

The Consumption of Acorns (from *Quercus* spp.) in the Central West of the Iberian Peninsula in the 20th Century

ENRIQUE GARCÍA-GÓMEZ^{*,1,2}, ROSA PÉREZ-BADIA¹, JUAN PEREIRA³,
AND RAJINDRA K. PURI⁴

¹University of Castilla-La Mancha, Institute of Environmental Sciences (Botany), Avenida Carlos III s/n, 45071, Toledo, Spain

²Diputación Provincial de Toledo, Plaza de la Merced, 4, 45002, Toledo, Spain

³University of Castilla-La Mancha, Faculty of Humanities, Plaza de Padilla, 4, 45071, Toledo, Spain

⁴University of Kent, Centre for Biocultural Diversity, Canterbury, CT2 7NR, UK

*Corresponding author; e-mail: eggomez@diputoledo.es

There is evidence of the consumption of acorns from *Quercus* species in the Iberian Peninsula from prehistory through the 20th century up until the 1960s. Acorns were used primarily for human consumption, mainly during food shortages. The high abundance and even distribution of *Quercus* tree species made it possible for acorn consumption to be widespread across the Iberian Peninsula. The favored species was the holm oak (*Quercus ilex* subsp. *ballota*), because a large part of its harvest consists of sweet acorns, while in other species the acorns are almost always bitter. People developed a substantial knowledge base underpinning a great variety of uses of acorns, from eating them directly from the tree to preparation with very simple treatments, such as drying, roasting, or boiling. By manipulating levels of bitterness in a number of species, cooks were able to prepare dishes that ranged from salty to sweet.

Based on interviews with knowledgeable people and a review of ethnobotanical papers, this article describes the forms of consumption, the processed products, and the other uses of acorns of the species of the genus *Quercus* in the central west of the Iberian Peninsula. We also suggest why acorns lost their prominence in the late 1960s. At present, the main use of the acorn is as food for Iberian black pigs to obtain quality sausages. In addition, new products such as acorn liquor, caramels, and other items have recently appeared, marketed as distinctive products on a small scale.

En la península Ibérica hay evidencias del consumo de bellotas de las especies del género *Quercus* desde la prehistoria hasta los años sesenta del siglo XX. Las bellotas se utilizaron principalmente para el consumo humano, sobre todo durante épocas de escasez de alimentos. La gran abundancia y distribución de los árboles productores de bellotas, permitió que este consumo se extendiera por toda la península Ibérica. La especie favorita fue la encina (*Quercus ilex* subsp. *ballota*), porque en esta especie gran parte de la cosecha son bellotas dulces, mientras que en otras especies son casi siempre amargas. La gente desarrolló una base de conocimientos que hizo posible que las bellotas fueran usadas de formas muy variadas. Se comían directamente del árbol y se preparaban platos que van desde salados a dulces. Se les aplicaba tratamientos muy simples, como secarlas, tostarlas o hervirlas y en el caso de las bellotas amargas, se manipulaban para disminuir los niveles de amargor. A partir de la información obtenida de entrevistas a informantes conocedores del uso de las bellotas y de una revisión de documentos etnobotánicos, en este artículo se describen las formas de consumo, el procesado de los productos y otros usos de las bellotas de las especies del género *Quercus* en el centro-oeste de la península Ibérica durante el siglo XX. Asimismo, se indican las causas de porqué las bellotas perdieron su importancia a finales de los años sesenta. En la actualidad el uso principal de la bellota es como alimento para los cerdos negros ibéricos de los que se obtienen embutidos de gran

¹ Received 19 May 2016; accepted 22 August 2017;
published online 7 September 2017

calidad. Además, nuevos productos como licores de bellota, caramelos, etc., están siendo comercializados a pequeña escala como productos distintivos.

Key Words: acorn consumption, ethnobotany, *Quercus*, Iberian Peninsula, traditional knowledge.

Introduction

“This is a good village, a very wealthy people, because it has many acorns.”

Resident of the village of Grazalema, Andalucía, Spain, early 1950s (Pitt-Rivers 1954)

“In three quarters of the year the mountaineers are nourished only by acorns, which are dried and crushed and milled to make bread, which can be stored for a long time.”

Old reference of Strabo, Greek from the 1st century BCE, talking about the habitants of the north of Spain (García-Bellido 1976)

Edible wild fruits and vegetables have played an important role in feeding people from antiquity to the 20th century (Lukasz et al. 2013). In recent decades, however, there has been a general decline in the collection and consumption of wild edible plants, especially in industrialized countries (Menéndez-Baceta et al. 2017; Reyes-García et al. 2015; Serrasolses et al. 2016).

In different areas of the Iberian Peninsula, depending on ecological conditions, different woody species, both wild and domesticated, provide edible fruits. In the north, historically, the harvesting and consumption of hazelnuts, beechnuts, chestnuts, and apples were predominant. By contrast, in the Mediterranean area the harvest of pine nuts, olives, grapes, and figs was, and continues to be, most important (Buxó and Piqué 2008). However, the consumption of wild acorns (Fig. 1), given the wide geographical distribution of the species of the genus *Quercus*, was abundant throughout the Iberian Peninsula. In this area, there is abundant evidence of the use of acorns as a food since prehistory (Peña-Chocarro et al. 2013). For example, charred and stored acorns, remains in ceramic containers, and acorn flour in hand mills have all been found in archeological sites (Peña-Chocarro 1995; Pereira and García-Gómez 2002). We also have abundant references of the consumption of acorns in different historical periods and in different territories of Eurasia and America, although their use has been especially intense in the Mediterranean area (García-Gómez 2009; Mason 1992; Parsons 1962).

