

VERGI ÎN PRODUCEREA MATERIALULUI DE ÎNMULȚIRE POMICOL LA PIERSIC LINKS FOR MULTIPLICATION OF PEACH PROPAGATION MATERIAL

Corina Gavat¹, Catița Plopa², Cristina Moale¹, Leinar Septar¹

¹ Research Station for Fruit Growing Constanta, Romania

² Research Institute for Fruit Growing Pitesti, Romania

Corresponding author: Corina Gavat; e-mail corina_gavat@yahoo.com

Abstract

RSFG Constanța is the owner of the mother stock for biological superior categories of peach, so in order to align us with the new legislative requirements, starting with 2016 it was introduced in the evaluation process for obtaining Prebase Candidate mother plants for cultivars to which is maintainer: 'Catherine sel. 1', 'Cecilia', 'Florin', 'Filip', 'Iustin', 'Mimi', 'Minodora', 'Monica', 'Redhaven', 'Southland', 'Springcrest'. The evaluation was performed in terms of authenticity based on the test of distinction, uniformity and stability, as well as in terms of phytoviral. The evaluation of the phytoviral status has been done visually, by the biological method and by the DAS-ELISA serological test. The following pathogen agents were identified: *ACLSV*, *ApMV*, *PPV*, *PDV*, *PNRSV*, *ALV*, *PLMV*, *SLRSV*, *ACLR*. The results highlighted the presence of *PPV* in 'Cecilia', 'Redhaven' and 'Southland' cultivars, *PDV* in 'Florin' and *ApMV* viruses in 'Cecilia's peach plants. Healthy plants have been propagated.

Cuvinte cheie: *Prunus persica* L. Batsch, testare fitovirotică, pomi fructiferi, certificare.

Key words: *Prunus persica* L. Batsch, phytoviral tests, fruit trees, certification.

1. Introduction

Peach is one of the most valuable fruit species due to early fruiting, to the rapid growth of the vegetative organs in the nursery and in the first years after planting, and to the high and constant yields obtained when it is planted in favorable areas of cultivation. It has the capacity to recover easily if climatic accidents occur (Cociu, 1981).

In Romania, there is a large number of cultivars created or acclimatized, and with different ripening times, so that the season for fresh consumption or the possibility for fruit processing is over 100 days. As in the case of other fruit species, it is necessary to rehabilitate the peach through well-thought-out development programs (Sumedrea et al, 2014).

The planting material used to establish new orchards is the guarantee of efficient productions from the qualitative and quantitative point of view, as it must be authentic and healthy. Therefore, the quality of the mother plants from high biological categories and of the planting material obtained in the nurseries is very important.

The European Plant Protection Organization (EPPO) has set standards for the certification of Candidate plants, requirements for authenticity, including viral testing methods (PM 4/30 (1), 2001) in order to increase the quality of fruit propagating material, including for peach.

Regarding the supply with healthy planting material, for peach, the legislation in the field of production and maintenance of fruit propagation material refers to 9 viral and phytoplasmic pathogens (OM 784/2016 and OM 119/2020): *Apple chlorotic leaf spot virus (ACLSV)*, *Apple mosaic virus (ApMV)*, *Plum pox virus (PPV)*, *Prune dwarf virus (PDV)*, *Prunus necrotic ring spot virus (PNRSV)*, *Strawberry latent ring spot virus (SLRSV)*, *Apricot latent virus (ALV)*, *Apricot chlorotic leaf roll phytoplasma (ACLR)*, *Peach latent mosaic viroid (PLMV)*.

The research carried out until now on planting material and implicitly on productions has established that in peach the following have the highest incidence: *PPV*, *PDV*, *PNRSV* and *ACLR* (Chirilli, et. al, 2016; Milusheva, et. al, 2005).

The serological methods of diagnosis are most preferred for the identification of viruses, because they reduce the time required for testing, allow rapid diagnosis of the virus and immediate elimination of infected plants (Nemeth, 1986).

The aim of the paper is to evaluate the peach tree cultivars for which RSFG Constanța is maintainer, from the authenticity and phytoviral point of view, in order to obtain Prebase Candidate mother plants with the purpose of supplying the required propagation material used to obtain planting material.

