

Ecology and Flora of Wadi Al Jimi, Eastern Abu Dhabi Emirate, United Arab Emirates

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ABSTRACT : The present study deals with the flora and vegetation of wadi Al Jimi, Eastern Abu Dhabi, United Arab Emirates. Six locations were selected to represent different variations in habitats. 41 species were recorded belonged to 21 families and 36 genera. Perennials have the highest contribution 71% of the total flora while annuals 29% percent. 32% of the total species were recorded as common and very common and 45% as rare and very rare. Shrubby species have the highest number of species followed by herbs, grasses and trees (37%, 32%, 19% and 11% respectively).

Application of TWINSpan led to the recognition of three vegetation groups named after their dominant species. Two of these groups were dominated by *Aerva javanica* while the *Prosopis juliflora*. Application of DECORAND led to reasonable segregation between these groups.

Results of soil analysis showed significant variation in moisture, organic matter along DECORANA axes and the distribution of plant communities were related significantly to variation in these factors.

Key words: Vegetation, wadi, Diversity, Ordination, UAE

INTRODUCTION

Little attention has been paid for the evaluation of current status of natural vegetation of the United Arab Emirates (e.g. Oatham et al. 1995 a and b and Oatham 1997). In addition, visual observation indicated that many habitats in UAE are subjected to over-grazing (El-Ghonemy 1985, Western 1989, and Zahran 1997). Satchell *et al.* (1981) indicated that the land classification of UAE being the basis of a stratified scheme for vegetation sampling. El-Ghonemy (1985) described the climate, topography and soil of Al-Ain Oasis, and gave a short account of the main plant communities with a detailed description of the monocotyledons taxa. Mousa (2005) and Shaltout *et al.* (2008) analyzed the vegetation of rangelands in the United Arab Emirates. Recently Mousa and Fawzi (2010) analyzed the vegetation of wadi Al Ain.

The present study analyses the vegetation structure, physical components, and land-use in the wadi Al Jimi. The main objectives are determining the floristic composition of the different locations and habitats and identifying the main plant communities using the multivariate analysis. This study focuses our attention towards the species diversity of the rangelands in UAE.

Study Area

Wadi Al Jimi extends from Oman mountains at east through Al Ain City and ended in sand formations near Maqam in the west with total length of about 22 km. The study is semi-mobile dunes are the dominant visual feature, with a relatively high water table resulting in evaporative crusts in many depressions. The sands remain fairly well demarcated between the coastal oolitics and the inland Aeolian (Alsharhan *et al.* 2002). Low rainfall and high temperatures characterize the climate of the UAE. Temperature rises up to 49°C in July, while it can be as low as 5°C in January, though

this is rare on the coast because of the moderating influence of the sea. Most precipitation occurs between December and April, annual precipitation ranges between 87.3 and 180 mm, the range varied from year to another (Ministry of Agriculture and Fisheries, UAE 1965-2001).

MATERIALS and METHODS

Six locations were selected so as to represent the physiographic and physiognomic variation in wadi (Fig. 1). The main habitats are sand. In each stand the present species were recorded. Nomenclature was according to Western (1989), Mandaville (1990), Jongbloed (2003) and Karim and Fawzi (2007a and b). Plant cover was estimated visually according to Braun-Blanquet (1964) method for vegetation analysis.

TWINSpan and DECORANA were applied to the matrix of cover estimates of 108 species in 55 stands according to the computer programme of Hill (1979 a, b). Species richness of each vegetation group was calculated as the average number of species per stand. Species turnover (beta diversity) was calculated as the ratio between the total number of species recorded in a certain vegetation cluster and its alpha-diversity (Whittaker 1972). Shannon-Wiener index ($H' = -\sum P_i \log P_i$) for the relative evenness, and Simpson index ($C = \sum P_i^2$) for the relative concentration of dominance were calculated for each vegetation group on the basis of relative cover (pi) of species (Magurran 1988).

The probable environmental significance of DECORANA axes was investigated by the simple linear correlation analysis and the forward selection of stepwise multiple regression. ANOVA test was applied to assess the significance of variation in community and soil variables in relation to the vegetation clusters. These techniques were according to SPSS software (Nie *et al.* 2001).

