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Problems and Prospects of the Selection of Bean (*Vicia faba* L.) in Azerbaijan

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ABSTRACT

Newly created “Garaja” variety and the forms with lower lever of tanin introduced from ICARDA will allow widening of the field of Vicia Faba culture. Until present, culture of Vicia Faba in Azerbaijan was limited to household. In Azerbaijan, the sowing of vegetable beans does not have much production value. The culture is mainly used for research purposes and is cultivated in small areas, like garden. Therefore, the study of the morphobiological features of plants of the prospective variety in each region and the comprehensive study of the genetic resources of culture is relevant. The article is devoted to the results of a study of the local gene pool of horse or fodder beans and materials from ICARDA. Yield and analysis of crop structure, disease resistance were analyzed. Since samples with a low level of harmful substances are new for our republic. These studies are an important initial study for the subsequent production of new varieties. We hope that this will lead to an increase in the acreage of legumes in our republic.

Key words: Bean selection, Harmful substances, Prospect, Source material, Sort diseases.

INTRODUCTION

The genetic diversity of leguminous plants plays an important role in ensuring food safety and sustainable development of agriculture. These plants are a priority in the modern world since they are considered as the main components of the consumer basket that can meet the daily need for protein and be considered as an alternative nutrition. The importance of legumes, as an alternative source of nutrition, is associated with the content of essential amino acids, as well as vitamins, minerals and microelements. Nowadays, the search for cheap and profitable cereals occupies the minds of mankind, while the use of legumes can be one of the possible solutions. Replacement of animal protein with plant protein in daily diet may reduce the demand for cattle breeding and serve as a reason for replacing pastures with croplands. On the other hand, the fixation of atmospheric nitrogen by leguminous crops can reduce the technogenic load on the soil. Despite the fact that the size of mycobacterium by bacteria of atmospheric nitrogen is different for legumes, they are a good prerequisite for summer and autumn crops. Their positive impact lasts for 2 years and has a beneficial result on fertility (R.L. Tate, 1995). Most scientists claim that while reseeding legumes, 15-20% less nitrogen fertilizers are used (Orlov, 1986; Titova, 2012). After the harvest, the roots and discarded plant parts remain on the ground, which are a cheap and environmental friendly source of nitrogen and potassium (45-130 kg\ha N; 10-20 kg\ha F and 20-70 kg\ha K) (Basra, 2004).

Bean planting begins in the east of California and ends on the Japanese islands. Board bean has long been cultivated by people for nutrition. This can be proven by the remaining found in a number of European countries belonging to the stone, copper and iron era. Evidence shows that the first crops of legumes belong to the Stone Age (Gorin *et al*, 1968). These grains were found in the tomb of the Egyptian pharaoh, who lived in 2400 BC. In Greece and Rome, legumes were used in cooking, hence the name “faba”, which translates as “food”. Despite numerous studies, the origin of legumes is still a contentious issue (Keydel, 1986). This comes from a very limited number of testimonies of *Vicia faba* L. Sowing and the consumption of legumes began in the Middle East, and spread widely during the Neolithic age (Orlov, 1986). In ancient Egypt, legumes were a poor man’s meal. In Macedonia, beans were not only nutritious food, but also used as a green fertilizer. It is known about the use of beans in food in the Scandinavian countries, Germany and France since the 13th century. During Soviet times, the cultivation of board beans was advised in the front Caucasus, and especially in the Lankaran region of Azerbaijan. Some of these beans belonged to the Mediterranean group (it was characterized by tall-growing, wide flowers and leaves of light shades, with indehiscent pods, brown, flat and cylindrical grains) and the other to the var.equina (Reichb.) subvar. rugosa. sub-type. Murat.,f. mediterranea Murat (it was characterized by short stature (55-70 cm), a small number of branches (2-3 pieces), pink-yellow (laterint), medium-sized, longer fast-ripening grains). During the ripening phase, the inclination of the stem of the plant to the ground led to the loss of the pulse. During the Soviet times, this type bore the name “Lankaran Bob”, sowing occurred in spring and autumn (Gorin *et al*, 1968; Pryashnikov&Yakushin, 1938).

