



The Study on Some of Ecological Specifications of *Gentiana olivieri* a Medicinal Species in Rangelands of Fars Province, Iran

Damoun Razmjoue^{1*} and Zahra Zarei²

¹Department of Range and Watershed Management, Faculty of Natural Resources,
Behbahan Khatam Alanbia University of Technology, Behbahan, Iran.

²The Range management, Behbahan Khatam Alanbia University of Technology, Behbahan, Iran.

Authors' contributions

This work was developed in collaboration by the both authors, who contributed equally to the literature review and writing of the manuscript. Both authors read and approved the final manuscript.

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ABSTRACT

According to the importance of medicinal plants and the necessity of comprehensive understanding them for exploitation; some ecological aspects of *Gentiana olivieri* plant that is from Gentianaceae family were reviewed. This study was done in 5 counties that were as the habitat of this plant. In first stage in each site physiognomy units were separated, and in each unit, one reagent zone was specified; and in each site, by random systematic method, 4 transect with 100 m length and along each of transect, 5 plots 2×2 were selected. And the data related to vegetation and soil were gathered. The obtained results showed that the factors such as: vegetation percent, density, abundance and the height of plant in different sites are affected by the factors related to soil. As the areas that had the most percent of sand and minimum percent silt, clay and EC had the minimum vegetation percent; and the areas having the most amount of K,OC and EC, had the most plant height and the areas having the maximum clay amount and pH had the minimum density and abundance and plant height. Meanwhile, the habitats of this plant were from 1600 to 2000 m from

*Corresponding author: Email: d.razmjoue@gmail.com, d.razmjoue@bkatu.ac.ir;

sea level and were as the relatively hillside lands with the slop less than 20 percent and in all geographical directions.

Keywords: Ecological; medicinal plant; *Gentiana olivieri*; Fars province; rangelands.

1. INTRODUCTION

The plants as one of the main components of ecosystem, has a significant role in the life of other living things and protection and balance of ecosystem. According to the significance of plant species in rangelands, it is necessary to proceed for understanding the ecological specification of them [1]. The study on ecological specification of rangeland species, provides the necessary knowledge for proper usage of this species in modifying of rangeland ecosystem and its scientific management [2]. A key prerequisite of a rangeland management, is understanding the ecological relationship between its components, when in an environment a species plant grows, it affects on the soil specifications and also soil will affect on vegetation. The obtained results of studies have showed that soil specifications are as one of the effective factors on vegetation [3]. Many studies have done in the field of reviewing the interaction of vegetation and soil up to now. Kansaran et al. [4] by reviewing the ecological specifications of *Erisimum amasianum* species found that presence of this species causes increase of nitrogen, potassium and calcium in the soil. According to the obtained results of study on the relation between soil specifications with vegetation factors done by Akbarlou et al. [5] it was found that the percent of vegetation canopy and species diversity in comparison with the changes of soil factors is more affected by the changes in the soil factors. And the amount of clay percent and electrical conduction are as the effective factors on the vegetation factors. Moradi et al. [6] to study on some of the ecological specifications of plant communities of Baghe-Shad found that scattering and establishing the plant communities are related with the depth and texture of soil. And the other ecological factors such as pH, phosphorus, potassium, nitrogen and the percent of organic materials has less importance in dispersion of region plant communities. Jafari et al. [7] to study on the relation of vegetation with some of soil specifications in Nadooshan Rngeland of Yazd province got to this result that there is an especial relation between vegetation dispersal and soil specification; as the soil texture, gypsum, potassium salts, lime and electrical

