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ECOPHYSIOLOGICAL STUDIES ON SOME RANGE PLANTS IN NORTH WESTERN COAST OF EGYPT

Nour El-Din, Nahed M.; A. M. Ahmed and S. A. Khalifa
Plant Ecology and Range Management Dept., Desert Research Center, Matareya, Cairo, Egypt.

The present work was designed to study ecophysiological responses of three highly palatable range plants (*Kickxia aegyptiaca, Lycium europaeum* and *Salsola tetrandra)* growing naturally under different habitat conditions in the North Western Coast of Egypt. Results revealed that the degree of succulence was relatively low in all species which were collected in summer and winter seasons. There are higher percentages of total ash associated with higher cation and anion contents in all species which were collected in the dry season (July). Ca^{++} was accumulated in all plants to higher levels as compared to the other cations.

Organic constituents including crude protein, fats and total available carbohydrate had generally low levels during winter in all studied species, compared to their levels during summer.

Concentrations of protein amino-acids and Protein fractions electrophoresis showed wide variations due to differences in habitat conditions and growing season.

Keywords: range plants, succulence, anions, cations, organic constituents, protein amino acid, protein electrophoresis, north western coast of Egypt.

Arid regions of the world occupy extensive areas of continental land masses. In Egypt, hyper-arid and arid lands occupy the majority of total area (1 million km^2). The Mediterranean coastal region, with a shorter dry period has attenuated arid climate having annual rainfall of 150 - 200 mm (Zahran and Willis, 1992).

Desert vegetation thrives under unique conditions of environmental stresses. Soil and atmospheric drought as well as high thermal regimes during day time are generally presiding factors in such habitats (Zahran, 1989).

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The study area support the growth of natural vegetation responsible for supporting sheep, goats, camels and herbivorous in this location with its forage needed throughout the whole year. The vegetation is differed in its type, productivity and composition from location to another, due to the great difference along that district and the different environmental factors. So, desert plants have received much attention during recent years as a renewable natural resource. Many of such species (*Kickxia aegyptiaca, Lycium europaeum* and *Salsola tetrandra)* are consumed by grazing animals. On the other hand, these plants can be used as a source of crude matter for several chemical products. They may also be used as indicators for habitat types (Ibrahim, 1995; El-Toukhy, 1997).

The aim of the present investigation is to study the physiological adaptive responses of some range plants in the north western coast of Egypt collected from different sites during wet and dry seasons to some possible changes in physical and chemical properties of the soil in their habitats. Plant analyses were also carried out to determine the metabolic changes inside plants in relation to different habitat conditions.

MATERIALS AND METHODS

The present study was carried out during summer and winter seasons of 2002-2003.

Plant materials were collected from 5 localities extending along the north western coast. *Kickxia aegyptiaca (L.) Nabelek; Family: Scrophulariaceae* was sampled from both mid stream portion of wadi Umm Ashtan I and from the coastal sandy strip at 65 km west of Matrouh. Samples of *Lycium europaeum L.;Family:Solanaceae* were obtained from the coastal salt affected zone of wadi Umm Ashtan II and Kleopatra coastal oolitic sand dunes west Matrouh. *Salsola tetrandra (forssk.); Family: Chenopodiaceae* samples were collected from both Kleopatra coastal oolitic sand dunes since west of Matrouh and at 30 km on the highway to Siwa Oasis *Salsola tetrandra* has wide ecological amplitude. It was recorded in saline habitats (Migahid *et al.*, 1974 and Morsy, 2002), and in saline depression and alluvial plains (El-Ghonemy *et al.*, 1977)

Soil Analysis

Soil profiles supporting the growth of the concerned plants were sampled at different depths. Granulometric analysis were accomplished using the sieve method after Jackson (1967) and Wilde *et al.* (1979).

The electrical conductivity (EC) of the soil saturated paste was determined according to Richards (1954) and expressed as mmhos/cm. The soil reaction was determined in saturated soil paste using Fisher's pH meter according to Jackson (1962).

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Plant Analysis

The analysis methods adopted in the present investigation for plant sampling can be summarized as follows;

Degree of Succulence; degree of succulence was calculated according to initial fresh weight/dry weight ratio as followed by Dehan and Tal (1978), Ahmed and Girgis (1979), Ahmed and Shalaby (1985).

Ash content; the analysis of the elements present in the ash of different plant organs was carried out according to Johnson and Ulrich (1959).

Total nitrogen; the total nitrogen was determined in the dry powdered tissues after digestion by the conventional micro-kjeldahl method (Pirie, 1955).

Total Fats; one hundred gm of the air-dried powdered samples were extracted with petroleum ether (b. p. 40-60°C): ether (1:1) for 24 h using soxhelet apparatus (Güenther, 1972).

Total carbohydrate; total carbohydrates were estimated colorimetrically applying the phenol-sulphuric acid method (Dubois *et al.*, 1951) and values were expressed as g/100g dry weight.

Cations and Anions; soil and plant cation and anions including chloride, sulphates (meq/100g) were determined in the soil paste and plant extract (acid digests) as described by Jackson (1967) and Wilde *et al.*, (1979). Sodium and potassium were determined photometrically as described by Stewart (1974). Magnesium was determined using atomic absorption Spectrophotometer as described by Stewart (1974). Calcium was determined according to the method described by Richards (1954). Phosphorus was estimated colorimetrically applying the ascorbic acid method described by Frie *et al.*, (1964).

