Fruit Growing Research, Vol. XXXIV, 2018 DOI 10.33045/fgr.v34.2018.08
http://publications.icdp.ro/index.php

SOIURI NOI DE MĂR CU REZISTENŢĂ GENETICĂ LA BOLI CREATE LA STAŢIUNEA DE CERCETARE DEZVOLTARE PENTRU POMICULTURĂ VOINEŞTI

NEW VARIETIES OF APPLE WITH GENETIC RESISTANCE TO DISEASE CREATED AT THE RESEARCH AND DEVELOPMENT STATION FOR FRUIT GROWING VOINESTI

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Abstract

Between 2014-2017 at the Research Station for Fruit Growing Voinesti it was evaluated the performance of three brand new scab apple varieties: 'Valery', 'Cezar' and Revidar', all patented by ISTIS in 2016. The growth vigor of trees in the 10th year, grafted on the M9 rootstock, is well defined by the trunk circumference, which records between 14.9 cm in the 'Caesar' variety and 16.5 cm in the 'Valery' variety. The crown volume calculated at the surface unit and for a density of 2,857 trees/ha was of 8,200 mc/ha for the 'Caesar' and 'Revidar' and 8,900 mc/h for the 'Valery' variety. Productivity of trees in the ages of 7-10 years was between 35-40 t/ha in the 'Caesar' an 'Valery' varieties and 28.30 t/ha at the 'Revidar' variety. The fruit weight ranged from 160 to 190 g, smaller fruits being recorded in the 'Revidar' variety and higher in the 'Caesar' and 'Valery' varieties, which correspond to market requirements. The Remarkable quality of the varieties fruits recommends them for an increasingly demanding fruit market, meeting the current quality requirements and consumer's needs.

Cuvinte cheie: rezistenţă Vf, productivitate, calitate, soi.
Key words: Vf resistance, yield, fruit quality, variety.

1. Introduction

Apple's assortment has seen a significant change in the past decades, promoting varieties that primarily target the producer's requirements, sensitive to economic efficiency, high production potential, fruit appearance, ripening time, etc., as well as consumer tastes. These requirements are satisfied by expanding the cultivars of apple varieties with genetic resistance to diseases, which for the new plantations are linked of the efficient economic technology, with immediate effect by the total or partial elimination of the fungicide treatments (Petre, 2009, 2014).

In the promotion of varieties of apple with genetic resistance to diseases, an important role was played by the Research and Development Station for Fruit Growing Voinesti, either by own creation or by studying foreign varieties, managing to greatly change the vision of the fruit farmers and the gradual change of the assortment.

The continuous breeding process has allowed the creation and patenting of 18 varieties of apple with genetic resistance to diseases (Cociu et al, 1999), among them 'Valery', 'Cezar' and 'Revidar', were approved in 2016, valuable varieties which will surely meet the growing demands of consumers.

2. Materials and methods

The complex genetic base existing at the Research Station for Fruit Growing Voinesti, consisting of selection fields, hybrid nursery and competition microcultures, was the main source of selection of valuable apple tree elites and registered with ISTIS for testing for new patenting varieties. Elite apple H 1/16-90, H 1/78-90, H 4/ 37-04, existing in the microculture set up in 2009 for compete, corresponded in terms of fruit productivity and quality, being registered at ISTIS To be tested for approval from 2014, it being reviewed for 2 years (2014-2015) and analyzed according to the DUS and VAT test criteria and techniques required for approval. These became varieties from 2016 under the names 'Revidar', 'Caesar' and 'Valery'.

In order to highlight the performance traits of the three varieties still existing in the competition microculture set up in 2009, the crop technology was applied correctly in order not to affect the production capacity and the quality of the fruits.

The researches carried out during the period 2014-2017 highlight the growth and fruiting potential of new varieties of apple-resistant apple, 'Revidar', 'Caesar 'and 'Valery', where the trees were planted at a distance of 3.5 x 1 m (2,857 trees / ha), grafted on the M9 rootstock, with the spindle shape of a crown.

During the study years, observations and determinations have been made regarding the growth in trunk thickness, tree crown size, production record and fruit quality, by their biomass and dry matter content.

