

‘Rafel’ and ‘Belgida’, Two Apricot Cultivars Resistant to Sharka

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‘Rafel’ and ‘Belgida’ are mid- to early-ripening apricot cultivars (*Prunus armeniaca* L.) with good yield, excellent fruit quality, self-compatibility, and resistance to Sharka, a disease caused by the *Plum pox virus*, a serious limiting factor for apricot production in Europe. Their fruits have excellent organoleptic characteristics and are larger than the traditional Valencian cultivars. ‘Rafel’ and ‘Belgida’ are very well adapted to the climatic conditions of the Valencia and Murcia areas.

Origin

‘Rafel’ and ‘Belgida’ both resulted from a cross made in 1993 at Valencia, Spain, between the North American cultivar Goldrich and the Spanish cultivar of unknown origin, Ginesta (Fig. 1). This cross was made with the objective of obtaining cultivars resistant to Sharka, early- to midripening and self-compatible with good fruit quality and better size than traditional Valencian cultivars. ‘Goldrich’ was selected as the female parent as a result of its resistance to Sharka, its large fruit size, and its adaptability to mild winters. ‘Ginesta’ was used as the male parent because it ripens early in the season, has excellent fruit quality, and is self-compatible.

Description

Tree characteristics

Tree description. ‘Rafel’ and ‘Belgida’ were selected as seedlings in 1996. They were subsequently grafted on apricot rootstock and located in experimental plots in different climatic zones in the Valencia and Murcia regions (four trees per variety). They were planted according to commercial distances (5 × 4 m) and received standard cultural practices. Data presented in Table 1 were collected during four growing seasons on trees 4 years old at the IVIA (Valencia, Spain) experimental plot (lat. 39°34′ N, long. 0°24′ W, altitude 55 m). Trees of ‘Rafel’ were vigorous, have a spreading habit, and vegetative bud

break occurs in mid-March. Mean yield from 4 cropping years was 67 kg/tree. ‘Belgida’ trees were also vigorous, have a spreading habit, and vegetative bud break occurs the third week of March. Mean yield from 4 cropping years was 98 kg/tree (Table 1).

Plum pox virus resistance. Sharka disease, caused by the *Plum pox virus* (PPV), is a serious limiting factor for temperate fruit production in those areas where the virus has spread (Kölber, 2001). During the 1980s and 1990s, apricot production was seriously affected by PPV in Spain, France, and Italy (Roy and Smith, 1994). All native apricot cultivars are susceptible to PPV and removal of infected trees was ineffective in eradicating the disease (Llácer and Cambra, 1998), whereas several cultivars from North America such as ‘Goldrich’, ‘Sunglo’, ‘Orange Red’, and ‘Stark Early Orange’ show resistance to PPV and are

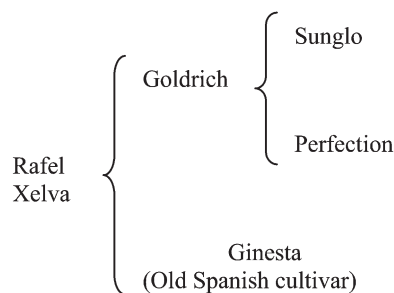


Fig. 1. Pedigree of ‘Rafel’ and ‘Belgida’ apricots.

Table 1. Comparative analysis of tree and fruit characteristics of ‘Rafel’, ‘Belgida’, ‘Ginesta’, and ‘Goldrich’ under experimental conditions in IVIA, Valencia, Spain.

Characteristics	Rafel	Belgida	Ginesta	Goldrich
Tree				
Vigor	Vigorous	Vigorous	Medium	High
Vegetative bud break	14 Mar.	21 Mar.	3 Mar.	1 Apr.
Flowering date (full bloom)	24 Feb.	8 Mar.	20 Feb.	24 Mar.
Flower intensity	High	High	High	Medium
Floral compatibility	Self-compatible	Self-compatible	Self-compatible	Self-incompatible
Mean yield (1–9)	8	9	7	6
Fruit				
Ripening date	26 May	1 June	26 May	16 June
Skin ground color	Yellow	Light orange	Yellow	Orange
Percent red blush	35	20	55	—
Intensity over color	Medium	Low	High	—
Flesh color	Light orange	Orange	Yellow	Orange
Fruit size (g)	48	69	40	69
Firmness (kg·cm ⁻²)	0.9	2.3	1.2	0.8
Soluble solids (°Brix)	14.5	14	15	13.5
Acidity (g·L ⁻¹ malic acid)	29	27	22	24

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used as parents in breeding programs aimed at introducing resistance to PPV (Egea et al., 1999). In the case of ‘Rafel’ and ‘Belgida’, ‘Goldrich’ was used as the donor of resistance looking for better adaptability to warm winters. Evaluation of PPV resistance was performed in controlled greenhouse conditions following the methodology described by Moustafa et al. (2001). Seedlings grafted on peach GF-305 infected with PPV went through two cycles of cold treatment after inoculation to mimic two normal season cycles to speed up the selection followed by enzyme-linked immunosorbent analysis and polymerase chain reaction analysis. No symptoms were observed on either cultivar and presence of the virus was not detected by either analysis method. Additionally, three trees per accession were planted in a production area heavily infected with PPV. These trees were surrounded by infected, susceptible cultivars and inoculated by chip budding in the open field with the Dideront-type PPV isolate (López-Moya et al., 2000). No symptoms were observed 3 years after inoculation. PPV symptoms were observed in the neighboring susceptible trees. Results showed that ‘Rafel’ and ‘Belgida’ are resistant to Dideront-type PPV isolates.

