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'HERA' NEW TOMATO VARIETY OBTAINED BY VRDS BUZĂU

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Abstract

Concerns for tomatoes breeding at SCDL Buzau were done since 1957, the year of its foundation. At present, the station has approved and patented a number of 16 varieties registered in the Official Catalog of Romanian Crop Plants. VRDS Buzau currently has a valuable germplasm collection on this species, consisting of more than 1500 genotypes that are in various breeding stages. In 2018 was patented 'Hera' tomato variety with indeterminate growth, suitable for greenhouse or open field crops in trellis system. The variety is distinguished by a distinct phenotypic expressivity of long and red pepper shaped fruits, preserving the taste and aroma of the traditional tomatoes. The variety is intended for fresh consumption with a high production potential of over 3.5 kg/plant. Regarding the variability of the main characters, a significant decrease was found a Prebase seed field to the selection field. Since seeds and seedlings were given as promotional offers to growers, this fact generated positive feedback and starting with 2019 year, the variety will be introduced into the certified seed production program.

Key words*: certified seed, fresh consumption, genotype, germplasm, Solanum lycopersicum.*

INTRODUCTION

The Official Catalog of Vegetable Plants in the European Union \ 2015 presents the situation of tomato varieties and hybrids totalling 3695 varieties, of which 2913 hybrids and 782 varieties. The first place in the EU with regard to the number of varieties submitted is the Netherlands with 1466 varieties and at the far end is Sweden with only a variety inscribed. Romania has registered 49 varieties in the EU Official Catalogue. Italy, France, Spain, Hungary, Portugal etc., are among the top countries with most varieties and hybrids. (Common Catalogue of Vegetable Varieties, 2015).

Tomatoes are the most widely used and consumed species in the world, with a diversity of varieties and shapes. Thus, it has a genetic basis that is still untapped, but its improvement must rehabilitate lost genes and capitalize on it to create new varieties. Tomato enhancement began quite late in Europe.

The tomato had reached a fairly advanced stage of domestication before being taken to Europe in the 15th century and further domestication on a much more intense level occurred throughout Europe in the 18th and 19th centuries. (Bai, 2017).

Vegetable Research and Development Station Buzau (V.R.D.S. Buzau) has tradition concerning tomato breeding.

From the establishment to the present, the research station has approved over 45 varieties of tomatoes and has also managed to build a rich and valuable germplasm collection for this species, structured on growth patterns, usage directions, and genetic stability. Since 1996, researches have been resumed intensively with the aim of obtaining strictly specialized creations by destination. A special emphasis has been put on the recovery of local populations that have preserved very well the characteristics of traditional tomatoes, concretized especially in taste and aroma.

Commercially available tomatoes are renowned these days for sturdiness, but perhaps not for flavor. Heirloom varieties, on the other hand, maintain the richer flavors and sweeter tomatoes of years past (Tieman, 2017).

Thus, strictly specialized tomatoes, varieties for industrialization or varieties for fresh consumption have been obtained, not only in our country but also abroad. Processing tomato yields have increased by 53% over the past 35 years (Hanson B et.al, 2006). With the improvement of specialty varieties, deficiencies have occurred with regard to the main plant features.

Respecting the technology for seed production ensures their quality (Drăghici, 2014).

Domestication has led to dramatic changes in agronomic traits of interest such as non-shattering seeds, loss of germination inhibition, compact growth habit and increased size of fruit (Sim et. al, 2011).

V.R.D.S. Buzau aimed to rehabilitate some local populations through conservative selection and discovering the lost traditional taste and aroma.

Fruit quality and consumer acceptability in tomatoes are strongly related to the pigment content, concentration of soluble solids, and titratable acidity in the ripened fruits. The size and quality of mature tomatoes are also determined by the accumulation of water and total dry matter (Brezeanu et al., 2016).

The information about characters' variation driven by the variety of genotypes demonstrated possibility of changing the parameter in the direction required at this stage of selection (Mihnea N., 2015).

As the fruit of breeding works, it has recently been approved and introduced in the Official Crop Plants Catalogue of Romania, 'Hera' tomato variety that is the subject of this work.