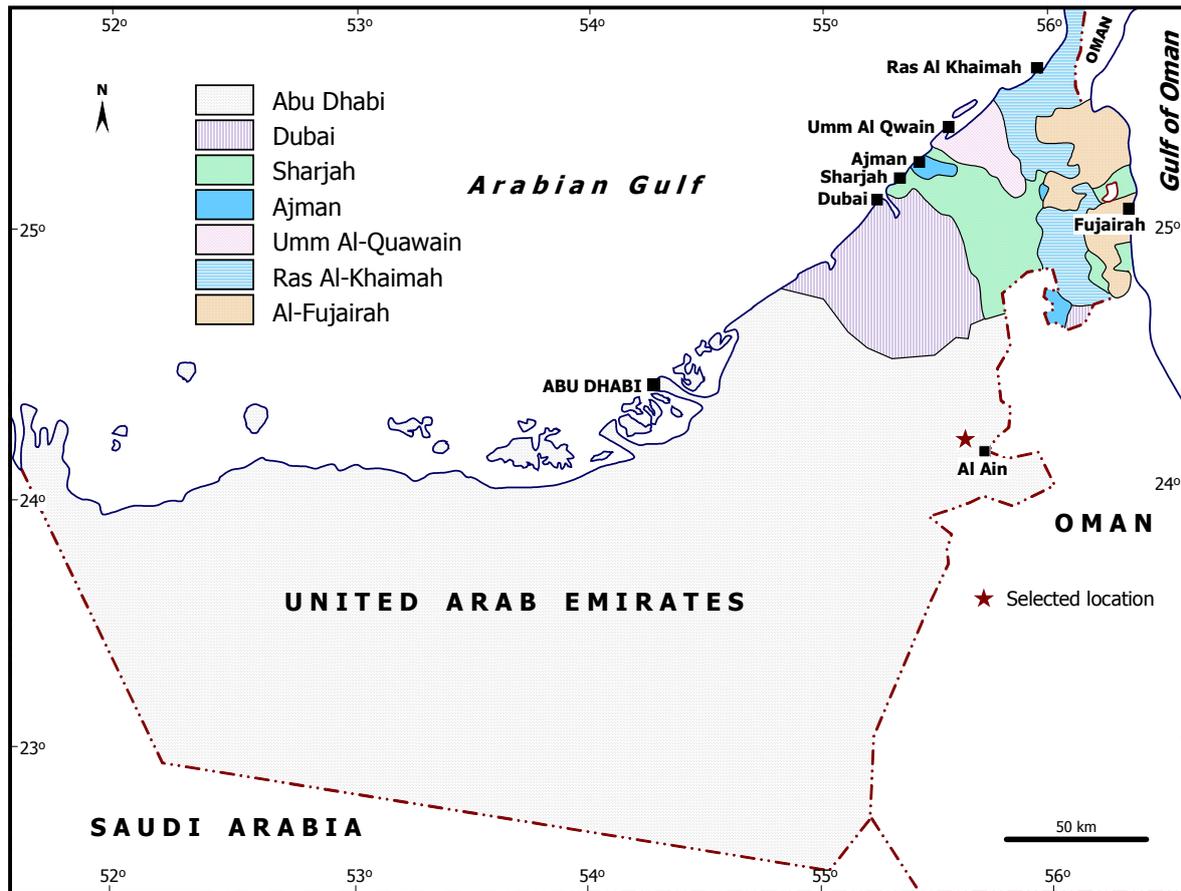


Figure 1. Location map of the United Arab Emirates showing the study area.

RESULTS

The total number of species recorded is 41 species belong to 21 families, list of the recorded species; families and their percentages are listed in appendix 1. Two species were recorded as common, 11 as common and 10 uncommon, rare and very rare species were 18 (Table 1). Perennials total 29 species, and annuals 12 species. (Table 2) Six vegetation groups (VG) were generated at the level three of TWINSpan; the results of applications of DECORANA indicated a reasonable segregation among these groups (Fig. 2). Vegetation groups I, II, III and VI dominated by *Aerva javanica* while *Prosopis juliflora* dominated in group IV and V. Shrubs have the highest contribution (36.6%) followed by herbs (31.7%), grasses (19.5%) and trees (12.2%) (Table 3).

DISCUSSION

Spatial distribution of plant species and communities over small geographic area in desert ecosystems is related to heterogenous topography and land pattern (Kassas 1952, Al wadie 2002). In the area of the present study, six vegetation groups are generated after

the application of two way indicator species analysis (TWINSpan) to the cover estimate of 108 species in 55 stands.