The orchard soil is brown eumesobasic, slightly pseudogley, with a acidic pH (5.7 - 5.9), the humus content is medium to surface (2.0-2.9%), medium supplied with nitrogen, poorly supplied in phosphorus and potassium. The climatic conditions were favourable for growing and fruiting of trees, characterized by an average annual temperature higher than 1.0°C, normal for the area of 8.8°C, with an annual rainfall of 755 mm.

In the orchard, the soil was maintained as permanent grass cover and weedy clean interval on the row of trees. To control pests, 6 to 8 treatments were applied with insecticides only. The other works were executed according to the technology specific to the high-density orchards.

3. Results and discussions

In the process of developing performances in fruit production, varieties must be promoted with a genetic basis that allows:

- increasing the production potential and the quality of the fruit;
- natural increase of resistance to diseases and pests in order to protect the environment;
- suitability in the application of high performance technologies.

An essential condition is compliance with the crop technology in order not to affect the production capacity of the variety and the quality of production. Proper application of technologies preserves or improves varieties' performance.

Obtaining varieties of apple is a long-lasting activity and a great deal of complexity, especially when it comes to obtaining varieties of genetic resistance to disease, irrespective of the research method used.

A new variety, in addition to the productivity, superior fruit quality, genetic resistance to diseases, depending on the area of culture, has to meet other attributes that are added to the essential conditions, namely:

- degree of adaptability to climatic conditions;
- destination of the production, depending on the degree of knowledge of the variety;
- market requirements of the production obtained;
- safety of the production and delivery source of the fruit propagating material;
- economic efficiency of cultural technology.

In the competition microculture, an agrotechnical scheme was applied to the varieties of genetically resistant apple cultivars, including varieties patented in 2016 (mowing the grass between the rows, herbicidation along the row of trees, phytosanitary treatments, only insecticide) and monitoring the vegetation condition of the biological material.

In the 10 years of vegetation, apple elites / apple varieties approved in 2016, 'Valery', 'Cezar' and 'Revidar' have grown properly, fruiting since the 3rd leaf, proving superior quantitative and qualitative production, resistance to scab and mildew.

In order to highlight the characteristics of apple varieties approved in 2016, the growing and fruiting traits recorded during the exam period, namely 2014 - 1017, are forward reproduced. The vigour of trees in quantitative terms is given by the volume of vegetative growth accumulated annually, expressed by the size of the trunk, the height and size of the tree crown, these being determined by the vigour of the variety, the stable factor being the rootstock. Growth vigour in tree of nine years old, when the growth potential is well defined, indicates that there are significant differences in the growth in trunk thickness, the height and crown dimensions between the apple varieties with genetic resistance to the diseases under study (Table 1).

The trunk circumference of the three varieties of apple, grafted on the M9 rootstock, recorded values between 14.9 cm in the 'Caesar' variety and 16.5 cm in the 'Valery' variety, compared to 14.2 cm as recorded to the variety 'Jonathan' assigned as a control.

The volume of the crown provides the structure for supporting the branches, the leaves and the fruits and ranges according to the size of the trees. The height of the trees in year 10 records values between 270 cm and 290 cm comparing to the 'Jonathan' variety where the height of the trees was of 280 cm. The thickness of the fruit tree fence has values corresponding to the three varieties of apple taken in the study, including the 130 cm of the control variety.

The volume of the crown calculated at the surface unit at the planting density of 2,857 trees / ha was of 8,200 mc / ha for the 'Caesar' and 'Revidar' varieties and 8,900 mc / ha for the 'Valery' variety, with the medium values at the 'Jonathan' variety as a control with 8,500 mc / ha.

Based on vigour values, the present varieties studied have been included into middle- strength varieties ('Valery') and small-medium vigorous varieties ('Caesar', 'Revidar').

For the evaluation of the rhythm of the fructification phenophases, the data related to: the beginning and the end of the flowering, its duration, but also the maturation period of the fruits were recorded.

From the dates recorded between 2014 and 2017, the first flowers were opened in 'Caesar' and 'Revidar' varieties from April 22 to 28, followed by the 'Valery' variety between 24 and 29.04. The end of the bloom took place between 30.04 and 06.05 so that the three varieties studied are enclosed into varieties with a medium flowering period and a flowering period of 7 to 9 days, depending on the evolution of climatic conditions. The varieties taken in the study overlapped totally or partially during flowering, allowing mutual pollination.

