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Similarities between elevations in a rare species of some locations at Al- Jabal Al-Akhdar in Libya

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ABSTRACT

Survey of rare species in fifteen sites selected according to elevation of Al-Jabal Al-Akhdar, Libya of 828-232 m M.S.L. The site of Habun and Shahat old city is approaches in altitude from sea level, Habun site elevation 614 M.S.L. while the Shahat old city 580 m M.S.L, indicating the importance of the elevation importance in distribution of rare species in Al-Jabal Al-Akhdar. It was noticed that 85 % of species was perennial and 15 % was annuals. Herbs 43 %, Shrubs 40 %, 17 % Trees. Most of the species following Chamaephytes which represented 37 % of the species, while, Phanerophyte annual plants 30 % followed by Therophytes 15 %, Geophytes and Hemicryptophytes 7 %, as well as Hydrophytes 4 %. The variation in the number of plants per species gave two groups the first group was in the two sites of Slonta and Sidi Alhamri, about 781 – 802 m M.S.L., and 75 %, the second group is divided into the Shahat old city group, Cyrenaica is the largest plant diversity region in Libya.One species of Extinct was *Narcissus tazetta* L. in IUCN was Endangered. Five species classified Critically Endangered includes *Ephedra alata* **(**Decne.), *Foeniculm vulgar* (Mill. Fennel), *Laurus azorica* ((Seub.) Franco) and *Laurus nobilis* L. in Shahat old city, except, *Salvia fruticosa* (Mill.) in Belgara. It was found a convergence between sites AlMansoura (2) and Shahat old city (3) in content SAR. The site was divided at the rare species and different distribution pattern according to the elevation mean sea level, indicating the importance of the elevation importance to distribution of rare species inAl-Jabal Al- Akhdar. A similarity was found between Sidi Alhamri (1), Sidi Alhamri (2), and Slonta in rare species and soil characteristics as described in PCA Correlation. Each increase in altitude from sea level decreases pH. The electrical conductivity increasingly increasing altitude, the electrical conductivity in the soil sector ranges from 0.86 to 1.40 ds/m, increases in surface of the soil and the soil is considered saline.

Keywords: Al- Jabal Al- Akhdar, Elevation, Rare species, Life forms, Raunkiaer's .

Introduction

The distribution of plant species along elevation gradients is governed by a series of interacting biological, environmental and historical factors (Colwell and Lees, 2000). Al- Jabal Al- Akhdar elevation during the three-Grove for up to 882 meters (Rodford *et al*., 2011). About 60,000-100,000 species of plant are threatened with extinction a quarter of the total largely because of human behaviour, whether through the clearing or over-exploitation of land or climate change. Plants provide the air we breathe, clean water, and we all depend on plants for food, with a focus on the plants endangered and most beneficial for the future (RBGK, 2015). The extinction rate of species is increasing and threatens the biodiversity of nature (Pimm and Raven 2000).

The area of Libya's 1.7 million km^2, mostly desert. The most important areas of plant diversity are the coastline and the mountains of the coastal strip 1900 km. (Rodford *et al*., 2011). The natural geography and climatic conditions unique separating Cyrenaica mountains from the rest of Libya has qualified Al- Jabal Al- Akhdar to contain 75-80% of Libya plants, and that includes task and a high proportion of endemic plant species in Libya, although it accounts for only 1% of the area of Libya (Rodford *et al*., 2011). Al-Jabal Al-Akhdar an important plant area a

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priority dominates the Cyrenaica region, where is located in the north-east of Libya, an island biogeographic, bordering the Mediterranean Sea to the north and west and the Golan Marmarika from the east and south of the Sahara. The presence or absence of an individual plant species may have limited value as an ecological indicator. Ecological indicators are often evaluated for their effectiveness in discriminating among sites based on degree of human influence or ecological integrity (Karr and Chu, 1999; Mack, 2006 and Rooney and Bayley, 2010). Ecological attributes that reliably increase or decrease along a gradient of environmental degradation are considered to be appropriate indicators (Karr and Chu, 1999). Considering that Al-Jabal Al-Akhdar has a high diversity of plant species, identification of possible links between a species and its habitat is poorly studied. The main objective of the present work is to survey rare species of sites at Al-Jabal Al- Akhdar Libya, Identify and classify rare species and study similarity between the rare species in sites and environmental factors, relationship the elevation with rare species. Also, this study has attempted to analyze the interaction between soil analysis and rare species sites.

The Study Area

1. Location Description

The study area is located in the Mediterranean Sea Coast of Libya between latitude 32° 35′ 52.84 ″ N and longitude 21° 28′ 22″ E (Wikipedia, 2016). Compilation of rare species of fifteen different natural sites of the Al- Jabal Al-Akhdar–Libya during spring, summer, autumn and winter seasons of 2014 - 2017 shown in Table 1, Fig. 1 and 2.
The sites are divided according to elevation (GPS reading) as follows

Table 1: Fifteen different natural sites above mean sea level (AMSL) of the Al- Jabal Al-Akhdar-Libya

AMSL and sites	Elevation (m)	latitude	longitude	Habitat
1-Altitude greater than 800 m				
1- Slolnta	828	32° 35′ 830″ N	21° 43′ 714″ E	mountain top
2- SidiAlhamri (1)	802	32º41′ 067″ N	21º 48′ 034″ E	mountain top
2-Altitude greater than 700 m				
1- Ashnaishn	791	32º 37′ 052″ N	21º 54′ 805″ E	mountain top
2- SidiAlhamri (2)	781	32º 40′ 089″ N	21º 48′ 126″ E	mountain top
3- Habun (AinAlshallala)	614	32º 48′ 901″ N	21º 54′447″ E	Northern slope
4- Alhamama (JabalAlosaita)	612	32° 46′ 707″ N	21 º 42′ 815″ E	Northern slope
3-Altitude 600 m				
1- Wadi ralles (1)	600	32º 46′ 450″ N	21º 43′ 460″E	mountain top
4-Altitude greater than 500 m				
1- Shahat old city (AtharShahat) Cyrene	580	32º 49′ 371″ N	021º 51′ 226 ″ E	Northern slope
2- Balghara (1)	536	32º 43′ 811″ N	21º 41′ 629″ E	mountain top
3- Wadi ralles (2)	516	32 º 46′ 326″ N	21º 43′ 677″ E	Wadi
4- Balghara (2)	512	32 º 43′ 816″ N	21º 41′ 674″ E	mountain top
5-Elevation from 200-500				
1- Satiea	436	32 º 50′ 338″ N	21º 57′ 190″E	mountain top
2- Al mansoura	326	32º 50′ 804″ N	021º 54′ 805″ E	Rocky
3- Gandafora	280	32° 53′ 556″ N	21° 43′ 614″ E	Forest
4- Maibra	232	32° 52′ 299″ N	21° 39′ 839″ E	mountain top

2. Climate

The climate of Libya varies between the Mediterranean coast and the Sahara desert, in terms of temperature and particularly precipitation. Al Jabal Al Akhdar is the wettest part of Libya, largely as a consequence of its proximity to the Mediterranean and its upland character

(Motawil, 1995). In general the climate of Al Jabal Al Akhdar area classified according to (FAO, 1969 and 1971) as subtropical Mediterranean.

The distinctive features of climate are a concentration of rainfall during the cool winter season and a very marked summer drought. The average annual rainfall is 550 mm and the average annual temperature is 16°C (Fig. 3, 4 and 5) January was the coldest month, while August was the warmest (Fig. 3) Rain falls from October to April, with a maximum in December and January. In winter, air masses over the Mediterranean, an area of convergence between air of Eurasian and Saharan origin, are often rendered unstable by the sea. The result was often cyclonic precipitation, enhanced by orographic uplift, which may be intense (Allan *et al*., 1973 ; Hamad, 2012). However, the Al Jabal Al Akhdar frequently experiences long dry periods within the wet season (Kanter, 1967).

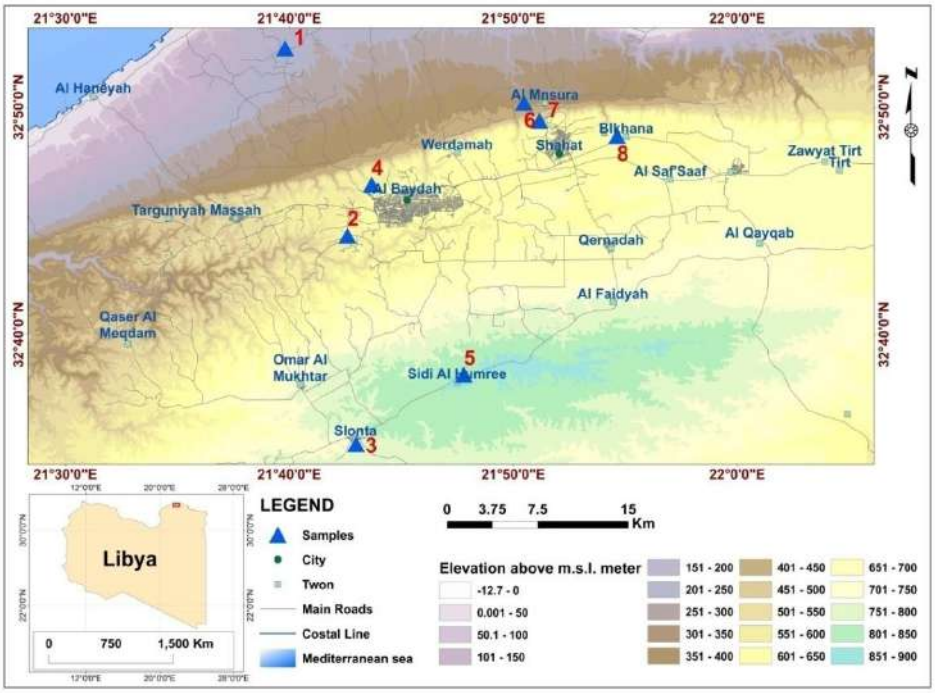

Fig. 1: Location of the study sites (map of Libya) .