2. Material and methods

The authenticity analysis was done according to the recommendations of the relevant legislation (OM 784/2016, OM 119/2020, OM 1295/2005- Annex No. 6- Variety characteristics and mode of expression (characteristics that coincide with the DUS test, as described by UPOV) at the peach cultivars studied: 'Catherine sel.1' (fig. 1), 'Cecilia', 'Florin' (fig. 2), 'Filip' (fig. 3), 'Iustin', 'Mimi' (fig. 4), 'Minodora', 'Monica' (fig. 5), 'Redhaven', 'Southland' (fig. 6) and 'Springcrest' (fig. 7).

The data were recorded between 2016 and 2018; 10 trees were evaluated for each cultivar in the maximum fruiting period (year 5 after planting). The analyzed fruit trees are located in the experimental lots from RSFG Constanța.

The paper presents 11 characters considered the most important for the international harmonization of the description of peach cultivars, as follows:

Fruit tree: type- normal; -spur.

Flowering shoot: anthocyanin coloration: - absent; - present.

Flowering time: - very early; - early;- intermediate; - late; - very late.

Flower type:- showy; -non-showy.

Petals- size: - very small; - small; - medium;- large; - very large.

Peduncle- nectaries glands: - absent; - present.

Peduncle- shape of nectaries glands:- round; - reniform.

Fruit skin pubescence: - absent; - present.

Fruit ground colour: - white; - yellow to yellow-orange; - red.

Flesh to stone adherence: - absent; - present.

Harvest time: - very early; - early;- intermediate; - late; - very late.

The characters regarding the tree were observed during the dormancy period, those referring to the flower were noted at full flowering, by collecting and analyzing the flowers from the central part of the annual branches. Similarly, for leaves, fully developed ones from the middle area of the shoots were analyzed. The shape of the nectaries glands was determined on the mature leaves in late July. In order to be able to make an accurate assessment of the characteristics of the flesh color, the fruits of each peach cultivar analyzed were harvested at consumption maturity.

The determination of the viral status was accomplished by combining several methods:

1. Field assessment: visual inspections were carried out several times a year.

2. The biological testing was performed according to the recommendations of the International Working Group on Fruit Tree Viruses, (Jelkmann, 2001).

The biological testing was performed on 'GF 305' and 'Elberta' seedlings and in accordance with the recommended diagrams, using the structure: number of repetitions / temperature / observation period (w = weeks), as follows:

- 'GF 305' seedlings (5/20⁰C/8w), to identify: *Apricot latent virus (ALV)*, *Apricot chlorotic leaf roll phytoplasma (ACLR)*, *Peach latent mosaic viroid (PLMV)*;

- 'Elberta' seedlings (5/20⁰C/12w), to identify: *Apricot latent virus (ALV)*, *Apricot chlorotic leaf roll phytoplasma (ACLR)*, *Peach latent mosaic viroid (PLMV)*;

3. The serological testing was performed to highlight the following viruses: *ACLSV*, *ApMV*, *PPV*, *PDV*, *PNRSV*, *SLRSV*, by using the DAS-ELISA method (Clark and Adams, 1977), in accordance with the protocol recommended by the kit manufacturer. The sampling of the test samples was performed at the end of May and beginning of June, in order to avoid high temperatures that would lead to a decrease in viral concentration.

3. Results and discussions

A. Assessment of authenticity

The analyzed peach cultivars displayed standard branches, with the exception of the Cecilia cultivar (dwarf) that had spur branches, table 1.

The flowering season is an important criterion in choosing peach cultivars, because the climatic accidents (late frosts or hoar) that occur in the second half of March or early April are becoming more frequent in recent years.

The flowering duration and rhythm depend on temperatures and cultivar (Popescu et al., 1992). According to Baldini, quoted by Cepoiu (2006), the critical temperatures for peach are -1.7°C for the floral bud and 1.3°C for open flowers.

In the climatic conditions of the RSFG Constanta during the research years, peach flowering was recorded between March 28 and April 5 (in 'Springcrest', a cultivar identified for its very early flowering), and between April 10 and April 20, respectively (in 'Mimi' a cultivar with late flowering); the flowering time difference between the earliest and the latest was 12 days and 15 days, respectively.

