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FLORISTIC FEATURE OF PLANT COVER ASSOCIATED WITH SOME SPECIES OF GENUS *SUAEDA* IN EGYPT

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ABSTRACT

The present study provides an investigation of the floristic features, including list of plant species, life-span, life-form spectra and floristic analysis of the plant life associated with *Suaeda maritima*, *Suaeda monoica*, *Suaeda pruinosa* and *Suaeda vera* in family Chenopodiaceae in the Deltaic Mediterranean coast and Wadi Hagul of Egypt. This study also aims at recording the floristic structure to be used in measurement of plant diversity and ecological conservation plan of the study area in future. The total number of the recorded plant species surveyed in the study area was 103 species belonging to 80 genera and related to 23 families. These species are classified into three major groups according to their duration (life-span) as follows: 47 annuals (45.63%), 2 biennial (1.94%) and 54 perennials (52.42%). The main families are: Asteraceae (23 species), Poaceae (19 species) followed by Chenopodiaceae (17 species) and Fabaceae (7 species). The recorded species are also grouped under six types of life forms as follows: therophytes, chamaephytes, cryptophytes (comprising geophytes and helophytes), hemicryptophytes, phanerophytes and parasites. Out of the recorded species 56 species (about 54.36 % of the total species) are Mediterranean taxa, 18 species (17.48%) was belonging to Monoregional Saharo-Sindian element, 19 species are either Cosmopolitan (10 species = 9.71%), Palaeopical (5 species = 4.85%), Neotropical and Pantropical (2 species = 1.94 each).

Contribution/Originality: The paper's primary contribution is surveying the plant species associated with *Suaeda* species of family Chenopodiaceae in the Nile Delta coast and Wadi Hagul to detect the taxonomic and phytogeographical significance of its life–form spectra and floristic components. Thus, the efforts have directed towards the utilization of renewable resources of the cultivated and non-cultivated areas to produce more food and forage

1. INTRODUCTION

The genus *Suaeda* belongs to family Chenopodiaceae, order: caryophyllales, subclass: Caryophyllidae. According to Boulos [1] and Allen [2] The genus *Suaeda* is: annual or perennial herbs, shrubs or rarely small trees, glabrous or slightly hairy on the juvenile parts, leaves alternate, succulent, terete, sub terete, sub globose or flattened, fruit free or andante to the perianth, seeds horizontal or vertical, embryo spiral.

Suaeda Maritima Annual herb 15-60cm, glabrous, glaucous, drying grayish-green to brownish, stems erect or ascending, tprete to slightly angled, leaves 1-2.5 × 0.05-0.1cm. The plant is distributed in salt marshes, coastal sand and mud flats, Canary Islands, Eurobe, Mediterranean region, Caucasus, Asia, Australia, northeast coast of North America and Argentina. In Egypt it occurs in the Nile region including the delta, valley and faiyum; Bahariya oases, the Mediterranean coastal strip from the border with Libya near El-Sallum to Port Said; and the Desert east of the Nile [2, 3].

Suaeda Monoica Small tree or shrub 2-4m, trunk 10(-25) cm in girth at the base, stems much branched, frequently with conspicuous inset-galls; leaves 1-3.5 x 0.1 – 0.3 sessile or short. The plant is distributed in coastal and inland sandy soils, edges of salt marshes Cape Verde Islands, Chad, East Africa from Mozambique to Sudan and Egypt, South of Dead Sea, Arabia, Iran and Sri Lanka. In Egypt, it occurs in the oases of the western desert, desert east of the Nile, the Red sea coastal strip, Gebel Elba and the surrounding mountainous region and the entire Sinai Peninsula [2, 4].

Suaeda Pruinosa Shrub 0.5-1.2m glabrous to glabrescent, stems woody at the base, much branched. The plant is distributed in edges of salt marshes, Spain, Sicity and North Africa. In Egypt it occurs in the Mediterranean coastal strip from the border with Libya near El-Sollum to Port Said and the entire Sinai Peninsula [2]. *Suaeda vera* small shrub 20-50cm, glabrescent or slightly mealy, stems woody, erect or ascending, much branched. The plant is distributed in saline depressions and crustal sands. In Egypt it occurs in northern delta, the Mediterranean coastal strip, desert east of the Nile and the entire Sinai Peninsula [2, 4].

Egypt is rich in its natural wealth of flora especially in the region of the relatively high rainfall like the northern Mediterranean coast and Nile Delta. The flora of the Nile Delta coastal land is rich by many wild plants, which seem to be promising economically. Thus, the efforts have directed towards the utilization of renewable resources of the cultivated and non-cultivated areas to produce more food and forage [5]. Several studies carried out by Egyptian scientists were directed towards introducing and cultivating some of our native wild plants as forage plants, building materials, furniture, in agriculture, paper, textiles, baskets, mats, etc in Egypt [6-10]. Therefore, the present study aims at surveying the plant species associated with *Suaeda* species of family Chenopodiaceae in the Nile Delta coast and Wadi Hagul to detect the taxonomic and phytogeographical significance of its life–form spectra and floristic components.

