Studii şi Cercetări	Martie 2018	Biologie	27/1	124-127	Universitatea"Vasile Alecsandri" din Bacău

STUDY OF *PHASEOLUS COCCINEUS* BIODIVERSITY IN ORDER TO SELECT VALUABLE GERMOPLASM

Creola Brezeanu, Silvica Ambăruş, Petre Marian Brezeanu, Crina Andreea Antal

Key words: *beans, local population, biodiversity, agro-productivity, variability*

INTRODUCTION

Phaseolus coccineus L. is closely related to *P. vulgaris* and is the third most important cultivated *Phaseolus* species.

The origin center of the large beans is found in Mexico and Central America, being introduced in culture in the period 9000-7000 î.H. It was probably introduced in Europe in the 16th century, but the first mention of this species appears in Gerard's "Herball" (1633), described as an ornamental plant.

Little is known about the patterns of its diversity. A certain reduction of diversity occurred with introduction into Europe. The European and Mesoamerican gene pools are clearly differentiated. The genetic diversity of both WFs and LRs is an important source for *Phaseolus* spp. breeding programs and deserves to be preserved in situ and ex situ. (Spataro, 2011)

The large bean (*Phaseolus coccineus* L.) is a well-known species in our country but occupies relatively small areas, especially in the rural population of the countryside. The plant is mainly grown for its dry or green beans, being fewer known forms from which pods are used.

The large beans found favorable conditions for cultivation, as evidenced by its wide spread in all regions of the country, having both food and ornamental utilities. However, the species was not imposed in culture as a species of great economic importance, probably due to lower economic efficiency, but also to other factors that we mention: the reduced attractiveness for the bean-like forms, less suitable for mechanization, the lack of a breeded material (being cultivated exclusively local populations), variable yields from year to year (depending on meteorological conditions), lack of modern and / or standardized cultivation technology, and so on.

Previous studies (Munteanu, 2006, Munteanu, 2007, Popa Diana, 2006) underlined the large diversity of the existent populations in the collection of University of Agricultural Sciences and Veterinary Medicine Iasi from different perspectives: morphological, physiological and agro productive. The yield is considered to be a determining factor for the promotion of a new cultivar.

Genetic diversity of runner bean has been less extensively studied. The largest set of European landraces, more than 300, was evaluated by cpSSRs and a smaller set was studied also for phenotypic traits (Rodriguez et al, 2013).

The aim of our work was (1) to acquire knowledge, experience and data that will enable better and more efficient use of PGR. (2) to provide useful contributions to further *Phaseolus coccineus* research and production (3) to ensure the valuable use of *Phaseouls* resources for diffrent purposes.

MATERIAL AND METHODS

The experiments were conducted at the Vegetable Research and Development Station in Bacau, Romania. The biological material used in our experiments was an assortment of 10 local populations, namely accessions coming from various ecological areas: plain, hill, mountainous depression, collected in different missions organized for this purpose.

Biological material has been evaluated for three years in an organic farming polygon.

The collection study highlighted the main morphological and physiological characteristics of each accession. In the collection, we used as many plants as possible for each variant to evaluate the variability and eventual utility of some characters.

RESULTS AND DISCUSSIONS

The collected material, seeds of *P. coccineus* was morphometric characterizated was performed according to adopted Community Plant Variety Office-Technical Protocol (CPVO-TP) for 14 different seed characteristics. Morphometric characterisation covers seed length (L) [mm], width in longitudinal cross section (T) [mm], shape of median-cross section (W) [mm], L/W and W/T ratios, seed colour, number of colours present on seeds, main colour, predominant secondary colour, distribution of secondary colour, veining, seed shape, average 10 seeds weight [g] and seed colour and coat pattern. Seed pigmentation, shape and pod cross

shape, were investigated according Descriptors list for *Phaseolus*, presented in figure 2.

The results obtained highlighted the great morphological diversity of the assortment studied – figure 1 presents the general aspect of flowers. The character that confirms the most obvious distinction is the seed color. Thus, biodiversity has been highlighted by the presence of different color and sizes of seeds. These were unicolour (white) or bicolour, with purple background and dark purple arabesque drawing with beige background and brown arabic drawing.

