



Vegetation Survey for Vascular Plants of Protected Area of the University of Tripoli-Libya

Fathi Goma Al-Sghair✉, Mohammed Hadi Mahklouf

Department of Botany, Faculty of Sciences, University of Tripoli, Libya

✉ **Corresponding author:**

Mohammed Hadi Mahklouf, Email: mahklouf64@yahoo.com

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General Note

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ABSTRACT

The aim of the present study is to elucidate the floristic composition and to document the current plant diversity of protected area (Researches Station) of Agriculture Faculty, University of Tripoli. The current study revealed that (110) plant species belonging to (95) genera and (35) families (31 dicots and 4 monocots) were recorded from the study area. The most highly represented families are the Asteraceae (22 species), the Poaceae (16 species), and the Fabaceae (12 species). The dominance of Asteraceae and Poaceae families are an indication of the increased diversity of herbs in the area, as well as of the cosmopolitan nature of the families and they are dominated the Mediterranean climate conditions. To determine the floristic composition of plant species in the study area the following characters were studied: life forms, chorotypes and create a list of vascular plants species. According to Raunkiaer's method, the highest life form recorded were Therophytes (52.73 %), Hemicryptophytes (14.54%), and Chamaephytes (13.63%), while the least represented life forms were the Phanerophytes with five species (6.36%) and Nanophanerophytes with three species (2.72 %). The only halophytic plant we registered was *Scirpus holoschoenus*. The combination of the high percentage of Mediterranean species and the high percentage of therophytes reflects the Mediterranean character of the flora of the studied area. The dominance



of Therophytes and Mediterranean chorotypes were expected because the study area is located within the Mediterranean region in which the Mediterranean Therophytes are dominating.

Keywords: Protected area, Vascular Plants, Floristic analysis, Life Forms, Chorotype.

1. INTRODUCTION

Protected areas are significant tools for the preservation of biodiversity by protecting species, habitats, and other biodiversity features within their frontiers (CBD, 2010). The protected area was identified as an area of land and/or sea, specially committed to the protection and upkeep of biological diversity, natural and associated cultural resources, and managed through legal or other effective means (IUCN, 1994). Protected areas are places where efforts are made to maintain not only wild species but also the ecosystems in which species live (Stolton et al., 2015). Throughout the world, protected areas could be the only natural or near-natural ecosystems remaining in large areas (Cardinale et al., 2012), they are the key to conserving biodiversity, and they provide food, also other ecosystem services essential for human sustenance (DeFries et al. 2007). The plants develop in communities; each community is characterized by species diversity, growth forms, and structures, dominance successional trends. Conversion of habitat leads to a simplification of natural communities, resulting in the promotion of species that are tolerant to altered environments (Dosso et al., 2012). The aim of the present study is to elucidate the floristic composition and to document the current plant diversity of protected area (Researches Station) of Agriculture Faculty, University of Tripoli.

2. MATERIALS AND METHODS

Study area



Figure 1. Location of Protected area in the University of Tripoli
(Via <https://www.Google Earth>).

The study area is located within the University campus, between latitudes ($32^{\circ} 50' 29.59''$ and $32^{\circ} 51' 02.51''$) North and longitude ($13^{\circ} 13' 38.44''$ and $13^{\circ} 14' 05.99''$) East with a total area of 35 ha (Fig. 1). The area is characterized by the nature of a different flat land in the rise and it's about 8 Km from the sea, and it rises to about 11m above the sea level. The study area located within the

influence of the Mediterranean climate, warm rain in the winter, and hot dry summers (Betelmal, 2010). Climate is one of the most important factors affecting biodiversity, vegetation distribution, and soil composition, and the high temperature affects vegetation and the dominant species.

Data collection

This research has been carried out during April and May 2019 and February to April 2020 in the experimental the protected area (Researches Station of Agriculture Faculty) University of Tripoli. To determine the floristic composition of plant species in the study area the following characters were studied: life forms, chorotypes and create a list of vascular plants species. The collected plant species were classified according to their life form (Rankiaer, 1934). Nomenclature and identification of plants followed the flora of Libya. The chorotypes of the recorded species were determined from the flora of Libya (El-Gadi, A. (Eds) 1977-1989).

