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Landscape with chestnut trees at Montesinho Natural Park. Photo by Maria do Sameiro Patrício

The Bread Tree:

A Primer on the Culture of Sweet Chestnut (*Castanea sativa* Mill.) in Portugal

Maria S. Patrício,[1] Miguel Galante,[2] and Yurij Bihun[3]

Background

The European or sweet chestnut (*Castanea sativa* Mill.) is an important multipurpose tree that is much heralded in Portuguese history and culture, for both the quality of its wood and its exceptionally versatile nuts. The sweet chestnut's specific nomenclature *sativa* is derived from the Latin botanical adjective meaning *cultivated* and is used to designate certain seed-grown, domestic crops. Most Portuguese take it for granted that the cultivation of the chestnut tree, or *castanheiro*, was introduced and spread by the Romans. Studies based on fossil records, however, reveal that the occurrence of the *Castanea sativa* formations in Portugal date as far back as 8,000 years—pre-dating the Roman occupation of the Iberian Peninsula by millennia (Paiva 2007).

Although chestnut can be found throughout Portugal, it is most widely distributed in the northern and central mountainous areas of the country. It can also be found in the mountains of São Mamede (northern Alentejo province) and the Monchique escarpment in the northern

Monumental Trees

Portugal has several notable "stands" or groves of monumental chestnut trees. Some of them are protected by law, such as the "Guilhafonso chestnut" in Guarda in east central Portugal which is believed to be over 500 years old. In the Trás-os-Montes region, there is a designated tourist route for these monumental chestnuts known as the "Millenary Route," which provides an opportunity to observe these superb chestnut trees which, in the words of the Portuguese writer, Miguel Torga seem "as old as the world itself." This route is based in Montesinho Natural Park (near Bragança, in the northeastern part of the country), which has adopted the chestnut bur as its logo.

[1]Mountain Research Center (CIMO), Polytechnic Institute of Bragança, School of Agriculture, Bragança, Portugal (sampat@ipb.pt)

[2] Forestry Consultant, Lisboa, Portugal (mg.forests@gmail.com)

[3] Director, Shelterwood Systems, Jericho, Vermont, and, President, VT/NHChapter, The American Chestnut Foundation (shelterwoodsystems@comcast.net)

Algarve, Portugal's southernmost province. These discontinuous or disjunct populations are similar to the stands described by Acker in Jerez in southern Spain (Acker 2014).

Until the introduction and widespread use of potatoes in Europe, the nuts of the sweet chestnut or *castanha* were important in human consumption, particularly as a subsistence crop for rural populations in the more remote mountainous areas. Later, with the expansion of cereal production, wheat and other grains became the base for the white bread consumed in urban areas and larger population centers, while chestnuts remained in the dark, dried bread of the mountain regions. Even to this day, in the mountainous regions of rural Portugal, the chestnut tree is referred to as *a árvore do pão*—the "bread tree"—and the delimitation of land and its economic value is based on the number of grafted chestnut.

Chestnut trees around a small mountain village in Trás-os-Montes. Photo by Maria do Sameiro Patrício

The bread tree has historical, economic and social importance unmatched by any other tree species in Portugal, especially in the northern and central part of the country. Given its cultural importance, "chestnut" is mentioned in the names of many villages and is the basis for countless traditions.

The Culture of Chestnut

One of the distinguishing characteristics of the montane chestnut-based economy was the introduction of plantations with large spacing between trees (10m x 10m) for multipurpose nut and wood production interplanted with agricultural crops, such as rye, or pastures in the open understory. In Portugal, this age old agro-sylvo-pastoral system is called *souto*. The exploitation of the multifunctional bread tree was a necessary precaution of the native highland populations, who were more or less isolated and had to become self-sufficient in food, timber and firewood (Monteiro and Patrício 2007).

