



ISSN (E): 2320-3862
ISSN (P): 2394-0530
NAAS Rating: 3.53
JMPS 2019; 7(2): 12-17
© 2019 JMPS
Received: 07-01-2019
Accepted: 10-02-2019

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Floristic study on the vegetation of Hajjah government, West of Yemen

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Abstract

The present paper deals with some important plant species in Hajjah governorate, West of Yemen. The study was carried out during the period from September 2017 to March 2018. In this research 43 families, 97 genera and 125 species were identified, including 60 herbs, 16 shrubs, 29 under-shrubs, 20 trees species have been included. The most highly represented families were Fabaceae (18 species; 11 genera), Asteraceae (17 species; 14 genera), Euphorbiaceae (8 species; 4 genera), Lamiaceae (7 species; 6 genera), Solanaceae (6 species; 5 genera), Acamthaceae (6 species; 4 genera), Amranthaceae (5 species; 4 genera), Asclepiaceae (4 species; 4 genera), Apocynaceae & Cucurbitaceae (3 species; 3 genera) Moraceae (4 species; 1 genera), and Plantaginaceae (3 species; 1 genera), also, 6 families are represented by two species and two genera, and 4 families are represented by two species and one genus, while there 21 families are represented with one species and one genus in each. Plant life forms were categorized as Chamaephytes (43 species; 34.4%), Phanerophytes, (36 species; 28.8%), Therophytes (25 species; 20%), Hemicryptophytes (15 species; 12.8%), Geophytes (5 species; 4%).

Keywords: Floristic survey, plant diversity, habit, life forms, Hajjah governorate, Yemen

1. Introduction

Plant diversity is one of the main elements of any living society, which maintains its stability and the performance of its functions, whether this diversity is among the species representing this compound or in the biotic relations among the various groups of its members, this assures that, diversity creates stability^[14, 18]. Therefore, floristic studies acquire increasing importance in recent years in response to the need of developing and under developing countries to assess their plant wealth^[20]. Many floristic diversity studies have been conducted in different parts of world^[21].

Plant distribution is determined by their responses to variation in environmental factors, such as water availability, topography and soil. Many studies showed that topography of the area and the climate are the main factors affecting the degree of speciation^[4, 13].

Yemen is a generally mountainous country. The altitudinal range extends from sea level up to 3760 meters at mountain Al-Nabi Shauib, the highest point in the Arabian Peninsula. Such altitudinal variation results in a great diversity in climates and landscapes. It is characterized by a rich variety of natural habitats, species and genetic diversity, including many endemic species. These resources are of major economic importance because of their potential for tourism and the wildlife and fisheries they support. Also, numerous plants are used in traditional medicine, in local industries, and for grazing and fuel wood. However, in recent decades human activity has transformed the landscape and over-exploited available biological resources, which resulted the deterioration of many habitats, in major reduction in plant species, and in extinction of endemic rare, and endangered species.

The study area is characterized by a topographical, climatic, and environmental contrast and diversity. From the high mountains to the valleys located below sea level, which form typical natural shelters for the wild plants. This means that the diversity of the elements of the natural environment of the study area (topography - climate - soil - a variety of activities) is reflected on the plant biodiversity; therefore some patterns of different plant environments are resulted^[1]. Flora of Yemen is extremely rich and diverse. Species diversity is a result of considerable climatic changes in former periods, which enabled different species to survive in the different ecological habitats. Previous studies reported approximately 2836 plant species belonging to 1058 genera within 181 families^[8].

