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Effect of the Growth Regulator Uniconazole and Salt Stress on Growth, Yield and Nutrients Content of *Ammi majus L.* Plant

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Abstract: A pot experiment was conducted to study the effect of salinity levels of irrigation water (0, 2500, 5000, 7500 and 10000 ppm NaCl) and the growth regulator, uniconazole application (0, 20 and 30 ppm) on vegetative growth, fruitting character, cuomarin and nutrients content of *Ammi majus L.*plant. *Ammi majus L.* plant may ranked at the top of the group of plants considered to have medium salt tolerance, where dry weight/plant, No. of branches/plant, plant height, No. of umbels/plant, No. of umbellules/umbel and fruits production/plant were not affected by salinity levels of irrigation water up to 5000 ppm NaCl. The concentration of 7500 ppm NaCl slightly reduced the values of the previous characters, while the highest salinity level of 10000 ppm NaCl markedly depressed them. The concentration and the content of xanthotoxin of *Ammi majus L.*plant were significantly decreased by increasing NaCl concentration of the irrigation water up to the highest level of 10000 ppm. Gradually and significant decreases of N, P and K concentrations and highly significant increases in Na^+ and Ca^{++} concentrations in *Ammi majus L.*plant were occurred as a result of increasing salinity levels up to 10000 ppm NaCl in the irrigation water. The changes in Na^+ concentration in *Ammi majus L.*plant due to the chloride salinity levels showed completely an opposite trend to that of K^+ concentration. Increasing uniconazole concentration from 0 to 30 ppm significantly increased, plant height, No. of branches/plant, dry weight/plant, fruits and total umbels/plant, concentration and total content of xanthotoxin, macro (N, P, K, Na and Ca) as well as micronutrients (Fe, Zn, Mn and Cu) of *Ammi majus L.* plant. The highest values of the previous parameters were found by using the concentration of 30 ppm uniconazole as compared with 20 ppm and control treatments. The interaction between salinity levels and uniconazole application significantly affected all the growth and fruitting characters. (Except No. of umbels/plant and No. of umbellules/umbel). The highest values of growth and fruitting parameter were found under saline concentration of 2500 ppm and 30 ppm uniconazole. While weight of fruits/plant were obtained under 5000 ppm NaCl and 30 ppm uniconazole. The highest concentration and total content (mg/plant) of xanthotoxine were attained under irrigation with tap water and 30 ppm uniconazole. The highest values of all nutrients concentration were found by using 30 ppm uniconazole but differed under salinity levels i.e. N, K and Cu were found under irrigation with tap water. Sodium, Fe and Mn were found under salinity level of 10000 ppm NaCl. Calcium and Zn were found under salinity level of 7500 ppm NaCl.

Key words: uniconazole, stress, salinity, nutrient contents, xanthotoxin, *Ammi majus L.*

INTRODUCTION

In Egypt, several plant species, having medicinal values grow and yield well whether cultivated or wild ones. One of these wild plants is *Ammi majus L.* which contains natural cuomarins. Xanthotoxin is one of these cuomarins which is industrially utilized and used medically for the treatment of Leucodermia. It is of economical values for the Egyptian agriculture and pharmaceutical industry to cultivate such plant on economical basis, especially in recently cultivated regions using the available water sources including drainage as well as underground water.

Salinity is a major environmental problem which affects agricultural land in Egypt. Salt accumulation in soils from natural processes and irrigation adversely affects seed germimination, seedling growth as well as related metabolic processes of plants. The response of plants to salinity varied with species, organs and stage of development (Munns, 2002). Sodium chloride stress negatively influenced nitrate reductase activity of plants (Tabatabaei, 2006). It increased protease capacity (Muthukumarasamy *et al.*, 2000). Accumulation of organic

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solutes under saline conditions is an adaptive response of plants against osmotic stress (Tejera *et al*., 2004). Attempts have been made to employ growth regulators overcome the drastic effects of salinity, and used as a new tool for controlling nearly all the physiological processes and metabolic activities that occur within the plants and control their growth, development, flowering and yield. Uniconazole, as a potent and active member of the triazole family, was developed for use as plant growth retardant and is increasingly used to manipulate plant growth and yield (Zhang *et al*., 2006).

