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THE ROLE OF ASCORBIC AND SALICYLIC ACIDS IN MODYFING THE GROWTH AND CHEMICAL COMPOSITION OF SALT- STRESSEDKHAYA SENEGALENSIS SEEDLINGS

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ABSTRACT

The influence of ascorbic and salicylic acids in alleviating the adverse effects of soil salinity on growth and chemical composition of *Khaya senegalensis* seedlings was investigated.

Soil salinity, especially at the high level (0.7%) decreased different vegetative growth characters, namely, plant height, stem diameter , number of leaves and dry weight of leaves, stem and roots , as well as, chlorophyll a & b, carotenoids and leaves % of N, P and K. While, leaves % of Na, Ca and proline were increased due to salinity treatments. On the other side, ascorbic acid and salicylic acid, particularly, at the high concentration (200 ppm) each, improved all prementioned vegetative growth traits and leaves content of the three photosynthetic pigments and N, P and K %, meanwhile, leaves % of Na, Ca and proline were reduced. Both ascorbic acid and salicylic acid were effective in alleviating the harmful effects of salinity on growth and chemical constituents of *Khaya senegalensis* seedlings.

INTRODUCTION

Khaya senegalensis, A. Juss. (African mahogany) is one of the most important multipurpose woody trees. It belongs to family Meliaceae and native to tropical West Africa, Sudan and Uganda. It was introduced to Upper Egypt as it grows well as shade and avenue tree. It is 20- 30 m height with wide dense crown and thick trunk, clean bole 10- 15 m long. The timber is reddish brown, solid and yields hard, heavy and durable wood, which used in manufacturing furniture, musical instruments, lumber works, carts, ships, boats and boxes (Badran *et al*., 1978).

Salinity is considered significant factor affecting plant production and agricultural sustainability in many regions of the world. It occurs, mainly, in arid and semi- arid regions where the precipitation is not enough to leach the excess soluble salts from the root zone. Many authors reported that salinity, particularly at higher levels, caused reduction in various vegetative growth characters and different chemical constituents such as photosynthetic pigments and N, P and K %, but increased Na, Ca and proline % of different woody plant species. Examples of those authors are Mohamed, 2002; Al-Qubaie, 2002; Abd- Elnaeem *et al.,* 2006; Abd –El aziz *et al.,* 2006; Badran *et al.,* 2006 a & b; Nasr, 2009; Abdou *et al.,* 2010 and Hafez *et al.,* 2011.

Meanwhile, ascorbic acid and salicylic acid were found to enhance growth and chemical composition of different plant species. They are known to overcome or alleviate the adverse effects of salinity on plant growth and development. The role of ascorbic acid in promoting growth and chemical composition, but reducing leaves content of N, Ca and proline was revealed by Abd- Elaziz *et al*., 2006; Ahmed, 2007; Moustafa, 2008; El- Quesni *et al.,* 2009; Abdou *et al.,* 2010; Hafez *et al.,* 2011; Yazadanpanah *et al.,* 2011 and Abou- Leila *et al.,* 2012. Similar findings, regarding salicylic acid, were found by Moustafa, 2008; Al- Taey, 2010; Abdou *et al.,* 2010; Parizi *et al*., 2011; Yazadanpanah *et al.,* 2011 and Shekoofeh *et al.,* 2012. On the other side, the beneficial role of ascorbic and salicylic acid in alleviating or counteracting the harmful effects of salinity was indicated by Khodary, 2004; Abd- Elaziz *et al.,* 2006; Al- Taey, 2010; Hafez *et al.,* 2011; Parizi *et al.,* 2011; Ejaz *et al*., 2012; Enteshari & Sharifian, 2012 and Shekoofeh *et al.,* 2012.

MATERIALS AND METHODS

The present trial was carried out during the two successive seasons of 2010 and 2011 at the experimental farm, Fac. of Agric., Minia Univ. to explore the effect of soil salinity, as well as, ascorbic acid and salicylic acid on vegetative growth and chemical composition of *Khaya senegalensis* seedlings.

One- year old seedlings, with average height of 18 cm and stem diameter of 4 mm, were planted on the third week of March 2010 and 2011 for the first and second seasons by planting one seedlings in 25 cm square tin container filled with 10 kg sandy soil with physical and chemical properties shown in Table (a).

