Journal of Global Biosciences
ISSN 2320-1355
Volume 5, Number 4, 2016, pp. 3851-3868
Website: www.mutagens.co.in
E-mail: submit@mutagens.co.in
researchsubmission@hotmail.com

Research Paper

IMPACT FACTORS ON DISTRIBUTION AND CHARACTERISTICS OF NATURAL PLANT COMMUNITIES IN JAZAN REGION, SAUDI ARABIA

Salman A. A.[1] and M.A. Nabih[2]

[1]Botany Department,
Faculty of Science,
Port Said University, Port Said, Egypt.Now, Biology Department, Faculty of Science,
Jazan University, Saudi Arabia.
[2]Biology Department,
Faculty of Science,
Jazan University, Saudi Arabia.

Abstract
To identify impact factors on distribution and characteristics of natural plant communities in Jazanregion, Saudi Arabia. The main aim of this study was to examine the spatial pattern of vegetation and relationship between vegetation composition and environmental factors in Jazan area. Survey data from 88plant species related to 30families were recorded in this study area, soil properties data from Forty stands (20 x 20 m each) were measured in the study area in April(2013-2014). Analysis data involved two steps: classification (using TWINSPAN) and ordination (using CANOCO). The factors affecting the species distribution and correlation between the vegetation gradients and the edaphic variables are discussed. Eight major community types constitute the major part of the natural vegetation of the study area and are dominated by nine perennials: *Ziziphus spina-christi* (L.) Willd, *Calotroplsprocera* (Wild) R. Br., *Leptadenia pyrotechnica*l (Forssk.)Decne., *Suaedamonoica* Forssk., *Panicumturgidum* Forssk., *Salvadorapersica* L., *Acacia tortills* (Forssk) *Hayne, Tamarixaphylla* (L.) Karst,and *Cyperus conglomerates* Rottb. The complex interaction of different environmental factors in relation to edaphic variables leads to variation of habitat types and different plant distribution communities. Data analysis showed that pH, moisture, electrical conductivity, organic carbon, calcium carbonate, bicarbonate, soil cations: sodium, potassium, calcium, and thesodium adsorption ratio are the main operating edaphic factors in Jazan area. The results of this study confirm that the study area is a subtropical desert and belongs floristically to the Sudanian territory and also that therophytes are the most frequent lif-form in this region.
Key words: natural plant communities; plant distribution; soil properties; Jazan region.

INTRODUCTION
The aim of this paper is to examine the spatial pattern of floristic composition at species and community levels and to clarify the correlation between plant distribution and edaphic factors

of Jazan region, Saudi Arabia.

The southwestern region of Saudi Arabia is unique in regard to its nature, landform, climate and water availability [1].Several ecological studies have been done in some of the phytogeographical regions of Saudi Arabia [2], [3], [4], [5], [6], [7], [8], [9], [10], [11],[12].

Most of these studies were based on qualitative field observations and interpretation of the authors. Although these studies were focusing on preparing floristiclists[2], and[10], [11], [12]. some of them gave detailed description of the plant communities in relation to some ecological factors e.g. edaphic conditions, climate, aridity and topography[9], [13], [5], and [8]found that the complex interaction of different environmental factors in relation to altitude leads to variation of habitat types and different plant communities and vegetational belts.

[14]IdentifiedJazan region geomorphologically, by three main sectors; A) Mountains: E1-Sarwat mountains, B) Plains: 'Tihamah' coastal plains, and C) Islands: including those between Jazancity and Farasan islands.

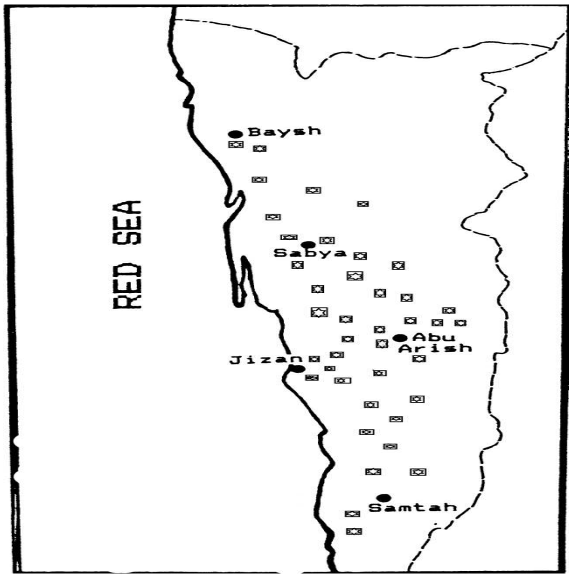
Ecologically, [15], distinguished five ecosystems inTihamah coastal plains namely: shoreline, sand formations, salt marshes, wadis and rocky hills. [16]discussed vegetation, species diversity and floristic relations in south-western Saudi Arabia and demonstrated remarkable change with altitude. There has been a broad discussion on the relationship among vegetation, soil factors and land use patterns[17], [18],[19],[20],[21],[22],[23],especially on the relationship between soil and vegetation distribution .The present study describes the structure of the plant communities and correlates their distribution with the edaphic variables of the habitat types. The primary questions were: is there any impact factor on plant distributions, Characteristics of natural plant communities with edaphicfactors in Jazanregion,Saudi Arabia.

MATERIALS AND METHODS

Studyarea

Jazan region located in the southwestern part of Saudi Arabia (lat. 16 ° 54' N & long. 42 ° 33' E). The research area is on coastal plains of Jazan region. The current study was performed in Jazan district, Saudia Arabia [Figure 1 A (Saudi Arabia) and B (The study area)]. The region is located in the southwestern part of the Kingdom of Saudi Arabia between the longitudes (42 - 43) east and latitudes (16 - 17) in the north, and bounded on the north and east Asir region to the west of the Red Sea along the coastline for about 330 km, and from the south and south-east as the Republic of Yemen, as has the average width of the area from east to west of about 100 km. The study period was for one year (April 2013 to April 2014). The present study focuses on using 40 stands (20 x 20 m each) [Fig. 2 A (Jazan-Jazan Dam), B (Sabya), C (Baysh), D (Abu Arish), and E (Samtah)], represented and covered the main physiographic variations of study region. Geologically, the study area belongs to the greater Afro-Arabian shield which is a part of the Precambrian crustal plate, generally exposed and locally covered by Tertiary volcanic rocks [24].

According to the climatic normal of Jazan region (averages of 2000-2010), Jazan area is generally hot during summer with the mean monthly air temperature ranges between 30°C during January and 40 °C during August. The maximum rainfall (18.0 mm) was recorded during December, while the minimum (0.8 mm) was attained during June. The climate diagram (Fig. 3) demonstrates dry period prevailing all the year round. The mean annual relative humidity of the study area is about 64.9%. The wind speed has a narrow range of variation (11- 12.2 km/h). Stormy wind with fine aeoline particles prevails during July-August with a northwestern direction [25].



