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The Role of Climatic Elements on the Distribution Gymnocarpus Decander Species: A Case Study of the North Persian Gulf Region

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Abstract: In order to investigate the role of climatic elements on the distribution of range species of *Gymnocarpus decander* in the Northen Persian Gulf region, three habitats in each rangeland of these region were selected and using strip transect and plot methods were calculated the density and percent of *G. decander*'s canopy. Climatic factors such as temperature, precipitation, relative humidity, wind speed, sunshine clock and evaporation pan in stations of each area were collected, climatic factors and plant factors (density and canopy percent) were considered respectively as independent variable and dependent variable and were analyzed using SPSS. The results of Kolmogorov-Smirnov test showed that the climatic and plant factors in province have a normal distribution. Then, to identify the most important climatic parameter affecting the distribution of range species of *G. decander* in the northen Persian gulf region, a matrix with dimensions of 90*14 was prepared through climatic and plant data, the matrix is composed of fourteen climatic elements. The factors were reduced to three main factors using factor analysis technique and were rotated using varimax rotation. Factor analysis technique which reduced factors to three main factors was done for eigenvalues <1. Generally, the temperature factor has the most important impact on the distribution of range species of *G. decander* in the North Persian Gulf region.

Key words: Analysis, *Gymnocarpus decander*, distribution, climate, range species

INTRODUCTION

Understanding the relationships between climatic factors and the distribution of important species in arid and desert ecosystems is essential in terms of plants conservation and sustainable use of them. Considering that to prepare appropriate projects of natural resources various factors such as water, climate, vegetation, etc., often studied regardless of the relationship between them and separately, the results of such projects are hardly applicable (Zolfagari *et al*., 2010). What must be considered in studying the range is that the vegetation is a part of ecosystem and has a close relationship with other parts of the ecosystem including climate (Zohary, 1973). Therefore, cognition and study of range and presenting a way for it will not be possible without consideration of range ecosystem components (Englisch, 2000). Vegetation, more than anything, is a function of climate and climatic changes and its factors in most habitats lead to settlement and dominance of specific plants. Understanding the relationships between climatic factors and the distribution of plant species have an important role in the planning and management of rangelands. This will be achieved just through investigating the relationships between plant species and effective factors in their settlement (Zare and Shafizadeh, 2008). Therefore, study of the relationships between climatic factors and the distribution of plant species will help us to select species susceptible of environmental planning for revival and development of rangelands through proposing resistant species to regional climatic conditions. Thus, the role of plants in the balance of ecosystem and the different uses that one makes of them either directly or by livestock, it is inevitable to recognize the relationships between plants and the environmental factors for its stability and resistance. Range species of *G. decander* in the north Persian Gulf region has a good distribution. This species has an important role in foddering livestock and soil stabilization of rangelands and recognition of this plant and proper understanding of the most important climatic parameter affecting the distribution (density and canopy percent) of this species can be useful in grounds such as management, planning, reform and revival of rangelands and desert areas and the development of this species in the North Persian Gulf region.

G. decander species, of the family *Caryophyllaceae* is one of the most important species in the North Persian

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Gulf region pasture that in terms of soil conservation and livestock production has a significant role. Lack of atmospheric and drought rainfalls, overgrazing and heavy the double pressure on this plant species entered. Yet, the stability of this plant against environmental rough conditions has been caused in large areas of the province as one of the main species along with other pasture species or as forming the type and or as the along species observed (Mansouri, 2011).

Hosseini *et al*. (2002) in investigation the relation between rainfall fluctuations and forage production in hamand absard concluded that between average of monthly, seasonal and annual with forage production there is a correlation. Mohammadi and Moghtaderi (2005) in investigation of climate parameters relationship and dehydration complications cluster of palm found that relative humidity on mentioned complications has most impact, so that with increasing one percentage of relative humidity the amount of 20% reduced of incidence of complications. Golchin and Jalali (2010) in investigation the impact of weather factors in the performance of honeybee hive in town of Ahar found that weather elements with modern hives performance of Ahar town have connected and are influenced and temperature and precipitation elements of other climatic elements have more effectiveness. Ehsani *et al*. (2007) in a study titled impact of climate conditions on pastures forage production in a steppe region of Akhtarabad Saveh concluded that germination season rainfall index in addition, the previous as a variable in production has played a major role and there is a linear relationship between season rainfalls in addition, the previous with production. Karabulu (2002) in a study titled the relationship between vegetation cover and rainfall with aimed to study, evaluate and measurement the vegetation cover reaction to rainfall regime came to the conclusion that rainfall has a significant impact on the development of vegetation cover and also rainfall humidity shortage condition has a significant negative impact on the development and expansion of vegetation cover.

