DYNAMICS OF THE FLAVONOIDS CONTENT IN SOME TOMATO CULTIVARS FROM NORD - EAST ROMANIA

EFECTUL STRESULUI SALIN ASUPRA DINAMICII CONȚINUTULUI DE FLAVONOIZI A UNOR POPULAȚII LOCALE DE TOMATE DIN NORD-ESTUL ROMÂNIEI

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Abstract. *The aims of the present work were to determine effects of salt stress on the flavonoids content in some tomato cultivars, to find the differeces of salt response in these cultivars. The impact of excess soil salinity on crop productivity is sometimes disastrous which results, in the identification and design of new genotypes of plants tolerant to osmotic stress conditions. Flavonoids, the most common group of polyphenolic compounds that are found ubiquitously in plants. The biological material was represented by local tomatoes populations collected from areas with saline soils from Moldavia region and compared with commercial type salt-tolerant tomato. The bifactorial experience was conducted in a pots experiment in randomized blocks with four repetitions. Ten tomato genotypes 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. Determination of flavonoids content of leaves was done by the spectrophotometric method. The results show that seven genotypes maintain a high level of flavonoids in the exposure of the two different solutions concentration compared to untreated.*
Key words: *Lycopersicon esculentum, salinity stress, flavonoids.*

Rezumat. *În cadrul acestui studiu a fost analalizat efectul stresului salin asupra conținutului de flavonoizi din frunzele unor genotipuri de tomate. Impactul salinității solului asupra productivității este de cele mai multe ori devastator, ceea ce duce la identificarea unor noi genotipuri de tomate rezistente la salinitate. Flavonoizii reprezintă grupul cel mai comun de compuşi polifenolici care se găsesc în plante. Materialul biologic a fost reprezentat de populații locale de tomate colectate din diferite areale cu soluri saline din regiunea Moldovei şi un soi martor rezistent la salinitate. Experiența de tip bifactorial cu 4 repetiții a fost înființată în vase de vegetație. Pentru o perioadă de 30 de zile, 10 genotipuri de tomate şi un soi rezistent la salinitate au fost supuse stresului salin. Plantele au fost udate cu soluție salină de 100 mM şi 200 mM. Metoda utilizată pentru determinarea conținutului de flavonoizi din frunze s-a realizat prin metoda spectrofotometrică. Rezultatele arată că la 7 genotipuri se menține un nivel ridicat de flavonoizi în cazul expunerii la cele două concentrații diferite de soluții saline față de varianta netratată.*
Cuvinte cheie: *Lycopersicon esculentum, stres salin, flavonoizi.*

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INTRODUCTION

Flavonoids, the most common group of polyphenolic compounds that are found ubiquitously in plants. These are widely distributed in plant fulfilling many functions. Flavonoids and other plant phenolics are especially common in leaves, flowering tissues and woody parts such as stems and bark. They are important in plant for normal growth development and defense against infection and injury. Flavonoids are the most important pigments for flower coloration producing yellow or red/blue pigmentation in petals (Khatiwora et. al., 2010).

Flavonoids represent one of the largest and most studied classes of phenylpropanoid-derived plant specialized metabolites, with an estimated 10.000 different members. Structurally, they consist of two main groups, the 2-phenylchromans (the flavonoids, including flavanones, flavones, flavonols, flavan-3-ols, and anthocyanidins) and the 3-phenylchromans (the iso- flavonoids, including isoflavones, isoflavans, and pterocarpans). Flavonoids act as attractants to pollinators and symbionts, as sunscreens to protect against UV irradiation, as allelochemicals, and as antimicrobial and antiherbivory factors. Their importance in plant biology goes beyond their specific functions within the plant (Dixon and Pasinetti, 2010).

In plants, polyphenol synthesis and accumulation is generally stimulated in response to biotic/abiotic stresses, such as salinity. Indeed, polyphenolic compounds participate in the defence against reactive oxygen species (ROS), which are inevitably produced when aerobic or photosynthetic metabolism is impaired by environmental stresses. Halophytes are naturally salt-tolerant plants that may be potentially useful for economical (oilseed, forage, production of metabolites) applications (Ksouri et. al., 2007).

To prevent the potential cytotoxic effects of ROS, the stimulation of antioxidant systems can assist in plant protection from oxidative stress. Plants have developed antioxidant enzymes such as superoxide dismutase, ascorbate peroxidase, glutathione reductase, catalase, peroxidase and non-enzymatic scavengers like glutathione, ascorbic acid, carotenoids and flavonoids which regularly maintain ROS balances within the cell. Flavonoids are reported as antioxidant agents by scavenging ROS, which are functioned by virtue of the number and arrangement of their hydroxyl groups attaches to ring structures. Their ability to act as antioxidants depends on the reduction potentials of their radicals and accessibility of the radicals (Chutipaijit et. al., 2009).

