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Vegetation and Environment in the Area Surrounding the Libyan Iron & Steel Company at Misrata, Libya

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Abstract

The Floristic Analysis, life forms and chorology were conduct in Qasr Ahmed area, surrounding the Libyan Iron & Steel company, Misrata. Libya. The Qasr Ahmed area is part of the northeastern coast of Misrata in Libya. The climate of the study area was considered as hot semi-arid (BSh) according to Koppen-Geiger climate classification system. The recorded of 80 species (54% annuals and 46% perennials) belonging to 34 families. In addition, results showed the absolute dominance of therophytes (46%), as well as the total chorological analysis of the surveyed flora presented revealed that 39 species 48.75% of the total recorded species are monoregional in being native to Mediterranean chorotype (20 species) and Saharo-Arabian chorotype (19 species).

Key words: Species diversity, Floristic composition, Life forms, Chorology, Ecosystem.

1. Introduction

The spatial composition of plant communities, and their distribution are related to various factors. They reflect the major climatic conditions and local geographical factors that vary within a single geographical space.

Libya has not any natural resources before the oil discovery, but it mainly hinged on vegetation and wildlife. Until recently, Libya population had remained strongly linked to the location where vegetation and hunting of wildlife and birds present. In addition, their dependence was mainly focused on natural plants such as: pasture, cut down trees for fuel, bees grazing, and using some medicinal plant for treatment. In addition, plants were used as a source of building materials. Furthermore, many types of natural plants are usually considered as a source of food for the population.

Ahmed et al., (2017) in a study to update a checklist of the Libyan flora, a 124 species belonging to 108 genera and 42 families were recorded Libya. Moreover, in a study performed by Aljarroushi and Almedham, (2016) mon Geographical distribution and Life form of plants in Sassu Valley, Misrata area, a total of 58 plant species, 31 perennials and 27 annuals, belonging to 51 genera from 23 different families were recorded.

Fathi et al., (2019) revealed that the family Poaceae in Libya is composed of 229 species belonging to 92 genera. Simpson's Diversity index showed that the Family Poaceae has high diversity. The largest genera in the Family Poaceae in the flora of Libya are Stipagrostis and Bromus.

Zaynab et al., (2019) studied Family Asteraceae in Libya depending on Flora of Libya comprises 240 plant species belonging to 97 genera. While Manam et al., (2019) found that number of recorded Libyan plants is about

2082 species; this is not proportionate with the huge area of Libya (1.75 million km2), nor with the significant variation amongst the various ecotypes in the different biogeographical zones of the country. Therefore, Libya is still needs more vegetational studies to fulfill gaps. The present study aims to identify the floristic diversity, life forms, and phytogeographic surrounding the Libyan Iron & Steel company region at Misrata.

2. Materials and methods

2.1. Location

Libya has different ecosystems, ranging from the Mediterranean coast in North to the semi-arid in middle and arid of the South. Therefore, flora of Libya is including a mix of plants suitable to its Mediterranean coasts and dry inland regions. However, descriptive flora of Libya was written by Jafri and El-Gadi (1976–1989) that provides a good reference point.

Misrata city is located at the north on the coast of the Mediterranean Sea about 210 km east of Tripoli and 850 km west of Benghazi with a coast 125 km and about 15 m above sea level, it is the third largest city in Libya and submitted under the Mediterranean climate. Misrata province is divided into: City center, Al Zarrok, El Remela, Qasr Ahmed, Zawiyet Al Mahjob, Al Dafniya, Al Gheran, Tomena, Al Kararim and Tawargha, as shown in Figure 1.

