

Plant diversity assessment of Wadi Al-Hilali, Northern Border region, Saudi Arabia

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Abstract

This study highlights the knowledge of floristic composition of one of the Wadis, which did not have sufficient previous studies. Number of plant species recorded in Wadi Al-Hilali 116 species. These plant species belong to 26 plant families. Asteraceae and Poaceae were the most common families with 18.1 % and 12.1 % of species composition, respectively. Both Brassicaceae and Fabaceae were represented by 10.3 % for both of them. The common life span was annuals with 72.4 %, followed by the perennials with 24.1 %. Therophytes were the majority life form with 70.7 %. According to phytogeographical affinities, the recorded species were classified into three groups: monoregional (29.3 %), bioregional (43.1) and pluriregional (14.7 %). In addition to, cosmopolitan species (6.9 %), paleotropical (2.6 %) and pantropical (3.4%).

Keywords: Plant diversity, Wadi Al-Hilali, Northern Border region, Saudi Arabia

Introduction

Saudi Arabia occupies most area of the Arabian Peninsula (four fifths of the whole area of the Arabian Peninsula) with 225,000 km². Flora of Saudi Arabia comprises about 2,250 plant species belonging to 142 plant families (Chaudhary, 1999–2001) [21]. Xerophyte species constitute the vast majority of the Flora of KSA (Zahran, 1982) [66]. Vegetation of KSA has been belonging to Saharo-Sindian phytogeographical zone (Zohary, 1973) [69].

Climate change and many human activities as overgrazing, wood fuel cutting, expansion in agriculture and urban encroachment, effect on the distribution of vegetation (Fahmy & Hassan, 2005) [8]. The protection of wild plants is a very urgent needs to preserve the ecological balance in addition to, the economic and medicinal importance of many wild plants. Therefore, countries may resort to the enactment of many laws and legislations in addition to, the establishment of many organizations to preserve these plants. As, did Saudi Arabia in 1985 by establishing Saudi Wildlife Commission.

Several previous studies have been conducted to study the Flora of KSA in several regions as Migahid & Hammuda (1974) [48]; Migahid (1996) [47], [21] (1999–2001); Al-Turki & Al-Olayan (2003) [14]; El-Deen (2005) [29]; Fahmy and Hassan (2005) [8]; Al-Huquial & Al-Turki (2006) [9]; El-Ghanim *et al.* (2010) [31]; Alatar *et al.* (2012) [6]; Osman *et al.* (2014) [56] and Osman & Abdein (2019 a and b) [54,55].

Within the limits of our information, the study of the Flora in Wadi Al-Hilali has not been done by any of the authors previously, so this study highlighted the work of a survey of wild plants found in this region in addition to, life forms, life span and floristic categories of the species.

Study area

Wadi Al-Hilali is situated in the northern border area of KSA in addition to, many other Wadis as Wadi Arar, Wadi Aba Al-Qour and Wadi Badna. Wadi Al-Hilali located between longitude 41° 21' and Latitude 30° 52' 37".

Study area and main cities map in Saudi Arabia were created by Arc GIS program (Fig. 1). Website www.meteoblue.com was used to obtained climatic data and these data were presented in Fig. 2 and 3.

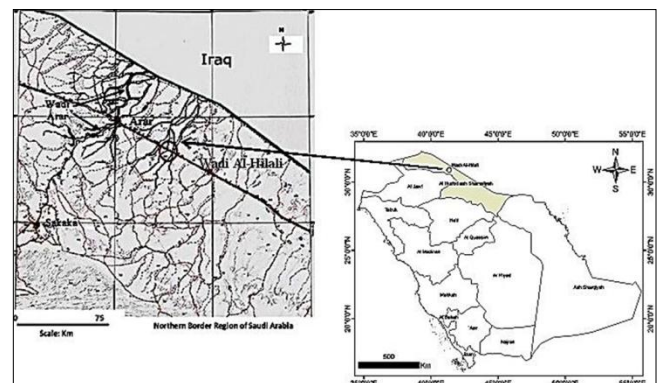


Fig 1: Map showing study area and main area in Saudi Arabia.

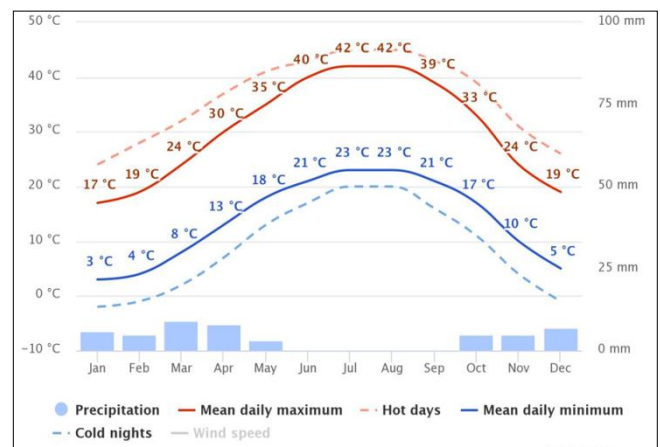


Fig 2: Klima diagram presenting mean maximum and minimum temperature and precipitation (rainfall) of study area (1988-2018).