Amino acids; were determined using gas liquid chromatography as described by Lamin and Gehrke (1966).

Protein electrophoresis; the basic principle of protein electrophoresis is the movement of the charged protein molecules through a supporting medium towards an electrode with the opposite charge. Proteins carry negative charges and thus move towards the anode. Solution of 12% SDS polyacrylamide slab gel was prepared according to the method of Laemmli (1970) as modified by Studier (1973).

RESULTS AND DISCUSSION

Soil Texture

Results of the granulcometric analysis of the soil associating the studied plant species indicated that soil texture was mainly fine sand with coarse sand fraction at different localities (Table 1). Data pointed out that the highest percentages of coarse sand were 61.3% and 36.8% in the bottom layers (20-40cm) in the two sites of *Kickxia aegyptiaca* and *Lycium*

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europaeum 65 km west of Matrouh and the coastal salt affected zone from Wadi Umm Ashtan II, respectively. The lowest values reached 13.0% and 11.1% in the surface layers (0-20cm) at Kleopatra coastal sand dunes west of Matrouh.

Meanwhile the maximum values for fine sand were 86.4% and 81.4% in the surface layers (0-30) and (0-20) at Kleopatra west of Matrouh and at 30 km south of the high way to Siwa Oasis, respectively and its minimum values were 38.1% in the bottom layers (20-40cm) at the site 65km west of Matrouh.

The percentage of silt and clay reached their maximum value of 5.3% in the surface layer (5-20cm) at a mid stream portion of Wadi Umm Ashtan I and its minimum value was 0.1 % in the surface layer (0-20cm) at 30 km south of the highway to Siwa Oasis.

Soil Chemical Properties

Table (2) indicated that soil pH was neutral or slightly alkaline with values ranging between 7.0 and 7.9 in the different layers at different locations.

The electrical conductivity (EC) ranged between 5.7 and 0.51 mmhos/cm in the surface layers (0-20) and 5.00 mmhos/cm in the bottom layers (30-60) at Kleoptra site west of Matrouh.

Soil moisture content (Table 2) showed that its seasonal variation is compatible with the seasonality of climatic factors. It varied between 0.07% and 0.01% in summer, while increased in winter and ranged between 0.37% and 0.16%.

TABLE (1). Granulcometric analysis of the soil supporting the different species of plants at two different studied habitats.

		Depth	Coarse sand %	Fine sand %	Silt + Clay %	Texture
Kickxia-aegyptiaca	Umm Asthan I	0-5	21.6	74.7	3.7	Fine sand
		5-20	26.8	67.9	5.3	Fine sand
		20-40	32.1	62.6	5.3	Fine sand
	West of Matrouh	0-5	49.5	50.3	0.2	Fine sand
		5-20	55.9	43.8	0.3	Coarse sand
		20-40	61.3	38.1	0.6	Coarse sand
Lycium europaeum	Umm Asthan II	0-5	30.0	67.4	2.6	Fine sand
		5-20	30.8	67.5	1.8	Fine sand
		20-40	36.8	60.0	3.2	Fine sand
	Kleoptra	0-30	13.0	86.4	0.6	Fine sand
		30-60	11.1	86.2	2.7	Fine sand
Salsola tetrandra	Kleoptra	0-30	13.0	86.4	0.6	Fine sand
		30-60	11.1	86.2	2.7	Fine sand
	30 km south of the highway to Siwa Oasis	0-20	18.5	81.4	0.1	Fine sand

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TABLE (2). Chemical analysis of the soil supporting of different plant species at the two different studied habitats.

Species	Location	Depth cm	pH	E.C m.mhos/cm	Soil moisture content %		Analysis of the soil saturation extract					
							Soluble cations (meq/100g d.wt)				Soluble anion (meq/100 d.wt)	
					summer	winter	K^+	Na^+	Ca^{++}	Mg^{++}	SO_4^{--}	Cl^-
Kickxia-aegyptiaca	Umm Asthan I	0-5 5-20 20-40	7.0 7.4 7.1	1.61 0.85 1.81	0.01	0.21	20	48.2	11.2	2.6	0.03	33.2
	West of Matrouh	0-5 5-20 20-40	7.6 7.8 7.2	1.72 0.51 3.24	0.07	0.34	21	50.1	10.1	5.3	0.04	30.1
Lycinum europaeum	Umm Asthan II	0-5 5-20 20-40	7.8 7.7 7.9	5.61 5.72 5.31	0.03	0.25	78	81.3	12.3	7.7	0.14	45.2
	Kleoptra	0-30 30-60	7.6 7.5	4.81 5.00	0.06	0.037	44.0	100	8.4	6.1	0.31	42.1
Salsola tetrandra	Kleoptra	0-30 30-60	7.6 7.5	4.82 5.0	0.06	0.37	44.0	100	8.4	6.1	0.31	42.1
	30 km south of the highway to Siwa Oasis	0-20	7.1	2.1	0.01	0.16	10.3	24.1	7.6	2.3	0.02	10.2

Results revealed that there was a gradual increase in the soil moisture content with increasing soil depth. This may be due to exposure of the surface layers of the desert soil to intense evaporation, compared with deeper layers. However, in desert soils below a certain depth, there was a permanently wet layer so as to supply deeply rooted plants with mositure (Abd El-Rahman *et al.*, 1971) such layers are characterized by high water-holding capacity (Zahran, 1989).