The importance of these acorns in the past is captured in popular culture, held in the vernacular languages, symbols, and traditions of peoples across

Iberia (Tardío et al. 2014). In the Iberian Peninsula, the use of acorns as a food source was maintained until after the mid-20th century and into the 1960s (Tardío et al. 2006), when a burst of socioeconomic development in Spain and Portugal led to the abandonment of traditional practices that had previously helped the survival of people. In the new modern era, acorns and other rural or wild harvested foods became symbols of poverty, backwardness, and the forgettable past (García-Gómez et al. 2013).

In the west and southwest of the Iberian Peninsula, *Quercus* trees are found in the context of a unique agrosilvopastoral system, high in biocultural diversity, called *Dehesa* in Spain and *Montado* in Portugal (Joffe et al. 1988; Pinto Correia 1993). The *Dehesa* system (Fig. 2) occupies large tracts forming a continuum along the Spanish-Portuguese border with the *Montado* system, which stretches almost to the Atlantic Ocean. This “cultural landscape” (sensu Acha and Newing 2015) is characterized by open to woodland forest of holm oak (*Quercus ilex* L. subsp. *ballota* [Desf.] Samp.), often mixed with the cork oak (*Quercus suber* L.) and other oak species (Table 1) (Aronson et al. 2009; Caballero et al. 2009). In this agrosilvopastoral system, the use of acorns was maintained as seasonal work carried out, generally, collectively and the acorn crop was divided between food for livestock and human consumption (Costa 1898; Fernández 1992).

Recently, however, this system has begun to transform in new ways, due to economic, cultural, and environmental changes both within and external to this system (Aronson et al. 2009). Much research is being conducted on this change focusing on the social and ecological impacts of agricultural intensification, urbanization (or rural flight), European Union and national agricultural policies, globalized markets and food supply chains, increasing water scarcity due to climatic change and increased demand for economic development, and the increase in pathogens and invasive species (e.g., Acha and Newing 2015; Aronson et al. 2009; Costa and Oliveira 2015; Pinto Correia et al. 2006; Plieninger and Schaar 2008; Ribeiro et al. 2014).

While the general public in the developed Western world tends to think of acorns as primarily



Fig. 1. Acorns from *Quercus ilex* subsp. *ballota*.

food for squirrels, the acorn is beginning to gain recognition as an underutilized fruit crop with great potential (Hamada Acorn Initiative 2015; Starin 2014) and its bromatological and nutraceutical characteristics are well known (Heinrich et al. 2016). The Koreans already consume huge amounts (Bainbridge 1985), in the form of acorn muk (dotorimuk), a jelly-like side or main dish, with a familiar story. “Acorn Muk used to be produced to relieve famine during poor harvest years. It has now become a favourite food served during national festivities and special celebration days. Its popularity is ever increasing in view of its natural properties and its taste very much depends on the region it originates from and the seasoning that accompanies it” (Chosun.com 2001).

A similar story appears to be unfolding in Europe and North America. For instance, it is being argued in the popular press that acorns are an abundant alternative to gluten, and a potential keystone species in a permaculture system of sustainable food production (Kraft 2012). According to Bainbridge (1985): “Acorns are a perennial ‘grain’ crop that can play an important role in restoring degraded lands and feeding hungry and malnourished people. They provide up to 600 kcal and 8 g of protein per 100 g. They offer well-balanced amino-acids that are complemented by milk, legumes or meat, and they provide plentiful vitamin A (180 IU/g) and vitamin C (up to 55 mg per 100 g).”

The question then arises as to how to make use of acorns in such a way as to fulfill this potential. We



Fig. 2. Dehesa system. Miramonte, Cáceres, Spain.

TABLE 1. SPECIES AND SUBSPECIES OF THE GENUS *QUERCUS* IN THE IBERIAN PENINSULA (AMARAL, 1991).

Quercus species	Spanish name	English name
Leaves evergreen		
<i>Quercus ilex</i> L.	Encina, carrasca	Holm oak
- <i>Quercus ilex</i> subsp. <i>ballota</i> (Desf.) Samp.		
- <i>Quercus ilex</i> subsp. <i>ilex</i>		
<i>Quercus coccifera</i> L.	Coscoja	Kermes oak
<i>Quercus suber</i> L.	Alcornoque	Cork oak
Leaves deciduous or marcescent		
<i>Quercus pyrenaica</i> Willd.	Rebollo, melojo	Pyrenean oak
<i>Quercus humilis</i> Mill.	Roble pubescente	Downy oak
<i>Quercus canariensis</i> Willd.	Quejigo andaluz	Algerian oak
<i>Quercus faginea</i> Lam.	Quejigo	Portuguese oak
- <i>Quercus faginea</i> subsp. <i>faginea</i>		
- <i>Quercus faginea</i> subsp. <i>broteroi</i> (Cout.) A. Camus		
- <i>Quercus lusitanica</i> Lam.		
Leaves deciduous		
<i>Quercus petraea</i> (Matt.) Liebl.	Roble	Sessile oak
- <i>Quercus petraea</i> subsp. <i>petraea</i>		
- <i>Quercus petraea</i> subsp. <i>huguetiana</i> Franco & G.López		
<i>Quercus robur</i> L.	Carballo	Pedunculate oak

argue here that a review of the historical and near contemporary uses of acorns across Iberia can contribute ideas and inspire innovative new uses for what often appears as a ubiquitous but useless crop (e.g., Ocean 2013). Simultaneously, we recognize a need to document and preserve local knowledge of past and current uses of all edible species, especially in Western societies, such as the Spanish and Portuguese, where knowledge relating to biodiversity is being lost as their bearers disappear (Pardo de Santayana et al. 2014).