Some physiological responses to salt stress have been used in determining salt tolerance of plants. Plant hormone levels, antioxidant enzyme activities, pigment contents, osmotic potential reduction, gas exchange characteristics, total soluble protein contents and proline, amounts were determined in different tolerant and sensitive plant varieties at wide range of salt concentrations (Doganlar et. al., 2010). The reported results suggest that an increase of the total phenolic content in rice genotypes as a result of salt stress protects plants from oxidative damage. It was swon that the total flavonoid content increased in salt-stressed

seedlings of salt tolerant rice varieties by 6.34-7.31% and 1.72-3.48% in alt sensitive plants, which indicates that probably flavonoides similarly to proline compounds serve a protective role under stress conditions (Parvaiz, 2013).

MATERIAL AND METHOD

The research was conducted under greenhouse condition and the analysis in the Laboratory of Plant Physiology, Faculty of Agriculture, from USAMV Iaşi.

The biological material was represented by 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. Ten tomato genotypes (*Moşna* $_{2}$*, Şcheia, Dorohoi* $_{4}$*, Dorohoi* $_{6}$*, Dorohoi* $_{8}$*, Copalău* $_{2,}$ *Copalău*$_{3}$*, Copalău* $_{4}$*, Copalău* $_{5}$*, 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 (fig. 1).

For determination of photosynthetic pigments of leaves we used a UV spectrophotometer type – 1800. The content of chlorophyll pigments was assessed by light absorption ability of the acetone extract of pigments (1%) in the visible spectrum (320-325 nm).

Fig. 1 - The biological material for research (local tomatoes populations)

RESULTS AND DISCUSSIONS

After 15 days the application of saline treatments, the experimental results showed for the plants watered with water only, values of flavonoid

pigment content appreciated on the ability to absorb light in the 320 nm wavelengthn, between 0.66 and 3.23 a.u. In seven of the genotypes studied values between 1.93 and 3.23 a.u. are superior to the variety *Ursula* $_{F1}$, resistant to salinity. The exposure to 100 mM *NaCl* caused an increase of absorbance in 6 genotypes (*Ursula* $_{F1}$, *Copalău* $_{2}$, *Copalău* $_{3}$, *Copalău* $_{4}$, *Copalău* $_{5}$, *Moşna* $_{3}$), subjected to salt stress compared to the control which is between 2.20 and 3.26 a.u. and compared to salt-tolerant type *Ursula* $_{F1}$ (1.70 a.u.) 100 mM a single cultivar (*Moşna* $_{3}$) showed higher values, namely 3.26 a.u. The others 9 genotypes had lower values between 1.70 and 3.13 a.u. The exposure to 200 mM *NaCl* caused an increase of absorbance values at 7 genotypes (*Ursula* $_{F1}$, *Dorohoi* $_{8}$, *Copalău* $_{2}$, *Copalău* $_{3}$, *Copalău* $_{4}$, *Copalău* $_{5}$, *Moşna* $_{3}$) subject to salt stress compared to the control which is between 2.10 and 3.23 u.a, and compared to salt-tolerant type Ursula F1 (2.63 a.u.) 200 mM, 4 genotypes (*Şcheia, Dorohoi* $_{4}$, *Dorohoi* $_{6}$, *Dorohoi* $_{8}$) showed higher values between 2.86 and 3.23 a.u. It is noted these genotype: *Ursula* $_{F1}$, *Copalău* $_{2}$, *Copalău* $_{3}$, *Copalău* $_{4}$, *Copalău* $_{5}$, *Moşna* $_{3}$ maintain a high level of flavonoids in the exposure of two different saline concentrations compared untreated variant (fig. 2).

After 30 days the application of saline treatments, the experimental results showed for the plants watered with water only, values of flavonoid pigment content appreciated on the ability to absorb light in the 320 nm wavelengthn, between 0.00 and 3.30 a.u. In 3 of the genotypes studied values between 2.90 and 3.30 a.u. are superior to the variety *Ursula* $_{F1}$ (2.86 u.a).

