HortScience 39(6):1500–1502. 2004.

'Valencia': A New Pepino (*Solanum muricatum*) Cultivar with Improved Fruit Quality

Adrián Rodríguez-Burruezo, Jaime Prohens, and Fernando Nuez
Centro de Conservación y Mejora de la Agrodiversidad Valenciana, Universidad Politécnica de Valencia, Camino de Vera 14, 46022, Valencia, Spain

Additional index words. breeding program, yield, soluble solids, aroma

Pepino (*Solanum muricatum* Aiton), also known as melon-pear, is a vegetatively propagated vegetable crop grown for its juicy and aromatic fruit. Great variation in fruit weight, shape, and color can be found among cultivars of pepino (Anderson et al., 1996; Heiser, 1985). Despite being an important crop in Pre-Columbian times in the Andean region, it has not achieved the same relevance as other New World cultivated Solanaceae such as tomato, pepper or potato (Prohens et al., 1996). However, during the last two decades, its cultivation has spread to many countries as a crop for diversifying greenhouse horticultural production.

Two types of pepino cultivars can be distinguished: sweet fruit with at least 8% soluble solids concentration (SSC) and a fruity intense aroma appropiate for use as a dessert fruit for which fruit sweetness is a key factor (El-Zeftawi et al., 1988); cultivars producing less sweet but more firm-fleshed fruit with a grassy (green) aroma suitable for use in salads in the same way as cucumber (*Cucumis sativus* L.).

In several areas of the Mediterranean region, pepino (in particular sweet cultivars) is being introduced as a new crop (Prohens et al., 2000). The main limitation to pepino production is the availability of sweet pepino cultivars with combined high yield and good fruit quality. Clones producing fruit with high SSC (8% to 10%) suited for use as a dessert fruit, usually have a low yield (< 20 t·ha^{-1}); in contrast, high yielding clones (>40 t·ha^{-1}) have an unacceptably SSC (<7%) (Rodríguez-Burruezo et al., 2002).

A research group of the Centro de Conservación y Mejora de la Agrodiversidad Valenciana (COMAV) of the Universidad Politécnica de Valencia has conducted a pepino breeding program since the early 1990s. The clonal hybrid cultivar Valencia is a result of this program. 'Valencia' has a higher fruit yield and better fruit quality than other current sweet pepino cultivars, and is adapted to a wide range of environmental conditions.

Received for publication14 May 2003. Accepted for publication 21 Jan. 2004. This contribution was financed by CICYT (AGF99-0552), INIA (OT99-002-C2-2) and Generalitat Valenciana (GV01-92). A. Rodríguez-Burruezo thanks MECD for a predoctoral research grant. The authors thank Prof. S. Nitz and Dipl. Ing. H. Kollmannsberger from Technische Universität München for help with analysis of volatile compounds.

Origin

The 'Valencia' clonal hybrid was developed from the cross 'Sweet Long' (also denominated *Sm-29*) x *Sm-26*. 'Sweet Long' was selected for its high fruit quality and dessert fruit. The *Sm-26* clone was selected from a cross between an Ecuadorian clone (called *152*) and clone *6-7*, which is a previous seedling selection from the Chilean clone *A* (Fig. 1).

The parents of 'Valencia' (*Sm-26* and 'Sweet Long') were chosen for high SSC of fruit, relatively high (0.25) AFLP-estimated genetic distance (GD) (a prediction for expected highly heterotic offspring for yield traits) (Prohens and Nuez, 1999), and high heterozygosity.

Preliminary evaluations for yield and fruit quality were conducted on the offspring of cross 'Sweet Long' x *Sm-26*. Advanced evaluations on these preselected hybrid clones were carried out eventually yielding the 'Valencia' selection. Because 'Valencia' is a hybrid between two genetically distant clones, it is highly heterozygous. Therefore, to maintain the characteristics of this cultivar it must be vegetatively propagated by herbaceous stem cuttings.

Description

'Valencia' was tested in replicated greenhouse trials under standard commercial production practices for several years in two locations of the Spanish Mediterranean coast: Almenara (Castellón) and Valencia. 'Valencia' was compared in these tests to parents 'Sweet Long' and clone *Sm-26*, and cultivar Puzol. 'Puzol' is a high-yielding cultivar with low SSC.

Plants of 'Valencia' are vigorous, and maximum yields are obtained using a planting density of two to three plants/m^2, where plants are trained with vertical strings in a one-leader system. In most trials, 'Valencia' produced yields ranging from 26 to 47 t·ha^{-1}, higher and statistically significant in most cases than either parental clone (Table 1) and, occasionally, close to the high yielding 'Puzol'. Fruit of 'Valencia' ripen earlier than other pepino cultivars. The time elapsed between transplanting and first harvest ranges between 23 and 25 weeks in the autumn-winter growing season.