Thus, the aim of the research reported here was to collect the uses and importance of acorns as food in the central west of the Iberian Peninsula during the last century. We also analyzed the different forms of consumption and preparation of different dishes. For these purposes, we have collected information about the use of holm oak acorns (*Q. ilex* subsp. *ballota*), the most commonly used. We have supplemented field work with bibliographical information regarding the uses of acorns of holm oak, as well as acorns of other *Quercus* species in other areas of the Iberian Peninsula.

Methodology

Our methods were primarily ethnographic field work in Extremadura and Castilla-La Mancha, central west Spain, complemented by a literature review

of ethnobotanical studies conducted in the Iberian Peninsula by other authors.

A survey of rural areas of Extremadura and Castilla-La Mancha was conducted by the lead author during 2002 and 2003. Sixty-five interviews of residents, living at 35 different locations, were conducted during that time. The informants were generally more than 60 years old (mean age 71 years old), and were not selected at random. They were part of a purposive sample that targeted people known to be either more knowledgeable about acorn use or known to use, or have used, environmental resources and that in their memories or customs preserved knowledge related to the use of the local flora.

Free, prior, and informed consent was requested and given, and interviewees' identities have been kept anonymous. Interviews were conducted in person, using a questionnaire survey, but discussion was not limited by the survey. The fieldwork was terminated when new contributions began to be negligible.

We also conducted a review of all ethnobotanical studies carried out in Spain in the last 35 years (e.g., Blanco and Cuadrado 2000), some of which were also historical in focus (e.g., Gutiérrez-Pajés 2006; Parsons 1962; Teofrasto 1988). We noted all mentions of *Quercus* species or their corresponding vernacular, their location, uses, preparations, and any

other relevant information about these human-oak or acorn interactions. For identification at subspecies level of *Q. ilex*, *Q. faginea*, and *Q. petraea* (see Table 1), we followed Amaral (1991). With this data, we analyzed the use of acorns during the 20th century by species and local use category. We also examined variation in use and importance by location and in time.

Results and Discussion

Prior to its devaluation, interviews and the literature review suggest an uneven utilization of the different species of the genus *Quercus* present in the Iberian Peninsula, primarily depending on whether their fruit was sweet or bitter. There is only one species that can produce sweet acorns regularly, *Q. ilex* subsp. *ballota*, although not all individuals of this species produce sweet fruit, and it was clear that acorn use for human consumption was mostly associated with this species. However, in northern areas, where the holm oak is not present or is very scarce, other species were important in consumption (Menéndez-Baceta et al. 2012). We think, although hard evidence is lacking, that over the years, preference for sweet acorns has led to the preservation of holm oak individuals with sweet acorns and the elimination of those with bitter acorns (presumably destined for other uses such as firewood, timber, or charcoal). This would explain the common observation that there are more holm oak trees of sweet acorn in the heavily managed *Dehesas* than in the unmanaged hill forests, where bitter acorns predominate (Blanco et al. 2005; González 1992).

In Table 1, we include species and subspecies of the genus *Quercus* present in the Iberian Peninsula, as well as common Spanish and English names for the species.

USE OF ACORNS FROM *QUERCUS ILEX* SUBSP. *BALLOTA*

The Spanish writer, Arturo Barea, reports that a young man from a village near the ancient city of Cáceres (Extremadura, Spain) told him in the first half of the last century:

“In the summer everything was fine, because we had lettuce and tomatoes and onions; but it was better in the autumn, because we had work in the holm oak wood pulling down the acorns for pigs, and they let us eat as much as we wanted. In the winter, we had nothing. A piece of dry bread and spread with garlic

and some onion... When we won something with the shaking of the acorns, mother made a stew of potatoes with a piece of bacon inside. But when there was no work, we put out traps for rabbits... and stole the acorns of the pig, but it was very risky” (Barea 2001, 114–115).

Except for acorns that were eaten fresh after picking them directly from the tree or in the days immediately after collection, it was normal to dry harvested acorns and store them for use until the next harvest. The drying process could be done in the upper rooms of houses (in Spain called *cámaras* or *trojes*), in warehouses or outdoors. To dry the acorns, layers of acorns, between 20 and 25 cm in thickness, were made and the acorns were turned every 2 or 3 days until they were completely dry. The process could take up to 2 or 3 months. Once dried, acorns could be consumed in a remarkable variety of ways; below, we summarize our findings from interviews and the literature on these past uses of the sweet acorns of the holm oak.

Raw

According to information provided by all informants, this use was very common and extended to all areas with holm oak. In the fields or at home in the days after the harvest, they were consumed fresh. To conserve and use them later, they were dehydrated and consumed like nuts; these were known as *bellotas de avellaneda* or *chonchas*. Some informants reported that they stored as much as 30–40 kg of dried sweet acorns to consume throughout the year; this reserve was known as an *avellanaero*.

Many times, the acorns were eaten with bread, because people thought that with bread they were sweeter and therefore better. One informant said, “with bread they are richer,” and another claimed, “acorns with bread are better than alone.”

There were some who reportedly used them as gifts for the children, because they were consumed as a snack. Some people ate acorns in winter in the bars, while they played cards.

Boiled, Roasted, and Roasted

Practically, all the people interviewed reported their consumption of acorns after boiling, and once boiled, the acorns remained edible for 5 or 6 days. In some cases, they were boiled only with water, but mostly they were boiled with water and aniseed

(*Pimpinella anisum* L.), which made the acorns tastier. Usually they were boiled unpeeled, and subsequently peeled, being much easier to remove the pericarp and membrane.

However, there were other ways of boiling acorns that gave them different flavors. They could be boiled with sugar, salt, cloves, orange peel, or thyme. One informant said that his grandparents taught him to add the leaves of cabbage.

