



ORIGINAL ARTICLE

Examination of effect of Topography (elevation and aspect) on Distribution of Medicinal plant *Ferula gummosa* Case study: Rangelands of Khombi and Saraii Germeh city in Khorasan Shomali Province

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ABSTRACT

*Establishment of plant communities occurs under the terms of climate and environmental conditions of the habitat and Environmental factors determine the characteristics of their habitat and have important role in plants distribution pattern. This study investigated the influence of topographic factors (elevation and aspect) on the distribution of medicinal plant *Ferula gummosa* case study Rangelands of Khombi and Saraii Germeh city in Khorasan shomali Province is situated at a distance of 128 kilometers of west Bojnourd city and 60 kilometers north of Jajarm. Following of determination of habitat *Ferula gummosa* and classification of the four classes of elevation 1600,1700,1800 and 1900 meter and 4 for the main geographical aspect its distribution in the 8.8-square-meter were investigated. The results show that elevation classes 1600 m with other elevation classes' is difference significant. Between the North and the other directions are also significant differences. So elevation and aspect with effects on the temperature and humidity are the main factors controlling the distribution of plant species.*

*Keywords: *Ferula gummosa*, Topography factor, Rangelands of Khombi and Saraii.*

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INTRODUCTION

Establishment of plant communities occurs under the terms of climate and environmental conditions of the habitat and the plants are not randomly distributed across the globe. It is possible distribution of any plant in specific geographic limitation because any plant has specific environmental requirements that, If have in a certain area of growth and reproduction, these requirements must be provided [1]. Environmental factors have determining the characteristics of their habitat and Play an important role in the distribution of the plants so that the plants control establishment and distribution. Therefore, the environmental conditions and the requirements of a species can be judge in determination of establishment location, density and their activity in different environments [2]. According to the impact of various factors of climate, topography, bedrock and biological factors on soil and vegetation and special relationship each of these factors with other in a particular environment, each region is characterized by natural vegetation that representative of specific soil is was faced [3]. Factors affecting the distribution of plants may be caused by environmental factors or features from both. Factors affecting the distribution of plants associated with plant characteristic typically in smaller scale and Properties are mainly associated with environmental factors in large-scale distribution [4]. Topography directly through modification of environmental factors, and indirectly through its effect on soil formation, has a major impact on plant communities. Knowing the topographic characteristics is essential and helps to manager's land. With the increasing of elevation above of sea level, the average temperature dropped due to other climatic factors led to the formation of climatic zones, As a result, areas of special plant species diversity is created [5,6]. Several studies on the effect of topography on the distribution of species occurred. . Khademhosayni, et

al., [7] the effect of topography and climate on the distribution of vegetation in shrub lands Arsanjan concluded that altitude and aspect effects on the temperature and humidity are the main factors controlling the distribution of plant species. Acknowledging that the results of this study suggest the effects of environmental factors on the control and distribution of plant species, However adverse effects of human activities on the sustainable management of rangelands is irrefutable. Abdullahi, et al., [8] height above sea level, geological structure, geographic aspect, the amount of available water, depth of soil, the most important factor in the distribution of plant species and soil characteristics affecting in classification of vegetation types in studied area. Haji Mirza Aghaii [9], results show that the highest value species richness at lower elevations and last its amount were observed at high altitudes, and can be attributed due to a lower temperature at high altitudes. Also with increasing elevation in the area decline depth of soil and water infiltration is reduced and precipitation moves run off and caused erosion in area that negative effect has on species richness in mountain. *Ferula gummosa* is the most important production of rangelands and also has medicinal and industrial value, grows abundantly in many parts of Iran and, of course, is the property of Khorasan, *Ferula gummosa* habitat extends from north to south Khorasan and the most important ones are: Khambi, Sarabin in Bojnourd and Golestan forest, Armatlo, Garmeh, Chamanbid, Robatkhayl and north elevations Bojnourd to Amozeshdakeh in Shirvan and Kastan, Gharehkhoh, Aghlameh and Binaloud mountain and Sabzevar elevations, Kashmar, Dej mountain, Badam in around of Ghochan, Hemati mountain between Sabzevar and Khashmar. The most of its utilization is in the provinces of Semnan, Tehran and Khorasan [10]. *Ferula gummosa* is a mountainous and summer plant [11]. Elevation ranges from about 1,000 to 4,000 meters, aspect mostly very steep slopes over 40%, mainly in the north and semi-arid climate sometimes cold and ultra-cold Mediterranean, and rainfall of 300 to 400 mm, means annual temperature between 35 and 12 °C, grows [12]. *Ferula gummosa* grows in spring at temperatures from 3 to 25°C and at temperatures above 25 °C, it growing stop and will have minimal activity [12]. Asgarizadeh *et al.*, [13] in examination of ecological characteristics and cropping *Ferula gummosa* in Mashhad concluded, So far in the province, about 27 sites *Ferula gummosa* have been identified *Ferula gummosa*. Habitat area is about 171,500 ha and the exploitation of gum receives amount 100 t/y that one milliard rails has impure income.

