International Oak Society

Oak News & Notes

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Ripening acorns of *Quercus marlipoensis* in Lao-Jun-San National Nature Reserve, Malipo County, Yunnan, China © Min Deng

Trials and Tribulations of *Quercus marlipoensis*

by Editorial Staff

A new study, funded in part by an IOS Oak Conservation and Research Grant, has analyzed the germination characteristics of the Critically Endangered oak *Quercus marlipoensis* and evaluated the impact these might have on conservation efforts to save this oak from extinction.

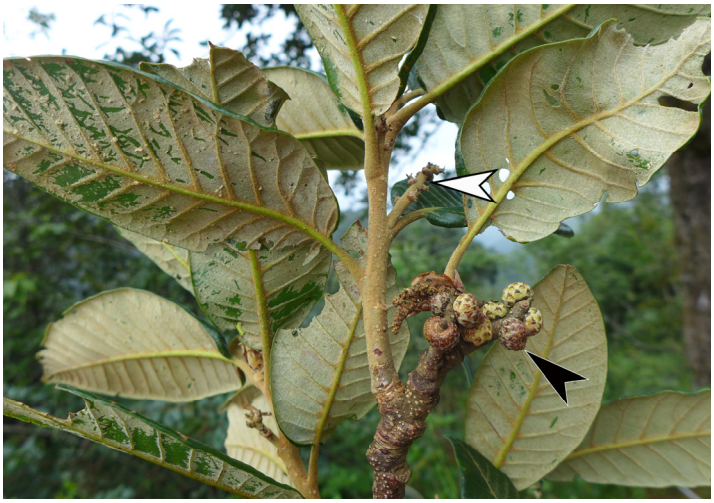
Seed germination is a crucial and vulnerable stage in plant life cycles. This is especially so in the case of *Q. marlipoensis*, an extremely rare oak found in only one population in the tropical montane cloud forests of southwestern Yunnan, China. The species appears to have difficulties in regeneration, and this study was an attempt to determine the biological traits of the species' acorns and the key restrictive germination factors that may be impeding regeneration.

The microclimate of tropical montane cloud forests is characterized by persistent, frequent, or seasonal cloud cover, with fog and mist enveloping the canopy. This type of habitat is highly vulnerable to climate change as

increases in temperature reduce mists and bring about the extinction of cloud forests on mountain peaks. *Quercus marlipoensis* is found exclusively in this habitat. It was first reported in 1951, based on a specimen collected in 1940 in Malipo County, Yunnan. Despite being sought during three national plant inventory surveys between 1990 and 2010, it was not found again till 2012, when it was rediscovered in Lao-Jun-San National Nature Reserve, the type location. The population showed signs of regeneration difficulties, as seedlings and saplings were rare. No other populations have been found.

About 4 kg of acorns were collected in October 2021 and subjected to a series of treatments and germination tests. The researchers were able to observe that the seeds of *Q. marlipoensis* exhibit typical epicotyl dormancy: they germinate quickly when mature, but the epicotyl does not elongate till 12 weeks later. Some acorns had the pericarp removed and one third or two thirds of the cotyledon removed. This increased the percentage of seeds that sprouted and also the speed of germination, indicating that the species can tolerate animal predation and only requires a little nutrition from its cotyledons to ensure germination. Other tests revealed that *Q. marlipoensis* acorns can cope with cool temperatures during the germination period, so long as humidity is sufficient, which is compatible with the conditions in its cloud forest habitat. The seed, however, is highly sensitive to desiccation and can only successfully germinate and establish seedlings in humid soils. Furthermore, *Q. marlipoensis* grows in limestone areas characterized by higher soil water evaporation, and consequently the species is especially vulnerable to drought stress.

The researchers conclude that the increasing length of the seasonal dry period and more frequent climate extremes in Southwest China has led to habitat degradation, and this has resulted in difficulties with seed germination and seedling establishment of *Q. marlipoensis* in its natural habitat. They recommend that conservation efforts should focus on manual ex-situ germplasm conservation to introduce seeds to nurseries and botanical gardens for propagation, from where large seedlings would later be reintroduced to suitable habitats in the wild.



Acorns beginning to form on *Quercus marlipoensis*; note the persistent tomentum on the leaf underside, one of the characteristics that distinguishes this species from the similar *Q. engleriana* © Min Deng

Seedlings in the greenhouse at Yunnan University propagated for reintroduction to natural habitat © Min Deng

Read the article here:

Liu, L., Y. Tu, Q. Li, and M. Deng. 2024. Seed Germination Characteristics of a Critically Endangered Evergreen Oak—*Quercus marlipoensis* (Fagaceae) and Their Conservation Implications. *Forests* 15(2): 235. doi.org/10.3390/f15020235

A New Book on Trompenburg Tuinen & Arboretum

by Gert Fortgens

It was a great pleasure for me to be able to write about my 31 years of involvement with Arboretum Trompenburg in Rotterdam. Dick van Hoey Smith, who founded the Arboretum, had published two books about the place he inherited and where he put a lot of effort into expanding the collection. Now it was up to me to write up the continuing development of what became Arboretum Trompenburg in 1958 and had a name change in 2008 to Trompenburg Tuinen & Arboretum (Trompenburg Gardens & Arboretum).

