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Original Research Article

Plant Species Associated with Some Asteraceae Plant and Edaphic Factor Effect

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Abstract: The family Asteraceae is the largest and the most cosmopolitan of the world particularly in semiarid region of the tropics and subtropics. In this present study investigate the ecology and edaphic factor effect of five species namely: *Nauplius graveolens* (Forssk.) Wiklund, *Picris asplenioides* L., *Reichardia tingitana* (L) Roth, *Sonchus oleraceus* L. and *Urospermum picroides* (L.) F.W. Schmidt. The study area is located in some selected governorates in the northern part of Nile Delta and Eastern Desert regions of Egypt. The total number of the recorded plant species in the present study was 182 species belonging to 144 genera and related to 37 families. Asteraceae contributing 18.13%, of all recorded species in the study area, followed by Poaceae, Chenopodiaceae, Fabaceae and Brassicaceae. The vegetation structure was classified by TWINSPAN classification into four groups. Group I was dominated by *Retama raetam*, group II was codominated by *Diplotaxis harra* and *Bassia muricata*, these groups represent the vegetation type of the inland desert. Group III was codominated by *Senecio glaucus* and *Rumex pictus* and group IV was codominated by *Cynodon dactylon* and *Phragmites australis*. Groups III and IV represent the vegetation type of the coastal desert and canal bank, respectively. The soil texture, water holding capacity, pH, calcium carbonate, chlorides and bicarbonates were the most effective soil variables which have high significant correlations with abundance and distribution of vegetation. Finally, anthropogenic disturbances have affected the floristic composition of the asteraceae family to an extent. Thus, there is need to control human activities in desert so as to protect the plant species for effective management and utilization.
Keywords: Floristic analysis, Vegetation structure, Asteraceae, Soil variables, Desert.

INTRODUCTION

Egypt comprises six phytogeographical regions [1, 2], namely: Mediterranean coastal region, Eastern Desert, Western Desert, Sinai Peninsula, Red Sea coastal region and River Nile region. The environmental conditions that prevail in each region (climate, soil, geomorphology, underground water, etc.) limit the number and extent of its ecosystems. The Egyptian desert is among the most arid parts of the world characterized by arid and/or extreme arid climate. Vegetation is, thus continuously exposed to extreme and drastic environmental condition [3]. Kassas [4] classified the desert vegetation into two groups: epheremals and perennials. The epheremals are active only in the vernal aspect of the vegetation. The appearance of epheremals and duration of their life are dependent on the chance occurrence of rainy seasons. The perennials are linked to the stands which they occupy, and are governed by the whole complex of physical and biotic conditions. The perennial plant cover forms the permanent framework of the desert vegetation and is the best indicator of the habitat conditions.

The Egyptian deserts are classified ecologically into: coastal and inland deserts. The coastal deserts are associated with and affected by the Mediterranean, Red Sea and the two Gulfs of Sinai. The inland deserts are those far from the effects of the seas including the oases Zahran & Willis [2]. The coastal desert (Deltaic Mediterranean coast) has been studied ecologically and phytosociologically from several stand points by many authors, e.g. Zahran *et al.* [5], Shaltout *et al.* [6], Galal and Fawzy [7], Zahran and El-Amier [8]. The vegetation analysis of the inland deserts (eastern desert) have been studied by several authors. Batanouny [3], Sharaf El-Din and Shaltout [9], Abd El-Ghani *et al.* [10], Salama *et al.* [11] and El-Amier & AbdulKader [12].

Since ancient times, plants have been utilized as a source of nutrition and healthcare product. Plants are a reservoir of diverse kinds of bioactive chemical agents and have often been utilized either in the form of traditional preparations or as pure active principles [13]. The family Asteraceae is the largest and the most cosmopolitan of the world particularly in semiarid region of the tropics and subtropics, about 1600 genera and 25000 species in the world [14]. In the flora of Egypt, Asteraceae is represented by about 228 species in 98 genera [15]. The most members are evergreen shrubs or subshrubs or perennial rhizomatous herbs; biennial and annual herbs are also frequent [16]. Plants in this family were widely unitized in the past and are still used today for their medicinal properties. In this present study, an attempt was made to investigate the ecology and edaphic factor effect of five species namely: *Nauplius graveolens* (Forssk.) Wiklund, *Picris asplenioides* L., *Reichardia tingitana* (L) Roth, *Sonchus oleraceus* L. and *Urospermum picroides* (L.) F.W. Schmidt.

STUDY AREA

Location and sampling sites

At Cairo the River Nile pursues a northwesterly direction for about 20 km till the Delta Barrage, where it divides into two branches: Rosetta branch and Damietta branch see Figure 1. The Nile Delta is a classic Delta with a triangular shape broader at its base than the sides. Its length from north to south is 170 km, and their breadth from east to west is 220 km with an area about of 22,000 km2 and thus comprises 63% of the Egyptian fertile lands. The middle section of the Mediterranean coastal land of Egypt (Deltaic coast) extends from Abu-Quir (in the west, Long. 32°19' E) to Port-Said (in the east Long.31°19' E) with a length of about 180 km, and with a width in a N-S direction for about 15 km from the coast [17, 2]. On the other hand, Cairo Suez desert road is located in the northern part of the Eastern Desert of Egypt (Isthmic Desert) which extends east of the Nile Delta. This desert road extends for about 130Km long. The gravel desert is one of the most characteristic features of this road.

The study area is located in some selected governorates in the northern part of Nile Delta and Eastern Desert regions of Egypt, which comprises different habitats (Figure 1). These include: 1. Canal bank habitat selected in three representative governorates in the north of Nile Delta region namely: Damietta, El-Dakahlyia, and Kafr El-Sheikh. 2. Deltaic Mediterranean coast, and 3. Desert habitat in Cairo Suez desert road and Wadi Hagul.

Water source

There are several water sources in the Nile Delta viz: rainfall, Nile water (comes from Damietta and Rosetta branches), Mediterranean Sea water, northern lakes and underground water. Therefore, the agriculture in the Nile Delta is mainly depending on the Nile water and partly on rainfall. The main water sources in the northeastern desert of Egypt are: groundwater, rainfall and fossil water. The Pleistocence deposits comprise the main aquifer of fresh water. This derives its water resources principally from the main aquifer of the Nile Delta [18].

Climate

The climatic conditions of the Nile Delta, the northern part of Egypt, is rather arid to semiarid [19], where the rate of evaporation exceeds many times the rate of precipitation. Ayyad *et al.* [20] stated that, the Mediterranean coastal region of Egypt is belonging to the dry arid climatic zone of Koppen's [21] classification system. The monthly means of air temperature ranged between 12.0 °C in January at El-Dakahlia to 26.5 °C in August at Kafr El-Sheikh. The relative humidity ranged from 53% in May at El-Dakahlia to 76% in August at Damietta. The total annual rainfall attained a value of 53.1, 106.7 and 175.2 at El-Dakahlia, Damietta and Kafr El-Sheikh.

The application of several methods suggested that, the Cairo–Suez desert road is belonging to arid mesothermal type of Thornthwaite [22] and the arid or extreme arid climate of Walter [23]. Meteorological data of the Suez District shows that, the climate of this region is obviously hot and dry. The low rainfall (23.9 and 16.3 mm at Cairo and Suez, respectively) and high temperature are the main aspects of its aridity.

MATERIALS AND METHODS

Floristic composition

For field studies, sixty stands dominated by studied species in family asteraceae were selected in the coastal desert (28), inland desert (17) and irrigation and drainage canal banks in Nile Delta (15). Within each stand, species present were recorded. In each stand, plant density of the present species was calculated and plant cover was estimated quantitatively by the line intercept method [24]. Relative density and cover of each species were summed to give its importance value (IV) out of 200. Life forms were identified according to the scheme of Raunkiaer [25], Taxonomic nomenclature followed Täckholm [26], updated by Boulos [27, 15].

Soil analysis

Three soil samples were collected from each stand. Soil textures were estimated using the bouyoucous hydrometer method [28]. Calcium carbonate content was determined according to Jackson [29]. Oxidizable organic carbon was measured using Walkely and Black rapid titration method as described by Piper [28]. Soil water extracts (1:5) were prepared for chemical analysis: determination of EC and pH using conductivity and pH meters, chlorides by direct titration against silver nitrate using potassium chromate as an indicator [29]. Sulphate content was estimated gravimetrically using 5% barium chloride solution [28]. Atomic absorption (A Perkin-Elemer, Model 2380, U.S.A.) was used for the determination of Ca^{+2} and Mg^{+2}, while Na^{+} and K^{+} were estimated using Flame Photometer (Model PHF 80B Biologie Spectrophotometer).

Data analysis

The classification technique applied here was the Two-Way Indicator Species Analysis (TWINSPAN). However, the ordination technique applied was Detrended Correspondence Analysis (DECORANA) [30, 31]. The relationships between vegetation groups and environmental variables can be indicated on the ordination diagram produced by Canonical Correspondence Analysis (CCA-biplot) described by ter Braak [32]. The significance of variations in environmental factors was assessed by ANOVA for groups with equal replication using the COSTAT program.

RESULTS

Floristic Composition

The total number of the recorded plant species surveyed in the present study was 182 species belonging to 144 genera and related to 37 families (Appendix 1). Asteraceae contributing 18.13%, of all recorded species in the study area, followed by Poaceae (17.58 %), Chenopodiaceae (7.69%), Fabaceae (6.59 %) and Brassicaceae (5.50%). These 5 families are represented collectively by 101 species (55.50% of the total species) (Figure 2). The highest relatively number of species (80) is recorded in the Deltaic Mediterranean coast habitat representing about (43.95%) of the total recorded species, while the inland desert habitat is represented by 74 species (40.65%) and the canal bank habitat is represented by 65 species (35.71%).

According to the duration the flora of the different habitats of the study area can be classified into three major groups: 82 annuals (45.05%), 3 biennials (1.65%) and 97 perennials (53.30%). It is of interest to denote that, the Deltaic Mediterranean coast is floristically the richest habitat (43.96 %), followed by the canal bank habitat (35.72 %), then the inland desert (40.66%). It is also obvious that, the perennials are the most frequent species (53.30%), followed by the annual species (45.05 %) and then the very rare biennial species in different habitats (1.65 %) (Figure 3).

According to Raunkiaer [33], the life-forms of the flora of the present study are grouped under six types as follows: therophytes (85 species = 45.21%), cryptophytes (32 species = 17.02 %), chamaephytes (30 species = 15.96 %), hemicryptophytes (26 species = 13.83%), phanerophytes (14 species = 7.44 %,/ m) and parasites (one species = 0.53%). It is evident that, the percentages of the life-form spectra vary from one habitat to the other (Figure 4).

The floristic analysis of the study area reveals that, 88 species or about 48.35 % of the total number of recorded species are Mediterranean taxa. These taxa are either Pluriregional (39 species = 21.43 %), Biregional (30 species =16.48 %) or Monoregional (19 species = 10.44 %). It has been also found that, 38 species or about 20.88% of the total number of the recorded species are either Cosmopolitan (8.79%), Pantropical (4.95%), Palaeotropical (4.95%) or Neotropical (2.20%). Other floristic categories are either poorly represented or completely missed in the different habitats. This may indicate that, the chorological analysis of the study area is relatively compatible with the north-southward distribution of the climatic belts in Egypt.

Fig-1: Location map of the study areas.

