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Response of the *Digitaria sanguinalis* (L.) Scop. to the soil salinity – a greenhouse experiment

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Summary. Large crabgrass is not registered in the Ellenberg's list of halophyte species, but it growths in salt contaminated soil along roads. Our manipulative experiment in greenhouse was focused on growth activities of Large crabgrass in salt soil condition. Saline solutions of sodium chloride were 0, 0.12, 0.25, 0.50, 0.99, and 1.96%. The experiment confirmed the successful growth and development of Large crabgrass in soil contaminated with salt (0.12% of NaCl). The inhibitive effect was found in soil with NaCl concentration more than 0.12%.

Key words: plant growth, soil contamination, weed.

1. Introduction

Large crabgrass (*Digitaria sanguinalis* (L.) Scop) is a summer annual species, having a prostrate or ascending growth habit with stems that root at the nodes. Stems are prostrate, spreading, branched, and rooting at the nodes. Fibrous root system corresponds with Poaceae family. It is non-native, invasive species in Europe (Jehlík 1998), which produce a large number of seeds per year (Šerá & Šerý 2004). Large crabgrass is considered to be an aggressive weed in some subtropical crops, mainly sugarcane, corn and soya. In Europe, it is a troublesome weed in corn (Mikulka et al. 2005). Large crabgrass has spread very quickly along all class roads (motorways with median stripes; roads of the I, II and III classes) in the Czech Republic (Šerá 2008). It is way, why this species probably belong to dangerous weed that could spread to agricultural areas via road network.

2. Materials and methods

The soil substrate consisted of two parts: a horticultural-flower potting soil (purchased from Rašelina a.s., Soběslav, Czech Republic) mixed with sand in a 2:1 ratio. The parts of the substrate used were sieved through a screen (mesh 3 x 3 mm). The soil substrates were neither fertilized nor sterilized. The soil mixture was enriched with pulverized limestone (3 g per 5 l) and 14 g of dried knotweed leaves were added per 1 l of soil substrate. Plastic flowerpots of size 4 x 4 x 6 cm were filled with 30 ml of the substrate and placed onto a watering tray.

The tested plants were collected on their field localities in the vicinity of České Budějovice, Czech Republic during spring 2010. Only undamaged vital seedlings of Large crabgrass were collected. One seedling was planted in each flowerpot. When the seedlings started to grow, the treatments (A–E) began to carry out. The soil substrate was contaminated by saline solution of NaCl: A 0.12%, B 0.25%, C 0.50%, D 0.99% and E 1.96%. Control sample

Table 1. Growth characteristics of Large crabgrass (*Digitaria sanguinalis*) cultivated in saline soil. Used saline solution of NaCl: K – 0%, A – 0.12%, B – 0.25%, C – 0.50%, D – 0.99% and E – 1.96%.

Treatment	Root length (mm)			Shoot length (mm)			Root weigth (mg)			Shoot weigth (mg)		
	Mean	SD	HSD	Mean	SD	HSD	Mean	SD	HSD	Mean	SD	HSD
K	124.00	20.63	a	476.08	37.37	a	0.022	0.006	a	0.087	0.033	a
A	130.00	29.43	a	468.75	44.57	a	0.021	0.007	a	0.091	0.026	a
B	94.50	27.45	b	413.00	50.95	b	0.014	0.005	b	0.086	0.029	a
C	111.67	26.75	a	384.42	45.30	bc	0.011	0.005	b	0.068	0.021	a
D	75.50	11.89	c	345.25	66.00	c	0.013	0.003	b	0.077	0.018	a
E	56.33	17.24	c	110.25	17.44	d	0.005	0.001	c	0.023	0.008	b

(K) was without saline contamination. For each assay (K, A–E), 144 flowerpots were prepared (132 flowerpots for using and 12 flowerpots as reserve).

The Large crabgrass plants were incubated in a greenhouse at 18°C during the day and 10°C at night for three months. The soil was regularly irrigated on the trays with the same amount of water. In time measurement data, 12 plants were removed from the flowerpots and measured. The morphological characteristics were registered: length and weight of root and shoot, number of leaves and inflorescences, ear weight.

One-way ANOVA and post hock comparison of Tukey's HSD test were used for data processing to evaluate the influence of each saline soil on growth and development of Large crabgrass plants. All the statistical tests were performed at the 0.05 level of statistical significance.

3. Results and discussion

Analysis of variance results revealed that increasing salinity reduces growth of Large crabgrass plants. Significant differences between control sample and treatment samples were found (Tab. 1). No differences were calculated between control sample and plants growing in saline soil with saline solution of 0.12% NaCl. The strongest growth inhibition was found in soil salinity of 1.96%. The plants were small, dried biomass was low, leaves was greyish green, but some plants flowered and produced seeds.

Soil salinity is a widespread problem that restricts plant species growth and agriculture production in many areas (Apse et al. 1999). Salt tolerance is the ability of plants to survive and grow under saline soil conditions. Salt tolerance is a variable trait that depends on many factors, above all on a taxonomic affiliation (Volkmar et al. 1998). Plants generally vary in response to soil salinity and Large crabgrass is not registered as a salt-tolerant plant species (Ellenberg et al. 1992).

Our preliminary results from manipulative experiment in greenhouse show that the Large crabgrass is able "to grow normally" in a contaminated saline soil, if the concentration of NaCl is 0.12%. Higher concentration of NaCl is closed with significant lower length/weight of root and shoot. Some of the plants growing in soil with concentration of 1.96% NaCl flowered and produced seeds.

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