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DETERMİNATİON OF INDİCATOR SPECİES AND COMPARİSON OF SOİL CHARACTERİSTİCS OF *CENTAUREA MUCRONİFERA* DC. AND *CENTAUREA PYRROHOBLEPHARA* BOİSS. DİSTRİBUTED İN TURKEY

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ABSTRACT

This study was carried out to determine the indicator plant species of *Centaurea mucronifera* and *Centaurea pyrrohoblephara* and to compare the spatial distribution of these species in relation to the soil characteristics. For this purpose interspecific correlation analysis was used. In general 46 positive and 4 negative indicator species of *C. mucronifera*, and 10 positive and 3 negative indicator species of *C.pyrrohoblephara* were determined. The highest "C" coefficient among the positive indicator species in the *C. mucronifera* was determined in the absence of other indicator species in relation to the variable formed by the presence of any seven positive indicator species. The highest "C" coefficient of *C. pyrrohoblephara* was determined in the absence of other indicator species in relation to the variable formed according to the presence of any one positive indicator species. Canonic discriminant analysis (CDA) was used for a comparison of soil characteristics of these species. In this analysis the discrimination was significant at a level of 5%. The success of discrimination classification was 76.7%, which is very high. This result depicts that *C. mucronifera* and *C. pyrrohoblephara* prefer different sites in terms of soil characteristics. The results subjected to an interspecific correlation analysis also support the statistically significant negative association among these species. According to the sand, loam, total lime, avaible P_2O_5 and organic matter contents. Latter showed that the discrimination between *C. mucronifera* and *C. pyrrohoblephara* was succesfull at a significant level of 5%. The classification succesfull for the discrimination was 76.7% , which is a very high value. This result is supported by the negative association we obtained between *C. mucronifera* and *C. pyrrohoblephara* via interspecific correlation analysis.

Key words: Canonic discriminant analysis, *Centaurea* sp., interspecific correlation analysis, soils

INTRODUCTİON

C.mucronifera and *C.pyrrohoblephara* are very important species both economically as well as biologically (Çelik 2003). There will be a great need to extend the spatial distribution areas of these species in future. For this purpose the site characteristics should be well investigated. The climate of the sites is the major factor in terms of limitation of spatial distribution of plant species (Irmak 1957). Lack of meteorological stations creates a big problem in this connection, especially in the mountainous areas. Besides, the existing stations measure only some climatic variables and majority have not enough data. Consequently, it's very difficult to determine the potential distribution areas of plant species using the data from meteorological stations in many areas of Turkey. In order to overcome this problem the indicator species of the plants can be determinated for their future evalution. The information on the spatial distribution of indicator species will provide us an opportunity to determine the potential areas of the plants under investigation (Özkan 2002). Furthermore, the differences between the indicator species of the plants with each other could mean that there are differences in not only climatic factors but also soil characteristics in terms of the potential areas of these species.The aim of this study was to determine the indicator plant species of *C. mucronifera* and *C. pyrrohoblephara* and compare their spatial distribution areas in relation to their soil characteristics.

MATERIALS AND METHODS

Location, Physiography, Geology and Climate

The study area is located between 29˚ 30' - 45˚ 30' north latitudes, and 38˚ 30' - 40˚ 30' east longitutes, including inner Anatolian, east Anatolian and Mediterranean regions in Turkey (**Fig.1**). These regions display a great variation in altitude, topography and land-forms i.e. erosional surface, structural surface with different levels and karstic land-forms. Mountainous chains extend over hundreds of kilometers, covering large areas in the north and south, and also vast plains occur within the tectonic basins. As a result of this, there are differences among the

regions in terms of macroclimate as well as local and microclimate even in the same region (Atalay 1987, Atalay 1994, Kantarcı 1991).