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Materials and Methods

The studies were conducted in 2013-2018 at the Institute of Genetic Resources (IGR) of the National Academy of Sciences (NAS) of Azerbaijan. The Scientific-Experimental Base is located on the Absheron peninsula (80 m above sea level), in a dry subtropical climate with very sunny and dry summers, warm and sunny falls, and mild and almost snowless winters.

The following method was used during the research: Methodology for the definition of a key set of characterization and evaluation descriptors for faba bean (*Viciafaba*) (Alercia, 2011).

Sowing of collection samples was carried out in duplicate with an area of food of one plant 10 x 45 cm at the optimum time, in the fall at the end of November. A standard sample was sown after every 10 samples. In the process of growing, the ranks made phenological observations, determined the time of onset of phenological phases. The onset of the phase was noted when there were signs in 10% of the plants, and complete - in the presence of signs in 75% of the plants. The height of the plant from the soil to its highest point (cm), the height of attachment of the lower bean (cm), the number of beans per plant, the mass of seeds from one plant, and the mass of 1000 seeds (g) have been measured.

154 samples were used as research material: 27 of them were local forms and 103 were samples obtained from ICARDA. Among the ICARDA samples used, 83 are fertile, and 20 resistant to ascohytosis were compared with local forms.

During the study of plants, phenol logical observations were carried out, the samples were evaluated by quantitative and qualitative characteristics, and correlation relations were determined between them.

Results and Discussion

Fertility of food beans is a complex trait, which is determined by the number of beans in a plant, the number of grains in a plant and the density of grains in the beans, and is calculated from a sample of 1000 plants. The plants are very sensitive to environmental characteristics: they quickly respond to changes in weather and soil conditions, feeding and irrigation.

The average height of plants at the standard was 107 cm, for collection samples - from 45 to 115 cm. The number of beans per plant was 29 for standard, for collection samples from 7 to 31 beans (Xav = 22.12 pcs; VC = 17.21%). The best indicators among the local forms are VIFA-3-93, VIFA-73 (26 pcs.) and VÝFA-2-93 (29 pcs.). Among the samples obtained in ICARDA, the best are FLIP15-030FB (31 pcs.) and FLIP15-044 FB (31 pcs.).

The number of seeds per plant is 60 for standard and 15 to 87 for collection samples (Xav = 36.98; VC = 20.47%) of seeds. The largest number of grains found in VIFA-57 (57 pcs.), VIFA-2-93 (60 pcs.), FLIP15-030 FB (81 pcs.), FLIP15-044 FB (87 pcs.); and the lowest in FLIP15-035 FB (15 pcs.), FLIP15-032FB (17 pcs.), FLI15-034 FB (17 pcs.), FLIP15-029 FB (17 pcs.).

The seed weight per plant is 68 g for a standard, 15 to 87 g for collection samples (Xav = 35.58 g; VC = 23.01%). In the studied samples, the lowest seed mass per plant was observed for samples FLIP15-033 FB (15.3 g), FLIP15-040 FB (15.6 g), FLIP15-034 FB (16.0 g), FLIP15-035 FB (16.9 g), the highest seed mass per plant in samples FLIP12-176 (53.1 g), VIFA-57 (56,84 g), VIFA 2-93 (68,12 g), No.- 18 (74.6 g), FLIP15-030 FB (87.2 g).

The mass of 1000 seeds for the standard was 1091 g, for collection samples from 635 to 1660 grams (Xav = 951 g; VC = 157.19%). Comparison of the weight of 1000 seeds with standard VIFA-2-93 (1091 g) was the largest sample FLIP12-139 (1215 g), Aquadulce (1291 g), FLIP12-183 (1428 g), Giza 3 (1487 g), VIFA -SPAN (1660). Among horse beans, the highest mass is 1000 seeds in samples of Giza 3-1487 g and VIFA-SPAN-1660 g, and the lowest in sample FLIP15-003FB (623 g).

It should be noted that the importance of the mass of 1000 seeds per beans varies depending on the direction of cultivation. Studies show that despite the fact that plants with large grains are more rapidly growing (1 month faster than small grains) and important as vegetables, they require large areas of crop (2-4 times smaller grains), while At the same time, modern sowing units are designed for small grains. From this it follows that the use of samples FLIP15-003FB (623 g), FLIP12-059 FB (760 g), FLIP12-060 FB (789 g) for selection would be more correct.

