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Photos. Cover: Guy Sternberg (*Quercus macrocarpa* Michx.); p. 7: Guy Sternberg (*Q. rubra* L.).

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Three New Oak Hybrids from Southwest Iberia (Spain and Portugal)

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ABSTRACT

The study of oak diversity in the Southern Iberian Peninsula resulted in the nomenclatural revision of following nothotaxa: *Quercus* ×*beturica* (F.M. Vázquez, Coombes, Rodr.-Coombes, Ramos & Doncel) F.M. Vázquez, C. Villaviçosa, C. Meireles & C. Pinto-Gomes stat. nov.; *Q.* ×*numantina* Ceb. & C. Vicioso nothosubsp. *discreta* F.M. Vázquez nom. nov., and *Q.* ×*tentudaica* (F.M. Vázquez) F.M. Vázquez stat. nov. Also, three new nothospecies are described: *Q.* ×*ordenensis* F.M. Vázquez, García Alonso & Márquez nothosp. nov. (sterile and rare shrub), *Q.* ×*alentejana* Pinto-Gomes & F.M. Vázquez nothosp. nov. (fertile and frequent Lusitanian tree), and *Q.* ×*pastorae* M.A. Pineda, F.M. Vázquez & Sánchez Gullón nothsp. nov. (fertile and rare tree).

Keywords: *Quercus, Fagaceae*, nothotaxa, Iberian Peninsula, taxonomy, nomenclatural review

Introduction

The oak species from the southwestern Iberian Peninsula have often been studied because of the difficulty of segregation between species, especially in section *Galliferae* (Spach) Gurke which includes the following species: *Q. broteroi* (Cout.) Rivas Martínez & Saénz de Rivas, *Q. canariensis* Willd., *Q. faginea* Lam., and *Q. lusitanica* Lam., all easily producing fertile hybrids that increase the identification problems and the introgression process, which is frequent in many oak groups and species. (Palmer 1948; Muller 1952; Saénz de Rivas et al. 1971; Burger 1975; Van Valen 1976; Vázquez 1995; Vázquez et al. 2000; Dodd et al. 2004.)

Previous studies of the genus *Quercus* L. from the Iberian Peninsula revealed new taxa such as *Q. pauciradiata* Penas, Llamas, Pérez-Morales & Acedo (Penas et al. 1997); *Q. orocantabrica* Rivas Mart., Penas, T.E. Díaz & Llamas (Rivas Martínez et al. 2002) and *Q. ×celtica* F.M. Vázquez, Coombes, Rodr.-Coombes, Ramos & Doncel (Vázquez et al. 2003). These studies revealed the high oak diversity of the Iberian Peninsula and showed the connection between European and North African oak diversity, with the southwestern Iberian Peninsula as a refuge for ancient European and North African oaks such as *Q. estremadurensis* O. Schwarz and *Q. canariensis* (Huguet del Villar 1958; Costa et al. 1997). The Iberian Peninsula is an area of very high oak diversity when compared with the rest of the Mediterranean (Vasconcellos et al. 1954; Franco 1971; Rivas Martínez et al. 1991).

Oak hybridization processes are frequent and they are important mechanisms of evolution, for the colonization of new habitats and for the creation of new species (Palmer 1948; Muller 1952; Rushton, 1993; Vázquez et al. 2000; Sánchez de Dios et al. 2006; Villaviçosa et al. in press). The aim of this work was to study the diversity of the genus *Quercus* in the southwestern Iberian Peninsula, specifically the deciduous hybrid taxa that have been conserved during the last 15 years in the Herbarium HSS (Holmgren et al., 1991, 2003) of the research centre "La Orden-CICYTEX" (Badajoz, Spain).

Methodology

The oak diversity of the southwestern Iberian Peninsula has been reviewed in the existing literature (Coutinho 1888; Sampaio 1910; Schwarz 1936a, 1936b, 1936-39; Camus 1938; Vicioso 1950; Vasconcellos et al. 1954; Huguet del Villar 1958; Sáenz de Rivas 1968; Franco 1971, 1990; Saénz Rivas et al. 1971; Rivas Martínez et al. 1991; Vázquez 1995; Penas et al. 1997; Vázquez et al. 2003, 2013). Material of the deciduous oaks preserved in the Herbarium HSS, collected from numerous populations where at least three deciduous oak species occur, was also studied. The morphological studies were based on characters that best allow the identification and recognition of each taxon as indicated in the review of oaks from the Iberian Peninsula by Franco (1991), while the study of foliar trichomes was based on Hardin (1979) and Vázquez (2013).

Results

The results are presented in two parts: a) the nomenclatural revision of deciduous oak hybrids from the southwestern Iberian Peninsula, and b) the new oak hybrids found there. These results are presented in tables and specific descriptions are given for each

new taxon, accompanied by drawings that emphasize the defining characters of each new hybrid. Finally we provide a list of the studied material (Appendix 1).

Nomenclatural revision of deciduous oak hybrids

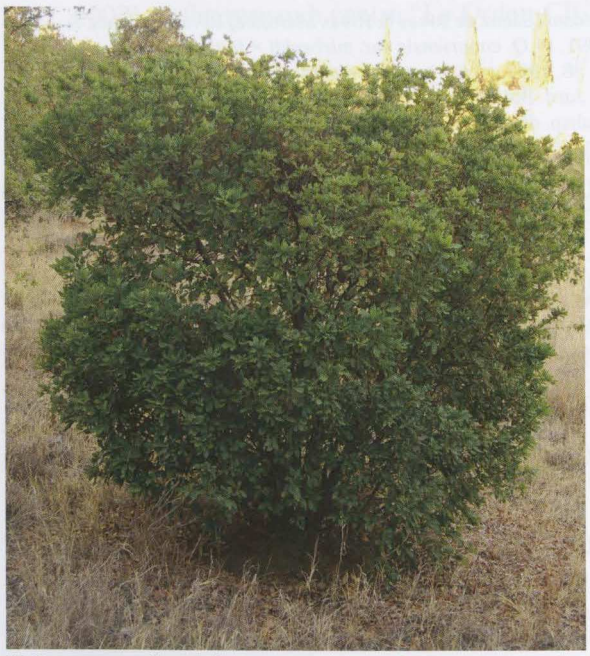
The oak hybrids recognized from the SW Iberian Peninsula (with deciduous species as parents) are listed below. (KEY: in **bold** = new names; underlined = hybrids with parents from different sectons; [ster.] = sterile hybrids].)

