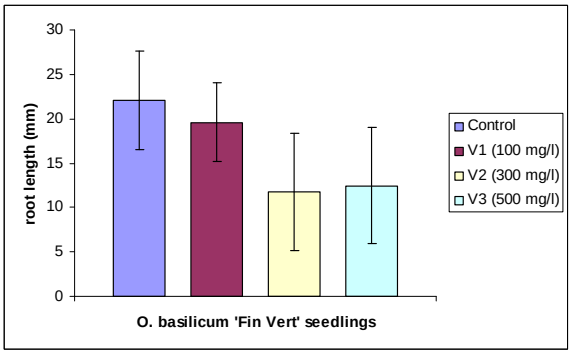

Fig. 9 Root length of *Ocimum basilicum* 'Fin Vert' seedlings for different concentrations of lead solutions (±s.d., n=15)

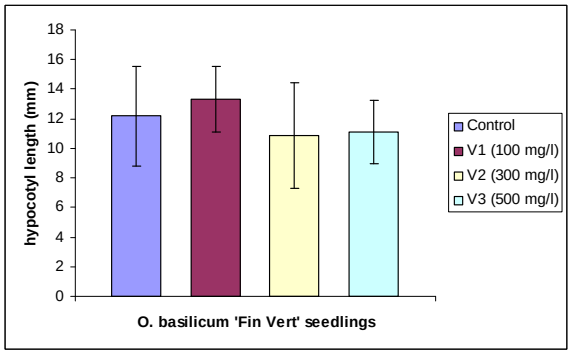

Fig. 10 Hypocotyl length of *Ocimum basilicum* 'Fin Vert' seedlings for different concentrations of lead solutions (±s.d., n=15)

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