

STUDY OF SOME QUANTITATIVE CHARACTERISTICS ON A LOCAL POPULATION OF RUNNER BEAN

STUDIUL UNOR CARACTERE CANTITATIVE LA O POPULAȚIE LOCALĂ DE FASOLE MARE

RĂDEANU Georgiana¹, MUNTEANU N.¹, PRECUPEANU Cristina¹, POPA Lorena-Diana², MIHALACHE Gabriela^{1,3}, TELIBAN G.C.^{1*}, STOLERU V.¹

*corresponding author, e-mail: gabrielteliban@uaiasi.ro

Abstract. *Phaseolus coccineus* L. is the third most cultivated species of bean, for consumption of grains and immature pods. Despite its agronomic potential, high nutritional value and special economic importance, it is cultivated on a small scale and less studied. The cultivation of this plant in the Romania environment could be a real success by using a special programme to optimize the technology and by cultivating valuable varieties. In this context, the purpose of this paper is to assess the variability of quantitative characters (number of pods per plant, number of beans per plant, mass of beans per plant, number of beans in pods) on a local runner bean population, collected from village Cozia, Iași county. The research was carried out in the experimental vegetable field of Didactic Station of IULS. By the analysis of the results for the four characters, it was observed that it does not fully meet the criteria of distinctiveness, homogeneity and genetic stability, so it is not sufficiently balanced being necessary to continue the selection work, motivated by its high potential of production.

Keywords: *Phaseolus coccineus* L., cultivar, variability, biological value

Rezumat. *Phaseolus coccineus* L. este a treia cea mai cultivată specie de fasole, în vederea consumului de boabe sau pentru păstăi imature. În ciuda potențialului agronomic, a valorii nutriționale ridicate și a deosebitei importanțe economice, aceasta este cultivată la scară redusă și în același timp mai puțin studiată. Cultivarea acestei plante în mediul din România ar putea fi un real succes printr-un program special de optimizare a tehnologiei și folosirea soiurilor valoroase. În acest context, scopul lucrării de față este de a evalua variabilitatea caracterelor cantitative (număr de păstăi pe plantă, număr de semințe pe plantă, masa semințelor pe plantă, număr de semințe în păstaie) la o populație locală de fasole mare, colectată din localitatea Cozia, județul Iași. Experiența a fost organizată în câmpul experimental legumicol ce aparține de Stațiunea Didactică a USV Iași. În urma analizei rezultatelor pentru cele patru caractere, s-a observat că populația locală studiată nu îndeplinește în totalitate criteriile de distinctibilitate, omogenitate și stabilitate astfel, aceasta nu este îndeajuns de echilibrată, fiind necesară continuarea lucrărilor de selecție, motivată de un potențial ridicat de producție.

Cuvinte cheie: *Phaseolus coccineus* L., cultivar, variabilitate, valoare biologică

¹Iasi University of Life Sciences „Ion Ionescu de la Brad”, Romania

²Agricultural Research and Development Station Secuieni-Neamt, Romania

³Integrated Center of Environmental Science Studies in the North Eastern Region (CERNESIM), “Alexandru Ioan Cuza” University of Iasi, Romania

INTRODUCTION

Runner bean (*Phaseolus coccineus* L.) is the third most cultivated species of the *Phaseolus* genus (Santalla *et al.*, 2004), being preferred by consumers for its superior characters, namely for its larger beans and crispier pods, compared to *Phaseolus vulgaris*, with which it is often confused (Munteanu, 1985, Teliban *et al.*, 2014, 2015).

The species is native to Central America and was introduced to Europe by Columbus. It has adapted over time by tolerating lower temperatures than in the original area (Spataro *et al.*, 2011), becoming an annual plant from a perennial plant in the original area, because the aerial organs do not tolerate negative temperatures (Rodino *et al.*, 2007).

At the national geofund level, runner bean shows a rather high variability, in Romania being cultivated a large number of local populations. However, no homologated varieties are registered in the Official Catalog of the crop plants in Romania (<https://istis.ro/image/data/download/catalog-oficial/CATALOG%202020.pdf>).

The creation of a variety adapted to the climatic conditions of our country requires laborious research of genetics and amelioration. Thus, at I.U.L.S. (Iasi University of Life Sciences) were carried out studies on the collection, selection and analysis of a large number of local populations of runner bean in order to assess their economic value or as a source of germplasm (Popa, 2010).

The research carried out and presented in this paper aimed to study a large, competitive local bean population based on productivity and some characteristics that give its own identity, with the aim of conducting a study on the variability of the main quantitative characters pursued in the breeding process.