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2. Study area

Hajjah governorate is located in the west of Yemen; it is approximately 123 kilometers away from the northwest of Yemeni capital, Sana'a, it is also regarded as the fifth largest city in the Republic of Yemen in terms of population as its population is estimated to be 1,480,897 people and with an accumulative percentage of (7.5 %) out of the total population of the country. Hajjah, according to the latest administrative division, is divided into thirty one districts, and its area is estimated to be 8228 kilometers. Hajjah is boarded by Saddah governorate to the north-eastern, Jizan governorate, which belong to Saudi Arabia to the north-west, Mahweet governorate to the south, Ammran governorate to the east, and Hodeidah governorate and the Red Sea to the west [Fig-1]. Hajjah governorate is characterized by various terrains in which it is surrounded by highly mountainous series from different directions, i.e. east, north and south. These series are classified within the western highlands region of the Republic of Yemen. Yet, there are large areas of flat lands and steppe regions in the western side of the city, which are classified within Tihamah region. Moreover, there are many troughs, plateaus, and valleys which are distributed in different parts of the governorate [23].

Due to the various topographical features of the governorate and which is clearly reflected on the climate, Hajjah is

dominated by a climate that is temperate in summer and cold in winter in the mountainous regions. As for the coastal plains areas, they are dominated by a tropical climate, hot, and humid in summer and temperate in winter. Furthermore, the eastern parts of the governorate, particularly the mountainous ones are characterized by heavy seasonal rainfall in the summer as well as some light winter rains. The summer rains in the western parts of the governorate are less in quantity than those in eastern parts [Fig-2]. Hajjah governorate is characterized by different types of soil as a result of the biotechnological, chemical and physical weathering of the rocks, on the basis of the geological structure of the rocks and the terrain situation of the governorate which have a direct role in the formation of soil and its types, it encompasses a varying soil either in terms of the mechanical and the chemical composition of the soil or in terms of physical properties. In addition, there is a direct relationship between the terrain situation and the depth and the thickness of the soil, the soil might be deep and rich of vegetation, organic matter and chemical elements in the valleys regions and plain flat areas, whereas, it might be of an average to little depth in the cliffs areas and high mountainous areas. It is also concomitant with a decrease in the vegetation density and a shortage in the chemical elements of the soil [23].

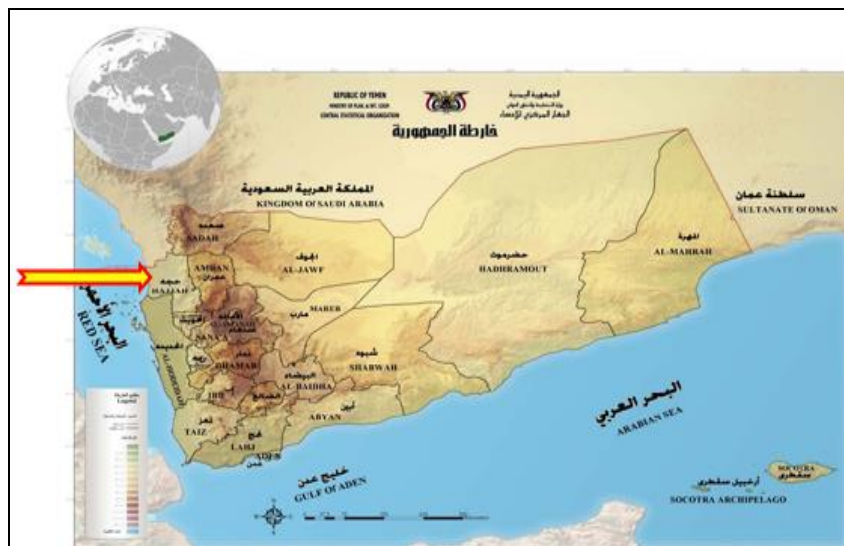


Fig 1: Map of Yemen Location (modified after Central Statistical Organization (2012) & Yemen (Orthographic Projection). Svg, (2012).