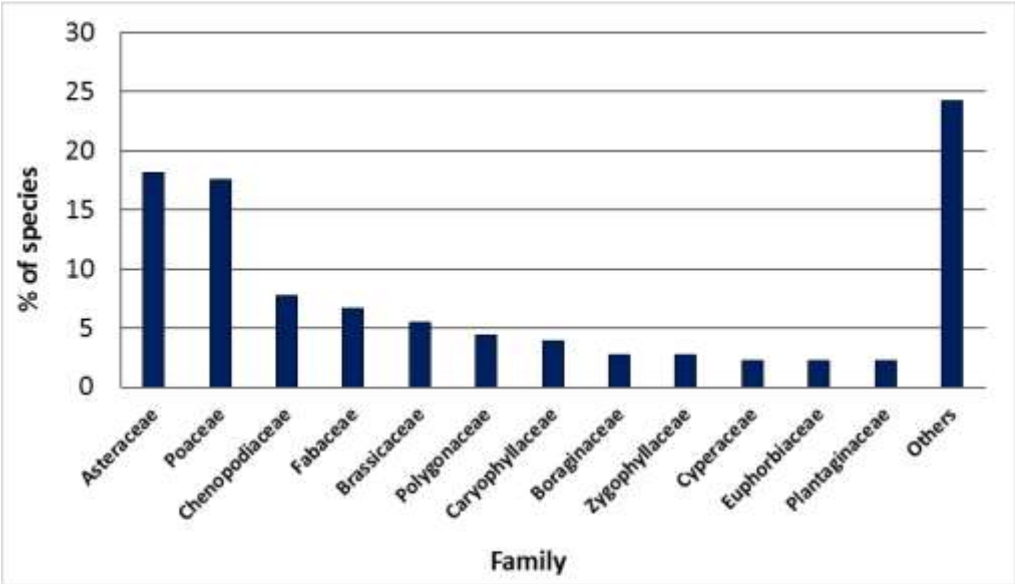

Fig-2: Family dominance of plant species in the three study habitats.

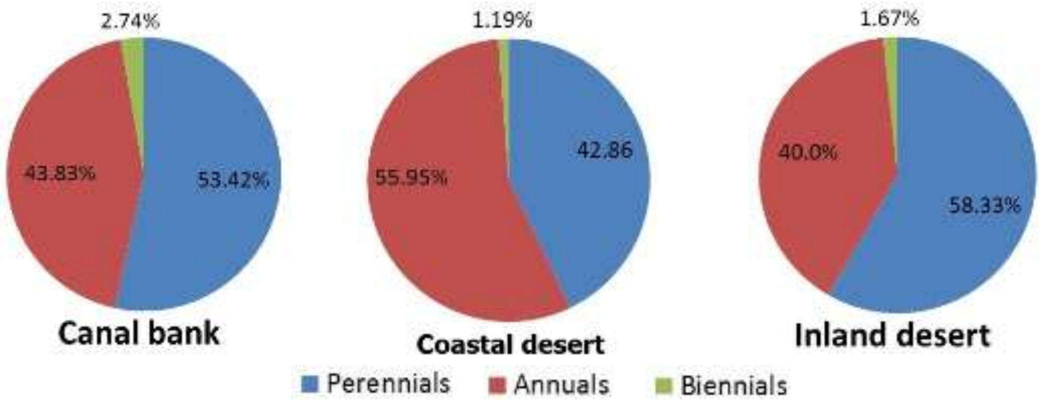

Fig-3: Plant life span spectra in the different habitats of the study area.

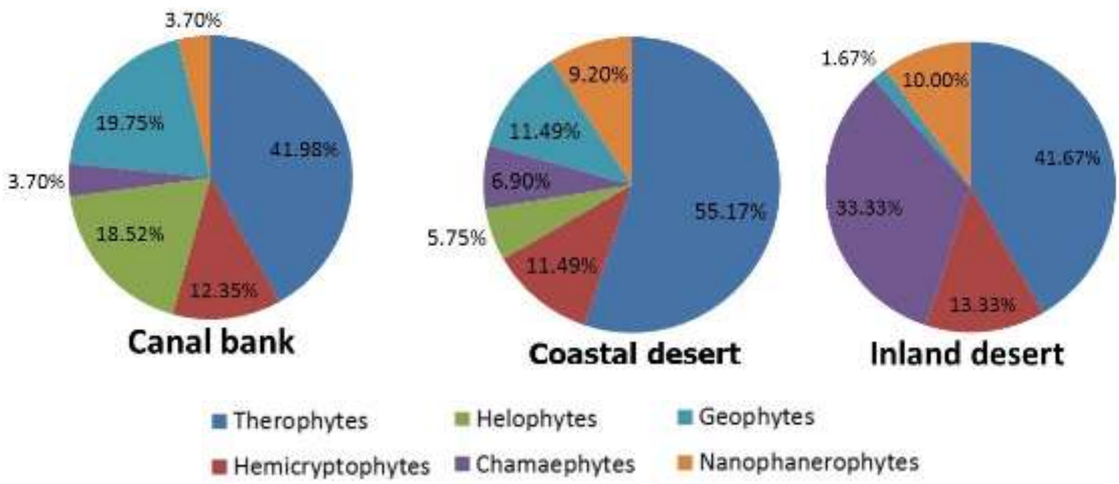

Fig-4: Plant life form spectra in the different habitats of the study area

Classification of vegetation data

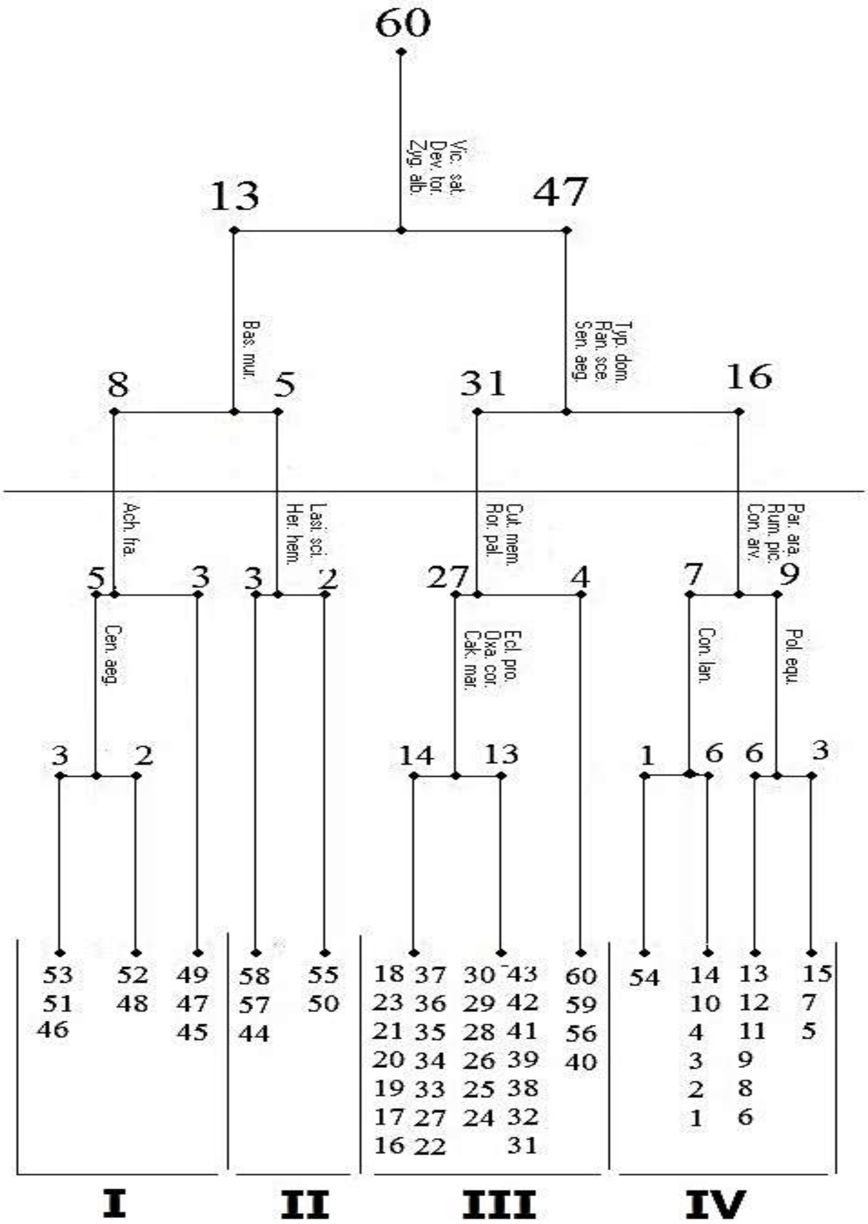

Fig-5: Two Way Indicator Species Analysis (TWINSPAN) dendrogram of the 60 sampled stands based on the importance values of the 182 species. The indicator species are abbreviated by the first three letters of genus and species respectively.

Stands ordination

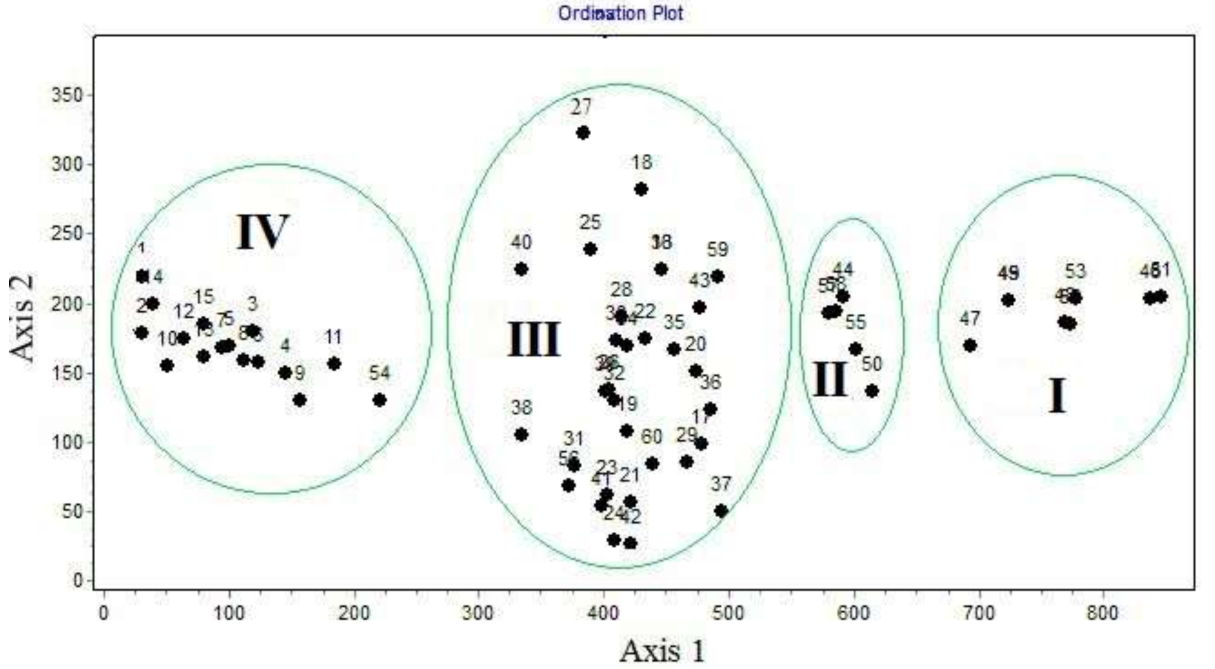

Fig-6: Detrended Correspondence Analysis (DCA) ordination diagram of the 60 stands with vegetation groups.

