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Wild Plants Diversity of the Hema Faid Region (Ha'il Province, Saudi Arabia)

¹A.M. Alshammari and ^{1,2}S.M. Sharawy

¹Department of Biology, Faculty of Science, Ha'il University, Ha'il, Saudi Arabia

²Department of Botany, Faculty of Science, Ain Shams University, Cairo, Egypt

Abstract: The present study aims to assess plant diversity in Hema Faid region at Ha'il province. The result revealed that the study region harbors 199 species of 161 genera distributed over 54 families; one species from pteridophytes (*Adiantum capillus-veneris* L.), one species from gymnosperms (*Ephedra foliata* Boiss. ex C.A. Mey) and 197 species from angiosperms. Majority of plants in the region belong to the therophytes group which constitute about 65% of total species recorded in this study. The most species-rich families were Asteraceae (14%), Fabaceae (11%), Poaceae (9%), Brassicaceae (6%), Boraginaceae, Caryophyllaceae, Chenopodiaceae and Zygophyllaceae (4% for each). Also this study revealed that Hema Faid region is more diverse compared with other well-studied phytogeographic regions in Ha'il province. In addition, 34 species were recorded in this study for the first time in Ha'il province. Some species recorded are endemic-endangered in Hema Faid region and others are endangered species to Ha'il province.

Key words: Floristic richness, plant diversity, vegetation, wild plants, Ha'il, Hema Faid

INTRODUCTION

Ha'il province is an exposed complex of Precambrian igneous and metamorphic rocks. It is also a part of the vast phanerozoic formations that overlap the northern and eastern edge of the Arabian Shield (Schultz and Whitney, 1986; Al-Turki and Al-Olayan, 2003). Ha'il province covers an area of 118.322 km² and bordered to the north by Al-Jauf and Northern Frontier, to the west by Tabouk and Madina Al-Munawarra regions, to the south by Al-Qassim and to the east by the Central and Eastern regions. Although the importance of the Ha'il region, a few number of researches have been carried out to study the vegetation of this region. Chaudhary (1983) described the vegetation of the Great Nafud; Collenette and Tsagarakis (2001) reported the botanical list for Aja Mountains. Al-Turki and Al-Olayan (2003) represented a comprehensive contribution to the flora of Ha'il. In addition, Sharawy and Alshammari (2009) studied the poisonous plants and animals in Aja Mountains. Only detailed study on floristic composition and vegetation analysis in Ha'il province have been carried by El-Ghanim *et al.* (2010).

Hema in the arabic language is the area which is pastured and protected from people activity and is used only for grazing (Ibn-Manzoor, 1989; Hassan, 2010). Hema Faid region named after the town of Faid which is located in the middle of the road between Kufa in Iraq and Mecca.

It had been vast diversity of vegetative in the Arabian Peninsula and early Muslims (sixth century) used it as pilgrimage route between the Arabian Peninsula and Iraq (Al-Rashid, 1993; Al-Shammari, 2010). It is characterized by variation in topography and geomorphology, with arid climate. The region is currently one of the most fertile regions in Ha'il province due to the abundance of water, soil fertility and the diversity of relief (open shallow valleys, mountains and small sand dunes).

This study aims to study the vegetation of Hema Faid region at Hail province in terms of species richness, taxonomic diversity life form and wild plant diversity. The results presented in this work are the first contribution to study the floristic diversity of the region and to increase the knowledge of plant diversity at Ha'il.

MATERIALS AND METHODS

The study area: Hema Faid is located in the southeast corner of Ha'il province and about 130 km from Ha'il city and lies between 26° 20' and 27° 34' E and 41° 23' and 42° 31' N (Fig. 1). According to Zahran (1983) and Al-Turki and Al-Olayan (2003), the study area is characterized by a mean minimum temperature of about 10°C in January and mean maximum temperature of about 31°C in August. As well as, El-Ghanim *et al.* (2010) reported the rainfall in Ha'il region is mainly winter fall, with highest precipitation in February (32.0 mm day⁻¹) and the average annual rainfall

