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NEW TOMATO HYBRIDS OBTAINED AT VRDS BUZAU

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Abstract

The goal of Romanian tomato hybrid favored the introduction of foreign cultivars usually inadequate for our climatic conditions. VRDS (Vegetable Research and Development Station) Buzau has tradition for tomato breeding, were achieved many cultivars that have demonstrated their genetic stability, durability and performance in crop production. Special attention was to establishment the germplasm resource; the collection presently holds a total of more than 800 genotypes in various breeding stages. After evaluating the germplasm collection, valuable genotypes have demonstrated genetic stability and useful features for the breeding process and were promoted from field collection in field work. Selected genotypes were subjected to intensive breeding work, the general and specific combinative capacity was tested, thus achieving a large number of hybrid combinations. To obtain new hybrid creations were detained genitors and hybrid combinations that showed the heterosis phenomenon in F1. Nineteen hybrid combinations manifested heterosis phenomenon clearly and was used as reference 'Siriana F1' hybrid. Hybrid combinations that exceeded significantly 'Siriana F1' regarding the quality and yield, will be proposed for approval at ISTIS.

Key words*: fenotype, genitors, genotype, heterosis.*

INTRODUCTION

Tomato breeding is a continuous process in which the researcher explores the genetic variability and selects genotypes possessing character or combination of characters and attributes corresponding to current and future needs of growers and consumers.

The number and value of these new combinations of genes that can be achieved by improvement depends on the diversity and value of the available genes from the germplasm collection available to the breeder.

It should be noted however that the breeder is working with hereditary potential whose expression may be enhanced or hindered by environmental conditions that are grown new creations.

The aims of tomato breeding for fresh consumption foresee getting new varieties and hybrids with high yield potential, earliness, high quality value and corresponding physiological traits. "Increased availability and adoption of improved varieties or hybrids have been recognized as a plausible solution for enhancing the productivity levels of vegetables."(Sudha et al., 2006)

"The trend of F1 hybrid seed usage in vegetable is increasing globally in term of species, cultivars and volume of seed used." (Tay, 2002)

Study and use of heterosis phenomenon lately is a primary goal of research, opening promising quantitative and qualitative increase of tomato yield.

Concerning tomato breeding at VRDS Buzau existed since the beginning. Over time were obtained valuable biological creations, durable, very much appreciated by growers. Although valuable varieties were obtained shortly after

its establishment, the hybrids were obtained quite late. The first hybrid was obtained and approved in 2006, as the 'Siriana'.
In the breeding works, emphasis was placed on the use of local populations.
"Less than 5% of the available genetic variation exists in tomato cultivars and the remainder is found in wild species of the genus" (Hu et al., 2012)
This paper aims to present some of the results of the tomato breeding at Buzau presently completed 20 hybrid valuable combinations.

MATERIALS AND METHODS

The unit has a valuable germplasm base in this species consists of over 965 lines in various stages of improvement. This germplasm base has been established over time and is enriched with new genotypes annually.
Germplasm base consists of a wide range of varieties of the *Lycopersicum* genus .
Germplasm base was divided into three groups according to the type of growth: indeterminate growth lines (SP +) semideterminate lines (SP) and determined growth lines. Their dispersion and genetic stability is shown in figure 1.

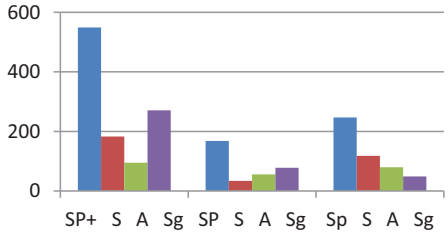


Figure 1. Germplasm base content and breeding phase. SP+(indeterminate growth lines)- 549 lines of which S (genetical stable) 183, A (advanced)- 95 and Sg (segregant)-271 lines
SP (self pruning lines) - 168 lines of which S (Stable) 34, A (advanced)- 56 and Sg (segregant)-78Sp- (determinated)- 247 lines of which S (Stable) 118, A (advanced)- 80 and Sg (segregant)-49

Sheets were prepared and each germplasm base genotype has undergone a thorough study.
The sorting of biological material and its use in the breeding work was done according to the scheme shown in Figure 2.

