

ORIGINAL PAPERS

STUDIES REGARDING SOME QUANTITATIVE TRAITS OF “CREOLICA”, ROUND PEPPER VARIETY

Creola Brezeanu, Silvica Ambăruș, Petre Marian Brezeanu, Maria Calin

Key words: variability, correlation, genotype

INTRODUCTION

Peppers are spread and used worldwide as vegetables, spices, ornamentals and condiments. It is generally accepted that the *Capsicum* genus originated in Bolivia and consists of 25–30 species (Eshbaugh, 1993).

Five of these *Capsicum* species were domesticated: *C. annuum*, *C. baccatum*, *C. chinense*, *C. frutescens*, and *C. pubescens*. The largest group of varieties is found among the *C. annuum* spp. which is grown worldwide. The wild progenitor of *C. annuum* is thought to be the bird pepper, whose domestication occurred in Mexico (Eshbaugh, 1993).

Two of the key traits that were selected during domestication of pepper were non-deciduous fruit that remained on the plant until harvest and the change in position from erect to pendant fruit. This latter change may be associated with an increase in fruit size, better protection from sun exposure, and predation by birds. Other changes associated with domestication and variety improvement were fruit appearance and reduced pungency. While, wild peppers can be found in several basic shapes including oval, spherical, or elongated, continued selection resulted in a large increase of shape variation and tremendous increases in fruit mass. The selection also resulted in yellow, orange, and brown fruit colors in addition to the wild-type red, which occurs in all cultivated pepper species. (Paran, 2007).

Domestication traits often seem to be controlled by independent mutations at orthologous loci (Paterson, 1995), although this observation does not hold true in all cases (Li and Gill, 2006).

Natural variation that exists within the cultivated germplasm pool will also continue to be exploited in the development of superior cultivars compared with the parental accessions. In addition, significant improvements will result from introgression of beneficial alleles from wild relatives. (Ronen, 2000).

Genetic diversity among and within species of the genus *Capsicum* has been extensively investigated (Souza & Maluf, 2003); the level of variation within the domesticated species is lower

then in their wild relatives, and variation in peppers with elongated and sweet fruit is limited compared to the diversity found among pungent peppers (Lefebvre et al., 1993; Portis et al., 2006, Maramba et al., 2009).

Significant progress has been made in the understanding of the genetic basis of many key fruit and plant traits that were selected during domestication and cultivar improvements of pepper. (Paran, 2005).

In this study were made a large number of observations and measurements of the main characters of the lines that make up the population.

Our purpose was to apply correct and efficient selection for seed production at round pepper variety named “CREOLICA”. Fruit size and shape are quantitative inherited characters. The purpose of the work was to develop a variability study of the main traits and also to highlight the significance for the conservative selection works.

Maintaining annually the quantitative and qualitative traits of variety within their variability in purpose to ensure the identity, uniformity and stability is achieved by the conservative selection works. Our undertaken studies show that studied variability of different traits is: low at plant height, $s\% \leq 10$; medium for length, diameter and weight of the fruit, $s\%$ between 10-20%; high ($s\% \geq 20$) for trait: production of fruit / plant.

Data presented in this paper reveal that the variety of pepper “CREOLICA” is stable and distinct within the normal variability.

MATERIAL AND METHODS

Studies have been developed to Vegetable Research and Development Station, Bacau on biological homogenized material form field of progenies study at *Capsicum annuum* L. ssp. *annuum* convar. *grossum* (L) Filov var. *grossum* (round pepper) variety named “CREOLICA”.

During vegetation period there were made phenological observations regarding:

- phenophase duration (number of days),
- the sum of ($^{\circ}\text{C}$) degree,

- rainfall (mm), for each phenophase.

The method of selection was mass selection. Our observations and determinations concerned the following features:

- plant's height – (cm)
- fruit's height – (cm)
- fruit's diameter – (mm)
- index of shape,
- fruit's weight – (g)
- seed weight / plant – (g)

Traits variability was assessed using a string of variation and histograms (Gause's curve), calculating the following statistical indices:

- the arithmetic average \bar{x} ,
- standard deviation (s),
- the coefficient of variation (S%),
- limits of variation $k \pm s$.

