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ADAPTATION OF *SILENE SUCCULENTA* FORSSK. AND *SPERGULARIA MARINA* (L.) BESSLER GROWING IN THE DELTAIC MEDITERRANEAN COAST OF EGYPT

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ABSTRACT

The present study is concerned with identifying the adaptive features of *Silene succulenta* (psammophytic species) and *Spergularia marina* (halophytic species) using a set of morphological, anatomical and physiological traits in response to soil salinity.

Morphological traits indicated that the highly stressed plants have thicker, narrower and shorter leaves than the less stressed plants.

Anatomical traits showed a reduction in xylem vessels size and increasing in leaf thickening.

The total protein and proline contents were found to increase with the increase of soil salinity, within limits, i.e. the highest soil salinity cause a decrease of total protein. Total free amino acid (except proline) did not show specific relationship to elevated soil salinity. SDS-PAGE analysis showed disappearance of protein bands and appearance of other bands in sites of high soil salinity.

Key words: *Silene succulenta* , *Spergularia marina* , adaptation, Egypt.

INTRODUCTION

Silene succulenta and *Spergularia marina* belong to family *Caryophyllaceae* which is a primarily temperate family, this family is found in all temperate parts of the world and sparingly on mountain in tropics with strong concentration in the Mediterranean region. *Silene succulenta* Forssk., is a succulent perennial herb, distributed in Egypt on the coastal sand dunes and coastal sand plains of the Mediterranean **[Bolous (1999); El Hadidi (2000) and Zahran & Willis (2009)]**. *Silene succulenta*, with *Cyperus macrorrhizus* coming close to being an indicator of a less mobile erosive environment **[Levin *et al.*, (2008)]**

The species is listed as a medicinal plant **[Batanouny (1999) and Abdelaziz *et al.*, (2008)]** reported that *Silene succulenta* extracts are highly effective in inducing cells proliferation of macrophages.

Spergularia marina (L.) has a cosmopolitan distribution in moist saline habitats [**Unger (1992)**]. In Egypt *Spergularia* is distributed in saline soils in Nile region including Delta, Valley and Fayium, Mediterranean region and in Sinai [**Bolous (1999)**] *Spergularia* species are known to accumulate sodium and chloride ions in their tissues, so it could help in soil desalinization [**Keiffer & Ungar (1997)**].

Plant morphology provides an indicator of ecosystem status and reflects both the plants history in an environment and its strategy for maximizing biomass production and reproduction in that environment [**Richard & Ivey (2004)**].

Anatomical features are the most conspicuous adaptation found throughout plant body [**Dickison (2000) and Gie-Wanowska *et al.*, (2005)**] found many anatomical features changes in *Dischampsia anatarctica* leaves exposed to high salinity. Water-deficit stress- induced anatomical changes in higher plants was studied by [**Shao *et al.*, (2008)**]

Accumulation of several nitrogen containing compounds such to stress as amino acids and proteins is regarded as a common response of plants to salinity stress [**Hurkman *et al.*, (1989) and El-Shintinawy & Hassanein (2001)**].

Proline accumulation is a common metabolic response of higher plants to water deficits and salinity stress [**Taylor (1996)**]

This work is an attempt to study the adaptive strategy of two selected species that belong to *Caryophyllaceae* namely, *Silene succulenta* (pasmmophytic species) and *Spergularia marina* (halophytic species). The morphological, anatomical and the biochemical features , were studied to characterize the distribution pattern of both species and to predict the future changes in their populations.

MATERIALS and METHODS

Soil samples and plant material were collected from 6 different sites for *Silene succulenta*. These sites are: interdune area, dune leeward, dune crest, dune horn, highway and site ca. 200 m far from the beach. Plants from these sites were symbolized: S.s.1, S.s.2, S.s.3, S.s.4, S.s.5 and Ss.6 respectively. Soil samples and plant material were collected from 4 different sites for *Spergularia marina* were Alswahel- Damietta, Cultivated land in Damietta, Garden in New Damietta and road side in New Damietta. Plants from these sites were symbolized: S.m.1, S.m.2, S.m.3 and S.m.4 Fig.(1).

The contents of calcium carbonates were determined according to [**Jackson (1962)**] and organic carbon [**Piper (1947)**]. They were estimated on air dry soil samples. A 1:5 soil solution was used in the estimation of soil pH [**Jackson (1962)**] Total-nitrogen was determined by using Microkhjeldahl method of [**Hawk *et al.*, (1947)**]. Total phosphorus was determined according to that of the [**APHA (1992)**]. Potassium, sodium and Calcium of the soil extract were measured by using Flame Photometer model Jenway PFP7.

Morphological traits e.g. shoot length, root length, internode length, leaf length and width for target species were measured. The leaf thickness and internodes diameter measured by using false foot for anatomical measurments, stem and leaf sections (10-12 µ) were prepared according to the paraffin method of Johansen (1940). Safranin and haematoxylin were used for staining.

For plant analysis, plant samples (four replications for each site) were kept in ice tank, and then divided into two parts one part was kept at -20 °C and used for determination of total protein content and for protein electrophoresis technique while the other part was dried in oven at 80 °C and used for proline and free amino acid determination.

Proteins were extracted according to **[Scarponi & Perucci (1986)]**. The protein content was determined according to **[Bradford (1976)]**. Free proline was determined according to the method of **[Bates (1973)]**.