The application of detrended correspondence analysis (DCA) to the same set of data supports the distinction between the 6 vegetation groups. Some groups are dominated by *Cenchrus ciliaris* - *Cynodon dactylon*, represent high moisture content of soil as a result of water supplies comes from near station in case of emergency. *Polypogon monspeliensis* - *Aerva javanica*, and *Polypogon monspeliensis* - *Sporobolus spicatus*, occupies vast area of the wadi have little water supply and its soil still moisten in time of study, salt cover this area after water evaporation. *Aerva javanica* - *Salsola imbricata* dominated the area of dry land in the wadi. *Salsola imbricata* dominated outside part of wadi characterized by sandy formation. Most of these vegetation groups were identified by El-Ghonemy (1985), Zahran (1997), Mousa (2005) and Shaltout et.al. (2008), some of these groups are comparable to those identified in the central and eastern Arabia (Shaltout and Mady 1996, Shaltout et al. 1997).

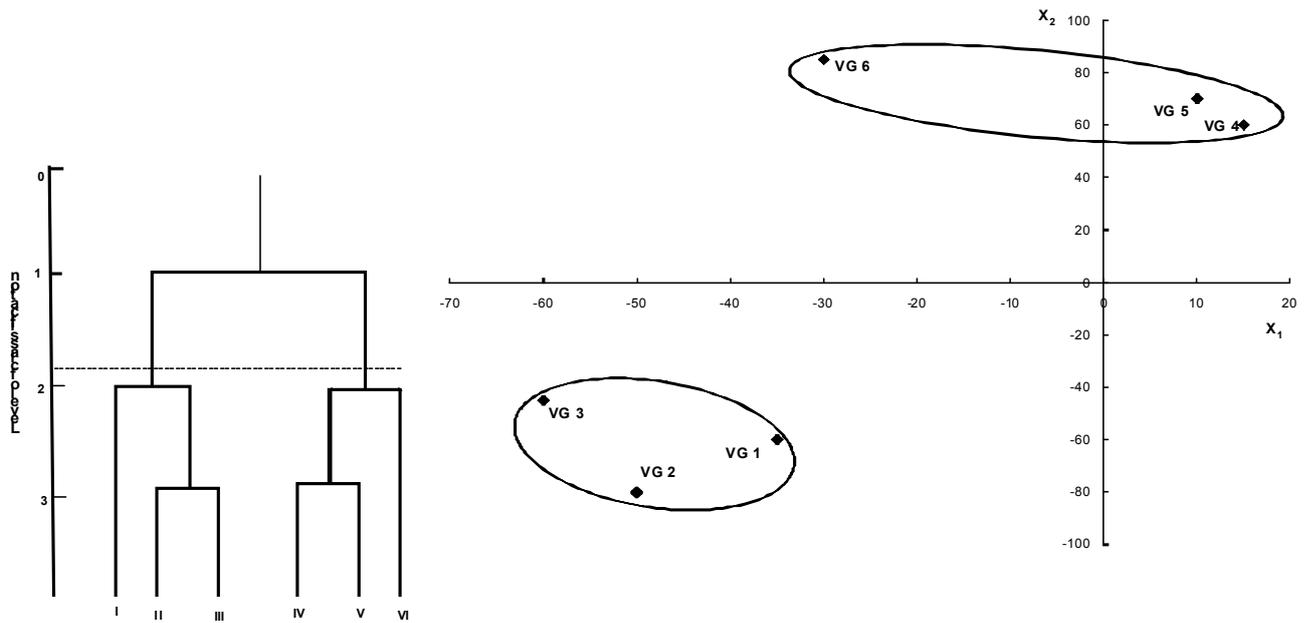


Figure 2. The relationship between the six vegetation groups segregated after the application of TWINSpan classification technique, and their centroids on the first and second axes of DECORANA.