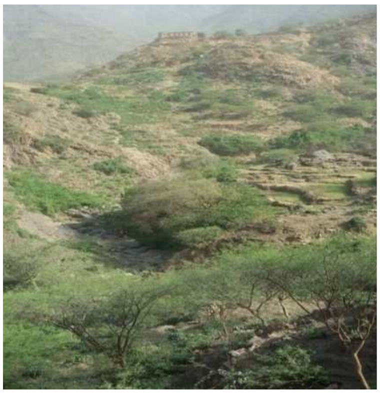
A(Saudi Arabia) B(The study area)

Fig. (1): showing (A) Saudi Arabia (B) showing location of the study area

Research design andsampling

Forty stands (20 x 20 m each) were selected and measured in the study area. In selecting each stand, care was taken to ensure reasonable degree of physiographic and physiognomic homogeneity of both habitat and vegetation Sampling sites were selected, representing the most common habitats and herbaceous communities in the data as described by [26],[27],[28], and[29]. Soil samples measured and described by [26], [28],and [29]. A count-floristic list was carried out for each stand and relative frequency and density for each perennial species were calculated, while the relative cover was determined using the line intercept method. The sum of the relative frequency, relative density and relative cover gave the importance value (IV) for perennial species. The annual species were recorded in each stand. Composite soil samples taken from each stand to a depth of 50 cm. Soil samples were air-dried, crushed and sieved (< 2 mm) as described by[30], [31] and [32].The Electrical conductivity (EC), pH and soluble ions were measured in soil saturation extracts. Na and K were measured by flame emission spectroscopy, Ca and Mg by atomic absorption spectroscopy, Cl and SO4 by visible spectrophotometry, Organic matter (OM) was measured using a modified Walkley& Black method and total inorganic carbonates (TIC) was analyzed using a pressure calcimeter[33].


A(Jazan-Jazan Dam)


B(Sabya)


C(Baysh)


D(Abu Arish)


E(Samtah)

Fig.2: (A, B, C, D and E) showing plant diversity and sampling in location of the study area.

Analysis of plant community composition

The following three indices reflecting the characteristics of plant community were selected: Species richness: Margalef index (MA) was adopted, which is expressed as [34]:MA=(S – 1)/lnN (1)where S is the number of species, and N is the number of individuals of all species in a community.Species diversity: Shannon-Weaver index (H) was used, which can be calculated as [34]:H = –∑PilnPi(2)where Pi=ni / N, ni is the importance value of species i, and N is the sum of the importance value of all species in a community. Species ecological dominance: Simpson dominance index (D) was used, which is expressed as:$D=\sum(ni/N)^2$(3) where ni is the number of species i in a community, andN is the number of all individuals in a community [34].

Vegetation and related environmental factors were analyzed using ordination techniques. A direct ordination method was used to enable us to test the environmental variables collected releves . The analyses were conducted using CAP and Canoco program (Version 4.5) [35], [36].Detrended Correspondence Analysis (DCA) was used to detect the length of the environmental gradient. Then, Canonical Correspondence Analysis (CCA) was applied because the data set was relatively heterogeneous and therefore, the length of ordination axes in DCA was relatively long [37]. Clustering methods were used to determine the patterns underlying species distribution and how plant communities may delineate habitat types in the study area.

Two Way Indicator Species Analysis [38] was used for this purpose. Floristic identification are according to [39],[40], [41], [42] and [43], [44], [45].

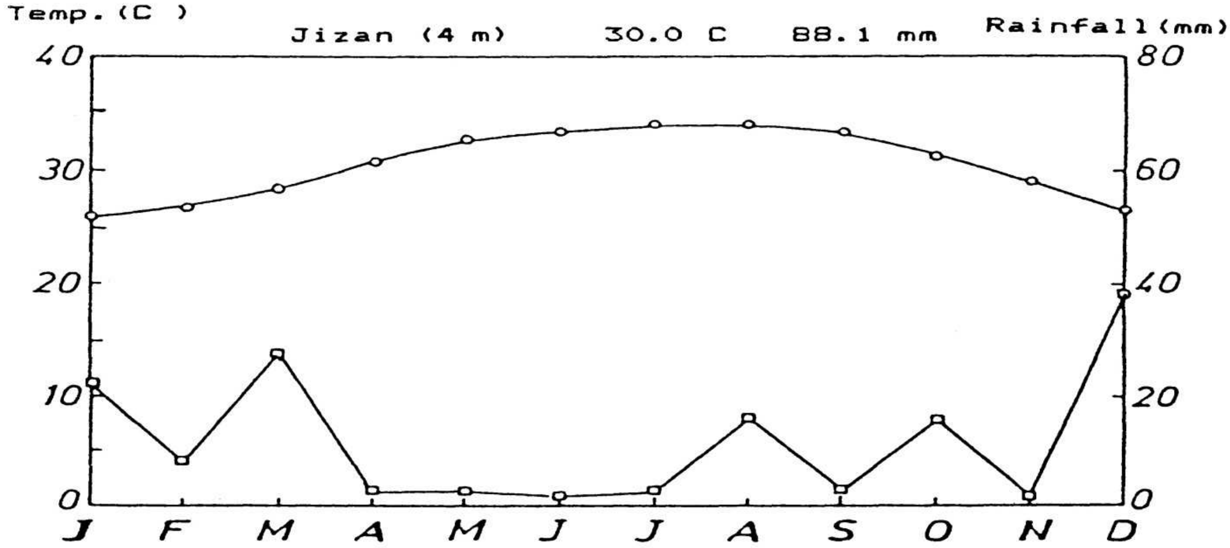


Fig.3: The climate diagram of the study area.

RESULTS

3.1. Analysis of plant communitycomposition

Eighty eight plant species related to 30 families were recorded in the study area. They constituted about 46 perennial and 42 annual species: Gramineae 27.0%, Leguminosae 12.4%, Zygophyllaceae, Euphorbiaceae and Solanaceae together 17.9%, Asclepiadaceae, Amaranthaceae, Cappariaceae and Cruciferae make up 15.9%, while the other 22 families make up 26.8% of the total (Appendix). The most common perennials recorded were: *Tephroslaapolllnea*, *Dipterygiumglaucum,Panicumturgidum* and *Acacia tortilis* (presence percentage: 40.0-57.5%). *Salvadorapersica*, *Zizlphus spina-christi*, *Leptadeniapyrotechnica*, *Calotropisprocera,Suaedamonoica,Aervajavanica,IndigoferaspinosaHeliotropiumarbainense,* and *Cassia italica* attain presence percentage ranging between 20.0 and 35.0%. The most common annuals in the study area are: *Cenchrusciliaris*, *Chloris virgata*, *Tribulusterrestris,T.longipetalus, Euphorbia prostrata, Schouwiathebaica,* and *Trianthemaportulacastrum.*Therophytes constituted about 48.3% of the total flora in the study area, followed by Chamaephytes (31.5%), Phanerophytes (10.1%), Cryptophytes (4.5%), Hemicryptophytes (5.6%). The majority of the recorded species belong to the sudanian and tropicalterritories.

