HOW FAR *VITEX AGNUS - CASTUS. L.* AND *PARKINSONIA ACULEATA L.* SHRUBS TOLERATE SALINITY OF IRRIGATION WATER

BY

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ABSTRACT

A trial was achieved at Orman Botanical Garden, Giza, Egypt during 2000 and 2001 seasons to study the effect of a commercial sea salt (NaCl) at the levels of 0, 2000, 4000, 6000, 8000 and 10000 ppm in irrigation water on growth, flowering and chemical composition of two ornamental shrubs; *Vitex agnus-castus. L.* and *Parkinsonia aculeata. L.*

The results show that no mortality was observed with increasing salinity levels although all vegetative and root growth traits of these two plants were declined, except for 2000 ppm level which increased vegetative growth of Vitex plants, aerial fresh and dry weights and root growth of Parkinsonia. Salinity concentrations above 4000 ppm delayed flowering of Vitex plants, whereas all concentrations reduced number of inflorescences/plant, inflorescence length (cm) and fresh weight (g) and number of seeds/inflorscence, except for the rate of 2000 ppm which slightly increased number of inflorescences/plant. Parkinsonia plants, however, didn't flower during the course of this trial. In general, chlorophyll a and b in the leaves, and total carbohydrates, N, P and K contents in the leaves and roots of Vitex and Parkinsonia plants were progressively decreased with increasing salinity level, whereas total carotenoids in the leaves, and Na, Cl and proline in the leaves and roots were increased.

INTRODUCTION

Increased need for salt tolerance ornamentals is still continuous due to both increased restriction of water resources and saline water intrusion into groundwater, specially along coastal areas and surrounded lakes where tourist villages and towns spreaded.

Vitex agnus-castus L. (Fam Verbenaceae) is an aromatic shrub which has opposite leaves, digitately 5- to 7- lanceolate or elliptic leaflets with terminal or axillary blue-violet cymes, grown in warm parts of the world for their beautifully aromatic foliage and fragrant flowers in late summer and autumn, used medicinally and in basketry (Bailey, 1976 and Huxley et al., 1992).

Parkinsonia aculeata L. (Fam leguminosae) is a grceful spiny shrub grown well in tropic and semi-desert areas for its pleasing habit, green to silver boughs, fine foliage and attractive yellow-orange flowers which become sweetly scented in spring, used as lawn specimens, in the shrub border and for hedging and screening (Bailey, 1976 and Huxley et al., 1992).

Both shrubs are now important as widely used in gardening and landscape design. So, this work was done to elicite how far these two shrubs can tolerate salinity of irrigation water, and to determine the effect of salinity on their growth behaviour and constituents.

Adequate information on tolerance to salinity is lacking for both shrubs while many attempts have been made on other trees and shrubs to indicate the adverse effects of salinity on their growth. In this concern, El-Khateeb (1994) on *Murraya exotica*, found that a mixture of NaCl and $CaCl_2$ (1:1) at 4500-7500 ppm significantly decreased vegetative growth and the pigments (Chlorophyll-a and -b and carotenoids) contents of leaves, while foliar proline, N, Na, Ca and Cl contents were generally increased with increasing salinity. Similar results were also gained by Venkatesan and Chellappan (1998) on *Ipomoea pes-caprae*, Botti et al. (1998) on jojoba, Sonneveld et al. (1999) on rose cv. Europa and El-Bagoury et al. (1999) who postulated that a mixture of NaCl and $CaCl_2$ at 20000 ppm reduced height, stem diameter, root length and fresh and dry weight of stem, branchlets and roots of *Casuarina equisetifolia* seedling. All salinity treatments (5000-20000 ppm) reduced chlorophyll a and b, but increased the carotenoids, carbohydrates, Na and Ca contents.