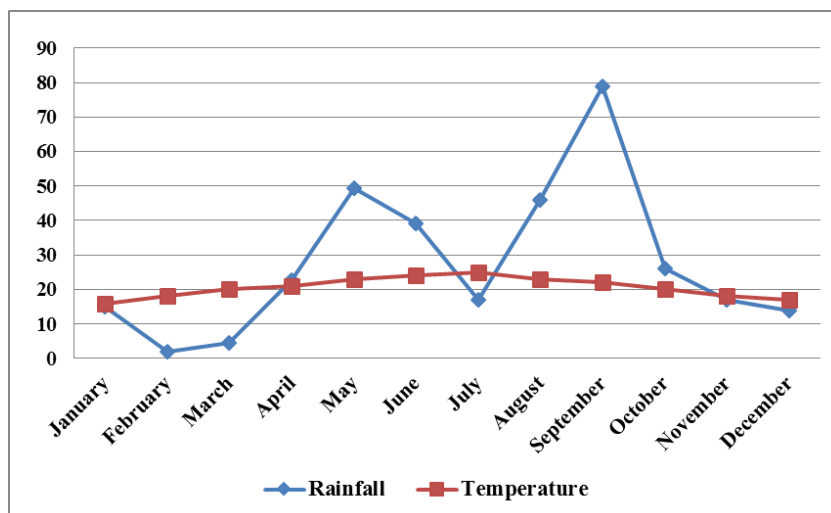


Fig 2: Monthly Average Temperature and Rainfall in the study area.

3. Materials and Methods

Several field trips were carried out to the study area from 2017 to 2018, extensive and intensive studies on the vegetation of Hajjah governorate were carried out to collect plant specimens from their natural habitats. The collected plant specimens were identified and named according to the available taxonomic and floristic literature [2, 3, 5-7, 9-11, 12, 15- 17, 19, 22].

The life forms (LF) were identified for each species according to Raunkiaer's system of classification (Raunkiaer, 1934). The plant taxa found in the study area are listed in (Table 1). This comprehensive list provides the scientific name, local name, life form and habit of each plant species. In addition, the families, genera and species within each family were arranged alphabetically.

4. Results

The present study shows that the plant diversity in Hajjah governorate is now decreasing to loss and less as compare to earlier studies and loss of plant diversity is not only an ethical tragedy but also a great social, economical and cultural loss. During the present works. We have noted 125 plant species belonging to 97 genus and 43 families have been reported in that particular zone [Fig-3], and result of the study are placed

in Table-1. In all- total of 60 herbs, 16 shrubs, 29 under-shrubs, 20 trees species have been included [Fig-4]. The most highly represented families were Fabaceae (18 species; 11 genera), Asteraceae (17 species; 14 genera), Euphorbiaceae (8 species; 4 genera), Lamiaceae (7 species; 6 genera), Solanaceae (6 species; 5 genera), Acamthaceae (6 species; 4 genera), Amranthaceae (5 species; 4 genera), Asclepiaceae (4 species; 4 genera), Apocynaceae & Cucurbitaceae (3 species; 3 genera) Moraceae (4 species; 1 genera), and Plantaginaceae (3 species; 1 genera)., also, 6 families are represented with two species and two genera, and 4 families are represented with two species and one genus in each 21 families are represented with one species and one genus in each [Fig-5]. Plant life forms were categorized as Chamaephytes (43 species; 34.4%), Phanerophytes, (36 species; 28.8%), Therophytes (25 species; 20%), Hemicryptophytes (15 species; 12.8%), Geophytes (5 species; 4%) [Fig-6]. Number of plant species lost is often most widely used for measuring of diversity depletion. The overall causes of diversity loss are the same as those responsible for land use and surface of land changed. This study also reveals that the ecological balance is being upset by rapid rise of human population with their increased demand for more utilization of natural resources.

Table 1: List of plant species, families, life form and habit for studied area.

