# VARIABILITY OF THE MAIN CHARACTERS AT THE *ISALNITA 43* GARDEN DWARF BEAN VARIETY IN THE PROCESS OF CONSERVATIVE SELECTION

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***Keywords: variability, beans, sandy soils.***

## ABSTRACT

*The researches carried out at the Research and Development Station for Plant Culture on Sands from Dăbuleni, in the period 2018 - 2020 regarding the variability of the main quantitative characters, for the Ișalnița 43 dwarf garden bean variety showed differentiated results, depending on the climatic conditions of each study year.*

*Through the statistical analysis of the main quantitative characters, the variety Ișalnița 43 presented a coefficient of variability (s%) small, medium and high for the studied characters.*

*The calculation and analysis of variability showed a medium variability (15.04%) for plant height. low variability (7.77%) for pod length. low variability (6.98%) for pod thickness / width ratio and high variability (30.42%) for the number of pods / plant.*

*The study of the coefficients of genotypic and phenotypic variation, are used to determine the genetic variability, and its correct estimation is an essential condition in the seed breeding and production program.*

## INTRODUCTION

The common bean *(Phaseolus vulgaris L.)* is one of the most cultivated species in the *Fabaceae* family (Schmutz et al., 2014). due to its high nutritional value and its potential to serve various pharmaceutical purposes.This represents more than 85% of the total world production of all species cultivated by *Phaseolus* (Singh., 1999).

Common beans serve as the main source of dietary protein in developing countries in Latin America, Africa and Asia Messina (1999). Being a rich source of quality protein (20-25%), it contains amino acids such as methionine and lysine that are deficient in cereal seeds (Bressani., 1983) and large amounts of energy sources such as carbohydrates, fiber, minerals (Fe, Zn, Ca, Mg, P, K, Na,Mn

and Se), vitamins (biotin and vitamin A, B6), beans being also called “poor human flesh” (WMO., 1992).
Globally, 23 million hectares are cultivated with common beans (http://www.cgiar.org/our-research/crop-factsheets/beans).However, the annual demand for this species far exceeds its availability.The deficit is mainly caused by low productivity due to genotypes with low production potential and unfavorable growth conditions due to low and poorly distributed rainfall (Wartmann & Allen., 1994).
Therefore, there is a great need to identify valuable, higher-yielding genotypes and drought-tolerant traits for cultivation in areas with thermoshydric stress or to be used as a parent in the hybridization program.
According to Alvares et al., understanding the extent of genetic variation present in a common bean population, as well as the appropriate characterization of useful physiological traits and their association with yield and yield components would be extremely necessary for scientists working to improve drought tolerance of the species.
Phenotypic variations result from the combined action of genotype, environment and their interaction, consequently, they are reflected differently in the sensitivity of genotypes to environmental variations, affecting their behavior and performance (Allard R.W., 1999).
A detailed knowledge of the genetic variability and diversity, the heredity and the genetic advance of the different quantitative traits, as well as their contribution to yield, is essential for any productivity improvement program.
Genotypic and phenotypic coefficient variation is useful in exploring the nature of variability in the breeding population, while heredity estimation provides an index of character transmissibility.

The conservative selection of the *Işalnița 43* garden dwarf bean variety aims at maintaining the initial genetic structure, within the limits established by the author / maintainer of the variety and the production of seed from higher biological categories.

## MATERIAL AND METHOD

The researches were carried out at the Research and Development Station for Plant Culture on Sands from Dăbuleni, in the period 2018-2020 and aimed at maintaining the varietal purity of the dwarf garden bean variety *Işalnița 43.*
The variety of *Işalnița 43* garden dwarf bean was obtained at the Research Center for Vegetables (SCDL), being approved in 1975.

