SORTIMENTUL DE PIERSICI CU FRUCTUL PLAT DE LA STAȚIUNEA DE CERCETARE-DEZVOLTARE PENTRU POMICULTURĂ CONSTANȚA
THE FLAT PEACH ASSORTMENT AT RESEARCH STATION FOR FRUIT GROWING CONSTANTA

Corina Gavăt[1], Cristina Moale[1], Mădălina Butac[2], Plopa Catița[2], Mădălina Militaru[2], Opriță V.A.[1]
[1]Research Station for Fruit Growing Constanța, Romania
[2]Research Institute for Fruit Growing Pitești, Romania

Abstract

At Research Station for Fruit Growing Constanta (RSFG Constanta) the programme for peach breeding started since 1977. The main objectives were: widening the harvest season, high quality of the fruit and good taste, resistance to transport, tolerance/resistance to the main diseases, etc. Also, the creation of new peach and nectarine varieties with flat fruit was one of the aims of the breeders. A good starting point for this work was the peach germplasm found which had more than 800 genitors, some of them with flat fruit. Standard breeding techniques as cross pollination, self pollination and open pollination were used and more hybrids were evaluated and 150 genotypes were tasted. From these, 7 peach and nectarine varieties with flat fruit were homologated. All of them have good average yields that ranged between 21.2 t/ha ('Liana') to 27.5 t/ha ('Filip') for a density of 833 trees/ha. Also, the peach and nectarine varieties mentioned proved to have flesh firmness, yellow or white color, very good aroma, red skin and good commercial aspect and tolerance to the main pathogen agents.

Cuvinte cheie: *Prunus persica*, calitatea fructelor, producții, agent patogeni
Key words: *Prunus persica*, fruit quality, yield, pathogen agent

1. Introduction

The flat (or 'pan-tao' from the Chinese words 'flat peach') fruit, introduced from China has long been a botanic curiosity in western countries (Bassi and Monet, 2008). The biotypes had mediocre taste, green color, easily cracked to maturity and the fruit tree productivity was low (Dumitru, 1997). The initial biological material was bred in the United States and Europe, and after more than 20 years many peach and nectarine cultivars were created and homologated. The new flat cultivars have very good yields, attractive fruit, yellow or white flesh, rich flavor and aroma. Compare with the standard peach genotypes the ratio between fruit/stone is superior (Cepoiu and Manolache, 2006). Fruit weight varies from less than 90 g in the wild varieties to 80-110 g for the very early ripening cultivars to 680 g (Bassi and Monet, 2008). The fruit can be used for fresh consumption or for processing as entire fruit (Dumitru, 2009; Dumitru et al., 2013).

The purpose of this paper was to point out the favorable features of the newly created flat peach and nectarine cultivars within Romania.

2. Material and methods

In 2010, seven flat peach and nectarine cultivars and one hybrid bred in Romania were planted in demonstrative lots; each cultivar is represented by 100 trees. The rootstock was Tomis 1- wild peach selection (Indreias et al., 2004).

The planting distance was 4m/3m and the canopy shape was improved vase. The trees were cultivated under mild water stress conditions during summertime, pruned every year and fertilized optimally; the phyto-sanitary treatments were applied uniformly in the field as recommended by the specialist in plant protection.

The soil is a Calcaro-Calcic Chernozem (World Reference Base for Soil Resources, 2006) or Entic Haplustolls (Soil Taxonomy, 1999) with a loamy texture and alkaline pH in topsoil, which has a proper soil structure and fertility. Land slope is between 2.0 and 2.5% and soil bulk density ranges from 1.18 to 1.25 g cm^{-3}. The physical soil properties allow a proper water movement within the rooting system of the orchard.

RSFG Constanta is located in the south-eastern part of Romania, in the area between the Danube River and the Black Sea, and has specific steppe climatic conditions, with a semi-arid character. Absolute temperature beyond the limits of resistance of peach and nectarine species, e.g. -25°C or above +40°C is rare (1/20 or 1/30 years). Rainfall is deficient to the requirements of the trees; the average amount of

rainfall is around 400 mm, with unequal time distribution in the active growing season (April 1 to September 30). Frosts return is a quite often phenomena in spring and affect fruit trees with early blooming as peach.

Phenological observations and physical and chemical analyses on plants were done. The beginning of flowering was considered when the first open flower was visible and its end was noticed when the last petals of the flowers fell. The blooming intensity was noted from 0 (absent) to 5 (abundant), according to the research methodology of fruit tree breeding (Cociu and Oprea, 1989).

Determination of dry matter was conducted by reading it directly from the refractometric scale (Zeiss) and the determination of acidity was based on potentiometric titration with the solution of sodium hydroxide (AOAC, 1995).