'Valencia' fruit weigh between 125 and 250 g (Table 1), adequate for dessert fruit. Fruit shape is elongated (Fig. 2), with a length/width ratio of 2.0 to 2.2 (1.3 for *Sm-26* and 3.0 for 'Sweet Long'). Both attributes (medium size and elongated shape) favor fruit packing and optimize box space. Fruit are attractive, with a golden color and narrow purple stripes covering less than 10% of fruit surface. The flesh also exhibits an intense yellow color (Fig. 2).

The flavor of 'Valencia' is appropriate for a dessert fruit. SSC levels of 'Valencia' fruit range from 8.6 to 10.0%, values that are higher and statistically significant in most cases than those of *Sm-26* and 'Sweet Long'. Furthermore, ascorbic acid concentration (AAC) levels are high, (between 400 and 600 mg·kg^{-1}) (Table 1). Titratable acidity (TA, mmol·kg^{-1} citric acid) values are comparable to the usual values for this species and always significantly lower than *Sm-26* (Nuez and Ruiz, 1996).

Most trials were conducted under autumn-winter growing season conditions (Prohens et al., 2000), since this is the best growing season for good fruit quality and yield (Rodríguez-

Fig. 1. Pedigree of 'Valencia'.

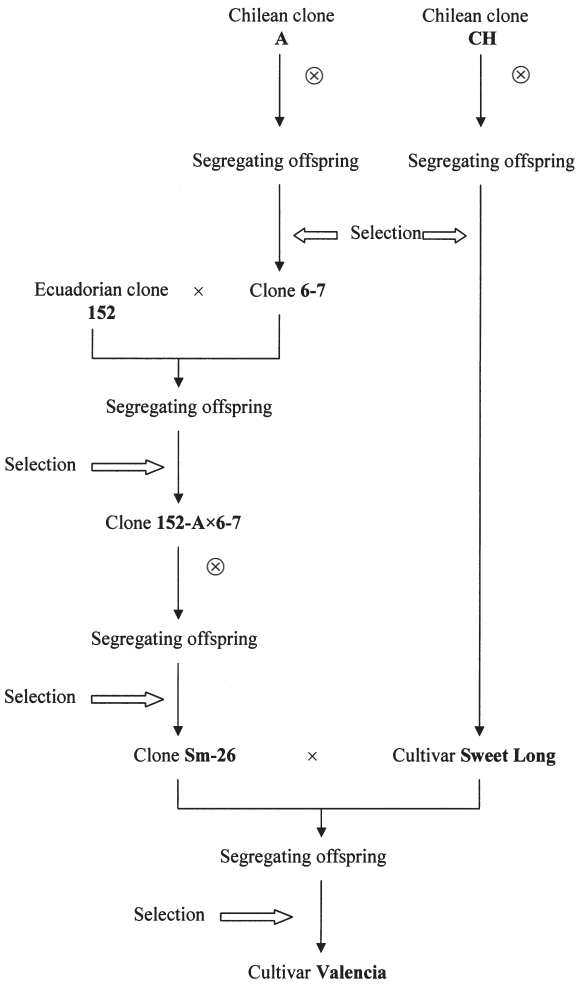

Table 1. Yield, mean fruit weight, soluble solids concentration (SSC), ascorbic acid concentration (AAC) and titratable acidity (TA) of 'Valencia', its parents ('Sweet Long' and *Sm-26*) and 'Puzol' in four greenhouse trials in Mediterranean localities of Spain: Almenara (ALM) and Valencia (VAL).

Clones	VAL Fall–winter 1999–20000	VAL Fall–winter 2000–01	VAL Fall–winter 2001–02	ALM Spring–summer 2002
Yield ($t \cdot ha^{-1}$)				
Valencia	37.9 b[z]	25.6 b	46.8 a	39.5 b
Sweet Long	19.7 c	18.5 b	29.9 b	20.1 c
Sm-26	18.0 c	0.0[y] c	22.1 b	10.5 c
Puzol	58.9 a	39.2 a	51.2 a	50.1 a
Mean fruit weight (g)				
Valencia	126 b	137 b	144 b	256 b
Sweet Long	137 b	161 b	145 b	125 b
Sm-26	119 b	111 b	116 b	157 b
Puzol	413 a	272 a	252 a	278 a
SSC (%)				
Valencia	10.0 a	8.8 a	9.7 a	8.6 a
Sweet Long	8.3 b	7.8 a	8.3 b	6.7 b
Sm-26	8.9 b	8.3 a	9.2 a	6.3 b
Puzol	5.7 c	6.3 b	7.0 c	5.1 c
AAC ($mg \cdot kg^{-1}$)				
Valencia	---	574 a	405 a	548 a
Sweet Long	---	283 b	349 b	301 b
Sm-26	---	296 b	315 b	289 b
Puzol	---	328 b	298 b	235 b
TA ($mmol \cdot kg^{-1}$)				
Valencia	---	7.6 b	8.3 b	6.6 c
Sweet Long	---	7.2 b	7.3 b	8.5 b
Sm-26	---	9.4 a	13.0 a	12.5 a
Puzol	---	7.2 b	7.0 b	8.2 b

[z]Mean values within a year separated by different letters are significantly different ($P < 0.05$) according to the Newman-Keuls test.