The variety has a dwarf bush, is semi-early, the vegetation period is 50-55 days and can ensure a production of 10-12 t pods / ha. The pod is cylindrical, green in color, without threads and is intended for fresh consumption and preservation.
This variety has resistance to common mosaic, common burns and anthracnose.
The study was performed on a psamosol with low natural fertility, poorly supplied with nitrogen (0.039%), medium supplied with phosphorus (30.5 ppm) and low potassium content (129 ppm).
The experiment was located in irrigated conditions, respecting the technology of growing beans on sandy soils.
Previous research has shown that in the area of sandy soils the garden bean has created during its phylogenetic development its own mechanisms of adaptation to specific pedoclimatic conditions.
In order to maintain the genetic integrity and biological purity of the variety, intheprocess of conservative selection, biometric determinations and morphological observations were made on the main quantitative traits and qualitative features.
An individual selection with a single choice applies in the choice field, followed in the other fields by a mass selection in negative characters.
At the technological maturity of the pods, the following quantitative and morphological characteristics were analyzed, from a biometric point of view: plant height (cm), pod length (cm), pod thickness / width ratio, number of pods / plant. Biometric data were statistically processed, calculated for each character $\overline{x}$ = average; s = standard deviation; s% = coefficient of variability; k = degree of dispersion (Săulescu N., 1968).
Based on the establishment of the coefficient of variability (s%) and dispersion (k) for each character, the choice was made of the biological material that expresses the genotype of the *Işalnița 43* dwarf garden bean variety.

## RESULTS AND DISCUSSIONS

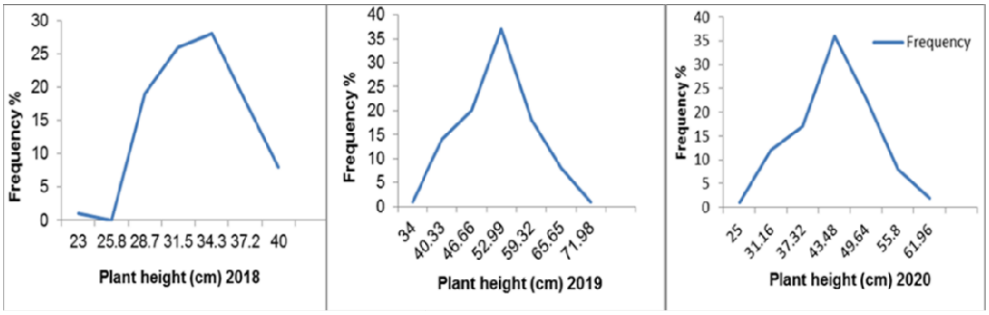
The variability of **the plant height** character is given by the statistical parameters calculated in table 1.The arithmetic mean, over the three years of study, was at the level of the choice field of 40.66 cm,varying between 32.0 cm and 49.81 cm. The coefficient of variation is medium, having a value of 15.04.

*Table 1*

**Variability of plant height (cm)**

| Indices | The year | | | x̄ years |
|---|---|---|---|---|
| | 2018 | 2019 | 2020 | |
| x̄ | 32.0 | 49.81 | 40.82 | 40.66 |
| s | 3.64 | 7.83 | 7.36 | 6.27 |
| s% | 11.4 | 15.71 | 18.03 | 15.04 |
| k = x̄± s | 28.4-35.7 | 41.98-57.64 | 33.46-48.18 | 34.61-47.17 |

From the graphical representation of the character variation string of the plant height, in the three years of study (figures 1, 2, 3) the curves of the almost symmetrical unimodal histograms with the distribution of the individuals evenly around the mean were highlig.