Harvest time was recorded in mid-June ('Springcrest' cv. - very early) until mid-August ('Iustin' cv. - late). It should be mentioned that the flowering season is not correlated with the ripening season in the studied peach cultivars. Thus, there are peach cultivars with late flowering but intermediate fruit harvest period (Catherine sel. 1, Mimi, Minodora). The destination of the fruit is mixed as they can be used both for fresh consumption and in the canning industry.

The flower type is an important morphological character in the identification of peach cultivars as the flowers in the analyzed cultivars are both showy and non-showy. The peach cultivars with non-showy flowers (table 2) have yellow fruit flesh ('Catherine sel. 1', 'Cecilia', 'Mimi', 'Minodora', 'Southland'). All peach varieties studied are self-fertile and have abundant pollen.

The nectaries glands are located at the base of the leaves on the petiole or on the edge of the leaf blade and secrete a sweet liquid (nectar), attractive to bees. The lack of glands on the petiole is correlated with the sensitivity of peach cultivars to powdery mildew (Asănică and Hoza, 2013). They are present in all the analyzed varieties, and the reniform nectaries glands were noted in most of the studied peach cultivars, table 2.

The ground color of the flesh and the flesh to stone adherence are important indicators in the evaluation of peach cultivars. The consistency of the pulp is correlated with its color. The white flesh found in 'Filip' and 'Monica' is softer at fruit maturity, the yellow or orange-yellow one is firm or very firm, similar to the 'Mimi', 'Minodora' and 'Catherine sel. 1'.

The assessment performed on the characters mentioned in Tables 1 and 2 coincides with the characteristics from the examination sheets used for registration with the purpose of description of the peach cultivars studied.

B. Evaluation of the phytovirotic status

The visual field monitoring carried out over the years of observations of the selected plants did not reveal the existence of symptoms that could be associated with diseases caused by viruses, viroids or phytoplasmas.

1) The visual field monitoring carried out over the years of observations on the selected plants, did not revealed the existence of symptoms that could be associated with diseases caused by viruses, viroids or phytoplasmas.

2) Biological testing

After the tests accomplished on the cultivars 'Catherine sel. 1', 'Cecilia', 'Florin', 'Iustin', 'Mimi', 'Minodora', 'Redhaven', 'Southland', 'Springcrest' that could be associated with the diseases concerned after indexation on the 'GF 305' and 'Elberta' seedlings (table 3), no symptoms associated with the targeted diseases were recorded, after indexing on the seedlings GF 305 and Elberta.

There was a good expression of *ACLR* phytoplasma symptoms in the 'Filip' variety for the selected tree coded T5, on both biological indicators used: GF 305 and Elberta. Also, positive results expressing symptoms produced by the *ACLR* phytoplasma were identified both on the biological indicator 'GF 305' and on the biological indicator 'Elberta' at the 'Monica' cultivar in the case of the trees coded T3 and T7. The positive plants were eliminated by burning.

3) The serological testing by DAS-ELISA to detect viral infections revealed individual infections (Table 4). The *PPV* virus was identified in most samples (trees), namely T3 'Cecilia', T2 and T4 'Redhaven' and T3 'Southland'. *PDV* was highlighted on 3 trees, namely T1 'Florin', T6 'Filip' and T6 'Southland'. The positive

samples were also identified with *ApMV* in T2 'Cecilia' and with *PNRSV* in T5 'Redhaven'. The trees identified as positive were removed from the selection process and burned.

4. Conclusions

The analyzed peach cultivars are very diverse in terms of fruit appearance and can be used fresh or in the canning industry from June to mid-August, being a sort that can be recommended to peach growers.

Trees of all studied peach varieties correspond in terms of distinctiveness, uniformity and stability.

The increased incidence of peach infections caused by *PPV*, *PDV*, *ACLR* pathogens, identified by testing even in the absence of symptoms in the selected plants is reconfirmed.

Although known with high incidence in peach, the viruses *PPV*, *PDV*, *PNRSV* and phytoplasma *ACLR* have not been identified in the varieties 'Catherine sel. 1', 'Justin', 'Mimi', 'Minodora', 'Springcrest'.

Acknowledgments

This paper was published within the project ADER 7.5.4/2019 of the Ministry of Agriculture and Rural Development.