Family Name	Botanical Name	Vernacular Name	Life Form	Habit
Acanthaceae 4 Genera; 6 Species	<i>Barleria bispinosa</i> (Forssk) Vahl.	Shakadh	Ch	Herb
	<i>Barleria trispinosa</i> (Forssk) Vahl.	Shakadh	Ch	Herb
	<i>Blepharis ciliaris</i> (L.) B. L.	Zughaf	He	Herb
	<i>Hypoestes forsskaolii</i> (Vahl) R. Br.	Sawrab	Th	Herb
	<i>Justicia flava</i> (Vahl) Vahl	Safra	Th	Herb
	<i>Justicia odora</i> (Forssk.) Lam.	----	Ch	Herb
Agavaceae 1 Genera; 1 Species	<i>Agave sisalana</i> Perrine.	Saaf	Ph	Tree
Alliaceae 1 Genera; 1 Species	<i>Allium cepa</i> L.	Passl	Ge	Herb
Amaranthaceae 4 Genera; 5 Species	<i>Achyranthes aspera</i> L.	Hamsched	Th	Herb
	<i>Aerva javanica</i> L.	Rua	Ch	Herb
	<i>Alternanthera pungens</i> Kunth.	Shook	Th	Herb
	<i>Amaranthus hybridus</i> L.	hagarat Al-Raaf	Th	Herb
	<i>Amaranthus viridis</i> L.	Selkh	Th	Herb
Anacardiaceae 1 Genera; 1 Species	<i>Mangifera indica</i> L.	Mango	Ph	Tree
Apocynaceae 3 Genera; 3 Species	<i>Adenium obesum</i> (Forssk.) Roem.	Adanh	Ph	Shrub
	<i>Carissa spinarum</i> L.	Shadn	Ph	Shrub
	<i>Nerium oleandar</i> L.	Defla	Ph	Shrub
Arecaceae 1 Genera; 1 Species	<i>Phoenix dactylifera</i> L.	Nakhil	Ph	Tree
Asclepiadaceae 4 Genera; 4 Species	<i>Calotropis procera</i> (Aiton) W. T. Aiton.	Oshar	Ph	Undershrub
	<i>Caralluma penicillata</i> (Defl.) N. E. Br.	Myapesh	Ge	Herb
	<i>Gomphocarpus fruticosus</i> (L.) R. Br. & Ait. f.	Sabeeh	Ch	Herb
	<i>Kanahia laniflora</i> (Forssk.) R. Br.	Kanh	Ch	Undershrub
Asparagaceae 1 Genera; 1 Species	<i>Sansevieria ehrenbergii</i> Schweinf. ex Bak.	Senh	Ge	Undershrub
Xanthorrhoeaceae 1 Genera; 1 Species	<i>Aloe vera</i> (L.) Burm.f.	Sabr	Ge	Undershrub
Asteraceae 14 Genera; 17 Species	<i>Artemisia abyssinica</i> Sch. Bip. ex, Oliv. & Hiern.	Boitheran	Ch	Herb
	<i>Bidens biternata</i> (Lour.) Merr.	Depes	Th	Herb
	<i>Conyza pyrrhopappa</i> Sch. Bib.	Sadaf	Th	Herb
	<i>Echinops spinosissimus</i> Turra.	Shook Al-Hmir	Ch	Herb
	<i>Eclipta prostrata</i> (L.) L	----	He	Herb
	<i>Flaveria trinerva</i> (Spreng.) Mohr.	Ward Al-Hamir	Th	Herb
	<i>Kleinia odora</i> (Forssk.) DC.	Khthra	Ch	Undershrub
	<i>Kleinia pendula</i> Forssk.	Ethkhr	Ch	Herb
	<i>Pulicaria jaubertii</i> Gamal-Eldin.	Ansif	Ch	Herb
	<i>Senecio hadiensis</i> Forssk.	Sala Al-Bgr	He	Herb
<i>Senecio lyratus</i> Forssk	----	He	Herb	