**1.** **2.** **3.**

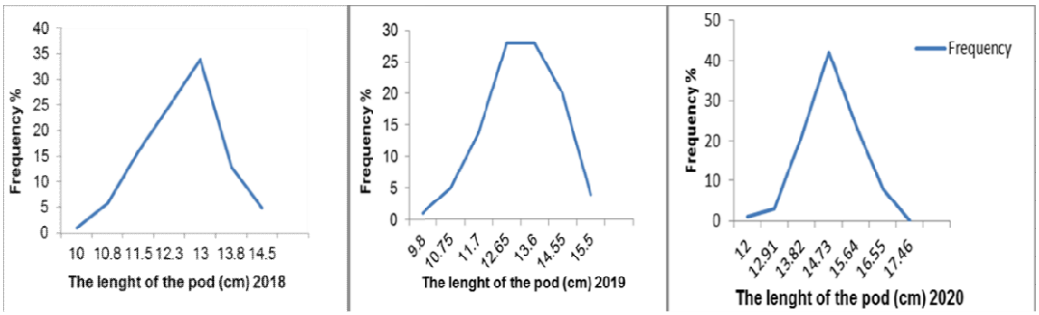
***Figures 1, 2, 3 - Curves of theunimodalhistograms of the character variation string of the plant height, in the period 2018-2020***

**The length of the pod** is an identity character, which defines the dwarf garden bean variety *Işalnița 43* (table 2), has values between 12.3 cm and 14.38 cm. with an average value of 13.18 cm and a small variability (7.77%).The dispersion of the pods around the average is uniform (figures 4.5 and 6), the variation curves being unimodal, slightly asymmetrical, except for 2019 which highlights a unimodal curve with two peaks. Most pods have a length in the range of variability interval k = 12.14 cm - 14.16 cm.

*Table 2*

**Variability of pod length (cm)**

| Indices | The year | | | x̄ years |
|---|---|---|---|---|
| | 2018 | 2019 | 2020 | |
| x̄ | 12.3 | 12.87 | 14.38 | 13.18 |
| s | 0.92 | 1.17 | 0.96 | 1.01 |
| s% | 7.5 | 9.15 | 6.67 | 7.77 |
| k = x̄± s | 11.4-13.2 | 11.61-13.95 | 13.42-15.34 | 12.14-14.16 |




**4.** **5.** **6.**

***Figures 4, 5, 6 - Curves of the unimodal histograms of the character variation string, the length of the pod in the period 2018-2020***

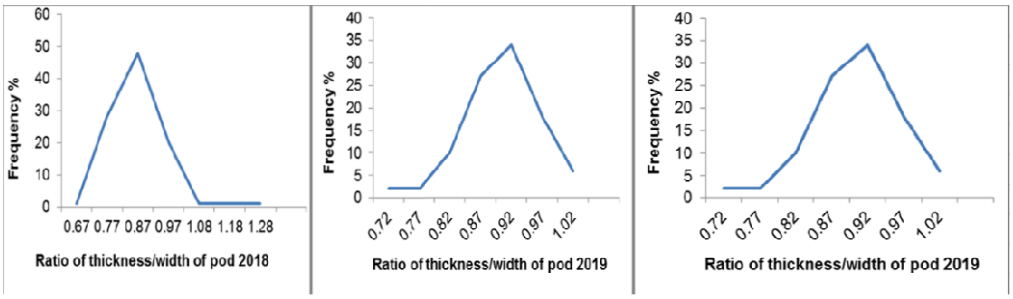
**The ratio between the thickness of the pod and the width of the pod** indicates the shape of the pod in cross section, being a character that defines the respective variety, depending on which the elites will be chosen in the conservative selection system.The main statistical indices of this character are shown in table 3. The average values of the study years vary between 0.82 and 0.88, with an average value of the 3 years of study of 0.85, indicating a slightly flattened pod, of ellipsoidal shape in cross section. The coefficient of variability has a small value (6.98%) for this character.

The curves of the normal distribution of the pods (figures 7, 8, 9) are unimodal, slightly shifted to the left, which requires that in the selection to be retained the elites that have a value of this character close to 1 (to tend towards an almost cylindrical pod ).

