THE PHENOTIPIC VARIABILITY
OF VALUABLE CHARACTERS OF TOMATO FRUIT

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Abstract. In this paper, there are presented the results of the phenotypic variability of the fruit characters as well as the fruit weight, thickness of the pericarp and the index of the loge number. It was found that the phenotypic variability of the fruit weight, pericarp thickness and the number of lodge is more pronounced. The fruit index was found to be more stable. The average variability of this character is 9%. This allows us qualifying the character as one with low variability, which demonstrates its pronounced genetic determinism.

Keywords: variability, tomato, breeding, genetic determinism.

Rezumat. Variabilitatea fenotipică a caracterelor valoroase ale fructului de tomate. În articol sunt prezentate rezultatele evaluării variabilităţii fenotipice a caracterelor fructului: masa fructului, grosimea pericarpului, indicele fructului şi numărul de loje. S-a constatat, că variabilitatea fenotipică a masei fructului, grosimii pericarpului şi a numărului de loje este destul de pronunţată. Indicele fructului s-a dovedit a fi mai stabil. Variabilitatea medie a caracterului dat este de 9%. Aceasta permite calificarea caracterului ca fiind cu variabilitate joasă, ceea ce demonstrează determinismul genetic pronunţat al acestuia.

Cuvinte cheie: variabilitate, tomate, ameliorare, determinism genetic.

INTRODUCTION

In the breeding practice, in order to increase the effectiveness of the selection process, an important role is played by the data about the genetic parameters. The absence of the comprehensive information about the level of the character variability does not allow to plan correctly the number of investigated plants in the experiences, the average value of sample, etc., finally, which results in obtaining of uncertain value of the statistic parameters. Furthermore, without such analysis, the breeder loses more forces and time to study the characters that really do-not provide veridical results, because the genetic structure of the population has become comparatively stable (IANUSHEVICH, 1972).

In breeding and genetic studies, for the elucidation of the regularity in the adaptive reactions of organisms, in the ontogenesis, it is largely used the coefficient of variation. This allows obtaining the information about the features of the norm of reaction for different species and varieties and ensuring in this case a comparison of the results. The information on the variation of the character, which depends on variety of the genotypes, indicates the possibility to change the parameter in the necessary direction at this stage of selection. The establishment of the heredity and variability features of the characters is important for breeder and offers the opportunity to optimize the selection program (FASOULAS, 1973).

In addition, the variability level of characters indicates the selection, as a directed method of breeding. Therefore, the knowledge of the variability legalities of the interested characters allows the correct planning of the breeding process and obtaining the intended results in a shorter period of time.

Independently of the research purpose and direction in the breeding, an important role has the fruit characters, because they determine the final result of the breeding. The main characteristic of tomato fruit are: weight, number of lodges, the thickness of the pericarp, the fruit form index. The knowledge about the variability level of these allows to use more efficiently the initial material in breeding research. Thereby, the aim of the present work is to study the phenotypic variability of the tomatoes fruit characters, with various geographical origin.

MATERIAL AND METHODS

For experiences there were used 37 samples of tomatoes with different geographical origins. As a relative measure of the phenotypic variability we used the coefficient of variation (V, %) (DOSPEHOV, 1985). Based on the values of the coefficient of variation, the studied characters were divided in to the following classes: 1) low variable (V< 10%); 2) medium variables (V = 10-20%); 3) high variable (V > 20%).

RESULTS AND DISCUSSIONS

Among the many features of the fruit the main is the weight, because it represents the economic value of the character. The requirements of the fruit size are different and are determined by the specific use. The heredity of the fruit weight is a multifactor character (ZHUCENCO *et al.*, 1973), what is necessary to take into account when planning the experience. The complexity of the character is determined by the control of several genes that interacts with environmental factors at different stages of plant development and ensures a high variability of this character.

The analysis of the data presented in Figure 1 demonstrates essential differences in genotypes according to the average fruit weight. Thus, have been evidenced 8 big fruit forms: Early Giant P0475, Maunta in Pride, Ailon, Raniy

Nush, Aurora 100, Tatinter, Marman de P.V., Samyi ranii zholtyi and a form with very big fruit Landrace from Kenya, with the average values of the weight - 218,5 gr.
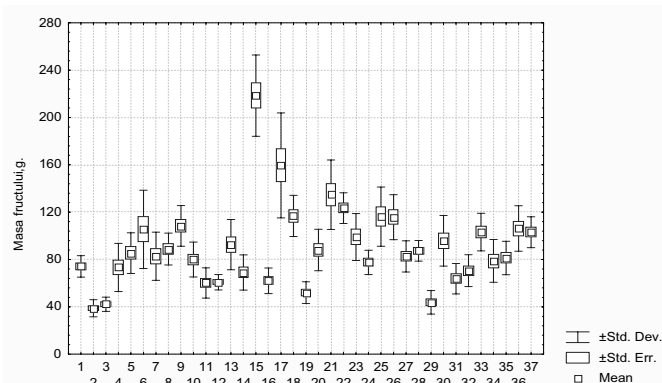

Figure 1. Phenotypic variability of fruit mass of tomato varieties. / Figura 1. Variabilitatea fenotipică a masei fructului la soiuri de tomate.

