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VARIABILITY AND EQUALITY OF BIOCHEMICAL QUALITATIVE CHARACTERISTICS VARIETIES AND LINES NEW TOMATO OBTAINED *IN VITRO*

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Abstract. *In the agrarian sector, lines, varieties, which had high uniformity, distinctiveness and stability of fruit productivity and quality in different environmental conditions, were of particular importance. The most important trend in the strategy of plant breeding at the stage of adaptive intensification in agriculture was combining the resistance of the varieties to the stress-producing abiotic factors of the environment with high levels of fruit productivity and quality. The determination of the genetic complex of quantitative characters, including drought resistance, hindered the success of the breeding process, the purpose of which was to create genotypes combining many valuable characters. As a result of distance hybridization, interest for the breeder also presents the spectrum of genetic variability, which increases the efficiency of genotypes selection with high productivity and increased resistance to environmental stressors. One of the main tasks of amelioration was grandiose blending in the same variety of high productivity and resistance to stress factors (drought).*

***Keywords: tomato, lines, varieties, variability, productivity*.**

INTRODUCTION

The climatic conditions of the Republic of Moldova allow for assured harvests of tomatoes grown in unprotected fields (seed crop) after rotation once every 3-4 years. Obviously, special attention is paid to adaptive breeding, which allows the creation of new varieties with increased productivity and resistance to stress factors. Of particular importance in the agricultural sector are varieties that have high uniformity, distinctiveness and stability of productivity and fruit quality in different environmental conditions. The most priority direction in the plant breeding strategy at the stage of adaptive intensification in agriculture is the

combination of resistance of varieties to abiotic stress factors of the environment with a high level of productivity and fruit quality.

The complex genetic determinism of quantitative traits, including drought resistance [3], hinders the success of the breeding process, the purpose of which is to create genotypes that combine several valuable traits. As a result of distant hybridization, the breeder is also interested in highlighting the spectrum of genetic variability, which increases the efficiency of selection of genotypes with high productivity and increased resistance to environmental stress factors [1]. One of the main tasks of breeding is the grandiose combination of high productivity and resistance to stress factors (drought) in the same variety. From the literature data it has been demonstrated that the prolonged action of high temperatures 30–35°C on tomatoes during fruit setting leads to plant sterility. The most sensitive phase of tomato development at high temperatures is from the beginning of flowering to fruit setting. Using the method of embryo culture and distant hybridization [4,5,6,7,8] a vast number of simple and compound interspecific hybrids were obtained between Solanum esculentum L. (cultivated tomatoes with large red fruits) and the spontaneous forms Lycopersicon hirsutum, Lycopersicon peruvianum and Lycopersicon chilense with very small, purple and green fruits) [4, 5, 6, 7, 8]. In the segregable generations a valuable material with a diverse soma clonal variability was obtained.

MATERIALS AND METHODS

The investigations were carried out in the laboratory "Genetics of Plant Resistance" and on the experimental lot of IGFPP. As the initial biological material in the study, 8 tomato varieties obtained by *in vitro* culture were used, for comparative research, control forms were cultivated (Peto 86, Elvira, Novinca Pridnestrovia.

Lines: L.20, L.25, L.47, L.55, L.63, L.64 and L.317, obtained based on interspecific hybridization and *in vitro* culture and standard forms Victorina, Kecskemet, Flacăra, Mia, Iulihirsutian, Anatolie, Cerrydani, Cerry brown pruniforme, Cerry red round. They were sown in the greenhouse (seedling culture) and planted in the field in the nursery for the multiplication of tomato varieties and lines.

Field planting scheme: (70 x70) x 30cm plant spacing, in 5m rows, 30 plants per variant. The placement of tomato forms was randomized in 2 replicates. All mentioned genotypes were evaluated for a complex of valuable traits. During the vegetation period, phenological evidence was carried out from the emergence of seedlings to fruit maturity (emergence of seedlings, flowering, fruiting, single and mass ripening). Morphological and biometric evidence: plant height, number of shoots on the main stem, number of nodes on the main stem, leaf length and width, number of inflorescences on the main stem, number of flowers and fruits on the first three clusters, number of flowers and fruits per plant. The results obtained were statistically processed as an average for two

repetitions. The statistical analysis was performed according to the STATGRAPHICS PLUS 5.0 software packages and EXCEL.