Figures 2 shows pictures of fifteen study sites in Al- Jabal Al- Akhdar, Libya.

Slonta

Ashnaishn

SidiAlhamri (1)

SidiAlhamri (2)

Alhamama (JabalAlosaita)

Habun (AinAlshallala)

Shahat old city (AtharShahat) Cyrene

Wadiralles (1)

Wadiralles (2)

Balghara (1)

Balghara (2)

Satiea

Al mansoura

Gandafora Maibra

Fig. 2: Pictures of study sites in Al- Jabal Al- Akhdar, Libya.

The rainfall is the highest on the central northern slope, in the area around Shahat, where it reaches an annual average of more than 550 mm, then decreases from this area in all directions, especially towards the interior. However, the zone of highest rainfall does not coincide with the zone of highest elevation (Hamad, 2012).

The wind is represented by the north-westerly winds which is 45 per cent of the total winds affecting Al Jabal Al Akhdar area. These are humid winds bringing rain during winter. Also At different times of the year the "Ghibli" winds blow from the desert in the south, affect the region which are very dry and hot, and their percentage frequency varies between 17 and 20 per cent of all winds affecting the Al Jabel Al Akhdar region. When the "Ghibli" blows in spring, it causes desiccation of the grain, which is still in the formative stage, while the dust borne by these winds from the desert represents a serious threat to vegetables and all types of trees and vegetations (Pallas, 1980 ; Hamad, 2012).

3. General Geology

Stratigraphy and surface geology of the exposed rocks in Al Jabal Al Akhdar area consist mainly of marine carbonate sedimentary units ranging in age from late Cretaceous to late Miocene. The tectonic and Structure geology of Al Jabal Al Akhdar regions represents the only mildy folded and faulted domal mountain chain in northern Libya. Unlike Libyan regions belonging to the Sahara platform, this mountain chain is an isolated large area of high ground occupying much of Northern Cyrenaica (Hamad, 2012).

4. Soil

The lime content of the sedimentary limestone of the area dissolves on weathering .The residue is a strongly calcareous clay, silty clay, clay loam or silty clay loam, which forms most important and common soil parent materials. Another important soil forming material is nummulitic limestone. Soils derived from these marly and chalky limestones contain high amounts of clay and $CaC0_3$ occupy minor areas (Hubert, 1964). As limestone soils, loamy to clay texture is dominant (Jahn *et al*., 1989). In fact one of the most important physical properties of these soils is their clayey texture. In general, the soils of the Al Jabal Al Akhdar are developed on a highly calcareous parent material. They are shallow with Terra Rossa (ferrosiallitic red soil) predominant (Ben-Mahmood and Al-Jindeel, 1984). The results in Table (4) demonstrate the differences in soil characteristics supporting the vegetation groups in the study area. The mineral ion content is variable among sites, and the pH value slightly alkaline to slightly acidic.

It was found high significant differences at the level of significance $P \leq 0.01$ between precipitation rates in 2014 compared to 2015 between the months when using the chi square test, where less precipitation rate of 461.12 mm / year in 2014 to 366.13 mm / year for 2015, which was 470.5 millimeters in 2013. There is no significant difference between the temperatures in the year of 2014 compared to the year 2015 between months.

There are no significant differences between the sites and also between the years in the amount of precipitation rate. The cluster design for the analysis of the variance between the sites to is used see the contrast between the sites and precipitation rate. Lack of rainfall by 25% for 2015 compared to 2014, indicating a decline in annual precipitation rate. There are significant differences in the rate of precipitation between the study years at the level of significant ≤ 0.001 and the value of Chi Square 36.45.

Material and Methods

Data Collection

Rare species study was undertaken during the period from 2014 to 2017 of all seasons of some location in Al- Jabal Al-Akhdar of Libya (Figure 1).

Standing Vegetation

Sample collection: The floristic categories and chorology of species recorded in the study area were made with their characteristic distribution terms. The plant life forms of the species were identified according to Boulos (1999, 2000, 2002 and 2005) and Jafri and El-Gadi, 1977-1993),determined class, order, family, scientific name, describe the life-forms present and endemic taxa. Used Raunkiaer's system to classify life-forms the vascular plants present in random 25 m^2 quadrats into habitats (Raunkiaer's, 1934). All plants species of each transect were classified into annualand perennial and their relative proportion was determined.All of the measurements were counted and scored within the 50 x 25 m area.To survey the rare species of the tree, shrub, and herbs fifty m and 20 quadrants were randomly selected within the 6 x 4 m^2 area (Krebs, 1985). The plants observed within these quadrants were counted and determined to species. Trees were subdivided into adult trees generally > 3 m and juvenile trees varied from 0.75-2 m. Shrubs were generally < 3 m, dwarf shrubs were < 1 m and climbing level. Herbs were forbs and grass plants.

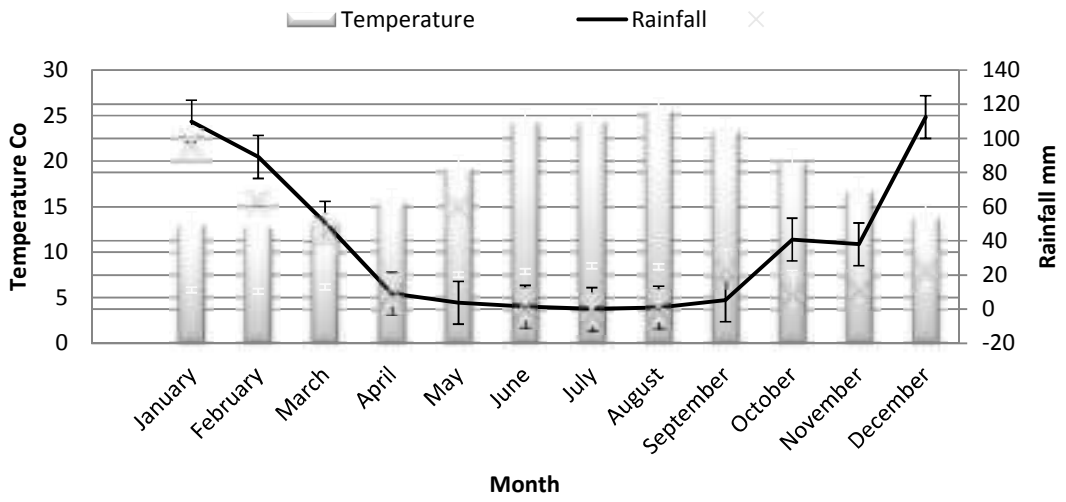

Fig. 3: Mean monthly temperature and rainfall of study area (Al-Jabal Al-Akhdar) in 2014 and 2015 (Source: Meteorological station Nasa, 2017).

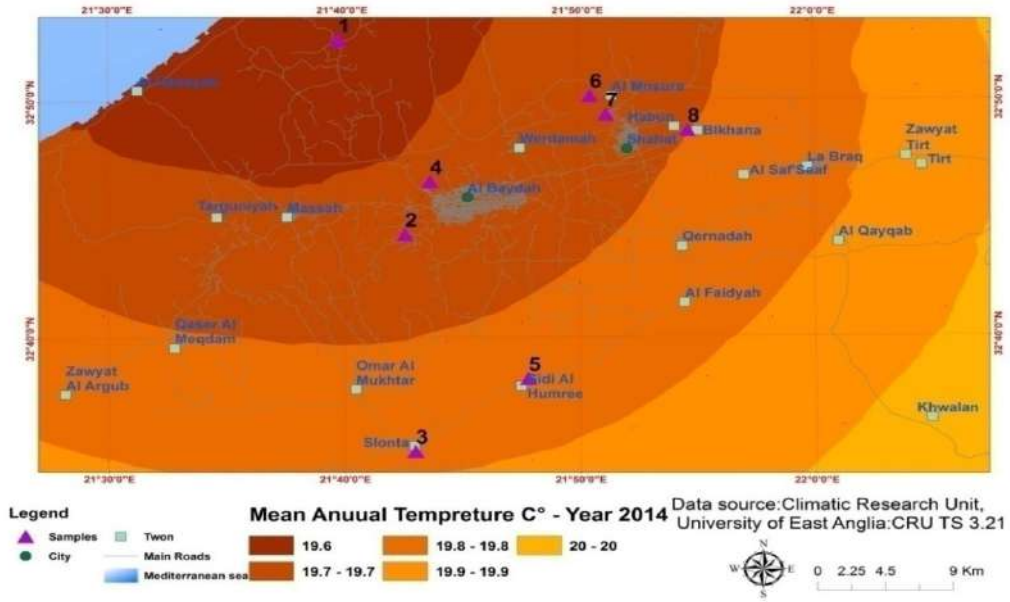

Fig. 4: Mean annual temperature C° in 2014 of study area (Al-Jabal Al-Akhdar) (Source: Climatic research unit university of east anglia, 2017).