The application of uniconazole inhances nitrate reductase activity, photosynthetic rate and increase soluble protein content (Yang *et al*., 1994). It improved the drought tolerance of certain plants as reported by Imam *et al*., (1995) on wheat, Abou El-Kheir (2000) on soybean, Kassab *et al*., (2006) on lupine and May and muna (2007) on datura.

The present investigation was conducted to study the effects of salt stress and uniconazole on growth, yield and nutrients contents of *Ammi majus L* plant. However, few studies have been conducted on the interactive effect of uniconazole and salt stress on metabolic processes of plant and non is reported so far on *Ammi majus L* plant.

MATERIALS AND METHODS

A pot experiment was carried out in the green house of the National Research Centre, Dokki, Cairo, Egypt. During the winter season of 2006/2007, to investigate the influence of saline irrigation water and uniconazole application on growth, yield, cuomarin content as well as macro and micronutrients content in *Ammi majus L* plant.

The experiment included 15 treatments which were the combination of five salinity treatments i.e: 0, 2500, 5000, 7500 and 10000 ppm sodium chloride and uniconazole concentrations (0, 20 and 30 ppm) applied twice as spray. Uniconazole is a triazole derivative chemically known as [(E)-1-(P- chlorophenyl-4, 4 dimethyl-2-(1, 2, 4-triazole-1-4-1- penten 3-01)]. For each treatment 5 replicates were used. The seed beds were metallic of 15 Cm diameter and 25 Cm height, having a drainage hole. In each pot 3 Kg of sandy loam soil were placed. Approximately 25 seeds of *Ammi majus L* were sown at 15/ 11/ 2006 in each pot and irrigation was carried with tap water. After 40 days from sowing, the plants were thinned to 10 per pot and a basal dose (2 gm/pot) of a mixed fertilizer NPK was added. The irrigation with desired saline water was carried at 3 days intervals.

Simultaneous to saline water addition, the first spray of uniconazole was applied. The second spray was carried one week later. Three weeks after saline irrigation and uniconazole application, the spraying with uniconazole solution was maintained till drip. Well established plants were counted and plants were thinned again to three plants per pot.

At harvest time 15 June, 2007, some growth and fruitting characters i. e., plant height, number of branch, number of umbles/plant and number of umbellules/umbel were measured. The fruit production /plant was recorded and the variation of their xanthotoxin content, the economically most important cuomarin of *Ammi majus L*, was taken as an evaluating criteria for the different treated plant samples.

Quantitative Analysis of Xanthotoxin:

The cuomarin mixtures of test plant seeds were prepared according to the procedure of Abu Mostafa *et al*., (1964). The analytical method of Abu Mostafa *et al*., (1970) for selecting the cuomarin content of *Ammi majus L* seeds, was partially modified, taken in consideration that the chromatographic procedure should showing separate xanthotoxin from any other cuomarin or interfering substance. Also, the spraying reagent used for developing before densitemetric analysis should give different colours with different cuomarins to avoid any possible interference.

Chromatography on thin layers of alumina or silica was tried, either free or imprefnated, using different solvent system. The system Toluene: Ethyl acetate 4:1 v/v on silica gel G (Merck) proved to be the most convenient. Spraying with chlorosulphonic acid: acetic acid 1:3 v/v followed by heating for 15 min. at 140 C gave a variety of stable colours with the different cuomarins. The RF values and developed colour of each cuomarin of *Ammi majus L* fruits, using the previously mentioned producer were.

mentioned procedure were:	RF	colour		RF	colour
Marmesin	0.10	Dark brown	Berganten	0.55	Yellow green
Iso pimpinellin	0.35	Brown	Impratorin	0.70	Pink
Xanthotoxin	0.45	Gray green	Iso Impratorin	0.70	Pink

Densitometric selection of xanthotoxin separated as previously mentined on 4×20 cm plates was carried out using a Carl Zeiss Jena densitometer equipped with a 530 nm filter. Standardization was carried out by using pure xanthotoxin and the resulted curve was found to obey Beer's low.

