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Vegetation-Environment Relations in Taif, Saudi Arabia

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Abstract: This study assesses the plant communities and environmental factors that govern species, abundance and distribution in Taif area, western Saudi Arabia, using TWINSPAN analysis. Twenty three vegetation groups were identified visual, seven groups dominated by *Aerva lanata*, *Pergularia tomentosa, Arnebia hispidissima, Salsola spinescens, Capparis decidua, Aizoon canariense* and *Blepharis ciliaris* in the sand plains, *Calotropis procera, Dipterygium gluacum, Bassia muricata, Haloxylon scoparium, Aerva gavanica, Anthemis melompodina* and *Coccinea grandis* in the valleys, *Halothammus bottae, Anvillea gracinii, Euryops arabicus, Dianthis strictus* and *Ecobolium gymnostachyum* in the slopes and *Capparis sinaica, Maerua oblongifolia, Salsola kali* and *Centaurea schimperi* in the plateaus. The application of TWINSPAN classified the community types into 10 clusters at level 15. The existence of vegetation discontinuities along the catena's depended largely on water table depth and salinity. These parameters decline with increasing altitude, whereas, $CaCO_3$ and organic carbon does not vary along well defined large scale gradients. The relationships of the habitat-floristic groups are not simple and hydromorphism interacts in complex way with halomorphism.

Key words: Saudi Arabia, vegetation, environment, habitats, soil analysis

INTRODUCTION

A general description of the vegetation of the western Saudi Arabia has been given by Vesey-Fitzgeraid[1] and recognized a number of vegetational and ecological types including littoral marshes, coastal desert plain, coastal foothills, mountain ranges and wadies. Batanouny[2], Fayed and Zayad[3] and Mahmoud and El-Tom[4] described the vegetation of the Makkah-Taif roads and recognized a number of vegetational and ecological types mostly organized in zones. Referring to the western provinces (Saudi Arabia) flora, Batanouny and Baeshin[5,6] gave lists of 135 species belonging to 108 genera and 43 families of angiosperms along Jeddah-Makkah road. El-Shourbagy *et al.*[7] recorded five community types in thirty stands at western provinces (Jeddah-Tuwal area). Some of the plant communities reported in those studies correlate and indicate extensions of regional importance. The soil moisture-salinity interaction has been widely recognized as the most important factor in the distribution of the stress tolerant plants[8]. Also the chemical and hydrophysical characteristics of soil affect the diversity and structure of the vegetation[9].

The aim of this study was to enrich our knowledge about the vegetation of western area Saudi Arabia. It assesses the plant communities and the environmental factors that govern species abundance and distribution in Taif area of western Saudi Arabia.

MATERIALS AND METHODS

Study area: The area of study belongs to the Asir Mountains, a range formed of crystalline and metamorphic basement materials and volcanic rocks[10]. It extends from Taif city to Al-Hawiah at north, of about 25×25 km (20° 18` - 22°00`N and 40° 00` - 41°16` E). Taif area rise of about 1540 m above mean sea level. The geological units that outcrop in this area from oldest to youngest are: Precambrian rocks. Tertiary sediments, Tertiary to Quaternary basalt, flows and Quaternary deposits. The Precambrian rocks constitute the oldest rock units and consist of a group of sedimentary and volcanic rocks that was subjected to a series of deformations[11,12]. Consolidated and unconsolidated marine clastic sediments of the tertiary age cropout along the western edges. Nebert[11] considered these sediments to include horizontally stratified, vari-colored, alternating clay, sand and gravel. The thickness of these sediments were reported by Liddicoat[12] to reach up to 50 m, these tertiary sediments lies unconformably over the Precambrian rocks, while they are overlain in many

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Table 1: Mean values of meteorological data of Taif area o f the last 10 years from 1992 to 2001, Station No . 41036, Station Name: Taif, LAT: 21 28 44N, LOG : 40 32 56E, Elevation : 1452.75 meter