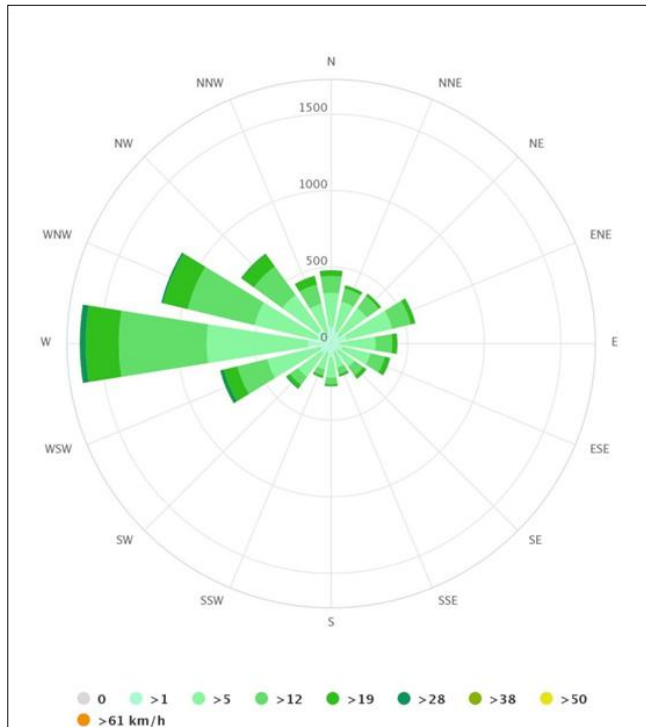


Fig 3: Wind direction of study area (1988-2018).

Materials and methods

This work was conducted to survey the wild plants found in Wadi Al-Hilali in the period from November 2017 to April 2018 during different periods of plant life. Plant species current within Wadi were listed later complete identification after Cope (1985) [24]; Migahid (1996) [47]; Collenette (1999) [22] and Chaudhary (1999–2001) [21]. Herbarium specimens were set and reserved in the herbarium of Biology Department, College of Sciences, Northern Border University. Life forms of the recorded species were identified after Raunkiaer (1934) [59], as adapted by Govaerts *et al.* (2000) [38]. Phytogeographical affinities were recognized after Eig (1931) [27]; Zohary (1966, 1972) [68] and Wickens (1978) [64].

Results

A total of 116 taxa and 85 genera belonging to 26 plant families were recorded in Wadi Al-Hilali. Asteraceae and Poaceae were the most common families with 21 species (18.1 %) and 14 species (12.1 %) of species composition, respectively.

Fabaceae and Brassicaceae were represented by 10.3 %. Chenopodiaceae was represented by 10 species (8.6 %). Boraginaceae, Plantaginaceae and Polygonaceae were represented by 4.3 %. Caryophyllaceae was represented by 4 species (3.4 %). Amaranthaceae, Euphorbiaceae, Geraniaceae and Zygophyllaceae were represented by 3 species each (2.6 %). Malvaceae, Resedaceae and Solanaceae were represented by 2 species (Tables 1 and 2, Fig. 4).

The majority life span of the recorded species was annuals with 84 species (72.4 %), perennials with 28 species (24.1 %), annual / short perennial with two species (*Alternanthera sessilis* and *Poa annua*). Both annual / biennial (*Lactuca serriola*) and short perennial (*Launaea mucronata*) were represented by only one species each (Tables 1 and 2, Fig. 5).

Six life forms were recorded in Wadi Al-Hilali; therophytes were the most common life form (82 species = 70.7 %), followed by Chamaephytes (18 species = 15.5 %), hemicryptophytes (11 species = 9.5 %), two species from two different genera were geophytes (*Convolvulus arvensis* and *Cynodon dactylon*), also phanerophytes was represented by two species from two genera (*Salsola imbricate* and *Tamarix tetragyna*). Cryptophytes was represented by a single species (*Reichardia tingitana*) (Tables 1 and 2 and Fig. 6).

According to phytogeographical affinities, the species were categorized into 3 groups; monoregional (43 species = 29.3 %), bioregional (50 species = 43.1) and pluriregional (17 species = 14.7 %). In addition to, cosmopolitan species (8 species = 6.9 %), paleotropical (3 species = 2.6 %) and pantropical (4 species = 3.4%) (Tables 1 and 3, Figs. 7 and 8).