Correlation between soil variables and vegetational gradients

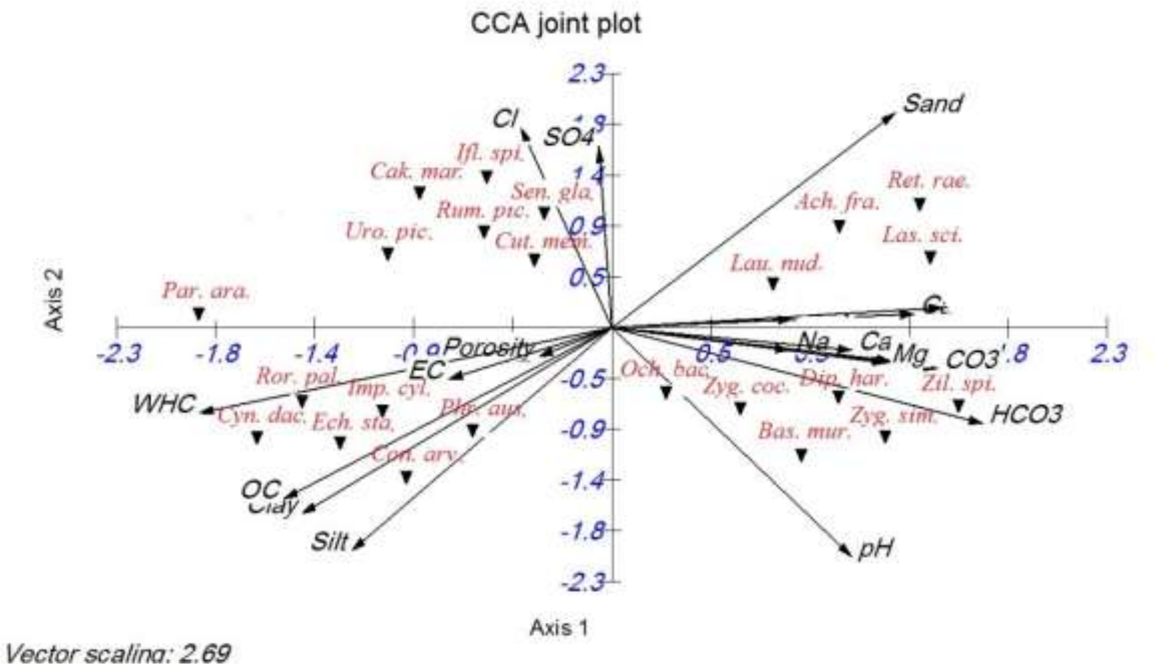

Fig 7: Canonical Correspondence Analysis (CCA) ordination diagram of plant species with soil variables represented by arrows in the study area. The indicator and preferential species are abbreviated to the first three letters of the genus and species respectively.

Soil Characteristics

The spatial variations in the physical and chemical properties of the soil collected from the three habitats of the study area are shown in Table 1. Soil texture, water-holding capacity, porosity, calcium carbonate and bicarbonate showed highest significant correlations ($P < 0.05$) among three habitats. Soil of canal bank had the highest values of fine fraction (silt =27.64% and clay = 12.96%), water holding-capacity (62.38%) and porosity (36.37%), but the lowest of Cl^- (0.1%) and potassium

(15.2 mg/100g). Soil of coastal desert stands had the highest of EC (553.21 µmhos/cm), sand (95.88%), Cl^- (1.05%) and SO_4^{--} (0.72%). On the other hand, the soil of inland desert had the highest content of $CaCO_3$ (16.63%), pH (8.17), HCO_3 (16.63%) and cations (Na^+ = 129.80, K^+ = 19.23, Ca^{++} = 24.06 and Mg^{++} = 21.72 mg/100g dry soil). Chloride, sulphates, potassium and magnesium exhibited low significant correlations ($P < 0.05$) among three habitats (Table 1).

Classification of vegetation data

According to the vegetation importance value of 182 plant species recorded in 60 sampled stands in the study area, communities were divided into four vegetation groups using TWINSPAN classification (Figure 5 and Table 2). The four vegetation groups were named after their characteristic species as follows:

Group I: *Retama raetam* (IV=26.19) is the characteristic species of this group, including 39 species and 8 stands (inland desert). The other important species which attain relatively high importance values in this group were *Ochradenus baccatus* (IV=17.24), *Zygophyllum coccineum* (IV=15.11), *Zilla spinosa* (IV=12.02), *Launaea spinosa* (IV=11.20) and *Pulicaria undulata* (IV=9.49). The indicator species in this group was *Achillea fragrantissima* (IV=5.08).

Group II: *Diplotaxis harra* - *Bassia muricata* (49 species), this group of 5 stands were located in inland desert. Codominated by *Diplotaxis harra* (IV=13.49) and *Bassia muricata* (IV= 13.38). The other important species in this group were *Launaea nudicaulis* (IV=12.86), *Zygophyllum simplex* (IV=12.68), *Haloxylon salicornicum* (IV=8.64) and *Erodium laciniatum* (IV=8.58). In this group, the indicator species were *Herniaria hemistemon* (IV = 0.38) and *Lasiurus scindicus* (IV = 5.14).

Group III: *Senecio glaucus* - *Rumex pictus* (107 species), comprises 31 stands were mostly occupying the coastal desert and characterized by the codominated of *Senecio glaucus* (IV=11.14) and *Rumex pictus* (IV=10.31). In this group, the other important species were *Ifloga spicata* (IV=7.68), and *Cakile maritima* (IV=7.64). The indicator species were *Cutandia memphitica* (IV = 1.94) and *Rorippa palustris* (IV = 0.13).

Group IV: This group of 16 stands and 101 species is characterized by the codominated by *Cynodon dactylon* (IV=24.90) and *Phragmites australis* (IV=21.79) inhibiting the canal bank. The other important species were *Echinochloa stagnina* (IV=9.37), *Urospermum picroides* (IV=9.10) and *Imperata cylindrica* (IV=8.49). The indicator species in this group include *Convolvulus arvensis* (IV=2.40), *Rumex pictus* (IV=1.77) and *Paronychia arabica.* (IV=0.95).

Stands ordination

The ordination of stands in the study area, given by Detrended Correspondence Analysis (DCA) is shown in Figure 6. It is clear that, the vegetation groups obtained by TWINSPAN classification were distinguishable and having a clear pattern of segregation on the ordination plane. Group I dominated by *Retama raetam* and group II codominated by *Diplotaxis harra* and *Bassia muricata* were separated at the right side of the DCA diagram. On the other hand, group III codominated by *Senecio glaucus* and *Rumex pictus* was separated at the middle part of the DCA diagram. Group IV codominated by *Cynodon dactylon* and *Phragmites australis* was separated at the left side of the DCA diagram.

Vegetation-Soil Relationships

Physical soil variables were comparable in all groups Table 3. The highest percentage of coarse fractions (sand = 94.91%) was obtained in group III, but the highest percentage of silt and clay fraction (26.44 % and 12.25%, respectively) was attained in group IV. In the contrary, the lowest percentages of sand (61.32%) was obtained in group IV, but the lowest percentage of silt and clay (3.84% and 1.24%, respectively) were obtained in group III. Soil porosity and Water-holding capacity attained the highest value (36.29% and 60.06%) in group IV, while the lowest percentage (30.34% and 28.02%) were obtained in group I and II, respectively.

The chemical soil variables showed variations from one group to another. The soil samples of group I attained the highest value of potassium (29.97 mg/100g dry soil), while group IV attained the lowest values (1.71 mg/100g dry soil). The highest value of organic carbon (2.44%) was estimated in group IV, while, the lowest values (0.16%) in group II. Calcium carbonate and sodium showed the highest value in group II (18.38% and 26.95 mg/100g dry soil, respectively), while the lowest values (7.82% and 3.05 mg/100g dry soil, respectively) in group IV. The soil reaction (pH) varied between pH=7.49 (slightly alkaline) in group III to pH=8.29 (moderately alkaline) in group II. The bicarbonate content was very low in all groups; it showed the highest value (0.79%) in groups II and the lowest value (0.13 %) in group III. Electrical conductivity showed the highest value in group III (514.20 µmhos/cm), while the lowest values (196.83 µmhos/cm) in group II. The percentages of chlorides, sulphates, calcium and magnesium showed the highest values (0.95%, 0.68%, 0.99 mg/100g dry soil and 0.68 mg/100g dry soil, respectively) in group III, while the lowest values (0.12%, 0.17%, 0.12 mg/100g dry soil and 0.17 mg/100g dry soil, respectively) were attained in group IV.

The correlation coefficient (r) between the different soil variables in the sampled stands are shown in Table 4. It has been found that, some soil variables were positively correlated with other soil variables such as sand fraction which is significantly correlated with chlorides, and sulphates. While, silt and clay fractions were significantly correlated with porosity, water-holding capacity, organic carbon and pH. Calcium carbonate showed high significant correlations with electrical conductivity, bicarbonates and calcium. Organic carbon showed high significant correlations with pH and calcium, while the soluble chlorides exhibited a significant correlation with sulphates only. Electrical conductivity exhibited very high significant correlations with sodium, potassium, and calcium.

Sodium cation exhibited significant correlations with potassium, calcium, magnesium, while potassium cation showed high significant correlation with calcium, magnesium. Calcium cation exhibited high significant correlations with magnesium. On the other hand, it has been also found that, some soil variables such as sand fraction, water-holding capacity, porosity, sulphates were either negatively correlated or have no any correlations with any other soil variables.

Correlation between soil variables and vegetational gradients

The correlation between vegetation and soil characteristics is indicated on the ordination diagram produced by Canonical Correspondence Analysis (CCA) of the biplot of species and environmental variables in the study area (Figure 7). It is clear that, the soil texture, water holding capacity, pH, calcium carbonate, chlorides and bicarbonates were the most effective soil variables which have high significant correlations with the first and second axes.

In the upper right side of CCA diagram, *Retama raetam* which was dominant species and *Achillea fragrantissima* which was important species in group I, *Launaea nudicaulis* which was important species and *Lasiurus scindicus* which was indicator in group II were collectively showed a close relationships with sand, pH, HCO_3 and $CaCO_3$. While, in the upper left side of the diagram *Senecio glaucus* and *Rumex pictus* which were codominant species, *Cutandia memphitica* which was indicator species and important species (*Ifloga spicata* and *Cakile maritima*) in groups III, *Paronychia arabica* which was an indicator species in group IV showed a close relationships with sulphates and chlorides. In the lower right side, *Diplotaxis harra* and *Bassia muricata* which were the codominant species and *Zygophyllum simplex* which was important species in group II, *Ochradenus baccatus*, *Zygophyllum coccineum* and *Zilla spinosa* which were important species in group I showed a close relationships with pH, HCO_3, Ca and Mg. In the lower left side, *Cynodon dactylon* and *Phragmites australis* (codominant species in group IV), *Echinochloa stagnina* and *Imperata cylindrica* (the important species in group IV), *Convolvulus arvensis* (indicator species in group IV) and *Rorippa palustris* (indicator species in group III) showed close relationships with silt, clay, WHC and organic carbon.

