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Full Length Research Paper

Environmental factors affecting the distribution of *ferulagummosa* (Boiss) in northwest rangeland of Iran

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In this study a number of ten 4-square-meter plots with 15 m. spacing on three 150-meter-long transects were systematically randomized in each key areas within each habitats. Characteristics such as total canopy cover, canopy cover of target species and percentage of sand and gravel on the soil surface were measured. Three mixed soil samples from the locations beginning, middle, and end of each transect were collected to determine soil properties. Physiographic and climate factors of each selected site were determined. Independent sample T-test, Analysis of Variance and Discriminant Analyses were used as statistical analyses methods. The results showed that all variables in the presence and absence places of F.gummosa have significant differences (p≤0.01). Results of discriminant analysis suggested that the quantity of electrical conductivity, acidity, organic carbon, potassium, phosphorus and percentage of sand and silt, the percentage of stone and gravel on the soil surface, amount of slope, geographical aspects, altitude, annual precipitation and environmental temperature in the presence or absence of F.gummosa species were effective. Our study results indicated that the variables of the total neutralizing value and geographical aspects were considered as the most effective factors in distributing the studied species.

Keywords: Environmental factors, *ferulagummosa*, Iran, species distribution.

INTRODUCTION

Iran with different climatic conditions and different geological formations and soils, is the habitat of many plant species, and by recognizing the effective factors on growth along with distribution of species and their compatibility, we can prevent excessive costs and time wasting in planning rangeland restoration (Jafari et al., 2008). Considering the difference in conditions and species between ecological species groups of one region, we can identify appropriate protection and management strategies for each group (Azarnivand & Zare, 2008). The correlation between vegetation and environmental factors is one of the most important issues affecting the formation of the structure of plant communities and their distribution in each area (Ghorbani et al., 2015). Analyzing the relationship between vegetation and environmental factors requires a full understanding of the processes of environmental factors affecting vegetation (Austin, 2005). Researchers illustrated that the soil characteristics is an important factor on planned community distribution particularly in dry regions (Ghorbani & Asghari, 2014). Plant communities are inherently dynamic with changing environmental factors such as changes in climate, topography and soil change (Drinbock, 2002). Discovering the relationships between the vegetation and environmental factors and awareness along with correct

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and realistic understanding from these relationship are considered as fundamental issues in systematic management and planning rangeland ecosystems, in dry regions in particular. These discoveries seem essential for systematic management and sustainable use of such ecosystems (Jafari et al., 2011).

Ferula gummosa (galbanum plant) is a perennial plant of the Apiaceae family and it yields flower only once. In the first few years of growth, it produces crown leaves and in the final year of growth it goes to its stem and produces flowers and seedling stages. The species of this family are mainly expanded in the Mediterranean, Turkey, Iran and Turkmenistan and in general in Central Asia to the West across the Mediterranean to North Africa (Mozaffrarian, 2007; Ghahraman, 1993). The genus of Ferula has 170 to 185 species (Kurzyna et al., 2008; Pimenov & Leonov, 1993). This plant is one of the most valuable medicinal and industrial plants that grows in the rangelands of Zanjan province in the North-West of Iran. In terms of soil and water conservation in rangelands and hay production this plant is worthwhile. According to studies, distribution of F.gummosa species in rangelands of Iran was limited and this species is endangered (Beygzadeh et al., 2015). Because of the lack of information about this species, this study was carried out aiming to investigate environmental factors involved in its dispersion, especially in rangelands of Zanjan Province, to determine the most effective ecological factors in its distribution in order to proceed for conservation and restoration and improvement of vegetative areas by implementing appropriate management strategies.

MATERIALS AND METHODS

The study area

Zanjan is one of the provinces in the northwest of Iran, which is situated in 35˚ 35' to 37˚ 15' north latitude and 47˚ 10' to 49˚ 21' east longitude. The selected F. gummosa habitats in this study are at the altitude of about 2,200 to 2,600 m above sea level. Geographical location of each selected habitat have been shown in Figure 1. The Characteristics of each selected sites are presented in Table 1. The habitats of F. gummosa were selected by the literature (Ghahreman, 1993; Mozaffarian, 2007; Aghajanlou et al., 2015), fieldwork, and considering the distribution range of species in the rangelands of the study area. Accordingly, four sites for the study of F. gummosa were selected as the presence of the target species, and in the selected habitats a sites without the distribution of target species were selected as the absence of this species in the adjacent area.