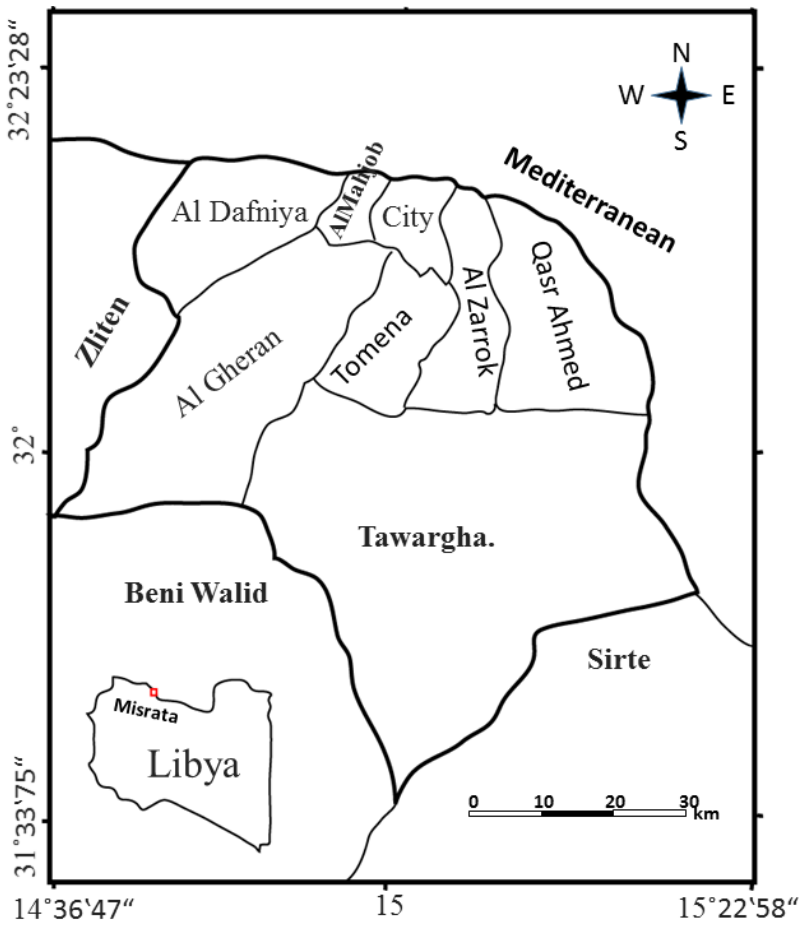

Figure 1: Map of Misrata area

Qasr Ahmed area is part of the northeastern coast of Misrata- Libya. It is surrounded on the south by Tawargha marsh (Sobkha) and on the west by Al-Zarrok region. Qasr Ahmed geographic coordinates is between longitude (32°15`&32°23`N) and latitude (15°10`&15°16`N), and about 831.6km2 in area, referring to Figure 2.