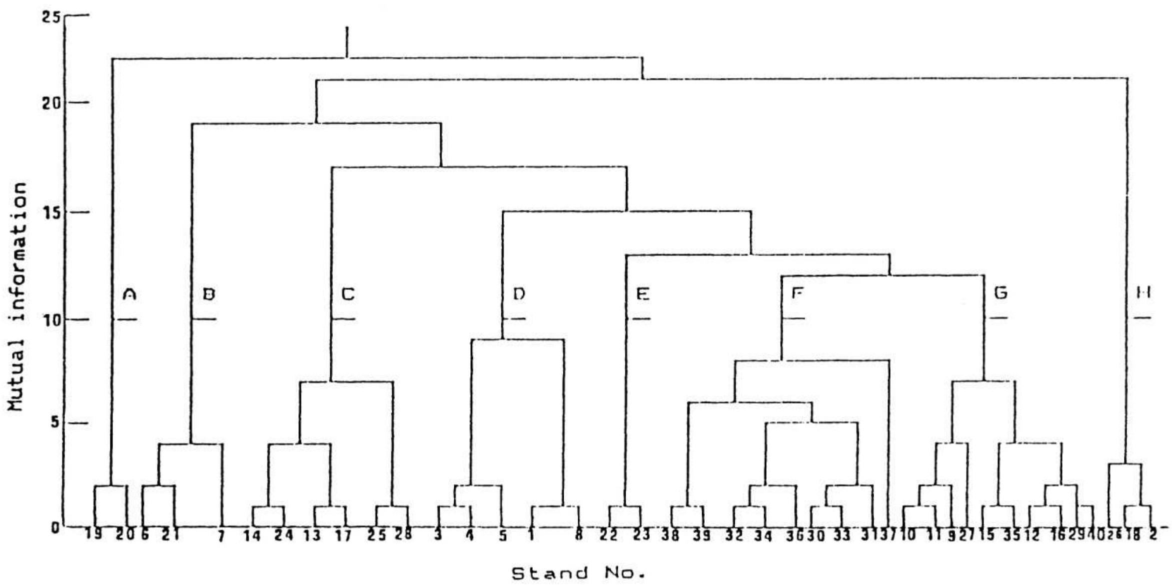


Fig.4:-**The dendrogram resulting from the cluster analysis of stands representing the study area. The dashed line denotes the levelat which thedendrogram yields eight distinct clusters:**
A:*Ziziphus spina-christi* B: *Calotropisprocera*
C:*Leptadeniapyrotechnica*D: *Suaedamonoica*
E: *Panicumturgidum*F: *Salvadorapersica*
G: *Acacia tortilis* H: *Tamarixaphylla-Cyperusconglemeratus.*

3.2. Impact factors of association group distribution

edendrogram resulting from the cluster analysis of stands representing the study area (Fig. 4&Table1), shows eight distinct clusters. Cluster 'A'comprises two stands dominated by *Ziziphusspina-christi*(IV=172.5/300), 'B' (3 stands) dominated by *Calotropisprocera* (IV=181.7), 4C (6stands) dominated by *Leptadeniapyrotechnica*(IV=161.0), 'D' (5 stands) dominated by*Suaedamonoica*(IV= 159.9), 4E' (2 stands) dominated,by*Panicumturgidum* (IV = 128.4), 'F' (9 stands) dominated by *Salvadorapersica* (IV = 122.1), 'G' (10 stands) dominated by *Acacia tortilis* (IV =86.2), 'H' (3 stands) and co-dominated by *Tamarixaphylla* and *Cyperusconglomeratus* (IV = 80 &72.3). Shortly after rainfall, the soil surface of the study area is covered with dense growth of annual species e.g. *Zygophyllum simplex*, *Chloris virgata,nchrusciliaris, Tribulusterrestris, Tribuluslongipetalus, Schouwiathebaica, Trianthemaportulacastrum,* and *Boerhaviadiffusa.*

Table 1.Means and standard devition of theimportance values (out of 300) of the perennial species in the different vegetationalclustersresulting from the agglomerative cluster analysis of stands of the study area.

Plant species	Clusters							
	A	B	C	D	E	F	G	H
Salvadorapersica	-	-	-	-	-	**122.0 ± 38.0**	**5.2 ± 9.3**	**6.1 ± 8.6 6.1**
Acacia tortilis	-	-	-	-	-	**1.4+1.4**	**86.1 ± 10.0**	
Panicumturgidum	-	-	**19 ± 29.4**	-		**2.1 ?4.1**		
Dipterygumglacum	-	**38.5 + 10**	**25.6 + 20.6**	-		**6.7 ± 17.8**		

Cassia italica	84.3 ± 16.2	14.8 + 3.7	-	-		3.2± 7		
Cassia senna	40.4 ± 0.6		3.0 ± 6.7	-		-		
Aeluropusmassuauensis	-		-			24.9±47		
Suaedamonoica	-		-	158 - ± 60.4		2.3 ± 6.0		24.0 ± 2.6
Leptadeniapyrotechnica	-		161 ± 42.1			-	7.8+13.1	
Euphorbia inarticulata	-		-			24.7±35		
Tephrosiapurpurea	2.1 + 1.6	17.8 ± 2	69.2 ± 55.3			3±7.7		
Arvapersica	0.2 ± 0.3	8.7 ± 4.9	-			1.2±2.6		
Cressacritica	-		-	32.7 ± 9.4		-		14.8 + 4.5
Sprobolusspicatus	-		-			11.2±21		
Aeluropuslittoralis	-		-			-		
Sporobolusvirgincus	-		-			-		
Corchorusdepressus	-		0.4 ± 0.8			10.5±28		
Indigoferaspinosa	-		1.8 ± 4.1			14±16.8		
Tamarixaphylla	172.5 ± 15.2		3.8 ± 8.6			-		
Abutionpannosum	-		0.3 ± 0.6			-		
Calotropisprocera	-	181.7 + 20	0.8 ± 1.7			-		
Cyperusconglumeratus	-		-			-		
Aloe vera	-		-			28.4±45		
Arstolocheabracteolata	-	17.6 ± 2.5	-			-		
Ziziphus spina-christi	-		-			-		
heliotropiumbacciferum	-		1.8 ± 4.0			0.9±2.5		
Belipharisciliaris	-		-			11.2±30		
Fagoniabruguieri	-		-			-		
Citrulluscolocynthins	-		-			-		
Carallumapenicilla	-		11.5 ± 25.8			-		
Lyciumshawii	-		1.8 ±			-		

			4.0					
Cissusquadrangular	-		-			-		
Stippagrostispulmosa	-		-			0.1±0.4		
Panicumrepens	-		-			-		

Table 2.Means and standard deviation of the different edaphic factors in the stands representing the different vegetational clusters of the study area. E.C: Electrical conductivity (?uS/cm), O.C.: Organic carbon (%), CaC03: Calcium carbonate (%), HC03: Bicarbonate (%), Na +,K+,Ca+ +, Mg+ +: Extractable cations (meql/1).

