

‘Cebasred’ and ‘Primorosa’ Apricots: Two New Self-compatible, *Plum pox virus* (Sharka)–resistant, and Very Early Ripening Cultivars for the Fresh Market

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‘Cebasred’ and ‘Primorosa’ are very early-season ripening apricot cultivars (*Prunus armeniaca* L.) which join high productivity, high fruit quality and attractiveness, with resistance to *Plum pox virus* (PPV), a valuable characteristic due to the growing incidence of sharka disease caused by this virus in the European apricot orchards (Rubio et al., 2017). In addition, ‘Cebasred’ and ‘Primorosa’ are self-compatible cultivars. ‘Cebasred’ and ‘Primorosa’ combine all the above mentioned characteristics with very low chilling requirements, which also let them to be cultivated in warm areas. These new varieties will contribute to broaden the ripening calendar with highly valuable sharka resistant germplasm also ready to be used in future breeding processes for low chilling warmer areas.

Origin

‘Cebasred’ resulted from a cross made in 2012 at CEBAS-CSIC of Murcia (Spain) between the apricot breeding line ‘1100-5-26’ (female parent), which was obtained from the CEBAS-CSIC breeding program, and the Spanish cultivar, of unknown origin, Colorado (male parent) (Fig. 1). This cross was made with the objective of obtaining self-compatibility, extra-early season ripening, and sharka (PPV)-resistant cultivars, as well as excellent fruit quality and optimal productivity level to replace traditional cultivars in areas affected by this viral disease (Egea et al., 1999). ‘Primorosa’ resulted from a cross

made in 2010 at Murcia (Spain) between the apricot cultivar Rojo Pasión (female parent), which was obtained from the CEBAS-CSIC breeding program (Egea et al., 2004), and the Spanish cultivar, of unknown origin, Búlida Precoz (male parent) (Fig. 1). This cross was also made with the objective of obtaining self-compatibility, early ripening, sharka resistance, and excellent fruit quality. ‘Cebasred’ and ‘Primorosa’ were selected as seedling trees on their own roots and then grafted onto 4-year-old apricot seedlings (*Prunus armeniaca* L.) rootstocks (three replications each) for agronomical evaluation.

Description

Tree characteristics

Tree description. Trees are vigorous with medium-upright habit for ‘Cebasred’ and

moderately spreading habit for ‘Primorosa’ trees. This tree architecture greatly facilitates pruning (reduced branching habit). ‘Cebasred’ and ‘Primorosa’ have a high and medium flower density, respectively. Both cultivars are characterized by their high productivity level in comparison with some traditional Spanish cultivars. Fruit production in ‘Cebasred’ occurs mainly on fruiting spurs of 2-year-old branches, whereas in ‘Primorosa’ the fruit production is located both in spurs of 2-year-old branches and brindles. They have a moderate need for thinning to obtain good fruit sizes (Table 1).

Plum pox virus resistance. All apricot cultivars traditionally grown in Europe are susceptible to sharka disease caused by PPV, whereas several cultivars from North America such as ‘Goldrich’, ‘Sunglo’, ‘Orange Red’, and ‘Stark Early Orange’ showed resistance to PPV (Martínez-Gómez et al., 2000) and are frequently used as parents in breeding programs (Egea et al., 1999). In the case of ‘Cebasred’ and ‘Primorosa’, the CEBAS-CSIC apricot breeding line ‘701-1’ and ‘Rojo Pasión’ cultivar were used, respectively, as parents to obtain PPV resistance (Fig. 1). The evaluation of PPV resistance was carried out in greenhouse conditions by grafting onto PPV-infected ‘GF305’ peach seedlings growing in pots and by grafting onto infected 7-year-old apricot trees strongly affected by the disease growing in a quarantine shelter (Rubio et al., 2009). Phenotyping against PPV in both conditions showed the resistance of ‘Cebasred’ and ‘Primorosa’ to PPV Dideron-type isolate 3.30 RB/GF-IVIA (GenBank: KJ849228.1) (absence of symptoms and ELISA-DASI and RT-PCR negatives in leaves), in comparison with the susceptibility of the traditional Spanish cultivars (Table 1).

Chilling requirements and blooming time. ‘Cebasred’ and ‘Primorosa’ need ≈38 chill portions according to the Dynamic Model (Fishman et al., 1987a, 1987b) to break

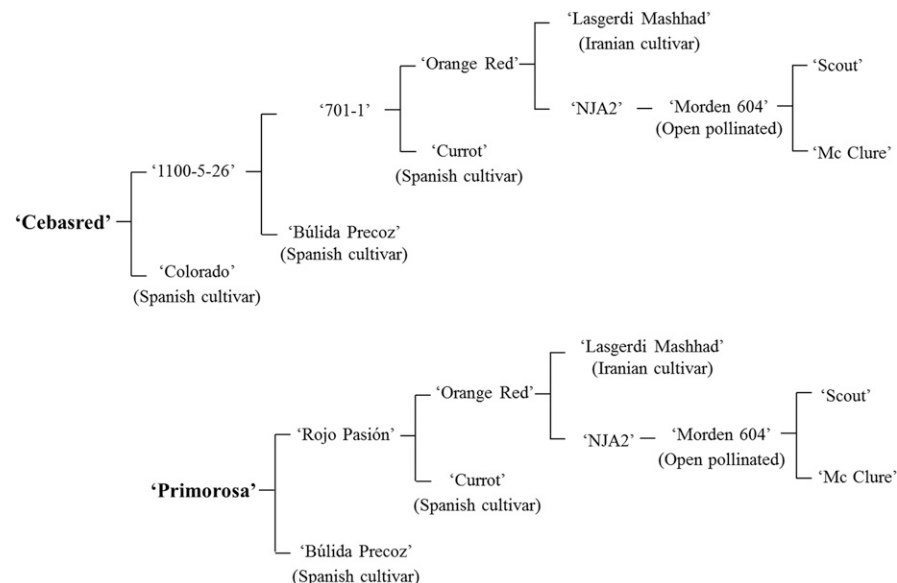


Fig. 1. Pedigree of apricot cultivars Cebasred and Primorosa.

