RESEARCH

ANALYSIS OF AGROMORPHOLOGICAL DESCRIPTORS TO DIFFERENTIATE BETWEEN DUKE CHERRY (*Prunus* x *gondouinii* (Poit. & Turpin) Rehd.) AND ITS PROGENITORS: SWEET CHERRY (*Prunus avium* L.) AND SOUR CHERRY (*Prunus cerasus* L.)

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ABSTRACT

The rapid identification of the hybrids between sweet cherry (*Prunus avium* L.) and sour cherry (*Prunus cerasus* L.) is not easy. In order to resolve this problem, 18 Spanish sweet, sour and duke cherry cultivars were surveyed and characterized using 43 agromorphological descriptors evaluated in flowers, leaves, dormant 1-yr-old shoots, fruits, and trees during 2005 and 2006. Based on quantitative parameters, ANOVA and stepwise discriminant analysis (SDA) were carried out. For qualitative descriptors, statistical comparisons were done by means of the chi-square (χ^2) test. As result of the study, two quantitative (titratable acidity and number of lenticels) and six qualitative descriptors (shape of the central and lateral lobes in the internal bracts of the flower fascicles, leaf shape and margin, pubescence in the veins of the lower side of the leaf, and type of sulci of the seed coat) were identified as differential parameters in *P. avium*, *P. cerasus* and *P.* x *gondouinii* (Poit. & Turpin) Rehd. Also, another four qualitative descriptors (petal coloration at the end of blooming, leaf stipule type, and seed shape and viability) were found to be useful for easy differentiation between sour and duke cherry. None of these parameters has been employed previously to discriminate among sweet, sour and duke cherry.

Key words: Rosaceae, characterization, quantitative parameters, qualitative parameters, SDA analysis.

INTRODUCTION

The sweet cherry (*Prunus avium* L., Rosaceae, $2n = 2x = 16$) is a deciduous and allogamous species that generally exhibits self-incompatibility. It is cultivated for its edible fruits and wood. The sour cherry (*P. cerasus* L., Rosaceae, $2n = 4x = 32$) is cultivated for its sour and succulent fruit. Sour cherry fruits are mostly used for industrial preserves (jam, liquor, and other uses). The sour cherry is also used as sweet cherry rootstock. Both species, which originated around the Black Sea and the Caspian Sea, are cultivated in temperate and cold regions. Both the sweet and sour cherry spread slowly from their origin to other regions via human and animal migrations (Moreno and Manzano, 2002). By 2007, the world production of sweet cherry and sour cherry was 3.27 million tonnes, being Turkey, USA, the Russian Federation, Ukraine and Iran the most important producing countries (approximately 55% of world cherry production). In 2007, Spain produced 72 600 t of sweet cherries and 2200 t of sour cherries (FAO, 2007). The main sweet and sour cherry producing areas in Spain are the Jerte river valley and neighbouring regions, Aragón-Catalonia, high altitude areas of Jaén-Granada, and the mountains of the Valencian Community.

In Spain, both species coexist in the northwest region of the country (Figure 1). The duke cherry (*Prunus* x *gondouinii* (Poit. & Turpin) Rehd., Rosaceae, $2n = 4x = 32$) is considered a taxon stemming from the fertilization of the sour cherry by unreduced gametes of the sweet cherry (Iezzoni *et al.*, 1990). Owing to disturbances during meiosis these hybrids are often sterile, but they are propagated clonally. The tree, flower, leaf and fruit characteristics of duke cherry trees are intermediate between those of their progenitors (Tavaud *et al.*, 2004; Pérez *et al.*, 2007). Identification of this taxon is always difficult because of its phenotypic variability, which

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Received: 05 September 2008.
Accepted: 31 March 2009.

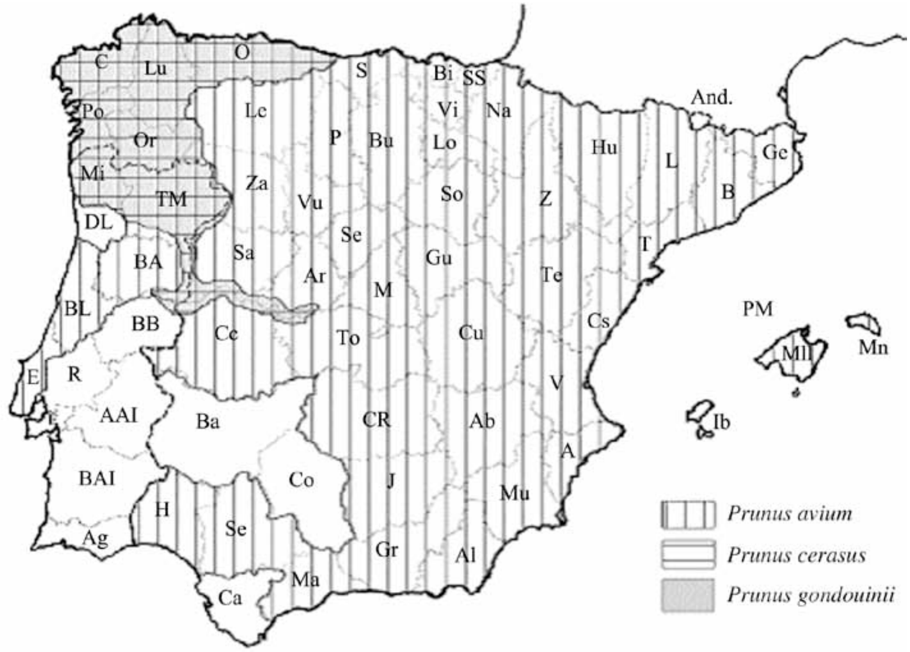


Figure 1. Distribution map of *Prunus avium*, *Prunus* x *gondouinii*, and *Prunus* cerasus in the Iberian Peninsula.

ranges between the morphological traits of *P. cerasus* and *P. avium*. Recently, many characterization studies have been carried out in sweet and sour cherry such as those of Moreno *et al*. (2001), Gella *et al*. (2001), and Cordeiro *et al*. (2008). However, to date no exhaustive studies addressing botanical and agromorphological descriptions in duke cherry have been published and no detail references can be found in the literature. Only Tavaud *et al*. (2004) fingerprinted 12 cultivars of duke cherry using 75 amplified fragment length polymorphism (AFLP) markers, and from the point of view agromorphological Pérez *et al*. (2007) were successful in identifying four cultivars of this taxon previously considered to be sour cherry trees.

The aim of the present study was to identify the characters of differential diagnostic value in duke cherry (*P.* x *gondouinii*) and its progenitors: the sweet cherry (*P. avium* L.) and the sour cherry (*P. cerasus* L.).

MATERIALS AND METHODS

The two main sweet and sour cherry-producing areas in the Province of Salamanca were prospected: "Arribes del Duero" and "Sierra de Francia". During this search process, trees with tree, flower, leaf and fruit characteristics intermediate between sweet and sour cherry were selected and labelled. These trees belonged to four cultivars of duke cherry -Guindo Tomatillo 1, Guindo Tomatillo 2, Guindo del País 2 and Guindo Garrafal Negro- previously identified by Pérez *et al*. (2007). Also, tree of the improved sweet cherry cvs. Blanca de Provenza, Burlat, Lamper, Monzón and Ramón Oliva, and trees of local sweet cherry cvs. De Valero, Del Valle, Mollar, Pico Colorao and Pico Negro were chosen to make comparisons. Finally, trees of the sour cherry cvs. Guindo Arribes Duero, Guindo Común, Guindo Sierra Francia and Guindo Silvestre were selected. A total of eight trees per cultivar were marked. For each tree, an information file was recorded that included data referring to the collection location (Table 1).