Table 1: Means and standard deviation of soil characteristics collected from represented stands of the main habitats of studied species. EC= electrical conductivity, WHC= water holding capacity, OC= organic carbon. ns = not significant at P < 0.05. *: Values are significant at P < 0.05, **: Values are significant at P < 0.01, *: Values are significant at P < 0.001.**

Soil variables		Habitats			*Mean*	*P-value*
		Canal bank (n=15)	*Costal desert (n=28)	*Inland desert (n=17)		
pH		7.95^{a}±0.09	8.08^{a}±0.11	8.17^{a}±1.98	8.07±0.73	0.32ns
EC (µmhos/cm)		365.58^{a}±14.84	553.21^{a}±19.97	270.89^{a}±11.70	396.56±15.84	0.13ns
Sand	%	59.41^{c}±1.95	95.88^{a}±0.48	89.69^{b}±21.75	81.66±8.06	0.000***
Silt		27.64^{a}±1.13	2.96^{c}±0.40	8.58^{b}±2.08	13.06±1.20	0.000***
Clay		12.96^{a}±0.92	1.16^{b}±0.22	1.72^{b}±0.42	5.28±0.52	0.000***
WHC		62.38^{a}±3.58	39.39^{b}±1.24	28.91^{b}±7.01	43.56±3.94	0.0001***
Porosity		36.37^{a}±2.13	31.32^{b}±0.93	31.45^{b}±7.63	33.05±3.56	0.0032**
$CaCO_3$		6.41^{b}±0.72	2.99^{b}±0.17	16.63^{a}±4.03	8.68±1.64	0.0001***
OC		2.59^{a}±0.32	0.37^{b}±0.03	0.18^{b}±0.04	1.05±0.13	0.0032**
Cl^{-}		0.13^{b}±0.03	1.05^{a}±0.16	0.19^{b}±0.05	0.46±0.08	0.025*
SO_4^{--}		0.15^{b}±0.04	0.72^{a}±0.11	0.31^{ab}±0.07	0.39±0.07	0.041*
HCO_3^{-}		0.22^{b}±0.02	0.04^{b}±0.01	0.80^{a}±0.19	0.35±0.07	0.0003***
Na^{+}	mg/100g dry soil	4.88^{b}±1.35	40.42^{c}±8.78	129.80^{a}±31.48	58.37±13.87	0.003**
K^{+}		0.16^{b}±0.04	6.14^{b}±1.09	19.23^{a}±4.66	8.51±1.93	0.041*
Ca^{++}		1.31^{b}±0.38	11.04^{b}±2.21	24.06^{a}±5.84	12.14±2.81	0.0071**
Mg^{++}		0.87^{b}±0.25	4.26^{b}±0.74	21.72^{a}±5.27	8.95±2.09	0.019*

*Costal desert: Deltaic Mediterranean coast, *Inland desert: Cairo-Suez desert road and wadi Hagul.

Table 2: Mean of the importance values (out of 200) of the recorded species in the different vegetation groups resulting from TWINSPAN classification of the study area.

Species	Vegetation group			
	I	II	III	IV
No. of stands	8	5	31	16
No. of species	39	49	107	101
Studied species				
Reichardia tingitana (L.)Roth	1.86	3.73	7.51	1.26
Nauplius graveolens (Forssk.)Wilklund.	0.99	1.21	-	-
Sonchus oleraceus L.	-	-	0.37	3.65
Urospermum picroides (L.)F.W. Schmidt	-	-	2.57	9.10
Picris asplenioides L.	-	-	0.67	-
Associated species				
Species present in all groups				
Echinops spinosus L.	2.13	2.20	4.45	1.77
Erodium laciniatum (Cav.) Willd.	3.14	8.58	5.69	2.01
Retama raetam (Forssk.)Webb & Berthel.	26.19	0.92	0.62	0.76
Rumex vesicarius L.	2.36	4.16	0.87	0.95
Senecio glaucus L.	1.20	5.05	11.14	2.01
Species present in three groups				
Anthemis cotula L.	-	0.55	0.24	0.39
Atractylis carduus (Forssk.) C.Chr.	0.38	-	0.73	0.12
Bassia indica (Wight) A.J. Scott.	-	1.24	2.16	0.39
Bassia muricata (L.) Asch.	2.77	13.38	-	0.71
Chenopodium murale L.	-	2.19	2.92	2.48
Cynanchum acutum L.	-	3.96	1.92	1.97
Cynodon dactylon (L.) Pers.	-	4.13	6.61	24.90
Diplotaxis harra (Forssk.) Boiss.	1.52	13.49	-	1.01
Haloxylon salicornicum (Moq.) Bunge ex Boiss.	-	8.64	0.80	1.56
Hyoscyamus muticus L.	-	1.57	0.33	1.57
Ifloga spicata (Forssk.)Sch.Bip.	-	3.24	7.68	1.02
Launaea nudicaulis (L.)Hook. f.	0.87	12.86	3.96	-
Launaea mucronata (Forssk.)Muschl.	-	4.97	2.15	0.27
Lotus glinoides Delile	3.02	1.10	0.19	-
Malva parviflora L.	-	6.50	0.61	4.15
Matthiola longipetala (Vent.)DC.	-	4.68	1.40	0.26
Ochradenus baccatus Delile.	17.24	8.37	1.17	-
Zilla spinosa (L.)Prantl.	12.02	8.45	-	1.48
Zygophyllum coccineum L.	15.11	7.27	0.70	-
Zygophyllum simplex L.	-	12.68	0.26	0.54
Species present in two groups				
Alhagi graecorum Boiss.	-	-	4.39	0.72
Anagallis arvensis L.	-	-	0.33	0.17
Astragalus bombycinus Boiss.	-	3.14	0.21	
Avena fatua L.	-	-	0.43	0.72
Brassica tournefortii Gouan	-	6.35	2.06	-
Calotropis procera (Aiton) W. T. Aiton	-	6.11	0.76	-
Calligonum comosum (L, Her.) Soskov	-	-	3.41	3.03
Centaurea aegyptiaca L.	5.78	1.90	-	-
Chenopodium album L.	-	-	0.41	0.31
Convolvulus arvensis L.	-	-	0.21	2.40
Crotalaria aegyptiaca Benth.	5.87	-	-	0.03
Cyperus rotundus L.	-	-	0.98	4.23
Deverra tortuosa (Desf.)DC.	6.75	0.72	-	-

Echinochloa stagnina (Retz.) P. Beauv.	-	-	2.42	9.37
Emex spinosa (L.)Campd.	-	2.06	0.54	
Euphorbia retusa Forssk.	1.85	2.76	-	-
Farsetia aegyptia Turra.	1.01	2.61	-	-
Gypsophila capillaris (Forssk.)C.Chr.	3.26	1.91	-	-
Halocnemum strobilaceum (Palla.) M. Bieb.	-	-	2.03	0.54
Hordeum leporinum L.	1.95	-	-	0.48
Hordeum murinum L.	-	-	5.11	1.00
Imperata cylindrica (L.) Raeusch.	-	-	0.38	8.49
Iphiona mucronata (Forssk.)Asch. & Schweinf.	5.47	4.92	-	-
Lasiurus scindicus Henrard	-	5.14	0.41	-
Launaea spinosa (Forssk.) Sch.Bip. ex Kuntze.	11.20	0.86	-	-
Lavandula coronopifolia Poir.	6.36	1.40	-	-
Lotus halophilus Boiss. & Spruner	-	-	1.37	0.82
Melilotus indicus (L.)All.	-	-	0.30	0.04
Mesembryanthemum forsskaolii Hochst. ex Boiss.	-	5.33	-	0.90
Mesembryanthemum crystallinum L.	-	-	2.41	0.30
Pancratium maritimum L.	-	-	1.96	0.85
Panicum caloratum L.	-	1.83	0.60	-
Limonium pruinosum (L.) Chaz.	-	-	1.49	1.55
Lolium multiflorum Lam.	1.35	-	-	0.48
Panicum turgidum Forssk.	0.94	-	0.67	-
Parapholis incurva (L.) C. E. Hubb.	-	2.42	1.24	-
Persicaria salicifolia (Brouss.ex Wild.)Assenov	-	-	0.22	3.12
Phragmites australis (Cav.) Trin.ex Steud.	-	-	7.33	21.79
Pluchea dioscoridis (L.) DC.	-	-	0.80	6.42
Poa annua L.	-	-	1.26	0.39
Polycarpaea repens (Forssk.) Asch.& Schweinf.	-	0.38	-	0.45
Salsola kali L.	-	-	2.26	0.26
Silene vivianii Steud.	-	-	0.38	0.26
Solanum nigrum L.	-	-	0.31	1.69
Stipagrostis lanata (Forssk.) De Winter	-	-	0.63	0.96
Suaeda pruinosa Lange	-	-	1.09	0.36
Tamarix nilotica (Ehrenb.)Bunge.	-	4.79	4.08	-
Trichodesma africanum (L.)R.Br	4.37	1.91	-	-
Trigonella stellata Forssk.	3.16	-	0.15	-
Species present in one groups				
Achillea fragrantissima (Forssk.) Sch. Bip.	5.08	-	-	-
Aegliops bicornis (Forssk.) Jaub. & Spach	-	-	2.29	-
Aegilops kotschyi Boss.	-	-	3.65	-
Alternanthera sessilis (L.)DC.	-	-	-	1.18
Amaranthus lividus L.	-	-	-	2.30
Amaranthus viridus L.	-	-	0.04	-
Anabasis articulata (Forssk.) Moq.	4.98	-	-	-
Anchusa humilis (Desf.) I.M. Johnst.	-	-	0.88	-
Artemisia judiaca L.	0.71	-	-	-
Arundo donax L.	-	-	-	1.66
Astragalus peregrinus Vahl	-	-	0.16	-
Atriplex halimus L.	-		-	3.16
Atriplex semibaccata R.Br.	-	-	0.90	-
Beta vulgaris L.	-	-	-	0.33
Bidens pilosa L.	-	-	-	1.95
Atriplex lindleyi Moq.	-	1.40	-	-
Bracharia mutica (Forssk.) Stapf	-	-	-	1.43
Bromus diandrus Roth	-	-	1.98	-

