Middle-East Journal of Scientific Research 25 (6): 1342-1348, 2017
ISSN 1990-9233

DOI: 10.5829/idosi.mejsr.2017.1342.1348

Floristic Composition and Life Forms for Wild Plants of Shada Highest Mountain and Wadi Sagamah at Al BahaArea, Saudi Arabia

M.A. Al Zubaide, H.S Al Zahrani and A.A. Al Toukhy

Department of Biological Sciences, Faculty of Science,
King Abdulaziz University, Jeddah, Saudi Arabia

Abstract: Study area lies in southern region of Saudi Arabia between the latitudes of 41º 30 ˙ North and longitudes of 19º 84 ˙ East. Ten stands in different highest above sea level were chosen to study floristic composition and life form for wild plants with recognizing plant communities, life forms spectra, abundance and economic uses. Total number of recorded species in study area were 29 belongs to 27 genus and 20 families. Twenty one species representing perennial and eight species were annual with ratios 72.41% and 27.60 % respectively. Fabaceae (leguminosae) have the highest contributions, 13.8% followed by Poaceae (graminae) and Asteraceae with ratio(10.3%) Acanthaceae and Amaranthaceae with ratio (6.9%) *Apocynaceae, Aristolochiaceae, Asclepiadaceae, Boraginaceae, Cacurbitaceae, Cleomaceae, Convolvulaceae, Cappariceae, Crucifceae, Cucurbitaceae, Malvaceae, Rhamnaceae, Solanaceae and Tiliaceae* with (3.4%) for each. The tree represented by (17.2%), shrubs (51.8%) and weeds (31.1%) respectively. The economic use showed that medical (44.83%), grazing and edible (13.79), fuel (3.44), other (24.13%).

Key words: Floristic composition · Life forms · Wild plants

INTRODUCTION

Saudi Arabia, a part of the Arabian Peninsula, covers more than 2 million sq kms and comprises several distinct physiographical regions, such as mountains, Valleys (Wadis), sandy and rocky deserts, salt pans (Sabkhahs) and lava areas (Harrats), *etc*. [1]. Saudi Arabia's biodiversity is under threat from multiple stresses. Climate change is one of the several pressures. Although climate changes will have consequences all over Saudi Arabia, not all regions will be affected equally, nor all regions equally vulnerable to those impacts. Canonical correlation an Saudi Arabia, being located in the arid part of the world is expected to experience faster warming due to climate change than countries located in the tropical or temperate regions. However, significant variation can be anticipated due to the large size of the country, its diverse landscapes and also due to its Red Sea coast on the western side and the Arabian Gulf on the eastern side. The flora of Saudi Arabia has about 2281 species in 853 genera [2].

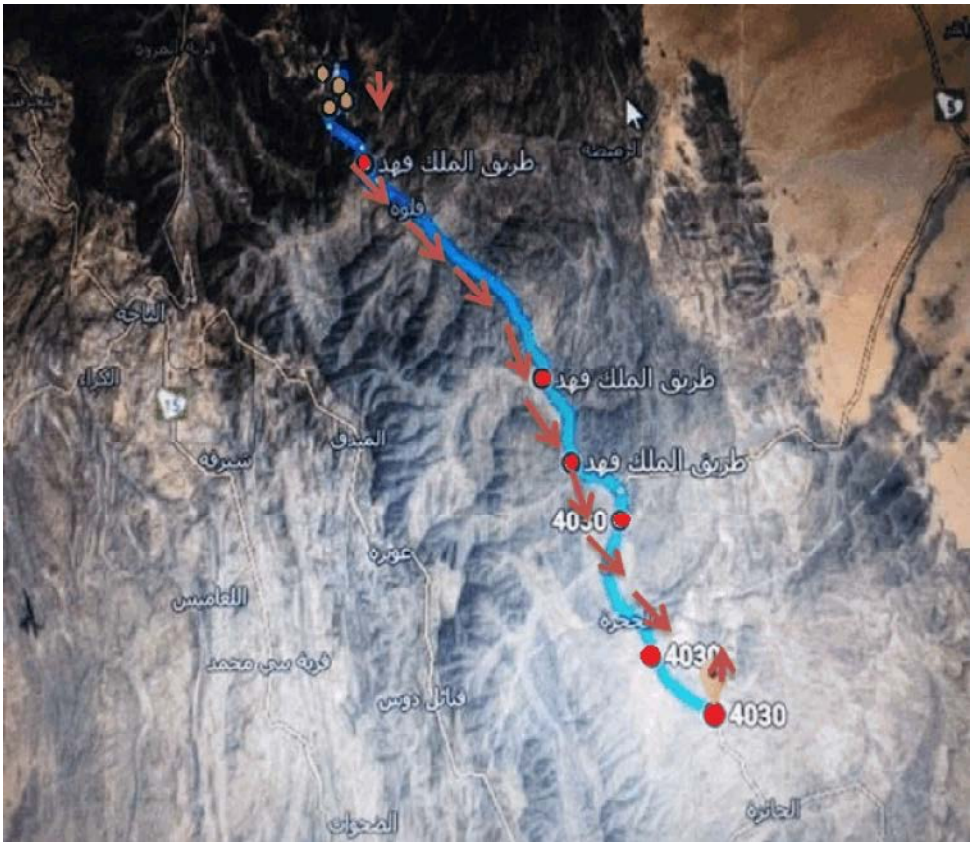
In Al-Baha province, Sothern of KSA, Shada Highest mountain and Wadi Sagamah. areas have a large importance diversity of the group of wild plants., 495 plant species falling in 314 genera and 76 families occurred in the Shada Mountains, including 19 endemic species and 43 endangered species and accounting for 22% of the total flora in Saudi Arabia [3].