Old chestnut trees in a traditional fruit orchard (souto). Photo by Maria Eugénia Gouveia

In general, there are three major typologies applied in the cultivation of chestnut: (1) *souto* (grafted trees for nut production with traditional cultivars in an agroforestry system), (2) "low forest" or coppice culture (production from shoots of dormant or adventitious stump buds), and (3) *castinçal*, "high forest" planted or natural regeneration originating directly from seed or seedlings for large dimension roundwood production. Chestnut is usually grown in pure stands, but it can grow in mixed stands in closed forests with the maritime or cluster pine (*Pinus pinaster)*, and oaks, such as Pyrenean oak (*Quercus pyrenaica*) and pedunculate oak (*Quercus robur).* Consequently, these different cultural approaches provide different chestnut forest types and products that require appropriate management models.

In Portugal, sustainable management of chestnut woodlands is essential to maintaining and enhancing their economic, social and environmental value for present and future generations. The chestnut *soutos* are part of the mosaic of vineyards, olive groves, and cork oak (*Quercus suber*) savannas that make up the working landscape and often provide the only livelihood for people in the most disadvantaged rural areas. The

Nut Production

Portugal is one of the largest European producers of chestnut – over 20,000 tons/year. There are four regional chestnut cultivars, which have received the designation of Protected Designation of Origin (DOP) appellations under the EU legislation: "*Castanha da Padrela*," "*Castanha da Terra Fria*," "*Castanha dos Soutos da Lapa*," and "*Castanha de Portalegre e Marvão*."

The northeastern Trás-os-Montes region is the most profitable chestnut production area. In 2012, nuts sales for the DOP "*Castanha da Padrela*," generated 15 million and the DOP "*Castanha da Terra Fria*" about €10 million. A significant part of the Portuguese chestnut production is exported. In 2012, Portugal exported 70% of its production, which represented 17.5 million in sales. The Portuguese chestnut is exported to 33 countries including Italy, France, Spain, Switzerland, Germany, Brazil, Angola, the United States and Canada.

economic future of the chestnut tree lies mainly in the net production of nuts obtained from the fruit orchards, associated with complementary products, such as firewood and mushrooms. There is also an interesting trend toward high-quality wood production that, combined with other non-wood forest products and ecosystems services, can become a profitable investment for forest owners.

Decline of Traditional Chestnut Culture

The second half of the nineteenth century brought significant changes to the established *souto* system with the rise of *doença da tinta*, or "ink disease" (caused by *Phytophthora* spp.), in Europe that threatened the sustainability of chestnut culture. Although major epidemics occurred during the nineteenth and twentieth centuries, due to the relative isolation of Portugal in the western corner of the Iberian Peninsula, the decline of this culture occurred mostly in the twentieth century. The phytosanitary situation of *souto* culture fell precipitously in the 1970s, following dramatic changes in rural landscapes resulting from shifting demographic patterns, with the exodus of rural populations to cities and abroad. This coincided with Portugal's entry into the EU, and subsequent modernization resulted in the decline of handicrafts in favor of new, man-made materials. This had a particularly strong impact on the wine industry, which traditionally absorbed a large part of chestnut material from the coppice culture to produce casks, baskets, and sticks and poles for vineyards. The combination of ink disease and the change in traditional livelihoods contributed to the abandonment of extensive areas of chestnut orchards and coppice culture.

Despite setbacks that have arisen throughout Portuguese history, chestnut culture fortunately continues to thrive in the new millennium. Outplanting chestnuts in new plantations is once again being advocated by foresters and sought by farmers, both for nut production orchards and silvicultural stands. Recently, the decline has stabilized, but the actual distribution area of about 40,000 hectares is a far cry from the 70,000 hectares registered in the first half of the twentieth century.

Threats to Sustainability

Over the course of the last three decades, globalization and changing climatic patterns with accompanying drought and erratic precipitation are increasing the incidence of forest pathogens such as insects and diseases. The main threats to the sustainability of chestnut throughout its range in Portugal and the Mediterranean basin are outlined below.

The roots systems of chestnut continue to be highly susceptible to ink disease caused by several species of the virulent, root-rotting fungi *Phytophthora* spp.; predominantly, *P. cinnamomi* and *P. cambivora* (Robin et al. 2006). Although ink disease is thought to have been present in Europe since the eighteenth century, the first incidence in Portugal was reported in 1838 (Fernandes 1955). This disease is by far the most common problem in orchards and is frequently exacerbated by incorrect cultural practices conducted by farmers.