Regarding soluble cation contents, K ion concentration reached its maximum value of 78 meq/100 g d.wt in the coastal salt affected zone of wadi Umm Ashtan II, while the minimum value was recorded at the site 30 km south of the highway to Siwa Oasis (10.3 meq/100g d.wt).

Sodium was the highest cation content which reached its maximum value at Kleopatra coastal sand dunes west of Matrouh (100 meq/100g.d.wt). The second major cation was calcium, its ion concentration was relatively higher at the coastal salt affected zone of wadi Umm Ashtan II (12.3 meq/100g d.wt.) than that of the site 30 km south of the highway to Siwa oasis (7.6 meq/100g d.wt). The highest content of magnesium (7.7 meq/100g d.wt) was also determined at the coastal salt affected zone of wadi Umm AshtanII.

Soluble sulphate of the soil extracts reached its maximum value of 0.31 meq/100 g d.wt at Kleopatra while the minimum value was recorded at 30 km. south of highway to Siwa Oasis (0.02 meq/100 g d.wt). Chloride

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Lycinum europaeum	Umm Asthan II	0-5 5-20 20-40	7.8 7.7 7.9	5.61 5.72 5.31	0.03	0.25	78	81.3	12.3	7.7	0.14	45.2
	Kleoptra	0-30 30-60	7.6 7.5	4.81 5.00	0.06	0.037	44.0	100	8.4	6.1	0.31	42.1
Salsola tetrandra	Kleoptra	0-30 30-60	7.6 7.5	4.82 5.0	0.06	0.37	44.0	100	8.4	6.1	0.31	42.1
	30 km south of the highway to Siwa Oasis	0-20	7.1	2.1	0.01	0.16	10.3	24.1	7.6	2.3	0.02	10.2

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ions concentration was relatively higher at the coastal salt affected zone of wadi Umm Ashtan II. It reached its maximum value of 45.2 meq/100 g.d.wt where the lowest value was recorded at 30km. south of the highway to Siwa Oasis (10.2 meq/100g d.wt).

From the previous results, positive correlation can be observed between Na^+ and each of K^+, Ca^{++}, Mg^{++} and EC. It appears that achievement of higher levels of monovalent ions (i.e. Na^+ and Cl^-) at Kleoptra coastal oolitic sand dunes (Saline habitat) were more than other locations. It could be considered as a possible compensatory mechanism for regulating salt concentration in saline environment. This is in accordance with Gorham *et al.*, (1980).

Physiological Studies and Chemical Components of Plants

Succulence

Data presented in tables (3 and 4) reveal the percentage of water content of species at the different ecological groups. Water content of *Salsola tetrandra* reached its maximum values of 3.6 and 2.8 in summer and winter, respectively at Kleopatra west of Matrouh, while its minimum values were reached in *Lycium europaeum* to1.5 and 1.6, respectively in the same seasons at the coastal salt affected zone of wadi Umm Ashtan II habitats. This was associated with a decrease of total soluble salts in their substrate. El Shourbagy *et. al.*, (1984), Youssef (1994), Zaki (2000) and Morsy (2002) reported that the development of succulence has effect on increasing ion dilution by increasing the volume to surface area ratio of plants.

The decrease in degree of succulence to its minimum value in either summer or winter at the different habitats may be due to the increase in the rate of transpiration of plants with increasing wind velocity during winter and temperature during summer (Jain, 1997). The results indicated also that the highest degree of succulence was associated with the highest Cl^- content. Similar results were recorded by Ahmed and Girgis (1979).

Ash Content

From tables (3 and 4), it is clear that the values of the ash content of the studied especies under different habitat conditions were fluctuated during summer and winter seasons. Higher values were attained in summer than in winter. The maximum values of ash contents were 36.6% in summer and 29.8% in winter at Kleopatra coastal sand dunes. It was noted that the plants under saline condition was attained higher ash content values than in the other habitats. This may be attributed to the increase of total ion accumulation as a result of increasing soil moisture stress. These results are agreed with that obtained by El-Monayeri *et al.*, (1981) and Larcher (1995).

Total Nitrogen

The data of total nitrogen content are given in tables (3 and 4), it is evident that plants in summer season attained higher values than in winter and also in those grow in saline habitats than in xeric ones.

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In summer, total nitrogen in *Kickxia aegyptiaca* attained its maximum value of 31.6%, while in winter the plants were disappeared due to exposure to overgrazing, though the minimum value of 7.1%was shown in *Lycium europaeum* in winter at the mid stream portion of wadi Umm Ashtan.

TABLE (3). Succulence and some metabolic activities of different species plants at two different studied habitats during summer season.