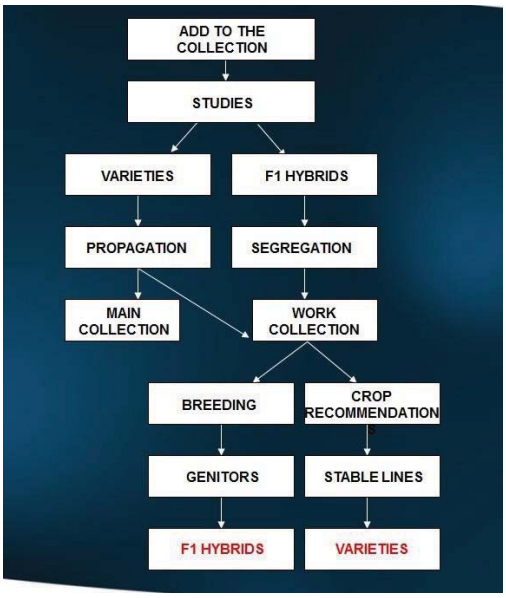


Figure 2. The use of germplasm base resource

Particular emphasis was placed on evaluating the two collector fields: general collection and collection work. Genotypes from the work collection have undergone extensive improvement works and were subject to general and specific combinative capacity test and 40 of these showed availability genetic hybridization process and showed visible phenomenon of heterosis.

RESULTS AND DISCUSSIONS

Breeding works have been completed to date with the establishment and evaluation of valuable germplasm base in this species. were obtained Stable lines that can be proposed for approval as varieties. It was obtained a large number of genetically distinct stabilized genitors that showed heterosis phenomenon in the process of hybridization.
Their relevant phenotypic expressivity is shown in Figure 3.

L 2 M
- 10 g fruits;
- High content of C vitamin;
- Yield/plant > 3 kg.

L 35
- High content of caroten;
- 10-15 g fruits;
- High yield potential.

L 532
- 120-140 g fruits
- yellow, banana type

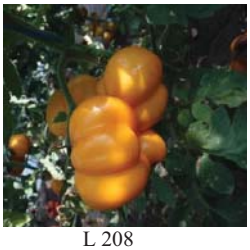
L 519
- big fruits, of over 250 g
- heavely ribbed

L 204
- 180 g fruits;
- striped, average firmness, yellow pulp

L 305
- 180 g fruits, chocolate orange colour

L 203
- yellow fruits, average firmness, of 140 g
- High yield potential

L 310
- 10-20 g fruits, striped
- Special taste and flavour
- Dens purple brownish pulp



L 208
- 180-220 g fruits
- Reduced number of seeds, 40-60 seed/fruit
- Seminal lodges with holes.

L 2000 C
240 g fruits, pink colour
- SP+, for open field

L 524
- Big fruits, 265 g
- Bell pepper type

L 529
- Big fruits, of over 500 g
- Pineapple type

Figure 3. Distinct genitors obtained through breeding process

L 311
- 120-140 g fruits
- striped, long pepper type

L 6 M
- 20 g fruit, orange yellowish, pink pulp, linear inflorescence.
- Yield/plant > 3,5 kg.

Following the large number of hybridization and their evaluation confirmed that 19 hybrid combinations showed heterosis in F1 visible phenomenon. Siriana hybrid was used as a control for assessing the qualitative and quantitative characteristics expressed by these hybrid combinations.

The main features of the new hybrids of plants obtained are presented in table 1.

