DIVERSITY OF IBERIAN OAKS

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Abstract

In this paper we examine the diversity of Iberian oaks on different levels. The main factor discussed is the difficult species concept in Quercus L. Our study addressed 11 species and their infra-specific diversity (subspecies, varieties and forms) and includes an in-depth treatment of hybrid diversity, with nearly 40 different hybrids identified. All species and subspecies are included, with information about their main characteristics, their distribution, and their ecological preferences. The final result is a complete guide to the oaks of the Iberian Peninsula, with a detailed discussion of specific and infra-specific diversity.

In order to bring the nomenclature of Iberian oaks up-to-date, the following new combinations are listed here:

Q. x coutinhoi nssp. subalpestris (A. Camus) F.M. Vázquez, S. Ramos & S. García, comb. et stat. nov. (Bas.: Q. x subalpestris A. Camus, Les Chenes 2: 412, 792, 1938-1939) (Q. faginea subsp. alpestris x Q. robur subsp. estremadurensis)
Q. rotundifolia var. avellaniformis (Colmeiro & Boutejou) F.M. Vázquez, S. Ramos & S. García, comb. nov. (Bas.: Q. avellaniformis Colmeiro & Boutejou, Examen Encinas 9, 1854)
Q. rotundifolia var. brevicupulata (Laguna) F.M. Vázquez, S. Ramos & S. García, comb. et stat. nov. (Bas.: Q. ilex f. brevicupulata Laguna in Fl. Fr. Española 1: 256, 1883).
Q. rotundifolia var. macrocarpa (Coutinho) F.M. Vázquez, S. Ramos & S. García, comb. nov. (Bas.: Q. ilex var. ballot a f. macrocarpa Coutinho, Bol. Soc. Brot. 6: 95, 1888)
Q. rotundifolia var. pilosella (F.M. Vázquez) F.M. Vázquez, S. Ramos & S. García, stat. nov. (Bas.: Q. rotundifolia for. pilosella F.M. Vázquez in Semillas Quercus, 84, 1998)

Key words: Distribution, Ecology, Hybrid, Infraspecific, Portugal, Quercus, Spain, Taxonomy.
Introduction

The Iberian Peninsula is the most western portion of the European continent, and has wide variability in climate, soils and forest types. We find pine forest in the northern and southern territory, and oak forests are widely distributed in the southern, northern, central, eastern or western parts. Species of genera such as *Tilia*, *Fraxinus*, *Ulmus*, *Celtis*, *Juglans*, *Alnus* and *Abies* are lesser components of the oak forests.

The most representative forests of the Iberian Peninsula are the oak forests, which comprise over 10 million hectares and include eleven different oak species. The habitats, diversity of landscapes, vegetation types, flora, fauna and soils are the most interesting parts of the oak forests’ ecosystems.

The origin of diversity in the oak forests is associated with the wide range of oak species in these forests. We can find three or four different types of oaks within a single hectare of oak forest. We can also find within the same habitat evergreen and deciduous oaks, hybrids between oaks, shrub oaks and oak trees, and oak species that have different physiological cycles. For instance, the holm oak (*Quercus ilex*) has annual phenological cycles and two vegetative cycles, while the cork oak (*Q. suber*) has annual and biennial phenological cycles and up to three annual vegetative cycles.

The diversity of flora in these forests produces a great diversity of animals and fungi. There are more than 3000 different fungi, close to 45,000 insect species, and approximately 500 bird species in the Iberian Peninsula. But the biggest diversity is within the oak species themselves. Iberian oaks have adapted physiologically, phenologically, and reproductively, and for these reasons, oaks have developed great tolerance to environmental stress. These adaptations are the source of diversity and the basis of the origin of new varieties, subspecies, and numerous hybrids.

The objective of this paper is to show the diversity of oak taxa: species, subspecies, varieties, forms and hybrids, found in the oak forests of the Iberian Peninsula. Also, the origin of the diversity and the problems linked to some of the complex oak species, such as the *Q. pubescens* group and the *Q. faginea* group, will be discussed.