3. RESULTS

Floristic analysis

The current study revealed that (110) plant species belonging to (95) genera and (35) families were recorded from the study area, of which 22 species and 20 genera belong to 4 monocyledones families (arranged according to their families), life-form and chorotypes, were outlined in the table (1) while 88 species and 75 genera belonging to 31 dicotyledones families (Table 2). The most represented families are the Asteraceae (22 species), the Poaceae (16 species), and the Fabaceae (12 species), followed by Boraginaceae (6 species), then Apiaceae, Lamiaceae, Plantaginaceae (each with 4 species), and Brassicaceae, Caryophyllaceae, Liliaceae, Polygonaceae (3 species). The remaining families were represented by two or less than two species in the table (3).

Table 1: Shows list of Monocots species recorded in the study area with their families, life form, Chorotypes. (T= Therophytes, H= Hemicyptophytes, G= Geophytes, Ch= Chaemephytes, NP= Nanophanerophytes, P= Phanerophytes, Ha= Halophtyes), (Med= Mediterranean, SaAr = Saharo-Arabain, IrTu = Irano-Turanian, EuSi = European Siberia, Plu = Pluri-regional, T=Tropical)

Family	Species	Life Form	Chroptype
Alliaceae	<i>Allium leucanthum</i> C. Koch.	G	Med
	<i>Allium roseum</i> L.	G	Sa-Ar
Cyperaceae	<i>Scirpus holoschoenus</i> L.	Ha	Med/Ir-Tu
Liliaceae	<i>Asphodellus festulosus</i> L.	G	Med
	<i>Muscari comosum</i> (L.) Mill.	G	Med/ Ir-Tu
	<i>Scilla peruviana</i> L.	G	Med
Poaceae	<i>Aegilops kotschyi</i> Bioss.	T	Ir-Tu/ Sa-Ar
	<i>Avena barbata</i> Pott ex Link	T	Med
	<i>Avellinia michelii</i> (Savi) Parl.	T	Med
	<i>Bromus diandrus</i> Roth.	T	Med
	<i>Cenchrus ciliaris</i> (L.) Link	H	Sa-Ar
	<i>Catapodium marinum</i> (L.) C.E.Hubb.	T	Med
	<i>Cynodon dactylon</i> (L.) Pers.	G	Plu-trop
	<i>Eragrostis cilianensis</i>	T	Plu-trop
	<i>Hordeum murinum</i> Huds.	T	Med/Ir-Tu
	<i>Hyparrhennia hirta</i> (L.) Stapf.	H	Med/Ir-Tu/ Sa-Ar
	<i>Imperata cylindrica</i> (Linn.) Raeuschel.	H	Med/Ir-Tu/ Sa-Ar
	<i>Lamarkia eurea</i> (L.) Moench.	T	Med/Ir-Tu
	<i>Lophochloa salzamnii</i> (Boiss.) H. Scholz.	T	Med
	<i>Piptatherum miliaceum</i> (L.) Cosson.	H	Med
	<i>Stipa barbata</i> Desf.	G	Ir-Tu/ Sa-Ar
<i>Stipa capensis</i> Thumb.	T	Ir-Tu/ Sa-Ar	



Table 2: Shows list of Dicots species recorded in the study area with their families, life form, Chorotypes.