Sampling

The sites with the presence of species, according to the distribution of the selected species, and in adjacent sites (absence of species), three points were randomly selected in the key area. In each point, a 150-meter transect was established and sampling was carried out systematically within 10 4-m2 plots with 15-meter intervals (overall, 30 plots in sites with the presence of species, and 30 plots in sites without the species presence). These transects were established parallel to each other and perpendicular to the slope. Plot size was calculated using minimal area method and the number of plots was obtained by graphical methods (Moghaddam, 2001). Total Canopy Cover (TCC), Canopy Cover of the Target Species (CCTS), Percentage of Stone and Gravel (PSG) on the soil surface were recorded in each sites. Soil samples were taken from the first, middle and last plots along each transect.

In each sites from a profile to rooting depth and then mixed as one sample for each transect. The soil properties such as Electrical Conductivity (EC), pH, Total Neutralizing Value (TNV), Organic Carbon (OC), K (Potassium), P (Phosphorus), Soil Texture (Sand, Silt, Clay) and Saturation Percentage (SP) (Jafarianetal., 2008), were determined in the Soil Laboratories Agricultural and Natural Resources Research Center of Zanjan. The climatic factors including annual precipitation and Mean Temperature (MeT), Maximum Temperature (MaT) and Minimum Temperature (MiT) were extracted using a derived gradient formula for each, which were derived from meteorological data (from synoptic stations and rain gauges adjacent) and calculated for each site. Digital Elevation Model (DEM) map was derived using 1: 25000 topographic maps of National Cartographic Center of Iran, with 10 m horizontal and vertical accuracy. Elevation, Slope and Aspect maps were derived from the DEM for the selected habitats and sites.

Data analysis

The normality of the data was assessed using Kolmogorov-Smirnov test. The t-test, analysis of variance and tukey's test were used to evaluate the differences among the variables studied in both presence and absence sites. Stepwise discriminant analysis was used to determine the significance of the variables studied in species distribution and verify grouping of sampling locations. Data were derived and analyzed using ArcGIS 10.2 and SPSS16 software.

RESULTS

The peculiarities of each habitats is presented in Table 2. In site 1 except for exchangeable potassium and percentage of clay, other variable along with and without presence in the sites in the level of 1% ($p < 0.01$) probability there were significant difference. In site 2 except exchangeable potassium and percentage of stone and gravel, other variables, there were a significant