Clusters	soil factors									
	moisture (%)	pH	E.C. (µg/cm)	O.C. (%)	CaCO3(%)	HCO3(%)	Na+	K+	Ca++	Mg++
A	0.15 ± 0.05	8.50 ± 0.04	400 ± 50.0	1.5 + 0.1	0.7 ± 0.1	0.6 ± 0.2	4.5 ± 0.1	0.35 ± 0.1	9.65 ± 0.2	2.4 ± 0.3
B	1.8± 1.50	7.2 ± 0.51	138 ± 25.9	1.5 ± 0.57	3.0 ± 1.4	0.24 ± 0.05	2.3 ± 1.6	0.1 ± 0.1	28.8 ± 16.0	2.9 ± 0.29
C	0.67 ± 0.20	8.50 ± 0.34	165 ± 6.2	1.0 ± 0.33	2.2 ± 0.2	0.5 ± 0.02	3.2 ± 0.69	0.3 ± 0.1	7.25 ± 2.3	2.2 ± 0.7
D	4.2 ± 3.00	7.5 ± 0.72	469.0 ± 355.2	0.54 ± 0.74	3.2 ± 3.10	0.23 ± 0.11	44.7 ± 77.7	0.3 ± 0.38	266 ± 483	3.14 ± 0.6
E	1.5 ± 0.15	8.2 ± 0.20	110 ± 10.0	1.5 ± 0.2	1.5 ± 0.50	0.38 ± 0.01	2.4 ± 0.10	0.21 ± 0.01	3.0 ± 0.10	2.4 ± 0.2
F	1.75 ± 1.14	6.80 ± 0.36	563 ± 549	0.92 ± 0.5	0.78 ± 1.3	0.2 ± 0.1	368 ± 324	0.7 ± 2.6	459 ± 142	3.23 ± 0.29
G	0.85 ± 0.3	8.33 ± 0.6	322.5 ± 395	1.3a ± 0.8	3.6 ± 2.74	0.43 ± 0.16	5.0 ± 1.87	0.41 ± 0.27	29.7 ± 67.1	2.34 ± 0.8
H	1.5 2 ± 1.2	8.16 ± 0.94	495 ± 339.4	0.8 ± 0.50	1.7 ± 1.2	0.16 ± 0.05	6.12 ± 2.68	0.34 ± 0.07	92.3 ± 122	3.13 ± 0.73

3.3.Impact factors of vegetation indices

The results in (Table 2) demonstrate the variation in edaphic factors between the different groups of stands representing the eight clusters of the vegetation in the study area. It is clear that communities of *Salvadorapersica*, *Suaedamonoica* and *Tamarixaphylla-Cyperusconglomeratus*dominates saline soils with an E.C.ranging between 400 and 563 /µS/cm, while communities of *Panicumturgidum*, *Calotropisprocera* and *Leptadeniapyrotechnica* dominates sites with the lowest salinity levels (E.C: 110-165 ^uS/cm. The*Suaedamonoica*community type dominates the sites with high moisture content (4.2%), while the very dry sites are dominated by communities of *Ziziphus spina-christi*, *Leptadeniapyrotechnica* and *Acacia tortilis* (0.15-0.85%). All communities dominate ites with alkaline soil except *Salvadorapersica* dominates places with slightly acidic soil.*Suaedamonoica* dominates communities growing on soil with the lowest content of organic carbon (0.54%). The maximum level of calcium carbonate was recorded in the soil under communities of *Acacia tortilis*,*Suaedamonoica* and *Calotropisprocera* (3-3.55%). The soil bicarbonate content recorded its maximum level under *Ziziphus spina christi* and *LeptadeniaPyrotechnica* communities (0.51-0.6%), while the minimum level was recorded in soils co-dominated by *Tamarixaphylla-Cyperusconglomeratus*. With regard to soil soluble cations, soil dominated by *Salvadorapersica* attained the maximum levels (Na+: 368.3,K+: 3.7, Ca++: 458.9 & Mg++: 3.23 meq/1).The minimum levels of sodium and calcium was recorded in soil inhabited by

Panicumturgidum, while that of potassium was recorded in soil in habited by *Calotropisprocera.* The soil dominated by *Leptadeniapyrotechnica* showed the minimum level of magnesium. The ordination of stands indicated a clear distinction of the groups obtained by the agglomerative cluster analysis (Fig.5). Groups A and F lie nearly on the positive side of axis I and the negative side of axis II. Group C occupies the positivepart of both axes, while groups B and G occupy the positive sides of axis II and the negative side of axis I. In the meantime, groups D, E and H occupy the negative sides of both axes. Table 3 shows that soil pH, bicarbonate, sodium, and potassium calcium and sodium adsorption ratio have high significant correlation with axis I, while soil pH, moisture, electrical conductivity bicarbonate and calcium carbonate show significant correlations with axis II.

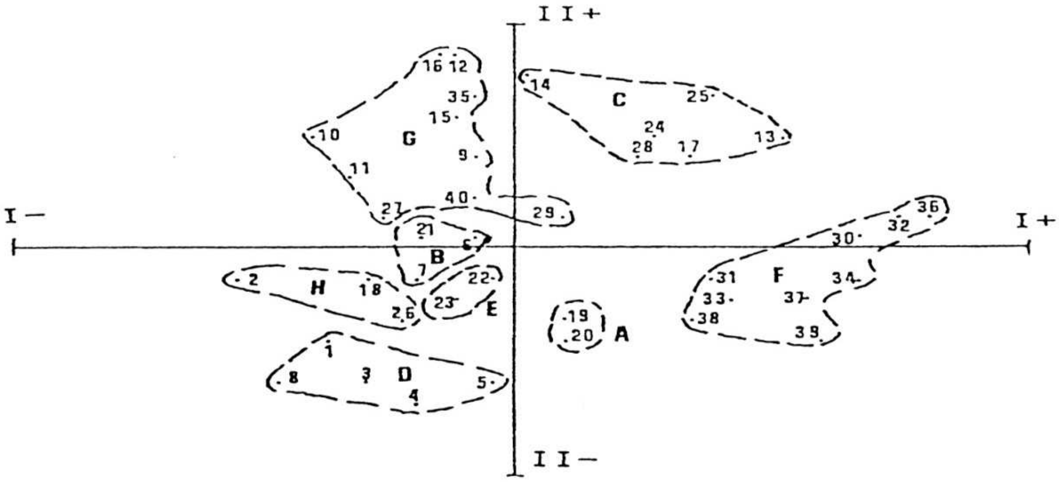


Fig. 5. Stand ordination of the study area on the first and second axes derived from the principal component analysis (PCA).The classification of standsby the cluster analysis is superimposed.

Table 3.Simple linear correlation coefficients (r) between the 1st & 2nd component axes as determined by the principal componentanalysis, and the edaphic variables (E.C: electrical conductivity, O.C.: Organic Carbon, *: P = 0.05, **: P = 0.01, ***:P =0.001).

Axes	Soil variables											
	pH	Moisture	E.C.	CaC03	O.C.	HC03	Na+	K+	Ca++	Mg++	PAR	SAR
I	-0.6118***	-0.0367	+0.0367	-0.3302**	-0.1510	-0.4268***	+0.5252***	+0.4951***	+0.6279***	+0.3087	+0.4968***	+0.1023
II	+0.3594*	-0.3388**	-0.3649*	+3858**	+1853	+3467*	-0.2479	-0.2226	-0.2466	-0.2856	-0.2431	-0.1385

DISCUSSION

Floristic Patterns with EcologicalGradients:

Impact Factors on Distribution, Characteristics of natural plant communities in Jazan region, Saudi Arabia demonstrate remarkable change from one site to other in the study area. The study area represents a continuation of the Sudanian tropical region with close similar climatic and topographic condition; therefore most of the recorded species in this study are afro-Tropical ones.

[46], regarded Southern Arabia and Ethiopia as a single phytogeographical unit, the Eritreo-Arabian province. In the meantime, [47], reported that the floristic composition of Southwest Arabia, especially those of the interior deserts show some floristic affinities to the Irano - Turanian and Mediterranean territories.