Results of relations between life forms and chorology were presented in Fig. 9. and Table 1. which show A list of the species recorded in Wadi Al-Hilali Area. Life span; (Short-lived perennial = s-P), (Annual = A), (Perennial = P), (Biennial = Bi). Life form; (Therophytes = Th), (Chamaephytes = Ch), (Geophytes = G), (Hemicryptophytes = H), (Cryptophytes = Cr), (Phanerophytes = Ph). Floristic categories; (Saharo-Sindian = SA-SI), (Pantropical = PAN), (Sudano-Zambesian = S-Z), (Saharo Arabian = SA), (Cosmopolitan = COSM), (Euro-Siberian = ER-SR), (Irano-Turanian = IR-TR), (Mediterranean = ME), (Paleotropical = PAL)

Table 1: A list of the species recorded in Wadi Al-Hilali Area, Life span; (Short-lived perennial = s-P), (Annual = A), (Perennial = P), (Biennial = Bi). Life form; (Therophytes = Th), (Chamaephytes = Ch), (Geophytes = G), (Hemicryptophytes = H), (Cryptophytes = Cr), (Phanerophytes = Ph). Floristic categories; (Saharo-Sindian = SA-SI), (Pantropical = PAN), (Sudano-Zambesian = S-Z), (SaharoArabian = SA), (Cosmopolitan = COSM), (Euro-Siberian = ER-SR), (Irano-Turanian = IR-TR), (Mediterranean = ME), (Paleotropical = PAL)

Family	Species	L.s.	L. f.	Floristic categories
Aizoaceae	<i>Aizoanthemum hispanicum</i> (L.) H.E.K.Hartmann (= <i>Aizoon hispanicum</i> L.)	A	H	ME
Amaranthaceae	<i>Alternanthera sessilis</i> (L.) R.Br. ex DC.	A/s-P	Th	PAN
	<i>Amaranthus graecizans</i> L.	A	Th	PAL
	<i>Amaranthus viridis</i> L.	A	Th	COSM
Apiaceae (Umbelliferae)	<i>Ducrosia anethifolia</i> (Dc.) Boiss.	P	Th	IR-TR + ER-SR
Boraginaceae	<i>Arnebia decumbens</i> (Vent.) Coss. & Kralik	A	Th	SA-SI + S-Z
	<i>Arnebia decumbens</i> subsp. <i>macrocalyx</i> (Coss. & Kralik) Riedl	A	Th	SA-SI + S-Z
	<i>Gastrocotyle hispida</i> (Forssk.) Bunge (= <i>Anchusa hispida</i> Forssk.)	A	Th	SA-SI + IR-TR

