THE INFLUENCE OF SALT STRESS ON STOMATAL CONDUCTANCE OF SOME TOMATO LOCAL CULTIVARS FROM N-E ROMANIA

INFLUENŢA STRESULUI SALIN ASUPRA CONDUCTANŢEI STOMATICE LA UNELE POPULAŢII LOCALE DE TOMATE DIN NORD-ESTUL ROMÂNIEI

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Abstract: *The stomata are some of the most interesting structures of plants. They control transpiration and absorption of carbon dioxide, but also react both to light and to the internal water balance of plants. The research was conducted under greenhouse condition. The biological material was represented by six local tomatoes populations collected from areas with saline soils from Moldavia region and compared with commercial type salt-tolerant tomato. Tomato genotypes in the study were subjected to salt stress for a period of 30 days is constantly wetted with saline solution to a concentration of 100 mM and 200 mM. The stomatal conductance was determinated whit a porometru. By direct measurements on leaves can learn important information on plant water stress, photosynthetic capacity or gas exchange with the atmosphere (O_2/CO_2). As a response to osmotic stress salt component to reduce transpiration stomata are partially closed. Stomata movements are affected by the osmotic effect of salt stress.*
Key words*:* salinity, stress, tomatoes, stomata, resistance

Rezumat: *Stomatele reprezintă unele dintre cele mai interesante structuri ale plantelor. Ele controlează transpiraţia şi absorbţia bioxidului de carbon, dar totodată reacţionează atât faţă de lumină cât şi faţă de bilanţul intern al apei din plante. Au fost luate în studiu 6 genotipuri de tomate colectate din solurile saline ale Moldovei şi un soi comercial rezistent la salinitate. Acestea au fost expuse stresului salin pe o perioadă de 30 de zile, fiind udate constant cu soluţii saline de concentraţie 100 mM şi 200 mM. Conductanţa stomatică foliară a fost determinată cu ajutorul porometrului. Prin măsurători directe asupra frunzelor se pot afla informaţii deosebit de importante referitoare la stresul hidric al plantelor, capacitatea de fotosinteză, sau schimbul de gaze cu atmosfera (O_2/CO_2). Ca o reacţie la componenta osmotică a stresului salin, pentru reducerea transpiraţiei stomatele sunt parţial închise. Mişcările stomatelor sunt afectate de efectul osmotic al stresului salin.*
Cuvinte cheie: salinitate, stres, tomate, stomată, rezistenţă

INTRODUCTION

Salinity is a major constraint to plant production in the arid and semiarid regions. Low rainfall, high surface evaporation, irigation with saline water and poor irrigation practices increase level of salinity in soil. The majority of plants with economic impoetance are susceptible to salinity at diferent levels. Salinity stress affects plant by lowering water potential of root medium leading to water deficit, toxic effects of ions, mainly Na^+ and Cl^-

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and imbalance in nutrient uptake or transport to shoot (Munns and Termaat, 1986; Lauchli, 1986; Marchner, 1995; Iknur *et. al*., 2011). Regulation of stomatal closing/opening is an important physiological event under salinity and drought stress. Lack of anability to close stomata under saline conditions has been proposedas an important reason for sensitivity to saline soils in some plants (Iknur *et. al.,* 2011).

The stomata are some of the most interesting structures of plants, not only because they control transpiration and absorption of carbon dioxide, but because they both react to light and to the internal water balance of plants. Whatever type of sweating discussed the positive effects of this process are found in plant life, and could nominate them as follows: cooling effect of the system foliar effect of water absorption and maintain turgor cells and effect on the absorption of mineral salts (Gâdea, 2009).

Stomatal cells functions as a hydraulic valve. Because to the unequal thickening of the cell walls when stomatal cells absorb water and become turgid, stomata open and when they lose water and become flaccid, stomata close (Toma and Jităreanu, 2007). Foliar gas exchange is performed by stomatal movements. This is crucial for the acquisition of carbon dioxide, which is directly linked photosynthetic biomass production and control transpiration to maintain fluid balance (Bartha, 2012).

MATERIAL AND METHOD

The research was conducted under greenhouse condition from USAMV Iaşi during the years 2014-2015. The biological material was represented by six local tomatoes populations collected from areas with saline soils from Moldavia region and compared with commercial type salt-tolerant tomato (*Ursula* $_{F1}$) from Israel. The bifactorial experience was conducted in a pots experiment in randomized blocks with four repetitions. Six tomato genotypes (*Moşna* $_{2}$, *Şcheia*, *Copalău* $_{3}$, *Copalău* $_{4}$,*Copălău* $_{5}$, *Moşna* $_{3}$) studied were subjected to salt stress for a period of 30 days is constantly wetted with saline solution to a concentration of 100 mM and 200 mM. The stomatal conductance was determinated whit a porometru. This device is used for measuring the flow of water vapor from the leaf stomata and the outside, which is a direct indication of the aperture and therefore the conductance of stomata. By direct measurements on leaves can learn important information on plant water stress, photosynthetic capacity or gas exchange with the atmosphere (O_2/CO_2). For interpretation of the results was used Anova Two Factor.

RESULTS AND DISCUSSIONS

Readings were made at 15 and 30 days of saline treatment application. The foliar stomatal conductance both after 15 days (fig. 1) and after 30 days (fig. 2) from the application of treatment saline was reduced in all seven genotypes of tomato under study, with the exception of genotype resistant to salinity *Ursula* $_{F1}$ 200 mM and the genotype *Moşna* $_{2}$ of the same variant.

