Asian Journal of Applied Sciences (ISSN: 2321 – 0893)
Volume 02 – Issue 05, October 2014

Phytosociological Studies of the Southern Sector of Tihahma Hill Slopes of Jazan Region, South West of Saudi Arabia

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ABSTRACT--- ***The present study provides an analysis of quantitative vegetation gradient and the edaphic variables in Tihamah hill slopes of Jazan region. A total of 68 species belonging to 31 families of the vascular plants were recorded from 17 sites. Phanerophyte and chamaephytes were most frequent, denoting a typical desert life form. Classification of the vegetation analyzed using two-way indicator species analysis (TWINSPAN) techniques, resulted in estimation of five major community types: Acacia ehrenbergiana Haynem, Anisotes triculcus (Forssk.) DC, Salvadora persica L and Ziziphus spina-christi (L.) Willd communities; Salvadora persica L. Ziziphus spina-christi (L.) Willd and Acacia asak (Forssk.) Willd communities; Acacia ehrenbergiana Haynem, Aerva javanica (Burm.f.) Juss and Indigofera spinosa Forssk communities; Dactyloctenium scindicum Boiss, Schweinfurthia pterosperma Rich and Acacia tortilis (Forssk.) Hayne communities and Tamarix nilotica (Ehrenb) Bunge and Dobera glabra (Forssk.) Juss communities. In addition, soil pH, organic carbon, calcium, magnesium, carbonate, moisture content, and chloride are the main operating edaphic factors in this area. The relationship between the vegetation and soil parameters were carried out by techniques of correspondence analysis (DCA). ANOVA program revealed fine sand and silt percentage were the most significant factors affecting the distribution of species and Acacia ehrenbergiana is the most common community in the present work.***

Keywords--- Arid ecosystems, Desert vegetation, Multivariate analysis, Plant communities, Saudi Arabia

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1. INTRODUCTION

The natural conditions and geographical position of the Jazan province make it a very distinctive region. This south-western region of Saudi Arabia is unique with regard to its nature, landform, climate and water availability (Abulfatih, 1981). Several studies on plant communities and floristic of Saudi Arabia were done (Vessey- Fitzgerald 1955, Baierle *et al.* 1985, Younes *et al.* 1983; Zahran *et al.* 1985; Batanouny 1979, and Batanouny & Baeshin, 1983). A1-Sheriff (1984) recognized Jazan region geomorphologically, into three main sectors Mountains; E1-Sarwat mountains, Plains: Tihamah coastal plains and Islands: including those between Jazan city and Farsan Islands. Correlation of soils and vegetation are important for most investigations of plant habitats. In the arid regions of Tihamah, E1-Demerdash and Zilay (1993) distinguished five ecosystems. El-Demerdash *et al.* (1994 & 1995) studied the plant communities and their distribution with the soil factors of the community. Hegazy *et al.* (1998) studied the altitudinal zonation, community types and species diversity of the vegetation starting from the sea level of Tihamah plains including a small area. Recently, Masrahi (2012) divided Jizan into three main regions; Tihamah coastal plain (including Farasan Island), Tihamah hill slopes and the mountains; described 524 plant species whether common species or rare. He also classified the vegetation characteristics of the main plant communities of this region. The present work aims at studying the vegetation characteristics of the southern sector of Tihama hill slopes of Jazan region and edaphic factors affecting the distributions of these communities.

2. MATERIALS AND METHODS

A total of 17 stands in 10 sampling quadrats (10 x10 m^2) have been caused to study the vegetation. These stands covered the main physiographic diversity of the area under study variations. A quantitative survey of the vegetation was carried out during the period of summer 2012 to autumn of the same year. Al Arda represented the center of sites; as the sites 1-8 lie south of Al Arda while the sites 9-17 lie north of Al Arda. GPS coordinates of these stands are given in

Table1 and the map of the study area is given in map 1. A count-floristic list was carried out for each stand. Composite soil samples were taken from each stand at a depth of 40 cm. One part of the soil sample was used to determine the soil moisture content using moisture balance analyzer, the second part was dried and sieved through 2 mm sieve before analysis and stored at room temperature for physical and chemical analysis. Soil texture was determined by method according to Piper (1950). Silt and clay were separated later using Pipette analysis method according to Carver (1971). Filtrate of 1:5 soil / distilled water (w/v) extract using HANNA HI98130 Digital Combo meter. Organic carbon (O.C.) was measured according to the method of Piper (1950). Carbonates and chlorides were estimated using the method described by Jackson (1967). Calcium and magnesium were estimated according to the procedure of Richards (1954). Phytosociological studies and vegetation analysis were carried out according to Shukla and Chandel, 1989. All the plants identified existing in each stand were listed after complete identified according to Chuddary, 1983.1999. 2000. 2001a and b; Migahid, 1996 and Wood, 1997 and deposited Jazan Herbarium. A checklist of all plant is given in Table 2. Different life forms were investigated according to Raunkiaer (1934). PC-ORD package 4.17 was used to perform the analysis of the data using the TWINSPAN and DECORANA tools according to McCune and Mefford (1999). SPSS 13.0 were used to clarify the significance of soil factors. Vegetation map were performed using ESRI ARC GIS version 9, ERDAS imagine.

The study area

Jazan Province is situated in the south-western part of Saudi Arabia 16.22 - 17.46 N and 41, 23-43. The foothills are characterized by rocky slopes, cliffs and crevices with granite, sandy soil whereas the hilly areas are generally formed of rocky cliffs, rocky ridges, granite boulders, granite outcrops, granite sandstones and crevices. The highest peaks of the mountains are heavily populated with new houses and agriculture lands added every year. The mean maximal rainfall (220 mm) during the study was recorded in April and the mean minimum in November. In the case of semi-arid foothills on the western side, the rains on slopes of the eastern side of the mountains are also characterized by low rainfall and warm summers (El- Farhan *et al.*, 2005).