	Temperature (Deg. C)												Surface Wind (Kts)				Pressure (hPa)			Precipitation (mm)					
	Mean			Extremes						Relative humidity%			Dir.	speed	Speed		Vapor	Station level	Sea level	Monthly			24 h total		
Months	MX	MN	M	MX	YY	DD	MN	YY	DD	MX	MN	M	Dir.	MIN	MX	DD	M	M	M	M	Ext.	YY	Ext.	YY	DD
01	22.6	7.9	15.3	29.2	1999	31	1.5	1997	20	100	9	63	W	6	45	22	10.7	856.7	4607.8	14.4	38.4	1992	27.9	1992	10
02	24.5	9.2	16.8	31.5	1999	24	6	1992	12	100	11	56	W	7	38	25	10.6	856.2	4606.9	0.2	2.0	1994	2.0	1994	27
03	26.8	11.8	19.4	33.0	2000	21	2.8	1992	03	98	4	51	W	8	36	23	11.2	855.2	4605.4	17.6	74.4	1998	72.9	1998	06
04	30.6	15.2	23.0	35.0	1999	26	9.0	1992	04	98	4	46	W	7	42	32	12.4	855.2	4604.4	32.9	198.5	1994	****	1994	18
05	33.7	18.6	26.1	39.0	1996	31	12.0	2000	02	97	2	39	W	6	45	27	12.8	855.3	4603.4	34.6	102.3	1995	46.5	1995	04
06	36.3	22.1	29.3	39.5	1998	14	15.6	1997	29	86		25	W	8	28	9	10.0	853.4	4601.0	4.8	46.7	1996	32.5	1996	07
07	35.2	22.5	28.7	40.0	1998	19	17.0	1992	22	81	2	27	W	**	50	32	10.6	852.7	4600.6	2.4	12.5	2000	8.8	2000	23
08	36.0	23.1	29.2	39.6	1996	03	15.8	1992	15	100	3	32	W	**	50	17	12.8	853.4	4600.4	33.8	143.2	1992	49.0	1992	12
09	35.1	20.2	27.8	38.2	2001	05	14.9	1996	27	91	2	35	W	6	50	28	12.6	854.9	3703.0	14.8	58.6	1997	51.6	1997	17
10	31.0	15.3	23.4	36.0	1998	03	8.3	1998	29	97	3	44	E	5	35	5	12.0	857.2	3706.4	25.9	127.4	1997	39.8	1992	11
11	26.5	11.7	19.2	32.0	1999	09	6.0	1996	15	100	6	59	W	5	40	22	12.5	857.4	3708.5	40.3	243.6	1996	****	1996	15
12	24.3	9.5	16.9	29.5	1998	14	1.0	2000	11	100	7	64	W	6	40	27	11.8	857.7	3709.6	6.0	17.6	1995	8.5	1993	16
MX	36.3			40.0						100					50						293.6		****		
MN		7.9					1.5																		
M			22.9									45		7			11.7	855.4	9304.8	19.0					

From Meteorology and Environmental Production Administration in Saudi Arabia, MX = maximum; MN= minimum; M=mean; YY= year; DD= daily degree; Dir.= direction; Ext.=extreme

parts by the tertiary to Quaternary basalt flows. According to Karpoff[13], these basaltic flows started in the Pliocene and continued throughout the Quaternary until recent times.

Climate: The climate of the study area falls in a transitional zone between the Monosoon and Mediteranean climatic types, which are modified by the Red Sea and the elevated Harrat Rahat.

The data obtained in Table 1 show the range of climatic conditions of Taif area for last ten years from 1992 to 2001. It is clear that January is the coolest month (mean temperature 15.3°C) and air temperature rises in February and such rise continued till August. There after, it decreases gradually and attained the lowest value in winter. Relative humidity exhibits considerable seasonal variations. June and July have the lowest humidity value (25 and 27%, respectively); the most humid months are December (64%) and January (63%). The wind direction is mainly in west side and the maximum wind speed recorded in April and July (32 km h^{-1}). October has the lowest wind speed (5 km h^{-1}). The total amount of precipitation ranged from 2 mm /month in February to 243.6 mm m^{-1} in November. From Table 1, it clear also that the number of precipitation days was 47.4 $year^{-1}$, while the number of mist days was 33.1 $year^{-1}$ and Hazo days about 41.6 $year^{-1}$.