Table 2. Life cycles of the plant communities of the recorded families, N: is the actual number and %: is the percentage. Tested by χ^2

Family	Life forms					
	Annuals		Perennials		Total	
	N	%	N	%	N	%
Amaranthaceae	2	16.7	1	3.4	3	7.3
Arecaceae			1	3.4	1	2.4
Asclepiadaceae			2	6.9	2	4.9
Boraginaceae			1	3.4	1	2.4
Brassicaceae			1	3.4	1	2.4
Caesalpinaceae			1	3.4	1	2.4
Chenopodiaceae			2	6.9	2	4.9
Convolvulaceae			2	6.9	2	4.9
Cucurbitaceae	1	8.3			1	2.4
Cyperaceae			1	3.4	1	2.4
Euphorbiaceae	1	8.3	1	3.4	2	4.9
Fabaceae	1	8.3			1	2.4
Malvaceae	1	8.3	1	3.4	2	4.9
Mimosaceae			3	10.3	3	7.3
Poaceae	2	16.7	6	20.7	8	19.5
Polygonaceae	1	8.3			1	2.4
Portulacaceae	1	8.3			1	2.4
Rhamnaceae			1	3.4	1	2.4
Tiliaceae	1	8.3			1	2.4
Urticaceae			1	3.4	1	2.4
Zygophyllaceae	1	8.3	4	13.8	5	12.2
	12	29.3	29	70.7	41	
P-value	<0.001		<0.001			

Table 3. Life forms of the plant communities of the recorded families in wadi Al Jimi, N: is the actual number and %: is the percentage.

Families	Life forms									
	Grass		Herb		Shrub		Tree		Total	
	N	%	N	%	N	%	N	%	N	%
Amaranthaceae			2	15.4	1	6.7			3	7.3
Arecaceae							1	20.0	1	2.4
Asclepiadaceae					2	13.3			2	4.9
Boraginaceae					1	6.7			1	2.4
Brassicaceae					1	6.7			1	2.4
Caesalpinaceae					1	6.7			1	2.4
Chenopodiaceae					2	13.3			2	4.9
Convolvulaceae					2	13.3			2	4.9
Cucurbitaceae			1	7.7					1	2.4
Cyperaceae			1	7.7					1	2.4
Euphorbiaceae			1	7.7	1	6.7			2	4.9
Fabaceae			1	7.7					1	2.4
Malvaceae			1	7.7	1	6.7			2	4.9
Mimosaceae							3	60.0	3	7.3
Poaceae	8	100							8	19.5
Polygonaceae			1	7.7					1	2.4
Portulacaceae			1	7.7					1	2.4
Rhamnaceae							1	20.0	1	2.4
Tiliaceae			1	7.7					1	2.4
Urticaceae					1	6.7			1	2.4
Zygophyllaceae			3	23.1	2	13.3			5	12.2
	8	19.5	13	31.7	15	36.6	5	12.2	41	
P-value	<0.001		<0.001		<0.001		<0.001			

REFERENCES

- Abbadi, G. A. and El-Sheikh, M. A. (2002). Vegetation analysis of Failaka Island (Kuwait). *J. Arid Env.* 50: 153-165.
- Ali, M. M. and Badri, M. A., Hassan, L. M. and Springuel, I. V. (1997). Effect of phisioeographical factors on desert vegetation, Wadi Allaqi Biosphere Reserve, Egypt: A multivariate analysis, *Ecologie*, 28 (2) 119-128.
- Alsharhan, A.S., Rizk, Z.A., Niran, A.E.N., Bakhit, D.W. and Alhajari, S.A. (2002). *Hydrology of an arid region: The Arabian Gulf and Adjoining Areas*. Balkema, Amsterdam.
- Al Wadie, H. (2002). Floristic composition and vegetation of wadi Talha, Aseer mountains, south west Saudi Arabia, *J. Biolog. Sci.* 2(5): 285-288.
- Braun-Blanquet, J. (1964). *Pflanzensoziologie*. Wien.
- El-Ghonemy, A.A. (1985). *Ecology and Flora of Al-Ain Region. I. Ecology and Monocotyledons*. Publications of UAE University. Al-Ain. pp 204.
- Hill, M.O. (1979a). TWINSPAN - A FORTRAN Program for Arranging Multivariate Data in an Ordered Two-Way Table by Classification of the Individuals and Attributes. Cornell Univ., Ithaca, 52 pp.
- Hill, M.O. (1979b). *DECORANA - A FORTRAN Program for Detrended Correspondence Analysis and Reciprocal Averaging*. Cornell Univ., Ithaca, 90 pp.
- Jongbloed, M. (2003). *Wild Flowers of UAE*. Environment Research and Wildlife Development Agency, Abu Dhabi.
- Karim, F.M. and Fawzi, N.M. (2007a). *Flora of the United Arab Emirates*. Vol. (1) Publications of United Arab Emirates University, Al-Ain, UAE.
- Karim, F.M. and Fawzi, N.M. (2007b). *Flora of the United Arab Emirates*. Vol. (2). Publications of United Arab Emirates University, Al-Ain, UAE.
- Kassas, M. (1952). Habitat and plant communities of the Egyptian deserts. I. Introduction. *J. Ecol.*, 40:342-351.
- Magurran, A.E. (1988). *Ecological Diversity and its Measurement*. Chapman and Hall, London, 179 pp.
- Mandaville, J. P. (1990). *Flora of Eastern Saudi Arabia*. Kegan Paul International, Riyadh.
- Ministry of Agriculture and Fisheries in UAE (1965-2001). *Annual Statistics Bulletin*. Karim Press., Dubai (in Arabic).