As regards the oaks in the collection, I was able to add information on the origin of some of the oaks that were planted by Dick. For example, we had been puzzled about the origin of our *Quercus robur* 'Pendula', a weeping form of English oak. According to Dick's records he had spotted the mother tree while on a bus

Pages from the book *Trompenburg Tuinen & Arboretum Rotterdam - Ontwikkeling en groei van de collectie* ("Development and growth of the collection"), published by Stichting LM Publishers / KIT last year

in Hamburg in 1953. He was so taken by the tree that he immediately took a taxi back to photograph it and collect acorns. He wrote on the photograph that the tree was on Kädenstrasse, but when we tried to find the oak, there was no street by that name in Hamburg. I was able to enlist the help of friends in the German Dendrological Society, one of whom recognized the location, which turned out to be on Körnerstrasse! Unfortunately, the weeping oak is no longer there…

There are several weeping forms of *Q. robur* mentioned in the book. A name that appears in old literature is *Q. robur* 'Dauvessei Pendula', of which Cornelis de Vos wrote in 1867 that it is "a very beautiful weeping tree." With this name, De Vos referred to the French tree nursery Établissement horticole de Transon-Gombault et D. Dauvesse in Orléans. In their catalog from 1845, a weeping oak is offered with the qualifications "very rare" and "high grafted as standard"; the offer price of 5 francs is far above the average price for trees and shrubs in those days. It is unclear whether De Vos saw this weeping oak himself or whether he based his information on the information from the French catalog. Unfortunately, it is now no longer possible to determine exactly which of the old still-existing weeping oaks it is. In some places in Europe you can find large weeping oaks in old parks or gardens, all of which can date from shortly after 1850. These specimens, still present in Het Hemelrijk, Belgium, the Schlosspark Gotha, Germany, and at Vallø Castle, Denmark (all pictured in the book), have similarities in their weeping habits, but they all seem slightly different. Unpruned, they have grown into large trees with a broad crown and strongly overhanging outer branches. One of them may belong to what C. de Vos called 'Dauvessei Pendula' at the time. It became common practice to give all weeping oaks the name *Q. robur* 'Pendula'' in the catalogs. A group name has been installed for some time now for the various weeping forms of the pedunculate oak: *Q. robur* Pendula Group.

Dick sometimes named the cultivars he selected by combining the names of the parent species. A well-known example is *Q.* 'Pondaim', a hybrid between *Q. **pon**tica* and *Q. dentata* (sometimes called **daim**yo oak, using the common name in Japanese). Another is *Q.* 'Macon', which is a hybrid between *Q. **ma**cranthera* and *Q. frainetto* (at one time called *Q. **con**ferta*). What I was able to find out is that it almost got a slightly different name. I found an article that predates the publication date of the name 'Macon' in which the author interviewed Dick and quotes him as considering the name 'Macracon' for the seedling. Why Dick later changed his mind and named it 'Macon' we do not know. It is my assumption that Dick (or his wife Riet) thought that it was too similar to a cookie named *maccaron* or even too close to the type of pasta *macaroni*.

Another interesting oak anecdote is the story behind *Q. cerris* 'Curly Head'. Maarten Bömer spotted four strangely shaped seedlings in a seed bed with hundreds of *Q. cerris* in his nursery. This one was the most striking of the four and he decided to propagate it. He told me he thinks it is his best introduction. The original seedling has grown into a narrow upright tree. The leaves are strongly curled, concave, and shiny, similar to a person's curly hair. In Dutch we call a person with hair like that *krullenkop* (literally "curly head").

One remarkable story concerns a mature *Q. acuta* specimen that has been grafted on *Q. robur* rootstock. These are unrelated species in different subgenera (*Q. acuta* from section *Cyclobalanopsis* in subgenus *Cerris* and *Q. robur* from section *Quercus* in subgenus *Quercus*), so one would normally not expect the graft to succeed. And yet the tree still stands, with the site of the graft clearly visible where the bark

The remarkable foliage of Quercus cerris 'Curly Head', named after the Dutch term *krullenkop* © Gert Fortgens

For more information and to acquire Gert's book, go to bit.ly/FortgensBook

transitions from smooth (*Q. acuta*) to fissured (*Q. robur*). One can also see that roots have formed from the *Q. acuta* section of the trunk and run down the *Q. robur* section to the soil. Perhaps that is the reason the tree survives, as the *Q. acuta* is in part growing on its own roots.

Thanks to the contacts and friendships in the International Oak Society, we were able to enlarge the oak collection substantially. In all, the book mentions just over one hundred different species and cultivars of oaks, and many more woody ornamentals, perennials, and succulents that were added over a period of 31 years. At the moment only a version in Dutch is available.

New Species of Gall Wasp Described on *Quercus grahamii*

by Editorial Staff

A new species of oak gall wasp has been described in Mexico, and it has been named in honor of our very own Allen Coombes, former President of the IOS (2006–2009), first Vice-President (1994–2000; 2003–2006), and co-Editor of *International Oaks* since 2012. *Andricus coombesi* is a cynipid gall wasp that induces galls on the acorns of the Mexican oak *Quercus grahamii*. The wasp has several characteristics that make it unusual. To better understand its significance, here is an overview of what is known about this fascinating group of insects.