Agromorphological descriptions of all the labelled trees were carried out, taking as a basis 19 of the descriptors established by the International Union for the Protection of New Varieties of Plants (UPOV, 2006a; 2006b) and another 24 descriptors considered being of interest for identification. For the determination of some of these descriptors, samples of flowers, fruits, leaves and dormant 1-yr-old shoots were taken during 2005 and 2006, following UPOV guidelines. Flowers were collected at full bloom. Ten flowers were taken from each of the eight trees studied per cultivar and year, and the following quantitative parameters were measured using a digital calliper: open flower diameter (cm), petal length (cm), petal width (cm) and pistil length (cm). The number of stamens in each flower was also counted. Moreover, a series of qualitative flower parameters were evaluated in the internal bracts of the flower fascicles: central lobe

Table 1. List of cultivars examined in this study with their origins.

Cultivar	*Taxon*	Origin
Blanca de Provenza	*Prunus avium*	Provenza (France)
Burlat	*Prunus avium*	Rhone Valley (France)
De Valero	*Prunus avium*	Sierra de Francia (Spain)
Del Valle	*Prunus avium*	Sierra de Francia (Spain)
Lamper	*Prunus avium*	USA
Mollar	*Prunus avium*	Sierra de Francia (Spain)
Monzón	*Prunus avium*	Germany
Pico Colorao	*Prunus avium*	Valle del Jerte (Spain)
Pico Negro	*Prunus avium*	Sierra de Francia (Spain)
Ramón Oliva	*Prunus avium*	Sierra de Francia (Spain)
Guindo Arribes Duero	*Prunus cerasus*	Spain
Guindo Común	*Prunus cerasus*	Salamanca (Spain)
Guindo Sierra Francia	*Prunus cerasus*	Sierra de Francia (Spain)
Guindo Silvestre	*Prunus cerasus*	Sierra de Francia (Spain)
Guindo del País 2	*Prunus x gondouinii*	Salamanca (Spain)
Guindo Garrafal Negro	*Prunus x gondouinii*	Sierra de Francia (Spain)
Guindo Tomatillo 1	*Prunus x gondouinii*	Salamanca (Spain)
Guindo Tomatillo 2	*Prunus x gondouinii*	Salamanca (Spain)

form, lateral lobe form, and the presence or absence of glandular hairs and teeth. Also, the coloration of the petals at the end of the blooming was noted.

Fruits were collected at full maturity. Maturity was determined on the basis of the color characteristics of each cultivar and regarding the information provided by the growers. A total of six fruits were sampled from each of the eight trees studied per cultivar and year. These fruits were used to study a series of quantitative and qualitative descriptors. The quantitative descriptors studied were stalk length (cm), endocarp volume (cm^3), sphericity (%), total soluble solids (º Brix) and titratable acidity (g malic acid 100 g^{-1} fresh weight). The length of the fruit pedicel was measured using a digital calliper with sensibility of 0.01 mm. This instrument was also used to measure the three linear dimensions of the endocarps, namely length (L_e), width (W_e) and thickness (T_e). The volumes of the endocarps were calculated using the formula $4/3\pi r^3$, where $r = (L_e+W_e+T_e)/6$. Also, following Baryeh (2001); Aydin (2003); Olajide and Igbeka (2003) and Vursavuş *et al*. (2006), the sphericity (Ø) of the fruits was calculated using the following equation $Ø = [(L_f W_f T_f)^{0.333}]/L_f$, being L_f (length), W_f (width) and T_f (thickness) of the cherry fruit. Total soluble solids were determined in each fruit with a digital refractometer (Atago PR-101, Atago, Tokyo, Japan) at 20 ºC and titratable acidity was also determined in each fruit by potenciometric titration with 0.1 N NaOH up to pH 8.1, using 1 mL of diluted juice in 25 mL distilled H_2O. In addition, the qualitative descriptors observed were: skin color, pulp and juice; fruit shape, endocarp and pistilar point; external discolorations; presence or absence of leaves at the base of the pedicel of the fruit; seed shape; seed viability and sulcus and raphe types of the seed testa.

The leaves were collected at the adult stage in the final days of July. From each of the eight trees studied per cultivar, seven leaves were sampled per year, and the following quantitative parameters were measured using a digital calliper with a sensitivity of 0.01 mm: leaf blade length and width, length of the petiole (cm) and using a protractor, the basal and apical angles of the blade (º). Two ratios were also calculated: length/width of leaf blade; and petiole length/leaf blade length. Moreover, the following qualitative descriptors were also evaluated: leaf shape, margins and stipules; pubescence in veins of lower side of the leaf and the anthocyanin pigmentation of the leaf glands. The dormant 1-yr-old shoots were collected at the end of the winter. From each of the eight trees studied per cultivar, three dormant 1-yr-old shoots were sampled per year, and their numbers of lenticels per 20 mm^2 were counted with a stereomicroscope (Model 104, Nikon, Japan). Regarding whole trees, only the vegetative habit of the different cultivars was evaluated.

The means and standard deviations were calculated for each of the quantitative parameters studied over a 2 yr period for the four duke cherry, 10 sweet cherry and four sour cherry cultivars. Based on these parameters, a stepwise discriminant analysis (SDA) and ANOVA were also carried out using the SPSS 17.0 program (SPSS, Chicago, Illinois, USA). For qualitative variables, statistical comparisons were done by means of the chi-square (χ^2) test, being the 5%, 1% and 0.01% the adopted significance levels.

RESULTS

Flowers

The flower size parameters showed remarkable differences among the cultivars of the three species studied (Table 2). Generally, the sweet cherry cultivars had the largest flowers and the highest stamen numbers of all the cultivars included in the study. On the other hand, the sour cherry cultivars showed the smallest flowers, with a mean open flower diameter for the species of 2.56 cm. Finally, the duke cherry cultivars had flowers with an intermediate sizes between those of the sweet and sour cherry cultivars. Similar stamen numbers were registered for sour and duke cherry cultivars.

Qualitative flower parameters are summarized in Table 3. Important differences were observed among sweet, duke and sour cherry at the level of the internal bracts of the floral fascicles base and also in the petal coloration acquired during last blooming phase. The sweet cherry cultivars presented internal bracts with an elliptical, pedicelled and dentate central lobe, and sessile, arched lateral lobes with glandular hairs. The duke cherry cultivars showed internal bracts with a sessile, semi-elliptic and dentate central lobe, and obtuse, poorly developed lateral lobes with glandular hairs. Finally, in sour cherry, the internal bracts presented a sessile, rounded and dentate central lobe, and triangular, poorly developed lateral lobes with glandular hairs (Figure 2). Regarding the coloration of the petals at the end of the blooming, the sweet and sour cherry cultivars maintained white petals until the end, whereas the petals of the duke cherry cultivars acquired a rosy coloration prior to withering (Figure 3).

Leaves

It can be seen that the main differences among the cultivars of the three species studied were related with the petiole length and the leaf blade size (Table 4). Generally, the sweet cherry cultivars had leaves with long petioles and large blade sizes. At the other extreme were the sour cherry cultivars. Their leaves showed the shortest petioles and the smallest foliar surface area. Finally, the duke cherry cultivars had leaves with an intermediate sizes between those of the sweet and sour cherry cultivars.