1. *Q. ×andegavensis* Hy. nothosubsp. *henriquesii* (Franco & Vasc.) Rivas Martínez & Sáenz de Rivas in *Rivasgodaya* 6: 108. 1991. (= *Q. pyrenaica* × *robur* subsp. *broteroana*)
2. *Q. ×aruciensis* C. Vicioso in *Rev. Gen. Quercus España* 139. 1950. (= *Q. broteroi* × *lusitanica*)
3. *Q. ×battandieri* A. Camus in *Les chênes. Monographie du genre* Quercus. Texte 2: 411, 792. 1939. [ster.] (= *Q. broteroi* × *coccifera*)
4. **Q. ×*beturica*** (F.M. Vázquez, Coombes, Rodr.-Coombes, Ramos & Doncel) F.M. Vázquez C. Villaviçosa & C. Pinto-Gomes **stat. nov.** (Basionym: *Q. ×coutinhoi* A. Camus nothosubsp. *beturica* F.M. Vázquez, Coombes, Rodr.-Coombes, Ramos & Doncel in *Int. Oaks* 14: 53. 2003. (= *Q. broteroi* × *estremadurensis*)
5. *Q. ×carrissoana* A. Camus in *Les Chenes, Monogr. Gen. Quercus*, Atlas II. Expl. Pl. (Encycl. Econ. Sylv.VII.): 59. 1935. (= *Q. canariensis* × *estremadurensis*)
6. *Q. ×celtica* F.M. Vázquez, Coombes, Rodr.-Coombes, Ramos & Doncel in *Int. Oaks* 14: 52. 2003. (= *Q. lusitanica* × *suber*)
7. *Q. ×clementei* C. Vicioso in *Rev. Gen. Quercus España* 140. 1950. (= *Q. broteroi* × *faginea* subsp. *alpestris*)
8. *Q. ×coutinhoi* Samp. in *Man. Fl. Port.*: 123. 1910. (= *Q. faginea* × *robur* subsp. *broteroana*)
9. *Q. ×diegoi* F.M. Vázquez, C. Pinto-Gomes, C. Vinagre & C. Villaviçosa, *Fol. Bot. Extremadurensis* 8: 95. 2014 [ster.] (=*Q. lusitanica* × *pyrenaica*)
10. *Q. ×diosdadoi* F.M. Vázquez, A.J. Coombes, M. Rodríguez, S. Ramos & E. Doncel in *Int. Oaks* 14: 52. 2003. [ster.] (= *Q. pyrenaica* × *rotundifolia*)
11. *Q. ×ferreirae* A. Camus, *Riviera Sci.* 21: 45. 1934. (= *Q. estremadurensis* × *faginea*)
12. *Q. ×fontqueri* O. Schwarz in *Cavanillesia* 8: 85. 1936. (= *Q. canariensis* × *pyrenaica*)
13. *Q. ×jahandiezii* A. Camus in *Les Chenes* (*Encycl. Econ. Sylv.* VII.) Texte 2: 409, 791. 1939. (= *Q. canariensis* × *faginea* subsp. *alpestris*)
14. *Q. ×jahandiezii* A. Camus nothosubsp. *viciosoi* (Sáenz de Rivas & Rivas Martínez) Rivas Martínez & Sáenz de Rivas in *Rivasgodaya* 6: 110. 1991. (= *Q. canariensis* var. *mirbeckii* × *faginea*)
15. *Q. ×neomairei* A. Camus, *Riviera Sci.* 24: 38. 1937. (= *Q. broteroi* × *pyrenaica*)
16. *Q. ×numantina* Ceb. & C. Vicioso in *Anal. Jard. Bot. Madrid* 2: 200. 1941. (= *Q. faginea* × *pyrenaica*)
17. **Q. ×*numantina*** Ceb. & C. Vicioso nothosubsp. ***discreta*** F.M. Vázquez (Basionym: *Q. ×coutinhoi* A. Camus in *Bull. Soc. Bot. France* 82: 438. 1936, nom. illeg.., non Sampaio 1910; (= *Q. faginea* subsp. *alpestris* × *pyrenaica*)
18. *Q. ×pacensis* F.M. Vázquez in *Anales Jard. Bot. Madrid* 53(2): 249. 1996. [ster.] (= *Q. broteroi* × *suber*)
19. *Q. ×senneniana* A. Camus in *Les Chenes, Monogr. Gen. Q.*, Atlas II. Expl. Pl. (Encycl. Econ. Sylv. VII.) 55. 1935. (= *Q. faginea* × *rotundifolia*)
20. *Q. ×subandegavensis* A. Camus, *Chênes* Atlas 2: 60 1935. (= *Q. estremadurensis* × *pyrenaica*)
21. **Q. ×*tentudaica*** (F.M. Vázquez) F.M. Vázquez ***stat. nov.*** (Basionym: *Q. ×senneniana* A. Camus nothosubsp. *tentudaica* F.M. Vázquez in *Anales Jard. Bot. Madrid* 53(2): 250. 1996. (= *Q. broteroi* × *rotundifolia*)
22. *Q. ×tingitana* A. Camus in *Les Chenes* (*Encycl. Econ. Sylv.* VII.) Texte 2: 411, 792. 1939. (= *Q. faginea* subsp. *alpestris* × *lusitanica*)
23. *Q. ×villariana* A. Camus in *Les Chenes* (*Encycl. Econ. Sylv.* VII.) Texte 2: 409, 791. 1939. (= *Q. faginea* subsp. *faginea* × *faginea* subsp. *alpestris*)

The main hybrids are formed between species of the same section (*Quercus* section *Quercus*) (16/23, all fertile), but sporadically one can observe hybrids between species of different sections (6/23, underlined) and they are mainly sterile (4/23, labeled: [ster.])