	<i>Heliotropium bacciferum</i> Forssk.	P	Ch	SA-SI + S-Z	
	<i>Lappula spinocarpos</i> (Forssk.) Asch. ex Kuntze	A	Ch	SA-SI + IR-TR	
Brassicaceae (Cruciferae)	<i>Brassica tournefortii</i> Gouan	A	Th	ME + SA	
	<i>Cakile arabica</i> Velen.	A	Th	ME + SA	
	<i>Farsetia aegyptia</i> Turra	P	Ch	SA-SI + S-Z	
	<i>Horwoodia dicksoniae</i> Turrill	A	Th	SA-SI	
	<i>Lepidium aucheri</i> Boiss.	A	H	IR-TR	
	<i>Malcolmia africana</i> (L.) R.Br.	A	Th	IR-TR	
	<i>Malcolmia crenulata</i> (Dc.) Boiss.	A	Th	IR-TR	
	<i>Matthiola longipetala</i> (Vent.) DC.	A	Th	ME + IR-TR	
	<i>Savignya praviflora</i> (Delile) Webb	A	Th	SA-SI + IR-TR	
	<i>Schimpera arabica</i> Hochst. & Steud.	A	Th	SA-SI	
	<i>Sinapis arvensis</i> L.	A	Th	ME	
	<i>Sisymbrium irio</i> L.	A	Th	ME + SA-SI + IR-TR + ER-SR	
Caryophyllaceae	<i>Herniaria hirsuta</i> L.	A	Th	ME + SA-SI	
	<i>Paronychia arabica</i> (L.) DC.	A	Th	ME + SA-SI + IR-TR	
	<i>Polycarphae robbairea</i> (Kuntze) Greuter & Burdet	P	Th	SA-SI + S-Z	
	<i>Pteranthus dichotomus</i> Forssk.	A	Th	ME + SA + IR-TR	
Chenopodiaceae	<i>Atriplex dimorphostegia</i> Kar. & Kir.	A	Ch	IR-TR	
	<i>Atriplex leucoclada</i> Boiss.	P	Ch	SA-SI + IR-TR	
	<i>Bassia eriophora</i> (Schrad.) Asch.	A	Ch	SA-SI + IR-TR	
	<i>Bassia muricata</i> (L.) Asch.	A	Th	SA-SI + IR-TR	
	<i>Dysphania ambrosioides</i> (L.) Mosyakin & Clemants (= <i>Chenopodium ambrosioides</i> L.)	A	Th	COSM	
	<i>Chenopodium murale</i> L.	A	Th	COSM	
	<i>Haloxylon salicornicum</i> (Moq.) Bunge ex Boiss.	P	Ch	S-Z.	
	<i>Salsola imbricata</i> Forssk.	P	Ph	S-Z.	
	<i>Salsola schweinfurthii</i> Solms	P	Ch	SA	
<i>Salsola villosa</i> Schult.	P	Ch	ME + SA-SI + IR-TR		
Cistaceae	<i>Helianthemum lippii</i> (L.) Dum.Cours.	P	Ch	SA-SI + S-Z	
Cleomaceae	<i>Cleome amblyocarpa</i> Barratte & Murb.	A	Th	SA-SI + S-Z	
Compositae (Asteraceae)	<i>Achillea fragrantissima</i> (Forssk.) Sch.Bip.	P	Ch	SA-SI + IR-TR	
	<i>Anthemis arvensis</i> L.	A	Th	SA	
	<i>Artemisia scoparia</i> Waldst. & Kitam.	P	Ch	IR-TR + ER-SR	
	<i>Aster squamatus</i> (Spreng.) Hieron.	A	Th	SA-SI	
	<i>Atractylis carduus</i> (Forssk.) C.Chr.	P	Th	ME	
	<i>Calendula arvensis</i> M.Bieb.	A	Th	ME + SA-SI + IR-TR	
	<i>Centaurea soistitalis</i> L.	A	Ch	SA-SI + IR-TR	
	<i>Glebionis coronaria</i> (L.) Cass. ex Spach (= <i>Chrysanthemum coronarium</i> L.)	A	H	ME + SA-SI	
	<i>Ifloga spicata</i> subsp. <i>albescens</i> Chrtek	A	Th	ME + SA-SI	
	<i>Koelipinia linearis</i> Pall.	A	Th	ME + SA + IR-TR	
	<i>Lactuca serriola</i> L.	A/Bi	Th	IR-TR	
	<i>Lasiopogon muscoides</i> (Desf.) DC.	A	Th	ME + SA-SI	
	<i>Launaea capitata</i> (Spreng.) Dandy	A	Th	ME + SA-SI	
	<i>Launaea mucronata</i> (Forssk.) Muschl.	s-P	Th	SA-SI + IR-TR	
	<i>Launaea nudicaulis</i> (L.) Hook.f.	P	Th	SA-SI + IR-TR + S-Z	
	<i>Launaea procumbens</i> (Roxb.) Ramayya & Rajagopal	A	Th	SA-SI	
	<i>Leontodon laciniatus</i> (Bertol.) Widder	A	Th	ME + SA-SI	
	<i>Picris cyanocarpa</i> Boiss.	A	Th	SA	
	<i>Reichardia tingitana</i> (L.) Roth	P	Cr	ME + SA-SI + IR-TR	
	<i>Senecio glaucus</i> L. subsp. <i>coronopifolius</i> (Maire) C. Alexander (= <i>S. desfontainei</i> Druce) *	A	Ch	SA-SI + IR-TR	
	<i>Sonchus oleraceus</i> (L.) L.	A	Th	COSM	
	Convolvulaceae	<i>Convolvulus arvensis</i> L.	P	G	PAL
	Cucurbitaceae	<i>Citrullus colocynthis</i> (L.) Schrad.	P	H	ME + SA-SI + IR-TR + S-Z
Euphorbiaceae	<i>Euphorbia granulata</i> Forssk.	A	Th	SA + S-Z	
	<i>Euphorbia peplus</i> L.	A	Th	COSM	
	<i>Euphorbia serpens</i> Kunth	A	Th	SA-SI + IR-TR	
Geraniaceae	<i>Erodium glaucophyllum</i> (L.) E. Hér.	P	H	SA	
	<i>Erodium laciniatum</i> (Cav.) Willd.	A	Th	SA	
	<i>Erodium touchyanum</i> Delile ex Godr.	A	Th	SA	
Fabaceae	<i>Astragalus asterias</i> Steven	A	H	ME	
	<i>Astragalus bombycinus</i> Boiss.	A	H	SA-SI + IR-TR	
	<i>Astragalus corrugatus</i> Bertol. (= <i>Astragalus cruentus</i> Balb.)	A	Th	IR-TR	
	<i>Astragalus palaestinus</i> Eig *	A	Th	ME	
	<i>Astragalus schemperii</i> Boiss.	A	Th	ME	