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Table 1. Description of tree and fruit traits of ‘Cebasred’ and ‘Primorosa’, the traditional Spanish cultivars Currot and Búlida, and the North American cultivar Orange Red under experimental conditions in Cieza (Murcia, Southeast Spain).

Characteristics	Cebasred	Primorosa	Currot	Búlida	Orange Red
	<i>Tree</i>				
Vigor	Vigorous	Vigorous	Vigorous	Very vigorous	Vigorous
Habit	Medium-upright	Moderately spreading	Moderately spreading	Moderately spreading	Moderately spreading
Flower density	High	Medium	High	Medium	Low
Flowering date	18 Feb.	20 Feb.	18 Feb.	8 Mar.	15 Mar.
Self-compatibility	Self-compatible	Self-compatible	Self-compatible	Self-compatible	Self-incompatible
Yield (1–9)	9	9	8	9	5
Level of thinning	Moderate	Moderate	Low	High	Low
Resistance to <i>Plum pox virus</i>	Yes	Yes	No	No	Yes
	<i>Fruit</i>				
Ripening date	30 Apr.	6 May	7 May	26 May	28 May
Fruit weight (g)	64.0	75.2	53.8	63.8	61.0
Firmness	Very High	High	Medium	Medium	High
Skin color	Orange (red blush)	Light orange (red blush)	White	Light orange	Orange (red blush)
Red blush (%)	45.0	25.0	15.0	10.0	45.0
Flesh color	Orange	Light orange	White	Light orange	Orange
Sugar (°Brix)	11.3	13.4	13.1	11.6	14.2
Acidity (g/100 mL) ^z	1.34	1.28	1.20	1.29	1.23

^zTitrate acidity expressed as grams of malic acid/100 mL of juice.

dormancy under our conditions in Murcia (southeast of Spain, lat. 37°N, long. 1°W, and 350-m altitude). Therefore, these new cultivars show very low chilling requirements (Ruiz et al., 2007). Full bloom for ‘Cebasred’ and ‘Primorosa’ occurs on average on 18 Feb. and 20 Feb. respectively, a very early flowering date similar to that of the traditional Spanish cultivar Currot (Table 1).

Floral compatibility. ‘Cebasred’ and ‘Primorosa’ are self-compatible as demonstrated in the field (by bagging branches) and in the laboratory (by observing pollen tube growth in 10 flowers) according to the methodology described by Burgos et al. (1993). In addition, the identification of their *S* genotypes by PCR using the consensus primers EM-PC2consFD and EM-PC3consRD (Sutherland et al., 2004) revealed that ‘Primorosa’ is homozygous for self-compatibility (ScSc), whereas ‘Cebasred’ is heterozygous for self-compatibility, showing the band corresponding to the Sc RNase allele and a band of 300 bp (agarose gel electrophoresis not shown).

Fruit characteristics

Ripening time. The ripening date for ‘Primorosa’ in our experimental conditions in Murcia (southeast of Spain, lat. 37°N, long. 1°W, and 350-m altitude) is ≈6 May, similar to the earliest ripening traditional Spanish cultivar Currot and the very early ripening releases from CEBAS-CSIC ‘Mirlo Blanco’ and ‘Mirlo Anaranjado’ (Egea et al., 2010). The ripening date for ‘Cebasred’ is ≈30 Apr., around 7 d earlier than ‘Primorosa’ and Currot, ≈26 d earlier than the Spanish cultivar Búlida, and 28 d earlier than the North American cultivar Orange Red (Table 1). This means that ‘Cebasred’ is considered as an extra-early cultivar with the earliest date of ripening of all the apricot cultivars grown in Spain. Fruit of both cultivars ripen uniformly. At that time in the season, there is very limited competition with apricots produced from other European countries, mainly in the case of ‘Cebasred’.



Fig. 2. ‘Cebasred’ (left) and ‘Primorosa’ (right) fruits in the tree and after harvesting.

Fruit description. ‘Cebasred’ and ‘Primorosa’ trees and reference cultivar trees (‘Currot’, ‘Búlida’, and ‘Orange Red’) were grown in the same orchard according to standard apricot orchard management. Fruit characterization was made at commercial ripening on the basis of their visual skin ground color (degreening stage and fully colored). Three replications of 10 fruits each were selected for each cultivar and year. ‘Cebasred’ bears slightly oblong fruits with an average weight of 64.0 g, which means significantly larger fruits than the early ripening reference cultivar Currot and quite similar to the reference cultivars Búlida and Orange Red. ‘Primorosa’ bears large and globose fruits with an average weight of

75.2 g, larger than all the early ripening cultivars grown to date and larger than the reference cultivars Búlida and Orange Red (Table 1; Fig. 2). ‘Cebasred’ and ‘Primorosa’ are characterized by high fruit firmness at commercial ripening when they were harvested, improving the firmness of Spanish traditional cultivars Currot and Búlida. Both new releases are skin cracking resistant as it was corroborated in the years 2016 and 2017 with rainfall conditions (30 mm in 2017) just before the time of fruit ripening. Fruits of the two new cultivars are freestone and not susceptible to pit burning (flesh browning close to the stone). ‘Cebasred’ fruit has orange skin ground color and the fruit surface is covered by an extensive and intense red