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Plant diversity in Majameà Al-Hadb reserve in Wadi Ad-Dawasir, Saudi Arabia

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Abstract
Majameà Al-Hadb Reserve is a natural reserve in the Kingdom of Saudi Arabia under the supervision of the National Center for the Development of Wildlife. It is an area fed by many valleys and home to many perennial and annual plant communities. This study presents the determination of the fluorescent composition of plants and the knowledge of their areas of existence, their quantity, their life forms, and their geographical distribution in three of the most important valleys within the reserve. 27 different sites were selected within the reserve. Each site had an area of 50m2. The plant species present there were recorded, and their floristic category and global geographical distribution were determined. The total number of plant species reached 57 species, belonging to 45 genera and 23 families. The most abundant family was Fabaceae, followed by Zygophyllaceae, poeaece, as for the species represented by one species, it reached 12 families. Annual and perennial herbs were prevailing. In addition that the monoregional regions are the most highly representative, with a percentage of 49.12% and the Sudanese desert region was the highest among the monoregions of geographical distribution. Majameà Al-Hadb Reserve can be considered a reservoir of local seed species, as no invasive species were recorded, and this makes us call for attention to the management of the reserve and the prevention of overgrazing during the flowering days of the plants.

Keywords: Majameà Al-Hadb reserve, Wadi Al-Dawaser, plant diversity, Saudi Arabia

Introduction

The study of vegetation in protected areas is of great importance in evaluating the role of protection and its impact on plant diversity, either negatively or positively. Al-Walayi (1996) [9] pointed out that the emergence of natural reserves in the Kingdom came to preserve the rare wildlife in the Kingdom, referring to the strengthening of the Kingdom's role in preserving endangered species through the rehabilitation of rare plants and animals, protecting them from hunting, and activating eco-tourism by expanding nature reserves and providing job opportunities. For those living in its vicinity. The study (Zahran and Younes, 1990) [17] indicated that the total vegetation cover reached 96% within the protected areas of Khamis Mushait compared to the vegetation cover in the grazing areas (45%). This increase in species richness and total vegetation cover is mainly due to the emergence of palatable grasses and weeds, which were reduced by heavy grazing before protection. The study conducted by Al-Mishileh and Kawas (2001) [3]

confirmed that protection has a positive effect on plant species in Al Ghada Reserve in Al-Qassim, where the coverage rate in the protected area was 78%, while in the unprotected areas it was 13%.

MajameàAl-Hadb reserve is one of the nature reserves in the Kingdom of Saudi Arabia that were newly established after the issuance of the Royal Decree 4/71/ dated August 2, 1990. The reserve is located northwest of Wadi Al Dawasir Governorate, east of Rania Governorate, and southwest of the Kingdom of Saudi Arabia. Majameà Al-Hadb Reserve was established on January 19, 1992, in an area of 292.57 km2. It is one of the reserves that contain a distinct plant diversity scattered throughout the reserve, where rainwater falls on a large area of rocky slopes and collects in valleys, which leads to the emergence of communities of perennial plants, including Acacia tortilis and Haloxylon persicum and other plant species, in this study to determine the fluorescent diversity of MajameàAl-Hadb reserve.

Topography and Climate

MajameàAl-Hadb reserve contains a variety of terrain, where many main valleys intersect within its borders, as shown, refer to figure (1), the most important of which is Wadi Al-Tiri and Wadi Al-Farsha, which is the main valley in the reserve. It is located on Wadi Bisha and Wadi Rania. Long after it rains. Wadi Al-Farsha joins Wadi Tathleeth and they form Wadi Al-Dawasir. Most of the mountains of the reserve are made of granite and dark volcanic rocks, which are smooth, and some of them rise by 200 m above the surrounding plains, which leads to the accumulation of rainwater, forming a dense vegetation cover.

The study area climate is a continental desert climate characterized by hot and dry summers and cold winters with moderate rains. The average temperature in the Majma'a al-Hadab Reserve is 25 ° C, rising to more than 46 ° C in summer and -2 ° C in winter. Rain falls on the reserve in the spring.