Qualitative parameters of the leaves are summarized in Table 5. The sweet cherry cultivars showed leaves with a spear-like or elongate elliptical shape (‘Blanca de

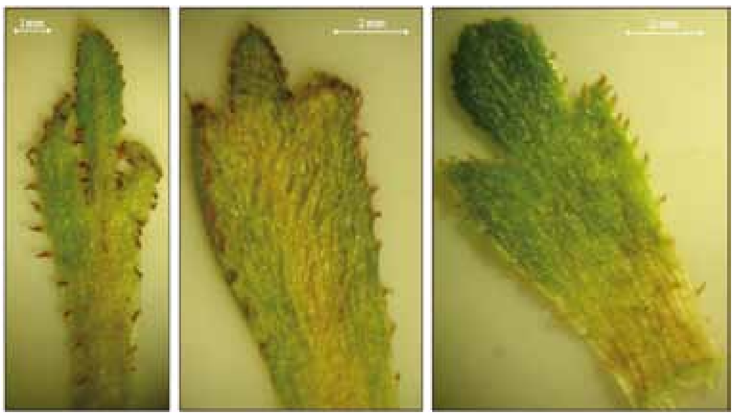
Table 2. Quantitative flower parameters in sweet (sw) (*Prunus avium*), sour (so) (*Prunus cerasus*) and duke (du) (*Prunus* x *gondouinii*) cherry cultivars, including standard deviation.

Cultivar	Open flower diameter	Petal length	Petal widht	Pistil length	Numbers of stamens
	cm				
Blanca de Provenza (sw)	3.29 (0.39)	1.40 (0.16)	1.12 (0.17)	1.34 (0.10)	38.42 (3.02)
Burlat (sw)	3.81 (0.45)	1.68 (0.18)	1.33 (0.12)	1.58 (0.05)	33.54 (3.39)
De Valero (sw)	3.41 (0.32)	1.46 (0.12)	1.27 (0.15)	1.45 (0.12)	31.99 (2.95)
Del Valle (sw)	3.25 (0.25)	1.41 (0.12)	1.18 (0.16)	1.33 (0.11)	25.90 (4.27)
Lamper (sw)	3.62 (0.34)	1.55 (0.15)	1.21 (0.14)	1.47 (0.14)	34.02 (3.49)
Mollar (sw)	3.36 (0.24)	1.48 (0.14)	1.21 (0.11)	1.55 (0.09)	32.78 (3.54)
Monzón (sw)	3.78 (0.43)	1.63 (0.13)	1.35 (0.19)	1.53 (0.10)	31.62 (2.69)
Pico Colorao (sw)	3.43 (0.25)	1.46 (0.11)	1.22 (0.10)	1.30 (0.10)	32.77 (4.62)
Pico Negro (sw)	3.21 (0.33)	1.38 (0.15)	0.95 (0.13)	1.31 (0.11)	33.46 (3.13)
Ramón Oliva (sw)	3.71 (0.39)	1.56 (0.09)	1.30 (0.12)	1.48 (0.12)	33.86 (2.68)
Guindo Arribes Duero (so)	2.68 (0.19)	1.15 (0.11)	1.14 (0.15)	1.12 (0.10)	27.94 (3.02)
Guindo Común (so)	2.56 (0.24)	1.11 (0.08)	1.01 (0.14)	1.08 (0.11)	28.62 (2.12)
Guindo Sierra Francia (so)	2.71 (0.22)	1.16 (0.16)	1.17 (0.11)	1.14 (0.12)	28.44 (2.76)
Guindo Silvestre (so)	2.27 (0.28)	1.01 (0.12)	0.99 (0.12)	0.91 (0.13)	29.01 (3.11)
Guindo del País 2 (du)	3.10 (0.29)	1.30 (0.14)	1.27 (0.18)	1.35 (0.10)	27.59 (3.83)
Guindo Garrafal Negro (du)	3.15 (0.32)	1.27 (0.11)	1.24 (0.11)	1.37 (0.10)	29.83 (2.86)
Guindo Tomatillo 1 (du)	3.07 (0.38)	1.27 (0.16)	1.20 (0.17)	1.34 (0.11)	27.89 (2.81)
Guindo Tomatillo 2 (du)	3.38 (0.21)	1.45 (0.07)	1.50 (0.09)	1.36 (0.14)	24.15 (2.04)

Value in parenthesis correspond to standard deviation.

Table 3. Qualitative flower parameters in sweet (sw) (*Prunus avium*), sour (so) (*Prunus cerasus*) and duke (du) (*Prunus* x *gondouinii*) cherry cultivars.

Cultivar	Internal bracts of the floral fascicles base			Petal coloration at the end of blooming
	Central lobe shape	Lateral lobes shape	Glandular hairs and teeth presence or absence	
Blanca de Provenza (sw)	Elliptic and pedicelled	Sessile and arched	Glandular teeth in margins of central lobe and glandular hairs in margins of lateral lobes	White
Burlat (sw)				
De Valero (sw)				
Del Valle (sw)				
Lamper (sw)				
Mollar (sw)				
Monzón (sw)				
Pico Colorao (sw)				
Pico Negro (sw)				
Ramón Oliva (sw)				
Guindo Arribes Duero (so)	Sessile and rounded	Poorly developed and triangular	Glandular teeth in margins of central lobe and glandular hairs in margins of lateral lobes	White
Guindo Común (so)				
Guindo Sierra Francia (so)				
Guindo Silvestre (so)				
Guindo del País 2 (du)	Sessile and semi-elliptic	Poorly developed and obtuse	Glandular teeth in margins of central lobe and glandular hairs in margins of lateral lobes	Pink
Guindo Garrafal Negro (du)				
Guindo Tomatillo 1 (du)				
Guindo Tomatillo 2 (du)				



Prunus avium L. *Prunus* x *gondouinii* Rehd. *Prunus cerasus* L.

Figure 2. Internal bracts at the base of the floral fascicles in sweet, duke and sour cherry.

Prunus avium L. *Prunus* x *gondouinii* Rehd. *Prunus cerasus* L.

Figure 3. Flowers in sweet, duke and sour cherry.

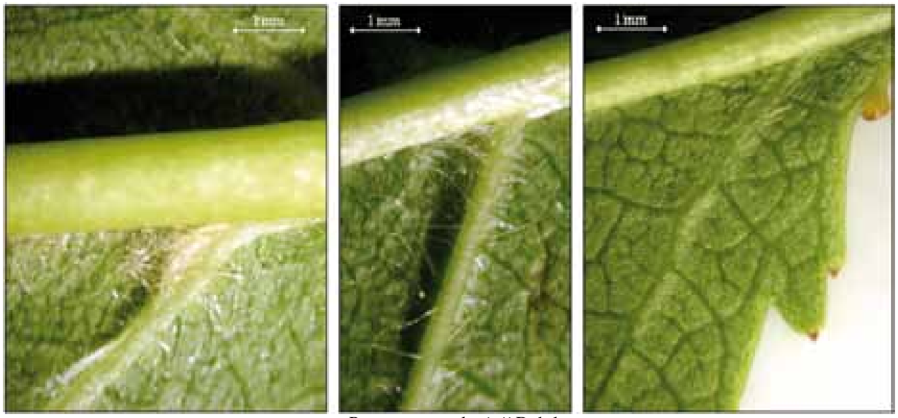
Table 4. Quantitative leaf parameters in sweet (sw) (*Prunus avium*), sour (so) (*Prunus cerasus*) and duke (du) (*Prunus* x *gondouinii*) cherry cultivars.

