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Floristic study and plant diversity of Wadi Abo Alakmal basin west Tobruk city in North-eastern Libya

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دراسة التنوع النباتي والفلورا لحوض وادي أبو القمل غرب مدينة طبرق ـ شمال شرق ليبيا.

أ. عمر عبد الله فركاش أرواق
قسم الأحياء، كلية التربية، جامعة طبرق، طبرق، ليبيا.

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Abstract

This work was conducted along Wadi Abo Alakmal in north Libya on the Mediterranean coastal region. The aim of the present study is to assess the floristic composition and plant diversity of the Wadi Abo Alakmal basin. The floristic studies carried out in the vegetation season from 2022 to 2024 led to the identification of 85 plant taxa belonging to 66 genera and 27 botanical families. The predominant families are Asteraceae with 14 species (16.47%), followed by Fabaceae 12 species (14.11%) and Amaranthaceae 9 species (10.58%). Furthermore, the most dominant genera were Limonium with 4 species (4.71%) of the recorded species, followed by Euphorbia and Lathyrus 3 species (3.52%) each. Two endemic taxa (Echinops cyreaicus E. A. and Limonium cyrenaicum (Rouy) Brullo) and one near-endemic taxa (Limonium tubiflorum (Delile) Kuntze) have been collected in the present research. Data of the present study revealed that perennials had the highest contribution (49.41%) than annuals (47.05%). In addition, the most frequent life span class was herbs 45 species (52.94%), followed by shrubs 30 species (35.29%) and sub-shrubs 10 species (11.76%). Regarding the life forms spectra, Therophytes had the highest records with 39 species (45.88%), followed by Chamaephytes with 24 species (28.23%) and Phanerophytes with 12 species (14.11%). Furthermore, Chorotype spectrum analysis of the recorded flora has shown that dominance of the Monoregional (55.29%) of the total flora, followed by the Biregional (35.29%) and finally Pluriregional (9.41%). In conclusion, this research shows that even small portion of the Mediterranean cost such as Wadi Abo Alakmal has high species diversity. In addition, this study provide data on floristic diversity for effective implementation of conservation approaches in study area.

Keywords: Chorotype, Flora, Plant diversity, Wadi Abo Alakmal, Tobruk-Libya.

الملخص

أجريت هذه الدراسة في وادي أبو القمل شمال ليبيا في منطقة ساحل البحر الأبيض المتوسط. تهدف الدراسة إلى تقييم التركيب الزهري والتنوع النباتي في حوض وادي أبو القمل. أدت الدراسة التي أجريت في موسم النمو من 2022 إلى 2024 إلى تصنيف 85 نوعاً نباتياً تنتمي إلى 66 جنس نباتي و 27 عائلة نباتية. وقد أظهرت النتائج أن أكثر العائلات النباتية سيادة هي العائلة المركبة متمثلة بعدد 14 نوع (16.47%) تليها العائلة البقولية حيث احتوت 12 نوع (14.11%) والعائلة القُطيفية تضمنت 9 أنواع (10.58%). بالإضافة إلى ذلك، قد أظهرت نتائج الدراسة بأن أكبر الأجناس هي Limonium حيث احتوى على 4 أنواع نباتية (4.71%) تليه Euphorbia and Lathyrus حيث احتو كل جنس على 3 أنواع نباتية (3.52%). علاوة على ذلك، تم جمع وتعريف 2 أنواع نباتية متوطنة في ليبيا (Echinops cyreaicus E. A. and Limonium cyrenaicum (Rouy) Brullo) ونوع نباتي واحد شبه متوطن (Limonium tubiflorum (Delile) Kuntze). وأظهرت النتائج أن حوالي 52.94% من النباتات التي تم حصرها هي نباتات معمرة والنباتات الحولية مثلت بنسبة (47.05%). بالإضافة إلى ذلك، وجد أن السيادة للنباتات العشبية 45 نوع (52.94%) تليها الشجيرات 30 نوع (35.29%) ثم

النباتات تحت شجيرة 10 أنواع (11.76%). وأظهرت نتائج تحليل أشكال النمو (صور الحياة) السيادة للنباتات الحولية 39 نوع (45.88%) تليها النباتات القصيرة المعمرة 24نوع (28.23%) ومن ثم النباتات الطويلة المعمرة 12 نوع (14.11%). وبينت نتائج تحليل المنطقة الجغرافية النباتية أن أكثر النباتات سيادة هي أحادية المنطقة الجغرافية (55.29%) تليها النباتات ثنائية المنطقة (35.29%) وأخيراً النباتات ثلاثية المناطق (9.41%) أقل تواجداً. وقد خلصت هذه الدراسة إلى أن حتى جزء صغير من ساحل البحر الأبيض المتوسط مثل وادي أبو القمل يتميز بتنوع نباتي كبير. كما تُوفر هذه الدراسة معلومات حول التنوع النباتي مما يُساهم في تطبيق مناهج الحفظ بفاعلية في منطقة الدراسة لتحقيق التنمية المستدامة للغطاء النباتي الطبيعي.
الكلمات الدالة: التنوع النباتي، المنطقة الجغرافية، الفلورا، وادي أبو القمل، طبرق - ليبيا.