In general Taif climate is warm desert for most climatic classifications. Ahmed[14] recorded that, the primary classification of Taif climate according to the basis of Blair[15] is considered dry climate because the rainfall is less than 10 inch, also Trewartha and Horn[16] show the same result because the humid is less than 40% for most months. It may be concluded that Taif climate is dry and in desert or semi- desert side. Also the middles temperature in Taif decreases the dryness in the angle of rain and evaporation, so it effects on vegetation.

Sampling and analysis: Two-hundred and thirty quadrates were sampled representing the habitat and community variations in the study area (from October 2004 to October 2005). In each quadrate, a list of species and their abundance were estimated. Two way indicator species analysis TWINSPAN was applied to the abundance estimates of 23 community in 230 quadrates each of 10×10 m[17].

Soil samples were collected at three depths, surface (0-15 cm), subsurface (15-30 cm) and bottom (30-45 cm) from each habitat. The soil moisture content was estimated according to Jackson[18]. $CaCO_3$ was determined by titration methods as described by Jackson[18], while organic carbon by Walkley and Black rapid titration method (Piper, 1947). Soil water extracts (1:5 were prepared for the determination of pH using pH meter; total soluble salts by drying methods; chlorides by titration with standard silver nitrate solution, sulphates gravimetrically as $BaSO_4$ and soluble bicarbonates by acid titration[19].

RESULTS

Twenty-three floristic groups were identified, sociologically structured in four groups or noda (habitat) namely sand plain (A, San. Pla.), valley (B, val), slopes of wadi (C, slo.) and plateau (D, pla.). The arrangement of groups by the multivariate analysis reflected the influence of a complex gradient representing, xeromorphic and halomorphic factors in compositional patterns, from group A in the lower topographical positions to group D in the more elevated topographical positions (Table 2).

The sequence begins with the nodum A; sand plain habitat where seven floristic groups dominated by *Aerva lanata*, *Pergylaria tomentosa*, *Arnebia hispidissima*, *Salsola spinescens*, *Capparis decidua*, *Aizoon canariense* and *Blepharis ciliaris* were recorded. In nodum B, seven floristic groups (communities) are dominated by *Calotropis procera*, *Dipterygium glaycum*, *Bassia muricata*, *Haloxylon scoparium*, *Aerva javanica*, *Anthemis melompodina* and *Cocinea grandis* on the valleys habitats. In nodum C five floristic groups are dominated by *Halothamnus bottae*, *Anvillea gracinii*, *Euryops arabicus*, *Dianthis strictus* and *Ecobolium gymnostachyum* on slope habitats, while the nodum D four floristic groups dominating by *Capparia sinaica*, *Maerua oblongigolia*, *Salsola kali* and *Centaurea schimperi* on the plateau habitats. Nodum B or valley habitats have types dominant in lands of relatively high salinity, (3.48-7.58%). These noda are tall shrubs and grasslands form and the most frequent biological forms that are caespitose and scapose hemicryptophytes as well as scapose and caespitose therophytes. Nodum B is dense, short grassland whereas the dominant biological forms are geophytes with rhizomes, geophytes with sprouting roots and cespitose hemicryptophytes. Noda C and D are short grasslands with predominance of rhizomatous and sprouting root geophytes.

The vegetation group that has high number of associated species is *Calotropis procera* (13 species quadrate^{-1}), while the last groups have low species ranging from 6-9 quadrate^{-1}.

Table 2: Synoptic table of the four habitats and the vegetation groups (1-23) at Taif area (log of abundance)