The plants were harvested at 15 June, dried, grounded and well ashed for macro and micronutrients determination using the standard methods described by Cottenie *et al*., (1982). The analysis of the data was carried out according to procedure outline by Snedecor and Cochran (1982). For comparison between means L.S.D. test at 5 % level of probability was used.

RESULTS AND DISCUSSION

Growth Characters:

From the results obtained in Table (1), it could be concluded that plant height, No. of branches/plant and dry weight/plant were not affected with salt concentration up to 5000 ppm sodium chloride. However, the previous parameters were significantly decreased at higher salt concentrations of 7500 and 10000 ppm NaCl. This reduction may be attributed to increase the osmotic pressure of the irrigation water which leads to a depression in water absorption by plants, consequently reduced plant photosynthesis. Such reduction may be due to the inadequency of nutrients presented in the growing media (Sliman and Ghandoor, 1988) or to the decrease in water rate into plant (Shreif, 2000) since under saline condition root pressure is reduced causing a decrease in water flow. That means less water is taken up by the roots and transported into shoot. Consequently, less water is available for normal growth and development (Abou El-Nour, 2002).

The decreases in growth characters mentioned before may be due to the inhibition effect of salt stress on protein accumulation as reported by Abd-El-Baki *et al*., (2000) and Mutlu and Bozcuk (2005) on zea mays and sunflower plants. The obtained results of growth characters coincided with the results obtained by many investigators [Javed *et al*., (2003); Tester and Davenport, (2003); Aziz and Taalab (2004); Shi and Sheng (2005); Ashraf *et al*., (2005) and Abdel-Sabur *et al*., (2005)]

Table 1: Effect of salinity levels and uniconazole application on growth, fruitting characters, fruit-yield and cuomarin (mg/g xanthotoxin) concentration and production (mg/plant) of *Ammi majus L* plants.

Treatments		Growth characters			Fruitting characters					Xanthotoxin content	
Salinity levels ppm	uniconazole. conc. ppm	D.W. of Plant (gm)	No. of Branches/ plant	Plant Height (Cm)	No. of umbels/plant Fruiting umbels	Total umbels	Fertility %	No.of Umbellules /umbel	Wt. of Fruits/ plant (mg/g)	mg/g Fruits	mg/ plant
	0	0.735	4.42	30.8	3.56	4.60	77.4	17.82	324	5.3	1.88
(Control)	20	0.921	4.80	34.9	4.42	4.90	90.2	18.16	353	6.0	2.22
Tap water	30	1.180	5.60	35.8	4.54	5.10	89.0	20.28	356	7.85	2.58
Mean		0.945	4.94	33.8	4.17	4.87	58.5	18.75	344	6.38	2.23
	0	0.764	4.40	32.8	3.18	4.40	72.3	16.24	290	5.20	1.70
2500	20	1.008	4.62	34.6	3.66	5.02	74.4	16.80	360	6.57	2.00
	30	1.216	5.74	35.9	4.8	5.14	93.4	18.18	365	7.05	2.14
Mean		0.996	4.92	34.4	3.88	4.85	80.0	17.07	338	6.27	1.95
	0	0.798	4.26	32.7	3.56	4.26	83.6	16.52	288	4.86	1.40
5000	20	0.927	5.08	33.9	3.80	5.08	76.4	16.54	311	5.85	1.70
	30	1.096	5.14	35.8	4.03	5.10	78.4	17.76	381	6.90	2.04
Mean		0.940	4.83	34.2	3.82	4.82	79.4	16.94	327	5.87	1.71
	0	0.699	4.08	23.1	2.82	4.08	69.1	15.60	269	3.00	1.40
7500	20	0.715	4.14	23.9	3.28	4.14	79.2	16.40	273	5.10	1.50
	30	0.736	4.68	29.4	3.36	4.68	71.8	17.3	289	6.01	1.55
Mean		0.717	4.30	25.5	3.15	4.30	73.4	16.43	277	4.70	1.48
	0	0.622	3.62	20.5	2.49	3.62	68.8	12.10	205	2.80	0.60
10000	20	0.646	4.06	21.8	2.62	4.06	64.5	15.8	269	4.11	1.30
	30	0.726	4.32	25.5	3.02	4.32	69.9	16.00	279	5.12	1.50
Mean		0.665	4.00	22.6	2.71	4.00	67.8	14.63	251	4.01	1.13
Mean values	0	0.724	4.16	27.89	3.12	4.19	74.5	15.66	275	4.23	1.40
Of uniconazole	20	0.843	4.54	29.82	3.57	4.64	76.9	16.74	313	5.53	1.74
Concentration (ppm)	30	0.991	5.1	32.5	3.95	4.87	80.9	17.9	334	6.59	1.96
L.S.D 5 % salinity		0.138	0.16	2.99	0.71	0.16	-	1.34	39.5	0.35	0.19
Uniconazole		0.05	0.8	2.1	0.5	0.51	-	NS	20.1	0.27	0.15
Salinity *uniconazole		0.111	0.28	5.19	NS	NS	-	NS	45.7	0.62	0.33