Cakile maritima Scop.	-	-	7.64	-
Carduus getulus Pomel	-	-	0.68	-
Carthamus tenuis (Boiss. & Blanche) Bornm.	-	-	2.19	-
Cistanche phelypaea (L.) Cout.	-	-	-	0.06
Convolvulus lanatus Vahl	-	-	0.65	-
Conyza aegyptiaca (L.) Dryand.	-	-	-	-
Conyza bonariensis L.Cronquist	-	-	-	0.35
Cutandia memphitica (Spreng.) Benth.	-	-	1.94	-
Cyperus alopecuroides Rottb.	-	-	-	0.74
Cyperus capitatus Vand.	-	-	2.73	-
Cyperus laevigatus L.	-	-	-	0.27
Daucus litoralis Sm.	-	-	0.99	-
Echium angustifolium Mill.	-	-	0.30	-
Eclipta prostrata (L.) L.	-	-	-	1.93
Elymus farctus (Viv.) Runem. ex Melderis	-	-	2.68	-
Erysimum repandum L.	-	0.85	-	-
Ethulia conyzoides L.f.	-	-	-	0.36
Euphorbia helioscopia L.	-	-	-	0.13
Euphorbia peplus L.	-	-	-	0.11
Frankenia hirsuta L.	-	-	-	0.52
Heliotropium curassavicum L.	-	-	0.88	-
Herniaria hemistemon J. Gay	-	0.38	-	-
Hordeum spontaneum K. Koch	-	-	-	0.19
Limbarda crithmoides (L.) Dumort.	-	-	0.79	-
Lepidium draba L.	-	-	0.13	-
Ipomoea carnea Jacq.	-	-	-	1.75
Juncus acutus L.	-	-	2.51	-
Juncus rigidus Desf.	-	-	1.29	-
Lactuca serriola L.	-	-	-	0.43
Launaea capitata Spreng. Dandy	1.57	-	-	-
Leersia hexandra Sw.	-	-	-	3.62
Leptadenia pyrotechnica (Forrsk.)Decne.	8.40	-	-	-
Limoniastrum monopetaulm (L.) Boiss.	-	-	-	3.13
Lolium perenne L.	-	-	6.47	-
Lotus polyphyllos E.D. Clarke	-	-	0.44	-
Lycium shawii Roem. & Schult.	0.76	-	-	-
Mentha longifolia (L.)Huds.	-	-	-	3.19
Mesembryanthemum nodiflorum L.	-	-	2.01	-
Moltkiopsis ciliata (Forssk.) I. M. Jonst.	-	-	0.51	-
Ononis serrata Forssk.	-	-	2.06	-
Oxalis corniculata L.	-	-	-	0.22
Panicum repens L.	-	-	-	4.55
Paronychia arabica (L.) DC.	-	-	-	0.95
Paspalidium geminatum (Forssk.) Stapf	-	-	-	5.63
Pennisetum setaceum (Forssk.)Chiov.	-	-	-	3.47
Cenchrus cillaris L.	-	-	-	0.25
Persicaria lapathifolia (L.) Gray	-	-	-	0.38
Phoenix dactylifera L.	-	-	0.76	-
Phyla nodiflora (L.) Greene	-	-	-	3.68
Plantago squarrosa Murray	-	-	1.49	-
Plantago crassifolia. Forssk.	-	-	0.26	-
Plantago lagopus L.	-	-	0.75	-
Plantago major L.	-	-	-	0.69
Polygonum equIsetiforme Sm.	-	-	-	0.45
Polypogon monspeliensis (L.)Desf.	-	-	0.65	1.66

Portulaca oleracea L.	-	-	-	0.18
Pulicaria undulata (L.)C.A.Mey.	9.49	-	-	-
Ranunculus sceleratus L.	-	-	0.23	0.23
Reseda decursiva Forssk.	-	0.86	-	-
Ricinus communis L.	-	-	0.74	-
Rorippa palustris (L.)Besser.	-	-	0.13	1.65
Rumex pictus Forssk.	-	-	10.31	1.77
Rumex dentatus L.	-	-	1.17	3.09
Saccharum spontaneum L.	-	-	-	2.43
Senecio aegyptius L.	-	-	-	0.11
Silene succulenta Forssk.	-	-	0.97	-
Silybum marianum (L.)Gaertn.	-	-	0.77	-
Sisymbrium irio L.	-	-	-	0.36
Spergularia marina (L.) Griseb.	-	-	0.93	-
Sphenopus divaricatus (Gouan) Rchb.	-	-	1.05	-
Sporobolus spicatus (Vahl) Kunth	-	-	1.05	-
Suaeda maritima (L.) Dumort.	-	-	0.66	-
Symphyotrichum squamatum (Spren.) Nesom	-	-	-	0.92
Tamarex aphylla (L.) H. Karst.	8.40	-	-	-
Tamarix tetragyna Ehrenb.	-	-	1.06	-
Thymelaea hirsuta (L.) Endl.	-	-	0.78	-
Torilis arvensis (Huds.) Link	-	-	-	0.73
Typha domingensis (Pers.) Poir.ex Steud.	-	-	-	0.61
Urtica urens L.	-	-	-	0.57
Verbena officinalis L.	-	-	-	0.10
Vicia sativa L.	-	-	-	0.09
Volutaria lippii (L.)Cass. ex Maire	1.03	-	-	-
Zygophyllum aegyptium Hosny	-	-	4.10	-
Zygophyllum album L.f.	-	-	5.04	-
Zygophyllum decumbens Delile.	4.31	-	-	-

Table 3: Mean value and standard error of soil variables in the different vegetation groups obtained by TWINSPAN classification in the study area. WHC=Water-holding capacity; OC= Organic carbon; EC = Electrical conductivity. ns = not significant at P < 0.05. *: Values are significant at P < 0.05, **: Values are significant at P < 0.01, *: Values are significant at P < 0.001.**

Soil variables		Vegetation groups				*Mean*	*P-value*
		I (n=8)	**II** (n=5)	**III** (n=31)	**IV** (n=16)		
pH		$8.10^{a}\pm0.09$	$8.29^{a}\pm0.14$	$7.49^{a}\pm0.32$	$7.97^{a}\pm0.09$	7.96±0.16	0.35ns
EC (µmhos/cm)		$381.20^{b}\pm15.89$	$196.83^{c}\pm34.00$	$514.20^{a}\pm10.46$	$346.79^{b}\pm26.23$	359.76±21.56	0.0022**
Sand	%	$90.46^{a}\pm2.27$	$90.72^{b}\pm1.33$	$94.91^{a}\pm0.71$	$61.32^{c}\pm2.64$	84.35±1.74	0.000***
Silt		$8.13^{bc}\pm2.09$	$7.22^{b}\pm1.96$	$3.84^{c}\pm0.63$	$26.44^{a}\pm1.60$	11.41±1.57	0.000***
Clay		$1.42^{b}\pm0.30$	$2.06^{b}\pm0.77$	$1.24^{b}\pm0.21$	$12.25^{a}\pm1.12$	4.24±0.60	0.000***
Porosity		$30.34^{a}\pm1.72$	$31.52^{a}\pm2.22$	$31.50^{a}\pm0.87$	$36.29^{a}\pm1.99$	32.41±1.70	0.68ns
WHC		$30.67^{c}\pm1.93$	$28.02^{c}\pm3.02$	$38.18^{b}\pm1.39$	$60.06^{a}\pm4.08$	39.23±2.61	0.000***
$CaCO_3$		$12.14^{ab}\pm3.37$	$18.38^{a}\pm5.90$	$9.39^{b}\pm0.84$	$7.82^{b}\pm1.57$	11.93±2.92	0.066ns
OC		$0.24^{b}\pm0.06$	$0.16^{b}\pm0.06$	$0.34^{b}\pm0.03$	$2.44^{a}\pm0.34$	0.80±0.12	0.0018**
Cl^{-}		$0.20^{b}\pm0.07$	$0.31^{b}\pm0.20$	$0.95^{a}\pm0.16$	$0.12^{b}\pm0.03$	0.40±0.12	0.0012**
SO_4^{--}		$0.27^{b}\pm0.06$	$0.33^{b}\pm0.17$	$0.68^{a}\pm0.10$	$0.17^{b}\pm0.04$	0.36±0.09	0.0022**
HCO_3^{-}		$0.69^{ab}\pm0.19$	$0.79^{a}\pm0.17$	$0.13^{c}\pm0.06$	$0.28^{bc}\pm0.06$	0.47±0.12	0.0030**
Na^{+}	mg/100 g dry soil	$17.72^{b}\pm6.27$	$26.95^{a}\pm12.46$	$13.30^{b}\pm2.39$	$3.05^{c}\pm1.77$	15.26±5.72	0.0024**
K^{+}		$29.97^{a}\pm16.84$	$12.70^{b}\pm5.87$	$5.51^{c}\pm0.97$	$1.71^{c}\pm0.87$	12.47±6.14	0.0017**
Ca^{++}		$0.20^{c}\pm0.07$	$0.31^{b}\pm0.20$	$0.99^{a}\pm0.16$	$0.16^{c}\pm0.03$	0.42±0.12	0.0040*
Mg^{++}		$0.27^{b}\pm0.06$	$0.33^{b}\pm0.17$	$0.68^{a}\pm0.10$	$0.17^{c}\pm0.04$	0.36±0.09	0.0042*

Table 4: Pearson-moment correlation (r) between the soil variables in the stands surveyed in the study area

	Sand	**Silt**	**Clay**	**Porosity**	**WHC**	**$CaCO_3$**	**OC**	**pH**	**EC**	**Cl^-**	**SO_4^{--}**	**HCO_3^-**	**Na^+**	**K^+**	**Ca^{++}**	**Mg^{++}**
Sand	1															
Silt	-0.990**	1														
Clay	-0.960**	0.912**	1													
Porosity	-0.326*	0.293*	0.372**	1												
WHC	-0.709**	0.670**	0.745**	0.383**	1											
$CaCO_3$	0.119	-0.048	-0.253	-0.195	-0.410**	1										
OC	-0.787**	0.760**	0.792**	0.248	0.558**	-0.315*	1									
pH	-0.600**	0.634**	0.497**	0.144	0.119	0.257*	0.377**	1								
EC	0.089	-0.087	-0.089	0.225	0.182	-0.125	0.001	-0.271*	1							
Cl^-	0.434**	-0.484**	-0.310*	0.061	-0.051	-0.255*	-0.218	-0.566**	0.279*	1						
SO_4^{--}	0.403**	-0.432**	-0.324*	0.016	-0.101	-0.061	-0.246	-0.469**	0.239	0.949**	1					
HCO_3^-	-0.093	0.173	-0.072	-0.045	-0.365**	0.647**	-0.182	0.588**	-0.139	-0.390**	-0.216	1				
Na^+	0.165	-0.126	-0.232	0.092	-0.253	0.248	-0.217	0.108	0.444**	-0.075	-0.03	0.367**	1			
K^+	0.202	-0.154	-0.284*	-0.011	-0.317*	0.291*	-0.281*	0.123	0.397**	-0.093	0.011	0.381**	0.887**	1		
Ca^{++}	0.259*	-0.186	-0.388**	-0.128	-0.393**	0.636**	-0.389**	0.072	0.410**	-0.049	0.129	0.560**	0.509**	0.554**	1	
Mg^{++}	0.134	-0.087	-0.22	0.033	-0.292*	0.303*	-0.228	0.19	0.315*	-0.154	-0.061	0.426**	0.948**	0.973**	0.509**	1

WHC=Water-holding capacity, OC= Organic carbon, EC = Electrical conductivity, * = Significant at $p \leq 0.05$, ** = Significant at $p \leq 0.01$

Appendix 1. Floristic composition of the recorded species in the study area. Life span: Per. = Perennials, Bi. = Biennials, Ann. = Annuals; Life form: Th. = Therophytes, H.= Hemicryptophytes, G.= Geophytes, He.= Helophytes, Nph. = Nanophanerophytes, Ch. = Chamaephytes, MMPh = Meso & Megaphanerophytes, P = Parasites; Floristic Category: COSM = Cosmopolitan, PAN = Pantropical, PAL = Palaeotropical, NEO= Neotropical, ME= Mediterranean, SA-SI = Saharo-Sindian, ER-SR = Euro-Siberian, IR-TR = Irano-Turanian, S-Z = Sudano-Zambezian, Cult. & Nat. = Cultivated and Naturalized, AUST = Australian.