According to Koppen's climatic system, the Tihamah coastal area lies within the subtropical dry zone of the desert, characterized with high temperature ranges (29-38 °C), relative humidity(64.2 %), and low rainfall (0.8-19.0 mm). Summer rainfall is connected with the influence of Indian monsoon, while, the winter rainfall is related to the Mediterranean regime [48]and [42].Since the local climate over the coastal plains of Tihamah is almost uniform, therefore, the distribution and species composition of the plant communities seem to be more affected by various edaphic factors.Shortly after rainfall, the soil surface of the study area is covered with dense growth of annual species,e.g. *Zygophyllum simplex*, *Chloris virgata*,*Cenchrusciliaris*, *Tribulusterrestris*, *T. longlpetalus*, *Schouwiathebaica*, *Trianthemaportulacastrum*, and *Boerhaviadiffusa*. The amount and seasonally of rainfall together with the high temperature controls the growth of these communities.

[49], reported similar communities inthe coastalplain, foothills and wadis of the gulf of Elat and demonstrated that these communitiestolerate lower annual temperature (23-26C) and receivehigher annual rainfall (5-30 mm) ascompared to habitat condition in Tihamah plains(29-38 °C& 0.8-19 mm respectively). [50], reported that *Ziziphus spina-christi*growsin diffusedpattern on the Mediterranean coastalplains and in the Jordan Valley, and that *Tamarixaphylla* has a very wide range of distribution inNorth & South Africa and Western Asia, anddescribed*Suaedamonoica* as thermophilic species which cannot withstand even mild winter.[51], reported *Acacia tortills* as a Sudanian treedominating the more arid places of thesouthern coast of Sinai. [52],and [13].Described similar communitiesalong the coastal plains of the Saudi Red Seacoast.[42], gavedetaileddescription of the habitats and plantcommunities in Tihamahplains on the coast ofYemen. Kassas and [53], and [54],described similar communitiesalong the Egyptian Red Sea coast.

According to [43],the southern Arabian phytogeographicalregion(including Yemen) contains 2000-2500species of the flowering plants[55]. The most important tropical genera in Arabia are Acacia, Indigofera, Euphorbia, Solanum, Aristida, Caralluma, Tephrosia, Pulicaria, Barleria, Grewia, Commiphora, and Cadaba. About 20% of the floristic elements of southern Arabia are endemic [56],[57].

The present study records 88 species in 30 familiesinthe Tihamah coastal plains of Jazan region, of which 46 are perennial and 42 annual. Multivariate analysis including classification and ordination can provide more detailed and comprehensive information on the patterns in vegetation and the response of plant species to the underlying gradients [58], [59].The classification of the stands representing the study area using the agglomerative cluster analysis led to the identification of eight major plant community types forming the major part of the natural vegetation. These communities are dominated by nine perennials: Ziziphus*spina Christi* growing mainly inwadis characterized with fine soil, with high water retaining power. While communities dominated by *Calotropisprocera* always inhabit sand plains around villages and farms. *Leptadeniapyrotechnica*, *Panicumturgidum*, and *Acacia tortilis* community types dominate the inland hyperarid sand plains forming a poor savanna scrub. Communitiesdominatedby*SalvadoraPersica*occupy old wadi beds characterized with its salt affected sandy soil. This habitat represents a transition between sand plains and salt marshes. In the meantime, communities dominated by*Suaedamonoica*, *Tamarixaphylla* and *Cyperusconalomeratus* occupy the salt marsh habitat type.

The study area represents a continuation of the Sudan region which has close similar climatic and topographic features, therefore most of the recorded species are Afro-Tropical ones, and belong to the Paleotropic kingdom [76].

Scrub savanna include a wide range of vegetation types and are defined in many different ways. [61], grouped savanna in three groups: climatic, edaphic and anthropogenic savanna. Synthetically, savanna can be characterized by a continuous herbaceous layer and a discontinuous cover of shrubs and trees [62].

Besidesspatial variations in the species composition of plant communities, the composition of life-forms reflects theresponse of vegetation tovariation in certain environmental factor. The life-formspectra is thought to be either a hereditary adjustment to environment [63], or represent the residual effects of somehistorical, climatic or biotic conditions on the population of the plant [50]. In thisstudy, therophytesare the most frequent life-form in thestudy area, followed by chamaephytes,phanerophytes, cryptophytes, hemicryptophytes.

The dominance of both therophytesandchamaephytes over the other life-forms in Tihamah coastalplains seem to be a response to the hot dryclimate, topographic variations, and biotic influence. Acomparison of the life-form spectra, indicates that the Southernregion contains moretherophytes, chamaephytes and less hemicryptophytes (48.3, 31.5 & 5.6%) than the Eastern region (46, 23 and 6%) respectively. In the meantime, it contains almost the same figure ofcryptophytes about 4.5% and about half of thephanerophytes (10.1%).

The correlation analysis demonstrated that pH, bicarbonate, sodium, potassium, and calcium to sodium adsorption ratio have high significant correlation, while soil pH, moisture, electrical conductivity, bicarbonate and calcium carbonate showed significant correlations as (Fig. 5). The ratio Na +/ (Ca + + + Mg ++), and K %/(Ca% + Mg %) determines the adsorption pattern of these cations by the exchange complex [50], [63],[11], [12].However, our results showed that silt and clay content, organic matter and electrical conductivity are mainly related to vegetation distribution. In addition, [64] reported that edaphic factors provide the primary explanation for describing the distribution of plant communities in the Western Desert of Egypt. Soil texture controls dynamics of soil organic matter in many simulation models or organic matter decomposition and formation [65], [66], [67],and influences infiltration and moisture relation and the availability of water and nutrients to plants [68]. Under the condition of low and irregular rainfall which prevail in the study area, local topography and water redistribution within the local landscape [69], [70].

In accordance with the other studies of the desert ecosystems [71], [5], [7], [72],[73], [74],[60], the present study indicated that the distribution of the recognized plant communities in Jazan region is affected mainly by physiographic features, climatic conditions as well as soil attributes, and that these communities are modified both in their distribution and abundance by the effects of some other factors that threaten the plant life in Tihamah area including:- a)Agricultural activities, b) Heavy grazing, c)Woodfuel cutting and d)Termites [13], [76], [77].

Spatial distribution of plant species and communities over a small geographic area in desert ecosystems is related to heterogeneous topography and landform pattern [78]. The heterogeneity of local topograohy, edaphic factors, microclimatic conditions lead to the variation in the distributional behavior of the plant associations of the study area.

On thetropical scale, [79], detectedsome similar communities on an aridmistymountainplateau in Sudan and concluded thatthespecies composition, at all spatial scales isdirectly or indirectly related to variation in temperature and moisture. [80]While dealing with the vegetation typesandpatterns in Senegal described communities of *Calotropisprocera*, *Acacia tortilis* and *Ziziphus spp.*in the Sahelian grassland.

In conclusion, this study showed that the vegetation in thestudy area belongs to the Sudanianterritory. Edaphic factors play the leading role inthe distribution of the differentplant communitytypes. Human and animal impacts modified thedistribution and abundance of the plant speciesand life-formspectrum.