The climatic features of *C. mucronifera* were pooled up from the data provided by 13 meteorological stations from different geographical distribution areas namely; Kazımkarabekir (Karaman), Sarız (Kayseri), Yahyalı (Kayseri), Ulukışla (Niğde), Ermenek (Karaman), Yozgat, Göksun (Kahramanmaraş), Pınarbaşı (Kayseri), İmranlı (Sivas), Zara (Sivas), Kangal (Sivas), Gürün (Sivas), Kemaliye (Erzincan)) (DMIGM 2002). In the case of C. pyrrohoblephara data from 5 meteorological stations was used namely; Erzincan, Sivas, Refahiye (Erzincan), Bayburt, Harput (Elazığ)) (DMIGM 2002). These were evaluted according to the Formula of Emberger (Erinç 1984; Çelik 2003).

In general, climate changes from arid to semiarid mediterranean climate , being cold to very cold in winter in the distribution areas of *C. mucronifera* and *C. pyrrohoblephara*. The study area also involves various bedrocks including limestone, gnesis, micaschist, gypsum, peridotite, serpantine accumulated in different facies during the Antropozoic, Paleozozic, Mesozoic and Tertiary periods (Atalay 1987,1994).

Field Sampling and Laboratory Methods

All 59 sites were surveyed (16 sites for *C. mucronifera*, 14 sites for *C. pyrrohoblephara* and 29 sites outside these species) and presence/absence features of 258 vascular plant species were recorded, along with their soil physical features.

The soils collected from 0-10 cm depth of soil surface at each site of *C. mucronifera* and *C. pyrrohoblephara* were analysed accoding to the following methods. The texture by hydrometer method (Bouyoucos 1962), pH with glass electrode (1/2.5 soil-solution ratio) (Peech 1965), total calcium carbonate ($CaCO_3$) with Scheibler calcimeter (Allison & Moodie 1965), total nitrogen by Semimicro-Kjeldal (Bremner 1965), organic matter by Wakley-Black method (Wakley & Black 1934), and available phosphorus (P2O5) by Olsen method (Olsen & Sommers, 1982).

Statistical Analysis

Interspecific correlation analysis is applicable to show relationship among species (Cole 1949, Poole 1974, Holbrook 1979, Shmida & Whittaker 1981, Özkan 2002). For determination of indicator species of *C. mucronifera* and *C. pyrrohoblephara*, qualitative observation (absence/presence) data was tested in 59 sample plot, using interspecific correlation analysis. For this purpose firstly the data was arranged in a 2X2 table association between the species, Chi-square test ("exact methot" of Fisher like Cole's preference) was applied and finally the coefficient of corelation was calculated. Our preference was Karl Pearson' formula. Because, this formula has more advantages than the Forbes' coefficient (Cole 1949).

$$\chi^2 = \frac{(ad-bc)^2 n}{(a+b)(a+c)(c+d)(b+d)}, \quad C = \frac{ad-bc}{\sqrt{(a+b)(a+c)(b+d)(c+d)}}$$

Discriminant analysis is applicable to a wide range of ecological problems in which multiple measurements are made on samples of observation possessing an identifiable group structure (Williams 1988, Özkan et al. 1998, Özkan 2000). In this study, Canonical Discriminant Analysis (CDA) was applied to compare C. mucronifera (16 sample plots) and C. pyrrohoblephara (14 sample plot) using soil variables. Before applying discriminant analysis, pearson correlation analysis was applied among independent variables for searching multiple relation problem (Özdamar 1999).

$$r = \frac{\sum \sum XY - (\sum X \sum Y)/n}{\sqrt{(\sum X^2 - (\sum X)^2/n)(\sum Y^2 - (\sum Y)^2/n)}} .$$

CDA was prefered than LDA (Linear discriminant analysis) to obtain equal of groups covariance matrices. In CDA approach, Linear components are calculated,

$b = (S_1^{-1} - S_2^{-1})(\bar{x}_1 - \bar{x}_2)'$ or $A = (S_1^{-1} - S_2^{-1})$ is taken and thus, $b = A \times (\bar{x}_1 - \bar{x}_2)'$.

Besides, discriminant function is determinated, Y= $(\bar{x}_1 - \bar{x}_2)' Ax$.