Roasted acorns were those that were placed in the glowing hot embers of the fire, while toasted acorns were made in a pan or similar container on the fire (Fig. 3). In both cases, it was necessary to puncture them so that they would not burst.

Roasting acorns was mentioned in association with family gatherings. Many informants recalled that at night, after dinner, it was customary to roast acorns in the embers. While people were eating acorns, they had conversations and told stories. This custom disappeared when the television appeared in the 1960s (Blanco and Cuadrado 2000).

Flour, Bread and Sweets

The acorns, once dry, often were ground into flour (Fig. 4). For human consumption, they were always sweet acorns. Sometimes acorns were ground for livestock, to supplement their feed, and in this case it did not matter if the acorns were bitter. According to some informants, stone mills (usually of granite) were made specifically for this function, while in other cases existing grain mills were used. The flour was then used to produce several dishes.

The study carried out in the *Dehesas* of southwestern Spain by the Californian geographer Parsons (1962) in the late 1950s reported that acorn bread and acorn porridge were consumed by poorer people, especially in times of scarcity.

Although there is abundant evidence that the acorn bread (Fig. 5) was prepared continuously in the Iberian Peninsula from prehistory (García-Gómez et al. 2013), it is true that throughout the 20th century its consumption was rather infrequent. In this century, its use for bread was higher mainly during the Spanish Civil War (1936–1939) and the post-war years. These years are still remembered in Spain by all the people who lived through them as the “years of hunger.” Two of our informants told us that acorns were their staple food during the years of hunger, and for this reason, there was no hunger after the war, because their village was “rich in hunting, acorns and figs.”

The acorns were also used as desserts. Sweets were mostly homemade dishes, according to informants. One was called “sweet acorn paste,” which was made from a porridge of mashed, boiled acorns mixed with sugar.

“Acorn nougat” was made with roasted and caramelized sugar, lightly toasted acorns, and breadcrumbs, all placed in a mold. “Sweet acorns” were produced by toasting sugar and pieces of acorns to produce a compact mass or *guirlache*.

Acorn cakes were also popular: acorns were left to dry and the skin removed with a knife, then crushed and mixed with water and some milk to make a compact dough, which was flattened and fried in a pan. Once cool, it was covered with sugar or honey.

A candy substitute was eaten at Christmas when there was no money to buy real nougat. Practically all people recognized, made, and ate this kind of nougat, which consisted of a sweet acorn, previously peeled, either green or dry, placed inside a dried fig. This famous Christmas sweet in Spain had other Spanish names: *casementera*, *boda*, and *zurrón*.

Coffee Substitute

Many of our informants told us that in many households, acorn coffee was made for domestic use, and this custom was widespread during the first two thirds of the 20th century. But in certain areas, the acorn harvest was the basic raw material for the industrial production of acorn coffee, which was used domestically and exported as a coffee substitute.

– *Home coffee*

In every home, the preparation of the acorn coffee was similar. First, the acorns were roasted or toasted (sweet and bitter, both were used), then they were cut up or milled, and boiled in a pot to make the coffee substitute. In some cases, people mixed the roasted acorns with roasted and ground barley. Although we found this use commonly reported, one of the interviewees commented that it was “an underappreciated product that was only made in a time of deep crisis.”

This form of consumption was not unique to Spain and Portugal; in many European countries in times of war, oak acorns were used to prepare an infusion that replaced coffee (Hageneder 2006). Another substitute of coffee made with acorns was *eichel kaffee*, which was recommended as a



Fig. 3. Acorns and chestnuts roasting.

medicinal drink, with astringent and antidiarrheal properties (Pinto 2008).

– *Industrial coffee*

In the central west of the Iberian Peninsula, between the provinces of Toledo and Cáceres, from the 1940s to 1960s, acorns were gathered to make acorn coffee in large quantities. Sometimes, the acorn roasting companies were located near the train stations because once roasted, the acorns were sent by train to Madrid, where the factories were located, the processing finished, and the final product marketed on a large scale.

Informants reported that when holm and cork oak occurred in the same area, both were harvested,

although the price for the acorns of the cork oak was cheaper, about half the price of that from holm oak.

This use generated income for the people where the acorns were collected. For a couple of months every year, during the period of maturation of the acorns, there were numerous groups, composed of eight to ten people each, dedicated to the collection of the acorns. The trucks went to load the acorns at the farms or at the big properties, where acorns were in “piles,” while smallholders had to group their acorns into a common site, and they were transported when there were sufficient quantities. In every village, usually there was a person (*corredor*) who was appointed to buy and ensure the quality of acorns.



Fig. 4. Acorn flour.



Fig. 5. Acorn bread (dark) and wheat bread.

The company that purchased the product was called Cafés Columba (later absorbed by Cafes Saimaza). Currently, the company Achicoriosa, which was responsible for buying the acorns for Columba, still makes and sells chicory (*Cichorium intybus* L.) at its plants in Segovia and Valladolid in central Spain. Acorn coffee disappeared from the market in the early 1970s, with the increased living standards of the population and the possibility to buy and drink real coffee.

Oil

Acorns were crushed and boiled in water, so that the oil contained in them was clear and floated on the surface, from which it was collected with a spoon or a small saucepan. The oil obtained was for family consumption, for frying, or for oil lamps. With this method, one could get around 5% oil with respect to the weight of dry acorns.

In Andalucía, in the south of Spain, the harvest of 1964–1965 produced 2,200,000 kg of acorns that were processed into 940,000 kg of flour and 93,000 kg of oil (ABC 1966).

We also have reports of its use in Portugal (Pinto 2008). Until the mid-20th century, the acorns were processed to produce oil as raw material for the food industry. At present, oil is no longer produced at an industrial level, but it is still recognized by Portuguese law as an edible oil. In addition, it was regarded as massage oil.