References

1. Asănică A., Hoza D., 2013. Pomology. Ed. Ceres, București, pag. 459.
2. Cepoiu N., Constantin M., 2006. The peach - assortments and modern technologies. Ed. Ceres, București, pag. 296.
3. Cirilli Marco, Filippo Geuna, Anna R. Babini, Valentina Bozhkova, Luigi Catalano, Beniamino Cavagna, Sylvie Dallot, Véronique Decroocq, Luca Dondini, Stefano Foschi, Vincenza Ilardi, Alessandro Liverani, Bruno Mezzetti, Angelantonio Minafra, Marco Pancaldi, Tiziana Pandolfini, Thierry Pascal, Vito N Savino, Ralph Scorza, Ignazio Verde, Daniele Bassi, 2016. Fighting Sharka in Peach: Current Limitations and Future Perspectives, *Frontiers in Plant Science* 7(379).
4. Clark M.F. and A.N. Adams, 1977. Characteristics of the micro plate method of enzyme-linked immunosorbent assay for the detection of plant viruses. *J. Gen. Virol.* 34: 475-483.
5. Cociu V., 1981. Peach culture. Ed. Ceres, București, pag. 140.
6. Jelkmann W., 2001, International Working Group on Fruit Tree Viruses Detection of Virus and Virus-Like Diseases of Fruit Trees, *Acta Horticulturae* 550: XVIII International Symposium on Virus and Virus-like Diseases of Temperate Fruit Crops - Top Fruit Diseases.
7. Milusheva A., Borisova A.Z., 2005. The Incidence of Prunus Necrotic Ringspot and Prune Dwarf Viruses in *Prunus* Species in South Bulgaria's, *Biotechnology & Biotechnological Equipment*, Volume 19.
8. Nemeth M., 1986. Virus, mycoplasma, and rickettsia diseases of fruit trees. – Budapest, Hungary.
9. Popescu and colab., 1992. Fruit trees growing, Ed. Didactică și Pedagogică, București.
10. Sumedrea D., Isac I., Iancu M., Olteanu A., Coman M., Duțu I. (coordonators), 2014. Fruit trees, fruit shrubs and strawberry- Technical and economical guide. Ed. Invel Multimedia, Pitești, pag. 286.
11. Ștefan N., Glăman Ghe, Braniște N., Stănică Fl., Duțu I., Coman M., 2018. New peach, nectarine, walnut, new fruit species, berries, strawberry and rootstocks bred in Romania, vol. X, Ed. Ceres, București, pag. 47-118.
12. OEPP/EPPO, 2001. PM 4/30, Certification scheme for almond, apricot, peach and plum, *Bulletin OEPP/EPPO* 31, 463-478..
13. Order no. 1295/2005 for the approval of the Rules and technical norms regarding the production for marketing, control, quality certification and/or marketing of fruit propagating and planting material, Annex no. 6-the characteristics of the varieties and the way of expression.
14. Order no. 784/2016 for the specific requirements for genera and species of fruit plants listed in Annex I to Council Directive 2008/90/EC of 29 September 2008 on the marketing of fruit propagating and planting material intended for fruit production, the specific requirements to be comply of suppliers and detailed rules on official inspections within the scope of Directive 2008/90 / EC, *Official Gazette*, Part I no. 410 from May 31, 2016.
15. Order no. 119/2020 for the amendment and completion of some normative acts in the field of seed quality and propagating material, *Official Gazette*, Part I no. 389 from May 14, 2020.
16. UPOV, 2010. TG/53/7- Peach- Guidelines for the conduct of tests for distinctness, uniformity and stability, pag. 46.

