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PHYTOSOCIOLOGICAL AND FLORISTIC FEATURES OF BIR GENDALI, HYPERARID DESERT, EGYPT

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Wadi Gendali is located across the main traffic road (Katamiya -Ain Sukhna) to the Red sea. The down stream of the wadi is located near the gravel desert while the middle and upper stream are in the limestone desert. The application of classification (TWINSPAN) and ordination (CANOCO) techinques produced three vegetation groups; *Anabasis articulata - Zilla spinosa*, *Zygophyllum coccineum – Zilla spinosa* and *Anabasis articulata – Nitarira retusa* . The correlation between vegetation and soil characters indicated that soil moisture, total dissolved salts and soil textures are the most effective variables on the species and community distribution in Wadi Gendali. Chamaephyte life form dominates the vegetation constituting 35% of the total recorded species. The higest values of species richness and diversity values are found in stands of the middle and down stream parts of Wadi Gendali.

The floristic comparision between the pioneer study (El Abyad,1962) and present study reveals that *Anabasis articulata* and *Nitraria retusa* still the main communities in the wadi. The *Zilla spinosa* and *Zygophyllum coccineum* associated species become the main communities in this study. Fifty one species are recorded in this study of which 14 species are not recorded in the previous study.

Keywords: Desert, Egypt, Flora, Gendali.

Wadi Gendali is bounded by longitudes 31° 40'- 31° 50' E and latitude 29° 50'- 30° 10' N. The wadi extends from Gebel Abu Shama at the south (upstream) passing through the Katamiya-Ain Sokhna road and continues until Cairo-Suez road (downstream). It extends in north-east direction and associated with several tributaries. These tributaries include Wadi El-Ka'ah which drains from Gebel Abu Shama, Wadi Umm Sanadik and Wadi El-Katamiya from Gebel El-Katamiya, Wadi Abu Argan from Gebel Ukhshein and Wadi Abu Riyash from the gravel plain. The upper stream part of Wadi Gendali cuts in the Eocene era , sands and gravels, and in the Miocene at its middle and down stream parts (El Abyad, 1962).

A few quantative studies were carried out on the vegetation structure in relation to the controlling environmental factors in the Egyptian desert wadis (Mashaly, 1996). The main objective of the present study is to analayse the vegetation distribution of wadi Gendali in relation to the enviromental factors after 40 years from the pioneer study of El Abyad (1962).

STUDY AREA

Nine stands were sampled along the wadi Gendali drainge system (Fig. 1). The study area belongs to hyperarid province with mild winter and hot summer. (mean temperature of the hottest month; 20-30°C)with winter rainfall. The rain in this province is less than 30 mm/ year and occasional and unpredictable (Ayyad and Ghabbour, 1986).

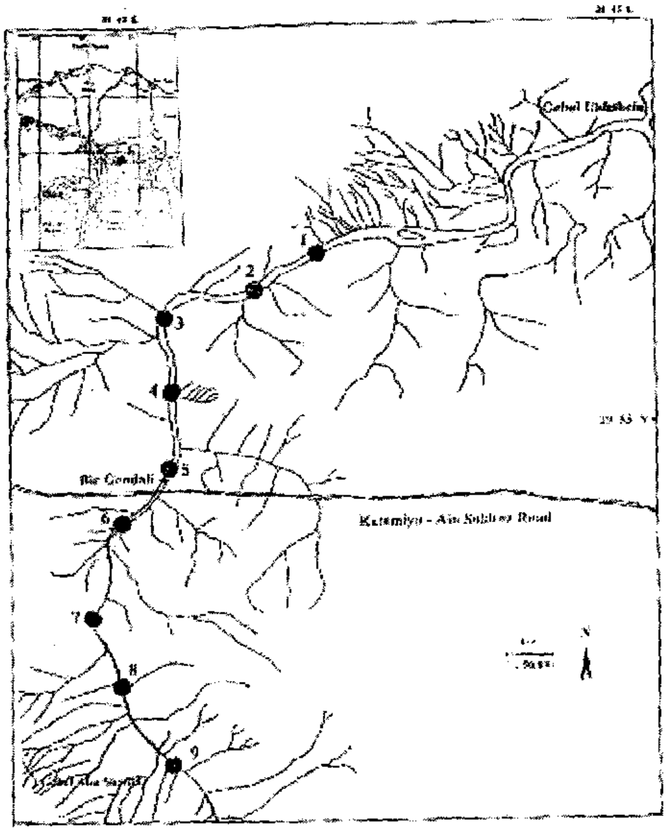

Fig. (1). Location of nine stands in Wadi Gendali drainage system.