Table 1. The main characteristics of tomato hybrids studied in the greenhouse

Studied features/hybrids	Growth type	Offspring no.	Leaves no./plant	Leaves no. Under the first inflorescence	Inflorescence no.	Inflorescence type	Flower no./inflorescence.	Idistance between inflorescences (cm)	The pedicle presence
SIRIANA(control)	SP+	8	26	5	8	Composed	5	20	Present
H 1 S A	SP+	17	20	4	4	Liniar	8	25	Present
H 1 S B	SP+	20	20	5	5	Liniar	9	15	Present
H 2 S	SP+	8	20	3	6	Liniar	11	20	Present
H 3 S	SP+	11	15	5	8	Composed	7	20	Present
H 4 S	SP+	8	17	4	8	Composed	4	15	Present
H 5 S	SP+	9	21	3	5	Liniar	6	30	Present
H 6 S	SP+	13	16	3	6	Liniar	4	30	Present
H 7 S	SP+	15	17	4	6	Liniar	5	25	Present
H 8 S	SP+	17	17	4	6	Bifurcated	6	20	Present
H 9 S	SP+	8	18	5	7	Liniar	8	20	Present
H 10 S	SP+	9	18	3	5	Bifurcated	6	20	Present
H 11 S	SP	4	11	3	4	Bifurcated	5	15	Present
H 12 S	SP	7	11	4	6	Liniar	8	20	Present
H 13 S A	SP	7	21	5	9	Liniar	6	15	Present
H 13 S B	SP+	7	20	5	7	Liniar	5	15	Present
H 14 S A	SP	5	17	5	10	Liniar	8	20	Present
H 14 S B	SP+	6	15	5	8	Liniar	4	20	Present
H 15 S A	SP	9	30	5	10	Liniar	5	20	Present
H 15 S B	SP+	5	16	5	5	Bifurcated	5	20	Present

Phenotypical and biometrical observations were made throughout the vegetation. New hybrids obtained showed distinct characteristics in terms of the type of growth, so 'Siriana' and a total of 14 hybrids showed indeterminate growth while 5 of them showed up semideterminated.

In terms of offspring issuing plant hybrid H1 SB stands with a total of over 20 offsprings / plant and the opposite, with the lowest number of offsprings per plant is H11 S with a total of four offsprings. Regarding of the number of leaves per plant, hybrid H 15 SA ranks first with a total of 30 leaves and last stands hybrids H 12 and H 11 with a total of 11 leaves.

Special attention was paid to the number of leaves below the first inflorescence finding that there is a direct correlation between earliness and number of leaves below the first inflorescence.

Ten hybrids, including 'Siriana' (control) recorded a total of five leaves below the first inflorescence and five of them recorded minimum value of three leaves below the first inflorescence.

In terms of the number of inflorescences per plant was found that hybrids with indeterminate growth recorded a higher number of inflorescences, first hovering hybrids H 14 S and H 15 S with a total of 10 inflorescences and the lowest number inflorescence was recorded hybrid H 11 S , 4 inflorescences per plant.

Determinations on the type of inflorescence revealed three types of inflorescences: linear, bifurcated and composed. Number of flowers per inflorescence varied from H 11 S hybrid flowers up to 4 flowers per inflorescence recorded hybrids H 14 SB, H4 and H 6 S.

The distance between inflorescences varied from 30 cm at H6 and H5 S respectively to the minimum of 15 cm recorded by 5 hybrid combinations. All hybrid combinations showed absence of *Jointless* gene.

Regarding the fruit observations, (table 2 and 3) mainly focused on identifying genes U

(immature fruit with green cap), u (whitish fruit without lid) and UG (uniform green fruit). Analyzing mature fruit color, most hybrids showed red H1 except SB which shows yellow fruit. Observations made on the pistilar point form demonstrated that it is a genetic characteristic is greatly influenced by the type of flower, fruit quality and size fertilization. Hybrids obtained showed several pistilar point: star, irregular point. Regarding the weight of the fruit, hybrid H 14 SA ranked first at 234 g and ranked last H1 hybrid SB with 110 g. The number of fruits per plant varies from 45 fruits made of hybrid H 13 SA and 15 fruits at H 15 SB hybrid.