The variety can be grown in both open field and greenhouse in a palisade system.

MATERIALS AND METHODS

The research started with formation of a germplasm collection, its evaluation and selection of the best genotypes to be introduced in the future breeding works.

Nowadays, the germplasm collection consists of over 1500 genotypes which are in different breeding stages.

Evaluation and selection of these genotypes were made according to some criteria like: growth habit and linage genetic stability.

After 1996, research on tomato breeding at V.R.D.S. Buzau resumed intensively after a well-organized schedule:

Phase I objective was a continuous enrichment and improvement of germplasm collection in this species.

Phase II aimed to evaluate the germplasm collection and its distribution on fields and breeding phases.

Phase III aimed the introduction of valuable genotypes in intensive breeding works.

Phase IV aimed to develop germplasm collection by acquiring new genotypes, varieties and hybrids.

Germplasm collection has been divided into distinct groups according to the type of plant growth and genetic stability (Figure 1).

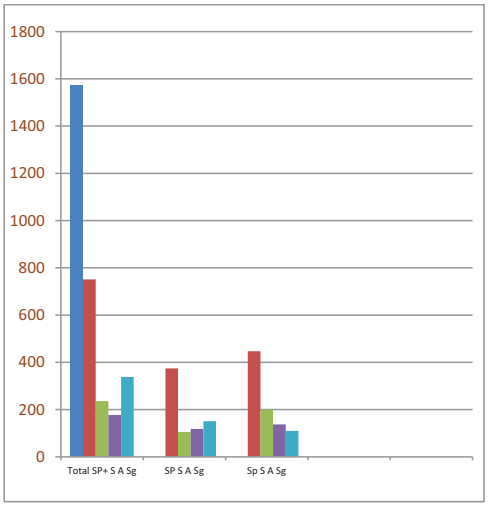

Figure 1. Germplasm collection structure and breeding phases

SP+ (indeterminate accessions) - 751 accessions from which S (Stable) 236, A (advanced)- 177 and Sg (segregating)-338

SP (semi determinate accessions) - 374 accessions from which S (Stable) 105, A (advanced) - 118 and Sg (segregating)-151

Sp -(determinate accessions)- 447 accessions from which S (Stable) 200, A (advanced)- 137 and S (segregating)-110

Collected germplasm resources were evaluated in terms of stability and their use in breeding process according to the following plan (Figure 2):

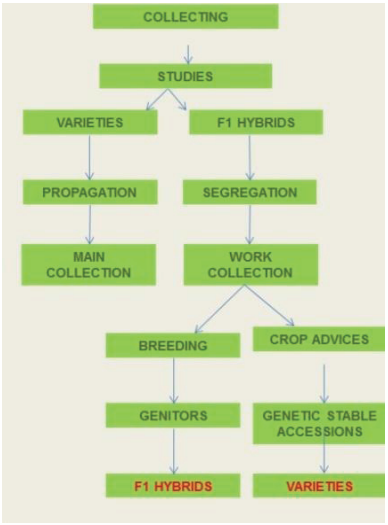

Figure 2. The use of germplasm resources of tomato

Due to the large number of genotypes collected and evaluated, several methods of selection and improvement have been implemented.

A special emphasis has been placed on species-specific, such as repeated individual selection.

However, in addition, hybridization, segregation, induction of mutations and controlled induction of genetic drift were used.

Efficient use of old greenhouses for growing vegetables in the current period is only possible by applying modern technology that unconventional fluid and mineral nutrition is achieved by fertirigation with nutrient solutions of growing media (Chirică M. et al., 2012).

The applied technology was specific to tomatoes specifying that the establishment of culture, for all the cultivars was done through direct sowing and planting stock.

Sowing for seedling production has been carried out on the 10th of March and the planting was carried out on the 25th of April (Figure 3).

Figure 3. Tomato seedlings

For direct sowing variant, all cultivars were seeded on the 20th April.

Soil preparation was made in September through levelling, followed by fertilization.