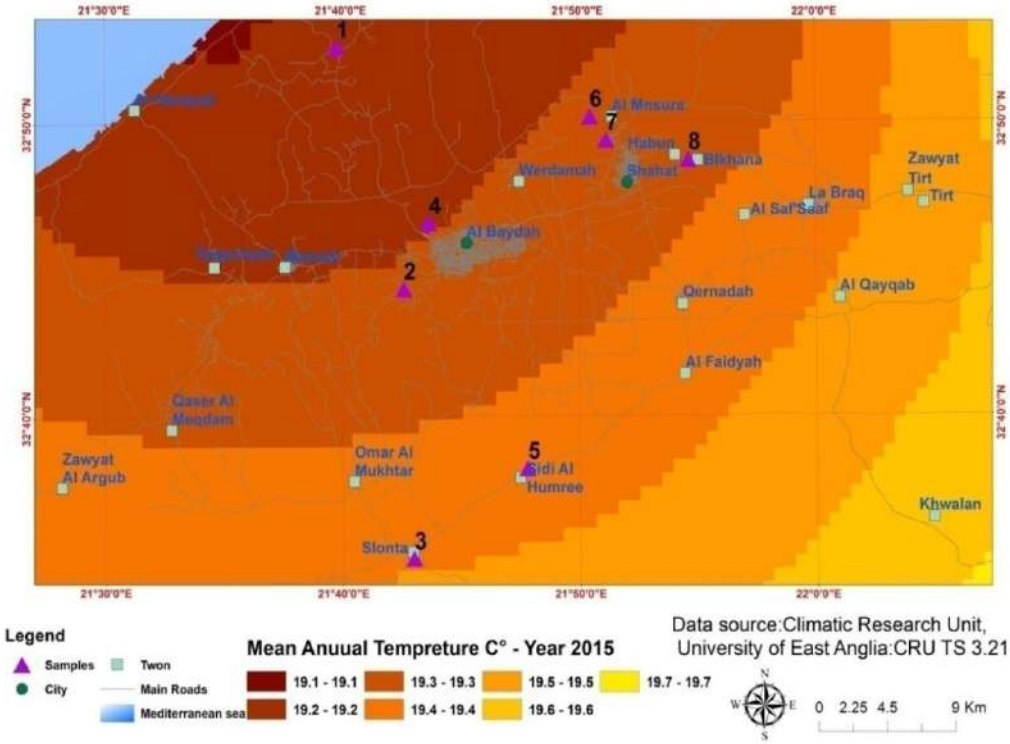

Fig. 5: Mean annual temperature C° in 2015 of study area (Al-Jabal Al-Akhdar) (Source: Climatic research unit university of east anglia, 2017).

Experimental plan

Use Running mean method which includes throwing two points, then the average density of a rare species then take a third point, and calculates the average of the same species density

then take fourth point and calculates the average account and so on until we note that throwing extra points does not influence noticeable on the mean when the number placed points be enough to express the plant community, which dominated this species, named method point- Centered Quarter Methods (Andronov and Chinarova, 2014). The stands with an area of 6 × 4 m^2 were taken in all seasons at the whereabouts of the rare species in the study area.

Rare species study was undertaken during the period from 2014 to 2017 of all seasons were collected of some location in Al- Jabal Al-Akhdar of Libya (Figure 1).

Area each site not less than 1 km^2. The plant species of Al- Jabal Al-Akhdar were scored for the parameters of the rare species, according to IUCN 2001 ; Sapir *et al*., 2003 and FAO, 2006

Least Concern (LC) 0.5%–0.1% of the area (11- 3 sites)

Vulnerable (VU) 0.1%–0.05% of the area (3 -2 sites)

Endangered (EN) 0.05%–0.01% of the area (2-1 sites)

Critically Endangered (CR) 0.01% of the area (< 1 sites)

Extinct (EX) 0.005% of the area, the species disappeared late in the sites.

The presence of species in one site compared to the other 15 sites, and frequency and density of species in the squares studied.

Density (m^{-2}) = (number of individuals ÷ area sampled)

Frequency (plant/m^2) = (number of sampled quadrates in which a species occurs ÷ total number of quadrates in the stand), according to (Abusaief, 2010).

The IUCN Red List of Threatened Species category: EX = Extinct, Critically Endangered (CR); Endangered (EN) and Vulnerable (VU) and Least Concern (LC) (Milovi and Miti, 2012 and Nikoli and Topi, 2005)

Study similarity coefficient between the rare species in the study sites were used Jaccard's coefficient = (The number of species common to the two sites) / (The total number of species on the two sites) x 100 (Williams and Sc., 1949).

Jaccard (presence or absence), Jaccard's coefficient of rare species is dependent on the between numbers of sites and numbers of species in all sites, the higher the value of the coefficient the closer the similarity between the two locations (Jaccard, 1912 and Greig-Smith, 1983).

Soil analysis

Soil samples were collected from the different sites in the study area. Three soil samples were collected from each stand at depth (0 – 10 cm). The samples were pooled together to from one composite sample. Each sample was air dried, passed through a 2 mm. sieve to remove gravel and debris and packed in plastic bages to be ready for physical and pH was estimated using a electric pH meter, EC Was estimated by electrical conductivity meter,Cl^-, $SO4^{--}$, $CO3^-$, $NaCl^-$, Ca^{++}, and Mg^{++} by titration method, will Na^+ and K^+ by Flame photometer Black *et al*. 1965 a and b.

Statistical analysis

The statistical treatments applied were according to (Nie *et al*., 1975). Use the cluster design for the analysis of the variance between the sites to see the contrast the sites and precipitation rate. Chi Square of the rate of precipitation between the years at the level of significant ≤ 0.001. The similarity coefficient between all sites and for adifferent species within the same sites using principal components analysis (PCA) using CAP Program (Rohlf, 1993).

Results and Discussion

Fifteen sites were studied from different area of Al - Jabal Al - Akhdar -Libya. The sites were selected according elevation of 828-232 m and some areas were divided. Not all sites contain rare species despite the availability of other wild species, whereas six sites had no rare

species (Gandafora, Ashnaishn, Satiea, Alhamama (Jabal Alosaita), Wadi rels (1) and Sidi Alhamri (2)). The sites differed in the distribution and number of rare species. Most rare species are distributed in elevation between 512 – 614 m such as Habun, Shahat old city, Balghara 2 and Wadi ralls.

A. Raunkiaer's life-form and type of plant

According to the analysis of life forms the largest portion of species following Chamaephytes**w**hich represented 37 % of the species(10 species), while, Phanerophyte plants 30 % (8 species) followed by Therophytes whichbuds on persistent shoots near the ground– woody plants 15 % (4 species), Fig. (6). Geophytes and Hemicryptophytes 7 % (2 species), as well as Hydrophytes one species did not exceed 4 %. Previous studies have differed that the life forms the vascular plants were Therophytes 59.4%, is represented by the largest number of species, Chamaephytes has 13.1%, Hemicryptophytes has a moderate value of 11.4%, Geophytes represents about (10.3%) of Al Mansora in Al- Jabal Al- Akhdar- Libya. Relationship the life forms with seasons increase Therophytes in spring and autumn, respectively (Abusaief and Dakhil, 2013), also founded Chamaephytes highly during season autumn and summer. Hemicryptophytes low in all seasons except spring season. Geophytes are highest in autumn and winter, lowest during summer and spring season. Phanerophytes are highest during summer and autumn season of Al Mansora in Al- Jabal Al- Akhdar- Libya (Abusaief and Dakhil, 2013). One of Raunkiaer's life-form categories, being a plant whose perennating buds or shoot apices are borne on aerial shoots. Such plants are the least protected of those in Raunkiaer's scheme and therefore are most typical of environments where drought, cold, and exposure to strong winds are relatively infrequent.

Perennial plants accounted for the largest proportion of 85% (24 species) compared to 15 % (4 species) only of plants annuals in all sites, Fig. (7). It was noticed that 53% of species was annuals, 3 % biennials and 45 % perennials of Al Mansora in Al- Jabal Al- Akhdar- Libya (Abusaief and Dakhil, 2013).