Certain insects have the ability to cause plants to form tumor-like, nutrient-rich growths called "galls". In doing so they perform a fascinating example of parasitic symbiosis, an intimate, long-term interaction between two different species where the parasite benefits and the host plant is harmed in some way. The ability has evolved independently in six insect orders, one of which is *Hymenoptera* (bees, wasps, and ants), and a large number of vascular plant species are susceptible to galling insects, including genera important to agriculture, such as *Vitis* (grape), *Triticum* (wheat), *Orzya* (rice), and *Vaccinium* (blueberry). In these cases they can cause substantial drops in crop yields.

Within the Hymenoptera, gall wasps are found in a group called the Cynipoidea, a lineage dominated by parasitoids that attack insect larvae. It is thought that gall induction on plants evolved from a common ancestor that parasitized other insects. About 70% of cynipids are oak gall wasps, i.e., they attack trees in genus *Quercus*. Each species of gall wasps typically attacks a single species of oak or closely related group of species, inducing a distinct gall on a single type of plant tissue, e.g., roots, stems, buds, leaves, petioles, fruit, or flowers. The galls can contain one or several chambers, each housing one or many developing wasps.

A gall is created when the wasp co-opts molecular control of the oak's tissue to create a novel organ for its own purposes. The initiation, development, and maintenance of the galls are controlled by the wasp, but the gall itself is all plant tissue. Little is known about how galls are induced, but the most common theory involves plant hormones such as auxin. Galls are initiated when the wasp inserts one or more eggs, together with a maternal secretion from the venom gland, into the oak's meristematic tissue, which contains cells that can develop into different plant parts. The cells next to the egg promptly die, while the remaining tissue differentiates into a type of wound callus. Rapid cell growth then takes place: nutritive cells form the gall's inner larval chamber, and then a secondary layer of tissue differentiates into the species-specific structure of the gall's outer cortex. It has been shown that the wasps significantly modify the expression of almost a third of the oak genome: they not only alter the oak's tissue but create a novel organ on the host plant. It is also thought that the larvae continue to manage the gall's growth through their active chewing and salivary gland secretions.

An adult *Andricus coombesi* © Betzabeth Pérez Torres

By creating galls, wasps receive nutrition from the oak and secure protection against environmental conditions and numerous predators. Morphologically the galls are very diverse, and each of these factors is thought to have played a role in the evolution of this variation. Some of their traits are known to significantly reduce mortality from natural enemies, something the wasps desperately need, as their enemies are legion and can inflict high mortality (up to 99% in some cases).

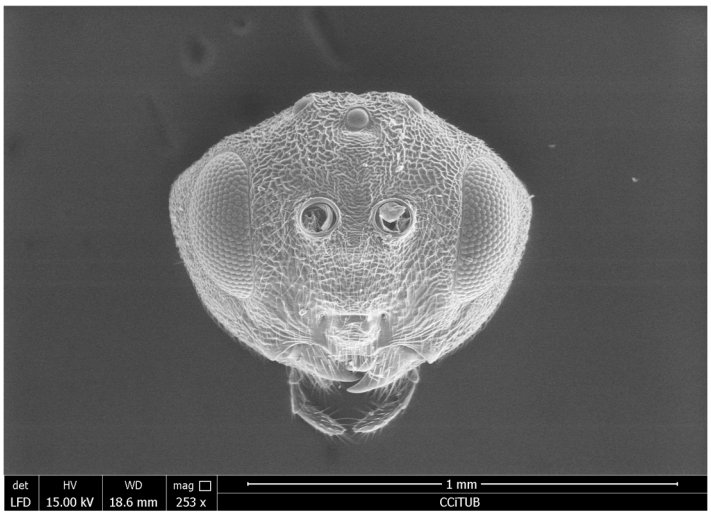
Cynipid gall wasps have complex reproductive processes. They reproduce via what is termed cyclical parthenogenesis, involving two annual generations, alternating sexual and asexual reproduction. If the term parthenogenesis reminds you of an ancient temple in Athens, you are on the right track: parthenogenesis, which refers to asexual reproduction, derives from Ancient Greek παρθένος (*parthénos*, "virgin") and γένεσις (*génesis*, "origin, creation, generation"); the Parthenon in Athens derived its name from the name of the goddess *Athena Parthenos* (Athena the Virgin). While other organisms are cyclically parthenogenic, most of them primarily reproduce asexually and occasionally sexually, induced by changes in environmental conditions. In gall wasps, the alternation is mandatory: the sexual generation mates and produces the asexual generation, then this second generation produces males or females parthenogenetically. Within the same wasp species, each generation creates different kinds of galls, depending on the different enemies and challenges they face.

Gall wasp systems are thus a source of undiscovered diversity. They exhibit a global distribution, being found on every continent save Antarctica, and estimates of the number of species are still imprecise. This is due in part to the fact that many of the regions that are predicted to be the most biodiverse are not yet explored. Regions with a high potential for host diversity are likely to have a high diversity of gall wasp species. Two regions are especially notable: Mexico and Central America, one of the global diversity hot spots for *Quercus*, and the oak forests of Southeast Asia, Japan, and China, which have not so far been intensively sampled.