Presented data in Table (1) show that spraying *Ammi majus L* plants with uniconazole solution markedly pronounced increasing plant height, No. of branches/plant and dry weight/plant, especially at the rate of 30 ppm. The mean values of uniconazole treatments on plant height showed the typical increasing effect of this substance on stem elongation with significant differences. The highest values of the growth parameter under study were attained by using the concentration of 30 ppm followed by 20 ppm and non sprayed treatment (control) in decreasing order. The favourable effect of uniconazole may be due to its role as a potent and active member of the triazole family which was developed for use as plant growth retardant and increasingly used to manipulate plant growth and yield (Zhang *et al*., 2006). Confirm the obtained results Imam *et al*., (1995); Nabila, Zeki (1999); Abou El-Kheir (2000) and Kassab *et al*., (2006) who stated that spraying wheat, fababean, soybean and lupine with 20 ppm of uniconazole increased all the growth and yield parameter as compared with untreated plants.

Application of uniconazole solution with saline water irrigation significantly affected, plant height, No. of branches/plant and dry weight/plant of *Ammi majus L* plants (Table 1). The spraying rate of 30 ppm unicolazole increased the dry weight/plant as compared with control treatments by 37.71, 37.17, 27.18, 5.03 and 4.33 % for the salinity levels of 0, 2500, 5000, 7500 and 10000 ppm NaCl respectively. These results are of interest as they revealed the uniconazole application under high saline condition (7500 and 1000 ppm NaCl) increased dry weight of *Ammi majus L* plants lower than those obtained under the lower (2500 ppm) and medium concentration (5000 ppm NaCl). Data also reveal that, the highest values of dry weight/plant, No. of branches/plant and plant height were obtained under saline concentration of 2500 ppm and using unicolazole concentration of 30 ppm. While the lowest ones were attained under saline condition of 10000 ppm NaCl and control treatment (non sprayed with unicolazole solution). In this connection Leul and Zhou (1998) stated that when uniconazole applied foliarly on rape seeds, it enhanced tolerance to stress.

Fruit Characters:

Number of Umbels/plant:

The total number of umbels/plant confirmed precisely the number of branches/plant, where each branch possessed one umbel at a terminal position. However, sterility of some umbels occurred (umbels practically gave no fruit even after blooming), consequently, the fertility percentage was varied according to both salinity and uniconazole treatments (Table 1).

