

The Inheritance of Parthenocarpy and Associated Traits in Pepino

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ABSTRACT. Parthenocarpy in pepino (*Solanum muricatum* Aiton) can overcome poor fruit set caused by pollination deficiencies. In two families involving a parthenocarpic parent (P_p), a nonparthenocarpic parent (P_{np}), and the generations $P_p \otimes P_{np}$, F_1 , BC_p , BC_{np} , and F_2 , we studied three traits that are often confused: parthenocarpy, efficiency of parthenocarpy over seeded fruit set, and the degree of facultative parthenocarpy. Plants were trained to two stems (A and B). On stem A we emasculated six flowers per truss; three were pollinated and the other three were left unpollinated. We considered that a plant was parthenocarpic if it set one or more seedless fruit similar in size and shape to those seeded, and nonparthenocarpic if it only set seeded fruit. The efficiency of parthenocarpy over seeded fruit set was measured with a parthenocarpic fruit set index (PFSI), defined as twice the ratio of seedless to total fruit on stem A. In stem B all flowers were left to self-pollinate naturally. We quantified the degree of facultative parthenocarpy as the percentage of seedless fruit of the total. Parthenocarpy is controlled by one dominant gene for which we propose the symbol P . Parthenocarpic fruit set in the homozygote PP was as efficient as the seeded one (PFSI ≈ 1); in the heterozygote Pp it was less efficient (PFSI ≈ 0.6). The dose of gene P explained the differences found between generations for the PFSI and made it possible to predict the PFSI of a given generation from the proportions of PP and Pp genotypes. Although for the Pp hybrids parthenocarpic fruit set was less efficient than the seeded one, their ability to set seedless fruit in conditions of deficient pollination, together with their high degree of heterosis, makes them agronomically useful. The degree of facultative parthenocarpy seemed to be a complex trait with low heritability. In environments unfavorable for pollination, parthenocarpic genotypes set seedless fruit, thus ensuring crop production and yield stability. Using the degree of facultative parthenocarpy to classify plants for parthenocarpy is not recommended. Developing parthenocarpic cultivars can help spread this crop and stabilize yields.

The pepino (*Solanum muricatum*) is an Andean herbaceous crop grown for its edible fruit. It is an evergreen vegetatively propagated from stem cuttings and usually grown as an annual (Nuez and Ruiz, 1996). The fruit weigh 100 to 300 g and are consumed, when ripe, as a fresh dessert fruit and, to a lesser extent, when mature-green, as a vegetable for salads. Recently, the pepino has stimulated an increasing interest in the exotic fruit markets of Europe, North America, and Japan, and the production and marketing of pepinos is rising. Despite its potential as a new crop for many mild-temperate, frost-free areas around the world, most attempts to spread its cultivation outside the Andes have not been successful, mainly because of poor fruit set (National Research Council, 1989; Prohens et al., 1996).

The pepino is self-compatible and autogamous (Mione and Anderson, 1992). Although it blooms profusely (10 to 40 flowers per truss) it usually sets only 0 to 3 fruit per truss (Burge, 1989), even in favorable conditions. Low pollen fertility and release are major factors that cause a lack of fruit set (Ruiz et al., 1996). Pollen fertility is highly variable and is affected by many environmental factors, especially temperatures >30 °C, that may lead to loss of viability (Ercan and Akilli, 1996; Grigg et al., 1988; Ruiz et al., 1996). Lack of pollen shedding also limits fruit set if there is little flower movement (Burge, 1989; Nuez and Ruiz, 1996). Selection efforts for clones that undergo efficient pollination and fertilization processes under adverse conditions are difficult since, similar to tomato (Fernández-Muñoz et al., 1995), they seem to have low

heritability and complex inheritance. However, some pepino clones set fruit without pollination because they are parthenocarpic.

Vegetative parthenocarpy in the pepino was reported many years ago (Bailey, 1891; Nanetti, 1912). In some clones parthenocarpy is obligate due to male sterility, while in others it is facultative, yielding seeded fruit upon successful pollination and fertilization (Murray et al., 1992). Parthenocarpic clones are more productive than the nonparthenocarpic ones due to their ability to set fruit in a wider range of conditions, especially when temperatures are high during fruit set (Ruiz et al., 1992; Ruiz and Nuez, 1993). Developing parthenocarpic cultivars could expand pepino cultivation to new regions of the world.

