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Research Article

Morphological Variability of Colored Dry Bean (*Phaseolus vulgaris* L.) Germplasm From Artvin Province

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ABSTRACT

In this study, 74 villages were selected and a total of 279 samples were taken from those villages according to the progressive sampling system. Regarding the seed size and color of the materials, 400 genotypes were grouped. These genotypes were sown in Samsun. Description of the genotypes was performed according to morphologic description criteria developed by IBPGR and EU-CPVO. A total of 68 observations were performed by adding some important agronomic traits. Description data for the rest colored genotypes were mentioned in the text. Of all colored seed producing genotypes, it was determined that 54 genotypes were dwarf, 15s genotypes were semi-dwarf and 78s genotypes were climbing. To determine the morphologic variability of local bean varieties of Artvin province, the collected material was divided into two groups as white and colored seeds. 145 white seeded and 147 colored seeded genotypes were subjected to Cluster analysis and dendogrames were formed. As a result of the cluster analysis it was established that bean genotypes having colored seed formed 26 subgroups. All the data obtained shows that this material has a rich variation and could be used for both new cultivars developing as dry and fresh consumption and different breeding purpose.

INTRODUCTION

Bean (*Phaseolus vulgaris* L.) is a legume which was introduced to Turkey later just like significant field crops such as maize, potato and tabacco and also is well adapted to Turkey, especially Black Sea Region although it is originally not familiar to Turkish native flora. It is so important that it has been considered as if it were Turkish national food which is grown throughout Turkey and consumed as fresh and dry. Protein (22.6%), carbohydrate (56%), rich mineral matter and vitamin content of bean seeds make the plant a very significant crop as if it were both meat and bread for Turkish kitchen (Sözen, 2012). According to 2011 data of FAO, sowing area of dry bean in Turkey is 94 625 ha (FAO, 2011). Bean among grain legume crops is situated in the 3rd rank after chickpea and lentil considering sowing areas. Dry bean production in Black Sea Region is 26, 080 tonnes from 32 069 ha, which equals 13 % of total dry bean production of Turkey. With this production, Black Sea Region is in the first rank regarding the production (TUIK, 2011). Not only is dry bean important for our country, but it is also very important as an agricultural crop for the world. As a matter of fact, according to 2011 data of FAO, dry bean is the most sown grain legume crop in the world with 25, 500, 000 ha sowing area (FAO, 2011).

Dry bean (*Phaseolus vulgaris* L.) shows a wide distribution and diversity. Breeding studies on bean and number of new cultivars have increased as in many plant species. However, it is necessary to improve new cultivars because of different demands such as balanced diet, ecological differences and pest diseases. Artvin province is located in the northeastern Turkey, neighbor to Georgia and a gate opening to Black Sea Region for eastern provinces. Geographical and topographical structure of the province show differences. For this reason, it is possible to see many plants from subtropics to continental species in the flora or production which are grown or naturally exist in Turkish geography (Sözen, 2012).

Dry bean sowing area in the province occupies 355 ha of 4894 ha agricultural sowing area (Artvin Tarım İl Müdürlüğü, 2012). There is a rich dry bean diversity which is one of the most three important crops for local farmers in Artvin provinces. Because of the dams to be established on River Çoruh, constructional areas or water gathering basins have been evacuated . Therefore , many crops and plant species of the flora face risk of disappearance. In terms of agriculture, there is a closed traditional agriculture in the province. Commercial cultivars are not grown in the region, so untouched local dry bean varieties are extremely important genetic resources. The study aimed to find out the morphological definitions and differences of the bean gene resources collected from Artvin province which has rich genetical bean diversity.

In the breeding studies, realizing the similar collected materials prevents waste of time and source. It is also useful to use both statistical methods which have recently been developed and genetic studies. Otherwise, it is not possible to have such conclusion by the observations which are under the effect of many genes. Factor and principal component analysis called as multivariate analysis methods give a chance to analyze more than one character together. Cluster analysis is also considered as a multivariate method since it analyses many variables all together (Rencher, 1955).