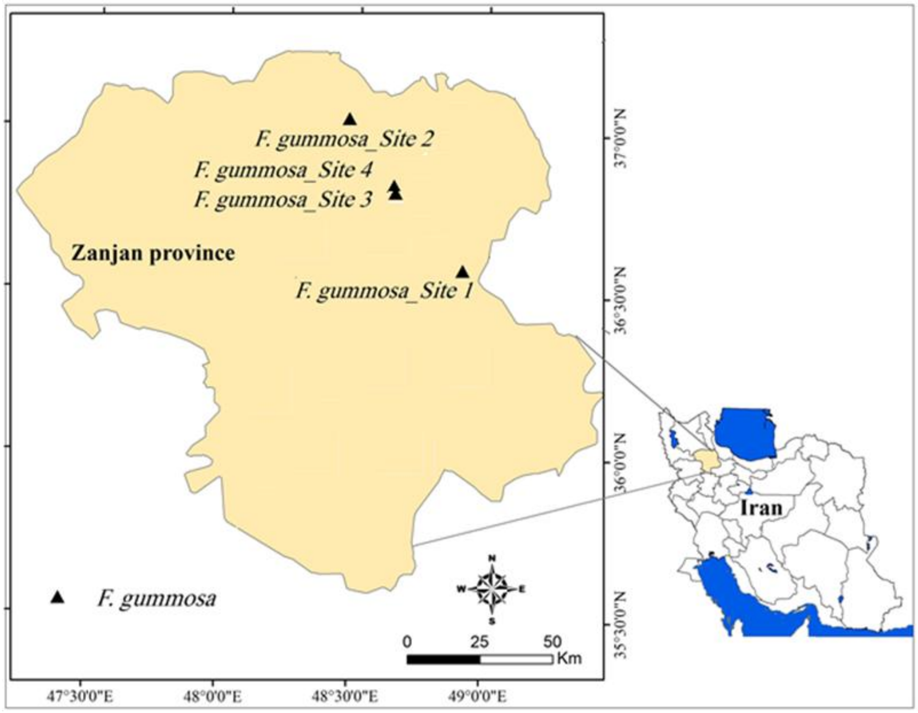

Fig1 The location of the study area, and selected sites

Table 1. Characteristics of studied sites.

Species	Site	Longitude	Latitude	Average altitude (m)
F.gummosa	Site 1	48° 54' 42"	36° 34' 51"	2340
	Site 2	48° 28' 19"	37° 02' 10"	2565
	Site 3	48° 37' 49"	36° 50' 04"	2496
	Site 4	48° 37' 44"	36° 50' 11"	2497

difference in the level of 1% probability among the presence and absence site of the species. In site 3, the saturated humidity, electrical conductivity, the percentage of sand and silt, the percentage of slope, aspect and the quantity of soil organic carbon content at the level of 1% among presence and absence site of the species, there was a significant difference. And in terms of elements such as acidity, potassium and total of neutralizing value (TNV) there was no significant difference between the sites of presence or absence of F.gummosa at the level of 5%. In site 4 also variables of electrical conductivity, phosphorous, the percentage of clay, altitude and percentage of stone and gravel didn't have a significant difference between presence and absence sites at the probability level of 5%. However, organic carbon at the level of 5% and other examined variables there was a significant difference at the probability level of 1% between the presence and absence sites of F.gummosa. The studied species on the slopes of north, northeast and southeast with the slope rate of 55 to 70%, at an altitude of 2200 to 2600 meters above sea level has been distributed. 18.2 percent of target species composition (PTSC) in site 2 belonged to this species which the most amount among the studies habitat. The amount of electrical conductivity in this habitat on the average was 0/63 ds per meter, pH was 6.9, the percentage of total neutralizing value(TNV) was 2.13, the percentage of organic carbon was 2.14, potassium was 247 ppm and phosphorus was 6.3 ppm, the altitude was 2565 meter, the amount of slope was 70% and aspects was northeast.

The analysis of variance of variables in different sites under study indicated that the variables examined in the studied sites had a significant difference at the level of 1% ($p<0.01$) (table 2).

The results of discriminant analysis showed that the DA was able to identify four canonical functions, which the first function has 79% of the variance, the second function 19.5%, the third function 12.59% and the fourth function 7.06% of the variance. Eigen values and canonical correlation was more in the first function than the second function (Table 3). On the other hand, Wilks'

Table 2. Compares the properties measured in the presence and absence of species habitats studied.