Increasing salinity levels in irrigation water significantly decreased the fruitting as well as total umbles/plant. However, this effect was very clear under the highest levels of saline i.e. 7500 and 10000 ppm NaCl only as compared with those obtained under salinity levels of 2500 and 5000 ppm NaCl. Data also show that, there was non significantly differences in fruiting and total number of umbels under the lower (2500ppm) and medium (5000 ppm) NaCl salinity. This means that the reduction in fruitting and total umbels/plant was pronounced and highly significant only at the higher level of 10000 ppm NaCl. Moreover, data in Table (1), show that the fertility % decreased gradually by increasing the salinity levels of irrigation up to 10000 ppm NaCl. This effects may be due to the salinity which mediates a damages to the apparatus of protein synthesis and blocks transcription of RNA from DNA with subsequent depressed translation into protein through binding of DNA and/or RNA with certain inhibitors as recommended by Datta *et al.*, (1997). Confirm the obtained results Javed *et al.*, (2003) who studied the differential response of three barley genotypes at four levels of NaCl (2.5 as control, 10, 15 and $20dsm^{-1}$), and found that salinity caused reduction in all the yield components of barley genotypes such as spike length, number of spikelets per spike, fertile tillers per plant, grain yield and 100 grain weight.

Irrespectively of the salinity effects, the uniconazole application significantly increased fruiting umbels and total umbels/plant, as compared with those obtained under non sprayed treatment control (Table 1). Furthermore, the fertility % also increased as the concentrations of uniconazole increased from 0 to 30 ppm.These results suggest that application of uniconazole may have a promotive effect on umbels production and fruit set of *Ammi majus L* plants. In this concern, Yang *et al*., (1994) reported that uniconazole enhances nitrate reductase activity, photosynthetic rate and increase soluble protein content.

The interaction effect of salinity and uniconazole application proved to be significant (Table 1). The highest values of fruiting as well as total numbers of umbels/plant were obtained under salinity concentration of 2500 ppm and the uniconazole level of 30 ppm, while the lowest ones were attained under the highest level of salinity concentration (10000 ppm NaCl) and the unsprayed treatment with uniconazole (control).

No. Of Umbellules/umbel and wt. Of Fruits/plant:

Data presented in Table (1) show continuous decreases in the No. of umbellules/umbel as well as wt. of fruits/plant by increasing salinity level up to 10000 ppm NaCl in irrigation water. This reduction was not significant up to 7500 ppm NaCl for No. of umbellules/umbel, while it was only significantly decreased at the highest salinity treatment (10000 ppm NaCl).

The obtained data reveal that the nun saline treatment (control) and the lower salinity treatment (2500 ppm

NaCl) showed a pronounced increase in fruit production (wt. of fruit/plant). This could be attributed directly to the higher fertility % of plant umbels subjected to such treatments. Moreover, the data indicate also that fruit production/plant did not decrease even under medium salinity treatment of 5000 ppm NaCl. At higher salinity levels i. e. 7500 and 10000 ppm NaCl, the production of fruit significantly depressed especially by irrigation plants with the highest level of 10000 ppm NaCl. This may be due to the stress imposed by NaCl (higher levels) which promotes the activity of hydrolytic enzymes involved in protein degradation as stated by Munjal *et al*., (1995).

It is clear from Table (1) that spraying the *Ammi majus L* plant with 20 or 30 ppm uniconazole, resulted in a slight but non significant increases in the No. of umbellules per umbel. While, spraying the plants with 20 or 30 ppm uniconazole showed significantly increases in fruits production (wt. of fruits/plant) as compared with untreated control. In this concern El-Moursi (1976) observed a slight increase in fruits production of *Ammi visnaga* by application of very low rat of 50 ppm uniconazole. However, when uniconazole was applied together with high salinity levels there was a marked effect, which tends towards increasing salt tolerance of *Ammi majus L* plant, resulting finally in a pronounce increase in fruits production. This may be due to the acceleration effect of salt and water absorption induced by uniconazole applications, which enable the plant to withstand the toxic effect of salinity. The positive effect of uniconazole noticed in the present study is in accordance with the findings of Abou El-Kheir (2000) and kassab *et al*., (2006).