The aim of the present study is to investigate floristic composition life form spectra, abundance and economic uses in Shada Mountain and Wadi Sagamah in Al- Baha province at KSA.

MATERIALS AND METHODS

Ten stands (four in Shada Mountain &6 at Wadi Sagamah) were selected to represent the environmental variations (Fig 1). The stand size 20 × 20 m. In each stand, list of species, common species were recorded to Braun-Blanquet scale [4], the abundance and life form were calculated according to Braun- Blanquet cover abundance scale as follows:Scale 5, 4, 3, 2, 1, + and r cover abundance, 75%, 50-70%, 25-50%, 5-25%, 1-5%, few and solitary respectively, where life forms of the species were identified following the Raunkiar scheme as follows [5], Code Ph, Ch, G, Th and P means life form Phanerophytes, Chamaephytes, Geophytes-Helophytes, Therophytes,

Corresponding Author: Abdul Moneam A. Al-Toukhy, Biological Sciences Department, Faculty of Science, King Abdulaziz University, Jeddah, Saudi Arabia.



Stands from 1 to 4
Stands from 5 to 10
Fig. 1: Distribution of 10 stands along study area by using their coordinates (GPS).

Therophytes and Parasites respectively. The potential and actual economic uses of wild plants were assessed on three bases; field observations, information collected from local inhabitants and literature review [6-21]. The economic uses were classified into 5 major categories: grazing, fuel, medicinal uses, human food and other uses (*e.g.* ornamental uses, sand binder, soap manufacture and oil and dye extraction…*etc.*). As almost all the plants are ecologically important (*e.g.* keeping stability and biodiversity of the ecosystems, sharing in soil stabilization and symbiosis, *etc.*), this criterion was not taken into consideration in the evaluation of the economic importance of the plant.

RESULTS

Floristic Composition

The recorded species in the study area, their families,, life forms, habits, abundance and their uses are listed in Tables 1, 2 & 3 and 4. Table (1) cleared that total number of recorded species in the study area was 29 species belong to 27 Genus and 20 families. Table(2) &. Fig. (2) showed that more than 72.41% of the recoded species are perennials (21 species) and 27.60 % are annuals (8 species). Fabaceae (leguminosae) have the highest contributions, 13.8% followed by Poaceae (graminae) and Asteraceae with ratio (10.3%) Acanthaceae and Amaranthaceae with ratio (6.9%) Apocynaceae, Aristolochiaceae, Asclepiadaceae, Boraginaceae, Cacurbitaceae, Cleomaceae, Convolvulac ae, Cappariceae, Crucifceae, Cucurbitaceae, Malvaceae, Rhamnaceae, Solanaceae and Tiliaceae

With (3.4%) for each. The tree represented by(17.2%), shrubs(51.8%) and weeds(31.1%) respectively. One species was recorded 100% (Acacia haulms), two species were recorded 90 % (Aerva javanica & Solanum incanum),80%(Senna Alexandria &Citrulls colocyanthis) 70% (Cassia etalica & Zizphus spina chiristi). The rest of species (22 species) were recorded in less than 60 % of the total stand.