Noda (habitat)	A (San. pla.)								B (Val.)							C (Slo.)					D (Pla.)			
Vegetation group	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Presence
Aerva lanata	9	2	2	1	-	-	-	1	1	1	-	2	1	1	-	-	-	-	-	-	-	-	-	43.5
Pergularia tomentosa	2	8	1	-	2	-	1	-	-	-	-	-	-	-	1	1	1	1	1	1	1	1	-	56.5
Arnebia hispidissima	1	-	9	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	1	30.4
Salsaola spinescens	1	1	1	9	1	1	-	1	1	1	1	-	-	1	-	-	-	-	-	-	-	-	-	47.8
Capparis decidua	-	2	-	-	8	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	17.4
Aizoon canariense	-	1	-	1	1	8	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	21.7
Blepharis ciliaris	-	-	1	-	-	2	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13.1
Calotropis procera	-	-	-	-	-	-	-	9	2	2	2	-	-	1	-	-	-	-	-	-	-	-	-	21.7
Dipterygium glaucum	-	-	-	-	-	-	-	1	9	-	1	1	-	-	-	-	-	-	-	-	1	1	1	30.4
Bassia muricata	2	2	-	1	1	-	-	2	2	9	-	-	1	1	-	-	-	-	-	-	-	-	-	39.1
Haloxylon scoparium	1	2	-	-	2	1	1	1	1	1	9	1	1	1	-	-	-	-	-	-	-	-	-	52.2
Aerva javanica	-	-	-	-	-	-	-	-	1	1	2	9	-	-	-	-	-	-	-	-	-	-	-	17.4
Anthemis melompodina	-	-	1	1	-	-	1	1	-	-	1	-	8	1	-	-	-	-	-	1	-	1	1	43.5
Coccinea grandis	-	-	-	-	-	-	-	1	-	-	1	1	1	9	-	-	-	-	-	-	-	-	-	21.7
Halothamnus bottae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6	1	1	-	1	-	1	1	-	26.1
Anvillea gracinii	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	9	1	1	-	-	-	-	-	17.4
Euryops arabicus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	7	2	1	-	-	-	-	17.4
Dianthis strictus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	8	1	-	-	-	1	21.7
Ecobolium gymnostachyum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	2	7	-	-	-	-	13
Capparis sinaica	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	1	9	2	1	-	26.1
Maerua oblongifolia	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	2	8	-	1	21.7
Salsala kali	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	1	2	1	7	-	26.1
Centaurea schimperi	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	10	8.7
Pulicaria crispa	1	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13
Heliotropium arbainense	-	-	2	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13
Euphorhia inaequilatera	-	1	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	21.7
Pancratium sickenbergeri	-	-	1	1	-	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	17.4
Cryptollum edulis	-	-	2	1	2	-	-	1	1	1	-	1	1	-	-	-	-	-	-	-	-	-	-	34.8
Convolvulus spp	1	1	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13
Launea mussauensis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	1	1	-	-	-	-	-	-	13
Citrullus colocynthis	-	-	-	-	-	-	-	1	1	-	1	2	-	-	-	-	-	-	-	-	-	-	-	17.4
Micromeria spp.	-	-	-	-	-	-	-	1	-	-	-	-	1	2	-	-	-	-	-	-	-	-	-	13
Barleria trispinosa	-	-	-	-	-	-	-	1	-	-	1	1	1	1	-	-	-	-	-	-	-	-	-	21.7
Ehretia obtusifolia	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	4.4
Salvia aegyptiaca	-	-	-	-	-	-	-	1	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	13
Juniperus procera	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	8.7
Commelina albescens	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	1	-	-	-	-	13
Monolluma quadrangula	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	1	-	1	-	-	-	-	17.4
Marrubium vulgare	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-	8.7
Echinops spinosi	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	1	13
Halianthemum lippii	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	8.7
Periploca aphylla	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	1	-	13
Lavandula dentata	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	8.7

San Pla.= sand plain; Val.= valley; Slo.= Slop of wadi; Pla.= plateau.

Table 3: Mean values of soil analysis associated with different habitats of Taif area