	<i>Sonchus oleraceus</i> L.	Dalb	Th	Herb
	<i>Tagetes minuta</i> L.	Shegr Al-Hamer	Th	Herb
	<i>Taraxacum campyloides</i> G. E. Haglund.	Tarkshgon	Th	Herb
	<i>Tridax procumbens</i> L.	-----	Th	Herb
	<i>Xanthium spinosum</i> L.	Shook Torky	Ch	Herb
	<i>Xanthium strumarium</i> L.	Lyzeeg	Ch	Herb
Bignoniaceae 1 Genera; 1 Species	<i>Tecoma stans</i> (L.) H. B.K.	Tecoma	Ph	Tree
Boraginaceae 2 Genera; 2 Species	<i>Cordia africana</i> Lam.	Tanb	Ph	Tree
	<i>Ehretia cymosa</i> Thonn.	Gharaf	Ph	Tree
Capparaceae 1 Genera; 2 Species	<i>Capparis cartilaginea</i> Decne.	Lassf	Ch	Undershrub
	<i>Capparis spinosa</i> L.	Lassf	Ch	Undershrub
Burseraceae 1 Genera; 1 Species	<i>Commiphora habessinica</i> (O. Berg.) Engl.	Khadash	Ph	Shrub
Cactaceae 1 Genera; 2 Species	<i>Opuntia dillenii</i> (Ker-Gawl.) Haw.	Bals	Ch	Undershrub
	<i>Opuntia ficus-indica</i> (L.) Mill.	Tin Shawki	Ch	Undershrub
Celastraceae 2 Genera; 2 Species	<i>Catha edulis</i> (Vahl) Forssk.	Qat	Ph	Tree
	<i>Gymnosporia senegalensis</i> (Lam.) Loes.	Orm	Ch	Undershrub
Chenopodiaceae 1 Genera; 1 Species	<i>Chenopodium murale</i> L.	Fatteeh	Th	Herb
Cleomaceae 1 Genera; 1 Species	<i>Cleome angustifolia</i> Forssk.	Hacek Al-Hameer	Ch	Undershrub
Convolvulaceae 1 Genera; 2 Species	<i>Convolvulus arvensis</i> L.		He	Herb
	<i>Ipomoea purpurea</i> (L.) Roth.	Mdad	He	Herb
Cucurbitaceae 3 Genera; 3 Species	<i>Citrullus colocynthis</i> (L.) Schrad.	Hadag	He	Herb
	<i>Coccinia grandis</i> (L.) Voigt.	Habhab Bry	He	Herb
	<i>Cucurbita pepo</i> L.	Kosa	He	Herb
Cyperaceae 1 Genera; 1 Species	<i>Cyperus rotundus</i> L.	Al-Soad	Ge	Herb
Dipsacaceae 1 Genera; 1 Species	<i>Scabiosa columbaria</i> L.	-----	Th	Herb
Euphorbiaceae 4 Genera; 8 Species	<i>Acalypha ciliata</i> Forssk.	Thefran	Ch	Undershrub
	<i>Acalypha fruticosa</i> Forssk.	Thefran	Ch	Undershrub
	<i>Euphorbia ammak</i> Schweinf. **	Amg	Ph	Shrub
	<i>Euphorbia cactus</i> Ehrenb.	Killah	Ch	Undershrub
	<i>Euphorbia granulata</i> Forssk.	Libanah	Th	Herb
	<i>Euphorbia heterophylla</i> L.	-----	Th	Herb
	<i>Jatropha curcas</i> L.	Sharp	Ph	Shrub
	<i>Ricinus communis</i> L.	Kharoua	Ph	Shrub
Fabaceae 11 Genera; 18 Species	<i>Acacia ehrenbergiana</i> Hayne.	Salam	Ph	Shrub
	<i>Acacia etbaica</i> Schweinf.	Qarad	Ph	Shrub
	<i>Acacia mellifera</i> (Vahl) Benth.	Thubah	Ph	Shrub
	<i>Acacia origina</i> Wood.	Talh	Ph	Shrub
	<i>Acacia tortilis</i> (Forssk.) Hayne.	Talh, Somer	Ph	Shrub
	<i>Cadia purpurea</i> (Picc.) Ait.	Hawmir	Ch	Undershrub
	<i>Ceratonia siliqua</i> L.	Khurub	Ph	Tree
	<i>Crotalaria emarginella</i> Vatke.	-----	Th	Herb
	<i>Crotalaria retusa</i> L.	Jljl	Ch	Undershrub
	<i>Delonix regia</i> (Boj.) Raf.	Ranf	Ph	Tree
	<i>Dolichos trilobus</i> L.	Gera	He	Herb
	<i>Indigofera arabica</i> Jub. Spach.	Zahrat Al-Mraa	Ch	Undershrub
	<i>Parkinsonia aculeata</i> L.	Saysiban	Ph	Tree
	<i>Pterolobium stellatum</i> (Forssk.) Brenan.	Houjam	Ph	Shrub
	<i>Prosopis juliflora</i> (S.W.) DC.	Ghaf Al-Bahri	Ph	Shrub
	<i>Senna alexandrina</i> Miller, Gard.	Ashrq	Ch	Undershrub
	<i>Senna occidentalis</i> (L.) Link.	Juljul	Ch	Undershrub
	<i>Senna sophora</i> (L.) Roxb.	Mjljl	Ch	Undershrub
Lamiaceae 6 Genera; 7 Species	<i>Lamium amplexicaule</i> L.	-----	Th	Herb
	<i>Leucas urticifolia</i> (Vahl) R. Br.	-----	Ch	Herb
	<i>Micromeria imbricata</i> (Forssk.) Christ.	Shahi	Th	Herb
	<i>Ocimum basilicum</i> L.	Rihan	Ch	Herb
	<i>Ocimum forskolei</i> Benth	Hubaq	Th	Herb
	<i>Otostegia fruticosa</i> (Forssk.) Schweinf.	Shaqab	Ch	Undershrub
	<i>Rosmarinus officinalis</i> L.	Eklil Al-Gabal.	Ch	Undershrub
Meliaceae 1 Genera; 1 Species	<i>Trichilia emetica</i> Vahl.	Roka	Ph	Tree
Moraceae 1 Genera; 4 Species	<i>Ficus carica</i> L.	Teen	Ph	Tree
	<i>Ficus cordata</i> Thunb, Diss.	Athap	Ph	Tree
	<i>Ficus sycomorus</i> L.	Bidah	Ph	Tree
	<i>Ficus vasta</i> Forssk.	Taluq	Ph	Tree