RESULTS AND DISCUSSIONS

For the data set to be conclusive, it was necessary to have a sufficient number of individuals in each line.

Changing the frequency of genes and genotypes conclude in changes of the traits average, so changes at variety characteristics. For this reason the structure of variety should be known, and after each selection cycle is has to be compared with its original structure.

In conservative selection process, variability study is on samples taken from statistics population. An individual value that is owned or operated in the analysis of variability belongs:

- to some traits whose degree of externalization is identified based on the qualitative determinations, (qualitative characters);

- to some quantitative traits (characters that can be measured and weighed).

All registrations were made in pepper culture for seed production, during the vegetation period.

The investigated phenophases were:

- sowing to seed emergence,
- seed emergence to planting time,
- planting time to appearance of first flowers,
- appearance of first flowers to appearance of first fruits,
- appearance of first fruits to first harvest,
- first harvest to last harvest,

For each phenophase we established:

- phenophase duration (number of days)
- sum of ($^{\circ}\text{C}$) degree
- rainfall (mm)

All these registrations are presented in Table 1.

The total period of vegetation for "CREOLICA" variety was 127 days. Harvesting was the longest phenophase and took place over a period of 92 days. In this phenophase we registered 1289.8 $^{\circ}\text{C}$ a total sum of ($^{\circ}\text{C}$) degree and 67.8 mm rainfall.

The shortest phenophase was: appearance of first flowers to appearance of first fruits during 8 days we registered a sum of 110 ($^{\circ}\text{C}$) and 31.8 mm rainfall.

Statistical and mathematical processing of data drawn from the measurements, showed the following ranges of variation of pepper variety "CREOLICA" Table 2.

In case of plant's height variation limits were between 45.5 and 57.5 with an average of 51.5 Coefficient of variation was 6.2% which represents small variability (s% <10) for this character.

Table 1. The main phenophases at "CREOLICA" round pepper variety

No	Phenophase	Phenophase duration From – to (number of days)		Sum of ($^{\circ}\text{C}$) degree	Rainfall (mm)
1	sowing - springing	24.02	10.03	-	-
		14 days			
2	springing – planting time	10.03	08.05	-	-
		58 days			
3	planting time -appearance of first flowers	10.05	04.06	662	190.8
		25 days			
4	appearance of first flowers - appearance of first fruits	04.06	12.06	115	31.8
		8 days			
5	appearance of first fruits – first harvest	12.06	15.07	920	78.8
		31 days			
6	first harvest - last harvest	15.07	10.10	1262.8	66.8
		92 days			
7	vegetation period from springing at first harvest	10.03	15.08	3719.2	375.2
		127 days			

Table 2. Variability study of some traits at "CREOLICA" round pepper variety

No	Analyzed traits	Average (x)	Standard deviation (s)	Coefficient of variation (s%)	Limits of variability (k)	Signification
1	Plant's height (cm)	51.5	2.78	6.2	45.5 - 57.5	<10
2	Fruit's length (cm)	4.25	1.72	14.3	2.5 - 6	10-20
3	Fruit's diameter (mm)	8.5	0.82	16.1	6.5-10.5	10-20
4	Fruit's weight (g)	220	9.04	10.7	70-370	10-20

- >20 - high level of variability
- 10-20 - medium level of variability
- <10 - low level of variability

For traits: fruit's length the limits of variation were between 2.5 and 6.0 with an average of 4.25. Coefficient of variation was 14.3%, which represents middle variability (s% between 10 and 20).

Coefficient of variation was 16.1%, which represents middle variability (s% between 10 and 20).