Table A: Physical and chemical analysis of the soil

Character	**1st season**	**2nd season**	**Soil properties**	**1st season**	**2nd season**
Sand %	81.70	82.30	Exchangeable K (milliequivalent/100 g soil)	0.60	0.64
Silt %	11.80	11.60	Available N %	0.06	0.06
Clay %	6.50	6.10	Available P %	3.50	3.45
Texture	Sandy	Sandy			
Org.matter %	0.30	0.28	Fe ppm	1.10	1.21
$CaCO_3$ %	14.30	14.40	DTPA Mn ppm	0.60	0.62
pH 1: 2.5	7.80	7.85	Ext. Zn ppm	0.30	0.33
CEC mg/ 100 g soil	9.20	8.25			

A complete randomized block design, in split plot layout with three replicates and five plants/ replicate is used. The main plot included four soil salinity levels (0, 0.3 , 0.5 and 0.7 %) prepared by mixing NaCl and $CaCO_3$, 1:1 by weight / 10 kg sandy soil for each container. While, the sub- plot assigned to ascorbic acid and salicylic acid each at 100 and 200 ppm and addition to control treatment. Both ascorbic and salicylic acids were foliar sprayed three times, 45 days from planting date with 3 week intervals . Irrigation was done according to the field capacity (4 liter / container) twice a week during March, April and May, then three times a week from June to Aug., and again twice a week during Sept. and Oct. for both seasons. All plants received general NPK fertilization at the rate of 6 g ammonium sulphate 20.5 % N, 6 g calcium superphosphate 15.5 % P_2O_5 and 3 g potassium suphate 48.5% K_2O/container. These fertilizer amounts were added on the second week of May and again on the second week of June and July for each season.

Vegetative data were recorded on the second week of Oct. for plant height, stem diameter (5 cm above soil surface), number of leaves/ plant and dry weights of leaves, stem and roots. In addition, chlorophyll a and b and carotenoids contents in leaves were determined on mid. Sept. for both seasons according to Fadl & Seri- Eldeen, 1978, while N, P , K , Na and Ca % in the leaves were determined following the method of Page *et al*., 1982. Meanwhile, proline % in the leaves was estimated according to method of Bates *et al*., 1973. All obtained data were subjected to statistical analysis (Little & Hills, 1978).

RESULTS

Vegetative Growth Characters:

Data in Tables 1 & 2 show that all vegetative growth characters, namely, plant height, stem diameter, number of leaves/ plant and dry weight of stem, leaves and roots of *Khaya senegalensis* seedlings were gradually decreased parallel to the gradual increase in soil salinity %. Significant differences were obtained between 0.5 and 0.7% soil salinity on one hand and control treatment on the other hand in both seasons. The harmful effects of salinity on different vegetative growth traits were revealed by Abd-Elnaeem *et al*., 2006 and Badran *et al*., 2006a on jojoba, Abd- Elaziz *et al*., 2006 on *Khaya senegalensis* and Nasr, 2009 on *Acokanthera spectabilis*.

Ascorbic acid at 200 ppm and salicylic acid at 100 and 200 ppm caused a significant increase in all vegetative growth character, in both seasons, over those of control plants. The highest values due to salicylic acid at 200 ppm are clearly shown in Tables 1 & 2. The role of ascorbic acid in promoting growth traits was previously reported by Abd- Elaziz *et al*., 2006 on *Khaya senegalensis* , Moustafa, 2008 and Abdou *et al*., 2010 on *Chorisia speciosa* and Hafez *et al.,* 2011 on mango rootstocks.

Table (1): Effect of soil salinity, ascorbic and salicylic acids on vegetative growth characters of *Khaya senegalensis* seedlings during 2110 and 2011 seasons.