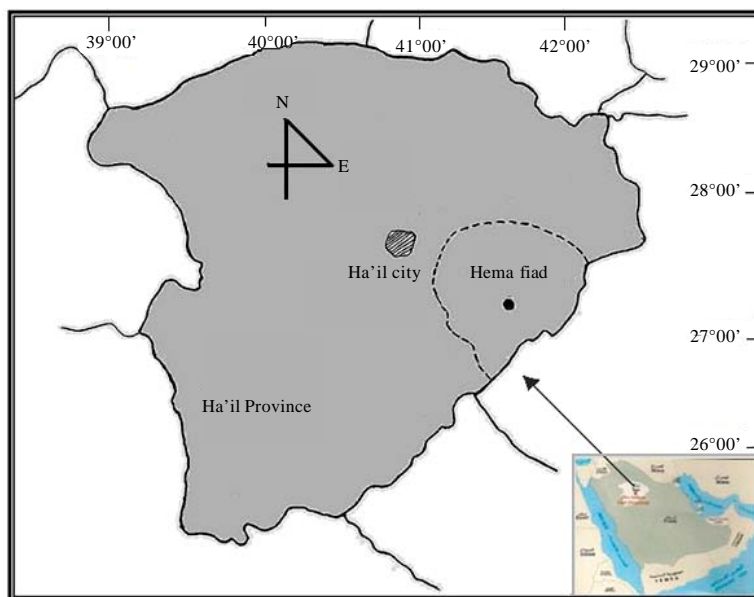


Fig. 1: Location map of Hama Faid region, Ha'il province

104.4 mm day⁻¹. In addition the relative humidity is extremely low in summer (14-15%) and relatively high in winter (57%).

Vegetation survey: Several field trips were carried out to the study area to collect plants species from 2007 to 2009. The collected specimens were identified according to Zohary (1966, 1972), Tackholm (1974), Mandaville (1990), Heemstra *et al.* (1990), Chaudhary (1983, 1989, 1999, 2000), Al-Farhan (1994), Migahid (1996), Al-Eisawi (1998), Collenette (1998, 1999) and Al-Turki and Al-Olayan (2003). The life forms (LF) were identified for each species according to Raunkiaer's system of classification (Raunkiaer, 1934). Also the system of classification proposed by Cronquist (1981) is followed in this study to arrange the families while the taxa below the rank of families are arranged in alphabetic order.

RESULTS AND DISCUSSION

Floristic richness: The total of 199 species belonging to 161 genera from 54 families was recorded during the study (Table 1). More than 60% of the recorded species belong to 11 species-rich families. The largest families in terms of the number of genera are Asteraceae (22), Poaceae (16), Fabaceae (12), Brassicaceae (12), Chenopodiaceae (8), Boraginaceae, Caryophyllaceae, (7 for each), Asclepidaceae (6), Lamiaceae (5), Solanaceae, Zygophyllaceae (4 for each) and Euphorbiaceae and Malvaceae (3 for each). These families are the most

Table 1: Floristic richness at Hama Faid region

| Plant groups | Families | Genera | Species |
|---------------------|-----------|------------|------------|
| Ferns | 1 | 1 | 1 |
| Gymnosperms | 1 | 1 | 1 |
| Angiosperms | | | |
| Dioctyledons | 45 | 136 | 171 |
| Monocotyledons | 7 | 23 | 26 |
| Total Number | 54 | 161 | 199 |

common in the flora of Saudi Arabia (Migahid and Hammouda, 1978; Collenette, 1985; Mandaville, 1990; El-Ghani and El-Sawaf, 2004). In addition, the families Poaceae, Fabaceae, Asteraceae, Boraginaceae, Chenopodiaceae and Lamiaceae comprise the main bulk of the wild plants in Ha'il province (Collenette and Tsagarakis, 2001; Al-Turki and Al-Olayan, 2003).

The floristic analysis showed that the majority of wild plants in this study area are annual herbs, while the minority group is in the tree category where 11 species were recorded (Fig. 2). The result is conform previous studies that were carried by Al-Turki and Al-Olayan (2003) and Sharawy and Alshammari (2009) on Ha'il province. Moreover, members of the family Asteraceae dominate the wild plants of Hama Faid region (29 species), followed by Poaceae (18 species), Fabaceae (21 species), Brassicaceae (12 species); while twenty six families are monotypic (Fig. 3).

Taxonomic diversity: Pielou (1975) and Magurran (1988) stated out that, in intuitive terms, taxonomic diversity will be higher in an area in which the species are divided amongst many genera as opposed to one in which most

species belong to the same genus and still higher as these genera are divided amongst many families as opposed to few families. Taxonomic diversity in Hema Faïd region is 1.23 for species/genera ratio and 2.98 for genera/families. The comparison of the taxonomic diversity of the studied region with other floristically known regions in Ha'il indicates higher taxonomic diversity (lower ratio) in the studied region than in other areas (Table 2). This high diversity due to the abundance of water sources, soil fertility and the diversity of relief (open shallow valleys, mountains and sand dunes) as mentioned by Al-Shammari (2010).

Life Form: In the present work the Life Form (LF) spectrum (Fig. 4) is characteristic of an arid desert region with dominance of therophytes (65% of total species recorded in the study), followed by Chamaephytes (14%),

phanerophytes (12%), geophytes (4%), hemicryptophytes (3%) and parasites (2%).