For SDS-PAGE electrophoresis of proteins; proteins were resolved as described by **[Laemmli (1970)]**, a known amount of fresh plant material (leaf) was ground in extraction buffer (80 mM Tris-HCl PH 7.4) was added (200 µl for each 200 mg of the plant material). After complete mixing, the debris was removed by centrifugation at 14000xg for 5 minutes). **[kleibaum *et al*, (1998)]**

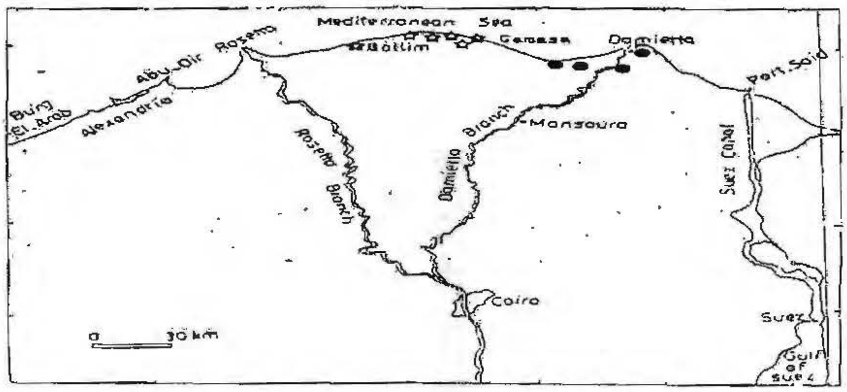


Fig.(1):Location map of *Silene succulenta* (*)and*Spergularia marina*(.)

Samples were heated in water bath at 95°C for 5 minutes. 12% polyacrylamide slab gel containing SDS were prepared as described by **[Laemmli (1970)]** and a sample of about 10 µg of protein was loaded in each well, Samples were run at 150 v until the tracking dye reached the end of the gel, then the power supply was disconnected and the gels were removed. Gels were stained using 0.25% Brilliant blue R 250 until bands appeared and destained with 10 % methanol to get a clear gel background. Statistical analysis was carried out according to **[kleibaum *et al*, (1998)]**

RESULTS

Data of soil analyses are presented in table (1) Total dissolved salts have been measured for the soil of the two species and there is a great variation in soil salinity for the two species. The electric conductivity ranged from 64 µS/cm to 188 µS/cm for *Silene succulenta* soil, the highest was in soil sample (6) and the second in order was number (4). The electric conductivity ranged from 360 µS/cm to 1376 µS/cm in *Spergularia marina* soil samples, the most stressed was in soil sample (2).

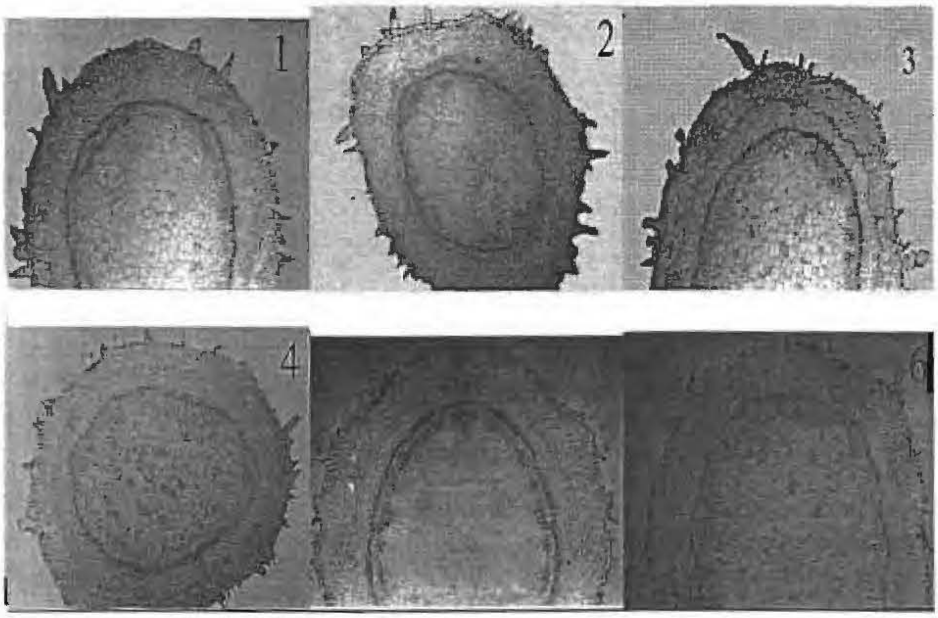


Fig. (2): *Silene succlenta* stem cross section (x=42)

The moisture content ranged from 3.2% to 7.2% in *Silene*, while it ranged from 9.7% to 25.8% in *Spergularia* . In *Silene* soil pH ranged from 7.77 to 8.73 and ranged from 7.82 to 8.05 in *Spergularia* soil extract.

Calcium carbonates was about 4.6 % in soil samples (2, 4 and 5) of silene while it was 5.4% in sample number (3) and 2% in sample number (1). It ranged from 0.31% to 5.25% in *Spergularia marina* samples .Organic carbon was low and ranged from 0.001% to 0.6% in soil samples of *Silene* while in soil samples of *Spergularia,* it was more and ranged from 0.57% to 2.7%.Sodium ion concentration in *Silene* soil extract ranged from 24.8 to 58.7 mg/100 mg. In *Spergularia* soil extract sodium ion concentration were less variable and ranged from 79.9 to 1788 mg/100 mg soil. Potassium ion contents in soil samples for *Silene* ranged from 0.1 to 0.3 mg/100 mg. While in *Spergularia* soil samples K^+ ranged from 0.3 to 105 mg/100 mg.