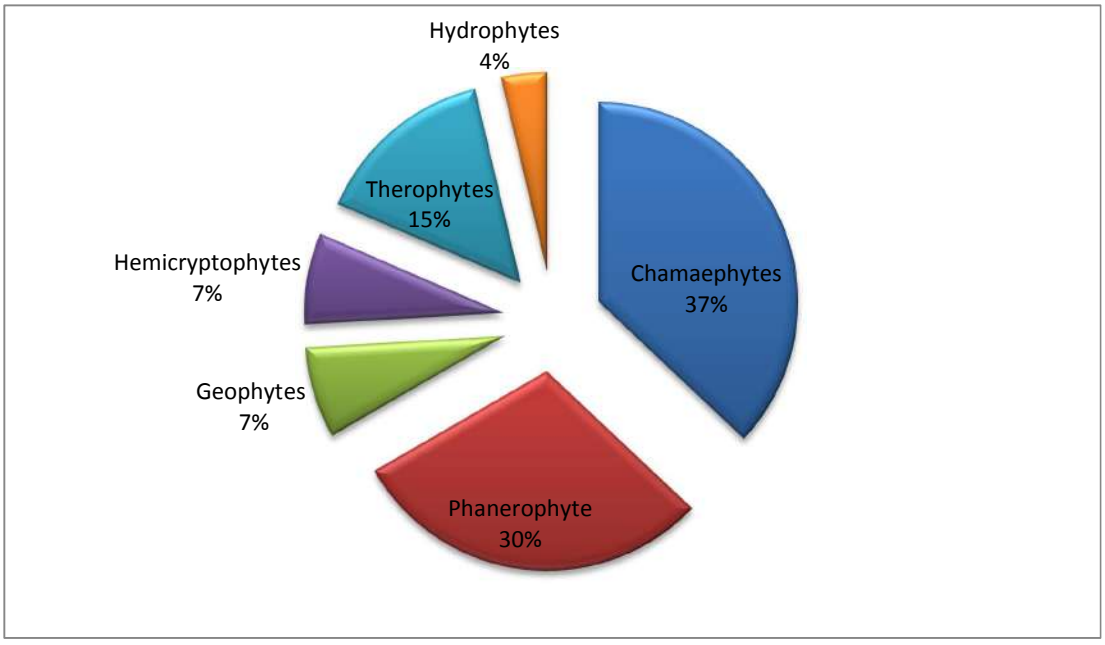

Fig. 6: Raunkiaer's life-form categories of rare species recorded in some Al- Jabal Al- Akhdar sites.

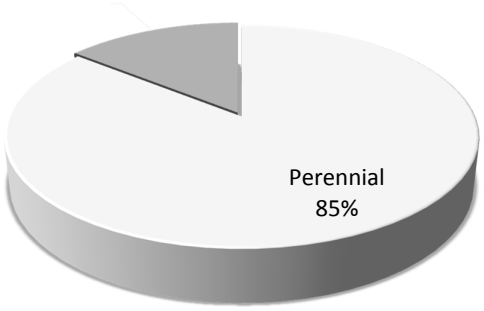

Fig.7: Life duration of rare species recorded in some Al- Jabal Al- Akhdar sites

Most of the rare species dominated by herbs 43 % (12 species), shrubs species 43 % divided to dwarf shrub 11 % (8 species) and climbingshrub 4 % (Fig.8). The same trend mentioned by Hegazy *et al*. (2011) where they form low altitude vegetation dominated by shrubs and trees which constitute about 60% of the plant life forms in Al- Jabal Al- Akhdar. Also, out of the surveyed, Kinds of Forbs gave 109 species followed by shrubs 38 species, Grass 26 species, trees 6 species. The most dominant species were broad-leaved (forbs) (Abusaief, 2013).

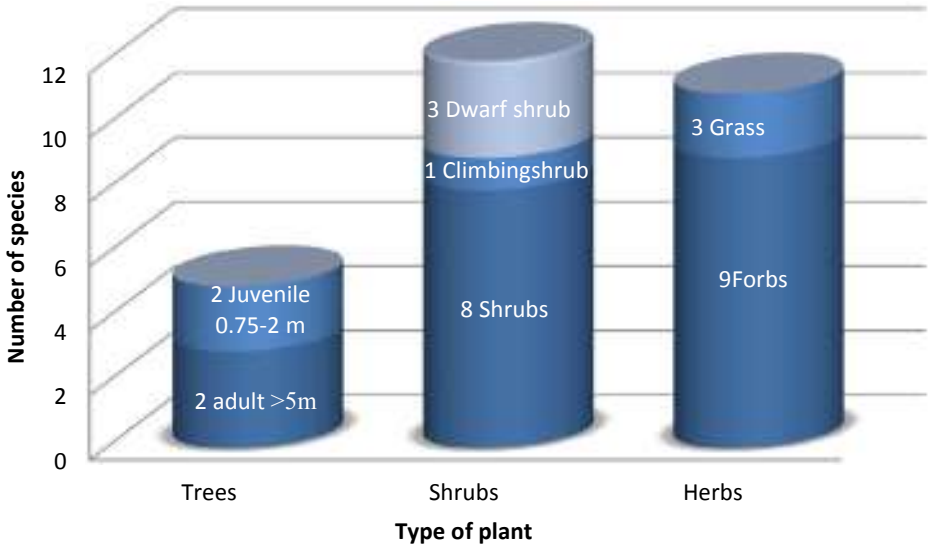

Fig. 8: The percentage of rare species for each type.

B. Families order the rare species

The rare species that belong to 20 families, there included three species of Lamiaceae and Apiaceae, two species for each of Rosaceae, Crassulaceae, Lauraceae and Asteraceae, one species for other families (Fig. 9). There results are in agreement with these obtained by Abusaief and Dakhil, 2013 that less common families was Lamiaceae (6.9%) 12 species followed Fabaceae (12%) represented by 21, the most common species were families in rocky habitat are Asteraceae (15.4%) containing 27, Poaceae (12.6%) represented by 22 species of Al Mansora in Al- Jabal Al- Akhdar- Libya (Abusaief and Dakhil, 2013). Outof the existing identified 3 species of

Lamiaceae were *Salvia fruticosa* Mill., *Thymus capitatus L.* Hoffm. & Link and *Teucrium apollinis* Maire et Weiller.

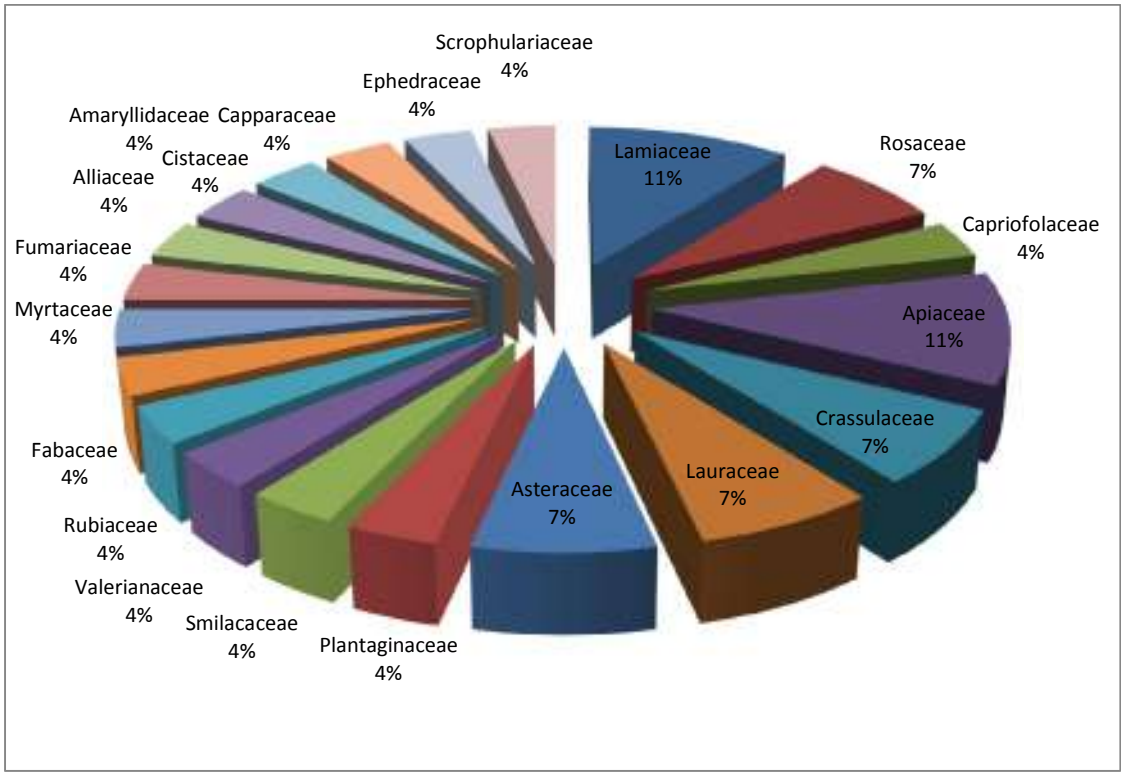

Fig. 9: Families percentage recorded in some Al- Jabal Al- Akhdar sites.

Order Lamiales 5 species (17 %) was the most important followed by three species order Apiales (11 %), two species for each of Rosales, Liliales, Asterales, Saxifragales, Asparagales, Dipsacales and Laurales and one species for other orders. Whereas Abusaief and Dakhil, 2013 recorded 22 order and order Asterales was the largest of Al Mansora in Al- Jabal Al- Akhdar, Libya.

C. Category of Rare species

Rare species study was undertaken during the period from 2014 to 2017 of some locations in Al- Jabal Al-Akhdar of Libya.

The presence of species in one site compared to the other 15 sites, and frequency and density of species in the squares studied, also the IUCN Red List of Threatened Species category: EX = Extinct, Critically Endangered (CR); Endangered (EN) and Vulnerable (VU) and Least Concern (LC). (Milovi and Miti, 2012 and Nikoli and Topi, 2005).