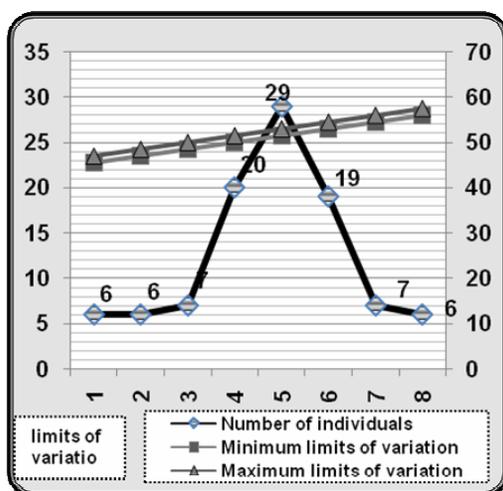


Fig. 1. Histogram of plant's height variation (cm)

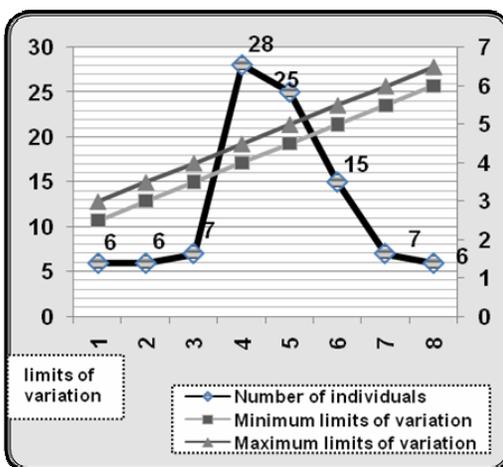


Fig. 2. Histogram of fruit's length variation (cm)

Regarding fruit's diameter variation of limits were between 6.5 and 10.5 with an average of 8.5.

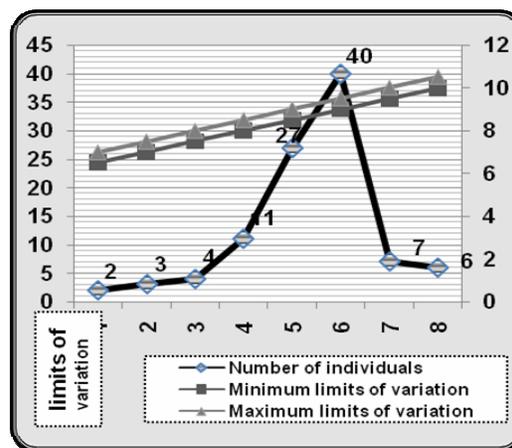


Fig. 3. Histogram of fruit's diameter variation (cm)

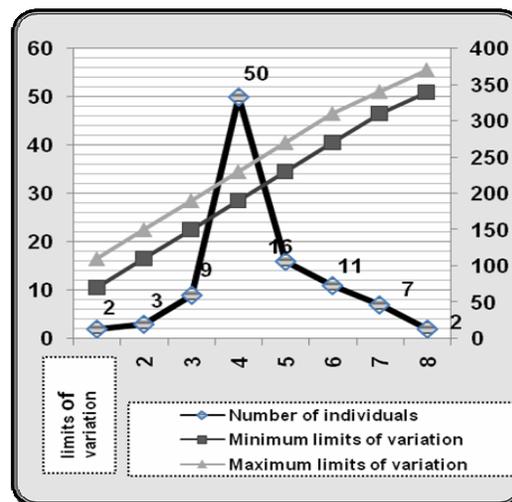


Fig. 4. Histogram of fruit's weight variation (g)

Limits of variability for fruit's weight were between 70-370 g, with an average of 220 g. Coefficient of variation was 10.7%, which represents medium variability (s% between 10 and 20).

CONCLUSIONS

“CREOLICA” variety is uniform, stable and distinct. Studied characters showed the following average values:

- plant's height (cm) – 51.5;
- fruit's height (cm) – 4.25;
- fruit's diameter (mm) –98.5;
- fruit's weight – (g) 220 g;
- total vegetation period duration was 127 days in climatic condition of North East part of Romania.