MATERIALS AND METHODS

Nine stands were chosen to represent the variation in physiography and vegetation of the wadi. Each stand included 5 quadrats (5 x 5 m^2). For each stand the floristic list and the plant cover were determined. The line intercept method (Muller-Dombois and Ellenberg, 1974) was applied to estimate the plant cover. Frequency and density were also calculated. The importance value (Ivs) was calculated as: Ivs = relative density + relative frequency + relative cover.

Two-Way Indicator Species Analysis, TWINSPAN, (Hill, 1979) was applied as a classification technique. Canonical Correspondence Analysis, CCA, (ter-Braak, 1988) was applied to the vegetation data of the nine stands .Soil texture was determined using sieves method and soil moisture content was eastimated by weighing method according to Allen *et al.* (1974). PH value of the soil samples was determined by pH meter. Total dissolved salts were measured by conductivity meter. Sulphate content was measured gravimetrically by barium sulphate and chloride by titration with standard silver nitrate. Bicarbonate, carbonate and total carbonate were determined by acid titration. Organic matter was determined by ignetion at 450° Ċ. These methods are adopted according to Jackson (1962) and Allen *et al.* (1974).

The relationships between vegetation and environmental gradients are indicated on the ordination diagram of the Canonical Correspondence Analysis (CCA biplot or centroids), on which points represent species and arrows represent environmental variables (ter-Braak, 1987).

The statistical treatments applied in the study were according to Nie *et al.* (1975) and Snedecor and Cochran (1980). Species diversity (Shannon-Wiener index (H`), was determined in each stand and for vegetation groups (Magurran, 1988). Species richness was estimated as a number of species per stand then as a mean for vegetation groups. Cover- abundance values of the species following (±10) modified Domin scale (Muller-Dombois and Ellenberg, 1974) were used to Compare between the floristic features of the pionner study (El Abyad, 1962) and the present study.

Species were identified according to Taeckholm (1974), El Hadidi and Fayed (1994/1995), Boulos (1995) and Boulos (1999, 2000 and 2002).Voucher specimens were deposited in Helwan Faculty of Science Herbarium, Helwan University, Egypt.

RESULTS

Sixty species belong to 23 families were recorded in the study area, and 13 families were represented by one species (Table 1). From table (2), the chamaephytes constitutes 35% of the total species, among these are

Gymnocarpos decandrus, Anabasis articulata, Echinops spinosissimus, Iphiona mucronata, Farsetia aegyptia, Zilla spinosa, Zygophyllum album and *Zygophyllum coccineum*. Therophytes constitute 25% of the species and represnted by 15 species while hemi-cryptophytes are represented by 14 species which constitute 23.3% of the species. Phanerophytes constitute 11.7% of the species and includes 7 species; *Atriplex halimus, Ephedra alata, Retama raetam, Ochradenus baccatus, Lycium shwaii, Nitraria retusa* and *Tamarix nilotica.*

TABLE (1). The cover- abundance values (± 10) according to modified Domin scale and floristic categories (Wickens, 1978) and Zohary, 1973) of the recorded species in the study area.

Species	Floristic category	A	B
Aizoaceae			
* *Aizoon hispanicum* L.	ME,SA-SI&IR-TR	-	-
Asclepiadaceae			
Pergularia tomentosa L.	SA-SI&S-Z	1	+
Boraginaceae			
* *Anchusa aegyptiaca* (L.)A. DC.	ME,SA-SI&IR-TR	-	-
Caryophyllaceae			
Gymncarpos decandrus Forssk.	SA-SI	1	1
Paronychia arabica (L.) DC.	SA-SI,IR-TR&S-Z	0	1
* *Spergula fallax* (Lowe) E.H.L. Krause	ME,SA-SI&IR-TR	-	-
Chenopodiaceae			
Agathophora alopecuroides (Delile)Fenzl	SA-SI	+	+
Anabasis articulata (Forssk.)Moq.	SA-SI&IR-TR	1	5
Atriplex halimus L.	ME&SA-SI	3	5
Bassia muricata (L.) Asch.	SA-SI,IR-TR&S-Z	0	+
Halocnemum strobilaceum (Pall.) M. Bieb	IR-TR,SA-SI&EU-SB	0	+
* *Haloxylon salicornicum* (Moq.) Bunge ex Boiss	SA-SI&IR-TR	+	0
Salsola imbricata Forssk.	SA-SI- S-Z	1	+
* *Salsola longifolia* Forssk.	SA-SI&ME	-	-
Cleomaceae			
Cleome amblyocarpa Barratte & Murb.	SA-SI&S-Z	+	+
Compositae			
Achillea fragrantissima (Forssk.) Sch.Bip.	SA-SI & IR-TR	1	4
Artemisia judica L.	SA-SI	1	+
Centaurea aegyptiaca L.	SA-SI	+	2
Cotula cinerea Delile	SA-SI	0	+
Echinops spinosissimus Turra	SA-SI& IR-TR	1	1
Iphiona mucronata (Forssk.) Asch.& Schweinf.	SA-SI	2	3
Launaea nudicaulis (L.) Hook.f.	SA -SI,S-Z & IR-TR	1	1
Nauplius graveolens (ForssK.)Wiklund , Nord.	SA-SI	+	+
Convulvulaceae			
**Convulvulus lanatus* Vahl	SA-SI	+	0