In the study, it is aimed to collect the local dry bean varieties and acquire them to gene bank and researchers.

MATERIALS AND METHOD

In the result of the survey accomplished in April 2005, bean seeds were collected from 279 points of 74 districts. The seeds were sorted concerning their seed types and shapes and 400 genotypes were formed. These 400 genotypes and 5 control cultivars were sown in the experimental field of Black Sea Agricultural Research Institute in Samsun. Dwarf bean types and creeping and climbing types were sown in different row spaces, 50 cm and 70 cm, respectively. Row lengths were 5 m for all dry bean types. During sowing, 4 kg Nitrogen and herbicide were applied. During the vegetation period of the seedlings, 4 times irrigation and 3 times weed control by hand were implemented.

Identifications of the genes were fulfilled according to the criteria of IBPGR and EU CPOV. For each group, 68 treatments were observed. In the study, 147 of 400 genotypes gave seed and these genotypes were evaluated. These 147 genotypes with colorful seeds were evaluated with cluster analysis and dendograms were obtained. Evaluating the subsamples according to cluster analysis, 51 qualitative and quantitative characters were considered (Table 1).

Table 1: Characters considered at experiment

Anthocyanin coloration of hypocotyl	Seed-color of hilar ring	Pod:shape of cross section
Plant-habit type	Seed-shape of median cross section	Pod:Ratio iransverse thickness
Plant-growth type	Seed-width in cross section	Pod:ground color
Dwarf beans only:plant	Seed:size	Pod:İntensity of ground color
Dwarf beans only:Inflorescence	Seed:shape of median cross section	Pod:secondary color
Leaf-Plosity on surface	Seed:main color	Pod:hue of secondary color
Leaf- Pilosity on back side	Seed-Glossiness	Pod:density of flecks of secondary color
Leaf-green color	Seed-Distribution of predominant	Pod:stringiness

	secondary color	
Leaf-rugosity	Seed:width in cross section	Pod:degree of curvature
Terminal leaflet-size	White seeded varieties only:Grain	Pod:shape of distal part
Terminal leaflet-shape	Seed:shape of median longitudinal section	Pod:length of beak
Terminal leaflet-apex	Seed:predominant secondary color	Pod:bean curvature
Flower	Seed-veining	Pod:texture of surface
Flower:size of bract	Dwarf beans only:Pod	Pod:constrictions
Flower:color of standard	Climbing beans only:Pod	Varieties with kidney –shaped seeds only:seed
Flower:color of wings	Pod:median width	Time of flowering
Seed-number of colors	Pod-Type of secondary color	Setting of pod

RESULT AND DISCUSSION

It was observed that 26 groups in the dendogram were formed at the end of the cluster analysis (Figure 1). Among the 26 groups, Group S had the highest number of subsamples (16), however, Group I, İ, T and Z had the lowest number of subsamples (1 each). The subsamples 313 and 333 located in the Group İ, were the closest subsamples to each others. The subsample 313 was collected from Çıralı district of Yusufeli town but the subsample 333 was obtained from Oruçlu district of Artvin province. In a study to determine similarity in terms of morphological properties between 66 domestic bean varieties collected from Spain and to correlate them with phaseoli seed protein levels, Escribano et al., (1998) reported 11 clusters based on 14 quantitative and 5 qualitative properties. 3 clusters consisted of samples with Meso-American origin and remaining 8 groups consisted of samples with Andean-American origin.