Fig 1: A map showing the topography of the Plateau Reserve. (Google earth)

Materials and Methods

Study area

The present study was carried out on 27 sits in various regions of Majameà Al-Hadb reserve refer to figure (2) and table (1).

Survey method

1. Extensive field trips were conducted to study the various sites in the study during October and September of 2021, the area was divided into 3 main sections, and was subdivided into 27 subsections evry subsections divided again to 3 squares with an area of 50 m^2.
2. The plant species were identified and named according to the The literature, and Flora Books of (Chaudhary, 2001; Chaudhary and Al Jowaid, 1999; Chaudhary, 1999; Collenette, 1998) [12, 13, 11, 14], and verify its definition by reviewing the herbarium of Botany and Microbiology Department, College of Science, King Saud University.
3. 57 of the study samples were deposited in the Herbarium of the Department of Botany and Microbiology, College of Science, King Saud University.

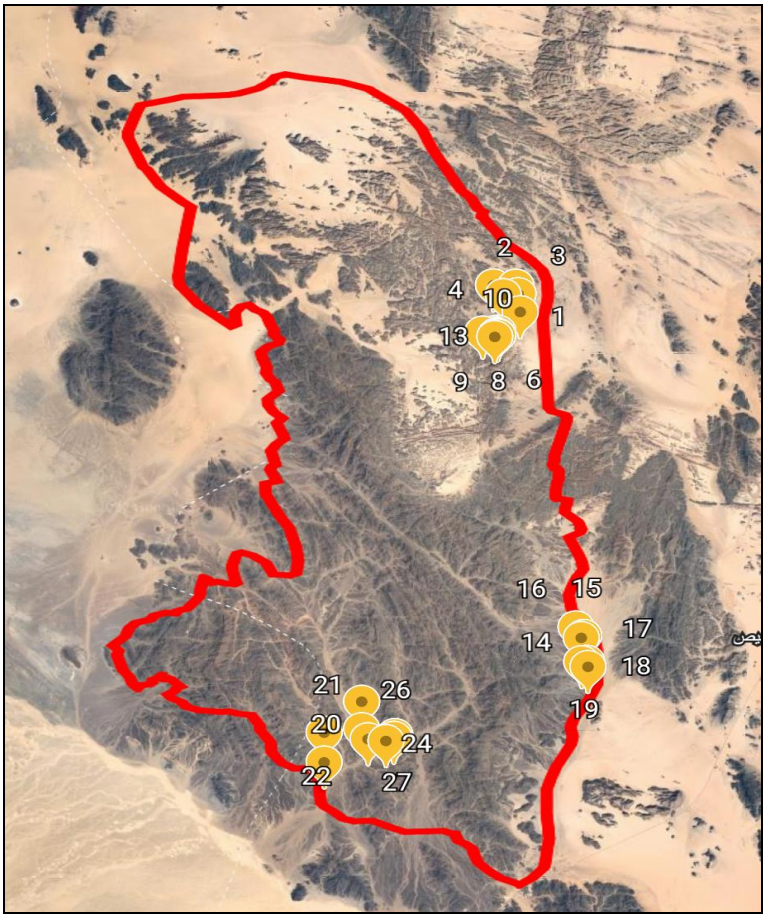

Fig 2: A map showing the study sites within Majameà Al-Hadb reserve (Google earth)