New galls produced by *Andricus coombesi* on *Quercus grahamii* at Puebla University Botanic Garden (in December)
© Betzabeth Pérez Torres

The newly described species of oak gall wasp was first observed by Allen Coombes in June 2022, on several *Q. grahamii* specimens at the Botanic Garden of Puebla University, where Allen is currently Curator of Scientific Collections. Allen in fact observed the old galls, from which the adult wasps had already emerged. The following January, Betzabeth Pérez-Torres collected new galls and was able to rear asexual adult gall wasps, which were studied, described, and deposited in several institutions as type specimens for the new species. So only the asexual generation is known. The sexual generation may be observed at a later stage. This is the case with many gall wasp species, which are known only from the generation that reproduces through parthenogenesis. It seems likely that the unknown sexual generation develops quickly: the asexual adults emerge in January and the following (sexual) generation would have to deposit their eggs shortly afterward, because the galls start to form in the first stages of acorn development.

What is unusual about *Andricus coombesi* is that it attacks the acorns and destroys them, causing them to practically disappear. This is the first gall wasp found on *Q. grahamii*, which for a long time was considered to be a synonym of *Q. acutifolia*; in 2015 *Q. grahamii* was formally recognized as a distinct species, and the name *Q. acutifolia* was transferred to what had been known as *Q. conspersa*, a similar species. While a few other gall wasps had been described on *Q. acutifolia* (previously *Q. conspersa*), none of them attack acorns. Only two other Mexican species of wasps are

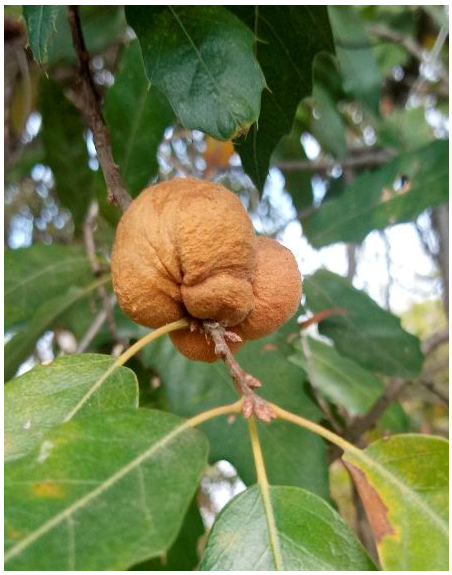


Mug shot of *Andricus coombesi* taken with a field-emission gun environmental scanning electron microscope
© Juli Pujade-Villar

known to produce galls on or in acorns, but they do not cause the acorn to disappear as this new species does.

The paper that describes the species includes a detailed technical description of the insect and fascinating photos taken by Juli Pujade-Villar using a scanning electron microscope. The images look like some of the aliens we are used to seeing in science-fiction movies about extraterrestrial invasions (it should be noted that the wasp was named after Allen in recognition of his having found the galls of the species, not due to any physical resemblance!). The galls themselves, also illustrated in the paper, are equally monstrous, and in their case an appropriate cinematographic reference might be David Lynch's *The Elephant Man* (e.g., the image below).

The galls produced by *A. coombesi* resemble those of other species in the genus that produce woody tuberous galls, but they differ in that they are not strongly lignified. They are multilocular, meaning they contain several chambers that house the larvae; they are located on female flowers and completely deform the acorn. The galls are light yellowish with a velvety surface when young and turn brown and smooth when mature. The wasp is distinguished from other *Andricus* species due to certain differences detailed in the paper.



A mature gall in January © Betzabeth Pérez Torres

So far *A. coombesi* has only been found on *Q. grahamii* and in the state of Puebla, but it is expected that it will be found in the other Mexican states where the oak grows, and probably on other oaks. The fact that the gall destroys the acorn makes *A. coombesi* potentially harmful, affecting the regeneration of *Q. grahamii*. In Mexico all previously described harmful or potentially harmful species attack branches; this new species is the first potentially harmful species for acorns. Though certain aspects of the discovery suggest a horror story, we should remember that these are important steps in discovering the mostly unknown biodiversity of this fascinating family of insects and their relationship to our favorite genus of trees.

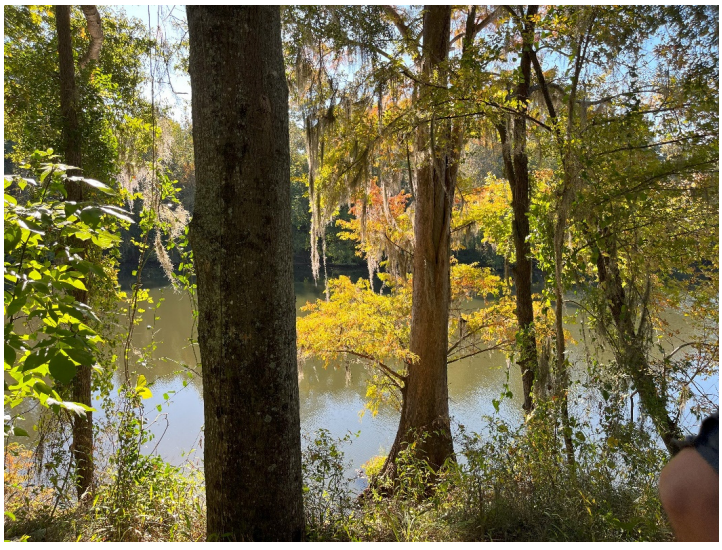
The description of *Andricus coombesi* Pujade-Villar & Pérez-Torres n. sp. can be found here:

