

Evolution of Chestnut Illustrations in Works of XVI Century – A Contribution to the History of Botany

Andreia Marlise Carneiro de Carvalho¹ e Isilda Teixeira Rodrigues²

¹Student of PhD in Earth Sciences and Life of University of Trás-os-Montes and Alto Douro. University of Trás-os-Montes and Alto Douro, Vila Real, Portugal.

²Depart. Education and Psychology, Vila Real, Portugal. Research of CIIE - Centre for Research and Educational Intervention, University of Psychology and Educational Sciences, University of Porto, Porto, Portugal.

¹andreamcc_500@hotmail.com, ²isilda@utad.pt

Abstract: *This study integrated a broader research and had as main objectives: a) to survey chestnut illustrations in works of the sixteenth century; b) reflect on the importance of chestnut illustrations for the increase of the history of botany; c) reflect about the status of science history as a teaching tool in science education.*

The chestnut existed around thousands years following the man from the Paleolithic. It was called bread tree, because in the Middle Ages, this tree was cultivated in several areas of the world and constituted a valuable resource for the sustainability of populations. This investigation used a quality methodology with the help of documentary analysis of several works of authors considered as references in XVI century.

It was found that since the sixteenth century the authors had some knowledge of the morphological features of the different vegetative organs of sweet chestnut species, allowing the visualization and differentiation of root, stem, leaves and fruit.

Keywords: *Botany; chestnut; illustrations; bread tree.*

1. INTRODUCTION

The chestnut was introduced in Greece from Asia Minor, thence to the North and West (France, Germany, Great Britain), Ireland and subsequently passed to Italy, reaching the Iberian Peninsula, including Portugal [1]. Other researches commented that during the Roman Empire, these civilization bring together the knowledge of cultivating these specie for many European countries [2] [3].

Over the time the chestnut became a precious resource for mountains communities, and this tree has been considered the tree of life, providing food, the timber for carpentry, the fabrication of supporting poles for vineyards, as well as for heating purposes [4] [5].

The first images of plants date back four thousand years ago, originated in Mesopotamia and Egypt, where developed agricultural civilizations included images of plants on the walls of their temples [6].

Theophrastus (371 a. C – 286 a. C), one of the most important botanical in Antiquity and considered as "the father of Botany," wrote two of the most influential works on Botany of Antiquity: *De historia Plantarum* and *De causis Plantarum*, published in 1483 and 1529 respectively. It was considered by some authors, indispensable guide to understanding and teaching Botany. This botanic was, considered advanced for its time because of his innovative research, such as the practice of plant acclimatization, introduction of new technical terms, a distinction of forms of reproduction and inflorescences, and also studied the germination seeds of various species [7].

Dioscorides (?- 70 d. C.) greco-roman author, was considered one of the founders of Pharmacology and wrote the work *De Materia Medica* in 1478, in which described more than 600 plants with its medicinal properties, and some botanical respective descriptions and illustrations [8]. This work is considered the first illustrated Herbarium [7].

According to other researcher, in the XV and XVI century's the Botany developed as a scientific discipline, for this contributed several factors: the invention of printing; the appearance of the paper for the preparation of herbal; the development of botanical gardens and botanical expeditions. All

these factors have enabled the remarkable increase in the number of known species and allowed the dissemination of local or regional knowledge on a global scale [8].

The history of botanical illustrations as a source of accurate and useful information about plants is generally considered to have begun in classical times, with the publication of the first known herbals—books describing the medicinal properties of plants. In the Renaissance, the herbals included accurate representations of plants drawn from nature [9].

The botanical illustrations provide valuable information about the different species of plants [9].

The illustration art is a tool for science and it provides international communication by creating a visual language to spread knowledge. The aim of botanical illustration is to record the plants and to trace a country's or region's flora [10]. Other authors add that illustrations allow representing a sample of a plant and these may be used by students or researchers to identify that species in the field or to differentiate that plant from related species [9].

The scientific illustration appeared in the accounts of travelers, natural philosophers, who explored the unfamiliar territory over the centuries. The expeditions stimulated the development of drawing and painting, as it was required the faithful witness of the findings and to identify plants with potential use in pharmacology, chemistry and agriculture [11] [12]. For over two millennia plants were been reported in designs to make their identification easier and reliable [13].

Scientists allude that the scientific illustration was and still is a chart area that combines science and art in a single communication model [14].

The images are more attractive and easier to understand and they also contribute to better explain the written text [15].