Table 1: Species and families recorded in study areas (Shada mountain and Wadi Sagamah)

	Species	Families
1	Justicia flava	Acanthaceae
2	Justicia minuta	
3	Aerva javanica	Amaranthaceae
4	Celosia trigyna	
5	Aderium obessum	Apocynaceae
6	Aristo lochia bracteolate	Aristolochiaceae
7	Pergalaria tomentosa	Asclepiadaceae
8	Pulicaria Arabic	Asteraceae
9	Tagetes minuta	
10	Conzya incana	
11	Heliotropium europaeum	Boraginaceae
12	Citrullus colocynthis	Cacurbitaceae
13	Capparis spionosa	Cappariceae
14	Cleome droserifolia	Cleomaceae
15	Ipomea sinensis	Convolvulaceae
16	Morettia canscons	Crucifceae
17	Corallocarpus schimperi	Cucurbitaceae
18	Ricinus communis	Eupharbiaceae
19	Acacia hamulosa	
20	Astagalus spinonsus	
21	Senna alexandrina	Fabaceae (leguminosae)
22	Cassia etalica	
23	Abutilom figarianum	Malvaceae
24	Setaria pumila	
25	Cenchrus ciliaris	Poaceae (graminae)
26	Aristida adsconsionis	
27	Ziziphus spina-christi	Rhamnaceae
28	Solanum incanum	Solanaceae
29	Grewia tenax	Tiliaceae

Table 2: Life form for species recorded in study areas (Shada mountain and Wadi Sega amah)

		Species	LF.	P %
1	Justicia flava	Per	Shrub	%16
2	Justicia minuta	Per	Shrub	%18
3	Aerva javanica	Per	Shrub	%33
4	Celosia trigyna	Ann	Shrub	%17
5	Aderium obessum	Per	Tree	%25
6	Aristo lochia bracteolate	Ann	Shrub	%34
7	Pergalaria tomentosa	Per	Shrub	%8
8	Pulicaria Arabic	Ann	Weed	%11
9	Tagetes minuta	Ann	Shrub	%19
10	Conzya incana	Per	Weed	%21
11	Heliotropium europaeum	Ann	Weed	%28
12	Citrullus colocynthis	Per	Weed	%13
13	Capparis spionosa	Per	Shrub	% 8
14	Cleome droserifolia	Per	Shrub	%11
15	Ipomea sinensis	Ann	Weed	%16
16	Morettia canscons	Ann	Shrub	%33
17	Corallocarpus schimperi	Per	Weed	%25
18	Ricinus communis	Per	Shrub	%19
19	Acacia hamulosa	Per	Tree	%14
20	Astagalus spinonsus	Per	Shrub	%18
21	Senna alexandrina	Per	Tree	%23
22	Cassia etalica	Per	Tree	%13
23	Abutilom figarianum	Per	Shrub	% 8
24	Setaria pumila	Per	Weed	%11
25	Cenchrus ciliaris	Per	Weed	%36
26	Aristida adsconsionis	Per	Weed	%25
27	Ziziphus spina-christi	Per	Tree	%13
28	Solanum incanum	Ann	Shrub	%21
29	Grewia tenax	Per	Shrub	%16

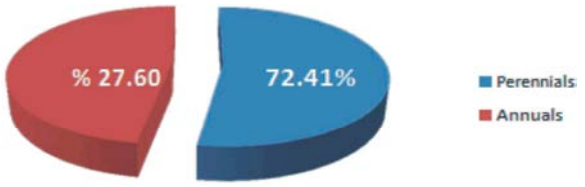


Fig. 2: Percentage of habits of the recorded species in study area(Shada mountain an Wadi Sagamah)

Table 3: The economic uses of the recorded species in Shada mountain and Wadi Sagamah.

