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Ecological study of *Juniperus phoenicea* L. in EL-Gabal El-Akhdar area, Libya

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ABSTRACT

Juniperus phoenicea L. is one of important plants in EL-Gabal EL-Akhdar area. This plant species expose to danger of extinction due to different factors. The effect of climatic changes in the area, especially increasing temperature and decreasing rainfalls were clear noticed, in addition, human impacts such as over grazing, agricultural expansion, medical plants collection, fires...etc. This study was carried out to find some ecological data and parameters for juniper plants in the area to assay their situation and to be used in conservation programs in the future. The area was classified to three different sites depending on the elevation gradient. Quadrate method with three replicates of an area of 100 m² were made in each site, and parameters of plant height, number of cones, stem diameter, vegetation cover and plant frequency were recorded and found. The results showed that the vegetation cover and frequency of juniper was differed among the study site. It was 14.77%, 11.04% and 18.50% for the cover, respectively, while the frequency was 49%, 28.50% and 88%, respectively. The growth parameters revealed different measurements for the junipers in the area.

Key words: Libyan flora: Climatic changes: Human impacts; Juniperus phoenicea

INTRODUCTION

During last decades, the amount of vegetation in the world has changed significantly. Recently, many studies focused on the possible impacts of climatic changes and human activities on plants and vegetation composition. Changes in seasonal patterns, weather events, temperature ranges, and other related phenomena have all been reported [6],[7]. This attributed to physical factors "global climate change" and anthropogenic activities, which responsible of around 30% of the damage of vegetation worldwide.

The seasonal activity of vegetation affects by the climate. Since the 1850s the effects of climatic changes, especially global warming, have been anticipated by the rise of temperature. Climate change impacts on alpine vegetation may be more pronounced than on vegetation at lower altitudes [17]. In addition, vegetation changes in central Europe have been well documented. In the arid and semi arid zones, temperature and the availability of water (precipitations) are the largest factors influencing plant growth. Depending on the amounts of rainfalls, Libya describes as one of arid zones [9]. Thus, the effect of climatic changes on its vegetation is more pronounced.

The main human activities throughout history were grazing, gathering wood for fuel, production of bees honey, gathering medication species and wood products, source of food. Therefore, the vegetation in this area is exposing to the damage by human factor [8],[9].

J. phoenecea is one of the Libyan flora, which consists of 1800 species [15]. It is evergreen, aromatic, coniferous high shrub or tree, up to 10 m high. It has a dense and conical crown. The bark is grey-brown or white-grey in ageing plants. Leaves are small, opposite, scale-like. The male cones are yellow and the female blackish-violet. They appear between February and April. The fruit is a berry-like globes cone, lustrous, dark reddish-brown, up to 1.5 cm in diameter, with 3-6 seeds.

The Phoenician juniper is a species occurring naturally in southern Europe, south Asia and northern Africa. In Libya, it distributes in the east part of Libya at El-Gabel El-Akhdar (Cyrenica) and it constitutes about 80% of the total vegetation of this area [14]. On the other hand, it is rare in the west part lands (Tripolintana).

This species is listed as threatened tree by IUCN Red List in different regions of the world [16]. Recently, death symptoms were noticed on this species in its habitat. Its exist as one of the climax plant community in the area, is exposed to the dangerous, and revealed how it suffered from global and regional climatic changes. Thus, the mean aim of this study was to assess the ecological situation of *J. phoenecea* and to provide the information to authorities. This might help to find out suitable methods to prevent its disappearing from the area during next few years.

MATERIALS AND METHODS

Study area: The study area lies on the Mediterranean coast in north eastern part of Libya (Figure 1). EL-Gabal EL-Akhdar (green mountain) extends for distance of about 250 km. Its topography includes three different levels of altitude above sea level, therefore, three different study sites with different levels were selected for this study. The vegetation and flora of EL-Gabal EL-Akhdar consists of a number of plant species using different strategies to avoid and escape from extreme climatic factors. These factors contrast the Mediterranean climatic conditions, which have the long period of drought and heat in summer with variable low precipitations in winter.



Figure 1: The study area (EL-Gabal EL-Akhdar) which appears as dark in the figure and located in the east northern part of Libya

Field study and growth characteristics of *J. phoenecea*: The study area was divided into three different sites depending on the elevation above sea level and different visits were made to the study sites. Notes and observations about the habitat like soil type, elevations, plant communities...etc. were collected and recorded. Climatic data for the last years were obtained from Libyan Metreological Authority and they were analyzed. Quadrates of 100 $m^2(10*10 m)$ with three replicates in each site were made to find out the quantitative and morphological characteristics of juniper plants. Human impacts in the study sites were noticed and recorded.