Family	Species	Life Form	Chrotype
Aizoaceae	<i>Mesembryanthemum crystallinum</i> L.	T	Med/Eu-Si/
Apiaceae	<i>Bupleurum semicompositum</i> L.	T	Med - Ir-Tu - Sa-Ar
	<i>Daucus capillifolius</i> Gilli.	T	Med
	<i>Daucus syrticus</i> Murb.	T	Med
	<i>Pituranthos tortuosus</i> (Desf.) Asch.	Ch	Sa-Ar
Asteraceae	<i>Achillea santolina</i> L.	Ch	Med_IrTh/Tu
	<i>Artemisia campestris</i> L.	Ch	Eu-Sib/Med
Asteraceae	<i>Atracylis serratuloides</i> Sieb. ex Cass	H	Sa-Ar
	<i>Calendula arvensis</i> L.	T	Med./Ir-Tu/ Sa-ar
	<i>Carduncellus eriocephalus</i> Boiss.	H	Sa-Ar
	<i>Carduus argentatus</i> L.	T	E.Med/ W.Ir-Tu
	<i>Centaurea dimorpha</i> Viv.	H	Med/Ir-Tu
	<i>Chrysanthemum coronarium</i> L.	T	Med
	<i>Echinops spinosissimum</i> Turra.	T	Med
	<i>Filago desertorum</i> Pomel.	T	Sa-Ar/Ir-Tu
	<i>Filago pyramidata</i> L.	T	Med/Ir-Tu
	<i>Hedypnois cretica</i> (L.) Dum	T	Med
	<i>Ifloga spicata</i> (Fork.) Schultz-Bip.	T	Med/Sa-Ar
	<i>Launaea resedifolia</i> (L.) O. Kuntze	T/H	Sa-SindiTh
	<i>Leontodon simplex</i> (Viv.) Widder	T	Med
	<i>Nollitia crysocomoides</i> (Desf.) Cass.	H	Med
	<i>Phagnalon rupestre</i> (L.) DC.	Ch	Med/ Ir-Tu
	<i>Reichardia tingitana</i> (L.) Roth	T/H	Ir-Tu/Sa-ar
<i>Rhantherium suareolens</i> Desf.	H	Steppe /Sa-ar	
<i>Senecio gallicus</i> Chiaux	T	Med	
<i>Sonchus oleraceus</i> L.	T	Eu-Si./Med./Ir-Tu	
<i>Tragopogon porrifolius</i> L.	T/H	Med	
Boraginaceae	<i>Alkanna tinctoria</i> Tausch	Ch	Med
	<i>Cirenthe major</i> L.	T	Eu-Si./Med
	<i>Elizaldia calycina</i> (Roem & Schultes.) Mair.	T	Med
	<i>Echiochilon fruticosum</i> Desf.	Ch	Sa-Ar
	<i>Echium ahgustafolium</i> Mill.	Ch	Med
	<i>Hormuzakia aggregata</i> (Lehm.) Gusul.	T	E.Med/ E.Sa-Ar
Brassicaceae	<i>Brassica tournefortii</i> Gouan	T	Med/Sa-Ar
	<i>Hussonia pinnata</i> (Viv.) Jafri	T	Sa-Ar
	<i>Sisymbrium orientale</i> L.	T	M/Ir-Tu./Eu-Sib.
Caryophyllaceae	<i>Arenaria serpyllifolia</i> L.	T	Eu-Si/Med
	<i>Silene gallica</i> L.	T	Med/Eu-Si
	<i>Silene conoidea</i> L.	T	W. Ir- Tu/ E. Med
Chenopodiaceae	<i>Chenopodium murale</i> L.	T	Plu-trop
Cistaceae	<i>Helianthemum lippii</i> (L.) Dum.Cours	Ch	Sa-Ar - Su
Cuscutaceae	<i>Cuscuta planiflora</i> Ten.	T	Med/ Sa-Ar
Dipsacaceae	<i>Scabiosa arenaria</i> Forssk	T	Sa-Ar
Euphorbiaceae	<i>Euphorbia terracina</i> L.	T	Med./ Er-Si.
Fabaceae	<i>Argyrolobium uniflorum</i> (Decne.)Jaub	Ch	Sa-Ar
	<i>Astragalus peregrinus</i> Vahl.	T	Sa-Ar
	<i>Astragalus sinaicus</i> Boiss.	T	Med