Cruciferae			
Diplotaxis harra (Forssk.) Boiss	SA-SI	+	2
Dilotaxis acris (Forssk.) Boiss.	SA- SI	0	+
Farsetia aegyptia Turra	SA-SI	0	+
Zilla spinosa (L.) Prantl	SA-SI	2	5
Ephedraceae			
* *Ephedra alata* Decne	SA-SI & IR-TR	2	0
Euphorbiaceae			
Euphorbia retusa Forssk.	SA-SI	0	+
Gramineae			
Cynodon dactylon (L.) Pers.	SA -SI,S-Z & IR-TR	1	+
Desmostachya bipinnata (L.) Stapf	SA-SI & S-Z	+	+
Imperata cylandrica (L.) Raeusch	PAN	0	+
Pennisetum divisum (J.F.Gmel.) Henrard	SA-SI & S-Z	0	+
Phragmites australis (Cav.)Trin.ex Steud	PAN	0	+
Leguminosae			
Alhagi graecorum Boiss	ME,SA-SI & IR-TR	2	1
Astragalus spinosus (Forssk.) Muschl.	SA-SI & IR-TR	+	1
* *Crotalaria aegyptiaca* Benth.	SA-SI & S-Z	+	0
* *Hippocrepis unisiliquosa* L.	ME,SA-SI & IR-TR	-	-
Retama raetam (Forssk.) Webb & Berthel	SA-SI & IR-TR	1	4
* *Trigonella stellata* Forssk.	SA-SI,ME,IR-TR&S-Z	0	+
Malvaceae			
Malva parviflora L.	ME,EU-SB,IR-TR&SA-SI	+	+
Orobanchaceae			
Cistanche phelypaea (L.) Cout.	SA-SI,ME,IR-TR&S-Z	0	+
Plantaginaceae			
Plantago ovata Forssk.	SA-SI,ME,IR-TR&S-Z	0	+
Polygonaceae			
Rumex vesicarius L.	SA -SI,S-Z & IR-TR	0	+
Resedaceae			
Caylusea hexagyna (Forssk.)M.L.Green	SA-SI & S-Z	0	+
Ochradenus baccatus Delile	SA-SI & S-Z	1	1
Scrophulariaceae			
Kickxia aegyptiaca Nabelek	SA-SI	0	+
Solanaceae			
Hyoscymus muticus L.	SA-SI & IR-TR	+	1
Lycium shawii Roem. & Schult.	SA-SI & S-Z	2	4
Tamaricaceae			
Reaumuria hirtella Jaub.& Spach	SA-SI	1	2
Tamarix nilotica (Ehrenb.) Bunge	SA -SI,S-Z & IR-TR	3	3
Umbelliferae			
Deverra tortuosa (Desf.) DC.	SA-SI	1	3
Zygophyllaceae			

Fagonia arabica L.	SA-SI	+	[illegible]
Fagonia mollis Delile	SA-SI	+	2
Nitraria retusa (Forssk.) Asch.	SA-SI & S-Z	5	7
Peganum harmala L.	IR-TR,ME,EU-SB&SA-SI	1	3
Zygophyllum album L.f.	SA-SI,ME,IR-TR&S-Z	+	4
Zygophyllum coccineum L.	SA-SI & S-Z	3	4
Zygophyllum simplex L.	SA-SI & S-Z	+	1

Legend

A= Species recorded in the pioneer study of El Abyad (1962).

B= Species recorded in the present study

* :Recorded in the study aera but not collected

COSM : Cosmoplitan

PAN : Pantropic

SA-SI: Saharo-Sindian

S-Z : Sudano-Zambezian

IR-TR : Irano- turanian

ME : Mediterranean

EU-SB : Eurpian-Siberian

TABLE (2). Life form spectrum of the recorded species in the study area according to Raunkiaer (1934).

Life form	Actual number	Relative number (%)
Therophytes	**15**	**25**
Chamaephytes	21	35
Hemi-cryophytes	14	23.3
Phanerophytes	7	11.7
Geophytes	2	3.3
Parasites	1	1.7
Total	60	100

Geophytes constitue 3.3% of the total species and represented by; *Cynodon dactylon* and *Desmostachya bipinnata*. Parasites constitute 1.7% of the species and represented by *Cistanche phelypaea*.