Q. estremadurensis has often been considered as a subspecies (Camus 1938) of *Q. robur* L., however, the study of its distribution, habitat and ecological behavior, phenology, morphological characters such as the hairiness and shape of leaves, as well as the form and development of the embryo, can justify the separation of this taxon as an independent species, as argued originally by Schwarz (1936b) and again suggested by Villaviçosa et al. (in press).

1/ *Quercus ×ordenensis*



2/ *Quercus ×ordenensis*

New oak hybrids

The study of oaks from different geographical locations has revealed the presence of the following new intersectional hybrids: a) *Q. canariensis* (*Quercus* L. sect. *Quercus*., subsect. *Galliferae* (Spach) Gurke) × *coccifera* L. (*Quercus* sect. *Cerris* Spach subsect. *Cocciferae* A. Camus); b) *Q. robur* (*Quercus* sect. *Quercus*) × *suber* L. (*Quercus* sect. *Cerris*). Also, the study of the deciduous southwestern Iberian forest has revealed a new hybrid between species of the same subsection (*Quercus* sect. *Quercus*, subsect. *Galliferae*: *Q. broteroi* × *marianica* C. Vicioso , pro nothosp.).

Figure 1/ *Quercus ×ordenensis* F.M. Vázquez, García Alonso & Márquez. A: Branch with leaves; B: Leaf diversity; C: Leaf trichome diversity (drawing by F.M. Vázquez Pardo).

1) ***Quercus ×ordenensis*** F.M. Vázquez, García Alonso & Márquez **nothosp. nov.** ≡ *Q. canariensis* × *coccifera* (Fig. 1).

Type: SPAIN (HS): Extremadura: Badajoz (Ba): Guadajira, Centro de Investigación La Orden, [38°51'09.20''N 6°40'07.93''W], 213 m alt., 14 Sep 2012, *F.M. Vázquez*; (Holotype: HSS 56533! (Single specimen), Isotype: HSS 56532!).

Diagnosis. Fruticetum sterile usque ad 1.8 m,[1] altus ramosis. Foliis perenne coriaceous, oblongis-lanceolate vel lanceolate, cuneato-attenuatis, serratis, dentibus acutis, spinescent, adulta subtus pubescentis, petiole (3)5-10(12) mm. Hybrida a parentibus Q. coccifera et Q. canariensis, Q. coccifera similis in habitum, folium adseveratione (perennis) et folium margine, et Q. canariensis similes in petiolum et lamina.

Etymology. The nothospecific epithet refers to the origin of the new nothotaxon: La Orden, Research Centre, Badajoz, Spain.

Description. Sterile shrubs up to 1.8 m, rounded, very branched. Short young branches pilose, canaliculate. Buds globose, with ciliate bracts, concave, red. Leaves persistent, oblong lanceolate to lanceolate, glabrescent above with frequent fasciculate trichomes, glabrescent to pubescent below with radiate, stellate, and frequent multi-stellate trichomes, coriaceous, plane, margins serrate and spiny, (2.5)4-7(8) × (1)2-3.5(4) cm with more than 9 parallel vein pairs, veins yellow abaxially, green adaxially, with long and short simple hairs below; petiole glabrous, coriaceous, yellow, (3)5-10(12) mm. No male (catkins) and female (racemes) flowers (inflorescences).

Distribution. In southern Spain, in local populations of *Q. canariensis* together with *Q. coccifera* in Badajoz, Cadiz, Ciudad Real and Malaga provinces.

Habitat. The original shrub was discovered in an experimental plantation, but the origin of the acorns was a mixed oak forest including *Q. canariensis*, *Q. coccifera*, *Q. lusitanica*, *Q. rotundifolia* Lam., and *Q. suber*. The area has up to 1,200 mm (47 in) annual precipitation, deep (up to 160 cm/63 in) acidic (<6,5 pH) soil, with relictual vegetation such as *Laurus nobilis* L., *Rhododendron ponticum* subsp. *baeticum* (Boiss. & Reut.) Hand.-Mazz., *Ruscus hypophyllum* L., and *Ilex aquifolium* L.

1. For measurement conversions see page 152.

Characters		*Q. canariensis*	*Q. ×ordenensis*	*Q. coccifera*
Habit		Tree to 35 m	Shrub to 1.8 m	Shrub to 3.5 m
Bud	Morphology	Obovate	Ovate	Ovate
	Bracts	Long-ciliate	Short-ciliate	Pubescent
Leaf blade	Persistence	Deciduous	Evergreen	Evergreen
	Size (cm)	6-10(14) × 1.8-3.5(4)	(2.5)4-7(8) × (1)2-3.5(4)	0.8-2.5(3.5) × 0.7-1.4
	Morphology	Oblong-lanceolate	Oblong-lanceolate to lanceolate	Ovate to oblong
Leaf blade margin	Type	Crenate	Serrate	Dentate
	Spines	-	+	+
Leaf petiole	Size (cm)	(1)1.5-2.5	(0.3)0.5-1(1.2)	0.2-0.6
	Pubescent	Pubescent	Glabrous	Glabrous
Leaf blade midrib	Pair number	>10	>9	Up to 7
	Type/Angle	Straight/<32°	Straight/<37°	Sinuous/>40°
	Pubescent	Pubescent	Pubescent	Scabrous
Abaxial leaf surface trichomes	Simple	+	+	+
	Uniseriate	+	+	+
	Stellate	+	+	+
	Fasciculate	+	+	-
	Radiate	+	+	-
	Multi-stellate	+	+	+
	Fused-stellate	-	+	+
Adaxial leaf surface trichomes	Simple	+	+	-
	Uniseriate	+	+	-
	Stellate	+	+	+
	Fasciculate	+	+	-
	Radiate	+	+	-
	Multi-stellate	-	-	-
	Fused-stellate	-	-	-
Reproductive state		Fertile	Sterile	Fertile

Table 1/ Morphological and micromorphological characters for *Quercus ×ordenensis* nothosp. nov., and its parents.

Key for distinguishing *Q. ×ordenensis* nothosp. nov., from its parents

1 Leaves deciduous, margin crenate, spineless, petiole pubescent (1)1.5-2.5 cm, bud bracts long-ciliate..... *Q. canariensis*

1' Leaves persistent, margin spiny, serrate, petiole pubescent to scabrous, 0.2-1.8 cm, bud bracts short-ciliate or not ciliate..... 2.