	<i>Calicotom villosa</i> (Poir.) Link	NP	Med
Fabaceae	<i>Hedysarum spinosissimum</i> L.	T	Med
	<i>Hippocrepis bicontorta</i> Lois	T	Med/Sa-Ar
	<i>Lotus edulis</i> L.	T	Med
	<i>Lotus halophilus</i> Boiss.et Spruner	T	Med
	<i>Medicago polymorpha</i> L.	T	Eu-Si/Med/Ir-Tu
	<i>Ononis natrrix</i> L.	Ch	Med
	<i>Ononis serrata</i> Forsk.	T	Med/Sa-Ar
	<i>Retama raetam</i> (forsk)we	NP	Sa-Ar
Gentianaceae	<i>Centaurium pulchellum</i> (Swartz) Druce	T	Med/Ir-Tu
Geraniaceae	<i>Erodium arborescens</i> (Desf.) Willd.	H	Sa-Ar
	<i>Erodium laciniatum</i> (Cav.) Willd.	T	Med
Illecebraceae	<i>Paronychia argentea</i> Lam.	H	Med
	<i>Paronychia arabica</i> (L.) DC	T/H	Sa-Ar
Lamiaceae	<i>Ajuga iva</i> (L.) Schreb.	Ch	Med
Lamiaceae	<i>Salvia lanigera</i> Poir.	Ch	Med/ Sa-Ar
	<i>Teucrium davaeanum</i> Coss	Ch	Sa-Ar
	<i>Teucrium polium</i> L.	Ch	Med/ Ir-Tu
Linaceae	<i>Linum strictum</i> L.	T	Med
Malvaceae	<i>Malva parviflora</i> L	T	Med/ Ir-Tu
Mimosaceae	<i>Acacia cyanophylla</i> Lindley	P	Australian
Myrtaceae	<i>Eucalyptus camaldunensis</i> Denhardi	P	Australian
	<i>Eucalyptus gomphocephala</i> DC.	P	Australian
Neuradaceae	<i>Neurada procumbens</i> L.	T	Sa-Ar
Oxalidaceae	<i>Oxalis pes-caprae</i> L.	H	Plu-trop
Oleaceae	<i>Olea europea</i> L.	P	Med
Pinaceae	<i>Pinus halepensis</i> L.	P	Med
Plantaginaceae	<i>Plantago albicans</i> L.	H	Med/ Sa-Ar
	<i>Plantago coronopus</i> L.	T/H	Eu-Si/Med/Ir-Tu
	<i>Plantago phaeostoma</i> Bioss & Heldr.	T	Sa-Ar
	<i>Plantgo lagopus</i> L.	T	Med
Polygonaceae	<i>Emex spinosa</i> (L.) Campd.	T	Med
	<i>Polygonum equisetiforme</i> Sm.	H	Med/Ir-Tu
	<i>Rumex tingitanus</i> L.	H	Ir-Tu
Primulaceae	<i>Anagallis arvensis</i> L.	T	Eu-Si/Med/Ir-Tu
	<i>Asterolinon linum-stellatum</i> (L.) Duby.	T	Med/Ir-Tu
Ranunculaceae	<i>Nigella arvensis</i> L.	T	W.Med/Ir-Tu
Scophulariaceae	<i>Linaria tenius</i> (Viv.) Spreng	T	Sa-Ar
	<i>Kickxia aegyptiaca</i> (L.) Nabelek	Ch	Med/Sa-Ar
Solanaceae	<i>Nicotiana glauca</i> Graham	NP	Plu-trop
Thymeleaceae	<i>Thymelaea microphylla</i> Coss. et Dur.	H	Sa-Ar

Table 3. Shows the number of species depending on family of collected species.

Family	Number of species
Asteraceae	22
Poaceae	16
Fabaceae	12
Boraginaceae	6
Apiaceae	4

Lamiaceae	4
Plantaginaceae	4
Brassicaceae	3
Caryophyllaceae	3
Liliaceae	3
Polygonaceae	3
Alliaceae	2
Geraniaceae	2
Illecebraceae	2
Myrtaceae	2
Primulaceae	2
Scophulariaceae	2
Other 18 family	1

Life forms

The dominant life form in the study area reflects the characteristics of the environmental region (Hayat et al. 2019). It is in an ecosystem that indicates the adaptations of plant species' physiognomy to the surrounding climate (Archibold, 1995 & Alsherif et al., 2013). According to Raunkiaer's method (1934), the plant life form classes along the protect area indicated a high proportion of herbs (annuals then perennials) (Table 4). Figure 2 shows that the highest life form recorded was for the Therophytes (52.73 %), followed by Hemicryptophytes (14.54%), and Chamaephytes (13.63%). The least represented life forms were the Phanerophytes with five species (6.36%) and Nanophanerophytes with three species (2.72 %). *Scirpus holoschoenus* was the only halophytic plant we registered.