Ascorbic & Salicylic acids Conc. ppm (B)	First season					Second season				
	Soil salinity levels % (A)									
	0	0.3	0.5	0.7	Mean	0	0.3	0.5	0.7	Mean
	Plant height (cm)									
Control	52.2	49.4	41.2	36.3	**44.8**	59.0	56.9	46.7	40.1	**50.7**
Asc. 100	55.2	52.6	43.3	38.4	**47.4**	61.1	59.3	49.0	42.2	**52.9**
Asc. 200	58.3	55.8	45.6	41.6	**50.3**	62.4	61.5	50.9	43.7	**54.6**
Sal. 100	60.3	55.1	44.6	42.3	**50.6**	62.9	62.1	53.0	43.6	**55.4**
Sal. 200	63.3	60.0	47.5	44.8	**53.9**	65.1	63.5	55.7	45.6	**57.5**
Mean salin	**57.9**	**54.6**	**44.4**	**40.7**		**62.1**	**60.7**	**51.1**	**43.1**	
L.S.D. 5%		A	B	AB			A	B	AB	
		3.3	**3.2**	**6.4**			**1.2**	**2.7**	**5.4**	
	Stem diameter (cm)									
Control	1.06	1.02	0.88	0.84	**0.95**	1.10	1.07	0.98	0.94	**1.02**
Asc. 100	1.08	1.05	0.92	0.86	**0.98**	1.15	1.11	1.04	0.98	**1.06**
Asc. 200	1.11	1.07	0.94	0.91	**1.01**	1.18	1.13	1.04	0.99	**1.09**
Sal. 100	1.13	1.08	0.97	0.92	**1.03**	1.19	1.15	1.05	1.01	**1.10**
Sal. 200	1.15	1.09	1.00	0.95	**1.05**	1.24	1.16	1.06	1.01	**1.12**
Mean salin	**1.11**	**1.06**	**0.94**	**0.90**		**1.17**	**1.12**	**1.03**	**0.99**	
L.S.D. 5%		**A**	**B**	**AB**			**A**	**B**	**AB**	
		0.09	**0.02**	**0.04**			**.05**	**.04**	**.08**	
	Number of leaves / plant									
Control	17.6	16.0	10.3	8.6	**13.1**	18.2	16.7	12.1	9.9	**14.2**
Asc. 100	20.4	18.5	12.5	10.2	**15.4**	20.6	19.1	15.2	12.2	**16.8**
Asc. 200	22.4	19.4	13.3	11.3	**16.6**	22.1	21.3	15.4	13.1	**18.0**
Sal. 100	24.1	20.3	14.6	12.4	**17.9**	22.7	21.3	16.7	14.8	**18.9**
Sal. 200	26.0	22.2	15.7	14.7	**19.7**	24.3	23.0	18.3	15.5	**20.3**
Mean salin	**22.1**	**19.3**	**13.3**	**11.4**		**21.6**	**20.3**	**15.5**	**13.1**	
L.S.D. 5%		**A**	**B**	**AB**			**A**	**B**	**AB**	
		1.4	**1.8**	**3.6**			**1.6**	**1.4**	**2.8**	

While that of salicylic acid was demonstrated by Moustafa, 2008 and Abdou *et al.,* 2010 on *Chorisia speciosa* and Al- Taey, 2010 on olive seedlings.

The interaction between soil salinity and either ascorbic or salicylic acids was significant for plant height, stem diameter, number of leaves / plant and stem dry weight in both first and second seasons. It was clear that ascorbic acid at 200 ppm and salicylic acid at 100 and 200 ppm were capable of alleviating the adverse effects of soil salinity on different growth characters of *Khaya* seedlings as indicated in Tables 1 &2. The data in this research are in agreement with these results obtained Khodary, 2004 on maize plants, Al-Taey, 2010 on olive seedlings, Enteshari & Sharifian, 2012 on *Panicum miliaceum* and Ejaz *et al*., 2012 on sugarcane plants.

Table (2): Effect of soil salinity, ascorbic and salicylic acids on vegetative growth characters of *Khaya senegalensis* seedlings during 2110 and 2011 seasons.