ACKNOWLEDGEMENT
This work was carried out whileSalman A. A is working as a teaching staff as assistant teacher in Biology department, Faculty of science, Jazan University, Saudi Arabia, and M. A. Nabih an assistant lecture in Faculty of Science, Biology department, Jazan University, Saudi Arabia.

REFERENCES

[1].Abulfatih, H. A. Wild plants of Abha and its surroundings Proceeding of the Saudi Biol. Soc. 1981; 5: 143-159.

[2]. Vesey-Fitzgerald, D.F. (1955). Vegetation of the Red Sea coast south of Jedda, Saudi Arabia. Journal of Ecology, 43: 477–489.

[3].Khodair, A. Ecological studies in Riyadla district. M.Sc. Thesis, Ain Shams University, Egypt. 1963.

[4].Popov, G. &Ziller, W. Ecological Survey Report on the 1962 survey in the Arabian Peninsula, U.N. Special Fund, Desert Locust Project Programme Report (FAO(U'NSF/DC/ES6). 1963; 94 pp.

[5].Batanouny, K. G. Vegetation along the Jeddah-Meccaroad: patteren and process as affected by human impact. J. of Arid Environ. 1979; 2: 21- 30.

[6].EI-Sharkawi, H.M., Fayed, A.A. &Salama F.M. Vegetation of inland desert wadisin Egypt. II. Wadi E1-Matuli and Wadi E1-Qarn. FeddesReportorium, 1982; 93: 125-133.

[7].Zahran, M. A. Vegetation types of Saudi Arabia. Fac. of Meteoro. And Arid Environ. King Abdul-Aziz Univ. press.Jeddah.1982; pp. 61.

[8].Batanouny, H. H. &Baeshin, N. A. Plant communities along Medina- Badrroad across the Hedjaz mountains,Saudi Arabia. Vegetation. 1983; 53: 33-43

[9].Younes, H. A., Zahran, M. A. & E1-Qurashy, E.M. Vegetation-Soil relationship of a sea-inlandward transect, Red Sea Coast, Saudi Arabia. J. of Arid Environ. 1983; 6: 349- 356

[10].Baierle, H. V., El-Sheikh, A. M. & Frey, W. Vegetation and Flora immittleren Saudi Arabien (AI-Taif-Riyad), Beih. Tubinger Atlas Vorder Orient, Reihe A (Naturwissenschaften), 22: Wiesbaden. 1985.

[11].Salman A. A**.**,2015.Correlation between plant distribution and edaphic factors in coastal plains of Jazan region, Saudi Arabia.Journal of Applied Biology & Biotechnology Vol. 3 (03), pp. 042-049.

[12].Salman A. A**.**, 2016. Life- form and geographical distribution of plants in along altitudinal gradient in south- west Saudi Arabia. **Journal of Global Biosciences** ISSN 2320-1355 Volume 5, Number 1, 2016, pp. 3591-3603

[13].Zahran, M. A., Younes, H. A. &Tawil, B. A. 1985. Ecology of four community types: Red Sea coastal desert, Saudi Arabia. J. of Coastal Res. 1No. 3: 279-288.

[14].AI-Sheriff, A. S. The Geography of Kingdom of Saudi Arabia. Part II: The SouthWestern Province. Dar E1-Marikh. Riyadh. 1984; pp 483.

[15].El-Demerdash, M. A. &Zilay A. M. 1993. An Introduction to habitats and plant communitiesinTihamah coastal plains of Jazan area, Saudi Arabia.(Submitted to the Arab Gulf J. of Sei.Res.).

[16].Hegazy, A.K., El-Demerdash, M.A., and Hosni, H.A. Vegetation, species diversity and floristic relations along an altitudinal gradient in south-west Saudi Arabia. Journal of Arid Environments. 1998; 38: 3- 13

[17].E1-Demerdash,M.A., A. K. Hegazyt and A. M. Zilay. Vegetation-soil relationships in Tihamah coastal plains of Jazan region, Saudi Arabia.Journal of Arid Environments.1995; 30:161-174.

[18].Byeong M M, Kim J H, 1997. Soil texture and desalination after land reclamation on the West coast of Korea. Korean Journal of Ecology, 120(2): 133–143.

[19].Ukpong I E, 1997. Salinity in the Calabarmangrove Swamp. Ni- geria: Mangroves and SaltMarshes.

[20].Critchley C N R, Chambers B J, Fowbert J A et al., 2002. Plant species richness, functional type and soil properties of grass- lands and allied vegetation in English environmentally sensi- tive areas. Grass and Forage Science, 57(2): 82–92. doi: 10.1046/j.1365-2494.2002.00305.x

[21].Abd E I, Ghani M M, Amir W M, 2003. Soil vegetation relation- ships in a coastal desert plain of southern Sinai, Egypt. Journal of Arid Environments, 55(4): 607–628. doi: 10.1016/0140- 963(02)00318-X

[22].He Qiang, Cui Baoshan, Zhao Xinsheng et al., 2009. Relation- ships between salt marsh vegetation distribution/diversity and soil chemical factors in the Yellow River Estuary, China. ActaEcologicaSinica, 29(2): 676–687. (in Chinese)

[23].Yang Jinsong, Yao Rongjiang, 2009. Evaluation of soil quality in reclaimed coastal regions in North Jiangsu Province. Chinese Journal of Eco-Agriculture, 17(3): 410–415. (in Chinese)

[24].Schmidt, D. L., Hadley, D. G., Greenwood, W. R., Gonzalez, L. Coleman, R. G. & Brown, G. F. Stratigraphy and Tectonism of the Southern part of the Precambrian Shield of Saudi Arabia: U.S. Geological Survey, Saudi Arabian Project Report. 1972; pp.136-139.

[25].Anonymous. Surface Annual Climatological Report. 1964-1990. Climate Directorate, Jazan Airport (personal communication). 1990

[26].E1-Demerdash, M.A., A. K. Hegazyt and A. M. Zilay. Distribution of the plant communities in Tihamah coastal plains of Jazan region, Saudi Arabia. Vegetatio.1994; 112: 141-151.

[27].Moustafa, A. and J. Klopatek. Vegetation and Landforms of the St. Katherine area, Southern Sinai, Egypt. Journal of arid Environments, 1995; 30: 385-395.

[28].Hegazy, A.K., El-Demerdash, M.A., and Hosni, H.A. Vegetation, species diversity and floristic relations along an altitudinal gradient in south-west Saudi Arabia. Journal of Arid Environments.1998; 38: 3- 13.

[29].Salman A. A.. Ecological studies on vegetation of wadi systems on South Sinai, Egypt, Ph.D. Thesis, Botany Department, Fac. of Sci., Ismailia, Suez Canal University, Egypt, 2004; pp: 188.

[30].Ball, D.F. Site andsoils .In: Champan,S.B. (ed.):mendos in plant ecology Blackwell Scientific Publications. 1976; Pp. 297-367.

[31].Hausenbuiller.R. L. Soil Science Principles and Practices. 3ed., C. Brown Company Publishers, 1985; 610 pp.

[32].Wild,S. A., and Voigt, G. k., and Lyer, J. G. Soil and plant analysis for tree culture. Edition by Golden Chester.Applied Science Publishers. 1972; 172 pp

[33].Page, A. l., Miller, R. H &Keeney,D. R. Methods of soil analysis . part 2- chemical and microbiological properties, Agronomy, 1982; 9 (2), Madison, WI

.