Oak Species

The diversity of the oak flora of the Iberian Peninsula came about in different ways. The deciduous oaks originated during the last glaciation, when large parts of northern and central Europe were covered by ice. The recession of the ice provided an opportunity for colonization of subspecies of the common oaks, whose origins are associated with the glaciation. These include *Quercus canariensis* Willd. And *Q. robur* subsp. *estremadurensis* (O.Schwarz) A.Camus.

Other species are more typical of the Mediterranean climate, and these species are associated with the higher temperatures of the present interglacial.
period. They grow in warm environments, such as *Q. coccifera* L. and *Q. rotundifolia* Lam. These species are associated with the dry territories of the central, northern and southern parts of the Iberian Peninsula. Oceanic conditions are the typical habitat for species like *Q. ilex* L. The holm oak occupies areas without frost, with high environmental humidity, and with sandy soils.

The rest of the species of the Peninsula originated by combinations of different causes. The *Q. pubescens* group is a combination of microspecies that live in different conditions of the northern and central Iberian Peninsula with an unknown origin, though they are likely associated with glacial oak species which later adapted to Mediterranean conditions. As a result, the populations close to the glacial oak species are different from populations better adapted to Mediterranean conditions. This last case is similar to the origin of the *Q. faginea* group.

**The species currently growing in the Iberian Peninsula are the following:**

- **Q. canariensis** Willd.
  
  Tree of up to 35 m, with deciduous and glabrous, large- to medium-sized leaves at maturity, with long and abundant hairs on the young leaves; laminae with lobules on their margins, and long petioles. Annual fruit with short cupules and medium-sized bitter acorns with 1 to 5 fruits per raceme, on short peduncles.
  
  **Distribution and habitat:** Associated with the humid zones of the Mediterranean coast of Andalucía and Cataluña. This species also grows inland in the Monchique (Portugal), Sierra Morena, and Toledo Mountains. It is a species that grows in the Iberian Peninsula, Morocco and Algeria.

- **Q. cerris** L.
  
  Tree of up to 22 m, with medium- to small-sized deciduous pubescent leaves, the laminae with dentate to lobuled margins and acute apexes. Biennial fruits of medium size in cupules with free bracts and bitter acorns in groups of 2-4 per raceme, with short peduncles.
  
  **Distribution and habitat:** This species originated in central Europe, and was introduced in the XVII century close to Madrid, where it grows today in the Prado oak forest with cork oak.

- **Q. coccifera** L.
  
  Shrub of up to 4 m, with populations in Arrabida (Portugal), Malaga (Spain) and the Odemira (Portugal) coast, with large specimens of up to 15 m. Evergreen species with small, glabrous leaves and laminae with prickles on the margins. Biennial fruits with large to small cupules and medium-sized acorns, normally 1 fruit per raceme, with short peduncles.
  
  **Distribution and habitat:** This species grows in harsh conditions, with high contrasts of humidity and temperature in open areas. It is common in all areas where there is a Mediterranean influence, from the Near East to the Iberian Peninsula, but it prefers calcareous soils and a southerly exposure.

- **Q. faginea** Lam.
  
  Tree of up to 27 m, with medium- to small-sized pubescent deciduous leaves, and laminae with obtuse to acute apexes of the lobules. Small to medium sized, annual fruits with short cupules and 1 to 7 fruits per raceme, on long or short peduncles.
Q. cerris L., an introduced species to the Iberian Peninsula.  

(© Guy Sternberg)
**Distribution and habitat:** *Q. faginea* grows in many different habitats where other oaks also grow. We can see *Q. faginea* in the typical habitats of *Q. pyrenaica* Willd., *Q. suber* L., *Q. rotundifolia* Lam., or *Q. lusitanica* Lam. For this reason, it is difficult to define an exclusive ecosystem for *Q. faginea*. It grows in the western Mediterranean area, in Morocco, Tunisia, Algeria, France and throughout the Iberian Peninsula.

- **Q. ilex** L.
  Tree of up to 37 m, with medium-sized evergreen pubescent leaves and lanceolate, acute laminae with entire margins. Annual fruits with medium-sized cupules and medium-sized bitter acorns, normally with 2 to 6 fruits per raceme, with short peduncles.
  