- Mousa. M.T. (2005). *Ecological Study on Some Desert Rangelands*. Ph. D. Thesis, Tanta Univ., Tanta, Egypt. 221 pp.
- Mousa. M.T. and Fawzi, N.M. (2009). Vegetation analysis of Wadi Al Ain, United Arab Emirates. *Academic Journal of Plant Sciences*. 2 (1): 09-15
- Nie, N.H., Hull, C.H., Jenkins, J. G., Steinbrenner, K. and Bent, D.H. (2001) *SPSS: Statistical Package for the Social Science*. New York: McGraw Hill Inc.
- Oatham, M.P. (1997). Water relations of *Zygophyllum hamianse*, *Heliotropium kotschyi* and *Panicum turgidum*. *Arid Envir*. 35: 95-110.
- Oatham, M.P., Nicholls, M.K. and Swingland, I.R. (1995a). Manipulation of vegetation communities on the Abu Dhabi rangelands. I. The effects of irrigation and release from long term grazing. *Biodiv. and Conser*. 4: 696-709.
- Oatham, M.P., Nicholls, M.K. and Swingland, I.R. (1995b). Manipulation of vegetation communities on the Abu Dhabi rangelands. II. The effects of top soiling and drop irrigation and release from long term grazing. *Biodiv. and Conser*. 4: 710-718.
- Satchell, J. E. Mounford, M.D. and Brown, W.M. (1981). Land classification Map of the UAE. *Arid Envir*. 4: 275-285.
- Shaltout, K.H. and Madi, M.A. (1996). Analysis of raudhas vegetation in central Saudi Arabia. *J. Arid Envir*. 34: 441-454.
- Shaltout, K.H., El-Halawany, E. F. and El-Garawany, M. M. (1997). Coastal lowland vegetation of Eastern Saudi Arabia. *Biodiversity and Conservation* 6: 1027-1040.
- Shaltout, K.H., El Keblawy, A.A. and Mousa. M.T. (2008). Vegetation analysis of some desert rangelands in United Arab Emirates, *Middle-East Journal of Scientific Research* 3(3): 149-155.
- Vesey-Fitzgerald, D.F. (1957). The vegetation of the central and eastern Arabia. *J. Ecol*. 45: 779-798.
- Western, R.A. (1989). *The Flora of the United Arab Emirates: An Introduction*, Publications of United Arab Emirates University, AlAin, UAE.
- Whittaker, R.H. (1972). Evolution and measurement of species diversity. *Taxon* 21: 213-251.
- Zahrán, M.A. (1997). Ecology of the United Arab Emirates. In Hala, N. Barakat and Ahmad K. Hegazy (eds) *Reviews in Ecology: Desert Conservation and Development*. A Festschrift for Prof. M. Kassas on the occasion of his 75th Birthday, pp.297-331. UNESCO, IDRC, CRD, Metropolitan, Cairo.