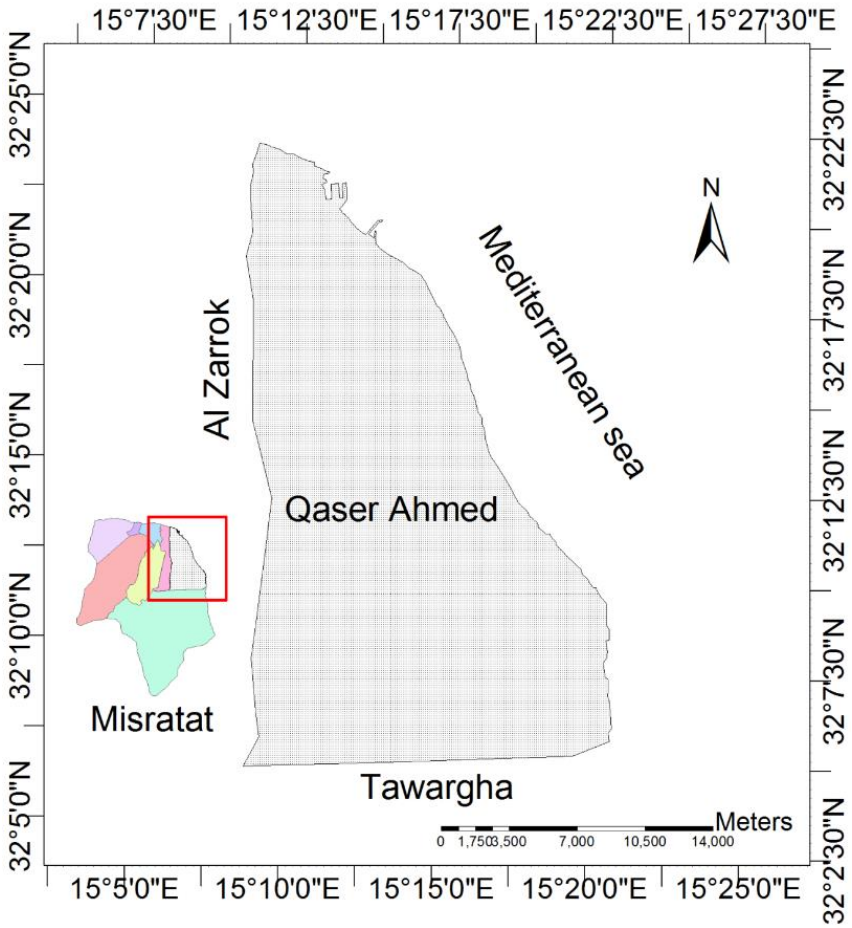

Figure 2: Map of Qaser Ahmed area

Despite the fact that Qasr Ahmad is very big in terms of area where is 831.6 km2 area but with low population density, around 17.981 people are living in this big spot in Misrata. In general, Qasr Ahmad area is considerably industrial zone as it harbor Iron and Steel Company, Misrata Free Zone, Oil and Gas Al-Barqiyah Company, a power station, house of Industry and Marine Maintenance, many small factories and seaport of Misrata.

2.2. Climate

Climate usually affects various features of life on earth's surface. Therefore, most countries of the world pay great importance on studying the climate, as a result achieve the greatest return in their agricultural and industrial production for the benefit of their people. However, the relationship between climate and natural plant is very strong. The distribution of natural plant coverings on the surface of the earth is directly related to the climatic elements of temperature, rainfall and the relative humidity. In addition, the climate also affects the soil in which the plant grows.

Qasr Ahmed has a humid rainy winter climate and dry hot summers in summer, and there are no mountains, and it looks like a peninsula encircle by the sea from the north, east and west, and the Qaser Ahmad had appeared as a prominent marine head named in the old name Kivali.

The climate of the study area is considered as hot semi-arid (BSh) according to Koppen-Geiger climate classification system. However, the rainfall has fluctuated from year to year in study area, because through five years ago had 2015 (202.1 mm/year), 2016 (223 mm/year) while 2017 had 303.8 mm/year, 176.9 mm/year (2018), and 2019 (248.4 mm/year). In addition, the wide range of temperature variation in both winter and summer season, where it ranged between 24C° and 28.8C° in summer and between 11.8C° and 16.2C° in winter. The data of the different climatic variables, rainfall, temperature, wind velocity and the relative humidity are taken from Misrata Metrological Station, see Figure 3.