RESULTS AND DISCUSSION

The results of morphological and growth characteristics are given in table 1. From this table, the site number 3 reflected the highest value of plant height and stem diameter. They were 272 cm and 40.75 cm, respectively. Surprisingly, there were no male or female cones in this site(table 1).

Table 1: Morphological and growth characteristics of *J. phoenecea* L. in EL-Gabal EL-Ahkdar area. Data are means of 7 to 14 individuals with standard deviations. Site 3 revealed 0% of cones even though it appeared the highest morphological values

Study site	Plant height (cm)		Stem diameter(cm)		Cone ratio(m/f)
	Mean	SD	Mean	SD	
Site 1	203.25	97.26	16.9	16.9	18.33%
Site 2	221.57	104	10.54	6.58	31.33%
Site 3	272	142	40.75	34.2	0.00%

The quantitative results showed that the vegetation cover and frequency of juniper was differed among the study site (figure 2 and 3). It was 14.77%, 11.04% and 18.50% for the cover, respectively, while the frequency was 49%, 28.50% and 88%, respectively. The growth parameters revealed different measurements for the junipers in the area.



Figure 2: The vegetation cover (%) of juniper plants in three different sites in EL-Gabal EL-Akhdar area. Note that the site number 3, which classified as the highest one, revealed the highest value



Figure 3: The total percentages of juniper plant frequency in the study area. The frequency percentage is the mean of values in each study site

It is clear from the results that *J. phoenecea* plants in EL-Gabal EL-Akhdar area are exposed to huge stress which caused by climatic changes. During obvious years, the rates of precipitation in the study area were clearly decreased, while temperature levels and seasonal drought period were increased. The phenomena of "plant-climate interactions" was clear in our results and it was reflected by increasing damage and death of juniper plants because of shortage of water (rainfalls). The healthy growth, good vegetation cover, and increasing plant frequency in study site number

three which located on about 700 m above sea level and receive the highest amount of rain falls in Libya (around 700 ml/year), reflected to what extent the juniper plants in other study sites suffered from shortage of water. On the other hand, finding some juniper healthy plants in other sites might explained by availability of environmental factors in micro habitat for each individual plant.

Not only the nature plays rule in this damage, but anthropogenic factors. Due to over population in the area during few last years, the pressure on vegetation composition was increased rapidly and subsequently, huge number of plant species like juniper were affected. The activities those noticed and recorded in the study area included mining, overgrazing, fire wood collection and fire making, expansion of urbanization, agricultural processes, medicinal plants collection, and effect of weekenders (figures 4 and 5). The over growth of lichens in interaction with plants in study site number two was recorded for about 15 km, but it was not responsible for the damage of juniper plants (figure 6).

Our results were agreed with different number of studies that considered the effect of climatic changes on juniper forests. Asmode (1989) showed that *J. phoenecea* trees in Sudia Arabia, which found at low altitudes, were exposed to rapidly damage. Ahmed *et al* (1990) reported that the human activities and over population were significantly affected juniper forests of *Juniperus excelsa* in Baluchistan. Gardner and Fisher (1995) mentioned that junipers, which occurred on the slopes of mountains, are expose to water stress. Increasing temperature and seasonal drought period with decreasing rainfalls for long time can be considered as main reasons behind death of juniper trees [5], [12]. Many studies showed that climatic changes especially low precipitations and drought, in addition rural human activities such as agricultural expansion and wood cuttings were behind disturbance of juniper [6], [7]. Yeh and Wensel (2000) and Bertaudiere (2001) explained that the growth rates and annual rings of juniper trees were influenced by climatic changes.

Recently, attentions have focused on the possible impact of climatic changes on plants and vegetation. Disappearing *J. phoenecea* from EL-Gabal EL-Akhdar area might happened while plants may respond to a climatic change using different basic ways. Extinction was described as one of these ways [3], [13]. Thus, we focused to find out some data which can be used as basics in any further conservation programs of juniper plants and other plant species in the area.



Figure 4: The effect of overgrazing by goats and sheep on juniper and other plant species



Figure 5: Impact of weekenders on study area especially the solid materials, which left by weekenders, are non degradable



Figure 6: Over growth of lichens on juniper trees at the study area. This growth distributes and extends to around 15 km in study site number 2

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