2. STUDY AREA

The studied area is located in the northern part of the Nile Delta region and Wadi Hagul of Egypt. The Nile Delta is 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, while the area of the Nile Valley is about 13000 km² [11]. 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 200 km, and with a width in a N-S direction ranged between 5-15 km from the coast [5].

The Eastern Desert of Egypt occupies the area from the Nile Valley eastward to the Red Sea and the Gulf of Suez, which is approximately 223,000 km², (21% of the total area of Egypt). It is higher than the Western Desert as it consists essentially of a backbone of high, rugged mountains running parallel to and at a relatively short distance from the coast. On the other hand, Cairo-Suez desert road and Wadi Hagul are located in the northern part of The Galalah Desert of Egypt (the Eastern Desert) which extends east of the Nile Delta. Wadi Hagul, found the valley depression between the Kahaliya ridge to the south and Gebel Ataqa to the north, collects drainage on both sides and debouch into the Gulf of Suez. It is characterized by local physiographic variations and physiognomic heterogeneity [5].

3. MATERIALS AND METHODS

After regular visits to the different sites of the study area, 50 stands (area = 10×10 m each) have been selected for sampling vegetation as follows: 40 stands in Deltaic Mediterranean coast and 10 stands in Wadi Hagul. During each visit, plant specimens were recorded and collected from different sites for identification. The description and classification of life-forms in the present study were according to Raunkiaer [12, 13]. The classification, identification and floristic categories were according to Tutin, et al. [14]; Davis [15]; Zohary [16]; Tackholm [17]; Meikle [18]; Feinbrun-Dothan [19] and up to date by Boulos [1].

4. RESULT AND DISCUSSION

4.1. Floristic Composition

The recorded plant species of the present study are summed in terms of presence percentages (P %). Table 1 represented the floristic composition of the plant species in the surveyed two habitats in Deltaic Mediterranean coast and inland desert (Wadi Hagul). The tabulated data showed that, the total number of plant species recorded in the study area is 103 plant species. The highest number of species (81) is recorded in the Deltaic Mediterranean habitat representing about (78.64%) of the total recorded species and the inland desert habitat is represented by (49) species (47.57%) Figure (2).

The recorded species in the study area (103) can be classified under three major groups according to their duration as follows: 54 perennial species, 2 biennial species and 47 annual species.

The perennial species were recorded during all visits throughout two years of survey (2013-2014). Out of the perennials, eight species were very abundant and have a very wide ecological amplitude, which were recorded in the two habitats (P = 100%). These species are *Cyondon dactylon*, *Launaea mucronata*, *Launaea nudicaulis*, *Phoenix dactylifera*, *Phragmites australis*. *Polygonum equsetiforme*, *Retama raetam*, *Zygophyllum coccineum* 46 abundant perennial species have a moderate ecological amplitude, which recorded in one habitat (P = 50%) such as *Alhagi graecorum*, *Anabasis articulata*, *Artemisia judiaca*, *Arthrocnemum macrostachyum*, *Atractylis carduus*, *Atriplex halimus*, *A. portulacoides*, *A. semibaccata*, *Calligonum comosum*, etc.

The list of floristic composition includes only 2 biennial species, namely: *Centaurea aegyptiaca*, and *Spergularia marina* in one habitat (P=50%). The annual species (47) can also be classified according to their presence percentages (ecological amplitude) as follows: Five species have very wide ecological amplitude, being recorded in all habitats (P = 100%), these species *Bassia muricata*, *Chenopodium murale*, *Emex spinosa*, *Reichardia tingitana*, *Senecio glaucus*. 42 annual species have presence percentage of 50%, among of these species are *Aegilops bicornis*, *Atriplex prostrata*, *Avena fatua*, *Bassia indica*, *Bromus diandrus*, *Bupleurum semicompositum*, *Cakile maritima*, *Carduus getulus*, *Carduus pycnocephalus* etc. This agreed with the studies of Shaltout and El-Fahar [20]; El-Demerdash, et al. [21]; Fossati, et al. [22]; Shaltout, et al. [23]; Galal and Fawzy [24] and El-Amier, et al. [25].

4.2. Plant Life-Span in the Study Area

According to the duration (life-span) and as shown in Figure 3, the plant life in the study area can be classified into three major groups: annuals, biennials and perennials. As mentioned before, the total number of species recorded in the study area is 103 taxa. These species are distinguished into 47 annuals (45.63%), 2 biennial (1.94%) and 54 perennials (52.42%). In the costal desert habitat, 81 species were recorded and grouped into 40 annuals (38.83%), one biennial (0.97%) and 40 perennials (38.83 %). While, in inland desert habitat, 49 species were recorded and classified into 20 annuals (19.41%), one biennial (0.97%) and 28 perennials (27.18%).

It is interested to denote that the plant life-span (duration) is comparable in the different habitats of the study area Table 3. The highest presence percentage of annuals and perennials were recorded in coastal desert habitat, followed by inland desert habitat (Figure 3).

4.3. Plant Life-Forms in the Study Area

According to the description and classification of life-forms [12] the life-forms of the recorded species in the present study are grouped under six types as follows: therophytes, chamaephytes, cryptophytes (comprising geophytes and helophytes), hemicryptophytes, phanerophytes and parasites (Table 3 & Figure 4).