conduction has a significant effect on regional vegetation. Fu et al. [8] in a study on relation between soil specifications and plant diversity in China found that the organic materials of soil and the total amount of nitrogen, have the most effect on the dispersion of plants communities. Medicinal plant of *Gentiana olivieri* form Gentianaceae family has dispersion in Turkey, Iran and Iraq. This plant is as a perennial herbaceous plant, having blue- violet flowers, oval and brown seeds, with the length of 0.8 to 1 mm, Stems erect, slender, simple, glabrous. Inflorescences terminal corymbose cymes of 3-5 flowers. Stamens inserted just below middle of corolla tube; filaments 6-8 mm; anthers linear, 2.5-3 mm Testa is thin reticulate and grows in calcareous soils, clay, maren and the rangeland covered by grass and in height of 350- 2300 m. Height of this plant is 10-30 cm from a basal rosette. Root stock is sheated with a fibrous collar at apex [9]. This plant because of having flavonoids and alkaloid compounds, is used for diabetes, depression, dyspepsia, gastrointestinal diseases and colds. Also is useful as a analgesic and anti-inflammatory [10,11,12]. According to the importance of *Gentiana olivieri* plant and as the analysis of vegetation and soil status provide the most data for classification of habitat and availability of food, the main purpose of this study is studing on some ecological factors of this species and determining the most important effective soil factors on the mentioned species so that, by cognition of the relation and generalize the obtained results in similar areas, by spending minimum time and cost, propose the managerial strategies to improve and development of rangelands.

2. MATERIALS AND METHODS

2.1 Introduction of Studied Sites

- Khoh Pardis site of Laar county

This site is located 50 km from this county between longitude of 53°33 ' 17 " to 53°22 ' 56 " and latitude of 27°29 ' 19 " to 27°25 ' 32 " ; the average temperature is between 25-30°C and rainfall mean is annual 80-210 mm (Fig. 1).

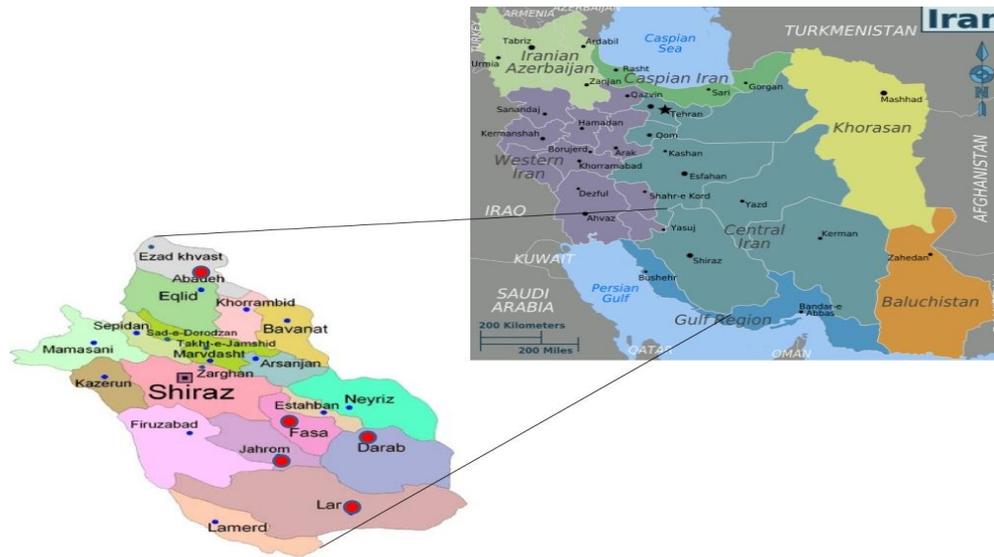


Fig. 1. Study sites of *Gentiana olivieri* in Fars province

- The site of Abadeh-Tashk county

This site is located 100 km from Neyriz county that is between longitude of 53°45' 58" to 53°39' 48" and latitude of 29°49' 22" to 29°45' 17" and the mean temperature is between 20-25 °C and rainfall average is annual 250- 350 mm (Fig. 1).

- The site of Jahroom county

This site is located 160 km from south of Shiraz that is between longitude of 53° and 32° eastern and latitude of 28° and 29° northern. Rainfall average is 230 mm and the annual mean temperature is 23°C (Fig. 1).

- The site of Darab county

This site is located 180 km from Shiraz that is between longitude 33° and 54' eastern, and latitude of 28° and 45' northern; that the rainfall average in this site is 180 mm and the annual mean temperature is 19°C (Fig. 1).

- The Site of Fasa county

This site is located 145 km from south of Shiraz that is between longitude 53° and 39' eastern and latitude 28° and 55' northern. The annual rainfall average of this site is about 300 mm and annual average temperature is 18.5°C (Fig. 1).

2.2 Vegetation Sampling

In 2013 by desert reviews and librarian studies, the main habitats of mentioned plant were identified; and by using aerial photographs scale

of 1: 20000 and topographic map with a scale of 1: 50000, it was preceded to separate the physiognomy units.

