

Agronomical Characteristics of Some Chickpea Ecotypes (*Cicer arietinum*) Grown in Turkey

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Abstract: Chickpea is an important field crop for less quality fields and enduring to drought. In Isparta ecology as a sowing duty covers large area. This research has been done for determining the most suitable chickpea line and varieties in the grain-chickpea sowing duty system of the Isparta city ecological conditions. 11 cultivars and lines grown in Turkey were used in this two year long study (between the years 1996 and 1997) which has randomized block experimental design with four replications. Data were analyzed by multivariate statistical methods. According to the two-year results, the differences between the lines and cultivars were found to be important in all components observed. The differences between the years were proved to be significant in all components, except the number of per plant and the height of the first pod from the ground. In both years anthracnose (*Ascochyta rabiei* pass. Lab.) wasn't found in all cultivars and lines in natural conditions. It was found one Principal Component (PC1) by factorial analyses. But, eleven examined cultivars were separated in two main group and three subcluster by cluster analyses.

Key words: Chickpea · breeding · factor analysis · cluster analysis

INTRODUCTION

In today's world, paralleling to population growth, nutrition problem is growing increasingly. Especially production of high-range protein foods has been important for the solving nutrition problem. For this reason, it is necessary growing the most productive and high-quality varieties to the regions.

Growing of chickpea on the less quality fields and enduring to drought, makes important to this products. Chickpea, which has large market and entered to sowing duty with wheat pillar, is a demanded plant for dry and salty areas [17]. When processed in the food industry, consumed as a roasted chickpea, if we look at to roasted chickpea export, it is a necessary product [2].

In the Isparta ecology, when chickpea duty in the drought fields, grain-chickpea, grain-common vetch, grain-lentil, grain-fallow land implementing as a sowing duty, covers an important area [3]. This research was carried out to determine the adaptation of some chickpea lines and cultivars under the ecological conditions of Isparta province in Turkey. [6, 8, 11, 13 and 15] were studied some researches on the agronomical characteristics of some Chickpea cultures.

Factor analysis with principal component and cluster analysis were used to determine the suitability of some features to characterize the variation of the observations and to determine natural groups from the

cultivars studied [1, 2]. In the first phase, factor analysis has been used for identification of the number of PCA's. In the second phase, cluster method has been used to determine disparities and similarities.

In this research, multivariate statistical methods were used for determining of data to obtain more results than variance analysis. Rudimentary, exploratory procedures are often quite helpful in understanding the complex nature of multivariate relationships. Analysis of principal components is more of a means to an end rather than an end in them because they frequently serve as intermediate steps in much larger investigations. For example, principal components may be inputs to a multiple regression or cluster analysis. Moreover, principal components are one 'factoring' of the covariance matrix for the factor analysis model [10].

Cluster analysis when searching the data for a structure of 'natural' groupings is an important exploratory technique. Grouping can provide an informal means for assessing dimensionality, identifying-outliers and suggesting interesting hypotheses concerning relationships [10]. The term of cluster analysis encompasses a large number of techniques developed to identify groups of observations with similar characteristics. It is based on the minimizing of the variance in the group and maximizing of the variance among groups [10]. The distance between two variants in which data have been standardized, can be stated as the

monotonic transformation of the correlation between the two variables.

MATERIAL AND METHOD

This research has been carried out in the 1996-1997 years, so as to determining suitable chickpea varieties and lines for Isparta ecological conditions. In the research, assured from different agricultural institutions; Eser 87 (V1), Akçin 91 (V2), Canitez 87 (V3), Diyar 95 (V4), ILC-482 (V5), AK-7112 (V6), ICC-5566 (V7), Red roasted chickpea (ecotype) (V8), 4N-495/2 (V9), Spanish Chickpea (ecotype growing in the region) (V10) and Aziziye (V11), variety and lines have been used as a material.

While Atabey test area, which this research had been carried out in 1996, is axle-clay, silt, not salty, a little bit alkaline with much limely, average in phosphorus and medium level in organic matter, Çüntür Kampus area which this research had been carried out in 1997 is silt,

slight alkaline, not salty, mostly limely, average phosphorus and poor in organic material [4]. The average precipitation of the years 1996-1997 was realized different from average long years [5].

Study have been set up every twice year, as randomize block experimental design with four replications. Every twice year, sowing have been done in the middle of March month. Data about productive elements have been proved from counting and measurements from ten plants which taken from every parcel before harvest. Seed productivity has been found from whole test field (6 m²) with added ten plant production.

So as to find the natural grouped between varieties and examining the changes in the data, principal component factor analysis and cluster analysis as multivariate statistical analysis methods have been used [1, 10].

