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**RESEARCH ON THE VARIATION OF MORPHOLOGICAL  
AND AGRONOMIC TRAITS IN SOME COMMON BEAN  
(*PHASEOLUS VULGARIS* L.) LANDRACES  
FROM ROMANIA**

**CERCETĂRI PRIVIND VARIABILITATEA UNOR CARACTERE  
MORFOLOGICE ȘI AGRONOMICE LA UNELE POPULAȚII DE  
FASOLE (*PHASEOLUS VULGARIS* L.) DIN ROMÂNIA**

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**Abstract.** *The objective of this study was to evaluate variability of morpho-physiological and agronomic characters of some common bean landraces (*Phaseolus vulgaris* L.), well adapted to pedoclimatic conditions from different regions sites of the country, conditioned by the genetic factors of the species. All these local landraces were collected from local farmers, who prefer and grow them in their gardens due to the multiple uses in food and the adaptation to biotic and abiotic stress factors, in the context of current climate changes. The study was carried out at the Suceava Genebank and included 120 common bean local varieties. Morpho-physiological and agronomic traits were evaluated during the growing season in accordance with the IPGRI descriptors list of *Phaseolus vulgaris*. The investigations carried out showed differences between the populations for all the analyzed traits. All the local bean varieties collected showed high variability, representing potentially valuable genetic resources for breeding programs. Common bean crop is of great economic interest, being among the most used legumes in human nutrition. Also, it can use like organic crop, with great ecological plasticity, cultivated from the plains to high altitudes, also being a good precursor for other crops, leaving the soil rich in nitrogen. Therefore, we must give priority to the phenotypic characterization of local bean germplasm in order to provide breeders with valuable genetic sources, useful in creating of productive advanced cultivars, resistant to adverse environmental factors, to ensure food security.*

**Key words:** common bean landraces, variability, variation, phenophasic, morphological and agronomic traits

**Rezumat.** *Obiectivul acestui studiu a fost de a evalua variabilitatea caracterelor morfo-fiziologice și agronomice ale unor populații de fasole comună (*Phaseolus vulgaris* L.), bine adaptate la condițiile pedoclimatice din diferite regiuni ale țării, condiționate de factorii genetici ai speciei. Toate aceste populații locale au fost colectate de la fermierii locali, care le preferă și le cultivă în grădinile lor datorită multiplelor utilizări în alimentație și adaptării la factorii de stres biotici*

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*și abiotici, în contextul schimbărilor climatice actuale. Studiul a fost realizat la Banca de Gene Suceava și a inclus 120 de populații locale de fasole comună. Caracterele morfo-fiziologice și agronomice au fost evaluate în timpul sezonului de creștere, în conformitate cu lista descriptorilor IPGRI pentru Phaseolus vulgaris. Investigațiile efectuate au evidențiat diferențe între populații pentru toate caracterele analizate. Toate varietățile locale de fasole colectate au prezentat o variabilitate ridicată, reprezentând resurse genetice potențial valoroase pentru programele de ameliorare. Cultura fasolei comune prezintă un interes economic deosebit, fiind printre cele mai utilizate leguminoase în alimentația umană. De asemenea, poate fi utilizată ca cultură organică, cu o mare plasticitate ecologică, cultivată de la câmpie până la altitudini mari, fiind și un bun precursor pentru alte culturi, lăsând solul bogat în azot. Prin urmare, trebuie să acordăm prioritate caracterizării fenotipice a germoplasmei locale de fasole pentru a pune la dispoziția amelioratorilor surse genetice valoroase, utile în crearea unor cultivare avansate productive, rezistente la factorii de mediu nefavorabili, pentru asigurarea securității alimentare*

**Cuvinte cheie:** populații locale de fasole, variabilitate, variație, aspecte fenofazice, morfologice și agronomice

## INTRODUCTION

*Phaseolus vulgaris* L. (common bean), a traditional grain legume in Romania is the most important cultivated species of the genus *Phaseolus* and today it is cultivated on large areas (Bîlteanu, 1989). It has a high economic interest, being among the most used legumes in human nutrition (Abdollahi *et al.*, 2016). In general, seeds are used for their high content of digestible proteins rich in essential amino acids, but pods are also consumed; and sometimes young shoots are used as a salad.