Classification criterion of x_0, observetion vector, is calculated.

If, $-\frac{1}{2}x_0' A x_0 + (\bar{x}_1' S_1^{-1} \bar{x}_1 - \bar{x}_2' S_2^{-1})x_0 - k \geq \left[\left(\frac{c\langle 1|2\rangle}{c\langle 2|1\rangle}\right)\left(\frac{p_2}{p_1}\right)\right]$, x_0 first population element;

If not, second element. k is calculated , $k = \frac{1}{2} In\left(\frac{|S_1|}{|S_2|}\right) + \frac{1}{2}(\bar{x}_1' S_1^{-1} \bar{x}_1 - \bar{x}_2' S_2^{-1} \bar{x}_2)$.

RESULTS

C. mucronifera was associated positively with 46 and negatively with 4 (*C. pyrrohoblephara*, *Poa pratensis*, *Scutellaria orientalis* ssp. *orientalis*, *Taraxacum officinale*) species out of 258 species to which interspecific correlation analysis ($p<0,05$) was applied. *C. mucronifera* was strongest with *Aegilops triuncialis* ssp. *triuncialis*, *Acroptilon repens*, *Cichorium intybus*, *Adonis aestivalis* ssp. *aestivalis*, *Cirsium lappaceum* ssp. *anatolicum*, *Crepis macropus*, *Hypericum scabrum*, *Taraxacum farinosum* and *Veronica multifida* (Table 1).

Interspecific correlation analysis was also applied according to the existence of number among positive indicator species of *C. mucronifera* (Table 2). The "C" coefficient was increased to the existence of minimum seven species from the existence of minimum one species among all positive indicator species. The maximum "C"coefficient of *C. mucronifera* was determined to the variable formed according to the existence of minimum seven species among all positive indicator species. The "C" coefficient was decreased to the existence of minimum ten species from the existence of minimum seven species among all positive indicator species (Table 2, Fig. 2).

Interspecific association between *C. pyrrohoblephara* and the other vascular plant species *C. pyrrohoblephara* was, positively associated with 10 species and negatively with 3 (*C. mucronifera*, *Centaurea urvillei* ssp. *urvillei* and *Cichorium intybus*) species out of 258 species to which interspecific correlation ($p<0.05$) was applied. The strongest positively related species with *C. pyrrohoblehara* were *Cotonester nummularia* and *Pilosella hoppeana* ssp. *pilisquama* (NP.) (Table 3).

Interspecific correlation analysis was also applied according to the existence of number among positive indicator species of *C. pyrrohoblephara* (Table 3). The maximum "C"coefficient of *C. pyrrohoblephara* was determined to the variable formed according to the existence of minimum one species among all positive indicator species. The "C" coefficient decreased after the existence of minimum one species (Table 4, Fig. 3).

Comparison of the sites of *C. mucronifera* and *C. pyrrohoblephara* according to Soil Characteristics

Before applying canonical discriminant analysis, correlation analysis was applied among independent variables in order to search multiple relation problem (Table 5). It was found that strong relationships exist between organic matter content and total nitrogen content; among sand content, clay content, loam content and avaible P_2O_5 content. Hence some of the independent variables were omitted to solve multiple relation problem. The variables, loam content ($r=-0,843$) and total nitrogen content ($r=0.991$), showing strongest correlation, were omitted. As a result, canonical discriminant analysis was applied to the sand content, clay content, total lime content, organic matter content, and avaible P_2O_5 content.

Only one function of CDA was performed because of two classification group (Table 6). Wilks' Lambda test of the function showed statistically significant correlation at level 5%(Table 7). Box's M of CDA also showed that the covariance matrices of *C. mucronifera* and *C. pyrrohoblephara* were equal because of $p>0.05$ (Table 8).