		Uses				
	Species	M	G	E	F	O
1	Justicia flava					
2	Justicia minuta					
3	Aerva javanica					
4	Celosia trigyna					
5	Aderium obessum					☐
6	Aristo lochia bracteolate	☐				
7	Pergalaria tomentosa	☐				
8	Pulicaria Arabic	☐				
9	Tagetes minuta	☐		☐		
10	Conzya incana					☐
11	Heliotropium europaeum					☐
12	Citrullus colocynthis			☐		
13	Capparis spionosa	☐		☐		
14	Cleome droserifolia	☐				
15	Ipomea sinensis					☐
16	Morettia canscons		☐			
17	Corallocarpus schimperi					☐
18	Ricinus communis	☐				
19	Acacia hamulosa	☐				
20	Astagalus spinonsus	☐				
21	Senna alexandrina	☐				
22	Cassia etalica	☐				
23	Abutilom figarianum	☐				
24	Setaria pumila		☐	☐		
25	Cenchrus ciliaris		☐			
26	Aristida adsconsionis					☐
27	Ziziphus spina-christi	☐	☐		☐	☐
28	Solanum incanum	☐				
29	Grewia tenax	☐				

Economic Uses: Result in Table (3) and Fig. (3) showed that medical plants represented by families *Aristolochiaceae, Asclepadeaceae, Astreaceae, Cappariceae, Cleomeace Fabceae, Malvaceae Rhamnaceae and Salaneaceae*, the economic uses showed that medical (44.83%), grazing and edible(13.79), fuel (3.44), other (24.13%).

Life Form Spectra: The life form spectra of the vegetation in Shada mountain and Wadi Sagamah indicated that, perennials had the highest contribution in the study area (72.41% of the total recorded species), devided by

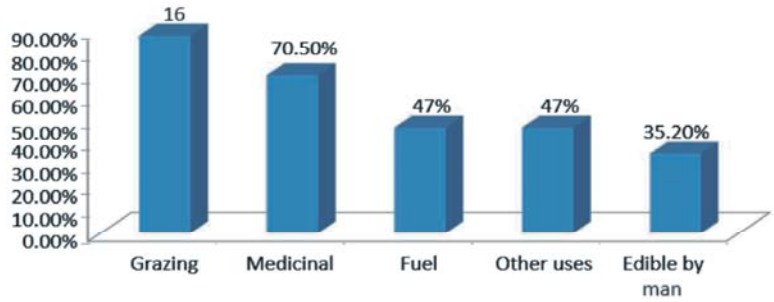


Fig. 3: Descending arrangement of the economic uses of the recorded species in Shada mountain and Wadi Sagamah.

Table 4: Determination the abundance of species according to Braun- Blanquet cover-abundance scale.

Family	Species	1	2	3	4	5	6	7	8	9	10	Presence
Acanthaceae	Justicia flava	1	0	2	1	0	0	1	0	0	0	4
	Justicia minuta	0	1	1	3	0	1	0	0	0	0	4
Amaranthaceae	Aerva javanica	2	3	2	0	1	2	1	2	1	1	9
	Celosia trigyna	0	2	0	1	0	0	1	0	0	0	3
Apocynaceae	Aderium obessum	3	1	2	2	0	1	0	0	1	0	6
Aristolochiaceae	Aristo lochia bracteolate	2	0	2	1	2	0	0	0	1	0	5
Asclepiadaceae	Pergalaria tomentosa	1	1	3	2	1	0	1	0	0	0	6
	Pulicaria Arabic	0	2	2	0	1	0	1	1	0	0	5
Asteraceae	Tagetes minuta	1	0	1	3	1	0	0	1	0	0	5
	Conzya incana	1	3	0	2	0	0	1	1	0	1	6
Boraginaceae	Heliotropium europaeum	0	0	3	1	2	2	1	0	0	1	6
Cacurbitaceae	Citrullus colocynthis	1	1	2	1	1	1	3	0	1	0	8
Cappariceae	Capparis spionosa	0	0	0	0	1	0	1	1	0	0	3
Cleomaceae	Cleome droserifolia	0	0	0	1	0	1	0	0	0	0	2
Convolvulaceae	Ipomea sinensis	2	0	1	0	1	0	0	0	0	0	3
Crucifceae	Morettia canscons	1	4	2	0	1	0	1	0	0	0	5
Cucurbitaceae	Corallocarpus schimperi	1	1	2	1	1	0	0	1	0	0	6
Eupharbiaceae	Ricinus communis	2	1	1	0	1	1	0	0	1	0	6
	Acacia hamulosa	4	4	2	3	3	1	1	3	2	1	10
Fabaceae, leguminosae	Astagalus spinonsus	0	0	0	1	0	2	1	0	0	2	4
	Senna alexandrina	0	0	1	1	1	2	3	1	2	1	8
	Cassia etalica	0	1	0	1	2	2	2	3	0	2	7
Malvaceae	Abutilom figarianum	0	3	2	0	1	1	0	1	0	0	5
	Setaria pumila	2	1	2	0	1	0	2	1	0	0	6
Poaceae,graminae	Cenchrus ciliaris	0	2	2	2	1	1	0	0	0	0	5
	Aristida adsconsionis	0	0	0	1	2	2	1	3	0	1	6
Rhamnaceae	Ziziphus spina-christi	0	1	0	0	2	1	2	2	1	2	7
Solanaceae	Solanum incanum	2	4	2	3	2	1	1	0	1	1	9
Tiliaceae	Grewia tenax	2	1	0	2	0	0	1	0	0	0	4