When dealing with parthenocarpy, terminology is often confusing. We consider that in this work it is important to clarify and separate the following three terms:

PARTHENOCARPY. A plant is parthenocarpic if it is able to set one or more seedless fruit similar in size and shape to seeded fruit (George et al., 1984), irrespective of the total number of seedless fruit set. Parthenocarpy is therefore a qualitative trait and a plant can only be one or other—parthenocarpic or nonparthenocarpic. However, determining parthenocarpy in the pepino, as with the tomato (Cuartero et al., 1987), presents some difficulties. Parthenocarpic genotypes may bear all fruit seeded if the flowers are pollinated (Burge, 1989). On the other hand, without pollination, a nonparthenocarpic clone may set a few seedless fruit (accidental parthenocarpy) (Murray et al., 1992; Ruiz et al., 1994). In tomato, accidental parthenocarpy is attributed to the accumulation of ample carbohydrate reserves when conditions do not allow fruit set (George et al., 1984). Both situations affect the expression of parthenocarpy (Nuez and Ruiz, 1996) and can hinder the identification of parthenocarpic and nonparthenocarpic genotypes. This problem may be overcome by using controlled pollination in emasculated flowers.

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EFFICIENCY OF PARTHENO-CARPY OVER SEEDED FRUIT SET. This term refers to the relative ability of unpollinated flowers to set seedless fruit compared to pollinated fruit (seeded). This can be studied with an experimental design that allows the development of seedless and seeded fruit under the same conditions. Although this trait is intimately related to the parthenocarpy, it is much more complex, as it does not depend only on the development of seedless fruit set, but also on the development of seeded fruit. Unlike parthenocarpy, it is not a qualitative trait but a quantitative one. It can be expressed as a ratio between seedless and total (seedless + seeded) fruit when, in a given truss, the number of pollinated and unpollinated flowers is the same. A higher percentage of seedless fruit indicates more efficiency of parthenocarpic fruit set. This trait indirectly affects the crop yield in unfavorable pollination conditions. Its genetic control, *a priori*, may depend on more genes than those related to parthenocarpy.

DEGREE OF FACULTATIVE PARTHENO-CARPY. This is defined as the percentage of seedless fruit of the total under natural pollination and is also a quantitative trait. The degree of facultative parthenocarpy is very dependent on environmental conditions (Cuartero et al., 1987; Lin et al., 1983), as it is influenced by all biotic and abiotic factors that affect the pollination, fecundity, and fruit development processes. In this way, maximum temperatures >30 °C reduce pollen viability in most pepino clones, increasing the degree of facultative parthenocarpy (Ruiz et al., 1996). The facultative character of parthenocarpy allows reproduction by seed of interesting materials and the development of hybrids.

Material and Methods

PLANT MATERIAL. We studied parthenocarpy in two families (Family 1 and Family 2). Each family included a strong parthenocarpic parent clone (P_p), a nonparthenocarpic parent clone (P_{np}), the parents selfed ($P_p \otimes$ and $P_{np} \otimes$, respectively) except the $P_p \otimes$ for the Family 2, a cloned F_1 , the backcrosses of the F_1 to each parent (BC_p and BC_{np}), and the F_2 . P_p clones (NZ/1 for Family 1 and NZ/2 for Family 2) are full-sibs obtained from the selfing of an original parthenocarpic plant. Parthenocarpy in NZ/1 is facultative, while in NZ/2 it is obligate because of male sterility, so the $P_p \otimes$ for Family 2 could not be obtained. P_{np} clones (OV-8 for Family 1 and 6-21 for Family 2) have a different genetic background. OV-8 is a Chilean cultivar and 6-21 is a selection obtained from seed in our program.

All plant material was grown in Valencia (Spanish Mediterranean). Plants from the P_p , P_{np} , and F_1 generations were obtained from softwood cuttings taken from mother plants on 3 Nov. 1993. They were rooted in vermiculite and transplanted to small (9 × 9 × 11-cm) pots filled with a standard potting mix before transplanting. Plants from the $P_p \otimes$, $P_{np} \otimes$, BC_p , BC_{np} , and F_2 were obtained from seeds germinated *in vitro* (Cornejo et al., 1990) in June and July. In August and September they were transplanted to the same type of pots aforementioned. On 3 Nov. 1993, one cutting was taken from each plant and grown as described above for the P_p , P_{np} , and F_1 generations.