Cultivar	Petiole length	Leaf blade length	Leaf blade width	Apical angle	Basal angle	2/3 ratio	1/2
	cm	cm	cm	(º)	(º)		
Blanca de Provenza (sw)	3.46 (0.48)	14.09 (1.68)	6.46 (0.68)	64.21 (6.07)	138.26 (13.26)	2.18 (0.19)	0.24 (0.03)
Burlat (sw)	4.18 (0.63)	13.27 (1.35)	5.97 (0.50)	43.61 (4.98)	143.63 (7.64)	2.22 (0.15)	0.31 (0.05)
De Valero (sw)	5.42 (0.37)	13.62 (1.24)	7.96 (0.67)	41.79 (4.11)	121.97 (6.88)	1.71 (0.17)	0.39 (0.03)
Del Valle (sw)	4.67 (0.51)	11.22 (1.15)	6.33 (0.81)	34.82 (3.01)	95.37 (14.35)	1.75 (0.11)	0.42 (0.05)
Lamper (sw)	4.28 (0.72)	11.71 (1.23)	6.11 (0.69)	42.31 (4.55)	143.91 (9.90)	1.91 (0.18)	0.36 (0.03)
Mollar (sw)	5.39 (0.45)	12.04 (1.29)	6.21 (0.91)	41.66 (4.86)	86.46 (9.13)	1.93 (0.21)	0.44 (0.04)
Monzón (sw)	3.89 (0.64)	14.23 (1.13)	6.64 (0.53)	40.74 (5.70)	129.31 (12.04)	2.14 (0.15)	0.27 (0.05)
Pico Colorao (sw)	4.80 (0.42)	12.66 (0.97)	6.23 (0.49)	35.31 (3.54)	88.24 (4.71)	2.03 (0.09)	0.37 (0.04)
Pico Negro (sw)	4.90 (0.51)	12.79 (0.85)	6.51 (0.64)	30.80 (6.49)	107.37 (11.03)	1.96 (0.18)	0.38 (0.06)
Ramón Oliva (sw)	4.88 (0.67)	13.93 (1.98)	6.48 (0.85)	38.83 (4.27)	135.68 (10.22)	2.14 (0.16)	0.35 (0.03)
Guindo Arribes Duero (so)	2.17 (0.28)	9.14 (0.99)	4.78 (0.48)	46.02 (5.22)	119.17 (6.58)	1.91 (0.11)	0.23 (0.05)
Guindo Común (so)	2.05 (0.33)	8.97 (0.72)	4.49 (0.49)	45.77 (3.14)	118.17 (8.43)	1.99 (0.13)	0.22 (0.04)
Guindo Sierra Francia (so)	2.21 (0.34)	9.24 (0.95)	4.82 (0.51)	46.13 (4.11)	120.18 (9.44)	1.91 (0.12)	0.23 (0.04)
Guindo Silvestre (so)	1.94 (0.25)	8.62 (1.11)	4.31 (0.44)	44.93 (2.28)	119.03 (10.83)	2.00 (0.19)	0.22 (0.05)
Guindo del País 2 (du)	3.26 (0.08)	10.69 (0.74)	5.12 (0.38)	39.93 (1.92)	120.81 (3.89)	2.08 (0.15)	0.30 (0.02)
Guindo Garrafal Negro (du)	3.17 (0.39)	10.47 (0.94)	5.41 (0.51)	45.61 (1.62)	112.89 (3.69)	1.93 (0.15)	0.30 (0.04)
Guindo Tomatillo 1 (du)	3.90 (0.70)	11.21 (1.78)	6.30 (0.97)	35.63 (6.02)	128.35 (7.46)	1.77 (0.24)	0.34 (0.06)
Guindo Tomatillo 2 (du)	3.86 (0.34)	10.96 (0.86)	6.79 (0.53)	48.54 (3.08)	124.29 (2.72)	1.61 (0.17)	0.35 (0.03)

Value in parenthesis correspond to standard deviation.

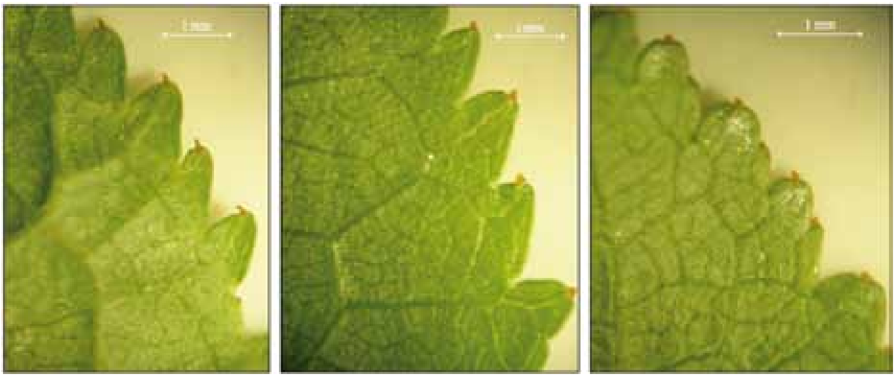
Table 5. Qualitative leaf parameters in sweet (sw) (*Prunus avium*), sour (so) (*Prunus cerasus*) and duke (du) (*Prunus* x *gondouinii*) cherry cultivars.

Cultivar	Form of leaves	Form of leaf margins	Form of leaves stipules	Pubescence in veins of lower side of the leaves	Anthocyanin pigmentation of leaf glands
Blanca de Provenza (sw)	Spear-like or elongate elliptic shape with rounded base	Crenate-serrated with elongated and thin glandular teeth	Linear and with frequent glandular hairs		Green
Burlat (sw)					Reddish
Lamper (sw)				Strong	Green
Monzón (sw)					Reddish
Ramón Oliva (sw)					Red
De Valero (sw)	Obovated with the base of the blade pointed and a sharply pointed tip	Crenate-serrated with elongated and thin glandular teeth	Linear and oblong with frequent glandular hairs		
Del Valle (sw)					
Mollar (sw)				Strong	Red
Pico Colorao (sw)					
Pico Negro (sw)					
Guindo Arribes Duero (so)	Elliptic, acuminate and round-based	Crenate-toothed with frequent thick glandular teeth	Linear and vigorous with numerous glandular teeth and some glandular hairs		
Guindo Común (so)					
Guindo Sierra Francia (so)				Absence	Green
Guindo Silvestre (so)					
Guindo Garrafal Negro (du)	Obovate-elliptic and acuminate	Crenate-serrated with thick glandular teeth	Linear and with frequent glandular hairs		
Guindo del País 2 (du)				Medium	Reddish
Guindo Tomatillo 1 (du)					
Guindo Tomatillo 2 (du)					



Prunus avium L. *Prunus* x *gondouinii* Rehd. *Prunus cerasus* L.

Figure 4. Pubescence in veins of the lower side of leaves in sweet, duke and sour cherry.



Prunus avium L. *Prunus* x *gondouinii* Rehd. *Prunus cerasus* L.

Figure 5. Margins and glandular teeth in the leaves of sweet, duke and sour cherry.

Prunus avium L. *Prunus* x *gondouinii* Rehd. *Prunus cerasus* L.

Figure 6. Leaf stipules in sweet, duke and sour cherry.