The majority of the recorded species are therophytes (49 species = 45.37%) followed by chamaephytes (22 species = 20.37), cryptophytes and then hemicryptophytes (15 species = 13.49 each) and phanerophytes attained value of 5.55% (6 species). The lowest value of life-forms is that of parasites which attained value of 0.93 % (one species). It is evident that, the percentages of the life-form spectra vary from one habitat to the other (Figure 4). In the coastal desert habitat, the recorded species (83) can be grouped into six types of life forms: therophytes (49.39%), cryptophytes (15.66%), chamaephytes (13.25 %), hemicryptophytes (14.45 %), and phaneropytes (7.22%). In the inland desert, the recorded species (42) can be classified into the following life forms: therophytes (50%), chamaephytes (30.95%), hemicryptophytes (9.52%), cryptophytes (4.76%), phaneropytes (2.38%) and parasites (2.38%). The previous results agreed with those reports by El-Demerdash, et al. [26]; El-Halawany, et al. [27] and El-Amier, et al. [28]. The dominance of therophytes over the other life forms seems to be a response to the local climate (annual rainfall), topography variation and biotic influence [29]. The relatively high values of chamaephytes, hemicryptophytes and cryptophytes may be attributed to the ability of species to resist drought, salinity, sand accumulation and grazing [30, 31].

4.4. The Floristic Analysis of the Study Area

The recorded plant species surveyed in the present study is 103 species belonging to 80 genera and linked to 23 families. Table 3 showed that, Asteraceae comprises 23 species each (22.33%), Poaceae comprises 19 species each (18.44%) of the total recorded species, followed by Chenopodiaceae comprises 17 species (16.50%) and Fabaceae (7 species) (6.79%). Brassicaceae comprises 6 species (5.82%), Polygonaceae and Zygophyllaceae are represented by 5 species each (4.85%). Caryophyllaceae is represented by 3 species (2.91%). Aizoaceae, Juncaceae and Cyperacaea are represented by 2 species each (1.94%). The other remaining families (12) are represented by only one species each.

The floristic categories of the families in the study area are shown in Table 3. The most common floristic elements of the family Asteraceae are Biregional (6 species) Saharo-Sindian (8 species each), Pluriregional (3 species), Mediterranean (3 species), Cosmopolitan, Neotropical and Palaeotropical (one species). In Poaceae, the most common floristic categories are Pluriregional (6 species), Cosmopolitan and Palaeotropical (4 species), Biregional (2 species) Saharo-Sindian, Mediterranean and Pantropical represented by only one species. The common floristic elements in Chenopodiaceae are Biregional (6 species), Cosmopolitan and Pluriregional is represented by 4 species each, Mediterranean, Saharo-Sindian and Australion represented by only one species. In the family Fabaceae (Leguminosae), Biregional consisting of 4 species, Pluriregional, Saharo-Sindian and Sudano-Zambezian are represented by one species only. In Boraginaceae, the most common floristic categories are Biregional (4 species), Neotropical and Saharo-Sindian represented by one species only. Similar investigations have been described by many authors e.g. Sheded [32]; Serag [33]; El-Amier, et al. [25]; Salama, et al. [34]; Salama, et al. [35] and El-Amier, et al. [28].

The floristic element in Polygonaceae, is, Biregional (3 species), Pluriregional (2 species). The floristic element in Zygophyllaceae is Saharo-Sindian (3 species), Mediterranean and Biregional (one species each). The floristic element in Caryophyllaceae are Pluriregional, Biregional and Mediterranean represented by only one species. In Aizoaceae common floristic element is Pluriregional and Biregional one species each. The common floristic categories in family Cyperacaea is Pantropical and Mediterranean, (one species each). In Juncaceae is Pluriregional (2 species). The other families comprise different types of floristic elements which were generally represented by one only species.

The floristic analysis of the study area as shown in Table 3 revealed that, 56 species (about 54.36 % of the total species) are Mediterranean taxa. These taxa are either Biregional or Pluriregional (23 species = 22.33% each) and Monoregional (10 species= 9.71%). Table (5) revealed also that 18 species (17.48%) of the total recorded species was belonging to Monoregional Saharo-Sindian element. It has been also found that, 19 species or about 18.44% of the total number of recorded species are either Cosmopolitan (10 species = 9.71%), Palaeopical (5 species = 4.85%), Neotropical and Pantropical (2 species = 1.94 each). The other floristic categories are poorly represented, which comprise a few numbers of species.

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Contributors/Acknowledgement: All authors contributed equally to the conception and design of the study.