The mass of seeds from 1 m2 for standard VIFA-2-93 was 900.0 g. This indicator for collection samples varied from 100.0 g to 1000.0 g.

From the experience of breeding it is known that one of the main conditions is the study by the breeder the correlation between the elements of fertility. The choice of one indicator directly or indirectly affects changes in the other. In this case, the correlation of elements is measured by its volume and characteristics of the impact, and the degree of correlation from the relativity of variability and dependence on the year of study. Correlation coefficients are the most convenient indicator for studying the interdependence of quantitative traits. The results of the study of correlations are of interest when creating adaptive genotypes and obtaining the required performance characteristics. In the literature there is little data on the relationship of quantitative traits in beans [Davletov, 2008].

The indicators obtained during our studies suggest that all the structural elements of all the samples included in the selection are interdependent, and the increase in one of them does not lead to an increase in overall fertility.

The results of the correlation analysis revealed a correlation of genotypes of faba bean fertility indicators:

- A direct high positive relationship is noted between the number of seeds per plant and the mass of seeds per plant (r = 0.79**), between the mass of seeds on the plant and mass of 1000 seeds (r = 0.47**), between the number of seeds per plant and yield (r = 0.33**), mass of 1000 seeds and yield (r = 0.39**);

- The average positive correlation is noted between the height of the plant and the number of beans per plant (r = 0.34**), between the height of the plant and the mass of seeds on the plant (r = 0.26*), between the number of beans per plant and the mass of seeds on the plant (r = 0.23*),

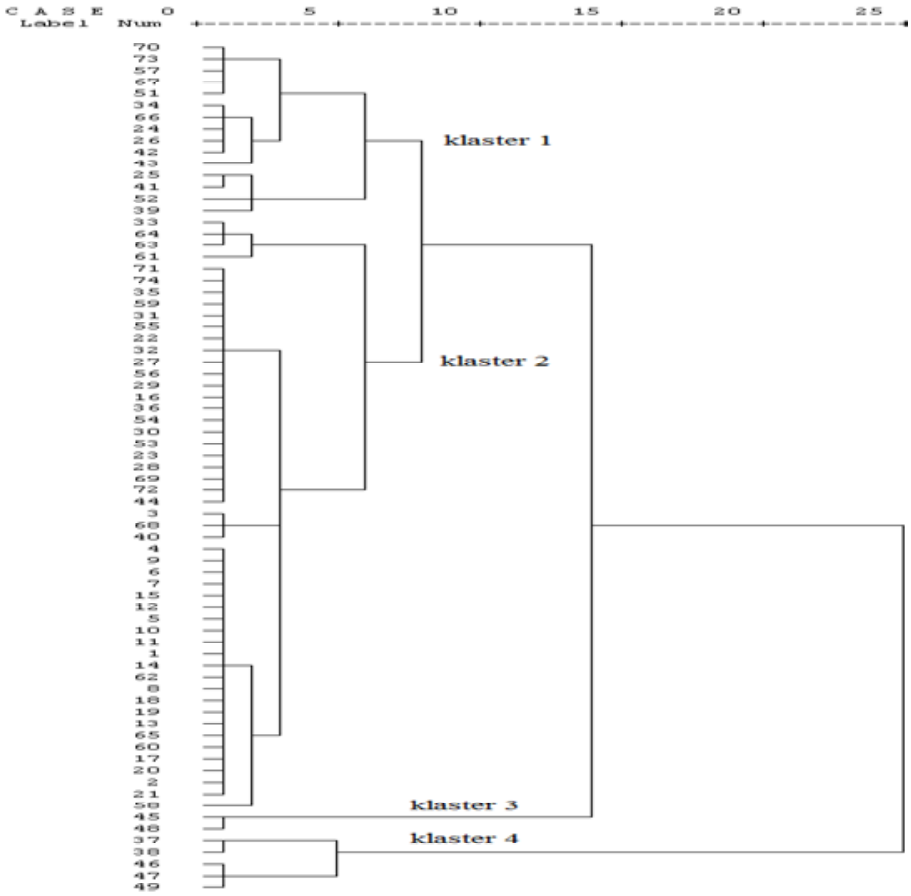


Fig 1: Dendrogram of clustering of faba bean samples on the elements of productivity and suitability for mechanical collection.

between the number of beans per plant and the number of seeds per plant (r = 0.31 *);

- A strong negative relationship is noted between the number of beans per plant and yield (r = -0.30).