It was found that species Extinct and Endangered located in Shahat old city area and only one species ofEndangered in Belgara As described in Table (2), rare species are belong to different families.

The distribution of rare species varies according to sites and elevations in the number of rare species Fig. (10) and Table (3).

It found one species of Extinct, *Narcissus tazetta* L. and five species classified critically endangered includes *Ephedra alata*Decne.,*Foeniculm vulgar* Mill. Fennel, *Laurusazorica* (Seub.) Franco and *Laurusnobilis* L. in Shahat old city, except,*Salvia fruticosa* Mill. inBelgara.
Endangered plants consist of eleven species, *Capparisspinosa* L. var. krugeriana (Pamp.) Gafri, *Myrtuscommunis* L.(Mersin), *Potentillareptans L.*, *Rubussanctus*Schreber, *Serratulacichoraceae*,

Ptilostemon gnaphaloides Cyr., *Putoria calabrica* (L. f.) DC., *Valerianella muricata* (Stiven ex M.Bieb.) .W.Loudon, *Sedum rubens* L., *Allium ampeloprasum* L. and *Fumaria capreolata* L.

Table 2: Families and sites of scarcity species recorded in some Al- Jabal Al- Akhdar sites.

Scarcity	Family	Sites
Extinct		
	Amaryllidaceae	Shahat old city
Critically Endangered		
	Ephedraceae	Shahat old city
	Apiaceae	Shahat old city
	Lauraceae	Shahat old city
	Lamiaceae	Belgara
Endangered		
	Alliaceae	Sidi Alhamri
	Capparaceae	Shahat old city
	Fumariaceae	Habun
	Myrtaceae	Habun
	Rosaceae	Habun and Shahat old city
	Asteraceae	Belgara and Shahat old city
	Rubiaceae	Al Mansoura
	Crassulaceae	wadi rels
	Valerianaceae	Belgara
Vulnerable		
	Fabaceae	Habun
	Crassulaceae	Slonta
	Cistaceae	Sidi Alhamri
	Plantaginaceae	Mibra
	Liliaceae	Mibra and Habun
	Lamiaceae	wadirels, Belgara and Al Mansoura
	Scrophulariaceae	Shahat old city
	Capriofolaceae	Mibra, Belgara, Sidi Alhamri and Shahat old city

Extinct species *Narcissus tazetta* L. in Shahat old city**.** This plant is found in previous studies in the book of Mediterranean plants, Flora of Egypt and Flora of Libya in Shahat, flowers white with simple cylindric disc, Al – Gubba. Ain Mara. It is also reported by Keith (l. C.) from Ain Mara in Gebel Akhdar area in Libya. It has distinct nerves on the corona. *Vern*: Nargis (Jafri and El-Gadi, 1978). Critically Endangered *Salvia fruticosa* Mill. InBelgara, this plant is found in the book of Mediterranean plants. 5 km from Shahat on way to Susa, ruins, flowers purplish pink, cultivated perennial herb, Also reported from Gebel Akdhar between El Merj-Tolmetta, Derna, Wadi Derna by Keith, (1. C.). Sometimes used for flavouring tea and cultivated as an ornamental. *Vern* : Shahi Derna, Teffah el Shahi (Jafri and EL-Gadi,1985). The genus *Salvia* is one of the largest plant genera, with approximately 1000 species (Walker *et al*., 2004). Of the approximately 250 species that are common in the Mediterranean region (Hedge, 1972). The other species of Critically Endangered *Foeniculm vulgar* Mill. Fennel, in Shahat old city. This plant is found in previous studies in the book of Mediterranean plants, Flora of Egypt and Flora of Libya in Shahat, roadside, C.1 m tall, fls. Yellow (Jafri and El-Gadi, 1985; Boulos, 2000). Agree with Nawash *et al*., 2014 and Taifuor & El-Oqlah, 2014 that *Salvia fruticosa* Mill was Endangered, while, Not Agree that *Foeniculm vulgar* Mill was near threatened from the Mediterranean Forest in Northern Jordan, also, *Ephedra alata* Decne of red list but least concern, it considered three species of *Salvia officinalis***,** *Salvia fruticosa* Mill and *Salvia brachyodon* Vandas of the endangered endemic species in the Mediterranean (Radosavljevic *et al*., 2015).

The other species of Critically Endangered *Ephedra alata* Decne.,in Shahat old city. Found in (Jafri and El-Gadi, 1985 ;Boulos, 2000), in Ras El-Hilal, near coastal road (Sherif and El-Taife, 1986). The seeds present in the ovulate cones are oval and acuminate in shape. This

plant species flowing/fruiting season is between March and May. The roots of this plant are very fibrous and help the plant firmly anchor in sandy soil (Unknown, 2012). *Ehpedra alata* is used for medicinal purposes.The stem of this plant contain alkaloid ephedrine which is a medicine used for the treatment of asthma and other respiratory ailments and Cancer (Bell and Bachman, 2011).

Laurus azorica (Seub.) Franco found in Shahat old city. It seems to thrive well in Gebel Akhdar area, while Keith (l. C.) considered it to be extinct from our area (Jafri and El-Gadi, 1977).

Laurus nobilis L. found in Shahat old city. Reported from Cyrenaica (Tokra, Derna etc.) by Durand and Barratte, (l.C.), pampanini ,1931(l.C.) and Maire (l.C.); also as cultivated in Tripoli (Jafri and El-Gadi, 1977).

In addition Vulnerable *Globularia alypum* L. and *Smilax aspera* L. in Mibra, as well as in Habun *Smilax aspera* L. While in Belgara**,** AlMansoura and wadirels *Thymus capitatus* L. Hoffm. **&** Link, in Habun *Anagyris foetida* L., wadirels *Teucrium apollinis* Maire et Weiller, Sidi Alhamri *Helianthemum* spp.a in Slonta *Sedum ebracteatum*Viv., in Shahat old city*Veronica anagallis* Aquatica L.

Moreover Endangered *Serratula cichoraceae* and *Valerianella muricata* (Stiven ex M.Bieb.)W.

Loudon in Belgara, *Putoria calabrica* (L. f.) DC. in Al Mansoura.

Myrtus communis L. (Mersin), *Fumaria capreolata* L. in Habun and *Rubus sanctus* Schreber**.** In Habun and Shahat old city. *Sedum rubens* L. In wadirels, *Allium ampeloprasum* L. in Sidi Alhamri. In Shahat old city *Ptilostemon gnaphaloides* Cyr.,*Capparis spinosa* L. var. krugeriana (Pamp.) Gafri and *Potentilla reptans* L.

This is in agreement Skelin *et al*., 2014 which found rare plant species of Croatian flora: *Scaligeria cretica* (Mill.) Boiss. and *Narcissus serotinus* L. were found in the islet of Zečevo. Record species *Narcissus tazetta*cv. Meskin at the risk of extinction in the southern regions of Iran (Farahmand and Nazari, 2015). That human activity is responsible for mass extinction at present is now beyond argument.

Narcissus tazetta, Bunch-flowered Daffodil, Chinese sacred lily, cream narcissus, joss flower, polyanthus narcissus is a perennialornamental plant that grows from a bulb. Cultivars of *N. tazetta* include 'Paperwhite', 'Grand Soleil d'Or' and 'Ziva', which are popularly used for forcing indoors, as is the form of *N. tazetta* known as Chinese Sacred Lily (Tovah, 2000). *Narcissus tazetta* is amongst the tallest of the narcissi, and can grow to a height of up to 80 cm (Michaux*,* 2009) with thin, flat leaves up to 40 cm long and 15 mm wide. Umbels have as many as 8 flowers, white with a yellow corona (Linnaeus, 1753). A recent medicinal use is that a certain protein known as lectin has antiviral properties against influenza (Nigel, 1997).

Narcissus tazetta was found in the study of Wadi Alkuf, also Book flora of Libya 1977 - 1993 by Jafri in Shahat and Keith in Ainmara, recently don't appear in the study of vegetation and several recent studies in El-Jabal El-Akhdar Region.

When inventory rare species based on abundance and presence or absence each sites. It was one species extinct in Shahat old cityfollows a family Amaryllidaceae to *Narcissus tazetta*L. Also, in Shahat old city four families are critically endangered belong to Ephedraceae such as *Ephedra alata* Decne., Apiaceae such as *Foeniculm vulgar* Mill. Fennel, Lauraceae family content two species *Laurus azorica* (Seub.) Franco and *Laurus nobilis* L.another thingFamily Lamiaceae such as *Salvia fruticosa* Mill. inBelgara. However, nine families are **e**ndangered Apiaceae in wadi rels, Alliaceae in Sidi Alhamri, as well as, Capparaceae inShahat old city while, Fumariaceae and Myrtaceae inHabun, However, there are two speciesof Rosaceae inShahat old city and Habunand family Asteraceae too butin Shahat old city and Belgara. While, family Rubiaceae inAlMansoura, *Crassulaceae* in wadi relsand *Valerianaceae* in Belgara**.**

Table 3: Order, families and categories and scientific name in some Al- Jabal Al- Akhdar sites.