Table 1: Locations of the study area and their coordinates

Area name	Stands	Coordinates
Main location	1	N21°37 67.19' E43°47 86.36"
	2	N21°38' 35.91" E43°47 19.99"
	3	N21°38' 39.93" E43°47 78.23"
	4	N21°38' 74.80' E43°46 81.36"
	5	N21°38' 73.82 E43°47 69.24"
Wadi al-Majameà	6	N21°36 85.20 E43°46 81.21"
	7	N21°36 85.35 E43°46 39.19"
	8	N21°36 79.04 E43°46 94.58"
	9	N21°36 75.61 E43°46 99.58"
	10	N21°37 67.19 E43°46 86.36"
	11	N21°3673.20 E43°46 59.36"
	12	N21°36 73.21 E43°46 88.36"
	13	N21°36 88.29 E43°46 90.19"
Wadi Tayri	14	N21°24 50.79 E43°50 25.21"
	15	N21°24 64.63 E43°50 36.20"
	16	N21°24 59.46 E43°50 03.28"
	17	N21°23 39.30 E43°50 52.17"
	18	N21°3630.42 E43°50 28.07"
	19	N21°23 58.63 E43°50 2787"
Wadi Jakhjukh	20	N21°19 54.53 E43°4640 16.34"
	21	N21°20 74.60 E43°41 63.69"
	22	N21°20 89.17 E43°41 63.74"
	23	N21°21 99.20 E43°41 63.69"
	24	N21°20 48.45 E43°40 88.96"
	25	N21°20 41.20 E43°42 58.96"
	26	N21°20 32.80 E43°42 54.20"
	27	N21°20 65.60 E43°42 94.20"

Results

Refering to Table (2). The number of plant species in the study area was 57 species, belonging to 45 genera and 23 plant families. The most abundant family in the environments of the study area was the Fabaceae, where the number of its species reached ten plant species (17.54%) Figure (3), followed by Zygophyllaceae, has seven species (12.28%), then Poaceae with six species (10.52%), and then the Brassicaceae family with four species (7.01%). While Boraginaceae, Asteraceae, Asclepiadaceae, and Chenopodiaceae represented three species (5.26%), Cucurbitaceae and Euphorbiaceae (3.51%), the species represented by only one species amounted to 12 families, with a rate of (1.75%) for each. This is considered the least widespread species in MajameàAl-Hadb, including Solanaceae, Rhamnaceae, Apocynaceae, Acanthaceae, and others.

As for the form of life, it ranged between trees with a presence of 6.7%, shrubs 31.1%, semi-shrubs 35.6%, and annual and perennial herbs 26.7%. Also, through the table (2) and figure (4), the monoregional regions are the most representative, as the number of plant species in them reached 18 species, at a rate of (49.12%) belonging to 9 geographical regions. The Sudanese desert SU was the highest among the monoregional regions including 9 species (15.79%), followed by the Arab desert region SA with 8 species (14.04%), and then the Iranian region IT with 4 species (7.02%). As for the bi-regional regions, they were represented by 19 species, or 33.33%, followed by 11 geographical regions, Zambezi Arab SA-SZ was the highest among the regions of the dual geographical distribution, as it contained 6 species (10.53%), comes after it Sudanese Arab desert region SA-SU with 3 species (5.26%). whereas in the regions with multiple geographical distributions, there were 10 species, with a mean of (17.54%) belonging to 9 geographical regions. All regions of multiple geographical distributions were represented by only one species (1.75%), except for the Mediterranean-Iranian-Turanian-Saharan-Arabian Med-IT-SA region, which was represented by 2 species (3.51%).

Table 2: Plant specie, families, and life formsand their geographical distribution in MajameàAl-Hadb reserve

Species	Family	Life Form	Floristic Categories
Acacia ehrenbergiana	Fabaceae	Shrub	SM
Acacia gerrardii	Fabaceae	Tree	SA
Acacia oerfota	Fabaceae	Shrub	TR-AF
Acacia torilis	Fabaceae	Tree	SM
Aizoon canariense	Aizoaceae	Herb	SM
Ajuga arabica	Lamiaceae	Shrub	SA
Aristida adscensionis	Poaceae	Perennial grass	Med-IT-SA
Arnebia hispidissima	Boraginaceae	Herb -Annual or perennial	SA-SM
Artemisia sieberi basser	Asteraceae	Perennial herb	Med
Astragalus spinosa	Fabaceae	Subshrub	IT
Blepharis ciliaris	Acanthaceae	Annual herb	SA-IT
Boerhavia diffusa	Nyctaginaceae	Perennial herb	SA
Calligonum comosum	Polygonaceae	Shrub	SA-IT
Calotropis procera	Asclepiadaceae	Shrub	SM
Citrullus colocynthis	Cucurbitaceae	Herb	SW