	<i>Astragalus spinosus</i> (Forssk.) Muschl.	P	Ch	SA-SI + IR-TR
	<i>Astragalus tribuloides</i> Delile	A	Th	SA-SI + IR-TR
	<i>Medicago laciniata</i> (L.) Mill. var. <i>brachyacantha</i> Boiss.	A	Th	SA-SI
	<i>Melilotus indicus</i> (L.) All.	A	Th	PAL
	<i>Onobrychis ptolemaica</i> (Delile) DC.	P	H	IR-TR
	<i>Trigonella hamosa</i> Del. ex Smith	A	Th	ME + SA-SI
	<i>Trigonella stellata</i> Forssk.	A	Th	SA-SI + IR-TR
Malvaceae	<i>Althaea ludwigii</i> L.	A	Th	SA-SI
	<i>Malva parviflora</i> L.	A	Th	PAN
Nitrariaceae	<i>Peganum harmala</i> L.	P	H	ME + SA-SI + IR-TR
Papaveraceae	<i>Fumaria parviflora</i> Lam.	A	Th	COSM
Plantaginaceae	<i>Plantago amplexicaulis</i> Cav.	A	Th	SA-SI + IR-TR
	<i>Plantago ciliata</i> Desf.	A	Th	ME + SA-SI + IR-TR
	<i>Plantago cylindrica</i> Forssk.	A	Th	SA-SI + IR-TR
	<i>Plantago ovata</i> Forssk.	A	Th	SA + IR-TR
	<i>Plantago psammophila</i> Agnew & Chal.-Kabi	A	Th	SA-SI + IR-TR
Poaceae (Gramineae)	<i>Avena barbata</i> Pott ex Link	A	Th	ME
	<i>Bromus danthoniae</i> Trin.	A	Th	IR-TR
	<i>Bromus haussknechtii</i> Boiss.	A	Th	IR-TR
	<i>Bromus moeszii</i> Pénzes (= <i>Bromus sericeus</i> Drobow).	A	Th	IR-TR
	<i>Cynodon dactylon</i> (L.) Pers.	P	G	PAN
	<i>Eremopyrum bonaepartis</i> (Spreng.) Nevski (= <i>Eremopyrum confusum</i> Melderis)	A	Th	IR-TR
	<i>Hordeum murinum</i> subsp. <i>glaucum</i> (Steud.) Tzvelev	A	Th	ME + IR-TR
	<i>Lolium rigidum</i> Gaudin	A	Th	ME + IR-TR
	<i>Phalaris minor</i> Retz.	A	Th	ME + IR-TR
	<i>Poa annua</i> L.	A/s-P	Th	ME + IR-TR + ER-SR
	<i>Polygogon monspeliensis</i> (L.) Desf.	A	Th	ME + SA-SI + IR-TR
	<i>Rostraria pumila</i> (Desf.) Tzvelev	A	Th	ME + SA-SI
	<i>Schismus arabicus</i> Nees	A	Th	ME + SA + IR-TR
<i>Schismus barbatus</i> (L.) Thell.	A	Th	ME + SA-SI + IR-TR	
Polygonaceae	<i>Emex spinosa</i> (L.) Campd.	A	Th	PAN
	<i>Polygonum argyrocoleon</i> Steud. ex Kunze	A	Th	IR-TR
	<i>Polygonum aviculare</i> L.	A	Th	COSM
	<i>Polygonum palaestinum</i> Zohary *	A	Th	ME + SA
	<i>Rumex vesicarius</i> L.	P	Th	ME + SA-SI + S-Z
Portulacaceae	<i>Portulaca oleracea</i> L.	A	Th	ME + SA-SI
Resedaceae	<i>Oligomeris linifolia</i> (Vahl ex Hornem.) J.F. Macbr. (= <i>Reseda linifolia</i> Vahl ex Hornem.)	A	Th	ME + SA + S-Z
	<i>Reseda muricata</i> C. Presl	A	Th	SA-SI + IR-TR
Solanaceae	<i>Hyoscyamus muticus</i> L.	P	Ch	SA-SI + IR-TR
	<i>Solanum americanum</i> Mill. (= <i>Solanum nigrum</i> L.)	P	Ch	COSM
Tamaricaceae	<i>Tamarix tetragyna</i> Ehrenb.	P	Ph	SA-SI + S-Z
Zygophyllaceae	<i>Fagonia bruguieri</i> DC.	P	H	SA-SI + IR-TR
	<i>Fagonia glutinosa</i> Delile	P	H	SA-SI
	<i>Tribulus macropterus</i> Boiss.	A	Ch	SA-SI + IR-TR

Table 2: The number of vegetation diversity, Life span and life form of Wadi Al-Hilali species

Vegetation diversity	Life span		Life form		
	Face of Comparison	Number	Face of Comparison	Number	
Families number	26	A	84	Th.	82
Genera number	85	P	28	Ch.	18
Taxa number	116	A / s-P	2	H.	11
Species number	111	A / Bi	1	Cr.	1
Subspecies number	4	s-P	1	G.	2
Varieties number	1			Ph.	2