Calcium ion in *Silene* soil samples ranged from 15.5 to 52.4 mg/100 mg. while in *Spergularia* case it was higher than *Silene* soil sample and ranged from 51.04 to 115.04 mg/100 mg. Nitrogen content in *Silene* soil samples ranged from 1.039 to 2.106 mg/g dry weight. In *Spergularia* soil samples total nitrogen content ranged from 0.365 to 2.361 mg/g dry weight.

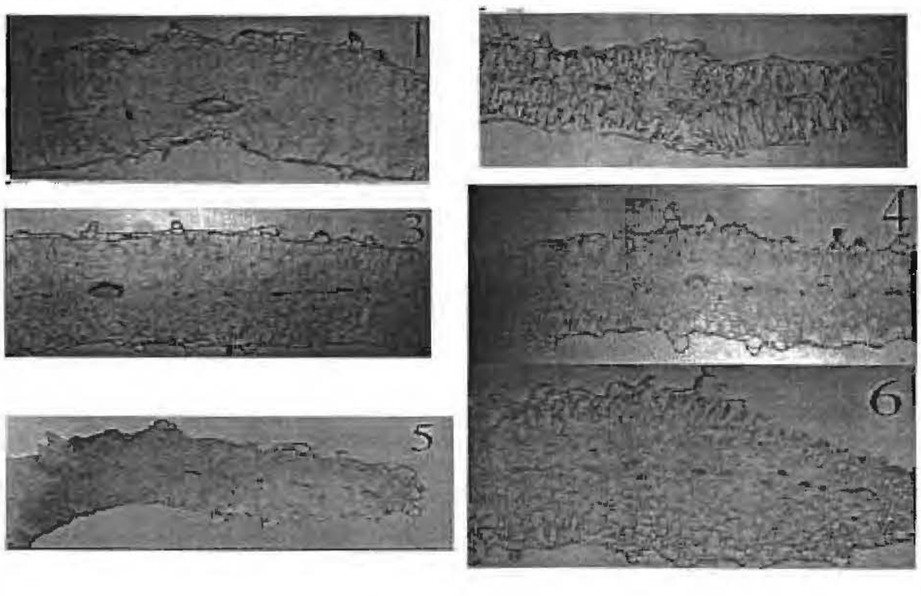
In *Silene* soil phosphorus content ranged from 0.042 to 1.827 mg/g dry weight while in *Spergularia* it ranged from 1.21 to 2.607 mg/g dry weight.

Table (1): Chemical analysis of soil supporting the growth of *Silene succulenta* and *Spergularia marina*

Soil variable	*Silene succulenta*			*Spergularia marina*		
	Range	Mean	S.D.±	Range	Mean	S.D.±
M.C. %	3.2-7.2	4.83	1.473	9.7-25.08	18.475	6.676
PH	7.77-8.73	8.19	0.352	7.82-8.05	7.96	0.100
E.C (µs/cm)	64-188	113	47.898	360-1376	773.5	440.494
O.C. %	0.001-0.6	0.193	0.235	0.57-2.7	1.867	0.913
CaCO3 %	4.6-5.4	4.7	0.339	0.31-5.25	2.04	2.285
Na+(mg/100g)	24.8-58.7	42.22	14.201	79.9-1788	753.725	805.694
K+(mg/100g)	0.1-0.3	0.166	0.082	0.3-105	0.825	0.537
Ca++(mg/100g)	15.5-52.4	32.01	15.883	51.04-115.0	68.8	31.094
Mg++(mg/100g)	10.2-85.5	39.966	28.584	16.2-86.4	62.45	32.886
Total-N (mg/g)	1.04-2.11	1.463	0.405	0.37-2.36	1.122	0.873
Total-P (mg/g)	0.04-0.95	0.45	0.360	1.21-2.61	2.032	0.630

M.C.= Moisture Content , E.C. = Conductivity , O.C. = Organic Carbon

Fig. (3):*Silene succlenta* leaves cross section (x=42).



Morphological and anatomical variation:

Silene plants did not vary considerably except *Silene* (4) which exhibit less shoot length because of its short internode length and both ecodemes (4) and (6) have thicker, narrower and shorter leaves than other ecodemes. *Spergularia* (1) exhibits shorter shoot length as compared to all other ecodemes and *Spergularia* (2) exhibit longer and thicker leaves and longer shoot length Tables (2).

The cortex width of *Silene succulenta* ranged from 0.258 mm to 0.352mm. the highest cortex width recorded in ecodeme (6) which differ significantly for all ecodemes except ecodeme (1) while ecodeme (2) different significantly from all other ecodemes. In *Spergularia marina* cortex width ranged from 0.058 mm to 0.142 mm. Ecodeme (3) has the highest cortex width while ecodeme (4) has the lowest width and was significantly different than ecodemes (1) & (3).

The pith /cortex ratio have been recorded and found to be ranging from 3.049 to 4.918 while in *Spergularia marina* it found to rang from 1.673 to 4.088, the ecodeme (4) was significantly different from all other ecodemes.