Recently, Wahome et al. (2000) postulated that necrosis on the leaves of *Rosa chinensis* c.v Major, *R. rubiginosa* and *R. hybrida* cv. Kardinal was observed as a result of NaCl treatment at 5, 10, 20 or 30 mM/L after two months. The NaCl treatments decreased vegetaive growth and root dry matter in all genotypes, as well as led to a significant reduction in the length of cut flowers. Likewise, Rodriguez-Perez et al. (2000) reported that fresh and dry matter production in *Protea obtusifolia* were lowest when plants were treated with NaCl+$CaCl_2$ (2:1) at 4.2 and 8.2 dSm^{-1} and coincided with the greatest foliar values of Na and Cl and the lowest percentage of K and Ca. Auda (2000), however, elicited that salinity of irrigation water till 5000 ppm had no effect on survival % of *Melaleuca armillaris* plants, while the highest ones (7000 and 9000 ppm) reduced it. The highest concentrations reduced also stem length, root length, fresh and dry weights of foliage parts and of roots. Increasing salinity levels caused a reduction in leaves contents of chlorophyll a and b and N and P, while carotenoids, K and proline contents were increased.

MATERIALS AND METHODS

The present study was conducted at Orman Botanical Garden, Giza, Egypt during 2000 and 2001 seasons.

Seventy five days old *Vitex agnus-castus* transplants (produced from cuttings rooted under plastic house, its initial height was 25.0±2.0 cm) and two months old *Parkinsonia aculeata* transplants (produced from seeds germinated under nursery conditions, its initial height was 20±1.5 cm) were translocated on May, 15th. For both seasons into 20-cm diameter plastic pots (one plant/pot) filled with loamy soil which chemical analysis is presented in Table (A).

A commercial sea salt (NaCl) produced by Alexandria Max Company without purification was used for salinizing irrigation water. The chemical analysis of that salt was Cl^{-}=13312.5, SO_4^{--} = 5616, Ca^{++} = 400, Mg^{++} = 1560, K^{+} = 315 and Na^{+} = 7866 ppm. Plants were irrigated after 2 weeks from transplanting with 250 ml of saline water per pot (day by day) at the concentrations of 2000, 4000, 6000, 8000 and 10000 ppm, whereas the control was irrigated with tap water (250 ppm).

A Kristalon fertilizer (17 N- 6P- 18 K- 2 Mg + microelements, DSM Agrospecialists Co., Holland) was added every 3 weeks at the rate of 2 g/pot. The layout of the experiment in the two seasons was a complete randomized design of three replicates with five plants per replicate. At budding of *Vitex agnus-castus* plants started, number of days from the first irrigation with saline water at June, 1st to emergence of first flower bud was calculated. At flowering, number of inflorescences/plant, inflorescence length (cm), number of seeds/inflorescence and inflorescence fresh weight (g) were monitored. Before ending of the experiment by 2 weeks, fresh leaf samples from the two shrubs were taken to determine pigments content (Chlorophyll a, b and total carotenoids, mg/g F.W.) according to Saric et al. (1976). At the end of the experiment, (November 1st), the following measurements were recorded for the two shrubs: Survival %, plant height (cm), stem diameter (cm), number of leaves/plant, aerial parts fresh and dry weight (g), the longest root length (cm) and roots fresh and dry weight (g). Moreover, number of branches/plant, leaf area (cm^2) and number of lateral roots/plant were recorded for Vitex plant, while for Parkinsonia leaf length (the petiole and middle vein) was measured. In addition, a salt resistance index (SRI) was calculated as described by Wu and Huff (1983) from the following equation:

$$SRI = \frac{\text{Mean root length of the longest root in salt treated plant}}{\text{Mean root length of the longest root in control plant}} \times 100$$

Table (A): **Chemical analysis of the used soil in the two seasons (2000 and 2001).**

Property	First season	Second season
S.P. (%)	43.00	42.38
E.C. (mmhos/cm)	1.38	1.46
pH	7.98	8.07
<u>Soluble anions:</u>		
HCO_3^- (meq/L)	3.80	4.65
Cl^- (meq/L)	11.00	10.21
SO_4^{--} (meq/L)	33.91	34.33
<u>Soluble cations:</u>		
Ca^{++} (meq/L)	17.56	18.00
Mg^{++} (meq/L)	9.42	9.04
Na^+ (meq/L)	20.00	20.28
K^+ (meq/L)	1.73	1.87
<u>Ferility:</u>		
N (%)	0.07	0.07
P (%)	0.069	0.063

Table (B): **Electric conductivity (E.C., mmhos/cm) and salinity class of the used soil cultivated with *Vitex agnus castus L.* and *Parkinsonia aculeata L.* at the end of the experiment.**