Table 1. Global Positioning System (GPS) coordinates of the different sites.

Stand No.	Latitude (N)	Longitude (E)
1	17 00.889	42 55.571
2	16 59.132	43 02.934
3	16 59.284	43 02.873
4	16 59.896	43 03.132
5	17 01.713	43 01.025
6	17 00.570	43 02.976
7	17 01.042	43 03.085
8	17 01.440	43 06.540
9	17 02.740	43 02.693
10	17 04.758	43 02.999
11	17 06.130	43 02.589
12	17 09.848	43 02.271
13	17 13.030	43 01.758
14	17 15.321	43 02.256
15	17 13.922	42 59.808
16	17 13.922	42 55.240
17	17 14.377	42 52.712

The climate diagram of the study area represented here by station east of Abu Arish, the mean temperature during the year is 31°C and the rainfall is recorded men amount / year 290 mm the area is a semi-arid in their characters (Fig. 1).

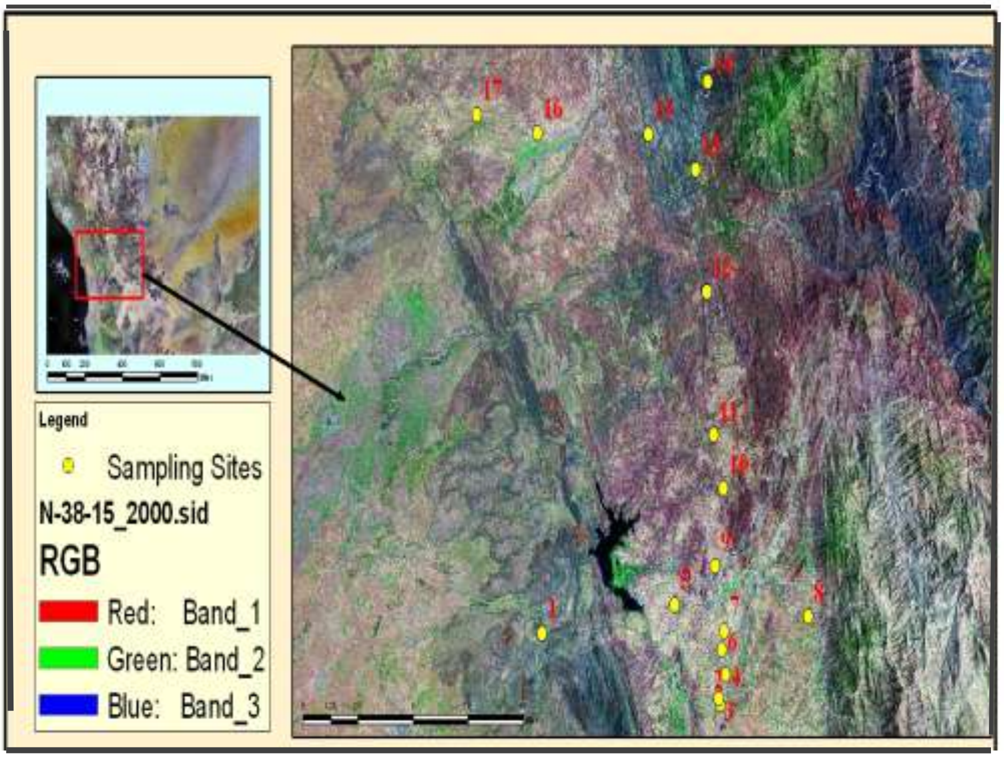


FIGURE 1. Satellite map for the study area of Tihama hill slopes of jazan area.

3. RESULTS

In total, 68 species representing 31 families were collected and identified. The families Asclepediaceae (7 species), Poaceae (6 species) and Mimosaceae (5 species) whereas 12 families, of the total flora was represented by one species each. The genus *Acacia* was most common represented by 5 species. As for the life forms of the plants recorded, phanerophyte constituted 38.23 % of total species, followed by Chamaephytes 33.82%, Cryptophytes 10.29 %, therophytes 8.82 % and Hemicryptophytes 6.8 % (Table 2).

Table 2: Species list recorded in the study area and their abbreviations in TWINSPAN program.

No.	Species	Family	Abbreviations	Life form
1	*Acacia mellifera (Vahl) Benth.*	Mimosaceae	aca melif	Phanerophyte
2	*Acacia ehrenbergiana Hayne,*	Mimosaceae	Aca ehre	Phanerophyte
3	*Acacia tortilis (Forssk.) Hayne*	Mimosaceae	Aca tort	Phanerophyte
4	*Acacia oerfota (Forssk.) Schweinf*	Mimosaceae	Aca oerf	Phanerophyte
5	*Achyranthes aspera L.*	Amaranthaceae	Achy asp	Therophyte
6	*Aristida mutabilis Trin. & Rupr.*	Poaceae	Arestida	Therophyte
7	*Acacia asak (Forssk.) Willd*	Mimosaceae	acac ask	Phanerophyte
8	*Aerva javanica (Burm.f.) Juss.*	Amaranthaceae	Aerva jav	Cheamophyte
9	*Aerva lanata (L.) Juss. ex Schultes*	Amaranthaceae	Aerva lan	Cheamophyte
10	*Abutilon hirtum (Lamk.) Sw.*	Malvaceae	Abutilon	Cheamophyte
11	*Adenium obesum Roem.&Schult*	Apocynaceae	Adenum	Phanerophyte
12	*Amaranthus hybridus L*	Amaranthaceae	Amara hy	Therophyte
13	*Anisotes triculcus (Forssk.) DC*	Acanthaceae	Anistes tri	Phanerophyte
14	*Argemone ochroleuca Sweet*	Papavaraceae	argemo	Thearophyte
15	*Blepharis ciliaris (L.) B.L.*	Acanthaceae	Beliphares	Cheamophyte
16	*Brachiaria leersioides Hochst.*	Poaceae	Brach le	Cryptophyte
17	*Caralluma edulis (Edg.) Benth.*	Asclepiadaceae	Carol acut	Cheamophyte
18	*Calotropis procera (Ait.) R. Br.*	Asclepiadaceae	Calotropis	Phanerophyte
19	*Cenchrus ciliaris L.,*	Poaceae	Senchrus	Cryptophyte
20	*Chenopodium ambrosioides L.,*	Chenopodiaceae	Cheno am	Thearophyte
21	*Chrozophora oblongifolia Del.)Juss.*	Euphorbiaceae	Chro sp.	Cheamophyte