Species	Location	Succu-lence	Total ash %	Total nitrogen (g/100g)	Fats %	Total carbohydrat (g/100g)	Cations (meq/100 g)					Anions (meq/100mg)	
							Na^+	K^+	Ca^{++}	Mg^{++}	P^{+++}	SO_4^{--}	Cl^-
Kickxia-aegyptiaca	Umm Asthan I	1.8	22.8	31.6	5.3	5.4	15.1	12.2	101	44	1.4	6.6	25
	West of Matrouh	1.7	30.6	22.6	8.1	6.7	12.4	7.9	104	32	0.99	7.8	32
Lycium europaeum	Umm Asthan II	1.5	11.9	22.9	7.3	9.1	47.9	21.7	149	87	0.77	10.3	60
	Kleoptra	2.2	8.8	12.6	5.7	12.9	39.3	29.3	159	186	1.3	6.9	51
Salsola tetrandra	Kleoptra	3.6	36.6	24.7	7.6	16.7	90.9	39.4	168	213	7.1	12.3	98
	30 km south of the highway to Siwa Oasis	2.0	30.8	13.6	5.9	4.5	45.3	19.4	144	115	4.3	10.8	21

Table (4). Succulence and some metabolic activities of different species plants at the two different studied habitats during winter season.

Species	Location	Succu-lence	Total ash %	Total nitrogen (g/100g)	Fats %	Total carbohydrat (g/100g)	Cations (meq/100 g)					Anions (meq/100mg)	
							Na^+	K^+	Ca^{++}	Mg^{++}	P^{+++}	SO_4^{--}	Cl^-
Kickxia-aegyptiaca	Umm Asthan I	-	-	-	-	-	-	-	-	-	-	-	-
	West of Matrouh	-	-	-	-	-	-	-	-	-	-	-	-
Lycium europaeum	Umm Asthan II	1.6	9.2	7.1	4.2	4.3	11.1	11.4	103	46	0.34	3.1	33.2
	Kleopatra	1.7	10.1	8.2	5.7	6.7	14.2	27.1	121	96	0.91	3.9	41.6
Salsola tetrandra	Kleopatra	2.8	29.8	7.8	6.7	9.2	82.2	31.1	142	200	6.2	8.2	72
	30 km south of the highway to Siwa Oasis	1.7	21.3	7.6	3.3	4.7	31.2	11.4	87.3	100	2.3	6.2	31.6

-= The plants disappeared due to overgrazing

Fats %

It is obvious from tables (3 and 4) that the percentage of fats fluctuated between the minimum value of 3.3% in *Salsola tetrandra* during winter at the site 30 km south of the highway to Siwa Oasis and the maximum value of 8.1% in *Kickxia aegyptiaca* during summer at the site 65 km west of Matrouh. This may be due to the variation in the habitat conditions. Salama (1989) found clear variation in the fatty acids of *Tamarix nilotica* growing in different habitats, while Baraka (1990) reported variation in the number and concentration of fatty acids of the leaves of *Jsonia montana* growing in rock shapes and wadi bed habitats in Sinai. On the other hand, Abd El-Fattah (1990) stated that there was variation in the number and concentration of fatty acids of plants grown under different levels of soil moisture stress.

Total Carbohydrate

Values of carbohydrate content shown in tables (3 and 4) are consistently higher in all investigated species during summer than in winter. Total carbohydrates were generally higher in saline habitat (Kleopatra coastal sand dunes) than in the non-saline habitats during the two seasons. In summer, the values of total carbohydrates in *Salsola tetrandra* at Kleopatra site were higher (16.7%) than in winter (9.2%). Thus, it can be concluded that the accumulation of total carbohydrates was closely correlated with the stresses of both drought and salinity. Therefore, it may be considered as a one of the most effective physiological characteristics and safeguards or adaptive response against stress conditions. In this regard, Doddema *et al.* (1986) showed that carbohydrates may be used to balance osmotic shocks, but probably there are another compatible compounds which are necessary to maintain long-term osmotic equilibrium.

Cations and Anions Accumulation

The accumulation of cations and anions showed seasonal fluctuations among the investigated species, mineral content of all species were higher in summer than in winter. *Salsola tetrandra* in summer and winter at Kleopatra site attained higher mineral accumulation (Tables 3 and 4) where $Mg^{++} > Ca^{++} > Na^{+} > Cl^{-} > K^{+} > SO_4^{--}$ and P^{+++}, respectively than the other species. This means that some halophytic species may contribute to desalinization process in saline habitats.

Ash plays an important role in building osmotic pressure of plants. Ahmed and Girgis (1979) reported that the mechanism of osmotic adjustment of halophytes and xerophytes is distinct. They showed that electrolytes play a greater role in the osmotic adjustment of halophytes while organic intermediates are more important to xerophytes. The minimum values of ions were attained in *Kickxia aegyptiaca* at 65 km west of Matrouh in summer where $Ca^{++} > Mg^{++} > Na^{+} > K^{+} > Cl^{-} > SO_4^{--} > P^{+++}$,respectively.

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Amino Acids

Amino acids play an important role in nitrogen metabolism in plants (Beevers, 1976 and Miflin, 1981). Amino acids are involved in the biosynthesis of all the other nitrogenous plant compounds; proteins, alkaloids, amides, cyanogenic glycosides, porphyrins, purines, pyrimidines and cytokinins.

Investigations of protein amino acids of different species at two different habitats were achieved using Gas Liquid Chromatography. Results presented in table (5) show that *Kickxia aegyptiaca* contained fourteen amino acids with different concentrations at the two habitats. Data showed that concentration of glutamic acid represents the highest one of 385.9 mg/100g in summer compared to 300.1 mg/100g in winter followed by aspartic acid which was 316.9 mg/100g in summer and 301.2 mg/100g in winter.