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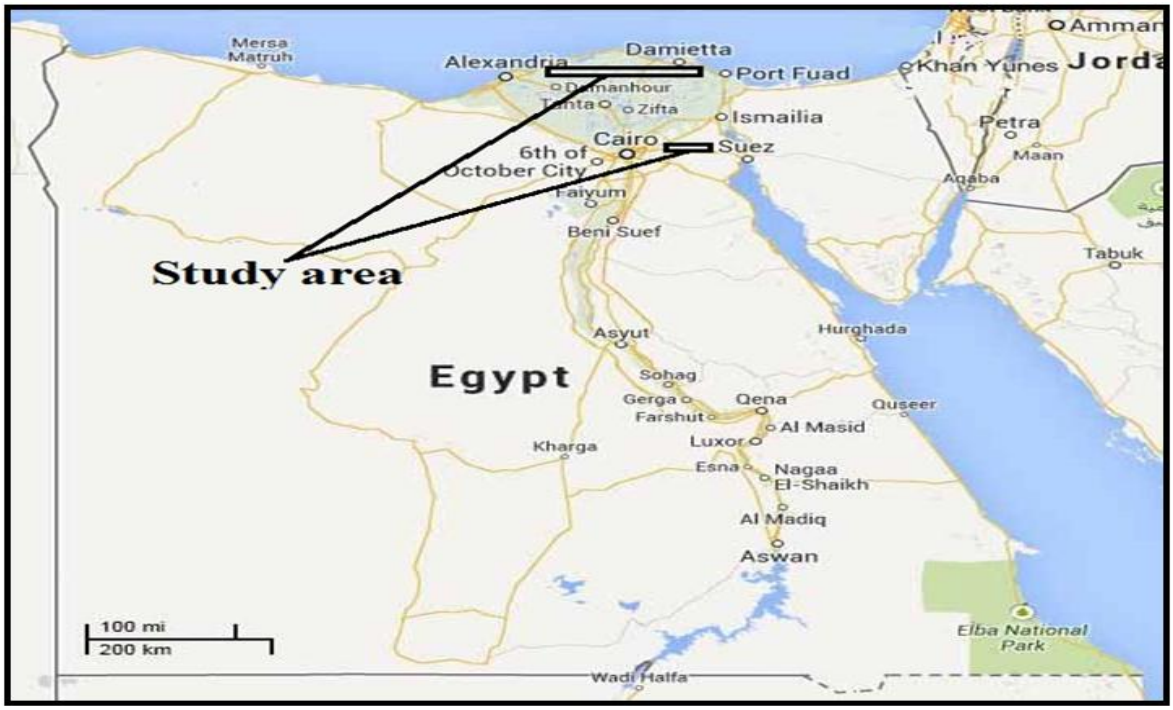

Fig-1. Map of the Nile Delta region showing different localities of the study area
Source : https://www.google.com.eg/maps/@28.0900132,31.8839465,5.61z?hl=en

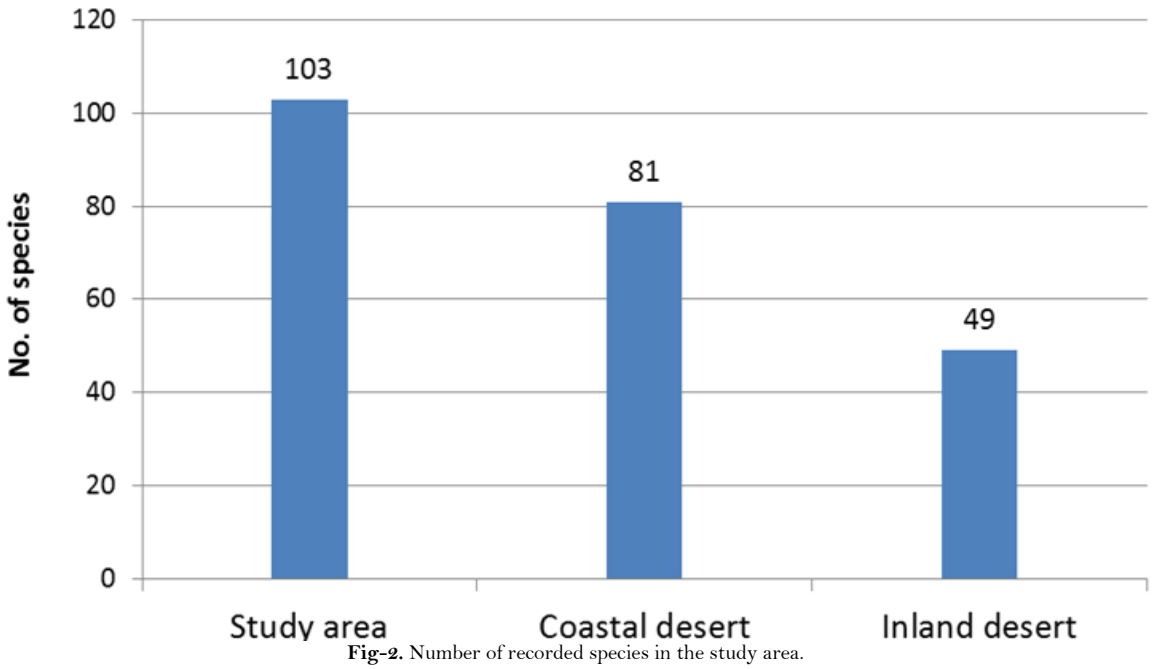

Fig-2. Number of recorded species in the study area.