22	*Citrullus colocynthis (L.) Schrad*	Cucarbitaceae	Coloynths	Cheamophyte
23	*Cleome gynandra L*	Capparaceae	Cleome	Cheamophyte
24	*Conyza stritica L*	Asteraceae	Conyza	Phanerophyte
25	*Commicarpus grandiflorus. Rich*	Nyctaginaceae	Comm car	Hemicryptophyre
26	*Cucumis prophetarum L.,*	Cucarbitaceae	Cuc proph	Cheamophyte
27	*Cissus rotundifolius(Forssk.) Vahl*	Vitaceae	Cissus round	Cheamophyte
28	*Cissus quadrangularis L.,*	Vitaceae	Cissus qud	Cheamophyte
29	*Cyperus alopecuroides Rottb*	Cyperaceae	Cyperus	Cryptophyte
30	*Dactyloctenium scindicum Boiss.*	Poacaee	Desm bi	Therophyte
31	*Datura stramonium L.,*	Malvaceae	Datura	Cheamophyte
32	*Desmostachya bipinnata L.*	Poaceae	Desm bi	Cryptophyte
33	*Dobera glabra (Forssk.) Juss.*	Salvadoraceae	Dobera	Phanerophyte
34	*Eragrostis ciliaris (L.) R. Br*	Poaceae	Erag cil	Cryptophyte
35	*Euphorbia inarticulata Sch.*	Euphorbiaceae	Euph inar	Phanerophyte
36	*Euphorbia triaculeata Frossk..*	Euphorbiaceae	Eupho tri	Cheamophyte
37	*Fagonia indica Burm.f.*	Zygophylaceae	Fagonia	hemicryptophyre
38	*Grewia tembensis Fresen*	Tiliaceae	Grewa	Phanerophyte
39	*Ficus sycomorus L*	Moraceae	Ficus sal	Phanerophyte
40	*Ficus populifolia Vahl, Symb.*	Moraceae	Ficus pop.	Phanerophyte
41	*Hyphaene thebaica (L.) Mart*	Palmae	Hyph	Phanerophyte
42	*Indigofera arabica Jaub. & Spach*	Papillonaceae	Indigo arab	Cheamophyte
43	*Indigofera spinosa Forssk*	Papillonaceae	Indigo spi	Cheamophyte
44	*Kanahia laniflora*	Asclepiadaceae	Kana lan	Phanerophyte
45	*Leptadenia pyrotechnica Decne*	Asclepiadaceae	Lept pyro	Phanerophyte
46	*Leptadenia arborea Schwein*	Asclepiadaceae	Lepta orb	Cheamophyte
47	*Ocimum forsskalii Benth.*	labiatae	Ocimum	Cheamophyte
48	*Opuntia dillenii (Ker) Haw.*	Cactaceae	Opuntia	Phanerophyte
49	*Pandanus odoratissimus L.*	Pandaceae	Pandanus	Phanerophyte
50	*Panicum turgidum Forssk*	Poaceae	Pani tur	Cryptophyte
51	*Pentatropis nivalis (Gmel.) Wood*	Asclepiadaceae	Penta od	Cheamophyte
52	*Phoenix dactylifera L.*	Palmae	Phoenix	Phanerophyte
53	*Pulicaria petiolaris Jaub. & Spach*	Asteraceae	Pulicaria	Cheamophyte
54	*Ricinus communis L.*	Euphorbiaceae	Ricinus	Phanerophyte
55	*Ruellia patula Jacq.*	Acanthaceae	Rullia	Cheamophyte
56	*Salvadora persica L.,*	Salvadoraceae	Salvadora	Phanerophyte
57	*Sarcostemma viminale (L.) R. Br.*	Asclepiadaceae	Sarco vim	Cheamophyte
58	*Schweinfurthia pterosperma Rich.*	Sclerophulariaceae	Schwenf	Therophyte
59	*Senna alexandrina Mill.*	Ceasilpinaceae	sen alx	Cheamophyte
60	*Senna italica Mill*	Ceasilpinaceae	sen etalica	Cheamophyte
61	*Solanum incanum L.*	Solanaceae	sol inc	Phanerophyte
62	*Solanum surattense Burm.f.*	Solanaceae	sol sp	Thearophyte
63	*Tamarix nilotica (Ehrenb.) Bunge*	Tamaricaceae	Tamr nelo	Phanerophyte
64	*Tamarix aphylla (L.) Karst.*	Tamaricaceae	Tamr apyll	Phanerophyte
65	*Tribulus terrestris L.,*	Zygophylaceae	Triblus	Thearophyte
66	*Typha domingensis (Pers.) Steud.*	Typhaceae	Typha	Cryptophyte
67	*Zaleya pentandra (L.)*	Aizoaceae	Zal pent	Thearophyte
68	*Ziziphus spina-christi (L.) Willd*	Rhamnaceae	Zizy spi	Phanerophyte