MATERIALS AND METHOD

The experiment was carried out in the experimental field of the Vegetable Growing discipline of IULS, by using the seeds of a local population of runner bean collected from Cozia, Iasi County. The crop establishment was achieved by direct sowing in the field, on unpatterned land, on 16 of May 2020. The emergence of the plants occurred around 26 of May.

The sowing was done in equidistant rows, spaced at 100 cm, each with its own trellis. The plants were placed 40 cm apart.

During the vegetation period, growing practices recommended in the specialized literature were carried out in order to ensure the necessary conditions for the growth and development of runner bean plants (Rusti and Munteanu, 2008; Hamburda and Munteanu, 2016).

A special practice specific to seed cultures is represented by the purification of the culture, aiming to preserve in the culture only the typical specimens, with the desired characters (Dumitrescu *et al.*, 1977).

The harvest began on 28 of September 2020, when 100 plants were quantitatively analyzed: number of pods per plant, number of seeds per pod, number of seeds per plant and weight of seeds per plant.

The experimental results were statistically analyzed by using the methods recommended by Munteanu (2000), Munteanu and Falticeanu (2008), Popa *et al.* (2020).

RESULTS AND DISCUSSIONS

The number of pods per plant (fig. 1) varied from 21 to 84 pods per plant, with a range of variation of 63 pods and an arithmetic mean of 44.09. The standard deviation of the individual values for this character was equal to 14.79. The coefficient of variability of 33.53 expresses a high variability, thus, the selection range was between 37 and 51 pods per plant, which fits the arithmetic mean.

The high coefficient of variability is specific to local populations that are studied for homologation, the total variability being influenced exclusively by the environment and the culture conditions.

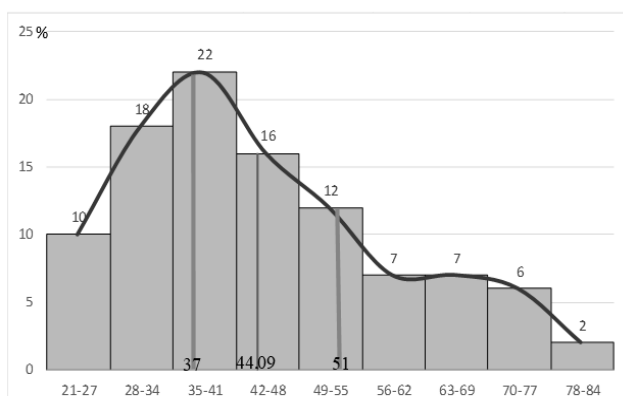


Fig. 1 Histogram of variation for the trait Number of pods per plant (NPP)

By analyzing Figure 1, it can be seen that the number of pods per plant is highlighted by a variation curve with a shape very close to the bell, with a maximum frequency point equal to 22, from which we can assume that this population is relatively balanced.

The number of seeds per plant (fig. 2) is an indicator of great importance in the multiplication rate of plants, but also in examining their yield. The number of seeds per plant was between 34 and 200 seeds, with a range of variation of 166 seeds and an arithmetic mean of 96.44. The standard deviation was of 34.27 seeds, and the coefficient of variability was of 35.54. As in case of the number of pods per plant, this indicates a high variability. The maximum confidence interval for the values of the number of seeds per plant was between 79 and 114 seeds, the arithmetic mean being located in the middle. Importantly, the variability of this character was phenotypically influenced.

Figure 2 shows a very high variability of the trait number of seeds per plant, the presence of two peaks on the variation curve (22% and 18%), indicating the presence of two subpopulations.

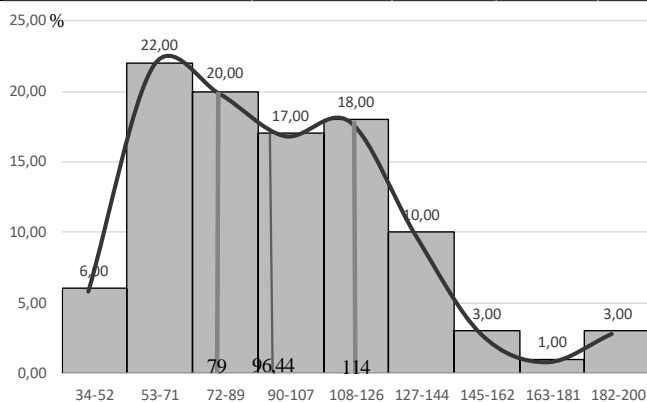


Fig. 2 Histogram of variation for the trait Number of seeds per plant (NSP)

Therefore, taking into account the results of the number of seeds per plant, it can be concluded that the runner bean population, collected from Cozia, Iasi County, presents a very high variability and two subpopulations, further studies for creating a new variety being possible with seeds from elite plants that are included in the class range 53-71 or with the second population (108-126).

