

## Effect of different levels of nickel in nutrient solution containing $\text{NH}_4\text{NO}_3$ on lipid peroxidation and activity of some antioxidant enzymes in cucumber leaves

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### Abstract

Nickel (Ni) is necessary for plants at low concentrations; but excess Ni has toxic effects on plant growth. In this research, the effects of different Ni levels (0, 50, 100 and 200  $\mu\text{M}$  from  $\text{NiCl}_2$ ) on leaf antioxidative response of two cucumber cultivars (*Cucumis sativus* L. cvs. Super Dominus and Negin) supplied with  $\text{NH}_4\text{NO}_3$  as nitrogen source in nutrient solution was investigated. The results showed that by increasing Ni concentration in the nutrient solution and growth period, Ni concentration in the leaves of both cucumber cultivars was increased. This increase was greater at the vegetative growth stage compared with the reproductive stage. Higher levels of malondialdehyde (MDA) were also produced at the vegetative stage with respect to the reproductive stage. Application of 50  $\mu\text{M}$  Ni significantly reduced MDA concentration, produced from lipid peroxidation, in comparison with the Ni-free control treatment. The effect of Ni on catalase (CAT) activity was dependent on the cucumber cultivar and concentration of this element in the growth medium. At the vegetative stage, Ni addition had no significant effect on activity of CAT in Super Dominus cultivar, while significantly reduced leaf activity of CAT in Negin cultivar. At the reproductive stage, Ni addition reduced activity of CAT in comparison with Ni-free treatment, regardless of the cucumber cultivar. Results showed that at the vegetative stage, application of 50  $\mu\text{M}$  Ni to the growth medium resulted in lower activity of guaiacol peroxidase (GPX) in the leaves of both cucumber cultivars. By increasing the Ni level to 100 and 200  $\mu\text{M}$ , the activity of this enzyme was increased. At the reproductive stage, activity of the ascorbate peroxidase (APX) in the leaves was dependent on the cultivar and concentration of this element in the medium. According to the results obtained from the present study, in general, the effect of Ni on activity of antioxidant enzymes in cucumber leaves varies with plant cultivar, Ni level and enzyme type.

**Keywords:** Oxidative stress, Catalase (CAT), Guaiacol peroxidase (GPX), Ascorbate peroxidase (APX).

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