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Effect of Salicylic Acid and Salinity on Some Morphological Characteristics of *Aloe vera*

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Abstract: *Aloe vera* plant belongs to Liliaceous family and it is one of the important herbs. Importance of this plant is for its leaves and gel. Since salinity stress can be effective on the quality of some characteristics of *Aloe vera*, this study performed to investigate the effect of salicylic acid and salinity on some morphological characteristics of *Aloe vera* plant. Completely randomized factorial design with 3 replicates was used and data were analyzed by using the General Linear Model Procedure of SAS, 2001. Data from this study showed that salicylic acid and salinity had significant effect on biochemical and morphological characteristics for *Aloe vera*. Data showed that leaves diameter was affected by salinity and use salicylic acid (0.05 mm) could significant effect on leaves diameter, Also increase of salinity could reduce wet and dried gel weight, but the interaction between salinity and Salicylic acid (SA) could reduce salinity effects. In conclusion data showed that salicylic could damp some effect of salinity on *Aloe vera* plant.

Key words: *Aloe vera* · Salicylic Acid · Salinity · Morphological Characteristics

INTRODUCTION

Aloe vera L. is a perennial liliaceous plant with succulent green leaves joined at the stem in a whorled pattern. It is highly appreciated due to its short growth period and high economic value among all the aloe species and is used in pharmaceuticals, folk medicine, healthcare, cosmetic products and food products [1]. There is, however, little scientific evidence of the effectiveness or safety of *Aloe vera* extracts for either cosmetic or medicinal purposes and what positive evidence is available is frequently contradicted by [2], [3] and [4]. *Aloe*, an anti-oxidant rich plant, contains vitamins such as A, C and E plus the minerals, zinc and selenium. Anti-oxidants help boost the immune system and combat free radicals in the body. Another component of *Aloe vera* consists of the lignins, a major structural material of cellulose content that allows for penetrative properties. [5, 6]. *Aloe vera* contains salicylic acid which is an aspirin-like compound with anti-inflammatory, analgesic and anti-bacterial properties. It has anti-pyretic properties for reducing fevers. Other constituents of *Aloe vera* would include prostaglandins, tannins, magnesium lactate, resins, mannins and proteins such as lectins, monosulfonic acid and gibberlin [7, 8]. Salt stress is a limiting factor of plant growth and yield and becoming a serious problem in the world [9, 10, 11]. Salinity stress is one of the most important abiotic factors that it can reduce the growth on dry and semi-dry plants [12, 13, 14, 15, 16, 17]. Since, there are many dry lands are available in Iran study about salinity for growth factor is important. Salicylic acid (SA) is a mono hydroxy benzoic acid, a type of phenolic acid and a beta hydroxy acid [4, 18]. This colorless crystalline organic acid is widely used in organic synthesis and functions as a plant hormone. SA is a phenolic phytohormone and is found in plants with roles in plant growth and development, photosynthesis, transpiration, ion uptake and transport. SA also induces specific changes in leave anatomy and chloroplast structure. SA is involved in endogenous signaling, mediating in plant defense against pathogens [19]. It is plays a role in the resistance to pathogens by inducing the production of pathogenesis-related proteins [20]. It is involved in the systemic acquired resistance in

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which a pathogenic attack on one part of the plant induces resistance in other parts. The signal can also move to nearby plants by salicylic acid being converted to the volatile ester, methyl salicylate [12]. SA which is produced by root cells plays a prominent role in various physiological processes such as plant's growth, ions uptake, photosynthesis and germination [18, 20]. Since SA is one of the important compounds to resistance from plant stress this study is about effect of salicylic acid and salinity on some morphological characteristics of *Aloe vera* plant.

MATERIALS AND METHODS

The experiment was conducted in a greenhouse during (2013-2014 season) in the Faculty of Agriculture, University of Khorasgan, Isfahan, Iran. This experiment was conducted in bi-factorial design in completely randomized design with three replications. At the end of experiment data were collected and analyzed by using the General Linear Model Procedure of (SAS, 2001). Differences between means were analyzed by Duncan's multiple ranges test and P value less than 0.05 was considered as significant [22].

Plant Material: Sprouts of *Aloe vera* with 12 cm length obtained in vitro culture used in this work.

Culture Conditions and Treatments: *Aloe* sprouts were cultured in greenhouse in pots with 20 cm diameter containing cocopeat and perlite and were irrigated with nutrient solutions containing different levels of NaCl (0, 24, 12 and 36 ds/m) and spraying Salicylic acid (0,0.5,1 and 1.5 mM) on leaves. After 9 month from growth period some characteristics such as leaves diameter and depth of them, wet gel weight, dry gel weight, gel pH and EC were evaluated.

RESULTS

Data showed that leaves depth in E0. S0 and E0. S0.5 was higher than other and leaves diameter was higher for E0. S1.5, E0. S1 and E12.S0.5, respectively ($p<0.05$). Also EC gel were higher when E24 and E36 were used. The pH was affected by of experimental treatments ($p<0.05$). Wet gel and dry gel weight were higher when E0. S0 and E0.S0.5 were applied and the minimum weight of wet and dried gel was for E36. S1.5 ($p<0.05$).

DISCUSSION

Salinity is one of the main problems which can negatively affect soil fertility and productivity. Salinity of soil can lead to osmotic stress, decrease in available water, ionic stress and cells' ionic imbalance. Salinity decreases germination, fresh and dry weight of radical and plumule in germination phase [14, 15, 16, 17].