No.	**Species**	**Family**	**Life span**	**Life form**	**Floristic category**	**Habitat types**			**P %**
						Canal bank	**Costal desert**	**Inland desert**	
	No. of species					63	82	75	
	No. of stands					15	28	17	
1	*Achillea fragrantissima* (Forssk.) Sch. Bip.	Asteraceae	Per.	Ch	IR-TR+SA-SI	-	-	+	2.07
2	*Aegilops kotschyi* Boss.	Poaceae	Ann.	Th	IR-TR+SA-SI	-	+	-	0.62
3	*Aegliops bicornis* (Forssk.) Jaub. & Spach	Poaceae	Ann.	Th	ME+SA-SI	-	+	-	1.55
4	*Alhagi graecorum* Boiss.	Fabaceae	Per.	H	ME+IR-TR	+	+	-	2.29
5	*Alternanthera sessilis* (L.) DC.	Amaranthaceae	Per.	He	PAN	+	-	-	1.44
6	*Amaranthus lividus* L.	Amaranthaceae	Ann.	Th	ME+IR-TR	+	-	-	1.44
7	*Amaranthus viridus* L.	Amaranthaceae	Ann.	Th	ME	+	-	-	0.48
8	*Anabasis articulata* (Forssk.) Moq.	Chenopodioideae	per	Ch	IR-TR+SA-SI	-	-	+	0.83
9	*Anagallis arvensis* L.	Primulaceae	Ann.	Th	COSM	+	-	-	0.41
10	*Anchusa humilis* (Desf.) I.M. Johnst.	Boraginaceae	Ann.	Th	ME+SA-SI	-	+	-	0.96

11	*Anthemis cotula* L.	Asteraceae	Ann	Th	ME	-	-	+	0.46
12	*Artemisia judiaca* L.	Asteraceae	Per.	Ch	SA-SI	-	-	+	0.83
13	*Arundo donax* L.	Poaceae	Per	He, G	Cult.& Nat.	+	-	-	0.41
14	*Astragalus bombycinus* Boiss.	Fabaceae	Ann	H	IR-TR+SA-SI	-	-	+	0.96
15	*Astragalus peregrinus* Vahl	Fabaceae	Ann.	Th	SA-SI	-	+	-	0.41
16	*Atractylis carduus* (Forssk.) C.Chr.	Asteraceae	Per.	H	ME+SA-SI	-	+	+	2.40
17	*Atriplex halimus* L.	Chenopodiaceae	Per.	Nph	ME+SA-SI	+	-	-	0.93
18	*Atriplex lindleyi* Moq.	Chenopodiaceae	Ann.	Th	ME+IR-TR+ER-SR	-	-	+	1.45
19	*Atriplex semibaccata* R.Br.	Chenopodiaceae	Per.	H	AUST	-	+	-	0.48
20	*Avena fatua* L.	Poaceae	Ann.	Th	PAL	+	+	-	0.31
21	*Bassia indica* (Wight) A.J. Scott.	Chenopodiaceae	Ann.	Th	S-Z+IR-TR	-	+	+	1.12
22	*Bassia muricata* (L.) Asch.	Chenopodiaceae	Ann.	Th	IR-TR+SA-SI	-	-	+	2.84
23	*Beta vulgaris* L.	Chenopodiaceae	Ann.	Th	ME+IR-TR+ER-SR	+	-	-	2.02
24	*Bidens pilosa* L.	Asteraceae	Ann.	Th	PAN	+	-	-	1.73
25	*Bracharia mutica* (Forssk.) Stapf	Poaceae	Per.	H	PAN	+	-	-	1.25
26	*Brassica tournefortii* Gouan	Brassicaceae	Ann.	Th	ME+IR-TR+SA-SI	-	+	+	1.19
27	*Bromus diandrus* Roth	Poaceae	Ann.	Th	ME	-	+	-	1.25
28	*Cakile maritima* Scop.	Brassicaceae	Ann.	Th	ME+ER-SR	-	+	-	1.24
29	*Calligonum comosum* (L, Her.) Soskov	Polygonaceae	Per.	Nph	IR-TR+SA-SI	-	+	-	1.55
30	*Calotropis procera* (Aiton) W. T. Aiton	Asclepiadaceae	Per.	Ph	SA-SI + S-Z	-	-	+	3.30
31	*Carduus getulus* Pomel	Asteraceae	Ann.	Th	SA-SI	-	+	-	0.77
32	*Carthamus tenuis* (Boiss. & Blanche) Bornm.	Asteraceae	Ann.	Th	ME	-	+	-	1.55
33	*Cenchrus cillaris* L.	Poaceae	Per.	H	ME+PAL	+	-	-	0.77
34	*Centaurea aegyptiaca* L.	Asteraceae	Bi.	Th	SA-SI	-	-	+	0.93
35	*Chenopodium album* L.	Chenopodiaceae	Ann.	Th	COSM	+	-	-	1.70
36	*Chenopodium murale* L.	Chenopodiaceae	Ann.	Th	COSM	+	+	+	2.85
37	*Cistanche phelypaea* (L.) Cout.	Orobanchaceae	Per.	P, G	ME+SA-SI	-	+	-	2.22
38	*Convolvulus arvensis* L.	Convolvulaceae	Per.	H	COSM	+	-	-	5.95
39	*Convolvulus lanatus* Vahl	Convolvulaceae	Per.	Ch	SA-SI	-	-	+	0.15
40	*Conyza aegyptiaca* (L.) Dryand.	Asteraceae	Ann.	Th	ME	-	-	+	3.37
41	*Conyza bonariensis* L. Cronquist	Asteraceae	Ann.	Th	NEO	+	-	-	0.41
42	*Crotalaria aegyptiaca* Benth.	Fabaceae	Per.	Ch	SA-SI	+	-	+	0.96
43	*Cutandia memphitica* (Spreng.) Benth.	Poaceae	Ann.	Th	ME+IR-TR+SA-SI	-	+	-	0.96
44	*Cynanchum acutum* L.	Asclepiadaceae	Per.	H	ME+IR-TR	+	+	+	2.56
45	*Cynodon dactylon* (L.)Pers.	Poaceae	Per.	G	COSM	+	+	+	0.72
46	*Cyperus alopecuroides* Rottb.	Cyperaceae	Per.	He	PAN	+	-	-	3.04
47	*Cyperus capitatus* Vand.	Cyperaceae	Per.	G	ME	-	+	-	7.88
48	*Cyperus laevigatus* L.	Cyperaceae	Per	G, He	PAL	+	-	-	0.48
49	*Cyperus rotundus* L.	Cyperaceae	Per.	G	PAN	+	-	-	1.08

50	*Daucus litoralis* Sm.	Umbelliferae	Ann.	Th	ME	-	+	-	0.96
51	*Deverra tortuosa* (Desf.) DC.	Apiaceae	Per.	Ch	SA-SI	-	-	+	2.88
52	*Diplotaxis harra* (Forssk.) Boiss.	Brassicaceae	Per	Ch	ME+SA-SI	-	-	+	1.24
53	*Echinochloa stagnina* (Retz.) P. Beauv.	Poaceae	Per	G, He	PAL	+	-	-	2.49
54	*Echinops spinosus* L.	Asteraceae	Per.	H	ME+SA-SI	-	+	+	2.90
55	*Echium angustifolium* Mill.	Boraginaceae	Per.	H	ME	-	+	-	3.85
56	*Eclipta prostrata* (L.) L.	Asteraceae	Ann.	Th	NEO	+	-	-	3.16
57	*Elymus farctus* (Viv.) Runem. ex Melderis	Poaceae	Per.	G	ME	-	+	-	0.93
58	*Emex spinosa* (L.) Campd.	Polygonaceae	Ann.	Th	ME+SA-SI	-	+	+	1.44
59	*Erodium laciniatum* (Cav.) Willd.	Geraniaceae	Ann.	Th	ME	-	+	+	1.70
60	*Erysimum repandum* L.	Brassicaceae	Ann	Th	ME+IR-TR+ER-SR	-	-	+	1.34
61	*Ethulia conyzoides* L. f.	Asteraceae	Ann.	Th	PAL	+	-	-	5.22
62	*Euphorbia helioscopia* L.	Euphorbiaceae	Ann.	Th	ME+IR-TR+SA-SI	+	-	-	1.19
63	*Euphorbia peplus* L.	Euphorbiaceae	Ann.	Th	ME+IR-TR+ER-SR	+	-	-	1.25
64	*Euphorbia retusa* Forssk.	Euphorbiaceae	Ann.	Th	SA-SI	-	-	+	1.25
65	*Farsetia aegyptia* Turra.	Brassicaceae	Per.	Ch	SA-SI + S-Z	-	-	+	1.25
66	*Frankenia hirsuta* L.	Frankeniaceae	Per	H	ME+IR-TR+ER-SR	-	+	-	2.02
67	*Gypsophila capillaris* (Forssk.) C.Chr.	Caryophyllaceae	Per.	H	IR-TR+SA-SI	-	-	+	1.60
68	*Halocnemum strobilaceum* (Palla.) M. Bieb.	Chenopodiaceae	Per.	Ch	ME+IR-TR+SA-SI	-	+	-	0.93
69	*Haloxylon salicornicum* (Moq.) Bunge ex Boiss.	Chenopodiaceae	Per.	Ch	SA-SI	-	-	+	2.43
70	*Heliotropium curassavicum* L.	Boraginaceae	Per.	Ch	NEO	-	+	-	1.91
71	*Herniaria hemistemon* J.Gay	Caryophyllaceae	Ann	Th	ME+SA-SI	-	-	+	1.19
72	*Hordeum leporinum* L.	Poaceae	Ann.	Th	ME+IR-TR+ER-SR	-	-	+	1.08
73	*Hordeum murinum* L.	Poaceae	Ann.	Th	ME+IR-TR+ER-SR	-	+	-	1.19
74	*Hordeum spontaneum* K. Koch	Poaceae	Ann	Th	ME+IR-TR	-	-	+	1.60
75	*Hyoscyamus muticus* L.	Solanaceae	Per.	Ch	SA-SI	-	+	+	2.84
76	*Ifloga spicata* (Forssk.)Sch.Bip.	Asteraceae	Ann.	Th	SA-SI	-	+	+	1.19
77	*Imperata cylindrica* (L.)Raeusch.	Poaceae	Per.	H	PAL	+	-	-	1.34
78	*Iphiona mucronata* (Forssk.)Asch. & Schweinf.	Asteraceae	Per.	Ch	SA-SI	-	-	+	3.98
79	*Ipomoea carnea* Jacq.	Convolvulaceae	Per.	G	PAN	+	-	-	2.40
80	*Juncus acutus* L.	Juncaceae	Per.	He	ME+IR-TR+ER-SR	-	+	-	0.41
81	*Juncus rigidus* Desf.	Juncaceae	Per.	G, He	ME+IR-TR+SA-SI	-	+	-	2.07
82	*Lactuca serriola* L.	Asteraceae	Ann.	Th	ME+IR-TR+ER-SR	+	-	-	0.96
83	*Lasiurus scindicus* Henrard	Poaceae	Per.	G	SA-SI+S-Z	-	-	+	0.83
84	*Launaea capitata* Spreng. Dandy	Asteraceae	Ann.	Th	SA-SI + S-Z	-	-	+	0.41
85	*Launaea mucronata* (Forssk.)Muschl.	Asteraceae	Per.	H	ME+SA-SI	-	+	+	0.48