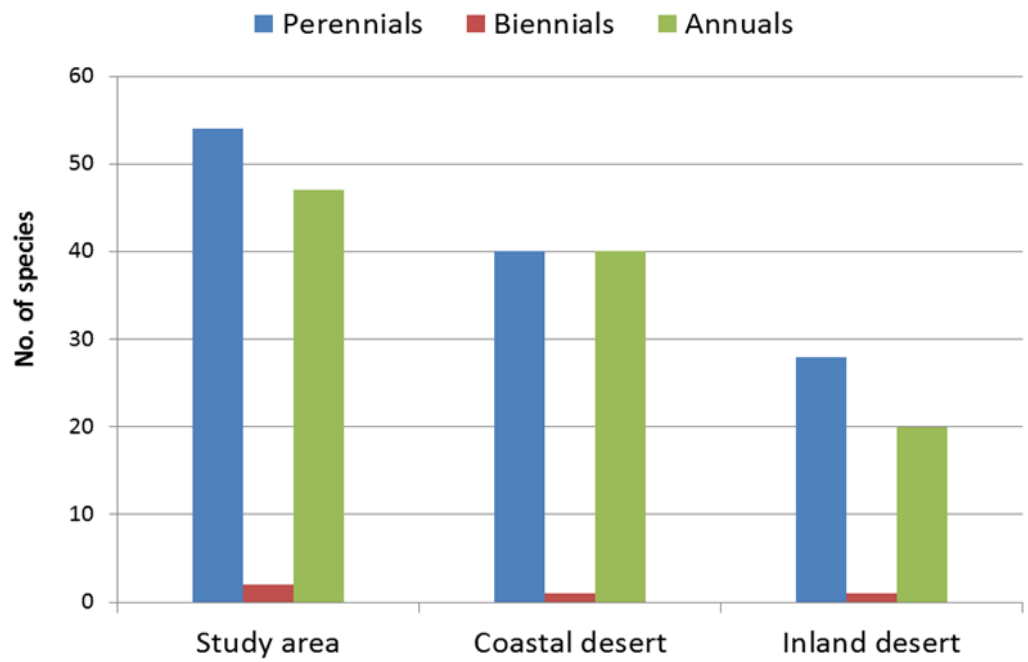

Fig-3. Plant life span spectra in the different habitats of the study area.

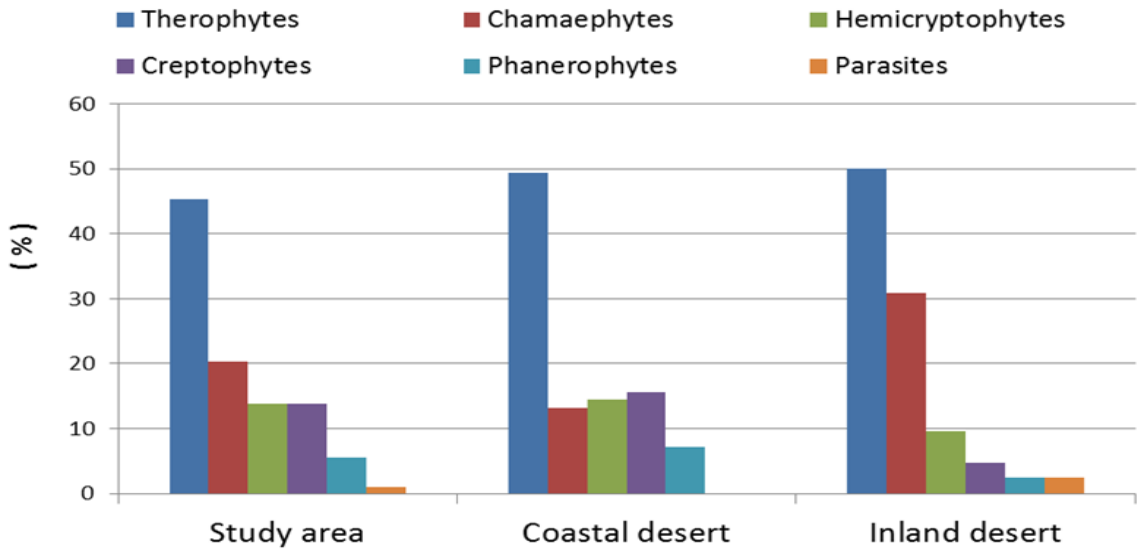

Fig-4. Plant life form spectra in the different habitats of the study area.

Table-1. Floristic composition of the recorded species in the study area. Life Form: H.= Hemicryptophytes, G.= Geophytes, He.= Helophytes, Th.= Therophytes, 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, AUST = Australion, CULT. & NAT.=Cultivated and Naturalized.

No.	Species	Family	Life form	Floristic category	Habitat type		P	P (%)
					Coastal desert	Inland desert		
Perennials								
1	*Cyondon dactylon* (L.) Pers.	Poaceae	G	COSM	+	+	2	100
2	*Launaea mucronata* (Forssk.) Muschl.	Asteraceae	H	ME+SA-SI	+	+	2	100
3	*Launaea nudicaulis* (L.) Hook.f.	Asteraceae	H	SA-SI	+	+	2	100
4	*Phoenix dactylifera* L.	Palmae	MMPh	CULT.	+	+	2	100