1. Introduction

Libya occupies an area of about 1,759,540 km^2, approximately 94.72% of its land is desert and 5.28% is the Mediterranean coastal strip from the Tunisian to The Egyptian borders (El-Darier & El-Mogaspi, 2009; Boulos, 1972). Although 94.72% of the total area of Libya is desert, the Libyan flora is diverse. Previous studies identified approximately 2118 plant species belonging to 864 genera and 161 botanical families, of which 2088 species, 844 genera and 145 families are Angiosperms, 15 species belonging to 8 genera and 6 families are Gymnosperms and 15 species belonging to 12 genera and 10 families are Pteridophyta (Ali & Jafri 1977; Jafri & El-Gadi 1977-1986; Klopper et al, 2007; Mahklouf & Etayeb, 2018; Feng et al, 2013). The most important comprehensive floristic studies in Libya were conducted by Pampanini Renato published two volumes of the Flora of Libya, the first volume "Plantae Tripolitanae" (Pampanini, 1914) and the second volume "Prodromo della Flora Cirenaica" (Pampanini, 1931). (Maugini, 1931) studied the pastures of Cyrenaica and classified 35 families of flowering plants according to the palatability by grazing animals. In addition, (Maire & Weiller, 1939) studied the vegetation in Cyrenaica. (Corti, 1942) published "Flora e Vegetazione del Fazzan e della Regione di Gat" made rich collections about 1081 species of flowering plants. (Keith, 1965) published "A preliminary check list of Flora of Libya". (Faruqi, 1980) studied the Libyan grasses, collected about 230 species and described a new generic record for Libya. Moreover, (Jafri & El-Gadi 1977-1986; El-Gadi 1988-1990; Qaiser & El-Gadi 1984) published the encyclopedia of the Flora of Libya describing 152 families in 152 books. Despite these studies, the floristic composition of plants in Libya is still poorly known, long out of date and an open field of research (Valderrabano et al, 2018; Gawhari et al, 2018; Saaed et al, 2019). Therefore, the objectives of the present study are to surveying and identification of wild plant species in the northern eastern part of Libya along Wadi Abo Alakmal.

2. Materials and methods

2.1. Study area

This work was carried out in the Wadi Abo Alakmal basin, located on the Mediterranean coast of Libya in the west of Tobruk city. The area lies between Longitude 23°. 50. - 23°. 45. E and Latitude between 32°. 08. - 32°. 02. N. Location of study area is shown in Figure 1. The Sahara Desert and the Mediterranean climate are dominated in Wadi Abo Alakmal, characterized by dry summers (June – October) and relatively wet winters (November – May). The average temperature is ranging from 21 to 43 C° in summer and from 10 to 23 C° in winter. The annual rainfall ranges from 110 mm to 135 mm. Humidity rises in summer, reaching 90%.

Figure 1: Location map of the study area (by the author).

2.2. Data Collection

In this botanical survey over Forty field trips were conducted seasonally to the study area from 2022 to 2024, collections included all wild flora plant species. Specimens were identified based on the Flora of Libya by (Boulos 1972; Boulos 1975, 1977, 1979a, 1979b; Ali & Jafri 1977; Jafri & El-Gadi 1977-1986; El-Gadi 1988-1990; Qaiser & El-Gadi 1984) and the Flora of Egypt (Boulos 1999, 2000, 2002, 2005). Furthermore, plant-life forms were categorized based on Raunkiaer's biological spectrum (Raunkiare, 1934). In addition, the website Kew Royal Botanic Gardens was used to confirm the scientific name and the related family.

3. Results and discussion

3.1. Floristic analysis

The floral diversity of Wadi Abo Alakmal is rich. The checklist of plant species from this study area includes 85 species belonging to 66 genera and 27 families is presented in Table 1 apathetically. Moreover, the majority of these families were classified as Angiospermae plant species. Furthermore, it was determined that, 24 families, 62 genera and 81 species belonged to Dicotyledons while 3 families, 4 genera and 4 species belonged to Monocotyledons as shown in Figure 2.