86	*Launaea nudicaulis* (L.) Hook.f.	Asteraceae	Per.	H	SA-SI	-	+	+	2.49
87	*Launaea spinosa* (Forssk.) Sch. Bip. ex Kuntze.	Asteraceae	Per.	Ch	SA-SI	-	-	+	2.64
88	*Lavandula coronopifolia* Poir.	Lamiaceae	Per.	Ch	SA-SI	-	-	+	0.83
89	*Leersia hexandra* Sw.	Poaceae	Per.	He	PAN	+	-	-	1.65
90	*Lepidium draba* L.	Brassicaceae	Per	H	ME+IR-TR	-	-	+	2.49
91	*Leptadenia pyrotechnica* (Forrsk.) Decne.	Asclepiadaceae	Per.	Nph	SA-SI	-	-	+	1.66
92	*Limbarda crithmoides* (L.) Dumort.	Asteraceae	Per.	Ch	ME+ER-SR+SA-SI	-	+	-	1.92
93	*Limoniastrum monopetaulm* (L.) Boiss.	Plumbaginaceae	Per.	Ch	ME	-	+	-	0.83
94	*Limonium pruinosum* (L.) Chaz.	Plumbaginaceae	Per.	H	SA-SI	-	+	-	0.15
95	*Lolium multiflorum* Lam.	Poaceae	Ann.	Th	ME+IR-TR+ER-SR	-	-	+	0.31
96	*Lolium perenne* L.	Poaceae	Per.	Th	ME+IR-TR+ER-SR	-	+	-	0.83
97	*Lotus glinoides* Delile	Fabaceae	Ann.	Th	S-Z	-	-	+	2.27
98	*Lotus halophilus* Boiss. & Spruner	Fabaceae	Ann.	Th	ME+SA-SI	-	+	-	1.34
99	*Lotus polyphyllos* E.D. Clarke	Fabaceae	Per.	Th	ME	-	+	-	2.43
100	*Lycium shawii* Roem. & Schult.	Solanaceae	Per.	Nph	SA-SI+S-Z	-	-	+	2.01
101	*Malva parviflora* L.	Malvaceae	Ann.	Th	ME+IR-TR	+	+	+	1.60
102	*Matthiola longipetala* (Vent.)DC.	Brassicaceae	Ann.	Th	ME+IR-TR	-	-	+	4.06
103	*Melilotus indicus* (L.) All.	Fabaceae	Ann.	Th	ME+IR-TR+SA-SI	+	-	-	1.19
104	*Mentha longifolia* (L.) Huds.	Fabaceae	Per.	He	PAL	+	-	-	1.73
105	*Mesembryanthemum crystallinum* L.	Aizoaceae	Ann.	Th	ME+ER-SR	-	+	-	1.73
106	*Mesembryanthemum forsskaolii* Hochst. ex Boiss.	Aizoaceae	Ann.	Th	SA-SI	-	-	+	1.81
107	*Mesembryanthemum nodiflorum* L.	Aizoaceae	Ann.	Th	ME+SA-SI+ER-SR	-	+	-	1.19
108	*Moltkiopsis ciliata* (Forssk.) I. M. Jonst.	Boraginaceae	Per.	Ch	SA-SI+S-Z+ME	-	+	-	2.16
109	***Nauplius graveolens* (Forssk.)Wilklund.**	Asteraceae	Per.	Ch	SA-SI	-	-	+	0.15
110	*Ochradenus baccatus* Delile.	Resedaceae	Per.	Nph	SA-SI	-	-	+	1.24
111	*Ononis serrata* Forssk.	Fabaceae	Ann.	Th	ME+SA-SI	-	+	-	2.49
112	*Oxalis corniculata* L.	Oxalidaceae	Per.	H	COSM	+	-	-	0.93
113	*Pancratium maritimum* L.	Amaryllidaceae	Per.	G	ME	-	+	-	0.48
114	*Panicum caloratum* L.	Poaceae	Per	G	SA-SI	-	-	+	0.93
115	*Panicum repens* L.	Poaceae	Per.	G	PAN	+	-	-	0.41
116	*Panicum turgidum* Forssk.	Poaceae	Per.	H	SA-SI	-	+	+	1.92
117	*Parapholis incurva* (L.) C.E. Hubb.	Poaceae	Ann.	Th	ME+IR-TR+ER-SR	-	+	+	1.24
118	*Paronychia arabica* (L.) DC.	Caryophyllaceae	Ann.	Th	SA-SI+ME+S-Z	-	+	-	0.83
119	*Paspalidium geminatum* (Forssk.) Stapf	Poaceae	Per.	He	PAL	+	-	-	0.15
120	*Pennisetum setaceum* (Forssk.) Chiov.	Poaceae	Per.	H	ME+PAL	+	-	-	2.40
121	*Persicaria lapathifolia* (L.) Gray	Polygonaceae	Ann.	G	PAL	+	-	-	0.48

122	*Persicaria salicifolia* (Brouss. ex Wild.)Assenov	Polygonaceae	Per.	G	PAL	+	-	-	0.48
123	*Phoenix dactylifera* L.	Arecacea	Per.	MMPh	CULT.	-	+	-	0.48
124	*Phragmites australis* (Cav.) Trin.ex Steud.	Poaceae	Per.	G, He	COSM	+	+	+	2.40
125	*Phyla nodiflora* (L.) Greene	Verbenaceae	Per	Ch	PAN	+	-	-	0.93
126	***Picris asplenioides* L.**	Asteraceae	Ann.	Th	ME+IR-TR	-	+	-	8.63
127	*Plantago crassifolia* Forssk.	Plantaginaceae	Per	H	ME	-	+	-	1.73
128	*Plantago lagopus* L.	Plantaginaceae	Ann.	Th	ME+IR-TR	-	-	+	1.08
129	*Plantago major* L.	Plantaginaceae	Per	H	COSM	+	-	-	1.24
130	*Plantago squarrosa* Murray	Plantaginaceae	Ann.	Th	ME	-	+	-	0.41
131	*Pluchea dioscoridis* (L.) DC.	Asteraceae	Per	Nph	SA-SI + S-Z	+	-	+	0.41
132	*Poa annua* L.	Poaceae	Ann.	Th	COSM	+	+	+	0.48
133	*Polycarpaea repens* (Forssk.) Asch. & Schweinf.	Caryophyllaceae	Per.	Ch	SA-SI	-	-	+	4.26
134	*Polygonum equIsetiforme* Sm.	Polygonaceae	Per.	G	ME+IR-TR	+	-	-	1.36
135	*Polypogon monspeliensis* (L.)Desf.	Poaceae	Ann.	Th	COSM	+	-	-	0.83
136	*Portulaca oleracea* L.	Portulacaceae	Ann.	Th	COSM	+	-	-	0.96
137	*Pulicaria undulata* (L.) C.A. Mey.	Asteraceae	Per.	Ch	SA-SI	-	-	+	1.44
138	*Ranunculus sceleratus* L.	Ranunculaceae	Ann.	Th	ME+IR-TR+ER-SR	+	-	-	0.48
139	***Reichardia tingitana* (L.) Roth**	Asteraceae	Ann.	Th	ME+IR-TR	-	+	+	1.24
140	*Reseda decursiva* Forssk.	Resedaceae	Ann	Th	SA-SI	-	-	+	0.96
141	*Retama raetam* (Forssk.)Webb & Berthel.	Fabaceae	Per.	Nph	SA-SI	-	+	+	7.03
142	*Ricinus communis* L.	Euphorbiaceae	Per.	Nph	Cult.& Nat.	-	+	-	0.41
143	*Rorippa palustris* (L.) Besser.	Brassicaceae	Bi.	Th	ME+IR-TR+ER-SR	+	-	-	2.23
144	*Rumex dentatus* L.	Polygonaceae	Ann.	Th	ME+IR-TR+ER-SR	+	-	-	0.15
145	*Rumex pictus* Forssk.	Polygonaceae	Ann.	Th	ME+SA-SI	-	+	-	0.96
146	*Rumex vesicarius* L.	Polygonaceae	Ann.	Th	ME+S-Z+SA-SI	-	-	+	5.37
147	*Saccharum spontaneum* L.	Poaceae	Per.	H	ME+IR-TR+SA-SI	+	-	-	4.33
148	*Salsola kali* L.	Chenopodiaceae	Ann.	Th	COSM	-	+	+	1.66
149	*Senecio aegyptius* L.	Asteraceae	Ann.	Th	ME+IR-TR+ER-SR	+	-	-	0.96
150	*Senecio glaucus* L.	Asteraceae	Ann.	Th	ME+IR-TR+SA-SI	-	+	+	1.60
151	*Silene vivianii* Steud.	Caryophyllaceae	Ann.	Th	SA-SI	-	+	-	0.48
152	*Silene succulenta* Forssk.	Caryophyllaceae	Per.	H	ME	-	+	-	6.51
153	*Silybum marianum* (L.) Gaertn.	Asteraceae	Per.	H	ME+IR-TR+ER-SR	+	-	-	0.57
154	*Sisymbrium irio* L.	Brassicaceae	Ann.	Th	ME+IR-TR+ER-SR	+	-	-	0.46
155	*Solanum nigrum* L.	Solanaceae	Ann.	Th	COSM	+	-	-	0.48
156	***Sonchus oleraceus* L.**	Asteraceae	Ann.	Th	COSM	+	+	-	0.48
157	Spergularia marina (L.) Griseb.	Caryophyllaceae	Bi.	Th	ME+IR-TR+ER-SR	-	+	-	2.40

158	Sphenopus divaricatus (Gouan) Rchb.	Poaceae	Ann.	Th	ME+IR-TR+SA-SI	-	+	-	4.29
159	*Sporobolus spicatus* (Vahl) Kunth	Poaceae	Per.	G	S-Z+SA-SI+ME	-	+	-	0.31
160	*Stipagrostis lanata* (Forssk.) De Winter	Poaceae	Per.	G	SA-SI	-	+	-	0.41
161	*Suaeda maritima* (L.) Dumort.	Chenopodiaceae	Ann.	Th	COSM	-	+	-	0.93
162	*Suaeda pruinosa* Lange	Chenopodiaceae	Per.	Ch	ME	+	+	-	0.46
163	*Symphyotrichum squamatum* (Spren.) Nesom	Asteraceae	Per	Ch	NEO	+	-	-	0.72
164	*Tamarex aphylla* (L.) H. Karst.	Tamaricaceae	Per.	Nph	SA-SI+S-Z	-	-	+	0.79
165	*Tamarix tetragyna* Ehrenb.	Tamaricaceae	Per.	Nph	ME+IR-TR+SA-SI	-	+	-	0.83
166	*Tamarix nilotica* (Ehrenb.)Bunge.	Tamaricaceae	Per.	Nph	SA-SI	-	+	+	1.65
167	*Thymelaea hirsuta* (L.) Endl.	Thymelaeaceae	Per.	NPh	ME	-	+	-	0.41
168	*Torilis arvensis* (Huds.) Link	Apiaceae	Ann.	Th	ME+IR-TR+ER-SR	+	-	-	0.15
169	*Trichodesma africanum* (L.) R.Br.	Boraginaceae	Per.	H	SA-SI + S-Z	-	-	+	0.96
170	*Trigonella stellata* Forssk.	Fabaceae	Ann.	Th	IR-TR+SA-SI	-	-	+	2.49
171	*Typha domingensis* (pers.) Poir. Ex Steud.	Typhaceae	Per.	He	ME+IR-TR+SA-SI	+	-	-	0.83
172	***Urospermum picroides* (L.)F.W .Schmidt**	Asteraceae	Ann.	Th	ME+IR-TR	+	+	-	0.48
173	*Urtica urens* L.	Urticaceae	Ann.	Th	ME+IR-TR+ER-SR	+	-	-	8.14
174	*Verbena officinalis* L.	Verbenaceae	Per.	Ch	COSM	+	-	-	0.96
175	*Vicia sativa* L.	Fabaceae	Ann.	Th	ME+IR-TR+ER-SR	+	-	-	0.48
176	*Volutaria lippii* (L.) Cass. ex Maire	Asteraceae	Ann.	Th	SA-SI	-	-	+	0.96
177	*Zilla spinosa* (L.) Prantl.	Brassicaceae	Per.	Ch	SA-SI	-	-	+	3.73
179	*Zygophyllum aegyptium* Hosny	Zygophyllaceae	Per.	Ch	ME	-	+	-	2.22
180	*Zygophyllum album* L.f.	Zygophyllaceae	Per.	Ch	ME+SA-SI	-	+	-	1.91
181	*Zygophyllum coccineum* L.	Zygophyllaceae	Per.	Ch	SA-SI	-	+	+	3.89
182	*Zygophyllum decumbens* Delile.	Zygophyllaceae	Per.	Ch	SA-SI	-	-	+	1.66
183	*Zygophyllum simplex* L.	Zygophyllaceae	Ann.	Th	SA-SI	-	-	+	0.83

DISCUSSION

The family Asteraceae (sunflower family) is distributed over most of the earth and in almost all habitats particularly in semiarid region of the tropics, subtropics and warm temperate regions of South, Southeast and East Asia, Africa and Central South America [34]. The current work aims to study of the floristic characterization and ecological features of five selected species in family Asteraceae namely; *Nauplius graveolens*, *Picris asplenioides*, *Reichardia tingitana*, *Sonchus oleraceus* and *Urospermum picroides* in Nile Delta and inland desert of Egypt.