5	*Phragmites australis* (Cav.) Trin. ex Steud.	Poaceae	G, He	COSM	+	+	2	100
6	*Polygonum equsetiforme* Sm.	Polygonaceae	G	ME+IR-TR	+	+	2	100
7	*Retama raetam* (Forssk.)Webb & Berthel.	Fabaceae	Nph	SA-SI	+	+	2	100
8	*Zygophyllum coccineum* L.	Zygophyllaceae	Ch	SA-SI	+	+	2	100
9	*Alhagi graecorum* Boiss.	Fabaceae	H	ME+IR-TR	+	-	1	50
10	*Anabasis articulata* (Forssk.) Moq.	Chenopodiaceae	Ch	SA-SI+IR-TR	-	+	1	50
11	*Artemisia judiaca* L.	Asteraceae	Ch	SA-SI	-	+	1	50
12	*Arthrocnemum macrostachyum* (Moric.) K. Koch	Chenopodiaceae	Ch	ME+ SA-SI	+	-	1	50
13	*Atractylis carduus* (Forssk.) C.Chr.	Asteraceae	H	ME+ SA-SI	+	-	1	50
14	*Atriplex halimus* L.	Chenopodiaceae	Nph	ME+SA-SI	+	-	1	50
15	*Atriplex portulacoides* L.	Chenopodiaceae	Ch	ME+IR-TR+ER-SR	+	-	1	50
16	*Atriplex semibaccata* R.Br.	Chenopodiaceae	H	AUST	+	-	1	50
17	*Cynanchum acutum* L.	Asclepiadaceae	H	ME+IR-TR	+	-	1	50
18	*Cyperus articulatus* L.	Cyperacaea	G, He	PAN	+	-	1	50
19	*Cyperus capitatus* Vand.	Cyperaceae	G	ME	+	+	1	50
20	*Deverra tortuosa* (Desf.) DC.	Apiaceae	Ch	SA-SI	-	+	1	50
21	*Diplotaxis harra* (Forssk.) Boiss.	Brassicaceae	Ch	ME+ SA-SI	-	-	1	50
22	*Echinochloa stagnina* (Retz.) P. Beauv.	Poaceae	G, He	PAL	+	-	1	50
23	*Echinops spinosus* L.	Asteraceae	H	ME+SA-SI	+	-	1	50
24	*Euphorbia retusa* Forssk.	Euphorbiaceae	H	SA-SI	-	+	1	50
25	*Farsetia aegyptia* Turra	Brassicaceae	Ch	SA-SI+ S-Z	-	-	1	50
26	*Frankenia pulverulenta* L.	Frankeniaceae	H	ME+IR-TR+ER-SR	+	+	1	50
27	*Gypsopila capillaris* (Forssk.) C.Chr	Caryophyllaceae	H	SA-SI+IR-TR	-	-	1	50
28	*Halocnemum strobilaceum* (Pall.) M. Bieb.	Chenopodiaceae	Ch	ME+IR-TR+SA-SI	+	+	1	50
29	*Haloxylon salicornicum* (Moq.) Bunge ex Boiss.	Chenopodiaceae	Ch	SA-SI	-	-	1	50
30	*Heliotropium curassavicum* L.	Boraginaceae	Ch	NEO	+	-	1	50
31	*Imperata cylindrica* (L.) Raeusch.	Poaceae	H	PAL	+	-	1	50
32	*Juncus acutus* L.	Juncaceae	He	ME+IR-TR+ER-SR	+	-	1	50
33	*Juncus rigidus* Desf.	Juncaceae	G, He	ME+IR-TR+SA-SI	+	+	1	50
34	*Kickxia aegyptiaca* (L.) Nάbelek.	Scrophulariaceae	Ch	ME+SA-SI	-	+	1	50
35	*Launaea spinosa* (Forssk.) Sch. Bip. ex Kuntze	Asteraceae	Ch	SA-SI	-	-	1	50
36	*Limbarda crithmoides* (L.) Dumort.	Asteraceae	Ch	ME+ER-SR+SA-SI	+	-	1	50
37	*Panicum repens* L.	Poaceae	G	PAN	+	-	1	50
38	*Panicum turgidum* Forssk.	Poaceae	H	SA-SI	-	+	1	50
39	*Paspalidium gaminatum* (Forssk.) Stapf	Poaceae	He	PAL	+	-	1	50
40	*Plantago major* L.	Plantaginacaea	H	COSM	+	-	1	50
41	*Pluchea dioscoridis* (L.) DC.	Asteraceae	Nph	SA-SI+S-Z	+	-	1	50
42	*Saccharum spontaneum* L.	Poaceae	H	ME+IR-	+	-	1	50