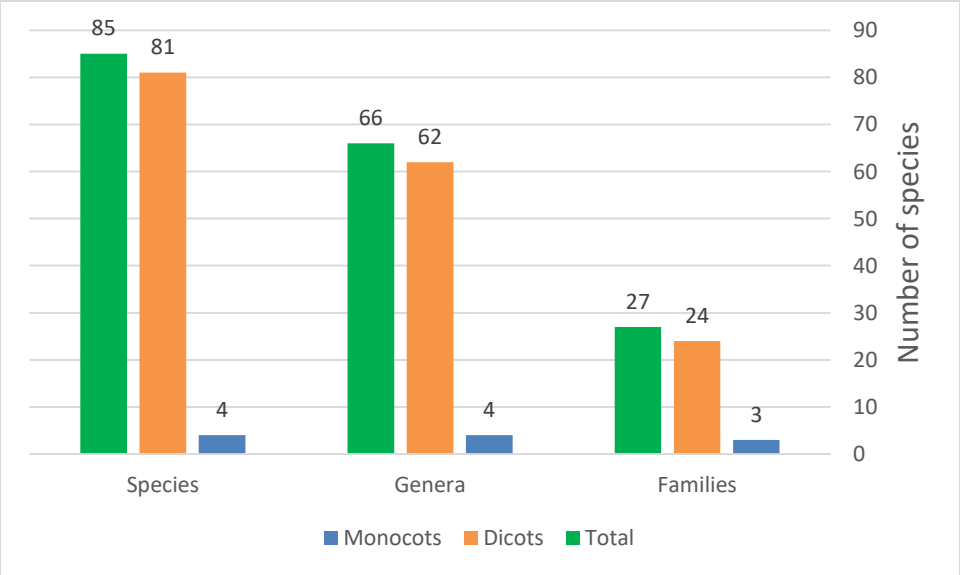

Figure 2: The histogram of the families, genera and species number based on class Dicotyledonous and Monocotyledonous in Wadi Abo Alakmal.

The Asteraceae family was the most prominent in terms of the number of species and represented 16.47% of the plant identified (14 species), followed by the Fabaceae (14.11%, 12 species), and Amaranthaceae (10.58%, 9 species). These three families along represented more than a third (41.17%) of the flora inventoried in the study area, followed by Plumbaginaceae, Euphorbiaceae and Brassicaceae as shown in Figure 3.

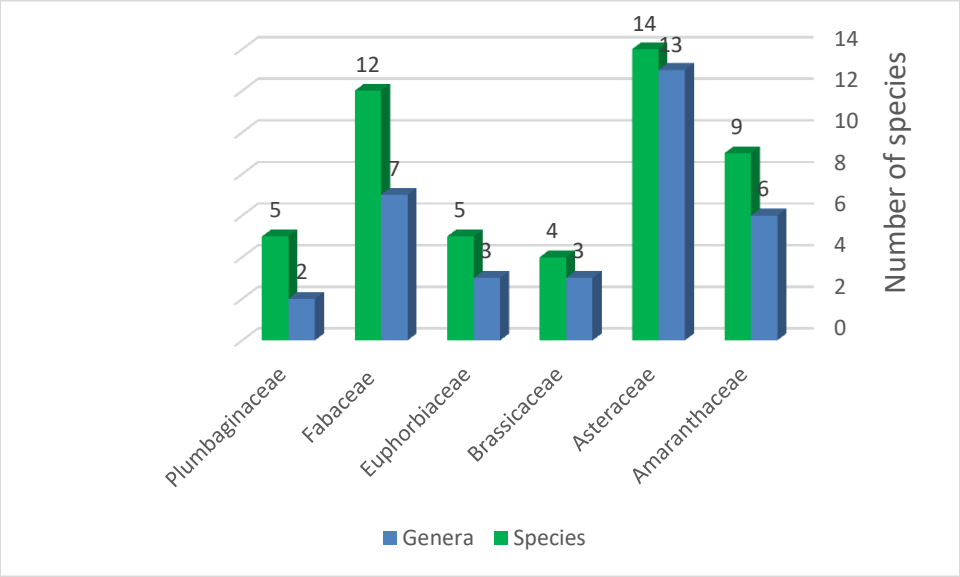

Figure 3: The richest 6 families according to the number of species and genera in the study area.

The dominance of these families is due to their high compatibility with Mediterranean climate condition (Mahklouf & Al-Sghair, 2016; Sherif et al, 2002). Similarly, (Abusaief, 2013) reported the predominance of the family Asteraceae in Jarajar oma with 28 species, it was also the largest family in Wadi Alkuf, represented by 50 species (El-Mokasabi, 2024), it was the most prominent family in Al-Jabal Al-Akhdar with 16 species (Mohamed et al, 2021), dominated in Wadi Kaam with 30 species (Almushghub et al, 2022) and in Al-Dafna plateau with 31 species (Arwag, 2022), as well as in Msallata – Garaboulli Province Asteraceae dominated by the present of 78 species (Mahklouf et al, 2020), and in Farwa Isaland by 16 species (Mahklouf et al, 2023). In general, Asteraceae has been documented as the most predominance family in Libyan flora with 240 species (Al-Sghair & Mahklouf 2017; Feng et al, 2013; Keith, 1965). Whereas, the rest of the families are represented by 5 species or less.

According to the number of species in each genus in the study area, the most represented genera are Limonium represented by 4 species (4.71%) of the total taxa, followed by Euphorbia has 3 species (3.52%) and Lathyrus has 3 species (3.52%) as well, the rest of genera are represented by 2 or 1 species each as presented in Table 2.