Provenza', 'Burlat', 'Lamper', 'Monzón', and 'Ramón Oliva') and also leaves with the blade base pointed and a sharply pointed tip ('De Valero', 'Del Valle', 'Mollar', 'Pico Colorao', and 'Pico Negro'). All leaves of the sweet cherry cultivars presented strong pubescence in the veins of the lower side of the leaf. Their margins were crenate-serrated and presented elongated and thin glandular teeth. The stipules were linear and with frequent glandular hairs (Figures 4 to 6). Their leaf glands showed green, reddish or red anthocyanin coloration. The leaves of duke cherry cultivars were obovate-elliptic and acuminate and they also presented crenate-serrated leaf margins with thick glandular teeth and a medium degree of pubescence in the veins of the lower side of the leaf. The stipules were linear, with frequent glandular hairs, and the anthocyanin coloration of leaf glands was reddish. Finally, the leaves in sour cherry were elliptic, acuminate, round-based and hairless in veins of back leaves. They also presented crenate-toothed leaf margins, with frequent thick glandular teeth. Their stipules were linear, vigorous and displayed numerous glandular teeth and some glandular hairs. The anthocyanin coloration of the leaf glands was green.

Fruit

Quantitative fruit parameters showed remarkable differences among the cultivars of the three species studied (Table 6). Generally, the sweet cherry cultivars had elongate and sweet fruits with large endocarps, long stalk lengths and low titratable acidity levels. On the other hand, the fruits of sour cherry cultivars showed flattened shapes, short stalk lengths and high acidity levels, with a mean value for this last parameter in the species of 1.40 g of malic acid per 100 g fresh weight. Finally, the duke cherry cultivars had fruits with intermediate values of stalk length, endocarp volume, total soluble solids and titratable acidity between those of the sweet and sour cherry cultivars.

Regarding qualitative fruit characteristics, a remarkable degree of variability among cultivars was observed (Table 7). Some of the sweet cherry cultivars studied had fruits with black skin and purple pulp. This was the case of 'Del Valle', whereas others, such as 'Blanca de Provenza', had fruits with a yellow skin and a white/cream-colored pulp (Figure 7). The color of the juice in the sweet cherry also varied between colorless and purple. In general, all the sweet cherry cultivars studied had fruits without leaves at the pedicel and slight discolorations of the skin. For the sweet cherry, diverse shapes of fruits and endocarp were also observed. In contrast, in sour and duke cherry all of the cultivars had fruits with flattened shapes, fairly rounded endocarps, and even/concave pistil points. The 'Guindo Garrafal Negro' showed the greatest differences as compared to the other sour and duke cherry cultivars studied; its skin was dark (purple-black) and its pulp and juice were red-purple. By contrast, 'Guindo Común', 'Guindo del País 2', 'Guindo Tomatillo 1' and 'Guindo Tomatillo 2' were characterized by having a white/cream-colored pulp, a colorless juice, and a light reddish skin. In the sour and duke cherry cultivars studied, leaves were frequently observed at the pedicel of the fruits (Figure 8). With respect to seed parameters, both the sweet and sour cherry cultivars showed viable pear-shaped seeds and elongated raphe. In contrast, the seeds of the duke cherry cultivars were unviable because they presented the typical external deformations of the hybrids (Figure 9). Important differences were also observed among the sweet, sour and duke cherry cultivars at the level of the seed testa. The sweet cherry seeds showed unbranched and branched sulci towards the chalaza and micropyle. In sour cherry, these sulci were branched towards the micropyle and in duke cherry they were branched towards the chalaza and micropyle.

Vegetative habit of the tree

The habits of the trees are summarized in Table 8. Very diverse habits were observed for the sweet cherry trees:

Table 6. Quantitative fruit parameters in sweet (sw) (*Prunus avium*), sour (so) (*Prunus cerasus*) and duke (du) (*Prunus* x *gondouinii*) cherry cultivars.

Cultivar	Stalk length	Sphericity	Endocarp length	Endocarp width	Endocarp thickness	Endocarp volume	Total soluble solids	Titratable acidity[1]
	cm	%	cm			cm³	°Brix	g 100 g⁻¹
Blanca de Provenza (sw)	3.82 (0.41)	103.16 (3.45)	1.10 (0.08)	0.95 (0.07)	0.74 (0.08)	0.42 (0.10)	16.38 (1,28)	0.43 (0.08)
Burlat (sw)	3.11 (0.53)	96.06 (4.61)	1.26 (0.08)	0.97 (0.06)	0.69 (0.07)	0.48 (0.07)	15.41 (1.08)	0.50 (0.03)
De Valero (sw)	6.57 (0.49)	93.35 (5.36)	1.22 (0.10)	0.92 (0.08)	0.68 (0.06)	0.43 (0.05)	19.05 (1.29)	0.48 (0.09)
Del Valle (sw)	4.46 (0.39)	95.42 (6.77)	1.12 (0.07)	0.94 (0.09)	0.66 (0.04)	0.39 (0.05)	18.14 (2.34)	0.39 (0.11)
Lamper (sw)	4.22 (0.51)	98.97 (3.46)	1.10 (0.09)	0.97 (0.07)	0.70 (0.08)	0.41 (0.07)	17.02 (1.48)	0.39 (0.06)
Mollar (sw)	5.75 (0.49)	95.07 (4.83)	1.28 (0.09)	0.93 (0.06)	0.71 (0.07)	0.48 (0.08)	23.58 (1.54)	0.47 (0.05)
Monzón (sw)	3.95 (0.47)	94.60 (6.18)	1.24 (0.08)	0.86 (0.05)	0.69 (0.07)	0.42 (0.06)	18.42 (1.23)	0.51 (0.04)
Pico Colorao (sw)	5.14 (0.39)	88.97 (8.28)	1.29 (0.04)	0.92 (0.07)	0.68 (0.06)	0.46 (0.06)	21.98 (2.34)	0.49 (0.10)
Pico Negro (sw)	4.69 (0.55)	86.74 (4.92)	1.31 (0.08)	0.91 (0.07)	0.65 (0.05)	0.45 (0.09)	20.74 (2.02)	0.62 (0.05)
Ramón Oliva (sw)	4.12 (0.42)	94.40 (3.58)	1.28 (0.06)	1.08 (0.08)	0.66 (0.09)	0.53 (0.08)	17.36 (1.39)	0.40 (0.06)
Guindo Arribes Duero (so)	3.46 (0.28)	105.28 (4.02)	0.91 (0.07)	0.83 (0.07)	0.64 (0.06)	0.26 (0.05)	15.69 (1.38)	1.36 (0.06)
Guindo Común (so)	3.37 (0.45)	105.16 (5.03)	0.89 (0.06)	0.82 (0.08)	0.63 (0.06)	0.24 (0.06)	15.43 (1.84)	1.38 (0.04)
Guindo Sierra Francia (so)	3.54 (0.32)	105.58 (8.95)	0.92 (0.08)	0.84 (0.08)	0.65 (0.08)	0.27 (0.07)	15.75 (2.03)	1.40 (0.08)
Guindo Silvestre (so)	3.18 (0.31)	105.52 (3.69)	0.84 (0.06)	0.79 (0.07)	0.59 (0.07)	0.21 (0.06)	15.03 (1.96)	1.45 (0.07)
Guindo del País 2 (du)	4.41 (0.35)	107.46 (3.97)	0.97 (0.10)	0.92 (0.06)	0.70 (0.08)	0.33 (0.07)	17.13 (1.91)	0.63 (0.03)
Guindo Garrafal Negro (du)	3.81 (0.41)	103.59 (3.61)	1.01 (0.16)	0.86 (0.08)	0.70 (0.07)	0.32 (0.03)	17.37 (1.28)	0.79 (0.04)
Guindo Tomatillo 1 (du)	4.07 (0.38)	106.21 (9.71)	0.99 (0.14)	1.00 (0.07)	0.81 (0.09)	0.42 (0.09)	17.17 (1.72)	0.68 (0.03)
Guindo Tomatillo 2 (du)	4.79 (0.39)	119.16 (5.65)	1.11 (0.12)	0.92 (0.06)	0.82 (0.06)	0.44 (0.05)	16.89 (2.01)	0.70 (0.05)

[1]Grams of malic acid per 100 grams fresh weight; value in parenthesis correspond to standard deviation.