Bork *et al*. (2001) in a study titled relation between the pastures forage production with annual rainfall in grass lands of central Alberta concluded that significant relationship between annual rainfall and pasture forage production is there. Martin *et al*. (1995) in investigation of the climate effect on species forage production of sen cherus kelari in Sonoran wilderness pastures, existence of a significant correlation between summer rainfalls with production is reported. Wylie *et al*. (1992) in a study titled forage production calculation by using the rainfall information in Niger concluded that rainfall index as a variable plays a major role and forage production relation with rainfall in rainfall seasons has been confirmed. Dyksterhius (1949) in a study titled the relationship between forage production and the amount of rainfall concluded that given the pasture situation degrees and amount of rainfall, forage manufacturing deal and pasture capacity can be estimated.

MATERIALS AND METHODS

The case study area: Evaluating the effect of climatic parameters on pasture species transmittal of *G. decander* in pastures level of the North Persian Gulf region has been taken that their geographical characteristics are as follows.

This ragion with width 71.192 km^2, 4.4% of country area has engulfed and as coastal narrow strip from West to East in azure beaches of the Persian Gulf and Oman Sea Azure has been drawn. Research area in Latitude 25°, 24° until 28-53° Northern and Longitude 52°, 44° until 59°, 14° East is located. From North and Northeast to Kerman Province, Southeast to Sistan and Baluchistan Province, from West to the provinces of fars and bushehr and also from South to Persian Gulf and Oman Sea has been limited.

Characteristics of *G. decander* species botany: Small a shrub plant with twisted branches, young branches fluff and white, older branches glabrous and gray (Fig. 1). The mutual leaves, without petiole, glabrous, a cylindrical or spoon, fleshy with a small beak. Membranous earrings, triangular. Pistil inflorescence, along the stems. Triangular leaves, leading to yellow thistle. Bowl 5-part, reddish brown sepals, at the bottom of joined and tube, sometimes fluff in dorsal surface. Corolla 5-part, cotton and thin petals. Flags 5 pieces, Conical and covered ovaries of glandular petioles. Stigma 3-branch, Hazel fruit, brown, ovate (Mansouri, 2011).

Fig. 1: Image of *G. decander* species

For doing this research, the climate factors from meteorological data of three stations synoptic in bandar abbas, haji abad and bandar lengeh has been extracted.

These factors include: the average of annual temperature (tm); the average of annual temperature minimum (tml); the average of annual temperature maximum (tmh); the number of days with maximum temperature 30°C and higher (tm30); the number of days with temperature minimum and higher 21°C (tm21), the amount of annual rainfall (pm); the average of rainfall of high rainfall three months continuously, the average of annual relative humidity (rh), the average of annual evaporation from evaporation pan (et), the average of wind speed (wind) and the average of annually sunshine clock (sun) (Table 1).

Required plan data of this research that included density and canopy cover with desert operations perform at the three sites levels in the northen Persian gulf region and to method of strip transect and plot up were measured for this purpose in every region 30 plots and totally 90 plots have been harvested. Then, the plant data obtained density and canopy cover as the dependent variable and climatic parameter as independent variable by using the spss statistical software, were analyzed. Based on Kolmogorov-Smirnov test that was known Goodness-of-Fit test and also except considered part of nonparametric tests, the significance of data was checked.

The results showed that Z value in all invoices is between -1.96 to +1.96 (Table 2) and as a result with 95% confidence can be ruled to normality of distribution (Momeni, 2010).

The following the amount of correlation between climate and vegetation parameters (density and canopy cover percentage) in the Northen Persian Gulf region were examined and it was determined that a significant relation can be found between climate and vegetation parameters.

Then all of climate and vegetation data matrix with dimensions 90×14 is formed and desired data were analyzed. Mentioned variables by using principal components analysis method were reduced to three components and by using the max rotation were rotated. Components analysis were reduced from three factors with the eigenvalues >1.