Endemism: my survey of Wadi Abo Alakmal identified several plants of special interest. Notably, a number of 2 recorded species are considered as endemic to Libya such as Echinops cyreaicus E. A. and Limonium cyrenaicum (Rouy) Brullo, representing 2.66% of total endemic plant in Libya, which is fairly low in comparison of total number of endemic taxa 81 species (Mahklouf & Etayeb, 2018; El-Darier & El-Mogaspi, 2009). While, only one near-endemic taxa was recorded in this research namely; Limonium tubiflorum (Delile) Kuntze, representing 8.33% of total near-endemic taxa in Libya which is 12 species, representing 0.6% of Libyan flora (Saaed et al, 2019). In comparison, (Shaltont et al, 2018) reported 19 near-endemic taxa in Egypt and Libya. Although, the study area is near Egypt only one near-endemic species was recorded in this study. Moreover, one endemic taxa to North Africa was recorded in this research namely; Anacyclus monanthos (L.) Thell. Interestingly, these endemic species are in imminent danger of genetic erosion because of overgrazing, urban expansion, woodcutting and global climate change. These factors may generally push the endemic species to extinction. Since, these factors are contributing in the habitat loss and degradation. Therefore, the preservation of these endemic species is required by using biotechnological approaches (Coelho et al, 2020).

	Family	Species	Genus	L. D.	Chorotype	L. F.	L. S.
1.	Amaranthaceae	Atriplex halimus L.	Atriplex	P	Med / SA-Ar	Ph	Sh
2.		Atriplex mollis Desf.	Atriplex	P	Sa -Ar	Ph	Sh
3.		Caroxylon imbricatum (Forssk.) Moq.	Caroxylon	P	Ir-Tu / Sa-Ar	Ph	Sh
4.		Caroxylon tetragonum (Delile) Moq.	Caroxylon	P	Sa - Ar	Ph	Sh
5.		Haloxylon scoparium Pomel	Haloxylon	P	Ir-Tu / Sa-Ar	Ch	Sh
6.		Noaea mucronate (Forssk.)	Noaea	P	Ir-Tu / Sa-Ar	Ch	Sh
7.		Salicornia fruticose (L.)	Salicornia	P	Med / Sa-Ar	Ph	Sh
8.		Suaeda vera Forssk. Ex J. F. Gmel	Suaeda	P	Med / Sa-Ar	Ch	Sh
9.		Suaeda vermiculata Forssk.	Suaeda	P	Ir-Tu / Sa-Ar	Ch	Sh
10.	Amaryllidaceae	Allium roseum L.	Allium	P	Med / Sa-Ar	G	H
11.	Apiaceae	Deverra tortuosa (Desf.) DC.	Deverra	P	Sa-Ar	Ch	Sh
12.		Eryngium campestre L.	Eryngium	P	Med / Eu -	H	H

					Si		
13.		Ferula tingitana L.	Ferula	P	Med	H	H
14.	Asphodelaceae	Asphodelus ramosus L.	Asphodelus	P	Med	G	H
15.	Asteraceae	Anacyclus monanthos (L.) Thell.	Anacylus	A	End – Nor, Afr	Th	H
16.		Anacyclus radiatus Loisel.	Anacylus	A	Med	Th	H
17.		Atractylis cancellate L.	Atractylis	A	Med	Th	H
18.		Artemisia herba-alba	Artemisia	P	Med / Sa-Ar	Ch	Sh
19.		Carlina lanata L.	Carlina	A	Med	Th	H
20.		Carthamus glaucus M. Bieb.	Carthamus	A	Med	Th	H
21.		Centaurea alexandrina Delile	Centaurea L.	A	Med	Th	H
22.		Echinops cyreaicus E. A.	Echinops	P	End	H	Sh
23.		Filago desertorum Pomel	Filago	A	Med / Ir-Tu / Sa-Ar	Th	H
24.		Glebionis coronaria	Glebionis	A	Med	Th	H
25.		Hedypnois rhagadioloides (L.) F. W. Schmidt	Hedypnois	A	Med	Th	H
26.		Limbarda crithmoides (L.) Dumort	Limbarda	P	Med	Ch	Sh
27.		Phonus lanatus (L.).	Phonus	A	Med / Sa-	Th	H

