

RESEARCH ARTICLE

Hussien M. AlWadie

PLANT COMMUNITIES IN WADI AYAA SOUTHWESTERN SAUDI ARABIA

ABSTRACT

Wadi Ayaa occurs between latitudes 18° 57' 24, 2" North and longitudes 42° 31' 16, 3" East with elevation 2100 - 1750 m (ASL). It lies in the upper part of the Eastern slopping of Bellesmer Mountains in the Southwestern region of Saudi Arabia. It extends 50 km from Bahwan center in the South to Wadi Bisha in the North. Underground water stream of small, shallow river almost run all the year in the middle of the valley, which represents the most critical factor that determine the type of plant communities. This is the first study, so far, to monitor the plant species composition and the vegetation cover of different communities occurring in Wadi Ayaa. A maximum 53 plant species belonging to 24 families were collected and identified to distribute among six plant communities dominated by *Acacia* ssp., *Zizyphus spina-Christi*, *Conyza incana*, *Tamarix nilotica*, *Argemone ochroleuca*, and *Calotropus procera*. These six plant communities are showing to cover three distinct types of vegetation sectors: ayaa plateau, slope and valley according to altitude, habitat factors and moisture availability.

Key words:

Plant communities, Wadi Ayaa, Saudi Arabia

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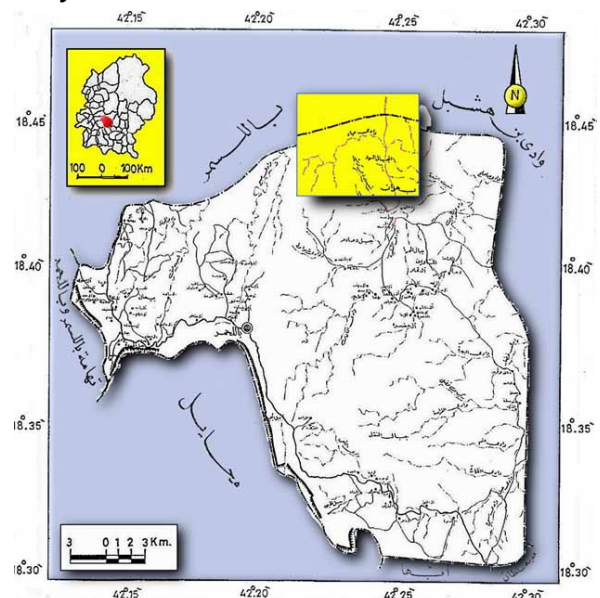
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INTRODUCTION

The natural geographic position of the Southwestern region of Saudi Arabia is very distinctive region, as it has a specific floristic composition differ from that of the North of Arabian Peninsula. Numerous studies had been carried out on the vegetation of the South of Arabian Peninsula in different habitats including Vesey-Fitz Gerald (1955), Brown *et al.* (1962), Migahid & El-Sheikh (1977), Migahid (1978 & 1996), Abulfatth (1979), Batanouny & Baeshin (1983), Batanouny (1987), Zahran (1983), Baierl *et al.* (1985), Boulos (1985), Fayed & Zayed (1989), Fayed *et al.* (1987), El-Karemy & Zayed (1992), Heneidy & Bidak (2001), and Zareh (2003). These studies indicated that the altitude and water resources seem to be the most critical ecological factors in determining the type and richness of vegetation.

The aim of the current research is to study the different types of plant communities and some environmental conditions which controlling their distribution. Beside, this study may consider the first monitoring of vegetation cover of this version area.

Study area



The Aseer Mountain chain is the highest land in the Arabian Peninsula, which tilts from west to east. East of the mountains the land slopes gradually to the Arabian Gulf. The mountains are composed mainly of sedimentary rocks (limestones, sandstones and shales) of Jurassic, Cretaceous and lower Tertiary periods. These overlie a basement complex of Pre-Cambrian granites igneous rocks (Miller, 1994).

Geographically, the Aseer region is situated on a high plateau that receives more rainfall than the rest of the country and contains the country's highest peaks, which rise up to about 3,000 meters at Jabeles Alsawda near Abha. Wadi Ayaa lies in the upper part of the eastern slopping of Bellesmer Mountains, its boarder as the following: Wadi Bisha lies in the northern part of Wadi Ayaa, while Bahwan center in the south, from the east El-Hema and El-Batna village and El-Mashraqa Mountain from the west of Wadi Ayaa.