Vegetation Analysis of the study Area

Because of relatively high rainfall in this area, a number of annuals plants appear in the rainy season and these annuals disappear at the beginning of summer. In site 5, *Dactyloctenium scindicum* and *Acacia tortilis* represented a co dominant plant community; *Schweinfurthia pterosperma* and *Acacia tortilis* was co dominant perennials herb in site 7 while *Indigofera spinosa* in site 1 and *Aerva javanica* in sites 2 and 3 (Fig. 3).

Stand Classification

Seventeen sites occupying south and north of Al-Arda area were classified using TWINSPAN. The classification resulted in five vegetation groups (A, B, C, D and E), each of which has a distinct indicator species and soil factors which play important role in the distribution of these groups (Fig 2).

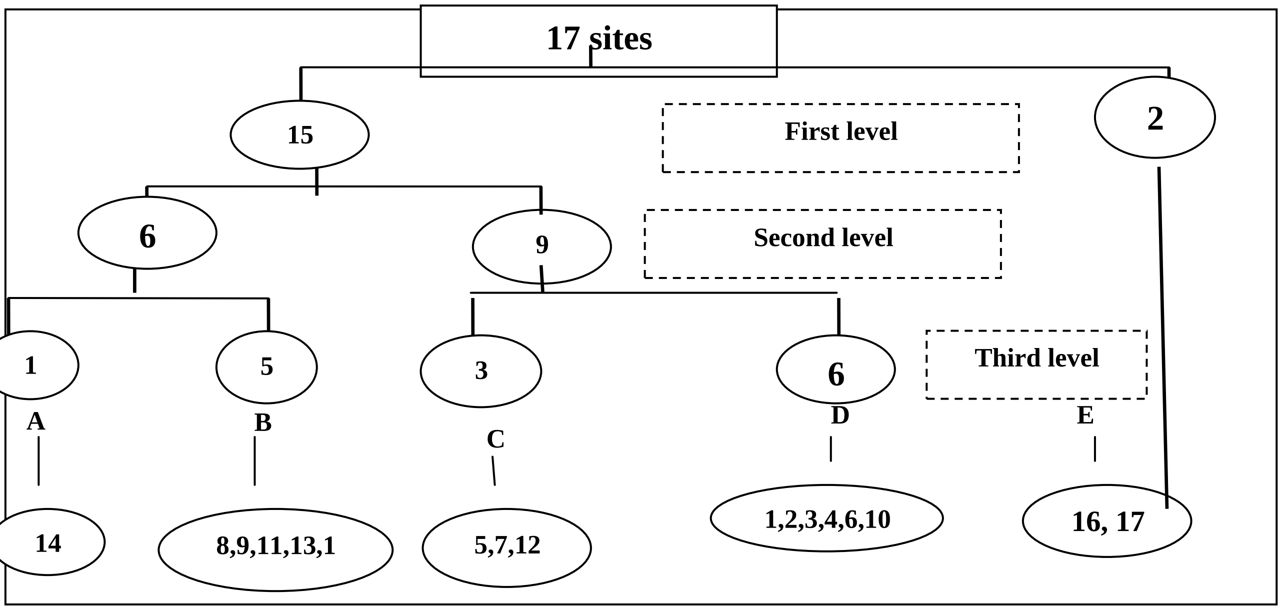


FIGURE 2. Diagram of 17 stands showing the three distinct vegetation levels produced from the TWINSPAN technique

Group A, formed at the third level of the classification. It includes only one stand (14) which represents a high elevation area of study because of its proximity to Fayfa Mountain. The indicator species of this group were *Acacia ehrenbergiana*, *Anisotes triculcus*, *Salvadora persica* and *Ziziphus spina-christi;* these species are dominant in the terrace and wadi bed as well as mountain slope. *Adenium obesum* and *Solanum surattense* are reported as rare species. Soil characteristics this group is: calcium 2.2 ml/L, fine sand 25 % and silt 52 %.

Table 3. Standard deviation (S. D.), Mean values and ANOVA F values of the soil variables in the sites.

Soil variable	**TWINSPAN Group**					**Mean ±S.D.**	**F-ratio**	***P* value**
	A	B	C	D	E			
Ca^{2+} mg 100ml^{-}	2.2	1.56 ±0.74	4.41 ±4.27	3.53 ±0.80	2.9 ±0.98	3.11 ±2.73	0.74	0.58
Mg^{2+} mg 100ml^{-1}	5	19.76 ±16.98	3.23 ±2.67	2.2 ±0.91	18.9 ±21.92	9.85 ±13.20	2.00	0.15
Cl^{-} %	0.039	0.1472± 0.12	0.19± 0.10	0.08± 0.04	0.08± 0.03	0.13 ±0.10	1.09	0.40
CO_3^{--} %	0.12	1.364± 2.19	0.19 ±0.15	0.3 ±0.20	0.09± 0.04	0.81 ±0.10	0.75	0.57
Organic carbon %	0.816	0.88 ± 0.10	0.77 ±0.04	0.75 ±0.09	0.85 ± 0.008	0.81 ±0.10	1.01	0.43
Moisture content %	0.88	7.16± 5.78	3.61± 2.17	2.32 ±0.61	1.99 ±0.33	4.08 ±3.83	1.46	0.27
pH	7.74	7.48 ±0.12	7.12 ±0.37	7.51 ±0.41	7.45 ±0.14	7.37 ±0.33	1.69	0.21
Gravel %	1.44	23.72 ± 0.09	17.51 ±21.91	28 ± 14.92	43.23 ±13.78	23.27 ±19.66	0.99	0.44
Coarse sand %	4.6	20.48 ±10.35	24.37 ±12.28	22.11 ±8.01	43.23 ±3.12	23.27 ±10.26	0.82	0.53
Fine sand %	25.14	10.4± 2.62	7.43 ±3.51	7.94 ±1.88	9.15 ±5.31	9.63 ±5.03	6.78	0.004
Silt %	52.16	26.36 ±17.71	19.95 ±5.44	15.88 ±4.16	12.32 ±5.92	22.11 ±13.23	2.70	0.08
Clay %	16.67	19.04 ±10.61	30.72 ± 11.67	26.05 24.73	10.36 ± 5.67	23.24 ±14.16	1.03	0.42