		Hill			Ar		
28.		Pseudopodospermum undulatum (Vahl)	Pseudopospermum	A	Sa-Ar	Th	H
29.	Boraginaceae	Echium angustifolium Mill.	Echium	P	Med	Ch	Su-Sh
30.	Brassicaceae	Biscutella didyma L.	Biscutella	A	Med – Ir-Tu	Th	H
31.		Matthiola tricuspidate (L.) R. Br.	Matthiola	A	Med	Th	H
32.		Moricandia arvensis (L.) DC.	Matthiola	Bi or P	Med / Sa-Ar	Ch	Su-Sh
33.		Sinapis alba L.	Sinapis	A	Eu-Si / Med / Ir-Tu	Th	H
34.	Caryophyllaceae	Silene vivianii Steud	Silene	A	Sa-Ar	Th	H
35.	Convolvulaceae	Convolvulus althaeoides L.	Convolvulus	P	Med	H	H
36.		Cressa cretica L.	Cressa	A	Med / Ir-Tu	Th	H
37.	Euphorbiaceae	Euphorbia dendroides L.	Euphorbia	P	Med	Ph	Sh
38.		Euphorbia paralias L.	Euphorbia	P	Med	Ch	Su-Sh
39.		Euphorbia retusa Forssk.	Euphorbia	A or	Sa-Ar	Ch	Sh

				P			
40.		Mercurialis annua L.	Mercurialis	A	Med / Eu - Si	Th	H
41.		Ricinus communis L.	Ricinus	P	Tro-Afr	Ph	Sh
42.	Fabaceae	Astragalus boeticus L.	Astragalus	A	Med	Th	H
43.		Astragalus schimperi Boiss.	Astragalus	A	Sa-Ar	Th	H
44.		Lathyrus aphaca L.	Lathyrus	A	Med / Eu-Si / Ir-Tu	Th	H
45.		Lathyrus gorgoni Parl.	Lathyrus	A	Med	Th	H
46.		Lathyrus setifolius L.	Lathyrus	A	Med	Th	H
47.		Lotus cytisoides L.	Lotus	P	Med	Ch	Su-Sh
48.		Lotus glinoides Delile	Lotus	A	Sa-Ar / Ir-Tu	Th	H
49.		Medicago laciniata (L.) Mill.	Medicago	A	Sa-Ar	Th	H
50.		Medicago truncatula Gaertn.	Medicago	A	Med	Th	H
51.		Onobrychis crista-galli (L.) Lam	Onobrychis	A	Sa-Ar	Th	H
52.		Retama raetam (Forssk)	Retama	P	Sa-Ar	Ph	Sh
53.		Trifolium tomentosum L.	Trifolium	A	Med / Ir-Tu	Th	H
54.	Geraniaceae	Erodium crassifolium	Erodium	P	Sa-Ar	H	Sh

		L'Her					
55.		Erodium laciniatum (Cav.) Willd.	Erodium	A	Med / Ir-Tu	Th	H
56.		Geranium rotundifolium L.	Geranium	A	Med / Eu-Si / Ir-Tu	Th	H
57.	Grassulaceae	Umbilicus intermedius Boiss.	Umbilicus	P	Med / Ir-Tu	G	Sh
58.	Lamiaceae	Ajuga iva (L.) Schreb.	Ajuga	A	Med	Ch	Su-Sh
59.		Marrubium alysson L.	Marrubium	P	Med / Sa-Ar	Ch	Su-Sh
60.		Salvia lanigera Poir.	Salvia	P	Med / Sa-Ar	Ch	Sh
61.	Malvaceae	Malva aegyptia L.	Malva	A	Med / Sa-Ar	Th	H
62.		Malva sylvestris L.	Malva	Bi or P	Med / Eu-Si	H	Sh
63.	Papaveraceae	Papaver dubium L.	Papaver L.	A	Med / Eu-Si / Ir-Tu	Th	H
64.		Papaver hybridum L.	Papaver L.	A	Med / Ir-Tu	Th	H
65.		Fumaria densiflora DC.	Fumaria	A	Med	Th	H
66.	Plantaginaceae	Plantago arenaria Waldst. & Kit.	Plantago	A	Med / Eu-Si / Ir-Tu	Th	H
67.	Plumbaginaceae	Limonium cyrenaicum	Limonium	P	End	Ph	Sh

		(Rouy) Brullo					
68.		Limonium lobatum (L. f.) Chaz.	Limonium	A	Sa-Ar	Th	H
69.		Limonium pruinosum (L.)	Limonium	P	Sa-Ar	Ch	Sh
70.		Limonium tubiflorum (Delile) Kuntze	Limonium	P	Ne-End Ly & Eg	Ch	Su-Sh
71.		Limoniastrum monopetalum (L.) Boiss.	Limoniastrum	P	Med	Ch	Sh
72.	Poaceae	Arundo donax L.	Arundo	P	Med / Ir-Tu	Ph	Sh
73.		Bromus madritensis L.	Bromus L.	A	Med / Ir-Tu	Th	H
74.	Polygonaceae	Emex spinosa (L.) Campd	Rumex	A	Med / Sa-Ar	Th	H
75.		Polygonum equisetiforme Sm.	Polygonum	P	Med / Ir-Tu	Ch	Su-Sh
76.	Primulaceae	Anagallis arvensis L.	Anagallis	A	Med / Eu-Si / Ir-Tu	Th	H
77.	Rosaceae	Sanguisorba minor Scop.	Sanguisorba	P	Med / Eu-Si / Ir-Tu	H	H
78.		Sarcopoterium spinosum (L.) Spach	Sarcopoterium	P	Med	Ch	Sh
79.	Rubiaceae	Galium setaceum Lam.	Galium	A	Med + Ir-Tu	Th	H