The potential future value of acorns for oil is recognized by FAO: “Further study of all the oaks is needed to identify the sweetest, best-tasting

acorns for food and the oiliest acorns for making acorn oil—which is very similar to olive oil” (Bainbridge 1985).

Popular culture originates spontaneously from the people, and it is passed down orally from generation to generation, through stories of experiences and traditions from different places. One local saying that survives today refers to acorn oil: “acorn oil will grow hair on your boots.”

Main Courses: Purees, Omelet, and Crumbs

A puree, or porridge, could be prepared in several ways: acorn flour was boiled in water with aniseed until it thickened; acorn flour might be mixed with the same proportion of wheat flour and then boiled with milk or water depending on the taste of consumers, until it had a floury texture. It was a popular food, eaten hot usually in winter, and with all the diners around the cooking pot, each one with a spoon.

We have collected different recipes to prepare “acorn omelets.” Most commonly, an omelet was prepared from acorn puree and then cooked with beaten eggs in a frying pan, much as Spanish tortillas are today, except acorns replace the potatoes. In another recipe, the acorns were peeled, scraped, and grated to be fried, and then eggs were beaten and mixed with it and cooked in a frying pan. Another called for the acorns to be simply crushed and mixed with beaten egg, and then cooked in a frying pan. Finally, acorn flour could be mixed with brown sugar and milk, combined with beaten eggs, and cooked in a pan with a little oil. A few informants

explained that acorn omelets were only made during the Spanish post-war period.

Crumbs (*migas*) is a typical dish from the center of Spain that is made from the crumbs of stale bread. In this case, the acorns replaced the bread. The way of preparation was to cut acorns into thin slices and fry them in a pan with some oil and garlic, and stir them until they were ready. This was the main meal of the day. The diners ate directly from the pan, which was located in the center of them.

Beverages and Liqueur

A beverage from acorns was used traditionally as medicine, mainly for diarrhea. A handful of dried and shelled acorns were pounded into medium-size pieces. These were mixed with about half a liter of water, boiled for a while, then set aside to cool down. The liquid was consumed cold when needed, and if there was honey or sugar available, it was added to sweeten the medicine.

Another drink is the acorn liqueur, which today has wide acceptance and popularity in Spain. However, it is produced in modern factories and, as far as we know, was never made at home.

Other Uses

Cocoa or chocolate substitutes were also made from acorns. Making use of its astringent properties, a powdered mixture was made from roasted and milled acorns and cocoa (Alfonso 2003). Throughout the 20th century, this powder was sold in Spain in various products commercialized under the name of “cocoa acorns.” They were primarily used to combat diarrhea (García-Gómez and Pereira 2013).

Another true by-product from acorns is acorn honey. It is made by bees from the secretions of immature acorns that may fall in a storm in August. Bees seek out these acorns, collecting the secretions and then producing an acorn honey. There is a Spanish saying used when there is a storm in August, “good for beekeepers, bad for pork butchers,” because you lose acorns to fatten pigs but honey is produced instead. The Greek poet Hesiod (8th–7th centuries BCE) said that the oak plus fruit produce honey and bees (Teofrasto 1988).

In some places, acorns were used as an ingredient in the stews prepared with game meat (Gutiérrez-

Pajés 2006), and in other places they even prepared lentils with acorns.

Finally, for curing olives, to remove the bitterness, three or four acorns were added to every bucket full of olives and water. The acorns were added at the same time as the olives and remained with them while the olives were curing. Given the astringent properties of the acorns, which are rich in tannins, the olives remained hard despite the long soaking in water.

USE OF ACORNS FROM THE OTHER *QUERCUS* SPECIES

All the acorns from *Quercus* species have, to a greater or lesser extent, tannin (tannic acid), which gives them a bitter taste. Its concentration varies not only between species but also between individuals of the same species, and even among the acorns from the same individual. However, all acorns are edible if they are treated to remove the bitterness. Leaching, boiling, or toasting was the main process used to eliminate or neutralize the bitterness. Given the available technology and fairly simple preparations, it is assumed that all acorns were used as human food in the past. In fact, we found documentation of the use of acorns from most Iberian species of the genus *Quercus*. Table 2 summarizes the different forms of consumption of the acorns for all of the species where data were available.

The acorns from *Quercus coccifera* L. were generally underappreciated, but we know that they were consumed raw sporadically in the south of the Iberian Peninsula, where one resident said that “the acorn constipates a lot if you eat a lot” (Fernández 2000).

The acorns from *Quercus faginea* Lam., as with *Q. coccifera*, were also underappreciated; however, its consumption is documented as raw, roasted, or to make coffee. Referring to these acorns, people said “they were roasted, so much of the bitterness was removed” (Ramiro et al. 2005; Tardío et al. 2004).

The acorns from *Quercus humilis* Mill. were reportedly consumed raw, roasted, or as an ingredient for making coffee only in particular areas (Pérez 2006).

In the northeast of the Iberian Peninsula, where the other variety of holm oak *Q. ilex* subsp. *ilex* is found, its acorns, called *kiskurras*, were used raw, boiled, roasted, like coffee, or transformed into flour. In addition, its milled flour was mixed with an equal amount of corn flour and water to make

TABLE 2. SPECIES OF THE GENUS *QUERCUS* WITH EVIDENCE OF HUMAN CONSUMPTION OF THE ACORNS IN THE IBERIAN PENINSULA AND FORMS OF CONSUMPTION.