Climate:

The natural conditions and geographical position of the southwestern region of Saudi Arabia make it a very distinctive region, as it occupies a key position as a bridge between south and north of Arabian Peninsula. The climate of the study area changes drastically from hot dry in low lands to rainy cold in high mountains. The available climatic data were collected from Abha station (Lat.18° 14' N Long.42° 39' E, elevation: 2093.96 m asl).

Winters, from December to February, are cool, and frost and snow may occur in the southern highlands. Average mean maximum temperatures for the coolest months, December and January, are reached to 21.1°C and 19.8°C, respectively, while the mean minimum temperatures ranged from 7.5°C in December and 7.9°C in January (Figure 1). Summers, from June to August, are hot, with day time temperatures in the shade didn't exceed 32°C. The mean maximum temperature ranged from 31.1°C in June and 30.7°C in august, while mean minimum temperature ranged from 16.7°C to 16.8°C, respectively. The high percentage of relative humidity is recorded in December to February at the maximum in January (70%). In the summer, relative humidity reached 37% in June and rose to 51% in August (Figure 2).

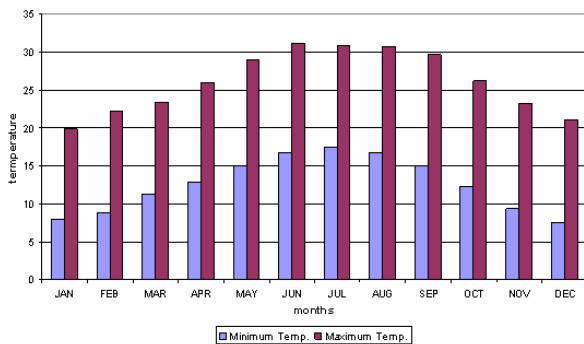


Fig. 1. Monthly mean minimum and maximum temperature in the study area (average of 10 years: 1997-2006).

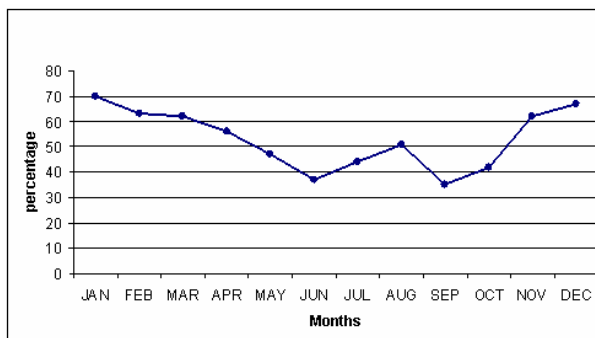


Fig. 2. Mean relative humidity of the studied area

Precipitation is also low throughout the study area (Figures 3 & 4). In high lands of Aseer more than 500 mm/year may be received falling mostly between March and August when the summer monsoon winds prevail. The mean annual precipitation decreased to reach less than 200 mm in the last year 2007, however, March-April and August considered the two main rainy seasons in Aseer.

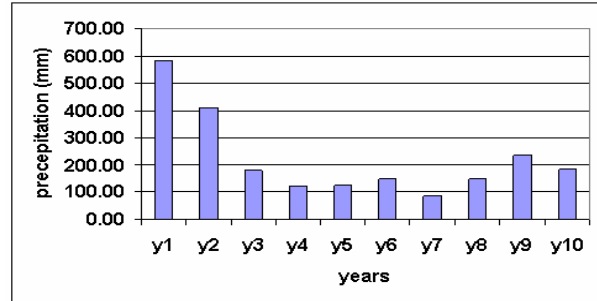


Fig.3. Mean annual rainfall (mm) in last ten years in the studied area

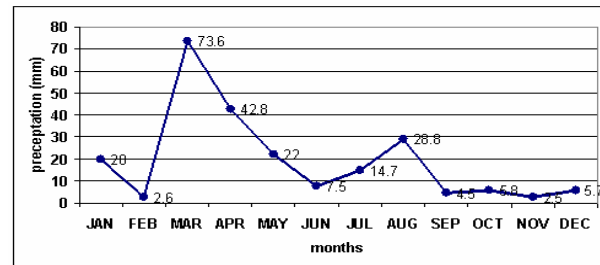


Fig. 4. Average monthly rainfall of last ten years in the studied area

MATERIALS AND METHODS

The current study was carried out along the different seasons during the period from month 2006 and month 2007. According to the considerable variations in plant cover, more than thirty stands were chosen. These stands represent more than 50% of the total area of Wadi Ayaa. In each stand list of species and their life form were recorded. The studied species were rated according to Braun-Blanquet (1964). The combined abundance- dominance scales and sociability are recorded.