Fruit maturation took place between 25th and 31st of August in the 'Revidar' variety, being considered as summer variety, 15-20.09 in the 'Caesar' variety and 25.09-01.10 in the 'Valery' variety, which has a longer storage of the fruits.

The duration of fruit storage was 30-35 days for the 'Revidar' variety, 80-86 days for the 'Caesar' variety and 145-150 days for the 'Valery' variety, compared to the 'Jonathan' variety as control, where the storage duration of the apples in the cooling space is 125 - 135 days.

One of the priority objectives of the study is the evaluation of the production capacity, being the most important characteristic in promoting of the varieties for the establishment of the new commercial plantations. The high productive potential, associated with superior fruit quality, expresses to the highest degree the capacity of apple varieties with genetic resistance to diseases, taken in the study to assimilate and capitalize the ecological conditions of the area in which they are grown.

Productivity of apple varieties is a complex attribute, genetically determined by the hereditary base from which it originates, but is influenced by the interaction between the variety and the climatic conditions of the area of culture. Other factors contributing to the shaping of this attribute are related to the yielding precocity, the type of fructification, applied technology, disease resistance, grafting and pollination compatibility, planting density and rootstock used.

The production potential at 7 to 10 trees year old in the experimented varieties of apple cultivated in a high-density system was between 35 to 40 t / ha for the 'Caesar' and 'Valery' varieties and of 28 to 30 tons / ha in the 'Revidar' variety.

The quality of the fruits expressed in their biomass was between 160 g and 190 g, smaller fruits registered in the 'Revidar' variety and higher in the 'Caesar' and 'Valery' varieties. Dry matter content ranged between 13% and 16.5%.

Apple varieties with genetic resistance to diseases, patented in 2016, have other valuable features, as follows:

- 'Valery' (sin. H 4/37 - 04) - fruits are conic- truncated, yellow-orange on the sunny side, with a yellowish-yellow pulp, crisp at harvest, with a sweet and very good taste (Figure 1). It is resistant to scab and poorly attacked by *Podosphaera leocotricha.* It is characterized by precocity, outstanding fruit quality and constant production.

- 'Cezar' (sin H 1/79 - 90), present conical-globular fruits, covered with red on almost the entire surface (Figure 2). White, sweet, slightly acidified pulp is very tasty. It is resistant to *Venturia inaequalis* and *Podosphaera leocotricha*. It is distinguished by small- medium vigour, precocity, fruit quality and constant production.

- 'Revidar' (sin H 1/16 - 90), have conical-shaped fruits, covered in red on 2/3 of the surface (Figure 3). The pulp is white, acidified and juicy, with good taste. It is resistant to scab and mildew. It is distinguished by medium- small growth, precocity, productivity and constant yielding trait.

The studies and researches undertaken at RSFG Voineşti present for apple growers a group of varieties with different ripening range covering a long period of consumption with apples from genetically resistant varieties. Nowadays, the basic assortment includes varieties with genetic resistance to diseases such as: 'Romus 1', 'Romus 3', 'Romus 4', 'Prima', 'Pionier', 'Voinea', 'Ciprian', 'Florina', which are propagated in the Romanian fruit nurseries. Some of the varieties mentioned, even if they currently meet the requirements in terms of fruit resistance, productivity and quality, they can be replaced by new varieties more valuable in this respect.

Table 2 displays apple varieties with genetic resistance to diseases, 'Revidar', 'Caesar' and 'Valery', which were the subject of the study between varieties of apple with genetic resistance to diseases from the current assortment of apple.

Depending on the period of maturation and consumption of fruits, the apple varieties studied, which have been distinguished by genetic resistance to disease, productivity and quality of fruit, fall differently in the variety conveyor for Dâmboviţa fruit basin.

Therefore, after the apple varieties as 'Romus 1', 'Romus 3', 'Romus 4', it can be introduced 'Irisem' and 'Real', varieties with ripening time in the last decade of August to first decade of September. After 'Prima' variety, the apple variety 'Revidar', which has a consumption period from 25 to 31 August until 1 October is very welcomed.

'Remar' apple variety is situated between the varieties 'Voinea' and 'Pionier' , with the perspective of replacing 'Voinea' by the 'Remar' variety, because it has some superior qualities, both for taste and for fruit coloring. For autumn season, the 'Iris' and 'Voinicel' varieties represent also the alternative for 'Pionier' variety.