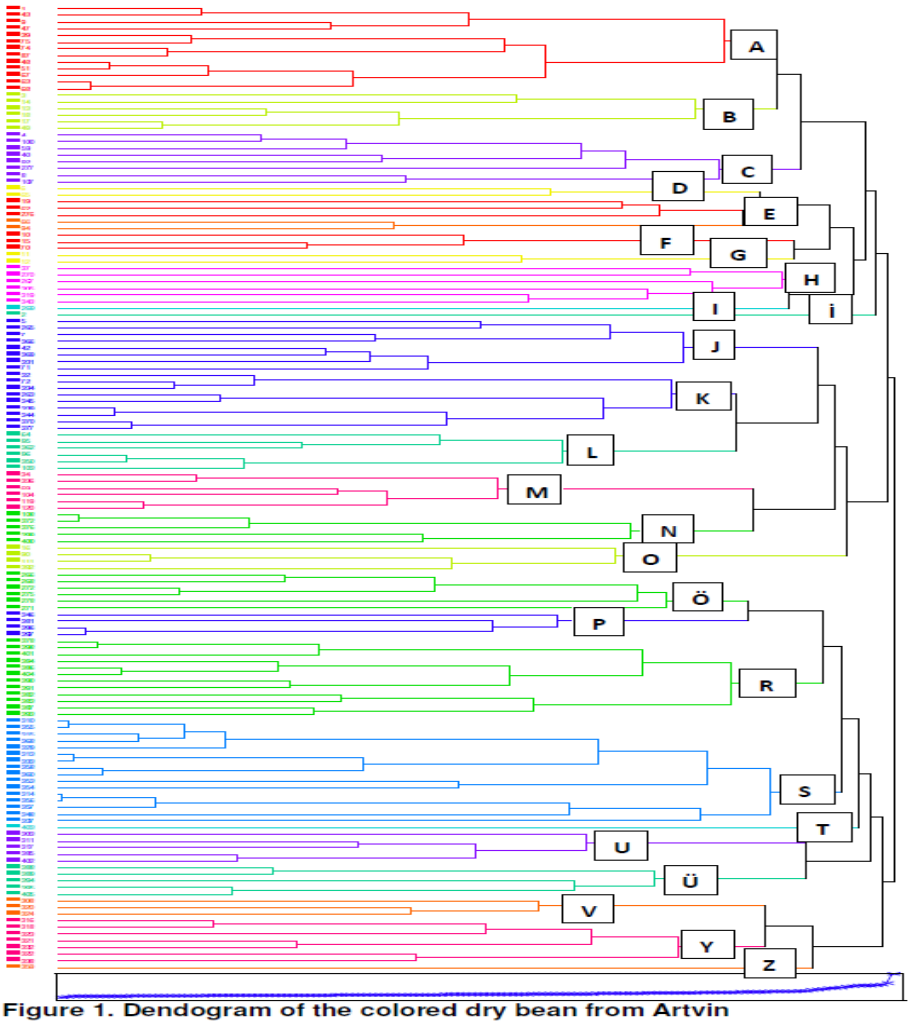

Figure 1. Dendogram of the colored dry bean from Artvin

Plant height of the 147 genotypes with colorful seeds ranged from 20 to 250 cm. The average plant height of 16 genotypes representing Group S was 186.15 cm and placed in the first rank among all groups. On the contrary, Group F had the shortest subsamples with 37.93 cm plant height and the subsamples showing dwarf form characters were gathered under the Group F. Bozoğlu and Gülümser (1999) reported that there is a positive and significant relationship between yield and plant height, and that the degree of heredity is high.

Similarly, It was determined that Group D had the subsamples growing earlier with 76 days. First pod height is an important criteria for mechanized harvest to decrease harvest losses of dry bean. The subsamples of Group T were in the first rank with 8 cm height. Regarding 100 seed weight, subsamples ranged from 19.5 to 59.8 g. Bozoglu ve Gülümser (1999) stated that 100 seed weight of bean cultivars and varieties changed between 26.62 and 50.43 g. Different studies have reported that this value varies between 32.1 and 39.1 g (Şehirali, 1988) and 46 and 62 g (Escribano et al., 1991).

In the study, Group N had five subsamples with the highest average 100 seed weight (50.76 g), whereas Group Z was in the last rank with 25.5 g 100 seed weight. On the other hand, subsamples of Group T had the shortest period of 50% pod setting with 45 days.