According to the classification results, 13 sample plots (81.3%) belonging *C. mucronifera* occupied their own group, 3 sample plots (18.8%) occurred in *C. pyrrohoblephera*. 10 sample plot (71.4%) belonging to *C. pyrrohoblephara* occupied their own group except for 4 sample plots (28.6%) which occupied *C.mucronifera*. In conclusion, 76.7% ((16x81.3%+14x71.4%)/30) of the original groups were correctly classified (Table 9).

The degree of effectiveness of soil characters on the separation of groups was determined by means of standardized CDA coefficients. The most effective variable was sand (%) , on the contrary the least effective variable was P_2O_5 (Table 10).

In comparison with the group of *C. mucronifera*, the group of *C. pyrrohoblephara* has more clay (%) and avaible P_2O_5 content and less sand (%), organic matter (%) and $CaCO_3$ contents (%) (Table 11).

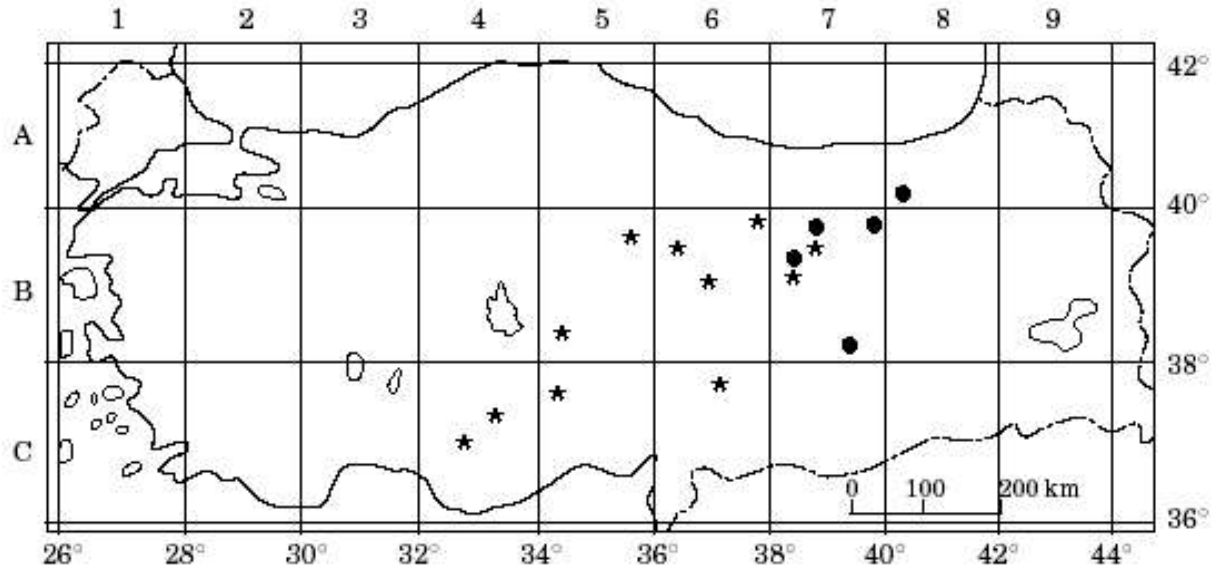

Fig. 1. MAP of the (⋆) *Centaurea mucronifera* and *Centaurea pyrrohoplephara* (●)