properties	Site 1			Site 2			Site 3			Site 4			F
	F.gummosa			*F.gummosa*			*F.gummosa*			*F.gummosa*			
	presence Mean±S.E	absence Mean±S.E	t	presence Mean±S.E	absence Mean±S.E	t	presence Mean±S.E	absence Mean±S.E	t	presence Mean±S.E	absence Mean±S.E	t	
SP	45. 7 ^{ab}±0. 8	42.3 ^{bc}±0. 1	3.97**	44 ^{bc}±0. 84	47 ^{a}±0. 26	-3.4**	36.7 ^{e} ±0.61	40.7 ^{d} ±0.9	-3.78**	44.3 ^{abc} ±0.5	40.7 ^{d}±0.9	3.75 **	24.5 **
EC	0.54 ^{b}±0. 01	0.42 ^{c}±0. 02	4.82**	0.63 ^{ab}±0. 06	0.38 ^{cd}±0. 0	4.58**	0.7 ^{a} ±0.02	0.28 ^{d} ±0.01	15.70 **	0.30^{d}±0.0	0.28^{d} ±0.01	1.64 ^{ns}	46.5 **
pH	6.91^{c}± 0.03	7.32^{a} ± 0.01	-12.4**	6.9^{c} ± 0.03	6.79 ^{d} ± 0.03	3.02**	7.1 ^{b} ±0.01	7.1 ^{b} ±0.01	-0.47 ^{ns}	7.3 ^{a} ± 0.01	7.1 ^{b} ± 0.0	22.18 **	104.6 **
TNV	1.47^{ed} ± 0.02	1.03^{a} ± 0.1	3.45**	2.13^{cd} ± 0.3	1.07^{e} ± 0.1	3.76**	3.1 ^{b} ±0.01	2.9 ^{bc}±0.01	0.49 ^{ns}	4.7 ^{a} ± 0.1	2.9 ^{bc} ± 0.3	5.41 **	38.25 **
OC	2.7 ^{a}±0.1	2.2 ^{b}±0.03	3.27**	2.14^{bc} ± 0.06	2.4 ^{ab} ± 0.04	-4.2**	1.8 ^{c} ± 0.1	2.2 ^{b} ± 0.1	-2.66 **	2.5 ^{ab} ± 0.1	2.2 ^{b} ± 0.1	2.18 *	8.86 **
K	263 ^{a}±16	298 ^{a}±17	-1.49^{ns}	247 ^{a}±15.9	273 ^{a}±13.8	-1.24^{ns}	246 ^{a}±13.1	262 ^{a}±7.3	-1.11 ^{ns}	244^{a} ± 6.8	262 ^{a} ± 7.3	-1.23 ^{ns}	12.6 **
P	7.1 ^{cd}±0.21	9.3 ^{bc}±0.36	-5.15**	6.3 ^{d}±0.4	8 ^{cd}±0.4	-1.19**	11.7 ^{ab}±0.5	12.6 ^{a}±0.99	-0.76 ^{ns}	12.2^{a} ± 0.31	12.6 ^{a} ± 0.99	-0.13 ^{ns}	19.7 **
Sand	56 ^{b}±0.6	66.7 ^{a}±0.3	-15.2**	41 ^{d}±0.3	47.3 ^{c}±0.8	-5.37**	41.3 ^{d}±0.8	47.3 ^{c}±0.5	-6.72 **	31.3^{e} ± 0.7	47.3^{c} ± 0.5	-19.1 **	339.1 **
Silt	36 ^{e}±0.6	25 ^{f}±0.0	16.89**	47.3 ^{ab}±0.2	41 ^{b}±0.6	9.68**	44 ^{c}±0.8	37.3 ^{e}±0.5	7.10 **	54 ^{a} ± 1.1	37.3 ^{e} ± 0.5	13.92 **	190.9 **