RESULTS AND DISCUSSIONS

Literature data demonstrated that the long-term impact of 30-35°C on tomatoes during fruit forming resulted in plant sterility. The most sensitive phase of developing tomatoes at high temperatures is from the beginning of flowering to the fruit forming. Thus, the research goal consisted in obtaining the new tomato genotypes with valuable characters, useful for the breeding process. The research was carried out within the Plant Resistance Genetics laboratory of the Institute of Genetics, Plant Physiology and Plant Protection. As a subject of study, 7 varieties of tomato were produced, created through interspecific crosses and application of *in vitro* culture. *Iulihirsutian, Anatolie, CerryDani, Jacot)* approved in the Republic of Moldova, (*Flacara and Mia*) were tested at the State Commission for Testing Plant Varieties. The evaluation of the native varieties was carried out according to the most valuable biochemical qualitative indices (dry matter content, sugar content, ascorbic acid accidie content, titratable acidity and sugar/acidity ratio). As a control variety, the varieties (*Solaris, Elvira, Peto-86 and Novinca pridnestrovia*) were used. At the assembly of experiments there were used seeds and seed culture. Estimating the dry matter content and the percentage of sugar in tomatoes was performed using the refractometer. As a result of the application of remote hybrids and *in vitro* culture, varieties *(Iulihirsutian, Anatolie*', *CerryDani, Jacot, Flacara and Mia*). The results of the investigations showed that local tomato varieties surpassed the check varieties (*Solearis, Elvira, Peto 86 and Novinca pridnestrovia*) by the following characters – the dry matter content, sugar content and total acidity. As a result of the remote hybridization the interest for the breeders also provided the spectrum of genetic heredity variability, which increases the efficiency of selection of genotypes with high productivity and increased resistance to environmental stressors. One of the main tasks of the improvement was the gorgeous ffixing of several characters (productivity, precocity and high quality of fruit to stress factors (drought and low positive temperatures). The study of the obtained results demonstrated that the limits of variability of biochemical components content, which determined the quality of the fruits, were very large. Of particular interest was the early average varieties characterized by an increase in the dry matter content eg. the latter in the variety increased by 17 % compared to the check variety *Solaris* and *Iulihirsutian* by 20 % against the check variety *Elvira*). These varieties possessed superior qualities of the dry matter content with the variability of 13.33 % and 14.13 %. In late varieties (Anatolie and Jacot) the variation coefficient oscillated between 12.03 to 8.14 %. The early variety (*CerryDani*) exceeded the check variety (*Peto-86*) by 14.24 %. Concerning the

percentage of sugar content the maximum values against the check varieties accumulated the early average varieties.

The sugar content of the tomato varieties constituted 5.32 to 7.10 % with different values of the variation from 5.86 to 10.63 % compared to the check varieties of 4.89 to 6.39 % as well as the coefficient of variation 5.87 to 10.79 %. The use of the genetic potential of spontaneous forms was also of great importance for increasing the size, shape and quality of the fruit with high vitamin C content. Biochemical determinations of ascorbic acid (vitamin C) were also of great importance because they determined the quality of fruits that had high taste qualities. The biochemical content of ascorbic acid in tomato fruits showed a very high variability. Noteworthy that the indices of vitamin C content in tomato varieties formed the limit of variability of 9.66 to 34.15 % compared to check varieties of 8.43 to 24.03 %.

In assessing new tomatoes varieties, the ratio of sugars to acidity was a very important one, because this index determined the taste properties of the fruits. Based on the data obtained previously and taking into account the specific biochemical properties characterized by the accumulation capacity of the maximum volume of dry matter, sugar and, in particular, ascorbic acid (vitamin C), the varieties mentioned were to be used in the improvement programs as donors of valuable biochemical peculiarities of the fruits.

According to the investigations carried out by the application of *in vitro* culture, there was a harmonization of recombinant genes, possessing some precious qualities that allowed creating high performance varieties, fruits with high taste qualities, distinct technological qualities and increased resistance to drought, low positive temperatures and diseases. As a result, new lines with valuable economic characters were created, producing high yields of fruits with lower vegetation periods compared to the check variants. As a source of initial research material, 10 performance lines of tomatoes were used (L.20, L.25, L.47, L.55, L.63, L.64 and L.317) created in the plant resistance genetics laboratory and three varieties as a check (*Peto-86*', *Novinca Pridnestrovia and Elvira*). The evaluation of the lines was carried out according to the most phenol phasic valuable indices of the phases which determined the period of vegetation (emergence – single blooming, blooming-blooming in the mass, single rising- fructification, baking-baking single breading-baking, morphological characters fructus, fruit shape, pericarp and mesocarp thickness, pedicle length and biochemical characters (fruit acidity, dry matter content, sugar content and total harvest). It was necessary to emphasize that the selective analysis of the most successful tomato lines showed that during the study period, recombinant lines with various types of precocity (early, early and late average) were revealed. The results obtained showed that the early tomato lines (L.63 and L.64) exhibited a lower precocity period compared to the (11–7) days of the check variety (Peto-86). Investigations performed on early medium-grain

tomato lines (L.20 and L.47) demonstrated the longevity of the reduced maturity period (11 and 10) days compared to the check variant (*Novinca Pridnestrovia*). For the medium-term lines (L.20, L.25), the precocity ratio was lower than the control (Elvira') with (12.4, 10.4) days. Two lines (L.55 and L.317') were at the check level. Analyzing the preliminary results, it was concluded that the performance of tomato obtained *in vitro* with various types of precocity showed a lower fruit maturity period compared to the check varieties Based on the experimental data obtained, it was apparent that in tomato promising lines the plant's height varied within the limits of the values (45.1–77.4) cm, the blank forms (55.4–67.5) cm. The plants of the studied lines were characterized by a high vigor, with higher level, which resulted in a better adaptation of the fruit in the unfavorable conditions of the environment. In most *in vitro* lines, the descendants of the populations were genotypes of the native type, inclined towards the characters of the parent plant, at the same time another set of genotypes was composed of paternal descendants where most of the morphological characters predominated from the plant and a source of genotypes that predominated intermediate inheritance characters from both genitors.