Ascorbic & Salicylic acids Conc. ppm (B)	First season					Second season				
	Soil salinity levels % (A)									
	0	0.3	0.5	0.7	Mean	0	0.3	0.5	0.7	Mean
	Stem dry weight (g)									
Control	14.4	11.4	8.1	6.4	**10.1**	16.1	15.3	10.1	8.4	**12.5**
Asc. 100	15.7	13.1	10.5	8.4	**11.9**	18.2	16.3	11.6	9.8	**14.0**
Asc. 200	17.0	15.1	12.5	9.6	**13.6**	19.7	17.6	12.4	10.7	**15.1**
Sal. 100	17.8	15.7	12.2	11.0	**14.2**	20.6	19.0	13.1	12.3	**16.3**
Sal. 200	20.0	17.0	13.2	11.8	**15.5**	21.5	19.7	14.7	12.6	**17.1**
Mean salin	**17.0**	**14.5**	**11.3**	**9.6**		**19.2**	**17.6**	**12.4**	**10.8**	
L.S.D. 5%		**A**	**B**	**AB**			**A**	**B**	**AB**	
		1.3	**1.0**	**2.0**			**1.7**	**1.1**	**2.2**	
	Leaves dry weight (g)									
Control	9.3	8.3	6.6	5.7	**7.5**	11.2	10.2	7.0	6.1	**8.6**
Asc. 100	11.2	10.2	7.5	6.5	**8.9**	13.5	12.6	9.5	7.3	**10.7**
Asc. 200	12.3	11.7	8.4	7.2	**9.9**	14.4	13.5	10.4	7.5	**11.5**
Sal. 100	13.3	11.7	8.8	7.9	**10.4**	15.1	14.1	10.7	9.4	**12.3**
Sal. 200	15.3	13.5	9.7	8.5	**11.7**	17.5	15.3	12.4	10.5	**13.9**
Mean salin	**12.3**	**11.1**	**8.2**	**7.2**		**14.3**	**13.1**	**10.0**	**8.2**	
L.S.D. 5%		**A**	**B**	**AB**			**A**	**B**	**AB**	
		1.1	**1.8**	**N.S.**			**1.2**	**2.0**	**N.S**	
	Roots dry weight (g)									
Control	11.4	10.1	7.4	5.3	**8.6**	11.5	10.7	6.8	6.1	**8.8**
Asc. 100	13.5	11.5	8.4	6.1	**9.9**	13.1	12.5	8.6	7.7	**10.5**
Asc. 200	14.1	12.2	9.5	7.4	**10.8**	14.6	12.8	9.3	8.6	**11.3**
Sal. 100	15.4	12.3	10.5	8.4	**11.7**	16.0	14.0	9.2	9.3	**12.1**
Sal. 200	16.5	14.3	11.1	9.5	**12.9**	16.8	15.2	10.8	10.7	**13.4**
Mean salin	**14.2**	**12.1**	**9.4**	**7.3**		**14.4**	**13.0**	**8.9**	**8.5**	
L.S.D. 5%		**A**	**B**	**AB**			**A**	**B**	**AB**	
		1.8	**1.4**	**N.S.**			**0.7**	**1.9**	**N.S.**	

Chemical constituents :

Photosynthetic pigments and N, P and K (%):

Obtained data in Tables 3 &4 for the three photosynthetic pigments, chlorophyll a, chlorophyll b and carotenoids contents, as well as, leaves % of nitrogen, phosphorus and potassium revealed that all these chemical constituents were gradually decreased according to the gradual increase in soil salinity levels with the least values being given due to the high salinity level (0.7%) in both seasons. The reducing effect of salinity on the three photosynthetic pigments was previously reported by Al- Qubei, 2002 on neem, Abd-Elaziz *et al.,* 2006 on *Khaya senegalensis* and Abd- Elnaeem *et al*., 2006 and Badran *et al*., 2006 b on jojoba. While, that imposed on N, P and K was revealed by Abd- Elaziz *et al.,* 2006 on *Khaya senegalensis*, Badran *et al.,* 2006 b on jojoba, Nasr, 2009 on *Acokanthera spectabilis*, Abdou *et al*., 2010 on *Chorisia speciosa* and Hafez *et al.,* 2011 on mango rootstocks.

Table (3): Effect of soil salinity, ascorbic and salicylic acids on photosynthetic pigments (mg/gF.W.) of *Khaya senegalensis* seedlings during 2110 and 2011 seasons.