  **Distribution and habitat:** This species is found in large parts of southern Europe, in regions influenced by the Mediterranean Sea. The populations of this species prefer a temperate climate with high humidity and frost-free areas. In the Iberian Peninsula we can see it in the northern territory and the eastern coast close to the Mediterranean Sea, from Murcia to Cataluña regions.

- **Q. petraea** (Matt.) Liebl.
  Tree of up to 30 m, with medium to large-sized, deciduous, glabrous leaves and round, obtuse apex, the laminae with lobed margins and medium-sized petioles. Annual fruits with small- to medium-sized cupules and small- to medium-sized acorns, with 1 to 4 fruit per raceme, with long peduncles.
  
  **Distribution and habitat:** *Q. petraea* grows in the northern part of the Iberian Peninsula, and is common in the Pyrenean, Cantabrian and Basque Mountains. It also grows in the central part of the Peninsula in deep valleys with constant humidity.

- **Q. pubescens** Willd. *nom. cons.*
  Tree of up to 20 m, with medium- to small-sized, deciduous, pubescent leaves and oblong lanceolate to obovate laminae, with acute to obtuse apexes and small to incised lobules on the margins. Annual fruits with medium- to small-sized cupules and small- to medium-sized bitter acorns, with 1 to 4 fruits per raceme, with short peduncles.
  
  **Distribution and habitat:** The optimum environment for this species are the Pyrenean conditions and the protected valleys of the interior Iberian Peninsula. The main distribution areas are Cataluña, Navarra and Aragon, but we can find this species in the central and northeastern regions also.

- **Q. pyrenaica** Willd.
  Tree of up to 28 m, with medium- to large-sized, deciduous, pubescent leaves and oblong to round obtuse laminae, with lobed to pinnate margins. Annual fruits on medium-, small- to large-sized cupules and small, medium or large, bitter acorns, with 1 to 4 fruits per raceme, with short peduncles.
  
  **Distribution and habitat:** This species grows in southern France, the Iberian Peninsula, and northwest Africa, associated with small mountain areas with medium humidity and fertile soils. In the Iberian Peninsula it is frequent in the central territory associated with the Central Mountains.
• *Q. robur* L.
  Tree of up to 37 m, with small- to medium-sized deciduous, glabrous leaves, with rounded apexes, the laminae with lobuled margins. Fruits annual with medium- to small-sized, bitter acorns, with 1 to 4 fruits per raceme, medium-sized cupules and long peduncles.

  **Distribution and habitat:** This common oak grows in northern areas of the Iberian Peninsula, but populations can also be found in the central territory and there is an endemic subspecies confined to the southwest part of the region.

• *Q. rotundifolia* Lam.
  Tree of up to 25 m, with medium- to small-sized evergreen, pubescent leaves, the oblong to round, obtuse laminae with entire margins. Annual fruits with a medium to large cupule and small, medium or large, sweet acorns, with 1 to 7 fruits per raceme, on short peduncles.

  **Distribution and habitat:** This species grows in southern France, the Iberian Peninsula, and northwest Africa, associated with temperature and precipitation contrasts and indifferent to soil type. In the Iberian Peninsula, it is found in all regions and is the most common oak species there.

• *Q. suber* L.
  Tree of up to 27 m, with medium- to small-sized evergreen leaves, glabrous to pubescent beneath, the laminae with obtuse apexes and dentate margins. Annual to biennial fruits with medium- to large-sized cupules and small, medium or large, bitter acorns, with 1 to 9 fruits per raceme, with short peduncles.

  **Distribution and habitat:** The cork oak grows in southern France, the Iberian Peninsula and northwest Africa, associated with acid soils and moderate rainfall. In the Iberian Peninsula, it is most commonly found in the southwest.

**Infraspecific Variations**

Variations within species fall into two distinct categories: the subspecies concept, and the variant and form concepts. The subspecies concept is a term used to differentiate between forms of the same species resulting from populations growing in two different habitats. Typical examples are subspecies growing in coastal and continental habitats, respectively.

The variant and form types originated as a result of mutation and a plastic genotype. The oak species have many small variations in habitats (edaphic, climatic, geological).