Legend: 1. Zastava; 2. Krasnoiarskii raniy; 3. Lyallypor selected; 4. Druzhba; 5. De Marmande Clause; 6. Portugues; 7. Meritra; 8. Talenskiy scorospelyy; 9. Early Giant P0475; 10. Riccio di Parma; 11. C-38; 12. Altayskiy ranniy; 13. Mestnyy; 14. 106/2 Paradisommag; 15. Mestnyy (Keniya); 16. Kolobok; 17. Maunta in Pride; 18. Ailon; 19. Costral; 20. Losinoostrovskiy; 21. Raniy Nush; 22. Aurora 100; 23. Altayskiy gruntovyy; 24. Olomoucke nizke; 25. Tatinter; 26. Marman de P.V.; 27. Obilnyy 387; 28. Ovale di Torelame; 29. Earlinorth; 30. Ottava 33; 31. Buschtomaten line 1209/04; 32. Severyanin; 33. Samyy ranniy jeltyy; 34. Kecskemeti 700; 35. Ermak. 36. Yuliana. 37. Potok.

The average value of the variation coefficient of the analysed tomato **fruit weight** was 18.6%, which indicates a pronounced variability of the character. The variability of the **fruit weight** was more pronounced at the forms: Druzhba (27.8%), De Marmande Clause (20.1%), Portugues (31.4%), Meritra (24.6%), C-38 (21.2%), 106/2 Paradisommag (21.5%), Maunta in Pride (27 (%), Raniy Nush (21.7%), Tatinter (21.5%), Earlinorth (22.7%), Ottava 33 (22.7%), Kecskemeti 700 (22.9%).

The requirements of the fruit form also vary depending on the use and destination. This character has a special importance for the mechanized cultivation. It is obvious that the level of the fruit damaging, as a result of mechanized cultivation, depends not only on the fruit density, but also on its form. Therefore, it is recommended to use a sample of **ovoid and ovate** form since they may easily detach from the pedicle.

Table 1. The phenotypic variability of the following tomatoes characters: pericarp thickness, fruit index and the number of lodge.
Tabel 1. Variabilitatea fenotipică a caracterelor, grosimea pericarpului, indicele fructului și numărul de loje la tomate.

No.	Varieties	Thickness of pericarp, mm		The fruit form index (h/d)		Number of cores	
		$X \pm S_x$	V,%	$X \pm S_x$	V,%	$X \pm S_x$	V,%
1	Zastava	4.3±0.21	15.6	0.91±0.01	3.0	3.5±0.22	20,3
2	Krasnoiarskii raniy	3.7±0.45	38.4	0.96±0.01	5.0	3.9±0.28	22,3
3	Lyallypor selected	3.7±0.42	35.9	1.06±0.12	6.5	2.2±0.13	19,1
4	Druzhba	4.5±0.34	24.0	0.81±0.03	11.0	3.5±0.22	20,3
5	De Marmande Clause	6.9±0.50	23.0	0.74±0.03	13.2	6.0±0.26	13,7
6	Portugues	6.5±0.40	19.5	0.90±0.02	7.9	4.7±0.21	14,2
7	Meritra	4.6±0.26	18.3	0.81±0.02	7.8	4.9±0.23	15,1
8	Talenskiy scorospelyy	4.2±0.24	18.8	0.89±0.02	6.8	4.9±0.37	24,5
9	Early Giant P0475	5.2±0.29	17.7	0.87±0.01	5.6	3.7±0.30	25,7
10	Riccio di Parma	4.3±0.42	31.2	0.97±0.02	6.4	3.4±0.16	15,0
11	C-38	6.8±0.41	19.4	1.27±0.03	7.9	2.5±0.17	21,2
12	Altayskiy ranniy	3.1±0.35	35.5	0.90±0.01	4.4	3.8±0.13	11,0
13	Mestnyy	4.7±0.39	26.6	0.76±0.03	13.9	5.2±0.53	32,5
14	106/2 Paradisommag	5.3±0.45	26.6	1.07±0.02	6.6	2.8±0.20	22,5
15	Mestnyy (Keniya)	5.9±0.31	16.8	0.71±0.06	29.1	9.6±0.37	12,2
16	Kolobok	5.6±0.22	12.5	0.89±0.02	6.8	4.1±0.10	7,8
17	Maunta in Pride	6.4±0.30	15.1	0.78±0.02	10.1	5.0±0.25	16,4
18	Ailon	5.5±0.48	27.4	0.86±0.02	8.1	4.3±0.33	24,6
19	Costral	5.2±0.42	25.4	1.36±0.04	9.0	2.2±0.13	19,1
20	Losinoostrovskiy	3.5±0.34	30.8	0.88±0.02	5.8	3.7±0.30	25,7
21	Raniy Nush	3.7±0.15	13.0	0.84±0.03	12.5	5.0±0.21	13,4
22	Aurora 100	3.6±0.45	39.7	0.85±0.01	5.4	3.8±0.13	11,0
23	Altayskiy gruntovyy	4.9±0.31	20.2	0.77±0.01	5.3	5.5±0.17	9,6
24	Olomoucke nizke	2.5±0.22	28.4	0.92±0.02	6.5	3.3±0.33	32,1
25	Tatinter	5.1±0.37	23.5	0.76±0.01	5.8	6.8±0.24	11,6
26	Marman de P.V.	3.9±0.45	37.2	0.72±0.02	8.9	6.4±0.22	10,9
27	Obilnyy	4.9±0.17	11.6	0.80±0.02	8.2	3.8±0.20	16,6
28	Ovale di Torelame	5.3±0.42	25.3	1.25±0.05	12.5	2.5±0.22	28,4
29	Earlinorth	3.0±0.29	31.3	0.87±0.02	7.2	4.4±0.16	11,8