2 Leaf adaxial surface pubescent to pilose, vein pairs more than 9 diverging from the midrib at up to 37°. Sterile shrub..... *Q. ×ordenensis* nothosp. nov.

2' Leaf adaxial surface glabrous, vein pairs up to 7, diverging from the midrib at more than 40°. Fertile shrub..... *Q. coccifera*

Figure 2/ *Quercus ×alentejana* Pinto-Gomes & F.M. Vázquez. A: Branch with leaves; B: Leaf diversity; C: Leaf trichome diversity (drawing by F.M. Vázquez Pardo).

2) ***Quercus ×alentejana*** Pinto Gomes & F.M. Vázquez **nothosp. nov.** ≡ *Q. marianica* pro nothosp. × *pyrenaica* (Fig. 2).

TYPE: PORTUGAL (LU): Alto Alentejo (AAl): Montemor o Novo a Arriolos, [38°40'56.49''N 8°08'00.03''W] 285 m alt., 26 Oct 2010, *J. Blanco, M. Cabeza de Vaca, D. García, C. Pinto-Gomes, F.M. Vázquez* (holotype: HSS 49040, single specimen)

Diagnosis. Arbor fertile usque ad 35 m, altus. foliis deciduis coriaceous, lanceolate vel oblong-lanceolate, cuneato-attenuatis, serratis, dentibus acutis vel spines, adulta subtus pubescentibis, petiole (4)5-10(12) mm. Hybrida a parentibus Q. pyrenaica et Q. marianica; Q. pyrenaica similis in foliis pubescentibus et floribus bracteis; et Q. marianica similes in petiolum foliis, et lamina margines.

Etymology. The nothospecific epithet refers to the geographic region of origin of the new nothotaxon (Alentejo, Portugal).

Description. Fertile trees up to 35 m, young branches pubescent. Buds globose, with pubescent bracts, concave, brown. Deciduous leaves lanceolate to oblong-lanceolated, pubescent (below/above) with large diversity of trichome types, coriaceous, plain, serrate and with frequent spines to mucronate margins, 4-10(12) × (2)2.5-4(5) cm; up to 13 parallel pair ribs, below yellow ribs, above green ribs, with long, simple, stellate types, fasciculate types and ramified hairs below; petiole pilose, coriaceous, green, 5-10(12) mm. Catkins long up to 9,5 cm, with (17)21-38(44) male flowers. Female inflorescences are variable; peduncle (3)5-21(28) mm; with 1-7(9) female flowers. (Figure 2)

Distribution. The populations of *Q. ×alentejana* are distributed throughout the southwestern Iberian Peninsula and are quite frequent in the provinces of Algarve, Baixo and Alto Alentejo and Estremadura (Portugal), also small groups or isolated individuals are found in the Badajoz and Huelva provinces of Spain.

Habitat. The populations and individuals grow in deep (>1 m) clay soils, with pH >6,5, moderate precipitation 700-1000 mm/annual, in deciduous to mixed forest with evergreen (*Q. suber*) and deciduous species (*Q. broteroi*, *Q. marianica*, *Q. pyrenaica* Willd., or *Q. estremadurensis*), together with evergreen shrubs such as: *Arbutus unedo* L., *Viburnum tinus* L., *Cistus populifolius* L., and *Q. lusitanica* Lam.

Characters		*Q. pyrenaica*	*Q. ×alentejana*	*Q. marianica*
Habit		Tree to 42 m	Tree to 35 m	Tree to 38 m
Bud	Morphology	Ovate	Ovate	Lanceolate
	Bracts	Pubescent	Pubescent	Shortly pilose
Leaf blade	Persistence	Deciduous	Deciduous	Deciduous
	Size (cm)	(5)7-16.5(19) × 3.5-8.5(11)	4-10(12) × (2)2.5-4(5)	(4)4.5-11(12.5) × (1.5)2-3.5(4.5)
	Morphology	Oblong	Oblong-lanceolate to lanceolate	Lanceolate
Leaf blade margin	Type	Lobulate to pinnate	Serrate	Serrate
	Spines	-	+/-	+/-
Leaf petiole	Size (mm)	5 -17(19)	5-10(12)	(8)10-15(18)
	Pubescent	Pubescent	Pubescent	Pilose
Leaf blade midrib	Pair number	<10	7-11(13)	>10
	Type/Angle	Sinuous/>37°	Straight/<37°	Straight/<35°
	Pubescent	Pubescent	Pubescent	Scabrous
Abaxial leaf surface trichomes	Simple	+	+	+
	Uniseriate	+	+	+
	Stellate	+	+	+
	Fasciculate	+	+	-
	Radiate	+	+	-
	Multi-stellate	+	+	-
	Fused-stellate	+	+	-
Adaxial leaf surface trichomes	Simple	+	+	+
	Uniseriate	+	+	+
	Stellate	+	+	+
	Fasciculate	+	+	+
	Radiate	+	+	-
	Multi-stellate	+	+	-
	Fused-stellate	+	+	-
	Ramified	-	+	+

Table 2/ Morphological and micromorphological characters for *Q. ×alentejana* nothosp. nov. and its parents.

Key for distinguishing *Q. ×alentejana* nothosp. nov., from its parents

1. Leaves spineless, lobulate to pinnate. Veins sinuous, diverging at more than 37° from midrib. Leaf hairs unbranched..... *Q. pyrenaica*

1' Leaves serrate with mucronate to spiny teeth. Veins straight, diverging at less than 37° from midrib. Leaves with branched hairs..... *2.*

2 Shoot, bud, petiole and lamina pubescent. Leaf margin with mucronate to spiny teeth. Veins distributed irregularly..... *Q. ×alentejana* nothosp. nov

2' Shoot, bud, petiole and lamina pilose to glabrous. Marginal teeth frequently mucronate. Veins distributed regularly..... *Q. marianica*

3 a-c/ *Quercus ×alentejana*

3) *Quercus ×pastorae* M.A. Pineda, F.M. Vázquez & Sánchez Gullón nothosp. nov. ≡ *Q. robur* × *suber* (Fig. 3).