There are several varieties, classified according to the shape of the grain: compressus, oblongus, ellipticus, sphaericus, according to the type of growth: nanus (small type), vulgaris (climbing type) and various intermediate biotypes between varieties (Musango *et al.*, 2016). Within the varieties there are different types differentiated by color as follows, unicolor (white, black, brown, beige, etc.), punctatus (dotted), maculatus (spotted), variegatus (motley) and zebrinus (striped) (Muntean, 1995, Stoilova *et al.*, 2013).

The landraces (climbing and dwarf beans) which was studied in this paper, is grown only in peasant gardens, microfarms because it is preferred by the rural population due to the quality of pods, long harvest period and production far superior to large grain beans.

The objective of this study was to analyze variability of morphological descriptors and variation of the main agronomic traits of

locally adapted varieties from different regions of the country, conditioned by the genetic factors of the species.

A good knowledge of the available genetic diversity will permit not only a good management of the common bean germplasm, but also facilitate its valorization (Bareke, 2019).

## MATERIAL AND METHOD

In the present study, both morphological and phenotypical characterization were employed to highlight bean germplasm diversity. The studies were focused on 120 populations belonging to the species *Phaseolus vulgaris*, which were collected from different eco-geographical areas.

The biological material used in this study consisted of local populations of common beans, climbing type and small type, collected from regions with different ecological conditions (table1). The experimental design and field management was laid out in blocks, with length row of 2 m, and the distance between rows of 70 cm on a cernoziomoid soil (3-5 % humus) in the experimental field of the Suceava Gene Bank.

During the growing period, data related to phenological, morphological and agronomic traits were characterized in accordance with the IPGRI descriptor list (2009). Characters were recorded on 10 randomly selected plants. The following phenophasic parameters were analysed: number of days from emergence to flowering, number of days from flowering to maturity, number of days from emergence to maturity.

Table 1

The passport data of the evaluated common bean landraces

Accession number	Collecting sites	Region	Country of origin	Latitude	Longitude	Elevation
12477	Grumăzești	Neamț	Romania	470835N	0262542E	361
15156	Belioara	Alba	Romania	462853N	0232328E	672
5412	Baia de Fier	Vâlcea	Romania	450959N	0234526E	550
7853	Bolduț	Cluj	Romania	463800N	0235900E	405
12074	Păltinoasa	Suceava	Romania	473258N	0255828E	442
3899	Năruja	Vrancea	Romania	454923N	0264552E	500
19379	Lipovăț	Vaslui	Romania	463400N	0274200E	193
2749	Godeanu	Mehedinți	Romania	450115N	0223954E	750
2284	Frasin	Suceava	Romania	473154N	0254757E	620
7468	Budureasa	Bihor	Romania	464042N	0222947E	460
15303	Huta Voivozi	Bihor	Romania	470915N	0222833E	642
12498	Țibucani	Neamț	Romania	470712N	0263205E	359
5449	Lăpușnicel	Carasă Severin	Romania	445859N	0221337E	479
2927	Orăștie	Hunedoara	Romania	455044N	0231231E	600
7460	Budureasa	Bihor	Romania	464042N	0222947E	460
10999	Cușma	Bistrița Năsăud	Romania	470800N	0244200E	696
7584	Brăduleț	Argeș	Romania	451701N	0244707E	640

In order to highlight the morphological variation among landraces, the following morpho-physiological descriptors were determined in the field and in the

laboratory: number of leaves per plant, number of flowers per plant, insertion height of the first pod, pod length, pod width, number of pods per plant, number of seeds in the pod, flower characters, number of seeds/plant, pod characters (cross section, length, width, curvature, colour, the presence of fibers), seed characters (shape, colour, length, width, thickness, seed mass/plant, mass of 1000 seeds). Seed characters were determined on 10 seeds per sample.

## RESULTS AND DISCUSSIONS

A moderate variability was observed among landraces in terms of phenophasic and morphological traits. Data on phenological characters (two morphological descriptors - leaf length and pod length and 3 physiological ones (no. of days from emergence to flowering, no. of days from flowering to maturity and no. of days from emergence to maturity) are presented in table 2. The variability of the bean populations studied was assessed using the amplitude of variation and the coefficient of variation. The correlation coefficient between the studied characters was also determined. The interpretation of the results is based on the determination of the coefficient of variation, as an expression of the diversity of the studied biological material.