Habitat	Depth	pH	MC%	OC%	$CaCO_3$%	TSS%	Cl^- %	SO_4^- %	HCO_3^- %
Plateau	0-15	6.7±0.2	1.81±0.1	0.56±0.01	10.03±0.3	0.95±0.01	0.15±0.01	0.09±0.01	0.05±0.01
	15-30	7.2±0.2	3.10±0.1	0.67±0.01	12.43±0.3	2.15±0.1	0.18±0.01	0.12±0.01	0.05±0.01
	30-45	7.0±0.2	3.10±0.1	0.67±0.01	12.43±0.3	2.15±0.1	0.18±0.01	0.12±0.01	0.05±0.01
Slopes of wadi	0-15	7±0.2	1.56±0.1	0.93±0.01	11.32±0.3	0.43±0.01	0.06±0.01	0.0	0.05±0.01
	15-30	7.2±0.2	2.99±0.1	1.84±0.01	13.43±0.3	0.97±0.1	0.09±0.01	0.12±0.01	0.06±0.01
	30-45	7.3±0.2	4.41±0.1	3.89±0.1	14.33±0.3	1.28±0.1	0.13±0.01	0.17±0.01	0.07±0.01
Sand plain	0-15	6.5±0.2	7.54±0.1	2.27±0.1	16.36±0.3	1.83±0.1	0.07±0.01	0.15±0.01	0.07±0.01
	15-30	6.7±0.2	3.22±0.1	2.63±0.1	14.50±0.3	2.00±0.1	0.14±0.01	0.16±0.01	0.08±0.01
	30-45	6±0.2	4.72±0.1	4.09±0.1	15.68±0.3	2.00±0.1	0.17±0.01	0.18±0.01	0.11±0.01
Valleys	0-15	7.7±0.2	9.20±0.3	1.4±0.1	02.39±0.3	3.48±0.1	0.180±0.01	0.13±0.01	0.10±0.01
	15-30	8±0.2	12.05±0.3	1±0.1	05.32±0.3	4.72±0.1	0.207±0.01	0.14±0.01	0.11±0.01
	30-45	8.4±0.2	13.15±0.3	3.4±0.1	7.94±0.3	7.58±0.1	0.298±0.01	0.15±0.01	0.13±0.01

MC= Moisture content; OC= Organic carbon; TSS= Total soluble salts;

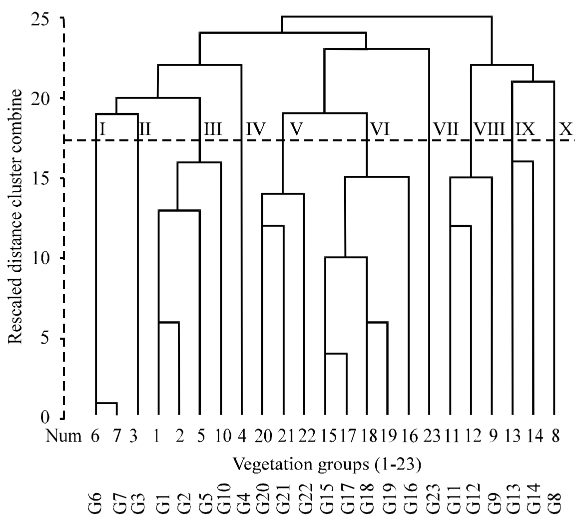

Fig. 1: Dendrogram of the 23 vegetation groups identified after the application of Twinspan

The application of the agglomerative clustering technique to the floristic composition of 23 vegetation groups of the different habitats leads to the distinction of 10 clusters (Fig. 1). Cluster 1 comprises two vegetation groups 6 and 7 (*A. canari* and *B. ciliaris*), cluster 2 include the group 3 dominated by *A. hispidissima*. Four groups are included in cluster 3 (*A. lanata, P. tomentosa, C. decidua* and *B. muricata*), *S. spinescens* is included in cluster 4, three groups are included in cluster 5 (*C. sinaica, M. ablongifolia* and *S. kali*). Five vegetation groups are included in cluster 6 (*H. bottae, E. arabicus, D. strictus, E. gymnostachyum* and *A. gracinii*), cluster 7 included *C. schimperi* only, while cluster 8 included three groups (*D. glaucum, H. scoparium, A. javanica*). Cluster 9 included two groups (*A. melompodium* and *C. gtrandis*) and clusters 10 included *C. procera* groups only.