Clay	8.3 ^{c}±0.5	8.3 ^{c}±0.4	0.0^{ns}	12 ^{b}±0.0	13.7 ^{ab}±0.2	-9.52**	14.7 ^{a}±0.4	15.3 ^{a}±0.1	-1.85 ^{ns}	14.7 ^{a} ± 1.1	15.3 ^{a} ± 0.1	-0.58 ^{ns}	38.3 **
Slope	58 ^{bc}± 0.4	57 ^{c}± 0.4	2.69**	70 ^{a}± 0.4	41.7 ^{e}± 0.4	64.73**	60. ^{b}± 0.0	48.3. ^{d}± 0.4	26.66 **	58.3 ^{bc} ± 0.9	48.3 ^{d} ± 0.4	10.22 **	358.8 **
Aspect	135 ^{b}± 0.0	90 ^{c}± 0.0	67.0**	135 ^{b}± 0.0	90 ^{c}± 0.0	67.0**	90 ^{c}± 0.0	60 ^{d}± 0.4	7.62 **	360 ^{a} ± 0.0	60 ^{d} ± 4	76.16 **	2486 **
Altitude	2340 ^{c}± 3	2440 ^{d}± 4	19.89**	2565 ^{a}± 3.2	2579 ^{a}± 1.5	-3.96**	2496 ^{b}± 6.7	2495 ^{b}± 3.8	0.17 ^{ns}	2497 ^{b} ± 3.2	2495 ^{b} ± 3.8	0.34 ^{ns}	362.2 **
PSG	43 ^{a} ±3	18.4 ^{b}±2	6.77**	34.9 ^{a} ±3.1	31.7 ^{ab} ±14.2	0.78 ^{ns}	32.4 ^{ab} ±3	31.8 ^{ab} ±5.1	0.17 ^{ns}	31.7 ^{ab} ± 3.2	31.8 ^{ab} ± 5.8	-0.008 ^{ns}	3.51 **
Precipitation	408 ^{c}±0.5	396 ^{d} ±0.4	20.20**	422.5 ^{a}±0.8	424 ^{a}±0.4	-3.75^{ns}	414.5 ^{b}±0.3	414.5 ^{b}±0.2	0.15 ^{ns}	414.8 ^{b} ± 0.4	414.5 ^{b} ± 0.2	0.41 ^{ns}	355.6 **
MeT	8.6 ^{a}±0.02	9.1^{a} ±0.02	-20.2^{ns}	7.9 ^{a}±0.03	7.8 ^{a}±0.02	7.47^{ns}	8.3 ^{a}±0.01	8.3 ^{a}±0.0	0.0 ^{ns}	8.3 ^{a} ± 0.02	8.3^{a} ± 0.02	0.0^{ns}	61.9 **
MiT	-1.3 ^{b}±0.03	-0.6^{a}±0.02	-20.9**	-2.1 ^{d}±0.05	-2.2 ^{d}±0.03	5.11^{ns}	-1.7 ^{c}±0.01	-1.7 ^{c}±0.01	0.0 ^{ns}	-1.7 ^{c} ± 0.02	-1.7 ^{c} ± 0.02	0.0 ^{ns}	396.3 **
MaT	15.8 ^{b}±0.01	16.2^{a} ±0.01	-20.4**	15.3 ^{d}±0.01	15.3 ^{d}±0.01	5.38^{ns}	15.6 ^{c}±0.0	15.6 ^{c}±0.0	0.0 ^{ns}	15.6 ^{c} ± 0.02	15.6 ^{c} ± 0.02	0.0 ^{ns}	375.2 **
TCC	41.6 ^{bc}±2.4	51.5 ^{ab}±2.6	-2.81**	45 ^{bc}±2.9	47.8 ^{ab}±2.3	-0.78**	35.4 ^{c}±2.7	50.7 ^{ab}±3.1	-3.75 **	58.2 ^{a} ± 3.3	35.4 ^{c} ± 2.7	5.36 **	8.44 **
CCTS	6.3 ^{a} ±0.9	0.0^{b}±0.0	6.7**	8.2 ^{a} ±1.1	0.0^{b}±0.0	7.22**	7.6 ^{a} ±1.5	0.0^{b}±0.0	4.99 **	9.2 ^{a} ± 1.3	0.0 ^{b} ± 0.0	7.1 **	23.5 **