Convolvulus oxyphyllus	Convolvulaceae	Subshrub	SW
Crotalaria incana	Fabaceae	Herb	SA
Cucumis prophetarum	Cucurbitaceae	Subshrub	SA
Cymbopogon commutatus	Poaceae	Perennial herb	SW
Dipterygium glaucum	Capparaceae	Subshrub	SA
Eruca sativa	Brassicaceae	Herb	SW
Euphorbia granulata var. *glabrata*	Euphorbiaceae	Herb	S-SW
Euphorbia granulata	Euphorbiaceae	Herb	S-SW
Fagonia bruguieri	Zygophyllaceae	Subshrub	SM
Fagonia indica burm	Zygophyllaceae	Herb	SA
Fagonia sehweifurtbia	Zygophyllaceae	Herb	SA
Farsetia aegyptia	Brassicaceae	Subshrub	SH-SM-SA
Haloxylon persicum	Chenopodiaceae	Shrub	SW
Haloxylon salicornicum	Chenopodiaceae	Shrub	SW
Halothamnus iraqensis	Chenopodiaceae	Shrub	SW
Heliotropium crispum	Boraginaceae	Subshrub	SA
Heliotropium digynum	Boraginaceae	Subshrub	SA-SM
Indigofera spinosa	Fabaceae	Sherb	SW
Launaea capitata	Asteraceae	Herb	Med-IT-SA
Leptadenua pyrotechnica	Asclepiadaceae	Shrub	Cosmo
Lycium shawii	Solanaceae	Shrub	SA
Maerua crassifolia	Capparaceae	Tree	SA
Morettia parviflora Boiss	Brassicaceae	Subshrub	SM
Moringa peregrina	Moringaceae	Shrub	SZ
Ochradenus baccatus	Resedaceae	Shrub	SA-SM
Ochthochloa compressa	Poaceae	Perennial grass	SM
Panicum turgidum	Poaceae	Perennial grass	SA
Pergularia tomentosa	Asclepiadaceae	Subshrub	SW
Polycarpaea repens	Caryophyllaceae	Subshrub	SA
Retama reatem	Fabaceae	Subshrub	SA
Rhanterium epapposum	Asteraceae	Subshrub	SA
Rhazya stricta	Apocynaceae	Shrub	SA-SM
Seetzenia lanata	Zygophyllaceae	Herb	SA
Senna holosericea	Fabaceae	Subshrub	SA
Senna italica	Fabaceae	Subshrub	SA
Stipagrostis plumosa	Poaceae	Annual grass	SA-SM
Stipagrostis raddiana	Poaceae	Perennial grass	SA
Tribulus pentandrus	Zygophyllaceae	Herb	SA
Tribulus arabicus	Zygophyllaceae	Subshrub	TR AF
Tribulus terrestris	Zygophyllaceae	Herb -Annual	SA-SM
Zilla spinosa	Brassicaceae	Herb	EU-Med- IT
Ziziphus spinosa-christi	Rhamnaceae	Shrub	SA

COSM: Cosmopolitan; IT: Irano Turanian; Med: Mediterranean; SA: Saharo Arabian; SH: Sahelian; SM: Somalia Masai; TR: Tropical; AF: African; SZ: Sudano-Zambezian; ZA: Zambezian; SU: Sudano; Sib: Siberia.

