

Germination profiling of pumpkin genotypes under salinity stress



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Introduction

Salinity is one of the most severe environmental stresses, limiting growth productivity of several important crop species, including pumpkin. Its detrimental effects on plant growth, development and metabolism are observed at the whole-plant level and occur as a consequence of several alterations at essential physiological and biochemical processes. Given that vegetable crops, including pumpkin, are relatively sensitive to increased salinity, the release of salt-tolerant cultivars is the most substantial means to enhance productivity in saline soils, this study aimed at investigating the response of pumpkin germplasm to salinity stress at germination stage.

Materials and Methods

The genetic material consists of seven pumpkin genotypes, including two commercial varieties (Fytro FS 243 and Big Max) and five local landraces (1, 2, 3, 4, 5). Salinity stress was conducted by the addition of NaCl at three different levels of stress: 100, 200 and 300 mM, whereas non-stressed plants were also included as controls. Plants were grown under controlled conditions (25°C, 16 h light/8 h dark) for a period of 20 days. All analyses were performed on 4 independent biological replications, each consisting of 30 seeds. Resistance evaluation was performed on a daily basis and referred to the following traits: germination percentage, seed water absorbance, root and shoot length, seedling water content, seedling vigor index and number of seedlings with abnormal phenotype. Data were separately analyzed by ANOVA, combining NaCl concentrations and genotypes, while differences between means were compared by the LSD test ($p \leq 0.05$).

Percentage of water uptake (WU %) in relation to genotype (G) and salinity stress (mM of NaCl) at the 1st day after stress initiation.

Day	Genotype (G)	NaCl (mM) (C)				Mean (G)
		0	100	200	300	
1 st						
	FYTRO FS 243	116.67abc	83.33b	75.00bc	83.33ab	89.58b
	Local landrace 1	139.29a	110.72a	107.14a	100.00a	114.28a
	BIG MAX	87.50d	50.00c	37.50d	54.17cd	57.29c
	Local landrace 2	135.00ab	95.00ab	70.00c	70.00bc	92.50b
	Local landrace 3	78.12d	50.00c	34.37d	31.25d	48.43c
	Local landrace 4	100.00cd	100.00ab	100.00ab	87.50ab	96.87b
	Local landrace 5	112.50bc	93.75ab	106.25a	100.00a	103.12ab
	Mean (C)	109.87a	83.25b	75.75b	75.17b	