Type. SPAIN (HS): Andalusia: Sevilla (Se): Sanlúcar la Mayor, [37°21'54.47''N 6°12'01.07''W], 129 m alt., May 2012, *M.A. Pineda, E. Sánchez Gullón*; (holotype: HSS 57709, single specimen).

Diagnosis. Arbor fertile usque ad 8 m, altus. Foliis deciduis subcoriaceous, lanceolate, cuneato-attenuatis, serratis, dentibus subacutis vel obtusis, adulta subtus glabrescentis, petiole (6)7-11 mm. Fructis bractea libera. Hybrida a parentibus Q. robur et Q. suber; Q. robur similis in petiolum frutis et foliis deciduis; et Q. suber similes in petiolum foliis, lamina pubescentis et bractea fructis.

Etymology. The nothospecific epithet refers to the common name of the Sanctuary of El Rocío (Huelva, Spain) (Sanctuary of the "Divina Pastora"), near to Sanlúcar la Mayor (Seville, Spain).

Description. Fertile trees up to 8 m, long young branches glabrous, canaliculate.

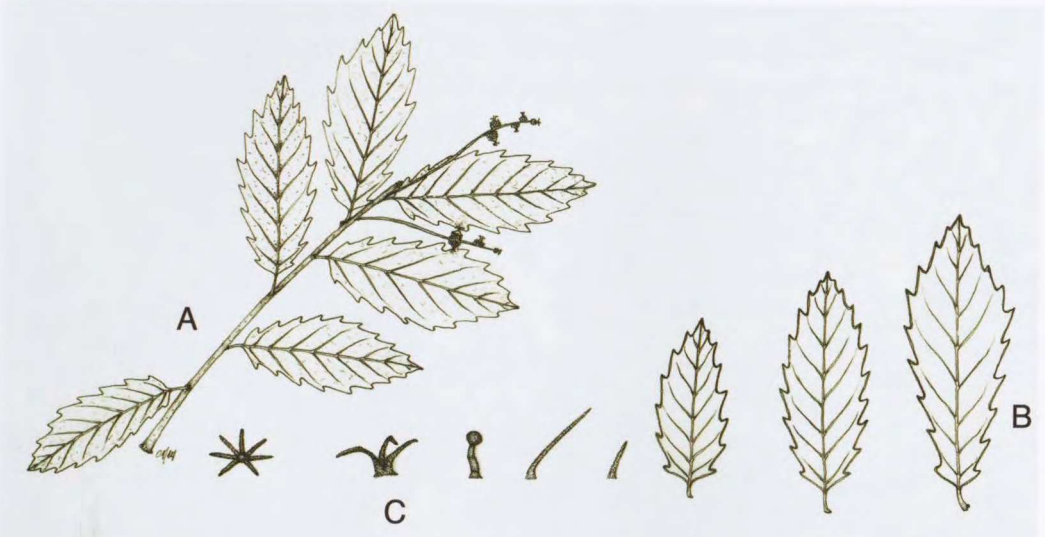
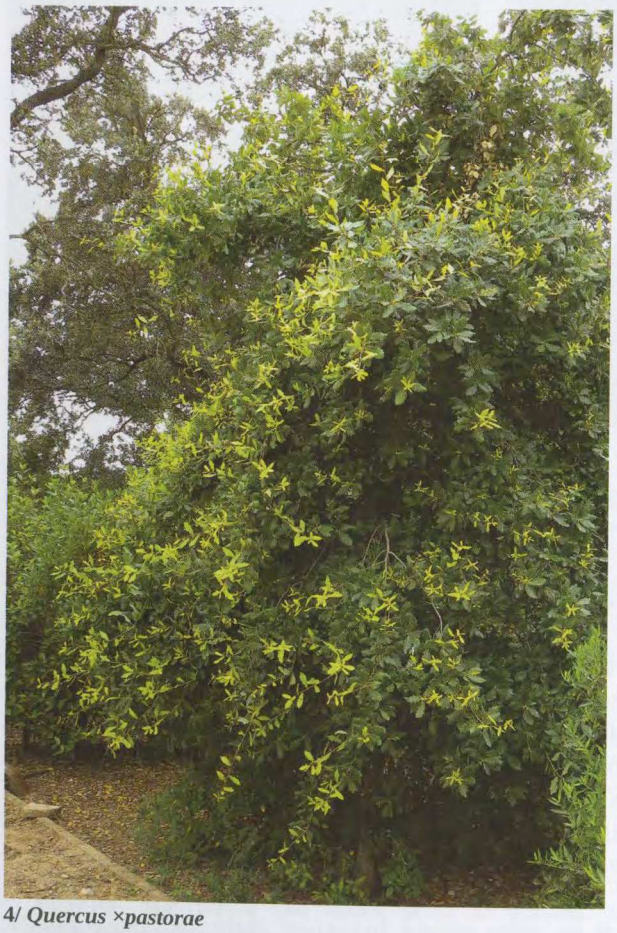


Figure 3/ *Quercus ×pastorae* M.A. Pineda, F.M. Vázquez & Sánchez Gullón. A: Branch with leaves; B: Leaf diversity; C: Leaf trichome diversity (drawing by F.M. Vázquez Pardo).



4/ *Quercus ×pastorae*

Buds globose, with ciliate bracts, concave, brown. Leaves deciduous, lanceolate, glabrescent above with frequent simple trichomes, glabrescent below with fasciculate and multi-stellate trichomes, coriaceous, plane, with serrate and mucronate to smooth margins, (5.5)6-8(8.5) × (1.5)2-4(4.5) cm; up to 10 parallel vein pairs, veins yellow-red to green-red on the abaxial side, green on the adaxial side with long and short simple hairs below; petiole pilose, coriaceous, red, (6)7-11 mm. Catkins up to 7.5 cm long with 12-37 male flowers. Female inflorescences with peduncle up to 3.5 cm long with 2-6(8) female flowers. (Figure 3).

Distribution. This single tree appeared in an area in which *Q. robur* has been cultivated for reforestation close to a natural cork oak (*Q. suber*) forest in the south of the province of Seville (Spain).