Pujade-Villar, J., B.C. Pérez-Torres, A.J. Coombes, A. Aragón-García, M. Rodríguez-Acosta, J.F. López-Olguin, and G. Melika. 2024. Description of the first species of gall wasp (Hym., Cynipidae: Cynipini) on *Quercus grahamii* (Fagaceae). *Zootaxa* 5403 (3): 309 –376. doi.org/10.11646/zootaxa.5403.3.6

Seeking *Quercus austrina* for Conservation

by Alexandra Faidiga

When we think about plant conservation, activities like invasive species removal, habitat restoration, and population monitoring typically come to mind. This is what's known as in-situ ("on-site") conservation, i.e., protecting plants where they grow naturally in their native habitats. Holden Forests and Gardens (HF&G)[1] has a long history of conducting in-situ conservation work within our natural areas at the Holden Arboretum to preserve our native flora and wildlife. However, as a public garden, we also have the unique opportunity to conduct what's known as ex-situ ("off-site") conservation as well, i.e., the conservation of rare and endangered plants within our living collections. Armed with the knowledge, skills, and infrastructure to care for plants, public gardens are essential resources for conserving the world's biodiversity. In this article, I want to share some highlights from an October 2023 collecting trip taken by the HF&G collections team. This expedition, generously funded by an American Public Gardens Association Tree Gene Conservation Grant, focused on the



Typical *Quercus austrina* habitat: a sandy bluff overlooking the Flint River in southeastern Georgia © Alexandra Faidiga

[1] Holden Forests & Gardens is a nonprofit organization based in Northeast Ohio, US. It operates two major institutions: the Holden Arboretum and the Cleveland Botanical Garden.

Tom Arbour using a throw line to pull down a bluff oak branch for easier access; Ron Lance looks on in anticipation
© Alexandra Faidiga

collection of acorns from the rare oak species *Quercus austrina* (bluff oak) for ex-situ conservation within our living collections.

Quercus austrina is widely distributed throughout the Southeastern Coastal Plain, but bluff oaks are not locally common, and most populations range-wide consist of only a few trees. This may be due in part to the fact that bluff oaks are quite particular about their habitat; wild individuals occur only on wooded bluffs near streams on very sandy soil.

To make things more complicated, the taxonomic relationships between bluff oak and its closest relatives have historically been poorly understood. Given that traits like leaf shape can be highly variable among individuals and that oaks have a pronounced tendency to hybridize with one another, identification can be challenging. Luckily, we were able to collaborate with North American Land Trust botanist Ron Lance to accompany us on our trip and lead us to many sites where he had previously identified *Q. austrina* populations. Armed with pole pruners, herbarium presses, road snacks, and Ron's vast knowledge of southeastern US botany, we would travel south to hunt acorns of the elusive bluff oak in early October.

Due to the wide range of sites we planned to visit across four states, our journey had to be completed in two legs. First, Curator of Living Collections Tom Arbour and Nursery Propagation/Grower Technician M Onion would drive from Cleveland to Birmingham, Alabama (in one day!) where they joined Ron and colleague Emily Ellingson, Curator and Assistant Director at Polly Hill Arboretum. Over the course of the week, the team traveled across Alabama and Mississippi with a brief visit to the western tip of Florida searching for *Q. austrina*.

The team stopped at roadsides, recreation areas, and boat launches far and wide in search of acorns over five days. Altogether, they were able to collect from trees at five sites and secure a sizable number of acorns. Two weeks later, Tom would return with Rhododendron Collections Manager Connor Ryan and me (Alex Faidiga, Plant Recorder) to search for acorns in Georgia and Florida.

Our first site in Georgia was a great introduction to *Q. austrina* because it was home to the largest population on our list. This gave us the opportunity to study the key features of bluff oak and get a sense of the type of variation we could expect among individuals. One thing I noticed immediately about this site and all other bluff oak sites we would visit on our trip was just how sandy the soil was. It was quite a contrast from the heavy clay soils we are used to in northeast Ohio.

Also present at this site was another species, *Q. margaretta* (sand post oak), which commonly hybridizes with *Q. austrina*, and we did indeed find among the population some trees that appeared to be hybrids. In the photo of a putative hybrid below, you can see that, while there may be some subtle differences in the leaves, the hybrids are not very distinct from "true" bluff oak. The most important feature to examine when trying to distinguish bluff oak from its close relatives is the acorn and particularly the acorn cap,

Putative *Quercus austrina* × *margaretta* hybrid © Alexandra Faidiga

My first bluff oak! © Alexandra Faidiga

which is quite distinct from other oaks with which it co-occurs (*Q. austrina* cupules are turbinate in shape, cover one third to half of the nut, and are tight against the nut). These southern oaks were certainly putting our botanical observation skills to the test! At this site alone, we were able to secure more acorns than we were on the entire first leg of our trip, which was a great start to the week. (For more detail on the relationship between *Q. austrina* and co-ocurring oaks, see Ron Lance's article in *International Oaks* No. 33, "Revisiting the Taxonomic and Nomenclatural Problems of the *Quercus sinuata* Walter Complex".)