Salinity level (ppm)	E.C. (mmhos/cm)	Salinity class (According to FAO, 1980)
Vitex agnus - castus, L.		
Control	1.88	Salinity free
2000	4.36	Slightly affected
4000	12.06	Moderately affected
6000	14.83	" "
8000	16.62	Strongly affected
10000	19.19	" "
Parkinsonia aculeata, L.		
Control	1.55	Salinity free
2000	5.34	Slightly affected
4000	9.15	Moderately affected
6000	11.70	" "
8000	12.05	" "
10000	26.49	Strongly affected

In dry samples of leaves and roots, the following parameters were determined, total carbohydrates content (mg/g D.W) using a method given by Herbert et al. (1971), N (mg/g D.W.) by micro-Kjeldahle) method described by Jackson (1973), P (mg/g D.W.) by ascorbic acid method explained by Cottenie et al. (1982), K and Na (mg/g D.W.) using Flame-Photometer set, Cl (mg/g D.W.) by titration method indicated by Jackson (1973) and Proline content according to the method of Bates et al. (1973) as µg/ml and salinity class of the used soil were registered at the end of the experiment as shown in Table (B).

SAS program, (1994) was used for statistical analysis and Duncan's Multiple Range Test, 1955 was employed to test the differences among means of various treatments.

RESULTS AND DISCUSSION

I- Effect of saline irrigation water on survival %, vegetative growth, SRI, flowering and constituents of *Vitex agnus-castus* transplants:

1- Effect on survival %, vegetative growth and SRI:

According to data presented in Table (1), no mortality was observed in both seasons although top growth of all Vitex plants was severely reduced, specially at the highest salt levels. In general, all saline water treatments reduced plant height (cm), stem diameter (cm), number of branches/plant, number of leaves/plant, leaf area (cm^2) and aerial parts, fresh and dry weights with highly significant differences in most cases of the two seasons. except for irrigation with 2000 ppm saline water, as this treatment slightly increased all pervious parameters over control means with nonsignificant differences in both seasons.

Concerning root traits, data revealed that root length (cm), number of lateral roots/plant and roots fresh and dry weights were decreased in response to various salinity concentrations applied with highly significant differences in most cases of both seasons, except for the plants treated with 2000 and 4000 ppm saline water, as they gave means in a rank similar to that control means.

The observed reduction in top and root growth may be attributed to a decrease in cell volume at constant cell number caused by salinity (Yasseen et al., 1987). Such results however, are coincidenced with those of El-Khateeb (1994) on *Murraya exotica*, Botti et al. (1998) on jojoba, Sonneveld et al. (1999) on rose and Auda (2000) who stated that salinity of irrigation water till 5000 ppm had no effect on survival % of *Melaleuca armillaris*, whereas the highest concentrations (7000 and 9000 ppm) significantly reduced stem length, root length, fresh and dry weights of foliage parts and roots.

As for salt resistance index (SRI%), as a real indicate for salinity tolerance, data show that raising salinity rate progressively decreased SRI means, specially the highest concentrations (8000 and 1000 ppm) which declined this parameter to values lower than 50% in both seasons with significant differences when compared to control or other salinity concentrations, hence, Vitex plants can tolerate salt stress with good health up to 6000 ppm in irrigation water.

Table (1): Effect of saline irrigation water on survival percentage, vegetative and root growth parameters of *Vitex agnus castus L.* transplants during 2000 and 2001 seasons.