Group B, includes many small wadies formed at the third level of the classification. It includes five sites (8, 9, 11, 13 and 15) with its indicator species as *Salvadora persica*, *Ziziphus spina-christi* and *Acacia asak*, and, the co dominate species of this group are *Typha domingensis*, *Dobera glabra* and *Pandanus odoratissimus*. *Salvadora persica* and *Pandanus odoratissimus* are dominants in the terrace of the wadi while in the wadi bed where water current is heavy; many water plants are growing especially monocotyledonae. Among these five sites 9, 11, 13 and 15 lies north of Al Arda, whereas only 8 only of this group laid south Al Arda. Soil factors which characterize this group are highly level values of magnesium 19.87 ml/L, carbonate 1.36 %, organic carbon .88 % and moisture content 7.1 %.

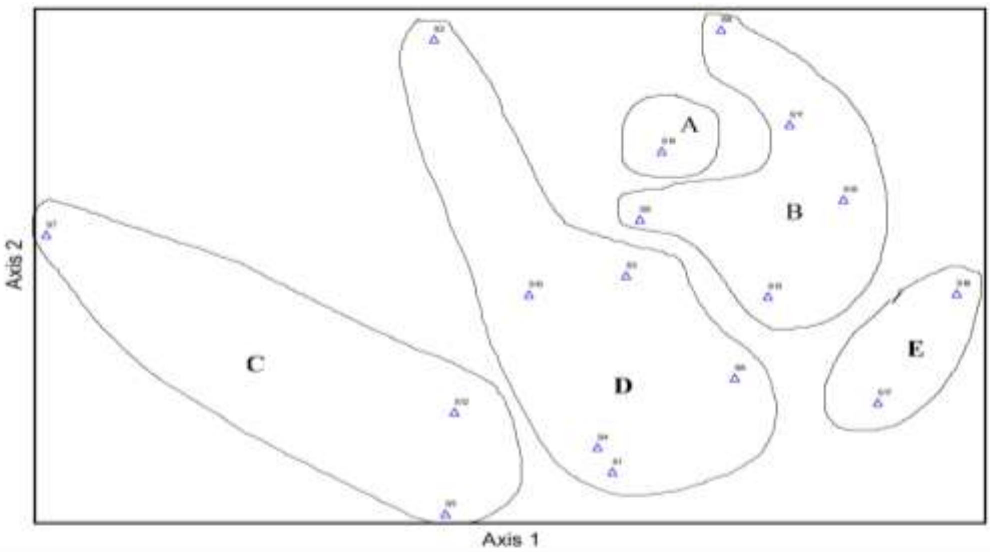
Group C, formed at the third level of classification and represent sand plains of the study area including sites 1, 2, 3, 4, 6 (all sites lies south of Al Arda) and site 10 also plain but lie at north of Al Arda. *Acacia ehrenbergiana*, *Aerva javanica* and *Indigofera spinosa* are dominant species whereas; *Blepharis ciliaris* and *Dobera glabra* constitute the co-dominants plant. Soil factors which characterize this group are the high values of chlorides 0.19 % and clay 30 %.

Group D, formed at the third level of the classification and included sites 5 and 7 (south of Al Arda rocky plains) and site 12 (north of Al Arda); sites 7 and 12 represent rocky plains and site 5 represent sandy plain. The characteristic communities of this group are *Dactyloctenium scindicum*, *Schweinfurthia pterosperma* and *Acacia tortilis*. Codominant species are *Opuntia dillenii* and *Anisotes triculcus*. Soil factors which characterize this group are low level of magnesium 2.2 ml/L.

Group E, separated directly from second level to third including sites 16 and 17 east of Sabya and represent open sand plains, the common species here are *Tamarix nilotica* and *Dobera glabra whereas* the codominant species are *Acacia ehrenbergiana* and *Panicum turgidum*. A soil characteristic of this group is the highest values of gravel (43 %) as well as coarse sand (Table 3).

DECORANA (De trended Corresponded Analysis)

DECORANA was used to clarify the relations between the distribution of plants and soil factors along two axes to form a graph ordination. DECORANA classification of sites was related to TWINSPAN classification (negative groups A, B, C, and D as well as positive group E) except arrangement of negative groups were as the following: Group A lie at the top of graph and related with axes 1, group B occupy the corner of axes 1, group C situated at the middle of graph and some sites were positive correlated with axes 1, except site 2 was positively correlated with axes 2, groups D lie left of graph included sites 5 and 12 (positively correlated with axes 1) and site 7 (positively correlated with axes 2) and group E which lie at the right of graph (sites 16 and 17) and positively correlated with axes 1**.** Figure 3, shows the ordination results of the DCA analysis of the floristic data. The 17 site scores are plotted along axes 1 and 2, which tend to cluster into five groups that resulted from TWINSPAN analysis. SPSS program are used to analyze the data of the soil to determine the most significant soil factors which affect the classification of stands through the measure of mean and standard deviation for each factor in each group. One-way ANOVA (Analysis of Variance) were run to determine the F-ratio and *P* value of each soil factor for all groups together.