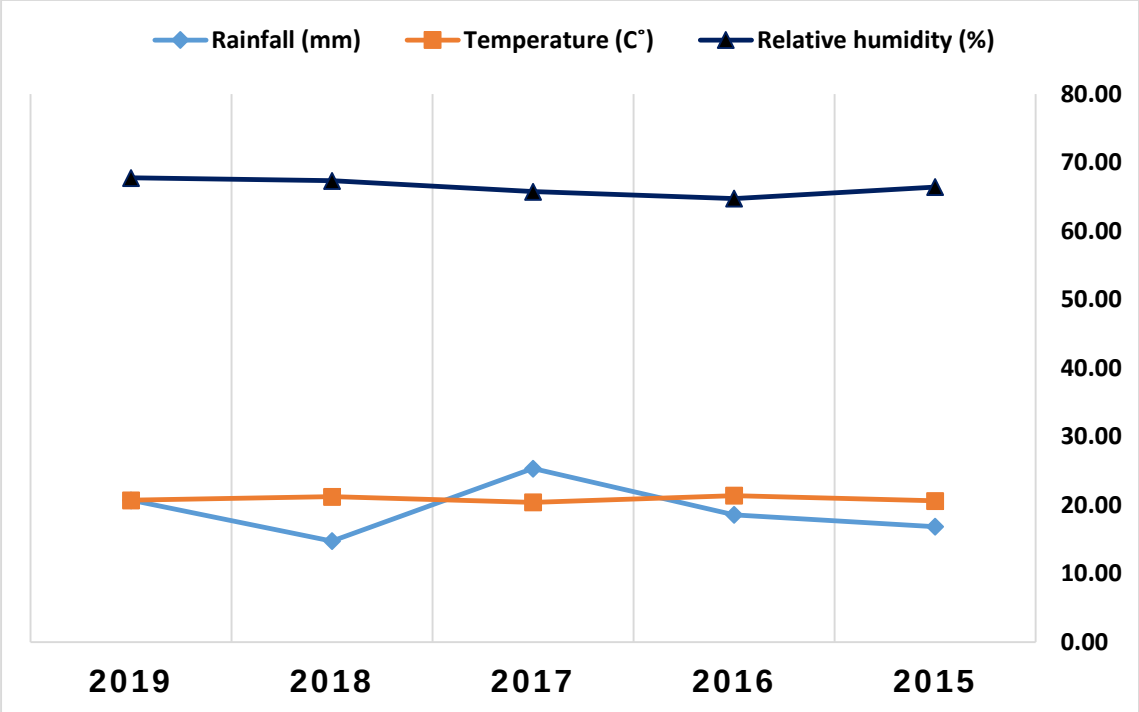

Figure 3: Annual average values of rainfall, temperature and relative humidity in Misurata area (Data obtained from Misrata Metrological Station).

2.3. Samples collections

Forty-nine sites were randomly chosen at the Qasr Ahmed region around the Libyan Iron & Steel company, with a diameter of 8 km during 2018/2019 (Figure 4).

Figure 4: Cites of samples collections

Specimens were preserved in a plant press and identified using the Flora of Libya (Jafri, & El-Gadi, eds1976–1989). The Flora of Egypt (Boulos, 1999) was used to identify those species which are not found in the former. The plant samples were collected from each stand placed in plastic bags and transported to the herbarium located in Faculty of science, university of Misrata for drying, preservation, and record, after identification, the scientific name, date of collection was fixed on each plant depending on the available flora of Libya. The scientific name, last name, and date of collection after it was defined by the herbarium of the Faculty of Sciences University Misrata, and depending on some available fluors such as flora of Libya.

3. Results

3.1. Floristic Analysis

A total of 80 species (54% annuals and 46% perennials) belonging to 34 families are recorded in Table 1. The largest families were Asteraceae and Poaceae (13 and 12 species respectively), Chenopodiaceae (6 species) and Solanaceae (5 species); Euphorbiaceae and Geraniaceae (4 species for each); Apiaceae, Fabaceae, Plantaginaceae (3 species for each); Brassicaceae and Lamiaceae two species for each. Twenty-two families are represented by only one species (Aizoaceae, Amaryllidaceae, Boraginaceae, Casuarinaceae, Caryophllaceae, Cistaceae, Cucrbitaceae, Juncaceae, Malvaceae, Mimosaceae, Myrtaceae, Nittrariaceae, Nuradaceae, Oleaceae, Orobanchaceae, Papaveraceae, Pinaceae, Plumbaginaceae, Polygonaceae, Resedaceae, Tamaricaceae.

Table 1: Floristic composition of the recorded species in the study area: Per. = Perennials, Ann. = Annuals; Th. = Therophytes, H.=Hemicryptophytes, G.= Geophytes, Ch. = Chamaephytes, P = Parasites; COSM = Cosmopolitan, PAN = Pantropical, Med= Mediterranean, SA = Saharo-Arbian, ES = Euro-Siberian, IT. = Irano-Turanian, SZ = Sudano-Zambezian.