According to the chorological analysis (Table 1), Sahro- Sindian element represented by 18 species (30 %of the total species) while the bi-regiopnal elements represnted by 22 species (36% of total of species). Pluri-regional element represented by 18 species while the pantropic element represented by *Imperata cylindrica* and *Phragmites australis*.

The application of TWINSPAN classification based on the Importance Values (Ivs) of the species recorded in the 9 stands led to recognize three groups (Fig. 2). Group A comprises four stands and 23 speies. The dominant species are *Anabasis articulata* and *Zilla Spinosa* which attained the highest Ivs values of 60.38 and 51, respectively. There is no indicator species in this group. The *Lycium shawii*, *Retama raetam* and *Atriplex halimus* have Ivs ranged from 25.6 to 41.6. The remaining associated species have Ivs within the range of 1.1 to15.9. Some of the associated species are *Achillea frgrantissima, Zygophyllum album, Echinops spinosissimuss*, *Ochradenus baccatus* and *Euphorbia retusa*. Group B comprises one stand that contains 11 species. The indicator species is *Agathophora alopcuroides*. The dominant species are *Zygophyllum coccineum* and *Zilla spinosa* that have the highset Ivs of 81.6 and 62.5, respectively. The common species are *Retama raetam*, *Zygophyllum album* and *Achillea fragrantissima* with Ivs ranged from 26.1 to 43.4. The remaining associated species have Ivs ranged from 7.3 to 12.1 (*Hyoscyamus muticus, Atriplex halimus* and *Tamarix nilotica*). Group C comprises four stands that contain 26 species. *Anabasis articulata* and *Nitraria retusa* are the dominant species of this group that attained the highest Ivs of 42.1 and 34.6, respectively. *Nitraria retusa* and *Tamarix nilotica* are the indicator species. The common species are *Zilla spinosa, Achillea fragrantissima, Zygophyllum album* and *Retama raetam* where these Ivs ranged from 29.4 to 33.5. The remaining associated species have Ivs within the range of 1 to 17.9. Some of the associated species are *Atriplex halimus, Cistanche phelypaea, Desmostachya bipinnata, Halocnemum strobilaceum, Reaumuria hirtella* and *Gymnocarpos decandrus*.

Most of the soil characteristics (Table 3) show a little variation among the different groups of stands. The soil texture in all groups is formed mainly of fine and coarse sand then gravel and partly of fine fractions (silt and clay). Fine sand percentage ranges from 36.84% in the soil of group B to 38.29% in the soil of group C. The highest value of silt of 18.54% was found in stands of group C, while the lowest value of 8.83% was found in stands of group B. The highest percentage of clay of 4.07% was found in stands supporting group A then group C has value of 3.52% and the lowest value of 1.28% was found in stands of group B. pH values indicate that the soil reaction is slightly alkaline in all groups. The total dissolved salts attained its highest mean value of 605 mg/l in soil of group B, while chloride and sulphate content show the highest mean values in group A.

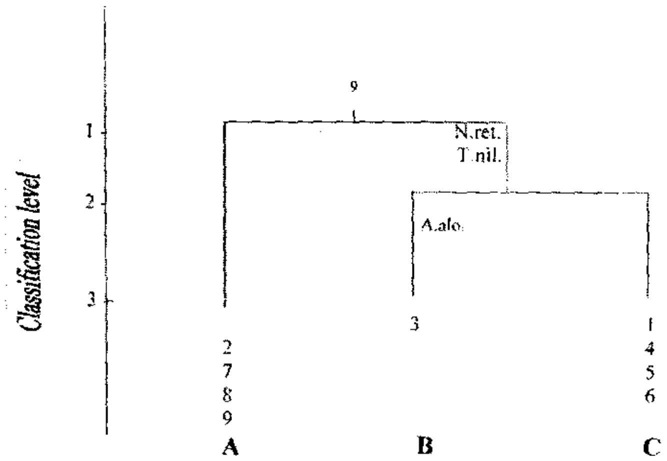

Fig. (2). Dendogram of 9 stands based on the importance value of 38 species in Wadi Gendali. Three vegetation groups are produced by TWINSPAN analysis (A, B and C). Indicator species names are abbreviated to the first letter of the genus and three letters of

TABLE (3). Mean ± standard error of the different soil variables in the stands represented the different vegetation groups obtained by TWINSPAN classification in Wadi Gendali.