Fig. 1. General aspect of flowers

The following objectives were considered when studying the production capacity of local populations: knowledge of the main elements of productivity; the appreciation of production capacity in a series of comparative crops organized in relation to the annual conditions. Our phenological and morphologycal study obtained results presented in tables 1 – 5. The productivity of the assortment studied was assessed by the cumulation of many elements, namely: the number of seeds per plant, the size of the pods, the size of the seed, the number of seeds in pod, the mass of 1000 grains (MMB), the seed production, and so on.

As regards the assessment of the production capacity of an assortment of local populations in interaction with environmental conditions, following analysis and statistical processing of the obtained results, the populations LP - 93 and LP - 91 proved to be the best, populations which were studied in the process of breeding for creating new genotypes.

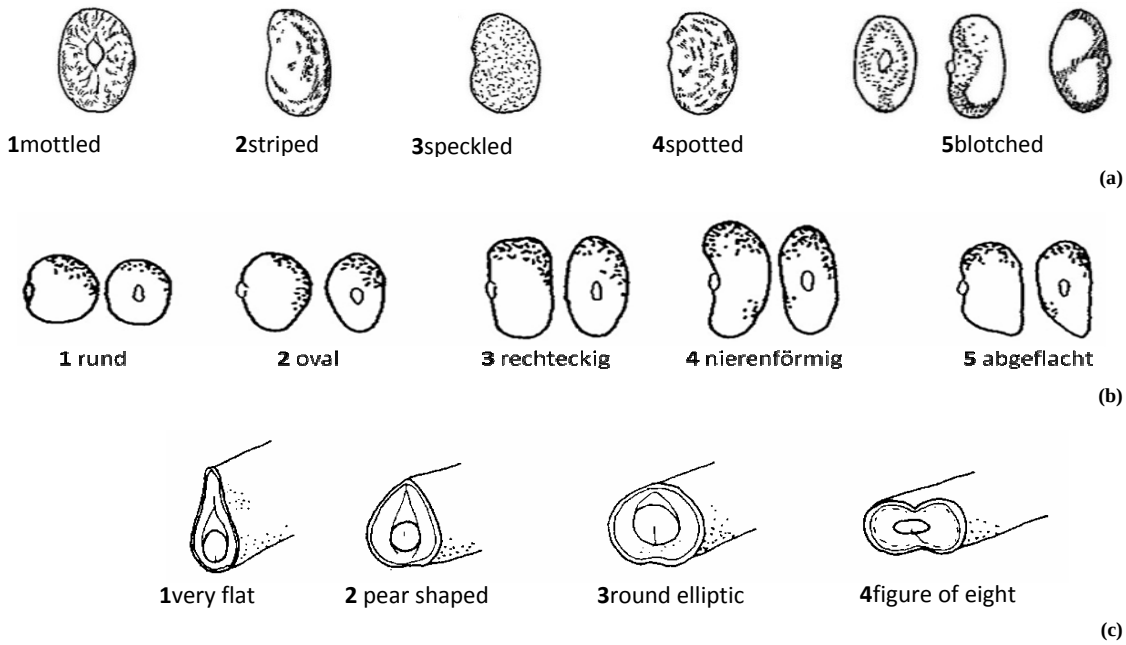

Fig. 2. Seed (a) pigmentation (b) shape and (c) pod cross shape, according Descriptors list for *Phaseolus*

Table 1. Investigations according to Descriptors list for *Phaseolus coccineus*

ACC	Days from sowing to 50 % flowering	Plant height [cm]	Pod curvature	Days to 90% pod maturity	Seeds per pod
LP - 31	45	260	slightly curved	155	3
LP - 91	55	275	slightly curved	145	4
LP - 86	55	265	slightly curved	155	3
LP - 93	70	280	slightly curved	149	4
LP - 82	60	295	medium curved	155	3
LP - 83	70	275	slightly curved	170	3
LP - 80	59	320	medium curved	155	3
LP - 88	60	290	straight	157	3
LP - 87	60	330	slightly curved	157	3
LP - 66	60	315	slightly curved	170	3

Table 2. Leaf and flower investigation according to Descriptors list for *Phaseolus coccineus*