Over the next five days, we would travel to numerous state parks, campgrounds, and roadsides and collect acorns and herbarium specimens along the way. A highlight of the trip was when we made a detour to visit the runner-up Georgia state champion live oak (*Q. virginiana*), which was located in a large cotton field.

We also had the opportunity to visit the Apalachicola National Forest in northern Florida to search for *Q. austrina* at a campsite there. The bluff oaks we were seeking turned out to have only a handful of acorns left, as the squirrels had already claimed their share. We noted that the further south we went, the fewer acorns we encountered, either due to squirrels or the trees not appearing to have produced many acorns this year.

Altogether we were able to obtain the largest number of acorns from our sites in Georgia, followed by Alabama, Mississippi, and just a handful of acorns from Florida. The acorns are currently tucked in for the winter at our nursery where many of them have already germinated. Once the acorns have grown into seedlings, a portion will be planted in our collections, and a portion will be distributed to other botanic gardens and arboreta across the Eastern US for safekeeping in various living collections.

Oak seeds are what we call recalcitrant, meaning that they cannot be stored in seed banks due to their intolerance for desiccation. Consequently, living collections that house oaks and other recalcitrant species effectively act as "gene banks", serving as backups for wild populations. HF&G is one of several institutions holding a Nationally Accredited *Quercus* Multisite Collection, meaning that we have made an unwavering commitment to the perpetual ex-situ conservation of oaks within our living collections. This trip is just one example of how we are honoring that commitment, and it underscores the critical interplay between in-situ and ex-situ conservation that botanic gardens are uniquely positioned to support.

Evolution and Classification of Section *Cerris* Oaks

by Editorial Staff

A study by Thomas Denk and colleagues published in April 2023 in the *Annals of Botany* explores the evolutionary and biogeographical history of the oak species in section *Cerris*. This relatively small section includes 15 species distributed across Eurasia, from the Atlantic coast of Portugal and Morocco to the Pacific Coast of Japan. They are remarkable in that their leaf morphology is highly variable, ranging from deeply lobed leaves of *Quercus cerris* to the dentate margins of *Q. macrolepis* and the finely toothed leaves of *Q. acutissima*. The study traces the migration of these oaks from their origin in northern East Asia across the continent to Western Europe, and describes how their adaptations evolved over millions of years. A greater understanding of the phylogeny of these trees allows us to see into the past but also illuminates our knowledge of our ecosystem and its bio-

Acorns of *Quercus acutissima*, one of the species included in Section *Cerris*, Subsection *Campylolepides* (from Ancient Greek for "curved scales") © Roderick Cameron

diversity.

The team of researchers employed cutting-edge techniques to decipher the history of section *Cerris*. To come up with a dated phylogeny of the species in this section and the closely related section *Ilex*, they used what is known as RAD-seq, or Restriction site-Associated DNA sequencing. In simple terms, this method involves identifying specific locations in an organism's DNA, called restriction sites, and then sequencing the DNA fragments adjacent to these sites. This technique helps researchers study genetic variations within populations, track evolutionary relationships, and investigate traits related to specific regions of the genome. Dr. Denk and his team combined this procedure with D-statistics, short for allele frequency differentiation statistics, which are measures used in population genetics to understand how genetic variations are distributed among different populations or groups of individuals. This allowed them to explore hypotheses related to gene flow. They also estimated divergence times using a model based on fossilized birth–death, which is used to estimate the rates of speciation (birth of new species) and extinction (death of species) over time. To calibrate the model they used 47 oak fossils. In addition, they analyzed modern species' climatic and biotic niches using the Köppen Climate Classification System, which classifies climates based on temperature and precipitation patterns.

The researchers determined that section *Cerris* oaks initially branched apart into East Asian and Western Eurasian lineages around 40 to 35 million years ago, in the geological epoch known as the Eocene (defined as approximately 56 to 33.9 million years ago). Later, four Western Eurasian lineages evolved during the Oligocene (33.9 to 23 million years ago) and Miocene (23 to 5.3 million years ago). The evolution of leaf size, shape, and texture seems to be related in part to the various transitions from humid temperate climates to Mediterranean, arid, and continental climates. As a result, species that shared the same ecology developed similar leaf traits, despite being distantly related.

Subsection *Aegilops* (clockwise from left): *Quercus macrolepis* (Greece © Allan Taylor), *Q. brantii* (Zagros, Iran © Eike Jablonski), *Q. ithaburensis* (Noura, Lebanon © Jean Stephan)

Subsection *Libani* (clockwise from top): *Quercus afares* (Arboretum des Pouyouleix, France © Béatrice Chassé), *Q. trojana* (Arboretum Wespelaar, Belgium © Philippe de Spoelberch), *Q. libani* (Pantentuin Meise, Belgium © Charles Snyers)

The study shows that section *Cerris* oaks, which originated from temperate biomes in the Eocene to Oligocene periods, were restricted to higher (i.e., northern) latitudes, from Siberia to north of the Paratethys Sea, which was a large inland sea that existed in the region that is now southeastern Europe. Meanwhile, the section *Ilex* oaks, which also originated in temperate biomes, were able to migrate during the Eocene to the south and southwest into what was then subtropical southern China and southeastern Tibet. Later they moved west along the pre-Himalayan mountain ranges that existed at the time.