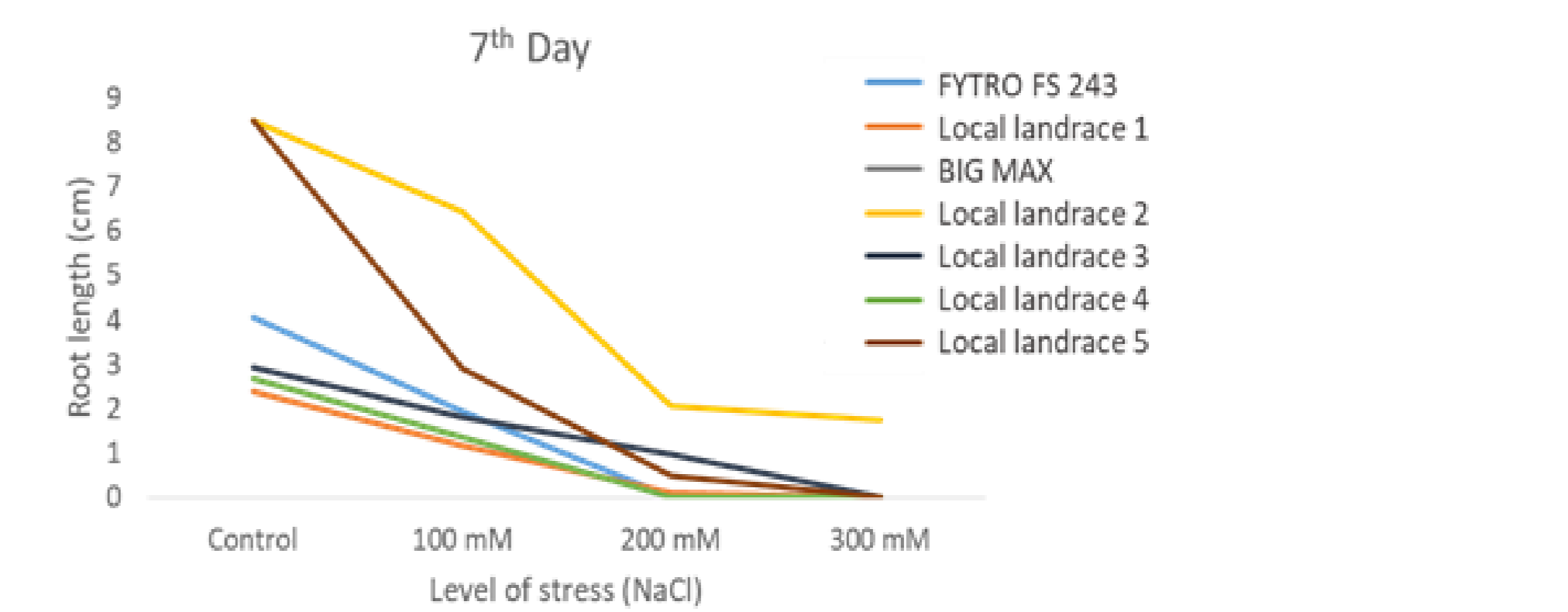
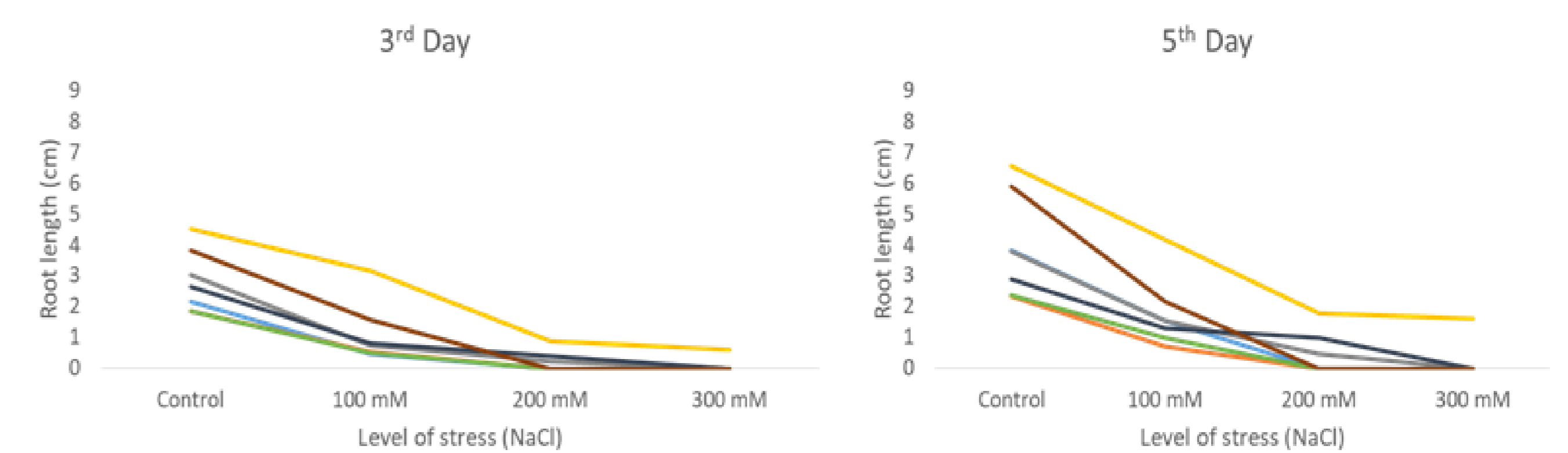
Percentage of water uptake (WC %) in relation to genotype (G) and salinity stress (mM of NaCl) 15 days after stress initiation.

Day	Genotype (G)	NaCl (mM) (C)				Mean (G)
		0	100	200	300	
15 th						
	FYTRO FS 243	1054.16a	1266.66a	0.00b	-	580.20a
	Local landrace 1	440.47c	497.50cd	0.00b	-	234.49bc
	BIG MAX	1626.50a	783.33bc	300.00a	-	511.45ab
	Local landrace 2	1055.83a	920.83bc	0.00b	-	569.16a
	Local landrace 3	766.66b	500.00cd	0.00b	-	316.66abc
	Local landrace 4	407.14c	333.33d	0.00b	-	185.11c
	Local landrace 5	762.50b	833.33bc	0.00b	-	398.95abc
	Mean (C)	821.32a	733.57a	42.85b	-	