The work was followed by deep plowing. In spring, the soil has been mobilized with disc harrows, followed by soil modeling. Maintenance works were the classical ones, a number of 7-8 irrigations during the vegetation period, filling in gaps, manual and mechanical cultivation.

Planting has been carried out using the following scheme of crop setting (Figure 4):

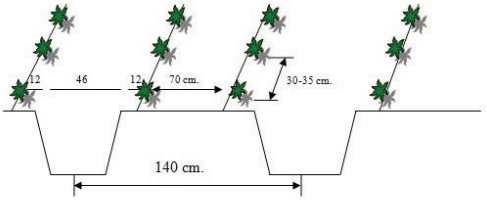

Figure 4. Crop setting scheme on modeled soil

The same establishment scheme was used to direct sowing crop variant specifying that the norm of seed was 1 kg/ha, followed by thinning work, after the plants have reached the cross stage.

Starting in 2016, the variety was introduced into the selection program, using the conservative selection of tomatoes (Figure 5)

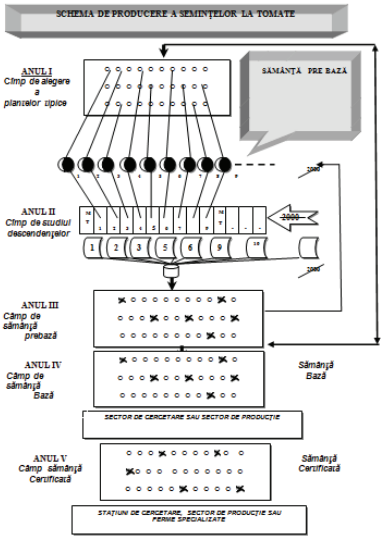

Figure 5. Tomato seeds production scheme

The selection programme started with the authors' seed, setting up the selection field

from which were retained 300 elite plants which were analyzed in descendence study field. From this field were selected 180 descendences which constituted prebase field. During the selection program, phenological and biometric observations as well as repeated biological controls were carried out with the aim of eliminating from the culture of non-typical, diseased, delayed plants that did not fit into the phenophases specific to the variety.

RESULTS AND DISCUSSIONS

At VRDS Buzau it was obtained a distinct, uniform and stable tomato variety. The variety has a large margin of variability of the main characters, but it can be seen that within the selection program they have significantly reduced from year to year (table 1, table 2 and table 3).

Table 1. Variability of the main features at 'Hera' tomato variety in the conservative selection field (first year)

Studied Feature	x̄	S	C.V.%	x̄±S
Fruit weight (g)	289	193	66.7	96-482
Fruit lenght (cm)	11.4	2.8	24.5	8.6-14.2
Fruit median diametre (cm)	5.8	1.6	27.5	4.2-7.5
Fruit number/ plant (buc.)	26	3	11.5	23-29
Yield/plant (g)	3734	162	4.3	3572-3896

Table 2. Variability of the main features at ''Hera'' tomato variety in the descendent's study field (second year)

Caracterul studiat	x̄	S	C.V.%	x̄±S
Greutatea fructului (g)	302	186	61.5	116-488
Lungimea fructului (cm)	11.8	2.6	22	9.2-14.4
Diametrul median fruct (cm)	6.3	1.4	22.2	4.9-7.7
Nr. Fructe/planta (buc.)	27.5	2.5	9	25-30
Productia totala/ planta (g)	3803	120	3.1	3683-3924

Table 3. Variability of the main features at ''Hera'' tomato variety in the conservative selection field of prebase (third year)

Caracterul studiat	x̄	S	C.V.%	x̄±S
Greutatea fructului (g)	317	193	60.8	124-510
Lungimea fructului (cm)	13.3	2.4	18	10.9-15.7
Diametrul median fruct (cm)	6.9	1.3	18.8	5.6-8.2
Nr. Fructe/planta (buc.)	30.5	2.5	8.1	28-33
Productia totala/ planta (g)	4383	108	2.4	4275-4492

*the main used statistics indices were the ones recommended for this type of study and are the following: average (x̄), standard deviation (S), variation coefficient (CV%), variation aplitude (x̄±S) (Potlog and Velican, 1971)

The main characters analyzed in the selection program were fruit weight, fruit length, fruit diameter / fruit / plant, total / plant production.