Time of bloom and floral compatibility.

Full bloom of ‘Rafel’ occurred at a similar time as ‘Ginesta’, in the last week of February, ≈1 month ahead of ‘Goldrich’ (Table 1). ‘Rafel’ had high flowering intensity, mainly localized (85%) on fruiting spurs of 2- or more year-old branches. Flower bud drop was low and the flowers were self-compatible. On the other hand, full bloom of ‘Belgida’ occurred in the second week of March, which is an average flowering date compared with its parents (Table 1). ‘Belgida’ also had high flowering intensity, mainly localized (90%) on fruiting spurs of 2 or more year-old branches. Bud drop was medium–low and flowers were self-compatible. Self-compatibility was demonstrated in the field by enclosing whole trees in insect-proof screening and in the laboratory using molecular markers from RNAs developed by Vilanova et al. (2005).

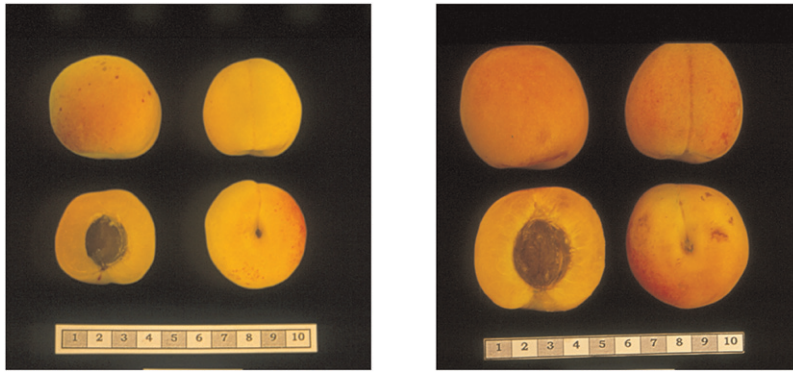


Fig. 2. 'Rafel' (left) and 'Belgida' (right) apricot fruits. Bar in centimeters.

Fruit characteristics

Maturation time. 'Rafel' and 'Belgida' are mid- to early-ripening cultivars in comparison with traditional Spanish apricot cultivars. In our experimental conditions, the ripening date average for 'Rafel' and 'Belgida' was the last week of May for 'Rafel' and 5 d later for 'Belgida' (Table 1). 'Rafel' and 'Belgida' fruits mature moderately staggered within the tree canopy and uniformly within individual fruit. Fruit cracking was low in both cultivars. Fruits of 'Rafel' are produced on fruiting spurs (100%) and mainly (85%) on fruiting spurs for 'Belgida'.

Fruit size, firmness, and color. Fruit characterizations of 'Rafel' and 'Belgida' were measured from a sample of 25 fruit from each cultivar at the stage of physiological maturity. Fruits of 'Rafel' were round with a slight asymmetry, a slightly sunken suture, and a smooth pubescent surface (Fig. 2). The fruit

surface ground color was yellow with a solid red blush of medium intensity covering $\approx 35\%$ of the surface. The flesh was yellow to light orange. The pit was free. 'Rafel' fruits averaged 48 mm in diameter (cheek to cheek), 58 g weight, with a firmness of $1.8 \text{ kg}\cdot\text{cm}^{-2}$. Fruits of 'Belgida' were rounded-ovalate with a slight asymmetry, a medium sunken of suture, and a smooth pubescent surface. The surface of the fruit had a light orange ground color with solid red blush covering $\approx 20\%$ of the surface. The flesh was orange and clingstone. 'Belgida' fruits averaged 48.5 mm in diameter, 69 g weight, with a firmness of $4.6 \text{ kg}\cdot\text{cm}^{-2}$.

Organoleptic characteristics. At the physiological maturity stage, 'Rafel' and 'Belgida' fruits showed soluble solids concentration of 14.5 and 14%, respectively, and titratable acidity of 29.0 and 27.0 $\text{g}\cdot\text{L}^{-1}$ malic acid, respectively (Table 1). 'Rafel' and 'Belgida'

fruits had an excellent taste, juiciness, and typical apricot aroma.

Availability

The Rafel and Belgida cultivars are protected by the Spanish Office for Varietal Protection with the registration numbers 2001/4347 and 2007/4737, respectively. Virus-tested plants are available from authorized nurseries in Spain registered at <http://www.agroalimed.es>. The plants are tested and free of the following viruses: PPV, *Prune dwarf ilarvirus*, *Prunus necrotic ringspot ilarvirus*, *Apple chlorotic leaf-spot closterovirus*, and *Apple mosaic ilarvirus*.

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