Table 4. Life forms of study species.

Life forms	No. of species	% of total species
Therophytes (T)	58	52.7
Hemicryptophytes (H)	16	14.5
Therophytes / Hemicryptophytes (T/H)	5	4.5
Geophytes (G)	7	6.4
Chaemephytes (Ch)	15	13.6
Nanophanerophytes (NP)	3	2.7
Phanerophytes (P)	5	4.5
Halophytes (Ha)	1	0.91

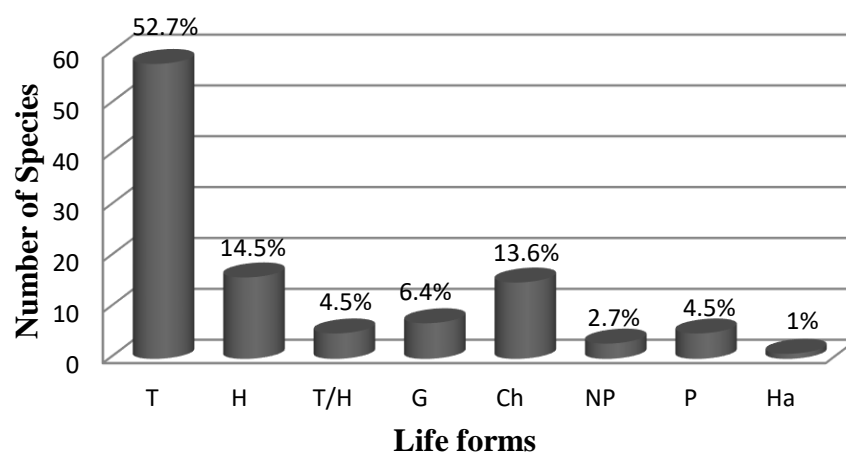
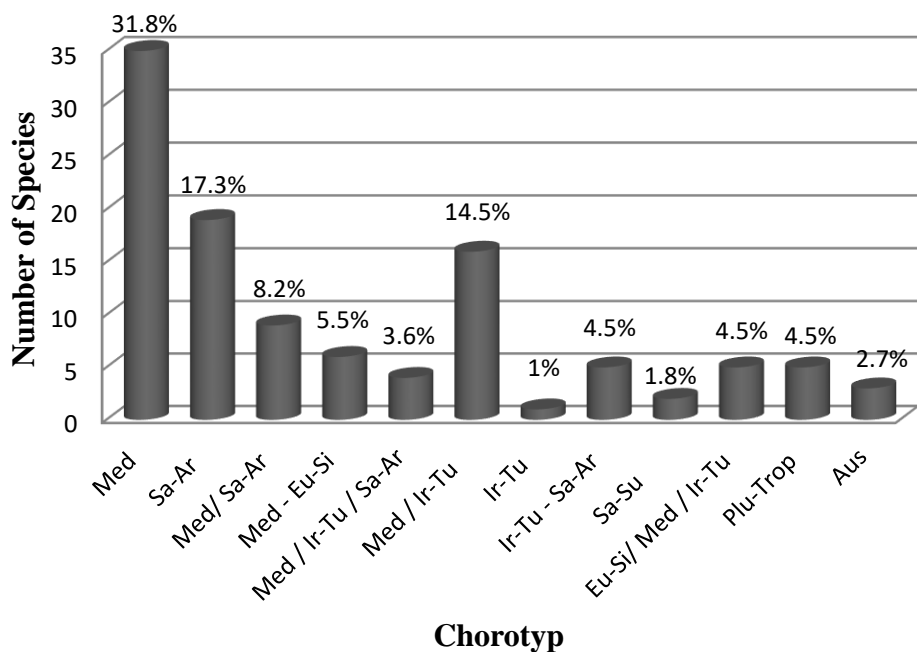


Figure 2. Shows the number of species and percentage of Life forms in the Study area.