This mode of heredity of the plant's height occupied an intermediate position and played the leading role both in plant evolution and in the amelioration of a certain character, which was defined as an attribute of an individual in a population by which it differed from other individuals in another population or taxon, any morphological, physiological or biochemical particularity of an individual or group of individuals that was determined by a gene or group of genes in interaction with environmental conditions. The preliminary analysis of the performance lines showed that during the research period the lines (L.20, L.25 and the control variety (Elvira') were highlighted with maximum values of the fruit mass (123.4, 112.7 and 125.0 grams respectively). The smallest values were accumulated in the lines (L.317, L.63, L.64) compared to check varieties (*Peto- 86' and-Novinca Pridnestrovia*). The shape of the fruit varied according to the genotype from round to cylindrical. From the bibliographic data it was known that the thickness of the pericarp was an important feature that depended on the quality of the fruits. In this contest, the tomato lines had more pronounced values (0.6–0.8mm) than the check (0.4–0.7mm). According to the results of the mesocarp thickness, there was an increase compared to the check variant (L.20, L.25) compared to the check variant *(Peto-86, Novinca Pridnestrovia and Elvira*). It was found that tomato lines with thickness indices of pericarp greater than 6 mm and the thickness of the 8 mm mesocarp were destined for the transport of the fruits. An especially important role was for the character of the fruit pedicel. The pedicel was without and with a geniculate joint where some fruits were easily detached from it while other were detached more difficult. Due to the data obtained on the biochemical quality of the fruit, it was clear that the content of dry substances was

largely dependent on the conditions of the year. Under dry conditions, the dry matter content was high and in the rainy weather dry matter ways low in fruit. However, in some lines the level of dry matter was greater than that of the check varieties. Concomitantly, the fruit sugar content in some lines showed an advantage of 6.23–6.43 % compared to the check varieties of 5.23–5.63 %. Productivity on promising lines was peaked at 49.5–58.7 t/ha. compared to 33.9–50.7 t/ ha. Analysis of *in vitro* tomato populations demonstrated that remote hybridization was indeed a method incompatible with other methods in the transformation of nature into heredity of crop plants. 0ne of the most important issues of breeding is development of new varieties in which to assemble more valuable characters, high productivity, increased resistance to unfavorable environmental factors and precocity with large and qualitative fruits. However, to accelerate the process of creating such varieties, it is necessary to apply new selection methods and technologies. We mentioned that a real perspective in this aspect was presented by the modern biotechnology methods and techniques, based on the principles of molecular genetics, genetic and cellular engineering, cell cultures and vegetal tissues, accelerated micro-propagation, induced variability and soma clonal variability, remote hybrids. Remote hybridization methods with the mobilization of the spontaneous Geno fond and the application of the *in vitro* culture allowed us to settle many issues in the amelioration process. Through classical hybrids, efficient capacities have been transferred to the activity of plant regeneration by crossing spontaneous species with the crop species through the embryo callus culture. The hybridization of different genetically-stable species varied according to the degree of kinship between them, with the transmission of genetic information that results in some valuable economic carcasses from spontaneous species to culture species. Thus, the emergence of biotechnologies, especially *in vitro* culture, produced a real revolution in the process of improving vegetable crops and other agricultural species.

CONCLUSIONS

1.The varieties (Iulihirsutia, Anatolie, Jacotă and CerryDani) exceeded the control varieties (Elvira and Peto -86), both in terms of overall yield and commodity, precocity and fruit quality.

2.The varieties (Iulihirsutia, Anatolie, Jacotă and CerryDani) exceeded the control varieties (Elvira and Peto -86), in terms of biochemical composition of the fruits.

3.The varieties (Iulihirsutia, Anatolie, Jacotă and CerryDani) exceeded the control varieties (Elvira and Peto -86), in terms of drought and disease resistance.

4.Concomitantly, the fruit sugar content in some lines showed an advantage of 6.23–6.43 % compared to the check varieties of 5.23–5.63 %. Productivity on

promising lines was peaked at 49.5–58.7 t/ha. compared to 33.9–50.7 t/ ha. Varieties Agaphia and Vladigen approved in the Republic of Moldova were tested at the State Commission for Testing of Plant Varieties.

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