Table (2): Morphological traits of *Silene succulenta* (Ss.) and *Spergularia marina* (Sm)

Site	Shoot Length (cm)	Root Length (cm)	Internode Length (cm)	Internode diameter (cm)	Leaf Length (cm)	Leaf Width (cm)	Leaf Thickness (cm)
Ss.1	21.63^{acf}	-	2.43^{bd}	0.4167^{adf}	1.57^{acf}	1.28^{ac}	0.1325^{acf}
Ss.2	28.5^{f}	-	3.01^{bf}	0.3483^{a}	2.08^{f}	1.65^{e}	0.124^{ab}
Ss.3	225.82^{adf}	-	2.48^{be}	0.3833^{acf}	1.65^{adf}	1.31^{ad}	0.1175^{a}
Ss.4	17.01^{a}	-	1.8^{a}	0.465^{aef}	1.1^{a}	0.92^{a}	0.147^{aef}
Ss.5	26.28^{fae}	-	2.4^{bc}	0.373^{abf}	1.7aef	1.2ac	0.136adf
Ss.6	20.18abf	-	2.1b	0.555f	1.23ab	0.93ab	0.165f
Sm.1	14.55a	20d	1.787a	0.148ab	1.878a	0.143ab	0.075a
Sm.2	25d	11.3a	2.567ac	0.245b	3.0667b	0.31d	0.095ad
Sm.3	19.17ab	16.5acd	2.567ac	0.117a	2.433ab	0.113a	0.085ab
Sm.4	20.75ac	13.3ab	2.138ab	0.14abc	2.47abc	0.153ac	0.09ac

Data are means of four replications.

Means with common letter are non significantly different at $p \leq 0.05$ level according to LSD at 5% level of significance [**Kleinbaum** ***et al.*****, (1998)**].

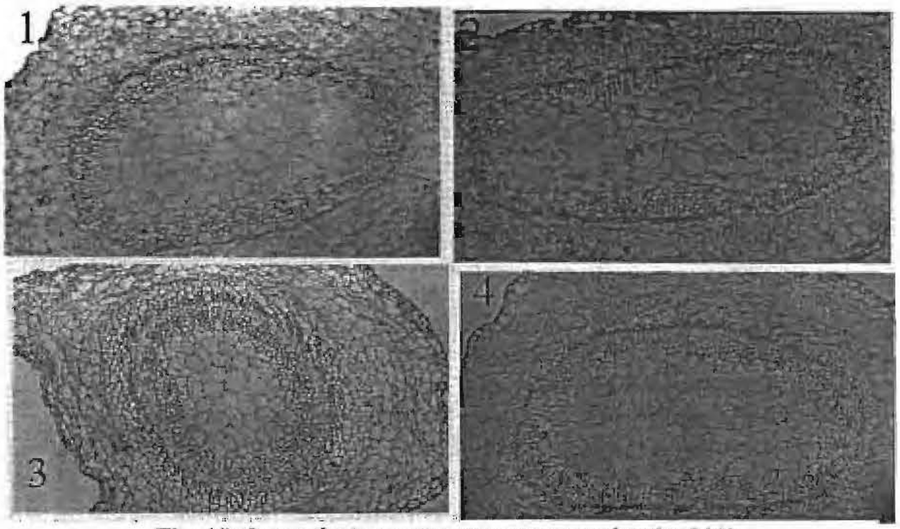


Fig. (4):*Spergularia marina* stem cross section (x=200).

Reduction in xylem vessels size with increasing soil salinity was observed for both species. The radius of xylem vessels for *Silene succulenta* ranged from 0.021 mm to 0.037 mm. The most stressed ecodeme (6) have the lowest xylem vessels size and significantly different from all other ecodemes except the second stressed one ecodeme (4). For *Spergularia marina* xyleme vessels radius ranged from 0.012 mm. to 0.016 mm., ecodeme 2 of the highest soil salinity has the lowest xyleme vessels size.

The cross section of leaf taken from node number three. The leaf width, in *Silene succulenta* ranged from 6.23 mm to 7.89 mm. In *Spergularia marina* leaf width ranged from 0.25 mm to 0.52 mm, the ecodemes (1) & (2) were significantly different from other ecodemes, while ecodemes (3) & (4) were non significantly different Table (3).

The leaf thickness of *Silene succulenta* ranged from 0.65 mm to 1.49mm, the ecodeme (6) &(4) are non different significantly each other but to all other ecodemes and has the highest leaf thickness. In *Spergularia marina* leaf thickness ranged from 0.193 mm in ecodeme (3) to 0.338 mm in ecodeme (2) which were significantly differed to each other and to the other two ecodemes. The midrib thickness in *Silene succulenta* ranged from 0.093 mm to 0.0122 mm while in *Spergularia marina* it ranged from 0.027 mm to 0.043 mm. The leaf thickness/midrib thickness for *Silene succulenta* ranged from 6.15 to 14.89 while in *Spergularia marina* it ranged from 6.365 to 10.358 Table (3)

For *Silene succulenta* stomatal frequency ranged from 74.5 to 135.28 stomata/mm^2, while for *Spergularia marina* ranged from 93.5 to 115.3 stomata/mm^2. for both species stomatal frequency found to be decreas with increasing soil salinity.