				TR+ER-SR				
43	*Silene succulenta* Forssk.	Caryophyllaceae	H	ME	+	-	1	50
44	*Sporobolus spicatus* (Vahl) Kunth	Poaceae	G	ME+SA-SI+S-Z	+	-	1	50
45	*Suaeda monoica* Forssk.	Chenopodiaceae	Ch	ME+SA-SI	-	-	1	50
46	*Suaeda pruinosa* Lange	Chenopodiaceae	Ch	ME	+	-	1	50
47	*Suaeda vera* Forssk. Ex J. F. Gmel.	Chenopodiaceae	Ch	ME+SA-SI+ER-SR	+	-	1	50
48	*Symphyotrichum squamatum* (Spreng.) Nesom	Asteraceae	Ch	Neo	+	-	1	50
49	*Tamarix nilotica* (Ehrenb.) Bunge	Tamaricaceae	Nph	SA-SI	+	-	1	50
50	*Thymelaea hirsuta* (L.) Endl.	Thymelaeaceae	Nph	ME	+	+	1	50
51	*Zilla spinosa* (L.) Prantl	Brassicaceae	Ch	SA-SI	-	-	1	50
52	*Zygophyllum aegyptium* Hosny	Zygophyllaceae	Ch	ME	+	-	1	50
53	*Zygophyllum album* L.	Zygophyllaceae	Ch	ME+SA-SI	+	+	1	50
54	*Zygophyllum decumbens* Delile	Zygophyllaceae	Ch	SA- SI	-	+	1	50
Biennials								
55	*Centaurea aegyptiaca* L.	Asteraceae	Th	SA-SI	-	-	1	50
56	*Spergularia marina* (L.) Griseb.	Caryophyllaceae	Th	ME+IR-TR+ER-SR	+	-	1	50
Annuals								
57	*Bassia muricata* (L.) Asch.	Chenopodiaceae	Th	SA-SI+ IR-TR	+	+	2	100
58	*Chenopodium murale* L.	Chenopodiaceae	Th	COSM	+	+	2	100
59	*Emex spinosa* (L.) Campd.	Polygonaceae	Th	ME+SA-SI	+	+	2	100
60	*Reichardia tingitana* (L.) Roth	Asteraceae	Th	ME+IR-TR	+	+	2	100
61	*Senecio glaucus* L.	Asteraceae	Th	ME+IR-TR+SA-SI	+	+	2	100
62	*Aegilops bicornis* (Forssk.) Jaub. & Spach	Poaceae	Th	ME+ SA-SI	+	-	1	50
63	*Atriplex prostrata* Boucher ex DC.	Chenopodiaceae	Th	ME+IR-TR+ER-SR	+	-	1	50
64	*Avena fatua* L.	Poaceae	Th	PAL	+	-	1	50
65	*Bassia indica* (Wight) Scott.	Chenopodiaceae	Th	S-Z+IR-TR	+	-	1	50
66	*Bromus diandrus* Roth	Poaceae	Th	ME	+	-	1	50
67	*Bupleurum semicompositum* L.	Asteraceae	Th	ME+IR-TR+SA-SI	+	-	1	50
68	*Cakile maritima* Scop. subsp.aegyptiaca (Willd.) Nyman	Brassicaceae	Th	ME+ER-SR	+	-	1	50
69	*Carduus getulus* Pomel	Asteraceae	Th	SA-SI	+	-	1	50
70	*Carduus pycnocephalus* L.	Asteraceae	Th	SA-SI	+	-	1	50
71	*Carthamus tenuis* (Boiss & Blanche) Bornm.	Asteraceae	Th	ME	+	+	1	50
72	*Chenopodium album* L.	Chenopodiaceae	Th	COSM	+	-	1	50
73	*Conyza aegyptiaca* (L.) Dryand.	Asteraceae	Th	ME	+	-	1	50
74	*Conyza linifolia* (Willd.) Täckh.	Asteraceae	Th	ME	+	-	1	50
75	*Erodium laciniatum* (Cav.) Wild.	Geraniaceae	Th	ME	+	-	1	50
76	*Ethulia conyzoides* L.f.	Asteraceae	Th	PAL	+	+	1	50
77	*Hordeum murinum* L.	Poaceae	Th	ME+IR-TR+ER-SR	+	-	1	50

78	*Ifloga spicata* (Forssk.) Sch. Bip.	Asteraceae	Th	SA-SI	+	-	1	50
79	*Lolium perenne* L.	Poaceae	Th	ME+IR-TR+ER-SR	+	+	1	50
80	*Lotus glinoides* Delile	Fabaceae	Th	S-Z	-	-	1	50
81	*Lotus halophilus* Boiss.	Fabaceae	Th	ME+SA-SI	+	+	1	50
82	*Malva parvifolra* L.	Malvaceae	Th	ME+IR-TR	+	-	1	50
83	*Matthiola longipetala* (Vent.) DC. subsp. *livida* (Delile) Maire	Brassicaceae	Th	ME+IR-TR	-	-	1	50
84	*Melilotus indicus* (L.) All.	Fabaceae	Th	ME+IR-TR+SA-SI	+	-	1	50
85	*Mesembryanthemum crystallinum* L.	Aizoaceae	Th	ME+ER-SR	+	-	1	50
86	*Mesembryanthemum nodiflorum* L.	Aizoaceae	Th	ME+ER-SR+SA-SI	+	-	1	50
87	*Ononis serrata* Forssk.	Fabaceae	Th	ME+SA-SI	+	+	1	50
88	*Orobanche crenata* Forssk.	Orobanchaceae	Th, P	ME+IR-TR	-	-	1	50
89	*Parapholis incurva* (L.) C.E. Hubb	Poaceae	Th	ME+IR-TR+ER-SR	+	-	1	50
90	*Phalaris minor* Retz.	Poaceae	Th	ME+IR-TR	+	-	1	50
91	*Poa annua* L.	Poaceae	Th	COSM	+	-	1	50
92	*Polypogon monspeliensis* (L.) Desf.	Poaceae	Th	COSM	+	-	1	50
93	*Rumex dentatus* L.	Polygonaceae	Th	ME+IR-TR+ER-SR	+	-	1	50
94	*Rumex pictus* Forssk.	Polygonaceae	Th	ME+SA-SI	+	+	1	50
95	*Rumex vesicarius* L.	Polygonaceae	Th	ME+SA-SI+S-Z	-	-	1	50
96	*Salsola kali* L.	Chenopodiaceae	Th	COSM	+	-	1	50
97	*Sonchus oleraceus* L.	Asteraceae	Th.	COSM	+	-	1	50
98	*Sphenopus divaricatus* (Gouan) Rchb.	Poaceae	Th	ME+IR-TR+SA-SI	+	-	1	50
99	*Suaeda maritima* (L.) Dumort.	Chenopodiaceae	Th	COSM	+	+	1	50
100	*Trigonella stellata* Forssk.	Fabaceae	Th	SA-SI+IR-TR	-	-	1	50
101	*Urospermum picroides* (L.) F.W. Schmidt	Asteraceae	Th	ME+IR-TR	+	+	1	50
102	*Volutaria lippii* (L.) Cass. Ex Maire	Asteraceae	Th	SA-SI	-	+	1	50
103	*Zygophyllum simplex* L.	Zygophyllaceae	Th	SA-SI	-	+	1	50