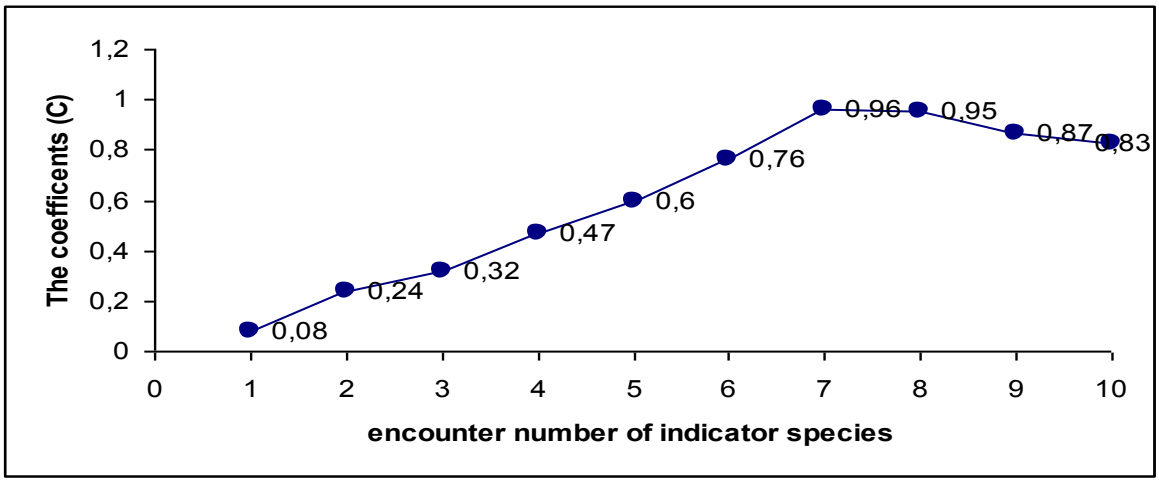

Fig. 2. C values according to the existence number of positive indicator species of *C. mucronifera*.

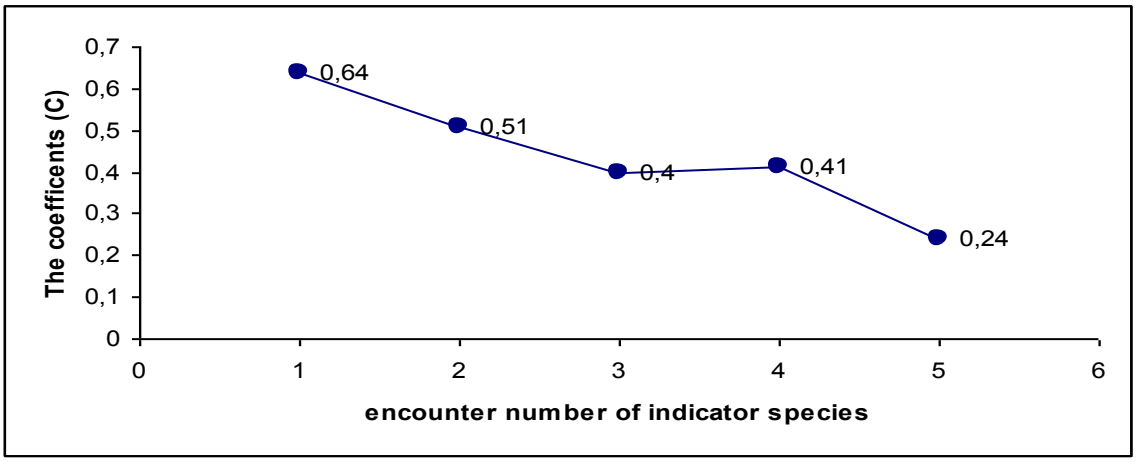

Fig. 3. C values according to the existence number of positive indicator species of *C. pyrrohoblephara*.