The majority of recorded annual plants in the present study are winter form species; some are summer form species (e.g., *Amaranthus graecizans* L., *Beta vulgaris* L., *Portulaca oleraceae* L. and *Zygophyllum simplex* L.) and a few are non-seasonal species responding to rainfall at any time of the year (*Malva parviflora* L., *Sisymbrium irio* L., *Chenopodium murale* L. and *Tribulus terrestris* L.). As in most arid regions, the desert vine species are very rare (Abd El-Wahob *et al.*, 2008); only one vine species is recorded in this study (e.g., *Convolvulus arvensis* L.). The occurrence of the 4 parasitic plants (*Cuscuta planiflora* Ten., *Cistanche phelypaea* (L.) Cout., *Orobancha cernua* L. and *O. ramosa* L.) denotes the importance of water conservation.

Abd El-Ghani and Abd El-Khalik (2006) revealed that the relative advantages of the presence of trees and shrubs over the grasses when water is limited, as in this study can be explained by their extensive root systems, which are capable of utilizing water at different soil depths, whereas grasses only use the water stored in the

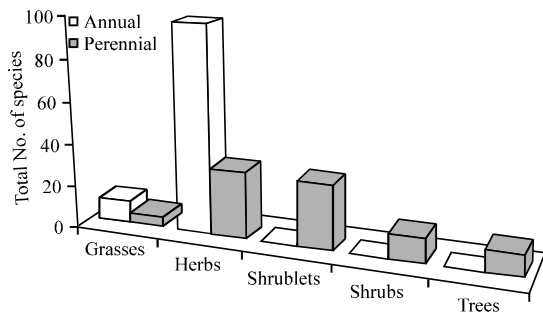


Fig. 2: Diagram of growth form in Hema Faïd region

Table 2: Comparative floristic and taxonomic diversity at Nafud desert, Aja Mountains and at Hema. Faïd region

| | Hema feed Nafud desert (1) | | Aja mountains (2) |
|---------------------------|----------------------------|------|-------------------|
| Total No. of species (S) | 199 | 286 | 223 |
| Total No. of genera (G) | 161 | 204 | 152 |
| Total No. of families (F) | 54 | 59 | 39 |
| S/G | 1.23 | 1.40 | 1.46 |
| G/F | 2.98 | 3.45 | 3.89 |

Sources: 1: Chaudhary (1983); 2: Collenette and Tsagarakis (2001)

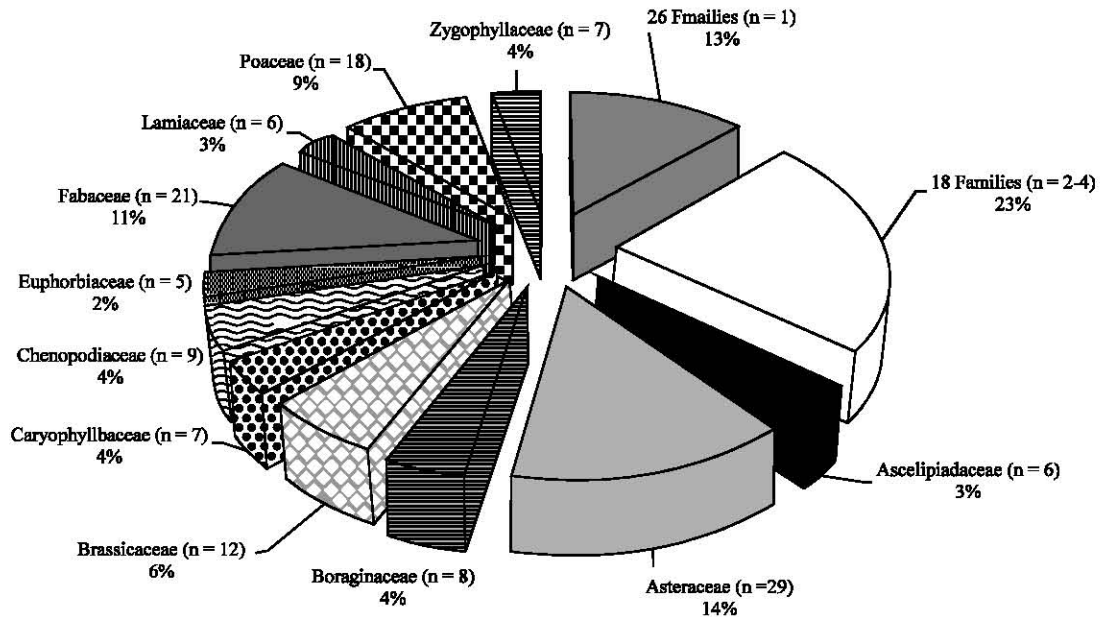


Fig. 3: Diagram of floristic composition with the 11 species-rich families (n = number of species)