Table 2

**Phenological characters of the evaluated common bean landraces**

Accession number	Collecting sites	Number of days from emergence to flowering	Number of days from flowering to maturity	Number of days from emergence to maturity
12477	Grumăzești	49	35	84
15156	Belioara	48	43	91
5412	Baia de Fier	48	43	91
7853	Bolduț	42	35	77
12074	Păltinoasa	47	35	82
3899	Năruja	47	35	82
19379	Lipovăț	47	49	96
2749	Godeanu	47	35	82
2284	Frasin	47	43	90
7468	Budureasa	47	35	82
15303	Huta Voivozi	48	35	83
12498	Țibucani	48	35	83
5449	Lăpușnicel	47	35	82
2927	Orăștie	47	43	90
7460	Budureasa	47	35	82
10999	Cușma	48	35	83
7584	Brăduleț	47	35	82

A large coefficient of variation it is observed for the descriptors: pod length and no. of days from flowering to maturity. Mean values of the coefficient of variation were recorded for the descriptor leaf length and minimum values, were recorded for the

descriptors: no. of days from emergence to flowering. Regarding the important traits for evaluation of common beans (beginning of flowering, end of flowering and maturity stage), the landraces had a range of variation from 77 to 96 days from emergence to maturity.

The leaf length observed among landraces had a range of 5,28 cm to 7,58 cm. The landrace from Orăștie (Hunedoara county) had the highest value for leaf length (7,58 cm). The landraces also presented variation for colour of flowers (tab. 3, fig. 1).

Table 3

The plant morphological characters of the evaluated common bean landraces

Accession number	Collecting sites	Leaf length (cm)	The colour of flower
12477	Grumăzești	5.28	white with lilac edges
15156	Belioara	6.63	white
5412	Baia de Fier	6.87	white with red edges
7853	Bolduț	7.36	white with lilac edges
12074	Păltinoasa	5.76	white with lilac edges
3899	Năruja	7.97	red
19379	Lipovăț	7.04	lilac
2749	Godeanu	7.09	white with lilac edges
2284	Frasin	7.37	white
7468	Budureasa	6.88	white with lilac edges
15303	Huta Voivozi	6.68	lilac
12498	Țibucani	7.53	white with lilac edges
5449	Lăpușnicel	7.44	white with lilac edges
2927	Orăștie	7.58	white
7460	Budureasa	7.46	lilac
10999	Cușma	6.37	white
7584	Brăduleț	5.54	white



Fig.1. The flowers of common bean landraces from Naruja, Orăștie and Lipovăț

Referring the pod length, had been recorded a range from 4 cm to 19 cm. The colour of the pod at maturity is yellow, pale yellow with colored stripes and spots or violet (fig. 2). The average number of seeds per pod varied between 4 and 8 (tab. 4).

Table 4

## Pod morphological characters of the evaluated common bean landraces

Accession number	Collecting sites	Pod length (cm)	Colour of pod at maturity	Number of seeds per pod
12477	Grumăzești	10.5	yellow	7
15156	Belioara	15.5	yellow	6
5412	Baia de Fier	19	yellow	8
7853	Bolduț	16	yellow	7
12074	Păltinoasa	13	yellow	5
3899	Năruja	15	yellow	5
19379	Lipovăț	19	violet	7
2749	Godeanu	16	yellow	5
2284	Frasin	5.6	yellow	4
7468	Budureasa	17.5	yellow	5
15303	Huta Voivozi	13.5	yellow	6
12498	Țibucani	17	pale yellow with colored stripes and spots	6
5449	Lăpușnicel	4	yellow	2
2927	Orăștie	13	yellow	7
7460	Budureasa	13	yellow	6
10999	Cușma	5.6	yellow	4
7584	Brăduleț	11.5	beige	5



Fig.2. Pods of common bean from Lipovăț (climbing type) and Brăduleț (small type)

It were revealed the correlations between the growth type and morpho-physiological descriptors (pod length, leaf length, no. of days from emergence to flowering, no. of days from emergence to maturity and no. of days from flowering to maturity) (fig. 3).