Ascorbic & Salicylic acids Conc. ppm (B)	First season					Second season				
	Soil salinity levels % (A)									
	0	0.3	0.5	0.7	Mean	0	0.3	0.5	0.7	Mean
	Chlorophyll a content (mg/gF.W)									
Control	2.20	2.18	1.88	1.42	**1.92**	2.08	1.99	1.76	1.28	**1.78**
Asc. 100	2.28	2.24	1.92	1.48	**1.98**	2.16	2.07	1.84	1.34	**1.85**
Asc. 200	2.31	2.26	1.95	1.50	**2.01**	2.18	2.10	1.88	1.38	**1.89**
Sal. 100	2.25	2.22	1.90	1.46	**1.96**	2.14	2.06	1.80	1.31	**1.83**
Sal. 200	2.28	2.25	1.94	1.48	**1.99**	2.18	2.08	1.82	1.34	**1.86**
Mean salin	**2.26**	**2.23**	**1.92**	**1.47**		**2.15**	**2.06**	**1.82**	**1.33**	
L.S.D. 5%		**A**	**B**	**AB**			**A**	**B**	**AB**	
		0.04	**0.03**	**NS**			**0.03**	**0.02**	**NS**	
	Chlorophyll b content (mg/g FW)									
Control	1.56	1.48	1.18	0.94	**1.29**	1.32	1.28	0.94	0.78	**1.08**
Asc. 100	1.62	1.54	1.28	0.98	**1.36**	1.38	1.34	0.98	0.84	**1.14**
Asc. 200	1.64	1.55	1.30	1.01	**1.38**	1.40	1.35	0.99	0.86	**1.15**
Sal. 100	1.60	1.51	1.24	0.96	**1.33**	1.36	1.33	0.96	0.80	**1.11**
Sal. 200	1.62	1.52	1.26	1.00	**1.35**	1.37	1.35	0.98	0.84	**1.14**
Mean salin	**1.61**	**1.52**	**1.25**	**0.98**		**1.37**	**1.33**	**0.97**	**0.82**	
L.S.D. 5%		**A**	**B**	**AB**			**A**	**B**	**AB**	
		0.04	**0.02**	**0.04**			**0.05**	**0.02**	**0.04**	
	Carotenoids content (mg/g FW)									
Control	1.74	1.68	1.36	1.08	**1.47**	1.55	1.48	1.26	0.94	**1.31**
Asc. 100	1.80	1.74	1.44	1.14	**1.53**	1.61	1.53	1.32	0.98	**1.36**
Asc. 200	1.82	1.76	1.46	1.16	**1.55**	1.63	1.55	1.33	1.01	**1.38**
Sal. 100	1.78	1.70	1.40	1.12	**1.50**	1.59	1.50	1.30	0.96	**1.34**
Sal. 200	1.80	1.72	1.44	1.14	**1.53**	1.60	1.54	1.31	0.98	**1.36**
Mean salin	**1.79**	**1.72**	**1.42**	**1.13**		**1.60**	**1.52**	**1.30**	**0.97**	
L.S.D. 5%		**A**	**B**	**AB**			**A**	**B**	**AB**	
		0.03	**0.02**	**0.04**			**0.05**	**0.02**	**0.04**	

Table (4): Effect of soil salinity, ascorbic and salicylic acids on chemical composition of *Khaya senegalensis* seedlings during 2110 and 2011 seasons.