The trees and fruit characteristics were evaluated according to the Methodology for trying new varieties of fruit trees, shrubs and rootstock in order to approve the homologation and International Union for the Protection of New Varieties of Plants (UPOV) guidelines.

During 2014-2016 the fruit yield was recorded starting with the 4^{th} year after planting, when fruit production was considered stable. The average yield was evaluated by weighing the fruit of five peach trees of each variety (kg/tree) and then as kg/ha.

Observations were carried out concerning the behaviour of the certain peach tree cultivars towards the attack of the main pathogen agents under conditions of natural infection (Crossa, 1969). The evaluation technique consisted in assessing the frequency of the attacked organs and the intensity with, which the symptoms showed themselves.

During 2015-2016 the main pathogens attack were performed by grading the intensity of the attack on a scale from 0-4, as follows: **W.A**. = cultivars without attack (F%= 0 and I= 0); **T** = tolerant cultivars (F%= 0.1-5% and I= 0 + +); **We.A**. = weakly attacked cultivars (F%= 5.1% - 10% and I= +); **M.A**. = moderately resistant cultivars (F%= 10.1% - 25% and I= +); **S** = sensitive cultivars (F%= 25,1 – 50% și I= + ^{2} 4); **V.S.** = very sensitive cultivars **(**F%= 50,1% - 100%, I= + ^{4} 4).

3. Results and discussions

3.1. Cultivars description

'Florin' has medium to high vigor; the fruiting occurs in the second year after planting, very productive (27.5 kg/tree). The fruit is flat, the average weight is medium to big (150 g) with fine skin, yellow-green covered with red, juicy and flavored. The flesh is yellow to orange, small stone, no adherence.

'Filip' is a peach cultivar with flat fruit; the tree is standard type with medium-high vigor; the average yield is good (33.0 kg/tree); fruit is very attractive, flavored, very sweet (table 3), rose-red, with juicy white flesh, very good for fresh consumption and for can, too. The stone is small, no adherence.

'Monica' is also a 'sandwich' peach, which has the ripening time after 'Filip' with a very attractive fruit, coloured in red-carmin; the flesh is white, very sweet and juicy (table 2), small stone.

'Sel. Ptt R3P1' is another flat peach with white flesh and very good fruit qualities. The ripening time is at the begining of August, after 'Monica' cultivar (table 1). It can be recommended for fresh consumption and canning industry.

'Iustin' is also newly a introduced standard flat clingstone cultivar with late fruit ripening (19.08-03.09); the tree is medium vigorous and it has high and constant yield (26 kg/tree and 21.7 t/ha, table 1). The fruit has medium size (95 g), large flat and slightly asymmetric with white-cream flesh; the fruit is juicy, flavored, very tasty and sweet, dry matter is 12.5%, the acidity (0.41 mg %) is low. It can be used for can industry or fresh consumption.

'Creola' is a flat nectarine with yellow flesh and with medium vigor; the cultivar is auto fertile and productive (28.5 kg/tree); the average weight of the fruit is about 90 g (table 2); the flesh is yellow-orange, firm and very tasty.

'Marina' is a nectarine with a medium vigour of the tree; the fruit weight is 100 g, very attractive; the flesh is orange and juicy, good for fresh consumption and processing, too.

'Liana' has a small-medium vigour of the tree; precocious, with a high and constant yield (25.5 kg/tree). The fruit is a flat nectarine, the size is about 70 g, white flesh and a very good taste (14.5 % dry matter), juicy and flavoured, both for fresh consumption and processing.

3.2. The behaviour of the flat peach and nectarine to the main pathogen agents 2015-2016

According to the intensity (I) of the attack the studied cultivars were clasified as follows: ***Taphrina deformans***- 6 resistance classes (table 3):

- Cultivars without attack (WA): Three cultivars, the intensity of the attack being zero: 'Florin' (2015) and 'Liana', 'Iustin' (2016).

- Tolerant cultivars (T): 'Florin' (2016); 'Filip' and 'Sel. Ptt. R3 P1' (2015 and 2016); 'Creola', 'Liana', 'Iustin' (2015).

- Weakley attacked (WeA): 'Monica' (2015);
- Sensitive (S): 'Creola' and 'Monica' in 2016;

None of the studied cultivars entered the moderately attacked (M.A.) or very sensitive classes (VS).

The perennial cancer of the peach tree caused by the *Cytospora cincta* Sacc fungus is, together with the blistering caused by the *Taphrina deformans*, the most important pathogen which diminishes fruit yield:

- Cultivars without attack (WA): 'Florin' și 'Filip' (2015 and 2016).
- Tolerant cultivars (T): 'Liana' and 'Iustin' in 2015 and 2016.
- Weakley attacked (WeA): 'Monica', 'Sel. Ptt. R3 P1' and 'Creola' in 2015 and 2016.