The interaction between salinity levels and uniconazole application did not show any significant affect on the No. of umbellules/umbel. While, the fruits production (wt. of fruits/plant) significantly affected by the interaction between salinity levels and uniconazole application. The highest values were found under salinity level of 5000 ppm NaCl and using uniconazole concentration of 30 ppm. While the lowest ones were obtained under salinity level of 10000 ppm NaCl and untreated control with uniconazole. In this concern May and Muna (2007) stated that uniconazole reversed the adverse effects of salinity through accumulation of soluble protein in the developed seedlings. They revealed a significant decrease in protease activity in datura species by the combined treatment of uniconazole and salinity.

Xanthotoxin Concentration and Content:

Table (1) indicates that the concentrations of xanthotoxin in *Ammi majus L* fruits (mg/g) as well as the total amount mg/plant were significantly decreased by increasing NaCl concentration in the irrigation water up to the highest level of 10000 ppm NaCl. Data also show that the concentration (mg/g) of xanthotoxin under saline level of 2500 ppm NaCl did not significantly differ with those obtained under the control treatment (irrigated with tap water). These results related directly to fruit production/plant which also depressed at higher salinity levels. The reduction of xanthotoxin concentration and content under saline conditions could be attributed to the decrease in the dry matter accumulation and the inadequency of osmotic regulation induced by imbalance uptake of nutrients presented in the soil as affected by the salinity level of irrigation water. Confirm this hypothesis Abou El-Nour (2002).

Application either 20 or 30 ppm of uniconazole induced significantly increased in xanthotoxin concentration (mg/g) and total content (mg/plant) as it is shown in Table (1). These increases in concentration and total content of xanthotoxin were significantly under any treatment of saline irrigation water (from control to 10000 ppm NaCl) The highest values of xanthotoxin concentration and total production were attained by applying the higher rate of 30 ppm uniconazole as compared with 20 ppm and control treatment which sprayed only with water. This would be a result of uniconazole which enhanced mobilization of photosynthetic from leaves to productive organs. In this concern El-Bahay *et al*., (2003) reported that foliar spray with different concentration of uniconazole (5-20 ppm) increased DNA, RNA and protein in soybean seeds. Uniconazole possibily exerted its action upon DNA-RNA synthezing protein machinery at transcriptional and/or translational levels.

The interaction between salinity levels of irrigation water and uniconazole application significantly affected the concentration (mg/g) as well as total content (mg/plant) of xanthotoxin substance in *Ammi majus L* plant. The highest values of the concentration and total content of xathotoxin were found under irrigation with tap water (control) and using 30 ppm uniconazole. While the lowest ones, were obtained under the highest level of salinity in irrigation water (10000 ppm NaCl) and using the control treatment which sprayed with water without any uniconazole addition.

From the foregoing discussion of obtained results it appeared that *Ammi majus L* tended to become adapted to their surrounding in such a way to maintain a suitable growth and production under saline irrigation. In addition the results added the new species of (*Ammi majus L*) in which its growth and production were improved pronouncedly by uniconazole spraying, especially when plants grown under different saline conditions.

Nutrients Concentration:

Data in Table (2) show the influence of salinity levels of irrigation water, uniconazole application and their interactions on concentration of macro (N, P, K, Na and Ca) and micronutrients (Fe, Zn, Mn and Cu) in *Ammi majus L* plant.

Table 2: Effect of salinity and uniconazole application on the concentration of macro and micronutrients in *Ammi majus L* plants.