Order	Family	Category and Scientific name	Site
EX Extinct			
Asparagales	Amaryllidaceae	*Narcissus tazetta* L.	Shahat old city
CR Critically Endangered			
Ephedrales	Ephedraceae	*Ephedra alata*Decne.	Shahat old city
Apiales	Apiaceae	*Foeniculm vulgar* Mill. Fennel	Shahat old city
Laurales	Lauraceae	*Laurus azorica* (Seub.) Franco	Shahat old city
Laurales	Lauraceae	*Laurus nobilis* L.	Shahat old city
Lamiales	Lamiaceae	*Salvia fruticosa* Mill.	Belgara
Endangered			
Liliales	Alliaceae	*Allium ampeloprasum* L.	Sidi Alhamri
Capparales	Capparaceae	*Capparis spinosa* L. var. krugeriana (Pamp.) Gafri	Shahat old city
Ranunculales	Fumariaceae	*Fumaria capreolata* L.	Habun
Myrtales	Myrtaceae	*Myrtus communis* L.(Mersin)	Habun
Rosales	Rosaceae	*Potentilla reptans L.*	Shahat old city
Asterales	Asteraceae	*Ptilostemon gnaphaloides* Cyr.	Shahat old city
Rosales	Rosaceae	*Rubus sanctus* Schreber	Habunand Shahat old city
Saxifragales	Crassulaceae	*Sedum rubens* L.	wadirels
Asterales	Asteraceae	*Serratula cichoraceae*	Belgara
Dipsacales	Valerianaceae	*Valerianella muricata* (Stiven ex M.Bieb.) .W.Loudon	Belgara
Vulnerable			
Apiales	Apiaceae	*Bupleurum gerardi* All.,Auct.	Shahat old city
Dipsacales	Capriofolaceae	*Lonicera nummularifolia* Jaub. & Spach.	Belgara and Sidi Alhamri
Fabales	Fabaceae	*Anagyris foetida* L. ,Sp.	Habun
Gentianales	Rubiaceae	*Putoria calabrica* (L. f.) DC., Prodr.	AlMansoura
Lamiales	Lamiaceae	*Teucrium apollinis* Maire et Weiller	wadirels
Lamiales	Lamiaceae	*Thymus capitatus* L. Hoffm. & Link	Belgara, wadirels and AlMansoura
Liliales	Liliaceae	*Smilax aspera* L. Sp.	Mibra, Habun
Lamiales	Plantaginaceae	*Globularia alypum*Linn., Sp. Pl.	Mibra
Lamiales	Scrophulariaceae	*Veronica anagallis* Aquatica L., Sp.	Shahat old city
Malvales	Cistaceae	*Helianthemum* spp.	Sidi Alhamri
Saxifragales	Crassulaceae	*Sedum ebracteatum* Viv. Fi.	Slonta
Least Concern (LC)			

Dipsacales	Capriofolaceae	*Lonicera etrusca Santi.*	Mibra, Belgara, Sidi Alhamri and Shahat old city
Cyperales	Cyperaceae	*Cyperus longus* L.	Shahat old city
Ericales	Ericaceae	*Arbutus pavarii*Pamp.	Mibra, Belgara, Habun and Sidi Alhamri
Fabales	Fabaceae	*Calicotome villosa* (Poir.) Link	Mibra and Belgara
Fabales	Fabaceae	*Ceratonia siliqua* L.	Mibra
Fagales	Fagaceae	*Quercus coccifera* L.	Mibra and Belgara
Lamiales	Lamiaceae	*Teucrium barbeyanum* Aschers	Mibra and wadirels
Lamiales	Oleaceae	*Phillyrea latifolia* L.	Mibra, Belgara and Habun
Rosales	Rhamnaceae	*Rhamnus lyciodes* L.	Mibra, Belgara and Shahat old city
Alismatales	Araceae	*Arum cyrenaicum*	Belgara, AlMansoura, Habun and Shahat old city
Apiales	Apiaceae	*Lagoecia cuminoides* L.	Belgara
Apiales	Apiaceae	*Scaligera cretica* Mill	Belgara and wadirels
Apiales	Apiaceae	*Torilis leptophylla*	Belgara
Asterales	Asteraceae	*Cicerbitahaimanniana* (Ascher.) Beau	Belgara
Asterales	Asteraceae	*Helichrysum stoechas* (L.) Dum.-Courset	Belgara and Slonta
Ericales	*Myrsinaceae*	*Cyclamen rohlfsianum* Aschers.	Belgara
Lamiales	Lamiaceae	*Ballota psedo-dictamnus* L.Benth	Belgara, Shahat old city and Slonta
Lamiales	Lamiaceae	*Origanum cyrenaicum* Beg. et Vaccari	Belgara, AlMansoura and Shahat old city
Lamiales	*Orobanchaceae*	*Parentucellia latifolia* (L.) Caruel	Belgara, wadirels and Sidi Alhamri
Lamiales	Oleaceae	*Olea europaea* var. oleaster (Hoffmg. & Link) Dc.	Belgara and
Malvales	Cistaceae	*Helianthemum salicifolium*(L.) Mill.	Belgara
Violales	Violaceae	*Viola scorpiuroides*Coss.	Belgara and AlMansoura
Liliales	Asparagaceae	*Bellevalia sessiliflora* (Viv.) Kunth	AlMansoura
Saxifragales	Crassulaceae	*Umbilicus horizontalis Guss.* DC.	AlMansoura
Solanales	Cuscutaceae	*Cuscuta epithymum* (L.) Murray	AlMansoura

Apiales	Apiaceae	*Apiam nodiflorum*	Habun
Apiales	Apiaceae	*Smyrniumolusatrum* (L.)	Habun and Shahat old city
Asterales	Asteraceae	*Phagnalonrupestre* L. Dc.	Habun and wadirels
Dipsacales	Caprifoliaceae	*Centranthuscalcitrapae* (L.) Dufresne	Habun and Shahat old city
Liliales	Liliaceae	*Asparagus aphyllus* L.	Habun
Rununculales	Ranunculaceae	*Clematis cirrhosa* L.	Habun and Sidi Alhamri
Lamiales	Apiaceae	*Tordylium apulum* L.	wadirels
Apiales	Apiaceae	*Thapsia garganica*Lag.	Sidi Alhamri
Asterales	Asteraceae	*Tragopogon porrifolius* L.	Sidi Alhamri
Fabales	Polygalaceae	*Polyga laaschersoniana* Chodat	Sidi Alhamri
Gentianales	Rubiaceae	*Rubia tenuifolia* L.	Sidi Alhamri
Lamiales	Lamiaceae	*Prasium majus* L.	Shahat old city and Sidi Alhamri
Malpighiales	Linaceae	*Linum strictum*L. var. spicatumPers	Sidi Alhamri
Malvales	Cistaceae	*Helinthemum aegyptiacum* (L.) Mill	Sidi Alhamri
Ranunculales	Rananculaceae	*Rhamnus alaternus* Sub Sps. Pendulus	Shahat old city and Sidi Alhamri
Apiales	Apiaceae	*Bupleurum gerardi* All.	Shahat old city
Asterales	Asteraceae	*Echinops cyrenaicus* Durand &Barratte	Shahat old city
Malpighiales	Euphorbiaceae	*Euphorbia charasis* L.	Shahat old city
Pinales	Cupressaceae	*Platycladus* orientalis *Biota orientalis* (L.) Endl	Shahat old city
Pinales	Pinaceae	*Pinus halepensis* Mill	Shahat old city
Polemoniales	Boraginaceae	*Cerinthe major* L.	Shahat old city
Ranunculales	Fumariaceae	*Fumaria macrocarpa* Parlatore	Shahat old city
Rosales	Urticaceae	*Parietaria judaica*	Shahat old city

Figure (10) shows the rare species in 10 study areas, the number of extinct species 3.5% of the total rare species and critically endangered species were 17.9%, while those at endangered and critically species were 39.3 % in the 2014 to 2017 growth seasons, this is a dangerous indicator of the poor exploitation of the land as well as not to highlight the importance of wild plant species and the accumulation of seeds as a stock for future generations, while the families percentage of Scarcity presents, (63%) of the species was least concern, and the percentage of extinct species is 1.3% of the total number of species, critically 6.6% and there are areas of Al-Jabal Al- Akhdar, such as Derna, Ras Al-Hilal, Darnah Falls and AinMarara, which contain many species critically endangered. Due to security conditions, we could not limit the rare plants in those areas, it mentioned in the reference Flora of Libya.