In each physiognomy unit the reagent zone was selected and in each site by using random systematic method, 4 transects with 100 m length (according to the distribution, density and vegetation) and along each transect, 5 plots of 2x2 S² were selected. The size of sampling unit in each type by minimum area method and also the number of plot by statistical method was specified. After installing transects and plots, the data related to vegetation include percentage of vegetation canopy, density, abundant, height of plant (In the months of May and June) and plant phenology (In all months) were gathered and measured.

2.3 Soil Sampling

In relation to the Soil (agrology) studies, according to the habitat characteristics in terms of size and homogeneity in geology and topography, in order to investigate the characteristics of the soil 3 profiles along transects were dug in each site at the foot of *Gentiana olivieri* (totally 15 profiles in two depth). Likewise in each profile two depth, one affected by the organic matter (10-0 cm) and the other not affected by the organic matter (50-10 cm) were taken.

From each level and each sample approximately two kilograms were harvested and to evaluate

the physical and chemical properties such as texture (clay, silt and sand) with a hydrometer, organic carbon (OC) using black linen and nitrogen (N) using crude, phosphorus (P) by Olson and colleagues, and potassium (K) measured by flame (flame photometry), PH and EC Soil were transferred to the laboratory.

Soil samples transferred to the laboratory were flattened on thick papers and rough parts, pebbles, roots, leaves and other inseparable organic residues were separated. After drying the samples in air, we ground them in a mortar and screened them in two mm sieve John.

3. RESULTS

3.1 Study on Vegetation

According to the obtained results of floristic study, 160 plant species were identified in 5 considered sites that the most species are belonging to families (Laminaceae, Papilionaceae, Poaceae) in sites of Abadeh Tashk and laar and (Astreaceae, Poaceae, Apiaceae) were found in Darab, Jahroom and Fasa sites.

3.2 Phenology Study on *Gentiana olivieri* Plant

The study on phenologic stages showed that the start time of this species growth according to the climatic conditions in all sites is mid February and early March and in late April, vegetative growth completely terminate according to the climate and physiographic specifications of the zone.

From early May, flowering stage of this plant starts and in late June ends. Its seeding stage starts completely from late July and ends to the late August; and then aerial parts of plant become dry and from early October is seen as a dried and inactive plant (Fig. 2).

3.3 Vegetation Specifications

To determine the difference between vegetation specifications of table analysis, the one side variance was formed; and it was determined that the percent of vegetation in level of %5 and density and plant height in level of %1 have significant difference (Table 1).

By using Duncan multi range comparison test (Table 2) it is seen that the most vegetation percent is related to Abadeh Tashk site and their minimum is related to Laar site, although there is not any significant difference between these four sites (Laar, Jahroom, Darab, Fasa) (Fig. 3).

In terms of density, the minimum is belongs to two sites of Darab and Laar and the most of them is related to Fasa an Abadeh Tashk (Fig. 4). In terms of abundance factor, the maximum abundance is related to Fasa, and the minimum is related to Darab (Fig. 5). And finally Jahroom and Abadeh Tashk allocated the most rates of plant height to themselves; while the minimum plant height was seen in Darab (Fig. 6).

3.4 Study on Soil Specifications

General comparison of variance analysis table of sites in both deeps of (1-10 and 10 -50) shows that only in K amount, there is a significant difference in level of %5 (Table 3).