Appendix 1. List of the recorded species and their families

Family	Species	Arabic Name	Life form	Life cycle	Abundance
Amaranthaceae	<i>Aerva javanica</i>	أرا	Shrub	Perennial	Very Common
Amaranthaceae	<i>Amaranthus graecizans</i>	سندر	Herb	Annual	Very rare
Amaranthaceae	<i>Amaranthus viridis</i>	عرف الديك	Herb	Annual	Rare
Arecaceae	<i>Phoenix dactylifera</i>	نخيل	Tree	Perennial	Very Rare
Asclepiadaceae	<i>Calotropis procera</i>	أشعر - عشار	Shrub	Perennial	Uncommon
Asclepiadaceae	<i>Leptadenia pyrotechnica</i>	مرخ	Shrub	Perennial	Rare
Boraginaceae	<i>Heliotropium bacciferum</i>	رمرام	Shrublet	Perennial	Common
Brassicaceae	<i>Zilla spinosa</i>	سلا	Shrub	Perennial	Very rare
Caesalpinaceae	<i>Senna italica</i>	عشرج - سنا	Shrublet	Perennial	Common
Chenopodiaceae	<i>Haloxylon salicornicum</i>	رمث	Shrub	Perennial	Common
Chenopodiaceae	<i>Salsola imbricata</i>	فريط - خريط	Shrublet	Perennial	Common
Convolvulaceae	<i>Convolvulus deserti</i>	رخام	Shrublet	Perennial	Common
Convolvulaceae	<i>Convolvulus virigatus</i>	رخام	Shrublet	Perennial	Rare
Cucurbitaceae	<i>Citrullus colocynthis</i>	حنظل	Herb	Annual	Common
Cyperaceae	<i>Cyperus rotundus</i>	سعد	Herb	Perennial	Very rare
Euphorbiaceae	<i>Chrozophora oblongifolia</i>	غبيرة	Shrublet	Perennial	Rare
Euphorbiaceae	<i>Phyllanthus rotundifolius</i>	ام الحليب	Herb	Annual	Very rare
Fabaceae	<i>Medicago sativa</i>	برسيم - علف	Herb	Annual	Very rare
Malvaceae	<i>Hibiscus sabdariffa</i>	كر كندية	Shrublet	Perennial	Very rare
Malvaceae	<i>Malva parviflora</i>	خبيزه	Herb	Annual	Very rare
Mimosaceae	<i>Acacia tortilis</i>	سمر	Tree	Perennial	Uncommon
Mimosaceae	<i>Prosopis cineraria</i>	غاف	Tree	Perennial	Very rare
Mimosaceae	<i>Prosopis juliflora</i>	غويف - غويفه	Tree	Perennial	Common
Poaceae	<i>Aristida adscensionis</i>	صمعه	Grass	Annual	Uncommon
Poaceae	<i>Cenchrus ciliaris</i>	سبط - مخاضير	Grass	Perennial	Common
Poaceae	<i>Cynodon dactylon</i>	نجيل	Grass	Perennial	Uncommon
Poaceae	<i>Dactyloctenium aegyptium</i>	عيله - نجم	Grass	Annual	Very rare
Poaceae	<i>Dichanthium foveolatum</i>	تيراب	Grass	Perennial	Very common
Poaceae	<i>Panicum antidotale</i>	سيسون	Grass	Perennial	Uncommon
Poaceae	<i>Pennisetum divisum</i>	ثمام - مخاضير	Grass	Perennial	Uncommon
Poaceae	<i>Sporobolus spicatus</i>	حلفا	Grass	Perennial	Very Rare
Polygonaceae	<i>Rumex vesicarius</i>	حمض	Herb	Annual	Very Rare
Portulacaceae	<i>Portulaca oleracea</i>	بقله	Herb	Annual	Uncommon
Rhamnaceae	<i>Ziziphus spina-christi</i>	نيق - سدر	Tree	Perennial	Uncommon
Tiliaceae	<i>Corchorus trilocularis</i>	ملوخية الغراب	Herb	Annual	Uncommon
Urticaceae	<i>Forsskaolea tenacissima</i>	لصيق	Shrublet	Perennial	Uncommon
Zygophyllaceae	<i>Fagonia ovalifolia</i>	شيكاف - شكاف	Shrublet	Perennial	Common
Zygophyllaceae	<i>Tribulus omanense</i>	قطب - زهر	Herb	Perennial	Rare
Zygophyllaceae	<i>Tribulus terrestris</i>	قطب - حساك	Herb	Perennial	Uncommon
Zygophyllaceae	<i>Zygophyllum mandavillei</i>	هرم - حمض	Shrublet	Perennial	Common
Zygophyllaceae	<i>Zygophyllum simplex</i>	حميض - قرمل	Herb	Annual	Rare