No.	Species	Families	Duration	Chorotypes	Life Forms
1	*Acacia tortilis* (Forssk.) Hayne	Mimosaceae	Per.	SA+SZ	Ph
2	*Ammi visnaga* (L.)Lam.Fl. Fl. Franc.	Apiaceae	Ann.	M	Th
3	*Anabasis articulate* (Forssk.) Moq.	Chenopodiaceae	Per.	SA+IT	Ch
4	*Anacyclus radiatus* Loisel.	Asteraceae	Ann.	M	Th
5	*Anthemis arvensis*	Asteraceae	Ann.	SA	Th
6	*Aristida adscensionis* L.	Poaceae	Per.	Pan	Th
7	*Avena sterilis* L.	Poaceae	Ann.	M+IT	Th
8	*Avena sativa* L.	Poaceae	Ann.	M+IT+ES	Th
9	*Bromus diandrus* Roth	Poaceae	Ann.	M	Th
10	*Bromus rigidus* Roth.	Poaceae	Ann.	M	Th
11	*Bromus catharticus* Vahl	Poaceae	Ann.	M+ES+IT	Th

12	*Carduus argentatus* L.	Asteraceae	Ann.	M	H
13	*Casuarina equisetifolia* L.	Casuarinaceae	Per.	Pan	Ph
14	*Centaurea dimorpha* Viv.	Asteraceae	Per.	M+IT	Th
15	*Centaurea glomerata Vahl*	Asteraceae	Ann.	SA	Th
16	*Chenopodium murale* L.	Chenopodiaceae	Ann.	Cosm	Th
17	*Chrozophora obliqua* (Vahl) A.Juss. ex Spreng.	Euphorbiaceae	Per.	M+IT	Ch
18	*Conyza bonariensis (L.) Cronq.*	Asteraceae	Ann	M	Th
19	*Crepis aculeata* (DC.) Boiss.	Asteraceae	Ann	M	Th
20	*Cucumis melo* var. flexuosus	Cucurbitaceae	Ann.	SA+SZ	H
21	*Cynodon dactylon* (L.) Pers.	Poaceae	Per.	M+SA+IT	H
22	*Datura stramonium* L.	Solanaceae	Per.	SA+IT	Ph
23	*Deverra tortuosa* (Desf.) DC.	Apiaceae	Per.	SA	Ch
24	*Diplotaxis harra* (Forssk.) Boiss.	Brassicaceae	Per.	SA	H
25	*Echim angustifolium Mill*	Boraginaceae	Per.	M	Ch
26	*Echinops galalensis* Schweinf.	Asteraceae	Per.	M	H
27	*Emex spinosa* (L.) Campd.	Polygonaceae	Ann.	M+IT	Th
28	*Erodium cicutarium* (L.) L'Her.	Geraniaceae	Ann.	M+IT+ES	Th
29	*Erodium pulverulentum* (Boiss.) Batt.	Geraniaceae	Ann.	M+SA+IT	Th
30	*Erodium glaucophyllum* (L.) L'Her.	Geraniaceae	Ann.	SA	H
31	*Eryngium maritimum* L.	Apiaceae	Per.	M	H
32	*Eucalyptus camaldulensis* Dehn.	Myrtaceae	Per.	Cosm	Ph
33	*Euphorbia paralias* L.	Euphorbiaceae	Ann.	M	Ch
34	*Euphorbia helioscopia* L.	Euphorbiaceae	Ann.	M+ES	Th
35	*Filago desertorum* Pomel	Asteraceae	Ann.	SA+IT	Th
36	*Haloxylon scoparium* Pomel	Chenopodiaceae	Per.	SA+IT	Ch
37	*Helianthemum lippii* (L.) Dum.Cours.	Cistaceae	Per.	SA	Ch
38	*Hordeum vulgare* L.	Poaceae	Ann.	M+ES+IT	Th
39	*Hyoscyamus albus* L.	Solanaceae	Ann.	M	Th
40	*Juncus acutus* L.	Juncaceae	Per.	M+IT	H
41	*Launaea mucronata* (Forssk.) Muschl	Asteraceae	Ann.	SA	H
42	*Launaea resedifolia (L.) Kuntze.*	Asteraceae	Ann.	M	H
43	*Limonium pruinosum* (L.)Chaz.	Plumbaginaceae	Per.	SA	H