ACC	Colour of banner	Colour of flower wings	Leaf shape	Presence or absence of anthocyan	Leaflet length [cm]
LP - 31	carmine	dark lilac with purple	triangular	present	11.5
LP - 91	white	white	quadrangular	absent	10
LP - 86	white	white	round	absent	9.5
LP - 93	white	white	quadrangular	absent	9.5
LP - 82	carmine	dark lilac with purple outer edge	triangular	absent	7
LP - 83	white	white	round	absent	8
LP - 80	white	white	quadrangular	present	10
LP - 88	white	white	round	present	12
LP - 87	white	white	quadrangular	absent	8.5
LP - 66	white	white	round	absent	9

Table 3. Pod and plant features according Descriptors list for *Phaseolus coccineus*

ACC	Plant growth habit	Pod cross-section	Pod colors from fully expanded immature pod
LP - 31	indeterminate bush	very flat	normal green
LP - 91	indeterminate bush	very flat	shiny green
LP - 86	indeterminate bush	pear shaped	normal green
LP - 93	indeterminate bush	very flat	shiny green
LP - 82	indeterminate bush	very flat	normal green
LP - 83	indeterminate bush	very flat	normal green
LP - 80	indeterminate bush	very flat	normal green
LP - 88	indeterminate bush	very flat	purple stripe on green
LP - 87	indeterminate bush	pear shaped	normal green
LP - 66	indeterminate bush	very flat	normal green

Table 4. Seed and pod investigations according Descriptors list for *Phaseolus coccineus*

ACC	Dimensions of pods cm			Dimensions of seeds mm	
	lenght	width	diameter	lenght	width
LP - 31	18	1.9	1.3	20	11
LP - 91	17	1.8	1.3	19	12
LP - 86	15	1.5	1.2	20	11
LP - 93	18	1.6	1.3	18	13
LP - 82	13	1.6	1.2	17	14
LP - 83	12	1.4	1.1	16	13
LP - 80	10	1.5	1.3	17	12
LP - 88	11	1.7	1.4	18	12
LP - 87	9	1.9	1.2	19	11
LP - 66	10	1.8	1.4	17	13
The average	**13.3**	**1.67**	**1.27**	**18.1**	**12.2**

Table 5. Seed shape and coat caracteriyation according Descriptors list for *Phaseolus coccineus*

ACC	Seed shape	Seed coat colour	Second colour of seed	Seed coat pattern
LP - 31	kidney shaped	green–oliv	red	speckled
LP - 91	kidney shaped	white	brown	blotched
LP - 86	kidney shaped	white	-	-
LP - 93	kidney shaped	white	-	-
LP - 82	oval	white	blak	speckled
LP - 83	oval	white	-	-
LP - 80	kidney shaped	purple	cream	blotched
LP - 88	kidney shaped	purple	cream	blotched
LP - 87	oval	purple	cream	speckled
LP - 66	oval	white	-	-

Table 6. Characterization of assortment on the main elements of productivity

ACC	No. seeds/pod	No. seeds /plant	100-seed weight [g]	Seed prod. kg/ha
LP - 31	4-6	120	99.3	2900
LP - 91	3-4	142	105.2	3250
LP - 86	4-5	124	103	3000
LP - 93	4-5	145	103.5	3200
LP - 82	2-3	118	96.4	2700
LP - 83	3-4	112	90.2	2850
LP - 80	4-5	115	87.1	3000
LP - 88	4-5	115	98.18	2280
LP - 87	5-6	118	98.6	2950
LP - 66	2-3	119	90.9	3120
The average	**4,05**	**122,8**	**97.24**	**2925**

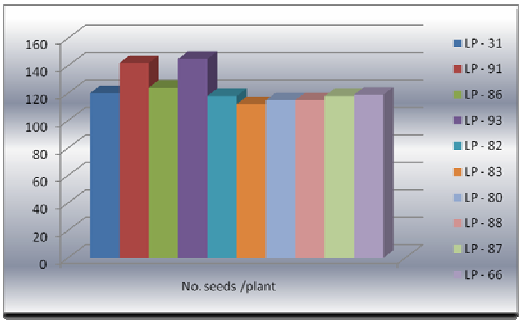

Fig. 3. Graphical representation of character – number of seeds per plant

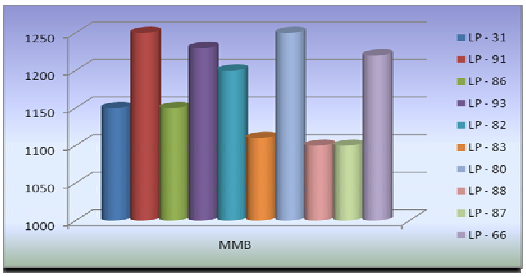

Fig. 4. Graphical representation of character – the mass of 1000 grains (MMB)