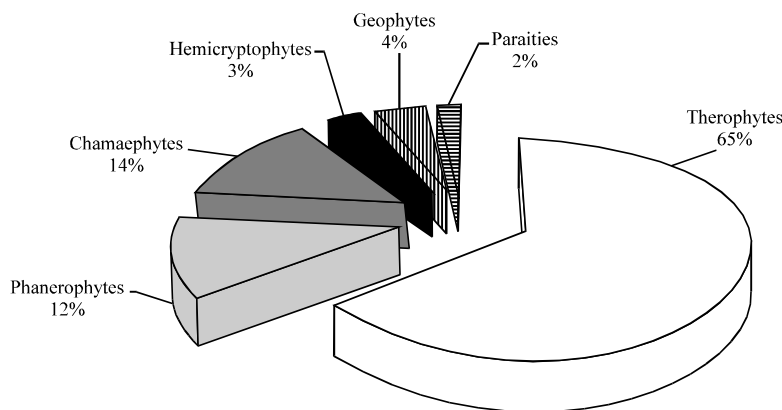


Fig. 4: Diagram of life form (LF) of the vascular flora in Hema Faid region

upper soil layers. Also, the dominance of therophytes, phanerophytes and chamaephytes over other life forms are seen to be a response to the hot dry climate, topographic variation and human and animal interference.

Diversity of wild plants in Hema Faid: Synoptic analysis of the flora reveals that 199 wild plants belonging to 161 genera distributed over 54 families were recorded in the study area including one species from pteridophytes (*Adiantum capillus-veneris* L.) and one species from gymnosperms (*Ephedra foliata* Boiss. ex C.A. Mey). Among the remaining 197 angiosperm species, dicots comprised 170 species of 135 genera distributed over 45 families, while monocots comprised 27 species of 24 genera distributed over 7 families. Most of these recorded species are annuals (115 species) with the dominance of *Anthemis deserti* Boiss., *Launaea nudicaulis* (L.) Hook.f., *Reichardia tingitana* (L.) Roth., *Sisymbrium irio* L., *Chenopodium murale* L., *Trigonella stellata* Forssk., *Erodium ciconium* (L.) L'Her., *Malva parviflora* L., *Plantago afra* L., *Hordeum leporium* Link., *Froskaolea tenacissima* L., *Rumex vesicarius* L., *Tribulus terrestris* L. and *Zygophyllum simplex* L. The perennial plants in this study totaled 84 species, of which the following species are the most common; *Aizoon canariense* L., *Artemisia monosperma* Delile., *Heliotropium ramosissimum* (Lehm.) Sieb. ex. A.DC., *Farsetia aegyptia* Turra., *Zilla spinosa* (L.) Prantl., *Haloxyton salicornicum* (Moq.) Bunge. ex. Boiss., *Citrullus colocynthis* (L.) Schard., *Acacia tortilis* (Forssk.) Hayne., *Ochradenus baccatus* Delilie., *Fagonia cretica* L. and *Fagonia glutinosa* Delilie (Table 3).

Among the collected species, 34 species were recorded for the first time in Ha'il province (Table 3). Collenette and Tsagarakis (2001) and Al-Turki and Olayan

(2003) recorded *Juncus bufonius* L., *Limonium lobatum* (L.f.) Chaz. and *Cistanche phelypaea* (L.) Cout. for the first time in Ha'il province, these species were also recorded during the study. *Adiantum capillus-veneris* L., *Artemisia judaica* L., *Helianthemum lipii* (L.) Dum-Cours., *Ephedra aphylla* Fisch. et Mey ex C.A. Mey., *Acacia seyal* Del., *Hippocrepis constricta* Kunze, *Gagea reticulata* (Pall.) A. and H. Schultes and *Panicum turgidum* Forssk. are endemic-endangered in the study region, while *Helianthemum lipii* (L.) Dum-Cours. and *Ephedra aphylla* Fisch. et Mey ex C.A. Mey. are endangered species to Ha'il province (Collenette and Tsagarakis 2001).

Many species in this study have a medicinal value and are used by the local people for example (*Acacia tortilis* (Forssk.) Hayne, *Achillea fragrantissima* (Forssk.) Sch.Bip., *Artemisia judaica* L., *A. monosperma* Delile., *Citrullus colocynthis* (L.) Schrad., *Ephedra aphylla* Fisch. et Mey ex C.A. Mey., *Malva parviflora* L., *Plantago afra* L., *Pulicaria undulate* (L.) C.A.Mey., *Solanum nigrum* L., *Teucrium polium* L. *Urtica urens* L. and *Zygophyllum album* L.f.). Sharawy and Alshammari (2009) recorded about 65 poisonous plants in Aja Mountains in Ha'il region; most of them are scored in this study. In addition many species that grow in Hema Faid are being used by local peoples as grazing plants.