Species / Soil variables	Group		
	A	B	C
Gravel (%)	18.19 ± 2.84	31.87	18.04 ± 3. 34
Coarse sand (%)	26.06 ± 2.29	21.04	20.63 ± 5.94
Fine sand (%)	37.68 ± 2.67	36.84	38.29 ± 5.02
Silt (%)	12.78 ± 2.3	8.83	18.54 ± 3.32
Clay (%)	4.07 ± 0.99	1.28	3.52 ± 0.42
PH	8.04 ± 0.10	7.68	7.83 ± 0.07
T.D. S (mg/l)	516. 50 ± 219.95	605	530.50 ± 39.61
Cl^- (%)	0.06 ± 0.04	0.02	0.02 ± 0.00
SO^{-2}_4 (%)	0.04 ± 0.00	0.02	0.02 ± 0.01
$CaCO_3$ (%)	5.6 ± 0.69	6.60	4.20 ± 1.00
HCO^-_3 (%)	0.09 ± 0.01	0.12	0.11 ± 0.02
M.C (%)	2.62 ± 0.69	1.75	1.69 ± 0.29
O.M (%)	0.33 ± 0.08	0.90	0.29 ± 0.01

T.D.S =Total disssolved salts
M.C = Moisture content
O.M = Organic matter

The calcium carbonate content attained the highest value of 6.6% in the soil of group B, while the moisture content attained the highest value of 2.62% in the soil of group A. The highest mean value of organic matter of 0.9% was attained in the soil of group B.

The correlation coefficient (r) between the different soil variables in the surveyed stands is shown in table (4). Several edaphic variables are significantly correlated with each other such as gravel, coarse sand, fine sand, clay, total dissolved salts and the moisture content. Soil variables such as pH, sulphate, calcium carbonate and bicarbonate show a limited correlation with other soil variables. Chloride and organic matter have no correlation with any of the other soil variables.

The correlation between vegetation and soil characteristics is indicated on the ordination diagram produced by Canonical Correspondence Analysis (CCA) of the stands (Fig. 3a) and the biplot of species–soil relationship (Fig. 3b). It is clear that the percentages of moisture content, sulphate, pH, coarse sand, organic matter, calcium carbonate, total dissolved salts and chloride are the most effective soil variables which have high significant correlations with the first and second axes. The species of group A show a close relationship with high percentages of moisture content, sulphate, pH, calcium carbonate, coarse sand, chloride and clay. The species of groups B and C exhibit a strong relation with high percentages of bicarbonate, organic matter, silt, fine sand and total dissolved salts. Phytosociologically and edaphically, the vegetation types of groups B and C show a close affinity between each other.

Differences in species richness and species diversity are shown in figures (4a and 4b). The vegetation group C dominated by *Anabasis articulata* and *Zilla spinosa* is the highest species richness value of average 13.5 ± 4.21. The vegetation groups A and B have shown a similar richness values of 11.5 ± 1.29 and 11± 0.0 respectively. The highest value of the Shannon diversity index (H') of 2.4 ± 0.19 was recorded in the vegetation group C. The remaining groups A and B dominated by *Zygophyllum coccineum*, *Zilla spinosa*, *Anabasis articulata* and *Nitraria retusa* have values of 1.96 ± 0.16 and 2.4 ± 0.0, respectively (Fig. 4b).

TABLE (4). Pearson- moment correlation between different soil variables in the stands surveyed in Wadi Gendali.

	Gravel	Coarsand	Finesand	Silt	Clay	Ph value	T.D.S.	Cl^-	SO_4^{2-}	$CaCO_3$	HCO_3	M.C.	O.M
Gravel	1												
Coar.sand	0.5171	1											
Finesand	-0.649*	-0.8839***	1										
Silt	-0.818**	-0.7969**	0.6952*	1									
Caly	-0.7015*	-0.1937	0.1784	0.5117	1								
PH value	-0.211	0.1349	-0.0067	-0.0048	0.4184	1							
T.D.S.	-0.4024	-0.3864	0.2699	0.4105	0.6544*	-0.2973	1						
CL^-	-0.4498	-0.0051	0.1798	0.2268	0.5215	0.0596	0.5863	1					
SO_4^{2-}	-0.2445	0.2438	0.054	-0.1821	0.53	0.6484*	0.1722	0.5218	1				
$Ca\ CO_3$	-0.6071	0.687	-0.6344*	-0.8492***	-0.3253	-0.2264	-0.1195	-0.2239	0.0392	1			
HCO_3	-0.0713	-0.5299	0.3379	0.4291	-0.2785	0.0436	-0.259	-0.2037	-0.5383	-0.6031*	1		
M.C	-0.3862	-0.1227	0.1582	0.1407	0.7895**	0.1618	0.8168**	0.5727	0.6289*	0.058	-0.4865	1	
O.M.	0.4513	-0.1238	0.0676	-0.2458	-0.389	-0.4453	0.2725	0.3047	-0.1277	0.1511	0.1583	0.0214	1