On 4 Feb. 1994, all plants were transplanted in a fiberglass greenhouse. They were arranged in a completely randomized design and spaced at 0.5 m within the row and 1 m between rows. Plants were pruned to two stems (A and B) and trained with vertical wires. Periodic pruning of the laterals was necessary to maintain the two leader system. Maximum temperatures during fruit set ranged from 23 to 35 °C and minimum varied from 8 to 19 °C. These temperatures are normal during fruit set in a spring and summer cycle in Mediterranean climates.

IDENTIFICATION OF PARTHENO-CARPIC PLANTS. In stem A, all flowers were removed except six in each of the first four trusses of each plant. One day before anthesis flowers, were emasculated and three were pollinated with pollen from a very fertile nonparthenocarpic clone (stainability >75%) grown in a chamber at a maximum temperature of 25 °C, while the other three were left unpollinated. Each flower was tagged to indicate the pollination treatment received. Pollinated flowers either set seeded fruit or did not set; unpollinated flowers either set seedless fruit or did not set. We did not find pseudofruit, which in the tomato can sometimes be confounded with true parthenocarpic fruit (Cuartero et al., 1987). A plant was considered parthenocarpic if it set one or more seedless fruit similar in size and shape to those seeded, or nonparthenocarpic if only seeded fruit were set.

EFFICIENCY OF PARTHENO-CARPY OVER SEEDED FRUIT SET. This was determined on the same stem (A) and trusses used for identifying parthenocarpy. Under our experimental conditions, there were three pollinated and three unpollinated flowers (all six emasculated) subjected to the same environmental conditions. Therefore, the relative number of seedless fruit of the total indicated the efficiency of parthenocarpy over seeded fruit set. We have studied this efficiency by developing a parthenocarpic fruit set index (PFSI), defined as twice the ratio seedless to total fruit. When seedless fruit set is as efficient as the seeded fruit set, the final number of both types of fruit will be the same (PFSI = 1). When the seedless fruit set is less efficient than the seeded one, the number of seedless fruit is lower than the number of seeded ones ($0 < PFSI < 1$), and when it is more efficient the opposite is true ($1 < PFSI \leq 2$).

We have studied the relationship between the inheritance of parthenocarpy and the efficiency of parthenocarpy over seeded fruit set. From the PFSI values for parthenocarpic plants in P_p and F_1 generations we have developed a model that explains the efficiency of parthenocarpic fruit set in any generation. In both families we estimated the PFSI values for each parthenocarpic genotypic class from means of the available generations by weighted

Table 1. Segregation of parthenocarpy for two families derived from one parthenocarpy, source and goodness-of-fit tests for control by a single dominant gene.

	Plants (no.) ^x		Expected ratio	χ^2	P
	P	NP			
Family 1					
P_p	6	0	1:0	---	1.00
$P_p \otimes$	27	0	1:0	---	1.00
P_{np}	0	21	0:1	---	1.00
$P_{np} \otimes$	0	27	0:1	---	1.00
F_1	6	0	1:0	---	1.00
BC_p	19	0	1:0	---	1.00
BC_{np}	9	12	1:1	0.43	0.51
F_2	56	15	3:1	0.57	0.45
Family 2 ^y					
P_p	9	0	1:0	---	1.00
P_{np}	0	6	0:1	---	1.00
$P_{np} \otimes$	0	14	0:1	---	1.00
F_1	10	0	1:0	---	1.00
BC_p	37	0	1:0	---	1.00
BC_{np}	12	12	1:1	0.00	1.00
F_2	55	23	3:1	0.84	0.36

^xP = parthenocarpic, NP = nonparthenocarpic.

^yGeneration $P_p \otimes$ for this family could not be obtained due to male sterility of P_p .

Table 2. Values observed (mean \pm SE) for the parthenocarpic fruit set index (PFSI) in plants classified as parthenocarpic (*PP* and *Pp* genotypes); coefficients (c_1 and c_2)^z of the parameters (f_1 and f_2)^y for the model proposed to explain the observed PFSI values; and, expected PFSI values (mean \pm SE) for the means of parthenocarpic plants in each generation.