Table 1. Interspecific association results of *C. mucronifera*

Species	**Chi square**	**p**	**The coefficents**
Centaurea pyrrohoblephara Boiss.	6.83	0.009	-0.34
Achillea teretifolia Lam.	11.20	0.001	0.44
Acroptilon repens (L.) DC.	17.04	0.000	0.54
Adonis aestivalis ssp. *aestivalis* L.	14.68	0.000	0.50
Aegilops triuncialis L.ssp. *triuncialis* L.	17.95	0.000	0.55
Anchusa leptophyla Roem. & Schultes ssp. *incana*	7.89	0.005	0.37
Astragalus acmophyllus (Bunge) Podlech	11.53	0.001	0.44
Astragalus condensatus Ledeb.	8.49	0.004	0.38
Carduus nutans ssp. *nutans* L.	3.89	0.049	0.26
C. drabifolia Sm. ssp. *detonsa* (Bornm.) Wagenitz	7.89	0.005	0.37
Centaurea solstitialis ssp. *solstitialis* L.	7.17	0.007	0.35
Centaurea urvillei DC.ssp. *urvillei*	11.92	0.001	0.45
Cichorium intybus L.	14.96	0.000	0.50
Cirsium arvense (L.) Scop. ssp. *arvense* (L.) Scop.	5.15	0.023	0.30
Cirsium lappaceum Bieb.) Fischer ssp. anatolicum Petrak	14.68	0.000	0.50
Convolvulus arvensis L.	11.53	0.001	0.44
Crepis macropus Boiss. et Heldr.	14.68	0.000	0.50
Cynodon dactylon (L.)Pers. var. *dactylon*	4.86	0.027	0.29
Dactylis glomerata L. subsp. *Hispanica* (Roth) Nyman	4.98	0.026	0.29
Echinophora tournefortii Jaub. & Sapch	5.86	0.015	0.32
Echium italicum L.	3.99	0.046	0.26
Eryngium campestre L. var. *virens* Link	5.29	0.220	0.30
Geranium rotundifolium L.	11.53	0.001	0.44
Helianthemum ledifolium (L.) Miller subsp. l*edifolium* var. *microcarpum* (Cosson) Willk.	11.53	0.001	0.44
Heliotropium dolosum De Not.	5.86	0.015	0.32
Hypericum scabrum L.	14.68	0.000	0.50
Jurinea pontica Hausskn. et Freyn ex Hausskn.	7.89	0.005	0.37
Malva sylvestris L.	5.86	0.015	0.32
Pinus nigra Arn. ssp. *pallasiana* (Lamb.) Holmboe	8.49	0.004	0.38
Poa pratensis L.	4.48	0.034	- 0.28
Qercus cerris L. var. *cerris* L.	10.68	0.001	0.43
Quercus pubescens Willd.	11.53	0.001	0.44
Ranunculus arvensis L.	11.20	0.001	0.44
Roemeria hybrida (L.) DC. ssp. *hybrida*	11.20	0.001	0.44
Salvia cyrptantha Montbret et Aucher ex Bentham	4.98	0.026	0.29
Scorzonera suberosa C.Koch ssp. *suberosa* C.Koch	11.53	0.001	0.44
Scutellaria orientalis L. ssp. *orientalis* L.	9.64	0.002	-0.40
Silene vulgaris (Moench) Garcke var. *vulgaris* (Moench) Garcke	5.86	0.015	0.32
Stipa holosericea Trin.	6.59	0.010	0.33
Taraxacum farinosum Hausskn. et Bornm.	14.68	0.000	0.50
Taraxacum officinale Wiggers.	6.83	0.009	-0,34
Teucrium multicaule Montbret & Aucher ex Benth.	11.53	0.001	0.44
Trifolium pratense L. var. *pratense* Boiss.et Bal.	4.86	0.027	0.29
Veronica multifida L.	14.68	0.000	0.50
Viola occulta Lehm.	8.49	0.004	0.38
Xeranthemum annuum L.	4.67	0.031	0.28

Table 2. The results of interspecific correlation analysis according to the existence number among positive indicator species of *C. Mucronifera*.

TNEIS	Chi square	P	The coefficents
ONS	0.38	0.538	0.08
TWS	3.44	0.063	0.24
TRS	6.20	0.013	0.32
FOS	13.05	0.000	0.47
FIS	21.22	0.000	0.60
SIS	34.36	0.000	0.76
SES	54.24	0.000	0.96
EIS	54.06	0.000	0.95
NIS	44.81	0.000	0.87
TES	40.48	0.000	0.83

TNEIS: the number existence of indicator species, ONS: the existence of anyone species among all positive indicator species, TWS the existence of minimum two species among all positive indicator species, TRS: the existence of minimum tree species among all positive indicator species, FOS: the existence of minimum four species among all positive indicator species, FIS: the existence of minimum five species among all positive indicator species, SIS: the existence of minimum six species among all positive indicator species, SES: the existence of minimum seven species among all positive indicator species, EIS: the existence of minimum eight species among all positive indicator species, NIS: the existence of minimum nine species among all positive indicator species, TES: the existence of minimum ten species among all positive positive indicator species.