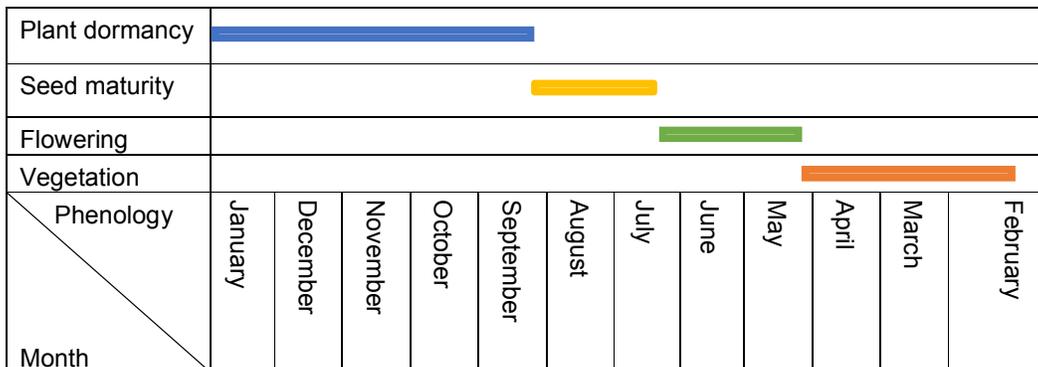


Fig. 2. Phenology stages of *Gentiana olivieri* in Fars province

Table 1. The results of variance analysis and significant levels of sites in vegetation specifications

	Significance level	F amount	Mean squares	Freedom degree	Sum of squares		
*	0.049	2.59	53.148 20.549	4 47	212.592 965.814	Sight error total	Vegetation percent (%)
**	0.000	7.854	3.179 0.405	4 46	12.716 18.618	Sight error total	Density
ns	0.164	1.668	0.41 0.246	4 95	1.64 23.35	Sight error total	Abundance
**	0.000	11.895	664.326 55.849	4 42	2657.304 2345.675	Sight error total	Plant height (cm)
				46	5002.979	total	

In each column, the averages having common letters don't have significant difference with each other in level of 5 percent. * Significant at the 5% level; ** Significant at the 1% level; NS- Not significant

Table 2. The comparison results of vegetation specifications average in different sites by Duncan test in level of 5 %

Height (cm)	Frequency	Density	Cover (%)	Site
B 32.40	AB 0.50	B 1.80	B 0.140	Lar
A 48.90	AB 0.55	A 2.55	B 0.460	Jahrom
B 28.50	B 0.30	B 1.33	B 0.147	Darab
B 34.00	A 0.70	A 2.71	B 0.164	Fasa
A 45.13	AB 0.50	A 2.70	A 3.531	Abade Tashk