ANOVA analysis showed that .the most effective soil factors affecting the assembly of sites into groups A, B, C, D and E, as well as aggregating the species into these groups were fine sand (with F- ratio =8.2, *P* value 0.004) and silt (with F-ratio =2.7, P value 0.08) On the other hand, other soil factors are non-significant in the classification of both stands and species in the studied area (Table 4).

Table 4. Dominant, co dominant and resident species and their importance values (I V) in the study area.

No.	Dominant	Co dominant	Resident
1	*Indigofera spinosa* I V = 78.2	*Blepharis ciliaris* I V = 56.7	Acacia orfota I V = 49.1
2	*Aerva javanica* I V = 53.4	*Cenchrus ciliaris* I V = 48.7	*Acacia ehrenbergiana* I V = 41
3	*Aerva javanica* I V = 77	*Acacia ehrenbergiana* I V = 73	*Dobera glabra* I V = 37
4	*Acacia tortilis* I V = 73	*Blepharis ciliaris* I V = 72.2	*Acacia ehrenbergiana* I V = 50
5	*Dactyloctenium scindicum* I V =79.1	*Acacia tortilis*I V = 71.4	*Caralluma edul I V = 32.2*
6	*Acacia ehrenbergiana* I V = 137.5	*Dobera glabra* I V = 72.2	*Blepharis ciliaris* I V = 69.7
7	*Schweinfurthia pterosperma* I V = 88.1	*Acacia tortilis* I V = 68	*Opuntia dillenii* I V = 29
8	*Salvadora persica* I V = 53	*Pandanus odoratissimus* I V = 49	*Calotropis procera* I V = 30
9	*Salvadora persica* I V = 74	*Dobera glabra* I V = 43	*Calotropis procera* I V = 40
10	*Acacia ehrenbergiana* I V = 108	*Blepharis ciliaris* I V = 41	*Adenium obesum* I V = 38
11	*Salvadora persica* I V = 86.7	*Typha domingensis* I V = 73.11	*Acacia ehrenbergiana* I V = 34
12	*Acacia tortilis* I V = 152	*Opuntia dillenii* I V = 72.2	*Anisotes triculcus* I V = 49
13	*Ziziphus spina-christi* I V = 52	*Typha domingensis* I V = 48	*Opuntia dillenii* I V = 37
14	*Acacia ehrenbergiana* I V = 79.3	*Anisotes triculcus* I V = 59	*Ziziphus spina-christi I V = 48.1*
15	*Acacia asak* I V = 70.1	*Typha domingensis* I V = 60.7	*Hyphaene thebaica* I V = 53
16	*Tamarix nilotica* I V = 118.5	Acacia ehrenbergiana I V =113.7	*Panicum turgidum* I V = 110.3
17	*Dobera glabra* I V = 111.3	*Panicum turgidum* I V = 84.5	*Acacia ehrenbergiana* I V = 77.2

Pearson and Kendall correlations with ordination axes showed the same results as obtained from DCA. Soil factors were positively correlated with axes 1 were fine sand, pH, calcium, magnesium, chloride, organic carbon, silt and clay, while those related to axes 2 were gravel, moisture content, carbonate and coarse sand (Table 5).

Table 5. Pearson (r) correlation of the soil variables with ordination axis of DCA.

soil factor	axis 1	axis 2
Ca^{2+} mg $100ml^{-1}$	.300	.045
Mg^{2+} mg $100ml^{-1}$	.035	-.243
Cl^{-} %	.028	-.054
CO_3^{--} %	-.291	.020
Organic carbon	-.025	-.064
Moisture content %	-.482	-.291
pH	-.166	-.382
Gravel	.228	.212
Coarse sand %	-.082	.247
Fine sand	-.184	-.387
Silt	-.256	-.331
Clay	.048	-.026

4. DISCUSSION

Species numbers recorded in the study area are 68, these numbers not really number of the study area because of changing of vegetation type. The largest families recorded are Asclepiadaceae (7 species), Poaceae (6 species), Mimosaceae (5 species) and Euphorbiaceae (4 species). The plant life forms showed that phanerophytes were the most forms 37 %, followed by Chamaephytes constituted about 33 %, Therophytes 15 %, Cryptophytes 11 % and Hemicryptophytes 3 %, this result of dominant phanerophytes life form because the climate of Tihamah hill slopes is mild temperature and heavy rainfall. On the other hand, the dominance of both therophytes and chamaephytes over the other life-forms in Tihamah coastal plains seem to be a response to the hot dry climate, topographic variations (E1-Demerdash *et al*., 1994).

