Current Trends in Natural Sciences Vol. 8, Issue 15, pp. 64-67, 2019

Current Trends in Natural Sciences (on-line)
ISSN: 2284-953X
ISSN-L: 2284-9521

Current Trends in Natural Sciences (CD-Rom)
ISSN: 2284-9521
ISSN-L: 2284-9521

THE ROLE OF NATURAL EXTRACTS AS ALLEVIATORS OF SALT STRESS IN PLANTS

Monica Popescu [1,*]

[1] University of Piteşti, Faculty of Science, Physical Education and Informatics, Department of Natural Sciences, Târgu din Vale St. 1, 110040, Piteşti, Romania

Abstract
More and more cultivated areas are affected by high salt content. Natural extracts such as seaweed extracts or extracts obtained from different plant organs often enhancing growth, and ability to tolerate abiotic stress. Carrot roots extract or garlic extracts are some of the natural biostimulant compounds. Extracts from different kinds of plant material contain vitamins or precursors of vitamins, organic acids, phenolic compounds, hormones, which may be responsible for stimulating growth and increasing stress tolerance. In our work we investigated the response of seeds treated with natural extracts, under salt stress conditions (100 mM NaCl). Depending on the species and the concentration of the extracts, the germination and growth parameters showed significantly improved values, compared to the soaked seeds in the saline solution.

Keywords: carrot roots extract, garlic extract, seaweeds extract, salt stress.

1. INTRODUCTION

More and more cultivated areas are affected by high salt content. Natural extracts such as seaweed extracts or extracts obtained from different plant organs often enhancing growth, and ability to tolerate abiotic stress. Carrot roots extract or garlic extracts are some of the natural biostimulant compounds. Extracts from different kinds of plant material contain vitamins or precursors of vitamins, organic acids, phenolic compounds, hormones, which may be responsible for stimulating growth and increasing stress tolerance. Using some antioxidant products: ascorbic acid, α-tocopherol, humic acid, seaweed extract, salicylic acid, Sakr and Amal El-Mahdy (2010) demonstrated that these materials alleviate the harmful effect of high soil salt stress on growth of maize plants.

Carrot roots have been successfully tested to reduce salt stress in different plant species. Carrot roots extract contain vitamin A, B1, B2, B6, C, D, E, protein, carbohydrates, fat. Components such as polyacetylenes, carotenoids, starch and pectin have a distribution that varies among carrot cultivars, and Baranska et al. (2005) observed a significant difference between cultivated and wild carrot. Some researchers have shown that carrot roots contain substances that explain the role of carrot extract in salinity tolerance (Abbas and Akladious, 2013).

Marine bioactive substances extracted from seaweeds are used for a long time to improve plant productivity (Popescu, 2013). Seaweeds extract obtained from *Ascophyllum nodosum* have been used both to improve the growth and production parameters, but also to decrease the oxidative stress produced by abiotic stress (Popescu and Popescu, 2014; Popescu, 2016)

*Corresponding author, E-mail address: monica_26_10 @yahoo.com

Current Trends in Natural Sciences (on-line)
ISSN: 2284-953X
ISSN-L: 2284-9521

Current Trends in Natural Sciences (CD-Rom)
ISSN: 2284-9521
ISSN-L: 2284-9521

Galic cloves contain volatile oil which is responsible for its pharmacological properties. But, garlic has been succssefully used to reduce the negative effects of abiotic or biotic stress in plants (Alghabari, 2015; Kasim et al., 2017; Hayat et al, 2018).
The aim of this study was to determine the effect of 100 mM level of saline stress on the seeds germination and seedlings growth in tomato, pepper and pumpkin, and to evaluate the role of germination of seeds in solutions with garlic, carrot and seaweeds extracts in the alleviation of harmful salt effects.