Significant at ≤ 0.05, ** Significant at ≤ 0.01, *** Significant at ≤ 0.001

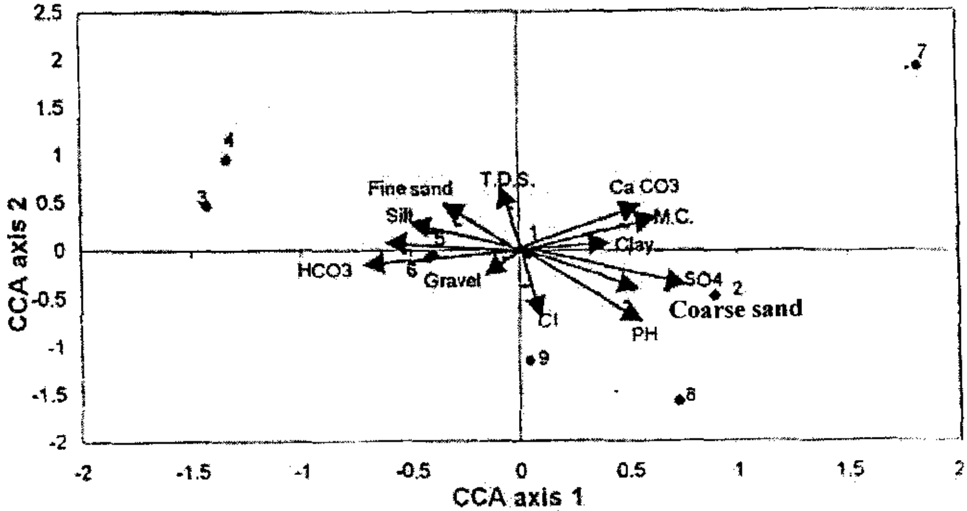

Fig. (3a). CANOCO (CCA) biplot of 9 stands represented by points and soil variables indicated by arrows in Wadi Gendali.

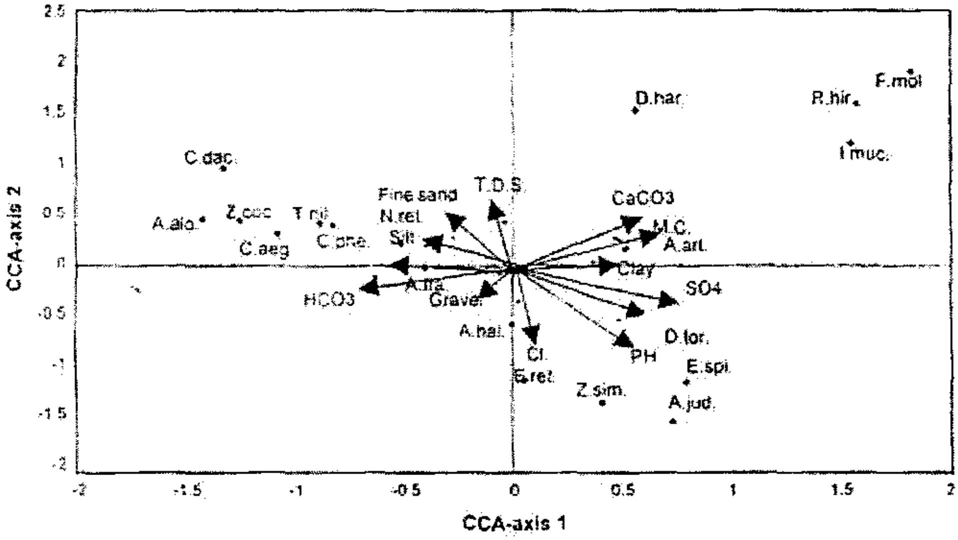

Fig. (3b). CANOCO (CCA) biplot of indicators and preferential species represented by points (first letter of genus and three letters of the species name) and soil variables indicated by arrows in Wadi Gendali.

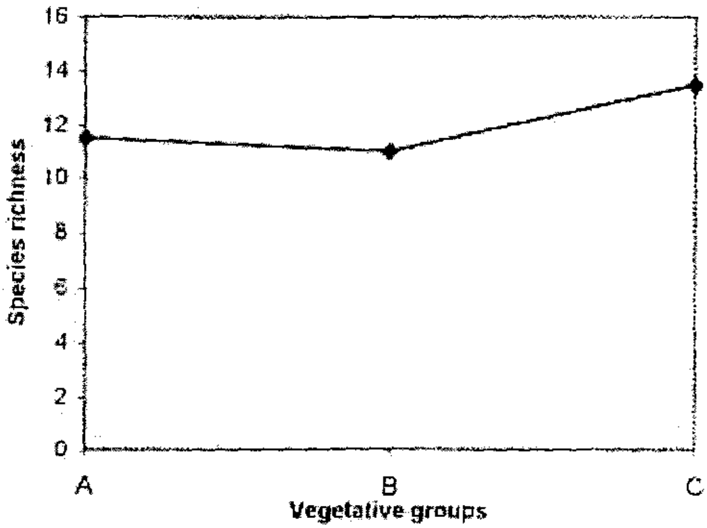

Fig. (4a) Species richness in different vegetation groups.