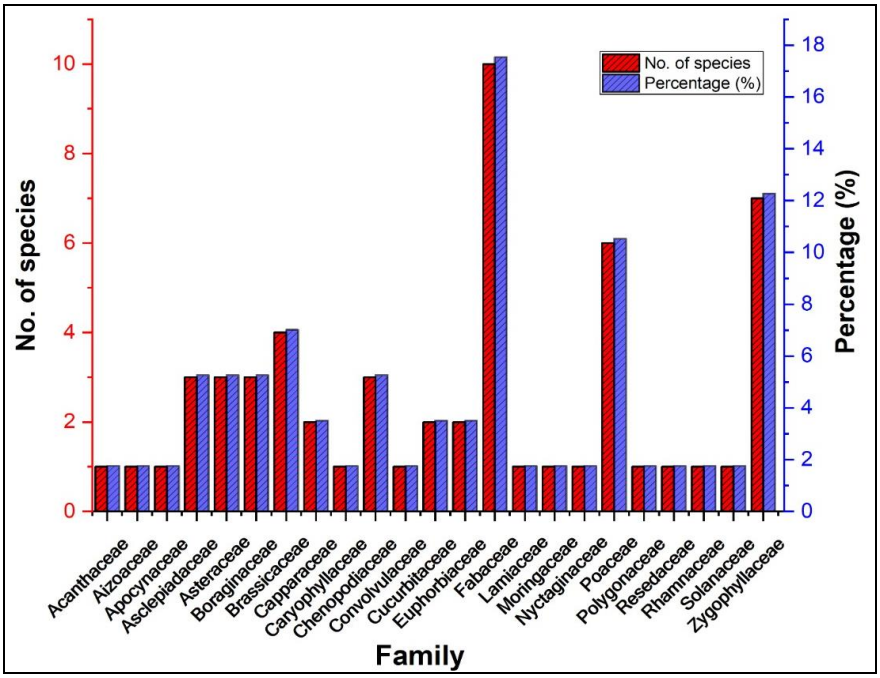

Fig 3: Graphically representation of plant species in MajameàAl-Hadb reserve

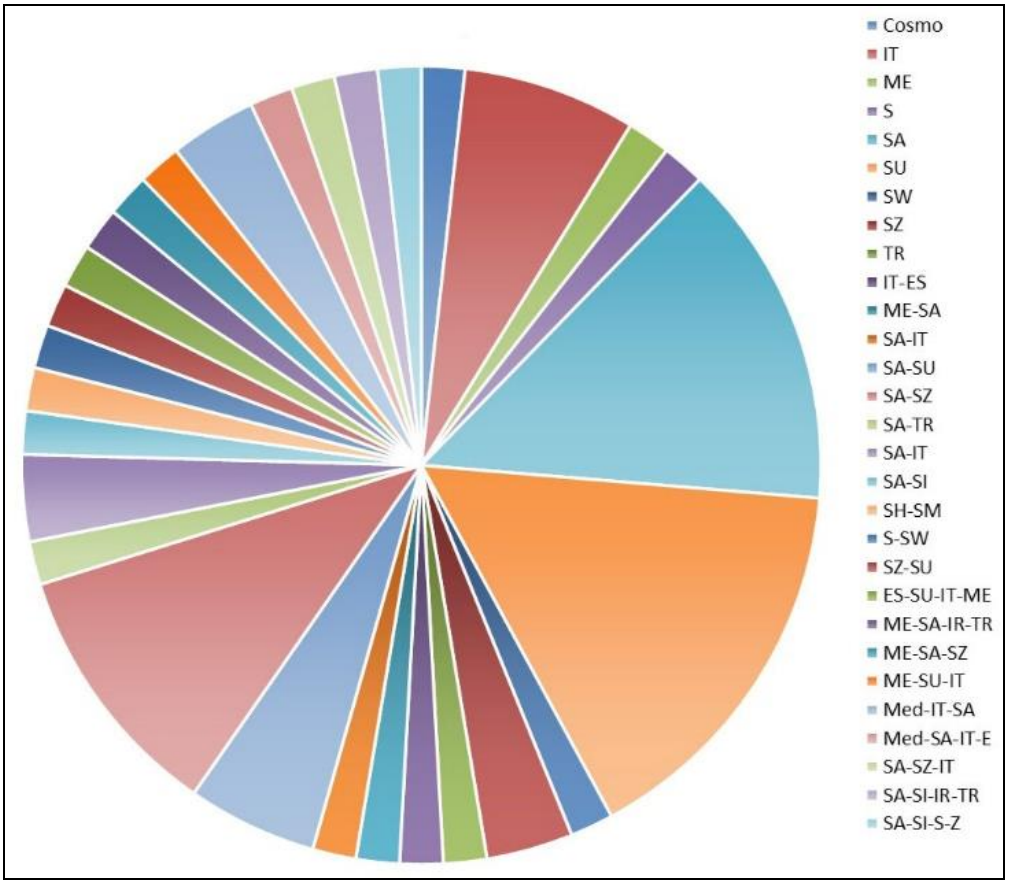

Fig 4: Floristic category of Majameà Al-Hadb Reserve region

Discussion

The current study focused on the description of plant diversity in three valleys in the reserv of Majameà Al-Hadbb, which includes al-Majameà, Tayri, and Jakhjukh. A total of 57 species, belonging to 45 genera and 23 plant families, have been registered. We can conclude that the study area appears to be low in plant diversity considering its relatively large area, which is approximately 292.57 km2, but this is not surprising if we know that one of the characteristics of the vegetation cover in the Kingdom of Saudi Arabia is the its low floristic diversity (Al-Sodany *et al*., 2016) [7]. Its continental climate also has an impact on plant diversity, The most abundant family was the Fabaceae, followed by Zygophyllaceae, then Poaceae, and then the Brassicaceae, These findings were largely in line with the numerous investigations conducted in various Saudi Arabian habitats, such as Abdul Khalik *et al*. (2017) and Farrag (2012) [15], In addition to these, Poaceae and Fabaceae were mentioned as the most prevalent families in their studies by Al-Turki and Al-Qlayan (2003) [8]. While Boraginaceae, Asteraceae, Asclepiadaceae, and Chenopodiaceae represented three species, in addition to 12 families represented by only one species, These results are consistent with many previous investigations conducted in several desert reserves in Saudi Arabia (Osman *et al*., 2019; Al-Sherif *et al*., 2013) [16, 6], It also contradicted the study of Alghamdi *et al*. (2018) [2] in Jabal Salma, in the eastern part of the Hail region, n which Asteraceae was the most prevalent, They demonstrated that the family Asteraceae was the most dominant family, followed by Brassicaceae, Fabaceae, Boraginaceae, Caryophyllaceae, and Poaceae.

In regard to life span, the plurality of the registered species in this research was annual and perennial herbs (26.7%) of the total recorded species. Those outcomes were in conformity with Al-Rowaily *et al*. (2012) [5], who mentioned that the main components of vegetation type in Saudi Arabia were annual plants.