Vegetation analysis of tree communities revealed *Acacia ehrenbergiana* located in sites 6, 10 and 14, *Acacia tortilis* dominant in sites 4 and 12, *Acacia asak* in site15, *Ziziphus spina-christi* in site 13 and *Dobera glabra* in site 17. The shrubs analysis illustrates *Salvadora persica* in sites 8, 9 and 11 and *Tamarix nilotica* community in site 16; this result is agreement with Walter (1971). The perennials herbs were dominants as the following; *Aerva javanica* in sites 1 and 2, *Indigofera spinosa*, *Dactyloctenium scindicum* community in site 5 and *Schweinfurthia pterosperma* abundant in site 7. Monod (1954) recognized two types of desert vegetation, namely contracted and diffuse. Both types refer to permanent vegetation that can be accompanied by ephemeral (or annual) plant growth depending on the amount of precipitation in a given year. These results also in agreement with Howaida (2005). El-Demerdash *et al* (1995) reported that, vegetation, species diversity and floristic relations in south-western Saudi Arabia demonstrate remarkable change with altitude. The Tihamah plains (about 0–500m a.s.l.) includes different habitat types, i.e. coastal marshes, sand formations, gravel plains, depressions, dry wadies and water runnels. The application of TWINSPAN on the vegetation data yielded five vegetation groups: group A. High elevated area of study: in this group *Acacia ehrenbergiana* dominates. Group B. Wadies; in which *Salvadora persica*, *Ziziphus spina-christi* and *Acacia asak* are occasionally recorded. Group C. Sand plains of the study area*:* in this group *Acacia ehrenbergiana*, *Aerva javanica* and *Indigofera spinosa* are found. Group D. Rocky plains, in this area *Dactyloctenium scindicum*, *Schweinfurthia pterosperma* and *Acacia tortilis* are dominated. Group E. Open sand plains, *Tamarix nilotica* and *Dobera glabra* are recorded Soil characteristics of each of the five vegetation groups show highly significant differences in Soil pH, organic carbon, calcium, magnesium, carbonate, moisture content, and chloride show highly significant differences between groups. DECORANA classification of sites, group A and group B were positive correlated with axis 1 with fine sand, pH, calcium, magnesium, chloride, organic carbon, silt and clay whereas group C lie at the middle of graph. Some sites were positive correlated with axes 1 except site 2 which was positive correlated with axes 2 with Gravel, moisture content, carbonate and coarse sand , groups D included sites 5 and 12 (positive correlated with axes 1) and site 7 (positive correlated with axes 2) and group E (sites 16 and 17) and positive correlated with axes 1. *Acacia ehrenbergiana* represented the most dominant species in the present work because it was recorded in most habitats as dominant, co dominant or resident. DECORANA also indicated *Acacia ehrenbergiana* gives positive correlation with axes 1 with fine sand silt (Fig. 4).

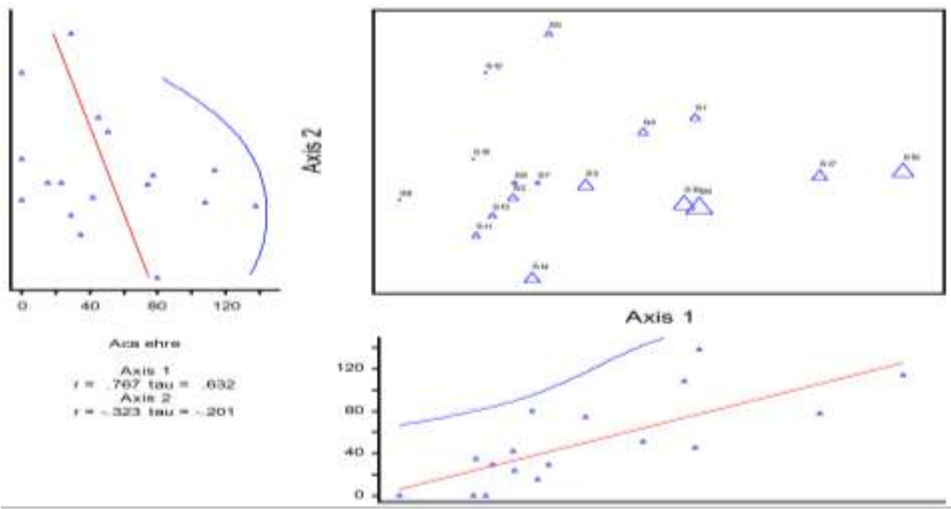


FIGURE 4. DCA ordination of *Acacia ehrenbergiana.*

Batanouni and Baeshin (1983) reported that *Acacia ehrenbergiana* community is not widespread in the study area. It occurs in the coastal plain to the west of the study area, as well as in the sector of Wadies. Zayed and Fayed (1989) reported that *Acacia ehrenbergiana* communities were usually found on the gravelly slopes and terraces. Application of ANOVA analysis showed that .the most effective soil factors affecting the assembly of sites into groups A, B, C, D and E. As well as aggregating the species into these groups were fine sand (with F- ratio =8.2, *P* value 0.004) and silt (with

F- ratio =2.7). ANOVA analysis showed that most effective soil factors affecting the assembly of sites into groups A, B, C, D and E, as well as aggregating the species into these groups were fine sand (with F- ratio =8.2 , *P* value 0.004) and silt (with F- ratio =2.7 , *P* value 0.08). El Saied (2007) reported that soil variables affect the species distribution are moisture contents, organic carbon, carbonates, fine sand and silt. The recommendation of the present work is to complete the survey of the northern sector of Tihamah Hill Slope in the future which may lead to record a new species. Finally, this study could be considered as a reference for the study area and its species because this study is the first which described the community types by using advances programs especially satellites map for vegetation of the area.