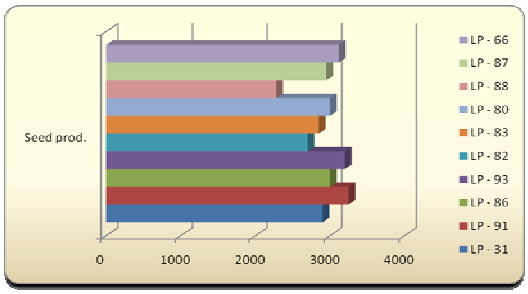

Fig. 5. Graphical representation of character – seed production

The most important items related to productivity are presented in figure 3 (number of seeds per plant), figure 4 (mass of 1000 grains) and figure 5 (yield, seed productivity).

CONCLUSIONS

The results demonstrate the importance of the species and also the need of continuity of investigation in order to detect and select the most suitable resources for each purpose of use.

ABSTRACT

The lack of systematic (scientific) knowledge about the biology and ecology of the species in the specific conditions in our country has been an element that contributed to the lower "progress" of this species.

The climbing large bean (*Ph. coccineus*), although well-known in culture, little information is known about its biology and genetics. There is a high degree of rusticity and ecological plasticity, which is higher than at common beans due to resistance or tolerance to pathogens. Highly important is the fact that this rusticity provides a high degree of suitability for sustainable farming systems, including organic.
The aim of our work was (1) to acquire knowledge, experience and data that will enable better and more efficient use of PGR. (2) to provide useful contributions to further *Phaseolus coccineus* research and production (3) to ensure the valuable use of *Phaseouls* resources for diffrent purposes.
The obtained data provides a strong base for establishing a working plan for breeding activities.

ACKNOWLEDGEMENTS

This work was supported by a grant of the Romanian Ministery of Research and Innovation, CCCDI - UEFISCDI, project number PN-III-P1-1.2-PCCDI-2017-0850/ contract 14 PCCDI /2018, within PNCDI III" also from The National Sectorial Program ADER 2020.

REFERENCES

1. ECPGR, 2018- European Search Catalogue for Plant Genetic Resources. http://eurisco.ecpgr.org
2. GERARD JOHN, 2 The herball or, Generall historie of plantes;
3. MUNTEANU N., STOLERU V., AMBĂRUŞ SILVICA, STOLERU CARMEN, 2006 - Production results an assortment of some local populations of runner bean, Lucrări ştiinţifice, seria Horticultură, USAMV Iaşi, vol. 53;
4. MUNTEANU N., POPA DIANA-LORENA, STOLERU V., 2007 - Valoarea agrobiologică a unor populaţii locale de fasole mare (*Phaseolus coccineus* L.) Lucrări ştiinţifice, Seria Horticultură, vol. 50, ISSN 1454-7376;
5. MUNTEANU N., POPA DIANA LORENA, TELIBAN G., 2007 - Pretabilitatea speciei Phaseolus coccineus L. pentru cultivare în sisteme de agricultură sustenabilă. Lucrări ştiinţifice, Seria Horticultură, vol. 50, ISSN 1454-7376;
6. SPATARO, G., TIRANTI, B., ARCALENI, P. et al. Theor Appl Genet, 2011 122: 1281. https://doi.org/10.1007/s00122-011-1530-y

AUTHORS' ADDRESS

BREZEANU CREOLA, AMBARUS SILVICA, BREZEANU PETRE MARIAN, ANTAL CRINA ANDREEA - Vegetable Research and Development Station, Calea Barladului, Street, no. 220, Bacau, Romania, e-mail: creola.brezeanu@yahoo.com