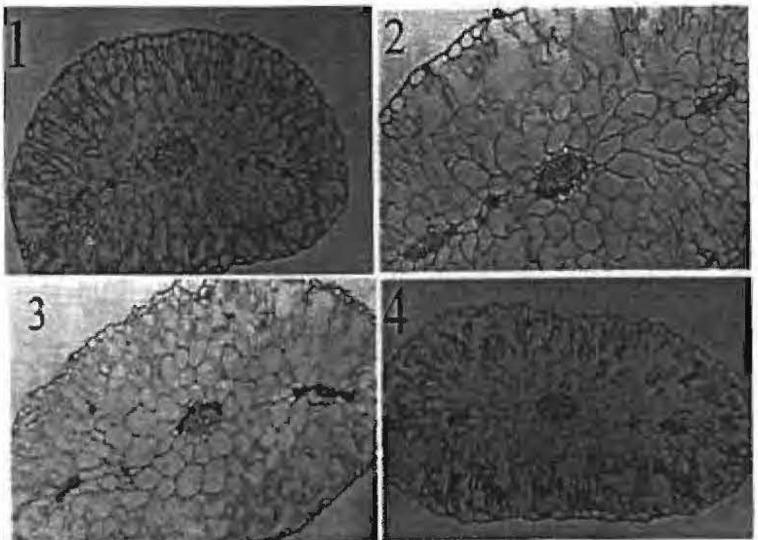


Fig. (5): *Spergularia marina* leaves cross section (x=200).

Table (3). Anatomical characteristics of *Silene succulenta* (Ss.) and *Spergularia marina* (Sm.)

Site	Stem				Leaf				
	Cortex Width (mm)	Pith Diameter (mm)	Pith / Cortex ratio	Xylem Vessels Radius (mm)	Stomatal Frequency Stomata/mm²	Width (mm)	Thickness (mm)	Midrib (mm)	Thickness / Midrib Ratio
Ss.1	0.352cf	1.061ab	3.05a	0.0297c	119.8cd	6.88adf	0.709ab	0.093a	8.38ade
Ss.2	0.3073d	1.062ac	3.514acd	0.031cd	125.58c	7.89f	0.726ac	0.122ac	6.15a
Ss.3	0.266ac	1.319f	4.918fg	0.037ce	135.28f	6.62acf	0.647a	0.099ab	7.73ace
Ss.4	0.258a	0.999a	3.892de	0.025ab	75.22ab	7.14ef	1.216e	0.112ad	12.12cf
Ss.5	0.264ab	1.243acf	4.733f	0.028bc	98.8c	6.43ab	0.732ad	0.109ac	7.46abc
Ss.6	0.347c	1.19adf	3.439abd	0.021a	74.5a	6.22a	1.49cf	0.112ad	14.89f
Sm.1	0.117b	0.22b	1.67a	0.015b	112.2ac	0.25a	0.253b	0.432c	6.365a
Sm.	0.098ab	0.2a	2.15ac	0.012a	93.5a	0.52d	0.338d	0.033a	10.337c

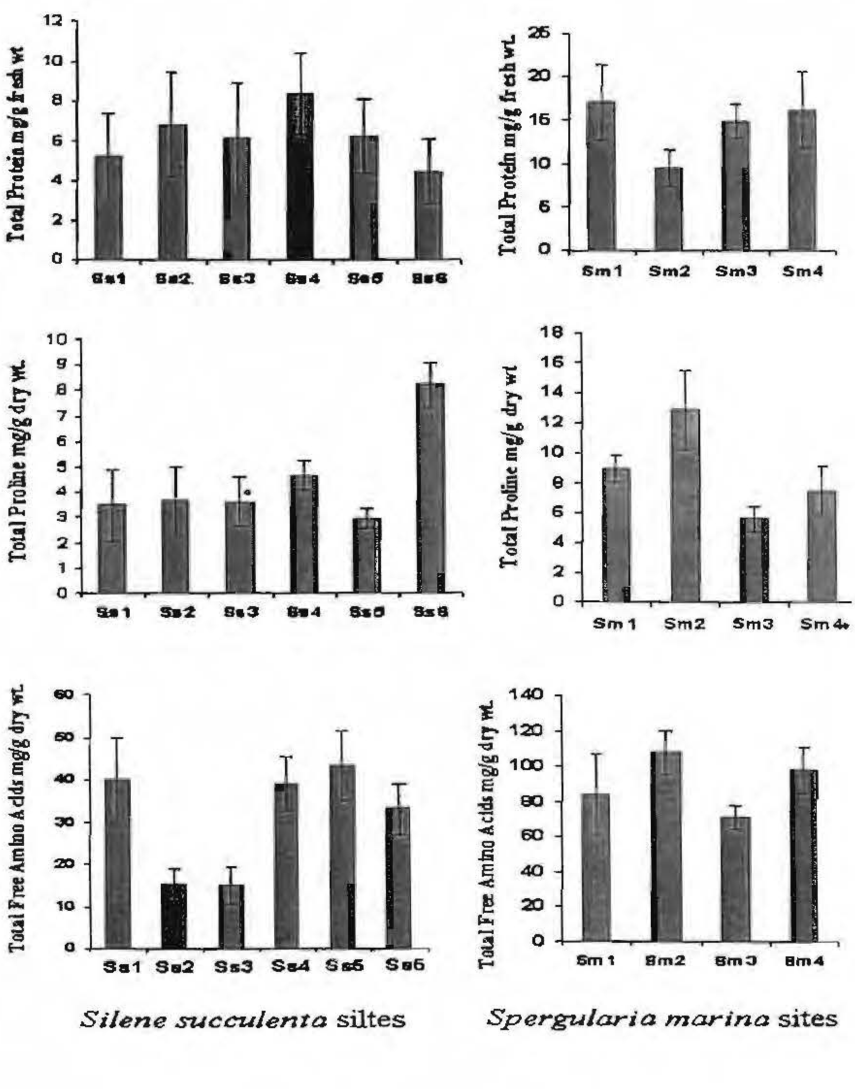
Data are means of four replications.