Generation	Observed PFSI		Coefficients		Expected PFSI ^x	
	Family 1	Family 2	c_1	c_2	Family 1	Family 2
P_p	1.07 \pm 0.06	0.98 \pm 0.07	1	0	0.98 \pm 0.03	1.02 \pm 0.06
$P_p \otimes$	0.92 \pm 0.04	---	1	0	0.98 \pm 0.03	---
F_1	0.61 \pm 0.07	0.58 \pm 0.06	0	1	0.62 \pm 0.04	0.57 \pm 0.03
BC_p	0.85 \pm 0.08	0.80 \pm 0.06	1/2	1/2	0.80 \pm 0.04	0.79 \pm 0.05
BC_{np}	0.53 \pm 0.07	0.53 \pm 0.05	0	1	0.62 \pm 0.04	0.57 \pm 0.03
F_2	0.80 \pm 0.05	0.75 \pm 0.04	1/3	2/3	0.74 \pm 0.04	0.72 \pm 0.05

^z c_1 and c_2 represent, respectively, the proportion of genotypes *PP* and *Pp* on the total of parthenocarpic plants in a given generation.

^y f_1 and f_2 represent, respectively, the estimated values for PFSI in each family for the *PP* and *Pp* genotypes.

^xExpected PFSI (generation) = $c_1 f_1 + c_2 f_2$; e.g., PFSI (F_2) = $1/3 f_1 + 2/3 f_2$.

least squares, taking as weights the reciprocal of the squared standard error of each mean. Comparison of the observed generation means with expected values derived from the estimates of the PFSI was effected assuming the sum of squares minimized in the fitting process to be distributed as a chi-square, with degrees of freedom being the number of generations in which the estimation has been performed less the number of genotypic classes for which values were estimated (Fisher, 1946).

DEGREE OF FACULTATIVE PARTHENOCAIRY. The degree of facultative parthenocarpy (DFP) was studied on stem B of each plant classified as parthenocarpic. In this stem, flowers were allowed to self-pollinate naturally, and the number of seeded and seedless fruit was recorded. DFP was quantified as $100 \times (\text{seedless}/\text{total fruit})$. We also evaluated pollen fertility and pollen release of each plant. Pollen fertility was estimated by staining with a carmine solution and pollen release was scored on a scale from 0 (no release) to 4 (high release) (Ruiz et al., 1996).

Results

IDENTIFICATION AND INHERITANCE OF PARTHENOCAIRY. The identification method proved to be adequate. For both families the P_p , $P_p \otimes$, F_1 , and BC_p were parthenocarpic; P_{np} and $P_{np} \otimes$ were nonparthenocarpic; and in the BC_{np} and F_2 the ratio parthenocarpic to nonparthenocarpic plants fitted 1:1 and 3:1 distributions, respectively (Table 1). These results show that in both families parthenocarpy is controlled by a single dominant gene for which we propose the symbol *P*.

EFFICIENCY OF PARTHENOCAIRY OVER SEEDED FRUIT SET—PFSI. There were no differences between the two families in the PFSI values for parthenocarpic plants (Table 2). However, differences between different generations within each family were evident. Particularly, values for the PFSI in F_1 generations were much lower than those observed in the P_p , suggesting that there is a major contribution of the gene dose of *P* to the PFSI values. When studying the $P_p \otimes$ generation, we found segregation for several characters (data not shown), as the clone P_p is not a pure line. However, PFSI values were very similar to those of P_p , confirming the effect of the dose of *P* on PFSI. In more detail, in each of the trusses of genotypes homozygous *PP* (generations P_p and $P_p \otimes$) we found a similar number of seedless and seeded fruit, although total fruit set in the upper trusses diminished (Table 3). In the heterozygote *Pp* (F_1 and parthenocarpic plants of BC_{np}) we found a similar number of total fruit to those found on the homozygotes; however, in each of the trusses studied, the number of seedless fruit was always lower than the number of seeded ones. This suggested a major effect of the dose of *P* on the efficiency of parthenocarpy

over seeded fruit set. However, categorizing individual parthenocarpic plants in heterozygotes or homozygotes by their PFSI seemed unrealistic because PFSI showed a continuous variation in the segregating generations, and even in the nonsegregating generations a considerable variation between individual plants was found. This hampered the classification of individual plants from segregating generations in discontinuous classes (*PP* and *Pp*).