The obtained results showed that, the study area is rich in its wild species both at specific and generic levels. The natural plant wealth of this area was composed of 182 species belonging to 144 genera and related to 37 families. Out of these families, Asteraceae (18.13%) and Poaceae, Chenopodiaceae, Fabaceae and Brassicaceae (contribute collectively about 37.31%) of the total number of recorded species, these five families are leading taxa and constitute the major bulk of the flora of the study area. Family Asteraceae is usually represented by the largest number of wild species in coastal mountain and desert regions. In many areas of the world, members of this family comprise 10 to 20 percent of the total flora [35].

Asteraceae are especially common in open and dry environments, seeds are ordinarily dispersed intact with the fruiting body, the cypsela. Wind dispersal is common (anemochory) assisted by a hairy pappus. Another common variation is epizoochory, in which the dispersal unit, a single cypsela (e.g. *Bidens*) or entire capitulum (e.g. *Arctium*) provided with hooks, spines or some equivalent structure, sticks to the fur or plumage of an animal (or even to clothes, as in the photo) just to fall off later far from its mother plant [36]. This agreed more or less, with the findings of many authors e.g. Quezel [37] concerning the floristic structure of the Mediterranean Africa, Shaltout and El-Fahar [38] on the weed vegetation of the main crops in Nile Delta, El-Halawany [39] on the vegetation of north Nile Delta, Shaltout *et al.;* [40] on the vegetation of the different habitats in south Nile Delta and El-Amier *et al.;* [41] on vegetation ecology of coastal and inland parts of the deserts in Egypt.

In Egypt, most species are annuals and very few species are true biennials. The perennial plant species are mostly herbaceous either with woody base or with tuberous underground parts and few are shrubs. The flora of the study area was composed of 82 annuals (45.05%), 3 biennials (1.65%) and 97 perennials (53.30%). The dominance of annuals may be attributed to the fact that, annuals have higher reproductive capacity, ecological, morphological and genetic plasticity under high levels of disturbance and agricultural practices [42]. On the other hand, the predominance of life-span is related to annual species (≤50%) this may be due to the time of study and climatic variables in the study area. On the other hand, the perennial species constitute the second component floristic composition (>50%). This agreed with the studies of Shaltout and El-Fahar [38], Shaltout *et al.;* [6], El-Demerdash *et al.;* [43], El-Halawany [44], Shaltout *et al.;* [40] and El-Amier *et al.;* [45].

Beside the spatial variations in species composition of plant duration, the composition of life-forms provides information which may help in assessing the response of vegetation to variations in certain environmental factors [46]. Raunkiaer [33, 25] designated the Mediterranean climate type as therophyte climate because of the high percentage (more than 50% of the total species) of this life-form in the Mediterranean floras. This is confirmed later by Hassib [1] in Egypt, Zohary [47] in Palestine and Quezel [37] in North Africa. In the present study, the life-form spectra in the Nile Delta and North Eastern Desert (inland desert) of Egypt were predominantly therophytes (45.21%). Cryptophytes was the second frequent life-form attaining value of 17.02% of the total life-form spectrum. The present study illustrated that, therophytes were the most frequent life-form in Nile Delta and inland desert of Egypt. Therophytes are equally less adapted to drought and salinity and their presence is a seasonal phenomenon, they become abundant only during the rainy season and where salinity is not a limiting factor [48]. The nature of the prevailing arid climate in the study area, the degree of water availability and the sandy nature of the soil help therophytes to dominate during the favourable season. The high frequency of cryptophytes as an active life-form in the study area could be related to certain features of both their growth habit and the nature of the soil. Most of the recorded cryptophytes are rhizomatous species; this is an advantage for their successful growth and their distribution [49].

By comparing the results between the different life-form spectra in the present study with some other related studies. In the earlier study by Hassib [1], therophytes were estimated by 50.3% for the whole Egyptian flora compared with 58.7% for the Mediterranean region and 59.4% for Egyptian Nile region. Also, Shaltout *et al.;* [6] recorded about 52.6% of this life-form in the vegetation analysis of Nile Delta region. El-Sheikh [50] illustrated that, about 59.3% of the therophytes were recorded in the ruderal vegetation in the Nile Delta, El-Kady *et al.;*[51] recorded 68.8% in characterization of habitats in the North Western part of the Nile Delta, El-Halawany [39] reported about 54.1% in vegetation changes in North Nile Delta within two decades, and El-Amier *et al.;* [45] recorded about 52.17% of therophytes in the sand formations in the northern part of Nile Delta, By comparing the percentage of therophytes (about 54.03%) in the present study, it was higher than that in the study by El-Amier *et al.;* [41] who recorded about 40% of therophytes in the Northern sector of Eastern Desert of Egypt.

The percentage of cryptophytes (17.02%) in the present study agreed with Hassib [1] who reported 25.8% of this life-form in the Egyptian flora, 15.9% in the Mediterranean region and 16.2% in the Egytptian Nile Delta region. This life form contributed about 20.5%, 20.5%, 18.49%, and 17.86% in the studies by Al-Sodany [52], El-Halawany [39], El-Amier *et al.;* [41, 45], respectively. On the other hand, it was lower (25.8% and 26.3%) than that in the studies by El-Sheikh [53] and Shaltout *et al.;* [40].

The important environmental factors which regulate the growth and development of Mediterranean region include rainfall distribution, soil and air temperatures, before and during a seasonal growth-period. These factors may vary from year to year, which may give the plants adequate conditions for prolonging the vegetative growth-period up to late spring with flowering and fruiting stages occurring in early summer [54]. The floristic analysis of the present study indicated that, the Mediterranean taxa were represented by relatively high percentage of plant species (48.35 %). These taxa were Pluriregional, Bioregional or Monoregional. This was confirmed by El-Demerdash *et al.;* [55], Abd El-Ghani [56], and Shalaby [57], Shaltout *et al.;* [40] and El-Amier [58]. On the other hand, the Cosmopolitan, Palaeotropical, Neotropical, Pantropical, Saharo-Sindian, Irano-Turanian and Sudano-Zambezian elements were represented by varying the percentages of species. The high percentages of Saharo-Sindian and Cosmopolitan elements in the study area may be attributed to their capability to penetrate this region and to the influence of man in the study area.

In the present study, the pure Monoregional Mediterranean element was poorly represented, while the Biregional and Pluriregional Mediterranean elements were highly represented. The Mediterranean elements extending into the Euro-Siberian Territory attained relatively high representation as compared with the Mediterranean taxa extending into Saharo-Sindian Territory. These results support finding that, the presence of a transitional Mediterranean Territories in Egypt between the Mediterranean and the Euro-Siberian Territory at north and between the Saharo-Sindian Territory at south. Similar results were obtained by El-Demerdash *et al.;* [43], El-Halawany *et al.;* [59]. Generally, the present investigation favours that, the flora of north Nile Delta is mainly belonging to the Mediterranean Territory. This opinion is supported by the findings in different directions such as; the climatic constitution of the study area, life-form spectra, floristic and vegetative features, distribution patterns, altitudinal zonation and historical-floral events.

The results of vegetation analysis have then been related to environmental data. Alternatively, vegetation-habitat relationships have been derived from a single analysis of combined floristic and environmental variables [32]. In the present study, the vegetation structure was classified by TWINSPAN classification into four groups distributed in the Nile Delta and inland desert habitats. Group I was dominated by *Retama raetam*, group II was codominated by *Diplotaxis harra* and *Bassia muricata*, group III was codominated by *Senecio glaucus* and *Rumex pictus* and group IV was codominated by *Cynodon dactylon* and *Phragmites australis*. Groups I and II represent the vegetation type of the inland desert, while group III represent the vegetation type of the coastal desert and group IV represent the vegetation types of canal bank. Two groups (I and II) may represent the true xerophytic vegetation types recognized in the northern part of Galalah Desert (Eastern Desert) of Egypt, where the association of these groups may be similar to those described by Kassas and Zahran [60, 61], Batanouny [62], Recently by Salama *et al.;* [63] on the vegetation analysis, phonological patterns and chorological affinities in Wadi Qene in the Eastern Desert of Egypt, Abd El-Ghani *et al.;* [64] on desert roadside vegetation in Eastern Desert of Egypt and environmental determinates for its distribution, and by Salama *et al.;* [11] on plant communities and floristic composition of Wadi Al-Assiuty and Wadi Habib in the Eastern Desert and on variations in vegetation structure, species dominance and plant communities in south of the Eastern Desert of Egypt, respectively.

The most important soil gradients correlated with the distribution of vegetation as recognized by El-Sheikh [53], Al-Sodany [52], El-Halawany [39] and El-Amier [58] are: soil salinity (EC), moisture gradient, soil fertility (organic carbon and phosphorus content), soil texture (sand, silt and clay), calcium carbonate, chlorides and pH value. In the present study, the application of Canonical Correspondence Analysis (CCA biplot) indicated that, the most important soil variables correlated with the distribution of vegetation types in the study area include the soil texture, water holding capacity, pH, calcium carbonate, potassium adsorption ratio (PAR), chlorides and bicarbonates.

CONCLUSION

The study revealed that, the sunflower family includes a great diversity of species, including annuals, perennials, stem succulents, vines, shrubs and trees. It is well-represented in parks and gardens throughout the world, with bedding plants, ground covers and shrubs [36]. Some of the genera of this family are ornamentals and most of them have medicinal values. Boulos [65] recorded also 42 species of Asteraceae as medicinal plants. Many species of this family have great importance in the fields of cosmetics and pharmacy due to the production of essential oils. Some are widely cultivated in the field as vegetables and foods. It contains over 40 economically important species; they are used as food (lettuce), oil (sunflowers and safflower), medicine (chamomile) and many as ornamental shrubs (*Chrysanthemum*, Dahlia, Zinnia and Marigold) [66].

Anthropogenic disturbances have affected the floristic composition of the asteraceae family to an extent. Logging affected the structural composition of this family through the removal of large number of species. Thus, there is need to control human activities in desert so as to protect the plant species for effective management and utilization.

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