Means with common letter are non significantly different at p≤ 0.05 level according toLSD at 5% level of significance (Kleinbaum *et al.*,1998).

Biochemical characteristics:

Total protein content in *Silene* ranged from 4.5 to 8.4mg /g fresh weight. Ecodeme 4 has the highest protein content and differed significantly from all other ecodemes Fig. (6). *Spergularia* total protein content ranged from 9.5mg/g fresh wt. to 17.1mg/g dry wt. ecodeme (2) has the lowest protein content and was highly significant as compared to other ecodemes as shown in and Fig. (6). The free amino acid Proline has been measured in oven dry leaves. In *Silene* it ranged from 2.96 to 8.24mg/g dry weight Fig. (6). The ecodeme 6 has the highest proline content which differed significantly from all other ecodemes, while in *Spergularia* leaves proline content ranged from 5.62 to 12.92mg/g dry wt. ecodeme 2 has the highest proline content and significantly differed from all other ecodeme Fig. (6).

In *silene succulenta* free amino acid content ranged from 21.2 to 40.4mg/g dry wt (Fig 6.). In *Spergularia marina* the total free amino acid content ranged from 56.56



Silene succulenta siltes *Spergularia marina* sites

to2.12mg/g dry wt. Fig. (6). The ecodemes 2 and 3 are significantly different.
Fig.(6): Plant analysis of Silene succulenta and Sprgularia marina.

SDS- PAGE Protein Analysis:

For both species samples are loaded on fresh weight bases not on protein bases. Bands of approximately molecular weight 209 KDa, 54 KDa, 55.3 KDa and 49.1 KDa exist for both species.

For all ecodemes of *Silene succulenta* the first five bands (a, b, c, d and e of approximately molecular weight 209 KDa , 54 KDa, 41.9 KDa, 38.2 KDa , 30.9 KDa respectively) were exist, Their locations in the gel indicate that they are similar in terms of the molecular weights,while band f (approximately molecular weight 24.7 KDa) was found only in ecodeme number 3. The band h (approximately molecular weight 20.6 KDa) exist in ecodemes number 1, 2, 4, 5 and 6 Fig. (7).

In *Spergularia marina* there are 8 different bands recorded six bands (a, b, c, d, e and h, of approximately molecular weight 209 KDa, 171 KDa, 91 KDa, 54 KDa , 50.1 KDa and 38.4 KDa respectively) were obaerved in all ecodemes. The band f (approximately molecular weight 49.1 KDa) observed in ecodeme 3. The band g (approximately molecular weight 44.2 KDa) found in ecodemes 1, 2 and 4 Fig. (8).