Plant species material were collected from their natural habitats of the different locations in Wadi Ayaa and compared with the herbarium specimens at the Biology Department, Faculty of Science, King Khalid University, Abha, Saudi Arabia. Identification and nomenclature of plant species was based on the previous studies on the flora of Saudi Arabia (Migahid, 1978; Mandaville, 1990; Abulfatih, 1991; Collenette, 1999). Data on the distribution of the plant in Saudi Arabia were obtained from Migahid (1996).

Results

Fifty three species belonging to twenty four angiospermic families are recorded in Wadi Ayaa. The different types of plant communities in the study area reflect the variation in environmental conditions such as habitat, altitudinal factors and moisture availability. Therefore, six plant communities are identified and arranged according to their dominant species along the elevation of Wadi Ayaa from North to South (Table 1).

Table 1. Florestic composition of six communities identified in Wadi Ayaa.

Species	Per/ Ann	Community												
		I		II		III		IV		V		VI		
		P (%)	AD	P (%)	AD	P (%)	AD	P (%)	AD	P (%)	AD	P (%)	AD	
Amaranthaceae														
<i>Aerva javanica</i> (Burn.f.) Juss.ex Schult.	Per.			33	1	33	1.1							
Asclepiadaceae														
<i>Calotropus procera</i> (Aiton) W.T.Aiton	Per.					73	1.1						100	3
<i>Kanahia laniflora</i> (Forssk.) R.Br.	Per.									16	+			
<i>Sarcostemma vanlessenii</i> Lavr.	Per.					73	1.1							
<i>Leptadenia pyrotechnica</i> (Forssk.) Decne.	Per.			16	+									
<i>Crenulluma petraea</i> (Lavr.) Plowes	Per.					33	+1							
Caryophyllaceae														
<i>Paronychia argentea</i> Lam.	Per.					33	+1	45	1					
<i>Sphaerocoma aucheri</i> Boiss.	Per.					33	+1	33	1					
<i>Arenaria deflexa</i> Decne.	Per.					33	+1	33	1					
Chenopodiaceae														
<i>Chenopodium glaucum</i> L.	Ann.					33	1.1							
<i>Salsola spinescens</i> Moq.	Per.					33	+1							
Compositae														
<i>Francoeuria crispa</i> (Forssk.) Cass.	Per.							33	1					
<i>Pulicaria jaubertii</i> Gamal-Eldin	Ann.							33	1					
<i>P. crispa</i> (Forssk.) Oliv.	Per.							45	1				16	+
<i>Vernonia shmperi</i> Sch.- Bip.	Per.							33	+1					
<i>Xanthium c.f. pungens</i> Wallr.	Ann.					33	+1						-	+
<i>Conyza incana</i> Willd.	Pre.					100	2							
Cruciferae														
<i>Erysimum repandum</i> L.	Ann.							33	+1					
<i>Sisymbrium irio</i> L.	Per.					33	+1	33	+1					
Cucurbitaceae														
<i>Citrullus colocynthis</i> (L.) Schrad.	Per.			33	+1									
<i>Coccinea grandis</i> (L.) Voigt	Per.							33	1					
Euphorbiaceae														
<i>Ricinus communis</i> L.	Per.					83	1.2							
Fabaceae														
<i>Acacia asak</i> (Forssk.) Willd	Pre.	100	1.1											
<i>A. seyal</i> Delile	Pre.	100	1.1											
<i>A. tortilis</i> (Forssk.) Hayne	Per.	100	1.1	83	1									
<i>Indigofera spinosa</i> Forssk.	Pre.	16	+											
Gramineae														
<i>Aegilopus peregrine</i> (Hack.) Maire & Weiller	Ann.					-	+							
<i>Poa annua</i> L.	Ann.					-	+	-	+	-	+			
<i>Cynodon dactylon</i> (L.) Pers.	Pre.					66	1.1	66	1.1	16	+1			
Labiatae														
<i>Lavandula citriodora</i> A.G. Mill.	Per.					33	+1							
<i>L. pubescens</i> Decne.	Per.					33	+1							
<i>Mentha longifolia</i> (L.) Huds.	Pre.					66	1.1	66	2					
ssp. <i>Schimperi</i> (Briq.) Briq.	Pre.					66	1.1	66	2					
<i>Teucrium pilosum</i> (Decne) Asch. & Schweif.	Per.					33	+1	16	+					
Moraceae														
<i>Ficus glumosa</i> Delile	Per.							33	+1	33	1			
Nyctaginaceae														
<i>Commicarpus grandiflorus</i> (A. Rich.) Standl.	Per.							66	2.1					
<i>C. plumbagineus</i> (Cav.) Standl.	Per.							66	2					
Palmae														
<i>Phoenix caespitosa</i> L.	Per.	66	+1											
Papaveraceae														
<i>Argemon ochroleuca</i> Sweet	Ann.			16	+					100	3	33	1.2	
Rhamnaceae														
<i>Zizyphus spina-christi</i> (L.) Desf.	Per.	33	+1	100	1.1					73	1.2			
Rubiaceae														
<i>Pentas lanceolata</i> (Forssk.) K. Schum.	Per.							33	+1					
Salvadoraceae														
<i>Salvadora persica</i> L.	Per.									16	+			
Scrophulariaceae														
<i>Bacopa monnieri</i> (L.) Pennell	Per.					16	+							
<i>Veronica anagallias-aquatica</i> L.	Per.					-	+							
ssp. <i>michauxii</i> (Lam.) A. Jelen	Per.					-	+							
Solanaceae														
<i>Datura fastuosa</i> L.	Ann.							33	1					
<i>D. stramonium</i> L.	Ann.							33	1				16	+
<i>Lycium shawii</i> Roem. & Schultes	Per.	36	+1											
<i>Solanum incanum</i> L.	Per.					46	1.1							
<i>S. nigrum</i> L.	Ann.					16	+							
<i>Withania somnifera</i> (L.) Dunal	Per.					16	+							
Tamaricaceae														
<i>Tamarix nilotica</i> (Ehrenb.) Bunge	Per.					46	1.1	100	3	33	1	33	2	
Typhaceae														
<i>Typha elephantina</i> Roxb.	Per.							66	2					
Urticaceae														
<i>Forsskaolea tenacissima</i> L.	Ann.					83	1.2							
Zygophyllaceae														
<i>Fagonia schweinfurthia</i> Hadidi	Ann.	16	+											