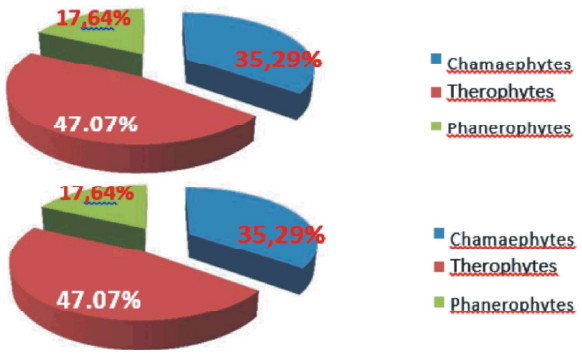


Fig. 4: Life form spectra of the recorded species in study areas (Shada mountain and Wadi Sagamah).

chamaephytes (35.29%) followed by phanerophytes (17.64%) and therophytes (47.07%) of the total recorded species) (Fig. 4).

Abundance: Data in Table (4) showed that was found at all stands (10 stands) which repress location the percentage 5 – 75 %. *Acacia hamusa* found in all locations (stands) as common species where it was found in one stand, abundance ranged between less than 1 % and 50 % and solitary in stands). Also, the *Aerva javanica & Solanum incum* were found as common species where it was found in 9 stands. The number of individuals of this species represent 25–75 % present in

the stands 1& 2 and between 1–5 % in stands 6,7, followed by *Senn alexandria &Citrulls colocyanthis* presence found in 8 stands, the abundance was from 5–50 % and *Cassia etalica & Ziziphus spina- chriistic* (presence in 7 stands) and the abundance was from 5–50 % in stinds 2,6,7, 8 and 10, from 1–5 % in stands 4,5 &7 *Heliotropium europaeum* (*presence in 6 stands) and Morettia canscons (presence in 5 stands*) *showed* abundance between 5–50 % which was found in stands from 1-8 stands. *Zygophyllum simplex* was found in stands 2 & 5-10, the abundance was 25–50 %. Abundance in *Justicia flava Justicia minuta* (presence in 4 stands) and *Celosia trigyna* (pesence in 3 stands) ranged between 1–25 %. Also we found that abundance of *Aerva javanica* (presence in 9 stands).

DISCUSSION

The recorded species in the present study (29 species) represent about 1.34% of the whole flora of Saudi Arabia and their families (20) represent about 2.34 %. From the biodiversity viewpoint. The present study can conclude that this area seems to be the higest area of the Kingdom. One of the main characteristics of the vegetation cover of Saudi Arabia is its low floristic diversity. The number of plant species that recorded in the country is 2172 species, many of which are in the wetter areas of its south–western part. Which include Sarrawat Mountains these species belong to 840 genera and 149 families [22]. The number of species increased to 2250 by adding subspecies, extinct and species that have not been identified yet [23]. Numbers of families, genera and species are very low compared to Saudi Arabia's vast land area, which is probably, the result of the harsh environmental conditions that prevail in the Sahara-Arabian region which covers vast area of the country. The greatest plant diversity, approximately 74% of the total plant species of Saudi Arabia, is found in the mountainous western area which includes the study area due mainly to a greater rainfall [24].

It is evident that the composites (family Asteraceae) have the highest contribution, followed by graminoides (family Poaceae). These results similar to the whole flora of Saudi Arabia where the highest families in the Whole flora are Poaceae (262 species =12.1%), Asteraceae (233 species = 10.7%) and Fabaceaee (210 species = 9.7%) which represented by 705 species or 32.5% of the total plant species in the Kingdom [25]. Also, similar trend to the flora of other similar studied region in the Kingdom such as [1] whom found that the major plant families present in the area in question were Poaceae (42 species) followed by papilonaceae (20 species), Euphorbiacea and Asteraceae (18 and 15 species, respectively), while 18 families were represented by only one species.