Table 7. Qualitative fruit parameters in sweet (sw) (*Prunus avium*), sour (so) (*Prunus cerasus*) and duke (du) (*Prunus* x *gondouinii*) cherry cultivars.

Cultivar	Skin color	Pulp color	Fruit juice color	Fruit shape	Endocarp shape	Pistilar point shape
Blanca de Provenza (sw)	Yellow	Cream-white	Colorless	Flat-round/round	Elongate	Even
Burlat (sw)	Mahogany	Pink	Purple	Kidney shape/Flat-round	Elongate	Concave
De Valero (sw)	Mahogany-black	Red	Purple	Elongate-cordate	Round-elongate	Concave-even
Del Valle (sw)	Mahogany-black	Purple	Red	Kidney shaped	Round-oval	Concave-even
Lamper (sw)	Vermillion on yellow ground color	Cream-white	Colorless	Elongate-cordate	Round-oval	Concave-even
Mollar (sw)	Vermillion	Cream-white	Colorless	Kidney shaped	Elongate	Even-pointed
Monzón (sw)	Vermillion on yellow ground color	Cream-white	Colorless	Elongate-cordate	Elongate	Concave-even
Pico Colorao (sw)	Vermillion	Cream-white	Colorless	Elongate-cordate	Round-elongate	Pointed
Pico Negro (sw)	Mahogany-black	Red	Purple	Cordate	Elongate	Even
Ramón Oliva (sw)	Mahogany	Purple	Purple	Kidney shaped/Flat-round	Round-elongate	Concave-even
Guindo Arribes Duero (so)	Vermillion	Cream-white	Colorless	Flat-round	Round	Concave-even
Guindo Común (so)	Vermillion	Cream-white	Colorless	Flat-round	Round	Concave-even
Guindo Sierra Francia (so)	Vermillion	Cream-white	Colorless	Flat-round	Round	Concave-even
Guindo Silvestre (so)	Vermillion	Cream-white	Colorless	Flat-round	Round	Concave-even
Guindo del País 2 (du)	Orange red	Cream-white	Colorless	Flat-round	Round	Concave-even
Guindo Garrafal Negro (du)	Mahogany-black	Red-purple	Red-purple	Flat-round	Round	Concave-even
Guindo Tomatillo 1 (du)	Orange red	Cream-white	Colorless	Flat-round	Round	Concave-even
Guindo Tomatillo 2 (du)	Orange red	Cream-white	Colorless	Flat-round	Round	Concave-even

Table 7. Qualitative fruit parameters in sweet (sw) (*Prunus avium*), sour (so) (*Prunus cerasus*) and duke (du) (*Prunus* x *gondouinii*) cherry cultivars. Continuation.

Cultivar	External discolorations	Leaves on fruit stalk	Seed shape	Seed viability	Type of sulcus on seed testa	Type of raphe on seed testa
Blanca de Provenza (sw)	Weak	None	Pyriform	Yes	Non branched and branched towards the chalaza and micropyle	Elongated
Burlat (sw)	Weak					
De Valero (sw)	Weak					
Del Valle (sw)	Weak					
Lamper (sw)	Strong					
Mollar (sw)	Medium					
Monzón (sw)	Strong					
Pico Colorao (sw)	Medium					
Pico Negro (sw)	Weak					
Ramón Oliva (sw)	Weak					
Guindo Arribes Duero (so)	Weak	Few	Pyriform	Yes	Branched towards the micropyle	Elongated
Guindo Común (so)						
Guindo Sierra Francia (so)						
Guindo Silvestre (so)						
Guindo del País 2 (du)	Medium	Few	Pyriform with external deformations	No	Branched towards the chalaza and micropyle	Elongated
Guindo Garrafal Negro (du)	Weak					
Guindo Tomatillo 1 (du)	Medium					
Guindo Tomatillo 2 (du)	Medium					

Prunus avium L. *Prunus* x *gondouinii* Rehd. *Prunus cerasus* L.

Figure 7. Fruits of sweet, duke and sour cherry.

Prunus avium L. *Prunus* x *gondouinii* Rehd. *Prunus cerasus* L.

Figure 8. Presence or absence of small leaves at the pedicel of the fruits in sweet, duke and sour cherry.

Prunus avium L. *Prunus* x *gondouinii* Rehd. *Prunus cerasus* L.

Figure 9. Seeds with hard endocarp in sweet, duke and sour cherry.

Table 8. Tree habits and number of lenticels in sweet (sw) (*Prunus avium*), sour (so) (*Prunus cerasus*) and duke (du) (*Prunus* x *gondouinii*) cherry cultivars, including standard deviation.

Cultivar	Tree habit	Number of lenticels
Blanca de Provenza (sw)	Medium-spreading	10.35 (0.82)
Burlat (sw)	Upright	10.64 (0.56)
De Valero (sw)	Spreading-drooping	10.91 (0.96)
Del Valle (sw)	Spreading	9.94 (1.25)
Lamper (sw)	Medium-spreading	11.02 (0.60)
Mollar (sw)	Upright-medium	10.68 (1.16)
Monzón (sw)	Spreading-drooping	10.47 (1.01)
Pico Colorao (sw)	Very upright	10.28 (0.93)
Pico Negro (sw)	Upright	9.87 (0.79)
Ramón Oliva (sw)	Spreading-drooping	11.26 (0.68)
Guindo Arribes Duero (so)	Drooping	3.42 (0.67)
Guindo Común (so)	Drooping	3.02 (0.51)
Guindo Sierra Francia (so)	Drooping	2.96 (0.58)
Guindo Silvestre (so)	Drooping	3.12 (0.43)
Guindo del País 2 (du)	Medium	5.53 (0.47)
Guindo Garrafal Negro (du)	Spreading	5.91 (0.39)
Guindo Tomatillo 1 (du)	Medium	5.12 (0.64)
Guindo Tomatillo 2 (du)	Medium	4.88 (0.52)

Value in parenthesis corresponds to standard deviation.

from upright to very upright (as was the case of 'Pico Colorao') to spreading-drooping (as were the cases of the cvs. Monzón, De Valero and Ramón Oliva). The duke cherry cultivars exhibited medium-spreading habits and the sour cherry cultivars showed a bush-like shape.

Dormant 1-yr-old shoots

The dormant 1-yr-old shoot parameters measured are shown in Table 9. The number of lenticels presented a high discrimination power for the three studied *taxa*. Its values ranged from about 9 to 11 in sweet cherry and around 4 to 5 in duke cherry. The lowest numbers of lenticels were registered for the sour cherry cultivars, with a mean value for this parameter of 3.13 (Figure 10).