Ascorbic & Salicylic acids Conc. ppm (B)	First season					Second season				
	Soil salinity levels % (A)									
	0	0.3	0.5	0.7	Mean	0	0.3	0.5	0.7	Mean
	Leaves nitrogen (%)									
Control	1.52	1.46	1.41	1.32	**1.43**	1.44	1.41	1.32	1.30	**1.37**
Asc. 100	2.08	2.04	1.92	1.95	**2.00**	2.15	2.07	1.92	1.92	**2.02**
Asc. 200	2.88	2.77	2.62	2.53	**2.70**	2.93	2.83	2.72	2.57	**2.76**
Sal. 100	1.80	1.74	1.68	1.65	**1.72**	1.71	1.70	1.64	1.57	**1.66**
Sal. 200	2.41	2.37	2.30	2.27	**2.34**	2.47	2.44	2.32	2.28	**2.38**
Mean salin	**2.14**	**2.08**	**1.99**	**1.94**		**2.14**	**2.09**	**1.98**	**1.93**	
L.S.D. 5%		**A**	**B**	**AB**			**A**	**B**	**AB**	
		0.04	**0.03**	**0.06**			**0.03**	**0.05**	**0.10**	
	Leaves phosphorus (%)									
Control	0.213	0.208	0.202	0.197	**0.205**	0.219	0.210	0.207	0.203	**0.210**
Asc. 100	0.262	0.256	0.250	0.248	**0.254**	0.258	0.251	0.248	0.212	**0.242**
Asc. 200	0.319	0.311	0.300	0.290	**0.305**	0.311	0.308	0.302	0.294	**0.304**
Sal. 100	0.236	0.236	0.226	0.217	**0.229**	0.244	0.237	0.233	0.227	**0.235**
Sal. 200	0.289	0.279	0.276	0.268	**0.278**	0.290	0.282	0.279	0.273	**0.281**
Mean salin	**0.264**	**0.258**	**0.251**	**0.244**		**0.264**	**0.258**	**0.254**	**0.242**	
L.S.D. 5%		**A**	**B**	**AB**			**A**	**B**	**AB**	
		0.005	**0.012**	**NS**			**0.006**	**0.016**	**NS**	
	Leaves potassium (%)									
Control	1.86	1.82	1.77	1.71	**1.79**	1.82	1.78	1.72	1.68	**1.75**
Asc. 100	2.42	2.37	2.32	2.25	**2.34**	2.46	2.41	2.38	2.32	**2.39**
Asc. 200	2.98	2.88	2.82	2.74	**2.86**	2.94	2.90	2.82	2.75	**2.85**
Sal. 100	2.15	2.10	2.04	2.00	**2.07**	2.23	2.11	2.04	1.94	**2.08**
Sal. 200	2.69	2.60	2.52	2.47	**2.57**	2.76	2.69	2.56	2.45	**2.62**
Mean salin	**2.42**	**2.35**	**2.29**	**2.23**		**2.44**	**2.38**	**2.30**	**2.23**	
L.S.D. 5%		**A**	**B**	**AB**			**A**	**B**	**AB**	
		0.09	**0.05**	**NS**			**0.05**	**0.05**	**0.10**	

Tables 3 & 4 also show that ascorbic acid and salicylic acid, at 100 and 200 ppm each , caused significant promotion in both seasons for the six prementioned chemical constituents in comparison with control plants. Among the two tested stimulants, ascorbic acid proved to be much more effective than salicylic acid. The high concentration of each of ascorbic acid or salicylic acid gave higher values than the low one. These results are in accordance with those reported by Abd- Elaziz *et al.,* 2006 on *Khaya senegalensis*, Ahmed, 2007 on *Datura* plants, Moustafa, 2008 on *Chorisia speciosa*, El- Quesni *et al.,* 2009 on *Hibiscus rosa- sinensis* and Abou- Leila *et al.,* 2012 on *Jatropha curcas*. And concerning salicylic acid were the findings of Moustafa, 2008 and Abdou *et al*., 2012 on *Chorisia speciosa*.

The interaction between soil salinity levels and both ascorbic and salicylic acids concentrations was significant for chlorophyll b, carotenoids and nitrogen % in both seasons and potassium % in the second season as indicated in Tables 3 &4. The role of ascorbic acid or salicylic acid, especially at the high concentration (200 ppm), in alleviating, counteracting or overcoming the harmful influence of soil salinity is obvious as shown in Tables 3 &4. On the same line with our results were the findings of Khodary, 2004, Abd- Elaziz *et al.,* 2006, Hafez *et al.,* 2011 and Parizi *et al.,* 2011 on maize, *Khaya*, mango and basil plants.

Leaves Sodium, Calcium and Proline (%):

In contrast with photosynthetic pigments and leaves N, P and K % as negatively affected by soil salinity, each of sodium, calcium and proline % in the leaves were greatly and significantly increased in the two seasons due to soil salinity treatments (Table 5). Such effect was gradual according to the gradual increase in soil salinity, which the highest values of Na, Ca and proline % being given by the highest soil salinity level (0.7 %). The role of salinity in increasing sodium and calcium leaves (%) was previously demonstrated by Mohamed, 2002 on three woody trees, Al- Qubaie, 2002 on neem, Nasr, 2009 on *Acokanthera spectabilis* and Abdou *et al*., 2010 on *Chorisia speciosa*. Meanwhile, such effect of salinity in stimulating proline (%) was emphasized by Abd – Elaziz *et al*., 2006 on *Khaya*, Abd Elnaeem *et al.,* 2006 on jojoba and Hafez *et al.,* 2011 on mango rootstocks.