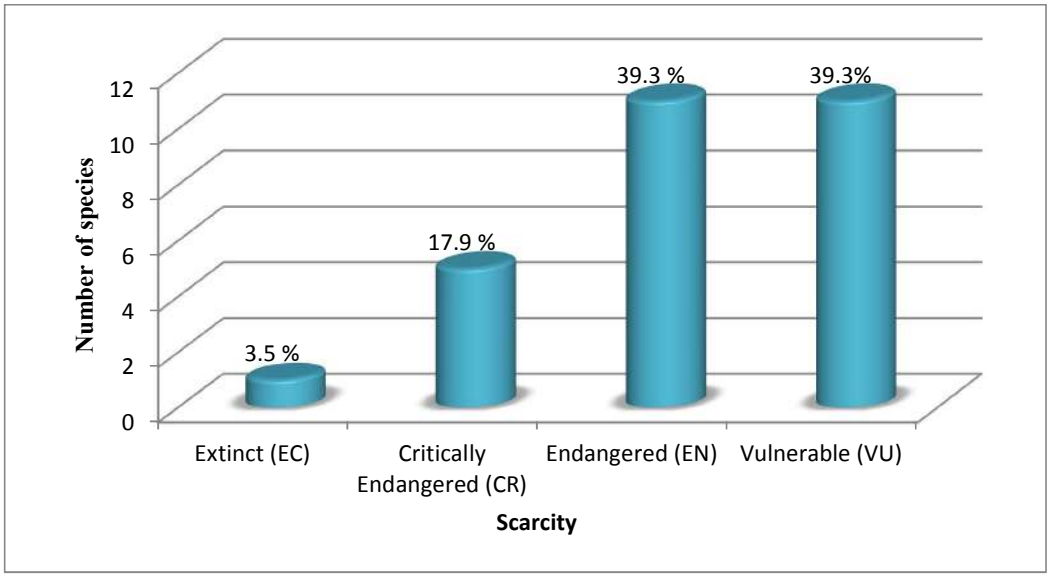

Fig. 10: Species percentage of Scarcity recorded in some Al- Jabal Al- Akhdar sites.

Displays table (4) the soil analysis of Shahat old city, Belgara and Habun showed that it was alkaline soils, while Sidi Al Humee, AlMansoura and Slonta were pH temperate soils. There was no difference in elevation from sea level to the same area, whereas the elevation of the sea level differed between regions. Each increase in altitude from sea level decreases pH. The electrical conductivity increasingly increasing altitude, the electrical conductivity in the soil sector ranges from 0.86 to 1.40 ds/m, increases in surface of the soil and the soil is considered saline, compatible with Abusaief *et al*., 2013). Sodium Absorption Ratio (SAR) if it is more than 13, the soil is considered as a sod (Saejiew *et al*., 2004).

Cation soluble (meq/l) is high except potassium in all study sites Soluble anions (meq/l) the chlorine increased to its highest level in the area of Sidi Al Humee 2 to 18 meq/l as well SO4 reached 12 meq/l while in Slonta increased to HCO_3- meq/l. There was a weak inverse relationship between pH and sodium, potassium, calcium, bicarbonate, chlorine and sulfate. The results showed that sulphate was significantly correlated with electrical conductivity and also sodium with potassium and calcium gave significant correlations with chlorine and sodium were strong correlation with positive relationship. Chlorine with Sodium Absorption Ratio (SAR) gave significant correlation and calcium, chlorine and sulfate has a strong significant correlation.

Table 4: Results of soil analysis, Chemical analysis of soil in all study area.

Soil Analysis Sites	pH	E.C. ds/m	Cation soluble (meq/l)				Soluble anions(meq/l)			SAR
			Na^+	K^+	Ca^{++}	Mg^{++}	$HCO3^-$	Cl^-	$SO4^{--}$	
Belgara	8.105d	1.67c	8.3 c	0.30 c	5.57g	2.60e	4.00h	10.0b	2.80f	4.1 c
AlMansoura 1	7.885f	0.64h	5.7 g	0.20 d	5.20h	0.40h	5.60g	7.0 e	1.00h	3.4de
AlMansoura 2	7.745h	1.14e	8.6 b	0.40 b	7.80d	5.40d	8.40c	9.0 c	4.80c	3.3e
Habun	8.125c	0.71g	3.8 i	0.30 c	5.60g	7.20b	8.20d	4.0 h	4.7 c	1.5h
Sidi Alhamri 1	7.575 i	0.80 f	4.3 h	0.30 c	6.20f	5.60c	8.20d	5.0 g	3.20e	1.8g
Sidi Alhamri 2	7.815g	1.97b	16.1a	0.50 a	15.80a	5.40d	7.80e	18.0a	12.0a	4.9b
Slonta	7.805g	1.14e	6.5 e	0.30 c	9.00b	1.8 f	13.0a	7.0e	2.2 g	2.8f
Shahat old city 1	8.245a	1.4 d	8.7 b	0.40 b	4.20i	0.80g	5.57 g	9.0 c	0.30i	5.4a
Shahat old city 2	7.925e	1.09e	7.8 d	0.50 a	7.20e	2.60e	6.60 f	8.0 d	3.5 d	3.5d
Shahat old city 3	8.155b	2.5 a	5.9 f	0.30c	8.60c	11.0a	11.40 b	6.0 f	8.4 b	1.8g

Displays Table (5) PCA Correlation**,** Belgara strong significant correlated with AlMansoura, Shahat old city and Sidi Alhamri these sites have been involved in rare species.

Also, Habun with Sidi Alhamri (1) and Shahat old city (3) was a strong correlation reaching 0.9. While, Shahat old city (1) and Shahat old city (3) soil properties were associated with a weak correlation, this is due to the variation of the soil of the site of Shahat old city *Foeniculm vulgar* Mill. Fennel, *Laurus azorica* (Seub.) Franco and *Laurus nobilis* L. in the convergent sites, compared to the strong relationship between sites spaced out such as Sidi Alhamri 1 and Shahat old city (3).

Table 5: Results of soil analysis, PCA correlation in some study areas.

Soil Analysis / Sites	Belgara	AlMansoura 1	AlMansoura 2	Habun	Sidi Alhamri 1	Sidi Alhamri 2	Slonta	Shahat old city 1	Shahat old city 2	Shahat old city 3
Belgara	1									
AlMansoura 1	0.9154	1								
AlMansoura 2	0.868	0.8584	1							
Habun	0.4907	0.5787	0.7927	1						
Sidi Alhamri 1	0.6346	0.7436	0.8899	0.9642	1					
Sidi Alhamri 2	0.8288	0.6926	0.8551	0.4591	0.5714	1				
Slonta	0.6491	0.8402	0.8556	0.7337	0.8697	0.6117	1			
Shahat old city 1	0.9366	0.9461	0.7893	0.4081	0.5859	0.6577	0.701	1		
Shahat old city 2	0.9319	0.9535	0.962	0.6818	0.8182	0.8467	0.8592	0.889	1	
Shahat old city 3	0.4089	0.435	0.7713	0.9517	0.9003	0.5275	0.6736	0.2752	0.6094	1

Dendrogramme

Analysis of chemical soil properties allowed the creation of Dendrogramme, Figure (11) of the studied sites, showing relationships between 10 sites and soil analysis. Through the Dendrogramme Figure (11) shows the existence of two main groups at the level of about 70 % Similiarité of the percentage of convergence that shows a relationship. The first group: the electrical conductivity, potassium, bicarbonate and SAR with percentage high. The second group: divided into two groups: Where there is a convergence between magnesium content and sulfate as a group, pH, carbonate, sodium, chlorine, calcium, magnesium and sulfate. Dendrogramme illustrates relationship between chemical analysis of soil in 10 sites.

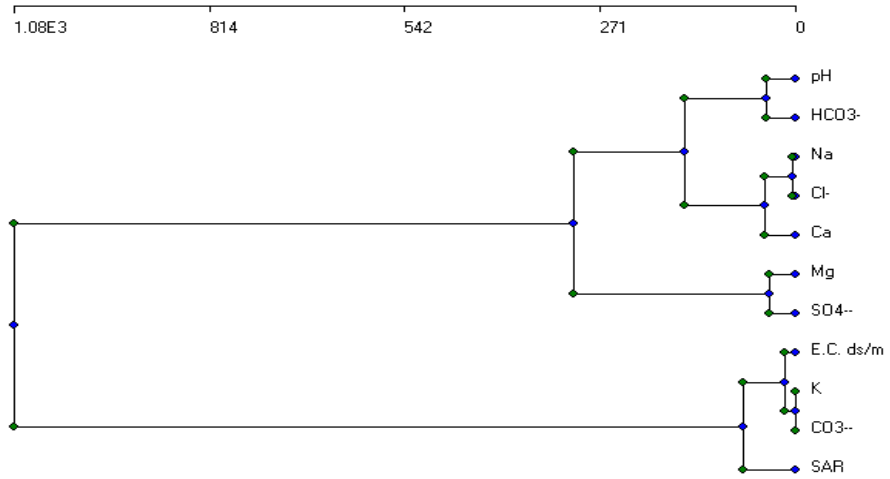

Fig. 11: Dendrogramme ordination diagram of importance soil analysis to stands of sites.

Principal component analysis (PCA)

Obtained the results from the soil analysis showed several significant correlations between the studied measures. An important variation was observed between the ten sites. The two groups were most distinguished for soil measurements. Belgara and AlMansoura (1) *Thymus capitatus* L. (Hoffm. & Link) gave an approximate sodium and chlorine content. Habun and Shahat old city (2) *Narcissus tazetta* L. were similar in the *Cation exchange capacity* (*CEC*) is the total capacity of a *soil* to hold exchangeable cations. Also similar in content potassium and carbonates are also similar in rare species Fig. (12). Found convergence between sites AlMansoura (2) and Shahat old city (3) *Helianthemum* spp. in content SAR. While, a similarity was found between Sidi Alhamri (1), Sidi Alhamri (2), and Slonta in rare species and soil characteristics as described in PCA Correlation.