[y]As in 2000–01 clone, *Sm-26* did not set fruit on its own, hand-pollination with pollen from other clones was necessary to obtain fruit for evaluating fruit traits. Consequently, *Sm-26* yield for this year was considered nil.

Burruezo et al., 2002). However, 'Valencia' also exhibited good fruit quality under spring-summer growing season, which under the experimental conditions of this trial results in lower SSC levels than in autumn-winter. SSC of 'Valencia' in the spring-summer was 8.6%, while values for the other clones were lower than 7% (Table 1). Moreover, yield and AAC in spring-summer were similar to values obtained in autumn-winter, suggesting that 'Valencia' is more stable over different seasons than other cultivars.

'Valencia' fruit have a fruity and delicate aroma, with slightly green notes. This aroma is the result of a unique combination of volatiles with sensory value obtained from the parents (Table 2). 'Valencia' fruity notes are due to high levels of 3-methyl-2-buten-1-ol (prenol) and several acetates found in both parents and related to banana/pear-like aromas. β-Damascenone (the most important compound in the essential oil of rose), methoxyfuraneol (an important volatile in the aroma of strawberries and pineapple) and several lactones (with a creamy coconut/peach-like aroma) have been inherited from 'Sweet Long' and contribute to the pleasant exotic notes of 'Valencia' fruit aroma. Finally, the distinctive grassy/green notes are the result of aldehydes that have been inherited from *Sm-26* (Table 2).

'Valencia' produces a higher yield and better and more stable fruit quality than present sweet-fruited cultivars of pepino. Consequently, 'Valencia' represents a substantial improvement over presently available cultivars.

Fig. 2. Fruit of 'Valencia' hybrid clone. Fruit cluster with incipient yellow skin color (**above**) and ripe fruit (**below**).

Table 2. Concentration (ppb) of volatiles with sensory importance in the volatile fraction of 'Valencia' and its parental clones.

Compound	Sweet Long	Sm-26	Valencia
Fruity notes			
Butyl acetate	5120	1935	2780
Hexyl acetate	647	256	322
3-Methyl-2-buten-yl acetate	9063	8167	12658
3-Methyl-3-buten-yl acetate	11900	20200	16236
3-Methylbuthyl acetate	1024	668	978
3-Methyl-2-buten-1-ol (prenol)	2928	1759	2471
Pentyl acetate	37	0	90
Exotic notes			
β-damascenone	Traces	Traces	Traces
γ-decalactone	<20	0	<20
Massoialactone	128	0	100
Methoxyfuraneol	69	0	50
γ-Nonalactone	Traces	Traces	Traces
Green/grassy notes			
Hexanal	42	197	664
(E) 2-Hexenal	256	1078	3564
(E,Z) 2,6-Nonadienal	235	6061	2478
(E) 2-Nonenal	272	2961	1385
(Z) 6-Nonenal	55	3231	726

Availability

'Valencia' can be obtained through the Centro de Apoyo a la Innovación, la Investigación y la Transferencia de Tecnología, Universidad Politécnica de Valencia (CTT, UPV, Camino de Vera 14, 46022, Valencia, España; e.mail: ctt@ctt.upv.es) by a concession agreement. Material for research purposes can be obtained from Fernando Nuez, UPV, Camino de Vera 14, 46022 Valencia, Spain; e.mail: fnuez@btc.upv.es.

Literature Cited

Anderson, G.J., R.K. Jansen, and Y. Kim. 1996. The origin and relationships of the "pepino", *Solanum muricatum* (*Solanaceae*). Econ. Bot. 50:369–380.

El-Zeftawi, B.M., L. Brohier, L. Dooley, F.H. Goubran, R. Holmes, and B. Scott. 1988. Some maturity indices for tamarillo and pepino fruit. J. Hort. Sci. 63:163–169.

Heiser, C.B. 1985. Of plants and people. Univ. Okla. Press, Norman.

Nuez, F. and J.J. Ruiz. 1996. El pepino dulce y su cultivo. FAO, Rome.

Prohens, J. and F. Nuez. 1999. Strategies for breeding a new greenhouse crop, the pepino (*Solanum muricatum* Aiton). Can. J. Plant Sci. 79:269–275.

Prohens, J., J.J. Ruiz, and F. Nuez. 1996. The pepino (*Solanum muricatum*, *Solanaceae*): A "new" crop with a history. Econ. Bot. 50:355–368.

Prohens, J., J.J. Ruiz, and F. Nuez. 2000. Growing cycles for a new crop, the pepino, in the Spanish Mediterranean. Acta Hort. 523:53–60.

Rodríguez-Burruezo, A., J. Prohens, and F. Nuez. 2002. Genetic analysis of quantitative traits in pepino (*Solanum muricatum*) in two growing seasons. J. Amer. Soc. Hort. Sci. 127:271–278.