Salinity Level (ppm)	Survival percentage	Plant Height (cm)	Stem Diameter (cm)	No. Branches/ plant	No. Leaves/ Plant	Leaf Area (cm^2)	Aerial Parts F.W (g)	Aerial Parts D.W (g)	Root Length (cm)	No. Lateral roots/ plant	Roots F.W. (g)	Roots D.W. (g)	S.R.I percentage
First season (2000)													
Control	100.00a	83.23a	0.87a	3.00ab	57.33a	27.93b	47.53a	22.96a	57.05a	5.20a	46.27a	20.52a	100.00a
2000	100.00a	88.17a	0.88a	4.00a	58.67ba	29.39a	48.44a	24.09a	56.00a	3.50b	29.80b	13.93b	98.16a
4000	100.00a	71.50b	0.63b	2.00bc	40.00bc	19.91c	40.51b	19.95b	54.51a	3.00c	25.97c	11.03c	95.55a
6000	100.00a	58.00c	0.57b	1.67bc	33.33c	19.00c	24.83d	12.52c	38.54b	2.87c	18.80d	5.41d	67.56bc
8000	100.00a	42.67d	0.37c	1.33c	28.00c	18.74c	18.80e	9.53d	28.01c	2.10d	8.60e	3.50e	49.00c
10000	100.00a	38.00d	0.30c	1.33c	26.00c	12.77d	17.62e	9.36d	21.79d	1.90d	5.40f	3.17f	38.20d
Second season (2001)													
Control	100.00a	84.67a	0.89a	3.09ab	58.15a	28.40a	49.70a	23.86a	58.14a	5.00a	47.25a	20.32a	100.00a
2000	100.00a	89.75a	0.91a	4.12a	59.00b	29.15a	50.00a	24.00a	57.42a	3.58b	30.36b	13.67b	98.76a
4000	100.00a	72.45b	0.66b	2.10bc	40.86c	21.50c	42.80b	21.23b	55.10a	3.00c	26.51c	11.56c	94.77a
6000	100.00a	59.35c	0.56bc	1.81bc	34.08cd	19.08c	28.33cd	14.18c	38.76b	2.76cd	19.20d	7.50d	66.67cb
8000	100.00a	43.68d	0.40c	1.37c	29.12dc	18.93c	22.41d	10.96d	28.58c	2.15d	9.18e	3.85e	49.00c
10000	100.00a	39.28d	0.38c	1.35c	26.25dc	13.40d	20.76e	10.30d	22.24d	2.00d	6.15f	3.06e	38.25d

SRI: Salts resistance index.

Mean separation within columns by Duncan's multiple range at 1% level

2- Effect on flowering:

Data of the time to flowering, shown in Table (2) indicate that using saline water increased the number of days to flowering by about 2 days for Vitex plants irrigated with saline water at 2000 and 4000 ppm with nonsignificant differences comparing to control, whereas flowering was delayed by about 22, 23 and 30 days for treated plants with 6000, 8000 and 1000 ppm saline water, respectively with highly significant differences when compared to untreated plants. In addition, salinity of irrigation water induced highly significant reduction in number of inflorescence/plant, inflorescence length (cm), number of seeds/inflorescence and inflorescence fresh weight (g), except for the treatment of 2000 ppm which gave averages for number of inflorescence/plant near to those of control plants with nonsignificant differences among them.

Such records may be attributed to the inhibitory effect of salinity on cell division and enlargement, and consequently suppression of the plant development rate. In this respect, Sonneveld et al. (1999) found that NaCl at 5.2 dSm^{-1} reduced flower yield of gerbera, carnation, rose, aster and lily. Also, Wahome et al. (2000) pointed out that NaCl treatments led to a significant reduction in the length of roses cut flowers.

Table (2): Effect of saline irrigation water on flowering of *Vitex agnus castus L.* transplants during 2000 and 2001 seasons.

Salinity level (ppm)	No. days to Flowering (days)	No. Inflorescences/ Plant	Inflorescence Length (cm)	No. seeds/ Inflorescence	Inflorescence F.W. (g)
First season: 2000					
Control	67.33^{b}	3.00^{a}	10.00^{a}	48.67^{a}	2.70^{a}
2000	69.00^{b}	4.00^{a}	9.27^{ab}	42.00^{b}	2.31^{b}
4000	69.33^{b}	2.33^{bc}	8.73^{abc}	31.00^{c}	2.01^{b}
6000	89.00^{a}	1.67^{bc}	7.23^{bcd}	24.67^{de}	1.69^{c}
8000	90.67^{a}	1.67^{bc}	6.23^{cd}	20.00^{de}	1.45^{c}
10000	97.67^{a}	1.33^{c}	4.87^{d}	16.33^{e}	1.38^{c}
Second season: 2001					
Control	68.70^{b}	4.00^{a}	11.08^{a}	55.69^{a}	3.11^{a}
2000	70.38^{b}	4.00^{a}	10.20^{ab}	49.36^{b}	2.66^{b}
4000	71.00^{b}	2.40^{bc}	9.46^{ab}	40.00^{c}	2.31^{b}
6000	90.78^{a}	1.75^{bc}	7.91^{bc}	33.28^{cd}	1.96^{c}
8000	92.85^{a}	1.78^{bc}	7.42^{bc}	27.41^{d}	1.73^{c}
10000	99.69^{a}	1.39^{c}	7.00^{c}	21.66^{e}	1.62^{c}

Mean separation within columns by Duncan's multiple range at 1% level.