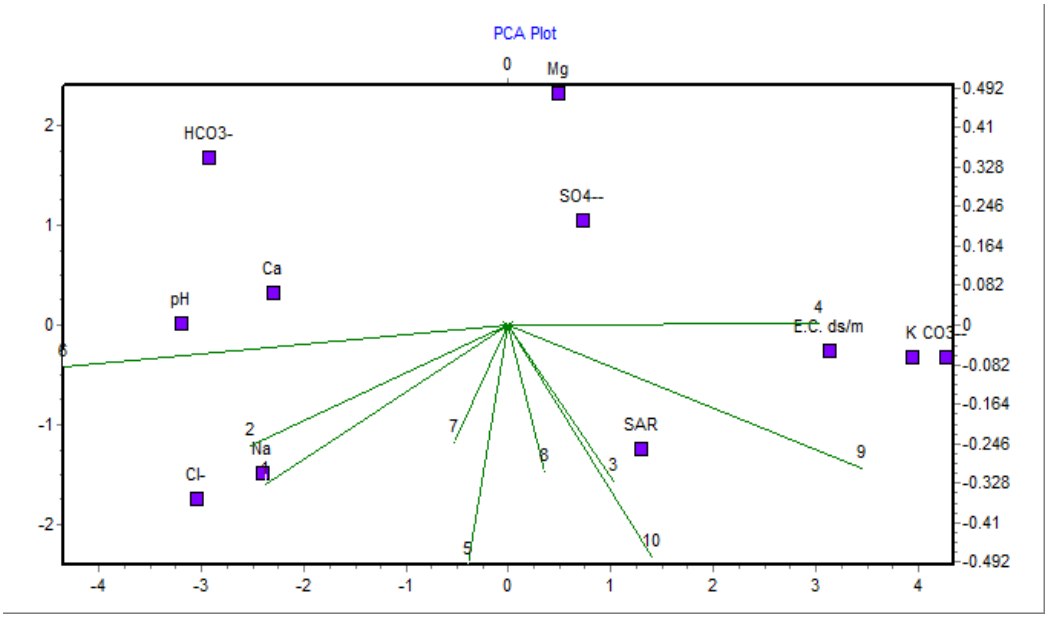

Fig. 12: Principal component analysis (PCA) 1=Belgara, 2= AlMansoura 1, 3= AlMansoura2, 4,*Habun, 5= Sidi Alhamri 1, 6= Sidi Alhamri 2, 7= Slonta, 8= Shahat old city 1, 9= Shahat old city 2, 10= Shahat old city 3*

There was a weak inverse relationship between pH and sodium, potassium, calcium, bicarbonate, chlorine and sulfate. While, showed the results that sulphate was significantly correlated ($P \leq 0.05$) with electrical conductivity and also sodium with potassium and calcium gave significant correlations with chlorine and sodium. Chlorine with significant correlation, calcium, chlorine and sulfate has a strong correlation.

The results showed differences ($P \leq 0.05$) between the study areas as well as between the different heights of the same sites, such as the difference between the AlMansoura site in the two elevations, and also between the elevations of Sidi Al Hume and three elevations of Shahat old city in pH, EC, Na^{+}, K^{+}, Ca^{++}, Mg^{++}, $HCO3^{-}$ and Cl^{-}, $SO4^{--}$ and SAR.AlMansoura and Shahat old city did not differ significantly in the ratio of sodium, while, Belgara andHabun did not differ in the ratio of calcium and the highest level of calcium was in site Sidi Hamri, the second elevation reached 15.8 meq/l. as well as sodium 16.1 meq/l. AlMansoura and Habun are similar in content to sulfur.

Similarity Index Comparisons

The similar of the number of species in the sites, Figure (13) shows the similarities in the number of rare species in the sites represented in two groups. The first group was Sidi Al-Hamri and the second group was represented in the most common sites in the number of rare species: Slonta, Al Mansoura, Habun, Shahat old City.

The variation in the number of plants per species gave two groups. The first group was in the two sites of Slonta and Sidi Alhamri, about 781 – 802 M.S.L., and the similarities were 3.51 degree or 75 %, The second group is divided into the Shahat old city group, which represents 1.47 degree or 40 % with the group AlMansoura and Habun sites they have a similarity 475 degrees in the number of plants per species.

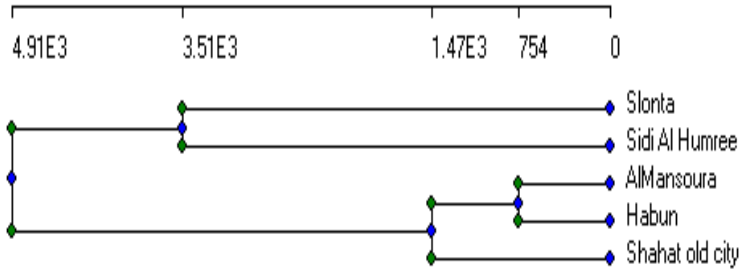

Fig. 13: Dendrogramme the variation in the number of plants per species

The site of Habun and Shahat old city is approaches in altitude from sea level, Habun site elevation 614 meters M.S.L. while the Shahat old city 580 meters M.S.L. was the most sites common of rare species followed by AlMansoura.

Conclusions

Fifteen sites studied to stand at rare species and the elevation. Because of the vulnerability plant species in Al- Jabal Al- Akhdar to degradation as a result of the negative vegetation practices and the loss of many of the important species and the scarcity of studies on rare species. Although sites was fifteen sites of 828-232 m elevation but six sites were not found rare species were Gandafora, Ashnaishn, Satiea, Alhamama (Jabal Alosaita), Wadi rels (1) and Sidi Alhamri (2). The sites differed in the distribution and number of rare species. Most rare species are distribution in elevation between 512 – 614 m such as Habun, Shahat old city, Balghara (2) and Wadi ralls. Of the 28 rare species one species was extinct *Narcissus tazetta* L in Shahat old city, it is considered one of the most species extinct in the world. The variation of the soil of the site of Shahat old city in the convergent sites, although they are the same elevation compared to the strong relationship between sites spaced out such as Sidi Alhamri (1) and Shahat old city (3). No correlation was found between seed bank density and sites. Significantly greater seed bank densities were found at Slonta, Shahat old city and Habun than at AlMansoura for both sampling times. Strong positive correlation was found between calcium, sodium, calcium, sulfate, sodium and potassium.

Recommendation

This study recommends preserving the rare species in Al- Jabal Al- Akhdar from the risk of extinction, establishing a seed bank. The study of the rare species of Ras Al-Hilal, Ein Mara, Wadi Al-Kouf and Shalalat Darnah, due to the existence of rare and endangered species in these sites. For the difficulty of collecting seeds from the soil it is advised to know when the seeds mature for each rare species and seed morphology for each species.

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Appendices

Table (a): Density and Frequency of plant species recorded in 15 site of Al-Jabal Al-Akhdar, Libya.

No.	Scientific name	Density (m^{-2})	Frequency (plan/m^2)	Site
1	*Narcissus tazetta* L.	0.00041	0.01	Shahat old city
2	*Ephedra alata* Decne.	0.00041	0.01	
3	*Foeniculm vulgar* Mill. Fennel	0.00083	0.02	
4	*Laurus azorica* (Seub) Franco.	0.00041	0.01	
5	*Laurus nobilis* L.	0.00083	0.02	
6	*Salvia fruticosa* Mill.	0.00083	0.02	Balgara
7	*Allium ampeloprasum* L.	0.00041	0.01	Sidi Alhamri
8	*Capparis spinosa* Linn. Subsp. *orientalis* (Duh.) var. *orientalis*.	0.00083	0.02	Shahat old city
9	*Fumaria capreolata* L.	0.00125	0.03	Habun
10	*Myrtus communis* L.	0.00083	0.02	
11	*Potentilla reptans* L.	0.00083	0.02	Shahat old city
12	*Ptilostemon gnaphaloides* Cyr.	0.00041	0.01	
13	*Rubus sanctus* Schreber.	0.00041	0.01	Shahat old city and Habun
14	*Sedum rubens* L.	0.00041	0.01	Wadi ralles
15	*Serratula cichoraceae* (L.) ssp. *mucronata* (Desf.)	0.00041	0.01	Balgara
16	*Valerianella muricata* (Stiven & M.)	0.00041	0.01	
17	*Bupleurum trichopodum* Boiss.	0.00041	0.01	Shahat old city
18	*Lonicera nummularifolia* Jaub.	0.00041	0.01	Balgara and Sidi Alhamri
19	*Anagyris foetida* L.	0.00041	0.01	Habun
20	*Putoria calabrica* (L.f.) DC.	0.00041	0.01	Al Mansoura
21	*Teucrium apollinis* Maire.	0.00041	0.01	Wadi ralles
22	*Thymus capitatus* L.	0.00041	0.01	Balgara , Wadi ralles and Al Mansoura.
23	*Smilax aspera* L.	0.00041	0.01	Mibra and Habun
24	*Globularia alypum* L.	0.00083	0.02	Mibra
25	*Veronica anagallis* Aquatica L.	0.00125	0.03	Shahat old city
26	*Helianthemum* spp.	0.00041	0.01	Sidi Alhamri
27	*Sedum bracteatum* Viv.	0.0025	0.06	Slonta