In conclusion, the present study is the first botanical study of the Hema Faid region. This study shows the importance of this region in terms of plant diversity due to the presence of many species from spermatophytes and pteridophytes groups, as well as high taxonomic diversity (low ratios). Among the species recorded, 34 species were recorded for the first time in Ha'il province. Many species are threatened with extinction due to the increase of human activity in this region through the overgrazing or

Table 3: List of the recorded wild plants, their growth form and life form in Hema Faid Region (Ha'il) from 2007 to 2009

| Family | Species | Growth form | Life form |
|----------------|--|-------------|-----------|
| Acanthaceae | <i>Blepharis ciliaris</i> (L.) B.L.Burt. | Perennial | Ch |
| Adiantaceae | <i>Adiantum capillus-veneris</i> L. | Perennial | G |
| Aizoaceae | <i>Aizoon canariense</i> L. | Perennial | H |
| | <i>Mesembryanthemum nodiflorum</i> L. | Annual | Th |
| Alliaceae | <i>Allium desertorum</i> Forssk. * | Perennial | G |
| | <i>Allium stamineum</i> Boiss. | Perennial | G |
| Amaranthaceae | <i>Aerva javonica</i> (Burn.) Spreng. | Perennial | Ch |
| | <i>Amaranthus graecizans</i> L. | Annual | Th |
| Amaryllidaceae | <i>Pancratium sickenbergeri</i> Asch. et Schweinf. ex Boiss. * | Perennial | G |
| Anacardiaceae | <i>Rhus tripartita</i> (Ucria) Grand | Perennial | Ph |
| Apiaceae | <i>Ducrosia ismaelis</i> Asch. | Annual | Th |
| | <i>Ferula sinaica</i> Boiss. * | Annual | Th |
| Apocynaceae | <i>Rhazya stricta</i> Decen. | Perennial | Ch |
| Asclepiadaceae | <i>Calotropis procera</i> (Ait.) Ait. f. * | Perennial | Ph |
| | <i>Gomphocarpus sinaicus</i> Boiss. | Perennial | Ch |
| | <i>Leptadenia pyrotechnica</i> (Forssk.) Decne | Perennial | Ph |
| | <i>Pergularia tomentosa</i> L. | Perennial | Ch |
| | <i>Periploca aphylla</i> Decne. | Perennial | Ph |
| | <i>Solenostemma argel</i> (Del.) Hayne * | Perennial | Ch |
| Asphodelaceae | <i>Asphodelus tenuifolius</i> Cav. | Perennial | G |
| Asteraceae | <i>Achillea fragrantissima</i> (Forssk.) Sch. Bip. | Perennial | Ch |
| | <i>Anthemis desertii</i> Boiss. | Annual | Th |
| | <i>Anthemis edumea</i> Eig. | Annual | Th |
| | <i>Anthemis pseudocotula</i> Boiss. | Annual | Th |
| | <i>Amvillea garcinii</i> (Burn.) DC. | Perennial | Ch |
| | <i>Artemisia judaica</i> L. | Perennial | Ch |