The study showed the decrease of the variability margin for all the studied characters, both in the selection field and the descending field of study and the prebase field.

In the case of fruit weight, the coefficient of variability decreases from 66.7% to 60.8%. In the case of the fruit's length character, it decreased from 24.5 cm in the field of choice to 18 cm in the prebase field. The most significant decline was recorded by the diameter of the fruit that decreased from the selection field to the prebase field by 8.7 points. And the lowest variability was recorded by the total production /plant that dropped from the selection field to the prebase field by only 1.9 points.

This decrease in character variability demonstrates the typicality of the new variety and the homogeneity of the variety in terms of the main characters of interest. The selection program aims at obtaining uniform and stable genetic varieties and maintaining their purity in accordance with the variety-specific parameters.

The 'Hera' variety comes from Line 28, a line that has long been selected and improved for over 30 years. During this time, the line was genetically polished and obtained a stable variety with characteristics that give it distinctness, uniformity and genetic resistance. It is an undetermined growth line, which can be cultivated both in greenhouse and open field, in a palisade system, intended for fresh consumption as well as for industrialization (figure 6).

Figure 6. Plant and fruits detail of 'Hera'

It presents large fruits in the shape of long peppers, ranging from 100-150 g, with high dry content. The identity of this line is given by the shape of the fruit. They are large in size, with elongated shape, with a slight mucrone, similar to long pepper.
In the seedling phase, the variety does not show anthocyanic coloration on the hypocotyl and the puberty of the hypocotyl is medium. The length of the cotyledons is 3.2 cm and the width is 0.3 cm. the height of the plant can reach up to 2.3 m in protected areas and 1.8 m in the field. It does not show anthocyanic staining on the strain and the puberty of the strain is medium.
The length of the internodes is 20.1 cm. The number of axillar sprouts is 15-17 on average and plant vigor is high.
The number of leaves on the plant is 23-25 and is of medium green color. The gloss of the leaf is weak but the blistering is strong. The number of leaves under the first inflorescence is 5 and the length of a leaf is 44.8 cm (figure 7).

Figure 7. Leaf detail

The diameter of the bush can reach up to 63 cm and the leaf position on the plant is at 90 °C. The leaf is of the standard type without anthocyanic staining on the rib. The color of the flower corolla is yellow and the staminal cone is open.
The plant shows 6-8 inflorescences on the plant with 5 flowers / inflorescence. The fruit shows the jointless gene at the peduncle. The immature fruit is green with a cap and mature red. Its shape is long pepper and the weight of a fruit is 271.6 g on average.
The fruit has traditional flavor and aroma and a 5.7% sugar content (figure 8).

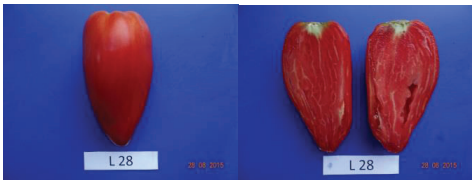

Figure 8. Fruit detail and fruit section

The firmness of the fruit is average, the number of seedlings is 2, the thickness of the pulp is 0.4 cm and the seed color is light yellow.
The fruit has a 3.2 cm mucron that is rounded to the top (figure 9 and figure 10).
Variety shows genetic resistance to attack by pathogens.

Figure 9. Group of fruits in different maturation phases

Figure 10. Group of 'Hera' fruits

CONCLUSIONS

The research has been accomplished with the 'Hera' variety approval and its widespread dissemination.
In the conservative selection program, the variability of the main characters has been decreased.
Research has contributed to the enrichment and knowledge of the germplasm collection.
Feedback received from growers and consumers who received seed and promotional seedlings was positive because the 'Hera' variety is distinguished by its high productivity,

ecological plasticity, and last but not least, faithfully renders the taste and aroma of Romanian tomatoes.

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