Table 2. The main fruit features of tomato hybrids

Features/hybrids	Immature fruit colour	Riped fruit colour	Pistilar form	Fruit shape	Fruit weight (g)	Absicion diameter (cm)	Fruit no./plant	Total fruit weight /plant (Kg)
SIRIANA(control variant)	Light green with lid	Red	Star	Round	180	0,6	40	4,200
H 1 S A	Whitish green	Red	irregular	Round	125	0,8	24	3,100
H 1 S B	Whitish green	yellow	Point	Round	110	0,8	30	3,300
H 2 S	Green with light lid	Red	Star	Round	150	0,9	30	4,500
H 3 S	Green with light lid	Red	Star	High round	114	0,9	40	4,560
H 4 S	Whitish green	Red	Star	Roound	157	1	28	4,396
H 5 S	Whitish green	Red	irregular	Lightly flattened	232	1,1	25	5,800
H 6 S	Green with light lid	Red	Star	High round	125	0,7	24	3,000
H 7 S	Green with light lid	Red	Star	flattened	198	0,8	24	4,752
H 8 S	Green with light lid	Red	Star	Round	203	1	18	3,654
H 9 S	Whitish green	Red	Point	Lightly flattened	120	1	35	4,200
H 10 S	Whitish green	Red	Star	Round	165	0,6	23	3,795
H 11 S	Whitish green	Red	Star	Heart shaped	155	0,8	34	5,270
H 12 S	Green with light lid	Red	Star	High round	178	0,8	30	5,340
H 13 S A	Green with light lid	Red	Point	High round	120	1	45	6,150
H 13 S B	Green with light lid	Red	Star	High round	170	0,9	35	6,100
H 14 S A	Green with light lid	Red	Star	High round	234	0,7	40	6,100
H 14 S B	Green with light lid	Red	irregular	Round	218	0,8	40	6,200
H 15 S A	Whitish green	Red	Star	High round	212	0,9	40	6,600
H 15 S B	Whitish green	Red	Star	High round	208	0,7	15	6,500

Table 3. The main features of tomato hybrids

Features/Hibrids	Fruit firmness	Seminal lodges no.	Pulp thickness (cm)	Shelf life (days)	Pathogens attack genetical resistance	Genetical stability
SIRIANA(control variant)	good	5	0,7	30	good	Stable
H 1 S A	good	3	0,7	32	average	Segregant
H 1 S B	good	2	1	50	average	Stable
H 2 S	good	4	0,8	26	good	Stable
H 3 S	good	5	0,7	39	good	Stable
H 4 S	average	5	0,8	28	average	Stable
H 5 S	good	5	0,8	39	slabă	Stable
H 6 S	good	4	0,9	28	average	Segregant
H 7 S	good	5	1	38	good	Segregant
H 8 S	good	6	0,7	28	good	Segregant
H 9 S	good	5	0,6	39	good	Stable
H 10 S	good	4	1	63	good	Stable
H 11 S	good	2	0,9	84	average	Stable
H 12 S	good	6	0,7	34	average	Stable
H 13 S A	average	4	0,7	108	average	Stable
H 13 S B	good	6	0,8	63	average	Stable
H 14 S A	good	6	0,8	77	average	Stable
H 14 S B	good	5	0,8	42	average	Stable
H 15 S A	good	4	0,8	42	average	Stable
H 15 S B	good	4	0,9	42	average	Stable

The shape and appearance of the fruit in cross section and longitudinal top hybrids obtained. (fig. 4)

Figure 4. Fruit details of H 13 (left) and H 15 (right) hybrids

In terms of fruit firmness was demonstrated that most hybrids have firm fruit, widely requested feature cultivator. Assessing the number of seminal lodges, lodges lowest number was recorded seminal hybrids H1 and H11 SB S 2 and 4 hybrids seminal lodges recorded a maximum of six seminal lodges. The smallest thickness of the cap was recorded in the hybrid H 9 and 6 mm and hybrids H1 SB, H 7, H 10, S respectively recorded 10 mm.
Special attention was given to the duration of storage after harvesting the fruits are kept in laboratory conditions, in normal room climate without controlled atmosphere. The smallest shelf life was recorded by hybrid H2 S with 26 days and the record was recorded by hybrid H 13 SA in 108 days.
In terms of genetic resistance, most hybrids have resistance recorded and sensitivity to specific diseases recorded species hybrid H 5 S. Regarding genetic stability, although all hybrid combinations showed heterosis phenomenon, in terms of expressiveness uniformity characters behaved differently and H 1 SB, S H6, H7 and H8 S hybrids were uneven (segregant). A total

of five hybrids showed heterosis phenomenon, productions being higher than the parents of maternal and paternal, but to 'Siriana' recorded lower production (Figure 5.) The lowest production was recorded by hybrid H 6 S with 3 kg / plant.