In these tables we consider the nation P = presence value in %; AD = combined abundance – dominance scale of six grades (+ to 5), + = Associate species which of negligible AD values.

I- *Acacia asak*, *A. seyal* and *A. tortilis* community

This community occurs on a rocky hillside at the entrance of Wadi Ayaa at about 1700 m asl. The

plant cover percentage is about 25% on fine-textured sandy soil.

II- *Zizyphus spina-cristi* var. *inermis* community

This community is widely spread on wide hard sandy soil among low rocky hills, at an altitude between 1800-1700 m ASL. This community is co-

dominated by *Acacia tortilis*. The plant cover percentage is about 35%.

III- *Conyza incana* community

This community is widely spread on moist sandy soil among rocks near the water-stream in the Wadi at altitude of about 1850 m ASL. This community is co-dominated by *Ricinus communis* and *Forsskaolea tenacissima*. The soil is relatively compact, deep and with fine texture. The plant cover percentage is about 60%.

IV- *Tamarix nilotica* community

This species may form pure stands in Wadi Ayaa gravely beds. The soil supporting this community is coarse-texture with barren conglomerates and boulders covering the ground surface and may form a pure community. This community occurs at an altitude of 1900 m ASL. The plant cover is about 30%.

V- *Argemon ochroleuca* community

This community abounds at the valley on moist hard sand around water stream of the small river. The altitude is about 1950m ASL. The soil is moist and of deep alluvial deposition. The plant cover percentage is about 10 %.

VI- *Calotropis procera* community

This community occurs on sandy soils among gravelly rocky ridges at an altitude between 2100-2000 m ASL in gravelly-rocky ridges. The plant cover percentage is about 5%.