Tables and Figures

Table 1. Data regarding the characters of the analyzed peach trees, flowering period and harvest time, 2016-2018, Valu lui Traian

Cultivar	Fruit tree-type	Flowering shoot: anthocyanin coloration	Flowering time	Harvest time
Catherine sel. 1.	normal	present	late	intermediate
Cecilia	spur	present	intermediate	intermediate
Florin	normal	present	intermediate	early
Filip	normal	present	intermediate	intermediate
Iustin	normal	present	intermediate	târzie
Mimi	normal	present	late	intermediate
Minodora	normal	present	late	intermediate
Monica	normal	present	intermediate	intermediate
Redhaven	normal	present	intermediate	intermediate
Southland	normal	present	late	late
Springcrest	normal	present	very early	very early

Table 2. Characteristics of the flowers and fruits of the peach cultivars, 2016-2018, Valu lui Traian

Cultivar	Flower type	Flower size	Peduncle-nectaries glands	Peduncle – the shape of the nectaries glands	Ground color of the flesh	Flesh to stone adherence
Catherine sel. 1.	non-showy	large	present	reniform	yellow-orange	present
Cecilia	non-showy	large	present	reniform	yellow	present
Florin	non-showy	very small	present	round	yellow	absent
Filip	showy	very large	present	reniform	white	present
Iustin	showy	medium	present	reniform	white	present
Mimi	showy	very small	present	reniform	yellow-orange	present
Minodora	non-showy	medium	present	reniform	yellow-orange	present
Monica	showy	large	present	reniform	white	absent
Redhaven	showy	medium	present	reniform	yellow	absent
Southland	non-showy	small	present	reniform	yellow	absent
Springcrest	showy	medium	present	reniform	yellow	present

Table 3. Results of the viral evaluation by the biological method

No.	Cultivar	Biological indicator	Symptoms
1.	Catherine sel. 1	GF 305	-
		Elberta	-
2.	Cecilia	GF 305	-
		Elberta	-
3.	Florin	GF 305	-
		Elberta	-
4.	Filip	GF 305	T5 -the presence of specific <i>ACLR</i> symptoms
		Elberta	T5 -the presence of specific <i>ACLR</i> symptoms
5.	Iustin	GF 305	-
		Elberta	-
6.	Mimi	GF 305	-
		Elberta	-
7.	Minodora	GF 305	-
		Elberta	-
8.	Monica	GF 305	T3; T7– the presence of specific <i>ACLR</i> symptoms
		Elberta	T3; T7– the presence of specific <i>ACLR</i> symptoms
9.	Redhaven	GF 305	-
		Elberta	-
10.	Southland	GF 305	-
		Elberta	-
11.	Springcrest	GF 305	-
		Elberta	-

Table 4. Results of the viral evaluation of the PREBASE-Candidate plants by the DAS-ELISA method in peach cultivars

No.	Peach cultivar	<i>Infected trees/virus</i>					
		<i>ACLSV</i>	<i>ApMV</i>	<i>PPV</i>	<i>PDV</i>	<i>PNRSV</i>	<i>SLRSV</i>
1.	Catherine sel. 1 T1,T2,T3,T4,T5,T6,T7,T8,T9,T10	-	-	-	-	-	-
2.	Cecilia T1,T2,T3,T4,T5,T6,T7,T8,T9,T10	-	T2	T3	-	-	-
3.	Florin T1,T2,T3,T4,T5,T6,T7,T8,T9,T10	-	-	-	T1	-	-
4.	Filip T1,T2,T3,T4,T5,T6,T7,T8,T9,T10	-	-	-	T6	-	-
5.	Iustin T1,T2,T3,T4,T5,T6,T7,T8,T9,T10	-	-	-	-	-	-
6.	Mimi T1,T2,T3,T4,T5,T6,T7,T8,T9,T10	-	-	-	-	-	-
7.	Minodora T1,T2,T3,T4,T5,T6,T7,T8,T9,T10	-	-	-	-	-	-
8.	Monica T1,T2,T3,T4,T5,T6,T7,T8,T9,T10	-	-	-	-	-	-
9.	Redhaven T1,T2,T3,T4,T5,T6,T7,T8,T9,T10	-	-	T2; T4	-	T5	-
10.	Southland T1,T2,T3,T4,T5,T6,T7,T8,T9,T10	-	-	T3	T6	-	-
11.	Springcrest P1,P2,P3,P4,P5,P6,P7,P8,P9,P10	-	-	-	-	-	-



Fig. 1. Catherine sel. 1 cv.



Fig. 2. Florin cv.



Fig. 3. Filip cv.



Fig. 4. Mimi cv.



Fig. 5. Monica cv.



Fig. 6. Southland cv.



Fig. 7. Springcrest cv.