2. MATERIALS AND METHODS

Two laboratory experiments were performed at Plant Physiology Laboratory, University of Pitesti.
For the first experiment we used tomato seeds, which were placed in Petri dishes, on filter paper soaked in: distilled water, 100 mM NaCl solution, 100 mM NaCl solution and carrot roots extract 30%, carrot roots extract 30%, 100 mM NaCl solution and seaweeds extract (SuperFifty) 1:1000, seaweeds extract (SuperFifty) 1:1000.
For the second experiment we used pepper and pumpkin seeds, on filter paper soaked in: distilled water, 100 mM NaCl solution, 100 mM NaCl solution and garlic extract, and garlic extract.
Both experiments were performed in three repetitions (three Petri dishes for each variant), with 20 seeds in each.
To obtain the carrot extract we proceeded as follows: 100 g carrot roots from the market was sliced and blended with 160 distilled water and 160 ml of ethanol. These were filtered with Whatman filter paper and distilled water was added up to a concentration of 30%.
SuperFifty is a concentrated extract of seaweeds with antioxidant activity. We used the concentration of 1:1000, considering the results of the previously published study (Popescu, 2016).
Garlic extract was prepared according to this method: first step was to crush a few garlic cloves into a paste in the mortar with pestle. This pasta was filtered with Whatman filter paper and distilled water was added up to a concentration of 30%.
For all experimental variants, from the two experiments, were made determination of germination rate, roots and shoots length of seedlings.
Experimental dates were statistically analyzed using analysis of variance, and means were compared using Duncan test (significance level: 0.05).

3. RESULTS AND DISCUSSIONS

The salt stress determined by the concentration of 100 mM NaCl caused the reduction of germination rate in tomato seeds from 81.66% to 8.33% (table 1). Even if the seaweeds extract did not stimulate the germination of tomato seeds, adding in the germination medium of the seeds maintained in the presence of sodium chloride resulted in a significant reduction of salt stress. Seaweeds extracts contain most of the major and minor nutrients, amino acids and vitamins, cytokinins, auxin, gibberellic acids and other growth substances, and, due to the presence of these substances, that extracts can alleviate the harmful effect of salinity stress, or another forms of abiotic stress (Sakr and El-Mahdy, 2010).
Regarding the length of roots and shoots of tomato seedlings, the seaweeds extract did not significantly influence their growth. But, the SuperFifty 1:1000 added in the medium with 100 mM NaCl resulted in a significant improvement in these growth parameters, which had been significantly inhibited by salt stress (table 1).

*Corresponding author, E-mail address: monica_26_10 @yahoo.com

Current Trends in Natural Sciences (on-line)
ISSN: 2284-953X
ISSN-L: 2284-9521

Current Trends in Natural Sciences (CD-Rom)
ISSN: 2284-9521
ISSN-L: 2284-9521

The seeds maintained in the presence of carrot extract 30% did not germinate (table 1). In this case, research should be continued using lower concentrations, controlling the pH level and carrying out tests on other plant species.

Carrot roots extract contain several compounds which contribute to the anti-oxidative effect. Salt stress determines oxidative stress. Under salt stress, in presence of carrot roots extract, the level of antioxidant compounds content from cowpea seedlings (anthocyanins, ascorbic acid, flavonoids and phenol compounds) was increased (Abbas and Akladious, 2013). These authors demonstrated that low concentration of carrot roots extract was more effective in alleviating of salt stress in cowpea.

Table 1. Effect of seaweeds and carrot roots extracts on the germination rate and growth of tomato seedlings germinated under salt stress

NaCl concentration	Extract and concentration	Germination rate (%)	Shoot length (cm)	Root length (cm)
0 mM	0	81.66±2.886 a	1.991±0.731 a	6.22±1.816 a
	Seaweeds extract 1:1000	80.00±8.660 a	2.752±1.221 a	5.186±1.677 a
	Carrot roots extract 30%	0±0 c	0±0 c	0±0 b
100 mM	0	8.33±5.773 c	0.64±0.337 bc	1.39±0.664 b
	Seaweeds extract 1:1000	31.66±2.886 b	1.666±0.288 ab	1.533±1.361 b
	Carrot roots extract 30%	0±0 c	0±0 c	0±0 b

Data are reported as means ±standard deviations. Means were compared by Duncan test, different letters indicate a significant difference at $p<0.05$.

Table 2. Effect of garlic extract on the germination rate and growth of pepper and pumpkin seedlings germinated under salt stress

Species	Germination medium	Germination rate (%)	Root length (cm)	Shoot length (cm)
Pepper	Distilled water	95.00±5.000 a	4.371±1.867 a	3.253±1.500 a
	100 mM NaCl	78.33±7.637 b	0.25±0.051 c	0.012±0.033 c
	100 mM NaCl and garlic extract 30%	81.66±7.637 b	0.733±0.547 c	0.214±0.417 c
	Garlic extract 30%	86.66±5.773 ab	3.23±2.274 b	2.534±1.716 b
Pumpkin	Distilled water	85.00±5.000 a	5.818±4.484 a	5.054±2.910 a
	100 mM NaCl	40.00±5.000 c	4.34±3.195 a	3.44±2.329 b
	100 mM NaCl and garlic extract 30%	61.66±2.886 b	3.595±2.831 a	2.666±1.758 b
	Garlic extract 30%	85.00±5.000 a	3.873±3.096 a	3.088±2.772 b

Data are reported as means ±standard deviations. Means (for the same species) were compared by Duncan test, different letters indicate a significant difference at $p<0.05$.