DISCUSSION

The different types of communities in Wadi Ayaa are governed mainly by altitude, habitat factors and moisture availability. The present study provides an overview of species abundance and dominance in different land forms. Moustafa (1990) in St. Catherin (Sinai Peninsula area) found that the organization of community types or associations is the net result of the behavior of species in response to environmental conditions. Ayaad *et al.* (2000) in Sinai Peninsula recorded that the extent of species replacement or biotic change between different land forms reveals that the high values between habitats may reflect rapid and ecologically significant change and may also reflect the large extent of biotic change of different habitats.

The study area comprises three main types of vegetation sectors according to the altitude and variation in environmental conditions, particularly those of land forms, and water resources. These sectors can be distinguished as follows:-

1- Ayaa plateau (1700-1800 asl).

Ayaa dry plateau is situated at the entrance of Wadi at an altitude of about 1700 m asl on fine-textured sandy soil. The water resource in this area depends on the drainage system of the high land and moderate water supply from rainfall. The plant cover is around 15 %. This area is distinct by desert vegetation and almost represented by communities (I&II) dominated and co-dominanted by *Acacia asak*, *A. seyal*, *A. tortilis*, *Phoenix caespitosa*, *Lycium shawii*, *Zizyphus spina-christi*, *Indigofera spinosa*, *Fagonia schweinfurthia*, and *Calotropis procera*.

2- Valley (1800-1900 asl).

This area is situated around the water stream of small, shallow river in the middle area of the Wadi between mountains. It depends for its water resources on water stream, water drainage and rainfall. The plant cover is 30-60 % mainly due to moderate temperature, high humus content in the moist sandy soil of deep alluvial deposition and abundant water resources. Due to the high humidity, the vegetation is very rich (perennials and ephemerals) at the bordered of the water stream and almost represented by communities (V&VI) dominated and co-dominated by *Argemon ochroleuca*, *Forsskaolea tenacissima*, *Erysimum repandum*, *Xanthium pungens*, *Datura stramonium*, *Pulicaria jaubertii*, *Aegilopus peregrine*, *Forsskaolea tenacissima*, *Cynodon dactylon*, *Erysimum repandum*, *Conyza incana*, *Sisymbrium irio*, *Pulicaria crispa*, *Commicarpus grandiflorus*, *C. plumbagineus*, *Aerva javanica*, *Leptadenia pyrotechnica* and *Mentha longifolia*,

3- Slope (1900-2800 asl).

This area is characterized by its rugged rocky soil with moderate climatic conditions. The elevation range is in between 2800 m asl at the summit of the mountain to 1900 m asl the area of water stream level. In this area the plant cover is around 10 % due to the high slope. The water resources depend on the drainage system of High Mountain and moderate water supply from rainfall. The slope is almost represented by communities (III&IV) dominated and co-dominated by *Tamarix nilotica*, *Lavandula citriodora*, *L. pubescens*, *Pentas lanceolata*, *Phoenix caespitosa*, *Xanthium pungens*, *Ficus glumosa* and *Salvadora persica*.

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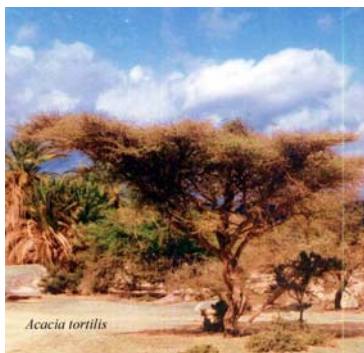
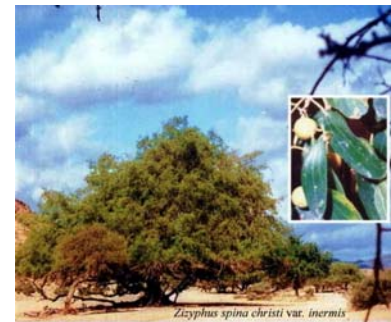
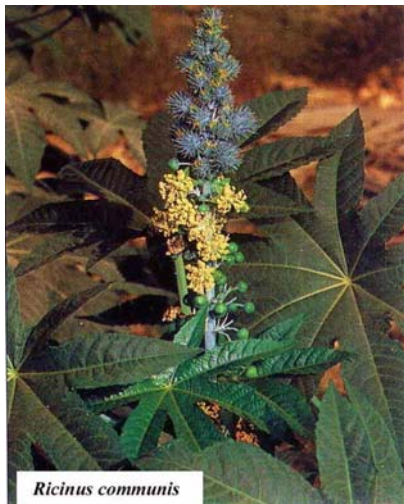