The variations of the subspecies concept are constant characteristics, whereas the characteristics of variant and form are variable. The largest diversity is in taxa variants and forms, creating great problems with nomenclature and taxonomy.

**Iberian Oak Subspecies**

The Iberian oaks that have subspecies are listed below:

• *Q. coccifera* L.
  This species has two subspecies: *Q. coccifera* subsp. *coccifera* and *Q. coccifera* subsp. *calliprinos* (Webb) Holmboe. We can segregate these two
subspecies by means of leaf characteristics. *Q. coccifera* subsp. *coccifera* is a shrub of up to 4 m and has glabrous leaves and petioles, whereas *Q. coccifera* subsp. *calliprinos* is a tree of up to 15 m, and the petioles and leaf bases have hairs. *Q. coccifera* subsp. *coccifera* lives in areas with widely varying temperature and frost conditions, while *Q. coccifera* subsp. *calliprinos* lives in frost-free areas and in valleys near the coast.

*Q. faginea* Lam.

In *Q. faginea* we can see three different subspecies differing in leaf morphology. The three subspecies are *Q. faginea* subsp. *faginea*, *Q. faginea* subsp. *broteroi* (Coutinho) A. Camus and *Q. faginea* subsp. *alpestris* (Boiss.) A. Camus. The differences between the subspecies are the following: *Q. faginea* subsp. *faginea* is characterised by the presence of subglabrous leaves and short laminae with obtuse apexes. *Q. faginea* subsp. *broteroi* has medium to large sized, pubescent leaves with obtuse apexes; whereas *Q. faginea* subsp. *alpestris* has medium-sized pubescent leaves with acute apexes of the laminae.

*Q. faginea* subsp. *faginea* grows throughout the Iberian Peninsula; *Q. faginea* subsp. *broteroi* grows in the southern and central Iberian Peninsula; and *Q. faginea* subsp. *alpestris* is distributed in southern Iberia.

![Q. faginea, a native oak of the Iberian Peninsula.](© Guy Sternberg)

*Q. petraea* (Matt.) Liebl.

The subspecies of *Q. petraea* are *Q. petraea* subsp. *petraea* and *Q. petraea* subsp. *huguetiana* Franco & G. López. These two subspecies have different leaf characteristics. *Q. petraea* subsp. *petraea* has short leaves with 2-5 pairs of lobules and medium-sized leaves up to 20-cm long, whereas *Q. petraea* subsp. *huguetiana* has leaves up to 30-cm long with 4-9 pairs of lobules.
The typical habitat of *Q. petraea* subsp. *petraea* are the valleys of the northern and central regions of the Iberian Peninsula, while *Q. petraea* subsp. *huguetiana* grows in the deep valleys of the northeastern regions of the Iberian Peninsula.

- **Q. pubescens** Willd.

  In the Iberian Peninsula we find see three different taxa of the *Q. pubescens* group: *Q. cerrioides* Willk. & Costa, *Q. subpyrenaica* Huguet del Villar, and *Q. lanuginosa* (Lam.) Thuill. The nomenclature and taxonomic considerations are complex in this group and we can regard the taxa as species, subspecies, or variants of *Q. pubescens* Willd.

  It is difficult to distinguish between the three taxa because they frequently form hybrids and differentiation is possible only in pure populations. *Q. cerrioides* has small, short-pubescent leaves with obtuse lobules; *Q. lanuginosa* has medium sized, long-pubescent leaves with obtuse lobules; and *Q. subpyrenaica* has large to medium sized, glabrous to pubescent leaves with acute lobules. The *Q. pubescens* group grows in the northern Iberian Peninsula; there is also a small population in central Iberia.

- **Q. robur** L.

  There are three different subspecies of *Q. robur*: *Q. robur* subsp. *robur*, *Q. robur* subsp. *broteroana* O. Schwarz, and *Q. robur* subsp. *estremadurensis* (O. Schwarz) A. Camus. The three subspecies can be distinguished by their leaves. The leaves of the typical subspecies (*Q. robur* subsp. *robur*) are short with 2-5 pairs of obtuse lobules which are glabrous. *Q. robur* subsp. *broteroana* has leaves with 3-7 pairs of obtuse lobules and with dispersed hairs on the abaxial surface. *Q. robur* subsp. *estremadurensis* has leaves with 3-7 pairs of acute lobules and the abaxial and adaxial surfaces have hairs.