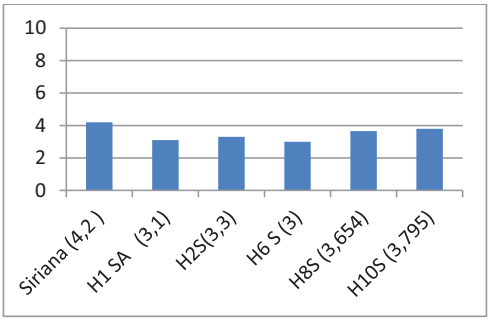


Figure 5. hybrids yield lower than 'Siriana' (kg/plant)

A total of five hybrids recorded a production close to the value obtained by control, showed visible phenomenon of heterosis values oscillating between 4.2 kg recorded by the hybrid H 9 S and 4.752 kg / plant hybrid H 7 S. (figure 6)

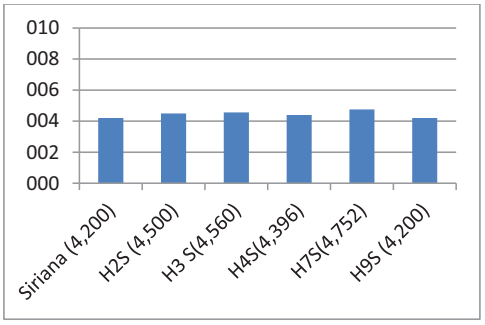


Figure 6. Hybrids yield resembling with 'Siriana' (kg/plant)

Three hybrids obtained higher yield than 'Siriana', with yields of more than 5 kg / plant. Research for these hybrids will continue both in terms of hybridization partners and their cultivation in various technological methods.
Of this group of hybrids, the highest production was recorded by H5 S Hybrid which achieved 5.8 kg yield / plant (figure 7).

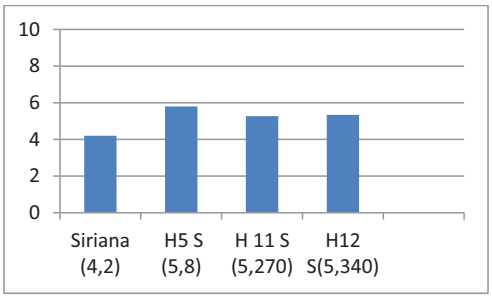


Figure 7. Hybrids with higher yields than 'Siriana' (kg/plant)

Six hybrid combinations productions recorded significantly higher than 'Siriana' (figure 8).

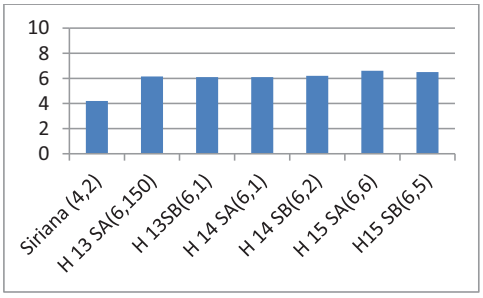
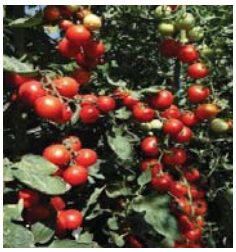


Figure 8. Hybrids with significantly higher yields than 'Siriana' (kg/plant)

They recorded higher output than 6 kg / plant, the record was obtained by hybrid H15 SA 6.6 yield kg / plant.
It should be noted that the hybrid H15 SA is the result 24 x 13 hybridization, which was a consecrated genitor used to obtain the most efficient Romanian hybrid, Export II and also in our research was used as genitor capacity tester for testing combination.
Since 2015, this group of hybrids was introduced in crops on large areas and those that will further demonstrate the performance will be proposed for approval. (figure 9)



H 15 SA

H 15 SB

H 14 SB

H 13 SA

Figure 9. Crop detail of new obtained hybrids

CONCLUSIONS

The breeding program of tomatoes from VRDS Buzau to date has achieved its objectives: to obtain a solid germplasm collection at this species embodied in genotypes with distinct phenotypical expression.

This evaluation was performed by testing germplasm general collection and specific combinative capacity; they obtained a large number of lines that can be approved as varieties and also a large number of available genitors to obtain new hybrid combinations.

The large number of hybrid combinations made between genitors selected from field work was completed with 19 hybrid combinations showed heterosis phenomenon and 6 hybrids significantly exceeded the control, obtaining 6 kg yield/ plant.

Record yields were obtained using classical crop technology of tomatoes, however by implementing new technologies or technological links (eg - nutrition) yields obtained by these hybrids can increase significantly.

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