| | <i>Artemisia monosperma</i> Delile | Perennial | Ch |
| | <i>Asteriscus pygmaeus</i> (DC.) Coss. and Dur. | Perennial | Ch |
| | <i>Calendula tripterocarpa</i> Rupr. | Annual | Th |
| | <i>Centaurea eryngioides</i> Lam. | Annual | Th |
| | <i>Centaurea sinaica</i> DC. | Annual | Th |
| | <i>Chrysanthemum coronarium</i> L. | Annual | Th |
| | <i>Conyza bonariensis</i> (L.) Cronquist | Annual | Th |
| | <i>Conyza linifolia</i> (Willd.) Tackh. * | Annual | Th |
| | <i>Crepis aspera</i> L. | Annual | Th |
| | <i>Echinops hussoni</i> Boiss. | Perennial | Ch |
| | <i>Gymnarrhena micrantha</i> Desf. | Annual | Th |
| | <i>Koelpinia linearis</i> Pall. | Annual | Th |
| | <i>Launaea nudicaulis</i> (L.) Hook.f. | Perennial | Th |
| | <i>Matricaria aurea</i> (Loefl.) Sch. Bip. | Annual | Th |
| | <i>Picris cyanocarpa</i> Boiss. | Annual | Th |
| | <i>Pulicaria arabica</i> (L.) Cass. | Annual | Th |
| | <i>Pulicaria incisa</i> (Lam.) DC. | Perennial | Ch |
| | <i>Reichardia tingitana</i> (L.) Roth. | Annual | Th |
| | <i>Rhantarium epapposum</i> Oliv. | Perennial | Ch |
| | <i>Scorzonera papposa</i> DC. | Perennial | Ph |
| | <i>Senecio flavus</i> (Decne.) | Annual | Th |
| | <i>Senecio glaucus</i> L. | Annual | Th |
| | <i>Sonchus asper</i> L. | Annual | Th |
| Boraginaceae | <i>Alkana orientalis</i> (L.) Boiss. | Perennial | Ch |
| | <i>Anchusa aegyptiaca</i> (L.) DC. | Annual | Th |
| | <i>Arnebia hispidissima</i> (Lehm.) DC. | Annual | Th |
| | <i>Arnebia linearifolia</i> DC. | Annual | Th |
| | <i>Echium arabicum</i> R.Mill | Annual | Th |
| | <i>Heliotropium ramosissimum</i> (Lehm.) Sieb. ex. A. DC. | Perennial | Ch |
| | <i>Moltkiopsis ciliates</i> (Forssk.) I.M.Johnst. | Perennial | Ch |
| | <i>Trichodesma africanum</i> (L.) R.Br. | Perennial | Ch |
| Brassicaceae | <i>Alyssum hamalocarpum</i> (Fisch. and C.A.Mey.) | Annual | Th |
| | <i>Brassica tournefortii</i> Gouan. | Annual | Th |
| | <i>Cakile arabica</i> Valen and Bormm. | Annual | Th |
| | <i>Capsella bursa-pastoris</i> (L.) Medicus | Annual | Th |
| | <i>Diplotaxis acris</i> (Forssk.) Boiss. | Annual | Th |
| | <i>Eruca sativa</i> Miller | Annual | Th |
| | <i>Forssetia aegyptia</i> Turra | Perennial | Ch |
| | <i>Isatis lusitanica</i> L. | Annual | Th |
| | <i>Lepidium aucheri</i> Boiss. | Annual | Th |
| | <i>Matthiola longipetala</i> (Vent.) DC. | Annual | Th |