ns,** &*are no-significant differences , significant at 1 & 5 percent probability level respectively and similar words indicating no difference and different letters indicate significant differences are in a row.

Lambda values had increased from the first function to the four audit function, and chi-square value is significant in all functions at the level less than 0.01.Thus, the average of groups was different (Table 4), the principles, the first function has higher discrimination power in separating the groups.

Table of discriminant coefficients of the variables showed the linear correlation among environmental variables and discrimination function. The total of neutralizing value (TNV)and aspect were primarily the most influential factor in the first function, mean temperature in the second function, Slope, total of precipitations, maximum temperature and minimum temperature, percentage of silt, altitude, quantity of phosphorus and potassium in the third function and finally, percentage of sand and clay, saturation percentage , organic carbon, electrical conductivity, acidity and percentage of stone and gravel (PSG) on the soil surface were

Table 3. Eigen values and the percentage of variance explained by the first four discriminant analysis.

Function	Eigenvalue	Percent of Variance	Cumulative %	Canonical Correlation
1	1094.41	79.0	79.0	1.000
2	264.44	19.5	98.5	0.998
3	12.59	0.9	99.5	0.963
4	7.06	0.5	100	0.936

Table 4. Wilks' Lambda value.

Test of Function (s)	Wilks' Lambda	Chi-square	df	Sig.
1 through 4	0.000	3424.76	64	0.000
2 through 4	0.001	2040.06	45	0.000
3 through 4	0.009	932.16	28	0.000
4	0.124	414.20	13	0.000

Table 5. Discriminant coefficient of factors in canonic functions.

Variables	Functions			
	1	2	3	4
TNV	-0.413*	0.154	-0.047	-0.230
Aspect	0.228*	0.108	-0.077	0.166
MeT	-0.013	0.129 *	-0.125	-0.070
Slope	0.008	0.070	0.283 *	0.022
Precipitation	0.013	-0.129	0.148 *	0.091
MaT	-0.016	0.127	-0.141 *	-0.116
Silt	0.027	0.030	-0.139 *	0.128
MiT	-0.012	0.131	-0.137 *	-0.092
P	0.008	0.010	-0.132 *	-0.063
Altitude	0.003	0.008	0.123 *	-0.094
K	0.017	-0.006	-0.048 *	-0.010
Clay	0.006	0.001	-0.060	-0.197 *
SP	0.008	-0.020	0.057	0.194 *
Sand	-0.025	-0.024	0.138	0.191 *
OC	0.006	-0.010	-0.017	0.165 *
EC	-0.014	0.034	0.096	-0.122 *
pH	0.017	-0.006	0.095	-0.118 *
PSG	0.000	0.012	0.011	0.077*

in the places as the affecting factors in identifying the sites and distribution of species (table 5).

According to Table 6, the properties including, the amount of saturation humidity, electrical conductivity, acidity, organic carbon, potassium, phosphorus, sand, silt, slope, aspect, altitude, percentage of stone and gravel (PSG) on the soil surface, precipitation and temperatures have been determined as significant factors in detecting the presence or absence of the target species. Therefore, the discrimination equation for the first function will be as Equation 1.

Equation1=0.267Sp+2.175Ec+25.691pH-6.335Oc+0.030K+0.207P+0.426San+0.466Sil-0.295Slo+0.286Asp+0.065Alt+0.012PSG+2.197Preci+11.424MeT+67.739MiT-90.789MaT+113.184

The results relating to the classification of studied habitats using discriminant analysis have been shown in table 7.

Frequency percentage provided in this table (table 7) represents level of the matching observed and estimated items. Accordingly, if the data of the F. gummosa were placed in discrimination function (Group 1,2, 3, 4), the function would recognize correctly in 100 % of cases the membership of the species in the Group 1, 2, 3 and 4. If the data of the sites without the target species were in discrimination function (Group 5), the function would

Table 6. Canonical Discriminant Function Coefficients.

Variables	Function				Variables	Function			
	1	2	3	4		1	2	3	4
Sp	.267	-.307	-.253	-.028	Aspect	.286	.024	.006	.023
Ec	2.175	-4.960	3.341	.452	Altitude	.065	-.048	.037	-.034
pH	25.691	-11.361	-1.794	-12.731	PSG	.012	.018	-.007	.014
Oc	-6.335	2.790	2.410	1.711	Precipitation	2.197	2.260	.819	1.604
K	.030	-.019	.004	-.002	Mean. tem	11.424	134.437	-1.527	46.105
P	.207	.688	-.179	.127	Min. tem	67.739	-65.178	4.475	5.553
Sand	.426	-.589	.055	.080	Max. tem	-90.789	50.037	11.634	-19.763
Silt	.466	-.418	-.103	-.056	(Constant)	113.184	-2.756E3	-589.048	-561.663
Slope	-.295	.930	.254	-.093					

Unstandardized coefficients

Table 7. The results of classification using discriminant analysis.