Studies have shown that to meet the need for seeds of beans, it is necessary to create new varieties, models of which combine, along with morphological features (compact bush, high attachment of the lower bean) and a set of economically useful traits. In order to more accurately compare the samples of productivity and suitability for mechanized harvesting of the samples of beans, they were divided into groups using cluster analysis (Stoilova*et al*, 2013).

To analyze the results of the study of the main economically valuable traits in the studied samples of the rank, the method of cluster analysis was used. To construct the dendrograms, the Euclidean distance and the method of unweighted pairwise grouping with averaging UPGMA - unweighted pair group method using arithmetic averages) were used. According to the most important economically valuable attributes (plant height, height of attachment of the lower bean, number of beans and seeds per plant, seed weight per plant and 1000 seed weight, biological productivity), a statistical analysis was performed using the SPSS software package with further grouping.

In Fig 1 it can be seen that all the studied genotypes according to the aggregate morphological characters were classified into 4 main clusters. The resulting dendrogram made it possible to group genotypes depending on the level of seed productivity.

Cluster I is characterized as medium-high and high-yielding samples. Samples FLIP15-012FB, AsCOT, FLIP15-009FB, FLIP 15-008FB, FLÝP12-063 are characterized as large-seed, medium-growing and high-yielding.

Cluster II includes a large number of samples (40.5%). Cluster II is characterized as low-growing and small-seeded samples. Samples FLIP15-032FB, FLIP15-034FB, FLIP15-027FB, FLIP15-038FB, FLIP15-048FB are characterized as undersized and small-seeded.

Among the samples of cluster III, 78.2% are local forms. Cluster III is characterized as tall, small-seeded and low-yielding samples. Samples VIFA-57, VIFA-5-94, FLIP15-008FB, FLIP15-003FB are characterized as tall, small-seeded and low-yielding

ClusterIV includes only 6.7% of the sample. These samples are tall, large-seeded and high-yielding. Samples of Aquadulce, Giza 3, Elisar are characterized as tall, large-seeded and high-yielding.

As a result of the study of variety samples, beans were identified promising samples that can be successfully used as starting material for the selection of beans. When creating new varieties of beans as a crop, as a source material, more attention should be paid to plants belonging to the first and

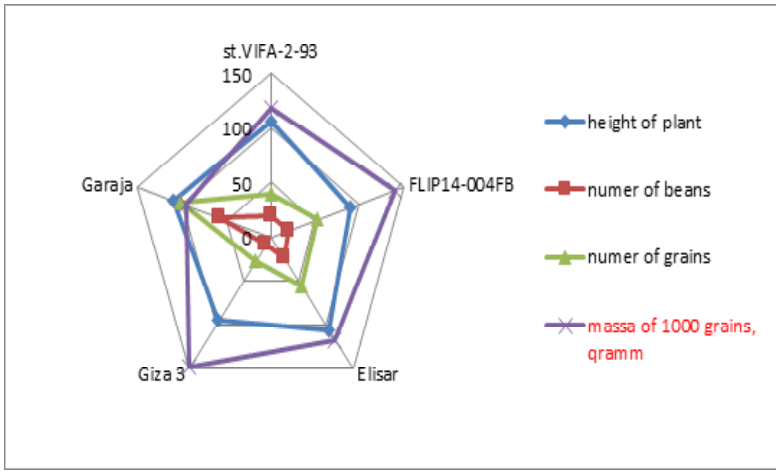


Fig 2: Characteristics of the samples selected as a source of high fertility among *faba* beans.

fourth clusters. The plants of these samples have a complex of positive economically valuable traits, the selection of which is most desirable for the selection of beans for high productivity.