44	*Lobularia libyca* (Viv.) C.F.W.Meissn.	Brassicaceae	Ann.	SA	Th
45	*Lolium rigidum* Gaudin	Poaceae	Ann.	M+IT	Th
46	*Lycium shawii* Roem. & schult.	Solanaceae	Per.	SA	Ph
47	*Malva parviflora* L.	Malvaceae	Ann.	M+IT	Th
48	*Marrubium vulgare* L.	Lamiaceae	Per.	M+IT	Ch
49	*Medicago littoralis* Rhode ex Loisel.	Fabaceae	Ann.	M	Th
50	*Mesembryanthemum crystallinum* L.	Aizoaceae	Ann.	M+ES	Th
51	*Monsonia nivea* (Decne.) Webb	Geraniaceae	Per.	SA	Ge
52	*Neurada procumbens* L.	Nuradaceae	Ann.	SA	Th
53	*Nictiana glauca* Graham	Solanaceae	Per.	M	Ph
54	*Nitraria retusa* (Forssk.) Asch.	Nittrariaceae	Per.	SA	Ph
55	*Olea europaea* L.	Oleaceae	Per.	M	Ph
56	*Orobanche cernua* Loef.	Orobanchaceae	Per.	M+SA+IT	Par
57	*Pancratium maritimum* L.	Amaryllidaceae	Per.	M	Ge
58	*Papaver humile* Fedde	Papaveraceae	Ann.	SA	Th
59	*Paronychia argentea* Lam.	Caryophyllaceae	Per.	M	H
60	*Phoenix dactylifera L.*	Palmaceae	Per.	SA	Ph
61	*Phragmites australis* (Cav.) Trin. ex Steud	Poaceae	Per.	Pan	H
62	*Pinus halepensis* Mill.	Pinaceae	Per.	M	Ph
63	*Plantago notata Lag.*	Plantaginacea	Ann.	SA+IT	Th
64	*Plantago arenaria*Waldst.&Kit.	Plantaginacea	Ann.	M+SA	Th
65	*Plantago ovata* Forssk.	Plantaginacea	Ann.	M+SA+IT	Th
66	*Pulicaria arabica*(L.)Cass.	Asteraceae	Per.	M+IT	H
67	*Reseda pruinosa* Delile	Resedaceae	Ann.	SA	Th
68	*Retama raetam* (Forssk.) Webb & Berthel.	Fabaceae	Per.	SA	Ph
69	*Ricinus communis* L.	Euphorbiaceae	Per.	Cosm	Ph
70	*Salsola kali* L.	Chenopodiaceae	Ann.	Cosm	Th
71	*Salvia verbenaca* L.	Lamiaceae	Ann.	M	H
72	*Schismus arabicus* Nees	Poaceae	Ann.	M+SA+IT	Th
73	*Senecio vulgaris*	Asteraceae	Ann.	M+IT	Th
74	*Solanum nigrum L.*	Solanaceae	Ann.	M+ES+IT	H
75	*Stipagrostis plumosa* (L.) Munro ex T. Anderson	Poaceae	Per.	M+SA+IT	H
76	*Suaeda vera* forssk.	Chenopodiaceae	Per.	M+SA	Ch
77	*Suaeda vermiculata* J.F.Gmel.	Chenopodiaceae	Per.	SA	Ch

78	*Tamarix nilotica* (Ehrenb.) Bunge	Tamaricaceae	Per.	M+SA+SZ	Ph
79	*Trigonella stellata* Forssk.	Fabaceae	Ann.	SA	Th
80	*Urtca urens* L.	Urticaceae	Ann	M+ ES	Th

3.2. Life Form

The total number of species in the study area was 80, belonging to five different life forms, see Figure 5. Therophytes (46%) constitute the largest number of species (37 species). Hemicryptophyte and Phanerophytes have high value of 21and16% respectively. Chamaephytes are 10 species represented by which are about 13% of the flora. Geophytes constitute 3% and represented by two species. The percentage of Parasites was 1% and was represented by one species namely Orobanche cernua.