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30	Ottava 33	4.1±0.27	21.2	0.89±0.02	6.7	4.3±0.35	22,1
31	Buschtomaten line 1209/04	4.0±0.33	26.2	0.91±0.03	11.0	4.4±0.22	15,9
32	Severyanin	3.8±0.24	20.8	0.78±0.03	13.8	4.4±0.16	11,8
33	Samyy ranniy jeltyy	4.7±0.15	10.2	0.84±0.02	9.5	4.1±0.31	24,1
34	Kecskemeti 700	5.2±0.44	26.9	0.77±0.02	8.0	3.9±0.17	14,6
35	Ermak	4.1±0.34	26.8	1.03±0.03	10.4	4.2±0.29	21,9
36	Yuliana	4.8±0.29	19.2	0.89±0.03	12.3	3.7±0.15	13,0
37	Potok	5.4±0.61	36.1	0.91±0.03	9.1	3.9±0.23	19,0
Average			24.2		9.0		18.1

According to the data presented in the scientific literature, the opinions of the researchers about the variability of the character **fruit index** are more contradictory, depending on variety and evaluated climate conditions. Some authors (2) indicate the high variability of the fruit form, while others (BACULINA, 1970; BLAŞCIUC, 1983; KUZIOMENSCHII, 2004) consider that its variability is insignificant.

The obtained data indicate the insignificant variability of the character **fruit index** (V = 3.3 . . . 13.9%), except the variety Landrace from Kenya with V = 29.1%. For most of the forms the coefficient of variation does not exceed 10% (Table 1). The average variability of evaluated samples is 9%. This allows us to qualify it as a character with low variability, which demonstrates a pronounced genetic determinism.

The study of the lodge topography and symmetry in the fruit demonstrated that most of the varieties have a regular placement, except the varieties Landrace from Kenya, Tatinter, Marman PV., in which it was found their asymmetry. According to the opinion of (IANUSHEVICH, 1972), the irregular placement of the lodges contribute to the formation of the fruit with a smooth surface, especially the varieties with many lodges. In our experience the average of this character is 4. The majority of varieties had more than 3 lodges (Table 1).

The experimental results show a wide range of variability in the number of lodges at the examined varieties, which was within limits V = 9.6-32.5%. The average variation of this character is 18.1% indicating a high variability.

An important character of the tomato fruit is **pericarp thickness** that determines the fruit value. The size and variability of this index are recommended to be taken into account in the creation of varieties for mechanized cultivation. GUSEVA, 1989 considers that intensive varieties must have a pericarp thickness more than 0.2 cm. The data in the literature (BACULINA, 1970; BLAŞCIUC, 1983) denote a large genotypic variability of this character. The evaluated forms according to this character differ essentially (Table 1).

CONCLUSIONS

1. It was found that the average of the coefficient of variation of the **fruit weight, pericarp thickness and number of lodges** is more pronounced at the analysed varieties. The evaluated forms according to this character differ essentially.

2. The fruit index was found to be more stable. The average variability of this character is 9%. This allows us to qualify the character as one with low variability, which demonstrates its pronounced genetic determinism.

3. As a result of this investigations, there have been highlighted the varieties C-38, 106/2 Paradisommag that show a high rate of fruit (smooth surface, significant pericarp thickness) and can be recommended for use in breeding to create high-quality varieties.

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