Many investigators [22, 24-29]. were studied the vegetation–environment relations, vegetation ecosystem and flora of some regions in K.S.A, they found that the most plant species of Saudi Arabia belong to a limited number of plant families, for example, 1586 species belong to 23 families or 15.4% of the total families and these plant species represent 73% of the total species in the Kingdom. Also 46 families or 30% of the families in the country such as Aloaceae, Celastraceae, Commelinaceae and Burseraceae are found only in Sarrawat Mountains.

The life form spectrum indicated that therophytes were the most represented followed by chamaephytes and phanerophytes. These results agree with the studies in the same region [25]. which indicated that therophytes had the highest contribution. This may be due to the sampling in the present study was during season in which many annuals are dead. Moreover, he indicated that the loss of chamaephytes was due to overgrazing in that area. On the other hand, the results of the present study disagree with that of Heneidy and Bidak [30]. On Bisha, Asir region in southwestern of Saudi Arabia and E l-Demerdash *et al*. [31]. in the southern region. They concluded that the dominance of chamaephytes and therophytes over other life forms in that region would seem to be the hot dry climate, topography variations and biotic influence. Also, Chamaephyte life form is able to withstand water logging, high salinity levels and a wide range of temperature variability [32].

The present study indicated that wild plants grow at low and high altitudes, they grow at altitude from 150 to 2800 m above sea level. This may due to animal browsing, human interference, poor seed–setting, change in land use patterns and prevalence of unfavorable climatic conditions [34].It is necessary to consider all possible causes of vegetation change at high altitudes. This is of particular significance in the case of endemic plants confined to high summits. At the species level, the changes observed must have not only affected the trees but also modified the distribution of associated taxa that are less easily detectable in aerial images [35].

Wild plants in the study area hae 5 economic uses: grazing, medicinal, fuel, other use and edible by man. Four species (13.79% of total recorded species) are grazing &edible 15 species (51.72% of total recorded species) are medicinal, these results agreement with resource of the

Ministry of Agriculture [36]. whom stated that overgrazing is a major impediment to the regeneration of wild plants.