When creating new varieties of beans as suitability for mechanized harvesting as a starting material, more attention should be paid to plants belonging to the first and second clusters. The plants of these samples have a complex of positive economically valuable traits, the selection of which is most desirable for the selection of beans for high productivity and suitability for mechanized harvesting.

Evaluation of samples for quantitative and qualitative characteristics, identifying the relationship between their characteristics, led us to the conclusion that these models of varieties are promising. As a result of studies, the most high-yielding and high-quality samples FLİP 14-004FB, Elisar, Giza 3, Garaja ("Qaraca" in azerb.) (Fig 2).

Nowadays, one of the main directions of legume breeding is the creation of varieties resistant to diseases. Unfortunately, the genetic characteristics and immunity mechanism of disease resistance are not well understood. In spite of it, the International Center for Agricultural Research in the Dry Areas, a joint project of England, Canada, Poland and France, revealed forms resistant to the most widespread disease among leguminous plants, ascochytosis (*Ascochytafabae*).The 68 forms identified in (ICARDA) and resistant to ascochytosis were used in our studies in 2015-2016 (of which 24 were included in 2015, and 44 in 2016). These samples were studied in comparison with st.Fam 54 (ICARDA) and local forms VIFA-2-93. It should be noted that the susceptibility of samples to diseases has changed due to soil and climatic conditions [Vishnyakov M.A. (2008) and Zakrzewska E. (1988)]. Thus, under Absheron conditions, at least some of these samples were subjected to diseases of 1-2 points. But most of them retained resistance to this disease. In our Republic, the forms FLIP115-017FB, FLIP15-018FB, FLIP15-041FB, FLIP16-207 and FLIP16-215 were included to the lit of samples resistant to this disease.

On the Absheron Peninsula, the samples were heavily infected with black aphids, dangerous for faba bean. Exposure to this pest increases with higher percentage of moisture.

The degree of susceptibility of samples to ascochytosis is 1-2 points, while, depending on the immune characteristics, susceptibility to olive mold was estimated at 2-5 points. Strong susceptibility to dangerous black aphid was observed in 2014-2017. As a result of high humidity (over 80%) in 2014 and 2017, the samples were exposed to the fungus, *Cladosporiumherbarum*- seed mold, despite the fact that the disease was estimated at 2-5 points, it was found in relatively stable forms. Samples of FLIP14-051FB, FLIP14-013FB, FLIP14-050FB, FLIP14-001FB, FLIP14-005FB were more resistant, and FLIP14-053FB, FLIP14-058FB, FLIP14-012FB, FLIP14-016FB, FLIP14-062FB, FLIP14-010FB, FLIP14-056FB hadhigher damage rate. Samples FLIP12-132FB, FLIP12-150FB, FLIP12-063FB, FLIP12-008FB were more sensitive to anthracnose; FLIP12-054FB, st.Fam 54B, FLIP15-053FB and FLIP15-061FB,



Picture 1: *Vicia Faba* L., "Garaja" variety.

FLIP15-069FB, FLIP15-097FB, FLIP15-025FB and FLIP15-042FB to ascohitoz.

Also in these years there was a characteristic bean disease - chocolate spot. This disease is transmitted by the fungus *Botrytis fabae*Sard of the *Hyphomycetalis* family.

With frequent rains and high air humidity (above 80%), plant leaves and beans are more often exposed to this disease. In this case, the surface of the leaves appears dark circular spots (necrosis). After some time, the circumference of these spots becomes gray-red, and the inside becomes gray. During a strong infection, flowers, beans and seeds also become infected. This disease is more dangerous for horse bean. In Morocco, 80% of the horse bean harvest is exposed to this disease each year [Bouhassan A. (2003a)]. In our study, the susceptibility of samples to this disease was estimated at 1-2 points. We can say that, this disease was found among the majority of samples (1-2 points).

In recent years, a number of European countries are looking for varieties of beans that do not contain or contain very small amounts of the substance vitsine and convitsine. Even in VIR, works are being carried out to find similar genotypes. A literature review indicates that the answer may be legumes with white flowers (Bond & Duc, 1993). As a result, in Pushkin laboratory 14 samples, with white flowers and with a bright scar-like sign on the grains were investigated, and the substance vitsine and convitsine are missing or contained in very small amounts.