Geographical Elements of Species Level (Chorotype)

Chorological characteristic of the recorded species showed that 35 species (31.8%) are dominated in the Mediterranean region (Figure 3). A ratio of 17.3% (19 species out of the total) belongs to Saharo-Arabain region, 14.5% (16 species) belong to Mediterranean /Irano-Turanian regions, 8.2% (9 species) belong to Mediterranean / Saharo-Arabain regions, 5.5% (6 species) belong to Mediterranean / Euro - Siberian / regions, 5 species with a ratio of 4.5% belong to Irano-Turanian/ Saharo-Arabain, Euro - Siberian / Mediterranean / Irano –Turanian and Cosmopolitan- Tropical regions, 3.6% (4 species) belong to Mediterranean/ Irano-Turanian/ Saharo-Arabain regions.



Abbreviations: Med = Mediterranean, SaAr = Saharo-Arabain, IrTu = Irano-Turanian, EuSi = European Siberia, Plu = Pluri-regional, Torp=Tropical, Su=Sudanain, Aus= Australian.

Figure3. Geographical distribution of species showing number & percentage of species in each Chorotype in the study area.

4. DISCUSSION

This study documents the occurrence of 110 species, 95 genera, and 35 families of vascular plants reflecting the high plant diversity within a limited area, and the floristic composition of the area shows the dominance of Angiosperms and a 4:1 ratio of Dicots (80%) to Monocots (20%).

The dominance of Asteraceae and Poaceae families are an indication of the increased diversity of herbs in the area, as well as of the cosmopolitan nature of the families and they are dominated the Mediterranean climate conditions. Our findings regarding the dominant families are Asteraceae and Poaceae of the study area. Mahklouf and Al-Sghair (2016) reported Asteraceae and Poaceae as the dominant families at Al-Hadaba treatment plant (same region of the study area). Furthermore, Mahklouf and Al-Sghair (2016) stated that Poaceae and Asteraceae were the leading families in the Mallaha Wetland.

The present study findings showed that most plant species belong to Mediterranean species with 35 species (31.8%), followed by Saharo-Arabain species with 19 species (17.3%), then Mediterranean / Irano-Turanean species with 16 species (14.5%), therefore, the plant species belong to these three phytogeographical regions constituted almost 63.6% compared to other chorotypes. The species of the families Asteraceae and Poaceae showed that the most common life-forms were the Therophytes, also the geographical distribution of the species showed that most plant species belong to the Mediterranean region (Al-Sghair and Mahklouf, 2017, Al-Sghair *et al.*, 2019).

General physiognomy of flora and vegetation are reflected in life form from effected by the particular set of environmental conditions (Badshah *et al.*, 2016).

The life form spectra of the vegetation in the study area indicated the dominance of therophytes (52.7% of the total recorded species), followed by Hemicyptophytes (14.5%) and chamaephytes (13.6%). Due to the long dry periods during the year in Libya the Therophytes is dominated (El-Mokasabi, 2017). The combination of the high percentage of Mediterranean species and the high

percentage of therophytes reflects the Mediterranean character of the flora of the studied area. It seems the better strategy in the temperate desert of Libya is annual and perennial life forms (AL Sghair *et al.*, 2019).

5. CONCLUSION

This study set out to present the first vegetation survey for vascular plants of the protected area. The current study listed 110 species, belonging to 95 genera and 35 families from the study area. 22 species are belonging to 4 Monocot families and 88 species belonging to 31 Dicot families. The family Asteraceae (22 species) was the most dominant followed by Poaceae (16 species), it is expected because these families are dominated the Mediterranean climate conditions. The life form spectra of the vegetation in the study area indicated the dominance of therophytes (52.7% of the total recorded species), followed by Hemicryptophytes (14.5%). However, in the phytogeographical analysis, most of the collected species belong mainly to three chorotypes; Mediterranean, Saharo-Arabian, and Mediterranean /Irano-Turanian. The dominance of Therophytes and Mediterranean chorotypes were expected because the study area is located within the Mediterranean region in which the Mediterranean Therophytes are dominating.

Conflict of interest

The author has no conflict of interest to declare that are relevant to the content of this article.

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Data and materials availability:

All data associated with this study are present in the paper.

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