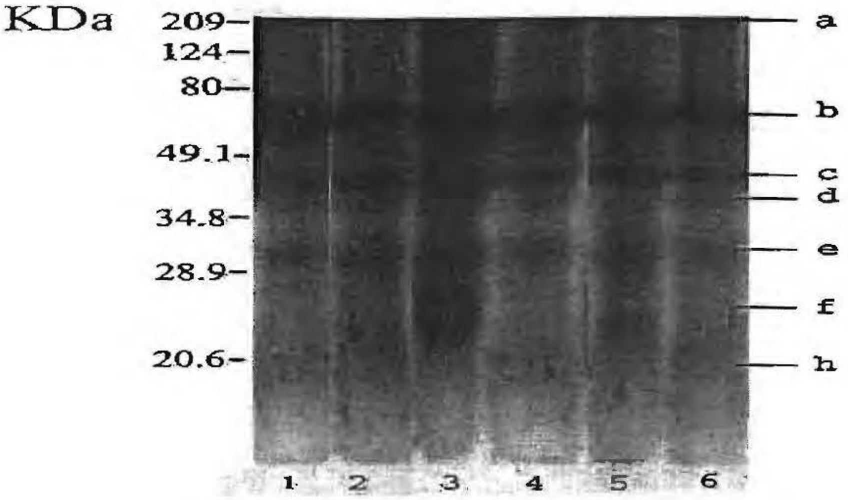


Fig. (7): SDS-PAGE protein of *Silene succulenta.*

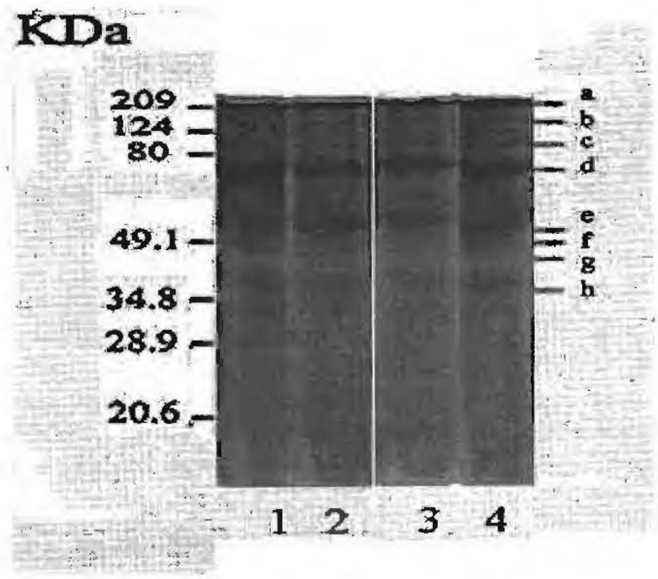


Fig. (8): SDS-PAGE protein of *Spergularia marina.*

DISCUSSION

Silene succulenta is a psammophytic species which is commonly met with in the coastal dune of the Mediterranean sea. Low water and nutrient availability and significant sand movement, salt spray and soil salinity are typical of coastal dunes, these conditions are generally unfavorable for the various life stages of plants and especially for seedlings **[Gagné & Houle (2001)]**.

In the present study the soil supporting *Silene succulenta* is characterized by relatively low salinity (64 µS/cm – 188 µS/cm) and too low moisture content (3.2% - 7.2%). Calcium carbonates content was ranged from 46% to 54%. The Ca^{++} was the main cation in the soil samples was higher as compared to Na^{+} content, while the K^{+} content was too low Table (1). **[Abo El-Soud (1991)]** reported that the soil supported *Silene succulenta* which was collected from the sand dunes of the Deltaic coast is generally sandy in nature, neutral in reaction, poor in organic carbon and rich in phosphorus.

Spergularia marina a halophytic species mainly growing in salt marshes habitat, in the present study, the soil supporting *Spergularia marina* was characterized by a relatively high salinity (360 µS/cm–1376 µS/cm) and water holding capacity of (9.7 % - 32.8 %). Ca^{++}, Na^{+} and K^{+} content were higher than soil supporting *Silene succulenta.* Organic carbon was relatively higher in soil supporting *Spergularia marina* compared with that of *Silene succulenta.*

Growth suppression is directly related to total concentration of soluble salts or osmotic potential of soil water [**Flowers (2004); Katerji** *et al.*, **(2005) and Pascale** *et al.*, **(2005)**].

The most remarkable changes are notable in leaf [**Wahid (2003)**]. In saline soil, leaves of plants often thicker and more succulent than those growing in salt free soil [**Waisel (1991); and Shannon** *et al.*, **(1994)**]. Reduced size of xylem vessels also appear as an anatomical characteristic of stressed plants as stated by [**Daubenmir (1974)**]. This feature was found in stressed *Inula* and *Sphaeranthus* [**Abou El-Naga & Abougadallah (2004)**].

Morphological traits may be useful as an image for anatomical changes. For *Silene succulenta* reduction in shoot length (due to internode length reduction) of ecodemes of high soil salinity (ecodeme 4 and 6) observed but reduction were more in ecodeme 4 which may be related to lower moisture content of soil supporting ecodeme 4 as compared to soil supporting ecodeme 6 Table (1&2). Reduction in shoot length have been observed in maize plant grown under saline conditions [**Zörb** *et al.*, **(2004)**]. Shoot height of both mung bean and tomato were greatly decreased on salinized media [**El-Feky (2004)**].

While for *Spergularia marina* ecodeme of highest soil salinity ecodeme (2) have the highest shoot length, while ecodeme 1 have the lowest shoot length this may be also related to lower moisture content of soil supporting ecodeme 1. [**Shao** *et al.*, **(2008)**] found that stem length was decreased in *Albizzia* seedlings under drought stress.

In the present study in both studied species ecodemes of high soil salinity have the highest leaf thickness Table (2).

The low pith/cortex ratio feature characterizes stress tolerant species rather than stress sensitive ones [**Fahn (1983)**]. This was not consistent with *Spergularia marina* in which the pith/cortex ratio of ecodeme (2) which had the highest values of soil salinity did not vary significantly to ecodemes (1) and (3) of low soil salinity Table (3). For *Silene succulenta* ecodemes of low soil salinity (3) have higher pith/cortex ratio than ecodemes of high soil salinity Table (3), these results are consistent with the obtained results by [**Abou El-Naga & Abogadallah (2004)**]who reported that the pith/cortex ratio was higher in unstressed ecodemes of *Inula* than in stressed ones.

In present study the stressed ecodemes 4 and 6 had the lowest vessels size, respectively. Reduced xylem vessels of stressed ecodemes also recorded for *Spergularia marina* in ecodeme 2 of highest soil.

Reduction of xylem vessels is a feature known to characterize stressed plants as stated by [**Moya** *et al.*, (2002)] who mentioned that smaller vessels sizes in vascular tissues is a main trait for salt tolerance. In the present study reduction in vessels radius was recorded in highly stressed ecodemes of both species. The most conspicuous changes to salinity stress are notable in the leaf [**Wahid (2003)**]. Both species (*Silene succulenta* and *Spergularia marina*) are responded to the increase of the soil salinity by an increase in the leaf thickness. High salinity always caused increasing leaf thickness [**Flowers** *et al.*, (1986) **and Gie- Wanowska (2005)**].

Stomatal frequency in ecodeme 3 of *Silene succulenta* of the lowest soil salinity was significantly higher to all other ecodemes and decreased with the increase of the soil salinity. Decreasing in stomatal frequency with the increase of the soil salinity also reported for *Spergularia marina* ecodemes. These results agree with the obtained results by [**Abogadallah (1995)**].