Myrtaceae 1 Genera; 1 Species	<i>Eucalyptus camaldulensis</i> Behnh.	Kaphor	Ph	Tree
Oleaceae 2 Genera; 2 Species	<i>Jasminum grandiflorum</i> L.	Yasmin	Ch	Undershrub
	<i>Olea europaea</i> L.	Zyton, Etm.	Ph	Tree
Plantaginaceae 1 Genera; 3 Species	<i>Plantago afra</i> L.	Hashishet Al-Brageeth	He	Herb
	<i>Plantago lanceolata</i> L.	Athan Al-Kabsh	He	Herb
	<i>Plantago major</i> L.	Wathnh	He	Herb
Plumbaginaceae 1 Genera; 1 Species	<i>Plumbago zeylanica</i> L.	Ward	Ch	Undershrub
Polygonaceae 1 Genera; 1 Species	<i>Rumex nervosus</i> Vahl.	Othrb	He	Herb
Portulacaceae 1 Genera; 1 Species	<i>Portulaca oleracea</i> L.	Rijlh	Th	Herb
Rhamnaceae 1 Genera; 1 Species	<i>Ziziphus spina-christi</i> (L.) Willd.	Sidr, Dom	Ph	Tree
Rubiaceae 2 Genera; 2 Species	<i>Breonadia salicina</i> (Vahl) Hepper & J. R. I. Wood.	Tharah	Ph	Tree
	<i>Coffea arabica</i> L.	Bon	Ph	Tree
Rutaceae 1 Genera; 1 Species	<i>Ruta chalepensis</i> L.	Shadhab	Ch	Herb
Solanaceae 5 Genera; 6 Species	<i>Datura innoxia</i> Mill.	Banj	Th	Herb
	<i>Datura stramonium</i> L.	Banj	Th	Herb
	<i>Lycium shawii</i> Roem & Schult.	Aosg, Zarb	Ch	Shrub
	<i>Nicotiana glauca</i> R. C. Graham, Edinb.	Hashesh	Ch	Shrub
	<i>Solanum incanum</i> L.	Nuqum	Ch	Undershrub
	<i>Withania somnifera</i> (L.) Dun.	Ebab	Ch	Undershrub
Sterculiaceae 2 Genera; 2 Species	<i>Melhania velutina</i> Forssk.	-----	Ch	Undershrub
	<i>Waltheria indica</i> L.	-----	Ch	Herb
Tamaricaceae 1 Genera; 1 Species	<i>Tamarix aphylla</i> (L.) Karst.	Ethel	Ph	Tree
Tiliaceae 2 Genera; 2 Species	<i>Corchorus olitorius</i> L.	Molokhia	Ch	Undershrub
	<i>Grewia tenax</i> Forssk.	Shohd	Ch	Undershrub
Vitaceae 1 Genera; 2 Species	<i>Cissus quadrangularis</i> L.	Sila	He	Herb
	<i>Cissus rotundifolia</i> (Forssk.) Vahl.	Halas	He	Herb
Zygophyllaceae 1 Genera; 1 Species	<i>Tribulus terrestris</i> L.	Adhrass Al-Kilab	Th	Herb