Methionine attained the lowest content of 29.4 mg/100g in *Kickxia aegytiaca* which grow in the coastal sand sheets 65km west of Matrouh , while it was 36.4 mg/100g at the mid stream portion of wadi Umm Ashtan I in summer. Methionine, isoleucine, leucine and α-amino buteric acid disappeared from *Kickxia aegytiaca* plants during winter at the mid stream portion of wadi Umm Ashtan I as well as the site 65km west of Matrouh .These amino acids may be converted into ketoacids

Data in table (5) showed that *Lycium europaeum* attained its highest content of glutamic acid in different seasons and different habitats in summer, whereas tyrosine showed the lowest contents in winter in the two studied sites. In this context, Smith (1976) reported that protein variation occurs between plants in different populations of the same species, notable is the polymorphism of many enzymes when studied on a population basis. He added that plants have the capacity to produce several or many iso-enzymes probably have different selective advantages in different environments.

Methionine amino acid which contains sulfur group disappeared in the two seasons at the two different habitats of *Salsola tetrandra*. It is apparent from table (5) that the highest concentration of protein amino acids was recorded at Kelopatra (Saline habitat). Similar results were also obtained by Baraka (1990) who stated that there was variation in the number and concentration of amino acids in leaves of *Jasonia montana* collected from rocky and wadi bed habitats.

The variation in concentration of amino acids as well as presence or absence of certain amino acids could be explained in the light of the findings of Goss (1973) who stated that any amino acid can react with any α-keto acid to give a new amino acid and new keto acid through the mechanism of transamination. Also, Shams *et al.* (1986) reported that there was a variation in the composition and concentration of protein amino acids in the leaves of *Polygonum salcifolium* in response to habitat conditions.

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Protein Electrophoresis

Electrophoretic analysis of total protein is assumed to provide information concerning the type and biosynthesis of different protein fractions.

Three species of naturally growing plants (*Kickxia aegyptiaca, Lycium europaeum* and *Salsola tetrandra*) were fingerprinted by SDS-PAGE of total proteins. They exhibited a maximum number of 28 bands (Table 6) which were not necessarily present in all species at the two studies seasons. Band number (2) with molecular weight of 98.26 KDa was a common band, while the other 27 remainder bands were polymorphic with (96%).

The data of SDS-PAGE revealed that these three species showed different genetic behavior in the two seasons and attained the maximum number of bands in summer season, which gave 23, 17 and 19 bands, (L_1, L_2 and L_4, respectively). The results showed also that the three species had some specific bands which could be used to distinguish them among others. For instance, L_1 have one positive specific band with molecular weight of 13.21 KDa while L_2 could be distinguished from other species by band number 16 with molecular weight of 30.27 KDa. On the other hand, band number 3 with molecular weight of 97.40 KDa and band number 21 with molecular weight of 18.18 KDa exhibited only in *Salsola tetrandra* (L_5 and L_4, respectively). These results suggest that the production of these stress adaptive proteins may represent a common mechanism which enables halophytes to withstand under the harmful effects of salinity. Some of the salt adaptive proteins may be involved in many functions related to some aspects of protein metabolism such as stabilizing native proteins (Li *et al.*, 1999). Thus the new synthesizing protein bands may be induced for stress adaptation during summer while the disappearance of other bands may be attributed to the degradation of some proteins (Vierling, 1991).

The data of SDS-PAGE of total proteins are given in table (7) exhibited a maximum number of 19 bands which were not necessarily present in all species under different localities. The bands were detected with different molecular weights ranged from 97.40 KDa to 10.22 KDa. Bands number 1and 3 were present in all species and could be considered as common bands. The other bands were polymorphic with 98.0%. From results in table (7), it is obvious that *Kickxia aegyptica* had different genetic behaviors at two different localities attaining13 bands in L_1 and 6 bands in L_2. On the other hand, the other two species *(Lycium europaeum* and *Salsola tetrandra)* showed the similar genetic behavior. L_3 and L_4 attained total bands number (10 bands), also L_5 and L_6 had 9 bands.

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TABLE (5). Amino acids composition (mg/100g) of different species of plants during summer and winter seasons at different habitats conditions.