Table 3: Number and percentages of species belonging to chorology

Phytochoria	Number of species	Percent (%)
Monoregionals		
ME	7	6.035
IR-TR	12	10.345
SA	6	5.172
SA-SI	7	6.035
S-Z	2	1.724

Total	34	29.31%
Biregionals		
ME + IR-TR	4	3.448
ME+ SA	3	2.586
ME + SA-SI	9	7.759
IR-TR + ER-SR	2	1.724
SA + IR-TR	1	0.862
SA + S-Z	1	0.862
SA-SI + IR-TR	22	18.966
SA-SI + S-Z	8	6.896
Total	50	43.10%
Pluriregionals		
ME + IR-TR + ER-SR	1	0.862
ME+ SA + IR-TR	3	2.587
ME + SA + S-Z	1	0.862
ME + SA-SI + IR-TR	8	6.897
ME + SA-SI + S-Z	1	0.862
SA-SI + IR-TR + S-Z	1	0.862
ME + SA-SI + IR-TR + ER-SR	1	0.862
ME + SA-SI + IR-TR + S-Z	1	0.862
Total	17	14.66%
COSM	8	6.896
PAL	3	2.586
PAN	4	3.448
Total	15	12.93%
The Sum	116	100%

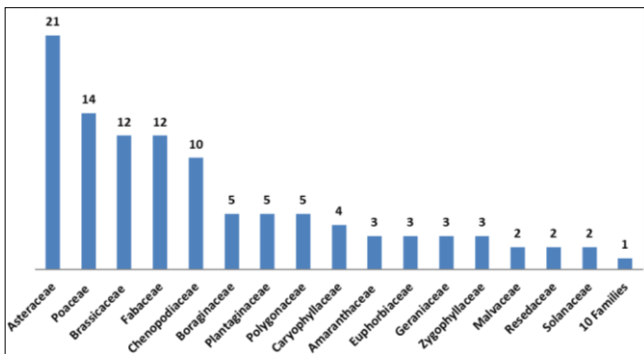


Fig 4: The plant families of Wadi El-Hilali species.

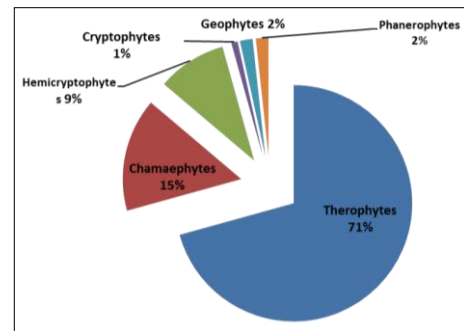


Fig 6: Life forms of Wadi El-Hilali plant species.

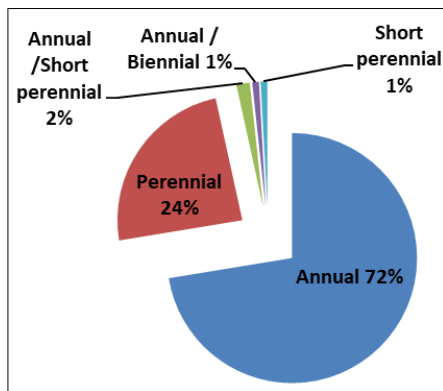


Fig 5: Life span of Wadi El-Hilali species.

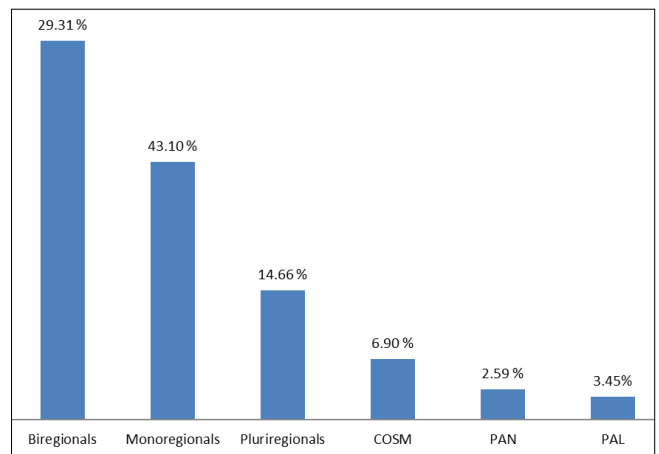


Fig 7: Floristic category of Wadi El-Hilali species.