The registered species were divided into monoregional, biregional, or pluriregional groups based on their phytogeographic distribution. 18 species, or 49.12% of the total number of species listed, were monoregional of different affinities. Sudano region was the highest monoregional phytochorium (9 species), Biregional geoelements were represented by 19 species forming 33.33% of recorded species and the highest biregional phytochorion was Saharo Arabian- Zambezian region. The whole pluriregional geoelements were represented by 10 species (17.54%), and the highest pluriregional phytochoron was Mediterranean-Iranian-Saharo, These results are in agreement with many studies such as (Al-Qahtani, 2020) [4], which indicated that Monoregional is higher compared to other plant regions. As well as a study (Al-Yasi *et al*., 2009) in the Sarawat Mountains, where they noted the dominance of single species with a geographical distribution over the rest of the regions by 45.6%. This indicates that the vegetative covering in the Kingdom of Saudi Arabia is a mixture of different plant species from Africa and the Arabian Desert, and that the study area collects many plants from different geographical regions of the neighboring regions. And this indicates that the vegetative covering in the Kingdom of Saudi Arabia is a mixture of different types of plants from Africa and the Arabian Desert, and that the study area collects many plants from different geographical regions of the neighboring regions.

Conclusion

The number of species that have been counted in different locations of Majameà Al-Hadb Reserve is relatively small, but the plant diversity of the species is large, due to the lack of rainfall and the high temperature in the reserve, as well as the presence of sites where grazing is possible. The reserve needs more care to preserve its biodiversity and to conduct more studies in different months of the year to determine the extent of its plant diversity**.**

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