80.	Solanaceae	Lycium europaeum L.	Lycium	P	Med	Ph	Sh
81.	Tamaricaceae	Reaumuria hirtella Jaub. & Spach	Reaumuria	P	Sa-Ar	Ch	Sh
82.		Reaumuria vermiculata L.	Reaumuria	P	Sa-Ar	Ch	Sh
83.	Thymelaeaceae	Thymelaea hirsuta (L.) Endl.	Thymelaea	P	Med + Sa-Ar	Ph	Sh
84.	Zygophyllaceae	Fagonia arabica L.	Fagonia L.	P	Sa-Ar	Ch	Su-Sh
85.		Zygophyllum scabrum (Forssk)	Zygophyllum	P	Sa-Ar	Ch	Su-Sh

Table 1: A list of recorded species in Wadi Abo Alakmal area with their families, genera, life duration, chorotype, life forms and life span.

Life duration (L.D.) abbreviations: A = Annual; Bi = Biennial; P = Perennial.

Chorotype (Floristic categories) abbreviations: End = Endemic; Ne-End Ly & Eg = Near-Endemic to Libya and Egypt; Tro-Afr = Tropical Africa; End – Nor, Afr = Endemic to North Africa; Eu-Si = Euro-Siberian; Ir-Tu = Irano-Turanian; Med = Mediterranean; Sa-Ar = Saharo-Arabian.

Life form (L. F.) abbreviations: Ch = Chamaephytes; G = Geophytes; H = Hemicryptophytes; Ph = Phanerophytes; Th = Therophytes.

Life span (L. S.) abbreviation: H = Herb; Sh = Shrub; Su-Sh = Sub-Shrub.

Genus	Number of species	Percentage
Limonium	4	4.71%
Euphorbia	3	3.52%
Lathyrus	3	3.52%
Atriplex	2	2.35%
Anacylus	2	2.35%
Lotus	2	2.35%
Matthiola	2	2.35%

Table 2: The dominant genera in Wadi Abo Alakmal.

3.2. Life Forms

Regarding the life forms spectra, the most prevailed life-forms in the study area were Therophytes (Th) with 39 species, (45.88%) of the recorded species, followed by Chamaephytes (Ch) were represented by 24 species (28.23%) and Phanerophytes (Ph) with 12 species (14.11%). Whereas, Hemicryptophytes (H) were represented by 7 species

(8.23%) and Geophytes (G) were represented by the lowest percentage (3.52%) with only 3 species. Figure 4 shows the percentage of life forms of the recorded species according to Raunkiaer 1934. The results of this biological spectrum are very similar to the majority of research in many areas located on the Mediterranean cost. Since, Therophytes complete their life-cycle in one single season. In addition, Therophytes are adapted to the droughts and high temperatures that characterize the Mediterranean climate and thus account for more than 50% of the floristic composition present in the Mediterranean cost (Archibold, 1995). Similarly, (El-Mograby & El-Barasi, 2024) reported that Therophytes dominated 56% of total species in sultan area Cyrenaica and (El-Werfalyi et al, 2020) indicated that Therophytes represented by higher percentage 60.89% in Musallata. In addition, the same results have been reported for the majority of regions investigated in Libyan coastal strip; in Jarjar oma (Abusaief, 2013), Al-Hdaba Treatment Plant (Mahklouf & Al-Sghair, 2016), Wadi Alkuf in Al-Jabal Al-Akhder (El-Mokasabi, 2014), Al Mansora in Al-Jabal Al-Akhdar (Abusaief & Dakhil, 2013), Tripoli Province (Mahklouf, 2020), in Msallata – Garaboulli Province (Mahklouf et al, 2020), Wadi Kaam (Almushghub et al, 2022), Cyrene (campus Apollo) (Ali et al, 2024) and in Farwa Isaland (Mahklouf et al, 2023). On the other hand, (Mohamed et al, 2021) reported the dominance of Phanerophytes in their research in Al-Jabal Al-Akhdar.