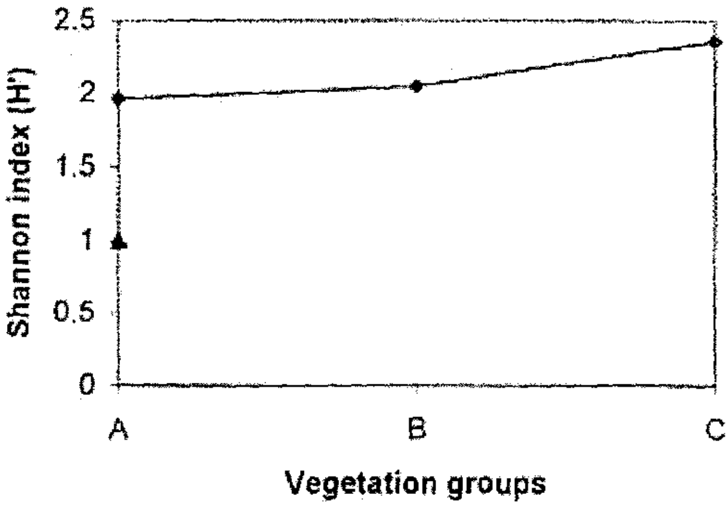

Fig.(4b) Shannon index (H') in different vegetation groups. Calculations are based on the importance value.

DISCUSSION

In Wadi Gendali, the upstream part (25 km.) cuts across Eocene country. Two main community types are recognized within its channel (north of lat. 29° 55') which are dominated by *Anabasis articulatata* and *Nitraria retusa*. The community is wide spread within the course of this wadi extending down stream for 10 km north of its emergence from the edge of the plateau. Near its emergance from the plateau, Wadi Gendali receives its tributary Wadi El-Katamiya which extends across the limestone plateau. *Zygophyllum coccineum, Pennisetum divisum* and *Achillea fragrantissima* which distinguish the limestone country are recorded. The *Anabasis articulata* part of the wadi is followed by a part where the vegetation is mostly the *Ephedra alata* community type. Within this part, the wadi receives many affluents that drain the gravel country which it traverses. These affluents are mostly lined with sand and are inhabited by *Panicum turgidum* grassland type (Wadi Abu Riyash). The finner runnels are inhabited by *Lasiurus scindicus* community type. A little before the cross between Wadi Gendali and the Cairo-Suez road, the *Ephedra alata* community type is replaced by *Haloxylon salicornicum* community type

Fifty-one species collected in the present study of which 14 species were not recorded in the pioneer work of El Abyad (1962): *Paronychia arabica, Bassia muricata, Halocnemum strobilaceum, Cotula cinerea, Diplotaxis acris, Farsetia aegyptia, Euphorbia retusa, Imperata cylindrica, Plantago ovata, Cistanche phelypaea. Trigonella stellata, Caylusea hexagyna, Rumex vesicaius* and *Kickxia aegyptiaca. Crotalaria aegyptiaca, Haloxlon salicornicum* and *Convlvulus lanatus.*

The dominating life forms are therophytes and chamaeophytes in the study area and this results coincide with Hassib (1951) and Danin and Orchan (1990). The chorological analysis shows the domination of Sahro-Sindian and the bi-regional elements. The results coincide with Fossatil *et al.* (1998) and El Hadidi (1993).

In the present study, the vegetation of the bed of Wadi Gendali, is classified by TWINSPAN classification into three groups. Each group comprises number of stands which are similar in terms of vegetation and characterized by dominant species as well as by a number of indicator and/or preferential species. The recognized vegetational groups in the study area named after their dominants are *Anabasis articulata - Zilla spinosa* (Group A), *Zygophyllum coccineum - Zilla spinosa* (group B) and *Anabasis articulata- Nitraria retusa* (Group C).