In the illustrations, the type of trace, the use of color, the contrast of the picture and the design are basic elements that help the student in understanding the vision, concepts and the structures. In addition, educational, conceptual, aesthetic and technical decisions on the representation and processing of information constitute the field of scientific illustration [16].

The sixteenth century botany illustrations demonstrate the importance of visual information in the pursuit of knowledge about the natural world. Early modern natural history was profoundly dependent on creation of images, many of them replicable by way of print, such as like drawings, could enable identification and, in turn, use or classification of what they represented [17].

The botanical illustration clarifies doubts, enables easier understanding and makes visible images formed from fragments. It's considered an investigative activity that requires mastery of specific techniques, like visual acuity and scientific knowledge [18].

Curiosity regarding the medicinal properties of plants was the humble origin of scientific botany [19]. Botanical illustration has been essential to botany since its inception as a modern science in the nineteenth century, because the illustrations were more accurate and informative than the accompanying texts [20].

The study of the evolution of illustrations allows understanding the techniques used in the history of illustrated books for representation of images, the illustrations suffered various processes, e. g., illuminated manuscripts, woodcut and lithography. As a result of development and adaptation of new image and writing breeding techniques there was the increasing need to edit a larger number of volumes and consequently an intensification in the amount of readers. In each period it was used one or more different processes of illustration, its recognition as well as the reason for their choice has become important sources of study for History of Science. This information allowed us to understand what kind of knowledge was possessed by the scholars of each century and their evolution over the time, with all the social, religious and cultural pressures, that they have been subjected [12].

The use of illustrations to convey scientific information is very valuable, botanists knew that in order to be successful at transmission of scientific knowledge, is important to making botany an attractive science and keeping it a serious discipline [21]. The value of scientific illustration is to enable the reader an easy comprehension of the written text [22]. Often in Natural Sciences, illustration enables immediate recognition of the physical characteristics of an organism, by color, shape, among other things, eliminating the need for a lot of text.

Researchers of education area mention that the introduction of the History of Science in Science Education contributes to improve understanding of concepts developed by Science; it explains the historical, social, political and economic influences, as important for scientific development in a given historical moment [23]. Besides this the history of science can also help the students know the Science from another perspective, so that it becomes more attractive, awakening interest in scientific knowledge and as well in the discussions around Science [24]

The chestnut belongs to genus *Castanea*, what include several species, and in this study we will only address the European chestnut (*Castanea sativa* Mill.) and equine species (*Castanea equina*), originating from the Balkans and currently cultivated across Europe. The main distinction between these species of chestnut is that European chestnut presenting 2 to 3 fruits per hedgehog, with their nuts often used in foodstuffs. In other turn, the equine species presents only one chestnut for hedgehog. Their seeds, bark and leaves are used in medicine. The current classification of common chestnut, European species addressed in the related work is *Castanea sativa* Miller (1768) due to the English botanist Philip Miller (1691-1771). The species *Castanea equina* classified by Charles l'Écluse in 1583 and more later was classified and named *Aesculus hippocastanum* by Linnaeus in 1753 [25].

All this knowledge about the evolution of illustrations, including those related to the chestnut, may constitute, as already noted, a valuable contribution to the history of botany and a broader perspective for the History of Science in general. The study of the illustrations can later be used as a tool for the introduction of the History of Science in Science Education.

This paper is structured as follows: introduction, next abstract, the presentation of the methodology and the works that we used for this study then present the chestnut illustrations, with the respective analysis and description and finally the conclusions.

2. MATERIALS AND METHODS

A qualitative methodology was used in this research work, applying the documentary analysis of several works. The research was mainly carried out in primary sources, because they were more reliable records and also was used some secondary sources. The works used in this study were:

- *De historiastirpium commentarii insignes* (1551) of Leonhart Fuchs;
- *Naturalishistoriae opvs novvm in qvotracta* (1551) of Adam Lonicer;
- *Index Dioscoridis* (1558) of Amato Lusitano;
- *New Kreüterbuch: Mit den allerschönstenvndartlichsten figuren allergewechß, dergleichen vormals in keener sprach nie an tag kommen* (1563) of Pietro Mattioli;
- *Phytognomonica Io. Baptistae Portae* (1589) of Giovanni Battista della Porta;
- *Rariorum plantarum historia* (1601) of Charles d'Écluse.

All of these works were part of the period deeply famous by great advances in the sciences - the Renaissance. This period of history was considered the period in European civilization that have been described by a surge of interest in classical learning, values and the opportunity to support creativity and change in Europe [26]. The Renaissance produced a golden age with many achievements in art, literature, and science and the rebirth of cultural and intellectual pursuits [27].