REFERENCES

1. Al-Sherif, E.A., A.M. Ayesh and S.M. Rawi, 2013. Floristic composition, life form and chorology of plant life at Khulais region, western Saudi Arabia. Pak. J. Bot., 45(1): 29-38.
2. Thomas, A., 2011. Prelude to the plant diversity of Saudia Arabia http://plantdiversityofsaudiarabia.info/ Biodiversity-Saudi-Arabia/Vegetation/Vegetation.htm.
3. Nouf Al-Aklabi1, Wejdan Al-Dowsari1 and Despena Andrioti, 2016. Investigating the Correlation between Food Prices and University Students Awareness of the Effects of Fast Food Consumption on their Health, International Journal of Community & Family Medicine.
4. Mueller-Dombois, D. and H. Ellenberg, 1974. Aims and Methods & Vegetation Ecology, Wiley and Sons. New York, pp: 547.
5. Raunkiaer, C., 1937. Plant Life Forms. Clarendon, Oxford.\\
6. Allred, B.W., 1968. Range Management Training Handbook for Saudi Arabia. FAO. Rome.
7. Truax, R.E., D.D. Culley, M. Griffith, W.A. Johnson and J.P. Wood, 1972. Duckweed for chick feed. Louisiana Agri., 16(1): 8-9.
8. Täckholm, V., 1974. Student's Flora of Egypt. Cairo University Press. Cairo, Egypt, pp: 888.
9. FAO, 1979. China: Azolla propagation and small-scale biogas technology. FAO Soils Bull., Report, 41: 81.
10. Haslam, S.M., 1978. River Plants: The Macrophytic Vegetation of Watercoures. Cambirdge University Press: London, UK.
11. El-Kady, H.F., 1980. Effect of Grazing Pressures and Certain Ecological Parameters on Some Fodder Plants of the Mediterranean Coast of Egypt. M.Sc. Thesis, Faculty of Science, Tanta University, Tanta, pp: 97.
12. Zohary, M., 1987. Flora Palaestina (Part II). Jerusalem. Isr. Acad. Sci. Human.
13. Feinbrun - Dothan, N.A., 1978. Flora Palaestina (Part III). Jerusalem. Isr. Acad. Sci. Human.
14. Danin, A., 1983. Desert Vegetation of Israel and Sinai (Jerusalem: Cana Publishing House). de Felice, Venenos Sagrados, pp: 1936-1975.
15. Boulos, L., 1983. Medicinal Plants of North Africa. References publication, Inc. Algonac, Michigan, pp: 286.
16. Sculthorpe, C.D., 1985. The Biology of Aquatic Vascular Plants. Edward Arnold, London.
17. Mossa, J.S., M.A. Al-Yahya and I.A. Al-Meshal, 1987. Medicinal Plants of Saudi Arabia (Vol. 1). Riyadh, King Saud University liberaries, pp: 340.
18. Mandaville, J.P., 1990. Flora of Eastern Saudi Arabia. Kegan Paul International, London, pp: 482.
19. Ayyad, M.A., (ed.), 1992. Rangland study of El-Qasr Rural development project. Final Report. (GTZ) GMBH., pp: 130.
20. Belal, A.E. and I. Springuel, 1996. Economic value of plant diversity in arid environment. Nature & Environment, 32: 33-39.
21. Shaltout, K.H., 1997. Current situation of flora and vegetation of south- west Egypt. In: Integrated Land Development of Southern Egypt: Available Resources and Alternative Options. Abdel-Ghaffar, A.S., Marei, S.M. and Gaber, H.M. (eds.). ICDR, CDRI, Canada, pp: 199-241.
22. Al-Nafie, A., 2004. Plant Geography of Saudi Arabia, (In Arabic). 659p. King Fahd National Library. Riyadh. Saudia Arabia.
23. Collenette, S., 1999. Wild Flowers of Saudi Arabia. NCWCD (National commission for Wildlife Conservation and Development, Publication), Saudi Arabia, pp: 799.
24. Al-Nafie, A., 2008. Phytogeography of Saudi Arabia. Saud. J. Biol. Scien., 15(1): 159-176.
25. Mosallm, H.A., 2007. Comparative study on the vegetation of protected and nonprotected areas, Sudera, Taif, Saudi Arabia. Intenational Journal of Agriculture and Biology, 2: 202-214.
26. Al-Turki, T.A. and H.A. Al-Olayan, 2003. Contribution to the flora of Saudi Arabia; Hail region. Saudi J. Biol. Sci., 10(2): 190-222.
27. Al-Turki, T.A., 2004. A prelude to the study of the flora of Jabal Fayfa in Saudi Arabia. Kuwait J. Sci. Eng., 31(2): 71-145.
28. Abdel-Fattah, R.T. and A.A. Ali, 2005. Vegetation-Environment relation in Taif, Saudi Arabia, Int. J. Botany, 4: 1-6.
29. Al-Zahrani, H.S., 2003. Study on the vegetation and ecosystem of Bani Saad Mountains, South of Al-Taif City, Umm Al- Qura. Univ. J. Sci. Med. Eng., 15: 1-13.
30. Heneidy, S.Z. and L.M. Bidak, 2001. Multipurpose Plant species in Bisha, Asir region, Southwestern Saudi Arabia. J. King Soud. Univ., 13: 11-26.

31. El-Demerdash, M. A., A. K. Hegazy and A. M. Zialy, 1994. Distribution of the plant communities in Tihamah coastal plains of Gazan region, Saudi Arabia. Vegetatio, 112: 141-151.
32. Beeftink, W.G., 1977. The coastal salt marshes of western and northern Europe. In: Chapman V.J. (ed.), Ecosystems of the World 1. Elsevier, Amsterdam, pp: 109-155.
33. Zahran, M.A., 1982. Ecology of the halophytic vegetation of Egypt. In: Sen D.N. and Rajpurohit K.S. (eds), Tasks for Vegetation Science. Dr W. Junk Publisher, The Hague, pp: 3-20.
34. Negash, L., 2002. Successful vegetation propagation techniques for the threatended African pencil cedar (*Juniperus procera* Hoechst. Ex Endl). Forest Ecology ana Management, 161: 53-64.
35. Sanz-Elorza, M., E.D. Dana, A. Gonzalez and E. Sobrino, 2003. Changes in the high-mountain vegetation of the central Iberian Peninsula and a probable sign of global warming. Ann. Bot., 92: 273-280.
36. Ministry of Agriculture, 2000. Department of economic and statistics- Agricultural statistical year book. 10. Riyadh Saudia Arabia.