Source: Boulos (1999-2005) and Tackholm [17]

Table-2. The principal floristic categories of the families in the study area.

No.	Families	Genus	Species	Floristic categories										
				COSM	NEO	PAN	PAL	Plui regional	Bi regional	ME	SA-SI	S-Z	AUST	CULT
1	Asteraceae	19	23	1	1	-	1	3	6	3	8	-	-	-
2	Poaceae	18	19	4		1	4	6	2	1	1	-	-	-
3	Chenopodiaceae	9	17	4	-	-	-	4	6	1	1	-	1	-
4	Fabaceae	6	7	-	-	-	-	1	4	-	1	1	-	-
5	Boraginaceae	6	6	-	1	-	-	-	4	-	1	-	-	-

6	Polygonaceae	3	5	-	-	-	-	2	3	-		-	-	-
7	Zygophyllaceae	1	5	-	-	-	-	-	1	1	3	-	-	-
8	Caryophyllaceae	3	3	-	-	-	-	1	1	1	-	-	-	-
9	Aizoaceae	1	2	-	-	-	-	1	1	-	-	-	-	-
10	Cyperacaea	1	2	-	-	1	-	-	-	1	-	-	-	-
11	Juncaceae	1	2	-	-	-	-	2	-	-	-	-	-	-
12	Apiaceae	1	1	-	-	-	-	-	-	-	1	-	-	-
13	Asclepiadaceae	1	1	-	-	-	-	-	1	-		-	-	-
14	Euphorbiaceae	1	1	-	-	-	-	-	-	-	1	-	-	-
15	Frankeniaceae	1	1	-	-	-	-	1	-	-	-	-	-	-
16	Geraniaceae	1	1	-	-	-	-	-	-	1	-	-	-	-
17	Malvaceae	1	1	-	-	-	-	-	1	-	-	-	-	-
18	Orobanchaceae	1	1	-	-	-	-	-	1	-	-	-	-	-
19	Palmae	1	1	-	-	-	-	-	-	-	-	-	-	1
20	Plantaginacaea	1	1	1	-	-	-	-	-	-	-	-	-	-
21	Scrophulariacea e	1	1	-	-	-	-	-	1	-	-	-	-	-
22	Tamaricaceae	1	1	-	-	-	-	-	-	-	1	-	-	-
23	Thymelaeaceae	1	1	-	-	-	-	-	-	1	-	-	-	-
Total		80	103	10	2	2	5	21	32	10	18	1	1	1

Source: Boulos (1999-2005) and Tackholm [17]

Table- 3. Number of species and percentage of various floristic categories in the different habitats in the study area

Floristic category	Study area		Habitat types			
			Coastal desert		Inland desert	
	No.	%	No.	%	No.	%
COSM	10	9.71	10	12.35	4	8.16
NEO	2	1.94	2	2.47	0	0.00
PAN	2	1.94	2	2.47	0	0.00
PAL	5	4.85	5	6.17	1	2.04
ME+IR-TR+ER-SR	11	10.68	11	13.58	2	4.08
ME+IR-TR+SA-SI	7	6.80	6	7.41	3	6.12
ME+ER-SR+SA-SI	4	3.88	4	4.94	0	0.00
ME+SA-SI+S-Z	1	0.97	1	1.23	0	0.00
ME+IR-TR	9	8.74	7	8.64	5	10.20
ME+SA-SI	14	13.59	11	13.58	10	20.41
SA-SI+IR-TR	4	3.88	1	1.23	4	8.16
S-Z+IR-TR	1	0.97	1	1.23	0	0.00
SA-SI+S-Z	2	1.94	1	1.23	1	2.04
ME	10	9.71	10	12.35	3	6.12
SA-SI	18	17.48	7	8.64	14	28.57
S-Z	1	0.97	0	0.00	1	2.04
AUST	1	0.97	1	1.23	0	0.00
CULT	1	0.97	1	1.23	1	2.04
Total	103	100	81	100	49	100

Source: Boulos (1999-2005) and Tackholm [17]