Could the PFSI observed values in the segregating generations be explained by the expected proportions of parthenocarpic homozygotes and heterozygotes? If we call f_1 = PFSI of the homozygote *PP* and f_2 = PFSI of the heterozygote *Pp*, mean PFSI values of parthenocarpic plants expected in any generation will be obtained as a sum of the products of coefficients c_1 and c_2 by the respective parameters (f_1 and f_2). Coefficients c_1 and c_2 , respectively, represent the proportion of genotypes *PP* and *Pp* on the total of parthenocarpic plants in a given generation. For example, PFSI(F_2) = $1/3 f_1 + 2/3 f_2$. From this model and the observed PFSI, we obtained by least squares regression the values of both parameters. Values for f_1 were 0.98 \pm 0.03 for Family 1 and 1.02 \pm 0.06 for Family 2, while for f_2 values were 0.62 \pm 0.04 for Family 1 and 0.57 \pm 0.03 for Family 2, coinciding with those expected for generations P_p and F_1 (Table 2). Expected values for each segregating generation are very similar to those observed. When the model is validated, values of the chi-square for the goodness of fit are not significant ($P > 0.05$) in any of both families.

DEGREE OF FACULTATIVE PARTHENOCAIRY. Evaluation of plants classified as parthenocarpic in natural self-pollination resulted in a degree of facultative parthenocarpy mean values ranging from 17.1% to 100% depending on the generation studied (Table 4). The degree of facultative parthenocarpy was negatively correlated with pollen fertility ($r = -0.96$; $P < 0.001$) and release ($r = -0.91$; $P < 0.001$). Pollen fertility and release in the families studied seemed to have a complex pattern of inheritance with several major genes and modifiers involved (data not shown). As pollen fertility and release were highly variable in segregating generations, highly

Table 3. Mean number of seedless and seeded fruit on each truss in *PP* (generations P_p + $P_p \otimes$) and *Pp* (generations F_1 + parthenocarpic plants of BC_{np}) genotypes.

	<i>PP</i>			<i>Pp</i>		
	Seedless	Seeded	Total	Seedless	Seeded	Total
1 st Truss	0.95	0.98	1.93	0.43	1.16	1.59
2 nd Truss	0.40	0.50	0.90	0.27	0.78	1.05
3 rd Truss	0.48	0.38	0.86	0.41	0.57	0.97
4 th Truss	0.24	0.26	0.50	0.14	0.38	0.51
Total	2.07	2.12	4.19	1.25	2.89	4.14

Table 4. Values (mean \pm SE) for the degree of facultative parthenocarpy (DFP), pollen fertility, and pollen release of plants classified as parthenocarpic.

Plant	DFP (%)	Pollen fertility (%)	Pollen release
Family 1			
P _p	80.3 \pm 10.0	25.8 \pm 7.5	1.50 \pm 0.22
P _p Q	39.5 \pm 7.2	53.4 \pm 5.9	2.19 \pm 0.16
F ₁	48.5 \pm 4.4	30.8 \pm 5.1	1.67 \pm 0.21
BC _p	69.3 \pm 9.0	26.2 \pm 7.7	1.63 \pm 0.16
BC _{np}	22.6 \pm 10.1	65.5 \pm 12.0	2.56 \pm 0.18
F ₂	70.2 \pm 4.6	17.1 \pm 3.7	1.10 \pm 0.10
Family 2			
P	100.0 \pm 0.0	0.0 \pm 0.0	0.00 \pm 0.00
F ₁	17.1 \pm 7.9	69.3 \pm 8.2	2.30 \pm 0.30
BC _p	53.0 \pm 7.2	47.3 \pm 6.5	1.51 \pm 0.16
BC _{np}	27.7 \pm 8.9	65.4 \pm 10.0	2.42 \pm 0.23
F ₂	58.5 \pm 5.3	35.1 \pm 4.6	1.55 \pm 0.12

fertile plants classified as parthenocarpic on stem A only set seeded fruit. On the contrary, several low fertile or male-sterile plants classified as nonparthenocarpic set one or a few seedless fruit (accidental parthenocarpy).

Discussion

Pollination and fecundity processes in pepino are sensitive to environmental conditions, especially high temperatures (Grigg et al., 1988; Hermann, 1987; Ruiz et al., 1996), restricting the production range of this crop (Prohens et al., 1996). Usually, growing cycles must be planned so that fruit set takes place in an adequate range of temperatures (minimum 10 °C and maximum 25 °C). Parthenocarpic cultivars circumvent the need for pollination and fertilization to set fruit and permit successful production in a wider range of temperatures (Murray, 1992; Nuez and Ruiz, 1996). The parthenocarpic parents—NZ/1 and NZ/2—used in this work have a strong tendency to set parthenocarpic fruit at high temperatures.