The soils of nodum B (valleys) tend to be more saline and have the highest value of total soluble salts. The following results may be noted from Table 3:

- The soil moisture content is low in all habitats of Taif area. It ranges from 1.56% in surface layer (soil of slopes) to 13.15% in bottom (soil of valleys).
- The organic carbon content varied between 0.56% (0-15 cm layer) in soil of plateau habitat and 4.09% (30-45 cm layer) in soil of sand plain habitat and brought about dense vegetation cover.
- Calcium carbonate content recorded higher values in sand plain and slope habitats than in other ones. The highest value of $CaCO_3$ was (16.36%) in bottom layer (0- 15 cm) at sand plain habitat.
- The soil reaction changed between slightly acidic to alkaline. In sand plain were mainly acidic (pH 6.0-6.7) but in valleys were mainly alkaline (pH 7.7- 8.4).
- The total soluble salts showed the highest value in the valleys habitat (7.58%) at bottom layer, while the lowest value (0.43%) at surface layer in slopes habitat. The data show that the total soluble salts increase with depth; this may be attributed to continuous leaching of salts from surface layer to bottom[20]. Chlorides and sulphates were the most common anions, while carbonate was almost absent.

DISCUSSION

Since climatic, topographic, edaphic and biotic conditions vary to a greater or lesser degrees within the desert plain landscape, several habitats and community types are formed and become manifest in a mosaic vegetation. The casual factor or factors behind the change of vegetation is of primary concern. Variations in the environmental gradients may be caused by variations in texture, organic carbon, pH and salinity of soil that might be of direct or indirect influence on plant life and existence. In trying to account for the distribution of community types in Taif, several edaphic differences concerned in the present study may be considered as solely responsible. On studying soil-communities relationships, the whole soil profile should be considered since in some cases tap roots pass through horizons of variable characteristics[1,7].

The obtained results revealed that valleys and sand plain habitats are characterised with relatively high species richness compared with those of slopes and plateaus of Taif area. This may be related to the rocky nature of the soils of both slopes and plateaus as they have the highest exposed rocks[21]. Certain groups have low species richness but relatively high total cover (*Pergularia tomentosa, Capparis decidua* and *Halothamnus bottae* community types). These groups occupy the highly saline flats or the driest rocky habitats. Those habitats have a limited number of species which act as stress tolerators to adverse conditions[21,22] and have a high plant cover (i.e., high phytomass). The study showed that most of scrubland community types (*Capparis decidua, Pulicaria crispa* and *Heliotropium arabinense*) were recognized in sand plains, which are covered with deep alluvial soil with relatively low salinity.

The valley habitat could be considered as an example of valley system at advanced stage of development. The natural climax of this system would be a *Calotropis* or/and *Haloxylon* cluster 7 and 10. The bed is covered with deep alluvial soil and the plant species exhibit a wide range of variation in size and vitality. These differences reflect variation in soil depth and water resources. The distribution of species composition of each in specific ecologically defined habitats would substantiate the fact that such community types are useful as indicators for their habitat characters[23], even under adverse conditions of disturbance agencies encountered in these habitats. In sand plains *Pergularia tomentosa* is widespread; it dominates in cluster III and recorded in four other communities of these habitats. Mossallam and Bazaid[24] showed that *P. tomentosa* is widespread in Taif and latex of its stem and leaves is irritant to the skin and eyes and can cause inflammation and pain and if ingested can cause stomach cramps and diarrhea. In medicine it is used as expectorant and purgative.

Calotropis procera grows in either pure quadrates or associated with *Dipterygium glaucum* and *Salosla spinescens* in the valleys habitats, it grows also in separate cluster 10. Its soil is characterized by relatively higher salinity. Fayed and Zayed[3] observed that *C. procera* community type is in disturbed habitats around settlements and in the vicinity of towns at Taif area and its soil is deep, fine textured and relatively high salinity.

However, some of the species have wide ecological and sociological ranges of distribution. These are *Aerva lanata, Salsola spinescens* and *Haloxylon scoparium*. Where *Calotropis procera, Dipterygium glaucum, Aerva juvanica, Anthemis melompodina* and *Coccinea grandis* are moderately distributed. In contrast, other species are confined to certain plant communities: *Ehretia obtusifolia* associated with *C. grandis* community in valley habitats and *Dianthis strictus* associated with *C. schimperi* in plateau habitats.

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