Table 3. Interspecific association results of *C. Pyrrohoblephara*.

Species	Chi square	P	The coefficents
Centaurea mucronifera DC.	6.83	0.009	- 0.34
Alcea pallida (Waldst. & Kit. ex Willd.) Waldst. & Kit.	3.97	0.046	0.26
Centaurea urvillei DC. ssp. *urvillei*	4.69	0.030	-0.28
Cichorium intybus L.	5.19	0.023	- 0.30
Cotonester nummularia Fisch. et Mey.	10.16	0.001	0.41
Hordeum murinum L. ssp.*glacum* (Steudel) Tzelev.	6.23	0.013	0.33
Hypericum lydium Boiss.	6.23	0.013	0.33
Melica ciliata L. ssp.*ciliata*	6.80	0.009	0.34
Onosma sericeum Willd.	3.97	0.046	0.26
Pilosella hoppeana (H.Schult.) CH &. FWSchultz ssp. *pilisquama*	10.16	0.001	0.41
Stipa pulcherrima C.Koch.	3.97	0.046	0.26
Tanacetum chilliophyllum (Fisch. et Mey.)Schultz Bip. var. *chilliophyllum* (Fisch. et Mey.)Schultz	10.16	0.001	0.41
Taraxacum sieheanum Van Soest	3.97	0.046	0.26

Table 4. The results of interspecific correlation analysis according to the existence number among positive indicator species of *C. Pyrrohoblephara*.

TNEIS	Chi square	p	The coefficents
ONS	24.07	0.000	0.64
TWS	15.51	0.000	0.51
TRS	9.96	0.002	0.40
FOS	10.16	0.001	0.41
FIS	3.27	0.071	0.24

TNEIS: the number existence of indicator species, ONS: the existence of anyone species among all positive indicator species, TWS the existence of : minimum two species among all positive indicator species, TRS: the existence of minimum tree species among all positive indicator species, FOS: the existence of minimum four species among all positive indicator species, FIS: the existence of minimum five species among all positive indicator species.

Table 5. Correlations among independent variables

	Sand (%)	**Loam (%)**	**Clay (%)**	**$CaCO_3$ (%)**	**Org. matter (%)**	**P_2O_5 (ppm)**	**Total nitrogen (%)**
Sand (%)	-	-0.84***	-0.75***	-0.25	-0.08	-0.45*	-0.09
Loam (%)	-0.84**	-	0.36*	0.258	0.20	0.48**	0.24
Clay (%)	-0.75***	0.36*	-	0.077	0.09	0.25	0.08
$CaCO_3$ (%)	-0.25	0.26	0.07	-	-0.21	0.17	-0.19
Org.Matt.(%)	-0.08	0.200	0.09	-0.208	-	0.31	0.99***
P_2O_5 (ppm)	-0.45**	0.48**	0.25	0.170	0.31	-	0.33
Total nitrogen	-0.09	0.24	0.08	-0.19	0.99***	0.33	-

*. Correlation is significant at the 0.05 level (n=30)
**. Correlation at significant at the 0.01 (n=30)
***. Correlation is significant at the 0.001 (n=30)

Table 6. Eigenvalues.

Function	Eigenvalue	% of Variance	Cumulative %	Canonical Correlation
1	0.67	100	100	0.6331

Table 7. Wilks' Lambda.

Test of Function(s)	Wilks' Lambda	Chi-squarre	df	Significant level
1	0.599	13.073	5	0.023

Table 8. Test results of Box's M.

Box's M	F	df1	df2	Significant level
0.200	0.193	1	2320.16	0.660

Table 9. Classification results.

