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DISSERTATION SUMMARY

Adaptive responses to high salinity of two subspecies of *Aster tripolium* on different nitrogen sources

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Soil salinity is an important agricultural problem. One possible way to use affected fields is planting salt tolerant crops such as *Aster tripolium* L.

Aster tripolium is a typical halophyte species with two horizontally isolated subspecies (Borhidi 1995). The ssp. tripolium is a maritime halophyte, while ssp. pannonicus is common on the continental alkaline salty meadows rich in $NaHCO_3$. The two subspecies are different concerning their habitats, morphology and physiology. Both ssp. accumulate inorganic ions (especially Na^+) even at low external concentrations. Physiologically, sea aster was more intensively studied (Shennan et al. 1987ab) because of its recently increasing commercial importance as halophyte crop.

In our experiments, adaptive responses to high salinity of two subspecies of *Aster tripolium* were studied at different pH values and Na^+ concentrations and on different nitrogen sources.

Plants were grown hydroponically in complete modified Hoagland nutrient solution of different pH values (from 4 to 10). On the basis of protein content data, pH 5 and 8 were selected for further experiments when plants were grown at 0, 50, 100, 200 and 300 mM NaCl concentrations added to the complete nutrient solution. Chlorophyll, protein content and cation concentrations were measured. Ssp. tripolium obviously suffered under low salt conditions combined with high pH values as shown by the low pigment concentrations. In both subspecies, qualitative and quantitative alterations were observed in protein concentrations with increasing salinity and pH values. At low pH and medium salt concentrations, ssp. tripolium had higher protein levels than ssp. pannonicus, while at high pH values ssp. pannonicus had higher performance. Very high Na^+ concentrations were accumulated in the leaves in both pH regions. Calcium is known to play a special role in tolerance under salinity. Surprisingly, in ssp. pannonicus Ca^{2+} accumulation increased under the highest NaCl concentration (300 mM), while in contrast, ssp. tripolium showed a decreasing tendency in calcium accumulation under increasing external salinity (Sági and Erdei 2002).

In the following, our intention was to investigate enzymes involved in nitrogen metabolism as a function of Na^+ concentration. We selected pH 5 and nitrate or ammonium as nitrogen source at 0, 10, 50, 100, 200 mM NaCl in the nutrient solutions. Ion concentrations (Na, Fe, K, Ca and Mg), nitrate reductase (NR) and glutamine synthetase (GS) activity were measured in both leaves and roots. One of our interesting result was that young leaves of *Aster tripolium* ssp. tripolium treated with NH_4^+ and relatively low NaCl concentrations, became chlorotic, while on high salt concentrations the signs of NH_4^+ toxicity was observed (toxicity symptoms: roots turn brown and appear unhealthy, with necrotic root tips; plant growth is decreased; necrotic lesions occur on stems and leaves).

In plants, grown on solution containing NH_4^+, in the root of both subspecies (but more accented in ssp. pannonicus) GS activity increased as a function of Na^+ concentration. In the leaf, GS activity was also enhanced. Data suggest that when the nitrogen source was nitrate, the scene of nitrate processing was not in the root, since GS activity was about threefold higher in leaves than in roots, and it was much lower than in the roots of plants grown on NH_4^+. It seems that ammonium uptake is enhanced by NaCl. This result was also supported by the NR activity data. In plants grown on NH_4^+, NR activity decreased with increasing NaCl concentrations in both subspecies (it is more distinct in ssp. tripolium). This can be a reason of the abundancy of NH_4^+ at high Na^+ concentrations. Similarly to GS, in plants grown on nitrate, NR activity was also higher in leaves than in roots and showed higher values than in plants grown on NH_4^+.

We conclude that adaptive responses, including changes in nitrogen metabolism, are different under salt stressed circumstances in the two subspecies.

References

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