3- Effect on chemical composition:

Data in Table (3) exhibit that chlorophylls a and b were progressively decreased, while total carotenoids were gradually increased with raising salinity level in irrigation water in the leaves of Vitex plants, except for 2000 ppm treatment which gave the highest content of chlorophyll a comparing with control and other treatments. Such results showed a similar trend to those obtained by El-Khateeb (1994) on *Murraya exotica*, El-Bagoury et al. (1999) on *Casuarina equisetifalia* and Auda (2000) on *Melaleuca armillaris*.

Concerning other constituents, it was obvious that total carbohydrates, N, P and K contents were progressively decreased with increasing salinity concentrations in the leaves and roots of Vitex plants, this might point out the role of high salinity on depressing the water potential of the nutrient medium and hence restrict minerals and water uptake by plant roots. On the other hand, Na and Cl contents were increasingly raised comparing with control because the higher salt concentration in the nutrient medium leads usually to an increase in the uptake of some highly hydrophilic ions (e.g. Na or borate) as mentioned by Mengel and Kirkby, 1979.

As for proline content in the leaves and roots of Vitex plants, data in table (3) indicated that all saline water treatments markedly increased this parameter, specially the highest concentrations which recorded the utmost high means in this concern. It was suggested that accumulation of some amino acids and amides in the leaves and roots of salinity stressed-plants may be due to *de novo* synthesis and not the result of protein degradation (Gilbert et al., 1998).

The aforesaid findings, however, are in line with those gained by Venkatesan and chellappan (1998) on *Ipomoea pescaprae*, Wahome et al. (2000) on roses and Rodrigueez-Perez et al. (2000) on *Protea obtusifolia*.

I- Effect of saline irrigation water on survival %, vegetative growth, SRI% and constituents of *Parkinsonia aculeata L.* transplants:

1- Effect on survival, vegetative growth and SRI%:

Data averaged in Table (4) indicate that there was no mortality among Parkinsonia plants treated with saline water at various levels as the survival percentage was 100% for all treatments in both seasons. On the other hand, plant height (cm), stem diameter (cm), number of leaves per plant, leaf length (cm) and aerial parts fresh and dry weights (g) were highly significant reduced as a result of irrigation with different salinity concentrations, with the exception of plants treated with 2000 ppm saline water as they gave heaviest fresh and dry weights for the aerial parts, but with nonsignificant differences when compared to untreated ones.

Table (3): Effect of saline irrigation water on chemical composition of *Vitex agnus castus L.* transplants during 2000 season.

Salinity Level (ppm)	Leaves pigments (mg/g F.W) Chl.a	Chl.b	Carot.**	Total carb.* (mg/g D.W) Leaves	Roots	N (mg/g D.W) Leaves	Roots	P (mg/g D.W) Leaves	Roots	K (mg/g D.W) Leaves	Roots	Na (mg/g D.W) Leaves	Roots	Cl (mg/g D.W) Leaves	Roots	Proline μg/ml Leaves	Roots
Control	1.067	0.428	0.318	25.00	25.48	21.07	20.50	0.75	0.52	16.62	18.38	1.73	5.28	00.89	20.16	0.045	1.383
2000	1.195	0.410	0.522	24.64	24.50	20.00	18.00	0.67	0.43	15.45	17.21	5.10	9.78	13.31	22.19	0.058	1.427
4000	0.998	0.381	0.578	24.47	24.22	18.72	16.70	0.50	0.38	13.88	16.91	6.44	12.87	16.86	26.63	0.074	1.623
6000	0.846	0.330	0.605	24.60	23.60	14.80	13.86	0.50	0.27	11.14	14.66	8.40	14.72	19.53	29.28	0.155	1.768
8000	0.754	0.335	0.626	23.92	22.50	15.00	12.00	0.38	0.25	9.78	10.75	12.88	16.10	26.60	31.10	0.186	2.531
10000	0.636	0.273	0.703	22.80	22.36	14.00	10.36	0.25	0.21	9.39	9.78	17.46	16.41	31.93	47.50	0.374	3.604

*Carb. = Carbohydrates **Carot. = Carotenoids

Table (4): Effect of saline irrigation water on survival percentage, vegetative and root growth parameters of *Parkinsonia aculeata L.* during 2000 and 2001 seasons.