Concerning ascorbic acid and salicylic acid, at both 100 and 200 ppm, caused a considerable and significant reduction in the leaves (%) of sodium, calcium and proline in both seasons comparing to those of control plants as clearly shown in Table 5. Moreover, the high concentration, for either ascorbic or salicylic acid and for the three constituents; sodium, calcium and proline (%), was significantly more effective than the low concentration, (Table 5). These results are in harmony with results of Abd- Elaziz *et al.,* 2006 on *Khaya senegalensis*, Hafez *et al*., 2011 on mango rootstocks, Yazdanpanah *et al.,* 2011 on *Satureja hortensis* and Abou- Leial *et al*., 2012 on *Jatropha curcas*. While, Yazdanpanah *et al*., 2011 on *Satureja hortensis* and Parizi *et al*., 2011 and Shekoofeh *et al.,* 2012 on basil plants revealed the role of salicylic acid in reducing Na, Ca and proline (%).

The interaction between salinity and ascorbic and salicylic acids for eth leaves (%) of Na, Ca and proline was significant in both seasons as declared in Table 5. It could be noticed that ascorbic acid and salicylic acid, especially at 200 ppm, were able to alleviate or counteract the adverse effects of salinity on such three chemical constituents. These results are in agreement with those of Abd- Elaziz *et al*., 2006 on *Khaya senegalensis* and Parizi *et al*., 2011 and Shekoofeh *et al.,* 2012 on basil plants; and regarding proline with the findings of Abd Elaziz *et al*., 2006 on *Khaya*, Hafez *et al*., 2011 on mango, Ejaz *et al*., 2012 on sugarcane Enteshari & Sharifian, 2012 on millet and Shekoofeh *et al*., 2012 on basil plants.

Table (5): Effect of soil salinity, ascorbic and salicylic acids on chemical composition of *Khaya senegalensis* seedlings during 2110 and 2011 seasons.

Ascorbic & Salicylic acids Conc. ppm (B)	First season					Second season				
	Soil salinity levels % (A)									
	0	0.3	0.5	0.7	Mean	0	0.3	0.5	0.7	Mean
	Leaves sodium (%)									
Control	0.99	1.16	1.31	1.47	**1.23**	0.92	0.98	1.16	1.24	**1.08**
Asc. 100	0.66	0.80	0.95	1.00	**0.85**	0.76	0.80	0.93	1.00	**0.87**
Asc. 200	0.39	0.52	0.68	0.74	**0.58**	0.48	0.51	0.63	0.69	**0.58**
Sal. 100	0.83	1.00	1.12	1.18	**1.03**	0.80	0.88	0.96	1.11	**0.94**
Sal. 200	0.50	0.62	0.77	0.80	**0.67**	0.53	0.62	0.68	0.79	**0.66**
Mean salin	**0.67**	**0.82**	**0.97**	**1.04**		**0.70**	**0.76**	**0.87**	**0.97**	
L.S.D. 5%		**A**	**B**	**AB**			**A**	**B**	**AB**	
		0.04	**0.12**	**0.24**			**0.02**	**0.06**	**0.12**	
	Leaves calcium (%)									
Control	3.03	3.10	3.38	3.49	**3.25**	3.21	3.26	3.44	3.52	**3.36**
Asc. 100	2.62	2.74	2.97	3.05	**2.85**	2.55	2.64	2.71	2.82	**2.68**
Asc. 200	2.09	2.13	2.33	2.56	**2.28**	2.00	2.06	2.28	2.34	**2.17**
Sal. 100	2.87	2.96	3.02	3.11	**2.99**	2.86	2.88	3.01	3.11	**2.97**
Sal. 200	2.33	2.43	2.55	2.77	**2.52**	2.33	2.38	2.43	2.52	**2.42**
Mean salin	**2.59**	**2.67**	**2.85**	**3.00**		**2.59**	**2.64**	**2.77**	**2.86**	
L.S.D. 5%		**A**	**B**	**AB**			**A**	**B**	**AB**	
		0.06	**0.05**	**0.10**			**0.06**	**0.06**	**0.12**	
	Leaves proline (%)									
Control	8.37	10.65	11.96	13.13	**11.03**	8.14	10.48	11.80	12.18	**10.65**
Asc. 100	7.78	8.98	11.13	12.22	**10.03**	7.63	9.07	9.82	10.42	**9.24**
Asc. 200	7.19	7.33	8.53	9.53	**8.15**	7.25	7.65	8.37	8.96	**8.06**
Sal. 100	7.53	8.16	8.91	10.02	**8.66**	7.36	8.83	9.23	9.88	**8.83**
Sal. 200	6.86	7.22	8.38	8.95	**7.85**	6.82	7.38	8.07	8.47	**7.69**
Mean salin	**7.55**	**8.47**	**9.78**	**10.77**		**7.44**	**8.68**	**9.46**	**9.98**	
L.S.D. 5%		**A**	**B**	**AB**			**A**	**B**	**AB**	
		0.22	**0.17**	**0.34**			**0.18**	**0.15**	**0.30**	