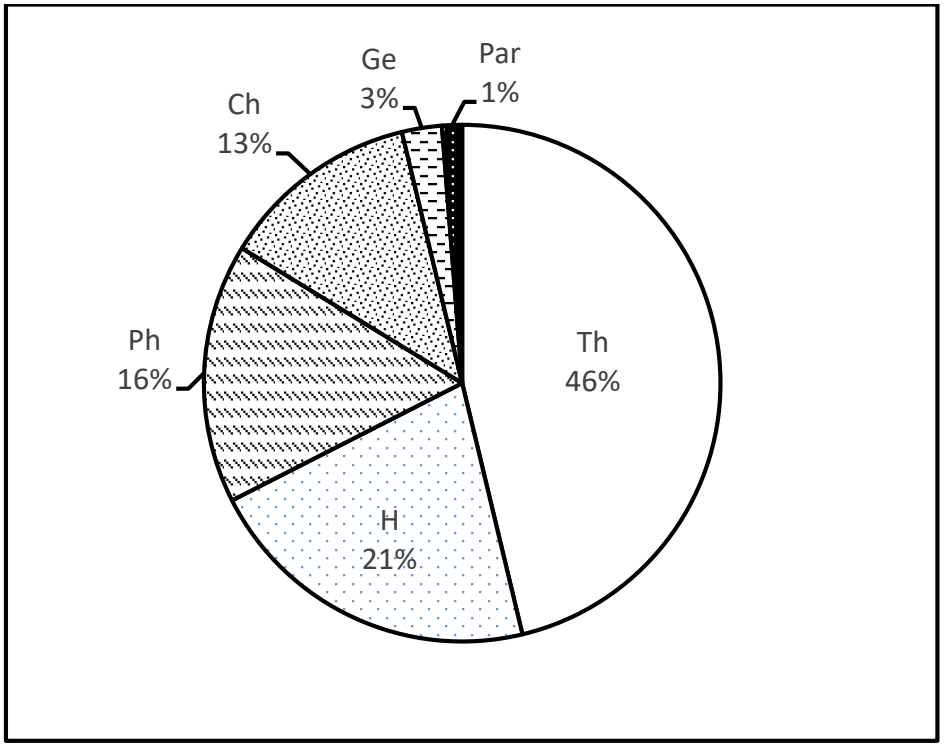

Figure 5: Life forms spectrum of the recorded species. (for abbreviations see table 1)

3.3. Chorology

Results of the total chorological analysis of the surveyed flora presented in Figure 6, which revealed that 39 species (48.75%) of the total recorded species were monoregional in being native to Mediterranean chorotype (20 species) and Saharo-Arabian chorotype (19 species). About 27.5% of the recorded species were Bi-regional (22 species) in being native to Mediterranean + Euro-Siberian, Mediterranean + Irano-Turanian, Mediterranean + Saharo-Arbian, Saharo-Arbian + Irano-Turanianand Saharo-Arbian + Sudano-Zambezianregions. Pluri-regional (23%) extending their distribution all over the Mediterranean, Saharo-Arabian, Irano-Turanian and Sudano-Zambezian regions (Table 2).