Species	Forms of consumption	Sources
<i>Q. ilex</i> subsp. <i>ballota</i>	Raw, boiled, roasted and toasted, dried fruit, flour, bread, coffee, oil, puree, omelet, crumbs, beverage, sweets, poor nougat, cocoa/chocolate, honey, stews, olives tanning	Interviews; Pardo de Santayana et al. 2014
<i>Q. coccifera</i>	Raw	Fernández 2000; Ramiro et al. 2005
<i>Q. faginea</i>	Raw, roasted, coffee	Tardío et al. 2004; Ramiro et al. 2005
<i>Q. humilis</i>	Raw, roasted, coffee	Pérez 2006
<i>Q. ilex</i> subsp. <i>ilex</i>	Raw, boiled, dried fruit, roasted, coffee, flour for making cakes, bread	Pérez 2006
<i>Q. petraea</i>	Raw, roasted, coffee, dried fruit, medicinal	Lastra 2003; Pérez 2006
<i>Q. pyrenaica</i>	Boiled, raw, roasted	Tardío et al. 2004; Pérez 2006
<i>Q. robur</i>	Boiled, raw, roasted, coffee, medicinal	Pérez 2006
<i>Q. suber</i>	Raw, coffee	Interviews; Pardo de Santayana et al. 2014

cakes. The cakes were cooked in an iron skillet (Pérez 2006). Sometimes, this flour was mixed with cereal grain flour and made into bread.

Concerning the acorns from *Quercus petraea* (Matt.) Liebl., we know that in the north of the Iberian Peninsula they were eaten raw, roasted, as dried fruit, or as acorn coffee (Lastra 2003). The use of these acorns as raw fruit was rare. They were occasionally used in the País Vasco and Navarra, but only for the magical-medicinal purpose of transferring the strength of the oak to the people, so they would not get sick (Pérez 2006).

The acorns from *Quercus pyrenaica* Willd. were consumed boiled with aniseed and orange peel, and only sporadically roasted or eaten raw. According to a popular expression, there are also some people who ate the bitter acorns “when they are ripe and fallen with some frost on them” (Tardío et al. 2004).

Regarding the acorns from *Quercus robur* L., in the north of the Iberian Peninsula, they were used to make coffee, roasted in the coals or boiled, in times of famine. According to Pérez (2006), one reason to eat these acorns was the belief that the person who consumed the acorns acquired the oak’s strength and good health.

In Extremadura, the acorns from the cork oak, *Q. suber* L., were occasionally eaten raw or made into acorn coffee. Some consumers discovered that after consuming these, they did not need to urinate for a while.

The data collected in this study clearly shows the predominance of holm oak species (*Q. ilex* subsp.

ballota) in terms of the diversity of uses per species and also its widespread distribution across most of the Iberian Peninsula (the north excepted). According to our informants, acorns served for many years to supplement the household food supply and diet and support the local economy. However, these uses, and the knowledge that underpins them, can be considered largely anecdotal today, in the sense that they are no longer practiced.

At present, gathering and using oak acorns is exclusively a resource for feeding the native black Iberian pig (*Sus scrofa domesticus*), which produces delicious, renowned, and healthy hams and pork sausages. Other new products made from acorns are under development, and some are already on the market (Starin 2014). Perhaps more important for the economic and cultural revival of the countryside, the acorn is coming to symbolize naturalness and rurality, and beginning to be used as an element of prestige, rather than referencing famine foods and backwardness as it did in the past. Among the new uses, which will help to maintain the local economy, the ecosystem, and the biocultural diversity, we have highlighted acorn chocolates, acorn flour and bread, acorn liquors, beer and other beverages, acorn caramels, and acorn honey. All of these products represent a clear and distinctive manifestation of the growing positive perception of acorns and their products.

There is a hopeful future for the use of acorns (Kraft 2012; Starin 2014), which may just blossom in time to help maintain this ancient biocultural system, including the tree and other plant diversity

and also the cultural beliefs and knowledge associated with managing the landscape and using the acorns.

Conclusions

Among the acorns of the different Iberian species of the genus *Quercus*, *Q. ilex* subsp. *ballota* was the most important, in terms of historical depth, wide geographical distribution, and high diversity of uses. It is the only species that produces large crops of acorns that are more or less sweet, and, perhaps not coincidentally, it is the most abundant species of *Quercus* in the Iberian Peninsula. More research is needed to test our proposition that selection by human consumers and managers of the *Dehesa/Montado* agroecosystem is responsible for the observed distribution of sweet and bitter holm oaks in Iberia.

While the sweet acorns of the holm oak were preferred, in areas where none existed or holm oak was scarce, other species of bitter acorns were used. To facilitate its palatability, and to lose the bitterness of its tannins, these acorns were leached in water, and then roasted or thoroughly boiled.

The main use of acorns was for human consumption. The ethnographic data indicate that consumption in the past was either as raw, roasted, or boiled. Consuming raw acorns, when they were fresh or green, was only possible during the ripening period, which in most cases happened over 3 months. This was considered by our informants as the most immediate and convenient way to consume them. The rest of the year acorns were dried and stored, and then had to be leached, processed, and cooked in some manner, a much more time-consuming process.

The results of this study indicate that human consumption of acorns was common until the 1960s, then went into decline with post-war modernization and was, until recently, considered largely moribund. The black Iberian pig, used to obtain the best sausages produced in Spain, has become the main consumer of holm oak and other oak acorns. In addition, new products from acorns have emerged produced by trademarks and marketed with quality labels, such as chocolates, liqueurs, tarts, or acorn caramels.

Acknowledgements

This paper was prepared while the lead author was on an ERASMUS Scholarly Exchange at the Centre

for Biocultural Diversity, School of Anthropology and Conservation, University of Kent, Canterbury, UK. We thank Dr. Miguel Alexiades for his comments on the manuscript.