		Predicted Group Membership					
	Group	1	2	3	4	5	Total
Original Count%	1	100.0	.0	.0	.0	.0	100.0
	2	.0	100.0	.0	.0	.0	100.0
	3	.0	.0	100.0	.0	.0	100.0
	4	.0	.0	.0	100.0	.0	100.0
	5	.0	.0	.0	.0	100.0	100.0

a.100.0% of original grouped cases correctly classified.

detect correctly in 100% of cases the membership of them in the Group 5; this indicates that the right selection of factors affecting the distribution and dissemination of the studied species. Generally, 100% of the original groupings were classified properly.

DISCUSSION

Our study indicated that the F. gummosa species in North-West rangelands of Iran (Zanjan rangelands) is distributed at the altitude of about 2200 to 2600 meters above sea level, on slopes of 50 to 70% and in aspects that the amount of humidity is more than other aspects (Northern, North-West, North-East). This species is distributed in these places as a dominant species. Without a doubt, the factor of aspects influences on the amount of available water for the plants, the temperature of soil and the amount of light received by the planets. On the other hand, the difference in light intensity in different aspects of a hillside causes a local climate change (Gonzales et al., 2014). It seems that the local climatic changes created in the region, is regarded as one of the main affective factors on the distribution of the species under study.

Regarding this fact, the Egyptian researchers also assessed the effect of different environmental factors on plant communities and called the characteristics as altitude, slope and its aspects, longitude, and the depth of soil as the most important factors (Abdel-Ghani et al., 2014). On the other hand, it seems in view of different reasons including habitat degradation due to in appropriate and unsuitable usage and even converting fields into dry farms in some places to produce feed-stuff including hey throughout the years, in this study, we see that this species has taken refuge in slopes with scattered rocks and has chosen these areas to continue its growth and reproductions. The amount of electrical conductivity and total of neutralizing value in places that the species is present was more than the places without it as well and significantly different. Therefore, it seems that the species studied, would rather relatively calcareous sites (on the average 3.2 percent) with the average electrical conductivity of 0.7 ds per meter in ecological situation of the region under study. These factors are effective in distribution of this species. While the aute-ecological study of this species, the amount of electrical conductivity of its habitat is mentioned to 0.62 ds per meter (Bashari & Shahmoradi, 2004). On the other hand, it is observed that the species studied more prefers the medium textured soil. In different studies the texture of soil is considered as one of the important factor to distribution of the plant groups (Taghipour et al., 2008; Drinbock, 2002). Considering the growth form and root gland and multiple splits system on the neck and relatively long (up to 140 cm) in F.gummosa (Bashari & Shahmoradi, 2004), it seems that the study species requires to spread its root to meet its food requirements and on the other hand, it requires a kind of soil texture that the water could easily penetrate through and maintain moisture in itself that this is an issue causes more food and water to be provided for the species. However, the quantity potassium and phosphor in places that the species is present was less than the places without the target species. On the other hand, after nitrogen phosphorus in plant nutrition is the most important nutrient that plays an effective role in the growth and potassium is involved in almost all metabolic processes of plants and its quantity varies in plant tissues from plant to plant (Leyles, 1975). Since the distribution of F.gummosa was relatively in higher slopes, therefore, it seems that the clay soil due to decreased by leaching and also,it is possible that the decrease of this element could be attributed to the presence of F.gummosa species.

Variety of research mentioned phosphorus and potassium as influential factors in distribution of rangeland species (Tarmi et al., 2009; Khatibi et al., 2012). The results of different studies also suggest that the presence and distribution of plants in rangeland ecosystems is not accidental or arbitrary, but it is under the influence of climatic characteristics, topography and soil physical and chemical properties (Davies et al., 2006; Zare & Zare, 2010). Regarding the results of eigen values and Canonical Correlation Coefficient of the first function in discriminant analysis, the obtained results indicate the suitability of the estimates of the separation of the groups and the resolution is appropriate. Out of the variables under study, the variables of the total neutralizing value and aspects were considered as the most effective factors in distributing the studied species.

Also, we concluded that the electrical conductivity, acidity, organic carbon, potassium, phosphorus, percentage of sand and silt and the percentage of stone and gravels on the soil surface, slope, geographical aspect, altitude, annual precipitation and environmental temperature in the presence or absence of species are effective.

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