None of the studied peach and nectarine cultivars entered the moderately attacked (M.A.), sensitive (S) or very sensitive classes (VS), table 3.

As far as the attack of *Monilinia laxa* and *Monilinia fructigena* Aderh et Ruhl Honey fungi is concerned, seven studied cultivars proved to be tolerant (T), both the frequency (F%) as well as the intensity of the attack (I) being graded with zero; the exception was 'Filip' cultivar that was considered as being weakley attacked (WeA) in 2016.

4. Conclusions

All studied peach and nectarine varieties had an abundant flowering (noted with 5). The data (2014- 2016) show the limits of the beginning blooming period between 23.03 and 23.04.

The ripening time for the studied peach and nectarine with flat fruit was between 02.07 ('Florin') and 19.08 ('Iustin'). The newly created cultivar ('Iustin') widens the assortment (fruit ripening is recorded in August).

The flat fruit has a yellow and white flesh, dry matter content is high, ranging between 11.5% and 14.5%. The average weight of the fruit even is smaller than desert peach, has very good qualities as good flavor and aroma.

Most of the studied cultivars manifested an increased resistance towards the attack of the harmful pathogen agent *Taphrina deformans* being either without attack (WA) or tolerant (T); 'Monica' and 'Creola' cultivars proved to be sensitive attacked in the climatic conditions of 2016.

All studied cultivars were considered tolerant to *Monilinia laxa* and *Monilinia fructigena*. In 2016, 'Filip' cultivar was considered as being weakly attacked to *Monilinia fructigena*.

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Tables

Table 1. Phenological stages and average yield (Multiannual data) RSFG Constanta, Romania

Genotype	Beginning of flowering	Flowering intensity[x]	Ripening time	Yield	
				Kg/tree	t/ha[y]
Florin	03.04-25.04	5	02.07-11.07	27.5	22.9
Filip	23.03-22.04	5	14.07-29.07	33.0	27.5
Monica	01.04-22.04	5	03.08-13.08	32.0	26.7
Sel. Ptt R3P1	02.04-23.04	5	06.08-15.08	27.0	22.5
Iustin	29.03-21.04	5	19.08-03.09	26.0	21.7
Creola	29.03-20.04	5	22.07-01.08	28.5	23.7
Marina	28.03-23.04	5	11.07-20.07	30.0	25.0
Liana	27.03-09.04	5	20.07-01.08	25.5	21.2

[y]The orchard density: 833 trees/ha for standard;
[x]Flowering intensity: 0 = 0%, 1= 0% to 25%, 2= 25% to 50%, 3= 50% to 75%, 4= 75% to 100%, 5= 100%.

Table 2. Fruit characteristics (Multiannual data) RSFG Constanta, Romania

Genotype	Category	Fruit mean weight (g)	Dry matter (%)	Acidity[z] (mg %)	Fruit destination
Florin	Peach with yellow flesh	150	11.5	0.52	Fresh consumption
Filip	Peach with white flesh	90	14.0	0.42	Fresh consumption and processing
Monica	Peach with white flesh	90	13.6	0.38	Fresh consumption and processing
Sel. Ptt R3P1	Peach with white flesh	100	13.0	0.40	Fresh consumption and processing
Iustin	Clingstone peach with white flesh	95	12.5	0.41	Processing and fresh consumption
Creola	Nectarine with yellow flesh	90	13.5	0.90	Fresh consumption
Marina	Nectarine with yellow flesh	100	11.2	0.79	Fresh consumption
Liana	Nectarine with yellow flesh	70	14.5	0.40	Fresh consumption and processing

[z]Acidity: mg malic acid/100 g flesh fruit

Table 3.The behaviour of the flat peach and nectarine to the main pathogen agents 2015-2016, RSFG Constanta, Romania

No.	Cultivar	Year	Intensity of attack (note)			
			Taphrina deformans	*Cytospora cincta*	*Monilinia laxa*	*Monilinia fructigena*
1.	Florin	2015	WA	WA	T	T
		2016	T	WA	T	T
2.	Filip	2015	T	WA	T	T
		2016	T	WA	T	WeA
3.	Monica	2015	WeA	WA	T	T
		2016	S	WeA	T	T
4.	Sel. Ptt. R3 P1	2015	T	WeA	T	T
		2016	T	WeA	T	T
5.	Creola	2015	T	WeA	T	T
		2016	S	WeA	T	T
6.	Liana	2015	T	T	T	T
		2016	WA	T	T	T
7.	Iustin	2015	WA	T	T	T
		2016	T	T	T	T