  The habitat of *Q. robur* subsp. *robur* is the Eurosiberian region of the northern Iberian Peninsula. *Q. robur* subsp. *broteroana* grows in the northern and central regions of the Peninsula, and *Q. robur* subsp. *estremadurensis* grows in the southwestern part of Peninsula, in deep valleys with constant humidity and temperature.

**Varieties and Forms of Iberian Oaks**

The greatest taxonomic difficulty is differentiating between variety and form in *Quercus* L. We prefer to associate the term “variety” with variations associated with consistent characteristics such as size or form of the fruits, whereas inconsistent characteristics are referred to as “form category” and include the size or morphology of the leaves.

When the acorns are small, taxa often bear the epithet “microcarpa” or “microbalanus”, like *Q. pubescens* var. *microcarpa* (Guss.) F.M. Vázquez, S. Ramos & S. García or *Q. robur* var. *microbalanans* (Heuff.) Schur. At other times we can see large acorns and the epithets used for these taxa are often “macrocarpa” or “macrobalanus”, such as *Q. rotundifolia* var. *macrocarpa* (Coutinho) F.M. Vázquez, S. Ramos & S. García, or *Q. faginea* var. *macrobalanans* A. Camus.

When acorns have small cupules, the taxa are often given epithet
"brevicupulata", such as: *Q. coccifera var. brevicupulata* Batt. & Trabut or *Q. rotundifolia var. brevicupulata* (Laguna) F.M. Vázquez, S. Ramos & S. García. Another situation is when the acorns are included inside the cupules. In these instances, the taxa often carry epithets “subinclusa” or “avellaniformis” such as: *Q. lusitanica var. subinclusa* (Coutinho) F.M. Vázquez, S. Ramos & S. García or *Q. rotundifolia var. avellaniformis* (Colmeiro & Boutelou) F.M. Vázquez, S. Ramos & S. García.

Inflorescences often differ between the individuals within the same population, and the character is constant. In these cases we can see different groupings of the fruits in the tree associated with the female inflorescence. The epithet applied to these taxa is often “racemosa”, such as *Q. suber var. racemosa* Borzi. And finally, we sometimes see pubescent acorns. In this case the epithet can be “pilosa”, such as *Q. rotundifolia var. pilosella* (F.M. Vázquez) F.M. Vázquez, S. Ramos & S. García.

Variations associated with leaf morphology are often given the rank of forma. Within the group of the these forms we can see species with pinnate leaves receiving the epithet “pinnatifida”, such as *Q. pyrenaica f. pinnatifida* O. Schwarz or *Q. pyrenaica f. pinnatifida* (Sennen) C. Vicioso. Others may have large leaves such as *Q. suber f. macrophylla* (Coutinho) F.M. Vázquez, S. Ramos & S. García.

Apart from variations associated with leaves, flowers and acorns, we can find variations in other organs such as the branches or the wood. Specimens exist with pendulous branches such as *Q. rotundifolia f. pendula* (Batt. & Trabut) Luebbert (Bas.: *Q. ilex var. pendula* Batt. & Trab., Fl. Algerie 825, 1888-1890). On other occasions, it is possible to find specimens with cork in the wood such as *Q. faginea f. subsuberosa* (Coutinho) Luebbert (Bas.: *Q. lusitanica* f. *subsuberosa* Coutinho, Bol. Soc. Brotn. 6: 68,1988).

**Hybrid Diversity**

The most important source of diversity in the Iberian oaks results from combinations between different species. The ease with which different species, subspecies or varieties hybridize causes the greatest problems in identification and characterization of taxa within *Quercus*.

Along with hybridization, it is necessary to include the combinations between hybrids and their parents. The final result is a large group of combinations with intermediate characteristics between the hybrids and their parents. This creates a large problem with little possibility of finding a solution.