Statistical and mathematical processing of data drawn from the measurements, showed the following ranges of variation of “CREOLICA” pepper variety:

- low at plant height, $s\% \leq 10$;
- medium for length, diameter and weight of the fruit, $s\%$ between 10-20%;
- high ($s\% \geq 20$) for trait: production of fruit / plant.

Data presented showed that the pepper variety - “CREOLICA” is stable and distinct within the normal variability.

ABSTRACT

The purpose of this paper is to present a study of the variability of the main characters in the round pepper species and at the same time to emphasize the significance of this variability for conservative selection work. The annual maintenance of the varietal qualitative and quantitative characteristics in order to ensure identity, uniformity and stability is achieved through conservative selection work. Our study on the “Creolica” round paper variety showed different variability within the investigated characters as follows:

- low, for the height of the plant. with $\% \leq 10$;
- average for the length, diameter and weight of the fruit, $s\%$ between 10-20%;
- high ($s\% \geq 20$) for the index: fruit / plant weight.

The data presented showed that the “Creolica” round pepper variety is stable, distinct and is within normal limits of variability.

REFERENCES

1. ESHBAUGH W.H., 1993 - History and exploitation of a serendipitous new crop discovery. In: Janick J, Simon JE, eds. New crops. New York: Wiley, 132–139;
2. LEFEBVRE V., PALLOIX A., RIVES M., 1993 - Nuclear RFLP between pepper cultivars (*Capsicum annuum* L). Euphytica 71:189-199;
3. LI W., GILL B.S., 2006 - Multiple genetic pathways for seed shattering in the grasses. Functional and Integrative Genomics 6, 300–309;
4. MARAME F., DESSALEGNE L., FININSA C., SIGVALD R., 2009 - Heterosis and heritability in crosses among Asian and Ethiopian parents of hot pepper genotypes. Euphytica 168:235-247;
5. PARAN I., ELITZUR T., BOROVSKY Y., KALUZKY G., NAHUM H., ESHED Y., 2005 - Use of natural and induced variation to study the genetic control of plant architecture in pepper. Second Solanaceae Genome Workshop. Italy: Ischia, LS70;
6. PARAN I., VAN DER KNAAP E., 2007 - Genetic and molecular regulation of fruit and plant domestication traits in tomato and pepper, Journal of Experimental Botany, Vol. 58, No. 14, pp. 3841–3852, doi:10.1093/jxb/erm257;
7. PATERSON A.H., LIN Y.R., LI Z., SCHERTZ K.F., DOEBLEY J.F., LIU S.C., STANSEL J.W., IRVINE J.E., 1995 - Convergent domestication of cereal crops by independent mutations at corresponding genetic loci. Science 269, 1714–1718;
8. PORTIS E., NERVO G., CAVALLANTI F., BARCHI L., LANTERI S., 2006 - Multivariate analysis of genetic relationships between Italian pepper landraces. Crop Science 46:517-525;
9. RONEN G., CARMEL-GOREN L., ZAMIR D., HIRSCHBERG J., 2000 - An alternative pathway to beta-carotene formation in plant chromoplasts discovered by map-based cloning of beta and old-gold color mutations in tomato. Proceedings of the National Academy of Sciences, USA 97, 11102–11107;
10. SOUZA J.A., MALUF W.R., 2003 - Diallel analyses and estimation of genetic parameters of hot pepper (*Capsicum chinense* Jacq). Scientia Agriculturae 60:105-113.

ACKNOWLEDGEMENTS

This work was co-financed from the Sectorial program ADER 2020, VRDS Bacau projects.

AUTHORS' ADDRESS

BREZEANU CREOLA - VRDS Bacau, Calea Barladului, Street, no. 220; University of Agricultural Science and Veterinary Medicine, Iasi, e-mail: creola.brezeanu@yahoo.com

AMBARUS SILVICA, BREZEANU PETRE MARIAN, CALIN MARIA - VRDS Bacau, Calea Barladului, Street, no. 220, e-mail: silvia_ambarus@yahoo.com; brezeanumarian@yahoo.com; calin_maria@yahoo.com