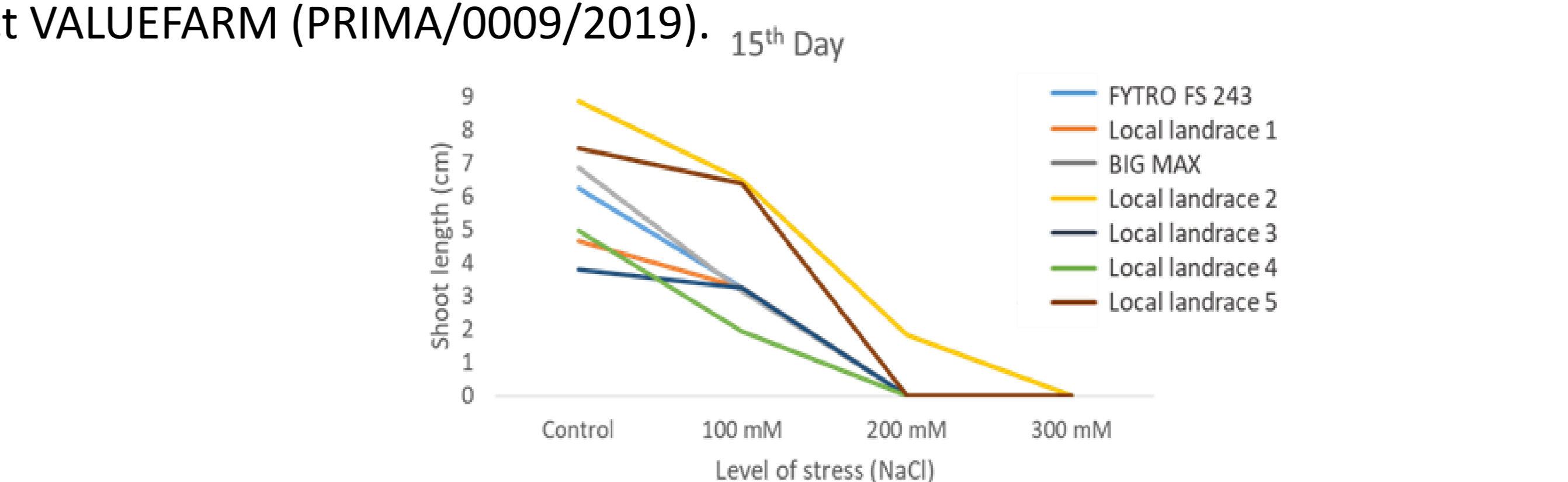
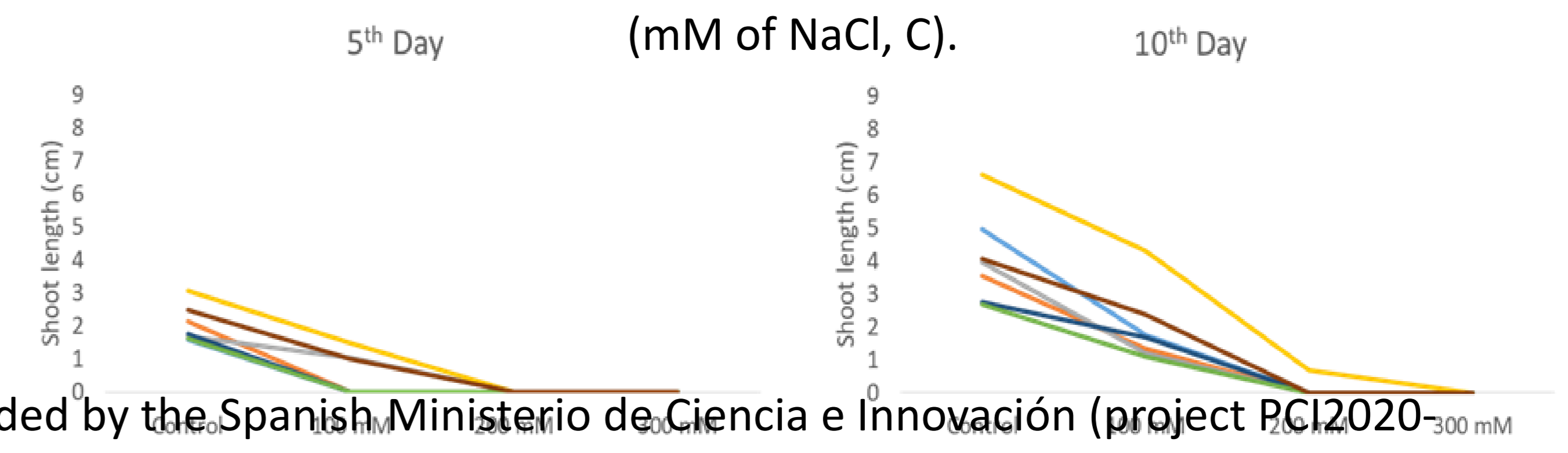
Seedling vigour index (SVI %) in relation to genotype (G) and salinity stress (mM of NaCl) 7 days after stress initiation

Day	Genotype (G)	NaCl (mM) (C)				Mean (G)
		0	100	200	300	
7 th						
	FYTRO FS 243	348.00b	57.00de	0.00b	-	101.25b
	Local landrace 1	153.75c	35.50de	0.00b	-	47.31b
	BIG MAX	395.00b	114.25c	0.00b	-	127.31b
	Local landrace 2	662.50a	430.00a	41.50a	-	283.50a
	Local landrace 3	96.25c	73.75cd	0.00b	-	50.62b
	Local landrace 4	129.50c	11.00e	0.00b	-	35.12b
	Local landrace 5	379.25b	207.50b	0.00b	-	146.68b
	Mean (C)	313.82a	132.71b	5.92c	-	

Values followed by the same letter, within each factor, are not significantly different according to LSD ($P \leq 0.05$).



Root length at day 3, 5 and 7 in relation to genotype (G) and salinity stress level (mM of NaCl, C).



Shoot length at day 5, 10 and 15 in relation to genotype (G) and salinity stress level (mM of NaCl, C).

Results and Discussion

Salinity stress affected all traits associated with germination and seedling growth, with its effects being analogous to the stress level applied. However, genotypes differed significantly in their response to the varying salinity levels, thus pointing to the existence of considerable genetic variation related to salt tolerance at germination stage. In this context, landrace 2 proved the most salt-tolerant genotype. Overall findings, underline the feasibility to employ such screening approach for the selection of salt tolerant pumpkin germplasm for cultivation in saline soils or exploitation as valuable breeding material.

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