The range of adaptability *Ferula gummosa* is high, So that in forest of Pestehshorlagh in Serakhs area at an elevation of 650 meters and at elevation Shaskou in Ghaen area in ranges between 2,000 and 2,800 meters distribute. It can be seen in the aspect of north-south and east-west. *Ferula gummosa* in semi depth soils with coarse texture can be seen. Ecological studies have shown that the best habitat is in the northern aspect at an elevation of 2,000 to 4,000 meters with deep soil with good drainage and too much calcic and organic matter.

Although its range of adaptability is high but it is found in areas where the elevation, rainfall, humidity and temperature, and consequently the vegetation and flora closely with other and have similar ecological conditions and an average elevation of 2000 meters grows and mainly on the northern aspect with the high organic matter comparison with southern aspect has high density. The slope of the study area is between 30 percent in Gerokalat area and 70 percent in Jozak in Bojnourd. According to the strategic importance of this species and its distribution in the province aim of this study was to examine the influence of topography on the distribution of *Ferula gummosa* species.

MATERIALS AND METHODS

Materials

Location of the study area

Area at a distance of 128 kilometers west Boujnourd and 60 kilometers North Jajarm was located. The highest point is 1942 meters above sea level in the southwest region and the lowest point at an altitude of 1185 meters above sea level is near Cheshmeh khan thus the difference between the minimum and the maximum altitude is 769 m. Study area, the area is rich *Ferula gummosa* is a mountainous area with a slope of more than 60 per cent. Rainfall means in the study area is 300/7 mm that The most rainfall in April and the lowest rainfall on August 49/6 mm 3/1 mm respectively. The absolute maximum and minimum temperature in a period of 20-year in the study area is, 43 and 18 °C respectively and the monthly average temperature is 14.3°C. The regional climate is semi-arid climate in Domarten view climate and in climate view of Ambrgeh is semiarid cold.

Methodology

After identification of the sites *Ferula gummosa* study area classified four classes elevation, 1600, 1700, 1800 and 1900 m and four aspect to South, West, East and North. In this research by using the method of minimal area plot size was 8 x 8 and for determination of number size by using statistical method bu using the following formula

Formula (1) $N = \left(\frac{t \cdot CV}{d}\right)^2$

N: Minimum number of sample t: t-Students CV: Coefficient of variation d: is the percentage of accuracy. 64 plots were estimated and randomly were steered and for determination distribution presence or absence of species in all plots was examined.

RESULTS

Analysis of percentage *Ferula gummosa* in different aspect

In this regard, the ANOVA test shows significant differences between the performances of aspects in vegetation distribution (table 1).

Table 1 – Mean of variance test distribution of *Ferula gummosa* in different aspects

| Source of change | Sum of square | df | Mean square | F | Significant level |
|------------------|---------------|----|-------------|-------|-------------------|
| Between group | 1322/114 | 3 | 440/705 | 3/607 | 0/020* |
| Within group | 6109/354 | 50 | 122/187 | | |
| Total | 7431/468 | 53 | - | | |

*: Significant at 5% level

According to result of table 2, there were no significant differences between the northern and southern aspect, So that the maximum distribution is seen on the northern aspect. But between the southern, eastern and western aspect there is no significant difference. Also lowest distribution in the southern aspect was seen.