Table 1: The average of the case study stations climate data (reference: country meteorological organization)

Units	Year (ad)	Jan.	Feb.	Mar.	Apr.	May	June	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Bandar abbas one region													
pm	85-2010	40.1	42.1	33.7	16.5	2.1	0.5	0.1	1.6	0	1.7	7.1	23.4
tm	85-2010	18.0	18.2	21.4	24.9	29.6	32.9	34.2	34.3	32.6	30.3	26.0	20.5
tml	85-2010	12.0	13.4	16.8	20.3	24.5	27.7	30.3	30.4	28.1	24.1	19.1	14.1
tmh	85-2010	23.4	24.2	26.6	31.5	36.3	38.5	38.3	37.5	36.5	35.3	31.1	26.2
rh	85-2010	62.7	65.3	66.7	62.9	60.2	61.7	65.8	66.9	68.6	63.4	62.4	61.0
sun	85-2010	218.3	223.9	215.0	252.7	296.1	319.8	282.3	276.1	273.1	270.7	262.6	223.5
et	2000-10	75.2	81.5	99.6	141.5	182.6	206.5	207.4	269.7	174.1	143.3	115.0	83.9
tm21	98-2005	0.0	0.0	4.0	17.0	31.0	30.0	31.0	31.0	30.0	29.0	7.0	0.0
tm30	98-2005	0.0	1.0	9.0	27.0	31.0	30.0	31.0	31.0	30.0	31.0	19.0	2.0
wind	99-2005	2.4	2.8	3.0	3.3	3.4	3.5	4.0	4.0	3.6	2.9	2.9	2.6
Haji abad two region													
pm	85-2010	38.2	37.9	35.4	40.8	16.2	7.1	7.3	3.6	5	2.8	8.9	19.7
tm	85-2010	11.2	12.0	15.8	20.0	26.8	31.3	33.8	34	31.1	25.5	19.8	13.5
tml	85-2010	4.8	6.7	9.3	12.7	18.7	22.8	26.2	27.1	23.6	17.3	11.9	6.7
tmh	85-2010	18.3	19.5	25.0	29.5	36.1	40.9	42.6	41.7	39.4	35.1	29.1	22.2
rh	85-2010	54.2	54.4	45.2	42.5	28.4	26.8	33.3	29.4	34.2	33.0	40.2	48.6
sun	85-2010	235.7	249.5	251.4	288.1	334.0	358.3	331.1	333.4	325.9	310.2	284.6	245.3
et	2000-10	52.1	71.3	101.5	147.9	242.7	283.5	317.1	283.3	232.2	168.7	109.7	66.5
tm21	98-2005	0.0	0.0	0.0	2.0	8.0	21.0	30.0	31.0	18.0	2.0	0.0	0.0
tm30	98-2005	0.0	0.0	3.0	25.0	31.0	30.0	31.0	31.0	30.0	30.0	2.0	0.0
wind	99-2005	1.8	2.1	2.6	2.8	3.0	2.8	3.3	2.9	2.6	1.8	1.7	1.7
Bandar lengeh three region													
pm	85-2010	29.31	30.63	21.14	15.02	1.77	0.3	0.0	1.12	0.06	0.01	3.29	25.89
tm	85-2010	18.60	18.90	21.50	25.20	29.60	32.0	33.7	34.40	32.90	30.00	26.10	21.30
tml	85-2010	14.70	14.80	17.70	21.00	25.50	28.1	30.5	32.20	30.10	26.60	21.80	17.60
tmh	85-2010	23.10	23.50	26.50	30.30	34.80	36.1	37.3	37.90	36.50	34.50	31.40	26.30
rh	85-2010	61.70	63.00	64.60	63.00	61.90	65.2	67.3	66.70	67.80	64.90	60.50	60.80
sun	85-2010	227.60	247.10	232.30	266.90	305.10	330.2	304.0	292.80	287.10	279.30	273.40	241.90
et	2000-10	70.80	78.50	96.00	144.60	169.70	175.5	167.2	192.20	169.00	142.30	111.40	86.60
tm21	98-2005	0.00	1.00	7.00	21.00	31.00	30.0	31.0	31.00	30.00	31.00	16.00	1.00
tm30	98-2005	0.00	0.00	6.00	22.00	31.00	30.0	31.0	31.00	30.00	31.00	16.00	0.00
wind	99-2005	2.20	2.40	3.00	3.20	3.20	2.7	3.2	3.40	2.90	2.20	2.60	2.20

Table 2: The results of Kolmogorov-Smirnov test

Trakm	Tajposh	pm	tm	tml	tmh	rh	sun	tm21	tm30	wind	et
1.67	1.48	1.29	0.94	0.5	0.95	1.8	0.45	1.38	1.74	0.56	0.7