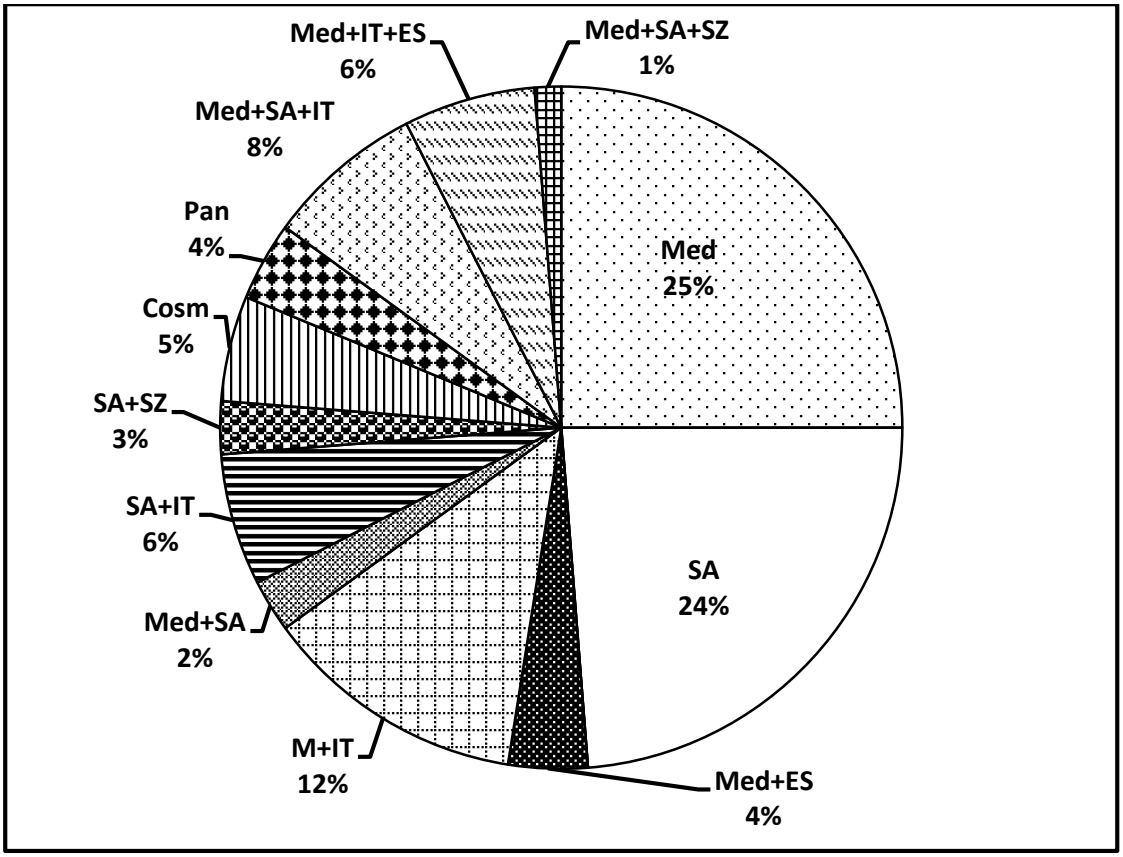

Figure 6: Chorological analysis of the recorded species. (for abbreviations see table 1)

Table (2): Chorological analysis of the recorded species

Floristic regions	No. of species
Pluri-regional	
Med+SA+IT	6
Med+IT+ES	5
Med+SA+SZ	1
Cosm	4
Pan	3
23.75%	
Bi-regional	
Med+ES	3
Med+IT	10
Med+SA	2
SA+IT	5
SA+SZ	2
27.50%	
Mono-regional	
Med	20
SA	19
48.75%	

4. Discussion

Libya climate is desert or semi-desert with only the Mediterranean coast having extensive areas of vegetation. The country has only patchy areas of natural forest in the Jabal al-Akhdar Mountains, east of Benghazi; and Nafusah mountains, Southwest of Tripoli. The desert in the south as well as the Mediterranean Sea to the north influences Libya's climate.

The vegetation in the study area is scarce compared to total space of the studied area, as well as consistent with Flora of Libya, for lack of rainfall. In addition, the region suffers from an increase in human activities such as plowing, uprooting plants, logging, throwing waste and Land attack especially after the 17 February revolution.

Vegetation surrounding the Libyan Iron & Steel Company shows an abundant diversity of life forms. The obtained results showed the absolute

dominance of therophytes, consistent with the study of Makhlouf 2020, who studied the vegetation cover on the costal area of Tripoli and researchers such as Fawzy et al., (2013); Yasser et al., (2015) and Abd El-Ghani (2000), which reported similar results, the dominance of therophytes may be due to human activities. Therefore, therophytes can be regard as indicators of human activities influence (Horvat, 1949).

Geographical distribution of the studied area showed the dominance of Mediterranean and Saharo-Arbian, which can be due to lack of rain. It seems that the annual life form is the preferable strategy in the study area. In addition, the dominance of Asteraceae and Poaceae families was an expected result, because most of its members ware herbaceous plants. However, perennial plants often are distinguished from annual plants in that they complete their life cycle during a relatively short favorable growth period. Drought and high temperatures place severe restrictions on plant growth from late spring to early fall. Such conditions generally favor short-lived life forms such as annuals.

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