The NaCl 100 mM solution caused a significant inhibition ($p<0.05$) of the germination rate of the seeds of pepper and pumpkin. Also, the growth of the roots and shoots of the seedlings has significantly smaller dimensions compared to the seedlings grown in distilled water (table 2). Garlic extract (30%) did not produce significant changes ($p<0.05$) in the germination rate in pepper and

http://www.natsci.upit.ro

*Corresponding author, E-mail address: monica_26_10 @yahoo.com

Current Trends in Natural Sciences (on-line)
ISSN: 2284-953X
ISSN-L: 2284-9521

Current Trends in Natural Sciences (CD-Rom)
ISSN: 2284-9521
ISSN-L: 2284-9521

pumpkin. Garlic extract inhibited the growth of roots and shoots in pepper seedlings, as well as the growth of pumpkin seedlings shoots. The garlic extract (30%) added in the germination medium with 100 mM NaCl solution had a salt stress reduction effect only in the case of germination rate of the pumpkin seeds.

Other authors noted an improvement in growth parameters in the presence of garlic extract. The enhancement of growth parameter of *Vicia faba* seeds with garlic and carrot extracts may be due to the presence of vitamins, auxin substances, gibberellic acids, cytokinins, K, P, Mg and Zn (Kasim et al., 2017). The results obtained by Hayat et al. (2018) revealed stimulatory responses in the growth of the growth of the eggplant and pepper seedlings and significant alterations in chlorophyll, carotenoids and soluble sugars. Exogenous foliar application of garlic extract at reproductive stages depicted remarkable recovery by alleviating salinity induced negative effects (Alghabari, 2015).

4. CONCLUSIONS

Concentration of 1:1000 SuperFifty added in the germination medium with 100 mM NaCl resulted in a significant improvement in growth parameters of seedlings, which had been significantly inhibited by salt stress.

The seeds maintained in the presence of carrot extract 30% did not germinate and research should be continued using lower concentrations and controlling the pH level.

The garlic extract (30%) added in the germination medium with 100 mM NaCl solution had a salt stress reduction effect only in the case of germination rate of the pumpkin seeds.

5. REFERENCES

Alghabari, F. (2015) Exogenous applied Allium sativum alleviate salinity induced stress in late sown wheat and alfalfa. *Scientia Agriculturae, 11(2)*, 69-75.

Abbas, S.M., Akladious, S.A. (2013). Application of carrot root extract induced salinity tolerance in cowpea (*Vigna sinensis* L.) seedlings. *Pakistan Journal of Botany, 45(3)*, 795-806.

Baranska, M., Schulz H., Baranski R., Nothnagel T., Christensen L.P., 2005, In situ simultaneous analysis of polyacetylenes, carotenoids and polysaccharide in carrot roots, *Journal of Agricultural and Food Chemistry, 53(17)*, 6565-6571.

Hayat, S., Ahmad, H., Ali, M., Hayat, K., Khan, M.A., Cheng, Z. (2018). Aqueous garlic extract as a plant biostimulant enhances physiology, improves crop quality and metabolite abundance, and primes the defense responses of receiver plants. *Applied Sciences, 8*, 1505.

Kasim W.A., Nessem, A.A., Gaber, A. (2017). Alleviation of drought stress in *Vicia faba* by seed priming with ascorbic acid or extracts of garlic and carrot. The 7th Inter. Conf. „Plant & Microbial Biotech. & their role in the development of the society, 45-59.

Popescu, G. C., Popescu, M. (2014). Effect of the brown alga *Ascophyllum nodosum* as biofertilizer on vegetative growth in grapevine (*Vitis vinifera* L.). *Current Trends in Natural Sciences, 3(6)*, 61-67.

Popescu, M. (2013). Agricultural uses of seaweeds extracts. *Current Trends in Natural Sciences, 2(4)*, 36-39.

Popescu, M. (2016). Comparative studies of seaweeds extract on seeds germination of tomato. *Current Trends in Natural Sciences, 5(10)*, 117-122.

Sakr, M.T., El-Mahdy A.A.A. (2010). Alleviation the harmful effect of soil salt stress on maize plant bz using some applied antioxidants. *Journal of Plant Production. 1(3)*, 405-415.

*Corresponding author, E-mail address: monica_26_10 @yahoo.com