Table 3: Distributed total variance

	Initial eigenvalues			Extraction sums of squared loading			Rotation sums of squared loading		
Factors	Cumulative (%)	Variance (%)	Total	Cumulative (%)	Variance (%)	Total	Cumulative (%)	Variance (%)	Total
1	65.93	65.93	9.230	65.93	65.93	9.23	60.33	60.33	8.44
2	88.19	22.27	3.110	88.19	22.25	3.11	85.32	24.99	3.49
3	97.98	9.79	1.370	97.98	9.79	1.37	97.98	12.67	1.77
4	100.00	2.01	0.282	-	-	-	-	-	-

RESULTS AND DISCUSSION

By using the components analytical technique in spss software environment in beginning of variables shared values after the factors extraction (or components) were reviewed for analysis. Given that whatever extractive share amounts is greater, agent extracted show variables better and if the amounts each of the extracted variables have amounts <0.5 should be deleted (Momeni and Ghaumi 2010), in this study, all of the extracted amounts were >0.8, so remained for analysis.

By considering results table of total variance distribution (Table 3) can overlook the factors that eigenvalues of their correlation matrix is <1. That in this study, the first, second and third factor in analysis remained and from other factors were overlooked.

In the case of non-rotation eigenvalues for the first factor 9.23 and for factor second 3.11 and for the third factor 1.37; in the case eigenvalues for the first factor 8.44 and for factor second 3.49 and for the third factor 1.77 have been obtained.

In total, these three factors allocated 97.98% of the total variance that percentage of variance of each factor for the first factor 60.33%, for second factor 24.99% and for third factor 12.67% is, other factors in about 2.01% of the total variance justify that due to poor impact and a role that having as the factors affecting are not mentioned.

According to the factor of matrix scores results in the rotated status (Table 4) and significant factors advantages and the factors status in rotated space (Fig. 2) determined that in *G. decander* species transmittal has role different three factors.

These factors with eigenvalues >1 justify 97.98% of the total variation are justify. Therefore first factor that allocated the coefficient highest scores and the highest percentage of variance to itself was named as the temperature and then respectively rainfall and as the second factor and wind as a third factor. These three parameters of climate on over density and canopy cover percentage of *G. decander* pasture species in the Northen Persian Gulf region have the most impact.

Table 4: Scores of rotated factor matrix

		Factors		
Rows	Invoice	1	2	3
1	tarakm	-0.054	0.192	0.901
2	tajposh	0.063	0.082	0.925
3	pm	-0.998	0.053	0.029
4	pmh	-0.711	0.689	0.140
5	Tm	0.936	0.350	0.046
6	Tml	0.985	0.172	0.012
7	tmh	-0.014	0.983	0.180
8	Tm30	0.650	0.750	0.125
9	Tm21	0.971	0.237	0.024
10	rh	0.928	0.369	0.050
11	sun	-0.702	0.702	-0.115
12	hight	-0.996	-0.093	0.002
13	wind	0.618	0.776	0.130
14	et	-1.000	-0.008	0.018

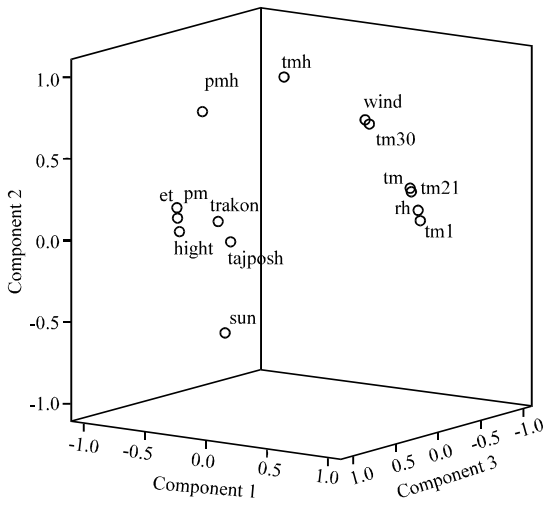

Fig. 2: Factors in rotated space

CONCLUSION

In this study, the effects of climate parameters on vegetation parameters (density and canopy cover percentage) *G. decander* pastures species in the northen Persian gulf region by using spss statistical software was used for analysis. By doing components analytical, it has been indicated that this technique is a useful method for investigating the role of climatic parameters on *G. decander* pastures species transmittal in the Northen Persian Gulf region. The obtained results showed that

three factors are more fundamental role. These factors given to, eigenvalues >1, the highest factor coefficient scores and maximum percentage the total variance between variables allocated to them. Having factors rotation in space and scores matrices as the first and most important factor temperature and second named precipitation factor and third wind factor.

Therefore, the most effecive factor in *G. decander* pastures species transmittal in the Northen Persian Gulf region is temperature. So, during the pastures corrective and revival activities the temperature limitations as the specifically must be considered.

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