As a response to osmotic component of salt stress to reduce transpiration, stomata are partially closed. Stomatal movements affect the supply of carbon dioxide and therefore have established a balance between reducing transpiration and providing carbon dioxide. Because the stomatal movements are affected by osmotic effect of salt stress (Munns and Tester, 2008), we conclude that genotypes *Moşna* $_{2}$ and *Ursula* $_{F1}$ shows better tolerance to osmotic stress, compared with other genotypes. Please note that after 30 days of exposure to salt stress induced by 100 mM *NaCl* and 200 mM *NaCl* have not been observed symptoms of stress ion, such as senescence, premature leaf or symptoms of toxicity (chlorosis, necrosis).

Similar results have been shown in the literature to salad (Bartha, 2012), corn and beans (Stefarţă *et al.,* 2013).

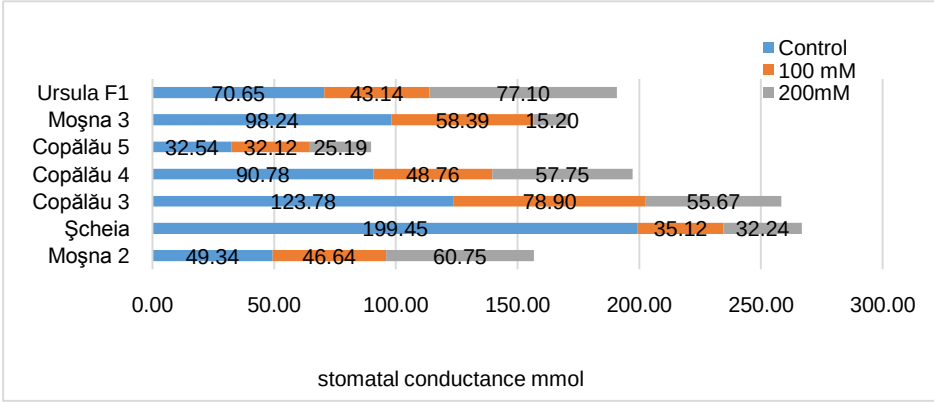

Fig. 1 The 15 days effect of the saline stress on the foliar stomatal conductance on tomato

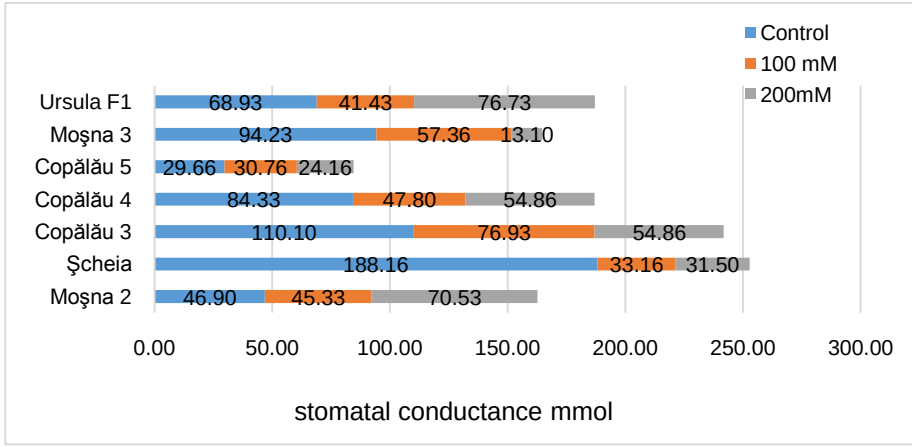

Fig. 2 The 30 days effect of the saline stress on the foliar stomatal conductance on tomato

Table 1.

The variance analysis of the tomato genotypes under stress salinity of stomatal conductance after 15 days

Source of variance	SP	GL	MS	F	P-value	F crit	Influence
Genotype	7364.02	6	1227.33	0.95216	0.49497	2.99612	NS
Concentration	10479.2	2	5239.61	4.06487	0.04488	3.88529	*
Error	15467.9	12	1288.99				
Total	33311.2	20					

Anova Two- Factor: ^{NS} insignificant statistical differences ($p \geq 0,05$); * significant statistical differences ($p \leq 0.05$); ** distinctly significant statistical differences ($p \leq 0,01$); *** highly significant statistical differences ($p \leq 0.001$), F> F crit null hypothesis rejected

Table 2

The variance analysis of the tomato genotypes under stress salinity of stomatal conductance after 30 days

Source of variance	SP	GL	MS	F	P-value	F crit	Influence
Genotype	6268.97	6	1044.82	0.85199	0.55498	2.996	NS
Concentration	8182.69	2	4091.34	3.33623	0.07044	3.885	NS
Error	14716	12	1226.33				
Total	29167.7	20					

Anova Two- Factor: ^{NS} insignificant statistical differences ($p \geq 0,05$); * significant statistical differences ($p \leq 0.05$); ** distinctly significant statistical differences ($p \leq 0,01$); *** highly significant statistical differences ($p \leq 0.001$), F> F crit null hypothesis rejected

Statistical analysis on the influence of salt stress on the stomatal conductance, highlights significant differences between genotypes of the same variants, both after 15 days and after 30 days of treatment application saline and significant differences between genotypes of the different variants, which suggests that salt stress significantly influences stomatal conductance (tab. 1, tab. 2).

CONCLUSIONS

Stomatal conductance decrease is a mechanism of resistance to salinity as it prevents water loss from plants.

As a response to osmotic component of salt stress to reduce transpiration, stomata are partially closed, so we can conclude that genotypes *Moşna* $_{2}$ and *Ursula* $_{F1}$ shows better tolerance to osmotic stress, compared with other genotypes.

Salt stress has a significantly influences stomatal conductance.

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