[34].Ren Jizhou, 1998. Grassland Research Methods. Beijing: Chinese Agriculture Press. (in Chinese)

[35].TerBraak, C. and P. Smilauer. CANOCO Reference Manual and Cano Draw for Windows User's Guide: Software for Canonical Community Ordination Version 4.5). MicrocomputerPower, Ithaca, New York. 2002.

[36].Hejcmanova-Nezerkova, P. and M. Hejcman. A canonical correspondence analysis CCA) of the vegetation-environment relationships in Sudanese savannah, Senegal. South African Journal of Botany, 2006; 72: 256-262.

[37].Leps, J. and P. Smilauer. Multivariate Analysis of Ecological Data Using CANOCO.Cambridge University Press, Cambridge, UK. 2003; pp: 282.

[38].Hill, M.O. TWINSPAN–A FORTRAN Programme for Arranging Multivariate Data in an Ordered Two-way Table by Classification of Individuals and Attributes. Cornell University, Ithaca, N.Y., 1979; pp: 90.

[39].Tackholm, V. Students Flora of Egypt. 2 "d ed., Cairo Univ. Press. 1974; pp. 888

.

[40].Migahid, A. M. Flora of Saudi Arabia. 3nd ed. Vol. 1 and 2, King Saud Univ. Press. 1989.

[41].Batanouny, K. G. Ecology and Flora of Qatar. Centre for Sci. and Applied Res. Univ. of Qatar, Alden press, Ltd. Oxford. 1981; pp 239.

[42].AI-Hubaishi, A. &Hohenstein, K. M. An Introduction to the Vegetation of Yemen. Ecological Basis, Floristic Composition and Human Influence. Deutsche GesellschaftftlrTechnischeZusammenarbeit (GTZ) GmbH. 1984; pp 209.

[43].Mandaville, J. P. Flora of Eastern Saudi Arabia. Kegan Paul International Ltd. London and New York, 1990; pp 482.

[44].Boulos,L. Flora of Egypt: volume four (Alismataceae- Orchidaceae). Al-Hadara publishing, Cairo, Egypt, 2005; pp:617

[45].Boulos,L. Flora of Egypt: (Chacklist revised annotated Ed.). Al- Hadara publishing, Cairo, Egypt, 2009; pp:410

[46].Newton, L. E. 1980. Phytogeographical Associations of the succulent plant Flora of South-West Arabia and the Horn of Africa. Nat. Cact. Succ. J. 35: 83-88.

[47].Zohary, M. 1973. Geobotanical foundations of the Middle East.vol. 1-2 Gustav Fischer Verlag, Stuttgart.

[48].AI-Sheriff, A. S. The Geography of Kingdom of Saudi Arabia. Part II: The SouthWestern Province. Dar E1-Marikh. Riyadh. 1984; pp 483.

[49].Danin, A. 1983. Desert Vegetation of Israel and Sinai.Cana Publishing House, pp. 148.

[50].Waisel, Y. Biology of Halophytes. Academic Press.New York and London.1972; pp. 395.

[51].Halevy, G. &Orshan, G. Ecological studies on Acacia species in the Negev and Sinai. 1 - Distribution of Acacia raddiana and A. gerrardii spp. negevensis as related to some environmental factors. Israel J. Bot. 1972; 21: 197-208.

[52].Zahran, M. A. 1982. Vegetation types of Saudi Arabia. Fac. of Meteoro, and Arid Environ. King Abdulaziz Univ. press.Jeddah.pp. 61.

[53].Kassas, M. A. &Zahran, M. A. Studies on the ecology of the Red Sea coastal land. II. The district from EI-GalalaEI-Qibliya to Hurghada. Bull. Soc. de Georaphied'Egypt.1965; 38: 155-193.

[54].Zahran, M. A. &Mashally, I. A. Ecological notes on the flora of the Red Sea coastal land of Egypt. Bull. Fac.Sci.Mansoura Univ. 1991; 18: 251-292

[55].Salman A. A.. Ecological studies on cement dust pollution on vegetation of Amran, Reoublic of Yemen,M.SC. Thesis, Botany Department, Faculty of sciences, Sanaa University 1992 pp.155.

[56].Schwartz, O. Flora des tropischenArabien. Mitt.Inst, allg.Bot, Hamburg.1939; 10: 1-393.

[57].Salman A. A., Zaghloul M.S. and Moustafa A,A. Impact of Improved Soil Properties on Establishment of Moringaperegrina Seedlings and a Trial to Decrease its Mortality Rate. Egypt. J. Bot. (2012).

[58].Gauch, H. Multivariate Analysis in Community Ecology. Cambridge University Press, Cambridge. 1982.

[59].TerBraak, C. Ordination. In: Jongman, R.H., TerBraak, C.J., Van Tongeren, O.F. Eds.), Data Analysis in Community Ecology and Landscape Ecology. Cambridge University Press, Cambridge. 1995; pp: 91-173.

[60].Salman A. A. and Zaghloul,.Usage of Herbal Remedies for the Management of Vaginal Infection among Women in Jazan Area at Saudi Arabia. The EgyptionSocityForEnviromental Science. CATRINA), 2012; 7 (1):87-96.

[61].Backeus, I. Distribution and Vegetation dynamics of humid savannas in Africa and Asia. J. of Veget.Sci.1992; 3:345-356.

[62].Vetaas, O. R. Gradients in field - layer vegetation on an arid misty mountain plateau in the Sudan. J. of Veget. Sci. 1992; 3: 527-534.

[63].El-Demerdash, M. A. 1984. Ecological Studies on Juncus Plants. Ph.D. Thesis, Fac. of Sei., Mansoura Univ., Egypt, pp. 156.

[64].Ayyad, M. A. & El-Ghareeb, R. Salt marsh vegetation of the western Mediterranean desert of Egypt. Vegetation.1982; 49: 3-19.

[65].Ayyad, M. The vegetation and environment of the western Mediterranean coastal land of Egypt. IV. The habitat of non-saline depressions. Journal of Ecology, 1976; 64: 713-722.

[66].Parton, W., J. Stewart and V. Cole. Dynamics of C, N, P and S in grassland soils: a model. Biogeochemistry, 1988; 5: 109-131

.

[67].Raich, J., E. Rastetter, J. Melillo, D. Kicklighter, P. Steudler, B. Peterson, A. Grace, B. Moore III and C. Vorosmarty. Potential net primary productivity in South America: application of a global model. Ecological Applications.1991; 1: 399-429.

[68].Rastetter, E., M. Ryan, G. Shaver, J. Melillo, K. Nadelhoffer, J. Hobbie and J. Aber.A general biochemistry model describing the responses of the C and N cycles in terrestrial ecosystems to changes in CO2, climate and N deposition.Tree Physiology.1991; 9: 101-126.

[69].Sperry, J. and U. Hacke. Desert shrub water relations with respect to soil characteristics and plant functional type. Functional Ecology. 2002; 16: 367-378.

[70].Salman A. A..and Mohamed. F. Azzazy. Pollen Grains Indicators to Plant Habitat Conditions at Some Arid Regions Sadat Area Egypt.CATRINA (2013), 8 (1): 21 – 28

[71].Zohary, M. Plant Life of Palestine, Israel and Jordan. Ronald Press, New York, 1962; pp: 262.