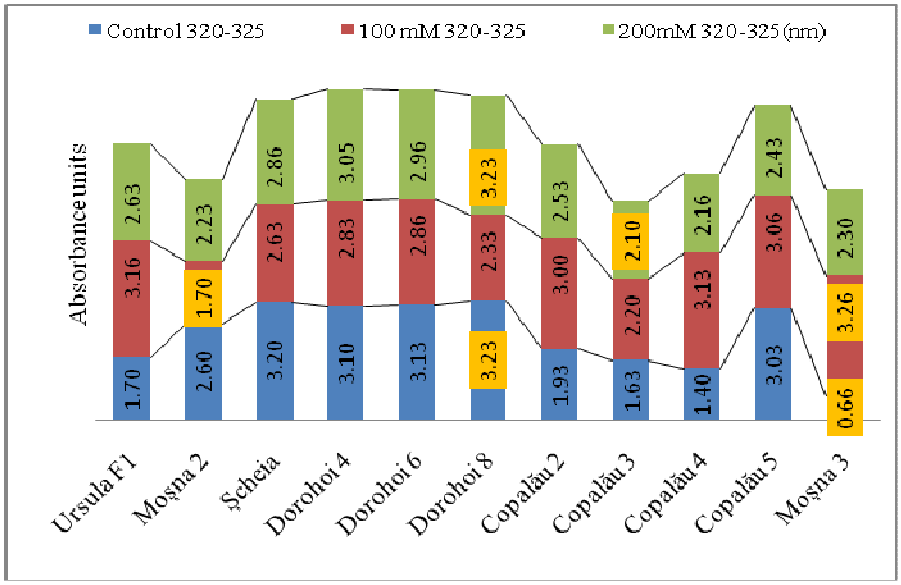

Fig. 2 - The content of flavonoid, after 15 days of saline treatment

The exposure to 100 mM *NaCl* caused an increase of absorbance in all genotypes subjected to salt stress compared to control and to *Ursula* $_{F1}$ values is the same for all genotypes, namely 4.00 a.u.

The exposure to 200 mM *NaCl* caused an increase of absorbance in 9 genotypes compared to control, with values between 2.73 and 3.56 a.u. A single genotype (*Copalău* $_5$) with a value less than the correspondent untreated variant. Compared with *Ursula* $_{F1}$ (3.30 a.u.) 200 mM, 7 genotypes (*Şcheia, Dorohoi* $_4$, *Dorohoi* $_6$, *Dorohoi* $_8$, *Copalău* $_3$, *Copalău* $_4$, *Moşna* $_3$) showed the hight values between 3.33 and 3.56 a.u. (fig. 3).

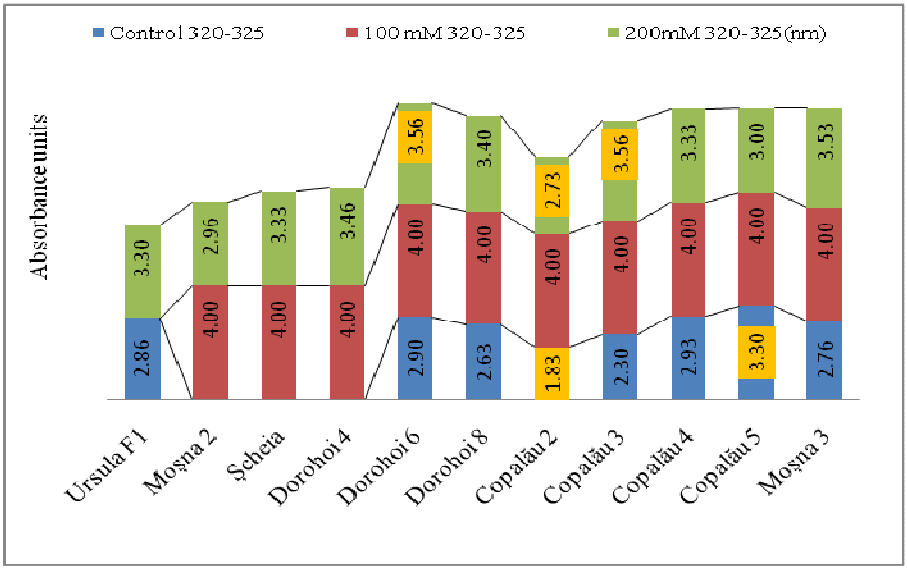

Fig. 3 - The content of flavonoid, after 30 days of saline treatment

CONCLUSIONS

After 15 days of saline treatment it is noted that's genotype: *Ursula* $_{F1}$, *Copalău* $_2$, *Copalău* $_3$, *Copalău* $_4$, *Copalău* $_5$, *Moşna* $_3$ maintain a high level of flavonoids in the exposure of two different saline concentrations compared untreated variant.

After 30 days of saline treatment the exposure to 100 mM *NaCl* caused an increase of absorbance in all genotypes subjected to salt stress compared to control and the exposure to 200 mM *NaCl* caused an increase of absorbance in 9 genotypes compared to control.

Compared with commercial type salt-tolerant tomato (*Ursula* $_{F1}$) after 15 days of saline treatment , 5 genotypes (*Moşna* $_3$, *Şcheia, Dorohoi* $_4$, *Dorohoi* $_6$, *Dorohoi* $_8$) showed a higher level of the flavonoid contents and after 30 days it is noteds that the exposure to100 mM *NaCl* showed a higher level for the all ten

genotypes. The exposure to 200 mM, showed a higher values for 7 genotypes (*Şcheia, Dorohoi $_4$, Dorohoi $_6$, Dorohoi $_8$, Copalău $_3$, Copalău $_4$, Moşna$_{3)}$* .

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