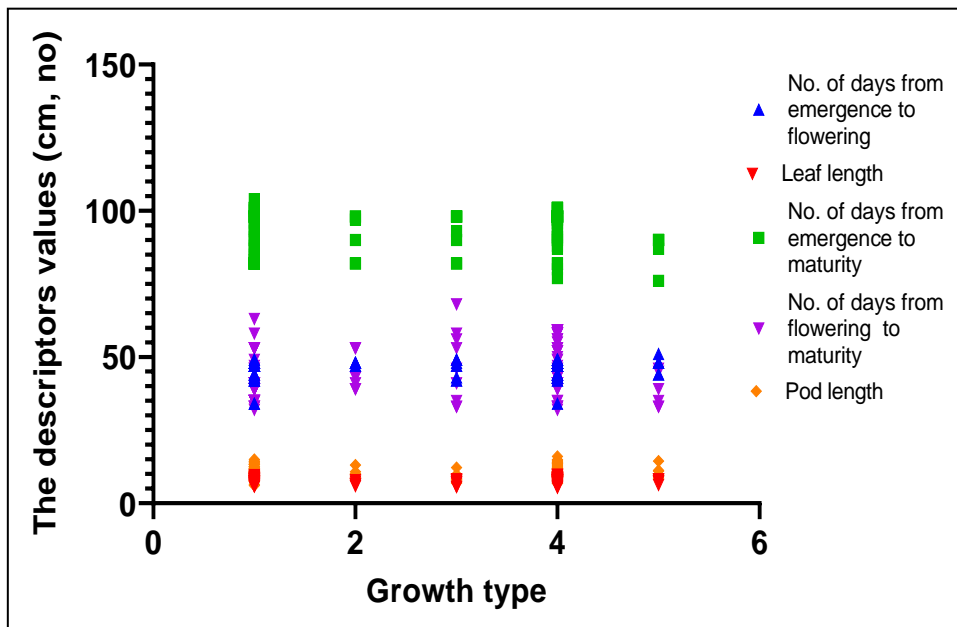


Fig. 3 Distribution of the values of 5 morpho-physiological traits according to the type of growth

The main differences observed between local landraces were in agronomic components. The seeds are different in shape, colour, brightness (tab. 5, fig. 3). Seed colour varied from white, beige, greenish yellow to brown, black or white with black spots (fig. 4).



Fig.4 Seeds of common bean from Grumăzești

The 1000 seed mass was recorded between 229 and 488. Also, for the samples taken in study was recorded differences in average seed sizes (length, width, thickness) (tab. 5).

Table 5

**Seed morphological characters of the evaluated landraces**

<b>Accession number</b>	<b>Collecting sites</b>	<b>Seed shape</b>	<b>Seed size</b>	<b>Seed colour</b>	<b>1000 seed mass</b>
12477	Grumăzești	oval	large	brown	430
15156	Belioara	kidney	medium	brown	396
5412	Baia de Fier	oval	large	brown	439
7853	Bolduț	cuboid	large	violet with white spots	459
12074	Păltinoasa	cuboid	medium	violet with white spots	429
3899	Năruja	oval	large	violet with white spots	395
19379	Lipovăț	kidney	large	beige	333
2749	Godeanu	kidney	medium	beige	300
2284	Frasin	kidney	medium	white with black spots	418
7468	Budureasa	oval	large	violet with white spots	368
15303	Huta Voivozi	oval	medium	black	380
12498	Țibucani	oval	large	violet with white spots	419
5449	Lăpușnicel	oval	large	violet with white spots	488
2927	Orăștie	oval	medium	brown	318
7460	Budureasa	oval	small	black	229
10999	Cușma	oval	small	white	297
7584	Brăduleț	oval	medium	beige	327



These results of agronomic descriptors of some common bean landraces from Romania highlighted variability that could be offer potentially valuable genetic resources for selection and improvement of this crop. These accessions represent an essential source of traits of interest for crop improvement, especially for tackling climate change, because their genetic background and potential have not been well studied.

## CONCLUSIONS

The studied populations represent a diversified biological material with a high variability.

The variability of the studied populations was observed for the descriptors seed color, number of seeds/pod, pod length, while the lowest variability was observed for the descriptor pod color at maturity.

The existence of genetic diversity in this crop could be useful to evolve and cope with current environmental change, thereby ensuring sustainability in the agricultural production system.

For common bean crops, as for all other crops, any breeding program is essentially based on local populations that include an important genetic background for specific traits.

The results of this study represent the starting point from which the genetic diversity of our collection was assessed, thereby making it possible to optimize new breeding strategies for planning future breeding programs to individuate specific traits useful in the environment.

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