Principal component analysis (PCA) is concerned with explaining the variance-covariance structure through a few linear combinations of the original variables. Its general objectives are (1) data reduction and (2) interpretation. PCA method provides to form free new sets which are different from the beginning set. Reflecting of the variables at 'R' is one of advantages of the method. The usual objective of the analysis is to see if the first few components account for most of the variation in the original data [1].

Clustering (or grouping) is distinct from the classification methods. Cluster analysis is a more primitive technique in that no assumptions are made concerning the number of groups on the group structure. Grouping is done on the basis of similarities or distances

(dissimilarities). The theory behind clustering is an expected positive relationship between the variables Euclidean distance and the similarity of the observations [10]. As a result, cluster analysis is driven by the trade-off between minimizing the Euclidean distance of observations within a cluster and maximizing the Euclidean distance between clusters. Clustering can be conducted directly on the data set or as a two-step procedure in combination with other statistical methods like factor analysis and principal component analysis.

The number of clusters is not a *priori* given, to decide which number of clusters to choose. It's based on the aim of cluster analysis, which is maximizing the difference between the clusters. There are a large number of different available how to conduct cluster analysis.

RESULTS AND DISCUSSION

In this study multivariate statistical methods were used to classify a group of chickpea varieties on the basis of their agronomic characteristics. Classifying of investigated varieties into two basic groups which consist of eight groups has been suggested according to the cluster analysis.

According to the two years analysis results obtained from chickpea cultures, it is proved that in the whole examined features, varieties differences are important (Table 1). Except the high of first pod from ground and the number of pod in the plant, it has been proved that there are differences between years on the other features. Except for thousand seed weight and unit field seed productivity, year and variety interaction have been important as statistically.

When Akçin-91 variety (26.68 cm) has been found the most length of plant, kırmızı nohut (22.05 cm) has the smallest length of plant. [18] was determined the length of plant changed between 12.47 and 26.87 cm. Also [16] obtained similar results (15-50 cm).

Accounted values of height from ground of first pod are changed between 14.8 and 19.14 cm. [9] was found these values as 13.0-33.6 cm.

If we look at to number of side brunch, kırmızı nohut (3.44) has the most, ICC 5566 (2.52) has the least values. [16] (0.3-22.7) and [9] (1.4-6.4) were found similar results.

ILC482 has the most (10) and Diyar95 has the least (5.53) values of pod number per plant. These results are near to researches of [16] (4-100), [9] (3-12), [15] (8.5-21.8), but they are small than results of [7] (14.4-67), [13] (53.5).

Mostly number of main brunch in the plant from ILC-483 line and the less one is obtained from ICC-5566 and Akçin-91. Results have showed paralleling to the findings of [9, 11, 16, 18].

Table 1: Categories of varieties, average values of quantitative characteristics (1996-1997)

Varieties	1	2	3	4	5	6	7	8	9	10	11
Eser87	24.38	16.93	2.99	2.92	9.70	10.52	311.6	3.07	0.52	115.3	20.98
Akçin91	26.68	17.35	2.60	3.11	7.43	7.93	419.8	3.12	0.49	123.2	21.80
Canitez87	23.87	15.52	2.79	3.31	7.22	7.60	516.4	3.59	0.49	110.9	19.08
Diyar95	25.38	17.80	2.84	3.30	5.53	5.95	449.6	2.67	0.49	114.6	19.63
ILC482	22.12	15.59	3.15	3.37	10.00	10.63	320.0	3.06	0.51	107.8	20.57
Ak7112	23.88	15.47	2.78	2.83	6.81	7.35	368.4	2.76	0.47	111.5	19.41
ICC5566	26.63	19.14	2.60	2.52	8.96	9.58	320.0	2.87	0.44	110.9	20.69
Kır.Nohut	22.05	14.80	2.70	3.44	6.93	7.25	522.6	3.56	0.51	111.3	19.36
4N-495/2	25.39	16.95	2.90	3.43	6.94	7.34	510.8	3.36	0.50	104.6	18.64
Ispany.No	26.19	17.54	2.85	3.07	7.34	7.68	504.8	3.56	0.47	125.6	21.09
Aziziye	24.73	16.69	2.73	2.73	6.38	6.74	415.5	2.98	0.48	105.1	23.25
Average	24.66	16.70	2.81	3.08	7.56	8.04	423.6	3.14	0.49	112.8	20.41
LSD(%5)	0.543	0.4491	0.2169	0.3473	0.8838	0.88	6.173	1.090	1.852	6.89	0.49