In this paper we offer information on the diversity of Iberian oak hybrids that are listed below under their parent species:

**Hybrids of *Q. canariensis* Wild.**

*Q. x carrisoana* A. Camus (*Q. canariensis* x *Q. robur* subsp. *estremadurensis*)

*Q. x fontqueri* O. Schwarz (*Q. canariensis* x *Q. pyrenaica*)

*Q. x jahandiezi* A. Camus (*Q. canariensis* x *Q. faginea* subsp. *alpestris*)

*Q. x jahandiezi* nssp. *viciosoi* Rivas Martínez & Sáenz (*Q. canariensis* var. *mirbeckii* x *Q. faginea*)

*Q. x lagunai* Luebbert (*Q. canariensis* x *Q. lusitanica*)

*Q. x marianica* C. Vicioso (*Q. canariensis* x *Q. faginea* subsp. *broteroi*)

*Q. x paui* C. Vicioso (*Q. canariensis* x *Q. pubescens* x *Q. pyrenaica*)

*Q. x subglaucescens* A. Camus (*Q. canariensis* x *Q. pubescens* subsp. *subpyrenaica*)
Hybrids of *Q. cerris* L.
*Q. x hispanica* Lam. (*Q. cerris* x *Q. suber*)

Hybrids of *Q. coccifera* L.
*Q. x airensis* Franco & Vasc. (*Q. coccifera* x *Q. rotundifolia*)
*Q. x auzandrii* Gren & Godr. (*Q. coccifera* x *Q. ilex*)
*Q. x battandieri* Trubut (*Q. coccifera* x *Q. faginea* subsp. *broteroii*)

Hybrids of *Q. ilex* L.
*Q. x alboescens* Rouy (*Q. ilex* x *Q. pubescens*)
*Q. x autumnalis* Vázquez, F.M., S. Ramos & E. Doncel (*Q. ilex* x *Q. rotundifolia*)
*Q. x auzandrii* Gren & Godr. (*Q. coccifera* x *Q. ilex*)
*Q. x morisii* Borzi (*Q. ilex* x *Q. suber*)
*Q. x turneri* Willd. (*Q. ilex* x *Q. robur*)

Hybrids of *Q. faginea* Lam.
*Q. x allorgeana* A. Camus (*Q. faginea* x *Q. pubescens* subsp. *subpyrenaica*)
*Q. x battandieri* Trubat (*Q. coccifera* x *Q. faginea* subsp. *broteroii*)
*Q. x coutinhoii* nssp. *duriensis* Vasc. & Franco (*Q. faginea* var. *salicifolia* x *Q. robur*)
*Q. x coutinhoii* nssp. *ferreirae* (A. Camus) F.M. Vázquez, S. Ramos & S. García (*Q. faginea* x *Q. robur* subsp. *estremadurensis*)
*Q. x coutinhoii* Samp. (*Q. faginea* x *Q. robur*)
*Q. x jahandiezii* A. Camus (*Q. canariensis* x *Q. faginea* subsp. *alpestris*)
*Q. x jahandiezii* nssp. *viciosoi* Rivas Martínez & Sáenz (*Q. canariensis* var. *mirbeckii* x *Q. faginea*)
*Q. x marianica* C. Vicioso (*Q. canariensis* x *Q. faginea* subsp. *broteroii*)
*Q. x numantina* (*Q. faginea* x *Q. pyrenaica*)
*Q. x numantina* nssp. *neomairei* (Coutinho) Luebbert (*Q. faginea* subsp. *broteroii* x *Q. pyrenaica*)
*Q. x numantina* nssp. *transmontana* (Coutinho) Luebbert (*Q. faginea* subsp. *alpestris* x *Q. pyrenaica*)
*Q. x pacensis* F.M. Vázquez (*Q. faginea* subsp. *broteroii* x *Q. suber*)
*Q. x salcedoi* C. Vicioso (*Q. faginea* x *Q. petreae* subsp. *huguetiana*)
*Q. x seneniana* A. Camus (*Q. faginea* x *Q. rotundifolia*)
*Q. x seneniana* nssp. *tentudaicus* F.M. Vázquez (*Q. faginea* subsp. *broteroii* x *Q. rotundifolia*)
*Q. x tingitana* A. Camus (*Q. faginea* subsp. *alpestris* x *Q. lusitanica*)
*Q. x villariana* A. Camus (*Q. faginea* subsp. *faginea* x *Q. faginea* subsp. *alpestris*)