In their conclusion, the researchers propose that this divergence may be related to the evolutionary legacy of the evergreen section *Ilex* and the (semi-)deciduous section *Cerris*, resulting from their differential early range expansions from Northeast Asia. Section *Cerris*'s shift to deciduous or semi-deciduous leaves would have preadapted the lineage to the dry and cold climates it encountered in its westward expansion. Section *Ilex*, on the other hand, did not lose its evergreen character and did not need to adopt deciduousness while colonizing winter-dry and -cold habitats in the Himalayas and warm, summer-dry environments in the Mediterranean region. Western Eurasia became the meeting ground for three lineages: section *Cerris* from Northeast Asia, section *Ilex* from Southeast

Asia, and the eastern North American oaks of section *Quercus*, which joined the party about 10–20 million years ago. These legacies would explain why species from these sections co-occur in the Mediterranean climate of Western Eurasia and how their distributions follow environmental and climatic gradients in the wider Mediterranean region.

The study also puts forward a subsectional classification of the species in section *Cerris*, which builds on previous classifications proposed by Ørsted (1871), Schwarz (1936), Camus (1936–1954), and Menitsky (1984). The species are grouped into five subsections, four of which are found in Western Eurasia. The three species found in East Asia (*Q. acutissima*, *Q. variabilis*, and *Q. chenii*), are grouped in subsection *Campylolepides*, a name that was coined by Aimée Camus and refers to the recurved scales on the cupules. It is derived from Ancient Greek καμπύλος (*kampúlos*, "bent, curved") + λεπίς (lepís, "scale"). Subsection *Suber* includes *Q. suber* and *Q. crenata*, commonly considered a hybrid between *Q. suber* and *Q. cerris*.[1] Subsection *Aegilops* comprises the Southeastern European/West Asian species *Q. brantii*, *Q. ithaburensis*, and *Q. macrolepis*. Three other species that had been grouped with this last group in previous classifications are here separated in the new subsection *Libani*: *Q. afares*, *Q. libani*, and *Q. trojana*. Finally, subsection *Cerris* consists of *Q. cerris*, *Q, look*, *Q. castaneifolia*, and the recently recognized species *Q. euboica* (with subsection *Libani* morphology but genetically closer to subsection *Cerris*).

Leaves of *Quercus* ×*hispanica* (referred to in Denk et al. 2023 as *Q. crenata*), the hybrid between *Q. cerris* and *Q. suber*, here in Castelnuovo di Val di Cecina, Toscana, Italy; Image: AndreaC, iNaturalist)

[1] For which the correct name is *Q.* ×*hispanica*.

The recently recognized *Quercus euboica*, endemic to the Greek island of Euboea, is morphologically similar to *Q. libani*, but genetically closer to *Q. cerris* © P. Trigas

For more detail, read the article:

Denk, T., G.W. Grimm, A.L. Hipp, J.M. Bouchal, E.-D. Schulze, and M.C. Simeone. 2023. "Niche evolution in a northern temperate tree lineage: biogeographical legacies in cork oaks (*Quercus* section *Cerris*)," *Annals of Botany*, 131(5), pp. 769–787. Available at: doi.org/10.1093/aob/mcad032

Propagation Protocol for *Quercus insignis*

by Karina Orozco

The Global Conservation Consortium for Oak published in October 2023 a protocol for the propagation of *Quercus insignis* (*Protocolo de Propagación para el roble amenazado* Quercus insignis).

New growth on Quer*cus insignis* © Maricela Rodríguez-Acosta

This propagation protocol is the result of a collaborative conservation research project between institutions in Costa Rica, Mexico, and the US. *Quercus insignis* is an Endangered oak species distributed from southern Mexico to western Panama, most often found in tropical montane cloud forest habitat. Deforestation for agriculture, urbanization, and grazing lands have severely fragmented its populations, making it locally rare as often only a few individuals are found together. Upon beginning this project, it became clear that not enough knowledge has been generated regarding the species propagation, ecology, or use in restoration. Several contributors helped by providing results from germination trials and ecological studies, which were synthesized along with advice on seed collection, germination techniques, and transplant to the field. The

Plastic bags used to increase humidity for acorns during the germination process © Karina Orozco

text is in Spanish to ensure the publication is accessible to those living and working in the species' native range across Latin America. We hope that this information will aid in the successful germination of *Q. insignis* seedlings to restore populations in situ, as well as increase its representation in living collections.