Note: 1. Length of plant (cm), 2. Height from ground of first pod (cm), 3. Num. of main brunch, 4. Num. of side brunch, 5. Pod num. per plant, 6. Seed num. per plant, 7. 1000 seed weight (g), 8. Seed productivity per plant (g), 9. Harvest index (%), 10. Seed Productivity (kg da⁻¹), 11. Protein ratio (%) (1997)

Table 2: Accounted principal components and communalities rates for variables

Varieties	Principal components coefficients	Communalities (h ²)	Variance matrix (ε, Ψ)
V1	0.9945	0.9890	0.0110
V2	0.9998	0.9995	0.0005
V3	0.9967	0.9934	0.0066
V4	0.9998	0.9996	0.0004
V5	0.9963	0.9926	0.0074
V6	0.9986	0.9973	0.0027
V7	0.9938	0.9876	0.0124
V8	0.9958	0.9917	0.0083
V9	0.9962	0.9923	0.0077
V10	0.9986	0.9971	0.0029
V11	0.9996	0.9991	0.0009

When we look at to seed numbers, ILC-482 has the most; Diyar 95 has the least values. These results are near to the [9, 15, 16], but far from [7, 13].

It was obtained that kırmızı nohut has high value (522.6 g); Eser 87 has small value (311.6 g) for 1000 seed weight. [16] was obtained between 87-791 g and [8] was obtained between 240-360 g for this characteristic.

Canitez 87 variety has the most seed productivity value (3.59 g); Diyar 95 has the least value (2.67 g). These values are near to values of [7] (3.5-15.1 g) and [9] (0.4-5.8 g), but they are small than values of [18] (5.58-21.67 g). In both years anthracnose (*Ascochyta rabiei* pass. Lab.) wasn't found in all cultivars and lines in natural conditions.

When giving importance to seed productivity, it has been noticed that with Spanish chickpea (125.6 kg da⁻¹) which is grown from producer and passed from natural selection and Akçin 91 (123.2) varieties are suitable for Isparta conditions. While [9] 200-208 kg., [14] informed 150-237 kg. productivity have been obtained, [8] have informed the most 277 kg. productivity has been obtained in 1989. Also, these varieties have advantage for suitable consumer wishes with high thousand seed weight [12].

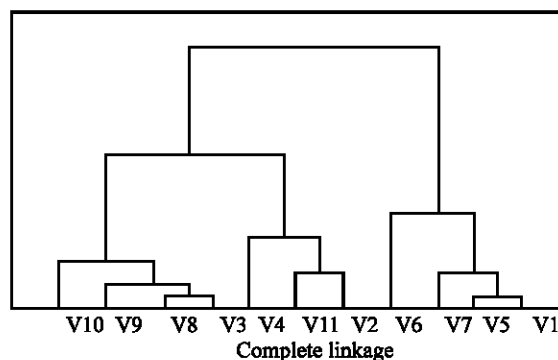


Fig. 1: Dendrogram obtained by cluster analysis on the initial data

Protein ratios of varieties were obtained for 1997 product. When we look at the characteristic, Aziziye variety has the most value (23.25%); 4N-495/2 variety has the least value (18.64%). [11] (16.44%) and [6] (19.95-24.3%) was obtained similar results.

According to the principal component factor analysis results, one principal component (PC1) have been obtained (it's explain 99.45 percent of the total variance) (Table 2). For this reason, ignorant information lost is low degree in research (% 0.55). Communality values showed that, examined cultures have important degree of similarity genetic feature and data are reliable. When done ordering the varieties as their important degree (how can be act the group) they are enumerated as; V₂, V₄, V₁₁, V₆ and V₁₀ which are more important varieties and the least important culture is V7 which has the smallest principal component coefficient.

When making of the principal component values rotation, the most important varieties of the whole group are in sequence, V4, V2 and V11. While V1 and V8 have the farthest and the most different features (Euclidean distance 301), the nearest two cultures are V3 and V8

(Euclidean distance 14). It shows that, similar cultures have easily used for the others. When adaptation applications are done between varieties which are farthest one another, so different and new cultures can be obtained.

According to the dendrogram results produced by cluster analysis, varieties are separated to two main and three little groups (Fig. 1). Beside, there are more different three main groups (3 sub cluster) by cluster analysis.

V1, V5, V7 and V6 cultures have formed the first population different from the others and high similarities second main group which is formed by the other separates to two little group. The most similar ones between cultures are; V8 and V3, V11 and V2, V5 and V1. It has been noticed that, examined varieties are divided thirdly groups. Similar cultures have importance for preference richness of producer. While the representation culture of first group is V4 (and V2), the most important culture of the second group is V6.

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