	Amino acids	*Kickxia aegyptiaca*				*Lycium euro paeum*				*Salsola tetrandra*			
		Summer		Winter		Summer		Winter		Summer		Winter	
		a	b	a	b	a	b	a	b	a	b	a	b
Acidic	Aspartic	316.9	301.2	201.1	168.4	319.2	268.2	199.2	162.1	529.9	309.2	491.2	286.1
	Therionine	174.4	160.1	150.1	131.2	189.4	150.3	151.5	128.1	260.6	151.3	251.4	132.4
	Serine	201.0	184.2	121.4	104.1	201.2	176.5	119.6	100.2	286.9	181.6	261.2	141.5
	Glutamic	385.9	300.1	241.3	202.1	370.5	311.4	230.1	203.1	453.3	250.7	401.3	199.2
	Glycine	193.5	178.2	156.2	131.2	180.4	161.2	151.3	127.5	268.8	161.3	22.1	141.0
Basic	Alanine	166.7	140.1	124.3	110.2	163.3	132.5	116.4	100.2	222.8	110.5	200.1	100.2
	Valine	203.6	196.6	170.2	149.3	205.3	185.4	172.5	141.1	293.2	182.3	211.2	133.4
	Methionine	36.4	29.4	-	-	-	-	-	-	-	-	-	-
	Isoleucine	153.3	122.2	-	-	149.6	119.3	-	-	241.9	131.5	195.4	110.1
Aromatic	Leucine	227.8	200.7	-	-	227.2	201.2	-	-	334.3	230.13	226.2	222.4
	Tyrosine	67.2	50.1	41.2	30.2	65.9	49.2	39.1	29.0	154.5	105.2	144.3	102.1
	Phenylalanine	133.4	110.2	96.2	82.6	140.1	116.2	100.2	86.4	297.9	161.4	27.1.2	144.6
	Histidine	146.9	131.7	11.5	103.2	148.6	129.5	114.3	100.7	267.6	141.3	251.3	99.5
	Lysine	209.6	191.5	122.3	110.3	223.5	190.2	12.06	108	24.1	12.4	19.6	8.6
	α-amino buteric acid	415.1	361.2	-	-	442.2	351.3	-	-	29.3	11.6	-	-
	Total number	14	14	10	10	14	14	10	10	13	13	12	12

Kickxia aeyptiaca	a= Mid stream portion of wadi Umm Ashtan I. b= at 65 km west of Matrouh.
Lycium europaeum	a= Coastal salt zone of wadi Umm Ashtan II. b= Kleopatra towards Matrouh.
Salsola tetrandra	a= Kleopatra towards Matrouh. b= At 30 km. south of the highway to Siwa Oasis.

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TABLE (6). Seasonal fluctuations in protein banding patterns of the studied species.

Plant species	Kickxia aegyptiaca				Lycium europaeum		Salsola tetrandra	
Lanes			L1	Absent	L2	L3	L4	L5
Rows	M.wt K Da	Marker	Summer	Winter	Summer	Winter	Summer	Winter
1	99.12	97.40	+	–	+	+	+	
2	98.26		+	–	+	+	+	+
3	97.40			–				+
4	59.71		+	–	+	+	+	
5	87.66			–	+		+	
6	79.60		+	–	+	+		
7	75.51		+	–		+	+	
8	71.01			–	+	+	+	
9	67.97	65.70	+	–		+	+	
10	59.93		+	–	+	+	+	
11	55.59		+	–			+	
12	42.78		+	–	+			
13	40.79		+	–			+	
14	35.02	39.20	+	–	+	+		
15	33.68		+	–				
16	30.27			–	+			
17	30.10		+	–			+	
18	28.46	26.60	+	–	+		+	
19	24.03		+	–			+	+
20	20.30	21.50	+	–	+		+	+
21	18.18			–			+	
22	17.96		+	–	+			+
23	15.25		+	–	+		+	
24	15.12		+	–	+		+	
25	13.54	14.40	+	–	+			+
26	13.43		+	–	+		+	
27	13.38		+	–			+	
28	13.21	6.00	+	–				
Total bands			23	–	17	9	19	6

- = The plants disappeared due to overgrazing

Generally, the results of protein system indicate that genetic behavior of the three species under study are affected by environmental conditions. Similar results were obtained by many investigators that the protein electrophoretic bands could be considered as a good tool for the identification and differentiation among the species .Many studies have been carried out on *Acacia* species, halophytic plants and *Tephrosia apollinea*

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protein banding patterns using SDS-PAGE electrophoretic as a useful tool for differentiation (Ahmed *et al.*, 2003; Fareida, 2004 and Fareida and Ahmed 2004).

CONCLUSION

Result of this study clarified that the selected range plants could be considered as renewable natural resources consumed for animal nutrition. These plants are rich in carbohydrates, nitrogenous compounds and fats, particularly during the dry season.

The chemical composition of plants which were collected from different localities, differ greatly from site to another and from dry to wet season.

Results of protein system indicate that the different behaviour of the three species under the study are affected by environmental conditions.

TABLE (7). Protein analysis of the studied species under different habitat conditions.

Plant species	Kickxia aegyptiaca				Lycium europaeum		Salsola tetrandra	
Lanes			L1	L2	L3	L4	L5	L6
Rows	M.wt K Da	Marker	Umm Asthan I	West of Matrouh	Umm Asthan II	Kleopatra	Kleopatra	30 km south of the highway to Siwa Oasis
1	97.40	97.40	+	+	+	+	+	+
2	97.34		+		+	+	+	+
3	62.10	66.20	+	+	+	+	+	+
4	58.34	65.70	+		+	+	+	
5	54.22		+	+		+		+
6	49.30		+		+			
7	41.14	39.20					+	+
8	35.58				+	+	+	
9	33.45		+			+		
10	28.19		+					
11	25.13	26.60	+				+	
12	22.79					+		+
13	20.22	21.50	+		+			
14	18.29		+					
15	16.40			+	+			
16	15.32			+	+	+		+
17	13.23		+	+				+
18	11.59		+		+	+	+	+
19	10.22						+	
Total bands			13	6	10	10	9	9

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REFERENCES

Abd El-Fattah, R. I. (1990). Ecological studies on the adjustment of the plants to their environments. *Ph.D. Thesis, Fac. Sci., Zagazig Univ., Benha, Egypt.*

Abd El-Rahman, A. A.; A. F. Shalaby and M. O. El-Monayeri (1971). Effect of moisture stress on metabolic products and ion accumulation. *Plant and Soil*, 43: 365-375.