Table 3: Continued

| Family | Species | Growth form | Life form |
|-----------------|---|-------------|-----------|
| | <i>Sisymbrium irio</i> L. | Annual | Th |
| | <i>Zilla spinosa</i> (L.) Prantl | Perennial | Ch |
| Capparaceae | <i>Capparis spinosa</i> L. | Perennial | Ch |
| | <i>Cleome amblyocarpa</i> Barratte and Murb. | Annual | Th |
| | <i>Cleome glabrescens</i> DC. | Annual | Th |
| Caryophyllaceae | <i>Arenaria foliacea</i> Turrit | Annual | Th |
| | <i>Gypsophila capillaris</i> (Forssk.) C. Chr. | Annual | Th |
| | <i>Herniaria hirsuta</i> L. | Annual | Th |
| | <i>Paronychia arabica</i> (L.) DC. | Annual | Th |
| | <i>Silene apetala</i> Willd. | Annual | Th |
| | <i>Spergula fallax</i> (Lowe) E.H.L.Krase | Annual | Th |
| | <i>Spergularia diandra</i> (Guss.) Boiss. | Annual | Th |
| Chenopodiaceae | <i>Anabasis lachnantha</i> Aellen et Rech. f. * | Perennial | Ch |
| | <i>Atriplex dimorphostegia</i> Kar and Kir. | Perennial | Ch |
| | <i>Bassia muricata</i> (L.) Aschers. | Annual | Th |
| | <i>Beta vulgaris</i> L. | Annual | Th |
| | <i>Chenopodium murale</i> L. | Annual | Th |
| | <i>Haloxylon salicornicum</i> (Moq.) Bunge ex Boiss. | Perennial | Ch |
| | <i>Salsola imbricata</i> Forssk. | Perennial | Ch |
| | <i>Salsola tetrandra</i> Forssk. | Perennial | Ch |
| | <i>Suaeda pruinosa</i> Lange * | Perennial | Ph |
| Cistaceae | <i>Helianthemum lipii</i> (L.) Dum-Cours | Perennial | Ch |
| Convolvulaceae | <i>Convolvulus arvensis</i> L. | Perennial | H |
| | <i>Convolvulus lanatus</i> Vahl. * | Perennial | Ch |
| Cucurbitaceae | <i>Citrullus colocynthis</i> (L.) Schard | Perennial | H |
| Cuscutaceae | <i>Cuscuta planiflora</i> Ten. | Annual | P |
| Cyperaceae | <i>Cyperus schimperianus</i> Steud. * | Perennial | G |
| | <i>Scirpioides holoschoenus</i> L. | Perennial | G |
| Ephedraceae | <i>Ephedra foliata</i> Boiss. ex C.A. Mey | Perennial | Ph |
| Euphorbiaceae | <i>Chrozophora tinctoria</i> (L.) A. Juss. ex Spreng. | Annual | Th |
| | <i>Euphorbia granulata</i> Forssk. | Annual | Th |
| | <i>Euphorbia peplus</i> L. | Annual | Th |
| | <i>Euphorbia retusa</i> Forssk. | Annual | Th |
| | <i>Ricinus communis</i> L. | Perennial | Ph |
| Fabaceae | <i>Acacia ehrenbergiana</i> Hayne * | Perennial | Ph |
| | <i>Acacia seyal</i> Del. * | Perennial | Ph |
| | <i>Acacia tortilis</i> (Forssk.) Hayne | Perennial | Ph |
| | <i>Alhagi maurorum</i> Medic. * | Perennial | Ch |
| | <i>Astragalus annularis</i> Forssk. * | Annual | Th |
| | <i>Astragalus corrugates</i> Bert. * | Annual | Th |
| | <i>Astragalus hamosus</i> L. | Annual | Th |
| | <i>Astragalus sieberi</i> DC. | Perennial | Ch |
| | <i>Astragalus spinosus</i> (Forssk.) Muschl. | Perennial | Ch |
| | <i>Astragalus tribuloides</i> Delile | Annual | Th |
| | <i>Hippocrepis constricta</i> Kunze | Annual | Th |
| | <i>Lotus halophilus</i> Boiss. * | Annual | Th |
| | <i>Lygos raetam</i> (Forssk.) Heywood * | Perennial | Ph |
| | <i>Medicago laciniata</i> (L.) Mill. | Annual | Th |
| | <i>Melilotus indica</i> (L.) All. * | Annual | Th |
| | <i>Senna italica</i> Mill. | Perennial | Ch |
| | <i>Trifolium fragiferum</i> L. * | Annual | Th |
| | <i>Trifolium tomentosum</i> L. | Annual | Th |
| | <i>Trigonella hamosa</i> L. | Annual | Th |
| | <i>Trigonella stellata</i> Forssk. | Annual | Th |
| | <i>Vicia monantha</i> Retz. | Annual | Th |
| Fumariaceae | <i>Fumaria parviflora</i> Lam. | Annual | Th |
| Geraniaceae | <i>Erodium ciconium</i> (L.) L'Her | Annual | Th |
| | <i>Erodium glaucophyllum</i> (L.) L'Her. | Annual | Th |
| | <i>Erodium laciniatum</i> (Cav.) Willd. | Annual | Th |
| | <i>Erodium neuradaefolium</i> Del. ex Godron * | Annual | Th |
| Juncaceae | <i>Juncus bufonius</i> L. | Annual | H |
| Lamiaceae | <i>Ballota undulate</i> (Sieb. ex Fres.) Benth. | Annual | Th |
| | <i>Lavandula pubescens</i> Decne. | Perennial | Ch |
| | <i>Mentha longifolia</i> (L.) Huds. | Perennial | H |
| | <i>Salvia deserti</i> Decne. | Perennial | Ch |
| | <i>Salvia lanigera</i> Poir. | Annual | Th |
| | <i>Teucrium polium</i> L. | Perennial | Ch |