References

- ABC Sevilla. 1966. Industrialización de la bellota. June 21:28.
- Acha, A. and H. Newing. 2015. Cork oak landscapes, promised or compromised lands? A case study of a traditional cultural landscape in Southern Spain. *Human Ecology* 43(4): 601–611.
- Alfonso E. 2003. Curso de medicina natural en cuarenta lecciones. Buenos Aires, Argentina: 1^a ed. 14^a ed. Kier
- Amaral J. 1991. *Quercus* L. In: Flora Ibérica vol. 2, eds. S. Castroviejo, M. Lainz, G. López González, P. Monserrat, F. Muñoz, J. Paiva and L. Villar, 15–36. Madrid, Spain: Real Jardín Botánico, CSIC.
- Aronson, J., J. S. Pereira, and J. G. Pausas. 2009. Cork oak woodlands on the edge: Ecology, adaptive management and restoration. Washington, DC: Island Press.
- Bainbridge, D. 1985. Acorns: A crop for the future. *Unasyuva* 150. <http://www.fao.org/docrep/r5265e/r5265e0a.htm> (08 October 2015).
- Barea, A. 2001. La forja de un rebelde II. Barcelona, Spain: Ediciones Bibliotex.
- Blanco, E., M.A. Casado, M. Costa, R. Escribano, M. García, M. Génova, M. Gómez, F. Gómez, J. C. Moreno, C. Morla, P. Regato and H. Sainz, 2005. Los bosques ibéricos: Una interpretación geobotánica. Barcelona, Spain: 4^a ed. Planeta,
- , and C. Cuadrado. 2000. Etnobotánica en Extremadura: Estudio de La Calabria y La Siberia extremeñas. Madrid, Spain: Ed. del autor y del C.E.P. de Alcoba de los Montes.
- Buxó, R. and R. Piqué. 2008. Arqueobotánica. Los usos de las plantas en la península Ibérica. Barcelona: Ed. Ariel.
- Caballero R., F. Fernández, R. Pérez-Badia, G. Molle, P. Roggero, P. S. Bagella, P. D'Ottavio, V. P. Papanastasis, G. Fotiadis, A. Sidiropoulo and I. Ispikoudis. 2009. Grazing systems and biodiversity in Mediterranean areas: Spain, Italy and Greece. *Pastos* 39(1): 4–154.
- Chosun.com 2001. Muk- typical Korean jelly food. http://www.chosun.com/english/contents/magazine/2001/Cuisine200108_3.html (08 October 2015).

- Costa, A. and G. Oliveira. 2015. Cork oak (*Quercus suber* L.): A case of sustainable bark harvesting in Southern Europe. In: Ecological sustainability for non-timber forest products: dynamics and case studies of harvesting, eds. C. M. Shackleton, A. K. Pandey, and T. Ticktin, 179–198. London, United Kingdom: Routledge.
- Costa, J. 1898. Colectivismo Agrario en España. León, Spain: Ed. Instituto Leonés de Cultura.
- Fernández, A. M. 2000. Estudio etnobotánico en el Parque Natural de las Sierras de Cazorla, Segura y Las Villas. Investigación química de un grupo de especies interesantes. Tesis doctoral. Jaén, Spain: Facultad de Ciencias Experimentales, Universidad de Jaén.
- Fernández M. 1992. Los aprovechamientos comunales del monte en el cuadrante Noroccidental de España. Madrid. Anales del Museo del pueblo español. Tomo IV. Ministerio de Cultura: 49–83.
- García-Bellido, A. 1976. España y los españoles hace dos mil años según la <<Geografía>> de Strabon. Madrid: Colección Austral. Espasa Calpe.
- García-Gómez, E. 2009. El aprovechamiento de las bellotas para el consumo humano en la península Ibérica. Trabajo de Investigación para la obtención del Diploma de Estudios Avanzados. Madrid, Spain: Universidad Autónoma de Madrid.
- . and J. Pereira. 2013. El uso medicinal de la bellota. *Medicina Naturista* 7(1): 42–50.
- ., ———., F. J. Tardío, and M. Pardo de Santayana. 2013. Historia, elaboración y consumo de pan de bellota en España. *Pastry Revolution* 3: 84–97.
- González, F. 1992. La frutalización del paisaje mediterráneo. In: Paisaje Mediterráneo, eds. M. Chaves, J. Blanc, and G. Cremonese, 136–141. Milán, Italy: Editorial Electa.
- Gutiérrez-Pajés, L. 2006. Plantas útiles para el hombre. Historia natural y cultural de las plantas comestibles. Barcelona, Spain: Argania editio, S. C. P.
- Hageneder, F. 2006. La sabiduría de los árboles. Barcelona: Blume.
- Hamada Acorn Initiative. 2015. <http://www.iloveacorns.com/> (07 October 2015).
- Heinrich M., S. Kerrouche and K.S. Bharij. 2016. Recent advances in research on wild edible plants and their biological-pharmaceutical activity. In Mediterranean wild edible, eds. M.C. Sánchez Mata and J. Tardío: 253–269. New York: Springer.
- Joffre, R., J. Vacher, C. de los Llanos, and G. Long. 1988. The dehesa: An agrosilvopastoral system of the Mediterranean region with special reference to the Sierra Morena area of Spain. *Agroforestry Systems* 6:71–96.
- Kraft, J.C. 2012. This thanksgiving, consider cooking with acorn flour. *Earth Island Journal*. November 21, 2012. <http://www.earthisland.org/journal/index.php>. (08 October 2015).
- Lastra, J. J. 2003. Etnobotánica en el Parque Nacional de Picos de Europa. Madrid: Organismo Autónomo de Parques Nacionales.
- Lukasz L., M. Zovko Končić, T. Miličević, K. Dolina and M. Pandzatiija. 2013. Wild vegetable mixes sold in the markets of Dalmatia (southern Croatia). *Journal of Ethnobiology and Ethnomedicine* 9:2 DOI <https://doi.org/10.1186/1746-4269-9-2>
- Mason, S. 1992. Acorn in human subsistence. Doctoral Thesis. London: Institute of Archaeology. University College London.
- Menéndez-Baceta, G., L. Aceituno-Mata, J. Tardío, V. Reyes-García, M. Pardo de Santayana. 2012. Wild edible plants traditionally gathered in Gorbeialdea (Biscay, Basque Country). *Genet Resour Crop Evo.* 59:1329–1347.
- ., M. Pardo de Santayana, L. Aceituno-Mata, J. Tardío, and V. Reyes-García. 2017. Trends in wild food plants uses in Gorbeialdea (Basque Country). *Appetite* 112: 9–16.
- Ocean, S. 2013. Acorns and Eat'em. Grass Valley, CA: Ocean-Hose.
- Pardo de Santayana, M., R. Morales, L. Aceituno-Mata, and M. Molina, eds. 2014. Inventario español de los conocimientos tradicionales relativos a la biodiversidad. Madrid: Ministerio de Agricultura, Alimentación y Medio Ambiente.
- Parsons, J. J. 1962. The acorn-hog economy of the oak woodlands of southwestern Spain. *Geographical Review* 52:211–235.
- Peña-Chocarro, L. 1995. Avance preliminar sobre los restos vegetales del yacimiento de la Edad del Bronce de Peñalosa (Baños de la Encina, Jaén). *Actas 1º Congreso de Arqueología Peninsular. Trabajos de Antropología e Etnología.* 34 (3–4): 159–167
- ., G. Pérez, J. Morales, and L. Zapata. 2013. Neolithic plant use in the western Mediterranean region: preliminary results from the Agriwestmed project. *Annali di Botanica* 3: 135–141.