Habitat. The area is one with moderate rainfall (up to 900 mm annual precipitation), the soil is

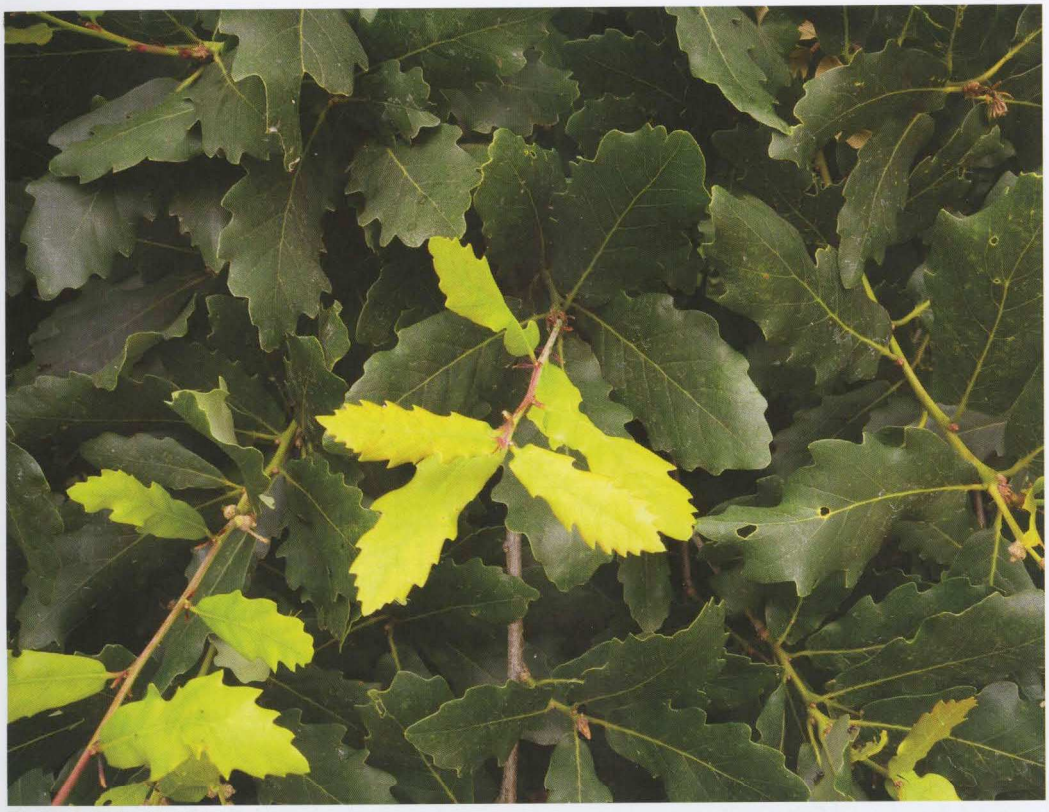
acidic (<6,7 pH), deep (up to 240 cm) and sandy. In the habitat are species representative of cork oak forests from the south of the Iberian Peninsula such as *Arbutus unedo, Viburnum tinus, Pistacia terebinthus* L., and *Smilax aspera* L.

Characters		*Q. robur*	*Q. ×pastorae*	*Q. suber*
Habit		Tree to 40 m	Tree to 8 m	Tree to 25 m
Bud	Morphology	Ovate	Globose	Ovate
	Bracts	Short-ciliate	Long-ciliate	Pubescent
Leaf blade	Persistence	Deciduous	Deciduous	Perennial
	Size (cm)	5-15(17) × 2-6(8)	(5.5)6-8(9.5) × (1.5)2-4(4.5)	2-8(9.5) × 1-4(5.5)
	Morphology	Lanceolate	Lanceolate	Ovate to ovate-lanceo-late
Leaf blade margin	Type	Crenate/Serrate	Serrate	Dentate
Leaf petiole	Size (mm)	0.5-1	(6)7-11	5-9(12)
	Pubescent	Glabrous	Pilose	Pubescent
Leaf blade midrib	Pair number	Up to 11	Up to 10	Up to 7
	Pubescent	Glabrous	Pubescent	Scabrous
Abaxial leaf sur-face trichomes	Simple	+	+	-
	Uniseriate	+	+	+
	Stellate	+	+	+
	Fasciculate	-	+	+
	Radiate	-	-	-
	Multi-stellate	-	+	+
	Fused-stellate	-	-	+
Adaxial leaf sur-face trichomes	Simple	+	+	-
	Uniseriate	+	+	-
	Stellate	-	-	+
	Fasciculate	-	-	+
	Radiate	-	-	-
	Multi-stellate	-	-	+
	Fused-stellate	-	-	-
Reproductive state		Fertile	Fertile	Fertile

Table 3/ Morphological and micromorphological characters of *Q. ×pastorae* nothosp. nov. and its parents.

Key for distinguishing *Q. ×pastorae* nothosp. nov., from its parents

1 Leaves persistent, denticulate. Fruits with curved and free bracts..... *Q. suber*
1' Leaves deciduous, crenate to serrate. Fruits with plane imbricated or free bracts 2
2 Petiole (>6mm) pilose, Leaves glabrescent below.
Fruits with free bracts..... *Q. ×pastorae* nothosp. nov.
2' Petiole glabrous, up to 1 mm. Leaves glabrous below. Fruits with imbricated bracts ..... *Q. robur*



5/ *Quercus ×pastorae*

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Appendix 1 (Specimens examined)

SPECIES

***Quercus broteroi* (Cout.) Rivas Mart. & Sáenz de Rivas**

SPAIN (HS): Andalusia: Cádiz (Ca): Arcos de la Frontera - El Bosque, cerca de Arcos de la Frontera, [36°44'52.45''N 5°34'09.12''W] 278 m alt., 14 Ago 2003, *A. Coombes, F.M. Vázquez* (HSS 10384). Huelva (H): Santa Ana la Real, bosques de Q. suber en vaguadas profundas muy sombrías, [37°52'07.46''N 6°43'48.68''W], 679 m alt., 13 Nov 2000, *J. Blanco, F.M. Vázquez* (HSS 5219). **Extremadura**: Badajoz (Ba): Monesterio, Sierra de Tentudía, [38°04'14.97''N 6°15'45.80''W], 740 m alt., 07 Feb 2001, *Salvador, F.M. Vázquez* (HSS 7232). Cáceres (Cc): Villareal de San Carlos, Salto del Gitano, [39°49'41.32''N 6°02'22.06''W], 228 m alt., 16 Mar 2006, *S. Aguilar, J. Blanco, M. Gutiérrez, F. M. Vázquez* (HSS 18037).