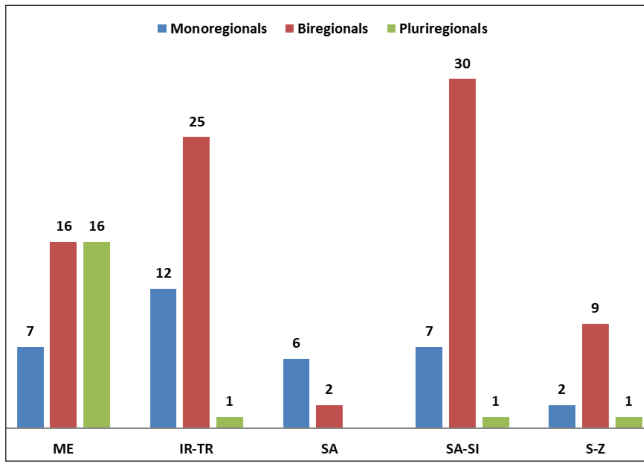


Fig 8: Distribution of monoregional, biregional and pluriregional geoelements among the recorded species of Wadi El-Hilali.

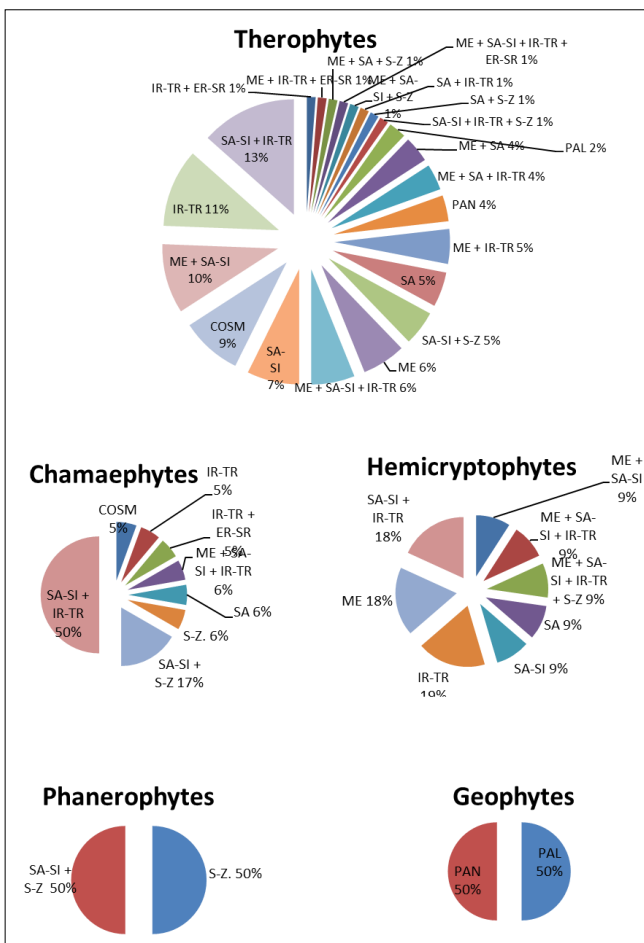


Fig 9: Distribution of chorotypes among the different life forms

Discussion

Asteraceae, Poaceae, Fabaceae and Brassicaceae were the most common plant families in this study. Meanwhile, ten families were noted by only one species. These results were in accordance with Collenette (1999) [22], Al-Nafie (2004) [10] and Moawed & Ansari (2015) [59] who mentioned that Asteraceae (233 species), Poaceae (262 species) and Fabaceae (210 species) were the most common plant families in the Flora of KSA. It is worth mentioning that many of the plants that belong to these plant families are

characteristic feature of desert zones (Batanouny and Baeshain 1983) [16]. In addition to, many families were recorded with only one species per families. This may be due to the fact that few of these plant species have the ability to cope and adapt with the difficult conditions in these areas (Pielou, 1975; Magurran, 1988; Al-Nafie, 2008; El-Ghanim *et al.*, 2010 [31] and Al-Sherif *et al.*, 2013) [57, 43, 10, 12].

Many previous studies have been conducted on many places inside KSA reported that Asteraceae, Poaceae, Fabaceae and Brassicaceae the most common plant families (Migahid & Hammouda, 1978 [48]; Collenette, 1985 [22]; Mandaville, 1990; El-Ghani & El-Sawaf, 2004 and Alshammari & Sharawy, 2010) [43]. On the other hand, other studies indicating that Asteraceae and Poaceae the most common plant families in other area (Al-Turki & Al-Olayan, 2003 [14]; El-Ghanim *et al.*, 2010 [31]; Farrag, 2012 [32]; Alatar *et al.*, 2012 [6]; Al-Sodany *et al.* 2013 [13]; Osman *et al.*, 2014 [56]; Osman & Abdein (2019 a and b) [54,55] and Seraj *et al.*, 2014) [60].

The majority life span of the recorded species was annuals, followed by the perennials. These results were consistent with Al-Turki & Al-Olayan (2003) [14] and Sharawy & Alshammari (2009) [11].

Topography and landform are the most important factors to determined plant life forms (Hodgson, 1963; Kassar & Girgis, 1964; Zohary, 1973; Mckenzie, 1977; Mengel & Kirkby, 1978; Abd El-Hamid, 1983; Orshan, 1986; Slik *et al.*, 2003; Al-Farhan *et al.*, 2005; Deenik & Yost, 2006; Shaltout *et al.*, 2010 and Alatar *et al.*, 2012) [6, 40, 42, 69, 45, 46, 4, 53, 63, 7, 25, 61].