The three samples located in Group V had the highest average pod number per plant with 38.26, while the subsamples of Group J gave the lowest average pod number per plant (3.93). In a study to determine agricultural properties of dry bean, Anlarsal et al., (1998) report important positive correlations between the number of pods and yield.

The yield of subsamples per plant showed a great variation (10-590 g). When we evaluated the yields per plant at the base groups, a subsample placed in Group I, had 590 g per plant and it was ranked in the first place. However, Group T had the subsamples having the least average yield per plant and was in the last rank (7.2 g). Pekşen ve Gülümser (2005) conducted a research to find out yield and yield characters of some *Phaseolus vulgaris* L. genotypes between 2002 and 2003. The researchers reported the yields between 2.56 and 36.83 g per plant.

The colorful genotypes showed a large variation considering main seed color. As a matter of fact, six main seed colors were determined in the colorful genotypes. Brown main seed color group had the highest genotype number with 121 (41.4%). The Groups A, B, D, E, J, M, N, U had the subsamples belonging to brown main seed color group. Red main seed color group had 10 genotypes located in the Groups İ,C,F,P,Ü. Furthermore, dark yellow, green, black, violet and grey main seed color groups were also found in the genotypes with colorful seeds.

CONCLUSION

After realizing the characterization studies of 400 subsamples under field conditions collected from Artvin province, 147 subsamples with colorful seed were revealed. With the aim of determining the morphological variability among the sub samples, these subsamples were taken under cluster analysis with 46 different qualitative and quantitative characters. According to the obtained dendogram, 26 groups were figured out. These groups had different subsample numbers and ranged from 1 to 16.

A highly wide variation was observed regarding qualitative and quantitative characters when the dendogram formed at the end of the cluster analysis was evaluated. This wide variation is a very promising genetic base for further selection and breeding studies.

Table 2. The colored beans group and sub-groups and their number obtained From cluster analysis

Group	Sub Groups	Genotypes	Group Number	Group	Sub Groups	Genotypes	Group Number
A	1	1, 43	2	N	1	108, 372,376	3
	2	9, 47	2		2	399, 400	2
	3	39, 75	2	O	1	16	1
	4	74, 87	2		2	90, 111, 392	3
	5	48, 51, 67	3	Ö	1	266, 268	2
	6	63, 68	2		2	272, 275	2
B	1	3, 14	2		3	271	1
	2	13, 18	2		4	278	1
	3	17, 49	2	P	1	346	1
C	1	4, 100, 59	3		2	381	1
	2	40, 92	2		3	396, 397	2
	3	277	1	R	1	378, 398,401	3
	4	8, 107	2		2	384, 386,404	3
D	1	6, 65	2		3	390, 391	2
E	1	19, 62	2		4	382, 383	2
	2	276	1		5	387, 393	2
	3	66, 94	2	S	1	310, 355	2
F	1	10	1		2	315, 368	2
	2	15, 70	2		3	329	1
G	1	11, 12	2		4	313, 333,253	3
H	1	37, 270	2		5	358, 360	2
	2	267	1		6	353, 354	2
	3	305, 319, 343	3		7	314, 356,357	3

I	1	269	1		8	348	1
İ	1	2	1		9	337	1
J	1	5, 265,307	3	T	1	403	1
	2	7, 366	2	U	1	303	1
	3	42, 369,331	3		2	311, 317	2
	4	71	1		3	385, 402	2
K	1	32, 72, 334	3	Ü	1	388, 389	2
	2	263, 345	2		2	394	1
	3	339, 344	2		3	395,405	2
	4	370, 377	2	V	1	308, 320,324	3
L	1	64, 95,362	3	Y	1	316, 318,323	3
	2	96, 350,103	3		2	321, 332	2
M	1	34, 336	2		3	322, 338	2
	2	69, 104	2	Z	1	359	1
	3	119, 120	2				
							147

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