Salinity Level (ppm)	Survival percentage	Plant Height (cm)	Stem Diameter (cm)	No. Leaves/ plant	Leaf Area (cm^2)	Aerial Parts F.W (g)	Aerial Parts D.W (g)	Root Length (cm)	Roots F.W. (g)	Roots D.W. (g)	S.R.I percentage
Control	100.00a	106.00a	0.80a	41.33a	21.10a	34.00a	15.82b	37.17b	16.10b	5.40b	100.00a
2000	100.00a	80.53b	0.73b	32.33b	16.57b	38.13a	17.64a	42.08a	16.66a	6.10a	113.21a
4000	100.00a	72.66b	0.63ba	32.00b	15.83b	28.63b	13.78c	37.13b	11.96c	4.86c	99.89a
6000	100.00a	58.00c	0.57 b	25.33c	13.17c	18.50c	9.74d	21.89c	6.68d	2.89d	58.89c
8000	100.00a	38.66d	0.33c	19.67d	10.83d	13.78d	7.18e	20.79c	4.80e	1.87e	55.93c
10000	100.00a	29.00e	0.30c	13.35e	9.00d	9.66d	6.15e	14.98d	2.96f	1.63e	40.30d
Control	100.00a	103.76a	0.84a	45.16a	21.52a	39.12a	17.95a	36.72b	16.32b	5.51b	100.00b
2000	100.00a	84.00b	0.78ab	38.56ba	17.34b	40.85a	18.40a	42.00a	17.00a	6.23a	114.38a
4000	100.00a	76.29b	0.72ba	38.00b	16.32b	32.89b	14.81b	36.00b	12.20c	4.90c	98.04b
6000	100.00a	63.15c	0.59b	27.00c	14.28c	20.70c	10.40d	22.10c	7.14d	3.00d	60.19c
8000	100.00a	42.67d	0.36c	21.20d	11.18d	15.28dc	8.00de	20.86c	5.10e	2.08e	56.81dc
10000	100.00a	30.78c	0.32c	14.00de	9.26de	10.19d	6.11ed	15.12d	3.12f	1.75f	41.18d

SRI: Salts resistance index.

Mean separation within columns by Duncan's multiple range at 1% level

Table (5): Effect of saline irrigation water on chemical composition of *Parkinsonia aculeata L.* transplants during 2001 season.

Salinity Level	Leaves pigments (mg/g F.W)			Total carb.* (mg/g D.W)		N (mg/g D.W)		P (mg/g D.W)		K (mg/g D.W)		Na (mg/g D.W)		Cl (mg/g D.W)		Proline µg/ml	
(ppm)	Chl.a	Chl.b	Carot.**	Leaves	Roots	Leaves	Roots	Leaves	Roots	Leaves	Roots	Leaves	Roots	Leaves	Roots	Leaves	Roots
Control	2.358	1.588	0.380	25.54	25.89	32.00	19.00	0.90	0.64	21.12	14.66	4.83	8.40	22.19	19.52	0.071	1.408
2000	2.313	1.356	0.643	24.25	24.30	28.10	17.12	0.70	0.50	20.72	14.27	6.44	9.89	18.86	26.65	0.093	1.930
4000	1.429	1.424	0.647	24.22	23.57	26.50	16.30	0.64	0.41	20.33	13.83	6.80	10.93	20.98	28.62	0.116	2.138
6000	1.389	1.338	0.878	23.57	23.60	25.00	15.00	0.51	0.29	19.94	9.78	9.78	13.80	31.06	30.18	0.182	2.283
8000	1.187	0.535	0.975	23.26	23.31	21.00	12.80	0.42	0.25	17.99	8.99	18.86	16.10	47.04	34.67	0.210	2.318
10000	1.181	0.510	1.278	23.22	22.50	20.05	10.75	0.31	0.20	16.21	7.43	19.32	19.78	53.25	52.36	0.396	3.776

*Carb. = Carbohydrates **Carot. = Carotenoids

Regarding roots traits, it is clear that the lowest salinity levels (2000 ppm) induced a highly significant increase in root length (cm) and roots fresh and dry weights (g) comparing with control, while the opposite was the right for the higher levels.