5. REFERENCES

- Abulfatih, H. A. 1981. Wild plants of Abha and its surroundings. Proceeding of the Saudi Biol. Soc. 5: 143-159.
- Alfarhan, A. H., Al Turky, T.A. and Basahy, A. Y. 2005. Flora of Jizan Region. Final Report Supported by King Abdulaziz City for Science and Technology Vol – 1 & 2 pp. 545.
- Al-Sheriff, A. S. 1984. The Geography of the Kingdom of Saudi Arabia. Part II: The South Western Province. Dar El-Marikh. Riyadh. pp 483.
- Baierle, H. V., El-Sheikh, A. M. & Frey, W. 1985. Vegetation und Flora im mittleren S audi Arabien (AI-Taif-Riyad), Beih. Tubinger Atlas Vorder Orient, Reihe A (Naturwissenschaften), 22: Wiesbaden
- Batanouny, K. G. 1979. Vegetation along the Jeddah-Mecca road: patteren and process as affected by human impact. J. of Arid Environ. 2: 21-30
- Batanouny, K. H. and Baeshin, N. A. 1983. Plant communities along the Medina-Badr road across the Hejaz Mountains, Saudi Arabia. Dr W. Junk Publishers, The Hague. Printed in The Netherlands. Vegetation, Vol. 53, 33 - 43.
- Carver, R. E. 1971. Procedure in Sedimentary Petrology. John Willey & Sons, Inc., Canada, pp. 653
- Chaudhary, S.A. 1999. Flora of the Kingdom of Saudi Arabia. V. (1). Ministryof Agriculture and Water, national Herbarium, National Agriculture andWater Research Center, Riyadh .Saudi Arabia. 1:1-625.
- ------------ 2000. Flora of the Kingdom of Saudi Arabia. V. (2), Part 3. Ministry of Agricultural and water, national Herbarium, National Agriculture and Water Research Center. Riyadh .Saudi Arabia. 2(3)1-419.
- ------------ 2001a. Flora of the Kingdom of Saudi Arabia. V. (3). Ministry of Agricultural and water, national Herbarium, National Agriculture and Water Research Center. Riyadh. Saudi Arabia. 2(1)1-653
- ------------ 2001b. Flora of the Kingdom of Saudi Arabia. V. (2), Part 1. Ministry of Agricultural and water, national Herbarium, National Agriculture and Water Research Center. Riyadh Saudi Arabia. 2(2)1-523.
- E1-Demerdash, M. A. & Zilay A. M. 1993. An Introduction to habitats and plant communities in Tihamah coastal plains of Jazan area, Saudi Arabia. (Submitted to the Arab Gulf J. of Sci. Res.).
- El-Demerdash, M.A. Hegazy, A.K. & Zilay, A.M. 1994. Distribution of the plant communities in Tihamah coastal plains of Jazan Region, Saudi Arabia, Vegetatio, 112: 141-151.
- El-Demerdash, M.A., Hegazy, A.K. and Zilay, A.M. 1995. Vegetation-soil relationships in Tihamah coastal plains of Jazan region, Saudi Arabia. Journal of Arid Environments, 30:161–174.
- El Saied, E. M. 2007. Vegetation mapping of the plant communities of Eastern Sector of Isthmic of Egypt M Sc Theses. Botany & Microbiology Dept. Fac. Sci . Azhar Uni. Egypt
- Hegazy, A. K., El-Demerdash, M. A.and H. A. Hosni, H. A. 1998. Vegetation, species diversity and floristic relations along an altitudinal gradient in south-west Saudi. Journal of Arid Environments, Vol. 38: 3–13
- Howida, M. E. 2005. Population Ecology of *Rhazya stricta* Decne in Western Saudi Arabia International J. of agricultural & biology Vol. 6: 932–938.
- Jackson, M. L. 1967. Soil Chemicals analysis. Prentice-Hall of India. Private, New Delhi, India.
- Masrahi, Y. S. 2012. A Brief illustrate to Wild Plants in Jazan Region. King Fahad Library, Jeddaha pp. 302.
- McCune, B., and M. J. Mefford. 1999. PC-ORD for Windows version 4.17.Multivariate analysis of ecological data. MjM Software, Glenenden Beach, Oregon, USA.
- Migahid, A.M. 1996. Flora of Saudia Arabia. Ed .4. 3 Vols. King Saud Univ. Libraries, Riyadh, Saudia Arabia
- Monod, T. 1954. Mode contracté et diffuse de la végétation Saharienne. *In:* Cloudsley–Thompson, J.L (ed.), *Biology of Desert*, pp. 35–44.
- Piper, C. S. 1950. Soil and Plant Analysis. Univ. of Adelaide Press. Australia.
- Raunkaier, C. 1934. The Life Forms of Plants and Statistical Plant Geography. Clarendon Press. Oxford.
- Richards, L. A. 1954. Diagnosis and improvement of saline and alkaline Soils. U. S. Dept. Agric. Handbook No. 66.
- Shukla, R. S. and Chandel, P. S. 1989. Plant Ecology and soil Science. S. Chand & Co., New Delhi, India
- Surfer Users Guide 1995. Contouring and 3 D. surface mapping for scientists and engineers. Golden software, Inc. 809 14th street Golden, Colorado USA
- Vessey-Fitzgerald, D. F. 1955. Vegetation of the Red Sea coast south ofJeddah, Saudi Arabia. J. Ecol. 43: 477-489

- Walter, H. 1971. Ecology of Tropical and Subtropical Vegetation. Oliver and Boyes. Edinburgh
- Wood, J. R. 1997. A handbook of the Yemen. Flora. Royal Botanic gardens, Kew, UK.
- Younes, H. A., Zahran, M. A. & E1-Qurashy, E.M. 1983. Vegetation-Soil relationship of a sea-in landward transects, Red Sea Coast, Saudi Arabia. J. of Arid Environ. 6: 349-356.
- 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. 1 No. 3: 279-288.
- Zayed, K and A.A. Fayed (1989). Vegetation of the area between Taif and Baha, SW Saudi Arabia. *Taeckholmia*, 10: 77-105.