The weight of seeds per plant (fig. 3), expressed in grams, is one of the most important characters in the multiplication rate of plants and in analyzing their productivity.

The weight of the seeds per plant varied between 43.91 and 249.89 g, having a range of variation of 205.98 g. The arithmetic mean of the values for the weight of seeds per plant was equal to 123.85 g. The values deviate from the arithmetic mean by 47.38. For this character, a coefficient of variability of 38.5 was obtained, which according to standard norms represents a very high value.

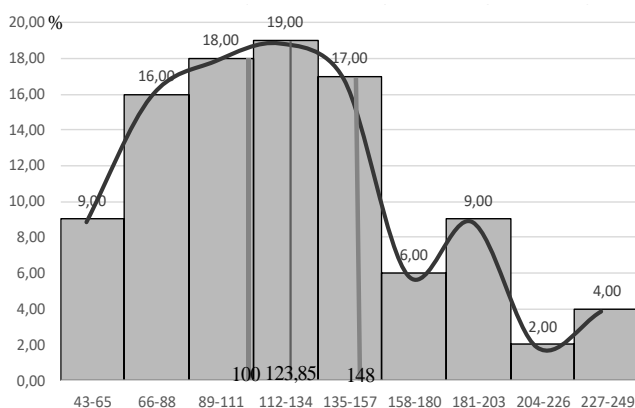


Fig. 3 Histogram of variation for the trait Weight of seeds per plant (WSP)

The confidence interval was between the values 100 and 148, and the arithmetic mean was in this interval. It should be highlighted that all the

characters of the plant including the weight of the seeds per plant are directly influenced by the cultivation conditions.

Figure 3 shows two maximum peaks on the variation curve, the first with the maximum value of 19% and the second with the maximum point of 9%, which explains the fact that the local population of beans taken in the study is divided into two subpopulations, the one with the value of 19% being representative.

If the last 2-3 classes on the right side of the histogram are excluded, the variation curve of the local population under study tends to be bell-shaped, which could demonstrate that it is a balanced population.

Depending on the breeder decisions, elites can be chosen and examined in the further fields, or seeds can be taken from the second subpopulation and an attempt can be made to create a new variety more valuable than the original population.

The number of seeds in the pod (fig. 4) was between 1.53 and 3.24 seeds, with a range of variation of 1.71 seeds and an arithmetic mean of 2.21 seeds in the pod. Considering that the standard deviation was of 0.30 and the coefficient of variability (s%) was of 13.74, the resulting variability is average.

The maximum confidence interval for the number of seeds in the pod was between 1.91 and 2.51. The average coefficient of variability is specific to the local populations to be approved, the total variability being directly influenced by the cultivation conditions.

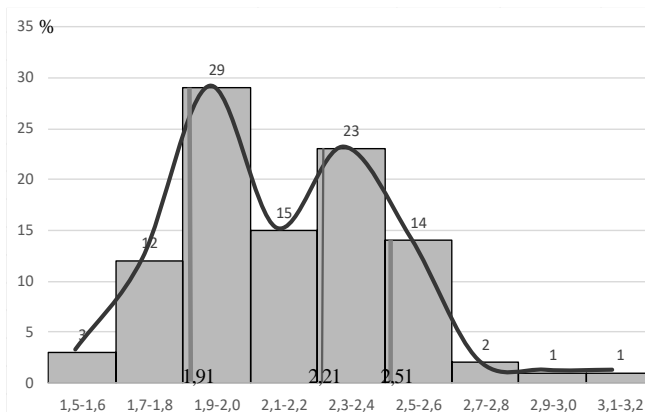


Fig. 4 Histogram of variation for the trait Number of seeds in pod (NSPd)

Figure 4 highlights the existence of two subpopulations indicated by the existence of two maximum peaks on the variation curve (29 and 23).

Also, it can be observed a very wide selection interval with values between 1.91 and 2.51. The arithmetic mean falls within the selection range. Considering that both populations have high values, it is recommended to study them separately. Moreover, taking into account the results, the population of runner bean taken in the study is not balanced.

CONCLUSIONS

1. The local population of runner bean taken in the study, collected from Cozia, Iași county, is a population with a relatively high biological value. However, after analyzing the results of the Number of pods per plant, Number of seeds per plant, Weight of seeds per plant and Number of seeds per pod, it was observed that the studied population is not sufficiently balanced.

2. It is recommended to continue the breeding of this population, because it has potential to be introduced into the current assortment of varieties in Romania.

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