The illustrations by great botanicals in this era, contributed to the advancement of scientific knowledge in the field of Botany, about the different species of plants, and more particularly on the chestnut.

3. RESULTS AND DISCUSSION

Some considerations on the illustrations of chestnut found in the works of the sixteenth century

In this section we state some considerations about the illustrations of the chestnut, found in some works of the sixteenth century.

The art of illustrating plants is an old one. The development of civilizations, contributed for some botanical illustrations, they can be described with the same detail as a scientific text. The first naturalists made their sketches in their own environment, they just used the vision, hand, pencil to record what observed, producing beautiful detailed boards, which currently represented true works of art [28].

Scientific illustrations can supplement the text, replacing it completely or supporting it by giving it a visual form [29].

Scientific Naturalism emerged in the Renaissance and marked significantly the way of making botanical illustrations. Other authors allude that scientific illustration is the visual component of Science that, in the sphere of Botany, is dedicated to the vegetable kingdom, in other words, is the scientific design of the plant. It requires from the designer the same scientific curiosity featuring an investigator, leading him to research the guidance of the botanists who study the plant species, to meet the elements of plants that are illustrating [18].

The sciences of botany and medicine, fostered by expeditions around the world, had included the art of the scientific illustration for some time [30].

Over time various authors published chestnut illustrations.

Leonhart Fuchs (1501 - 1566), German doctor and botanist, in his work *De historia stirpium commentarii insignes*, published in 1551 in Basilea, presents a chestnut illustration (Figure 1). This work marked him as one of the first to use botanical nomenclature [31] and is best known today as one of the pioneers of accurate representations of plants in the history of scientific illustrations [32].

Observed the Figure 1 that was drawn in black and white and has little detail, but it is perceived with the serrated leaves and asymmetrical aspect, both are characteristics of chestnut leaves and form part of the knowledge of their biological characterization. Furthermore, it is visible to the observer on the foliage, demonstrating the illustrator's ability to represent the closest to the true leaves (Figure 1).



Figure 1. Chestnut illustration in the work *De historia stirpium commentarii insignes* [33].

The hedgehogs were made with precision and were covered with thorns. It is also observed in this picture the chestnut roots but is not perceived the branch of secondary roots from the primary root, one of their morphological features (Figure 1).

Adam Lonicer (1528 - 1586), another German botanist, published in his work *Naturalis historiae opvs novvm in qvotRACTA*, printed in 1551 in the city of Frankfurt, a chestnut illustration. The image of Lonicer (Figure 2) was published in the same year as the picture of Fuchs, but unlike the previous one, was presented in color and only one branch of the tree and not the overall look of the chestnut.



Figure 2. Chestnut illustration in the work *Naturalis historiae opvs novvm in qvotRACTA* [34].

In this image (Figure 2) the leaves have a sawnform and fasciculate hedgehogs that constitute their real characteristics and this picture has a greater level of detail than Fuchs. It also can be observed that the hedgehogs are brown, indicating its maturation stage, the green color of the leaves and the fact that the author has outlined the catkins (flowers) of chestnut near the foliage, a characteristic appearance. However, catkins were designed with little singularity because they aren't observed in the glomeruli.

Amato Lusitano (1511 - 1568), a major Portuguese doctor in his work *Index Dioscoridis*, published in 1558, in Leon, presents an illustration of chestnut drawn in black and white (Figure 3). This picture is similar to Leonhart Fuchs published in *Naturalis historiae opvs novvm in qvot tractatibvs* in 1551, both authors may have been aware of each other's work or may have used the same illustrator.



Figure 3. Chestnut illustration in the work *Index Dioscoridis* [35].

The Italian naturalist Pietro Mattioli (1501 - 1577), by this time, published the work *New Kreüterbuch: Mit den allerschönsten vnd artlichsten figuren aller gewechß, dergleichen vormals in keiner sprach nie an tag kommen*, which was printed in Prague in 1563. This book presented a color illustration of the European chestnut. The Figure 4 presented one of the principal morphological leaves, which is toothed. Hedgehogs were designed with little detail, but it is visible that their characteristic coating of thorns. We can still observe some catkins, and other flowers like dandelion, the latter out of context, because European chestnut has only its flowers on the edge of the branches in the form of clusters (catkins).

This illustration (Figure 4) is representative, but indistinct and a little bit confusing since all chestnut constituents are superimposed.