Hybrids of *Q. lusitanica* Lam.
*Q. x celtica* Vázquez, F.M., A.J. Coombes, M. Rodríguez, S. Ramos & E. Doncel (*Q. lusitanica* x *Q. suber*)
*Q. x gallaeica* Penas, Llamsas & A. Acedo (*Q. lusitanica* x *Q. robur*)
Q. x lagunai Luebbert (Q. canariensis x Q. lusitanica)
Q. x tingitana A. Camus (Q. faginea subsp. alpestris x Q. lusitanica)

Hybrid of Q. petraea (Matt.) Liebl.
Q. x cantabrica Vicioso (Q. petraea x Q. pyrenaica x Q. robur subsp. broteroana)
Q. x rosacea nsssp. secalliana (C. Vicioso) Rivas Martínez & Sáenz (Q. petraea x Q. robur subsp. broteroana)
Q. x rosacea O. Schwarz (Q. petraea x Q. robur)
Q. x salcedoi C. Vicioso (Q. faginea x Q. petraea subsp. huguetiana)
Q. x streimii Hueffel (Q. petraea x Q. pubescens)
Q. x streimii nsssp. costae (C. Vicioso) Luebbert (Q. cerrioides x Q. petraea subsp. huguetiana)
Q. x subglaucescens A. Camus (Q. canariensis x Q. pubescens subsp. subpyrenaica)
Q. x trabutii Hy (Q. petraea x Q. pyrenaica)
Q. x trabutii nsssp. legionensis (O. Schwarz) Sáenz (Q. petraea subsp. huguetiana x Q. pyrenaica)
Q. x viverti Sennen (Q. canariensis x Q. petraea subsp. huguetiana)

Hybriss of Q. pubescens Willd.
Q. x albescens Rouy (Q. ilex x Q. pubescens)
Q. x allorgeana A. Camus (Q. faginea x Q. pubescens subsp. subpyrenaica)
Q. x firmurensis Hy (Q. pubescens subsp. lanuginosa x Q. pyrenaica)
Q. x kermers nsssp. montserratii (C.Vicioso) Rivas Martínez & Saenz (Q. pubescens subsp. subpyrenaica x Q. robur)
Q. x paui C.Vicioso (Q. canariensis x Q. pubescens x Q. pyrenaica)
Q. x streimii nsssp. costae (C. Vicioso) Luebbert (Q. cerrioides x Q. petraea subsp. huguetiana)
Q. x subglaucescens A. Camus (Q. canariensis x Q. pubescens subsp. subpyrenaica)

Hybrid of Q. pyrenaica Willd.
Q. x andegavensis Hy (Q. pyrenaica x Q. robur)
Q. x andegavensis nsssp. henriquensis (Franco & Vasc.)Rivas Martínez & Sáenz (Q. pyrenaica x Q. robur subsp. broteroana)
Q. x cantabrica Vicioso (Q. petraea x Q. pyrenaica x Q. robur subsp. broteroana)
Q. x diosdadoi Vázquez F.M., A.J. Coombs, M. Rodríguez, S. Ramos & E. Doncel (Q. pyrenaica x Q. rotundifolia)
Q. x firmurensis Hy (Q. pubescens subsp. lanuginosa x Q. pyrenaica)
Q. x fontqueri O. Schwarz (Q. canariensis x Q. pyrenaica)
Q. x numantina nsssp. neomairei (Coutinho) Luebbert (Q. faginea subsp. brotero x Q. pyrenaica)
Q. x numantina nsssp. transmontana (Coutinho) Luebbert (Q. faginea subsp. alpestris x Q. pyrenaica)
Q. x paui C.Vicioso (Q. canariensis x Q. pubescens x Q. pyrenaica)
Q. x streimii Hueffel (Q. petraea x Q. pyrenaica)
Q. x trabutii Hy (Q. petraea x Q. pyrenaica)
Q. x trabutii nsssp. legionensis (O. Schwarz) Sáenz (Q. petraea subsp. huguetiana x Q. pyrenaica)
Hybrids of *Q. robur* L.