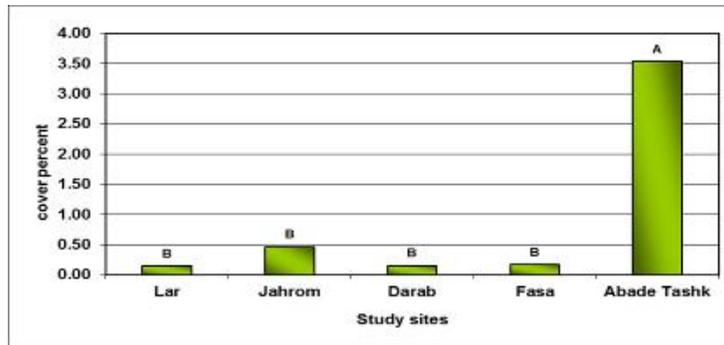


Fig. 3. Cover percent of *Gentiana olivieri* in studied sites

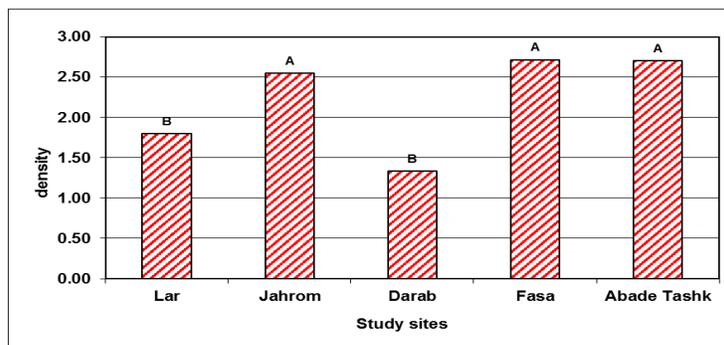


Fig. 4. Density of *Gentiana olivieri* in studied sites

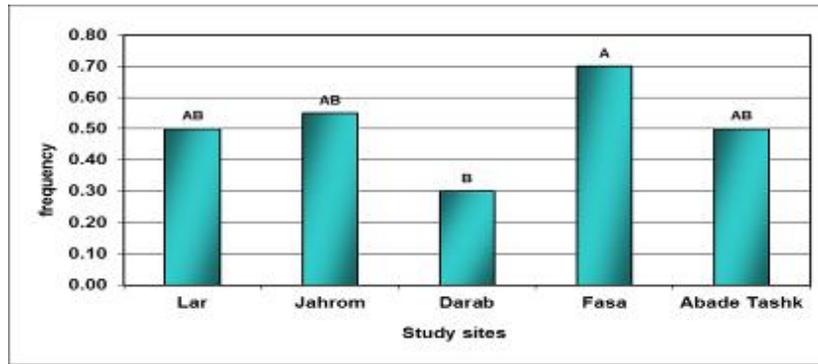


Fig. 5. Abundance of *Gentiana olivieri* in studied sites

Table 3. The variance analysis results of pedological specifications in 0-10 (cm) and 10-50 (cm) deeps

	Significant level	Famount	Average of squares	Free degree	Sum of squares		
ns	0.229	1.513	0.234	4	0.934	Site	EC
			0.154	25	3.858	Error	
				29	4.792	Total	
ns	0.105	2.142	0.258	4	1.033	Site	pH
			0.121	25	3.014	Error	
				29	4.048	Total	
ns	0.251	1.438	0.751	4	3.003	Site	OC
			0.522	25	13.05	Error	
				29	16.053	Total	
ns	0.594	0.708	0.009	4	0.034	Site	N1
			0.012	25	0.3	Error	
				29	0.334	Total	
ns	0.255	1.426	36.533	4	146.133	Site	P1
			25.628	25	640.708	Error	
				29	786.842	Total	
*	0.05	2.763	13417.8	4	53671.2	Site	K1
			4855.92	25	121398	Error	
				29	175069.2	Total	