*Table 3*

**The variability of the pod thickness / width ratio**

| Indices | The year | | | x̄ years |
|---|---|---|---|---|
| | 2018 | 2019 | 2020 | |
| x̄ | 0.82 | 0.88 | 0.84 | 0.85 |
| s | 0.08 | 0.05 | 0.04 | 0.05 |
| s% | 10.5 | 5.68 | 4.76 | 6.98 |
| k = x̄± s | 0.74-0.92 | 0.83-0.93 | 0.8-0.88 | 0.79-0.91 |




**7.** **8.** **9.**

***Figures 7, 8, 9 - Curves of the unimodal histograms of the string of variation of the character of the pod thickness / width ratio, in the period 2018-2020***

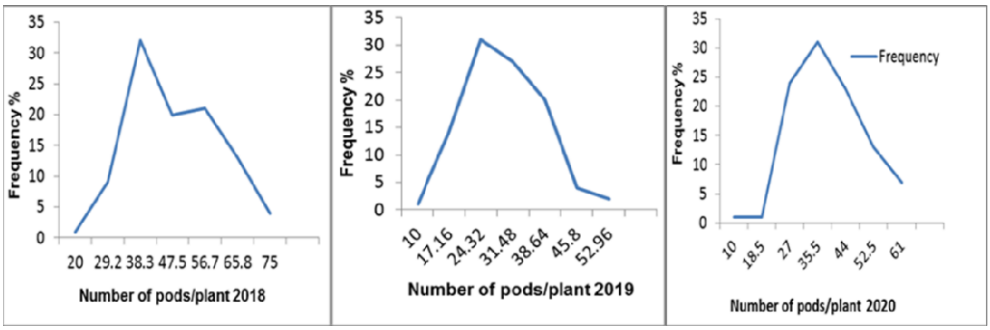
The number of pods per plant is another quantitative character that determines the productivity of the variety, a character influenced by the environmental conditions and the applied technology. This character was considered to be the most important in assessing productivity, and therefore in maintaining (conserving) the productive potential of the variety.The results obtained in table 4, on average over three years, show that the number of pods per plant was about 35 (34.9). Based on the values of the standard deviation (s), a very high coefficient of variability (s%) was obtained (over 30%) which reveals very high variability of this character.

*Table 4*

**Variability in the number of pods / plant**

| Indices | The year | | | x̄ years |
|---|---|---|---|---|
| | 2018 | 2019 | 2020 | |
| x̄ | 43.5 | 26.3 | 34.87 | 34.9 |
| s | 12.08 | 8.78 | 10.49 | 10.45 |
| s% | 27.8 | 33.38 | 30.08 | 30.42 |
| k = x̄± s | 31.4-55.6 | 17.52-35.08 | 24.38-45.36 | 24.43-45.34 |

The graphical representation of the variation string (figures 10, 11, 12) highlighted a unimodal curve. The peak of the curve is shifted to the left, towards small values of character, except for 2018 which highlights a unimodal curve with two peaks. The first tip pointing to the left indicates a small number of pods per plant, and the second tip pointing to the right indicates a large number of pods per plant.




**10.** **11.** **12.**

***Figures 10, 11, 12 - Curves of the unimodal histograms of the string of variation of the character number of pods per plant in the period 2018-2020***

## CONCLUSIONS

The statistical analysis of the main quantitative characters of the *Ișalnița 43* dwarf garden bean variety highlighted the stability and homogeneity of these characters.

The quantitative characters taken in the study registered the following values of the variability coefficient (s%) in the 3 years of study (2018 - 2020):

• the plant height: $\bar{x}$ = 40.66; s = 6.27; s% = 15.04, ie the coefficient of variability is medium, and k = 34.61 - 47.17;

• the length of the pod: $\bar{x}$ = 13.18; s = 1.01; s% = 7.77, ie the coefficient of variability is small, and k = 12.14 - 14.16;

• the pod thickness / width ratio: $\bar{x}$ = 0.85; s = 0.05; s% = 6.98, ie the coefficient of variability is small, and k = 0.79 - 0.91;

• the number of pods/plant: $\bar{x}$ = 34.9; s = 10.45; s% = 30.42, ie the coefficient of variability is high, and k = 24.43 - 45.34.

The values of the calculated statistical indices of the characters studied require the continuation of the selection process in order to maintain them within the limits of specific variability.

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