After the 'Pionier' variety, the 'Caesar' variety filling gaps with the fruits harvested between September 15 - 20 and consumed until the end of December.

'Redix' variety completes a period of consumption that extends until December to January.

'Inedit' variety exceeds 'Redix' consumption period, closer to that of the 'Florina' variety. During the 'Florina' variety season, the 'Valery' variety arises, with Golden delicious fruit type.

The orientation towards apple varieties with genetic resistance to diseases in Romania will gradually be imposed not only as a result of economic efficiency, but also for the fact that they are the main factor in obtaining organic production.

4. Conclusions

The new varieties of apple 'Valery', 'Cezar' and 'Revidar', patented in 2016, meet the requirements of the producers, oriented to economic efficiency, high production potential, quality fruits, and consumers demands.

The growth vigour of the trees in the 10^{th} year after planting, represented by the circumference of the trunk and trees height, rank 'Valery' variety as more vigorous than "Revidar" and "Cezar" which are similar in vigour.

The volume of the crown calculated at the surface unit, at the density of 2,857 trees / ha, oscillated between 8,200 mc / ha in the 'Caesar' and 'Revidar' varieties, and 8,900 mc / ha in the 'Valery' variety.

The highest production potential was achieved in the 7^{th} - 10^{th} years by 'Caesar' and 'Valery' varieties with yields of 35-40 t / ha and 28-30 t / ha by the 'Revidar' variety.

Apples varieties created and patented by RDSFG Voineştiin 2016 cover a large period of the consumption season alongside other varieties with genetic resistance to diseases already known and appreciated on the market by consumers, completing the conveyer recommended for Dambovita area.

By promoting the varieties of apple with genetic resistance to diseases, there are beneficial economic outcomes for producers, environmental protection and apple production with low pesticide residues.

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Tables and Figures

Table 1. Growing and fruiting particularities of the new varieties with genetic resistance to diseases patented in 2016

Item	Variety			
	'Valery'	'Cezar'	'Revidar'	Jonathan (control)
I. Growth vigour				
Trunk circumference - cm	16.5	14.9	15.0	14.2
Trees height - cm	290	270	270	280
Fruit tree fence thickness - cm	130	130	130	130
Crown volume - mc/ha	8,900	8,200	8,200	8,500
II. Fruiting				
Phenophoses				
Start of blossom	24 - 29.04	22 - 28.04	22 - 28.04	20 - 26.04
End of blossom	01 - 06.05	30.04 - 05.05	30.04 - 05.05	28.04 - 03.05
Blooming time	7 - 9	7 - 9	7 - 9	8 - 9
Date of the fruit ripening	25.09 - 01.10	15 - 20.09	25 - 31.08	20.09 - 30.09
Consumption period	Oct. – March	Oct- Dec.	September	Oct. - January
Storability (days)	145 - 150	80 - 86	30 - 35	125 - 135
Yield (t/ha)	35 - 40	35 - 40	28 - 30	28 - 30
Production quality				
Fruit weight (g)	185	190	160	155
Dry substance content (%)	16.5	13.8	13.0	13.5

Table 2. Consumption time and position of brand new varieties inside the assortment chart of the scab resistant varieties in the Voineşti area

Variety	Month																										
	VII			VIII			IX			X			XI			XII			I			II			III		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
Romus 1		•	•																								
Romus 2		•	•																								
Romus 3				•	•																						
Irisem(Vf)						•	•																				
Real (Vf)						•	•																				
Prima						•	•	•																			
Revidar						•	•	•	•																		
Remar								•	•	•	•	•															
Iris (Vf)								•	•	•	•	•															
Voinea									•	•	•	•															
Voinicel(									•	•	•	•	•	•	•												
Pionier(V									•	•	•	•	•	•	•												
Cezar										•	•	•	•	•	•	•	•	•									
Inedit(Vf)										•	•	•	•	•	•	•	•	•	•	•	•	•	•				
Generos										•	•	•	•	•	•	•	•	•	•	•	•	•	•				
Redix										•	•	•	•	•	•	•	•	•	•	•	•	•	•	•			
Valery										•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		
Florina										•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•

DOI 10.33045/fgr.v34.2018.08

Figure 1. `Valery` Fruits

Figure 2. `Cezar` Fruits

Figure 3. `Revidar` Fruits