PORTUGAL (LU): Algarve (Ag): Loulé, Salir, sierra calcárea, [37°15'41.98''N 8°02'09.11''W] 410 m alt., 26 Apr 2012, *C. Pinto-Gomes, F.M. Vázquez, C. Villaviçosa* (HSS 54332). **Alto Alentejo** (AAl): Aldeia Velha, zonas de margen de bosque y cultivos, [39°47'51.38''N 8°16'23.08''W], 213 m alt., 10 Dec 2011, *L. Concepción, C. Pinto-Gomes, F.M. Vázquez* (HSS 54827). **Baixo Alentejo** (BAl): Odemira, Sao Teotónio, proximidades del cementerio, [37°31'22.13''N 8°40'41.04''W], 181 m alt., 20 May 2011, *C. Villaviçosa, C. Pinto-Gomes, F.M. Vázquez* (HSS 50547). **Estremadura** (E): Setúbal, Sierra de la Arrábida, [38°31'29.06''N 8°58'06.88''W], 103 m alt., 30 Oct 2010, *J. Blanco, D. García, F.M. Vázquez et al.*, (HSS 53553).

***Quercus canariensis* Willd.**

SPAIN (HS): Andalusia: Cádiz (C): Los Barrios, paraje de La Montera del Torero, [36°09'58.84''N 5°31'32.63''W], 98 m alt., 20 Nov 2000, *J. Blanco, S. Ramos, F. M. Vázquez* (HSS 26058); Ubrique a Cortés de la Frontera, [36°36'53.06'N 5°25'03.36''W], 737 m alt., 14 Ago 2003, *A. Coombes, F. M. Vázquez* (HSS 10378). Málaga (Ma): Cortes de la Frontera, [36°35'49.13''N 5°22'29.17''W], 675 m alt., 29 Jul 1992, *M. Pérez, F.M. Vázquez* (HSS 3465a).

MOROCCO (MO): Tanger: Chauen, Talassemtane, en bosques de Quercus pyrenaica Willd., Q. suber L. y Q. canariensis Willd., [35°09'06.36''N 5°10'20.10''W], 1778 m alt., 15 May 2010, *R. Ferreira, R. Gavilán, C. Pinto-Gomes, D. Sánchez, F.M. Vázquez, B. Vilches* (HSS 49187).

***Quercus coccifera* L.**

SPAIN (HS): Extremadura: Badajoz (Ba): Valle de Santa Ana, [38°21'39.06''N 6°46'55.32''W], 497 m alt., 14 Oct 2010, *J. Blanco, M. Cabeza de Vaca, D. García, F.M. Vázquez* (HSS 48789).

PORTUGAL (LU): Alto Alentejo (AAl): Estremoz, Orada, [38°52'11.61''N 7°28'31.34''W], 328 m alt., 20 Mar 2010, *F.M. Vázquez* (HSS 44226)

***Quercus marianica* C. Vicioso**

SPAIN (HS): Andalusia: Cádiz (Ca): Ubrique a Cortés de la Frontera, [36°36'53.06'N 5°25'03.36''W], 737 m alt., 14 Ago 2003, *A. Coombes, F.M. Vázquez* (HSS 10373). Huelva (H): Santa Ana la Real, Bosques de Q. suber en vaguadas profundas muy sombrías, [37°52'07.46''N 6°43'48.68''W], 679 m alt., 13 Nov 2000, *J. Blanco, F. M. Vázquez* (HSS 5234). Jaén (J): Santa Elena, parque Natural de Despeñaperros, [38°21'45.78''N 3°32'58.73''W], 639 m alt., 30 May 2011, *M. Hervé, A. LeHardy, M. Timacheff, F.M. Vázquez* (HSS 50961). **Extremadura**: Badajoz (Ba): Valle de Santa Ana, [38°20'12.43''N 6°44'42.02''W], 512 m alt., en bosques de alcornoques, 30 Jun 2002, *F.M. Vázquez* (HSS 11523). Cáceres (Cc): Alía, La Calera. Parte baja del Collado de Sobacorbas, [39°28'48.79''N 5°16'54.72''W], 830 m alt., 21 Jun 2011, *D. García, F. Márquez* (HSS 51233).

PORTUGAL (LU): Algave (Ag): Monchique, Ctr. EN267, Km. 32,4, [37°19'07.68''N 8°35'20.37''W], 814 m alt., 20 May 2011, *C. Pinto-Gomes, F.M. Vázquez, C. Villaviçosa* (HSS 50531). **Baixo Alentejo** (BAl): Grândola, [38°09'28.22''N

8°35'42.24''W], 186 m alt., 13 Jan 2012, *C. Villaviçosa* (HSS 56732).

***Quercus pyrenaica* Willd.**

SPAIN (HS): Extremadura: Badajoz (Ba): Cabeza la Vaca, sierra de Tentudía, [38°05'24.03''N 6°22'05.38''W], 713 m alt., 21 Oct 1994, *M. A. Suárez, M.P. Baselga, F. M. Vázquez* (HSS 1144). Cáceres (Cc): Navatrasierra, ctra. CC20, pto. km. 33,35. Turbera de Hospital del Obispo. Garganta del Hospital, [39°34'42.42''N 5°20'59.12''W], 1057 m alt., 26 Jun 2012, *J. Blanco, D. García, F. Márquez, F.M. Vázquez* (HSS 55451).