Some researchers showed that the impact of salt stress has been correlated with some morphological and physiological traits like reduction in fresh and dry weight [1]. In fact, salinity affects plant metabolism by disturbing physiological and biochemical processes of plants due to ionic and osmotic imbalances which results in the reduction of plant growth and productivity [9]. The deleterious effects of salinity on plant growth are associated with low osmotic potential of soil solution, nutritional imbalance, specific ion effect, or a combination of these factors [4, 23]. Zan *et al.* [24], studying the physiological and ecological characters on Aloe Vera under seawater irrigation (EC= 23.4 dS m^{-1}) reported that salinity stress caused a decrease in tissue water, total soluble sugars and glucose. Moghbeli *et al.* [11], showed that salinity affected the number of leaves, plant height, number of sprout, root weight, plant weight, leaves weight, total gel weight and root dry weight.

Moghbeli *et al.* [11] had shown, salinity decreased plant leaves and roots growth and their dry matter all measured characteristics showed differences between control and 2,4,6 and 8 dS/m salinity. Zan *et al.* [24], indicated that salt stress led to decreasing TSS in both cultivars of *Aloe vera* and it is a limiting factor of plant growth and yield. Fuentes *et al*. [25] reported similar results and revealed that the height of leaves and sprouts reduced with increasing salinity in different *Aloe* spp. Senaratna *et al.* [26] reported that the effective dose of SA for alleviating the injury of tomato and bean plants under water stress, ranged from 0.1 to 0.5 mM.

Abdullahi *et al.* [1] showed that the comparison of means showed that the effect of various levels of salicylic acid on all characteristics was separate at different statistical levels.Salicylic acid is a phenolic substance. Phenols are defined as compounds with a hydroxyl group with active derivatives. Salicylic acid is found in many plants [18, 21, 19]. Talebi *et al.* [15] had shown treating the borage seeds with salicylic acid has increased root's fresh weight. Abdullahi *et al.* [1] showed that plant growth and plant gel TSS levels increased as a result of salicylic acid treatment. The axial role of salicylic acid in translating

Table 1: Mean comparison of morphological characteristics of *Aloe vera*

Treatment	Leaves depth	Leaves diameter	EC gel	pH	Wet gel weight	Dried gel weight
E0.S0*	0.40^{de}	14.26^{c}	3.34^{j}	4.76^{c}	11.58^{b}	1.51^{a}
E0.S0.5	0.40^{de}	15.76^{a}	2.74^{l}	4.64^{d}	13.06^{a}	1.14^{b}
E0. S1	0.13^{e}	14.41^{b}	2.76^{l}	4.74^{c}	8.70^{de}	0.60^{h}
E0. S1.5	0.17^{e}	15.76^{a}	3.22^{k}	4.94^{a}	7.45^{f}	1.02^{c}
E12.S0	0.63^{cd}	11.44^{d}	6.52^{h}	4.74^{c}	8.19^{ef}	0.93^{e}
E12.S0.5	0.63^{cd}	14.00^{c}	5.93^{i}	4.90^{a}	10.72^{c}	0.97^{d}
E12.S1	0.73^{cd}	11.31^{d}	5.92^{j}	4.75^{c}	4.26^{g}	0.79^{f}
E12. S1.5	0.80^{c}	9.68^{e}	6.52^{i}	4.82^{b}	8.77^{d}	0.78^{g}
E24. S0	1.80^{b}	8.57^{g}	7.94^{d}	4.61^{d}	1.72^{j}	0.20^{n}
E24. S0.5	2.20^{a}	6.81^{h}	7.32^{g}	4.84^{b}	4.31^{g}	0.27^{j}
E24. S1	1.83^{ab}	9.06^{f}	7.57^{e}	4.76^{c}	2.54^{i}	0.24^{l}
E24. S1.5	1.73^{b}	5.30^{i}	7.45^{f}	4.64^{d}	3.44^{h}	0.27^{i}
E36. S0	2.23^{a}	5.58^{i}	10.33^{a}	4.65^{d}	2.56^{I}	0.19^{o}
E36. S0.5	1.97^{a}	5.37^{i}	9.44^{c}	4.74^{c}	2.64^{i}	0.22^{m}
E36. S 1	2.23^{a}	4.55^{j}	9.74^{b}	4.65^{d}	2.79^{i}	0.25^{k}
E36.S1.5	1.77^{b}	4.89^{j}	9.45^{c}	4.64^{f}	1.38^{j}	0.16^{p}

* E = Salinity, S= Salicylic acid

messages as a defense response against pathogenic factors is well known.Salicylic acid also plays an active role in controlling transpiration, stomata closure, seed germination, fruit yield, glycolysis, flowering, heat generation and heat tolerance [20]. The role of salicylic acid in plant leaves and generative systems is well known and its highest level is found in tropical plants infected by necrotizing pathogens. The type of effect that salicylic acid had on plants provides a good indication that this substance increased the chlorophyll level and as a result the degree of photosynthesis, carbohydrate reserve, cellular division and leaf surface [1, 21, 25, 15].

CONCLUSION

Our findings demonstrate that salinity and salicylic acid had detrimental effect on *Aloe vera* characteristics as there were differences in biochemical characteristics and morphological characteristics on treats. Salicylic acids by synthesis some compounds maybe can induce effects by salinity stress.

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