Table 3: Continued

| Family | Species | Growth form | Life form |
|------------------|--|-------------|-----------|
| Liliaceae | <i>Gagea reticulata</i> (Pall.) A. and H. Schultes | Perennial | G |
| Malvaceae | <i>Althaea ludwigii</i> L. | Annual | TH |
| | <i>Hibiscus micranthus</i> L. f. | Perennial | Ch |
| | <i>Malva parviflora</i> L. | Annual | Th |
| Moraceae | <i>Ficus palmata</i> Forssk. | Perennial | Ph |
| Myrtaceae | <i>Eucalyptus</i> spp. | Perennial | Ph |
| Neuradaceae | <i>Neurada procumbens</i> L. | Annual | Th |
| Orobanchaceae | <i>Cistanche phelypaea</i> (L.) Cout. | Perennial | P |
| | <i>Orobanche cernua</i> Loeff. * | Annual | P |
| | <i>Orobanche ranose</i> L. * | Annual | P |
| Oxalidaceae | <i>Oxalis corniculata</i> L. * | Annual | Th |
| Palmae | <i>Phoenix dactylifera</i> L. | Perennial | Ph |
| Papaveraceae | <i>Papaver rhoeas</i> L. * | Annual | Th |
| | <i>Romeria hybrid</i> (L.) DC. | Annual | Th |
| Plantaginaceae | <i>Plantago qfra</i> L. | Annual | Th |
| | <i>Plantago ciliata</i> Desf. | Annual | Th |
| | <i>Plantago ovate</i> Forssk. | Annual | Th |
| | <i>Limonium lobatum</i> (L.f.) Chaz. | Annual | Th |
| Plumbaginaceae | <i>Limonium thouini</i> (Viv.) Ktze * | Annual | Th |
| | <i>Aegilops kotschyii</i> Boiss. | Annual | Th |
| Poaceae | <i>Aristida adscensionis</i> L. | Annual | Th |
| | <i>Avena fatua</i> L. | Annual | Th |
| | <i>Bromus fasciculatus</i> Boiss. | Annual | Th |
| | <i>Bromus rubens</i> Jusl. ap. L. | Annual | Th |
| | <i>Cyanodon dactylon</i> (L.) Pers. | Perennial | H |
| | <i>Eragrostis minor</i> Host. | Annual | Th |
| | <i>Hordeum leporium</i> Link. * | Annual | Th |
| | <i>Lolium perenne</i> L. * | Annual | Th |
| | <i>Oryzopsis holciiformis</i> (M. Bieb.) Hack. | Annual | Th |
| | <i>Panicum turgidum</i> Forssk. * | Perennial | G |
| | <i>Pennisetum divisum</i> (Forssk. Ex J. F. Gmel.) Henrard * | Perennial | H |
| | <i>Pennisetum setaceum</i> (Forssk.) Chov. | Perennial | H |
| | <i>Phalaris minor</i> Retz. | Annual | Th |
| | <i>Polypogon monspeliensis</i> (L.) Desf. | Annual | Th |
| | <i>Schismus barbatus</i> (Hojer ejusd. L.) Thell. | Annual | Th |
| | <i>Stipa capensis</i> Thunb. | Annual | Th |
| | <i>Tetrapogon villosus</i> Desf. | Annual | TH |
| Polygalaceae | <i>Polygala negevensis</i> Danin | Perennial | Ph |
| Polygonaceae | <i>Calligonum comosum</i> L'Her. | Perennial | Ph |
| | <i>Emex spinosus</i> (L.) Campd. | Annual | Th |
| | <i>Rumex pictus</i> Forssk | Annual | Th |
| | <i>Rumex vesicarius</i> L. | Annual | Th |
| Portulacaceae | <i>Portulaca oleraceae</i> L. | Annual | Th |
| Primulaceae | <i>Anagallis arvensis</i> L. | Annual | Th |
| Resedaceae | <i>Ochradenus baccatus</i> Delile | Perennial | Ph |
| | <i>Reseda Arabica</i> Boiss. | Annual | Th |
| Rhamnaceae | <i>Ziziphus spina-christi</i> (L.) Willd. | Perennial | Ph |
| Rutaceae | <i>Haplophyllum tuberculatum</i> (Forssk.) Juiss. | Annual | Th |
| Scrophulariaceae | <i>Linaria simplex</i> (Willd.) DC. in Lam. et DC. | Annual | Th |
| | <i>Scrophularia desertii</i> Delile | Perennial | Ch |
| Solanaceae | <i>Datura innoxia</i> Mill. * | Perennial | Ph |
| | <i>Lycium shawii</i> Roem and Schult. | Perennial | Ph |
| | <i>Solanum nigrum</i> L. | Perennial | Ch |
| | <i>Withania somnifera</i> (L.) Dun. in DC. | Perennial | Ph |
| Tamaricaceae | <i>Tamarix aphylla</i> (L.) H.Karst. | Perennial | Ph |
| Urticaceae | <i>Froskaolea tenacissima</i> L. | Annual | Th |
| | <i>Urtica urens</i> L. * | Annual | Th |
| Verbenaceae | <i>Lippia nodiflora</i> (L.) Michx. * | Annual | Th |
| Zygophyllaceae | <i>Fagonia cretica</i> L. * | Perennial | Ch |
| | <i>Fagonia glutinosa</i> Delile | Perennial | Ch |
| | <i>Fagonia indica</i> Burm. F. | Perennial | Ch |
| | <i>Peganum harmala</i> L. | Perennial | Ch |
| | <i>Tribulus terrestris</i> L. | Annual | Th |
| | <i>Zygophyllum album</i> L. f. * | Perennial | Ch |
| | <i>Zygophyllum simplex</i> L. | Annual | Th |

Th: Therophytes; Ph: Phanerophytes; Ch: Chamaephytes; H: Hemicryptophytes; G: Geophytes, P: Parasites. *Species recorded for first time in Ha'il province

unsustainable gathering of firewood or use of specific species for medicinal purposes. Further field works must be done to construct a complete view of the biodiversity for this natural reserve region.

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