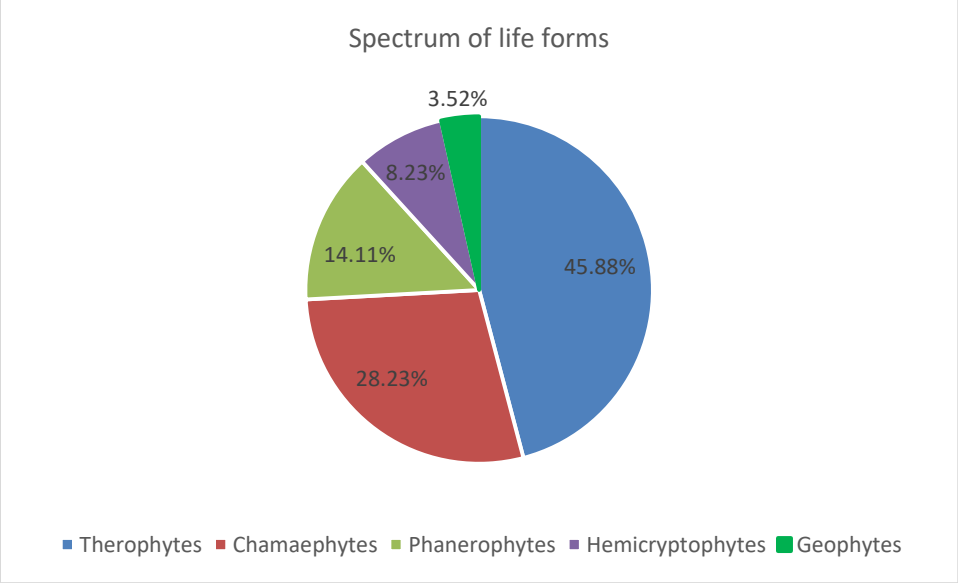

Figure 4: Life form relative spectrum of recorded plants in Wadi Abo Alakmal (categorized according to Raunkiaer's system; Raunkiaer, 1934).

3.3. Phytogeographical Distribution

Considering the global floristic region, the highest percentage of the recorded species belong to the Monoregional (55.29%). It comprised six chorotypes; the Mediterranean (Med) phytogeographical region with a species number of 25 species representing (29.41%), Saharo Arabian phytogeographical region with 17 species (20%), Endemic to North Africa 1 species (1.17%), Endemic to Libya 2 species (2.35%), Tropical Africa 1 species (1.17%), near-endemic to Libya and Egypt 1 species (1.17%). Followed by the Biregional elements were represented by (35.29%) of the total species (Mediterranean + Saharo-Arabian elements with 12 species (14.11%), Mediterranean + Irano-Turanian with 10 species (11.76%), Med + Eu-Si 3 species (3.52%), Ir-Tu + Sa-Ar 5 species (5.88%). And finally, Pluriregional representing (9.41%) of the total species Med +Eu-Si + Ir-Tu with 7 species (8.23%) and Med + Ir-Tu + Sa-Ar elements with only 1 species (1.17%). Figure 5 shows the distribution of the phytogeographical elements in the Study area.

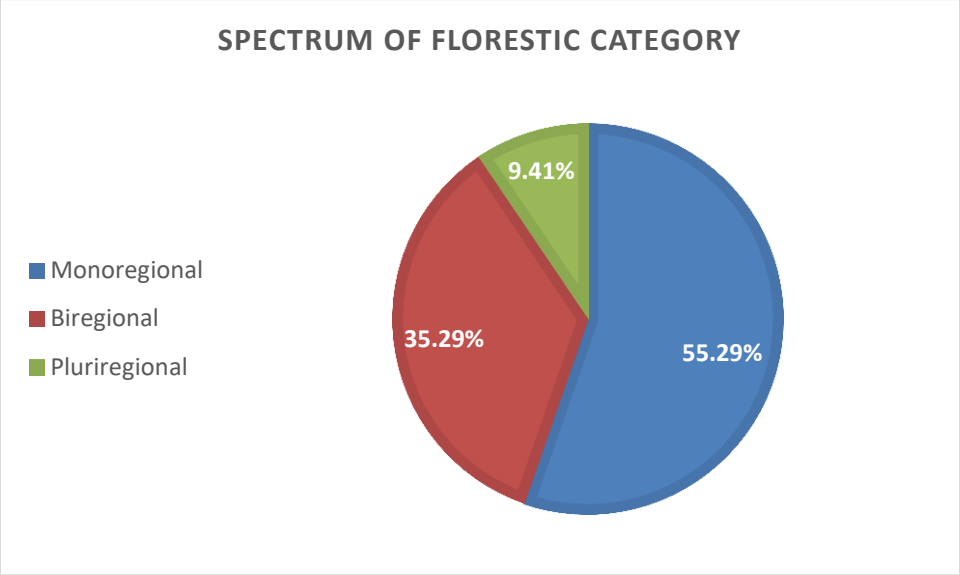

Figure 5: The frequency of the recorded plant species in Wadi Abo Alakmal area in relation to their floristic category.

3.4. Life duration.

The taxa recorded in Wadi Abo Alakmal belong to different life durations; 42 species are perennials (49.41%), 40 species were annuals (47.05%), 2 species are biennials and perennials (2.35), and only one species is annuals and perennials (1.17%). Similarly, (Baayo, 2008; Nafea, 2008) reported the dominance of perennial species in their studies. The dominance of perennial species over the other life durations can be attributed to its tolerant of climatic changeability than annuals. Figure 6 shows the percentages of life duration between the recorded species.