DISCUSSION

The role of soil salinity in reducing different vegetative growth traits, photosynthetic pigments and N, P and K (%) , as well as increasing Na, Ca and proline (%), as found in the present study, could be attributed to the reduction in cell division, cell enlargement and meristemic activity, osmotic inhibition of water absorption and specific ions concentration in the saline medial interfering with normal stomatal closure causing excessive water loss and leaf injury symptoms like those of drought, (Bernstein *et al.,* 1972). Also, Hanafy (1996) pointed out that salinization impaired N accumulation and incorporation into protein and reduced the availability of P to the plant due to raising the pH of the soil.

The stimulating influence of ascorbic acid might be due to its role in regulating the cell division and expanding and many metabolic and physiological processes, (Shaddad *et al.,* 1990). In addition, Oertil (1987) stated that ascorbic acid has a significant resistance against many plant pathogens such as nematode, fungi, bacteria and parasitic plants. Concerning salicylic acid, it has direct involvement in plant growth and ions uptake, ethylene biosynthesis, stomatal movement and reversing the effect of ABA on leaf abscission, (Romani *et al.,* 1989). It was found also to accelerate the photosynthetic rate, modify the activity of important enzymes, increase the leaf area and dry mass production and to exhibit a rapid rate of root differentiation, (Singh, 1993 and Ahmed & Hayat, 2007).

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دور حامض الإسكوربيك وحامض السالساليك فى تخفيف التأثير الضار للملوحة على النمو الخضرى والتركيب الكيماوى لشتلات الكايا

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يهدف هذا البحث الى دراسة دور حامض الاسكوريك وحامض السالسيلك فى تخفيف التأثير الضار لملوحة التربة على شتلات الكايا سنجالينسز.

حدث نقص فى الصفات الخضرية المختلفة وهى طول النبات وقطر الساق وعدد الأوراق والوزن الجاف للأوراق والساق والجذور، وكذلك كلورفيل أ و كلورفيل ب والكاروتينويدات ونسبة النيتروجين والفوسفور والبوتاسيوم بالأوراق بينما زادت النسبة المئوية فى الأوراق من كل من الصوديوم والكالسيوم والبرولين وذلك نتيجة معاملات الملوحة وبصفة خاصة التركيز المرتفع منها وهو ٠,٧ ٪ ومن ناحية أخرى فقد حدث تحسن فى الصفات الخضرية السابق ذكرها وكذلك محتوى الأوراق من كل من الصبغات الضوئية الثلاثة ونسبة النتروجين والفوسفور والبوتاسيوم بينما حدث انخفاض فى كل من الصوديوم والكالسيوم والبرولين بالأوراق نتيجة استعمال حامض الاسكوربيك وحامض السالسيلك وخاصة بالتركيز المرتفع (٢٠٠ جزء فى المليون). اتضح أيضا أن كل من حامض الاسكوربيك وحامض السالسيلك أثبتا قدرتهما على تخفيف التأثير الضار لملوحة التربة على النمو الخضرى والمكونات الكيماوية لشتلات الكايا سنجالينسز.

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