Treatments		mg/g dry weight					µg/g dry weight			
Salinity levels ppm	uniconazole conc. ppm	N	P	K	Na	Ca	Fe	Zn	Mn	Cu
	0	11.67	2.08	9.08	3.97	32.04	681.60	240.0	146.0	23.4
(Control)	20	13.17	2.22	11.94	6.22	39.82	756.80	360.0	168.0	70.2
Tap water	30	14.89	2.39	13.27	6.81	41.59	801.30	415.0	190.0	80.0
Mean		13.24	2.23	11.43	5.67	37.82	746.57	338.3	186.0	57.9
	0	10.25	1.25	8.490	9.02	48.92	733.73	340.0	150.0	11.7
2500	20	12.92	2.17	10.07	10.64	56.92	828.90	370.0	175.0	12.1
	30	13.77	2.47	10.12	11.19	57.14	896.46	400.0	200.0	23.4
Mean		12.31	1.96	9.560	10.28	54.33	819.69	370.0	175.0	15.73
	0	10.92	1.10	8.700	12.53	59.09	816.63	360.0	165.8	9.36
5000	20	11.79	1.74	8.790	12.95	63.72	890.33	400.1	192.0	8.90
	30	12.86	2.21	9.480	12.99	67.72	994.73	410.2	204.9	11.7
Mean		11.85	1.68	8.990	12.82	63.51	900.56	390.1	187.57	10.0
	0	10.29	0.91	8.400	14.91	63.41	838.80	332.5	166.2	7.00
7500	20	11.51	1.50	8.310	15.51	66.99	922.8	440.0	191.0	8.20
	30	12.10	2.10	9.110	16.00	70.99	977.90	560.0	205.3	8.80
Mean		11.30	1.50	8.610	15.47	67.13	913.17	444.17	187.5	8.00
	0	9.350	0.80	7.100	16.80	62.33	893.40	325.0	172.5	6.80
10000	20	10.22	1.38	7.800	17.60	63.00	1003.9	370.0	185.0	7.00
	30	11.65	1.91	9.800	17.80	69.04	1105.8	402.3	210.0	7.30
Mean		10.41	1.36	8.230	17.4	64.79	1001.03	365.8	189.17	7.03
Mean values	0	10.5	1.23	8.530	11.45	53.16	792.83	319.5	160.10	8.70
Of uniconazole	20	11.92	1.8	9.380	12.58	58.09	880.55	388.02	182.22	21.28
Concentration (ppm)	30	13.05	2.22	10.36	12.96	61.3	955.12	437.52	202.04	26.24
L.S.D 5% salinity		0.89	0.08	0.251	0.3	0.78	10.8	8.91	NS	0.9
Uniconazole		0.72	0.06	0.28	0.096	0.699	28.63	25.72	6.99	1.44
Salinity *uniconazole		1.11	0.23	0.621	0.219	1.461	57.3	38.22	14.15	3.4

Data show a gradual and significant decreases of N, P and K concentrations in *Ammi majus L* plant as a result of increasing salinity levels up to the level of 10000 ppm NaCl in the irrigation water. In this concern, Tabatabaei, 2006 and May and Muna (2007) reported that under saline condition nutrient absorption is restricted by lack of nutrients or by the small water potential in the rooting medium. They added that salt stress imposed by NaCl induced a significant decrease in protein content along with activity of nitrase in the developed seedlings and these changes were more significantly at higher salinity levels. Concerning salinity treatment, it is clear that macronutrient contents generally, decreased as compared with control treatment (Table, 2). These results are in good agreement with those obtained by Aziz and Taalab (2004) who stated that all the salinity levels reduced the concentration and uptake of nutrient by dragonhead plant, and the effect was more severe under the highest level of salinity.

Data presented in Table (2) show that pronounce and highly significant increases in Na^+ and Ca^{++} concentrations occurred by growing *Ammi majus L* plant under all salinity levels with only one exception, that Ca^{++} concentration at 10000 ppm NaCl was significantly decreased as compared with its concentration under 7500 ppm NaCl. It is interesting to note that the change in Na^+ concentration in *Ammi majus L* plants due to chloride salinity levels showed completely an opposite picture to that previous reported for potassium. Actually such results reflect to great extent the competition between the uptake of these two cations i.c Na^+ and K^+. Such competition might be due to the existence of general carrier for their absorption by the roots. The metabolism of Na^+ and K^+ is an important component of salt stress. Usually, Na^+ increases and K^+ decreases in plants stressed by salt (De Lacerda et al., 2003).

