# 1- Certain Growth and Metabolic Indices of Stress induced by Visible Light and UV Radiation in Broad Bean Seedlings

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## Abstract

Certain growth and metabolic indices of stress induced by visible light and UV radiation in broad bean seedlings. Phyton.(Horn, Austria) 52 (2): 203-218. The effects of either visible light or UV-radiation on growth and metabolism of broad bean (Vicia faba) seedlings were investigated. Exposure of seedlings to low and high visible light and UV-radiation, either alone or in combination, induced variable significant decreases in the levels of growth parameters throughout the experimental period, as compared with values of control seedlings grown in darkness or ambient visible light. In addition, induced pronounced significant changes in the total amount and in the relative composition of pigment fraction contents, associated with significant variable decreases in photosystem II (PSII) activity were observed. In relation to controls, direct exposure of broad bean seedlings to visible light and UV-radiation, induced significant variable changes in the total amount and in the relative composition of the carbohydrate pool. Concurrently with carbohydrate changes, significant variable increases in the activities of both invertase and a-amylase of broad bean seedlings were maintained throughout the entire period of the experiment.

**KeyWords:** *Vicia faba*; growth parameters; photosynthetic pigments; PSII; carbohydrates; invertase; alpha-amylase.

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## 2- An enhancing effect of visible light and UV radiation on phenolic compounds and various antioxidants in broad bean seedlings

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### Abstract

Exposure of dark- or ambient visible light-grown broad bean seedlings to low (LL) and high (HL) visible light intensities, UV-A or UV-C, either alone or in combination, induced significant increases in total phenolic compounds as well as in anthocyanins content, throughout the germination period, as compared with the respective levels in control seedlings. In general, as compared with control levels, exposure of both dark- or light-grown broad bean seedlings to LL, HL, UV-A or UV-C, induced significant increases in the contents of non-enzymatic antioxidants (total ascorbate; ASA-DASA and total glutathione; GSSG-GSH) and enzymatic antioxidant activities (superoxide dismutase; SOD, catalase; CAT, ascorbate peroxidase; APO and glutathione reductase; GR). The obtained results are discussed in relation to induced mechanisms of protection and repair from the inevitable exposure to damaging visible light and UV-radiation.

**KeyWords:** *Vicia faba*, anthocyanins, phenolic compounds, total ascorbate, total glutathione, SOD, APO, CAT, GR

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## 3- Exogenously applied ascorbic acid ameliorates detrimental effects of NaCl and mannitol stress in Vicia faba seedlings

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### Abstract

The adverse effects of either NaCl or mannitol on growth, nitrogen content, and antioxidant system in Vicia faba seedlings were investigated. The role of exogenous ascorbic acid in increasing resistance to these stressors was also evaluated. Thus, with an increase in concentration of either NaCl or mannitol in culture media, a progressively greater significant decrease in percentage germination, in growth parameters, and in nitrogen constituents of the germinating beans, was observed. On the other hand, amide-, nitrate-, and total soluble-N contents appeared to show a progressive significant increase. Exogenous addition of ascorbic acid (4 mM) to the stressful media induced a pronounced significantly increased percentage germination and the growth attributes, whereas nitrogen constituents were variably changed in relation to values maintained in beans treated with either NaCl or mannitol. Furthermore, exogenous addition of ascorbic acid to NaCl or mannitol media induced a significant increase in the contents of ascorbate and glutathione and enzymatic antioxidant activities, in particular, in beans treated with the three highest concentrations of NaCl or mannitol, throughout the period of the experiments (12 days). Thus, ascorbic acid ameliorates the adverse effects of the stressful media; the magnitude of amelioration being a function of the type and the concentration of the stressful agent as well as of the duration of treatment. The importance of the above-mentioned changes in growth and metabolism to stress tolerance in broad bean is discussed.

**KeyWords:** *Vicia faba*; NaCl; Mannitol; Ascorbic acid; Growth; Nitrogen constituents; Antioxidant system

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## 4- Salinity-biofertility interactive effects on nitrogen and phosphorus metabolites and enzyme activities in *Lactuca sativa*

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### Abstract

In contrast with a progressively greater significant increase in NO(3)(-)-N and total soluble-N (TSN) as well as in phospholipid-P contents. an opposite pattern of changes in NH(4)(+)-N, protein-N and total-N (TN) as well as in inorganic-, organic- and total-P contents was obtained with an increase in concentration of NaCl used, in relation to water control levels. Although a significant increase in NH(4)(+)-N, protein-N and TN contents was obtained concurrently with a significant greater decrease in NO(3)(-)-N and TSN contents of the salinized plants fortified with phosphorein, yet addition of nitrobein to the saline culture media induced an additive increase in the contents of all N fractions determined, in relation to respective saline control levels. Furthermore, either an additive significant increase or significant decrease in all P fractions determined was obtained in response to treatment with phosphorein or nitrobein, respectively. The activities of nitrate reductase (NR), asparaginase (AS), glutamine synthetase (GS) and acid phosphatase showed, in general, significant variable increases in response to treatment with phosphorein, as compared with the activities in salinized lettuce plants. On the other hand, these enzyme activities in lettuce plants treated with NaCl in combination with nitrobein biofertilizer, showed additive significant decreases, throughout the entire period of the experiment. The present results with lettuce plants are discussed in relation to applicability of two biofertilizers to sodic salty soils in Egypt.

**KeyWords:** Enzyme activities; lettuce; nitrobein; phosphorein; salinity

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# 5- Plant growth, metabolism and adaptation in relation to stress conditions. XXIV. Salinity-biofertility interactive effects on proline, glycine and various antioxidants in *Lactuca sativa*

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## Abstract

Proline and glycine contents in lettuce plants appeared to show additional significant increments, in response to treatment with phosphorein biofertilizer, above those increments maintained in response to salinization. Administration of nitrobein biofertilizer to the NaCl media led to significant increases in proline and glycine contents above the water control levels, but the amino acid content of NaCl-treated plants appeared consistently higher than that content in NaCl + nitrobein-treated plants. Supplemental addition of phosphorein to the salinized culture media induced significant increases in the contents of antioxidant compounds, throughout the experimental period. As compared with the saline control values, total ascorbate (ASA + DASA) and total glutathione (GSSG + GSH) contents were found either to decrease (with 4 & 6 mmhos NaCl) or to increase (with 8 & 10 mmhos NaCl) significantly in response to addition of nitrobein to the saline culture media. The activities of superoxide dismutase (SOD), catalase (CAT), ascorbate peroxidase (APO) and glutathione reductase (GR) in the salinized lettuce plants fortified with the recommended dose of phosphorein or nitrobein were, in general, significantly up-regulated above the salinized control levels; the magnitude of up-regulation being dependent on the concentration of NaCl, the stage of growth and on the enzyme under investigation. With lettuce plants, the present results are discussed in relation to applicability of two biofertilizers to sodic salty soils in Egypt.

**KeyWords:** Lettuce; salinity; biofertilizers; amino acids; antioxidant compounds

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