Table 2- Duncan test of mean of distribution *Ferula gummosa* in different aspects

| Aspect | Mean of distribution |
|--------|----------------------|
| North | 22/82 b |
| South | 8/014 a |
| East | 13/57 ab |
| west | 14/38 ab |

Analysis of percentage *Ferula gummosa* in elevation levels

Analysis of variance of vegetation distribution data according to elevation factor show that there was significant difference in distribution of plant (Table 3).

Table 3 – Mean of variance test distribution of *Ferula gummosa* in different elevation

| Source of change | Sum of square | df | Mean square | F | Significant level |
|------------------|---------------|----|-------------|-------|-------------------|
| Between group | 1345/490 | 3 | 448/49 | 3/685 | 0/0018* |
| Within group | 6085/978 | 50 | 121/720 | - | |
| Total | 7431/468 | 53 | - | - | |

*: Significant at 5% level

Mean difference of *Ferula gummosa* distribution that there is significance difference between 1600 m elevation class with other elevation classes. So that 1600 m elevation has the most distribution and there was no significant difference among 1700, 1800 and 1900 m elevation (table 4).

Table 4- Duncan test of mean of distribution *Ferula gummosa* in different elevation

| Elevation | Mean of distribution |
|-----------|----------------------|
| 1600 | 2a4/57 b |
| 1700 | 11/59 a |
| 1800 | 15/93 a |
| 1900 | 12/04 a |

DISCUSSION AND CONCLUSION

Elevation effect

According to result, distribution of *Ferula gummosa* decreased with increasing elevation. Despite the numerous studies Saied, *Ferula gummosa* distribution elevation in the high elevations about 1000 to 4000 m [14], but it has decreased with increasing elevation. Since the high-elevation wind velocity is more and for this reason the intensity of vaporization is more, so the high elevation is less favorable for plant growth. Also, because of the short growing season of plants and the lack of adequate heating and plant uniform growth was limited in the highlands [15]. On the other hand, it can be attributed to lower temperatures at high elevation. Based on the study, optimal temperature for growth is between 5 and 25 °

C [12]. Also with increasing elevation in the area decline depth of soil and water infiltration is reduced and precipitation move run off and cause of erosion, loss of soil fertility and water availability in the region [8]. Since *Ferula gummosa* needs deep soil, good drainage and high organic calcareous material and calcic ecologically, So its distribution at high elevation are affected that with results of other studies such as [13,16, 17, 18], corresponded. On the other hand, in high elevation intensity of solar radiation reduce and UV intensity funeral will be higher and Plant growth reduced and *Ferula gummosa* is plant long day (2) hence its distribution was limited in high elevation.

Aspect effect

The *Ferula gummosa* distribution varied in different aspect, northern aspect have the greatest amount of distribution, but the eastern aspect, west and south aspect were no different. In the northern hemisphere, temperature by changing aspect from the north to the East and the West and South increased. Aspect of slope has considerable impact on the vegetation and animal grazing. In general in northern hemisphere South and West aspect time and focus of sun's rays on the surface is longer and comparison with north lands. Moisture content is less and production and plant diversity is varying in east and north aspects [19]. Topography with changing climate on the one hand accelerating gradients of temperature and evapotranspiration increases in south aspect and on the other hand reduces this processes in north aspect and this makes in north aspect deeper soil, more organic matter and vegetation is denser. According to *Ferula gummosa* dependent on soil with rich humus and organic matter therefore its distribution will be more in north aspect. On the other hand southern and eastern aspect receives more radiant energy received and at result *Ferula gummosa* growth is limited. By increasing the temperature to about 33 ° C during three days, the plants turned yellow and dry. According to habitats of *Ferula gummosa* at elevation of 2,000 to 3,000 meters temperature of about 30 degrees in the summer in most areas exceeds, it also can be one of the reasons arrive the plant to summer dream [14].

CONCLUSIONS

Favorable conditions in the northern aspects could be caused distribution this species, although this specie for tolerance unfavorable conditions and high adaptability especially xerophyte in west and south aspects is more sustainable but because of much destruction factors in southern aspect, unfortunately its dominant decrease and in north aspect has better distribution. So it is necessary protection of this specie.

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