Life form; Ch: Chamaephyte, Ge: Geophytes, He: Hemicytophyte, Ph: Phanerophyte, Th: Therophyte.

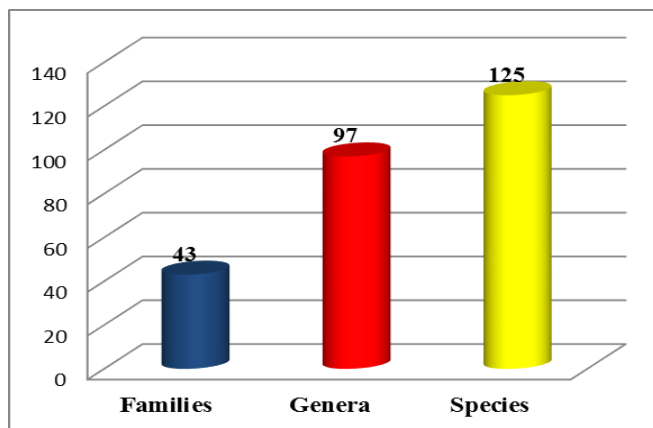


Fig 3: Proportion of Families, Genera and Species.

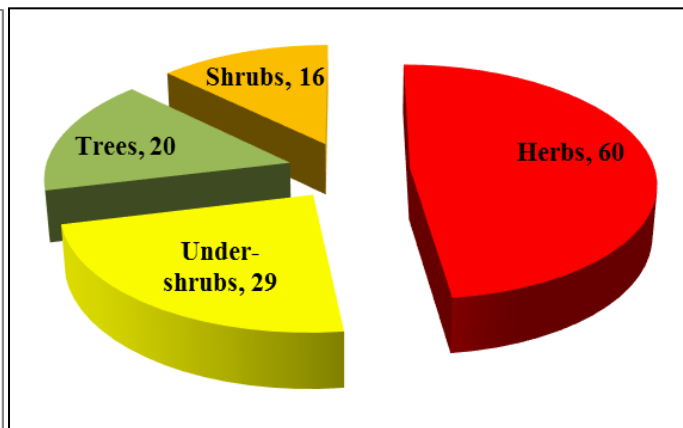


Fig 4: Growth forms (habits).