These groups have analogues in other studies. By comparing with the study of Kassas and Imam (1954) on the wadi bed ecosystem in the Egyptian desert, *Zygophyllum coccineum - Zilla spinosa* (group B) may represent the shallow soil and complex and confusing vegetation pattern of the intermediate stage, respectively. El-Abyad (1962) recognized *Anabasis articulata* - *Nitraria retusa* (Group C) as two community types in middle and upstream sectors of this wadi. He recognized that *Anabasis articulata* community type within the course of Wadi Gendali extends downstream for 10 km north of its emergence from the edge of the limestone plateau.

From the CCA ordination biplot plane, there is high affinity between *Nitraria retusa* and the amount of silt in the soil, this is obvious in the distribution of *Nitraria retusa* in the wadi bed, where *Nitraria retusa* community type is restricted to the silt terraces that are well developed on the sides of the Wadi in the Bir Gendali environment. The associate species grow within the spaces inbetween those patches. The most abundant associate is *Zygophyllum album. Atriplex halimus* is also common. *Cistanche phelypaea* and *Halocnemum strobilaceum* are less common. The dominant and these four associate are known to be salt tolerant. This agrees with El-Abyad (1962) but he has not recorded *Cistanche phelypaea* nor *Halocnemum strobilaceum*.

After 40 years of the study carried out by El-Abyad (1962) on the vegetational and ecological features of Wadi Gendali, it is interseting to notice that some of the dominant species are still leading dominant with relatively high importance values in the present study such as *Anabasis articulata* and *Nitraria retusa,* one of the leading shrubs in steppes, deserts and saline soils (Shaltout *et al.,* 2003). Others which were associate species are now becoming domoinant species such as *Zilla spinosa* and *Zygophyllum coccineum.* Other species were less common (low cover –abundance values) and are now becoming common such as *Achillea fragrantissina, Retama raetam* and *Lycium shawii* (high cover- abundance values) while some were dominant species are now becoming associated species or less common in their community types, e.g. *Ephedra alata* and *Haloxylon salicornicum,* which were dominant in the area near Cairo-Suez road. This may be attributed to the local habitat disturbance and regeneration of vegetation which is always in dynamic state according to the variation in the enviromental conditions prevailing in the study area, as well as due to the human interference and grazing animals in this wadi system.

This is a documented floristic study because of high human activities in the area (New road from Maadi- Katamiya) parallel to the old road, many trees are removed and in progress the floristic features will change. Human impacts modifies to a considerable extent, the pattern and distribution of desert plant communities. The prevailing environmental conditions help in reducing the rate of establishement of plants (Batanouny, 1983).

In the present study, the application of Canonical Correspondence Analysis (CCA biplot) between the position of vegetation groups on the ordination plane and soil variables of their stands indicates that coarse fraction (sand%), fine fractions (silt and clay%), soil reaction, moisture content, sulphates and organic matter in the soil are the most critical edaphic factors controlling the distribution and richness of vegetation in the study area. Species diversity increases as the number of species per sample increases, and as the abundance of species within a sample become even (Magurran, 1988). Consequently, the communities of group C of the present study are more diverse than those of the other groups, since they have the highest number of perennial species per stand.

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دراسة العلاقات الإجتماعيه للنباتات وفلورة وادى جندالى – شمال الصحراء الشرقية – مصر

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وادى الجندالى يقع فى الطريق (القطامية – العين السخنة) إلى البحر الأحمر.
الجزء السفلى من الوادى يقع فى الصحراء الحصوية بينما الجزء الوسطى والعلوى للوادى يقع فى الصحراء الجيرية.
فى هذه الدراسة تم التعرف على المجموعات النباتية والأنواع الكاشفة لهذه المجموعات بإستخدام طرق التصنيف والتسلسل الإحصائى حيث تم تمييز ثلاث مجموعات نباتية بالوادى كما يلى:
مجموعة (أ) ويشارك سيادتها كل من نبات السلة ونبات الجلو
مجموعة (ب) ويشارك فى سيادتها كل من نبات الرطريط الصحراوى ونبات السلة.
مجموعة (ج) يشارك فى سيادتها كل من نبات الجلو ونبات الفرقة.
ويصبح قوام التربة وكمية الأملاح الذائبة والمحتوى المائى للتربة من أهم العوامل إرتباطاً بمحاور التسلسل التى تمثل المجموعات النباتية والتى بدورها تؤثر فى توزيع وكثافة الغطاء النباتى فى وادى جندالى وقد تم مقارنة الأنواع المسجلة فى دراسات سابقة بالأنواع المسجلة فى الدراسة الحالية.
بعد ٤٠ سنة من الدراسة الأولى للوادى فإن الكساء الخضرى والظروف البيئية قد تغيرت حيث أصبحت بعض النباتات المصاحبة مثل السلة والرطريط نباتات سائدة الآن.
ومازالت بعض النباتات السائدة موجودة مثل نبات الجلو ونبات الفرقة.