

# THE RESPONSE AND TOLERANCE MECHANISMS OF LETTUCE (*LACTUCA SATIVA L.*) EXPOSED TO INCREASED ZINC CONCENTRATIONS IN AQUATIC CULTURES

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## INTRODUCTION

Zinc (Zn) is an essential microelement of plants. In plants, Zn is required at optimal concentrations, but in combination with heavy metals in the soil it can be a major problem in agricultural production. Under such conditions, Zn accumulates in excess in plant tissues, reaching toxic concentrations for plants and causing physiological changes in plants. Also, zinc has important functions in the cell, because it activates many enzymes, participates in proteosynthesis and metabolism of carbohydrates, lipids and nucleic acids.

## RESULTS & DISCUSSION

The application of Zn treatment has led to a significant decrease in the intensity of photosynthesis, stomatal conduction, and water efficiency.

Glutathione was slightly elevated, whereas proline was significantly increased. An increased parameter of lipid peroxidation indicates significant stress disturbed the cell membranes. Among the six measured activities of antioxidant enzymes, treatment of zinc led to an increase in super-oxide dismutase and ascorbate peroxidase indicating to moderate activation of the antioxidant system.

## METHOD / DESIGN

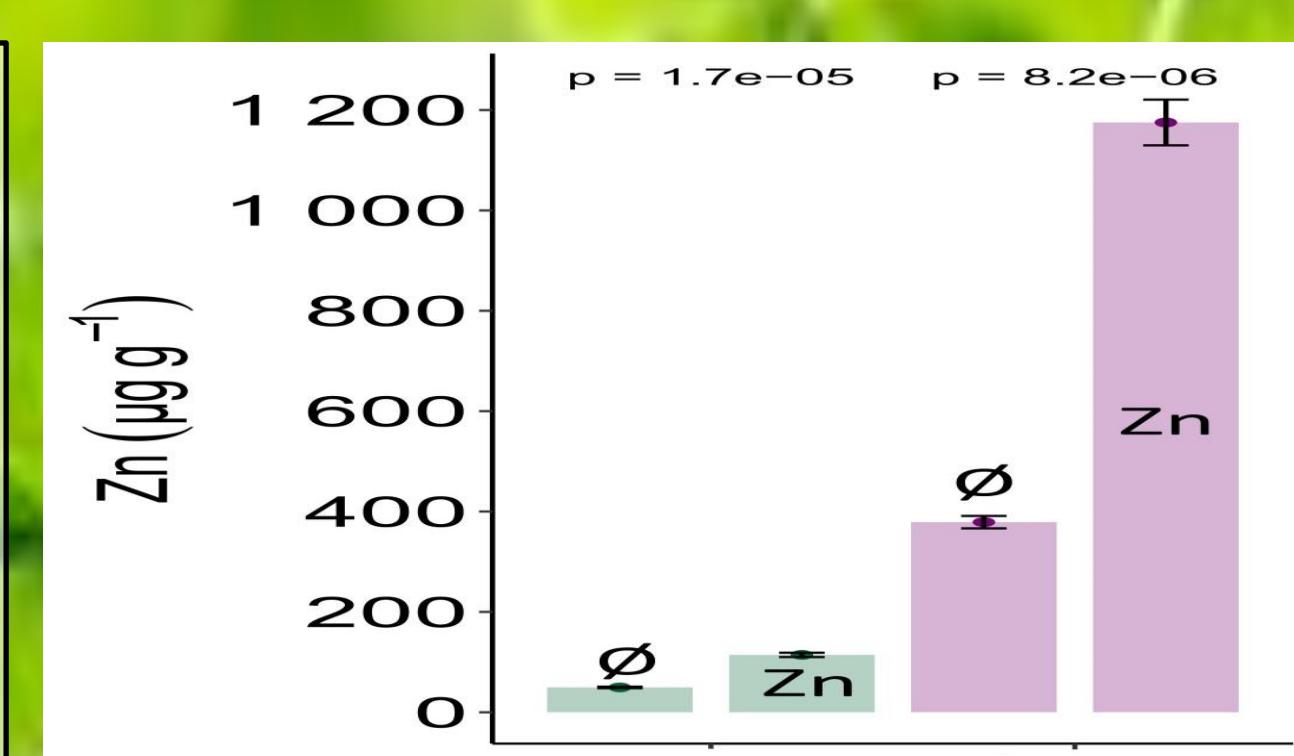
- Plants were grown by the method of static aqueous cultures with aeration, using Hoagland's 100% nutrient solution (pH = 5.8).
- After 40 days of plant growth on the nutrient solution, plants were separated in two 14 liter pots.
- For the next seven days, the control plants were grown on a pure nutrient solution, whereas half of the plants were exposed to twentyfold higher concentrations of zinc comparing to the control solution.
- After sampling, measurements of photosynthesis parameters, biochemical parameters, water regime, activity of antioxidant enzymes and Zn content were measured.



## CONCLUSIONS

Based on the obtained results, it is concluded that the application of Zn treatment led to the initiation of tolerance mechanisms in lettuce, with some moderate biochemical distress, which did not result in morphological symptoms of toxicity.

Thus in moderate Zn load, lettuce plants proved to be a good potential candidate for phytoextraction applications.



Zn accumulation in leaves and roots of control and Mn treated plants

Zn treatment had a moderate effect on the activity of respiratory enzymes, but without statistical significance. The accumulation of Zn in treated plants was significantly higher (49.5 µg/g in leaves of the control and 114.3 µg/g in the treated plants), especially higher in the root than in lettuce leaves (378.8 µg/g in control, and 1175.2 µg/g in the treated plant roots).