Cryphonectria parasitica, the fungal pathogen responsible for the chestnut canker blight, was introduced in Europe around 1938. In Portugal and other parts of the range, this fungus does not cause large-scale dieback as witnessed in North America but is an opportunist pathogen principally infecting grafted trees. This pathogenic agent has a significant impact on the decline of orchards as well as high-forest stands of chestnut.

Oriental or Asian chestnut gall wasp (*Dryocosmus kuriphilus*), however, is a relatively new threat, which has the potential to be the most devastating pest of European chestnuts. Although the presence of the Asian chestnut gall wasp was identified early and its etiology has been well analyzed, control measures to

Young chestnut tree plantation for timber production. Photo by Maria do Sameiro Patrício

limit its spread are still being developed. The female gall wasp lays eggs in the buds of chestnut trees in early summer (May/June) and their growth begins the following spring, when the tree buds begin to develop. At this point in the life cycle, the larvae induce the formation of galls on the leaf buds, which can be very damaging to the tree. They occur on the new growth, disrupting the fruiting process, and can reduce the tree yield up to 70% and, in some instances, can cause mortality, particularly if the trees are stressed by drought or other site factors. It is estimated that this pest has the potential to cause 40 million in damages to Portuguese chestnut production. Control measures include pruning infested buds on trees. Pesticides are generally not effective because the insects take cover inside the galls. The most successful gall wasp control method is the introduction of the *Torymus sinensis* wasp. This parasitoid has proved effective as an agent of biological pest control against the gall wasp in Japan. Ongoing research in Portugal will determine the feasibility of its release into infected regions.

Paths for the Future

Portugal is a country with a long and rich tradition in the cultivation and management of sweet chestnut. The *soutos* and woodlands of *Castanea sativa* have exceptional environmental, economic and cultural importance not only for Portugal but for the global patrimony as well. The potential of this multifunctional tree species is responsible for the peculiar "civilization of the chestnut" (Adua 1999) in the Mediterranean region. Throughout the range, millions of obstinate but modest peasant farmers have shaped beautiful landscapes and are the tireless producers of these precious nuts from generation to generation (Pitte 1992).

As we move further into the twenty-first century, the culture of chestnut is enduring and may even be considered to be thriving in Portugal. It is experiencing a renaissance as new growers and farmers return to chestnut culture with new varieties and techniques for nut-growing plantations, as well as silvicultural techniques for quality timber production. The taste and quality of Portuguese nuts, regarded as the best in the world, are the "new gold" for the next generation of small farmers in the north and central mountain areas.

In the forefront of this effort is the Mountain Research Center (CIMO), based at the Polytechnic Institute of Bragança, School of Agriculture, which is developing research on growth and yield modeling, sustainable management of chestnut production areas, genetic resources (namely, adaptive characteristics and resistance to diseases), health and phytosanitary protection of the chestnut, as well as production, technology and socio-economic valuation of the chestnut. The economic, ecological, and social importance of the chestnut justifies

the investment in combating its decline and promoting its protection and management. In Portugal, several NGOs are dedicated to promoting chestnut culture and its products. A good example is the Confraria Ibérica da Castanha, whose mission is to contribute to and enhance the chestnut sector. Although there are increasing threats to and demands on chestnut production, with the help of ongoing research, the "bread tree" will continue to produce nuts, shade, habitat, and timber as well as other ecosystem benefits for the foreseeable future.

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St. Martin's Day

In the autumn, fairs and festivals are made around the sweet chestnut, highlighting its social and economic value. Many of these festivities take place on or around November 11th—St. Martin's Day—*Dia de São Martino*—the day traditionally associated with the celebration of the year's wine maturation process and the first day when the new wine can be tasted. The celebration—*magusto*—is made by the family or in the community, traditionally, around a bonfire, eating chestnuts roasted in the embers and tasting the new wine (*água-pé*).

In collaboration with Portuguese counterparts, Yurij Bihun, President of the VT/NH Chapter, TACF, is soliciting interest in organizing a fund-raising, study-tour to Portugal that coincides with the *Dia de São Martinho* festivities in November 2015. If you have ideas or are interested in being part of this tour, please contact Yurij at ybihun@uvm.edu.