*Q. x andegavensis* Hy (*Q. pyrenaica x Q. robur*)
*Q. x andegavensis* nssp. *henriquensis* (Franco & Vasc.) Rivas Martínez & Sáenz (*Q. pyrenaica x Q. robur subsp. broteroana*)
*Q. x cantabrica* Vicioso (*Q. petraea x Q. pyrenaica x Q. robur subsp. broteroana*)
*Q. x carrisoana* A. Camus (*Q. canariensis x Q. robur subsp. estremadurensis*)
*Q. x coutinhoi* nssp. *duriensis* Vasc. & Franco (*Q. faginea var. salicifolia x Q. robur*)
*Q. x coutinhoi* nssp. *ferreirae* (A. Camus) F.M. Vázquez, S. Ramos & S. García (*Q. faginea x Q. robur subsp. estremadurensis*)
*Q. x coutinhoi* nssp. *subalpestris* (A.Camus) F.M. Vázquez, S. Ramos & S. García (*Q. faginea subsp. alpestris x Q. robur subsp. estremadurensis*)
*Q. x coutinhoi* Samp. (*Q. faginea x Q. robur*)
*Q. x gallaica* Penas, Llama s & A. Acedo (*Q. lusitanica x Q. robur*)
*Q. x kernerii* nssp. *montserratii* (C.Vicioso) Rivas Martinez & Saenz (*Q. pubescens subsp. subpyrenaica x Q. robur*)
*Q. x rossaea* nssp. *secalliana* (C. Vicioso) Rivas Martínez & Sáenz (*Q. petraea x Q. robur subsp. broteroana*)
*Q. x rossaea* O. Schwarz (*Q. petraea x Q. robur*)
*Q. x turneri* Willd. (*Q. ilex x Q. robur*)

Hybrids of *Q. rotundifolia* Lam.

*Q. x airensis* Franco & Vasc. (*Q. coccifera x Q. rotundifolia*)
*Q. x autumnalis* Vázquez, F.M., S. Ramos & E. Doncel (*Q. ilex x Q. rotundifolia*)
*Q. x diosodaidoi* Vázquez, F.M., A.J. Coombes, M. Rodríguez, S. Ramos & E. Doncel (*Q. pyrenaica x Q. rotundifolia*)
*Q. x mixta* Villalobos (*Q. rotundifolia x Q. suber*)
*Q. x sennieniana* A. Camus (*Q. faginea x Q. rotundifolia*)
*Q. x sennieniana* nssp. *tentudaica* F.M. Vázquez (*Q. faginea subsp. broteroii x Q. rotundifolia*)

Hybrids of *Q. suber* L.

*Q. x celtica* Vázquez F.M., A.J. Coombes, M. Rodríguez, S. Ramos & E. Doncel (*Q. lusitanica x Q. suber*)
*Q. x hispanica* Lam. (*Q. cerris x Q. suber*)
*Q. x mixta* Villalobos (*Q. rotundifolia x Q. suber*)
*Q. x morisiia* Borzi (*Q. ilex x Q. suber*)
*Q. x pacensis* Vázquez F.M. (*Q. faginea subsp. broteroii x Q. suber*)

The greatest diversity of oak hybrids is in deciduous species, with the most significant number of hybrids for *Q. faginea*, probably resulting from the wide range of habitats occupied by this species and the great diversity of subspecies. There is also a great amount of hybridization for *Q. robur*, *Q. petraea* and *Q. pubescens* in northern Iberia. On the other hand, the evergreen species have the most specific habitats and reproductive success is more specific in time and space.

**Conclusions**

In conclusion, the diversity of oaks in the Iberian Peninsula can be reduced to two levels associated to adaptation models for taxa. Within this concept we can
introduce the diversity of species, subspecies, varieties and forms, with more than 50 different Iberian oak taxa. In the second level, associated with the competition between species for habitats, we introduced the concept of hybrid diversity of Iberian oaks, with close to 40 hybrids. The most significant conclusion is that there is great diversity of oaks in the Iberian Peninsula, with close to 100 different oak taxa.

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References