Stepwise discriminant (SDA), variance (ANOVA) and chi-squared (χ^2) analysis

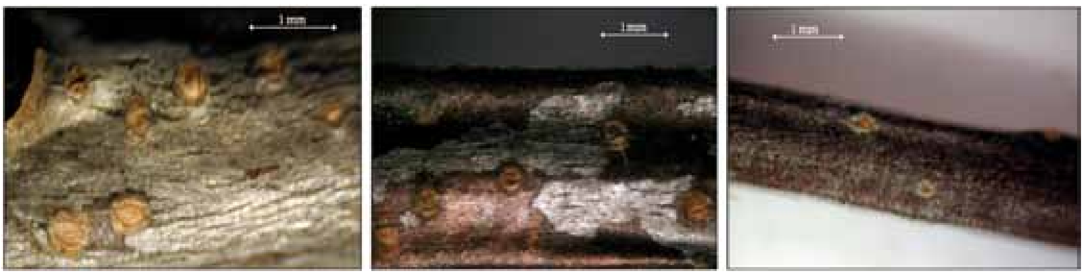
The SDA selected titratable acidity and number of lenticels as the two variables with higher discriminant power and showed two canonical discriminant functions that showed 100% of the total variance. The first canonical discriminant function illustrated variations in number of lenticels, pistil length, open flower diameter, total soluble solids, leaf blade width, petiole length, and stalk length. The second canonical discriminant function was performed by titratable acidity, sphericity, number of stamens, leaf blade length, and endocarp volume. Figure 11 shows a scatter plot of these two canonical discriminant functions elaborated for the 18 cultivars studied and based on the main two quantitative variables. Three groups were created that included all cultivars: sour cherry, sweet cherry and duke cherry. This analysis showed that cultivars can be classified with 100% success. Moreover, an ANOVA based on quantitative parameters was also performed for the three *taxa* studied (Table 9). All the parameters studied in this analysis showed statistically significant differences at the 95% of confidence level for some *taxon* with the exception of the length/width ratio of the blade parameter. Only five parameters presented significant differences within the three *taxa*: open flower diameter, petiole length, fruit volume, titratable acidity, and number of lenticels. In relation with the chi-squared analysis, six qualitative variables showed differential diagnostic value for the three species at the 99% of confidence level (Table 10). These variables were: shape of the central and lateral lobes in the internal bracts of the flower fascicles, leaf shape and margin, pubescence in the veins of the lower side of the leaf, and type of sulcus of the seed coat.

As a summary of the results, a description of sweet, sour and duke cherry is shown. The sweet cherry cultivars show internal bracts at the base of the floral fascicles with an elliptic, pedicelled and dentate central lobe, and the lateral lobes sessile, arched, and with

Table 9. Main quantitative parameters of flower, leaf, fruit and dormant 1-yr-old shoot in sweet (*Prunus avium*), duke (*Prunus* x *gondouinii*) and sour (*Prunus cerasus*) cherry species.

	Prunun avium				
Parameters	**Local cultivars**	**Improved cultivars**	**Mean**	***Prunus* x *gondouinii***	***Prunus cerasus***
Open flower diameter, cm	3.33^{1}	3.64^{2}	3.49a	3.18b	2.56c
Pistil length, cm	1.39^{1}	1.48^{1}	1.44a	1.36a	1.06b
Number of stamens	31.38^{1}	34.29^{1}	32.84a	27.37b	28.50b
Petiole length, cm	5.04^{1}	4.14^{2}	4.59a	3.55b	2.09c
Length/width ratio of the blade	1.88^{1}	2.12^{2}	2.00a	1.85a	1.95a
Stalk length, cm	5.32^{1}	3.84^{2}	4.58a	4.27ab	3.39b
Total soluble solids, ºBrix	20.70^{1}	16.92^{2}	18.81a	17.14ab	15.41b
Titratable acidity[1], g 100 g^{-1}	0.49^{1}	0.45^{1}	0.47a	0.70b	1.40c
Number of lenticels	10.34^{1}	10.75^{1}	10.55a	5.36b	3.13c

Letters indicate differences between species at the 95% confidence level; numbers indicate differences between local and improved sweet cherry cultivars at the 95% confidence level.
[1]Grams of malic acid per 100 grams fresh weight.



Prunus avium L. *Prunus* x *gondouinii* Rehd. *Prunus cerasus* L.

Figure 10. Lenticels in the periderm of the young shoots of sweet, duke and sour cherry.

glandular hairs. Their leaves present a strong degree of pubescence in veins of the lower side of the leaf, crenate-serrated margins with elongated and thin glandular teeth, and two different shapes. The improved cultivars have leaves with a spear-like or elongate elliptical shape, whereas the local cultivars show leaves with the base of the blade pointed and the tip sharply pointed. The fruits of these cultivars present low levels of titratable acidity and their seeds show unbranched and branched sulci towards the chalaza and the micropyle. Moreover, a high number of lenticels, around 10, per 20 mm^2 are observed in their young shoots.

The duke cherry cultivars present internal bracts at the base of the floral fascicles with a sessile, semi-elliptic and dentate central lobe, and the lateral lobes obtuse, poorly developed, and with glandular hairs. The floral petals acquire a rosy coloration prior to withering. The leaves are obovate-elliptic and acuminate, and showed crenate-serrated leaf margins with thick glandular teeth and a medium degree of pubescence in the veins of the lower side of leaf. The fruits of these cultivars show intermediate levels of titratable acidity: between those of the sweet and sour cherries. The seeds are unviable because they present the typical external deformations of the hybrids and they also present sulci branched towards the chalaza and the micropyle. An intermediate number of lenticels, around 5, per 20 mm^2 between sweet and sour cherry cultivars is observed in their young shoots.

Finally, the sour cherry cultivars show internal bracts at the base of the floral fascicles with a sessile, rounded and dentate central lobe, and triangular lateral lobes, poorly developed and with glandular hairs. The leaves are elliptic, acuminate, rounded at the base and hairless in the veins of the lower side of the leaf and they present crenate-toothed leaf margins, with frequent thick glandular teeth. Their stipules are linear, vigorous and with frequent glandular teeth and some glandular hairs. The fruits of these cultivars show high levels of titratable acidity and their seeds present sulci branched towards the micropyle. The sour cherry trees exhibit a bush-like shape, and their young shoots present a low number of lenticels per 20 mm^2, around 3.

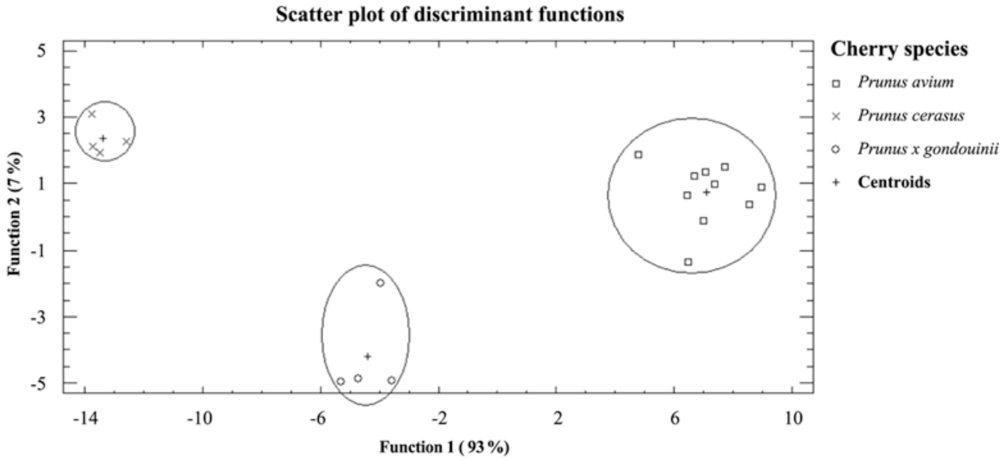


Figure 11. Scatter plot of the canonical scores from the stepwise discriminant analysis for sweet, sour and duke cherry cultivars.

Table 10. Results of the chi-square (χ^2) test in sweet (*Prunus avium*), duke (*Prunus* x *gondouinii*) and sour (*Prunus cerasus*) cherry species.