In the present study the protein content in *Silene succulenta* was found to increase with the increase of soil salinity as in ecodeme (4) which had the highest protein content and significantly different to all other ecodemes, but higher soil salinity, as observed in ecodeme (6), it decreased and it also observed for *Spergularia marina* the ecodeme (3) growing in the lower soil salinity and had protein content less than ecodeme (1) & (4) which had higher soil salinity while the ecodeme (2) of the highest soil salinity had the lowest protein content.

An increase in protein content as a result of salt stress was also reported in mung bean [**Ashraf & Rasul (1988)**], *Nicotiana rustica* [**Cusido** *et al.*, **(1987)**], tomato [**Abdel-Samad (2002)**].

In the present study, protein pattern modification has been observed. In *Silene succulenta*, the band 24.7 KDa have been found only in ecodeme (3) of the lowest soil salinity while disappear in all other sites, while band 20.6 KDa disappeared only from ecodeme (3) and recorded in all other ecodemes. The appearance and disappearance of bands also are observed for *Spergularia* samples, where the 49.1 KDa disappeared from ecodemes 1, 2 and 4 and observed only in ecodeme (3) with the lowest soil salinity. Also band 44.2 KDa appear in all ecodemes except (3).

Appearance and disappearance of protein bands recoded in other studies, [**Abogadalh (2003)**] found that salt-stress down regulated six proteins and induced three others in barley leaves. [**Hassan** *et al.*, **(2004)**] reported that salinity stress induced an accumulation of new bands in treated mung bean and tomato whereas some bands were found only in the control and disappeared in the treated plants. This suggest that a defense-response genes could be activated by putrescine treatment [**Zeid (2004)**].

In present study proline content is found to increase with the increase of soil salinity for both species. Proline accumulation was enhanced in Tomato by salinity regardless to salinity source [**Inal (2002)**]. Proline accumulation in response to environmental stress has been considered by a number of workers as an adaptive trait concerned with stress tolerance, and it is generally assumed that proline is acting as a compatible solute in osmotic adjustment [**Silveria** *et al.*, **(2003)**], while some researches reported proline accumulation as pathological [**Rai** *et al.*, **(2003)**].

Besides proline, other amino acids [**Karamanos (1995)**] could protect plant tissue against osmotic stress.

In the current study, total free amino acid content for the leaves of *Silene succulenta* did not show significant correlation to soil salinity Fig. (6) While in case of *Spergularia marina* the site (3) with the lowest soil salinity had the lowest total free amino acid content and increased with the increase of soil salinity of other ecodemes Fig.(6).The accumulation of free amino acids in response to stress has been observed in many plants grown in different habitats [**Migahid (2004)**].

We may conclude that both species, *Silene succulenta* and *Spergularia marina* had been responded similarly to elevated soil salinity. The chemical composition of plant showed an accumulation of nitrogen containing compounds such as protein and free amino acid in particular proline. Elevated soil salinity also cause a modification in protein pattern. The anatomical structure also showed some changes like increase of the leaf thickness and decrease of stomatal frequency and xylem vessels size.

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الملخص العربى

مظاهرتأقلم نباتى أبو النجف (خبيزة البحر) *Silene succulenta* Forssk و نبات أبو غلام (المليح) *Spergularia marina* (L.)Bessler بالمنطقة الساحلية للدلتا.

أمينة زكريا أبو النجا- ممدوح سالم سراج- رضا أبو مصطفى
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تهدف الدراسة الى القاء الضوء على أهم العوامل البيئية وبالذات عوامل التربة والتى تؤثرعلى أقلمة نباتى أبو النجف(خبيزة البحر) *Silene succulenta* Forssk و نبات أبو غلام (المليح) *Spergularia marina* (L.) Bessler فسيولوجيا ومورفولوجيا وتشريحيا حيث ان لهذين النباتين أهمية طبية.

وقد تم أخذ عينات من التربة ذات درجات مختلفة من الملوحة وعينات من النباتات النامية فيها وتم تحليلهم كيميائيا ودراسة النباتات مورفولوجيا وتشريحيا.

وجد أن المحتوي البروتينى الكلى و تركيز البرولين (حمض أمينى) فى أوراق كلا النباتين يزيد مع زيادة ملوحة التربة إلا إنه عند أعلى المواقع ملوحة ظهر فيها المحتوى البروتينى أقل. بينما المحتوى الكلى للأحماض الأمينية (عدا البرولين) لم تظهر علاقة محددة مع زيادة الملوحة فى أوراق كلا النباتين.و قد وجد أيضا خلال التحليل SDS Electrophorsis ظهور وإختفاء بروتينات فى المواقع الأعلى فى ملوحة التربة بالنسبة لأوراق كلا النباتين

أظهرت النتائج أن زيادة ملوحة التربة تؤثر على التركيب الكيميائى والتشريحى للنباتين موضوع الدراسة. وإن إستجابة النباتين كانت متشابه تقريبا. وكانت أبرز الاختلافات التشريحية هى نقص قطر أوعية الخشب فى الساق وزيادة سمك أورلق العينات النباتية المأخوذة من المواقع ذات الملوحة العالية.

النتائج المتحصل عليها لها قيمة بيئية عند وضع برامج إدارة سليمة لصون وحماية النباتات البرية بمنطقة الكثبان الرملية بالمنطقة الساحلية للدلتا وبيئة المستنقعات الملحية.