ns	0.858	0.325	11.617	4	46.467	Site	Clay
			35.72	25	893	Error	
				29	939.467	Total	
ns	0.104	2.15	77.783	4	311.133	Site	Silt
			36.173	25	904.333	Error	
				29	1215.467	Total	
ns	0.583	0.726	57.167	4	228.667	Site	Sand
			78.78	25	1969.5	Error	
				29	2198.167	Total	

* Significant at the 5% level; ** Significant at the 1% level; ns Not significant

Also it can be concluded from comparison of sites average (Table 4) related to both deeps that the most amount of OC, EC and K has seen in Jahroom, while the most percent of clay and pH is related to Darab site.

Laar also has the most sand percent amount and the minimum percent amount of silt, clay and EC. The difference of sand, clay and silt percent is probably related to different textures of studied sites (Fig. 7).

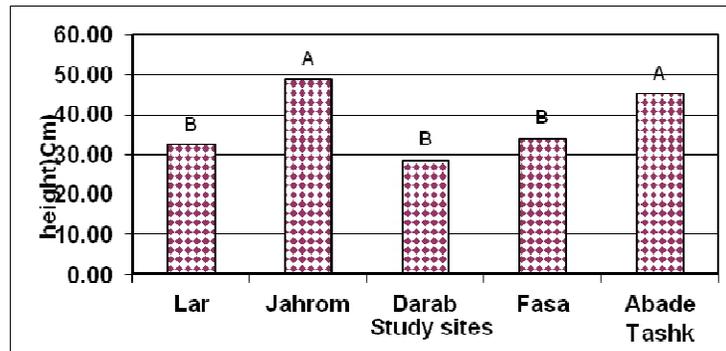
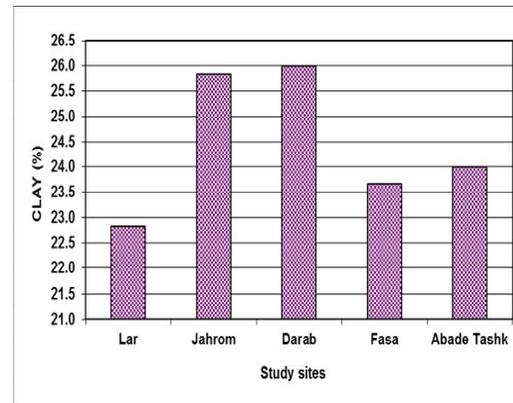
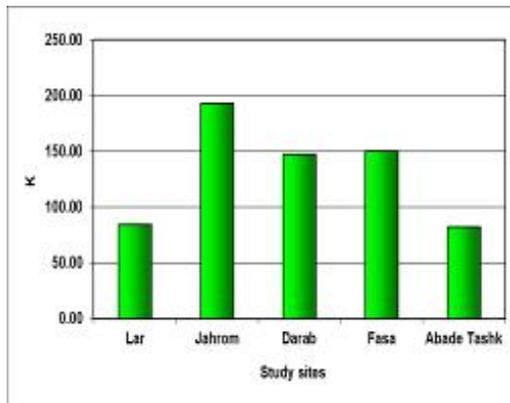
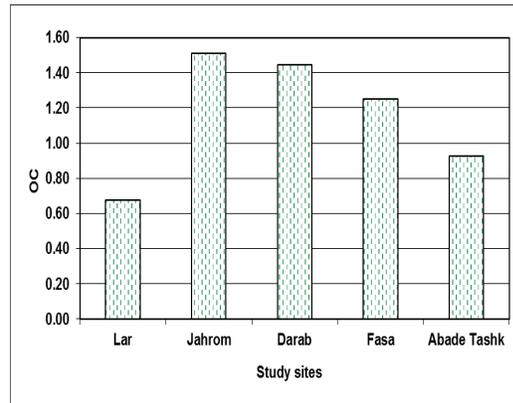
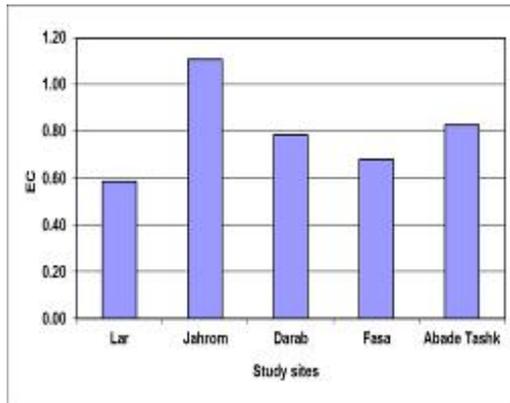