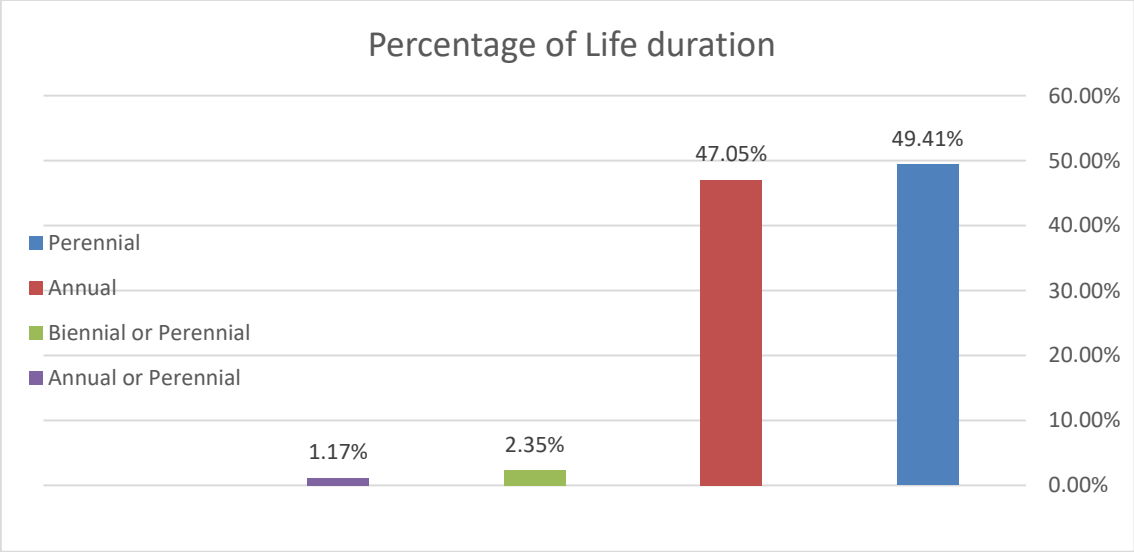

Figure 6: The percentage of life duration in Wadi Abo Alakmal area.

3.5. Life span.

Regarding the life span spectra, the predominant life span in the study area was Herbs (52.94%) 45 species, followed by Shrubs (35.29%) 30 species and Sub-Shrubs (11.76%) 10 species as shown in Figure 7. The dominance of herbs over the other life span can be attributed to the short life cycle that increase their ability to resist the instability of the ecosystem (Gomaa, 2012).

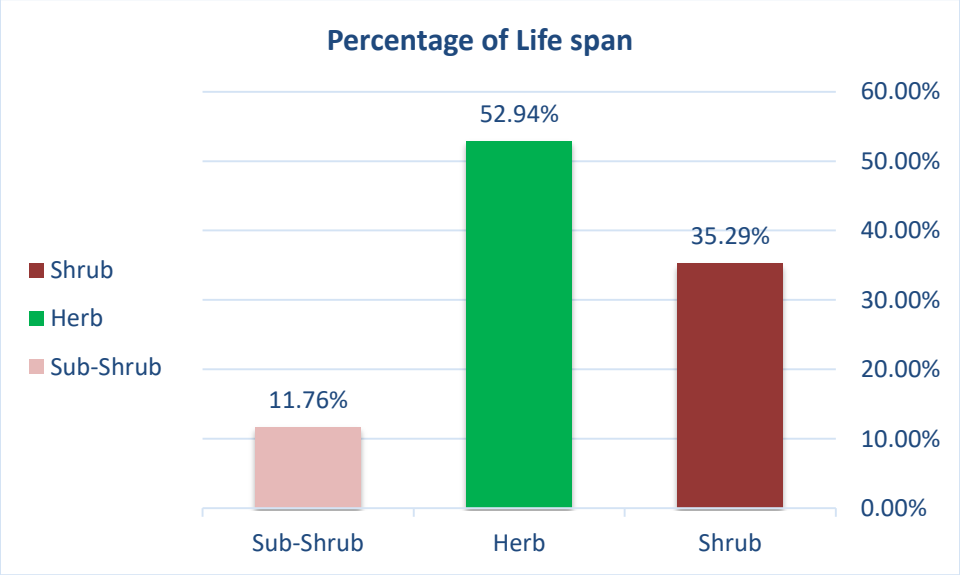

Figure 7: The percentage of life span in the study area.

4. Conclusion

The present study is the first floristic study of Wadi Abo Alakmal and has shown the importance of plant diversity in this region. The dominance of the families Asteraceae and Fabaceae was expected. Since, these families are dominant in the Mediterranean region. Furthermore, the findings of this research have important implications for understanding of plant diversity and distribution in Wadi Abo Alakmal area in west Tobruk city. Endemism, only 2 endemics taxa to Libya, one near-endemic and one endemic taxa to North Africa were reported in this study. Finally, it is necessary to protect these plant taxa of biological and heritage value in the study area.

Conflict of interest

The author has no conflicts of interest, financial or otherwise to declare.

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