Ahmed, A. M. and A. A. Shalaby (1985). Ecophysiological responses of *Zygophyllum album* L. and *Nitraria retusa* Asch.under different habitat condition of Sinai, Egypt. *Desert Inst. Bull., Egypt.*, 35: 609-624.

Ahmed, A. M. and W.A. Girgis (1979). Adaptive responses of plants of different ecological groups from Wadi Gharandal, Sinai, Egypt. *Desert Inst. Bull., Egypt*, 29: 487-512.

Ahmed, A. M.; Fareida M. EL-Saied and Amal A. Morsy (2003). Bio chemical genetic fingerprinting of eight *Acacia* species from Egypt. *Egyptian J. Desert Res.*, 53 (2) : 217-228.

Baraka, Dina (1990). Ecological and phytochemical studies on *Jasonia montana. Ph.D. Thesis, Fac. Sci., Zagazig Univ., Benha, Egypt.*

Beevers, L. (1976). In *"Nitrogen Metabolism in Plants"*. Edward Arnold, London.

Dehan, K. and M. Tal (1978). Salt tolerance of the wild relatives of the cultivated tomato: Response of *Solanum pennellii* to high salinity. *Irrigation Science*, 1, p71.

Doddema, H.; A. S. Raja and Abdel Mahsneh (1986). Effect of seasonal changes of soil salinity on the nitrogen metabolism of the halophyte *Arthrocnemum fruticosum. Plant and Soil*, 92(2): 279-294.

Dubois, M., K. Gilles; J. K. Haelton; P. A. Rebers and F. Smith (1951). A colorimetric method for the determination of sugars. *Nature*, 168-176.

El-Ghonemy, A.A.; A. M. El-Gazzar; A. Wallace and E. M. Romney (1977). Mineral element composition of the natural vegetation along a Transect of Mareotis, Egypt. *Soil Sci.*, 124: 16-26.

El-Monayeri, M.O.; M. M. Youssef and A. A. El-Ghamry (1981). Contributions to the autoecology of two *Zygophyllum* species growing in the Egyptian desert. *Egyption J. Bot.*, 24(1): 49-68.

El-Toukhy, S. A. (1997). Mangement system of new improved range areas of North Western coast to control desertification. *Ph.D. Thesis, Fac. Agric., Ain Shams Univ., Egypt.*

CamScanner المسوحة ضوئيا بـ

El-Shourbagy, M. N.; A. M. Ahmed; M. E. Osman and E. M. Hamoda (1984). Adjustment of different halophytes to Mediterranean salt marshes of North Egypt. *Phyton*, 24: 101-112.

Fareida, M. EL-Saied (2004). Molecular genetic analysis of Alkaloids content in *Tephrosia apollinea* Under Different habitat conditions. *Egypt. J. Genet. Cytol.*, 33 (2): 257-278.

Fareida, M. EL-Saied and A. M. Ahmed (2004). Genetics and biochemical variants of some halophytes from shalateen region-the south eastern portion of Egypt. *Annals Agric. Sci., Ain Shams Univ., Cairo*, 49(1): 209-222.

Frie, E.; K. Payer and E. Schutz (1964). Determination of Phosphorus by ascorbic acid Schew-land. *Werschaft Forschung Heft.*, 3: 318-328.

Gorham, J.; I. L. Huglies; R. C. Wyn Jones (1980). Chemical composition of salt-marsh plants from Ynys Mon (Anglesey): The concept of Physiotypes. *Plant, Cell and Environ.*, 3: 309-318.

Goss, J. (1973). In "*Physiology of plants and their cells*". Pergamon Press Inc., New York.

Güenther, E. (1972). In "*The essential oils*". Vol. I., Robert. E. Kreiger ed., Publ. comp., Huntinglon, New York.

Ibrahim, K. M. (1995). Productivity and nutritive value of some range plants of the North Western Coast. *M.Sc. Thesis, Fac. Agric., Ain Shams Univ., Egypt.*

Jackson, M. L. (1962). In "*Soil chemical analysis*". Constable and Co. Ltd., London.

Jackson, M. L. (1967). In "*Soil chemical analysis*". Printice-Hell of India Private, New Delhi, India.

Jain, V. K. (1997). In "*Fundamentals of Plant Physiology*". 5th ed. published by S. Chang Company Ltd., Ram Nagar, New Delhi, India, 137pp.

Johnson, C. M. and A. Ulrich (1959). Analytical methods for use in plant analysis. *M.S. Thesis, Dept. Agric., Calif. Univ. Agric., Inforn. Bull.* 766.

Laemmli, U. K. (1970). Cleavage of structural proteins during assembly of the head of bacteriophage T4. *Nature*, 227: 680-685.

Lamin, W. M. and C. W. Gehrke (1966). Quantitative gas chromatography of amino acids: Preparation of hybutyl-N-Tri fluoroacetyl esters. *Anal. Chem.*, 2: 383-389.

Larcher, W. (1995). In "*Physiological plant ecology*". Springer Verlage, Berlin Heidelberg, Germany, 506pp.