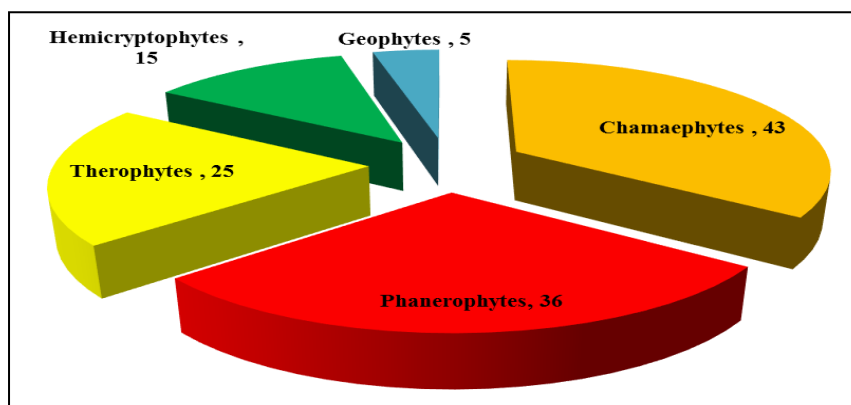


Fig 5: Life form spectrum of study area vegetation.

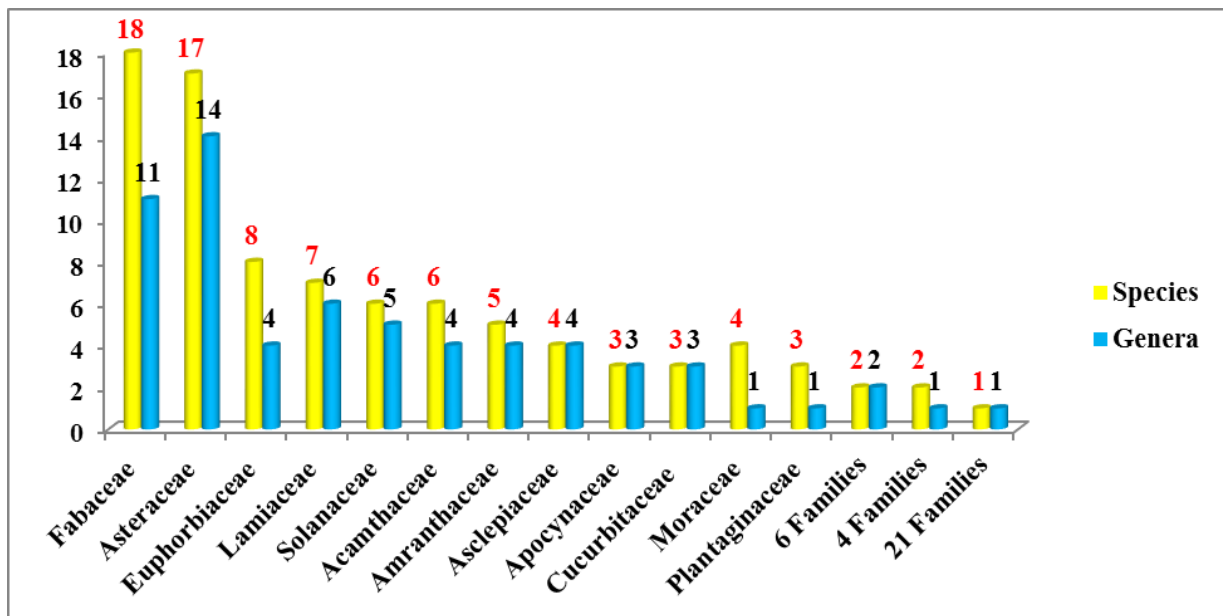


Fig 6: The families in the studied area in regard to number of species and genera.

5. Conclusion

Knowledge of taxonomy is a great tool for identification of the different plant species. Taxonomic knowledge is crucial to meet the challenges of biodiversity conservation in the 21st century. It is of fundamental importance for understanding biodiversity and ecosystem functioning, as it provides us with the data to explore and describe biodiversity through scientific analysis. The present study provides the basic information about the different plant species, which are currently found in Hajjah governorate. Such a list could play an important role for the local and regional authorities interested in to conserve this precious phyto-diversity for better future use of welfare of for coming generations and sustainable development of the area.

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