In this study, therophytes and chamaephytes were the most abundant life form. These results were in accordance with Deschenes (1969) [26]; Barbero *et al.* (1990) [15]; El-Demerdash *et al.* (1995) [30]; Abd-El-Ghani (1997); Chaudhary, (1999-2001) [21]; Al-Turki & Al-Olayan (2003) [14]; Fahmy & Hassan (2005) [8]; Abd El-Ghani & Abdel-Khalik (2006); Mosallam (2007); El-Ghanim *et al.* (2010) [31]; Alatar *et al.* (2012) [6]; Farrag (2012) [34]; Al-Sherif *et al.* (2013) [12]; Al-Sodany *et al.* (2013) [13]; Osman *et al.* (2014) [56]; Seraj *et al.* (2014) [60] and Moawed & Ansari (2015) [59].

The dominance of therophytes more than other life forms in deserts and semi-desert habitats because of several reasons as topography, biotic influence and dry climate (Cain, 1950; Dechenes, 1969; Barbero *et al.*, 1990 [15]; Ahmed, 1997; Abd El-Ghani & Abd El-Khalik, 2006 and Alshammari & Sharawy, 2010) [11, 1]. Gomaa (2012) [37], pointed out that the reason may be therophytes have a short life span.

Mediterranean species was the most common floristic categories in this study (39 species), followed by Saharo-Sindian and Irano-Turanian (38 species each). These results were in agreement with Quézel (1978) [58], Al-Hassan (2006) [8] Osman *et al.* (2014) [56] and Osman & Abdein (2019 a and b) [54,55]. But, Saharo-Sindian elements the most common species in the northern sector and south west of KSA (El-Ghanim *et al.*, 2010 and Fadl *et al.*, 2015) [32].

Besides, the importance of wild plants as a component of ecosystems, many recorded plants in this study have a lot of medicinal and economic importance (Table 4).

Table 4: Economic and medicinal uses of some recorded species

Species	Part used	Economic and medicinal uses	References
<i>Alternanthera sessilis</i> (L.) DC.	Flowering branches	Antihyperglycemic and analgesic activity	(Hossain <i>et al.</i> , 2014) ^[41]
<i>Glebionis coronaria</i> (L.) Tzvelev	Flowering branches	Aromatic source and ornamental	(Bidak <i>et al.</i> , 2015) ^[18]
<i>Launaea mucronata</i> (Forssk.) Muschl.	Flowering branches	Grazing	(Bidak <i>et al.</i> , 2015) ^[18]
<i>Launaea nudicaulis</i> (L.) Hook. f.	Flowering branches	sGrazing	(Bidak <i>et al.</i> , 2015) ^[18]
<i>Senecio glaucus</i> L.	Whole plant	Antimicrobial activity	(El-Amier <i>et al.</i> , 2014) ^[28]
<i>Sonchus oleraceus</i> L.	Leaves	Malaria	(Namukobe <i>et al.</i> , 2011) ^[51]
<i>Sisymbrium irio</i> L.	Flowering branches	Grazing	(Bidak <i>et al.</i> , 2015) ^[18]
<i>Chenopodium murale</i> L.	Flowering branches	Aromatic source and edible food	(Bidak <i>et al.</i> , 2015) ^[18]
<i>Convolvulus arvensis</i> L.	Roots	Antihemorrhagic	(Bellakhdar, 1978) ^[17]
<i>Euphorbia peplus</i> L.	Latex	Diuretic and treatment of some pulmonary diseases	(Fournier, 1948) ^[36]
<i>Melilotus indicus</i> (L.) All.	Seed	For diseases of genital organs of both sexes	(Nauroy, 1954) ^[52]
<i>Emex spinosa</i> (L.) Campd.	Flowering branches	Edible food and grazing	(Bidak <i>et al.</i> , 2015) ^[18]
<i>Malva parviflora</i> L.	Seed	As a cataplasm, rectal injection or gragle according to the case	(Bellakhdar, 1978) ^[17]
<i>Cynodon dactylon</i> (L.) Pers.	Rhizomes	For renal and urinary troubles, depurative, diuretic, refreshing agent, sudorific and emollient	(Fourment and Roques, 1941) ^[35]
<i>Polypogon monspeliensis</i> (L.) Desf.	Flowering branches	Grazing	(Hassan, 2005) ^[8]
<i>Portulaca oleracea</i> L.	Whole plant	Diuretic, abscesses, anaphrodisiac, vermifuge, refreshing agent and antidiabetic	(Nauroy, 1954) ^[52]
<i>Hyoscyamus muticus</i> L.	Leaves	As cigarettes against asthma	(Boulos, 1966) ^[19]

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