[72].Kassas, M. A. & Imam, M. Habitat and plant communities in the Egyptian desert. III. The wadi-bed ecosystem. J. Ecol. 1954; 42: 424- 441.

[73].Abd El-Ghani, M. Environmental correlates of species distribution in arid desert ecosystem of eastern Egypt. Journal od Arid Environments, 1998; 38:297-313.

[74].Salman A. A., Zaghloul M.S. and Moustafa A,A, Conservation and Productivity of Two Threatened Species Nepetaseptemcrenata and O riganumsyriacum subsp. Sinaicum in Saint Catherine Protectorate, South Sinai, Egypt.. Assiut Univ. J. of Botany 2010 , 39(1), P-P.81-99.

[75]Salman A. A.,and Mohamed. F. Azzazy.Determination of Honey Floral SourcesUsing Pollen Grains. Journal of Jazan University - Applied Sciences BranchVol.2 No.2 May 2013 (Rajab1434 H)45.

[76].White, F. & Leonard, J. Phytogeographical leaks between Africa and southwest Asia. Flora etVegetatio Mundi.1991; 9: 229-246.

[77].Salman A. A., Moustafa., A.A., Zaghloul., M.S and Raafat.,H.Monitoring of population dynamics of the Acacia species populations in Southern Sinai, Egypt.**Journal of Global Biosciences** (ISSN 2320-1355) Volume 4, Number 5, 2015.pp.2119-2123.

[78].Salman A. A.,Moustafa., A.A., Zaghloul., M.S and Raafat.,H. . Age structure of Ficusbenghalensis L.: a Threatened Introduced Population in Ismailia, Egypt. Life Science Journal 2014;11(11):90-97

[79].Kassas, M. and K. Batanouny. Plant Ecology. In: Cloudsley- Thompson, J.J. Ed.), Sahara Desert. Pergamon Press, Oxford. 1984; pp: 348.

[80].Frederiksen, P. &Lawesson, J. E. 1992. Vegetation types and patterns in Senegal based on mulitivariate analysis of fieldand NOAA-AVHRR satellite data. J. ofVeget.Sei.3: 535- 544.

Appendix

Floristic List of the Recorded Species in Coastal Plains of Jazanregion,Saudi Arabia.

1. Acanthaceae: *Blephariscilliaris CL.)* B.L.Burtt
2. Aizoceae: *Aizooncanariense*L.;*Tr~anthemaportulacasrrumL.*
3. Amaranthaceae: *Aeroajavanica*(Burro. f.) Juss.;*Amaranthusgraecizans*L.; *Digeramuricata*(L.)Mart.
4. Aristolochiaceae: *AristolochiabracteolataLain.*
5. Asclepidaceae: *Calotropisprocra*(/kit.) Aitf.;*Carallumapenicillata*(Deft.) N.E. Br.;*Leptadeniapyrotechnica*(Forssk.)Decne.
6. Boraginaceae: *Heliotropiumarbainense*Fresen.
7. Capparaceae: *Capparis decidua* (Forssk.) Edgew.;*Capparisspinosa*L.; *Cleome viscosa*L.;*Dipterygiumglacuum*Decne.; *Crynandropsisgynandra (L.)*Briq.
8. Chenopodiaceae: *Halopeplisperfoliata*(Forssk.) Bunge ex Schweinf.;*Suaedamonoica*Forssk.
9. Commelinaceae: *Aneilematacazeanum*Hochst. ex. C.B.C1.
10. Compositae: *Launaea sp.; XamhiumspinosumL.*
11. Convolvulaceae: *CressacrericaL.*
12. Crucfferae: *Anastaticahierochuntica*L.:; *Savignyaparviflora*

(Del.) Webb *Schouwiathebaica*Webb

13. Cucurbitaceae: *Citrulluscolocymhis (L.)*Schrad.
14. Cyperaceae: *Cyperusconglomeratus*Rottb.
15. Euphorbiaceae: *Euphorbia hirta*L.; *Euphorbia articulata*L.; *Euphorbia prostrata*Ait.;*Euphorbia aculeata*L.; *Jatropha glaucaVahl*
16. Gramineae: *Aduropuslagopoides*(L.) Trill. exThw.;*Aeluropuslittoralis*(Gouan) Parl.;*Cenchrusciliaris*L.; *Chloris virgata*Sw.; *Crypsisaculeata (L.)* Alton; *Cutandiadicotoma*(Forssk.) Trabut; *Cutandiamemphitica*(Spreng.) Benth.;*Dacrylocteniumae~ptium(L.)*

P. Beauv.; *Digitaffaciliaris*(Retz.) Koel; *Digitariasanguinalis (L)* Scop.;*Echinochloacolona (L.) I.£mk; Eragrostiscilianensis*(All.) Vign.-Lut.; *Imperatacylindrica (L.)*Raeusch; *Panicumrepens*L.;*Panicumturgidum*Forssk.;*Phalaris minor* Retz.; *Polypogonmonspeliemis (L.)* Desf.;*Rosrrariacristata (L.)* Tzvelev.;*Setariaverticillata*(L.) P. Beauv.; *Setaffaviridis (L.) P.* Beauv.; *Sorghum bicolor (L.)* Moench; *Sporobolusplumosa (L.)*Munro ex T. Anders.; *Sporobolusspicatus (Vahl)* Kunth; *Sporobolusvirginicus (L.)Kunth*

17. Leguminoseae: *Acacia ehrenbergiana*Hayne; *Acacia mellifera (Vahl)* Benth.;*Acaciaraddiana*Savi; *Acacia torrilis*subsp, *radiana*(Forssk.) Hayne; *Indigoferahochstetteri*Baker; *Indigoferaspinosa*Forssk.;*Rhynchosia minima (L.)* DC. vat. *memnonia*(Del.) Cooke.; *Senna alexandrina*Forssk.; *Senna italica*Mill.; *Tephrosiaapollinea*(Del.) Link; *Trigonellahierosolymitana*Boiss.
18. Liliacea: *Aloe vera L*
19. Malvaceae: *Abutilon pannosum*(Forst. f.)Schlecht.
20. Portulacaceae: *PortulacaoleraceaeL.*
21. Rhamnaceae: *Ziziphus spina-christi (L.)*WiUd.
22. Salvadoraceae: *SalvadorapersicaL.*
23. Scrophulariacaea: *Strigahermomhica*Benth.
24. Solanaceae: *Datorainnoxia*Mill.;*Datorastramonium*L.;*Lyciumshawii*Roem. &Schult.;*Solanumincanum*L.; *Solanum nigrumL.*
25. Tamaricaceae: *Tamarixmannifera*(Ehrenb.)Bunge
26. Tiliaceae: *Corchorusdepressus (L.)*Stocks

27. Urticaceae: *UrticaurensL.*
28. Vitaceae: *CissusquadrangularisL.*
29. Zygophyllaceae: *Fagoniabruguieri*DC.;*Fagoniaindica*Burro. f.; *Tribuluspentandrus*Forssk.;*Tribulusterrestris*L.; *Zygophyllum album* L.; *ZygophyllumsimplexL.*
30. Cleomaceae *Cleome viscose*L.