		Predicted group			
		C. mucronifera		***C. pyrrohoblephara***	
		Count	Percentage	Count	Percentage
Actual group	*C. mucronifera*	13	81.3	3	18.8
	C. pyrrohoblephara	4	28.6	10	71.4

Table 10. Standardized CDA Coefficients

Soil characters	**Function 1**
Sand (%)	0.675
Clay (%)	-0.452
CaC O_3 (%)	0.536
Org. Matter (%)	0.542
P_2O_5	-0.114

Table 11. Group statisticts.

	C. mucronifera		*C. pyrrohoblephara*	
Soil characters	**Mean**	**Std. deviation**	**Mean**	**Std. deviation**
Sand 8%)	66.90	16.13	48.59	15.13
Clay (%)	10.49	8.00	22.98	13.16
$CaCO_3$ (%)	8.44	12.31	6.64	10.83
Org. Matter (%)	5.90	3.13	4.90	4.13
P_2O_5	53.87	47.07	69.29	46.15

DISCUSSION

Interspecific correlation analysis was applied to find out indicator species of *C. mucronifera* and *C. pyrrohoblephara* by means of presence/absence data of vascular plant species. It was found that there are 4 negative (*Centaurea pyrrohoblephara*, *Poa pratensis*, *Scutellaria orientalis* ssp. *orientalis*, *Taraxacum officinale*) and 46 positive indicator species for *C. mucronifera*, and 3 negative (*C. mucronifera*, *Centaurea urvillei* ssp. *urvillei* and *Cichorium intybus*) and 10 positive indicator species for *C. pyrrohoblephara*. Negative indicator species may point out the sites which lie outside the boundary of potential distribution area of *C. mucronifera* and *C. pyrrohoblephara*. On the contrary, positive indicator species point out the sites which can be their potantial distribution areas.

Interspecific correlation analysis was also applied to determine the coefficient of the variables characterized according to the existence of number among positive indicator species of *C. mucronifera* and *C. pyrrohoblephara*. The maximum "C"coefficient of *C. mucronifera* was determined to the variable formed according to the existence of minimum seven species among all positive indicator species. This expression means that the sites occupying minimum seven positive indicator species of *C. mucronifera* are the most probable potential areas for *C. mucronifera*. The positive indicator species number of *C. pyrrohoblephara* is less than the positive indicator species number of *C. mucronifera*. As a result of this, the maximum "C"coefficient of *C. pyrrohoblephara* was determined to the variable formed according to the existence of minimum one species among all positive indicator species. Therefore, the most associated species (*Cotonester nummularia* and *Pilosella hoppeana* ssp. *pilisquama*) among positive indicator species of *C. pyyrohoblephara* can be suggested as priority for determination of potential distribution areas of *C. pyrrohoblephara*.

There is also negative association between *C. mucronifera* and *C. pyrrohoblephara*. This result points out the differences of the site preferences of *C. mucronifera* and *C. pyrrohoblephara*. It is impossible to support this hypothesis by climatic data in the light of dificulties mentioned earlier. However, soil characteristics can be used to support the hypothesis.

Canonical Discriminant Analysis (CDA) was applied to compare the soil characters of *C. mucronifera* (16 sample plot) and *C. pyrrohoblephara* (14 sample plot). Before applying discriminant analysis, Pearson correlation analysis was applied among independent variables in order to search multiple relation problem. As a result of Pearson correlation analysis, variables total nitrogen and loam content were omitted. On the other hand, organic matter explains total nitrogen, and sand content explains loam content. Therefore, these variables are both unnecessary and problem in terms of correction of CDA because of multiple related problem caused inequality in covariances.

In conclusion, CDA was applied to the 5 soil variables (sand content, loam content, total lime content, avaible P_2O_5 content , organic matter content). CDA showed that the discrimination between *C. mucronifera* group and *C. pyrrohoblephara* was succesfull being significant at 5% level. The most important variables of this discrimination were sand, total lime and organic matter contents. The classification was succesfull as the discrimination showed very high value with 76.7%. According to this result, It can be said that *C. mucronifera* and *C. pyrrohoblephara* prefer different sites in terms of soil characteristics.

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