Results in Table (2) show progressive and consistent decreases of Fe and Cu concentrations by increasing salinity levels. These decreases may be due to the depressive effect of salinity on root growth and distribution in soil. Zinc concentration tends to significantly increase by increasing NaCl concentration up to 7500 ppm. The further increase in salinity (10000 ppm NaCl) resulted in a decrease in Zn concentration in *Ammi majus*

L plant. Moreover, data also show that Mn concentration did not show any significant affect by increasing salinity levels in irrigation water. Confirm the obtained results Abou-El-Nour (2002).

Data presented in Table (2) proved that increasing uniconazole application from 0 to 30 ppm significantly increased all the macro (N, P, K, Na and Ca) as well as micronutrients (Fe, Zn, Mn and Cu) in *Ammi majus L* plants. In this concern, it is shown that corn plants treated with GA3 recorded a highest content of Zn, Mn, Fe and Cu, a result which suggested that such materials (growth regulators) might enhance nutrient uptake by the roots (Hassan *et al*., 1979). While May and Muna, (2007) stated that uniconazole countered the adverse effect of salinity and significantly increased protein levels and stimulated nitrate reductase activity, particularly at lower NaCl concentrations.

The interaction between salinity and uniconazole application significantly affected all the macro and micronutrients concentration in *Ammi majus L* plants (Table 2).

The highest values of N and K concentration were obtained under control (irrigated with tap water) and using the 30 ppm uniconazole, while the highest P concentration were found under salinity level of 2500 ppm NaCl and using the 30 ppm uniconazole. On the other hand, the lowest values of N, P and K concentrations were attained under the highest saline level of 10000 ppm NaCl and non sprayed treatment with uniconazole (control). Concerning the concentration of Na^{+} and Ca^{++}, data show that the highest levels of Na^{+} were found under the highest level of saline (10000 ppm NaCl) and 30ppm uniconazole, while the highest levels of Ca^{++} concentration were attained under saline level of 7500 ppm NaCl and sprayed with 30 ppm uniconazole. Moreover, the lowest values of Na^{+} and Ca^{++} were found under control treatment (irrigated with tap water) and the treatment which did not sprayed with uniconazole (control).

The highest values of Fe and Mn concentration in *Ammi majus L* plants as affect with the interaction between salinity and uniconazole application were found under the highest salinity level of 10000 ppm NaCl and sprayed with 30 ppm uniconazole, but for Zn concentration, the highest values were attained under saline level of 7500 ppm NaCl and sprayed with 30 ppm uniconazole. While the lowest values of Fe, Zn and Mn concentration were found under control treatment (irrigated with tap water) and non sprayed treatment with uniconazole. For copper concentration, the highest values were obtained under control and sprayed with 30 ppm uniconazole, while the lowest ones were found under the highest salinity level of 10000 ppm NaCl and non sprayed treatment with uniconazole (control).

Generally, the literature on this subject is very rare especially that concern with the effect of uniconazole and its interaction with salinity on nutrition content of *Ammi majus L* plants, whether macro or micronutrients. However, the obtained results pointed that uniconazole application increased the salt tolerance of *Ammi majus L* as indicated by dry matter yield, especially at higher salinity level of irrigation water. Moreover, uniconazole application together with saline irrigation, increased plant capacity for macro and micronutrients uptake as a result which is similar to that found by Papadakis (1968), with other plant species.

Exogenous application of the growth regulator uniconazole was partially effective in overcoming the adverae effects of salinity; mediated by restoring the metabolic alterations imposed by salt stress May and Muna, (2007). Thus application of uniconazole improved the nutrients status of *Ammi majus L* when cultivated under such condition.

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