Fig. 6. The height of *Gentiana olivieri* in studied sites

Table 4. The comparison results of pedological specifications average in 0-10 (cm) and 10-50 (cm)

Site	EC	pH	OC	N	P	K	Clay	Silt	Sand
Lar	0.585 B	7.833 AB	0.675 A	0.082 A	2.583 A	84.500 B	22.833 A	34.167 A	41.500 A
Jahroom	1.107 A	7.800 AB	1.510 A	0.143 A	8.417 A	192.670 A	25.833 A	41.500 A	35.667 A
Darab	0.783 AB	7.997 A	1.443 A	0.108 A	7.583 A	147.170 AB	26.000 A	37.333 A	37.333 A
Fasa	0.680 AB	7.900 A	1.250 A	0.182 A	7.250 A	150.170 AB	23.667 A	41.667 A	41.333 A
Abadeh Tashk	0.828 AB	7.450 B	0.927 A	0.123 A	8.583 A	82.500 B	24.000 A	34.667 A	35.000 A



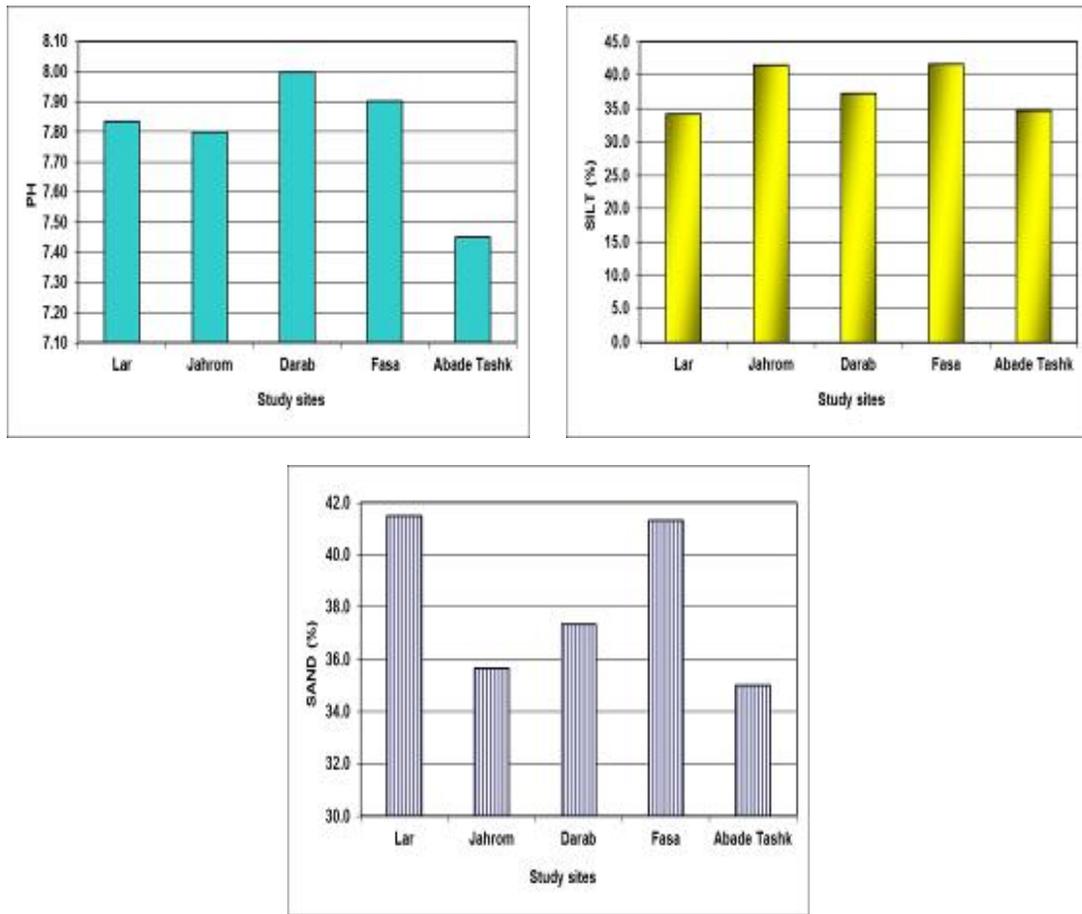


Fig. 7. The amount of soil components in studied sites

4. DISCUSSION AND CONCLUSION

Gentiana olivieri species in rangelands of Fars province have height range of 1600-2000 m. The long term rainfall average of this habitat is annual about 230 mm and annual average temperature of these zones is 20°C.

This species is commonly seen in flat zones toward hillsides and in low slopes. Phenologic process of *Gentiana olivieri* plant starts always from mid February and to late April its vegetative growth ends.

From early May the plant flowering stage starts and to late July ends; and then the plant starts its seeding stage and after producing seed, it is seen as a dried plant. Some differences in the phenology time of this plant in studied sites were seen but this difference is negligible and is not significant; so this principle confirms the Ahrar's theory [13].

According to the obtained results of botany field studies of this research, in each site about 50 species and totally 160 species were identified. It is worth mentioning that there is remarkable number of another species in the ecological habitat of *Gentiana olivieri* species; and it is hoped that this ecosystems are sustainable; and is as principle of competitive exclusion or ball [14].

According to obtained results of studies on the soils of studied zone it can be concluded that the zones with most percent sand and minimum silt, clay and EC, has the minimum percent of vegetation; this results are comply with the results of study done by Akbarlou et al. [5] that said the percent of vegetation canopy and species diversity are affected by changes of soil factors such as amount and percent of clay and electronic conductivity.

The plants in the regions having the most amount of K, OC and EC, have the maximum plant height and the regions having the most amounts of clay and pH, have the minimum density and abundance and plant height. That the obtained results of this study in quite comply with the results of studies done by Jafari et al [7] and Moradi et al. [6] and Fu et al. [8] that knew soil chemical and physical factors as the factor of plants dispersion and also considered it effective on vegetation factors. This mentioned items totally are caused by climatic status and are more affected by soils of studied regions [15].

Najafi [16] in a study on the relation of ecological factors with dispersion of plant communities of protected Geno zone, has mentioned organic carbon as one of the effective factors on separation of plants communities. In another study, Boer and Sargeant [17] also in the east of Saudi Arabia proved the relation between vegetation and texture; in the mentioned study, this matter is proved as well.

Anyway, in general, this study showed that soil factors is as one of the effective ecological factors on dispersion of this plant in 5 considered sites; and because *Gentiana olivieri* plant is as one of the medicinal plant of this regions, so, by recognition of other regions soils, some effective steps can be taken toward modification and development of this plant.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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