- Pereira, J. and García-Gómez, E. 2002. Bellotas, el alimento de la Edad de Oro. *Arqueoweb* 4(2):1–31.
- Pérez, D. M. 2006. La bellota: Alimento de humanos. *Aunia* 17:106–112.
- Pinto, A. M. 2008. A bolota. *O Gorgulho. Boletim Informativo sobre Biodiversidade Agrícola* 8:11–13.
- Pinto Correia, T. 1993. Threatened landscape in Alentejo, Portugal: The “montado” and other “agro-silvo-pastoral” systems. *Landscape and Urban Planning* 24:43–48.
- , T., R. Gustavsson and J. Pirnat. 2006. Bridging the gap between centrally defined policies and local decisions: Towards more sensitive and creative rural landscape management. *Landscape Ecology* 21(3):33–46.
- Pitt-Rivers, J. A. 1954. *People of the Sierra*, 1954. London: Weidenfeld and Nicolson.
- Plieninger, T., and M. Schaar, 2008. Modification of land cover in a traditional agroforestry system in Spain: Processes of tree expansion and regression. *Ecology and Society* 13:1–17.
- Ramiro J. M., M.R. González-Tejero and C. Sánchez Rojas 2005. Ethnobotany in Sierra de Huelva (South Spain): Wild edible plants. The Fourth International Congress of Ethnobotany (ICEB 2005). Istanbul, Turkey.
- Reyes-García, V., G. Menéndez-Baceta, L. Aceituno-Mata, R. Acosta-Naranjo, L. Calvet-Mir, P. Domínguez, T. Garnatje, E. Gómez-Baggethun, M. Molina-Bustamante, M. Molina, R. Rodríguez-Franco, G. Serrasolses, J. Vallès, and M. Pardo de Santayana. 2015. From famine foods to delicatessen: Interpreting trends in the use of wild edible plants through cultural ecosystem services. *Ecological Economics* 120: 303–311.
- Ribeiro, P. F., J. L. Santos, M. N. Bugalho, J. Santana, L. Reino, P. Beja, and F. Moreira. 2014. Modelling farming system dynamics in high nature value farmland under policy change. *Agriculture, Ecosystems and Environment* 183: 138–144.
- Serrasolses, G., L. Calvet-Mir, E. Carrió, U. D’Ambrosio, T. Garnatje, M. Parada, J. Vallès, and V. Reyes-García. 2016. A matter of taste: Local explanations for the consumption of wild food plants in the Catalan Pyrenees and the Balearic Islands. *Economic Botany* 70(2): 176–189.
- Starin, D. 2014. Is reintroducing acorns into the human diet a nutty idea? *Scientific American, News*: May 14, 2014. <http://www.scientificamerican.com/article/is-reintroducing-acorns-into-the-human-diet-a-nutty-idea/> (7 October 2015).
- Tardío J., L. Aceituno-Mata, M. Molina, M. J. Macía and R. Morales. 2014. *Quercus ilex*. In *Inventario español de los conocimientos tradicionales relativos a la biodiversidad*, eds. Pardo de Santayana, M., R. Morales, L. Aceituno-Mata, and M. Molina, 171–176. Madrid: Ministerio de Agricultura, Alimentación y Medio Ambiente.
- Tardío, J., H. Pascual, and R. Morales. 2004. *Alimentos silvestres de Madrid. Guía de plantas y setas de uso alimentario tradicional en la Comunidad de Madrid*. Madrid: Ediciones La Librería.
- , M. Pardo de Santayana, and R. Morales. 2006. Ethnobotanical review of wild edible plants in Spain. *Botanical Journal of the Linnean Society* 152:27–71.
- Teofrasto. 1988. *Historia de las plantas. Introducción, traducción y notas de José María Díaz-Regañón*. Madrid: Editorial Gredos.