According to Nitsch (1970), a plant is parthenocarpic if it exceeds a threshold in the concentration of growth regulators during a critical period at anthesis. We have found that, in the materials studied, *PP* and *Pp* genotypes are parthenocarpic, suggesting that the threshold of growth regulators necessary for fruit set and development of seedless fruit is passed in both genotypes. Therefore, gene *P* is dominant. However, differences between *PP* and *Pp* genotypes in the concentration of growth regulators could affect the efficiency of parthenocarpy over seeded fruit set. Although parthenocarpy is controlled by a single gene, the efficiency of parthenocarpy over seeded fruit set may have a more complex genetic control, as many other factors may affect this trait (Murray et al., 1992). However, in this study we found that the differences observed between different generations in the efficiency of parthenocarpy over seeded fruit set can be explained to a great extent by the dose of gene *P*. We found that the PFSI of any generation can be predicted if the proportions of *PP* and *Pp* genotypes in this generation are known. In the homozygous *PP*, the PFSI = 1, so in these genotypes parthenocarpic fruit set is as efficient as seeded fruit set. In the heterozygotes *Pp*, the PFSI is only \approx 0.6. These results suggest that the dose of gene *P* considerably affects growth regulator levels, so that the parthenocarpic fruit set is more effective when the dose of gene *P* is higher. Reduced fruit set in the upper trusses indicates a fruit load effect on fruit set. However, the

ratio of seeded to seedless fruit did not vary among trusses and, therefore, the efficiency of parthenocarpy over seeded fruit set was similar in all trusses.

Pepino hybrids are highly productive and have a high yield stability (Acebrón, 1997; Ruiz and Nuez, 1997). As the genetic control of parthenocarpy is dominant, the development of *Pp* hybrids only requires one parthenocarpic parent. Although in the *Pp* genotypes seedless fruit set was less efficient than the seeded one, their ability to set fruit in conditions of deficient pollination when compared to the nonparthenocarpic ones makes them agronomically useful for this characteristic. Ruiz et al. (1996) compared fruit set of a nonparthenocarpic clone, a parthenocarpic clone homozygous *PP*, and its hybrid at two temperatures (25 and 35 °C). At 25 °C all clones had a good fruit set. However, at 35 °C the nonparthenocarpic clone set no fruit, while the parthenocarpic parent and the hybrid had good yields.

We found that the degree of facultative parthenocarpy is affected by pollen fertility and release. Probably other biotic and abiotic factors also affect this trait, suggesting that its genetic control is complex. In environments with good pollination conditions, the degree of facultative parthenocarpy is low (Burge, 1989; Ercan and Akilli, 1996; Morley-Bunker, 1983) and the parthenocarpic and nonparthenocarpic genotypes set seeded fruit. However, when conditions for pollination are unfavorable, fruit set of nonparthenocarpic genotypes diminishes, while in the parthenocarpic ones seedless fruit set compensates the lack of seeded fruit set and the degree of facultative parthenocarpy increases (Ruiz et al., 1996).

Variability of the degree of facultative parthenocarpy with environmental conditions (Cuartero et al., 1987) has several technical implications for pepino breeding. Even in strongly parthenocarpic genotypes, seed set is possible if they are grown in favorable environments (Burge et al., 1989; Ruiz et al., 1996). However, due to its variability, the use of the degree of facultative parthenocarpy for identifying parthenocarpic plants is not advisable. Plants with high pollen fertility and release in stem A (emasculated flowers) proved able to set seedless fruit and, therefore, are parthenocarpic; on stem B (natural self-pollination) they only set seeded fruit. According to their degree of facultative parthenocarpy (=0) these plants would have been mistakenly classified as nonparthenocarpic. If the mode of inheritance of parthenocarpy had been studied under natural pollination, several misleading conclusions might have been drawn.

From a breeding standpoint, selection for highly productive parthenocarpic genotypes can be performed under conditions of high temperature. Under these conditions, nonparthenocarpic plants either will set no fruit or will set one or two seedless fruit (accidental parthenocarpy) and therefore will be discarded. When grown under normal conditions, the selected parthenocarpic genotypes can either have a good fertility and set seeded fruit or have low fertility and set seedless fruit. This is a point of minor importance, as pepino seeds are soft, tiny, edible, and, because they are concentrated in the core, easily removed if desired.

In conclusion, in this work we separated and clarified three terms that often are confused: parthenocarpy, efficiency of parthenocarpy over seeded fruit set, and degree of facultative parthenocarpy. Our results show that parthenocarpy in the pepino has a simple mode of inheritance. Development of parthenocarpic clones can contribute to a wider adaptation of pepino in areas with environments different from those of its native home and to stabilize yields.

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