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ROOT HALOTROPISM?

SALINITY EFFECTS ON KOCHIA (*Bassia indica*) ROOTS

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ABSTRACT

Roots are responsible for the acquisition of nutrients and water from the soil, and possess an important role in establishing plant tolerance to stress conditions. Roots control their growth orientation by displaying differential growth (i.e. a tropism) in response to environmental cues such as gravity and water content. Gravitropic responses are widely studied; however other tropisms in roots have not been studied extensively. Salinity is a major environmental stress for plants in general and especially for roots that have major effects on the response of the whole plant. Our observations on root architecture of Kochia (*Bassia indica*), offer that roots may exhibit tropism cued by salinity ("halotropism").

We found Kochia roots in the field growing horizontally towards saline soil. In our greenhouse experiments Kochia plants were grown in 100 L pots with artificial soil salinity gradient, achieved by irrigation of saline and tap water. We found that roots grown in low or no salt areas were growing horizontally towards the salt gradient peak. In the salt peak area roots were growing vertically towards the salt. Plants growing in hydroponic solution showed higher growth rates in 80 mM NaCl compared to tap water. This study presents a novel finding of halotropism in which roots grow towards salt and seem to require salinity for growth.

Key words: root tropism, halotropism, salinity, Kochia (*Basia indica*)

BACKGROUND AND RESULTS

Bassia indica (Wight) A.J.Scott (Kochia), Chenopodiaceae, is an annual shrub, widespread in Israel and dominant in disturbed desert lands. We found in field conditions that some first order roots of *Bassia indica* grew horizontally (fig. 1). Measurements of soil salinity in the areas in which the roots grew horizontally indicated that the roots were growing towards relatively salt soil (fig.2).

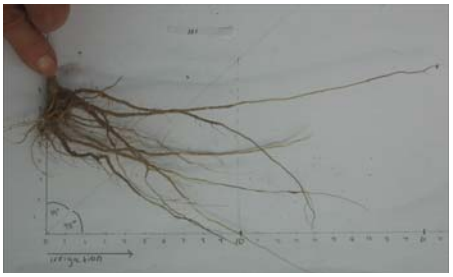

Figure 1. *Bassia indica* roots growing horizontally.

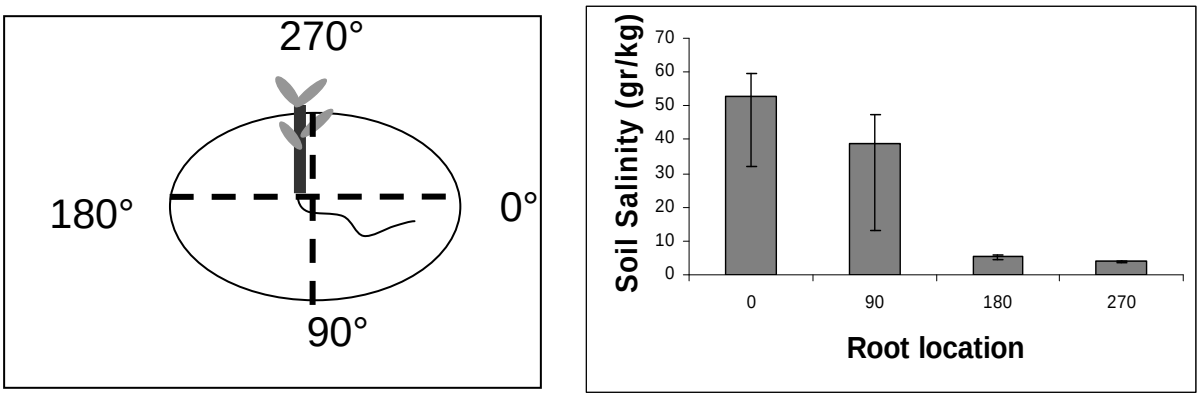

Figure 2. Horizontal roots of *Basia indica* as found in the field growing towards saline soil. The left scheme indicates root location: 0°= location of horizontal root, 180°= the opposite direction, 90°/270° the perpendiculars respectively. The right graph shows the average soil salinity for each location.

We hypothesized that roots exhibit tropism towards saline environment (“root halotropism”). To test our hypothesis we planted seedlings in soils with an artificial salt gradient and in various levels of saline water in hydroponic system. Results of the artificial salt gradient experiment showed that roots grew toward the salinity peak, while roots growing without any salt gradient, either with salt or without did not exhibit halotropism (fig. 3). The growth experiments in hydroponics, showed high growth rates in 80 mM NaCl in comparison to tap water medium. Kochia plants grew well in 150 and 250 mM NaCl, though in a lower growth rate.

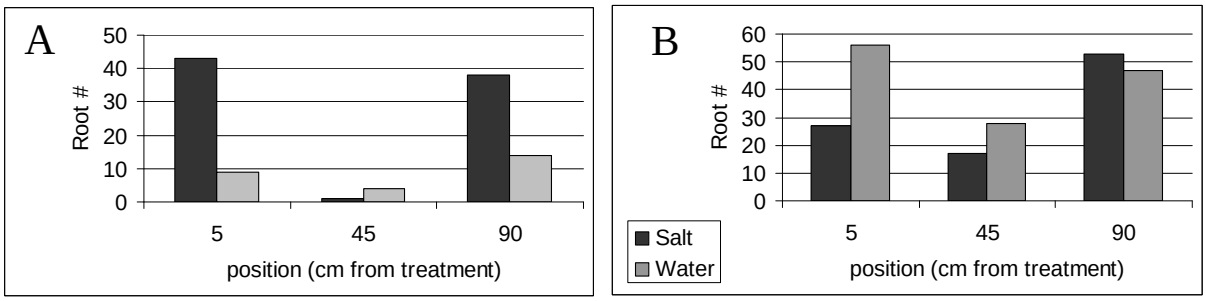

Figure 3. Effect of artificial salt gradient on root structure. A= number of horizontal roots in salt gradient versus tap water irrigation (peak of salt gradient is in the middle – 45 cm from treatment); B=number of vertical roots in salt gradient versus tap water irrigation.

CONCLUSION

This study presents a novel finding of halotropism in which roots grew towards salt and seem to require salinity for growth.