In order to enrich the collection, samples FLIIP15-100FB, FLIP15-077FB, FLIP15-096FB, FLIP15-097FB, FLIP15-079FB, FLIP15-061FB, FLIP15-098FB, FLIP15-099 FB, ICAWHAZ with white flowers, which were immune resistant, were selected, fertile, with a low level of harmful substances (tannin). Since samples with a low level of harmful substances are new for our republic, these studies are an important initial study for the subsequent production of new varieties. We hope that this will lead to an increase in the area of legume croplands in the Republic of Azerbaijan.

On the other hand, one of the priorities in the selection of beans in Azerbaijan is the creation of new varieties resistant to bending in order to avoid the loss of crops due to the fall of the body in the growing phase. From this point of view productive variety “Garaja” which is obtaine d by hybridization and resistant to bending is of great impor tance (Picture 1).

Conclusion

The results of the research collection, samples were selected Flip15-100FB, Flip15-077FB, Flip15-096FB, Flip15-097FB, Flip15-079FB, Flip15-061FB, Flip15-098FB, Flip15-099 FB, ICAWHAZ with white flowers that were immunologically stable, fertile, with a low level of harmful substances (tannin). We hope that this will lead to an increase in the acreage of legumes in our republic. Newly-obtained and resistant to bending variety “Garaja” will also play an important role in expanding the plow cultivation area in Azerbaijan

References

Alercia, A. (2011) Key characterization and evaluation descriptors: methodologies for the assessment of 22 crops. Bioversity International 602 p.

BasraA. (2004). Plant growth regulators in agriculture and horticulture: their role and commercial uses. Food products Press, 264 p.

Bond D.A., Duc G. (1993). Plant breeding as means of reducing anti-nutritional factors grain legumes. Proceeding of the second international Workshop on “A ntinutrional Factors (ANF) in Legume Seeds” Wageningen, p. 379-396.

Bouhassan A., M. Sadiki and B. Tivoli (2003a.). Evaluation of a collection of faba bean (*Viciafaba* L.) genotypes originating from the Maghreb for resistance to chocolate spot (*Botrytis fabae*) by assessment in the field and laboratory. Euphytica. 135: p.55 –62.

Davletov F.A. (2008).Selection of non-crumbling pea varieties in the conditions of the Southern Urals, Ufa. 236 p.

Gorin À.P., Dunin M.S., Konovalov Y.B., Mitrofanov K.S., Pausheva Z.P., Samosonov M.P., Selavri M.K., Ukolov A.A. (1968). Workshop on breeding and seed production of field crops. (Edited by Professor. A.P. Gorin).M.: Kolos. 440 p.

Keydel F. (1986). Arbeitsschwerpunkte und erste Regebnces der Akerbohnenzuchtung in Weinenstephan. RAPS. V. 4.1. p.36-38.

Methodology for the definition of a key set of characterization and evaluation descriptors for faba bean (*Viciafaba*) (2011). In Alercia A. (ed), Key Characterization and Evaluation Descriptors: Methodologies for the Assessment of 22 Crops. Bioversity. Rome, Italy. Bioversity International.p.188-215.

Orlov V.P. (1986). Leguminous crops in intensive agriculture-M.:Agropromizdat, 197 p.

Pryashnikov D.N., Yakushin I.V. (1938). Field crops (*private farming*) OGIZ. Selkhozgiz.-M.: p. 285-287.

Tate R. L. (1995). Soil Microbiology. Wiley, New York.

Titova E.M. (2012). The effect of biologics on barley productivity. Vestnik Orel GAU. 4 (37). p.58-60.

Stoilova T., Pereira G., Tavares-de-Sousa M. (2013). Morphological characterization of a small common bean (*Phaseolus vulgaris* L.) collection under different environments // Journal of Central European Agriculture, v.14 (3): p. 854-864.

Vishnyakov M.A. (2008). Genofond of leguminous crop sand adaptive breeding as factors of biologization and ecologization of crop farming: Agricultural Biology.3. p. 3-23.

Zakrzewska E. (1988). Variability in resistance of Viciafaba L. to AskochytafabaeSpeg. // HodowlaRosl. Aklimat. Nasienn. V.32. p.1-2. 311-31.

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