Li, Q. B; D. W. Haskell; Col Guy (1999). Coordinate and non-coordinate expression of the stress 70 family and other molecular

CamScanner المسوحة ضوئيا بـ

chaperones at high and low temperature in spinach and tomato. *Plant Mol. Biol.*, 39: 21-34.

Miflin, B. J. (ed.) (1981). In *"Biochemistry of plants: Amino Acids and Derivatives"*. Vol. 5, Academic Press., New York, U.S.A.

Migahid, A. M.; E. M. El-Sharkawy; K. H. Batanouny and A. F. Shalaby (1974). Phytosociological and ecological studies of Maktila sector of Sidi-Barrani.1. Sociology of the communities. *Feddes Reportorium*, 84: 747-760.

Morsy, A. A. (2002). Ecophysiological studies on certain wild plants grown in different habitats in the Egyptian Deserts. *Ph. D. Thesis, Fac. Science, Ain Shams University, Egypt.*

Pirie, N. W. (1955). In "*Proteins Modern Methods of Plant Analysis*". (Peach, K. and M. V. Tracey, eds.). Vol. 2, p23, Sringer-Verlag, Berlin.

Richards, L. A. (1954). Diagnosis and improvement of saline and alkali soils. *M. S. Thesis*, Dept. Agri. Handbook, 60pp.

Salama, H. (1989). Ecological and phytochemical studies on *Tamarix nilotica* (Ehrenb), *M.Sc. Thesis., Fac. Sci., Zagazig Univ., Benha, Egypt.*

Shams, H. M.; H. Y. Olama and Dina, Baraka (1986). Investigation of amino and fatty acids of *Polygonum salcifolium* naturally growing in Qalubiya. *Egypt. J. Appl. Sci.*, 1(1): 113-117.

Smith, Ph. (1976). In "*The chemotaxonomy of plants*". J.W. Arrow Smith Ltd., Bristol, England.

Stewart, E. A. (1974). In "*Chemical Analysis of Ecological Material*". Blackwell Scientific Publication, Oxford, London, Edinburgh, Melbourn.

Studier, F. W. (1973). Analysis of bacteriophage T7 early RNAs and protein of slab gels. *J. Mol. Biol.*, 79: 237-248.

Vierling, E.(1991). The role of heat shock proteins in plants., Plant Physiol., 492: 579-620.

Wilde, S.A.; R. B. Corey; J.G. Lyer and G.K.Voigt (1979). Soil and plant analysis for tree culture. Oxford and IBH Publ. Co., New Delhi and Bombay, India.

Youssef, A. M. (1994). Ecological studied on certain plants of different ecological groups from S. W. Sinai. *Ph. D. Thesis, Bot. Dept., Fac. Sci., Ain Shams Univ., Cairo, Egypt.*

Zahran, M. A. (1989). In "*Principles of plant Ecology and Flora of Egypt*". Dar El Nashr for Egyptian Universities, Elwafa Library, Cairo, Egypt, 388pp.

Zahran, M. A. and A. J. Willis (1992). In "*The vegetation of Egypt*". Chapman and Hall, London, 424pp.

Zaki, V.A. (2000). *Phyto-biodiversity in some valleys in Elba Natural reserve. Ph. D. Thesis*, African Studies Institute for Natural Resources, Cairo University, Egypt.

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دراسات بيئية فسيولوجية لبعض نباتات المراعى النامية طبيعياً بالساحل الشمالى الغربى لمصر

ناهد محمد نور الدين ، أحمد مرسى أحمد ، سيد على خليفة
قسم البيئة النباتية والمراعى ، مركز بحوث الصحراء - المطريه- القاهره- مصر

أستهدفت هذه الدراسة اختيار مجموعة من النباتات النامية طبيعيا بالساحل الشمالي الغربي حيث تم تجميعها من منطقتين مختلفتين لكل نبات *Kickxia aegyptiaca*, *Lycium europeum* and *Salsola tetrandra* (عشب الديب، العوسج، الضمران)· وقد أسفرت الدراسة عن النتائج التالية:

١ - انخفضت القيمة العصارية لبعض الأنواع النباتية خلال فصلى الصيف والشتاء فى الأماكن المختلفة ويرجع ذلك لزيادة معدل النتح بسبب زيادة سرعة الرياح وارتفاع درجات الحرارة·

٢ - ارتفعت قيم الرماد النباتي خلال فصل الصيف عنه فى فصل الشتاء وقد صاحب ذلك ارتفاع في تراكم الانيونات والكاتيونات كما تراكم عنصر الكالسيوم فى الغالب خلال فصلى الصيف والشتاء·

٣ - أظهرت نسبة كل من البروتين الخام والدهون والكربوهيدرات الكلية أعطت اقل قيمة لها فى فصل الشتاء عنها فى فصل الصيف·

٤ - اختلف تركيز كل من الأحماض الأمينية سواء كانت الحمضية أوالقاعدية أو الأروماتية فى معظم الأنواع النباتية طبقا للتنوع البيئى والموسمى الذى تعرضت له تلك النباتات·

٥- أظهرت النتائج أن التفريد الكهربي لجزيء البروتين يعكس اختلاف في الأوزان الجزئية وعدد البروتينات التي تدخل في تركيب جزئ البروتين تبعا لاختلاف المواسم والمواقع·

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