PORTUGAL (LU): Alto Alentejo (AAl): Ctra. Escorial - Montemor-o-Novo, [38°33'54.96''N 8°10'10.98''W] 281 m alt., 08 Oct 2010, *J. Blanco, M. Cabeza de Vaca, D. García, C. Pinto-Gomes, F.M. Vázquez* (HSS 48695). **Baixo Alentejo** (BAl): Évora, Freguises, [38°34'10.90''N 7°52'46.58''W] 262 m alt., Oct 2011, *C. Villaviçosa* (HSS 56709). **Beira Baixa** (BB): Fundão, Serra da Estrela, [40°07'38.30'N 7°30'20.23''W], 686 m alt., 14 Jun 2012, *F.M. Vázquez* (HSS 55055).

***Quercus robur* L. subsp. *broteroana* O. Schwarz**

SPAIN (HS): Extremadura: Cáceres (Cc): Garganta la Olla, Ctra. Garganta la Olla-Cuacos de Yuste. Garganta de Pedro Chate, [40°06'00.32''N 5°45'02.28''W], 647 m alt., 03 Oct 2006, *J. Blanco, F.M. Vázquez* (HSS 28172).

PORTUGAL (LU): Beira Baixa (BB): Manteigas, Penhas Douradas, entre Manteigas y Penhas Douradas, Robledal, [40°26'37.01''N 7°35'58.34''W], 1168 m alt., 06 Jun 2000, *M. Ladero, S. Rivas Martínez* (HSS 54198).

***Quercus suber* L.**

SPAIN (HS): Extremadura: Badajoz (Ba): Salvatierra de los Barros, [38°28'56.32''N 6°41'18.81''W], 684 m alt., 2 Oct 1992, *A. Burzaco, L. Mateos, M.C. Pérez, F.M. Vázquez* (HSS 1282)

PORTUGAL (LU): Alto Alentejo (AAl): Ponte do Sor, Ervideira, [39°13'43.27''N 8°11'36.90''W] 175 m alt., 21 Nov 1999, *F.M. Vázquez* (HSS 3855).

NOTHOSPECIES (HYBRIDS)

***Quercus ×alentejana* Pinto-Gomes & F.M. Vázquez nothosp. nov**

SPAIN (HS): Extremadura: Badajoz (Ba): Valle de Santa Ana, [38°21'39.06''N 6°46'55.32''W], 497 m alt., 14 Oct 2010, *J. Blanco, M. Cabeza de Vaca, D. García, F.M. Vázquez* (HSS 48794).

PORTUGAL (LU): Alto Alentejo (AAl): Lavre, salida a Coruche, [38°46'49.65''N 8°21'52.23''W], 125 m alt., 8 Oct 2010, *J. Blanco, M. Cabeza de Vaca, D. García, C. Pinto-Gomes, F.M. Vázquez* (HSS 48733); Montemor o Novo a Arriolos, [38°40'56.49''N 8°08'00.03''W] 285 m alt., 26 Oct 2010, *J. Blanco, M. Cabeza de Vaca, D. García, C. Pinto-Gomes, F.M. Vázquez* (HSS 49040 (Holotype)); ibídem, Foros de Vale de Figueira, [38°40'51.09''N 8°08'02.25''W] 271 m alt.,, 8 Oct 2010, *J. Blanco, M. Cabeza de Vaca, D. García, C. Pinto-Gomes, F.M. Vázquez* (HSS 48653).

***Quercus ×andegavensis* Hy. nothosubsp. henriquesii (Franco & Vasc.) Rivas Martínez & Sáenz**

PORTUGAL (LU): Beira Baixa (BB): Fundão, Serra da Estrela, [40°07'38.30'N 7°30'20.23''W], 686 m alt., 14 Jun 2012, *F.M. Vázquez* (HSS 55056).

***Quercus ×beturica* (F.M. Vázquez, A. Coombes, M. Rodriguez-Coombes, S. Ramos & E. Doncel) F.M. Vázquez, C. Villaviçosa & Pinto-Gomes**

SPAIN (HS): Extremadura: Badajoz (Ba): Valle de Santa Ana, [38°21'41.16''N 6°46'52.22''W], 482 m alt., May 1993, *F.M. Vázquez* (HSS 2451 (Holotype); HSS 2452 (Isotype)).

PORTUGAL (LU): Baixo Alentejo (BAl): Odemira, Sao Teotonio, próximo a Espedanas, [37°31'17.65''N 8°40'40.21''W], 173 m alt., 20 May 2011, *C. Vila-Viçosa, C. Pinto Gomes, F.M. Vázquez* (HSS).

***Quercus ×neomairei* A. Camus**

SPAIN (HS): Extremadura: Badajoz (Ba): Salvatierra de los Barros, Salvatierra de los Barros a Salvaleón. Finca "El Chorrero", [38°29'27.02''N 6°44'43.37''W], 761 m alt., 04 Dec 2009, *J. Blanco, M. Gutiérrez, F.M. Vázquez*, (HSS 43896).

PORTUGAL (LU): Baixo Alentejo (BAl): Cemitério de São Teotónio, São Teotónio, Odemira, [37°31'22.13''N 8°40'41.04''W], 181 m alt., 20 May 2011, *C. Villaviçosa, C. Pinto-Gomes, F.M. Vázquez* (HSS).

***Quercus ×ordenensis* F.M. Vázquez, García Alonso & Márquez nothosp. nov**

SPAIN (HS): Extremadura: Badajoz (Ba): Guadajira, Centro de Investigación La Orden, [38°51'09.20''N 6°40'07.93''W], 213 m alt., 14 Sep 2012, *F.M. Vázquez* (HSS 56533 (Holotype)).

***Quercus ×pastorae* M.A.Pineda, F.M.Vázquez & Sánchez Gullón nothosp. nov**

SPAIN (HS): Andalusia: Sevilla (Se): Sanlúcar la Mayor, [37°21'54.47''N 6°12'01.07''W], 129 m alt., May 2012, *M.A. Pineda, E. Sánchez Gullón*; (HSS 57709 (Holotype)).

***Quercus ×subandegavensis* A. Camus**

PORTUGAL (LU): Baixo Alentejo (BAl): Odemira, Sao Teotónio, proximo a Espedanas, [37°31'17.65''N 8°40'40.21''W], 173 m alt., 20 May 2011, *C. Villaviçosa, C. Pinto-Gomes, F.M. Vázquez* (HSS 50583).