Figure 4. Chestnut illustration in the work *New Kreüterbuch: Mit den allerschönsten vnd artlichsten figuren aller gewechß, dergleichen vormals in keiner sprach nie an tag kommen* [36].

The physical and Italian naturalist Giovanni Battista della Porta (1535 - 1615) in his work *Phytognomonica Io*, published in 1589 in the city of Frankfurt, displays a hand-drawn illustration of chestnut tree fruit (Figure 5). This figure arises after the Lonicer and was designed in black and white, unlike the previous image that was drawn with colors.

This author represents the nut with great detail and observed the elliptical, elongated and bulky shape. The presence of the shell to cover the fruit, which is smooth, leathery and presents groove and splines. These aspects are related to the real morphological characteristics of brown, revealing a painstaking work by its illustrator.



Figure 5. Chestnut illustration of genus *Castanea* in the work *Phytognomonica Io. Baptistae Portae* [37].

Charles de l'Écluse (1525 - 1609) was a Belgian doctor, considered one of the most influential botanists and horticulturist of the sixteenth century. Published in 1601, based on the work of the *Conferences Simple*, of medical and botanical Portuguese Garcia de Orta (1500-1568) an important treaty of Botany, *Rariorum Plantarum historia*, illustrated with over a thousand engravings and group the species by its affinity.

Analyzing the illustration of Charles de l'Écluse (Figure 6), we detected the ribs of leaves are clearly evident. The leaves are opposite, with long petioles, divided into 5 to 7 leaflets with variable size widening the apex and terminate in obtuse tip, however in this image doesn't observe the catkins. This author also presents one of the burrs of this semi-open type, with many thorns. The fruit is irregularly and rough, the morphological characteristics represented in this illustration are distinct from reality, because the nut is bulky and has a rounded shape.

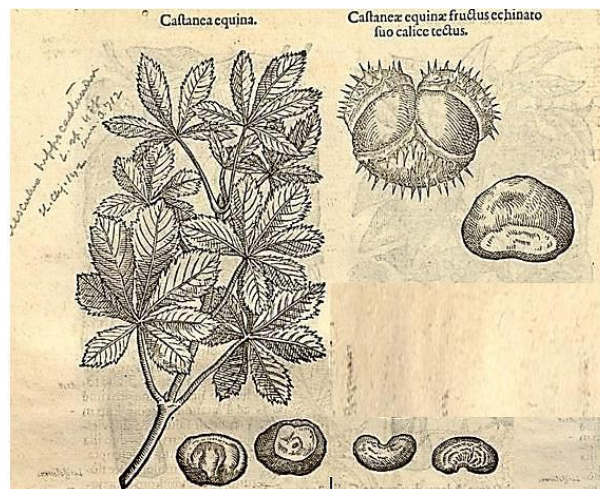


Figure 6. Illustration of *Castanea equina* in the work *Rariorum Plantarum historia* [38].

4. CONCLUSIONS

This study contributed to better understand the evolution of the illustrations of the chestnut over time, they have been influenced by the different techniques of representation and the contributions of the various artistic currents that dominated the period of history in which they were carried out.

The illustrators of the sixteenth century already had some knowledge about morphological features about the different vegetative organs of sweet chestnut species, allowing the visualization and differentiation of root, stem, leaves and fruit. Most of the sixteenth century graphics were performed coal, representing the chestnut in general and with little detail. Throughout the sixteenth century, the illustrations presented a greater number of constituent elements of the chestnut, gradually more complete and detailed. Of all the illustrations of the XVI century the most complete one was the illustration of Mattioli, which has a greater number of constituent elements of the chestnut, however, some illustrations of the same season showed different characteristics, such as the della Porta that only shows the outline of a chestnut.

The illustrations can be used as a resource in science education and can also help students to better understand that throughout history. This research can help in the comprehension of how the plant evolved, depending on the degree of scientific development time and existing visual representation techniques and can also contribute to better understanding the evolution of scientific knowledge on the chestnut during the sixteenth century, and therefore the history of botany.

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AUTHORS' BIOGRAPHY



Andreia Marlise Carneiro de Carvalho, Degree in Biology and Geology, master's degree in Biology and Geology teaching in the 3rd cycle of basic education and secondary education. PhD student in Earth Sciences and Life, she performs research on the theme of chestnut.



Isilda Teixeira Rodrigues, Assistant Professor at the University of Trás-os-Montes and Alto Douro, Portugal. PhD in Education/History of Science. Published 27 articles in journals, 80 proceedings and 10 books and chapters. Works in Science Education, Health Education, History of Science and Didactics of Science.