Plate1: Selected species in Wadi Ayaa vegetations

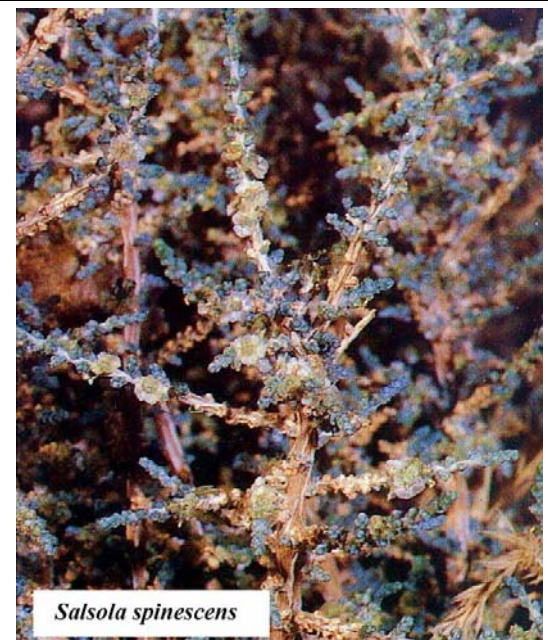
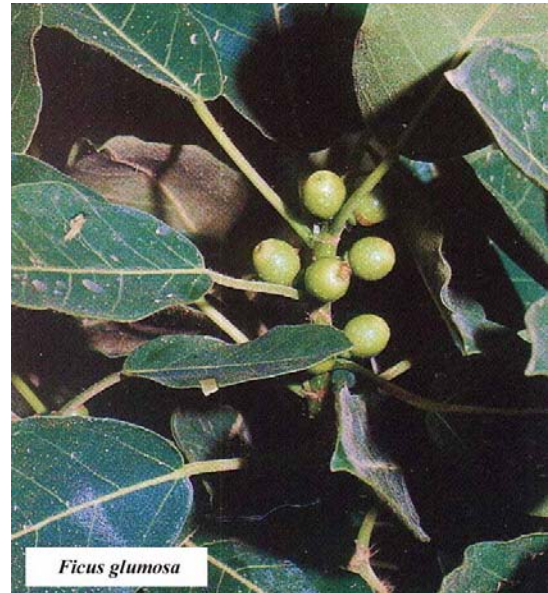


Plate 2: Selected species in Wadi Ayaa vegetations



Plate 3: Selected species in Wadi Ayaa vegetations

دراسة الغطاء النباتي وفلورا وادي عياء جنوب غرب المملكة العربية السعودية

حسين بن مانع الوداعي

قسم علوم الحياة- كلية العلوم- جامعة الملك خالد

أبها- المملكة العربية السعودية

وقد خلصت الدراسة إلى أن الارتفاع عن سطح البحر وكمية المياه المتاحة ونوع التربة من أهم العوامل التي تلعب دوراً أساسياً في تحديد أنواع العشائر النباتية وتوزيعها وهذا يؤكد الدراسات السابقة التي تمت في المنطقة الجنوبية. كما تم تحديد ثلاثة قطاعات من الغطاء النباتي في هذا الوادي تبعا للارتفاع عن سطح البحر وهي :

1- Ayaa plateau (1700-1800 asl)

2- Valley (1800-1900 asl)

3- Slope (1900-2800 asl)

يقع وادي عياء على على خط طول "24,2' 57° 18 وخط عرض "16,3' 31° 42 ويمتد حوالي 50 كم من بهوان في الجنوب حتى وادي بيثا في الشمال وارتفاع 1750 - 2100 m عن سطح البحر، ويتخلل الوادي مجرى مائي ضيق وضحل ينبع من مياه جوفية. وتعتبر هذه الدراسة هي الأولى لهذه المنطقة.

تم تسجيل 53 نوع نباتي ينتموا إلى 24 عائلة منتشرين في 6 عشائر نباتية وهي:

Acacia ssp., Zizyphus spina-Christi, Conyza incana
Tamarix nilotica, Argemone ochroleuca, and Calotropus
procera

المحكمون: أ.د. كمال حسين شلتوت قسم النبات - علوم طنطا
أ.د. مجدي محمد مراد قسم النبات - علوم عين شمس