Qualitative variable	Between *Prunus avium* and *Prunus cerasus*	Between *Prunus avium* and *Prunus* x *gondouinii*	Between *Prunus cerasus* and *Prunus* x *gondouinii*
Central lobe shape	14.0***	14.0***	8.0**
Lateral lobes shape	14.0***	14.0***	8.0**
Glandular hairs and teeth	0.0	0.0	0.0
Petals coloration	0.0	14.0***	8.0**
Leaf shape	14.0***	8.0**	8.0***
Form of leaf margins	14.0***	14.0***	8.0**
Form of leaf stipules	14.0***	0.0	8.0**
Pubescence in back leaves	14.0***	14.0***	8.0**
Coloration of leaf glands	7.4*	7.4*	8.0**
Skin color	7.4	10.3	8.0*
Pulp color	3.1	4.8	1.14
Fruit juice color	3.1	4.8	1.14
Fruit shape	14.0*	14.0*	0.0
Endocarp shape	14.0**	14.0**	0.0
Pistilar point shape	3.1	3.1	0.0
External discolorations	2.2	3.9	4.8*
Leaves on fruit stalk	14.0***	0.0	0.0
Seed shape	0.0	14.0***	8.0**
Seed viability	0.0	14.0***	8.0**
Type of sulcus on seed testa	14.0***	14.0***	8.0**
Type of raphe on seed testa	0.0	0.0	0.0

*p < 0.05; **p < 0.01 and ***p < 0.001.

DISCUSSION

Although no exhaustive agromorphological descriptions have been carried out, many authors have measured some of the descriptors used in this study. Blanca and Díaz De La Guardia (2001) also observed leaves with elongated elliptic shapes, crenate-serrated margins and glandular teeth in *Prunus avium* species, and elliptic and acuminate leaves with crenate-toothed margins and linear stipules in *Prunus cerasus* species. Moreno and Manzano (2002) stated that the leaves of sour cherry were hairless, whereas the leaves of sweet and duke cherry were pubescent in the lower side of the leaf.

Titratable acidity is a parameter that is often studied as quality factor. Thus, Revilla and Vivar (2004), Vursavuş *et al.* (2006), and Cordeiro *et al.* (2008) reported lower levels of titratable acidity in sweet cherries in comparison with the sour cherries.

In order to determinate hybridization, one parameter that can be analyzed is seed viability. The seeds of the hybrids are frequently unviable because of disturbances during meiosis and show external deformations. Tavaud *et al.* (2004) also tested that the duke cherry seeds are often sterile.

The drooping habit is a parameter frequently used to differentiate between sweet and sour cherry (UPOV, 2006a, 2006b). Gella *et al.* (2001), Moreno and Manzano (2002), Moreno and Trujillo (2006) and Pérez *et al.* (2008), among others, studied the vegetative habit to characterize different cultivars. Cordeiro (2004) also observed that the duke cherry cultivar Guindo Garrafal Negro shows a spreading habit more similar to those of sweet cherry trees than those of the sour cherry trees.

In the present study, with the 21 quantitative characters analyzed it was possible to identify all cultivars of sweet, sour and duke cherry studied, as can be observed in the SDA scatter plot based on these parameters. Moreover, important differences were also observed between the local and improved sweet cherry cultivars. As seen from the ANOVA test, by themselves only two quantitative parameters (titratable acidity and number of lenticels) were able to distinguish among the three *taxa* since they revealed statistically significant differences among *P. avium*, *P.* x *gondouinii* and *P. cerasus* at the 95% confidence level, while they failed to do so between local and improved sweet cherry cultivars. Also, open flower diameter, petiole length, and fruit volume would have *a priori* been considered as a differential parameter between sweet, sour and duke cherry, although this cannot be recommended because these parameters also revealed significant differences between local and improved sweet cherry cultivars and it would be possible to confuse a local sweet cherry cultivar with a duke cherry cultivar.

Moreover, the following qualitative parameters were useful for differentiating among the three *taxa*: the shape of the central and lateral lobes at the internal bracts of the floral fascicles, leaf shape and margins, pubescence in the veins of the lower side of the leaf, and type of sulcus of the seed coat. These parameters could to discriminate among the species studied with a minimum significance level of 99%.

Also, four qualitative parameters (petal coloration at the end of blooming, leaf stipule type and seed shape and viability) were seen to be especially useful for differentiating *P. cerasus* from *P.* x *gondouinii* since they showed significant differences for these last two species at the 99% of confidence level.

CONCLUSIONS

Two quantitative (titratable acidity and number of lenticels) and six qualitative descriptors (shape of the central and lateral lobes in the internal bracts of the flower fascicles, leaf shape and margin, pubescence in the veins of the lower side of the leaf, and type of sulcus of the seed coat) have been identified as differential parameters in *Prunus avium*, *Prunus cerasus* and *Prunus* x *gondouinii*. Also, another four qualitative descriptors (petal coloration at the end of blooming, leaf stipule type and seed shape and viability) have been found to be useful for easy differentiation between sour and duke cherry. None of these parameters have been employed previously to discriminate among sweet, sour and duke cherry. Use of these parameters would permit growers and researchers to identify -in an easy, quick and effective way- the duke cherry and its progenitors, thus avoiding the frequent confusions among them.

ACKNOWLEDGEMENTS

We gratefully acknowledge the growers of Sierra de Francia and Arribes del Duero (Salamanca, Spain) for allowing us to study their trees, and for the valuable information about the cherry germplasm existing in these areas. Financial support for this work was provided by INIA (Proyect Grant RF02-023), and Rodrigo Pérez was supported by a fellowship from the Regional Government of Castilla & León (Spain).

RESUMEN

Análisis de descriptores agromorfológicos para diferenciar entre cerezo Duke (*Prunus* x *gondouinii* (Poit. & Turpin) Rehd.) y sus progenitores: cerezo (*Prunus avium* L.) y guindo (*Prunus cerasus* L.) Los híbridos de cerezo (*Prunus avium* L.) y guindo (*Prunus cerasus* L.) no son fáciles de identificar. Para resolver este problema, 18 cultivares de cerezo, guindo y sus híbridos fueron prospectados y caracterizados agromorfológicamente mediante el estudio de 43 descriptores evaluados en flores, hojas, frutos, ramas de 1 año y árbol durante los años 2005 y 2006. En base a los resultados obtenidos del estudio de los diferentes parámetros cuantitativos se realizaron un ANDEVA y un análisis discriminante escalonado (SDA). Los descriptores cualitativos fueron analizados mediante el test de Chi-cuadrado (χ^2). Como resultado del estudio se identificaron dos parámetros cuantitativos (acidez titulable y número de lenticelas) y seis parámetros cualitativos (forma del lóbulo central y de los lóbulos laterales de las brácteas internas de los fascículos florales, forma de la hoja y de sus márgenes, nivel de pubescencia en el envés y tipo de sulcos en la testa seminal) que, por si mismos, tienen valor diagnóstico diferencial para los taxones *P. avium*, *P. cerasus* y *P.* x *gondouinii* (Poit. & Turpin) Rehd. Además, se identificaron cuatro descriptores cualitativos (coloración de los pétalos al final de la floración, tipo de estípulas foliares y forma y viabilidad de la semilla) que se muestran útiles para diferenciar, de una forma rápida y sencilla, entre los guindos y el híbrido. Ninguno de estos parámetros ha sido usado previamente para discriminar entre cerezos, guindos y su híbrido.

Palabras clave: Rosaceae, caracterización, parámetros cuantitativos, parámetros cualitativos, análisis discriminante escalonado.

LITERATURE CITED

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