You can download a copy of the *Protocolo de Propagación* here: bit.ly/ProtocoloQinsignis

Tours & Events Update

The Tour Committee has put together for 2024 what is likely our most ambitious events program ever. Five events are scheduled to take place over the Northern Hemisphere's summer and fall. We begin in early June with an **Oak Open Day (OOD) event in France**, comprising a whirlwind tour of four phenomenal French oak collections: Arboretum des Pouyouleix (Béatrice Chassé), Arboretum du Passadou (Jean-Louis Hélardot), Arboretum de la Bergerette (Shaun Haddock), and Arboretum Chocha (Michel Duhart). An optional extra day offers the possibility of crossing the border into Spain to see the famed Iturraran Botanical Garden. The following weekend we meet for the **United Kingdom OODs**, with visits to Silkwood Park, The Saville Garden and Windsor Great Park, Borde Hill, and Wakehurst.

Two Tours in the US are scheduled for the fall: a Tour of California in September and a Tour of the Carolinas (in between, you can fit in the **International Oak Symposium** at the University of Tennessee Institute of Agriculture). The final event of the program is a **Tour of Taiwan**. Our highly successful Webinars are settling into a quarterly schedule, the latest having taken place on February 22, and the next one scheduled for next May. For more information, see the Upcoming Events on the IOS website (bit.ly/OAKEvents) or write to tours@internationaloaksociety.org.

Action Oak's Partner Event 2024

by Annabel Narayanan

Members of the IOS are warmly invited to join Action Oak's Annual Partner Event at Cathays Park in Cardiff, UK on Thursday, May 9, 2024, 09:30-15:00. This event is an opportunity to learn about the current research happening in the UK in support of protecting native oak species *Quercus robur* and *Q. petraea*. The day also includes a site visit to Bute Park.

ActionOak
PROTECTING OUR OAK TREES

Please email actionoakevents@woodlandheritage.org to register your interest, places are limited.

From the Board

On the recommendation of the Development and Outreach Committee, the Board introduced a new membership type for institutions that wish to support the Society at a higher level. The new Institutional Memberships will significantly help us achieve our mission and goals and maintain the standard of our publications. The Supporting and Standard Institutional Membership types were launched January 1, 2024, and we are delighted to welcome already four new Institutional Members: Denver Botanic Gardens and The Morton Arboretum (Supporting) and Bartlett Tree Experts and San Antonio Botanical Garden (Standard). As part of the benefits this membership type includes, these institutions will be acknowledged in our communications, events, and publications. You can find out more about Institutional Memberships on our website: bit.ly/JointheIOS. If you think your institution could join the IOS at this level, please get in touch with membership@internationaloaksociety.org.

Membership numbers have been increasing, with a steady flow of new members. We now have 581 members, but, of those, well over 100 have "Grace" status, meaning they expired at the end of last year and have not yet renewed. We encourage you to check the expiry date of your membership at the beginning of each year, and we hope you will continue to support the IOS and enjoy membership benefits by renewing if you haven't done so already.

We are particularly pleased to welcome as a new member The Linnean Society of London. The Linnean is a learned society dedicated to the study and dissemination of natural history, evolution, and taxonomy. It was founded in 1788 and named in honor of the Swedish botanist Carl Linnaeus, who is renowned for his work in developing the modern system of binomial nomenclature for living organisms. The Society serves as a forum for scientists and researchers to exchange ideas, publish scientific papers, and promote the understanding of the natural world. Most notably, it was at the Linnean that Darwin's theory of evolution was first announced to the public, in a meeting in 1858. The Linnean houses an excellent library, and it is an honor for the IOS that our Journal will now be available there.

On other news, the Oaxaca 2025 Conference Committee held its first meeting last December. Lead by Committee Coordinator Béatrice Chassé, the meeting assigned roles and responsibilities, and set up a schedule for the tasks ahead. The Committee will assist Committee Chair, Antonio González Rodríguez, in the organization of the Conference and associated Tours scheduled for September/October 2025.

Finally, the Taxonomy and Nomenclature Committee has also been busy, resolving several taxonomical and nomenclatural issues at a meeting last September (it also resolved to add "Nomenclature" to its name, to better reflect that work it carries it out). A group of its members have been meeting regularly to prepare a new website to house the IOS's Oak Names Checklist, under the leadership of Charles Snyers. We look forward to sharing news of its publication!

And we also look forward to an excellent year for the IOS, with a record number of events to provide opportunities for good cheer and quercophile pursuits (see **Tours & Events Update** on the previous page). See you there!

Roderick Cameron

President

IOS Service Awards

Call for Nominations

The International Oak Society Service Awards honor individuals (non-members as well as members of the Society) who have devoted significant long-term efforts to the genus *Quercus* and/or the advancement of the goals of the IOS. There are two types: the **Lifetime Service Award** and the **Special Service Award**. Recipients will be selected by the IOS Board prior to the 2025 Conference in Mexico, where the Awards will be presented. IOS members are invited to nominate anyone they consider deserves an IOS Award. Nominations for both Awards should be sent **before March 31, 2024** to the IOS Secretary Dan Kostka, secretary@internationaloaksociety.org, along with a note specifying the reasons for the nomination.

Points of Contact

Submissions for the Newsletter

Roderick Cameron - Ryan Russell:
newsletter@internationaloaksociety.org

Submissions for the Journal

Béatrice Chassé - Allen Coombes:
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The International Oak Society acknowledges the generous support of the following institutions:

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