According to SRI% values registered in table (4), it is obvious that Parkinsonia plants can tolerate salinity of irrigation water up to 8000 ppm because the mean of SRI% at that level is still more than 50% in the two seasons. So, Parkinsonia plants are considered to some extent, more tolerant to saline water than Vitex ones (Table B)

The aforementioned results, however, could be discussed as these obtained in case of *Vitex agnus-castus* plants as previously mentioned.

2- Effect on chemical composition:

The means of pigments content (mg/g F.W.) in the leaves of Parkinsonia plants presented in Table (5) indicate that chlorophyll a and b were progressively decreased, while total carotenoids increased with raising salinity concentration in irrigation water. A trend similar to that of chlorophylls was observed with total carbohydrates content (mg/g D.W.) in the leaves and roots.

With regard to minerals in the leaves and roots, data in general, show that N, P and K contents (mg/g D.W.) were declined, but Na and Cl contents were increased with raising salt concentration in water of irrigation.

The response of proline content to salinity of irrigation water was similar to those of Na and **Cl,** as proline contents in the leaves and roots of treated plants as was markedly increased with increasing salinity rate.

All previous gains, however may be discussed as attained in the case of Vitex plants.

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الملخص العربى

إلى أى مدى تتحمل شجيرات كف مريم والباركينسونيا ملوحة مياه الرى

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أجريت تجربة في وحدة بحوث الزينة بحديقة الأورمان النباتية –الجيزة– مصرخلال عامين متتالين هما ٢٠٠٠–٢٠٠١، لدراسة تأثير ملوحة الرى (كلوريد الصوديوم) بتركيزات: صفر، ٢٠٠٠، ٤٠٠٠، ٦٠٠٠،٨٠٠٠، ١٠٠٠٠ جزء في المليون على النمو والازهار والتركيب الكيماوى لنوعين من شجيرات الزينة الهامة هما: كف مريم (*Vitex agnus-castus. L.*) والباركنيسونيا (*Parkinsonia aculeata. L.*).

ولقد أظهرت النتائج عدم حدوث موت للنباتات المعاملة بزيادة تركيز ملوحة مياه الرى حتى ١٠٠٠٠ جزء فى المليون على الرغم من حدوث انخفاض تدريجي في معدل النمو الخضرى والجذرى والذى بلغ أوجه فى النباتات المعاملة بالتركيزات المرتفعة (٨٠٠٠ و ١٠٠٠٠ جزء فى المليون) ، غير أن الرى بمياه تركيز الأملاح بها ٢٠٠٠ جزء فى المليون أحدث زيادة فى جميع قياسات النمو الخضرى لنباتات كف مريم ، بينما زاد الوزن الطازج والجاف فقط للنمو الخضرى في نباتات الباركينسونيا مع زيادة معدل النمو الجذرى بها. ادت معاملات الملوحة الأعلى من ٤٠٠٠ جزء فى المليون الى تأخير ازهار نباتات كف مريم معنوياً، فى حين ادت جميع المعاملات الى خفض عدد النوات لكل نبات، طول النورة (سم) ، عدد البذور المتكونة على كل نورة وكذلك الوزن الطازج للنورة (جم)، إلا أن المعاملة ٢٠٠٠ جزء فى المليون أحدثت زيادة بسيطة فى عدد النورات لكل نبات. لم تزهر نباتات الباركينسونيا خلال مدة التجربة فى أى من الموسمين. بصفة عامة انخفض محتوى الأوراق من كللورفيللى أ، ب كما إنخفض محتواها والجذور من الكربوهيدرات الكلية، النيتروجين، الفوسفور، والبوتاسيوم، بينما زاد محتوى الأوراق من الكاروتينويدات، كما زاد محتواها والجذور من الصوديوم والكلوريد والحمض الأمينى برولين كلما ارتفعت تركيزات الملوحة.